WORKING PAPER

The Congestion Question

Could road pricing improve Auckland's traffic?

Workstream 3

Longlist development and evaluation

February 2019

Working draft vC

Auckland Council · NZ Transport Agency · Ministry of Transport · The Treasury · State Services Commission · New Zealand Government

Table of contents

1 Executive summary

Phase II of The Congestion Question (TCQ) project involves identification and analysis of potential pricing options for demand management purposes in Auckland.

This paper provides information on the longlist development and evaluation methodologies, and the resulting shortlist that was agreed.

The longlist was developed through consideration of the objectives as set out in the terms of reference, Phase I findings and information about Auckland's transport network and travel patterns.

A longlist of 26 options with the potential to improve congestion, ranging in size, scale and type was developed. These were analysed against an evaluation framework that at a high level considered the potential impact on congestion (network performance), social/equity impacts and practical considerations around flexibility and feasibility.

The options were scored against a range of criteria within this framework under those three high level categories. The scoring was supported by a range of information and data about Auckland's demographics and census data, travel patterns, household income, and international lessons from implementing congestion pricing schemes.

Based on the results of the evaluation, subsequent sensitivity testing and merging a number of very similar options (those being based on the "strategic network"), five options have been identified to take forward to the shortlist stage for further development and analysis.

These options are:

1. **City Centre Cordon** – vehicles charged to enter or exit the city centre area
2. **Isthmus Area** – vehicles charged to enter, exit or travel within the Auckland isthmus area
3. **Target Congested Corridor** - vehicles charged on congested roads to achieve a target speed or level of congestion
4. **Target Congested Corridor and City Centre Cordon/Area** – reflecting a hybrid option of the first and third option above.
5. **Regional Network** - vehicles charged on any part of the network where there is congestion, using satellite based technology

These options represent a spectrum of pricing schemes, from small localised schemes to a region-wide scheme that would be highly flexible and targeted, ranging in complexity and ease of implementation. The options will be subject to further refinement (eg around boundaries) and the application of a tariff policy that will be developed in a later stage of Phase II.

A number of the longlist options (parking policy, car sharing, public transport fares and reverse tolling) were not considered sufficiently effective on a stand-alone basis, but could be considered as part of a broader demand management toolkit. These could be potential complementary measures and/or mitigations associated with a congestion pricing scheme.

2 Purpose

Phase II of The Congestion Question (TCQ) project involves identification and analysis of potential pricing options for demand management purposes in Auckland.

This paper details the:

- development of the longlist of options
- evaluation framework and application
- results of the evaluation
- confirmed shortlist of options.

3 Options longlist development

3.1 Purpose

The purpose of developing a longlist of options for improving congestion in Auckland was to ensure the project cast a wide net in terms of the concepts that might be applicable and could be considered. It is highly unlikely that any of the options generated at the longlist stage would be the exact scheme that might eventually be implemented. Subsequent phases of the project allow for further refinement of any preferred option, so it was not necessary to either define the precise details of each longlist option or test every possible permutation of congestion pricing options. The aim was to develop the longlist options to a sufficient level of detail to enable an evaluation of their comparative performance.

3.2 Methodology

A number of inputs were used to guide the development of the longlist:

- the project objectives as set out in the Terms of Reference (ToR)
- data about congestion, land-use and trip patterns in Auckland
- Auckland's topography and existing transport network constraints
- findings from Phase I, including international evidence and previous investigations in Auckland.

Some of the background information used to support the development of the longlist is included in Appendix A.

Terms of Reference (ToR)

The objective of pricing, within the ToR of the project, is to improve the performance of Auckland's transport network, in particular through improved congestion results. Consideration must also be given to economic, social and environmental effects.

The aim was to therefore develop a longlist of options that had the potential to improve congestion. At this stage, it was also important to consider a broad range of options of different size and scale to ensure the longlist of options was comprehensive and diverse.

Auckland's congestion and trip patterns

Phase I of the project included establishing a congestion baseline for Auckland, which provided updated information about where and when the network is congested.

Other relevant information that was drawn on to assist in developing the longlist of options included trip pattern and journey to work data (based on 2013 census data), Auckland's population projections and Auckland Council's development strategy that sets out where and when future development is likely to occur. This assisted in defining different size options that covered different areas of Auckland.

Auckland's topography and existing transport network

Auckland's coastline plays a large role in shaping the urban form, and therefore the transport system. In particular, it means access to/from the Auckland isthmus is confined to a small number of corridors,

leading to congested pinch points across the transport network – but providing obvious choices for some pricing scheme features such as cordon boundaries.

Phase I findings

The Phase I report sets out the four conceptual types of congestion pricing, described in Table 1.

Table 1: Types of congestion pricing

Type of scheme	Description
Area-based	Charging vehicles for crossing a boundary and/or driving within that boundary (eg London).
Cordon-based	Charging vehicles for crossing a ring or line of charge points. Unlike area-based schemes, cordon-based schemes do not charge for traffic movement solely within the cordon (eg Stockholm).
Corridor-based	Charging vehicles to use one or more of the roads in a specific corridor(s) (eg Singapore's current system).
Network-based	Charging vehicles for travel on all congested roads in a defined geographical area, utilising satellite-based technology connected to in-car units (eg Singapore's proposal from 2020).

Common features that are not specific to these concepts include the ability to differentially charge by time of day, location or vehicle type; payment mechanisms or technology solutions. Area, cordon and corridor based schemes could either utilise automatic number-plate recognition technology, or emerging satellite-based systems. A network-based scheme is only practical through the use of satellite-based systems due to the number of charging points that would be required for full network coverage.

The project also acknowledged that other types of interventions, initiatives or policies would also have the potential to improve network performance through incentivising behaviour change. It was therefore appropriate to incorporate these types of interventions in the longlist of options. These included things such as increased fuel taxes, parking levies and ride-sharing. These interventions are subsequently referred to as "non-pricing" options. We realise that some of them could actually have a price component, but do not represent the types of options that would be commonly thought of when discussing 'congestion pricing' (eg London/Stockholm).

Exclusions

In any pricing scheme, there are a number of 'non-exclusive' components; that is, where there are a number of options for each component, but all the options are applicable to any overall scheme. Therefore, for the purposes of developing and evaluating the longlist of options, the different options for these components have not been considered or defined as they would not act as differentiating factors. These components include:

- the procurement and/or operating model
- back office components (including systems for billing, payment, user interface and support)

- tariff type (eg a distance-based charge, an access charge or a cordon charge), noting that different schemes may have multiple tariff types that are applicable. For example an area or network scheme could have an access or distance based charge associated with it, whereas a cordon-based scheme could only utilise a cordon charge.
- the prices that users are charged, as they can be varied across all of the conceptual pricing schemes.

Definition of these components is not required to undertake an initial qualitative analysis of the schemes as they will be subject to considerable refinement in later stages. In particular, the tariff policy (eg where different parameters such as time of day, location, vehicle class etc. can be varied), will be developed separately.

3.3 Longlist of options

Taking into account the factors described above, a longlist development workshop was held where a wide range of options were brainstormed and developed by members of the TCQ project team. This included both pricing schemes and non-pricing options. The general approach was to identify a range of sizes for each pricing scheme type (eg area/cordon/corridor/network). A smaller scheme may have lesser impacts on congestion, but will typically be easier to implement, have less equity impacts and be more publically acceptable whilst having the option for further future expansion. A larger scheme may have significant impacts on congestion but be complex to implement and considered unfair.

The TCQ project team then reviewed this initial list of options and developed enough detail for the concept to be understood and evaluated, such as approximate boundaries, geographic coverage or policy detail.

The majority of longlist options includes variations of concepts which have been implemented around the world. These concepts include:

- area schemes
- cordon schemes
- schemes targeting particular sections of road and more specifically, the speed on particular sections of road
- schemes targeting high-density employment centres (thereby targeting journeys to/from work)
- user-pays schemes for dedicated express lanes

Alternative transport policies to manage/influence demand are also considered as options including policies to:

- increase the cost of vehicle ownership
- increase the cost of parking
- reduce (or remove) the cost of public transport
- reward people for travelling at non-peak times
- use a control mechanism to exclude certain vehicles from being allowed to travel on certain days/times

The full longlist of options is described in Table 2 (with further detail and maps in Appendix D).

Table 2: Longlist of options

Option number	Option name	Description	Rationale
1	City Centre cordon	Vehicles charged to enter or leave the city centre	The city centre has the highest proportion of trips to it from outside the area (approx. 90%), and widespread trip origins. By charging vehicles to enter and exit the city centre, this will reduce the number of vehicles travelling along the main feeder routes into and out of the city centre and thus also reduce congestion on these routes. This targets vehicles passing across the city centre cordon boundaries. This type of scheme is similar to schemes that have been implemented around the world (eg Stockholm) so has been tested and proven internationally.
2	City Centre area scheme	Vehicles charged to enter, leave or travel within the city centre	This option is as per the city centre cordon option, and additionally targets the traffic circulating within the city centre to further reduce vehicle movements in the area (expected to be mainly short taxi/uber trips). This type of scheme is similar to the London Congestion Charging scheme which has been successfully operating since 2003.
3	Inner urban cordon	Vehicles charged to enter or leave the inner urban area (city centre plus fringe suburbs)	This has the same principle as the city centre cordon, but covers a larger cordon around the inner urban area (city centre plus Ponsonby, Newmarket, Parnell). This should capture twice the number of trips as the city centre cordon – about 10% of all morning peak trips. The congestion reducing effects will be observed on the feeder routes into and out of the inner urban boundaries. However, short, local trips within the area will not be charged under this option.
4	Inner urban area	Vehicles charged to enter, leave or travel within the inner urban area (city centre plus fringe suburbs)	This option is as per the inner urban cordon option, and additionally targets the traffic circulating within the inner urban cordon making short, local trips (about 30% of all trips finishing in the area also start there) to further try to reduce congestion *within* the area.

Option number	Option name	Description	Rationale
5	Isthmus cordon	Vehicles charged to enter or leave the Auckland isthmus area	This option has the same principle as the city centre and inner urban cordon, but covers a larger cordon around the Auckland isthmus area. The topography/geography of Auckland makes this scheme the next incremental jump up the scale of cordons on the longlist. The congestion reducing effects will be observed on the feeder routes into and out of the isthmus boundaries. However, local trips within the isthmus cordon will not be charged under this option.
6	Isthmus area	Vehicles charged to enter, leave or travel within the Auckland isthmus area	This option is as per the isthmus cordon option, and additionally targets the traffic travelling within the isthmus area to further reduce congestion in the isthmus. The isthmus shows concentrated levels of congestion (based on congestion heat maps) and a high proportion of short, local trips (about 50% of trips finishing in the isthmus also start there). This option will capture a large number of vehicles travelling within the isthmus area potentially having a large impact on reducing congestion.
7	Urban cordon	Vehicles charged to enter or leave the Auckland urban area	This has the same principle as the other cordon options, but moves the cordon boundary further out from the city centre to be at the approximate boundary of the Auckland urban area. This option focuses on targeting long distance commuting trips with the intention that the congestion reducing effects will be observed on the major routes across the network once those long distance trips are removed/reduced. Trips within the urban cordon will not be charged under this option.
8	Urban area	Vehicles charged to enter, leave or travel within the Auckland urban area	This option is as per the urban cordon option, and additionally targets all traffic travelling within the urban area to comprehensively cover urban Auckland. This option will capture a significant proportion of trips on the network (about 90%).

Option number	Option name	Description	Rationale
9	Double cordon	Vehicles charged to cross either (or both) of two cordons (for example, city centre and urban area)	This option targets vehicles crossing one (or both) cordon boundaries, but not those circulating within or between the two cordons to reduce the impacts on short local trips. This option would see congestion reduced on the feeder routes into and out of the two cordons, capturing trips to and from a large number of employment centres. This option is a more targeted version of a single cordon scheme, aiming to ease congestion on specific feeder routes. It effectively increases the scale of options like the Stockholm scheme.
10	Employment centres	Vehicles charged to enter and exit the ten main Auckland regional employment centres[1]	This is a cordon based scheme which is aimed at capturing a significant proportion of work trips to/from regional employment centres, in addition to flows to and from the city centre (as the main employment centre). The behaviour change that this option aims to generate is use of alternative modes to travel to/from places of employment, particularly for employment locations outside the city centre and fringe where the private vehicle mode share is at least 80%.
11	Zonal cordon	Vehicles charged to cross boundaries of defined 'zones' within Auckland (see map in Appendix D)	This option aims to reduce congestion on routes crossing defined zone boundaries leading to and from employment centres. It is an alternative way of trying to target the same trips as the Employment Centres scheme. This type of scheme has the potential to capture a large number of peak period trips without affecting local 'neighbourhood' trips. The behaviour change that this option aims to generate is use of alternative modes to travel to/from places of employment.

[1] City Centre, Takapuna/Glenfield/Wairau, Westgate, Henderson/New Lynn, Ellerslie/East Tamaki, Onehunga, Airport precinct, Papatoetoe, Manurewa and Papakura

Option number	Option name	Description	Rationale
12	State highway corridors	Vehicles charged to travel on the state highway network	This option aims to reduce congestion on the state highway network across Auckland, which has the greatest concentrations of traffic. Effectively a user-pays scheme for motorways in Auckland, the behaviour change this option aims to generate is a change in time of travel or mode to reduce volumes of traffic using the state highway network during peak periods. It is intended to have significant benefits to business and freight trips by pricing off other traffic from the motorways. It operates in a similar manner to many of the European motorway systems that are tolled.
13	Strategic corridors	Vehicles charged to travel on state highways and key arterial roads	This option is as per the state highway corridors option, but includes charging for arterial roads as well. The inclusion of the arterial roads is intended to mitigate some of the expected diversion that would occur with the state highway corridor option and capture a greater number of trips across the region (both long and short distance trips that are contributing to congestion).
14	Target congested corridor	Vehicles charged on congested roads to achieve a target speed or level of congestion (irrespective of hierarchy/ONRC classification)	This option aims to charge for travel on particular road corridors in order to maintain a target speed (which is a proxy for congestion/level of service) – regardless of road classification (ie not restricted to state highways or arterials as per the previous two options). Target speeds can be adjusted for local circumstances and differ by road classification. Singapore operates this target-speed system of charging on a subset of roads within their network.
15	Strategic corridor and city centre area	Combination of options 2 and 13	The combination of strategic corridor and city centre area schemes is aimed at discouraging peak period trips to/from and within the city centre and capturing dispersed peak period trips across the Auckland region on all strategic links.

Option number	Option name	Description	Rationale
16	Regional network scheme	Vehicles charged on any part of the network where there is congestion, using satellite based technology	This option aims to reduce congestion across the entire Auckland road network by charging vehicles according to trip distance, time and location. Note that there would be no intention to charge vehicles on uncongested routes. This option would require an in-vehicle unit, so provision would need to be made for occasional, tourist and out of town travellers. This option has the potential to charge for travel on any congested road in Auckland so is a sophisticated demand management tool. It provides a highly flexible and technology enabled option.
17	Express lanes	Vehicles have an option to pay additional charges to travel on dedicated express (reallocated) traffic lanes on the motorways to obtain improved service levels	This option puts a price on the privilege of driving in a dedicated express lane, which would have an improved level of service (generally travel speed) compared to other non-priced lanes. This type of options is fairly common in the USA (eg HOT lanes) and has generated significant improvements for travellers in the express lanes in particular.
18	Strategic corridor and express lanes	Combination of options 13 and 17	This option combines options 13 and 17 and aims to improve levels of service (generally travel speed) by making users pay to use the strategic corridors and pay more, to use express lanes on those corridors.
19	Regional fuel tax (RFT)	An additional fuel excise tax is introduced in a specific region for the purpose of reducing trips by raising the cost of travel for motorists.	This option attempts to influence travel demand by making the cost of vehicle travel more expensive. This is an indirect way to target congestion, though it will also impact uncongested travel. It builds on the RFT that has been recently implemented (noting that the intention of the RFT was to raise revenue).
20	Regional registration fee	Increasing the costs of annual licensing charges and/or registration fees to reduce vehicle numbers by raising vehicle ownership costs	This option attempts to influence travel demand by making the cost of vehicle ownership more expensive. This is an indirect way to target congestion, though it will also impact uncongested travel.

Option number	Option name	Description	Rationale
21	Parking policy	Covers a range of parking policy interventions such as parking levies and increasing the costs of parking (either private, public or both)	This option aims to influence travel demand by disincentivising vehicle use through increasing the cost or reducing the supply of parking. It could act in a similar way to the specific cordon schemes (eg city centre cordon or employment centre options), but the charge is levied on the parking space, rather than on the vehicle.
22	Car sharing (also called car pooling or ridesharing)	Encouraging/incentivising more people to share vehicles to increase average vehicle occupancy and reduce costs	Car sharing aims to reduce the number of vehicles on the road, and the associated congestion, by increasing the occupancy of vehicles via an opt-in or incentivised scheme. There are already established programs to encourage and support car sharing that could be leveraged.
23	Mobility rationing	Influencing vehicle trips through a form of quota system that limits vehicle use according to time, day or another metric (eg carless days in 1979-80)	This option reduces the number of vehicles using the road network, and therefore congestion, by enforcing a control mechanism on the ability to drive different vehicles at different times.
24	Reverse tolling	Rewarding people (either through financial or non-financial incentives) to change the time or way in which they travel	This option aims to influence demand through an incentive (rather than a disincentive) mechanism. People are rewarded for changing their behaviour and contributing to reducing congestion.
25	Infrastructure pricing	Levying charges on new infrastructure assets to the users (eg tolling)	This option aims to provide additional capacity to reduce congestion (as opposed to targeting the demand side of the equation) and use an alternative funding stream, by introducing a user-pays scheme on new transport links (much like the Auckland Harbour Bridge when it was first opened or the Northern Gateway). This would build on the existing toll road policy.
26	Free public transport	Lowering the costs of public transport to encourage a shift away from private vehicles	By providing free (or lower cost) public transport, this option aims to shift significant numbers of private vehicle users into public transport modes, thereby reducing the number of vehicles on the road network. This would require additional public transport capacity to be provided.

4 Longlist evaluation

4.1 Methodology

The options were assessed using the evaluation framework developed in Phase I that incorporated three categories to reflect the ToR. These are listed below with initial category weightings shown in brackets. The weightings were developed and agreed by the Steering Group to reflect the ToR and the ability of the categories to differentiate between longlist options:

1. how effective they would be in reducing congestion (65%)
2. economic, social, environmental and safety considerations (20%)
3. efficiency, flexibility and wider considerations (15%).

Each of these three categories had a number of criteria that made up the overall evaluation framework, against which the options were scored in a multi-criteria analysis (MCA). The categories and a summary of the criteria and information used to support the evaluation are shown in Table 3. Refer to Appendix B for detailed background information used to support the evaluation and Appendix C for the full evaluation framework.

Table 3: MCA categories, criteria and supporting information

Category	Summarised criteria	Supporting information
Network performance	• Travel time and reliability • Unintended consequences (eg diversions) • Impacts on freight routes • Improvement in public transport and active modes	• Auckland's demographics and topography • Origin/destination and travel to work data • Scale and location of projected growth in Auckland
Economic, social, environmental and safety considerations	• Public acceptability • Household, business and spatial equity • Emissions and environmental impacts • Safety	• Household income data • Car-free households and access to public transport • EEM guidance on safety and economic considerations
Efficiency, flexibility and wider considerations	• Efficiency • Flexibility • Enforcement • Privacy • Risk • Revenue transparency	• Indicative cost considerations • International experience of pricing and other initiatives

The evaluation was predominantly a qualitative assessment undertaken by the project Steering Group, supported by the project team and technical experts, utilising available information and data along with informed judgement and discussion during a facilitated workshop. The purpose of the evaluation was to differentiate the options relative to each other and establish an overall ranking of the options to assist

with selecting the shortlisted options to progress to further development. For simplicity, the impacts of each option were considered in the context of the weekday morning peak period only, noting that in later stages of the project, impacts across the day will be considered.

A seven point scoring scale (-3 to +3) was utilised in the MCA, and the performance of each option under each category/criteria was compared to that of a reference option. For example:

- A 'score' of zero shows that the option is considered to perform about the same as the reference option.
- A 'score' of +3 shows that the option being evaluated is considered to perform much better than the reference option.
- A 'score' of -3 shows that the option is considered to perform significantly worse than the reference option.

This approach of adopting a reference option, if selected carefully, allows both the positive and negative ends of the scale to be better utilised and assists with undertaking a more meaningful evaluation given the overall qualitative nature of the exercise (ie using both positive and negative is easier to comprehend than finer degrees of 'positiveness'). The isthmus cordon (Option 5) was selected as the reference option at the outset as it was considered to represent an option that would be somewhere near the middle prior to the evaluation exercise.

At the end of the workshop, with the initial evaluation complete, the weighted 'scores' for each option were summed to determine a total score between -3 and +3. The actual magnitude of this number is somewhat arbitrary as it is a comparative exercise and the ranking of the options is the more meaningful output. However the individual option scores can show how close options were in the overall ranking.

For practicality and efficiency, particularly around the desire to limit the number of options to be modelled in the subsequent stage, the Steering Group resolved to identify no more than five options as a shortlist, provided a sufficient spectrum of options was identified.

4.2 Evaluation results

4.2.1 Initial results

Unsurprisingly, in general we found that, due to the widespread nature of Auckland's congestion, the schemes that covered a larger part of the network were considered to have the greater potential for reducing congestion – but also had a greater potential for negative social/equity impacts. In this light, the larger schemes that were more targeted at congestion performed more positively than those larger area schemes which capture all trips within an area.

The Regional Network scheme (Option 16) was consistently the highest or second highest scoring option as it could most effectively target the widest amount of congestion and presented an extremely flexible option. However, the supporting materials and the workshop discussion suggested that there are a number of issues to work through to enable deployment of this option in the near future, primarily associated with risks around the supporting technology, cost and negative public acceptability.

The Urban Area scheme (Option 8) was consistently a high scoring option due to its coverage and potential impact on congestion. However, this was also identified as a very blunt option that would involve a lot of uncongested trips being priced, as is currently the case in London. This, as well as considerable risks around its scale, cost and negative public acceptability, suggested that this option would be challenging to deploy.

A number of the highest ranking options were very similar, being variations on options based on the Strategic Network (Options 13, 14, 15 and 18).

The initial results were then 'sense checked' to ensure individual scores and rankings were consistent and to check the relativity of the option scoring, accepting the qualitative nature of the longlist MCA process.

The ten highest-scoring options are presented in Table 4.

Table 4: Longlist evaluation outcome

Rank	MCA scoring
1	**Option 16** - Regional Network
2	**Option 14** - Target Congested Corridor
3	**Option 13** - Strategic Corridor
4	**Option 15** - Strategic Corridor and City Centre Area
5	**Option 8** - Urban Area
6	**Option 18** - Strategic Corridor and Express Lanes
7	**Option 6** - Isthmus Area
8	**Option 11** - Zonal Cordon
9	**Option 10** - Employment Centres Cordon
10	**Option 5** - Isthmus Cordon

A summary of the evaluation for each option is in Appendix D. The full matrix of scores for all options is included in Appendix C.

The smaller cordon and area schemes (Options 1, 2, 3 and 4) generally scored poorly as ultimate options because of their limited estimated impact on overall network performance. However, the supporting materials and the workshop discussion suggested that these options potentially represent a logical first step (or potentially a pilot scheme) towards a more comprehensive congestion pricing scheme.

4.2.2 Non-pricing options

The longlist evaluation found that none of the non-pricing options were considered to represent effective stand-alone interventions where the objective is to generate a meaningful improvement in network performance. However, a number of the non-pricing options could be considered as part of a broader demand management toolkit and therefore could complement any congestion pricing scheme. Most of the non-pricing options may have some ability to influence demand, though for those imposing a cost this would be achieved by increasing overall private travel costs, rather than specifically targeting travel in

congested conditions. For example, the Regional Fuel Tax adds cost to any vehicle trip through increased fuel pricing regardless of whether that trip is contributing to congestion.

Table 5 provides an overview of their potential contribution in this context.

Table 5: Non-pricing option commentary

Option	Comment
Option 19: Regional Fuel Tax Does not specifically target congestion and is aimed at generating revenue rather than reducing congestion.	Low potential to be considered in conjunction with pricing intervention.
Option 20: Regional Registration Fee Has significant equity and enforcement issues.	Low potential to be considered in conjunction with pricing intervention.
Option 21: Parking Policy Major implementation issues as a congestion tool.	Some potential to be considered in conjunction with pricing intervention.
Option 22: Car Sharing Already in practice and should continue to be promoted, noting it is unlikely to make a significant impact on network performance.	Some potential to be considered in conjunction with pricing intervention.
Option 23: Mobility Rationing Has significant equity issues, favouring those with multiple vehicles or existing alternatives.	Low potential to be considered in conjunction with pricing intervention.
Option 24: Reverse Tolling On-going funding would present long-term challenges for sustainability, and raises significant equity issues.	Some potential to be considered in conjunction with pricing intervention.
Option 25: Infrastructure Pricing Already an available option but few potential candidates.	Low potential to be considered in conjunction with pricing intervention.
Option 26: Free Public Transport Significant capacity constraints and on-going funding would present long-term challenges for sustainability. Reducing fares (higher subsidy levels) may be more effective.	Some potential to be considered in conjunction with pricing intervention, noting that "free" could be unrealistic and therefore variations on subsidies and differentiated pricing should also be considered.

4.2.3 Sensitivity analysis

In addition to the initial category weightings adopted for the MCA workshop, four alternative scenarios were modelled to test the sensitivity of the results to different weightings where emphasis on each category is increased or decreased. Given improved network performance is the objective in the ToR, this remained the highest in all scenarios.

Table 6 outlines the category weightings under the different sensitivity scenarios.

Table 6: Sensitivity analysis scenario weightings

Scenario	Category weighting		
	Network performance	Economic, social, environmental and safety considerations	Efficiency, flexibility and wider considerations
Initial workshop scenario	65%	20%	15%
Scenario A Moderate rebalancing	55%	25%	20%
Scenario B Equal emphasis on social and practical considerations	50%	25%	25%
Scenario C More emphasis on social considerations	50%	30%	20%
Scenario D Strong emphasis on social and practical considerations	40%	30%	30%

Table 7 presents the top 10 option rankings for the adjusted initial MCA workshop scenario and the four alternative scenarios.

Table 7: Sensitivity analysis results

Rank	MCA workshop 65/20/15	Scenario A 55/25/20	Scenario B 50/25/25	Scenario C 50/30/20	Scenario D 40/30/30
1	**Option 16** Regional Network	**Option 16** Regional Network	**Option 14** Target Congested Corridor	**Option 14** Target Congested Corridor	**Option 14** Target Congested Corridor
2	**Option 14** Target Congested Corridor	**Option 14** Target Congested Corridor	**Option 16** Regional Network	**Option 16** Regional Network	**Option 16** Regional Network
3	**Option 13** Strategic Corridor	**Option 13** Strategic Corridor	**Option 13** Strategic Corridor	**Option 13** Strategic Corridor	**Option 13** Strategic Corridor
4	**Option 15** Strategic Corridor and City Centre Area	**Option 15** Strategic Corridor and City Centre Area	**Option 15** Strategic Corridor and City Centre Area	**Option 15** Strategic Corridor and City Centre Area	**Option 15** Strategic Corridor and City Centre Area
5	**Option 8** Urban Area	**Option 18** Strategic Corridor and Express Lanes	**Option 18** Strategic Corridor and Express Lanes	**Option 18** Strategic Corridor and Express Lanes	**Option 1** City Centre Cordon
6	**Option 18** Strategic Corridor and Express Lanes	**Option 8** Urban Area	**Option 8** Urban Area	**Option 8** Urban Area	**Option 18** Strategic Corridor and Express Lanes
7	**Option 6** Isthmus Area	**Option 6** Isthmus Area	**Option 6** Isthmus Area	**Option 1** City Centre Cordon	**Option 5** Isthmus Cordon
8	**Option 11** Zonal Cordon	**Option 11** Zonal Cordon	**Option 1** City Centre Cordon	**Option 6** Isthmus Area	**Option 2** City Centre Area
9	**Option 10** Employment Centres Cordon	**Option 5** Isthmus Cordon	**Option 5** Isthmus Cordon	**Option 5** Isthmus Cordon	**Option 3** Inner Urban Cordon
10	**Option 5** Isthmus Cordon	**Option 1** City Centre Cordon	**Option 3** Inner Urban Cordon	**Option 3** Inner Urban Cordon	**Option 6** Isthmus Area

The sensitivity analysis indicated that:

1. Option rankings are not sensitive to moderate changes in category weightings.
2. The top four ranked options remain unchanged in all of the sensitivity analysis scenarios:
   - Regional Network
   - Target Congested Corridor
   - Strategic Corridor
   - Strategic Corridor and city centre Area.
3. When the category weightings are shifted more towards social and practical considerations, the City Centre Cordon option improves its position in the ranking due to the impacts being over a smaller area and its potentially greater public acceptability – this reinforces its potential as an initial scheme or pilot.
4. The non-pricing options (Options 19-26) ranked low regardless of scenario – they were always outside the top 10. This reflected the fact that these options were expected to have a negligible impact on network performance.
5. Overall, the sensitivity analysis confirmed that the evaluation results were considered to be robust, particularly around identifying the highest ranking options for further development and more detailed assessment.

4.2.4 Other considerations

- Options 13, 14, 15 and 18 are very similar, as they are all centred around the strategic roading network. Following the evaluation, the Steering Group agreed to collapse these options into one representative option – the "target congested corridor" option – for assessment at the shortlist stage.

- Concerns were discussed and documented during the workshop around the practicalities of implementing the Express Lanes option on the existing Auckland strategic network. Due to the lack of available space to implement such an option, it would be confined to very small sections of the state highway network, and then only where three lanes exist and there is adequate space between interchanges. This would likely have a negligible impact on congestion, so options 17 and 18 were not considered for further analysis.

- The Urban Area scheme (Option 8) was consistently a high scoring option due to its coverage and potential impact on congestion. However, this was also identified as a very blunt option that would involve a lot of uncongested trips being priced, as is currently the case in London. This, as well as considerable risks around its scale, cost and negative public acceptability, suggested that this option would be challenging to deploy.

- As discussed earlier, the options as presented in the longlist are representative, and those taken to the shortlist will be further refined. Including an appropriate representative option from all the concepts (cordon/area/corridor/network) would help prevent the exclusion of a potentially effective option that could be bundled with another option to create a hybrid scheme.

5 Shortlist identification

Based on the results of the longlist MCA evaluation, subsequent sensitivity testing and merging a number of very similar options (those being based on the "strategic network"), five options have been identified to take forward to the shortlist stage for further development and analysis.

These options are:

1. **City Centre Cordon** (based on Option 1), primarily due to its likely high public acceptability and ease of implementation and potential as a pilot or introductory scheme.
2. **Isthmus Area** (based on Option 6)
3. **Target Congested Corridor**, representing the range of Strategic Corridor based options (based on Option 14)
4. **Target Congested Corridor and City Centre Cordon/Area**[2] (based on Option 15), reflecting a hybrid option that is considered to be both practical and effective. It can be compared to Options 14 and 1 to determine if any meaningful benefit is likely to be achieved by combining them.
5. **Regional Network** (based on Option 16)

These options represent a spectrum of pricing schemes, from small localised schemes that could be implemented relatively easily, to a region-wide scheme that would be highly flexible and targeted but complex to implement. The options will be subject to further refinement (eg around boundaries) and the application of a tariff policy that will be developed in the next stage of Phase II (the shortlist development and assessment).

A number of non-price options, Options 21, 22, 24 and 26 (parking policy, car sharing, reverse tolling and public transport fares) were not considered sufficiently effective on a stand-alone basis, but could be considered as part of a broader toolkit of potential complementary measures and/or mitigations associated with a congestion pricing scheme.

[2] The longlist evaluation showed similarities between the city centre cordon and area options in terms of congestion impact, but simpler implementation/operation for a cordon option.

Appendix A – Considerations to support longlist development

OPTIONS DEVELOPMENT

Auckland Smarter Transport Pricing

25 August 2017

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Auckland Transport
An Auckland Council Organisation

Introduction

- The purpose of the Smarter Transport Pricing (STP) project is to undertake a thorough investigation sufficient to support a decision on whether or not to proceed with introducing pricing for demand management purposes in Auckland.
- The TOR state that the objective is to improve the performance of the Auckland transport network having due regard for economic, social and environmental factors.
- This PPT sets out a proposed process and background information to assist the Steering Group to generate a long-list of pricing options using a public sector business case framework.
- It is recognised that options development will be iterative and evolutionary in nature, and that options will be amended and added/deleted/combined as appropriate.
- The presentation is organised into four sections:
  1. Options development envelope
  2. Auckland traffic data
  3. Potential pricing options
  4. Next steps.

Part One:
Options Development Envelope

Options Development Envelope

- There are myriad of potential road pricing interventions with the ability to improve Auckland's network performance.
- Potential options can differ according to their objectives, scale, design, target customers, tariffs, technology platform, risks, costs and impacts.
- To aid the Steering Group to develop a potential options long-list it is useful to undertake this exercise within an envelope created by:
  - The TOR objectives and considerations
  - The technology frontier
  - Lessons from international schemes
  - Local research and analysis
  - Other project matters
  - An understanding of Auckland traffic (Section Two).
- The objective of the exercise is not to constrain the options development process but to develop a logical schematic to expose the underlying assumptions to support their description, classification and evaluation, and provide guidance to ensure resources are not expended on ineffectual and/or unacceptable schemes.

STP Project Objectives

- Pricing of road capacity to improve network performance is the primary service objective of all potential schemes under consideration as directed by the TOR. This raises the central question of what level of network performance is any intervention aimed at achieving?
- The following target network KPIs (when compared with the do-minimum scenario) are based on broad outcomes achieved by international congestion pricing schemes:
  - 20% improvement for average travel speed for am and pm peak periods
  - 20% improvement for travel reliability for am and pm peak periods
  - 10% improvement for average travel speed for inter-peak periods
  - 10% improvement in travel times for main commercial routes
  - 5% increase in PT boardings
  - 5% increase in active modes
  - 5% reduction in serious crashes
  - 5% improvement in environmental outcomes.
- These KPIs provide a logical and defensible basis to evaluate the projected outcomes of different road pricing options for Auckland.

STP Project Considerations

- Different options will have different implications for social, economic and environmental impacts. This might reflect differences in the options in terms of geographical coverage and/or tariff design, noting that it is difficult to fully anticipate these effects.
- The considerations specified by the TOR do not constrain the options envelope, but the long-list options development process should aim to expose any significant impacts to ensure red-flag issues are noted and unacceptable options are excluded.
- To illustrate, a potential scheme that inadvertently creates a tariff boundary in the middle of a residential neighbourhood, is likely to be seen as unacceptable to the affected communities and is unlikely to be included on the options long-list.
- Potential mitigation measures may be integral to scheme design or they may be treated separately and be common to a number of options.
- Ideally the options development process should aim to expose the nature and magnitude of any proposed mitigation measure for each option considered. This will help ensure comparisons are made on a consistent basis, and options are not accepted/rejected without due consideration of mitigation measures.

Technology Frontier

- The technology frontier for options development has been broadly outlined in the research undertaken by D'Artagnan Consulting on international schemes that concluded:
  - All schemes require roadside automatic number plate recognition (ANPR) for enforcement and most also use it as the sole vehicle identification technology for charging purposes.
  - Because ANPR performance has improved considerably and reduced in cost, this technology has effectively rendered DSRC (tag and beacon) systems unnecessary for new projects.
  - GNSS technology is no longer seen as unproven, but the risk, timing, and cost to retrofit a large urban vehicle fleet remain a significant barrier to implementation.
  - Auckland's technology choices will be about whether it uses ANPR exclusively or includes an in-vehicle GNSS option (enabling charging by distance) to support scheme evolution over time.
- Singapore is planning to introduce a next generation GNSS system by 2020 to provide greater flexibility for system expansion and enable a wider range of value added services.
- The Singapore experience should prove pivotal in informing any debate around the move towards full network charging in Auckland using in-vehicle GNSS hardware (plus ANPR).

International Schemes- Main Lessons: 1

- A number of key lessons from the review of international schemes provide valuable guidance for options development. In particular:
  - Auckland's urban form, trip patterns, and governance require bespoke policies, public engagement, design, and delivery that build incrementally to address the most widely acknowledged problem(s).
  - Other cities offer features to borrow and lessons to heed, but congestion pricing requires deep understanding of local geography and responsiveness to local conditions and concerns.
  - Focus on designing a scheme, that can be easily implemented, that will demonstrate clear, sustainable results, without constraining options for scalability and flexibility to evolve further.
  - Do not seek to develop the perfect solution as the first scheme that is introduced. Complexity risks greater confusion, suspicion and opposition from the public, who may not accept too much of a change from the start.
  - Seek to balance the desirability of simplicity and ease of understanding with targeting congestion where and when it occurs.
  - The blunter the scheme, like area charges, the more the concerns about fairness and need to mitigate equity issues.

International Schemes- Main Lessons: 2

- No schemes to date have had to address serious distributional impacts.
- Most schemes have sought to mitigate equity impacts through provision of additional public transport and careful attention to scheme design to minimise division of residential areas.
- Traffic management and road improvements can also support a charging scheme.
- Public acceptability improves when government dedicates charge revenues to improving transport, but the question of which modes (roads vs. public transport) depends on local conditions.
- Transport modelling has limitations but is useful for designing the first set of tariffs.
- Tariffs should be adjusted to reflect target levels of service, and different charges by time of day helps spread demand to improve network performance.
- Take care in applying discounts and exemptions.
- Privacy is an issue, but is likely to be exaggerated.
- To maximise economic efficiency, charging should be focused when and where congestion is imposing significant delays (and therefore costs) on road users.
- Avoid charging uncongested traffic. This also will improve the public acceptability of charging.

Local Research and Analysis

- The Steering Group has identified that the project needs to undertake a number of research activities to better inform options development, and to support the wider engagement exercise. Proposed research activities include:
  - Stakeholder meetings and workshops.
  - Focus groups, interviews and public surveys.
  - Consulting with transport and other specialists, and agency experts to gather data and information relevant to the project.
- The research program is scheduled to largely take place in 2018 however these activities do not represent an immediate constraint or dependency in relation to the development of the long-list of potential options.
- Likewise results from the on-going ART traffic model update and enhancement exercise are not required to undertake long-list options development.

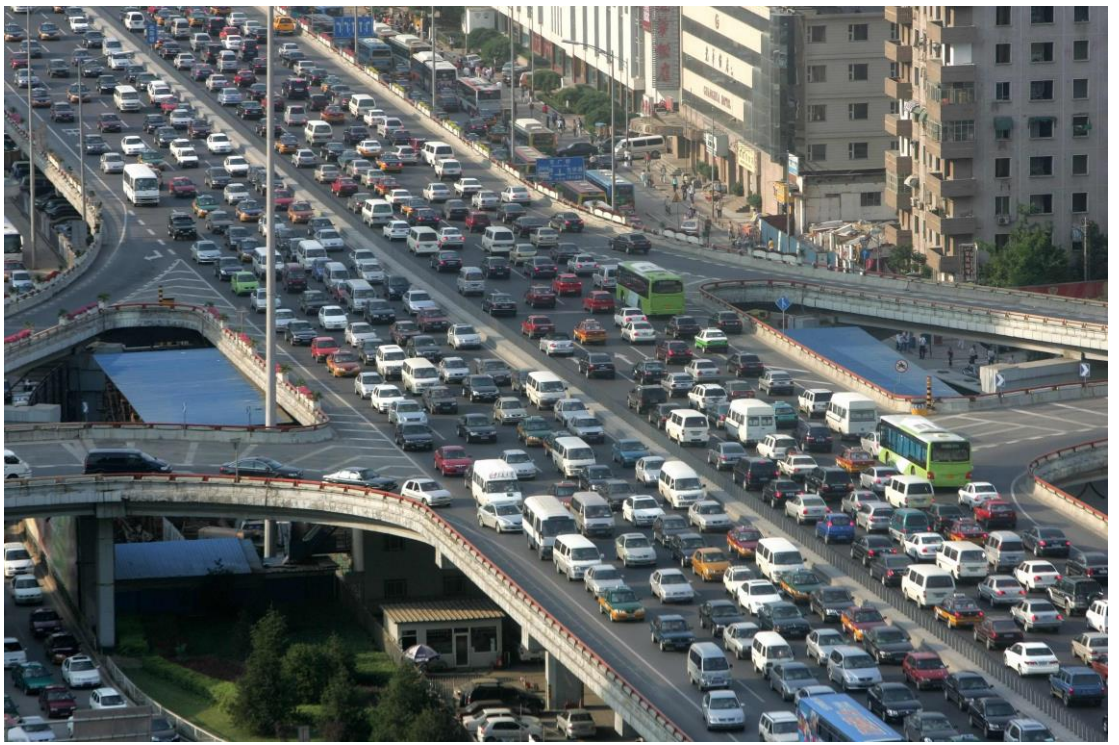
Costs and Funding

- The potential magnitude of development and operational costs, and implications for funding should be indicated for each option within the constraints of the data and tools available. In particular:
  - **Development Costs -** Development costs are likely to reflect the supporting technology, functional requirements, scheme coverage and complexity.
  - **Operational Costs -** Operational costs are likely to reflect the operating model, supporting technology, scheme coverage and complexity.
  - **Funding** - Scheme options are likely to have different long term impacts on the current land transport pricing system, and may also have different implications for how they support the goal of transparency on the use of net revenues raised for demand management purposes.

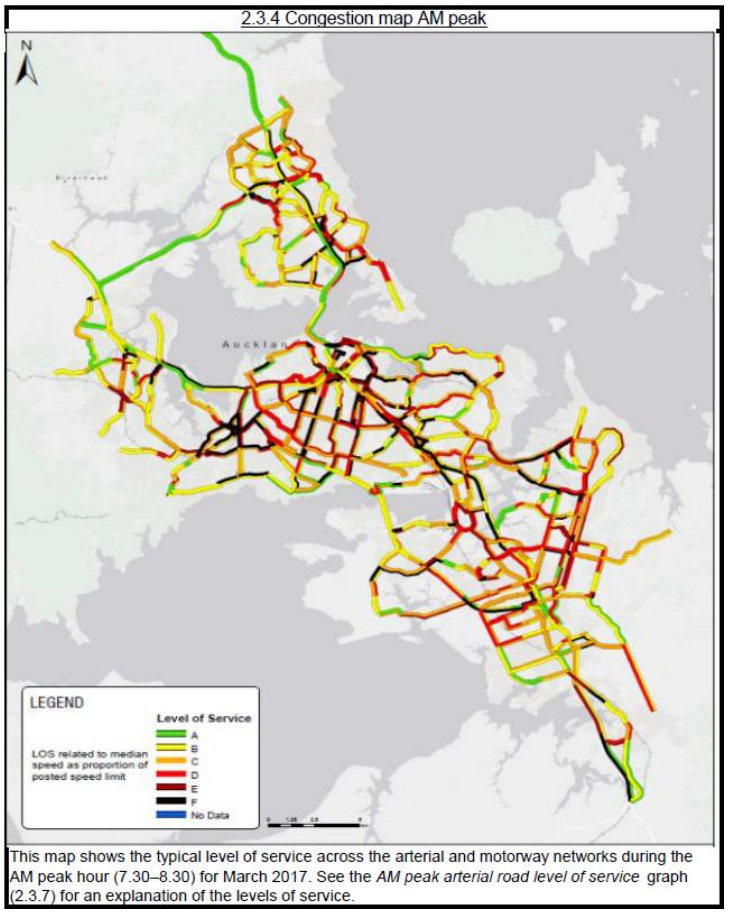
Timetable and Risks

- It is important that option development considers and makes explicit the expected implementation timetables and general magnitude of risks associated with each potential scheme option within the constraints of the data and tools available. In particular:
  - **Timetable -** Different options will require a range of implementation timetables, depending on their scale, complexity, operating model, procurement approach and supporting technology.
  - **Risk** - Different schemes are likely to have markedly different risk profiles and these should be an important dimension supporting the long-list options development. Project risks can reflect a number of option characteristics including scale, technology, procurement approach, operating model, revenue, the legal framework, and public and political acceptability.

Part Two:
Auckland Traffic Data



Traffic Indicators: 1

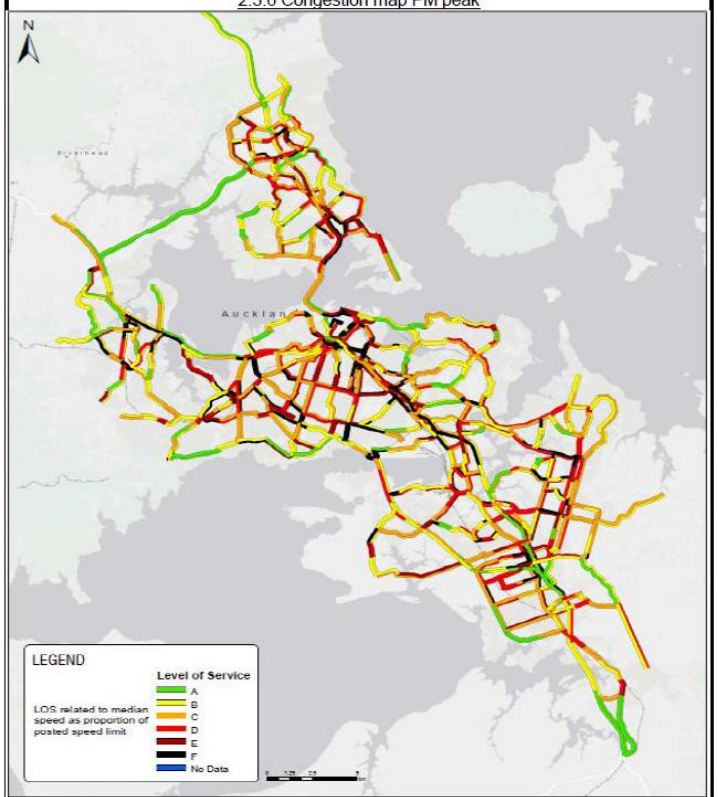


This map shows the typical level of service across the arterial and motorway networks during the AM peak hour (7.30–8.30) for March 2017. See the *AM peak arterial road level of service* graph (2.3.7) for an explanation of the levels of service.

- Congestion 'heat maps' are based on median travel speeds across the arterial and motorway network for AM peak, inter-peak and PM peak travel times.
- Colour mapping reflects Level of Service (LOS) achieved relative to posted speed limits.
- Maps illustrate the performance of the road network by revealing relative scale and location of congested corridors.
- Maps also illustrate Auckland topography and constrained nature of arterial road network, and highlight traffic bottlenecks.

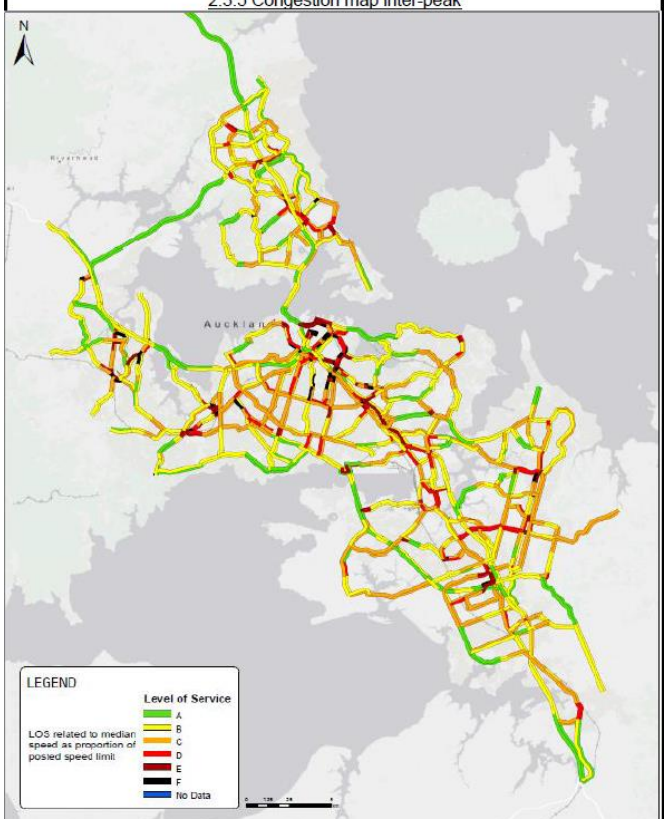
Traffic Indicators: 2

2.3.6 Congestion map PM peak



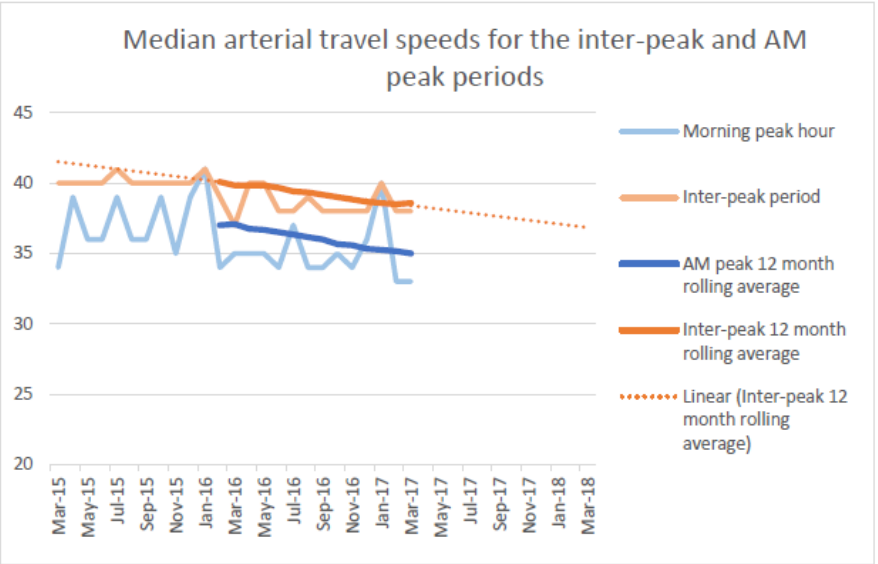
This map shows the typical level of service across the arterial and motorway networks during the PM peak hour (4.30–5.30) for March 2017. See the *AM peak arterial road level of service* graph (2.3.7) for an explanation of the levels of service.

2.3.5 Congestion map inter-peak



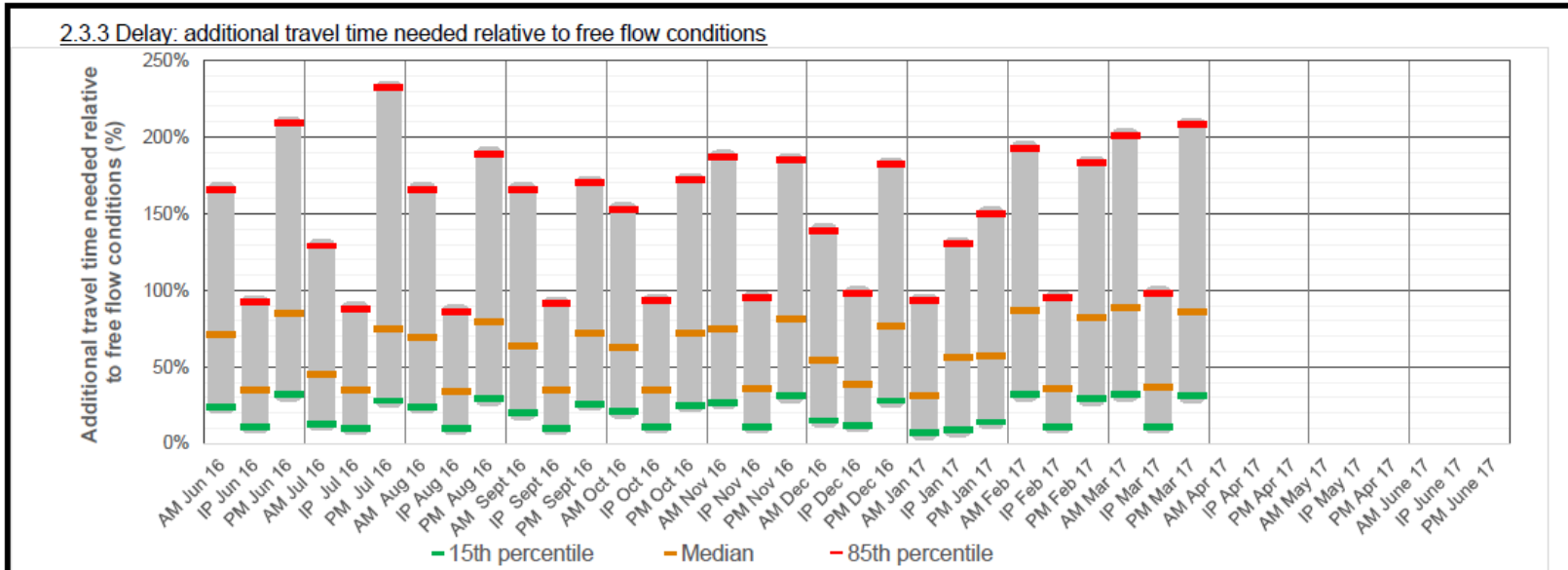
This map shows the typical level of service across the arterial and motorway networks during the Interpeak period (9 am–4 pm) for March 2017. See the AM peak arterial road level of service graph (2.3.7) for an explanation of the levels of service.

Traffic Indicators: 3



- Available data shows a trend decline in median speeds across the arterial network over the last year
- Growth in demand for travel is leading to a significant deterioration in arterial network performance, particularly in the peak period, which translates into a decline in access to labour within a fixed travel time.
- Increasing inter-peak congestion will have significant implications for businesses and freight movement in terms of longer travel times, higher costs and greater unpredictability of travel.

Traffic Indicators: 4

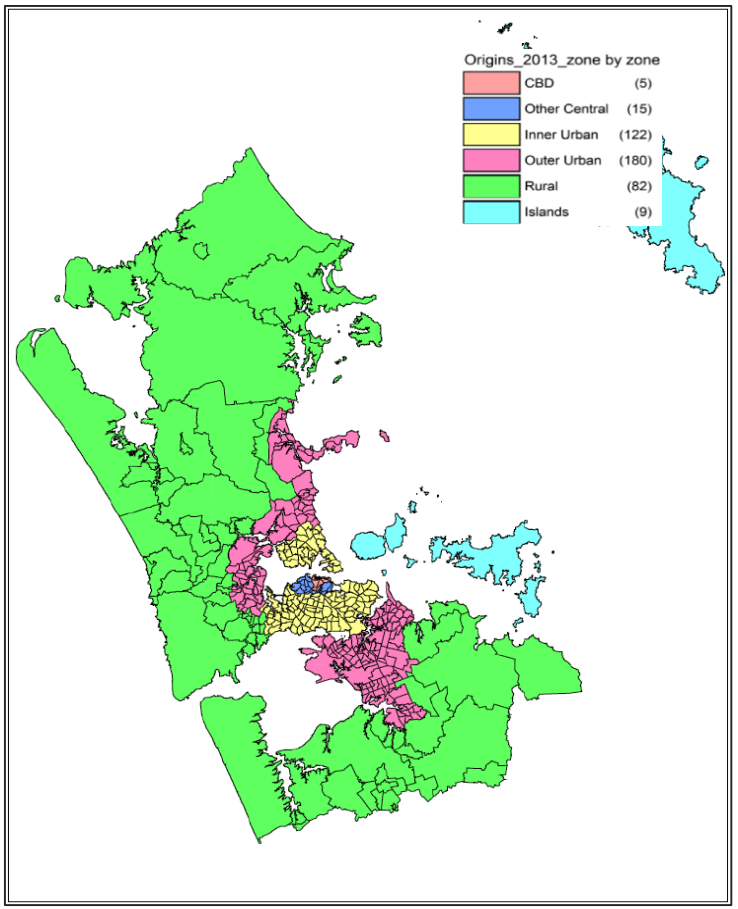


This figure shows AM peak, inter-peak and PM peak travel times for the 15th percentile, typical (median) and 85th percentile* trips on the combined arterial and motorway network, relative to free flow conditions.

During the March 17 AM peak, the 15th percentile delay was 32%, typical delay was 89% while the 85th percentile delay was 201%.

*85% of all trips will take less than the 85th percentile.

Travel to Work Patterns: 1



- Journey to work patterns in Auckland based on 2013 Census data provide insights on underlying causes of congestion but important limitations:
  - exclude other trips undertaken for educational, social, business and other purposes.
  - the totals from the Census include work trips undertaken at all times of the day.
  - high population, economic and PT growth since 2013, means data now dated
  - because journeys can involve more than one mode, measures of distance only relate to the main mode identified for the journey.

Travel to Work Patterns: 2

Table 4.2
Destinations and Origins for Auckland Commuting Trips 2013

Sector	Total by Destination		Total by Origin		Ratio of Resident Workers to Jobs
	No	Per cent	No	Per cent	
CBD	68,139	13.7%	12,351	2.5%	18%
Other Central	43,281	8.7%	21,777	4.4%	50%
Inner Urban	168,537	34.0%	188,337	38.0%	112%
Outer Urban	177,075	35.7%	210,078	42.3%	119%
Rural	39,078	7.9%	63,567	12.8%	163%
Total	**496,110**	**100.0%**	**496,110**	**100%**	**100%**

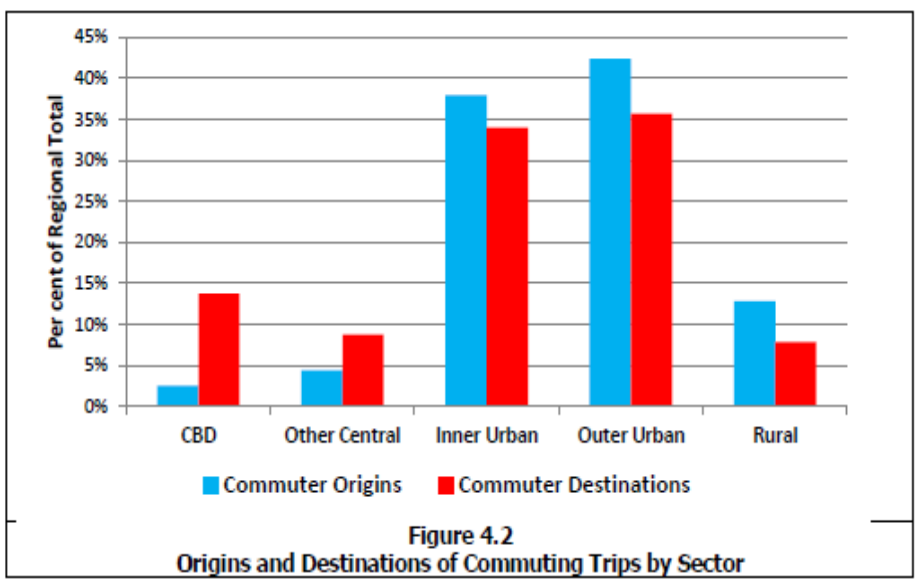


Figure 4.2
Origins and Destinations of Commuting Trips by Sector

- CBD accounts for 14% of trip destinations, and Other Central 9%
- Inner Urban sector for 34%, Outer Urban sector for 36% and Rural for 8%.
- Central areas have low proportion of jobs to resident workers resulting in high inflows from the other areas.
- Central sectors have substantially more jobs than workers but for the other sectors the position is reversed with these having more workers than jobs.
- Auckland employment patterns are generally broadly dispersed, and are not dominated by inflows towards CBD.

Travel to Work Patterns : 3

Table 4.4
Commuting Journeys by Sector 2013 : Total Trips

Origin	Destination					
	CBD	Other Central	Inner Urban	Outer Urban	Rural	Total
CBD	6,681	1,773	2,475	1,242	180	12,351
Other Central	6,318	8,001	4,782	2,346	330	21,777
Inner Urban	33,189	20,340	97,518	33,939	3,351	188,337
Outer Urban	17,775	10,281	52,026	122,808	7,188	210,078
Rural	4,176	2,886	11,736	16,740	28,029	63,567
Total	68,139	43,281	168,537	177,075	39,078	496,110

Table 4.5
Commuting Journeys by Sector 2013 : Shares of Total Trips

Origin	Destination					
	CBD	Other Central	Inner Urban	Outer Urban	Rural	Total
CBD	1.3%	0.4%	0.5%	0.3%	0.0%	2.5%
Other Central	1.3%	1.6%	1.0%	0.5%	0.1%	4.4%
Inner Urban	6.7%	4.1%	19.7%	6.8%	0.7%	38.0%
Outer Urban	3.6%	2.1%	10.5%	24.8%	1.4%	42.3%
Rural	0.8%	0.6%	2.4%	3.4%	5.6%	12.8%
Total	13.7%	8.7%	34.0%	35.7%	7.9%	100.0%
Per cent of jobs filled by resident workers	10%	18%	58%	69%	76%	53%

Table 4.6
Commuting Journeys 2013 : Shares of Total Trips to Area by Sector

Origin	Destination					
	CBD	Other Central	Inner Urban	Outer Urban	Rural	Total
CBD	9.8%	4.1%	1.5%	0.7%	0.5%	2.5%
Other Central	9.3%	18.5%	2.8%	1.3%	0.8%	4.4%
Inner Urban	48.7%	47.0%	57.9%	19.2%	8.6%	38.0%
Outer Urban	26.1%	23.8%	30.9%	69.4%	18.4%	42.3%
Rural	6.1%	6.7%	7.0%	9.5%	71.7%	12.8%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

- For the region 53% of workers have jobs within sector in which they reside.
- CBD has a very high share of workers from other areas, but this declines with distance from the centre.
- Inner Urban has majority of employment filled by resident workers.
- Outer Urban and Rural has very high shares of jobs are filled by workers resident in the areas.
- Inner Urban has majority of employment is filled by workers residing in the sector within which they live,
- Regional work patterns demonstrate importance of internal transport linkages.

Travel to Work Patterns: 4

Table 4.12 Modes Used by Workplace Sector 2013						
	CBD	Other Central	Inner Urban	Outer Urban	Rural	Total
Summary by Destination : Trip Numbers						
Private vehicle	37,149	30,861	131,691	146,358	26,190	372,249
Bus	14,166	3,711	7,140	3,993	594	29,604
Train	4,041	1,101	1,746	1,320	180	8,388
Walked/jogged	6,948	2,931	6,483	4,929	1,494	22,785
Bicycle	1,185	843	1,806	1,440	258	5,532
Other	3,447	1,443	4,827	5,253	1,275	16,245
Worked at home	1,203	2,391	14,844	13,782	9,087	41,307
Total	**68,139**	**43,281**	**168,537**	**177,075**	**39,078**	**496,110**
Summary by Destination : Per cent of total						
Private vehicle	55%	71%	78%	83%	67%	75%
Bus	21%	9%	4%	2%	2%	6%
Train	6%	3%	1%	1%	0%	2%
Walked/jogged	10%	7%	4%	3%	4%	5%
Bicycle	2%	2%	1%	1%	1%	1%
Other	5%	3%	3%	3%	3%	3%
Worked at home	2%	6%	9%	8%	23%	8%
Total	100%	100%	100%	100%	100%	100%

- Mode share of private transport by destination for all commuting trips is 75% but higher once working from home excluded.
- Private vehicle use increases with distance away from the central area with the mode share for private vehicles reaching 83% for Outer Urban.
- The mode share for PT for trips to CBD amounts to 27% but falls with increasing distance from central area.
- Active mode share decreases with distance away from the central area
- Census now dated but reveals strong reliance on private vehicles for commuting outside of central area.

Travel to Work Patterns : 5

Table 4.13 Commuting to Central Areas as a Share of Total Flows by Mode 2013			
Mode	CBD	Other Central	Total Central
Private vehicle	10%	8%	18%
Bus	48%	13%	60%
Train	48%	13%	61%
Total PT	*48%*	*13%*	*61%*
Walked/jogged	30%	13%	43%
Bicycle	21%	15%	37%
Other	21%	9%	30%
Worked at home	3%	6%	9%
Total	14%	9%	23%

- Trip making to the central areas accounts for about 60% of all commuting journeys by PT, with bus and train having similar shares.
- Trip making to the central area accounts for 43% of all walking trips and a similar share 37% of cycling trips
- Commuting trips to CBD only accounts for 10% of total private vehicle trip flows, and 18% to total central area.
- Flow data for private vehicles illustrates Auckland peak period congestion driven by widely dispersed work travel patterns.

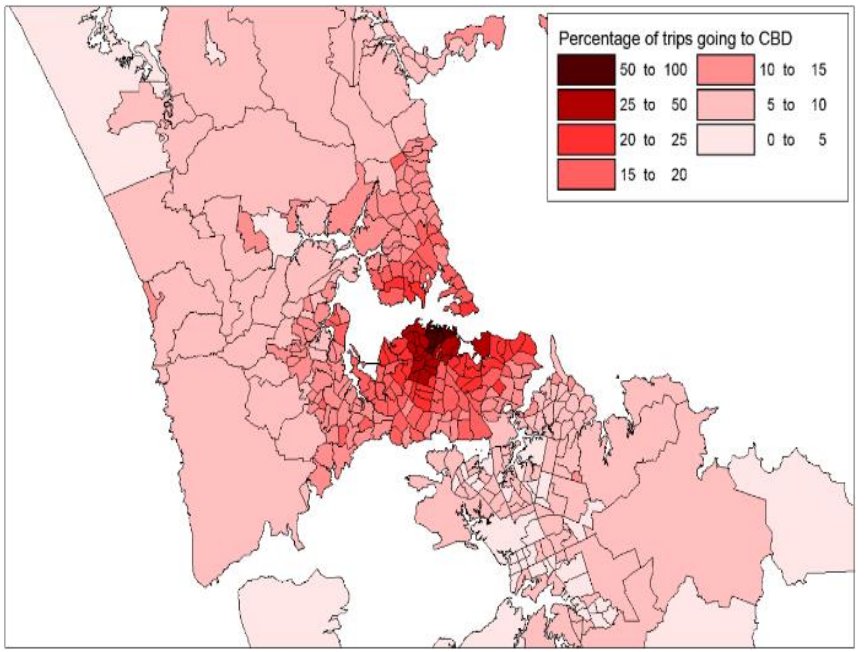
Travel to Work Patterns: 6

Table 4.8 Average Trip Lengths by Main Mode	
Mode	Average Trip Length (kms)
Private vehicle	13.5
Bus	11.4
Train	15.9
Public transport	12.4
Active modes	6.7
Average all modes	**11.8**

Table 4.9 Trip Lengths by Sector 2013 (kms)				
Sector	By Place of Work		By Place of Residence	
	Average Distance (kms)	Per cent of Average	Average Distance (kms)	Per cent of Average
CBD	12.1	103%	5.1	43%
Other Central	11.2	95%	6.1	52%
Inner Urban	10.8	92%	9.2	78%
Outer Urban	12.4	105%	13.1	111%
Rural	13.4	114%	18.9	160%
Total	**11.8**	**100%**	**11.8**	**100%**

- With exception of active modes, the average trip lengths by mode are broadly similar, with the longest average trip lengths recorded by train commuters.
- Trip length data by destination reveals that work distances are broadly similar.
- Trip length data by residence sector reveals that work distances increase with increasing distance from central area.
- Overall trip length data by sector is consistent with widely dispersed work and residential patterns.

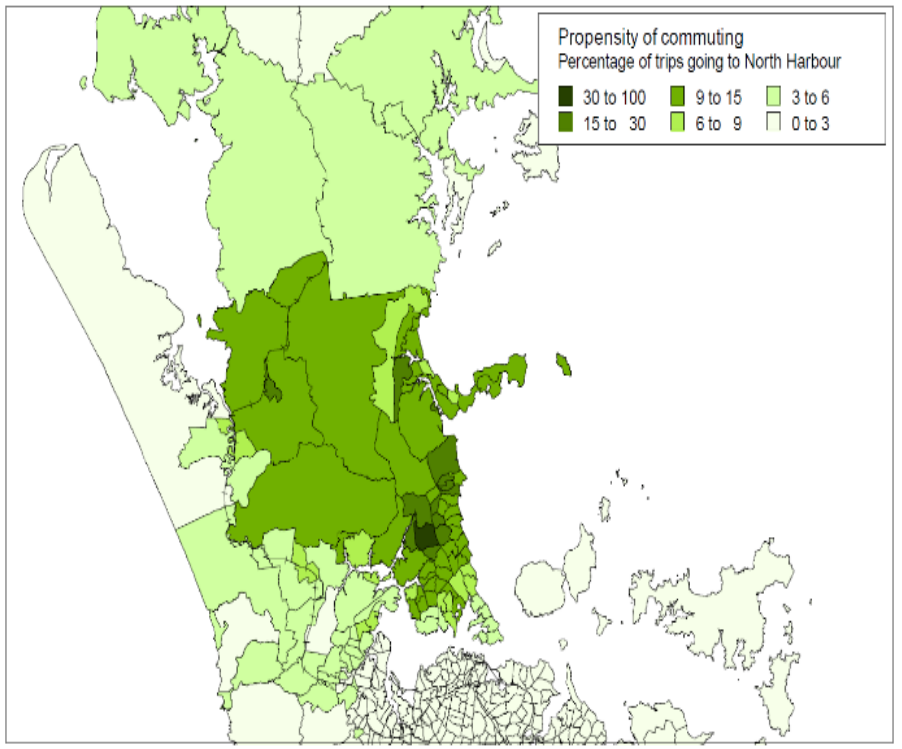
Travel to Work Patterns: 7

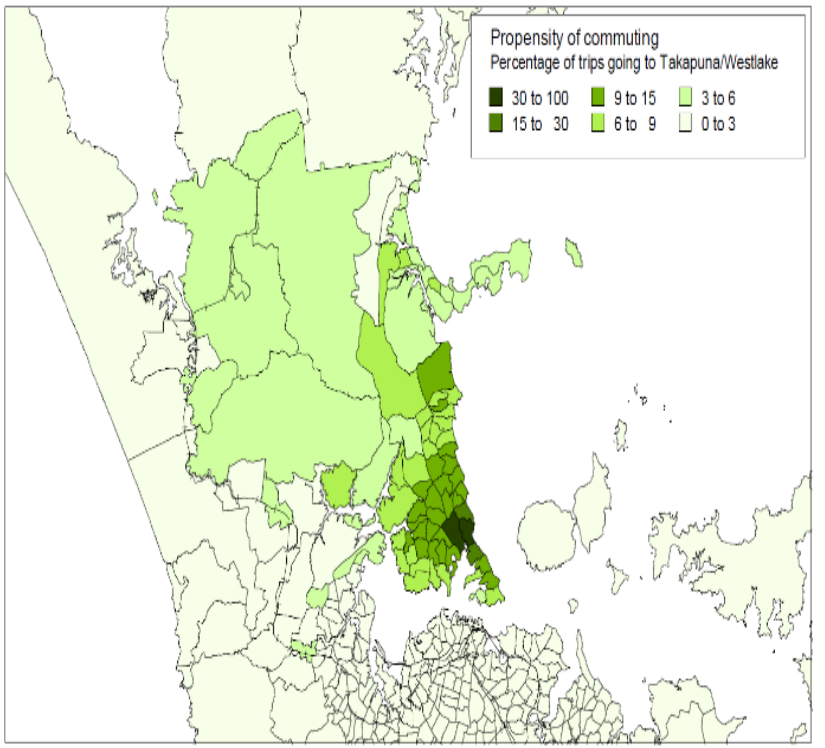


- Regional patterns are available by looking at the proportions of workers in a Census Area Unit* which commute to a particular employment centre.
- The CBD has a high share of resident workers commuting as a proportion of the total commuting trips within the area estimated at around 45%.
- The trend then declines in broadly concentric bands with a proportion of 25% or more from a ring including the CBD fringe.
- There is a relatively high propensity to travel to the CBD along the route of the Northern Busway and the Northern Motorway.

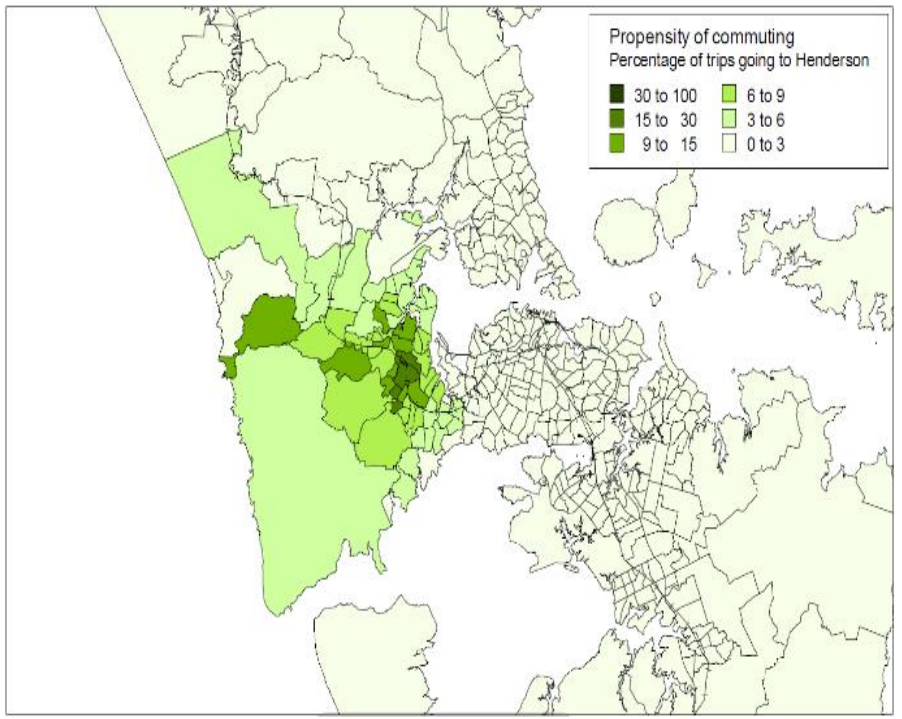
* CAUs consist of 3000-4000 persons.

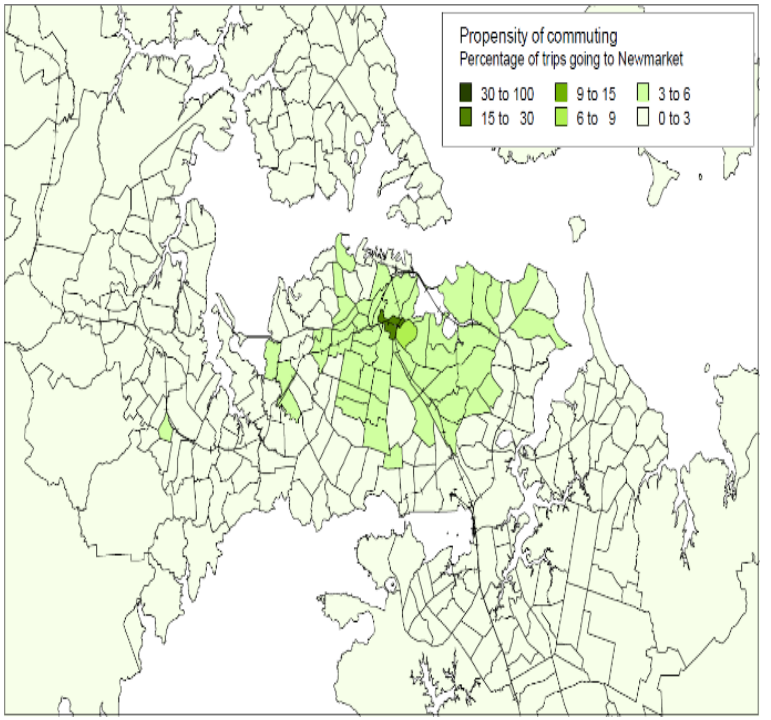
Travel to Work Patterns: 8



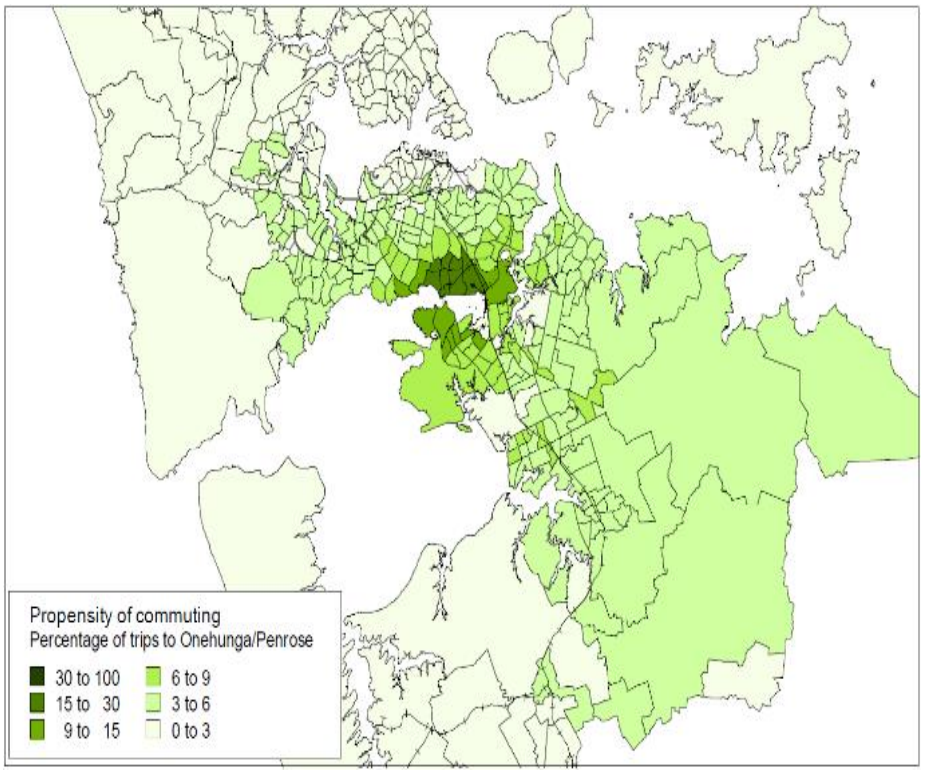


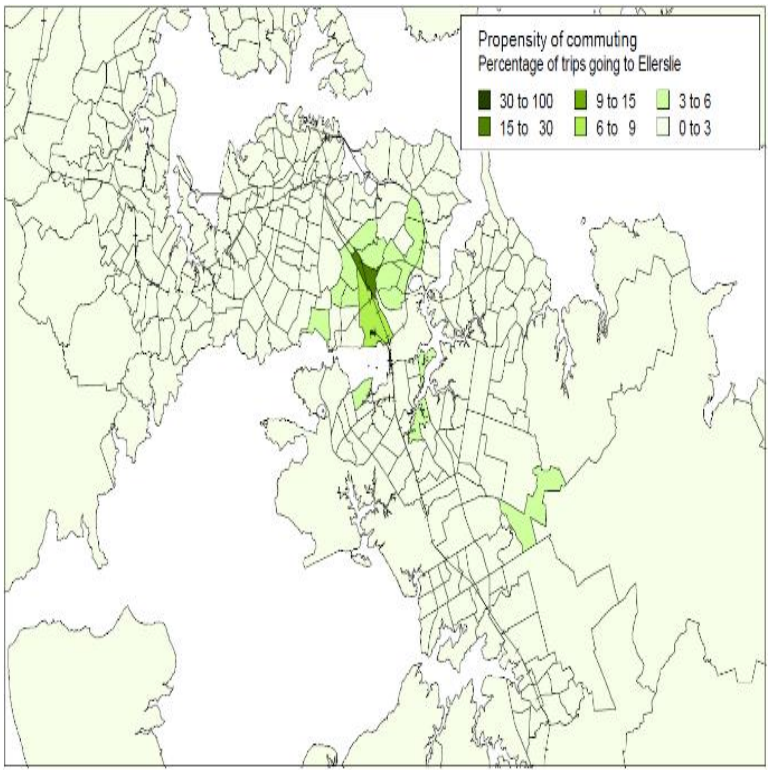
Travel to Work Patterns: 9



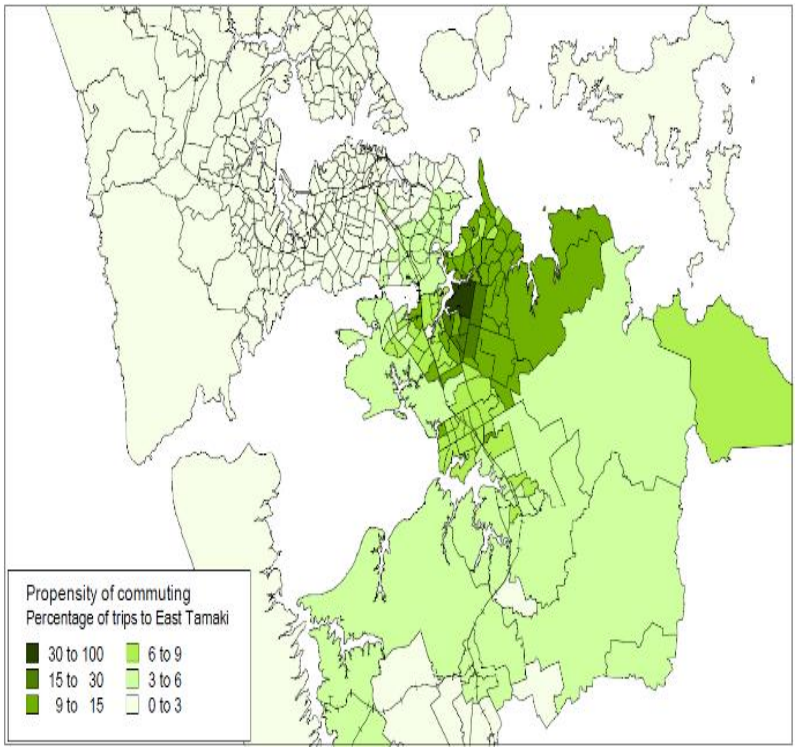


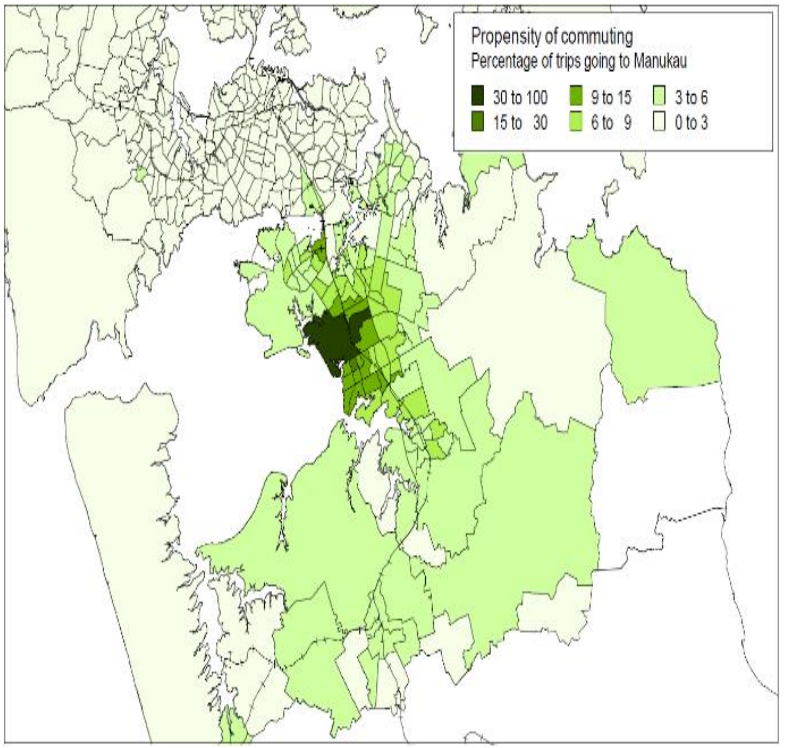
Travel to Work Patterns: 10



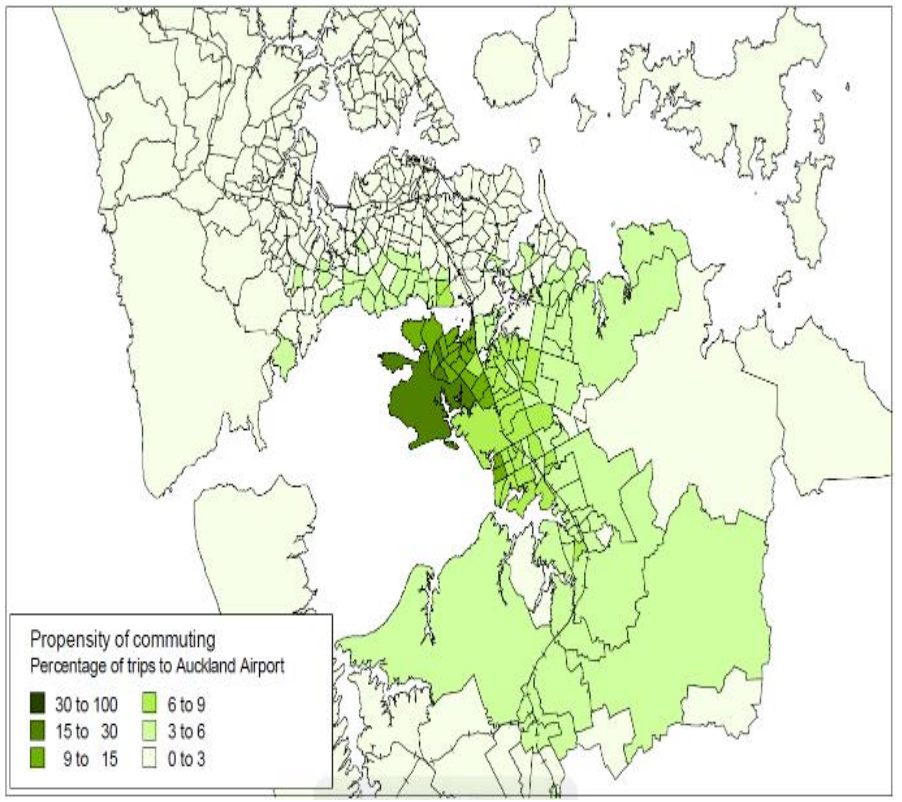


Travel to Work Patterns: 11





Travel to Work Patterns: 12



- A number of themes emerge from analysis of regional centres:
  - They generally attract workers from surrounding local areas.
  - For most areas the main commuting movements lie along axes connecting the sources of workers with the CBD.
  - The extent of reverse commuting is relatively small.
  - For smaller centres there is only limited commuting across the Waitemata Harbour.
- Historically suggests workers are attracted to regional employment centres to take advantage of lower priced housing – rather than undertake longer commutes to the CBD.

Travel to Work Patterns: 13

Table 7.10
Summary of Characteristics of Trips to Selected Employment areas

	North Harbour	Takapuna/ Westlake	Hender -son	New- market	Onehunga/ Penrose	Ellerslie South	Highbrook/ East Tamaki	Manukau Central	Airport & Environs	Region average
Total commuting destinations	17,679	15,249	7,092	9,315	19,761	7,320	16,716	10,221	13,239	
Modal Splits										
Private vehicle	92.0%	81.3%	83.7%	70.1%	86.7%	84.8%	93.8%	91.1%	92.6%	75.0%
Bus	2.3%	7.8%	3.1%	11.1%	3.4%	4.0%	1.0%	2.1%	1.7%	6.0%
Train	0.1%	0.3%	2.8%	6.0%	1.2%	3.8%	0.1%	0.9%	0.3%	1.7%
Walked or jogged	1.4%	4.5%	3.2%	6.3%	2.2%	3.0%	0.8%	1.3%	0.7%	4.6%
Bicycle	0.6%	1.4%	1.5%	2.0%	1.0%	0.8%	1.0%	0.6%	0.6%	1.1%
Other	1.9%	2.0%	3.1%	3.0%	2.6%	2.6%	2.4%	3.3%	3.1%	3.3%
Work at home	1.6%	2.6%	2.6%	1.4%	3.0%	1.1%	1.0%	0.7%	1.1%	8.3%
Average travel distance (kms)	**15.7**	**12.9**	**12.8**	**12.1**	**13.9**	**13.5**	**14.1**	**15.4**	**18.1**	**11.8**

- The share of private vehicle trips for regional employment centres is typically high reflecting the lack of PT services and availability of parking.
- PT use is high in Newmarket and Takapuna/Westlake which are served by major bus corridors.
- Rail use is higher than the regional average in Newmarket, Henderson and Ellerslie South which lie along the rail corridors.
- Travel distances are generally higher than the regional average for the employment centres.

Appendix B – Background information to support longlist evaluation

LONG-LIST OPTIONS

Auckland Smarter Transport Pricing

Background Information for MCA Evaluation

16 February 2018

Introduction

- The TOR states that the STP is tasked with undertaking an investigation to support a decision on whether to introduce pricing for demand management purposes in Auckland.
- The TOR states that the primary objective of pricing is to improve the performance of Auckland's transport network, in particular through improved congestion results.
- The Steering Group has identified a long-list of 26 preliminary options potentially capable of meeting the TOR's objectives.
- The preliminary options presented reflect the findings of two Steering Group workshops held on the 22 November and 28 September 2017.
- This PPT provides a summary of background research undertaken to support a MCA evaluation to select an options short-list for further development and evaluation.
- The MCA evaluation also draws on the modelling outputs prepared for the Phase I report and the D'Artagnan Consulting report on lessons from international schemes.
- The presentation is organised into four sections:
  1. Auckland features and traffic patterns
  2. Congestion pricing, and preliminary social, environmental and safety considerations
  3. International lessons and preliminary economic considerations
  4. Other background research.

Part One: Auckland features and traffic patterns

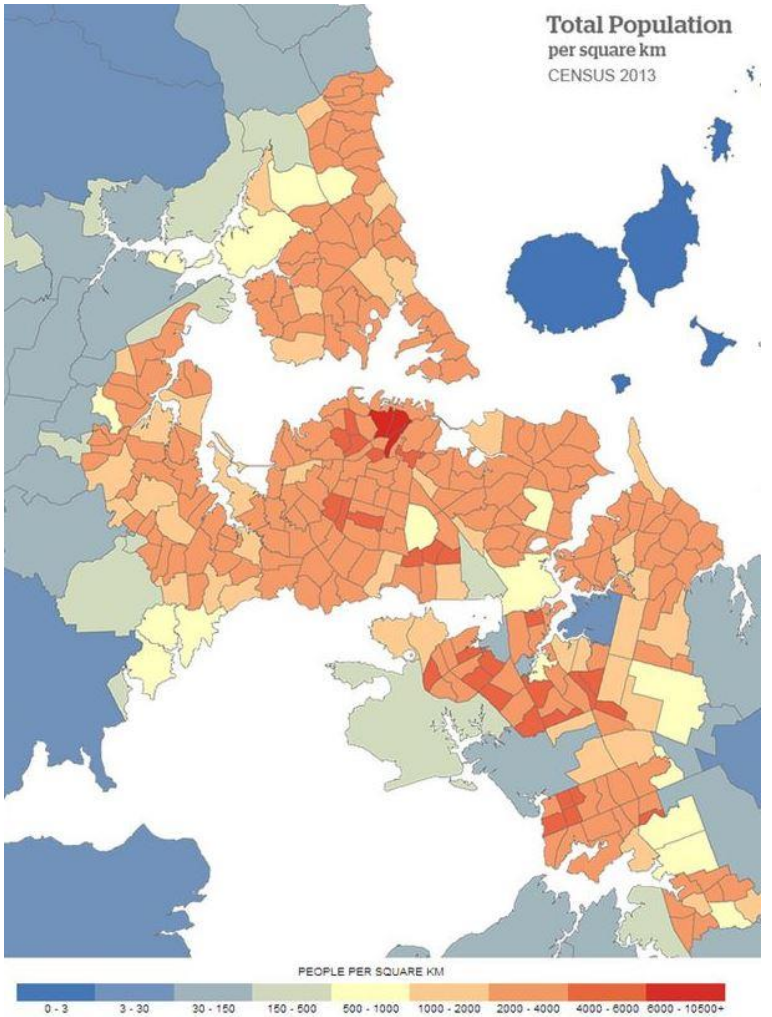
1.1 Population

- Around 1.6 million people currently live in Auckland.
- Over the next 30 years the Auckland population could grow by an additional 740,000 people to reach 2.4 million.
- By 2050, most growth will be focussed in and around the city centre, the nodes of Albany, Westgate and Manukau, supported by Development Areas.
- Incremental growth will happen across existing urban areas as the up-zoning provided by the Unitary Plan is taken up.
- Outside the core urban area, the satellite towns of Warkworth and Pukekohe will act as rural nodes. They will support significant business and residential growth as well as servicing their surrounding rural communities, and will be connected to urban Auckland through state highways and, in the case of Pukekohe, by rail.

	Population 2018	Population growth 2018-2048	Dwellings 2018	Dwelling growth 2018-2048
Development Areas	447,407	228,446	150,133	90,932
Existing Urban	1,029,252	214,168	337,755	103,609
Future Urban	68,804	251,353	24,940	103,242
Rural	120,346	35,220	44,590	19,878
Total	**1,665,809**	**729,188**	**557,419**	**317,661**

Source: Revised Auckland Development Strategy

1.2 Population Density (2013)

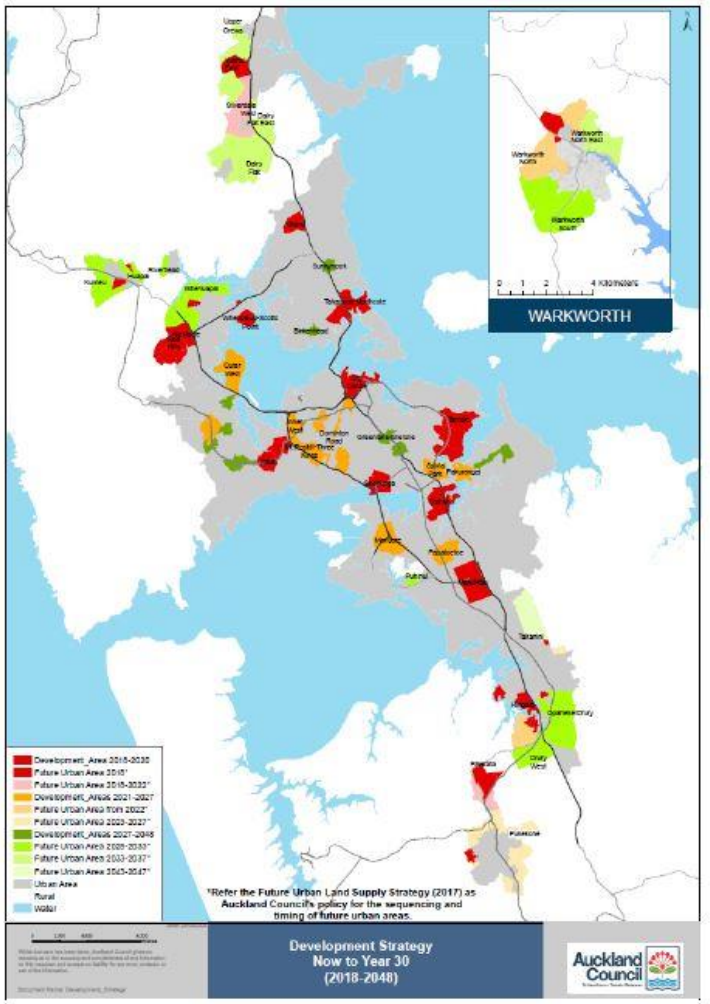


1.3 Topography

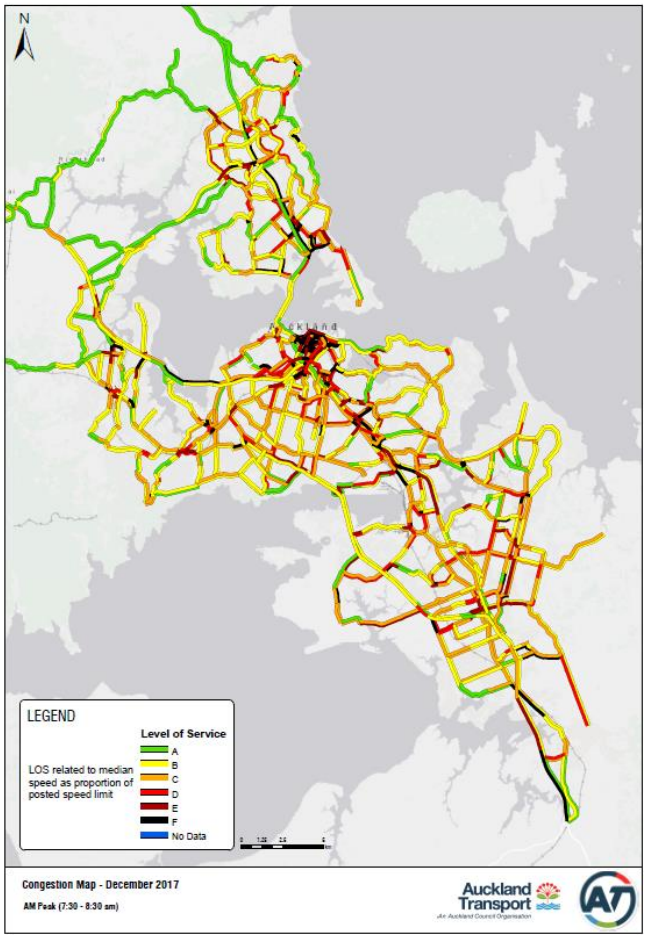
- Geography will continue to shape and constrain Auckland's development.
- Auckland's urban pattern of lower density suburbs, enabled by the motorway system and widespread car ownership, is the dominant feature of Auckland's urban form.
- The urban area is home to over 90 per cent of residents, many of whom live along a narrow axis stretching from Orewa in the north to Drury in the south.
- Auckland region comprised of four large 'cities', the Isthmus, North Shore, Manukau and West Auckland, each with established local amenities encompassing employment, education, retail, health, and leisure facilities.
- Residents are not generally required to travel long distances for many work and non-work trips.
- Physical pinch points, particularly where the isthmus is at its narrowest, constrains and complicates development and the transport network.
- Presence of water boundaries and other topographical features restrict the number of routes available for those wishing to avoid any charging scheme, even when origin/destinations are outside potential charging zones.

Source: Revised Auckland Development Strategy

1.4 Development (2017)

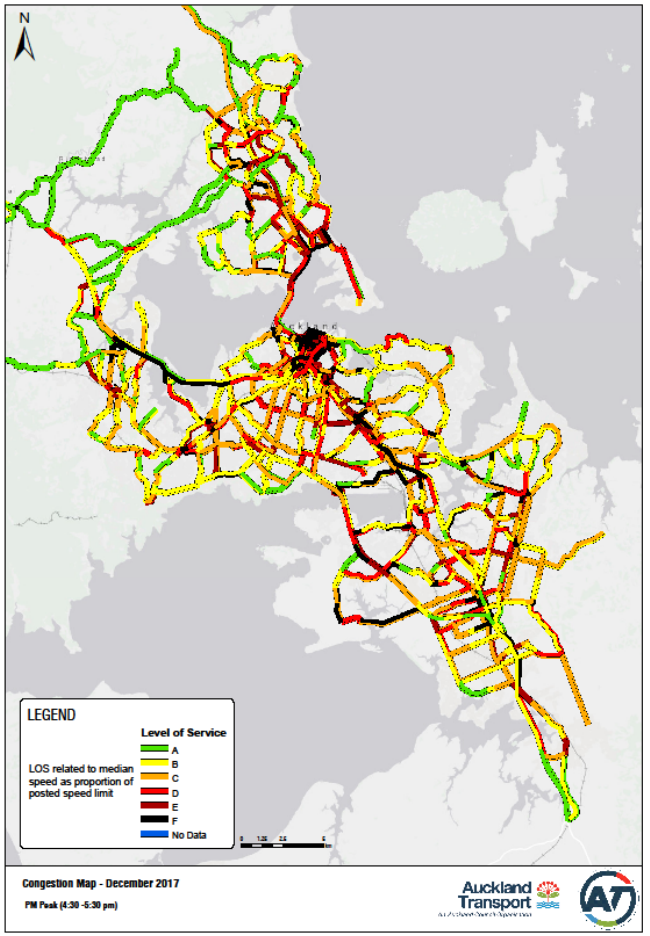


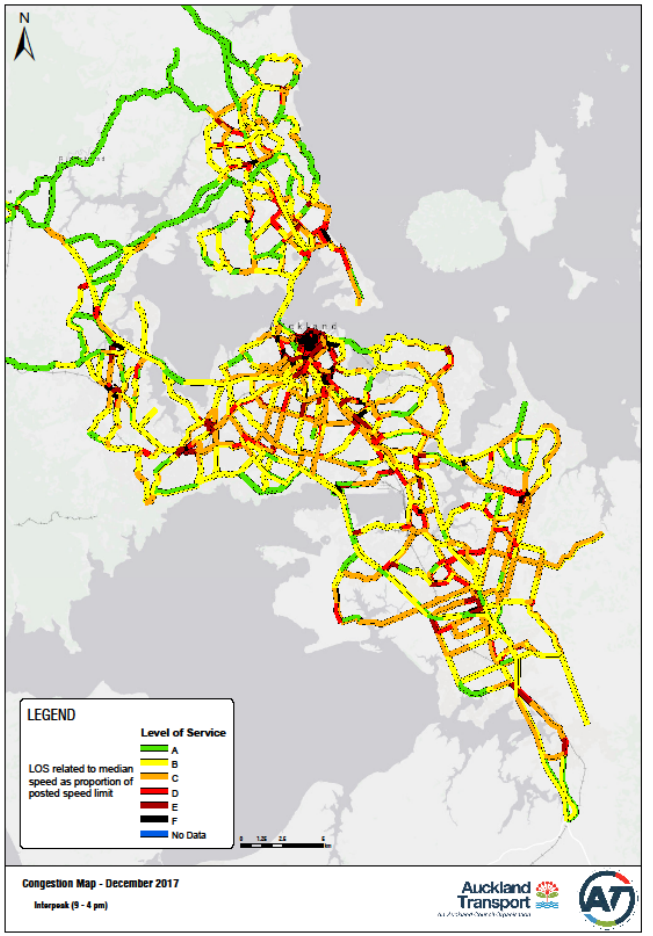
1.5 Traffic Indicators (2017)



- Congestion ‘heat maps’ are based on median travel speeds across the arterial and motorway network for AM peak, inter-peak and PM peak travel times.
- Colour mapping reflects Level of Service (LOS) achieved relative to posted speed limits.
- Maps illustrate the performance of the road network by revealing relative scale and location of congested corridors.
- Maps also illustrate Auckland topography and constrained nature of arterial road network, and highlight traffic bottlenecks.

1.6 Traffic Indicators (2017)



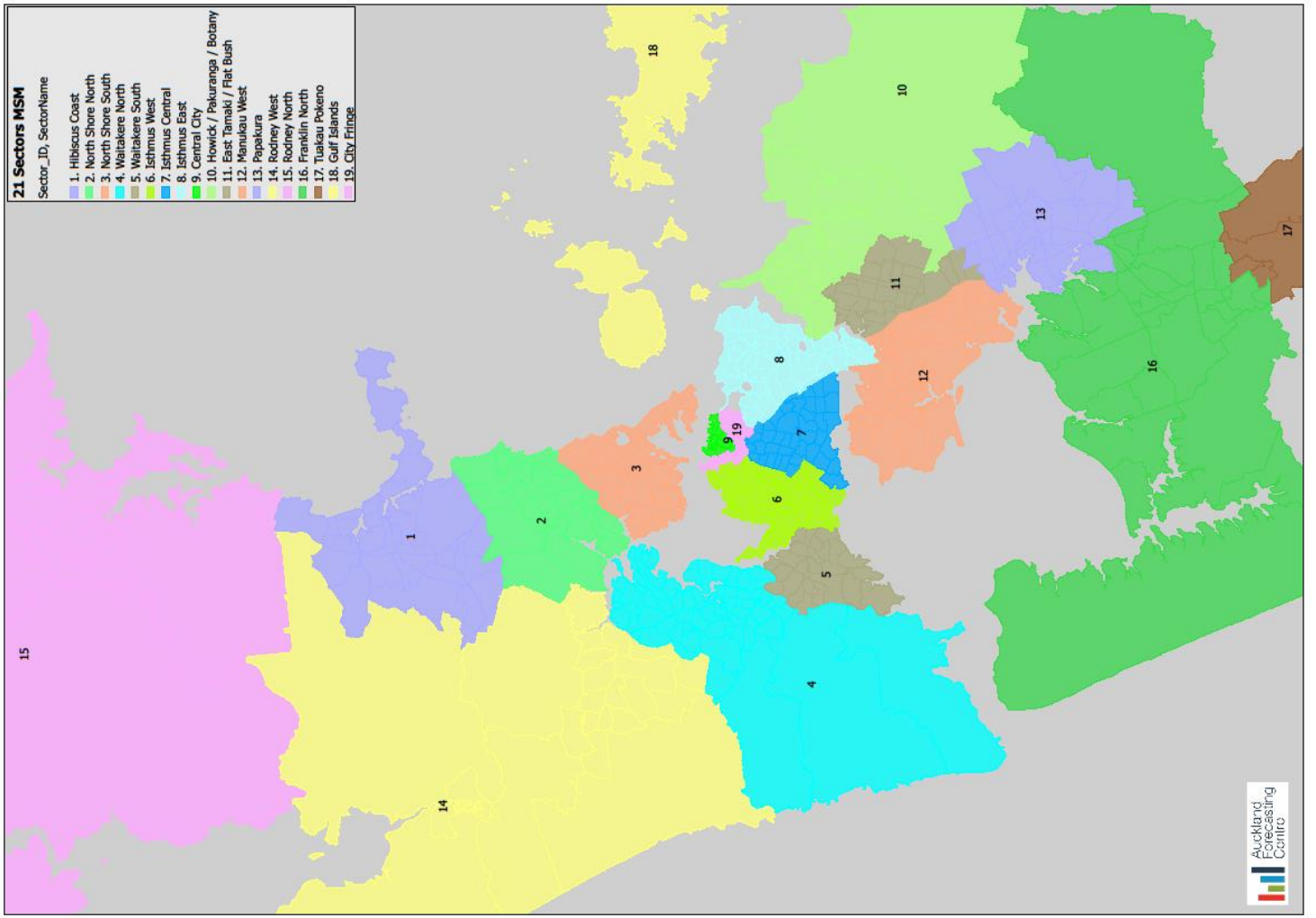


1.7 Origin/Destination Patterns (2016)

- The Origin/Destination tables present modelling results for total private vehicle movements in the AM peak (two hour period) using a 2016 baseline.
- The ART3 model exercise separates Auckland into a total of 19 sectors (Waiheke/Gulf Islands excluded) including sectors for both external north and external south, while the Central City is split into CBD and City Fringe.
- Total vehicle trips are recorded as the sum of the following purposes:
  1. Home based work
  2. Home based education
  3. Home based shopping
  4. Home based other
  5. HCV
  6. Non-Home based employer's business
  7. Non-Home based other
  8. No purpose recorded (external origin or destination / airport trips / travel for the purpose of catching PT)
- Total number of trips in the two hour AM peak was estimated at 558,093.

Source: Auckland Forecasting Centre (2018)

1.8 Origin/Destination Patterns (2016)



Total vehicle trips (AM peak)	
Total trips in Auckland region (excludes PT travel)	558,093

Sectors MSM

Sector_ID, SectorName

1. Hibiscus Coast
2. North Shore North
3. North Shore South
4. Waitakere North
5. Waitakere South
6. Isthmus West
7. Isthmus Central
8. Isthmus East
9. Central City
10. Howick / Pakuranga / Botany
11. East Tamaki / Flat Bush
12. Manukau West
13. Papakura
14. Rodney West
15. Rodney North
16. Franklin North
17. Tuakau Pokeno
18. Gulf Islands
19. City Fringe

1. Hibiscus Coast	
Number of trips to sector	15,550
Sector trips as percent of total trips	2.79%
Local trips as percent of trips to sector	73.4%

2. North Shore North	
Number of trips to sector	40,298
Sector trips as percent of total trips	7.22%
Local trips as percent of trips to sector	54.5%

3. North Shore South	
Number of trips to sector	45,893
Sector trips as percent of total trips	8.22%
Local trips as percent of trips to sector	65.9%

9. Central City	
Number of trips to sector	27,715
Sector trips as percent of total trips	4.97%
Local trips as percent of trips to sector	10.3%

19. City Fringe	
Number of trips to sector	29,118
Sector trips as percent of total trips	5.22%
Local trips as percent of trips to sector	18.4%

8. Isthmus East	
Number of trips to sector	58,928
Sector trips as percent of total trips	10.6%
Local trips as percent of trips to sector	51.8%

10. Howick / Pakuranga / Botany	
Number of trips to sector	30,232
Sector trips as percent of total trips	5.43%
Local trips as percent of trips to sector	64.4%

11. East Tamaki / Flat Bush	
Number of trips to sector	35,004
Sector trips as percent of total trips	6.27%
Local trips as percent of trips to sector	31.3%

15. Rodney North	
Number of trips to sector	8,007
Sector trips as percent of total trips	1.43%
Local trips as percent of trips to sector	87.6%

14. Rodney West	
Number of trips to sector	7,871
Sector trips as percent of total trips	1.41%
Local trips as percent of trips to sector	51.4%

4. Waitakere North	
Number of trips to sector	35,268
Sector trips as percent of total trips	6.32%
Local trips as percent of trips to sector	59.4%

5. Waitakere South	
Number of trips to sector	18,778
Sector trips as percent of total trips	3.36%
Local trips as percent of trips to sector	52.9%

6. Isthmus West	
Number of trips to sector	43,900
Sector trips as percent of total trips	7.87%
Local trips as percent of trips to sector	46.8%

7. Isthmus Central	
Number of trips to sector	52,094
Sector trips as percent of total trips	9.33%
Local trips as percent of trips to sector	38.2%

12. Manukau West	
Number of trips to sector	68,967
Sector trips as percent of total trips	12.4%
Local trips as percent of trips to sector	51.1%

13. Papakura	
Number of trips to sector	17,022
Sector trips as percent of total trips	3.05%
Local trips as percent of trips to sector	56.0%

16. Franklin North	
Number of trips to sector	17,585
Sector trips as percent of total trips	3.15%
Local trips as percent of trips to sector	72.1%

17. Tuakau Pokeno	
Number of trips to sector	2,200
Sector trips as percent of total trips	0.39%
Local trips as percent of trips to sector	38.4%

Definitions of measures	
Number of trips to sector	*Includes origins occurring within the same sector*
Sector trips as percent of total trips	*Number of trips to sector as a percentage of total trips*
Local trips as percent of trips to sector	*Number of trips that both originate and terminate within the same sector, as a percentage of number of trips to sector*

Auckland Forecasting Centre

1.9 Origin/Destination Patterns (2016)

Total vehicles in the AM peak (2 hour period)

Origins \ Destinations	External North	Rodney North	Rodney West	Hibiscus Coast	North Shore North	North Shore South	Waitakere North	Waitakere South	Isthmus West	Isthmus Central	Central City	City Centre Fringe	Isthmus East	Howick / Pakuranga / Botany	East Tamaki / Flat Bush	Manukau West	Papakura	Franklin North	Tuakau Pokeno	External South	Total from
External North	0	3	11	40	61	71	7	3	16	28	88	25	40	5	14	99	19	21	1	24	576
Rodney North	0	7015	101	381	179	121	48	8	14	23	64	19	16	5	9	42	5	5	2	24	8081
Rodney West	4	120	4049	861	908	518	1380	120	245	318	501	471	230	31	66	75	11	5	1	21	9935
Hibiscus Coast	83	319	544	11418	2738	1562	415	91	165	209	552	309	161	21	67	170	22	17	3	51	18916
North Shore North	21	148	410	1343	21968	6099	1204	285	280	312	1037	466	268	50	118	249	33	25	4	90	34411
North Shore South	50	86	142	543	8506	30228	947	467	1602	1259	2531	1720	812	120	286	809	93	62	8	186	50457
Waitakere North	7	32	1327	220	2763	1220	20953	3295	1969	1478	1802	1912	1021	136	340	842	52	31	4	95	39499
Waitakere South	3	12	308	65	419	295	4568	9940	3826	1081	1957	571	625	102	161	1029	63	36	6	91	25158
Isthmus West	38	11	251	47	477	694	2142	2837	20556	7246	3679	5100	2845	240	638	2109	147	76	16	140	49287
Isthmus Central	13	38	201	108	411	852	894	558	6365	19919	2115	3909	6412	450	1111	3494	209	122	21	139	47341
Central City	39	15	79	32	111	293	598	222	1414	1293	2863	2509	1291	114	446	968	148	83	13	139	12669
City Centre Fringe	22	6	68	22	128	327	482	179	2724	2862	1774	5360	1930	145	334	467	91	69	10	91	17093
Isthmus East	34	52	159	165	638	1446	653	209	2157	8843	5074	4012	30543	1679	2658	3825	331	171	24	227	62900
Howick / Pakuranga / Botany	51	9	40	23	88	158	153	73	732	1962	1489	773	5579	19518	7360	2708	526	242	33	158	41677
East Tamaki / Flat Bush	6	44	22	122	389	809	106	78	426	1093	499	774	1839	4768	10942	9378	1398	331	45	141	33208
Manukau West	165	64	122	140	410	1014	584	349	1189	3691	1426	930	4307	1993	6778	35211	2571	799	114	583	62440
Papakura	18	3	7	6	22	49	45	29	108	216	63	55	521	627	2467	4754	9532	1121	140	268	20053
Franklin North	31	7	7	5	16	34	24	24	57	121	40	32	242	240	892	1959	1373	12686	899	457	19146
Tuakau Pokeno	0	2	1	1	2	5	4	3	11	26	7	5	36	38	131	291	191	1232	845	42	2873
External South	18	20	23	8	63	99	61	7	44	112	154	167	212	43	188	487	204	453	10	0	2372
Total to	604	8007	7871	15550	40298	45893	35268	18778	43900	52094	27715	29118	58928	30323	35004	68967	17022	17585	2200	2968	558093

1.10 Origin/Destination Patterns (2016)

- Within the Auckland region, 49.01% of all trips had an origin and destination within the same sector (50.99% of trips crossed a sector border).
- CBD core accounts for 27,715 of trip destinations (4.97%). This increases to 56,833 by combining both CBD and City Fringe (10.18%). The Isthmus area accounts for 38.0% of total AM Peak vehicle trips across Greater Auckland.
- The North Shore accounts for 15.5%, the Waitakere area 9.7%, while the Manukau West sector accounts for 12.4% of total AM Peak vehicle trips, the single largest destination.
- The sectors with the highest total traffic flows (ODs) were Manukau West (96,196), Isthmus East (91,285), Isthmus Central (79,516) and Isthmus West (72,632).

	Total trips originating within area	Staying within area	Leaving area
North / West	187,033	151,054 (80.76%)	35,979 (19.24%)
Central	189,291	152,796 (80.72%)	36,496 (19.28%)
South	181,769	147,167 (80.96%)	34,601 (19.04%)

Source: Auckland Forecasting Centre (2018)

1.11 Origin/Destination Patterns (2016)

Vehicle trips as a percentage of total trips in Auckland (AM Peak)

Origins \ Destinations	External North	Rodney North	Rodney West	Hibiscus Coast	North Shore North	North Shore South	Waitakere North	Waitakere South	Isthmus West	Isthmus Central	Central City	City Centre Fringe	Isthmus East	Howick / Pakuranga / Botany	East Tamaki / Flat Bush	Manukau West	Papakura	Franklin North	Tuakau Pokeno	External South	Total from
External North	0.00%	0.00%	0.00%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.01%	0.02%	0.00%	0.01%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.10%
Rodney North	0.00%	1.26%	0.02%	0.07%	0.03%	0.02%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	1.45%
Rodney West	0.00%	0.02%	0.73%	0.15%	0.16%	0.09%	0.25%	0.02%	0.04%	0.06%	0.09%	0.08%	0.04%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	1.78%
Hibiscus Coast	0.01%	0.06%	0.10%	2.05%	0.49%	0.28%	0.07%	0.02%	0.03%	0.04%	0.10%	0.06%	0.03%	0.00%	0.01%	0.03%	0.00%	0.00%	0.00%	0.01%	3.39%
North Shore North	0.00%	0.03%	0.07%	0.24%	3.94%	1.09%	0.22%	0.05%	0.05%	0.06%	0.19%	0.08%	0.05%	0.01%	0.02%	0.04%	0.01%	0.00%	0.00%	0.02%	6.17%
North Shore South	0.01%	0.02%	0.03%	0.10%	1.52%	5.42%	0.17%	0.08%	0.29%	0.23%	0.45%	0.31%	0.15%	0.02%	0.05%	0.14%	0.02%	0.01%	0.00%	0.03%	9.04%
Waitakere North	0.00%	0.01%	0.24%	0.04%	0.50%	0.22%	3.75%	0.59%	0.35%	0.26%	0.32%	0.34%	0.18%	0.02%	0.06%	0.15%	0.01%	0.01%	0.00%	0.02%	7.08%
Waitakere South	0.00%	0.00%	0.06%	0.01%	0.08%	0.05%	0.82%	1.78%	0.69%	0.19%	0.35%	0.10%	0.11%	0.02%	0.03%	0.18%	0.01%	0.01%	0.00%	0.02%	4.51%
Isthmus West	0.01%	0.00%	0.04%	0.01%	0.09%	0.12%	0.38%	0.51%	3.68%	1.30%	0.66%	0.91%	0.51%	0.04%	0.11%	0.38%	0.03%	0.01%	0.00%	0.03%	8.83%
Isthmus Central	0.00%	0.01%	0.04%	0.02%	0.07%	0.15%	0.16%	0.10%	1.14%	3.57%	0.38%	0.70%	1.15%	0.08%	0.20%	0.63%	0.04%	0.02%	0.00%	0.02%	8.48%
Central City	0.01%	0.00%	0.01%	0.01%	0.02%	0.05%	0.11%	0.04%	0.25%	0.23%	0.51%	0.45%	0.23%	0.02%	0.08%	0.17%	0.03%	0.01%	0.00%	0.02%	2.27%
City Centre Fringe	0.00%	0.00%	0.01%	0.00%	0.02%	0.06%	0.09%	0.03%	0.49%	0.51%	0.32%	0.96%	0.35%	0.03%	0.06%	0.08%	0.02%	0.01%	0.00%	0.02%	3.06%
Isthmus East	0.01%	0.01%	0.03%	0.03%	0.11%	0.26%	0.12%	0.04%	0.39%	1.58%	0.91%	0.72%	5.47%	0.30%	0.48%	0.69%	0.06%	0.03%	0.00%	0.04%	11.27%
Howick / Pakuranga / Botany	0.01%	0.00%	0.01%	0.00%	0.02%	0.03%	0.03%	0.01%	0.13%	0.35%	0.27%	0.14%	1.00%	3.50%	1.32%	0.49%	0.09%	0.04%	0.01%	0.03%	7.47%
East Tamaki / Flat Bush	0.00%	0.01%	0.00%	0.02%	0.07%	0.14%	0.02%	0.01%	0.08%	0.20%	0.09%	0.14%	0.33%	0.85%	1.96%	1.68%	0.25%	0.06%	0.01%	0.03%	5.95%
Manukau West	0.03%	0.01%	0.02%	0.03%	0.07%	0.18%	0.10%	0.06%	0.21%	0.66%	0.26%	0.17%	0.77%	0.36%	1.21%	6.31%	0.46%	0.14%	0.02%	0.10%	11.19%
Papakura	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.01%	0.02%	0.04%	0.01%	0.01%	0.09%	0.11%	0.44%	0.85%	1.71%	0.20%	0.03%	0.05%	3.59%
Franklin North	0.01%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.01%	0.02%	0.01%	0.01%	0.04%	0.04%	0.16%	0.35%	0.25%	2.27%	0.16%	0.08%	3.43%
Tuakau Pokeno	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.02%	0.05%	0.03%	0.22%	0.15%	0.01%	0.51%
External South	0.00%	0.00%	0.00%	0.00%	0.01%	0.02%	0.01%	0.00%	0.01%	0.02%	0.03%	0.03%	0.04%	0.01%	0.03%	0.09%	0.04%	0.08%	0.00%	0.00%	0.43%
Total to	0.11%	1.43%	1.41%	2.79%	7.22%	8.22%	6.32%	3.36%	7.87%	9.33%	4.97%	5.22%	10.56%	5.43%	6.27%	12.36%	3.05%	3.15%	0.39%	0.53%	100%

1.12 Origin/Destination Patterns (2016)

Vehicle trips as a percentage of all trips to each destination, per origin (AM Peak)

Origins \ Destinations	External North	Rodney North	Rodney West	Hibiscus Coast	North Shore North	North Shore South	Waitakere North	Waitakere South	Isthmus West	Isthmus Central	Central City	City Centre Fringe	Isthmus East	Howick / Pakuranga / Botany	East Tamaki / Flat Bush	Manukau West	Papakura	Franklin North	Tuakau Pokeno	External South
External North	0.00%	0.04%	0.13%	0.25%	0.15%	0.16%	0.02%	0.02%	0.04%	0.05%	0.32%	0.09%	0.07%	0.02%	0.04%	0.14%	0.11%	0.12%	0.06%	0.82%
Rodney North	0.00%	87.61%	1.28%	2.45%	0.44%	0.26%	0.14%	0.04%	0.03%	0.04%	0.23%	0.06%	0.03%	0.02%	0.02%	0.06%	0.03%	0.03%	0.10%	0.82%
Rodney West	0.73%	1.50%	51.44%	5.54%	2.25%	1.13%	3.91%	0.64%	0.56%	0.61%	1.81%	1.62%	0.39%	0.10%	0.19%	0.11%	0.06%	0.03%	0.04%	0.70%
Hibiscus Coast	13.76%	3.98%	6.91%	73.43%	6.79%	3.40%	1.18%	0.48%	0.38%	0.40%	1.99%	1.06%	0.27%	0.07%	0.19%	0.25%	0.13%	0.10%	0.14%	1.72%
North Shore North	3.44%	1.85%	5.21%	8.64%	54.51%	13.29%	3.41%	1.52%	0.64%	0.60%	3.74%	1.60%	0.46%	0.16%	0.34%	0.36%	0.20%	0.14%	0.18%	3.05%
North Shore South	8.24%	1.07%	1.80%	3.49%	21.11%	65.87%	2.69%	2.49%	3.65%	2.42%	9.13%	5.91%	1.38%	0.40%	0.82%	1.17%	0.55%	0.35%	0.36%	6.26%
Waitakere North	1.23%	0.40%	16.86%	1.41%	6.86%	2.66%	59.41%	17.55%	4.48%	2.84%	6.50%	6.57%	1.73%	0.45%	0.97%	1.22%	0.31%	0.17%	0.19%	3.20%
Waitakere South	0.48%	0.16%	3.91%	0.42%	1.04%	0.64%	12.95%	52.94%	8.72%	2.08%	7.06%	1.96%	1.06%	0.34%	0.46%	1.49%	0.37%	0.21%	0.25%	3.07%
Isthmus West	6.23%	0.13%	3.19%	0.30%	1.18%	1.51%	6.07%	15.11%	46.82%	13.91%	13.27%	17.52%	4.83%	0.79%	1.82%	3.06%	0.86%	0.43%	0.73%	4.73%
Isthmus Central	2.19%	0.47%	2.55%	0.69%	1.02%	1.86%	2.53%	2.97%	14.50%	38.24%	7.63%	13.43%	10.88%	1.48%	3.17%	5.07%	1.23%	0.69%	0.93%	4.69%
Central City	6.47%	0.19%	1.01%	0.20%	0.28%	0.64%	1.70%	1.18%	3.22%	2.48%	10.33%	8.62%	2.19%	0.38%	1.27%	1.40%	0.87%	0.47%	0.59%	4.67%
City Centre Fringe	3.67%	0.07%	0.87%	0.14%	0.32%	0.71%	1.37%	0.95%	6.21%	5.49%	6.40%	18.41%	3.28%	0.48%	0.95%	0.68%	0.54%	0.39%	0.44%	3.07%
Isthmus East	5.68%	0.65%	2.02%	1.06%	1.58%	3.15%	1.85%	1.12%	4.91%	16.98%	18.31%	13.78%	51.83%	5.54%	7.59%	5.55%	1.94%	0.97%	1.07%	7.64%
Howick / Pakuranga / Botany	8.53%	0.11%	0.51%	0.15%	0.22%	0.34%	0.43%	0.39%	1.67%	3.77%	5.37%	2.65%	9.47%	64.37%	21.03%	3.93%	3.09%	1.37%	1.52%	5.33%
East Tamaki / Flat Bush	0.96%	0.55%	0.28%	0.78%	0.97%	1.76%	0.30%	0.41%	0.97%	2.10%	1.80%	2.66%	3.12%	15.72%	31.26%	13.60%	8.21%	1.88%	2.03%	4.76%
Manukau West	27.28%	0.80%	1.55%	0.90%	1.02%	2.21%	1.66%	1.86%	2.71%	7.09%	5.14%	3.19%	7.31%	6.57%	19.36%	51.05%	15.11%	4.54%	5.20%	19.63%
Papakura	3.02%	0.04%	0.09%	0.04%	0.05%	0.11%	0.13%	0.15%	0.24%	0.41%	0.23%	0.19%	0.88%	2.07%	7.05%	6.89%	56.00%	6.37%	6.38%	9.04%
Franklin North	5.09%	0.09%	0.09%	0.03%	0.04%	0.07%	0.07%	0.13%	0.13%	0.23%	0.14%	0.11%	0.41%	0.79%	2.55%	2.84%	8.07%	72.14%	40.89%	15.39%
Tuakau Pokeno	0.00%	0.02%	0.01%	0.01%	0.01%	0.01%	0.01%	0.02%	0.02%	0.05%	0.02%	0.02%	0.06%	0.12%	0.37%	0.42%	1.12%	7.00%	38.44%	1.42%
External South	3.01%	0.25%	0.29%	0.05%	0.16%	0.21%	0.17%	0.04%	0.10%	0.22%	0.56%	0.57%	0.36%	0.14%	0.54%	0.71%	1.20%	2.58%	0.44%	0.00%
Total to	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

1.13 Origin/Destination Patterns (2016)

- The Sector O/D matrices demonstrates Auckland travel patterns are very dispersed, with most sectors dominated by local trips.
- 55.9% of all AM Peak trips to the CBD, were originated in the Auckland isthmus, with North Shore trip origins accounting for 13.3% of trips to the Central City.
- 51.1% of all AM Peak trips to Manukau West originate locally, with the total rising to 71.6% once East Tamaki and Papakura are included. Manukau West includes trips to the airport, and the airport as an employment centre/commercial hub.
- 65.9% of AM Peak trips to the North Shore South originate locally, with the total rising to 79.2% once North Shore North is included.
- 59.4% of AM Peak trips to Waitakere North originate locally, with the total rising to 78.4% once Waitakere South and Isthmus West are included.
- Long range commuters from outside the Auckland region accounted for 0.53% of total AM Peak trip across the Auckland region.

Source: Auckland Forecasting Centre (2018)

1.14 Travel to Work Patterns (2013)

Table 4.2
Destinations and Origins for Auckland Commuting Trips 2013

Sector	Total by Destination		Total by Origin		Ratio of Resident Workers to Jobs
	No	Per cent	No	Per cent	
CBD	68,139	13.7%	12,351	2.5%	18%
Other Central	43,281	8.7%	21,777	4.4%	50%
Inner Urban	168,537	34.0%	188,337	38.0%	112%
Outer Urban	177,075	35.7%	210,078	42.3%	119%
Rural	39,078	7.9%	63,567	12.8%	163%
Total	**496,110**	**100.0%**	**496,110**	**100%**	**100%**

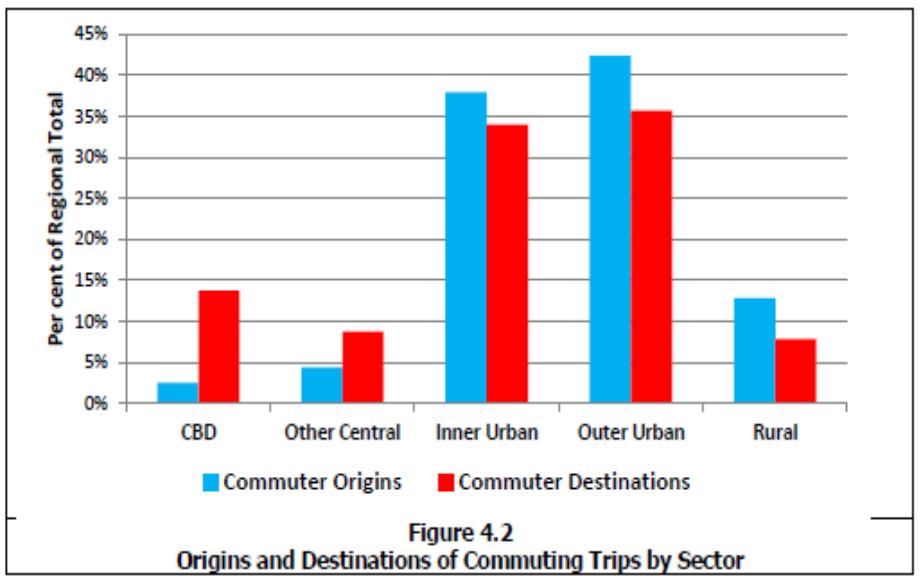


Figure 4.2
Origins and Destinations of Commuting Trips by Sector

- CBD accounts for 14% of trip destinations, and Other Central 9%
- Inner Urban sector for 34%, Outer Urban sector for 36% and Rural for 8%.
- Central areas have low proportion of jobs to resident workers resulting in high inflows from the other areas.
- Central sectors have substantially more jobs than workers but for the other sectors the position is reversed with these having more workers than jobs.
- Auckland employment patterns are generally broadly dispersed, and are not dominated by inflows towards CBD.

Source: Richard Paling Consulting (2014)

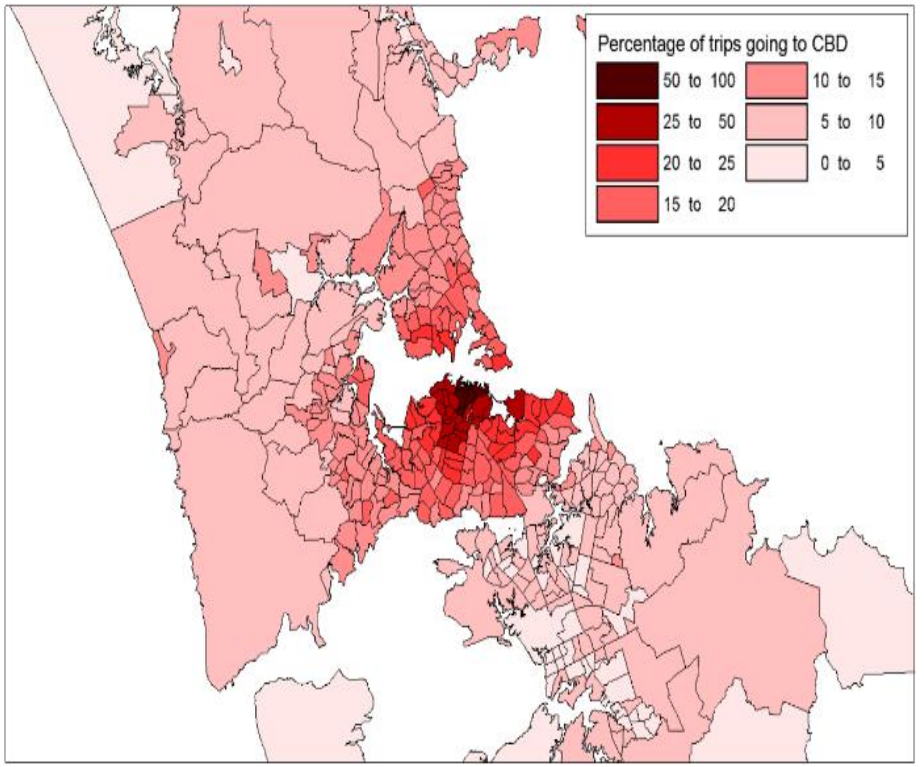
1.15 Travel to Work Patterns (2013)

Table 4.12 Modes Used by Workplace Sector 2013						
	CBD	Other Central	Inner Urban	Outer Urban	Rural	Total
Summary by Destination : Trip Numbers						
Private vehicle	37,149	30,861	131,691	146,358	26,190	372,249
Bus	14,166	3,711	7,140	3,993	594	29,604
Train	4,041	1,101	1,746	1,320	180	8,388
Walked/jogged	6,948	2,931	6,483	4,929	1,494	22,785
Bicycle	1,185	843	1,806	1,440	258	5,532
Other	3,447	1,443	4,827	5,253	1,275	16,245
Worked at home	1,203	2,391	14,844	13,782	9,087	41,307
Total	**68,139**	**43,281**	**168,537**	**177,075**	**39,078**	**496,110**
Summary by Destination : Per cent of total						
Private vehicle	55%	71%	78%	83%	67%	75%
Bus	21%	9%	4%	2%	2%	6%
Train	6%	3%	1%	1%	0%	2%
Walked/jogged	10%	7%	4%	3%	4%	5%
Bicycle	2%	2%	1%	1%	1%	1%
Other	5%	3%	3%	3%	3%	3%
Worked at home	2%	6%	9%	8%	23%	8%
Total	100%	100%	100%	100%	100%	100%

- Mode share of private vehicle by destination for all commuting trips is 75% but higher once working from home excluded.
- Private vehicle use increases with distance away from the central area with the mode share for private vehicles reaching 83% for Outer Urban.
- The mode share for PT for trips to CBD amounts to 27% but falls with increasing distance from central area.
- Active mode share decreases with distance away from the central area.
- Census now dated but reveals strong reliance on private vehicles for commuting outside of central area.

Source: Richard Paling Consulting (2014)

1.16 Travel to Work Patterns (2013)



* CAUs consist of 3000-4000 persons.

- A number of themes emerge from analysis of regional centres:
  - They generally attract workers from surrounding local areas.
  - For most areas the main commuting movements lie along axes connecting the sources of workers with the CBD.
  - The extent of reverse commuting is relatively small.
  - For smaller centres there is only limited commuting across the Waitemata Harbour.
- Historically suggests workers are attracted to regional employment centres to take advantage of lower priced housing and seek to avoid longer commutes to the CBD.

Source: Richard Paling Consulting (2014)

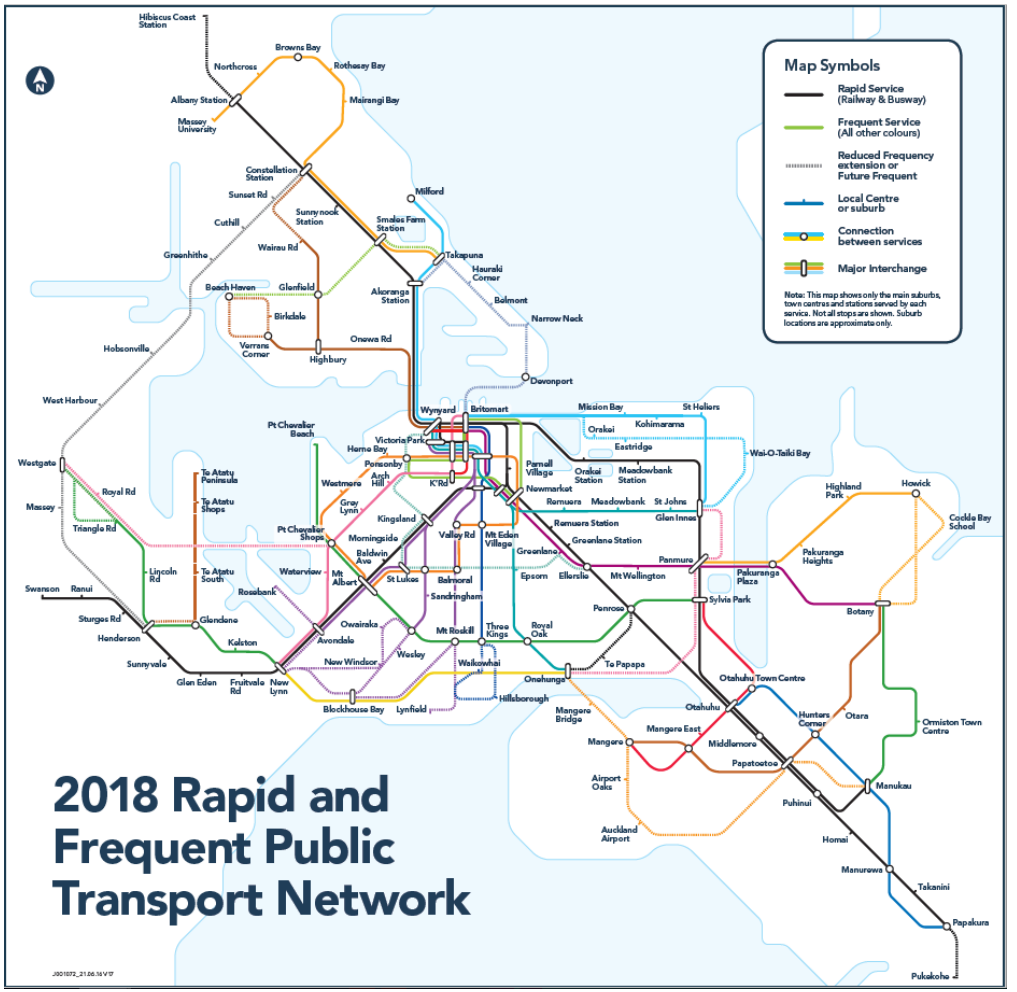
1.17 Travel to Work Patterns

Table 7.10
Summary of Characteristics of Trips to Selected Employment areas

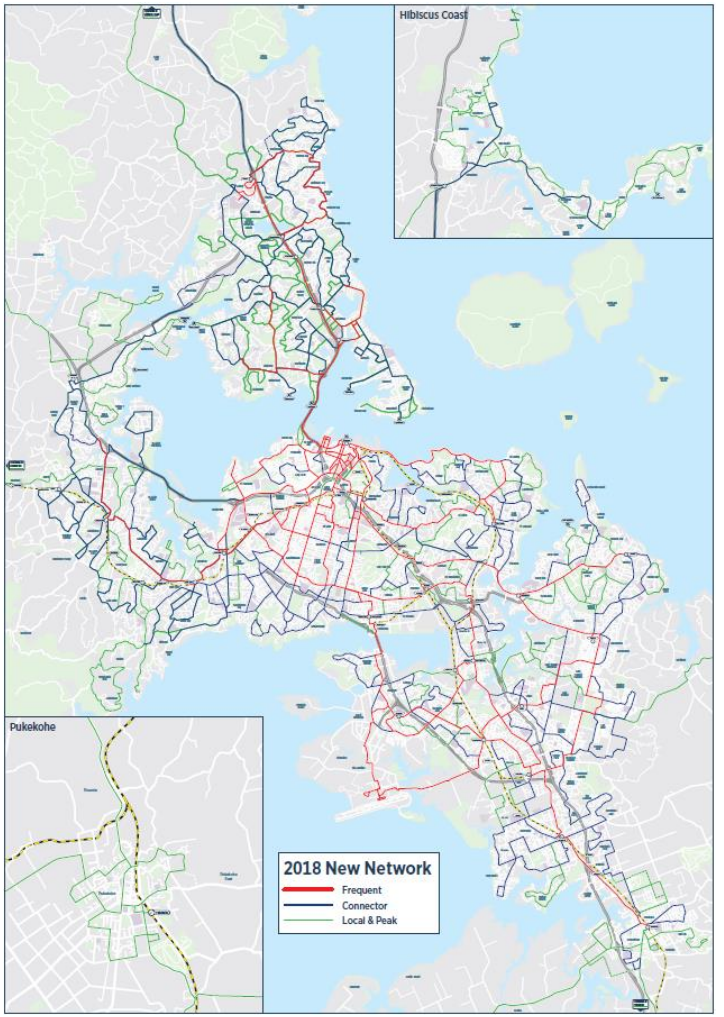
	North Harbour	Takapuna/ Westlake	Hender -son	New- market	Onehunga/ Penrose	Ellerslie South	Highbrook/ East Tamaki	Manukau Central	Airport & Environs	Region average
Total commuting destinations	17,679	15,249	7,092	9,315	19,761	7,320	16,716	10,221	13,239	
Modal Splits										
Private vehicle	92.0%	81.3%	83.7%	70.1%	86.7%	84.8%	93.8%	91.1%	92.6%	75.0%
Bus	2.3%	7.8%	3.1%	11.1%	3.4%	4.0%	1.0%	2.1%	1.7%	6.0%
Train	0.1%	0.3%	2.8%	6.0%	1.2%	3.8%	0.1%	0.9%	0.3%	1.7%
Walked or jogged	1.4%	4.5%	3.2%	6.3%	2.2%	3.0%	0.8%	1.3%	0.7%	4.6%
Bicycle	0.6%	1.4%	1.5%	2.0%	1.0%	0.8%	1.0%	0.6%	0.6%	1.1%
Other	1.9%	2.0%	3.1%	3.0%	2.6%	2.6%	2.4%	3.3%	3.1%	3.3%
Work at home	1.6%	2.6%	2.6%	1.4%	3.0%	1.1%	1.0%	0.7%	1.1%	8.3%
Average travel distance (kms)	**15.7**	**12.9**	**12.8**	**12.1**	**13.9**	**13.5**	**14.1**	**15.4**	**18.1**	**11.8**

- The share of private vehicle trips for regional employment centres is typically high reflecting the lack of PT services and availability of parking.
- PT use is high in Newmarket and Takapuna/Westlake which are served by major bus corridors.
- Rail use is higher than the regional average in Newmarket, Henderson and Ellerslie South which lie along the rail corridors.
- Travel distances are generally higher than the regional average for the employment centres.

PT Network (2018)



PT Network (2018)

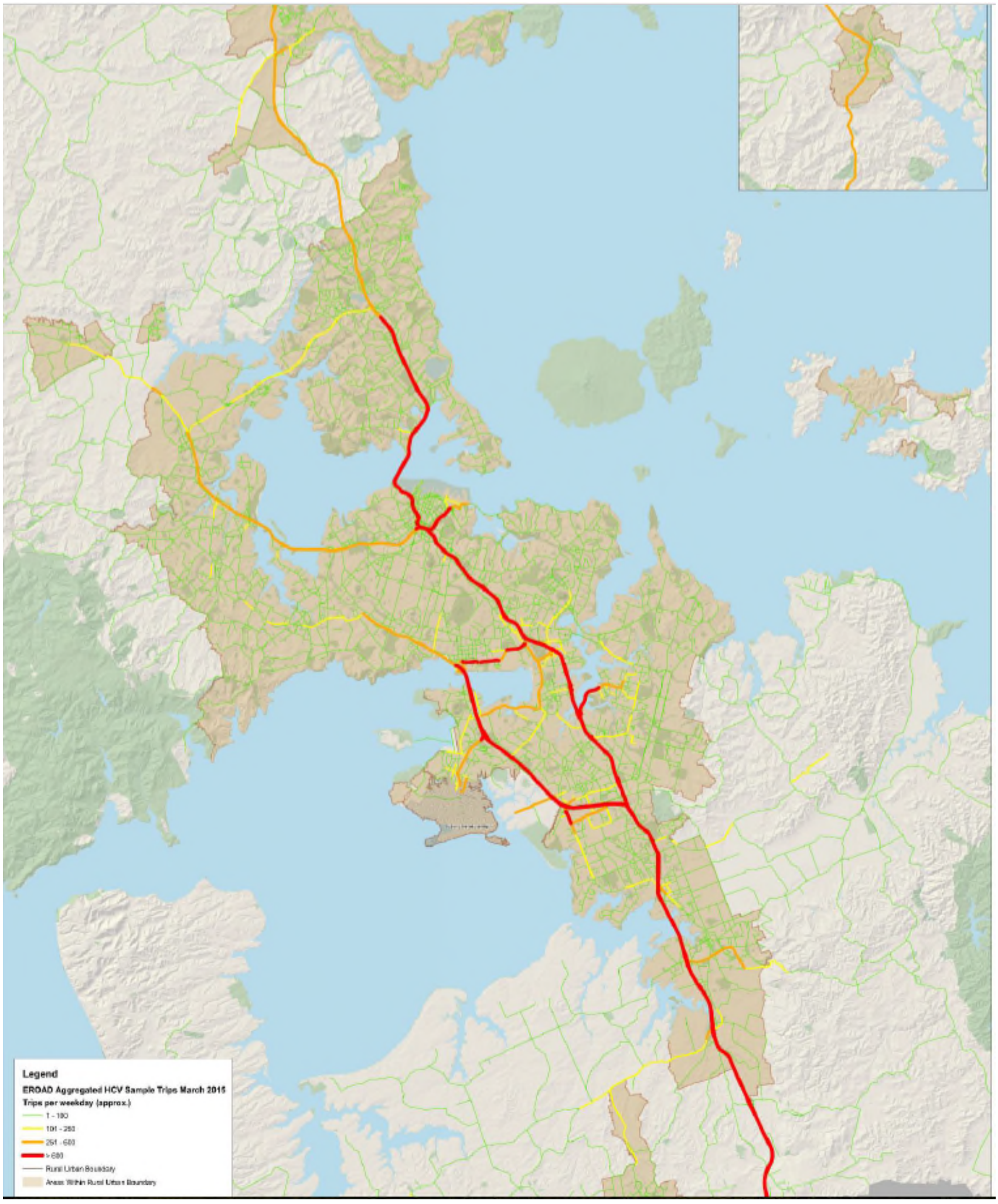


Strategic Freight Network

*Higher resolution hopefully to follow

Strategic Freight Network

*BECA Demand study March 2015



Part Two: Congestion pricing, and preliminary social, environmental and safety considerations

2.1 Congestion Pricing – Theory

- Road congestion is when traffic speeds decline and queues appear, the result of additional people attempting to drive on road links or through bottlenecks, such as intersections.
- The decision to travel made by an additional car is based on their own travel costs (private or internal costs). They ignore any increase in travel costs for all other car users (the external costs).
- This is inefficient when private costs are below the full social cost of the decision to travel and consequently too much of a good (in this case, travel) will be consumed.
- A congestion charge is intended to confront users with costs imposed on other users to align private with social costs.
- By adding a congestion charge to the total price of the trip (monetary and non-monetary costs) will suppress some demand, reduce congestion and improve welfare.
- More formally, road pricing seeks to correct for congestion externalities. In doing so, two potential sources of efficiency gains are identified:
  - Deadweight losses – static classical models of congestion show that road pricing can reduce the deadweight losses that arise from excess demand and the congestion externalities that result
  - Monetisation of delays – dynamic 'bottleneck' models of congestion show that road pricing monetizes delays and incentivises drivers to adjust departure times.

Source: Treasury (2018); Borjesson (2017); MRCagney (2017); Eliasson (2014)

2.2 Congestion Pricing – User Responses

- International schemes demonstrate that congestion pricing can be highly effective at managing road capacity and generate measurable improvements in network efficiency from lower traffic volumes, higher average travel speeds, improved trip reliability and higher PT mode share.
- The effectiveness of any proposed congestion pricing scheme design depends on the aggregation of user responses, which can be categorised as follows:
  - Do nothing – The user continues with their previous route and pay the higher price
  - Shift routes – The user finds an alternative route with no charge or a lower charge
  - Shift modes – The user takes an alternative form of transport
  - Shift travel time – The user shifts their travel to a different time of day when the charge may be lower
  - Choose a different destination – The user opts to travel to a different location to avoid or minimise the charge
  - Choose a different origin – The user opts to move their home/business location to avoid or minimise the charge
  - Avoid trips – The user decreases the number of trips they make to avoid the charge, for example by online shopping
- The demand for transport is relatively inelastic with individuals responses constrained by location, the availability of alternatives, employment opportunities and work arrangements.
- Where pricing delivers significant time savings and improved trip reliability, commuters and businesses can perceive they are better off even after paying any road charges.
- Alternatively road users with a low value of time are likely to switch to PT or defer/cancel trips.

Source: Treasury (2018); Borjesson (2017); MRCagney (2017); Eliasson (2014)

2.3 Scheme Impacts: Stockholm and Gothenburg

- In Stockholm the reduction in traffic volumes from congestion charging was around 20% generated from:
  - 9 percentage points of work trips switching to transit
  - 1 percentage points of work trips that changed departure times
  - 5 percentage points of discretionary trips that disappeared
  - 5 percentage points of commercial trips that disappeared.
- In Gothenburg the reduction in traffic volumes was around 12%, noting the smaller market share for PT services (25% peak hour trips) in comparison with 75% in Stockholm.
- For both cities the adaptation mechanisms observed were broadly similar noting around 50% of drivers are commuters with the balance comprised of commercial, education, shopping, and other discretionary trips.
- A study of observed long-run pricing elasticities (effect on traffic volumes over time) found:
  - Congestion charging remained effective in Stockholm, but price elasticities decreased slightly in Gothenburg, which is smaller and less dense, with most workplaces located outside the city centre.
  - Gothenburg commuters have fewer ways to adapt to charges in the long-term compared to Stockholm.
  - Commercial vehicles are relatively price insensitive to the charges, with the number of company cars and trucks actually increasing when the charges were increased in Stockholm.
  - For both cities the behavioural effect of scheme extensions and increases in charges is diminishing - the likely reason being that the most price-sensitive traffic was already priced off the road when the scheme was started.

Source: Borjesson (2017)

2.4 Scheme Impacts: London, Singapore and U.S.

- In London, with a 68% PT/Active mode share, the congestion charging scheme resulted in a 10% reduction in traffic volumes from baseline conditions, and an overall reduction of 11% in vehicle kms in London between 2000 and 2012.
- In London traffic speeds have slowed due to interventions to reduce network capacity to improve the urban environment, prioritise PT and Active modes, and an increase in supporting road works.
- In Singapore, with a 67% PT/Active mode share, traffic in the restricted zone declined by around 13% during ERP operational hours, and average road speeds increased by about 20%.
- In Singapore average road speeds for expressways and major roads have remained steady despite rising traffic volumes, noting that ERP rates are adjusted regularly to reflect traffic conditions with the goal of maintaining average vehicle speeds by route.
- In U.S, HOT lane schemes have generated improved travel speeds for HOT lane users, and in some cases increased overall vehicle throughput for highway corridors.

Source: D'Artagnan Consulting (2017); Borjesson (2017); OECD (2010); GAO (2014)

2.5 Fairness

- Fairness and equity consider the relative distribution of benefits and costs between individuals and social groups, whereas efficiency describes the total society returns from an intervention.
- To assist policy-makers to understand how congestion pricing can impact different household, business and geographic groups, it is important to account for both monetary and non-monetary costs and benefits.
- Fairness in the context of congestion pricing has a number of dimensions:
  - Vertical Equity - How benefits and costs are distributed across income groups.
  - Horizontal Equity - How benefits and costs are distributed across similar groups of users, households, and communities.
  - Spatial Equity - How benefits and costs for households and businesses are distributed across geographical areas.
- Ideally a scheme design should aim to:
  - Target charges on motorists who generate social costs from congestion
  - Avoid charging motorists who travel in uncongested conditions
  - Provide benefits for motorists who are charged in the form of time savings and improved reliability
  - Provide alternatives or mitigation for motorists who are priced off the road
  - Treat similar groups of motorists and other affected parties in a consistent manner
  - Avoid generating adverse impacts, such as traffic diversion and severance, on road users, communities and vulnerable groups.
- A major goal of the STP is to design a scheme that is effective in terms of network performance and acceptable in terms of the individual's perception of transport costs resulting from the new charging regime.

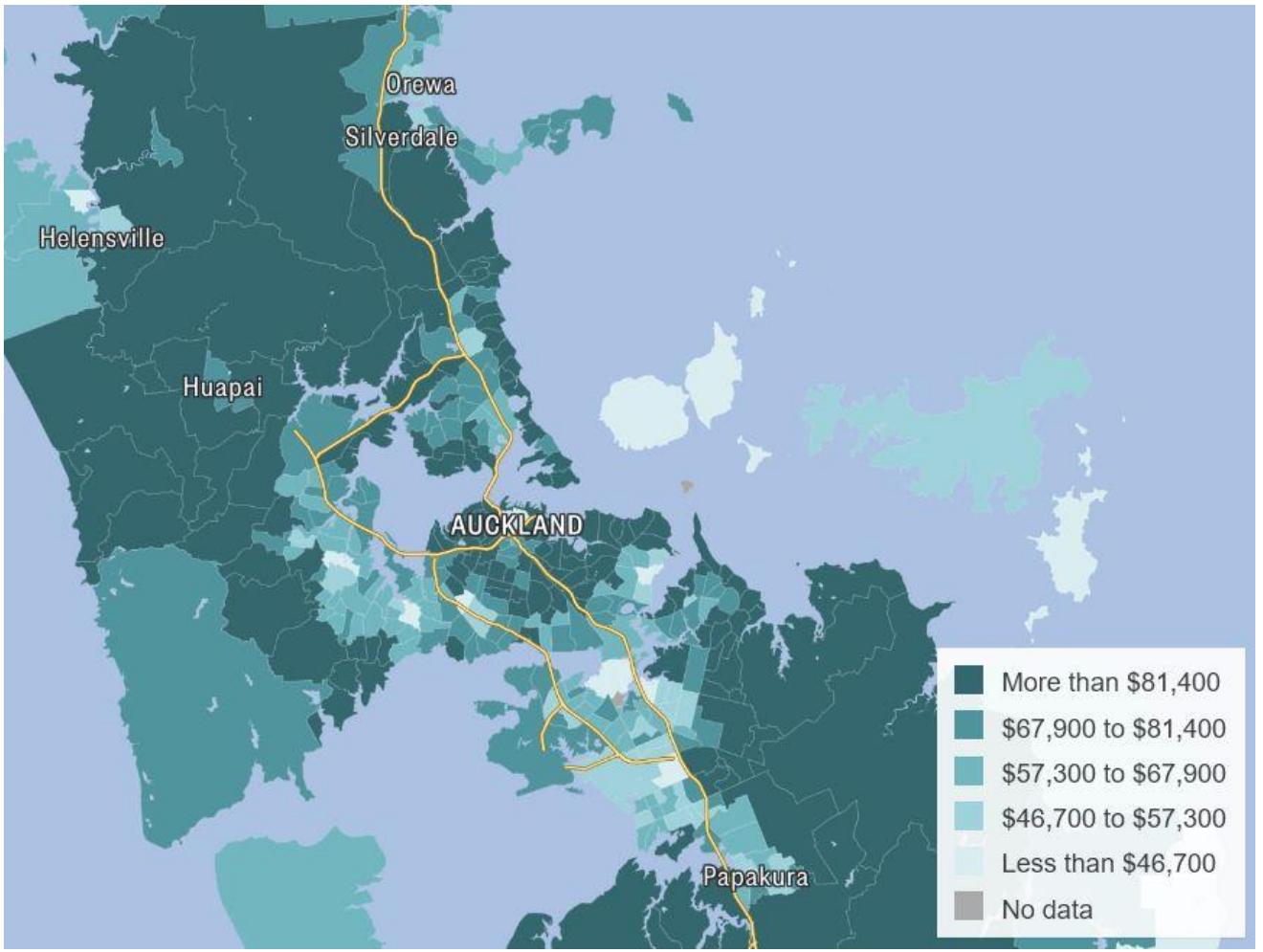
Source: D'Artagnan Consulting (2017); MRCagney (2017)

2.6 Equity

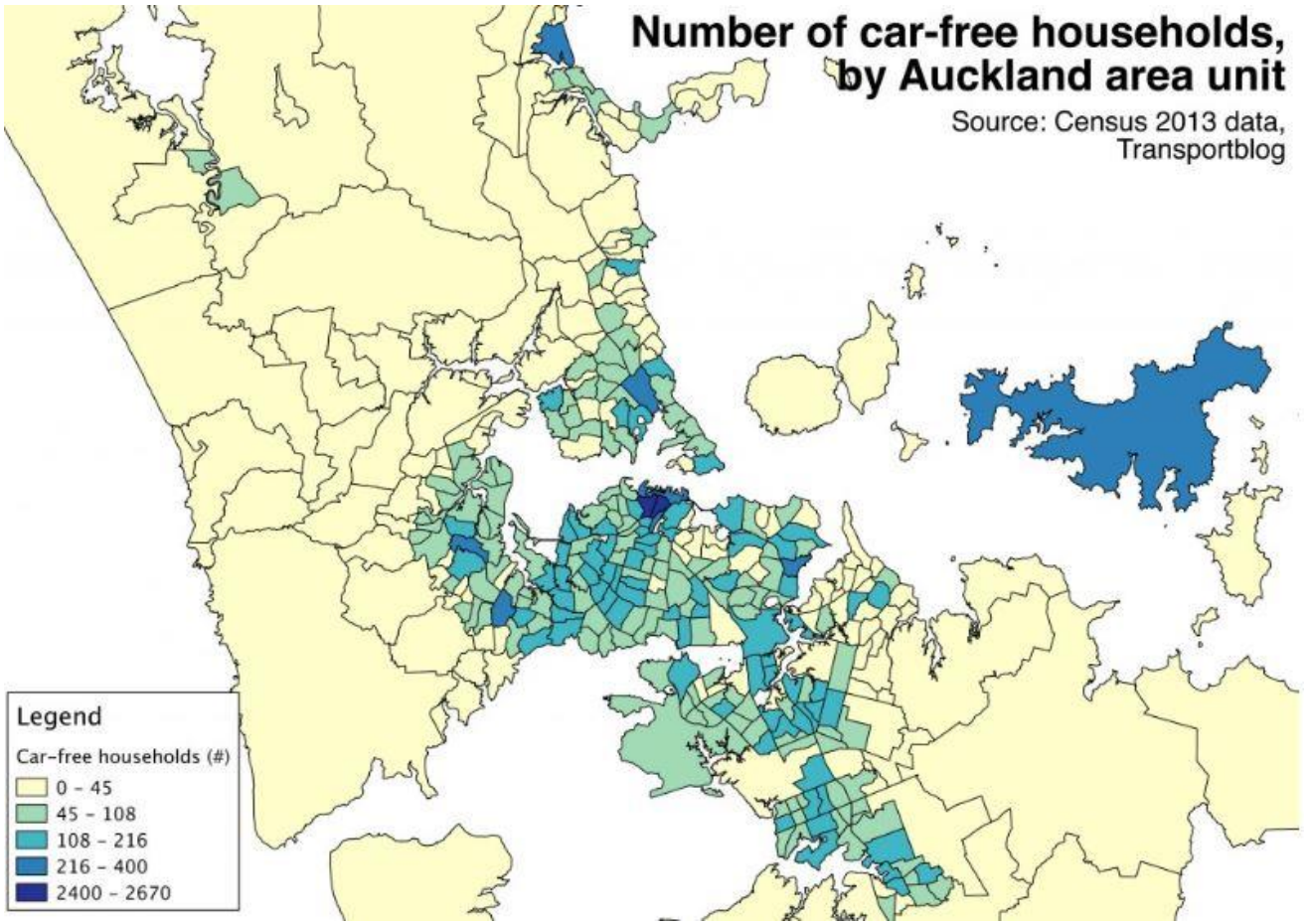
- The review of international schemes undertaken for the ASTPP reported that abandoned schemes arguably failed due to an inability to articulate a satisfactory response to concerns about equity.
- Most schemes seek to mitigate equity impacts through additional PT services, minimise division of residential areas, target congested travel, and provide discounts/exemptions to highly impacted groups.
- Equity impacts are primarily defined by existing travel patterns, with the direction dependent upon:
  - The design of the charging scheme, such as whether it is a cordon charge, area charge, motorway charge, or another type
  - Location and coverage of the charging scheme
  - The availability and quality of non-car transport choices
  - The location of high- and low-income households (or other at-risk people), and the types of trips that they make
  - How revenues are spent or redistributed.
- In general, congestion charges benefit users with high values of travel time (such as business users), and can be progressive, neutral or regressive depending on the distribution of benefits and costs across different groups.
- Higher values of time are positively correlated with income, but studies have also found wide heterogeneity across socio-economic groups, with time sensitivity influenced by trip purpose, occupation, trip length and gender.
- Many equity concerns can be addressed through scheme design and mitigation measures.

Source: D'Artagnan Consulting (2017); MRCagney (2017); Crozet & Mercier (2017)

2.7 Median Household Income (2013)



2.8 Car Free Households (2013)



2.9 Safety

- Reducing congestion may have positive and negative impacts on road safety. Increased trip speeds can lead to more crashes but lower traffic volumes may reduce accident rates.
- The analysis of safety impacts for options evaluation is generally separated into two groups:
  - Projects where most of the benefits from an intervention are safety related such as a black-spot upgrade
  - Other projects where there may be safety benefits or dis-benefits that should be considered but these are not the primary goals of the intervention, such as a new motorway link.
- Potential pricing and non-pricing options aimed at improving network performance will have safety impacts but these will only be a small proportion of the overall benefits and costs. The direction of these impacts will be related to:
  - Overall network vehicle/kms of travel
  - Average speeds and traffic volumes by link
  - The pattern of traffic and in particular the extent to which trips are being diverted to alternative routes.

Source: NZTA EEM Manual (2016)

2.10 Environmental

- Road travel generates a number of negative external impacts, and in particular congestion raises vehicle emissions from higher traffic volumes and stop/start driving. Other external impacts include:
  - Noise and vibration
  - Visual disturbance
  - Community severance
  - Disturbance of special areas
  - Pollution of surface and ground water
  - Ecological damage.
- Potential pricing and non-pricing options aimed at improving network performance will generate external impacts, and generally these will be a small proportion of the overall benefits and costs.
- However it is important to consider the options separately as some design parameters could generate significant negative or positive external impacts.

Source: NZTA EEM Manual (2016)

2.11 Environmental

- The direction of the external impacts from potential pricing and non-pricing options will be related to its influence on:
  - Overall network vehicle/kms of travel
  - Average speeds and traffic volumes by link
  - The pattern of traffic and in particular the extent to which trips are being diverted to alternative routes.
  - Characteristics of the areas affected.
  - Mode choice and availability.
  - Potential for mitigation and/or compensation mechanisms
- External impacts, such as vehicle emissions, may be able to be measured in natural units, monetised, and considered within a B/C evaluation framework.
- Many external effects do not lend themselves to quantification, such as community severance. In these situations, non-monetised impacts should be described and a qualitative assessment applied to estimate their severity.

Source: NZTA EEM Manual (2016)

Part Three: International lessons and preliminary economic considerations

Indicative costs

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9 February 2018

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Schemes 1-11

No.	Scheme title	Points	Est. capex	Opex factor
1	CBD Cordon	28	Low ($46m)	Low
2	CBD Area	42	Mid ($66m)	Low
3	Inner Urban Cordon	60	Mid ($68m)	Low
4	Inner Urban Area	80	Mid ($92m)	Low
5	Isthmus Cordon	23	Low ($43m)	Medium (need exemptions)
6	Isthmus Area	103	High ($179m)	Medium (need exemptions)
7	Urban Cordon	52	High ($100m)	Medium (need exemptions)
8	Urban Area	152	V High ($263m)	Medium (need exemptions)
9	Double Cordon	80	High ($146m)	Medium (need exemptions)
10	Employment Centres	261	V High ($332m)	Medium (need exemptions)
11	Zonal Cordon	177	V High ($307m)	Medium (need exemptions)

Number are only indicative for comparative purposes and should not be relied on for any purposes other that contributing to multi-criteria analysis to rank options

Schemes 16, 19-26 notes

No.	Scheme title	Comments
16	Regional Network	800,000 OBUs = $125m need either parallel large scheme scheme = $100m-$263m. est. CAPEX V High ($388m). Opex moderate
19	Regional Fuel Excise	Costs very low
20	Regional Registration	Capital costs very low, low opex for enforcement
21	Parking Policy	$14m-$70m capital cost depending on size of areas. Opex moderate
22	Car Sharing	Costs low, depending on scale of subsidies
23	Mobility Rationing	Isthmus similar to scheme 6, urban similar to scheme 8
24	Reverse Tolling	Capex $3m per route, opex volume dependent but high
25	Infrastructure Pricing	Only for new infrastructure so costs low
26	Free PT	Loss of fare revenue, removal of fare collection systems, additional subsidies for capital/opex to meet increased demand. Very high opex, high capex

Preliminary cost considerations

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5 February 2018

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Capital costs are a function of scale

- Key cost factor is whether to operate a pure ANPR system or ANPR supplemented by other technologies:
  - ANPR for user detection and declaration, with users interacting via online accounts, mobile phone applications, call centre.
  - GNSS OBUs for metering of road use, backed up by ANPR
- Even if GNSS OBUs were made compulsory for users of a system, ANPR would still be needed to identify those that were non-compliant.
- Capital costs are directly related to the number and size of charging points, which can cost $2m-$15m each depending on site, road width.
- NZTA's existing tolling back office system may or may not have sufficient capacity and capability to manage the volumes of transactions and complexity of queries for an urban congestion pricing scheme.
- Account management and customer management services need not be provided by a dedicated bespoke operation, but can be delivered by competing entities offering products to users.

Operating costs can be managed through policy and procurement

- GNSS OBUs add to operating costs, as inventory needs to be managed. ANPR on its own avoids this cost.
- Operating costs can be minimised by having a scheme that users understand, can pay for easily and manage with minimal need for call centre interaction.
- Simplicity reduces costs, but scheme needs to be sophisticated enough to target congestion by time and location.
- Automation of payments, online and mobile phone app based account management can minimise operating costs.
- Minimise number and complexity of discounts/exemptions, to reduce administrative costs and scope for fraud.
- Minimise rate of non-compliance/fraud, both from lack of understanding by users and deliberate attempts to rip off the system.
- Maximise the number of account holders relative to occasional users. Occasional users cost much more per transaction due to the average level of human interaction.
- Delivery models that encourage competing customer service provision can help optimise costs and enhance service to users.

Preliminary technology considerations

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5 February 2018

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Technology choices are relatively simple in the medium term

- All operating urban congestion pricing schemes have used Automatic Number Plate Recognition (ANPR) technology to identify vehicles for enforcement purposes, and most also use it to identify vehicles for charging.
- ANPR systems read vehicle number plates, matching these to account databases for payment or to the Motor Vehicle Register for enforcement. This is already used in New Zealand for all three modern free-flow toll roads, successfully and economically.
- ANPR system reliability, accuracy and cost means that tag and beacon (also known as DSRC) systems, widely used for toll roads in Australia, are no longer needed.
- ANPR systems can readily be applied for cordon, area and point based charging schemes. The key limitation is a matter of scale, as each charging point requires roadside infrastructure.
- Unless some form of on-board unit is made compulsory for all vehicles in NZ, an ANPR system will be essential for enforcement.
- Of currently viable technologies, ANPR offers the fastest deployment at the lowest cost.

Other technologies may offer options in the longer term, but face major challenges

- Global Navigation Systems by Satellite (GNSS) on-board units (OBUs) could enable full network charging by distance, location and time of day, with unparalleled flexibility.
  - This would require OBUs to be distributed and managed to road users, with an ANPR scheme retained for those unequipped.
- Although several jurisdictions (including NZ) use GNSS OBUs for road user charging on a network basis for heavy vehicles (based on distance, vehicle type and broad location), no city has used such technology yet for urban congestion pricing. Singapore will from 2020, but initially to simply replicate its existing system and allow for expansion over time.
- Smartphones may offer an option for user account management and dissemination of pricing and traffic information and value-added services but are not a substitute for ANPR or GNSS OBUs.
- Native in-vehicle telematics unlikely to provide a viable option for NZ within the next ten years.

Preliminary efficiency, flexibility and risk considerations

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Efficiency, flexibility

- The selected scheme need not target a high proportion of severe congestion from the start, but should be a relatively simple effective first step, which can be expanded and developed over time (as in Singapore).
- Simplicity shouldn't mean bluntness.
- The first scheme should be designed to minimise any major negative impacts (particularly diversion that results in severe congestion or local safety, environmental impacts), but deliver net benefits to those who pay (and have wider benefits to others).
- Any scheme concept and technology should be scalable, so that it may be introduced on additional roads where desirable.
- Any scheme concept and technology should be flexible, so charging hours, rates and direction of charging, on any charged road, can be adapted and refined over time, according to performance.

Risk

- The simpler the system technically, the lower the implementation risk. ANPR alone is a low risk option, GNSS OBUs *in addition* to ANPR create a much higher risk and longer time for implementation.
- Delivery models can affect risk; an open market for customer service and account management can transfer risk to the market
- Largest risk of all schemes is public acceptability, which is a function of:
  - Demonstrably targeting congestion where and when it occurs;
  - Ease of understanding and ease of compliance;
  - Prices based on network performance, with regular performance-based reviews;
  - Scheme design avoiding or addressing any equity issues;
  - Scheme designed to avoid undesirable geographic edge effects
  - Use of revenues being transparent, and linked to transport improvements or cuts in other charges;
  - Media campaign at the right time, leading the narrative, explaining clearly the objectives and how the scheme will work.

Main lessons from international schemes

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5 February 2018

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Key strategic lessons

- Auckland's urban form, trip patterns and geography require a scheme that is distinctly different from those in other cities.
- A scheme should be easy to implement and easy for the public to understand, with clear objectives and intended outcomes.
- Schemes need not be the perfect solution from the start, but should be scalable and flexible over time.
- It is important to maintain momentum from scheme development, through to detailed design and implementation.
- Schemes that did not proceed almost always failed due to lack of public acceptability, which is a function of:
  - Scheme design targeting congested locations and times only
  - Effective mitigation actions to address localised scheme effects
  - Transparency around use of revenues, particularly for improving transport networks relevant to those affected by the scheme
  - Convincing those who have to pay that they will benefit from the scheme
  - Leading the media narrative to negate the risk of an organised campaign of opposition.

Scheme design and implementation lessons

- No schemes to date have addressed serious equity/distributional issues.
- Once a scheme proves effective in managing congestion, public acceptability improves, as long as there are not major negative impacts.
- Prices should be set at levels to optimise traffic flow.
- Demand modelling has been effective at estimating the impact of introducing a scheme. However, price setting itself is one of the latter issues to be resolved.
- Regular revision of prices, based on network performance, enhances acceptability and helps minimise negative impacts.
- Care should be taken with discounts and exemptions, as they may undermine scheme effectiveness and equity.
- Privacy and security needs to be taken into account, but these concerns should not be overstated.
- Successful pricing schemes have been implemented as part of a package of measures including road and public transport improvements.

Part Four: Other background research

Summary Research into Option 19: Regional Fuel Tax

What is the purpose, size and nature of this option?

What does the option do?

The RFT is being introduced to raise revenue. A fuel tax is paid at the pump and it applies to all those who purchase fuel within a defined geographical area (usually large – national or regional) and at all times.

How does the option address congestion?

Fuel taxes are a uniform tax and they are not targeted at congestion by location or by time. Because fuel taxes increase the costs of travel they may discourage some people from driving, thereby reducing the number of vehicles on roads within the defined area at any time, regardless of whether congestion is being experienced. In this regard a fuel tax may have an indirect and inconsistent impact on congestion. There are no estimates of the short and long term impacts of an increase in fuel prices on vehicle use as a proxy for congestion

Generally vehicle kilometres travelled (VKT) decreases in the short term when fuel prices increase, but it returns to normal levels in the long term. The level of decrease in VKT depends on the rate of change rather than the magnitude of change, for example VKT decreases more if the price of fuel increases 10c over two weeks than if it increases 10c over two months.

What is the coverage of the scheme?

An entire region

How wide spread would the effects be?

All types of trip and locations within the region would be effected unless fuel was purchased outside of the region.

How well targeted is the scheme to congestion?

Not targeted at all (the purpose of regional fuel tax is not to reduce congestion).

Are there other transport modes or uncharged routes available to users?

PT, walking and cycling

Would there be potential fairness, equity and distributional issues? Can they be mitigated?

- A regional fuel tax is only a proxy for the use of a region's roads. Fuel use varies by vehicle fuel efficiency and fully electric vehicles use no petrol or diesel. This means some people will pay less tax than others for travelling the same distance.
- This cannot be mitigated at the moment, but technology may allow us to move to a single electronic charging platform where vehicles can be charged by distance instead of fuel use.
- There is some evidence that a regional fuel tax will have a greater impact on low income households, which spend more of their total income on private travel costs (eight percent of total income by decile 1 and 2 households, versus six percent of total income by deciles 5 to 8). Low income households may also have older, less fuel-efficient vehicles. The average age of vehicles owned by decile 1 households is 15 years, whereas the average age of vehicles owned by decile 10 households is 11 years.
- Low income households could benefit from the new transport infrastructure funded by a regional fuel tax, such as public transport.

What evidence is there of this option being efficient and practical to implement?

- Regional fuel taxes are relatively common in many parts of the world. They are particularly widely used in Canada and the US. Canada and the US have both successfully implemented differential fuel taxes at state, city and local level without major difficulties[1]. In New Zealand, the need to run a refund system for off-road diesel users reduces the efficiency of the scheme.

What evidence is there of this option evolving into a long-term solution?

- This option is not intended to be a long-term solution. However, a RFT could continue indefinitely as long as fuel taxes are in place. In the future the revenue system could evolve into a differential charging system where each region pays a different amount of tax depending on their funding needs.

[1] John Williams, Kel Sanderson, and Jason Leung-Wai, "Investigation of concerns regarding a regional fuel tax," *Transport Committee*, July 1, 2017.

Option 20: Regional Registration Fee Scheme

Purpose

A regional registration fee scheme (RRFS) is where a significant increase in annual licensing charges and/or initial registration fees is used to reduce vehicle numbers by raising vehicle ownership costs. In the NZ context, a RRFS could apply a premium to vehicles registered in the Auckland region.

The impact on congestion in the Auckland region is unknown, however in Singapore the scheme is a strong policy component contributing to a reduction in vehicle numbers and therefore congestion.

Examples

The Singapore Vehicle Quota System (VQS) was introduced in 1990 to control vehicle population growth. A limited number of Certificates of Entitlements (COE) are auctioned to the highest bidders and allow the use of the vehicle for 10 years. In 2013, the COE bidding price for cars under 1600c was NZD$80,870[ii]. Prior to 2009 the growth rate of vehicle ownership in Singapore was 3% per year. From February 2015 to January 2018, the growth rate was anticipated to be 0.25% per annum[i]

A VQS operating in Shanghai is similar to the Singapore scheme, except that licences are for the lifetime of ownership, not 10 years[iii]. While Singapore categorises cars by engine capacity, Shanghai does not.

Economic Impacts

- Registration fee schemes add to business costs. These can be significant if the business is reliant on vehicles, which many are. They also add to private and household costs for those who hold COEs
- The revenue from registration schemes can be used for other transport options, such as public transport. However as with other pricing schemes, it is important for public acceptance of a vehicle registration scheme that users know where revenue will be spent
- Registration fee schemes negatively impact upon small car dealership businesses. This was the case in Singapore, where small car dealerships complained that they lacked the scale to compete with larger distributors for licences[iv].

Social Impacts

- In Singapore, once an individual has paid for a COE, he or she may be encouraged to use the vehicle extensively[v].
- Registration fee schemes can encourage the use of other means of transport if individuals do not have access to a vehicle. However, Singapore already had very high public transport ridership on a mature system.

Environmental Impacts

- In the Singaporean example, vehicles were found to travel similar numbers of kilometres when compared to other countries without quota systems, however there are clearly fewer vehicles than there would be without the scheme.

Distributional Impacts

- Singapore's COE auction system is extremely regressive, favouring the wealthy who can afford to pay high prices for a certificate
- Individuals who have limited access to other transport options such as public transport, may be negatively impacted.

Efficiency Impacts

- The reasons why an individual may purchase a COE, or the use to which the vehicle is put are not taken into consideration
- In Shanghai the VQS lump sum fee does not differentiate between types of cars, and thus does not favour more efficient cars over others[vi]. By increasing the cost of owning a vehicle in Shanghai, high-income consumers tended to buy vehicles with larger engine capacities, reducing efficiency[vi].

Flexibility Implications

- With Singapore's VQS operating on an auction system, there is flexibility in the price paid for the certificate. This means the Government has the ability to control the number of vehicles on the road by adjusting the reserve price.

Wider Implications

- The operation of a registration scheme regionally could be challenging in terms of cross boundary issues. Travelling through the region (for example, a trip from Waikato to Northland) may cause extra costs to users who do not use Auckland region roads frequently, unless they are exempt
- In the NZ context, the challenge of people purchasing and registering vehicles outside Auckland but using them within would need to be met, probably using technology
- Enforcement of the scheme would need to be considered, which would be more difficult than in Singapore (a very small island nation)
- Under the VQS, 44% of Singaporean households own a vehicle[vii]. This implies the necessity for an adequate supply of alternate transport modes that meet the needs of the public.

[i] Land Transport Authority, 2015, https://www.lta.gov.sg/content/ltaweb/en/roads-and-motoring/owning-a-vehicle/vehicle-quota-system.html
[ii] COE Bidding Results, 2013, https://www.lta.gov.sg/content/dam/ltaweb/corp/PublicationsResearch/files/FactsandFigures/COE_Result_2010_2013.pdf
[iii] Xiao and Zhou and Hu (date unknown), Vehicle Quota System and Its Impact on the Chinese Auto Markets: A Tale of Two Cities
[iv] Winston, 2004, Congestion Control and Vehicle Ownership Restriction: The Choice of an Optimal Quota Policy.
[v] Asian Development Bank (2017), Travel Demand Management Options in Bejing
[vi] Xiao and Zhou (2013), An Empirical Assessment of the Impact of the Vehicle Quota System on Environment: Evidence from China.
vii Tan (2015), Why Singapore still needs more cars, Straits Times

Summary Research into Option 21: Parking

What is the purpose, size and nature of this option?

What does the option do?:

- There are many approaches which could be taken to addressing congestion through amendments to current parking arrangements. Approaches with direct pricing elements include:
    - An annual parking levy per car parking space (most likely restricted to those attached to non-residential uses and in centres)
    - A direct charge for people arriving to park in a parking space during peak hours. This could apply to varying extents to: just publicly owned/managed spaces; all publicly accessible spaces; and all parking spaces.

  Other non-direct pricing approaches include:
    - Increasing the use of clearways on congested roads
    - Removing minimum and increasing the use of maximum parking rates

How does the option address congestion?

- The parking levy and direct peak parking charge would increase the cost of parking thereby increasing the cost of private vehicle travel to areas with this charge and discouraging people from driving to the area.
- The non-pricing options would increase road capacity by reallocating space to moving rather than parked vehicles; and reduce the number of new parking spaces thereby reducing the number of vehicles able to drive and park at their destination.

What is the coverage of the scheme?

- These could in theory apply across the entire region*. but would most likely be targeted at major centres and corridors with a significant proportion of non-residential uses and good quality PT.

How wide spread would the effects be?

- Those who own/rent/use carparks in these areas would be financially affected.
- Those driving to the areas would be impacted financially or through having to find an alternative method of travel or location of parking.
- Transport network effects would be most pronounced around areas with the charge.

* Parking charges could only realistically be applied in zones with no minimum parking requirement, therefore to apply regionwide would require Unitary Plan rule changes.

Summary Research into Option 21: Parking

What evidence is there that this option has the potential to reduce congestion? How does this option impact economic, social and environmental outcomes?

How well targeted is the scheme to congestion?

Parking levy

- This scheme is likely to have some impact on localised congestion near the centres where it applies and a more dispersed impact across the region.
- Unless applied to all employment areas (including outside of centres) it is unlikely to have a significant region wide impact on congestion.
- The effectiveness of targeting trips in congestion under this option depends on what spaces are charged. Charging of long-term/commuter spaces would have the greatest effect given the relationship with peak hour travel; residential parking spaces (in centres) are likely to have the least given if used during the peak hour they are most likely travelling counter peak.
- An indirect effect of a levy may be the more productive use of floor area in centres (i.e. residential or commercial) contributing to the compact city and thereby reducing the need for car travel in congestion.

Peak hour/s parking charge

- Could be targeted reasonably well to trips during the regionally most congested times.
- However it would not relate to the level of congestion specifically experienced, and contributed to, on each trip.
- The scale of any effect would depend on the extent to which the peak charge would apply (applying only to public owned/managed spaces would have minimal effects).

Clearways

- Would only apply to congested routes. However would be unlikely to resolve bottlenecks (such as intersections), and could in fact exacerbate congestion in these locations.

Parking rates

- Is not particularly targeted at congestion. Applying only to specific uses could improve this to some degree.

Are there other transport modes or uncharged routes available to users?

- PT (if applied to centres and in a few other locations), walking and cycling are available. It may also be that a person could choose to park outside the parking charge zone and walk/PT the rest of the way.

Information Used in the Preliminary Assessment

Would there be potential fairness, equity and distributional issues? Can they be mitigated?

Parking levy and peak hour/s parking charge

- A parking levy is only a proxy for the use of roads. There is no guarantee someone owning/using a parking space is driving on congested roads or at congested times. People who own/use a space will therefore be charged the same amount while contributing to different extents to congestion.
- This can be mitigated to some degree by targeting charges to uses and locations most likely to contribute to congestion. Targeting specific uses however can be difficult to implement and enforce.
- The 2006 APRES work found that a parking levy (on Central Auckland, Takapuna, Henderson and Manukau) had moderate effects compared to other schemes and that most trips in the region would be unaffected by the charge. It noted that impacts are generally on lower income households, but had much less impact on areas of deprivation than most of the other options (such as cordons).

Clearways and parking rates

- Unlikely/minimal

What evidence is there of this option being efficient and practical to implement?

Parking levy and peak hour/s parking charge

- A reduction in parking supply is not a guarantee that congestion will decrease, as through trips (i.e. those not terminating within the levied area), population and employment growth, and ride sharing services may absorb any corridor capacity that is freed up.
- However, levies have been shown to be successful internationally at reducing the number of parking spaces provided, growing the share of trips made by non-car based modes, and reducing congestion (albeit on a medium term basis).
- International cities with parking levies include Sydney, Melbourne, Perth, and Nottingham. Studies looking at Perth, Melbourne and Nottingham have seen a small but notable reduction congestion probably due to the charges.
- An investigation conducted for Auckland Council in 2012 concluded that it would be possible to apply a levy to the City Centre. It estimated that a $400 levy per stall for the City Centre would generate approximately $16m per annum (gross). It didn't investigate the corresponding effect on congestion.
- A peak hour parking charge which applies beyond public owned/managed car parks will not be easy to implement. Applying this to any non-publicly available spaces, i.e. business owned/dedicated spaces, will be difficult and costly.

Clearways

- This can be practically implemented. However increasing the extent/time of these in centres is likely to meet considerable retailer opposition.
- Most arterials (and obviously all motorways) already have no parking during the primary peak times. Combined with the continued existence of bottlenecks at intersections there is unlikely to be significant value in implementing this on it's own. It should however continue to be looked at as part of the Network Optimisation work being undertaken by AT and NZTA.

Parking rates

- Parking minimums have already been removed for nearly all activities in centres and maximums already apply to the CBD and office activity in general. The extent of these could be increased.
- Existing parking rates have recently been determined through the Unitary Plan hearings process and an Environment Court appeal. Without a change in the RMA landscape (such as central government guidance/NPS) it is unlikely that a significantly different outcome would result from any plan change process.

What evidence is there of this option evolving into a long-term solution?

Parking levy and peak hour/s charge

- This option would not be a long-term congestion solution by itself as it is not sufficiently targeted at congestion; however it could form part of a package of tools and/or be adopted for it's landuse as well as congestion reducing intentions.

Peak hour/s parking charge

- To successfully work as a long-term congestion solution this charge would have to apply beyond publicly owned/managed spaces, and most likely to all spaces in an area. As noted this would be difficult.

Parking rates

- Rates should continue to be monitored and amended as appropriate to support the overall approach to transport and land use in Auckland.

Summary Research into Option 22: Car sharing

What is the purpose, size and nature of this option?

What does the option do?

The average vehicle occupancy rate in the AM peak is 1.36 (based on 2013 data). Car sharing (also called car pooling or ride sharing) is when people who have similar origins and destinations share a vehicle rather than travelling on their own.

There is already work underway to look at increasing vehicle occupancy through Mobility as a Service, and Auckland Transport and NZTA both promote various car sharing initiatives (through access to carpooling and T2/T3 lanes)– various apps and websites already exist designed to help people find existing carpools and set up new ones

How does the option address congestion?

Car sharing increases the vehicle occupancy of cars, meaning fewer cars on the road, and as a result, a reduction in congestion. Incentivising car sharing can increase the amount of people who share cars.

ATAP modelling suggested that a 50% increase in vehicle occupancy (to 1.61) would reduce the proportion of time spent in severe congestion in the AM peak by around 5%. A 100% increase (to 1.73) would only slightly improve results (a further reduction of around 1%).

What is the coverage of the scheme?

Up to the whole region, depending on how the scheme is designed.

How wide spread would the effects be?

Depends on the coverage and design of the scheme.

How well targeted is the scheme to congestion?

The scheme could be targeted to road users on trips that are more likely to contribute to congestion (eg trips to work/school in the peak times)

Are there other transport modes or uncharged routes available to users?

All routes will be uncharged.

Information Used in the Preliminary Assessment

Would there be potential fairness, equity and distributional issues? Can they be mitigated?

- As long as people are not penalised or rewarded for not car sharing/car sharing, there are unlikely to be any fairness, equity or distributional issues. If there are financial incentives for car sharing, there may be equity issues because car sharing will not be a realistic option for everyone (some people may not have similar origins and destinations to others).

What evidence is there of this option being efficient and practical to implement?

- Car sharing/car pooling schemes already exist in Auckland – there is limited evidence as to how efficient they are in reducing congestion. There is evidence (eg recent ITF study into shared mobility in Auckland) to suggest that people are less open to sharing vehicles when it is with only one or two other people and anecdotal evidence suggests the barriers to more people using car sharing services are cultural rather than technical.

What evidence is there of this option evolving into a long-term solution?

- Has the potential to link into Mobility as a Service work.
- Auckland Transport have tentatively estimated the following rates of uptake over the next 30 years:

	2026	2036	2046
Proportion of trips shared	<2 - 5%	5 - 10%	15 - 50%

Summary Research into Option 23: Mobility rationing

What is the purpose, size and nature of this option?

What does the option do?

Mobility rationing, or road space rationing, restricts traffic access into an area at certain times or days (for example, only cars with certain license plate digits being allowed into the CBD).

Carless days were introduced in New Zealand in 1979 in an attempt to reduce petrol consumption following the oil shock. Evidence suggests they were largely ineffective due to the large number of exemptions, people owning more than one vehicle to bypass the exemption, and people driving more to achieve their daily travel needs on days they had the use of one car rather than two.

How does the option address congestion?

Most examples of mobility rationing implemented elsewhere are focused on reducing air pollution, however, it could also reduce congestion by restricting the number of cars on the roads. In theory, banning two digits for one day a week would result in a 20% reduction in traffic. Internationally, it has had mixed success – it proved effective in reducing traffic and emissions in Beijing and Paris, but less so in Bogota and Mexico (due to people finding ways to circumvent the ban).

What is the coverage of the scheme?

Anywhere from a small area to regionwide.

How wide spread would the effects be?

Depends on the coverage of the scheme.

How well targeted is the scheme to congestion?

- Elsewhere, mobility rationing has been found effective in reducing congestion in the short term. However, in the long term users affected by the scheme can get round its impacts by purchasing a second car. In Auckland, 58.3% of households already have access to two or more cars (based on 2013 census data).

Are there other transport modes or uncharged routes available to users?

- PT and active modes would remain uncharged.

Would there be potential fairness, equity and distributional issues? Can they be mitigated?

- There are likely to be equity and fairness issues, particularly between those who can afford to own two cars (thereby circumventing the charge) and those who cannot. Some people are likely to have no alternative to driving to their destination (particularly during work hours in the peak).

What evidence is there of this option being efficient and practical to implement?

- Mobility rationing has been implemented in many cities worldwide (although, as discussed, primarily targeted at air pollution not congestion). An enforcement system would need to be developed as well as any exemptions – previous experience in New Zealand suggests care needs to be taken with exemptions as they can undermine the effectiveness of the scheme.

What evidence is there of this option evolving into a long-term solution?

- None.

Summary Research into Option 24: Reverse tolling

What is the purpose, size and nature of this option?

What does the option do?

This option incentivises people to change the time or way in which they travel by rewarding them for doing so. One proposal for Auckland suggests using a smart phone app to tag carpool passengers, which could then be used to pay passengers, with payments varying depending on the time, route and direction of travel.

How does the option address congestion?

Reverse tolling should be targeted at getting people to change the time or way in which they travel during times and at locations where there is high congestion. If it is successful at getting people to change their behaviour, there should be less vehicles on the road during peak times, and as a result, a reduction in congestion.

What evidence is there that this option has the potential to reduce congestion?

There is limited information available on reverse tolling. *SLIM uit de spits*, a project executed by ARS Traffic & Transport Technology, which was carried out in 2013-2014 challenged participants to avoid driving their car during peak hours. Drivers succeeded at avoiding rush hour by driving at different times, taking the bicycle or making use of public transport. For each rush hour avoided, participants were rewarded points, which served as currency in an online shop that offered a wide variety of products.

The approach was effective: the potential reward, supplemented by extra travel information and subsequent challenges, led to a weekly decrease of 35.000 rush hour drives – the article didn't provide a reference to the base against which the reduction occurred.

[ARS Traffic & Transport Technology, "Reverse Tolling," ARS Traffic & Transport Technology, http://www.ars-traffic.com/en/reverse-tolling.]

How does this option impact economic, social and environmental outcomes?

- Dependent on costs of running the scheme and travel time savings. A proposal for Auckland suggests running this scheme would cost $100m per year (it is not clear what travel time savings this would deliver), and congestion estimated to cost $200 - $400 million annually in Auckland [NZIER, Dieter Katz].

How well targeted is the scheme to congestion?

- The scheme could be targeted at particular times of day and locations.

Are there other transport modes or uncharged routes available to users?

- All routes will be uncharged.

Would there be potential fairness, equity and distributional issues? Can they be mitigated?

- This option could potentially have less distributional issues than a scheme that charges users. However, it depends who will be getting the reward and what the reward is – for example, wealthier people may have more flexibility with their work hours, so would be benefitting from the reward, while shift workers wouldn't.

What evidence is there of this option being efficient and practical to implement?

- Apart from the Dutch trial, there is no evidence of this option being implemented. The proposal for Auckland suggests piloting a scheme to test for proof of concept.

What evidence is there of this option evolving into a long-term solution?

- Unclear.

Option 25: Infrastructure Pricing - Tolling

Purpose

Infrastructure pricing is a charge passed on to the user of an asset. Infrastructure pricing (specifically transport infrastructure) can address a disconnection between what users pay (or have paid) to use the infrastructure and the actual cost of providing and/or operating the infrastructure. Infrastructure pricing has the potential to enable the provision of new infrastructure that may not have otherwise been constructed, or it can bring forward construction and unlock its benefits earlier.

Infrastructure pricing is of interest in the Auckland region because New Zealand has existing legislation allowing new roads to be tolled, as long as there is an adequate alternative. Tolling may reduce congestion on parts of the network, depending on the toll.

Tolling

Tolling is the primary example of transport infrastructure, user-pay pricing in New Zealand. This type of infrastructure pricing is a targeted charge, in which the user is paying for only the use of that particular asset. New Zealand currently has three toll roads, the Northern Gateway Toll Road north of Auckland, and the Tauranga Eastern Link Toll Road and Takitimu Drive Toll Road, both in Tauranga. All of these systems are based on a flat-toll rate according to the vehicle type using the asset.

Tolls can also be variable, altering by day or by time of day. Variable toll pricing has been applied to the Sydney Harbour Bridge and tunnels and shown to incentivise commuters to travel at different times or take public transport during peak hours[i] .

Economic Impacts

- While tolls increase costs they do not have noticeable impacts on consumer prices.
- Vehicles travelling along the diversion are taking a less efficient option than the toll road.

Social Impacts

- **Safety Benefits**
  - Lower crash rate on tolled roads. Sydney's toll road network has provided the net benefits of $1b in accident reductions[ii] .
  - Safety benefits of trips are increased. The BCR of the Tauranga Eastern Link was predicted to have $13.9m in safety benefits if the road was tolled[iii] .

- **Travel Time Benefits**
  More convenient trips undertaken. Tolls in New South Wales were found to have a $5.4b benefit to users (both personal and business) in travel time savings over 10 years. An additional $0.4b benefit to personal and business users occurs for travel time reliability[ii].
- **Vehicle Operating Costs**
  - Sydney's toll road network has found that there is a $3.7b saving of vehicle operating costs[ii].
  - Willingness to pay may vary significantly by the type of user and the trip being undertaken.

Environmental Impacts

- When looking across all toll roads in Australia, work undertaken by KPMG found that the benefits from toll roads on the environment had been calculated to be worth $336m in a reduction to environmental emissions[ii].
- May encourage ridesharing to minimise costs.

Distributional Impacts

- Tolling is quite regressive in that it charges the same rate to all users, no matter the individual's ability to pay
- The regressive nature of some tolls may be managed by the redistribution of the tolling revenues

Efficiency Implications

- Varying tolls (in the Sydney example) have found that people adapt well to variations, adjusting travel patterns to suit.

Flexibility Implications

- Variations in tolls would be would mean that benefits of new infrastructure, such as speed maintenance and level of service continue.
- Varying tolls in a NZ context will require them to be in accordance with the Land Transport Management Act (LTMA). For example when varying the toll on the Northern Gateway Toll Road, the price needs to be in accordance with the Order in Council. This includes a maximum base amount.

Wider Implications

- The impacts of diversions can be significant on tolled roads. This may mean the crash rate on the diverted route increase, and those who live along these routes may experience decreased quality of life with increased traffic volumes.
- There may be difficulties in applying this to other infrastructure types. Under the LTMA, road tolling can only be applied to new infrastructure, not pre-existing infrastructure.

Are there other transport modes or uncharged routes available to users?

Under the LTMA, there is a requirement to provide alternative routes to users.

[i] NZ Transport Agency (2013)
[ii] Economic Contribution of Australia's Toll Roads (KPMG, 2015)
[iii] Ministry of Transport (2010)

Summary Research into Option 26: Free Public Transport

What is the purpose, size and nature of this option?

What does the option do?

- This option removes the cost of travelling on public transport.

How does the option address congestion?

- By reducing the cost of public transport, it makes PT more attractive relative to other modes of travel thereby reducing use of motor vehicles and levels of congestion.

What is the coverage of the scheme?

- This would apply across the entire region though in effect would only apply in areas served by PT.

How wide spread would the effects be?

- The impacts would be spread across the region.

Summary Research into Option 26: Free Public Transport

What evidence is there that this option has the potential to reduce congestion? How does this option impact economic, social and environmental outcomes?

How well targeted is the scheme to congestion?

- There are few examples of where free PT has been tried fully (rather than in short trials or with small segments of the population) making it difficult to estimate it's likely effect on citywide congestion. The largest example is Tallinn (Estonia) a city of ~400k people where residents get free PT:

  > *"Almost a year after the introduction of FFPT, public transport usage increased by 14 % and there is evidence that the mobility of low-income residents has improved."*

  The study cautioned though that the level of increase was probably affected by:

  > *"the good level of service provision, high public transport usage and low public transport fees that existed already prior to the FFPT."*

- However, while there was an increase in PT patronage a notable portion of these trips were instead of walking and that while there were fewer vehicle trips total VKT was greater due to longer trips.
- This is in keeping with many of the smaller studies which found that while there may be a large percentage increase in PT usage (in some cases 500-1000%) these were always off a small base and the vast majority of additional trips were by existing transit users or walkers and cyclists, not car drivers.
- This scheme in it's widest form is not targeted at congestion. It would apply for all trips (at all times and on all routes) whether there is congestion or not.
- It may be possible to restrict free travel to times when road congestion is at it's worst; however this is also when public transport services are at their most congested transferring congestion from roads to PT services (also when the marginal operational cost of PT is at it's highest).
- Studies have found that the elasticity of ridership to public transport fares is lower than the cross-elasticity to car usage price. Disincentives for car usage might result in a greater model shift from car to public transport than those gains by reducing public transport fares.

Are there other transport modes or uncharged routes available to users?

- People would still be able to drive, walk or cycle.

Information Used in the Preliminary Assessment

Would there be potential fairness, equity and distributional issues? Can they be mitigated?

- Free PT is not a direct extra charge or disincentive to avoid congestion, but instead an incentive to use an alternative. As it does not directly restrict the ability to drive the direct negative effects are low.
- The cost of a free PT scheme would have to be recovered through other revenue sources such as rates or taxes. The amount any person would pay would not directly correspond to the amount of benefit they see as they may not travel at peak times or places.
- The method of revenue generation would dictate the type and extent of fairness, equity or distributional issues. However, as the costs aren't directly tied to the benefits, it is certain there would be some effects.
- While there are no direct costs, there are relative equity impacts between those who see varying levels of benefit. Those who would benefit most from free PT are those who:
  - travel further as there is no direct cost of their travel
  - live near PT services (and high quality PT services most of all)
- It would also benefit those:
  - who travel to more intensive areas as drivers switching to PT in these areas would avoid higher parking costs;
  - on lower incomes who will save relatively more money. However without considerable improvements in PT service levels (especially to poorer areas, and to industrial areas, this reduction in monetary cost will often be offset by an increase in journey time.

What evidence is there of this option being efficient and practical to implement?

- Removing PT fares (even if restricted only to Auckland residents) could be practically implemented. However the increase in PT services (and physical infrastructure) required to provide for the increase in patronage would likely be substantial.
- The opex cost of removing fares (at current patronage levels) would be approx. $200 million pa. A ten percent increase in patronage would roughly increase opex by 20 percent of this cost i.e. $40 million.

What evidence is there of this option evolving into a long-term solution?

- As previously mentioned there is little evidence of this option being applied at scale. From what information there is it is unlikely to significantly impact on congestion.
- Given Auckland's low usage of PT even a 50% increase in PT trips due to free fares would only see a 4% reduction in vehicle trips. Factoring in the fact the majority of new trips are likely to be from existing PT users and walkers/cyclists this reduction in reality this figure would be even smaller.
- Given it is a second best option in reducing congestion, compared to increasing the cost of operating a car, it is unlikely to be a strong long-term solution.

Appendix C – Multi criteria analysis matrix

Smarter Transport Pricing
MCA Evaluation Matrix - long list options

Weighting Scenario			**Base**	**Key**	Significantly Positive	Moderately Positive	Slightly Positive	Neutral	Slightly Adverse	Moderately Adverse	Significantly Adverse																							
					3	2	1	0	-1	-2	-3																							
A. Main Objectives					CBD Cordon	CBD Area	Inner Urban Cordon (City + fringe)	Inner Urban Area (City +fringe)	Isthmus Cordon	Isthmus Area	Urban Cordon	Urban Area	Double Cordon	Employment Centres Cordon	Zonal Cordon	SH Corridor	Strategic Corridor	Target Congested Corridor	Strategic Corridor and CBD Area	Regional Network	Express Lanes	Strategic Corridor and Express Lanes	Regional Fuel Tax	Regional Registration Fee	Parking Policy	Car Sharing	Mobility Rationing	Reverse Tolling	Infrastructure Pricing	Free Public Transport
Network Performance	**No.**	**Criteria**	**Explanation**	***Weighting***	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**	**Option 7**	**Option 8**	**Option 9**	**Option 10**	**Option 11**	**Option 12**	**Option 13**	**Option 14**	**Option 15**	**Option 16**	**Option 17**	**Option 18**	**Option 19**	**Option 20**	**Option 21**	**Option 22**	**Option 23**	**Option 24**	**Option 25**	**Option 26**
Reduce Congestion	1	*Traffic coverage*	Extent to which the option maximises the impacts on congested network areas	*15.00%*	-2	-2	-1	-1	0	2	-2	3	-1	2	2	-2	2	3	2	3	-1	2	-2	-2	-1	-2	-2	-2	-3	-1
	2	*Average speed / trip time*	Extent to which the option improves average trip speeds and times	*9.00%*	-2	-2	-1	-1	0	2	-2	3	-1	2	2	-2	2	3	2	3	-1	2	-2	-2	-1	-2	-2	-2	-3	-1
	3	*Unintended consequences*	Extent to which the option generates negative unintended network impacts	*9.00%*	1	1	1	1	0	0	1	1	1	-3	-2	-3	0	1	0	3	-2	-1	1	1	-2	2	1	1	1	0
	4	*Severe congestion*	Extent to which the option reduces the amount of time spent in severe congestion	*9.00%*	-2	-2	-1	-1	0	2	-2	3	-1	2	2	-2	2	3	2	3	-1	2	-2	-2	-1	-2	-2	-2	-3	-1
	5	*Freight trips*	Extent to which the option impacts freight trip times	*9.00%*	-1	-1	-1	-1	0	2	-1	3	-1	2	2	2	3	3	3	3	-2	3	0	0	0	0	1	0	-1	0
	6	*Travel reliability*	Extent to which the option improves travel reliability	*9.00%*	-2	-2	-1	-1	0	2	-2	3	-1	2	2	-2	2	3	2	3	-1	2	-2	-2	-1	-2	-2	-2	-3	-1
Improve PT and Active Modes	7	*PT mode share*	Extent to which the option increases PT mode share *(assumes increase in PT m/s is viewed as +ve)*	*2.50%*	1	1	0	1	0	1	0	1	0	1	0	0	1	1	1	1	-1	1	0	0	1	-1	1	2	-2	3
	8	*Active mode share*	Extent to which the option increases active mode share *(assumes increase in active m/s is viewed as +ve)*	*2.50%*	1	1	0	1	0	1	0	1	0	1	0	0	1	1	1	1	-1	1	0	0	1	-1	1	1	-2	-2
SUB-TOTAL	**8**			***65.0%***	-0.79	-0.79	-0.42	-0.37	0	1.07	-0.84	1.67	-0.42	0.8	0.84	-0.93	1.16	1.67	1.16	1.85	-0.83	1.07	-0.75	-0.75	-0.55	-0.71	-0.61	-0.675	-1.36	-0.395
B. Social/Economic/Environmental/Safety Considerations																																	
Social/Economic	**No.**	**Criteria**	**Explanation**	***Weighting***	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**	**Option 7**	**Option 8**	**Option 9**	**Option 10**	**Option 11**	**Option 12**	**Option 13**	**Option 14**	**Option 15**	**Option 16**	**Option 17**	**Option 18**	**Option 19**	**Option 20**	**Option 21**	**Option 22**	**Option 23**	**Option 24**	**Option 25**	**Option 26**
Promote Fairness	9	*Public acceptability*	Extent to which the option is considered 'fair' in terms of those generating congestion, those paying for mitigation and those benefiting from intervention	*7.00%*	**3**	**2**	**1**	**-1**	**0**	**-2**	**-3**	**-2**	**-2**	-3	-2	2	2	2	2	-1	-1	2	3	-3	-2	3	-3	1	2	2
Minimize Equity Impacts	10	*Household equity*	Extent to which the option impacts groups of users and households (eg costs/benefits) in an equitable manner	*2.00%*	3	3	1	1	0	-1	-2	-2	-2	-3	-2	-2	1	1	1	1	-2	1	-1	-3	-2	1	-3	0	2	3
	11	*Business equity*	Extent to which the option impacts businesses (eg costs/benefits) in an equitable manner	*2.00%*	3	3	0	-1	0	-1	-1	-2	-1	-3	-2	1	1	1	1	1	1	1	1	-1	-2	1	0	1	2	1
	12	*Spatial equity*	Extent to which the option impacts communities/geographical areas (eg costs/benefits) in an equitable manner	*4.00%*	3	3	0	0	0	-1	-2	-3	-2	-3	-2	-2	1	1	1	1	1	1	2	2	-1	1	1	1	0	2
Environmental																																	
Lower Vehicle Emissions	13	*Vehicle emissions*	Extent to which the option reduces vehicle emissions	*1.00%*	0	0	0	0	0	1	0	1	0	0	1	-1	2	2	2	3	-1	2	-1	-1	-1	-1	-1	-1	-1	0
Improve External Outcomes	14	*External impacts*	Extent to which the option minimises other external impacts including air quality, noise, visual disturbance, vibration, water quality and community severance	*3.00%*	0	-1	0	-1	0	-1	0	0	0	-2	-3	-3	-1	-1	-1	2	1	-1	1	1	-1	1	1	1	1	1
Safety Impacts																																	
Improve Transport Safety	15	*Safety*	Extent to which the option improves transport safety outcomes	*1.00%*	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1
SUB-TOTAL	**7**			*20.0%*	0.45	0.35	0.09	-0.1	0	-0.24	-0.35	-0.33	-0.28	-0.52	-0.38	-0.07	0.21	0.21	0.21	0.1	-0.03	0.21	0.31	-0.19	-0.3	0.3	-0.21	0.15	0.24	0.32
C. Other Considerations																																	
Scheme Efficiency	**No.**	**Criteria**	**Explanation**	***Weighting***	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**	**Option 7**	**Option 8**	**Option 9**	**Option 10**	**Option 11**	**Option 12**	**Option 13**	**Option 14**	**Option 15**	**Option 16**	**Option 17**	**Option 18**	**Option 19**	**Option 20**	**Option 21**	**Option 22**	**Option 23**	**Option 24**	**Option 25**	**Option 26**
Promote Efficiency	16	*Efficiency*	Extent to which the option is cost effective to develop, build and operate	*4.00%*	0	0	0	0	0	-1	-1	-2	-1	-2	-2	-1	-2	-2	-2	-3	-1	-3	3	3	1	3	1	-3	3	-3
Promote Flexibility	17	*Flexibility*	Extent to which the option is adaptable to changing circumstances, technology and scheme coverage	*4.00%*	0	-1	0	-1	0	-1	0	-1	0	0	0	0	0	0	0	3	-1	-1	-3	-3	1	2	-2	2	-2	-3
Promote Compliance	18	*Enforcement*	Extent to which the option can be readily enforced	*1.00%*	0	-1	0	-1	0	-1	0	-1	0	-2	-1	0	-1	-1	-1	-3	0	-1	3	-3	-3	1	-3	-2	2	3
Support Privacy	19	*Privacy*	Extent to which the option can address privacy concerns	*1.00%*	0	-1	0	-1	0	-1	0	-1	0	0	0	-1	-1	-1	-2	-3	-1	-1	0	-2	-2	0	0	-2	0	0
Minimize Risks	20	*Risk*	Extent to which risks associated with the option are unknown or cannot be mitigated	*3.00%*	2	1	0	-1	0	-2	0	-3	0	-3	-2	-3	-1	-1	-1	-3	-3	-3	0	0	-2	0	-2	-3	2	-3
Revenue and Funding																																	
Promote Transparency	21	Revenue	Extent to which the option can be transparent around the use of any net revenue raised	*1.00%*	0	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-2	-1	-1	0	-2	-2	0	-1	0	2	0
Support Funding Reform	22	Funding	Extent to which the option impacts the current land transport pricing system (eg FED & RUC)	*1.00%*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	-1	-1	0	0	0	-2	0	-3
SUB-TOTAL	**7**			*15.0%*	0.06	-0.03	0	-0.09	0	-0.16	-0.05	-0.24	-0.05	-0.2	-0.16	-0.15	-0.14	-0.14	-0.15	-0.14	-0.19	-0.28	0.02	-0.08	-0.05	0.21	-0.14	-0.19	0.14	-0.33
Weighted Score				***100.0%***	**-0.28**	**-0.47**	**-0.33**	**-0.56**	**0**	**0.67**	**-1.24**	**1.1**	**-0.75**	**0.08**	**0.3**	**-1.15**	**1.23**	**1.74**	**1.22**	**1.81**	**-1.05**	**1**	**-0.42**	**-1.02**	**-0.9**	**-0.2**	**-0.96**	**-0.715**	**-0.98**	**-0.405**
Ranking				***100.0%***	**12**	**16**	**13**	**17**	**10**	**7**	**26**	**5**	**19**	**9**	**8**	**25**	**3**	**2**	**4**	**1**	**24**	**6**	**15**	**23**	**20**	**11**	**21**	**18**	**22**	**14**

Smarter Transport Pricing
MCA Evaluation Matrix - long list options

Significantly Positive	Moderately Positive	Slightly Positive	Neutral	Slightly Adverse	Moderately Adverse	Significantly Adverse
3	2	1	0	-1	-2	-3

A. Main Objectives																														
				CBD Cordon	CBD Area	Inner Urban Cordon (City + fringe)	Inner Urban Area (City +fringe)	Isthmus Cordon	Isthmus Area	Urban Cordon	Urban Area	Double Cordon	Employment Centres Cordon	Zonal Cordon	SH Corridor	Strategic Corridor	Target Avg Speed	Strategic Corridor and CBD Area	Regional Network	Express Lanes	Strategic Corridor and Express Lanes	Regional Fuel Tax	Regional Registration Fee	Parking Policy	Car Sharing	Mobility Rationing	Reverse Tolling	Infrastructure Pricing	Free Public Transport
Network Performance	**No.**	**Criteria**	**Explanation**	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**	**Option 7**	**Option 8**	**Option 9**	**Option 10**	**Option 11**	**Option 12**	**Option 13**	**Option 14**	**Option 15**	**Option 16**	**Option 17**	**Option 18**	**Option 19**	**Option 20**	**Option 21**	**Option 22**	**Option 23**	**Option 24**	**Option 25**	**Option 26**
Reduce Congestion	1	*Traffic coverage*	Extent to which the option maximises the impacts on congested network areas	Less impact due to smaller coverage, than IC	Similar to CBD cordon.	Slightly less impact than IC.	Slightly less impact than IC.		Significantly better impact than IC. 17% vs 44% of trips due to internal trip charge.	Less impact than IC because it doesn't pick up congestion within cordon.	Significant coverage as it's covering all trips within area.	Replicates the performance of the cbd option. Less impact than IC.	More targeted as a proxy for congestion than the IC. Significantly better impacts than the IC.	Better than the IC as it captures more than the isthmus.	Could have significant diversion impacts and therefore inducing congestion on the surrounding roads. Significantly worse than IC.	Will cover significant areas of congestion.	Specifically targets areas where we want to reduce congestion. Significantly better impact than IC.	Very similar to strategic corridor, overall significantly better impacts than IC.	GPS based scheme, should be perfect (albeit can't be implemented yet). Significantly better impact than IC.	Less impact than IC as they take away capacity and will be practically constrained in their implementation.	Very similar to strategic corridor option.	10% increase in fuel cost will have a negligible impact targeted on congestion. Fuel costs currently fluctuate anyway. Whilst it covers all trips, it does not target congestion directly.	Poorly targeted in terms of time of day, but if cost is high enough, it might be similar or have a better impact that RFT.	Could target this better than RFT and RRF, however there is a lot of private parking, so it may not target enough. Applying a levy to private parking would have the most impact, but highly problematic. Ability to reduce congestion - may be a suitable complementary option. This was looked at in the ARPES study and it was evaluated as performing poorly, partly because of implementation challenges.	NZTA study on mobility as a service has identified transport sharing apps. HOT lanes in the US are not having a big impact on congestion. Considered less effective than the isthmus cordon scheme. Existing T2 and T3 lanes in Auckland are underutilised. Has practicality issues and lacks incentive to do it. Supporting measure.	Less effective than previous non-price options. Likely to reduce car travel, but not necessarily congestion.	Not sustainable over a long period of time. It has had an impact on congestion in the trials in the Netherlands, however it is not economically sustainable.	Limited opportunity to create new infrastructure. More likely to accelerate congestion.	Would not have a strong effect, without additional PT intervention due to existing PT capacity constraints. Unlikely to be economically sustainable.
	2	*Average speed / trip time*	Extent to which the option improves average trip speeds and times	Comment as for #1																										
	3	*Unintended consequences*	Extent to which the option generates negative unintended network impacts	Small area and less potential for diversion affects. Slightly better than IC	Small area and less potential for diversion affects. Slightly better than IC	Very similar to IC	Very similar to IC		Very similar to IC	Less unintended affects than the IC, due to cordon being further out and likely harder to avoid.	Less unintended affects than the IC. Less potential for diversion etc.	Similar to the CBD and Urban cordon. Urban cordon and CBD were both ranked 1.	May require resident parking schemes on local residential areas. Lots of diversion opportunity. Negative unintended impact, including parking just outside cordons.	Slightly worse than IC, due to extent of cordons proposed.	Significantly worse than IC. Will create diversions.	Will get a bit of local rat running. Multiple barriers, likely to suppress short trips. Similar on balance than IC for unintended consequences.	Suggests this is better than the corridor option. Should be slightly better than the IC as it will be targeted and dynamic.	Will be similar to strategic corridor and CBD area, so similar impact compared to IC unintended consequences.	Pricing everything, so no diversion potential, therefore significantly better than IC. No ability to avoid.	Practicality issues. Unlikely to have unintended consequences, therefore, slightly less impact than IC.	On balance, similar to strategic corridor and therefore similar to IC.	People who don't travel on the network (ie. diesel users for tractors and boats etc) will still have to pay, however that wont be a negative impact on the network.	All company fleets etc would be registered outside of Auckland, however that wont be a negative impact on the network.	Worse than isthmus cordon as it will cause people to park irregularly Will have significant unintended consequences near the cordon boundaries.	No unintended affects or impact on network.	Similar to RFT etc in regards to adverse network affect.	Better than IC as it is paying people not to drive.	Under law, a non tolled option must be available. New capacity will mean that the unintended consequences are less than the IC.	Crowding. PT creates congestion/informal park'n'ride. Similar to IC on balance.
	4	*Severe congestion*	Extent to which the option reduces the amount of time spent in severe congestion	Comment as for #1																										
Improve PT and Active Modes	5	*Freight trips*	Extent to which the option impacts freight trip times	Will impact on the Port due to the off ramp, which could be positive for freight, but just less than the IC due to coverage.	Similar to CBD Cordon option.	Similar to CBD cordon option, slightly less than IC due to coverage.	Less freight affected, compared to IC. Slightly less impact compared to IC.		Significantly better impact than IC because of the area nature.	Less impact than IC.	Significantly better impact than IC due to area coverage.	Wont do much more than the Urban cordon, slightly less impact than IC.	Better impact than IC, will be on par with Isthmus area score	Similar to the isthmus area performance on balance, will be better than IC.	Will be good for freight on the SH's, however it will still be congested getting to the network. Slightly better impact than IC.	One of the best for freight trip impacts. Better than the SH option. Significantly better than IC.	One of the best for freight trip impacts. Better than the SH option. Significantly better than IC.	Very similar to strategic corridor, overall significantly better impacts than IC.	Very similar to strategic corridor, overall significantly better impacts than IC.	Less than cordon as it takes away effective freight capacity (freight can't use express lanes).	One of the best for freight trip impacts. Better than the SH option. Significantly better than IC.	All freight trips are impacted (cost), but time to pay, likely similar or only slightly worse than IC.	All freight trips are impacted (cost) unless registered outside region, but time impact likely similar or only slightly worse than IC.	Will have less of an affect on freight, than the isthmus cordon.	Not getting the benefit of an isthmus cordon, however that is only within cordon. On balance, similar to IC.	Freight assumed as exempt, whilst number of cars on road reduced, therefore better impact on freight trip times than IC.	Assuming only private vehicles affected, therefore freight not affected compared to IC.	Less impact on freight than IC. Highly dependent on where new infrastructure occurs.	More capacity available for freight, so may be similar to IC.
	6	*Travel reliability*	Extent to which the option improves travel reliability	Comment as for #1																										
	7	*PT mode share* *Based on existing PT Networks* *(assumes increase in PT mj's is viewed as net)*	Extent to which the option increases PT mode share	Assume more trips can be readily made with PT alternative, so better than IC	Assume more trips can be readily made with PT alternative, so better than IC	Similar to IC	Similar to IC		Similar to IC	Similar to IC	Similar to IC	Similar to IC	Slightly better than IC because of PT nodes at most employment centres	Similar to IC	Similar to IC	Incentivised to use alternative modes of transport. Should be better than IC to increase PT due to PT coverage	Incentivised to use alternative modes of transport. Should be better than IC to increase PT due to PT coverage	Incentivised to use alternative modes of transport. Should be better than IC to increase PT due to PT coverage	Incentivised to use alternative modes of transport. Should be better than IC to increase PT due to PT coverage	Inferior to IC. Can undermine public transport.	Incentivised to use alternative modes of transport. Should be better than IC to increase PT due to PT coverage	Similar or less impact on PT mode share, than Isthmus cordon	Will be similar to the RFT	Likely to incentivise people more to use PT, than the isthmus cordon	Negative impact on Public Transport use	Forcing people to use PT.	Incentivising people to use PT/alternatives	Providing new capacity, likely to induce more vehicle demand.	Would increase PT mode share significantly.
	8	*Active mode share* *(assumes increase in active mj's is viewed as net)*	Extent to which the option increases active mode share	Better than IC. Will increase active modes for very short walk trips.	Better than IC. Will increase active modes for very short walk trips.																						Not as incentivised as shift to PT.		Would discourage walking achievable distances (people now opt for 'lazy' option).
SUB-TOTAL	**8**		61.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

B. Social/Economic/Environmental/Safety Considerations																														
Social/Economic	**No.**	**Criteria**	**Explanation**	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**	**Option 7**	**Option 8**	**Option 9**	**Option 10**	**Option 11**	**Option 12**	**Option 13**	**Option 14**	**Option 15**	**Option 16**	**Option 17**	**Option 18**	**Option 19**	**Option 20**	**Option 21**	**Option 22**	**Option 23**	**Option 24**	**Option 25**	**Option 26**
Promote Fairness	9	*Public acceptability*	Extent to which the option is considered 'fair' in terms of those generating congestion, those paying for mitigation and those benefiting from intervention	Significant better acceptability vs IC	Better than IC, not as good as CBD cordon however due to area nature	Not as good as CBD cordon, but better than IC as less people affected.	Less acceptable than IC due to resident impacts.		Large area. Areas are less acceptable / fair than cordons due to coverage.	Feels like a gate to Auckland. Worse impact than IC.	Not acceptable, people will be very against having to pay every time they go somewhere.	Less acceptable than the CBD cordon, significantly less acceptable than IC	Significantly adverse, may prevent employment	Very poor, but noted that you can circulate within zones.	this will be seen as quite fair, compared to the IC	People know that motorways and other main arteries are congested, so this will be seen as a fairer option than IC. Could be more outcry, but considered fairer.	People know that motorways and other main arteries are congested, so this will be seen as a fairer option than IC. Could be more outcry, but considered fairer.	Same as previous, better than IC	Big change, acceptable in the future. Like moving to a whole new world, people may not like OBU's and there could be a lack of trust. Alternatives not available to certain areas, ie. large rural areas that are uncongested. Significantly worse impacts than the IC.	In America, seen as inequitable and unfair "Lexus lanes". Worse than IC.	Similar to strategic corridor	There has been minimal impact (backlash) to the RFT. It may appear acceptable, but it is regressive.	This will be highly unacceptable. People are likely to register cars elsewhere and wont see it as fair compared to other regions.	Parking is seen as a right. Has historically been highly contentious.	Well received as a good idea. High public acceptability.	Not considered acceptable	Will be quite polarising. Considered more acceptable than isthmus cordon as it is not directly taking money away from people.	Considered fair compared to isthmus cordon as not charging for an existing service.	Could be quite polarising. Believe this would be seen as acceptable by most, until funding is discussed/realised
Minimize Equity Impacts	10	*Household equity*	Extent to which the option impacts groups of users and households (eg costs/benefits) in an equitable manner	Significantly better than IC	Very similar to CBD cordon	Better than IC	More equitable than cordon and IC as it charges people that live within the area (who also get the benefit) also.		All will benefit, but not all will impact on congestion. Less equitable than IC	Significantly adverse for people outside of cordon	Significantly worse than IC	Same as urban cordon	will target many lower socio economic groups whose residence are near employment centres	cordon lines will create significant household equity issues within neighbourhoods	SH's are the only option for many areas. This will have negative affects	Slightly better than SH corridor option. Will impact more people. Slightly better than the IC.	Slightly better than SH corridor option. Will impact more people. Slightly better than the IC.	Same as previous, slightly better than IC	Better potential to target those causing congestion and benefitting from reduction. Better than IC.	Significantly worse. Benefits higher income people, eg. 'Lexus Lanes'	Similar to strategic corridor	Regressive, compared to the IC.	Significant negative affect on households, compared to IC. Highly regressive.	Likely to affect more lower income people as they tend to drive more. Potentially regressive. Will affect all people who drive to work and park outside of CBD, which isn't currently charged.	No/negligible equity issues so slightly better than IC	Similar to Regional Registration. Will have significant negative impact, compared to IC.	We don't yet know who would take up this benefit. Likely to favour those who are affluent and able to be flexible with travel times. Similar effect to IC.	Better than IC as beneficiaries are paying.	Very positive for household equity vs IC (dependent on funding)
	11	*Business equity*	Extent to which the option impacts businesses (eg costs/benefits) in an equitable manner	Significantly better than IC	Very similar to CBD cordon	Similar to IC in relation to business	May reduce business, therefore negative impacts vs IC.		Slightly worse than the cordon given the area coverage	Slightly adverse for businesses compared to IC	Significantly worse than IC	Same as urban cordon	Targets business trips located in major employment areas. Significant business inequity issues.	Will have considerable business equity issues due to extent of cordons	Better impact than the IC from business perspective	Similar to SH corridor option, better than the IC.	Similar to Strategic corridor option, better than the IC.	Similar to Strategic corridor option, better than the IC.	Better potential to target those causing congestion and benefitting from reduction. Better than IC.	Slightly better than IC. Business can opt to pay for the benefit they receive	Similar to Strategic corridor option, better than the IC.	Better than the isthmus cordon as all business' are affected equally	Big business' can probably avoid it, however small business' won't be able to. Larger inequity issues than IC - discriminates by business size.	Penalises businesses who have parking. Doesn't affect businesses equally	No/negligible equity issues so slightly better than IC	Minor business equity issues due to rationing impact impacting businesses to different extent. On balance similar to IC	No/negligible business equity issues so slightly better than IC	Better than IC as beneficiaries are paying.	Better than IC. Business's may have better access to a larger labour pool and favoured when located near PT nodes.
	12	*Spatial equity*	Extent to which the option impacts communities/geographical areas (eg costs/benefits) in an equitable manner	Significantly better than IC	Very similar to CBD cordon	Some spatial inequity, similar to IC on balance	Some spatial inequity, similar to IC on balance		Slightly worse than the cordon given the area coverage impacting all people on one side of the line	Significant impacts due to cutting through south area communities	Significant impacts due to cutting through south area communities and impacting the part of communities on the inside of the area	Same as urban cordon	Cordon lines will create significant spatial equity issues around the employment areas	Creates boundary effects though circulation within zones unaffected, worse than IC	Affects main routes that don't have good alternatives. Not as bad as employment centres option. Not as bad as the urban area, but worse than the IC.	Slightly better than the IC as no boundary effects	Similar to Strategic corridor option, better than the IC.	Similar to Strategic corridor option, better than the IC.	Better potential to target those causing congestion and benefitting from reduction. Better than IC.	Limited application means spatial issues will be minimal, slightly better than IC	Similar to Strategic corridor option, better than the IC.	Better than IC as doesn't discriminate between areas	Better than IC as doesn't discriminate between areas	More areas to impact, so less equitable. Higher impact than IC.	No/negligible spatial equity issues so slightly better than IC	No/negligible spatial equity issues so slightly better than IC	No/negligible spatial equity issues so slightly better than IC	Neutral with IC.	Better than IC.
Environmental																														
Lower Vehicle Emissions	13	*Vehicle emissions*	Extent to which the option reduces vehicle emissions	Similar to IC	Similar to IC	Similar to IC	Similar to IC		Larger impact (area covered), better emission reduction potential	Similar to IC	Larger impact (trips/area covered), better emission reduction potential	Similar to IC	Similar to IC	Larger impact (trips/area covered), better emission reduction potential	Diversion to local network may increase emissions	Larger impact (trips/area covered), better emission reduction potential	Larger impact (trips/area covered), better emission reduction potential	Larger impact (trips/area covered), better emission reduction potential	Best impact (in theory) to reduce emissions	Increases congestion (and therefore emissions) on surrounding areas as capacity is removed	Larger impact (trips/area covered), better emission reduction potential	May reduce some travel, but doesn't target congestion - balance slightly poorer performance than IC	May reduce some travel, but doesn't target congestion - balance slightly poorer performance than IC	No/negligible impact on emissions	No/negligible impact on emissions	No/negligible impact on emissions given ways to avoid scheme	No/negligible impact on emissions	May actually increase emissions	On balance similar to IC
Improve External Outcomes	14	*External impacts*	Extent to which the option minimises other external impacts including air quality, noise, visual disturbance, vibration, water quality and community severance	Similar to IC	Area type scheme generally have worse community severance issues. Small area, slightly worse than IC	Similar to IC	Area type scheme generally have worse community severance issues. Small area, slightly worse than IC		Area type scheme generally have worse community severance issues. Slightly worse than IC	Similar to IC on balance, even though cordon is much larger	Large area reduces impact of community severance. On balance, similar to IC	Similar to IC on balance, even though cordon is much larger	Significant community severance, large residential populations within the employment zones	Major community severance issues	Major community severance issues, given SH travel is only practical options for many communities	Coverage of strategic corridors will create more community severance than the IC	Coverage of strategic corridors will create more community severance than the IC	Coverage of strategic corridors will create more community severance than the IC	No community severance issues, therefore better than IC	Limited application means severance will be minimal, slightly better than IC	Coverage of strategic corridors will create more community severance than the IC	No community severance issues, therefore better than IC	No community severance issues, therefore better than IC	Likely to create more community issues than the IC (depending on reach of scheme),	No community severance issues, therefore better than IC	No community severance issues, therefore better than IC	No community severance issues, therefore better than IC	No community severance issues, therefore better than IC	No community severance issues, therefore better than IC
Safety Impacts																														
Improve Transport Safety	15	*Safety*	Extent to which the option improves transport safety outcomes	No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC		No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC	Boundary effects of many cordons increase potential safety risk in those areas	No/negligible difference to IC	Likely diversion to local network increases safety risk	No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC	Personal safety risk, albeit low	No/negligible difference to IC	No/negligible difference to IC	No/negligible difference to IC	Crowding on PT can have slight safety concerns
SUB-TOTAL	**7**		39.00%																											

C. Other Considerations																														
Scheme Efficiency	**No.**	**Criteria**	**Explanation**	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**	**Option 7**	**Option 8**	**Option 9**	**Option 10**	**Option 11**	**Option 12**	**Option 13**	**Option 14**	**Option 15**	**Option 16**	**Option 17**	**Option 18**	**Option 19**	**Option 20**	**Option 21**	**Option 22**	**Option 23**	**Option 24**	**Option 25**	**Option 26**
Promote Efficiency	16	*Efficiency*	Extent to which the option is cost effective to develop, build and operate	Low capex and low opex costs.	Medium capex and low opex costs.	Medium capex and low opex costs.	Medium capex and low opex costs.	Low capex and low-medium opex costs.	High capex and medium opex costs.	Medium capex and medium opex costs.	V. High capex and medium opex costs.	High capex and low-medium opex costs.	V. High capex and medium opex costs.	V. High capex and medium opex costs.	High capex and low-medium opex costs.	V. High capex and low-medium opex costs.	V. High capex and low-medium opex costs.	V. High capex and medium opex costs.	V. High capex and high opex costs.	High capex and low opex costs.	V. High capex and medium-high opex costs.	Complex implementation Very low cost	Simple and easy to implement, hard to enforce. Very low cost, moderate opex	Depends on implementation and enforcement regime. Generally builds on existing policy/scheme	Low cost, building on existing initiatives.	Depends on implementation and enforcement regime.	Depends on implementation. May require capex for extra PT capacity and supporting infr. V high capex, V high opex	Can help with funding gap for new infr in the long term.	Would require large subsidy cost. Also require capex for extra capacity and supporting infr. Will have real constraints in terms of additional capacity creation.
Promote Flexibility	17	*Flexibility*	Extent to which the option is adaptable to changing circumstances, technology and scheme coverage	Supports scheme extension and advanced technology.	Supports scheme extension and advanced technology. Area slightly less flexible than cordon.	Supports scheme extension and advanced technology.	Supports scheme extension and advanced technology. Area slightly less flexible than cordon.	Supports scheme extension and advanced technology.	Supports scheme extension and advanced technology. Area slightly less flexible than cordon.	Supports scheme extension and advanced technology.	Supports scheme extension and advanced technology. Area slightly less flexible than cordon.	Supports scheme extension and advanced technology.	Supports scheme extension and advanced technology. Extent of scheme less flexible than cordon.	Supports scheme extension and advanced technology.	Supports scheme extension and advanced technology.	Supports scheme extension and advanced technology.	Supports scheme extension and advanced technology.	Supports scheme extension and advanced technology.	Supports scheme extension and advanced technology.	Utilises advanced technology and supports range of tariffs. Highly flexible	Express lanes require considerable fixed infrastructure	Express lanes require considerable fixed infrastructure	No flexibility. Doesn't support targeting congestion or adaption to advanced schemes	No flexibility. Doesn't support targeting congestion or adaption to advanced schemes	Can be adapted and scaled over time. Already being delivered, but could be expanded.	Technology enabled, should be adaptable to broad transport change.	Variable payment/reward by time/location can help target outcomes. Requires technology support	Highly inflexible.	Highly inflexible.
Promote Compliance	18	*Enforcement*	Extent to which the option can be readily enforced	Low risks around enforcement.	Low risks around enforcement.	Low risks around enforcement.	Some risks around enforcement due to area coverage	Low risks around enforcement.	Some risks around enforcement due to area coverage	Low risks around enforcement.	Some risks around enforcement due to area coverage	Low risks around enforcement.	High risks around enforcement.	Some risks around enforcement due to scale	Low risks around enforcement.	Some risks around enforcement.	Some risks around enforcement.	Some risks around enforcement.	Very high risks around enforcement.	Low risks around enforcement.	Some risks around enforcement.	None required. Work with petrol companies.	Very high risks around enforcement.	Very high risks around enforcement. Difficult to enforce with private land owners. (impossible?) Would require increased parking enforcement	Less enforcement risk than IC	Very high risks around enforcement.	High risks around enforcement.	Existing enforcement can be leveraged	None required
Support Privacy	19	*Privacy*	Extent to which the option can address privacy concerns	Minimal privacy concerns.	Minimal privacy concerns. Area scheme slightly worse than IC	Minimal privacy concerns.	Minimal privacy concerns. Area scheme slightly worse than IC	Minimal privacy concerns.	Minimal privacy concerns. Area scheme slightly worse than IC	Minimal privacy concerns.	Minimal privacy concerns. Area scheme slightly worse than IC	Minimal privacy concerns.	Minimal privacy concerns.	Minimal privacy concerns.	Minimal privacy concerns. Corridor scheme slightly worse than IC	Minimal privacy concerns. Corridor scheme slightly worse than IC	Minimal privacy concerns. Corridor scheme slightly worse than IC	Minimal privacy concerns. Corridor scheme slightly worse than IC	Very strong privacy concerns.	Minimal privacy concerns. Corridor scheme slightly worse than IC	Minimal privacy concerns. Corridor scheme slightly worse than IC	Minimal privacy concerns.	Significant privacy concerns related to enforcement.	Significant privacy concerns related to enforcement.	Minimal privacy concerns.	Minimal privacy concerns.	Depends on implementation. Eg travel tracking may raise privacy concerns.	Minimal privacy concerns.	Minimal privacy concerns.
Minimize Risks	20	*Risk*	Extent to which risks associated with the option are unknown or cannot be mitigated	Low risk and international precedents. Good stepping stone. Better than IC	Low risk and international precedents. Good stepping stone. Better than IC	Low risk and international precedents.	Low risk and international precedents, larger area coverage. On balance slightly riskier than IC	No international precedent for large scheme.	No international precedent for large scheme, area scheme adds risk	No international precedent for large scheme.	No international precedent for large scheme, area scheme adds risk	No international precedent for large scheme.	Major risk related to ability to confine/define employment zones.	No international precedent for zonal scheme. Significant risks with defining cordons	Major risk to surrounding road network	Similar to Singapore	Concept well proven in Singapore.	Similar to Singapore	Major risk and no international precedent	Concept well proven and international precedents, but very few obvious locations to implement for AKL	Concept well proven and international precedents, but very few obvious locations to implement for AKL (for express lanes)	Minimal privacy concerns.	Potential to create 'black market' for cars. Eg unregistered vehicles	Considerable reputation risk/backlash, implementation risk	Negligible/no risk	Need to manage abuse of system. Major risk	Need to manage abuse of system. Major risk	Major risk relates to extent of supplementary investment required ($) and service overcrowding
Revenue and Funding																														
Promote Transparency	21	Revenue	Extent to which the option can be transparent around the use of any net revenue raised	No real difference to IC	No real difference to IC	No real difference to IC	No real difference to IC	Transparency enabled	No real difference to IC	Not as transparent given scale of cordon	Not as transparent given scale of area	Not as transparent given scale of cordon	Not as transparent given scale of cordon	Not as transparent given scale of cordon	Not quite as transparent as IC given corridor nature	Not quite as transparent as IC given corridor nature	Not quite as transparent as IC given corridor nature	Not quite as transparent as IC given corridor nature	Not as transparent as IC given wide network coverage	Not quite as transparent as IC given corridor nature	Not quite as transparent as IC given corridor nature	Difficult to be transparent - other than back into the region. Non-targeted	Difficult to be transparent - other than back into the region. Non-targeted	Likely to lumped into wider parking revenue - may create transparency difficulties	N/A - score 0	Difficult to be transparent - other than back into the region. Non-targeted	N/A - score 0	Ability to use toll payment for project finance - highly transparent	N/A - score 0
Support Funding Reform	22	Funding	Extent to which the option impacts the current land transport pricing system (eg FED & RUC)	No real difference to IC	No real difference to IC	No real difference to IC	No real difference to IC	No/negligible impact on funding system	No real difference to IC	No real difference to IC	No real difference to IC	No real difference to IC	No real difference to IC	No real difference to IC	No real difference to IC	No real difference to IC	No real difference to IC	No real difference to IC	Major positive impact on transport funding	No real difference to IC	No real difference to IC	Increased complexity with FED/RUC	Increased complexity with FED/RUC	No real difference to IC	No real difference to IC	No real difference to IC	Considerable strain on transport funding	No real difference to IC	Major strain on transport funding
SUB-TOTAL	**7**		39.00%																											

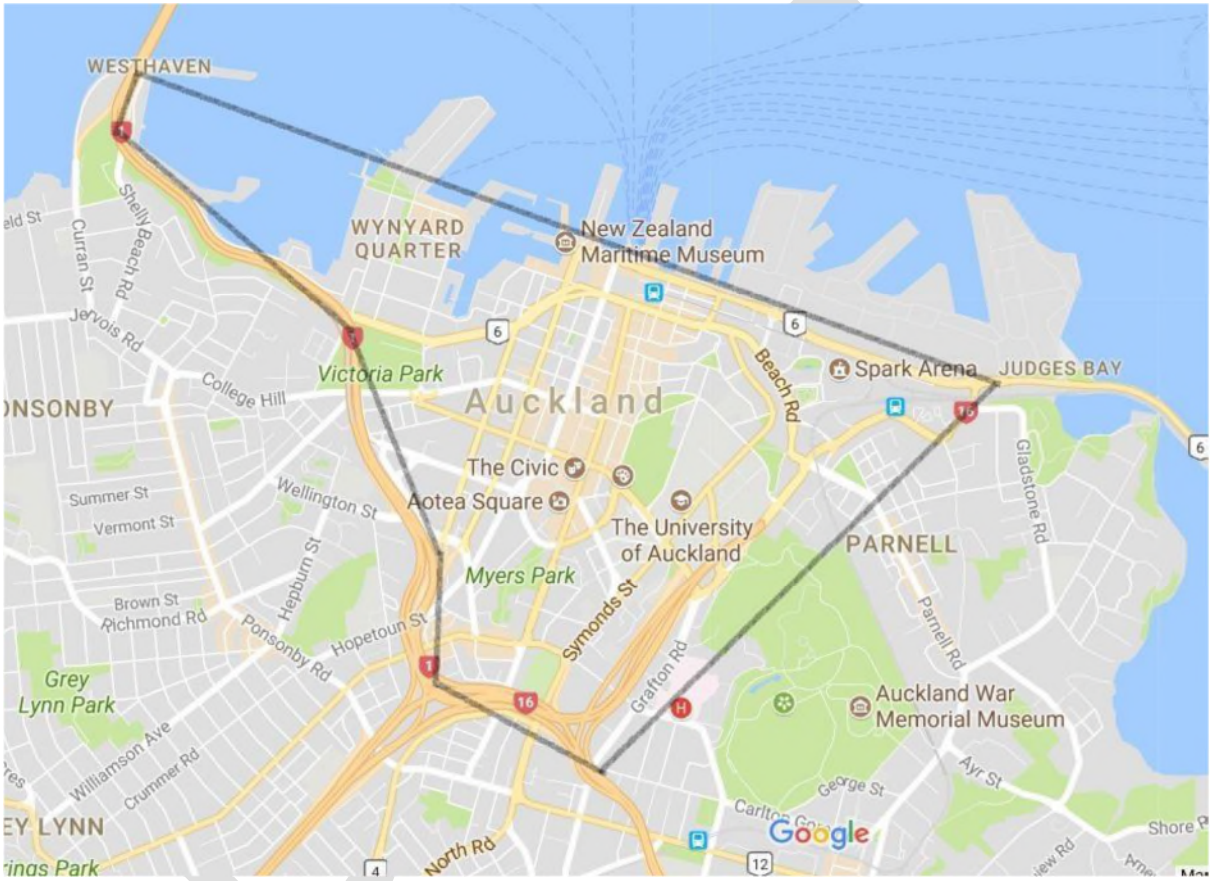
Appendix D – Longlist evaluation summary

Note: Scheme boundaries are indicative for the longlist of options, illustrating approximate coverage/location and will be subject to further refinement.

Option 1 – city centre cordon

A city centre cordon scheme is where vehicles are charged to enter and exit the city centre area (see Figure 1).

FIGURE 1: INDICATIVE MAP OF CITY CENTRE CORDON



The objective is to reduce congestion on routes leading into and across the cordon area. The scheme would target commuters passing across city centre cordon boundaries, but not traffic circulating within the city centre. Through traffic on motorways would be exempt.

Potential to improve congestion

A city centre cordon could ease congestion on key corridors leading into the city centre, such as Symonds Street, Fanshawe Street, etc. However, only approximately 6% of morning commuter trips would be impacted so it would have only a small impact on congestion at a region-wide level. Diversion impacts (people diverting to avoid paying the charge) would be minimal due to the constrained area.

Economic, social and equity considerations

Compared to the rest of Auckland, the city centre area is well-served by public transport and walking and cycling infrastructure, so many people would have alternatives to paying the charge. There is already a high mode share (39%) for public transport/active modes for work trips.

Although people travel from all over into the city centre, a large majority of morning trips (66%) originate in the Auckland isthmus. The area within the cordon is largely business-related rather than residential (for inbound trips), so the impacts on residents would be small compared to other schemes.

Efficiency, flexibility and wider considerations

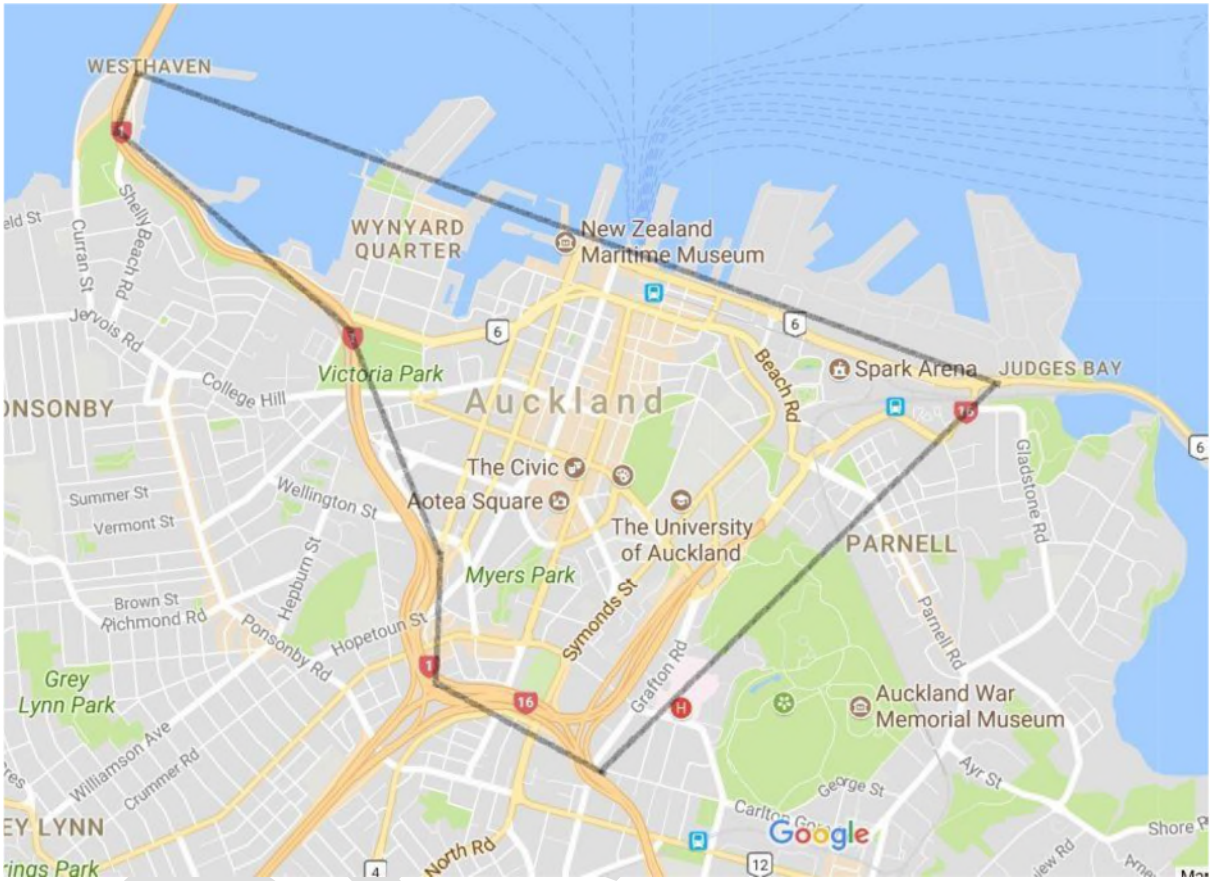
A city centre cordon would be one of the simplest and cheapest congestion pricing options to implement and operate, although it would still need infrastructure at a number of charging points to detect cars passing the cordon. It could be flexible to further expansion of congestion pricing and to new technology, such as GPS-based charging systems. It could present a low-risk 'stepping stone' to a more comprehensive pricing system.

Outcome: Progressed to shortlist.

Option 2 – city centre area

A city centre area scheme is where vehicles are charged to enter, exit and travel within the city centre area.

FIGURE 2: INDICATIVE MAP OF CITY CENTRE AREA SCHEME



The objective is to reduce congestion on routes leading into, across and within the area. The scheme would target commuters passing across city centre cordon boundaries, and traffic circulating within the city centre (for example, short taxi journeys). Through traffic on motorways would be exempt.

Potential to improve congestion

A city centre area scheme would capture only slightly more trips than a city centre cordon, so would have a very similar impact on congestion – still only targeting a small amount of congestion across the region.

Economic, social and equity considerations

Similar to the city centre cordon, this scheme would have relatively good alternatives by way of public transport, walking and cycling infrastructure, for both trips into/out of and within the area. The additional trips contained within the area would be small distances so many people would have alternatives to paying the charge. There is already a high mode share (39%) for public transport/active modes for work trips.

Efficiency, flexibility and wider considerations

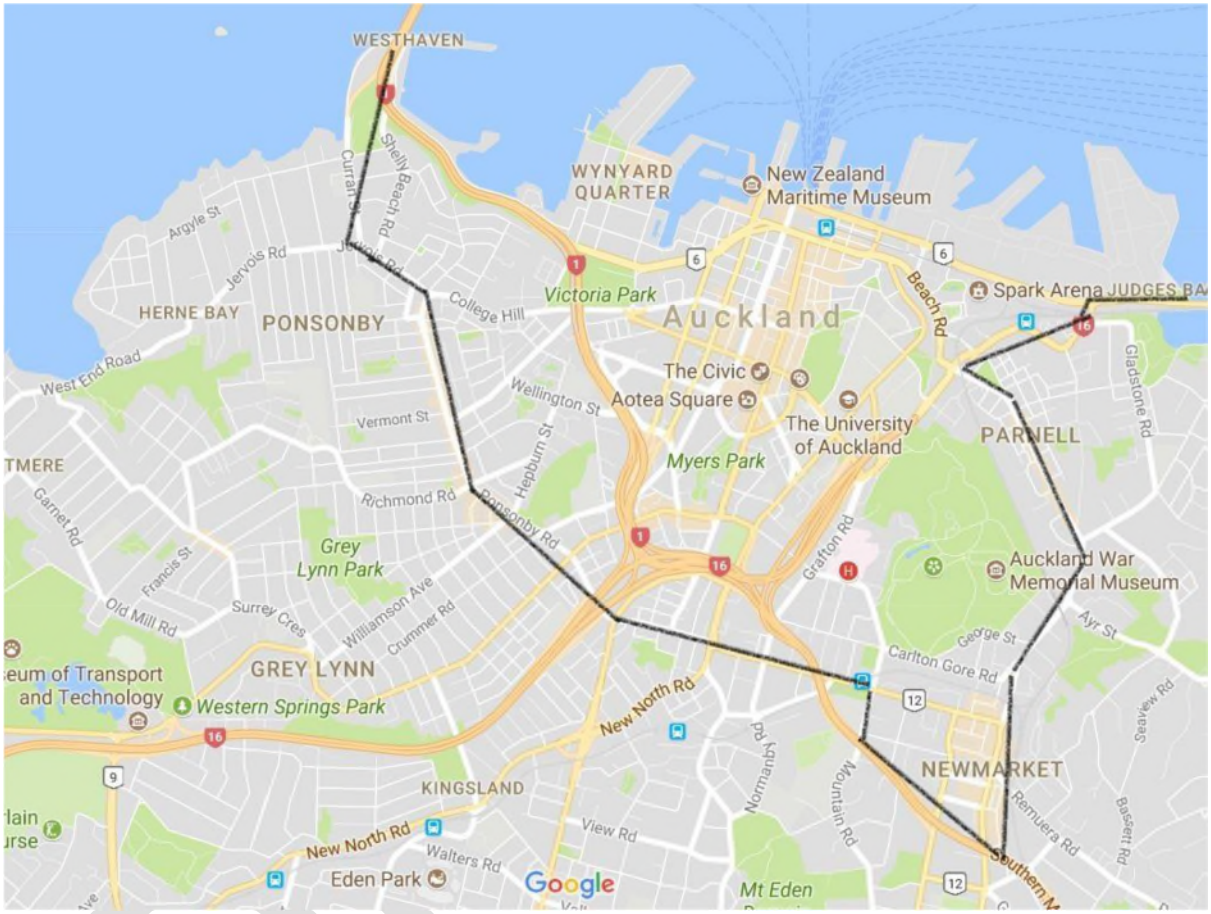
A city centre area would be more complex to operate and enforce than a city centre cordon, as detecting trips circulating within the area would require additional charging points, for very little benefit in terms of congestion reduction. On an Auckland-wide scale, it would still represent a relatively straightforward entry point into implementing congestion pricing, noting it offers little (if any) benefit over a cordon scheme.

Outcome: Not progressed to shortlist.

Option 3 – Inner urban cordon

An inner urban cordon would charge vehicles to enter and exit the inner urban area (defined approximately as the area in Figure 3 below).

FIGURE 3: INDICATIVE MAP OF INNER URBAN CORDON SCHEME



The objective is to reduce congestion on routes leading into and across the cordon area. Through traffic on motorways would be exempt.

Potential to improve congestion

An inner urban cordon would capture slightly more trips than the city centre cordon (approximately 9% vs 6% in the morning peak) therefore its impact on congestion is expected to be slightly better.

Economic, social and equity considerations

Similar to the city centre schemes, the inner urban area is reasonably well-served by public transport, walking and cycling infrastructure. The mode share for public transport/active modes for work trips is 30%.

This scheme has the potential for community severance issues as the cordon would cut through some of the inner urban residential suburbs (Parnell, Newmarket, Ponsonby). This creates spatial equity issues for those living on either side of the boundary, and could impact businesses close to the cordon.

Efficiency, flexibility and wider considerations

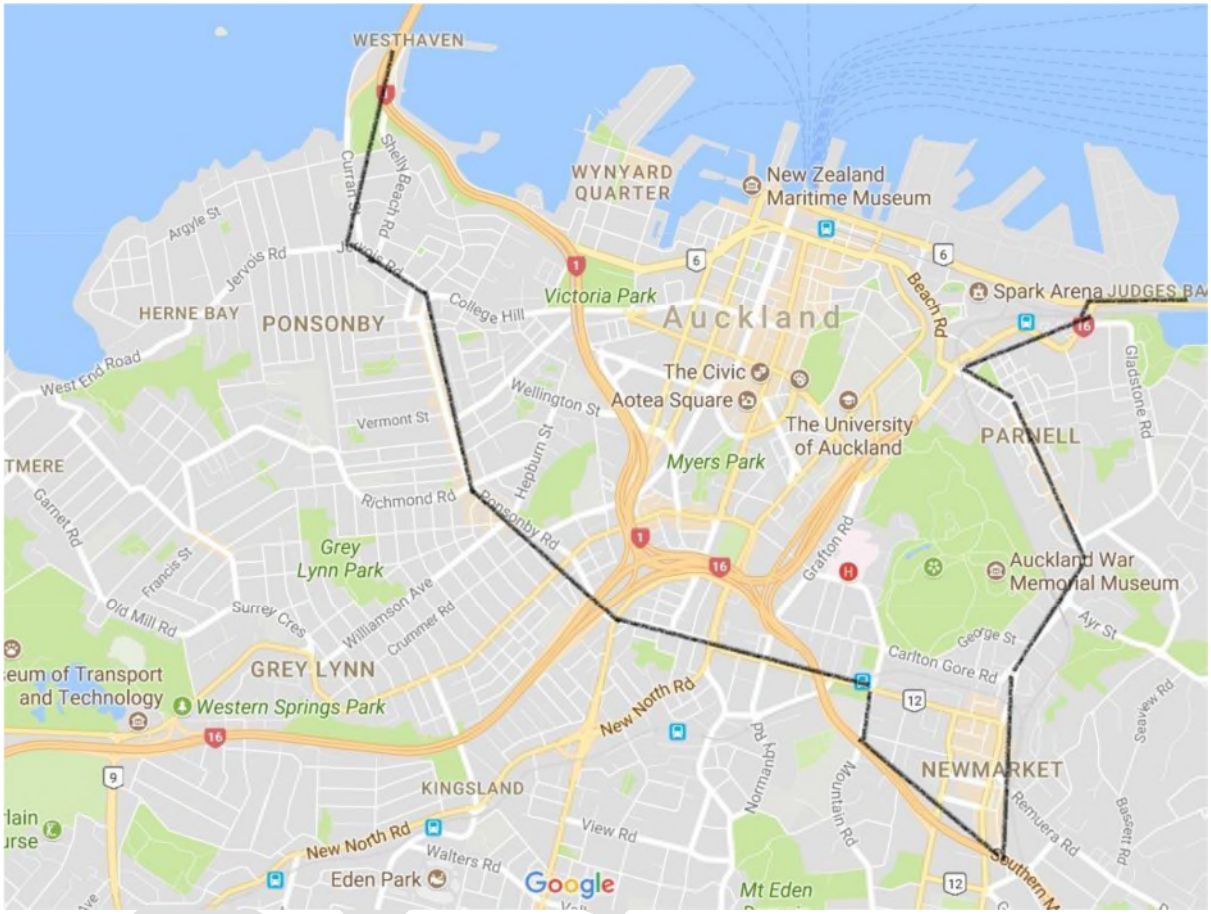
The larger cordon comes with slightly higher capital and operating costs than a city centre scheme, but still low compared with most of the options.

Outcome: Not progressed to shortlist.

Option 4 – Inner urban area

An inner urban area scheme would charge vehicles to enter, exit and travel within the inner urban area.

FIGURE 4: INDICATIVE MAP OF INNER URBAN AREA SCHEME



The objective is to reduce congestion on routes leading into, across and within the area. Through traffic on motorways would be exempt.

Potential to improve congestion

As with the city centre area and cordon, the inner urban area scheme captures marginally more trips than the equivalent cordon scheme (10% vs 9.0% of trips in the morning peak).

Economic, social and equity considerations

As with the other city centre-focused schemes, this is one of the better areas for public transport, walking and cycling alternatives in the region. However, it also has the same severance issues that the inner urban cordon scheme does, with potentially worse side effects as residents would be charged to travel anywhere within the area.

Efficiency, flexibility and wider considerations

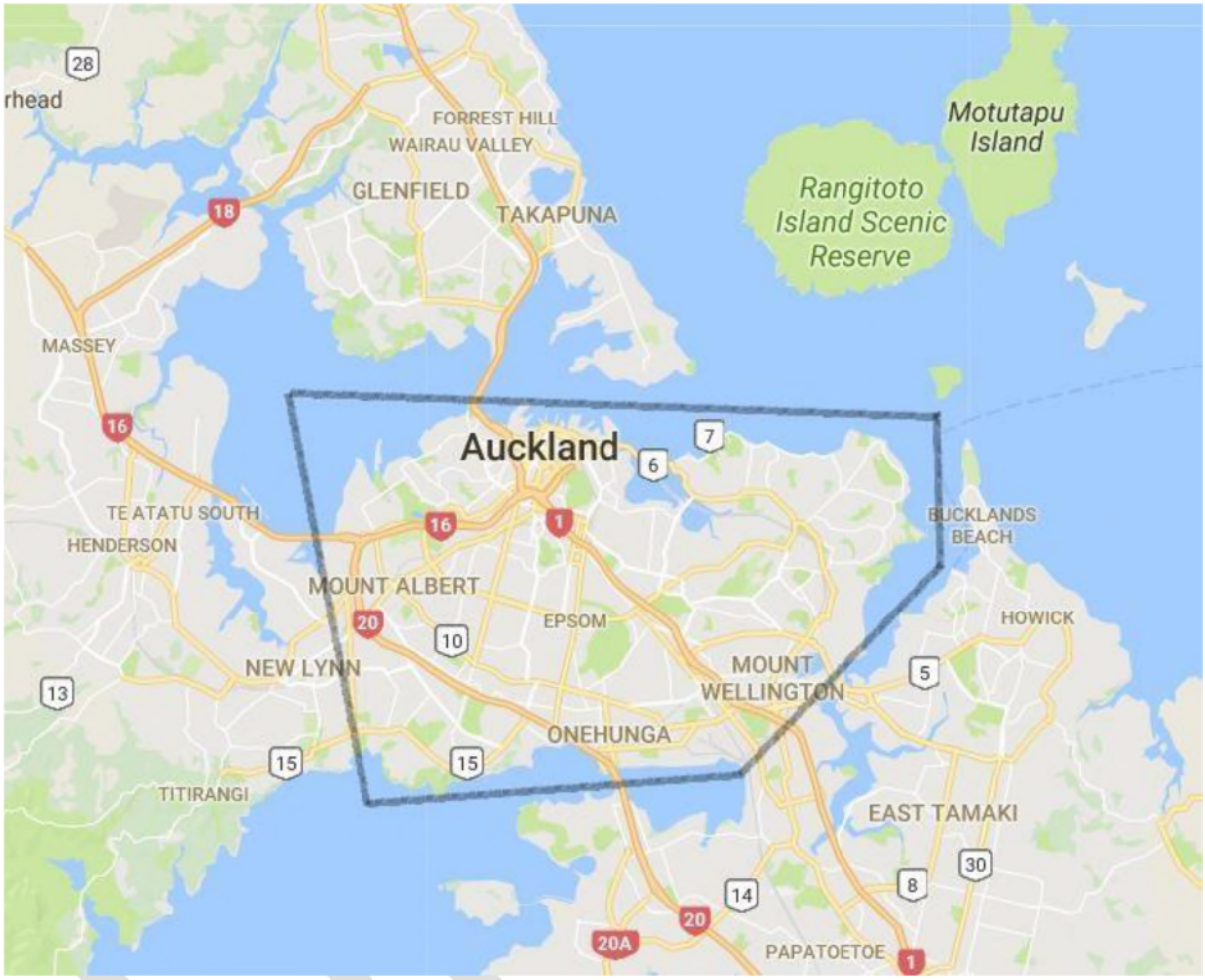
Costs would be slightly higher than the cordon equivalent, due to the wider coverage, and ease of implementation and flexibility would be slightly reduced.

Outcome: Not progressed to shortlist.

Option 5 – Isthmus cordon

An isthmus cordon scheme would charge vehicles to enter and exit a cordon around the Auckland isthmus area (see Figure 5).

FIGURE 5: INDICATIVE MAP OF ISTHMUS CORDON SCHEME



The objective is to reduce congestion on routes leading into and across the cordon area which has a number of routes with significant congestion.

Potential to improve congestion

The isthmus cordon would impact around 17% of total morning trips – around 80% of trips that originate within the isthmus area stay within the area, and would not be affected. This means the impact on congestion is expected to be moderately low. It would be difficult for traffic to divert around the cordon given the limited number of entry points into the isthmus.

Economic, social and equity considerations

Total public transport/active mode share is 18% - trips travelling along the main routes and to the city centre would have good alternatives to driving, but cross-area trips are less well supported. There could

be negative equity impacts as those living and travelling within the cordon – where average household incomes are higher – would not have to pay, whereas those travelling from west and south Auckland into the area – where average household incomes are lower – would be charged.

Efficiency, flexibility and wider considerations

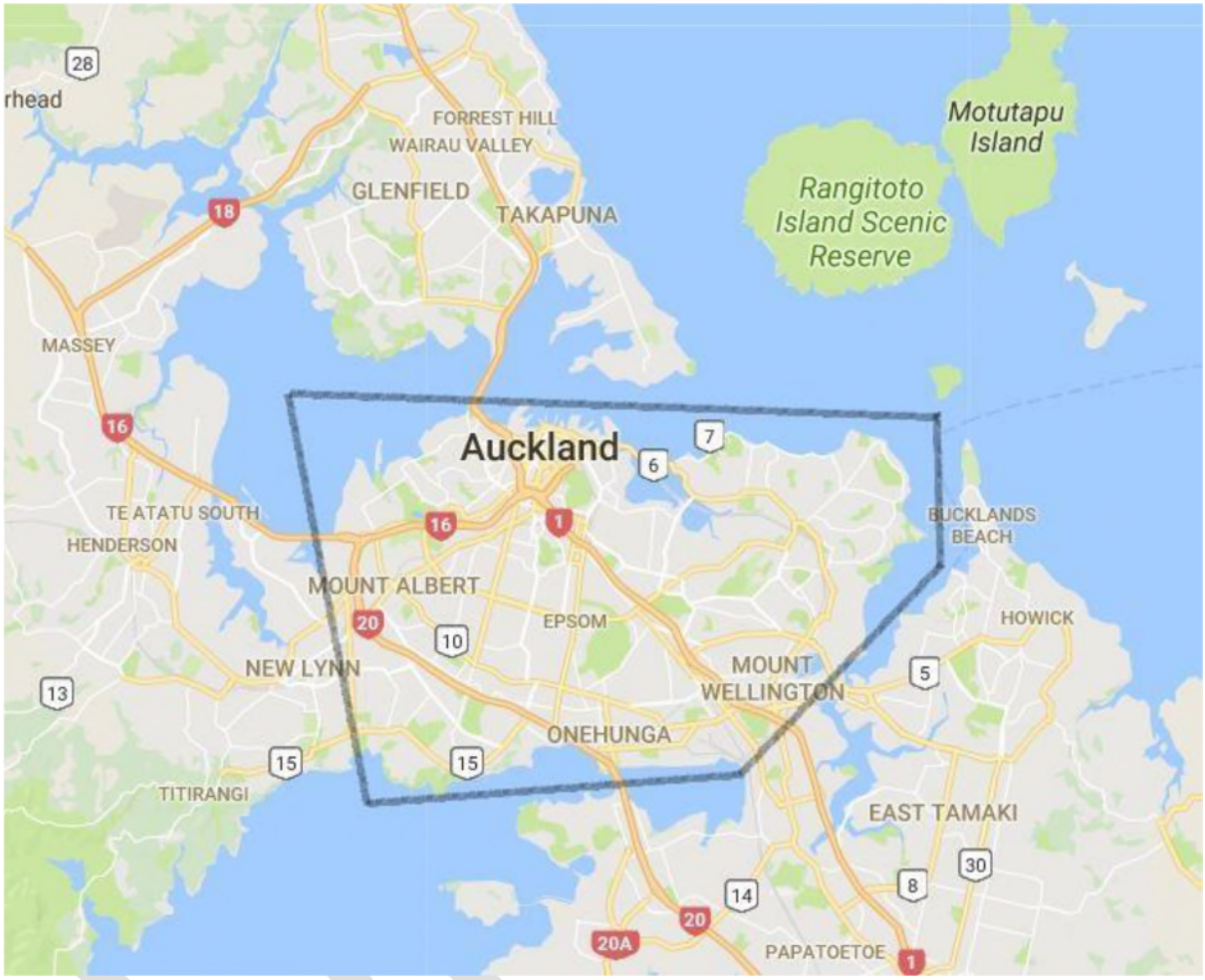
Given the small number of entry points into the area, it would be reasonably low cost and simple to implement. However, there is no international precedent for a cordon scheme this large.

Outcome: Not progressed to shortlist.

Option 6 – Isthmus area

An isthmus area scheme would charge vehicles to enter, exit and travel within the Auckland isthmus area (see Figure 6).

FIGURE 6: INDICATIVE MAP OF ISTHMUS AREA SCHEME



The objective is to reduce congestion on routes leading into, across and within the isthmus area, by targeting commuters passing across the boundary and circulating within the area. Through traffic on motorways would be exempt.

Potential to improve congestion

The scheme would capture a significant number (44%) of commuter trips, so is expected to have a significant impact on congestion.

Economic, social and equity considerations

As with the isthmus cordon area, there would be scope for some journeys to shift to public transport/active modes, although not all. It would capture a much higher proportion of trips than the cordon scheme, so overall its impacts would be greater but the likelihood of charging trips that do not

contribute to congestion is higher (it becomes difficult to target congestion, as an area scheme, especially a large one, is 'blunt'). The isthmus area scheme avoids some of the negative impacts of the cordon scheme, as trips originating within the area (from, on average, higher income households) are charged in addition to those coming from outside.

Efficiency, flexibility and wider considerations

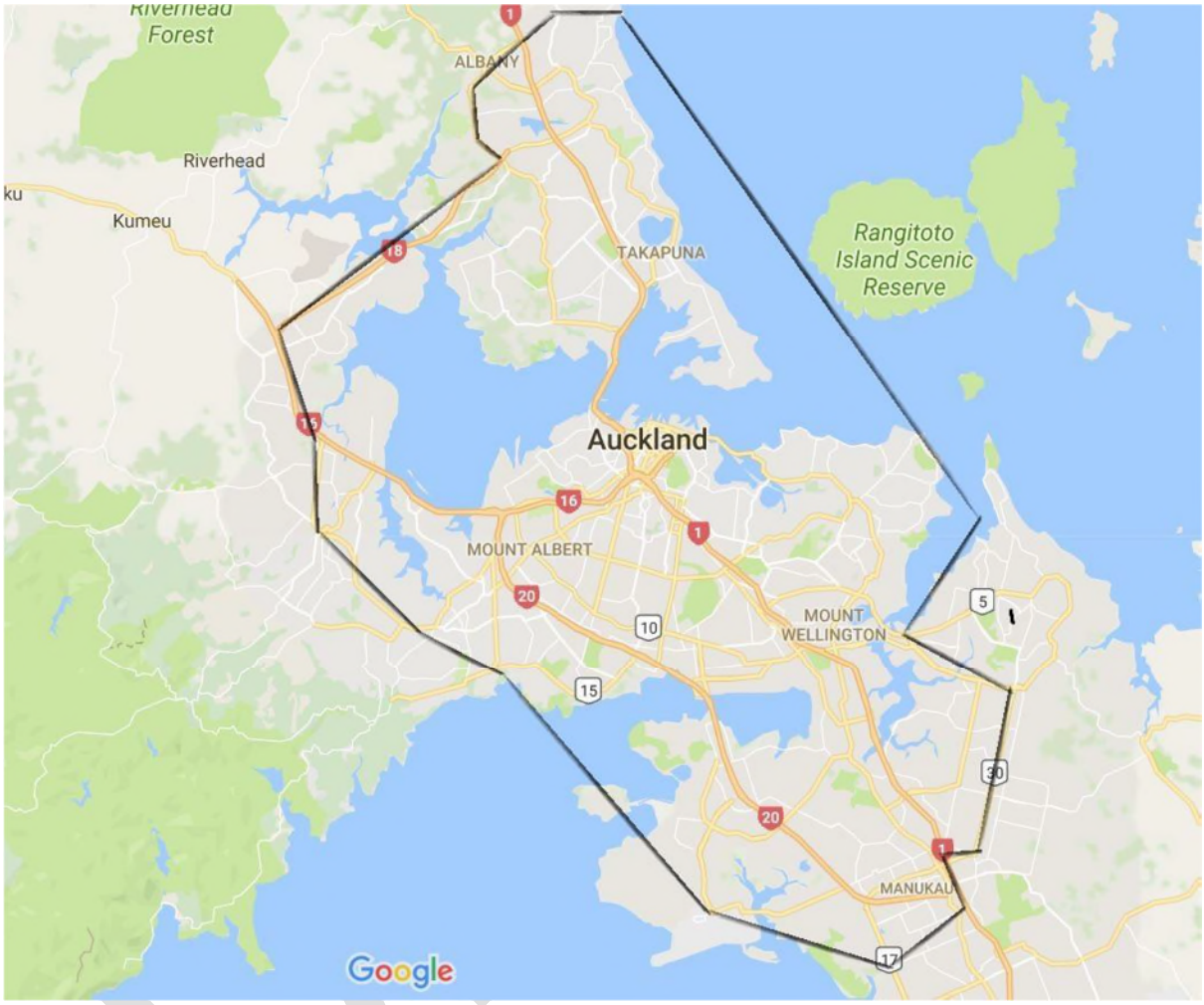
The large coverage of the area scheme means that this would have reasonable high set up and running costs, as well as making enforcement more complex and costly. Implementing an area scheme on this scale would have risks, as there is no international precedent.

Outcome: Progressed to shortlist.

Option 7 – Urban cordon

An urban area scheme would charge vehicles to enter and exit and cordon that encompasses the Isthmus and extends north to Albany, west to Henderson and south to the Airport and Wiri (see Figure 7).

FIGURE 7: INDICATIVE MAP OF URBAN CORDON SCHEME



The objective would be to reduce congestion on routes leading into the wider urban area. Through traffic on motorways would be exempt.

Potential to improve congestion

The cordon would capture around 18% of trips in the morning peak, as due to the boundaries being very wide most trips will be taking place within the boundaries and therefore not priced. It would therefore have quite a limited impact on congestion – only one percent higher than the isthmus cordon in terms of the morning peak trips that it would capture.

Economic, social and equity considerations

The cordon has a high potential for severance impacts and would impact most on those living close to but outside the cordon in north, west and south Auckland, where average household incomes are lower. The prevalence of these boundary effects raises significant equity concerns with this type of option.

Efficiency, flexibility and wider considerations

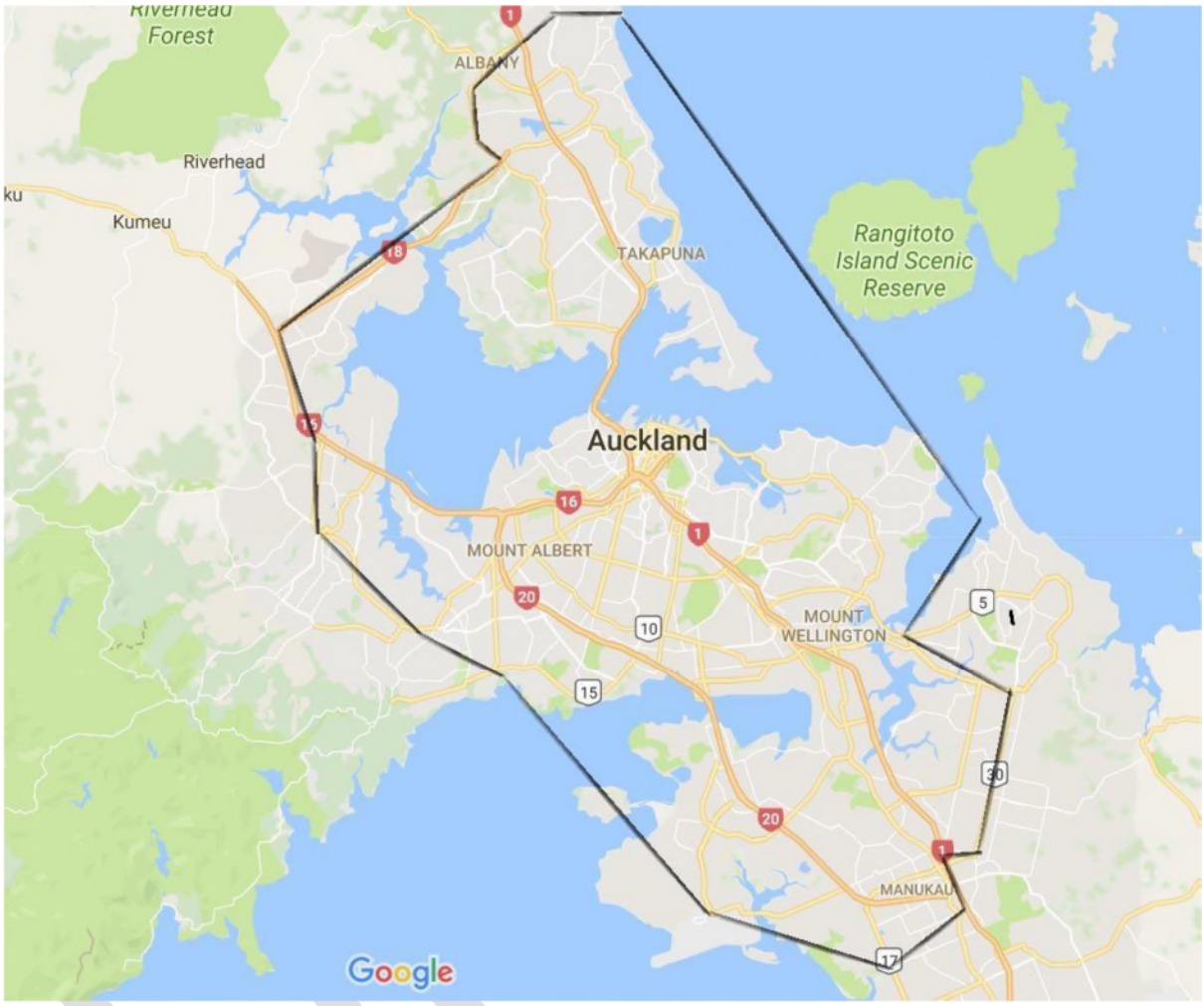
There would be a high number of charging points due to the extent of the cordon, meaning reasonably high set up and operating costs. Setting the boundary points would be a contentious issue.

Outcome: Not progressed to shortlist.

Option 8 – Urban area

An urban area scheme would charge vehicles to enter, exit and travel within the urban area (see Figure 8).

FIGURE 8: INDICATIVE MAP OF URBAN AREA SCHEME



The objective is to reduce congestion on routes leading into, across and within Auckland's wider urban area.

Potential to improve congestion

The area scheme would capture around 79% of morning trips, due to its extensive coverage, and is therefore expected to have a high impact on congestion. However, the nature of the scheme means that it is would be blunt and not targeted at congested trips.

Economic, social and equity considerations

The scheme would charge any trip during the morning peak within the entire area, and therefore will target some trips that do not contribute to congestion. As with the urban cordon, there is the potential for boundary effects and community severance, including in lower income areas such as south and west Auckland.

Efficiency, flexibility and wider considerations

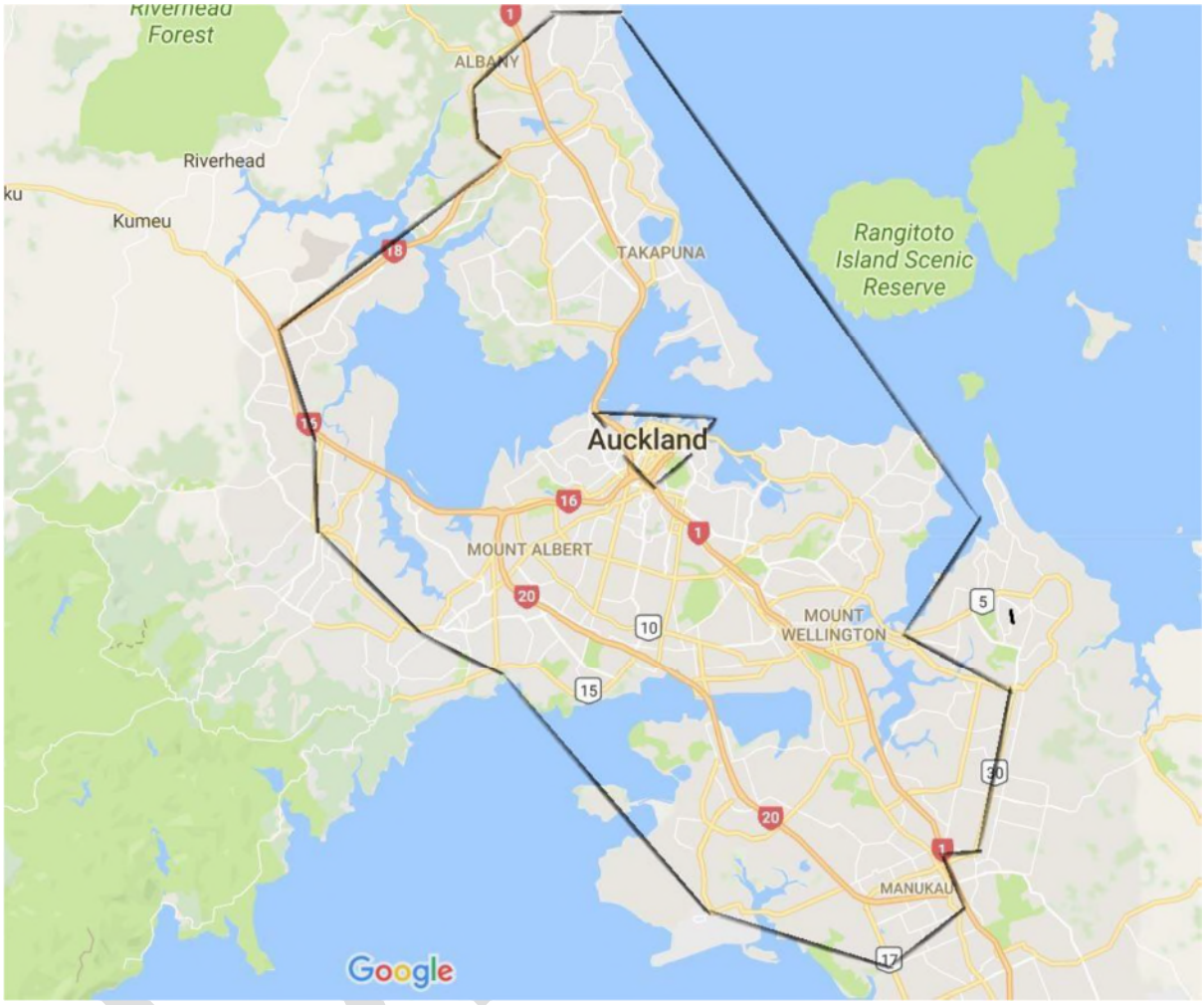
The scheme would have very high capital costs due to the scale of the coverage and number of charging points required, as well as being more difficult to enforce. The scale of the area introduces significant data and technology challenges as well.

Outcome: Not progressed to shortlist.

Option 9 – Double cordon scheme

The double cordon scheme would charge vehicles to cross either (or both) of two cordons (see Figure 9). Traffic circulating within either of the cordons would not be charged.

FIGURE 9: INDICATIVE MAP OF DOUBLE CORDON SCHEME



The objective is to reduce congestion on routes leading into and across the two cordon areas.

Potential to improve congestion

The scheme would impact around 24.2% of commuter trips, so could have a moderate impact on congestion.

Economic, social and equity considerations

The scheme would have the same potential impacts as the inner urban cordon, plus those of the city centre cordon. It would have a high impact on trips to and from west and south Auckland across the boundary locations and has a high potential for community severance in lower income areas.

Efficiency, flexibility and wider considerations

The double cordon has an additional level of complexity that could make it more challenging to implement and for users to understand. A large number of charging points around the cordons would be required so initial set up costs would be high.

Outcome: Not progressed to shortlist.

Option 10 – Employment centres scheme

This scheme would charge vehicles to enter and exit the ten main Auckland regional employment centres (city centre, Takapuna/Glenfield/Wairau, Westgate, Henderson/New Lynn, Ellerslie/East Tamaki, Onehunga, Airport precinct, Papatoetoe, Manurewa and Papakura – four of these are illustrated in Figure 10).

FIGURE 10: EXAMPLES OF INDICATIVE EMPLOYMENT CENTRES

Potential to improve congestion

The scheme would impact over 50% of commuter trips, so could have a significant impact on congestion. However, there is high potential for trips to divert around the cordons which could push traffic out onto roads that are not currently congested, having negative unintended consequences.

Economic, social and equity considerations

The scheme would have potentially negative impacts on access to employment, particularly as many of the trips to these centres would not have alternative public transport or quality walking/cycling access. Some employment centres are industrial areas which those on lower incomes would struggle to access (airport, Penrose etc) and are harder to serve with alternatives due to being lower density. It could also

negatively impact businesses in being able to attract and retain workers and lead to complex land use changes.

Efficiency, flexibility and wider considerations

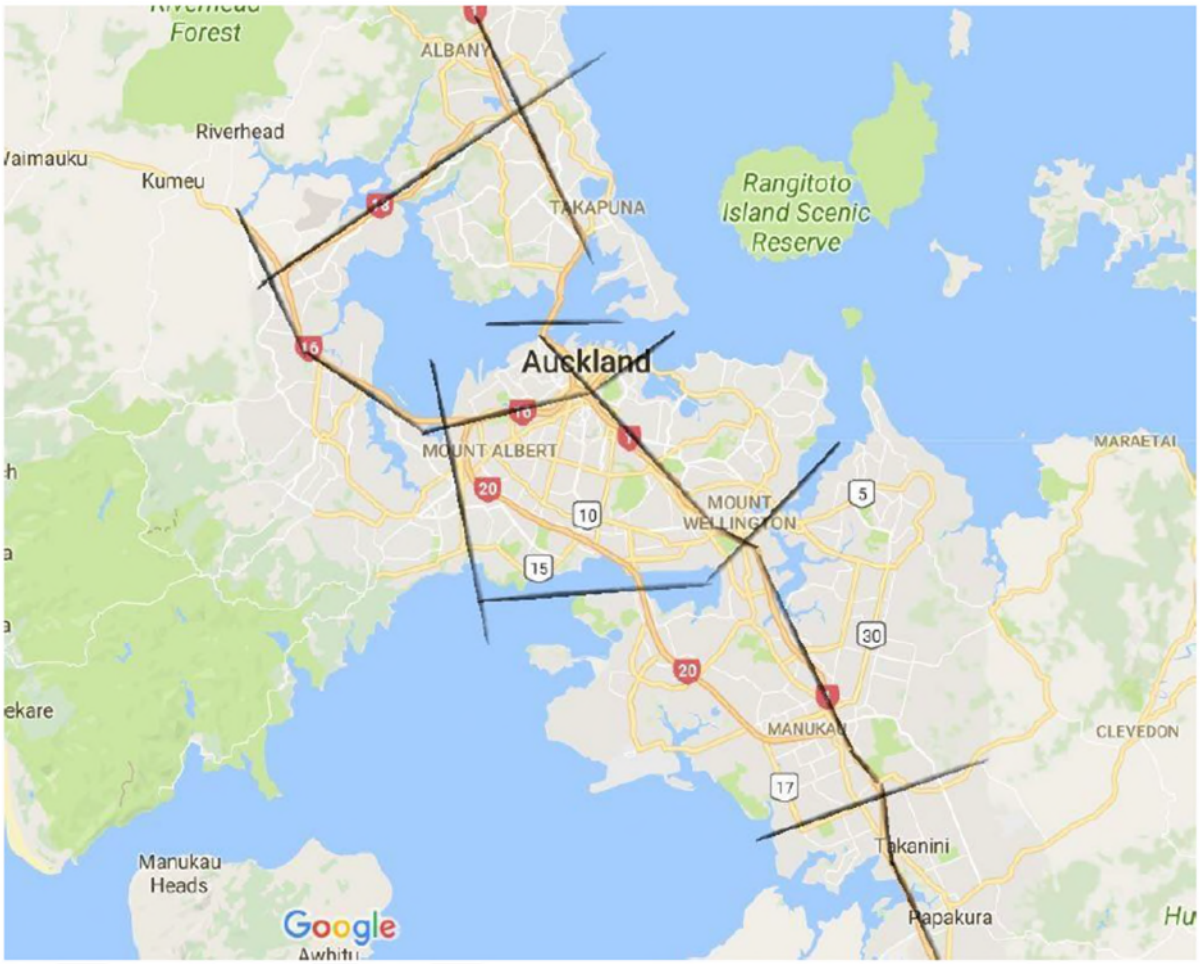
The scheme would be expensive to set up and run given its scale. It would be complex to define the employment centre boundaries and the boundary effects would likely induce a range of perverse behaviours and localised congestion issues.

Outcome: Not progressed to shortlist.

Option 11 – Zonal cordon

A zonal cordon scheme is where vehicles are charged to cross boundaries in either direction (see Figure 11 –illustrating approximate boundaries of the scheme).

FIGURE 11: INDICATIVE MAP OF ZONAL CORDON



The objective is to reduce congestion on routes crossing zone boundaries leading to and from employment centres. The zones are determined based on employment centres, with boundaries created by state highway/strategic corridors and topographical features. Through traffic on motorways would be exempt.

Potential to improve congestion

A zonal cordon could ease traffic on key corridors leading into employment centres. It has the potential to impact approximately 28% of morning peak trips, so could have a large impact on congestion at a region-wide level. However, there is significant potential for diversion due to the large area covered.

Economic, social and equity considerations

The city centre, Newmarket and main travel corridors are well-served by public transport, and walking and cycling infrastructure compared to the rest of Auckland. However, many employment centres are heavily car dependent due to a lack of viable alternative mode choices.

This option is likely to create significant household equity issues within neighbourhoods due to the cordon boundaries capturing residential areas. There are also significant business equity issues and spatial equity issues due to boundary effects.

Efficiency, flexibility and wider considerations

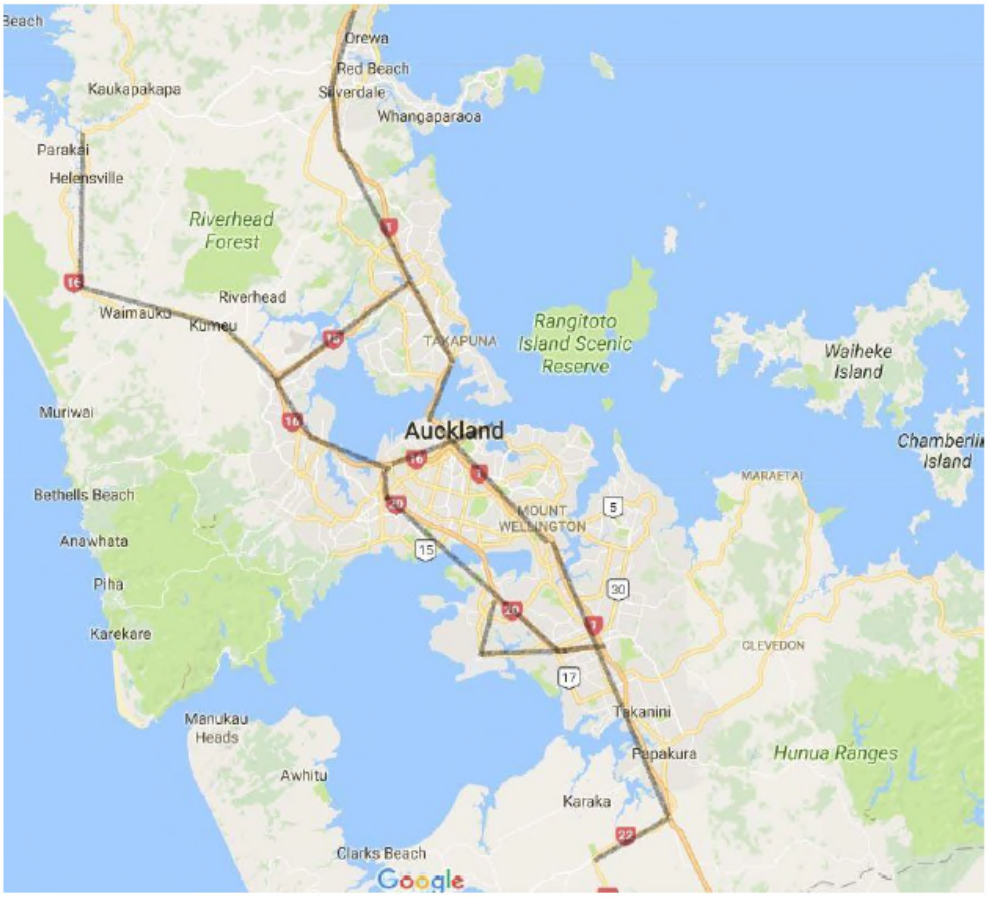
A zonal cordon would be expensive and complex to implement due the large area coverage and multiple different cordon boundaries. It would require infrastructure at a large number of charging points to detect vehicles as they pass through each cordon. It could be flexible to further expansion and new technology, such as GPS-based charging systems.

Outcome: Not progressed to shortlist.

Option 12 – State highway corridor

A state highway corridor scheme is where vehicles are charged to travel on Auckland's state highway network in the Auckland region (see Figure 12).

FIGURE 12: INDICATIVE MAP OF STATE HIGHWAY CORRIDOR SCHEME



The objective is to reduce congestion on state highway routes.

Potential to improve congestion

A state highway corridor has the potential to reduce congestion on state highway routes and has the potential to impact some 38% of morning peak trips. However, this option is likely to have significant diversion impacts as many arterial roads are available to circumvent the motorway charges which will induce congestion on surrounding roads that may have been previously uncongested.

Reduced congestion on the state highway network would also benefit freight trips who rely on the network to transport goods – however, this benefit could be undermined by increased congestion on feeder routes onto the state highway network, caused by trip diversion if overall behaviour change was insufficient.

Economic, social and equity outcomes

Some state highway trips have public transport alternatives – particularly those starting and ending along the corridor, for example via the Northern Busway, rail network and on the isthmus for city centre destinations. However, there are limited public transport options for cross-city trips, and in many areas there are no alternative options to using state highways – particularly in south and west Auckland, where household incomes also tend to be lower.

This option also has the potential to create adverse safety and environmental outcomes resulting from traffic diversion.

Efficiency, flexibility and wider considerations

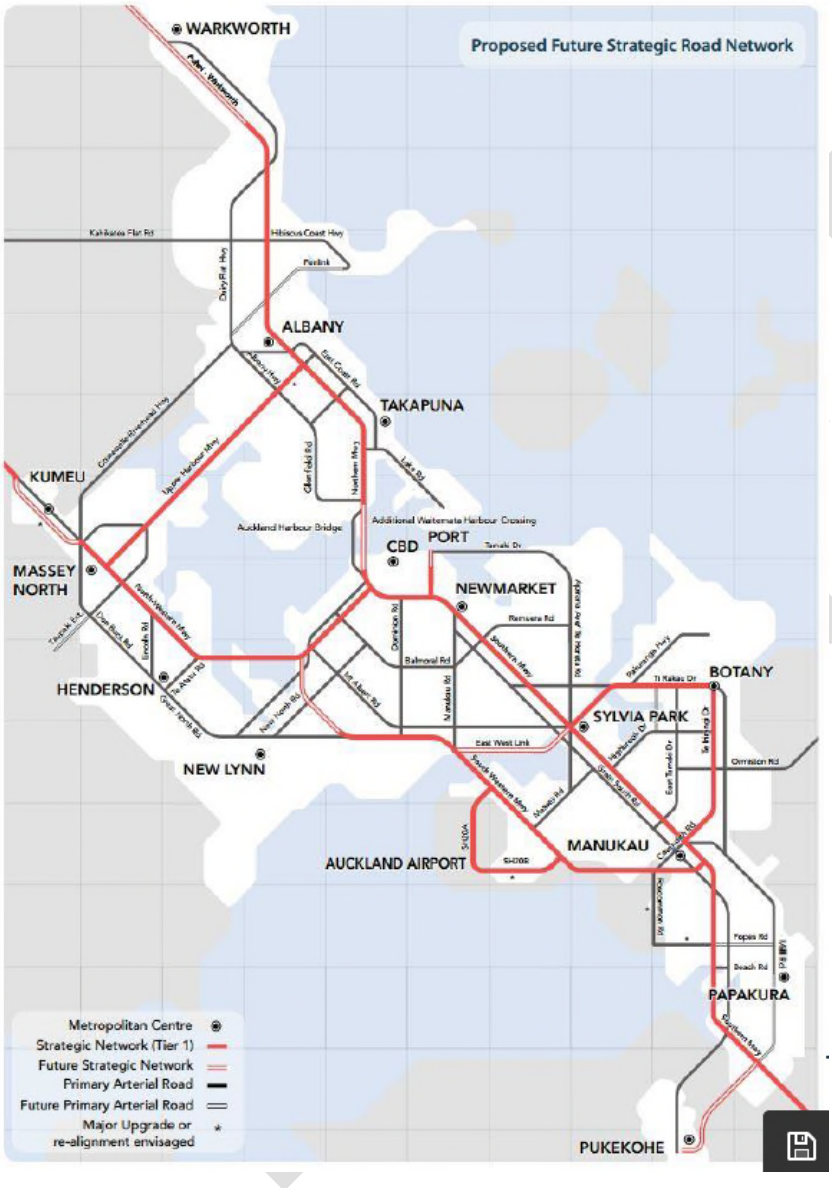
A state highway corridor would involve high capital costs to establish due to the large number of charging points needed as a result of length of the state highways and the large number of possible entry and exit points. It could be flexible to further expansion of congestion pricing and to new technology, such as GPS-based charging systems.

Outcome: Not progressed to shortlist (alternative, more flexible schemes considered to better mitigate potential side effects).

Option 13 – Strategic corridor

A strategic corridor scheme is where vehicles are charged to travel on Auckland's strategic and arterial network within the Auckland region.

FIGURE 13: PROPOSED STRATEGIC CORRIDOR NETWORK



The objective is to reduce congestion on state highways and arterial routes.

Potential to improve congestion

A strategic corridor scheme could ease congestion on state highways and arterials, where much of the congestion is already, throughout Auckland. This option will cover significant areas of congestion and has the potential to impact approximately 83% of morning peak trips. There is limited potential for diversion due to a lack of alternatives as a result of constrained topography, but there is the potential for some diversion onto smaller local roads ('rat running').

Economic, social and equity considerations

The strategic network is relatively well-served by public transport, with service extensions planned for many routes. This means that many people would have alternatives to paying the charge. However, as with the state highway scheme, this option would impact many low income households and there is potential for community severance, which could result in negative equity impacts.

This option also has a large positive impact on the strategic freight network compared with other options.

Efficiency, flexibility and wider considerations

Implementing this option would involve high capital costs as a large number of charging points would be required, which means a large amount of infrastructure would also be needed. The operating costs would be low to medium.

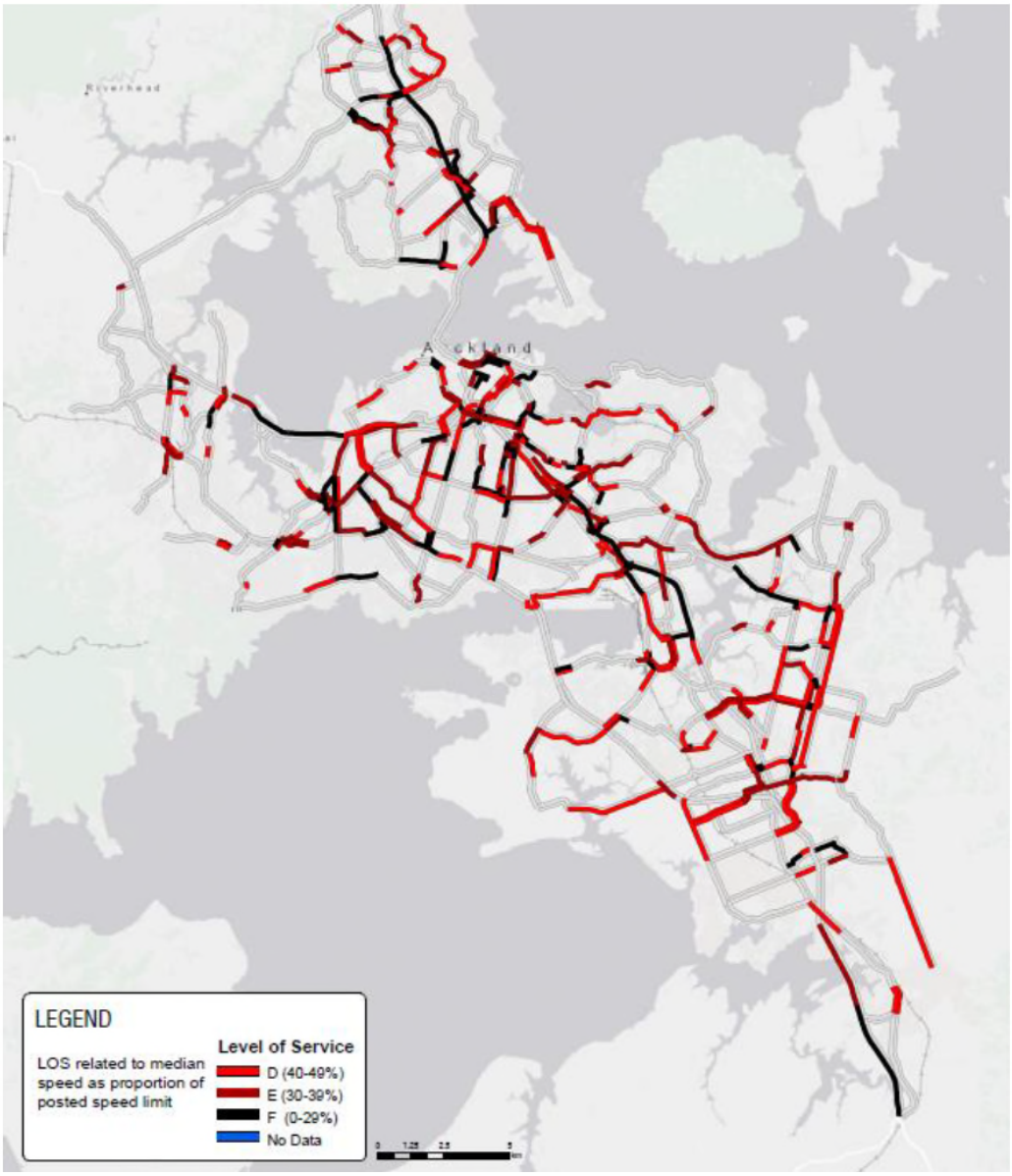
The large coverage of the scheme would make enforcement more challenging. This option supports scheme extension and advanced technology (ie potential future transition to a GPS-based scheme).

Outcome: Combined into 'targeted congested corridor' option and progressed to shortlist.

Option 14 – Target congested corridor

This scheme would involve charging vehicles on congested roads to achieve a target speed or level of congestion (see Figure 14 as example below – this shows where average speed is less than 50% of the posted speed limit for a certain period).

FIGURE 14: LOS FOR AUCKLAND'S ROADING NETWORK (SPEED PROXY)



The objective is to improve network performance on congested routes.

Potential to improve congestion

This scheme is similar to the strategic network option but more targeted, as it would not include the parts of the strategic network that were not congested (eg SH18) and would include roads outside that

classification that were. It could ease congestion on all congested roads across the Auckland region using historical average speed data and other performance indicators, which could be adjusted over time.

It has the potential to impact 83% of morning peak trips. There is limited potential for diversion as there are limited alternative routes due to constrained topography. The potential for some diversion onto smaller local roads ('rat running') remains.

Economic, social and equity considerations

Public transport services are available for the strategic network and there are service extensions planned for different routes. This would provide an alternative to private car use for some of the routes that would be impacted. This option also has a potentially high impact on the strategic freight network.

This scheme would avoid charging people for travelling on uncongested roads and so have a good link between those who are paying seeing the benefits. The likelihood of negative equity impacts are similar to those of the strategic network option and it would have some impact on low income households.

Efficiency, flexibility and wider considerations

This option has very high capital costs due to the large number of charging points required, and the development of a rules-based tariff policy that can identify congested routes and calculate the correct price. It has low to medium operating costs.

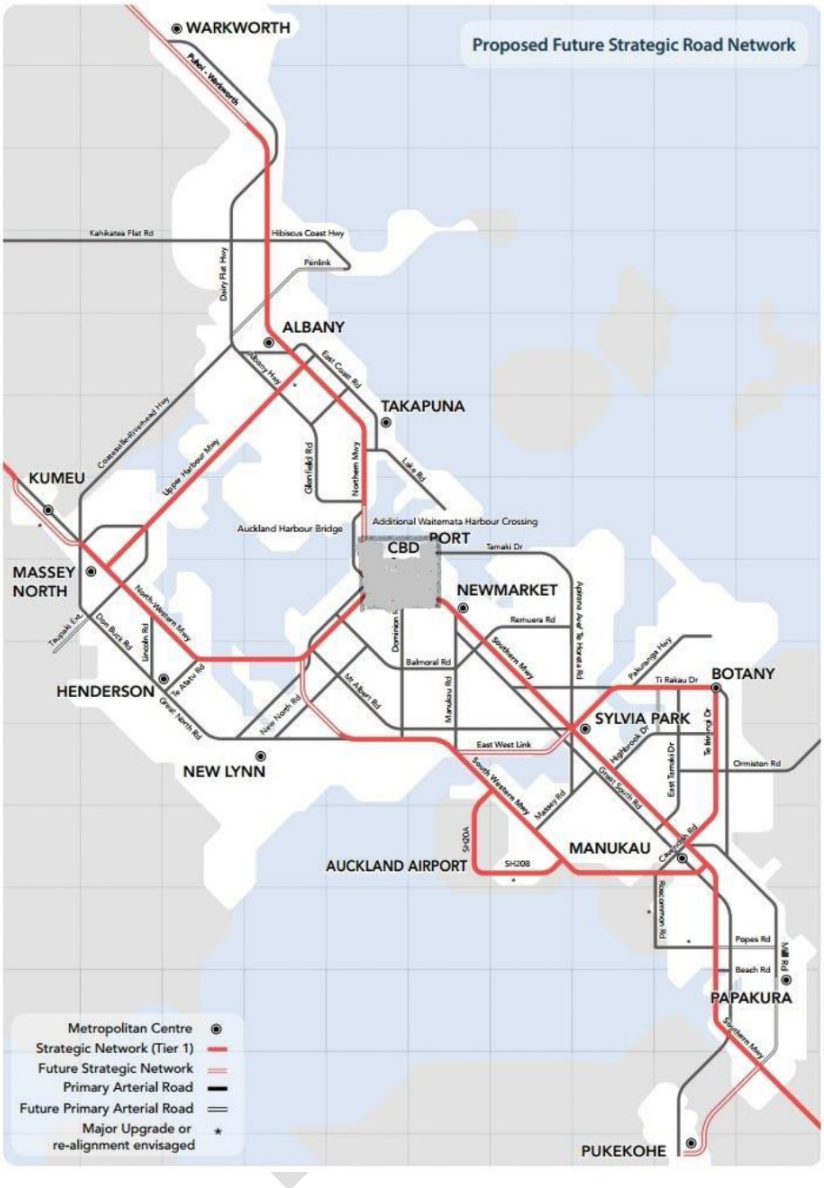
There is some risk around enforcement with this option. The concept is well-proven in Singapore, and it supports scheme extension and advanced technology.

Outcome: Progressed to shortlist.

Option 15 – Strategic corridor and city centre area scheme

A strategic corridor and area scheme is where vehicles are charged to travel on the strategic network and travel into, out of, and within the city centre area (see Figure 15).

FIGURE 15: AUCKLAND STRATEGIC ROAD NETWORK AND CITY CENTRE AREA



The objective is to reduce congestion on strategic routes and discourage peak period trips to, from, and within the city centre.

Potential to improve congestion

A strategic corridor and city centre area scheme has the potential to reduce congestion on strategic routes and reduce trips to, from and within the city centre during peak times. This option has the potential to impact 84% of morning peak trips. There is limited potential for diversion under this option as there are limited alternative routes due to constrained topography.

This option also has the potential to have a large impact on the strategic freight network.

Economic, social and equity considerations

This option impacts a large number of trips and a range of income groups, but the availability of alternatives will impact the fairness of this option. Compared to the rest of Auckland, the city centre area is well-served by public transport, walking and cycling infrastructure, so many people travelling to and from the city centre would have alternatives to paying the charge. There is already a high mode share (39%) for public transport/active modes for work trips to and from the city centre.

There are public transport services available for the strategic network, with service extensions planned for many routes.

Efficiency, flexibility and wider considerations

This option would require a very large capital investment to implement due to the large number of charging points required. Once established, operating costs would be low to medium.

This option supports scheme expansion and advances in technology. However, there are some risks around enforcement due to the large number of different charging points required.

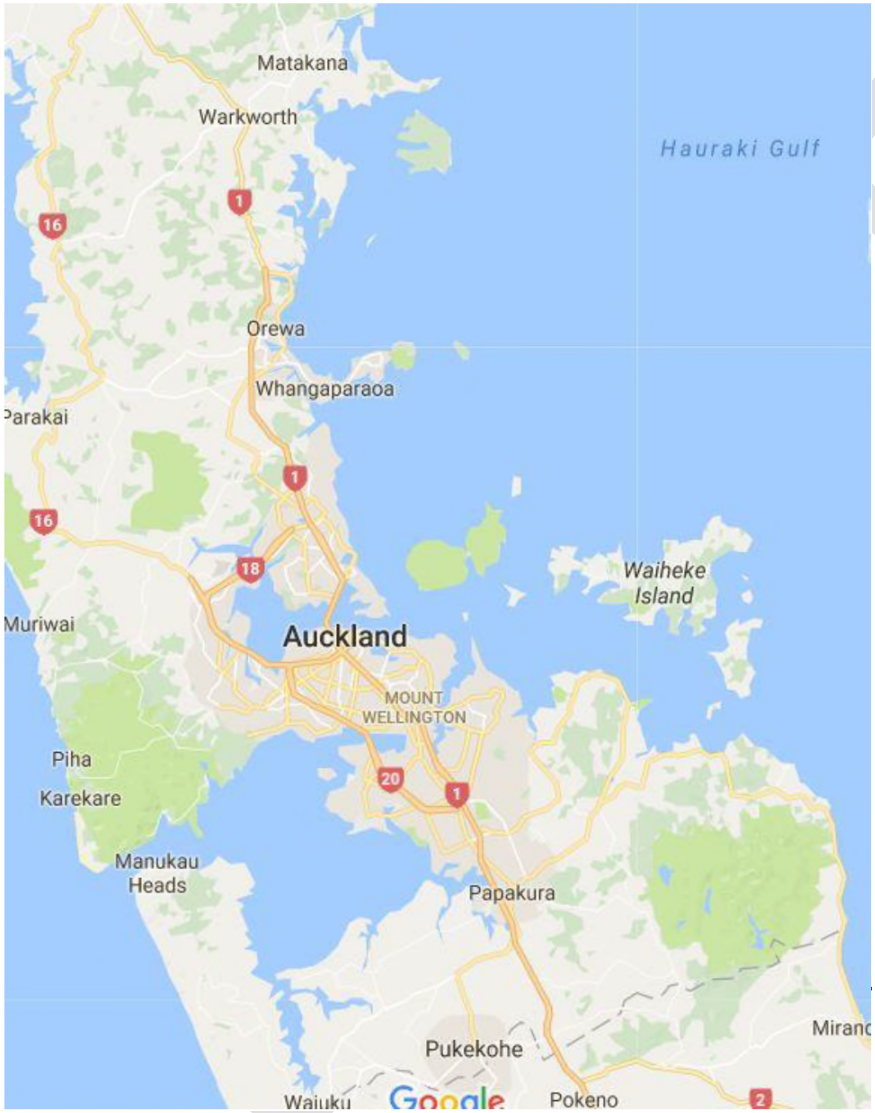
An alternative to this option would be to combine the corridor scheme with a city centre cordon rather than city centre area – little difference in performance would be expected although the cordon scheme could be easier to understand and implement due to the lower number of charging points.

Outcome: Slight variant progressed to shortlist (utilising the targeted corridor option and city centre cordon).

Option 16 – Regional network scheme

A regional network scheme is where vehicles are charged according to trip distance, time and location using in-vehicle global navigation satellite system (GNSS) capable hardware. This scheme would cover the entire Auckland region (see Figure 16 below).

FIGURE 16 REGIONAL NETWORK SCHEME - ALL INCLUSIVE



The objective is to decrease congestion across the whole Auckland road network.

Potential to improve congestion

This option will have a large impact on congestion over the whole Auckland network as it will target 100 percent of trips, with no option for vehicles to divert or avoid (assuming adequate enforcement). Only those travelling on congested roads would be expected to pay (based on the project's objectives) so this is likely to have similar impacts to the target congested corridor scheme, but delivered through different technology.

Economic, social and equity considerations

Public transport provision is not consistent across the Auckland region, with some parts (particularly in south and west Auckland) still highly dependent on private vehicles. This will impact on the alternatives people have to paying the charge, which could create significant social and equity impacts unless coverage increases prior to implementation and/or other alternatives are possible.

There is a large range of income groups impacted, but the impact of the charge would be closely tied to those who benefit from the reduced congestion.

Efficiency, flexibility and wider considerations

This option requires a very large capital investment to implement as it would require the establishment of back office systems to operate the scheme and for GNSS capable units to be fitted in every vehicle in Auckland. It would also require ANPR cameras to be installed to capture occasional users and for enforcement purposes which adds to the complexity.

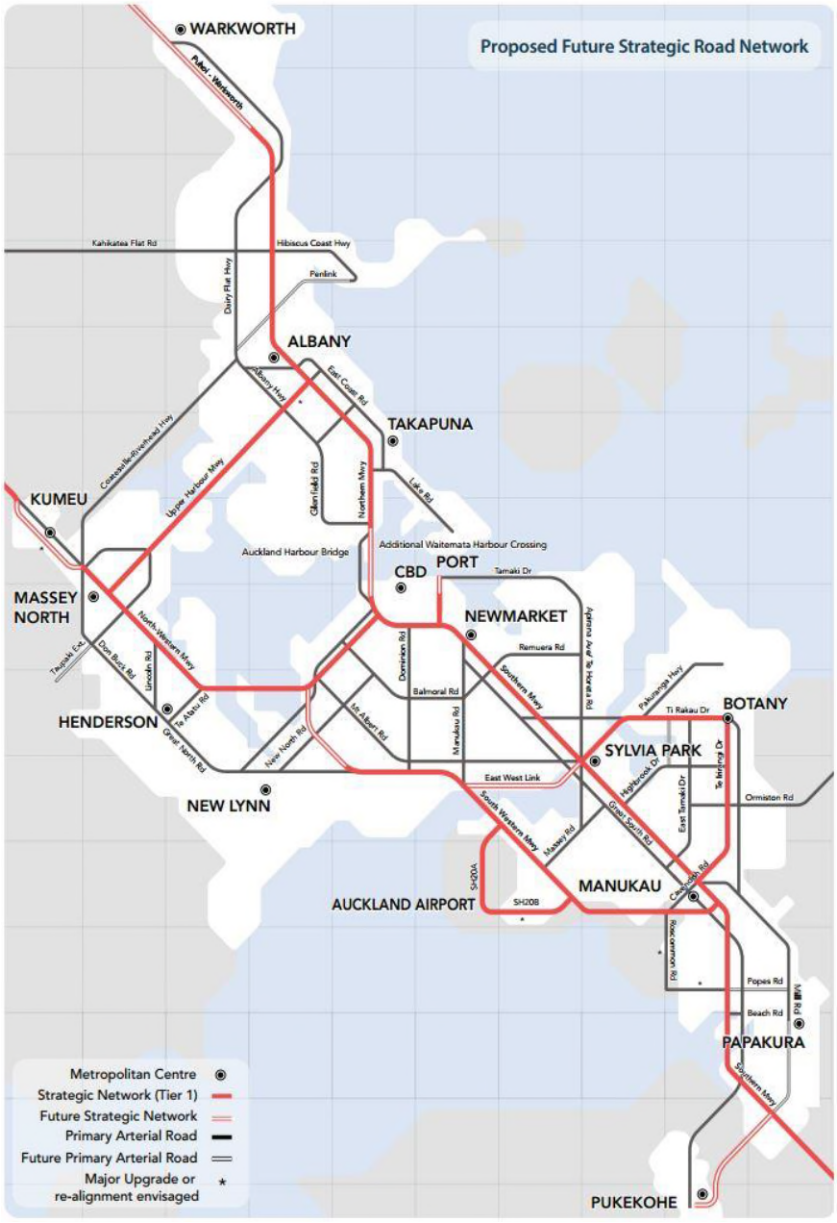
There are very high risks around enforcement, and very high privacy concerns due to the GNSS nature of the scheme. This type of scheme has not been implemented before anywhere in the world, although Singapore is getting close to developing their current scheme into a GNSS based scheme.

Outcome: Progressed to shortlist, noting technology challenges.

Option 17 – Express lanes

An express lanes scheme is where vehicles have an option to pay additional charges to travel on dedicated express lanes (as opposed to corridors) to obtain improved service levels. This would be complex to implement and be limited to only parts of the Strategic Network (see Figure 17 below).

FIGURE 17 EXPRESS LANES - FOCUSSED ON PARTS OF THE STRATEGIC NETWORK



The objective is to reduce congestion on the strategic network.

Potential to improve congestion

This option has relatively little potential to improve congestion due to the limited ability to implement them. Only people who choose to pay to use the express lane will experience better service levels. This option only has the potential to target some 5% of morning peak trips.

This option is unlikely to have a large impact on average trip speed/trip time as express lanes will take away some network capacity, and only a segment of commuters will pay to receive better levels of service. It also has a likely negative impact on the strategic freight network as express lanes will take away freight capacity, as freight cannot typically use express lanes.

Economic, equity and social considerations

This option could be seen as inequitable and unfair as only those who can afford to pay will experience benefits of improved service levels.

Efficiency, flexibility and wider considerations

There are major concerns around the practicalities of implementing the Express Lanes option on the existing Auckland strategic network. Roads with express lanes would need at least three lanes in each direction to be feasible, which currently would confine it to small sections of the state highway network where there is adequate space between interchanges.

This option has very high capital costs as it would require additional lanes to be added or converted into express lanes, as well as gantries and ANPR cameras to be installed to capture trips. It is also inflexible to expand due to the constraints of geography.

Outcome: Not progressed.

Option 18 – Strategic corridor and express lanes

A strategic corridor and express lanes scheme is where vehicles are charged to travel on Auckland's strategic arterial network and also have an option to pay more to travel on dedicated express lanes to obtain improved service levels. Refer notes for options 17 and 13 as the assessment combines these points.

Option 19 – Regional fuel tax

A regional fuel tax scheme where an additional fuel excise tax is introduced in a specific region for the purpose of reducing trips by raising the cost of travel for motorists.

Potential to improve congestion

Fuel taxes are a uniform tax and they are not targeted at congestion by location or by time. Because fuel taxes increase the costs of travel they may discourage some people from driving, thereby reducing the number of vehicles on roads within the defined area at any time, regardless of whether congestion is being experienced. In this regard a fuel tax may have an indirect or inconsistent impact on congestion. There are no estimates of the short and long term impacts of an increase in fuel prices on vehicle use as a proxy for congestion.

Economic, equity and social considerations

There are equity concerns with this option as vehicles are penalised by the same amount regardless of when and where they travel. Fuel taxes are already regressive (low income households generally spend a greater proportion of their income on fuel), and an increase in price will hit low income households even harder. Electric vehicle owners, who tend to be wealthier, will benefit as they do not consume fuel, but still drive.

Efficiency, flexibility and wider considerations

There is no flexibility with this option as it doesn't support the targeting of congestion or adoption of advanced schemes.

Outcome: Not progressed to shortlist.

Option 20 – Regional registration fee scheme

A regional registration fee scheme (RRFS) is where a significant increase in annual licensing charges and/or registration fees is used to reduce vehicle numbers by raising vehicle ownership costs. In the New Zealand context, a RRFS could apply a premium to vehicles registered in the Auckland region.

Potential to improve congestion

It is difficult to know what the impact on congestion would be – increasing the costs high enough could suppress car ownership to the extent that there are fewer cars on the road, however, once an individual has paid the high fees there is also the possibility they would be incentivised to drive more to make it worthwhile. It is poorly targeted towards congestion as there is no ability to focus only on congested locations or times of day.

Economic, social and equity considerations

The schemes would be regressive and have a significant impact on households, particularly those with few or no alternatives to driving. It could reduce access to jobs and other opportunities for those on low incomes. It would also add to business costs, which small businesses would find more difficult to bear.

Efficiency, flexibility and wider considerations

It would be relatively simple to implement, but difficult to enforce. There could be boundary issues, where some people could purchase and register vehicles outside Auckland but still contribute to congestion if they drive in the region. There is no flexibility to evolve into a more targeted demand management scheme.

Outcome: Not progressed to shortlist.

Option 21 – Parking policies

This covers the range of parking policy interventions such as:

- an annual parking levy per car parking space (most likely restricted to those attached to non-residential uses and in centres)
- a direct charge for people arriving to park in a parking space during peak hours. This could apply to varying extents to: just publicly owned/managed spaces; all publicly accessible spaces; and all parking spaces.

Potential to improve congestion

This depends on the nature and extent of the changes. Changes to public parking might not be sufficient due to the extent of private parking available. Increases/changes to parking policies in employment and town centres could have a localised impact on congestion. Charging of long term/commuting spaces are likely to have the most impact as this tends to be correlated to peak hour travel.

Economic, social and equity considerations

Could affect those with lower incomes who tend to drive more or have poor access to public transport. The policies could be applied where sufficient alternatives (such as public transport or active modes) currently exist in the first instance to help mitigate social/equity concerns. Historically changes to parking have raised real or perceived concerns from businesses.

Efficiency, flexibility and wider considerations

Changes to public parking would be reasonably straightforward to implement. Parking charges which apply beyond publicly owned/managed car parks will not be easy to implement. Applying this to any non-publicly available spaces, ie business owned/dedicated spaces, will be difficult and costly.

Outcome: Progressed under complementary measures/mitigations options.

Option 22 – Car sharing scheme

Car sharing (also called carpooling or ridesharing) is when people who have similar origins and destinations share a vehicle rather than travelling on their own. This scheme would aim to encourage or incentivise ride sharing on an opt-in basis to decrease single occupancy trips and improve vehicle productivity.

Current efforts to increase ride-sharing and decrease vehicle occupancy include T2 and T3 lanes, apps and websites that connect drivers and passengers, and parking discounts for those carpooling.

Potential to improve congestion

The existing efforts that are underway by the project agencies to encourage car sharing have so far had mixed success – for example, T2 and T3 lanes in Auckland are underutilised. The potential of this option to improve congestion is therefore uncertain.

Economic, social and equity considerations

There are unlikely to be any fairness, equity or distributional issues provided those who choose not to car-share are not penalised.

Efficiency, flexibility and wider considerations

If building on existing initiatives to promote car-sharing, this would be reasonably straightforward to implement.

Outcome: Progressed under complementary measures/mitigations options.

Option 23 – Mobility rationing

A mobility rationing scheme is where vehicle trips are influenced through some form of quota system that limits vehicle use according to time, day or another metric. One example is only cars with certain license place digits being allowed into the city centre on certain days.

Potential to improve congestion

Most examples of mobility rationing implemented elsewhere are focused on reducing air pollution, however, it could also reduce congestion by restricting the number of cars on the roads. In theory, banning two digits for one day a week would result in a 20% reduction in traffic. Internationally, it has had mixed success – it proved effective in reducing traffic and emissions in Beijing and Paris, but less so in Bogota and Mexico (due to people finding ways to circumvent the ban).

In the long term, users affected by the scheme can get round its impacts by purchasing a second car. In Auckland, 58.3% of households already have access to two or more cars (based on 2013 census data) which could undermine the effectiveness of the scheme.

Economic, social and equity considerations

There are likely to be significant negative equity impacts, particularly between those who can afford to own two cars (thereby circumventing the scheme) and those who cannot. Some people are likely to have no alternative to driving to their destination (particularly during work hours at peak times).

Efficiency, flexibility and wider considerations

These depend on implementation and the scale of any intervention (for example, whether it is just focused on city centre or at a region-wide level). There are high risks around enforcement and people attempting to find ways round the system.

Outcome: Not progressed.

Option 24 – Reverse tolling

This option incentivises people to change the time or way in which they travel by rewarding them for doing so. One proposal for Auckland suggests using a smart phone app to tag carpool passengers, which could then be used to pay passengers, with payments varying depending on the time, route and direction of travel.

Potential to improve congestion

A trial in the Netherlands was successful in decreasing peak trips by rewarding participants with points that could be used to purchase things online. However, in the long term it is not clear whether that this would be sustainable due to the costs of paying passengers.

Economic, social and equity considerations

Social and equity impacts could be less of a concern given that the scheme involves paying, not charging people. However, it depends who will be getting the reward and what the reward is – for example, those more affluent may have more flexibility with their work hours, so would be able to take advantage of the reward on offer, compared with those on fixed schedules.

Efficiency, flexibility and wider considerations

There could be high costs associated with the reward scheme, as well as potentially more investment needed in public transport capacity and infrastructure. There are also high risks around enforcement and the potential for people to abuse the system.

Outcome: Progressed under complementary measures/mitigations.

Option 25 – Infrastructure pricing

Infrastructure pricing is where charges are levied on new infrastructure assets to the users. In New Zealand, this is most commonly done in the form of tolling, where users pay towards the funding of a particular transport asset. New Zealand currently has three toll roads: the Northern Gateway Toll Road, north of Auckland; the Tauranga Eastern Link Toll Road; and the Takitimu Drive Toll Road, also in Tauranga.

Under current legislation, there is a requirement to ensure an alternative route to the one that is tolled is available.

Potential to reduce congestion

Tolls can be varied by day or time, which could be used to reduce congestion by increasing the price during congested periods and lowering the price outside of this.

Variable toll pricing has been applied to the Sydney Harbour Bridge and tunnels and shown to incentivise commuters to travel at different times or take public transport during peak hours.

However, in Auckland, there are few opportunities to build substantive new transport infrastructure, limiting the usefulness of tolls for congestion reduction purposes.

Economic, social and equity considerations

Tolling charges the same rate to all users, regardless of their ability to pay, so could be considered regressive. It does have a strong "user pays" element which is considered by some to be fairer.

Efficiency, flexibility and wider considerations

As tolling already exists in New Zealand, this option is reasonably low risk and well proven – however its limited use to new infrastructure means it is highly inflexible.

Outcome: Not progressed – continue to be considered for new infrastructure.

Option 26 – Free public transport

A free public transport scheme aims to encourage a move away from private vehicles by dramatically lowering travel costs for public transport services. The objective is to reduce use of private vehicles during peak times by making public transport a more attractive option.

Potential to reduce congestion

The impact is difficult to estimate given limited international experience and also the characteristics of Auckland. Evidence from London and Estonia suggests that the vast majority of additional trips resulting from free public transport are by existing public transport users, walkers or cyclists, or *new* trips, rather than existing motorists.

Given Auckland's low usage of public transport, even a 50% increase in public transport trips due to free fares would only see a 4% reduction in vehicle trips. Factoring in the fact the majority of new trips are likely to be from existing PT users and walkers/cyclists, in reality this figure would be even smaller.

Economic, social and equity considerations

Compared with other options, free public transport is likely to have more positive equity and social impacts as it improves access to public transport and could promote social inclusion for those for whom the cost of travel is currently a barrier. However, it is unlikely to be economically sustainable given more investment in public transport would be needed to accommodate the rise in demand, whilst at the same time decreasing revenue intake from fares.

Efficiency, flexibility and wider considerations

This option would be very costly to operate and invest in additional capacity/services. There are major risks relating to the extent of supplementary investment required and service overcrowding.

Outcome: Progressed under complementary measure/mitigations, on the basis of changing fare subsidies, rather than making public transport travel free.