

The Global Evidence Base for the Transport Emissions Reduction Pathway



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Contents

Global context	3
Learning from other cities	3
Key trends and lessons.....	4
1. Supercharge walking and cycling.....	4
2. Massively increase public transport patronage	6
3. Resource and prioritise sustainable transport.....	8
4. Reduce travel where possible and appropriate	10
5. Neighbourhoods for people.....	11
6. Build up not out	14
7. Electrify private vehicles.....	16
8. Enable new transport devices.....	17
9. Low-emissions public transport.....	19
10. Efficient freight and services	20
11. Empower Aucklanders to make sustainable transport choices	22
Applying the lessons	23

Global context

Climate change is a global issue and Auckland is not alone in facing the challenge of needing to rapidly reduce its emissions. Te Tāruke-ā-Tāwhiri's targets of halving the region's emissions by 2030 and reaching net zero emissions by 2050 are consistent with the commitments of numerous cities around the world.

As a member of the C40 Cities group since 2015, Auckland has been recognised for its commitment to reducing emissions, and the city benefits from being part of a knowledge-sharing network with almost 100 other global cities. While some of these cities have had climate plans or comparable documents for several decades, many others are at a similar stage to Auckland in their emissions reduction journeys.

Globally, momentum has grown throughout recent decades to rise to the challenge of reducing greenhouse gas emissions. Auckland Council voted unanimously to declare a Climate Emergency in 2019 and, as of mid-2022, more than 2,000 jurisdictions throughout the world have made similar declarations. Along with Auckland, these cities are now tasked with developing emissions reduction pathways to give effect to their climate declarations, commitments and targets.

A common theme across the wide range of cities which have committed to mitigating the impacts of climate change is a recognition of the essential role that transport needs to play in achieving emissions reductions. Not only do transport emissions comprise a significant proportion of most cities' current emissions profiles, but there is a growing body of evidence from around the world that taking action to reduce transport emissions is both feasible and effective.

While the specific approaches adopted by different jurisdictions vary based on their unique contexts, thousands of cities across the globe are united in their commitment to reducing their transport emissions. This reflects cities' increasing recognition of their responsibility to contribute to the creation of a more sustainable, equitable and healthy planet for current and future generations.

Learning from other cities

Auckland has had the opportunity to learn from the experiences of other cities to inform the development of its own transport emissions reduction pathway (TERP). By building on the lessons learned from cities across Aotearoa and around the world, Auckland can focus on adapting and applying global best practice to the context of Tāmaki Makaurau, rather than needing to try and reinvent the wheel.

An important component of learning from other cities is understanding their similarities to and differences from Auckland, to allow lessons to be applied in a manner which is both useful and relevant. While no city provides a perfect comparison to Auckland, by learning from the experiences of a wide range of other cities, it is possible to triangulate the key trends and apply these to the development of a robust and evidence based pathway for Tāmaki Makaurau.

As part of the development of TERP, research has been undertaken into a wide range of global cities, focusing both on the actions which cities have already taken as well as their plans for achieving transport emissions reductions in the future. This research yielded two key types of findings which assisted with the development of TERP: empirical evidence showing the effectiveness of various actions, and examples of other cities' emissions reduction pathways, as manifested in their plans, strategies and other documents.

Plans and strategies from more than two-dozen cities were examined, with a deliberate emphasis on including a diverse range of cities in terms of urban form, socio-cultural characteristics and current emissions

The Global Evidence Base for the Transport Emissions Reduction Pathway

profile. There was also a specific focus on contexts with notable similarities to Auckland, including cities experiencing rapid population growth, urban areas where past development has been predicated on car dependency and jurisdictions which have committed to embedding an indigenous lens into the heart of their climate strategies. Overall, research into other cities' approaches shows that many cities have plans for reducing their transport emissions which are comparable to Auckland's proposed pathway, either encapsulated in a standalone transport emissions strategy or as part of a broader climate plan.

Some of the case study cities have historically had lower transport emissions than Auckland, but there are also examples of formerly car-dependent cities which have demonstrated success at achieving the kind of transformational change that Auckland needs to meet its climate targets. The lessons from these cities show what can be achieved through a committed and coordinated plan to addressing the challenges presented by climate change, and also highlight specific actions which have proven to be successful.

Applying case study research to the development of TERP helps ensure that Auckland adopts an effective and evidence based approach which reflects global best practice, while responding to the unique context of Tāmaki Makaurau.

Key trends and lessons

Analysis of the pathways adopted by cities across the globe reveals several important trends and lessons which span across a diverse range of contexts. One of the most important lessons is the need for a multi-faceted approach which addresses all aspects of the transport system and focuses on achieving transformational change. Cities which are on the path to reducing their transport emissions tend to have adopted an integrated package of actions, consisting of a complementary mix of policy changes, infrastructure projects and service enhancements.

This document aims to provide a succinct summary of the global evidence base for each of the TERP's transformation areas, while the main *Sustainable Access for a Thriving Future* document incorporates these trends and lessons into a pathway for Tāmaki Makaurau. Specific trends and relevant lessons are summarised below, grouped according to the pathway's eleven identified areas of transformation over the next eight years.

1. Supercharge walking and cycling

Facilitating an increase in walking and cycling mode share sits at the heart of many cities' emissions reduction plans. Shifting private vehicle trips to active modes of transport is widely recognised as one of the most effective and affordable methods of reducing transport emissions, and the evidence from other cities shows that there is great potential for Auckland to achieve success in this area.

Auckland's current cycling mode share is much lower than many other cities around the world, even places with similar urban characteristics such as Canberra and Melbourne, which have approximately double and triple Auckland's mode share, respectively. Census data also shows that Tāmaki Makaurau has a significantly lower rate of cycling for journeys to work and education than other large urban areas in Aotearoa, including Wellington, Christchurch, Hamilton and Tauranga. In Christchurch, residents are five times more likely to cycle to work and six times more likely to cycle to their place of education than people living in Auckland.

An example of a city which has invested heavily in cycling is Seville, which has rolled out an extensive cycleway network from a low baseline since 2005, precipitating a tenfold increase in cycling mode share. The

The Global Evidence Base for the Transport Emissions Reduction Pathway

first 80km of its new network, which relied heavily on the transformation of existing traffic lanes and parking spaces, was built between 2005 and 2007, costing NZ\$49m and leading to a 450% increase in cycling trips between 2006 and 2011. Subsequent phases resulted in a comprehensive network of safe cycleways, as shown in Figure 1, making cycling a viable option for a wide range of trips. A key factor in the success of the network is the consistent standard of physical infrastructure across the city, with cycleways generally following arterial roads, making them highly visible and legible for potential users.

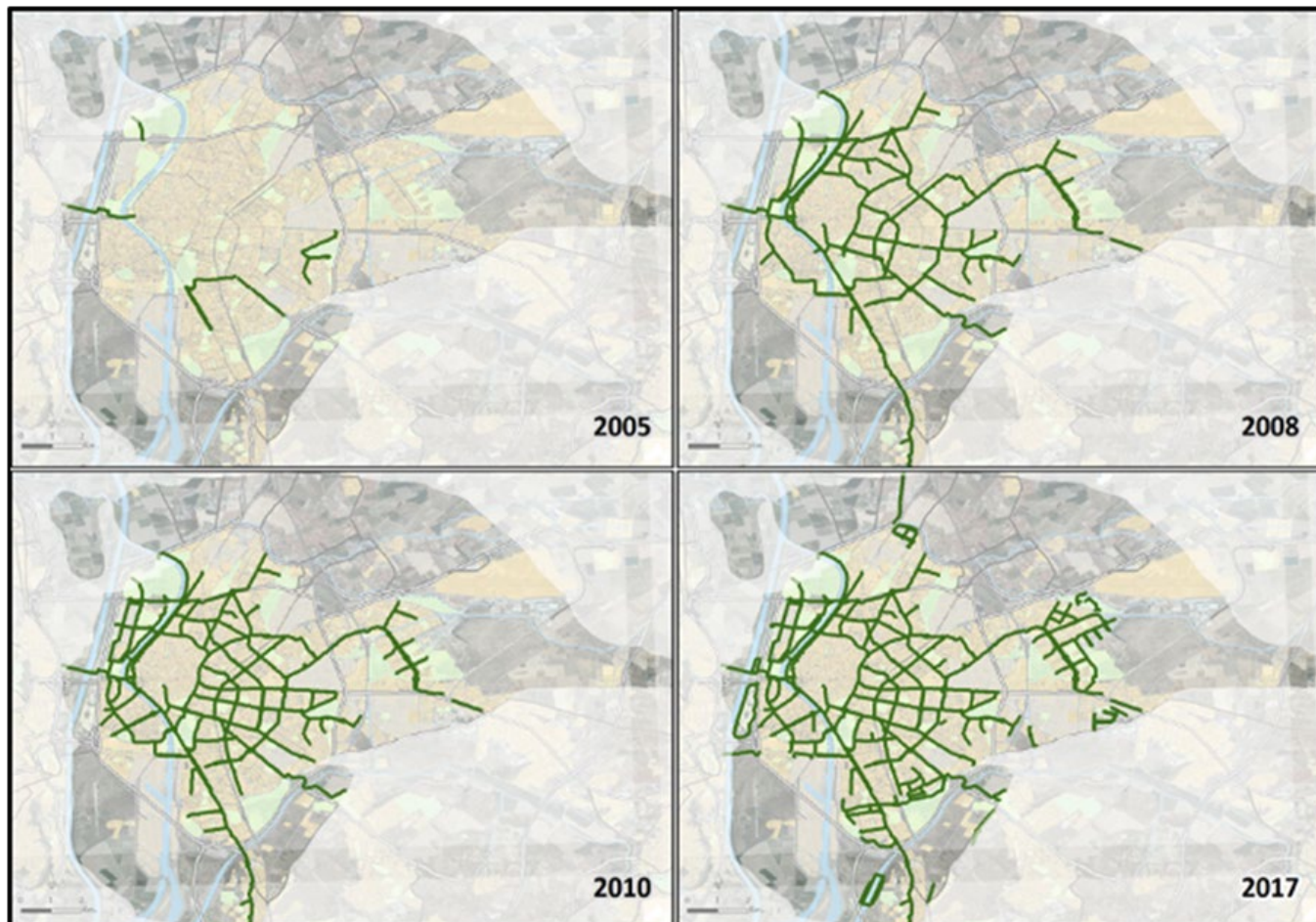


Figure 1: Growth of Seville's cycleway network between 2005 and 2017. For scale, the dimensions of each map are approximately 18km by 14km.¹

In Aotearoa, Christchurch has demonstrated success at delivering an extensive network of cycleways within a similar regulatory, political and geographical context to Auckland. As with many other cities, road space reallocation has been integral to allowing Christchurch to expand its cycling network in a timely and cost-effective way, although shared paths and cycleways have also been provided along streams, railway lines and motorway corridors. The city is still in the process of addressing several notable gaps in its network, although a key facet of its success has been the focus on creating a cohesive and connected network of safe cycling routes, making cycling a viable mode of transport for a wide range of journeys and potential users.

While the topography of Christchurch is generally flatter than Tāmaki Makaurau and it receives less rainfall on an annual basis, plenty of cities have overcome the potential barriers of weather and geography to create well-utilised cycling networks. For example, Tokyo, Munich and Vancouver all have similar levels of annual rainfall and average sunshine hours to Auckland yet have significantly higher cycling mode shares.

¹ Figure 1: <https://usa.streetsblog.org/2020/10/13/best-practices-how-seville-became-a-city-of-cyclists/>

The Global Evidence Base for the Transport Emissions Reduction Pathway

Another case study of successful investment in cycling is London, which has been incrementally expanding its cycling network for several decades. More recently, the city extended its cycleway network by more than 100km during the first year of the Covid-19 pandemic, primarily by reallocating road space. The proportion of Londoners living within 400m of a safe cycling route grew from 12% in 2019 to 18% by October 2020, showing the massive change that was made possible by adopting a quicker and more resourceful approach to rolling out cycling infrastructure. Expansion of the safe cycling network across the city is continuing, with a target of growing the network to reach 33% of residents by 2025. London also launched a public bicycle hire scheme in 2010, allowing tourists and people who do not own a bike to utilise the city's expanded cycling network. It has been highly successful, with more than 10 million trips taken in 2019, and the number of bicycles included in the scheme has progressively increased from 5,000 to 11,500 since its launch.

In addition to London, other cities are also working to provide universal and equitable access to bikes through a variety of actions including cycle hire schemes, community bike share programmes and price subsidies. An example of this is a programme in Ireland where employers can purchase bikes and cycling accessories for their employees and then deduct the costs from their pre-tax earnings over a 12-month period, serving as both an interest-free loan and a tax-based subsidy. Another city focusing on equitable access to bikes is Medellín, which plans to make 50,000 e-bikes available to rent at low cost, so that all residents have the opportunity to benefit from the city's new cycling infrastructure. Programmes like this are often accompanied by initiatives to provide people with the skills, information and confidence to fully take advantage of the benefits of cycling.

Many cities around the world are also investing in actions which make it easier and safer for people to walk throughout the city. This can include initiatives such as wider footpaths, safer crossing facilities and ensuring that pedestrian environments are accessible for people of all ages and abilities. Research by Soathong, Wilson, Ranjitkar & Chowdhury (2019)² shows that pedestrian fatalities in New Zealand have been reducing at a slower rate than nations like Sweden and the Netherlands, which were early adopters of Vision Zero and similar transport safety concepts. An extensive body of global research highlights how lower speed limits, slower street designs and policies which prioritise the safety of vulnerable road users are linked to a reduction in deaths and serious injuries for all road users, and also contribute to the creation of a more attractive pedestrian environment which encourages the uptake of active modes of transport.

2. Massively increase public transport patronage

Increasing public transport patronage and mode share is a goal shared by cities around the world. Although it has grown significantly in recent decades, Auckland's current public transport mode share is still far lower than many other cities, including those of a comparable size and density. Before the Covid-19 pandemic, Sydney's public transport mode share by distance was more than 16%, while Melbourne was more than 10% and Brisbane's was almost 8%. These figures are all much greater than Auckland's 2019 public transport mode share of 4% by distance and show that significant mode share growth is possible in cities with similar urban characteristics.

Other cities across the globe already have public transport mode shares greater than what the pathway models for Auckland in 2030. Prior to the pandemic, London had a journey-based public transport mode share of 36%, while, according to data compiled by Deloitte, São Paulo had 31% and Oslo had 30%. Toronto, a large but not particularly high-density city by global standards, had a public transport mode share of 23%

² Soathong, A., Wilson, D., Ranjitkar, P., & Chowdhury, S. (2019). A critical review of policies on pedestrian safety and a case study of New Zealand. *Sustainability*, 11(19), 5274.

The Global Evidence Base for the Transport Emissions Reduction Pathway

of trips prior to the pandemic, equal to what the pathway models in 2030. Toronto also demonstrates that high public transport mode share can be achieved without necessarily requiring a rapid transit network as extensive as cities like Paris, Shanghai or Tokyo.

Sydney is an example of a comparable city which is significantly expanding its rapid transit network. The city's extensive heavy rail system forms the backbone of its network, but recent projects have also included light rail, automated metro and busways. Investment in rapid transit is accelerating, with up to NZ\$60 billion planned to be spent on several major rapid transit projects over the next ten years. This will deliver almost 80km of new metro lines throughout the urban area and a new light rail system in the city's western suburbs. Sydney already has the largest public transport mode share of any major city in Oceania, but these projects form part of a plan to further increase public transport patronage across the city.

Singapore provides another case study of a city investing heavily in public transport infrastructure to facilitate patronage growth, particularly through the expansion of the MRT, the city's metro system. Between 2009 and 2019, daily MRT patronage increased by 88% to 3.4 million trips, while light rail ridership increased by 131% and bus patronage increased by 35%. The experiences of Singapore and Sydney both highlight the transformational potential of a comprehensive and well-integrated public transport system and show that infrastructure efficiencies can be achieved through long-term planning.

Other cities have achieved significant growth in public transport patronage without spending tens of billions of dollars on new infrastructure. For example, Bristol has been implementing a package of improvements to the city's bus services, which resulted in bus patronage increasing by more than 50% in the 5 years to 2018. Actions included the incremental creation of a bus rapid transit network centred on the roll out of 48km of busways and bus lanes (at a cost of NZ\$430m), as well as corridor improvements which reduced journey times on more than 70 bus routes. Even in cities with extensive rail-based rapid transit networks, buses still play an essential role in supporting patronage growth. This is demonstrated by the fact that more than 44% of all public transport trip stages in London were taken by bus in 2019, despite the city's highly extensive rail and metro networks.

Evidence from cities around the world shows that the fundamental factors for a successful and well-patronised bus network are consistent across almost all contexts. Frequency, speed, reliability and both the spatial and temporal coverage of the network are essential to increasing patronage, and cities which have taken steps to improve these factors, including Auckland, have usually seen corresponding increases in patronage. Many cities' approaches to reducing their transport emissions place a strong emphasis on improving their bus networks to encourage mode shift to public transport. A clear illustration of this is Melbourne's Climate Change Mitigation Strategy, which proposes the roll out of priority lanes for buses and trams as well as increasing the frequency of core bus routes to 10-minute headways.

Another way that cities are increasing public transport patronage is through initiatives to make their fares more affordable and equitable. Currently, Auckland's fares are more expensive than a number of comparable cities, especially as Auckland has very limited daily and weekly pass options and caps. In 2019, Sydney reduced its weekly fare cap to AU\$50 (NZ\$55), creating a more equitable fare structure and encouraging people to use public transport for a variety of trips throughout the week. Some cities, such as Tallinn and Luxembourg, have eliminated fares entirely, although results so far have been mixed in terms of the impact this has on mode shift from private vehicles to public transport.

Cities are also recognising the significant emissions reduction potential of shifting long-distance trips from private vehicles or aviation to public transport modes such as trains and coaches. For example, Barcelona's climate plan emphasises specific actions aimed at increasing the mode share of inter-city bus services as well as shifting trips from planes to high-speed rail. The provision of high-quality terminal facilities and

successful integration between long-distance public transport and local services is important for increasing their uptake, as has been achieved successfully in many cities including London, Sydney and Rotterdam. As well as long-distance trips, inter-regional public transport also encompasses shorter trips which cross regional boundaries, and other cities and countries have taken various approaches to overcoming the challenges of integrating public transport systems across jurisdictional boundaries, including those related to network design, funding provision and fares.

Finally, cities are also focusing on addressing barriers which discourage or prevent people from using public transport, through actions like improving the cleanliness of vehicles, addressing concerns about crime and making more stops universally accessible to people of all ages and abilities.

3. Resource and prioritise sustainable transport

Resourcing and prioritising sustainable modes of transport forms an integral part of many cities' emissions reduction plans and is primarily predicated on the creation of a more sustainable transport hierarchy. At its core, this tends to involve the reallocation of road space, funding and other resources away from catering for growth in private vehicle movements and towards supporting sustainable modes of transport. For example, lanes dedicated to private vehicles can be converted into bus lanes or cycleways, or entire streets can be transformed into pedestrian malls or transit malls, which prioritise sustainable modes of transport.



Figure 2: George Street in Sydney's City Centre, where space previously used for traffic lanes has been reallocated to create a light rail corridor and wider footpaths³

³ Figure 2: <https://commons.wikimedia.org/w/index.php?curid=95671317> Contributed by user: nicephotog (CC BY-SA 2.0)

The Global Evidence Base for the Transport Emissions Reduction Pathway

Several Australian cities, which generally have similar private vehicle mode shares to Auckland, have been undertaking projects which reallocate road space to more sustainable modes of transport in recent years. Within the past decade, Sydney and the Gold Coast have both reallocated a considerable amount of space previously used for driving and parking to construct light rail networks. In Sydney, this entailed the transformation of George Street (pictured in Figure 2), a major City Centre thoroughfare comparable to Auckland's Queen Street, with subsequent work being undertaken to fully pedestrianise some of the remaining traffic lanes along this corridor to provide even more space for active modes of transport.

Other methods of road space reallocation can include temporary street closures to facilitate events or to provide more space for active modes of transport at the busiest times of day. Dublin provides an example of this, as the city has been trialling the closure of selected streets to vehicle traffic on a part-time basis. This includes Henry Street, a major retail node in the City Centre, which is open to delivery vehicles between 6am and 11am but closed to all motorised traffic outside these hours. This approach creates more space for pedestrians, public events and outdoor dining throughout most of the day while retaining limited vehicle access for deliveries at specified times. Cities have also been organising events which offer the chance to trial the closure of an area to private vehicles, such as the Paris Respire scheme, where parts of the city are closed to private vehicles on the first Sunday of every month. Other places are adopting approaches grounded in tactical urbanism, including Open Streets events and temporary modal filters, both of which have been trialled in Auckland.

While the primary focus of road space reallocation is often on the densest parts of cities, where the uptake of sustainable modes of transport is usually greatest, many cities have also committed to ensuring that sustainable modes of transport are adequately resourced and prioritised across their entire urban area. For example, Buenos Aires' Climate Change Action Plan proposes the creation of Meeting Streets, where selected streets are closed to private vehicles and transformed into space for walking, cycling and recreation. The initial plan is to create at least one Meeting Street in each of the city's 48 neighbourhoods to spread the benefits of the initiative equitably across the urban area.

Cities are recognising that prioritising and resourcing sustainable modes of transport extends beyond the allocation of road space, and particularly encompasses the allocation of funding as well. In some countries, including Canada, the UK and New Zealand, central governments have created dedicated funds for specific transport modes, such as cycling and buses, which have historically suffered from underinvestment. Many cities' climate plans highlight the need to ensure new projects provide sufficient space for sustainable transport modes, and some cities are directly addressing existing imbalances in the allocation of space between various modes.

Portland is an example of a city which has taken steps to rebalance the allocation of space and funding between different modes of transport. In 2015, the city opened the Tilikum Crossing, a NZ\$200m bridge across the Willamette River which carries pedestrians, cyclists, buses, streetcars and light rail. The bridge does not include any space for private vehicles as the existing bridges across the river already provide a disproportionate amount of space for this mode. Similarly, Waterford City and County Council in Ireland has proposed the construction of a new bridge across the River Suir for pedestrians, cyclists and electric buses. This would improve connectivity between the City Centre and the train station and facilitate development on the northern bank of the river, without inducing more private vehicle trips through the provision of additional traffic lanes.

Finally, cities are also identifying and addressing regulatory factors which inhibit the implementation of a sustainable transport hierarchy. This includes amending statutory processes, adjusting the way that sustainable transport modes are funded and making changes to road rules. In 2022, Britain updated its Highway Code to reflect a road user hierarchy focused on mitigating the potential harm posed by motor

vehicles to more vulnerable road users. A key component of this was a rule change to give pedestrians priority over turning traffic at intersections. This formed part of a package of reforms aimed at addressing the imbalance caused by decades of decisions which prioritised the needs of private vehicles at the expense of other modes of transport.

4. Reduce travel where possible and appropriate

Cities around the world have recognised that reducing the number of trips people take is one of the simplest and most effective ways to reduce transport emissions. Noting that the goal is to reduce the number of trips taken without adversely affecting people's quality of life or generating inequitable outcomes, the focus of most cities has primarily been on improving the alternatives to making trips in order to give people the option of travelling less.

A key global trend among cities aiming to reduce avoidable trips is the implementation of road pricing or congestion charging schemes. These systems can take various forms, with the most common type being a charging scheme based on virtual cordons around a city centre, as has been adopted by cities including London, Milan and Stockholm. These three cities saw traffic reductions of between 20% and 30% following the launch of their schemes, and public support for congestion charging increased once the schemes were implemented and the positive impacts became clear. Stockholm's congestion charge was trialed in the first six months of 2006 and, after proving successful, introduced permanently from August 2007. Figure 3 shows the reduction in traffic volumes during the trial and the enduring reduction in traffic once the scheme was implemented on a permanent basis.

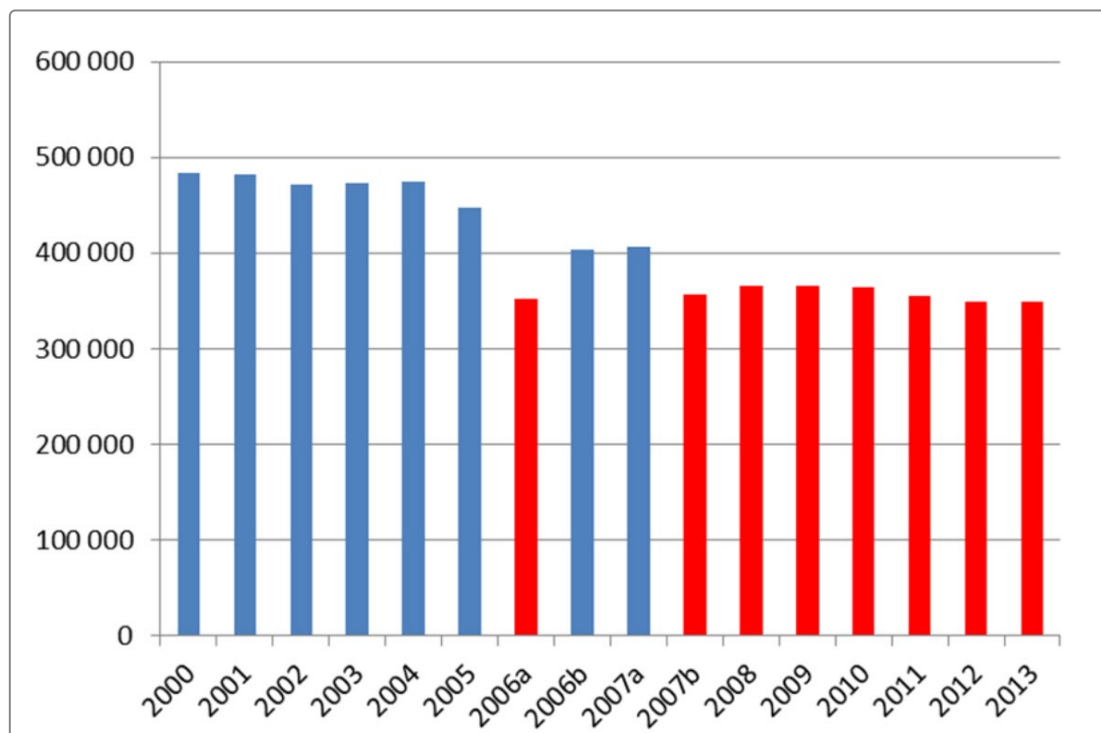


Figure 3: Average daily vehicle volumes crossing Stockholm's central city cordon before (blue) and after (red) congestion charging was implemented. 2006 and 2007 are split as the scheme was only operational for part of these years ⁴

⁴ Figure 3: Eliasson, J. (2014). The Stockholm congestion charges: an overview. Stockholm: Centre for Transport Studies CTS Working Paper, 7(42).

The Global Evidence Base for the Transport Emissions Reduction Pathway

More complex versions of this approach have also been implemented, such as Singapore's Electronic Road Pricing scheme. Tolls, which vary depending on the time of day, are charged at a network of gantries along expressways, arterial roads and the perimeter of the central city. Irrespective of the particular form they take, the impact of road pricing schemes on transport emissions is two-fold; they discourage avoidable trips while encouraging people to use sustainable modes of transport for the trips they choose to take.

Another global trend is the adoption of travel demand management strategies and initiatives, as has been highlighted in the climate plans of cities including Barcelona, Cape Town and Toronto. Decreasing the amount of travel people take for business purposes, especially by highly carbon intensive modes such as aviation, is a related way to reduce transport emissions. In most cities, councils have recognised that they have limited potential to directly influence this, other than through leading by example and reducing the amount of long-distance business travel they undertake.

A related method of reducing travel where appropriate is the substitution of trips with digital technology. The impact of the Covid-19 pandemic has led to a dramatic increase in the prevalence of working from home in many cities, which represents an opportunity to reduce the distances people need travel in their day-to-day lives. For example, Portland's climate plan proposes increasing the use of remote working within the council, supported by the roll out of more digital technology in its offices, along with training for staff on how this can be utilised to replace avoidable trips. However, some cities have also recognised that this approach can potentially pose equity issues, as only certain types of jobs provide the option of working from home.

The potential for the substitution of trips with digital alternatives extends beyond workplaces to activities such as education, healthcare and civic participation. In recognition of this, cities like Washington DC and Chicago are pursuing initiatives to provide internet access to households which currently lack digital connectivity. Other cities have sought to address this issue by expanding the availability of free Wi-Fi and access to digital technology in public places such as libraries. These initiatives address equity issues caused by the 'digital divide' by allowing more people to fully participate in these aspects of society without needing to make physical trips.

Cities are also recognising the impact of induced demand, particularly from major roading projects, and noting that this phenomenon acts counter to the goal of reducing transport emissions. Conversely, the phenomenon of trip chaining, where people make multiple stops on a single journey, has been highlighted as a way to reduce the total distances people travel and thereby reduce emissions. Cities have identified a range of actions to better facilitate trip chaining, including making pedestrian environments safer, providing more frequent public transport services and creating more mixed-use neighbourhoods.

5. Neighbourhoods for people

Across the globe, cities have recognised the integral role that land use must play in reducing transport emissions. The creation of vibrant, mixed-use neighbourhoods where people can access their daily needs within a short trip by either walking, cycling or public transport provides an opportunity to amend the car-dependent paradigms upon which many cities have been built. This idea forms the basis of a variety of planning theories which have been adopted by a diverse range of cities in recent years, such as the 15-Minute City, Complete Neighbourhoods and Superblocks.

One of the most prominent global planning concepts in recent years has been the 15-Minute City, as popularised by the city of Paris following Mayor Anne Hidalgo's championing of it in 2020. At its core, it is a theory which recognises the intrinsic relationship between transport and land use planning, and proposes that cities should be designed in a way which allows residents to access most of their daily needs within 15

The Global Evidence Base for the Transport Emissions Reduction Pathway

minutes by walking, cycling or public transport. It aspires to create cities where all residents are able to easily access key amenities, services, facilities and a range of employment and education opportunities, all without being required to own or use a car.

As encapsulated by C40 Cities, ‘the 15-Minute City weaves together strands of climate action and people-centric urban development.’⁵ In the context of Paris, the city is giving effect to the concept by ensuring that its sustainable transport networks support the density and diversity of land uses throughout its various neighbourhoods. This entails actions such as increasing the space allocated to active modes of transport, providing a greater range of services in each neighbourhood and encouraging people to live locally and support nearby businesses, particularly in response to the ongoing impacts of the Covid-19 pandemic. The overall goal is to harness synergies through implementing a range of connected actions to completely transform the city’s streetscapes, neighbourhoods and the ways people choose to travel.

Similar ideas are being adopted by cities around the world, including Melbourne, which has focused on a variant of the 15-Minute City theory called 20-Minute Neighbourhoods. Melbourne’s urban form is significantly less dense than Paris and primarily consists of single-use residential neighbourhoods, which shows how these concepts can be implemented in an urban context comparable to Auckland. The aim of 20-Minute Neighbourhoods is to create healthy and equitable communities, featuring the attributes shown in Figure 4, with the focus being centred on the walkable catchments of local centres. Pilot programmes have been launched in three suburbs, comprising actions to enhance the pedestrian environment, activate streetscapes and increase both the density and diversity of land uses within each neighbourhood.



Figure 4: Features of a 20-Minute Neighbourhood according to Plan Melbourne⁶

⁵ C40 Cities. (2021). *Introducing spotlight on: 15-minute cities*. C40 Knowledge Hub. <https://www.c40knowledgehub.org/s/article/Introducing-Spotlight-On-15-minute-cities>

⁶ Figure 4: <https://www.planning.vic.gov.au/policy-and-strategy/planning-for-melbourne/plan-melbourne/20-minute-neighbourhoods>

The Global Evidence Base for the Transport Emissions Reduction Pathway

Another city focusing on creating more people-centred neighbourhoods is Barcelona, which is implementing a concept called Superblocks, a form of low-traffic neighbourhood where active modes of transport are prioritised and through-traffic is restricted from certain streets. The implementation of Superblocks is being supported by an expanded cycling network, lower speed limits and enhancements to the city's public transport system. Results from the first Superblocks have shown improved air quality, reduced noise pollution and significant increases in residents' perceptions of walkability and accessibility within their neighbourhood. The city's Climate Emergency Action Plan has a target of calming at least 15km of streets through the creation of Superblocks by 2025.

Other cities have also implemented various forms of low-traffic neighbourhoods on either a permanent or trial basis, including London, Auckland and numerous cities in the Netherlands. The 2020 implementation of the South Fulham Traffic, Congestion and Pollution Reduction Scheme, a variant of a low-traffic neighbourhood in inner west London, demonstrates the potential for these approaches to achieve strong public support once the benefits become apparent. Polling shows that local support grew from 6% to 91% within 12 months, while traffic reduced by an average of 75% on the residential streets within the scheme's boundaries. Factors which likely contributed to this strong local support include post-implementation adjustments in response to public feedback and the use of camera-based enforcement instead of physical modal filters, which also kept the cost of implementing the scheme under NZ\$50,000.

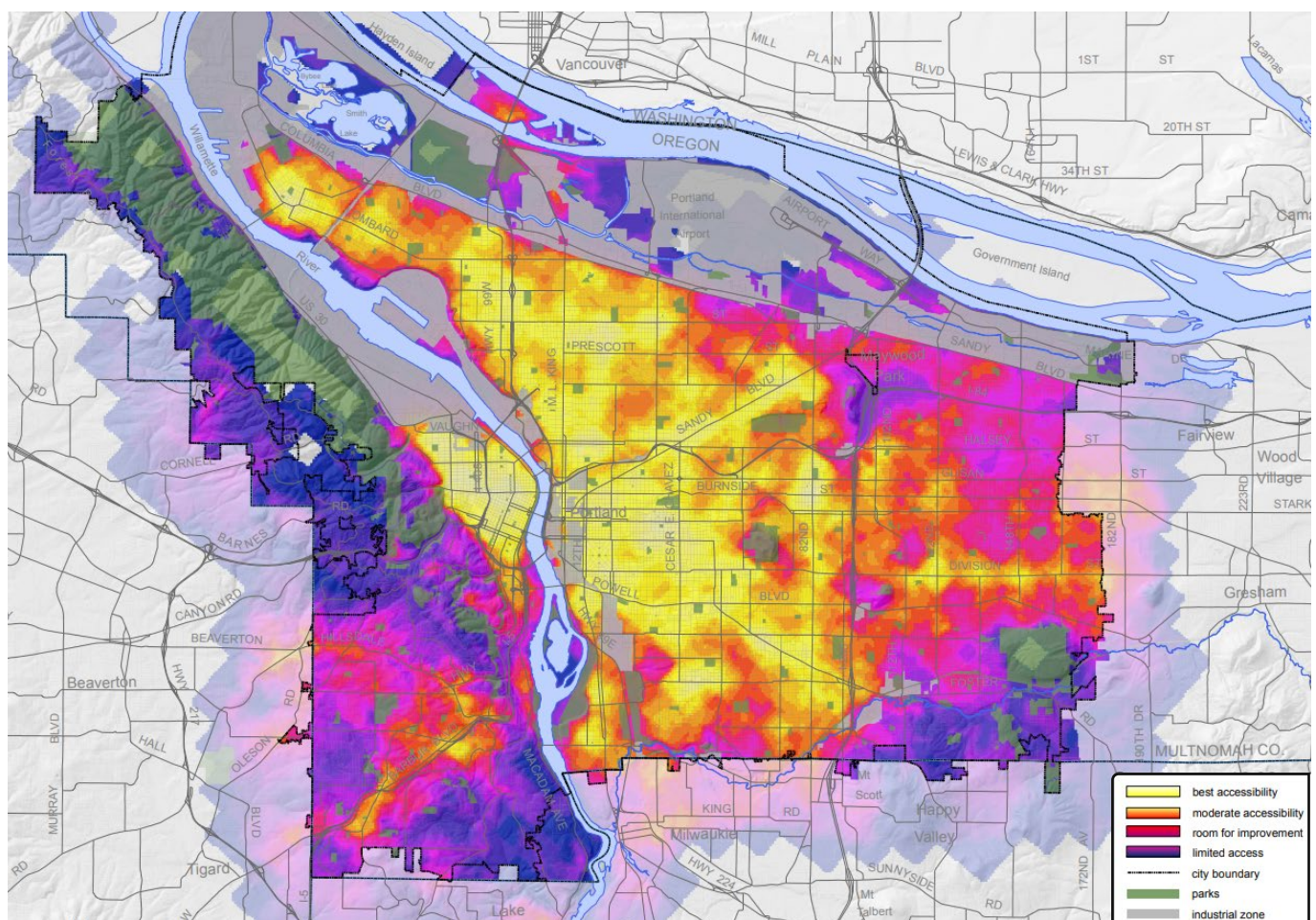


Figure 5: The accessibility analysis underpinning Portland's approach to the Complete Neighbourhoods concept⁷

⁷ Figure 5: <https://www.portlandonline.com/portlandplan/index.cfm?c=52256&a=288547>

The Global Evidence Base for the Transport Emissions Reduction Pathway

Portland is pursuing an approach to creating neighbourhoods for people called Complete Neighbourhoods. It is built around a strong focus on improving equity and recognising the impact that transport decisions can have on public health outcomes. Each neighbourhood in the city was assessed against a set of seven criteria based on its access to walking, cycling and public transport networks, as well as its proximity to parks, schools, healthy food and commercial services; the results of this analysis are displayed in Figure 5. Based on this assessment framework, transport and land use interventions are prioritised to address existing inequities and improve sustainable accessibility throughout the city in a targeted and effective manner.

Portland's approach to developing Complete Neighbourhoods is based on a bespoke methodology for assessing sustainable accessibility, while other cities around the world have adopted a range of different techniques for measuring similar attributes. Glasgow utilises the Place Standard Tool, which can be used to assess the transport, land-use, environmental and social factors of a location and identify gaps which need to be addressed. Another widely used metric is the Walk Score index, with Los Angeles setting a target of increasing the city's average Walk Score from 69 to 75 (out of 100) by 2025. Regardless of the specific assessment tools used, the adoption of a consistent and objective methodology for measuring sustainable accessibility has been integral to allowing cities to identify key priorities and monitor progress over time.

6. Build up not out

A key trend among cities committed to reducing their transport emissions is the recognition that the location of future urban growth and development will have a significant impact on their ability to achieve their climate goals. Many cities, including Auckland, have been developed around the needs of private vehicles since the mid-twentieth century, resulting in extensive low-density greenfield development which reinforces car dependency and increases transport emissions. Research shows that minimising further outward urban expansion and accommodating as much growth as possible within the existing urban footprint is the most effective way to avoid the adverse impacts that greenfield growth can have on transport emissions. While the specific approaches to achieving this outcome vary between different jurisdictions, they all reflect the growing global evidence of the strong relationship between land use planning and transport emissions.

Research based on the contexts of Sydney and Melbourne by Trubka, Newman & Bilsborough (2010)⁸ investigated the relationship between transport emissions and several spatial parameters. Regression analysis found that the distance from the city centre was the dominant variable and had a statistically significant correlation with transport emissions, even when accounting for density and public transport provision. The study calculated that the distance from the city centre accounted for 71% of the variance in transport emissions between the various suburbs within Sydney and Melbourne. As these two cities have similar urban characteristics to Auckland, it is probable that a comparable trend exists within the context of Tāmaki Makaurau. This is supported by data from the 2018 census, which shows that recently developed greenfield areas in Auckland tend to have higher private vehicle mode share for journeys to work and education than the regional average.

Canberra provides an example of a city which has previously relied heavily on greenfield expansion to accommodate growth but has recognised the need to limit further urban expansion to achieve its climate and environmental goals. The ACT Climate Change Strategy directs relevant authorities to deliver 'up to 70% of new housing within our existing town and group centres and along key transit corridors;' a target reiterated in the ACT Planning Strategy. Glasgow is another city which has previously focused on greenfield growth, but

⁸ Trubka, R., Newman, P., & Bilsborough, D. (2010). The costs of urban sprawl – predicting transport greenhouse gases from urban form parameters. *Environment Design Guide*, 1-16.

The Global Evidence Base for the Transport Emissions Reduction Pathway

one of the two key aims of its current City Development Plan is to create ‘a compact city form that supports sustainable development.’ To give effect to this, the city’s Sustainable Spatial Strategy states that the council will support development proposals which ‘utilise brownfield sites in preference to greenfield sites.’

In addition to accommodating future growth within existing urban areas instead of relying on greenfield expansion, another key trend across the world is the focus on maximising development and intensification in locations which are best served by public transport. To achieve this, cities are taking steps to facilitate and incentivise development on both public and private land within walking distance of their rapid transit networks and other frequent public transport corridors. Some cities have set explicit targets related to the proportion of new dwellings located within the walkable catchments of either rapid transit stations or their broader public transport networks. This includes Los Angeles, which is aiming for 57% of new dwellings to be located within 1500 feet (~450m) of public transport by 2025, growing to 75% of new dwellings by 2035.

Vancouver is a globally recognised exemplar of an urban area which has focused on concentrating growth along its rapid transit network. The region’s planning regime is based on the integration of land use and transport, with Figure 6 illustrating the close alignment between urban centres, identified development areas and the region’s frequent transit network. A high degree of intensification has been achieved within the walkable catchment of many of Vancouver’s SkyTrain stations, such as New Westminster and Burquitlam, as well as around ferry terminals and within the City Centre. Sydney also provides several examples of significant intensification within rapid transit catchments in a comparable urban context to Auckland, including high-density neighbourhoods like Chatswood, Mascot and Rhodes. Transit-oriented development in Sydney has taken the form of intensification on both public and private land within the walking catchments of rapid transit stations as well as over-site development above stations and sections of rail corridor.

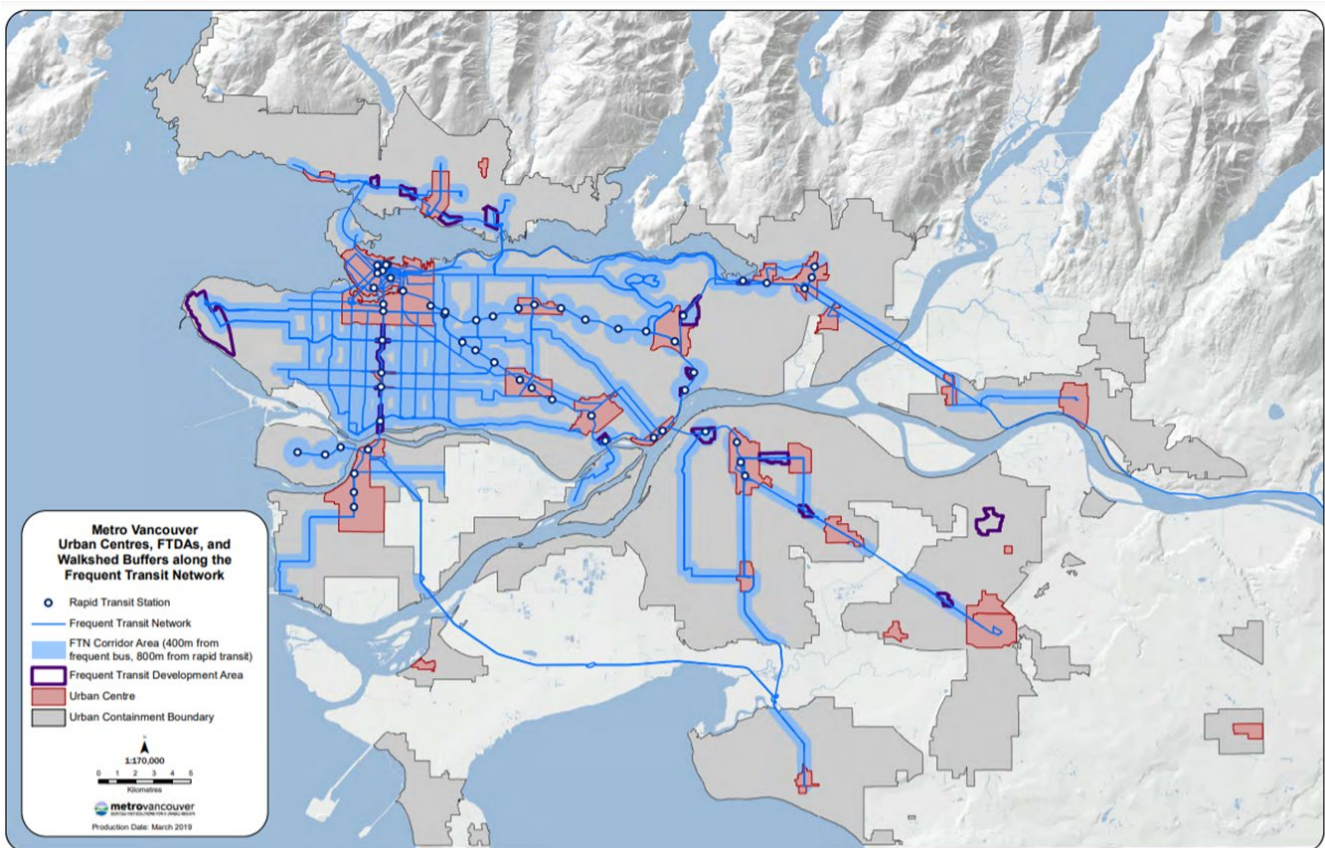


Figure 6: Metro Vancouver’s urban centres, development areas (FTDAs) and frequent transit network⁹

⁹ Figure 6: <http://www.metrovancouver.org/services/regional-planning/PlanningPublications/UrbanCentresFTDAsWalkshedBuffersFTN.pdf>

7. Electrify private vehicles

Adopting policies and strategies to support the electrification of light vehicles forms a key part of many cities' emissions reduction pathways. The primary actions to achieve this are broadly consistent across most contexts, although the relative emphasis placed on different initiatives varies between jurisdictions. Cities' main priorities tend to be providing sufficient charging infrastructure, incentivising the purchase and use of electric vehicles (EVs), and accelerating the electrification of certain types of light vehicles such as taxis. Equity considerations and the practical limitations of rapidly increasing the proportion of light vehicles which are electric are also common themes within many cities' plans.

There is significant variation in the current prevalence of EVs and other low-carbon innovations, such as plug-in hybrid vehicles, between cities across the world. Oslo is a global leader in the electrification of its light vehicle fleet, having the most EVs per capita of any city. This has been aided by actions taken by the city's council, like planning for a fully electric taxi fleet by 2024 and offering discounts for EVs on toll roads, but the transformation has largely been underpinned by policies adopted by the Norwegian government. Since the 1990s, Norway has offered a range of financial incentives for purchasing EVs, including discounts or exemptions from VAT, purchase tax and road traffic insurance tax, although the government has begun to scale back some of these incentives in recent years. In 2021, 65% of new passenger cars sold in Norway were EVs and a further 22% were plug-in hybrid vehicles, as shown by Figure 7.

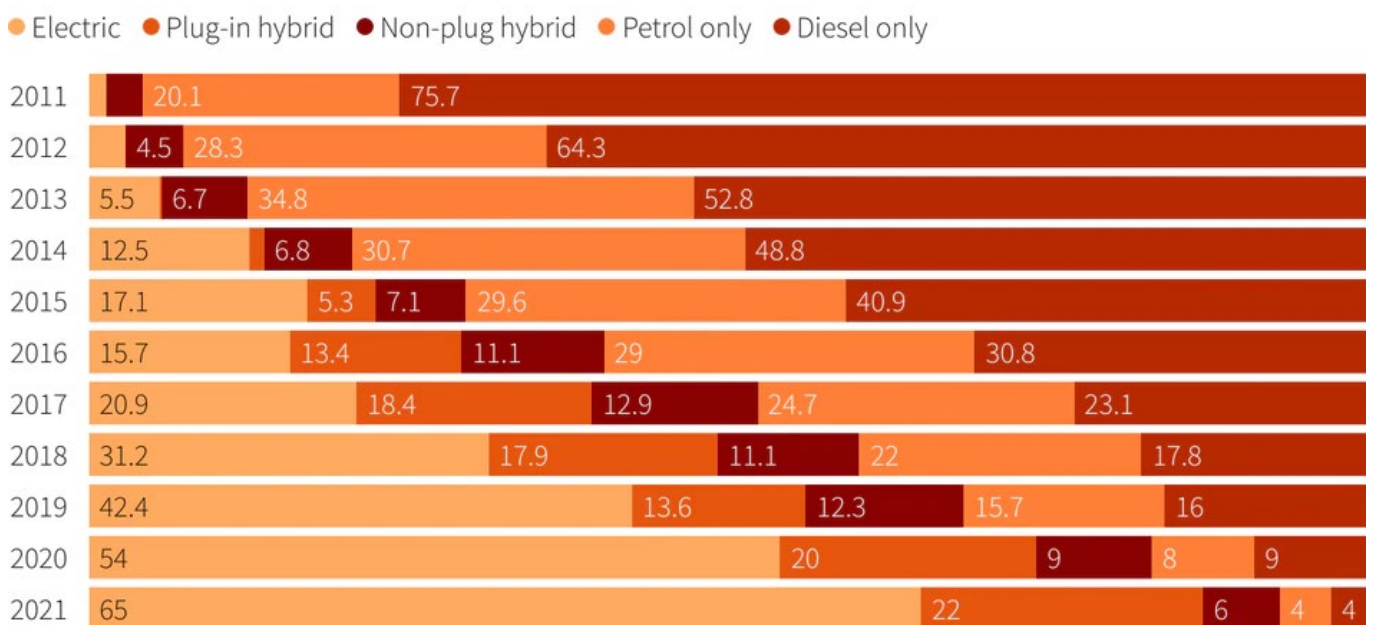


Figure 7: Percentage of new car sales in Norway by energy source from 2011 to 2021¹⁰

Another city placing a strong emphasis on the electrification of private vehicles is Calgary. The city's Climate Resilience Plan estimates that a shift to low emissions vehicles will produce almost NZ\$4b of energy savings annually and save 60.3Mt of greenhouse gas emissions by 2050. To realise these benefits, the city is proposing to reduce regulatory barriers to EV uptake, partner with educational institutions on EV research and collaborate with a variety of partners to roll out more charging infrastructure across the city. Providing sufficient charging options for EVs, both in public places and at people's homes, is a common trend across many cities' climate plans, with other examples including Dublin, Seattle and Darebin.

¹⁰ Figure 7: <https://www.reuters.com/business/autos-transportation/electric-cars-take-two-thirds-norway-car-market-led-by-tesla-2022-01-03/>

The Global Evidence Base for the Transport Emissions Reduction Pathway

The introduction of low emissions zones is another common approach that cities are taking to encourage the uptake of EVs. These initiatives impose bans or financial penalties on either all fossil-fuel powered vehicles or vehicles which do not meet specific emissions standards. In some cities, low emissions zones solely apply to heavy vehicles, but many cities are planning to use them to disincentive the use of carbon intensive light vehicles as well. Examples of cities pursuing this approach are Barcelona, Montreal and Paris, with the latter planning to ban all fossil-fuel powered vehicles from the city by 2030. A comparable approach is the implementation of variable parking charges based on vehicles' emissions, with cities such as Newcastle proposing this as part of their emissions reduction pathways.

Careful consideration of the potential equity implications of electrifying private vehicle fleets is reflected in many cities' climate plans, as well as analysis of the impact on other outcomes in addition to carbon emissions. Electrification addresses the issue of tailpipe emissions, but it does not remedy many of the other issues associated with private vehicles, such as safety and spatial efficiency. While EVs have generally been becoming cheaper over time, they are still more expensive to purchase on average than fossil-fuel powered cars. Combined with the current limited second-hand market for EVs, this can make the purchase of EVs unaffordable for a lot of households, creating a potential equity issue. Consequently, a key trend among cities is the recognition that policies to encourage the adoption of EVs must be pursued in parallel with, and not instead of, actions to improve other modes of transport like walking, cycling and public transport.

Another important equity consideration is access to charging infrastructure, as the inequitable distribution of both public and private EV charging facilities could limit people's ability to use EVs. Boston's Climate Action Plan emphasises an equity focused approach to EV deployment and includes two specific targets: that public EV charging infrastructure is available in every neighbourhood by 2023, and that all residents are within a 10-minute walk of a public EV charger or EV carshare facility. Other cities have noted the potential issues with EV charging infrastructure obstructing footpaths, reducing the accessibility of the pedestrian environment and contributing to inequitable outcomes for people with particular mobility needs.

Finally, a range of cities have recognised the practical limitations of planning to introduce large numbers of EVs into their light vehicle fleets within a short space of time, including the finite global manufacturing capacity for EVs and the need to ensure there is sufficient capacity in the electricity grid. In response to this, some cities have placed a specific emphasis on electrifying certain types of light vehicles, especially those which have the highest utilisation rate and therefore present the greatest potential for emissions reductions. This includes taxis, ride-share vehicles and shared vehicle fleets, with cities such as Amsterdam, Glasgow and Vancouver explicitly prioritising the electrification of these types of vehicles in their climate plans.

8. Enable new transport devices

The emergence of new transport devices represents a rapidly evolving area of innovation, and cities are at a range of different stages in terms of the extent to which they are enabling the adoption of various forms of micromobility. Some devices, like e-bikes and e-scooters, are well-established as urban modes of transport, while others, such as microcars, are still emerging technologies.

The rising prevalence of e-scooters as a mode of transport has occurred in many cities across the world in the past five years, with jurisdictions taking a range of different approaches to their adoption and regulation. While New Zealand has a relatively permissive regulatory environment for micromobility devices, other countries are more restrictive, including the UK where the operation of privately-owned e-scooters is illegal. In spite of this, Newcastle's climate plan recognises the potential for e-scooters to replace private vehicle trips and expand the catchment of the city's rapid transit network, by providing an effective 'first and last

The Global Evidence Base for the Transport Emissions Reduction Pathway

mile' solution. A 12-month trial of a shared e-scooter scheme, which was exempt from the country's e-scooter ban, launched in 2021 and was subsequently extended after being deemed a success.

In 2021, New York City joined the growing number of urban areas across the globe to launch an e-scooter hire scheme. Addressing transport inequity is integral to the scheme, with the initial pilot programmes being focused on areas with limited active transport options, such as the East Bronx. Future schemes are envisaged in other parts of the city, although e-scooters will not be allowed in Manhattan as the council considers that it is well served by a variety of other transport modes and many of its footpaths are already too crowded to safely accommodate e-scooters. Each operator in the pilot scheme is also required to offer more accessible micromobility devices and attachments for people with specific accessibility needs, to improve equity.

Electric cargo bikes are another form of micromobility which have been recognised for their potential to replace vehicle trips which are unable to be easily substituted by more conventional active modes of transport. Dublin's Climate Change Action Plan highlights the potential of innovations like electric bikes to replace vehicle trips, with the council launching a scheme in 2021 to offer businesses a subsidised trial of electric cargo bikes. Each bike (pictured in Figure 8) can carry up to 60kg of cargo and has a battery life of up to 160km, allowing them to replace certain journeys previously taken by cars or vans.



Figure 8: One of the electric cargo bikes included in Dublin's subsidised trial for businesses.¹¹

Another city embracing new micromobility options is Rotterdam, which has implemented a trial scheme where residents can hire an electric cargo bike and trailer for free if they need to transport heavy items to a recycling centre. This has the dual environmental benefit of encouraging people to recycle unwanted goods instead of sending them to a landfill, while also minimising the transport emissions from doing so.

Initiatives related to other recently developed transport devices, such as microcars, are currently less prevalent, although technology is rapidly evolving, so close attention will need to be paid to further innovations in this area in the coming years.

¹¹ Figure 8: <https://www.bleeperactive.com/blog/dublin-city-council-launches-cargobike-scheme>

9. Low-emissions public transport

Reducing the emissions from public transport vehicles is a key action that many cities are taking to reduce their transport emissions. Technological innovations have allowed for the rapid adoption of zero-emission buses and ferries in cities across the globe, primarily powered by batteries and hydrogen cells. These complement well-established zero-emission public transport technologies like trams, trolleybuses and electric trains. Shenzhen currently has the largest electric bus fleet in the world, having completed the electrification of its fleet of more than 16,000 buses in 2017. Other cities also have targets to transition to a fully electrified bus system, including Copenhagen by 2025, Los Angeles by 2030 and Manchester by 2031. This compares to Auckland's current target of fully electrifying its bus fleet by 2035.

While some cities are rolling out electric buses incrementally, others are taking a more rapid approach. One example of this is Coventry, which is planning to fully electrify its bus fleet by 2025. Joint funding from the city council, regional authorities, private bus operators and the Department for Transport will result in approximately 300 new electric buses being deployed in the city within the next few years. Bus depots are being upgraded with charging infrastructure to support the new electric buses, and at least one depot will have solar panels installed on the roof to provide a source of renewable electricity. Many major bus manufacturers have been accelerating the production of electric buses and hydrogen-powered buses in recent years, allowing the electrification of cities' bus fleets to occur much more rapidly than was previously possible, as demonstrated by the ambitious approach of cities like Coventry.

In addition to electrifying buses, many cities are also electrifying their ferry fleets, with cities such as Copenhagen, Bangkok and Lisbon procuring electric ferries to replace fossil-fuel powered vessels. Similar to electric bus technology, recent innovations have significantly improved the performance and viability of electric ferries, and increased demand and production of these vessels will likely continue to make them more affordable to purchase. Electric ferries have proved to be much more cost-effective to operate than fossil-fuel powered vessels, with research into a case study from Norway highlighting an 80% decrease in operating costs. Another aspect of electric ferry operation which is the subject of recent innovation is charging infrastructure, with new technology significantly reducing the amount of time required to charge electric vessels, overcoming one of the key barriers to electrification. For example, technology utilised as part of the introduction of electric ferries on Amsterdam's North Sea Canal routes allows the vessels to charge in less than three minutes for each 20-minute journey.

Another facet of reducing transport emissions is the decarbonisation of rail transport, with the electrification of both urban and long-distance railway lines being pursued by various cities as a way to maximise the carbon reduction benefits of shifting trips to trains. Recent technological developments like bimodal and trimodal locomotives have allowed other cities and countries to reduce the emissions from rail transport without requiring the installation of electrification equipment along their entire rail network. Using this technology, trains can run on electric power when using sections of track with overhead (or third-rail) electrification equipment, and then use either diesel or battery power when travelling along non-electrified sections of track. This reduces emissions and also minimises the avoidable noise and air pollution caused by operating diesel-powered trains along electrified sections of track, particularly within urban areas. This technology has already been adopted successfully in several countries including Australia, France and the UK.

Aviation is a highly carbon intensive mode of transport, and cities around the world have been formulating strategies to reduce the emissions generated by aviation, while noting that most cities are fairly limited in their ability to directly influence or regulate air travel. Over time, commercial aircraft are becoming more fuel efficient and innovative fuels have the potential to reduce emissions further, but aviation will likely remain a

carbon intensive mode of transport for at least the medium-term future. Within the context of New Zealand, Sounds Air is planning to operate small electric aircraft on short flights across the Cook Strait from 2026, although the adoption of electric aircraft for long-distance or high-capacity routes appears to be a more long-term prospect. Thus, cities are generally focusing on providing more sustainable alternatives to aviation, such as inter-city trains and buses, as well encouraging people to avoid air travel where possible. In France, which has an extensive high-speed rail network, domestic flights have been banned where alternative public transport options of two-and-a-half hours or less exist, in an effort to reduce avoidable transport emissions.

10. Efficient freight and services

Many cities are placing a strong emphasis on reducing freight emissions as part of their approach to transport decarbonisation. While cities have adopted a wide range of different approaches and priorities, most actions related to this topic can be categorised into three themes; shifting the mode used to transport freight, improving the efficiency of freight networks and decarbonising freight vehicles.

Shifting freight away from trucks to less carbon intensive modes of transport is one of the most effective ways of reducing freight emissions. This is particularly true if the alternative mode is fully electrified, such as trains hauled by electric locomotives, although research clearly shows that even non-electrified rail and water-based transport is often significantly less carbon intensive than fossil-fuel powered trucks. Several cities' climate plans highlight the need to shift freight from road to rail, including Barcelona, Darebin and Oslo. This imperative can be supported by a range of actions including the creation of new rail freight hubs, increasing the capacity of the rail network and implementing measures to make rail freight transport cheaper. Land use planning can also play a significant role, with the location of industrial zones and key industrial facilities relative to the rail network influencing the ease of transporting freight by rail. Some cities' plans, like Metro Vancouver's Climate 2050 Roadmap, advocate for the electrification of existing railway lines to maximise the emissions reduction potential of rail transport for both freight and passengers.



Figure 9: A cargo vessel on the River Seine in Paris, transporting goods for a supermarket chain¹²

¹² Figure 9: <https://commons.wikimedia.org/w/index.php?curid=36339443> Contributed by user: Tim Adams (CC BY 3.0)

The Global Evidence Base for the Transport Emissions Reduction Pathway

Looking at the specific approaches other cities are taking to reducing freight emissions, Paris is planning to ban all diesel vehicles from 2024, as part of a strategy to phase out all fossil-fuel powered vehicles by 2030, which will necessitate the decarbonisation of the city's freight fleet. In addition to the roll out of zero-emission trucks, the city is also focusing on increasing the use of alternative modes for freight transport. The city's Climate Action Plan proposes the creation of multi-modal logistics hubs throughout the city, to optimise freight transport and allow goods to transfer between trucks, trains, boats and active modes of transport. To support this, the city is investigating ways to increase the use of its rail network, canal system and the River Seine for freight transport (as shown in Figure 9), to reduce the distance freight needs to travel by road. Other cities have recognised that logistics hubs can also provide a location for people to pick up goods while en route to other destinations, an example of trip chaining, thereby reducing the emissions which arise from delivering goods directly to homes and businesses.

London is taking a comparable approach, with the London Environment Strategy aiming to 'reduce emissions from freight through encouraging a switch to lower emission vehicles, adopting smarter practices and reducing freight movements through better use of consolidated trips.' Several measures have already been implemented, including a Low Emissions Zone for heavy vehicles covering most of the urban area, which requires vehicles to meet minimum emissions standards or pay significant charges, ranging up to almost NZ\$600 per day for non-compliant trucks. The financial disincentives for driving highly emitting heavy vehicles in London are more significant than the fees charged under the corresponding scheme for light vehicles, the Ultra Low Emissions Zone, reflecting the higher emissions potential of trucks and other heavy vehicles. A number of other cities across the UK are implementing similar schemes called Clean Air Zones, in line with a national framework which specifies four different zone classes, with each applying to a different range of vehicle types. All the examples implemented so far are Class B or above, meaning they impose emissions standards on all heavy goods vehicles, and most cities' schemes also apply to vans.

Toronto is encouraging the adoption of electric freight and commercial vehicles, ranging from electric trucks for bulk transport to electric cargo bikes for short-distance deliveries. The city's Net Zero Strategy highlights the equity benefits of electrifying the heavy vehicle fleet, noting that disadvantaged populations are more likely to live near major freight routes and therefore disproportionately suffer the pollution-related health impacts. Potential challenges associated with the electrification of heavy vehicles have been noted by many cities, including Toronto, with identified solutions including subsidies for the installation of charging infrastructure and the provision of public charging points for heavy vehicles. In South Australia, four councils within the Adelaide urban area are collaborating on an electric rubbish truck trial, to investigate the feasibility of decarbonising rubbish collection services. As well as the emissions reduction potential, the councils have identified a range of co-benefits, such as lower operating costs, less noise and the opportunity to operate vehicles earlier in the morning and later at night due to the reduced potential for noise pollution.

In addition to land-based freight transport, many cities are also planning to reduce emissions from freight which is currently transported by aviation and shipping. For example, Barcelona's Climate Emergency Action Plan proposes taxes on aviation and shipping to encourage the use of less carbon-intensive vehicles or alternative modes of freight transport. Cities, ports and countries have collaborated on the implementation of Emission Control Areas in several of the world's bodies of water, including the North Sea, Baltic Sea and both coasts of North America. These schemes can be used to restrict several types of maritime emissions, including greenhouse gases like nitrogen oxide. Another initiative which cities are pursuing to decarbonise shipping is the provision of shore power at ports, so ships do not need to burn fossil fuels while they are docked. This has been proposed by cities such as Oslo, Vancouver and Copenhagen, and the Ports of Auckland recently conducted a feasibility study on adopting the practice in Tāmaki Makaurau.

11. Empower Aucklanders to make sustainable transport choices

Equipping residents with the knowledge, skills and support to make more sustainable transport choices is an integral component of many cities' approaches to reducing their transport emissions. A key element of this is harnessing grassroots support for climate action and channelling this into meaningful action within the realm of transport. The scale of change required is massive, and many of the potential actions cannot be achieved by councils alone, so cities are partnering with a range of entities such as community groups, businesses, subject-matter experts, universities and indigenous communities. Implementing methodologies which ensure strong local participation and consultation on proposed actions, while also achieving change within a short space of time, is a challenge which many cities are attempting to resolve.

Cities in various parts of the world, including Australia, Colombia and Canada, have engaged and partnered with indigenous communities as part of the development and implementation of their plans for reducing transport emissions. However, it is important to note that the specific approaches followed by these cities may not be entirely applicable to Tāmaki Makaurau due to the unique Te Tiriti context of Aotearoa. Te Tāruke-ā-Tāwhiri, which the TERP gives effect to, was developed as a partnership between Auckland Council and mana whenua, and drew upon a wide range of expertise, values and perspectives. A number of cities implementing similar pathways to the TERP have been pursuing methods for engaging with their communities in more effective and meaningful ways, while addressing barriers which impede the ability of residents to contribute to democratic decision making and stymie opportunities for change. Another way that cities are empowering their residents to have more influence on transport decision making is by proactively releasing a wider range of transport data and information to the public, to facilitate more informed and evidence based discourse on relevant transport issues.

Several cities have identified opportunities to capitalise on the potential offered by large events and occasions to build momentum for change and achieve a range of synergies by ensuring that all projects and initiatives, regardless of their primary focus, are implemented in a way which contributes to transport emissions reduction. Examples of this approach include Paris and Los Angeles, which are upcoming hosts of the Olympic Games, as well as Glasgow, which hosted the COP26 summit in 2021. Other jurisdictions have recognised the opportunities for change arising from the Covid-19 pandemic and the growing global awareness of the climate emergency, and are using this momentum to shift their transport emissions trajectories. Many cities have shown that the opening of major transport infrastructure projects, even if they pre-date the adoption of their city's equivalent of a transport emissions reduction pathway, can serve as a useful inflection point to shift people's travel choices and achieve a step change in public perception of sustainable modes of transport.

On a tangible level, many cities are empowering their residents to make more sustainable transport choices through initiatives like personalised journey planning, coordinated travel demand management and best-practice communication methods. Successfully applying these practices is essential to providing people with a seamless, reliable and convenient journey when using sustainable modes of transport. The importance of this for achieving transport emissions reductions is demonstrated by a recent example from Auckland, where service improvements to the bus route serving Millwater (Route 985) in June 2021, supported by extensive marketing of the improvements to both existing and potential bus users, resulted in a 41% increase in patronage within the first week of the service changes. The rapid uptake of the improved bus service highlights the importance of communications and marketing to empower people to fully take advantage of new infrastructure or improved services.

The Global Evidence Base for the Transport Emissions Reduction Pathway

At a broader scale, the varying governance structures of cities across the globe has a significant impact on their approaches to reducing transport emissions and plays a pivotal role in either empowering or hindering their ability to achieve their climate goals. Some cities have very streamlined governance systems for transport, while others have very complex transport decision making structures, with limited horizontal and vertical integration. Local government amalgamation in 2010 shifted Auckland's position on this spectrum, placing the entire city under the jurisdiction of a single local government entity. The experiences of other cities suggests that this governance structure should serve to empower Auckland's decision makers to more effectively implement a transport emissions reduction pathway, compared to the previous system.

A related factor which has had a major influence on other cities' success at achieving transport emissions reductions is the nature of their transport funding systems. Implementing changes to address transport emissions has often been particularly difficult in cities with rigid and inflexible funding frameworks which reinforce the status-quo and impede opportunities for change. In spite of this, another clear trend from the case study research is that cities with strong political leadership on transport emissions have shown that, although there may be challenges and obstacles to overcome, transformational change is possible.

Applying the lessons

All cities are unique, so no city provides a perfect comparison to Auckland, but by considering lessons from a diverse range of cities it is possible to understand global best practice and consider how this can be adapted and applied within the context of Tāmaki Makaurau. By learning from cities which are on a trajectory to achieving the kind of transformational change that Te Tāruke-ā-Tāwhiri requires, Auckland can gain an understanding of what is possible and which types of actions have been shown to be successful. While there is no 'one size fits all' approach to transport emissions reduction, taking advantage of the opportunity to learn from a global evidence base allows Auckland to adopt a robust and effective approach to reducing its transport emissions.

This document has provided a brief summary of the key trends and lessons learned from research into a broad range of global case studies for each of the eleven transformation areas which form the core of the pathway (TERP) laid out in the *Sustainable Access for a Thriving Future* document. The development of the pathway has been underpinned by this global evidence base, as well as research, modelling and engagement specific to the context of Tāmaki Makaurau. Lessons from cities around the world have informed the overall approach of TERP and the specific actions which constitute the pathway, with appropriate cognisance of both the benefits and limitations of learning from case study evidence.

As technology, transport trends and the global understanding of the challenges presented by climate change perpetually evolve, the opportunities to learn from other cities will continue to grow. Across the globe, ongoing collaboration, evidence sharing and benchmarking between various cities and countries will be essential to meaningfully reduce the planet's emissions. Within the context of transport emissions, Auckland will need to continue learning from the experiences of other cities and, going forward, other cities will likely be able to learn lessons from Auckland's approach as well. This symbiotic cycle of global knowledge-sharing, learning and cooperation will be vital to ensuring that cities including Tāmaki Makaurau can successfully implement the pathways required to address one of the most significant global challenges of our time.

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