From: Caitlin McInnarney
Sent: Friday, 7 October 2022 3:02 PM
To: Jemma Dacy
Cc: Official Correspondence; Leisa Coley; Cody Davidson
Subject: MINO-484 RESPONSE: AWHC documents
Attachments: Notice to Proponents (ALR & AWHC ROI _ 001).pdf; Notice to Proponents (ALR & AWHC ROI _ 002).pdf; Notice to Proponents (ALR & AWHC ROI _ 003).pdf; Technical overview_June 22_Short listed ALR Presentation.pdf; 20220512 AWHC-ALR Urban_Eng_Planning ROI - Final.pdf; ALR AWHC Industry Briefing Presentation 28042022.pdf; ATAP-Evaluation-Report.pdf; AWHC Comined Tunnel Feasibility Report 201208 FINAL.pdf

Hi Jemma,

Please find attached the requested documents on the AWHC project, including the AWHC/ALR procurement documents that were available on GETS.
The 2008 Crossing Study is available online at: https://www.nzta.govt.nz/projects/waitemata-harbour-connections/technical-reports/ 😊

The team also asked for me to pass on to you that 2020 work available here took into account all the previous thinking from the documents attached. We have not assessed the documents for release beyond the office.

Please let me know if there are any concerns, thank you!

Ngā mihi nui
Caitlin

Caitlin McInnarney

Senior Advisor, Ministerial Services
Te Waka Kōtuia | Engagement & Partnerships
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CONTRACT PROCEDURES MANUAL (SM021) PART A

Notice to proponents

Reference:

26/05/2022

ALR & AWHC Project Teams
Waka Kotahi
Level 5, AON Centre
29 Custom Street West, Auckland 1143, New Zealand

Dear all.

Contract number 5574 & 6395

Contract description: AWHC & ALR UEP Services

Notice to proponent's number: 001

Please find below the amended tables of the ROI document. These changes are identified in **bold green text.**

Section: ***Part B – AWHC, Appendix A – ROI Application Response Form, Part A – Relevant Experience (Page 27)***

~~**PART A: RELEVANT EXPERIENCE**~~
~~The following information should be provided for **three** multi-modal infrastructure business cases and/ or projects completed within the last five years, which the Applicant considers most relevant to this project.~~ ~~**All projects must be the same as nominated for Track Record.**~~ ~~Should nominations be less than the required number of projects this will be taken as a deficiency in the attributes for Relevant Experience and Track Record and will be scored accordingly. Where more than the required number of projects are submitted, only the first **three** nominated projects for Relevant Experience and Track Record will be considered.~~ ~~Applicants shall provide the following details for each **project** nominated for Relevant Experience:~~ • ~~Project name, location, contract value (scale: the value of the work carried out, or the value of the work completed so far if still incomplete) and when the project was completed (currency: when the work was carried out, or the % completed so far if still incomplete); and~~ • ~~Primary and secondary Client's Representative names, company and contact telephone numbers.~~

~~A separate table must be included for each **factor.** Each table shall include the following information:~~

- ~~A description of the work carried out; and~~
- ~~How this demonstrates the Applicant's experience in delivering the required factors below; and~~
- ~~The relevance of the nominated project to this submission.~~

~~It is expected that a nominated project may demonstrate an Applicant's experience against more than one of the following factors. There is a minimum requirement that Applicants demonstrate Relevant Experience and Track Record against each of the factors (minimum one contributing project).~~

PART A: RELEVANT EXPERIENCE

The following information should be provided for **three** multi-modal infrastructure business cases and/ or projects completed within the last five years, which the Applicant considers most relevant to this project.

All projects must be the same as nominated for Track Record.

Should nominations be less than the required number of projects this will be taken as a deficiency in the attributes for Relevant Experience and Track Record and will be scored accordingly. Where more than the required number of projects are submitted, only the first **three** nominated projects for Relevant Experience and Track Record will be considered.

Applicants shall provide the following details for each **project** nominated for Relevant Experience:

- Project name, location, contract value **(scale: the professional services fee value of the work carried out, or the professional services fee value of the work completed so far if still incomplete (~$20m benchmark))** and when the project was completed (currency: when the work was carried out, or the % completed so far if still incomplete); and
- Primary and secondary Client's Representative names, company and contact telephone numbers.

A separate table must be included for each **factor.** Each table shall include the following information:

- A description of the work carried out; and
- How this demonstrates the Applicant's experience in delivering the required factors below; and
- The relevance of the nominated project to this submission.

It is expected that a nominated project may demonstrate an Applicant's experience against more than one of the following factors. There is a minimum requirement that Applicants demonstrate Relevant Experience and Track Record against each of the factors (minimum one contributing project).

<u>Section:</u> ***Part C – AWHC, Appendix A – ROI Application Response Form, Part A – Relevant Experience (Page 56)***

~~**PART A: RELEVANT EXPERIENCE**~~

~~The following information should be provided for **four** projects which illustrate the Applicant's ability as a company/consortium to provide the technical and non-technical expertise required to successfully deliver the required outcomes as they relate to transport infrastructure projects in a complex urban environment.~~

~~Applicants should only identify projects which are complete, or for which at least one relevant phase is complete, and which have been completed within the last 5 years.~~

~~**All projects must be the same as nominated for Track Record.**~~

~~Should nominations be less than the required number of projects this will be taken as a deficiency in the attributes for Relevant Experience and Track Record and will be scored accordingly. Where more than the required number of projects are submitted, only the first **four** nominated projects for Relevant Experience and Track Record will be considered.~~

~~Applicants shall provide the following details for each **project** nominated for Relevant Experience:~~

- ~~Project name, location, contract value (scale: the value of the work carried out, or the value of the work completed so far if still incomplete) and when the project was completed (currency: when the work was carried out, or the % completed so far if still incomplete); and~~
- ~~Primary and secondary Client's Representative names, company, email addresses and contact telephone numbers.~~

~~Each project should be described to provide detail of how the following factors have been achieved, including the following information:~~

- ~~A description of the work carried out;~~
- ~~How this demonstrates the Applicant's experience in delivering the required factors below; and~~
- ~~The relevance of the nominated project to this submission.~~

~~It is expected that a nominated project may demonstrate an Applicant's experience against more than one of the following factors. There is a minimum requirement that Applicants demonstrate Relevant Experience and Track Record against each of the factors (minimum one contributing project).~~

~~Of the nominated projects, one must be an exemplar of each of the following:~~

- ~~Transport & Urban Integration~~
- ~~Urban Regeneration~~
- ~~Light Rail/Metro Experience~~

PART A: RELEVANT EXPERIENCE

The following information should be provided for **four** projects which illustrate the Applicant's ability as a company/consortium to provide the technical and non-technical expertise required to successfully deliver the required outcomes as they relate to transport infrastructure projects in a complex urban environment.

Applicants should only identify projects which are complete, or for which at least one relevant phase is complete, and which have been completed within the last 5 years.

All projects must be the same as nominated for Track Record.

Should nominations be less than the required number of projects this will be taken as a deficiency in the attributes for Relevant Experience and Track Record and will be scored accordingly. Where more than the required number of projects are submitted, only the first **four** nominated projects for Relevant Experience and Track Record will be considered.

Applicants shall provide the following details for each **project** nominated for Relevant Experience:

- Project name, location, contract value **(scale: the professional services fee value of the work carried out, or the professional services fee value of the work completed so far if still incomplete (>$100m benchmark))** and when the project was completed (currency: when the work was carried out, or the % completed so far if still incomplete); and
- Primary and secondary Client's Representative names, company, email addresses and contact telephone numbers.

Each project should be described to provide detail of how the following factors have been achieved, including the following information:

- A description of the work carried out;
- How this demonstrates the Applicant's experience in delivering the required factors below; and
- The relevance of the nominated project to this submission.

It is expected that a nominated project may demonstrate an Applicant's experience against more than one of the following factors. There is a minimum requirement that Applicants demonstrate Relevant Experience and Track Record against each of the factors (minimum one contributing project).

Of the nominated projects, one must be an exemplar of each of the following:

- Transport & Urban Integration
- Urban Regeneration
- Light Rail/Metro Experience

Yours sincerely

Process Manager
for Joint Procurement Lead (Ben Sherriff)

CONTRACT PROCEDURES MANUAL (SM021) PART A

Notice to proponents

Reference:

26/05/2022

ALR & AWHC Project Teams
Waka Kotahi
Level 5, AON Centre
29 Custom Street West, Auckland 1143, New Zealand

Dear all,

Contract number 5574 & 6395

Contract description: AWHC & ALR UEP Services

Notice to proponent's number: 002

We are removing the requirement for a post graduate degree for the following relevant skills roles.

Please find below the amended tables of the ROI document. These changes are identified in **bold green text.**

<u>**Section:**</u> ***Part B – AWHC, Appendix A – ROI Application Response Form, Part C – Relevant Skills Pages 31-33)***

~~**Position:** Transport Planning Lead~~ ~~**Weighting:** 15%~~	~~**Location:** Auckland based~~
~~**Qualifications (20%) and Experience (80%)**~~	~~**Key Responsibilities**~~
• ~~Experience in the transport planning discipline (at least 15 years preferred) with a post graduate degree relevant to transport planning or equivalent.~~ • ~~Successful delivery of transport planning elements on business cases for large (over $500m value) transport projects.~~ • ~~Knowledge of transport systems, network planning and operations, and system resilience.~~ • ~~Success in leading a team to develop, evaluate and design a range of solutions to meet the objectives of the programme.~~ • ~~Detailed knowledge and understanding of transport issues in the Auckland Region, particularly on the north shore, and integration with the wider transport system.~~ • ~~Understanding of the integrated land use and transport planning approach to achieve positive outcomes for equity, liveability, wellbeing, safety, and inclusivity.~~	• ~~Lead the development of a strategy to address transport issues on Auckland's north shore and wider city centre.~~ • ~~Responsible for delivering a large proportion of the technical analysis and evidence base into the business case.~~ • ~~A member of the Alliance Management Team.~~

Position: Transport Planning Lead **Weighting:** 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• Experience in the transport planning discipline (at least 15 years preferred) **with a degree** relevant to transport planning or equivalent. • Successful delivery of transport planning elements on business cases for large (over $500m value) transport projects. • Knowledge of transport systems, network planning and operations, and system resilience. • Success in leading a team to develop, evaluate and design a range of solutions to meet the objectives of the programme. • Detailed knowledge and understanding of transport issues in the Auckland Region, particularly on the north shore, and integration with the wider transport system. • Understanding of the integrated land use and transport planning approach to achieve positive outcomes for equity, liveability, wellbeing, safety, and inclusivity.	• Lead the development of a strategy to address transport issues on Auckland's north shore and wider city centre. • Responsible for delivering a large proportion of the technical analysis and evidence base into the business case. • A member of the Alliance Management Team.

~~**Position:** Planning and Consents Lead~~ ~~**Weighting:** 15%~~	~~**Location:** Auckland based~~
~~**Qualifications (20%) and Experience (80%)**~~	~~**Key Responsibilities**~~
• ~~Experience in the discipline (at least 15 years preferred) with a post graduate degree relevant to resource management, planning and consenting or a closely aligned discipline. NZPI membership or equivalent essential.~~ • ~~Successful development and delivery of a large and complex (over $500m value) consenting strategy in urban and coastal areas, with an emphasis on sensitive ecological environments, for the public and/ or private sectors.~~ • ~~Comprehensive working knowledge of the RMA and other relevant government legislation and treaty settlement agreements. Knowledge of Tikanga Māori and working alongside Mana Whenua.~~ • ~~A strong Track Record safeguarding sustainability and the environment within programme outcomes.~~ • ~~Experience developing collaborative working relationships with key external partners/ stakeholders.~~ • ~~Excellent communication skills, notably to the ability to synthesise complex information into 'easy to read' content, and present to diverse audiences.~~ • ~~Proactive risk management and mitigation planning.~~	• ~~Lead and manage planning outcomes and the development of an attainable consenting strategy and RMA process for the programme of projects.~~ • ~~Responsible for a sustainable solution within the legislation to outline a clear consenting pathway for the programme.~~ • ~~A member of the Alliance Management Team.~~

Position: Planning and Consents Lead **Weighting:** 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• Experience in the discipline (at least 15 years preferred) **with a degree** relevant to resource management, planning and consenting or a closely aligned discipline. NZPI membership or equivalent essential. • Successful development and delivery of a large and complex (over $500m value) consenting strategy in urban and coastal areas, with an emphasis on sensitive ecological environments, for the public and/ or private sectors. • Comprehensive working knowledge of the RMA and other relevant government legislation and treaty settlement agreements. Knowledge of Tikanga Māori and working alongside Mana Whenua. • A strong Track Record safeguarding sustainability and the environment within programme outcomes. • Experience developing collaborative working relationships with key external partners/ stakeholders. • Excellent communication skills, notably to the ability to synthesise complex information into 'easy to read' content, and present to diverse audiences. • Proactive risk management and mitigation planning.	• Lead and manage planning outcomes and the development of an attainable consenting strategy and RMA process for the programme of projects. • Responsible for a sustainable solution within the legislation to outline a clear consenting pathway for the programme. • A member of the Alliance Management Team.

~~**Position:** Business Case Lead~~ ~~**Weighting:** 15%~~	~~**Location:** Auckland based~~
~~**Qualifications (20%) and Experience (80%)**~~	~~**Key Responsibilities**~~
• ~~Experience developing and obtaining approval of large-scale linear infrastructure business cases.~~ • ~~At least 15 years of experience in developing and obtaining approval of large-scale linear infrastructure business cases with a post graduate degree relevant to transport planning.~~ • ~~Accredited certificate in The Treasury Better Business Cases™ (or equivalent).~~ • ~~Led and successfully delivered business cases for large scale (over $500m value) public and private projects through to approval.~~ • ~~Demonstration of strong thought leadership and development of evidence-based analysis to support decision making.~~ • ~~Led the development of business case content, including need for investment, option development, option appraisal, project justification, integrated transport planning, and next stage planning.~~ • ~~Implemented a collaborative working style, coordinating a range of resources under their leadership and across the programme to bring together a full and robust business case.~~ • ~~Supported stakeholder consultation and engagement to ensure effective buy-in from key stakeholders to the process.~~ • ~~Agile thinking to include analysis of relevant trends, such as Carbon Reduction, Transit Orientated Development, and Social Equity.~~ • ~~Ability to incorporate the urban directives into language suitable to be understood by Treasury.~~	• ~~Delivery of a well-structured, easy-to-read business case.~~ • ~~Lead and guide the wider project team in development of the business case (Aligned to Waka Kotahi IBC format.)~~ • ~~Responsible for bringing together a comprehensive document across all disciplines.~~ • ~~A member of the Alliance Management Team.~~

Position: Business Case Lead **Weighting:** 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• Experience developing and obtaining approval of large-scale linear infrastructure business cases. • At least 15 years of experience in developing and obtaining approval of large-scale linear infrastructure business cases **with a degree** relevant to transport planning. • Accredited certificate in The Treasury Better Business Cases™ (or equivalent). • Led and successfully delivered business cases for large scale (over $500m value) public and private projects through to approval. • Demonstration of strong thought leadership and development of evidence-based analysis to support decision making. • Led the development of business case content, including need for investment, option development, option appraisal, project justification, integrated transport planning, and next stage planning. • Implemented a collaborative working style, coordinating a range of resources under their leadership and across the programme to bring together a full and robust business case. • Supported stakeholder consultation and engagement to ensure effective buy-in from key stakeholders to the process. • Agile thinking to include analysis of relevant trends, such as Carbon Reduction, Transit Orientated Development, and Social Equity. • Ability to incorporate the urban directives into language suitable to be understood by Treasury.	• Delivery of a well-structured, easy-to-read business case. • Lead and guide the wider project team in development of the business case (Aligned to Waka Kotahi IBC format.) • Responsible for bringing together a comprehensive document across all disciplines. • A member of the Alliance Management Team.

Yours sincerely

Process Manager
for Joint Procurement Lead (Ben Sherriff)

CONTRACT PROCEDURES MANUAL (SM021) PART A

Notice to proponents

Reference:

30/05/2022

ALR & AWHC Project Teams
Waka Kotahi
Level 5, AON Centre
29 Custom Street West, Auckland 1143, New Zealand

Dear all,

Contract number 5574 & 6395

Contract description: AWHC & ALR UEP Services

Notice to proponent's number: 003

Kia ora koutou,

Please see responses to submitted clarifications regarding the Commercial Service procurement process.

1. If a supplier provides some services to the NOP as a subcontractor, are you please able to confirm that this supplier is not conflicted from tendering or being awarded other services outside of the core alliance (e.g. Funding & Financial Advisor services)?
    a. If you are successful member of, or subcontractor to, the UEP consortium you are still able to tender and potentially be awarded services under the separate Commercial Advisor services contract.

2. We understand that the same consortia cannot be awarded work in relation to both ALR and AWHC. We wanted to check whether this approach also applies to other services outside of the core alliance? i.e. could the same supplier be awarded Funding & Financial Advisor role across both projects?
    a. Yes, the same supplier will not be awarded the Commercial Advisor role for both contracts.

3. To the extent a supplier is able to bid for both projects (for 'other services') - can the same team be put forward for both or would you want to see separate teams?
    a. Yes, as per the answer in Question 2, you can use the same team while tendering.

Yours sincerely

Process Manager
for Joint Procurement Lead (Ben Sherriff)

Auckland Light Rail

Technical overview

June 2022

Auckland LIGHT RAIL
Bringing us closer

Purpose, notes & agenda

OBJECTIVE

Provide a technical overview outlining the iterations of work complete & respond to questions so teams can provide informed and quality proposals.

NOTES

- ✓ The presentation is additional to the information that will be shared in the data room.
- ✓ This session will not be recorded.
- ✓ Questions are encouraged – we will pause after each section and address any questions.

AGENDA

- Overview of all previous iterations of light rail (2015-2019)
- Update on how the current project team has progressed ALR since 2021

Previous iterations of light rail

2015-17
- Reference design (Auckland Transport)

2017-18
- IBC for City Centre to Mangere (Waka Kotahi)

2019
- Parallel process, s 9(2)(i) [redacted] (Waka Kotahi)

2021-22
- ALR Group IBC
- Government endorsement for Tunnelled Light Rail
- **Procurement process**

We are here → 2021-22

Reference design - 2015 - 2016

1. Wynyard Fanshawe
2. Queen Street
3. Dominion Road
4. Sandringham Road

s 9(2)(i)

s 9(2)(i)

[redacted]

Staged LRT project starting with Queen Street and Dominion Road, followed by a Wynyard Quarter connection and Sandringha

Auckland LIGHT RAIL
Bringing us closer

Airport route optioneering – early 2017

- Route options assessment undertaken between Mt Roskill and airport to identify preferred LRT route.
- Project objectives for LRT had not yet been confirmed and whether higher patronage should be prioritised over **45-minute travel time**.
- Decision on preferred route inconclusive pending project objectives and updated traffic modelling.

Depot options - 2017

Depot site required. 60,000m2 of contiguous land with min width of 80m and min length of 350m.

Long List

- 17 sites identified.
- Evaluated against set of technical criteria based on operational and design requirements including area, width, length, rail access and road access.

Short List

- Eight shortlisted.
- Subject to MCA workshop.
- Eight options scored against criteria based on project objectives and requirements including transport and accessibility, operations, public realm, environment, social and economic, constructability and financial and temporary effects.

Preferred Option – Carr Road:

- No conflicts with road vehicles and traffic
- Large site with room to expand
- Zoned light industry, so suitable land use
- No impact on trees, heritage sites, waterways
- No dead running, cheapest land cost, commercial neighbours

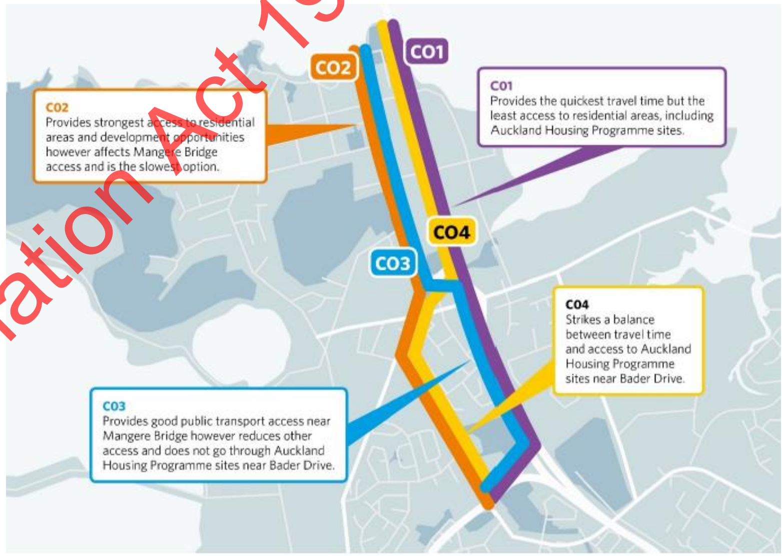
s 9(2)(i)

[redacted]

IBC for City Centre to Māngere corridor - 2018

Waka Kotahi review of the AT light rail design through the lens of the new strategic direction to:

- Confirm changes since the previous work completed
- Understand potential route options
- Identify further work required to confirm the route.



Section	Option	Description
Mt Roskill to Onehunga	A01	s 9(2)(i) [redacted]
	A02	
Onehunga to Māngere Bridge (Manukau Harbour Crossing)	B01	
	B02	
Māngere Bridge to Māngere Town Centre	C01	
	C02	
	C03	
	C04	
Māngere Town Centre to Auckland Airport	E01	
	E02	
	E03	

Strategic Urban Framework

- Supporting document to the Business Case
- Urban Integration context to the Strategic and Economic Cases
- Characteristics of the corridor, and expected growth both within the corridor and Auckland-wide
- Effect of Auckland Light Rail on growth, urban form and land values within the corridor
- Potential economic and social benefits, urban interventions and value capture.

Click to add text

City Centre to Māngere Light Rail

Draft Strategic Urban Framework

s 9(2)(i)

[redacted]

Auckland Light Rail Group – 2021/22

An update on the current project team and focus:

- Outcomes sought through IBC
- Short list options
- Preferred option
- Urban narrative
- Integration and future network considerations
- Treaty partnership
- Next steps

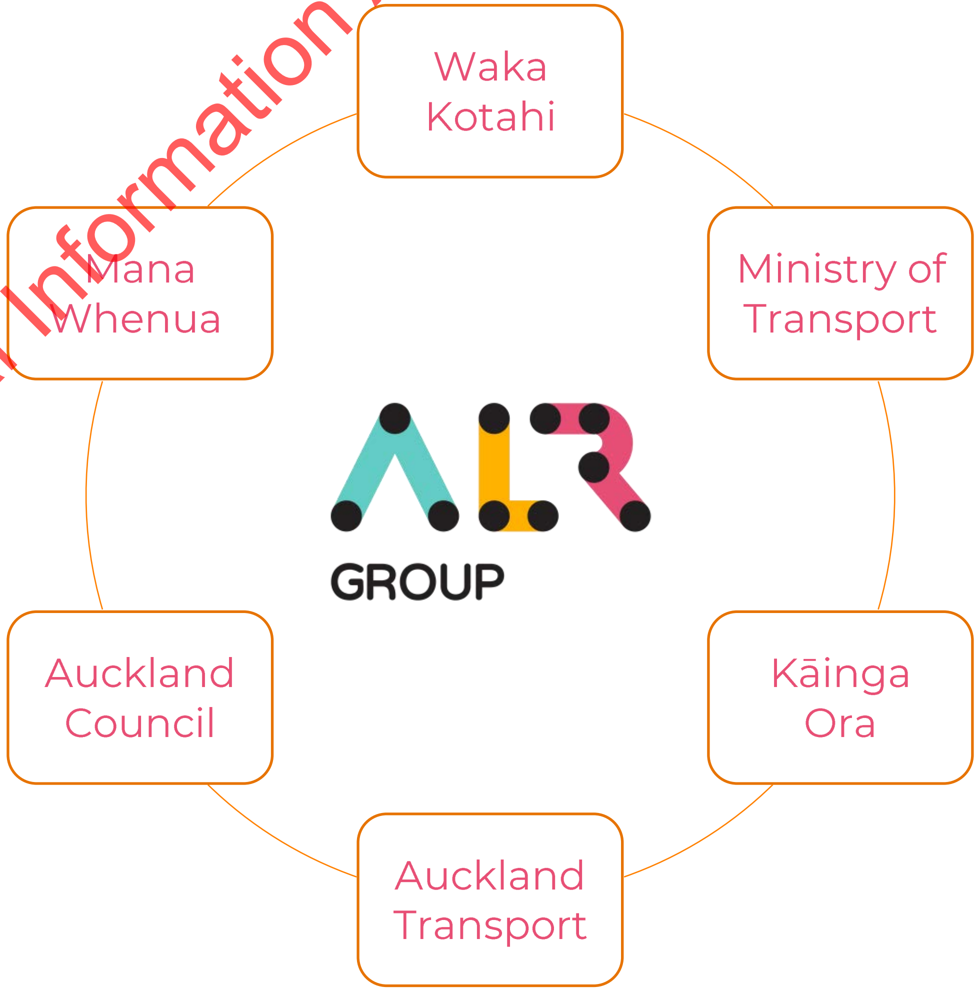
Auckland Light Rail Group

Tasked by Government to:

- ✓ Progress an indicative business case for City Centre to Māngere
- ✓ Advise on delivery entity options
- ✓ Set up mana whenua partnership
- ✓ Engage with stakeholders and communities. Building social license.

To enable decisions on:

- Mode
- Route
- Funding and financing
- Delivery entity



Outcomes: A More Connected, Accessible Auckland

Access & Integration

Improved access to opportunities through enhancing Auckland's Rapid Transit Network and integration with Auckland's current and future transport network

Environment

Optimised environmental quality and embedded sustainable practices

Urban & Community

Enabling of quality integrated urban communities, especially around Māngere, Onehunga and Mt Roskill

Experience

A high quality service that is attractive to users, with high levels of patronage

Value for Money

Effective and efficient use of all funding sources to achieve outcomes and maximise benefits.

Addressing Climate Change

Transport accounts for 43.6% of Auckland's GHG emissions.

Light Rail:

- Enables mode shift away from private vehicles, reducing car trip and GHG emissions
- Encourages higher numbers of public transport patronage, carrying up to 15,000 passengers an hour
- Will be built to integrate with quality walking, cycling and buses connections
- Supports regeneration of existing urban area rather than expansion into greenfields

Improving the reach, frequency and quality of public transport and making it more affordable for low-income New Zealanders is one of the key actions in the Transport Emissions Reduction Plan (TERP)

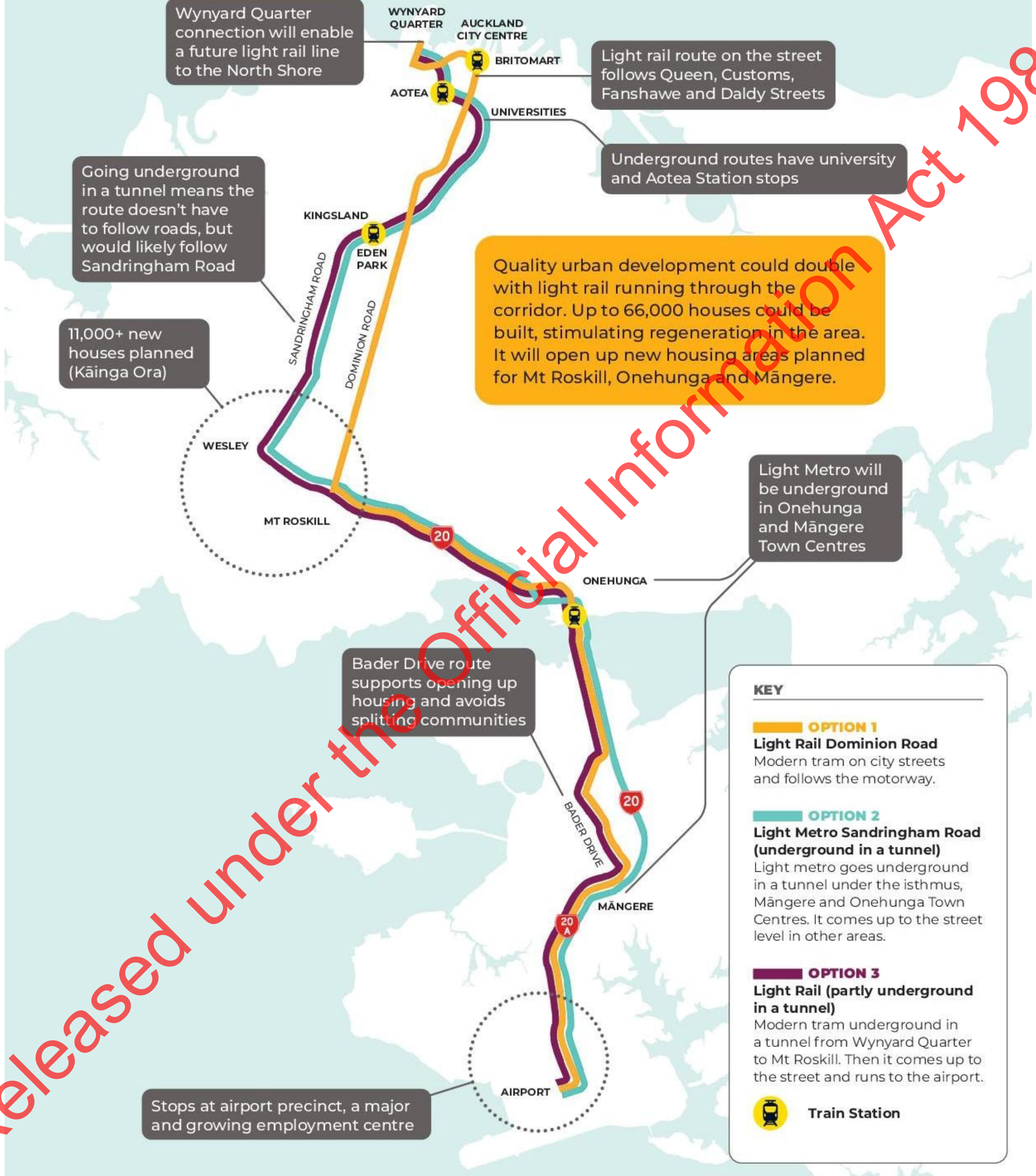
Short List Options

THERE IS STRONG CASE FOR A HIGH FREQUENCY RAPID TRANSIT SERVICE BETWEEN WYNYARD QUARTER AND THE AIRPORT BUSINESS PRECINCT.

The Establishment Unit identified three short listed options against the project's objectives.

- Light Metro - Grade separated mode. Would travel through tunnels build under densely populated areas. On surface through non-urban areas.
- Light Rail - Modern trams running on tracks embedded into the road but separated from traffic. Surface-based travel and stops.
- Tunnelled Light Rail - Modern tram that would be partly tunnelled from Wynyard Quarter to Mt. Roskill, with balance running on surface. Underground stations in the city centre

Short List Options



Auckland LIGHT RAIL Bringing us closer

Short List Options

		Light Rail	Light Metro	Tunnelled Light Rail
Description	Total boardings (Annually in 2051)	**22,300,000**	**34,950,000**	**31,200,000**
	Capacity Reached	**2070+**	**2085+**	**2070+**
	Number of Stations	**22**	**17**	**18**
Urban Development	Urban Uplift Potential by 2051			
	Household	20,000	35,000	35,000
	Jobs	12,000	16,000	16,000
	Accessibility (jobs within 45 minutes)			
	Māngere	247,000	452,800	346,200
	Onehunga	405,500	463,900	437,600
	Mt Roskill	414,700	423,000	403,300
	Jobs within 45 minutes of Central City and Airport	**475,600**	**569,600**	**515,900**
Travel Time	Travel Time	**57**	**36**	**43**
	To Airport Business Precinct			
	Māngere	7	5	7
	Onehunga	18	12	18
	Mt Roskill	27	20	30
	To City Centre (mid town)			
	Māngere	37	27	32
	Onehunga	25	20	21
	Mt Roskill	17	12	12
Impacts	Carbon (tonnes saved)	**860,000**	**940,000**	**980,000**
	Surface Properties Affected	**489**	**168**	**167**
Economics	Cost (p50)	**$9.0 Bn**	**$16.3 Bn**	**$14.6 Bn**
	BCR	**1.1**	**1.2**	**1.1**
Challenge	Key Risks	**Disruption Consentability**	**Affordability Market Capacity**	**Affordability Market Capacity**

Auckland LIGHT RAIL
Bringing us closer

Trade Offs Amongst Options

Level of transport opportunity (increased capacity and shift away from vehicles)	Light Metro, followed closely by Tunnelled Light Rail
Level of urban development opportunity	Light Metro and Tunnelled Light Rail enable more urban uplift, but cost more than Light Rail
Integrated transport (ability to future proof North/North-West future connections)	Light Metro and Tunnelled Light Rail show better integration due to tunnel and higher capacity
Carbon reduction	All options result in reduced greenhouse gases
Construction disruption	All options require construction in heavily populated areas. Light Metro and Tunnelled Light Rail tunnel in many areas, reducing service impacts.
Travel time	Light Metro holds the shortest travel time

Trade Offs Amongst Options

Costs

There is a substantial difference in estimated costs.

Light Rail	Light Metro	Tunnelled Light Rail
$9.0 Bn (NPV $7.1 Bn)[1]	$16.3 Bn (NPV $11.2 Bn)	$14.6 Bn NPV ($10.3 Bn).

Notes on the costs:

- Figures are for capital costs but do not include capital costs for enabling infrastructure for urban development.

s 9(2)(i)

[redacted]

Benefits

There is a substantial difference in forecast benefits, but they are comparatively similar, relative to the scale of investment.

	Light Rail	Light Metro	Tunnelled Light Rail
Benefits (NPV values over 60 years)	$8.0 Bn	$14 Bn	$11.6 Bn
BCR	1.1	1.2	1.1

Given the benefits are broadly commensurate with costs, all three options have benefit cost ratios (BCRs) of above one, and so broadly equivalent economic outcomes.

Establishment Unit's Preferred Option

Tunnelled Light Rail

31,200,000
Trips per year

18
Stops

980,000
Tonnes of carbon saved

2070+
Capacity reached

43 Minutes
Travel time

26,400
Trips at peak hour

The urban team and IBC phase outputs

ALR workstreams

- Urban
- Business Case
- Technical Design
- Transport Strategy
- Governance and Delivery Entity
- Comms and Engagement

Urban workstream

Lens over the workstream

What is the ambition for Auckland and the corridor?

- Urban form - urban / transport integration
- Climate change - contribution to reduction in emissions
- Mana Whenua - recognising values and discovering opportunities in partnership

Integration

Policy and Urban Context Report	Infrastructure (Enabling) Report	Growth and Development Report	Urban Value Report	Stations and Walkable Catchments Report	Urban Development Delivery
• Introduction to the strategic context. • Articulates why it is important to integrate urban and transport.	• Summary of infrastructure and geotechnical context, including existing capacity and planned projects. • Capturing risks in these areas as constraints to development for further analysis.	• Analysis of alternative growth scenarios for all shortlisted options. • Explains context of growth. • Implications of growth and development as a whole.	• Provides economic and urban value context for the project. • Articulates the importance of securing the urban benefits.	• Establishes how route and mode shape development potential and built form. • Articulates potential urban form outcomes. • Identifies next steps of realising opportunities around stops stations.	• Establishes a foundation for securing urban outcomes. • Recommends framework for assessing and securing large-scale transit supportive urban renewal. • Articulates need to leverage local and central government initiatives.
Strategic Case	*Technical*	*Economic Case*	*Economic Case*	*Technical*	*Commercial, Management and Financial Cases*

Interface

Urban Summary Technical Report

Appendix 1 to the Indicative Business Case

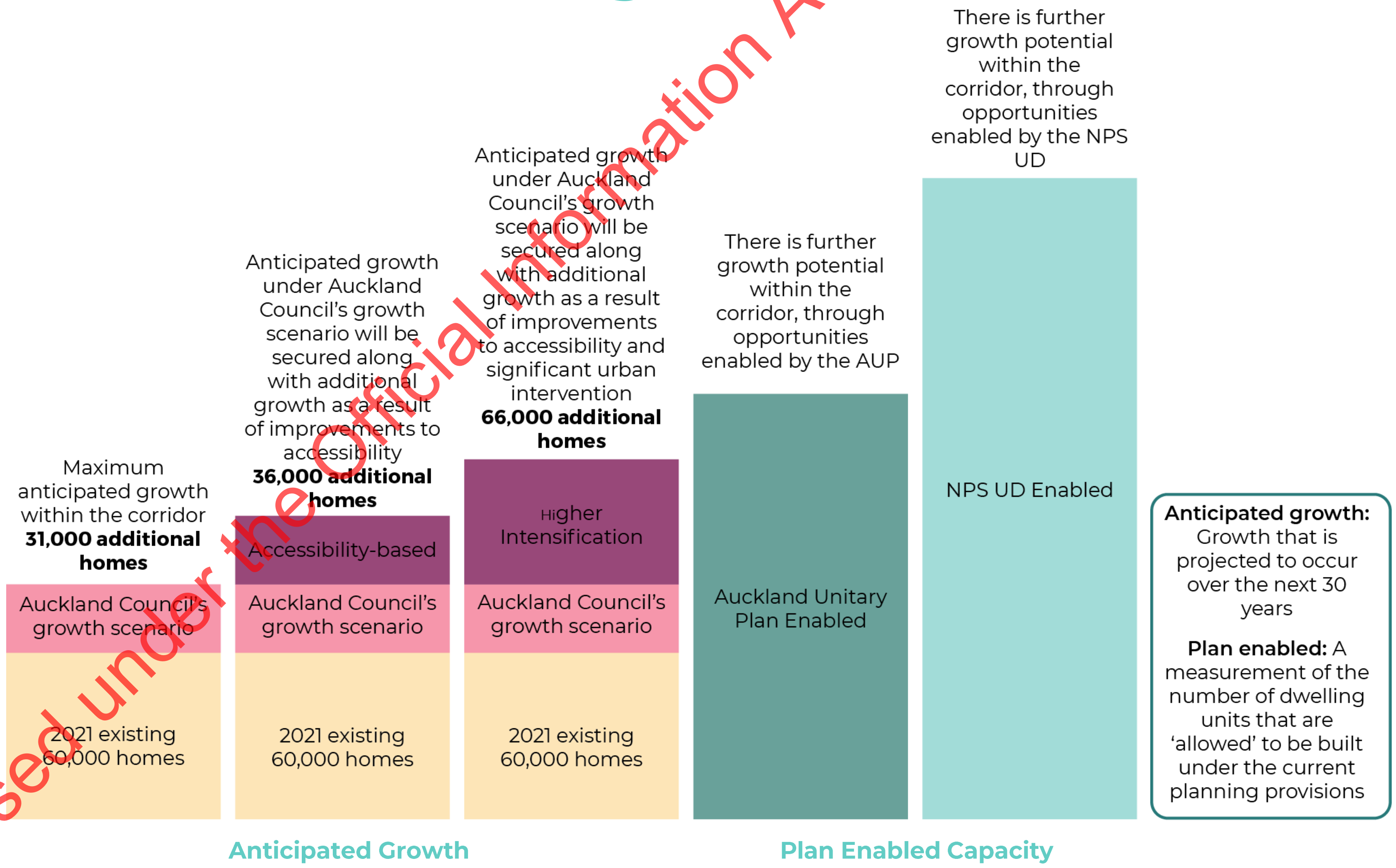
The Urban Story

Communications piece

Appendix 2 to the Indicative Business Case

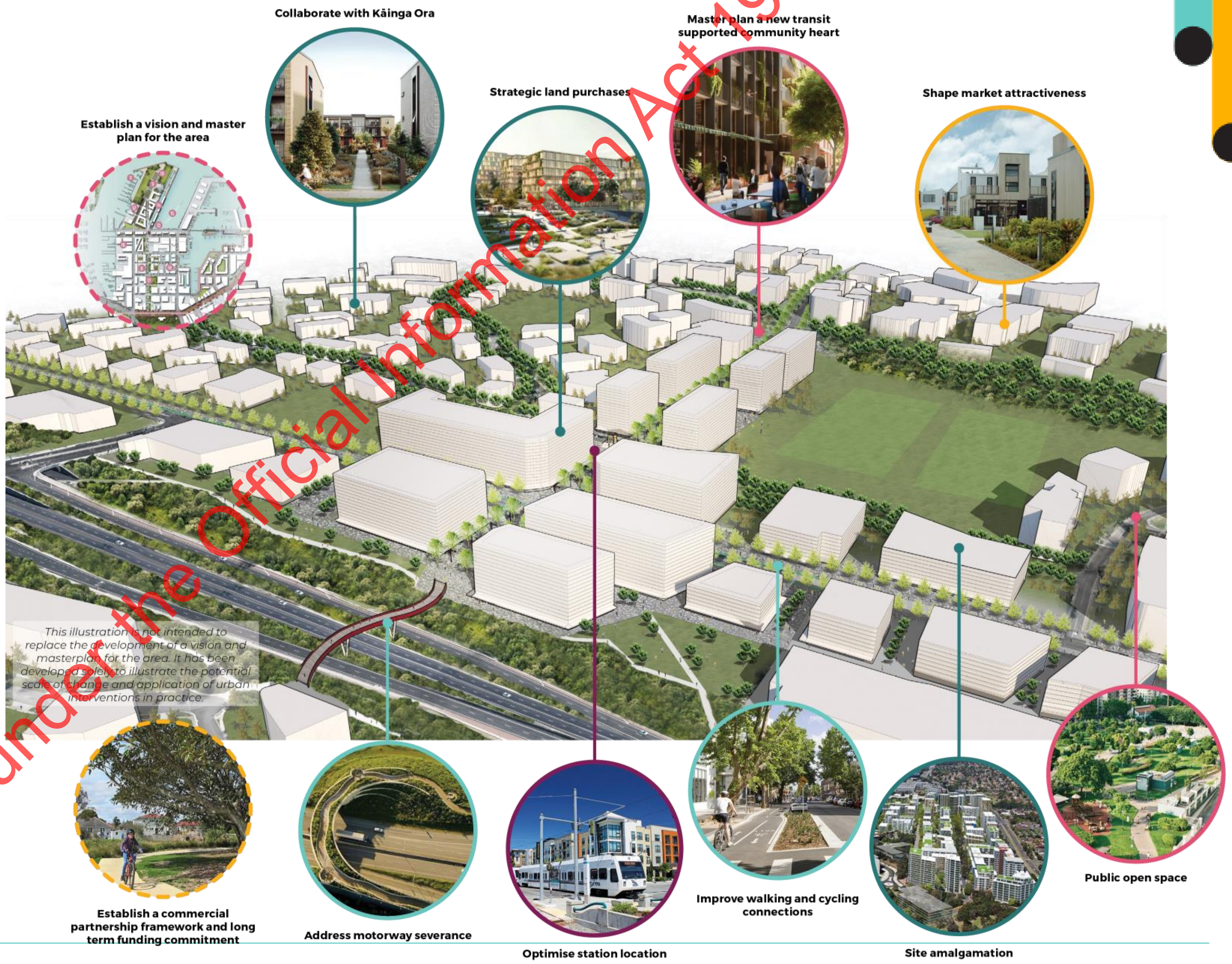
Growth scenario testing

Growth scenario testing was used to understand the quantitative benefits of investment - how much additional urban development could be triggered with investment in rapid transit, over and above Auckland Council's growth scenario.



Theoretical built form

- Parametric modelling
- Using Auckland Unitary Plan and NPS-UD parameters as a base



end of section – questions time

Concept of operation

Option 3 Hybrid via Sandringham Road

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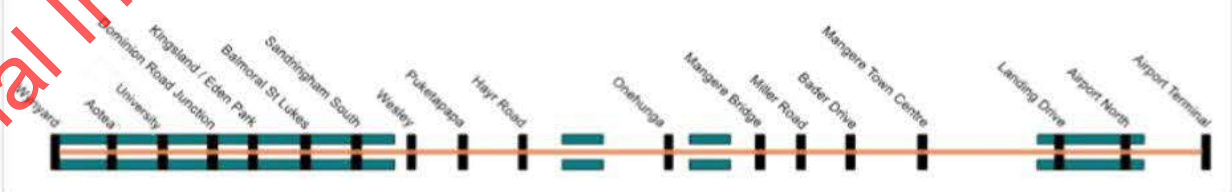
[redacted]

Key Facts

- Length: 24.426km
- High Speed segregated: 80kph
- High Speed shared: 50kph
- Steepest Ramp: 6.5%
- Total journey time: 46.3min
- Average Speed: 32kph
- Journey Time Allowance: 10%
- Rolling Stock: Light Rail Vehicles (33m)
- Maximum Capacity
  - Peak Hours: 8,400
  - Interpeak Hours: 2,100
  - Non-Peak Hours: 1,260

Journey Time	Aotea	Dominion JC
To Balmoral – St Lukes	8.5min	3.7min
To Wesley	12.5min	7.7min
To Hayr Road	17.4min	12.6min
To Onehunga	22.6min	17.8min
To Mangere Town Centre	35.2min	30.4min
To Airport	44.1min	39.3min

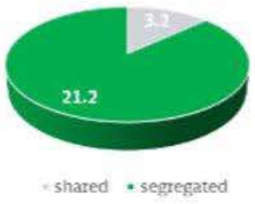


Headway	Weekdays	Weekends
Operating Hours	05:30-23:30	
05:30 – 07:00	10 minutes Single Unit	10 minutes Single Unit
07:00 – 09:00	3 minutes Double Unit	10 minutes Single Unit
09:00 – 15:00	10 minutes Single Unit	10 minutes Single Unit
15:00 – 18:00	3 minutes Double Unit	10 minutes Single Unit
18:00 – 21:30	6 minutes Single Unit	6 minutes Single Unit
21:30 – 23:30	10 minutes Single Unit	10 minutes Single Unit

Infrastructure

- Length: 24.426km
- Number of Crossovers: 8
- Number of Turnback Facilities: 3
- Length of bidi-sections: 22.203
- Minimum Technical Headway: 90s
- GOA: 0/3

Characteristics (in km)



Fleet

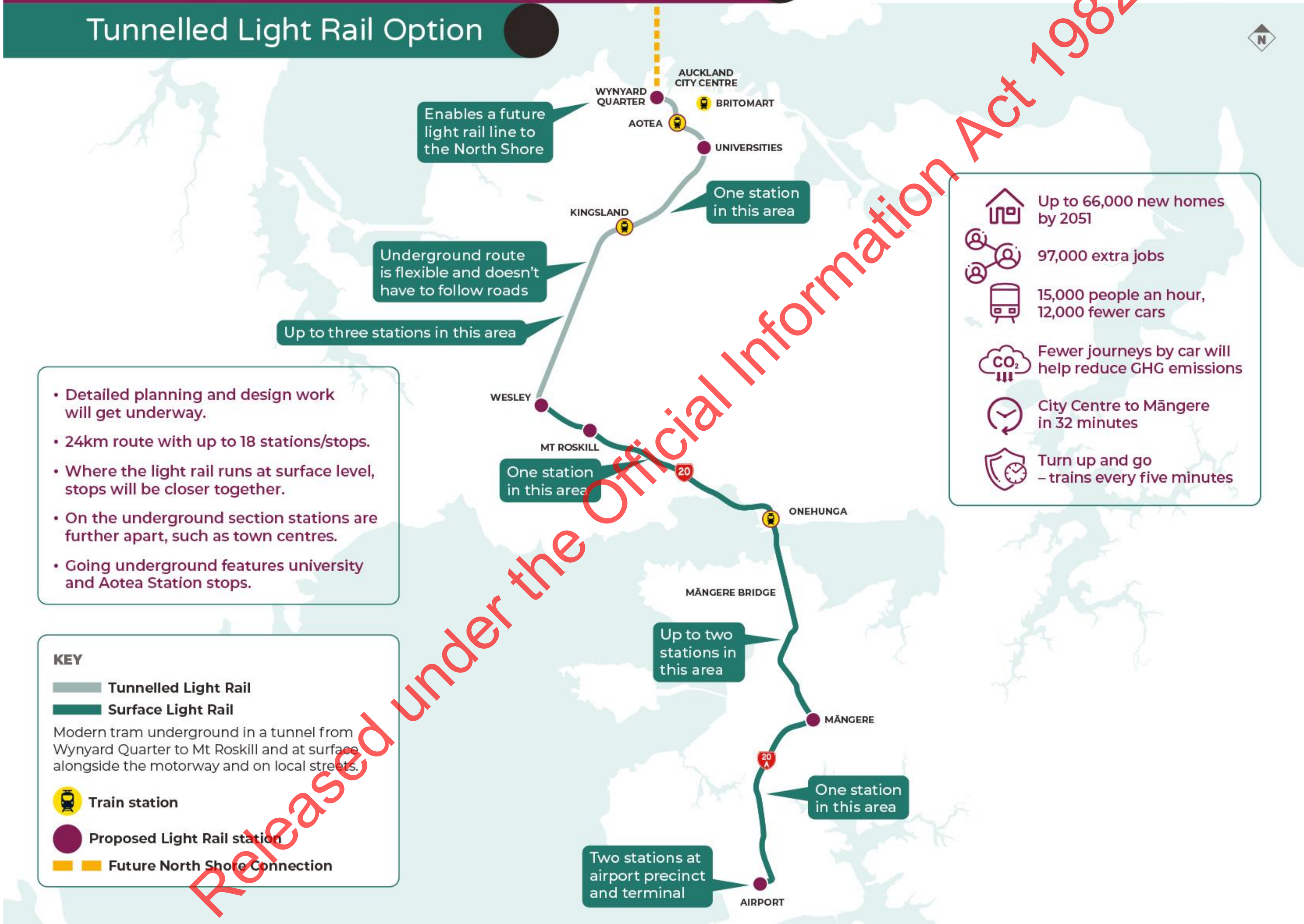
- Length: 33m
- Capacity: 210
- Traction Power: 750VDC
- Starting Tractive Effort: min. 75kN
- Motorised Axles: 100%
- Track Gauge: 1435mm
- Width: min 2650mm
- Height: 3300mm

Fleet Requirement

Auckland LIGHT RAIL Bringing us closer

AUCKLAND LIGHT RAIL

Tunnelled Light Rail Option



- Detailed planning and design work will get underway.
- 24km route with up to 18 stations/stops.
- Where the light rail runs at surface level, stops will be closer together.
- On the underground section stations are further apart, such as town centres.
- Going underground features university and Aotea Station stops.

KEY

- Tunnelled Light Rail
- Surface Light Rail

Modern tram underground in a tunnel from Wynyard Quarter to Mt Roskill and at surface alongside the motorway and on local streets.

- Train station
- Proposed Light Rail station
- Future North Shore Connection

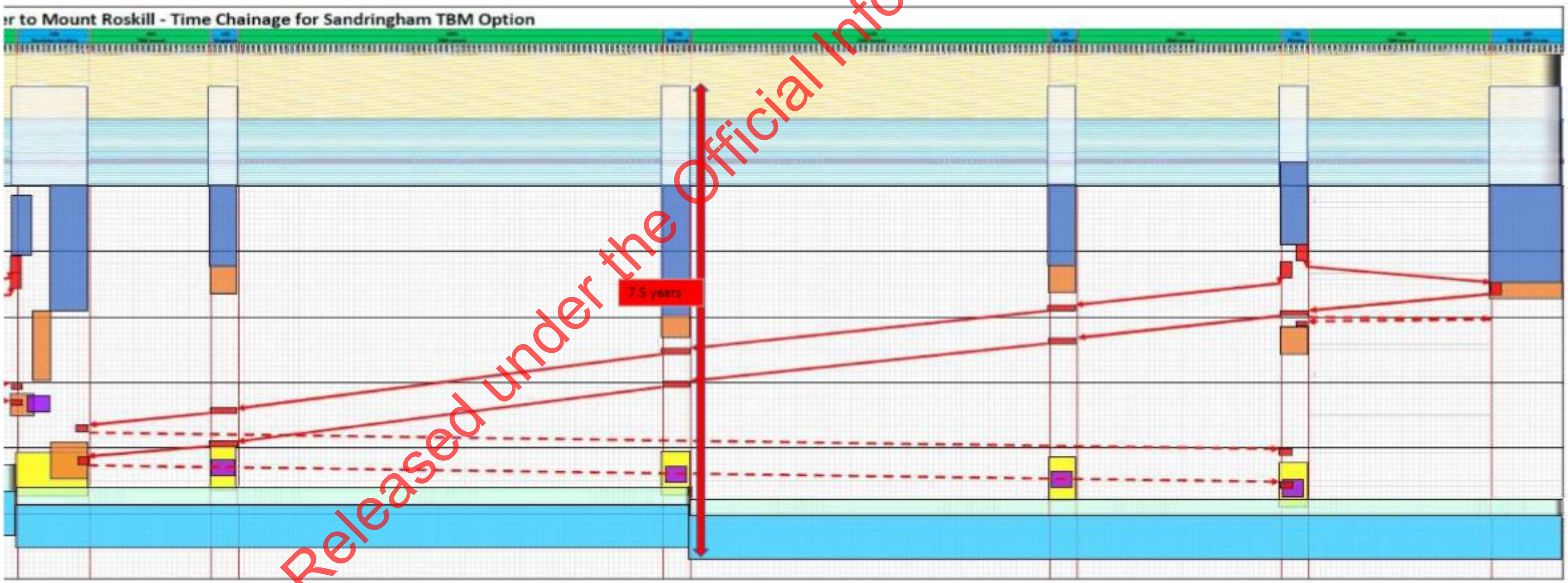
- Up to 66,000 new homes by 2051
- 97,000 extra jobs
- 15,000 people an hour, 12,000 fewer cars
- Fewer journeys by car will help reduce GHG emissions (CO_2)
- City Centre to Māngere in 32 minutes
- Turn up and go – trains every five minutes

Construction timeframe

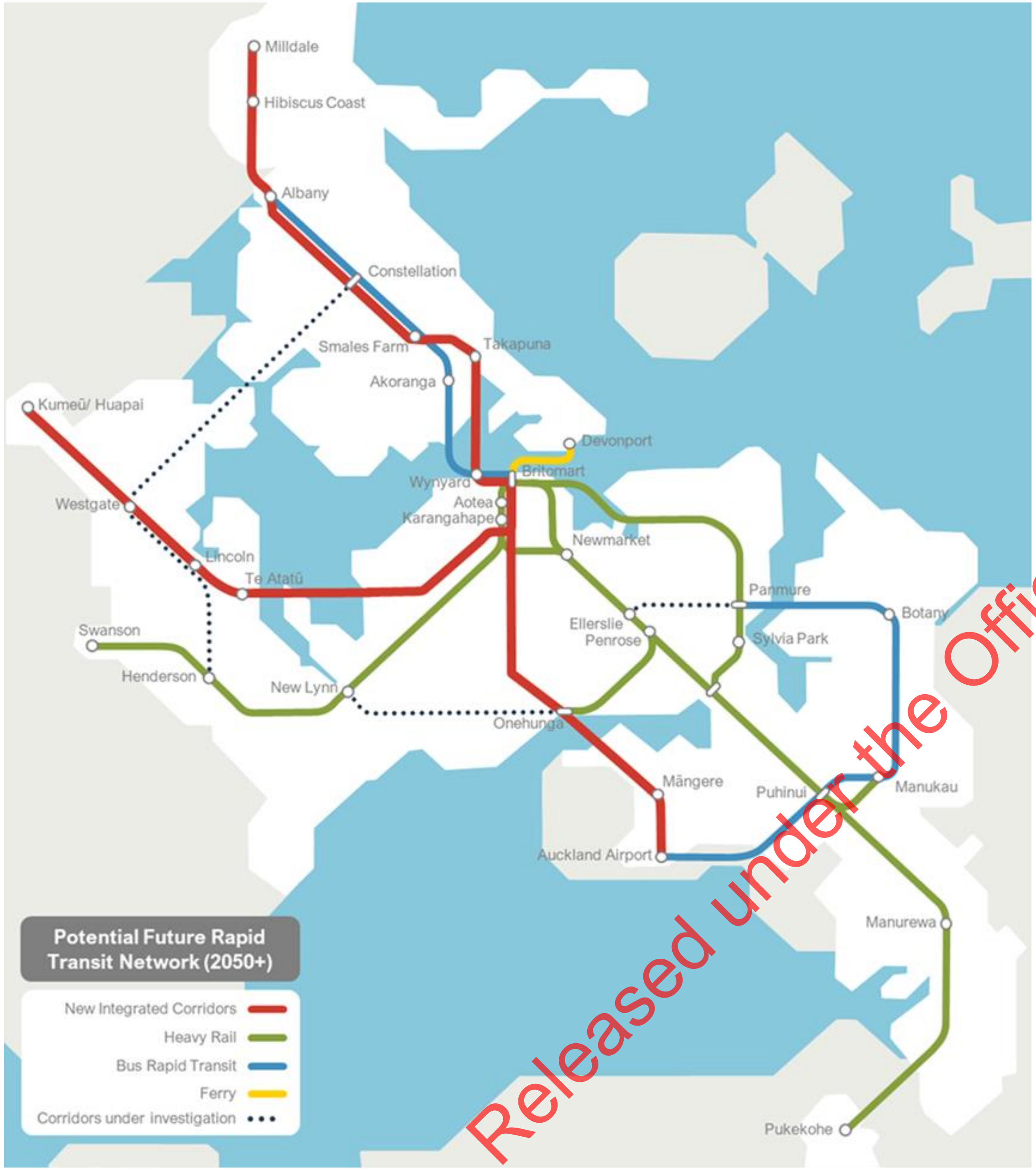
Approximate Construction Duration (Years) - Excludes Consenting Allowance					
	Wynyard to Dominion	Dominion to SH20	SH20 to Onehunga	Onehunga to Airport	Duration
1A Light Rail Sandringham	7.00	9.00	6.25	6.75	9.00
1B Light Rail Dominion	7.00	7.25	6.25	6.75	7.25
2A Light Metro Sandringham	7.00	7.50	6.50	7.00	7.50
2B Light Metro Dominion	7.00	8.00	6.50	7.00	8.00
3 Hybrid (Sandringham)	7.00	7.50	6.25	6.75	7.50

Includes additional 18months over and above standard enabling works period for movement of buried Vector 110kV utility

2A - Dominion to Mt Roskill



Future Rapid Transit Network



- The City Centre to Māngere line will be the backbone of the network; connecting with lines to the North Shore and North-West.
- A tunnel through the city centre better enables a seamless rapid transit connection to the North Shore/North-West.
- Tunnelled light rail has the capacity needed once connections to the North Shore/North-West are created.
- Tunnelled light rail gives flexibility for a new tunnel or bridge across the harbour in the future.
- Government has brought forward planning for an additional Waitematā Harbour crossing. This recognises the key dependencies across the two city-shaping projects to realise our future rapid transit network.

An integrated network lens must inform our thinking

From	To	Travel Times AM Peak			Comparison	
		Integrated TLR	Current PT	Current Car	TLR vs PT	TLR vs car
Mt. Roskill	Takapuna	20	65	23	-45	-3
Albany	Auckland Uni	20	42	24	-22	-4
Mangere	Smales	38	84	30	-46	9
Takapuna	Unitec	16	44	18	-28	-2
Silverdale	Aotea	32	49	33	-17	-1
Takapuna	Aotea	8	26	20	-18	-12

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[redacted]

Transformational for PT

Highly competitive with car – mode shift, emissions reduction

Significantly increases accessibility of places along route – city shaping, increases equity

Mana whenua partnership

- A critical success factor of this project will be achieving positive outcomes for Māori.
- Economic outcomes for growing the Māori economy and environmental outcomes have been identified by Mana Whenua as priority areas, as well as protecting sites of significance and waahi tapu.
- Ongoing Mana Whenua will play an even more active role in decision-making.

Te Rautaki Huanga Māori
Māori Outcomes Strategy

IBC phase

- Rangatira to Rangatira kōrero sets foundation for long term relationship
- Focus on information sharing
- Covid 19 constraints

Themes

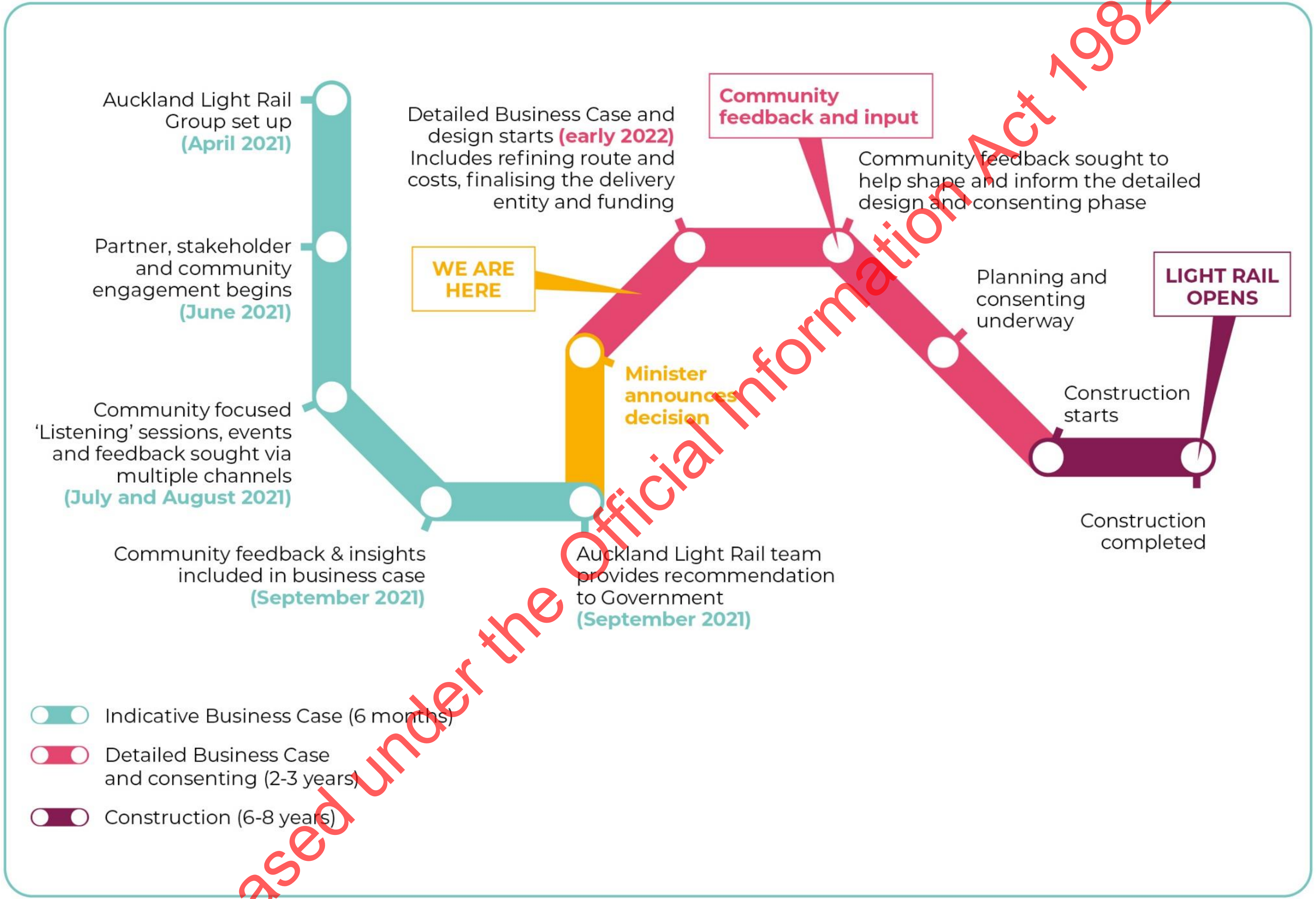
- Mana Whenua representation
- Kaitiakitanga and Treaty Settlements, Manukau Harbour
- Te Ōhanga Māori Growing the Māori Economy and intergenerational wealth
- Investment in Ngā Putanga Māori Māori Outcomes and Engagement
- Displacement through gentrification risk

Infrastructure Industry Challenges

Auckland Light Rail holds the potential to address several existing industry challenges, including:

- Unlocking quality urban form and planning
- Impact of climate change
- Attracting and retaining capability
- Funding and financing
- Technology and Innovation

Next Steps



Auckland Light Rail Group set up (April 2021)
Partner, stakeholder and community engagement begins (June 2021)
Community focused 'Listening' sessions, events and feedback sought via multiple channels (July and August 2021)
Community feedback & insights included in business case (September 2021)
Auckland Light Rail team provides recommendation to Government (September 2021)
Minister announces decision
WE ARE HERE
Detailed Business Case and design starts (early 2022) Includes refining route and costs, finalising the delivery entity and funding
Community feedback and input
Community feedback sought to help shape and inform the detailed design and consenting phase
Planning and consenting underway
Construction starts
LIGHT RAIL OPENS
Construction completed
Indicative Business Case (6 months)
Detailed Business Case and consenting (2-3 years)
Construction (6-8 years)

Mā te wā

www.lightrail.co.nz
info@aucklandlightrail.govt.nz

Auckland LIGHT RAIL
Bringing us closer

Additional Waitematā Harbour Connections Indicative Business Case

Contract 5574

Auckland Light Rail Preconstruction Planning Phase

Contract 6395

Registration of Interest

WAKA KOTAHI NZ TRANSPORT AGENCY

New Zealand Government

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CONTENTS

PART A: COORDINATED PROCUREMENT DETAILS

1 INTRODUCTION

1.1 General

A Registration of Interest (**ROI**) is invited from suitably experienced Applicants interested in being shortlisted as prospective Applicants for:

- the indicative business case (**IBC**) phase for the Additional Waitematā Harbour Connections (**AWHC**) project; and
- the pre-construction planning phase for the Auckland Light Rail (**ALR**), project.

Each project is integral to the development of the wider Auckland Rapid Transit Network, as multiple inter-dependencies and opportunities existing for the sharing of lessons and experience. Each project is seeking similar skills and requirements from the professional services market over a similar timeframe for delivery of their urban, engineering and planning services packages. As such, the AWHC and ALR projects are progressing with a coordinated procurement approach for the urban, engineering and planning professional services packages required for the above project phases.

This ROI is the first stage in a two-stage procurement process. From the ROI submissions, three Applicants for each project will be shortlisted and invited to submit a Proposal for Alliance Services in the second stage (Request for Proposal (**RFP**)). More detailed and specific attribute information will be requested in the second stage and will be required to be submitted with Proposals for the purpose of Proposal evaluation.

Applicants may choose to return ROI submissions for one or both projects, and subject to the evaluation process, successful Applicants could be shortlisted for the second stage for both projects. No one Applicant will be allowed to win both projects or be a Non-Owner Participant (**NOP**) on both projects.

1.2 ROI and Response Form

This ROI provides interested Applicants with details of the two projects and their specific contract strategies.

The information to be provided by Applicants is set out in the Applicant's Response Form, unique to each project (included within Part B for AWHC and Part C for ALR of this ROI) and will be used for evaluating the Applicant's attributes as the basis for selection as shortlisted Applicants. The details and proposed procurement information contained in this document for both projects are preliminary and will be replaced by the documents issued for the second stage.

The information is given in good faith for the guidance of Applicants. No warranty or representation is given as to the accuracy or completeness of such information and Waka Kotahi / Auckland Light Rail Group shall not be liable for any errors or omissions.

Waka Kotahi and Auckland Light Rail Group reserve the right to withdraw from the procurement process (including the ROI) at any time without notice before entering into the Interim Project Alliance Agreement. If Waka Kotahi / Auckland Light Rail Group withdraws from the procurement process, then no Applicant shall have any claim for compensation or otherwise against the Waka Kotahi or Auckland Light Rail Group.

1.3 Timetable

The following is a summary of the key dates in the procurement process. The information and detail contained elsewhere within the ROI documents shall take precedence if there is any ambiguity or conflict with the following table. The timetable is provisional and is therefore subject to change:

Table 1 - Key ROI Dates

KEY ROI DATES		
DESCRIPTION	**DATE**	**DOCUMENT REFERENCE**
Industry Briefing	3pm Wednesday 27 April 2022	Not Applicable
ROI Interactive Meetings	23 - 24 May 2022	Section 2.4
ROI Submission close	4pm Thursday 2 June 2022	Section 2.1
Targeted Shortlisting of Applicants	June 2022	Section 2.8
Targeted Issue of RFP documents	June 2022	Section 3.1
RFP close	August 2022	Not Applicable
Targeted RFP evaluation and preferred Applicants notified	September 2022	Not Applicable

2 ROI AND SHORTLISTING PROCESS

2.1 General

The ROI, and shortlisting, is the first stage in a two-stage procurement process.

Shortlisting does not constitute pre-qualification in terms of the Waka Kotahi *Procurement Manual* (the Procurement Manual). More detailed and specific attribute information will be required from Applicants for the purpose of the second stage of this procurement process.

Three Applicants will be shortlisted for the RFP process for each project.

If consortia are shortlisted for both projects, they can then bid for both in the second stage. However, shortlisted consortia can only win one of the two projects. Individual organisations are only able to be a NOP on one of the two projects.

2.2 Communications During ROI Period

Communications during the ROI period are from date of invitation to submit an ROI to the ROI closing date. All enquiries regarding the ROI must be directed to Waka Kotahi / Auckland Light Rail Group's Nominated Person. Applicants must not directly or indirectly approach any representative of Waka Kotahi / Auckland Light Rail Group, or any other person, to solicit information concerning any aspect of the ROI. Only Waka Kotahi / Auckland Light Rail Group's Nominated Person, and any authorised person of Waka Kotahi / Auckland Light Rail Group, are authorised to communicate with Applicants regarding any aspect of the ROI. Waka Kotahi / Auckland Light Rail will not be bound by any statement made by any other person.

When the Applicant receives the ROI documents, they shall notify the Waka Kotahi / Auckland Light Rail Group's Nominated Person in Section 2.2 of the name and contact details of the person within their own organisation with whom they will direct all communications during the tender period (the Applicant's Nominated Person).

All communications between the Waka Kotahi / Auckland Light Rail Group's Nominated Person and Applicants must be in writing. For the purposes of this ROI, this includes e-mail communication, which may include attachments.

Communications must be clearly labelled with the Waka Kotahi / Auckland Light Rail assigned contract number and name. Communications not so addressed may be delayed and/or not actioned. All Applicant's queries shall be addressed to:

For the Attention of:	Idris Jones
Contract Number:	5574 AWHC, 6395 ALR
Contract Name:	Additional Waitematā Harbour Connections Indicative Business Case and Auckland Light Rail Preconstruction Planning Phase
Email:	idris.jones@nzta.govt.nz

Applicant's enquiries shall be raised with the Waka Kotahi / Auckland Light Rail Group's Nominated Person as soon as possible, but not later than five (5) working days, before the ROI closing date. Waka Kotahi / Auckland Light Rail Group will endeavour to respond to all queries within 48 hours of receiving them.

It is the Applicant's responsibility to ensure that the Waka Kotahi / Auckland Light Rail Group's Nominated Person has received any enquiry that they have raised.

Where Waka Kotahi/Auckland Light Rail Group considers it necessary and/or appropriate, the answers to any questions will be made in writing, by way of Notice to Applicants, to all who have uplifted the ROI. All Applicants shall acknowledge receipt of each Notice to Applicants by emailing or returning the associated Acknowledgement Receipt to the Waka Kotahi / Auckland Light Rail Group's Nominated Person and also confirm receipt of each Notice to Applicants in their ROI submission.

2.3 Conflict of Interest, Risk of Bias or Collusion

Applicants are required to declare, at the commencement of the ROI process, as soon as practicable after uplifting the ROI documents, or as they become aware of them, any actual or potential conflicts of interest or risk of bias during the ROI procurement process, relating to any individual or company involved in the Applicant's bid. This includes individuals and companies engaged in any subconsultant, subcontractor or other supply arrangement. The Applicant must advise Waka Kotahi / Auckland Light Rail Group of the means that they intend to use to remove or mitigate such conflicts of interest or risk of bias.

Applicants are required to declare any conflicts of interest and submit them with their ROI response.

Applicants are required to warrant that their ROI response has not been prepared with any consultation, communication, contract, arrangement or understanding with any competitor, other than where:

- Joint venture arrangements exist between the Applicant and a competitor;
- The Applicant has communicated with a competitor for the purpose of subcontracting a portion of the application, and where the communication with the competitor is limited to the information required to facilitate that particular subcontract; and/or
- The Applicant and a competitor have an agreement that has been authorised by the Commerce Commission.

Any Applicant that is uncertain as to what would be considered by Waka Kotahi to be collusive or anti-competitive behaviour is encouraged to proactively discuss potential or perceived collusive behaviour with the nominated Probity Auditor, Commerce Commission and/or Waka Kotahi, in advance to preparing their submission. In such circumstances the Applicant may be required to disclose to Waka Kotahi the name of the competitor and the extent of any arrangements or agreements with them.

In the event that no such disclosure is made, the Applicant warrants that their submission has not been prepared with any consultation, communication, contact, arrangement or understanding with any competitor.

Waka Kotahi / Auckland Light Rail reserves the right, at its discretion, to report suspected collusive or anti-competitive conduct by Applicants to the Probity Auditor and/or other appropriate authority(s), and to provide them with any relevant information, including their response.

Similarly, Waka Kotahi / Auckland Light Rail Group may refer any actual or potential conflicts of interest or any risk of bias that it becomes aware of, to the Probity Auditor, and decide the appropriate action to remove or mitigate any potential conflicts of interest or risk of bias.

Waka Kotahi/Auckland Light Rail Group reserve the right to decline an application of an Applicant that:

- Has been found to contravene any warranty provided in the application; and / or
- Cannot satisfactorily remove or mitigate a conflict of interest or risk of bias that, in the opinion of Waka Kotahi / Auckland Light Rail Group, creates an unfair advantage or impropriety in the Proposal process.

2.4 ROI Interactives

An interactive tendering process will be adopted for these contracts. The aim of the process is to resolve issues relating to the ROI preparation and submission to ensure each Applicant's submission, meets all the requirements of Waka Kotahi / Auckland Light Rail Group. The meetings will be confidential and non-contractual.

The interactive meetings shall be held at Waka Kotahi's Auckland offices (Aon Centre) with the opportunity for Applicant participation in person or remotely via MS Teams. One (1) hour will be set aside for each meeting per project. The interactive meetings will be chaired by the Applicant. Technical and commercial advisers may be called on to attend part of the interactive meetings on an 'as-required' basis.

Applicants shall register their interest in attending an interactive meeting by emailing the Waka Kotahi / Auckland Light Rail Group's Nominated Person in Section 2.2 no later than **4:00PM on Tuesday 17 May 2022.** Applicants must indicate if they are intending to submit for one or both projects in this communication to allow confirmation of timing and other technical and commercial advisor attendance.

Applicants shall submit to Waka Kotahi / Auckland Light Rail Group their proposed agenda including key pertinent questions to support the discussion at least two Working Days in advance of the interactive meeting. The agenda should state which of Waka Kotahi / Auckland Light Rail Group's technical advisers are required to attend. This requirement is to allow structured and meaningful meetings to take place.

2.5 ROI Response Form

Applicants are asked to provide the information requested in the ROI Response Form in a clear and concise a manner, and in the format specified. Where limits on the extent of individual responses are stated in the Response Form, the portion of any response in excess of the limit will be disregarded. For details of the Response Form, and page limits refer to the appendices in Parts B and C.

The attribute evaluation scores will be used solely for the purposes of shortlisting Applicants and the successful Applicants will be required to resubmit Relevant Skills attribute information at the time of Proposal, which will be re-assessed for the purposes of Proposal evaluation.

Applicants who wish to register their interest, must electronically submit one copy of the completed Applicant's Response Form(s) and related supporting information not later than **4:00PM on Thursday 2 June 2022.**

AWHC submission files must be labelled '5574 - Additional Waitematā Harbour Connections Indicative Business Case - Registration of Interest'. ALR submission files must be labelled '6395 - Auckland Light Rail Preconstruction Planning Phase - Registration of Interest'.

Submissions must be uploaded to the GETS eTender box. The file upload limit is 50MB. Applicants should refer to the GETS website for instructions on uploading their submission files (https://www.gets.govt.nz/SupplierUserTenderHelp.htm).

2.6 ROI Evaluation Team

The Evaluation Team (**ET**), formed to evaluate the ROI, will comprise the following:

Table 2 - Evaluation Team

EVALUATION TEAM (ET)	
Martin Leak	Chair, Resolve Group Ltd (Qualified)
Tony Innes	Evaluator, Commute Transportation Consultants
Claire Stewart	Evaluator, AcqDiv
Rebekah Pokura-Ward	Evaluator, Waka Kotahi
Craig Turner	Evaluator, Waka Kotahi (Qualified)

Applicants will be notified in writing of any changes to the ET.

Applicants who believe there is an actual or potential conflict of interest or risk of bias with a member of the ET may write to the Probity Auditor, outlining their concerns so that the appropriate action can be taken.

2.7 ROI Evaluation

Applicants shall provide information on the non-price attributes listed below.

Sufficient relevant information shall be provided for each attribute in relation to the Applicants to allow the ET to mark the attribute for each party as provided for in the table below.

Table 3 - Non-Price Attributes

NON-PRICE ATTRIBUTES	
ATTRIBUTE	**OVERALL ATTRIBUTE WEIGHTING %**
Relevant Experience	35
Track Record	25
Relevant Skills	40

ET members will read the Applicants' responses and evaluate and grade the non-price attributes using the Applicant marking sheets in this ROI document.

The ET members will individually evaluate and grade the non-price attributes provided by the Applicant. For the evaluation they will take into account:

a) Records of contracts held by Waka Kotahi, Auckland Transport, Auckland Council and Kainga Ora that the Applicant has completed;

b) Their personal knowledge of any of the Applicant's experience;

c) Information from referees of other organisations the Applicant has worked for.

The ET will meet to agree each Applicant's non-price attribute scores and overall grade. The ET will evaluate the Applicants based on a direct comparison of each submission and rank each Applicant in order based on the markings gained in the evaluation. If the ET cannot reach a consensus, the ET Chair will consider the teams' attribute scores and decide the final attribute score.

Where the Applicant does not meet the minimum standard required of these ROI documents or a grade of 65 or less is awarded for any non-price attribute, the Applicant will be deemed to be a non-conforming Applicant and no further evaluation will take place.

The three highest overall scoring Applicants will be shortlisted and invited to submit a Proposal for Alliance Services.

If consortia are shortlisted for both projects, they can then bid for both in the second stage. However, shortlisted consortia can only win one of the two projects. Individual organisations are only able to be a NOP on one of the two projects.

2.8 ROI Applicant Shortlisting

On completion of the evaluation Applicants will be advised only whether or not they have been shortlisted, with no other evaluation information being given.

In the event that one or more of the shortlisted Applicants withdraws from the process, leaving less than three remaining, Waka Kotahi / Auckland Light Rail Group reserves the right to invite the next highest ranked Applicant to submit a Proposal, provided that this does not result in more than three invited Applicants proceeding through the Proposal process for each project.

If a shortlisted Applicant submits a Proposal for both projects, they may be shortlisted for both projects, subject to scoring.

2.9 ROI Interviews

Interviews may be held during the evaluation period with individual Applicants should any further clarification be required regarding the Applicant's submission.

3 OVERVIEW OF STAGE TWO TENDER PROCESS

3.1 Introduction

The shortlisted Applicants will be invited to submit a Proposal for the selected project. It is anticipated that the RFP documents will be issued during June 2022.

The RFP documents for the projects will be based on Waka Kotahi pro-forma documents.

The interactive Proposal period will be 8 weeks.

All Proposal costs are to be borne by the respective Applicants.

3.2 Changes to the Applicant's Team

Shortlisted Applicants should not change their team from that nominated in the Applicant's ROI Response Form. Waka Kotahi / Auckland Light Rail Group may allow the use of a different team if the Applicant can demonstrate sound reason for the change and can offer an equal or better alternative, and the change is approved in writing by Waka Kotahi / Auckland Light Rail Group.

3.3 Quality Assurance

The Applicant is expected to have systems certified to international quality standards (ISO 9001) and the Applicant must have a project specific Quality Management Plan that covers quality assurance and control minimum requirements as defined in Z/1 - *Waka Kotahi Minimum Standard for Quality Management Plans*.

3.4 Health and Safety

The Applicant must implement processes that meet the requirements of the *Health and Safety at Work Act 2015*, its regulations, supporting codes of practices and any guidance material that represents industry good practice.

The Applicant must also comply with all health and safety requirements of Waka Kotahi. Meeting these requirements will not relieve the contractor of any of its responsibilities to comply with the Health and Safety at Work Act 2015.

3.5 Interactive Tender Process

During the RFP period, meetings will take place between Waka Kotahi, Auckland Light Rail Group, the ET, and individual Applicants. The details of the interactive process will be communicated with shortlisted Applicants as part of the RFP documentation.

3.6 Evaluation Team

The RFP ET will be advised to Applicants in the RFP documents, however, is expected to be consistent with the ROI ET if possible.

3.7 Evaluation and Contract Award

The details for the evaluation of Proposals will be set out in the RFP documents and will be based on the Waka Kotahi *Contracts Procedures Manual*.

3.8 Probity

An independent probity auditor has been appointed to overview the tendering process and to verify that the procedures set out in the ROI documents and the RFP documents are complied with. The probity auditor is not a member of the ET. An Applicant concerned about any procedural issue has the right to contact the Probity Auditor and request their review. The outcome will be documented with copies to both the Applicant who raised the issue and to Waka Kotahi. The name and contact details of the Probity Auditor are as follows:

Shaun McHale
Managing Director, Team Leader, Probity Assurance Services
McHale Group Ltd
Level 1, Featherston Street
PO Box 25103
WELLINGTON 6146

Office: +64 (0) 04 496 5580
Mobile: +64 (0) 27 486 3412
Email: shaun.mchale@mchalegroup.co.nz

PART A - COORDINATED
PART B - AWHC
PART C- ALR

4 GLOSSARY

Terms used in this ROI are described below:

ALLIANCE SERVICES	The services to be delivered under the Alliance Agreement.
EVALUATION TEAM (ET)	The team appointed by Waka Kotahi / Auckland Light Rail Group who will evaluate the ROI responses and select the shortlisted Applicants.
INTERIM PROJECT ALLIANCE AGREEMENT (IPAA)	The interim Alliance agreement entered into by Waka Kotahi / Auckland Light Rail Group and the preferred Applicants to deliver the Interim Alliance Services.
MANA WHENUA	Hapu and Iwi which have ancestral relationships to certain areas of Tāmaki Makaurau where they exercise customary authority.
PROJECT ALLIANCE AGREEMENT (PAA)	The Alliance agreement entered into by Waka Kotahi / Auckland Light Rail Group and the preferred Applicants to deliver the Alliance Services.
PROPOSAL	The submission by shortlisted Applicants in response to the RFP.
REGISTRATION OF INTEREST (ROI)	This document, used to identify suppliers interested in, and capable of, delivering the required Alliance Services.
REQUEST FOR PROPOSAL (RFP)	The document prepared by Waka Kotahi and Auckland Light Rail Group, which contains the information on which shortlisted Applicants base their Proposal.
STATUTORY APPROVALS	Includes, but is not limited to, resource consents, permits, authorities and designations under the Building Act 1991, Resource Management Act 1991, Heritage New Zealand Pouhere Taonga Act 2014, the Wildlife Act 1953, National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health 2011, and other relevant legislation.

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PART B: ADDITIONAL WAITEMATĀ HARBOUR CONNECTIONS

1 PROJECT DESCRIPTION

1.1 Key Deliverables Required

This procurement process is seeking to select the core NOPs for the Additional Waitematā Harbour Connections Alliance (**AWHCA**). The NOPs will provide a team to supplement the capability and capacity of the project team (Waka Kotahi NZ Transport Agency, Auckland Transport and Auckland Council) to produce the following key deliverable:

> *Indicative Business Case (IBC)*: The IBC will articulate the case for investment in a range of interventions over time to improve multi-modal connections across the Waitematā Harbour. It will take account of city-wide conditions across a number of other programmes and projects. It will follow the Treasury business case approach to reach a preferred option and programme, as well as enable a decision by funders as to whether to proceed to the next stage.

1.2 Project Background

In late 2020 the Additional Waitematā Harbour Connections Business Case (effectively a Programme Business Case) was completed and endorsed by Auckland Transport, Auckland Council and Waka Kotahi. The outcomes this business case recommended for further development were:

- Detailed Business Case (**DBC**) for Busway Improvements: Development of the exact form of busway enhancements for early implementation.
- Strategic Transport Networks Single-Stage Business Case (**SSBC**) for:
  - An additional rapid transit connection across the Waitematā Harbour (Phase 1): This phase will confirm the form (including mode) and alignment of the new cross harbour rapid transit connection.
  - Strategic transport networks (road and rapid transit) (Phase 2): This phase confirms the form, function and timing of rapid transit improvements on the north shore, the form, function and timing of future road improvements and how road and rapid transit investments would interact.
  - Future proofing and route protection (Phase 3): This phase will seek to route protect the land needed from Phases 1 & 2.

The DBC for Busway Improvements has been completed by Auckland Transport and funding for implementation is being sought.

The scope of the AWHC IBC is therefore for the Strategic Transport Networks component of a larger programme of work, as outlined above, but also including several new elements relating to active modes, demand management, independencies with the ALR and City Rail Link projects, and land use planning.

Whilst the 2020 business case concluded that the next step should be a SSBC, the AWHC project board recently agreed it would be more appropriate to firstly undertake an IBC, given the scale and complexity of the potential interventions. The IBC will then inform the scope of subsequent DBCs (there is potential for several mode-specific DBCs to be required, depending on the preferred way forward).

The diagram below shows the hierarchy of documents for this business case:

Figure 1 – Hierarchy of documents

Relevant changes have occurred since the previous business case that will need to be considered in the early part of this IBC. These include (but are not limited to):

- Central and local government policy direction, particularly relating to emissions reductions;
- Growth assumptions, particularly in relation to the National Policy Statement on Urban Development and the medium density residential standard;
- Key assumptions about the wider transport network (e.g., Auckland Light Rail, long term Northern Pathway requirement, Access for Everyone, Te Tupu Ngātahi - Supporting Growth networks, etc.) and key broader transport initiatives (e.g., congestion pricing, etc.); and
- Any medium- and longer-term impacts of Covid-19 on growth and travel patterns.

As previously noted, the AWHC project contributes to the planning and development of Auckland's wider Rapid Transit Network (**RTN**) and has a key interface and interdependencies with the ALR project. The problem statements and investment objectives of the two projects (from the ALR IBC and 2020 AWHC Business Case) are similar, and many decisions made on the ALR project (e.g., operating requirements, Wynyard Quarter portal location) will have a direct impact on the AWHC project. Additionally, there is an opportunity for key lessons and experiences from the ALR IBC phase to be leveraged for the benefit of the AWHC IBC.

1.3 Objectives of the Alliance Services

Although the AWHC governance and project teams are made up of Waka Kotahi, Auckland Transport, and Auckland Council representatives, for the purposes of this commission, Waka Kotahi is the Owner Participant (OP). The objectives of the Alliance Services are to:

1. provide a recommended way forward in addressing the problems identified in the AWHC Strategic Case (which will be updated);
2. ensure close partnership with Mana Whenua, Waka Kotahi, Auckland Council, and Auckland Transport;
3. continually consult with the wider community in developing a recommended way forward and build a strong social licence; and
4. answer all the questions (even new questions which arise through this work), to the right quality, to give confidence to future funders that project risks have a plan to be mitigated.

A finalised and endorsed IBC is needed to allow funders to make an informed decision on the next steps in 2023. To achieve this programme, work needs to begin as soon as possible, and activities and workstreams will need to be undertaken in parallel. Following the IBC, the next stage will be DBC(s), with the partners looking for a quick transition into this phase, subject to performance of the Alliance NOP(s).

2 PROGRAMME MANAGEMENT & GOVERNANCE

2.1 Alliance Structure

As noted above, although the AWHC governance and project teams are made up of Waka Kotahi, Auckland Transport and Auckland Council representatives, for the purposes of this commission, Waka Kotahi is the OP.

The delivery of this Indicative Business Case will be through a Project Alliance Agreement (**PAA**). The PAA will be developed though an Interim Alliance Agreement (**IPAA**). The PAA will begin as agreed with the Project Alliance Board (**PAB**).

The IPAA is intended to promote a collaborative environment in which the following will be achieved:

- the participants will prepare and submit to Waka Kotahi a fully developed Proposal which represents a whole-of-life, value-for-money solution to the commercial, technical and environmental requirements of Waka Kotahi, and demonstrates certainty of achieving these outcomes; and
- to the maximum extent practicable, by the end of the procurement process, a fully functional Alliance structure exhibiting high performing team characteristics will have been established so that performance of the Alliance Services will be able to commence immediately upon signing of the Alliance Agreement.

2.2 Choice of Engagement Model

There are some key considerations that have informed the selection of the Alliance contract model:

- *Challenging Programme*: A finalised and endorsed IBC is needed to allow funders to make an informed decision on the next steps in 2023. To achieve this programme, work needs to begin as soon as possible, and activities and workstreams will need to be undertaken in parallel.
- *Complexities*: The project is at an early stage of development, and while the macro-scope of the services is well understood, there remains significant opportunity to innovate and provide flexibility to meet and overcome the complexities and challenges of the project within the timeframes.
- *Scale*: The IBC will be of a significant scale across transport planning, engineering and planning and consenting, the outcome of which could be multiple DBCs at the next stage.

To respond to these considerations, an Alliance has been selected as the preferred contract model.

The Alliance model is expected to deliver the following key benefits:

- The shared risk / reward model manages interface risks and drives best for project decision making.
- It supports flexibility and innovation, providing the best platform to achieve the objectives within the timeframe.
- It drives collaboration with the project team, the NOP(s), sponsors and partners, incentivising delivery of broader non-cost outcomes.
- Its transparent open book model and performance framework allows demonstration of value for money.
- It allows partners to be embedded into the team and have appropriate control and direction over critical decisions through the working together phase and into delivery.

Waka Kotahi is seeking to form an Alliance based on resources for a best for project outcome. The growing existing project team (with Waka Kotahi, Auckland Transport and Auckland Council representatives) will be supplemented by supplier resources within the Alliance. This will ensure that knowledge and experience developed through the work done to date is carried through.

Some key AWHCA leadership roles will be staffed by the existing project team resources, and the team will also be looking to staff other roles throughout the agreed Alliance structure.

2.3 Alliance Structure

The AWHC Alliance will be responsible for delivery of the project as described in Section 1. The OP will be Waka Kotahi. This procurement is focused on selecting the core NOPs to form the AWHCA.

It is anticipated that the core AWHCA NOPs will come from organisations providing the transport planning, engineering and planning services which will make up the bulk of the services required by the project. Therefore, this procurement process is focused on selecting the transport planning, engineering and planning services NOPs (the NOPs).

There are a number of ancillary “other services” that will be required to deliver the full scope, which will be procured through other processes (to be determined). Once selected, the AWHCA and the NOPs will work together to agree the appropriate commercial arrangements with respect to the other services. Those arrangements could include the other services being provided by one of the NOPs, traditional sub-contracts, sub-Alliances or inclusion of additional NOPs as appropriate.

This approach allows the focus of this procurement to be on selecting the core NOPs. It reduces the need for extended teaming arrangements and agreements though this initial tender period and allows the best suppliers of other services to be selected on a best for project basis rather than pre-existing teaming arrangements.

Note that the AWHC team procured through this process will be separate from the ALR team. However, integrated ways of working will be essential to this at governance, operational and technical levels. Suggestions are welcome on this in the RFP, noting the client expectation for joint modelling scenarios, land-use assumptions and shared technical forums.

Figure 2 sets out the proposed high-level structure of the programme and Alliance governance arrangements and is still under development.

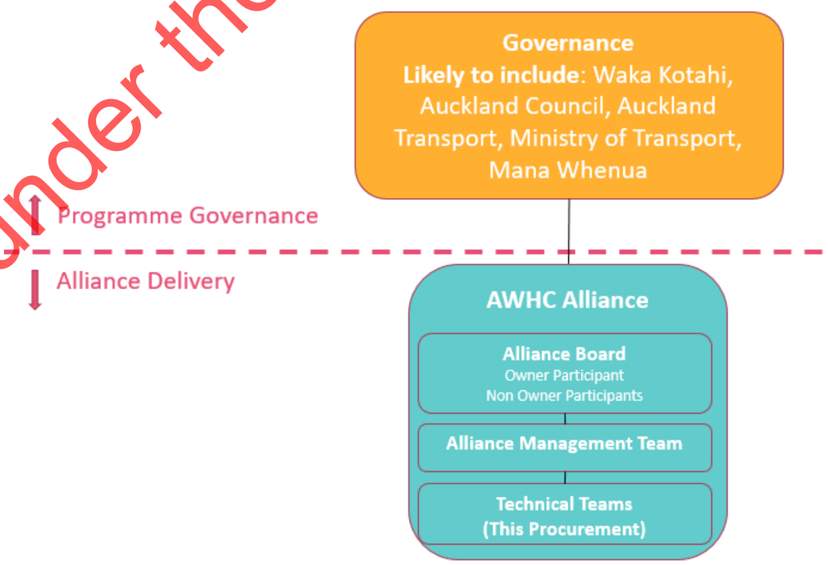


Figure 2 – Indicative Programme and Alliance Governance

2.4 Indicative Critical Success Factors

The final critical success factors will be developed alongside Waka Kotahi, Auckland Transport, and Auckland Council representatives as well as the NOP(s) during the IPAA phase. The final critical success factors are likely to be similar to the indicative critical success factors below:

- Deliver an endorsed business case to determine the final need, function, form and timing of the AWHC, with a focus on:
  - Partner alignment, including Mana Whenua input and endorsement
  - Social licence
  - Sustainable urban form
  - Innovation across all aspects of the project
  - Supporting broader outcomes such as:
    - Carbon emission reductions
    - Procurement and workforce – more diverse workforce and legacy for the industry
    - Network and system resilience, including freight considerations
  - Affordability and funding confidence
  - High performing Alliance culture

3 ALLIANCE SCOPE

The Alliance scope has been developed in partnership with Waka Kotahi, Auckland Transport, and Auckland Council.

3.1 Key Services

The key Alliance Services required from this procurement are summarised in the table below. It is important that these workstreams consider each other and are not "siloed".

Workstream/ Service	Description
Programme Wide Activities	• Develop a single IBC for the entire programme of works (active modes, rapid transit, road and supporting measures (e.g., land use development, urban interventions)). • Ensure the business case is focused on the transport system that supports Auckland's urban growth and considers opportunities for urban development. This will entail close working with Auckland Council and partner organisations. • Update the Strategic Case, including the Case for Change and outcomes sought, given latest policy changes and critical project decisions that impact the programme. • Work with Auckland Council and the Auckland Forecasting Centre to confirm land use forecasts with and without this programme, including a range of scenarios. • Establish the demand (and performance) forecasts for the entire transport system (including demand management, notably The Congestion Question workstream). • Support the Auckland Forecasting Centre when undertaking this modelling. • Interface with other projects / programmes in the region. • Undertake extensive engagement with partners, stakeholders and the community to obtain social licence and understand views on developing interventions. • Support a partnership approach with Mana Whenua. • Understand the environmental and consenting risks of the individual elements of the programme as well as the cumulative programme risks. • Undertake an assessment of embodied and enabled greenhouse gas emissions, and climate change adaptation requirements of each programme element. Confirm long term strategy and available use (including limitations) for the existing Auckland Harbour Bridge structure and utilities that make use of it currently. • Establish the optimal staging of individual elements of the programme, how the programme should be delivered and what the triggers for different elements are. • Deliver on the project broader outcome priorities.

PART A - COORDINATED
PART B - AWHC
PART C- ALR

Workstream/ Service	Description
Active Modes	• Confirm the long-term approach (including alignment and form) for active modes across the harbour and how this approach interfaces with the other elements of the programme and the wider transport network.
Enhanced busway	• Interface the ongoing enhancement of the performance and capacity of the Northern Busway with this project from a timing and demand perspective.
Rapid Transit	• Confirm the additional rapid transit mode, preferred alignment (including the location of stations), timing and impacts on wider transport system (during and post implementation), noting this is to the IBC-level. • Establish key operational considerations (e.g., rolling stock, depots, vehicle length etc.) of the rapid transit solution. • Confirm the preferred form (tunnel or bridge) of the cross-harbour connection. • Confirm urban development opportunities within the RTN catchment and consider what interventions (non-transport) are required to achieve these to ensure the communities develop as envisaged. • Confirm the interface with other Auckland rapid transit corridors and in particular the ALR and Northwest Rapid Transit projects, including capacity, services and timing of implementation. • Assess the pros and cons of delivery options, in conjunction with ALR investigations (i.e., utilising the ALR approach, versus a different model). • Confirm the interface with the wider transport network. • Establish the interface with other elements of the programme.
Roading Investigations	• Confirm the need for, alignment, function and timing of this element of the programme, including any required wider network changes (during and post implementation). • Establish the required mitigation for climate change resilience (sea level rise). • Establish an operational strategy to maximise benefits and minimise impacts (e.g., a managed lane strategy to ensure the freight network receives benefits and impacts from increases in the wider vehicle fleet are avoided). • Confirm the preferred form (tunnel or bridge) of the cross harbour connection. • Confirm the ongoing role and management of the existing Auckland Harbour Bridge (for all modes and heavy vehicles in particular). • Confirm the interface with the wider transport network. • Establish the interface with the other elements of the programme.

3.2 Other Services

The services set out in the table below are important inputs to the delivery of the project but are not part of this procurement. The successful Applicant teams will need to work with those providing these services, integrating their inputs onto deliverables, or providing outputs to support other workstreams.

As described in Section 2, once selected, Waka Kotahi, Auckland Transport, Auckland Council and the NOPs will work together to agree the appropriate commercial arrangements with respect to the other services. Those arrangements could include the services being provided by one of the NOPs, traditional sub-contracts, sub-Alliances or inclusion of additional NOPs as appropriate.

Workstream/Service	Description
Communications and Engagement	• The Communications and Engagement Lead will be supplied by the owner team from within Waka Kotahi. • Short-term communications and engagement resources are in the process of being procured for an early works package at present to support the project. • The NOPs will be required to support the process as needed.
RMA Legal	• Inputs to the development of the Statutory Approvals Strategy and recommended approvals pathway. • Review and advice related to the development of objectives and options assessment process. • Consenting risk management.
General Legal	• General and commercial legal advice.
Property Legal	• Legal services associated with acquisition of property and other related property matters.
Property	• Management and co-ordination of property acquisition. • Property negotiations with affected landowners. • Statutory property acquisition processes. • Valuations.
Funding & Financial Services	• Advice on financing models and value capture. • Development of financial models. • Support the NOPs with the writing of the Economic Case, Commercial Case, Financial Case, and Management Case. • Risk assurance to give funders confidence risks are being managed.
Peer Review	• Waka Kotahi will obtain an independent peer review of the draft and final IBC.

4 PART B APPENDICES

APPENDIX REFERENCE	SUBJECT
A	ROI Applicant Response Form
B	ROI Evaluation Marking Sheets

Appendix A – ROI Applicant Response Form

The Applicant's response must include answers to all the questions contained in this Response Form.

The response must not exceed **12** single sided A4 pages ordinary type (12 point Times Roman or similar typeface). Typeface requirements applicable to all text, tables and diagrams and additional pages. A3 size paper shall be deemed to be two A4 pages and shall be numbered accordingly.

For joint ventures and consortia, the number of projects to be submitted in Relevant Experience and Track Record Response Forms shall apply to the joint venture and/or consortia and not separately to the individual companies making up same, the parties must decide how many each member nominates.

Applicants shall number the pages. For submissions that exceed the page limit, only the first **12** pages, excluding the additional pages provided for below, will be considered during this evaluation.

Additional pages may be included as follows:

- Title Page (**one** page)
- Covering letter (**one** page)
- Index (**one** page)
- Applicant Declaration
- Final PACE (or equivalent) evaluation forms for nominated Track Record projects (**one** page per project)
- CVs (**two** pages for each person nominated in the submission)

Applicants must upload **one (1)** electronic pdf file of their completed Response Form together with supporting information as required.

For the avoidance of doubt, if an Applicant wants to be considered for both projects, then they will need to submit a completed Response Form from Part B and Part C. If submitting a response for both projects, where applicable, Applicants may nominate the same individuals for Relevant Skills, and the same projects for Relevant Experience.

PART A: RELEVANT EXPERIENCE

The following information should be provided for **three** multi-modal infrastructure business cases and/ or projects completed within the last five years, which the Applicant considers most relevant to this project.

All projects must be the same as nominated for Track Record.

Should nominations be less than the required number of projects this will be taken as a deficiency in the attributes for Relevant Experience and Track Record and will be scored accordingly. Where more than the required number of projects are submitted, only the first **three** nominated projects for Relevant Experience and Track Record will be considered.

Applicants shall provide the following details for each **project** nominated for Relevant Experience:

- Project name, location, contract value (scale: the value of the work carried out, or the value of the work completed so far if still incomplete) and when the project was completed (currency: when the work was carried out, or the % completed so far if still incomplete); and
- Primary and secondary Client's Representative names, company and contact telephone numbers.

A separate table must be included for each **factor.** Each table shall include the following information:

- A description of the work carried out; and
- How this demonstrates the Applicant's experience in delivering the required factors below; and
- The relevance of the nominated project to this submission.

It is expected that a nominated project may demonstrate an Applicant's experience against more than one of the following factors. There is a minimum requirement that Applicants demonstrate Relevant Experience and Track Record against each of the factors (minimum one contributing project).

RELEVANCE:

Provide details of your Relevant Experience relating to the following **factors** from your nominated projects. For each **factor** provide detail of the % value of work carried out by the Applicant's own directly employed labour and resources, and that undertaken by any subconsultants.

- Successful delivery of a business case for a complex international multi-modal (active modes, rapid transit, motorway) transport infrastructure (long span bridges, tunnels, supporting urban growth) project in a significant urban and ecological environment.
- Successful partnership building between complex organisations (Mana Whenua, Waka Kotahi, Auckland Council, Auckland Transport).
- Successful delivery of infrastructure in a New Zealand context (Treaty of Waitangi, Resource Management Act, Auckland Plan, State Highway).

Factor	Requirements
Complex multi-disciplinary infrastructure	Applicant should demonstrate experience and ability undertaking high-level design development for large scale, multi-modal infrastructure projects in complex and challenging environments.
Broader Outcomes Delivery	Applicant should demonstrate experience delivering broader cultural, economic, environmental and social outcomes for projects of a similar scale and complexity.
Business Case	Applicant should demonstrate experience delivering endorsed business cases for transport and urban infrastructure projects of a similar scale and complexity.
Statutory Approvals	Applicant should demonstrate ability to navigate the statutory approvals process for linear infrastructure projects of a similar scale and complexity.
Collaborative Working	Applicant should demonstration experience working within a collaborative delivery model, which resulted in a high performing blended team.
Communications, Engagement and Stakeholder Management	Applicant should demonstrate their ability to engage with multiple agencies, stakeholders and partners, and navigate the challenges that come with this, for projects of a similar scale and complexity. Seeking a demonstration of innovative solutions and delivery methods.

PART B: TRACK RECORD

The following information shall be provided for **three** projects under delivery or completed within the last five years, which the Applicant considers most relevant to this project.

All projects must be the same as nominated for Relevant Experience.

A separate table must be included for each project with copies of the PACE scores to be provided in an Appendix.

GENERAL INFORMATION:

Provide the following details for each **project** nominated for Track Record (any information provided for in Relevant Experience does not have to be duplicated for Track Record):

- Project name, location, contract value and when the project was completed or ongoing.
- Description of nominated works. If joint ventures and/ or consortia please identify which of your nominated projects were joint ventures or consortia, identify the joint venture / consortia partner(s) and the proportion and nature of the work undertaken by the Applicant's company.
- The most recently completed PACE (or equivalent performance assessment) score for the project. This can be final or interim depending upon whether the project is completed or ongoing.
- Two Client Referee's name, company, contact telephone number(s) and email address*: **Note it is essential that nominated referees had direct involvement with the Applicant for the nominated work package and that current correct contact details be provided. Failure to provide contact details will impact the ability of the ET to score Track Record.***

PART C: RELEVANT SKILLS

Attach CV's for each of the key positions identified below (**two** pages per CV). CV's need to demonstrate specific experience relevant to the position and should differentiate between technical and managerial skills where relevant to the position. Evaluators will place a higher value on individuals that have had direct involvement in the projects submitted under Relevant Experience.

The Applicant shall supply names and current contact telephone numbers of at least **one** person to act as referee, who has direct knowledge of the nominated person. Inadequate contact information or provision of non-applicable referees may result in downgraded scoring.

The Applicant must nominate the following personnel and state how the key technical and/ or managerial skills of each individual will be used to successfully deliver on this project.

POSITIONS

Position: Alliance Director **Weighting:** 25%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• Experience in the transportation field (at least 15 years preferred), particularly in leadership roles heading up combined client and consultant programme teams. • Relevant degree qualification or equivalent. • Prior successful leadership of an Alliance (or equivalent collaborative delivery model – leading multiple client and consultant teams) that involved the delivery of business cases for large (over $500m value) public infrastructure. • Demonstration of effective governance, culture, influence, decision making and communication at all levels. • Experience developing high performing teams. • Strong collaborative and relationship skills as well as an understanding of partner and stakeholder organisations, local government bodies and Manu Whenua. Relationships and prior experience with these groups is preferred. • Ability to challenge traditional thinking and ways of working to elevate the programme team and successful delivery to stretch targets.	• Overall leadership of the programme and Alliance. • Acts as a conduit to Governance. Mostly an upwards and external facing role (face of the Alliance). • Responsible to the Programme Alliance Board and ultimately accountable for ensuring that the Alliance Services are performed to achieve the Alliance objectives. • Lead the Alliance Management Team.

Position: Delivery Manager **Weighting:** 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• A recognised Project Management qualification, at least 15 years (preferred) of managing complex, multi-disciplinary projects over $500m value. • Working knowledge of commercial and financial frameworks, processes, procedures and reporting is essential. • Working knowledge of safety, quality and environmental processes and procedures is essential. • Successful management of large teams in a performance driven environment to delivery within time and cost. • Ability to step away from the detail and work strategically as and when required, empowering and delegating tasks to the wider team. • Highly collaborative, with excellent communication skills, having worked in environments that bring together multi-company and multi-agency staff to deliver a programme of work.	• Day-to-day execution and management of a well-run, efficient programme and the projects within it. • Responsible for HSE, time, cost and quality management and reporting. • A member of the Alliance Management Team.

Position: Transport Planning Lead **Weighting:** 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• Experience in the transport planning discipline (at least 15 years preferred) with a post graduate degree relevant to transport planning or equivalent. • Successful delivery of transport planning elements on business cases for large (over $500m value) transport projects. • Knowledge of transport systems, network planning and operations, and system resilience. • Success in leading a team to develop, evaluate and design a range of solutions to meet the objectives of the programme. • Detailed knowledge and understanding of transport issues in the Auckland Region, particularly on the north shore, and integration with the wider transport system. • Understanding of the integrated land use and transport planning approach to achieve positive outcomes for equity, liveability, wellbeing, safety, and inclusivity.	• Lead the development of a strategy to address transport issues on Auckland's north shore and wider city centre. • Responsible for delivering a large proportion of the technical analysis and evidence base into the business case. • A member of the Alliance Management Team.

Position: Design Integration Manager **Weighting:** 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• CPEng certification with a degree in engineering. At least 15 years (preferred) of experience in large, complex civil engineering environments. • Led the successful design development and delivery of large, multi-disciplinary engineering (over $500m value) projects. • Technical knowledge of civil, structural and geotechnical engineering design elements. • Experienced and knowledgeable in digital engineering solutions to deliver best practise in the industry. • Understanding of cost estimation techniques and analysis. • Effective communication skills across varied teams with the ability to drive delivery to time and cost. • Fully conversant with all necessary design regulations, standards, and guides to achieve a compliant, buildable design.	• Lead the development of design options to support the business case, with emphasis on geotechnical, tunnelling/ structural. • Responsible for achieving compliant buildable design solutions to achieve the objectives of the programme. • Contributes the transport needs into the design/concept of operations optioneering process. • A member of the Alliance Management Team.

Position: Planning and Consents Lead **Weighting:** 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• Experience in the discipline (at least 15 years preferred) with a post graduate degree relevant to resource management, planning and consenting or a closely aligned discipline. NZPI membership or equivalent essential. • Successful development and delivery of a large and complex (over $500m value) consenting strategy in urban and coastal areas, with an emphasis on sensitive ecological environments, for the public and/ or private sectors. • Comprehensive working knowledge of the RMA and other relevant government legislation and treaty settlement agreements. Knowledge of Tikanga Māori and working alongside Mana Whenua. • A strong Track Record safeguarding sustainability and the environment within programme outcomes. • Experience developing collaborative working relationships with key external partners/ stakeholders. • Excellent communication skills, notably to the ability to synthesise complex information into 'easy to read' content, and present to diverse audiences. • Proactive risk management and mitigation planning.	• Lead and manage planning outcomes and the development of an attainable consenting strategy and RMA process for the programme of projects. • Responsible for a sustainable solution within the legislation to outline a clear consenting pathway for the programme. • A member of the Alliance Management Team.

Position: Business Case Lead **Weighting:** 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• Experience developing and obtaining approval of large-scale linear infrastructure business cases. • At least 15 years of experience in developing and obtaining approval of large-scale linear infrastructure business cases with a post graduate degree relevant to transport planning. • Accredited certificate in The Treasury Better Business Cases™ (or equivalent). • Led and successfully delivered business cases for large scale (over $500m value) public and private projects through to approval. • Demonstration of strong thought leadership and development of evidence-based analysis to support decision making. • Led the development of business case content, including need for investment, option development, option appraisal, project justification, integrated transport planning, and next stage planning. • Implemented a collaborative working style, coordinating a range of resources under their leadership and across the programme to bring together a full and robust business case. • Supported stakeholder consultation and engagement to ensure effective buy-in from key stakeholders to the process. • Agile thinking to include analysis of relevant trends, such as Carbon Reduction, Transit Orientated Development, and Social Equity. • Ability to incorporate the urban directives into language suitable to be understood by Treasury.	• Delivery of a well-structured, easy-to-read business case. • Lead and guide the wider project team in development of the business case (Aligned to Waka Kotahi IBC format.) • Responsible for bringing together a comprehensive document across all disciplines. • A member of the Alliance Management Team.

PART D: DECLARATION

I/We certify that the information supplied is accurate to the best of my/our knowledge and that I/we accept the conditions and undertakings requested in the ROI Applicant Response Form. I/We understand that false information could result in my/our exclusion/removal from the shortlist of Applicants for the next stage of these two projects, and invalidate any responses submitted.

I/We hereby undertake to notify Waka Kotahi / Auckland Light Rail Group immediately of any material changes of information and/or circumstances including changes of address, occurring at any time subsequent to the date of this application.

I/we declare that at the time of submitting this ROI response, I am/we are not aware of any actual, potential or perceived conflict/s of interest in relation to the matters covered by this ROI having made all reasonable and proper enquiries or that may prevent us from providing the services and/or acting for Waka Kotahi and that I/we will keep Waka Kotahi updated in relation to any such conflict of interest and/or any relationships or circumstances that may give rise to such conflict of interest in relation to the provision of the services.

I/we hereby give consent to Waka Kotahi / Auckland Light Rail Group to discuss and verify the stated Relevant Experience and Track Record with all the parties associated with that Relevant Experience and Track Record.

I/We hereby agree to waiver any claim to confidentiality in relation to the works and/or projects listed as Relevant Experience and Track Record in the Response Form, on the basis that Waka Kotahi / Auckland Light Rail Group will only use such information for the purposes of evaluation for shortlisting Applicants for this project.

I/We hereby acknowledge that Waka Kotahi / Auckland Light Rail Group reserves the right to withdraw from the procurement process (including the Registration of Interest) at any time without notice before entry into the Interim Project Alliance Agreement. If Waka Kotahi / Auckland Light Rail Group withdraws from the procurement process, then no Applicant shall have any claim for compensation or otherwise against the Waka Kotahi or Auckland Light Rail Group.

Signed:	
Name (Printed):	
For and on behalf of:	
Date:	

This declaration must be signed by a Director or Authorised Representative in her/his own name and on behalf of the Applicant.

Appendix B – ROI Evaluation Marking Sheets

DESCRIPTION
Relevant Experience
Track Record
Relevant Skills

PART A - COORDINATED

PART B - AWHC

PART C- ALR

RELEVANT EXPERIENCE (WEIGHTING 35%])			FORM A
PROJECT	**RELEVANCE [70%]** • 35 or less: not related • 40,45: barely related • 50, 55: related • 60, 65, 70: particularly related • 75, 80, 85: very related • 90, 95, 100: extremely related (one score per project)	**CURRENCY [20%]** • 35 or less: 5+ years or < 40% complete • 40, 45: 4–5 years or 40-50% complete • 50, 55: 3-4 years or 50-60% complete • 60, 65, 70: 2-3 years or 60-75% complete • 75, 80, 85: 1-2 years or 75-90% complete • 90, 95, 100: 0-1 years or 90-99% complete (one score per project)	**SCALE [10%]** • 35 or less: <35% of estimate • 40, 45: 5-50% of Estimate • 50, 55: 50-70% of Estimate • 60, 65, 70: 70-90% of Estimate • 75, 80, 85: 90-100% of Estimate • 90, 95, 100: > or = Estimate (one score per project)
Summary Rating			
Applicant		**Relevant Experience Rating**	
Evaluators Comments (Continue on separate sheet if necessary)			
ET Note: Relevant Experience relates to the company, not individuals, and should include Relevant Experience of key subcontractors, if appropriate.			

TRACK RECORD (WEIGHTING 25%)			FORM B
PROJECT			**PERFORMANCE (100%)** • ≤35%: Unsatisfactory • 36% to 49%: Needs improvement • 50% to 59%: Acceptable • 60% to 70%: Requirements fully met • 71% to 85%: Exceeds requirements • 86% to 100%: Superlative
Summary Rating			
Applicant		**Track Record Rating**	

Evaluator's Comments (Continue on Separate Sheet if Necessary)

ET Note: Track Record relates to the company, not individuals, and should include Track Record of key subcontractors.

Where no formal performance evaluation (PACE or equivalent) is in the database or provided with the submission, a PACE form may be used when interviewing the referees.

The ET may factor the formal performance evaluation score (PACE or equivalent) and/or interviewed PACE score accordingly where a project nominated under Track Record is not consistent with referee checks and/or is contrary to the ET's knowledge and experience.

Where a project nominated under Track Record is less than relevant to the contract the ET may factor the normal performance evaluation score (PACE or equivalent) or interviewed PACE score accordingly.

PART A - COORDINATED
PART B - AWHC
PART C- ALR

RELEVANT SKILLS (WEIGHTING 40%)			FORM C
KEY PERSONNEL		**PRACTICAL EXPERIENCE [80%]**	**QUALIFICATIONS AND TRAINING [20%]** **(Formal Qualifications & Training)**
	Weighting	• 35 or less: Poor • 40, 45: Below Average • 50, 55: Average • 60, 65, 70: Above Average • 75, 80, 85: Good • 90, 95, 100: Excellent	• 35 or less: Barely adequate • 40, 45: Adequate • 50, 55: Meets requirements • 60, 65, 70: Related • 75, 80, 85: Very Related • 90, 95, 100: Directly Applicable
Alliance Director	25%		
Delivery Manager	15%		
Transport Planning Lead	15%		
Design Integration Manager	15%		
Planning & Consents Lead	15%		
Business Case Lead	15%		
Summary Rating			

Applicant		**Relevant Skills Rating**	
Evaluator's Comments (Continue on Separate Sheet if Necessary)			
ET Note: Relevant Skills relates to individuals, not the company, and should include Relevant Skills of key subconsultants if the positions listed are to be filled by subconsultants.			

PART C: AUCKLAND LIGHT RAIL

1 PROJECT DESCRIPTION

1.1 Key Deliverables Required

This procurement process is seeking to select the core NOPs for the Auckland Light Rail Alliance (**ALRA**). The NOPs will provide a team to supplement the capability and capacity of the Auckland Light Rail Group (**ALR Group**).

The core task facing ALR is to undertake an integrated urban and transport optioneering process to deliver the optimal urban and transport outcomes for Auckland. The findings of this optioneering process will be used to inform two of the key deliverables of the ALR project – the Corridor Strategic Framework (**CSF**) and the Corridor Business Case (**CBC**). These two will be fundamentally aligned, telling the same story of ALR but for different audiences using different languages.

Corridor Strategic Framework (CSF): This CSF is the long-term strategic framework that reflects the values, vision, core objectives and early key moves of the project in every respect. It is jointly informed by urban and transport disciplines. It covers areas inside and outside the designation and takes account of city-wide conditions. It helps to inform investment decisions across multiple organisations, Mana Whenua, key stakeholders and communities who will all have a role to play in bringing the vision to life over decades to come.

The purpose of the CSF is to articulate the corridor vision and inform the development of catchment development frameworks and strategies to embed the project aspirations within the wider spatial planning framework. The CSF is the accessible, public facing document that tells the integrated story of the community, urban, light rail and wider transport outcomes and the key moves to get there. Its interface with the CBC is shown in Appendix C – Corridor Strategic Framework & Corridor Business Case Interaction Diagram.

Corridor Business Case (CBC): The CBC will articulate the case for investment in both transport infrastructure (to a DBC level) and urban planning and development (to an IBC level) within the City Centre to Mangere (**CC2M**) corridor. It will enable a final investment decision on the transport infrastructure to be made by Government by early 2024, as well as allowing for subsequent urban interventions to progress.

The purpose of the CBC is to articulate the case for investment. It is targeted at sponsors and funders and will seek approval of the decision to invest in both transport infrastructure and urban interventions. It will describe the preferred transport and urban option and the technical plan to manage its development, funding and implementation. Its interface with the CSF is shown in Appendix C – Corridor Strategic Framework & Corridor Business Case Interaction Diagram.

The NOPs will also provide a team to supplement the capability and capacity of the ALR Group to produce these additional key deliverables:

Statutory Approvals: Delivery of the statutory approvals to protect the corridor and enable the construction of the transport infrastructure and urban realm improvements.

Reference Design and Requirements: Inputs to the procurement of the delivery phase of the transport infrastructure. This will include a reference design and requirements setting out the scope, functionally and performance criteria to be delivered.

1.2 Project Background

Indicative Business Case

The ALR Group completed an IBC in November 2021. This IBC set out the potential scale of urban response in the corridor as a result of the project as well as a preferred transport option, which included the mode, an indicative alignment, and indicative station locations.

The recommended option alignment and form was a tunnelled light rail that goes underground in a tunnel from Wynyard Quarter to Mt. Roskill, and then comes up to grade and runs alongside the SH20 motorway to the airport (as shown in Figure 3).

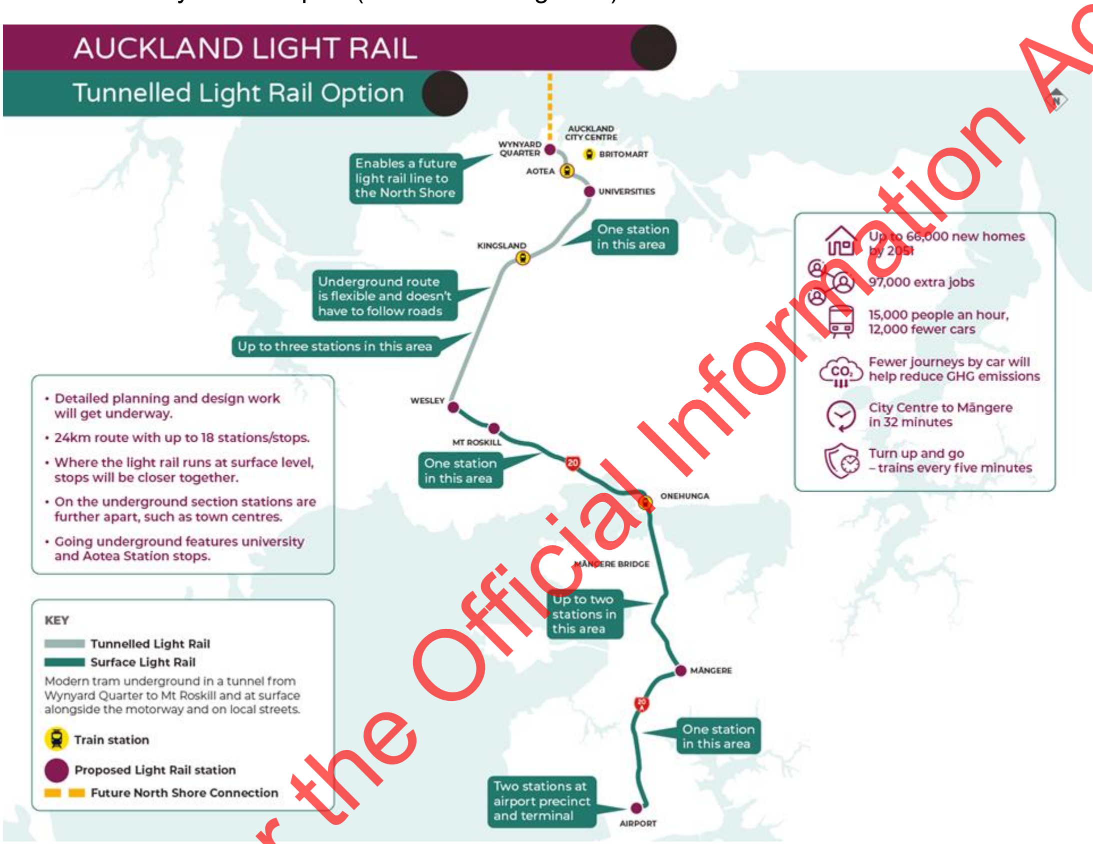


Figure 3 - ALR Recommended Option Alignment

Cabinet Decisions

In December 2021, Cabinet decided that the preferred mode for the CC2M corridor should be tunnelled light rail and approved the project being taken forward into a detailed (pre-construction) planning phase, with the parameters reflecting a greater focus on the integration of transport and urban development outcomes. The Auckland Light Rail decision to progress Cabinet Paper details their considerations.

Next Steps

An overview of recent and upcoming programme milestones for the ALR project is provided as Figure 4 below. The critical milestone for the ALR Group is completion of the CSF to ensure the delivery of the CBC by early 2024, with achievement of Statutory Approvals and completion of Reference Design by mid-2024 and gaining statutory approvals later in 2024.

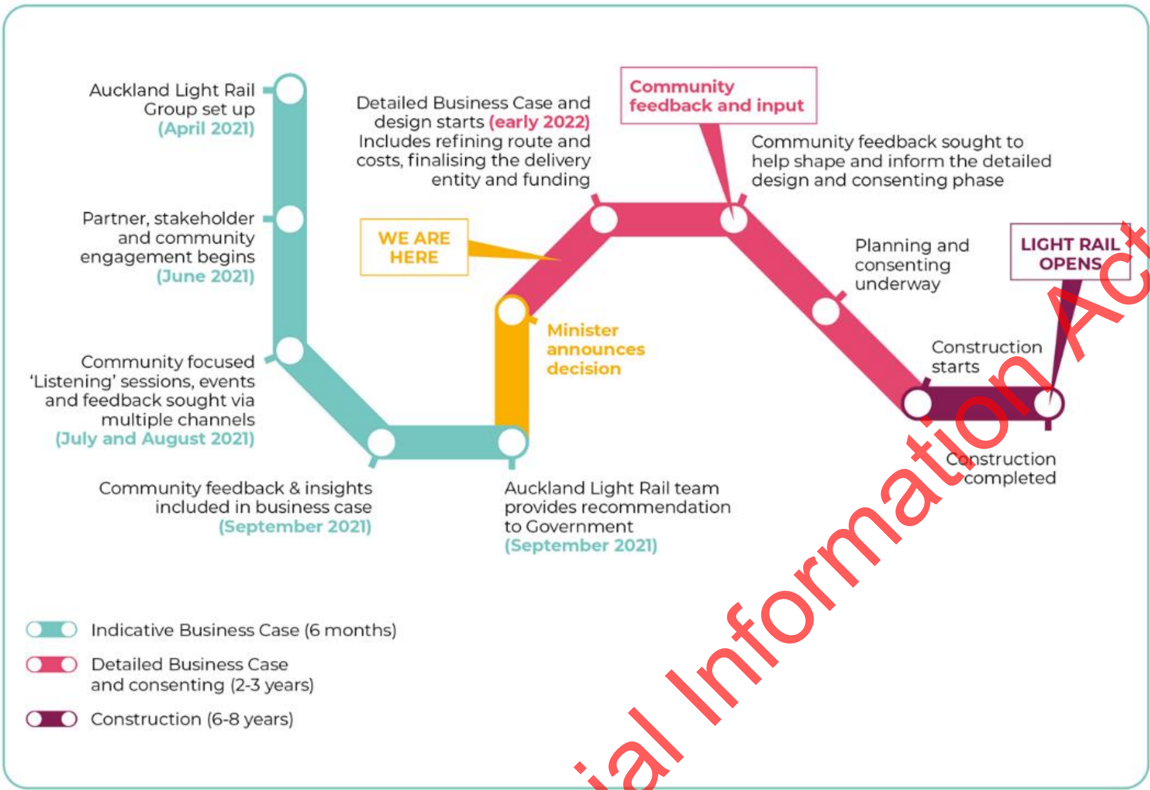


Figure 4 - ALR Overview of Recent and Upcoming Project Milestones

1.3 Project Objectives

Auckland is growing rapidly and struggling to keep pace with growth in a sustainable way.

Auckland is projected to account for about half of New Zealand's population growth over the next 30 years. By 2050, Auckland could grow by another 720,000 people to become a city of 2.4 million. The scale of Auckland's growth is putting significant pressure on housing and infrastructure.

Auckland must decide how to accommodate this growth in a way that positively shapes the city and meets the needs and aspirations of current and future communities.

Infrastructure, especially transport infrastructure, shapes cities and rapid transit will play an instrumental role in shaping Auckland's future urban form. Rapid transit will be a catalyst for urban transformation, influencing how the city grows to create quality, compact and highly accessible centres and communities. Most of the future growth will happen in urban areas.

A key opportunity to unlock this growth is through investment in rapid transit along the CC2M corridor. With its access to significant employment and education hubs, the CC2M corridor offers a unique opportunity to create well-functioning communities. Investing in the CC2M corridor also offers disadvantaged communities more choice and more affordable transport options.

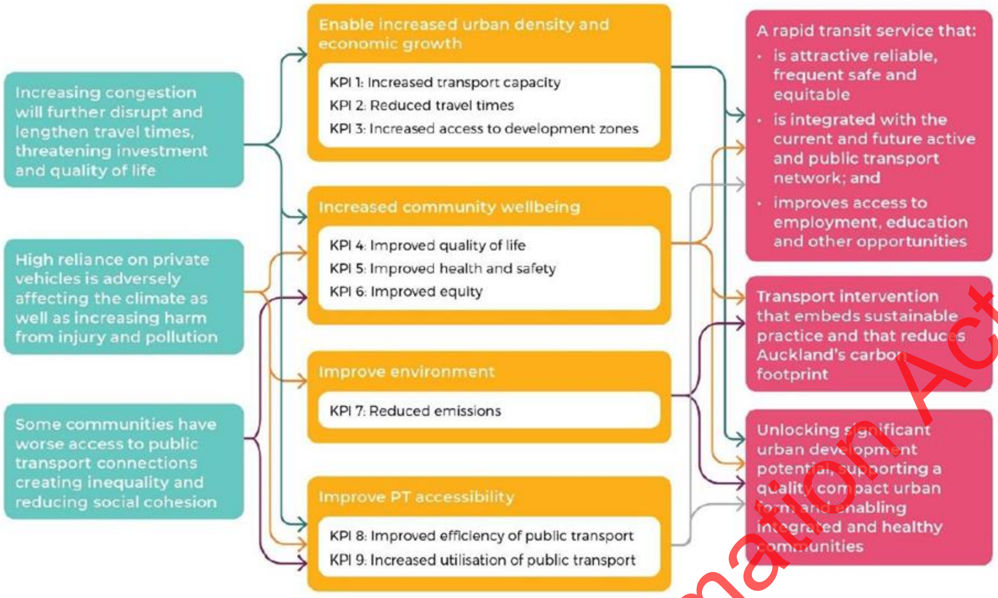


Figure 5 - 2021 Investment Logic Map

To realise this opportunity, the 2021 Investment Logic Map (ILM) (Figure 5) for the project confirmed the following investment objectives:

Objective 1: To implement a rapid transit service that:

- Is attractive, reliable, frequent, safe, and equitable;
- Is integrated with the current and future active and public transport network; and
- Improves access to employment, education, and other opportunities.

Objective 2: A transport intervention that embeds sustainable practice and reduces Auckland's carbon footprint.

Objective 3: To unlock significant urban development potential supporting a quality compact urban form and enabling integrated and healthy communities.

This ILM and the associated objectives will be refreshed prior the commencement of this commission but are expected to be broadly similar. These objectives will drive the outcomes sought (and delivered) through this commission and can only be achieved through a highly integrated urban and transport response in the corridor.

2 PROGRAMME MANAGEMENT & GOVERNANCE

2.1 Overview

The ALR project is being taken forward via a partnership of the Crown, Auckland Council and Mana Whenua as the foundational and enduring framework for overseeing the project. A sponsors' agreement will be put in place, setting out the agreed objectives. The Crown sponsors are the Minister of Transport, the Minister of Finance and the Minister of Housing. There will be representation from Auckland Council and Mana Whenua.

The sponsors effectively act as an alignment forum, with key decisions being retained by Cabinet/ Ministers and the Council governing body respectively.

The existing ALR unit will transition to a final delivery entity (the Auckland Light Rail Delivery Entity (**ALRDE**)), with decisions on the form of the entity to be made in 2022.

The ALR Group will partner with Auckland Council, Auckland Transport, Waka Kotahi and Kāinga Ora.

There is also a considerable policy work programme, to be taken forward by government departments, to enable Cabinet to make final investment decisions in 2024. That work is out of scope for this procurement, but the work will need to be taken forward as part of an integrated programme with the delivery programme.

The project is currently funded by Waka Kotahi, via the National Land Transport Fund (**NLTF**) and this will continue until June 2022. Funding for the pre-construction planning phase is expected to be confirmed in the 2022 budget.

The project will continue to be "housed" in Waka Kotahi, which will provide services to the ALR Group. Funding is expected to be via a Crown appropriation, to be administered by the Ministry of Transport. Pending the establishment of the final delivery entity, any new contracts (including the IPAA) would be entered into by Ministry of Transport directly, with specific provisions allowing simple transfer to the new ALRDE (including the transfer of the benefit of any of the work or output developed prior to the establishment of the ALRDE).

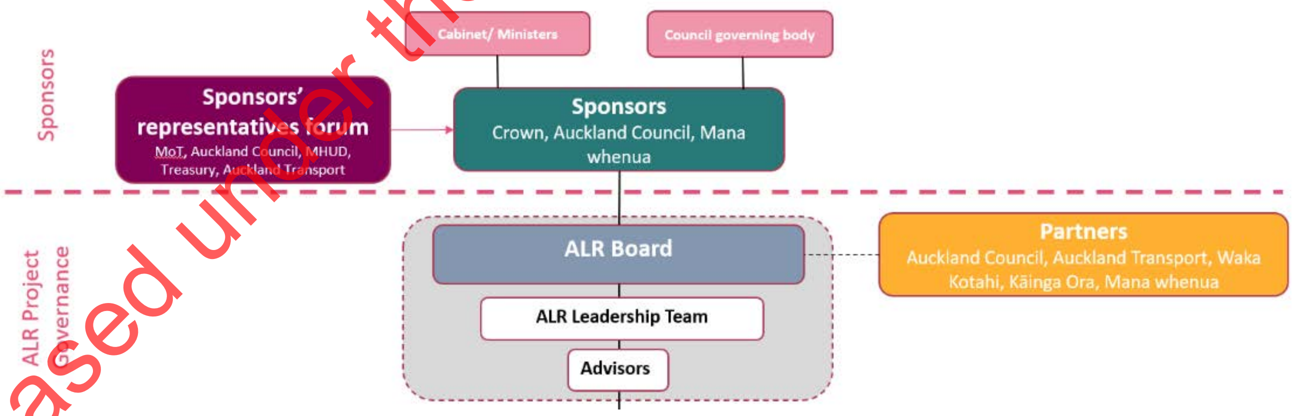


Figure 6 - Auckland Light Rail Governance & Sponsors Model

2.2 Choice of Contract Model

There are some key considerations that have informed our preference for an Alliance contract model:

ALR Group has a challenging programme to meet: An endorsed CBC, supported by the CSF, is required to support a final investment decision in 2024. Statutory approvals, and reference design and requirements are required to support the procurement of the delivery phase with construction of the main works commencing in 2026. To achieve this programme, work needs to begin as soon as possible, and activities will need to be undertaken in parallel.

ALR is of a significant scale: ALR will be the largest transport infrastructure project delivered in New Zealand. The scale of business case, urban planning and development, design and RMA planning required will be similarly significant.

There is significant complexity in the tasks to be undertaken: The project is still at an early stage of development, and while the macro-scope of the services is well understood, there is significant opportunity to innovate. Integrating the urban and transport elements of the programme is a core requirement and opportunity. The detailed scope of the services required needs to be informed by the CSF, the CBC optioneering, the development of consenting, and procurement and property strategies. Therefore, the detailed scope of this commission will need to be jointly developed with suppliers as early elements are completed in parallel.

To respond to these considerations, an Alliance has been selected as the preferred contract model for ALR.

The Alliance model is expected to deliver the following key benefits for ALR:

- Shared risk / reward model manages interface risks and drives best for project decision making.
- Supports flexibility and innovation, providing the best platform to achieve the objectives within the timeframe.
- Drives collaboration with the ALR Group, sponsors and partners, incentivising delivery of broader non-cost outcomes.
- Transparent open book model and performance framework allows demonstration of value for money.
- Allows appropriate control and direction by the ALR Group over critical decisions through the initial IPAA Phase (refer to Section 2.3) and into delivery.

The ALR Group is seeking a step change from traditional New Zealand, predominantly supplier resourced, Alliances – a "Tailored Alliance" with the following characteristics that differentiate it from a traditional Alliance:

Strong client led ethos: The Tailored Alliance will be characterised by a strong client led ethos where the ALRDE will retain control over the direction of the project. As shown in Figure 6, the ALRDE will continue to hold the key relationships with sponsors and partners, managing and facilitating project governance and strategic decision making. The ALRA will be responsible for delivering on the outcomes and direction set by the ALRDE.

Significant client representation in the Alliance team: The ALR Group is already established with significant capacity and capability provided through the partner organisations. This team brings with it the knowledge and experience from the IBC phase of the project. It is intended that a large proportion of the Tailored Alliance resources will come from within the existing ALR Group and wider partner organisations. Some key ALRA leadership roles will be staffed by ALR Group resources and ALR Group staff and advisors will be incorporated throughout the ALRA structure. NOP resources will supplement the existing team to fill capacity and capability gaps to form the ALRA.

2.3 Interim Project Alliance Agreement Phase

The delivery of this commission will be through a Project Alliance Agreement (PAA). The PAA will be developed though an Interim Project Alliance Agreement (IPAA). The PAA will begin as agreed with the Project Alliance Board (PAB).

It is envisaged that there will be an extended IPAA phase at the establishment of ALRA (refer Figure 7). This phase will run under an IPAA agreement.

During the IPAA phase the participants will prepare and submit to the ALR Group a fully developed Proposal which represents a whole-of-life, value-for-money solution to the commercial, technical and environmental requirements of ALR Group, and demonstrates certainty of achieving these outcomes.

To be able to meet the programme, delivery of initial high priority tasks will also be commenced by the ALRA immediately, with ALR Group maintaining ultimate control over scope and direction through this phase. This allows a rapid start to complete initial activities, development of a robust scope informed by the early tasks and enables the inputs from sponsors and partners to be incorporated within the Alliance scope.

Once sufficient certainty is developed around specific scope items and tasks, the delivery of these items will then be managed through a PAA. There is the potential for multiple Target Outturn Costs (**TOC**) to be developed through the project.

Using this approach, the benefits of the Alliance model will be leveraged from day one in terms of development of a collaborative culture, strong programme management (cost, risk, quality etc.) and work can progress in parallel with the establishment of the Alliance and longer-term commercial arrangements.

Figure 7 - Indicative IPAA Timeline

2.4 Alliance Structure

The Auckland Light Rail Alliance will be responsible for delivery of the project as described in Section 1. The Owner Participant (OP) will be the ALRDE. This procurement is focused on selecting the core NOPs to form the ALRA with ALRDE.

It is anticipated that the core ALRA NOPs will come from organisations providing the urban, engineering and planning services which will make up the bulk of the services required by the project. Therefore, this procurement process is focused on selecting the urban, engineering and planning services NOPs (the NOPs).

There are a number of ancillary "other services" that will be required to deliver the full scope, which will be procured through other processes (refer Section 3.2). Once selected the ALRDE and the NOPs will work together to agree the appropriate commercial arrangements with respect to the other services. Those arrangements could include the services being provided by one of the NOPs, traditional sub-contracts, sub-Alliances or inclusion of additional NOPs as appropriate.

This approach allows the focus of this procurement to be on selecting the core urban, engineering and planning services NOPs. It reduces the need for extended teaming arrangements and agreements though this initial tender period and allows the best suppliers of other services to be selected on a best for project basis rather than pre-existing teaming arrangements.

Figure 8 sets out the proposed structure of the programme and Alliance governance arrangements.

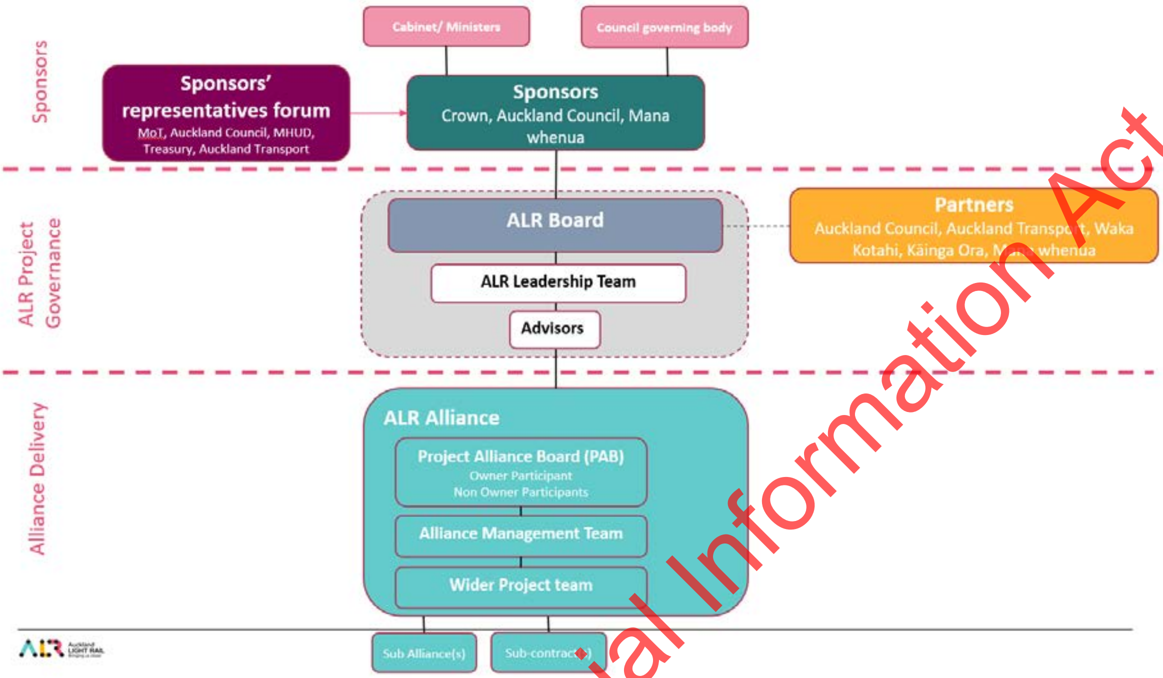


Figure 8 - Programme & Alliance Governance

2.5 Critical Success Factors

Light rail is a new mode in the New Zealand context and provides planning, technological, and regulatory challenges. The successful Applicant needs to bring the experience and lessons learnt from planning and implementing light rail in complex urban environments, integrating the transport infrastructure with the surrounding urban form to deliver an attractive customer focused offering. Demonstrating how international best practice has been translated into the local context is key to providing assurance to decision makers and the community.

The following critical success factors have been identified for the ALR project:

1. *Urban Regeneration Strategies*

ALR is not just a transport project, it is a city-shaping, transformational urban project. Successful delivery of this project will demonstrate the pathway to deliver substantial urban regeneration outcomes.

ALR will be an urban and transport integration exemplar that represents the needs of current and future communities and that responds to future market uncertainties to deliver market attractive and transit supportive outcomes. The strategies will be defined and quantified to a level required for the Corridor Business Case but more fully articulated within the CSF.

2. *Integration of Urban and Transport disciplines within a successful Corridor Business Case*

The CBC needs to deliver a clear investment story for both urban and transport interventions, (including cost, benefits, delivery certainty and financial implications) that is endorsed by sponsors and partners. It needs to bring the two workstreams together to demonstrate that optimal urban outcomes are achievable and how their delivery will be dependent on and support the transport investment.

To achieve an endorsed business case requires the development of urban and transport integration processes that balance complex and multiple objectives to deliver an integrated transformational outcome.

3. Genuine partnership with Māori

ALR is committed to a genuine partnership with Māori. Te Terewhiti ki Tāmaki Makaurau: Te Rautaki Huanga Māori, Mahuru 2021 (Māori Strategy for Auckland Light Rail), Waka Kotahi Te Ara Kotahi/Our Māori Strategy, and Auckland Transport's Māori Engagement Framework provide the framework for working with Māori (Mana Whenua and Mataawaka).

The following pou or pillars provide context and direction to Te Terewhiti ki Tāmaki Makaurau on Ngā Putanga Māori

- Genuine Partnership
- Mana Whenua Leadership
- Kaitiakitanga
- Promoting Tāmaki Makaurau.

Mana Whenua are partners as recognised under Te Tiriti o Waitangi, with Te Terewhiti ki Tāmaki Makaurau in the delivery of the ALR programme, being represented at all levels of decision making.

4. Maintain and build upon the social license for the project

ALR needs to maintain and build social licence by fostering support from stakeholders and actively bringing communities into the decision-making process. Uplifting communities through engagement is integral to this phase and will help shape future decisions such as the location and design of stations/stops, integration with other transport modes and urban outcomes. Community input will ensure the project is carried out reflecting the interests and concerns of the community, residents and businesses. This is a key driver of social outcomes including supporting positive community development, people's health and wellbeing and inclusive local employment opportunities.

5. Environmental Sustainability

ALR recognises that the environment is a Taonga that must be managed carefully. ALR needs to protect and enhance the environment by supporting the rapid transition to a low carbon transport system that reduces harmful emissions. The ALR programme will deliver emissions reductions and reductions of embodied carbon through the planning and design of infrastructure. By embedding sustainable practice throughout the programme, we aim to optimise environmental quality, improving biodiversity, water quality, and air quality.

6. Collaborative Culture

To deliver this challenging project within tight timeframes, ALRA needs to have a strong collaborative culture, enabling integration with the ALR Group and its partners and stakeholders. ALR is seeking an outcomes focused culture that seeks to deliver outcomes, rather than specific solutions through open minded and innovative thinking and challenge. This collaborative, outcomes focused culture is seen as key to delivering the objectives of the project.

7. Integration with Additional Waitematā Harbour Connections and wider Rapid Transit Network planning

The ALR solution needs to integrate with the wider Rapid Transit Network (RTN) planning underway. This is particularly important at the city end of the project where other projects such the Additional Waitematā Harbour Connections (AWHC) and Northwest Rapid Transit projects have significant interdependencies and opportunities for future integration. Therefore, ALR needs to be developed alongside and aligned with these projects. ALRA will need to ensure aligned outcomes with strong collaboration between the project teams including shared methodologies and assumptions

3 TAILORED ALLIANCE SCOPE

3.1 Key Services

The key services required from this procurement are broadly set out in the table below:

Workstream/Service	Description
Urban and Transport Integration	• Develop a Corridor Strategic Framework (CSF) incorporating: o A vision for the urban and transport outcomes and key moves within the corridor; o Corridor Strategies by discipline to support delivery of the vision; and o A summary of the preferred alignment and station/stop locations.
Urban Regeneration	• Support the CSF by providing urban inputs including: o Roles of each station/stop catchment within its local context and the broader ALR corridor; o Development and testing of catchment scenarios to feed into the optioneering process; o Scoping of provisional Catchment Development Frameworks (**CDFs**) (which are to be undertaken after the approval of the CBC) setting out the urban opportunities including the urban interventions required to enable regeneration within each station catchment; and o Inform the station forecourt and station/stop streetscape designs (mostly within the designation).
Transport Planning	• Plan the transport system including integration with the wider future RTN. • Integrate the scheme with the wider road network, public transport network, and active modes. • Integrate with Auckland wide spatial planning.
Business Case Development	• Develop a CBC which brings all the investigations and findings together to articulate the case for investment in both transport infrastructure and urban interventions within the CC2M corridor. • Develop the CBC to the equivalent of a Detailed Business Case (DBC) level for the transport infrastructure and an Indicative Business Case (IBC) level for the urban interventions (noting that some urban elements – such as oversite development – will need a greater level of detail). • Manage the production of the business case including co-ordination of the five standard 'cases'. Technical inputs to the financial, commercial and management cases will be provided by other services providers procured separately. However, the team will be responsible for bringing these together and presenting them as a coherent business case. • Develop an updated benefits framework as an input to the CBC.

Workstream/Service	Description
Planning and Consenting	• Prepare a detailed Statutory Approvals Strategy. • Input into objectives setting and options assessment during the CBC. • Support identification of specialists to undertake technical assessments. • Progress Assessments of Effects on the Environment (**AEE**). • Produce documents and applications for the statutory approvals required to protect the route and enable construction of the transport infrastructure or urban realm elements identified in the through the optioneering process. • Manage and coordinate specialist assessments and evidence. • Attend and coordinate hearings/BOI as determined by the Statutory Approvals Strategy. • Support any legislative or other powers approval processes necessary to secure appropriate powers or process. • Secure approvals needed for early works.
Design Services (Urban & Transport)	• Design the urban environment, including buildings and engineering works to inform cost estimates for the business case and the AEE for consent applications and the technical control group. • Develop a Concept Design detailing the preferred business case option. • Develop a Consenting Design to support Statutory Approvals. • Inform the ALR safety assurance process requirements, urban development considerations, regional consents, and development of a Reference Design and Minimum Requirements as a key input to future procurement of the detailed design and physical delivery of the transport infrastructure works. • Working with the procurement advisors to develop a delivery plan identifying packaging and staging options for physical works delivery. • Provide technical advisory and/or design support services through procurement and delivery of physical works. • Customer Experience design responses.
Programme Management	• Form a PMO to set up and operate systems and processes required to support the Alliance and the ALRDE in the delivery of the programme including: o Programme Controls: ▪ Programme cost management across all suppliers ▪ Risk management ▪ Programme (schedule) management

Workstream/Service	Description
	o Quality systems development, monitoring and audit o Delivery cost estimation and advisory including Basis of Estimates o Commercial and contract management o Data management o H&S systems and assurance
Investigations	• Plan, manage and undertake project specific physical investigations including collation and analysis of relevant data to inform the transport and urban design process (e.g., geotechnical, services, urban, environmental)
Detailed Design and Consenting of Early Works	• Through the development of the project and procurement strategy, elements of early works or delivery packages are likely to be developed. • Detailed design of some elements (in line with the procurement strategy) will likely be required. • Specify and procure early works.
Utilities	• Develop and maintain a utility assets geospatial platform. • Design utility works associated with development of the transport and urban aspects of ALR and co-ordination of design of utilities provided by others (e.g., Network Utility Operators (NUOs).)
Communications & Engagement	• Support the existing ALR Group to: o Engage with communities and stakeholders via the technical, digital, urban and planning disciplines. Providing and responding to the information needs of the community and stakeholders. o Develop the collateral and information that is needed (for example how feedback will be considered/incorporated). o Attend and support community and stakeholder focused events, speaking opportunities and workshops as required.
Sustainability	• Support ALR Group with development and implementation of a sustainability approach through ISC, Greenstar and Homestar. • Assess embodied emissions and enabled emissions reductions and delivering required emissions reductions through planning and design. • Ensure ALR Group meets relevant legislative and policy requirements and government direction on sustainability. • Advise on and design climate adaptation. • Support ALR Group and its Central Government partners to develop a Climate Implications of Policy Assessment (CIPA).

Workstream/Service	Description
Digital and Information Management Framework	• Operationalise the ALR Digital Engineering Framework (DEF) to implement the ISO 19650 Information Management standard for the Pre-construction and Planning phase.

3.2 Other Services

The services set out in the table below are important inputs to the delivery of the project but are not part of this procurement. The successful Applicant will need to work with those providing these services, integrating their inputs onto deliverables, or providing outputs to support other workstreams.

As described in Section 2, once selected the ALRDE and the NOPs will work together to agree the appropriate commercial arrangements with respect to the Other Services. Those arrangements could include the services being provided by one of the NOPs, traditional sub-contracts, sub-Alliances or inclusion of additional NOPs as appropriate.

Workstream/Services	Description
Operations & Maintenance	• Operations and maintenance advisors are in the process of being procured at present • Their scope will include development and refinement of the Concept of Operations and Concept of Maintenance including consideration of urban implications • These services will be shared with the AWHC project team and form a key input to the development of the preferred option
RMA Legal	• Inputs to the development of the Statutory Approvals Strategy and recommended approvals pathway • Review and advice related to the development of objectives and options assessment process • Consenting risk management • Review of assessments, applications and evidence • Development of Case and Hearing Strategy • Attendance at hearings
General Legal	• General and commercial legal advice
Property Legal	• Legal services associated with acquisition of property and other related property matters
Property	• Management and co-ordination of property acquisition • Property negotiations with affected landowners • Statutory property acquisition processes • Valuations
Funding & Financial Advisors	• Advice on financing models and value capture • Development of financial models • Economic assessment advice

Workstream/Services	Description
	• Responsible for providing inputs to the CBC to be incorporated by the Applicant
Procurement Advisors	• Advice on procurement of the project delivery phase • Responsible for providing inputs to the CBC to be incorporated by the Applicant
Specialist Assessments to support AEE	• Providers for these services will be jointly selected with the ALRA and RMA Legal team to ensure the most appropriate advisors are selected to manage statutory approvals risks
Detailed Urban Catchment Development Frameworks	• This scope is not included within the scope of this procurement • These services will likely be procured, managed and delivered separately in the future
Peer Review	• Construction methodology • Cost peer review

4 PART C APPENDICES

APPENDIX REFERENCE	SUBJECT
A	ROI Applicant Response Form
B	ROI Evaluation Marking Sheets
C	Corridor Strategic Framework and Corridor Business Case Interaction Diagram

Appendix A – ROI Applicant Response Form

The Applicant's response must include answers to all the questions contained in this Response Form.

The response must not exceed **14** single sided A4 pages ordinary type (12 point Times Roman or similar typeface). Typeface requirements applicable to all text, tables and diagrams and additional pages. A3 size paper shall be deemed to be two A4 pages and shall be numbered accordingly.

For joint Ventures and consortia, the number of projects to be submitted in Relevant Experience and Track Record Response Forms shall apply to the joint venture and/or consortia and not separately to the individual companies making up same, the parties must decide how many each member nominates.

Applicants shall number the pages. For submissions that exceed the page limit, only the first **14** pages, excluding the additional pages provided for below, will be considered during this evaluation.

Additional pages may be included as follows:

- Title Page (**one** page)
- Covering letter (**one** page)
- Index (**one** page)
- Applicant Declaration
- Final PACE (or equivalent) evaluation forms for nominated Track Record projects (**one** page per project)
- CVs (**two** pages for each person nominated in the submission)

Applicants must upload **one (1)** electronic pdf file of their completed Response Form together with supporting information as required.

For the avoidance of doubt, if an Applicant wants to be considered for both projects, then they will need to submit a completed Response Form from Part B and Part C. If submitting a response for both projects, where applicable, Applicants may nominate the same individuals for Relevant Skills, and the same projects for Relevant Experience.

PART A: RELEVANT EXPERIENCE

The following information should be provided for **four** projects which illustrate the Applicant's ability as a company/consortium to provide the technical and non-technical expertise required to successfully deliver the required outcomes as they relate to transport infrastructure projects in a complex urban environment.

Applicants should only identify projects which are complete, or for which at least one relevant phase is complete, and which have been completed within the last 5 years.

All projects must be the same as nominated for Track Record.

Should nominations be less than the required number of projects this will be taken as a deficiency in the attributes for Relevant Experience and Track Record and will be scored accordingly. Where more than the required number of projects are submitted, only the first **four** nominated projects for Relevant Experience and Track Record will be considered.

Applicants shall provide the following details for each **project** nominated for Relevant Experience:

- Project name, location, contract value (scale: the value of the work carried out, or the value of the work completed so far if still incomplete) and when the project was completed (currency: when the work was carried out, or the % completed so far if still incomplete); and
- Primary and secondary Client's Representative names, company, email addresses and contact telephone numbers.

Each project should be described to provide detail of how the following factors have been achieved, including the following information:

- A description of the work carried out;
- How this demonstrates the Applicant's experience in delivering the required factors below; and
- The relevance of the nominated project to this submission.

It is expected that a nominated project may demonstrate an Applicant's experience against more than one of the following factors. There is a minimum requirement that Applicants demonstrate Relevant Experience and Track Record against each of the factors (minimum one contributing project).

Of the nominated projects, one must be an exemplar of each of the following:

- Transport & Urban Integration
- Urban Regeneration
- Light Rail/Metro Experience

RELEVANCE:

Provide details of your Relevant Experience relating to the following **factors** from your nominated projects. For each **factor** provide detail of the % value of work carried out by the Applicant's own directly employed labour and resources, and that undertaken by any subconsultants.

Factor	Requirements
Transport & Urban Integration	Applicant should demonstrate successfully integrating transport and urban outcomes into large scale infrastructure delivery. Developing and undertaking complex multi-criteria assessment processes to deliver balanced integrated solutions with broad based endorsement of stakeholders.
Urban Regeneration	Applicant should demonstrate experience successfully developing pathways to deliver substantial urban regeneration outcomes for catchments of similar size and complexity.
Broader Outcomes Delivery	Applicant should demonstrate experience delivering broader cultural, economic, environmental and social outcomes for projects of a similar scale and complexity. Specifically, this should include experience in: • Growing the Māori economy • Improving employment opportunities for Māori • Implementation of Te Ao Māori principles through design
Business Case	Applicant should demonstrate experience delivering endorsed detailed business cases for transport and urban infrastructure projects of a similar scale and complexity
Statutory Approvals	Applicant should demonstrate experience successfully obtaining the statutory approvals for linear infrastructure projects of a similar scale and complexity.
Collaborative Working	Applicant should demonstration experience working within a collaborative delivery model, which resulted in a high performing blended team.
Reference Design & Requirements	Applicant should demonstrate ability to undertake reference design and development of requirements for large scale rail rapid transit projects in a complex urban environment.

PART B: TRACK RECORD

The following information shall be provided for **four** projects under delivery or completed within the last five years, which the Applicant considers most relevant to this project.

All projects must be the same as nominated for Relevant Experience.

A separate table must be included for each project with copies of the PACE scores (or equivalent performance assessment) to be provided in an Appendix.

GENERAL INFORMATION:

Provide the following details for each **project** nominated for Track Record (any information provided for in Relevant Experience does not have to be duplicated for Track Record):

- Project name, location, contract value and when the project was completed or ongoing.
- Description of nominated works. If **Joint Ventures and/ or Consortia** please identify which of your nominated projects were joint ventures or consortia, identify the JV/ consortia partner(s) and the proportion and nature of the work undertaken by the Applicant's company.
- The most recently completed PACE (or equivalent performance assessment) score for the project. This can be final or interim depending upon when the project is completed or ongoing.
- Two Client Referee's name, company, contact telephone number(s) and email addresses*: **Note it is essential that nominated referees had direct involvement with the Applicant for the nominated work package and that current correct contact details be provided. Failure to provide contact details will impact the ability of the ET to score the project.***

PART C: RELEVANT SKILLS

Attach CVs for each of the key positions identified below (**two** pages per CV). CVs need to demonstrate specific experience relevant to the position and should differentiate between technical and managerial skills where relevant to the position. Evaluators will place a higher value on individuals that have had direct involvement in the projects submitted under Relevant Experience.

The Applicant shall supply names and current contact telephone numbers of at least **one** person to act as referee, who has direct knowledge of the nominated person. Inadequate contact information or provision of non-applicable referees may result in downgraded scoring.

The Applicant must nominate the following personnel and state how the key technical and/ or managerial skills of each individual will be used to successfully deliver on this project.

POSITIONS

Position: Alliance Manager **Weighting**: 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• Experience in the transportation field (at least 15 years preferred), particularly in leadership roles heading up large teams. • Relevant degree qualification or equivalent. • Prior successful leadership within a collaborative delivery model for large (over $500m value), city-shaping public infrastructure projects is preferred. • Rapid Transit project and/or urban regeneration project experience is a benefit. • Demonstration of effective leadership skills including working with governance, influence, decision making and communication. • Experience supporting the development of strong organisational cultures and high performing teams. • Strong collaborative and relationship skills. • Experience working with Partner and Stakeholder organisations, local government bodies and Manu Whenua. • Ability to challenge traditional thinking and ways of working to elevate the Project Team to successfully deliver stretch targets.	• Overall leadership of the Alliance. • Reporting to Governance. • Responsible to the Programme Alliance Board and ultimately accountable for ensuring that the Alliance Services are performed to achieve the Alliance objectives.

Position: Urban & Transport Integration Lead **Weighting**: 20%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• Experience across both urban and transport fields (at least 15 years preferred). • Relevant degree qualification or equivalent. • Experience in planning rapid transit projects within complex urban environments. • Experience leading the design and direction of complete multi-criteria urban/transport optioneering processes. • Delivery of well-integrated land use and transport strategies that balance multiple objectives to deliver a transformational outcome. • Delivery of outcomes with broad stakeholder endorsement.	• Leads the development of the Corridor Strategic Framework • Responsible for leading the combined urban and transport optioneering process.

Position: Urban Regeneration Lead **Weighting**: 20%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• Experience in urban regeneration (at least 10 years preferred) • Relevant degree qualification or equivalent. • Proven delivery of on the ground urban regeneration outcomes (beyond masterplans and reports). • Experience working within an urban development authority (beyond conventional urban designer/planner).	• Delivery of urban strategies, interventions, and provisional Catchment Development Frameworks • Development of strategies for local movement, natural environment and climate, urban design, urban form, and urban development. • Incorporate the urban needs into the urban and transport optioneering process. • Leads the Urban Programme and short-term urban interventions.

Position: Design Integration Manager **Weighting**: 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• At least 15 years of experience in large, complex Civil Engineering environments. • CPEng certification (or equivalent international certification) with a degree in Engineering. • Experience leading the successful design development and delivery of large, multi-disciplinary engineering (over $500m value) projects. • Experience leading the design and specification of large light rail/metro rail projects. • Experience in digital engineering solutions to deliver best practise in the industry. • Effective leadership and communication skills across varied teams with the ability to drive delivery to time and cost. • Fully conversant with all necessary design regulations, standards, and guides to achieve a compliant, buildable design.	• Lead of the Design Team • Lead the development of design options to support the business case and statutory approvals. • Responsible for achieving compliant buildable design solutions to achieve the objectives of the programme. • Responsible for development of the reference design and requirements.

Position: Planning and Consents Lead **Weighting**: 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• At least 15 years of experience in consenting large infrastructure projects • Degree relevant to resource management, planning and consenting. NZPI membership or equivalent essential. • Experience securing statutory approvals for large and complex linear infrastructure projects in urban areas. • Experience as a Planning Witness in council hearings, Environment Court / Board of Enquiry. • Comprehensive working knowledge of the RMA and other relevant government legislation and treaty settlement agreements. Knowledge of Tikanga Māori and working alongside Mana Whenua. • A strong Track Record safeguarding sustainability and the environment within programme outcomes. • Experience developing collaborative working relationships with key external partners/ stakeholders. • Excellent communication skills, notably to the ability to synthesise complex information into ‘easy to read’ content, and present to diverse audiences. • Proactive risk management and mitigation planning. • Strong linear infrastructure and plan change type experience.	• Lead the development of an attainable consenting strategy and RMA process for the project. • Responsible for a sustainable solution within the legislation to outline a clear consenting pathway for the programme. • Acting as the key Planning Witness if required.

Position: Business Case Lead **Weighting**: 15%	**Location:** Auckland based
Qualifications (20%) and Experience (80%)	**Key Responsibilities**
• At least 10 years of experience developing and obtaining approval of large-scale (over $500m value) transport or urban infrastructure business cases • Relevant degree qualification or equivalent. • Accredited in the Treasury Better Business Case approach (or equivalent). • Demonstrates strong thought leadership and development of evidence-based analysis to support decision making. • Experience bringing together the 5 standard cases into a compelling easy to read document that achieved a positive investment decision. • Implementation of a collaborative working style, coordinating a range of resources under their leadership and across the programme to bring together a full and robust business case. • Supported stakeholder consultation and engagement to ensure effective buy-in from key stakeholders to the process. • Agile thinking to include analysis of relevant trends, such as Carbon Reduction, Transit Orientated Development, and Social Equity.	• Delivery of a well-structured, easy-to-read business case. • Lead and guide the wider project team in development of the corridor business case (aligned to Treasury's Better Business Case approach) • Responsible for bringing together a comprehensive document across all disciplines.

PART D: DECLARATION

I/We certify that the information supplied is accurate to the best of my/our knowledge and that I/we accept the conditions and undertakings requested in the ROI Applicant Response Form. I/We understand that false information could result in my/our exclusion/removal from the shortlist of Applicants for the next stage of these two projects, and invalidate any responses submitted.

I/We hereby undertake to notify Waka Kotahi / Auckland Light Rail Group immediately of any material changes of information and/or circumstances including changes of address, occurring at any time subsequent to the date of this application.

I/we declare that at the time of submitting this ROI response, I am/we are not aware of any actual, potential or perceived conflict/s of interest in relation to the matters covered by this ROI having made all reasonable and proper enquiries or that may prevent us from providing the services and/or acting for Waka Kotahi and that I/we will keep Waka Kotahi updated in relation to any such conflict of interest and/or any relationships or circumstances that may give rise to such conflict of interest in relation to the provision of the services.

I/we hereby give consent to Waka Kotahi / Auckland Light Rail Group to discuss and verify the stated Relevant Experience and Track Record with all the parties associated with that Relevant Experience and Track Record.

I/We hereby agree to waiver any claim to confidentiality in relation to the works and/or projects listed as Relevant Experience and Track Record in the Response Form, on the basis that Waka Kotahi / Auckland Light Rail Group will only use such information for the purposes of evaluation for shortlisting Applicants for this project.

I/We hereby acknowledge that Waka Kotahi / Auckland Light Rail Group reserves the right to withdraw from the procurement process (including the Registration of Interest) at any time without notice before entry into the Interim Alliance Agreement. If Waka Kotahi / Auckland Light Rail Group withdraws from the procurement process, then no Applicant shall have any claim for compensation or otherwise against the Waka Kotahi or Auckland Light Rail Group.

Signed:	
Name (Printed):	
For and on behalf of:	
Date:	

This declaration must be signed by a Director or Authorised Representative in her/his own name and on behalf of the Applicant.

Appendix B – ROI Evaluation Marking Sheets

DESCRIPTION
Relevant Experience
Track Record
Relevant Skills

RELEVANT EXPERIENCE (WEIGHTING 35%]) — **FORM A**

PROJECT	RELEVANCE [70%]	CURRENCY [20%]	SCALE [10%]
	• 35 or less: not related • 40,45: barely related • 50, 55: related • 60, 65, 70: particularly related • 75, 80, 85: very related • 90, 95, 100: extremely related (one score per project)	• 35 or less: 5+ years or < 40% complete • 40, 45: 4–5 years or 40-50% complete • 50, 55: 3-4 years or 50-60% complete • 60, 65, 70: 2-3 years or 60-75% complete • 75, 80, 85: 1-2 years or 75-90% complete • 90, 95, 100: 0-1 years or 90-99% complete (one score per project)	• 35 or less: <35% of estimate • 40, 45: 5-50% of Estimate • 50, 55: 50-70% of Estimate • 60, 65, 70: 70-90% of Estimate • 75, 80, 85: 90-100% of Estimate • 90, 95, 100: > or = Estimate (one score per project)
Summary Rating			
Applicant		**Relevant Experience Rating**	

Evaluators Comments (Continue on separate sheet if necessary)

ET Note: Relevant Experience relates to the company, not individuals, and should include Relevant Experience of key subcontractors, if appropriate.

TRACK RECORD (WEIGHTING 25%)			FORM B
PROJECT			**PERFORMANCE (100%)** • ≤35%: Unsatisfactory • 36% to 49%: Needs improvement • 50% to 59%: Acceptable • 60% to 70%: Requirements fully met • 71% to 85%: Exceeds requirements • 86% to 100%: Superlative
Summary Rating			
Applicant		**Track Record Rating**	

Evaluator's Comments (Continue on Separate Sheet if Necessary)

ET Note: Track Record relates to the company, not individuals, and should include Track Record of key subcontractors.

Where no formal performance evaluation (PACE or equivalent) is in the Database or provided with the submission, a PACE form may be used when interviewing the referees.

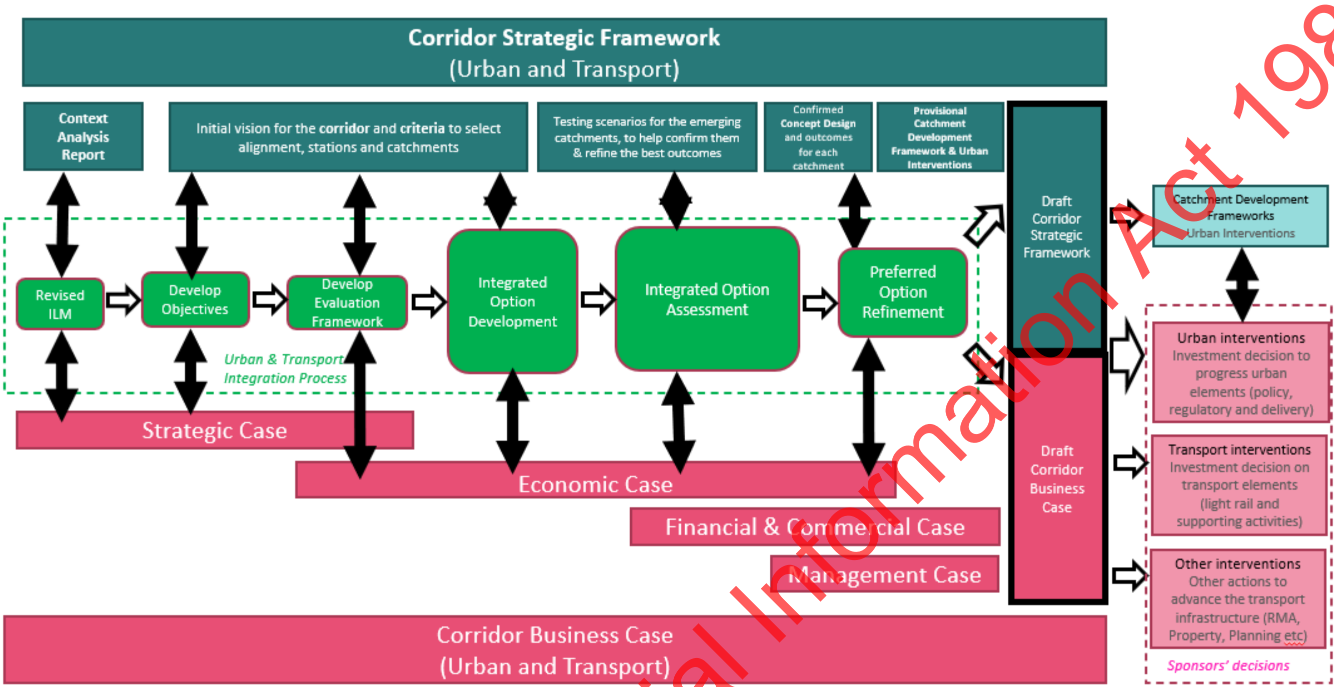
The ET may factor the formal performance evaluation score (PACE or equivalent) and/or interviewed PACE score accordingly where a project nominated under Track Record is not consistent with referee checks and/or is contrary to the ET's knowledge and experience.

Where a project nominated under Track Record is less than relevant to the tendered contract the ET may factor the normal performance evaluation score (PACE or equivalent) or interviewed PACE score accordingly.

RELEVANT SKILLS (WEIGHTING 40%)			FORM C
KEY PERSONNEL		PRACTICAL EXPERIENCE [80%]	QUALIFICATIONS AND TRAINING [20%] (Formal Qualifications & Training)
	Weighting	• 35 or less: Poor • 40, 45: Below Average • 50, 55: Average • 60, 65, 70: Above Average • 75, 80, 85: Good • 90, 95, 100: Excellent	• 35 or less: Barely adequate • 40, 45: Adequate • 50, 55: Meets requirements • 60, 65, 70: Related • 75, 80, 85: Very Related • 90, 95, 100: Directly Applicable
Alliance Manager	15%		
Urban & Transport Integration Lead	20%		
Urban Regeneration Lead	20%		
Design Integration Manager	15%		
Planning & Consents Lead	15%		
Business Case Lead	15%		
Summary Rating			

Applicant		**Relevant Skills Rating**	
Evaluator's Comments (Continue on Separate Sheet if Necessary)			
ET Note: Relevant Skills relates to individuals, not the company, and should include relevant skills of key subconsultants if the positions listed are to be filled by subconsultants.			

Appendix C – Corridor Strategic Framework & Corridor Business Case Interaction Diagram



INDICATIVE AS OF 28/04/22

Welcome to the Auckland Light Rail & Additional Waitematā Harbour Connections Joint Market Briefing – 27 April 2021

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Auckland LIGHT RAIL Bringing us closer

WAKA KOTAHI NZ TRANSPORT AGENCY

Auckland Council Te Kaunihera o Tāmaki Makaurau

New Zealand Government

INDICATIVE AS OF 28/04/22

Auckland Light Rail/ Additional Waitematā Harbour Connections

Industry Briefing

April 2022

Auckland LIGHT RAIL Bringing us closer

WAKA KOTAHI NZ TRANSPORT AGENCY

Auckland Council Te Kaunihera o Tāmaki Makaurau

New Zealand Government

Agenda

- Karakia
- Presenter Introductions
- Why we're (AWHC & ALR) working together
- Joint Procurement Approach
  - Philosophy
  - Process Overview
  - Relevant Skills & Relevant Experience
  - UEP Scope
  - UEP Out of Scope Services
- Project Overviews
  - Auckland Light Rail
  - Additional Waitematā Harbour Connections
- Next Steps
- Q&A

Context & Procurement

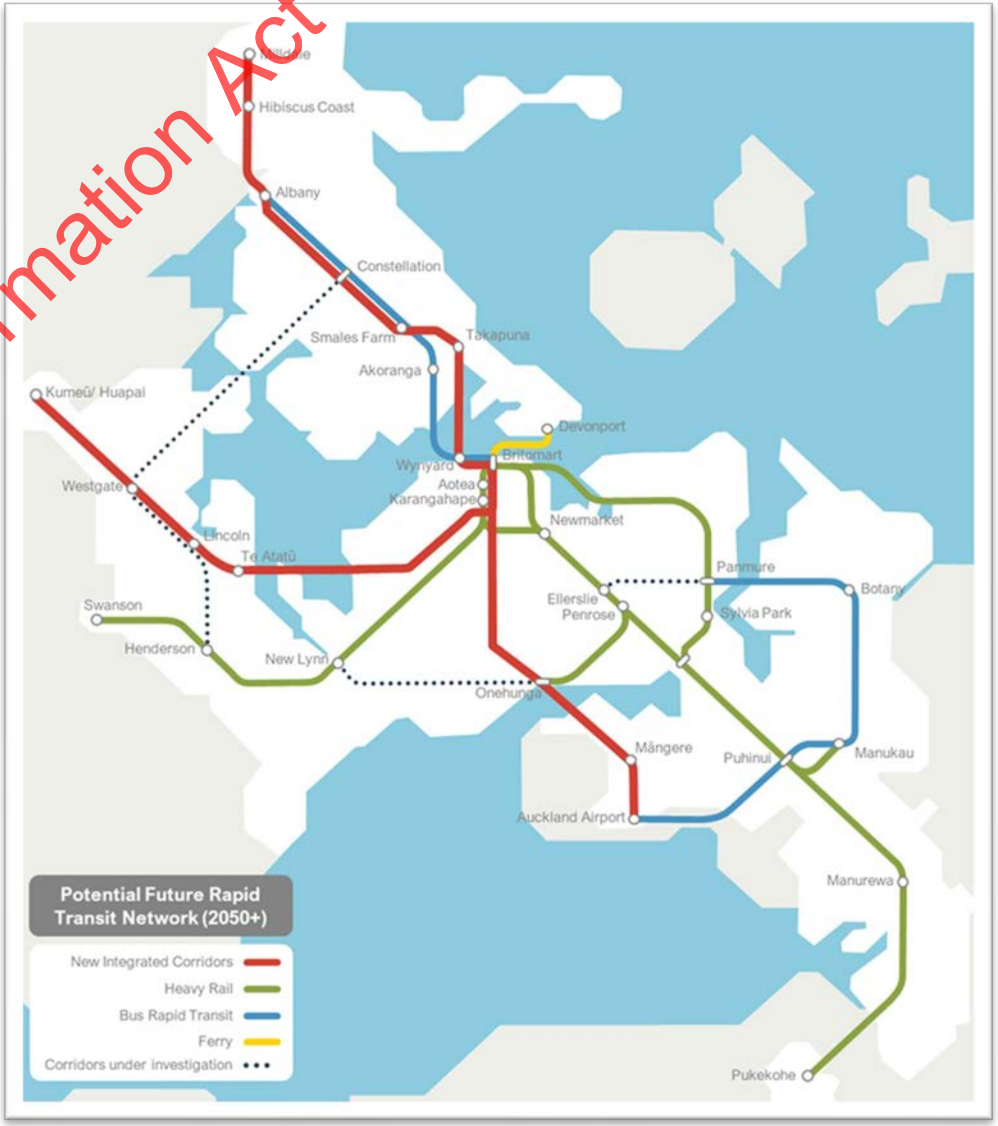
Coordination approach
ALR & AWHC

Broader context

- ALR is DBC, AWHC is IBC
  - Different but have a small but significant integration required
- Based on market engagement and internal discussions across the partners and projects, we are presenting strawman/indicative procurement approach that seeks to best address the commonalities
- Separate teams, working together
- Projects to coordinate together at Governance, Operational and Technical

Intended outcomes of coordinated procurement:

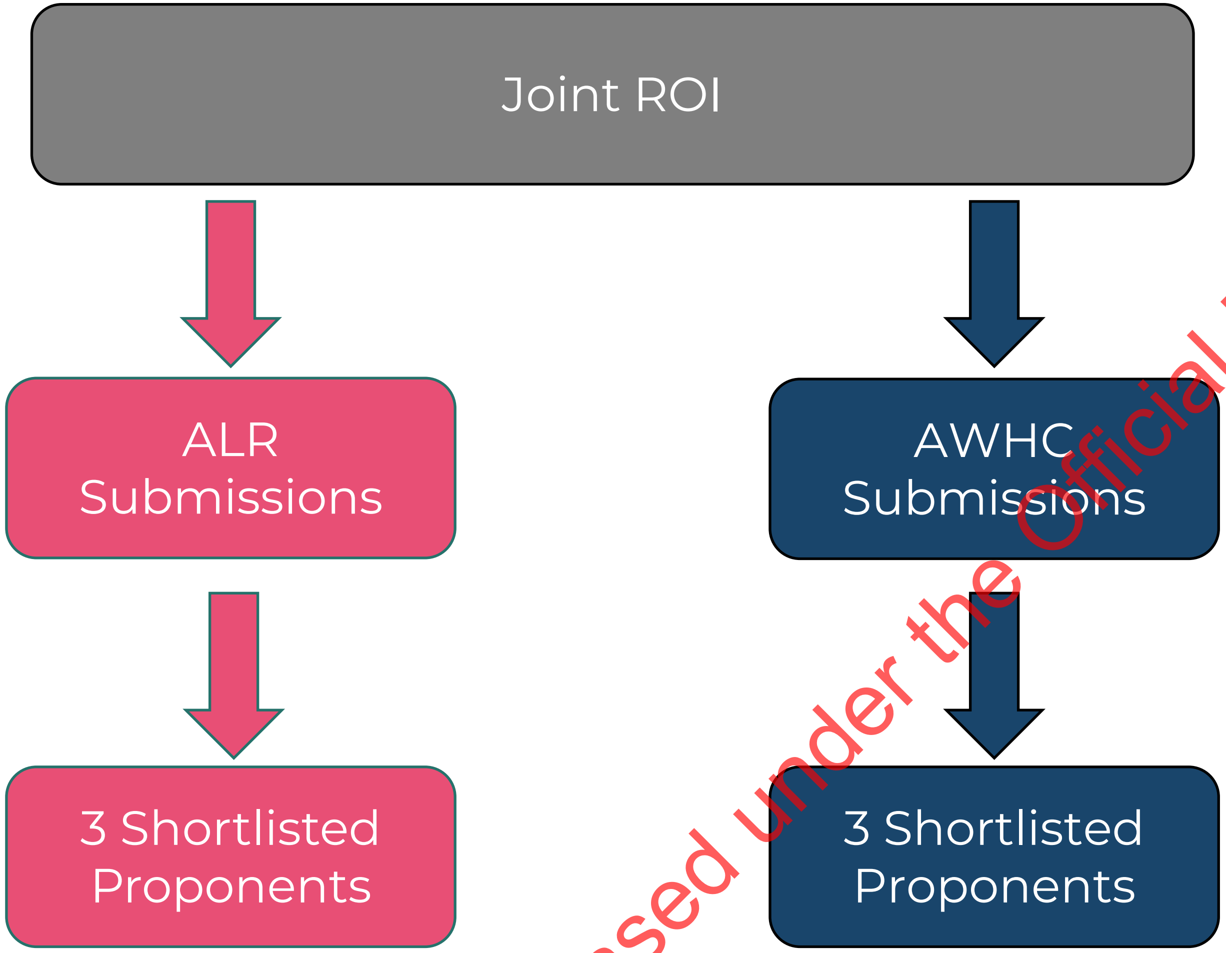
- Expedite the procurement process for both projects;
- Ensure that the most suitable market resources are applied to each project;
- Reduce the tendering burden on professional services suppliers given current market conditions; and
- Attract specialist advisor resource that can support both projects where appropriate.



INDICATIVE AS OF 28/04/22

Coordinated UEP Procurement Approach

ALR & AWHC



Notes:

- ONLY the procurement is integrated (i.e., separate contracts, governance for each project)
- A proponent can submit and be shortlisted for both projects but can only ultimately win one and only be a NOP on one.
- Common evaluation team for both projects.

The RFP phase will follow a similar structure to the ROI phase.

Alliance Model

- Both projects have similar characteristics
- So we are proposing to have an Alliance model
- Due to:
  - Uncertainty of scope
  - Transparent pricing mechanism
  - Supporting more Innovation
  - Integrating complex stakeholder environment
- Expectations around execution of the Alliance as a model
  - Advancing progress on the projects as expeditiously as possible in order to meet sponsors expectations
  - Having an extended Interim Alliance period in order to establish key scope outcomes for both projects
  - Proceed with the project alliance agreement when scope and risks have been better understood
- Further detail in project overviews

Project Overviews

Project Overviews

Auckland Light Rail

Outcomes: A More Connected, Accessible Auckland

ALR

Access & Integration

Improved access to opportunities through enhancing Auckland's Rapid Transit Network and integration with Auckland's current and future transport network

Environment

Optimised environmental quality and embedded sustainable practices

Urban & Community

Enabling of quality integrated urban communities, especially around Māngere, Onehunga and Mt Roskill

Experience

A high quality service that is attractive to users, with high levels of patronage

Value for Money

Effective and efficient use of all funding sources to achieve outcomes and maximise benefits

Critical Success Factors

ALR

Urban Regeneration Strategies

Integration of Urban & Transport Disciplines within a successful Business Case

Genuine partnership with Māori

Maintain and build upon the social license for the project.

Collaborative Culture

Integration with Additional Waitematā Harbour Connections and wider Rapid Transit Network planning

Critical Success Factors

ALR

Urban Regeneration Strategies

- Not just a transport project, a city-shaping, transformational urban project.
- Successful delivery will demonstrate the pathway to deliver substantial urban regeneration outcomes.
- An urban & transport integration exemplar:
  - Representing the needs of current and future communities
  - Responding to future market uncertainties
  - Delivering marking attractive and transit supportive outcomes
- Strategies to be defined and quantified to a level required for the corridor business case.

Critical Success Factors

ALR

Integration of Urban & Transport Disciplines within a successful Business Case

- The Corridor Business Case:
  - Should deliver a clear investment story for both urban & transport interventions (including cost, benefit, delivery certainty & financial implications)
  - Be endorsed by Sponsors & partners
  - Bring the two workstreams together to demonstrate:
    - Optimal urban outcomes are achievable
    - How their delivery will depend on and support the transport investment.

- Achieving an endorsed business case requires the development of urban & transport integration processes that balance complex & multiple objectives to deliver an integrated transformational outcome.

Critical Success Factors

ALR

Genuine partnership with Māori

- ALR is committed to a genuine partnership with Māori.
- The following provide the framework for working with Māori (Mana Whenua and Mataawaka):
  - Te Terewhiti ki Tāmaki Makaurau: Te Rautaki Huanga Māori
  - Mahuru 2021 (Māori Strategy for Auckland Light Rail)
  - Waka Kotahi Te Ara Kotahi/Our Māori Strategy
  - Auckland Transport's Māori Engagement Framework

- The following pou (pillars) provide context and direction to Te Terewhiti ki Tāmaki Makaurau on Ngā Putanga Māori:
  - Genuine Partnership
  - Mana Whenua Leadership
  - Kaitiakitanga
  - Promoting Tāmaki Makaurau

- Mana Whenua are partners as recognised under Te Tiriti o Waitangi, with Te Terewhiti ki Tāmaki Makaurau in the delivery of the Auckland Light Rail programme, being represented at all levels of decision making.

Critical Success Factors

ALR

Maintain and build upon the social license for the project

- ALR needs to maintain & build social licence by:
  - Fostering support from stakeholders
  - Actively bring communities into the decision making process

- Uplifting communities through engagement is integral & will help shape future decisions such as:
  - Location & design of stations/stops
  - Integration with other transport modes
  - Urban outcomes

- Community input will ensure the project is carried out reflecting the interests and concerns of the community, residents and businesses.

- Key driver of social outcomes including:
  - Supporting positive community development
  - Community health & wellbeing
  - Inclusive employment opportunities.

Critical Success Factors

ALR

Collaborative Culture

- To deliver this challenging project within tight timeframes, ARLA needs to have a strong collaborative culture, enabling integration with ALR Group & its partners and stakeholders.
- ALR is seeking an outcomes focussed culture that seeks to deliver outcomes, rather than specific solutions, through an open minded and innovative thinking and challenge.
- Collaborative, outcomes focused culture is seen as key to delivering the objectives of the project.

Critical Success Factors

ALR & AWHC

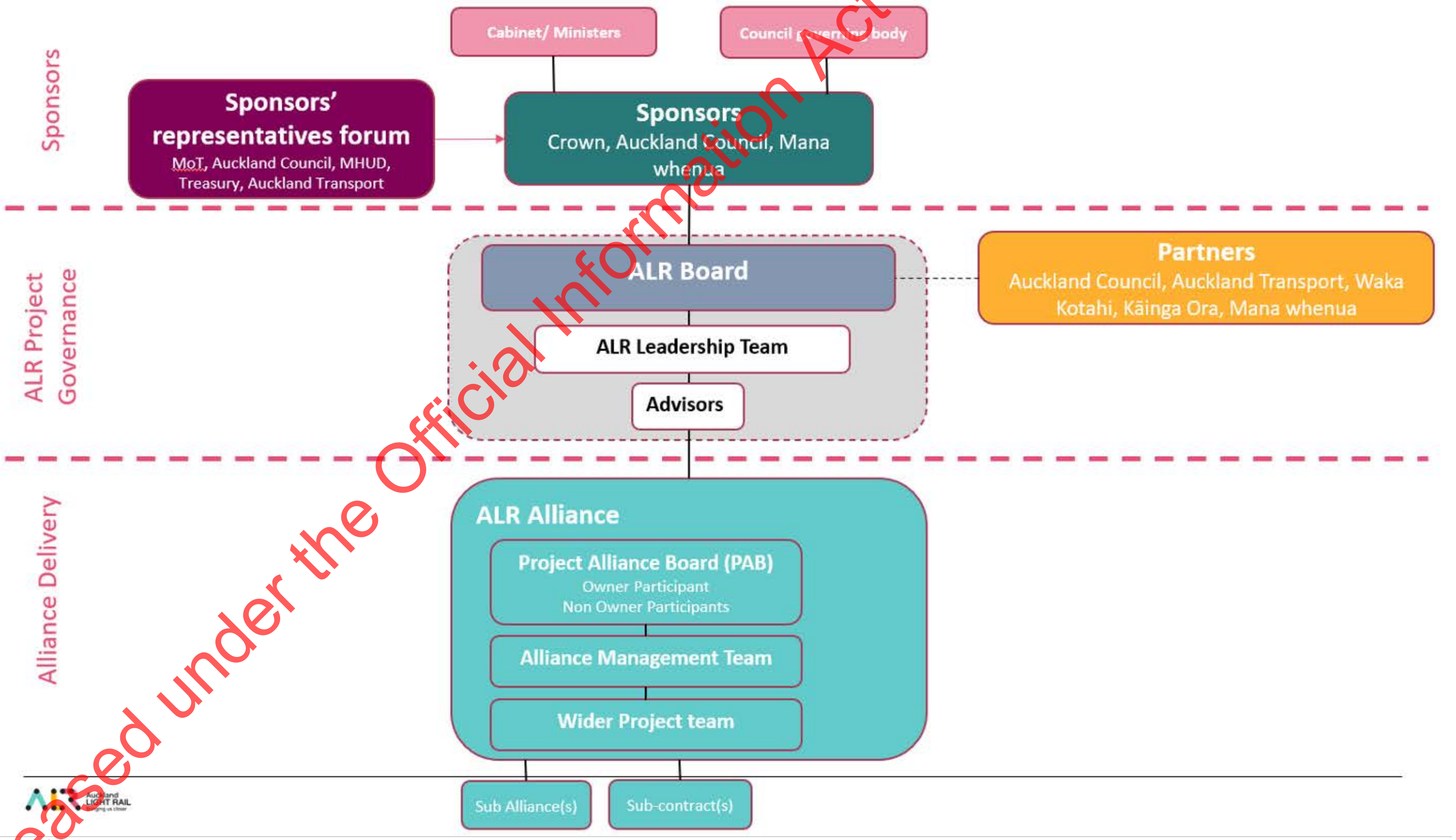
Integration with between Auckland Light Rail, Additional Waitematā Harbour Connections and wider Rapid Transit Network planning

- The ALR solution, AWHC recommended programme needs to integrate with the wider RTN planning underway.
- Particularly important at the city end, where all Rapid Transit Projects have significant interdependencies & opportunities for future integration.
- Needs to be developed alongside & aligned with these projects.
- Both teams need to ensure aligned outcomes with strong collaboration between project teams, including shared methodologies & assumptions.

Delivery Model

ALR

Tailored Alliance



What we need to achieve

ALR

Stage	Timeline
Alliance Services commencement	September 2022
Communications and Engagement	Quarter 3 2022 onwards
Preferred Option Confirmed	Mid 2023
Business Case Submission	Early 2024
Approved Business Case	Mid 2024

Project Overviews

Additional Waitematā Harbour Connections

Market Sounding: Headline Feedback

AWHC

- Timing with ALR critical
- Make procurement process less onerous
- Common areas between ALR and AWHC to be proactively identified
- Sync with Governance, Leadership and technical elements
- Do not over-integrate projects

- Collaborative agreement/Alliance allows speed of work, as long as structured well
- Select a model that Partner/client can manage
- Culture of model important to success of both projects due to political status; Alliance-type enables momentum to be maintained

- Good Governance needed
- Don’t default to BAU, Legacy-driven thinking and decisions

- International best-practice to be sought
- Cohesive story to be shared narrative around rapid transit network in Auckland

AWHC History

History

1988
- Waitematā Harbour Crossing Study

1997
- Further Investigation

2003
- Construction Feasibility

2007
- Screening of possible options

2008
- Long list of crossing locations and assessments

2009
- Form Assessment: Bridge vs. Tunnel

2010
- Preliminary Business Case

2012
- Combined Tunnel Feasibility

2015
- Route Protection Technical work

2019
- BC for Strategic Connection (AWHC)

Headline Important Elements for this phase

AWHC

AWHC has been proposed for over 30 years. Its need is well evidenced. Form, function & timing need to be validated/updated as part of this work.

The Indicative Business Case (IBC) will build on the key findings from the previous business case (2019), while ensuring key assumptions and drivers are updated and remain fit for purpose.

Comprehensively confirming the 'what' through a robust economic case looking at:

- Preferred mode, form and alignment for any additional rapid transit connection, including integration with rapid transit network
- Preferred form and alignment of the long-term cross-harbour active mode connection
- Preferred form and alignment of any road connectivity improvements. Determination of best land use integration and demand management responses
- Confirm the timing and order of these network elements

We now need to confirm the modes, form and timing to provide certainty and create opportunity.

We are looking for

AWHC Core Scope Approach

This AWHC IBC needs to deliver more than BAU; we're looking for more than great technical BC inputs, such as:

- Supporting Broader outcomes, such as:
  - Carbon Emissions
  - Procurement & Workforce
  - Resilience
- Actively guide and support Auckland's Growth Plan
- Genuine Partnership including Mana whenua
- Social licence
- Innovation
- Quick start team models

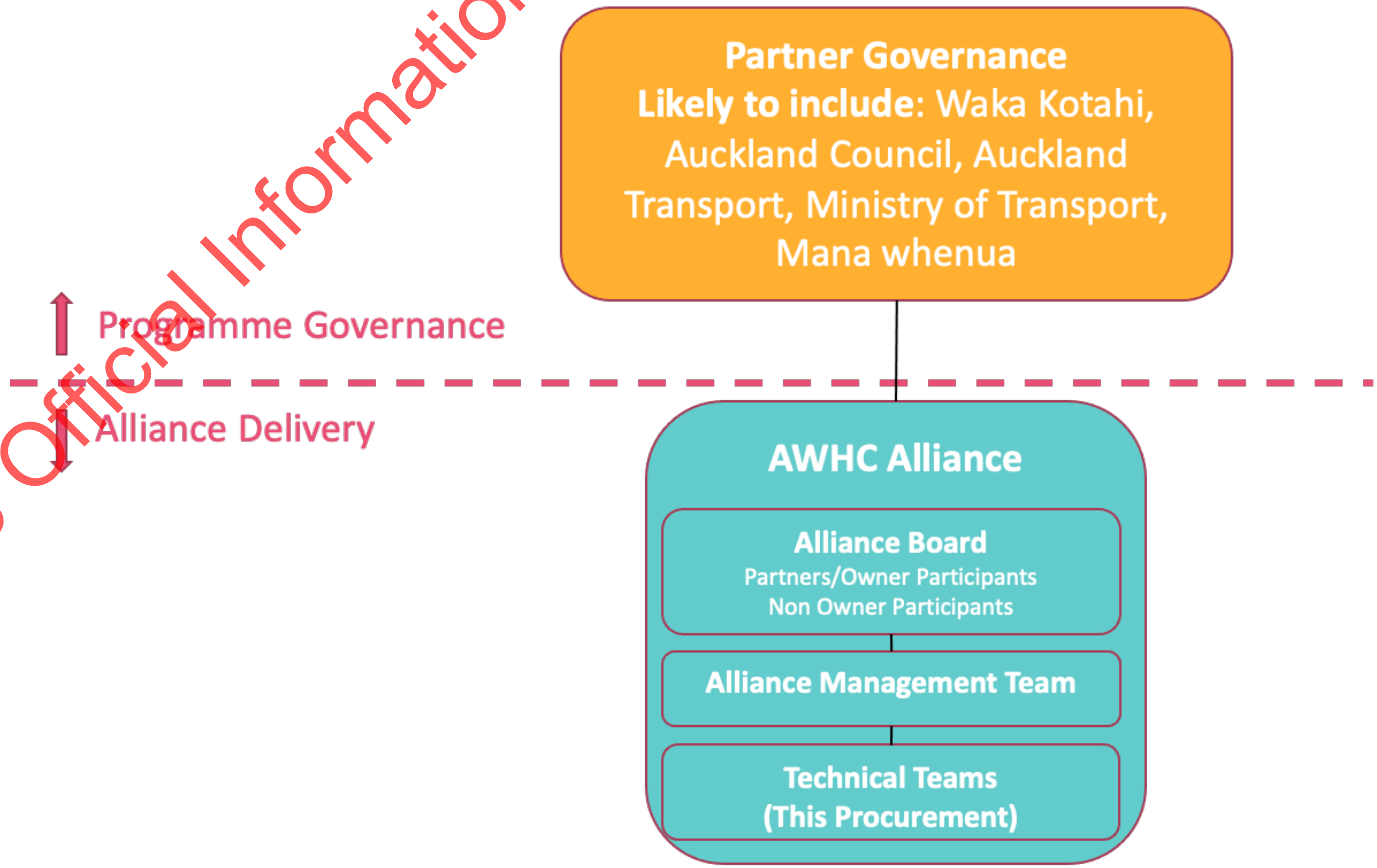
Following the IBC, the next stage will be DBC(s), with the Partners looking for a quick transition into this phase, subject to performance.

Proposed Governance & Delivery Model
AWHC

Likely to:

- Be a Planning Alliance
  - Client/Partners and Consultants
- Partners to be on the AWHC Board:
  - Waka Kotahi
  - Auckland Transport
  - Auckland Council
  - Mana whenua
  - Ministry of Transport Rep
  - Auckland Light Rail Rep

All Partners, including Mana whenua to be integrated into management & technical teams also



What we need to achieve

AWHC

Stage	Timeline
Communications and Engagement	Q2 2022 onwards
Alliance Services commence	September 2022
Recommended option confirmed	Mid 2023
Draft business case provided for review	Mid-Late 2023
IBC finalised for approval	Late 2023
Approved Business Case	Early 2024

Procurement Approach

ROI Procurement Approach

ALR & AWHC

	Relevant Skills	Relevant Experience
ALR	• Alliance Director • Design Integration Manager • Planning & Consents Lead • Business Case Lead • Urban & Transport Integration Lead • Urban Regeneration Lead	• Transport & Urban Integration • Urban Regeneration • Reference Design & Requirements • Business Case • Statutory Approvals • Broader Outcomes Delivery • Collaborative Working
AWHC	• Alliance Director • Design Integration Manager • Planning & Consents Lead • Business Case Lead • Delivery Manager • Transport Planning Lead	• Complex multi-disciplinary infrastructure • Communications, Engagement & Stakeholder Management • Business Case • Statutory Approvals • Broader Outcomes Delivery • Collaborative Working

UEP Scope

ALR

In this scope

Out of this scope

In this scope:

- Business Case Development (CBC)
- Transport Planning
- Planning & Consenting
- Utilities
- Urban & Transport Integration
- Urban Regeneration
- Programme Management
- Detailed Design & Consenting of Early Works
- Sustainability/ Carbon Reduction
- Digital & Information Management Framework
- Design Services (Urban & Transport)

Out of this scope:

- Investigations
- Māori Enterprise
- Property
- Property Legal
- RMA Legal
- General Legal
- Procurement Advisors
- Operations & Maintenance (Rail Based)
- Funding & Financial Advisors
- Specialist assessments to support AEE
- Peer Review
- Comms & Engagement

UEP Scope

AWHC

In this scope

Out of this scope

General Legal

RMA Legal

Property

Property Legal

Business Case Development (IBC)

Transport Planning

Urban Development

Sustainability/ Carbon Reduction

Active Modes

Rapid Transit

Regulation

Planning & Consenting

Operations & Maintenance

System & Network Resilience

Roading Investigations

Comms & Engagement

Programme Mngt.

Peer Review

Funding & Financial Services

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UEP Out of Scope Services

O&M Advisor (ALR)

- A procurement process will be commencing shortly.
- These services include:
  - Development and refinement of the Concept of Operations
  - Development and refinement of the Concept of Maintenance
  - Both will consider urban implications.
- These services will be shared with the AWHC project team and form a key input to the development of the preferred option.
- Contract expected to commence prior to the UEP contract.

UEP Out of Scope Services

Legal Services (ALR & AWHC)

- Both projects will require RMA, general and property legal services.
- These services will be procured separately for both projects.
- Packaging of services and timing of procurement is to be confirmed.

Funding & Financial Advisors (ALR & AWHC)

- These services are expected to include:
  - Advice on funding tools and value capture
  - Development of financial models
  - Economic assessment advice
  - Providing inputs to the ALR DBC and AWHC IBC to be incorporated by the Proponent Team
- Timing and details of procurement is to be confirmed.

Process & Probity

ALR & AWHC

Process Manager:

Idris Jones

All communication in writing to:
Idris.jones@nzta.govt.nz

Notices will be issued via email to proponent's nominated person.

Proposals close in GETS, please ensure your access.

Probity Auditor:

Shaun McHale
Managing Director, Team Leader, Probity Assurance Services
McHale Group Ltd
Level 1, Featherston Street
PO Box 25103
WELLINGTON 6146

Office: +64 (0) 04 496 5580
Mobile: +64 (0) 27 486 3412
Email:
shaun.mchale@mchalegroup.co.nz

Next Steps

ALR & AWHC

Key Dates

ROI Release:	12 May 2022
ROI Interactive:	Date TBC
ROI Close:	2 June 2022
Shortlist notified:	17 June 2022 (subject to approvals)
RFP Release:	20 June 2022 (subject to approvals)
RFP Interactives:	Dates TBC
RFP Close:	August 2022 (8-week RFP period)
Preferred Suppliers notified:	September 2022

Thank you for attending

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Auckland Transport Alignment Project

Evaluation Report

Contents

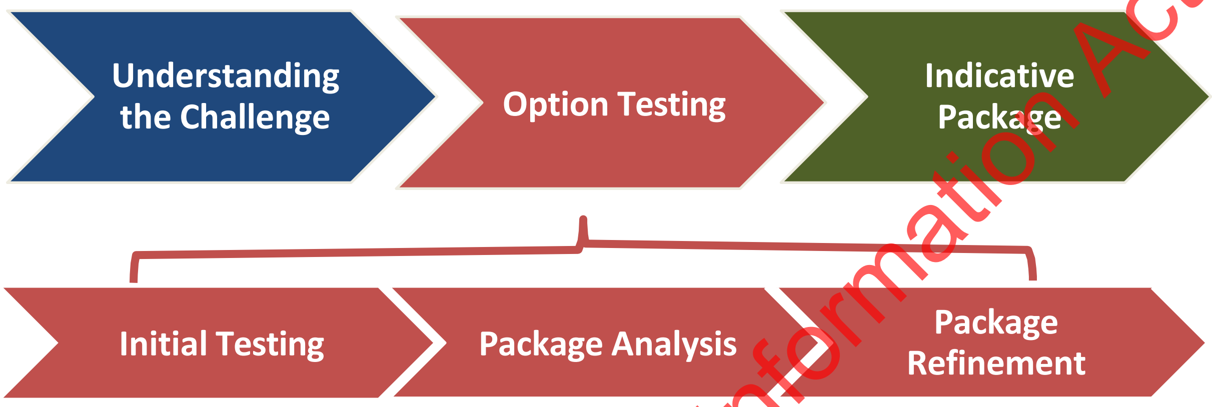
Preface

This is one of a series of research reports that were prepared as inputs to the Auckland Transport Alignment Project (ATAP). It is one of a number of sources of information that have been considered as part of the project, and which have collectively contributed to the development of the recommended strategic approach. The content of the 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.

Introduction

i. Purpose of Report

The purpose of the Evaluation Report is to present the results obtained from the testing of the transport packages and tools that were prepared to achieve the objectives of the Auckland Transport Alignment Project ("the project"). In total three phases of assessment were undertaken:



- **Phase 1 (Understanding the Challenge)** comprises the evaluation of the Auckland Plan Transport Network (APTN).
- **Phase 2 (Option Testing)** comprises three main stages of analysis to progressively refine the intervention packages:
  - **Initial Testing** examined a wide range of interventions to compare performance against the project objectives.
  - **Package Analysis** took the best performing interventions and tested the effect of changing the mix of investment and the potential from new technology and moving to smarter pricing.
  - **Package Refinement** compared increasing investment with a pricing focused approach.
- **Phase 3 (Indicative Package)** comprises the development of the strategic approach outlined in The Recommended Strategic Approach and is informed by the three stages of option testing.

ii. Project Objectives

The project's terms of reference highlight that its focus is on whether better returns from transport investment can be achieved in the median and long-term, particularly in relation to the following objectives:

i. To support economic growth and increased productivity by ensuring **access to employment/labour** improves relative to current levels as Auckland's population grows

ii. To improve **congestion** results, relative to predicted levels, in particular travel time and reliability, in the peak period and to ensure congestion does not become widespread during working hours

iii. To improve **public transport's mode share**, relative to predicted results, where it will address congestion

iv. To ensure any increases in the financial costs of using the transport system deliver **net benefits to users** of the system

iii. Project Deliverables

Analysis included in this report provided evidence for the following deliverables.

The Foundation Report

The Foundation Report was published in February 2016. It summarises work undertaken in Phase 1 of the analysis. Within the Foundation Report is a more detailed assessment of the Auckland Plan Transport Network against the project objectives.

The Interim Findings Report

The Interim Findings Report was published in June 2016. It summarises work undertaken in Phase 2 of the analysis. Specifically, it provides initial advice reporting on the testing and evaluation of the broad intervention packages and seeks feedback to inform the next deliverable.

The Final Report

The Final Report was published in September 2016. It summarises work undertaken in Phase 3 of the analysis. Specifically, it details the best performing intervention packages, a preferred strategic approach and recommendations including necessary changes to achieve implementation.

iv. Evaluation Framework

An evaluation framework outlined in the Foundation Report was developed to test how the Auckland Plan Transport Network performs against the project objectives. This framework is also used to test how the different packages that are developed in the subsequent phases of the project perform against the project objectives, an overall requirement to achieve value for money, and other key outcomes. For further information on the evaluation framework, refer to Appendix A.

For each objective, measures and key performance indicators (KPIs) have been developed to enable evaluation. For each measure there are headline KPIs that will be reported on and secondary KPIs that will primarily be used for analysis but may be reported on where they significantly add value to informing key decisions and trade-offs.

The headline measures and KPIs are shown in the table below.

Objective	Measure	Headline KPI
Improve access to employment and labour	Access to employment and labour within a reasonable travel time	• Jobs accessible by car within a 30 minute trip in the AM peak • Jobs accessible by public transport within a 45 minute trip in the AM peak • Proportion of jobs accessible to other jobs by car within a 30 minute trip in the inter-peak
Improve congestion results	Impact on general traffic congestion	• Per capita annual delay (compared to efficient throughput) • Proportion of travel time in severe congestion in the AM peak and inter-peak
	Impact on freight and goods (commercial traffic) congestion	• Proportion of business and freight trips spent in severe congestion in the AM peak and inter-peak
	Travel time reliability	• Proportion of total travel subject to volume to capacity ratio of greater than 0.9 during AM peak, inter-peak and PM peak
Increase public transport mode share	Public transport mode share Increase public transport where it impacts on congestion	• Proportion of vehicular trips in the AM peak made by public transport • Proportion of vehicular trips over 9 km in the AM peak made by public transport
	Increase vehicle occupancy	• Average vehicle occupancy
Increased financial costs deliver net user benefits	Net benefits to users from additional transport expenditure	• Increase in financial cost per trip compared to savings in travel time and vehicle operating cost
Ensure value for money	Value for money	• Package benefits and costs

In addition to the project objectives, a number of other key outcomes have been evaluated through the evaluation framework in the table below.

Other Key Outcomes	Measure	Headline Key Performance Indicator
Support access to housing	Transport infrastructure in place when required for new housing	• Transport does not delay urbanisation in line with timeframes of Future Urban Land Supply Strategy
Minimise harm	Safety	• Deaths and serious injuries per capita and per distance travelled
	Emissions	• Greenhouse gas emissions
Maintain existing assets	Effects of maintenance and renewals programme	• Asset condition levels of service • Renewals backlog

Other Key Outcomes	Measure	Headline Key Performance Indicator
Social inclusion and equity	Impacts on geographical areas	• Access employment in high deprivation areas • Distribution of impacts (costs and benefits) by area
Network resilience	Network vulnerability and adaptability	• Impact in the event of disruption at vulnerable parts of the network

Where quantitative information is available, it has been used to undertake assessments of the identified measures. Where quantitative information is not available, qualitative assessments have been undertaken.

v. Evaluation Tools

Background

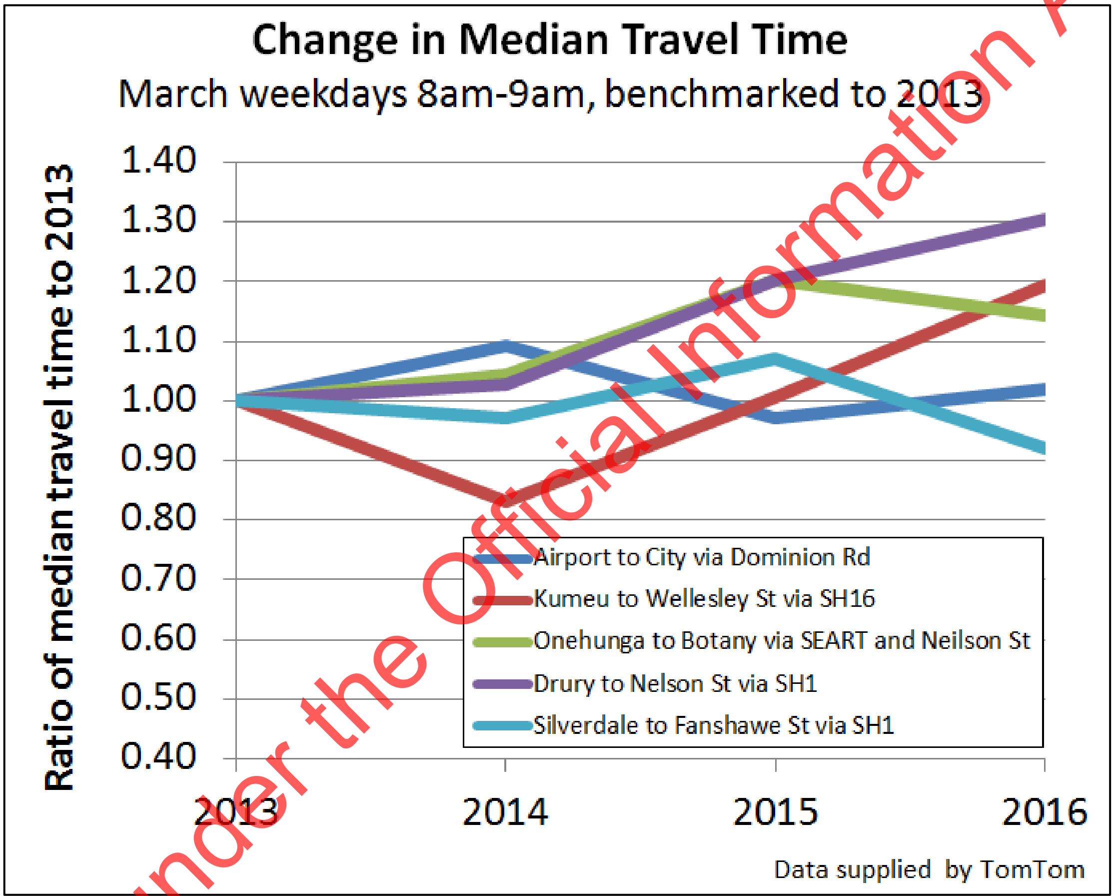
The Project uses the Auckland Regional Transport model (ART3) and Auckland Public Transport model (APT3) in its evaluation of projects and packages. Both models are regional scale demand models and have modelling strengths and limitations that need to be taken into consideration when selecting appropriate models for any test or forecast. These two models are linked but have different and largely independent model forms.

ART3	APT3
• Multimodal tool that includes private and public transport modes, daily trip generations and assignment of trips in the AM peak, inter-peak and PM peak periods. Multiple trip purposes are modelled. • Suited to test the regional effects of a major project on both road and public transport demand. It is also designed and has been used to test road pricing / tolling policies. • Limited when testing detailed, local network effects as it is based on a 2-hour average time period, average network capabilities, and does not include the effects of public transport crowding. • Splits private and public transport modes but the public transport modes are only split into rail, ferry and bus at the assignment stage.	• A more spatially detailed regional demand model than ART3 that only models passenger transport demands. • Only models the AM peak period. • Can be run with or without public transport crowding impacts. • Although there is an estimate of the effects of public transport projects on car trips, only demand changes are estimated (not actual road network effects). These demand changes can be fed back to the ART3 model to estimate road network responses; however this has not been undertaken in the project.

Both models utilise a land-use scenario, known as Scenario i9, which is based on the Auckland Plan's development strategy and reflects the likely location and timing of growth in newly urbanised areas (as outlined in the Future Urban Land Supply Strategy). Scenario i9's household and employment growth projections match reasonably well with the decision version of the Auckland Unitary Plan, with any significant differences being taken into consideration as part of the project.

Model results were produced for 2026, 2036 and 2046. The results for these years are indicative of the conditions that are expected to prevail towards the end of each of the three decades under review in this project (2018-28, 2028-38, and 2038-48).

Throughout the project we have used a base year of 2013 for our analysis, because the transport models are calibrated against Census information and travel patterns from this base year. It is important to note that since 2013 there has been a marked increase in travel demand, resulting in slower travel speeds and higher congestion (see graph below). Of the five routes examined, four showed increasing medium travel times, and three of these were significant (eg SH1 - Drury to Nelson Street travel times increased by 30%). This recent decline in performance on the Auckland road network needs to be taken into account when reviewing changes in performance between 2013 and 2026.



Model input assumptions

Model input assumptions were reviewed at the beginning of the project. Appendix B sets out the key input assumptions that were used, including how these were changed compared to modelling of previous strategic transport programmes in Auckland.

Application of the models to the evaluation

The table below shows the transport modelling tests undertaken at different stages of the project. In addition, various 'baselines' were used in each phase to help gain an understanding of the impact of the interventions tested.

Project Phase	Stage	Packages Tested	Pricing tests	Other tests
Understanding the Challenge		• Auckland Plan Transport Network (APTN)		
Option Testing	Initial Testing (Round 1)	• Individual project testing (particularly new ideas)	• CBD cordon • Motorway charge • Peak/off-peak network charge	
	Package Development (Round 2)	• 'Capacity Constraints' package • 'Employment Centres' package • 'Smarter Pricing' package	• "Smarter pricing" package tested a full network charge varying by time, location and route	• Scenario tests: effect of connected vehicles, and effect of higher vehicle occupancy • Test of new strategic corridor (eastern corridor)
	Refined Packages (Round 3)	• 'Higher Investment' package • 'Influence Demand' package	• Different pricing levels	• Scenario tests: effect of higher population growth rate
Refinement and Prioritisation	Final Indicative Package	• 'Indicative Package'		

The table below shows the transport modelling tests undertaken at different stages of the project. In addition, various 'baselines' were used in each phase to help gain an understanding of the impact of the interventions tested.

Package Description	ART results 2026	ART results 2036	ART results 2046	APT results 2026	APT results 2036	APT results 2046
Common Elements 1 (CE1)	Y	Y	Y			
Common Elements and Enhanced Interventions 1 (CEE1)	Y	Y	Y			Y
Common Elements and Enhanced Interventions 2 (CEE2)	Y	Y	Y			Y
Common Elements and Enhanced Interventions 3 (CEE3)	Y	Y	Y	Y	Y	Y
CEE3 with high population growth (2026 only)	Y					
Common Elements and Enhanced Interventions 4 (CEE4)	Y	Y	Y	Y	Y	Y
APTN i8b	Y	Y	Y			
APTN i9 without airport masterplan	Y	Y	Y			
APTN with updated input assumptions and airport masterplan	Y	Y	Y			Y
APTN with PT fare reduction			Y			Y
APTN with removal of bus lanes			Y			
APTN with bus step function and CEE4 bus services	Y	Y	Y	Y	Y	Y
Round 1 A group of interventions	Y	Y	Y			Y
Round 1 B group of interventions	Y	Y	Y			Y
Round 1 C group of interventions		Y	Y			Y
Round 1 D group of interventions	Y	Y	Y			Y
Round 2 Smarter Pricing	Y	Y	Y			Y
Round 2 Employment Centres	Y	Y	Y			Y
Round 2 Capacity Constraints	Y	Y	Y			Y
Round 3 Higher Investment	Y	Y	Y	Y	Y	Y
Round 3 Influence Demand	Y	Y	Y	Y	Y	Y
Pricing: CBD cordon		Y				
Pricing: Motorway tolls		Y				
Pricing: full network (flat rate)		Y				
Whole Motorway toll 40 30		Y				
Whole Motorway toll 40 10		Y				
Smarter Pricing (pricing 75%)		Y				
Smarter Pricing (pricing 50%)		Y				
Eastern Corridor: hybrid			Y			
Eastern Corridor: motorway			Y			
Technology Scenario: Med Occupancy		Y				
Technology Scenario: High Occupancy		Y				
Technology Scenario: Connected		Y				
Technology Scenario: Hi Occupancy + Connected		Y				
Round 4 Indicative Package	Y	Y	Y	Y	Y	Y
Indicative Package with high population growth (2046 only)			Y			
CEE4 with high population growth (2046 only)			Y			

Common baseline used for modelling purposes

A common baseline was established as a comparator to test the marginal effects of interventions and packages when compared to that baseline. The common baseline reflects projects either committed, generally agreed or needed for modelling tools to operate adequately (referred to as “Common Elements”) as well as a number of minor projects/programmes whose benefits are unable to be measured through available strategic modelling tools.

The composition of the common baseline changed from Rounds 1 to 3 of the evaluation. After evaluating the Round 1 results and engaging with various project teams, the transport infrastructure in greenfield areas was refined. In Rounds 2 and 3, a core network of transport infrastructure in the greenfield area was retained in the common baseline. The Auckland Rail Development Programme[1] was also refined after Phase 1. These refinements have been carried through to Rounds 3 to 4 with minor exclusion of interventions perceived to have low value for money and inclusions if perceived to be required.

Suggestions for future detailed modelling evaluation

The strategic transport model is considered to be suitable for testing and comparing the packages that were developed in the project, as confirmed by peer review of the strategic transport model.

The following suggestions were raised during the project for future detailed modelling evaluation:

- It was recognised that consideration should be given to understanding more detailed effects of technology changes and ridesharing programmes and their dynamic impact on demand.
- It was also identified that consideration be given to understanding more detailed socio-economic segmentations in order to have more detailed economic and equity assessments of road pricing.

It is proposed that the next step is to develop models that will address these important issues. In addition, Auckland Transport and the NZ Transport Agency will develop detailed business cases for each of the capital projects in the Indicative package.

[1] The Auckland Rail Development Programme is a 30 year rail investment programme jointly prepared by Auckland Transport and KiwiRail to accommodate anticipated growth in rail passenger and freight demand. It assumes growth as reflected in the Auckland Plan and incorporates infrastructure capacity and resilience enhancements, station capacity, enhancements, additional passenger rolling stock, freight efficiency and capacity enhancements and level crossing removal. The programme excludes network extensions.

Phase 1 – Understanding the Challenge

1. The Auckland Plan Transport Network

1.1 Package Description

The project's first phase focused on understanding Auckland's current and future transport challenges in detail through assessing the Auckland Plan Transport Network (APTN). The Foundation Report provides an overview of the key transport challenges facing Auckland over the next 30 years.

Background

The APTN was developed by Auckland Transport, the NZ Transport Agency and Auckland Council to inform the 2015 Regional Land Transport Plan and Long-term Plan. It includes approximately $27.8 billion capital expenditure programme over 30 years (excluding renewals).

The APTN was assessed to represent 'current plans', as referred to in the project Terms of Reference. The term APTN is used throughout this report to refer to 'current plans'.

Key Interventions by Time Period

Table 1.1 below briefly outlines key components of the APTN and the timing of their completion (by decade).

Table 1.1: APTN key interventions by decade

First Decade (2015-25)	Second Decade (2025-35)	Third Decade (2035-45)
• City Rail Link • Accelerated Motorway Project Package • AMETI (Panmure to Pakuranga) • East West Link • Western Ring Route • Puhoi-Warkworth • Implementation of new public transport network • Infrastructure to support Special Housing Areas	• AMETI (Pakuranga to Botany) • Penlink • Northwestern Busway (Westgate and Te Atatu Road) • Rail electrification to Pukekohe • Warkworth-Wellsford • Major infrastructure to support future urban growth	• Additional Waitemata Harbour Crossing • Heavy rail to Auckland Airport • Widening of outer urban motorways • Major infrastructure to support future urban growth

1.2 Key Findings

Analysis of the APTN against key indicators shows mixed results. The following sections provide a summary of the key points and conclusion.

Region-wide Transport Challenges

Under the APTN, road and public transport networks come under increasing pressure over time, leading to increased congestion, more frequent overcrowding, and reduce reliability. Many of the issues currently experienced during morning and evening peak periods are projected to spread to other times of the day.

At a regional level, the APTN delivers mixed results: addressing some of the challenges posed by Auckland's projected growth but struggling with others. Overall employment access is projected to grow over time, but access to employment by car only increases after 2030 with the delivery of a substantial motorway widening programme. Furthermore, increasing congestion over the next 20 years means that access to employment by car does not keep up with total projected employment growth. This results in the proportion of Auckland jobs within a 30-minute peak time car commute declining until the mid-2030s (see Figure 1.1 below).

Access to employment by public transport is projected to perform much better, with a substantial increase in the number and proportion of jobs able to be reached within a 45-minute trip.

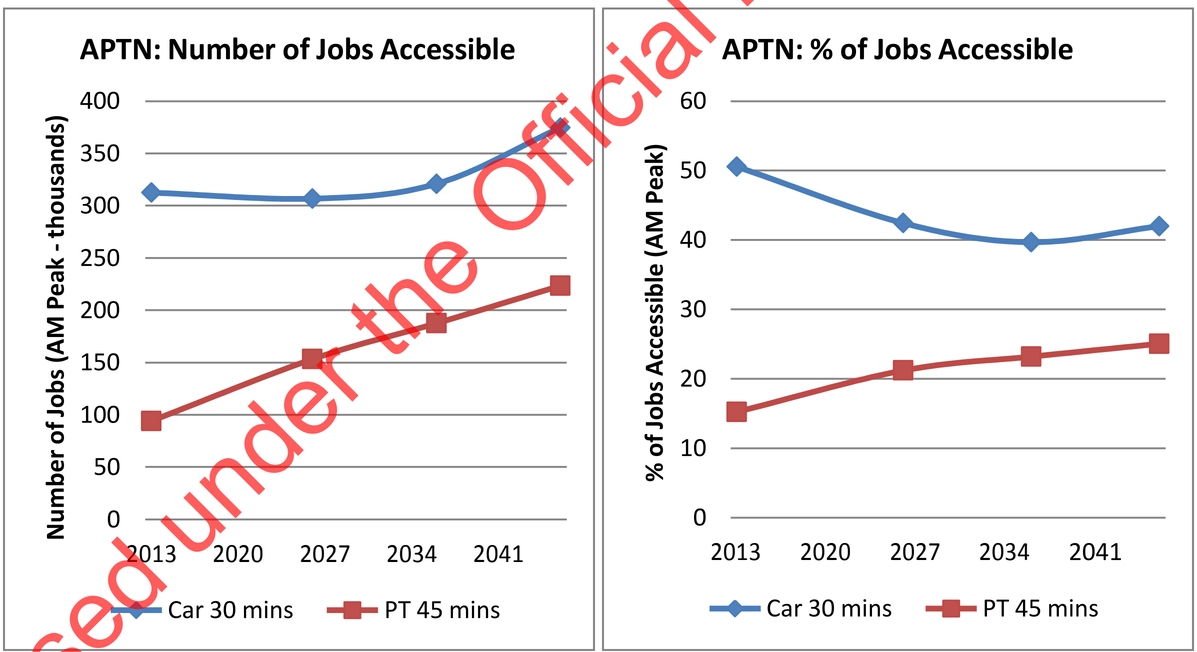


Figure 1.1: Accessibility to jobs for car and public transport in AM peak (APTN)

Under the APTN, congestion is projected to increase and spread as capacity is exceeded by growing demand (Figure 1.2). This crowding increasingly extends into the inter-peak, affecting travel throughout the business day, with particular impacts on high value commercial trips. Conditions are projected to improve in the longer term as investments increase capacity, but not sufficiently to get back to 2013 levels.

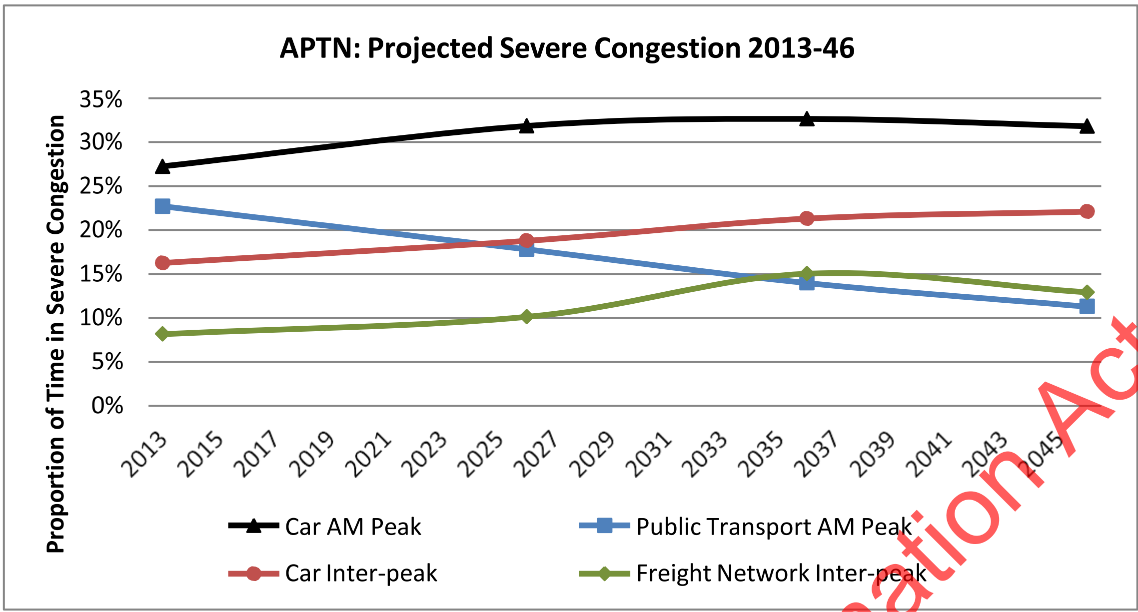


Figure 1.2: Projected severe congestion for car, public transport and freight (APTN)

Public transport mode share in the morning peak is projected to grow over time, more than doubling from 7% in 2013 to 15% by 2046 (Figure 1.3). For vehicular trips (i.e. excluding walking and cycling) to employment at peak times, public transport grows from 13% in 2013 to 29% by 2046.

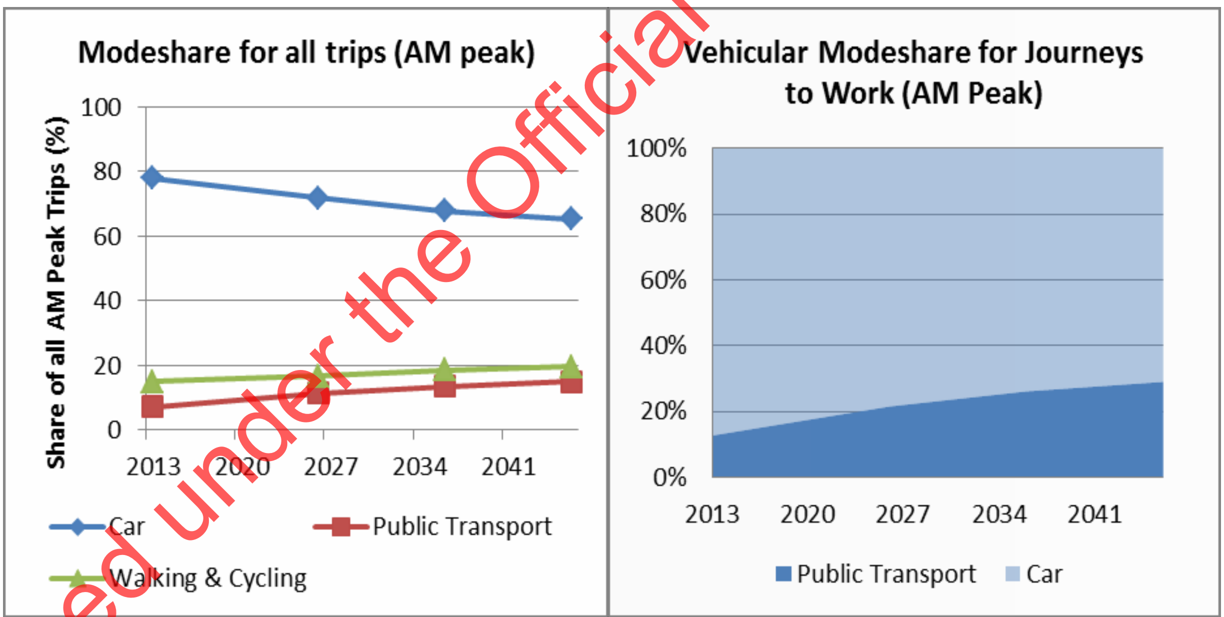


Figure 1.3: Projected mode share (APTN)

The Foundation Report concluded that future phases of the project needed to focus on addressing the following issues:

Access to Employment and Labour

- An overall decline in access to employment by car between 2013 and 2036, particularly in the west and south
- The slowing of public transport access improvements beyond 2026
- The extent to which transport interventions alone can improve access to employment

Congestion

- Increased levels of congestion between 2013 and 2036, particularly on the motorway network
- Key bottlenecks on the motorways and local road network which impact on overall accessibility and trip reliability

Public Transport Mode Share

- Investigation of options to increase public transport mode share, particularly attracting longer trips off the motorway network to reduce congestion
- The low level of public transport mode share growth in South Auckland, particularly in the first decade

Value for Money

- The APTN is the benchmark against which other packages or strategic approaches are assessed in terms of value for money. The parties to the project are seeking better performance in relation to the project objectives having regard to the cost to users and the amount of investment required for the 30 year programme.
- Overall, analysis of the APTN suggested that many of Auckland's most significant transport challenges appear to occur over the next 10 years, with planned investments beyond the next decade appearing to result in improvements. Auckland's significant growth since 2013, the base year for analysis, means that much of this challenge is likely to have already occurred.

Specific Transport Challenges

Accessibility in West and South Auckland

The accessibility projections in the Foundation Report highlight a significant unevenness to future employment accessibility and a growing polarisation of access to employment in the future. By 2046 more than a million people will be living in the western and southern parts of Auckland, nearly half the region's population. However these areas see relatively little improvement in their access to employment over time:

- In the west, car access sees a steep decline up to 2026. There are modest improvements after 2026 overall, with some areas seeing more significant gains. Public transport access improvements mostly occur after 2026 (Figures 1.4 and 1.5).
- In the south, there are widespread declines in car access up to 2026, with some subsequent improvement. Public transport improvements are generally modest throughout the whole 30 year period, with only isolated areas of significant increases (Figures 1.4 and 1.5).

The wider implications of these areas being at least partly excluded from the benefits of Auckland's expanding employment base over the next 30 years are potentially significant, particularly given they include parts of Auckland with higher levels of deprivation, as well as a number of key future urban growth areas. Overall the accessibility findings highlight the transport challenges in providing for increasingly concentrated employment growth coupled with widespread dispersed population growth.

Long-term solutions to these accessibility constraints potentially involve targeted capacity improvements as well as advancing the timing of interventions to better align with deficiencies.

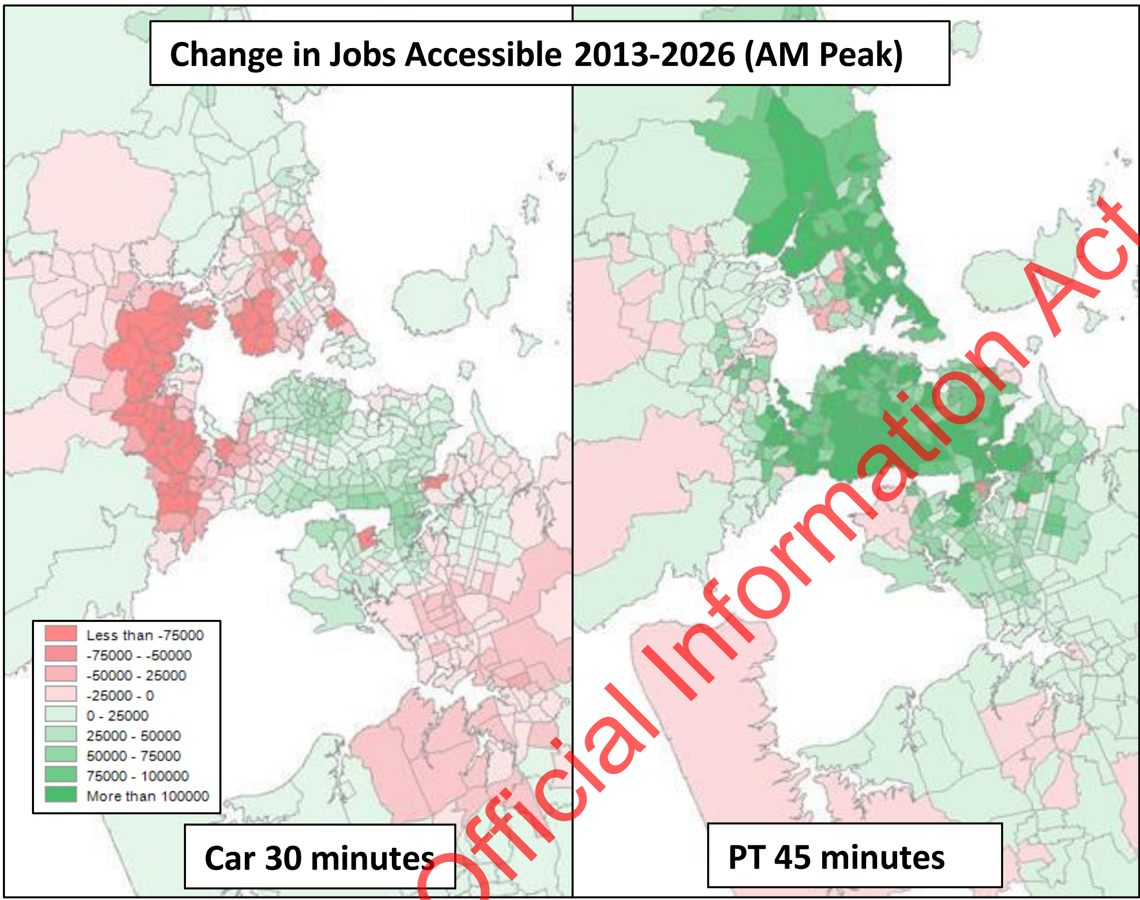


Figure 1.4: Change in accessibility to jobs 2013 vs 2026 (APTN)

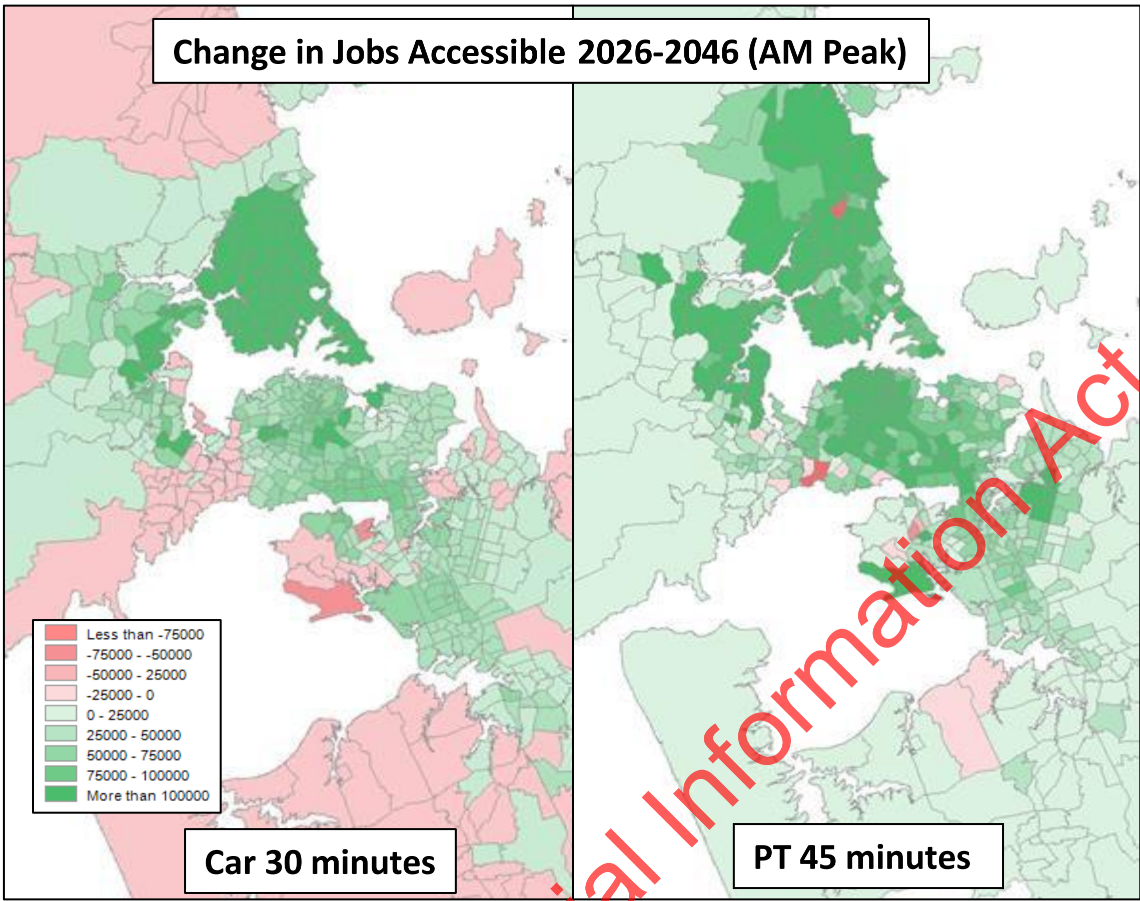


Figure 1.5: Change in accessibility to jobs 2026 vs 2046 (APTN)

1.3 Key Learnings

Analysis of the APTN highlighted a number of transport challenges expected to accompany Auckland's growth over the next three decades, even with the significant investments proposed in current transport plans. This relates particularly to increasing congestion in both the peak and inter-peak periods, and declining accessibility in the west and south.

A modest increase in public transport mode share occurs broadly over the next 30 years, although improvements are unevenly spread, with a particularly low level of mode share growth occurring in the south. For large parts of the overall transport task, particularly in outer areas of Auckland, public transport's role is not projected to notably increase under APTN.

Phase 2 – Option Testing

In this phase of the project, we progressively refined intervention packages in three main stages of analysis.

- **Initial Testing** examined a wide range of interventions to compare performance against the project objectives.
- **Package Analysis** took the best performing interventions and tested the effect of changing the mix of investment and the potential from new technology and moving to smarter transport pricing.
- **Package Refinement** compared increasing investment with a pricing focused approach

2. Initial Testing

Initial testing cast a wide net to look at different approaches to the APTN to see whether it was possible to achieve better performance against the project objectives.

A number of possible, new interventions were identified that could be applied either in addition to, or in place of, interventions in the current plans. The Supporting Information of the Final Report details these interventions.

Some of these interventions were tested without being brought forward into subsequent rounds of evaluation, including testing the current plans with reduced public transport fares or with bus lanes removed.

This section of the Evaluation Report provides information on two main interventions:

- Smarter Pricing: Initial Analysis (Section 2.1)
- Emerging Transport Technologies (Section 2.2)

2.1 Smarter Pricing: Initial Analysis

ATAP explored the potential to use variable road network pricing as a demand management tool to achieve better network performance against ATAP objectives. The goal of demand management pricing is to achieve better performance by pricing users to face a greater proportion of the true costs of their travel, including impacts on other users. Over time this can reduce the extent of investment required in the transport system.

In this initial phase, three approaches to varying the cost of private motor vehicle travel (we have called these interventions 'smarter road pricing' in the project) were tested[2] to understand their potential to improve performance against the project objectives:

- A city centre cordon scheme (a peak-time only charge for vehicles entering the city centre)
- A motorway network charge (a flat-rate charge for vehicles entering the motorway network, with a higher charge at peak times)
- A whole of network charge (a per kilometre charge across all parts of the road network, with a higher rate at peak times)

The options were assessed to understand their potential impact on the project's access, congestion, public transport mode share objectives. We also attempted to assess the options against the project's "net benefits to users" objective but the limitations of our analytical tools meant a robust assessment against this objective was not possible.

Initial testing and evaluation indicated all three approaches had the potential to improve congestion and increase public transport mode share, when compared to the unpriced APTN. Of the three schemes, the comprehensive network charge with its region-wide impact has by far the greatest impact on improving access (as measured by travel time), reducing congestion and increasing public transport mode-share.

However, as the initial option tested was a simplistic fixed-rate charge per kilometre for all trips across the network, analysis indicated poor net benefits to users. This was particularly the case for trips made in outer areas where there was little benefit from reduced congestion but a very high cost due to much longer average trip lengths and few realistic alternatives available to driving.

The city centre cordon charge had the smallest regional impact because of its narrow focus on the city centre, but it was effective at achieving modal shift to public transport and a corresponding reduction in car trips to the city centre. The main potential use of a city centre cordon charge could be as a transition to a broader scheme, but its relatively minor regional impacts means that other schemes were the focus of further analysis.

The motorway charge scheme improved regional congestion, particularly on the motorway network. However, the use of a 'flat-rate' and charging for the motorway network only, resulted in large scale diversion of motorway traffic onto local roads, with resulting congestion. A distance-based motorway charge was considered more likely to be successful in improving access and congestion so a higher per kilometre charge on the motorway network was incorporated into the network-wide system for the next phase of more detailed analysis.

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[2] For detailed analysis, see ATAP Demand Management Pricing Report. Peak prices tested in this round were: CBD Cordon ($10 inbound); Motorway Charge ($5 per trip); Whole of Network Charge (44 cents per kilometre).

2.2 Emerging Transport Technologies

The potential future impacts of developing transport technologies are profound, but highly uncertain. We developed two 'what if' scenarios[3] to test the effects of:

- Increasing vehicle occupancy rates
- The uptake of connected vehicles

To understand the impact of technology changes in isolation from other interventions, the impact of connected vehicles and ridesharing were analysed using a common baseline of interventions.

Increases in car occupancy were analysed through directly modifying assumed occupancy rates in the strategic modelling tools. Vehicle occupancy rates convert car person trips into car vehicle trips by purpose. The modelling tools are not able to simulate trip diversion to 'pick up' passengers or reflect any changes in trip generation rates that may occur through greater use of ridesharing. This means the analysis is likely to over-estimate the impact of increased occupancy on reducing demand levels for travel by other means (e.g. drive-alone or use of public transport).

The uptake of ride sharing is expected to vary by trip purpose. Due to their recurrent and regular nature, coupled with low existing occupancy levels, the greatest increase in occupancy rates is expected to be in trips to and from work.

Two scenarios were developed, based around a 50% and a 100% increase in occupancy rates for work-related trips. Changes in occupancy for other trip types were adjusted accordingly, as shown in Table 6.1 below.

Table 2.1: Changes to car occupancy rate

Trip Purposes	Car occupancy rate increase
Work Related	50%-100%
Education Related	10% - 20%
Shopping Related	10% - 20%
Other Purposes	10% - 20%
Employer's Business	5% - 10%

The potential impacts of increasing connected vehicle use were tested in the strategic transport modelling tools by increasing road-lane capacity and reducing the extent of lost time per phase at signalised intersections (i.e. interventions which increase network productivity through improved vehicle throughput). Advancements in Intelligent Transport Systems (ITS) will also improve the operation of signalised intersections. A 75% uptake of connected vehicles by 2036 was assumed for the purpose of this test.

The modelling showed a reduction in public transport trips. In reality, greater use of ridesharing is more likely to replace public transport service in lower density areas than in higher capacity routes where public transport is more likely to offer a time advantage over cars.

[3] For detailed analysis, see ATAP Technology Report.

The main areas where connected vehicles and higher occupancy rates improve performance against the project objectives are in relation to congestion (Figure 2.1) and car accessibility (Figure 2.2).

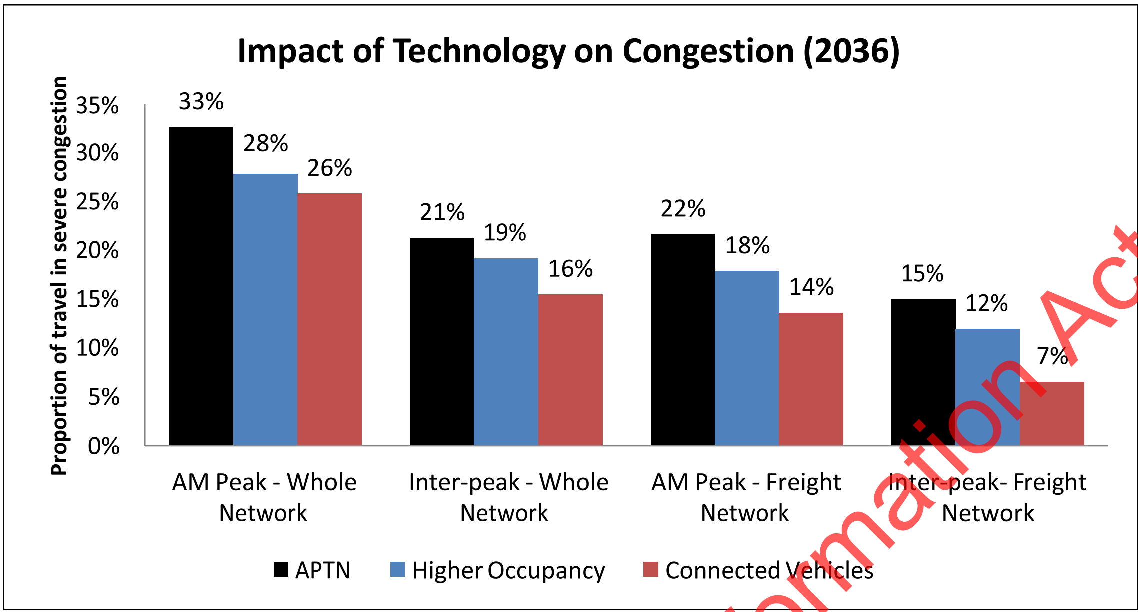

Figure 2.1: Impact of technology on congestion (2036)

Connected vehicles appear likely to have a larger effect on reducing congestion than increases in vehicle occupancy, although our analysis also showed that these impacts were independent and therefore cumulative if increased occupancy rates and connected vehicles occur simultaneously, as can be expected. Congestion reduction from connected vehicles was most significant on the motorway network, because this is where vehicle connectivity is projected to result in the greatest throughput increase due to fewer intersections and less interaction with pedestrians, cyclists and other vehicles.

Potential technology related congestion improvements translate directly into equivalent accessibility gains. The modelling indicates the accessibility gains could be greater than what could be achieved through infrastructure investments alone. This is likely to reflect the region-wide assumptions of technology improvements to Auckland's private motor vehicle fleet, road network and uptake of ride sharing.

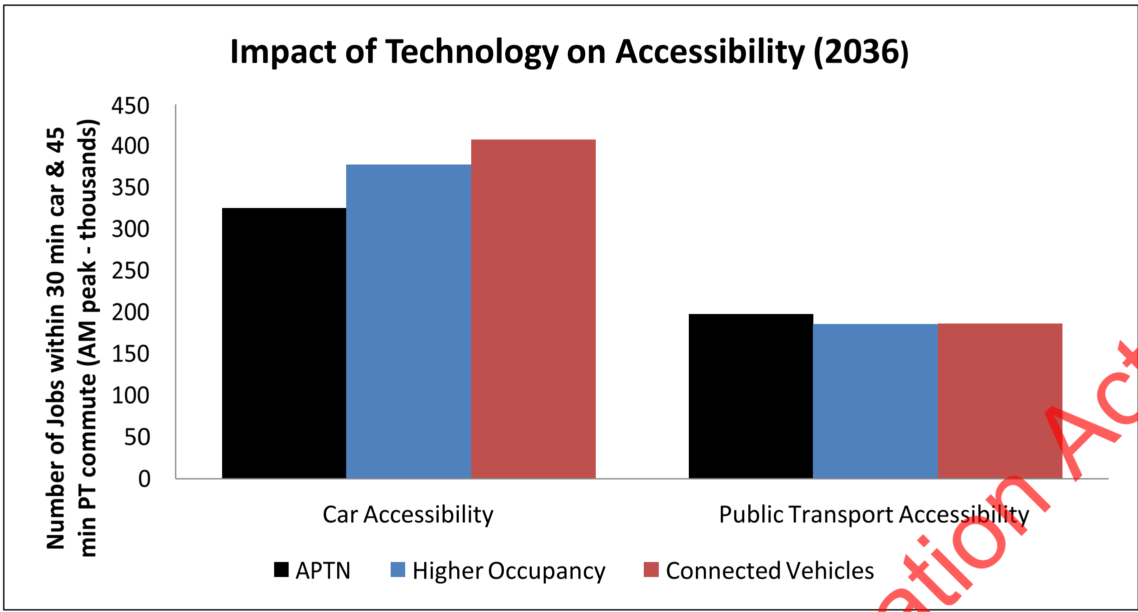

Figure 2.2: Impact of technology on accessibility (2036)

In contrast, public transport accessibility slightly reduced under the two technology scenarios when compared to the APTN. This suggests that neither technology development appears to result in faster public transport journeys. If public transport journeys did become faster, the improvement relative to car journey time is not significant.

As was the case for road pricing, it is important to recognise that with the technology scenario, the strategic modelling tools were being used for very different tasks than what they had been designed for. This was particularly the case for increased vehicle occupancy rates.

Given the level of uncertainty around the nature, scale and timing of technological innovation we decided not to build major technology assumptions into the later phases of technical modelling analysis. Some general conclusions were possible though:

- The benefits of developing vehicle technologies are likely to be substantial, and strongest on the motorway network.
- Increasing vehicle occupancy rates can help reduce congestion and improve car accessibility. Impacts on public transport are more complex, but seem more likely to affect demand in lower density areas more than along core strategic corridors.
- Ride sharing also has the potential to complement road pricing by offering practical alternatives for commuters where public transport is unlikely to be a realistic option under any of the packages we have analysed.

3. Package Analysis

Initial Testing → **Package Analysis** → Package Refinement

Information from initial testing was used to develop full packages of interventions that could be compared against each other and current plans to assess performance against the project's objectives. This work informed our Interim Findings report that was released in June 2016.

To test whether a different mix of investment could deliver better returns, two intervention packages were developed using broadly similar decade-by-decade levels of investment to the existing plan – the APTN. Each package was built around a 'theme' to describe its focus:

- Focus on Addressing Capacity Constraints (Section 3.1)
- Focus on Access to Employment Centres (Section 3.2)

In addition, a refined version of the Smarter Pricing tool was analysed in Section 3.3, while a cross package review was also undertaken in Section 3.4.

A common baseline for the packages reflects out-of-scope projects and helps assist in identifying differences in performance arising from the different mix of large, strategic interventions in the packages. These differences occur mostly in the second and third decades, because a substantial proportion of the first decade is already agreed and committed.

In fact, compared to the APTN, the first decade already appears 'over-subscribed' even without the inclusion of any discretionary capex items. This is due to a number of investments being added to the common baseline since the APTN was constructed or where project information (including scope and cost) has changed compared with what was used for APTN.

The packages were evaluated against the evaluation framework to test their performance against the project objectives. The intention of the package analysis was not to pick a winner from the three packages, but to understand each package's strengths and weaknesses and the extent to which each package delivers better returns than the current plans.

3.1 Focus on Addressing Capacity Constraints

3.1.1 Package description

The Capacity Constraints package tests the hypothesis that the best approach for achieving the project objectives is through adding capacity in all locations where demand exceeded available capacity.

Projected growth in travel demand is expected to exceed available capacity in an increasing number of locations around Auckland over the next 30 years, leading to congestion and declines in accessibility.

Many of the areas projected to have the most significant access and network performance problems in the future are outer areas that rely on the strategic networks in particular to perform adequately.

This package prioritises interventions that address the most severe capacity constraints on the road and public transport networks, particularly in areas and on parts of these networks that will benefit the greatest number of users.

The total estimated 30-year cost of new capital improvements (excluding renewals) of the Capacity Constraints package is $29.5 billion (in 2016 dollars). Figure 3.1 below provides a breakdown of costs by decade and project type. In broad terms, the bulk of investment in this package goes towards motorway widening and the Additional Waitemata Harbour Crossing project. These costs were identified prior to the revision of project costs in ATAP.

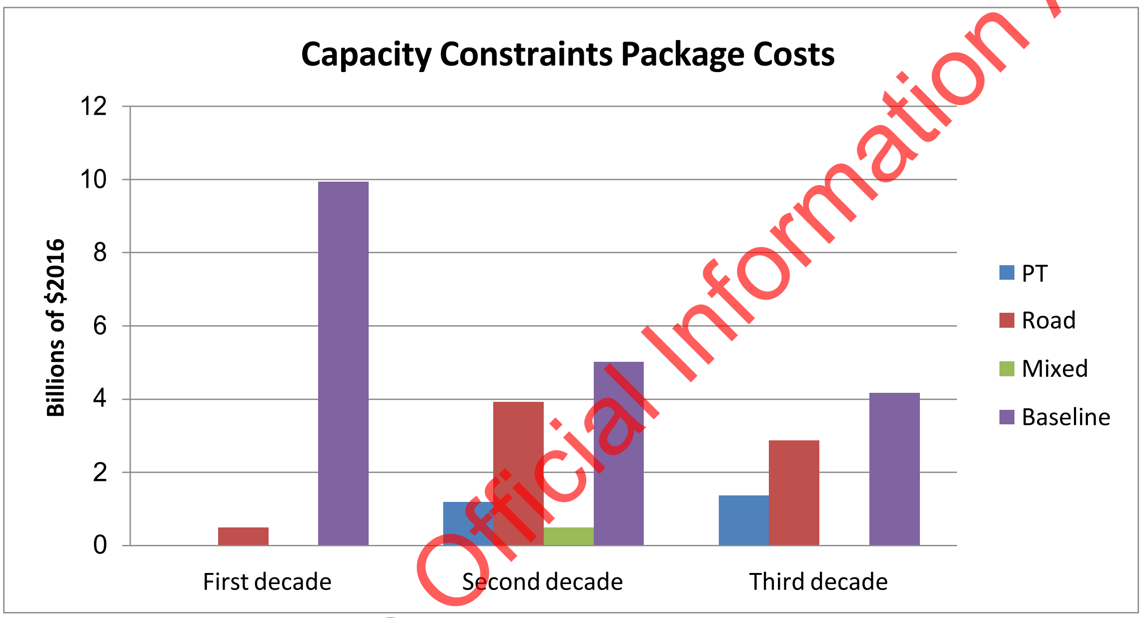

Figure 3.1: Estimated cost of new capital improvements (excluding renewals) of Capacity Constraints package (2018 – 2048)

Key interventions by time period

Key components of the package over and above the enhanced baseline are included in Table 3.1 below.

Table 3.1: Capacity Constraints key interventions by decade

First Decade (2015-25)	Second Decade (2025-35)	Third Decade (2035-45)
• Targeted SH20 widening	• Northwestern Busway (Point Chevalier to Newton) • Southern Motorway targeted widening and interchange upgrades • SH16 widening • AMETI Pakuranga to Botany	• Additional Waitemata Harbour Crossing (motorway tunnels) • City centre bus access improvements • Further SH20 widening • SH20A upgrade

3.1.2 Key Findings
Accessibility

Access to employment in the AM peak for car travel improves from 2026 onwards compared to the APTN, while public transport accessibility tracks very similarly to the APTN up until 2036, after which the APTN performs slightly better (Figure 3.2).

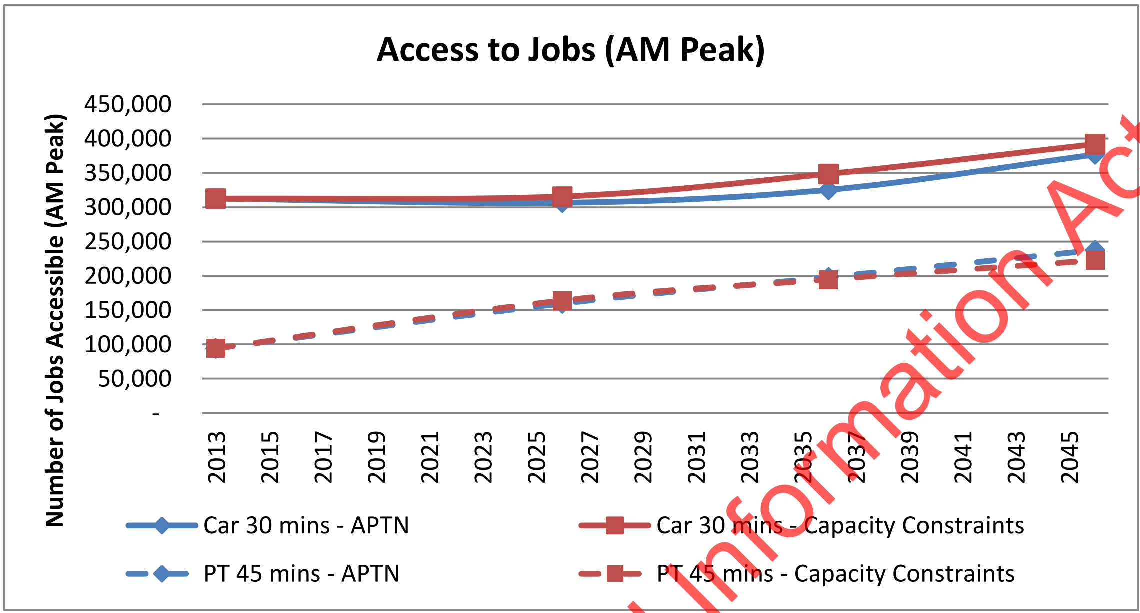

Figure 3.2: Access to jobs (Capacity Constraints and APTN)

Regional measures can mask sub-regional differences in performance, as shown in the accessibility maps below. At a sub-regional level, car accessibility declines in the west, northwest and parts of the North Shore under Capacity Constraints between 2013 and 2026 (Figure 3.3). However public transport accessibility increases significantly for most areas under the same period.

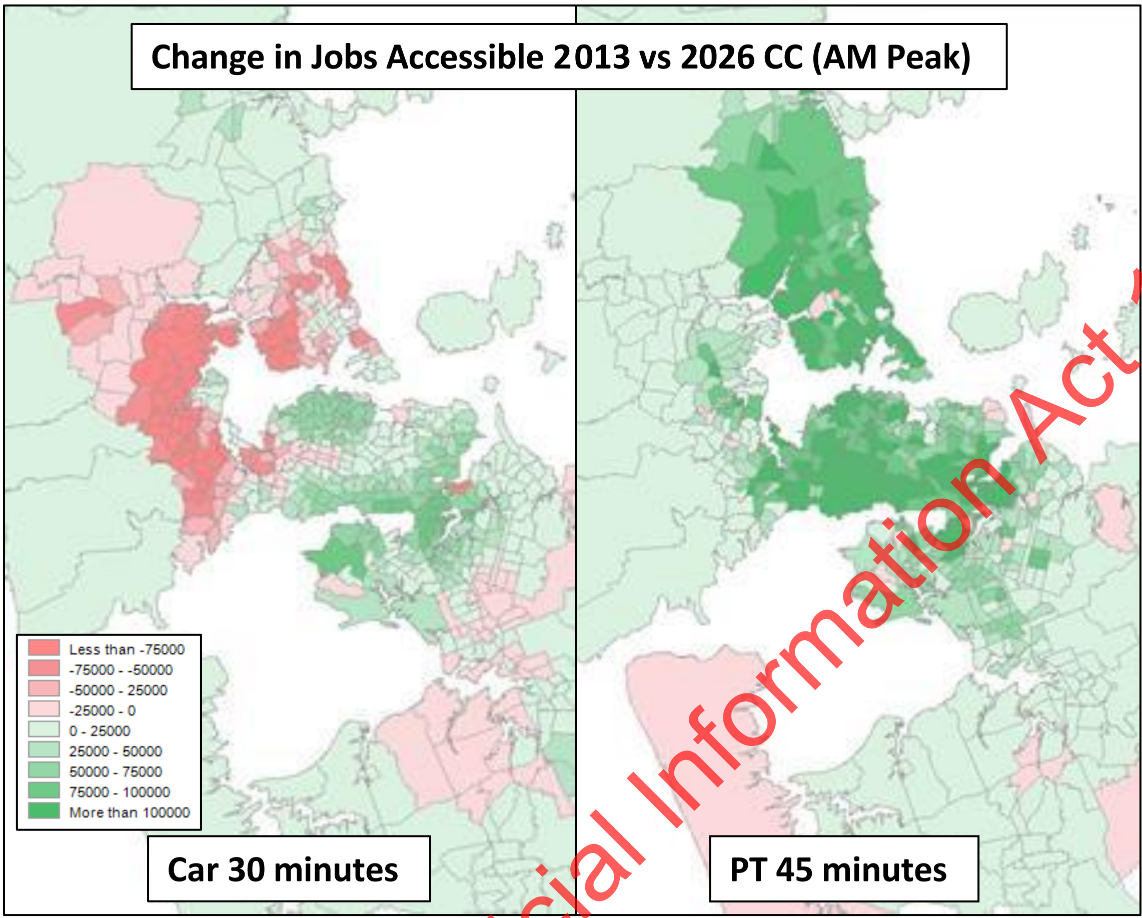

Figure 3.3: Change in accessibility to jobs 2013 vs 2026 (Capacity Constraints)

Between 2026 and 2046, car accessibility improves dramatically on the North Shore, northwest and parts of the isthmus under the Capacity Constraints package (Figure 3.4). However, accessibility declines in the west and around the Airport. Public transport accessibility improves across the region, especially in the isthmus and northwest.

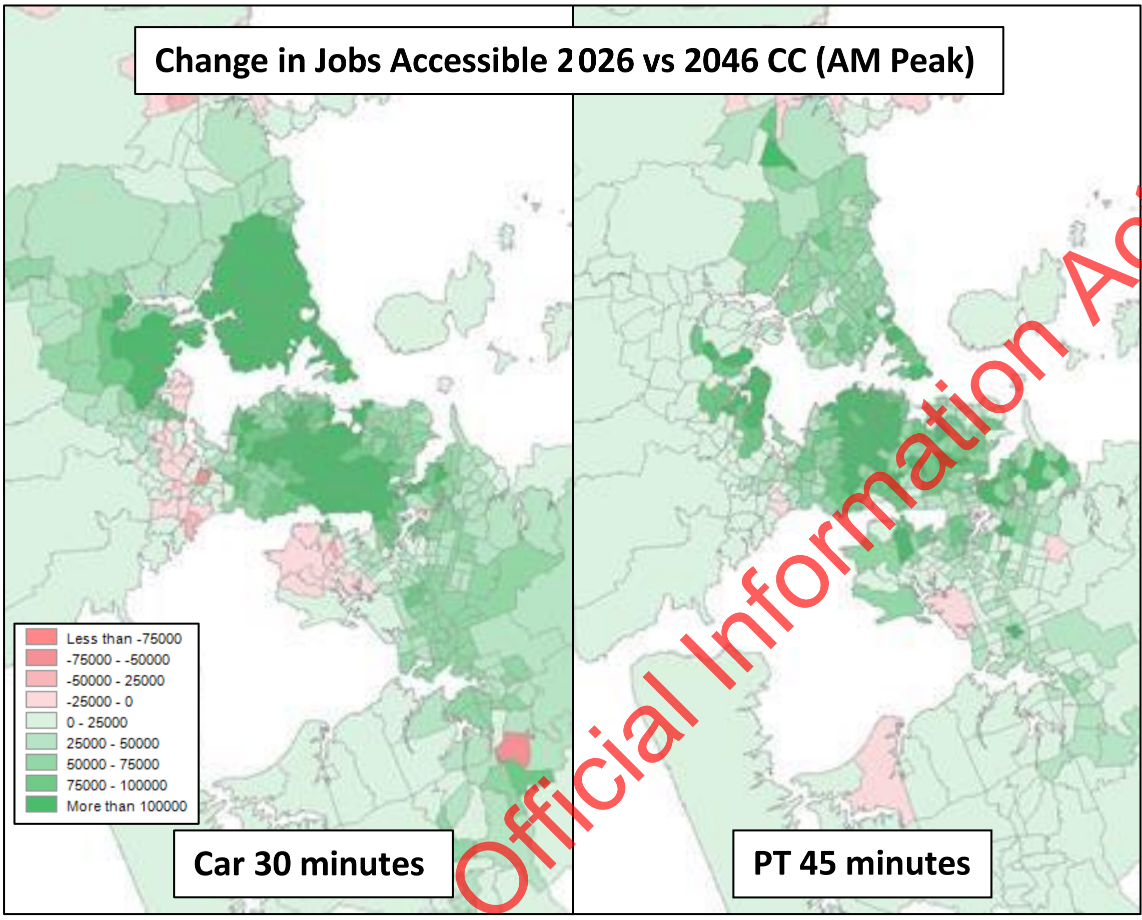

Figure 3.4: Change in accessibility to jobs 2026 vs 2046 (Capacity Constraints)

Compared to APTN, the Capacity Constraints package performs better for most of the isthmus, the inner west, parts of the northwest and the outer south (Figure 3.5). However, it performs worse for most of the lower North Shore, the outer west and the inner south. The reduction in accessibility for the North Shore may be due to the different improvements on SH1 in the area under APTN.

In terms of public transport, pockets of improvement can be seen around Howick and Mangere. However, accessibility declines for most of the region compared to APTN. Accessibility declines particularly for the northwest, likely due to the fact that this package provides for a busway from Point Chevalier to Newton Road, while APTN provides a busway corridor from Westgate to Te Atatu Road. Another reason may be that this package lacks the Upper Harbour strategic public transport route which runs between Henderson and Constellation.

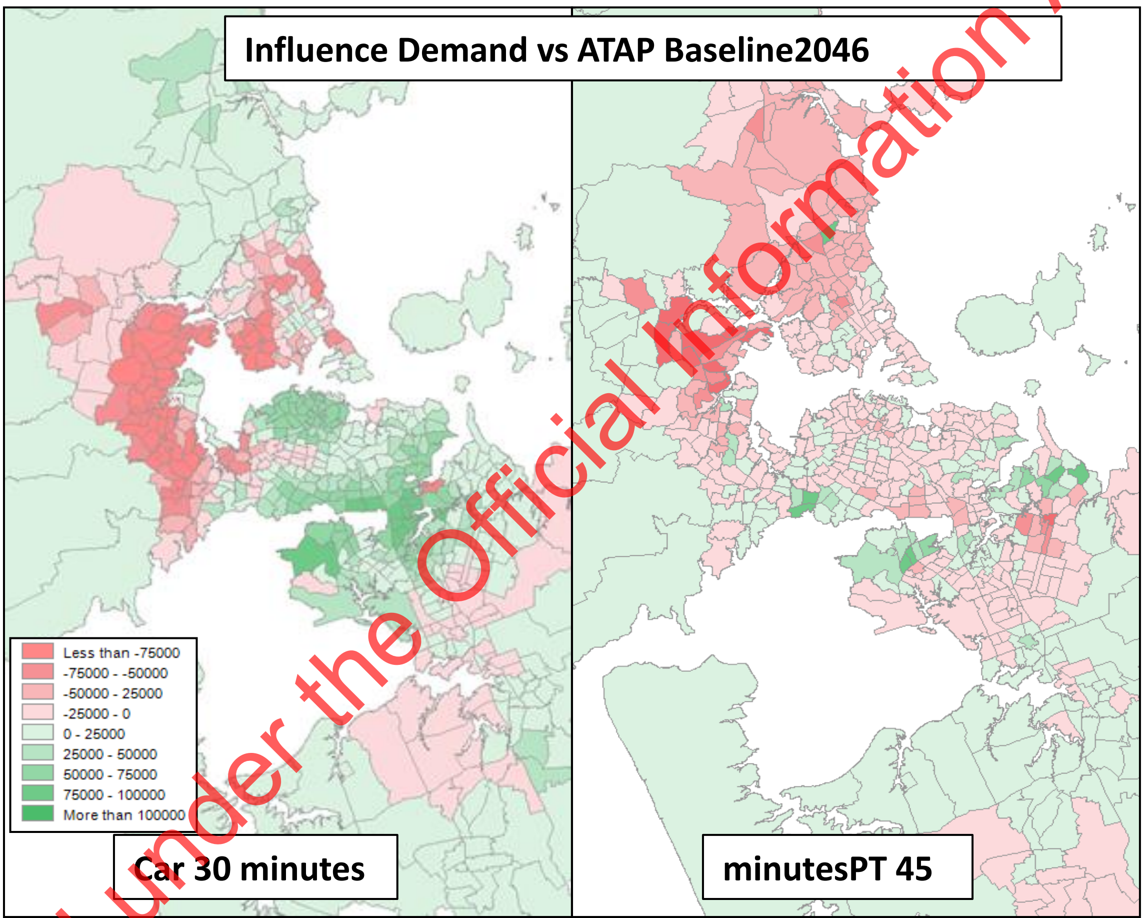

Figure 3.5: Accessibility to jobs (Capacity Constraints and APTN)

Congestion

Congestion levels in the AM peak and inter-peak improve moderately compared to APTN, with 2036 experiencing the greatest improvements (Figure 3.6)

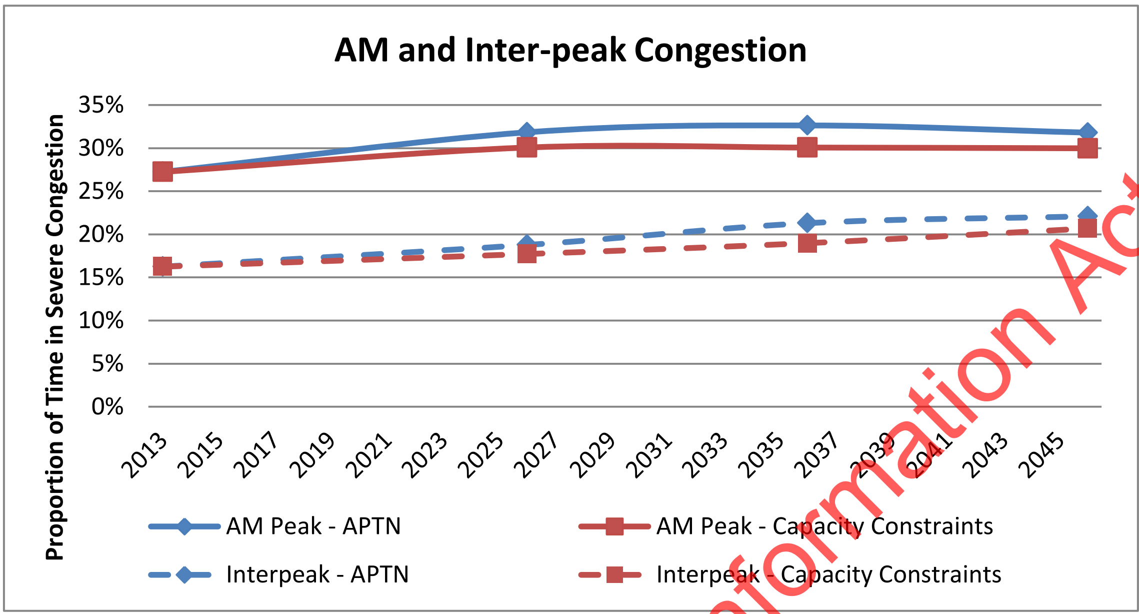

Figure 3.6: AM peak and inter-peak congestion (Capacity Constraints and APTN)

The freight network experiences greater congestion improvements compared to the road network, especially in the AM peak (Figure 3.7). A similar improvement to congestion is projected for the inter-peak. The year 2036 sees the greatest improvements to freight congestion.

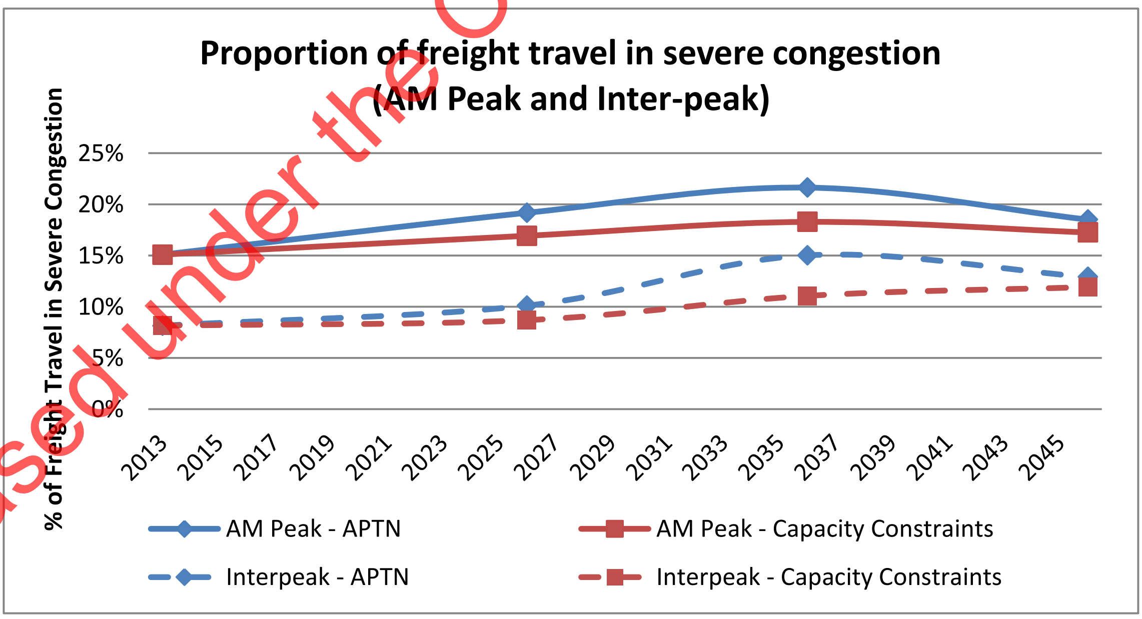

Figure 3.7: Proportion of freight travel in severe congestion (Capacity Constraints and APTN)

On a sub-regional level, the Capacity Constraints package alleviates some of the more severe congestion during the AM peak, in particular SH20A and parts of the Northern Motorway (Figure 3.8). However, severe pinch points remain on the motorway network.

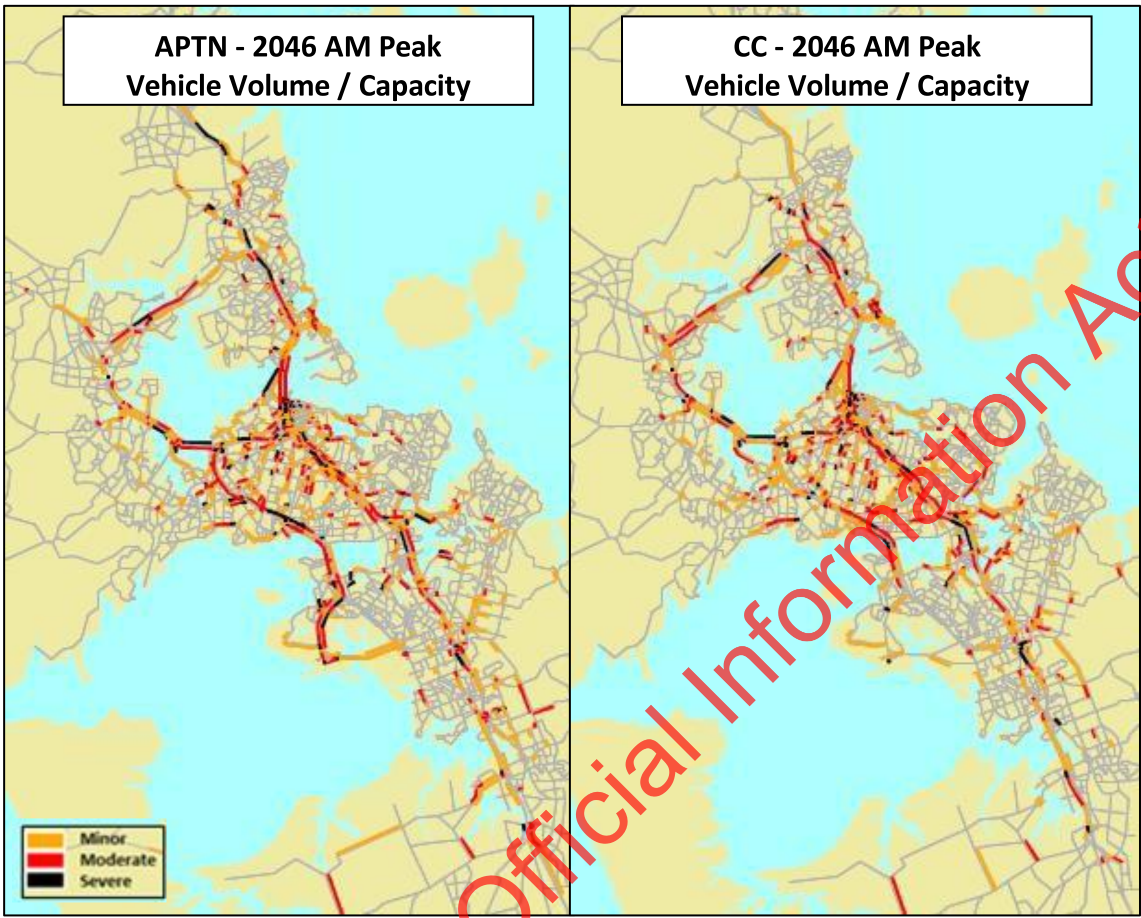

Figure 3.8: AM peak vehicle travel demand (Capacity Constraints and APTN)

The inter-peak experiences less severe congestion compared to the AM peak. The Capacity Constraints package continues to alleviate some of the more severe congestion on the motorway network, in particular SH20A and parts of the Northern Motorway (Figure 3.9). Limited severe congestion remains, particularly within the inner motorway network.

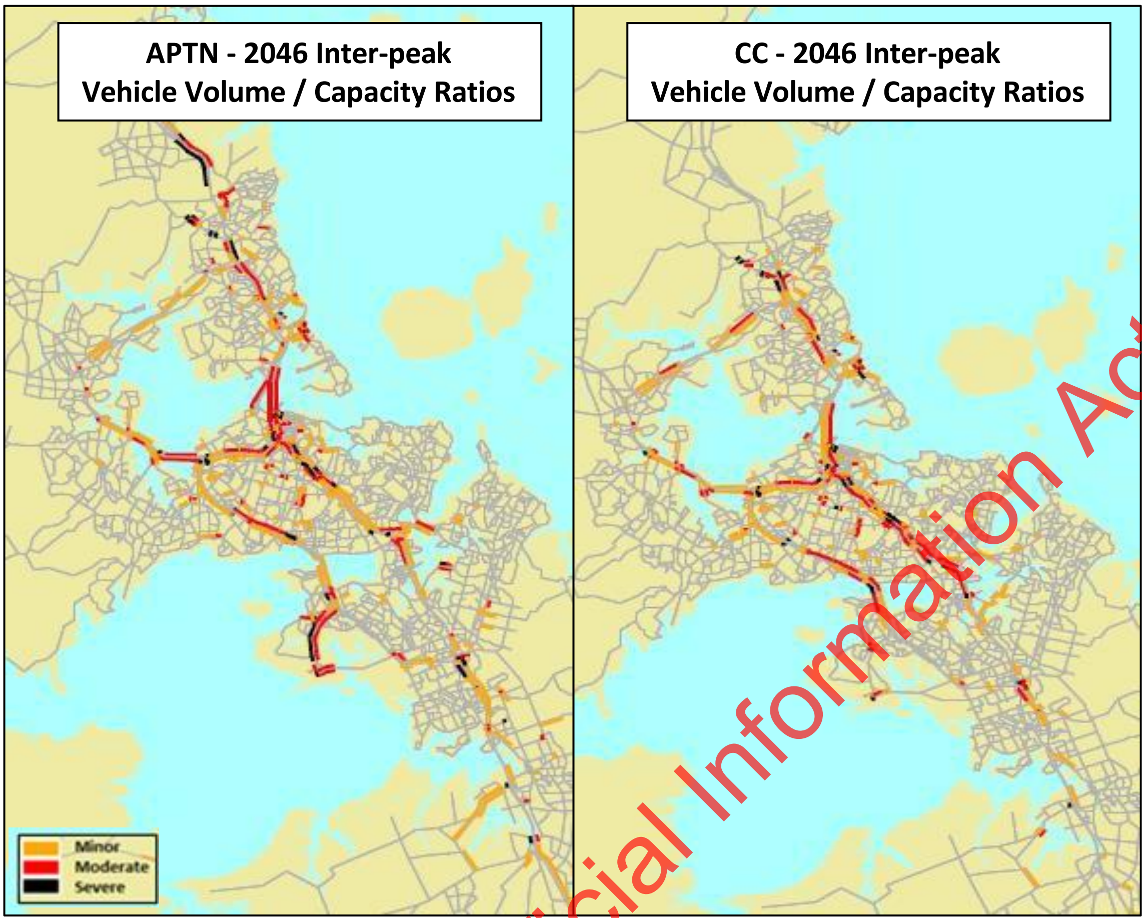

Figure 3.9: Inter-peak vehicle travel demand (Capacity Constraints and APTN)

Public Transport Mode Share

Public transport mode share remains virtually identical to APTN over the 30 year period (Figure 3.10).

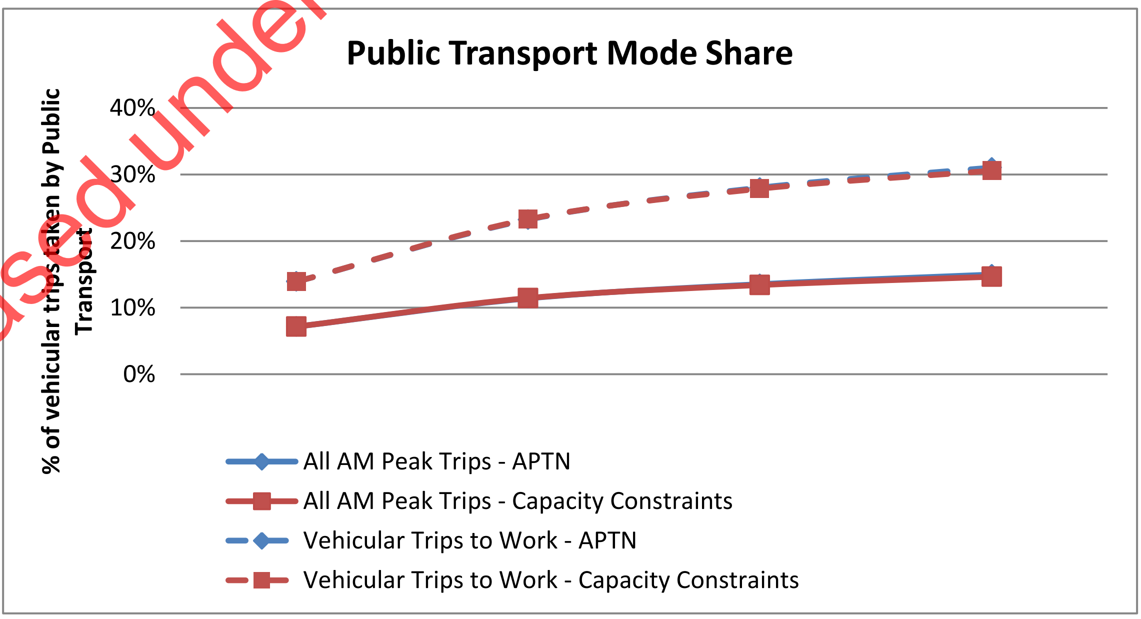

Figure 3.10: Public transport mode share (Capacity Constraints and APTN)

Bus demand continues to exceed capacity at parts of the network, broadly to a similar extent as APTN, with additional deficiencies to Panmure and Howick (Figure 3.11).

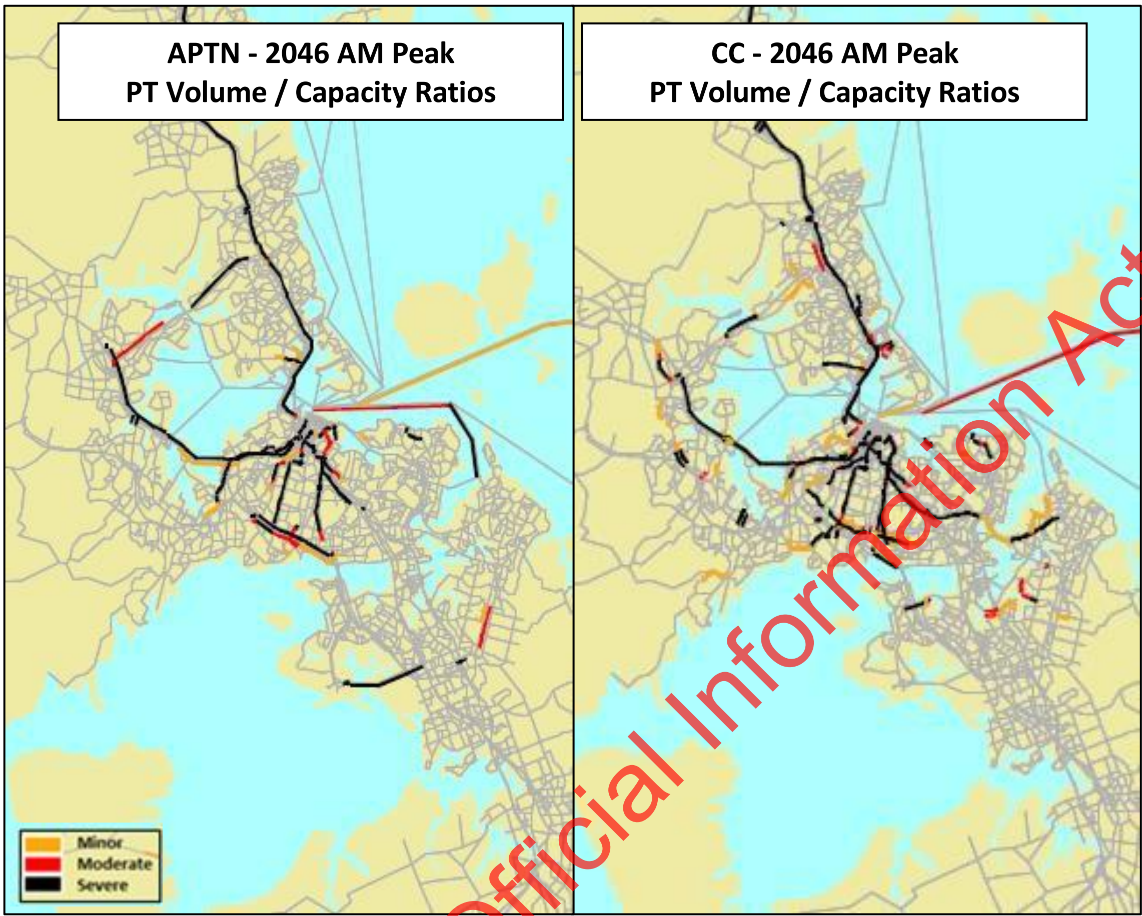

Figure 3.11: Public transport demand (Capacity Constraints and APTN)

Value for Money

Value for money assessments considered both network wide effects and isolating the contribution of projects at a sub-regional level, through an assessment of their impact on throughput and travel times relative to cost. These proxies for value for money were used to identify projects worth taking forward into the next round of evaluation.

The Capacity Constraints package has an estimated $29.5 billion capital expenditure programme over 30 years (excluding renewals) which is projected to have similar contributions to the ATAP objectives as the APTN. The package is projected to result in a higher proportion of jobs accessible by motorists of 44% (compared to 42% in the APTN), a slightly higher proportion of jobs accessible by public transport of 25% (compared to 27% in the APTN), a slightly lower proportion of travel time in severe congestion of 30% in severe congestion in AM peak (compared to 32% in the APTN) and a similar public transport mode share of 18.2% in the AM peak (compared to 18.6% in the APTN).

The Capacity Constraints package as a whole is projected to have a similar overall contribution to the ATAP objectives as the APTN package, with a similar sized capital improvement programme.

3.1.3 Key Learnings

Analysis of the Capacity Constraints package highlights some areas of strength, such as a significant improvement to congestion on the freight network, but also some areas of poor performance – particularly relating to congestion and car accessibility issues for parts of the west.

Targeted motorway widening, particularly on SH20 and parts outside the isthmus, improves car accessibility and provides marginal gains in congestion. Widening parts of the motorway network earlier also decreases the rate of deterioration.

While the package does not achieve a 'step-change' in regional performance, impacts at a sub-regional level are significant. In particular, improvements for the west and south appear possible through changes to the mix and timing of investment. In the south, whereas under the APTN access to employment by car declined and only increased strongly after 2036, the Capacity Constraints package shows better performance can be achieved in the south.

3.2 Focus on Employment Centres

3.2.1 Package Description

The Employment Centres package tests the hypothesis that because Auckland's employment growth is focused in a relatively small number of locations, the best approach to achieving the project objectives is by strongly focusing on improving access to locations with large numbers of jobs and where significant jobs growth is projected.

Auckland's employment is currently spread throughout the region, with a number of key centres forming important clusters. The key clusters are the central area (CBD), Auckland Airport, and Westgate. Employment growth in the future is projected to be highly focused on these clusters, reflecting an ongoing shift towards service-sector based jobs. Many of the areas projected to have the most significant access problems in the future are the parts of Auckland which are most distant from these clusters.

This package prioritises interventions that improve access to current and future major centres of employment (including the central area). Interventions that improve access to, from and between major employment centres will be prioritised in this package. The different characteristics and constraints of major employment areas need to be recognised in this process.

The total estimated 30-year cost of new capital improvements (excluding renewals) of the Employment Centres package is $29.6 billion (in 2016 dollars). Figure 3.12 below provides a breakdown of costs by decade and project type. In broad terms, the bulk of investment in this package is on light-rail and rapid transit, followed by motorway widening. These estimated costs were identified prior to the revision of project costs in ATAP.

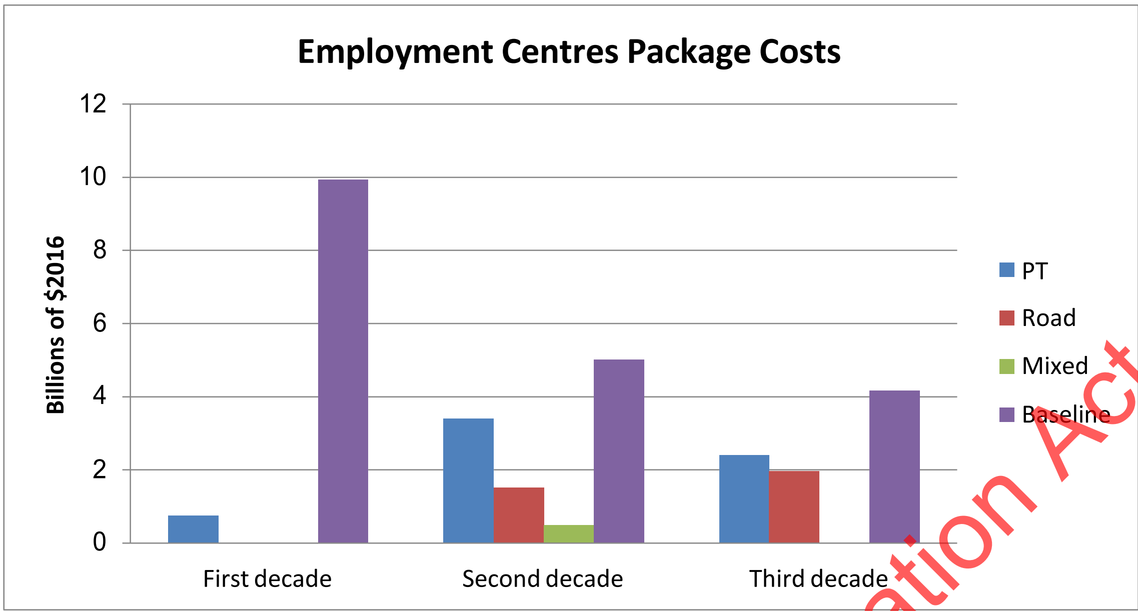

Figure 3.12: Estimated cost of new capital improvements (excluding renewals) of the Employment Centres package (2018 – 2048)

Key interventions by time period

Key components of the package over and above the enhanced baseline are outlined in Table 3.2 below.

Table 3.2: Employment Centres key interventions by decade

First Decade (2015-25)	Second Decade (2025-35)	Third Decade (2035-45)
• Northwestern Busway (Westgate to Newton)	• Targeted widening of Southern Motorway and SH20 • Isthmus light-rail • North Shore rapid transit (city centre to Takapuna) • Rail upgrades to enable Southern Line express trains • AMETI Pakuranga to Botany	• Extension of East-West Link east of SH1 • Targeted further Southern Motorway and SH20 widening • Upgrade to SH20A • Extension of light-rail to Airport from north • Extension of North Shore rapid transit to Albany

3.2.2 Key Findings

Accessibility

Access to employment in the AM peak tracks very similarly to APTN for car and public transport (Figure 3.13). Generally the Employment Centres package improves accessibility in 2026 and 2036, while APTN catches up in the final decade.

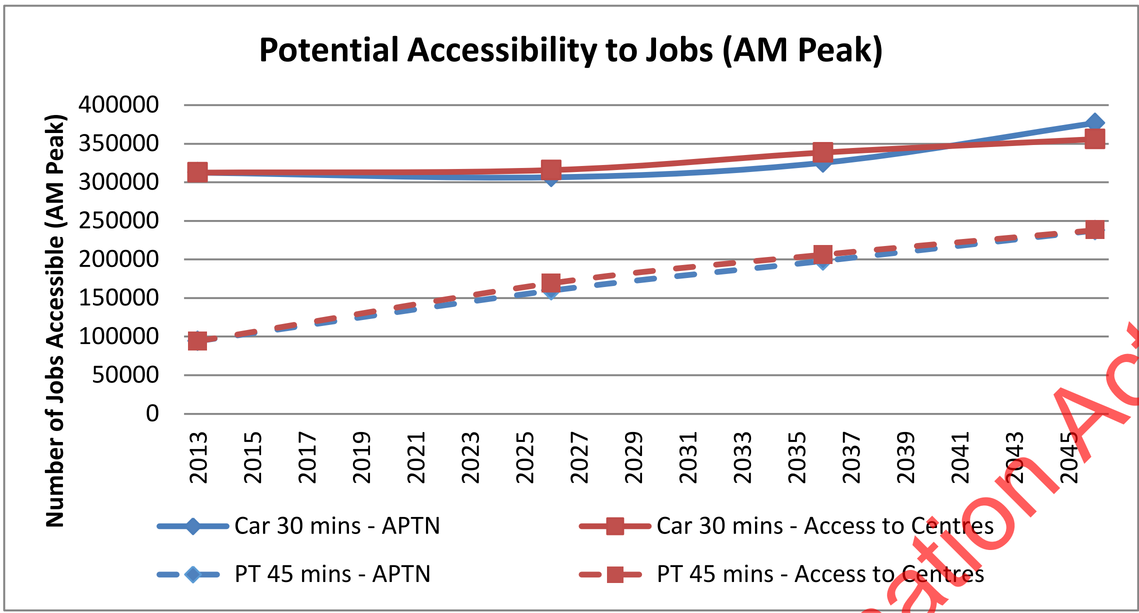

Figure 3.13: Potential accessibility to jobs (Employment Centres and APTN)

On a sub-regional level, car accessibility declines under the package in the west, northwest, and parts of the North Shore and outer south between 2013 and 2026 (Figure 3.14).

Public transport accessibility improves across the region over the same period. The decline in car accessibility in the northwest is offset by accelerating improvements of the Northwestern Busway into this timeframe.

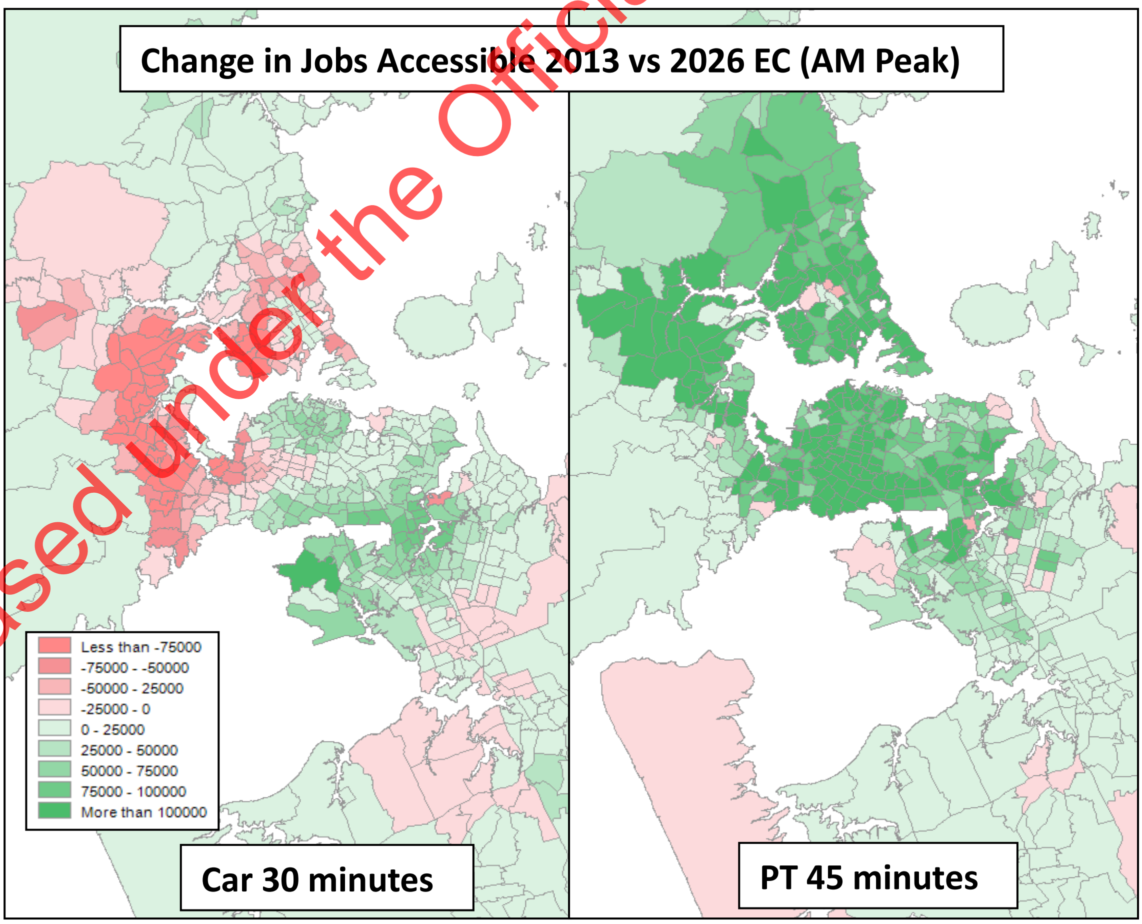

Figure 3.14: Change in accessibility to jobs 2013 vs 2026 (Employment Centres)

Between 2026 and 2046, there are generally better accessibility outcomes for both car and public transport (Figure 3.15). Some exceptions include car access from the Airport, northwest and parts of the North Shore. Even though this package does not include the Additional Waitemata Harbour Crossing, parts of the North Shore experience improvements in car accessibility.

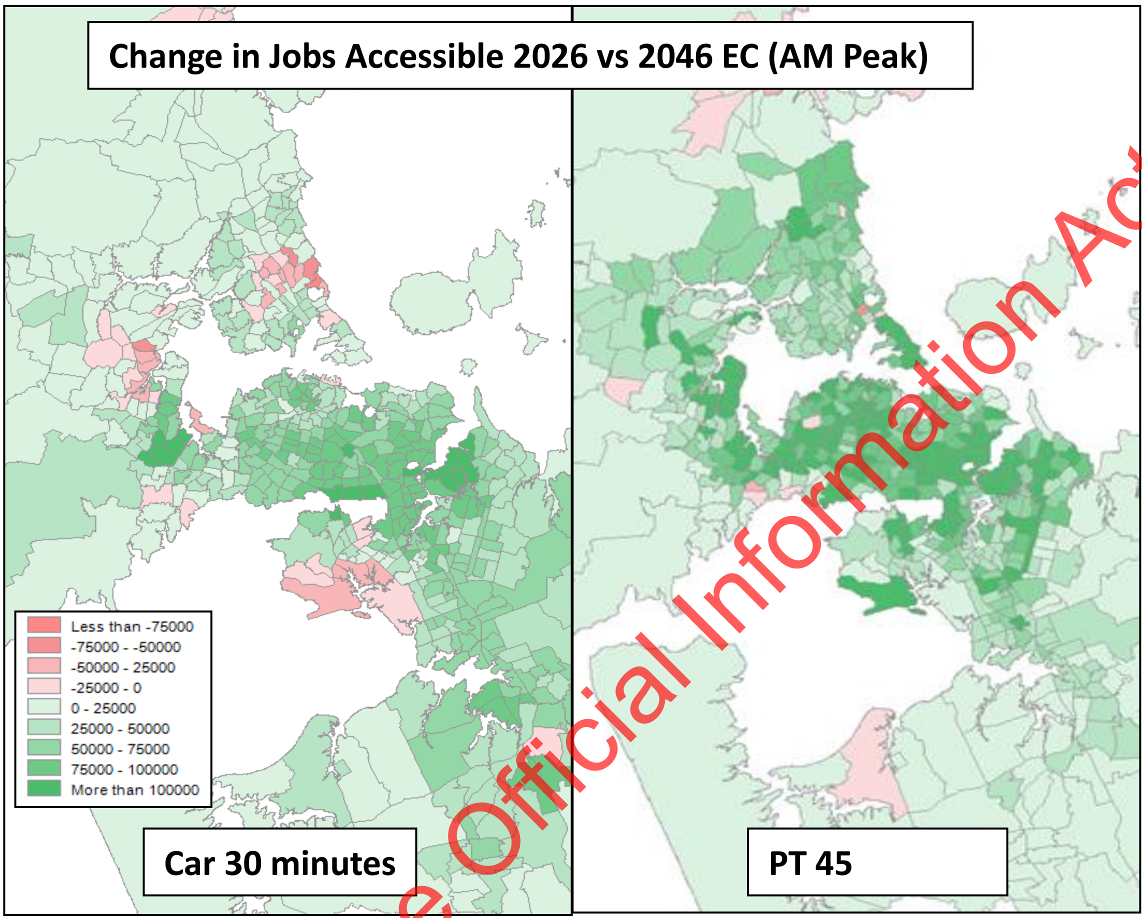

Figure 3.15: Change in accessibility to jobs 2026 vs 2046 (Employment Centres)

Compared to the APTN, the south and southeast areas generally perform better, likely due to the inclusion of a motorway connection from the East West Link to the Southeastern Highway (Figure 3.16). The North Shore on the other hand sees reduced accessibility – because it does not experience the significant access boost from the Additional Waitemata Harbour Crossing.

Public transport generally performs similarly except for the northwest, which performs better than APTN. This is likely to be due to the provision of a full grade Northwestern Busway corridor, as opposed to the combination of bus lanes and busway as specified in APTN.

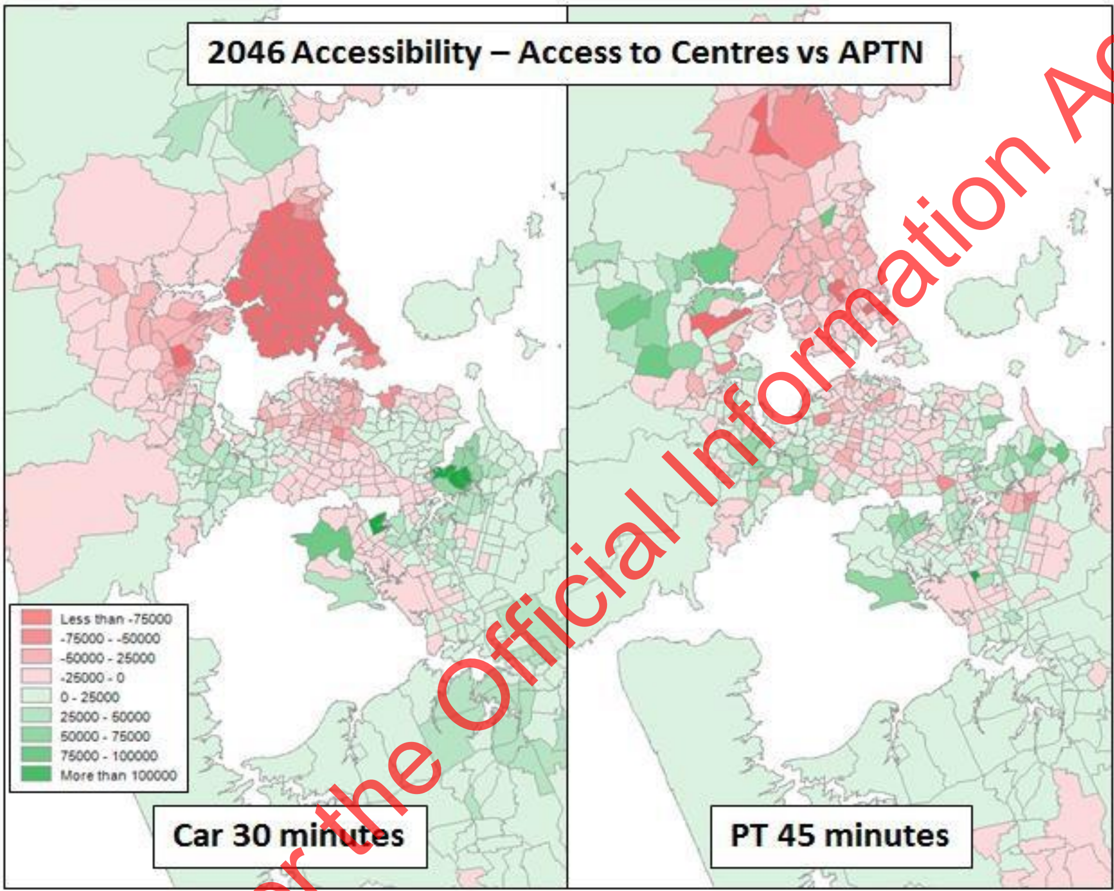

Figure 3.16: Access to jobs (Employment Centres and APTN)

Congestion

Congestion levels improve marginally under Employment Centres compared to the APTN, particularly between 2026 and 2036 (Figure 3.17). Both packages experience similar levels of congestion by 2046.

Similar levels of congestion improvements are seen for freight in the AM peak, although congestion worsens compared to APTN between 2036 and 2046 (Figure 3.18). Congestion levels improve to a lesser degree for the inter-peak, though similar to the AM peak, congestion increases slightly compared to APTN in the final decade.

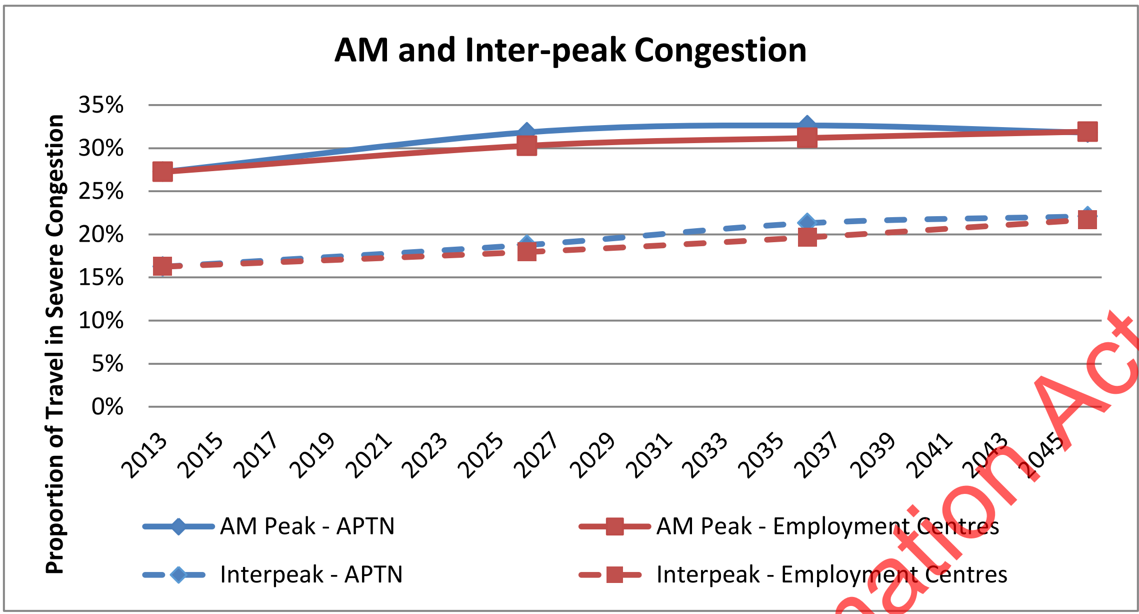

Figure 3.17: AM and inter-peak congestion (Employment Centres and APTN)

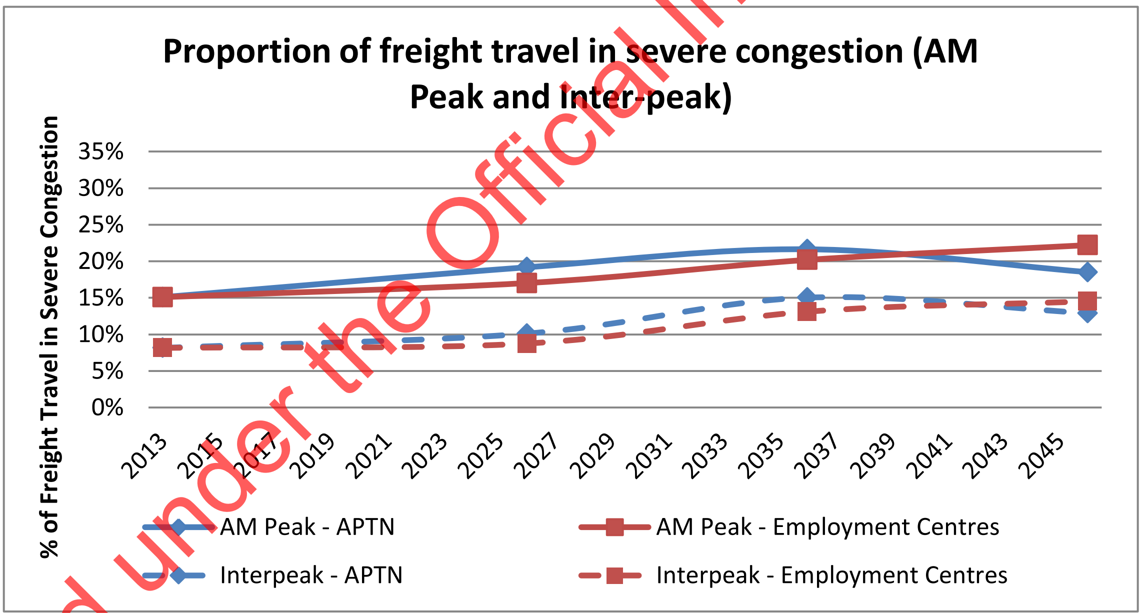

Figure 3.18: Proportion of freight travel in severe congestion (Employment Centres and APTN)

On a sub-regional level, the Employment Centres package alleviates some of the more severe congestion on the motorway network, most particularly on SH20A (Figure 3.19). However, severe congestion is extended along the Northern Motorway as well as parts of SH16 and SH18.

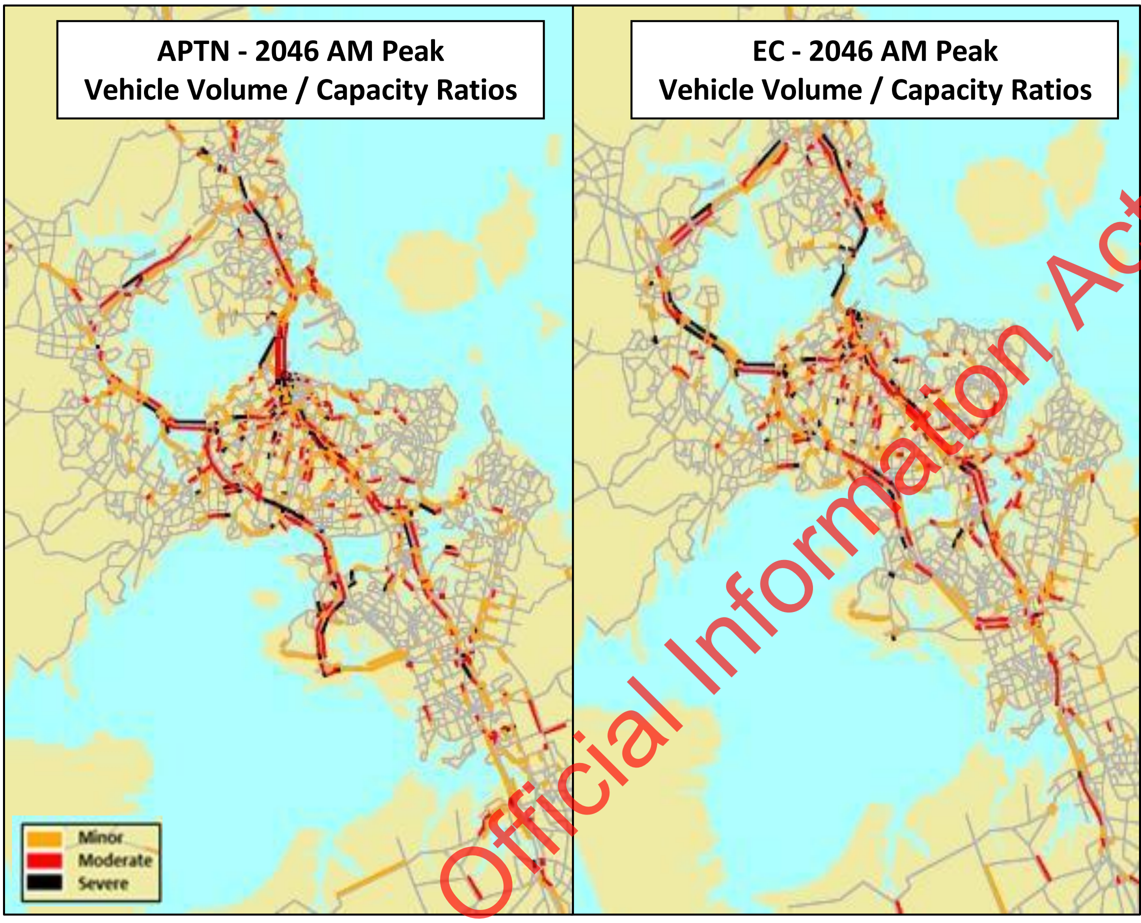

Figure 3.19: AM peak vehicle travel demand (Employment Centres and APTN)

The inter-peak experiences less severe congestion compared to the AM peak (Figure 3.20). The Employment Centres package continues to alleviate some of the more severe congestion on the motorway network, in particular SH20A and parts of the Northern Motorway. Limited severe congestion remains, particularly within the inner motorway network.

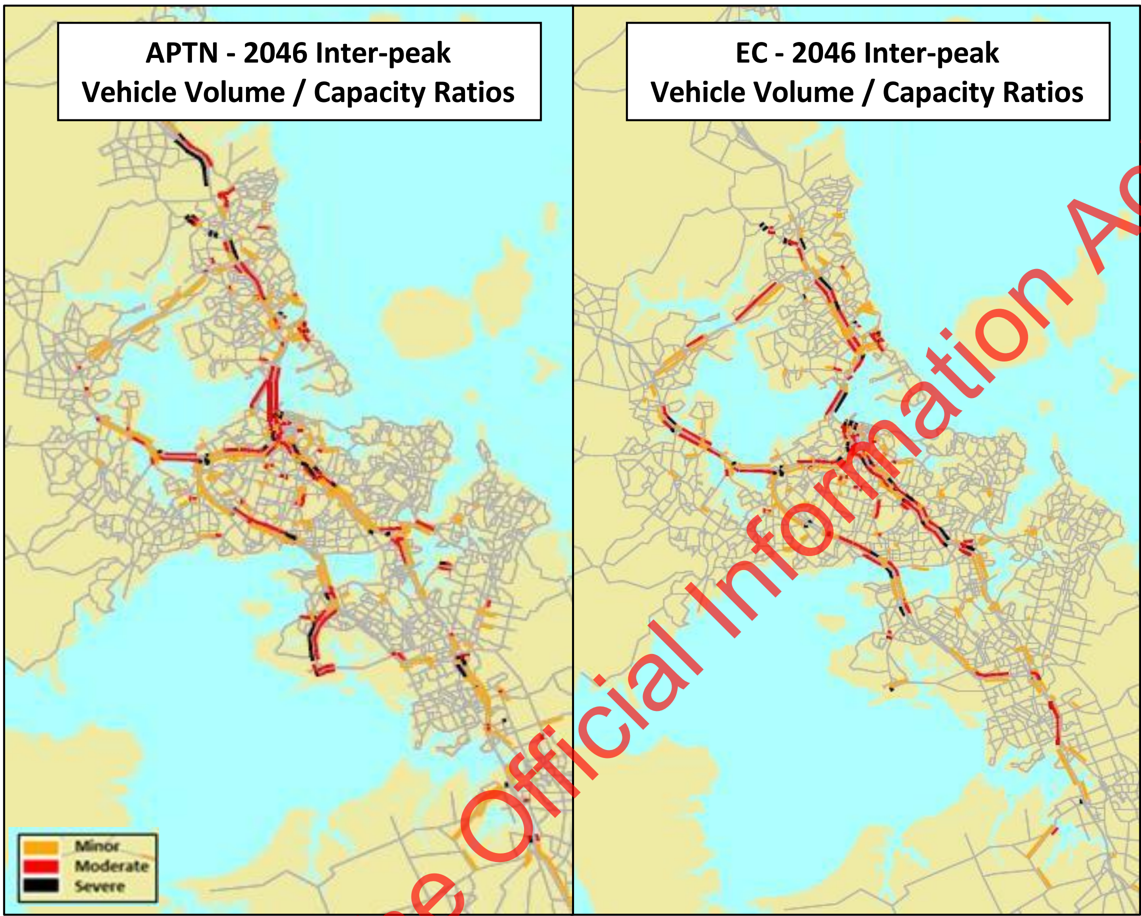

Figure 3.20: Inter-peak vehicle travel demand (Employment Centres and APTN)

Public Transport Mode Share

Public transport mode share is essentially identical to the APTN over the 30 year period (Figure 3.21).

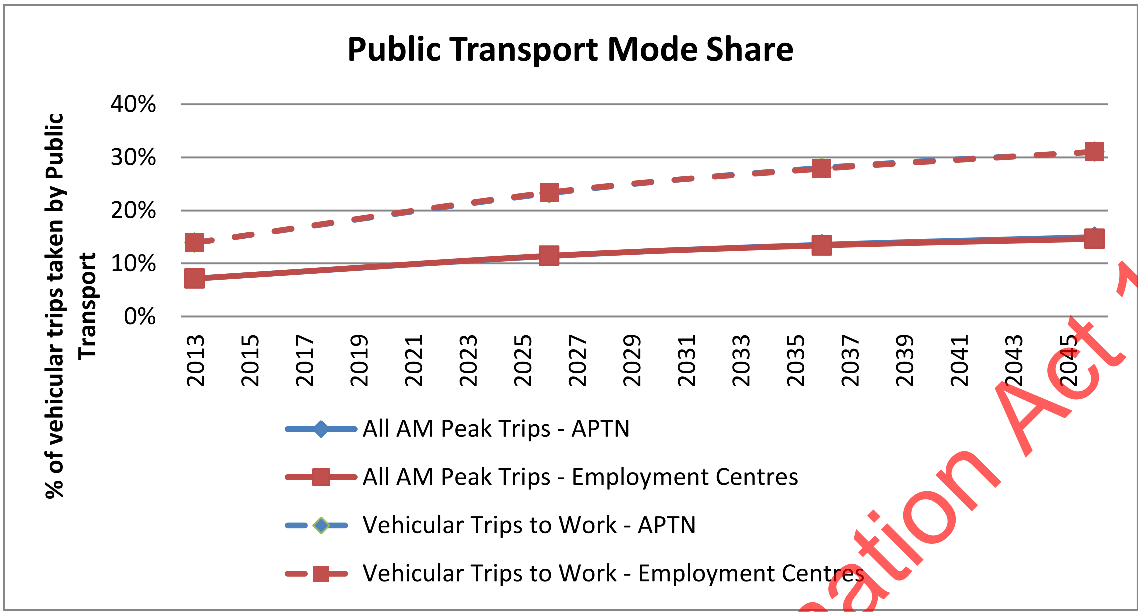

Figure 3.21: Public transport mode share (Employment Centres and APTN)

Mass transit on the North Shore and the isthmus removes the bus capacity issues faced under APTN for these routes (Figure 3.22). However bus demand continues to exceed capacity at parts of the network, to a much wider extent than the APTN, particularly in the east.

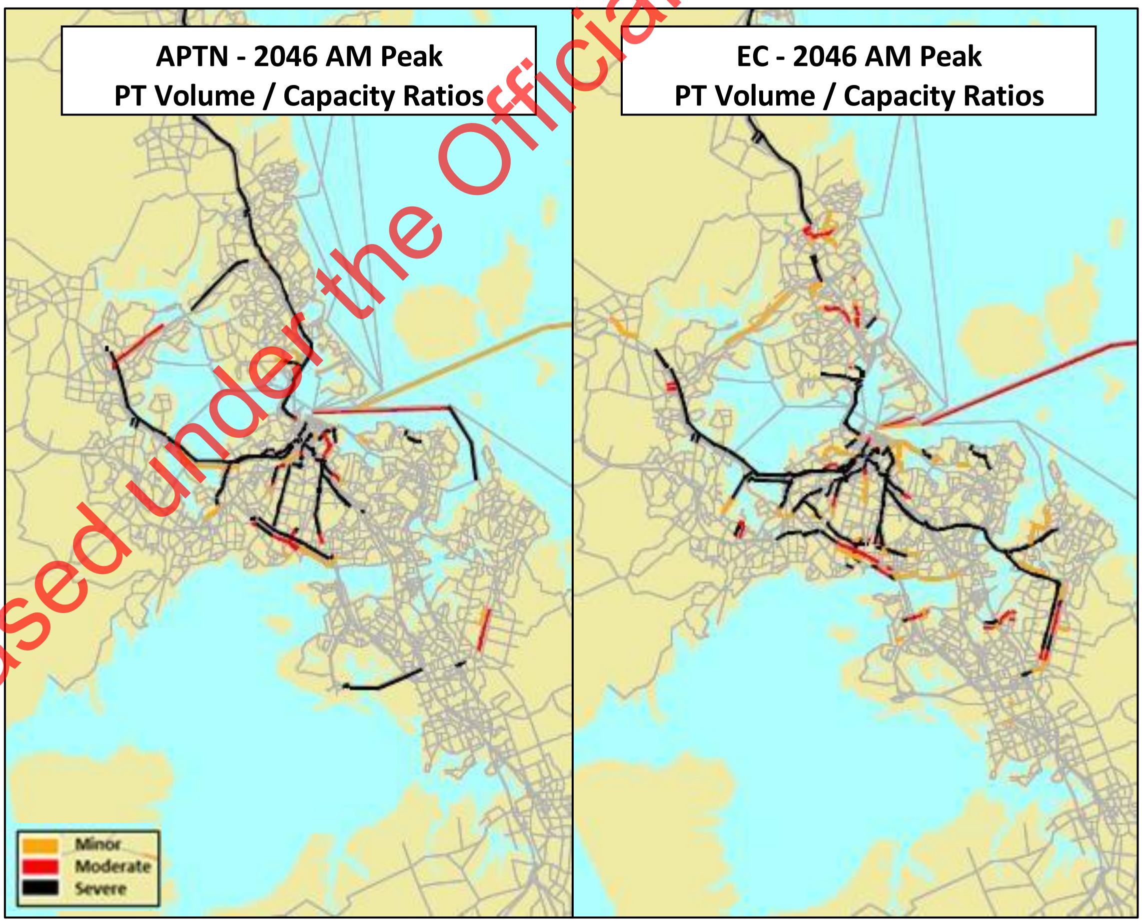

Figure 3.22: Public transport demand in 2046 (Employment Centres and APTN)

Value for Money

Value for money assessments considered both network wide effects and isolating the contribution of projects at a sub-regional level, through an assessment of their impact on throughput and travel times relative to cost. These proxies for value for money were used to identify projects worth taking forward into the next round of evaluation.

The Employment Centres package identified an estimated $29.6 billion capital expenditure programme over 30 years (excluding renewals) which is projected to have similar contributions to the ATAP objectives as the APTN. The Employment Centres package is projected to result in a slightly lower proportion of jobs accessible by motorists of 40% (compared to 42% in the APTN), the same proportion of jobs accessible by public transport of 27% (also 27% in the APTN), the same proportion of travel time in severe congestion of 32% in the AM peak (also 32% in the APTN) and a similar public transport mode share of 18.5% in the AM peak (compared to 18.6% in the APTN).

The Employment Centres package as a whole is projected to have similar overall contribution to the ATAP objectives as the APTN package, with a similar sized capital improvement programme.

3.2.3 Key Learnings

Analysis of the Employment Centres package highlights some areas of strength, such as improvements to accessibility for the south and west compared to the APTN, but also some areas of poor performance, such as declining accessibility for the North Shore and the isthmus. The package also sees a decrease in average travel time to work for most of the region and an increase in average trip length.

Although this package does not provide a step-change in regional performance, the impacts at the sub-regional level are significant. In particular, improvements for the west and south appear possible through changes to the mix and timing of investment.

In the south, this includes the extension of mass transit to the airport and the additional widening of SH1. In the northwest, the Northwestern Busway improves public transport accessibility. The extension of the East West Link appears to improve car accessibility to the east.

3.3 Smarter Pricing

3.3.1 Tool Description

As noted, the initial testing phase found that the whole of network pricing system had the greatest high-level potential for improving accessibility, congestion and public transport mode share.

The pricing scheme developed for this phase of analysis reflects these earlier findings by seeking to find balance between increasing the cost of travel to achieve mode, time or route shift that will improve network performance, while targeting this increase to areas where the greatest level of choice is available, average trip lengths are shorter and congestion is greatest.

Our analytical tools are not calibrated to assess the detail of a potential pricing system because of the following:

- They use fixed-trip matrices so are unable to show the extent to which the introduction of pricing may result in trip suppression (trips no longer being made).
- They are also not able to consider different values of time or vary prices at a more micro-level, so provide a very simplistic representation of what the impacts of a scheme might be.

Therefore, the pricing structure we developed for the second phase of the analysis should be considered very much 'hypothetical'.

Key interventions by time period

The pricing structure we developed for Smarter Pricing should be considered very much 'hypothetical'. The pricing structure used is summarised in Table 3.3 below, with prices varying between 3c/km and 40c/km depending on the time of day, location and type of network that the travel occurs within. We assumed that these prices would replace existing fuel excise and road user charges, which average approximately 6c/km.

Table 3.3: Hypothetical variable network-wide pricing system

Hypothetical price levels used for testing (c/km)				
Area	**Network**	**Peak**	**Inter-Peak**	**Off-Peak**
Inner Urban (isthmus)	Motorways	40	30	3
	Other Roads	30	20	3
Outer Urban	Motorways	30	20	3
	Other Roads	20	10	3
Rural	All Roads	3	3	3

The highest prices were targeted to areas with the most congestion and where travel alternatives are most available (e.g. the "inner urban" Auckland isthmus). In outer areas, prices were reduced from the levels used in the earlier round of testing.

The pricing system was tested with complementary infrastructure investment focused on providing improved public transport options and capacity to meet changing travel patterns. The pricing system was introduced for modelling purposes at 2026.

The total estimated 30-year cost of new capital improvements (excluding renewals) of the Smarter Pricing package is $28.7 billion (in 2016 dollars). Figure 3.23 below provides a breakdown of costs by decade and project type. These estimated costs were identified prior to the revision of project costs in ATAP.

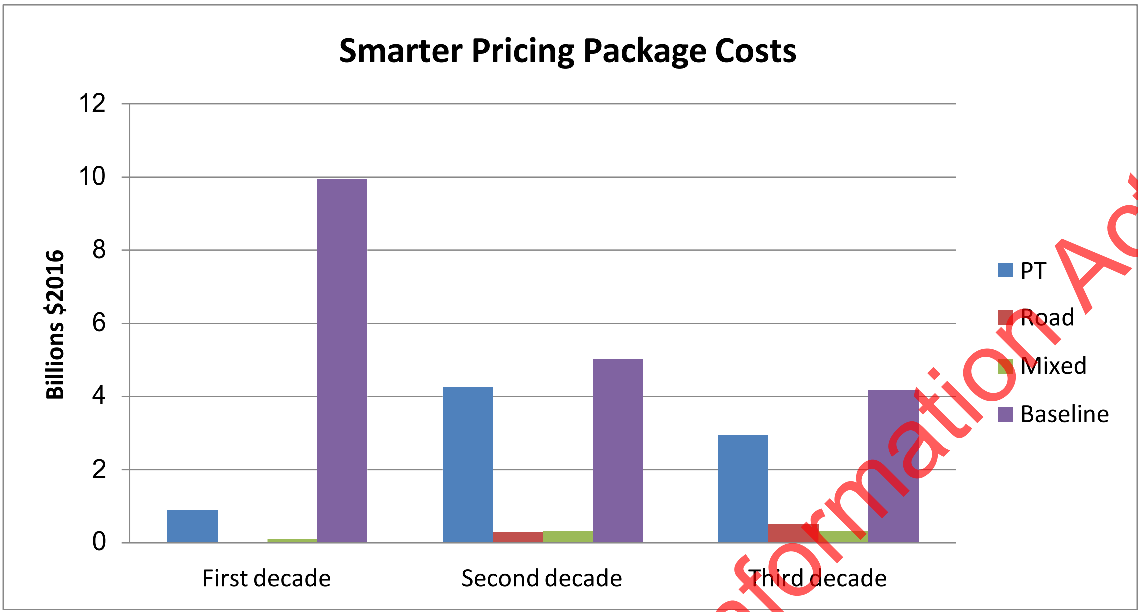

Figure 3.23: Estimated cost of new capital improvements (excluding renewals) of the Smarter Pricing package (2018 – 2048)

Key components of the package over and above the common baseline are outlined in Figure 3.4 below.

Table 3.4: Smarter Pricing key interventions by decade

First Decade (2015-25)	Second Decade (2025-35)	Third Decade (2035-45)
• Network wide pricing system • Northwestern Busway (Westgate to Point Chevalier)	• Penlink • Mt Roskill rail spur • Isthmus light-rail • North Shore rapid transit (city centre to Takapuna) • Rail upgrades to enable Southern Line express trains • AMETI Pakuranga to Botany • Northwestern Busway (Point Chevalier to Newton)	• Extension of isthmus light-rail • Extension of North Shore rapid transit to Albany and Birkenhead

3.3.2 Key Findings

The main effects of the pricing on travel patterns appear to be a slight reduction in trip length made by private vehicles and a mode shift from private vehicle to public transport. There were approximately 39,000 (6%) fewer private vehicle trips and around 16% less vehicle kilometres travelled at peak times in 2046 compared to current plans. These changes have a profound effect on the transport network's performance.

Accessibility

The number of jobs accessible within a 30 minute car journey during the AM peak increases substantially in this package compared to the APTN. This is due to the pricing system reducing the number of vehicle trips during the AM peak by approximately 6% and reducing average trip length by approximately 5%, thereby reducing congestion and increasing travel speeds (Figure 3.24). Public transport accessibility improves more modestly, potentially due to a more effective mix of interventions combined with bus services that mix in general traffic being able to travel at higher speeds due to lower congestion levels.

Car accessibility has a step change improvement through the introduction of smarter pricing in 2026. The trends in the subsequent decades mirror the projections for APTN.

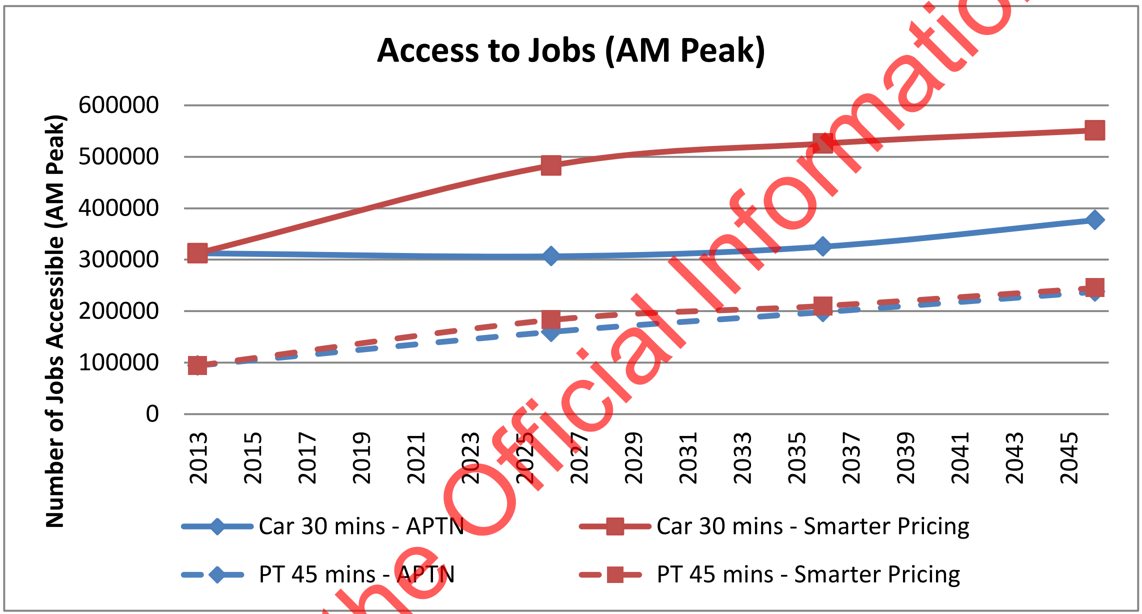

Figure 3.24: Access to jobs (Smarter Pricing and APTN)

On a sub-regional level, improvements in potential job accessibility by car are experienced in the isthmus and the east, as shown in Figure 3.25 below. Decreases in car access are experienced in the west, large parts of the North Shore, and the outer south.

On the other hand, public transport access increases significantly for most areas up to 2026.

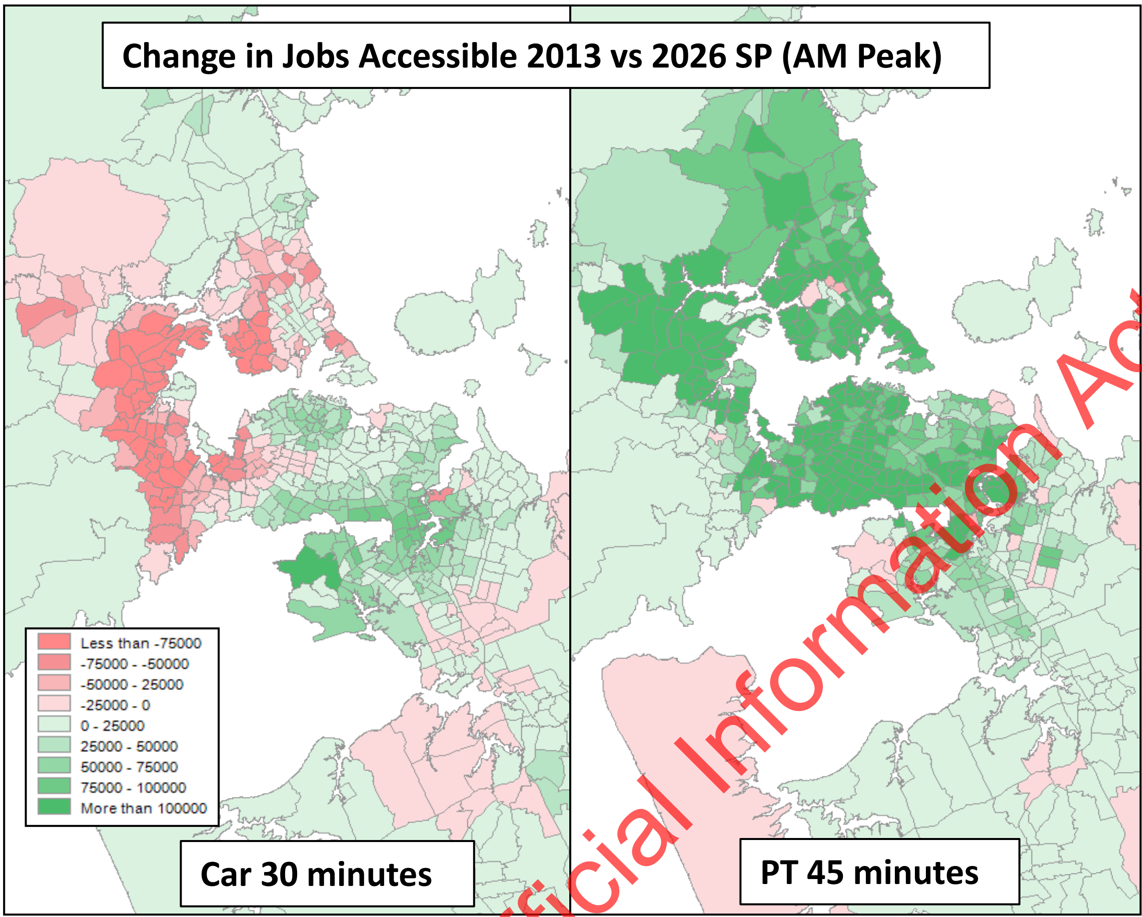

Figure 3.25: Change in jobs accessible 2013 vs 2026 (Smarter Pricing)

Improvements to accessibility continues after 2026 for car and public transport, particularly for the isthmus, northwest, and parts of the south (Figure 3.26). Car access declines for the outer north and the outer south.

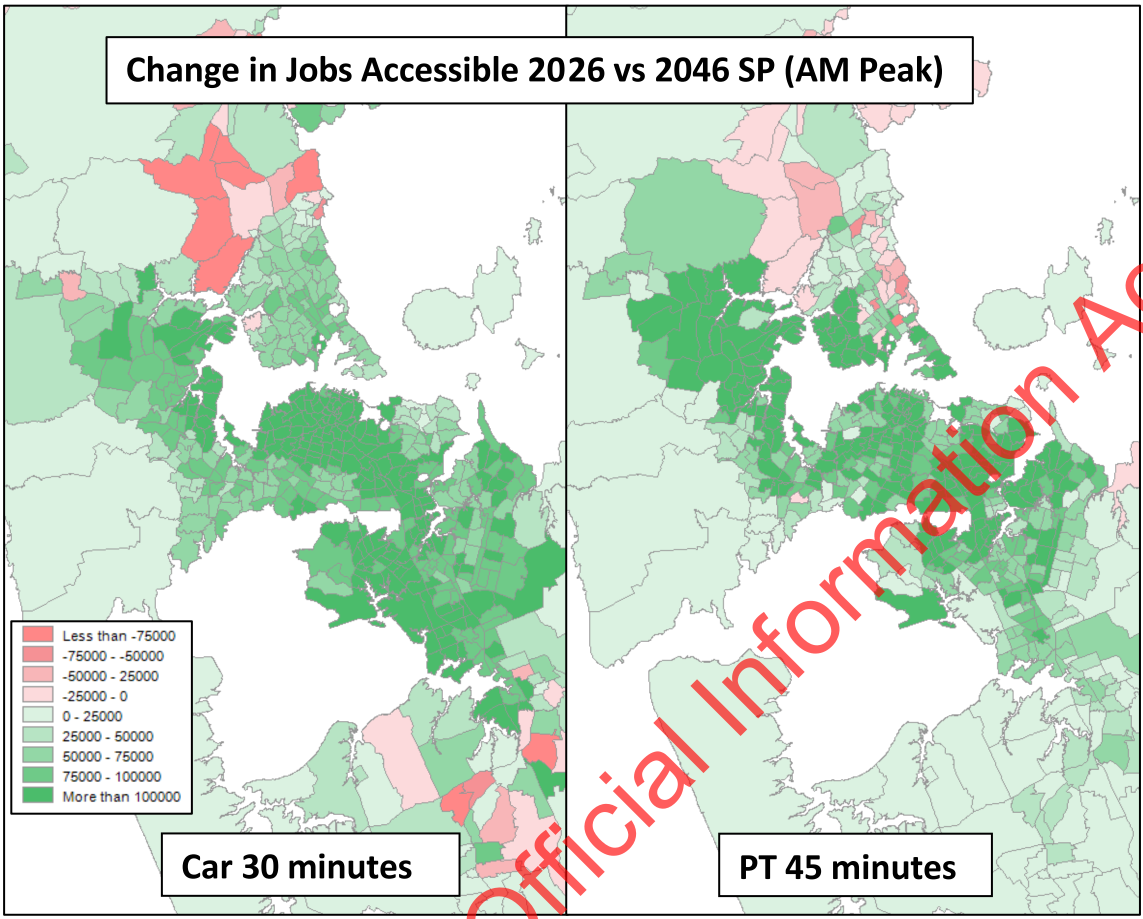

Figure 3.26: Change in jobs accessible 2026 vs 2046 (Smarter Pricing)

Compared to the APTN, car accessibility increases most strongly in the west and south – likely due to faster travel times in these areas bringing them within 30 minutes of the large concentration of jobs in the central area. Public transport accessibility results are more mixed, with the North Shore seeing a decline in access to employment. Upon investigating the reduction in public transport accessibility in the north in more detail, we found that it may have been caused by modelling methodology issues rather than representing a likely future (Figure 3.27).

The improvements in access to employment by car appear to be largely driven by road pricing – a reduction in car trips and shorter trip lengths compared to APTN enables faster travel speeds.

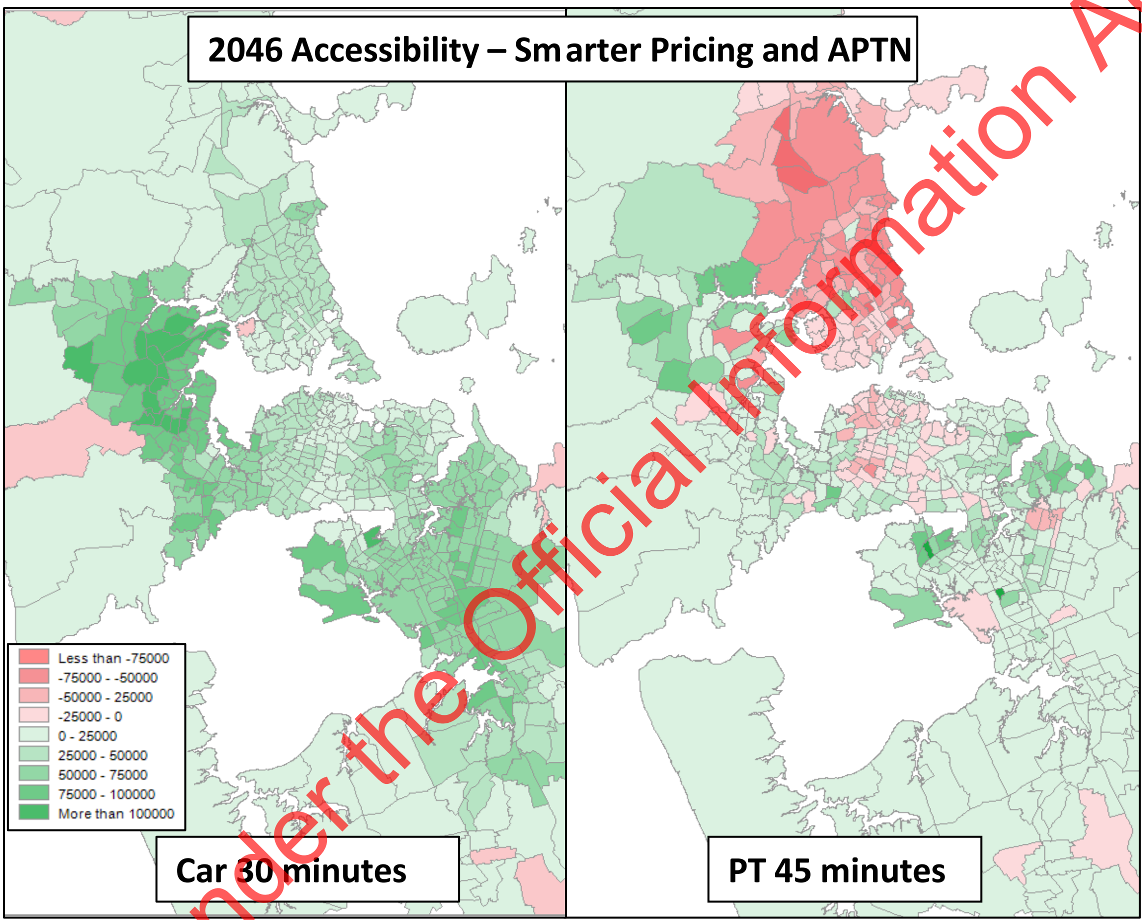

Figure 3.27: Access to jobs in 2046 (Smarter Pricing and APTN)

Congestion

Congestion in the AM peak reduces significantly from 2013 to 2026, due to the implementation of pricing (Figure 3.28). After 2026 there is a modest projected increase although congestion levels are still significantly lower than APTN projections.

Inter-peak congestion is projected to roughly remain at 2013 levels throughout the next 30 years under this package, substantially lower than the APTN projections, which indicate a steady increase over time.

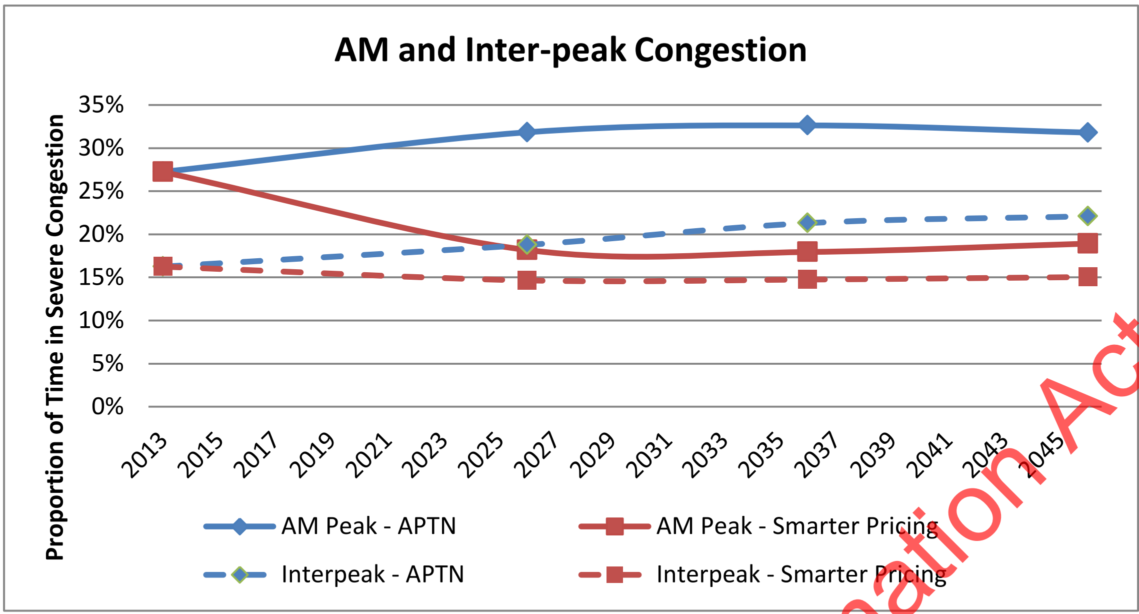

Figure 3.28: AM and inter-peak congestion (Smarter Pricing and APTN)

Freight travel sees similarly large reductions in AM peak compared to APTN (Figure 3.29). In the inter-peak, freight congestion decreases up until 2026, after which it remains constant until 2046. In comparison, inter-peak freight congestion under APTN keeps increasing until 2036, after which it declines slightly.

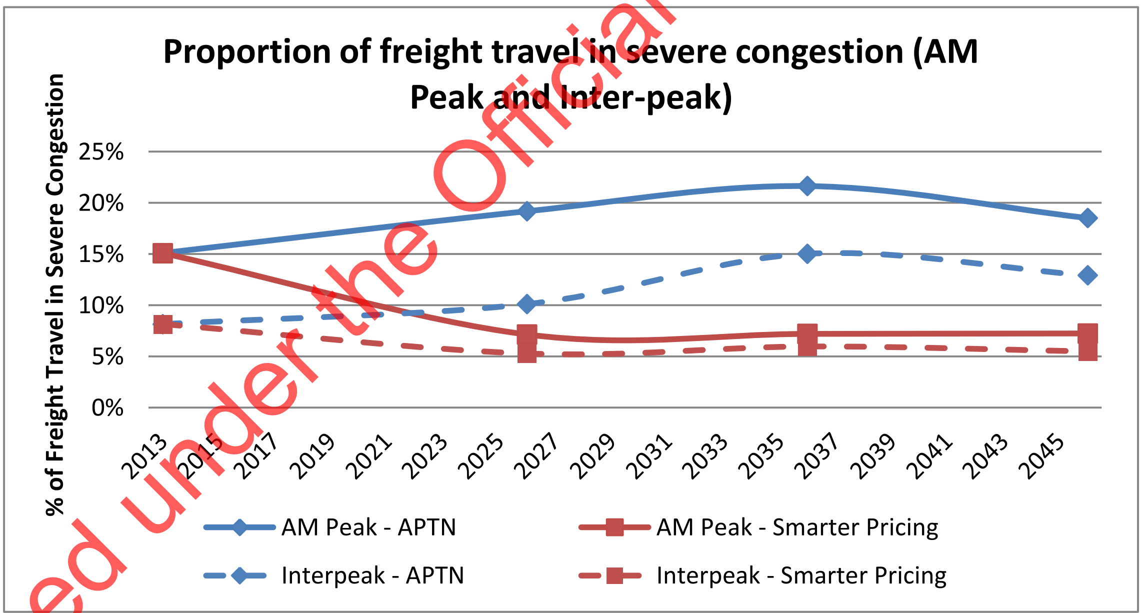

Figure 3.29: Proportion of freight travel in severe congestion (Smarter Pricing and APTN)

Some parts of the roading network still face severe congestion in the AM peak with the implementation of Smarter Pricing, although to a significantly lesser extent than the APTN (Figure 3.30). Severe congestion remains on the Auckland Harbour Bridge (with or without the Additional Waitemata Harbour Crossing) and sections of the Northern Motorway.

Focusing network improvements on areas that would still face congestion after the implementation of pricing provides a good indication of good value.

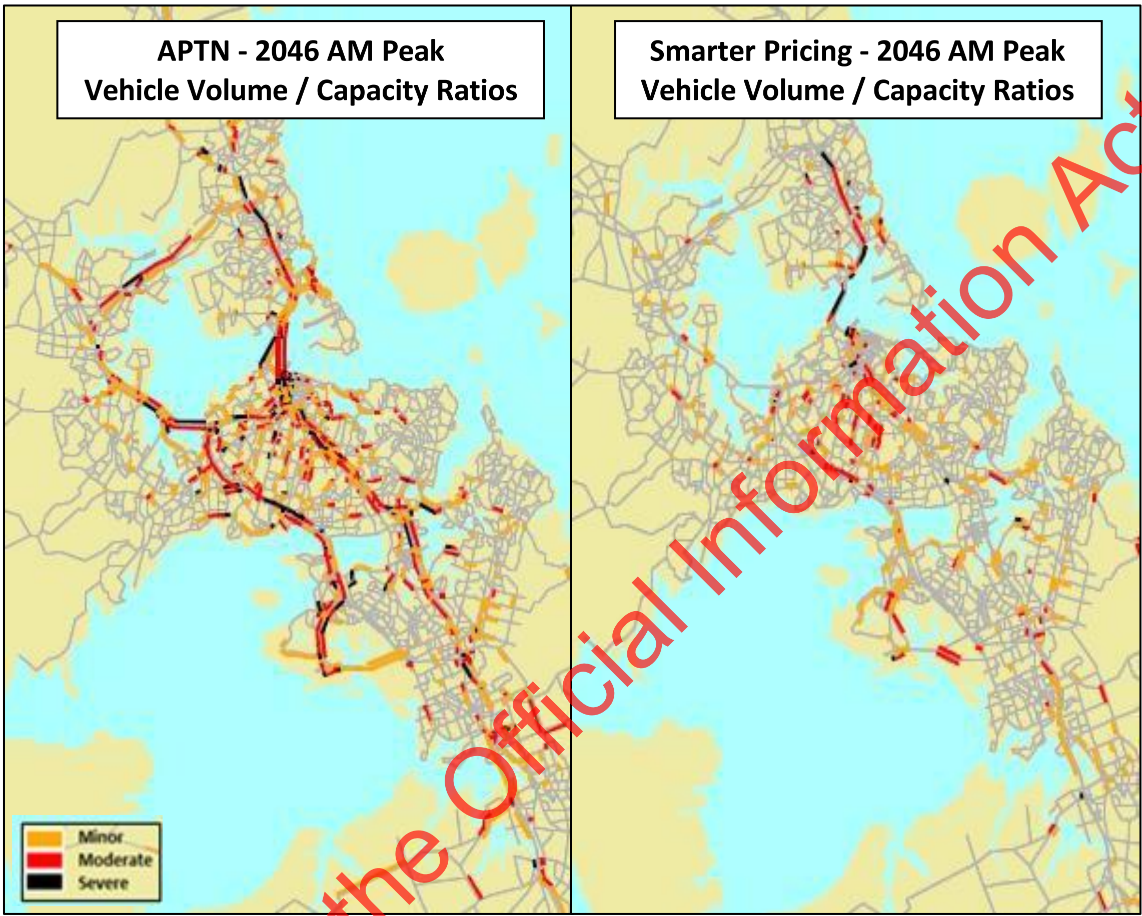

Figure 3.30: AM peak vehicle travel demand (Smarter Pricing and APTN)

Congestion is largely eliminated in the inter-peak under Smarter Pricing (Figure 3.31). While limited severe congestion remains at key pinch points on the network, the removal of even minor congestion suggests that pricing levels may be too high and the scheme applied too broadly.

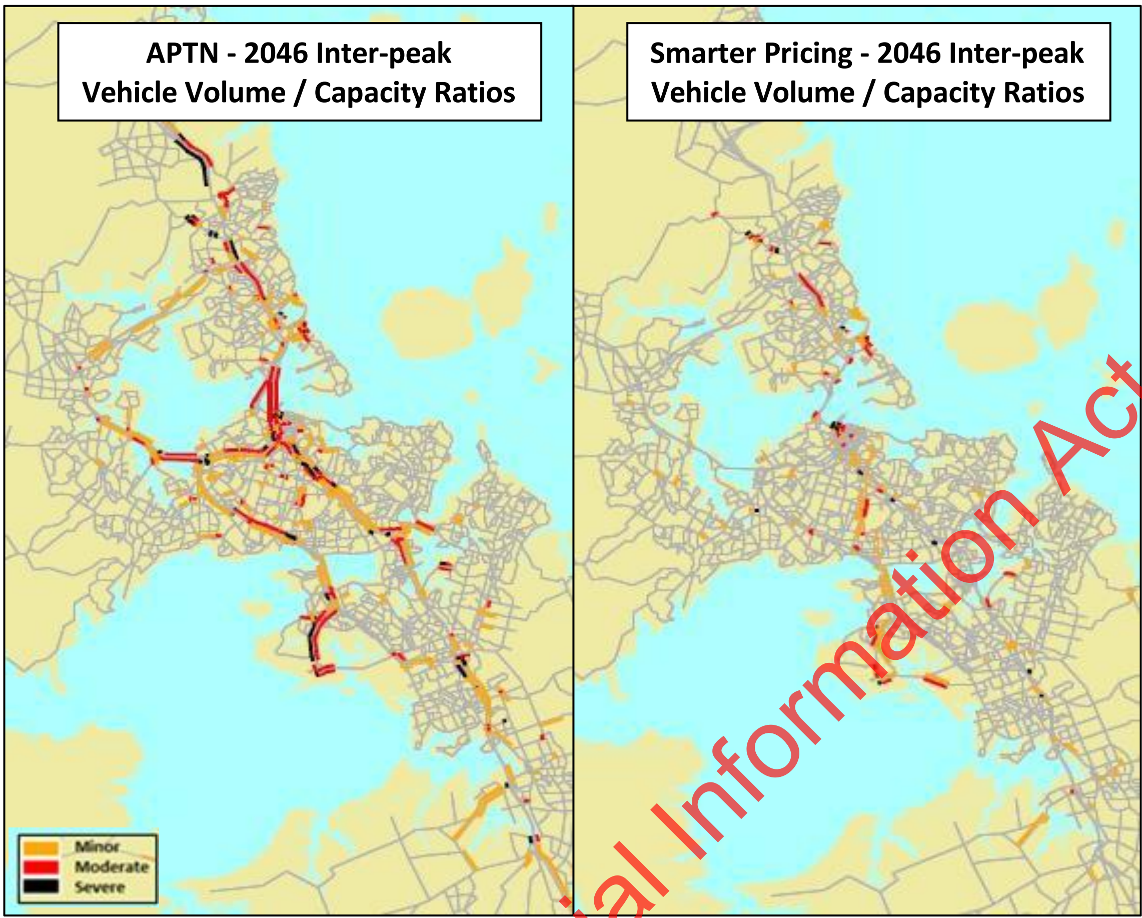

Figure 3.31: Inter-peak vehicle travel demand (Smarter Pricing and APTN)

Public Transport Mode Share

Compared to the APTN, public transport mode share increases substantially in this package, largely in areas where significant public transport investment has taken place (Figure 3.32).

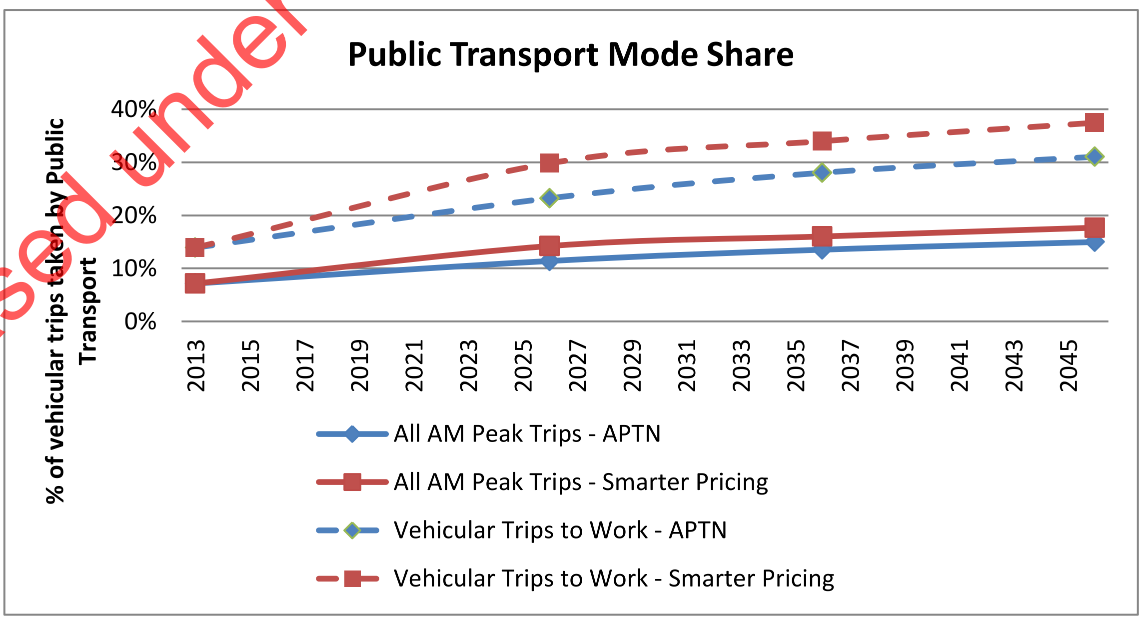

Figure 3.32: Public transport mode share (Smarter Pricing and APTN)

At a sub-regional level, the Smarter Pricing tool shows an increase in public transport mode share in parts of the region up until 2026 (Figure 3.33). By place of origin, this includes the city centre, isthmus, northwest and parts of the North Shore, partly due to the public transport investments occurring in those locations. By destination, the city centre and Westgate see the biggest increase in mode share.

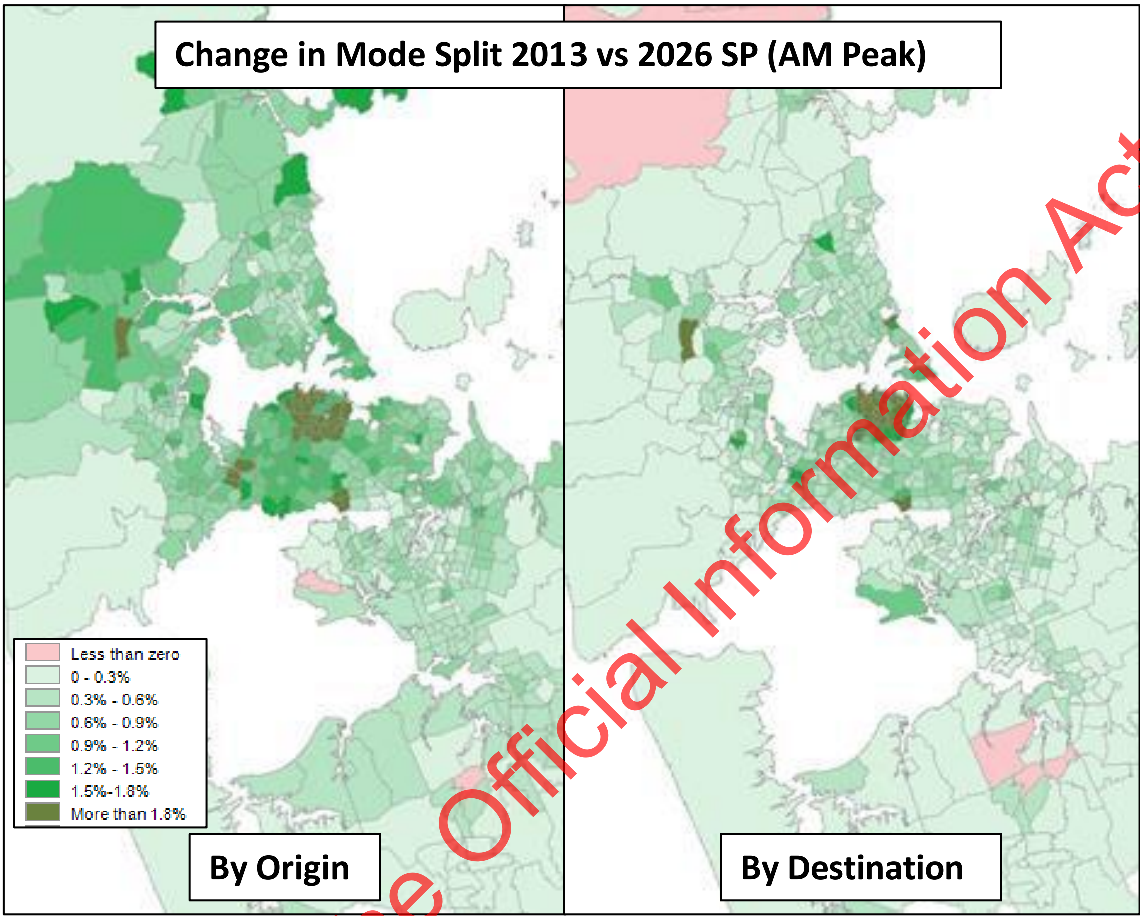

Figure 3.33: Change in mode split 2013 vs 2026 (Smarter Pricing)

Public transport mode share continues to increase after 2026 across the region, although at a lesser rate (Figure 3.34).

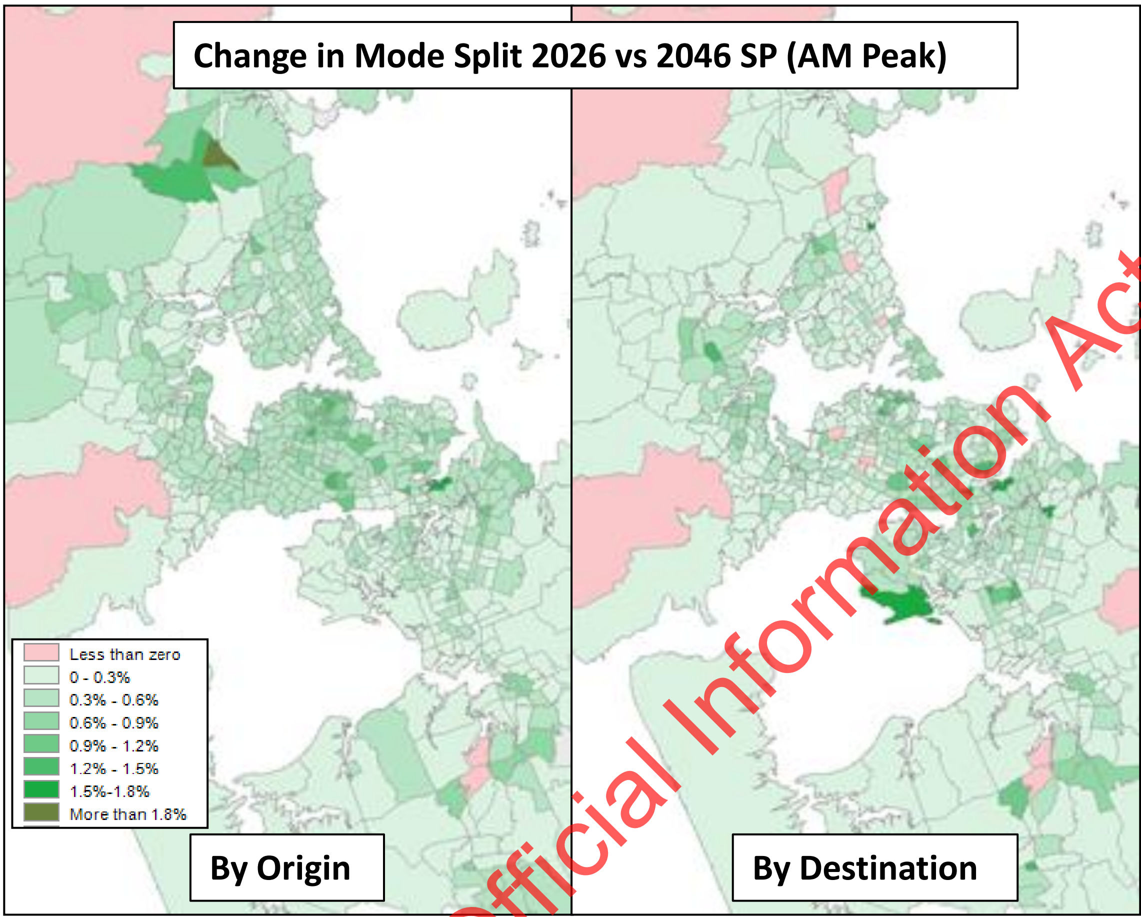

Figure 3.34: Change in mode split 2026 vs 2046 (Smarter Pricing)

While pricing has reduced demand for the roading network, it has substantially increased demand for the public transport network. The volume / capacity plots in Figure 3.35 show that under this pricing regime, much more public transport capacity is required.

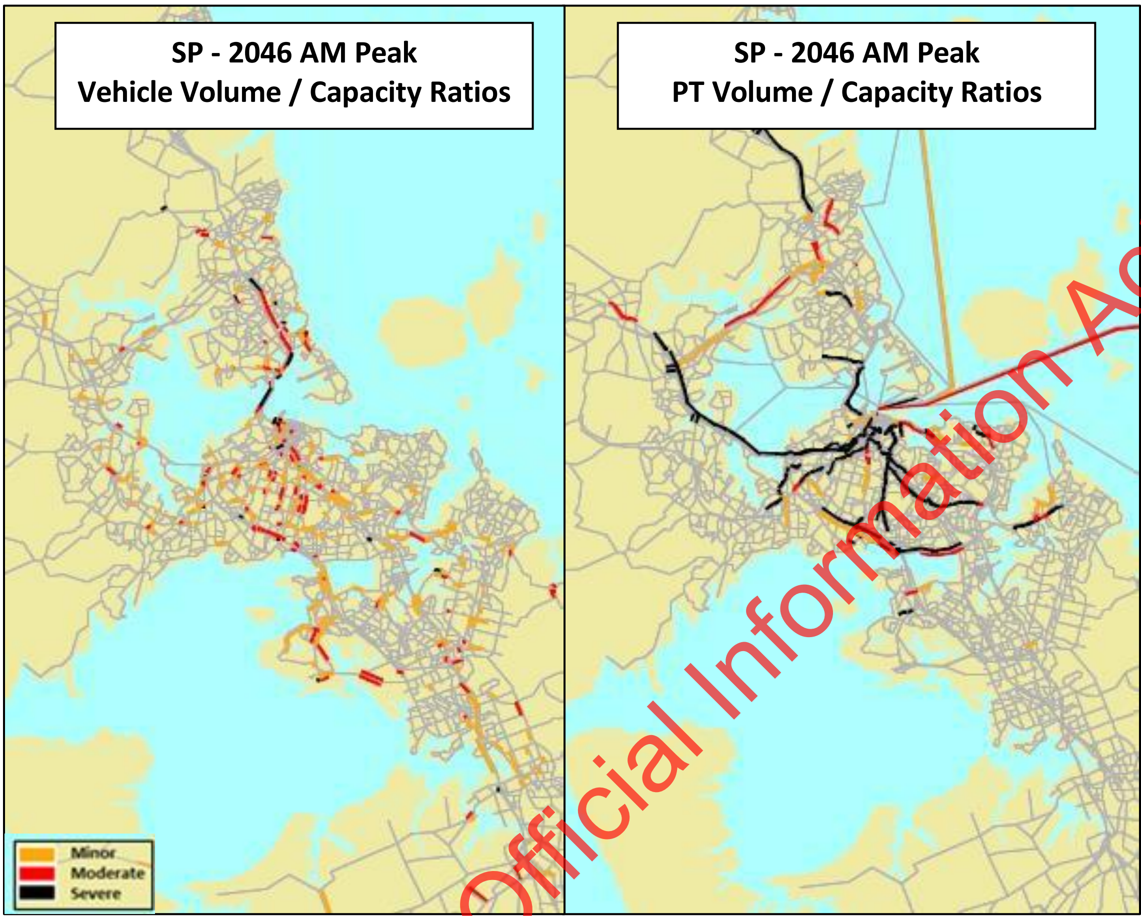

Figure 3.35: Vehicle and public transport demand (Smarter Pricing)

Net Benefits to Users

"Net benefits to users" was estimated because the Smarter Pricing package increases the financial costs of motorists using the transport system. Motorists receive a benefit from the improved network performance (in terms of shorter travel times and lower vehicle operating costs) but also face significantly increased costs from having to pay the network charges (Figure 3.36).

The following map shows the difference in projected generalised costs for motorists in different parts of Auckland in the morning peak in 2046 with Smarter Pricing, compared to the generalised costs in the APTN.

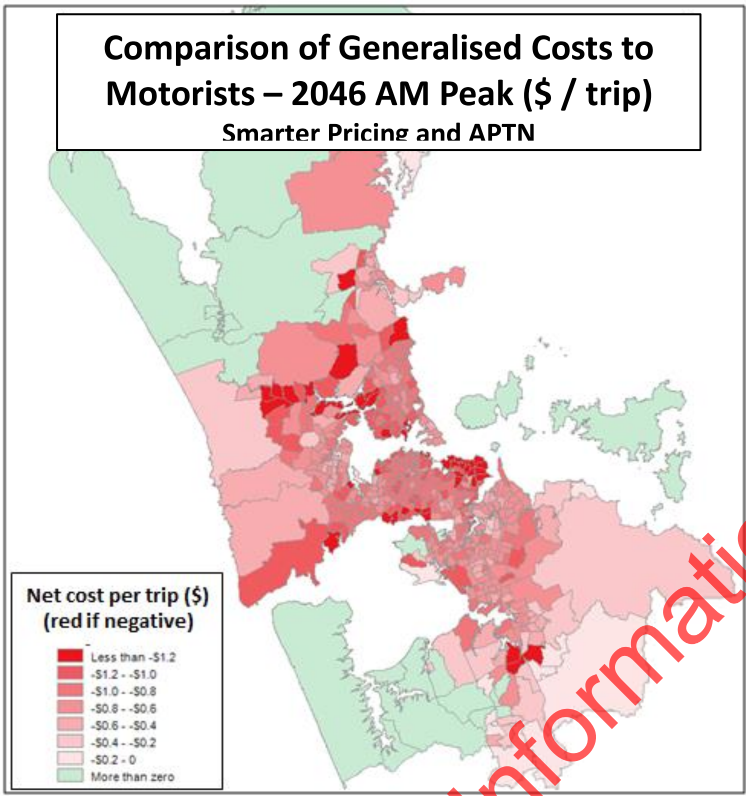

Figure 3.36: Generalised costs to road users - Smarter Pricing and APTN

This analysis balances the network charge that motorists pay against the savings in travel times and lower vehicle operating costs. However, the analysis does not take into account the wider benefits that users of the transport system would gain from increased accessibility and reduced congestion. The increases in net generalised costs above $1 per trip indicate that the price levels set in the morning peak may have been set too high. This assessment helps to inform a pricing level that provides desired demand management effects (i.e. increases in accessibility and reduction in congestion) at a lower financial cost to motorists.

Value for Money

Value for money assessments considered both network wide effects and isolating the contribution of projects at a sub-regional level, through an assessment of their impact on throughput and travel times relative to cost. These proxies for value for money were used to identify projects worth taking forward into the next round of evaluation.

The Smarter Pricing package has an estimated $28.7 billion capital expenditure programme over 30 years (excluding renewals) which is projected to result in significantly higher contributions to the ATAP objectives compared to the APTN. The package is projected to result in a higher proportion of jobs accessible by motorists of 62% (compared to 42% in the APTN), the same proportion of jobs accessible by public transport of 27% (also 27% in the APTN), a significantly lower proportion of travel time in severe congestion of 19% in severe congestion in the AM peak (compared to 32% in the APTN) and a higher public transport mode share of 22.1% in the AM peak (compared to 18.6% in the APTN).

3.3.3 Key Learnings

The Smarter Pricing package as a whole is projected to have significantly higher contributions to the project objectives than the APTN package, with a similar sized capital improvement programme, but at a higher average cost to motorists.

Our analysis of smarter pricing showed it offers the potential to achieve a step-change in transport network performance and should therefore form a core part of the strategic approach. However, setting prices at the right levels is extremely challenging as performance improvement, travel time savings and increased travel costs need to be carefully balanced.

3.4 Cross Package Review

3.4.1 Overview

The Capacity Constraints and Employment Centres packages as well as the Smarter Pricing packages were compared against the APTN to understand the extent to which they appear to deliver better returns than current plans. The main findings from the cross package review are listed below:

- Smarter Pricing shows significantly better travel time accessibility, congestion and public transport mode share results. However, at the price level it imposes significant financial costs on many users which may outweigh travel time reductions.
- The Capacity Constraints and Employment Centres packages show relatively similar regional results to APTN, despite a different mix of projects. However, regional results mask some sub-regional differences, with the impacts of most infrastructure investments seen at the sub-regional level.
- Bringing forward motorway widening provides some improvements to congestion in 2036, however only Smarter Pricing provides a major impact on congestion.
- A very large increase in projected bus passengers over the next 30 years is predicted, which will create capacity 'pinch points' with significant challenges to meet demand. It is unlikely that smarter transport pricing and technology will reduce this challenge.
- Care is needed in interpreting public transport results, as the ART model does not take account of crowding. In reality, public transport crowding would result in some users shifting to car, with increased congestion on the road network.
- The next phase of evaluation needs to test whether better results can be obtained by investing more in the first decade. Strategic choices appear to be between demand management and investing more on infrastructure.

3.4.2 Accessibility

Accessibility by Car

Both the Capacity Constraints and Employment Centres packages show slight to moderate improvements compared to the APTN up until 2036, after which accessibility provided under the Employment Centres package plateaus (Figure 3.37). However, Smarter Pricing produces the step-change in car access.

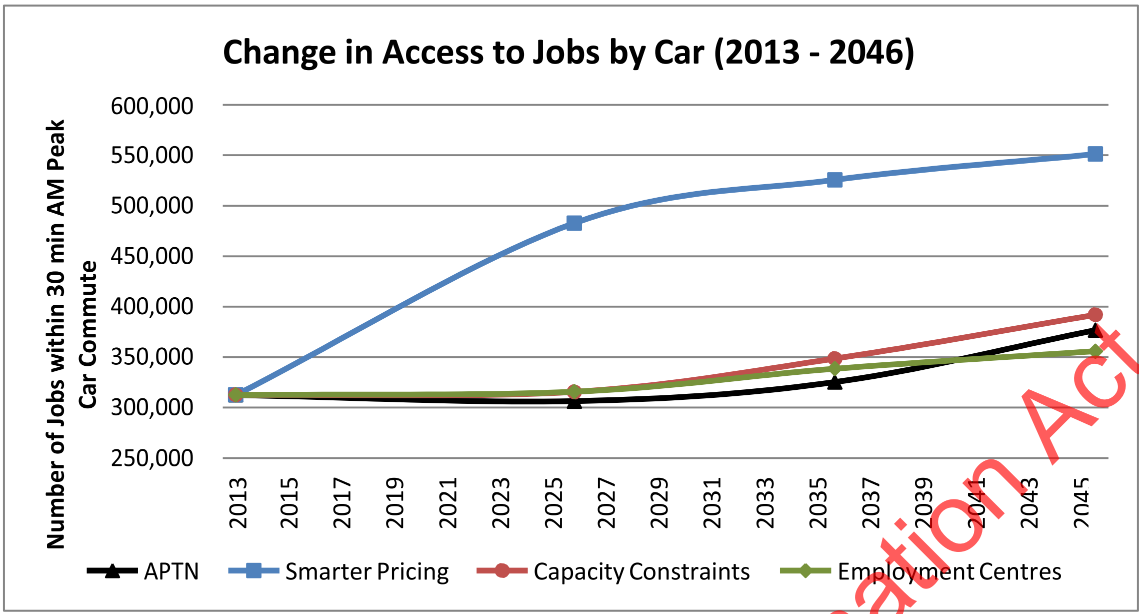

Figure 3.37: Change in number of jobs accessible within a 30 minute car commute AM peak (2013 – 2046)

In terms of public transport access, the Employment Centres package shows slight improvements compared to APTN (Figure 3.38). The Capacity Constraints package performs slightly better compared to APTN up until 2036. Smarter Pricing provides the highest level of public transport accessibility, particularly in the first and second decades, though at a more moderate scale compared to car access.

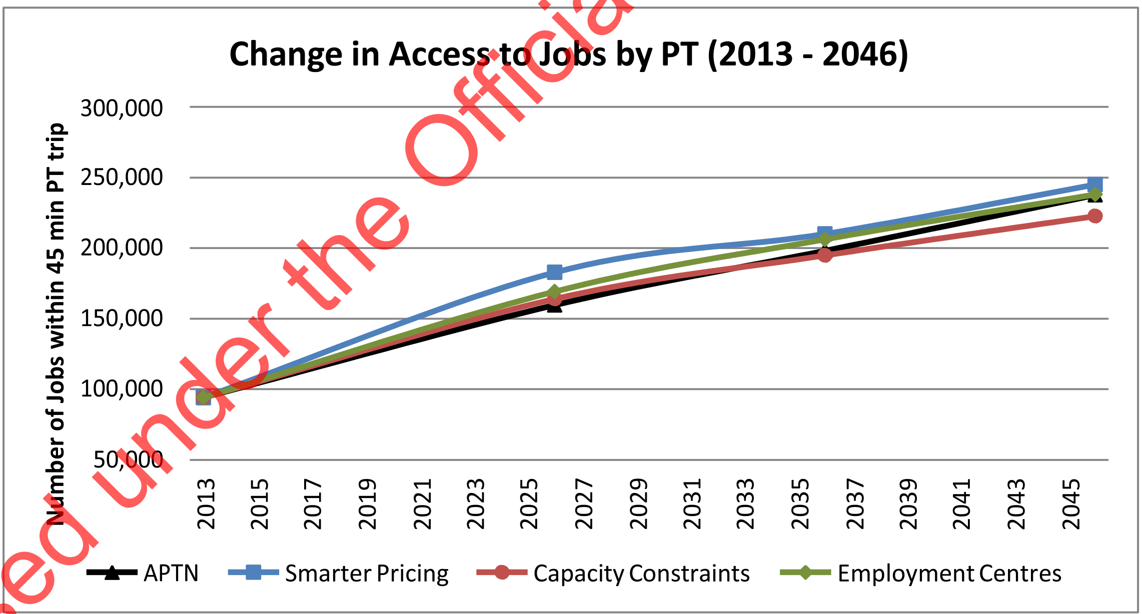

Figure 3.38: Change in number of jobs accessible within a 45 minute PT commute AM peak (2013 – 2046)

Despite having a very different mix of projects, the Capacity Constraints and Employment Centres packages show very similar results to the APTN on a regional level, particularly between 2013 and 2026.

Between 2026 and 2046, car accessibility improves across the region for Capacity Constraints, which has a motorway-widening theme, while public transport accessibility improves in certain parts of the region for Employment Centres, which focuses more on mass rapid transit.

Car accessibility by sub-region

The figures below show the potential accessibility to jobs by car for the four sub-regions. Calculating accessibility based on sub-region shows that smarter pricing provides the highest level of accessibility for all sub-regions.

While changing the mix of investment (through focusing on capacity constraints and employment centres) does not achieve a 'step-change' in regional performance, impacts at a sub-regional level are significant. In particular, improvements for the west and south appear possible through changes to the mix and timing of investment. This is important because these were areas where access challenges were found to be most significant in the first phase of the project.

West:

When assessing the change in car accessibility from 2013 in West Auckland, all three packages tested show better performance can be achieved, especially with Smarter Pricing (Figure 3.39). In comparison, access to employment by car under APTN declines in the first decade and only increases marginally after 2036.

Both Capacity Constraints and Employment Centres increase the number of jobs able to be reached within a 30 minute car commute from the west by around 20% in 2036 compared to the APTN.

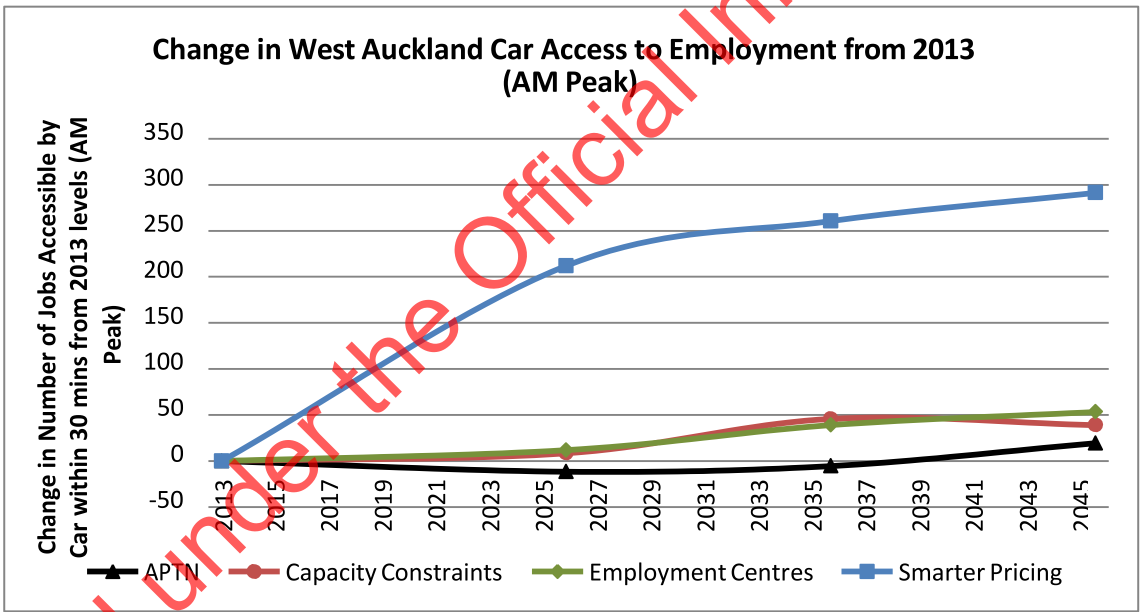

Figure 3.39: Change in West Auckland car accessibility AM peak from 2013

South:

In South Auckland, all three packages show improved performance on accessibility compared to APTN, which declines in the first decade and only improves strongly after 2036 (Figure 3.40). Some of the projects that may have had an impact include the selective widening of SH1, SH20A and SH20 in both the second and third decades.

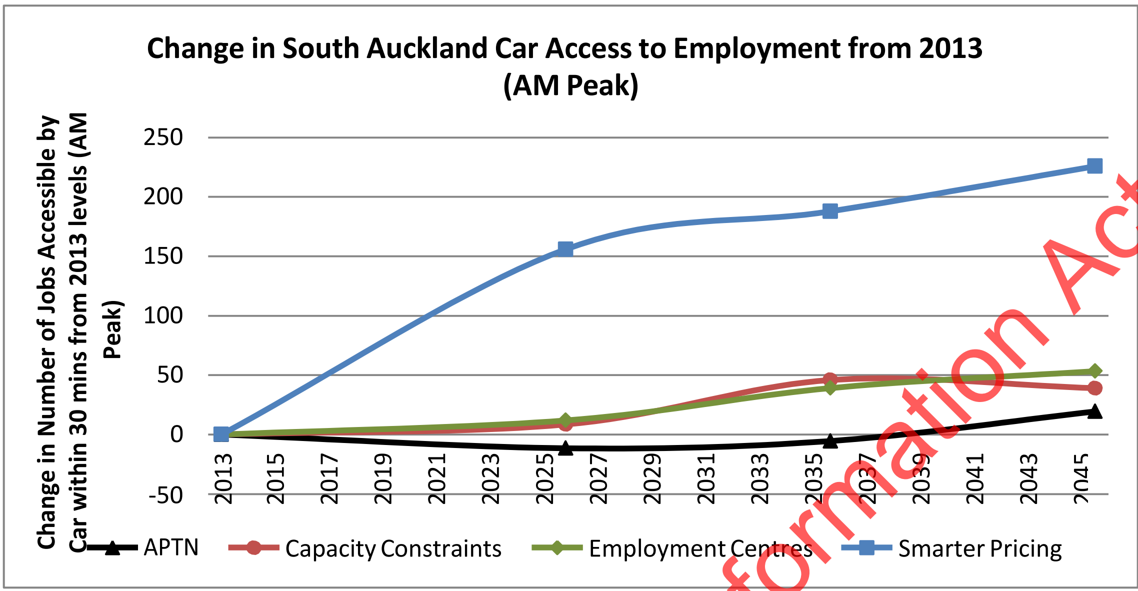

Figure 3.40: Change in South Auckland car accessibility AM peak from 2013

North:

Only Smarter Pricing brings a step-change to performance in accessibility for the north, despite the inclusion of the Additional Waitemata Harbour Crossing in both Capacity Constraints and APTN (Figure 3.41). Both Capacity Constraints and Employment Centres perform similarly to the APTN up until 2026, after which Employment Centres plateaus and Capacity Constraints perform similarly to APTN.

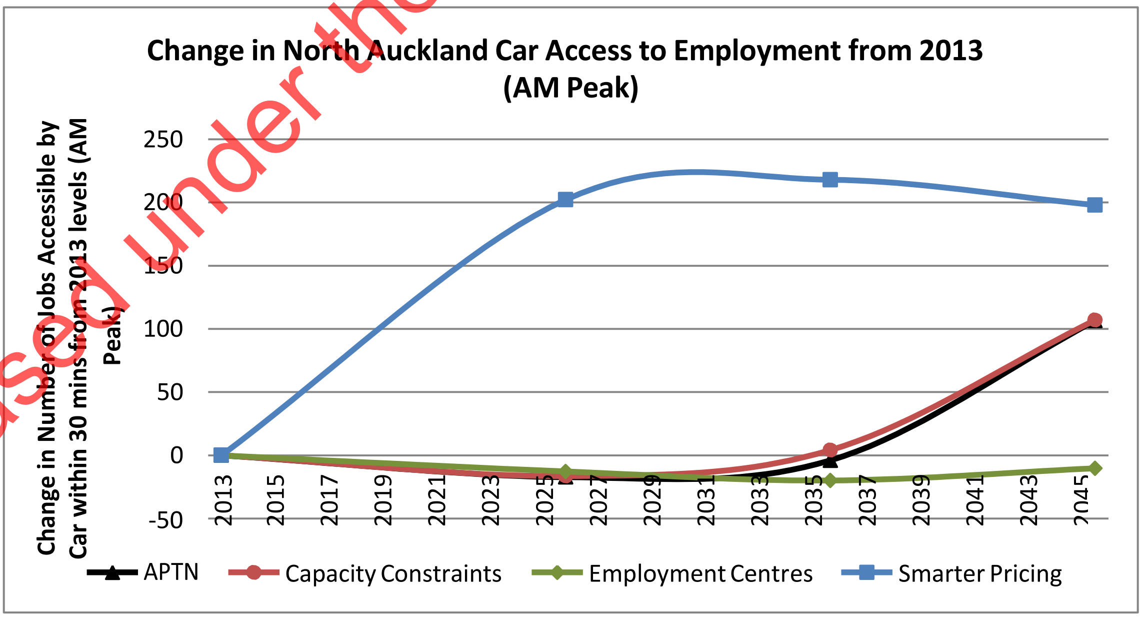

Figure 3.41: Change in North Auckland car accessibility AM peak from 2013

Central:

Central Auckland also sees Smarter Pricing providing the step-change in accessibility (Figure 3.42). Both Capacity Constraints and Employment Centres perform similarly to APTN up until 2026, after which both packages improve. Accessibility provided under Employment Centres plateaus after 2036.

Minor improvements in the central area such as the addition of a northbound lane at the Newmarket viaduct may have led to improved accessibility.

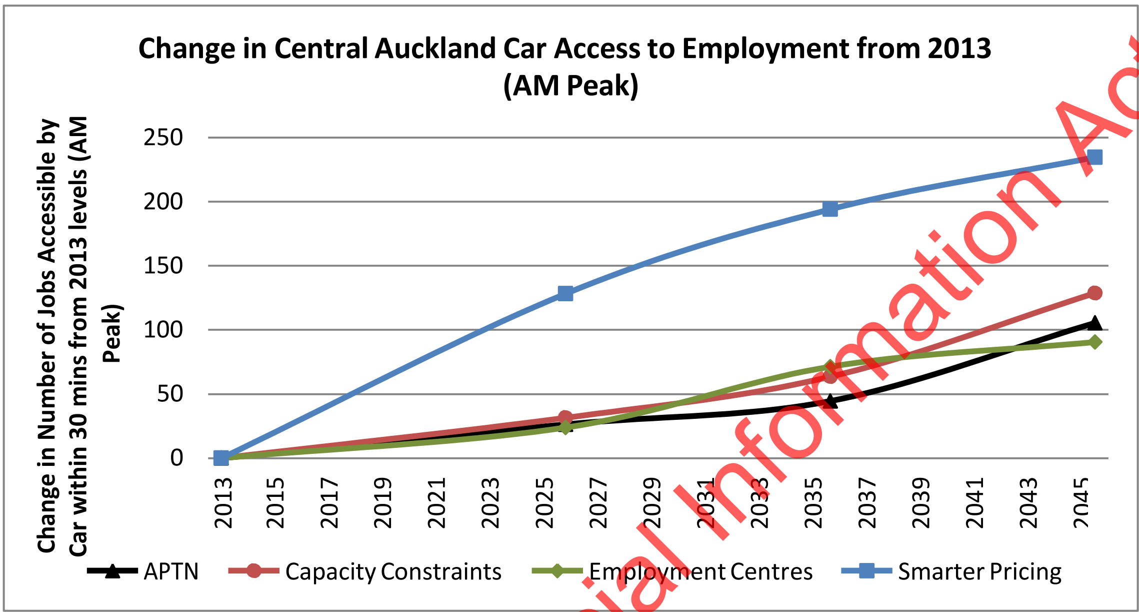

Figure 3.42: Change in Central Auckland car accessibility AM peak from 2013

Spatial analysis of car accessibility

Smarter Pricing increases car accessibility across the region between 2013 and 2026, whereas APTN, Employment Centres and Capacity Constraints largely show increased accessibility on the isthmus, inner south and outer north, and declining accessibility elsewhere (Figure 3.43).

Smarter Pricing continues to show increased car accessibility between 2026 and 2046, except for the area around Albany which sees a decline in accessibility (Figure 3.44). Both APTN and Capacity Constraints see improved accessibility for the North Shore due to the inclusion of the Additional Waitemata Harbour Crossing.

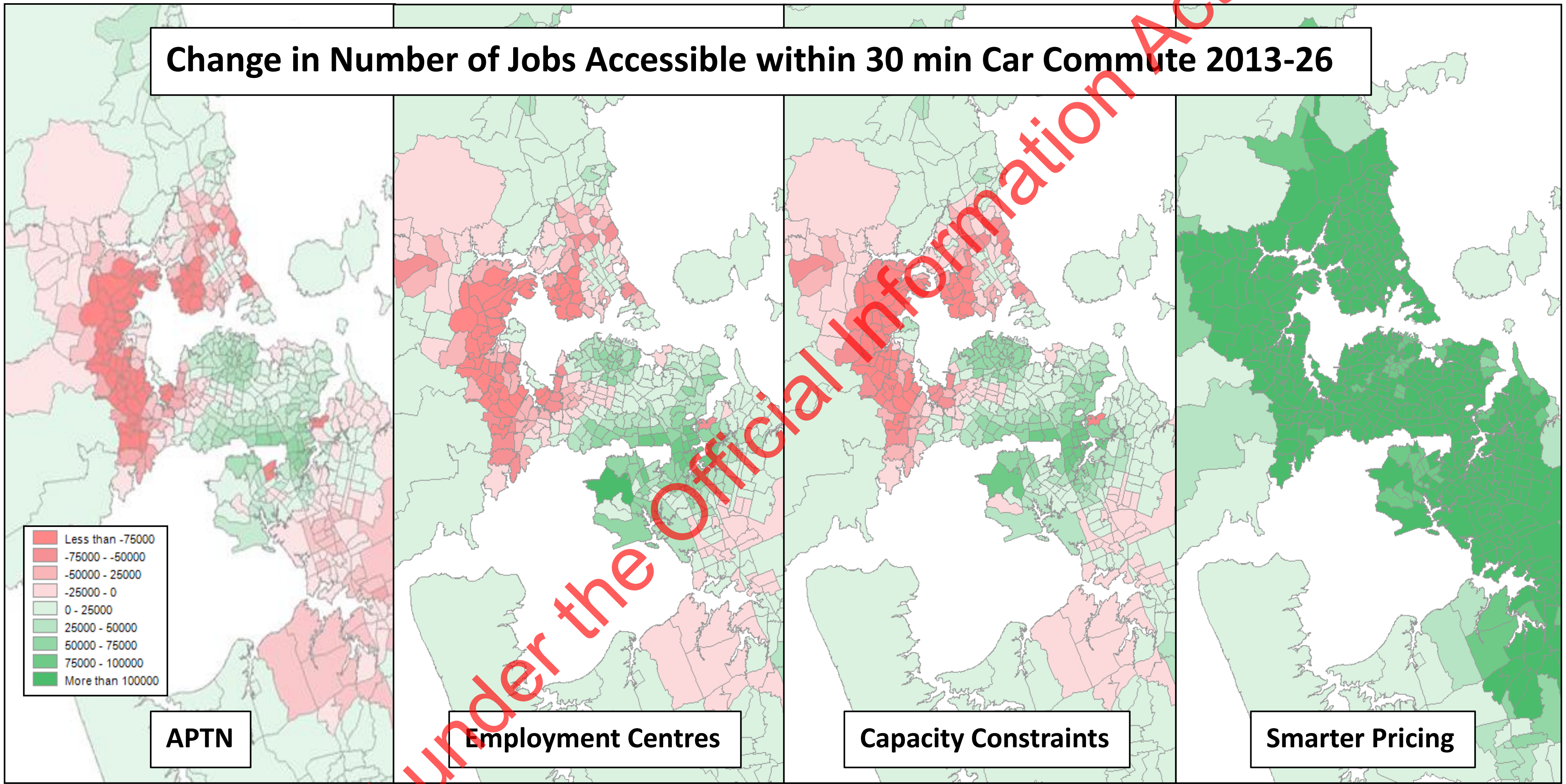

Figure 3.43: Change in number of jobs accessible within a 30 minute car commute AM peak (2013 – 2026)

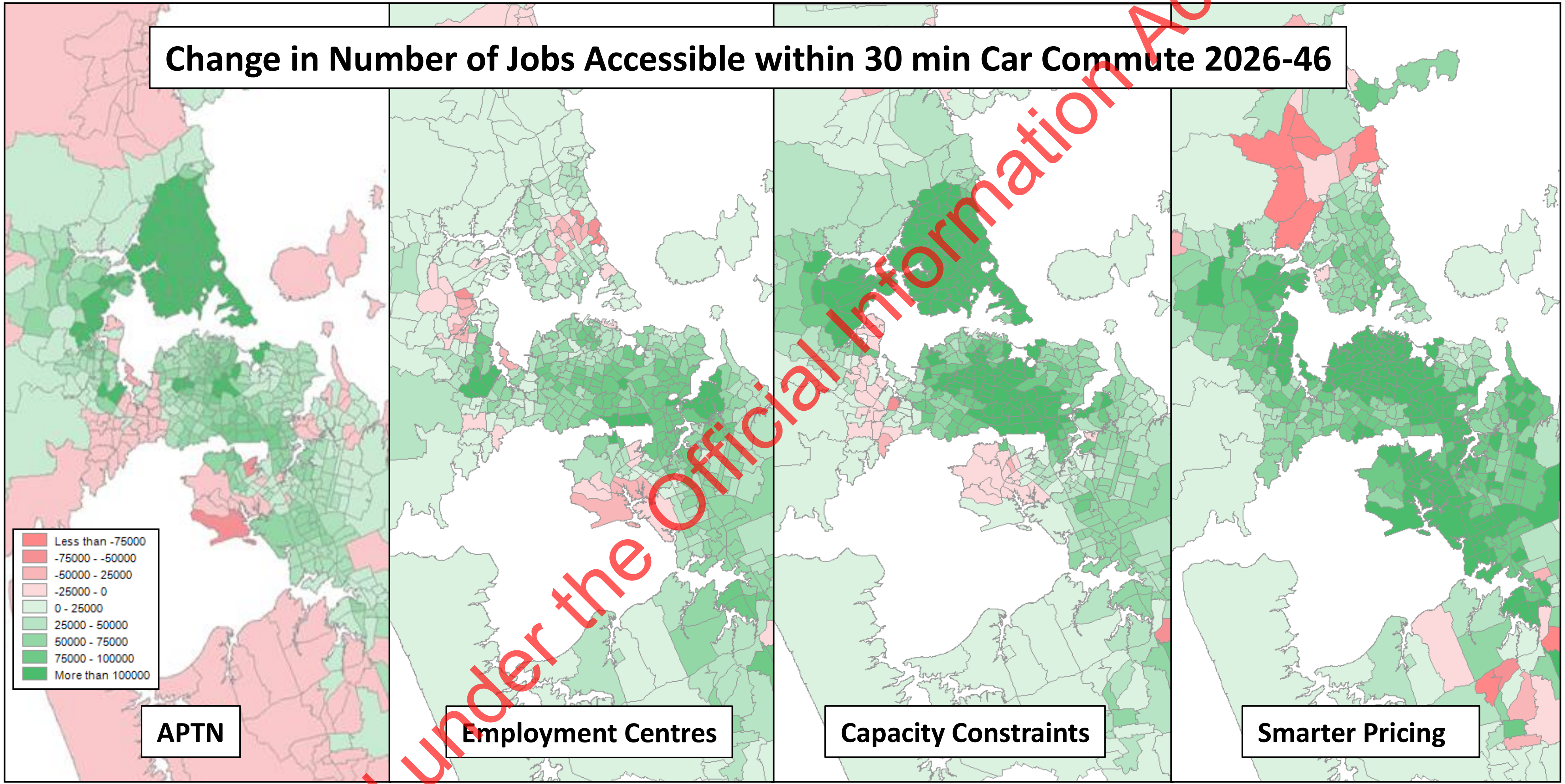

Figure 3.44: Change in number of jobs accessible within a 30 minute car commute AM peak (2026 – 2046)

Public transport accessibility

Public transport accessibility by sub-region

The figures below show the number of jobs able to be reached within a 45-minute public transport commute for each package on a sub-regional level.

The ART3 model is limited by the fact the capacity of public transport vehicles is not constrained.

West:

The west sees the greatest variation in public transport accessibility between the packages analysed (Figure 3.45). As mentioned before, Smarter Pricing and the Employment Centres package provided substantially higher public transport accessibility than the other packages, particularly in 2026 and 2036. Advancing the full Northwestern Busway from Kumeu to the city centre in this package is the main contributor to this improvement.

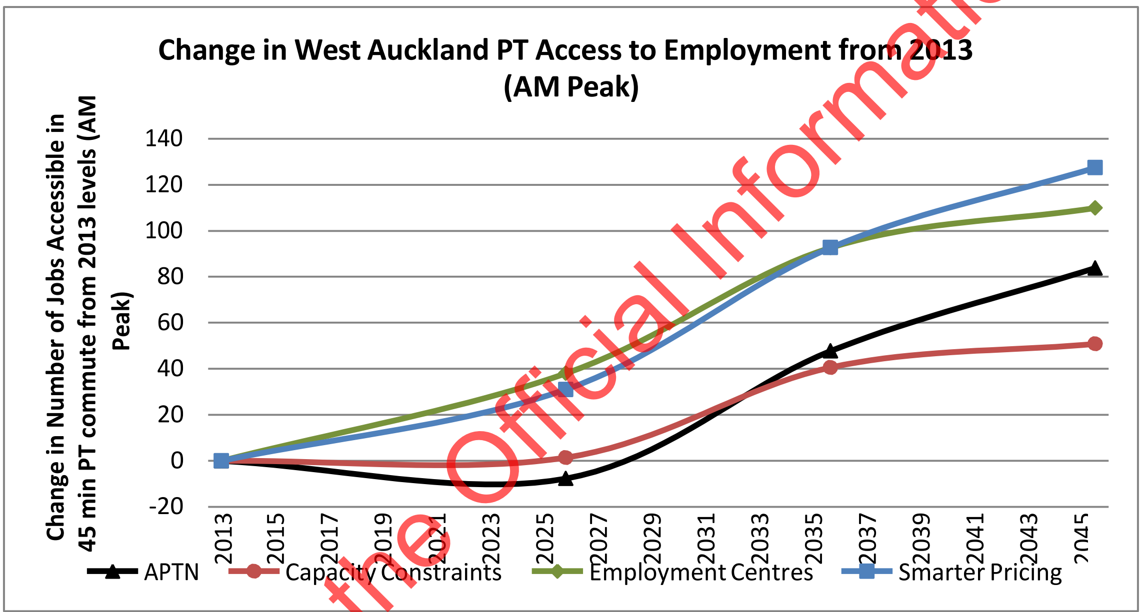

Figure 3.45: Change in West Auckland public transport accessibility AM peak from 2013

South:

In the south, both Capacity Constraints and Employment Centres provide similar levels of public transport access in the first decade compared to APTN (Figure 3.46). Smarter Pricing provides the highest level of accessibility, although the Employment Centres package catches up briefly in 2036. Rail upgrades to enable the Southern Line express trains are likely to be the main contributor to this improvement.

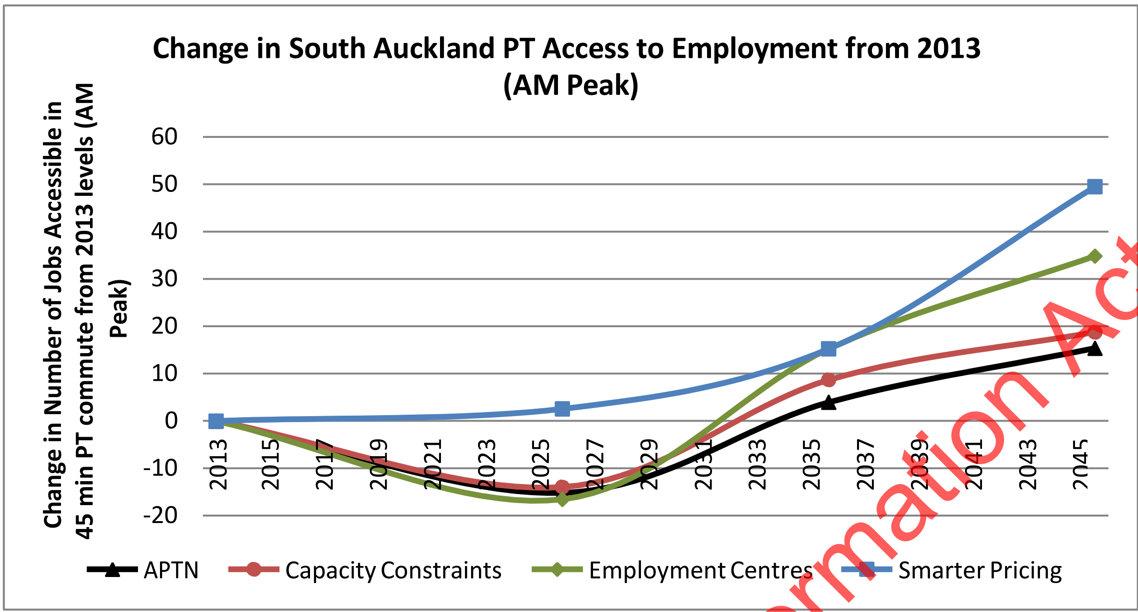

Figure 3.46: Change in West Auckland public transport accessibility AM peak from 2013

North:

In the north, all three packages tested perform better than APTN in the first decade, although the APTN catches up in the final decade (Figure 3.47).

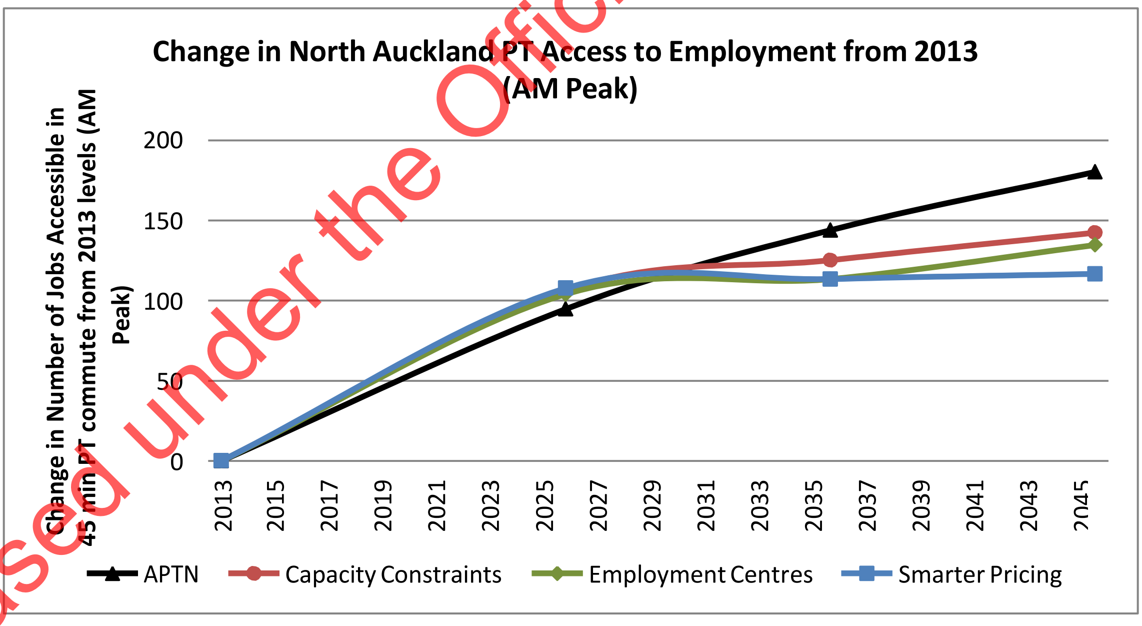

Figure 3.47: Change in North Auckland public transport accessibility AM peak from 2013

Central:

In the central area, Smarter Pricing sees the highest increase in public transport access between 2013 and 2036, largely due to the inclusion of both the isthmus mass transit and Mt Roskill rail spur (Figure 3.48). Capacity Constraints tracks similarly to APTN, while Employment Centres improves after 2026 to reach similar levels of accessibility as Smarter Pricing.

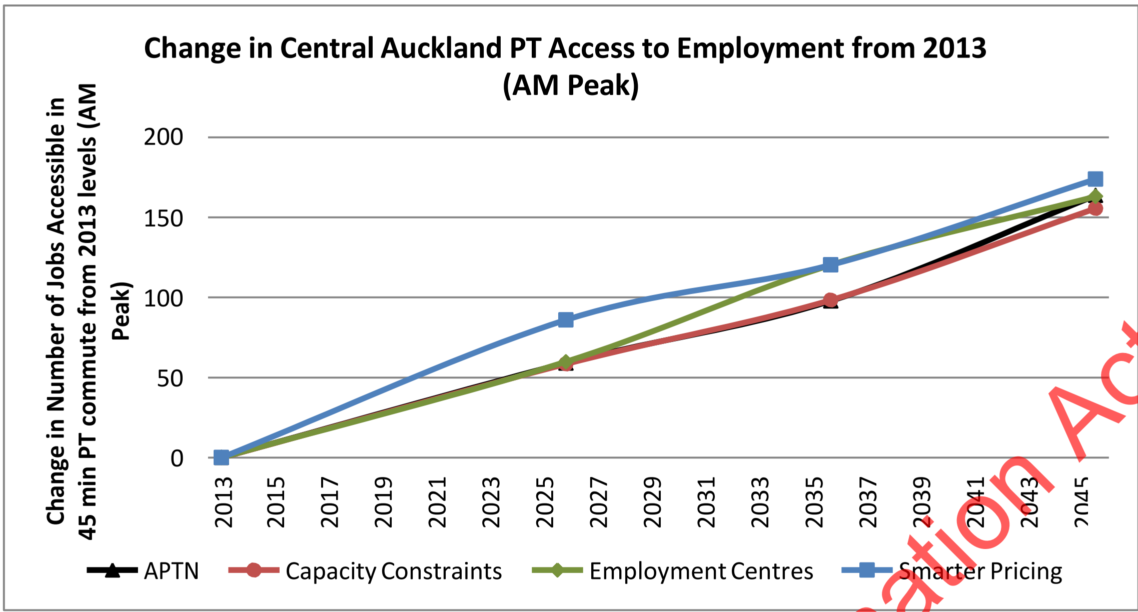

Figure 3.48: Change in Central Auckland public transport accessibility AM peak from 2013

Spatial analysis of public transport accessibility

APTN, Employment Centres, Capacity Constraints and Smarter Pricing all see increases to public transport accessibility across the region between 2013 and 2026, particularly around the isthmus and the North Shore (Figure 3.49). Employment Centres also see improved accessibility in the northwest as a result of the addition of the Northwestern Busway in the first decade.

Public transport accessibility improvements vary between the packages between 2026 and 2046 (Figure 3.50). Smarter Pricing sees the greatest improvement to public transport access, although it also sees decreases to accessibility on parts of the North Shore.

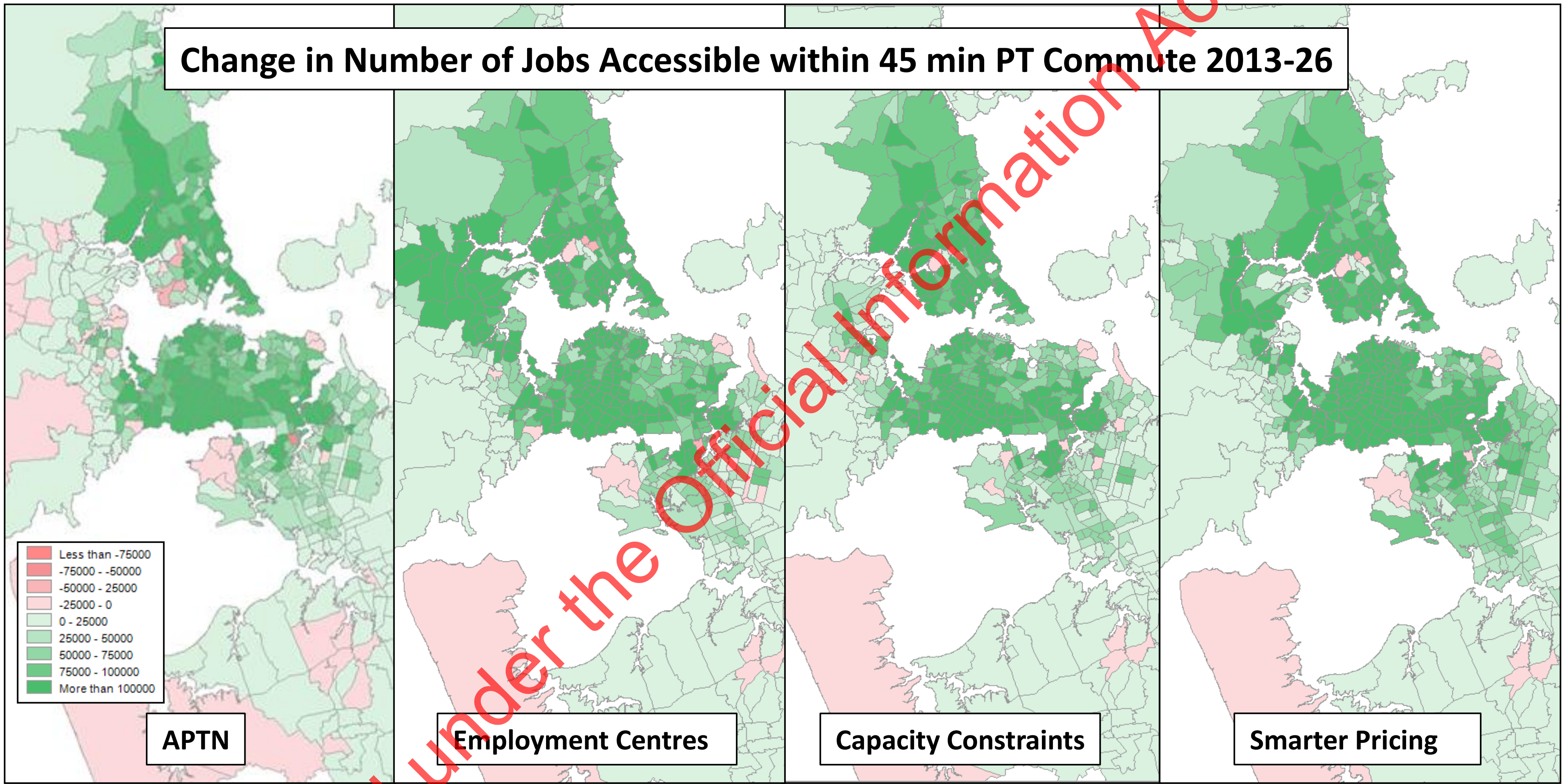

Figure 3.49: Change in number of jobs accessible within a 45 minute public transport commute AM peak (2013 – 2026)

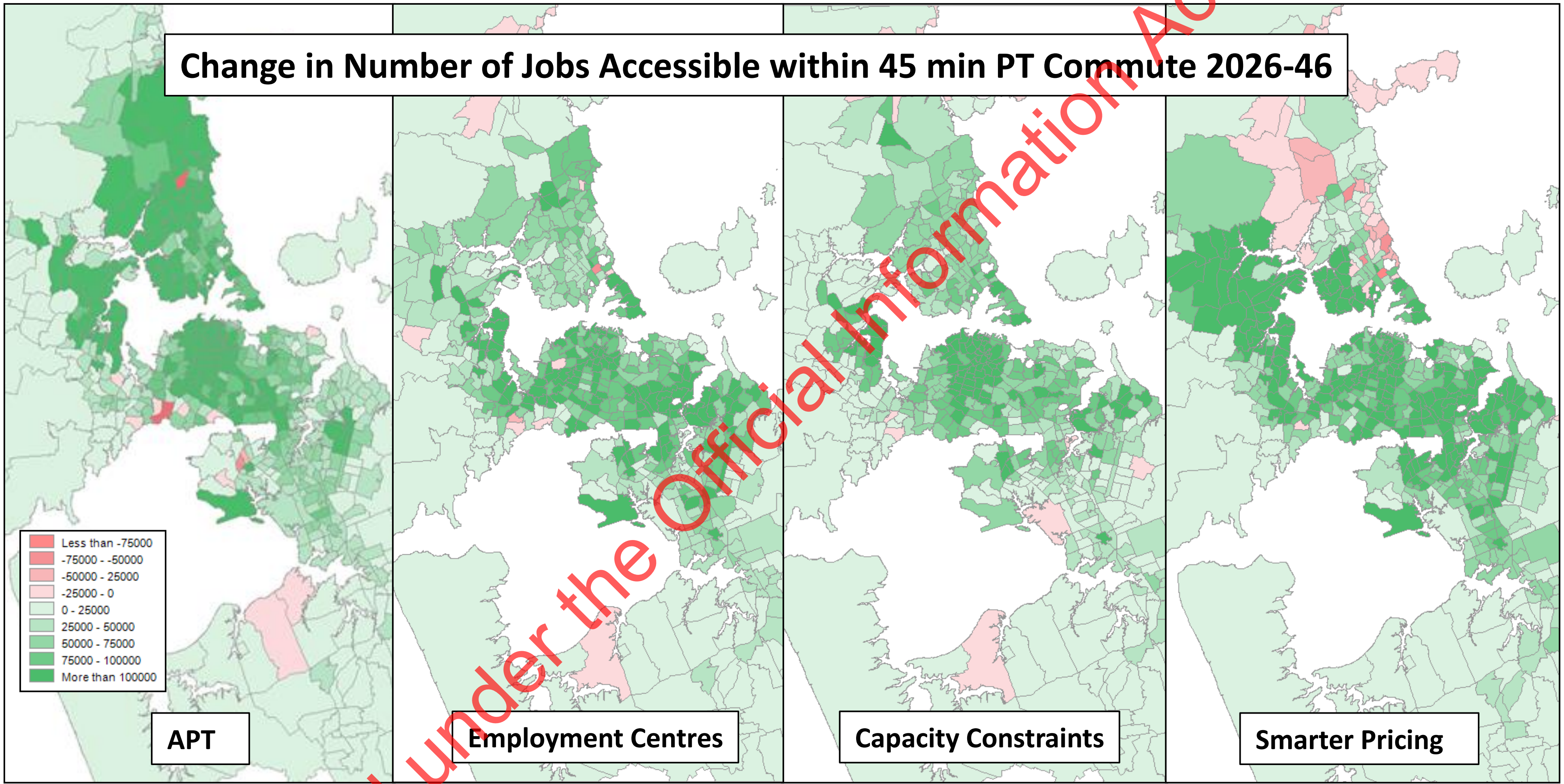

Figure 3.50: Change in number of jobs accessible within a 45 minute public transport commute AM peak (2026 – 2046)

3.4.3 Congestion

Both the Capacity Constraints and Employment Centres packages show small improvements compared to the APTN, particularly within the first decade (Figure 3.51). Congestion levels under Employment Centres gradually increase from 2026 until they reach the same level as APTN in 2046. Congestion levels remain the same under Capacity Constraints between 2026 and 2046. Smarter Pricing is the only option that shows a 'step-change' in congestion alleviation, with the biggest reduction taking effect in 2026.

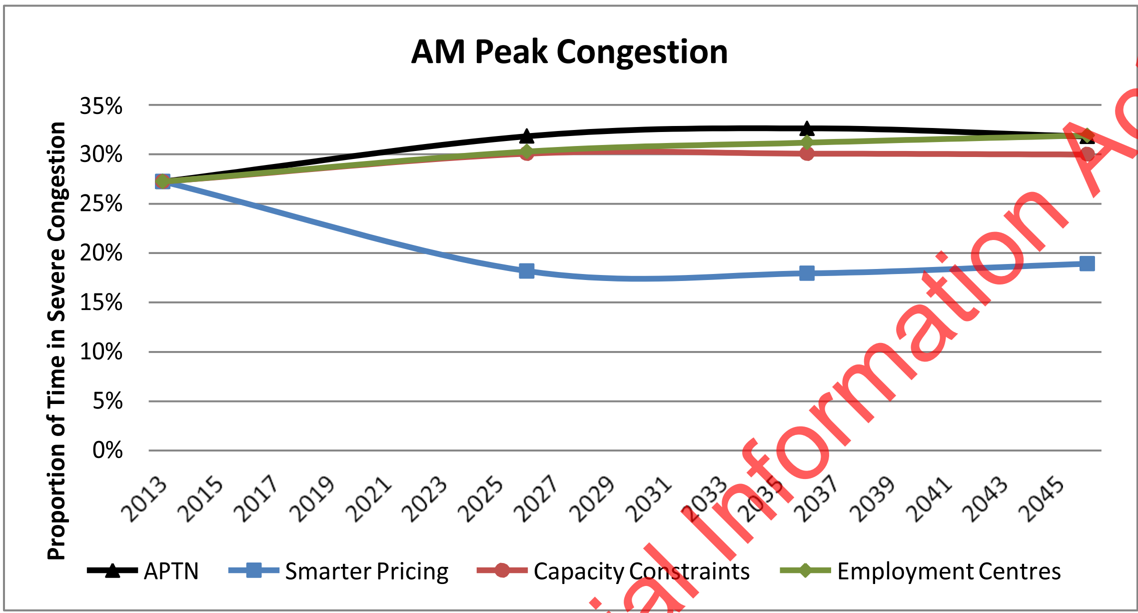

Figure 3.51: AM Peak Congestion (2013 – 2046)

Inter-peak congestion sees similar patterns to the AM peak, with Smarter Pricing showing the biggest reduction in congestion (Figure 3.52).

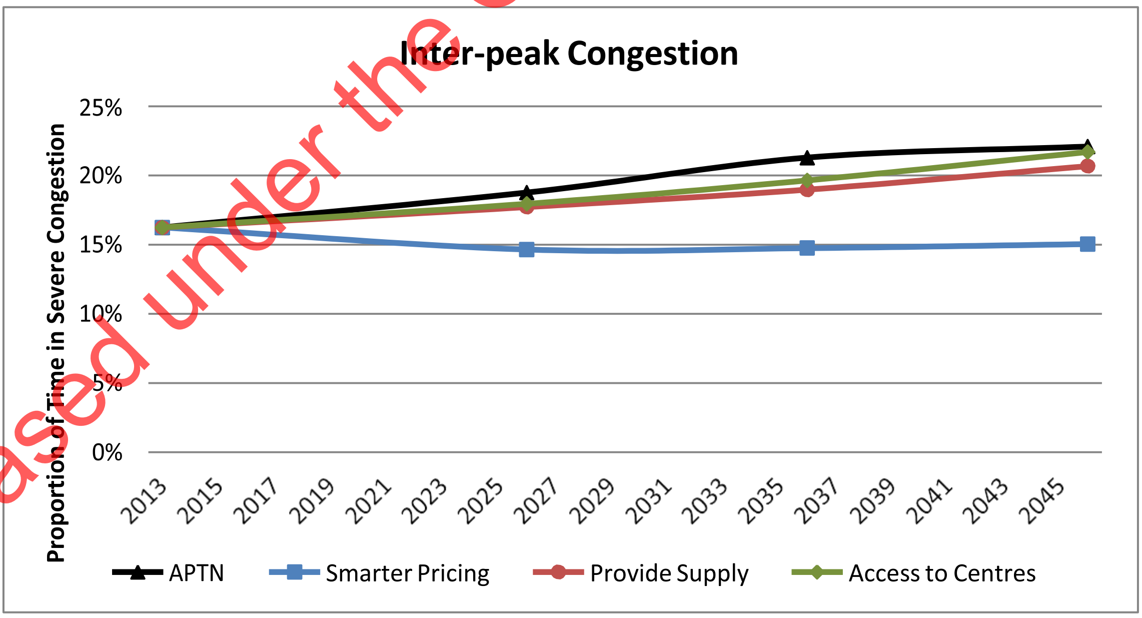

Figure 3.52: Inter-peak Congestion (2013 – 2046)

At a sub-regional level, congestion remains an issue in the 2046 AM peak under the Capacity Constraints package despite motorway widening being brought forward. Severe congestion is seen particularly on SH16, SH20, the Auckland Harbour Bridge and parts of the Northern Motorway (Figure 3.53). Only Smarter Pricing has any discernible impact on congestion, followed by the Employment Centres package.

The inter-peak sees less severe congestion on the network compared to the AM peak, although limited congestion remain on key pinch points (Figure 3.54). All packages see an improvement to inter-peak congestion compared to the APTN, particularly on SH20A and parts of the Northern Motorway. The removal of even minor congestion on the network under Smarter Pricing indicates that pricing levels may be too high.

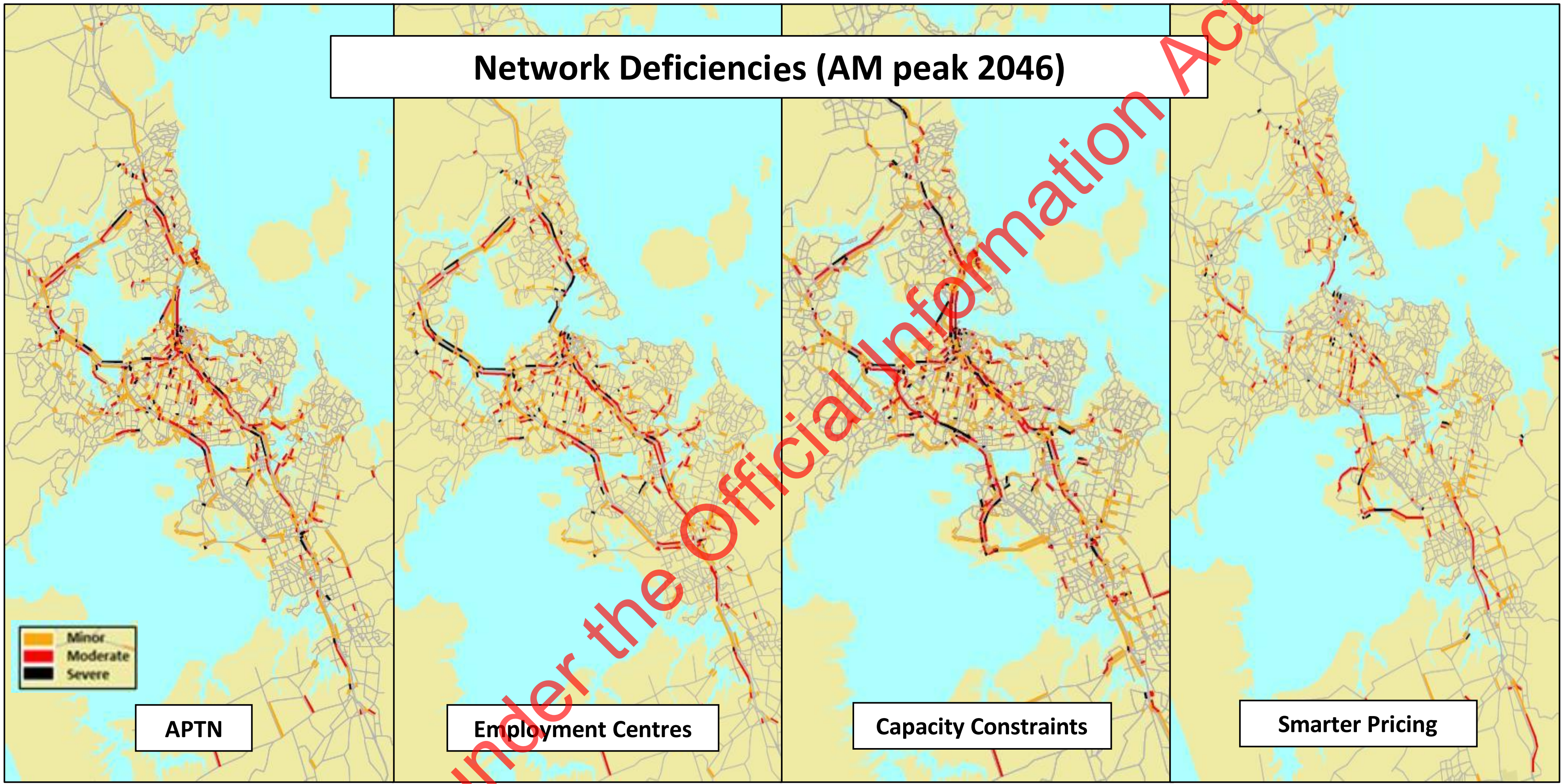

Figure 3.53: Network deficiencies in the AM Peak (2046)

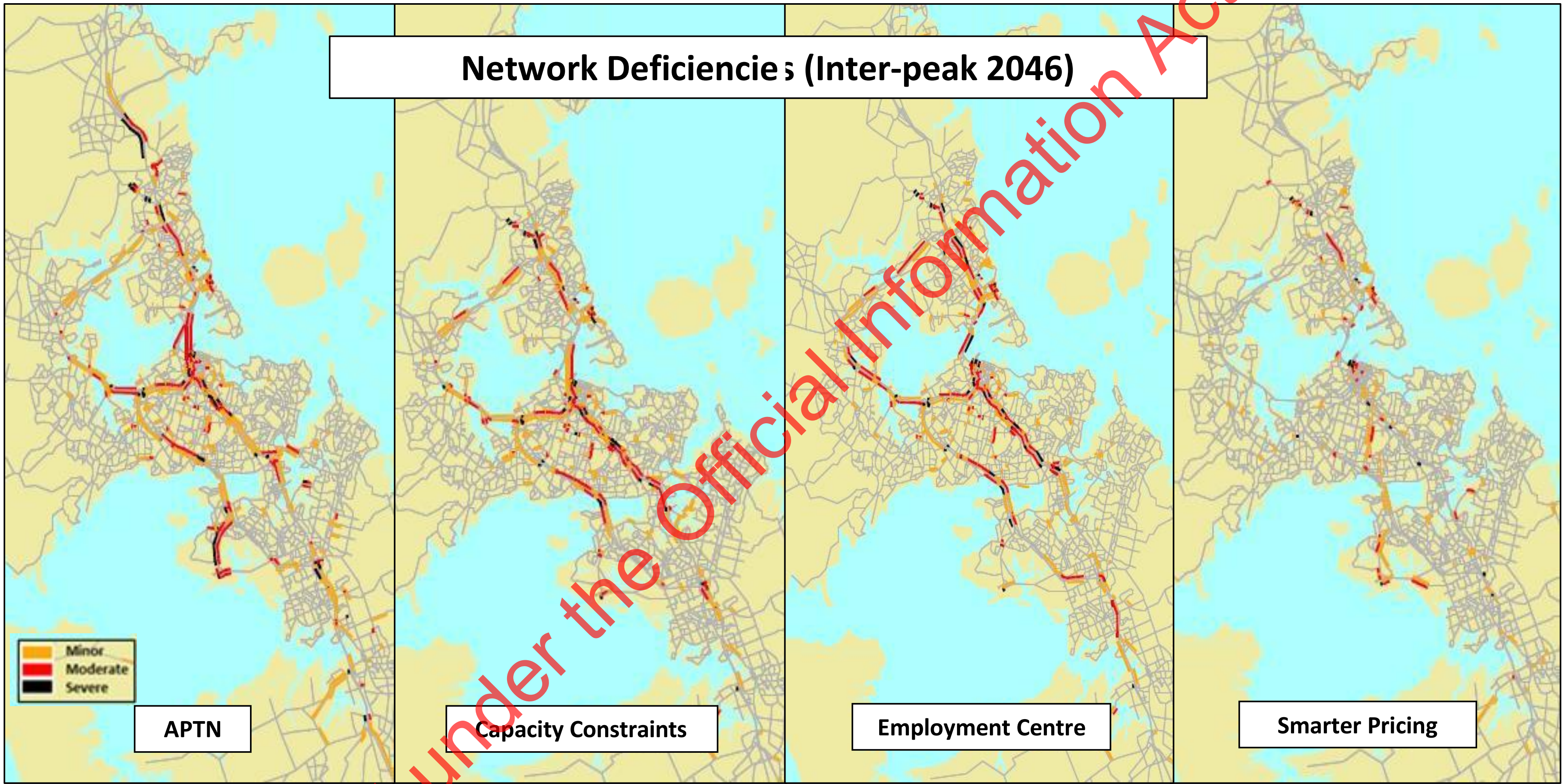

Figure 3.54: Network deficiencies in the Inter-peak (2046)

3.4.4 Public Transport Mode Share

Public transport mode share tracks similarly under APTN, Capacity Constraints and Employment Centres (Figure 3.55). Due to the increased cost of driving resulting from Smarter Pricing, public transport mode share shows moderate improvements.

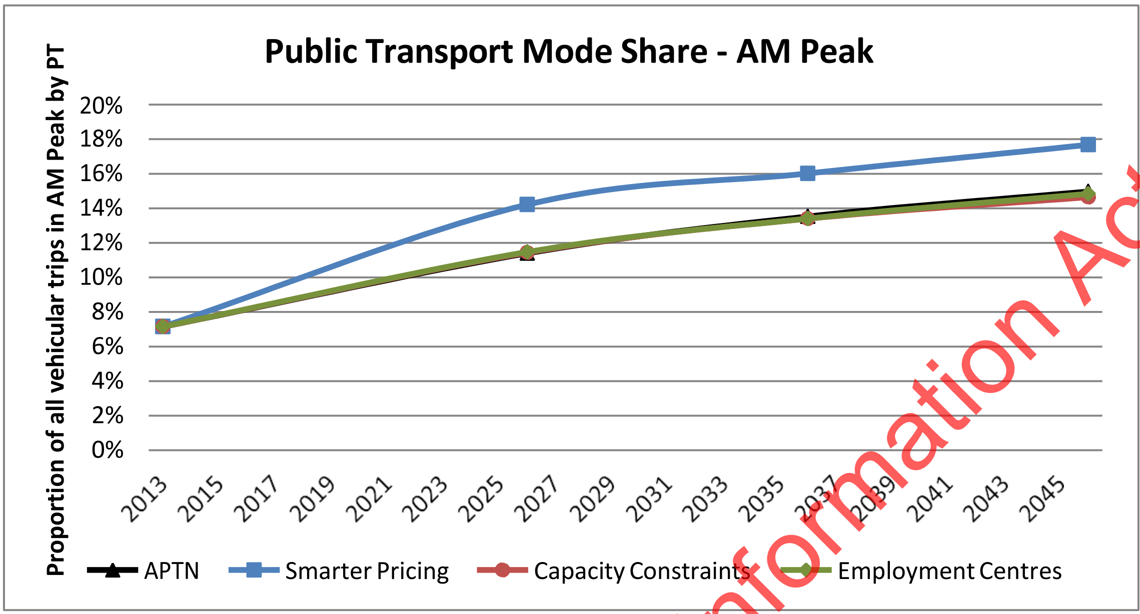

Figure 3.55: Public transport mode share in the AM peak (2013-2046)

Public transport constraints

A very large increase in projected bus passengers over the next 30 years is predicted, creating capacity 'pinch points' with significant challenges to meet demand.

Current bus demand for Symonds Street already exceeds medium capacity, and will exceed high capacity between 2018 and 2023 for all packages (Figure 3.56).[4]

[4] Medium capacity refers to a capacity of 120 buses per hour with 57 passengers per bus. High capacity refers to a capacity of 120 buses per hour with 80 passengers per bus. These are indicative corridor capacities and will vary according to specific circumstances.

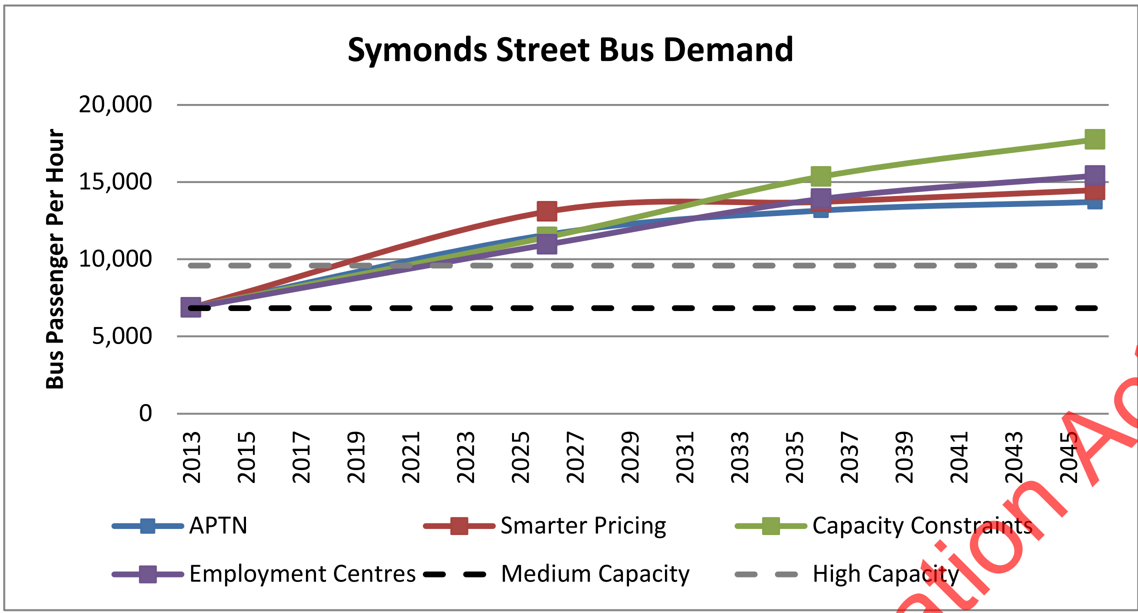

Figure 3.56: Symonds Street bus demand (2013-2046)

Bus demand for Fanshawe Street peaks at 2026 under the Employment Centres and Smarter Pricing packages, reaching medium capacity as a result of the introduction of the North Shore mass transit system (Figure 3.57). Without mass transit, bus demand continues to rise (as seen in the APTN and Capacity Constraints packages) until it exceeds high capacity at around 2036.

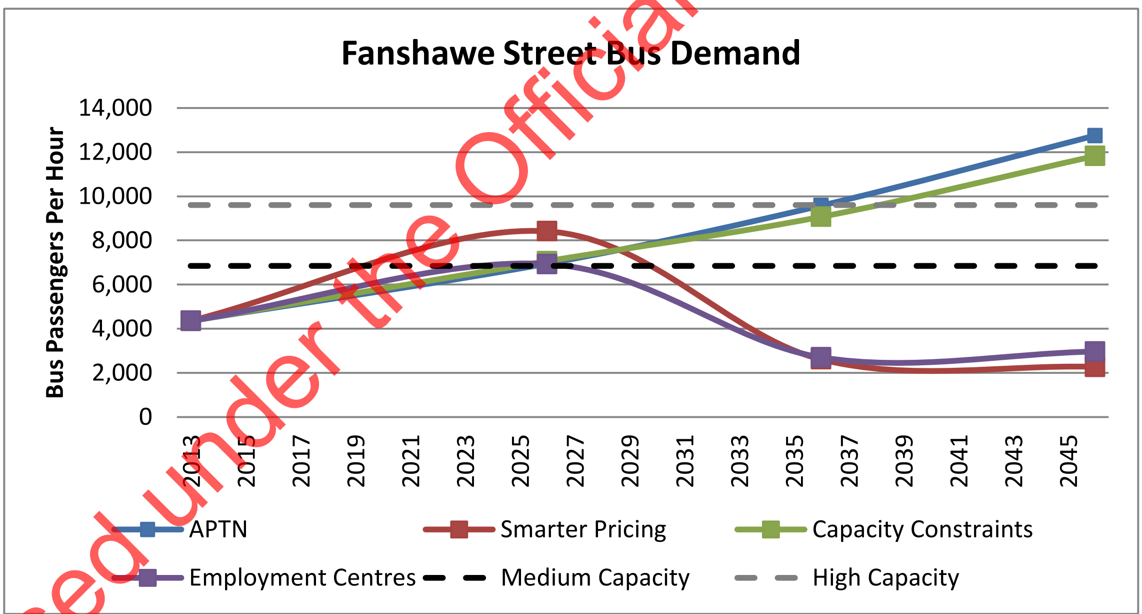

Figure 3.57: Fanshawe Street bus demand (2013-2046)

Bus demand for Karangahape Road reaches medium capacity in 2036 for both the Capacity Constraints and Employment Centres packages (Figure 3.58). High capacity is reached in 2046 with the smarter transport pricing tool.

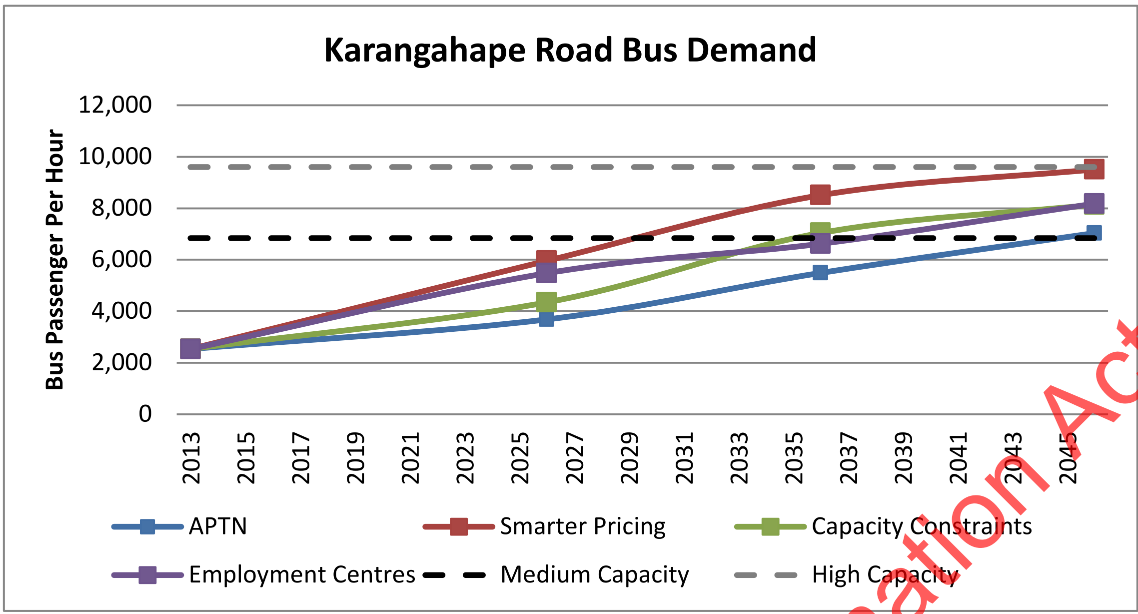

Figure 3.58: Karangahape Road bus demand (2013-2046)

Long-term solutions to these capacity constraints potentially involve substantial investments and have major network-wide implications. A network-wide approach to the planning, timing and funding of these interventions is therefore important to inform investment decisions.

It appears unlikely that smarter pricing and technology will reduce this challenge. Road pricing typically increases public transport demand, further increasing the challenge while any shift to ridesharing away from public transport in accessing the city centre is likely to increase, rather than reduce, congestion levels due to limited street-space.

However, care is needed in interpreting public transport results, as the ART3 model does not take into account the ‘crowding off’ of passengers from buses due to demand exceeding capacity. In reality, crowding would result in some users shifting to car, with increased congestion. When crowding is taken into account using the APT3 model, predicted bus demand is generally shown to be lower (Figure 3.59).

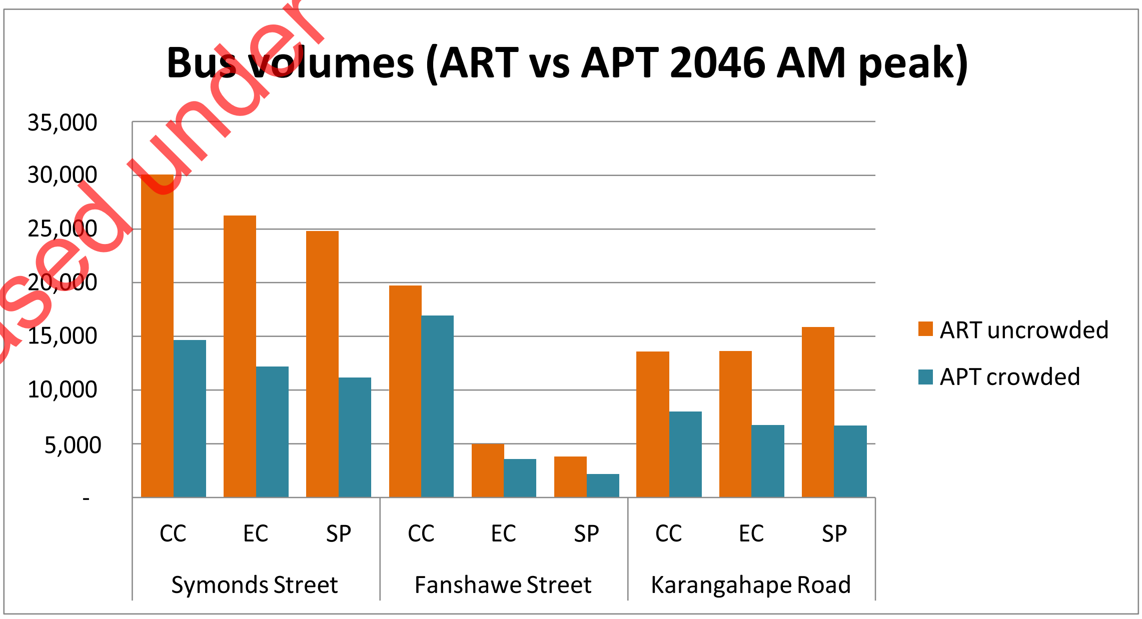

Figure 3.59: Isthmus bus demand ART uncrowded vs APT crowded (2013-2046)

3.4.5 Full Evaluation Results

The following table presents the results of our evaluation of the Capacity Constraints, Employment Centres and Smarter Pricing packages against the evaluation criteria established in the Foundation Report (Table 3.5). All results relate to the 2046 year unless otherwise specified.

Table 3.5: Evaluation framework – headline measures

Objective	Measure	Headline KPI	2013 comparison	Capacity Constraints 2046	Employment Centres 2046	Smarter Pricing 2046	APTN 2046	Comment
Improve access to employment and labour	Access to employment and labour within a reasonable travel time	• Jobs accessible by car within a 30 minute trip in the AM peak • Jobs accessible by public transport within a 45 minute trip in AM peak • Proportion of jobs accessible to other jobs by car within a 30 minute trip in the inter-peak	312,000 i.e. 51% of available jobs 94,000 i.e. 15% of available jobs 467,000 i.e. 75 % of available jobs	392,000 i.e. 44% of available jobs 223,000 i.e. 25% of available jobs 599,000 i.e. 67% of available jobs	356,000 i.e. 40% of available jobs 238,000 i.e. 27% of available jobs 588,000 i.e. 66% of available jobs	551,000 i.e. 62% of available jobs 245,000 i.e. 27% of available jobs 678,000 i.e. 76% of available jobs	386,000 i.e.43% of available jobs 215,000 i.e. 24% of available jobs 590,000 i.e. 66% of available jobs	The Capacity Constraints and Employment Centres packages increases the number of jobs accessible by car and PT (mainly due to growth) but does not increase the proportion of jobs that could be accessed by car. The Smarter Pricing package significantly increases car and PT accessibility (measured only in relation to travel time, not financial cost) in the morning peak (7-9 am) in 2046, with a moderate increase in accessibility by public transport.
Improve congestion results	Impact on general traffic congestion	• Per capita annual delay (compared to efficient throughput) • Proportion of travel time in severe congestion in the AM peak and inter-peak	7 hours 22 minutes per person per annum 27.3% AM peak 16.3% inter-peak	11 hours 53 minutes per person per annum 30.0% AM peak 20.7% inter-peak	13 hours 13 minutes per person per annum 31.9% AM peak 21.7% inter-peak	2 hours 49 minutes per person per annum 18.9% AM peak 15.4% inter-peak	13 hours 33 minutes per person per annum 31.9% AM peak 21.9% inter-peak	With Smarter Pricing, projected levels of congestion throughout the day are significantly better than the APTN. Projected levels of congestion for the Capacity Constraints and Employment Centres packages are expected to be similar to the APTN.
	Impact on freight and goods (commercial traffic) congestion	• Proportion of business and freight travel time spent in severe congestion on the strategic freight network (in the AM peak and inter-peak)	15.1% AM 8.3% inter-peak	17.3% AM 11.9% inter-peak	22.2% AM 14.5% inter-peak	7.2% AM 5.5% inter-peak	18.6% AM 12.9% inter-peak	Projected congestion on the strategic freight network varies considerably between the packages. With Smarter Pricing, projected congestion is significantly better throughout the day, compared to the APTN.
	Travel time reliability	• Proportion of total travel subject to volume to capacity ratio of greater than 0.9 during AM peak, inter-peak and PM peak.	15% AM peak 6% inter-peak 16% PM peak	18% AM peak 12% inter-peak 24% PM peak	19% AM peak 14% inter-peak 24% PM peak	8% AM peak 5% inter-peak 10% PM peak	19% AM peak 13% inter-peak 23% PM peak	With Smarter Pricing, projected reliability of travel times for motor vehicle trips is expected to be significantly better throughout the day, compared to APTN. Projected reliability for the Capacity Constraints and Employment Centres packages is expected to be similar to the APTN.
Increase public transport mode-share	Public transport mode share	• Proportion of vehicular trips in the AM peak made by public transport	8.5%	18.2%	18.5%	22.1%	18.0%	With Smarter Pricing, projected PT mode share is slightly higher than APTN. Projected PT mode share for the Capacity Constraints and Employment Centres packages is expected to be similar to the APTN.
	Increase public transport where it impacts on congestion	• Proportion of vehicular trips over 9 km in the AM peak made by public transport	18.3%	26%	27%	35%	31.7%	With Smarter Pricing, it is projected that a higher proportion of longer commute trips would be by PT, compared to the APTN. The proportion of longer commuter trips by PT is projected to be lower with the Capacity Constraints and Employment Centres packages, compared to the APTN.
	Increase vehicle occupancy	• Average vehicle occupancy	1.36 people per vehicle AM peak 1.25 people per vehicle inter-peak	-	-	-	-	It was not possible to model changes in vehicle occupancy. The input assumptions of an average of 1.36 people per vehicle in AM peak and an average of 1.25 people per vehicle in inter-peak remained constant for all packages and all model years.

Objective	Measure	Headline KPI	2013 comparison	Capacity Constraints 2046	Employment Centres 2046	Smarter Pricing 2046	APTN 2046	Comment
Increased financial costs deliver net user benefits	Net benefits to users from additional transport expenditure	• Increase in financial cost per trip compared to savings in travel time and vehicle operating cost	Not applicable	-	-	-	Not applicable	Financial costs from Smarter Pricing (see pricing schedule in Table 3.3) are assumed to replace road user charges and fuel excise duties. Savings in travel time and vehicle operating costs vary by trip. On average it is estimated that the financial costs exceed the savings in travel time and vehicle operating costs. Better model/tools are required to provide robust quantification of net benefits.
Ensure value for money	Value for money	• Package benefits and costs	-	-	-	-	-	Package benefits include the contributions to objectives as measured in this table. The costs of new capital expenditure (excluding renewals) for the 30 year programmes are estimated in billions of 2016 dollars as follows: Capacity Constraints: $29.5 b Employment Centres: $29.6 b Smarter Pricing: $28.7 b These cost estimates were identified prior to the revision of project costs in ATAP.

In addition to the project objectives, a number of other key outcomes have been evaluated through the evaluation framework in Table 3.6 below.

Table 3.6: Evaluation framework – other key outcomes

Other Key Outcomes	Measure	Headline Key Performance Indicator	2013 comparison	Capacity Constraints 2046	Employment Centres 2046	Smarter Pricing 2046	APTN	Comment
Support access to housing	Transport infrastructure in place when required for new housing	• Transport does not delay urbanisation in line with timeframes of Future Urban Land Supply Strategy	Existing transport infrastructure in greenfields is inadequate to support the growth required in the FULSS.	Approximately half the new bulk transport infrastructure required by FULSS in the Southern and NW greenfields areas is programmed to be in place by 2028. Approximately 20% in the North is programmed to be in place when required by 2038. Almost 100% in Warkworth is programmed to be in place when required by 2038.	Approximately half the new bulk transport infrastructure required by FULSS in the Southern and NW greenfields areas is programmed to be in place by 2028. Approximately 20% in the North is programmed to be in place when required by 2038. Almost 100% in Warkworth is programmed to be in place when required by 2038.	Approximately half the new bulk transport infrastructure required by FULSS in the Southern and NW greenfields areas is programmed to be in place by 2028. Approximately 20% in the North is programmed to be in place when required by 2038. Almost 100% in Warkworth is programmed to be in place when required by 2038.	Does not meet timeframes of FULSS.	The same programme in greenfields has been assumed in all three packages.
Minimise harm	Safety	• Deaths and serious injuries per capita and per distance travelled	48 deaths and 3,487 injuries p.a. from motor vehicle crashes. 25 injuries per 10,000 population 28 injuries per 100 million vehicle kilometres travelled	-	-	-	-	Model forecasts can't accurately identify number of deaths and serious injuries.
	Emissions	• Greenhouse gas emissions	8.4 million kg of CO_2 per day	8.1 million kg of CO_2 per day	8.0 million kg of CO_2 per day	7.0 million kg of CO_2 per day	8.1 million kg of CO_2 per day	Model projects 12.5% fewer emissions in the Smarter Pricing package than APTN. This is mostly due to fewer trips and shorter distance of trips. Projected emissions for the Capacity

Other Key Outcomes	Measure	Headline Key Performance Indicator	2013 comparison	Capacity Constraints 2046	Employment Centres 2046	Smarter Pricing 2046	APTN	Comment
								Constraints and Employment Centres are similar to the APTN.
Maintain existing assets	Effects of maintenance and renewals programme	• Asset condition levels of service • Renewals backlog	In 2015, approximately 1% of the transport network was in a "very poor" condition. This is equivalent to $157 million of backlog. [Source: Auckland Transport's Asset Management Plan 2015-2018]	Expected to achieve higher levels of service than in 2016 and similar levels of service to the APTN. This clears the renewals backlog.	Expected to achieve higher levels of service than in 2016 and similar levels of service to the APTN. This clears the renewals backlog.	Expected to achieve higher levels of service than in 2016 and similar levels of service to the APTN. This clears the renewals backlog.	Similar to these packages	The same maintenance and renewals programme has been assumed in all three packages.
Social inclusion and equity	Impacts on geographical areas	• Access employment in high deprivation areas • Distribution of impacts (costs and benefits) by area	As identified in the Foundation report, high deprivation areas in the south and west have lower access to jobs than other parts of the region. People in the west rely on a congested motorway link to jobs in the isthmus and south. People in the south also experience congestion on motorway links to jobs.	Similar to the APTN, accessibility issues remain in Mangere and parts of the west.	Similar to the APTN, accessibility issues remain in Mangere and parts of the west. Accessibility from high deprivation areas in the North Shore is worse.	Compared to the APTN, accessibility improves for high deprivation areas, but access by motor vehicle is subject to pricing. Motor vehicle accessibility from high deprivation areas in the North Shore is worse than the APTN.	The Deficiency Analysis identified significantly lower levels of access in the south and west.	Accessibility from high deprivation areas is similar to the APTN, except with Smarter Pricing. Generalised costs generally increase as a result of Smarter Pricing.
Network resilience	Network vulnerability and adaptability	• Impact in the event of disruption at vulnerable parts of the network	Vulnerable network due to incomplete State Highway, public transport and cycle networks and lack of capacity at peak times on the strategic road network to cope with disruptions.	Network resilience is similar to the APTN. This package improves resilience through additional roading links such as the Additional Waitemata Harbour Crossing.	Network resilience is similar to the APTN. This package improves resilience through additional roading links such as Penlink and the high capacity rapid transit network.	Network resilience is similar to the APTN. This package improves resilience through pricing of the road network. This reduces trips on the road network by about 10% which could result in less diversion and impact in the event of disruption to the road network. There is high capacity in the rapid transit network, which enables PT to take additional people in the case of disruption.	-	These packages have a similar level of network resilience to the APTN.

3.4.6 *Package Analysis Conclusions*

Overall, changing the mix of investments to reflect either a focus on addressing capacity constraints or accessing employment centres – with a similar overall level of investment – highlights the potential to achieve minor to moderate improvements in region-wide performance against the project objectives, but not a step-change. Sub-regional changes in performance suggested there was merit in continuing to optimise the timing and priority of investments. In particular, the analysis undertaken of different investment mixes suggests it would be possible to substantially improve employment accessibility in the south and west.

Analysis of smarter transport pricing showed it offers the potential to achieve a step-change in transport network performance and should therefore form a core part of the strategic approach. However, setting price levels is extremely challenging as performance improvement, travel time savings and increased travel costs need to be carefully balanced. While some further work was undertaken to assess different pricing levels, more sophisticated analytical tools will be required to undertake this work before a viable scheme could be developed.

4. Package Refinement

Drawing upon on the assessments undertaken in the package analysis phase, two refined packages were developed for the package refinement phase. These packages were developed differently to the initial ones, particularly because they did not have a “funding limit” placed on them. As the previous phase of analysis had highlighted, a step-change in performance was unlikely to be achieved through a different mix of investment. The refined packages focused on understanding the extent to which a step-change in performance could be achieved via two approaches:

- Focus on Higher Level of Investment (Section 4.1)
- Focus on Influencing Patterns of Travel Demand (Section 4.2)

A cross package review was undertaken in Section 4.3.

The common baseline for both packages was generally similar to that used for the previous packages. It is referred to interchangeably as the ATAP Baseline and the Base Network. The Base Network was refined and narrowed in greenfield growth areas to only include investments that were directly required to enable growth (i.e. local road networks). Other investments in greenfield areas were considered as part of one package or the other.

The common baseline has a capital cost of approximately $19 billion for new improvements (excluding renewals) over the 30-year period. Key components of the Base Network included committed projects (e.g. City Rail Link, East-West link, Puhoi-Warkworth etc.), the Auckland Rail Development Programme(because it cannot be effectively modelled using existing tools) and a variety of other minor investments either unable to be evaluated using current tools or would be expected to occur over the next 30 years (e.g. safety programmes, walking and cycling improvements, and minor road and public transport improvements).

4.1 Focus on Higher Level of Investment

4.1.1 Package description

This package tests the hypothesis that a higher level of investment (particularly in the first 10-20 years) could lead to a step-change in performance. The package tests a significantly higher and earlier level of investment. The focus is on ensuring the road and public transport networks keep up with growth so that levels of service are acceptable.

Compared with the previous packages, this package brings forward most infrastructure projects into the first two decades. It includes a substantial programme to improve the strategic roading network, targeting the most severe capacity issues in the first decade. The package also delivers a strategic public transport network.

The total estimated 30-year cost of new capital improvements (excluding renewals) of the Higher Investment package is $40.7 billion (in 2016 dollars). Figure 4.1 below provides a breakdown of costs by decade and project type.

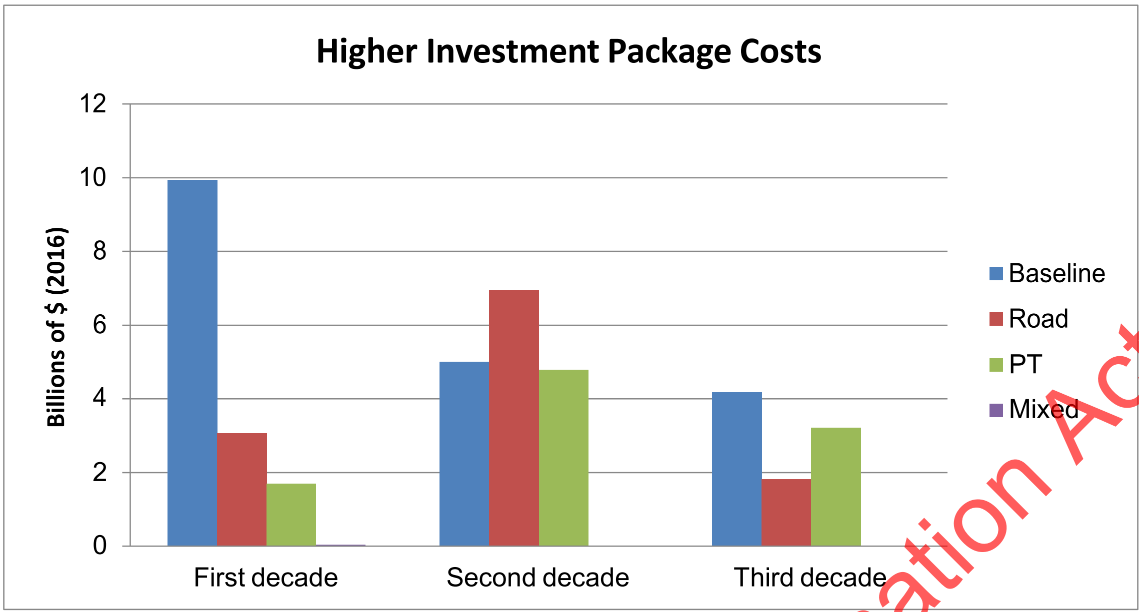

Figure 4.1: Estimated cost of new capital improvements (excluding renewals) of Higher Investment package (2018 – 2048)

Key interventions by time period

Key components of the package over and above the common baseline are included in Table 4.1 1 below:

Table 4.1: Higher Investment key interventions by decade

First Decade (2015-25)	Second Decade (2025-35)	Third Decade (2035-45)
• Northwestern Busway (Kumeu to Point Chevalier) • AMETI Pakuranga to Botany Busway • SH20 targeted widening • Southern Motorway targeted widening and interchange upgrades • Improved access to Port / Grafton Gully	• Northwestern Busway (Point Chevalier to Newton) • Additional Waitemata Harbour Crossing (motorway tunnels) • Isthmus mass transit • North Shore mass transit (city centre to Takapuna) • SH16 targeted widening • Cross isthmus mass transit • Southern Motorway further targeted widening	• City centre bus access improvements • Further SH20 widening • SH20A upgrade • Extension of isthmus mass transit • Extension of North Shore mass transit to Albany • Northern Motorway targeted widening and interchange upgrades • Extension of mass transit to Airport from north • SH20A targeted widening

4.1.2 Key Findings

The Higher Investment package in this phase was compared against both the APTN (to understand the extent to which they appear to deliver better returns than current plans) and the common baseline (to understand the value from additional investment above this baseline).

Accessibility

Access to employment in the AM peak for car travel improves from 2026 onwards compared to APTN and the Base Network, while public transport accessibility tracks very similarly to the APTN up until 2046 (Figure 4.2). Despite the higher level of investment in the first decade, the impacts on accessibility are not seen at a regional level until the 2036.

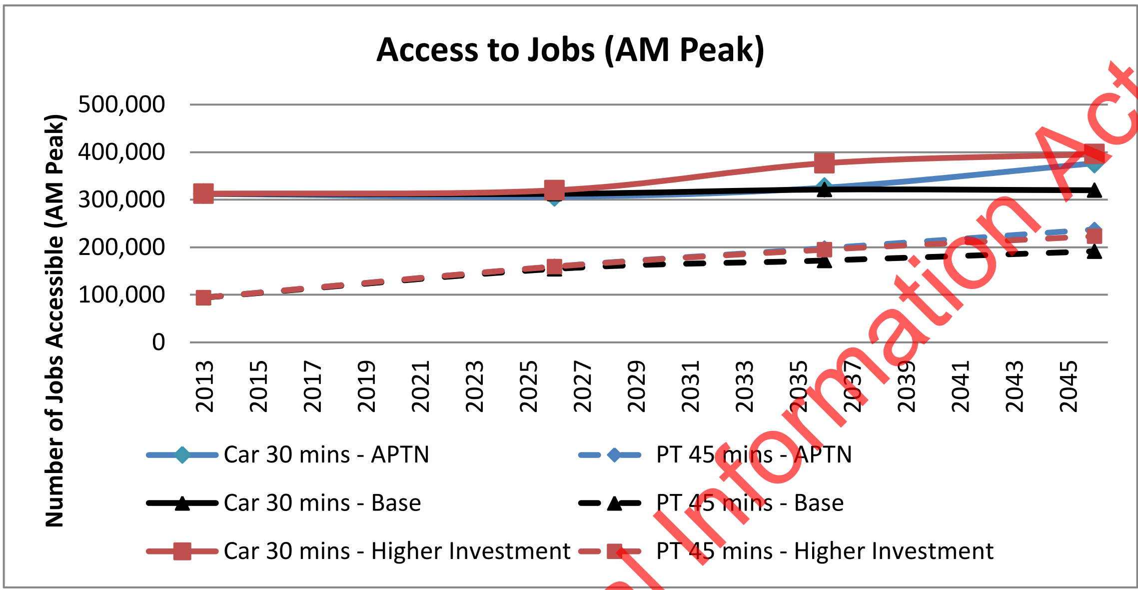

Figure 4.2: Access to jobs AM peak (Higher Investment, APTN and ATAP Baseline)

Regional measures can mask sub-regional differences in performance however, as shown in the accessibility maps below.

On a sub-regional level, car accessibility declines in the west, northwest and parts of the North Shore between 2013 and 2026 under the Higher Investment package (Figure 4.3). However, public transport accessibility increases significantly for most areas in the same period.

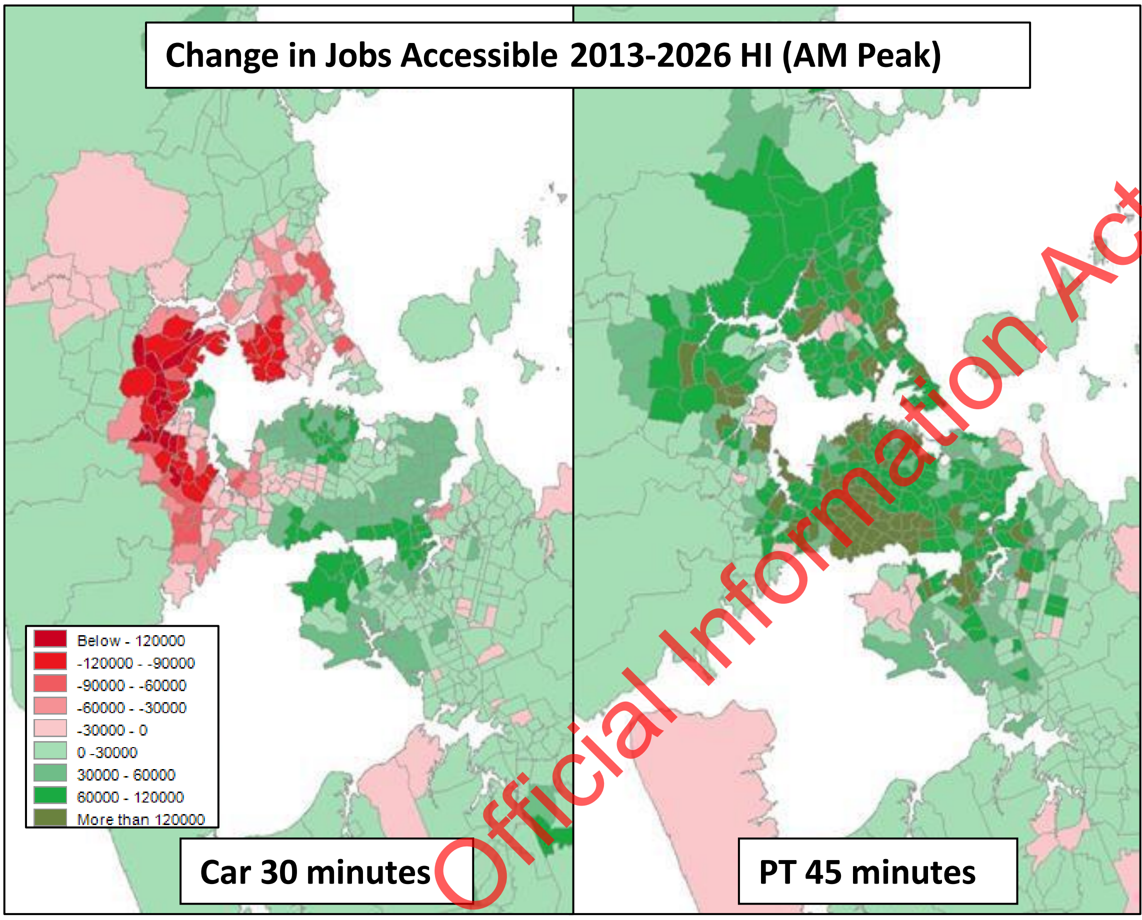

Figure 4.3: Change in accessibility to jobs AM peak 2013 vs 2026 (Higher Investment)

Between 2026 and 2046, car accessibility improves dramatically on the North Shore, northwest, as well as parts of the west and isthmus (Figure 4.4). However, accessibility declines within the inner south, particularly around Mangere and Otahuhu. The decline in accessibility occurs despite upgrades to SH20A and targeted widening of the Southern Motorway.

Public transport accessibility improves to a lesser extent across the region.

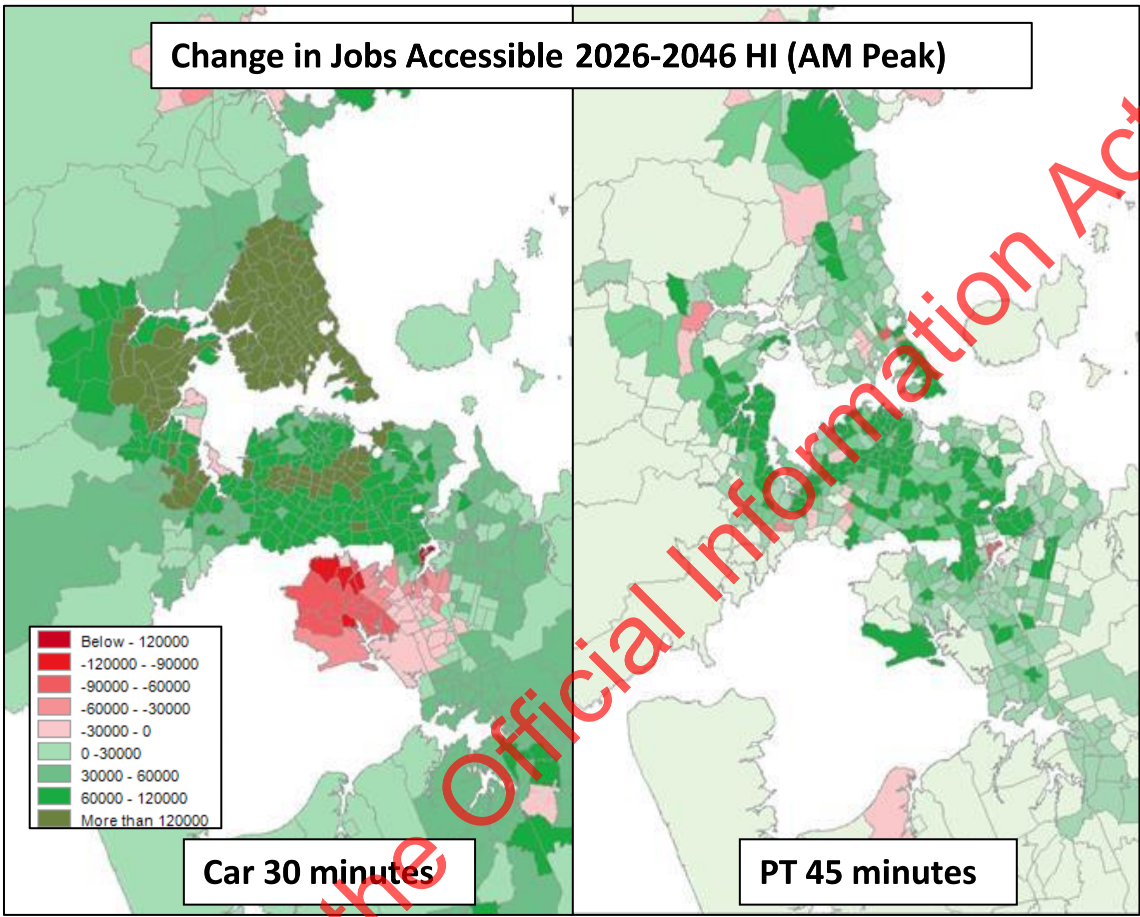

Figure 4.4: Change in accessibility to jobs AM peak 2026 vs 2046 (Higher Investment)

Compared to the Base Network, the Higher Investment package improves accessibility in 2026 for the northwest and parts of the west and outer south (Figure 4.5). These improvements indicate that the specific focus to improve accessibility in the west and south worked, to a certain extent. Accessibility declines in the inner south, despite upgrades to SH20A and targeted widening of the Southern Motorway between Manukau and Otahuhu.

The inner part of Auckland's motorway network falling inside the Western Ring Route currently experiences substantial capacity constraints and congestion, not only at peak times but also throughout the day. Our modelling of further widening in many parts of this network often showed very mixed results, by shifting around bottlenecks and congestion points rather than addressing them at a network level.

In terms of public transport, improvements are seen in largely in the northwest, as a result of the inclusion of a full grade separate right of way Northwestern Busway corridor (rather than the combination of bus lanes and busway as specified in APTN).

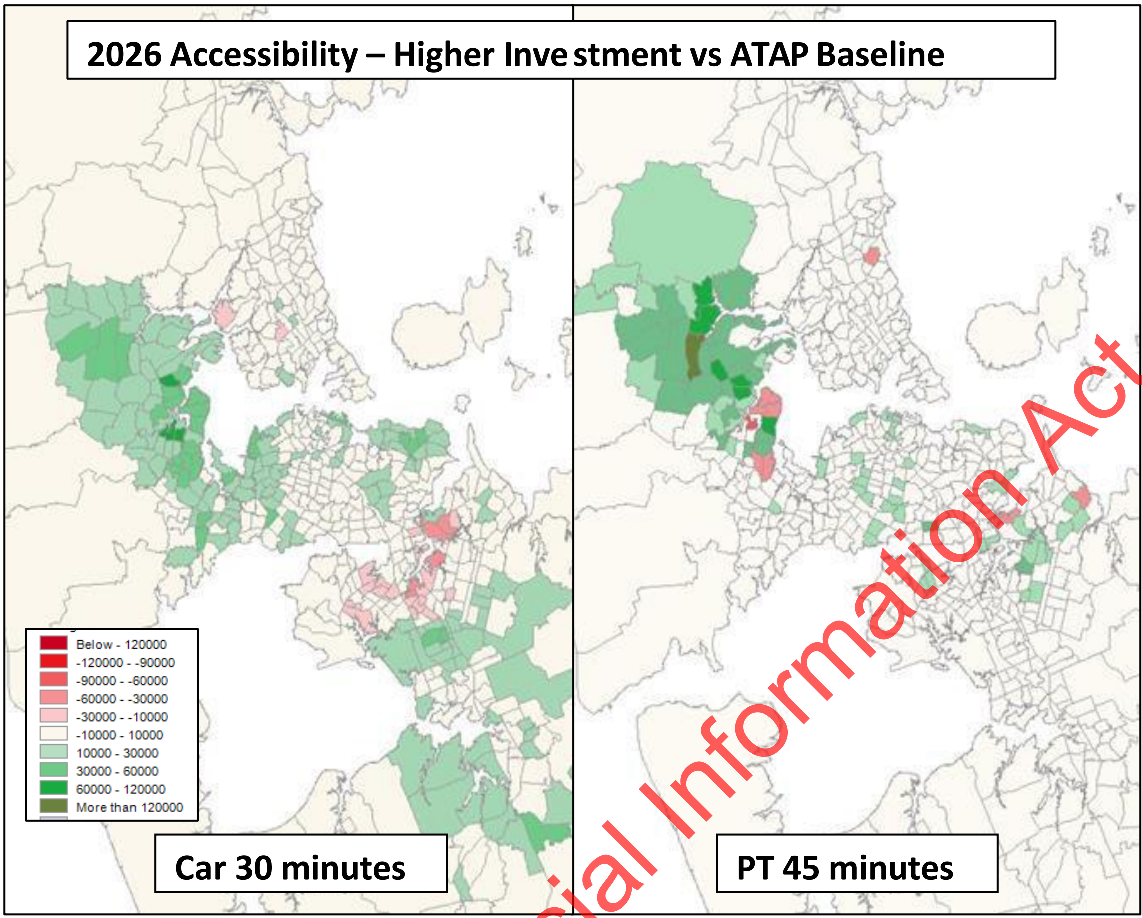

Figure 4.5: Accessibility to jobs AM peak 2026 (Higher Investment vs ATAP Baseline)

The improvements to accessibility in the northwest continue in 2046, spreading to the North Shore and parts of the west and isthmus (Figure 4.6). The inner south continues to experience declining accessibility.

For public transport, improvements to accessibility continue in the northwest and declines further on the North Shore.

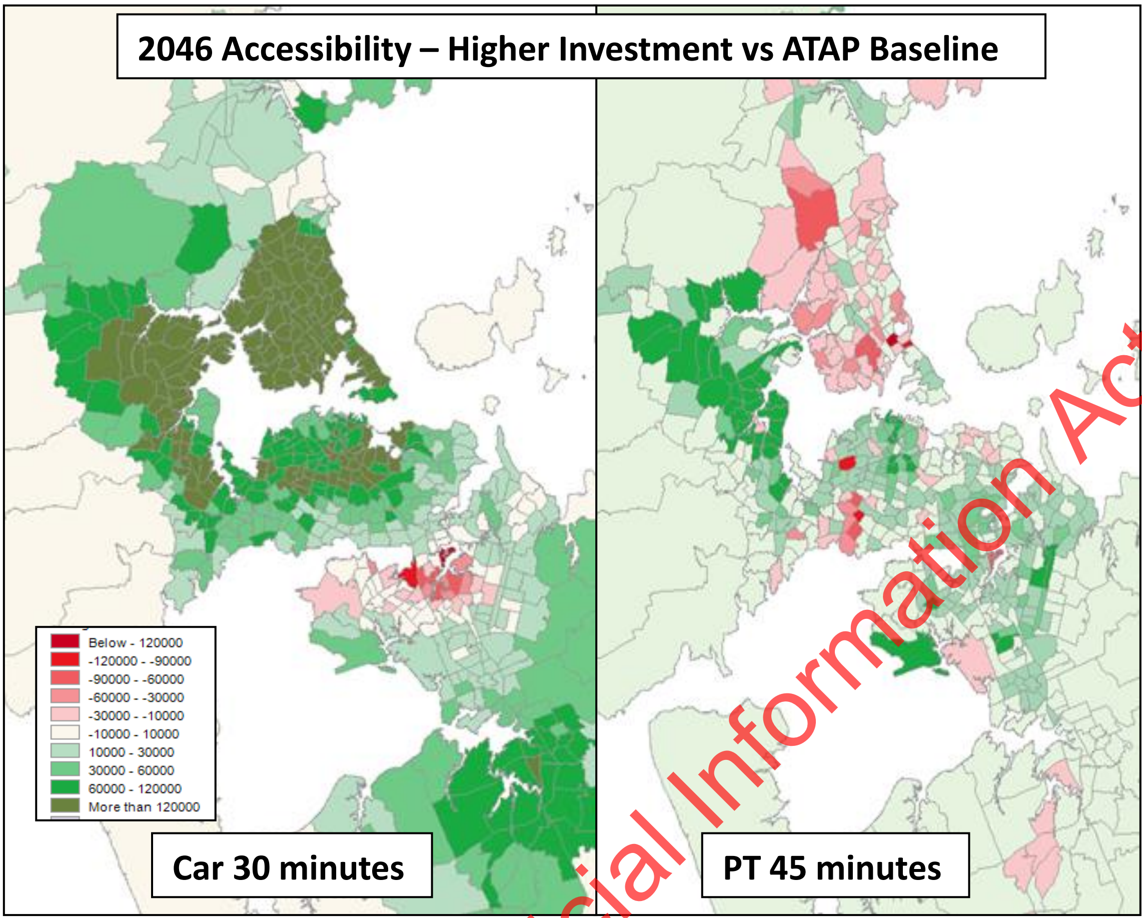

Figure 4.6: Accessibility to jobs AM peak 2046 (Higher Investment vs ATAP Baseline)

Two noteworthy findings are: Under the APTN and Higher Investment packages, people living near the airport area have limited access to employment as the motorways serving this area are congested in both directions at peak times, increasing travel times by car and public transport to jobs outside the airport area. Inclusion of the Additional Waitemata Harbour Crossing project into the second decade of the Higher Investment package creates a significant increase in car accessibility for the North Shore.

Congestion

Congestion levels in the AM peak and inter-peak reduce slightly compared to both APTN and the ATAP Baseline, particularly from 2036 onwards (Figure 4.7). This is considered to arise as a result of earlier investment in additional state highway capacity, compared to the APTN.

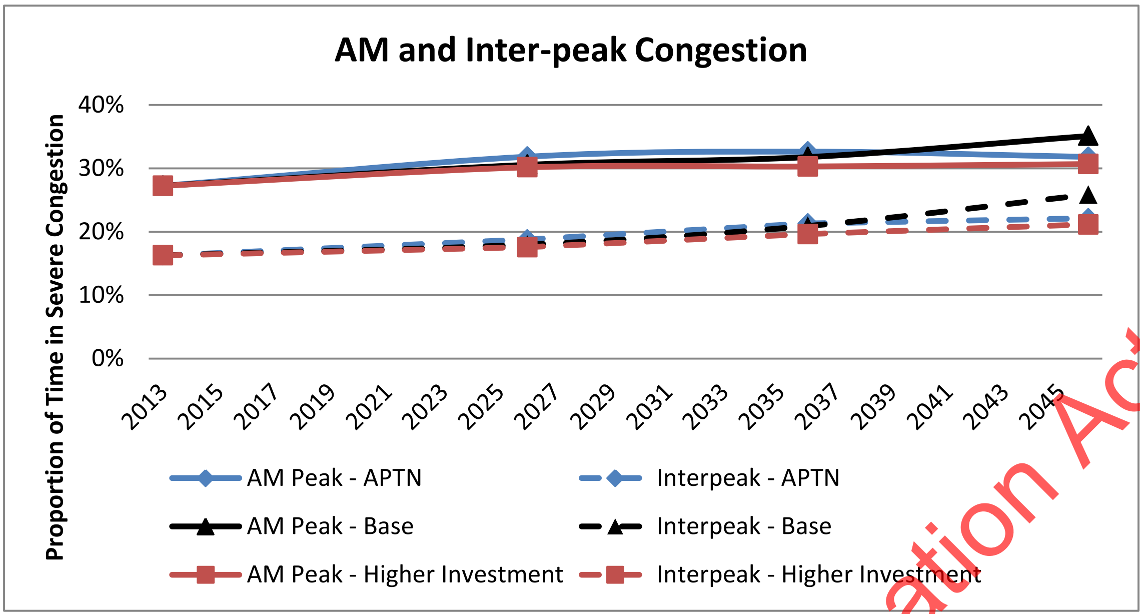

Figure 4.7: AM peak and inter-peak congestion (Higher Investment, APTN and ATAP Baseline)

The freight network under Higher Investment also experiences slight reductions in congestion compared to APTN and the Base Network, particularly in the first two decades (Figure 4.8).

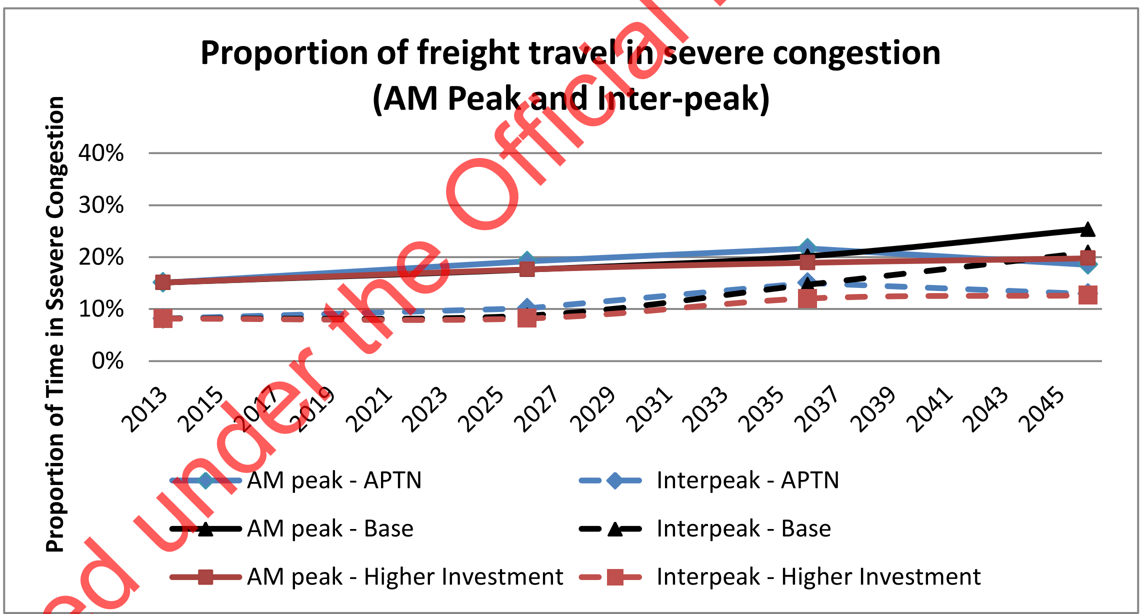

Figure 4.8: Proportion of freight travel in severe congestion (Higher Investment, APTN and ATAP Baseline)

At a sub-regional level, severe congestion is alleviated to a limited extent on parts of the network in the AM peak under Higher Investment, most particularly on SH20A and SH20 (Figure 4.9). However, the majority of constraints remain, most particularly on SH16 and parts of SH1 on the isthmus.

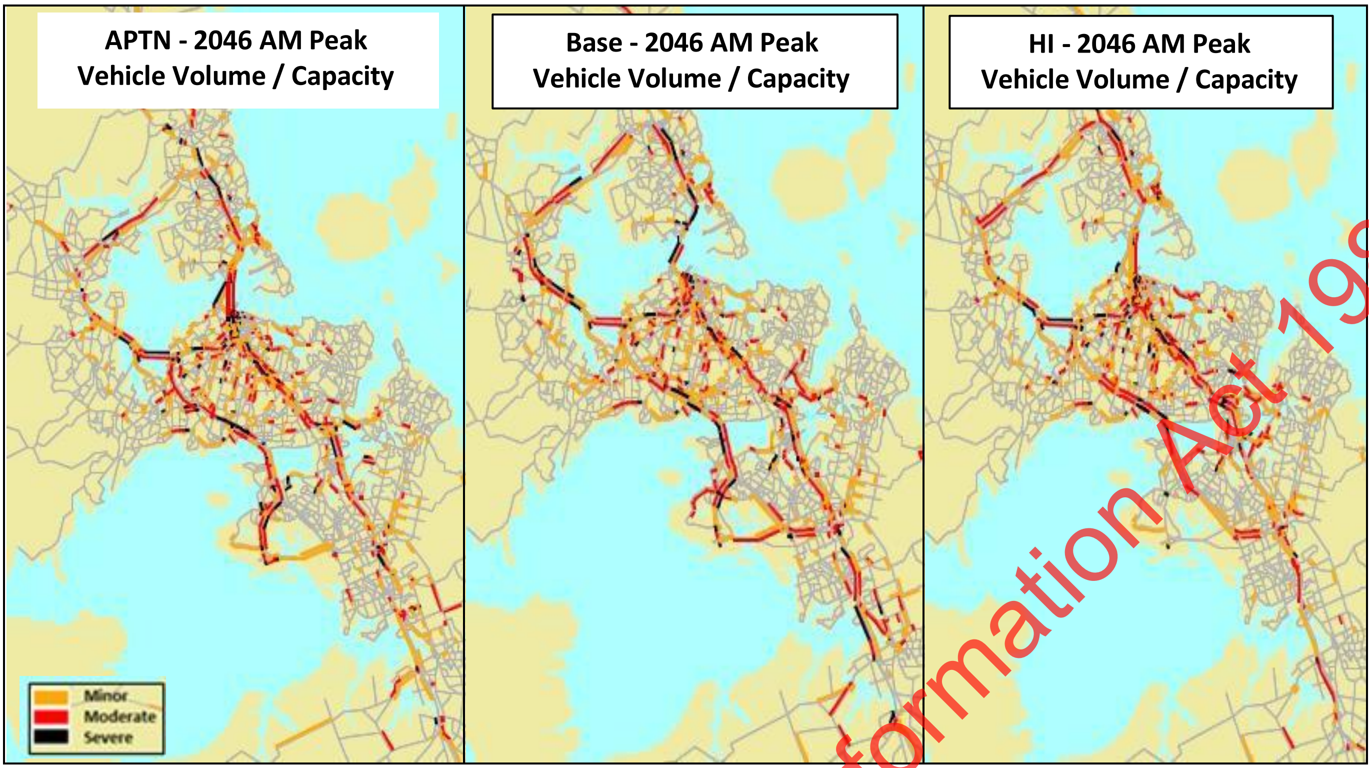

Figure 4.9: AM Peak vehicle volume to capacity (Higher Investment, APTN and ATAP Baseline)

During the inter-peak, severe congestion is eliminated on SH20A (Figure 4.10). However, on the whole, congestion under Higher Investment remains largely similar to APTN in 2046.

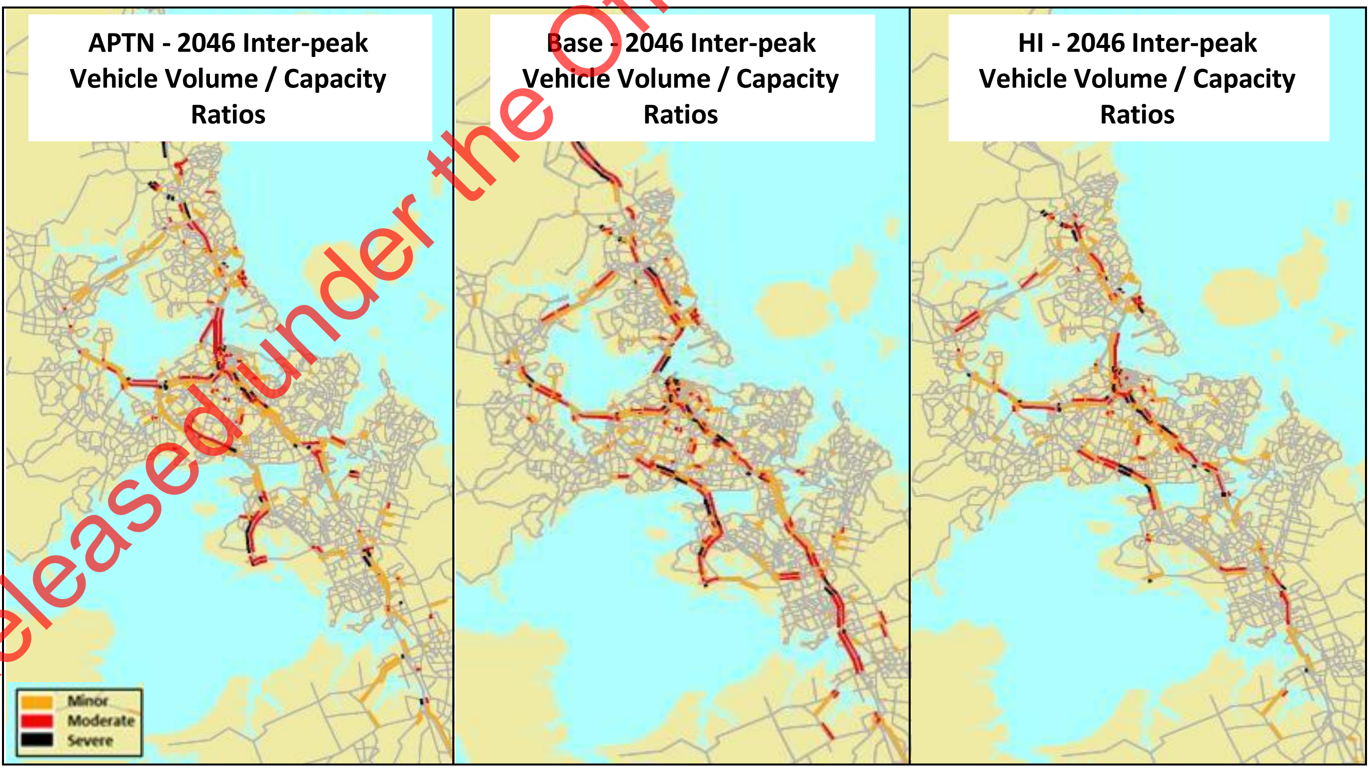

Figure 4.10: Inter-peak vehicle volume to capacity (Higher Investment, APTN and ATAP Baseline)

Public Transport Mode Share

Public transport mode share is virtually identical to the Base Network in 2026 (Figure 4.11). Mode share is slightly lower than under the APTN in the last two decades.

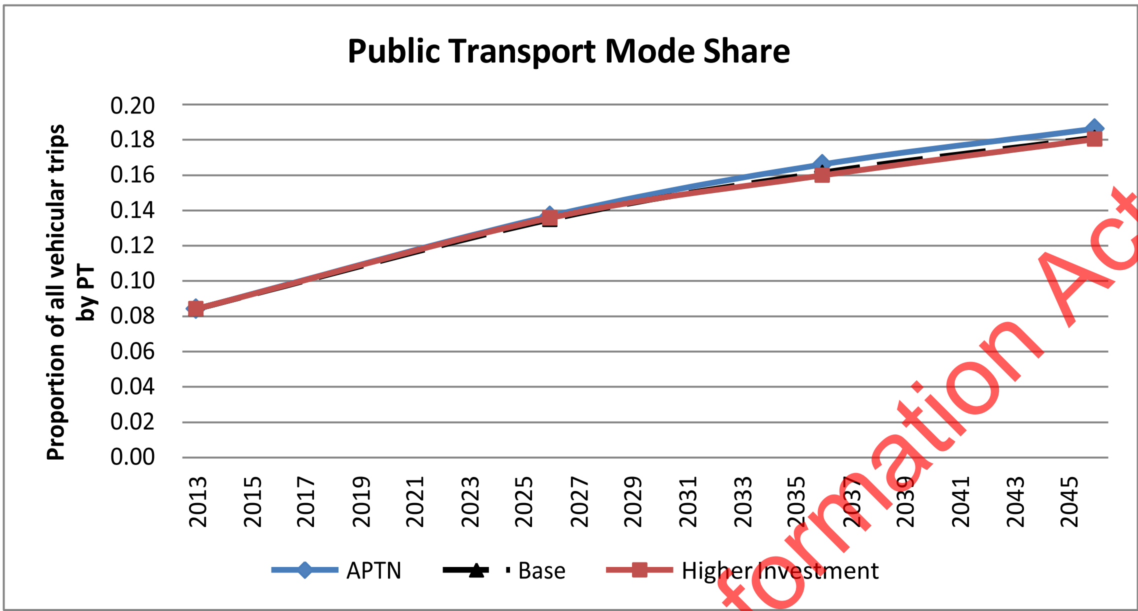

Figure 4.11: Public transport mode share AM peak (Higher Investment, APTN and ATAP Baseline)

Even though the Higher Investment package has a number of additional public transport investments, compared to the APTN, public transport patronage is slightly less than the APTN. Bus demand continues to exceed capacity at parts of the network, broadly to a similar extent as the APTN, although to a lesser extent compared to the Base Network (Figure 4.12). The North Shore mass transit in the Higher Investment package sees greater capacity compared to the Northern Busway under both APTN and the Base Network.

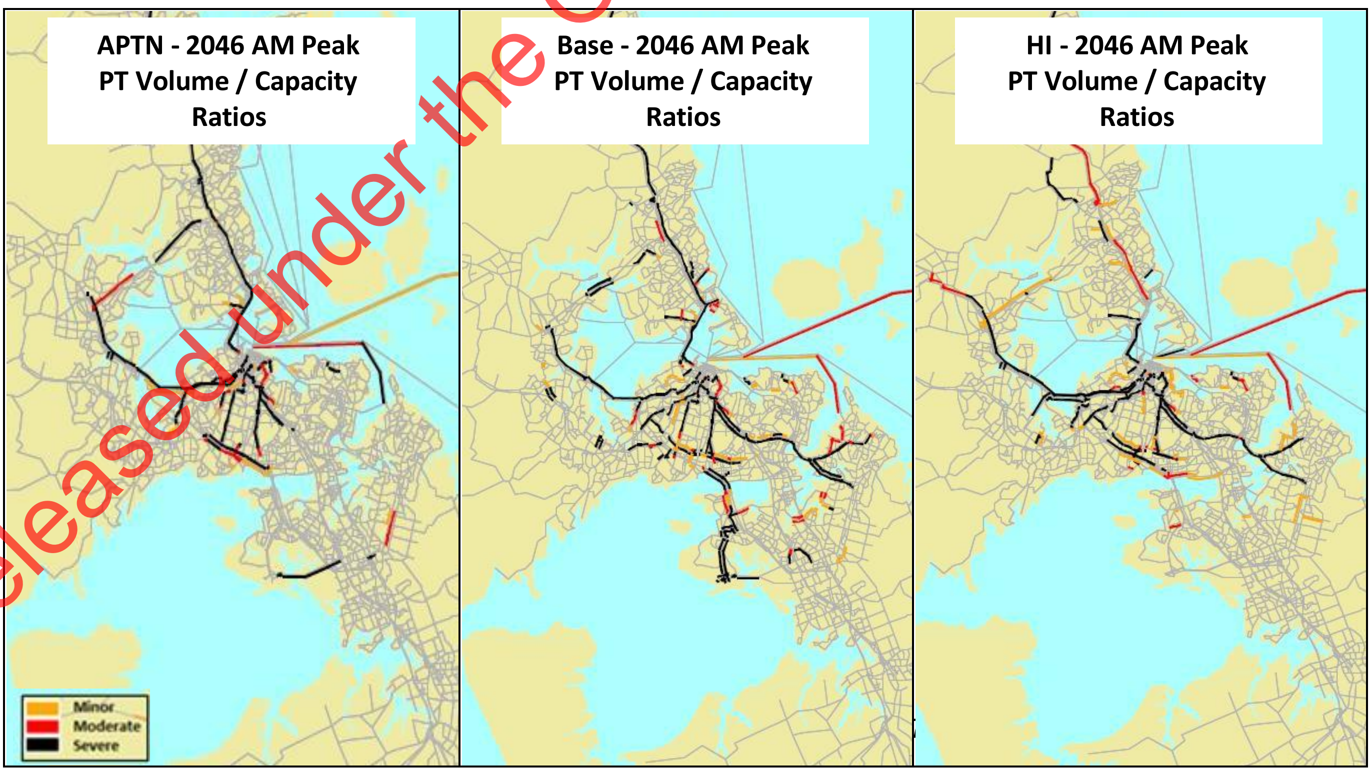

Figure 4.12: Public transport volume to capacity AM peak (Higher Investment, APTN and ATAP Baseline)

Value for Money

The Higher Investment package identified an estimated $40.7 billion capital expenditure programme over 30 years (excluding renewals) which is projected to have similar contributions to the ATAP objectives compared to the APTN. The package is projected to result in a slightly higher proportion of jobs accessible by motorists of 44% (compared to 43% in the APTN), a slightly higher proportion of jobs accessible by public transport of 25% (compared to 24% in the APTN), a slightly lower proportion of travel time in severe congestion of 31% in severe congestion in AM peak (compared to 32% in the APTN) and the same public transport mode share of 18.0% in the AM peak (compared to 18.0% in the APTN).

The Higher Investment package as a whole is projected to have a similar overall contribution to the project objectives as the APTN package, with a significantly larger capital improvement programme.

4.1.3 Key Learnings

Analysis of the Higher Investment package highlights a mix of performance levels, with car access improving compared to APTN. While congestion levels improve for car and freight compared to APTN, public transport mode share is slightly lower.

Additional investment in the first decade did not appear to improve performance against the project objectives at a regional level, but some of these extra investments did have some important sub-regional effects. For example, public transport access increases in the northwest as a result of the Northwestern Busway. Overall however, the Higher Investment package is likely to offer relatively poor value for money.

As such, the development of the Indicative Package in the next phase adopts a more targeted approach to identifying early priorities which both align with the project objectives and appear likely to deliver value for money.

4.2 Focus on Influencing Travel Demand Patterns

4.2.1 Package Description

The Influence Demand package tests the hypothesis that influencing patterns of demand could lead to a step-change in performance. This package tests the effect of variable road network pricing in 2036 and 2046. To support this, earlier investment in the strategic public transport network is provided, together with required improvements to the strategic road network to ensure that levels of service can be maintained.

Some significant road projects have been deferred or excluded. As a result, the Influence Demand package has a significantly lower level of total investment than the Higher Investment package.

The total estimated 30-year cost of new capital improvements (excluding renewals) of the Influence Demand package is $33.2 billion (in 2016 dollars). Figure 4.14 below provides a breakdown of costs by decade and project type.

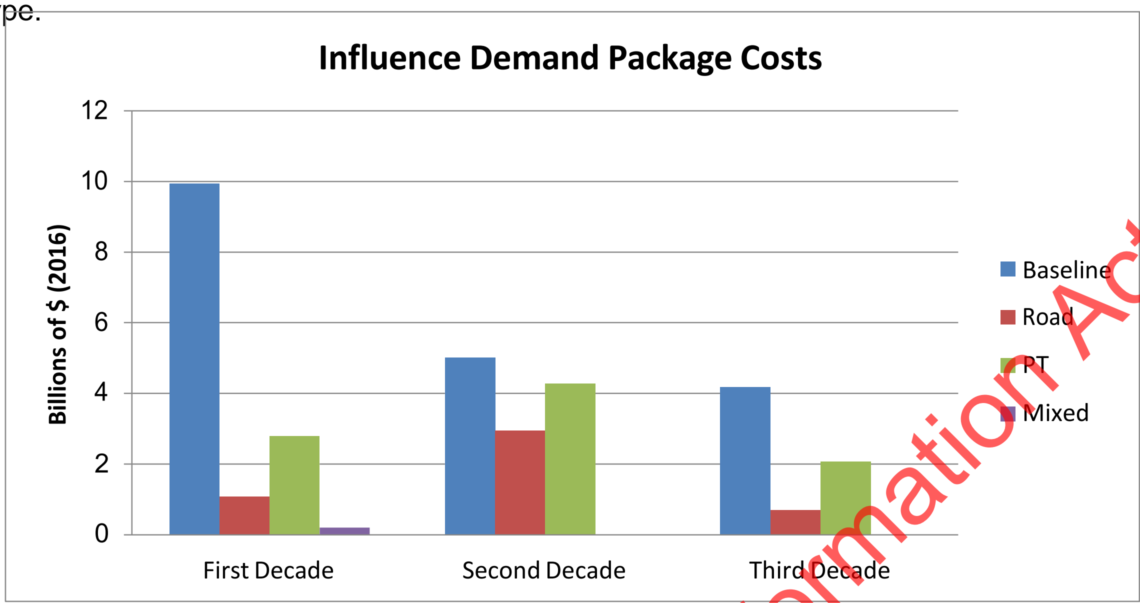

Figure 4.14: Estimated cost of new capital improvements (excluding renewals) of Influence Demand package (2018 – 2048)

Key interventions by time period

The hypothetical network-wide pricing system introduced in the package analysis phase was refined. In developing the Influence Demand package, different pricing levels were tested to better understand the relationship between the cost of travel and changed travel patterns. As a result of this analysis, price levels were reduced by 25% from what was tested in the previous stage. The refined network-wide pricing system maintains the variation in charges across different locations, parts of the network and time of travel (Table 4.2).

Table 4.2: Hypothetical smarter pricing system

Influence demand package: hypothetical price levels (c/km)				
Area	**Network**	**Peak**	**Inter-Peak**	**Off-Peak**
Inner Urban (isthmus)	Motorways	30	22.5	2.25
	Other Roads	22.5	15	2.25
Outer Urban	Motorways	22.5	15	2.25
	Other Roads	15	7.5	2.25
Rural	All Roads	2.25	2.25	2.25

The refined smarter pricing tool was tested with a complementary intervention package. Key components of the package over and above the common baseline are included in Table 4.3.

Table 4.3: Influence Demand key interventions by decade

First Decade (2015-25)	Second Decade (2025-35)	Third Decade (2035-45)
• Northwestern Busway (Kumeu to Point Chevalier)	• Implementation of smarter pricing • Northwestern Busway	• Continuation of Isthmus Mass Transit • Southern Motorway
• AMETI Pakuranga to Botany Busway • Cost to implement Road Pricing Infrastructure • Isthmus mass transit • SH20 targeted widening	(Point Chevalier to Newton) • Cross isthmus mass transit • Extension of mass transit to Airport from north • Additional Waitemata Harbour Crossing (PT only tunnel) • North Shore mass transit to Albany • Southern Motorway targeted widening • Upper Harbour strategic public transport route • TFUG projects*	further targeted widening • SH18 bus shoulder lanes • Extension of North Shore mass transit to Orewa • TFUG projects^

*Includes Mill Road upgrade and extension, Pukekohe expressway, SH1 widening from Papakura to Drury South, SH16 Kumeu bypass and SH16 to SH18 connection

^ Strategic public transport route from Oteha Valley Road to Grand Drive

4.2.2 Key Findings

Travel Patterns

Average trip time (Figure 4.15) and trip length (Figure 4.16) are projected to reduce under Influence Demand with the introduction of smarter pricing after 2026.

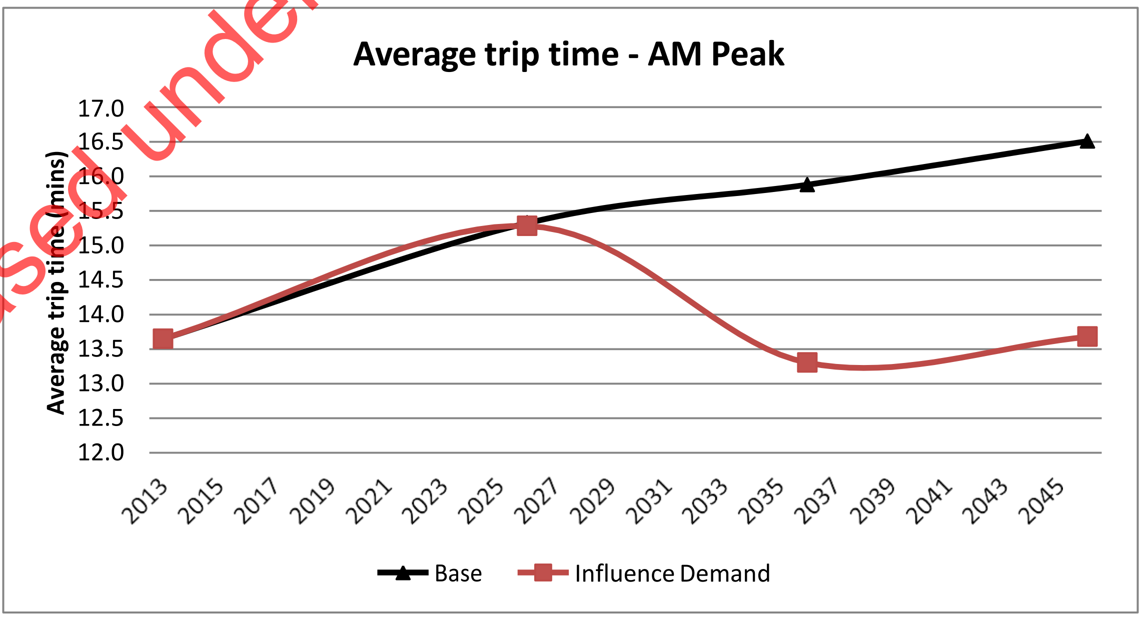

Figure 4.15: Average trip time during AM Peak (Influence Demand and ATAP Baseline)

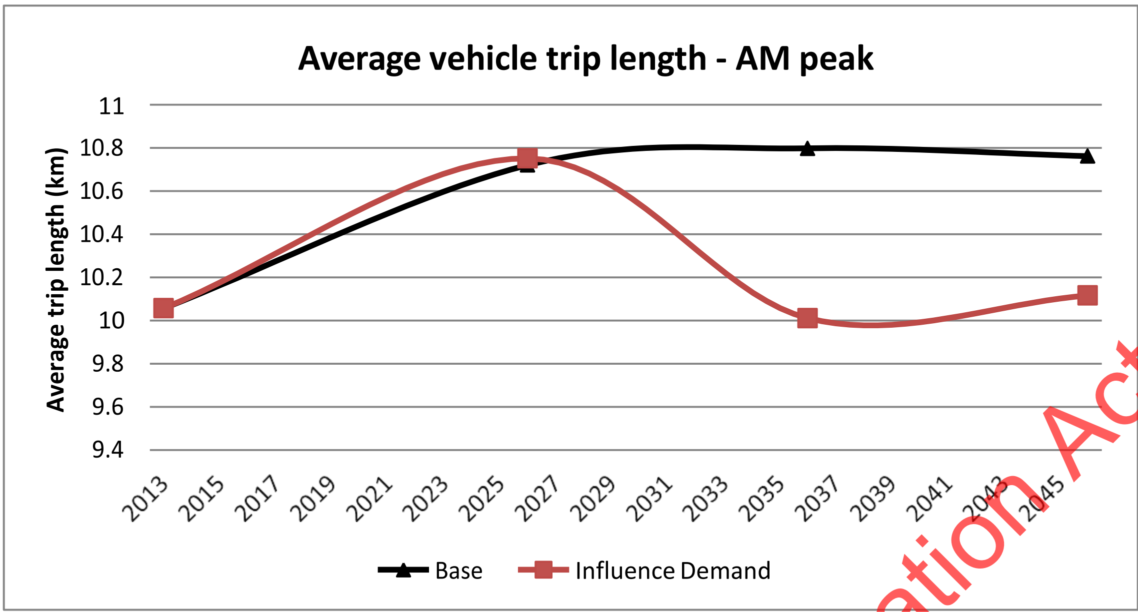

Figure 4.16: Average vehicle trip length during AM Peak (Influence Demand and ATAP Baseline)

Compared to the Base Network, there is a decrease in average travel time for trips originating from the northwest, and increases to the outer south and Howick in 2026 (Figure 4.17). The rest of the region is projected to experience a marginal change in average travel time.

In 2036 and 2046, average travel time is projected to decrease across the region. This is partly due to the reduced level of congestion and partly because travel distances are decreasing with the increased costs of travel.

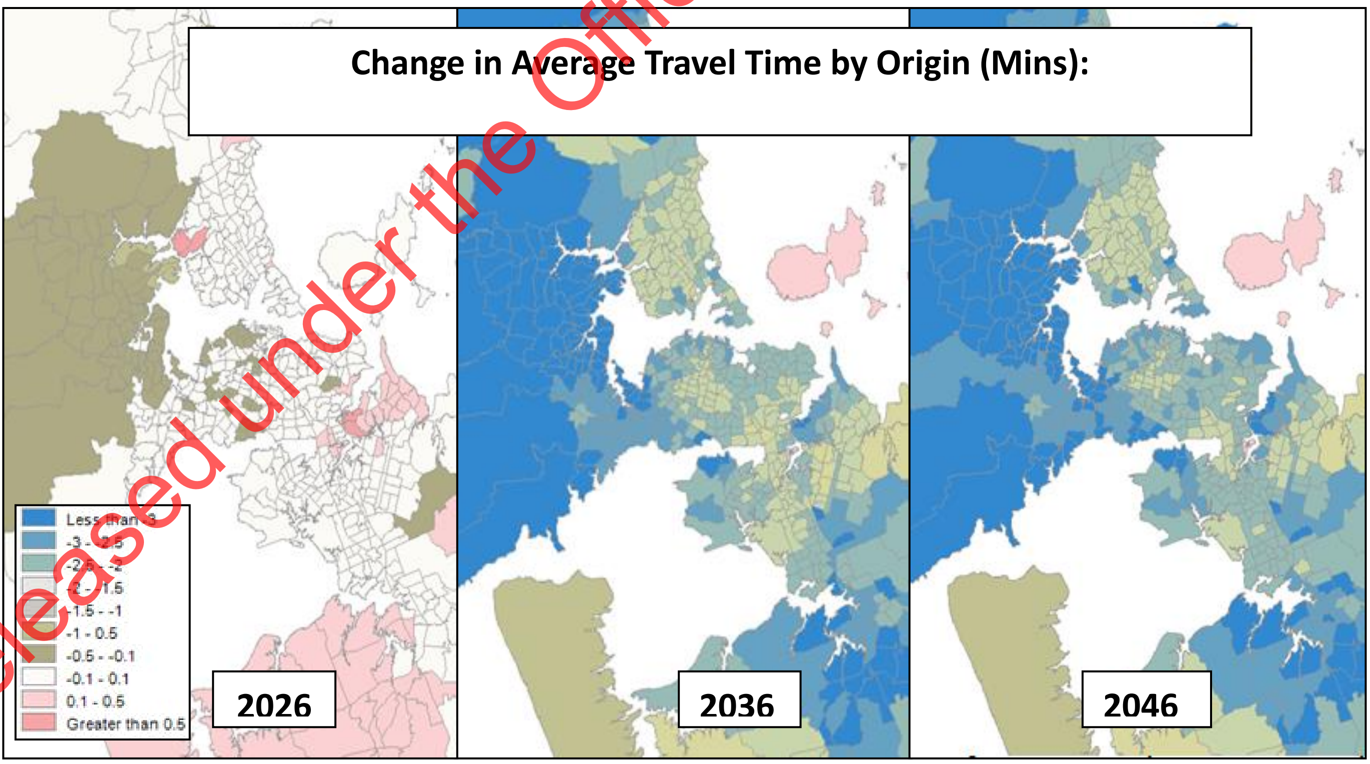

Figure 4.17: Change in Average Travel Time by origin during AM Peak (Influence Demand vs ATAP Baseline in three decades)

In 2026, trips from the isthmus and North Shore are getting shorter but trips from the west and other more peripheral areas are getting longer (Figure 4.18). With the increased costs of travel once smarter pricing is introduced, average trip length decreases across the region from between 2036 and 2046.

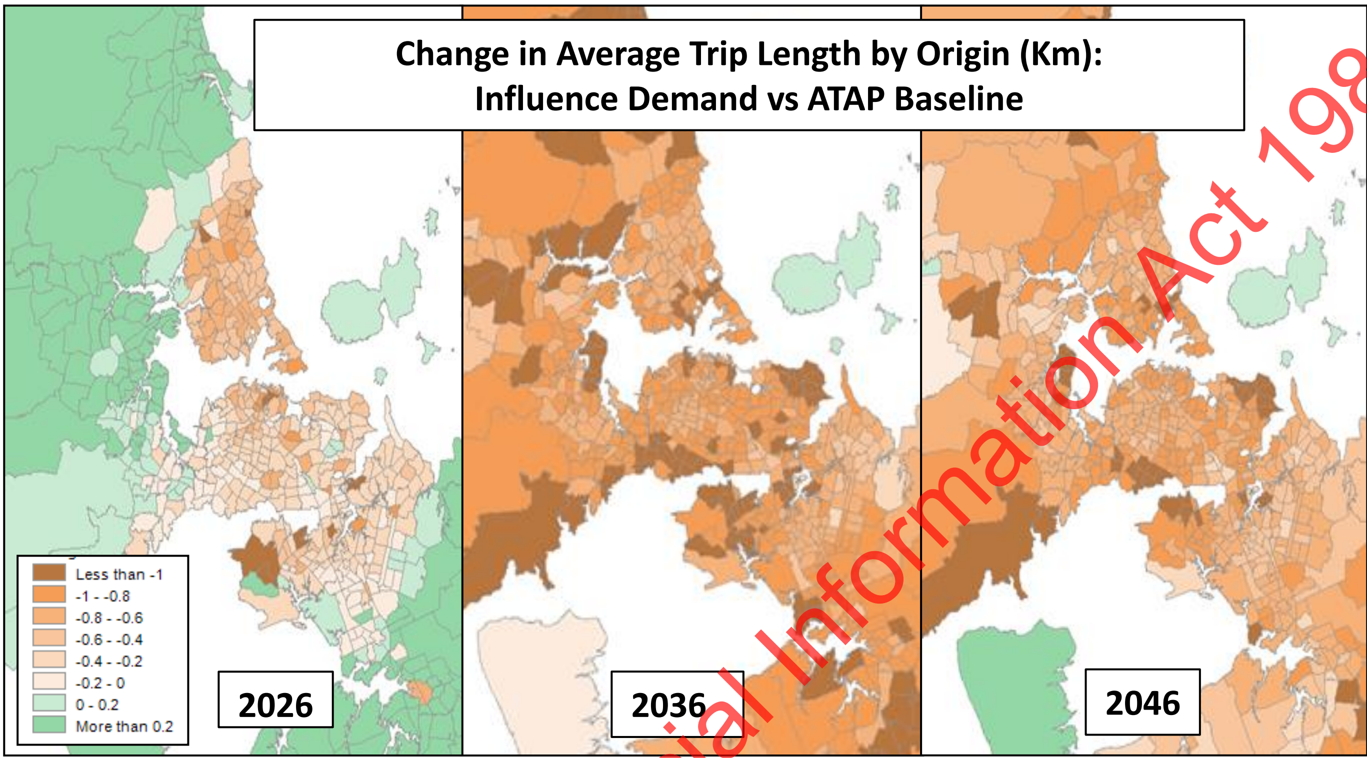

Figure 4.18: Change in Average Trip Length by origin during AM Peak (Influence Demand vs ATAP Baseline in three decades)

Accessibility

Between 2026 and 2036, the number of jobs accessible within a 30 minute car journey during the AM peak increases substantially under Influence Demand compared to APTN and the ATAP Baseline (Figure 4.19). This is due to the smarter pricing system reducing the number of vehicle trips during the AM peak, thereby reducing congestion and increasing travel speeds.

Public transport accessibility tracks very similarly to APTN for the entire duration of the evaluation. Despite the increase in public transport patronage and mode share under Influence Demand, the higher proportion of public transport investment ensures that public transport accessibility is maintained.

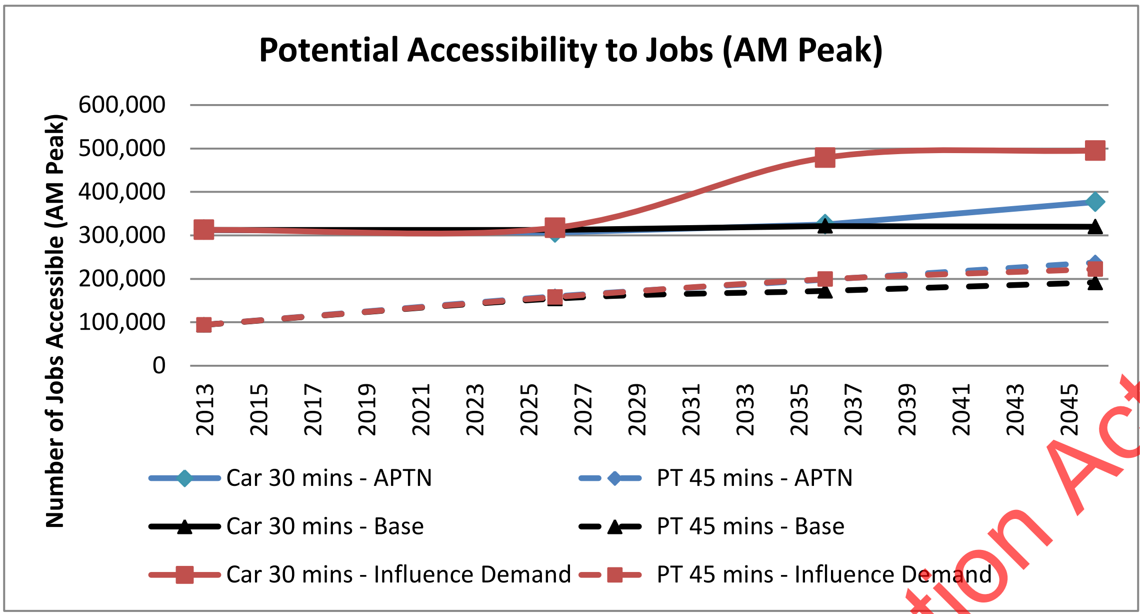

Figure 4.19: Potential accessibility to jobs AM peak (Influence Demand, APTN and ATAP Baseline)

At a sub-regional level, car accessibility improves in the south and the isthmus but declines in the west, northwest and parts of the North Shore between 2013 and 2026 under the Influence Demand package (Figure 4.20). However, public transport accessibility increases significantly for most areas under the same period.

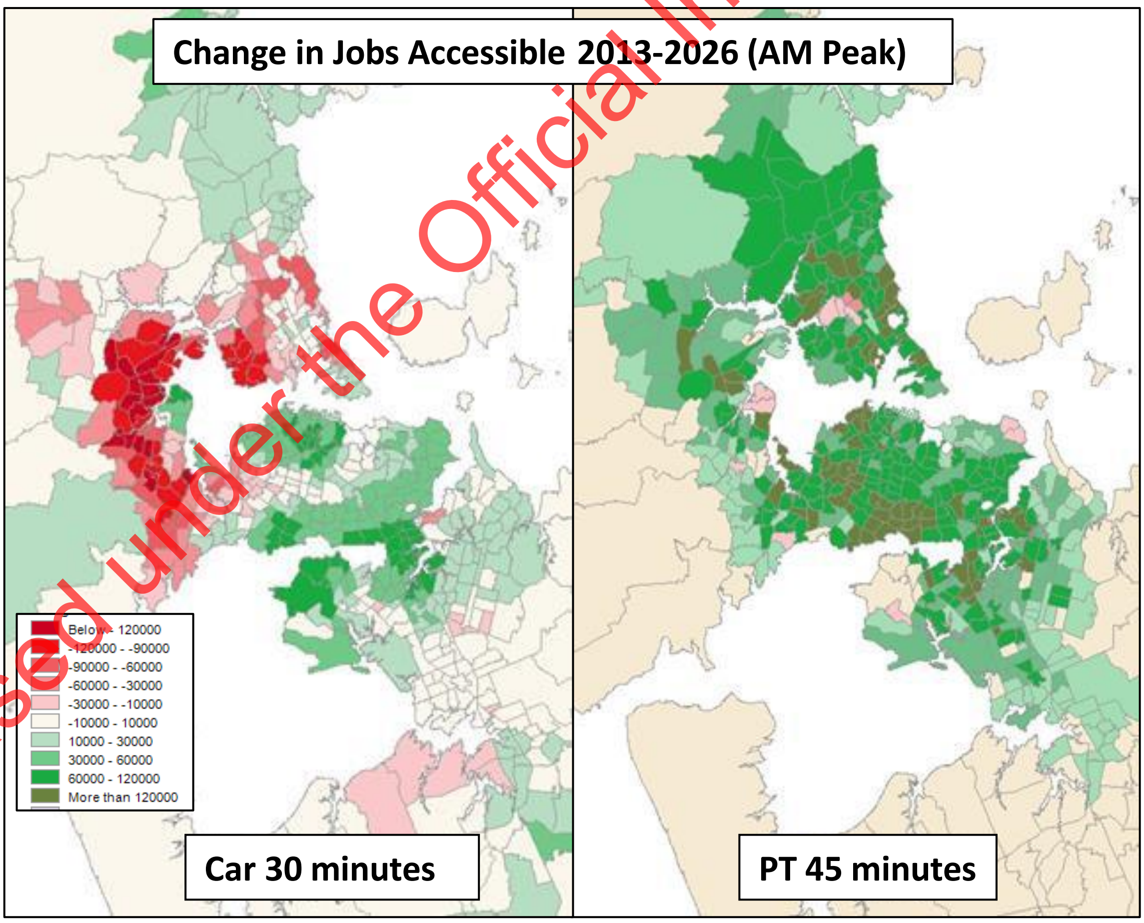

Figure 4.20: Change in accessibility to jobs AM peak 2013 vs 2026 (Influence Demand)

Between 2026 and 2046, as smarter pricing is implemented, car accessibility improves across the region, particularly for the northwest, North Shore and inner south (Figure 4.21). Public transport accessibility improves across most of the region.

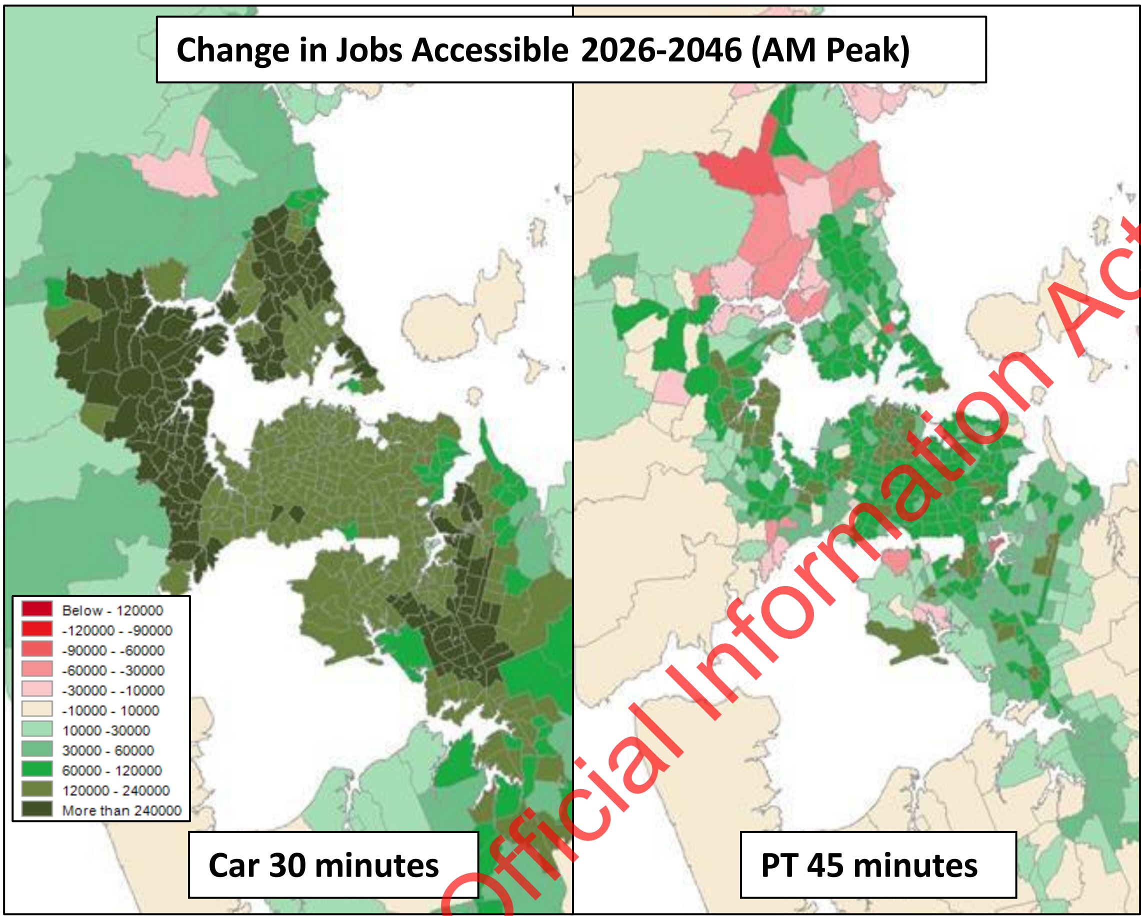

Figure 4.21: Change in accessibility to jobs AM peak 2026 vs 2046 (Influence Demand)

Compared to the Base Network, the Influence Demand package performs better for car accessibility in the northwest and parts of the west, while other parts of the region sees a slight reduction in accessibility, particularly the inner south (Figure 4.22). In terms of public transport, improvements in accessibility are largely seen in the northwest as a result of the inclusion of the Northwestern Busway, and the southeast as a result of the Pakuranga to Botany Busway.

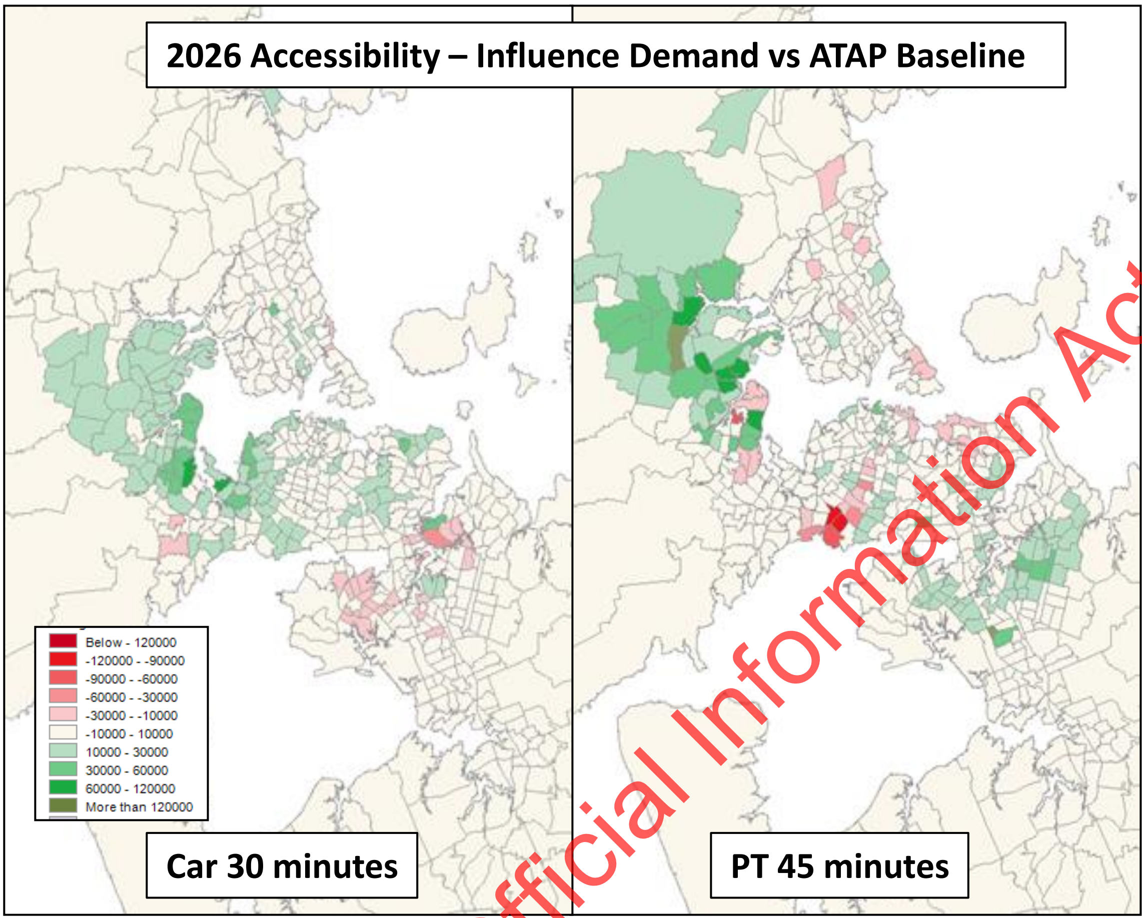

Figure 4.22: Accessibility to jobs AM peak 2026 (Influence Demand vs ATAP Baseline)

There is a dramatic improvement to car accessibility in 2046 compared to the Base Network (Figure 4.23). Virtually all of Auckland sees increased car accessibility, with the highest levels concentrated on the northwest and inner south. Apart from the targeted widening of the Southern Motorway and SH 20, most of the improvements to accessibility stem from the introduction of smarter pricing.

Public transport accessibility improvements are more uneven: improvements are seen in the northwest, and parts of the west, isthmus and inner south, while the upper North Shore sees a reduction in accessibility.

Two noteworthy findings are: Despite the exclusion of the roading element of an Additional Waitemata Harbour Crossing from the Influence Demand package, car accessibility for the North Shore is higher than under the APTN. The northwest and parts of the south appear to experience the greatest accessibility gains from the implementation of smarter pricing. This may be because pricing is particularly effective at reducing congestion along the routes serving these areas, bringing them back within a 30-minute travel time of the substantial employment opportunities in the central area. However, these travel time savings would need to be balanced against the increased direct travel costs from pricing to fully understand access impacts.

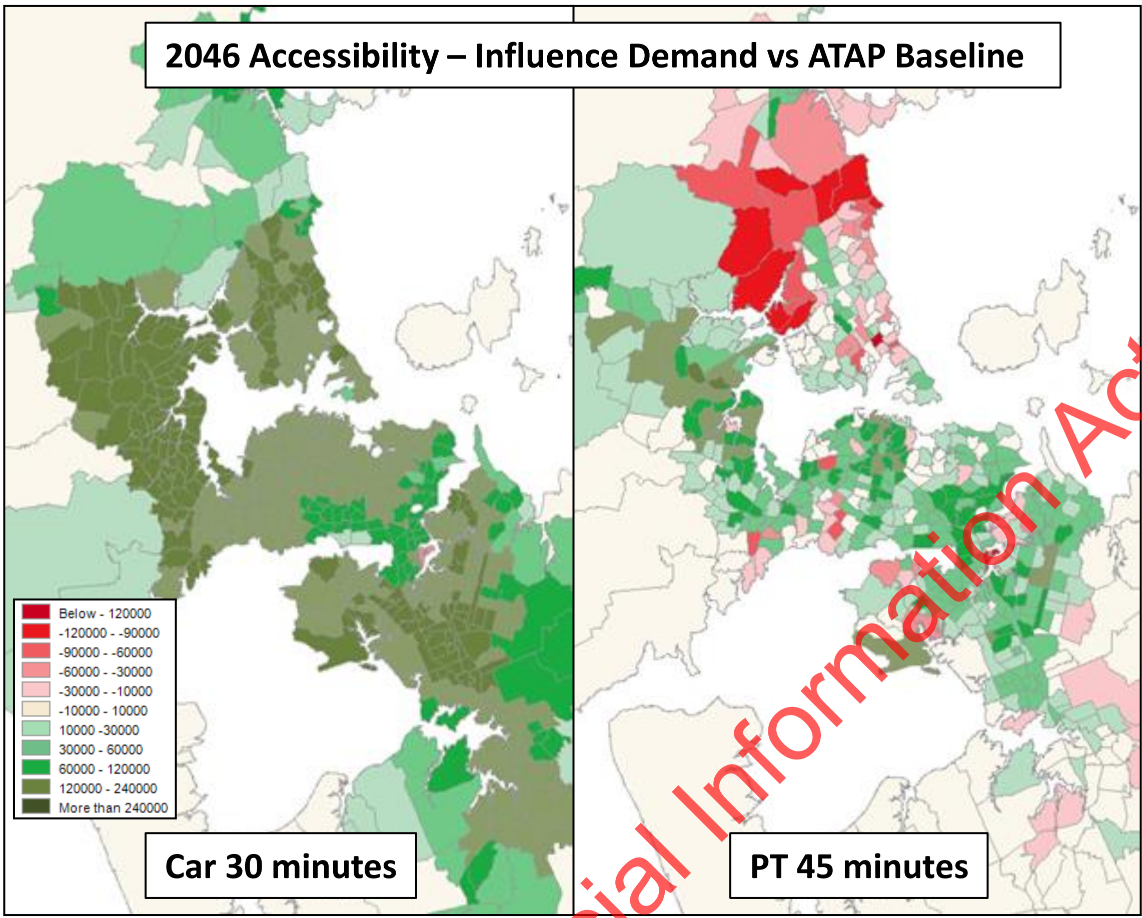

Figure 4.23: Accessibility to jobs AM peak 2046 (Influence Demand vs ATAP Baseline)

Congestion

The progressive introduction of smarter transport pricing in the Influence Demand package is projected to have a step change in reducing congestion levels. This is particularly apparent in the AM peak (Figure 4.24). Most of this change results from a combination of reduced trip lengths and a shift to public transport response to the increased cost of car travel. Inter-peak congestion is also projected to reduce under Influence Demand with smarter pricing. While some patches of congestion remain in the Influence Demand package at 2046, most of the inner motorway network is projected to operate below severe congestion levels in the inter-peak.

The Base Network and APTN perform similarly on congestion up until 2036, after which the Base Network sees an increase in both AM peak and inter-peak congestion while APTN remains largely flat.

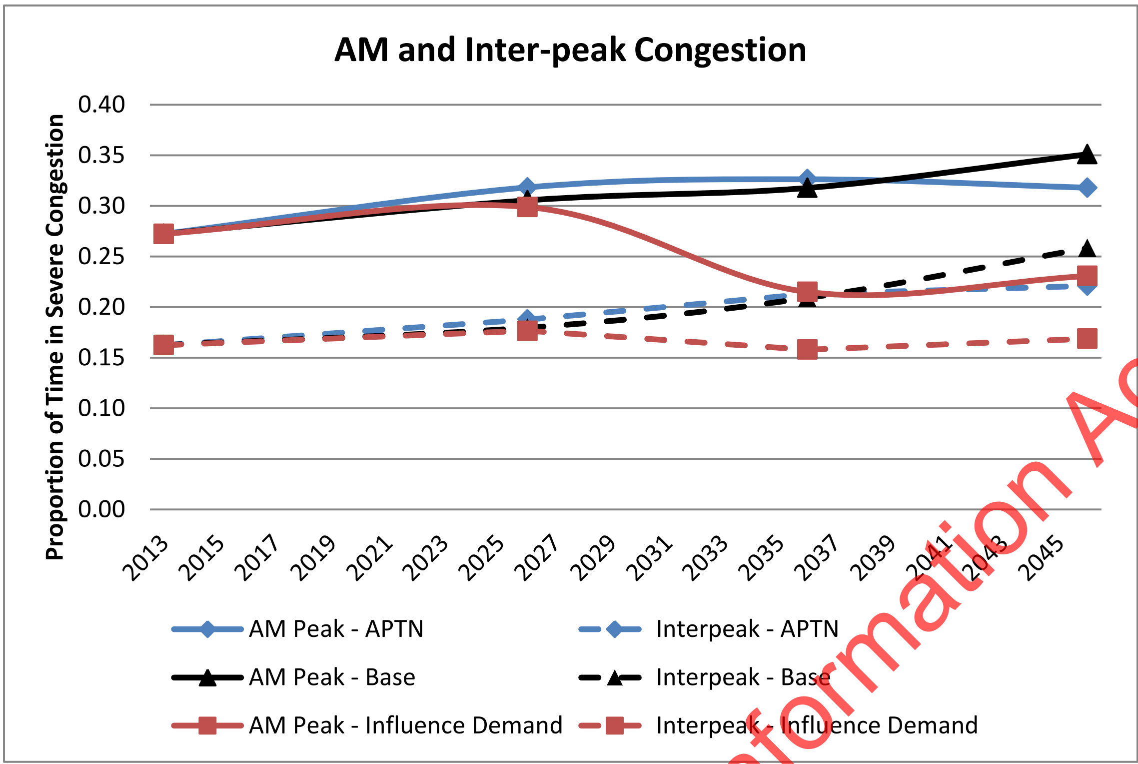

Figure 4.24: AM peak and inter-peak congestion (Influence Demand, APTN and Base Network)

Freight travel sees similar reductions in congestion for both AM peak and inter-peak (Figure 4.25). Inter-peak congestion levels rise significantly from 2026 under the APTN and the Base Network. Under the Influence Demand package however, inter-peak congestion is projected to decline after 2026 and remain below the 2013 congestion level.

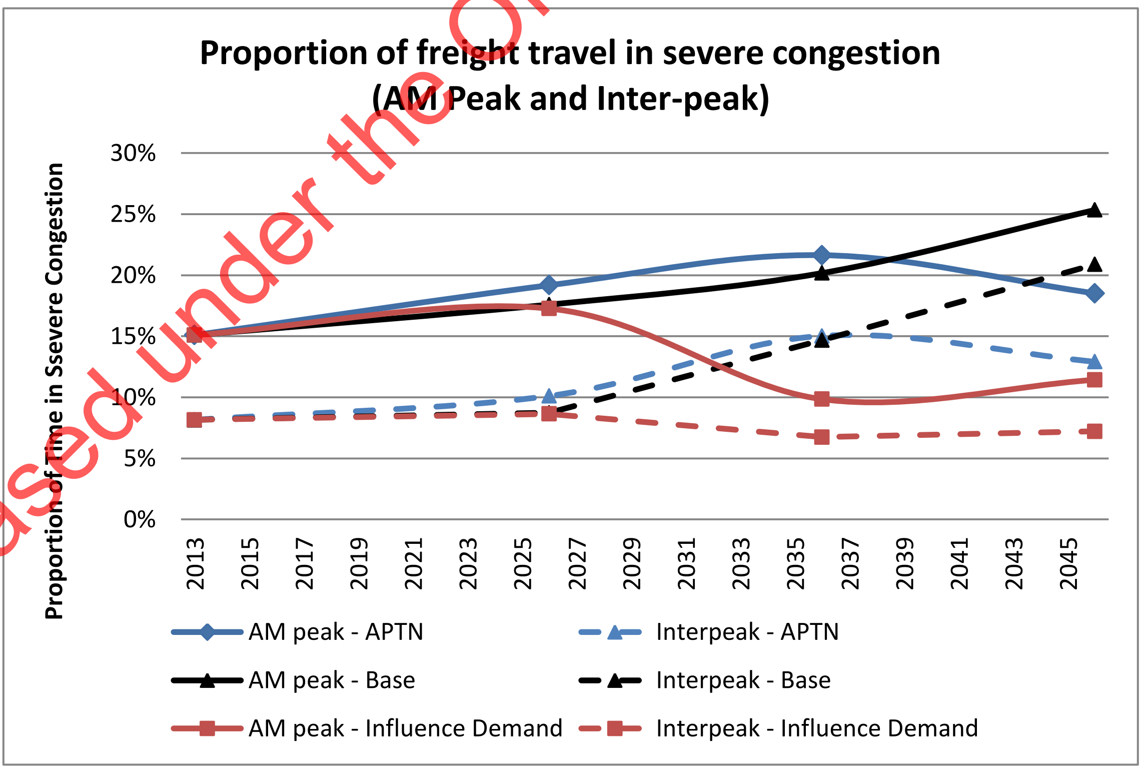

Figure 4.25: Proportion of freight travel in severe congestion (Influence Demand, APTN and Base Network)

At a sub-regional level, capacity constraints in the am peak in 2046 are projected to be alleviated on parts of the network, most particularly on SH20 and SH16 (Figure 4.26). However, constraints remain around the Airport as well as parts of SH1 on the isthmus.

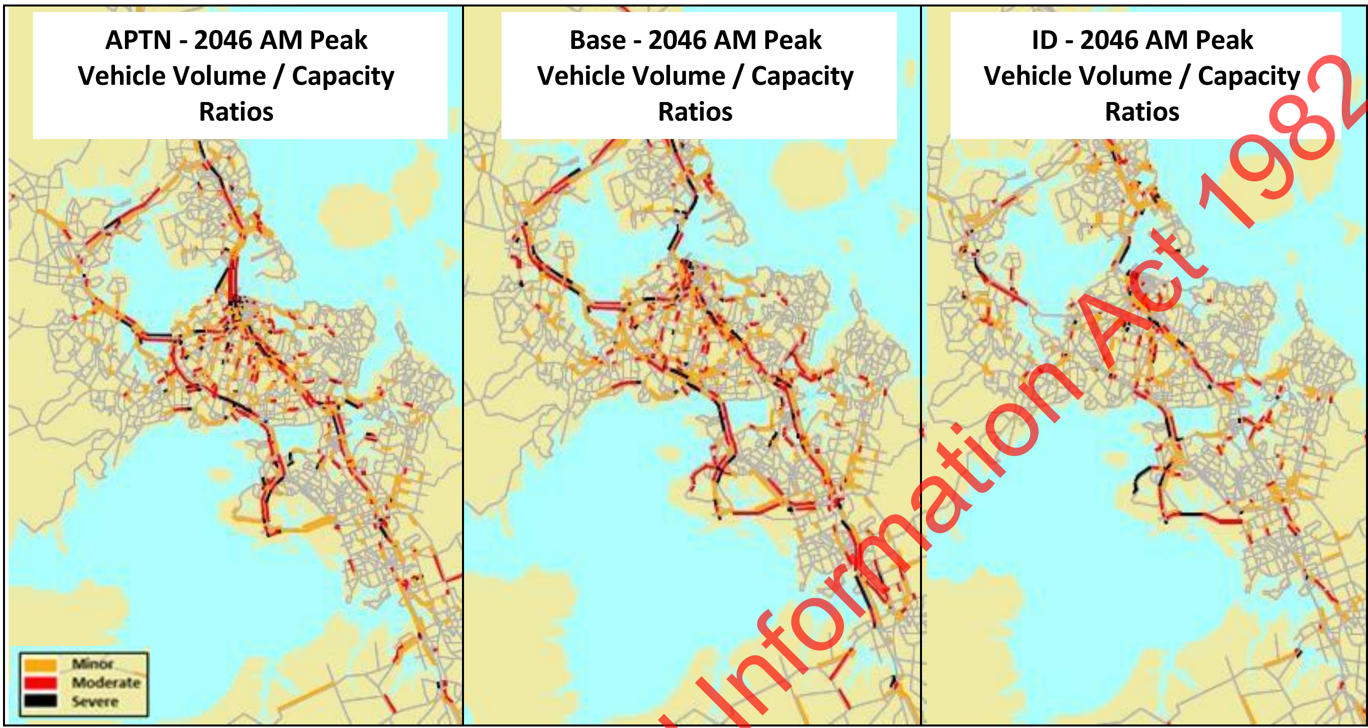

Figure 4.26: AM peak vehicle volume to capacity 2046 (Influence Demand, APTN and ATAP Baseline)

Inter-peak capacity constraints in the am peak are projected to dramatically reduce under Influence Demand, although limited severe congestion remains on the network in 2046 (Figure 4.27). The removal of most capacity constraints in the inter-peak shows that the pricing scheme may have been applied too broadly and that further analysis is required.

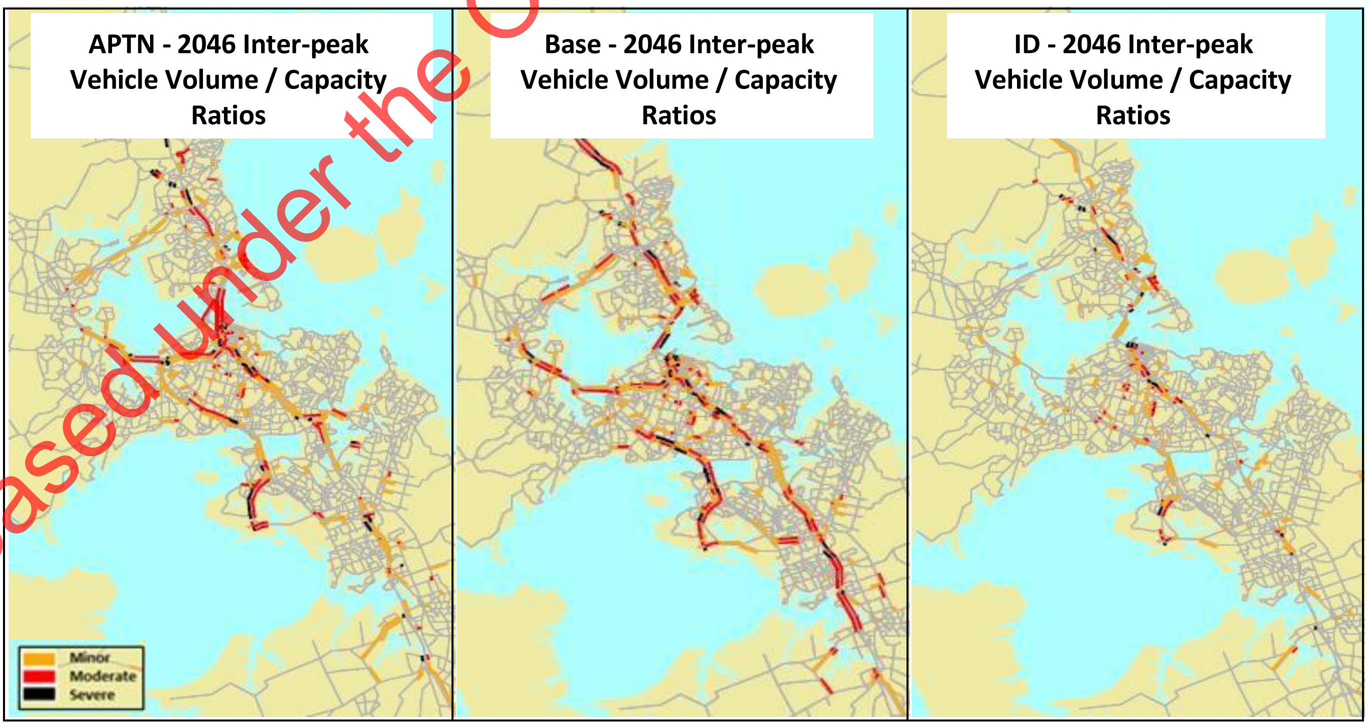

Figure 4.27: Inter-peak vehicle volume to capacity 2046 (Influence Demand, APTN and ATAP Baseline)

Public Transport Mode Share

Public transport mode share increases under Influence Demand as a result of the additional public transport expenditure and introduction of smarter pricing (Figure 4.28). Mode share for the ATAP Baseline and APTN remains largely similar over the 30 year period.

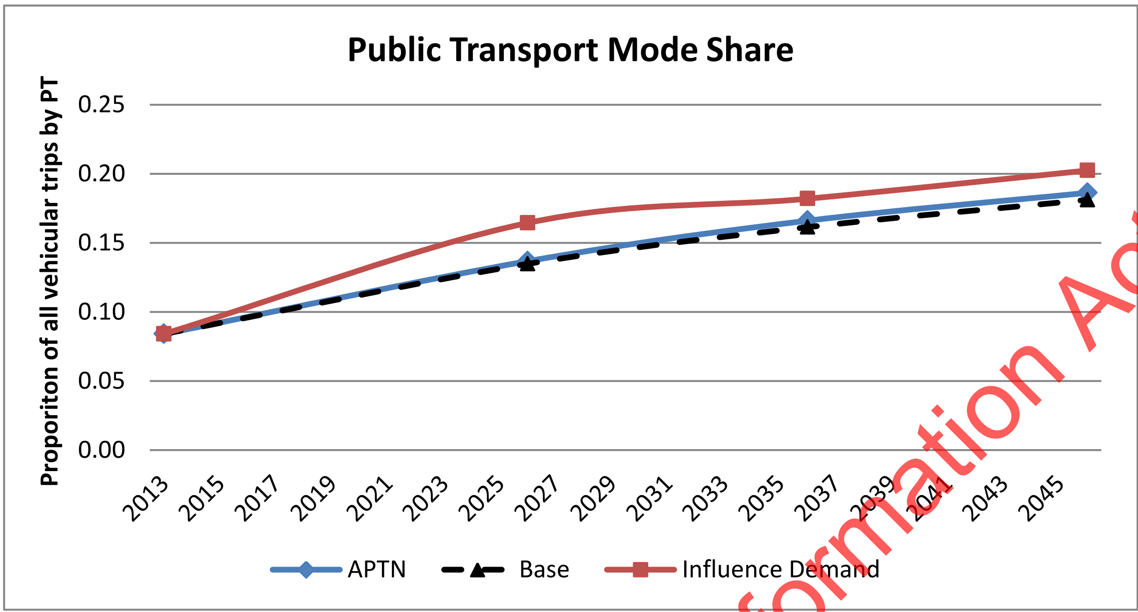

Figure 4.28: Public transport mode share AM peak (Influence Demand, APTN and ATAP Baseline)

While smarter pricing reduces demand for travel on the roading network, it substantially increases demand for the public transport network. Despite additional investments to public transport infrastructure, demand on the rapid transit network for bus continues to exceed capacity at parts of the network, particularly along the Northwestern and cross isthmus corridors, indicating the need for additional services or further investment (Figure 4.29).

Mass rapid transit to the Airport and North Shore, respectively, are projected to be operating within public transport capacity constraints under the Influence Demand package.

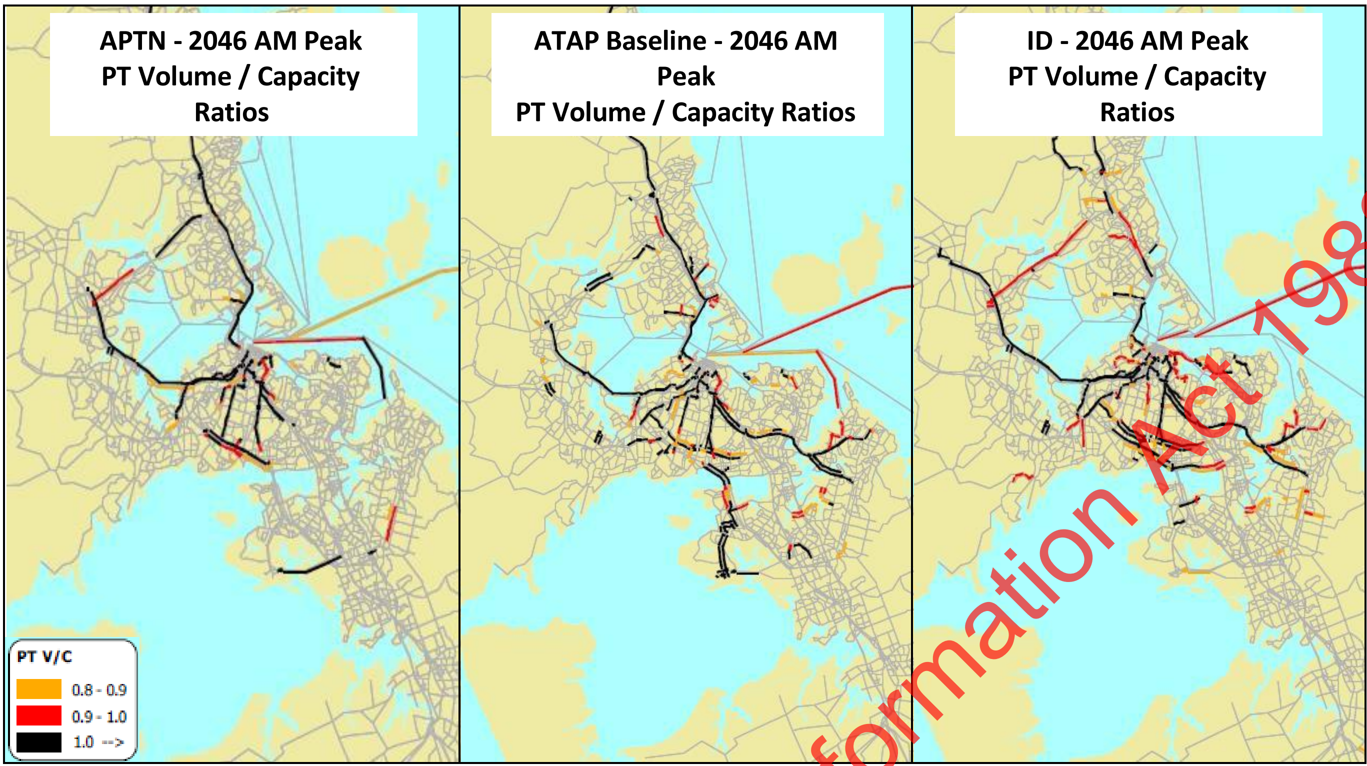

Figure 4.29: Public transport volume to capacity AM peak 2046 (Influence Demand, APTN and ATAP Baseline)

Net Benefits to Users

"Net benefits to users" was estimated because the Influence Demand package increases the financial costs of motorists using the transport system, depending on time of day and the route taken. While our analysis suggests moving to smarter transport pricing would deliver very material gains in travel times and a shift to public transport, it would impose additional cost on many road users. Motorists receive a benefit from the improved network performance (in terms of shorter travel times and lower vehicle operating costs) but also face increased costs from having to pay the network charges.

The following map (Figure 4.30) shows the difference in projected generalised costs for motorists in different parts of Auckland in the morning peak in 2046 with smarter pricing in the Influence Demand package, compared to the generalised costs in the APTN.

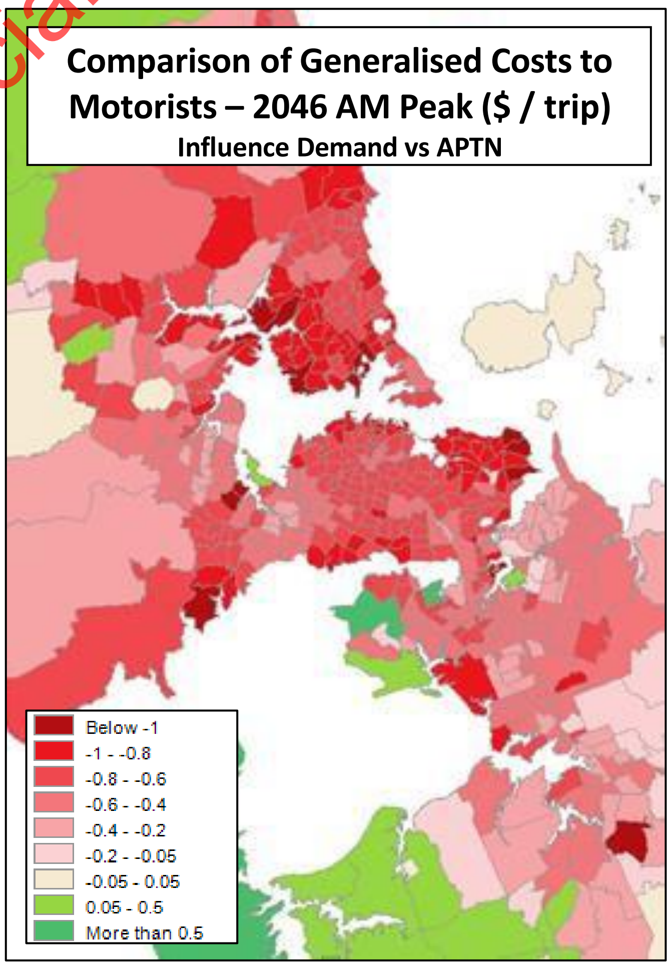

Figure 4.30: Generalised costs to road users AM peak 2046 (Influence Demand vs APTN)

Those generalised costs do not take into account the wider benefits that users of the transport system would gain from increased accessibility and reduced congestion.

Despite the reduction in pricing charges by 25% from the initial pricing scheme, this round of testing continues to impose additional financial costs on many road users, but to a much lesser extent than in the previous round. This analysis suggested that the prices charged would exceed the value of the time gained for the average road user, although for more peripheral regions where levels of congestion and the resulting charges are low, there would be net benefits to motorists.

These findings should be treated with caution. The analysis was a necessarily coarse approximation of how pricing might be applied, which means that some uncongested roads were subject to the same charge as congested routes. Furthermore, our analysis did not consider the likelihood that some users would place a much higher value on time savings than others. Further work, using much more detailed analytical tools, is required to identify efficient pricing levels which effectively address these issues.

We expect that more detailed development and analysis will go a long way towards ensuring overall net user benefits from the introduction of pricing, as prices could be adjusted to lower levels and a finer-grain (e.g. on uncongested counter-peak motorways) and would also be better information about the impacts on users with different values of time could be taken into account.

It will be important to understand where travel cost increases occur under a particular pricing structure so that equity impacts (including the affordability of travel to different groups, and the impact of pricing on access to jobs, education and services) can be assessed and any necessary mitigation can be developed.

Value for Money

The Influence Demand package has an estimated $33.2 billion capital expenditure programme over 30 years (excluding renewals) which is projected to result in significantly higher contributions to the ATAP objectives compared to the APTN. The package is projected to result in a higher proportion of jobs accessible by motorists of 55% (compared to 43% in the APTN), a similar proportion of jobs accessible by public transport of 25% (compared to 24% in the APTN), a significantly lower proportion of travel time in severe congestion of 23% in severe congestion in the morning peak (compared to 32% in the APTN) and a moderately higher public transport mode share of 20.2% in the morning peak (compared to 18.6% in the APTN).

The Influence Demand package as a whole is projected to have significantly higher contributions to the ATAP objectives than the APTN package, but with a larger capital improvement programme and a higher average cost to motorists.

4.2.3 Key Learnings

The Influence Demand package highlights significant improvements in potential accessibility, congestion and public transport mode share. These are counter-balanced by unclear net benefits to users that would require more detailed analysis.

Due to its significantly better performance against the project objectives, Influence Demand forms the base of the Indicative Package in the next phase of the project.

4.3 Cross Package Review

4.3.1 Overview

The Higher Investment and Influence Demand packages were compared against both the APTN (to understand the extent to which it appear to deliver better returns than current plans) and a common baseline (to understand the value from additional investment above this baseline). The main findings from the cross package review are listed below:

- Additional investment in the first decade did not appear to improve performance against the project objectives at regional level, but some of these extra investments did have some important sub-regional effects. Therefore, development of the Indicative Package in the next phase should adopt a more targeted approach to identifying early priorities which both align with the project objectives and appear likely to deliver value for money (refer to section 5).
- The introduction of smarter pricing in the Influence Demand package has the most significant impacts on the project objectives, but unclear net benefits to users that would require more detailed analysis.
- Because of its significantly better performance against the project objectives, Influence Demand should form the base of the Indicative Package in the next phase of the project.

4.3.2 Accessibility

Car accessibility outputs indicate a very similar situation between 2013 and 2026 across the packages, but with their differences subsequently growing (Figure 4.31). Additional investment before 2026 appears to have a very limited effect on car accessibility. After 2026, once the progressive implementation of a variable network charge has been introduced, car the Influence Demand package provides significantly higher car accessibility than any other package, despite containing around $8 billion less investment than the Higher Investment package.

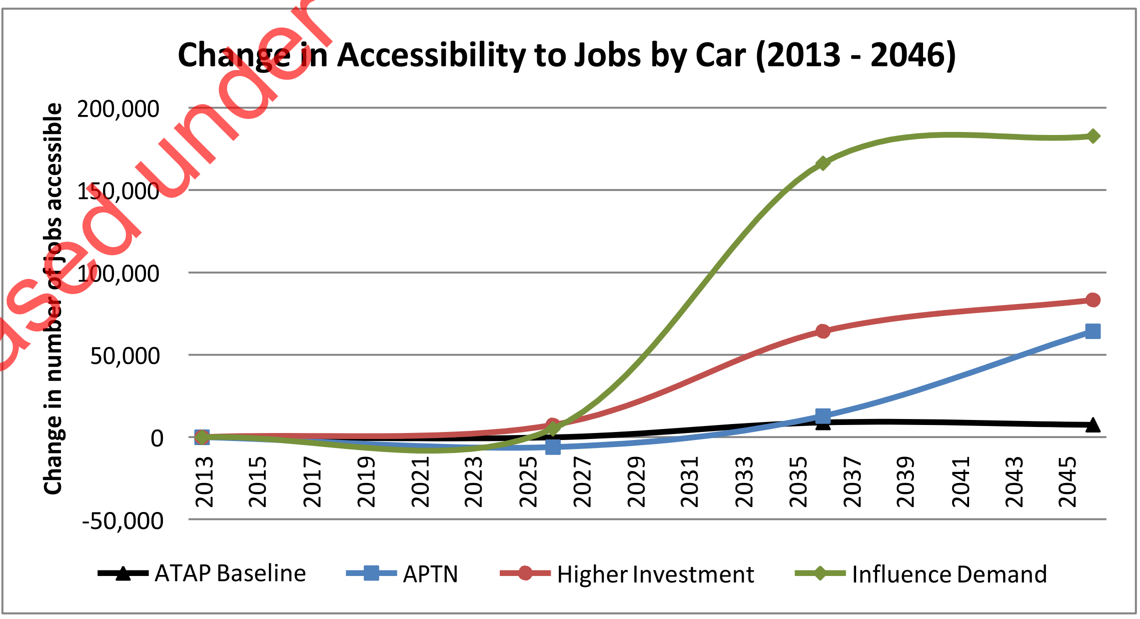

Figure 4.31: Change in number of jobs accessible within a 30 minute car commute AM peak (2013 – 2046)

Public transport accessibility modelling outputs hide some of the differences between packages, due to the limitations of the analytical tools. These limitations almost certainly mean performance of the ATAP baseline and the APTN are substantially over-stated. This is because capacity constraints arising from these packages being reliant on extremely high bus volumes along key corridors were not able to be assessed. The Higher Investment and Influence Demand packages perform very similarly over the 30 years, because the public transport investments in those packages are almost identical, with only the timing varying (Figure 4.32).

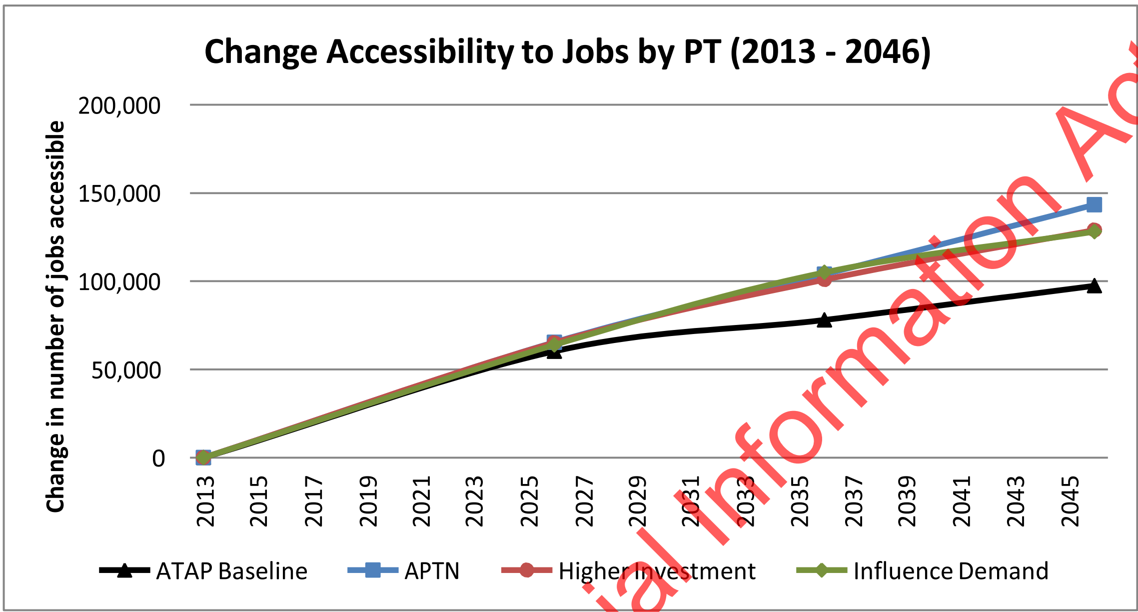

Figure 4.32: Change in number of jobs accessible within a 45 minute PT commute AM peak (2013 – 2046)

At a sub-regional level, all three packages show similar patterns in car access at 2026 (Figure 4.33). The isthmus sees a marginal increase in accessibility, while the northwest, west and North Shore see a reduction in accessibility. Higher Investment increases accessibility for most of the south, while Influence Demand sees relatively similar accessibility patterns to the APTN.

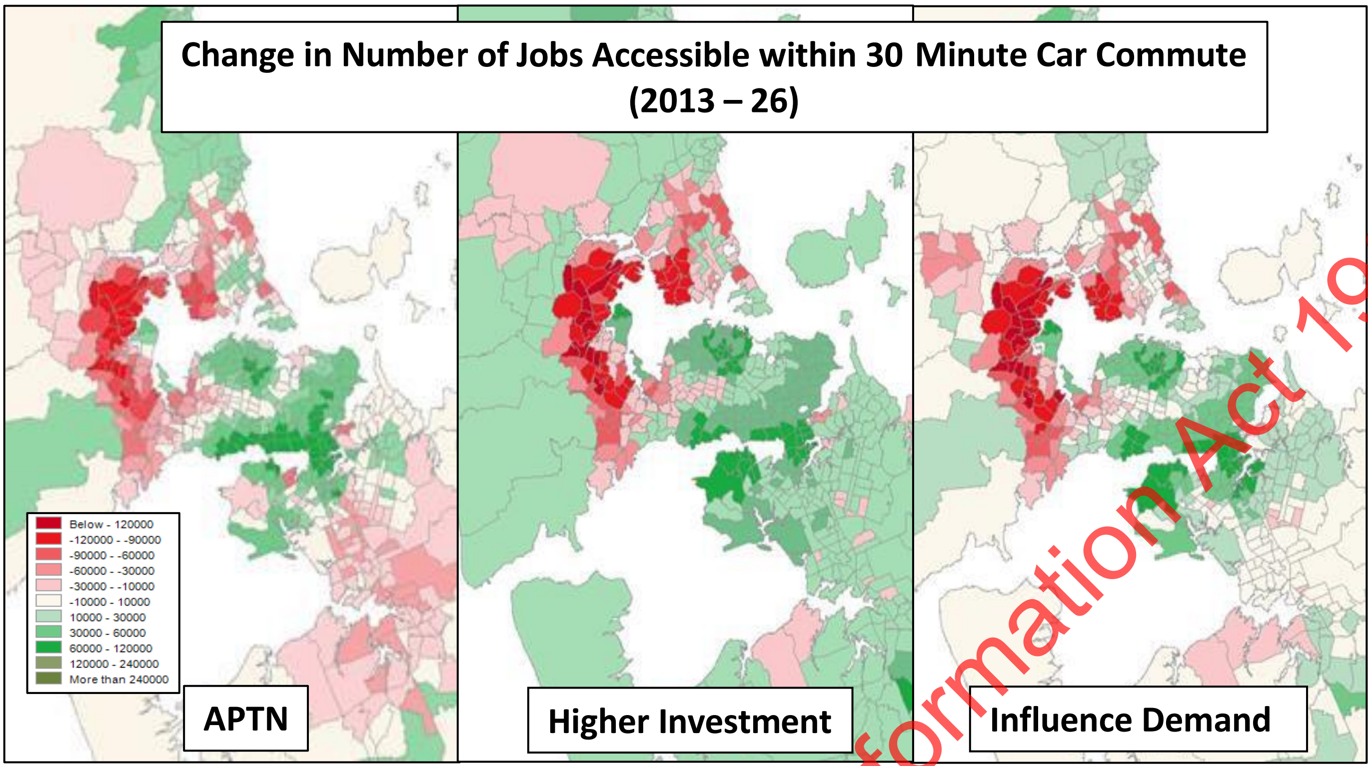

Figure 4.33: Change in number of jobs accessible within a 30 minute car commute AM peak (2013 – 2026)

Car accessibility improves dramatically under Influence Demand with the introduction of smarter pricing. This is reflected sub-regionally under Figure 4.34, with the northwest, North Shore and inner south seeing the greatest increase in accessibility. Higher Investment also experiences an increase in accessibility through most parts of Auckland, though at a smaller scale compared to Influence Demand. The inner south experiences declines in accessibility despite targeted widening in the Southern Motorway network.

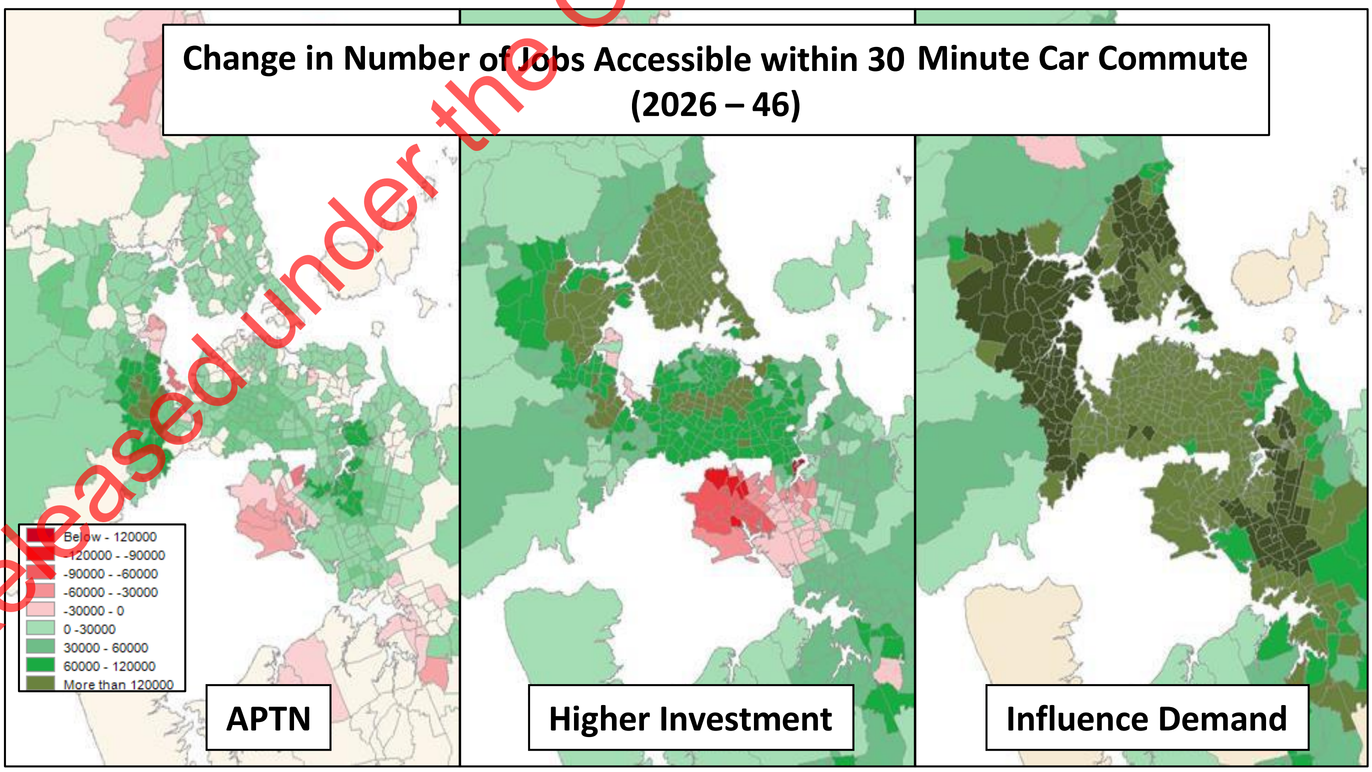

Figure 4.34: Change in number of jobs accessible within a 30 minute car commute AM peak (2026 – 2046)

At 2026, Influence Demand and Higher Investment are projected to have roughly similar patterns in public transport access improvements (Figure 4.35).

Between 2026 and 2046, improvements to public transport access are concentrated on the isthmus and northwest under Influence Demand (Figure 4.36). Accessibility declines on parts of the North Shore.

Higher Investment sees a more even distribution of public transport access improvements across the region, though the improvements are less dramatic compared to Influence Demand.

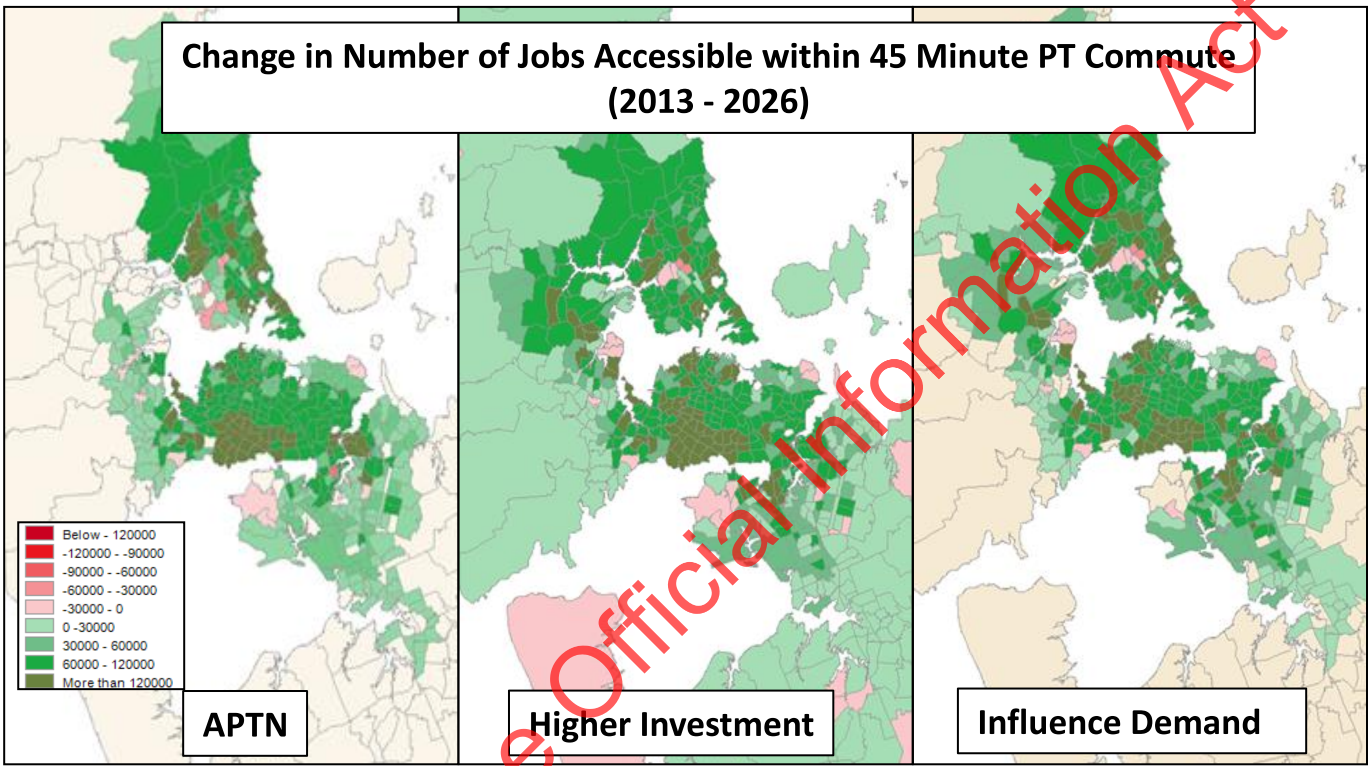

Figure 4.35: Change in number of jobs accessible within a 45 minute PT commute AM peak (2013 – 2026)

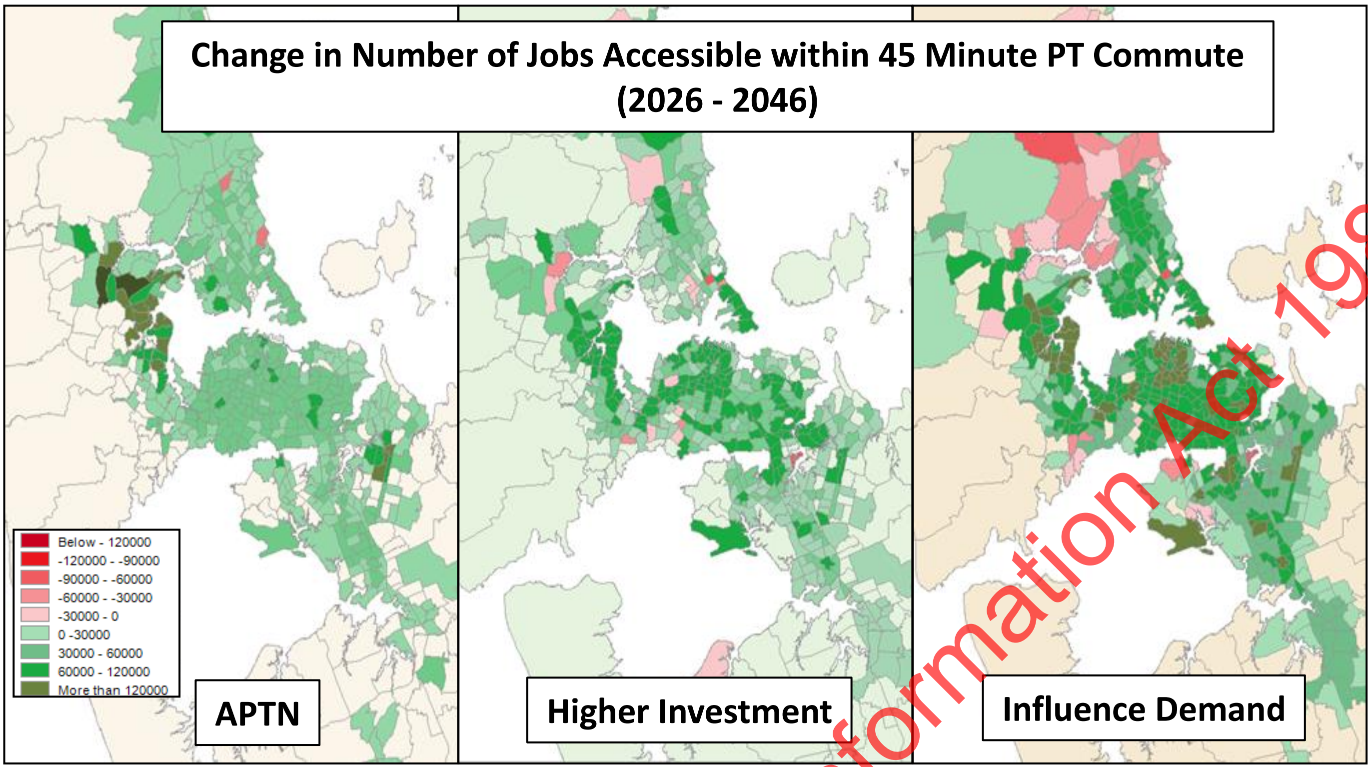

Figure 4.36: Change in number of jobs accessible within a 45 minute PT commute AM peak (2026 – 2046)

4.3.3 Congestion

Analysis of projected congestion levels mirrors the car accessibility outputs discussed above. While the Higher Investment package performs slightly better than the APTN (particularly in 2026 and 2036 as a result of earlier investment in additional highway capacity), it is only the progressive introduction of smarter transport pricing in the Influence Demand package that delivers a step-change impact on congestion levels (Figure 4.37).

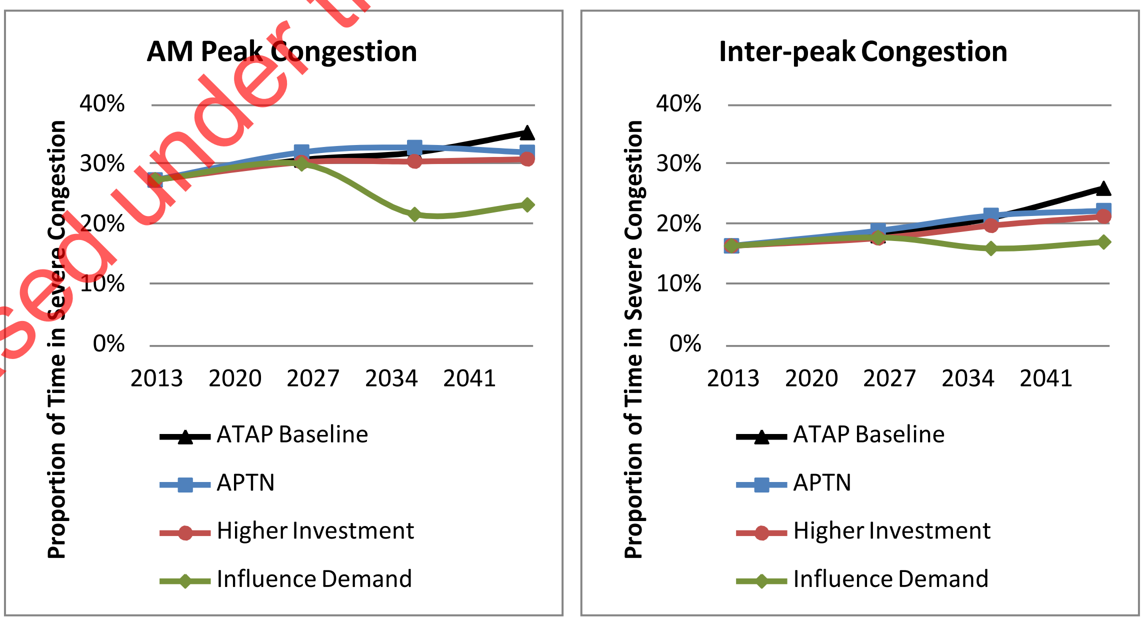

Figure 4.37: AM peak and Inter-peak Congestion (2013 – 2046)

Most of this change results from a combination of reduced trip lengths and a shift to public transport in response to the increased cost of car travel. The lower level of congestion for the Influence Demand package is reflected in the more detailed volume to capacity plots for 2046 (Figure 4.38). Under Higher Investment, key pinch points of the inner motorway network experience the highest levels of congestion.

These plots also indicate various areas of remnant congestion in the Influence Demand package, especially on the Northern Motorway and inner parts of the Southern Motorway. Addressing these areas of congestion informed the development of the Indicative Package, as well as the need to continue to refine the details of the pricing system over time, as changes to the pricing structure could also address these issues.

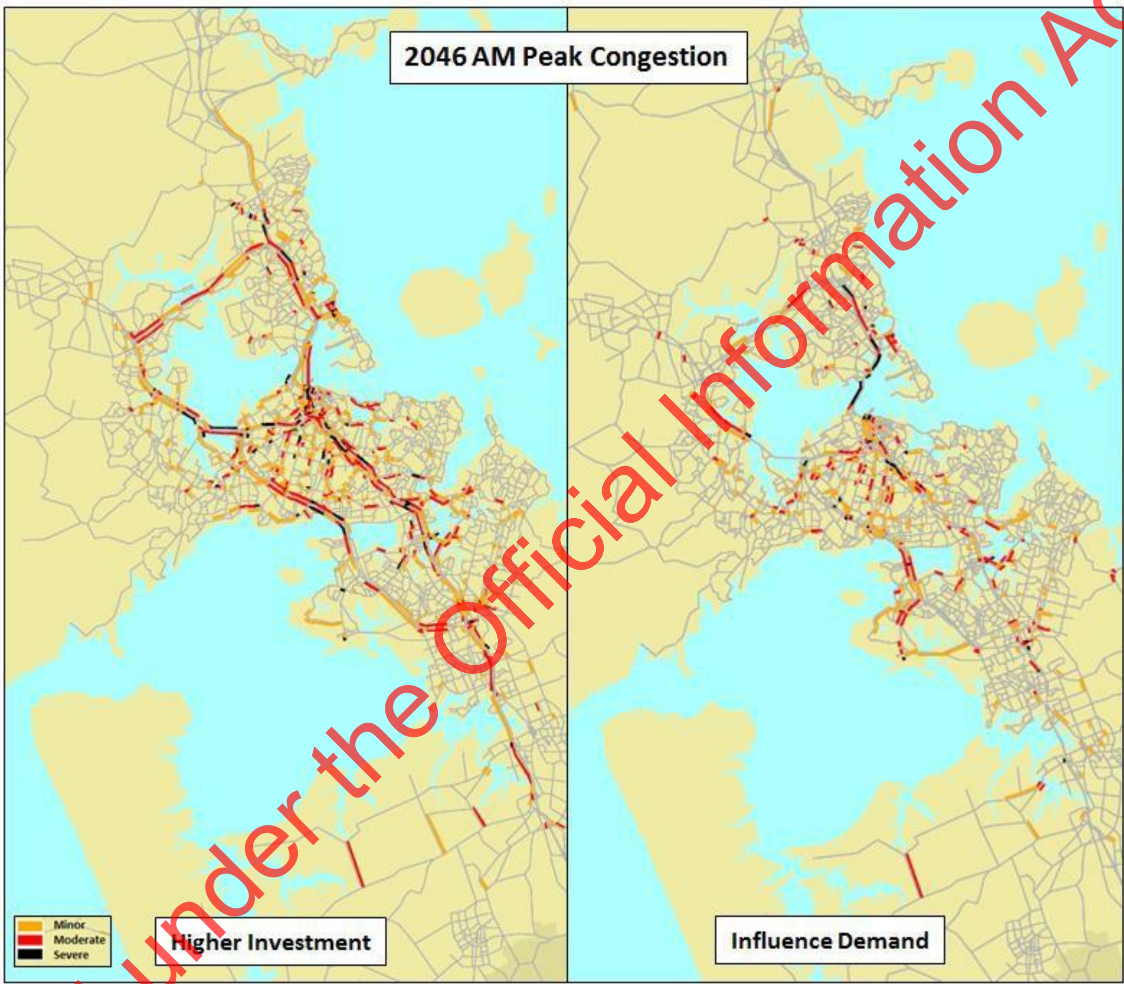

Figure 4.38: AM peak vehicle volume to capacity in 2046 (Higher Investment and Influence Demand)

Inter-peak congestion plots for the two packages also indicate a much lower level of congestion under Influence Demand (Figure 4.39). While some patches of congestion remain in the Influence Demand package, most of the inner motorway network is operating below moderate or severe congestion levels in 2046.

Moderate to severe congestion levels are found under Higher Investment, particularly within the inner motorway network.

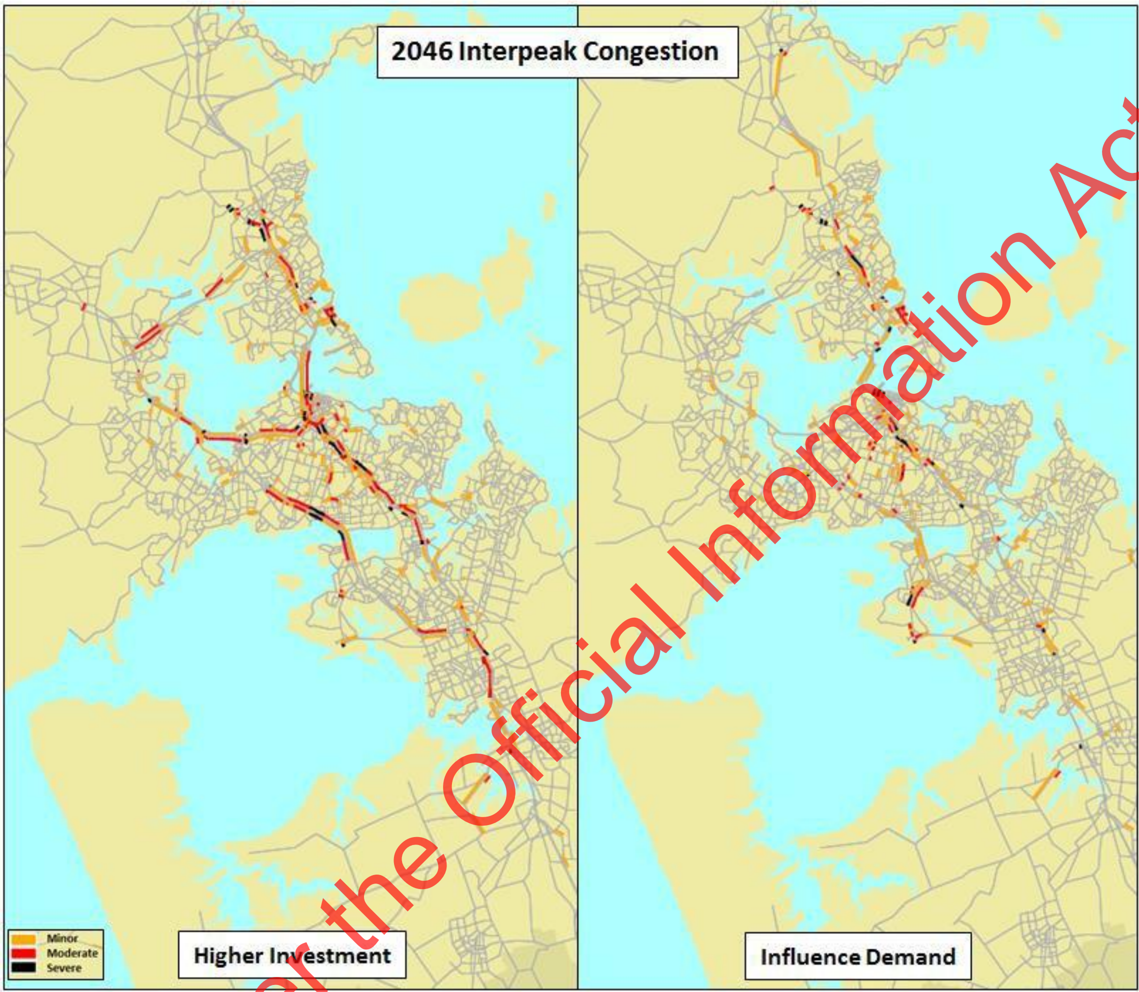

Figure 4.39: Inter-peak vehicle volume to capacity in 2046 (Higher Investment and Influence Demand)

4.3.4 Public Transport Mode Share

Public transport mode share tracks similarly for APTN, Higher Investment and the ATAP Baseline (Figure 4.40). Public transport mode share is projected to be higher under Influence Demand due to the increased cost of driving resulting from smarter pricing and further investment to the public transport network.

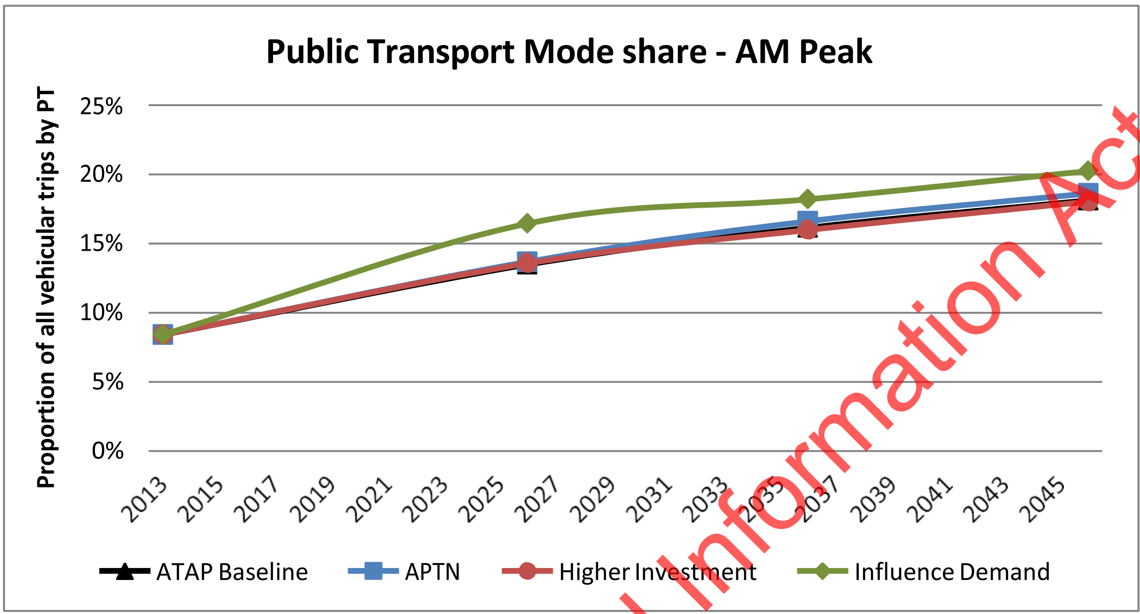

Figure 4.40: Public transport mode share in the AM peak (2013-2046)

4.3.5 *Full Evaluation Results*

The following table presents the results of our evaluation of the Higher Investment and Influence Demand packages against the evaluation criteria established in the Foundation Report (Table 4.4). All results relate to the 2046 year unless otherwise specified.

Table 4.4: Evaluation framework – headline measures

Objective	Measure	Headline KPI	2013 comparison	Higher Investment 2046	Influence Demand 2046	APTN 2046	Comment
Improve access to employment and labour	Access to employment and labour within a reasonable travel time	• Jobs accessible by car within a 30 minute trip in the AM peak • Jobs accessible by public transport within a 45 minute trip in AM peak • Proportion of jobs accessible to other jobs by car within a 30 minute trip in the inter-peak	312,000 i.e. 51% of available jobs 94,000 i.e. 15% of available jobs 467,000 i.e. 75 % of available jobs	396,000 i.e. 44% of available jobs 223,000 i.e. 25% of available jobs 593,000 i.e. 67% of available jobs	495,000 i.e. 55% of available jobs 222,000 i.e. 25% of available jobs 655,000 i.e. 74% of available jobs	386,000 i.e.43% of available jobs 215,000 i.e. 24% of available jobs 590,000 i.e. 66% of available jobs	The Higher Investment package increases the number of jobs accessible by car and PT in the morning peak (7-9am) in 2046, but does not increase the proportion of jobs that could be accessed by car. The Influence Demand package increases car and PT accessibility (measured only in relation to travel time, not financial cost) in the morning peak (7-9 am) in 2046.
Improve congestion results	Impact on general traffic congestion	• Per capita annual delay (compared to efficient throughput) • Proportion of travel time in severe congestion in the AM peak and inter-peak	7 hours 22 minutes per person per annum 27.3% AM peak 16.3% inter-peak	11 hours 58 minutes per person per annum 30.7% AM peak 21.1% inter-peak	4 hours 57 minutes per person per annum 23.1% AM peak 16.9% inter-peak	13 hours 33 minutes per person per annum 31.9% AM peak 21.9% inter-peak	Projected levels of congestion for the Higher Investment package are expected to be similar to the APTN. The Influence Demand package's projected levels of congestion throughout the day are significantly better than the APTN.
	Impact on freight and goods (commercial traffic) congestion	• Proportion of business and freight travel time spent in severe congestion on the strategic freight network (in the AM peak and inter-peak)	15.1% AM peak 8.3% inter-peak	19.8% AM peak 12.6% inter-peak	11.4% AM peak 7.2% inter-peak	18.6% AM peak 12.9% inter-peak	The Higher Investment package's projected congestion on the strategic freight network is similar to the APTN. The Influence Demand package's projected congestion is significantly better throughout the day, compared to the APTN.
	Travel time reliability	• Proportion of total travel subject to volume to capacity ratio of greater than 0.9 during AM peak, inter-peak and PM peak.	15% AM peak 6% inter-peak 16% PM peak	19% AM peak 13% inter-peak 24% PM peak	10% AM peak 6% inter-peak 12% PM peak	19% AM peak 13% inter-peak 23% PM peak	Projected reliability of travel times for motor vehicle trips with the High Investment package are expected to be similar to the APTN. The Influence Demand package's projected reliability of travel times is expected to be significantly better throughout the day, compared to the APTN.
Increase public transport mode-share	Public transport mode share	• Proportion of vehicular trips in the AM peak made by public transport	8.5%	18.0%	20.2%	18.0%	Projected PT mode share for the Higher Investment package is expected to be similar to the APTN. The Influence demand package's projected PT mode share is slightly higher than the APTN.
	Increase public transport where it impacts on congestion	• Proportion of vehicular trips over 9 km in the AM peak made by public transport	18.3%	31.7%	38.4%	31.7%	The proportion of longer commuter trips by PT with the Higher Investment Package is projected to be the same as the APTN. The Influence Demand package's projections shows a higher proportion of longer commute trips would be by PT, compared to the APTN.
	Increase vehicle occupancy	• Average vehicle occupancy	1.36 people per vehicle AM peak 1.25 people per vehicle inter-peak	-	-	-	It was not possible to model changes in vehicle occupancy. The input assumptions of an average of 1.36 people per vehicle in AM peak and an average of 1.25 in inter-peak remained constant for all packages and all model years.

Objective	Measure	Headline KPI	2013 comparison	Higher Investment 2046	Influence Demand 2046	APTN 2046	Comment
Increased financial costs deliver net user benefits	Net benefits to users from additional transport expenditure	• Increase in financial cost per trip compared to savings in travel time and vehicle operating cost	Not applicable	-	-	Not applicable	Financial costs from smarter pricing in the Influence Demand package (see pricing schedule in Table 4.2) are assumed to replace road user charges and fuel excise duties. Savings in travel time and vehicle operating costs vary by trip. On average it is estimated that the financial costs exceed the savings in travel time and vehicle operating costs. Better model/tools are required to provide robust quantification of net benefits.
Ensure value for money	Value for money	• Package benefits and costs	-	-	-	-	Package benefits include the contributions to Objectives as measured in this table. The costs of new capital expenditure (excluding renewals) for the 30 year programmes are estimated in billions of 2016 dollars as follows: Higher Investment: $40.7 b Influence Demand: $33.2 b These cost estimates were identified after the revision of project costs in ATAP. Better model/tools are required to provide robust quantification of net benefits.

In addition to the project objectives, a number of other key outcomes have been evaluated through the evaluation framework in Table 4.5 below.

Table 4.5: Evaluation framework – other key outcomes

Other Key Outcomes	Measure	Headline Key Performance Indicator	2013 comparison	Higher Investment 2046	Influence Demand 2046	APTN	Comment
Support access to housing	Transport infrastructure in place when required for new housing	• Transport does not delay urbanisation in line with timeframes of Future Urban Land Supply Strategy	Existing transport infrastructure in greenfields is inadequate to support the growth required in the FULSS.	Approximately half the new bulk transport infrastructure required by FULSS in the Southern and NW greenfields areas is programmed to be in place by 2028. Approximately 20% in the North is programmed to be in place when required by 2038. Almost 100% in Warkworth is programmed to be in place when required by 2038.	Approximately half the new bulk transport infrastructure required by FULSS in the Southern and NW greenfields areas is programmed to be in place by 2028. Approximately 20% in the North is programmed to be in place when required by 2038. Almost 100% in Warkworth is programmed to be in place when required by 2038.	The transport infrastructure in greenfields programme does not meet timeframes of FULSS.	The same programme in greenfields has been assumed in both the Higher Investment and Influence Demand packages. The projects in the greenfields are needed to unlock housing capacity.
Minimise harm	Safety	• Deaths and serious injuries per capita and per distance travelled	48 deaths and 3,487 injuries p.a. from motor vehicle crashes. 25 injuries per 10,000 population 28 injuries per 100 million vehicle kilometres travelled	-	-	-	Model forecasts can't accurately identify number of deaths and serious injuries.
	Emissions	• Greenhouse gas emissions	8.4 million kg of CO_2 per day	8.1 million kg of CO_2 per day	7.3 million kg of CO_2 per day	8.1 million kg of CO_2 per day	Projected levels of greenhouse gas emissions for the High Investment package are expected to be similar to the APTN. The Influence Demand package projects 10%

Other Key Outcomes	Measure	Headline Key Performance Indicator	2013 comparison	Higher Investment 2046	Influence Demand 2046	APTN	Comment
							fewer emissions in the Influence Demand package than the APTN. This is mostly due to fewer trips and shorter distance of trips.
Maintain existing assets	Effects of maintenance and renewals programme	• Asset condition levels of service • Renewals backlog	In 2015, approximately 1% of the transport network was in a "very poor" condition. This is equivalent to $157 million of backlog. [Source: Auckland Transport's Asset Management Plan 2015-2018]	Expected to achieve higher levels of service than in 2016 and similar levels of service to the APTN. This clears the renewals backlog within 10 years.	Expected to achieve higher levels of service than in 2016 and similar levels of service to the APTN. This clears the renewals backlog within 10 years.	Similar to these packages.	The same maintenance and renewals programme has been assumed in both packages.
Social inclusion and equity	Impacts on geographical areas	• Access employment in high deprivation areas • Distribution of impacts (costs and benefits) by area	As identified in the Foundation report, high deprivation areas in the south and west have lower access to jobs than other parts of the region. People in the west rely on a congested motorway link to jobs in the isthmus and south. People in the south also experience congestion on motorway links to jobs.	Compared to the APTN, accessibility improves for high deprivation areas, but issues remain in Mangere.	Compared to the APTN, accessibility improves for high deprivation areas, but access by motor vehicle is subject to pricing. Motor vehicle accessibility from high deprivation areas in the North Shore is worse.	The Deficiency Analysis identified significantly lower levels of access in the south and west.	Accessibility from high deprivation areas is similar to the APTN, except with smarter pricing. Generalised costs generally increase as a result of smarter pricing.
Network resilience	Network vulnerability and adaptability	• Impact in the event of disruption at vulnerable parts of the network	Vulnerable network due to incomplete State Highway, public transport and cycle networks and lack of capacity at peak times on the strategic road network to cope with disruptions.	Network resilience is similar to the APTN. This package improves resilience through additional roading links such as the Additional Waitemata Harbour Crossing.	Network resilience is similar to the APTN. This package improves resilience through pricing of the road network. This reduces vehicle kilometres travelled on the road network by about 10% which could result in less diversion and impact in the event of disruption to the road network. There is high capacity in the rapid transit network, which enables PT to take additional people in the case of disruption.	-	These packages have a similar level of network resilience to the APTN.

4.3.6 Growth Assumptions

Packages have been evaluated based on medium growth assumptions, as set out in Table 4.6 below.

Table 4.6: Population and employment medium growth forecast

	2013	2026	2036	2046
Population	1,471,108	1,871,614	2,064,205	2,279,341
Employment	618,152	722,932	808,839	892,457

A sensitivity test was done in respect of the Higher Investment and Influence Demand package. This was based on high growth assumptions for 2026 only, with a high growth forecast population of 1,889,795 and employment of 751,628 in 2026.

The projected results were similar to the 2026 results under medium growth assumptions, with only slightly worse performance in terms of accessibility and congestion. An additional 3.5% increase in vehicle kilometres travelled corresponds with an increase from 30% to 31% of cars in severe congestion in the AM peak in 2026 under both the Higher Investment and Influence Demand packages. Public transport mode share projections are virtually the same at 2026 under high growth and medium growth assumptions.

This limited analysis suggested that network performance in 2026 would not be unduly affected by high growth in the first decade under those packages.

4.3.7 Package Refinement Conclusions

Key findings from analysing the Higher Investment and Influence Demand packages that informed development of the final package were:

- Additional investment in the first decade did not appear to improve performance against the project objectives at the regional level, but some of these extra investments did have some important sub-regional effects. Therefore, development of the final package should adopt a more targeted approach to identifying early priorities which both align with the project objectives and appear likely to deliver value for money.
- The introduction of smarter pricing in the Influence Demand package has the most significant impacts on the project objectives, but unclear net benefits to users that would require more detailed analysis.
- Because of its significantly better performance against the project objectives, Influence Demand should form the base of the Indicative Package.

Phase 3 – Indicative Package

Drawing upon the analysis undertaken in the previous phase, a package of interventions was developed that is indicative of the project's recommended strategic approach. The Indicative Package was based on the Influence Demand package assessed in the previous phase, with the main focus of additional work on identifying early priority interventions to be progressed over the first decade.

The Indicative Package provides an indication of the types of investments, the overall scale of investment and gives an indication of possible sequencing. It is not an "investment programme" and all investments will need to go through existing statutory processes to proceed.

The APTN package has been updated to reflect changes to the bus network and an adjustment in the ART3 transport model to recognise the effects of bus congestion along bus corridors.

The common baseline (CEE4) in the Round 4 analysis was also refined. Referred to interchangeably as the ATAP Baseline and the Base Network, it is used in the evaluation as a low-cost comparator. CEE4 is broadly similar to CEE3, which was used in the previous phase of the evaluation. The main difference between CEE4 and CEE3 lies in the changes to the bus network. This involved updates to the bus network itself and bus frequencies to better reflect reality.

5. Indicative Package

5.1 Package Description

Key findings from analysing the Higher Investment and Influence Demand packages in Package Refinement phase (see previous section) informed the development of the Indicative Package in this phase. Although additional investment in the first decade did not appear to improve performance against the project objectives at regional level, some of these extra investments did have some important sub-regional effects. As such, the development of the Indicative Package adopted a more targeted approach to identifying early priorities.

Our prioritisation framework considered two broad factors:

- The extent to which investment targets the most significant first decade challenges
- The potential to deliver value for money in the first decade

Due to the stronger performance of the Influence Demand package against the project objectives, it forms the base of the Indicative Package. As discussed, more detailed analysis is required to understand the cost to users caused by the introduction of smarter pricing.

The total estimated 30-year cost of the Indicative Package is $84 billion (in 2016 dollars). Figure 5.1 below provides a breakdown of costs by decade and across major investment types. Unlike previous packages which focused only on capital costs, the estimated cost of this package includes asset maintenance, operations and renewals, net public transport operations and new investments.

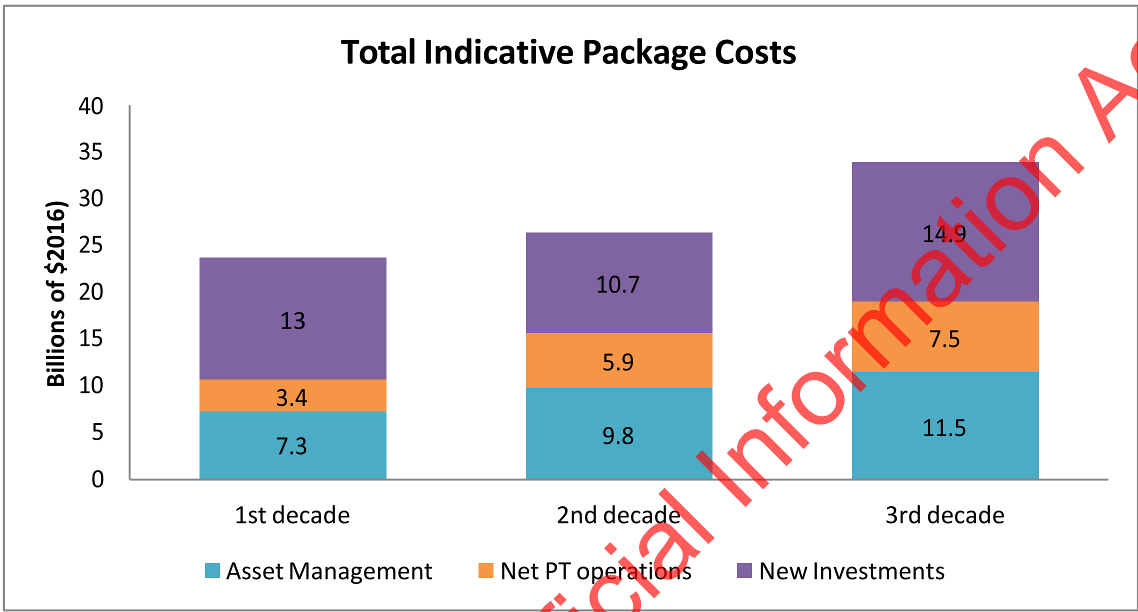

Figure 5.1: Estimated cost of new capital improvements (excluding renewals) of Indicative Package (2018 – 2048)

Of the total package, $38.6 billion (in 2016 dollars) is capital expenditure (excluding renewals). Figure 5.2 below provides a breakdown of those costs by decade and by broad type.

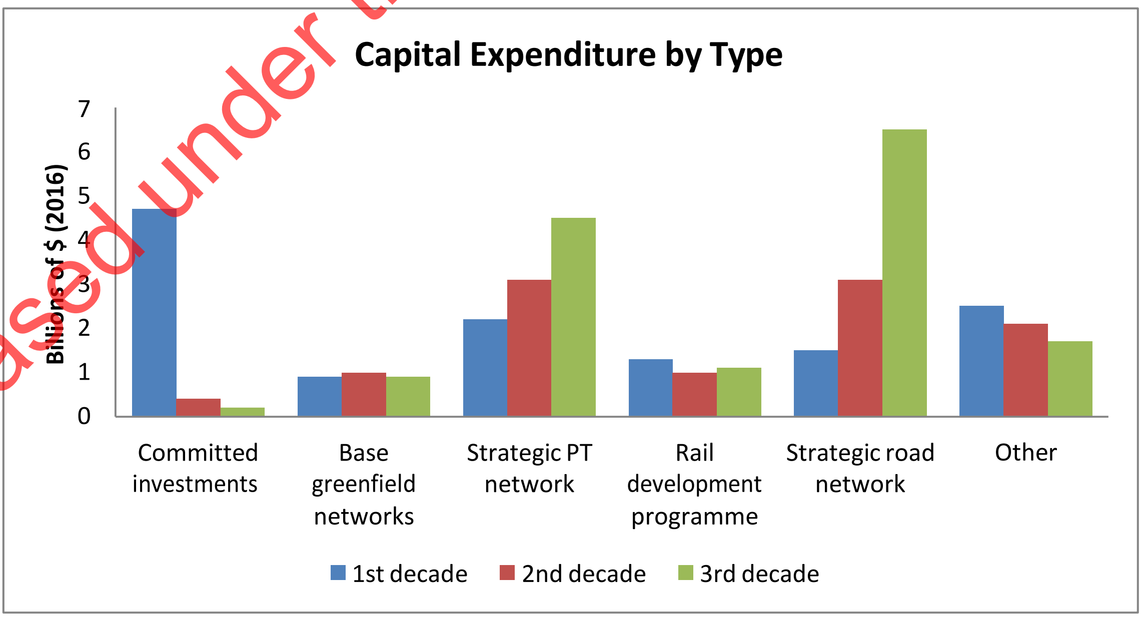

Figure 5.2: Capital expenditure of Indicative Package (2016 – 2046)

Key interventions by time period

Most investments likely to occur in the next decade are already committed or partly committed. This includes the City Rail Link, Accelerated Motorway Package, the Puhoi to Warkworth extension of the Northern Motorway, East West Link and a number of other, smaller projects. The indicative priority of investment additional to current commitments is outlined in Table 5.1 below.

Table 5.1: Indicative Package key interventions by time period

Indicative priorities for major new investments		
Early Priorities (completion in decade 1)	**Medium Term Priorities (completion in decade 2)**	**Longer Term Priorities (completion in decade 3)**
• Northwestern Busway (Westgate to Te Atatu section) • Address bottlenecks on Western Ring Route (SH20 Dominion Rd to Queenstown Rd) and Southern Motorway (Papakura to Drury) • New or upgraded arterial roads to enable greenfield growth in priority areas • Protect routes and acquire land for greenfield networks • Complete SH16 to SH18 connection • Early Rail Development Programme priorities • Upgraded eastern airport access (SH20B) • Investments to enable smarter pricing • Increased investment in Intelligent Network Management • Progress advance works on medium-term priorities	• Continued investment to enable greenfield growth • New strategic roads to Kumeu and Pukekohe • Implementation of mass transit on isthmus and then to the Airport • Bus improvements Airport – Manukau – Botany • Improved access to Port/Grafton Gully • Northwestern busway extensions • Improve connection between East-West Link and East Tamaki • Penlink • Medium-term Rail Development Programme priorities	• Continued investment to enable greenfield growth • Southern Motorway improvements south of Manukau • Southwest motorway (SH20) improvements and improved northern airport access • Northern motorway widening • Waitemata harbour crossing improvements, including mass transit upgrade of Northern Busway • Longer term Rail Development Programme priorities

These early investments were identified following a prioritization using a prioritization framework (Table 5.2).

Table 5.2: Prioritisation framework

ATAP Investment Prioritisation Framework

The purpose of this framework is to agree relative priority of investments for development of an indicative package for the final deliverable.

Items	Investments	- Interventions will be grouped by priority area / deficiency focus into future 'investments', which are then prioritised. - Investments will be grouped logically based on the the strategic networks and known deficiency areas.
	Interventions	- All interventions above $200m will be included. - Interventions relating to the strategic approach will also be included, such as pricing programme, demand management (HOT lanes park and ride etc), technology programmes, optimisation.

Alignment with objectives	Objectives	First decade focus	Targets deficiencies against objectives <u>in first decade</u>				
	Enable Auckland's growth	Enable housing growth; particularly SHAs and greenfield growth in the northwest and south.	✓✓✓ Direct requirement for new housing in priority greenfield areas (SHAs, Northwest and South).	✓✓ Enables and supports growth in priority greenfield areas (SHAs, Northwest and South).	✓ Enables and supports growth or intensification enabled by the unitary plan.	- Does not support areas identified.	× If an investment detracts from an objective.
	Employment accessibility	Improve employment accessibility; particularly from west and south.	✓✓✓ Addresses AM peak accessibility from the west.	✓✓ Addresses AM peak accessibility from the south, or to city centre, airport, or Westgate / Whenuapai.	✓ Addresses AM peak accessibility in other areas.		
	Congestion	Address severe congestion on the strategic road network, particularly in the interpeak period.	✓✓✓ Impacts areas with: - AM peak V/C ratios > 1.0 - Interpeak V/C ratios > 0.9	✓✓ Impacts areas with: - AM peak V/C ratios > 0.9 - Interpeak V/C ratios > 0.8	✓ Impacts areas with: - AM peak V/C ratios > 0.8	- Impacts areas with: - AM peak or interpeak V/C ratios < 0.8	
	Increase PT mode share	Increase peak person throughput on high volume corridors with targeted PT investment	✓✓✓ Increases PT capacity on corridors with 2-hour AM peak volumes > 10,000 persons.	✓✓ Increases PT capacity on corridors with 2-hour AM peak volumes > 5,000 persons.	✓ Increases PT capacity on corridors with 2-hour AM peak volumes > 2,000 persons.	- Does not increase PT capacity.	
	Overall alignment to objectives	High (total score more than ~8)		Medium (total score more than ~4)		Low (total score of less than or equal to ~4)	

Benefits Evaluation of potential investment benefits	Measures of potential benefits	Indicator	Source	Method
	Amount of housing enabled	Expected growth in number of households	TFUG business case, modelling inputs and FULSS.	This measure applies only to base TFUG networks. Compare before and after housing figures in 2028 and 2048.
	AM peak throughput	Expected change in AM peak person throughput (PT and road)	Evidence from package evaluation in ATAP Rounds 1, 2 and 3.	Agree key corridors for each investment. Compare forecast impact on key corridor(s) in 2026 between common elements and ATAP package tests.
	Corridor AM peak speed	Expected change in AM road speeds	Evidence from Rounds 1, 2 and 3 package evaluation. Supplemented by information from projects.	Agree key corridors for each investment. Compare forecast impact on key corridor(s) in 2026 between common elements and ATAP package tests.
	Corridor interpeak speeds	Expected change in interpeak road speeds	Evidence from Rounds 1, 2 and 3 package evaluation. Supplemented by information from projects.	Agree key corridors for each investment. Compare forecast impact on key corridor(s) in 2026 between common elements and ATAP package tests.

Estimated cost	Estimated range as developed for projects	- Cost information will be sourced from projects where possible.		
	Overall relationship of potential benefit and costs	High	Medium	Low

Strategic and project considerations	Consistency with strategic approach	Considerations include: - logical sequence to strengthen the strategic roading and public transport networks - whether this investment is sensitive to pricing or technology - sensitivity of an investment to potential changes in land use assumptions
	Existing project evidence	Evidence on projects will be used including expected impact on deficiencies as well as other data on BCRs, effects on resilience, safety, freight, etc.
Relative priority	Reasons for recommendation	This will be a statement outlining the assessment, based on the evidence presented on alignment with strategic objectives, potential benefits, costs, consistency with strategic approach and existing project evidence.
	Priority	Bands of priority classified as high / medium / low

5.2 Key Findings

Travel Patterns

The following is contextual information of projected travel patterns in relation to the Indicative Package, compared to the APTN.

Average trip time in the AM peak is projected to decrease from 2026 with the introduction of smarter pricing, and to plateau between 2036 and 2046 (Figure 5.3). In comparison, the APTN starts off with a lower average trip time which increases in 2026 to a higher level than the Indicative Package and plateaus between 2036 and 2046.

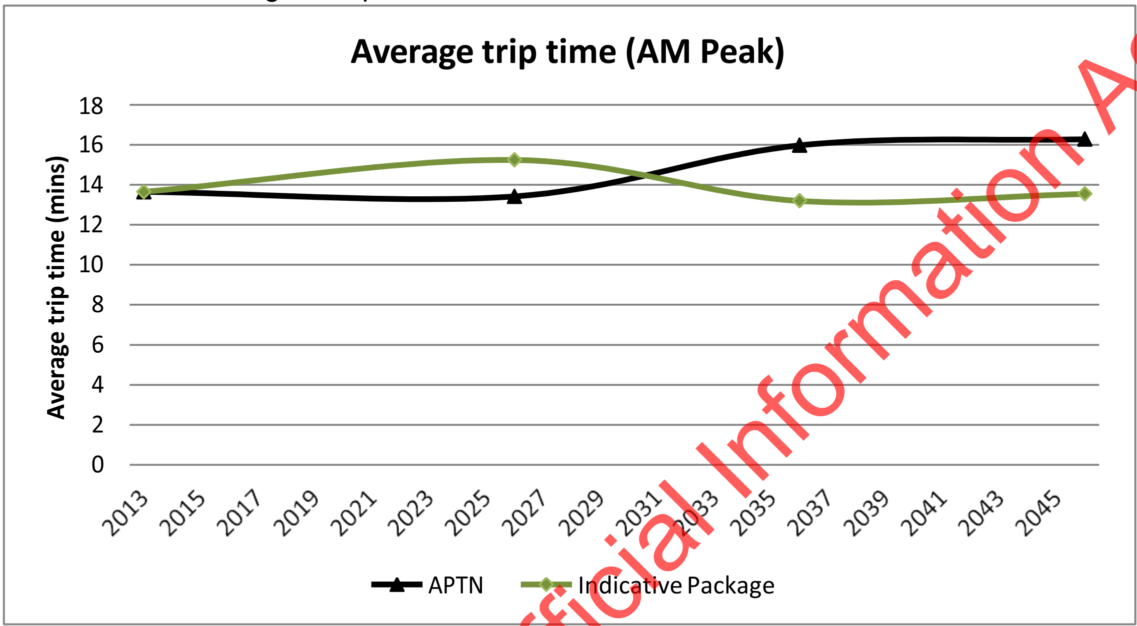

Figure 5.3: Average trip time during AM Peak (minutes)

A significant decrease in average trip length in the AM peak is projected under the Indicative Package, particularly between 2026 and 2036 (Figure 5.4). As smarter pricing is introduced, some trips during the peak period shift to other modes or other times. After 2026, average trip length evens out under the APTN and increases by 1km between 2036 and 2046.

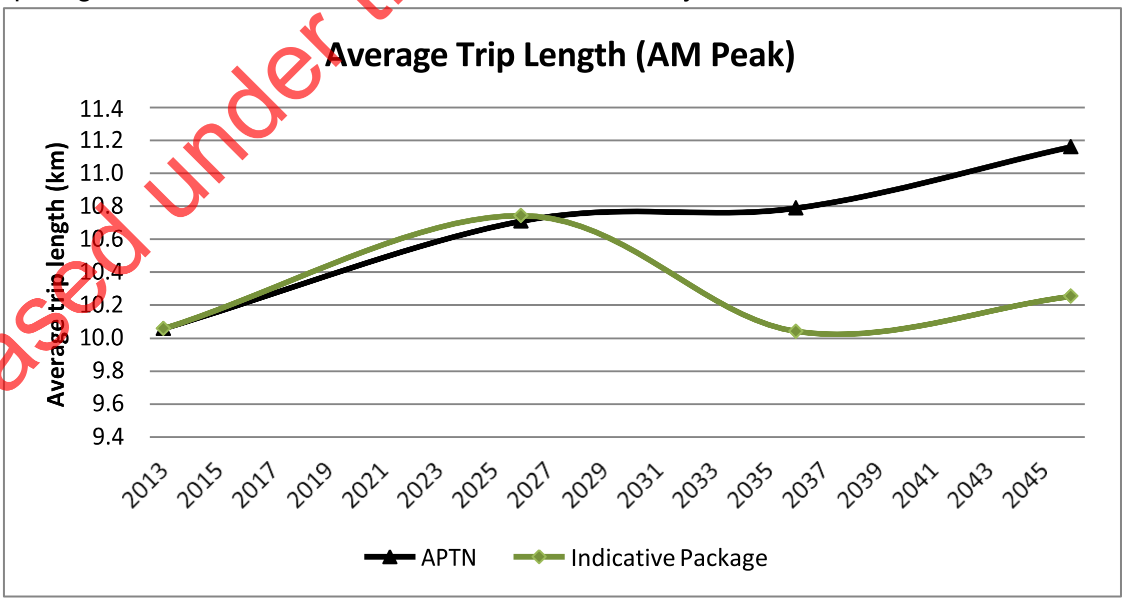

Figure 5.4: Average vehicle trip length during AM Peak (km)

A 3% reduction in the number of car trips taken in the AM peak is projected under the Indicative Package compared to the APTN, starting from 2036 when smarter pricing is in place (Figure 5.5). The number of public transport trips is projected to increase by 11% in 2036 under the Indicative Package.

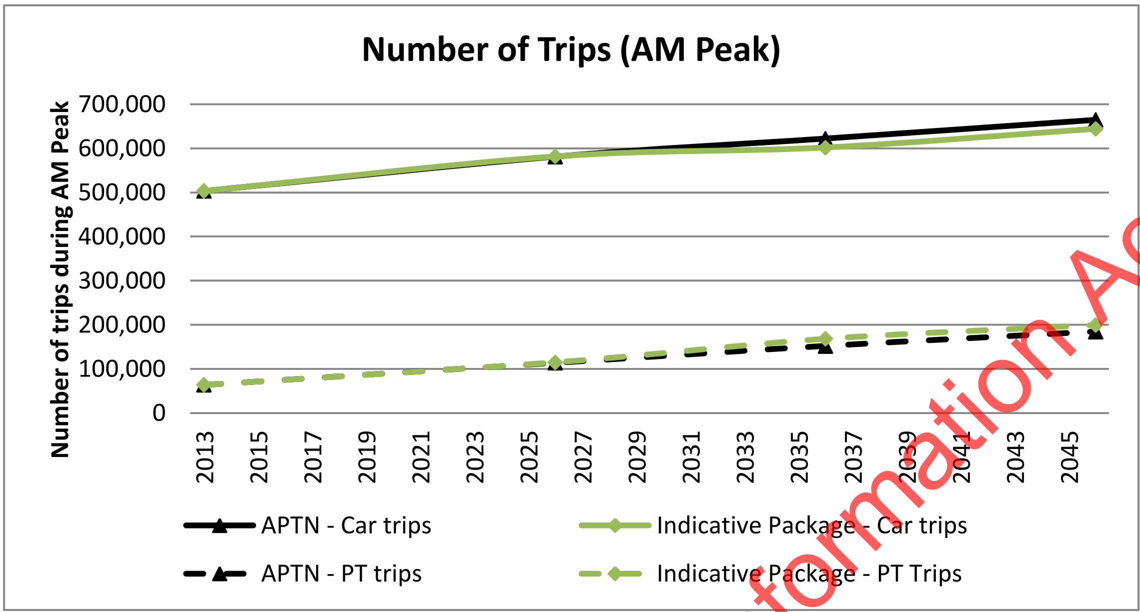

Figure 5.5: Number of trips during AM Peak by car and public transport (Indicative Package and APTN)

As a result of smarter pricing, there is a 10% decline in daily and peak vehicle kilometres travelled under the Indicative Demand compared to the APTN in 2036 (Figure 5.6).

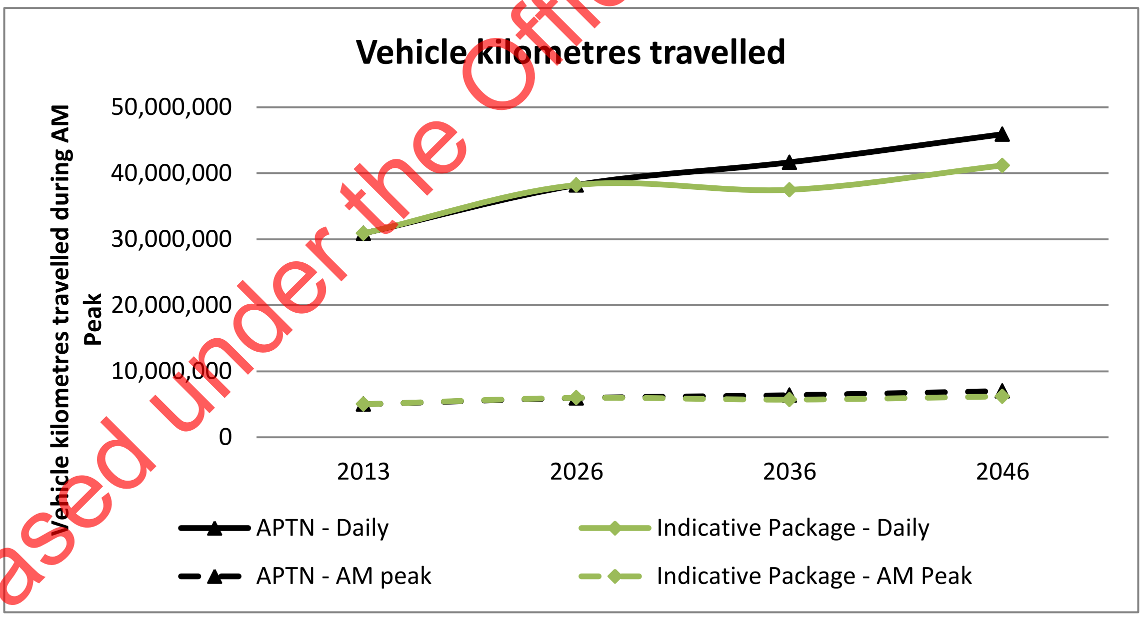

Figure 5.6: AM peak and daily vehicle kilometres travelled (km)
(Indicative Package and APTN)

Accessibility

Accessibility to employment by car under the Indicative Package is projected to significantly increase in the second decade in response to the implementation of smarter pricing. Additionally, third decade investment in the Indicative Package is projected to further increase car accessibility (Figure 5.7).

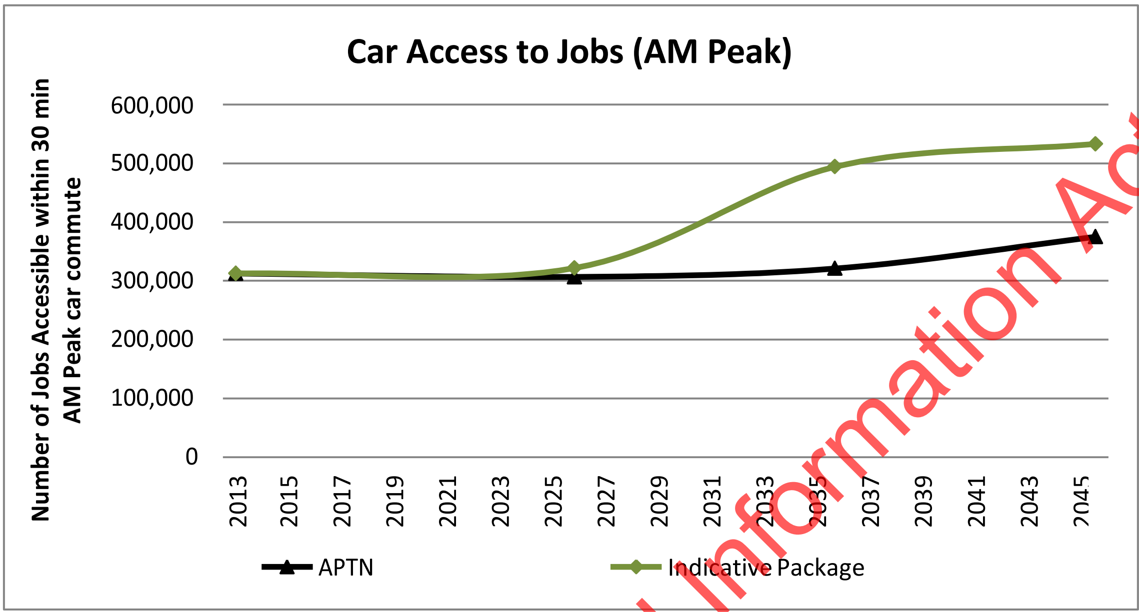

Figure 5.7 Car accessibility to jobs within a 30 minute car commute AM peak (Indicative Package and APTN)

Public transport accessibility is projected to be similar to the APTN (Figure 5.8). However, projections indicate slightly higher public transport accessibility than the APTN while providing for significant growth in public transport use.

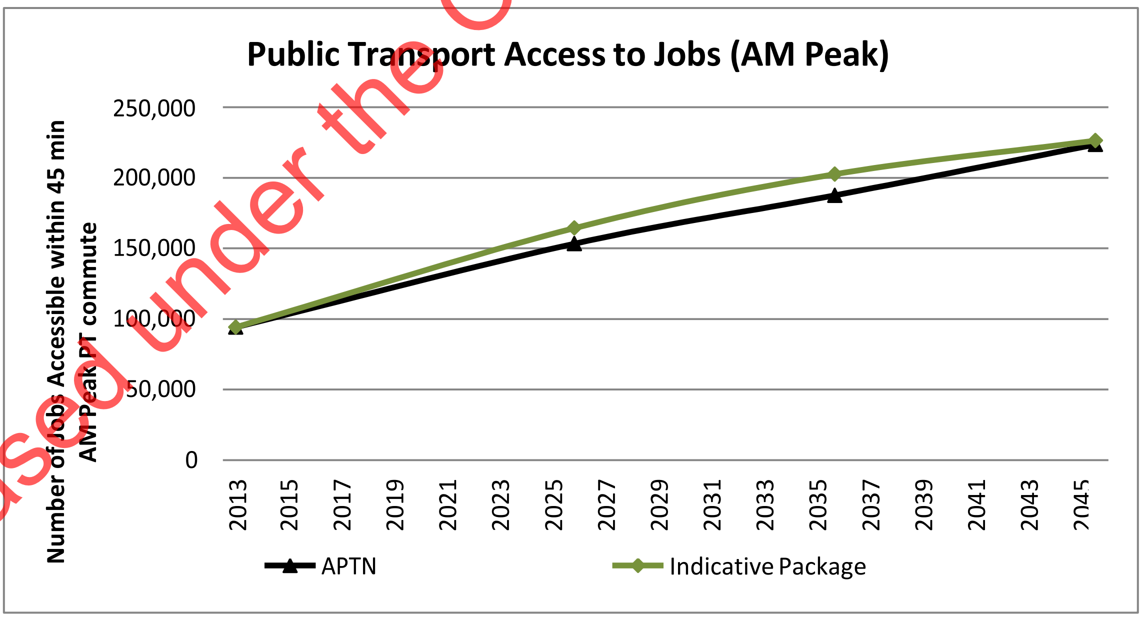

Figure 5.8: Public transport accessibility to jobs within a 45 minute PT commute AM peak (Indicative Package and APTN)

At a sub-regional level, there is a dramatic improvement to car access after 2026 under the Indicative Package as a result of the introduction of smarter pricing (Figure 5.9). Accessibility improves across the region, most particularly in the northwest, North Shore and parts of the south.

Car accessibility improves compared to the Base Network in 2026 particularly for areas outside of the isthmus. The Indicative Package highlights improved car accessibility from the peripheral areas of Auckland, due to motorway improvements to the outer motorway network.

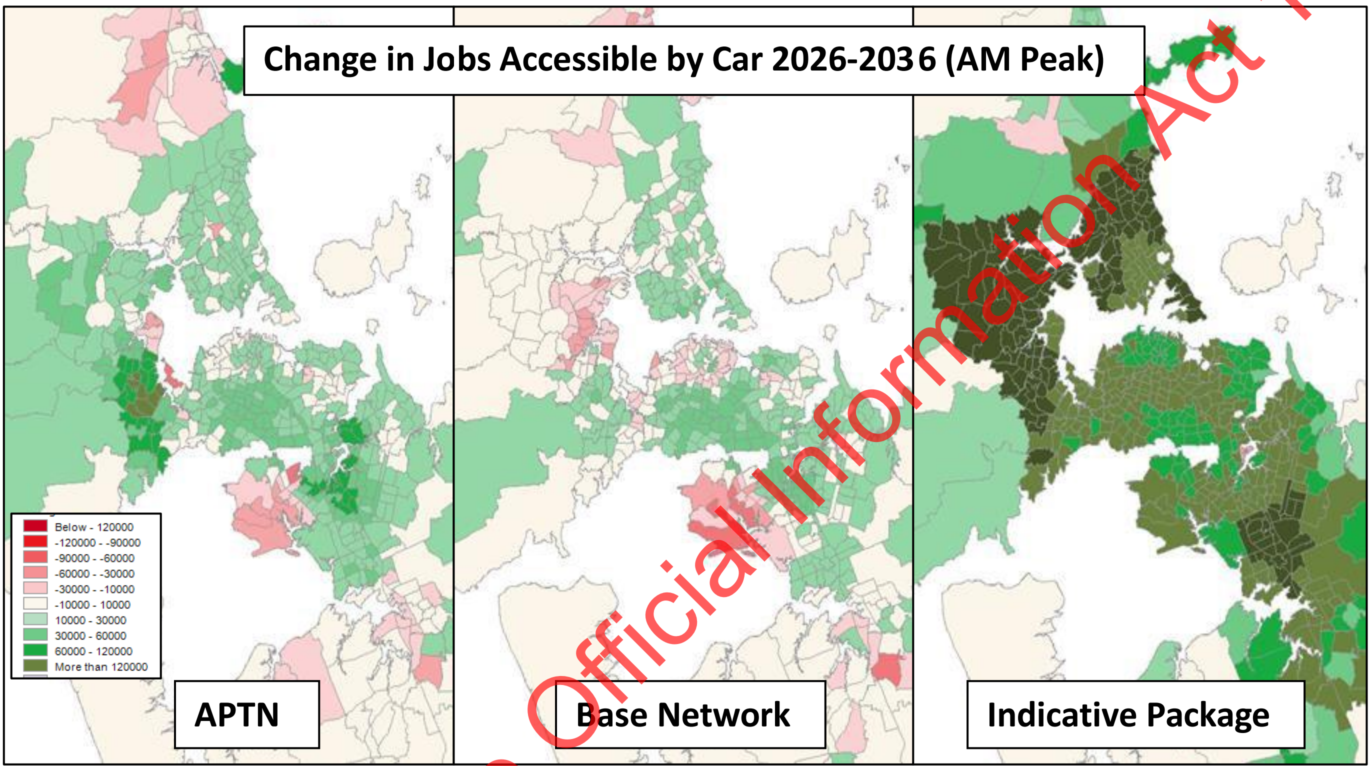

Figure 5.9: Change in car accessibility to jobs AM peak 2026 - 2036 (Indicative Package, APTN and Base)

Despite the increase in public transport use, public transport accessibility also improves in parts of Auckland after 2026 as a result of additional investments, although to a lesser extent compared to car accessibility (Figure 5.10). In particular, improvements are seen in the northwest, parts of the isthmus and parts of the southeast. Projects that would have improved travel times include extensions to the Northwestern Busway, mass transit from the Airport to the city centre, and bus improvements from Airport to Botany.

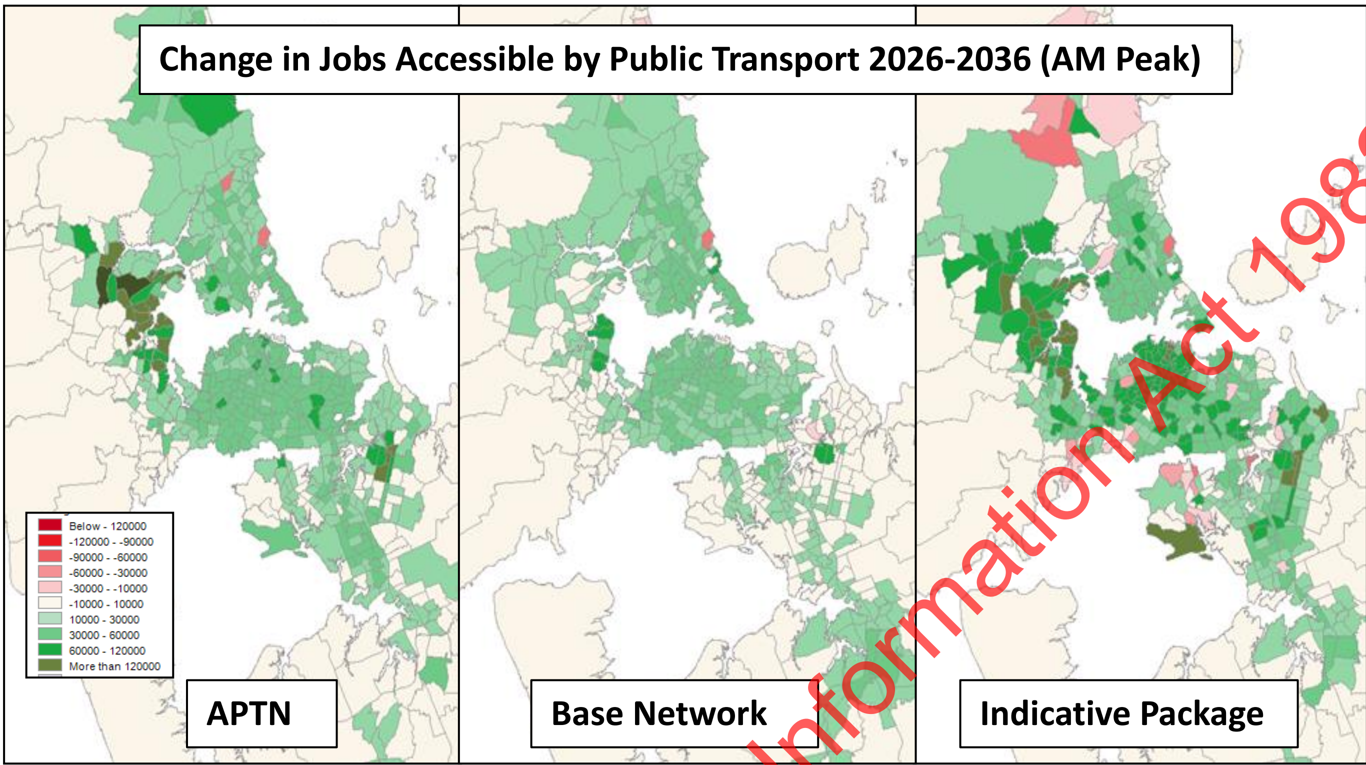

Figure 5.10: Change in PT accessibility to jobs AM peak 2026 - 2036 (Indicative Package, APTN and Base)

Accessibility by sub-region

West:

Car accessibility is projected to get worse in the first decade for both packages, and only just fully recovers by 2046 under the APTN (Figure 5.11). In the Indicative Package, the introduction of smarter pricing is very effective - bringing almost an additional 250,000 jobs within reach of a 30 minute car commute.

The Indicative Package provides noticeably higher public transport access in the first and second decades.

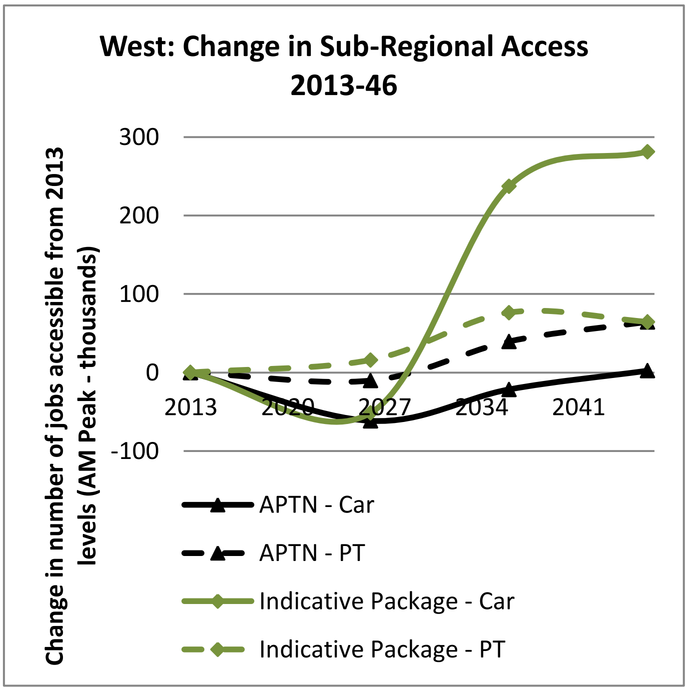

Figure 5.11: Change in sub-regional access to jobs from West Auckland AM peak (APTN and Indicative Package)

South:

The APTN results in poorer access over the first decade and minimal accessibility improvements over the next 30 years for either car or public transport (Figure 5.12).

Under the Indicative Package there is a marked improvement in car accessibility in the second decade, driven by the implementation of pricing. However, public transport access in the south remains low under the Indicative Package, barely increasing at all over time.

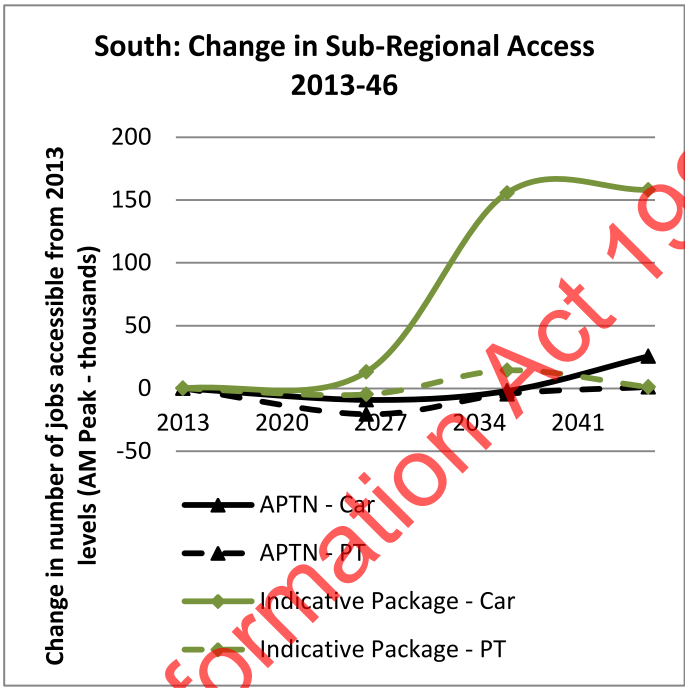

Figure 5.12: Change in sub-regional access to jobs from South Auckland AM peak (APTN and Indicative Package)

North:

Car accessibility for both packages does not improve in the first decade (Figure 5.13). Subsequently, the introduction of smarter pricing significantly improves car access, which is continued to a minor extent in the third decade by construction of a new harbour crossing.

Public transport access increases at a similar level for both packages throughout the next 30 years, with increases in the third decade driven by a major upgrade to a higher capacity mass transit option from the North Shore to the city centre.

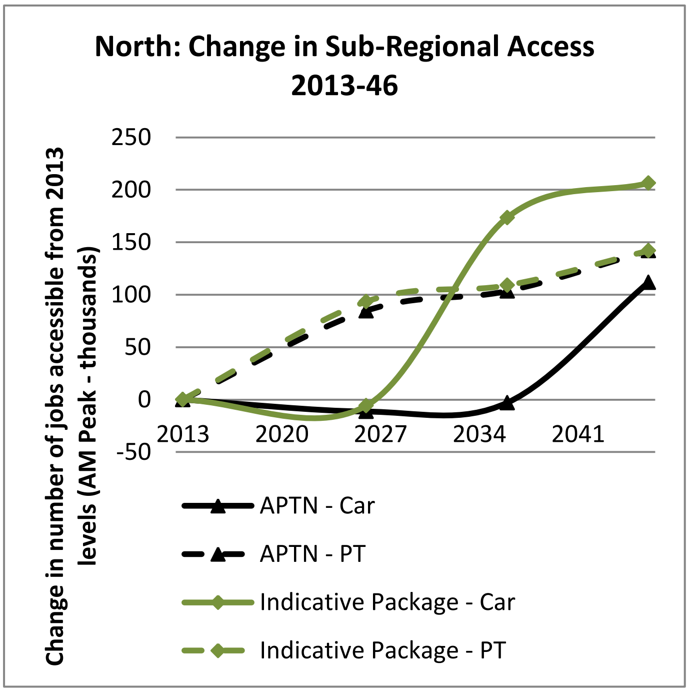

Figure 5.13: Change in sub-regional access to jobs from North Auckland AM peak (APTN and Indicative Package)

Central:

Both car and public transport accessibility steadily increase throughout the 30 year period under the APTN, reflecting the large growth in employment projected in central Auckland (Figure 5.14).

The Indicative Package provides a much greater increase in car accessibility in the last two decades.

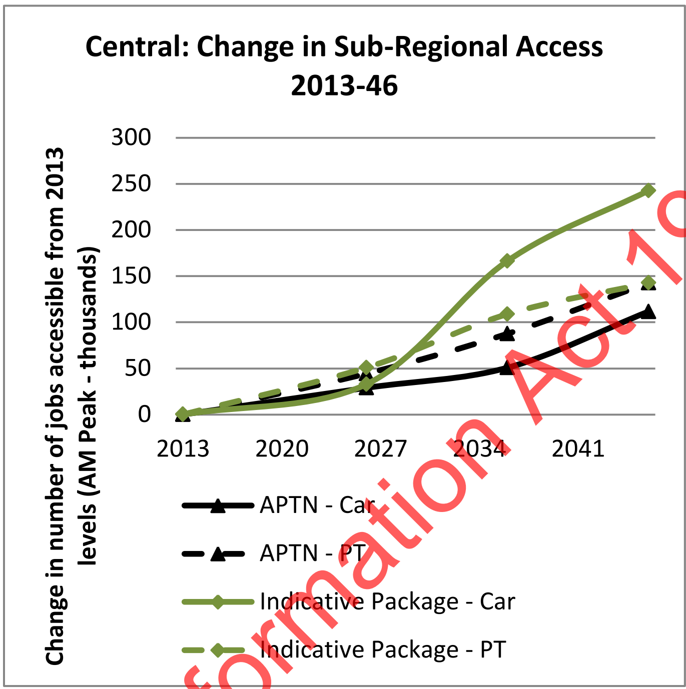

Figure 5.14: Change in sub-regional access to jobs from Central Auckland AM peak (APTN and Indicative Package)

Congestion

The Indicative Package addresses congestion to a greater extent than the APTN. The proportion of travel time in severe congestion during the morning peak, across the whole transport network, is projected to decline from 27% to 21% over the next 30 years (Figure 5.15). This mainly arises due to progressively implementing smarter pricing rather than increasing the level of investment in infrastructure.

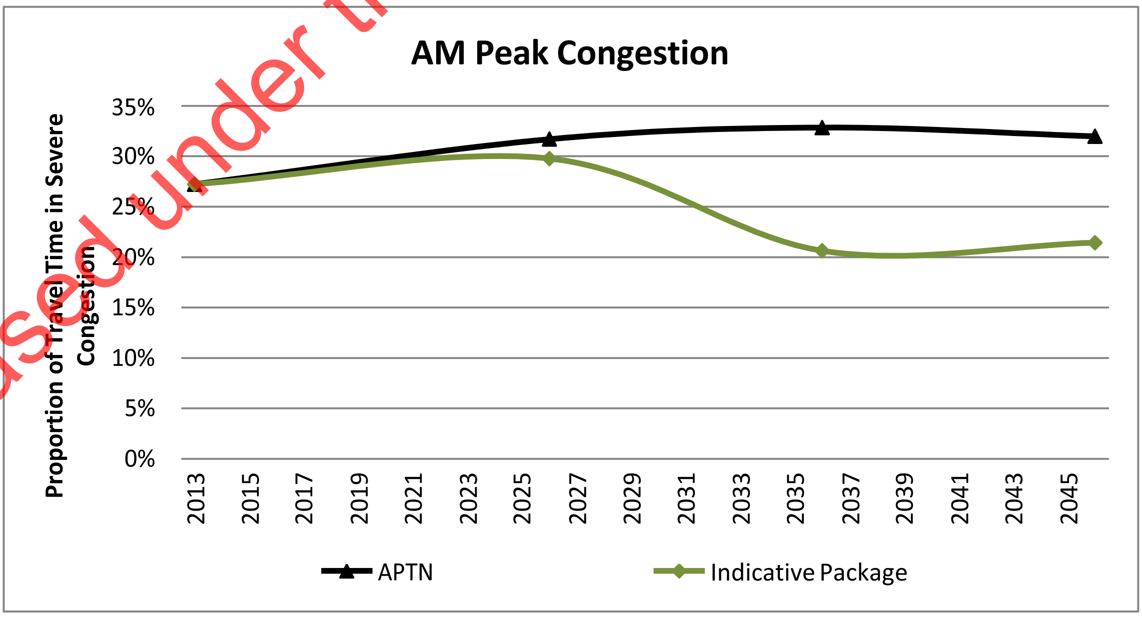

Figure 5.15: AM peak severe congestion (Indicative Package and APTN)

Projected inter-peak congestion shows similar trends, with the introduction of smarter pricing holding congestion at around 2013 levels over the next 30 years, despite population and employment growth (Figure 5.16).

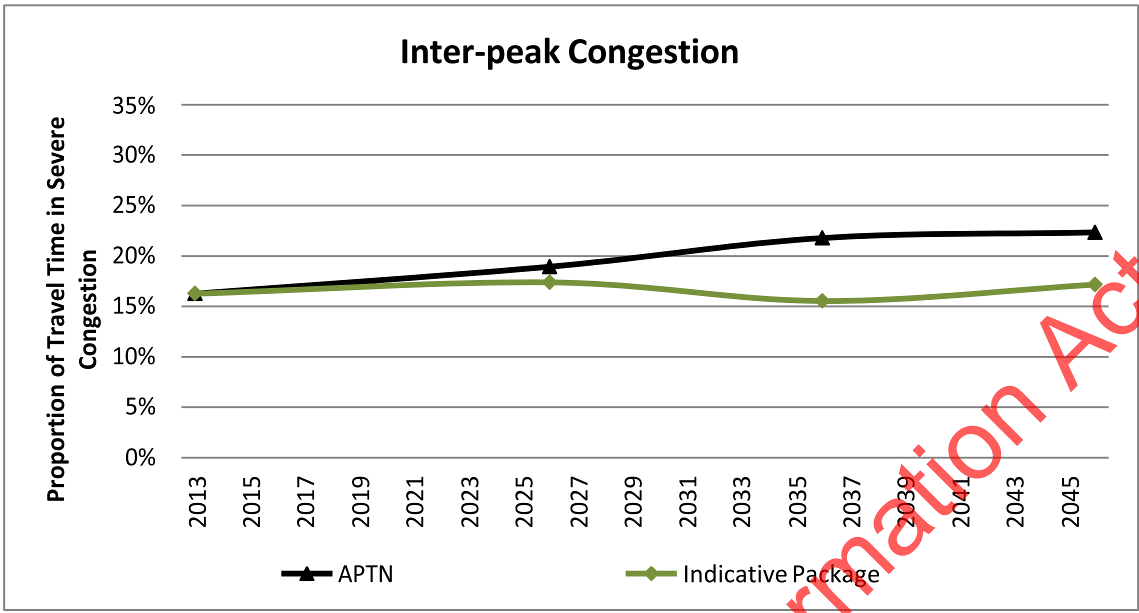

Figure 5.16: Inter-peak severe congestion (Indicative Package and APTN)

Freight congestion is projected to remain at similar levels between 2013 and 2026 under the Indicative Package, after which it reduces significantly between 2026 and 2036 before increasing slightly up until 2046 (Figure 5.17). In comparison, freight congestion increases steadily under APTN until 2036 before reducing, with congestion levels in 2046 remaining higher than 2013.

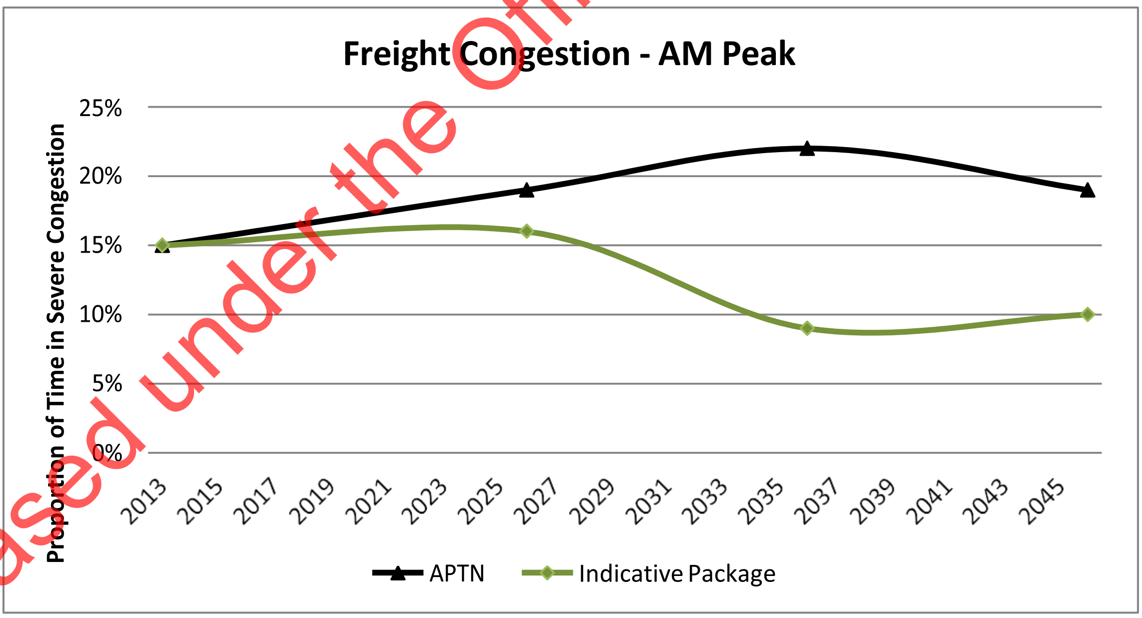

Figure 5.17: Freight AM peak severe congestion (Indicative Package and APTN)

The proportion of time spent in severe congestion for freight during the inter-peak remains significant, though lower compared to the AM peak. After 2026, congestion on the freight network reduces slightly under the Indicative Package and increases sharply under the APTN. After 2036, inter-peak freight congestion increases slightly under the Indicative Package and reduces under the APTN.

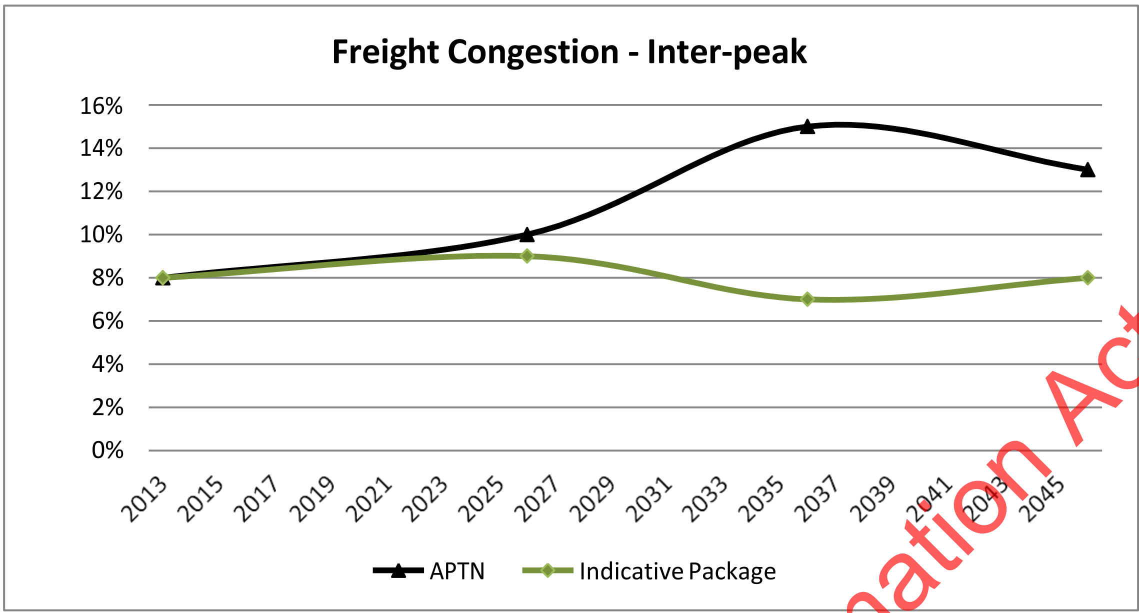

Figure 5.18: Freight inter-peak severe congestion (Indicative Package, APTN and ATAP Baseline)

At a sub-regional level, there are less capacity constraints during the AM peak in the Indicative Package network, compared to the APTN, as illustrated in more detail in the following volume to capacity plots (Figure 5.19).

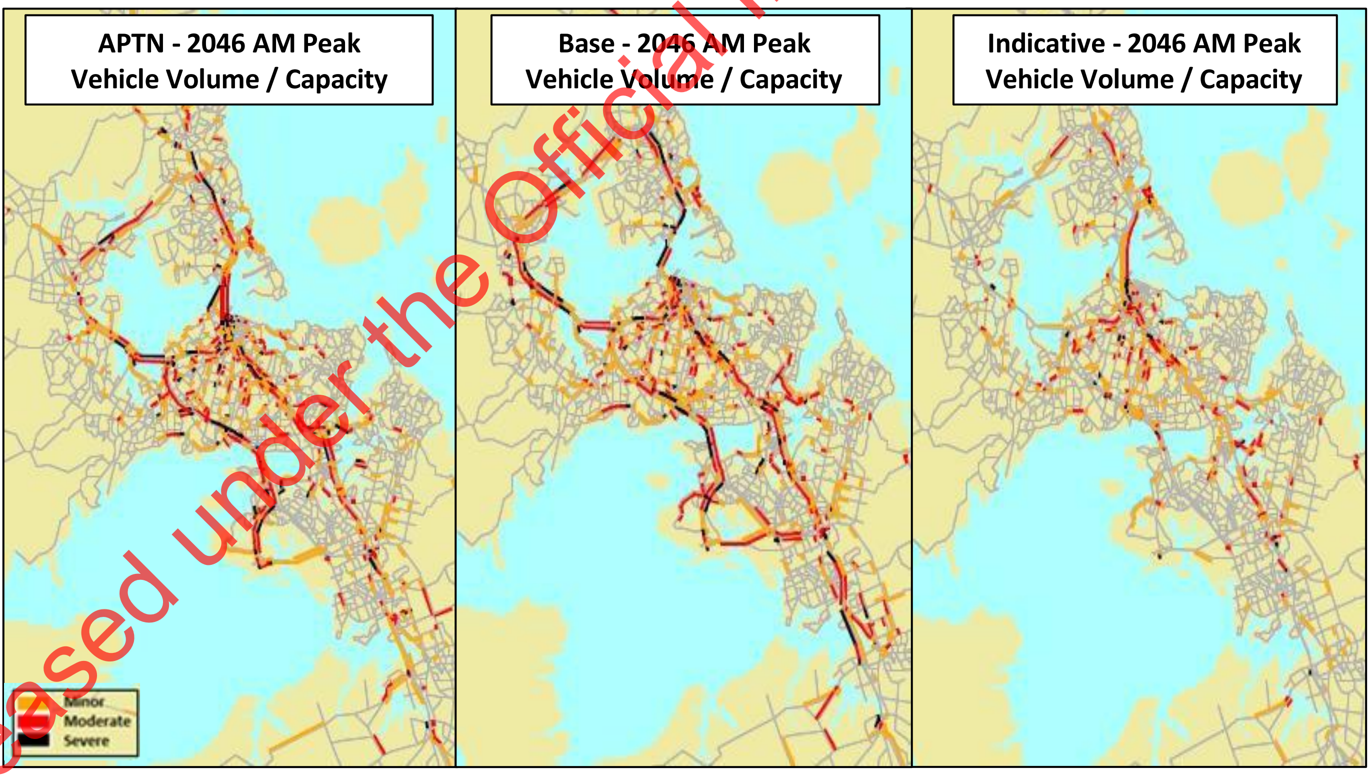

Figure 5.19: AM peak vehicle volume to capacity 2046 (Indicative Package, APTN and ATAP Baseline)

While some pinch points remain under the Indicative Package, most of the network is projected to operate below moderate or severe levels in 2046. In contrast, under the APTN much of the transport network, particularly the motorway network, is projected to experience moderate or severe congestion during peak periods (and increasingly during the inter-peak). With the Indicative Package severe congestion in the inter-peak is reduced to isolated pockets (Figure

5.20).

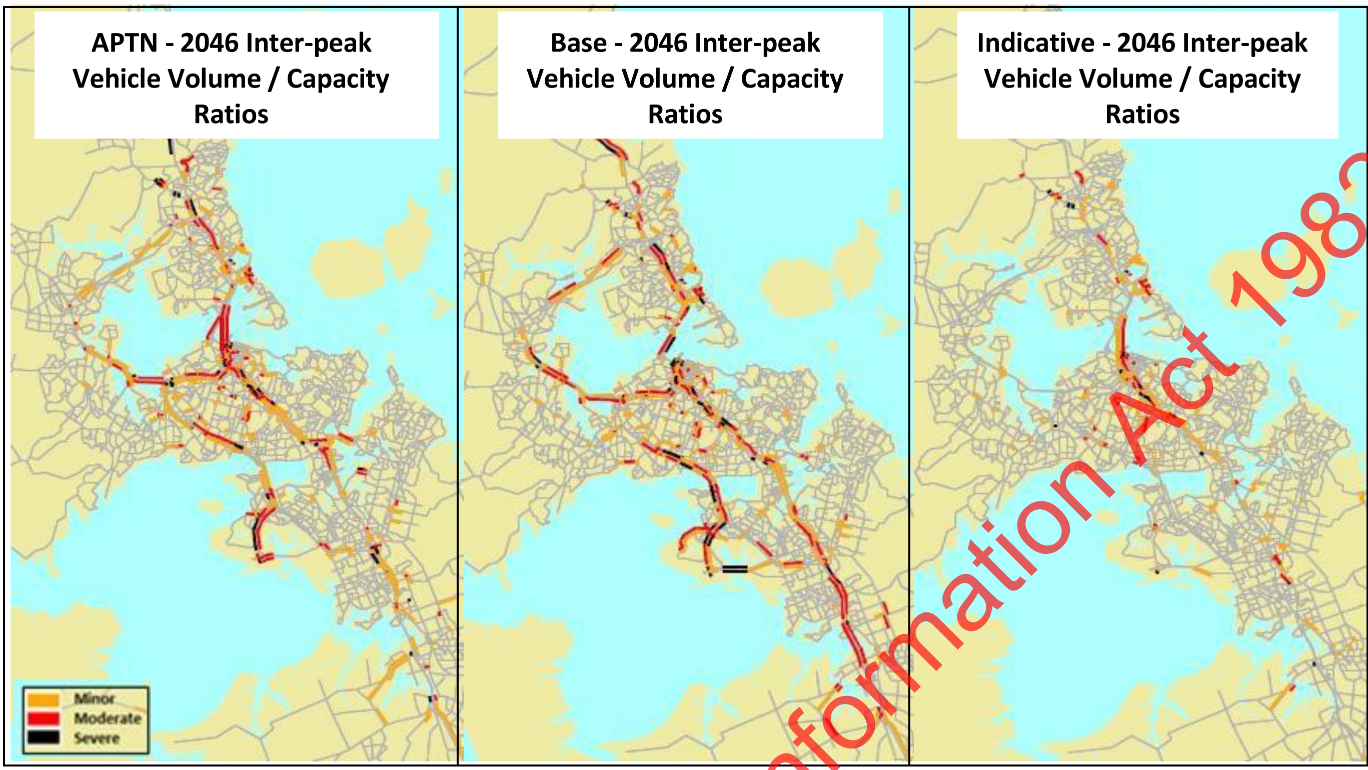

Figure 5.20: Inter-peak vehicle volume to capacity 2046 (Indicative Package, APTN and ATAP Baseline)

Public Transport Mode Share

The Indicative Package increases public transport mode share for all trips in the morning peak from what is projected to occur under the APTN. Between 2013 and 2026, the Indicative Package achieves similar levels of public transport mode share in the AM peak as APTN (Figure 5.21). After 2026, public transport mode share continues to increase under the Indicative Package. Mode share also increases under APTN, although at a slower rate.

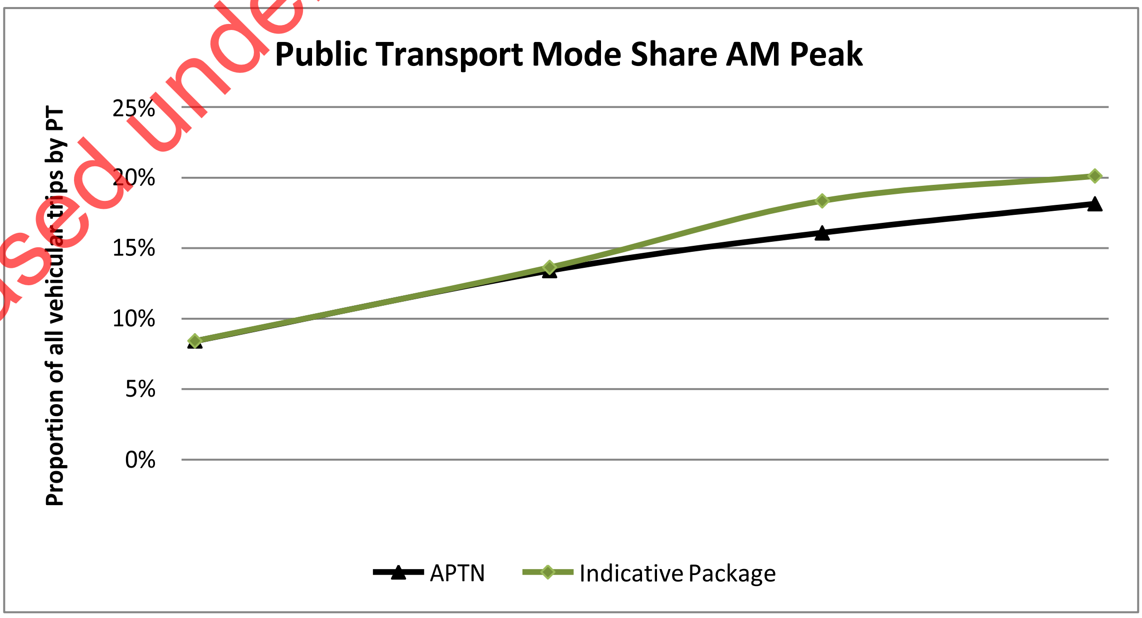

Figure 5.21: Public transport mode share AM peak (Indicative Package, APTN and ATAP Baseline)

Approximately a third of vehicular journeys to work (trips to employment either by public transport or private vehicle) in the morning peak are projected to be taken by public transport by 2046 under the Indicative Package, compared with 29% under the APTN. Combined with population growth, this growth in public transport mode share is projected to increase annual boardings from 83 million (in the year to July 2016) to around 265 million over the next 30 years.

While pricing has reduced demand for the roading network, it is projected to substantially increase demand for public transport services. The additional investment to public transport infrastructure over and beyond that allocated under Influencing Demand has reduced some constraints on the public transport network (Figure 5.22). However, demand on the bus RTN continues to exceed capacity at parts of the network, particularly along the Northwestern Busway and key isthmus corridors, indicating the need for further services or investment. On the other hand, capacity to the Airport, North Shore and southeast improves compared to the Base Network as a result of the inclusion of mass rapid transit in those areas.

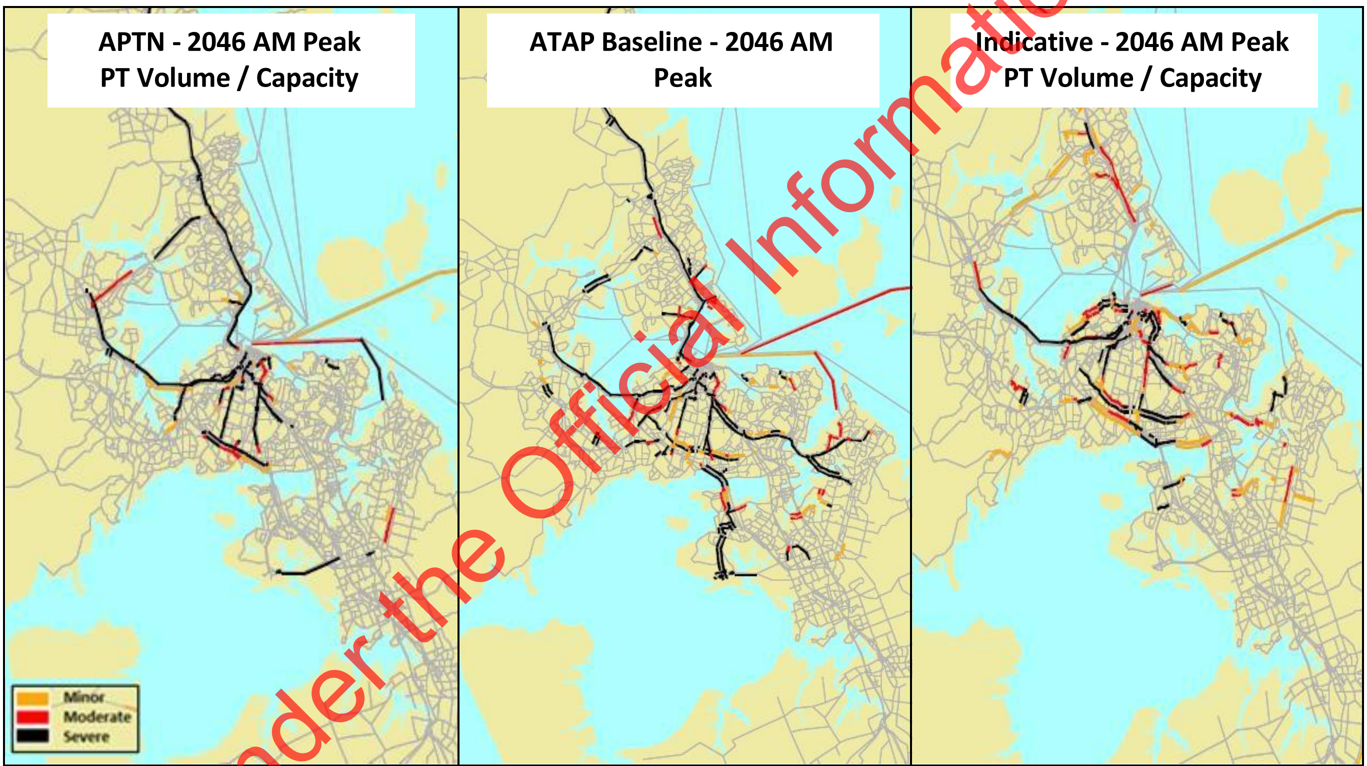

Figure 5.22: Public transport volume to capacity AM peak 2046 (Indicative Package, APTN and ATAP Baseline)

Net Benefits to Users

"Net benefits to users" was estimated because the Indicative Package increases the financial costs of motorists using the transport system, depending on time of day and the route taken. The same variable network pricing system was used in the Indicative Package as was used in the Influence Demand package (Table 4.2).

Motorists receive a benefit from the improved network performance (in terms of shorter travel times and lower vehicle operating costs) but also face increased costs from having to pay the smarter pricing. The estimated difference between those benefits received and the smarter pricing costs are set out in Figure 5.23 below.

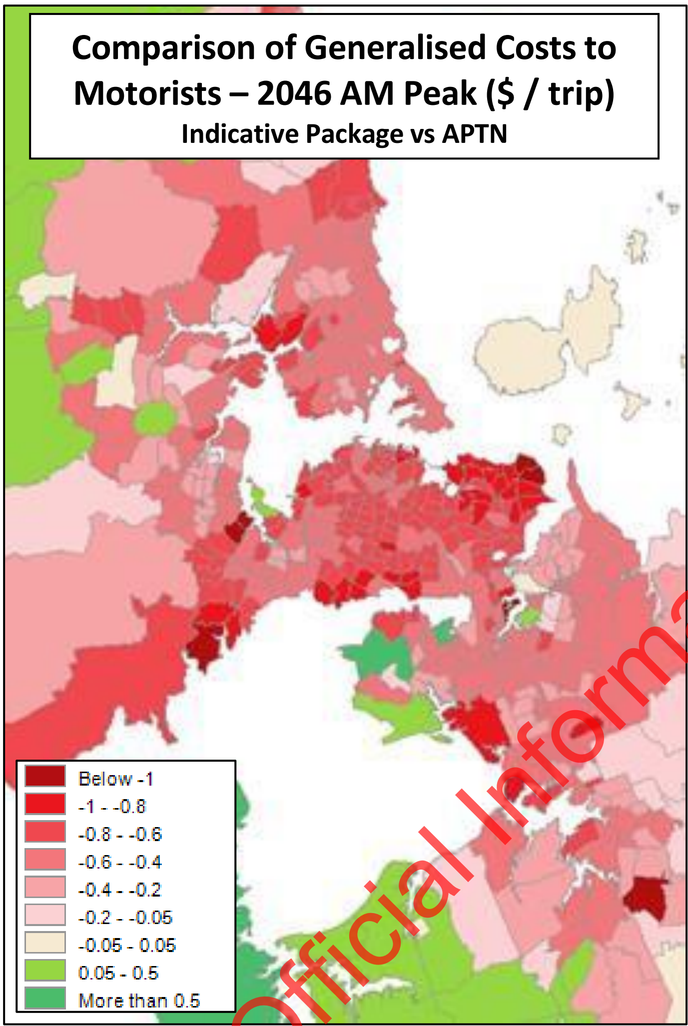

Figure 5.23: Generalised costs to road users AM peak 2046 (Indicative Package vs APTN)

The above calculations do not take into account the wider benefits that users of the transport system would gain from increased accessibility and reduced congestion. However, these findings should be treated with caution. This is a necessarily coarse approximation of how pricing might be applied, which means that some uncongested roads were subject to the same charge as congested routes. Furthermore, our analysis did not consider the likelihood that some users would place a much higher value on time savings than others. Further work, using much more detailed analytical tools, is required to identify efficient pricing levels which effectively address these issues.

As shown in the previous sections, our analysis suggests moving to smarter transport pricing would deliver very material gains in accessibility and reductions in severe congestion.

We expect that more detailed development and analysis will go a long way towards ensuring overall net user benefits from the introduction of pricing. Prices could be adjusted to lower levels and at a finer-grain (e.g. on uncongested counter-peak motorways). With better information, prices could also take into account the impacts on users with different values of time.

It will be important to understand where travel cost increases occur under a particular pricing structure so that equity impacts (including the affordability of travel to different groups, and the impact of pricing on access to jobs, education and services) can be assessed and any necessary mitigation can be developed.

Value for Money

The project's Terms of Reference require consideration of the costs and benefits of alternative combinations of interventions and whether better returns can be achieved from transport investment than current plans. Value for money is normally assessed through cost benefit analysis, which compares the level of benefits against the size of an investment.

The Indicative Package has an estimated $38.6 billion capital expenditure programme over 30 years (excluding renewals) which is projected to result in significantly higher contributions to the ATAP objectives compared to the APTN, but with a larger capital improvement programme and a higher average cost to motorists.

The Indicative Package is projected to result in a higher proportion of jobs accessible by motorists of 60% (compared to 43% in the APTN), a similar proportion of jobs accessible by public transport of 25% (compared to 24% in the APTN), a significantly lower proportion of travel time in severe congestion of 21% in severe congestion in the morning peak (compared to 32% in the APTN) and a moderately higher public transport mode share of 20% in the morning peak (compared to 18% in the APTN).

In assessing value for money, large differences between benefit-cost estimates at a 'package-wide' level and at a 'project' level became clear. In particular, more refined project level analysis appeared to capture project benefits to a much greater degree than the package-wide analysis. Table 5.3 below identifies the indicative benefit cost ratios of some of the key projects identified for the first decade which supports that conclusion.

Table 5.3: Indicative Benefit Cost Ratios of 1st Decade Projects

Project	BCR	Comments	Source
		Existing Commitments	
SH1 Northern Corridor Improvements	3.0	BCR includes busway extension to Albany	NZTA
SH1 Southern Corridor Improvements	6.0-9.0	BCR range depends on the growth scenario used	NZTA Board Paper – March 2015
East West Link	1.9		NZTA
Cycle sea path (AHB to Akoranga)	3.8		NZTA
Puhoi To Warkworth	1.1		NZTA
		Major Projects in Indicative Package	
SH20B	1.2	Overall Southwest Auckland and Airport Corridor programme	
TFUG South Northwest North Warkworth Total	 3.5-3.7 2.2-3.4 3.2-3.7 1.1 3.1-3.6	Preferred Programme compared with Do Minimum	TFUG draft Programme Business Case
North-western Busway	1.4	Westgate – City = 1.4 Westgate –Waterview = 1.2 Waterview – City = 1.9	NZTA
Mill Road (Northern section)	2.2	For northern section only	June 2013 Scheme Assessment Report
AMETI - Entire programme	1.5	Includes AMETI Link Road, Reeves Road flyover as well as busway from Panmure to Botany	June 2015 - AMETI Overall Package and Individual Component Economic Evaluation (2015)

Limitations of the strategic modelling tools were considered to be the likely cause of this difference and therefore we did not rely on package-wide benefit cost assessment based on modelling outputs. There are a number of uncertainties associated with a shift to smarter transport pricing that will require further more detailed analysis. Further understanding is required of how users will respond to the smarter pricing, and the social and economic consequences of those responses. Current analytical tools do not enable more detailed socio-economic segmentations in order to have more detailed economic and equity assessments of road pricing. Our analytical tools are not calibrated to assess the detail of a potential pricing system because of the following:

- They use fixed-trip matrices so are unable to show the extent to which the introduction of pricing may result in trip suppression (trips no longer being made).
- They are also not able to consider different values of time or vary prices at a more micro-level, so provide a very simplistic representation of what the impacts of a scheme might be.

Updated and more sophisticated analytical tools, with a particular focus on models that enable better testing of behavioural responses to pricing and technology changes, will be required to enable a more robust assessment of benefits and costs.

We focused on assessing the Indicative Package's value for money in the following ways:

- Ensuring identified 'early priorities' are likely to provide value for money if they are implemented over the next decade. Our prioritisation framework (Table 5.2) assessed the likely relative costs and benefits of major investments.
- A number of identified early priorities have existing value for money assessments indicating they deliver benefits that exceed their costs (Table 5.3).
- Analysis against our evaluation framework showed the Indicative Package will deliver better region-wide outcomes than current plans and significantly better results than a higher investment package that did not include smarter pricing (Table 5.4). This finding suggests that the inclusion of smarter pricing is key to achieving value for money.

Beyond these early priorities it becomes more challenging to assess value for money, as uncertainties relating to project costs, the location and quantum of growth, and the impacts of smarter pricing and new technologies become increasingly significant. Our most substantial uncertainty relates to large, longer-term infrastructure investments. The timing and scope of these investments should be monitored over time, particularly with regard to whether they provide value for money as we shift to a greater focus on influencing demand.

5.3 Full Evaluation Results

The following table presents the results of our evaluation of the Indicative Package against the evaluation criteria established in the Foundation Report (Table 5.4). All results relate to the 2046 year unless otherwise specified.

Table 5.4: Evaluation framework – headline measures

Objective	Measure	Headline KPI	Indicative Package	APTN	Comment in relation to Indicative Package
Improve access to employment and labour	Access to employment and labour within a reasonable travel time	• Jobs accessible by car within a 30 minute trip in the AM peak • Jobs accessible by public transport within a 45 minute trip in AM peak • Proportion of jobs accessible to other jobs by car within a 30 minute trip in the inter-peak	533,000 i.e. 60% of available jobs 226,000 i.e. 25% of available jobs 656,000 i.e. 74% of available jobs	386,000 i.e.43% of available jobs 215,000 i.e. 24% of available jobs 590,000 i.e. 66% of available jobs	The Indicative Package significantly increases car accessibility (measured only in relation to travel time, not financial cost) in the morning peak (7-9 am) in 2046, with a moderate increase in accessibility by public transport. Car accessibility (measured only in relation to travel time, not financial cost) during the day is at similar levels in 2046 as in 2013.
Improve congestion results	Impact on general traffic congestion	• Per capita annual delay (compared to efficient throughput) • Proportion of travel time in severe congestion in the AM peak and inter-peak	4 hours 8 minutes per person per annum 21.4% AM peak 17.2% inter-peak	13 hours 33 minutes per person per annum 31.9% AM peak 21.9% inter-peak	Forecast congestion on the road network is significantly better throughout the day, compared to the APTN.
	Impact on freight and goods (commercial traffic) congestion	Proportion of business and freight travel time spent in severe congestion on the strategic freight network (in the AM peak and inter-peak	10.1% AM peak 8.0% inter-peak	18.6% AM peak 12.9% inter-peak	Forecast congestion on the freight network is significantly better throughout the day, compared to the APTN.
	Travel time reliability	• Proportion of total travel subject to volume to capacity ratio of greater than 0.9 during AM peak, inter-peak and PM peak.	9% AM peak 7% inter-peak 11% PM peak	19% AM peak 13% inter-peak 23% PM peak	Forecast reliability of travel times for motor vehicle trips is expected to be significantly better throughout the day, compared to APTN.
Increase public transport mode-share	Public transport mode share	Proportion of vehicular trips in the AM peak made by public transport	20.1%	18.0%	Forecast PT mode share is slightly higher than APTN.
	Increase public transport where it impacts on congestion	• Proportion of vehicular trips over 9 km in the AM peak made by public transport	37.4%	31.7%	It is forecast that a higher proportion of longer commute trips would be by PT in the Indicative Package than APTN.
	Increase vehicle occupancy	• Average vehicle occupancy	-	-	It wasn't possible to model changes in vehicle occupancy. The input assumptions of 1.36 people per vehicle in the AM peak and 1.25 people per vehicle in the inter-peak remained constant for all packages and all model years. The Indicative Package includes programmes to increase vehicle occupancy.
Increased financial costs deliver net user benefits	Net benefits to users from additional transport expenditure	• Increase in financial cost per trip compared to savings in travel time and vehicle operating cost	-	Not applicable	Financial costs from a variable network charge (see pricing schedule in Table 4.2) are assumed to replace road user charges and fuel excise duties. Savings in travel time and vehicle operating costs vary by trip. This analysis requires better model/tools to provide robust quantification of benefits.
Ensure value for money	Value for money	Package benefits and costs	-	-	Package benefits include the improved contributions to objectives as measured in this table. The total cost of the 30 year programme is estimated as $84 billion (in 2016 dollars).

In addition to the project objectives, a number of other key outcomes have been evaluated through the evaluation framework in Table 5.5 below.

Table 5.5: Evaluation framework – other key outcomes

Other Key Outcomes	Measure	Headline Key Performance Indicator	Indicative Package	APTN	Comment in relation to Indicative Package
Support access to housing	Transport infrastructure in place when required for new housing	• Transport does not delay urbanisation in line with timeframes of Future Urban Land Supply Strategy	Approximately half the new bulk transport infrastructure required by FULSS in the Southern and NW greenfields areas is programmed to be in place by 2028. Approximately 20% in the North is programmed to be in place when required by 2038. Almost 100% in Warkworth is programmed to be in place when required by 2038.	Does not meet timeframes of FULSS.	Approximately half of major greenfield network projects are programmed to be in place in accordance with timeframes of the FULSS.
Minimise harm	Safety	• Deaths and serious injuries per capita and per distance travelled	-	-	Model forecasts can't accurately identify number of deaths and serious injuries.
	Emissions	• Greenhouse gas emissions	7.4 million kg of CO_2 per day	8.1 million kg of CO_2 per day	Model forecasts 9% fewer emissions in Indicative Package than APTN. This is mostly due to fewer trips and shorter distance of trips.
Maintain existing assets	Effects of maintenance and renewals programme	• Asset condition levels of service • Renewals backlog	The indicative package programme is expected to achieve higher levels of service than in 2016 and similar levels of service to the APTN. This clears any renewals backlog.	Similar to indicative package	The maintenance and renewals programme aims to achieve service levels that reflect the ONRC and AT's goal of attaining a network 'steady state' and achieve consistent levels of service across legacy networks.
Social inclusion and equity	Impacts on geographical areas	• Access employment in high deprivation areas • Distribution of impacts (costs and benefits) by area	Lower levels of accessibility by car and PT are forecast from high deprivation areas in the south and west, compared to the rest of the region. Generalised costs generally increase as a result of road pricing.	The Deficiency Analysis identified significantly lower levels of access in the south and west.	The indicative package has prioritised investment in the first decade to improve access from the south and the west. The evaluation working paper contains graphs showing the geographic impacts of the indicative package.
Network resilience	Network vulnerability and adaptability	• Impact in the event of disruption at vulnerable parts of the network	-	-	The Indicative Package network has a similar level of network resilience to the APTN. Resilience is improved in the Indicative Package in the following ways: Firstly, pricing of the road network reduces vehicle kilometres travelled on the road network by about 10% which could result in less diversion and impact in the event of disruption to the road network. Secondly, there is greater capacity in the PT network. This enables PT to take additional people in the case of disruption. Optimisation of technology provides choice and information during a disruption. There are a similar number of additional crossings in the Indicative Package compared to the APTN.

5.4 Growth Assumptions

The Indicative Package has been evaluated based on medium growth assumptions, as set out in Table 5.6 below.

Table 5.6: Medium growth forecast assumptions for population and employment growth

	2013	2026	2036	2046
Population	1,471,108	1,871,614	2,064,205	2,279,341
Employment	618,152	722,932	808,839	892,457

A sensitivity test was also done in respect of the Indicative Package based on high growth assumptions, as set out in Table 5.7 below.

Table 5.7: High growth forecast assumptions for population and employment growth

	2013	2026	2036	2046
Population	1,471,108	1,889,795	2,208,823	2,508,634
Employment	618,152	751,628	865,491	982,217

An evaluation of the Indicative Package based on high growth assumptions was done in relation to the 2046 model year only (building on the previous sensitivity testing which indicated similar results at 2026 for previous packages). The projected results indicated worse network performance in terms of accessibility and congestion. An additional 9.2% increase in vehicle kilometres travelled corresponds with an increase from 21% to 24% of the proportion of time that cars spend in severe congestion in the am peak in 2046 under the Indicative Package. The inter-peak results are projected to worsen from 17% to 19% in 2046. The proportion of jobs accessible by car within 30 minutes in the am peak in 2046 is projection to be 60% under medium growth assumptions and 56% under high growth assumptions. Public transport mode share projections are virtually the same at 2046 under high growth and medium growth assumptions.

This limited analysis suggested that high growth over the next 30 years would result in reduced accessibility to jobs and higher levels of congestion, compared with medium growth forecasts.

5.5 Indicative Package Conclusions

The Indicative Package is projected to deliver substantially better outcomes against the key project objectives of access to employment, congestion and public transport mode share, when compared to the APTN. The most significant gains are increases to accessibility by car and reductions in peak congestion levels.

The Indicative Package also addresses some of the key sub-regional challenges facing Auckland, although some of the challenges remain. The west achieves the greatest improvement in employment access, with around 280,000 more jobs being accessible compared to the APTN in 2046. However, car access in the west declines in the first decade. In the south, the Indicative Package provides access to around 130,000 more jobs within a 30-minute car ride in the AM peak than the APTN. However, there is little improvement to public transport access in the south.

It is important to emphasise that the step-change in performance against these objectives is largely driven by the introduction of smarter transport pricing, which is assumed to be fully implemented in the second decade. Further analysis is required to assess the impacts of pricing on net user benefits in greater detail. More sophisticated analytical tools will be required to undertake this work before a viable scheme could be developed.

Appendices

Appendix A – Evaluation Framework

1. Introduction

The purpose of this paper is to record and explain the framework used to evaluate transport packages in the Auckland Transport Alignment project to enable a robust and transparent analysis of different transport investments.

This paper outlines how the returns from transport investment over the next 30 years will be assessed. It identifies the objectives and other key transport outcomes (section 2) and key performance indicators (section 3) in relation to those objectives and outcomes.

A full list of key performance indicators is set out at the end of this Appendix.

The evaluation framework will be used for three key tasks:

- Assessing the existing transport programmes to understand where further performance improvements are required and where improved value for money could be obtained.
- Assisting with the initial round of intervention packages where the focus is on understanding the strengths and weaknesses of each intervention, rather than how the interventions compare to each other.
- Assessing refined intervention packages where the focus is on comparing the relative merits of the different packages in achieving the project objectives.

2. Project Objectives

The project's Terms of Reference outline its objectives, with the key focus being to test whether better returns from transport investment (i.e. value for money) can be achieved in the medium and long-term, particularly in relation to the following:

i. To support economic growth and increased productivity by ensuring access to employment/labour improves relative to current levels as Auckland's population grows
ii. To improve congestion results, relative to predicted levels, in particular travel time and reliability, in the peak period and to ensure congestion does not become widespread during working hours
iii. To improve public transport's mode share [relative to predicted results], where it will address congestion
iv. To ensure any increases in the financial costs of using the transport system deliver net benefits to users of the system.

The project objectives alone will not achieve all the broad outcomes sought from transport investment. A number of other key transport outcomes and demand on transport expenditure, such as maintaining existing assets and providing a basic level of infrastructure to enable growth, will require significant investment over the next 30 years and also need to be taken into account in the evaluation process.

The following is an explanation of the above objectives and other key transport outcomes that a transport system is expected to contribute to.

2.1. Improve access to employment and labour

Transport networks support the growth, productivity and success of urban areas and their catchments, by getting people to work, supporting deep, diverse and productive labour markets and allowing businesses within the area to reap the benefits of agglomeration.

This objective focuses on improving access to employment and labour in order to support the ultimate objective of achieving economic growth and increased productivity. The workforce should have access to an increasing number of jobs and proportion of the region's jobs, taking into account an increase in population and jobs over the next 30 years. Similarly, employers should have access to an increasing number of workers and proportion of the region's labour pool, taking into account an increase in population over the next 30 years. Access, in terms of a reasonable travel time and cost, is the important factor relating to this objective.

If people have a higher number of jobs within a reasonable commute time, this will increase their likelihood of finding the most suitable job, make it easier to build on their skills and reduce their vulnerability to long-term unemployment if they lose their job. Similarly, employers with larger labour pools (a greater number of people within reasonable commute time of their location) have a greater likelihood of finding the most suitable employees. For highly specialised employment types, where productivity levels are highest, accessing larger labour pools becomes particularly important.

This objective also focuses on access between business areas during the day to improve productivity and enable Auckland to carry out its freight and service functions efficiently.

2.2. Improve congestion results

This objective aims to achieve better congestion results, compared to the projected level of congestion from previously proposed programmes. The objective requires consideration of a different mix of interventions in the transport system, taking into account projected growth, value for money, and impacts of future changes in technology and travel behaviours.

Some level of congestion is a by-product of a successful city and generally cities with very low levels of congestion are either relatively small or in decline. However, congestion adds significant costs to doing business and moving freight, can reduce accessibility and quality of life and is a key concern for Auckland's travelling public. Congestion also impacts on the reliability of travel, adding costs by forcing travellers to add extra time to their journey to allow for the potential of delay. Therefore, congestion will be measured not only in terms of delay but also the reliability of travel times.

There are many different definitions of congestion. For the purposes of this project, congestion is defined as 'severe congestion', where the flow of traffic breaks down, speeds drop and stop-start-motoring begins[6]. This is also the point where traffic demand exceeds maximum practical capacity.

2.3. Improve public transport mode share where it will address congestion

This objective aims to achieve better public transport mode share from a transport package, compared to the projected public transport mode share from previously proposed programmes, where it will address congestion. The objective is focused on public transport use at times of the day and on parts of the network where there is congestion. The underlying assumption is that that people using public transport will not exacerbate congestion and therefore will have a positive impact on congested parts of the network.

Public transport carries a significant number of people efficiently along corridors of high demand, using space efficiently when compared to private vehicles. This attribute is particularly important in more intensive locations such as major centres where space is very valuable. Public transport trips are often focused at peak times to major centres of employment (especially the city centre) and are quite long – particularly trips on the rapid transit (rail and bus way) network.

Conversely, public transport often struggles as an attractive, cost-effective transport option in lower density areas, particularly when serving dispersed employment or low-intensity employment areas.

While the total mode share of public transport in Auckland is relatively small, this objective requires an examination of how public transport impacts on congestion.

2.4. Ensure increased financial costs deliver net user benefits

This objective assesses whether further charges to transport users in Auckland generate net benefits for those who will be paying the extra costs.

Policy interventions such as road pricing can achieve improved performance of the transport network through raising the financial cost of travelling, thereby influencing travel demand. It is important to weigh up the costs and benefits of pricing interventions to establish whether the additional costs of a road pricing charge are outweighed by the time savings benefit they provide.

2.5. Ensure value for money

The objective to ensure value for money relates to the overarching objective of the project to achieve better returns from transport investment, compared to forecast returns from current plans. Assessment of the intervention packages will need to demonstrate this outcome.

Developing, maintaining and operating the transport system has major costs – both public costs for Council and Government, and private costs for households and businesses. These costs have increased significantly over the last decade to address Auckland's growing transport demands. However, a decision to invest in upgrading Auckland's network imposes an opportunity cost for taxpayers, ratepayers and transport users. Investment made to

[6] In technical terms, this is Level of Service E, F or worse. It is assumed that reliability of travel times start to deteriorate on parts of the network where the volume to capacity ratio exceeds 0.9 (Source AECOM email 23/11/2015 and JMAC email 4/12/2015).

upgrade the network is money that cannot be invested to fund other government, council or individual priorities.

Assessing value for money will require understanding and measuring the total social benefits of a package of projects and ensuring they exceed the cost of the package. Achieving best possible value for money means that the package offers the greatest possible social benefits relative to its cost.

This project's objectives encompass the bulk of the social benefits that can be expected from transport projects. An understanding of how those objectives are met helps to understand the effects of a particular package of projects. This value for money measure reveals how the benefits stand in relation to the costs.

2.6. Other key outcomes

While the project is focused on the objectives outlined earlier, transport investment also contributes to a number of other important outcomes. These will be tracked to understand where achieving improved performance on the project's objectives may support or undermine achieving these other key outcomes. For example, it is important to ensure that interventions which may improve congestion or accessibility do not result in adverse safety impacts.

The following list of other key outcomes has been identified by the project team, based on long term outcomes contained in strategic planning documents such as the Government Policy Statement on Land Transport 2015 and the Auckland Plan. The Government Policy Statement highlights key focus areas of supporting economic growth and productivity, improved transport safety and ensuring value for money from investment. The Auckland Plan describes the key role of the transport system in facilitating liveability, economic growth and productivity is through creating better connections and accessibility within Auckland, across New Zealand and to the world.

- Support access to housing – Transport networks are expected to be in place to meet the demand for new housing in Auckland.
- Minimise harm – The transport programme is expected to avoid, reduce or mitigate the harmful impacts on people and the environment. Harm from the transport system includes risk of deaths and serious injuries, harmful emissions into the air, waterways and ecosystems, and negative impacts on heritage and communities.
- Maintain existing assets – It is expected that transport assets will be maintained and renewed at the optimal time to ensure a continued acceptable service to users of the transport system.
- Social inclusion and equity – The transport system is expected to be implemented with consideration of the fairness with which impacts (benefits and costs) are distributed and enable a cross-section of society to access everyday activities. This project will need to consider the distribution of benefits and costs arising from proposed interventions (not just those arising from an increase in financial costs as per the fourth project objective).
- Network resilience – The transport programme is expected to contribute to the resilience of the transport network in terms of its vulnerability to disruption and ability to adapt to disruption.

3. Evaluation criteria

This section outlines the indicators relating to the project objectives and other key outcomes. These form an evaluation framework which will be used to test existing and proposed transport intervention packages.

For each objective, measures and key performance indicators (KPIs) have been developed to enable evaluation. For each measure there are headline KPIs that will be reported on and will be used for analysis. Secondary KPIs are identified but may be reported on except where they significantly add value to informing key decisions. A small number of headline KPIs were identified in relation to each objective in order to provide meaningful and objective information that illustrates how well a package delivers on the objective.

Term	Working definition
Objective	What we want to achieve
Measure	How we will demonstrate achieving an objective
KPI	Extent to which we perform against a measure

The full evaluation framework comprises the headline KPIs and secondary KPIs is set out in Appendix A.

The project team will work through how the evaluation framework will be applied to the evaluation of packages. Broadly the intention is to use the information provided by the headline KPIs, and supporting KPIs where relevant, to inform judgements about how each package delivers against the objectives.

3.1. Improve access to employment and labour

This objective measures the extent to which Aucklanders have good access to employment opportunities, employers have good access to the labour pool and good access between businesses.

Measure 1: Access to employment and labour within a reasonable travel time	
Headline KPIs	**Explanation of how measured**
Jobs accessible by car within a 30 minute trip in the AM peak	This is calculated as the number of jobs that can be accessed from all different parts of Auckland within a 30 minute travel time by car in the AM peak. A 30 minute threshold for car trips has been used to broadly reflect existing average commute times in Auckland (approximately 25 minutes in the AM peak in 2014[7]) and a number of international cities as well as providing a good basis for comparing the impact of different interventions.
Jobs accessible by public transport within a 45 minute trip in AM peak	This is calculated as the number of jobs that can be accessed from all different parts of Auckland within a 45 minute travel time by public transport in the AM peak[8]. Travel time includes wait time and transfer penalties for transfers to a public transport service.

[7] MoT Household Travel Survey 2014

[8] It is commonly found in international research that the inclination to commute declines rapidly when commuting times exceed 45 minutes, regardless of gender, transport mode, and socio-economic factors (Sandow, E. and Westin, K Preferences for commuting in sparsely populated areas (2010) Journal of Transport and Land Use). Land use /employment patterns and transport are both expected to affect whether the current proportion of access to jobs across the region would remain the same or increase over time.

Measure 1: Access to employment and labour within a reasonable travel time	
Headline KPIs	**Explanation of how measured**
Proportion of jobs accessible to other jobs by car within a 30 minute trip in the inter-peak	This is calculated as an employment weighted average of jobs accessible from other jobs within a 30 minute car trip as a proportion of total jobs in the region. The inter-peak period is selected to differentiate commuter trips and to indicate the productivity of trips across the road network between business areas.
Supporting KPIs	**Explanation of how measured**
Proportion of jobs accessible within a 30 minute car trip in AM peak	This is calculated as a population weighted average of the number of jobs within a 30 minute travel time by car in the AM peak as a proportion of total jobs in the region.
Proportion of jobs accessible within a 45 minute public transport trip in AM peak	This is calculated as a population weighted average of the number of jobs within a 45 minute travel time by public transport in the AM peak as a proportion of total jobs in the region.
Average travel time by car or public transport in AM peak	This calculates the average travel time by car or public transport in the AM peak, which can be at the regional and sub-regional level. This helps to quantify the additional travel time to access jobs in the AM peak.
Access to specific origins and destinations e.g. City Centre and rest of region in AM peak	This uses the same calculation as the previous KPI, but differentiates access to/from the City Centre and the rest of the region. This could be further differentiated in terms of access to/from major centres and the rest of the region.

3.2. Improve congestion results

This objective measures the extent to which congestion results can be improved (relative to predicted levels of current plans) by different intervention packages. The measures and headline KPIs give strong consideration to travel time and reliability of travel time in the peak and inter-peak periods[9] as well as business trips caught in severe congestion on the network.

Measure 1: Impact on general traffic congestion	
Headline KPIs	**Explanation of how measured**
Per capita annual delay (compared to efficient throughput)	Annual per capita delay is calculated as the difference in travel time for motor vehicle trips on the road network throughout the day, compared to the travel time estimated if the network operates at an efficient throughput of vehicles (i.e. not free flow), for a year divided by the population. This represents the average time (in minutes) that a motorist is delayed in a year due to congestion. This is an indicator of the additional delay resulting from those parts of the network that are dealing with a throughput of vehicles greater than what is considered efficient (calculated in relation to Level of Service E).

[9] The transport model will not isolate the extent of the duration of peak traffic. The transport model does forecast volumes of traffic and level of congestion for different time periods: the am peak 7.00 to 9.00 am and an inter-peak period 9.00 am to 3.00 pm. The forecast volume of traffic and level of congestion in the inter-peak period may be affected to some extent by a spreading of the period of congestion in the morning. This information is indicative information about how widespread congestion is on the strategic road network. Interpretation is required to analyse the extent to which motorists are deferring trips (shopping, recreational, deliveries, etc) to the inter-peak period in order to avoid congestion in the am peak.

Measure 1: Impact on general traffic congestion	
Headline KPIs	**Explanation of how measured**
Proportion of travel time in severe congestion in the AM peak and inter-peak	This is calculated as the average time spent in severe traffic congestion as a proportion of total trip time travelled on the road network. This will be measured in the AM peak and inter peak periods. This KPI is an indicator of any increase in severe congestion for motor vehicle trips across the road network in the am and inter-peak periods of a working day[10].
Supporting KPIs	**Explanation of how measured**
Throughput of people at key parts of the network in the AM peak and inter-peak	This measures the volume of people travelling by any mode. This calculation will be done on routes to key employment areas including the City Centre and the airport, where there are screenlines at strategic parts of the network. This may be compared to the throughput to an industrial area (e.g. Highbrook). The selection of key parts of the network and routes will be done to help inform a sub-regional analysis of access to employment. This is an indicator of the productivity of corridors, which needs to be considered alongside indicators of congestion.
Proportion of the strategic road network (motorways, primarily arterials) in severe congestion during the AM peak and inter-peak	This measures vehicle kilometres travelled (VKT) in severe congestion as a proportion of total VKT on the strategic road network.
Proportion of VKT spent in severe congestion on state highways or regional arterials	This is a subset of the above KPI - the calculation would be done only in relation to state highways or arterial roads (that are part of the strategic road network).

Measure 2: Impact on freight and goods (commercial traffic) congestion	
Headline KPI	**Explanation of how measured**
Proportion of business and freight travel time spent in severe congestion on the strategic freight network in the AM peak and inter-peak	This is a specific calculation of the time spent by business trips in severe congestion as a proportion of total business trip time spent on the strategic freight network. This KPI is an indicator of any increase in severe congestion for business trips across the strategic freight network in the am and inter-peak periods of a working day.
Supporting KPIs	**Explanation of how measured**
Average travel times along strategic freight corridors	This is calculated as volume of vehicle trips x average speed / distance in relation to the following freight corridors: • Northern boundary to the port • Kumeu to the port • East Tamaki to the port • Metroport to the port

10 Severe traffic congestion is characterised by slower speeds, longer trip times, unreliable trip times and increased vehicular queuing (i.e. a traffic jam). Austroads explains that traffic congestion is considered severe at Level of Service E (or worse) when the volume of traffic is at this effective capacity limit of the road. Austroads 2013, Guide to traffic management Part 3, Traffic studies and analysis. For modelling purposes, severe congestion is identified on parts of the network where the modelled speed is less than 67 kph on a motorway, expressway or rural highway or less than 25 kph on other roads [Source: JMAC email 4/12/15].

	• Airport to the port • Southern boundary to the airport • Southern boundary to the port. The model output of average travel times for these point to point routes could be calculated in the AM peak and inter-peak.
Proportion of VKT spent in severe congestion on the strategic freight network	This measures VKT in severe congestion as a proportion of total VKT on the strategic freight network.

Measure 3: Travel time reliability	
Headline KPI	**Explanation of how measured**
Proportion of travel time subject to volume to capacity ratio of greater than 0.9 during AM peak, PM peak and inter-peak	This calculates the distance travelled in severe congestion as a proportion of the total vehicle distance travelled. This KPI is an indicator of the proportion of distance travelled which could be subject to variable travel times. Severe congestion is identified as closely associated with the parts of the network where the volume to capacity ratio exceeds 0.9[11]. When traffic volumes are greater than 0.9 of the capacity of a road, travel times begin to become unreliable[12]. In these conditions extra time (buffer) is needed to ensure on-time arrival for trips and most trips are likely to experience variable travel times. This has been developed to reflect the significant monetary costs of congestion on commercial traffic which results in the scheduling of 'buffer' periods that add cost and time.
Supporting KPI	**Explanation of how measured**
Breakdown by motor vehicle and public transport	This measures the proportion of travel kilometres by motor vehicle only i.e. VKT (or by public transport only i.e. PTKT) subject to volume to capacity ratio of greater than 0.9 during AM peak, PM peak and inter-peak (refer to explanation of headline KPI above). This enables an understanding of travel time reliability for motor vehicle trips only or public transport trips only.

Measure 4: Increase vehicle occupancy	
Headline KPI	**Explanation of how measured**
Average vehicle occupancy in the AM peak and inter-peak	Average vehicle occupancy is the average number of people per vehicle for particular trip types and is an input to the model. Current input assumptions about vehicle occupancy vary by trip purpose and time of day[13].

[11] AECOM email 23/11/2015.

[12] Variability of travel times start to occur when the volume to capacity ratio is between 0.8 and 1.0 (equating to Level of Service E) due to day-to-day or unusual fluctuations in demand. Travel times become more variable when the volume to capacity ratio is greater than 1.0 (equating to Level of Service F).

[13] Home Based Trips

<table>
<tr><th>Purpose</th><th>Prod</th><th>AM</th><th>IP</th><th>SC</th><th>PM</th><th>OP</th><th>24 hr</th></tr>
<tr><td rowspan="2">HBW</td><td>From Home</td><td colspan="5">1.10</td><td>1.10</td></tr>
<tr><td>To Home</td><td colspan="5">1.11</td><td>1.11</td></tr>
<tr><td rowspan="2">HBE</td><td>From Home</td><td>2.60</td><td>1.22</td><td>1.28</td><td>1.66</td><td>1.47</td><td>2.09</td></tr>
<tr><td>To Home</td><td>2.30</td><td>1.63</td><td>3.35</td><td>2.30</td><td>1.78</td><td>2.57</td></tr>
<tr><td rowspan="2">HB Sh</td><td>From Home</td><td colspan="4">1.27</td><td>1.63</td><td>1.31</td></tr>
<tr><td>To Home</td><td>1.10</td><td>1.22</td><td colspan="3">1.35</td><td>1.28</td></tr>
<tr><td rowspan="2">HBO</td><td>From Home</td><td>1.62</td><td>1.28</td><td>1.54</td><td>1.62</td><td>1.59</td><td>1.48</td></tr>
<tr><td>To Home</td><td>1.09</td><td>1.25</td><td>2.03</td><td>1.69</td><td>1.64</td><td>1.50</td></tr>
</table>

Non-Home Based Trips

Purpose	AM	IP	SC	PM	OP	24 hr
EB	1.08				1.15	1.08
NHBO	1.62	1.32	1.75	1.51	1.66	1.49

Source: Sinclair Knight Merz TIME OF DAY AND VEHICLE DRIVER FACTORS Report 24 January 2007

Supporting KPIs	Explanation of how measured
Average vehicle occupancy in PM peak	This measures average vehicle occupancy in the PM peak only (refer to explanation of headline KPI above). This enables an understanding of travel time reliability at the worst part of the day (currently).
Breakdown of average vehicle occupancy of cars and public transport	This breaks down the measurement of average vehicle occupancy for motor vehicles only and separates the average vehicle occupancy in relation to public transport trips. Out-of-model information may assist in understanding how average vehicle occupancy may be affected by a new mode of mobility service – one that serves a similar function to taxis, but becomes more widespread through technology changes.

3.3. Improve public transport mode share where it will address congestion

This objective will be measured by two headline KPIs to assess the extent to which public transport is used and its contribution to easing congestion on the road network.

Measure 1: Public transport mode share	
Headline KPI	**Explanation of how measured**
Proportion of vehicular trips in the AM peak made by public transport	This calculates the proportion of total vehicular trips in the AM peak that are made by public transport. It is recognised that the ART3 strategic transport model only differentiates motor vehicle trips and public transport trips, because the number of walking and cycling trips is an input to the model.
Proportion of vehicular trips over 9 km in the AM peak made by public transport	This calculates the number of trips made by PT as a proportion of total vehicular trips (in the AM peak) 0-9 km.
Supporting KPIs	**Explanation of how measured**
Proportion of trips in the AM peak made by public transport	This measures PT trips as a proportion of total trips (i.e. vehicular trips and active mode trips) in the AM peak.
Proportion of trips/vehicular trips in the inter-peak made by public transport	This measures PT trips as a proportion of vehicular trips (or total trips) in the inter-peak period. This enables an understanding of the role of PT during the inter-peak period for general trips.
Measure 2: Increase public transport where it impacts on congestion	
Headline KPI	**Explanation of how measured**
Proportion of vehicular trips over 9 km in the AM peak made by public transport	This recognises that long trips on the road network in the AM peak contribute to congestion in multiple parts of the network. The number of long trips taken by public transport would have a direct impact of alleviating congestion. This is calculated as the number of PT trips greater than 9 km as a proportion of total vehicle trips greater than 9 km in the AM peak. The purpose of identifying long public transport trips is to understand the extent to which public transport could potentially be removing trips off several sections of the road network that would otherwise be subject to congestion.

Supporting KPIs	Explanation of how measured
Proportion of vehicular trips made by public transport (rather than contributing to congestion) along severely congested routes	This compares the number of PT trips with motor vehicle trips along congested routes (refer to map of screenlines). It is calculated as the number of trips using public transport at congested parts of the network as a proportion of total trips at those parts of the network in the AM peak and inter-peak. This enables an understanding of the number of public transport trips that are being taken instead of adding to severely congested routes. Selected routes would be those which are severely congested and with motor vehicle and PT connections to a key employment centre (e.g. City Centre, airport, etc). This relies on point to point information from the model (current list is Airport to CBD, Silverdale to CBD, Albany to Highbury, Westgate to CBD, Pukekohe to CBD, Manukau to CBD, Manukau to Airport, Howick to CBD, Howick to Manukau, Botany to Airport, St Lukes to St Johns, Waterview to Manukau).
Proportion of journey trips unaffected by severe congestion	This calculates the journey **time** unaffected by severe congestion as a proportion of the journey time of total trips (PT and motor vehicle) from point to point. This reflects the fact that most bus trips on busways and bus lanes will have some part of the trip on a road affected by traffic congestion. This calculation would be done in relation to a selection of routes where point to point information is available from the model (see list above).
Proportion of vehicular trips made by public transport to major employment centres e.g. City Centre (AM peak and inter-peak)	This is a mode share calculation which shows the proportion of PT trips to total PT and motor vehicle trips to a major employment centre. This provides another indicator of the proportion of public transport trips that are being taken instead of adding to severe congestion.
Proportion of public transport services in the AM peak which are over-crowded or have low use	This is an output from the APT model and indicates services which have low or high demand. This information may assist in understanding which parts of the network have demand for increased service or have a low contribution to easing congestion on the road network.

3.4. Ensure increased financial costs deliver net user benefits

This objective will be measured by the extent to which the cost of travel will vary under different intervention packages. This is particularly relevant to understanding the true costs and benefits from packages that involve pricing schemes for demand management purposes, as these policies improve network performance through increasing the financial cost of travel.

Measure 1: Changes in the cost of travel	
Headline KPI	**Explanation of how measured**
Increase in financial cost per trip compared to savings in travel time and vehicle operating cost	This is calculated as the additional financial cost to users, isolated from financial costs that would be common to users under the different packages. The additional financial cost might be a congestion charge or an increase/reduction in PT fares of a package that is being tested. The total of the additional financial costs to users is divided by the number of trips by those users to calculate the increase in financial cost per trip. This is compared with the change in generalised cost of travel impacted by the proposed congestion charge or increase/reduction in PT fares. This helps to understand the net effects in terms of cost and time.

Supporting KPIs	Explanation of how measured
Total benefits and costs of a scheme as they apply to users	This provides a dollar value of total benefits to users and a dollar value of financial costs incurred by users. These benefits and costs to users are represented in the `generalised cost of travel'. This is the average monetary and non-monetary costs of all journeys. Monetary costs might include a fare on a public transport journey, or the costs of fuel, wear and tear, distance travelled and any parking charge, PT fare, or toll or congestion charge on a car journey. Non-monetary costs refer to the time spent undertaking a journey. Time is converted to a money value using a value of time figure, which in the model varies according to the purpose of the trip only.
Generalised cost of travel for specific trips (i.e. those being charged)	This calculates the generalised cost of travel (as per the first supporting KPI) applied to specific trips being charged e.g. business trips, journeys to work, etc.
Average cost of travel per capita	This calculates the average cost of travel, which is the total financial costs (including the charge) divided by the total population.

3.5. Ensure value for money

Better returns from investment, i.e. value for money, will be measured in a way that will highlight the overall benefits (to the extent that these can be effectively measured) and financial cost of a transport package or programme. Value is measured in the wider sense, in terms of the total societal benefits and impacts of a transport programme.

Measure 1: Value for money	
Headline KPI	**Explanation of how measured**
Package benefits and cost	This compares the financial cost of a package to the monetary value of potential benefits to both users and non-users in terms of: • Travel time savings • Vehicle operating cost savings • Impact on CO_2 emissions • Savings in accident costs • Improved reliability and greater throughout • Increased competition and agglomeration The calculation of benefits will be generally in accordance with NZ Transport Agency's Economic Evaluation Manual and using updated information e.g. value of time. This will enable a comparison of value for money between packages, rather than provide a definitive assessment of value for money.
Supporting KPIs	**Explanation of how measured**
Total cost of a package in current day dollars	30 year costs, both opex and capex, in $2016 values
Net present value of the total cost of a package	30 year costs, both opex and capex, in net present value
Average cost of travel for transport users (including time)	This is a calculation of the average generalised cost of travel for transport users (in terms of financial costs and time).

3.6. Other key transport outcomes

The measures and headline KPIs relate to outcomes outlined in the Government Policy Statement on Land Transport 2015 and the Auckland Plan. These headline KPIs enable consideration of contributions to outcomes that are not directly taken into account in relation to the project objectives discussed above.

Support access to housing

Measure 1: Transport infrastructure in place in future urban zones when required for new housing	
Headline KPI	**Explanation of how measured**
Transport does not delay urbanisation in line with timeframes of Future Urban Land Supply Strategy	This is calculated outside the model to measure the extent to which transport infrastructure is in place in future urban zones to support new housing in those areas. The timing of transport infrastructure is determined as an input to the model. The timing of these inputs is compared with the time frames identified in the Future Urban Land Supply Strategy. (Note that the Transport for future urban growth project is expected to identify the minimum transport networks required to enable housing to be established in future urban zones and the timing of those networks). The result can be calculated as a percentage of transport infrastructure that is provided within the timeframes. Because the common elements include the basic level of transport infrastructure and services supporting the future urban zones, this KPI would help to distinguish packages that apply different timing or amounts of additional transport infrastructure and services supporting the future urban zones. Another way to calculate this is a percentage of future urban zones that have transport infrastructure and services in place at the required time to support the future urban zones.
Supporting KPIs	**Explanation of how measured**
Cost of networks in future urban zones	This is calculated outside the model and comprises capital and operating costs relating to transport infrastructure and services that are modelled to service the future urban zones (residential and commercial). The costs could be calculated in current dollars and net present value to enable a comparison of packages.
Proportion of jobs accessible from future urban zones (30 minutes by motor vehicle, 45 minutes by public transport) in AM peak	This uses the same calculation as the headline KPI relating to access to employment. However, the calculation is applied to access from future urban zones only. The three future urban zones are in the southern, western and northern parts of Auckland as identified in the Future Urban Land Supply Strategy.

Reduce harm

Measure 1: Safety Emissions	
Headline KPI	**Explanation of how measured**
Deaths and serious injuries per capita and per distance travelled	This is a calculation made outside of the transport model, based on forecast data about travel speeds, vehicle kilometres travelled on different roads and the effects of the safety programme. The transport model provides a forecast estimate of future crashes (resulting in deaths or serious injuries) based on modelled travel speeds and total kilometres travelled on different road types. Two metrics are then calculated: per capita (usually per 100,000 population) and per vehicle kilometres travelled.

Supporting KPIs	Explanation of how measured
Number of deaths and serious injuries walking and cycling per capita and per distance travelled	This is a calculation made outside of the transport model, based on forecast data about travel speeds, number of trips by walking and cycling and the effects of the safety programme.
Cost of safety programme	This is a calculation of the total capital and operating costs of the safety programme.

Measure 2: Greenhouse gas emissions	
Headline KPIs	**Explanation of how measured**
Greenhouse gas emissions	The model provides a forecast estimate of greenhouse gas emissions based on vehicle kilometres travelled, changes in fuel efficiency and extent of travel in congested conditions. Emissions are largely dependent on the uptake of electric vehicles and improvements in vehicular efficiency and vehicle occupancy. This is a daily figure.

Maintain existing assets

Measure 1: Effects of maintenance and renewals programme	
Headline KPIs	**Explanation of how measured**
Asset condition levels of service	This is estimated outside of the model, based on the level of investment in maintenance and renewals and the level of service targeted in that programme.
Renewals backlog	This is estimated outside the model. The renewals backlog is calculated as the dollar value of the renewals programme that is deferred at the end of the 30 year period as a result of the level of investment in maintenance and renewals.
Supporting KPI	**Explanation of how measured**
Cost of maintenance and renewals programme	This is a calculation of the total capital and operating costs of the maintenance and renewals programme.

Social inclusion and equity

Measure 1: Fairness of distribution of impacts (benefits and costs)	
Headline KPIs	**Explanation of how measured**
Accessibility from high deprivation areas	This is a series of calculations of access from high deprivation areas to employment (AM peak) and employment areas (inter-peak) and the generalised cost of those trips. The following decile 10 areas have been selected to apply this calculation: West: Ranui; Central: Glen Innes; South: Mangere Central, Otara East, Rowandale, Papakura South. This provides a contrast to figures of accessibility at the regional level, which are calculated in relation to the headline KPI for access to employment. The generalised cost would be calculated and mapped across the region to identify differences.
Distribution of impacts (costs and benefits) by area	This draws from headline KPIs relating to other objectives and applies these to the four sub-regional areas i.e. north, west, central and south. This is expected to highlight any uneven distribution of costs and benefits of a transport programme. This geographical analysis will take into account a social deprivation index map to understand potential social impacts.

Supporting KPIs	Explanation of how measured
Impact on low deprivation areas	This uses the same method of calculation as the first headline KPI, but in relation to low deprivation areas (in the north and central areas) to provide a comparison of the range of access to employment and generalised costs between the low and high decile areas.
Access to important social services e.g. hospitals, education, shops	This calculates travel time by different modes to key destinations from high deprivation areas (as identified above).

Network Resilience

Measure 1: Network vulnerability and adaptability	
Headline KPI	**Explanation of how measured**
Impact in the event of disruption at vulnerable parts of the network	The headline KPI could be applied to key locations in the transport network where there is vulnerability to disruption. These locations would be on strategically significant routes and could be any mode. For example, Auckland Harbour Bridge, Crossings of Tamaki River, rail line, State Highway 1 at Drury. Travel times by an alternative route and volume of trips could be calculated to indicate the impact if a disruption occurs at a key location. The likelihood of a disruption could also be considered e.g. high likelihood of an accident or breakdown and low likelihood of a catastrophic failure. This KPI would enable packages to be compared to the extent that packages provide alternatives or ability to adapt to a disruption at these key locations. This could be calculated in different ways: using non-model information about travel times following incidents at these key locations; using modelled information about volumes and travel times on an alternative route; calculating travel time on an alternative route by switching off a key piece of infrastructure in the transport model.
Supporting KPI	**Explanation of how measured**
Composite index of economic and social indicators e.g. risk of disruption, transport choice (modes and routes), etc.	Research by NZ Transport Agency regarding measurement of economic and social impacts of resilience is underway and may add to the analysis as a supporting KPI. This research was not available for use during the ATAP.

Full list of key performance indicators

Objective	Measure	Headline KPI	Supporting KPI
Improve access to employment and labour	Access to employment and labour within a reasonable travel time	• Jobs accessible by car within a 30 minute trip in the AM peak • Jobs accessible by public transport within a 45 minute trip in AM peak • Proportion of jobs accessible to other jobs by car within a 30 minute trip in the inter-peak	• Proportion of jobs accessible within a 30 minute car trip in AM peak • Proportion of jobs accessible within a 45 minute public transport trip in AM peak • Average travel time by car or public transport in AM peak • Access to specific origins and destinations e.g. City Centre and rest of region in AM peak
Improve congestion results	Impact on general traffic congestion	• Per capita annual delay (compared to efficient throughput) • Proportion of travel time in severe congestion in the AM peak and inter-peak	• Throughput of people at key parts of the network in the AM peak and inter-peak • Proportion of travel time in severe congestion on the strategic road network during the AM peak and inter-peak • Proportion of VKT spent in severe congestion on state highways or regional arterials
	Impact on freight and goods (commercial traffic) congestion	• Proportion of time spent in severe congestion on the strategic freight network in the AM peak and inter-peak	• Average travel times along strategic freight corridors • Proportion of VKT spent in severe congestion on the strategic freight network
	Travel time reliability	• Proportion of total travel subject to volume to capacity ratio of greater than 0.9 during AM peak, PM peak and inter-peak.	• Breakdown by motor vehicle and public transport
	Increase vehicle occupancy	• Average vehicle occupancy	• Breakdown of average vehicle occupancy of cars and public transport
Increase public transport mode share	Public transport mode share	• Proportion of vehicular trips in the AM peak made by public transport	• Proportion of trips in the AM peak made by public transport • Proportion of trips/vehicular trips in the inter-peak made by public transport • Proportion of kilometres travelled by public transport (peak and inter-peak) • Proportion of vehicular trips by journey length during the AM peak made by public transport
	Increase public transport where it impacts on congestion	• Proportion of vehicular trips over 9 km in the AM peak made by public transport	• Proportion of vehicular trips made by public transport (rather than contributing to congestion) along severely congested routes during the AM peak • Proportion of vehicular trips made by public transport to major employment centres e.g. City Centre (peak and inter-peak) • Proportion of length of public transport trips unaffected by severe congestion • Proportion of public transport trips which are over-crowded or have low use
Increased financial costs deliver net user benefits	Net benefits to users from additional transport expenditure	• Increase in financial cost per trip compared to savings in travel time and vehicle operating cost	• Total benefits and costs of a scheme as they apply to users • Generalised cost of travel for specific trips (i.e. those being charged) • Average cost of travel per capita
Ensure value for money	Value for money	• Package benefits and costs	• Total cost of packages – 30 year costs, both opex and capex, in $2015 values and/or NPV • Average cost of travel for

			transport users (including time)
Other Outcomes	**Measure**	**Headline KPI**	
Support access to housing	Transport infrastructure in place when required for new housing	• Transport does not delay urbanisation in line with timeframes of Future Urban Land Supply Strategy	• Cost of networks in future urban zones • Proportion of jobs accessible from future urban zones (30 minutes by motor vehicle, 45 minutes by public transport) in AM peak
Mitigate harm	Safety	• Number of crashes per capita and per distance travelled	• Number of deaths and serious injuries walking and cycling per capita and per distance travelled • Cost of safety programme
	Emissions	• Greenhouse gas emissions	
Maintain existing assets	Effects of maintenance and renewals programme	• Asset condition levels of service • Renewals backlog	• Cost of maintenance and renewals programme
Social inclusion and equity	Distribution of impacts (costs and benefits) by area	• Accessibility from high deprivation areas • Distribution of impacts (costs and benefits) by area	• Impact on low deprivation areas • Access to important social services e.g. hospitals, education, shops
Network resilience	Network vulnerability and adaptability	• Impact in the event of disruption at vulnerable parts of the network	• Composite index of economic and social indicators e.g. risk of disruption, transport choice (modes and routes), etc.

Appendix B – Model Input Assumptions

This memo outlines changes to ART3 input assumptions that have been considered by the ATAP project team and are being recommended to JMAC for implementation as at 24th November 2015.

Recommended changes to input assumptions are noted below – along with supporting evidence where input assumptions have been checked or changes are recommended.

ART input assumptions grouped under the following headings:

- Land Use Inputs
- Policy/Economic Inputs
- Transport Infrastructure and services
- TDM Assumptions
- Safety (factors added post ART model run)
- Emissions and fuel use (factors applied post ART model run)

Input	2012 Auckland Plan scenario	2014-15 ITPv2 / IAB	Decisions For ATAP
Land Use Inputs			
Zonal land use inputs	Scenario H High growth	Scenario I8B Medium	Use land-use **i9 medium growth**.
Development of future 'Regional Growth Strategy' centres Affects the mode choice to access the identified centres. Relates to the TDM inputs listed below. Refer to ART3 User Manual – Feb 2009 (page 40) for details on how the trip end are effected with regard to RGS and non-RGS areas.	Scenario H	Auckland Plan Scenario I	Use existing assumptions.

Input	2012 Auckland Plan scenario	2014-15 ITPv2 / IAB	Decisions for ATAP
Policy/Economic Inputs			
GDP/capita growth rate Affects the number of heavy vehicle trips, the value of time and future parking charges.	1.8% pa	1.8% pa	**Advice from MoT and Treasury:** Use 1.5% real GDP growth pa (from 2013 onwards). **2006 – 2013 GDP growth**: Use 0.5% real GDP growth pa (from 2006 – 2013).
Value of Time	Escalated wrt GDP/Capita growth (1.8% pa), with elasticity of 1 on work travel and 0.8 for non-work travel (Ref:UK DfT - TAG)	Escalated wrt GDP/Capita growth (1.8% pa), with elasticity of 1 on work travel and 0.8 for non-work travel (Ref:UK DfT - TAG)	Use existing assumptions – although please note that GDP/capita growth rate reduced to 1.5% pa
Private vehicle operating costs	Lower growth based on forecast fuel price and estimate of improved fuel efficiency (Ref:RLTS2010 WP5-Price Forecasts for Transport Fuels and other Delivered Energy Forms, MoT)	Lower growth based on forecast fuel price and estimate of improved fuel efficiency (Ref:RLTS2010 WP5-Price Forecasts for Transport Fuels and other Delivered Energy Forms, MoT)	Price updated based on NLTF revenue spreadsheet provided by MoT (based on VFEM and Fuel forecast)
Integrated ticketing – effect on speed of boarding	Assumed faster bus boarding times than 2006 base – as per RLTS (Assume 10% improvement in boarding time; net effect of Integrated Ticketing and increased loading)	Assumed faster bus boarding times than 2006 base – as per RLTS (Assume 10% improvement in boarding time; net effect of Integrated Ticketing and increased loading)	Use existing assumptions.
Public Transport Fares From ART3 Input Review work undertaken by Ian Wallis Associates Ltd May 2011. Refer “PE2” in report “ART3InputsReview-IWallis1328 May 1 Update Table 1.doc” attached below: Fare increase = *(GDP/Capita)*$^{0.25}$ “*With the GDP/cap forecast increase of 1.8%pa, this results in an average fare increase of c.0.45%pa: this is midway between the RLTS assumption and the NZTA*”	Increased wrt to GDP/Capita with elasticity of 0.25	Increased wrt to GDP/Capita with elasticity of 0.25	Use existing assumptions – although please note that GDP/capita growth rate reduced to 1.5% pa
PT fare system	Stage based (matches current system). Calculated based on a: • Boarding fare + • Distance based fare	Stage based (matches current system). Calculated based on a: • Boarding fare + • Distance based fare	Use existing assumptions – although please note that GDP/capita growth rate reduced to 1.5% pa

Integrated fares	Assumed removal of second boarding fare for transferring passengers but with 2c/km increase in all fares to retain same overall revenue and average fare	**Basic** Assumed removal of second boarding fare for transferring passengers but with 2c/km increase in all fares to retain same overall revenue and average fare **APTN** As above but no additional 2c/km	Use existing assumptions
Parking Costs	Escalation wrt GDP/Capita with elasticity of 1.2 for commuter travel and 1.0 for non-commuter travel. (Parking costs location and as per attached maps)	Escalation wrt GDP/Capita with elasticity of 1.2 for commuter travel and 1.0 for non-commuter travel. (Parking costs location and as per attached maps)	Use existing assumptions – although please note that GDP/capita growth rate reduced to 1.5% pa Update 2006 and 2013 costs based on CPI adjusted 2013 data
Toll and road pricing	Toll in ALPURT and in other projects as per the Auckland Plan scenarios. Toll values escalated at CPI.	Toll in ALPURT, Penlink. Toll values escalated at CPI. Specific network charges as per IAB specifications to be provided.	Use existing assumptions
External trips (to/from Waikato and Northland)	3% per annum increase in the number of trips per annum (increasing from 2006 observed figure)	3% per annum increase in number of trips (increasing from 2006 observed figure)	Use 1.3% pa increase for Auckland-Waikato and Auckland-Northland external trips. **Evidence base:** Projected growth in the Auckland region is downloaded from statistics NZ. Spreadsheet was downloaded 5th of November 2015.
Flight related trips Creates trips to and from Auckland Airport. Also affects interregional trips (i.e. from Northland and Waikato to AIAL).	Private vehicle model only based on vehicle counts at Airport in 2006.	Based on 2011 observed data and escalated over time based on the increase in the number of air passengers as advised by AIAL. Includes private vehicle, taxi, taxi shuttle and bus along with people who fly and associated “farewellers” and “greeters”.	Use pre-existing assumptions **Evidence base:** Growth from January 2009 to August 2015 shows a cumulative increase of 3.6% per annum (Domestic: 3.4%, International: 3.8%). This aligns with pre-existing assumptions of 3 - 4% growth pa.
HCV Growth	Employment plus GDP multiplier (elasticity of 0.23) (Ref: NZTA - Additional Waitemata Harbour Crossing 2011)	Employment plus GDP multiplier (elasticity of 0.23) (Ref: NZTA - Additional Waitemata Harbour Crossing 2011)	Use existing assumptions – although please note that GDP/capita growth rate reduced to 1.5% pa

Input	2012 Auckland Plan scenario	2014-15 ITPv2 / IAB	Decisions for ATAP
Transport Infrastructure and services			
Rail, Bus and Ferry services	As agreed for each scenario	As per specification. Increased level of service in APTN compared to Basic.	To be specified for each modelling run
Road network	Auckland Plan	As agreed for Committed, Basic, APTN programmes.	To be specified for each modelling run
Interchange penalties (and quality of rail / busway stations)[14]	Assumed all upgraded to 'medium' quality	Assumed all upgraded to 'medium' quality (unless otherwise stated)	Specified for each model run

[14] The impact of having to interchange is modelled via 'time penalties' in ART. Penalties are modelled as follows:

1. A time penalty related to the quality of the interchange facility. This component of the penalty is modelled as follows:
    - 10 minute time penalty at low quality interchanges (and other places on the network where interchange is required between PT services)
    - 8 minute time penalty at designated medium quality interchanges
    - 5 minute interchange penalty at designated high quality interchanges
2. Plus a time penalty to reflect the waiting time required for the second service. This component of the penalty is calculated based on whether the interchange is planned or unplanned, and the frequency of the services.

Input	2012 Auckland Plan scenario	2014-15 ITPv2 / IAB	Decisions for ATAP
TDM Assumptions			
Working from home	60% of RLTS 2010 assumptions *	**Basic** 60% of RLTS 2010 assumptions **APTN** 60% of RLTS 2010 assumptions	Working group agrees to use existing assumptions and to include the basic investment package as part of 'common elements'. High investment TDM packages will be tested during refined packages stage.
Assumptions for behaviour change from Work Place Initiatives (WTI): Reduction in car trips to work – CBD	60% of RLTS 2010 assumptions*	**Basic** 30% of RLTS 2010 assumptions **APTN** 60% of RLTS 2010 assumptions	
Assumptions for behaviour change from Work Place Initiatives (WTI): Reduction in car trips to work – RGS Centres	50% of RLTS 2010 assumptions*	**Basic** 25% of RLTS 2010 assumptions **APTN** 60% of RLTS 2010 assumptions	
Assumptions for behaviour change from Work Place Initiatives (WTI): Reduction in car trips to work – Non-RGS Centres	60% of RLTS 2010 assumptions*	**Basic** 40% of RLTS 2010 assumptions **APTN** 60% of RLTS 2010 assumptions	
Assumptions for behaviour change from Education TDM initiatives	100% of RLTS 2010 assumptions*	**Basic** 100% of RLTS 2010 assumptions **APTN** 60% of RLTS 2010 assumptions	
Assumptions for behaviour change from Community TDM initiatives	25% of RLTS 2010 assumptions*	**Basic** 25% of RLTS 2010 assumptions **APTN** 100% of RLTS 2010 assumptions	

Input	2012 Auckland Plan scenario	2014-15 ITPv2 / IAB	Decisions
Safety (factors added post ART model run)			
Crash rate Number of crashes are based on vkt on each road type x the crash rate for each road type	Injury crashes by road type (Urban Arterials, Rural Arterials & Motorways), based on VKT. Crash rates and associated rate reduction through time is based on NZTA Economic Evaluation Manual.	Injury crashes by road type (Urban Arterials, Rural Arterials & Motorways), based on VKT. Crash rates and associated rate reduction through time is based on NZTA Economic Evaluation Manual.	Use existing assumptions
Emissions and fuel use (factors applied post ART model run)			
Fuel use, NOX, CO2, PM10 particulate Assumption relating to engine efficiency improvements, take up of electric vehicle etc have been included as part of this work by UoA. Report attached: Model and spreadsheets available upon request (not included due to size)	Based on report titled "Vehicle Emission Prediction Model version 4" and associated spreadsheet model. Prepared for NZTA and AC by Energy & Fuels Research Unit, Department of Mechanical Engineering, The University of Auckland.	Based on report titled "Vehicle Emission Prediction Model version 4" and associated spreadsheet model. Prepared for NZTA and AC by Energy & Fuels Research Unit, Department of Mechanical Engineering, The University of Auckland.	Use existing assumptions

Additional Waitemata Harbour Crossing

Combined Tunnel Feasibility Study

August 2012

NZ Transport Agency

Mott MacDonald

Additional Waitemata Harbour Crossing

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Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
Draft	13/01/12	VS/JS/BN/RH	RS	DG	Draft for comment
Draft	25/01/12	VS/BN	DG	DG	Executive Summary and Figures added - Draft for comment
Draft	06/03/12	BN/DRG/VS	JS	DG	Addressing further client comments
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Final	16/08/12	VS	DG	DG	Final Issue

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Content

Executive Summary

The New Zealand Transport Agency (NZTA) requested a study of the feasibility and implications of combining the proposed road and rail crossing of the Waitemata Harbour (option T1 in 2010 study) into two tunnels, each tunnel carrying road and rail.

Key considerations were:

1. The requirements/assumptions for road traffic envelope and rail structure gauge
2. Impacts of larger diameter tunnel cross sections in the Auckland environment in terms of tunnelling method
3. Fire and life safety and associated ventilation requirements
4. Connections to existing and proposed road and rail networks at either end of the tunnels in terms of alignment geometry and land requirements for construction.

A series of options were identified and assessed and it was determined that combined tunnels are feasible within the current state of knowledge regarding the ground conditions and the required geometric connections. Although there is limited precedence, large diameter tunnels similar to the diameter that are required for this project are already being built outside of New Zealand and it is expected that larger tunnels will be built in the future prior to design and construction of the Additional Waitemata Harbour Crossing (see Appendix B).

The recommended option comprises a road over rail configuration with land based cut and cover bifurcation structures North and South of the harbour crossing. The combined tunnel section is 2.6km in length. A detailed fire and life safety strategy and network operational plan has not been prepared but it is currently assumed that there will be network congestion leading to congestion within the tunnel which has led to the adoption of a smoke duct.

As requested the tunnel alignment is based on the 2010 road alignment. There is a significant operational risk associated with heavy commercial vehicles (HCV's) and the steep alignment at the southern end that requires further work. The rail alignment is lowered at Gaunt Street Station. The portals and southern connections remain unchanged although minor amendments to both mainline road and rail geometry are required at the northern end to retain existing connectivity.

The main areas of engineering complexity for the combined tunnel arise at the southern section given existing infrastructure, land use and the road and rail geometric constraints, in particular the Central Motorway Junction alignment, the Victoria Park Tunnel and viaduct and the proposed Gaunt St Station.

Although the cost of a combined tunnel may be less than the cost of separate tunnels potential savings are offset through the need for additional bifurcation structures at the southern end. The cost of these additional structures are more significant due to the comparatively short length of tunnel compared to some international examples (Shanghai Yangtze Tunnel, China which is 8km long). Based on the existing cost models, the recommended option presents a cost saving of NZ$370M, less additional property costs, by comparison to the 2010 tunnel option. Through further optimisation (tunnel diameter, removal of smoke duct, alignment changes, etc.) it is estimated that the savings could be further increased by about NZ$200M. This is a capital cost assessment only and does not take into consideration staging of expenditure and the timing of adjacent infrastructure. Moreover the initial cost data are high level estimates based on a series of approximations and assumptions and are stated to be accurate within plus/minus 30%. While the figures indicate potential cost savings with the combined option, the cost differential is well within the existing levels of uncertainty. The estimate of cost savings is likely to be no more accurate than the original estimate. For a more reliable cost assessment of the combined tunnel a revised bottom up cost estimate is required.

A greater level of design will allow further optimisation of the combined tunnel option and resolve the extent of the opportunities identified.

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1. Introduction

1.1 Background

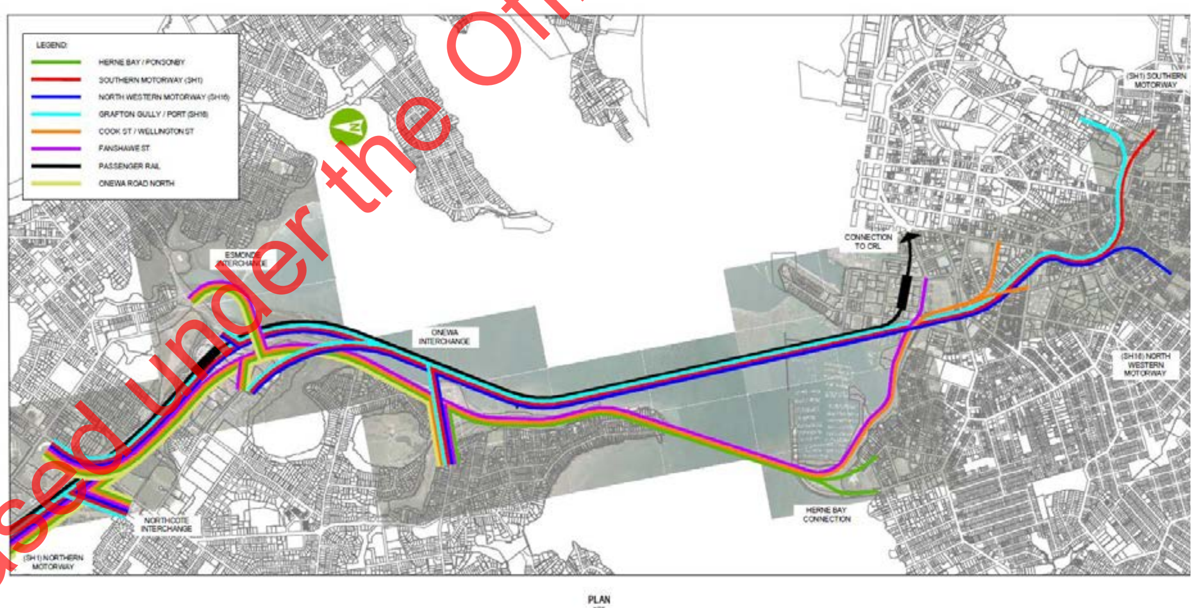
Previous studies have been undertaken to develop options for an additional Waitemata Harbour crossing (AWHC) in Auckland. The output of the 2010 study for the AWHC included a defined tunnel option (based on Option T1) which comprised four separate tunnels, two each for road traffic and rail passenger transport.

In the Defined Tunnel – T1 (2010) route, the road route extends from the Esmonde Road Interchange in the northern sector, follows along the eastern side of the existing motorway to Northcote Point before entering two bored tunnels (three lanes in each tunnel) and crosses under the harbour to Wynyard Quarter. The bored tunnels traverse the southwest corner of Wynyard Quarter to Victoria Park before continuing in cut and cover tunnels and trenches to the Central Motorway Junction (CMJ).

Rail is separated from road and follows a horizontal alignment between the Akoranga Busway Station and Wynyard Quarter. It is at grade from a future Akoranga Station (Esmonde) to Sulphur Beach and then crosses under the harbour via two bored tunnels (one track in each direction) to a future train station at Gaunt Street in the Wynyard Quarter.

Figure 1.1: AWHC Route

AWHC combined tunnel route



1.2 Study objectives

The New Zealand Transport Agency (NZTA) requested a study of the feasibility and implications of combining road and rail into two tunnels, each tunnel carrying road and rail. The objective of this study was to determine the feasibility of the combined arrangement and to assess the cost difference between the combined tunnel and separate tunnel arrangements. A copy of the project brief is included in Appendix A.

The limits of the study are:
- The cut and cover tunnel portal (adjacent to the open ramp) at the north end
- The cut and cover tunnel portal (adjacent to the open ramp) at the south end
- The west headwall of Gaunt Street Station

Figure 1.2: Study Limits

Study limits

1.3 Methodology

The key considerations regarding the feasibility of combined road and rail tunnels were:
1. The requirements/assumptions for road traffic envelope and rail structure gauge
2. Impacts of larger diameter tunnel cross sections in the Auckland environment in terms of tunnelling method
3. Fire and life safety considerations of the combined road and rail tunnel and changed ventilation requirements
4. Connections to existing and proposed road and rail networks at either end of the tunnels in terms of alignment geometry and land requirements for construction.
5. Cost

The feasibility study was undertaken in several stages:

- Literature review
- Understanding of constraints
- Preparing typical cross sections
- Fire and life safety assessment
- Options workshop
- Options assessment (alignment, configuration, constructability)
- Options review workshop
- Recommendations and final report (including cost delta)

Progress was reported through the use of technical notes:

- TN001 – Literature Review of combined Road and Rail TBM tunnels
- TN002 – Constraints
- TN003 – Fire Life Safety Considerations
- TN004 – Options Assessment
- TN005 – Initial South End Property Qualitative Impact Assessment

Copies are included in Appendices B to F and cross referenced in the body of this report.

The main body of the report presents a summary of the feasibility study while further details can be established by reference to the technical notes in the appendices.

1.4 Key Assumptions

The following key assumptions have been made as part of this study:

- Road vehicle envelope based on Waterview Connection Project minimum requirements
- Rail envelope based on Auckland City Rail Link (CRL) requirements
- Placarded goods vehicles use the existing Auckland Harbour Bridge (AHB) and do not use the bored tunnels. (NB The tunnelled crossing could be configured to include placarded goods but given that there is a nearby alternative and the significant additional costs of upgrading the fire and life safety measures it would be expected that the NZTA would opt for the operational solution assumed)
- Twin bore tunnels, with uni-directional traffic in each bore
- South portal location in Victoria Park fixed by existing constraints
- No changes to southern connections
- Cross passages will be required

2. Constraints

2.1 Project constraints

There are a number of existing constraints and opportunities that direct the way in which an AWHC can be achieved. These are presented in the 2010 Form Assessment Study Report (Document Reference No. NZ1-4074756).

2.2 Key constraints for a combined tunnel option

The key existing project constraints which are of particular relevance to this study are noted in the Table below.

s 9(2)(b)(ii)

[redacted]

Further discussion on constraints is provided in TN002 in Appendix C.

In addition to the constraints noted above, additional constraints may arise on a combined tunnel option as a result of fire and life safety considerations and the requirement for additional bifurcation structures to enable the road and rail to be co-joined and separated from one another in order to link their respective

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origins and destinations either side of Waitemata Harbour. These constraints and/or additional impacts are discussed more in Section 3.

The southern road and rail connections for the Additional Waitemata Harbour Crossing (AWHC) are more complex than the northern connections due to land use constraints including heritage buildings, the position of existing infrastructure and rising topography to the South from the Wynyard Quarter reclamations.

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[redacted]

3. Combined Road and Rail Tunnel Option Assessment

3.1 Typical Cross Sections

Many large diameter tunnels, including multi deck tunnels, for multipurpose use have been constructed in various locations worldwide and there are precedents for combining road and rail tunnels. Two examples of constructed combined road/rail tunnels are presented in Appendix B. These are the Silberwald Tunnel in Russia at 1.5km length and 14.2m in diameter constructed in 2007 (Figure 3.1) and the 15.4m diameter 8.1km Shanghai Yangtze Tunnel in China (Figure 3.2).

Figure 3.1: Silberwald Tunnel

Silberwald Tunnel Cross Section

Figure 3.2: Shanghai Yangtze River Tunnel

Cross Section

FLS Access

The Silberwald tunnel was constructed using a reconditioned TBM that constructed the Lefortovo road tunnel and has apparently addressed fire and life safety (FLS) issues by constructing a central service tunnel of around 7m diameter in parallel with the main bores accessible by cross passages. This is a relatively expensive solution.

The Shanghai Yangtze tunnel FLS provisions are unlikely to be acceptable in NZ as rail egress requires hatchways opening into the roadway creating significant safety concerns above before accessing cross passages. An acceptable solution would require a larger diameter bore.

Both the Silberwald tunnel and the Shanghai Yangtze tunnels have rail gauges that would not suit the Kiwirail structure gauge. The Shanghai structure gauge is only 3.15m x 2.5m whereas Kiwirail require 4.2m by 3.6m.

There are other examples of combined road/rail tunnels at concept planning stage. The information obtained about these schemes was given due consideration in the process of developing preliminary concepts for a combined road/rail tunnel for the AWHC in Auckland.

The road vehicle envelope has been developed based on that required by the Waterview Connection Project Minimum Requirements

Table 3.1: Geometric Parameters

Geometric Parameters

Item	Parameter
No of traffic lanes (per tunnel)	3
Lane width	3.5m
Posted clearance	4.6m
Traffic clearance	4.9m
Minimum lateral clearance (barrier to tunnel wall)	350mm

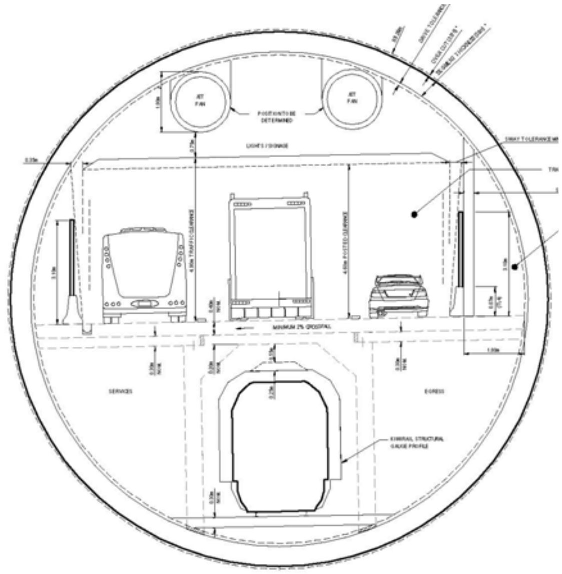
The rail envelope is based upon the rail envelope developed for the Auckland CRL project.

Two preliminary cross sections for a road over rail configuration have been produced as illustrated in Figure 3.3 below (see also sketch SK-C-101 & SK-C-102 in Appendix G), one incorporating a smoke duct and one without. The preliminary tunnel diameters are 17m and 16.1m respectively.

A rail over road cross section was also developed to consider the benefits of this configuration. A 17.4m diameter cross section is illustrated in Figure 3.3 below, (see also sketch SK-C-103 in Appendix G).

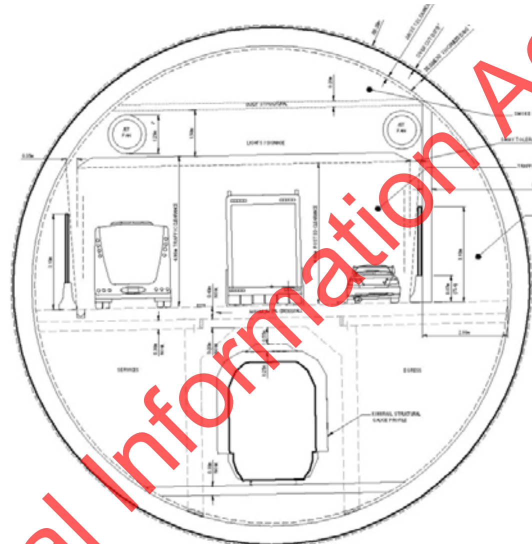
Figure 3.3: Road over Rail Typical Cross Sections

Road over Rail cross section without a smoke duct



Source: 297611-SK-C-101

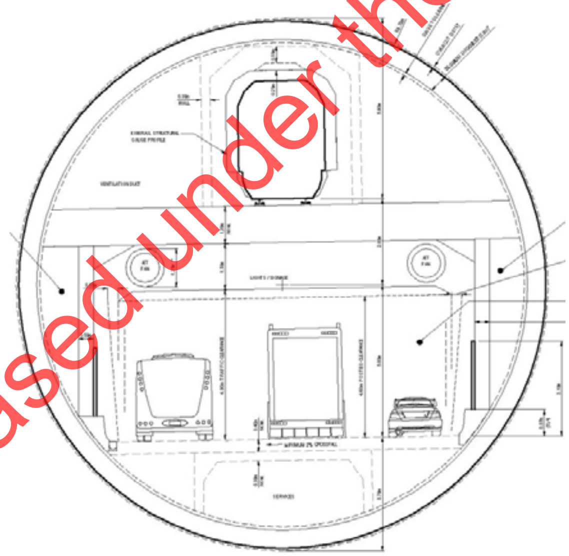
Road over Rail cross section with a smoke duct



Source: 297611-SK-C-102

Figure 3.4: Rail over Road Typical Cross Section

Rail over Road cross section



Source: 297611-SK-C-103

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3.3 Bifurcations

The combined road and rail tunnel concept requires that the road and rail be co-joined and separated from one another in order to link their respective origins and destinations either side of Waitemata Harbour.

The separation or bifurcation can be achieved using one of two basic structural forms, cut and cover construction using secant piled walls/diaphragm walls or mined caverns. For all options it is assumed that the bored tunnels are constructed from the northern end with one machine used for both bores.

Note: the mined cavern option was only considered for the southern bifurcation due to the property constraints in this area. The more simple cut and cover bifurcation structure at the north end can be incorporated into similar structures required for motorway connectivity. A mined option at the north end is much more expensive than the cut and cover option.

3.3.1 Cut and Cover

Cut and cover construction can relatively easily encompass the bifurcation and the crossover between the road and rail alignments within a single box. The crossover will not require any increase in the vertical separation of road and rail levels used in the remainder of the tunnel. The box will allow for the passage of the TBM through it to continue the TBM drives to the southern cut and cover portals.

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[redacted]

The boxes will be relatively deep with base slabs 36m to 39m below ground level. Box construction is likely to incorporate secant piled/diaphragm walls to prevent water ingress. Construction could be 'top down' or 'bottom up' depending on future use and contractor preference. If the space above the road deck and below ground is used for other purposes e.g. retail/parking, then top down constructed floors could brace the excavation. If the space is to be backfilled then bottom up and temporary bracing may be favoured.

[redacted]

To construct a cut and cover bifurcation structure within the marina area, a temporary sheet piled cofferdam structure would need to be created around the worksite.

3.3.2 Mined Cavern

The location, size and shape of the two mined caverns will allow for:

- The TBM to be pushed through the cavern
- A pillar of soil between the independent road and rail tunnels at the south end
- The northbound rail tunnel to pass under the southbound road tunnel with sufficient separation, currently assumed to be 16m between road and rail levels
- Track radius into Gaunt Street station

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[redacted]

Refer to TN004 in Appendix E for further details on these two forms of construction for the bifurcation.

The advantages/disadvantages of the two options are given in Table 3.2 below.

In summary the cut and cover option is cheaper and easier to construct than the mined cavern. However, it has the disadvantage of requiring significant property demolition although there is scope for resale of the land at a later date. The mined cavern requires the use of skilled personnel and there are few, if any, of these available in New Zealand. Surface disruption is still likely due to the need to monitor and control settlement arising from mining operations. The extent of this would be determined following detailed ground investigation

3.4 Preliminary Alignment and Connections

The general alignment of the crossing is based on the alignment of the road tunnels in the defined tunnel options of the 2010 study. In terms of vertical alignment of the decline/inclines, grades of up to 6.25% are considered (in line with previous option studies) to overcome constraints. The vertical alignment has not been examined in detail at the south end of the road tunnel but it is considered that there is significant operational risk associated with heavy commercial vehicles (HCV's) and the steep alignment that requires further work.

Six options have been considered. There are three alignments for each of the road over rail and rail over road configurations, with the location and form of bifurcation varying. See sketches 297611 SK-C-104 to 111 in Appendix G.

A summary of the alignments is given in Table 3.2 below. For further details refer to TN004 in Appendix E.

Table 3.2: Summary of alignment options

Summary of alignment options

Option	Configuration	Form of construction for bifurcation	Advantages	Disadvantages	Comments
1	Road over Rail	N:C&C box S:C&C box (Wynyard Quarter)	Increased length of the combined tunnel section & minimised length of additional rail tunnel,	Significant property acquisition and demolition Requires the rail alignment at Gaunt Street Station to be lowered Further land reclamation is required at northern end	Road alignment based on 2010 5% max grade option
2	Road over Rail	N:C&C box S:Mined caverns	Increased length of the combined tunnel section & minimised length of additional rail tunnel, potentially reduced surface impact	Requires the rail alignment at Gaunt Street Station to be lowered Further land reclamation is required at northern end Construction complexity and risk may require additional property acquisition	Road alignment based on 2010 5% max grade option
3	Road over Rail	N:C&C box S:C&C box (Marina)	Rail alignment at Gaunt Street Station unchanged minimises potential property acquisition	Impacts to Marina Shorter section of combined tunnel & longer length of additional rail tunnels Further land reclamation is required at northern end	Road alignment based on 2010 5% max grade option
4	Rail over Road	N:C&C box S:C&C box (Wynyard Quarter)	Reduced length of cut and cover tunnel section at the northern end	Larger tunnel diameter	Road alignment based on 6.25% grade option from the 2010 study (not feasible to adopt the 2010 5% road alignment due to existing constraints limiting how much the tunnel can be raised) road gradient and the platform level in Gaunt Street station is raised.
5	Rail over Road	N:C&C box S:C&C box (Marina)	Reduced length of cut and cover tunnel section at the northern end	Larger tunnel diameter Cut & cover box very long	Road alignment based on 6.25% grade option from the 2010 study (not feasible to adopt the 2010 5% road alignment due to existing constraints limiting how much the tunnel can be raised) raised platform in Gaunt Street station.
6	Rail over Road	N:C&C box S:C&C box (Marina)	Reduced length of cut and cover tunnel section at the northern end Platform level in Gaunt Street Station remains unchanged.	Larger tunnel diameter	Road alignment based on 6.25% grade option from the 2010 study (not feasible to adopt the 2010 5% road alignment due to existing constraints limiting how much the tunnel can be raised)

3.5 Impacts

The main impacts associated with the combined tunnel options are:

- Additional reclamation at the northern end to accommodate the revised rail alignment
- Building demolition and/or settlement impacts (southern end)(see above)
- A deeper platform level of the proposed Gaunt Street Station

Refer also to TN004 in Appendix E and TN005 in Appendix F.

4. Recommended Option

4.1 Options Considered

Feasible options considered were:
1. Road over rail in a single bore
2. Rail over road in a single bore
3. Cut and cover bifurcation structures at both ends of the combined tunnels
4. A mined bifurcation structure instead of the cut and cover structure at the south end
5. The cut and cover bifurcation structure at the south end being located in the marina instead of the Wynyard Quarter.

The advantages and disadvantages of the options were discussed with NZTA at the options review workshop held on the 13th December 2011.

The recommendation is to adopt Option 1 (CT 1), a road over rail configuration with cut and cover bifurcation structures due to the advantages of simplicity in construction, reduced impacts and smaller tunnel diameter. The very large diameter cavern options in uncertain ground conditions are harder to build and require specialist resources to construct. These resources would have to be brought in from outside Australasia.

It is noted that the preferred option does not present a fully optimised solution. Opportunities for optimisation are noted in Section 6.

4.2 Recommended Combined Tunnel Option 1

Road over Rail configuration with cut and cover bifurcations structures

4.2.1 Typical cross section

It is assumed that the baseline cross section will incorporate a smoke duct similar to previous tunnel configurations. Refer to 297611-SK-C-102 in Appendix G.

A detailed fire and life safety strategy and network operational plan has not been prepared. However it is assumed that there will be network congestion leading to congestion within the tunnel which has led to the recommended option adopting a smoke duct.

4.2.2 Alignment

The preliminary vertical and horizontal alignment is illustrated on the following sketches in Appendix G:
- 297611-SK-C-104
- 297611-SK-C-105

The combined tunnel section is 2.67km in length. The road alignment is unchanged compared to the 2010 5% maximum grade option while the rail alignment is lowered to -33m RL from -27m RL at Gaunt Street Station (all options maintain feasible connection to CRL at Aotea station).

The distance between the alignment bifurcation and the start of the Gaunt Street station platform is about 250m. As the rail alignment can only gain about 1.5m vertically within this length due to the long vertical curves and as a 16m clearance between rail and road levels is required based on the initial cross sections the rail station has to be lowered to avoid a clash of vehicle envelopes.

4.2.3 Bifurcation structures

The northern cut and cover bifurcation structure will be approximately 110m by 50m and 32m deep and incorporated into the cut and cover structures required for the road tunnel. The southern bifurcation structure would either be land based within Wynyard Quarter approximately 130m by 65m and 42m deep or could be constructed in the marina with permanent reinstatement to existing seabed level. The land based southern bifurcation is recommended at this time as this results in the maximum length of combined tunnel.

4.2.4 Connections

4.2.4.1 North end

Amendments to both mainline road and rail geometry are required to facilitate the northern bifurcation given the steepness of the grades of the road as the tunnel approaches the portal. The modified geometry adopts the same connectivity as the defined tunnel option at Onewa with a broadly equivalent environmental impact.

4.2.4.2 South end

The portal and southern connections remain unchanged from the 2010 defined tunnel option.

4.2.5 Impacts

Property impacts will be greater with the incorporation of a land based bifurcation at the southern end. Property acquisition is detailed in TN005 in Appendix F. The financial impacts can be reduced through resale of land after completion.

Additional reclamation in the order of 20,000m^2 will be required at the northern end.

5. Cost Considerations

5.1 Overview

A review of the existing cost model for the 2010 AWHC by Beca (Revision 6, October 2010) was undertaken to consider changes in cost arising from combined tunnel options (cost delta) as a capital cost assessment without consideration of the staging of expenditure.

5.2 Comments on the Existing Cost Model

The existing estimates have a combined expected cost of s 9(2)(b)(ii) and a 95th percentile estimate of s 9(2)(b)(ii) with an indicated accuracy of +/- 30% (Beca 12 Oct. 2010).

A review of the costing information provided for the AWHC study and the costing information undertaken for the CRL project reveals discrepancies (AECOM 2010). The rail tunnels for CRL and AWHC for example would utilise similar methods and have similar features and be excavated in similar geology. However, the base civil construction rate for the AWHC rail tunnels is significantly higher than the CRL rail tunnels. These differences in base rate are compounded by the various indirect cost elements (preliminary and general costs, contractors margin etc.)

A review of the cost models against the costs tendered for the Waterview Connection (noting the alliance procurement model) even with allowances for differences in diameter and additional elements required for the combined tunnel suggest that the base rates for the tunnels are higher than the market rates by up to 20%. Allowances for indirect costs and client costs compound these higher base rates such that overall the existing cost models are considered to over-estimate the costs of the tunnels.

5.3 Comments on Cost Delta

The initial cost data are high level estimates only with an accuracy of plus/minus 30%. It is largely based on a series of approximations and assumptions. The cost delta is unlikely to be more accurate than the existing estimate.

Given a relatively small increase in the cost (and risk) of tunnelling for a larger TBM (17m) it would be expected that two combined road and rail tunnels would cost less than two sets of separate road and rail tunnels (15.4 + 7m). The costs of connecting elements and property would not be significantly increased except for the bifurcation structure at the southern end. Potential savings are partially offset through the need for this bifurcation structure. These additional costs are more significant for AWHC due to its comparatively short length of tunnel compared to some international examples (Shanghai Yangtze Tunnel, China which is 8km long).

After considering the above it is estimated that the combined tunnel option would result in an overall reduction in the estimate of NZ s 9(2)(b)(ii) less additional property costs (see Appendix H for details). Through further optimisation it is estimated that the savings could be further increased by about NZ s 9(2)(b)(ii) less additional property costs.

For more accurate data it is recommended that a revised bottom up estimate be completed.

6. Risks and Opportunities

Only new areas of risk introduced by the new crossing form were considered by the study team. Existing risks to the project not affected by the new crossing were not rigorously assessed although of these the two main areas of potential concern are the siting of the ventilation outlets and the removal of the Victoria Park Viaduct. It is recommended that both of these elements of project risk are considered in more detail as the project develops.

s 9(2)(g)(i)

[redacted]

s 9(2)(g)(i)

[redacted]

The options for combining both rail tracks in one tunnel are worthy of further detailed consideration. This could result in further savings through a much simpler southern bifurcation structure with reduced property impact. However, this is likely to be offset by the need for an additional tunnelling machine.

7. Conclusions and recommendations

The scope of this engineering study was specifically to establish the feasibility and cost delta of a combined road and rail tunnel crossing of Waitemata Harbour based on the current transport corridor as defined and confirmed in 2008 and 2010 respectively. It was specifically not an optimisation exercise for the current twin road and twin rail tunnels, or a transport planning study.

Various options for combining the road and rail tunnels have been explored and all are feasible in terms of functionality albeit some of the options have greater engineering complexity and risk. The recommended option comprises two tunnels combining road and rail with interconnections between and between tunnel bores, and bifurcation structures at the North and South ends. This option minimises risks within the current state of knowledge regarding the ground conditions and the required geometric connections. The recommended option gives a potential cost saving of NZ[redacted], less additional property costs, when compared with the estimate prepared for the defined tunnel option (option T1). Through further optimisation it is estimated that the savings could be further increased by about NZ[redacted]. These estimates are unlikely to be more accurate than the existing overall estimate.

The main areas of engineering complexity for this study arise at the southern section of the project given existing infrastructure and land use and the road and rail geometric constraints, in particular the CMJ alignment, the Victoria Park Tunnel and viaduct and the proposed Gaunt Street Station. It is recommended that both the siting of the ventilation outlets and the removal of the Victoria Park Viaduct are considered in more detail as these pertain not only to this study but broader consideration of the scheme effects.

Possibilities for further optimisation of the combined tunnels are identified. It is recommended that geotechnical investigations are undertaken to improve the reliability of the assumed geotechnical conditions particularly at the southern area but also to further investigate some of the geophysical anomalies which have been identified by previous investigations.

It is further recommended that consultation with stakeholders commences and a detailed ‘bottom-up’ cost estimate is made

Appendices

Appendix A. Project Brief

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Appendix B. Similar Projects (literature review)

Technical Note

Technical Note No 297661 – 0001

Subject

Additional Waitemata Harbour Crossing Combined Feasibility Study

Literature Review of combined Road and Rail TBM tunnels

Revision	Date	Originator	Checker	Approver	Description
01	21 October 2011	J A Spaul	David Gutteridge	David Gutteridge	For information

1. Introduction

To aid the feasibility study a review of similar projects worldwide has been carried out using our in house knowledge and a web search. The information collected is presented in tabular form in section 2 of this technical note. Section 3 provides pictorial information on the projects identified in section 2. The Technical Note will be updated as and when further information becomes available.

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2. Characteristics of existing combined road and rail projects

Principle features	1. Alaskan Way	2. SMART	3. Silvertown	4. Shanghai Changjiang	5. A86	6. MadridM30	7. Orlowski Tunnel St Petersburg	8. Cross Sound Link	9. Silberwald	10.Bering Straits
Place	Seattle USA	KL Malaysia	London UK	Shanghai China	Paris France	Madrid Spain	St Petersburg, Russia	New York	Moscow Russia	Siberia-Alaska
Date	Construction about to commence	Completed 2007	Under Concept study	Completed for road traffic 2009	Open	Completed 2007	Construction scheduled for 2011	Under concept study	Completed2007	Under concept study
Use	Road - Cars and trucks	Road – light vehicles only Storm water relief	Road - Cars and trucks	Road - Cars and trucks Rail - Metro	Road – light vehicles only	Road - Cars and trucks	Road - Cars and trucks	Road and rail	Road and rail	Road and rail
Tunnel Length	2.8km	9.7km total with storm water tunnel centre 3km combined with road use	1.2km	7.17km	Approx 10km	Several tunnels of varying lengths amounting to ?????km	Reported as between 1 and 2 km	????	1.51km	85km in two stretches
Water crossing	No	No	Yes	Yes	No	No	Yes	Yes	No	Yes
Number of tubes	1	1	2	2	1	2	1	2 road, 1 rail plus escape	2 road plus rail, 1 escape/service	2 road plus rail, 1 escape/service
Number of Decks	2	2	1	2	2	1	2	1	2	2
No. of road traffic lanes per tube	4 (2 each way)	4 (2 each way)	2	3	4	3	6 (3 each way)	????	3	3
Road envelope height	4.57m	2.550m	5.03	???	Not known but vehicle height limit of 2.0m	????	Accommodates trucks	????	Accommodates trucks	????
No. of Rail tracks per bore	None	None	None under present options but considered in earlier options. Abandoned for Rail routing aspects not engineering feasibility.	1 (not yet operating) on lower deck in invert	None	None	None	2 tracks in the rail bore	1	1
Utility/invert use	Well utilised cross section unlikely to have space for significant utility use	Storm water relief. With traffic stopped whole bore is used.	Option for utility use	Literature indicates cable ways	Unkown by author	Very large invert but used for emergency rescue	Invert used as a means of escape via chutes	????	????	????
Internal diameter	15.85m	11.830m	11.0m	13.7m	10.4m	13.5	????	????	????	????
Lining thickness	610mm	500mm	550mm	???	???	700mm	????	????	????	????
Cut diameter	17.5m approx	13.2m	NA	15.43m	11.56m	15.2m	19.2m	????	14.2m Main tunnels 6.3m Escape/service	????

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Principle features	1. Alaskan Way	2. SMART	3. Silvertown	4. Shanghai Changjiang	5. A86	6. MadridM30	7. Orlowski Tunnel St Petersburg	8. Cross Sound Link	9. Silberwald	10. Bering Straits
TBM Manufacturer	Hitachi Zosen	Herrenknecht	NA	Herrenknecht	???	& TBMs used on the project. From Herrenknecht and a JV between Mitsubishi and Duro Felguera SA	Unknown, details from Herrenknecht	NA	Herrenknecht	NA
TBM Type	????	Mixshield	EPB or Slurry	Mixshield	EPB/Slurry (Mixshield)	EPB	Presumed Slurry	NA	Mixshield	NA
Type of ventilation	Semi Transverse	Longitudinal by external ventilation stations	????	Longitudinal with jet fans	Semi Transverse	????	Longitudinal with jet fans	????	????	????
Method of escape	Dedicated longitudinal passageway accessed from both decks	Cross passages at approx 250m c/c. These are external to the bore and allow access to the non-incident bore.	????	????	Cross passages at approx 200m c/c. These are external to the bore and allow access to the non-incident bore.	????	Stairs between decks at regular intervals	Cross passages to central bore	Cross passages to central bore	Bypasses every 3.2km
Other comments							Single bore double deck configuration not yet confirmed and may be twin bores.			

Notes:

1. NA = Not available
2. ???? Facts to be determined
3. Abc = Tunnels completed and operational

3. Pictorial Information on Combined Road and Rail TBM tunnel projects

3.1 Alaskan Way

Figure 3.1.1: Alaskan Way 3D model cross section

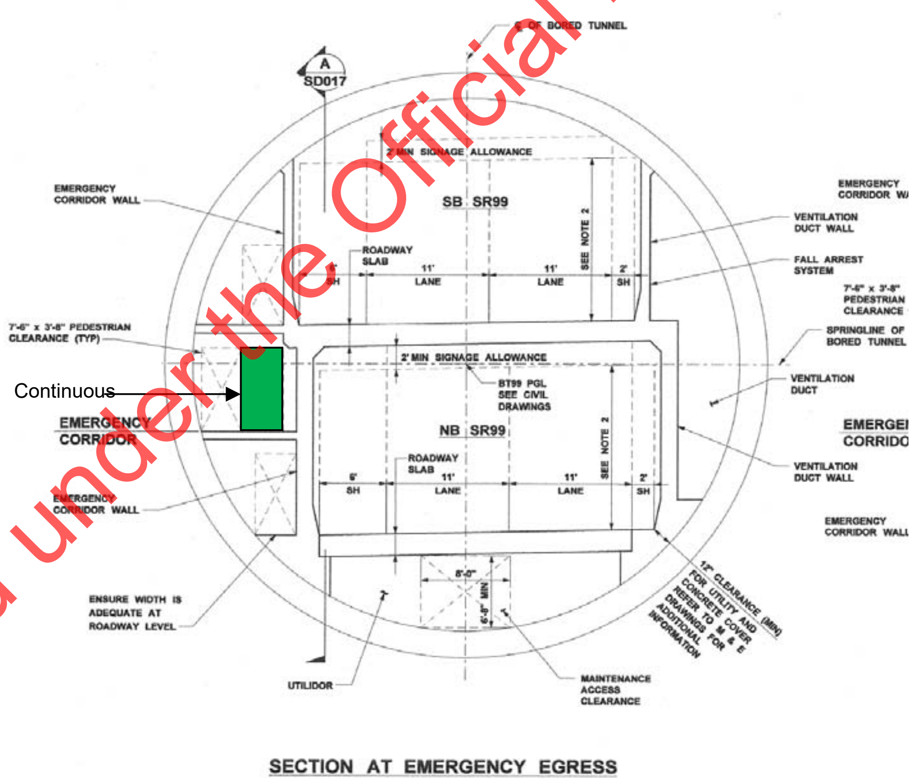

Figure 3.1.2: Alaskan Way - Cross Section at Emergency Egress

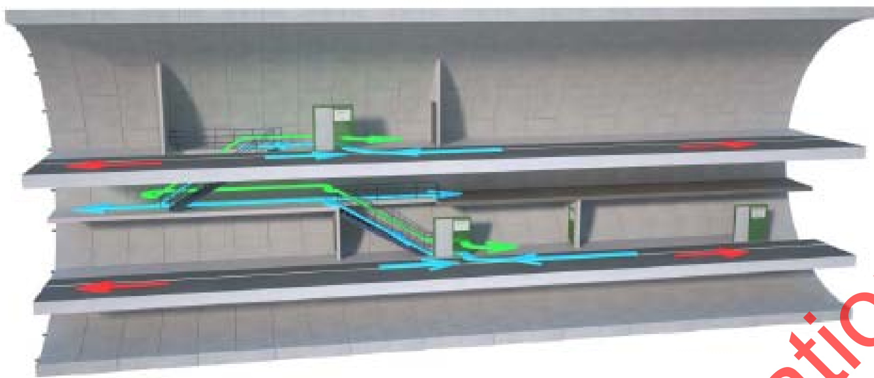

Figure 3.1.3: Alaskan Way - Longitudinal section through 3D model showing escape routes between decks

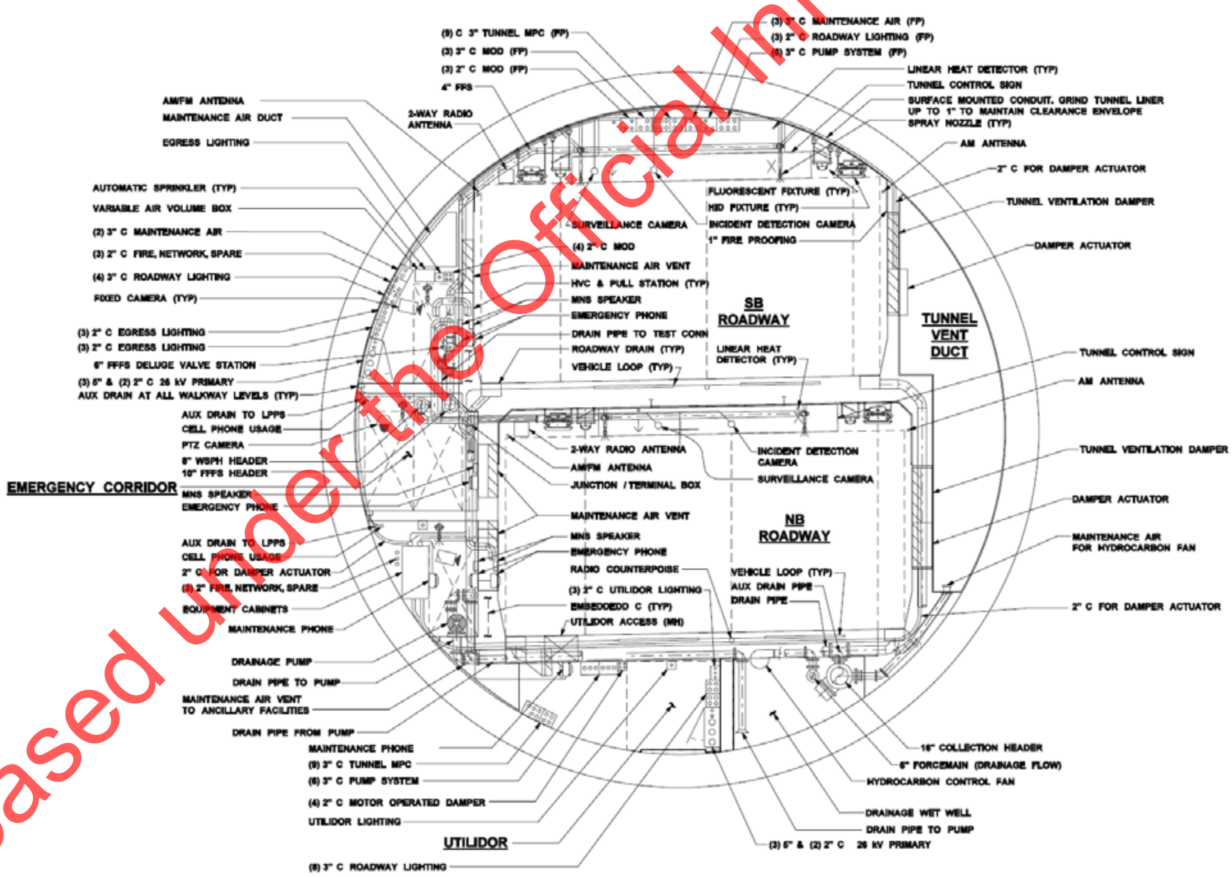

Figure 3.1.4: Alaskan Way - Tunnel systems, note spatial take up

3.2 SMART

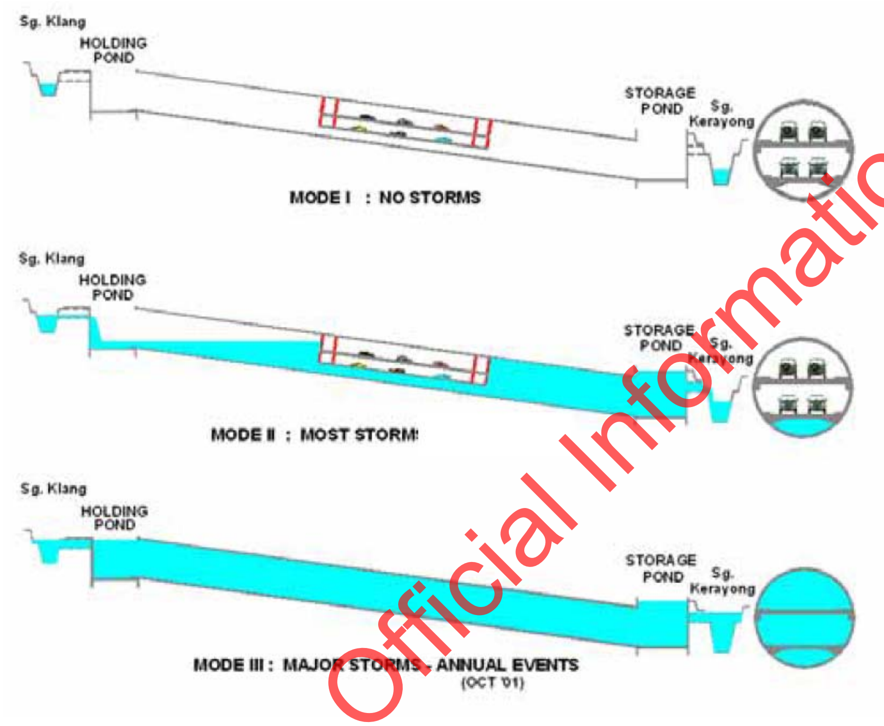

Figure 3.2.1: SMART - Dual purpose traffic and flood relief in three modes

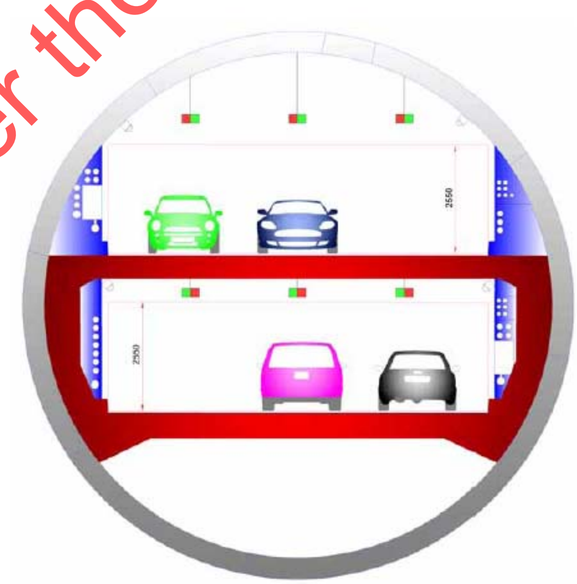

Figure 3.2.2: SMART - Typical cross section. Road decks designed to resist water pressures

Figure 3.2.3: SMART - Inside upper deck

3.3 Not used

3.4 Shanghai Yangtze Tunnel (Changjiang)

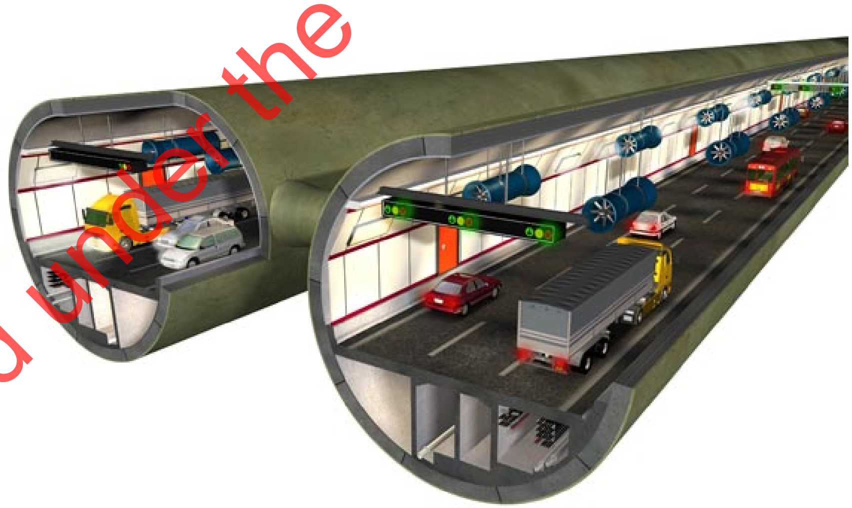

Figure 3.4.1: 3 lanes per bore. This view would appear to predate Railway in invert

Figure 3.4.2: Changjiang - Herrenknecht Mixshield used 17.5m cut diameter

Figure 3.4.3: Changjiang - Cross section showing provision for metro. Space would appear very tight, escape stairs appear to arrive in road lane.

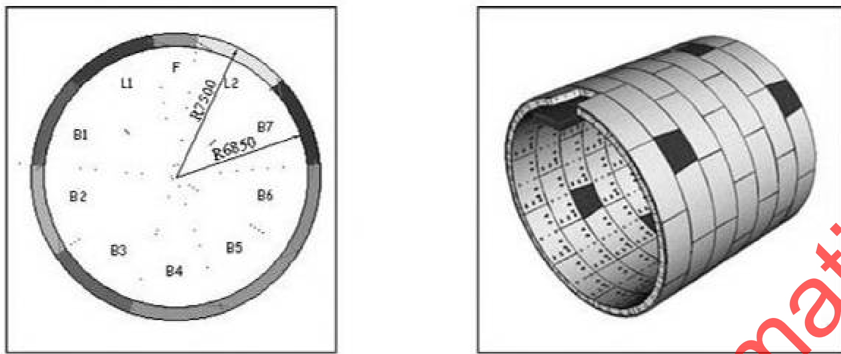

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Figure 1. Segment cross-section.

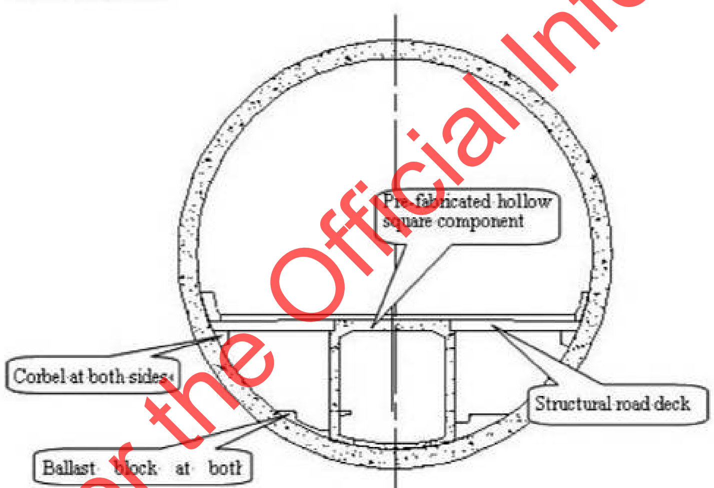

Figure 3.4.4: Changjiang - Lining and deck details

3.5 A86 Paris

Figure 3.5.1: A86 - Safety concept and view of lower deck

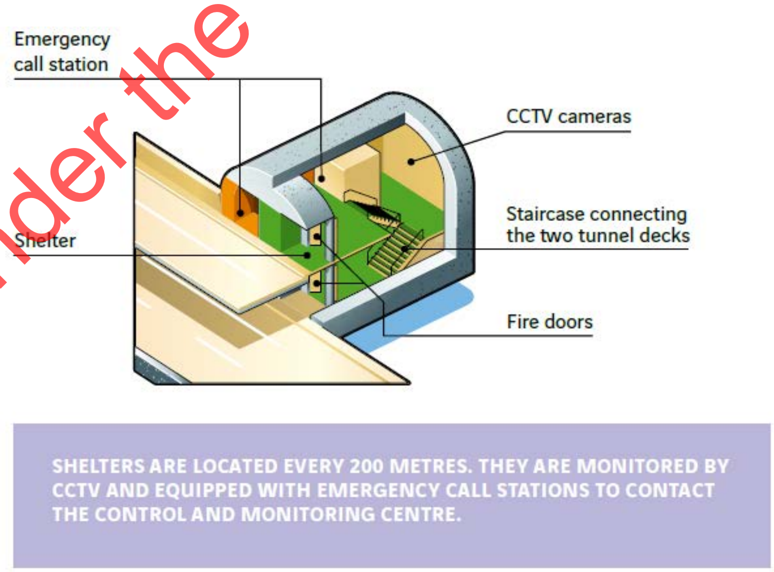

Figure 3.5.2: A86 - External ‘crosspassage’ between upper and lower decks (cf SMART)

3.6 M30 Madrid

Figure 3.6.1: Madrid M30 - Overlay of tunnel concept to replace surface road. Note deep inverts

Figure 3.6.2: Madrid M30 – Showing scale of TBM used, 15.2m

Figure 3.6.3: Madrid M30 - TBM Details

Figure 3.6.4: Madrid M30 – Completed tunnel prior to deck installation

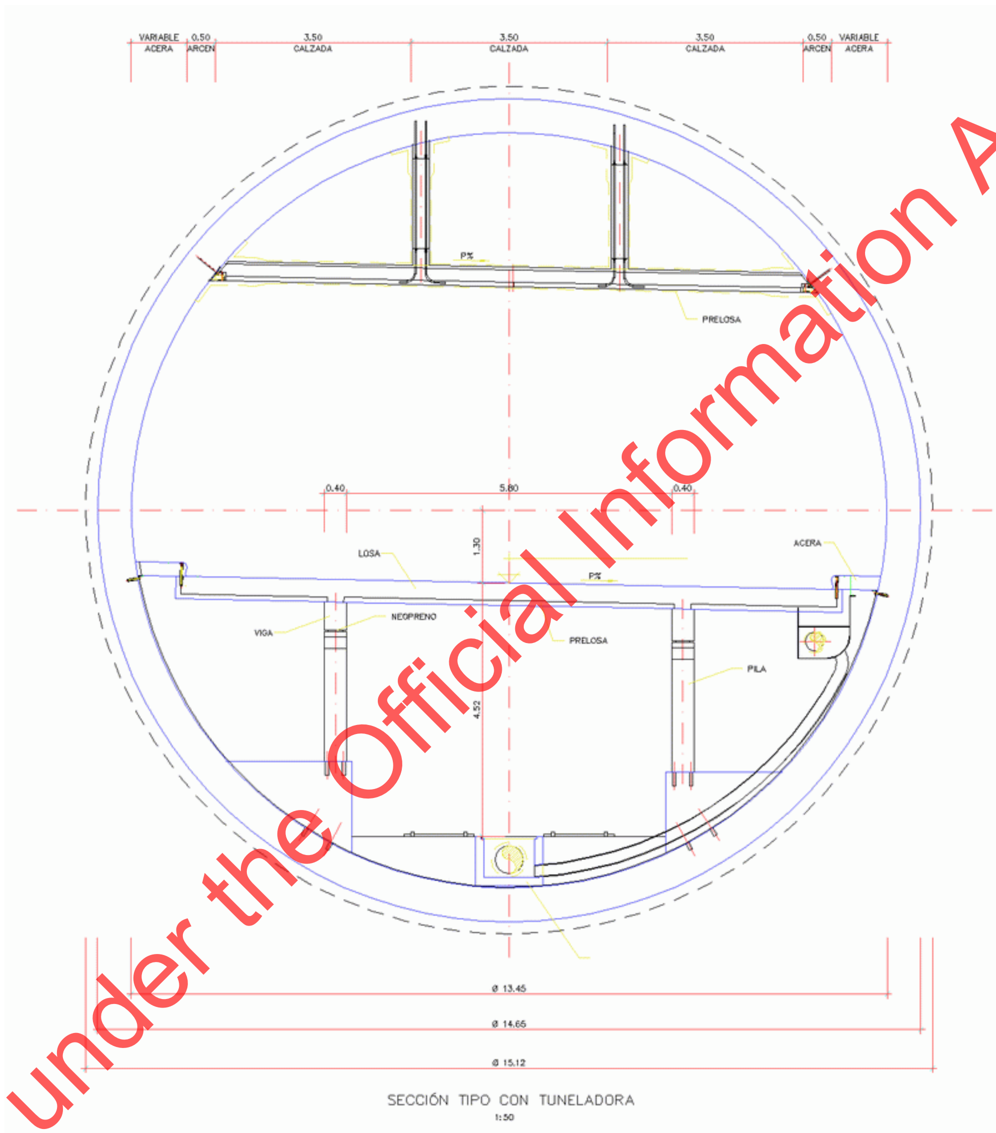

Figure 3.6.5: Madrid M30 – Cross section dimensions

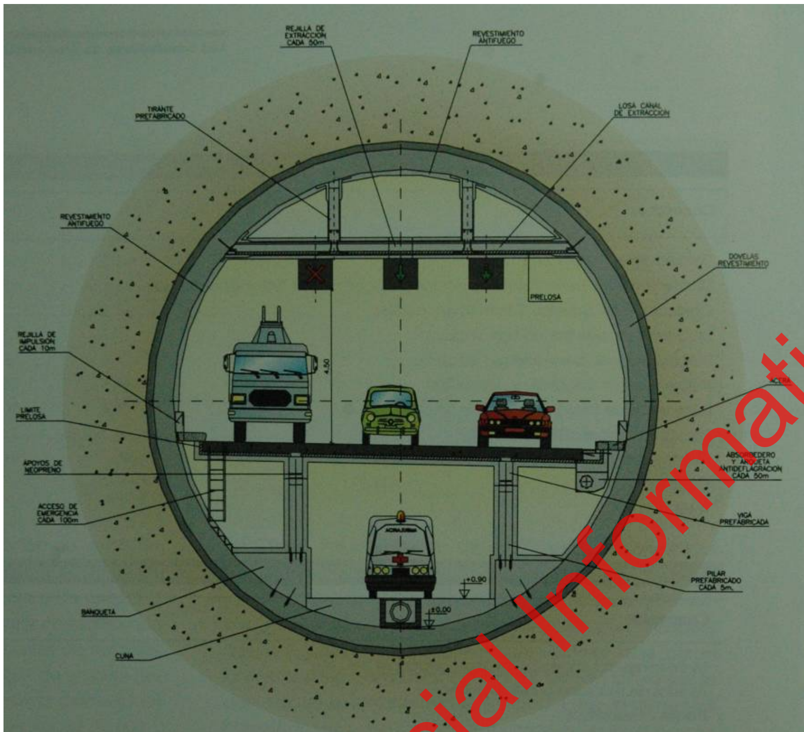

Figure 3.6.6: Madrid M30 - Cross section in use. Note that invert is used as a further means of escape but has a 'because it was there' feel about it.

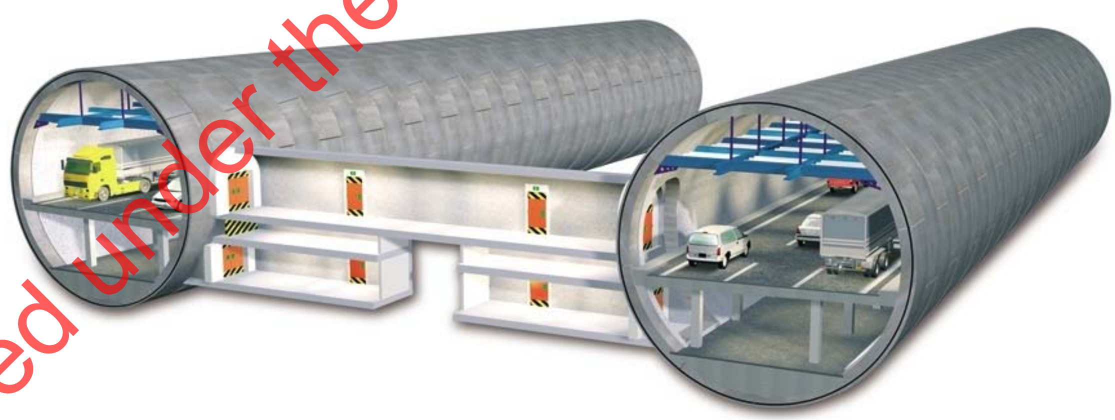

Figure 3.6.7: Madrid M30 – Cross passage

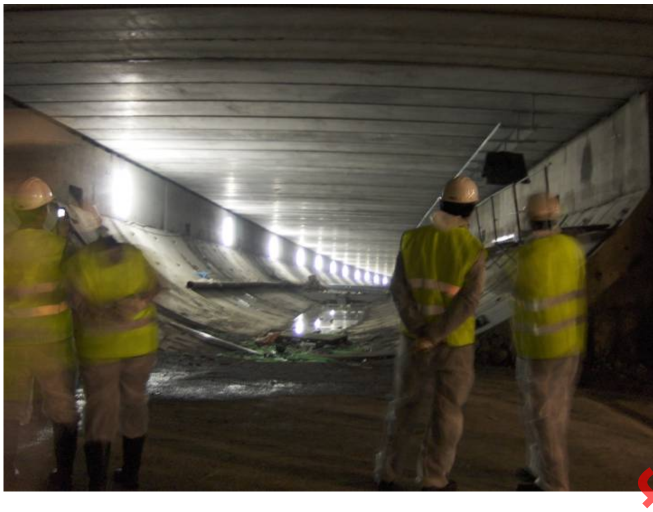


Figure 3.6.8: Madrid M30 – Precast deck structure

3.7 Orlowski Tunnel St Petersburg


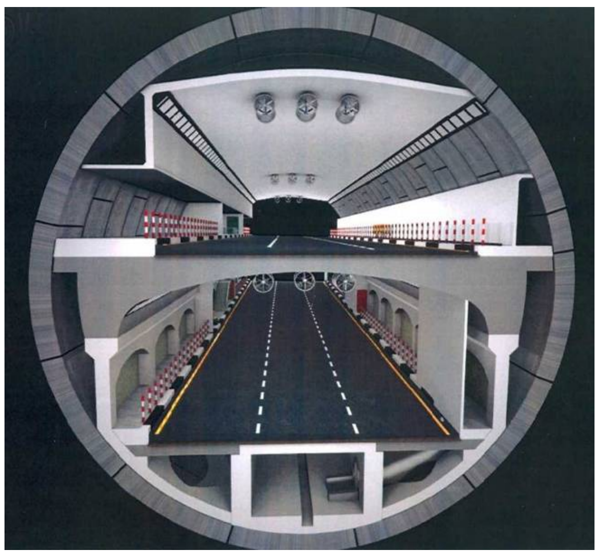

Figure 3.7.1: Orlowski 3D models

3.8 Cross Sound Link, New York, USA

Details awaited

3.9 Silberwald, Moscow Russia

Figure 3.9.1: Silberwald Moscow. Note central escape provision

Figure 3.9.2: Silberwald lining

3.10 Bering Straits (Siberia-Alaska)

Peace King tunnel (Bering Straits)
project summary sheet

Russia/USA

Length	278,870 ft
Diameter	46 ft for the main tunnels 23 ft for the service tunnel
Number of Bores	3 (2 main for transportation, 1 service)
Depth	229 ft
Number of Cross passages:	Bypasses every 10,650 ft, ducts ever 656 ft
Completion Date	2017
Cost at Completion of Construction	$65 billion

Figure 3.10.1: Details of concept for Bering Straits

Appendix C. Constraints

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4. Road Engineering

4.1 State Highway

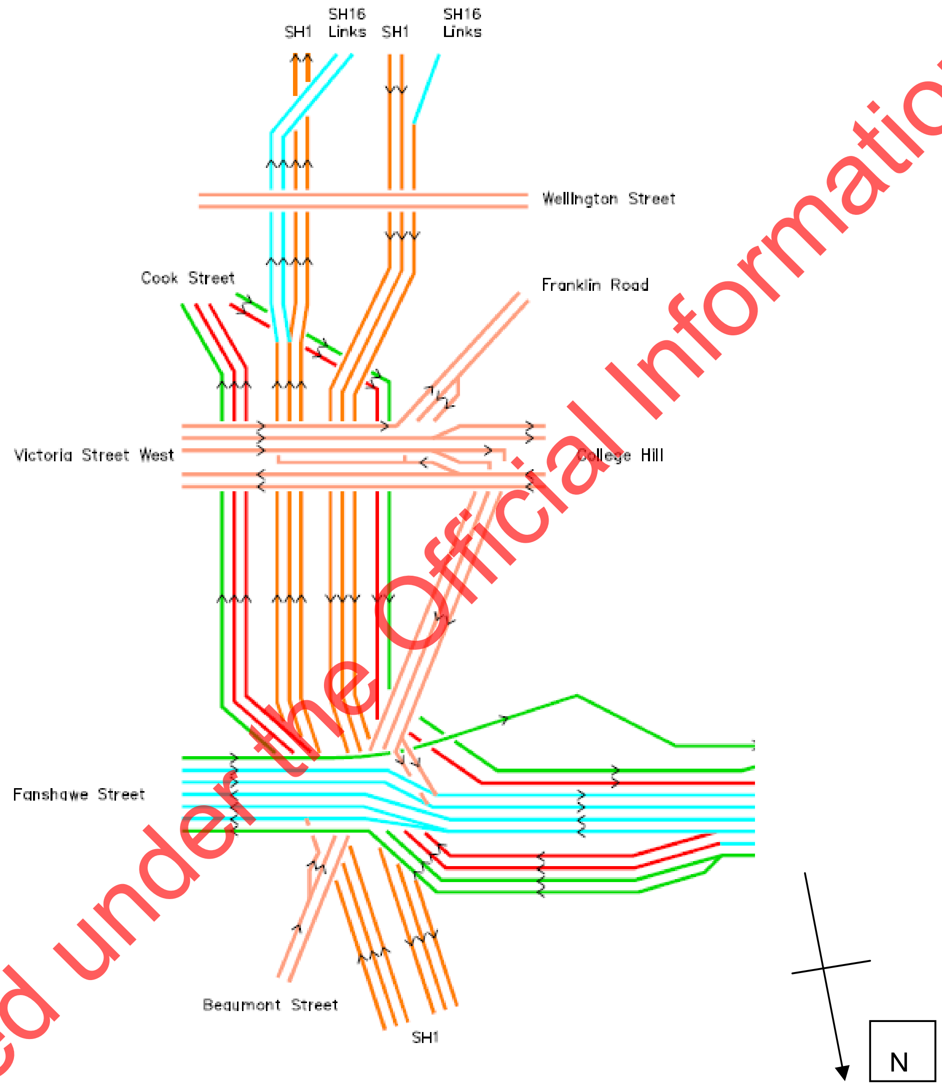

Figure 3. Southern Sector Road Connections (Extracted from DWG TR 032 of the 2010 Study)

The Northern Motorway currently comprises up to five traffic lanes in each direction as well as a southbound bus lane associated with the Northern Busway. The southbound bus lane runs form the Akoranga Station Bus Station (located north of the Onewa Road Interchange), along the seaward side of the motorway, to merge with the motorway lanes on the approach to the AHB.

At the southern landing of the AHB the Shelly Beach Road motorway off ramp and Curran Street motorway on-ramp provide connections between the North Shore and areas to the west of the

CBD, including Herne Bay, St Marys Bay, and Ponsonby. From the AHB southern landing the motorway follows the coastline at the base of the St Marys Bay cliffs before moving inland at Fanshawe Street, across Victoria Park Viaduct to the CMJ at Wellington Street. This section of the motorway currently accommodates a maximum of four lanes in each direction, reducing to two lanes in each direction across the Victoria Park Viaduct.

4.2 Local Roads – Southern Sector

Text in italics is extracted from the 2010 study.

Sector	*Road Classification*	*Roads Within the Study Area*	*Existing Traffic Flows (vpd)1*
Southern Sector	*Regional Arterial Road: these roads collect and distribute traffic to and from the arterial road network.*	*Fanshawe Street*	*30,300*
		Cook Street	*21,600*
		Curran Street	*9,000*
		Shelly Beach Road	*8,800*
	Collector Road: these roads collect and distribute traffic to and from the arterial road network.	*Wellington Street*	*12,300*

Relatively modest queues occur at a number of locations in the PM peak, including on the Victoria Park Viaduct northbound and on either side of the AHB.[1]

The network performance may change when the Victoria Park tunnel opens. However, this comment is included in respect of informing the options for 'baselining' the tunnel cross section. In a congested adjoining network scenario a smoke duct would be required. (For further details refer TN003)

4.3 Road Geometry - Southern Sector

4.3.1 Through Alignment Issues

The road alignment is constrained by Victoria Park tunnel horizontally to the West and vertically. The alignment is also constrained by proximity to the Cook St off-ramp which runs adjacent to Fanshawe St in cut and cover tunnel. (Refer Figure 2 above).

Any raising of the road alignment increases the geotechnical risks associated with the road tunnels through reducing the ground cover to the tunnel and increasing the effects of tunnelling at the surface.

[1] Additional Waitemata Harbour Crossing: Do Minimum Saturn Models, 15 September, 2010

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Based on the survey data available there is a moderate sag curve linking the flat grade of the Victoria Park Flyover (VPF) into the CMJ. This reaches a maximum grade of 6.25% north of the Wellington Street Underpass. The existing CMJ is a built-up environment and the existing configurations north of the Wellington Street overbridge are assumed to be largely fixed with the potential for only minor modifications for horizontal adjustments. Significant regrading through the area has not been considered and thus the CMJ connection points dictate the vertical levels which must be met.

4.3.2 CBD connection Issues

Existing situation:-

- Fanshawe Street on and off connections
- Cook Street off only
- Wellington Street on only

Option T1

- Fanshawe Street on and off connections – no change
- Cook Street off (2 lane) and on (2 lane) – additional capacity and direction
- Wellington Street on **closed**

4.3.3 Southbound Grades

Whilst the study is only required to consider differences between the combined tunnel and the separate road and rail tunnels we observe and comment upon the main line alignment with respect to the SH1 connections as these are fundamental to either scheme configuration.

Issues surrounding the steep grades and the effects upon HGV's were highlighted in the 2008 study with further work recommended. The 2010 study provides both a 6.25% and a 5% maximum grade alignment but this does not meet Austroads standards due to the lengths of these gradients. Referring to Figure 9.4 (under Austroads Section 9.5, for a B-double trailer), a length of road of 580m at 5% creates an operating speed drop from 80km/h to 40km/h, the maximum permissible. Therefore for a B-double trailer (worst case vehicle) the length of this grade is approximately 470m too long. For a semi –trailer (figure 9.3) the length of grade would be 350m too long.

The effect of slow HGV's clearly needs further analysis as it will have potentially significant effects on southbound capacity and operational safety.

Options for a climbing lane which are warranted under Austroads are limited by the space available to connect to SH1. It is noted that a climbing lane if provided, would need to extend beyond the end of the uphill grade so that the truck may accelerate again and merge with the rest of the traffic.

5. Auckland Harbour Bridge (AHB)

The following text in italics is extracted from the 2010 study.

Load Capacity Constraint

The AHB has been modified over the last 50 years to cater for the increasing traffic loading and requirements of modern standards. Traffic load monitoring of the AHB has been used to establish a bridge-specific live load for the crossing. The extension bridges have recently been strengthened to cater for current traffic loading and to provide as much margin as practicable for future growth. The limitations of the load-carrying capacity of the bridge have most recently been assessed in 2007 and forecasts based on measured trends in vehicle numbers and weights have indicated that without vehicle management regimes being put in place the northbound extension bridges will reach their load-capacity in the next one or two decades. If traffic load growth continues at current rates then it will be necessary to introduce load management (for example early morning incident management) to control the concentrations of heavy vehicles in critical peak traffic flows at some point in this timeframe. Further strengthening of the truss bridge is also required and planned in this timeframe.

As one of the NZ Transport Agency's key assets and a lifeline route for Auckland the AHB requires full-time monitoring and maintenance to keep it operational. As well as routine maintenance such as re-surfacing, painting and cleaning a dedicated team of contractors and consultants carry out ongoing structural services and maintenance activities to keep the bridge in safe working condition. Inspections and assessments are programmed and defect repairs are an ongoing requirement. One of the key maintenance tasks is monitoring and repairing fatigue cracks as they occur, particularly in the steel orthotropic deck of the box girder extension bridges. The fatigue life of the structure depends upon the numbers of heavy vehicles crossing the harbour and the lanes in which they travel.

It is noted that the continued operation and maintenance of the AHB and its role within the Auckland network is a critical factor in considering the timing of the AWHC.

6. Victoria Park Tunnel Project

The Victoria Park Tunnel (VPT) is now operational. The project includes a 440 metre long cut and cover tunnel beneath Victoria Park, providing three lanes for northbound traffic. The northbound tunnel has been specifically located and designed so as to not prevent a future southbound tunnel being built to replace the existing Victoria Park Viaduct. .

The location of the VPT constrains the main tunnel alignment.

7. Victoria Park Viaduct

The Victoria Park Viaduct (VPV) was constructed during the early 1960's to link the Southern Motorway to the AHB, replacing the link via Nelson Street and Fanshawe Street to the motorway through St Marys Bay. Currently the four lane layout proves to be a bottleneck on both sides of the AHB. This viaduct operates with four lanes Southbound and would be progressively dismantled as part of the Additional Waitemata Harbour Crossing.

8. Victoria Street

On the south side of Victoria Park runs Victoria Street West. This road has multiple signalized intersections and street frontages on the southern side which are assumed to prevent any significant changes to the vertical grade. The cut and cover tunnels from the proposed crossing are required to pass under Victoria Street and as such the potential for raising the tunnel is limited by Victoria Street.

The same vertical clearance between Victoria St and the new carriageway as has been proposed for the Victoria Park Tunnel (VPT) is assumed. Based on survey data provided, in order to pass under Victoria Street and then match the grades of the central motorway junction (CMJ) a vertical grade of 6.25% was determined in 2008. In 2010 both a 6.25% gradient and a 5% gradient option (with increased impacts on overlying buildings was developed

9. Victoria Park

It has been assumed that Victoria Park is to be made free of all surface and above surface motorway infrastructure. Accordingly, the road needs to be below the level of the park and that of Victoria Street as mentioned above.

10. Public Transport

The following text in italics is extracted from the 2010 study.

10.1 Suburban Passenger Rail

Auckland's rail system extends from Pukekohe in the south and from Waitakere in the west to the CBD (Britomart Transport Centre). Services are divided into three groups – eastern Line (Britomart to Waitakere) Southern Line (Pukekohe to Britomart via Ellerslie and Newmarket) and the Eastern Line (Pukekohe to Britomart via Sylvia Park and Glen Innes). Passenger rail is not currently available within North Shore City. Within the study area the closest train station to the AHB is at Britomart Transport Centre downtown in the CBD.

10.2 The Northern Busway

Opened in February 2008, the Northern Busway provides a dedicated, high capacity, passenger transport facility on the North Shore (between Albany and Onewa Road) and a limited capacity service using general traffic lanes and bus shoulders over the AHB and into the Auckland CBD on the eastern side of SH1. A future extension of the Busway further to the north will see a connection to the Albany Park and Ride Station. The Northern Busway is designed to allow bus services to join at different points resulting in variations in bus volumes along the corridor. Express services (trunk services) and local bus services ((feeder services) link into the Busway through stations at Constellation, Sunnynook, Smales Farm and Akoranga. The closest Busway station to the AHB is Akoranga Station at Esmonde Road. There is a southbound bus priority lane between Akoranga station and the northern approach to the AHB. Further connections to Albany Park and Ride (to the north) and Britomart (Auckland CBD) are achieved via a combination of kerbside/shoulder bus lanes and the road network.

The Northern Busway has experienced strong growth in demand over the last five years with a corresponding significant increase in bus services during the peak hours. The carries about 5,000 passengers per hour in the peak periods, with the peak hour flow of about 105 buses in 2009. Most Northern Busway services operating to the CBD approach along Fanshawe Street, with a small number operating to Newmarket via Shelley Beach Road and Ponsonby Road. The combination of trunk and feeder services operating to and from the CBD results in a gradual build-up of total bus volume on the Busway in the direction of the AHB.

Capacity between the AHB and the CBD is limited by operations on Fanshawe Street and in the vicinity of Britomart Transport Centre. North of the AHB, Busway capacity is limited by the

[redacted]

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operation of different stations, the lack of grade separation at the Upper Harbour Highway and conditions at the southern end of the Busway in the vicinity of Onewa Road.

11. Utilities

The following text in italics is extracted from the 2010 study.

Utilities

A number of major existing utilities run along or across the study area.

International Telecommunications Cables

The International Telecommunications Cables (ITC) cables are owned and operated by Telecom and connect New Zealand's telecommunications network to the rest of the world. A bank of approximately twenty ITC cables cross under the existing northern motorway in the vicinity of Northcote Road Interchange. The ITC passes under the existing SH1 from Stafford Road into the sea. The ITC cables pass through the southern sector at Victoria Street West and Victoria Park.

Transpower Linking Project

The Transpower Linking Project (TPLP) cables are owned and operated by Transpower. The TPLP cables have installed ducts for proposed 220kV power cables from Penrose to Albany and these run through the study area. The power cables will be pulled through these ducts in the next two years and will complete the main Auckland power supply loop to provide power security to the north of Auckland. In the northern sector the existing TPLP cables cross the AHB, enter the ground at the AHB abutment and run along the seaward edge of the motorway to Esmonde Road Interchange. The existing TPLP cables in the southern sector run under Fanshawe Street, the Fanshawe Street off-ramp and Westhaven Drive to the AHB.

Freemans Bay Stormwater Culvert

The Freemans Bay Stormwater Culvert (FBSC) crosses the motorway corridor on a diagonal from the eastern end of Weld St through Victoria Park (at a depth of approximately 5 metres) to Fanshawe Street. The culvert is a brick, egg shaped pipe (2.7 metres wide by 3.5 metres high). As part of the VPT project the FBSC has been diverted along the western side of VPT to provide the clear corridor required for construction. The new culvert remains on the western side of VPT until the tunnel is deep enough for the FBSC to cross it. All stormwater on the eastern side of VPT, including the CMJ stormwater is conveyed in a 1.8 metre diameter reticulated system down Union Street to the FBSC.

Orakei Main Sewer

The Orakei Main Sewer (OMS), owned and managed by Watercare, crosses the motorway corridor from Weld Street to Drake Street. The original alignment of the OMS crosses through the uncovered trench section of the VPT. As part of the VPT project the Victoria Park Alliance have diverted the 2.21 metre high egg shaped OMS north to pass over the covered section of VPT.

[redacted]

12. Rail Engineering

12.1 Rail Geometry

The rail alignments have been developed with a limiting vertical gradient of 3.5% compensated for horizontal curves.

12.2 Gaunt St Station

The 2010 Gaunt St station position and platform levels were adopted as developed by the 2008 study.

13. Geotechnical Conditions

13.1 East Coast Bays Formation (ECBF)

The ECBF is typically extremely weak to weak, highly weathered to slightly weathered, sub-horizontal thin to moderately thick interbedded sandstone and siltstone with extremely closely spaced to widely spaced fractures. Sandstone units in the ECBF are frequently uncemented to poorly cemented which has design/construction implications on sequential tunnelling methods.

The permeability of the ECBF is dominated by secondary porosity i.e. fracture flow. Therefore the permeability will not be consistent but will be dependent on localised fracture density and degree of interconnection. The bulk permeability of this group is in the order of 10^{-7} to 10^{-8} m/s' with higher permeability typically influenced by bedding planes and discrete joints.

The unconfined compressive strength of ECBF typically ranges between 1-4MPa.

The ECBF has been shown to be a good tunnelling medium in respect of its consistency when appropriate tunnelling methods are employed.

13.2 Other Geotechnical Units

These include weathered and residual ECBF overlying the bedrock, Tauranga Group alluvium and hydraulic fill. These overlying units may influence the amount of consolidation settlement to the degree that they are compressible and to the degree that the water pressure is reduced within the units.

13.3 Influence of Geotechnical Conditions for Combined Tunnel

The combined tunnel is somewhat larger in diameter than the T1 tunnels but not significantly so. For road alignment to be maintained the effects of tunnel construction may increase as the crown of the tunnel is closer to existing buildings structures and utilities.

Appendix D. Fire Life Safety Considerations

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Appendix E. Options Assessment

Technical Note

Mott MacDonald

aurecon

Technical Note No	297611 – TN004
Subject	Additional Waitemata Harbour Crossing Combined Feasibility Study Options Assessment

Revision	Date	Originator	Checker	Approver	Description
01	23 December 2011	John Spaul Bill Newns V Sayce	V Sayce	D Gutteridge	for discussion
02	16 January 2012	V Sayce Matvey Klopov	B Newns	D Gutteridge	Table updated

Summary

This technical note summarises the options assessment work undertaken since the options workshop held on the 26th of October 2011 and reviewed during the Options review workshop of the 13th December 2011.

Of the options considered a road over rail configuration with a cut and cover bifurcation structure is preferred at this stage (option 1) reflecting ease and lower cost of construction. It is recognised that there are options requiring less property and this may require further consideration at a later date.

This option is considered to offer the simplest combination of methods of construction although all options are considered in engineering terms at least, feasible. It is noted that the baseline option does not present a fully optimised solution. Opportunities for optimisation are noted separately.

Options Assessment

The starting point for option assessment was a road over rail configuration, with cut and cover bifurcation structures (Option 1). Two potential cross sections of combined tunnel (with and without smoke duct) were produced:

i) without smoke duct - SK-C-101

ii) with smoke duct - SK-C102

It is currently assumed that the baseline cross section will incorporate a smoke duct similar to previous tunnel configurations. A detailed fire and life safety strategy and network operational plan has not been prepared but the expectation of congestion within the tunnel dictates a smoke duct

Further alignment development has been undertaken (SK-C-104, SK-C-105, SK-C-106, SK-C-107) incorporating an allowance at the north end for the Onewa interchange and various alignment options at the southern end and this is documented in the Table 1.

A rail over road cross section was also developed to consider the benefits of this configuration.

iii) without smoke duct - 225416-SK-C-103

Corresponding alignment development for the rail over road option (SK-C-108, SK-C-109, SK-C-110, SK-C-111) is documented in the Table 1.

It was agreed at the options review workshop of the 13th December that the preferred configuration is road over rail as this is more robust and to determine the best configuration would require a greater level of design. The rail over road option has some benefits including a reduced amount of cut and cover tunnel construction at the North and the ability to raise the Gaunt St station (due to higher rail level in the combined tunnel) and this will be presented as an alternative option. However, the overall tunnel diameter is likely to be larger to incorporate safety walkways.

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Construcability Assessment for the Southern Bifurcation Structure (cut and cover vs mined)

Overview

The combined road and rail tunnel concept requires that the road and rail be separated from one another in order to reach their respective destinations after negotiating the Waitemata Harbour crossing.

The separation or bifurcation can be achieved using one of two basic structural forms, cut and cover construction using secant piled walls/diaphragm walls or underground mined caverns.

This section reviews these two forms of construction for the Southern Bifurcation and discusses the advantages and disadvantages of geometric options that exist.

Constraints

There are a number of key constraints that will affect the design of either structural form:

- Location of Gaunt Station;
- Desired maximum road gradient;
- Desired maximum rail gradient;
- Location of rock head (i.e., the upper surface of the unweathered East Coast Bays Formation) relative to the crown of mined tunnels;
- The road tunnels must pass under the Cook Street off ramp;
- The road tunnels must meet with a cut and cover section to pass under Victoria Park and Victoria Street realignment.

Ground Conditions

The local bedrock is the East Coast Bays Formation (ECBF). The NZ Transport Agency 2010 documentation Appendix E states the following:

'4.1.5 - *ECBF is typically extremely weak to weak, highly weathered to slightly weathered, sub – horizontal thin to moderately thick interbedded sandstone and siltstone with extremely closely spaced to widely spaced fractures. Sandstone units in the ECBF are often uncemented to poorly cemented.''*

'4.2.2.5 - The permeability of ECBF is dominated by secondary porosity i.e. fracture flow. Therefore the permeability will not be consistent but will be dependent on localised fracture density and degree of interconnection. The published permeability of this group is in the order of 10^{-7} to 10^{-8} m/s'.

From Table 4

'Unconfined Compressive strength of ECBF rock = 1.5MPa.'.

The Rockhead is 4 to 8m below ground level in the vicinity of the bifurcation structure/s.

a) Mined Methods

Geometrical Considerations

The concept is to construct a bifurcation cavern on the alignment of both the northbound and southbound tunnels so that north and south bound railway alignments can turn east towards

Gaunt Station (Refer to Figures 1 and 2). It has been assumed that the length of the cavern can be minimised by starting and finishing inboard of the tangent points.

The shape of the mined bifurcation cavern at its northern end will encompass the profile of the TBM driven tunnel (Refer Figure 3). The cavern will progressively widen towards its southern end to allow the railway horizontal alignment to depart from the road alignment at a suitable radii and with transition curves (Refer Figure 2). The length of the cavern will depend on the track radius, hence the tightest radius that does not compromise rail operation will be structurally favourable. A 250m radius rail curve has been used in Figure 2. The cavern will be of sufficient length such that the cross section of the continued road and rail tunnels have a sufficient separation or 'pillar' between them to allow their independent construction. An extrados separation of 2m is suggested in Figure 4 with an approximate centreline separation of 13m.

The crossover of the southbound road over northbound rail will occur external to the bifurcation caverns with sufficient clearance being made available for the individual tunnels to pass without interference. For the tunnels to pass, the vertical distance between road and rail at the crossing point will need to be substantially increased from that presently assumed within the combined tunnel to at least 16m (See Figure 4). To allow for this the caverns will need to be staggered to enable the southbound road to be free of the constraint within the TBM cross-section of being tied to rail gradients. It can then rise at a suitable gradient to achieve the vertical separation distance or the alignment of the northbound tunnel can be lowered.

The clearances suggested by figure 4 have been developed into the option sketches attached.

Construction Sequence

Assumptions

1. The TBM drives are from the north towards the south for both tunnels. The TBM launch for each tunnel is in the north end bifurcation box.
2. One TBM will be used to complete both north and southbound tunnels.
3. Programme efficiency can be achieved by commencing mined tunnel construction of the bifurcation caverns from the south while the TBM is being procured and driving south.

Sequence

1. Mined tunnels of nominal 6m diameter are constructed from the Victoria Park cut and cover portals on the road tunnel alignments. This size of tunnel will provide adequate plant access for the construction of the bifurcation caverns. Fibreglass spiling is used if needed, so that the tunnel can be later over excavated by the TBM. Note that the rail tunnels from Gaunt Street Station could be used to provide access for cavern construction but are likely to be constructed at a later date and so their presence cannot be relied upon.
2. The mined 6m access tunnels form pilot tunnels through the bifurcation caverns and form the first heading. Each cavern is then constructed by mining further headings in a conventional sequence using rock bolting, canopy tubes or spiling as appropriate. The bifurcation caverns are considerable structures being some 21m high and 26m wide at the wide end. Rock quality, permeability, fracturing and the amount of poorly cemented material will have an influence on the construction method and sequencing. Extensive grouting is likely to be necessary to manage water ingress and secure loose material.

3. The caverns are constructed so that there is 0.5m clearance to the external dimension of the TBM. Concrete infill in the shape of a cradle for the TBM is placed on completion of the invert for the TBM drive through.
4. On arrival at the north end of the cavern the TBM is driven through the cavern. A possible method is to temporarily lay invert lining segments on the cradle and use the TBM jacks to move the TBM along.
5. The TBM is then set up again to bore to the south portal by over cutting the previously constructed access tunnel.

Note: Construction of the bifurcation caverns by breaking out ring by ring from the TBM bore was reviewed and rejected due to programming considerations as it would significantly delay the completion of the bifurcation caverns. In addition the removal of heavy lining segments is considered a significant safety risk.

b) Cut and Cover Methods

The following assumptions are applicable to the cut and cover option:

- Wynyard property can be made available for construction;
- moorings can be relocated;
- permanent or temporary filling of harbour for cut and cover construction is allowable.

Cut and cover construction can easily encompass the bifurcation and the crossover within a single box. The crossover will not require any increase in the vertical separation of road and rail levels used in the TBM tunnel itself. The box will allow for the passage of the TBMs through it to continue the TBM drives to the cut and cover portals.

The boxes will be relatively deep with base slabs 35m to 38m down from ground level. Box construction is likely to incorporate secant piled walls/diaphragm wall to prevent water ingress. Construction could be top down or bottom up. The method will depend on future use and contractor preference. If the space above the tunnels is used then top down constructed floors could brace the excavation. If the space is to be backfilled then bottom up and temporary bracing may be favourable. The plan shape of the box should be kept as simple as possible to avoid complex ‘K’ bracing and the number of re-entrant corners minimised.

Opportunities

1. The rail structure gauge is normally central in the invert of the TBM segmentally lined tunnel. However there is space either side, albeit at the expense of services and egress passages for the rail alignment to move laterally. By moving the alignment to the opposite side from the rail ‘turnout’ the maximum amount of turnout curvature can be accommodated within the confines of the TBM tunnel. This will have the benefit of reducing the length of the cavern or cut and cover bifurcation structure.
2. The bifurcation caverns could be constructed using only one access tunnel by cross linking the two caverns

Risks

1. Excessive water inflows during cavern construction.

   Mitigation – grouting, probing ahead to confirm need and/or adequacy of grouting;
2. Ground instability in weak strata in headings during cavern construction.

Mitigation – Robust temporary works design, specialist and highly skilled and experienced construction crews, reliable monitoring systems and pre-determined response plans, site investigation, probing and grouting.

Attached Sketches & Figures

297611-SK-C-101

297611-SK-C-102

297611-SK-C-103

297611-SK-C-104

297611-SK-C-105

297611-SK-C-106

297611-SK-C-107

297611-SK-C-108

297611-SK-C-109

297611-SK-C-110

297611-SK-C-111

Figure 1 Bifurcation Caverns Layout

Figure 2 Bifurcation Cavern Plan

Figure 3 Section A-A

Figure 4 Section B-B

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Appendix G. Sketches

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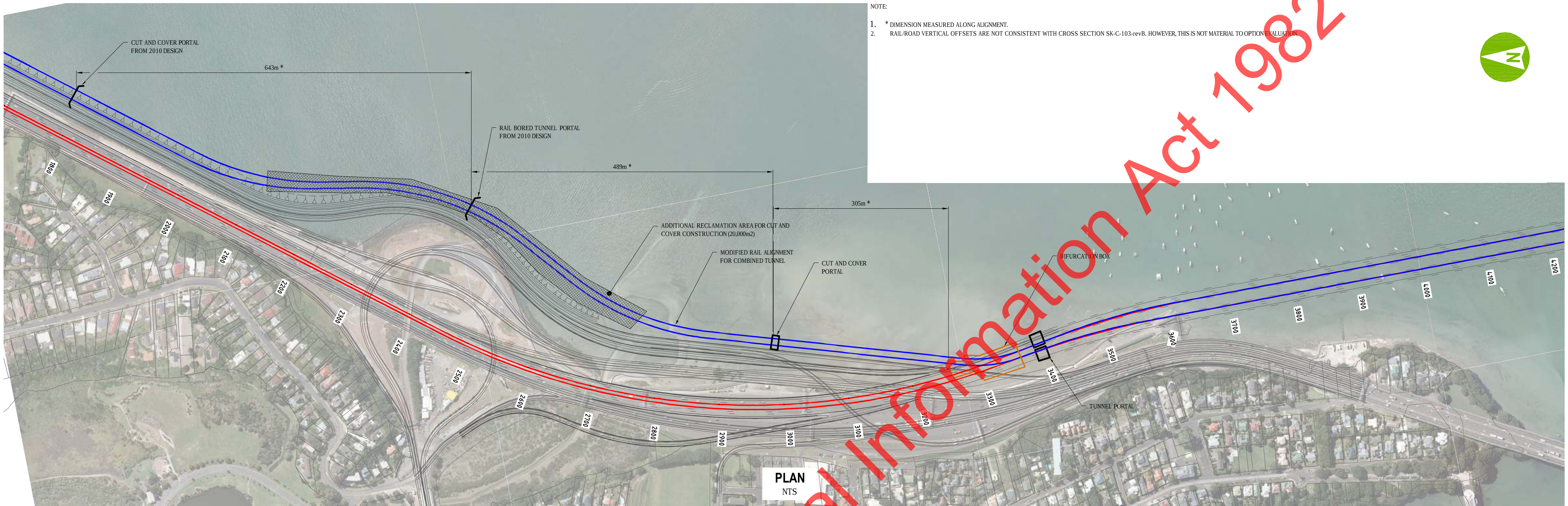
NOTE:

1. * DIMENSION MEASURED ALONG ALIGNMENT.
2. RAIL/ROAD VERTICAL OFFSETS ARE NOT CONSISTENT WITH CROSS SECTION SK-C-103-revB. HOWEVER, THIS IS NOT MATERIAL TO OPTION EVALUATION.



PLAN
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2100.	3.50	2.786
2150.	3.50	2.946
2200.	3.50	2.889
2250.	3.50	2.713
2300.	3.50	2.650
2350.	3.50	2.884
2400.	3.50	4.000
2450.	3.50	3.536
2500.	3.50	3.062
2550.	3.50	2.417
2600.	3.47	2.000
2650.	3.16	2.000
2700.	2.51	2.000
2750.	1.52	2.000
2800.	0.19	2.000
2850.	-1.47	2.000
2900.	-3.48	2.330
2950.	-5.82	2.397
3000.	-8.50	2.426
3050.	-11.50	2.407
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3150.	-17.49	2.000
3200.	-20.05	2.000
3250.	-22.27	2.000
3300.	-24.15	2.000
3350.	-25.79	2.000
3400.	-27.41	1.830
3450.	-29.03	1.572
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3550.	-32.27	1.193
3600.	-33.89	1.074
3650.	-35.51	1.193
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3800.	-40.37	-0.389
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3900.	-43.55	-0.996
3950.	-44.93	-1.452
4000.	-46.15	-1.846
4050.	-47.20	-1.956
4100.	-48.09	-2.000
4150.	-48.81	-2.485
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ROAD LONGITUDINAL SECTION ALONG DESIGN CONTROL LINE MC20

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1:2500 @ A3

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DATE: 23.12.11

PROJECT: WAITEMATA HARBOUR CROSSING

TITLE: NORTHERN CONNECTIONS ALIGNMENT OPTION 4, 5 AND 6 (RAIL OVER ROAD)

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REV: P1

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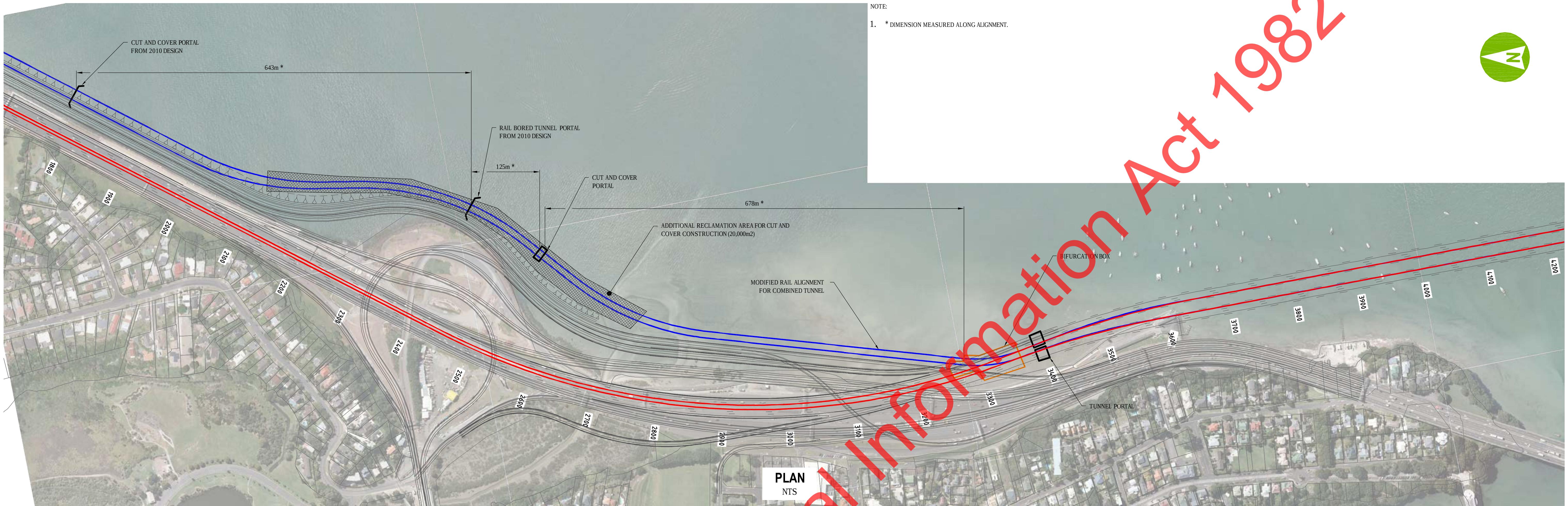
NOTE:

1. * DIMENSION MEASURED ALONG ALIGNMENT.



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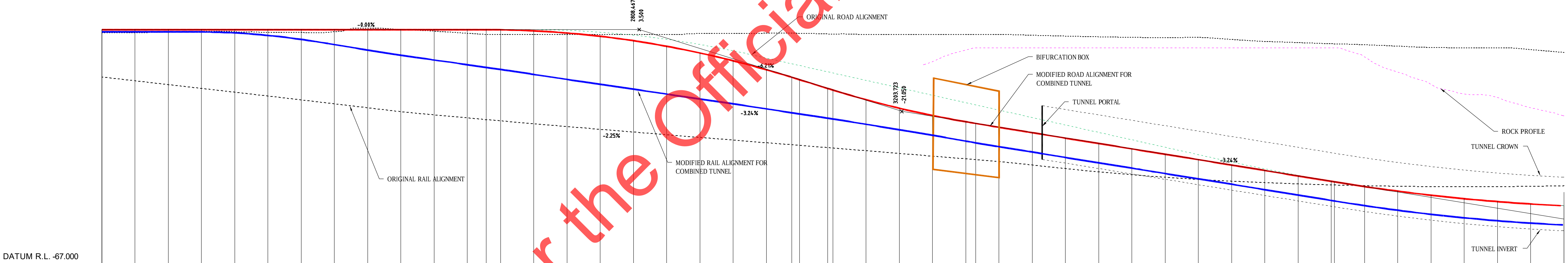

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CHAINAGE	DESIGN ROAD LEVELS	EXISTING
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2350.	3.50	2.884
2400.	3.50	4.000
2450.	3.50	3.536
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2550.	3.50	2.417
2600.	3.47	2.000
2650.	3.16	2.000
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2800.	0.19	2.000
2850.	-1.47	2.000
2900.	-3.48	2.330
2950.	-5.82	2.397
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ROAD LONGITUDINAL SECTION ALONG DESIGN CONTROL LINE MC20

1:1250 @ A1
1:2500 @ A3

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APPROVED: B. NEWNS
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PROJECT: WAITEMATA HARBOUR CROSSING

TITLE: NORTHERN CONNECTIONS
ALIGNMENT OPTION 1, 2 AND 3 (ROAD OVER RAIL)

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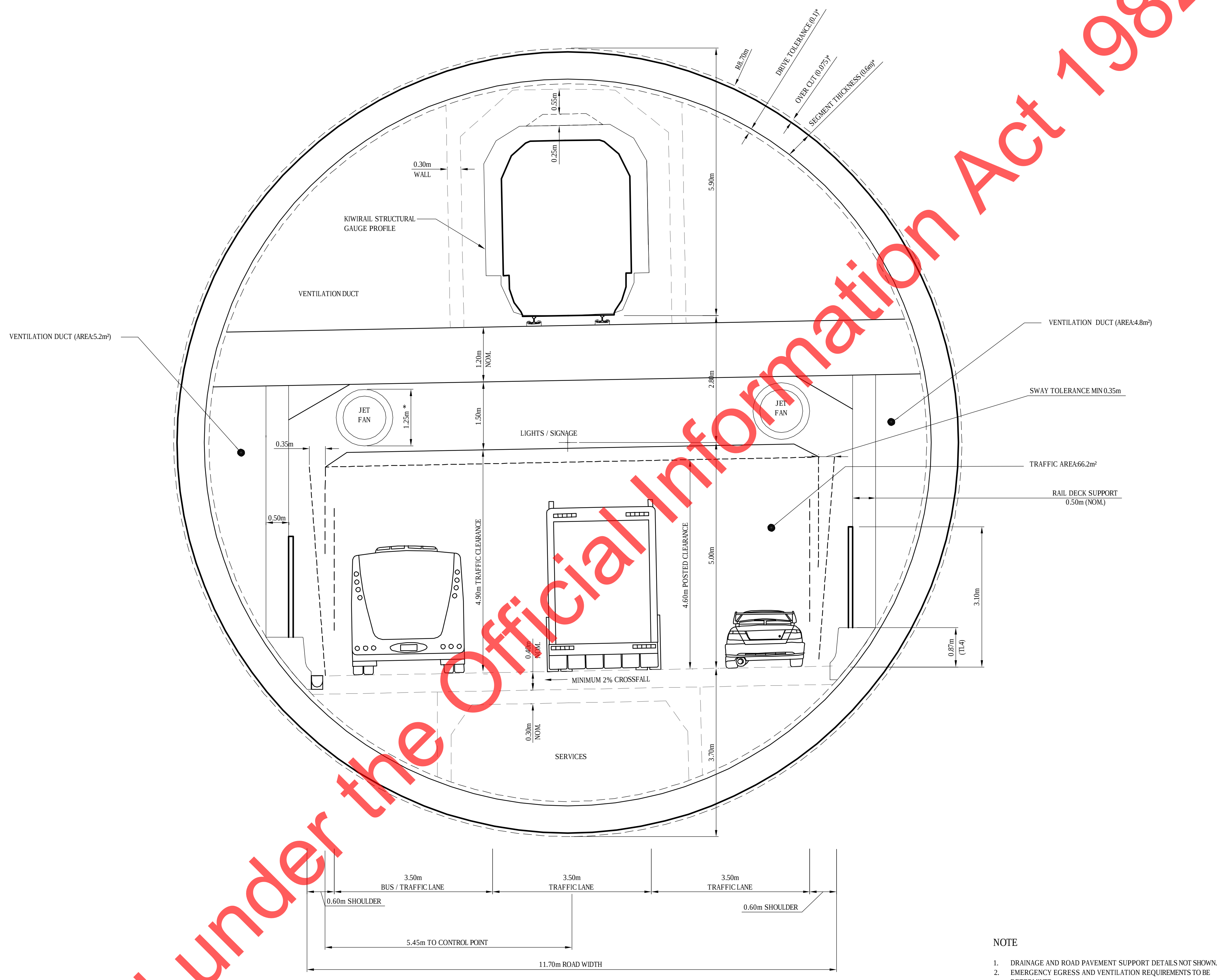

NOTE

1. DRAINAGE AND ROAD PAVEMENT SUPPORT DETAILS NOT SHOWN.
2. EMERGENCY EGRESS AND VENTILATION REQUIREMENTS TO BE DETERMINED.
3. * TOLERANCES TO BE DETERMINED.

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PROJECT: WAITEMATA HARBOUR CROSSING

TITLE: COMBINED RAIL OVER ROAD TUNNEL CROSS SECTION

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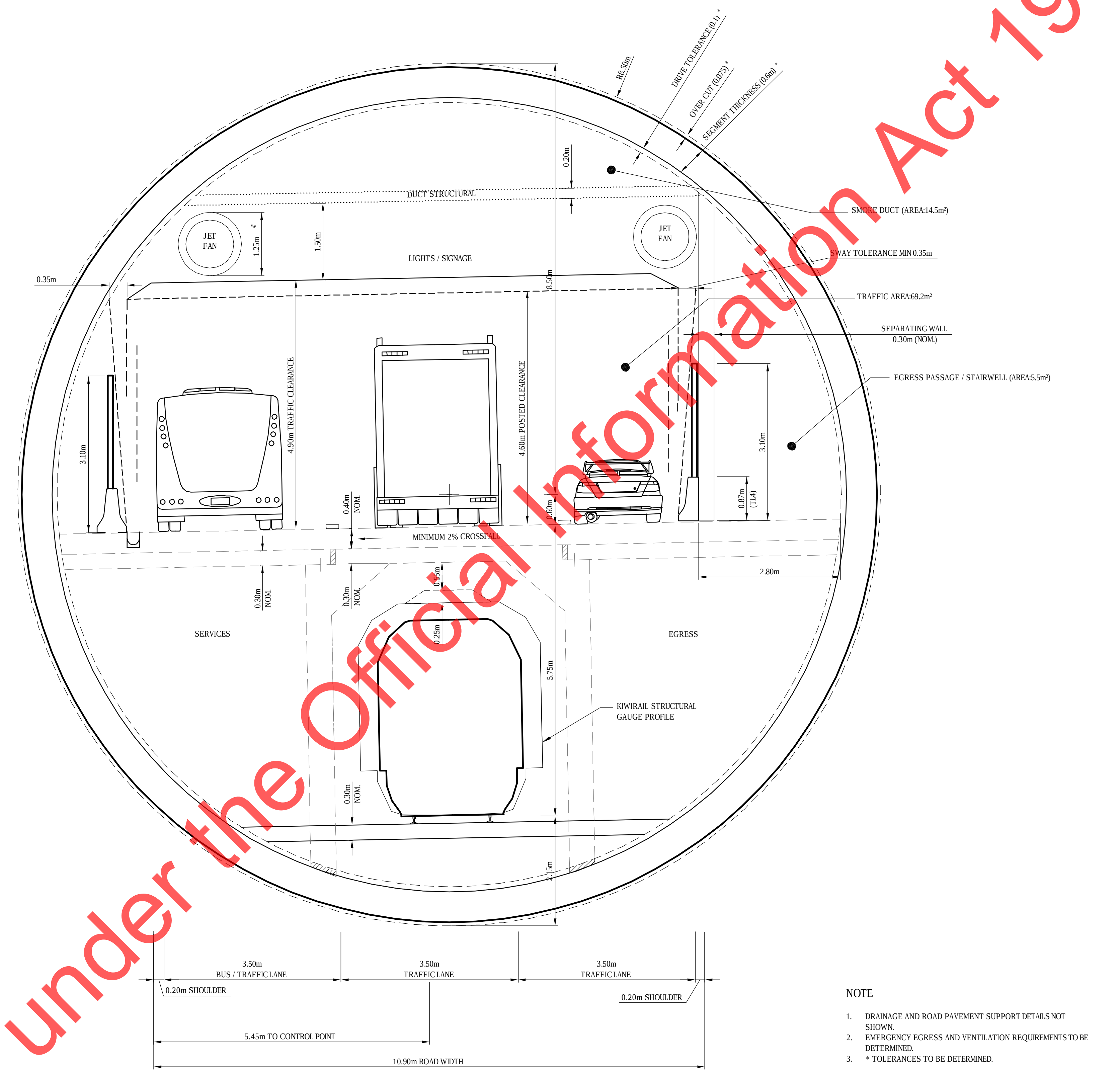

NOTE

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3. * TOLERANCES TO BE DETERMINED.

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TITLE
COMBINED ROAD OVER RAIL TUNNEL
CROSS SECTION WITH SMOKE DUCT

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225416

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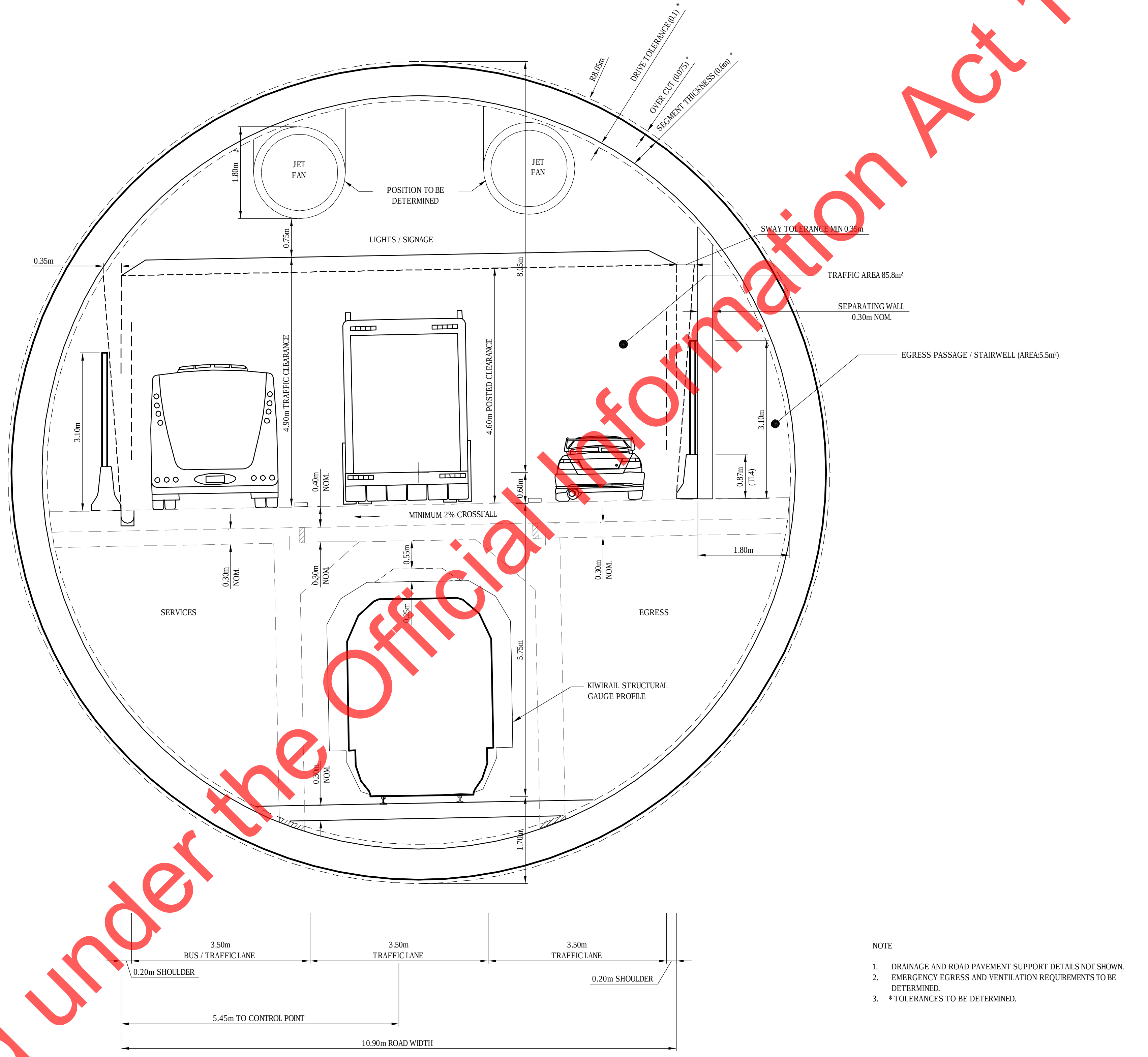

NOTE

1. DRAINAGE AND ROAD PAVEMENT SUPPORT DETAILS NOT SHOWN.
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3. * TOLERANCES TO BE DETERMINED.

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PROJECT
WAITEMATA HARBOUR CROSSING

TITLE
COMBINED ROAD OVER RAIL TUNNEL
CROSS SECTION WITHOUT SMOKE DUCT

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NOT FOR CONSTRUCTION

PROJECT No.
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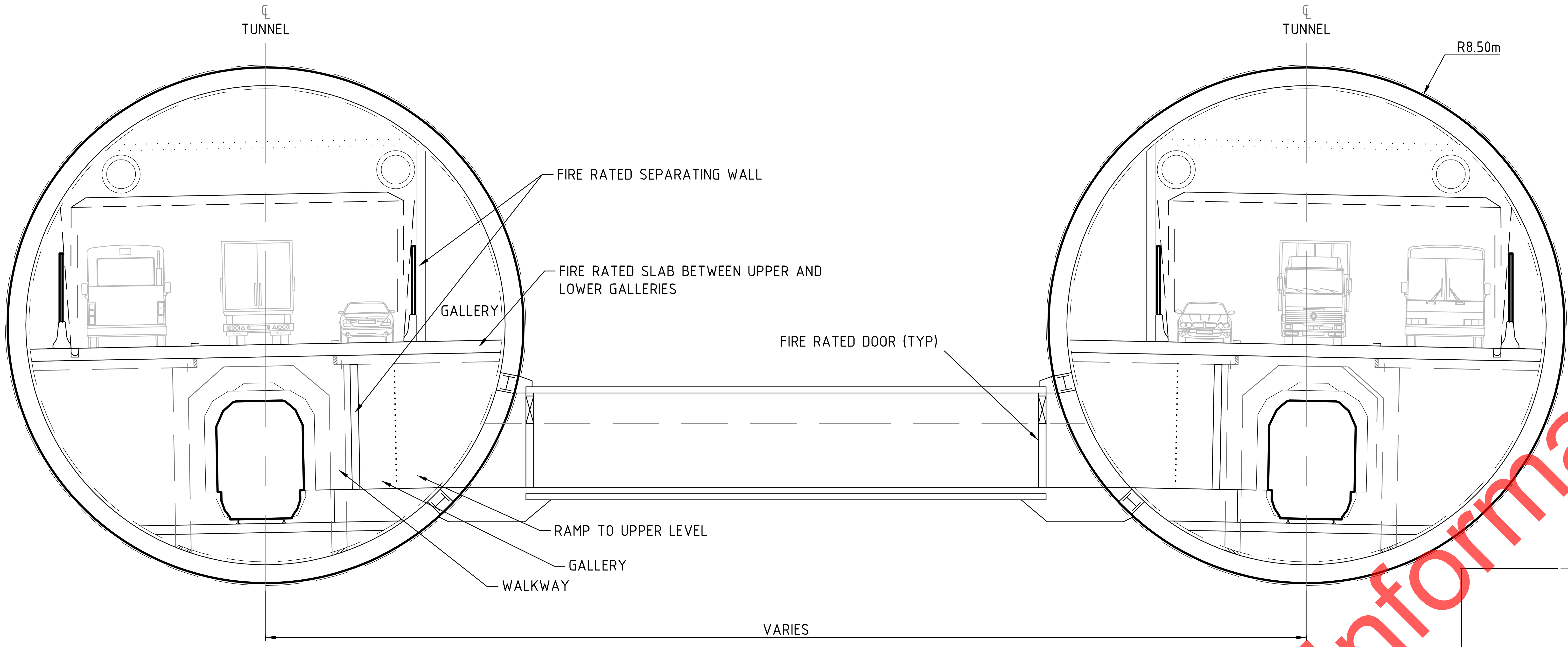

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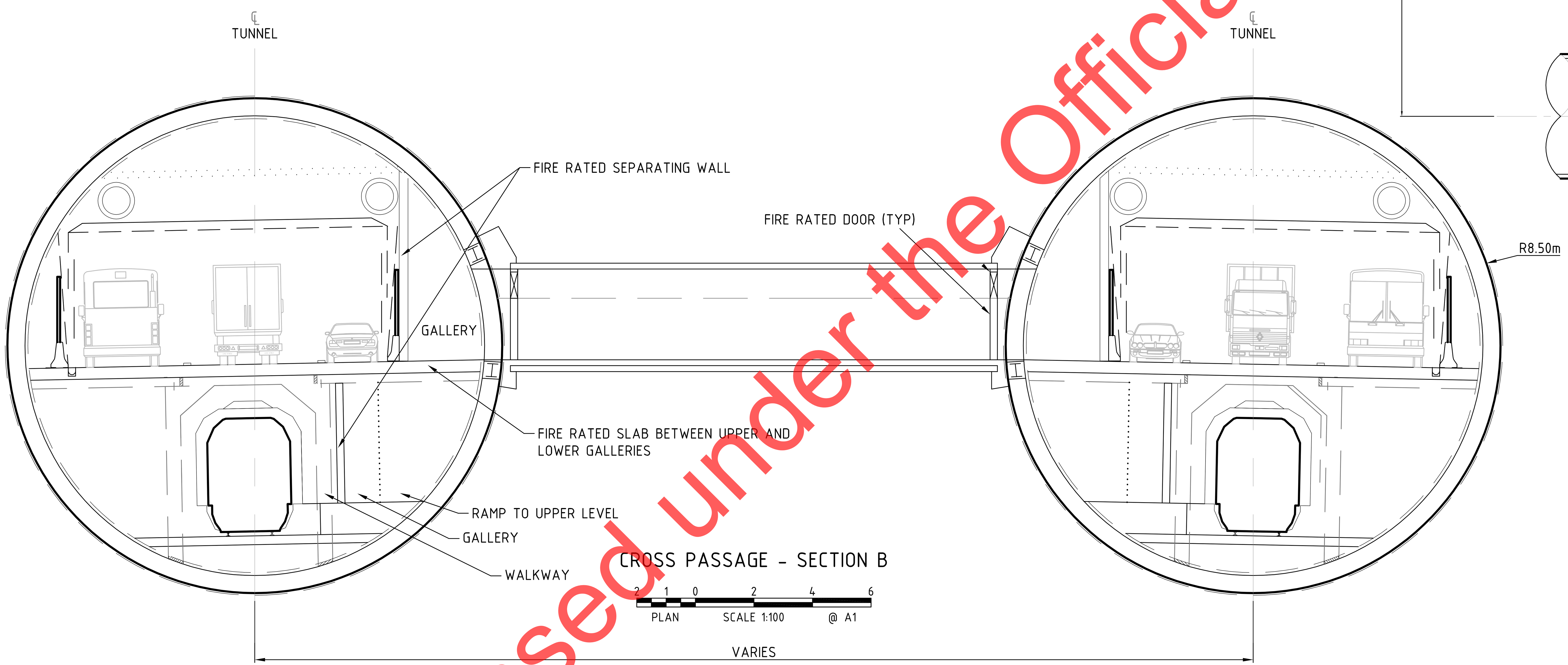

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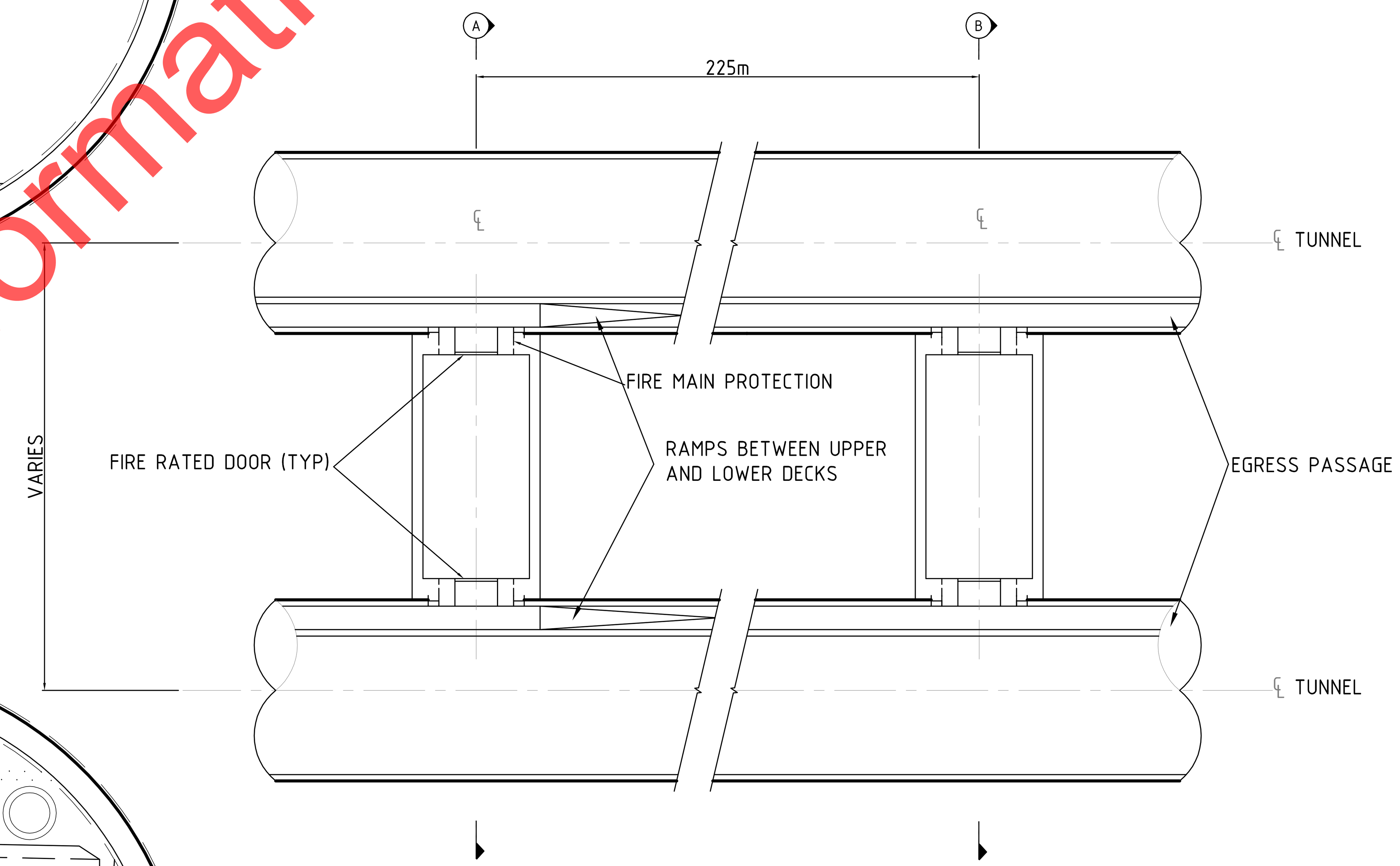
PLAN SCALE 1:100 @ A1

VARIES



CROSS PASSAGE - PLAN

10 8 6 4 2 0 10 20
PLAN SCALE 1:400 @ A1

NOTES

CROSS PASSAGE SPACING 450m AT EACH LEVEL, 225m BETWEEN ADJACENT CROSS PASSAGES.

INCIDENT GALLERIES WILL BE PRESSURISED.

THE GALLERY AND THE RAMP WILL REQUIRE PHYSICAL SEPARATION FOR PASSENGER CONTROL, TO AVOID PASSENGERS EVACUATING VIA THE RAMP (I.E. IN THE FORM OF A GATE).

HAND RAILS ON THE SIDE OF THE RAMPS TO BE PROVIDED.

CLIENT	REV	DATE	REVISION DETAILS	APPROVED
	P1	01.05.12	FOR INFORMATION	

DRAWN	DESIGNED
I.SUMMERS	V.SAYCE
CHECKED	
B. NEWNS	
APPROVED	
D.GUTTERIDGE	DATE 01.05.12

PROJECT: WAITEMATA HARBOUR CROSSING

TITLE: COMBINED ROAD OVER RAIL TUNNEL TYPICAL CROSS PASSAGES

DRAFT ISSUE
NOT FOR CONSTRUCTION

PROJECT No. 227818

SCALE: AS SHOWN — SIZE: A1

DRAWING No. 297611-SK-C-112 — REV P1

Appendix H. Cost Delta Assessment

s 9(2)(b)(ii)

[redacted]

s 9(2)(b)(ii)