

Creating Liveable Cities through **CAR-LITE** **URBAN MOBILITY**



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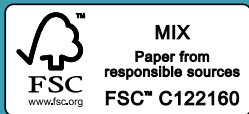
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ABOUT CENTRE FOR LIVEABLE CITIES

Set up in 2008 by the Ministry of National Development and the Ministry of the Environment and Water Resources, the Centre for Liveable Cities (CLC) has as its mission “to distil, create and share knowledge on liveable and sustainable cities”. CLC’s work spans four main areas – Research, Capability Development, Knowledge Platforms, and Advisory. Through these activities, CLC hopes to provide urban leaders and practitioners with the knowledge and support needed to make our cities better.

www.clc.gov.sg

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SINGAPORE

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The Urban Land Institute is a non profit education and research institute supported by its members. Its mission is to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. Established in 1936, the Institute has almost 40,000 members worldwide representing all aspects of land use and development disciplines.

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Asia Pacific

Creating Liveable Cities through **CAR-LITE** URBAN MOBILITY



FOREWORD BY DR LIU THAI KER

Chairman of Centre for Liveable Cities



The idea of going “car-lite” is certainly a worthy cause in our quest to tackle global warming. Today, the transport sector is responsible for 6.86 gigatonnes

of CO₂ equivalent global greenhouse gas emissions each year. This figure could potentially be reduced through planning for “car-lite” cities in an integrated and systemic manner.

Singapore has made a good start in planning for a “car-lite” city. Since our first Concept Plan in 1971, planners have consciously applied a transit-oriented urban planning approach to ensure that all new towns and commercial centres are well connected by a comprehensive bus-rail public transport system. Since then, the Singapore government introduced measures such as the Certificate of Entitlement (COE) and the Electronic Road Pricing (ERP) to control the ownership and usage of private vehicles.

Good local planning plays a critical role in promoting a “car-lite” lifestyle. Generally, town centres cover a service radius of two to three kilometres—that makes it possible for people to cycle from home to town centres. Neighbourhood centres are located within 500 to 700 metres of residential areas—a comfortable distance for residents to walk. Through stringent urban design guidelines, city planners ensure incorporation of pedestrian-friendly design features such as through-block links and sheltered walkways along buildings. All these efforts aim to make commuting on public transport and walking a pleasant experience, so that

people spend fewer hours on the road, and more time on personal activities.

For Singapore to progress towards going “car-lite”, we could consider the following areas:

- **Incorporate bicycle paths into road design standards.** This is feasible for new roads, but more challenging for existing roads. A good place to start is by selecting a new HDB new town and working out a comprehensive system to make it possible for its residents to travel everywhere within the town on bicycles. Once proven successful, the experience can be replicated in other new towns and eventually throughout the city.
- **Satisfy the needs of the first and last mile.** Despite much effort put into public transportation, more research needs to be devoted to developing a viable system that satisfies the needs of the first and last mile, and ultimately promoting a sustainable, “car-lite” Singapore.

The journey towards “car-lite” is both global and urgent. With this, CLC is happy to further our partnership with ULI, to jointly contribute to knowledge in this area. I hope this publication will encourage Singapore and cities around the world to keep exchanging information and best practices in our common pursuit of a new future in urban mobility.

Dr Liu Thai Ker

Chairman

Centre for Liveable Cities

FOREWORD BY PATRICK L. PHILLIPS

Global Chief Executive Officer of Urban Land Institute



For the past three years, the Urban Land Institute (ULI) has been exploring the role of urban design and development in creating places that

foster healthier lifestyles. Our work on the intersection between health and real estate, conducted through ULI’s Building Healthy Places initiative, is based on the premise that building for health and wellness is synonymous with building for sustainability and prosperity.

What we’ve learned from this initiative is that building for health and wellness is a global movement that is here to stay. It’s a sign of changing times—in terms of how cities around the world are rethinking how to grow for the future, and, as a result, are introducing services and amenities to encourage physical activity, healthy living choices, and social interaction to improve liveability and gain a competitive advantage.

Certainly, Singapore is a leader in this regard. ULI’s partnership with the CLC has flourished due to Singapore’s commitment to improve the quality of life for all its citizens. The success of this partnership is reflected in a 2013 ULI-CLC report focused on making the city’s high-density design more inviting and more connected to street activity; a 2014 report on improving cycling routes throughout the city; and our latest report, *Creating Liveable Cities Through “Car-Lite” Urban Mobility*, which looks at how to encourage biking, walking and other options to driving.

“Car-Lite” Urban Mobility offers several ideas on improving urban mobility, such as:

- Align the vision for transportation alternatives with other aspects of urban planning;
- Make public space accessible via a range of transportation options;
- Incorporate more mixed-use development to reduce travelling between places to live, work and play; and
- Make “car-lite” mobility “cool” enough to be broadly accepted as a doable transportation choice.

While each idea contributes to a strategy for creating a healthier living environment for Singapore, the strategy is not unique to Singapore. Rather, it can be used by any city seeking to reduce its dependence on automobiles and promote active mobility choices that lead to better health.

Through our Building Health Places initiative, we are seeking to leverage the power of ULI’s global networks to shape projects and places in ways that improve the health of people and communities. Our partnership with the CLC is helping us achieve this goal. The knowledge we are gaining from this collaborative effort and the example of Singapore is leading to new opportunities to expand ULI’s land use leadership in other areas of the world. We take great pride in working with such an extraordinary organization that shares our commitment to creating thriving, healthy, and highly liveable communities.

Patrick L. Phillips

Global Chief Executive Officer
Urban Land Institute



Singapore: Car-free Sunday (Source: Urban Redevelopment Authority)

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CHAPTER 1



WHY “CAR-LITE”, WHY NOW?

Cities move. The movement of people and goods, supported by extensive transport infrastructure and systems, are like heartbeats of a city—a reflection of its vigour and health. In the same way that the mass production of motor vehicles has changed the way we travel over the past century, it has also forever transformed the way in which cities measure and plan for their increased mobility demand. With more vehicles taking to the streets, indicators such as volume-to-capacity ratio, vehicle counts per hour, and number of lanes and efficiency, have dictated the prevailing paradigm of mobility planning, and formed the basis of what works and what does not.

However, there has been a sharp growth in population and urbanisation over the last century, during which the world’s population multiplied more rapidly than ever before, increasing from two billion in the early 1900s to over seven billion today. In the 21st century, this powerful whirlwind of urbanisation is likely to continue, and is expected to sweep across some of the most populous countries. It is estimated that by 2030, 60% of the global population will be living in cities, up from the present 50%. Over the same two decades, the middle class is likely to expand by about three billion, coming almost exclusively from emerging economies such as China and India.¹ One can expect most of tomorrow’s middle-class population—the typical contributors to the expected increase in automobile sales—to aspire for car ownership, thereby increasing vehicle sales from the current 75 million per year² to more than 130 million by 2030.³

These figures are of great significance to our future as our long-standing over-reliance on automobiles has negatively impacted the liveability of the world’s cities:

The environment can no longer handle the stress. Studies have shown that 14.5% of global greenhouse gases (GHG) emissions are contributed by the transport sector.⁴ Oil-based fossil fuels, which are harmful to the environment, are likely to remain a dominant energy source for the transport sector till at least 2030.⁵ In rapidly urbanising cities, air pollution caused by light-duty passenger vehicles contributes to the significant deterioration of the urban environment and its liveability. With the increase of vehicles brought about by urban growth, traffic congestion has become a serious problem in many cities. Building more infrastructure will not address these problems; rather, it would compound problems related to urban growth, such as pollution and traffic congestion.

The society is suffering from the negative impact of car-centric developments. Fast-moving cars kill. The World Health Organization reported in 2013 that the total number of road traffic deaths remains unacceptably high at 1.24 million every year on a global scale.⁶ Car-based urban development patterns can have a negative impact on an ageing population as well, leading to social isolation and inaccessibility to key amenities.⁷



Serious traffic congestion in developing cities necessitates more sustainable mobility systems. (Source: Safia Osman @https://flic.kr/p/dreQ72)

The economy suffers too. The economic costs to society arising from chronic traffic congestion, air pollution and road safety are estimated to be as high as 10% of a country's GDP.⁸ Unreliable transport systems and congestion can also negatively impact business activities and reduce the competitiveness of cities as a whole.

These factors, among others, necessitate the urgent need to look into a new urban mobility model that is more environmentally friendly, socially inclusive and economically efficient.

On the brighter side, recent studies have highlighted changing trends

in urban transport choices: there has been a decline in car ownership and car-based travel in the last few years, especially among the younger generation from denser urban areas of developed countries. Our increasingly connected world has also seen rapid technological advances, new business model innovations and urban policies in favour of more compact, transit-oriented development typologies. These positive signs call for cities to seize the opportunity in embracing a more sustainable urban mobility model—one that can steer cities' development of mobility systems in the right direction, and ensure that tomorrow's cities avoid mistakes made in the past.

ACCOUNTING FOR THE COSTS OF "CAR-HEAVY" AND THE BENEFITS OF "CAR-LITE"



"CAR-HEAVY"



Road traffic accidents are the ninth leading cause of death, accounting for 2.2% of all deaths globally.⁹



15% of global CO₂ emissions are attributed to the transport sector.¹⁰



On average, cars spend 80% of the time parked at home, 4% in motion and 16% parked elsewhere, mostly in urban areas.¹¹



Besides taking up road space, each car occupies two to six parking spaces (at home, work and other destinations)—more land than most urban homes. In contrast, walking, cycling and public transit require far less space.¹²



The average motorist wastes a total of 2,549 hours, or 106 days of his life, circling the streets in search of a parking spot.¹³



"CAR-LITE"



If ride-sharing were to replace all conventional traffic on the roads, this would reduce the number of road vehicles by 90% each day (or 65% during peak hours).¹⁴



Public transit provides seniors with independence. More than four in five seniors believe public transportation is a better alternative to driving alone, especially at night.¹⁵



Driverless technology removes the potential for human error behind the wheel—responsible for up to 94% of road accidents in the USA alone—and results in safer roads.¹⁶



A study has found that workers who give up their cars and take the bus or train to work are happier despite the crowds and disruption.¹⁷

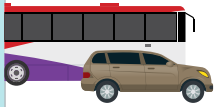


Traffic casualty rates tend to decline as public transit travel increases in an area. Residents of transit-oriented communities have only about a quarter of the per capita traffic fatality rate compared to residents from sprawled and automobile-dependent communities.¹⁸

FUTURE MOBILITY – WHAT MIGHT IT LOOK LIKE?

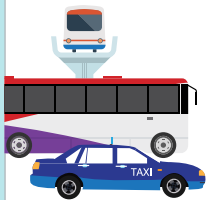
So if a paradigm shift in urban mobility is a necessary step towards a more sustainable urban future, what would this future look like?

FROM CURRENT...



LIMITED MOBILITY OPTIONS

Limited mobility options, especially between private cars and public transit, creating a stark difference between private and public transport in terms of comfort, convenience and efficiency.



LIMITED SERVICE PROVIDERS

Public transport dominated by a few players, with limited integration between different modes of transport. Private cars remain the most convenient mode of transport.



PEAK-CAPACITY-DRIVEN APPROACH TO PLANNING

Peak-capacity-driven approach to transport infrastructure planning. Roads and car parks, for example, may be mostly empty during non-peak hours.



CAR-ORIENTED INFRASTRUCTURE

Ownership-based transport system resulting in private-car-oriented infrastructure systems and low-density developments. This in turn affects liveability and sustainability.



FRAGMENTED ACCESS TO INFORMATION

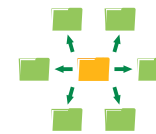
Fragmented access to information by both service providers and consumers limiting the potential for non-private car options such as taxis, shared cars, public transport to be fully exploited.

TO FUTURE



OPTIONS, OPTIONS, OPTIONS!

Numerous connected mobility options, which consumers can enjoy on-demand and at affordable prices, as well as customer-oriented mass transit services.



INTEGRATION OF PUBLIC AND PRIVATE SERVICE PROVIDERS

Private sector provides more mobility services, in parallel with those provided by the public sector. Greater convergence of various transport modes and services and integration of multiple channels and aspects of mobility (e.g. fare integration), and relevant supporting infrastructure and information.



OPTIMISED ASSET UTILISATION WITH DEMAND MANAGEMENT

Greater focus on mobility demand management to optimise the utility of both existing and planned urban systems in a technology-rich environment. Lower cost of travel.



PEOPLE-CENTRIC DEVELOPMENT

Shared mobility infrastructure and services; and value shifts from asset ownership and driving performance, to software and passenger experience.¹⁹ Inclusive and walkable urban environments which are more people-oriented.



DATA-DRIVEN CONNECTED COMMUNITIES

Large and comprehensive information systems, founded upon artificial intelligence and big data. Digitally savvy consumers who prefer service-based mobility packages to owning and maintaining a car.



CHAPTER 2

SINGAPORE'S "CAR-LITE" JOURNEY

Singapore's population is projected to grow steadily to about 6.9 million by 2030. Land supply, however, remains limited. At present, transport infrastructure takes up 12% of Singapore's land space, almost as much as that allocated for housing (14%). Adding more roads and parking lots is therefore neither feasible nor sustainable for land-scarce Singapore. Instead, the nation needs to embrace "car-lite" mobility sooner rather than later to ensure its long-term sustainability and liveability.

EARLY AND STEADY STEPS TOWARDS BEING "CAR-LITE"

The "car-lite" transport strategy is not new to Singapore, and has been adopted since the onset of the country's urbanisation process.

From the late 1960s, Singapore had already begun taking strong, early steps to slow the rate of motorisation. A State and City Planning (SCP) study had called for controls on the growth of private vehicles. Following its recommendations, a series of additional taxes as well as a Vehicle Quota System (VQS) were put in place to limit the number of privately-owned vehicles. Much effort also went into maintaining a congestion-free road network. Determined not to repeat the mistakes of many other Asian cities, Singapore became the world's first city to manage downtown travel demand through road pricing. The underlying thinking was clear—to develop an efficient road system as part of a well-functioning city machine that would appeal to both residents and investors. Although road pricing was met with considerable scepticism when it was first implemented in 1975, most Singaporeans today would agree that it

has played an important part in keeping traffic congestion in the city centre at bay.

Next, the Singapore government took measures to restrict the ownership and usage of private transport, and employed strategies to develop public transport as the backbone of the nation's transportation system. There was initially an intense debate over whether a cheaper all-bus system was preferable to a Mass Rapid Transit (MRT) system, but the pro-MRT argument prevailed. Today, commuting in Singapore would be unimaginable without the MRT service. Over time, the country has developed a more comprehensive public transport network based on a hub-and-spoke model, with buses and the Light Rail Transit (LRT) serving as feeder modes to bring people to transfer hubs. Despite infrastructural shortfalls (particularly in the rail network) in the mid-2000s, which led to unprecedented levels of crowding in trains and buses in recent years, Singapore is still widely regarded as having a world-class public transport system. The latest Land Transport Master Plan (LTMP) 2013, which was reviewed and refreshed from the initial 2008 version, is focused on creating a people-centred land transport system, with

renewed efforts to improve connectivity, reliability and inclusivity, so as to make public transport the choice mode of travel. Furthermore, the LTMP2013 has set a target that by 2030, 75% of all peak hour journeys will be made on public transport, and that 8 in 10 homes will be within 10 minutes walking distance of a train station.

Last but not least, Singapore's overall urban development strategy has been guided by a highly-integrated transport and land use planning approach with sustainable goals, long before the concepts of transit-oriented-

development (TOD) or sustainability became "fashionable." The 1971 Concept Plan—Singapore's first integrated land use and transportation strategy—already provided a fundamental framework for physical development along designated public transport corridors. It made projections up till 1992, and estimated a population of 3.4 to 4.0 million in the longer term. Today, Singaporeans enjoy easy access to public transport nodes that are well-integrated with retail and commercial uses, as well as medium- to high-density housing—benefiting from the earlier vision.



Urban systems and innovations to reduce car usage in Singapore: Transit-oriented development; Electronic Road Pricing system; Comprehensive public transport system. (Source: <top> Jeremy Hui @ <https://flic.kr/p/ftTFGi>; <bottom left> Simon_sees @<https://flic.kr/p/gVG6vK>; <bottom right> Yosynuts @<https://flic.kr/p/5BasYk>)

CURRENT CHALLENGES

Although many of these transport strategies are designed to curb car ownership and usage, in practice, conventional traffic modelling and road design have led to the creation of an ecosystem that prioritises the movement of cars over access for pedestrians and cyclists. The number of cyclist fatalities and injuries arising from accidents that involve motorists has been on the rise over the past few years, possibly due to a combination of factors such as

an increase in the number of cyclists, inadequate infrastructure provision and a lack of education regarding safe cycling. Beyond the roads, a minimum parking requirement has been in place in the development of buildings to ensure that there are sufficient parking spaces to satisfy projected peak demands. In land-scarce Singapore, such a requirement adds to the space constraint. And despite having some of the heftiest car ownership and usage taxes in the world, car usage in Singapore remains high.

SINGAPORE: MOBILITY IN FIGURES



89.2 sq km or **12%** of total land area for transport use



66% – Public transport mode share



17,500 km – Average annual mileage clocked per private car in 2014



1-2% – Cycling mode share



972,037 – Total number of vehicles, of which 55% are private cars and 17% are good vehicles



45% of households own at least one car



Road fatality rate: **2.82 per 100,000** population



538 – Number of pedestrian overhead bridges



URA and HDB manage a total of **631,000** parking lots. – An area of **9.5 sq km** for lot space alone (1 lot = 15 sq m)



54 – Number of pedestrian underpasses



9 hours – Amount of time that drivers in Singapore currently spend commuting on the roads on a weekly basis



9,834 – Number of road accident injuries recorded in 2014

(Source: Singapore Land Transport Statistics in Brief 2015)

ONGOING INITIATIVES

Recognising the need for a new ecosystem for urban mobility, the Singapore Sustainability Blueprint 2015 was launched in November 2014 as an impetus to realising the vision of a “Car-Lite Singapore”. It aims to reduce Singaporeans’ reliance on cars and promote the use of sustainable alternatives. As explained by Prime Minister Lee Hsien Loong at the launch of the Blueprint:

“We will aim for a ‘Car-Lite Singapore’ by promoting and developing other modes of transport, making them more convenient. We have to rely less on cars on the roads because we cannot keep on building roads—more roads for more cars. So we will provide more options for Singaporeans that are better than cars. Buses—more of course. Expanding the MRT network—that is happening everyday, but also other modes of transport, for example, bicycling... We also have to promote non-usage of cars and find ways to use them more efficiently so that we can use the car without feeling like we have to own a car and therefore without having to park a car downstairs in some HDB carpark, which is always not enough and not close enough.”²⁰

Many productive efforts have since gone into supporting this “car-lite” vision. With ongoing initiatives by the transport authority to ramp up the MRT system, enhance bus services and make improvements to first-and-last-mile

connectivity, the public transport system has benefitted from a capacity boost, better network coverage and service reliability. These are important steps. After all, commuters—especially those who own cars—need to be convinced that taking public transport can be a better alternative to commuting via private vehicles.

On the active mobility front, a new Active Mobility Unit was set up within the Land Transport Authority in 2015 to oversee all walking- and cycling-related policies and initiatives in Singapore. Apart from plans for hard infrastructure developments, such as the 700-kilometre National Cycling Network by 2030, the Unit has also introduced a slew of soft measures. These include clear rules and codes of conduct relating to the use of footpaths, cycling paths and shared paths (recommended by a multi-stakeholder Active Mobility Advisory Panel). In addition, bicycles and personal mobility devices (PMDs) are now allowed on footpaths; from July 2016, developers of selected commercial, retail, business parks and schools are required to factor the needs of pedestrians and cyclists into their designs by submitting a Walking and Cycling Plan as part of their development application. A six-month trial was also rolled out in July 2016 to test the feasibility of allowing users to bring foldable bicycles and PMDs onto trains and buses at all hours (as opposed to only during off-peak hours currently), while pilots for bike-sharing programmes are also in the pipeline.

Finally, the public has seen the introduction of Car-Free Zones and the launch of road-closure events like Car-Free Sundays and the pedestrianisation



Car-free zones initiatives in Singapore: Pedestrian Nights in Orchard Road; Streets for People road closure events; Car-Free Sunday events (Source: <top left> Orchard Road Business Association; <top right> Urban Venture by LOPELAB; <bottom> Choo Yut Shing @ <https://flic.kr/p/EGraUw>)

of Orchard Road, along with ground-up initiatives such as Streets For People initiated by the Urban Redevelopment Authority (URA). Despite their temporary nature, these schemes have demonstrated the potential of streets as great public spaces for people.

All of these new initiatives have contributed positively towards

Singapore’s aspiration to become a “car-lite” city. Moving forward, there remains scope to tighten collaborations amongst all relevant public-sector agencies beyond just the transport authority to make “Car-Lite Singapore” a strategic consideration in the policymaking process.

SINGAPORE'S "CAR-LITE" JOURNEY —50 YEARS AND BEYOND

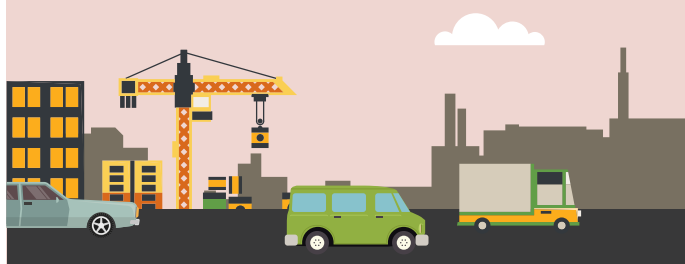
1950s - 60s

PRIVATE CARS



1962 – 73

Growth rate of motor vehicles averaged 8.8% due to rapid economic growth.



PUBLIC TRANSPORT



1950s

90% of the population depended on public transport.²¹

1967

State and City Planning (SCP) project commissioned to ensure a more integrated land use and transport system.



WALKING & CYCLING & NEW FORMS OF MOBILITY



1960

The bicycle was the main mode of transport besides public buses. Several major roads had bicycle tracks next to footpaths.²²



1970s - 1990s

1971

Concept Plan 1971 recommended restraints on car ownership and usage in the city to manage vehicular traffic.²³

1972

Tax measures were implemented to control the growth of the car population.

1975

Area Licensing Scheme (ALS) was introduced.²⁴



1990

Vehicle Quota System (VQS) was implemented to control the growth of vehicle population at sustainable levels.²⁸

1998

The Electronic Road Pricing (ERP) scheme replaced the ALS.



1970

10 privately owned bus companies were merged into three companies to ensure better service delivery.²⁵

1982

Decision to construct the MRT system was made after a 10-year public debate, with the first line completed in 1987.

1987

Public Transport Council was set up to manage the quality, affordability and profitability of public transport.



1970

Cars and motorcycles gained popularity. Bicycle usage decreased drastically. Cycling tracks were removed to widen roads.²⁶

1977

National campaign on road safety was launched.²⁷ The Walkway Unit was tasked to construct pedestrian paths along most roads.

1981

The Government Registry of Vehicles stopped registering bicycles.

1992

Completion of Singapore's first Park Connector at Kallang as part of a larger network that would link up major parks, coastal areas and activity nodes.

1995

Bicycle ownership in Singapore estimated at 240 bicycles per 1,000 population.²⁹



2000s–Present

PRIVATE CARS

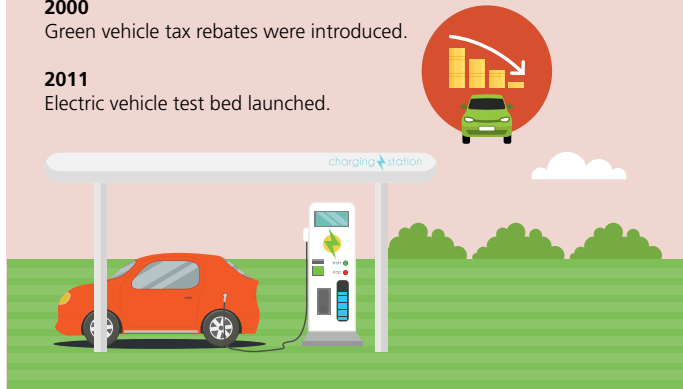


2000

Green vehicle tax rebates were introduced.

2011

Electric vehicle test bed launched.



2016

• Parking charges for public car parks set to increase by 20% from 1 Dec—the first time in 14 years.³³

• Building owners permitted to permanently convert excessive carpark spaces to commercial or other uses in the central area.³⁴



PUBLIC TRANSPORT



2007

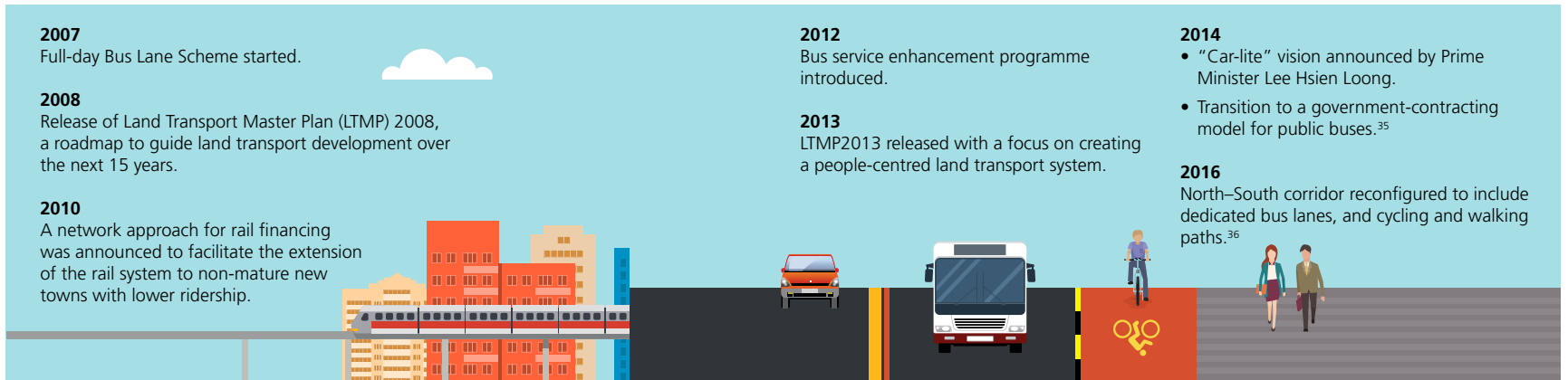
Full-day Bus Lane Scheme started.

2008

Release of Land Transport Master Plan (LTMP) 2008, a roadmap to guide land transport development over the next 15 years.

2010

A network approach for rail financing was announced to facilitate the extension of the rail system to non-mature new towns with lower ridership.



2012

Bus service enhancement programme introduced.

2013

LTMP2013 released with a focus on creating a people-centred land transport system.

2014

• “Car-lite” vision announced by Prime Minister Lee Hsien Loong.

• Transition to a government-contracting model for public buses.³⁵

2016

North–South corridor reconfigured to include dedicated bus lanes, and cycling and walking paths.³⁶

WALKING & CYCLING & NEW FORMS OF MOBILITY



2005

Tampines New Town piloted as a cycling town.

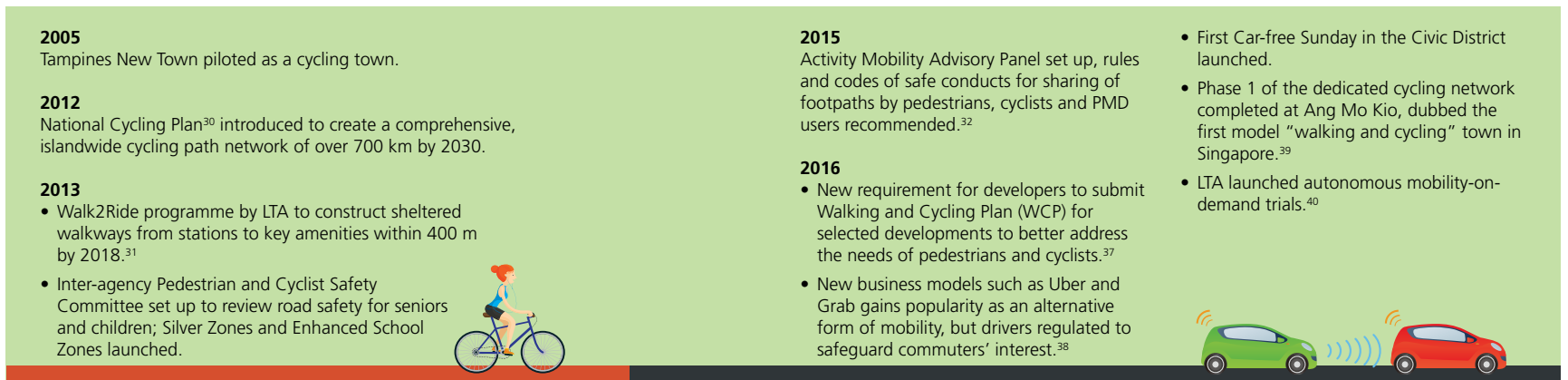
2012

National Cycling Plan³⁰ introduced to create a comprehensive, islandwide cycling path network of over 700 km by 2030.

2013

• Walk2Ride programme by LTA to construct sheltered walkways from stations to key amenities within 400 m by 2018.³¹

• Inter-agency Pedestrian and Cyclist Safety Committee set up to review road safety for seniors and children; Silver Zones and Enhanced School Zones launched.



2015

Activity Mobility Advisory Panel set up, rules and codes of safe conducts for sharing of footpaths by pedestrians, cyclists and PMD users recommended.³²

2016

• New requirement for developers to submit Walking and Cycling Plan (WCP) for selected developments to better address the needs of pedestrians and cyclists.³⁷

• New business models such as Uber and Grab gains popularity as an alternative form of mobility, but drivers regulated to safeguard commuters’ interest.³⁸

• First Car-free Sunday in the Civic District launched.

• Phase 1 of the dedicated cycling network completed at Ang Mo Kio, dubbed the first model “walking and cycling” town in Singapore.³⁹

• LTA launched autonomous mobility-on-demand trials.⁴⁰



CHAPTER 3

DRIVING THE SHIFT WITH ALTERNATIVES

The diversity of mobility options has grown tremendously in recent years. Yet, cities' understanding of how to get the best out of these options is still nowhere comparable to their understanding of car traffic. A closer look at the various non-car alternatives shows the ways in which they can positively contribute towards a "car-lite" mobility paradigm. Most importantly, the level of mobility that can be achieved through public transport operating in synergy with these other modes should not be underestimated. Many experts envisage that collectively, they can make private car ownership and usage a thing of the past.

WALKING—BACK TO BASICS

Ensuring good walkability is important because all commuters, even drivers, are pedestrians at some point or other. Walkability also contributes to urban vitality, which is popular with the creative class, especially millennials. Many cities have come to realise that by getting walkability right, they can provide the sort of liveable, urban environment that people want, and in turn attract the right sorts of people to boost a city's competitiveness.

With this people-centred approach to city planning and urban design gaining greater popularity around the world, cities such as Oslo, Madrid and Milan have announced plans to permanently ban private cars and make parts of

their downtown areas more pedestrian-friendly.

However, making cities walkable involves more than just car bans and street closures, and creating walkable communities needs more than well-designed sidewalks and apt placement of pedestrian crossings. Attributes such as a diverse mix of land uses, interesting and active streetscapes, good lighting, effective signage, and more greenery also play a part in enhancing walkability. To make walking "useful, safe, comfortable and interesting"—the four essential qualities of a desirable walking environment, according to urban planning and design expert Jeff Speck⁴¹—there needs to be a more comprehensive approach, supported by systematic reviews of the local built environment.



Legible London, a citywide way-finding system for Londoners and visitors. (Source: <left> Charlotte Gilhooly @ <https://flic.kr/p/78s6Wr>; <right> Momentum Sign Consultants @ <https://flic.kr/p/7E9G5B>)

INTERVIEW WITH JAN AND MIZAH PARTICIPATE IN DESIGN

P!D: Advocating Walkability through Play

Participate In Design (P!D) is a Singapore non-governmental organisations (NGO) focused on research, test bedding and developing innovative methods for participatory design involving local communities in Singapore. The CLC research team spoke to Jan Lim and Mizah Rahman from P!D regarding one of their latest projects, the Walkability Game, which aims to educate children on the importance of walkable communities and reducing our reliance on cars.

Tell us more about P!D.

P!D is a non-profit organisation consisting mainly of people from the design field. We focus on three areas: Design for the built environment—ranging from interior design to public spaces; Capacity-building for communities—including workshops and educational toolkits; and volunteer programmes. We always approach design from the community's point of view—the people who are affected by the

design—and explore how they can be involved. We find that people feel the greatest sense of ownership when they are involved in the design stage of the project.

What motivated P!D to advocate walkability and develop an educational game for children?

Our interest in walkability started with a project called “Safe Streets” in 2012, which was triggered by a road accident in MacPherson involving a boy. We focused on the safety aspect, as this was something that was accessible and familiar to people. We got together with the community and a group of volunteers to come up with ideas for physical changes to make the environment safer. However, we encountered difficulties in implementing these physical changes due to regulatory considerations of the authorities. We discovered that we could not go beyond the conversational level.



Mizah Rahman, Co-founder, P!D. (Source: P!D)

Nonetheless, we wanted to advocate the importance of road safety in planning, particularly for children, a vulnerable group that is often excluded from planning processes and decisions. We recognised that the bigger picture was really about active mobility and the built environment—and not just about the issue of safety. The main question was: How could we make road safety and urban planning concepts fun and accessible for kids? This eventually led to the idea of an educational board game.

The initial intention for the board game was broader; it aimed to educate children aged between 10 and 12 on urban planning concepts

and the built environment in general. We eventually realised that this approach lacked focus and that such broad concepts are also not easy to understand, even for adults.

So we thought of working on a topic that kids could relate to—for example, the idea of walking or cycling from home to school. Many children are chauffeured in private cars by their parents to school every day. When asking the children why they do not or cannot walk to school, we took the opportunity to introduce to them other mobility concepts such as car-pooling and pedestrianisation. This eventually developed into the Walkability Game.

How does the game introduce the concept of trade-offs between car use and a more people-friendly environment?

As part of the game, we make cars the “bad guys” that take the space away from pedestrians and cyclists. But the overall intention of the game is to allow people to understand how their neighbourhoods can be more “people-friendly.” We get the children to imagine the possibilities through the game, and trigger their curiosity on what their neighbourhoods can become.

The game also creates awareness among children about the built environment, and an awareness of themselves as part of the

environment. This allows them to adopt an alternative point of view, other than the environment they are exposed to everyday.

This is also meant to be a game for the whole family. Parents want the best for their children, and for them to be healthy and active. For parents who drive, introducing cycling and bus lanes during the game to create a better environment for the community—which includes their children—encourages them to see the bigger picture beyond their own needs as car drivers, and to recognise the value of active mobility in their own neighbourhoods.



Jan Lim, Co-founder, P!D. (Source: P!D)



Walkability Game workshop with primary school students. (Source: P!D)

How did P!D work with the community in developing the game?

We spoke to various parties—the Land Transport Authority, cycling advocates, parents, teachers and the traffic police—when we started working on the game. We tested out the game with parents, professionals and children over various sessions. At the end of the game, some of the children actually expressed interest in becoming

designers, to create people-friendly places. It was quite amazing to hear this coming from children at the end of a two-hour workshop!

We plan to approach more primary schools in Tampines in the future. This is arising from another road accident involving two boys in Tampines, which has created the desire to step up road safety efforts within the local community.



Children playing the Walkability Game with a facilitator from PID. (Source: PID)

What more do you think can be done to make Singapore a more liveable, car-lite city?

Broadly speaking, liveability is about having viable options. The challenge is in finding the space to accommodate the desire to walk, cycle, or adopt other different forms

of lifestyles within the physical confines of the city.

There is still this perception in Singapore that car ownership is desirable. But if we can design the environment so that people feel safe and experience the benefits of walkable neighbourhoods, we can make walking, cycling and more sustainable modes of transport more desirable choices, rather than modes that you have to rely on if you do not own a car. Instead of punishing people by making cars more expensive, could we not instead incentivise them to adopt other forms of mobility and by making the alternative a more pleasant experience?

CYCLING AND OTHER ALTERNATIVE PERSONAL MOBILITY DEVICES (PMDs)

Cycling and other personal mobility devices (PMDs) are equitable, affordable and efficient mobility options that offer much freedom and little adverse impact on the environment. These active mobility modes have also been recognised for providing a wide spectrum of positive health benefits.

To make cycling more attractive, experts and cycling campaigners have highlighted the importance of ensuring the safety of cyclists through the implementation of proper biking infrastructure, as well as cultivating mutual respect between cyclists and

motorists. Portland bike chief, Roger Geller, famously sorted Portlanders into four types of people based on their receptiveness towards cycling:⁴²

1. **Less than 1% of the city population:** "strong and fearless" riders who would be willing to ride in almost any traffic situation.
2. **10%** "enthused and confident" riders, who would be comfortable riding in painted bike lanes.
3. **60%** those who are "interested but concerned" to ride in the absence of protected bike lanes and paths.
4. **The remaining one-third of the population:** those who would never be willing to get on a bike no matter what.

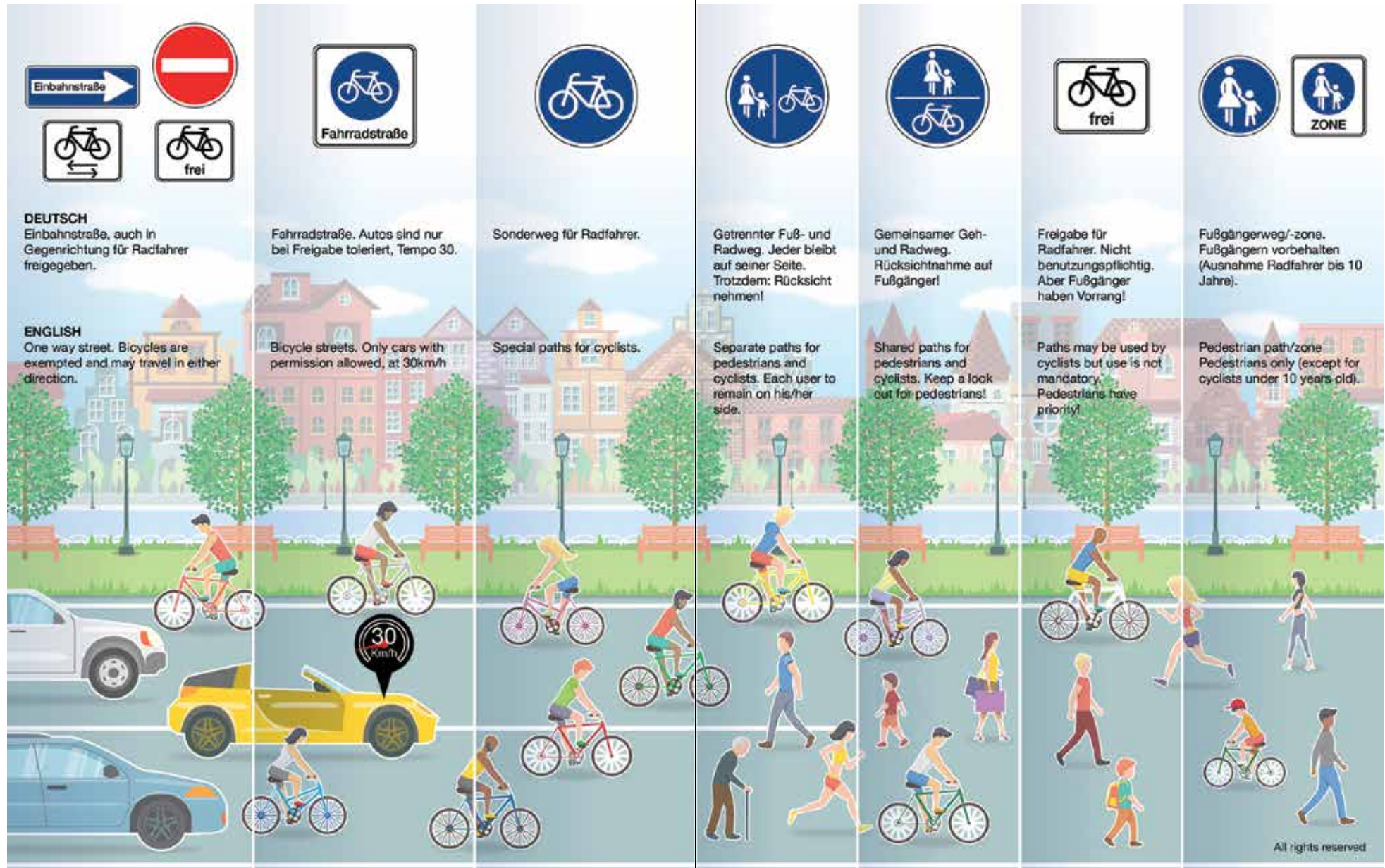


Singapore-made solar charging station for electric scooters. (Source: Floatility)

While citizens living in different parts of the world are likely to demonstrate different degrees of receptiveness towards biking, the above figures suggest that if cities adopt the right measures to make it safer and more convenient to cycle, the potential of cycling becoming a popular mode of transport can be huge.

The German city of Freiburg is a case in point. With cycling already being its second most popular transport mode after public transportation, Freiburg has plans to increase the share of bicycle commutes within the city centre to

35% by 2020. Cyclists are guided by sophisticated signboards indicating specific regulations for any stretch of road. For instance, roads that are "Fahrradstraße" require cars to drive at 30 km/h, while "Sonderweg" are paths where only bicycles are allowed (see infographic on the following page). Moreover, cars are obliged to give way to cyclists, and cyclists are expected to obey the same traffic rules that apply to motorists when sharing the roads. By ingraining civic-mindedness and mutual respect among road users, Freiburg's cyclists are able to ride on its roads safely and with confidence.



Cycling culture in Freiburg. To help motorists, cyclists and pedestrians coexist in harmony, the German city of Freiburg has created different rules for different streets. (Source: CLC)

Personal mobility devices (PMDs), such as e-scooters, e-bikes and other eco-mobility vehicles, have also gained popularity in recent years. Particularly in cities like Singapore where the climate is hot and humid all year round, these mobility tools have proven to be very attractive—even amongst executives and professionals—either for short commutes or as first-and-last-mile modes to complement longer trips on public transport.

With rapid growth in the variety of new mobility products and devices on the market, cities need to take a more progressive approach by looking beyond bikes and conventional PMDs alone, to proactively anticipate and plan for the kind of infrastructure and codes of practice required to cater for a broader category of alternative personal mobility options.



The variety of ecomobility modes are rapidly expanding beyond bikes and conventional PMDs alone. (Source: ICLEI)

“When hearing ‘car-lite’, many may be thinking of bicycles, public transport and shared cars. But let’s not forget that the urban mobility future will also feature a growing variety of vehicles and mobility aids ranging ‘between shoes and cars’ that are human-scaled and environmentally friendly. We have so far distinguished 460 types of such EcoMobility vehicles in the market: Human-powered or with electric drive; One-, two-, three- or four-wheelers; With footstep or one, two or more seats ... ‘car-lite’ cities need to take these alternative mobility options into consideration as they too, have a part to play in shaping the mobility future.”

Mr Konrad Otto-Zimmermann
Creative Director
The Urban Idea

SHARED CARS ON-DEMAND AND AUTONOMOUS VEHICLES

In the age of the sharing economy, peer-to-peer-based sharing of access to goods and services is gaining traction. From cars that are parked over 90% of the time to low-occupant vehicles that are driven around cities’ congested road networks during peak hours, shared vehicles are meant to plug the gap between public transit and private cars, tapping on the “latent” capacity in the system and capitalising on the “under-utilised” services and products in cities’ existing mobility system. In anticipation of a new era in urban mobility whereby ownership is expected to be obsolete, it would be to the advantage of the public sector to ride on the highly innovative and fast-growing sector of car-sharing and ride-hailing services to complement conventional public transport services.

The continued maturity of driverless technologies over time also presents

an opportunity to develop fleets of on-demand autonomous vehicles (AVs). Enabled by geo-fencing technology, these AV fleets could function as on-demand shuttle services between homes/workplaces and public transport nodes to help bridge the first-and-last-mile gaps, or serve as a form of micro-transit at the precinct level.

Improved connectivity provided by AVs is expected to significantly enhance the ease of mobility for the disabled and elderly population. The possibilities of how AV technology can be harnessed for mass-transport services such as buses and goods vehicles are also being actively explored. Besides ongoing studies of the regulatory and safety considerations surrounding AVs, town planners can capitalise on AV-enabled mobility to critically review planning norms and typologies, given the prospect of a more efficient use of road space, and a reduced number of vehicles—both parked and on the move.



London: The type of driverless pods that have been put on trial at Greenwich. (Source: Department for Transport, UK @ <https://flic.kr/p/FGSXF9>)

FREIGHT SYSTEMS & TECHNOLOGY

An efficient freight system forms an integral part of a productive economy. The movement of goods in most cities is mainly handled predominantly by trucks,⁴³ of which in Singapore, it constitutes 17% of all vehicular population.⁴⁴

In Singapore, where the container port and transshipment industry form a key part of the economy, there is every reason to ensure efficiency of the freight transportation system. Enabled by driverless technology, the use of autonomous truck platooning for cargo transport productivity between port terminals is expected to help alleviate the shortage of manpower in the trucking industry and raise productivity.⁴⁵ Studies of subterranean space usage are also ongoing to explore the possibility of diverting freight movement underground to reduce congestion on the regular road network.

But as with any other mobility solution, process enhancement is just as important as hardware improvement. In many cities, there remains much scope to tighten the freight distribution process such that the utilisation of logistics resources is optimised. In some instances, simple solutions have worked wonders. The Swedish city of Gothenburg launched Stadsleveransen (City Delivery) to pool together deliveries for shops and businesses within a central commercial zone stretching 10 blocks. A freight terminal, which consolidates packages delivered by private transport companies, is responsible for covering the last miles of the freight journey in a largely pedestrianised urban environment, using Stadsleveransen's zero-emissions fleet of electric cars, electric vans and cargo bikes.⁴⁶ The benefits to the city have been multifold: noise and congestion have been reduced, business efficiency has improved, and Freiburg's city core has become more attractive and competitive.



Hongkong: Delivery time at Kowloon. (Source: Alexander Synaptic @ <https://flic.kr/p/wWmYgz>)

“For urban freight, a more integrated model has potential to sharply increase the efficiency of the existing system. Deliveries done in an uncoordinated and unconsolidated manner will lead to congestion and low productivity. When this happens, retailers will assign more trucks for faster and quicker delivery, which ends up worsening the situation. However, things will become very different if retailers and logistics coordinators can work together in a more coordinated way.”

Mr New Soon Tee

Director (Logistics & Retail Sector)

Infocomm Media Development Authority of Singapore (IMDA)

SINGAPORE:

Efficient Urban Logistics as part of “Car-lite” mobility strategy

CURRENT CHALLENGE

Urban logistics form an integral part of the “car-lite” mobility strategy. Singapore, like many cities around the world, faces the challenge of sub-optimal utilisation of logistics resources. Currently, an estimated 4,000 trucks make over 20,000 delivery trips daily, and take up approximately 25% of Singapore’s road space.⁴⁷ Such an unconsolidated and uncoordinated manner of goods delivery has led to an inefficient use of delivery trucks, manpower shortages, as well as associated traffic congestion, air pollution, and noise from queuing trucks that spill beyond their immediate delivery destinations onto the surrounding urban precincts.

MORE EFFICIENT URBAN LOGISTICS AS PART OF INFOCOMM MEDIA 2025 PLAN

As part of the Infocomm Media 2025 Plan—which aims to create

a globally competitive infocomm media ecosystem that complements Singapore’s Smart Nation vision—the government has announced plans to test out new technologies and models to boost the productivity of the logistics sector. In particular, it has committed S\$20 million to improve the operational efficiency of urban logistics in the retail sector, as well as S\$15 million to automate the warehousing process.⁴⁸ Through nationwide implementation of the three key initiatives over time—in-mall distribution, offsite consolidation and federated lockers—the new aggregated freight distribution model is expected to reduce the number of trucks on the road by a quarter, cut delivery manpower by 40%, and decrease waiting and queuing time for deliveries by 65%.⁴⁹

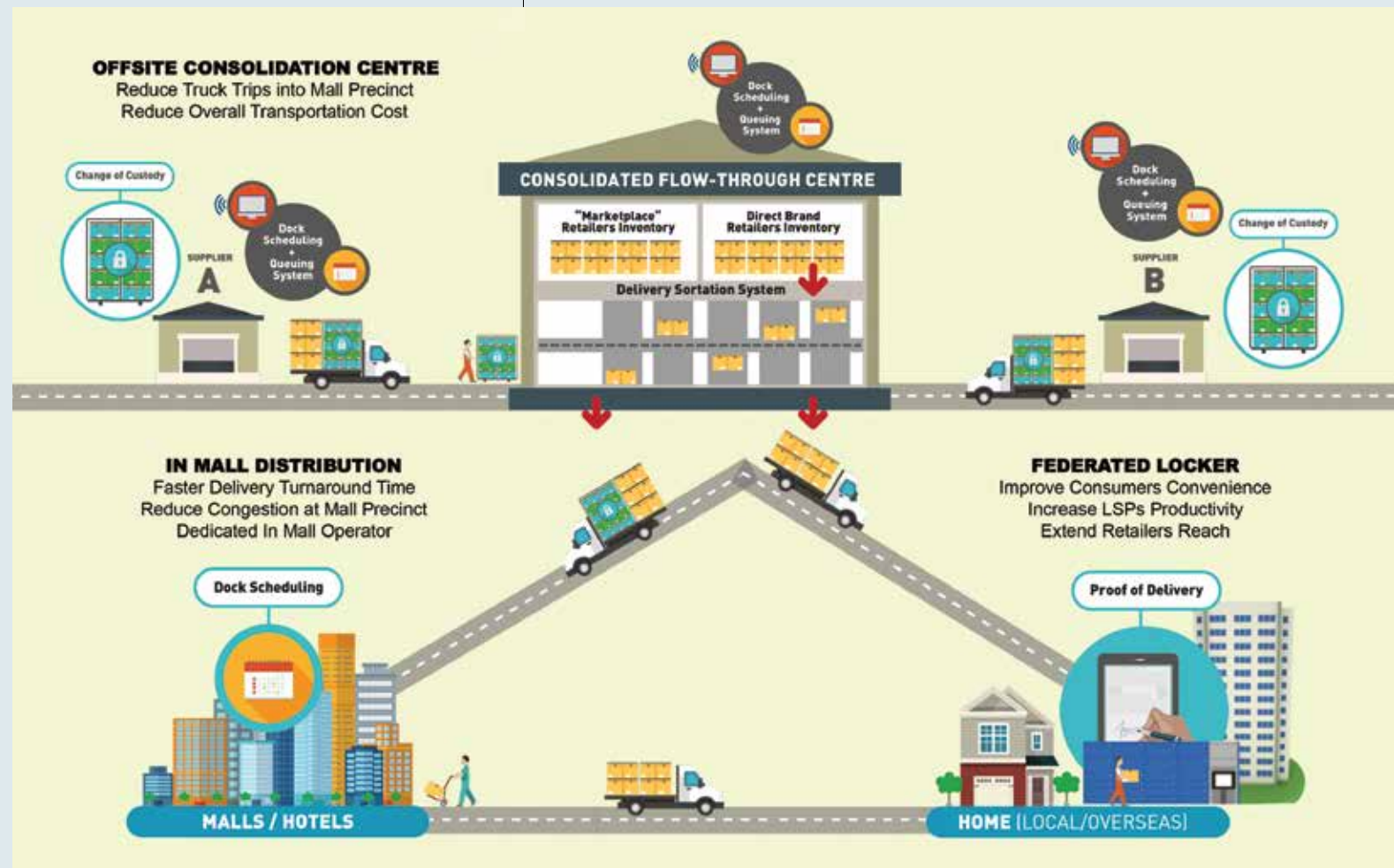
OFFSITE CONSOLIDATION CENTRE MODEL

Consolidation of freight distribution further up in the supply chain also forms a critical part of the overall Urban Logistics Programme. This is being explored through the offsite consolidation centre (OCC) model. The model seeks to optimise the efficiency of each delivery trip by enabling goods to be consolidated and sorted at an OCC first before being delivered to shopping malls and other destinations. Ultimately, by combining same-destination deliveries, truckload utilisation will be improved with fewer trip generations. In time to come, with the advancement in automation technologies, we can expect greater efficiency in the consolidation and sorting process, and higher manpower savings.

FEDERATED LOCKERS AND COLLECTION POINTS

Last but not least, in anticipation of continued change in retail patterns and rapid growth of e-commerce, there are plans to deploy a large-scale federated locker system in Singapore's key residential areas to improve customer experience of the last-mile delivery. Currently, the average local courier company can only complete 30 to 50 drop-offs a day as compared to 300 drop-offs daily in developed cities such as Tokyo. The proposed system would present a great opportunity for local courier companies to collaborate

with one another through the sharing of common infrastructure in one consolidated network. With the support of the Housing and Development Board (HDB), which provides housing for over 80% of



Consolidated and Coordinated Urban Logistics.
(Source: IMDA)

Singapore's population, the initiative has the potential to enjoy wider customer reach, improve utilisation

rates and reduce operating costs by leveraging on partnership and network synergy.

COMBINED MOBILITY PACKAGE

No single alternative mobility mode will be able to replace cars. In fact, leaving cities' mobility future entirely at the mercy of Uber or AVs without investing enough in the mass public transport would be naive. Hence, it is important that cities continue to promote public transportation, active mobility and other non-car-based sustainable alternatives as the core of the mobility ecosystem; and to complement these by on-demand, shared mobility alternative modes of transport supported by AV technology. Ultimately, going "car-lite" is not about banning cars from the streets, but about making the combination of the

alternatives so attractive that private car ownership "dies a natural death". To enhance the overall user experience of such a combined mobility package, cities like Helsinki are working to integrate all these individual mobility options under one single platform. Consequently, the enhanced accessibility to various transport options would increase the viability for commuters to opt for a slew of mobility modes tailored to their needs, which provides greater convenience and flexibility collectively. If the Helsinki model works and people get access to reliable transportation, private car ownership, particularly in cities, could eventually become obsolete.



Future mobility is about making the combination of sustainable alternatives so attractive that private car ownership becomes obsolete. (Source: [krakow.bicycles @ https://flic.kr/p/5CkU8Q](https://flic.kr/p/5CkU8Q))

MOBILITY AS A SERVICE: SUBSCRIPTION-BASED AND ON-DEMAND

Imagine never having to go through the trouble of parking, insuring or managing your car. Moreover, having a customisable package comprising public transit, taxis, ride-hailing, and personal mobility devices to fit your transport needs.

As private cars are parked 95% of the time, Finnish start-up MaaS Global is looking to introduce a Netflix- and Spotify-like on-demand subscription model for transit as a way to counter the high per-journey costs of owning a car. MaaS Global aims to launch Whim, a mobile app that works like an intelligent personal assistant who can plan routes according to users' calendar events and preferences, by late 2016.

KEY ENABLERS OF MOBILITY AS A SERVICE

INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT)

ICT enables the integration of multiple modes of transport into seamless trip chains, where users book and make payment for all legs of the trip through a single account. Similar to post-paid mobile phone plans, these services are managed by service providers who, in turn, bundle them into a customised package.

PUBLIC-PRIVATE-PEOPLE PARTNERSHIP

By building a regulative framework of planning and urban design guidelines, the **public sector** can integrate various mobility options by blurring the boundaries between different transport modes. The **private sector** can do its part by setting up innovative transport connection systems that can interoperate, and by tapping on profitable markets for new transport services. As for **the people**, they will no longer be just be on the receiving end as consumers—instead, based on their needs, the transport system will be designed and customised with the commuters in mind.

DATA-SHARING

Businesses may also consider opening access points to mobility data across the city so that users, who are constantly on the move, may actively contribute to this stream of information. At the end of the day, an inclusive ecosystem of equally-engaged stakeholders can be created, each with an incentive to help the other.



CHAPTER 4

WHAT'S HAMPERING THE SHIFT?

In urbanised cities today, the unprecedented availability of a wide range of mobility options has injected some much-needed momentum towards a paradigm shift in which people's safety and needs are placed before those of vehicles. However, the existing mobility system is still experiencing a fair amount of inertia and resistance against departing from the status quo. This section discusses some key challenges that prevent cities from going "car-lite".

MISALIGNMENT OF VISION AND POLICIES

Inconsistencies in policies and approaches often undermine good efforts that go into promoting sustainable travel behaviours. For example, although city governments invest heavily in expanding the public transport network to reduce the number of cars on roads, they do not adjust the existing parking policies which favour commuting by car (e.g. providing abundant and affordable parking at both origins and destinations).

In other instances, policymakers wishing to pursue a pro-cycling agenda may, at the same time, be reluctant to compromise drivers' interests by re-allocating road space to bike lanes. Very often, such inconsistencies arise from how cities view "going car-lite" only as a means to address a transport challenge, rather than a holistic approach towards achieving a broader spectrum of health, environmental and social benefits.

CONVENTIONAL TRAFFIC PLANNING APPROACH

People often lament about how historic urban districts built before the advent of automobiles are more walkable and human-scaled. In contrast, bigger block massing, wider roads and more spacious building setbacks are typical characteristics that dominate the planning and design of many newer urban precincts. These result in an urban environment that is less conducive for interaction and activities among people.

Moreover, the prevailing transport planning approach in most cities still prioritises vehicular movement and access over that of people's. Usually, with each new development added to a road network, surrounding roads are expanded to maintain the flow and efficiency of car-based movements. There are multiple downsides to such an approach: First, a system designed to anticipate and eliminate peak-hour congestion ends up being under-utilised during non-peak periods (i.e. for most of the day); second, streets that never choke up are great for cars, at the expense of the wider population.



Improvements to biking infrastructure should be consistent throughout the city. (Source: simon @ <https://flic.kr/p/4sjkDd>)

STRUGGLE TO SECURE STAKEHOLDERS' BUY-IN

Solving the mobility challenge requires strong support from the private and public sectors. Given that stakeholders have diverse incentives and interests, it can be difficult to secure their support for “going car-lite”. Ultimately, profit-driven businesses are still concerned about whether a “car-lite” proposition makes economic sense, and it is not easy to convince car-loving commuters to give up their car-dependent lifestyles.

RISK-AVERSE MANAGEMENT (OR POLITICS)

While many sustainable mobility initiatives, if successfully implemented, are beneficial to cities and their people, they may not necessarily win the popular vote, politically speaking. The reclaiming of road space from motorists, pedestrianising of busy thoroughfares, and implementation of road-pricing systems can in fact disrupt the status quo of systems already in place.

Moreover, contrary to the start-up world where failures and experimentations are celebrated, there is an ingrained culture of risk aversion within the public sector. Very often, the lack of incentives to innovate and the fear of failure are behind the strong inertia preventing policymakers from embracing new ideas that explore alternative ways of “getting things done”.

“WE DO NOT KNOW WHAT WE DO NOT KNOW!”

Many transport planners struggle with a “chicken-and-egg” problem, especially with the rising popularity of active mobility modes and shared-mobility modes (such as ride-hailing) in recent years. Despite growing acceptance and utilisation of these modes as everyday transportation options, the amount of reliable and accurate data available to support their growth remains limited.

Reported travel data collected through conventional methodologies, such as household travel surveys, often fall short of providing an accurate snapshot of their usage levels and patterns to inform policy and funding decisions. This tends to generate a vicious cycle whereby cities are unable to justify giving greater support to these mobility modes, despite their potential to complement public transit within a multimodal mobility ecosystem. For instance, if the current mode share for cycling is low and usage data is lacking, it is hard to convince the authorities to build a more extensive network of bike lanes. Without improvements to biking infrastructure, cycling becomes an unsafe and less attractive option for current or would-be cyclists. The end result is a lose-lose situation for all.

CHAPTER 5

GOING “CAR-LITE” THROUGH A COLLABORATIVE JOURNEY

COLLABORATE TO DRIVE CHANGES

For many decades, the public sector has assumed the key role of addressing major urban mobility challenges. Globally, transport authorities are investing heavily in public transit and hard infrastructure—to improve mobility. However, as the urban population continues to grow rapidly and commuters’ travel needs and behaviours become more diverse and dynamic, cities are finding it increasingly difficult to deliver good and efficient multimodal mobility.

At present, the public sector alone does not have the right mix of skill sets and capabilities required to build a more robust mobility ecosystem, especially with changes happening at breakneck speed. It is therefore crucial that the public sector stays nimble, forward-looking and open to collaborating with experts from other sectors.

In many cases, public and private sectors have started to forge partnerships to provide new mobility solutions. The number of successful bike-sharing schemes in cities around the world is proof that constructive public-private partnerships—built on clear expectations and a good understanding of each other’s incentives—can lead to win-win outcomes for both cities and businesses.

In other cases, the market has stepped in to fill the gaps in a conventional

mobility ecosystem. In the last five years or so, the urban mobility sector has seen the emergence of an ever-expanding range of new solutions that are consumer-oriented, on-demand and user-friendly which are largely driven by the private sector. While some of these “disruptions” in mobility service delivery have been met with mixed responses from city governments, consumers have generally been extremely receptive. Now that the private sector has demonstrated its great potential to develop smart yet relatively inexpensive mobility solutions in response to consumer demand, the public sector must decide how best to harness these solutions for the greater good of their city as a whole.

Globally, ground-up initiatives have made substantial contributions towards impactful changes. The public sector can therefore support these “agents of change” (civic groups and local communities) by tapping on their skills and experience. By engaging them in all stages of planning, design and implementation of the new mobility ecosystem, city governments can gain a deeper understanding of their people’s needs and be better placed to improve mobility services and urban spaces.

In summary, as urban mobility reaches the tipping point of a major paradigm shift, government agencies are re-examining their roles in the change management process. Many leaders and urban practitioners have gradually come to realise, through the successes

and failures of their own and others' endeavours, that a collaborative approach is the key to creating better urban and mobility ecosystems. Therefore, cities

need to establish functional frameworks, platforms or organisations that enable a diverse group of stakeholders to work together towards this end.

ABOUT THE PROJECT

Recognising the importance of this collaborative approach, this research project seeks to provide a platform for key stakeholders across different sectors to exchange views and brainstorm ways to work together and support one another during this major paradigm shift. Through our research, we hope to offer relevant lessons and takeaways by identifying best-practice examples, and by consolidating the inputs of international experts at multi-stakeholder workshop discussions. These recommendations aim to provide practical advice to cities wishing to embrace a "car-lite" mobility future; and are intended as a useful checklist for both **what** needs to be done (i.e., specific strategies and initiatives to create people-oriented urban districts and mobility systems) as well as **how** to get it done (i.e., approach and mindset required to get things done quickly and effectively).

FIRST WORKSHOP

Two research workshops were organised as part of this research. The first (held in February 2016) highlighted current initiatives taken by selected cities, including Singapore, to promote sustainable future mobility. It also examined the roles of key "enablers"—such as new mobility options supported by technologies and a sharing economy, progressive parking policies and good spatial design—in shaping aspiring "car-lite" cities' mobility future. The 62 workshop participants provided invaluable feedback on the major issues and challenges faced by the respective sectors and industries they represented. Group discussions were then held to examine how stakeholders from the public, the private and the people sectors could work together to tackle the challenges identified.

Presentations and a panel discussion touched on the following topics:

- "Going 'Car-Lite': Vision and Challenges Ahead" by the Ministry of Transport (MOT);
- "International Scan on 'Car-Lite' Initiatives" by the CLC;
- "The Role of Shared Mobility" by Park Chan, Uber;
- "'Car-Lite' Compatible Parking Policies for Singapore to Consider" by Professor Paul Barter, Lee Kuan Yew School of Public Policy;
- "Creating 'Car-Lite' Cities: The Role of Good Spatial Design" by Terence Seah, Benoy and;
- Panel discussion with representatives from the real estate industry, entitled: "Does 'Car-Lite' Make Economic Sense for Real Estate Developments in Singapore?"



(Left to right) Dr Limin Hee, Director of Research, CLC, engaging panellists Mr Mark Borland, Head of Projects (South Asia) at Hongkong Land; Mr Anthony Chia, Executive Vice President (Projects) at City Development Limited; and Mr Wong Heane Fine, Group CEO at Surbana Jurong Private Limited in a panel discussion. (Source: CLC & ULI)

WHAT WE HEARD DURING WORKSHOP 1



MOT participant Faith Perh presenting on Singapore's "car-lite" vision in Workshop 1. (Source: CLC & ULI)

"Singapore is already one of the forerunning cities in the world when it comes to promoting sustainable mobility. Looking ahead, going "car-lite" is something that should happen to make the city-state more liveable. The more important thing is to really approach mobility from people's perspective, not cars. Once we get our priorities right, slowly but surely, Singapore will become an even more competitive and attractive city for people to live, work and play in."

Mr Khoo Teng Chye
Executive Director
Centre for Liveable Cities



Group discussions at Workshop 1. (Source: CLC & ULI)

“I think we can be more liberal about peer-to-peer car sharing—it provides a good alternative option to owning a car when people need access to cars. For the rest of the time, they can make use of the excellent public transport system, or walk and cycle. Helsinki’s mobility-as-a-service [offered] in an integrated way is a good idea. The future of sustainable mobility is about offering a whole package of transport options that make owning private cars completely pointless.”

Professor Paul Barter
Lee Kuan Yew School of Public Policy
National University of Singapore

“I enjoy taking public transport because it takes away the strain of having to drive. Although it could be crowded, it is a relaxing way to spend the morning and evening commuting. To make public transit more comfortable and more convenient, we have to work on the last-mile—from MRT station to home—making this leg comfortable is a very important criterion to help make public transport a more attractive and convenient mode.”

Ms Hwang Yu-Ning
Director (Land & Liveability)
Prime Minister’s Office, Strategic Group

“Neighbourhoods and urban precincts that are planned and designed in a high-density setting for ease of walking and cycling provide an excellent base for reducing reliance on private cars. Instead of continuing to invest in road-widening and extension, we need to ensure the types of transport infrastructure investments made are strictly congruous to our ‘car-lite’ vision.”

Mr Anthony Chia
Executive Vice President (Projects)
City Development Limited

SECOND WORKSHOP

Key findings of the first workshop then served as the basis for the second multi-stakeholder workshop on 8 April 2016, which was held at Jurong Lake District (JLD), a major regional centre located in the western part of Singapore. Envisioned to be Singapore’s second Central Business District (CBD), it will also be the terminus site for the planned Singapore-Kuala Lumpur High Speed Rail project. Being redeveloped as a modern district, JLD presents exciting opportunities to implement new planning and mobility concepts including the prospect for a more people-oriented and less car-dependent district.

Using JLD as the case study area, this workshop’s main objective was to identify a few priority areas of action or “quick-wins” for potential implementation within the next two to three years—so as to support JLD’s “car-lite” vision. Most of the 65 workshop participants—real estate developers with existing projects in the area, and urban and transport planners involved in the district’s planning and development—were stakeholders with an active interest in shaping JLD’s future. Hence, the workshop provided a good platform for the exchange of ideas and

solutions to improve the accessibility and attractiveness of the area. Issues such as ways of promoting coordinated travel demand management at district-level, shared mobility and more people-oriented street designs were extensively discussed.

Presentations and panel discussions consisted of the following:

- “Key Takeaways from Workshop 1” by Centre for Liveable Cities (CLC);
- Keynote Presentation “Strategies on Creating ‘Car-Lite’ Cities: A Practitioner’s Guide to Driving Positive Changes in Cities’ Mobility Ecosystem Quickly and Effectively” by Gabe Klein;
- “In Conversation with Gabe Klein”;
- “Vision and Development Plans for Jurong Lake District (JLD)” by Urban Redevelopment Authority (URA) and Land Transport Authority (LTA) and;
- Panel Discussion entitled “Can ‘Car-Lite’ Work in JLD?” with Mr Mann Young, Director of Business Development at Lend Lease; Mr Toh Kim Sai, Deputy Chief Development Officer at CapitaMalls Asia; and Mr Arthur Aw, Executive Vice President (Special Projects, Integration & Growth Strategy) at Ascendas-Singbridge



Participants preparing for an experience on e-scooters at Jurong Gateway during Workshop 2. (Source: CLC & ULI)



Participants trying out personal mobility devices as part of the second workshop in Jurong Lake District. (Source: CLC & ULI)

As part of the second workshop, participants were taken on a fieldtrip around Jurong Gateway, the commercial hub within JLD. Conducted on foot and on personal mobility devices (PMDs), the fieldtrip provided an overview of the key concepts and strategies that had gone into the planning and development of the area. It also allowed participants to have a first-hand experience of using PMDs as a last-mile commuting mode at JLD.

Mr Gabe Klein, the former Transportation Chief of Chicago and Washington DC, was invited to this

workshop to lead the discussions. Coming from a start-up background and with a prior career path mainly in the private sector, Mr Klein stated that he firmly believes in the need to run the public sector agency with the energy, pace, creativity and change management approach typically found in the start-up world. He was therefore able to provide many proactive, yet practical insights and valuable tips on how city leaders and policymakers could work together with the community and the private sector more effectively to get meaningful initiatives off the ground quickly.



Mr Gabe Klein leading discussions on how stakeholders, including public agencies, private sector professionals and interest groups could work together to make "car-lite" work in Jurong Lake District. (Source: CLC & ULI)



Group discussions at workshop 2. (Source: CLC & ULI)

KEY IDEAS FROM WORKSHOP 2 FOR JURONG LAKE DISTRICT (JLD)

PEDESTRIANISE IT!

To promote public transport and prioritise pedestrians, create a fully pedestrianised zone around Jurong East Interchange.

CAR-FREE SUNDAY

FOCUS ON THE STREET LEVEL

Create active street fronts, narrower roads and plant big trees to facilitate walking at street level. Second-storey and underground pedestrian links should remain secondary.

CREATE INCLUSIVE STREETS

Road design should move away from car-centric models to encourage people to adopt more sustainable travel modes. Pavements should be widened beyond the current standard minimum 1.2m width, while "Slow Lanes" with speed limits of 20 to 25km/h can be piloted to facilitate space sharing with bikes and other non-car modes.

MAKE ALTERNATIVE MOBILITY OPTIONS CONVENIENT THROUGH SHARING

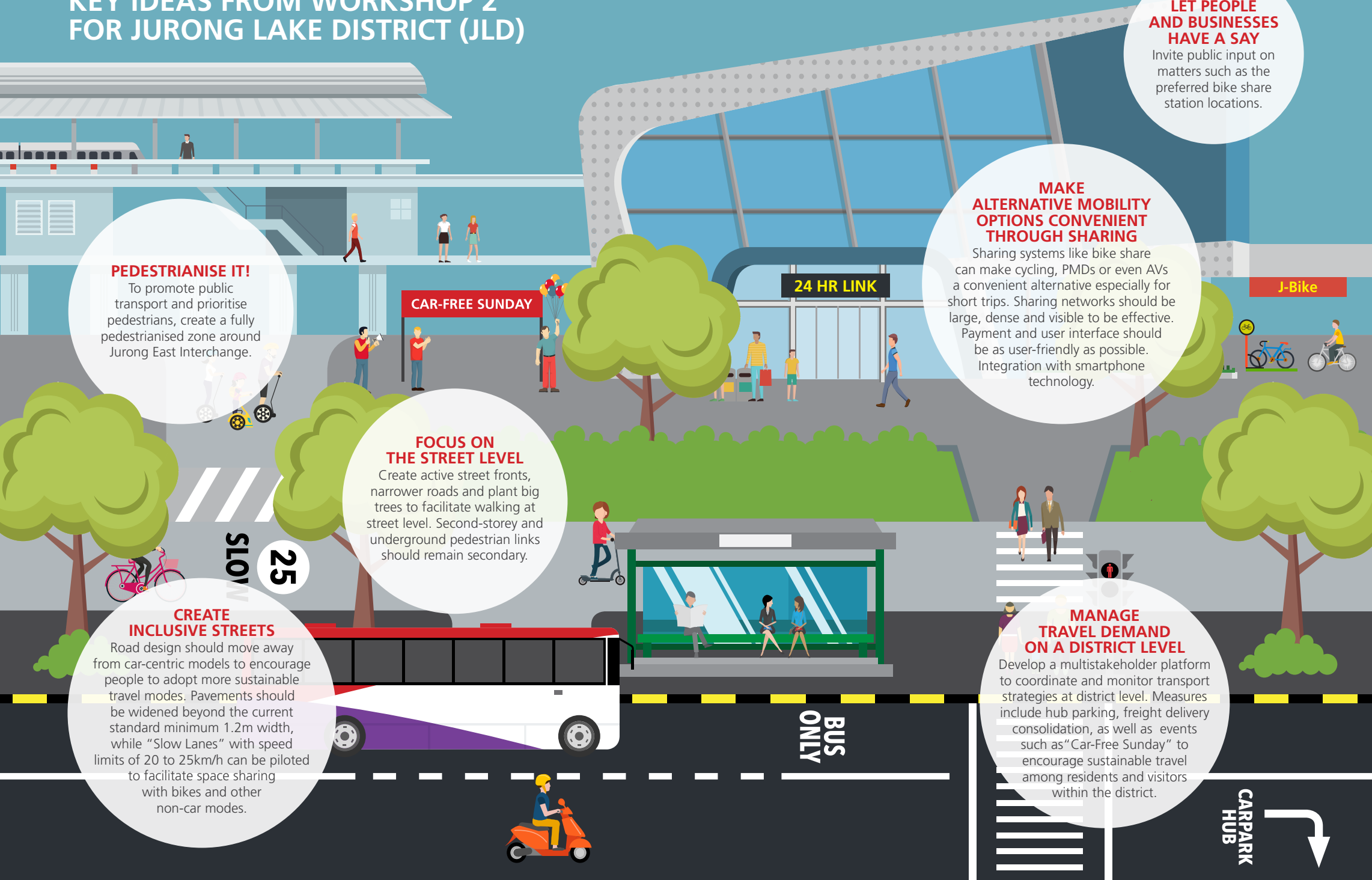
Sharing systems like bike share can make cycling, PMDs or even AVs a convenient alternative especially for short trips. Sharing networks should be large, dense and visible to be effective. Payment and user interface should be as user-friendly as possible. Integration with smartphone technology.

LET PEOPLE AND BUSINESSES HAVE A SAY

Invite public input on matters such as the preferred bike share station locations.

MANAGE TRAVEL DEMAND ON A DISTRICT LEVEL

Develop a multistakeholder platform to coordinate and monitor transport strategies at district level. Measures include hub parking, freight delivery consolidation, as well as events such as "Car-Free Sunday" to encourage sustainable travel among residents and visitors within the district.



CITY LEADERS AND EXPERTS ON “CAR-LITE” MOBILITY AND LIVEABILITY

The preliminary recommendations of the research project were presented at a co-located event held during the World Cities Summit 2016, Singapore. As part of the event, a panel of esteemed city leaders and experts shared their experiences and perspectives on the role of sustainable urban mobility in creating liveable cities.

Moderated by Mr Scott Dunn, Past Chair of ULI Singapore and Dr Limin Hee, Director of Centre for Liveable Cities, the panel discussed many practical ideas in cities’ transition towards a “car-lite” future.



A panel of esteemed city leaders and experts shared their experiences and perspectives on the role of “car-lite” urban mobility in creating liveable cities during the World Cities Summit 2016. (Source: CLC & ULI)

Mr Morten Kabell, Mayor for Technical and Environmental Affairs, City of Copenhagen, stated how infrastructure plays a key role in Copenhagen’s pursuit to achieve 40% of commuting by bicycles. He shared his views on green mobility: it is an easier, healthier and more efficient way to get around in the city, and an option accessible to everybody.

Copenhagen has for many years been promoting cycling as a fast and easy way means of commuting. A good cycling infrastructure, shorter travel times, and enhanced safety and security are major factors determining why Copenhageners choose to cycle, and why they are today more satisfied with this model of travel than ever before.

Moreover, during winter, snow is first cleared on the city’s bike lanes followed by car lanes. This sends a clear signal that in Copenhagen the needs of cyclists are prioritised over that of drivers. Mr Kabell also pointed out that—because the capacity for bicycles lanes is five times the number of people occupied in a car lane—the removal of car lanes could improve the overall capacity of the mobility system. He noted that it is not the number of vehicles on the roads that matters, but the number of people who are being transported.

Drawing upon Seoul’s experience, **Mr Kim Soo-hyun, President of Seoul Institute** reiterated the importance of developing the public transport network as the backbone of a “car-lite” mobility ecosystem, as well as the need for an aligned “car-lite” vision amongst all key stakeholders. Mr Kim further stressed that the internal alignment of interests among different government divisions is necessary to reconcile potential areas of conflict. He cited the example of the Seoul Metropolitan Government’s Department of Landscape: although the Department focuses on tree planting to promote greenery, these trees might, however, inadvertently obstruct pedestrian paths. Thus, holistic thinking and a coordinated approach are imperative in the execution of a “car-lite” vision.

To address mobility challenges, Mr Kim recommended combining big data and analytics to bring about innovative solutions. For instance, advanced IT techniques might enable the monitoring of the mass transit system in real time. In Seoul, the use of smartphone data allows users to identify the routes of

night buses operating between midnight and 5am.

Mr Gabe Klein, former Transportation Chief of Chicago and Washington DC, concurred with Mr Kim’s point on the need for a coordinated “car-lite” approach within the government and key stakeholders. To prevent silo thinking, he shared that the bicycle and pedestrian departments in were dissolved into the Complete Streets department in Washington DC. On how cities can work together with the private sector to create win-win solutions for commuters, Mr Klein further emphasised how cities should be “open to innovations and experiments” by conducting pilots that are low-risk and highly rewarding, which could serve as useful tools to help secure buy-ins and drive changes.

Mr Klein finally urged governments to boldly adopt the approach of “we are going to do it and want your feedback on how to do it” instead of “we want your feedback, whether we or not we are going to do it”.

“Singapore has been very successful at big infrastructure projects such as remaking the waterfront, doubling the train lines but reallocating the street space from the cars has been very challenging.”

Mr Gabe Klein
Former Transportation Chief
of Chicago and Washington DC



Dr Carsten Brosda, State Secretary for Culture, Media and Digital Affairs of the Free and Hanseatic City of Hamburg, highlighting the importance of providing people with a wide range of sustainable travel options. (Source: CLC & ULI)

Mr Konrad Otto-Zimmerman, Creative Director of the Urban Idea and Former Secretary-General ICLEI (Local Governments for Sustainability), shared his experience of organising the month-long Ecomobility Festival in Suwon (South Korea) and Johannesburg (South Africa). He believed that by closing off the roads to cars for a longer period, people would be encouraged to re-organise their daily life to complement the car-free lifestyle, during and possibly even beyond the Festival period. Through eco-mobility—walking, cycling and using public transport—people would get to experience a car-free city, and hear the sounds of people and birds on the streets instead of vehicle noises.

Mr Otto-Zimmerman pointed out that these initiatives are essentially community-building processes. The planning and preparation of the Festival

included an intensive public discussion, a process of negotiating with residents who had different views. However, the city's successful demonstration of going car-free led to the introduction of traffic calming initiatives in the district even after the Festival ended, e.g. reducing vehicles' speed limit to 20 km/h in certain segments and parking restrictions on major streets.

For **Dr Carsten Brosda, State Secretary for Culture, Media and Digital Affairs of the Free and Hanseatic City of Hamburg**, the key to cities' "car-lite" future lies with providing people with a wide range of sustainable travel options: "Offer people the options and have them seamlessly connected with the help of technology. Instead of telling commuters what to do, I think we can trust them to make sensible travel choices."

Dr Brosda stressed that the functionally differentiated city model in which people live in one place and work in another is incompatible with today's walkable and bikeable city context. People want to be able to do everything within a mile radius of where they live. He cited the example of HafenCity in Hamburg as one such urban regeneration project: once completed, the once old harbor will be replaced with residential areas and office complexes.

"Do everything, and do it now. Develop everything—build your underground, enable the buses to be emission-free, make your cities walkable and bikeable. Offer people the choices to decide the mode of transportation that they want to use in the city for themselves. They will make the right choices."

Dr Carsten Brosda
State Secretary for Culture
Media and Digital Affairs of the Free and
Hanseatic City of Hamburg



For more information on the panel discussion of the co-located event at World Cities Summit 2016, please scan the QR code or follow the web link below:



<https://youtu.be/38T5QHKdtnw>

CHAPTER 6

TEN IDEAS TO PREPARE CITIES FOR A “CAR-LITE” FUTURE

Creating liveable cities through “car-lite” urban mobility requires a multi-disciplinary and multi-stakeholder approach. Globally, while much attention has already been paid to reducing the adverse impacts of today’s car-oriented urban mobility paradigm, there remains scope to closely examine the nature of the challenges and effectiveness of the solutions, to ensure that cities are tackling root causes rather than merely reacting to the symptoms. There are several underlying principles that are key to a city’s transformation towards becoming “car-lite”: i) getting the fundamentals right, e.g., through mixed-use planning and good urban design; ii) focusing on outcomes-driven and people-centred innovations and business models that enable a greater integration of sustainable transport modes; and iii) adopting a multi-pronged approach that strikes a good balance in the joint use of “software tools” and “hardware improvements” to drive the changes.

With that in mind and the information input through the stakeholder workshops and experts input during the World Cities Summit Forum, the CLC and ULI have distilled 10 key ideas to provide practical advice and tactics to prepare cities for a new mobility paradigm.

IDEA NO. 1 ALIGN VISIONS, BOTH INTERNALLY AND EXTERNALLY

To successfully use policy changes to drive the mobility paradigm shift, it is imperative that there be an alignment of vision and efforts among individual organisations. Doing so will ensure support and effective execution at every level, and at times, the alignment process will require the shaking up of existing systems and processes. In Chicago, for example, individual mode-based units at the Chicago Department of Transportation (CDOT) were dissolved to create a unified Complete Streets Department. This resulted in more coordinated efforts that focused less on the individual modes of transport, but more on creating better streets for people.

Alignment of vision across the board is critical. Cities need to ensure that the promotion of sustainable mobility in transport planning is not managed in isolation from other related urban policies, but as a unifying agenda across all city agencies—by reaching beyond transport planning into other essential issues of land use, job creation, energy, climate change, health and social equity. Having a goal-based approach recognises and emphasises the need to break down the silos of agency-specific key performance indicators (KPIs) to focus more on the strategic well-being of cities as a whole. Such an approach not only enables more coherent and coordinated design and execution of key policies and plans, but also results in better projects outcomes.

"Is having good data important for driving this mobility paradigm shift? Sure, but we also need to remind ourselves that Mr Lee Kuan Yew was known as a man with vision and determination, not a man with data. Policy makers have a critical role to play in this process by driving the right changes."

Mr Mark Boland
Head of Projects (South-Asia)
Hongkong Land

INTERVIEW WITH GABE KLEIN

Public Sector's Role in Driving A Mobility Paradigm Shift



To view CLC's interviews with Gabe Klein as well as his public lecture on "Bridging the Public-Private Divide to Create Great Cities", please scan the QR code or follow the web link below.



https://www.youtube.com/playlist?list=PLGKE0U1p8RxjilNTTdAP0LVg_jh5JJCu0



Busy pedestrian crossing in Jurong Gateway. (Source: CLC & ULI)

How do you drive change within the bureaucracy? If you were to advise someone tasked to transform a city's urban mobility, what would be the first things they should do or look into?

I would inform somebody new coming in to, first of all, not be intimidated by the fact that they may not have the requisite résumé, or have come from 20 or 30 years of background in government, or with formal training in planning or engineering.

I think we need more diversity in leadership because individuals with unique experiences from different sectors bring with them unique perspectives. This is important when cross-sectorial collaborations are part and parcel of the public sector's day-to-day work. I also think that honest, transparent communication with people is critical when it comes to driving changes.

Risk-aversion hinders project implementation and innovation. How do you emerge from this rigid cycle to create more nimble public agencies?

Coming from the start-up world, I'm a big fan of experimentation. When I say "pilots" or "experiments", I do not mean flying by the seat of one's pants. These should be controlled experiments that involve putting together plans for quick iteration so that you can execute them over and over in different contexts, for different purposes. If you make your stakeholders—be they the Mayors, the council members, the business shopkeepers, the landowners, or the residents—part of the diagnosis and experimenting process, you'll find that they give you a lot longer leash to play with. And I would also argue that from what I've learned, it's typically much more fiscally responsible to pilot something to show people how it works, and



Gabe trying out e-scooting along a typical sheltered walkway in Singapore. (Source: CLC & ULI)

get their buy-in. Tactical urbanism projects can be extremely cheap but effective. You can then make it permanent later.

Rapid changes in technology and the emergence of new business models make it important for governments to be ready to adapt. How has the public sector in the United States creatively responded to disruptions with new policies or models of collaboration?

Indeed, new business models like Uber and Lyft can be hard to regulate. And on top of it, you have very smart consumers who typically want better service at lower prices. I think that the future of mobility lies with public-private partnership. If we test the waters properly, if we share the risks and rewards, we can really serve the citizenry better than we have ever had in the past.

Autonomous cars are already on the horizon. Or I should say, autonomous technology, because there will be a lot of applications. The US government is now leading a US\$50 million Smart City Challenge, comprising US\$40 million from the Federal Government and US\$10 million from the private company, Vulcan, owned by investor Paul Allen. So they are basically giving funding to one city to institute the most innovative smart-city technologies in the area of transportation, and to demonstrate what is possible with public-private collaboration.

So I think that there has been recognition in the US that the key to a sustainable urban future is through these partnerships.

What tips can you offer in terms of cultivating open and effective public communication within the public sector?

When I first joined the public sector, I was surprised at how opaque it was when it came to communication and how much was being done behind closed doors. Internal communication was problematic too. You had the “left-brain” people and the “right-brain” people: the latter were the creative planners who would go out and talk to the community and typically say yes, while the engineers were quietly saying no. As a result, the end product became very different from what was conveyed to the people.

We therefore made a conscious effort to open up the agency. It made the left-brain people uncomfortable, but it was the right thing to do. And I think that if you’re going to convince a customer that a product or service is good for them, you’ve got to actually explain the features, advantages and benefits of the product or service. We aggressively adopted the use of social media, though few government agencies were doing a lot of that (proactive communication). We were also communicating with people in two ways: we uploaded all our projects

the website, and updated the public on a weekly basis in terms of what we were doing well and not doing well. We said we were committed to doing X number of things within a period of one to two years, not a 10-year plan with nobody accountable for the outcomes. And then we'd report on it. No matter what happened, we were transparent about it and we even started our own blog to communicate directly with the people. I would respond personally

to citizens, because I think that sends a message to the public that this is a new day in government. This is very important, particularly if you're going to have an aggressive timeline for new initiatives. All of these efforts paid off—the people felt they were much more a part of the process, and that they had a voice in the outcomes of their communities. After all, we work for them, and it is the outcomes that matter, not propping up our fiefdoms.

IDEA NO. 2 FOCUS ON PEOPLE'S NEEDS, WORK WITH COMPETITION TO FIND WIN-WIN SOLUTIONS

The wide range of mobility services and concepts that are becoming available has the potential to profoundly transform the future of both public and private transit. While some of these new kids on the block are seen to have stepped on the toes of existing players, consumers have demonstrated strong receptiveness towards trying out and eventually taking up many of these modern transport services and products. According to statistics released by Singapore's Land Transport Authority (LTA), the number of rental cars on the roads had risen to a record high of 24,573 as of August 2015, a 38% surge from August 2014. A probable cause was the rising popularity of ride-hailing apps like Uber and Grab which work with rental firms to provide cars to drivers.⁵⁰

In an increasingly service-conscious age, it no longer matters who provides the services. Instead, what matters is how attractive the provided services are, with consumers playing the part of very reliable barometers. Indeed, fair competition in the transport sector is a prerequisite for innovation and efficiency, and it would not be an overstatement to say that fair competition among different transport modes and business models is a prerequisite for networking the system to create a truly integrated package of mobility services.⁵¹

Nevertheless, it is important to recognise that this is not a one-way street. For ride-hailing and car-sharing services to be accepted as part of the future mobility ecosystem, these new services must complement public transport modes, instead of attracting passengers away from public transit and generating more traffic on the roads. Presently, there is no definitive answer on their



With a better understanding of the impact of service options such as car clubs and ride-hailing on the bigger mobility ecosystem, cities may be more willing to integrate them as a part of the "car-lite" mobility solution. (Source: Felixkramer @ <https://flic.kr/p/61Uu5q>)

exact impact on transit. While more surveys and researches on this topic would certainly be useful, these new service providers should also come forward to share data with cities and the public.⁵²

"I think it is for the public to understand that there are all of these different options and one of the options may not be able to completely replace car ownership or be as good as owning your own car, but together—by walking and cycling more, by using public transit more, by sharing the rides—as a package it can, for sure, replace the convenience of driving your own car."

Park Chan
General Manager (South-East Asia)
Uber

CHICAGO

The Story of Divvy Bike Share

Amidst stiff global and regional competition, policymakers in Chicago saw prioritising sustainability as a key strategy for attracting and retaining talent. Mayor Rahm Emanuel and Chicago Department of Transportation (CDOT) Commissioner Gabe Klein envisioned a city-wide transport network that would translate the principles of liveability, sustainability and economic viability into projects that were quick to implement and would improve quality of life in Chicago. Transportation priorities within the city have evolved from rail- and car-centrism to an emphasis on walkability and bikeability, and the much-lauded Divvy bike-sharing scheme was one key initiative that was rolled out under this transition.

Initially planned for launch with 3,000 bicycles and 300 stations, the Divvy system's fleet has now expanded to over 5,000 bicycles and 500 stations spanning the Chicago metropolitan area, and covers the largest area of any bike-share system in North America.

A CONSTRUCTIVE PUBLIC-PRIVATE PARTNERSHIP CREATES WIN-WIN FOR BOTH

Typically, a considerable amount of capital is required to initiate a bike-share project, particularly when cities control the public space

and associated permits. In the case of Divvy, the private sector's aversion towards attempting such an ambitious and expensive project was offset by initial funding secured by the CDOT through both federal and municipal sources. As the only international company specialising in the management of bike-share services in cities at the time, Alta Bike Share, Divvy's contracted vendor, brought in high-calibre city managers to minimise operational hiccups. Alta Bike Share, together with the experienced CDOT team that had modelled and launched the well-received Capital Bikeshare in Washington DC, were important contributors to the success of Divvy.

Gabe Klein and his deputies adapted the marketing model of Washington DC's Capital Bikeshare by transferring the responsibility of marketing over to Alta Bike Share. Alta Bike Share would operate at-risk so that the Divvy system would only generate profits if the bike-share system pulled net profits after an initial three-year ramp-up period. This created an impetus for Alta Bike Share to market the service aggressively and meet their membership as well as usage targets. Global design firm IDEO and Chicago brand strategy studio Firebelly Design were hired to develop a unique brand identity in partnership with the CDOT to rouse

and maintain interest in bike-sharing and make it "feel like Chicago."

Playing the role of overseer and change facilitator, the CDOT worked closely with private corporations on the most fundamental and intimate aspects of the system. Strategic alignment of the objectives of public and private stakeholders provided motivation to make the system work. It also created secondary benefits by creating a profitable public service.

COMMUNITY INVOLVEMENT

Community involvement formed a key component in the planning, design and operations of the Divvy system. Klein stressed the need for the public to take ownership of the urban spaces they occupied, and believed that this should extend to the quality and safety of the transportation networks that they used.

For Divvy, the public was actively approached for suggestions during the planning phase of the project. Civic data firm Open Plans was hired by the CDOT to design a station crowdsourcing page where people could indicate desired station locations on an interactive map. To date, the page has recorded thousands of geo-located comments from the public. Additionally, Divvy usage data for each quarter is also made public, and a Data Challenge competition runs annually to encourage public involvement in finding new ways of visualising data, discovering novel trends and conducting studies on usage patterns. These have, in turn, supplied useful information for the Divvy operator and the CDOT to apply towards improving the system.

Embracing social media was another important aspect that increased the market outreach marketing team



Divvy rider and Chicago's protected bike lanes. (Source: Steven Vance @ <https://flic.kr/p/f1tuws>)



Chicago: The ubiquitous light blue Divvy bikes and the rare Divvy Red which was launched as part of the Divvy Red Campaign to get people excited about riding a bike. (Source: <top> Kevin Zolkiewicz @ <https://flic.kr/p/fVdatD>; <bottom> Andrew Seaman @ <https://flic.kr/p/h9hPpz>)

Divvy. The Divvy marketing team and the CDOT's bike and public relations team collaborated on the marketing efforts. These included a covert campaign, "Divvy Red", which encouraged commuters to ride on rare, red bikes, and post photographs on social media with the hashtag #DivvyRed. There was

also regular engagement with the press, as well as frequent sharing of positive stories about Divvy usage and users. People responded well to these efforts, and within a few weeks after the launch, "Did you Divvy?", "Divvy on!" and "I'm a Divvier" had become part of the city's vernacular. Members showed off their Divvy key fobs and took selfies with the bike with pride. Inspiring public participation increased the sense of ownership and quality of feedback that the CDOT received for the service.

CONCLUSION

The success of the Divvy bike share system depended heavily on the commitment of the CDOT to its vision for bicycling in Chicago, meaningful engagement with the private sector, and active encouragement of community involvement. Over time, the system has become widely accepted as a celebrated element of Chicago's transportation network, which its people also take pride in.

IDEA NO. 3 CREATE DEVELOPMENT- BASED MOBILITY DEMAND MANAGEMENT STRATEGIES

While the public sector has a key role to play in driving cities towards a more "car-lite" future, they *cannot* carry out the task alone. End-users, be they individuals or organisations, ought to play a bigger role alongside city governments in promoting sustainable travel behaviours. This is because it is ultimately their collective travel decisions that will have a significant impact on cities' transport networks and the urban environment. Additionally, beyond supply-driven solutions, policies and measures enable more effective management of mobility demand, being critical in optimising the existing urban capacity, so as to avoid the exorbitantly high costs of building major transport infrastructures.

In cities such as London, the inclusion of individual "trip-generators" in the travel demand management process has always been a key part of the city's overall transport strategy. From government buildings and schools, to shopping malls and hospitals, developers of major development projects are often required to put in place a site-specific "travel plan"—comprising a survey of current travel patterns, a set of new travel targets and a travel demand management package—for trips to and from home, as well as business trips during office hours. For example, in the case of a "workplace travel plan", the travel demand management package often requires employers to provide

employee incentives that promote greener and cleaner travel choices (e.g., working from home, flexible work hours, company bike-rental schemes, discounted public transport season passes, free car-share memberships), and take measures to discourage staff from driving (e.g., removal of staff season parking, and so on). In a study conducted by Hamre and Buehler, the authors found that when a company offers transit benefits to its employees (instead of free parking and subsidies to drive), the probability of taking the bus or train exceeds 76%, and driving becomes less appealing.⁵³ Not to stop short at just developing a plan, individual organisations were also tasked, as custodians of the travel plan, to monitor its effectiveness and report on its progress.

Over time, this approach would encourage the development of "customised" mini transport strategies that better cater to the context and needs of individual development projects. It would also foster a shared sense of responsibility among developers and users to ensure that every single new development contributes instead of compromising the city's overall efforts in promoting sustainable urban mobility.

In Singapore, the LTA and the URA have recently introduced a new requirement for developers to submit a Walking and Cycling Plan (WCP) so that the needs of pedestrians and cyclists are included as part of their development plans. While more can still be done in this regard, such a move is certainly one in the right direction.⁵⁴

“The ‘car-lite’ future is not something that the government can do alone. It depends a lot on private, public and community partnership. For the private sector, they can incorporate amenities into their developments such as bike parking and shower facilities. In some of the cities that we have visited, it is even in the employees’ contract that they have to take public transport to work. This can be something that we can look into in future.”

Ms Tracey Hwang

Director (Urban Design)
Urban Redevelopment Authority

LONDON

A Comprehensive Travel Demand Management Strategy

Like in many fast-growing metropolises in the world, London and its transport system face major challenges. Significant population and employment growth expected in the upcoming years are likely to further increase the pressure on the existing public transport system and road networks. London has already invested billions of pounds in the transport network to provide more capacity and better connectivity. But at the same time, it has consistently emphasised the need to manage and influence the demand for travel as part of a balanced and integrated transport strategy.

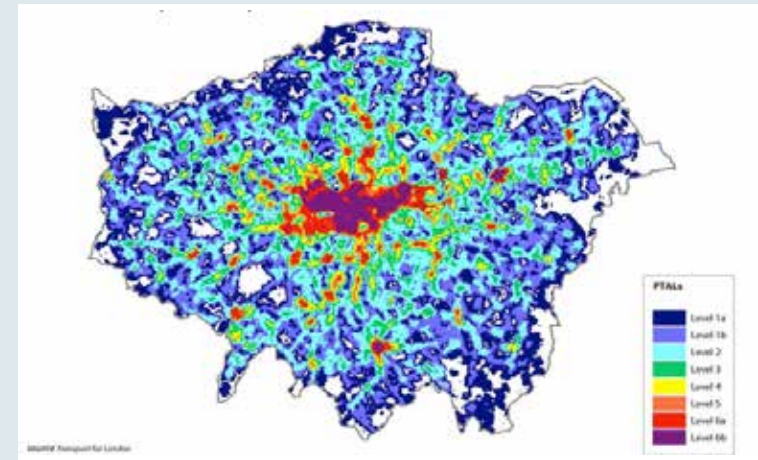
“CAR-LITE” COMPATIBLE CAR PARKING POLICY

The imposition of a maximum car parking standard has had a long history in London. From as early as 1976, the Greater London Development Plan had set maximum parking for parts of London to discourage commuting by car, particularly for commercial developments. While such standards

for residential developments have shifted over time, the 2004 London Plan dictated a complete shift from minimum to maximum car parking standards for both residential and non-residential uses across the city. Today, as a rule of thumb, all developments located in areas that enjoy good public transport accessibility should aim for car parking provision at a rate that is significantly below the maximum standards.

ACCESSIBILITY-BASED PLANNING

To facilitate easy assessment of the public transport accessibility level (PTAL) for every single plot of land in the city, Transport for London (TfL)⁵⁵ developed a free toolkit for use by the professional planning community. Through a dynamic system that is regularly updated to reflect the latest data inputs and local planning parameters, the toolkit allows planners to measure PTAL for individual development sites and produce travel time



London-wide Public Transport Accessibility Levels (PTAL) ranging from 1a to 6b, with 1a being the lowest and 6b the highest. (Source: Transport for London)

reports. Using PTAL as an indication for connectivity to public transport network, TfL strongly recommends car-free or “car-lite” developments in areas of high public transport accessibility. The toolkit also helps to identify accessibility gaps in the existing network.

DEVELOPMENT-BASED TRAVEL DEMAND MANAGEMENT

For all large-scale developments, TfL works closely with developers, local councils and other relevant stakeholders to mitigate the impact of trips generated by the project. As part of the planning process, developers have to submit a long-term management strategy that outlines the traffic impact assessment of the site, establish targets, and propose a suite of measures meant to encourage

sustainable travel amongst occupiers and visitors from the outset. Data and tools are made readily available to help developers build, test and review these travel plans.

ESTATE TRAVEL PLAN

In some cases, there is also value in developing an umbrella travel plan strategy for bigger districts, particularly when there is the presence of a single master developer or estate manager, and when there is strong need to coordinate travel issues, measure and monitor across individual developments in the area. In the case of Canary Wharf, a key business district and home to the headquarters of many major banks and professional services, effective travel demand management has always been an integral part of

its overall estate management strategy. On top of the travel plans of the individual developments, Canary Wharf Group, as the overall estate manager, is also committed to ensuring coordinated efforts in promoting access by non-car modes on an estate-wide basis. They do so through an estate travel plan that provides an overarching framework to individual companies across the estate. In addition, quarterly Transport Forums are also organised to bring together

stakeholders—including the local authority, TfL, transport operators and tenants/occupiers—to discuss and debate issues and potential solutions. Thanks to such an estate-wide approach, provision of key transport infrastructure and services such as secure cycle parking, car-sharing, cycle training and freight delivery are well coordinated and consistently delivered to ensure the area's long-term success, sustainability and vibrancy.⁵⁶



Canary Wharf, London adopted an estate-wide mobility demand management approach. (Source: La Citta Vita @ <https://flic.kr/p/ouyWjp>)

IDEA NO. 4 EXPAND PUBLIC TRANSPORT AMENITIES TO COVER THE FIRST-AND-LAST-MILE

To achieve “car-lite” urban mobility, the public transport network needs to form the backbone of the mobility ecosystem. Hence, as the first and most critical step, cities have to prioritise the development of a safe, reliable and convenient public transport system as they plan future mobility systems.

However, getting people out of their cars takes more than just having a shiny and well-run public transport system. Very often, it is challenging to convince drivers to give up the convenience of driving. Whereas car travel takes one from door-to-door, public transport presents the “first-and-last-mile” problem, i.e., the extra time and hassle needed to traverse the gaps between homes, mass transit hubs and workplaces. It is thus important for public transport operators who provide services for the bulk of public transport-based, multimodal trips to look into customers’ needs beyond the service network itself.

One way to do so is for public transport operators to establish strategic intermodal partnerships with taxi, car-sharing and bike-sharing providers to complete the trip ecosystem. For instance, if making space for cyclists and their bikes on congested peak-hour buses and trains is a real challenge, perhaps partnering a bike-sharing service

provider would be a good alternative that can help plug the “first-and-last-mile” gaps without compromising public transport commuters’ experiences. In time to come, the smartphone could well be the platform that brings everything together—from real-time trip planning to integrated ticket booking and collection of tickets—to make multimodal trips truly hassle-free and attractive. Last but not least, deployment of promotional materials and sharing of information about the services can be done together to improve the appeal of the “enhanced” mobility package as a whole.

“What is critical for an efficient public transit system is that it should be tightly knit throughout the city. Most of all, the ‘first-and-last mile’ of a trip is a decisive factor for individuals in deciding whether to take public transit or drive. To make it work, the transit network must be complemented with other sustainable green transport modes such as bicycles. In Seoul, ‘Ttarungi’, a bike sharing system, is being implemented around major subway stations to connect people between transit hubs and their final destinations. I think this is the kind of effort needed for cities to increase transit ridership.”

Mr Kim Soo-hyun
President
Seoul Institute

IDEA NO. 5 PLANNING MATTERS!

Solutions to more desirable and more sustainable mobility will not and should not be found solely within the realm of transport. As a starting point, it is always worthwhile to ask: Can some of those trips be avoided or shortened in the first place?

Mobility data analytics tools have enabled us to gain useful insights into the traffic issues while new mobility solutions supported by technology have promised faster and more effortless journeys. However, these solutions tend to focus more on the symptoms rather than dealing with the underlying causes of our urban challenge, i.e., the growing volume of traffic that continues

to clog up transport infrastructure, especially during peak travel periods. Minimising the number of road trips that are generated at the source can save us from having to fight battles that can be avoided in the first place.

At the strategic level, land use policy must continue to address the physical separation of activities and the means by which distances between these activities can be reduced. Jobs and homes must continue to be brought within closer proximity to relieve unnecessary stress on the road network and public transport infrastructure. Urban structures (in terms of location, mix and density of land uses) and transport systems must also continue to shape each other in ways that promote sustainable travel options.



Toa Payoh, a transit-oriented, high-density town in Singapore. (Source: Stephanie @ <https://flic.kr/p/7zDUZh>)

IDEA NO. 6 PUT A STOP TO CHEAP AND EASY PARKING & REFLECT THE FULL COST OF DRIVING

Beyond horizontal integration of high-density mixed land uses around public transport nodes, compatible uses should also be co-located within the same development vertically to minimise the need to travel. With improvements in industrial environmental regulations and the shift in economic activities towards a more knowledge- and creativity-based industry, particularly in more mature cities, we have seen the emergence of many new space usage types in recent years. Increasingly, such a trend has called out for the need to look into the weaknesses of zoning as a mixed-use facilitator, and how it can be tweaked to facilitate the creation of vibrant and diverse urban spaces that respond better to a dynamic market demands.

“In creating ‘car-lite’ cities, perhaps the most immediate and greatest impact this can have is reclaiming the city we live in for ourselves, a city long predicated on car-centric design and planning principles. In light of a ‘car-lite’ society, good planning seeks to optimise the much-needed flows and interactions that underpin the economic and social well-being of a city, whilst good urban design reimagines its exciting spatial possibilities. Like the great beautiful cities of near and far times, good planning and urban design has the ability to recreate cities characterised by a fine grain urban fabric of close proximities and richness, increased human interaction and enhanced conviviality.”

Mr Terence Seah
Divisional Director
Head of Singapore Studio
Benoy

Although frequently underestimated, parking is a critical factor in individual mobility choice. According to research conducted by the Paris-based firm Sareco, people choose their modes of transportation for urban trips based on the parking conditions at their origins and destinations.⁵⁷ Hence, even with excellent access to public transport, workplaces that provide ample parking spaces at affordable rates are likely to prompt both staff and visitors to drive. Similarly, a generous supply of residential parking lots at trip origins encourages vehicle ownership and reinforces the notion of parking as an entitlement. In other words, “counterproductive” parking policies can undermine cities’ efforts to optimise precious urban land use and promote “car-lite” urban mobility.

Cities first need to make better sense of their current parking usage. On the supply front, public agencies should take the lead to consolidate parking supply data and put together a city-wide parking inventory. On the demand side, with the help of technologies such as electronic parking and vehicle identification systems, city governments can partner with businesses and commercial car park operators to develop a better understanding of the pattern and duration of parking demand. Data collected from such parking surveys can be made available for research purposes while maintaining commercial and personal confidentiality to enable the development of more proactive policy interventions.

A more stringent parking provision framework that caps parking supply within individual developments has proven to be an effective parking reform tool. For existing developments with excess parking provision, the public sector can encourage the conversion of underutilised parking spaces for alternative revenue-generating uses through incentives such as granting of bonus Gross Floor Area (GFA).

Nonetheless, to prevent an overly broad-brushed approach, such reviews can be fine-tuned by calibrating provision standards against factors such as public transport accessibility, access to amenities and services, and so on. In larger, new development areas, consolidated public parking provision, coupled with district-wide parking strategies, should always be considered to encourage more efficient sharing of parking facilities and minimisation of space redundancy. To discourage private car ownership, car-sharing parking lots should also be provided whenever new car parking provisions are made within newly-built development projects, and be given greater ease of accessibility compared to normal parking lots, similar to electric vehicles or handicap spaces.

Parking rates have always had a significant impact on parking usage. Season parking or full-day parking passes do not reflect the real cost of parking spaces. In addition, as parking demand varies during different times of the day and locations, the conventional parking pricing system that is less sensitive to time and space has shown its limitations in managing parking spaces efficiently. Cities like San Francisco and Los Angeles have attempted to solve

this problem by piloting new demand-responsive systems that enable more systematic and precise price-setting. For instance, SFpark, San Francisco's new pricing programme, enables parking rate variation differentiated by intricately segmented parking zones, time of day and day of the week. Frequent price adjustments are also made based on occupancy data and occupancy targets.

Last but not least, to ensure that parking planning and management are more aligned with overall land use and transport policies, it makes sense to house municipal parking policies under a single authority. In doing so, the role of parking policy as a powerful travel demand management tool can be significantly enhanced.

"Plentiful parking promotes car ownership and driving, and is incompatible with a 'car-lite' city. Yet, Singapore requires parking with every building, based on an outdated fear that parking shortage means chaos. Cities such as London and Berlin have, without problems, abolished such minimum parking requirements, allowing developers to build less parking, especially in transit-rich locations where buildings can succeed with little or no parking. How do such cities achieve parking success without requiring excess? Modern parking management is key, enabled by digitally-enhanced enforcement and context-responsive pricing."

Prof Paul Barter

*Lee Kuan Yew School of Public Policy
National University of Singapore*

"CAR-LITE" COMPATIBLE PARKING STRATEGIES



CONVERT UNDERUTILISED PARKING SPACES:

Transform underused parking spaces into alternative revenue-generating uses through incentives such as granting of Gross Floor Area (GFA) bonuses.



HOUSE MUNICIPAL PARKING POLICY UNDER A SINGLE AUTHORITY:

Centralised authority to enhance parking policy as a powerful travel demand management tool.



SHIFT FROM MINIMUM TO MAXIMUM PARKING STANDARDS:

Limit parking supply, particularly in areas with good access to public transport. Abolish parking minimums and include on-site parking as floor area for new developments.



BETTER & SMARTER ENFORCEMENT:

Dedicated wardens and surveillance through CCTV to allow for effective enforcement. Impose proportionate penalties against habitual violators.



RESPONSIVE PRICING:

Demand-responsive pricing of parking that enables more systematic and precise price-setting for different parking zones based on occupancy data and targets.



CONSOLIDATED PUBLIC PARKING PROVISION:

Replace on-site private parking with consolidated public parking to encourage efficient sharing of parking facilities and minimise space redundancy.



DEMAND-MANAGEMENT STRATEGIES:

Gather parking supply data through electronic parking and vehicle identification system to understand patterns and durations of parking demands. Data to be made available for research purposes to enable proactive policy interventions.

Most drivers are seldom fully aware of car-running costs. If, with the assistance of information technology, they can obtain accurate information about the full, real-time cost of their journeys and at the same time enjoy easy access to alternative modes of travel, they may be persuaded to leave their cars behind more often.

The experiences of London, Milan, Singapore and Stockholm in the past decade have shown that congestion charging can be a very effective mobility demand management instrument that could be accepted over time despite its initial unpopularity. However, the “pay once and then drive as much as you want within the congestion zone” approach provides no incentive to avoid “frivolous driving”.

In Singapore, there are plans to take road pricing to a whole new level. Expected to be implemented by 2020, the existing electronic road pricing (ERP) system will be upgraded to one that uses satellites to determine when a vehicle enters a priced zone as well as the distance it clocks within the zone.⁵⁸ With this distance-based road-pricing system in place, drivers are expected to move away from a “one-time payment” mindset to that of “pay-as-you-use”, and hence become more mindful of the costs of their vehicular usage when entering a congestion charging area.

Many cities have also used measures such as vehicle quota schemes to control the number of privately-owned vehicles. Nonetheless, the cost structure of such measures has a significant bearing on whether they are “car-lite” compatible. In cases where high sunken costs are

incurred upfront to obtain such quotas, car owners tend to use their cars more intensively. Here in Singapore, private cars clocked up an average mileage of 17,800 kilometres⁵⁹ in 2013, far higher compared to other high-density cities like Hong Kong, Tokyo and New York.⁶⁰ To tackle this problem and encourage “lighter car usage”, tweaking the cost structure of the quota licence system to be distance-limited, rather than duration-limited, could be the way to go.⁶¹

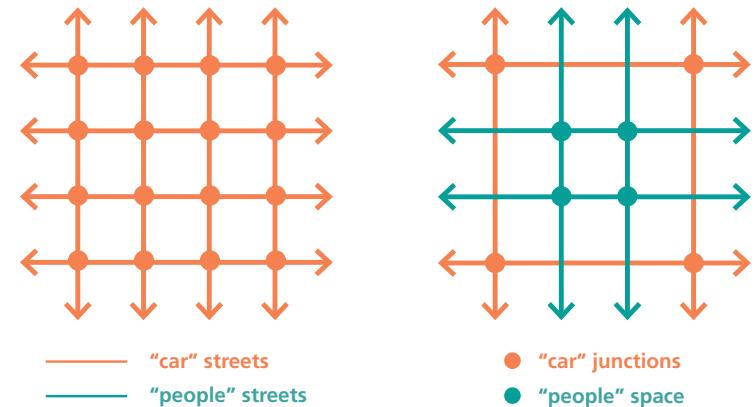
IDEA NO. 7 TURN STREET DESIGN ON ITS HEAD

In many cities, prevailing traffic planning and street design are still biased towards avoiding any possible delays for car users. Each time a new development is added to the road network, the surrounding roads are expanded with the aim of maintaining the efficient flow of vehicular traffic. Unfortunately, streets that are designed to never choke up are great for cars, but terrible for anyone else. As part of the mobility paradigm shift, it is therefore critical to recognise the dual functions of streets as both “links” and “places”, and re-prioritise street design in favour of pedestrians, cyclists and public transit users wherever possible.

It is a common misconception that creating “car-lite” urban districts simply means banning cars and removing roads everywhere. Looking to debunk this misconception, cities like Barcelona are exploring the reconfiguration of their existing local transport network within built-up neighbourhoods to

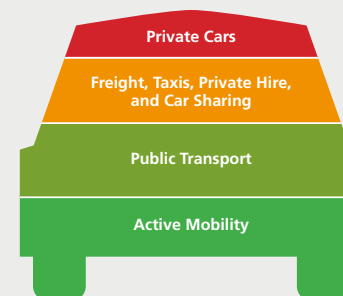
create people-friendly “superblocks.” Within each superblock, several smaller city blocks would be joined together, with pedestrians and cyclists being given priority. All motorised traffic are generally restricted to the roads in the superblock perimeters only, except those driven by residents, local businesses, urban services and emergency services which would be required to drive at a very slow speed, and be rerouted to

the periphery of the superblocks while pedestrians and cyclists will be given priority on all the roads within them. Upon implementation, Barcelona expects to remove fast-moving motorised traffic from 60% of its roads. With the elimination of traffic intersections within these superblocks, the city can therefore increase its provision of public space, parks and greenery.

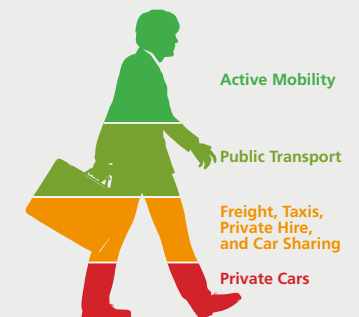


Street Design: How it Actually is vs. How it Should be

CAR-CENTRIC
How it actually is now



PEOPLE-CENTRIC
How it should be in a sustainable scenario





People-oriented, car-free streets in Barcelona. (Source: <top> Sarah Magwood @ <https://flic.kr/p/2ViSXz>; <bottom> Lisa Brideau @ <https://flic.kr/p/huwBtU>)



Emerald Hill Road, one of Singapore's first example of a shared street. (Source: Choo Yut Shing @ <https://flic.kr/p/pythcK1>)

Even for expressways and arterial roads that provide key links across the city, designing them innovatively to be inclusive for all modes of mobility is worth exploring. In Singapore, the government's plan to redesign a planned major expressway corridor⁶² to also incorporate cycling and walking paths and express bus lanes has been hailed as a bold move towards making walking, cycling and public transport the way of life for Singaporeans. Decisions like these ensure that all transport infrastructure investments, no matter big or small, are strictly congruous to the nation's "car-lite" vision.

Ultimately, a paradigm shift towards "car-lite" mobility requires a fundamental review of the way cities design their streets, such that multimodal streets that look after the safety and needs of all users are no

longer treated as special projects, but as a norm for all road network expansion and improvement projects.

"One of key areas when we plan for our 'car-lite' vision is not to look at it in the obsession of removing cars but to look at it from a more holistic point of view which is the experience of the people. For instance, walking along linkways and overhead bridges are actually not a very fun experience for people. But, if I can walk and cycle through streets that are filled with interesting stalls and activities on my way to the office, then that is an experience."

Dr Arthur Aw
Chief Development Planning Officer
Ascendas Singbridge

PARIS

Reclaiming Car Space for People

Over the past 10 years, 40% of Paris' population has shifted from driving cars to taking public transport or riding bikes, and only 7% of Parisians still use cars to commute on a daily basis.⁶³ This has not all happened by chance. While London-style congestion pricing was ruled out as a tenable solution to curb car traffic from a political and social equity point of view, the city, under the helm of former Mayor Bertrand Delanoë and current Mayor Anne Hidalgo, has similarly found other means to achieve its sustainable transportation agenda.

PLACEMAKING-LED URBAN TRANSFORMATION

In the two decades leading up to the millennium, Paris' urban policy had adopted a largely pro-car agenda. After Mayor Delanoë took office in 2001, he was determined to change this by finding the right places for cars in a dense and historic urban environment which had great potential to become much more people-friendly. To do this, the Mayor and his team re-examined how urban spaces were used and allocated, and decided on

a redistribution of public space in favour of pedestrians, cyclists and public transit.

During Delanoë's 13 years in city hall, many streets in Paris were redesigned to accommodate dedicated bus and cycling lanes. As this often involved the reallocation of car lanes or on-street parking, the expansion of the network did not come without its challenges. For instance, in the neighbourhood of Montparnasse, there was a huge outcry amongst the local community over how the loss of on-street parking to a proposed bus lane would "kill" the neighbourhood and its businesses.

Nonetheless, the city pressed on with its efforts to re-appropriate streets. According to the Institute of Transport and Development Policy (ITDP), within a short period of five years from 2003 to 2007, Paris' overall on-street parking supply was reduced by 9% (or 14,300 lots), while 95% of free lots were turned into paid parking lots.⁶⁴ During the same period, in the place of those lost parking bays, bike parking, car-

sharing lots, bus and tram corridors, as well as over 1,400 bike-sharing stations sprouted up across the city.

NO TURNING BACK—RIDING ON THE MOMENTUM TO RECLAIM MORE PUBLIC SPACES

During his tenure, Delanoë successfully re-oriented key public policies to focus more on enhancing the quality of urban space and peoples' urban experience. In fact, such a directive has become so entrenched in the political discourse that when Hidalgo took over as Mayor in 2014, carrying on the lasting legacy of her predecessor had become the obvious thing to do.

Along the River Seine, where Delanoë had championed the pedestrianisation of its Left Bank, Hidalgo announced plans in mid-2015 to replace a busy highway along the Right Bank with gardens, playgrounds and riverfront walkways.⁶⁵ Shortly after, the city and its leader rolled out further ambitious plans to transform the French capital's urban landscape. This included the €30-million infrastructure funding allocated to a complete makeover of seven of Paris's iconic public spaces

including Place de la Bastille and Place de la Nation between now and 2020.⁶⁶ Supported by a mandatory regulation, 50% of each square's surface area will be pedestrianised, while road traffic would be confined to lanes that are less than 12 metres wide. Where feasible, Paris will continue to introduce more "people spaces" such as new green spaces for people to sit, as well as weekly markets.

REDESIGN PROCESS SUPPORTED BY DATA AND EVIDENCE

It is worth highlighting that the redesign of Paris' public spaces goes beyond just churning out beautiful plans. Very often, the process is backed by comprehensive data analysis of existing usage patterns, user profiles, traffic volume of various modes, etc. In time to come, the city also hopes to work with companies that provide dynamic urban analytic tools to explore testing of various design scenarios.⁶⁷ Through an iterative process of designing, testing and redesigning, the decision-makers want to make sure that the best outcomes can be achieved and that public funds committed to these projects are well spent.



(Source: Christophe Marcheux (Own work) [GFDL (<http://www.gnu.org/copyleft/fdl.html>) or CC BY-SA 3.0 (<http://creativecommons.org/licenses/by-sa/3.0/>)], via Wikimedia Commons)



Paris: Previously a glorified traffic island, Place de la République was transformed into a place for people as part of a major public space revamp project in 2013. (Source: <top> Eduardo Llanquileo @ <https://flic.kr/p/a9Vm7Z>; <bottom> Panoramas @ <https://flic.kr/p/fpK3AC>.)

IDEA NO. 8 USE PUBLIC SPACES AS COMMON GROUND FOR PUBLIC-PRIVATE-PEOPLE COLLABORATIONS

Streets provide precious public spaces that support urban life. This function of streets is particularly important in high-density urban contexts, where public spaces that contribute to liveability are limited.

The role of the public sector to lead or initiate the transformation of car-dominated streets into people-oriented places is essential. As the custodian of public interests, the government needs to ensure that its interventions benefit the people while balancing the diverse interests of stakeholders.

However, governments cannot achieve this transformation single-handedly. Local communities and stakeholders have to be part of the process and solution to ensure that interventions and proposals align with local needs. Involving local stakeholders also helps to promote sustainability of the initiatives. Upon recognising the benefits that car-free or at least “car-lite” environments can bring to the neighbourhood—in terms of vibrancy, safety or more brisk businesses—communities would be more receptive towards investing the necessary resources to maintain the interventions, and even building on the initiatives over time. Such place-based collaborative efforts can also serve as an effective means to shift cultural mindsets by demonstrating tangible benefits for the people.

In Singapore, the Streets for People programme by the URA creates a platform for local communities to initiate

street closures, and transform their streets into car-free public spaces for events. Under this initiative, the URA formalised the street closure procedure, drew up guidelines (e.g., approval of surrounding stakeholders) and adopted the role of a middleman by assisting members of the public in navigating the process of street closure by connecting applicants to the relevant agencies, such as the Land Transport Authority (LTA), the Singapore Civil Defence Force (SCDF), the Singapore Land Authority (SLA), the Singapore Police Force (SPF) and the National Environment Agency (NEA).

Furthermore, necessary equipment for street closure (barriers, signs and safety personnel) and seed funding of up to S\$10,000 were also provided to offset costs incurred for agency clearance and marketing purposes.

“Here in Singapore, you have great examples of public spaces that are activated, like Haji Lane. In fact, when it comes to creating vibrant public spaces, it is often much more effective when the public and private sectors work together, as compared to the government coming in to do a mega project. And you can even use public spaces to create a common platform so that the entrepreneurs can plug in, the non-profits and the local community can plug in, the business community can plug in, to use them as a platform, as we did in Chicago.”

Mr Gabe Klein

Former Transportation Chief of Chicago
and Washington DC

INTERVIEW WITH LORENZO PETRILLO LOPELAB

Streets for People, Not for Cars—Urban Ventures at Keong Saik Road



In response to increasing interest in Singapore for vibrant, car-free streets, the URA launched the Streets for People programme in July 2015 to support community-initiated street closures. Urban Ventures at Keong Saik was one of the initiatives under this programme. The CLC team spoke to Lorenzo Petrillo, the founder of LOPELAB, who started Urban Ventures and organised the first event on 12 March 2016.

Tell us more about LOPELAB.

LOPELAB is a Singapore Design Studio that aims to improve people's everyday lives through design. In the last year, Lopelab has completely transformed the way Singaporeans interact in public spaces through the installation of Urban Ventures, a series of road closures that focuses on connecting the community through art and music in public spaces.

What motivated you to lead the transformation of Keong Saik Road into a car-free street?

It all began with Singapore Design Week in March 2015, where I got the idea to propose a long communal dining table at Duxton Plain to allow people to enjoy dinner together. When URA launched the Streets for People programme, it was the perfect opportunity to initiate a street closure at Keong Saik Road, a popular road known for its vivacity and popular dining establishments. While waiting for the permit to be approved, URA officers suggested that I participate in PARK(ing) Day⁶⁸ held on 18 September 2015 instead, as it would be a more straightforward process administratively. I managed to get a few stakeholders along the street to fund some outdoor furniture such as hammocks and recycled materials to be placed on the parking lots. We transformed 20 to 30 parking lots along Keong Saik Road into interesting public spaces that day, and the success was instrumental in demonstrating the potential of pedestrianising Keong Saik Road.

The first installation of Urban Ventures was eventually held on 12 March 2016 under the Streets for People programme. We hosted yoga classes, craft workshops and music



Community-initiated street closure event at Keong Saik Road, Singapore. (Source: Urban Ventures by LOPELAB)

performances by home-grown artists on the street. These activities demonstrated how streets can be reimagined, instead of allocating the space exclusively to cars.

Where were the challenges you faced in the process?

Convincing the stakeholders to participate was one of the key challenges. There were no organised business associations on Keong Saik, so I had to reach out to the stakeholders individually. I held six to seven meetings with them in order to explain what I intended to do with the street closure, and to convince them of the benefits. On top of that, I had to seek funding contributions from them to support bringing in

other activities such as performing artists as part of the event.

Getting a permit from the authorities also took up time and effort. While URA was helpful in facilitating the approval of permits from other agencies, as the organiser for the event, I had to prepare and provide all the necessary information for authority clearance for the event. In fact, there were instances of multiple agencies requesting for the same information and this meant I had to go through the same paperwork with each of the agencies!

How did you manage to persuade the stakeholders at Keong Saik to participate in the car-free event?

The key was to convince business owners of the potential returns for investing in the event. Fortunately, those who were supportive of the initiative were able to take a longer-term perspective in anticipation for higher footfall contributed by the pedestrianisation efforts. However, some restaurant owners were also concerned, as the majority of their patrons tend to arrive by private cars. This was easily addressed by re-directing parking to alternative locations in the area.

Beyond the three planned editions of Urban Ventures, I intend to apply for a six-month trial period for weekly road closures on Saturdays. This would create more flexibility for planning, and enable business owners to see the sustained benefits



Activities at Keong Saik Road during street closure event. (Source: Urban Ventures by LOPELAB)

of a pedestrian-friendly environment over a longer period of time, as opposed to an ad hoc, one-off initiative. Once people are able to see the benefits, they will embrace it!

The process of organising the street closure also allowed the businesses along Keong Saik to get to know each other better. As business owners and operators, we spend most of our time on this street. Hence, there is great incentive for us to organise ourselves into a community, take ownership, and position Keong Saik Road as a cool and vibrant neighbourhood.

What are some factors behind the success of Urban Ventures @ Keong Saik? What do you think could be done better?

Urban Ventures @ Keong Saik was successful as we differentiated the event from other street closures by creating a diverse mix of non-

commercial activities, such as inviting local artists to perform in a public setting. This diversity provided a more interesting urban public space experience. That being said, non-commercial activities still require substantial funding—artists need to be fed too! We need a mix of commercial activities to ensure sustainability of such community events. This will contribute to the funding requirements for the event too.

More flexibility could also be provided by the agencies on the restriction of commercial activities with street closures. If the authorities impose certain restrictions on commercial use, as they see the value of such non-commercial activities in creating more diverse and enjoyable public spaces, perhaps more public funding support could be given to encourage these non-commercial activities.

**IDEA NO. 9
DRIVE CHANGE THROUGH
DATA-DRIVEN RESEARCH AND
PILOTS**

While the process of trial-fail-iterate is embraced in the private sector, this mentality is typically absent in the DNA of public agencies. However, under the leadership of open-minded and innovative leaders, cities such as New York and Washington DC are showing that low-cost and quick-build urban projects can be highly impactful, and that doing it right can be a win-win situation for both governments and businesses. In times of tight budgets and uncertainty over a project's worth, governments can use pilots to determine the optimum solution. As part of Washington DC's revamp of its parking system, the city decided to try out eight different parking systems by eight different companies before settling on the final configuration with inputs from the public who had used the systems. Companies loved the idea too, as nothing beats being able to test their products and services out in the real world.

Pilots also provide excellent opportunities for evidence-gathering. For mobility modes like walking, cycling, personal mobility devices (PMDs), car-sharing or ride-hailing, the amount of reliable and accurate data necessary to support their growth still remains extremely limited in most cities. This is because reported travel data collected via conventional methodologies such as household travel surveys often fall short of providing an accurate snapshot of their usage to inform policy and funding decisions. However, through pilots and trials, data can be gathered to enable a better understanding of usage patterns, user profiles and sometimes "latent demand" associated with some of these modes.

As Ms Janette Sadik-Khan, former New York transportation commissioner, well-known for tackling tough challenges and building consensus through her data-driven approach, puts it, *"It was all about the data. If it works better for traffic, if it was better for mobility, if it was safer, better for business, we would keep it; and if it didn't work, no harm, no foul, we could put it back the way it was."*



New York: Broadway at Times Square before and after transformation. (Source: New York City Department of Transportation)

“City leaders can be more open-minded about using the city as a lab and open up its streets for creative solutions to be test-bedded. In Copenhagen, our Street Lab initiative offers real urban space for private companies to test out their smart city solutions. It helps showcase the potential of new technologies and urban solutions to citizens and decision-makers, and also provides a proof of concept for their scaling-up elsewhere.”

Mr Morten Kabell

Mayor for Technical and Environmental Affairs
City of Copenhagen

SEOUL

Transforming City Streets through Data-Driven Pilots

Seoul’s recent efforts to transform its mobility paradigm from a car-dominated one to a public transport and pedestrian-focused system have captured the attention of urban practitioners. Driving this change was a series of pilots backed by rigorous data collection to better inform planning and decision-making.

DEOKSUGUNG-GIL— EXEMPLIFYING THE BENEFITS OF A PEDESTRIAN- FRIENDLY ENVIRONMENT THROUGH PILOTS

Deoksugung-gil is a street in downtown Seoul popular with lunchtime crowds from the surrounding office buildings. However, the narrow street meant that pedestrians often spilled onto road spaces and mixed with vehicular traffic, creating safety concerns.

In May 2014, the Seoul Metropolitan Government (SMG)

conducted a pilot pedestrianisation of the street for two hours during lunchtime where all vehicles were prohibited from entering the car-free zone. During the two hours, pedestrian volume increased by 5%. When surveyed, over 90% liked the idea of a pedestrian street and more than 50% wished that the street could be car-free every day.

The positive survey results from the pilot helped strengthen the case for a regular pedestrianisation programme at Deoksugung-gil. After gathering opinions from denizens and monitoring the area, various facilities were improved before plans for turning the street closure into a regular operation were put in place. For example, motor-operated bollards were installed at the entrance of Deoksugung-gil and parts of the walkway were expanded. Some of the bollards within Deoksugung-gil were removed or changed to avoid creating obstructions for pedestrians.



Seoul: Lunchtime crowds at Deoksugung-gil before and after pedestrian-friendly improvements. (Source: Seoul Institute)

The regular lunchtime pedestrianisation of Deoksugung-gil was implemented swiftly by September 2014. To generate more buzz and interest, an event planner was appointed to curate different themes for each day of the week.

YONSEI-RO TRANSIT MALL—MITIGATING TRAFFIC IMPACT OF TRANSIT MALL THROUGH PILOT ROAD CLOSURES

Yonsei-ro is a popular 550 metres-long commercial street in Seoul’s Sinchon district, where several major universities in Seoul are located. The street was selected as the first transit mall to be implemented in Seoul, as part of Seoul’s plan to create an urban environment that puts people and public transport first. The aims were multifold—to reduce demand for private car use; to bring about urban rejuvenation; to enhance the public transport experience; and to improve the pedestrian environment.

Before implementation, Yonsei-ro was a congested and accident-prone

street with an average travel speed of only 10 km/h—far lower than the average travel speed of 25 km/h on Seoul’s main roads. The street was also crowded with pedestrians who were confined within narrow sidewalks.

Planners saw how a transit mall could potentially cause congestion, as cars would need to detour around the transit mall. A traditional traffic simulation model could only reflect how unfeasible the proposal was, and indicate the risk of congestion spreading to the surrounding area. To fully analyse the real impact of vehicle restrictions in Yonsei-ro, SMG implemented two car-free days on Yonsei-ro and collected data during these days. Analysis of the collected data indicated that vehicles going north-to-south were re-directed across nearby roads and did not contribute to the congestion in the surrounding areas. However, most of the vehicles going south-to-north had to pass an alternative three-way intersection in Donggyo-dong and make detours through Yanghwa-

ro and Yeonhui-ro, increasing congestion on these two roads. An alternative detour route for vehicles going towards Susaek was identified as a suitable way to address this congestion. To mitigate this, the city built an intersection in front of the underpass for Sinchon Train Station.

The above measures helped to contain the impact of the transit mall on congestion within the area, and showed that traffic impact need not be a deal-breaker for pedestrian-friendly projects. SMG also engaged and worked with the stakeholders to develop solutions for the design and management of the transit mall.

The proposed transit mall was successfully completed in January



Seoul: Yonsei-ro before implementation of transit mall. (Source: Seoul Institute)

2014. The benefits of the transit mall were immediately clear—traffic accidents fell by 34% just six months after the opening of the transit mall, and the number of visitors using public transport increased by 11.1%. The transit mall also brought financial benefits. Compared with 2013, the number of visitors who patronised the shops in Sinchon rose by 28.9%; the number of transactions that resulted in revenues went up by 10.6%, and total revenues rose by 4.2%. With the success of Yonsei-ro, SMG is actively seeking other suitable sites in Seoul to implement more transit malls and further reduce the city's reliance on private cars.



Seoul: Vibrant street life at Yonsei-ro after implementation of transit mall. (Source: Seoul Institute)

CONCLUSION

Many cities are often hesitant to carry out pedestrian-friendly projects due to concerns about potential traffic congestion arising from restrictions on vehicle access. Over-reliance on traffic simulation and modelling often fuel this bias, projecting the deterioration of traffic conditions based on current travel demand data, and leading to the expansion of road systems to accommodate an ever-increasing demand for private cars.

Having experienced serious traffic congestion that resulted in social costs totalling about US\$6 billion a year in the early 2000s, Seoul recognised the futility of car-based urban development on the one hand, and potential benefits of car-free environments beyond traffic

flow on the other. Seoul's evidence-based approach—which combined localised pilots and rigorous data collection—not only contributed to better-informed solutions, but also helped generate support among multiple stakeholders for the proposed pedestrian-friendly projects.

IDEA NO. 10 CHANGE MINDSETS AND MAKE “CAR-LITE” MOBILITY COOL

Commuters often make travel choices based on their perceptions of the convenience, cost, comfort and cool quotient of various mobility modes.⁶⁹ How far is the nearest bus stop? How much must we pay if we drive to office and park our cars in the CBD? Is the train crowded? How does it affect my self-image if I sell off my luxury car and start relying more on ride-hailing or car-share services? Instead of waiting for a change in mindset or accepting it as a given, the public sector can help shape commuters’ travel choices by influencing their perceptions. For instance, city governments could consider working closely with the media and educators to challenge the existing mentality that car ownership is a status symbol or lifestyle aspiration. By inspiring people with stories of high-powered executives or political leaders who take the train and squeeze in with the crowds on their daily

commutes, new norms can be shaped. As it stands, businesses or government agencies offering corporate travel plans have already brought about a growing public acceptance towards more sustainable travel modes.

When it comes to building a collaborative approach to change management, it is imperative that city governments lead by example by being open and proactive in communicating their visions and plans, and demonstrate that they are serious about activating and embracing change. While it is not an easy task changing people’s mindsets, effective and clear communication is of paramount importance because it creates better public awareness of mobility options and their impact. As a start, it would be useful to consider campaigns targeted at specific groups of audiences, such as schoolchildren, large businesses, public agencies, new residents and new employees moving into a certain area.



Cycling Skill Workshops for School Children. (Source: Green-Schools @ <https://flic.kr/p/sePhG2>)

“You have to start to market the savings to people, like you are with the big billboards for transit. When I started at DC, I had a car and driver but I rode my bike everywhere. Seven years later, a lot of Commissioners bike or walk, and are embarrassed to drive. Car ownership should be like shark fin soup — you can create a different culture where people feel stupid and embarrassed buying a car.”

Mr Gabe Klein

Former Transportation Chief of Chicago and Washington DC

TARGETED CAMPAIGNS TO GET “CAR-LITE” GOING!



SCHOOL CHILDREN: Targeting this group can influence the travel behaviours of both the younger and older generations, as today’s youths exert a powerful behavioural influence on their parents.



INCOMING RESIDENTS AND EMPLOYEES: Proactively offer them comprehensive information about sustainable mobility choices available, e.g., when they apply to open utility accounts or on their first day at work. Incentives such as discounted public transport season pass or a “trial voucher” for bike sharing, car clubs or PMDs rental could be offered before they become “addicted to driving”.



LARGE BUSINESSES: From multi-national companies (MNCs) and real estate developers, to shopping malls and hospitals, the travel choices and behaviours of visitors and employees of these key establishments can have a major impact on the mobility system. Effective intervention at the individual corporate level can lead to significant benefits collectively.



GOVERNMENT AGENCIES: Government officials need to walk the talk and show that they are serious in pursuing the “car-lite” agenda. Government premises should take the lead by adopting more stringent parking standards and by providing greater support to staff who commute on more sustainable modes of transport.

10 IDEAS TO PREPARE CITIES FOR A "CAR-LITE" URBAN MOBILITY FUTURE

1

Align Visions, Both Internally and Externally

- Internal alignment of vision across different teams within key agencies to ensure coherent efforts and targeted outcomes.
- Make sure all relevant agencies and stakeholders are on board to ensure transport planning is not done in isolation from other related policies.

2

Focus On People's Needs, Work With Competition To Find Win-Win Solutions

- Provide customer-oriented services.
- Public sector to encourage fair competition as a prerequisite for innovation, greater systematic efficiency and creation of an integrated package of "mobility as a service".
- Service providers to work with public sector to establish good understandings of newer mobility options such as ride-hailing and car/bike-sharing and their impact on the "car-lite" mobility ecosystem.

3

Create Development-based Mobility Demand Management Strategies

- End-users to play their parts in promoting sustainable travel behaviours.
- Develop site/estate-specific travel demand management plan that not only caters to local commuters' needs, but also ensures that all new development project contributes towards shaping cities' "car-lite" urban mobility.
- Monitor progress over extended time.

4

Expand Public Transport Amenities to Cover the First-and-Last-Mile

- Develop high-quality public transport network as the backbone of cities' future mobility system.
- Look beyond public transport network to also address commuters' first-and-last-mile needs.
- Public transport service providers to form strong intermodal partnerships with taxi, car-sharing and bike-sharing providers to complete the trip ecosystem.

5

Planning Matters!

- Use planning to address underlying causes, instead of symptoms, of urban mobility challenges by finding ways of avoiding or shortening trips in the first place.
- Bring jobs and homes closer to each other.
- Encourage high-density mixed land uses around public transport nodes.

6

Put A Stop To Cheap And Easy Parking & Reflect The Full Cost Of Driving

- Ensure better understanding of current parking supply and demand to facilitate development of proactive policy interventions.
- Consider a set of more stringent parking provision framework but calibrate provision standards against factors such as public transport accessibility and access to amenities and services.
- Price parking correctly by exploring demand-responsive systems with the help of technologies.
- District-wide parking strategies to encourage sharing and minimise redundancy of parking spaces.
- Ensure car owners are fully aware of car-running costs to make better travel choices.

7

Turn Street Design on its Head

- Get the fundamentals right by reviewing prevailing traffic planning and street design which generally prioritise vehicular traffic.
- Fine-tune road categorisation and street design in favour of pedestrians, cyclists and public transit users wherever possible.
- Make "complete streets" a planning and design norm.

8

Use Public Spaces as Common Ground for Public-Private-People Collaborations

- Public sector to lead/initiate transformation of car-dominated streets into people-oriented places.
- Communities, businesses and other stakeholders to be included in developing their own "car-lite" mobility solutions/initiatives that are financially sustainable in the longer term and also sensitive to the local context.

9

Drive Change through Data-Driven Research and Pilots

- Embrace "trial and error" in public sector's decision-making process.
- Use quick and cost-efficient pilot programmes to establish optimum and gather evidence.

10

Change Mindsets and Make "Car-lite" Mobility Cool

- Proactively shape perceptions instead of waiting for mindsets to change.
- Influence commuters' travel choices through creative use of media, education and campaigns.
- For a start, target specific groups of audiences, such as school children, corporations, public agencies, new residents and new employees.



CHAPTER 7



(Source: CLC & ULI)

CONCLUSION

Many argue that a “car-lite” mobility paradigm is a future that cities are not ready to embrace because private transport would still be indispensable. Without good alternatives for car users, any sanctions against private car ownership and usage will not be viable or politically palatable.

However, the reality is that the future is now or never—given the rising demand for transport from a rapidly urbanising world with a population size in the billions, cities simply have no time to waste but to proactively pursue an alternative mobility model that is less dependent on cars.

Globally, we have seen an unprecedented amount of resources and effort invested in reducing the negative impacts of car-oriented transport. Nevertheless, cities around the world—new and old, developed and less developed, high-density and low-density—still struggle with the daily challenges of traffic congestion, air and noise pollution, accidents and death on the roads. To move from a car-heavy to a “car-lite” mobility paradigm, cities need the support from all relevant stakeholders to tackle the root cause of the issue, instead of responding to the individual challenges and surface symptoms of traffic congestion, pollution and so on.

While there is no shortage of well-tested tools and measures that can be adapted and applied to improve the performance, affordability and efficiency of the mobility ecosystem, the deployment of technical solutions alone is insufficient. The execution process of these strategies and plans matters just as much, if not more. In other words, the art of driving the changes is just as important as the science behind it.

Going forward, a better mobility future has to be one that is **“for people, by people”**.

For people: It is crucial that city leaders and policymakers think on a human scale whenever they make key transport and urban decisions. By considering its people’s needs and well-being when developing urban infrastructure and policies, cities generate a benign cycle that demands for more people-centred urban solutions. As Janette Sadik-Khan, former transportation commissioner of New York, puts it:

“By designing infrastructure and developing real estate to support people who walk, ride bikes or take public transit, cities aren’t merely meeting existing demand, they are creating demand for the kind of growth the city wants to see, and needs to survive. If planning past is prelude, cities that invest in sustainable streets will get what they build for.”⁷⁰

By people: A point that is repeatedly emphasised throughout this book, the public sector can no longer work alone to drive this much-needed paradigm shift in urban mobility. Instead, it must work closely with innovators and city dwellers to provide the best mobility service package that will eventually turn the need or even the desire for private car ownership into a thing of the past. The journey from car-heavy to “car-lite”

may not be simple or straightforward. However, with a common vision and coordinated efforts from all sectors, we can achieve a more sustainable urban mobility that can dramatically improve the liveability and competitiveness of cities.

The future of urban mobility is in our hands.

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Creating Liveable Cities through “Car-lite” Urban Mobility

Singapore’s approach to urban mobility has been widely regarded as a policy success story. From curbing private car ownership to improving public transportation services, the government has continually sought to balance the mobility needs of the people with economic growth and a sustainable environment. In 2014, the government launched a new Sustainable Singapore Blueprint to guide the nation’s development over the next 15 years. By prioritising measures to reduce reliance on private transport in the Blueprint, the government signalled its commitment to a “car-lite” vision.

Building on this, the Centre for Liveable Cities (CLC) and the Urban Land Institute (ULI) held a series of dialogue sessions led by Dr Limin Hee and Mr Scott Dunn to explore the future of urban mobility through solutions such as car-free neighbourhoods, car-sharing, autonomous vehicles, and consolidated goods movement. To realise a “car-lite” vision in Singapore, a wider range of well-integrated, efficient, and comfortable alternative mobility options is needed so that Singaporeans will no longer feel the need to drive. At the same time, the potential impact on land use, development rights, real estate value and alternative roadway use should also be evaluated.

Taking input from public- and private-sector stakeholders as well as a distinguished review panel, this book offers ten ideas to prepare cities for a “car-lite” future. These ideas can guide policymakers, governments and businesses in understanding how mobility changes as density increases and technologies disrupt in order to better plan for infrastructure that enhances liveability.

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