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Committee Secretary
Standing Committee on Infrastructure, Transport and Cities
PO Box 6021
Parliament House
Canberra ACT 2600

Subject: Inquiry into the Australian Government's Role in the Development of Cities

Thank you for the invitation to provide a submission to the above inquiry.

This submission addresses the first sub-enquiry on sustainability transitions in existing cities, although some elements would equally apply to growing new cities or transitioning existing regional cities and towns. The submission focuses on the infrastructure aspects of sustainable cities, in particular sustainable transport and mobility for large and fast-growing cities.

Thank you for your time in considering this submission and I would be available to meet with you and provide further details or clarify any issues in the submission.

Yours sincerely

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Inquiry into the Australian Government's Role in the Development of Cities

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Background

As part of a more interconnected world, our cities are playing an increasingly active role in the global economy. According to the McKinsey Global Institute[1] (MGI), just 100 cities currently account for 30 percent of the world's economy. In 2025, 600 cities are projected to generate 58 percent of the global Gross Domestic Product (GDP) and accommodate 25 percent of the world's population. The MGI also expects that 136 new cities, driven by faster growth in GDP per capita, will make it into the top 600 by 2025, all from the developing world, 100 of them from China alone. Australian cities are also growing fast. For example, at 4.4 million people today, Melbourne is tipped to reach six million by 2031, seven million by 2041 and eight million people by 2051. The 21st century appears more likely to be dominated by these global cities, which will become the magnets of economy and engines of globalisation.

Whilst this urban growth will be largely driven by economic development and the search for a better quality of life, the resulting success will dramatically change the scale and nature of our communities, and put a tremendous strain on the infrastructure that delivers vital services like transport, electricity, water, and communications. Today, more than half the world's population lives in towns and cities and the percentage is growing. By 2050, 70 percent of the world is expected to live in cities and urban areas. Already, ageing infrastructures in many cities are at a breaking point with governments' budgets for major infrastructure projects under increasing pressure. In transport alone, energy consumption is forecast to double by 2050 if the current trends are allowed to continue. As more people move into cities, we need to think of new solutions to make our cities more sustainable.

This submission focuses on the reform of urban mobility for large and fast-growing cities. It outlines the urban transport challenges facing our cities, the emerging trends and the policy instruments required to promote sustainable urban transport in tomorrow's cities.

Reforming urban transport

The reform of urban mobility remains one of the major challenges confronting policy makers. Today, and despite decades of investment in transport infrastructure, mobility and access to economic opportunity is still hindered by high levels of congestion, long travel distances and unreliable travel times. These issues will become more pressing in the future with more people expected to live in urban areas.

One of the key themes running throughout recent initiatives for reforming urban mobility is a recognition that past (and still current) practices in urban and transport planning are fundamental causes of the transport problems we face today. The policies and practices that were adopted in the past are now having widespread negative effects on urban form, liveability, health and economic productivity. During the last half-century, cities worldwide have experienced rapid urban growth which led to urban sprawl and high demand for motorised transport. The traffic gridlocks experienced on urban roads and motorways were the catalyst for most urban transport strategies and policy responses during that time period. The solution that was prescribed for most cities was to build out of congestion by providing more infrastructures for cars, without equal attention to managing the demand for travel or improving alternative modes of transport in a sustainable manner. Equating mobility with building more roads has only nurtured a tendency towards increased motorisation, and an ever increasing inclination to expand the road network. This resulted in a range of unintended

[1] Urban world: Mapping the economic power of cities. http://www.mckinsey.com/mgi/

adverse environmental, social and economic consequences most of which are rooted in the high priority given to private vehicles in land-use and transport planning practices.[2]

Looking forward, it is important to commit to the premise that urban transport policies and practices can be transformed in a sustainable and socially equitable direction for the benefit of future generations. To achieve this, this submission calls for a conceptual leap and renewed thinking of how we address the contemporary challenges facing urban mobility and accessibility in our cities. This inquiry comes at a time when these challenges are greater than ever, and it is hoped that the inquiry will play a key role in bringing together valuable contributions which recognise the complexity of interactions between transport, land-use, infrastructure, mobility, access and accessibility, emissions, health and well-being in our cities.

This submission represents a call for action to overcome the unsustainable practices of the past. Rather than focusing on the infrastructure required to facilitate the physical movement of people and goods, the emphasis should shift to providing the mobility required for access to employment, goods and services. At the same time, it needs to be recognised that considerable investments are still required in urban transport infrastructure in most cities, but such investments should be guided by low carbon mobility priorities when and where they are most needed, and these investments should also be commensurate with community values and expectations.

The need, urgency and benefits of steering our cities towards a path of low carbon mobility are unmistakable. This need has been recognised before but progress has been slow. Yet, the changing context for how we build future cities – smart, healthy and low carbon - presents new opportunities for progressing innovate policies and programs for sustainable mobility. It should be emphasised here that any prospects for decarbonising our cities will depend to a large extent on realising the opportunities for a reduction in transport energy use. Therefore, more effort needs to be spent now on promoting and adopting pathways and solutions with the likelihood of greatest impact on achieving these reductions. These should be guided by a vision that the ultimate goal of urban mobility is to enhance access to jobs, places, services and goods. These pathways should also focus on the most significant challenge to greenhouse gas reduction in urban transport, specifically that relating to integrated land-use and transport policies.

The policies identified in this submission prioritise investment in dense and human scale cities; transit-oriented and pedestrian-oriented developments; optimised road network use; public transport and active travel options. If planned right, they will collectively lead to safe and sustainable walking, cycling, and public transport provisions while reducing private motor-vehicle dependence.

[2] Low Carbon Mobility for Future Cities – Principles and Application (Dia, H 2017)

Limitations of traditional approach – 'Predict and Provide'

The traditional approach to providing transport infrastructure - through expansion of capacity to meet travel demand - has met with limited success over the past few decades. In this approach, forecasts of economic growth are translated into projections for increased demand for transport, and therefore the need for investment in increasing the capacity of the transport network. The rationale behind this approach ('predict and provide') is that the lack of investment in infrastructure would result in more congestion which would impede economic growth.

One of the main limitations of this approach, where demand is predicted and then the infrastructure is provided, is the generation of induced demand. The theory of induced demand is now well understood and accepted. Road improvements which reduce travel times attract more trips from other routes and also encourage new more frequent travel which would have not occurred if the road has not been improved. This additional vehicle traffic consists in part of induced travel, which refers to increased total vehicle kilometres (VKT) compared with what would otherwise occur. If road capacity is increased, peak-period trips also increase until congestion delays discourage additional traffic growth. Research shows that the additional traffic generated would often fill a significant proportion of the capacity added[3].

The opportunities

There is increasing wide recognition and acceptance that addressing transport issues through building additional road capacity is not sustainable, and that it does not solve traffic congestion or improve mobility in cities.

Sustainable transport policies and intervention measures provide opportunities to meet the needs and demands of citizens and businesses in urban environments. Setting a city on a course towards sustainable transport requires a roadmap and a holistic vision which incorporates different strategies to meet the demand for travel, including public transport and active transport policies. In recent years, technology has also been playing a big part in enhancing the performance of existing assets and thereby reducing the need for building additional infrastructure.

A sustainable transport system is one that meets the mobility and accessibility needs of people while supporting the community's long-term social, environmental and economic goals and aspirations. The Centre for Sustainable Transportation at the University of Winnipeg in Canada offers a comprehensive definition: A sustainable transportation system is one that accomplishes the following:

1) Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.
2) Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy.
3) limits emissions and waste within the planet's ability to absorb them, minimises consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise.

[3] Low Carbon Mobility for Future Cities – Principles and Application (Dia, H 2017)

Low carbon mobility

Low carbon mobility is defined as 'mobility that results in substantially lower levels of carbon'. There are four key strategies to achieve this. The first one is the 'Avoid' strategy which implies the need to change the social norms and travel behaviour to ones that require less mobility (e.g. telecommuting and living nearer to shops and services). The second is to 'Shift' travel from energy-intensive modes to different forms of transport (e.g. from car to train or cycling or walking). The third is to 'Share' transport and mobility resources (e.g. ride-sharing or car-sharing). The fourth is the 'Improve' strategy which calls for improving the fuel efficiency and emission of vehicles (e.g. the use of hybrids and electric vehicles) and also maximising the efficiency of the physical infrastructure that is required for the movement of people and goods.

The topic of low carbon mobility is not new. Researchers and policy think tanks have tried to advance this agenda before but progress has been slow. The renewed interest and opportunity today stems from the new interpretations that have begun to focus on both the supply and demand sides of travel, and a better understanding for traveller behaviour. This has also been facilitated through the convergence of a number of forces such as shared mobility, digital innovations and disruptive mobility models which are introducing new options for travellers through ride-sharing and car-sharing through easy to use and reliable technology platforms. The proliferation of Intelligent Transport Systems throughout transport infrastructure also means that disruptions and incidents are detected quickly. This information is then provided to travellers with more ease and speed than ever before, providing them with options to change mode of travel or time of departure.

Planning for sustainable transport solutions

Traditional transport planning approaches focused on the provision of vehicular traffic without equal attention to other modes of transport. Today, transport professionals increasingly recognise that the infrastructure decisions that a city makes today will have a profound impact on the shaping of that city and people's travel behaviours in the future. In many cities around the world, greater emphasis is being given to integrated transport planning and sustainable modes of mobility such as public transport, cycling, and walking. Such policies play a key role in reducing greenhouse gas emissions and pollution. They also have a wide range of benefits to the community, and have been shown to enhance the fabric of urban environments and make cities more liveable. Well-planned mobility solutions for tomorrow's cities also improve accessibility to jobs and opportunities, which are preconditions for sound economic development and musts for mitigating emissions and pollution in urban centres.

Conventional approaches versus emerging trends in sustainable mobility solutions

Cities that have been successful in implementing sustainable transport solutions have adopted simple but radical approaches to meeting the travel needs of their citizens. Rather than focusing on the infrastructure required to facilitate the movement of private vehicles, the emphasis was shifted towards the movement of people and goods, regardless of the mode of transport. And instead of focusing on operational strategies that promote longer travel and through movements of traffic, the focus was shifted towards providing access and accessibility to all groups of society.

There's also been some renewed thinking in recent years about how we provide mobility and access to jobs and economic opportunities in our cities. Some of these emerging trends

and approaches to urban mobility have been partly due to a recognition that past practices have met with limited success and that new approaches are needed. And some of it is due to the widespread use of technology and innovations, and through the changing context of how we should plan and build future smart cities.

These encouraging trends recognise that the ultimate goal of city development is to enhance access to jobs, places, services and goods. The narrative is changing – the focus is shifting from 'transport' to 'mobility', and more emphasis is given to 'accessibility'. Instead of giving priority to building additional infrastructure, the focus is shifting to understanding and managing the demand for travel, maximising efficiency of existing assets, and improving their reliability and resilience.

These trends are also increasing the focus on the social dimensions of transport to ensure that mobility benefits are equally and fairly distributed for all income groups. Probably one of the most significant trends in recent times has been the challenge to car ownership models, and in particular car sharing and ride-sharing initiatives that have been made easier and more popular worldwide through mobile technology platforms.

Table 1 compares the basic premises between sustainable mobility solutions and the traditional approaches which focused on the dominance of motorised transport.

Table 1: Shifting urban transport towards low carbon mobility

Conventional approaches (transport planning and engineering)	Sustainable and emerging low carbon mobility approaches
Focus on supply and building additional infrastructure and capacity	Focus on demand management, maximising efficiency, reliability and resilience of transport systems
Physical dimensions	Social dimensions (mobility benefits are equally and fairly distributed; fair access to transport infrastructure and services for all income groups)
Focus on mobility or physical movement from an origin to a destination	Accessibility*: Focus on the mobility required for access to employment, opportunity, goods and services
Large in scale	Local scale - precinct level
Street as road for vehicles	Street as space to be shared between all modes
Vehicle-oriented	People-oriented and customer-focused. Balanced development of all transport modes and shifting towards cleaner and more sustainable modes such as public transport and active transport
Motorised transport	All modes of transport in a hierarchy with priorities for walking and cycling
Transport modelling approaches	Scenario development and modelling
Traffic forecasting	Visioning on cities
Focus on reacting to congestion and disruptions	Focus on positive business and operational outcomes
Travel as a derived demand	Travel as a valued activity as well as a derived demand
Minimisation of travel times	Reliability of travel times
Key performance indicators: Traffic throughput and speeds	Key performance indicators: Accessibility, sustainability, social equity, environmental quality, health and well-being and quality of life
Planning by experts	Planning through transparent and comprehensive stakeholder consultations
Segregation of people and traffic	Integration of people and traffic
Economic evaluation driven by transport efficiency gains	Multi-criteria analysis to take into account environmental and social concerns
Funds raised through petrol taxes, vehicle registration and licensing fees	Congestion and road pricing, and user-pay models
Private car ownership	New business models that challenge car ownership, promote public and active transport and a shift to car-sharing and ride-sharing solutions enabled by technology platforms
Spending on physical infrastructure	Spending on information technology solutions, data fusion, predictive analytics, integration, decision support systems and adaptive tools
Emphasis on "knowing and seeing", and measuring past performance against key performance indicators	Emphasis on "predicting and anticipating" in order to improve resilience and avoid disruptions

Source: Low Carbon Mobility for Future Cities – Principles and Applications (Dia, H 2017.)

Intelligent mobility for smart cities

Decision makers and leaders who run our complex cities are increasingly recognising the role of technologies in improving the efficiency of existing infrastructure and sweating of assets through better utilisation of available infrastructure. These systems can significantly improve operations, reliability, safety, and meet consumer demand for better services with relatively small levels of investment. Cities are essentially made up of a complex network of systems that are increasingly being instrumented and interconnected, providing an opportunity for better infrastructure management. An "Internet of Things" comprising sensors, monitors, video surveillance, and radio frequency identification (RFID) tags, all communicating with each other to enhance infrastructure capability and resilience, and capturing volumes of data. Through data mining, artificial intelligence and predictive analytics tools, smart infrastructure systems can help city managers to monitor the performance of vital infrastructure, identify key areas where city services are lagging, and inform decision makers on how to manage city growth and make our cities more liveable.

Smart cities of the future will include advanced network operations management and control systems that utilise field sensors to detect and respond quickly to equipment and infrastructure faults. Vital infrastructure downtimes will be cut using sensors that monitor the health of critical infrastructure, collect data on system functioning, alert operators inside an integrated urban control centre to the need for predictive maintenance, and identify potential breakdowns before they occur. In transport, smarter vehicles, trains and public transport systems will sense their surrounding environments, and slow down or stop without human intervention in emergency situations. On-board public transport, a range of GPS, position fixing, video surveillance, and communications equipment will provide accurate and reliable multi-modal real-time passenger information, resulting in better informed travellers and ensuring a smoother, safer and more reliable experience for customers. A combination of sensors and position fixing equipment will maximise the efficiency of existing roads by providing route and network-wide levels of priority for emergency vehicles, light rail, and other modes of transport so as to maximise the movement of goods and passengers safely and efficiently. Back-office systems that leverage sensors, web, mobile, and GPS technologies will utilise smart algorithms, data mining and predictive modelling tools to reduce delays to passengers by optimising schedules and capacities in real time. Near railroad level crossings, a range of train-to-infrastructure and train-to-vehicle technologies will improve passenger safety by detecting fast approaching vehicles and providing warnings to avoid collisions. Electric vehicle charging infrastructure will also be integrated into a smart grid network, providing consumers with access to sustainable and equitable forms of connected mobility. A combination of technologies and sensors will also improve safety and security by permitting operators to remotely disable or enable a public transport service in the event of a security threat (e.g. an unauthorised driver).

Adoption of technology-based customer-centric approaches have the potential to introduce substantial improvements in customer satisfaction, and create a shift in attitude to cost and value. A smarter city will mean better access to sustainable forms of transport; electricity and drinking water that can be counted on; and energy-efficient buildings resulting in enhanced standards and quality of life for today's increasingly empowered citizens and consumers. Given the maturity levels and affordability of smart technologies, these benefits can be achieved at a fraction of the cost of investment in new infrastructure. In a study published in 2009, Access Economics[4] reviewed the potential economic benefits from the adoption of smart technologies in transport, electricity, irrigation, health, and broadband communications. The report examined how smart systems will allow the use of vast amounts of data collected in all areas of

[4] The Economic Benefits of Intelligent Technologies.

city activity far more effectively, providing the potential to radically alter our economy and society for the better. Their research demonstrated that smart technologies would have significant benefits including a 1.5 percent increase in GDP, and increase in the net present value (NPV) of GDP by $35-80 billion over the first ten years. In another report prepared by The Climate Group[5] on behalf of the Global e-Sustainability Initiative, it is estimated that a 15 percent reduction in emissions can be realised in 2020 through smart technologies that achieve energy and resource efficiency using adaptive and proactive technologies.

Cities around Australia are anticipated to benefit from the use of smart technologies, but they must first overcome a number of challenges to improve infrastructure resilience and reliability. The deployment of these technologies, complemented by appropriate governance and regulatory changes, will enhance economic growth and deliver substantial benefits through improved city management systems, better informed consumers, improved economic productivity, and enhanced connectivity between vital infrastructure systems.

Whilst adoption of smart systems is encouraged by the Australian Government, deployment is still in its infancy. The benefits of investing in smart systems are compelling, particularly given the improvements that could be made in terms of providing innovative solutions to support economic growth and competitiveness, decision making and societal coordination, which in turn will lift our economic efficiency and living standards. Investment in smart infrastructure will give our cities an opportunity to modernise their infrastructure and help drive economic growth and create jobs for the 21st century.

Policy principles for low carbon mobility

Achieving low carbon mobility gains requires major policy, behavioural and technological changes The policy directions available to policy makers can be grouped into four broad categories: those that allow travel to be “avoided”; those that “shift” travel to more efficient modes; those that promote “sharing” of vehicles and rides; and those that “improve” the efficiency of vehicles and infrastructure. This section of the submission examines these strategic pathways and presents policy instruments that can help decarbonise transport while also addressing urban mobility challenges such as congestion and poor air quality.

Policy instruments

Rigorous yet flexible policy instruments play a key role in shaping low carbon mobility strategies. In the absence of such policies, provision of transport and mobility will continue to favour motorised transport modes which are not energy efficient. This would result in poor prioritisation of investments, which would encourage private vehicle usage while giving less weight to more efficient modes of travel.

The International Energy Agency (IEA) has undertaken substantial work on this and recommends several policy instruments to address low carbon mobility. These policies include demand management (e.g. congestion and road pricing), regulatory policies (e.g. parking restrictions) and supply-side strategies (e.g. introducing on-demand public transport). The IEA also suggests that incentives for private motorised travel are eliminated and replaced with taxation regimes to reflect the full range of external costs of fuels and vehicles.

Weak regulatory frameworks can also result in inadequate transport provisions. The most recent example of this is demonstrated by the wide range of policy responses to the ride-

[5] Smart 2020: Enabling the low carbon economy in the information age. http://www.smart2020.org/

sharing services such as Uber and Lyft. Policy and decision makers in many cities around the world are still struggling to regulate these new business models which are increasingly playing a crucial role in people's mobility in cities. Yet, these services are still considered illegal in many cities and blunt policy instruments are used to discourage rather than support disruptive modes of transport that have potential to curb private vehicle use. By improving or introducing regulatory policies that support innovations in transport provision, policy makers can increase transport system efficiency, improve the quality of transport services while influencing the shift to more efficient travel modes.

The "Avoid, Shift, Share and Improve" Framework

A package of measures, collectively known as the "avoid, shift and improve" approach, have been proposed over the past 12 years as necessary policy instruments to achieve sustainable transport improvements. This framework was proposed with the aim of (1) avoiding motorised travel when possible; (2) shift travel to more efficient modes; and increase the energy efficiency of vehicles, fuel technologies and maximising the utilisation of existing infrastructure. The framework has recently been extended to include the recent developments in car-sharing and ride-sharing services (Figure 1). Recent evidence suggests that these collaborative mobility-on-demand services have started to influence car ownership models and are reducing the total number of vehicles required to meet people's demand for travel. In the case of ridesharing, there is also increasing evidence that 'car-pooling' types of ridesharing services are increasingly being introduced in cities around the world and resulting in substantial benefits in terms of reductions in the total number of vehicle-kilometres of travel and reducing emissions and pollutions. Together, these policies can help to achieve significant reductions in emissions, while also addressing urban transport issues such as congestion and access to services and employment. The key characteristics of these policies are outlined next.

Avoid

Avoid policies aim to slow travel growth through integrated land-use transport planning and travel demand management. These policies include: (1) virtual mobility programs (e.g. tele-working); (2) initiatives to reduce trip length (high density and mixed land use developments); (3) initiatives to reduce the need or desire for travel (congestion pricing, promotion of car-sharing and ride-sharing schemes). Other examples include on-line purchasing and similar business models which help consumers to avoid shopping trips altogether.

Shift

These policies encourage travellers to shift their travel from private motorised vehicles to more efficient modes such as public transport, walking and cycling. Policies under this category include integrated public transport and land-use planning, improved bus routes and services, pricing strategies (road use pricing, congestion charging, vehicle quotas or bidding systems for license plates such as the Certificate of Entitlement (COE) in Singapore), road space allocation (dedicated lanes for cycling or bus lanes). Increasing the reliability and affordability of public transport, for example, can also promote their use over private vehicles which improves access to destinations. The same applies for incentives which make electric vehicles (EVs) more affordable.

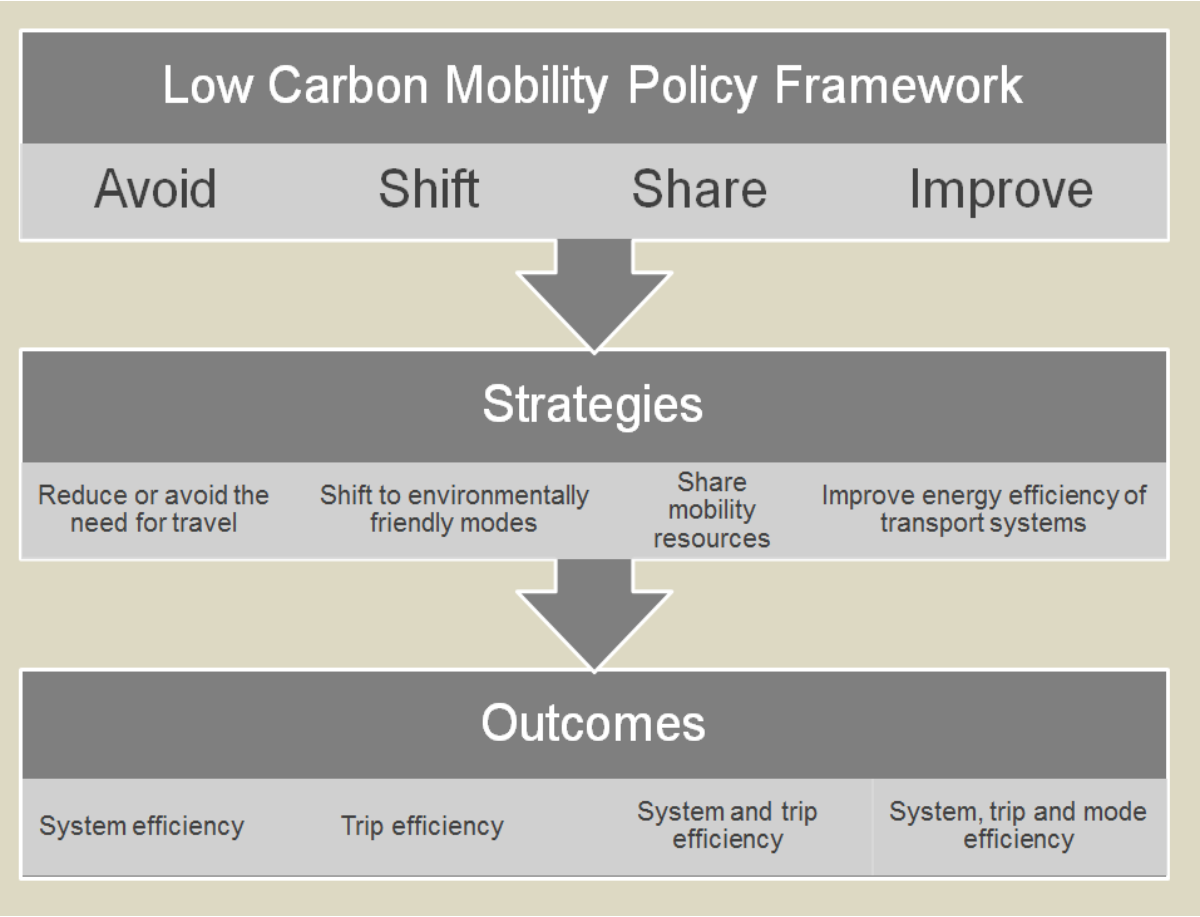

Figure 1: The Avoid, Shift, Share, Improve Framework
Source: Low Carbon Mobility for Future Cities- Principles and Applications (Dia, H 2017)

Share

Share policies enable and promote a shift from car ownership models and private vehicle use towards car-sharing, ride-sharing, bike-sharing (and even vehicle parking space sharing in resource restrained urban centres). Consumers today, especially younger generations, are no longer interested in the vehicle as a 'symbol status' nor owning an expensive asset that stays parked for 90% of the time. Consumers are also increasingly demanding a higher level of service, more efficient and less polluting mobility options that suit their modern-day lifestyles. Disruptive mobility trends, enabled by increasingly sophisticated app-based technology platforms, have the potential to fundamentally change the relationship between the consumer and automobile. The rise of the collaborative or sharing economy, popularised by the companies such as Airbnb, Zipcar and Uber, has enjoyed remarkable rapid growth over the last few years and looks set to expand over the next decade. Access to mobility rather than to car ownership will enable customers to be more selective in choosing from the door-to-door mobility services offered by 'mobility operators' for intercity, suburban as well as 'last kilometre' travel solutions. The transport sharing economy is therefore an opportunity to move people, goods and services collectively by sharing the transport mode. This will in the long-run help improve congestion, reduce emissions and air pollution and enable a new form of crowd-sourced on-demand mobility. With mobility offered as a service and on-demand (regardless of fixed bus routes or public transport schedules), consumers in the future will

have the flexibility to choose the best solution for a specific trip purpose during any time of the day using their smart phones.

Improve

The "improve" policies include initiatives which promote efficient fuels and more efficient combustion engine vehicles. They also include policy responses such the application of transport and urban information technologies, introduction of electric vehicles, and adoption of Intelligent Transport Systems, eco-driving, low-carbon electricity generation and smart grids for electric vehicle charging stations. This policy principle has been well embraced in recent years with the shift in the thinking on how to provide the infrastructure required to support our mobility needs. Instead of building additional road capacity, there is more reliance nowadays on using technologies to optimise the performance of existing infrastructure and sweating of assets, in addition to improving vehicle performance and energy efficiency.

A framework for rethinking urban mobility

A summary of the key elements for reframing how urban transport is planned and designed in cities, and how best to provide sustainable urban transport services is provided next. These elements have been recognised in previous studies which also explored similar pathways to reducing dependence on motorised transport.

A systems approach

Cities are a complex network of interconnected systems. The challenges facing transport in our cities – rapid urban growth, dependence on motorised transport, reduced access to services and activities etc. – are structural in nature and must be framed as part of a holistic approach to improve urban form in cities. Solutions and interventions which recognise this complexity will have a strong potential for charting a course towards sustainable urban mobility

Transport as a 'derived demand' and 'valued activity'

In planning and designing urban mobility solutions, it is essential to recognise travel as a 'derived demand' but also a 'valued activity'. Travel originates from the need for people to access places, jobs, opportunities, services, and activities. The purpose of most travel is to earn income, purchase goods, attend schools etc. The transport infrastructure and the vehicles, cars, trains, buses and bikes that move on it are simply the means to achieve these ends. Making this distinction shifts the focus to 'people' and 'places' and away from 'movement'. From a practical perspective, this implies planning and designing compact, mixed-use communities that reduces the need for travel and improves pedestrian and bicycling infrastructure. This in turn would lead to less reliance on private cars.

Accessibility over transport

Reframing the primary objective of urban transport as one for improving access to jobs and opportunities gives priority to policies and strategies which promote transit-oriented developments, improved public transport services, active transport infrastructure and less reliance on policies that encourage private vehicle usage. The concept of accessibility should apply to all segments of society to ensure that the poor and disadvantaged have good access to goods and services within the city.

Policies and strategies

There are ten key principles from the "Avoid, Shift, Share, Improve" framework that can be used by cities to promote sustainable transport. These include (1) Planning dense and human scale cities; (2) Developing transit-oriented cities; (3) Optimising the road network and its use; (4) Improving public transport; (5) Encouraging walking and cycling; (6) Controlling vehicle use; (7) Parking management; (8) Promoting clean vehicles; (9) Stakeholder consultation and engagement; and (10) Creating pathways and adapting regulations to comprehensive deployment.

These broad policies and strategies are grouped into six categories to demonstrate their strategic linkage and their cumulative potential for triggering policy and operational change.

1. Strengthening the linkage between land use and transport

The connection between land-use and transport needs to be re-built and strengthened to achieve sustainable urban mobility. An integrated approach to land use and transport shifts the focus of planning from placement of structures and designation of land use to that of enabling the realisation of people's needs and everyday functions in the most efficient and sustainable manner. Within this approach, the key challenge is therefore not merely to overcome the separate handling of transport and land-use planning. Rather, it is to foster an integration of multi-modal mobility within a holistic and sustainable land-use system. The use of Land-Use Transport Integration (LUTI) models which combine transport planning and land-use planning into the one tool will increasingly become important for planning future cities.

2. Rethinking urban planning and transport engineering designs

A strong link exists between transport supply and demand, and urban form. Mixed-land use developments reduce the need for travel and promote active transport. Quality transport connections between functional places and facilities improve access and increases functionality of each place, leading to a reduction in the distances and number of trips between origins and destinations. This can be achieved through creative planning and urban designs, combined with innovative infrastructure and transport engineering designs. For example, compact configurations complemented with transport-oriented developments reduce private cars while still making it viable for cities to invest in different modes of public transport.

3. Realigning transport infrastructure investment

Achieving low carbon mobility requires prioritisation in the choices of infrastructure investments. The current imbalance in funding and investments between private and public modes of transport needs to be corrected. This applies equally to developed and emerging countries. It is not sufficient to pursue policies that 'balance' investments between different modes of transport. More initial funding should be allocated to developing and expanding non-motorised and high-capacity public transport infrastructure. The option of value capture to complement public funding should be examined to generate sustainable funding streams. Besides being a politically appealing option, this funding model also reinforces the link between land use and transport.

4. Integrating urban transport facilities and service operations

Efficient land-use patterns (e.g. compact, mixed and walkable) allow for less reliance on expensive mobility systems in general. Properly designed transport systems also contribute to business expansion, increased economic output and employment generation. Efficiency must underpin management, operational and system design practices throughout the urban

transport sector. In the case of high-capacity public transport systems, this can take the form of redeploying buses and equipment to high-ridership markets that produce the highest fare-box returns. Integrated transport and land-use planning development must also be emphasized in national urban development policies and plans.

5. Urban governance frameworks

The development of a fully integrated and sustainable multi-modal urban mobility system requires a robust urban governance structure. Innovations and policies geared towards sustainable mobility require strong institutional and governance structures to oversee their successful implementation. Political will, sound leadership, transparency and accountability are essential in building public trust. Also vital to the entire process are the planning institutions, as these are capable of creating compelling visions of urban futures. There is also a need to inject efficiencies, accountability and transparency into the urban transport decision-making process. This requires the development of planning processes and evaluation approaches that are based on objective measures of performance and tied to well-articulated goals and hoped-for outcomes. This promotes both transparency and accountability.

6. Regulatory frameworks

The current regulatory frameworks for management of road space and urban form have perpetuated urban transport design that favoured motorised transport. Transforming our cities towards sustainable urban mobility requires major reforms in the legal and regulatory framework relating to urban transport management. The interventions highlighted in this submission call for changes in the management of space, the urban form, the engineering of transport, as well as in the institutional and financing arrangements related to urban development.

Conclusions and future directions

This submission highlighted how the dominance of motorised transport has resulted in high levels of mobility and urban sprawl which translated into high volumes and distances needed for travel to access economic opportunities and services, leading to high carbon mobility. Traditionally, transport investment has been based on the lack of capacity in the system, and a misconception that congestion can be solved by building additional infrastructure capacity. Infrastructure investments were based on travel time savings resulting in interventions that led to longer journeys using more energy and more dependence on motorised transport .

This submission has also emphasised that the need and urgency for steering our cities on a course towards low carbon mobility is important not only for reducing the costs associated with urban transport, but also for increasing the overall benefits to society. Widespread deployment of sustainable mobility systems would cut across the intersection of the most urgent challenges confronting the national and global communities today. Measures that seek to reduce greenhouse gas emissions or improve the quality of life for urban dwellers cannot succeed without addressing the challenges of sustainable mobility, nor without redressing the prevailing distortions in accessibility to our urban centres.

Addressing the challenges facing our cities in the 21st Century requires new approaches. Efforts to reduce carbon emission from transport fall under four categories: Avoid, shift, share and improve. These strategies, if well planned and communicated to the public, have strong potential to produce the desired outcomes. There is now sufficient evidence from cities around the world that low carbon mobility measures under these strategies have helped to

reduce motor vehicle traffic and promote more efficient and environmentally friendly travel. The policy measures implemented in these cities have also resulted in increases in transport efficiency, improved passenger mobility, safer roads, reduced congestion, improved health and better air quality.

Finally, it is recognised that sustainable urban mobility is an essential ingredient to many of the indicators by which we measure our quality of life: our health, happiness, prosperity, connectedness and security. It is further suggested that it is possible promote interventions that can effectively enhance the mobility and accessibility of our cities by providing policy makers with the instruments and strategies, such as those identified in this submission, to positively influence the well-being of city populations.