The Congestion Question

Main findings

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Auckland Council · WAKA KOTAHI NZ TRANSPORT AGENCY · Ministry of Transport TE MANATŪ WAKA · THE TREASURY Kaitohutohu Kaupapa Rawa · STATE SERVICES COMMISSION Te Kāmihana O Ngā Tari Kāwanatanga · New Zealand Government

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Overview

Central Government and Auckland Council officials have been working together for several years on a project called The Congestion Question (TCQ). The purpose of the project is to undertake a thorough investigation sufficient to support a decision on whether or not to introduce congestion pricing on part or all of Auckland's road network. Congestion pricing is a method used to improve network performance by charging road users to encourage some to change the time, route or way in which they travel.

The TCQ technical investigation builds on the findings of the Auckland Transport Alignment Project (ATAP), which sets out a 30-year vision for Auckland's transport system. This vision comprised three integrated elements: targeting investment to the most significant challenges, making better use of the existing network, and focusing more on managing travel demand. ATAP identified pricing as having significant potential to manage travel demand and reduce congestion, in conjunction with implementing a substantial investment programme.

Auckland is not alone in thinking about whether it is time to seriously consider congestion pricing. Congestion pricing has been applied successfully in a number of jurisdictions in other countries, including London, Stockholm, Gothenburg and Singapore, which have enjoyed sustained improvements in network performance, lower vehicle emissions and a lift in public transport mode share. New York has recently announced it will become the first American city to introduce congestion pricing, while other global cities, including Vancouver, Los Angeles, Jakarta, Beijing, Melbourne and Sydney, have programmes underway to consider congestion pricing. Overseas experience also shows that, where congestion pricing has been introduced, the new norm is supported by communities.

Traffic congestion is getting steadily worse in Auckland[1] and, although significant investments are being made to improve public transport services and expand the roading network, congestion is expected to continue to worsen. Congestion means trips take longer and traffic conditions become unpredictable. Motorists incur increased fuel and maintenance costs from idling, vehicle emissions increase, and economic productivity suffers. A recent survey[2] of Auckland businesses found that traffic congestion is now considered to be the main impediment to their growth and daily operations.

Following an extensive research and options evaluation exercise, the TCQ is of the view that congestion pricing could deliver significant benefits for Auckland. The investigation has confirmed that congestion pricing is practical and would generate significant benefits in the form of time savings and more reliable journey times.

1 See The Congestion Question – Phase One Report (2018)
2 Auckland Council Business Survey: Auckland Region Wave 6 Results (2019), Auckland Council and ATEED

The TCQ investigation indicates that with the right design, supported by improved public transport services and a mitigation programme to assist vulnerable road users, the opportunity exists for Auckland to benefit from a sustainable 8%–12% improvement in network performance once a full scheme becomes operational. This is similar to the improvement in traffic conditions observed during the school holidays.

Even a small improvement in network performance has the potential to generate a meaningful lift in transport and economic productivity, which will benefit employees, businesses and the wider Auckland region. Local communities will also benefit from less traffic and a more pedestrian and bike friendly street environment.

The introduction of an Auckland congestion pricing scheme has the potential to support an improvement in local air quality and reduce greenhouse gas emissions. Congestion pricing would align with a range of national and local level policies and strategic directions regarding climate change, water quality and air quality. These issues are becoming increasingly important given Auckland Council's declaration of a climate emergency and the national Zero Carbon Act.

One of the key tasks for the TCQ was to determine what kind of congestion pricing scheme would deliver the best results for Auckland. The investigation considered point-based, distance-based and access charges, and found that the congestion charge should be an access charge whereby every vehicle faces the same charge when it is detected on a charged road. Auckland's dispersed travel patterns and the prevalence of shorter trips mean that an access charge is required to encourage sufficient behaviour change and mode shift by travellers with flexibility. A well-designed access charge is easy to understand, difficult to evade, removes incentives to 'rat-run'[3], and means that travellers in outer suburbs are not faced with the prospect of cumulative charges for longer trips.

TCQ research, supported by extensive traffic modelling, indicates that congestion charges should vary by time bands, starting with a lower charge to travel during the shoulder period ($1.50), rising to a higher charge for peak-period travel ($3.50)[4]. As a comparison, the proposed peak charge aligns with an adult two-zone public transport fare using an AT HOP card. There would be no charge for travel during the inter-peak or off-peak periods and charges would apply Monday–Friday, with no charges levied on weekends or public holidays. Motorists would incur the highest charge detected within a two-hour 'journey window'[5] to recognise the multi-purpose nature of many trips. Heavy vehicles would pay double the charges incurred by light vehicles. Emergency vehicles, buses, motorcycles, scooters and unpowered vehicles would be exempt from the charge.

Research undertaken by the TCQ emphasises the need to carefully consider mitigation for those who may face an unreasonable and unavoidable increase in transport costs because of congestion charges. To help address financial impacts, the TCQ proposes that the first mitigation should take the form of daily charging caps whereby no motorist would face a daily charge greater than twice the highest peak-period charge. Secondly, financially vulnerable users should be provided with a discount on the congestion charges they incur. The TCQ has identified that the Community Services Card could be an appropriate existing mechanism for identifying those users. Additional mitigation measures could be introduced following implementation, depending on the scheme's observed social and financial impacts.

3 Diverting onto smaller roads to avoid congestion.
4 These indicative charges would be subject to review prior to implementation, and regular review once a scheme was operational.
5 A period of time within which one or more trips may be made.

Cost effective and proven technology is available to support the introduction of a congestion pricing scheme. Automatic number plate recognition (ANPR) cameras and supporting software have already been proven by Waka Kotahi NZ Transport Agency for open road tolling, and this type of technology could be readily applied for congestion pricing. Smartphones, while not a feasible option for vehicle identification and charging, can provide a user-friendly channel for payment and account management. A future move to utilise global navigation satellite system (GNSS[6]) technology could be made once current challenges with the technology are overcome.

The primary objective of congestion pricing is to improve network performance, not to raise additional funds from road users. Nevertheless, congestion pricing is by its nature a revenue source. In line with international precedents, the TCQ considers that net revenues should be hypothecated to pay for additional public transport infrastructure and services, fund mitigation measures and, if possible, remove the regional fuel tax to help counterbalance negative distributional impacts[7].

A congestion pricing scheme in Auckland should be introduced in stages that are generally linked to the delivery of additional public transport services and infrastructure investment over the next ten years. The first phase, based around the city centre area, could be introduced to coincide with the opening of the City Rail Link (CRL).

Then, over time, the congestion pricing scheme should be introduced along the most congested corridors, with the implementation timetable informed by the Regional Land Transport Plan (RLTP).

Prior to a final decision on whether to implement congestion pricing in Auckland, there needs to be a comprehensive public and stakeholder engagement exercise. Auckland travellers and local communities need the opportunity to respond to the provisional scheme design, and potential benefits and costs need to be clearly explained and articulated. Evolution of the scheme is expected to occur over time, as people become more comfortable interacting with the scheme, and the scheme is adapted to better meet its stated objectives.

Auckland should also consider whether to undertake a demonstration project to support public engagement. These initiatives can be valuable in building public confidence by focusing people on a real-life congestion pricing application.

6 Although the US Global Positioning System (GPS) is the most well-known satellite-based positioning system, there are now a number of systems. These are known collectively as GNSS.

7 In this context, distributional effects refer to how the impacts of transport projects or interventions vary across different groups within society.

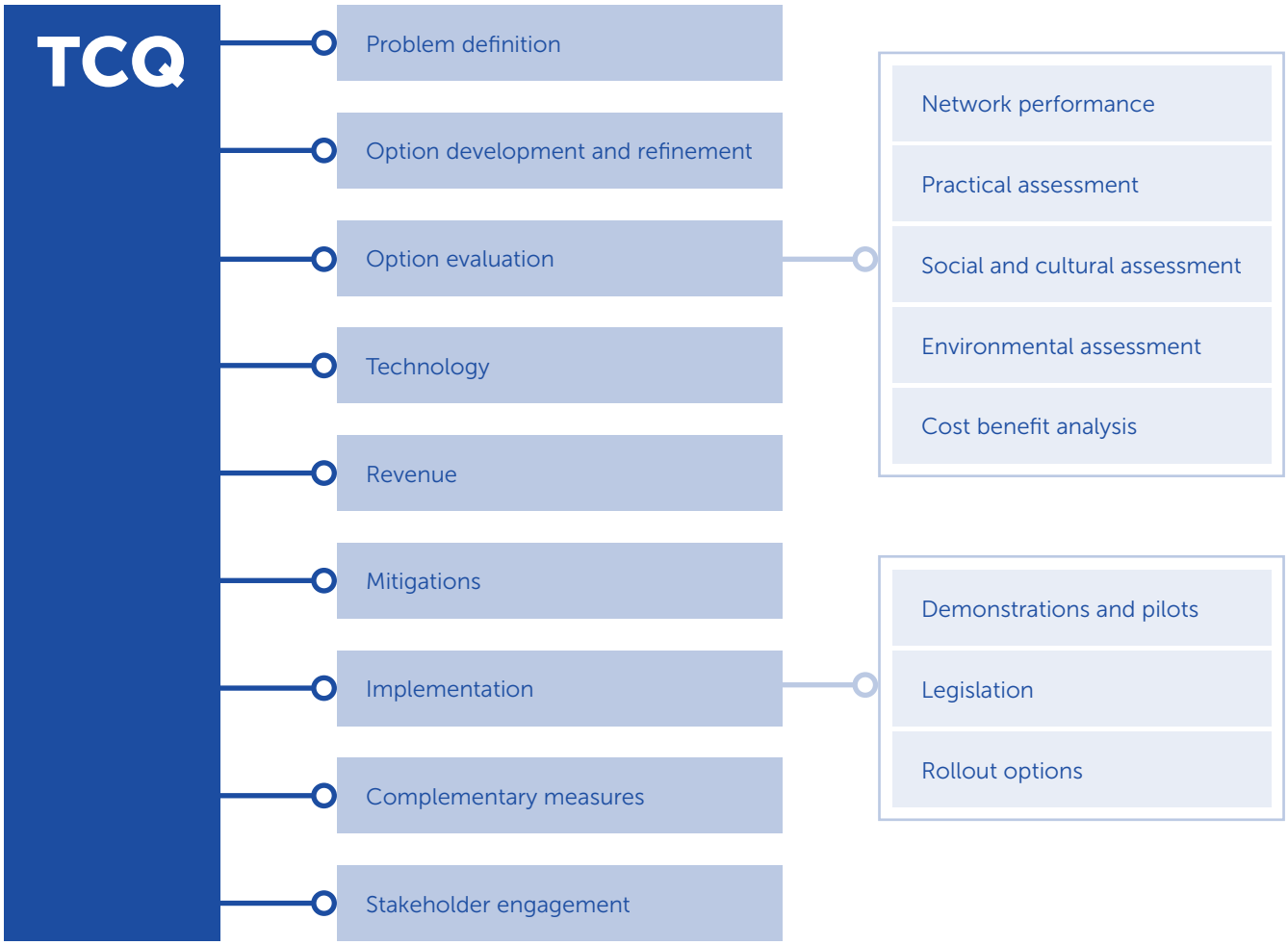
The Congestion Question project

Central Government and Auckland Council officials have been working together for several years on a project called The Congestion Question (TCQ). The purpose of the project is to undertake a thorough investigation sufficient to support a decision on whether or not to proceed with introducing congestion pricing in Auckland.

This report presents the main findings of the TCQ technical investigation, prepared by officials from the six agencies involved (the Ministry of Transport, Auckland Council, Waka Kotahi NZ Transport Agency, Auckland Transport, The Treasury and the State Services Commission).

This report brings together the TCQ's research, development and evaluation, as well as the technological, social and implementation considerations around a potential congestion pricing scheme for Auckland. It is intended to provide a platform for future discussions on congestion pricing in Auckland. Figure 1 summarises the comprehensive work programme that the project has undertaken.

Figure 1: TCQ work programme summary



The TCQ investigation builds on the findings of the Auckland Transport Alignment Project (ATAP), which sets out a 30-year vision for Auckland's transport system. ATAP confirmed that the well-discussed adage, 'you can't build your way out of congestion', is also true in Auckland. ATAP identified pricing as having significant potential to manage travel demand and reduce congestion, in conjunction with implementing a substantial investment programme, getting more out of our existing networks through efficiency and optimisation improvements, and other supporting measures. The ATAP report recommended the early establishment of a dedicated project to progress 'smarter' transport pricing with a primary focus on addressing congestion.

The project's Terms of Reference (ToR) required the TCQ to undertake design, testing and analysis of a shortlist of congestion pricing options to improve the performance of Auckland's road network by encouraging more efficient patterns of travel, taking into account economic, social and environmental outcomes. As part of achieving improved network performance, consideration had to be given to the following matters:

- Appropriately balancing any additional costs of travelling against the benefits of improved network performance.
- Ensuring pricing is flexible and adaptable to changing circumstances, such as developing technology or changing land-use patterns.
- Ensuring key impacts of pricing (including fairness, equity and distributional impacts) on those using the transport system, both businesses and households, are understood and appropriately addressed.
- How any net revenue raised through pricing would be used.
- Ensuring pricing is affordable and cost-effective to implement, operate, administer and enforce.

The Auckland environment

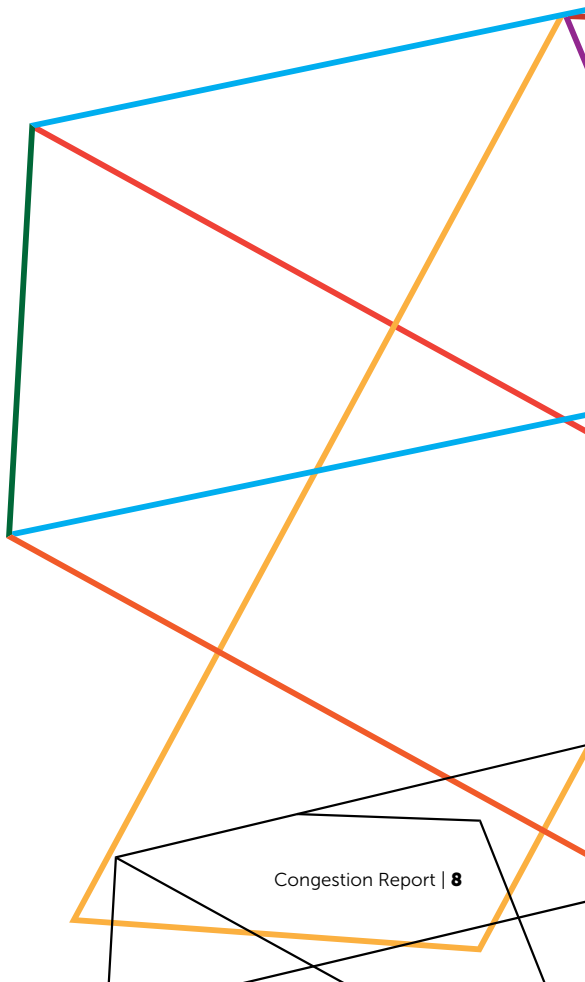
International precedents for successful congestion pricing schemes exist, but these need to be considered in the context of Auckland's unique environment. Schemes that have worked well elsewhere may not be as effective in improving congestion across Auckland. Any congestion pricing scheme must be firmly grounded in the local topography and take account of Auckland's specific transport challenges.

The form of the existing urban and suburban areas of Auckland has been heavily influenced by the transport modes of the time. The oldest and highest-density neighbourhoods – the central city and inner-city suburbs – were developed along tram and railway lines. These continue to be accessible by public transport, walking and cycling. In contrast, the development of the motorway system resulted in the rapid growth of lower density suburbs. Private vehicle use increases with distance from the central area, with the mode share for private vehicles reaching 90% for the outer suburbs.

The Auckland region comprises of four large 'cities' – the isthmus, North Shore, Manukau/South, and West Auckland – each with established local amenities encompassing employment, education, retail, health, and leisure facilities. Travel patterns reflect Auckland's urban form and dispersed employment arrangements, and residents are not generally required to travel long distances for most work and non-work trips.

Around 1.6 million people currently live in Auckland. Over the next 30 years the Auckland population is expected to 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, and the nodes of Albany, Westgate and Manukau. There will also be supporting growth in development areas in the north (Dairy Flat/Silverdale), north west (Massey North/Kumeu) and south (Drury/Pukekohe). Incremental growth will also happen across existing urban areas as the up-zoning provided by the Auckland Unitary Plan is utilised.

Faced with a rapidly rising population and increasing vehicle numbers, and underpinned by economic growth, the performance of the Auckland road network continues to deteriorate. Although future investment is expected to make a critical contribution, without some form of congestion pricing, overall network performance is forecast to deteriorate further. The result is that Aucklanders' access to jobs, education and other opportunities will become more frustrating and the benefits associated with growth will be constrained.



Why congestion is a problem

Traffic congestion is a condition on road networks that occurs as use increases and is characterised by longer and less reliable trip times. As demand approaches the capacity of a road (or of the intersections along the road), congestion increases. Traffic congestion affects users of the road network in that it delays journeys, limiting access to economic, educational and social opportunities. Direct costs of traffic congestion to individuals are increased fuel and maintenance costs, loss of time due to longer journeys, and inconvenience from the need to change travel times to avoid delays or allow extra time for trips in peak periods.

Traffic congestion is having a substantial impact on the Auckland economy. A recent study by NZIER[9] estimates the benefits of decongestion in Auckland would be between $0.9 billion and $1.3 billion per annum (approximately 1% to 1.5% of Auckland's GDP, based on 2016 prices). These estimates represent the economic and social benefits to Auckland if the road transport network was operating within its capacity, Monday to Friday.

The results from the 2019 Auckland Council and Auckland Tourism, Events and Economic Development (ATEED) Business Survey[10] reveal a dramatic rise in the number of businesses that are concerned about the impact traffic congestion is having on business confidence. The survey finds that traffic congestion, listed by 33% of respondents, is now viewed as the main impediment to growth and operations for Auckland businesses, ahead of other concerns such as staffing shortages. This compares with just 5% of respondents who mentioned traffic concerns in 2015.

9 Benefits from Auckland road decongestion (2017), New Zealand Institute of Economic Research
10 Auckland Council Business Survey: Auckland Region Wave 6 Results (2019), Auckland Council and ATEED

The case for congestion pricing

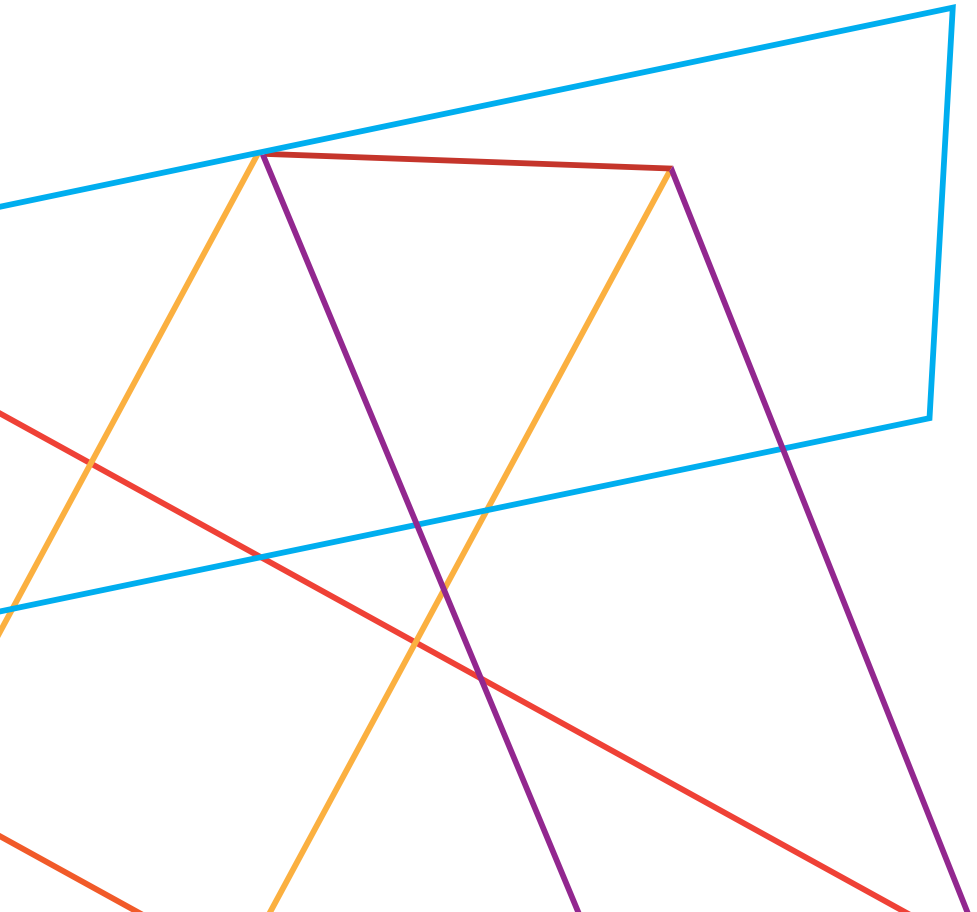
The economic argument for congestion pricing says that since travel times increase with traffic volumes, an additional car on the road slows down all other cars, increasing time costs for all the occupants of all cars. The decision to travel made by the occupants of an additional car is based on their own travel costs (their 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.

When decisions are only made based on private costs, too much of a good (in this case, travel) will be consumed. In most spheres of our lives when demand for a product or service exceeds supply, the price rises to a level where demand and supply meet (eg the price of strawberries on Christmas Eve or the price of airline flights during the school holidays). This is not the case for roads where the monetary cost of driving does not vary by time or location.

Congestion pricing is the concept of having to pay to travel on roads when there is high demand, that is, when they are congested. Congestion pricing is intended to correct for congestion externalities by confronting users with the costs imposed on other users. In doing so, two potential sources of efficiency gains are identified:

1. Deadweight losses – static classical models of congestion show that road pricing can reduce the deadweight losses that arise from excess demand and the resultant congestion externalities.

2. Monetisation of delays – dynamic bottleneck models of congestion show that congestion pricing monetises delays and encourages drivers to adjust departure times.



Benefits of congestion pricing

In practical terms, congestion pricing means that travellers experience faster journey times and generally more consistent travel speeds from less stop-start traffic. This would also improve trip reliability. People could then plan their journeys with more confidence knowing that it is unlikely they will be stuck in slow moving traffic, and consequently there will be a reduction in scheduling costs. People will not need to allow as much buffer time for trips, and tradespeople and freight operators will be able to schedule more jobs with the confidence that they can make them on time.

Because of the nature of congestion, a small change in people's travel behaviour can result in significant improvements in overall network performance. Those who pay the congestion charge and remain on the roads, benefit from improvements in network performance that congestion pricing delivers.

International lessons

A number of overseas cities, including Singapore, London, Stockholm and Gothenburg, have developed and implemented successful road congestion pricing schemes. These schemes have generated meaningful and sustained improvements in network performance, lifted public transport mode share, generated better environmental outcomes and helped provide sustainable funding streams. The international experience also shows that where congestion pricing has been introduced, the scheme is supported by communities who benefit. However, concern over distributional effects is clearly legitimate whenever public policy interventions impact different areas of the community in different ways.

There have also been several failed proposals for congestion pricing schemes in other cities, which were rejected, at least in part, on the basis that social issues had not been adequately addressed and that scheme designs would have adverse community impacts and generate insufficient benefits. These factors were amplified by poor and unclear communication around the proposed schemes, along with concerns over whether congestion pricing was being motivated by revenue raising, rather than improving network performance.

Auckland differs from Stockholm and London as there is higher use of public transport in these cities and a higher proportion of travel to their city centres. Likewise, Singapore's urban form and geography are significantly different to Auckland, with housing density being much higher, car ownership much lower and public transport much more extensive. Gothenburg has a similar car dependency to Auckland, but its congestion is more concentrated in a few areas, rather than widespread.

New York has recently announced it would become the first American city to introduce congestion pricing, while other global cities, including Vancouver, Los Angeles, Jakarta, and Beijing, have programmes underway to consider congestion pricing. Closer to home, congestion pricing has recently been proposed for Melbourne and Sydney, on the basis that existing strategies and extensive road building programmes have failed to deliver any meaningful improvement in congestion levels.

Technology assessment

A detailed technology assessment was carried out by the TCQ to determine which technology solution would be most practical and feasible in Auckland. The assessment addressed vehicle detection and identification, charge processing and back-end financial and customer services.

There is strong international precedent relating to the use of ANPR cameras, as the cameras and supporting software are now sufficiently accurate and reliable to be used as the primary technology for both vehicle detection and enforcement. In many congestion pricing and road tolling schemes overseas, ANPR cameras have now replaced the traditional (and obsolete) vehicle-tag and beacon technology. ANPR technology has already been proven in New Zealand for open road tolling and this type of technology could be readily applied to congestion pricing. ANPR technology is very cost effective and given it is the only practical enforcement mechanism, it is the compelling technology choice for congestion pricing.

In the future, in-vehicle technology incorporating GNSS could be expected to offer a more sophisticated congestion pricing solution. However, the application of GNSS technology is not yet proven for urban congestion pricing and there are a number of risks, logistical challenges and major cost barriers[11] to overcome before this is feasible. There are also concerns relating to the security and potential use of real-time tracking data that would need to be addressed.

Singapore has stated it intends to gradually rollout GNSS capable on-board units from late 2020 to enhance its existing infrastructure-based system[12]. Initially the devices will be used to provide value-added services, including real-time traffic information and ticketless parking options, though in time Singapore is considering a move to distance-based charging. It should also be noted that a future GNSS-based scheme still requires a camera network for enforcement purposes, meaning that an ANPR network installed to support a conventional congestion pricing scheme would not be redundant.

Smartphones do not provide an urban road pricing system solution in themselves because a smartphone tracks an individual not a vehicle. This means other trips like public transport and bicycle trips run the risk of being charged. In addition, not all road users will have a smartphone or have one that would be compatible with a congestion charging application. However, smartphones can provide a user-friendly channel for customer payment and account management.

The technology assessment undertaken by the TCQ also addresses whether the introduction of a scheme would necessitate the development and implementation of a completely new end-to-end solution or whether it could build upon available infrastructure and systems, including back office processing systems, communication and camera networks and customer interfaces. It found that a number of systems within Auckland Transport and the Transport Agency could be utilised to implement a congestion pricing scheme. In particular, the existing camera infrastructure – such as mounting poles, power, networking and roadside cabinets – could be used to support the installation of a suitable ANPR camera network. Using existing infrastructure has significant implications for reducing estimated scheme costs, the required timeline for delivery and overall project risks.

11 These include costs associated with development, supply, installation, maintenance and inventory management of the on-board units, in addition to monthly cellular and data costs.

12 Singapore's existing system uses dedicated short range communication (DSRC), a wireless communication technology that enables highly secure, high-speed direct communication between vehicles and the surrounding infrastructure, without any cellular infrastructure.

Options for congestion pricing in Auckland

The identification, design and assessment of potential congestion pricing options suitable for the Auckland environment was a key deliverable for the TCQ project. The options selection and evaluation process was undertaken in two stages, involving 26 longlist options and five shortlist options, followed by the development of an illustrative tariff concept suitable for the Auckland environment.

The longlist options were developed to address the TCQ's objectives and incorporated lessons from overseas and information about Auckland's transport network and travel patterns. These varied in size, scale and type of application including cordon, area and network congestion pricing schemes and alternative policy or pricing mechanisms that could potentially influence and manage demand.

Shortlist options

The longlist options were analysed against a multi-criteria analysis (MCA) evaluation framework, and the assessment was supported by a range of census data and information about Auckland's demographics, travel patterns and household incomes, along with lessons from overseas schemes. Based on the MCA evaluation, subsequent sensitivity testing and consolidation of similar options, five representative congestion pricing schemes were identified to be taken forward by the TCQ to the shortlist stage for further development and analysis:

1. **City Centre Cordon** – vehicles are charged to enter/exit the city centre (in the peak direction), using ANPR technology.

2. **Isthmus Area** – vehicles are charded to enter and travel within the isthmus area during congested periods, using ANPR technology.

3. **Strategic Corridors** – vehicles are charged to travel on congested corridors based on road hierarchy during congested periods, using ANPR technology.

4. **Strategic Corridors and City Centre Cordon ('Combination')** – a combination of options 1 and 3.

5. **Regional Network** – vehicles are charged to travel on all congested roads during congested periods. This option requires all vehicles to install GNSS/cellular in-vehicle hardware.

These options represent a spectrum of pricing schemes, from small localised schemes to a region-wide scheme, and range in complexity and ease of implementation. The five shortlist options were evaluated against the following criteria:

A. **Network assessment** modelling by Auckland Forecasting Centre (AFC) to provide a range of data and outputs to measure the impact of pricing options on the performance of the Auckland network.

B. **Practical assessment** based on international experience and benchmarks, including consideration of scalability/flexibility, enforcement, privacy, risks, revenues and costs.

C. **Social assessment** of the main equity and distributional impacts of congestion pricing on households and businesses.

D. **Environment assessment** of the forecast impact on environmental outcomes.

E. **Cost benefit analysis (CBA)** of the economic costs and benefits of the scheme.

Options evaluation results

The evaluation approach adopted reflects the TCQ's ToR, which require trade-offs to be considered between the potential impact on network and environmental performance, and community impacts, as well as practical considerations around cost and technical feasibility.

Key metrics from the transport modelling were used to compare the five options and observe the relative impact of each option on the Auckland transport network compared to the baseline. The baseline scenario was set at 2028, which assumes the infrastructure and service improvements committed in the RLTP have been made. The modelling followed an iterative process, with final tariff values of $2.30 adopted for the cordon/area schemes and $0.12/km for the strategic corridors and network schemes.

The comparative results from the traffic modelling for the five options are shown in Table 1. Estimated financial outcomes and results from a preliminary CBA are also presented. The estimated capital expenditure required to establish each option and the annual operating costs were based on evidence from overseas congestion schemes and New Zealand experience with open road toll facilities. The CBA methodology is consistent with the Transport Agency's Economic Evaluation Manual (EEM).

There are a number of important constraints and limitations with both traffic models and CBA calculations, so it is critical that the overall shortlist evaluation also includes the results from the social and practical assessments. More generally, in keeping with other complex public policy exercises, the TCQ adopted both a quantitative and qualitative approach to the overall evaluation exercise.

The shortlist evaluation yielded the following results:

Table 1: Shortlist options evaluation results

Evaluation metric	Shortlist option				
	City Centre Cordon	Isthmus Area	Strategic Corridors	Combination	Regional Network
Transport assessment					
No. of vehicle trips reduces by:	0.4%	4.7%	1.3%	1.7%	2.2%
Average vehicle travel time reduces by:	0.8%	5.4%	6.7%	7.6%	8.2%
Total travel time delay reduces by:	4.2%	26%	30.4%	34.6%	32.8%
Time spent in severe congestion reduces by:	2.5%	13.8%	16.1%	19.0%	20.3%
Freight vehicle kilometres travelled (VKT) in severe congestion reduces by:	1.6%	10.7%	22.4%	25.7%	23.9%
No. of jobs accessible within a 30 minute drive increases by:	1.9%	17.9%	14.6%	18.9%	17.1%
CO_2 emissions reduced by:	0.1%	0.3%	0.8%	0.7%	0.8%
Other emissions (VOC, NO_x, PM_{10}, $PM_{2.5}$) reduce by:	0.1%	0.3%	0.7%	0.8%	0.8%
Economic assessment ($million)					
Capital expenditure	$46	$198	$185	$207	$579
Annual operating costs	$10	$57	$84	$87	$267
Estimated revenues	$21	$259	$205	$223	$261
Annual benefits	$27	$182	$191	$216	$243
Benefit cost ratio	1.7	2.2	1.8	1.9	0.7

1. The **City Centre Cordon** covers a small area and has a limited impact on overall network performance, mainly targeting home to work (commuting) trips. Small scale and proven technology translates into low technical, implementation, operating, and privacy risks. Regional environmental impacts are likely to be minor due to the small scale of the scheme and small number of vehicles affected, but local air quality in the city centre would improve. Equity impacts are likely to be modest because of the small number of trips impacted and wide availability of public transport alternatives. For these reasons, along with its comparability to overseas schemes and potential for public acceptability, this option may represent a potential low-risk starting point for introducing congestion pricing.

2. The **Isthmus Area** option has the largest reduction in number of vehicle trips, but less impact on network performance because it focuses on a smaller spatial area than the Strategic Corridors, Combination and Regional Network options (as shown in the comparison of travel time, travel time delay and time spent in severe congestion metrics). Environmental impacts are likely to be modest for this option and focused in the charged area. Additionally, spatial and equity impacts are worse for the Isthmus Area option as households within the isthmus local board areas (LBAs) bear the brunt of the scheme.

3. The **Strategic Corridors** option is targeted and generates meaningful, region-wide network performance benefits and congestion relief. The option has low technical implementation and operating risks because it is relatively simple to develop, operate and manage. The estimated average change in financial costs for households is broadly similar by location. Spatial impacts are low because the scheme targets congested routes not boundaries. The Strategic Corridors option has positive environmental impacts similar in size to the environmental impacts of the Combination and Regional Network options.

4. The **Combination** option generates very similar impacts on network performance to the Strategic Corridors option. This suggests there are no meaningful additional benefits from considering the two individual options as a combined package. That said, there are also no observed detrimental effects when compared to the Strategic Corridors option alone.

5. The **Regional Network** option achieves a small incremental improvement to network performance over the Strategic Corridors option but has the lowest benefit-cost ratio because of high capital and operating costs. The requirement to install in-vehicle units capable of collecting time and location data for all trips, including uncharged road segments, raises significant privacy and acceptability concerns. With no international precedent, the scheme has the highest technical risk of all the options considered. Poor equity outcomes stem from significant financial impacts for all household types (partially associated with the costs of the in-vehicle units), with low income households disproportionately affected.

Preferred congestion pricing options

Based on the evaluation findings, the TCQ identified the City Centre Cordon and Strategic Corridors options as having the most potential for Auckland. The two preferred congestion pricing options differ in spatial scale and therefore their forecast impact on network performance. Both options represent workable solutions and have the potential to generate sensible trade-offs between improving network performance as a result of modifying travel patterns, and the requirement to minimise adverse social impacts.

However, the City Centre Cordon scheme's geographic coverage limits its effectiveness as an ultimate state for congestion pricing in Auckland. It would still be a viable and potentially low risk step as part of a phased introduction of the Strategic Corridors scheme. The preferred long-term option is therefore the Strategic Corridors scheme as it provides sufficient coverage and flexibility to deliver sustainable improvements in network performance into the future.

Illustrative tariff concept

The TCQ undertook an exercise to develop an illustrative tariff concept for Auckland. The tariff concept adopted is a key component of any road-pricing scheme because it determines the price that motorists are charged. Ideally, the tariff concept adopted will contribute to the greatest improvement in network efficiency, while minimising any adverse community impacts.

Tariff structures

There are two potential charging structures that are compatible with the ANPR technology platform:

1. Point-based charges, which have the following features:
   - Charges are cumulative
   - Charges can vary by time and location.

2. Access charges, which have the following features:
   - Every vehicle faces the same charge regardless of the location of the chargeable event[13]
   - Charges can vary by time
   - Charges are not cumulative, no matter how many times a vehicle is detected by the roadside infrastructure within a defined period of time ('journey window').

The TCQ investigation found that Auckland's travel patterns lend support to the adoption of an access charge for the following reasons:

- Access charges are simple to understand as the charge is only dependent on time of travel.
- Point-based charges are dependent on time of travel, distance travelled, and route taken, and are more difficult to understand.
- Access charges provide certainty for motorists of the charge that they will incur.
- With point-based charges motorists will not necessarily know in advance the charge they will face for their trip.
- Access charges only require one detection for an entire journey to trigger the charge, meaning there is little possibility of evading the charge by rat-running.
- Point-based charges are charged at each detection so there is a high incentive to rat-run to avoid any charging point.
- Low charges for short trips under point-based charges will favour residents of higher-income central suburbs.
- Cumulative charges from point-based charges will generate adverse social impacts because lower income households in outer suburbs will face higher charges due to longer average journeys.
- An access charge means that all vehicles travelling at the same time face the same charge regardless of the origin and destination location.

In addition to the charging structure, the tariff policy comprises of several related elements. Based on lessons from overseas, and Auckland's existing travel patterns, the TCQ defines and recommends the following tariff parameters:

- **Time**: charges vary by time bands to spread demand and avoid perverse travel behaviour.
- **Charge bands**: 30 minute bands to enable a practical number of graduated steps across the peak period.
- **Journey window**: vehicles incur the highest charge detected within a two-hour journey window.
- **Daily caps**: total daily charges are capped at twice the highest peak-period charge.
- **Travel days**: charges are incurred from Monday to Friday, with weekends and public holidays excluded.
- **Exemptions**: emergency vehicles, buses, motorcycles/scooters, and non-powered vehicles (eg trailers) are exempt.
- **Discounts**: to minimise the impact on vulnerable travellers (refer the following sections), discounts should be included in the mitigation measures.
- **Heavy vehicles (>3.5 tonnes)**: would incur higher charges compared to those for light vehicles.

13 A chargeable event refers to a detection of a vehicle on a road that is subject to a charge at the time when the detection occurs.

Illustrative tariff schedule

A key determinant in setting the level of congestion charges appropriate to the Auckland context is the target improvement sought in network performance. This, in turn, must reflect the ability for peak-period travellers to realistically respond to congestion charges through mode and time changes.

Overseas schemes were observed to have demand responses to the introduction of congestion pricing within the range of a 15%–20% reduction in traffic. An achievable improvement in network performance for Auckland is more likely to be in the order of 8%–12% given the underlying travel patterns and availability of practical alternatives like public transport. This level of network improvement is currently evident during the school holidays. This is comparable with the long-term reduction achieved in Gothenburg, a small city with a similar public transport mode share to Auckland. Social considerations (discussed in the following section) will also limit the level of network performance improvement that could otherwise be achieved through higher charges.

The illustrative tariff schedule, showing the 30 minute charging time bands and corresponding charges for an access-based tariff for light vehicles, is shown below. These are preliminary and would be subject to refinement through detailed design, further traffic modelling and periodic review. As a general comparison, the starting peak tariff value aligns with the adult two-zone public transport fare using an AT HOP card.

Table 2: Illustrative light vehicle congestion charges (Monday–Friday)

Time	Period	Tariff
06:00-06:29	Shoulder	$1.50
06:30-06:59	Shoulder/Peak	$2.50
07:00-07:29	Peak	$3.50
07:30-07:59	Peak	$3.50
0:800-0:829	Peak	$3.50
0:830-08:59	Peak/Shoulder	$2.50
09:00-09:29	Shoulder	$1.50
09:30-15:29	Interpeak	No charge
15:30-15:59	Shoulder	$1.50
16:00-16:29	Shoulder/Peak	$2.50
16:30-16:59	Peak	$3.50
17:00-17:29	Peak	$3.50
17:30-17:59	Peak	$3.50
18:00-18:29	Peak/Shoulder	$2.50
18:30-18:59	Shoulder	$1.50
19:00-05:59	Off-peak	No charge

Community assessment

Overseas case studies have found that although the overall distributional impacts of road pricing are generally modest, derived from an assessment of net overall benefits and costs, congestion pricing can clearly have a large impact on some vulnerable households and individuals. This is highly dependent on the specific design of the scheme and, in particular, the location of the charging points.

To ensure that the community impacts of the preferred congestion pricing schemes are fully understood, the TCQ commissioned a refined social assessment of the Strategic Corridors option. This examined the financial burden of a potential congestion charge on Auckland and Māori households, and businesses. The refined social assessment was confined to the Strategic Corridors scheme, as the preliminary assessment found that average equity impacts are likely to be modest for the City Centre Cordon option because of the small number of trips impacted and wide availability of public transport alternatives.

Social assessment results

The refined social assessment found that the increase in average travel costs, as a percentage of mean annual income, is generally modest. However, depending on how the revenue is used, as a proportion of household income, low-income households will spend more on congestion charges than higher income households.

Compared to the average impact on all households, financial impacts on Māori households are:

- similar within each income band
- greater in the Maungakiekie-Tāmaki, Franklin and LBAs
- the same in the Manurewa and Papakura LBAs
- lower in all other areas.

To a significant extent, these differences reflect the distribution of Māori households across low, medium and high-income bands. This means that the areas where the impacts are greater for Māori households are areas where there are proportionately more low-income Māori households than other low-income households.

Estimated annual average costs potentially mask the financial impact some individual households will face. Some households will make no trips during the peak periods (this might include for example, workers with flexible hours or retired people) and other households could be charged for multiple trips during peak periods, such as households with several working adults. To understand the level of charges a household could potentially face in a worst-case scenario, the TCQ examined possible costs for households when all their estimated peak-period trips were charged (compared to the average of 67% of trips for all households).

This scenario of higher congestion charges increases the estimated impacts to between 0.8%–3.3% of annual income for average low-income households. The effects could be even larger if the income levels of a specific household were lower than average, and there would also be regional variations across individual LBAs.

To better understand concerns around the potential distributional impacts associated with congestion pricing, the TCQ extended the social assessment to focus on vulnerable Auckland households that could be impacted by the introduction of a congestion charge. The assessment was based on a series of interviews undertaken with 50 households located across the Auckland region. It found that the main impact raised by participants was the pressure that additional, unavoidable, congestion charges would have on household budgets. Reduction in discretionary spending and saving were less likely to be identified by participants as causing hardship. Increased debt levels, reduced food budgets and resilience impacts were more likely to result in hardship and an element of budget stress.

Mana Whenua impacts

The social assessment included an assessment of the financial impacts on Māori households. In addition, an initial assessment of how the City Centre Cordon and Strategic Corridor options could affect access to places of importance, and in turn impact on the identity, wellbeing and values of Mana Whenua in Tāmaki Makaurau was also undertaken. The key conflict between congestion pricing and a thriving Mana Whenua wellbeing and identity was identified as the constraint that it might pose for Mana Whenua access to, and engagement with, such places:

- that define Mana Whenua identity
- where tikanga (Māori custom) determines behaviour and conduct
- where cultural obligations and benefits are fulfilled
- where Treaty redress obligations, including collective commercial interests, are fulfilled.

The findings suggest that both options are likely to have some negative impacts on Mana Whenua well-being and identity. The Strategic Corridor option affects more Mana Whenua groups in a more substantial way than the City Centre Cordon option, due to the area that the Strategic Corridor option covers being much larger.

However, there is the potential for the impacts of congestion pricing to be positive, if the outcomes, being improved network performance, actually facilitate improved access. The ability for congestion pricing to improve access for Mana Whenua can be determined by Mana Whenua during engagement. The question is whether the negative impact of restricting Mana Whenua access can be offset by the potential improvement in access by restricting others' movement.

The assessment identified a number of recommended actions to be carried out in any subsequent stages of the project and recommended that Te Tiriti o Waitangi and Māori responsiveness commitments should be considered prior to any final determination of a scheme.

Business trip impacts

Consistent with international evidence, the social assessment modelling exercise suggests that business related trips would enjoy a net $20 million benefit from the congestion charge. This is because reduced congestion on the road network generates travel time savings to businesses that exceed the costs of paying the congestion charge.

Mitigation measures

The introduction of a congestion pricing scheme will generate benefits. However, the social assessment indicated that a significant number of households may face an unavoidable increase in transport costs that would cause a financial burden, which illustrates the need for mitigation measures for these households.

The application of daily charging caps, whereby no motorist would face a daily charge greater than twice the highest peak-period charge, represents an effective mitigation measure for most households. Likewise, a daily cap means that businesses that are required to undertake multiple trips, such as couriers and commercial transport operators, would not be excessively penalised, while at the same time enjoying improved productivity from faster and more reliable journeys.

The TCQ considers that for vulnerable households, the mitigation of financial impacts from the introduction of a congestion pricing scheme would require supplementary support in addition to the daily cap. To avoid the costs and complexity of developing an entirely new mitigation measure, the TCQ suggests that the Community Services Card (and eligibility criteria) could be adopted as the delivery mechanism using:

- discounts linked to the eligible person's legally owned vehicle
- account credits linked to the eligible person's scheme account.

Mitigations for disability and mobility users could take the form of:

- charging exemptions for modified vehicles certified by the Low Volume Vehicle Technical Association
- increased funding to the existing Total Mobility Scheme to offset any increases that may be passed onto eligible people (eg through increased taxi fares).

Use of revenues

The primary objective of congestion pricing is to improve network performance, not to raise additional revenue from road users. Nevertheless, congestion pricing is by its nature a revenue source, as congestion pricing works by exposing road users to costs that are currently externalised, in order to achieve behaviour change.

Internationally, transparency around the use of funds generated from congestion pricing, and the use of revenues for public transport services and transport infrastructure projects, have been shown to be important factors in developing strong community support.

If a decision is made to introduce congestion pricing in Auckland, the TCQ recommends that scheme revenue, after operating costs are accounted for, should be used to address local community impacts as follows:

- Reinvest in public transport or other alternatives to provide more people with practical alternatives to paying the charge, helping to reduce the financial impact.
- Fund targeted mitigation measures to those identified as being severely negatively affected by the scheme.

There may also be an opportunity to use some of the net revenue to offset the Auckland regional fuel tax.

Ensuring clarity on how revenue would be used is critical to building public acceptance. It also helps for at least some of the revenue to be applied to roads, demonstrating a clear benefit to those paying to use the roads.

Scheme implementation

The evaluation exercise found that the City Centre Cordon and the Strategic Corridors options represent the congestion pricing schemes that the TCQ considered to have the most potential, as they balance improvements in network performance with practical and equity considerations. The two schemes cover a spectrum of geographically small to large areas, noting that relative spatial coverage will be the main determinant of the scheme's impact on improving network performance. Moreover, the two schemes are not necessarily exclusive – they could either be implemented as stand-alone demand management schemes in their entirety, or in some combined form. The City Centre Cordon scheme can also be viewed as a subset of the Strategic Corridors scheme.

Implementation options

There are several potential implementation options available to Auckland if a decision is made to introduce congestion pricing:

1. City Centre Cordon: this represents a low risk implementation option. However without further expansion, the scheme will generate limited improvements in network performance because of its restricted geographical coverage and small number of vehicle trips impacted.

2. Phased Strategic Corridors: adopting a phased approach to implementation would lower risks and enable learnings to be applied as the scheme expands. Over time, the phased Strategic Corridors scheme is likely to encompass all motorways, strategic arterials and main arterial routes in Auckland.

3. Comprehensive Strategic Corridors: this would generate meaningful, region-wide network performance benefits and congestion relief. However, this option has the greatest go-live risk due to the size of the scheme and volumes of transactions that will be generated from day one. This approach will also raise risks around scheme design, the supporting technology platform and implementation efficiency.

Preferred implementation option

The TCQ is of the view that Auckland should adopt a phased approach to implementing a congestion pricing scheme. A phased approach reduces tehcnical risks and reflects considerations relating to the objective to improve network performance, access to alternative transport choices and community engagement.

A phased approach would also give:

- More time to gain public acceptability and, in the long term, deliver the most credible scheme to solve Auckland's congestion problems.
- Time to review the impacts of the current scheme before moving to any additional stage.
- The chance to observe motorists responses and assess the effectiveness of mitigation measures while progressing through the phases.

Illustrative phasing

The TCQ considered a number of different options for phasing the implementation of a Strategic Corridors congestion pricing scheme. The selection of strategic roads for inclusion in each phase is proposed to be based on:

- Severity of congestion on the corridor(s).
- Availability of alternative modes of transport on the corridor(s).
- Social and spatial equity considerations.
- Feedback from community and scheme users.

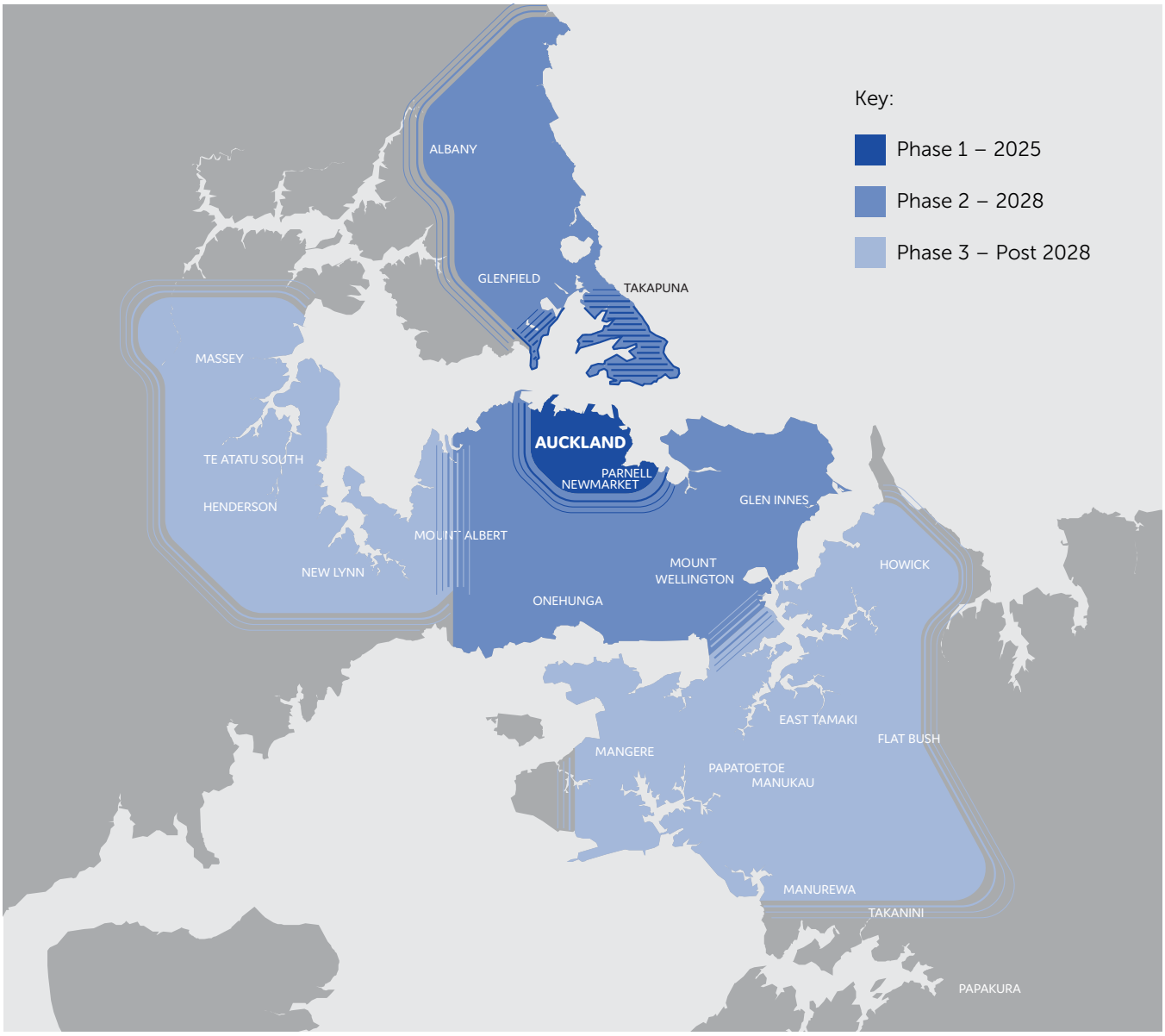
The first phase, a charging scheme around the central city area, could coincide with the CRL opening, Northern Busway extension and station upgrades, and Auckland Manukau Eastern Transport Initiative (AMETI) Eastern Busway. Depending on the geographic coverage of this phase, a minimum of two years for implementation is likely to be required.

Over time, the scheme would be expanded along the most congested roads and motorways, to coincide with public transport and additional corridor improvements. Subsequent phases, depending again on geographic coverage of each phase, may take 6–18 months for each rollout.

A potential timetable to introduce a comprehensive congestion pricing scheme would be in the order of ten years as indicated in the map in Figure 2.

Figure 2: Indicative phases of an Auckland congestion pricing scheme

Please note that boundaries are indicative only



Recommendation

Based on the technical work undertaken in the TCQ investigation, there is a strong case for implementing congestion pricing in Auckland for demand management purposes. However, prior to a final decision on whether or not to implement congestion pricing, the TCQ recommends that a comprehensive stakeholder and public engagement exercise be undertaken.

Next steps

The next steps for the TCQ would be to re-engage with the key stakeholders, update them on the main findings and gain feedback. Consideration will also need to be given to the form and timing of public engagement and the recommendations made in the initial Mana Whenua assessment.

Auckland travellers and local communities need the opportunity to respond to the provisional scheme design, and potential benefits and costs need to be clearly explained and articulated. The TCQ recognises that lack of public acceptance is the single biggest factor that has halted development of urban congestion pricing schemes internationally. Successful schemes have achieved synergy between policy, design and communications with the public, particularly those most likely to pay the congestion charges.

A decision to introduce a congestion pricing scheme in Auckland would require legislation. This could be achieved by amending the Land Transport Management Act 2003 (LTMA), which allows for the government to introduce a road tolling scheme. Alternatively, the government may prefer to introduce new enabling legislation for congestion pricing. It is expected that a legislative process to draft, consult and pass supporting legislation for the purposes of congestion pricing would take approximately 12–18 months once policy decisions have been made.

Decisions will also be required around the proposed ownership and operating model, and the preferred approach to procurement once the final design is developed. Complementary measures, such as additional support for active modes, car-sharing and parking policies, could be introduced to support the ability of motorists to change their travel habits in response to congestion charges.

Auckland should also consider whether to undertake a demonstration project to build confidence and support public engagement. A demonstration project could also be used for a variety of purposes, including testing technology and interfaces between customer service and account management, as well as for obtaining feedback on options from participants.

Auckland Council
WAKA KOTAHI NZ TRANSPORT AGENCY
Ministry of Transport TE MANATŪ WAKA
THE TREASURY Kaitohutohu Kaupapa Rawa
STATE SERVICES COMMISSION Te Kāmihana O Ngā Tari Kāwanatanga
New Zealand Government