International Transport Forum

Reversing Car Dependency

Summary and Conclusions

181

Roundtable

Reversing Car Dependency

Summary and Conclusions

181

Roundtable

The International Transport Forum

The International Transport Forum is an intergovernmental organisation with 62 member countries. It acts as a think tank for transport policy and organises the Annual Summit of transport ministers. ITF is the only global body that covers all transport modes. The ITF is politically autonomous and administratively integrated with the OECD.

The ITF works for transport policies that improve peoples' lives. Our mission is to foster a deeper understanding of the role of transport in economic growth, environmental sustainability and social inclusion and to raise the public profile of transport policy.

The ITF organises global dialogue for better transport. We act as a platform for discussion and pre-negotiation of policy issues across all transport modes. We analyse trends, share knowledge and promote exchange among transport decision makers and civil society. The ITF's Annual Summit is the world's largest gathering of transport ministers and the leading global platform for dialogue on transport policy.

The Members of the Forum are: Albania, Armenia, Argentina, Australia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, Chile, China (People's Republic of), Croatia, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, India, Ireland, Israel, Italy, Japan, Kazakhstan, Korea, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Mexico, Republic of Moldova, Mongolia, Montenegro, Morocco, the Netherlands, New Zealand, North Macedonia, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Tunisia, Turkey, Ukraine, the United Arab Emirates, the United Kingdom, the United States and Uzbekistan.

International Transport Forum
2 rue André Pascal
F-75775 Paris Cedex 16
contact@itf-oecd.org
www.itf-oecd.org

ITF Roundtables

ITF Roundtables bring together international experts to discuss specific topics notably on economic and regulatory aspects of transport policies in ITF member countries. Findings of ITF Roundtables are published in a Summary and Conclusions paper. Any findings, interpretations and conclusions expressed herein are those of the authors and do not necessarily reflect the views of the International Transport Forum or the OECD. Neither the OECD, ITF nor the authors guarantee the accuracy of any data or other information contained in this publication and accept no responsibility whatsoever for any consequence of their use. This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Cite this work as: ITF (2021), *Reversing Car Dependency: Summary and Conclusions,* ITF Roundtable Reports, No. 181, OECD Publishing, Paris.

Acknowledgements

This report was written by Tatiana Samsonova (ITF) and benefitted from input provided by Ombline de Saint Léon (ITF) and Stephen Perkins (ITF).

The report is based on expert discussion held at the ITF Roundtable on “Zero Car Growth? Managing Urban Traffic” on 16 and 17 December 2019 in Paris.

We would like to thank the authors of five discussion papers prepared for and presented at this Roundtable:

- Goodwin, P. (2020), “Trends in Car Use, Travel Demand and Policy Thinking”, presented by Phil Goodwin (University College London);
- King D. (2020), “Zero Car Growth: A Challenge for Transport Justice”, presented by David King (Arizona State University);
- Tennøy, A. and O. Hagen (2020), “Reallocation of Road and Street Space in Oslo: Measures for Zero Growth in Urban Traffic”, presented by Aud Tennøy and Oddrun Helen Hagen (Norwegian Centre for Transport Research);
- Franco S. (2020), “Parking Prices and Availability, Mode Choice and Urban Form”, presented by Sofia F. Franco (Nova University of Lisbon);
- Crozet Y. (2020), “Cars and Space Consumption: Rethinking the Regulation of Urban Mobility”, presented by Yves Crozet (University of Lyon).

We would like to thank Pedro Homem de Gouveia, Senior Policy and Project Manager at Polis Network for chairing the Roundtable discussions. The ITF Secretariat also wishes to thank the 28 participants, who came from 12 ITF member countries. A list of Roundtable participants is provided in the Annex.

Table of contents

Boxes

Executive summary

What we did

Managing the growth of urban traffic is vital for improving the liveability of our cities. This report examines how governments can encourage citizens to use alternatives to private cars in order to reduce car-dependency, regardless of how they are powered or who drives them. It analyses fiscal policies and other instruments for managing urban traffic and correcting current policy biases that favour automobile travel over more sustainable and affordable transport options. It also reviews international experience in co-ordinating transport planning with land-use development and in allocating space to walking and cycling in order to make transport more efficient and streets less congested.

What we found

Cities need more efficient, less damaging and fairer use of scarce space. Managing the growth of urban traffic is vital for achieving that and improving the liveability of our cities. More globally, reducing traffic is essential for scaling back the environmental and social costs associated with private car use in order to meet sustainability objectives. However, the car will likely be irreplaceable for much travel between peripheral areas. The objective must not be to suppress travel by car, but channel it to locations and uses where its value to the individual clearly exceeds the costs it imposes on society, including other car users.

The guiding principle for managing car use is to enable citizens to carry out their daily activities without a car and not having to rely on cars to satisfy their transport needs. The question for policy is how to ensure an adequate level of car-free accessibility through other travel options including public transport, cycling, shared micromobility and walking.

Boosting use of non-car transport modes requires safe walking and cycling infrastructure. It also involves adequate parking for vulnerable groups, such as disabled people, who have to rely on private vehicles for equitable access.

Significantly reducing the modal share of private vehicles in urban mobility implies significant long-term change in the spatial form of cities. In the short to medium-term, it means reallocating space away from roads and parking. In the longer-term, it implies changes in land-use patterns to maintain high levels of accessibility with lower overall levels of mobility.

Reallocation of road space is used more widely than road pricing to manage car use. Possibly, it is seen as more acceptable in view of concerns over the equity impacts of road pricing. The most effective urban mobility management systems deploy road pricing schemes together with road space allocation and land-use planning instruments.

High priority for more sustainable forms of transport will drive a more efficient use of road space, enhance the attractiveness of non-motorised modes and improve the accessibility of specific locations. It will also reduce damage to the environment, make street space more attractive and improve road safety for non-motorists.

What we recommend

Review the street space and urban land share allocated to cars

Governments should review how much road and parking space is allocated to the different transport modes. Cars tend to take up disproportionally more space than their modal share. Reallocating road and parking space to public transport, cycling and walking increases mobility options for non-drivers, encourages users to shift from cars to more space-efficient modes and thereby helps to achieve equity and efficiency objectives. The emergence of shared micromobility has increased demands for redistributing space. Expanding dedicated cycling lanes to accommodate e-scooters, e-bikes and similar micro-vehicles will do much to make these safer, and also perceived as safe, thus making micromobility a much more attractive alternative to cars.

Use road space allocation to proactively manage traffic

Reallocation of road space and changes to road layouts that give more space to cyclists and pedestrians should be used as a strategy to manage car use. A growing body of evidence suggests that a well-planned reduction of road space for private cars does not add to congestion. On the contrary, reduced road capacity can lead to “disappearing traffic”. Car drivers adapt to changed conditions in many ways, often too complex for computer models to predict. Empirical evidence from measures implemented is therefore as important as modelling for decision-making. The Improvements to public space and liveability associated with the reallocation of road space generally benefit retailers via increased footfall and associated sales. Citizens and local administrations are less prone to contesting road space reallocation than road pricing, as no cash payments are involved.

Abolish minimum parking space requirements for new developments

Minimum parking space requirements for new developments should be abolished. They tend to worsen car dependency, hinder infill development, contribute to urban sprawl, reduce the financial viability of real estate investments for developers and make home ownership less affordable for citizens. Reducing parking requirements reduces the shadow subsidies non-drivers must pay for parking facilities they do not need and thus increase economic efficiency and enhance fairness. Allowing developers to determine parking supply based on demand will contribute to more sustainable and compact urban development patterns.

Consider road pricing to drive more efficient use of scarce road space and urban land

Road pricing is an effective tool to manage congestion and use road capacity more efficiently. Flexible charges that vary by time and location can set prices to match drivers’ marginal cost of using roads and thereby change their behaviour. Road pricing may have unwanted effects on equity, however, as do many fiscal instruments. The scale of distributive impacts will depend on the travel patterns of the different income groups, the location of jobs and residential areas, and how tolling revenues are used. Earmarking tolling revenues for improvements in public transport can neutralise distributional impacts.

Use parking rates to discourage excessive driving

Cities should consider dynamic parking pricing systems that adjust tariffs in real time based on parking place occupancy in surrounding areas. Dynamic pricing can help prevent capacity saturation and unnecessary cruising in search of or in place of parking, as pilot projects have demonstrated. Where dynamic parking pricing is not possible, charging by the minute at average market price for kerbside parking is the best alternative. Retailers will tend to benefit because charging for the time the parking space is occupied increases turnover, which makes finding a parking space easier.

End employer-paid parking subsidies

Free parking at a workplace is a common fringe benefit. Employers should be encouraged to eliminate parking subsidies or widen their scope to include commuting by other modes, as an effective way to make commutes by car less attractive. Offering a cash payment or a comparable transit benefit equal to the cost of a parking space also gives employees an incentive to avoid commuting by car. Governments should also make bike-sharing and other emerging transport options that can reduce environmental impacts and congestion eligible for commuter benefits.

Ensure that quality alternatives to private cars are convenient and efficient

Providing quality public transport options at affordable prices is central to encouraging modal shift. Improving service quality of service has a stronger influence on demand than lowering ticket prices. Reducing crowding, increasing comfort and enhancing reliability are particularly effective. Peak pricing should be considered for public transport, with or without concomitant road pricing, especially where fares are low and use is high. This will help balance demand with supply and fund additional peak-time services. By reducing crowding and delays, peak pricing on public transport could contribute to reducing congestion on the road as some car users switch to better managed public transport.

Work towards integrated planning of transport and land-use

Promoting compact urban development should be at the core of any long-term strategy to reduce car dependency. Aligning transport networks with high-density residential and commercial corridors over several decades is highly recommended. Accessibility indicators have proved useful for co-ordinating land-use and transport planning and for identifying areas for development. Cities that already have high density could follow the example of Chinese cities that use investment in rail transit to manage urban growth by extending rail lines to less developed areas to steer the anticipated spatial expansion.

Review land-use regulations that hinder compact development patterns

Evidence suggests that relaxation of density regulations can reduce car use and emissions. Specifically, restrictions on building height or floor area ratios hamper densification. Policies that allow population density to increase can also sometimes curb growth in the cost of housing.

Introduction

The environment for urban living is degraded in many cities by individual motorised transport. Greenhouse gas emissions, air pollution, noise, traffic injuries and congestion are just some of the ramifications. Congestion produces major economic, environmental and social costs. Overdependence on car travel leads to adverse health outcomes, social inequalities and oil dependence. The cost to society is too high to ignore, but is generally not reflected in prices for road use or land for roads and parking space, and is overlooked in land-use planning systems. Cars, roads and parking spaces use up a large amount of the scarce space in cities that could be used for other purposes that would be more beneficial to overall economic welfare.

The combination of several policy distortions has encouraged overuse of cars from an economic perspective. These include planning practices that favour automobile travel over other modes, land-use development regulations that create automobile-dependent communities and prices that fail to reflect the external costs of travel, notably peak-period congestion costs. The impact of these policy distortions is cumulative and synergistic. These distortions exacerbate congestion, pollution and crash risks and impede accessibility, particularly for non-drivers, inflating consumer transportation costs for the population as a whole.

The roundtable meeting convened by the International Transport Forum in Paris in December 2019 examined how the planning and fiscal frameworks established by governments determine the share of urban mobility that is dependent on private car use and what governments can do to support a shift away from car dependency. The objectives of the roundtable were to examine:

- The main trends of car use and travel demand;
- Mechanisms to establish incentives for road space to be used efficiently;
- Road space reallocation to favour walking, cycling, public transport and other shared modes;
- Road pricing to manage growth of urban car traffic;
- The effects of parking pricing and parking availability on commute modal choice;
- Other transport-related pricing inefficiencies and hidden subsidies for car use.

The report is organised as follows: the first section looks at the effects of road space reallocation on car use and traffic. It reviews international experience with road space reallocation as a proactive strategy for managing traffic growth, the cases of Paris and Oslo are also examined. The section also considers the role of parking regulations and their influence on mode choice and urban form, based on evidence from Los Angeles. The second section discusses fiscal measures for managing urban traffic and correcting policy biases that favour automobile travel over more sustainable and affordable modes. This section discusses the example of Singapore, where road pricing has been applied since 1975 as part of a full set of integrated planning instruments to manage car use and ownership. The third section explores how governments can balance the quality and affordability of public transport in order to encourage modal shift. The final section examines the role of land-use policies for reducing over-reliance on private vehicles.

Reclaiming the streets: Ensuring efficient distribution of space between modes

The car is the most space-intensive mode of transport and in many cities transport infrastructure is largely devoted to cars. On average, cars consume five times more space per traveller than pedestrians (Table 1). The figures multiply the space taken up by each vehicle, including headway at average speed, by the time taken on average to cover a kilometre. Buses are even more space-efficient than walking when they are fully loaded. Two-wheeled motorcycles consume as much space as cars due to the headways they need when travelling at speed and their low occupancy rate. When a car is driven at 50 km/h, it requires 70 times more space than a cyclist or pedestrian (Nello-Deakin, 2019; European Commission, 2004). This also highlights the importance of discussing space as a function of speed (Crozet and Mercier, 2018).

Table 1. Road space consumption by vehicle type compared to walking

	Space used at average speed (m^2 x hours/vkm)	Average vehicle occupation rate	Space used per traveller (m^2 x hours/km)	Difference compared to walking
Walking	0.3	1	0.3	1
Bicycle	0.6	1	0.6	2x
Motorcycle	1.7	1.05	1.6	5x
Car	1.8	1.3	1.4	5x
Bus (12 m)	7	17	0.3	1.4x
Bus in peak hours	7	50	0.15	0.5x
Articulated bus (18 m)	10	23	0.3	1.4x
Articulated bus in peak hour	10	70	0.15	0.5x

Source: Héran and Ravalet (2008).

Parking – on-street and off-street – is also responsible for the consumption of vast amounts of land and accounts for a substantial share of the social costs of car ownership and use. On-street parking space typically represents 20-30% of urban road space (Litman, 2012). Estimates suggest that in the United States, there are approximately four parking spaces per vehicle. In some cities this number is much higher. Eric Scharnhorst (2018) of the Research Institute for Housing America, generated inventories of parking that combine on-street parking spaces, off-street surface parking lots and off-street parking structures in several American cities. Scharnhorst finds that there are more than 2 million parking spaces in Philadelphia, 1.85 million in New York, 1.6 million each in Seattle and Des Moines, and just over 100 000 in the city of Jackson, which has a population of only about 10 000. Parking takes up a huge amount of space: for instance, Jackson has more than 50 parking spaces per acre, 25 times its residential density of just two households per acre. This translates into 27 parking spaces for each of its households.

The question of space consumption is intensified by the strong trend observed in many countries to purchase sports utility vehicles (SUVs), which have a much larger footprint than the compact cars. The International Energy Agency (IEA, 2019) observes that SUVs now represent close to 40% of all cars globally. This trend towards ever-larger vehicles increases the land take, and in some cases these new vehicles do not fit into the roadside spaces allocated to them, resulting in infringement on footpaths and cycle lanes.

The current allocation of road space is frequently suboptimal from social, health, environmental and economic perspectives (Gössling, 2020). Several studies highlight the inequality of existing patterns of road space distribution by quantifying allocation to each mode (Gössling et al., 2016; Nello-Deakin, 2019; Colville-Andersen, 2018). Implicitly or explicitly, these studies treat the distribution as unfairly benefitting or disadvantaging users if it allocates more or less than the modal trip share to a particular mode. These studies highlight the mismatch between the amount of space given to different transport modes and their relative modal share, concluding that in many cities car travel is unfairly advantaged (Colville-Andersen, 2018). In Paris, for instance, cars occupy 50% of the public space, even though private cars account for only 15% of the total number of journeys in Paris (Apur, 2017). From an equality perspective, current space allocation is often even more counterproductive, as equality is focused on fairer outcomes. In this case, the outcome might be assessed in terms of access to jobs for people who cannot afford a car.

In light of these findings, reallocating road and parking space has become the goal for urban planners on many grounds, aiming to achieve modal split change as part of policies to protect the environment. This will require giving greater priority to more sustainable forms of transport — public transport, pedestrians and cyclists. Measures such as bus priority schemes, cycle lanes (where well-designed and appropriate for their context), wider footpaths and pedestrian areas can help to achieve a more efficient use of road space. These measures can also help improve the attractiveness of non-motorised modes, increase accessibility to specific locations, bring about environmental improvements, and improve safety. While in some areas parking is essential, in many cases a significant proportion of parking space could also be considered for reallocation to accommodate more sustainable modes and indeed other uses of road space.

With the emergence of shared micromobility, e-bikes and e-scooters the demand for redistribution of space has grown considerably (Gössling, 2020). Even if it is as yet unclear which trips e-scooters replace, they also require space. Expanding dedicated cycling lanes for these modes will vastly increase safety and safety perceptions, and make it much more attractive to cycle as well as to use electric micromobility.

Reallocation of road space can reduce access to urban centres for car-dependent households living on the periphery and in suburban areas that lack efficient public transport connections. Park and Ride schemes offer a good solution to satisfy transport needs in a sustainable manner by allowing car-dependent households to park in secure locations and complete their journey into the city centre by public transport. The vast majority of Park and Ride sites are situated outside the urban areas of city centres and are designed to relieve congestion along the roads leading into and located within the city centre. In most cases the user either pays for the bus service and parks free of charge or pays for their car parking and travels free of charge on the bus. To be effective, Park and Ride schemes should be part of a comprehensive effort to encourage public transport use and rideshare commuting.

Effects of road space reallocation on car use

There is a growing body of evidence to suggest that well-planned measures that reduce road space for private cars do not add to congestion. On the contrary, reductions in road capacity can lead to "disappearing traffic". The most comprehensive study of the phenomenon was carried out by Sally Cairns, Carmen Hass-Klau and Phil Goodwin in 1998 (Cairns et al., 1998). The study brought together more than 70 case studies of road space reallocation from 11 countries (and the collation of opinions from over 200 transport professionals worldwide). The results suggest that predictions of traffic problems resulting from reallocating space away from private vehicles are often unnecessarily pessimistic. The study found that in the right circumstances, significant reductions in overall traffic levels can occur, with people exhibiting a far wider range of behavioural responses than traditionally assumed. In the 70 cases examined, a mean traffic reduction of 21.9% was recorded, median 10.6%. In other words, in half of the case studies, there was a more than 10% reduction in the number of vehicles across the whole area where road space for traffic was reduced, including the main roads. The surrounding areas saw no additional traffic. The study confirms that reallocation of road space does not simply shift traffic from one place to another but leads to an overall reduction in the number of motor vehicles on roads.

Contrary to widespread assumptions, car drivers adapt to changes in road conditions in many different ways, often too complex for computer models to predict. The respondents in the Cairns study changed mode of travel, chose alternative destinations, changed the frequency of journeys, consolidated trips, took up car sharing or did not make the journey at all. The reductions observed are conditioned by local factors, such as the availability of alternatives, including the possibility of avoiding the need to travel or making use of public transport. In the long run, there can also be a shift of the locations of work and living places, with impacts on other markets (including property and labour markets) Cairns et al., 2002).

Oslo has shown similar results in the last four years. A reduction in capacity on three main roadways did not result in severe consequences in terms of delays or congestion. Car use on commutes fell from 21% to 16%, but the quality of the commuter experience (for all modes) remained high (Tennøy and Hagen, 2020). The city of Copenhagen reported that the total number of people travelling across a main thoroughfare bridge increased following the reduction of space for private motor vehicles and increasing space designated for walking, cycling, and public transport on the bridge (City of Copenhagen, 2017). The capacity of individual car users to change their travel behaviour in a range of creative ways presents real opportunities for urban planners seeking to optimise the use of space and quality of life in the city.

Using road space reallocation to manage traffic

González-Guzmán and Robusté (2011) argue that reallocation of road space could have similar results to road pricing in reducing car traffic to an optimal volume. Road space reallocation schemes are generally less contested by citizens and local administrations than road pricing schemes because no monetary payment for users is involved. Reallocation schemes also offer an opportunity to improve public space and liveability by improving conditions for pedestrians, cyclists or public transport users. Several cities across the globe have chosen road space reallocation as a way to proactively manage traffic while shifting their mobility solution away from private cars and towards more environmentally-friendly means. This is the case for Paris, Milan, Dublin, Brussels, Copenhagen and Bogota; all cities that have been reducing road capacity while investing in cycling infrastructure and pedestrianisation, as well as increasing public transport provision.

These cities implemented the measures with the declared aim of improving liveability, with the focus on benefitting citizens. This is important in communication strategies to avoid any impression that the authorities are simply anti-car. As an example, Copenhagen's successful transformation into a cycle city was based on a positive communication strategy that did not mention motorised vehicles or environmental challenges (Gössling, 2013). Instead, it focused on bicycle benefits, such as greater average speeds and better health. Significant investment in bicycle infrastructure (EUR 40 per person per year) was justified based on cost-benefit analyses showing a net benefit for society for each kilometre cycled.

Paris is one of the most prominent examples of a city that has adopted a proactive policy to reduce road space available for automobile traffic, transforming roads into urban public space. The city has put aside the idea of road pricing on the basis that it may risk creating a two-tier system that prices-out lower-income drivers without necessarily deterring the wealthy. As in many other cities, the main concern was that it would adversely affect working-class suburbs and that implementation would be politically infeasible. Instead, over the past 30 years, policy initiatives and programmes have promoted alternatives to private vehicle use while improving accessibility by public transport, bike and foot – including the reduction of car use through street layout and urban design.

Starting in 2002, Mayor Bertrand Delanoë introduced flagship initiatives including an urban tramway renaissance, a pioneering bike-share programme (2007) and the closure to cars of part of the expressway on the Left Bank of the Seine (2013). He also initiated the process of lowering speed limits throughout the city. While emphasising a low-profile issue – noise – instead of the highly contentious issue of car use, the Green Party leveraged national funds made available by new national legislation encouraging the introduction of traffic-calming measures and development of pedestrian zones as part of urban regeneration programmes. The initiatives were framed as part of the Delanoë administration's efforts to "give Paris back to its inhabitants" (TUT-POL, 2016).

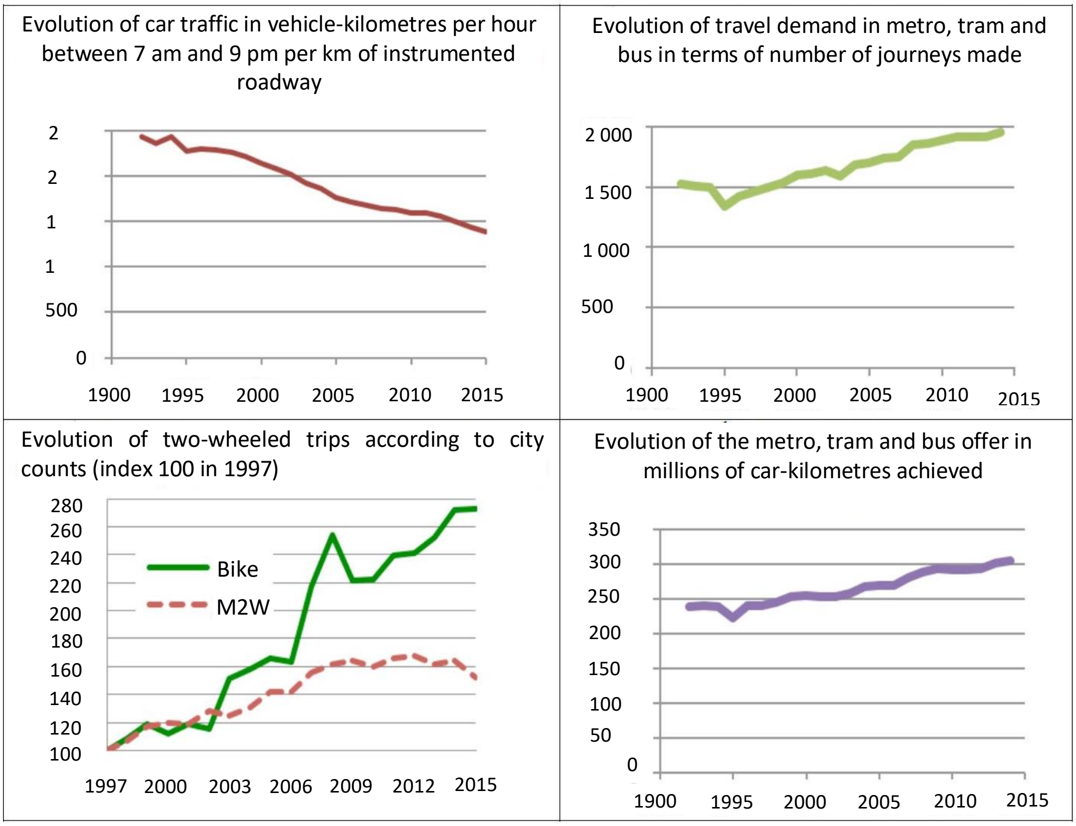
Anne Hidalgo, elected mayor in 2014, is continuing and arguably accelerating the change. As of January 2017, the oldest, most polluting diesel cars were banned from city streets during the day. Hidalgo promises to ban all diesel cars by 2024, with petrol cars following in 2030. The most important transformation Hidalgo has overseen has been the radical expansion of protected cycle lanes around the city and further closure of river bank expressways to car traffic. Many streets were considerably restructured as the bike path network grew 43% from 2014 to 2020, from 700 km to a total of 1 000 km (Hidalgo, 2014). Major intersections are also being redesigned to favour pedestrians and cyclists.

In the last seven years, the city eliminated approximately 15 000 parking spaces (Chauveau, 2019). According to Apur (2019), the city could further reduce its parking supply by 150 000 spaces, which represents a potential 96 ha that could be put to other uses. The city also established 2 500 parking spots dedicated to e-scooters, as a way to avoid cluttering narrow footpaths.

Although there has been some fierce criticism from taxi drivers and private car owners, the city has been progressively scaling up interventions to reduce the space allocated to private vehicles. As a result, since 1990 the modal share of the automobile has fallen by 45%, public transport has increased by 30% and the share of cyclists has increased tenfold (Figure 1). At the same time, Paris has seen a significant decline in traffic fatalities – roughly a 40% drop since 2010 (Héran, 2017).

Measures to reallocate road space have been applied not only in dense urban environments but also in some suburban areas. The example of Waltham Forest, a borough to the North-East of London, shows that changing roads to public spaces in suburban areas can also reduce traffic, improve safety and encourage sustainable travel (Box 1).

Figure 1. Evolution of mode split in Paris, 1990-2015



Note: M2W refers to two-wheeled motor vehicle.
Source: Héran (2017).

Box 1. Reallocation of road space in suburban areas: Waltham Forest, London

Waltham Forest, a suburban borough in the North-East of London, has trialled an integrated set of measures to reallocate road space to public space. The borough introduced a series of temporary road closures to reduce the amount of non-local traffic on its roads whilst improving local access for people walking or cycling. Raised road crossings, pedestrian crossings and junction improvements were implemented as part of the subsequent permanent scheme.

Previously, a high proportion of vehicles using Walthamstow Village were exploiting it as a cut-through between surrounding main roads, often at high speed. By restricting access to motor traffic at various locations, Waltham Forest dramatically reduced the amount of non-local traffic, which was redirected onto the main road network. The impact of this on traffic flow at major junctions was carefully monitored as part of the pilot process. Throughout the trial, the borough conducted an extensive consultation process with local residents and businesses.

The scheme reduced the average daily flow throughout the area from 8 500 to 4 800 vehicles. Overall, the number of vehicles was reduced by 22% and the average traffic speed was reduced from 22.3 mph to 21 mph, bringing it closer to the 20 mph limit. The effects on safety perception and liveability have been positive, with 74% of residents supporting the scheme.

Source: ITF based on Department of Transport (2016).

The increasing trend for car-free walking areas

Copenhagen, Denmark and Freiburg, Germany were among the first cities to adopt policies to regenerate city centres as completely car-free walking areas. Closing town centres to traffic has been the most effective, and radical, intervention. Following initial resistance, when well designed the move has generally proved popular. There have always been strong initial objections, which have stopped some schemes but ex-post analysis has shown positive results. In only a few cases has the policy been reversed. The improvements in liveability and air quality, as well as benefits for retailers outweigh the potential negative effects identified prior to scheme implementation. Lawlor (2013) found that well-planned improvements to public spaces increase retail footfall and trading by up to 40%, contrary to widespread fears, and that investing in better streets and spaces for walking can provide a competitive return compared to other transport projects. He argues that walking and cycling projects can increase retail sales by 30%. Put another way, people who walk to the shops spend up to six times more than people who arrive by car, often because they visit more frequently. Similarly, pedestrianisation of Madero Street – a busy city centre street in Mexico City – resulted in a 30% increase in commercial activity and a 96% reduction in reported crime (C40 Cities, 2016).

Car-free areas might mean increased difficulty in accessing city centres by the proportion of the population who do not live in the vicinity of these areas and who have to rely on private cars for access. It is important that this proportion of the population be given sufficient consideration so as not to exacerbate any currently existing inequalities. Potential negative effects arising from detouring traffic also need to be assessed to ensure that they do not exacerbate socio-economic divides and distributional effects (Markovich and Lucas, 2011; Schwanen et al., 2015). Using trial projects to measure and monitor all possible aspects of the situation before, during and after any trial scheme, has proven useful for addressing potential negative impacts. This can also help showcase the transformative effect of pedestrianisation on city centres.

Reviewing requirements for car parking space

The environmental problems and welfare losses associated with parking are largely caused by policies encouraging parking space oversupply and parking prices that are set lower than the social costs of provision (Russo, van Ommeren and Dimitropoulos, 2019). Determining how much parking space is useful starts with making an inventory of the on- and off-street parking that exists. Many cities, however, lack comprehensive parking data, meaning that city planners, for instance, have been prescribing parking as part of new construction for decades without first diagnosing the nearby parking supply. This has resulted in an oversupply of on-street and off-street parking, much of which has gone unused. Without the basic knowledge of how much parking is available, planners do not have a reliable basis for making decisions about future supply policy and parking regulations (Franco, 2020). Eric Scharnhorst (2018) used several data sources to develop parking inventories for five American cities. On-street parking inventories were derived from the geometries of street linework. Almost all of the off-street surface parking data came from satellite or aerial imagery. These data differed in resolution and kind for each city. Despite the source data inconsistencies, the method used to build parking inventories for the five cities can also generate parking inventories for other cities in the future.

Box 2. Parking prices and availability, mode choice and urban form: Evidence from Los Angeles

Common to many cities across the United States, Los Angeles County and the City of Los Angeles apply minimum parking requirements (MPRs) mandating the number of parking spaces that must be provided in a development. These requirements are uniform for all areas across the county. Following "Parking Generation Guidelines" MPRs are set with no connection to the market or the location features of the project site. Perceived parking shortages are often used to justify MPRs. The application of uniform parking requirements, however, has led to a large oversupply of parking in many areas. Franco (2020) argues that MPRs force developers to use more land per square foot of liveable area than the market would dictate, while raising the cost and reducing the profitability of development in areas with high land values.

Franco estimates that in the city of Los Angeles, complying with the default parking minimum increases the cost of an office building by an average of 48%. This high cost of parking is likely to incentivise developers to limit the density of development as well as the total amount of development. It also creates an incentive for developers to build in low-density areas of the city where land is less expensive and parking requirements can be met through surface parking lots, rather than more expensive underground parking.

In some situations, however, developers are willing to build more parking than required. This is the case in some old urban neighbourhoods in Los Angeles. Stangl (2019) estimates that in these areas developers build 34% more than the regulatory minimum, and 6% more than the default minimum applied in other neighbourhood types. This is probably the result of the scarcity of on-street parking in this type of neighbourhood. Developers build more parking to capitalise on scarcity, as higher prices can be charged.

Franco and Khordagui (2019) also find that parking space availability at home – both off-street and on-street – has a positive correlation with the probability of driving in Los Angeles County. On-street parking availability at home seemed to matter more than the availability of off-street parking. Their findings show that a 10% increase in on-street parking is associated with a 1.3% increase in the probability of driving, whereas a similar increase in residential off-street parking is associated with only a 0.6% increase in driving. A possible explanation is that despite the availability of a driveway or a garage, required by parking regulations, many residents still choose to park on street, while using garages for other purposes (e.g. storage). Such behaviour prevails because in many residential areas on-street parking is hardly regulated by price and/or time limits.

Source: Franco (2020).

Abolishing minimum parking requirements

An oversupply of off-street parking spaces is, to a large extent, an artefact of regulation and serves as a powerful subsidy to cars and car trips. Many cities apply minimum parking requirements (MPRs) in building codes and planning authorisations, mandating the number of parking spaces that must be included in a development. The main justification for MPRs has been to counter saturation of on-street parking space and counter congestion resulting from cruising to find parking spaces.

In the case of the United States, cities typically set off-street parking minimums by consulting "Parking Generation" guidelines, published by the Institute of Transportation Engineers, or replicate the requirements of other cities. For each category of land use, the “parking generation rate” is defined as the peak parking occupancy observed in surveys by transport engineers. The guidelines reflect the average peak parking occupancy at a few suburban sites with ample free parking and no public transport (Shoup, 1999). As a result of being set without reference to the market or the locational features of a project site, minimum parking requirements (MPRs) are likely to overestimate the amount of space actually needed. The frequent failure to charge for on-street parking, especially in residential areas, means that even where off-street parking is constructed, cars continue to be parked on the street, with garages used for storage space (Shoup, 1999).

There is an increasing consensus among academic researchers that car parking availability induces car ownership and car use (Shoup, 1999, 2011; Stangl, 2019; Litman 2020; Brueckner and Franco, 2015; Franco, 2020). Households own more cars, use them more often and drive them further if there is abundant off-street parking. As such, MPRs reflect an outdated vision that favours private vehicles over more sustainable modes. This in turn undermines current land use and transport goals for improved accessibility and sustainability.

Another problem with regulations that set minimum required provision of parking space is that they bundle the cost of unnecessary new parking with new housing and commercial developments. Franco (2020) estimates that in the city of Los Angeles, complying with the default parking minimum increases the cost of an office building by an average of 48%. These parking costs often make it financially unviable for developers to build affordable housing units in new residential developments. These costs are embedded in higher retail prices, lower workplace salaries, and higher rents, affecting lower-income residents the most. Since these costs are not paid directly by users, under minimum requirements even those who cannot afford to drive share in paying the cost of parking (Litman, 2020).

Minimum parking requirements also contribute to urban sprawl, as they prevent private developers from responding to market conditions, and lessen their interest in developing sites that are accessible without driving, especially in central areas. Parking structures are the most expensive to build in downtown areas and the opportunity cost of an above-ground parking space can be very high. To meet the requirements, developers have to build expensive underground parking. As a result, high construction costs create an incentive for developers to build in low-density areas where land is cheaper and parking requirements can be met with surface parking lots, rather than underground parking. If developers were allowed to directly address the high land costs of providing so much parking, the number of spaces would be the result of a careful economic calculation rather than a matter of satisfying a legal requirement (Franco, 2020).

With the oversupply of parking potentially reducing housing supply and increasing housing costs, while also encouraging more driving, eliminating minimum rate requirements is critically important. This approach is required at both the origin (place of residence) and destination (work, shops, etc.). Reducing parking requirements allows for an increase in economic efficiency and fairness by reducing the subsidies that non-drivers must pay for parking facilities they do not need. Critics sometimes imply that this will eliminate parking to an extent that will have a negative impact on users that have to rely on private vehicles. In truth, it will allow developers to determine parking supply based on user demand.

Approaches to parking reform vary. The first step has often been replacing minimum requirements with maximum limits. Some US cities have already done this. For instance, San Francisco limits downtown parking to 7% of the building’s floor area. Seattle allows a maximum of one parking space/1 000 ft^2 of downtown office space. At the liberal end of the spectrum is deregulation, with no minimum or maximum parking requirements. Many cities and towns take a mixed approach, with maximum limits in central business districts and transit-oriented developments, and reduced minimum requirements in other areas.

Cities elsewhere, including London in 2004 and Mexico City in 2017 (Box 3), have also moved from parking minimums to parking maximums. In London, this reform has been very effective and has reduced the number of parking spaces for new residential buildings by 49% (Guo and Ren, 2013). The recommended maximum parking standards in both housing and commercial developments are based on the principle that areas better connected to public transport need fewer parking spaces. Transport for London (TfL) uses Public Transport Accessibility Level (PTAL), an indicator of accessibility to public transport, to determine recommended maximum parking standards. In central London locations with high public transport accessibility, guidelines promote car-free developments (significantly less than one space per unit), with parking provided principally for disabled people. At the same time, developments in all parts of London must: 1) provide parking for disabled people; 2) ensure that 1 in 5 spaces provide an electrical charging point to encourage the uptake of electric vehicles; 3) meet the minimum cycle parking standards; and 4) provide for the needs of businesses for delivery and servicing (London Plan, 2016).

In outer London, when setting parking standards boroughs are required to take account of residents' car dependency, especially in areas with low public transport accessibility. The guidelines are flexible and do allow for boroughs to revise standards to include minimums where they find it necessary to reduce pressure on-street parking (London Plan, 2016).

Box 3. Mexico City parking reform

In 2017, Mexico City changed the construction code in order to abolish minimum parking requirements and establish maximum limits. For residential buildings, the limit is 3 parking spaces per unit regardless of the size of the unit, and for commercial buildings larger than 100 square metres, the limit is 1 parking space for every 30 square metres. The reform also mandates the inclusion of space for bicycle parking. Developers are also required to pay parking fees for every space provided above half the allowed maximum in the city centre. These revenues are directed to a Fund to Improve Mass Transit. This fund is used both to improve transit and subsidise affordable housing in central areas (CDMX, 2017). As a result of the reform, new living space increased by 15% while space allocated to parking decreased by 21% in only two years. It is estimated that by 2030 the change in the parking rule will have avoided 2.645 million tonnes of CO_2e (Core, 2019).

The reform was implemented after the Mexican office of the Institute for Transportation and Development Policy (ITDP) identified that the demand for parking space is actually lower than provided for by the minimum parking requirements. According to the ITDP, more than 40% of the land used in Mexico City is dedicated to parking. Between 2009 and 2013, 6 750 000 square metres of parking was built, which translates into approximately EUR 1.7 million, money that could have funded 18 bus rapid transit (BRT) lines to move 3 million users per day (ITDP, 2017).

Eliminating minimum parking requirements can inconvenience motorists (they will have fewer free spaces) and cause spillover effects (motorists parking in undesirable locations) which require more enforcement. Elimination of MPRs, therefore, needs to be accompanied by management strategies and enforcement programmes to address any potential resulting or secondary problems.

Franco's findings conclude that zoning regulations that require residential buildings to include off-street parking together with under-priced on-street parking contribute to an increase in driving to work. In this context, eliminating minimum rate requirements is critically important. Charging market prices for kerbside parking also makes economic sense. Under-priced parking increases cruising in already-congested traffic and distorts the individual choices of local residents on how to use on-site garages. If cities charge the right price for kerbside parking to leave one or two open spaces on each block, then there will be no parking shortage (Hampshire and Shoup, 2018). And if there is no shortage of on-street parking and spillover parking problems can be controlled, then MPRs will become redundant.

Fiscal instruments for efficient use of scarce road space and urban land

The under-pricing of the use of urban space and the external costs of car use is a key failure in transport policy. Today, most drivers in urban areas only pay a fraction of the costs associated with car traffic. Demand, therefore, greatly exceeds the optimum. This inefficiency will persist so long as prices remain unequal to the marginal social costs, or until measures are taken to curb traffic by other means. Policy makers and researchers have proposed various policy tools to optimise demand and mitigate congestion. Road pricing has been extensively studied in the relevant literature. Despite its robust theoretical underpinning, the application of road pricing is currently limited to a few cities including, notably, London, Stockholm, Singapore and Milan.

Road pricing

From an economic point of view, road pricing is widely considered an effective way to achieve efficient use of road capacity. Following Pigou (1920), academics such as Walters (1961) and Vickrey (1969) established the basis for an optimal tax for the use of infrastructure in relation to external congestion costs. Prices paid for individual journeys need to be aligned with the real costs of these journeys and as costs differ across time, space and vehicle type, this implies a need for differentiated prices.

Cities that have implemented some form of road pricing have been successful in reducing congestion and emissions (ITF, 2018). Despite this, and the theoretical potential, introducing new road user charges is always controversial. Reticence arises mostly because it is seen as a monetary penalty with a political cost for local authorities. Several writers such as Ison and Rye (2005) and Cain (2005) underline that gaining public acceptability is the major hurdle for implementing congestion pricing. A number of proposed cordon charging systems have been rejected largely because they were perceived to be unfair by some road users. Nevertheless, public scepticism can be overcome, as demonstrated by the mayor's effective communication strategy prior to the introduction of London's Congestion Charge, and Stockholm's referendum approving the reinstatement of the City's charging trial, based on real experience of its cost and benefits in practice.

A common argument against car use taxes and, in particular, congestion charges is that they disproportionately hurt financially-disadvantaged groups. Distance-based charges are, to some extent, regressive; consuming a greater proportion of the disposable income of low-income car drivers than high-income car drivers. Yet, few if any policies can compete in terms of effectiveness and probably none in terms of economic efficiency. The distributional impact of road pricing is no higher than fuel tax and it is less significant than generalised consumption taxes such as VAT. Moreover, a large proportion of low-income earners have no car access regardless of whether use is subject to road pricing or not.

Eliasson (2016) investigated the fairness of the congestion charges in Stockholm and Gothenburg and theoretical charging systems in Helsinki and Lyon. The method simultaneously takes into account differences in travel behaviour, in preferences (such as value of time) and supply of travel possibilities (car ownership, public transport level-of-service, etc.). His analysis shows that higher-income earners in all four cities pay (or would pay, in the case of Lyon and Helsinki) more in congestion pricing tolls simply because they drive more, especially in central areas. Lower-income groups, however, pay a higher share of their income. Further analysis (Eliasson, 2019), with a larger set of cities indicates that considering payments as a share of income, results are more mixed, but broadly speaking, average payments tend to be approximately proportional to income, but slightly regressive in prosperous countries and slightly progressive in impoverished countries. The overall regressivity tends to be caused by the outliers: the highest and lowest income groups do not drive proportionally to their (registered) income level. His analysis concludes that the two most important factors for the net impact of congestion pricing are the initial travel patterns and how revenues are used.

Eliasson argues that many car use taxes, in particular when fuel taxes were first introduced, have been fiscally motivated: they are simply a convenient way to raise revenues for various public expenditures. In such situations, it is clear that the taxes' distributional burden is relevant, and should be compared to other ways to raise public revenues such as income, sales or property taxes. But increasingly, car use taxes are seen as price corrections: they are motivated by a desire to adjust the price of driving to what it really should be. Without it, driving is subsidised from a social point of view. Car use taxes tend to place a higher burden on residents in rural areas, satellite cities and urban peripheries, which may run counter to societal goals to make such areas more attractive. If the purpose of a car use tax is to generate revenues for public expenditures, variation with income groups, higher burdens in rural areas and slight regressivity may be viewed as serious problems. If the purpose is to correct prices and allocate scarce resources more efficiently, it is unclear whether such distributional effects are relevant. Eliasson argues that problems with inequitable income and wealth distribution should instead be handled with other instruments. Allowing prices of car trips to be lower than their social cost effectively constitutes subsidies to car drivers from society at large, and these implicit subsidies will overwhelmingly accrue to wealthier groups.

Another significant factor in how congestion charging affects equity overall is how revenues are used (Eliasson and Mattsson, 2006). Earmarking revenues to improvements in public transport can reverse regressiveness if the majority of vulnerable low-income households depend on public transport. Cain and Jones (2008) quantify the vulnerability of car-dependent low-income households to loss of disposable income from a congestion charge, but income support provided to vulnerable households, car-dependent or otherwise, is a much more effective and efficient way of addressing this problem than foregoing the overall benefits of charging reform.

Singapore: An integrated strategy for managing car use and ownership and a zero car growth policy

Singapore is a valuable example of a city that uses the most extensive package of fiscal and non-fiscal instruments to manage car ownership and use. The government manages traffic congestion by limiting car ownership through permits to own a vehicle which are auctioned periodically and by pricing road use. Public transport systems are extensive, affordable and efficient with the highest share of passenger traffic carried by bus (ITF, 2017). Singapore uses an integrated approach to planning for transport and urban development. Approvals for all new developments are contingent on satisfactory accessibility and extensions to public transport networks are decided together with major housing and commercial development projects.

Singapore has applied area-wide cordon charges since 1975 in the central part of the city. The original paper licencing scheme – the Singapore Area Licensing Scheme (ALS) – was replaced with an electronic road pricing system and cars entering the city centre are charged automatically as they pass beneath gantries. From 1998, tolling was gradually extended along the main highways outside of the city. The charges in Singapore vary by vehicle size, gantry location, day of the week, and by half-hour period during peak times. In addition to the morning and evening peak hours, a third peak is applied in the middle of the day on weekdays, to cover peak movements around lunchtime and an afternoon peak in scheduled office meetings. Rates are reviewed and adjusted on a quarterly basis with the goal of maintaining speeds of 20 km/h to 30 km/h on arterial roads and 45 km/h to 65 km/h on expressways. Congestion charging sits at the apex of Singapore's traffic management policies. Its function is to fine-tune the system, maximising the flow of traffic that the infrastructure can sustain. The system is designed to optimise the use of urban space rather than increase speeds (ITF, 2018). Vehicles occupy more space at higher speeds and the distance between vehicles for safe operation increases more than proportionately with speed. Crozet and Mercier (2018) estimate that space consumption is indeed optimised at speeds between 20 km/h and 40 km/h.

Singapore's traffic management strategy relies on a set of travel demand management tools that include on-street parking charges. Parking, however, is paid for in fixed monthly payments meaning that there are fewer incentives to avoid driving within the period. Minimum parking requirements apply to new buildings but the regulations have been modified to allow developers to provide 20% less car parking space than the minimum in areas where public transport is available.

An integrated approach to planning transport and land use is an essential part of the strategy, aiming at creating a highly liveable and sustainable environment while maximising the utility and value of spaces surrounding transport nodes. This is achieved by aligning key transport networks with high-density development corridors (commercial and residential) and by ensuring that new developments take place in areas that are closely served by a robust transport network of roads and a rail-based mass rapid transit (MRT) system (Centre for Liveable Cities, Singapore, 2018).

Demand for cars in Singapore is regulated by a quota scheme that strictly limits the number of cars, thus making car ownership extremely costly. Buying a car in Singapore requires a Certificate of Entitlement (COE) issued by the government. COEs are distributed through a bidding process and are issued for a period of 10 years. Car owners also need to pay an Additional Registration Fee (ARF), which further elevates the cost of owning a car in Singapore. A Vehicle Quota System (VQS) is used to determine the number of COEs made available to the public in a given period and is set according to the rate of growth in car ownership deemed sustainable by the government. In 2018 the VQS growth rate was set at zero.

Singapore's zero car ownership growth policy does not translate directly into zero growth in car use. The effectiveness of demand management tools means that car use provides excellent access to all parts of the city. Those who have a car tend to maximise its use. Average annual mileage driven is higher for cars in Singapore than in other cities of a similar size.

Fixed charges – registration fees and COEs to own a vehicle – account for a large share of vehicle costs. In 2019, motor vehicle tax collected USD 2.5 billion and the revenue from COEs was estimated at USD 2.9 billion. Road pricing in Singapore accounts for only a small part of the tax on vehicle ownership and use, with annual net revenue of USD 100 million (FHWA, 2008). Ho Tech Hua, I.P.L Png and Sedat Reza (2017) argue that because the fixed charges represent substantial sunk costs, they significantly change the way cars are utilised. A strong incentive to maximise use is seen in the first 48 months of car ownership, with the effect attenuating faster than the age of the vehicle thereafter. They found that an increase in COE premiums from USD 11 278 to USD 24 316 from 2009 to 2013 resulted in owners driving their cars 86 km more per month. In other words, car owners seek to maximise car usage given the huge investment made in buying the car. This presents a paradox as high-cost car ownership may increase, rather than decrease, the number of vehicles on the road, thus rendering the government's strategy of raising car prices less effective. At the same time, car owners highly value the convenience of both car ownership and a congestion-free network.

Singapore is now gradually shifting its approach to a real-time variable pricing scheme based on actual traffic in order to change behaviour. Fixed costs are to be reduced, with usage charges set to increase. From 2020, Singapore is planning to upgrade its road-pricing system to use GPS to vary the amount drivers pay based on distance, time, location and vehicle type over more of the network. Drivers will receive real-time information on traffic conditions and the cost of driving. This will encourage people to consider other means of transport and may prove to be a more effective way to reduce congestion than imposing higher car ownership costs that inadvertently motivate motorists to drive more.

Parking pricing and hidden subsidies for car use

Underpriced parking leads to inefficient use of space and excessive parking demand. In many urban areas, not all car users have to pay for parking at their origin and destination, either because they can park their car for free on the street or because they are offered free parking by their employer or as a retail customer. However, unpriced parking is not actually “free”: consumers ultimately bear parking costs through higher taxes and retail prices, or reduced wages and benefits (Litman, 2020). Free parking also raises issues of equity because everyone pays for it but only those who can afford to drive benefit from it.

Ideally, parking management and pricing policies complement congestion charges. Both are necessary to reduce in-vehicle time losses and ensure the efficient use of road and kerbside space. In the absence of congestion charges, parking pricing can be used to rationalise car trips. However, parking tariffs account neither for the distance driven nor for the route taken to reach a given destination. Prices for on-street and public garage and workplace parking should reflect the social costs of parking space construction, the opportunity costs of alternative land uses, environmental costs and the costs of cruising for parking (Russo, van Ommeren and Dimitropoulos, 2019). In reality, parking is significantly underpriced, and prices of parking spaces rarely cover the costs of provision, let alone external costs (Inci, 2015).

Removing income tax exemption for employer-paid parking

Employer-paid parking is an implicit incentive for commuting by car. In the United States, free parking is the most common fringe benefit offered to employees and 95% of automobile commuters can park at work free of charge. Shoup (2005a) estimates that 91% of commuters drive to work and 93% of their vehicles have only one occupant. Employer-paid parking is also common in other countries. Surveys have found that the share of downtown automobile commuters who park for free is 76% in Auckland, 70% in Brussels, 80% in Cape Town, 96% in Dublin, 87% in Edinburgh, 81% in London, 68% in Paris and 59% in Seoul (Shoup, 2005a).

Russo, van Ommeren and Dimitropoulos (2019) provide insights into the effects of employer-paid parking on car use and the environment. In a typical European and North American city, the cost incurred by firms to provide a parking space has been estimated at EUR 5 per day per parking spot. Taking into account the average length and duration of commuting trips, the value of in-vehicle time, average fuel economy and the retail price of gasoline, the authors calculate that the average cost of a commuting trip by car (excluding parking) is about EUR 12 a day. This means that the supply of free parking to employees implies a subsidy equal to around 30% of the private costs of the trip. Considering a demand elasticity of car use with respect to private costs equal to -0.5 (Litman, 2017), the demand for car commuting is inflated by about 15% due to the provision of free parking at the workplace. Based on this, the authors evaluate the environmental consequences of free parking at the workplace across the United States. In 2016, passenger cars travelled around 1.614 trillion miles with an average vehicle fuel efficiency of 24 miles per gallon (mpg). This implies that commuting trips in 2016 were responsible for 338.9 billion miles travelled and for the consumption of about 14.1 billion gallons of gasoline. Taking into account the estimate of 15%, free parking at the workplace could be responsible for the emission of 17 million tonnes of CO_2 annually in the United States alone (Russo, van Ommeren and Dimitropoulos, 2019).

In this context, removing the exemption of employer-paid parking from employees' taxable income would be a step towards removing incentives to drive. Encouraging employers who rent parking spaces for their employees to offer parking cash-outs – a cash equivalent of parking subsidy – to all employees would be an effective way to make parking costs more salient (Shoup, 2005a; Brueckner and Franco 2018; Franco, 2020). In other words, an employer gives employees the choice to either keep a parking space at work or to accept a cash payment and give up the parking space.

Parking cash-outs are common in California, where many employers are required by law to offer commuters the option to choose cash in lieu of any parking subsidy offered. A survey of eight firms that offered cash-outs revealed the potential behavioural changes and mode share benefits. The number of solo drivers to work fell by 17% after cashing out; the number of car-poolers increased by 64%, the number of transit riders increased by 50%, and the number who walk or bike to work increased by 39%. Vehicle-miles travelled for commuting to the eight firms fell by 12%. Carbon dioxide emissions from commuting fell by 367 kilograms per employee per year (Shoup, 2005a).

Parking cash-outs can benefit businesses as they can reduce the need for employee parking and the costs associated with leasing parking space. They can reduce the maintenance costs of parking areas, allow businesses to convert employee parking spaces to customer parking spots and eliminate the need for new parking construction. However, unlike parking subsidy, cash income is taxable. As a result, firms that cash-out will generally see an increase in their payroll taxes associated with the cash that is provided to employees in lieu of parking. In order to minimise adverse tax impacts, employers can offer tax-exempt public transport passes or vanpool benefits. Governments should also make emerging transport services with the potential to reduce environmental impacts and congestion – such as bike-sharing – eligible for commuter benefits and consider following the example of countries such as Belgium and the Netherlands in allowing employers to make tax-free payments to employees who walk or bike to work. Any other tax exemption related to company car ownership or use similarly subsidises car use. It is important to consider removing such income tax exemptions, or apply them to reduce the costs of commuting by other modes (de Borger and Wuyts, 2009, 2011).

On-street parking pricing

As noted above, failure to charge a market price for kerbside parking creates an incentive to spend more time cruising, which often results in more congestion in urban areas. Inconsistent policies between off-street and on-street parking can exacerbate the problem where local governments charge a higher price for off-street parking. It has been estimated that in Los Angeles, for instance, in a 15-block commercial district cruising for kerb parking created nearly 1.5 million excess vehicle-kilometres of travel per year (Pierce and Shoup, 2013).

Critics often claim that parking pricing reduces economic activity by discouraging customers. Several studies that have examined the effects of parking policy changes, including pricing, on local economic activity show that this is not always the case (COST, 2005). More often, parking fees result in increased turnover which makes finding a parking space easier, reduces the number of parking spaces required at a location providing financial savings and reduces congestion. These studies conclude that parking fees are largely associated with positive effects on the local economy over the long term, though in the short term there may be a drop in the number of visitors. Economic impacts tend to be highly variable, depending on the type of businesses, the types of customers and the quality of alternative parking options, transport options and shopping destinations. In the case of Oslo, introducing free parking to enhance the economic viability of retail trade had adverse effects. The occupancy rate rose to nearly 100%, the average parking time increased by 30% and there was less circulation on the parking spaces. The majority of shopkeepers, were critical of free parking because their customers could not find any free spaces to park, as a result, free parking was abolished in 2000 (COST, 2005).

Given fluctuations in demand, a dynamic parking pricing system where tariffs vary over space and time using information on occupancy in surrounding areas is the ideal solution. Shoup (2005b) estimates that the optimal parking occupancy level should be around 85% or leaving at least one or two open parking spots per block to avoid cruising. Dynamic parking pricing can help achieve optimal occupancy rates, prevent parking capacity saturation and reduce cruising.

Several cities, including San Francisco, Seattle, and Washington, D.C. have initiated pilot projects that adjust kerbside parking prices to occupation in real time and by location. SFpark in San Francisco is one of the pioneering examples of such a pricing scheme (Box 4). The scheme was implemented in 2011 in seven pilot zones. Against the background of increasing car ownership, pilot areas saw a 30% decrease in vehicle-miles travelled from 8 134 miles per day to 5 721 miles per day between 2011 and 2013 (DDOT, 2019).

Box 4. Dynamic parking pricing: The case of San Francisco

SFpark took effect in April 2011, when SFMTA installed sensors in seven pilot zones that report the occupancy of each kerb space on every block, and parking meters that charge variable prices according to the time of day. An app informs drivers of the price of vacant places.

The city adjusts parking prices in response to the occupancy rates about once every six weeks. This trial-and-error process aims at keeping about 15% of spaces vacant on any given block. SFpark bases the price adjustments purely on observed occupancy. This is because planners cannot predict the right price for parking on every block at every time of day, but they can adjust prices in response to occupancy rates and find the right price by trial and error. Meter prices are increased by USD 0.25 per hour if the occupancy on a block exceeds 80%, and reduced if the occupancy is less than 60%. By adjusting the price, SFMTA expects to redistribute parking demand from very crowded blocks to less crowded ones, raising parking space availability and reducing cruising time (SFMTA, 2014). All parking meter revenue is used to subsidise public transit.

SFpark allocates parking spaces more efficiently than uniform prices can. Short-time parkers, carpoolers, those who have difficulty walking, and those who place a high value on saving time will shift toward the more convenient parking spaces. In contrast, long-time parkers, solo drivers, those who enjoy walking, and those who place a low value on saving time will shift toward the more distant parking spaces. In principle, the revenue raised will be equal to the value individuals derive from parking at locations optimally distributed when the social costs of congestion on the streets are taken into account.

Source: ITF based on SFMTA (2014), *SFpark book: Putting Theory Into Practice, San Francisco Municipal Transportation Agency*, http://sfpark.org/resources/docs_pilotsummary; and Pierce, D. and G. Shoup (2013), *Getting the Prices Right: An Evaluation of Pricing Parking by Demand in San Francisco*, https://www.tandfonline.com/doi/full/10.1080/01944363.2013.787307.

The ways in which parking is charged also affect the effectiveness of parking pricing policy. In Singapore, as noted, parking rates are set at a high level but parking is paid for in fixed monthly payments, meaning that there are no incentives to avoid driving within the given period. Shifting to daily payments may have a greater impact on behaviour by requiring a daily choice about whether to drive. Urban areas need to avoid discounts for long-term parking leases (i.e. cheap monthly rates). Litman (2019) recommends setting daily rates at least 6 times the hourly rates, and monthly rates at least 20 times the daily rates. A better option would be to eliminate unlimited-use yearly passes altogether and instead sell books of daily tickets, so commuters save money every day that they avoid driving. As with other fiscal instruments, high parking prices can negatively affect low-income users and those who have to rely on private vehicles for reaching job opportunities and services. When vulnerable population groups are negatively affected by parking policy interventions, they can be compensated through targeted complementary measures (Litman, 2018). People with disabilities may face many issues when it comes to parking in urban areas, including insufficient reserved parking and unauthorised use of accessible parking spaces. Providing a sufficient number of parking spaces near destinations for people with disabilities is important in ensuring that the needs of all user groups are addressed.

Providing quality alternatives to car use

Pricing parking and road use according to demand will improve the efficiency of congested road systems regardless of the available alternatives to car use. Reducing congestion will also benefit bus passengers, improving speed and reliability of service. Accompanying investments in improved public transport are, nevertheless, needed to provide good alternatives to car travel (ITF, 2014). In London, for example, revenue from the Congestion Charge is used entirely to fund public transport, and bus services were improved prior to its introduction in 2003, including through the allocation of more road space to buses. The reliability of bus services improved markedly both within the charging zone and more widely across London. Similarly, bus, metro and rail services were expanded in Stockholm before the Congestion Tax trial in 2006.

Norway has adopted a Zero Car Growth Objective, a proactive strategy to reduce car use and reallocate space to more sustainable modes while investing in public transport, walking and cycling. The objective itself states that “all growth in personal traffic in the largest cities will be covered by public transport, walking and cycling”. The legitimation of the target has been incremental, starting from a 2006 White Paper on Norwegian Climate Policy, in which the government put forward the goal of shifting travel to public transport, walking and cycling. From then on, the goal was included in all key national climate policy documents, such as the 2012 White Paper on Norwegian Climate Policy and the 2012 Climate Accord. In 2014, the National Transport Plan adopted the “Zero Growth Objective” which is now the key target for transport policy in cities. The “zero growth” aspect implies that there will be no growth in private car traffic. To ensure coherence between the target and local policies, long term “Urban Environment Agreements” are now being concluded between the central government, the county authorities and some municipalities in Norway’s largest urban areas. These binding agreements are the basis for government funding for local transport improvements. The amount of funding cities receive for local transport infrastructure is tied to how well the cities work towards meeting the “Zero Growth Objective”. This includes specific indicators that measure whether or not car traffic decreases. In 2016 and 2017, such Agreements were signed with all of the largest Norwegian cities, including Oslo, Trondheim, Bergen and Stavanger (Jæren district) (Haarstad, 2019).

In Oslo, funding received via the Urban Environment Agreement has supported important investments in public transport. This has included additional bus lanes and other upgrades to existing rail and tram networks. From 2017 to 2018, the number of boardings in the capital region increased by 4.2% – growth 3 times higher than that of the population in the same area. Public transport services measured in vehicle-kilometres increased by 5.9% in 2018 (Ruter, 2018).

Revenues from road and parking pricing are increasingly earmarked for improving public transport services in Norway. Revenues from Oslo’s toll ring are now a major element in financing public transport investments in the Oslo-Akershus Transport Master Plan. When it was introduced in 1990, 10% of toll ring revenues were used for public transport. Since then, the share has increased and since 2012, the City Council has directed 60% of revenues to public transport (Tennøy, A. and O. Hagen, 2020).

Getting public transport prices right

Public transport is often subsidised to provide affordable mobility for low-income households and to those without access to a car. Subsidising public transport is also sometimes viewed as a second-best approach to promoting efficiency in the transport system as a whole in the absence of charges for the use of roads and the external costs imposed by car use (De Borger and Swysen, 1999). The underlying argument is that reducing fares for public transport with subsidies will attract car users to public transport thus reducing congestion, air pollution and crash risks.

Following this argument, some cities have introduced fare-free public transport as a way to encourage the use of alternative modes. Yet in many cases, while generating some modal shift from cars the greater effect is often an undesired modal shift from walking or simply more trips generated by those who already used public transport before. This was the case for Tallinn, where after the introduction of fare-free public transport the use of public transport indeed intensified, however, the average length of car journeys increased by 31%, which meant there was more – rather than less – car traffic (Cats et al., 2016).

Subsidies and low fares often prove to be unsustainable and generate deficits making it difficult to increase much-needed capacity or to expand public transport networks to meet the demand stimulated. Many academics argue that service improvements, rather than fare reductions, are more effective at increasing public transport ridership. UITP (International Association of Public Transport) analysis of demand elasticity for metro networks worldwide shows that an average 10% reduction in fare levels results in only a 3% increase in patronage, while a 10% increase in capacity on a fixed network, through frequency enhancements or larger trains, can increase demand by over 5% (UITP, 2014). Quality and convenience of public transport are considered the strongest attraction for public transport use (Proost, 2017; Holmgren and Ivehammar, 2015).

When private transport is optimally priced, public transport pricing can and should be based on the same principles as pricing for road use; and should take into account the marginal external cost of an additional user, with higher prices at crowded times (Mayeres and Proost, 2004; Proost, 2017).

There are several reasons why it may be efficient to charge higher public transport fares during weekday peak periods. First, the marginal cost of providing services is higher in peak periods, as capacity-related costs are incurred to serve the times of highest demand. Second, road congestion is higher during peak hours, so there may be a higher external benefit of public transport use. Third, peak hour overcrowding in public transport (which increases user discomfort and reduces user welfare) could be an important issue for some cities. Expanding capacity is a natural way to alleviate crowding in public transport, but it could require significant investment. Fares contribute to investment as well as managing demand.

Proost (2017) analysed the data on the effects of congestion pricing introduced in Stockholm in 2016 on car and public transport demand. Based on this, the author modelled how the optimal pricing, frequency, bus size and number of bus lanes for a corridor depends on the presence of congestion pricing for cars. Proost argues that the best reform consists of peak and off-peak tolls for cars combined with higher bus fares and frequency in the peak and lower off-peak bus services at lower frequencies. Higher peak fares may also spread demand more evenly across the day, which could reduce capacity-related costs and make services less crowded. Fares in off-peak times may improve cost recovery, provided the additional passengers do not impose additional costs on the system over and above what they pay in fares.

Concessionary fares and financial sustainability

It is important to ensure that it is financially feasible for the most vulnerable low-income groups to use public transport systems. In some circumstances, it is most effective to provide support through generalised concessionary fares. Free travel for schoolchildren is a common example. Overcrowding in the morning peak in London (Proost 2017) led to the consideration of ending this concession in 2020. However, concern that fares might erode access to free school meals, as well as education, for vulnerable children resulted in free travel being maintained. In the Netherlands, travel is free on the national rail system for university students as part of a policy to facilitate access to university education for students who cannot afford to live away from home. These universal approaches nevertheless inflate the cost of concessionary fares. Setting just and efficient public transport fares requires targeting discounts only towards individuals who qualify on the basis of need. If governments have sufficient information to reliably identify everyone that qualifies for support, technology such as smart cards is available to deliver targeted support for vulnerable users of public transport. This is the approach in Bogota, where concessionary fares are granted on the basis of data from the national System for Selecting Beneficiaries of Social Spending (SISBEN). The SISBEN register is used by national and local governments for programmes to subsidise water, electricity and health care, and has been extended to public transport systems in Bogota and other cities (ITF, 2017). It should be noted, however, that some of the most marginalised people fail to be registered in the SISBEN system and thus have no access to discounted transport, despite measures taken to make smart cards accessible to all (payable by cash in very small amounts, without the need for a bank account or credit card).

Buenos Aires provides a good example of how fares can be increased to improve the financial sustainability of the public transport system while at the same time mitigating the impact on vulnerable households. The Red SUBE (*Sistema Único de Boleto Electrónico* or Single Electronic Ticket System) travel card system is used to deliver a discounted “social fare” for users from households registered in peripheral low-income suburbs. Fares are also structured to accommodate typical travel patterns of low-income commuters, who often have to take several separate bus rides to make long journeys. Commuters who take more than one ride within a two-hour period – regardless of whether they take different bus lines or switch between bus, rail or metro – pay a full fare for the first ride but have a 50% discount on their second ride and a 75% discount on subsequent rides. The discounts also apply to those benefitting from the “social fare”. Whilst this structure does nothing to discourage sprawl, it has made it possible to maintain low fares for vulnerable users while increasing revenues from tickets sold for investment in better services. This kind of reform is vital for public transport systems locked in a vicious circle of low social fares, inadequate public funding, overcrowding and poor quality of service.

Land-use policies to promote sustainable urban development patterns

In many cities, the increasing dispersal of residential areas and economic activities is making car use a necessity. Low-density urban sprawl often results in longer commuting distances and travel times on both public and private transport. For instance, UN-Habitat estimates that to cross Mexico City from North to South takes approximately five hours by public transport and about three hours if the trip is made using a private vehicle (UN-Habitat, 2018). Urban sprawl has various economic costs including environmental degradation, increased costs of providing utilities and government services, reduced accessibility and economic opportunity for non-drivers, and increased transport costs overall. According to a study conducted by the Victoria Transport Institute and the London School of Economics, urban sprawl costs the US economy over USD 1 trillion per year (5.4% of GDP) (Litman, 2015). In this context, compact urban development patterns and higher density combined with public transport planning have been highlighted as a way to avoid inefficient and costly patterns of development, encouraging citizens away from motorised transport. Urban development patterns are also an integral part of successful public transport systems, namely because these systems are more expensive to provide in low-density areas. Thus, policies that increase population density may reduce the subsidies public transport requires (OECD, 2018). As a result, policy reforms targeting a greener modal split are more effective in compact settings, where public transport services and soft mobility infrastructure can be provided at a lower social cost.

Integrated planning of transport and land use

Coordinating land-use and transport planning is central for enhancing accessibility, "the ease of people's access to goods, services and activities" (Litman, 2019). A number of indicators have been developed to support policy makers to integrate transport in decisions about where to encourage development and guide the decision-making process for investment. One of the most well-known examples is the Public Transport Accessibility Level (PTAL) indicator used by Transport for London (TfL) (Box 5). The indicator rates locations on a 0 to 6 scale according to their access to public transport services. Projects for dense commercial and residential developments are authorised only where the PTAL rating is sufficient to sustain them. PTAL is also combined with general location characteristics (central, inner and outer suburban) to generate a "Sustainable Residential Quality Matrix" used to establish recommended density ranges in the London Plan, the main spatial strategy guidance for the Greater London Area.

Box 5. Use of the Public Transport Accessibility Level London Plan

The Public Transport Accessibility Level indicator (PTAL) is a highly influential metric used by Transport for London to link urban development and transport. The indicator measures access to the public transport network across the Greater London area. The score provides information on how close a selected point in the city is to public transport and the frequency of services. Each location is given a score from 0 to 6, with 0 representing very low access. To make this data easily available to boroughs, developers and planners, TfL introduced WebCAT, an open web portal for connectivity assessment. WebCAT is an interactive mapping tool, which makes it possible to identify PTAL values and travel time plots for any location in London.

The London Plan uses a Sustainable Residential Quality Matrix to determine suitable densities for development across Greater London. The Matrix provides guidance on the basis of location type (i.e. central, urban or suburban) and PTAL. The London Plan also uses PTAL for calculating recommended parking standards in both housing and commercial developments on the principle that areas better connected to public transport need fewer parking spaces. PTAL can also be used to determine the share of business and commercial activities located in areas that have good connections to the public transport network (those with a PTAL of 5 or 6). This is used to monitor compliance with the London Plan goal of having a high share of workplaces that are well connected to public transport. The PTAL indicator is also used as part of the transport assessment required for specific development projects. It allows officials to evaluate the impact of developments and their relation to public transport access and thus serves as the basis for negotiating contributions from developers to public transport enhancements where a project is incompatible with current levels of access.

Source: ITF, based on TfL (2016), *Connectivity data to inform spatial planning – Exploratory Analysis*, Transport for London, London, https://www.london.gov.uk/sites/default/files/connectivity_data_to_inform_spatial_planning_-_exploratory_analysis_transport_for_london_2016.pdf.

Another example is the Housing and Transportation affordability index (H+T index) developed by the Center for Neighborhood Technology (CNT) in Philadelphia. The indicator is used in the United States for improving location efficiency from an affordability perspective. The H+T index incorporates transportation costs into measures of neighbourhood affordability and maps these relationships across US metropolitan areas. By taking into account both the cost of housing and the cost of transport, the H+T index is a valuable tool for directing housing developments towards locations well served by public transport. In the United States, the index has influenced decisions about funding allocation for housing developments through the Low-Income Housing Tax Credit, the largest source of funding for constructing and maintaining subsidised housing. In the project selection process, the index helps to prioritise the most location-efficient developments (i.e. projects located near transit or with good access to centres of employment). The Metropolitan Planning Council (MPC) in Chicago has used the H+T index to determine potential BRT locations. In several cities (Minneapolis-St. Paul, Washington, D.C., Boston and the San Francisco Bay Area) an adapted index is used by real estate agents to inform prospective homeowners of the location efficiency of properties and likely transportation costs. This helps them to explore housing and transport options and to understand the overall financial impact of living closer to or farther from work (ITF, 2017).

Densification, transit-oriented and transit-integrated development

Accessibility, with less car dependency, can be achieved through denser, mixed land-use development. Oslo's planning experience was discussed in detail at the roundtable (Tennøy and Hagen, 2020). Densification through co-ordinated land-use and transport planning is an important factor driving the city's development away from urban sprawl. The densification of public transport nodes is identified as an important step in strategies to reach the national government's goal of zero growth in private car traffic in Norwegian cities. Since the 1990s, there has been a professional and political consensus concerning urban densification as an overall strategy for urban development in Norway. A deliberate policy of transforming old industrial areas into housing combined with densification around public transport hubs aims to make car ownership unnecessary. A study of the three largest cities in Norway (Bergen, Kristiansand and Oslo) conducted by TOI (Institute of Transport Economics) confirms workplaces and dwellings located in proximity to transport nodes generate less car traffic per inhabitant and per employee than dwellings and workplaces located outside the nodes (Tennøy et al., 2017).

In many cities, however, density is already high and mixed land use is already common practice. In these contexts, the extent of car dependency is often associated with the quality of alternatives and the growth management strategy chosen. To avoid car-oriented expansion and deal with "dysfunctional" density (i.e. high-density sprawl along motorways), some cities use investment in rail transit as a growth management strategy – rail lines extend to vacant or underdeveloped areas to lead the anticipated spatial expansion. Such strategy has been labelled transit-integrated development (TID) (Chen et al., 2020), and is quite common in Chinese cities. In Shenzhen, for example, metro alignments and station placement have been planned in non- or less-populated places with the expectation that development will rapidly follow once the metro is in operation. As a result, here and elsewhere, new metro towns have emerged on the lines that reach the outer suburbs of metro regions. Wuhan and Nanjing have also developed metro towns outside their city cores in this way. To steer new developments towards rail stations, many Chinese cities have adopted a general policy that development within 500 m of rail transit can exceed the regulated maximum floor area ratio (FAR – floor space divided by the building plot area). Wuhan offers a density bonus of 20% FAR for residential uses within 400 m of metro stations and 30-59% FAR for commercial developments within 200 m of stations. This reduced form of London's public transport accessibility-level approach to planning has been employed in many cities worldwide, notably Sao Paolo.

The 'transit-integrated development" approach described for Chinese cities is a form of the traditional transit-oriented development (TOD), commonly defined as mixed-use urban development within close proximity (walking distance) to mass-transit facilities. The rationale behind TOD is that concentrating higher density mixed development near the station makes transit convenient, encourages public transport ridership and decreases car dependency. Hong Kong provides examples of the strongest form of TOD, where metro system extensions are financed through leases on land adjacent to new station sites for dense commercial and residential real estate development.

Land-use regulations to encourage compact and mixed-use development

Land-use regulations that affect the spatial structure of a city can play a substantial role in reducing vehicle kilometres travelled. Maximum density restrictions are common in many urban areas. Such land-use policies usually have effects persisting for many decades, as changing development patterns in existing urban environments is challenging. Density restrictions most often take the form of building height restrictions or limits on floor area ratio. They inevitably hamper densification and keep population density levels lower than would otherwise prevail (Bertaud and Brueckner, 2005; Brueckner and Sridhar, 2012). Although necessary in specific locations, such as close to airports and to protect the character of cities around historic buildings or other elements of cultural heritage, stringent maximum density regulations over large areas of the city are in many cases unwarranted (OECD, 2018).

An analysis of Auckland, New Zealand, conducted by the OECD (2020) explores how urban densification can shorten trip distances and lower car dependency, thereby reducing emissions and increasing housing affordability. Various policy packages are simulated in the study.

These are:

- a "promote public transport" policy package, which incentivises a switch to bus and rail transport through road pricing mechanisms and fare subsidies;
- a "promote electric vehicles" policy package, which exempts electric vehicles from increased operational costs imposed on conventional vehicles;
- "various densification" packages that relax maximum density regulations. The widespread and targeted densification policy packages are both implemented by relaxing vertical density (i.e. building height restrictions) and horizontal density regulations (or maximum density restrictions).

Results indicate that these policy packages provide effective pathways to reduce emissions from urban road transport in Auckland. The public transport package is found to reduce aggregate CO_2 emissions by 40% in 2050, relative to the reference case, while the electric vehicle package reduces aggregate emissions by 30% in 2050. The analysis concludes that general relaxation of density regulations in Auckland can reduce emissions by an additional 10% if implemented in combination with policy packages that promote public transport and electric vehicles. In addition to reducing emissions, policies that increase population density may entail further social benefits by curbing growth in the cost of housing. Auckland house prices are expected to triple over the period 2018-2050 on current trends and by implementing a set of land-use policies that enable widespread densification this could be reduced to a 57% increase.

Conclusions

Containing the significant environmental and social costs associated with private car use is essential to sustainable mobility. The policy-making discourse often focuses on the question of equal access to car use as a way to satisfy transport needs. But this can also be interpreted as forced car ownership when lower-income households often living in remote rural areas, which lack alternative transport options, are forced to depend on private vehicles. This results in a high proportion of their income being spent on car use. Any notion of a "right to use a car" might serve equity better by being recast as "a right to carry out daily activities without needing a car". The pertinent policy question is how to ensure an adequate level of car-free accessibility through travel choices that include public transport, walking, cycling and shared micromobility. This approach has become the planning basis for a large and increasing number of urban transport authorities. The object is not to suppress travel by car but channel it to locations and uses where its value to the individual clearly exceeds the costs it imposes on society (including other car users). It should be acknowledged that for travel between peripheral areas, the car is likely to be irreplaceable on many routes.

A reallocation of road space, and urban space more broadly, is key in achieving a more sustainable modal split and improving urban environments. Cars, roads and parking spaces use up a large amount of the already scarce space in cities that could be used for other purposes that would be more beneficial to overall economic welfare. In many cities, there is a mismatch between the amount of space given to each transport mode and the share of passengers actually carried, with car travel unfairly advantaged.

Parking is responsible for the consumption of vast amounts of land and accounts for a substantial share of the social costs of car ownership and use. This is because parking is often not supplied in line with demand and is often managed inefficiently. Outdated regulations mandating the number of parking spaces that must be included in a development have encouraged a general oversupply of both on-street and off-street parking serving as a powerful subsidy to cars and car trips. Most of the off-street parking is "free", which is also an equity concern because everyone pays for it but only those who can afford to drive benefit from it. To counter the problem of an oversupply of parking spaces, a new suite of parking policies has been developed, including reduced parking requirements, demand-based prices for on-street parking and removing the exemption of employer-paid parking from employees' taxable income.

Removing minimum parking regulations that inadvertently contribute to urban sprawl will also reduce the share of trips that can only be made by car. These planning guidelines, together with zoning regulations on the density of development – which drive the development of cities over the long term – need to be made consistent with transport interventions to regulate car use and address congestion and emissions.

Fiscal policy instruments, including vehicle taxes, parking pricing and congestion charges are effective tools for managing traffic and maximising the efficiency of urban transport systems. The fiscal package influences all decisions from whether to own a vehicle to the choice of itinerary to the time of commuting. The most effective urban mobility management systems deploy these tools together with road space allocation and land-use planning instruments. Concerns over the impact of pricing instruments on vulnerable households have, however, made many authorities prioritise reallocation of street space from cars to public transport, cycling, shared micromobility and walking in an effort to curb excessive car use. In practice, however, an integrated approach combining elements of both would achieve the best outcome.

References

Apur (2019), Évolution du stationnement et nouveaux usages de l'espace public, www.apur.org/fr/nos-travaux/evolution-stationnement-usages-espace-public (accessed 17/04/2020).

Apur (2017), Atlas de l'espace public urbain, Paris, Atelier Parisien d'Urbanisme, www.apur.org/sites/default/files/documents/atlas_espace_public_paris.pdf (accessed 17/04/2020).

Bertaud, A. and J.K. Brueckner (2005), "Analyzing building-height restrictions: Predicted impacts and welfare costs", *Regional Science and Urban Economics*, Vol. 35/2, pp. 109-125, https://doi.org/10.1016/j.regsciurbeco.2004.02.004.

Brueckner, J. and S. Franco (2018), "Employer-paid parking, mode choice, and suburbanization", *Journal of Urban Economics*, Vol. 104, pp. 35-46, https://doi.org/10.1016/j.jue.2017.12.002.

Brueckner, J. and S. Franco (2015), "Parking and Urban Form", *CESifo Working Paper Series*, No. 5324, SSRN: https://ssrn.com/abstract=2603570.

Brueckner, J.K. and K.S. Sridhar (2012), "Measuring welfare gains from relaxation of land-use restrictions: The case of India's building-height limits", *Regional Science and Urban Economics*, Vol. 42/6, pp. 1061-1067, https://doi.org/10.1016/j.regsciurbeco.2012.08.003.

C40 Cities (2016), *Benefits of Climate Action: Piloting a Global Approach to Measurement*, Appendix, C40 Cities Climate Leadership Group, www.c40.org/researches/measuring-benefits-appendix (accessed on 10/05/2020).

Cain, A. (2005). "Achieving majority public support for urban road pricing: Preserving the driver's right to choose", Transportation Research Record 1932, Vol. 1932, Issue: 1, Transportation Research Board, Washington, D.C., pp. 119-128, https://doi.org/10.1177/0361198105193200114.

Cain, A. and P. Jones (2008), "Does urban road pricing cause hardship to low-income car drivers? An affordability based approach", Transportation Research Record 2067, Vol. 2067, Issue: 1, Transportation Research Board of the National Academies, Washington D.C., pp. 47-55, https://doi.org/10.3141/2067-06.

Cairns, S., C. Hass-Klau and P. Goodwin (1998), *Traffic Impact of Highway Capacity Reductions: Assessment of the Evidence*, Landor Publishing, London, https://issuu.com/landorlinks/docs/cairns-hass-klau-goodwin-1998 (accessed 13 January 2021).

Cats, O., Y. O. Susilo and T. Reimal (2016), "The prospects of fare-free public transport: Evidence from Tallinn", *Transportation,* 44, pp. 1083-1104. https://doi.org/10.1007/s11116-016-9695-5 (accessed 10/02/2020).

Centre for Liveable Cities, Singapore (2018), *Integrating Land-use and Mobility: Supporting Sustainable Growth*, Urban System Studies, www.clc.gov.sg/docs/default-source/urban-systems-studies/uss-integ-land-use-mobility.pdf (accessed on 19/05/2020).

CDMX (2017), *Gaceta Oficial de la Ciudad de México* [Official Gazette of Mexico City], Órgano de Difusión del Gobierno de la Ciudad de México, No. 108 Bis, http://data.consejeria.cdmx.gob.mx/portal_old/uploads/gacetas/b1a0211fbbff641ca1907a9a3ff4bdb5.pdf (accessed 28/04/2020).

Chauveau, L. (2019), « A Paris, des parkings vides faute de voitures », *Sciences et à venir*, www.sciencesetavenir.fr/high-tech/transports/a-paris-des-parkings-inutiles-faute-de-voitures_134257 (Accessed 23/03/2020).

Chen C-L. et al. (eds.) (2020), *Handbook on Transport and Urban Transformation in China*, Edward Elgar Publishing, ISBN: 978 1 78643 923 9.

City of Copenhagen (2017), *Copenhagen City of Cyclists: The Bicycle Account 2016*, City of Copenhagen Technical and Environment Administration, https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=1698 (accessed on 14 April 2020).

Colville-Andersen, M. (2018), *Copenhagenize: The Definitive Guide to Global Bicycle Urbanism*, Island Press, Washington D.C., https://doi.org/10.5822/978-1-61091-939-5.

Core (2019), "Informe anual 2019" [Annual report 2019], Ciudades visibles y Amables [Visible and friendly cities], https://coreciudades.com/wp-content/uploads/2020/04/Informe-CoRe-2019-Final.pdf (accessed 28/04/2020).

COST (2005), Parking Policies and the Effects on Economy and Mobility, Technical Committee on Transport, Action 342, CROW, www.europeanparking.eu/media/1207/cost-action-342-final-report-1.pdf (accessed on 27/07/2020).

Crozet, Y. and A. Mercier (2018), "Urban Toll: Rethinking Acceptability through Accessibility", *International Transport Forum Discussion Papers*, No. 2018/16, OECD Publishing, Paris, https://doi.org/10.1787/af22477a-en.

De Borger, B. and B. Wuyts (2009), "Commuting, transport tax reform and the labour market: Employer-paid parking and the relative efficiency of revenue recycling instruments", *Urban Studies*, Vol. 46/1, pp. 213-233, https://doi.org/10.1177/0042098008098643.

De Borger, B. and B. Wuyts (2011), "The tax treatment of company cars, commuting and optimal congestion taxes", *Transportation Research Part B: Methodological*, Vol. 45/10, pp. 1527-1544, https://doi.org/10.1016/j.trb.2011.06.002.

De Borger, B. and D. Swysen (1999), "Public transport subsidies versus road pricing: An empirical analysis for interregional transport in Belgium", *International Journal of Transport Economics*, Vol. 26, No. 1, pp. 55-89, www.jstor.org/stable/42747356.

Department of Transport (2016), Case study: Changing roads to public spaces in Walthamstow Village, UK Department of Transport, www.gov.uk/government/case-studies/public-space-improvements-walthamstow-village (accessed on 12 January 2021).

DDOT (2019), "ParkDC: Multimodal Value Pricing Pilot for Metered Curbside Parking - Penn Quarter/Chinatown", Final report, District Department of Transportation, Washington D.C., https://ddot.dc.gov/page/multimodal-value-pricing-pilot-metered-curbside-parking-penn-quarterchinatown (accessed 02/03/2020).

Eliasson J. (2019), "Distributional effects of congestion charges and fuel taxes", *MPRA*, Paper No. 94328, https://mpra.ub.uni-muenchen.de/94328/ (accessed on 30/11/2020).

Eliasson J. (2016), "Is Congestion Pricing Fair? Consumer and Citizen Perspectives on Equity Effects", *International Transport Forum Discussion Papers*, No. 2016/13, OECD Publishing, Paris, https://doi.org/10.1787/79123657-en (accessed on 30/11/2020).

Eliasson J. and L-G. Mattsson (2006), "Equity effects of congestion pricing: Quantitative methodology and a case study for Stockholm", *Transportation Research Part A: Policy and Practice*, 2006, Vol. 40, Issue 7, pp. 602-620.

European Commission (2004), "Reclaiming city streets for people: Chaos or quality of life?", Directorate-General for Environment, https://ec.europa.eu/environment/pubs/pdf/streets_people.pdf (accessed on 16/05/2020).

FHWA (2008), Lessons Learned From International Experience in Congestion Pricing, Federal Highway Administration, United States Department of Transportation, Publication #FHWA-HOP-08-047, https://ops.fhwa.dot.gov/publications/fhwahop08047/02summ.htm.

Franco, S. (2020), "Parking Prices and Availability, Mode Choice and Urban Form", *International Transport Forum Discussion Papers*, No. 2020/03, OECD Publishing, Paris, https://doi.org/10.1787/04ae37c3-en.

Franco, S. and N. Khordagui (2019), "Commute mode choices and the role of parking prices, parking availability and urban form: Evidence from Los Angeles County", *UCI Working Paper*, University of California, Irving.

González-Guzmán, C.A. and F. Robusté (2011), "Road space reallocation according to car congestion externality", *Journal of Urban Planning and Development,* 137(3), pp. 281-290, https://doi.org/10.1061/(ASCE)UP.1943-5444.0000070.

Gössling S. (2020), "Why cities need to take road space from cars - and how this could be done", *Journal of Urban Design*, 25:4, pp. 1-6, https://doi.org/10.1080/13574809.2020.1727318 (accessed on 6/04/2020).

Gössling, S. (2013), "Urban transport transitions: Copenhagen, City of Cyclists", *Journal of Transport Geography*, Vol. 33, December 2013, pp. 196-206, https://doi.org/10.1016/j.jtrangeo.2013.10.013.

Gössling S. etal. (2016), "Urban space distribution and sustainable transport", *Transport Reviews*, Vol. 36, 2016, Issue 5, pp. 659-679, https://doi.org/10.1080/01441647.2016.1147101 (accessed on 17/04/2020).

Guo, Z. and S. Ren (2013), "From Minimum to Maximum: Impact of the London Parking Reform on Residential Parking Supply from 2004 to 2010?", *Urban Studie*s, Vol. 50, No. 6, 2013, pp. 1183-1200, *JSTOR*, www.jstor.org/stable/26144279.

Haarstad H. (2019), "Do Climate Targets Matter? The Accountability of Target-setting in Urban Climate and Energy Policy", in: Sareen S. (eds.) *Enabling Sustainable Energy Transitions,* Palgrave Pivot, Cham. https://doi.org/10.1007/978-3-030-26891-6_6.

Hampshire, R. and D. Shoup (2018), "What share of traffic is cruising for parking", *Journal of Transport Economics and Policy*, 52(3), 184–201, www.researchgate.net/publication/325247222_What_Share_of_Traffic_is_Cruising_for_Parking.

Héran, F. (2017), "About the modal shift: Lessons from the Parisian case", *Les Cahiers scientifiques du transport*, n° 71, 2017, p. 99-124, www.ruedelavenir.com/wp-content/uploads/2019/02/ReportModalParis_2017_F-Heran.pdf (accessed 07/04/2020).

Héran, F. and E. Ravalet (2008), *La consommation d'espace-temps des divers modes de déplacement en milieu urbain : Application au cas de l'Ile de France*, Rapport final pour le PREDIT (Programme national de recherche et d'innovation dans les transports terrestres), juin 2008, 188 p., http://temis.documentation.developpement-durable.gouv.fr/docs/Temis/0063/Temis-0063282/17652_2008.pdf (accessed on 10/04/2020).

Hidalgo, A. (2014), *Paris qui ose : Mon projet pour Paris 2014-2020*, issuu, https://issuu.com/oserparis/docs/prog-0412-rvb (accessed 04/03/2020).

Holmgren J. and P. Ivehammar (2015), "Public transport quality as a tool for reducing car dependency", AET, www.transportportal.se/Energieffektivitet/Etapp2/Public-Transport-Quality-As-a-tool.pdf

Hua, T. H., I.P.L. Png and S. Reza (2017), "Sunk cost fallacy in driving the world's costliest cars", *Management Science*, Vol. 64, No. 4, https://doi.org/10.1287/mnsc.2016.2651 (accessed on 05/05/2020).

IEA (2019), Growing Preference for SUVs Challenges Emissions Reductions in Passenger Car Market, International Energy Agency, www.iea.org/commentaries/growing-preference-for-suvschallenges-emissions-reductions-in-passenger-car-market (accessed on 15/04/2020).

Inci, E. (2015), "A review of the economics of parking", *Economics of Transportation*, Vol. 4/1-2, pp. 50-63, https://doi.org/10.1016/j.ecotra.2014.11.001.

Ison S. G. and T. Rye (2005), "Implementing road user charging: The lessons learnt from Hong Kong, Cambridge and Central London", *Transport Reviews*, Vol. 25, 2015, Issue 4, pp. 451-465, https://doi.org/10.1080/0144164042000335788.

ITDP (2017), "How Mexico City became a leader in parking reform", Transport Matters blog, Institute for Transportation & Development Policy, www.itdp.org/2017/07/26/mexico-city-became-leader-parking-reform/ (accessed 28/04/2020).

ITF (2018), *The Social Impacts of Road Pricing: Summary and Conclusions*, ITF Roundtable Reports, No. 170, OECD Publishing, Paris, https://doi.org/10.1787/d6d56d2d-en (accessed on 04/03/2020).

ITF (2017), *Income Inequality, Social Inclusion and Mobility*, ITF Roundtable Reports, No. 164, OECD Publishing, Paris, https://doi.org/10.1787/g2g7ae77-en (accessed 03 February 2020).

ITF (2014), *Valuing Convenience in Public Transport*, ITF Roundtable Reports, No. 156, OECD Publishing, Paris, https://doi.org/10.1787/9789282107683-en (accessed 03 February 2020).

Lawlor E. (2013), "The pedestrian pound: The business case for better streets and places", Just Economics, Living Streets, England, 2013, p. 7. R, https://www.justeconomics.co.uk/uploads/reports/Just-Economics-Pedestrian-Pound-Living-Streets.pdf.

Litman, T. (2020), "Parking requirement impacts on housing affordability", Victoria Transport Institute, Victoria, BC, www.vtpi.org/park-hou.pdf (accessed on 19/05/2020).

Litman, T. (2019), "Parking Pricing: Direct Charges for Using Parking Facilities", Victoria Transport Policy Institute, Victoria, BC, www.vtpi.org/tdm/tdm26.htm (accessed on 10/05/2020).

Litman, T. (2017), "Understanding transport demands and elasticities: How prices and other factors affect travel behavior", Victoria Transport Policy Institute, Victoria, BC, www.vtpi.org/elasticities.pdf (accessed 27/01/2020).

Litman, T. (2015), "Analysis of public policies that unintentionally encourage and subsidize urban sprawl", NCE cities – sprawl subsidy report, Victoria Policy Institute and London School Of Economics Cities, https://newclimateeconomy.report/workingpapers/wp-content/uploads/sites/5/2016/04/public-policies-encourage-sprawl-nce-report.pdf (accessed 27/01/2020).

Litman, T. (2012), "Transportation land valuation: Evaluating policies and practices that affect the amount of land devoted to transportation facilities", Victoria Transport Policy Institute, Victoria, BC, www.vtpi.org/land.pdf (accessed on 12/05/2020).

London Plan (2016), "Chapter 6: London's Transport", Parking addendum to Chapter 6, in The London Plan, Mayor of London, Greater London Authority, www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan/london-plan-chapter-six-londons-transport-0 (accessed on 19/05/2020).

Markovich, J. and K. Lucas (2011), "The social and distributional impacts of transport: A literature review", Working Paper No. 1055, Transport Studies Unit, School of Geography and the Environment, University of Oxford, https://www.tsu.ox.ac.uk/pubs/1055-markovich-lucas.pdf.

Mayeres, I. and S. Proost (2004), "Towards better transport pricing and taxation in Belgium", *Reflets et perspectives de la vie économique*, 2004/4, Tome xliii(4), 23-43, https://doi.org/10.3917/rpve.434.0023 (accessed on 19/05/2020).

Nello-Deakin, S. (2019), "Is there such a thing as a 'fair' distribution of road space?", *Journal of Urban Design*, 24 (5): 698-714. https://doi.org/10.1080/13574809.2019.1592664 (accessed on 18/05/2020).

OECD (2020), *Decarbonising Urban Mobility with Land-use and Transport Policies: The Case of Auckland, New Zealand*, OECD Publishing, Paris, https://doi.org/10.1787/095848a3-en.

OECD (2018), *Rethinking Urban Sprawl: Moving Towards Sustainable Cities*, OECD Publishing, Paris, https://doi.org/10.1787/9789264189881-en.

Pierce, G. and D. Shoup (2013), "Getting the prices right: An evaluation of pricing parking by demand in San Francisco", *Journal of the American Planning Association*, 79:1, pp. 67-81, https://doi.org/10.1080/01944363.2013.787307 (accessed 24/02/2020).

Pigou, A.C. (1920; 1932 ed.), *The Economics of Welfare*, 4th Edition, Macmillan, London 1932, https://edisciplinas.usp.br/pluginfile.php/4154221/mod_resource/content/0/Pigou-The_Economic_of_Welfare_1920.pdf.

Proost, S. (2017), "Reforming Private and Public Urban Transport Pricing", *International Transport Forum Discussion Papers*, No. 2018/15, OECD Publishing, Paris, https://doi.org/10.1787/3567dda4-en.

Russo A., J. van Ommeren and A. Dimitropoulos (2019), "The Environmental and Welfare Implications of Parking Policies", *OECD Environment Working Papers*, No. 145, OECD Publishing, Paris, https://doi.org/10.1787/16d610cc-en.

RUTER (2018), *Annual Report 2018*, Ruter, Oslo, https://aarsrapport2018.ruter.no/en/year-in-review-2018/from-the-managing-director (accessed 10/02/2020).

Scharnhorst E. (2018), "Quantified Parking: Comprehensive Parking Inventories for Five U.S. Cities", Research Institute for Housing America, special report, Mortgage Bankers Association, Washington D.C., available for download at: https://www.mba.org/2018-press-releases/july/riha-releases-new-report-quantified-parking-comprehensive-parking-inventories-for-five-major-us-cities.

Schwanen, T. et al. (2015), "Rethinking the links between social exclusion and transport disadvantage through the lens of social capital", *Transport Research Part A: Policy Practice*, Vol. 74, pp. 123-135, https://doi.org/10.1016/j.tra.2015.02.012.

SFMTA (2014), SFpark book: Putting Theory Into Practice, San Francisco Municipal Transportation Agency, http://sfpark.org/resources/docs_pilotsummary/ (accessed 24/02/2020).

Shoup, D. (2005a), *Parking Cash Out*, American Planning Association, Planning Advisory Service, Report Number 532, Washington D.C., http://shoup.bol.ucla.edu/ParkingCashOut.pdf (accessed on 19/05/05).

Shoup, D. (2005b), The High Cost of Free Parking, Planners Press, American Planning Association, Chicago, IL.

Shoup, D. (1999), "The trouble with minimum parking requirements", *Transport Research Part A,* Vol. 33, pp. 549-574, http://shoup.bol.ucla.edu/Trouble.pdf (accessed 19/02/2020).

Stangl K. (2019), "Parking? Lots! Parking Over the Minimum in Los Angeles", Masters submission, University of California for Los Angeles Department of City Planning, https://doi.org/doi:10.17610/T65P41.

Tennøy, A. and O. Hagen (2020), "Reallocation of road and street space in Oslo: Measures for zero growth in urban traffic", *International Transport Forum Discussion Papers*, No. 2020/14, OECD Publishing, Paris, https://doi.org/10.1787/6d7e9f43-en.

Tennøy et al. (2017), "Effects on traffic and emissions of densification in nodes in Bergen, Kristiansand and Oslo", TØI report 1575/2017, TØI – Institute of Transport Economics, Norwegian Centre for Transport Research, Oslo, (English summary of Norwegian-language report) www.toi.no/getfile.php/1346172/Publikasjoner/T%C3%98I%20rapporter/2017/1575-2017/1575-2017_summary.pdf.

TfL (2016), "Connectivity data to inform spatial planning – Exploratory Analysis", TfL Planning, NLP/DE/011, Transport for London, London, www.london.gov.uk/sites/default/files/connectivity_data_to_inform_spatial_planning_-_exploratory_analysis_transport_for_london_2016.pdf.

TUT-POL (2016)"Paris: From city streets to urban and regional transport governance", case study, Transforming Urban Transport-The Role of Political Leadership (TUT-POL), Harvard University Graduate School of Design, The President and Fellows of Harvard College, Cambridge, https://research.gsd.harvard.edu/tut/files/2020/07/ParisBrief617.pdf.

Vickrey, W.S. (1969), "Congestion theory and transport investment", *American Economic Review*, American Economic Association, Vol. 59, No. 2, pp.251-260.

Walters, A.A. (1961), "The theory and measurement of private and social cost of highway congestion", *Econometrica*, October 1961, Vol. 29, Issue 4, pp.676-699.

UITP (2014) "Better public transport fare policy for more resilient funding", policy brief, UITP, Brussels.

UN-Habitat (2018), "Superficie de CDMX crece a ritmo tres veces superior al de su población" [CDMX area grows at a rate three times higher than that of its population], webpage in Spanish, http://onuhabitat.org.mx/index.php/superficie-de-cdmx-crece-a-ritmo-tres-veces-superior-al-de-su-poblacion (accessed on 25/01/2020).

Annex A. List of participants

HOMEM DE GOUVEIA Pedro (Chair)	Senior Policy and Project Manager, Governance & Integration, Polis Network, Belgium.
BELTON CHEVALLIER Leslie	Researcher, IFSTTAR, France.
CHEN Chia-Lin	Lecturer in Urban Planning, University of Liverpool in London, United Kingdom.
CROZET Yves	Emeritus Professor, Urban Planning Transport Economics Laboratory, University of Lyon, Institute of Political Studies, France
DALES John	Director, Urban Movement, United Kingdom.
DE SAINT LÉON LANGLES Ombline	Research Officer, International Transport Forum (ITF).
DOCHERTY Iain	Dean, Institute of Advanced Studies and Professor of Public Policy and Governance, University of Stirling, United Kingdom.
FRANCO Sofia	Adjunct Associate Professor, Nova School of Business and Economics (Universidade Nova de Lisboa), Portugal.
GOODWIN Phil	Emeritus Professor of Transport Policy, University College London, United Kingdom.
HUERTA MELCHOR Oscar	Project Manager, Organisation for Economic Co-operation and Development (OECD).
KING David A.	Professor, School of Geographical Sciences & Urban Planning, Arizona State University, United States.
LITMAN Todd	Executive Director, The Victoria Transport Policy Institute, Canada.
LONGDON Alexander	Principal City Planner, Transport for London (TfL), United Kingdom.
MADRE Jean-Loup	Emeritus Researcher, IFSTTAR, France.
MAILER Markus	Professor, Head of Unit, Unit of Intelligent Transport Systems, Universität Innsbruck, Austria.
MATTIOLI Giulio	Research Fellow, Department of Planning, TU Dortmund University, Germany.
MC CARTHY Orla	Modeller/Analyst, ITF.

PENA IGLESIAS Gonzalo	Chief of Staff, Direction of Mobility Planning, Ministry of Urban Development and Transportation, Argentina.
PEON Gonzalo	Mexico Program Director, Institute for Transportation and Development Policy (ITDP), Mexico.
PERKINS Stephen	Head of Research and Policy Analysis, ITF.
PROOST Stef	Head of the Research Centre of Energy, Transport and Environment, Leuven KU, Leuven Faculty of Economics and Business, Belgium.
SAMSONOVA Tatiana	Policy Analyst, ITF.
SANTACREU Alexandre	Policy Analyst, Road Safety, ITF.
SAUNDERS Lucy	Director, HealthyStreets, United Kingdom.
SEER Stefan	Senior Scientist, Center for Mobility Systems, Austrian Institute of Technology (AIT), Austria.
TENNØY Aud	Chief Researcher, Institute of Transport Economics, Norwegian Centre for Transport Research, Norway.
THESEIRA Walter Edgar	Associate Professor of Economics, Singapore University of Social Sciences, Singapore.
THORESSON Karin	Senior Researcher, Swedish National Road and Transport Research Institute, Sweden.

International Transport Forum

Reversing Car Dependency

Managing the growth of urban traffic is vital for improving the liveability of our cities. This report examines how governments can encourage citizens to use alternatives to private cars in order to reduce car dependency, regardless of how they are powered or who drives them. The report analyses fiscal policies and other instruments for managing urban traffic and correcting current policy biases that favour automobile travel over more sustainable and affordable transport options. It also reviews international experience in co-ordinating transport planning with land-use development and in allocating space to walking and cycling in order to make transport more efficient and streets less congested.

All resources from the Roundtable on Zero Car Growth? Managing Urban Traffic are available at: www.itf-oecd.org/zero-car-growth-managing-urban-traffic-roundtable.

International Transport Forum
2 rue André Pascal
F-75775 Paris Cedex 16
+33 (0)1 73 31 25 00
contact@itf-oecd.org
www.itf-oecd.org

OECD

Published: 02/2021| Photo credit: gabriel12/Shutterstock