



ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Safe, Attractive, and Sustainable Cities: A mobility-oriented approach

Master's Thesis

Author: James Speirs

SCIPER N°: 276118

Supervisor: Prof. Matthias Finger

Course: Innovative Governance of Large Urban Systems (IGLUS)



INNOVATIVE GOVERNANCE
OF LARGE URBAN SYSTEMS

Acknowledgements

I would like to thank my parents for their patience and love without which none of this would have happened. My gratitude to friends and family for their support and guidance throughout this process. Particularly, Francine, Hanna, Emma, Michael, Stuart, Tara, Astrid, Brenda, and Nicco for advising and inspiring me.

I am indebted to Think City and the research fellowship which allowed me to better understand Malaysian cities and the complexities which shape them.

Abstract

Cities are complex systems which shape and are shaped by their transportation networks. Many cities have become dependent on cars as their principal mode of mobility. The consequences have been expensive, environmentally destructive, and deadly. While many acknowledge cars as problematic, they have become entrenched. This dissertation examines what alternatives cities have, the advantages of the alternatives, and the difficulties in implementing them.

Table of Contents

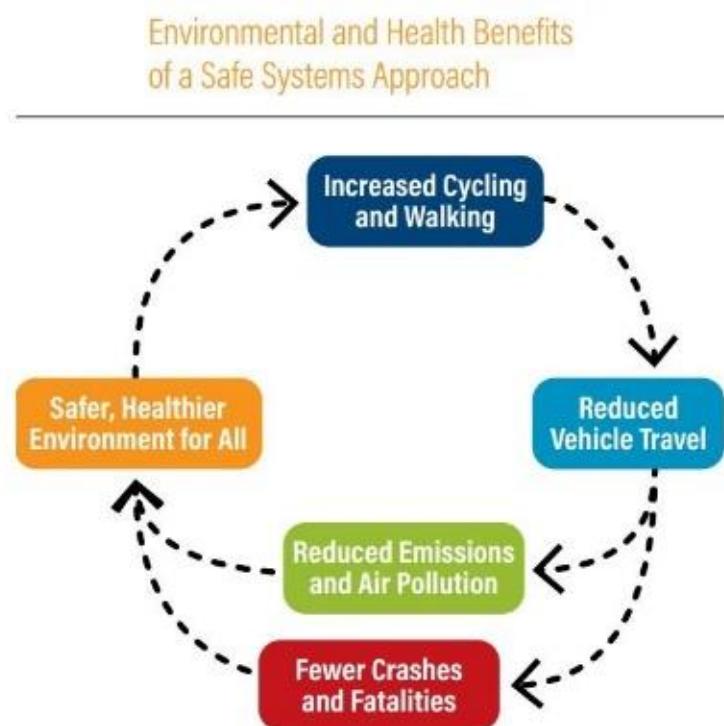
Acknowledgements.....	1
Abstract	1
Research Question.....	4
Key Concerns	4
Abbreviations	5
Chapter 1: Introduction	6
Cities as Systems	6
Literature Review	7
Scope	9
Multi-dimensional Approach	9
Focus on Malaysia	11
Chapter 2: The Cost of Cars	15
Economic Cost	15
Path Dependency.....	15
Congestion.....	17
Infrastructure: Looking Ahead	18
Road Collision Costs.....	19
Social Cost	20
Dividing Lines: Class and Race.....	21
Elderly People	24
Children.....	25
Case Study 1 – SJK Vivekananda	27
Environmental cost.....	29
Conclusion	29
Chapter 3: Healthy, Safer Cities	30
Healthier Cities.....	30
Air Pollution.....	30
Noise Pollution	33
Physical Activity and Associated Health	34
Safer Cities, Safer Streets	35
Conclusion	37
Chapter 4: Ineffectual Solutions	38
Increased Roads – Induced Demand.....	38
Smart City Technology	39

Electric / Autonomous Vehicles.....	40
Conclusion.....	40
Chapter 5: Effective Solutions - Incentives	41
Land Use Planning.....	41
Mixed-Use Development	42
Transport Oriented Development (TOD)	43
Polycentricism.....	43
Case Study 2 – Kota Kinabalu’s density distribution	45
Prioritise Safety	46
Road Design	47
Traffic calming.....	49
Pedestrian Infrastructure	50
Accessibility.....	52
Pedestrian Bridges and Underpasses	55
Mixed-Use Paving and Shared Spaces.....	58
Integrated Public Transport.....	60
Single System – Single Ticket.....	60
Data – Open and Accessible.....	61
Buses, BRT, and Rail.....	61
Taxis and Ridesharing.....	62
Bike-sharing.....	64
Case Study 3 - Sunway BRT: a cautionary case	65
Chapter 6: Effective Solutions - Disincentives.....	67
Vehicle Tax.....	67
Fuel Tax	68
Fuel Subsidies in Malaysia	69
Tolls and Congestion Pricing.....	71
Parking.....	72
Parking Management and Pricing	73
Case Study 4 – Jalan Padang Belia.....	75
Chapter 7: Conclusion.....	80
Further Research.....	82
Bibliography.....	83
Academic Articles	83
Unpublished	84
Books.....	84

Organisation Publication	84
Government Publications.....	86
Newspaper Articles and Online Publications.....	86
Video	90

Research Question

- What are the most effective policies to create a positive feedback loop for safer, healthier, more attractive cities?



Key Concerns

- Social equity – mobility, accessibility, public spending
- Safety – fewer people injured and killed
- Environmental – air quality and climate change

Abbreviations

- 1MDB – 1Malaysia Development Berhad
- APAD – Land Public Transport Agency
- AQI – Air Quality Index
- AV – Autonomous vehicle
- BN – Barisan Nasional (Malaysian political party)
- BRT – Bus Rapid Transport
- CBD – Central business district
- DALY – Deaths and disability-adjusted life-years
- DBKL - Dewan Bandaraya Kuala Lumpur (Kuala Lumpur City Hall)
- DSM – Department of Standards Malaysia
- GDP – Gross domestic product
- GST – Goods and sales tax
- GTFS – General Transit Feed Specification
- IPCC – Intergovernmental Panel on Climate Change
- ISO – International Organization for Standardization
- KL – Kuala Lumpur
- KTM – Keretapi Tanah Melayu Berhad
- LRT – Light Rail Transit
- MAB – Malaysian Association for the Blind
- MCA – Malaysian Chinese Association
- MIC – Malaysian Indian Congress
- MIROS – Malaysian Institute of Road Safety Research
- MP – Member of parliament
- MRT – Mass rapid transport
- NMT – Non-motorised transport
- PH – Pakatan Harapan
- PPP – Public private partnership
- RM – Malaysian ringgit (currency)
- SEA – Southeast Asia
- SPAD – Suruhanjaya Pengangkutan Awam Darat – Land Public Transport Commission (now defunct)
- TOD – Transit Oriented Development
- UMNO – United Malays National Organisation
- UNESCO – United Nations Educational, Scientific and Cultural Organisation
- USD – United States Dollar
- VKT – Vehicle kilometres travelled
- WHO – World Health Organisation
- YDPA – Yang di-Pertuan Agong (Malay royalty)
- YWP - Yayasan Wilayah Persekutuan – Federal Territories Foundation

Chapter 1: Introduction

Consider the man on horseback, and I have been a man on horseback for most of my life. Well, mostly he is a good man, but there is a change in him as soon as he mounts. Every man on horseback is an arrogant man, however gentle he may be on foot. ... Believe me, young man, the man in the automobile is one thousand times as dangerous. The kindest man in the world assumes an incredible arrogance when he drives an automobile ... I tell you, it will engender absolute selfishness in mankind if the driving of automobiles becomes common. It will breed violence on a scale never seen before. ... It will destroy the sense of neighbourhood and the true sense of nation. It will create giantised cankers of cities, false opulence of suburbs, ruined countryside ... It will make every man a tyrant.¹

Cities around the world have become dominated by cars. This has not increased people's freedom of movement or granted greater access to the city. The reverse is true: people have become dependent on cars and millions of people sit in gridlock. The negative consequences reach much further. Families are destroyed by violent traffic collisions. Smog chokes cities affecting the health of millions of people while exhaust fumes exacerbate climate change. Numerous illnesses arise from inactivity. Maintaining such a system carries a substantial economic cost. Finally, and significantly, our experience and enjoyment of where we live is compromised.

Cars have shaped cities in such a way as to ensure their own necessity. This is not, however, unavoidable. Proactive policies and decision making can reclaim cities, decrease dependency on cars, and increase access to safer, cleaner, more efficient, and healthier modes of mobility. To achieve this, we need assertive leadership to develop multifaceted policies to change how we move in cities.

Despite cars creating and perpetuating so many issues it is difficult to break the cycle of dependency. Many cities do not have the tools to address congestion and provide meaningful alternatives. This dissertation examines the problems associated with cars before looking at ways to discourage their use and facilitate better alternatives.

Cities as Systems

Cities are collections of systems which complement or cripple one another. These systems can feedback and reinforce each another or produce path dependencies which are hard to escape. Systems can generate momentum or can become paralysed with inertia. Cities must shape and direct the systems of which they are comprised to improve the lives of all who live in them.

This dissertation examines the transportation system in general and the mobility of people in particular (as opposed to goods). Many cities find that urban mobility systems have momentum. The direction these systems have taken, however, is inefficient, unsustainable, and dangerous. This direction is built on the prominence of cars.

As populations become more affluent their access to cars increases resulting in demand for additional infrastructure. This infrastructure often comes at the expense of other modes of transport which, in turn, makes driving more appealing. As more people drive alternatives become

¹ Lafferty, R.A. *Interurban Queen*, Berkley Publishing Corporation, 1970, pp. 1.

less attractive encouraging even more people to drive. This feedback loop continues and gathers momentum until the very urban form of a city is determined by the needs of cars.

When cities are shaped by cars they sprawl. Highways divide neighbourhoods making it difficult to use other modes of transport. Distances are too great to cycle and density too low to provide reliable public transport forcing residents to drive. Decades of investing in cars has made cars the only viable option for many communities. This is path dependency.

Many cities recognise this dependency on cars is undesirable. Breaking the cycle which perpetuates auto-oriented development, however, seems overwhelming. This paper considers how cities can put the brakes on cars – slowing their momentum and changing the direction of development of urban transportation systems.

For too long the complexity of urban mobility has been addressed with an oversimplified solution – cars. Modern cities require nuanced, multi-modal mobility options to adequately serve everyone. When cities begin investing and designing diverse mobility options, they can re-orient their transportation system. As alternatives increase, they become more attractive and gain momentum of their own. Nurturing this can lead to positive feedbacks which improve mobility, safety, and sustainability of cities. Creating this positive loop will be the focus of this dissertation.

Literature Review

This dissertation refers to a variety of sources to guide its reasoning, substantiate its claims, and provide illustrative examples.

Academic Publications

For academic enquiries the principal resource is generally academic publications such as journals. Naturally, this paper draws on numerous such publications.² Such resources are highly focused and specialised. Further, they are weighted with theory and exist as primary resources from which to build a foundation. While these are essential to any thesis, they do not make up the bulk of resources for this particular paper.

This is not the result of their being lacking information. On the contrary, this is because there are an excess of papers which discuss many of the key themes of this paper. While this research is invaluable and goes a long way to strengthen the arguments ahead many of the papers are narrow in scope. What they lack in breadth they make up for in depth. Many of these are technical and specialised. Often, this makes them less accessible – especially for government officials in previously colonised countries.

A fairly common concept, among academics examining transportation, is induced demand. This will be examined in some detail in Chapter 3, however, it suffices to say that when you build more roads it encourages more people to drive. This concept has been around for decades and has numerous studies detailing the rate at which it occurs from many different countries. This concept, however, has not made it into popular discourse. In my many interactions with senior government officials only one, Alan Wong in Kota Kinabalu, was familiar with the concept.

When what was commonplace in the academy is esoteric to those who implement policy and shape the cities in which we live there is a substantial problem. To address this, several organisations have examined the academic output and brought it together in more accessible publications and guidelines.

² This includes the use of a yet to be published paper from the University of Tennessee which will likely be published in the coming months.

Organisational Publications

To review and distil the substantial academic research is a difficult task and one which is best done through the reach of research organisations. Thus, this dissertation makes good use of publications and guidelines from a broad range of institutions.

The World Bank and World Health Organisation are giants in their field and provide data and statistics which no other organisations can. This information is extremely useful, especially in its comparative capacity. With relative ease, it is possible to see how many road fatalities occur in different countries and consider the relevant variables which may explain such phenomena. This is particularly useful for identifying global trends and garnering an appreciation of the scale of the issues at stake.

The World Resource Institute (WRI), National Association of City Transportation Officials (NACTO), and The Institute for Transportation and Development Policy (ITDP) bring a more nuanced international perspective. They draw on examples in cities across the globe to provide illuminating examples of success stories and best practice. Often, these publications are extremely practical in nature. They seek to provide solutions for cities which may not have the capacity or resources to independently conduct their research themselves. These documents are a source of innovative ideas, relatable case studies, and implementable solutions.

Think tanks such as Think City, The Penang Institute, and the Malaysian Institute of Road Safety Research provide vital contributions focusing on Malaysia. These organisations distil the available data further and tailor it for local conditions. Such work is vital and ought to play a larger role influencing national policy.

All these organisations have done a phenomenal job of creating accessible, informative, and balanced documents to help cities make better decisions. There is little which has escaped their scrutiny. By their very nature, however, they must be broad analyses of the problems which face global cities. While the academy produces research, which is highly specialised and narrow in scope, these organisations draw from many sources, producing widely accessible documents. These are designed to be as helpful for Kuala Lumpur or São Paulo as Johannesburg.

These cities face completely different issues. This is where this dissertation finds its relevancy. Rather than dwelling excessively on purely academic and highly specialised research papers it draws on the best reviews of global research. Leveraging the findings of international organisations to identify best practice, this paper hopes to bring it down to the tangible, practical level of Malaysian politics and policy.

To ensure the relevancy of this paper, however, it is crucial to stay up to date not merely with academic and organisational publications. Public discourse is vital to public policy and urban governance. Thus, this dissertation makes substantial use of newspapers and online publications.

Newspapers and Online Publications

Public discourse is vital for urban governance. Few academic articles, organisational publications, or international guidelines are accessible to the general public. Further, such publications tend to foster one-way communication rather than a dialogue. Newspapers and online publications are essential to reach the public and facilitate a public discussion around these ideas.

Many of these online publications are extremely reputable. Academics and professionals in the field also use online publications such as *Curbed* and *CityLab* to facilitate discussion and disseminate their ideas. While this is not peer reviewed in the same way an academic journal may

be, it can be argued that such publications are open to even more substantial scrutiny. Far more people read these and are free to reply and contribute to the public discussion. Thus, while the review process may not be as formal it is certainly thorough.

Added to this are the roles of newspapers – both local and international. Newspapers, be they print or digital, can be divided into news and opinion pieces. News covers events in real time and helps citizens know about developments in policy and infrastructure. It is principally descriptive. Opinion pieces are more normative in that they present what could or ought to be the case. These shape public opinion and can influence government plans and policy. In this way newspapers perform an important function for effective governance.

Such publications go a long way to educating the general public as they occasionally make their way onto social media and generate further discussions. The disconnect between the general public and international best practice is a substantial problem. While academics do not dispute the veracity of concepts such as induced demand, most people have never heard of such a concept. Thus, it is common that when congestion becomes a problem, voters demand roads are widened and capacity increased. It has been shown that the intuitive proposition that widening roads will alleviate congestion is not merely false but actively perpetuates the problem. These ideas, however, have few mediums through which to reach the general public if not through newspapers and online publications. These digital publications are essential for a better-informed public.

This is clearly not to say that all opinion pieces are in agreement or are correct. Quite the opposite. There are many dissenting views and many erroneous lines of reasoning but this precisely the point. Mistaken thinking is put out in the public and can be reviewed, discussed, and corrected. This may not always occur and occasionally poor ideas are put forward and accepted. This is all part of a Hegelian dialectic whereby the mistaken ideas may be accepted and implemented but in time the consequences will reveal the errors and allow them to be addressed and hopefully corrected.

Such digital publications have been used in this dissertation both as a resource for presenting some of the most progressive ideas concerning contemporary urbanism and to illustrate the kind of thinking which makes it to the general public. Further, included are articles written by the author in an attempt to influence public opinion as well as an article concerning the author's work in Kuala Lumpur.

Scope

Multi-dimensional Approach

Urban mobility is a complex issue which touches on many different elements. This paper examines the principal concerns without being so broad as to dilute them.

Safer, Healthier Cities

A central concern is to make cities better places to live. Cars compromise our safety as accidents regularly kill and injure people – particularly the most vulnerable. Emissions from cars compromise air quality affecting the health of all who live in cities. This pollution goes beyond harm at the local scale but contributes to global climate change.

Environmental Concerns

The inefficiency of private cars is a serious concern. Non-renewable resources are consumed rapidly by vehicles which often contain a single passenger. The emissions directly harm those who must breathe them while indirectly harming everyone by contributing to climate change. The heat generated from burning fossil fuels only contributes to urban heat islands and the associated problems. The solution cannot be “greener” private transport as the energy required and pollution generated manufacturing private transport is still incredibly high.

Equity and Class

Urban mobility has societal and environmental implications. How we move, or do not move, is a class issue. While the rich have access to multiple modes of transport and can live in more accessible areas of cities, poorer communities often face mobility issues in marginalised areas of cities. Sometimes this is not having access to light rail or bus transport. Other times it is lacking decent pavements and areas for pedestrians. Often it is both. This results in higher numbers of pedestrian deaths and injuries in poorer communities.

Alternatives to Cars – Pull and Push

Shifting urban mobility away from cars to safer, more sustainable options requires techniques that pull and push simultaneously. Alternatives to cars need to be provided. These must be sufficiently attractive to entice people to choose them. Trains must be on time, buses must be frequent, cycling must be safe, and walking must be pleasant. When alternatives are attractive, they pull users towards them making cities more sustainable, resilient, and efficient.

They are more sustainable as lower emissions are generated in the manufacturing and use of NMT. Cities become more resilient as transport becomes more multi-modal: thus, a breakdown in the bus service is less of a problem as there are alternatives.³ It is more efficient as 1) the energy consumed is human energy, 2) we decrease traffic congestion and increase mobility, 3) it is more cost effective. Regarding this final point, it is more cost effective as, although there is capital expenditure which cannot be reclaimed (you cannot toll a bike lane) the operational and maintenance costs of such infrastructure are almost non-existent (bicycles do not wear away paving like cars do).

To break the feedback loop and path dependency of auto-oriented cities, however, the pull of alternatives must be complemented by a push. Cars need to be discouraged. The best methods usually hinge on pricing models which make drivers bare the cost of the externalities associated with auto-oriented development. Practical alternatives are a prerequisite as punishing drivers without providing meaningful options is counter-productive. To institute policies which facilitate sustainable alternatives and discourage driving we require multi-level coordination between numerous stakeholders. Good governance lies at the centre of this.

Governance

First, the relevant stakeholders must be identified: national, state, and city governments, public transport operators, car owners, pedestrians, business operators, and the media. These interact and form a discourse around cities and the kind of communities people want. Often there are conflicting needs and desires. These must be negotiated and navigated in an open manner to ensure

³ Further – having a cycling culture can assist in times of crises. See for example the role of bicycles in the aftermath of the Mexico City earthquake in 2017.

De Jong, F. “Parks and bicycles were lifelines after Mexico City’s earthquake”, *CityLab*, 28 September 2017, accessed at <https://www.citylab.com/environment/2017/09/parks-and-bicycles-were-lifelines-after-mexico-citys-earthquake/541320/>

decisions can be made that can be understood by all and reflect the general interests of all stakeholders.

Transportation planning is particularly difficult as there are often disagreements about what constitutes efficient transportation. Many would simply widen roads and focus on the movement of cars. These people are almost always drivers who act, understandably, from self-interest. “Urban transport planning is fundamentally about moral and political choices – about what kind of cities we want for ourselves and our future generations, whether urban space is primarily for people or motor vehicles, and what we owe each other.”⁴

My research has included contributing to the master transport plan for the city of Kota Kinabalu in northeast Borneo. The plan is broad, ranging from pedestrian infrastructure, school buses, and a BRT feasibility study. The plan advocates policies for decreasing the number of cars on the road while increasing the modal share of NMT.

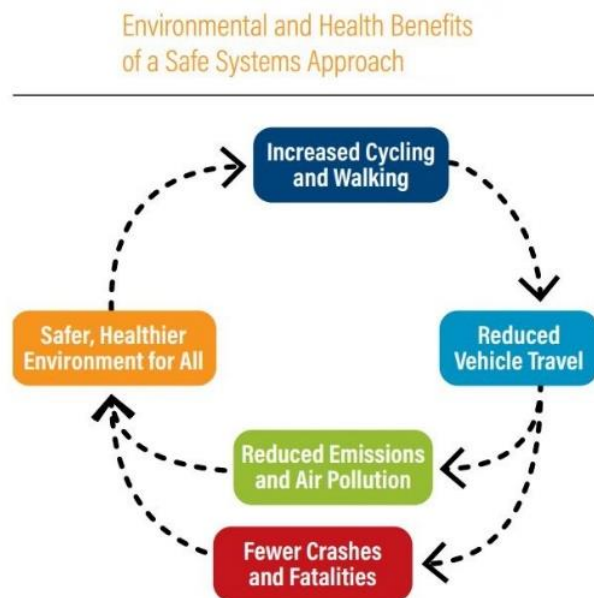


Figure 1: Making our cities safer creates a positive feedback loop.⁵

Focus on Malaysia

Cities around the world suffer from congestion and some of the problems and proposals contained in this document can be applied equally to Vancouver or Delhi. The focus, however, is on emerging economies which are seeing more people gain access to cars – often with fatal consequences.

Malaysia is a growing economy with aspirations of becoming a high-income nation. Large oil reserves allowed fuel to be subsidised for decades. This coupled with a national car manufacturer (Proton) facilitated some of the highest rates of car ownership in the world.

⁴ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 43.

⁵ Welle, B. et al. *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths*, World Resources Institute, Washington, 2018, pp. 24.

Government policy actively encouraged car ownership. Malaysia now suffers from heavy congestion and pollution. The government is attempting to address this is encouraging public transport. This makes Malaysia an ideal country to examine. With so much momentum behind car-oriented urbanism, what can cities do to provide an alternative which improves mobility?

Malaysian Governance

There are 13 states and three federal territories in Malaysia. Of the 13 states, 9 are headed by sultans while 4 are ruled by governors. The three federal territories and Kuala Lumpur, the administrative capital Putra Jaya, and the financial services island (tax haven) Labuan. These fall under the Ministry of Federal Territories and are headed by the Federal Territories Minister.

Barisan Nasional (BN), held power in the coalition known as the United Malays National Organisation (UMNO) since Malaya's independence in 1957. Until May 2018, the Prime Minister of Malaysia has always been from UMNO. In May 2018, however, BN's coalition government was voted out of power after ruling for 61 years. The following months resulted in substantial restructuring, much of which is ongoing. Many of the following observations were true at the time of the election and may have subsequently changed.

Federal

Malaysia is a federation of 13 states and three federal territories within a constitutional monarchy. This monarchy, or Yang di-Pertuan Agong (YDPA) is principally symbolic – rotating every 5 years from among the 9 sultans. True power lies with the federal constitution and the three branches of government – judiciary, legislature, and executive.

The judiciary purports to be independent, however, it is often perceived to serve at the pleasure of the ruling party. Its power to act independently was substantially eroded during the 1990s and it has not regained full independence.⁶ It is routinely used to curtail opposition and silence critics. It is not uncommon for people to be charged for the crime of insulting the Prime Minister on Facebook.⁷

The legislature is divided into the lower house, Dewan Rakyat (Citizen's Chamber), and the Upper house, Dewan Negara (National Chamber). The multi-party parliament is elected through a first-past-the-post system.⁸ The executive branch is headed by the Prime Minister and the cabinet who are chosen from both houses of the legislature.

Ministries

The Prime Minister's Department

Under BN rule this became a bloated cabinet as there are numerous overlaps: consider the Ministry of Agriculture and Agro-based Industry, the Ministry of Plantation Industries and Commodities, and the Ministry of Rural and Regional Development. There are two negative consequences.

Firstly, is institutional paralysis. Decision making is hampered as jurisdiction is unclear. If a farmer equally allocates resources to a palm oil plantation, rice paddies, and a homestay hotel

⁶ Milne, R and Mauzy, D. *Malaysian Politics Under Mahathir*. Routledge, New York, 1999. pp. 29.

⁷ Chelvi, S. "Two men and a woman claim trial to insulting Najib on Facebook", *The Sun Daily*, 18 August 2017, accessed at <http://www.thesundaily.my/news/2017/08/18/two-men-and-woman-claim-trial-insulting-najib-facebook-updated> and "Freelance photog (sic) claims trial to insulting PM on FB", *The Star*, 8 December 2017, accessed at <https://www.thestar.com.my/news/nation/2017/12/08/freelance-photog-claims-trial-to-insulting-pm-on-fb/>

⁸ This has caused some controversy with the current Prime Minister, Najib Razak losing the popular vote in the previous election. The ruling coalition only secured 47% of the vote but 60% of the seats in parliament (133 out of a possible 222).

which of the ministries does he fall under? To whom does he turn to for assistance? Secondly, there is a lack of accountability. If a problem arises in one sector it is easy to shift the blame between overlapping ministries until no one is accountable.

Malaysia has a third problem which is that some of the agencies which operate under the ministries are placed for political expedience rather than efficacy. An example which will be examined in greater detail is the Land Public Transport Commission (SPAD).⁹

One would assume that this operated under the Ministry of Transport which has 12 agencies under its purview. SPAD, however, fell under the Prime Minister's Department which oversees 91 agencies and organisations. These range from the Department of Statistics, the Malaysian Anti-Corruption Commission, the Election Commission, to Petroliaam Nasional Berhad (Petronas).¹⁰

It is worth noting how problematic some of these are. Most of the agencies and organisations would be better suited to the portfolio of other ministries. SPAD clearly belongs to the Ministry of Transport and the Department of Statistics would fit well with the Ministry of Home Affairs (with its total of 8 agencies). This could facilitate better oversight and more efficient governance.

The inclusion of the Anti-Corruption Commission, however, raises serious concern. The previous Prime Minister is embroiled in the largest corruption scandal in Malaysian history. Najib was named as Malaysian Official 1 in the 1MDB corruption probe initiated by the US Department of Justice. The news broke in July 2015. In August 2015 Najib replaced the incumbent attorney general. By January, the new attorney general exonerated Naib. Malaysian investigations have been reopened following his election loss.

Placing the Election Commission under the Prime Minister's department is also questionable. There have been sustained accusations of gerrymandering in both the local and international media. A damning article in *The Economist* documents rampant malapportionment – the act of making districts which support the opposition far more populous. Effectively, more votes are required to elect an opposition MP. The Malaysian constitution states that districts must be of approximately equal, however, the districts proposed by the Election Commission range from 18 000 to 146 000 voters. 14 of the 15 biggest districts are opposition areas while all but 1 of the 30 smallest districts support the ruling party.¹¹

It is understandable that The Economist Intelligence Unit's *Democracy Index 2017* categorised Malaysia as a "Flawed Democracy".¹²

⁹ SPAD played a crucial role in much of my professional work and research for this dissertation. Following the May 2018 elections there have been several shifts of policy deciding the fate of this organisation. This paper will attempt to be as contemporary as is reasonable.

¹⁰ Petronas is a Fortune 500 multinational which falls under the Prime Minister's Department. It was 191 on the 2018 ranking. <http://fortune.com/global500/petronas/>

¹¹ "Stop, thief! Malaysia's PM is about to steal an election", *The Economist*, 10 March 2018. Accessed at <https://www.economist.com/news/leaders/21738363-american-officials-say-he-already-stole-millions-taxpayers-malaysias-pm-about-steal>

¹² Accessed at <http://www.eiu.com/topic/democracy-index>

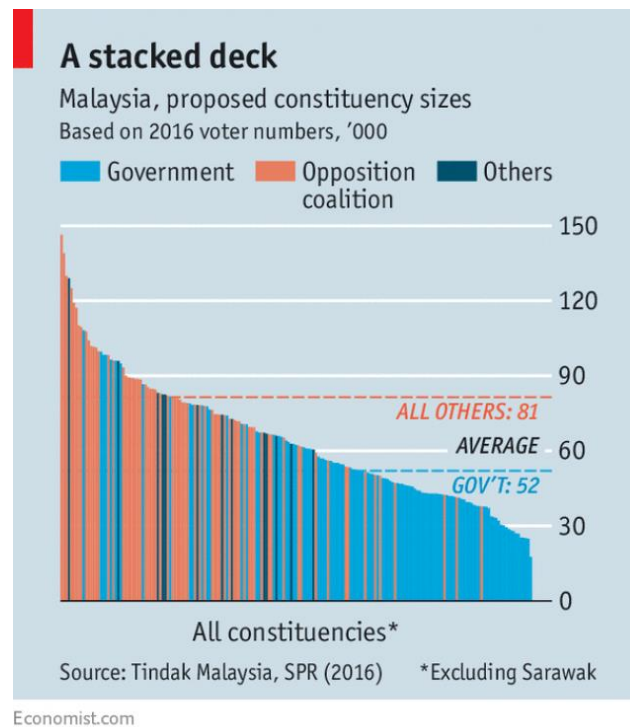


Figure 2: This made it possible for the ruling coalition to win the election with 22% of the vote.¹³

SPAD - Land Public Transport Commission (Suruhanjaya Pengangkutan Awam Darat)

Established in 2010 to plan, regulate and enforce rules concerning land-based public and freight transport in Malaysia. It is a statutory body authorised to enact legislation on behalf of the government.

As mentioned, SPAD fell under the purview of the Prime Minister's Department (along with 90 other agencies and organisations). In part, this has allowed for the bold claims that the RM 21 billion (USD 5 billion) Mass Rapid Transit project completed in 2017 was a "gift" from the Prime minister.¹⁴ This drew ample criticism from opposition parties who pointed out it was the government's duty to use taxes to provide infrastructure.¹⁵

New Prime Minister, Dr. Mahathir stated that SPAD would be "abolished" and its duties taken over by the Transport Ministry.¹⁶ It was later announced that SPAD would be placed under the Road Transport Department.¹⁷

¹³ "Tilting the playing field: How Malaysia's next election will be rigged", *The Economist*, 8 March 2018, accessed at <https://www.economist.com/news/asia/21738415-thanks-wildly-uneven-size-constituencies-it-takes-more-votes-elect-opposition-mp>

¹⁴ "MRT is Najib's gift to Malaysia, says minister", *The Malay Mail*, 17 July 2017, accessed at <http://www.themalaymailonline.com/malaysia/article/mrt-is-najibs-gift-to-malaysia-says-minister#ZDpFeLqKHM52ELkx.97>

¹⁵ "PKR leader: MRT not a gift, it's the government's duty", *Malaysiakini*, 18 July 2017, accessed at <https://www.malaysiakini.com/news/388894>

¹⁶ "Dr M: SPAD, Pemandu, Jasa and MPN among agencies to be abolished", *The Star*, 23 May 2018, accessed at <https://www.thestar.com.my/news/nation/2018/05/23/dr-m-spad-to-be-abolished/>

¹⁷ Abas, A. "800 SPAD staff to fill vacancies in RTD", *New Straits Times*, 24 May 2018, accessed at <https://www.nst.com.my/news/nation/2018/05/372696/800-spad-staff-fill-vacancies-rtd>

Chapter 2: The Cost of Cars

While cars have facilitated mobility and access to economic opportunity, the negative effects are vast. What follows is a brief overview of the negative consequences of cars and how the systems which they depend on stifle alternative options.

Economic Cost

Path Dependency

As cars become more accessible land use changes. Cars shrink distance allowing cities to sprawl. As cities grow, not only in population, but in area, the car becomes more necessary. Further, many of these roads create impassable barriers which restricts movement for those not in cars. Together, this creates a feedback loop.

In many cities, especially in previously colonised countries which lack adequate public transport, private transport often becomes a necessity. As more people begin driving congestion increases. Mobility becomes restricted and the only solution cities seem to employ is to invest in more roads. This become problematically cyclical. “the transportation industry exercises a radical monopoly by creating and shaping the need which it alone can satisfy.”¹⁸

When mobility is compromised through congestion cities often turn to traffic engineers to find solutions. Traffic is modelled and the solution usually proposed is increased vehicle capacity and more roads. “The iatrogenic nature of transportation planning, that is, its tendency to exacerbate the very problems it purports to address, leads to the need for more expertise, and transportation planning (and planners), like personal motor vehicles themselves, become self-perpetuating.”¹⁹ In essence, traffic planners plan for traffic.

The 20th century saw rapid urbanisation which was facilitated by, and oriented around, cars. Today, most infrastructure and land use has been determined by this. Re-orienting cities to any other design or goal is almost unachievable. Many of the people planning urban mobility have only been trained in the provision of private transport. We have come so far along this developmental trajectory it seems impossible to turn back or change our direction. This is path dependency.

The first step for cities is recognising there is a problem. This usually begins with public outcry over congestion and associated delays. Once aware, cities can attempt several avenues to improve mobility. We will begin by examining ineffectual solutions.

Sprawl

A key attribute of our dependency on cars is urban sprawl and low-density cities. Sprawl has its own costs for both residents and governments. For residents it means longer commutes which cost more in terms of time and fuel. Additionally, it can drive up property prices and displace poorer residents to the periphery of cities where services and opportunities are inferior. Sprawl also drives up the cost of public transport – in some cases it simply renders it impossible. This pushes people towards driving while discouraging active modes of transport. This contributes to

¹⁸ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 51.

¹⁹ Ibid., pp. 50.

increased emissions and pollution as well as lower levels of physical activity – all of which have negative consequences for the economy and health. This will be examined further in Chapter 3.

Sprawl also fosters unsafe roads, that is, roads which encourage higher speeds.²⁰ Cities in the United States with higher densities have substantially lower fatality rates per capita.²¹ While it may be insensitive to reduce death and disability to financial terms it cannot be ignored that increased rates of traffic collisions drain and divert resources of both cities and their residents.

Sprawl also increases the cost of public goods and services such as roads, schools, waste collection, and utilities.²² Detroit provides an illuminating example. Planned and designed with cars in mind, the “motor city” had a low population density even before the housing crisis which resulted in substantial depopulation. The city has a hard time funding services – waste collection trucks must drive further and serve fewer households. This means that costs are higher while revenue is lower. This is true for other goods and services too. Cities should discourage sprawl to ensure the ratio of cost/revenue is more in their favour so residents can receive better goods and services.

Sprawl is principally the result of poor urban policy – especially as it relates to land use and transportation regulation. Cities may also employ regulation seeking to contain urban boundaries such as greenbelts or taxation for greenfield development. These, however, “may backfire by causing fragmented, leapfrog development.”²³ Land use policies need to be nuanced and context specific if they are to contain sprawl. Stringent building height restrictions and lax restrictions allowing low density development are both barriers to compact cities. Cities need considered regulation to facilitate “optimum density”. This will be discussed further in Chapter 4’s examination of land use planning.

A final measure to restrict sprawl would be to place the burden of infrastructure provision to developers. If developers shoulder the cost of providing roads, public transport, water and sanitation they would be more likely to favour denser developments. This would cause housing prices in sprawling areas to better reflect the social cost of urban sprawl.²⁴

Regarding transportation regulation and its effect on urban sprawl, regulation is required to ensure drivers pay the full cost of their vehicle use. When use of private cars is too cheap cities must cover the high cost of their collective externalities such as congestion, greenhouse gas emissions, air and noise pollution. If cities are to discourage sprawl, they must discourage the use of private vehicles while encouraging public transport and active mobility. The most effective mechanisms for this are financial. These include road pricing policies, parking reform, and fuel and vehicular taxes. These will be discussed in greater detail in Chapter 4’s examination of disincentives.

²⁰ Welle, B. et al. *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths*, World Resources Institute, Washington, 2018, pp. 8.

²¹ Ibid., pp. 22.

²² Wells, H. “Urban sprawl triples public service costs, says OECD”, *Cities Today*, 18 June 2018, accessed at <https://cities-today.com/urban-sprawl-triples-public-service-costs-says-oecd/>

²³ *Rethinking Urban Sprawl: Moving Towards Sustainable Cities (Policy Highlights)*, Organisation for Economic Cooperation and Development (OECD), Paris, 2018, pp. 10.

²⁴ Ibid., pp. 12.

Congestion

Traffic is usually compared to a fluid: a certain volume must flow through the road system. But urban traffic is more comparable to a gas: it expands to fill available space.²⁵ Regardless of the size of the road network congestion is a problem. Often, the larger the network, the worse the congestion. “Build it and they will come” is true of car traffic. A now common adage, variously attributed, states that adding lanes to deal with congestion is like loosening your belt to cure obesity. It does little to address the cause while providing space for the problem to grow. This idea will be fleshed out in greater detail when attention turns to increasing road networks. For now, we need only appreciate that congestion is a problem – and that most proffered solutions have failed.

When commuting by car there is no possibility to be otherwise engaged. Your attention must be focused on driving for safety. When commuting via public transport you can read, or sleep, or send an urgent email before you get to the office. Commuting time can be accessed on public transport. Commuting time in a car is essentially lost.

This is of course only true for the driver. Passengers can use commuting time productively. The advent of autonomous vehicles may alleviate this and return time commuting time to car owners. This, however, may give sprawl a new lease.²⁶ If drivers are able to use commuting time productively, they will be able to live further from places of work which may lead to an increase in vehicle kilometres travelled.



Figure 3: Uber launched the "Unlocking Cities" campaign highlighting congestion in Kuala Lumpur.²⁷

There are many additional economic gains to be made from increasing mobility options and the ability of people to walk in a city. Many of these are indirect gains as lower levels of pollution and increased quality of life have broad economic benefits. There is increased

²⁵ Litman, T. “Generated Traffic and Induced Travel Implications for Transport Planning”, Victoria Transport Policy Institute, November 2011, pp. 2.

²⁶ Calthorpe, P. “7 Principles for Building Better Cities”, TED Vancouver, April 2017, time - 12:20.

Accessed at https://www.ted.com/talks/peter_calthorpe_7_principles_for_building_better_cities

²⁷ Accessed online at <https://www.unlockingcities.com/en-my/#6>

These figures are deduced from a study commissioned by Uber:

Chin, V. et al. “Unlocking Cities: The impact of ridesharing in Southeast Asia and beyond”, The Boston Consulting Group, Kuala Lumpur, 2017.

productivity from decreased congestion. It is estimated that Malaysia is losing RM 54 million (USD 12.9 million) every day due to congestion.²⁸

There are, additionally, direct economic benefits from improved pedestrian infrastructure. Crucially, there are economic gains to be made for local businesses. International research has shown that pedestrians and transit riders generally stay longer and spend more money at local businesses than people who drive cars.²⁹ A study in Hong Kong found a 17% increase in retail rents following pedestrianisation.³⁰ The most famous example is probably in New York where Broadway was closed to cars. Retailers in Times Square initially opposed the intervention but business boomed so much that rent doubled between 2012 and 2013.³¹

Infrastructure: Looking Ahead

Roads are expensive to maintain. Cars cause substantial damage necessitating frequent maintenance. Cities looking to save money should provide alternative mobility choices. Sidewalks and bike lanes require initial capital expenditure, however, almost no maintenance costs as the users of such infrastructure cause no damage to it. The cost of roads is not merely financial. There is also an environmental cost – not merely in their construction and maintenance but in the modes of transport which are facilitated and promoted by roads. The construction of infrastructure “locks-in emissions patterns over the lifetime of the project.”³² When cities choose to develop roads for personal cars, they commit themselves to decades of inefficient and environmentally destructive mobility.

Cities, however, are changing rapidly and technology is disrupting mobility choices and land use patterns. What was taken for granted a decade ago (before smartphones were prevalent) is no more. Cities are having to plan infrastructure for an uncertain future. How cities develop legacy infrastructure in this climate is difficult.

Many cities invested heavily in auto-oriented infrastructure only to dismantle it in a few short years. Seoul’s Cheonggyecheon river and Seullo 7017 projects are two prime examples of inner-city highways which had to be removed at great expense. Their removal was necessary to improve quality of life and, counterintuitively, to reduce congestion. The Embarcadero Freeway removal in San Francisco helped make the city one of the most liveable in the United States while bringing in thousands of tourists each year. Cities should be discouraged from building expensive highways a short-term solution which induce demand and worsen congestion in the medium-term, prove obsolescent in the long-term, and ultimately be costly to remove.

²⁸ Sander, G. et al. “Malaysian Economic Monitor: Transforming Urban Transport”, The World Bank, Washington, 2015: pp. 36.

²⁹ Tolley, R. “Good for Business: The benefits of making streets more walking and cycling friendly”, Heart Foundation South Australia, 2011, pp. 17.

³⁰ “Global Street Design Guide”, National Association of City Transportation Officials (NACTO) and Global Designing Cities Initiative (GDCI), Island Press, New York, 2016: pp 8.

³¹ Kimmelman, M. “A Street corner Serenade for the Public Plaza”, *The New York Times*, 31 May 2013, accessed at <http://www.nytimes.com/2013/06/02/arts/design/a-prescription-for-plazas-and-public-spaces.html>

³² Francke, E. et al. “Mobilising Private Investment for Bus Rapid Transit systems: The case of Metrobus, Mexico City”, CTS Embarq, Mexico City, 2012, pp. 5-6.



Figure 4: Before and After: Embarcadero Freeway, San Francisco

Evidently, cities should be wary of investing in vehicular infrastructure. The future of walking and public transport is certain but the future of cars is unknown. Their use, ownership, and infrastructure requirements will rapidly change with technology. Already, technology is disrupting industries through ridesharing like Grab and Uber. Between 2011 and 2016 the number of cars entering Manhattan fell by 5% despite the number of jobs increasing 14%. Much of this has been attributed to the rise of ridesharing.³³

The need for private cars is shrinking while parking is becoming less of a priority. Shawn Conrad, CEO of the International Parking Institute, explains that “drop-off and pick-up points at airports have led to declines in city revenues in the US as more fliers opt for ride-hailing services.”³⁴ Further, autonomous vehicles are developing at a rapid rate. These will change how people access cars and the infrastructure required. Parking is likely to prove superfluous or be repurposed in new and surprising ways. Much of this will depend of reliable and accessible data. Looking to the future, the International Parking Institute, British Parking Association, and European Parking Association have collaborated to develop the Alliance for Parking Data Standards.³⁵ This will leverage technology to better manage parking in the age of autonomous vehicles.

Road Collision Costs

It is crass to convert the tragedies of road collisions into economic terms. The suffering caused for victims and their families is so vast that putting a price on it is insensitive. Sadly, it is not irrelevant. For many policy makers, the bottom line is the financial angle. Recognising the harm caused, and aspiring to minimise it, is inadequate reason to invest in alternative infrastructure. Without clear financial motives, policies that support cars and perpetuate high collision rates, will remain in place.

The World Health Organisation estimates the global loss due to traffic injuries to be US\$ 518 billion, costing governments between 1-3% of gross national product.³⁶ This is a substantial

³³ Flamm, M. and Geiger, D. “Uber and Lyft crushed taxis—is the commercial parking industry next?”, *Crain’s New York Business*, 21 February 2018, accessed at <http://www.crainsnewyork.com/article/20180221/FEATURES/180219923>

³⁴ Aldane, J. “Parking presents new market for urban innovation”, *Cities Today*, 22 June 2018, accessed at <https://cities-today.com/parking-presents-new-market-for-urban-innovation/>

³⁵ Available at <https://www.britishparking.co.uk/Alliance-for-Parking-Data-Standards>

³⁶ *Global Status Report on Road Safety: Time for Action*, World Health Organisation, Geneva, 2009, pp. 2.

blow to any economy and there are steps which can mitigate it. Importantly, the actions this paper recommends are not expensive, rather, they are durable, increase economic activity, and enhance connectivity. When considering alternatives to car-oriented development there should be an express focus on ensuring economic prosperity.

Road collisions have many negative impacts on victims and their families. The pain, grief, and suffering people endure cannot be measured. The economic effects, though difficult to calculate, can be estimated. By examining the economic implications for families, employers, and to the Malaysian government, the Malaysian Institute of Road Safety Research (MIROS)³⁷ calculated that the value of a statistical life (VOSL) stood at RM1.35 million (USD 323 350) in 2008.³⁸ Transport Minister Liow Tiong Lai revealed that road collisions cost Malaysia RM 9.2 billion (USD 2.2 billion) in 2016.³⁹

Given the comparatively low cost of designing safer infrastructure – it makes economic sense to invest in it even if it were to save a single life each year. The role of design in making cities safer and more attractive will be examined in greater detail in Chapter 4.

Social Cost

The cost, however, is not merely financial. There is also the consumption of labour as health care services are strained. In Kenya, road traffic injuries represent between 45-60% of all admissions to surgical wards while in India they account for 20-50% of emergency room registrations, 10-30% of hospital admissions, and 60-70% of people hospitalised with traumatic brain injuries.⁴⁰ While this has substantial direct financial cost, we must consider the hours of work which are devoted to these injuries which could be spent assisting other patients. Many countries simply cannot afford to devote these resources to road traffic collisions when there are so many other health problems which need attending.

These problems include matters like childhood mortality, HIV/AIDS, malaria, and many other pestilences. These issues arise from, and perpetuate, poverty. Countries cannot afford to divert medical resources away from these issues. Furthermore, poorer families are not only at increased risk of becoming a road collision victim: they are less likely to be able to pay the direct and indirect costs related to a road traffic crash. In this way, many families are driven deeper into poverty.⁴¹ This perpetuation of poverty must be overcome if the most vulnerable in society are to prosper economically.

While poorer families are often more adversely affected by cars, they are usually too poor to access vehicles, and the advantages they may provide, themselves. Being unable to afford a car they must navigate cities designed for cars – a difficult and dangerous task. This is succinctly expressed by Badami: “But the group most seriously affected by the lack of pedestrian (and cycling) infrastructure and facilities, in terms of time and productivity losses and road safety, may well be the poor, who for the most part have no choice but to walk or cycle, regardless of how arduous it might be to do so. The poor benefit the least from urban transport infrastructure but are affected

³⁷ Malaysia ought to be commended for establishing MIROS as “few countries have an effectively empowered or appropriately funded lead agency for road safety” - Welle, B. et al. *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths*, World Resources Institute, Washington, 2018, pp. 13.

³⁸ Yusoff, M. et al. “The Value of Statistical Life in Fatal Injury Among Drivers and Riders in Malaysia Conjoint Analysis Method”, Malaysian Institute of Road Safety Research, Internal Report No.130, 2013: pp. 38

³⁹ Tong, L. C. “Road accidents: Can Liow Tiong Lai and SPAD buck up?”, *Free Malaysia Today*, 21 June 2017, accessed at <http://www.freemalaysiatoday.com/category/opinion/2017/06/21/road-accidents-can-liow-tiong-lai-and-spad-buck-up/> - It is worth noting this is a conservative estimate using the 2008 VOSL.

⁴⁰ *Global Status Report on Road Safety: Time for Action*, World Health Organisation, Geneva, 2009, pp. 4.

⁴¹ *Ibid.*, pp. 4.

however, let it suffice to say that those exposed to air and noise pollution face additional challenges in maintaining a good physical and mental health. Additionally, road collisions disproportionately affect poorer households. These households are often located beside poorly designed roads which facilitate higher speeds. These crashes perpetuate poverty or pull people into it.⁴⁵ Victims of collisions suffer from education and employment exclusion. Added to this are the medical costs which greatly affect poorer households.⁴⁶

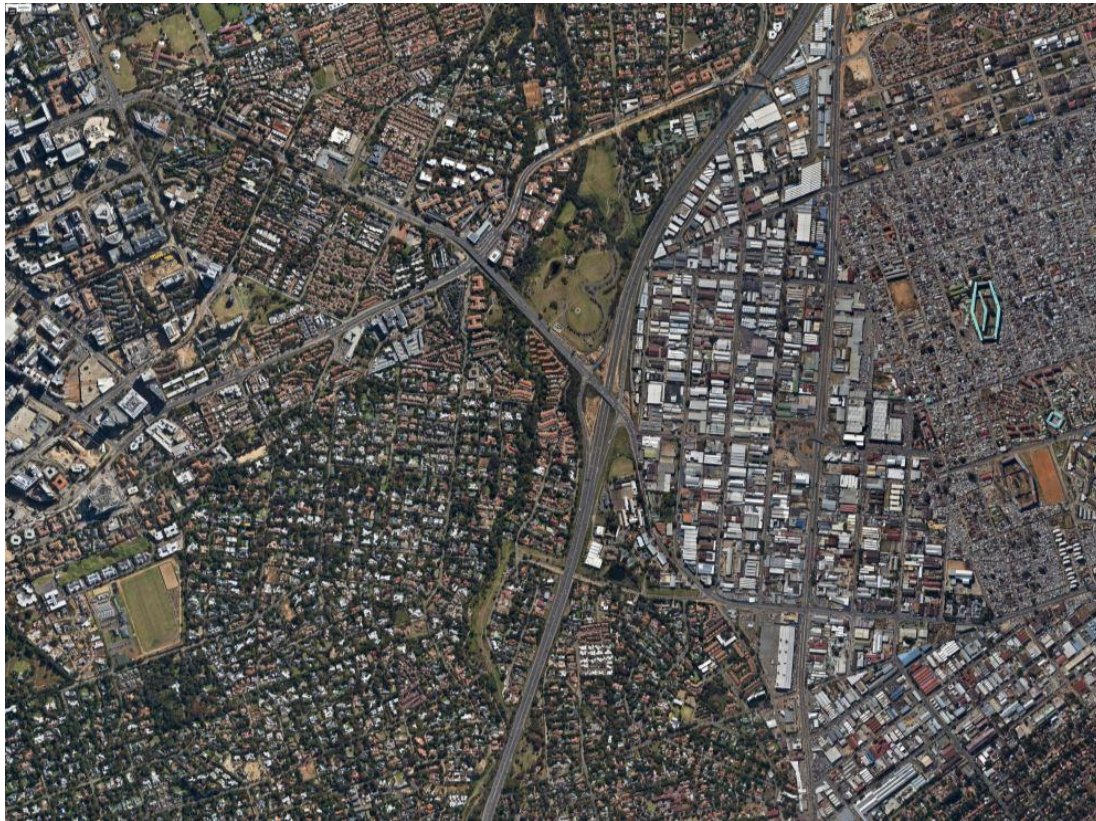


Figure 6: Johannesburg. West of the highway lies the affluent neighbourhood of Sandton with large plots and ample green space. East is an industrial buffer and the poor community of Alexandria with tiny plots, little foliage, and poor provision of services.

But this story of social division is not specific to South Africa. Being from “the wrong side of the tracks” is a common expression precisely because formal transportation infrastructure provides such a clear and seemingly immovable barrier within cities. Cities like Kuala Lumpur and Detroit offer distinct yet clear examples of cities which are dominated by cars and suffer from substantial inequalities. Living on one side of Jalan Ampang or 8 Mile are some of the world’s financial elites – on the other some of the most dispossessed.

But auto-oriented cities are not merely spatially divided on class lines. There are also divisions rooted on accessibility. Those who can afford a car can immediately access a wider range of opportunities and tend to have more social mobility. Transport and spatial planning for motor

⁴⁵ Welle, B. et al. *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths*, World Resources Institute, Washington, 2018, pp. 31.

⁴⁶ Kumar, G. et al. “Burden of out-of-pocket expenditure for road traffic injuries in urban India”, *BMC Health Services Research* 12:285, 2012, pp. 9.

vehicles “steal time from (poor and other disadvantaged) groups and reallocate it to (usually) richer groups.”⁴⁷ It is no surprise that one of the first purchases of a financially emerging family is a car or at least a motorbike. This is a competitive advantage to those who can access it. It is not, however, merely advantageous to motorists – it disadvantages all those who cannot access private transport.

Poorer people who must walk are vulnerable to collisions, must breathe exhaust fumes, and may find their bus stuck in traffic to list a few of the disadvantages. The problem is worsened by the fact that victims tend to be “a user on non-user externality”⁴⁸ – while drivers do kill and harm other drivers, they principally harm pedestrians and cyclists – most of whom are in a lower economic bracket.

Auto-oriented cities pit their residents’ interests against one another and encourage people to choose more harmful modes of mobility in order to protect themselves. If urban travel was principally public transportation and non-motorised modes users would not suffer “relative to one another, since the power to use the resource would be equally shared.”⁴⁹ Thus, private cars maintain and perpetuate class divisions. Walking, cycling, or taking the bus becomes less attractive and relegated to poorer households. As fewer people choose these sustainable modes cities tend to provide infrastructure for cars. Ultimately, “the fact that the other modes are becoming increasingly unviable is used as an excuse not to provide for them, which, in turn, makes them even less viable, and makes those who rely on these modes more vulnerable.”⁵⁰

Social Capital

Well-connected communities provide a platform for their residents to thrive: “connectivity provides an essential foundation for civic life, ensuring that all community members can take full advantage of their local parks, libraries, polling stations, and other civic assets.”⁵¹ Neighbourhoods which foster a sense of community build trust and increase access to shared resources and support. Research has shown people who feel connected to their community sleep better, are happier, and live longer.⁵² Living in such neighbourhoods is an advantage not only in quality of life but quality of experience and access to opportunity.

Such communities, however, are hard to nurture in the isolation endemic to car-oriented neighbourhoods. Interconnectedness is dependent on interactions – the kind people have while walking in their communities or not the kind which happens behind the wheel of a car. Social ties are weaker when people predominantly commute by car.⁵³

Communities divided by busy roads and cut off from opportunities face numerous additional challenges. Increased exposure to noise and air pollution results in more sick days which compromises a person’s ability to excel. Conversely, children who can independently access sports facilities and libraries have a substantial advantage over those who cannot or require an adult to drive there. “Those physically disabled as a result of a motor vehicle collision often face stigma and discrimination which can lead to social, educational, occupational and financial deprivation.

⁴⁷ Whitelegg, J. *Transport for a Sustainable Future – The Case for Europe*, Belhaven Press, 1993, pp. 72.

⁴⁸ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 45.

⁴⁹ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 46.

⁵⁰ *Ibid.*, pp. 50.

⁵¹ *Assembly: Civic Design Guidelines*, Centre for Active Design (CfAD), New York, 2018, pp. 21.

⁵² Williams, M. *Thrive 2: Health and Wellbeing in the City We Need*, United Nations University, Kuala Lumpur, 2016, pp. 40.

⁵³ *Assembly: Civic Design Guidelines*, Centre for Active Design (CfAD), New York, 2018, pp. 24.

In addition, many have mental health consequences such as post-traumatic stress disorder, phobias, anxiety and depression.”⁵⁴ Together, these factors contribute to a person or community’s social capital and greatly influence the opportunities available to residents.

Elderly People

Elderly people are negatively affected by car-oriented design. They get out less resulting in inadequate exercise and fewer social interactions. They are isolated in their homes, lack spaces to congregate, and means of getting there.

China sets a fine example of how to treat the elderly. Old age homes being frowned on, parents live with their children in their final years and pedestrian infrastructure, in most large cities, is ample. Elderly people congregate regularly on the many public squares for choreographed dancing classes and general social interaction. At Chaoyangmen subway station in Beijing, a tiny park of 20 square metres hosts a “dog club” – a group of elderly women with their lap dogs socialising most evening. This ability to “hang out” is just as important for an eighty-year-old as an eighteen-year-old. In cities which do not provide public spaces, or access to these spaces, the elderly become socially alienated and marginalised.

Being dependent on cars means some elderly people drive many years after it is not safe for them to do so. My grandmother was an example. She was unwilling to give up her independence and was fiercely proud. Limited mobility options and suburban sprawl meant her only option to get to supermarkets was to drive. Fortunately, she drove slowly, to the annoyance of other drivers, but she was reckless, visually impaired, and absent minded. A danger to herself and others. She was a victim of car-oriented spatial planning: the retirement village she lived in was far from amenities because of the faith in the car to connect people. Cars embody a self-fulfilling prophecy: “motorised vehicles create remoteness which they alone can shrink. They create distances for all and shrink them for only a few.”⁵⁵ Cars shrank the distance for my grandmother until she was unable to drive. Then the distance isolated her and made her dependent on her family for basic goods.

Cities around the world are aging rapidly. People are living longer urban planning and design ought to reflect this change in demographics. Cities which hope to cater to the needs of older residents need to provide public transport which is affordable and accessible. This in turn requires the provision of pedestrian infrastructure which is comprehensive, interconnected, and attractive. Older people should want to be *in* the city, immersed in its activities, and actively participating. “The lack of pedestrian accessibility affects all, since everyone, including motor vehicle users, is a pedestrian at some stage of their travel, but groups such as young children, the elderly, and the physically disabled, are particularly disadvantaged, and at serious risk of being hurt or killed in road accidents”⁵⁶ Let us now consider the effect on children.

⁵⁴ *Global Status Report on Road Safety: Time for Action*, World Health Organisation, Geneva, 2009, pp. 4.

⁵⁵ Illich, I. *Energy and Equity*, Harper & Row, London, 1974, pp. 30.

⁵⁶ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 45.

Children

“If children are not designed into our cities, they are designed out.” – George Monbiot⁵⁷

Safe and attractive cities are those that cater to the needs of young families. Cities dominated by cars leave little space for children to explore and develop independently. They become hostile spaces, fraught with danger, which necessitate adult supervision for almost all activities. Children are especially vulnerable to cars as they are smaller in stature and their bodies are still developing. Pollution can affect children’s development – both physically and mentally as several studies have linked it to autism spectrum disorders.⁵⁸ Young children, including those in prams, tend to be below 1 metre where they are exposed to 60% fine particulate pollution from exhaust fumes.⁵⁹

Malaysia provides an illuminating example of the consequences of car-centric mobility on the safety of children. Between 2003 – 2005 traffic injuries accounted for more children being admitted to government hospitals than the next 10 threats combined.⁶⁰ Nearly 90 000 children were admitted, while the next most significant threat came from falls with less than 40 000 children needing medical attention.

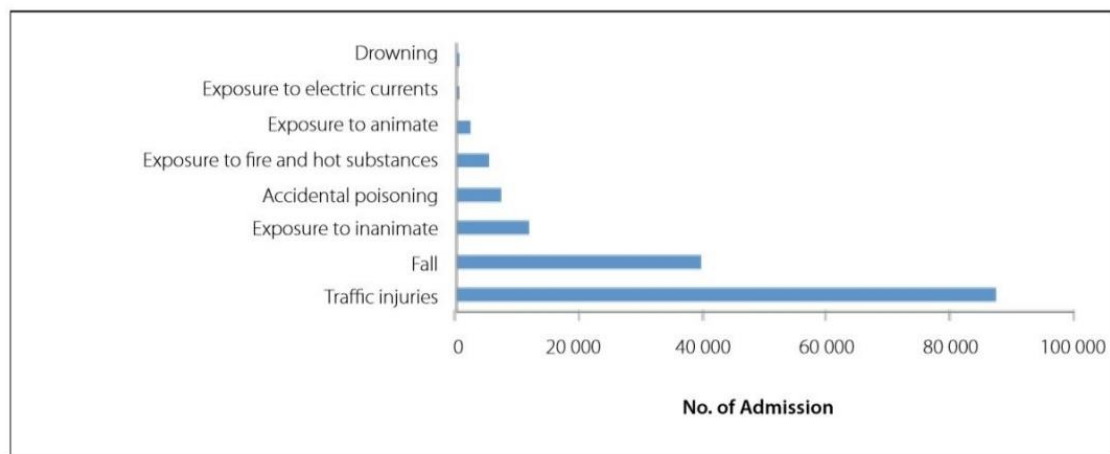


Figure 7: Leading causes of children's admission to government hospitals in Malaysia due to unintentional injuries 2003-2005.⁶¹

Parents are aware of the threat cars pose to their children. Their response, however, exacerbates the problem. Children are driven to school because parents worry about their safety. This results in heavier traffic near schools increasing the risk for children in these areas. The majority of children are injured in residential areas or near schools.⁶² This is understandable given these are areas children spend most of their time. These areas often have poor segregation of

⁵⁷ Williams, S. et al. *Cities Alive: Designing for urban childhoods*, Arup, London, December 2017, pp. 15.

⁵⁸ Raz, R. et al., “Autism Spectrum Disorder and Particulate Matter Air Pollution before, during, and after Pregnancy: A Nested Case–Control Analysis within the Nurses’ Health Study II Cohort”, *Environ Health Prospect*, Vol. 123, 2015, pp. 264.

⁵⁹ Sharma, A. and Kumar P., “A review of factors surrounding the air pollution exposure to in-pram babies and mitigation strategies”, *Environment International*, Vol. 120, 2018, pp. 262.

⁶⁰ Norlen, M. et al., “An Overview of Road Traffic Injuries Among Children in Malaysia and Its Implication on Road Traffic Injury Prevention Strategy”, Malaysian Institute of Road Safety Research, 2011, pp. 5.

⁶¹ Norlen, M. et al., “An Overview of Road Traffic Injuries Among Children in Malaysia and Its Implication on Road Traffic Injury Prevention Strategy”, Malaysian Institute of Road Safety Research, 2011, pp. 5.

⁶² Ibid., pp. 17.

pedestrians from motorised traffic and inadequate crossing facilities.⁶³ Parents insist on driving their children to school and expect better parking facilities to be provided. This restricts the provision of decent pedestrian infrastructure and generates a feedback loop. Essentially, “motor vehicle activity and planning for it to the exclusion of other modes lead to ever more motor vehicle activity and congestion, as people use motor vehicles to protect themselves from other motor vehicle users.”⁶⁴

Recognising there is an issue, appropriate action can be taken. In South Korea, 1766 children were killed in traffic collisions in 1988. By 2012 that number had fallen to 83.⁶⁵ Sweden’s “Vision Zero” redesigned streets causing road traffic deaths to fall by 50% between 1997 and 2016.⁶⁶ There is ample evidence that appropriate design can save children’s lives. Such design is well documented and prioritises the safety of children over the flow of traffic. This means implementing measures to calm the flow of traffic.

Researchers in Malaysia have echoed such sentiments asserting that the “implementation of the traffic calming measures should be highly considered during the planning and development of residential roads.”⁶⁷ The discussion concerning design and traffic calming will be examined in greater detail in Chapter 4. For now, it is enough to assert that cities need to consider the role of design in protecting children’s lives.

Arup’s child-oriented design guidelines identify cars as the largest threat to children – from both collisions and air pollution. It also has an effect on the development of independence: “the dominance of cars in cities is considered one of the biggest barriers to child-friendliness and a key factor in preventing parents from granting children independent mobility.”⁶⁸ Independent mobility is the ability of a child to move around their neighbourhood unaccompanied by an adult. The “popsicle test” is a common indicator: can a child safely walk from their home, buy a popsicle, and return home before it melts?⁶⁹ By designing cities for children, we make more inclusive cities and encourage physical activity. This is important as Malaysian children are the most obese in Asia.⁷⁰

One way to design for children is to ask them what they want. Boulder, Colorado engaged children from preschool to high school to contribute ideas for riverside restoration.⁷¹ Belfast asked 7000 children how they would change their neighbourhoods.⁷² Unsurprisingly, more play areas were the most common request. This is important because play is an essential part in development, physically, emotionally, and intellectually. Designated areas for play also increase children’s safety as it keeps them from playing in the road. “Children tend to use roads as a playing ground if safe

⁶³ Manan, M. et al., “Traffic Calming Scheme Around the Vicinity of School”, Malaysian Institute of Road Safety Research, 2009, pp. 2.

⁶⁴ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 46.

⁶⁵ Sul, J. “Korea’s 95% reduction in child Traffic Fatalities: Policies and achievements”, *Korea’s Best Practices in the Transport Sector (15)*, The Korea Transport Institute, Seoul, 2014.

⁶⁶ Williams, M. *Thrive 2: Health and Wellbeing in the City We Need*, United Nations University, Kuala Lumpur, 2016, pp. 36.

⁶⁷ Norlen, M. et al., “An Overview of Road Traffic Injuries Among Children in Malaysia and Its Implication on Road Traffic Injury Prevention Strategy”, Malaysian Institute of Road Safety Research, 2011, pp. 19.

⁶⁸ Williams, S. et al. *Cities Alive: Designing for urban childhoods*, Arup, London, December 2017, pp 12.

⁶⁹ *Ibid.*, pp. 15.

⁷⁰ *National Health and Morbidity Survey 2015; Volume 2: Non-Communicable Diseases, Risk Factors & Other Health Problems*, Ministry of Health, Kuala Lumpur, 2015, pp. 77.

⁷¹ Mintzer, M. “How kids can help design cities” TEDxMileHigh, November 2017, time – 3:40. Accessed at https://www.ted.com/talks/mara_mintzer_how_kids_can_help_design_cities#t-355561

⁷² “Taking Action for Child Friendly Places: First Steps”, City of Belfast, 2016, pp. 20.

spaces for play are not available. Therefore, safe play areas that are easily accessible, adequate in number should be incorporated into residential, school, and urban planning and development.”⁷³

Cars pose a significant threat to the wellbeing of children. Cities need to prioritise the safety of children over the movement of cars. This means providing safe pedestrian and cycling infrastructure, adequate and attractive play spaces, together with public transport around schools. Collectively, this reduces congestion, improves safety, increases physical activity, and fosters independent children.

Case Study 1 – SJK Vivekananda

The Global Initiative for Child Health and Mobility (coordinated and funded by the FIA Foundation) aspires to “safe and healthy journey to school for all children by 2030.”⁷⁴ Their focus is on safe footpaths, lower vehicle speeds, better public transport, and improved air quality. These aspirations helped inspire the following intervention.

SJK Vivekananda is a junior school located around 300m from KL Sentral station – the central hub of Kuala Lumpur’s mass transit. For many years the school lacked a basic pavement to the front gates. Lacking basic pedestrian infrastructure made it unsafe for children to walk in the vicinity of the school with almost all children being dropped at school on motorised transport.

A negative feedback loop was created: high numbers of vehicles coming to school compromised children’s safety which encouraged parents to drive and drop their children. Cars placed children at risk and the solution appeared to be to drive.

The message is problematic. Children are taught, daily, that the only way to navigate their city is by car. They are constantly reminded that they are not allowed outside the gates, walking is not an option, and that the city is a hostile place.

Further, with so many vehicles coming to collect children parking became a concern. Illegally parked vehicles caused congestion. Directly opposite the school is the Kompleks TLK parking building. This is owned and operated by the city. It has not seen a decent return on investment as motorists prefer to park illegally with little ramification.⁷⁵

This results from poor parking management. Firstly, there needs to be accountability and enforcement. Illegally parked vehicles must be held accountable.⁷⁶ Next, the price of parking should be structured to facilitate turnover and movement – rather than commuters who park all day. Kompleks TLK is priced at RM3 for the first hour and RM 1 for every subsequent hour capped at RM 10 per day. Parents picking up children would have to pay RM 3 to wait 20 minutes. Free parking for the first hour with increased fees for subsequent hours would ensure a higher turnover of vehicles and allow the parents to park responsibly.

⁷³ Norlen, M. et al. “An Overview of Road Traffic Injuries Among Children in Malaysia and Its Implication on Road Traffic Injury Prevention Strategy”, Malaysian Institute of Road Safety Research, 2011, pp. 20.

⁷⁴ <https://www.childhealthinitiative.org/about-us/our-mission>

⁷⁵ Bavani, M. “Few takers for multi-level parking in Brickfields”, *The Star*, 12 October 2017, accessed at <https://www.thestar.com.my/metro/metro-news/2017/10/12/few-takers-for-multilevel-parking-in-brickfields-shoppers-continue-to-doublepark-along-little-indias/>

⁷⁶ The cessation of clamping is unlikely to facilitate this. See:

Bavani, M. “KL mayor: No more clamping of vehicles in the city... for now” *The Star*, 26 May 2018, accessed at <https://www.thestar.com.my/news/nation/2018/05/26/kl-mayor-no-more-clamping-of-vehicles-in-the-city-for-now/>



Figure 8: SJK Vivekananda did not have any pedestrian paving leading to its front gate.

Having identified the problem, I raised the issue with my previous employer, Think City, who were involved in several projects in the vicinity. I also spoke with the residents' organisation (Rukun Tetangga) and Aecom Malaysia. The latter is involved with the River of Life – a large river revitalisation project with a focus on pedestrian infrastructure.⁷⁷

These organisations leveraged the upcoming elections to motivate the city into acting. A pavement was built leading up to the school, however, parking prices remain unchanged.



Figure 9: After coordinated efforts between city hall, Think City, and Aecom we were able to provide safe pedestrian access to the school. Note the car illegally parked.

⁷⁷ <https://www.aecom.com/projects/river-life/>

Environmental cost

The environmental cost of cars is substantial. The energy used to manufacture them, coupled with the energy used throughout their lifetimes, generates vast quantities of greenhouse gas emissions. Further, cars require more infrastructure per individual moved – wider roads and bridges – necessitating increased energy to build them and consequently more emissions. These emissions contribute to urban air pollution and global climate change.

Substantial energy is required to manufacture a car. Although gains have been made in renewable energy, most industries are dependent on energy generated from fossil fuels. This causes vast quantities of greenhouse gas emissions before a car even hits the road. This is true for *all* cars: diesel or electric, autonomous or traditional. The manufacturing of private transport requires vast power generation for vehicles which are stationary for most of their lives. While substantial power is still required to manufacture buses and trains these are busy most of the day and carry far more people. Thus, the energy to manufacture, relative to the number of people moved, is less.

Once on the road cars are principally powered by fossil fuels. This includes electric vehicles – if the electricity used to charge the batteries is generated in a coal power plant then the vehicle is effectively, if indirectly, running on fossil fuels. The advantage of electric vehicles, for the time being, is less that they do not cause pollution rather that the pollution they cause is not in densely populated cities. Traditional vehicles generate exhaust emissions which are harmful to the environment in general, however, these emissions are a substantial component of urban air pollution. The health consequences of this will be examined in detail in the following chapter.

Exhaust emissions, aside from being dangerous for public health, stain historic buildings. This phenomenon affects cities as varied as Penang, Cape Town, Detroit, and Rome. The consequence of this pollution is that buildings need to be restored, or at least cleaned, more frequently. This can come with a hefty price tag – in 2013 the Colosseum was cleaned at a cost of USD33 million.⁷⁸ The cost of this is not merely financial: this pollution slowly erodes history and culture. This affects tourism but more importantly it affects identity and heritage.

A final threat to the environment comes from the infrastructure required by cars. Highways and other road infrastructure require immense energy to be built. This is true for public transport as well, however, substantially more lanes are required for cars than, for example, a light rail route. Thus, bridges must be wider and costlier yet fewer commuters will be able to access the road.

This merely considers *moving* cars. There are also vast amounts of resources dedicated to *storing* cars when they are stationary – as they are for much of their lives. Multi-storey car parks use large amounts of energy in their construction while sprawling at-grade car parks use up valuable city space. Further, these sprawling car parks are impermeable and prevent rain from filtering into the soil. The increased runoff compromises water security while increasing flash floods with the associated environmental and economic consequences.

Conclusion

Having considered the economic, social, and environmental cost of cars our attention must now turn to the effects cars have on our safety. This too is a cost of the car but a cost so dear that it warrants its own chapter to fully examine. Cars compromise our safety through violent and often fatal collisions as well as through air and noise pollution. In the following chapter these will be examined in detail.

⁷⁸ “Saving the Colosseum: Restoration work begins on Rome's crumbling ancient monument”, *CBS News*, 23 December 2013, accessed at <https://www.cbsnews.com/news/restoration-work-begins-on-romes-aging-colosseum/>

Chapter 3: Healthy, Safer Cities

The environmental cost of cars and their contribution to climate change is at a global scale. These negative externalities, however, are acutely felt at the city scale. Exhaust emissions and noise pollution compromise residents' health and wellbeing. The consequences of this will be examined before attention falls on the threat cars pose to safety as a result of collisions.

Healthier Cities

Air Pollution

It has become clear that current levels of air pollution are unacceptable and compromise global health. In 2016 95% of the world's population lived in areas that exceeded the WHO Guideline for PM_{2.5}.⁷⁹ This leaves our cities less liveable and less attractive. The detrimental effect of air pollution on physical and mental health should not be downplayed.

Air pollution particularly affects vulnerable populations such as children and older people. In 2016, ambient PM_{2.5} air pollution contributed to 1.8 million deaths and 22 million disability-adjusted life-years (DALYs) in those older than 70 years and 1.3 million deaths and 37 million DALYs in those between 50 and 69 years old from these diseases.⁸⁰

A growing body of research is uncovering air pollution's harm to our mental health – especially for children whose brains are developing rapidly. One study examining over 500 000 children in Sweden illuminates a correlation between air pollution and mental illness in children.⁸¹ Further, air pollution is now recognised as contributing to poor cognitive performance. In part, this comes from lower attendance at school resulting from sick days. However, there are additional consequences for cognitive performance such as a 13% reduction in working memory gains.⁸²

These cognitive impairments are not limited to children. In a study of 20 000 Chinese citizens between 2010 and 2014 found that the longer people were exposed to air pollution the greater the damage to intelligence.⁸³ This is troubling as it especially affects poorer communities who are often subject to higher levels of pollution and cannot afford expensive air purifiers and face masks. Vulnerable communities are thus placed at a disadvantage which perpetuates poverty. Pollution affects all residents in a city but it affects the poor most of all. Addressing pollution is vital if cities hope to close gaps in opportunity and foster more equitable and just communities.

⁷⁹ *State of Global Air 2018*, Health Effects Institute (HEI), Boston, 2018, pp. 3.

⁸⁰ *Ibid.*, pp. 10.

⁸¹ Oudin, A. et al. "Association between neighbourhood air pollution concentrations and dispensed medication for psychiatric disorders in a large longitudinal cohort of Swedish children and adolescents", *BMJ Open*, 2016.

⁸² Sunyer, J. et al. "Association between Traffic-Related Air Pollution in Schools and Cognitive Development in Primary School Children: A Prospective Cohort Study", *PLOS Medicine*, Vol. 12., No. 3., 2015, pp. 2.

⁸³ Zhang, X. "The impact of exposure to air pollution on cognitive performance", *Proceedings of the National Academy of Sciences*, Vol. 115., No. 37., 2018.

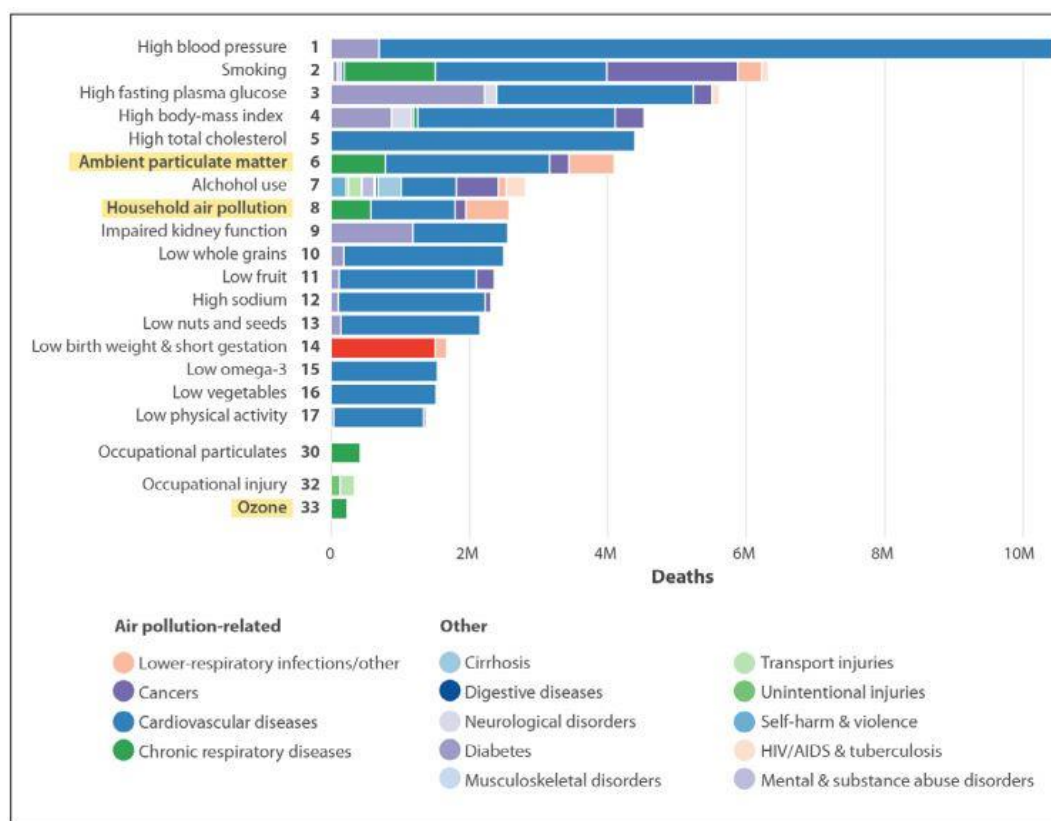


Figure 10: Global ranking of risk factors by total number of deaths from all causes for all ages and both sexes in 2016.⁸⁴

The principal sources of pollution are power generation (coal), vehicle emissions, household solid fuels, and agricultural slash and burn.⁸⁵ To adequately address the damage from pollution all these spheres ought to be addressed. The focus of this paper, however, is transportation. Green energy production, electricity provision (as an alternative to solid fuels), and sustainable agricultural practices unfortunately fall outside the scope of this research. With that in mind attention turns to some of the specifics of transportation-related urban pollution.

An alarming study by the United Nations Intergovernmental Panel on Climate Change (IPCC) announced that governments have until 2030 to limit global warming to 1.5°C.⁸⁶ Air pollution contributes to global warming and urban heat islands. Burning fossil fuels for power generation and fuel for motor vehicles generates substantial amounts of heat in cities. Heat islands generate “thermal plumes” – artificial convection currents which suspend pollution and particulate matter creating dust domes over cities. These blankets of pollution, however, exacerbate heat islands by preventing outgoing radiation – particularly at night. Consequently, the ability of cities to cool is diminished.⁸⁷ This creates a feedback loop whereby cities heat the air aggravating air pollution which in turn increases the urban heat island.

⁸⁴ *State of Global Air 2018*, Health Effects Institute (HEI), Boston, 2018, pp. 1.

⁸⁵ *Ibid.*, 2018, pp. 16.

⁸⁶ Allen, M. et al. “Global Warming of 1.5°C: Summary for Policy Makers”, Intergovernmental Panel on Climate Change, Incheon, The Republic of Korea, 2018. Accessed at <http://www.ipcc.ch/report/sr15/>

⁸⁷ Rao, V. L. “Effects of Urban Heat Island on Air pollution Concentrations”, *International Journal of Current Microbiology and Applied Sciences*, Vol. 3., No. 10, 2014, pp. 391.

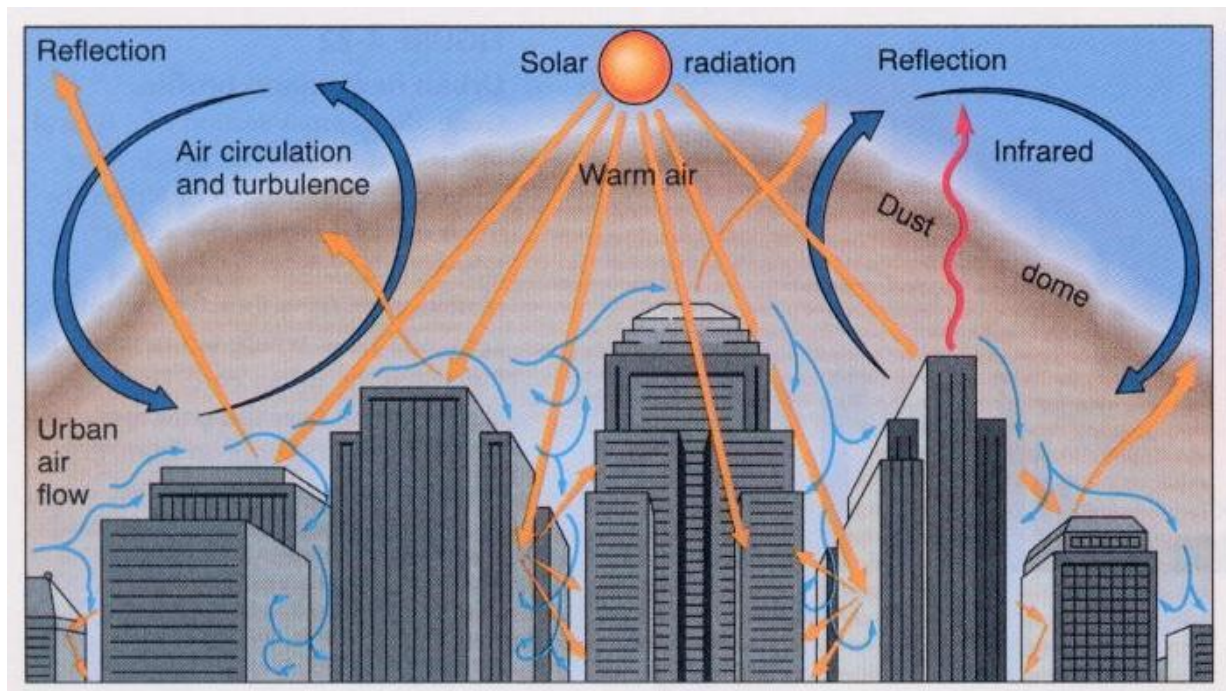


Figure 11: Pollution makes cities warmer and perpetuates urban heat islands.⁸⁸

There are several types of air pollution ranging from particulate matter to the presence of certain gases such as nitrogen dioxide (NO₂) which is principally emitted from diesel engines. Particulate matter is generally divided into two classes, PM₁₀ and PM_{2.5}. The former is particulate matter with an aerodynamic diameter of less or equal to 10 micrometres. These particles irritate the eyes and ears and cause general annoyance for the lungs. PM_{2.5} is comprised of fine particles with an aerodynamic diameter less than or equal to 2.5 micrometres. This is the most consistent predictor of mortality from cardiovascular, respiratory, and other diseases in studies of long-term exposure to air pollution.⁸⁹

Air quality affects health, quality of life, and subsequently the attractiveness of cities. ECA International conducts international liveability audits. While such audits are questionable and often biased, they do offer some insights. In 2013 Kuala Lumpur ranked 25th internationally for liveability. By 2018, the city had plummeted to 126. Lee Quane, regional director at ECA explains that “one of the main causes for this is that whilst other locations have improved their air quality, the high levels of pollution in Kuala Lumpur... have seen the city slip down the rankings.”⁹⁰ If cities are to become more attractive, they cannot ignore pollution and address its sources.

Public education and access to information is vital. Many people are not aware of pollution and the effect that it has on their wellbeing.⁹¹ Those that are aware often struggle to access reliable, real-time information regarding pollution levels. The Malaysian government promised PM_{2.5}

⁸⁸ Accessed online at

<http://www.atmo.arizona.edu/students/courselinks/fall09/atmo336/lectures/sec4/urban.html>

⁸⁹ *State of Global Air 2018*, Health Effects Institute (HEI), Boston, 2018, pp. 2.

⁹⁰ “KL’s liveability drops in survey; pollution and crime blamed”, *Malay Mail*, 13 March 2018, accessed at <https://www.malaymail.com/s/1597493/kl-liveability-drops-in-survey-pollution-and-crime-blamed>

⁹¹ To increase awareness, facilitate better understanding of pollution, and help people access information I have written several articles and posts on social media. This is written in an accessible manner targeting the layman with the goal of introducing the severity of pollution without fear-mongering. See for example: Speirs, J. and Fadzil, F. “Pollution in KL comparable to Beijing”, *Malaysiakini*, 6 June 2018 accessed at <https://www.malaysiakini.com/letters/428243>

readers would be operational by the end of 2016.⁹² These, however, were never deployed. At the World Urban Forum in February 2018 the United Nations offered to sponsor five air quality stations through the Clarity Clean Air Movement.⁹³

Noise Pollution

Motorised traffic is noisy and unpleasant. Noise pollution has shown to contribute to health issues such as sleep disturbance, cardiovascular issues, poor work and school performance, and hearing impairment.⁹⁴ Research has exposed a link between noise pollution and incidence of diabetes and hospital patient readmission rates.⁹⁵ Noise pollution from traffic has even been linked to higher incidences of dementia among the elderly.⁹⁷ Women in Ghana have even been advised to petition the Environmental Protection Agency to tackle noise pollution as it has allegedly disturbed their husbands' capacity to maintain erections.⁹⁸

Road traffic noise is caused by a combination of rolling noise and propulsion noise. Rolling noise is the interaction between the tyres and the road. For cars travelling above 40 km per hour it constitutes the main source of noise. Below those speeds, the main source of noise is the propulsion noise. That is the engine itself, the exhaust systems and transmission intake.⁹⁹

To some extent, this issue will be addressed once electric vehicles become the norm. This is still several years away, however, steps can be taken today to mitigate unnecessary noise. Firstly, any reduction in vehicle use or the number of vehicles on the road will curb noise pollution. The less dependent on cars a city is the quieter it will generally be (accounting, of course, for noise generated in construction and industry. Further, as mentioned, rolling noise is the primary source of vehicular noise pollution and increases as speed increases. As slowing vehicle speeds reduces the amount of noise they produce, traffic calming measures can be employed to not only reduce accidents but decrease the amount of noise generated. This will be examined in further detail shortly.

It is worth noting that noise pollution disproportionately affects poorer households. These families are already at risk. Any additional exposure to health threats can perpetuate systemic poverty. "Houses next to busy roads tend to be cheaper. The people who live in them tend to be on lower incomes and have fewer choices. And people on lower incomes tend to have more health problems... We live in a world where peace and quiet is increasingly a luxury item and noise and

⁹² "PM2.5 Technology Already Available in the Country", *The Rakyat Post*, 26 October 2015. Accessed online at

<http://www.therakyatpost.com/news/2015/10/26/pm2-5-technology-already-available-in-the-country/>

"KL to adopt PM2.5 air quality reading method by end of 2016", *Borneo Post*, 22 October 2015. Accessed online at

<http://www.theborneopost.com/2015/10/22/kl-to-adopt-pm2-5-air-quality-reading-method-by-end-of-2016/>

⁹³ Data accessible at <https://openmap.clarity.io/>

⁹⁴ *Global Street Design Guide*, National Association of City Transportation Officials (NACTO) and Global Designing Cities Initiative (GDCI), Island Press, New York, 2016: pp 12.

⁹⁵ Clark, C. et al., "Association of Long-Term Exposure to Transportation Noise and Traffic-Related Air Pollution with the Incidence of Diabetes: A Prospective Cohort Study", *Environmental Health Perspectives* 125.8, 2017.

⁹⁶ Basner, M. et al. "Auditory and non-auditory effects of noise on health", *The Lancet*, Vol. 383, 2014, pp. 1330.

⁹⁷ Hong, C. et al. "Living near major roads and the incidence of dementia, Parkinson's disease, and multiple sclerosis: a population-based cohort study", *Lancet*, 389, 2017.

⁹⁸ "Report erection-killing noise pollution to EPA – Ampaw to Kwasiwukrom wives", Ghana Web, 11 August 2018, accessed at <http://mobile.ghanaweb.com/GhanaHomePage/NewsArchive/Report-erection-killing-noise-pollution-to-EPA-Ampaw-to-Kwasitwukrom-wives-675995>

⁹⁹ Nugent, C. et al, "Noise in Europe 2014", European Environment Agency, Luxembourg, 2014, pp. 19.

stress are baseline conditions for the disadvantaged.”¹⁰⁰ Making our cities quieter not only makes them healthier places to live, it also makes them more socially integrated.

A final concern is the effect of noise pollution on the natural environment. Excessive noise is disruptive to wildlife.¹⁰¹ Noise may unsettle behaviour and constitutes a form of habitat destruction. The effect of vehicular noise on animals is often overlooked, however, it should not be discounted if we seek a complete picture of the consequences of auto-oriented cities.

Physical Activity and Associated Health

Physical activity is vital for good health yet many urban residents live sedentary lifestyles with little exercise. It is common for people to drive to work, take the elevator to their offices, sit for most of the day, and return home seated once more in their cars.

As cars gain prominence in cities, active modes of mobility become side-lined. As roads widen, pedestrian infrastructure often shrinks. As vehicular speeds increase cycling becomes dangerous and unappealing. In turn, more people choose to drive creating a feedback loop: active mobility is unattractive because of cars so more people choose to drive so active mobility become even less attractive. This limits the amount of exercise and social interaction residents get with negative consequences for their physical and mental health.

“Disease is written into the physical design of many cities, especially sprawling car-dependent cities which discourage walking and cycling and the attendant health benefits, besides the social interaction possible in walkable, people-friendly neighbourhoods.”¹⁰² The implications for health are becoming clearer.

The leading cause of death in Malaysia is heart disease.¹⁰³ This is closely linked to diet, physical activity, and weight. In terms of being overweight, Malaysia has been ranked second in East and Southeast Asia. Between 1996 and 2003 the number of overweight adults rose 60% while the prevalence of obesity more than doubled. While this rate has slowed the upward trend has continued: the Malaysian National Health and Morbidity Survey 2015 concluded that 30% were overweight and 17.7% were obese.¹⁰⁴

The Malaysian Ministry of Health has concluded that the “majority of adults are only minimally active.”¹⁰⁵ Increasing walking will not mitigate a poor diet but it is an important step. “At least 80% of premature heart disease, stroke and type 2 diabetes, and 40% of cancer could be prevented through healthy diet, regular physical activity and avoidance of tobacco products.”¹⁰⁶

Poor pedestrian infrastructure discourages walking which contributes to ill health by facilitating inactivity. There are further negative consequences for mental health and social wellbeing. Unattractive cities are not socially integrated and fail to facilitate active mobility. Research suggests that “we are less happy in neighbourhoods where cars and their infrastructure

¹⁰⁰ Godwin, R. “Sonic doom: how noise pollution kills thousands each year”, *The Guardian*, 13 July 2018, accessed at <https://www.theguardian.com/lifeandstyle/2018/jul/03/sonic-doom-noise-pollution-kills-heart-disease-diabetes>

¹⁰¹ Nugent, C. *et al*, “Noise in Europe 2014”, European Environment Agency, Luxembourg, 2014, pp. 51.

¹⁰² Williams, M. *Thrive 2: Health and Wellbeing in the City We Need*, United Nations University, Kuala Lumpur, 2016, pp. 19.

¹⁰³ *Health Facts 2016*, Ministry of Health Malaysia: Planning Division (Health Informatics Centre), 2016.

¹⁰⁴ Ghee, L. K. “A Review of Adult Obesity Research in Malaysia”, *The Medical Journal of Malaysia*, Vol 71, June 2016: pp. 2-3.

¹⁰⁵ *National Health and Morbidity Survey 2015; Volume 2: Non-Communicable Diseases, Risk Factors & Other Health Problems*, Ministry of Health, Kuala Lumpur, 2015: pp. 166.

¹⁰⁶ “Impact of Chronic Disease in Malaysia” – a supplementary report to *Preventing Chronic Diseases: a vital investment*, World Health Organisation, 2005.

prevent us from walking comfortably.”¹⁰⁷ When cars are the primary mode of transportation residents tend to engage one another less fostering “social isolation and higher rates of depression in car dependent neighbourhoods”¹⁰⁸ This can particularly affect the elderly. Thus, ensuring our cities are designed with their accessibility in mind is vital. Accessibility will be addressed in greater detail in Chapter 4 where we examine effective actions cities can take to become less auto-oriented, safer, and more attractive.

While it is clear that poor urban form can contribute to poor health the converse is equally true. “Yet the built environment can also be a potential treatment for chronic disease, and a place for disease prevention, if urban planners, designers, politicians, architects, health experts and transit specialists come together to reimagine and configure our cities for optimum health outcomes with minimal environmental impact.”¹⁰⁹ Good pedestrian infrastructure invites people to walk to the park or cafes and to run errands on foot. As they do so they engage and interact with the neighbourhood building a sense of belonging and improving social cohesion.

As people opt out of private cars as their preferred transport mode, they normalise active mobility and public transport. This encourages others to make similar choices. But these choices can come with risks. Cars pose a significant danger – it is to this threat which attention now turns.

Safer Cities, Safer Streets

Cars are dangerous. Every year about 1.25 million people are killed on roads.¹¹⁰ Road collision fatalities, currently ninth, are projected to become the fifth leading cause of death globally by 2030.¹¹¹ This affects all ages but the impact is most striking among the young: collisions are consistently one of the top three causes of death for people aged between 5 and 44 years.¹¹² This has substantial social and economic consequences. Many victims are just entering the economy and have a productive role to play. They are either killed or become unable to work. This places considerable strain on their families.

When considering which modes of transport cause the most fatalities it is clearly the car. Conversely, “almost half of those who die in road traffic crashes are pedestrians, cyclists, or users of motorised two-wheelers – collectively known as ‘vulnerable road users.’”¹¹³ These vulnerable groups are responsible for very few fatalities. “The sad irony is that the road users and modes that are the least responsible for traffic fatalities (and other urban transport impacts) are the most adversely affected”.¹¹⁴

It is imperative that vulnerable commuters are protected. That they are disproportionately injured is unjust. All residents of a city must be able to move freely and safely. Safe mobility should not be exclusively for those who can afford cars. “Policy-makers need to address the ability of road users to walk and cycle safely, ensure the availability of affordable and safe public transport,

¹⁰⁷ Williams, M. *Thrive 2: Health and Wellbeing in the City We Need*, United Nations University, Kuala Lumpur, 2016, pp. 24.

¹⁰⁸ *Ibid.*, pp. 33.

¹⁰⁹ *Ibid.*, pp. 19.

¹¹⁰ Welle, B. et al. *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths*, World Resources Institute, Washington, 2018, pp. 12.

¹¹¹ *Global Status Report on Road Safety: Time for Action*, World Health Organisation, Geneva, 2009, pp. 2.

¹¹² *Ibid.*, pp. 2.

¹¹³ *Ibid.*, pp. viii.

¹¹⁴ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 43.

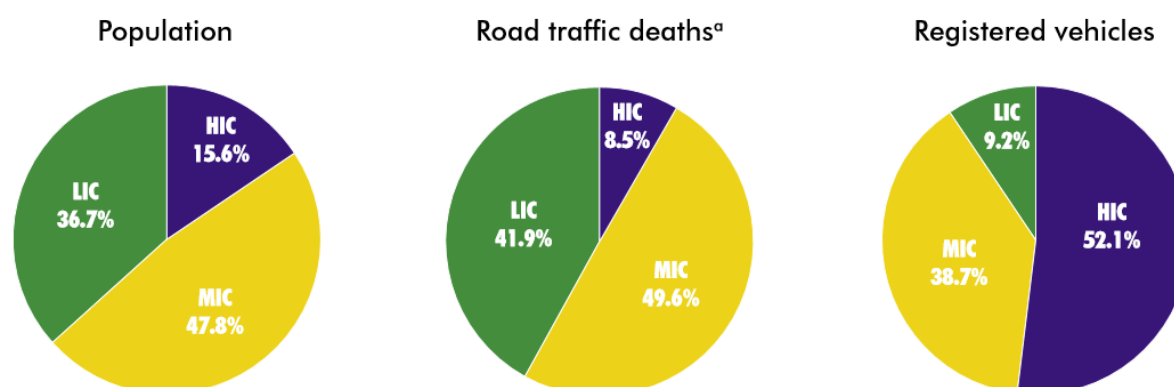
and seek ways to reduce dependency on the use of private cars.”¹¹⁵ If this is not done vulnerable groups will continue to suffer with numerous economic and social effects.

Road safety is a key component of development. As cities become wealthier more residents gain access to cars. This improves their quality of life and gives them access to larger areas of the city. It also results in pollution, congestion, and increased injuries or fatalities. Cities must facilitate growth while managing the negative consequences associated with increased car use. To achieve this, cities must ensure that infrastructure planning and investment make safety an integral element of mobility.

Table 1: Road Deaths by National Income¹¹⁶

National Income	Road Deaths per 100 000
Low	24
Medium	18
High	3
Malaysia ¹¹⁷	22.6

Figure 3. Population, road traffic deaths^a, and registered motorized vehicles, by income group



^a 30-day definition, modelled data.

HIC = high-income countries; MIC = middle-income countries; LIC = low-income countries

115 *Global Status Report on Road Safety: Time for Action*, World Health Organisation, Geneva, 2009, pp. 16.

116 Welle, B. et al. *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths*, World Resources Institute, Washington, 2018, pp. 5.

117 “General Road Accident Statistics in Malaysia”, Malaysian Institute of Road Safety Research (MIROS), accessed at <https://www.miros.gov.my/1/page.php?id=364>

118 *Global Status Report on Road Safety: Time for Action*, World Health Organisation, Geneva, 2009, pp. 11.

Table 2: General Road Accident Statistics in Malaysia ¹¹⁹

Year	Registered Vehicles	Population	Road Crashes	Road Deaths	Serious Injury	Slight Injury	Index per 10,000 Vehicles	Index per 100,000 Population	Index per billion VKT
1997	8,550,469	21,665,600	15,632	6,302	14,105	36,167	7.37	29.10	33.57
1998	9,141,357	22,179,500	11,037	5,740	12,068	37,896	6.28	25.80	28.75
1999	9,929,951	22,711,900	23,166	5,794	10,366	36,777	5.83	25.50	26.79
2000	0,598,804	23,263,600	50,429	6,035	9,790	34,375	5.69	26.00	26.25
2001	1,302,545	23,795,300	65,175	5,849	8,680	35,944	5.17	25.10	23.93
2002	2,068,144	24,526,500	27,711	5,891	8,425	35,236	4.90	25.30	22.71
2003	2,819,248	25,048,300	98,653	6,286	9,040	37,415	4.90	25.10	22.77
2004	3,828,889	25,580,000	26,815	6,228	9,218	38,645	4.52	24.30	21.10
2005	5,026,660	26,130,000	28,264	6,200	9,395	31,417	4.18	23.70	19.58
2006	5,790,732	26,640,000	41,252	6,287	9,253	19,885	3.98	23.60	18.69
2007	6,813,943	27,170,000	63,319	6,282	9,273	18,444	3.74	23.10	17.60
2008	7,971,907	27,730,000	73,071	6,527	8,868	16,879	3.63	23.50	17.65
2009	9,016,782	28,310,000	97,330	6,745	8,849	15,823	3.55	23.80	17.27
2010	0,188,565	28,910,000	14,421	6,872	7,781	13,616	3.40	23.80	16.21
2011	1,401,269	29,000,000	449,040	6,877	6,328	12,365	3.21	23.70	14.68
2012	2,702,221	29,300,000	62,423	6,917	5,868	11,654	3.05	23.60	13.35
2013	3,819,256	29,947,600	77,204	6,915	4,597	8,388	2.90	23.10	12.19
2014	5,101,192	30,300,000	476,196	6,674	4,432	8,598	2.66	22.00	10.64
2015	26,301,952	31,190,000	489,606	6,706	4,120	7,432	2.55	21.5	9.6
2016	27,613,120	31,660,000	521,466	7152	NA	NA	2.59	22.6	NA

Conclusion

Chapter 3 has examined the implications for safety, health and wellbeing. Cars compromise these essential features of our lives in multiple ways. Evidently, cities hoping to enhance health and wellbeing to become safer and more attractive need to shift their focus from prioritising the movement of cars to the movement of people. Chapter 4 examines commonly proposed solutions which are sadly ineffective. Many of these solutions still focus on the movement of cars or believe technology can save cities from the problems caused by cars. Chapter 5 will turn our attention to effective solutions which have proven successful in combatting the dominance of cars in cities and improving the lives of residents.

¹¹⁹ “General Road Accident Statistics in Malaysia”, Malaysian Institute of Road Safety Research (MIROS), accessed at <https://www.miros.gov.my/1/page.php?id=364>

Chapter 4: Ineffectual Solutions

Several solutions proposed to mitigate the harm caused by cars are not meaningful solutions. Some offer short term solution but perpetuate the problem in the medium and long terms. Others are merely marketing tools to sell new products. This chapter will examine these ineffectual solutions and expose their weaknesses.

Increased Roads – Induced Demand

Often, cities see restricted mobility through the lens of congestion. To do this is to ignore the many negative externalities of cars such as pollution and dangerous collisions. If, however, we suspend these concerns and examine congestion in isolation it becomes apparent that a commonly suggested panacea, increasing road capacity, cannot succeed. This is because as road capacity increases driving becomes more attractive which encourages more people to drive. An often-cited explanation for this comes from a 1997 letter to the Los Angeles Times: “Formerly, the model for traffic was a ‘liquid,’ where adding capacity relieved congestion. Now engineers are starting to see traffic as a ‘gas,’ where traffic volume expands to fill the capacity.”¹²⁰

No matter how much capacity is provided, traffic volume will expand to use all available capacity. Congestion is impossible to resolve by increasing roads due to generated traffic. Generated traffic has two components: diverted traffic and induced vehicle travel. Diverted traffic consists of cars that shift the time, route, and destination of their trip. Induced vehicle travel results when commuters shift from other modes, make longer trips, or make new vehicle trips. Diverted traffic happens first, and “tends to occur in the short-term, while induced travel is associated with longer-term changes in consumer behaviour and land use patterns.”¹²¹

If a new highway lane is opened the immediate consequence will be an alleviation of congestion. This alleviation will attract users who otherwise avoided that route due to congestion. It will also attract commuters who used that route at earlier or later times. This is diverted traffic. If there is any alleviation of congestion once these diverted users access the expansion new commuters will be attracted to the route. This is because roads usually have “latent travel demand, additional peak-period vehicle trips that will occur if congestion is relieved.”¹²² This is induced vehicle travel which is the result of a “triple convergence.”

“In response, three types of convergence occur on the improved expressway: (1) many drivers who formerly used alternative routes during peak hours switch to the improved expressway (spatial convergence); (2) many drivers who formerly travelled just before or after the peak hours start traveling during those hours (time convergence); and (3) some commuters who used to take public transportation during peak hours now switch to driving, since it has become faster (modal convergence).”¹²³

The problem is exacerbated by a feedback loop. “Induced travel increases many external costs. Over the long-term it helps create more automobile dependent transportation systems and land

¹²⁰ Jacobson, P. “‘Gas’ vs. ‘Liquid’ Models for Traffic”, *Los Angeles Times*, 14 May 1997, accessed at http://articles.latimes.com/1997-05-14/local/me-58478_1_freeways-capacity-traffic

¹²¹ Litman, T. “Generated Traffic and Induced Travel Implications for Transport Planning”, Victoria Transport Policy Institute, November 2011, pp. 20.

¹²² Ibid., pp. 2.

¹²³ Downs, A. *Stuck in Traffic: Coping with Peak-Hour Traffic Congestion*, Brookings Institution, 1992, pp. 28-29.

use patterns.”¹²⁴ Once cities become dependent on cars other modes of mobility become sidelined and less feasible. Buses are stuck in traffic and cyclists find it too polluted and dangerous. Congestion builds and cities are coerced into providing more capacity which ultimately makes congestion worse. “Over the long run induced travel represents an outward shift in the demand curve as transport systems and land use patterns become more automobile dependent, so people must drive more to maintain a given level of accessibility to goods, services and activities”¹²⁵

Increasing road capacity is subject to diminishing returns. While adding capacity in 1970 was affordable and yielded a relatively substantial benefit, today adding capacity is vastly more expensive (as cities are more built up and capacity is often added with elevated highways) and yields a smaller benefit. Further, adding more roads adds to annual maintenance costs. “Capital and maintenance expenditures on US highways have increased 15% and 19% per annum since the 1970s (as against an annual growth in motor vehicles of 3-4%), and in 2000, amounted to an astounding \$350 million every day. Notwithstanding this massive investment, congestion has worsened”.¹²⁶

This situation is the result of “predict and provide planning” which amounts to a self-fulfilling prophecy. “Planners extrapolate traffic growth rates to predict that congestion will reach gridlock unless capacity expands. Adding capacity generates traffic, which leads to renewed congestion with higher traffic volumes, and more automobile oriented transport and land use patterns. This cycle continues until road capacity expansion costs become unacceptable.”¹²⁷ This situation is summed up by the expression “build it and they will come.”

Induced demand is well documented and understood. Combatting congestion by building more roads is like fighting obesity by loosening one’s belt. It fails to address the root of the issue while providing more space for the problem to worsen. If cities are to enhance mobility without exacerbating the problems associated with cars more innovative solutions are required. Innovation, however, is not necessarily technological – in the following two sections, attention turns to “smart cities” and autonomous vehicles. While these may yield several benefits, the focus will fall on their shortcomings and why they are inadequate or unsuitable to addressing urban mobility.

Smart City Technology

Intelligent traffic systems, such as Siemen’s “Stratos”¹²⁸, use technology to monitor and control traffic. These systems generate excellent data such as vehicle numbers and travel times which can greatly assist transport planners. Further, they can control everything from traffic signals to parking management and collision reporting. This can alleviate congestion by smoothing traffic flow – essentially adding capacity.

Adding capacity by building new roads does not solve congestion, similarly, using technology to add capacity will yield similar results. The new capacity will induce demand and result in congestion in the medium to long term.

¹²⁴ Litman, T. “Generated Traffic and Induced Travel Implications for Transport Planning”, Victoria Transport Policy Institute, November 2011, pp. 28.

¹²⁵ Ibid., pp. 2.

¹²⁶ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 45.

¹²⁷ Litman, T. “Generated Traffic and Induced Travel Implications for Transport Planning”, Victoria Transport Policy Institute, November 2011, pp. 28.

¹²⁸ <https://www.siemens.co.uk/traffic/en/index/productssolutionservices/systems/traffic-management-system-stratos.htm>

Digitally increasing capacity does have many advantages. It does not require more land for roads essentially moving more people without expanding physical infrastructure. This can be crucial in cities which cannot build more roads due to space restrictions. While this does increase urban mobility, it does little to address many of the associated problems with cars such as class divisions and pollution.

Electric / Autonomous Vehicles

One way to address pollution is through electric vehicles. This only has a meaningful effect if the electricity is produced from sustainable sources – electric cars powered by coal power stations merely displace their emissions. This can still have some positive bearing in heavily polluted urban centres. Further, electric vehicles are far quieter contributing little to noise pollution. Electric vehicles, however, do not address many of the problems associated with cars. For example, they are still prone to congestion and pose a safety risk to pedestrians and cyclists.

Autonomous vehicles (AVs) seem to be addressing these safety concerns as they anticipate being far less prone to error than human drivers. Additionally, autonomous vehicles can improve mobility for those who are unable to drive: children, the elderly, and the disabled.¹²⁹ This will be of great benefit to these groups and improve access to urban mobility. AVs will also increase throughput of roads and reduce delays caused by collisions. For this, AVs ought to be commended.

However, it is likely that AVs will increase vehicle kilometres travelled (VKT).¹³⁰ AVs will reduce the cost of commuting – smoother traffic flow reduces fuel costs per, fewer collisions lowers insurance premiums, shared mobility would remove parking fees, the time in transit could be used leisurely or productively – this will allow people to live further from places to work. The result may be an increase in urban sprawl. Finally, these vehicles could be used to run errands *without* passengers – to collect takeout or drop a package.¹³¹ These additional VKTs will bring their own challenges which need to be considered.

Ultimately, electric and autonomous vehicles are substantial improvements on traditional vehicles. They improve urban air quality and will reduce the amounts of accidents and fatalities. These positives still do not address all of the problems associated with cars. They may exacerbate urban sprawl, they still contribute to congestion, and they perpetuate class inequality as they are only accessible to the wealthy.

Conclusion

This chapter has examined commonly promoted solutions to urban mobility and safety. Whether it is building more roads or trusting in technology to save cities these solutions are either ineffective or, at best, insufficient to make our cities safer and more attractive. The following chapter will look at effective solutions cities can implement. It is divided into two sections: incentives and disincentives. The first section considers positive measures to making our cities less auto-oriented and more people centric. The second section looks at ways to make driving less attractive by making motorists pay for their externalities and the effects they have on others.

¹²⁹ Anderson, J. *et al.*, “The Promise and Perils of Autonomous Vehicle Technology” in *Autonomous Vehicle Technology: A Guide for Policy Makers*, Rand Corporation, Santa Monica, 2016, pp. 17.

¹³⁰ Ibid., pp. 18.

¹³¹ Calthorpe, P. “7 Principles for Building Better Cities”, TED Vancouver, April 2017, time - 12:40. Accessed at https://www.ted.com/talks/peter_calthorpe_7_principles_for_building_better_cities

Chapter 5: Effective Solutions - Incentives

Effective solutions to car-oriented design can be divided into “pull” and “push” – those that encourage sustainable transport and those that discourage driving. Foremost are the pull factors – those which entice people to change their mobility mode. These are viable and attractive alternatives.

Incentives and disincentives play an important role in shifting people’s mobility choices. Without tangible alternatives, however, they are meaningless. This chapter examines ways to encourage alternative modes of transport and increasing mobility choices. These solutions come with their own set of advantages and disadvantages. Their feasibility is dependent on context. They are not either-or solutions but options which need to be facilitated in conjunction. Their co-ordination is what makes a city accessible.

Once alternatives are available, drivers must be encouraged to change their mode. Chapter 6 focuses on ways to discourage driving – such as congestion charges and fuel taxes. By making motorists pay fairly for their externalities we make driving less attractive in relation to the safer and more sustainable alternatives. Shifting cities away from auto-orientation towards more sustainable and resilient multimodal mobility requires coordinated action. Done in isolation, none of the following methods will result in a meaningful shift. “Enhancing public transit service, rational pricing of road use, and pedestrian accessibility comprise a three-legged stool, with each measure depending on the other two”.¹³² With this in mind, attention now turns to incentives to pull people away from cars and towards more sustainable modes of mobility.

Land Use Planning

Cities cannot discuss mobility without discussing land use planning. How the fabric of a city is woven determines what mobility choices are feasible and how attractive they are in relation to one another. This is why land use planning falls under incentives. Good planning can make alternatives to cars more attractive.

A principal determinant is density. Chapter 2 discussed the negative consequences of urban sprawl. The opposite of sprawl is density. At its extremes, however, density is problematic. High density can result in a cramped city with low quality of life. If cities increase their population or density at a greater rate than they provide alternative mobility options they become gridlocked. Optimum density seeks to find the mean between low and high density.

It is not merely congestion which is impacted by land use planning. How cities are planned plays an important role in how safe they are to move through. “Many problems in road safety can result from decisions, such as land use planning, that occur before roads are even constructed.”¹³³ Research examining Beijing and Delhi reveals “the greatest potential for reduction in road deaths when transport safety policies are combined with land use and transport policies that minimise reliance on privately owned motorized vehicles and emphasise space for walking, cycling, and public transport.”¹³⁴

¹³² Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 48.

¹³³ Welle, B. et al. *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths*, World Resources Institute, Washington, 2018, pp. 28.

¹³⁴ Ibid., pp. 29.

Cities need to be planned to encourage safer and more sustainable mobility modes. To start, cities could introduce “measures that promote the densification of urban areas by placing limits on the growth of new urban centres in peripheral areas. This reduces the length of average trips and the intensity of urban vehicle use.”¹³⁵ The next step is to redirect investment away from mobility which facilitates sprawl. “Investing less in new urban highways and more in public transport and soft mobility infrastructure, such as cycling paths and pavements, can contribute to reducing car dependency and may deter further urban sprawl.”¹³⁶

The urban form should encourage walking and make public transport feasible and attractive. “More research is needed on interventions that address vulnerable road users, while land use planning and road design should also take the needs of these road users into consideration.”¹³⁷ Two land use patterns which yield the greatest results are mixed-use development and transport-oriented development. These two policies are mutually reinforcing and should be applied simultaneously.

Mixed-Use Development

A key method to attaining optimum density is to ensure that land use is mixed. This generally entails making ground floors commercial spaces open to the public with residential properties on the floors above. Occasionally, there may also corporate spaces allocated to offices on the second or third floors. ITDP posits a 40:60 ratio between non-residential and residential land use as the optimum allocation of space in a mixed-use neighbourhood.¹³⁸

A central advantage to mixed-use areas is that they minimise the dependence on cars by placing key amenities in proximity to people’s homes. Short errands like trips to the shops can be quickly, conveniently, and safely conducted on foot or by bicycle. “Mixed-use development creates an environment in which there are many short trips that can be completed through walking.”¹³⁹ Conversely, single-use areas such as malls exacerbate congestion as they are almost exclusively accessible by car and draw numerous trips to a single location.

Ideally, mixed-use communities are also mixed-income communities. Affordable housing is essential to inclusive, equitable, and attractive cities. What constitutes affordable is debatable and context specific. ITDP proposes that an affordable rent is below 30% the mean income of the city.¹⁴⁰ Not all neighbourhoods can achieve mixed-income, however, cities need to recognise social exclusion as a serious problem. Additionally, poorer households may face mobility obstacles as they may not be able to afford private transport. Thus, mixed neighbourhoods need to be planned with transportation in mind.

¹³⁵ Francke, E. et al. “Mobilising Private Investment for Bus Rapid Transit systems: The case of Metrobus, Mexico City”, CTS Embarq, Mexico City, 2012, pp. 8.

¹³⁶ *Rethinking Urban Sprawl: Moving Towards Sustainable Cities (Policy Highlights)*, Organisation for Economic Cooperation and Development (OECD), Paris, 2018, pp. 13.

¹³⁷ *Global Status Report on Road Safety: Time for Action*, World Health Organisation, Geneva, 2009, pp. 16.

¹³⁸ *Pedestrians First: Tools for a Walkable City*, Institute for Transportation and Development Policy (ITDP), New York, 2018, pp. 51.

¹³⁹ *Ibid.*, pp. 25.

¹⁴⁰ *TOD Standard*, Institute for Transportation and Development Policy (ITDP), New York, 2017, pp. 69.

Transport Oriented Development (TOD)

Cities which aspire to public transport having a high modal share need to plan accordingly. An effective way to encourage public transport is to ensure that development occurs in proximity to transportation nodes. In some ways, TODs are built upon the principle of mix-use communities. As the World Bank explains: “TOD is a planning and design strategy to ensure compact, mixed-use, pedestrian and two-wheeler friendly, and suitably dense urban development organized around transit stations. It embraces the idea that locating amenities, employment, retail shops and housing around transit hubs promotes transit usage and nonmotorized travel. Well-planned TOD is inclusive in nature and integrates considerations of resilience.”¹⁴¹

Planning like this helps break dependency on private transport, increases accessibility to essential goods and services, and increases safety. Developing a city to facilitate high rates of public transport with appropriate pedestrian infrastructure can reduce fatalities from traffic collisions.¹⁴² It also encourages physical activity improving health while decreasing noise and air pollution. TODs may seem to be an excellent solution; however, they face a serious challenge.

A principle issue faced with TODs, especially in Malaysia, is increased property prices displacing transit riders. Brickfields, the neighbourhood where KL Sentral station is located, is designated a TOD. This resulted in the land value escalating. To recover their investments, property developers built high-end apartments. The people who can afford to rent these apartments can afford imported luxury vehicles which they prefer to taking public transport. Poorer families, who rely on public transport, cannot afford to live near such a TOD. One way to counter this is to facilitate a polycentric urban form.

Polycentricism

Polycentric land use balances land values, optimises density, and increases mobility within cities. Traditionally, cities have had single centres where businesses are concentrated. Many contemporary cities, however, have grown to the extent that having a single centre in which most business is conducted is no longer practical. Many CBDs are too crowded and congested as residents commute from sprawling suburbs to single city centres.

Monocentric cities see property values increase in the centre, often to the point that it becomes unaffordable to working families. This can compromise mobility. Such is the case of KL Sentral where housing prices surrounding a TOD exclude a key demographic of public transit users. Well-coordinated TOD, however, facilitates polycentrism. This decentralises the urban form which allows for different areas of the city to be developed – particularly land which was not previously expensive. In this way, new transportation hubs can be more inclusive and include mixed income communities.

Polycentricism balances density by creating alternative clusters of activity. When a city is more evenly spread it is less likely to suffer from areas of excessive density contrasting with areas of sparse sprawl. This balances and optimises density which contributes to improved mobility. Cities with a dominant urban centre and distant suburbs force commuters to all travel in one direction at certain times of the day. A means to alleviate this while retaining the advantages of density is to establish multiple centres connected by public transit. An excellent example is Seoul

¹⁴¹ Serge, S. and Gerald, O. "The 3V Framework: Maximizing Economic Opportunities in TOD Station Areas by Matching Place, Node, and Market Potential Values", The World Bank, Washington, DC, 2016, pp. 3.

¹⁴² Bhalla, K. et al. "A Risk-Based Method for Modelling Traffic Fatalities", *Risk Analysis* 27 (1), 2007, pp. 135.

which planned and developed the Gangnam CBD across the river from the historic CBD. Having several business centres has benefitted Seoul enormously.

A polycentric city will have, for example, some commuters traveling north to south in the morning while others travel south to north. In the evenings, after work, this pattern is reversed. This ensures transportation infrastructure is more optimally used. Highways will have traffic flowing in both directions rather than a single direction while the opposite lanes remain empty. The effect is also vital to public transport which will have tickets sold for trains heading in both directions. Currently, in Kuala Lumpur most people head into the city centre in the morning and empty trains are sent back out to the suburbs to collect more commuters. These empty trains cost money to move but generate no revenue. Were the city's population more evenly distributed transport operators would not face these inefficiencies.

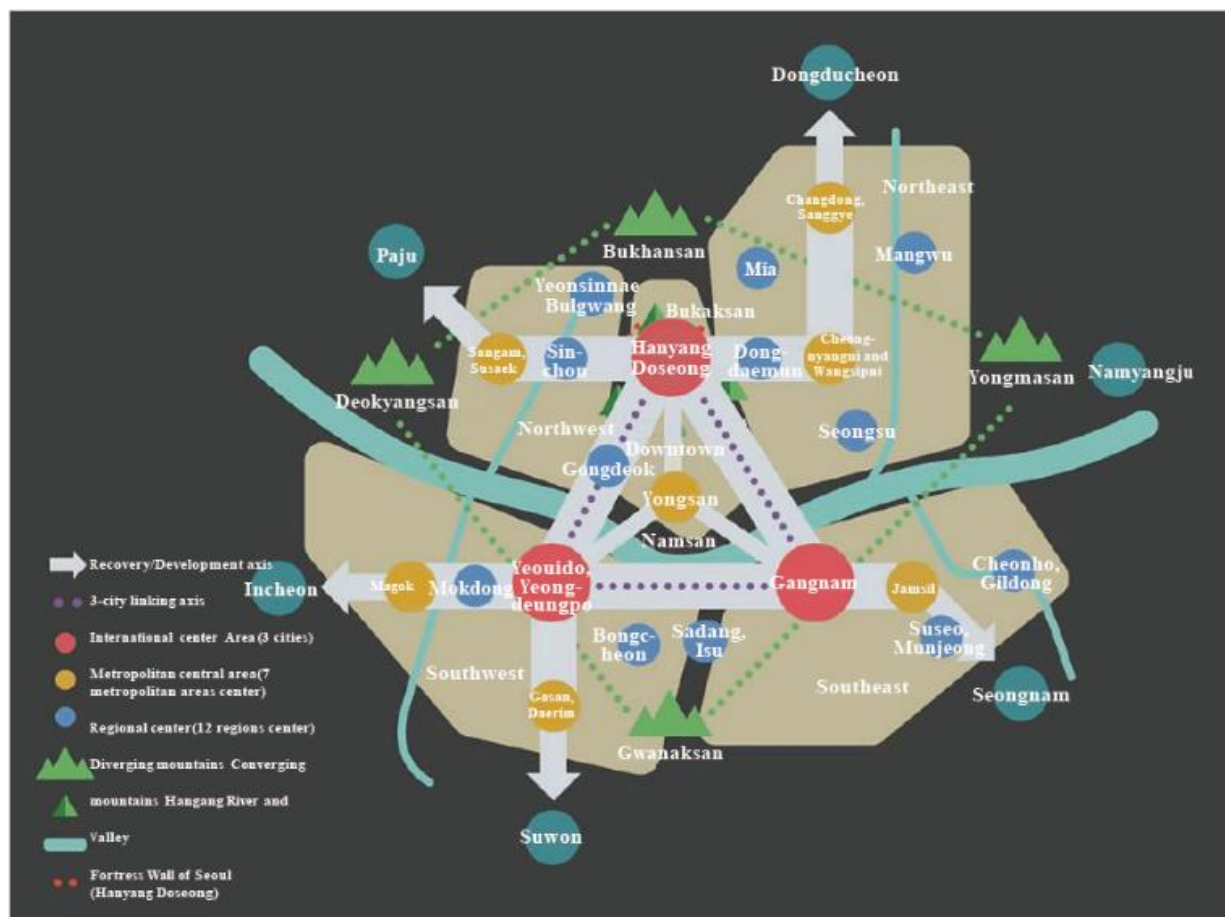


Figure 12: Seoul's polycentric approach means that population density is spread more evenly throughout the city and people's commutes do not all follow the same path during the same time of day.¹⁴³

¹⁴³ Kim, I. "2030 Seoul Plan", *The Seoul Institute*, July 2015, pp. 207.

Case Study 2 – Kota Kinabalu’s density distribution

The distribution of density in Kota Kinabalu shows how higher densities facilitate opportunities while lower densities restrict a city’s options. In the Likas area of Kota Kinabalu approximately 15 schools exist within a 2km² area. This makes it easy for schools to collaborate and compete. Scholars can walk to sporting events and easily network with their peers at other schools. While the density of schools has advantages it also presents challenges – principally congestion. In the mornings many parents drive their children to school and drop them off. The afternoons, however pose a more substantial problem. Rather than merely dropping their children and leaving, parents arrive early and wait for school to end. This results in long queues near school gates, ample illegal parking, and severe congestion. This is not insurmountable, rather, it is an opportunity. The density of schools makes facilitating public transport easier and more financially feasible.



Figure 13: Substantial congestion at a school in Kota Kinabalu (S.J.K St. James).

A well-planned school bus system could easily alleviate much of the congestion around the schools. The largest obstacle to an efficient school bus, however, is the low density of the residential areas and the poor provision of pedestrian infrastructure.¹⁴⁴ School buses would need to drive a great distance to drop a few children off as the suburban residential neighbourhoods are extremely low density. Additionally, they would need to drop children directly at their front doors as few of the suburban streets have *any* space for people to walk.

The density of schools in the Likas area evidently provides an opportunity for better provision of public services which could improve the lives of residents. The benefits of this density are undermined, however, by the low density of the areas which would need to be serviced. Increasing the density of residential areas and providing better pedestrian infrastructure or calmer streets, allowing children to cycle, would go a long way in alleviating congestion, reducing air pollution, and saving time.

¹⁴⁴ This is based on research I conducted for Atur Traffik in April 2018.



Figure 14: A school (S.J.K. Chung Hwa) in Kota Kinabalu allocates more of its land to parking than into facilities for the children.

Prioritise Safety

When it comes to planning and providing infrastructure the priority should always be safety. According to the WHO pedestrians, cyclists, and motorcyclists account for 46% of global road traffic deaths.¹⁴⁵ Although these vulnerable road users do occasionally harm others, they are usually victims. Often, they are the involved in collisions as there is inadequate infrastructure to serve their needs. Roads without pavements force pedestrians into conflict with vehicles. “Poor infrastructure and lack of pavements, and lighting are among the reasons why pedestrians have to share the road with cars, buses, taxis, and other modes of transportation.”¹⁴⁶

Strong policy and regulation is needed to ensure that equal, if not greater, consideration be granted to vulnerable road users. “Governments need to take into consideration the needs of all road users when making policy decisions that impact road safety. To date the needs of vulnerable road users have been neglected in many countries and should be given renewed emphasis,

¹⁴⁵ *Global Status Report on Road Safety: Time for Action*, World Health Organisation, Geneva, 2009, pp. 14.

¹⁴⁶ *Ibid.*, pp. 16.

particularly when decisions are made about road infrastructure, land use planning and transport services.”¹⁴⁷

Infrastructure that moves people safely and efficiently ought to be prioritised over infrastructure that is known to result in people being killed and maimed. In other words, pedestrian and cycling infrastructure coupled with public transport ought to be prioritised over roads for cars. By reducing the amount of infrastructure dedicated to cars and allocating more space to other modes it is possible to shift the modal mix. “Reducing exposure to the risk of injury or death on the road can also be achieved by reducing the total amount of motorised road transport. This in turn requires considerable investment in infrastructure that allows pedestrians and cyclist to walk and cycle safely.”¹⁴⁸

Roads with high vehicle velocity mean higher fatalities and worse injuries. “In many countries roads are planned and built to allow motor vehicles to travel faster while insufficient thought is given to the needs of pedestrians and cyclists, which means that these vulnerable road users face increasing risks in using and crossing roads.”¹⁴⁹ Cities which prioritise safety need to consider how roads are planned and designed to ensure the safety of all users. The following section examines road design and traffic calming as measures to increase the safety and attractiveness of cities.

Road Design

If people are going to choose walking, cycling, or public transport they need roads which are designed with their safety in mind. “For decades, streets have been evaluated based on the movement of vehicles and the safety of drivers, but the true mobility function of a street can only be measured when the safety and movement of all users are considered.”¹⁵⁰

In countries with the lowest road deaths, focus on safety has shifted from the people using the roads to the people designing them.¹⁵¹ Education, training, regulation, and enforcement are worthy endeavours. They are, however, expensive – requiring constant investment to be effective. Additionally, these programme’s effectiveness diminishes over time. Design is not only more effective at reducing collisions, it is more affordable. Human error is inevitable but the severity of the collision is the result of infrastructure design. “Many fatalities occur not because of driver error but because of driver error combined with a negligently designed road system.”¹⁵²

Often cities are reluctant to accept culpability for fatal traffic collisions. In April 2018 a 46-year-old woman was killed by a lorry when crossing Jalan Nosoob Hungab.¹⁵³ Penampang Police Chief blamed “pedestrian’s negligence” despite this occurring on a busy neighbourhood road which lacks *any* pedestrian infrastructure or traffic calming measures. This is clearly an issue of design and the victim should never have been blamed.

Media coverage of this sort is common and exacerbates the problem. Research in the United States reveals that media coverage of pedestrian fatalities typically focuses on aspects of

¹⁴⁷ Ibid., pp. x.

¹⁴⁸ Ibid., pp. 16.

¹⁴⁹ Ibid., pp. 14.

¹⁵⁰ “Global Street Design Guide”, National Association of City Transportation Officials (NACTO) and Global Designing Cities Initiative (GDCI), Island Press, New York, 2016: pp. 43.

¹⁵¹ Welle, B. et al. *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths*, World Resources Institute, Washington, 2018, pp. 3.

¹⁵² Job, R. et al, “Traffic Accidents are a Political Issue” in *Medical Journal of Australia* 151 (6), 1989, pp. 356.

¹⁵³ “Woman killed in KK mishap”, *Daily Express*, 3 April 2018, accessed at <http://www.dailyexpress.com.my/news.cfm?NewsID=123859>

the collisions which are indicative of an implicit bias in favour of drivers.¹⁵⁴ These articles commonly use passive rather than active language to mitigate blame: “a pedestrian was killed” rather than “a driver killed.” Further, the reports often focus on the behaviour of the victim rather than the “context about the quality of sidewalks and crosswalks, street lighting, other infrastructure and road conditions.”¹⁵⁵

Governments need to acknowledge that design choices directly impact safety and take steps to address this. They need be proactive rather than reactive in their approach to road safety.¹⁵⁶ International best practice must be identified and emulated. Safer design needs to become standardised for all transport projects. Once countries acknowledge safety is a design issue, they can take appropriate action. South Korea had 13 429 traffic fatalities in 1991. By 2012 that number had shrunk to 5 392.¹⁵⁷ Some of this has been attributed to driver education and improved safety features in vehicles. Central to this radical improvement lies changes to road design to slow vehicle speeds and reduce the number of points at which vehicles and people come into conflict.

Where governments are slow to take responsibility for design and public safety it is advantageous to have legal avenues through which to facilitate the change. In June 2018, the United States Court of Appeals found that an unsafe street design, demonstrated by a pattern of crashes or complaints, can be enough for a jury to find a public agency responsible for a collision.¹⁵⁸ The government is now legally responsible for poor design which generate “collision hotspots” and are obligated to address the issue. Having mechanisms such as an independent judicial system which can leverage the legislature in meaningful ways will greatly assist in accelerating the rate of change in favour of the public good.

Evidently, road design plays a crucial role in road safety. “Some of the solutions lie in appropriate modifications to the physical road environment and setting up a supportive policy framework rather than focusing on human behaviour as the primary cause of road traffic crashes.”¹⁵⁹ There are numerous proven safety countermeasures. To examine them all falls outside of the scope of this paper. The following section, however, examines traffic calming as a key feature of safer and more attractive cities.

¹⁵⁴ Campbell, A. and Robinson, C. “Dying while walking: Interrogating media coverage of pedestrian deaths in the United States”, University of Tennessee, 2018, pp. 27 – unpublished report, accessed at http://mediad.publicbroadcasting.net/p/wpln/files/dying_while_walking_wbn_presentation_final.pdf

¹⁵⁵ Gonzalez, T. “TSU Researchers: Pedestrian deaths are misunderstood, in part because of police and journalists”, *Nashville Public Radio*, 27 June 2018, accessed at <http://www.nashvillepublicradio.org/post/tsu-researchers-pedestrian-deaths-are-misunderstood-part-because-police-and-journalists#stream/0>

¹⁵⁶ Welle, B. et al, *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths*, World Resources Institute, Washington, 2018, pp. 16.

¹⁵⁷ Sul, J. “Korea’s 95% reduction in child Traffic Fatalities: Policies and achievements”, *Korea’s Best Practices in the Transport Sector (15)*, The Korea Transport Institute, Seoul, 2014, pp. 24.

¹⁵⁸ Lombardo, D. “Court ruling opens door to lawsuits over unsafe roads”, *Times Union*, 13 June 2018, accessed at <https://www.timesunion.com/news/article/Court-ruling-opens-door-to-lawsuits-over-unsafe-12991504.php>

¹⁵⁹ *Global Status Report on Road Safety: Time for Action*, World Health Organisation, Geneva, 2009, pp. 17.



Figure 15: Proven Safety Countermeasures - available on the U.S. Department of Transportation's Federal Highway Administration website. These provide detailed links explaining the intervention. Such guidelines from national governments can greatly assist regional and municipal governments to implement such countermeasures.¹⁶⁰

Traffic calming

Areas with calmer traffic are safer and more pleasant to walk or cycle through. Traffic calming hinges on two elements: lower vehicle speeds and smoother traffic flow. Speed is the central factor in determining the seriousness of a collision. Road design is the single largest determinant of traffic speed. Wide lanes with few features to control acceleration (regular traffic lights, etc.) allow vehicle speeds to become fatal. New road designs are essential for making safer cities. But traffic calming goes beyond merely making streets safer.

“Reducing vehicle travel and speeds to improve safety also reduces other negative externalities”¹⁶¹ Calmer traffic conditions also reduce noise pollution and exhaust fumes. This, as we have seen, affects health, wellbeing, and the attractiveness of a city. Calmer traffic, however, is not merely slower traffic but rather steady driving speeds.¹⁶² Breaking and accelerating increase both vehicle noise and exhaust emissions.

Well planned traffic calming ensures a moderate yet steady flow of vehicles. Calm traffic has an increased rate of flow and a higher vehicle capacity. Firstly, this is because calmer traffic

¹⁶⁰ <https://safety.fhwa.dot.gov/provencountermeasures/>

¹⁶¹ Welle, B. et al, *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths*, World Resources Institute, Washington, 2018, pp. 22.

¹⁶² Pharaoh, T. and Russell, J. “Traffic Calming Policy and Performance: The Netherlands, Denmark and Germany”, *The Town Planning Review*, Vol. 62, No. 1, 1991, pp. 22.

results in an even spread of vehicles with less bunching which exacerbates congestion. Secondly, driver error is lower meaning fewer accidents and interruptions. Finally, calmer traffic allows following distances to diminish allowing more vehicles in the same space.¹⁶³ Although traffic calming improves the situation for motorists its effect on other road users is more substantial. While the former are spared a few moments, the latter are far safer and less likely to be injured or killed.

A poor iteration of traffic calming, however, may have intermittent speed bumps which merely encourage drivers to accelerate rapidly and break sharply in order to swiftly leave the area. Traffic calming should not frustrate drivers – when done well it should not be noticed. In Malaysia, most traffic calming measures were “implemented on an ad hoc basis without any proper standard or guidelines, but purely on the basis of experiences of the local traffic engineer and request from the residents.”¹⁶⁴ Thus traffic calming has a poor public image – generally perceived as a nuisance.

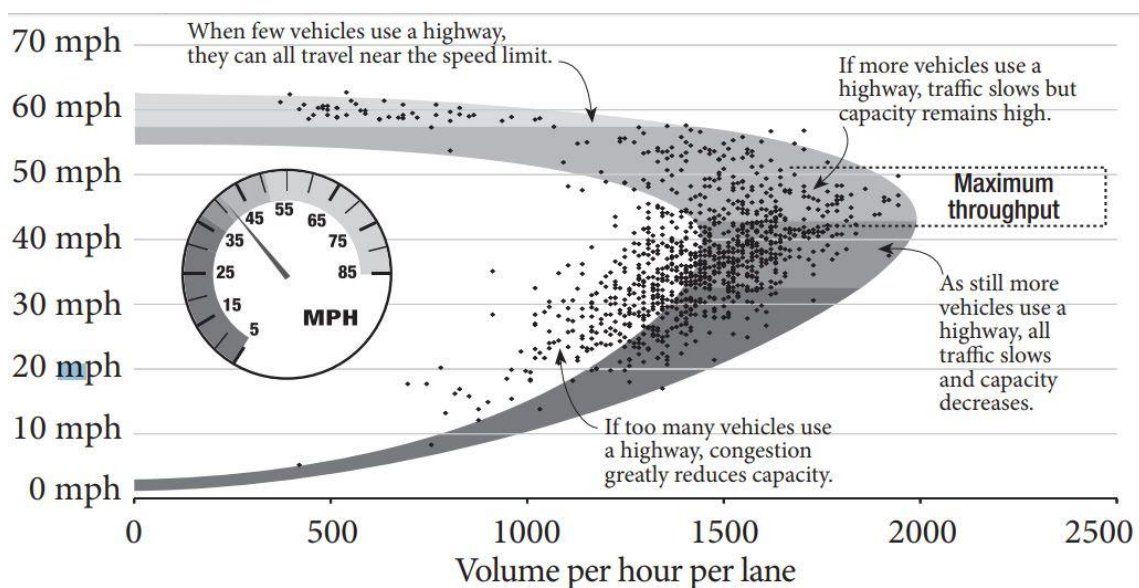


Figure 16: At a certain speed vehicle capacity begins to decrease. The speeds depicted here are for highways – similar trends can be observed on urban streets. Speeds, however, are lower.¹⁶⁵

Pedestrian Infrastructure

This is the foundation of mobility. Every person is a pedestrian at some point in their day. Further, if people are unable to walk safely to public transport, they are less likely to use it. Cities were predominantly pedestrian in 1900. The 20th century saw pedestrian infrastructure relegated and cars prioritised. Pedestrian infrastructure “needs to be *restored* more than *created*”.¹⁶⁶ It is about reclaiming the public realm for all.

¹⁶³ *Highway Capacity Manual*, Transportation Research Board, National Academy of the Sciences, 2000, pp. 29-9.

A typical freeway will have capacity of 75 vehicles per kilometre per lane with a vehicle spacing of 13.3m. An urban street will have capacity for 130 vehicles per kilometre per lane with a vehicle spacing of 7.5m.

¹⁶⁴ Manan, M. et al. “Traffic Calming Scheme Around the Vicinity of School”, Malaysian Institute of Road Safety Research, 2009, pp. 4.

¹⁶⁵ “WSDOT’s Congestion Measurement Approach: Evaluating System Performance”, Washington State Department of Transportation, Washington, 2011, pp. 2.

¹⁶⁶ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 47.

“To urge making pedestrian accessibility the foundation of urban transport policy is not to suggest that personal motor vehicles are not important”.¹⁶⁷ Cars can play an important role in cities, especially for those with mobility handicaps. Providing infrastructure for non-motorised transport, however benefits everyone. “Providing segregated facilities for pedestrians and cyclists would not cost much, but would allow all modes, including personal motor vehicles, to operate more efficiently.”¹⁶⁸ Provision of such infrastructure encourages increased active mobility. “‘Build it and they will come’ is as true of pedestrians (and cyclists) as it is of motor vehicles”¹⁶⁹

It is interesting comparing Sweden and Canada: “urban car modal share in Sweden is significantly lower than in Canada, despite similar per capita incomes and motor vehicle ownership, and not dissimilar densities (and average winter temperatures). Interestingly, the significantly lower car use in Sweden is not so much because of higher public transit use (indeed, the public transit share in Canadian cities is higher), but because of significantly higher walking and cycling shares relative to Canada.”¹⁷⁰ This frees up roads and allows traffic to flow more freely which increased mobility for everybody.

There are of course additional benefits of pedestrian infrastructure such as reduced air and noise pollution, improved physical and mental health from improved physical activity, and even benefits to the local economy. As mentioned in Chapter 2, when New York reclaimed Broadway and pedestrianised Times Square business thrived to the extent that rent doubled between 2012 and 2013.¹⁷¹ Reclaiming pedestrian space improves safety. “City officials say that after traffic was rerouted in Midtown, there were 35 percent fewer injuries from pedestrians being hit by cars and 63 percent fewer injuries to drivers and their passengers from fender-benders. And, in the three years after a plaza was created in Fort Greene, Brooklyn, accidents dropped 53 percent and injuries from crashes dropped 62 percent.”¹⁷²

Pedestrian infrastructure is vital to safer and more attractive urban mobility. Despite this there are still obstacles to its provision – specifically a lack of political will. Essentially, “decision-makers have what might be called a *car windshield view*, in part because, while those who walk and cycle have no say, those who have a say do not walk.”¹⁷³ Most politicians and planners who make policy and design streets leave their home in the suburbs, sit in traffic, arrive at the office, park in the garage, and leave again via their own car. They do not use mass transit nor do they do any meaningful walking in the city. This creates a disconnect between how they envision the city and the realities faced by the residents. Ideally, policy makers should use public transport more regularly and walk in their cities.

The political disconnect with infrastructure results in poor design and maintenance. The discontinuity of Kuala Lumpur’s sidewalks illustrates this point. The city, like so many developing cities, is plagued by “poor design and maintenance, vehicles being parked on them, electrical transformers and junction boxes, uncollected garbage, or encroachment by local businesses and

¹⁶⁷ Ibid., pp. 48.

¹⁶⁸ Ibid., pp. 48.

¹⁶⁹ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 48.

¹⁷⁰ Ibid., pp. 49.

¹⁷¹ Kimmelman, M. “A Street corner Serenade for the Public Plaza”, *The New York Times*, 31 May 2013, accessed at <http://www.nytimes.com/2013/06/02/arts/design/a-prescription-for-plazas-and-public-spaces.html>

¹⁷² Barron, J. “Lounge in Them. Dash Through Them. But Don’t Call Them Parks.”, *The New York Times*, 13 July 2018, accessed at <https://www.nytimes.com/2018/07/13/nyregion/lounge-in-them-dash-through-them-but-dont-call-them-parks.html>

¹⁷³ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 48.

hawkers”¹⁷⁴ Cities need to provide safe and accessible pedestrian infrastructure. The following sections will examine some key features of pedestrian spaces, what works, and what does not.

Accessibility

Accessibility is essential to equitable and attractive cities. “Pedestrian accessibility involves a wide range of issues, including street lighting, road drainage, tree cover, modal segregation (by way of, for example, bus bays), traffic and path management and control, garbage collection and disposal, the design and integration of electric and other utilities, and the provision of public toilets. Beyond this, urban roads need to be designed as public spaces for multiple groups, including pedestrians and cyclists, motor vehicle and transit users, the elderly, the young and the handicapped, and local businesses, including street hawkers – in short, as ‘complete streets.’”¹⁷⁵

Accessibility is of particular concern for those with restricted or compromised mobility. These people are particularly dependent on infrastructure such as elevators, vertical platform lifts, and access ramps. There are three principal groups who depend on this infrastructure to lead dignified lives: people whose mobility is compromised by physical disability, the very young, and the elderly.

Those with disabilities which impede their mobility require infrastructure which provides minimal obstructions and ease the use of mobility aids such as wheelchairs, walking frames, and rollators. Several things can impede access for these people; the most common of which are narrow pathways and steps. Ensuring adequate width of sidewalks, footpaths, and doorways is a basic necessity. Further, all buildings ought to ensure that they can be easily accessed by those with restricted mobility.

Access ramps are often mistakenly referred to as wheelchair ramps. These ramps, however, serve a much broader community. When we appreciate that most families require this infrastructure it becomes clear how important it is and how scarce it actually is. “Most architecture graduates think they’re designing access ramps for the odd wheelchair, not every child under three.”¹⁷⁶

Parents of young children know how difficult navigating the built environment can be. Without access ramps, children in prams are often cut off from areas of the city. This is particularly bad for public transport where train stations may be elevated or below ground. Catching the bus can also be difficult as many buses lack access ramps and are built with steep stairs. These pose a problem for young children even if they are out of the pram and capable of walking.

¹⁷⁴ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 45.

¹⁷⁵ Ibid., pp. 49.

¹⁷⁶ Murray, C. “What would cities look like if they were designed by mothers?”, *The Guardian*, 27 August 2018, accessed at <https://www.theguardian.com/commentisfree/2018/aug/27/architects-diversity-cities-designed-mothers>



Figure 17: A mother wheels her child off a curb. In the absence of a wheelchair ramp and good drainage, this pedestrian crossing in Kuala Lumpur is inconvenient.

Such obstacles, however, can be insurmountable for the elderly. As nations around the world become more affluent their demographic bell curves begin to shift. People are living longer and countries are facing aging populations unprecedented in human history. Cities need to ensure that they are accessible and attractive to the elderly. Older people need to feel they can navigate the city independently in order to get out, run common errands, and interact socially. This goes a long way to improving their quality of life, maintaining their physical health via daily activity, and, equally importantly, maintaining mental wellbeing through social interaction and inclusion.

Accessible design ensures that these vulnerable groups are not excluded from our cities. It is a matter of social inclusion and equity. Accessible cities, however, benefit all of us. Heavy goods being delivered often require trolleys. Cyclists benefit from access ramps when pushing their bikes into their buildings. Done well, accessible design cannot merely be functional. It can be beautiful. Good design is both accessible and attractive.



Figure 18: Robson Square in Vancouver seamlessly integrates accessibility and aesthetics. The Royal Architectural Institute of Canada recognised its contribution with the 2011 Prix du XXe siècle.¹⁷⁷

To ensure cities are accessible clear standards and regulation must be developed and enforced. It is vital that this information is easily accessible. Firstly, so that architects and planners can be familiar with them and secondly so that the public can hold them accountable. The Department of Standards Malaysia (DSM) is affiliated with the International Organization for Standardization (ISO) and is mandated to establish and accredit national standards in Malaysia. In this capacity they have accrued a document of accessibility standards known as MS 1184 “Universal Design and Accessibility in the Built Environment – Code of Practice”.

This thorough document details everything from elevator door widths to the appropriate angle of an access ramp. To download a digital copy, however, there is a fee of RM 240 (USD 57).¹⁷⁸ While this is an insignificant amount for a property developer, architectural firm, or international research institute – it remains prohibitively expensive for many citizens, residents’ associations, and special interest groups. It is these people who need access to such standards to advance accountability and ensure that cities are accessible for all.

Open access to data is vital for transparent governance of cities. It helps inform better decision making and encourages accountability. The role of open information is important at many levels and in many spheres of urban governance. We have seen how it has an important role to play in design of urban spaces. This paper will shortly examine how open information is essential to improving the user experience of public transport.

¹⁷⁷ <https://www.raic.org/raic/prix-du-xxe-siècle—2011-recipient-3>

¹⁷⁸ Downloadable, for a fee, at <https://www.msonline.gov.my/catalog.php?source=production&score=checked>

Pedestrian Bridges and Underpasses

Pedestrian bridges and underpasses are, counterintuitively, obstacles to non-motorised transport. Superficially, they appear to enhance mobility for pedestrians but upon closer examination there are three reasons they undermine pedestrian mobility. Firstly, they are expensive and misdirect resources which could be better spent. Secondly, they compromise pedestrian safety. Thirdly, they make pedestrians walk further and prioritise the flow of traffic. Today, some advocates for pedestrian safety propose referring to such infrastructure more accurately as “anti-pedestrian bridges” (“puentes antipeatonales”).¹⁷⁹

In many developing cities there is “an increasing tendency, in the name of providing pedestrian infrastructure to make inappropriate, and needlessly expensive, technological choices, by way of, for example, pedestrian over-bridges and underpasses.”¹⁸⁰ Pedestrian bridges and underpasses are extremely expensive to build. Bridges built near KL Sentral Station cost RM 11 million (USD 2.6 million) while another bridge spanning 10 lanes of traffic is estimated to have cost RM 65 million (USD 15.6 million).¹⁸¹ This is an issue I addressed in the Malaysian digital media as the bridges are almost completely unutilised.¹⁸² The money could have been put to much better use improving basic pedestrian infrastructure and providing at-grade crossings.

At-grade crossings are substantially cheaper and more convenient. They are also safer. Forcing pedestrians to use bridges or underpasses can also leave them vulnerable to crime. “By removing pedestrians from the natural surveillance of the street, they raise personal safety issues.”¹⁸³ This is particularly true for vulnerable groups such as women and the elderly who may feel unsafe and potentially cornered in the narrow passages of bridges and underpasses. By keeping people on the street, we increase not only their safety but the safety of others as well. A concept articulated as “eyes on the street” by Jane Jacobs.¹⁸⁴

At-grade crossings also play an important role in calming and regulating traffic flow. In city centres traffic should not be streamlined as the increase in vehicular speed greatly compromises pedestrian safety. Pedestrian bridges and overpasses are routinely ignored by pedestrians as they are an inconvenience which requires them to walk further. This results in increased jay walking in areas with higher vehicle velocity. A potentially deadly combination as the chance of an accident is increased as pedestrians forgo the safe, inconvenient, infrastructure in favour of convenient, illegal, and dangerous crossing. Additionally, for pedestrian bridges and overpasses to be accessible to the physically handicapped, the elderly, and parents with children in prams expensive elevators are required. Often these are not installed or poorly maintained causing vulnerable people to have no option but to cross hazardously.

To mitigate jay walking, Kuala Lumpur has erected pedestrian fencing at an additional cost. “If we do not fence it up, people run across the streets and that defeats the purpose of building

¹⁷⁹ Ishikawa, A. “Los puentes peatonales no sirven, pero seguimos construyéndolos”, *The Huffington Post* (Mexican edition), 27 August 2018, accessed at https://www.huffingtonpost.com.mx/armando-pliego-ishikawa/los-puentes-peatonales-no-sirven-pero-seguimos-construyendolos_a_23510217/

¹⁸⁰ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 49.

¹⁸¹ Bavani, M. “Monuments to failure”, *The Star*, 9 January 2017, accessed at <https://www.thestar.com.my/metro/community/2017/01/09/from-monuments-to-failures-automatic-street-toilets-a-taj-mahal-inspired-food-court-a-sophisticated-f/>

¹⁸² “It’s a design flaw, says urban planner”, *The Star*, 20 February 2017, accessed at <https://www.thestar.com.my/metro/community/2017/02/20/its-a-design-flaw-says-urban-planner/>

¹⁸³ “Global Street Design Guide”, National Association of City Transportation Officials (NACTO) and Global Designing Cities Initiative (GDCI), Island Press, New York, 2016: pp 84.

¹⁸⁴ Jacobs, J. *The Death and Life of Great American Cities*, Vintage Books, New York, 1961, pp. 35.

the bridge,” explains DBKL project management executive director Datuk Richards.¹⁸⁵ Evidently the purpose of building the bridge is not the convenience of pedestrians. “Underlying such facilities is the assumption that motor vehicle traffic is primary, and something which pedestrians should not disrupt.”¹⁸⁶ It is this attitude which needs to be acknowledged and addressed if cities are to transcend their auto-orientation to become more attractive and liveable.

IN SCHOOL

Importance of using pedestrian bridges

OCTOBER 19, 2012 00:00 IST

UPDATED: OCTOBER 24, 2016 11:27 IST

SHARE ARTICLE



PRINT



A



A



Figure 19: An article from India's largest English newspaper promoting pedestrian bridges with sponsorship from Michelin. Companies associated with auto-manufacturing have a vested interest in the elevated status of cars.¹⁸⁷

¹⁸⁵ Bavani, M. “Security fencing gives a ‘trapped’ feeling”, *The Star*, 20 February 2017, accessed online at <http://www.thestar.com.my/metro/community/2017/02/20/security-fencing-gives-a-trapped-feeling-pedestrians-find-dbkls-safety-measure-to-deter-snatch-thief/>

It is worth noting that similar problems have been encountered in Vietnam: “Pedestrian bridges underused in Ho Chi Minh City”, *Tuoi Tre News*, 26 September 2017, accessed online at <http://tuoitrenews.vn/news/society/20170926/pedestrian-bridges-underused-in-ho-chi-minh-city/41750.html>

¹⁸⁶ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 49.

¹⁸⁷ “Importance of using pedestrian bridges”, *The Hindu*, 24 October 2016, accessed at <http://www.thehindu.com/todays-paper/tp-in-school/Importance-of-using-pedestrian-bridges/article12562834.ece>

A final, and significant, criticism of pedestrian bridges and overpasses is that they perpetuate class division. Usually this means prioritising the movement of wealthier people in their cars. Often pedestrian bridges are found in poorer neighbourhoods particularly when these neighbourhoods are adjacent to highways. Wealthier residents of cities are seldom forced to cross the street via such bridges.

There are exceptions to this and Hong Kong provides an interesting example. The city centre is a maze of pedestrian over and underpasses such that, in some areas, it is uncommon to see people at street level. But these spaces are exclusive spaces. “The city's love affair with segregated pedestrian routes started in the 1960's, when the Hong Kong Land Company built an aerial walkway to connect one of its luxury hotels to the second floor of a shopping mall. The resulting influx of well-heeled tourists meant that higher rent could be charged on the second-floor shops, so naturally they began to do this on whatever project they could.”¹⁸⁸

Consequently, many, if not most, pedestrian bridges connect wealthy malls, high end hotels, and banks. These spaces, although they purport to be public are definitively private. This means that the right to accessibility is withheld from the city's most vulnerable. Homeless people or those, such as construction workers, who work “dirty jobs” are unable to pass through these pedestrian walkways as their presence outside the Louis Vuitton and Rolex retailers is deemed undesirable. This is an acute problem in Hong Kong where so much of the city and so many of the safe pedestrian crossings have become privatised.

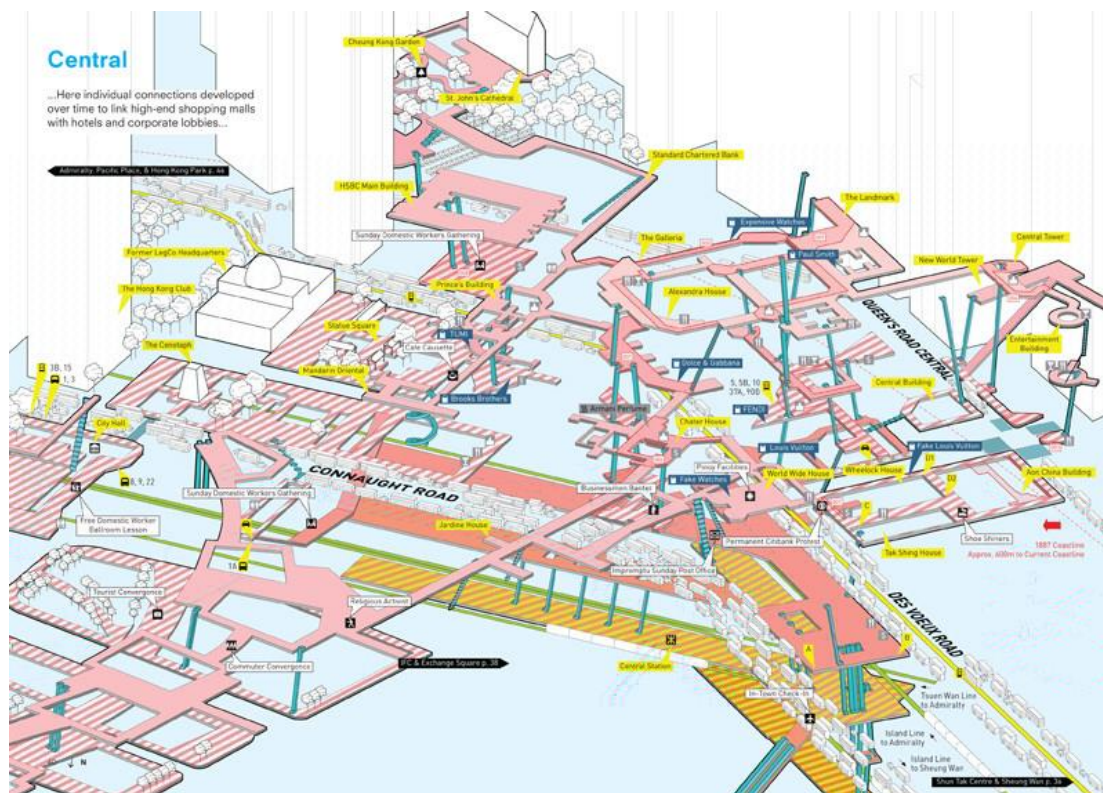


Figure 20: Hong Kong's CBD is a maze of private pedestrian crossings.¹⁸⁹

¹⁸⁸ Rackard, N. “Cities Without Ground: A Guide to Hong Kong's Elevated Walkways”, *Arch Daily*, 28 March 2013, accessed at <https://www.archdaily.com/352543/cities-without-ground-a-hong-kong-guidebook>

¹⁸⁹ <http://citieswithoutground.com/maps/>

Mixed-Use Paving and Shared Spaces

Ideally, cyclists and pedestrians should have separated infrastructure which prioritises their safety and mobility. This is often impossible to facilitate due to decades of development prioritising cars. Mixed-use paving and shared spaces are two options to improve mobility for non-motorised traffic. Mixed-use paving can be used by pedestrians and cyclists. The paving is adequately wide that both groups may access it safely. Shared spaces bring pedestrians and cars together and are “designed to improve pedestrian movement and comfort by reducing the dominance of motor vehicles and enabling all users to share the space rather than follow the clearly defined rules implied by more conventional designs.”¹⁹⁰ These will be considered in turn.

Opposition to mixed-use paving typically arises when paving designated specifically for pedestrians is proclaimed mixed-use. This is especially true if the paving remains the same size. If, however, there is no paving to begin with, mixed-use paving is welcomed. This improves the situation for everyone and pedestrian and cycling interests are united. Much of Malaysia lacks pavement. Even in the centre of Kuala Lumpur, sidewalks are scarce and discontinuous. Pavements often lead nowhere with no option but to turn back or illegally cross a busy road. Building mixed-use paving would facilitate pedestrian space while accommodating cyclists as well.

In many cities, cyclists are considered closer to cars than pedestrians. They are, however, non-motorised transport. Cycling with cars puts people at risk of serious injury or death. When walking with cyclists the risk is merely scrapes and bruises. To risk the lives of cyclists seems unnecessary. Cyclists have a bad reputation of being inconsiderate. This is principally true in traffic. On pavements, however, cyclists are far more considerate as they too are pedestrians and identify with the interests of pedestrians.



Figure 21: Mixed-use paving; in the absence of safe pedestrian crossings a family prepare to cross a four-lane road in Shah Alam, Malaysia.

¹⁹⁰ Hamilton-Baillie, B. “Towards shared space”, *Urban Design International* 13(2), 2008, pp. 6.

In shared spaces the dominance of cars is subverted and they are made to share the road, as equals, with pedestrians. The idea is that motorists will reduce their speed and be more considerate of pedestrians if pedestrians are relegated to the periphery of streets and not forced to cross at designated areas. “Indication of implied priority for motor vehicles is removed, as is a physical and psychological barrier to pedestrians which might discourage their using the full width of the road.”¹⁹¹

There are several problems with shared spaces. The most vocal opponents, perhaps unsurprisingly, are motorists. As their position of privilege is eroded, they voice concerns that such intersections are confusing and potentially dangerous. Better communication with the public is required so they understand that the confusing nature is precisely the characteristic which improves safety as motorists must slow down and negotiate their way as they traverse the space. There is, however, ample criticism of shared spaces – particularly from old people and the visually impaired, some of whom consider shared spaces “no-go zones.”¹⁹² Shared spaces have the potential to work but it is extremely context specific and requires ample public consultation.



Figure 22: A conceptual drawing for a shared space was approved by 64% of participants at a public exhibition in Bodmin, England.¹⁹³

¹⁹¹ *Manual for Streets 2: Wider Application of the Principles*, The Chartered Institute of Highways and Transportation, London, 2010, pp. 28

¹⁹² Moody, S. and Melia, S. “Shared space: Research, policy and problems”, *Proceedings of the Institution of Civil Engineers - Transport*, 167 (6), 2014, pp. 3.

¹⁹³ “Bodmin residents back ‘shared space’ scheme”, *Road Safety GB*, 10 August 2015, accessed at <http://roadsafetygb.org.uk/news/n-a-4512/#comments>

Integrated Public Transport

If cities are to encourage safer and more sustainable alternatives to cars, attractive, affordable and accessible public transport is essential. Two key factors determine the success of public transport. Firstly, the time and efficiency of public transport. Secondly, the price compared to the car. To facilitate this, all modes of public transport must be integrated.

Primary integration is spatial integration: different modes of public transport must overlap and complement one another. If there are long walks separating modes of transport then the speed, efficiency, and user experience is compromised. Further, route planning and spatial organisation need to be integrated. This ensures a wide network of coverage while reducing transport operators needlessly competing with one another. Other methods of integrating transport networks include unified branding and integrated ticketing systems.

Single System – Single Ticket

A single ticket for all modes of transport greatly improves user experience, inspires confidence in the network, and improves the attractiveness of public transport in relation to private cars. Technologically, this is not a difficult goal, however, many cities have failed to do this. Neither Cape Town, Bangkok, nor Kuala Lumpur have managed to integrate their public transportation – due, in part, to political will and fractured structures of governance.¹⁹⁴

An integrated payment system increases system efficiency while potentially reducing costs – both for users and operators. Having a single travel card that can be used on multiple modes of transport means that different tickets do not have to be bought at each modal shift. Moreover, prices can be subsidised when commuters shift mode. When changing from the bus to the train ticket prices can be lowered. This reduces the penalties of having to change modes while increasing the effective range of public transport. This is important as it lowers the cost of public transport in relation to car use. “An ideal system would let them move across a city for a single payment, transferring from trains to taxis to bicycles as needed. Building a platform to allow that is hard, and requires much sweet-talking of legacy networks as well as technology firms”¹⁹⁵

Key to an efficient transport network which services all areas of the city is cross-subsidisation whereby busy bus lines subsidise buses operating in quieter areas. Seoul’s 2004 reforms, under Mayor Myung-Bak Lee, provide an excellent model. Before, bus operators were paid according to the number of passengers. Thus, they competed for the busiest routes, did not serve quieter communities, and drove recklessly competing for passengers. The reforms changed how bus operators are “reimbursed on the basis of vehicle km of service instead of passenger trips (gross contracts), and fares collected for the whole system.”¹⁹⁶ Today more areas of the city are served, ridership has increased (along with fare collection), and the buses drive more safely. This would not be possible without a unified ticket.

A unified ticket has the added advantage of being able to generate data. Knowing where and when people travel allows for better planning and route coordination. But for this to be done effectively requires open and accessible data.

¹⁹⁴ Speirs, J. “Cape Town’s Public Transport – the political obstacles to a unified smart card”, IGLUS, 28 July 2016, accessed at <http://iglus.org/cape-towns-public-transport-the-political-obstacles-to-a-unified-smart-card/>

¹⁹⁵ “How to stop the decline of public transport in wealthy countries”, The Economist, 23 June 2018, accessed at <https://www.economist.com/leaders/2018/06/23/how-to-stop-the-decline-of-public-transport-in-rich-countries>

¹⁹⁶ Allen, H. “Bus Reform in Seoul, Republic of Korea”, *Global Report on Human Settlements*, Nairobi, 2011, pp. 6.

Data – Open and Accessible

It is vital that all relevant data is made available to all stakeholders. Information about travel trends can help planners develop new routes or reallocate resources to busier areas. But data is not just for transit operators – it ought to be accessible to those who use the services. Making data easily accessible gives users confidence in the system and helps them plan their movements more efficiently. Without this data being easily accessible public transport becomes less attractive.

Lessons from Kuala Lumpur are illuminating. In December 2016 the first phase of the MRT was opened. In July 2017 the final phase was completed. As of July 2018, Google Maps displays only half the MRT and no information on MRT feeder buses. The public cannot plan their trip on a third-party app but must access the MRT website, download the bus schedule pdf and plan from there. This is incredibly inconvenient for users and several members of the public have complained.¹⁹⁷

The operator has still not made the MRT routes publicly accessible to third parties. This is while they tested a proprietary journey planner app which they hoped would generate revenue for the company. I was privy to testing the beta version of their app. Ironically, while they were keeping the data private, they ran their application on open source Google base maps. The journey planner app is still not available despite being announced for the second quarter of 2018.¹⁹⁸

Making the data available can save cities from having to develop their own route planners which are often costly. SPAD has not released the cost of its Journey Planner app which has only fuelled rumours of the exorbitant cost. Long term, a city may aspire to develop an app for route planning, ticketing purposes, and brand development.

A necessary step to this is preparing the data. The immediate goal should be to gather all public transport routes and times for third party apps. Information should be provided in General Transit Feed Specification (GTFS)¹⁹⁹ – this is a global standard that allows apps like Google Maps and Moovit to provide information to the public. These are existing transport planning apps used globally – already familiar to most, including tourists. When people can easily navigate a city and plan their routes with confidence public transport becomes more attractive.

Buses, BRT, and Rail

Different cities have different needs and fiscal situations which determine which modes of transport are suitable for their context. Most cities have some kind of bus network of varying efficiency and capacity. In developing nations minibuses are particularly popular given lower cost, high network flexibility, and often lower city densities. As cities grow, full-sized buses become essential. Without dedicated bus lanes, however, buses are prone to being stuck in congestion. Private vehicles, often with low occupancy rates, compromise mobility for the majority.

One work around is to enforce dedicated bus lanes, or, if finances and ridership allow it, to develop a Bus Rapid Transit (BRT) network. BRT can be divided into “full-service” and “lite” categories.²⁰⁰ Full service BRTs use dedicated lanes, raised boarding platforms, and pre-boarding

¹⁹⁷ “Why the MRT is failing to reach its ridership target”, Malaysiakini, 30 October 2018, accessed at <https://www.malaysiakini.com/letters/449804>

¹⁹⁸ Bernama, M. “‘Journey Planner’ app to help KL public transport users”, Free Malaysia Today, 22 March 2018, accessed at <https://www.freemalaysiatoday.com/category/nation/2018/03/22/journey-planner-app-to-help-kl-public-transport-users/>

¹⁹⁹ <http://gtfs.org/>

²⁰⁰ Collier, P. *et al.*, *Accessing Opportunities: Policy decisions for enhancing urban mobility*, International Growth Centre, London, 2018, pp. 36.

fee collection. Lite systems occasionally mix with general traffic and have simpler station design to save costs. An added advantage is that such networks can be built on existing infrastructure making them more economically viable.²⁰¹ Dedicated lanes greatly increase the frequency and reliability of buses and makes them more attractive – especially if private vehicles are caught in their own congestion.

If cities reach peak ridership, and have the money to invest, they may turn to light rail and subway systems. While very effective, these are incredibly expensive. They are only necessitated by the highest densities in the largest cities of wealthy nations. Previously colonised nations have limited resources which should not be squandered on lavish public transport. Such expensive mass transit is dependent on efficient and reliable bus networks. These function to collect passengers within the catchment area and bring them to central rail networks. Additionally, there are diminishing returns on investment as outlined in the table below.

Table 3: Cost Benefit Analysis of BRT vs LRT²⁰²

Transport Type	Carrying Capacity / Hour	Annual operating cost / Km
BRT	10 000	\$250 000
LRT	12 500	\$600 000

Taxis and Ridesharing

In years gone by taxis offered an interesting middle point between private and public transport. They increased the effective range of public transport but their low occupancy meant that their relative contribution to congestion and pollution remained high. Ridesharing services such as Uber, Grab, and Didi have disrupted the taxi industry. Many taxi drivers feel threatened by ridesharing but these companies have greatly improved the convenience, reliability, and user experience. Moving forward these companies provide tangible mobility solutions and a practical alternative to owning a car.

There is still much debate whether ridesharing services complement or compete with public transport. The fundamental question is really if these services take people *to* public transport or *from* public transport. It seems too early to tell especially as the industry is constantly evolving. Further research examining these changes will be needed if we are to better understand the consequences of ridesharing.

Interestingly, some of the industry's fiercest opposition has come from the taxi industry. Faced with the quandary of effectively balancing the interests of the taxi industry and the public some cities have simply banned ridesharing. This is interesting as in many ways ridesharing is simply the latest iteration of the taxi industry which is more accessible and convenient. This simultaneously illuminates and obscures the role of ridesharing *vis-à-vis* public transport.

²⁰¹ Ceritalah, K. R. "What Malaysia's MRT can learn from Indonesia's BRT", *South China Morning Post*, 23 November 2018, accessed at <https://www.scmp.com/week-asia/opinion/article/2174635/what-malaysias-mrt-has-learn-indonesias-brt>

²⁰² Collier, P. *et al.*, *Accessing Opportunities: Policy decisions for enhancing urban mobility*, International Growth Centre, London, 2018, pp. 41.

It illuminates the potential role of ridesharing by saying that it will likely be the same as the taxi industry. It obscures as it is unclear whether the taxi industry is directly beneficial to public transport. Taxis provide an alternative to private car use and an alternative to public transport – they exist in a grey zone of private enterprise filling a gap in a public service.

What the development and evolution of ridesharing presents is an opportunity. Cities can, by means of careful legislation, facilitate an industry which is *more* complementary to public transport than the taxi industry has been thus far. By partnering with public transport through promotions and coordination ridesharing companies stand to increase not only their numbers but the numbers of people opting for public transport as well.



Figure 23: Grab was a partner for the 2017 SEA Games in Kuala Lumpur. They offered several promotions to encourage public transport in order to alleviate congestion at venues.²⁰³

Ridesharing can also fill gaps in public transport service in sparsely populated suburbs. Low-density neighbourhoods often cannot provide economically viable bus services. Referring to ridesharing services such as Uber: “although new forms of transport often compete with old ones in city centres, they ought to complement each other in suburbs. Taxi services and e-bikes could get people to and from railway stations and bus stops, which are often inconveniently far apart outside the urban core.”²⁰⁴ Some cities have cancelled bus routes with the lowest ridership and provided ridesharing discounts to residents in these areas.²⁰⁵ San Clemente, California, partnered with Lyft to provide discounted rides by as much as \$9 between 6am and 8pm which start and end near existing bus stops.²⁰⁶ Ridesharing has additional benefits such as reducing dangerous behaviour. Examining cities in the United States with populations over 100 000 between 2000 and 2014, one researcher estimates that ridesharing has reduced fatal alcohol-related collisions by up to 11.4%.²⁰⁷

²⁰³ Accessed online at https://www.grab.com/my/blog/sea_2017/

²⁰⁴ “How to stop the decline of public transport in wealthy countries”, The Economist, 23 June 2018, accessed at <https://www.economist.com/leaders/2018/06/23/how-to-stop-the-decline-of-public-transport-in-rich-countries>

²⁰⁵ D’Agostino, M. *et al.* “How Ride-Hailing Could Improve Public Transportation Instead of Undercutting It”, *Good*, 5 July 2018, accessed at <https://www.good.is/articles/lyft-uber-reducing-public-transit-use>

²⁰⁶ “Reimagining Public Transport in San Clemente”, *Lyft Blog*, 10 October 2016, accessed at <https://blog.lyft.com/posts/reimagining-public-transit-in-san-clemente>

²⁰⁷ Martin-Buck, F. “Driving Safety: An Empirical Analysis of Ridesharing’s Impact on Drunk Driving and Alcohol-Related Crime”, UT Austin, 2016, pp. 23.

Ridesharing is a complex issue which could be looked at in much greater detail – and indeed it has²⁰⁸ – however, it is not the focus of this dissertation. The discussion so far has simply revealed the multiplicity of issues surrounding this interesting industry as it develops and continues to change how people move. A similar industry which has developed rapidly is bike-sharing.

Bike-sharing

Bike-sharing is another option for cities looking to enhance mobility. Bike-sharing optimises mass transit by facilitating first and last mile connectivity. It increases the catchment area and effective range of expensive infrastructure like light rail. In cities, such as Beijing or New York, where mass transit is at capacity, bike-sharing can play a role alleviating overcrowding. By providing an alternative for short trips some commuters can be diverted from crowded mass transit. This, in effect, increases the number of people moving freely without relying on cars.

Two years ago, bike-sharing networks were expensive investments for cities. Today they are offered freely by dockless network providers such as Mobike and ofo. These services can cause problems for cities if they are not carefully regulated. Simply opening the market for these companies has resulted in “bike dumping” – careful tendering is required to ensure cities maximise the benefits while minimising the problems.

For bike-sharing to be successful it requires infrastructure for people to cycle safely. Ideally, this would entail designated bike lanes. This kind of infrastructure greatly enhances mobility options and comes at relatively little cost and inconvenience to cities and residents. “Whereas pedestrians and cyclists are highly vulnerable in a system designed for motor vehicles, the latter can operate efficiently in one that takes the needs of pedestrians and cyclists into account”²⁰⁹ For countries like Malaysia, still developing pedestrian infrastructure, bike lanes and bike-sharing is too ambitious. This has seen several companies try and ultimately fail.²¹⁰

As the industry becomes more established further research will be required to understand which policies and what infrastructure are prerequisites and how cities can encourage and facilitate bike sharing while mitigating some of the potential obstacles.

²⁰⁸ See for example: Henao, A. “Impacts of Ridesourcing – Lyft and Uber – on Transportation including VMT, Mode Replacement, Parking, and Travel Behavior”, A Doctoral Dissertation Defence, University of Colorado Denver, 2017.

²⁰⁹ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 48.

²¹⁰ “Bike-sharing firm ofo ceases operations in Malaysia after one year”, *The Straits Times*, 22 August 2018, accessed at <https://www.straitstimes.com/asia/se-asia/biking-sharing-firm-fo-fo-ceases-operations-in-malaysia-after-one-year>

Case Study 3 - Sunway BRT: a cautionary case

BRT's can offer an effective solution to car dependency. Any effective solution, however, must be implemented correctly. This case study examines Malaysia's first, and only, BRT which opened in June 2015. It considers the process by which the project was facilitated, the mistakes made, and how these lead to the project's failure.

The system is generally unpopular and has been used to disparage further attempts at BRTs. While high fares and poor design have been blamed for low ridership,²¹¹ focus will fall on how the project was negotiated and the absence of open tenders. This is symptomatic of problems with Malaysian public private partnerships (PPPs) as it is "usually the private sector who are the main initiators of these PPP projects."²¹²

It is a 5.4km elevated BRT which cost RM 634 million (USD 151.9 million), roughly RM 117 million (USD 28 million) per kilometre. The project was not put to tender, rather, it was shaped by direct negotiation with Sunway Berhad.²¹³ Several conflicts of interest have been identified, however, to date, no one has been officially charged.

Sunway Berhad owns many residential properties, a large mall, a theme park, a university, and a hospital along the BRT 5.4km route. A subsidiary – Sunway Construction – was awarded the contract to build the elevated route. Four of the seven stations directly reference Sunway while the station at South Quay is a large Sunway development. Finally, the entire system is branded as the Sunway BRT.

The project was funded 70% by Prasarana (public transport authority), 15% facilitation fund from the Prime Minister's Department, and 15% corporate social responsibility (CSR) contribution from Sunway.²¹⁴ Revenue from construction and the increase in property value exceeded the 15% contribution from Sunway. Additionally, Sunway affiliated businesses located near the BRT benefitted.

As construction was tendered to Sunway, they benefitted from any increase in construction costs. While the project was originally estimated to cost RM 300 million (USD 71.9 million).²¹⁵ The final cost, however, was more than double at RM 634 million (USD 151.9 million).²¹⁶ This arose from the unusual decision to elevate the entire route and all stations.

*"Conflicts of interest arise in that there is an incentive for the Sunway group to negotiate for a higher value to the construction contract in order to increase its profits from the construction portion of the contract and use some of those proceeds to cover for its CSR contribution."*²¹⁷

²¹¹ Selva, M. "Steep fares keep passengers away", The Star, 29 April 2016, accessed at <https://www.thestar.com.my/metro/community/2016/04/29/steep-fares-keep-passengers-away-lukewarm-response-to-brt-service-even-during-peak-hours/>

²¹² Ming, O and Fong, J. "The Sunway Bus Rapid Transit Line: Lessons for the Future", Penang Institute, Penang, 2016, pp. 8.

²¹³ Ibid., pp. 7.

²¹⁴ CSR is given tax incentives. UNICEF, "Corporate Social Responsibility Policy in Malaysia", UNICEF, Kuala Lumpur, 2012, pp. 40.

²¹⁵ "Najib launches BRT-Sunway line", The Borneo Post, 10 June 2012, accessed at <http://www.theborneopost.com/2012/06/10/najib-launches-brt-sunway-line/>

²¹⁶ Rosli, L. "Subang Jaya takes green city lead", New Straits Times, 7 November 2015, accessed at <https://www.nst.com.my/news/2015/11/subang-jaya-takes-green-city-lead>

²¹⁷ Ming, O and Fong, J. "The Sunway Bus Rapid Transit Line: Lessons for the Future", Penang Institute, Penang, 2016, pp. 9.

An additional reason to inflate costs stems from government stipulations regarding facilitation funding from the Prime Minister's Department. As this is capped at 15% of a project's cost "project owners have an incentive to artificially inflate their values in order to increase the amount of facilitation funds they are eligible for."²¹⁸

The high price of the project has resulted in exorbitant ticket prices. The first two months of the service were provided for free, however in August 2016 the service started charging. Ridership fell by 63% from 12 372 daily riders in July 2016 to 4 616 in August.²¹⁹ Further, while the BRT has an integrated ticket with the LRT station at USJ7 terminal it is not integrated with the KTM train network at Setia Jaya. This prevents cross subsidisation of ticket prices and inconveniences users. This is an issue of coordination and cooperation between the relevant authorities.²²⁰

Station / Stesen	Sunway - Setia Jaya	Mentari	Sunway Lagoon	SunMed	SunU - Monash	South Quay	USJ 7
Sunway - Setia Jaya		RM1.60	RM2.30	RM3.00	RM3.60	RM4.50	RM5.40
Mentari	RM1.60		RM1.60	RM2.30	RM3.00	RM3.90	RM4.70
Sunway Lagoon	RM2.30	RM1.60		RM1.70	RM2.30	RM3.20	RM4.00
SunMed	RM3.00	RM2.30	RM1.70		RM1.60	RM2.50	RM3.30
SunU - Monash	RM3.60	RM3.00	RM2.30	RM1.60		RM1.80	RM2.70
South Quay - USJ 1	RM4.50	RM3.90	RM3.20	RM2.50	RM1.80		RM1.80
USJ 7	RM5.40	RM4.70	RM4.00	RM3.30	RM2.70	RM1.80	

Figure 24: At RM1 per kilometre, the BRT is one of the most expensive modes of transport in Malaysia.²²¹

A final matter of concern is the side-lining of the local authority. Majlis Perbandaran Subang Jaya were not consulted on design and route alignment despite being well positioned to understand local commuter patterns better than the Prime Minister's Department. Not only would their knowledge be valuable but it would prove "easier to hold them accountable if they bowed to corporate pressure on issues that concern public welfare, instead of the relatively distant Federal agencies."²²²



Figure 25: The elevated BRT runs past Sunway Medical Centre, Sunway Lagoon Club, The Pinnacle Sunway, Sunway Resort and Spa, and Sunway Pyramid (all pictured).

²¹⁸ Ibid., pp. 10.

²¹⁹ Ibid., pp. 26.

²²⁰ I have examined the benefits of integrated ticketing systems elsewhere. See: Speirs, J. "Cape Town's Public Transport – the political obstacles to a unified smart card", IGLUS, 28 July 2016, accessed at <http://iglus.org/cape-towns-public-transport-the-political-obstacles-to-a-unified-smart-card/>

²²¹ <https://www.myrapid.com.my/traveling-with-us/how-to-travel-with-us/rapid-kl/brt-sunway-line>

²²² Ming, O and Fong, J. "The Sunway Bus Rapid Transit Line: Lessons for the Future", Penang Institute, Penang, 2016, pp. 29.

Chapter 6: Effective Solutions - Disincentives

While land use planning, urban design, and attractive public transport can encourage some people to not to drive, some additional measures can complement this by discouraging driving. While the previous chapter looked at the “pull” away from cars, this chapter focuses on the “push” – or more punitive measures. This is not to frame such policies as unfair, on the contrary, these measures are principally about ensuring motorists pay their fair share for the varied negative externalities arising from private car use.

Cities can use progressive regulation and policies to discourage vehicle use. Generally, motorists do not pay for their externalities such as congestion, air and noise pollution, greenhouse gas emissions, and damage to infrastructure.²²³ Cities can levy certain taxes and pricing mechanisms to ensure drivers pay their fair share. Revenue from these mechanisms can be used to fund better public transport and allied infrastructure.

Disincentivising vehicle ownership can shift modal choice and bring about substantial benefits for cities. The problem is political will – especially in cities with high vehicle ownership. Globally, Malaysian car ownership is the third highest (93%) and the highest for multiple car ownership (54% of households have more than one car).²²⁴ No politician wants to champion a shift in policy that will see an increase in living expenses for 93% of households. Ideally, these measures should be used pre-emptively to discourage growing vehicle ownership. With this in mind, attention now turns to these measures.

Vehicle Tax

A vehicle tax is a progressive tax which targets wealthier residents. This tax makes it markedly more expensive to own a vehicle. Typically, this can be done as a single sales tax on a vehicle, however, in some situations it may be administered as a licensing fee. The problem with a sales tax is it tends to be administered at a national level. Consequently, all citizens are forced to pay this – whether they live in urban centres with mobility options or rural areas.

A better method of taxing vehicles is through a licensing fee. This means that cities or administrative regions can set context specific rates. Rural areas where private vehicles are more necessary would see lower licensing fees than large cities which suffer from congestion.

As mentioned, such vehicle taxes, however, are difficult to implement once vehicle ownership is very high. In the runup to the Malaysia’s 2018 election some political parties sought to appease voters. The Malaysian Islamic Party promised interest free loans for first time car buyers.²²⁵ These policies contributed to the party’s election success – extending its 28-year grip on one state and recapturing another for the first time since 2004. Such policies, however, clearly encourage vehicle ownership.

Following the election, the new national government fulfilled an election promise by removing the unpopular 6% Goods and Sales Tax (GST). GST is a regressive tax which affects

²²³ *Rethinking Urban Sprawl: Moving Towards Sustainable Cities (Policy Highlights)*, Organisation for Economic Cooperation and Development (OECD), Paris, 2018, pp. 13.

²²⁴ <http://www.nielsen.com/my/en/press-room/2014/rising-middle-class-will-drive-global-automotive-demand.html>

²²⁵ Lim, I. “PAS manifesto pledges cheaper homes, interest-free loans for first car”, *Malay Mail*, 19 March 2018, accessed at <https://www.malaymail.com/s/1601681/pas-manifesto-pledges-cheaper-homes-interest-free-loans-for-first-car>

poorer households more. Further, when applied to cars it is a flat rate whether in rural or urban centres. Its removal and subsequent tax vacuum, however, was a boon for the auto industry and wealthy citizens. The price of vehicles dropped substantially with some brands advertising saving of up to RM 69 882 (USD 17 500) on high end models.²²⁶ These luxury items are being sold with a massive loss of tax revenue to the government and a substantial increase in vehicles on the road.

Fuel Tax

A vehicle tax affects vehicle ownership. A fuel tax, however affects vehicle use. “Motor fuel taxes are, in many cases, set at relatively low levels, which do not reflect the externalities from fuel consumption. Low motor fuel taxes cause excessive car use and may fuel urban sprawl by promoting a dispersion of jobs, residences and other key points of economic activity. This further increases the importance of setting motor fuel taxes at levels fully accounting for the environmental costs of fuel consumption.”²²⁷

Increasing the cost of fuel increases the cost of each VKT and can be used to offset their negative social consequences. This tax can be invested in public transport or emergency healthcare for collision victims. In South Africa, revenue from the General Fuel Levy is used to fund the Road Accident Fund which is a public health insurance for victims of collisions.²²⁸ Thus, motorists are held accountable for at least some of the negative consequences of driving.

One criticism of fuel taxes is they can contribute to inflation and stifle economic growth. If petrol and diesel are central to all transport then the cost of each economic stage increases. It costs more to get the wheat to the mill, the flour to the bakery, and the bread to the market. Thus, fuel taxes need to be carefully managed. One way to do this is to ensure regional levies. South Africa’s economic hub, Gauteng, is principally urban. It thus pays a “zone differential” in taxes.²²⁹ More rural areas of the country are not subjected to this additional tax which helps balance the effect of fuel taxes.

²²⁶ Huong, T., “Car sales to jump with big savings from zero GST”, *The Star*, 20 May 2018, accessed at <https://www.thestar.com.my/news/nation/2018/05/20/car-sales-to-jump-with-big-savings-from-zero-gst/>

²²⁷ *Rethinking Urban Sprawl: Moving Towards Sustainable Cities (Policy Highlights)*, Organisation for Economic Cooperation and Development (OECD), Paris, 2018, pp. 13.

²²⁸ “Petrol Price Breakdown”, *The Automobile Association*, 10 April 2018, accessed at <https://www.aa.co.za/insights/petrol-price-breakdown>

²²⁹ “What a litre of petrol would cost in South Africa without government’s steep taxes”, *Business Tech*, 8 August 2018, accessed at <https://businesstech.co.za/news/energy/264015/what-a-litre-of-petrol-would-cost-in-south-africa-without-governments-steep-taxes/>

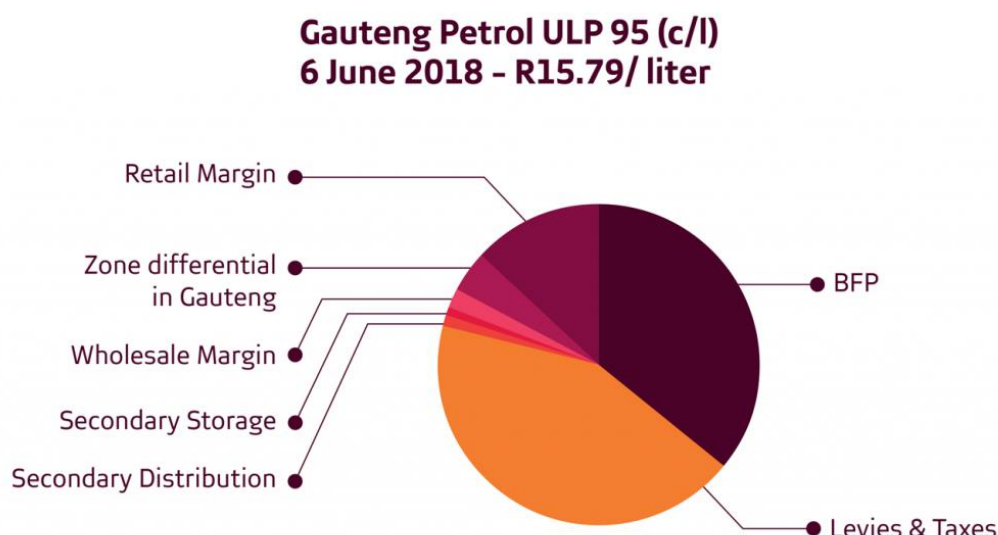


Figure 26: The basic fuel price compromises less of the final cost that the levies and taxes.

Fuel Subsidies in Malaysia

In Malaysia a fuel tax is not levied, rather, it is *subsidised*. Artificially lowering the price of fuel undercuts the competitiveness of public transport. Not only are the potential benefits lost but the problems of car use are exacerbated. These subsidies are detrimental in the long term as they perpetuate dependency on cars and undermine resilience. The inevitability of the depletion of oil reserves means Malaysia should be investing heavily in various public transport options. Having multiple modes of transport is key to ensuring resilience.

Malaysia began subsidising fuel in 1983. In 2011, 11% of the government's operating expenditure was spent on fuel subsidies. This is more than 43 per cent of its gross development expenditure. As a point of reference, the Ministry of Health and Ministry of Education accounted for just 3% and 13% respectively.²³⁰ The opportunity cost of these subsidies are substantial as this money could have been invested several alternative public projects. These substantial resources could have built legacy infrastructure such as mass transit.

Malaysia's 2011 GDP was USD 297.952 billion.²³¹ The 51km Sungai Buloh-Kajang MRT cost approximately USD 4.91 billion – 1.6% of the GDP.²³² The 2011 fuel subsidy accounted for 2.3% of GDP – roughly USD 6.9 billion. It is possible to speculate on the substantial infrastructure which could have been built over the 31-year period of fuel subsidies.²³³

²³⁰ "A citizen's guide to energy subsidies in Malaysia", The International Institute for Sustainable Development, 2013: pp. 4.

²³¹ The World Bank, accessed at <http://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=MY>

²³² Lai, A. "MRT Corp says Rafizi got it wrong, RM21bil for both Phase 1 and 2 of SBK Line", *New Straits Times*, 18 December 2016, accessed at <https://www.nst.com.my/news/2016/12/197743/mrt-corp-says-rafizi-got-it-wrong-rm21bil-both-phase-1-and-2-sbk-line>

²³³ Recent numbers indicate that Malaysia spent RM 29 billion (USD 6.9 billion) subsidising fuel in 2013. Annuar, A. "Treasury: Putrajaya still paying a few hundred millions in fuel subsidies", *Malay Mail*, 30 October 2017, accessed at <https://www.malaymail.com/s/1498803/treasury-putrajaya-still-paying-a-few-hundred-millions-in-fuel-subsidies>

Fuel subsidies were not the only automotive subsidies: automotive manufacturers in Malaysia have received substantial financial support from the government. In April 2016, Proton, a local auto-manufacturer, received RM 1.5 billion (USD 359 million) as compensation for money spent on research and development.²³⁴

These subsidies not only have an opportunity cost but encourage the use of vehicles. This is coupled with easy access to vehicle financing. Some companies offer loans with interest rates of 2.55% over a 9-year period.²³⁵ This makes buying a vehicle affordable and accessible. The result is high rates of vehicle ownership, traffic congestion, and the need for further investment in road infrastructure (both development of new infrastructure and increased maintenance). This effect become cyclical: as more people access cars, they demand increased road infrastructure. As road infrastructure is increased demand is induced and traffic volumes increase. Thus, Malaysian subsidies to fuel and auto manufacturers not only have an opportunity cost; there is also the increased demands on road infrastructure.

What is frustrating for many is how fuel subsidies are used for expediency by Malaysian politicians. In October 2017, Treasury secretary-general Irwan Serigar Abdullah stated the government still subsidising fuel “a few hundred million ringgit a month.”²³⁶ The opposition party where quick to condemn such expenditure. Two weeks ahead of the 2018 elections, opposition vice-president Rafizi Ramli accused the ruling party of silently subsidising fuel to contain discontent ahead of the election.²³⁷ Ramli’s party won the election and took office. Three weeks later they announced RM 3 billion (USD 715 million) fuel subsidies for the next 6 months.²³⁸ Evidently, the ruling party is aware of the shortfalls of fuel subsidies. They are, however, also aware of the political approval such subsidies can sustain.

*Table 4: Fuel Subsidies Under Government Operating Expenditure.*²³⁹

Year	As % of operating expenditure	As % of GDP
2005	11.23	2.05
2006	7.03	1.27
2007	6.06	1.14
2008	11.43	2.30
2009	3.95	0.88
2010	6.31	1.21
2011	11.18	2.30

²³⁴ “Johari: No more subsidy for Proton after RM1.1b R&D reimbursement”, *Malay Mail*, 24 May 2017, accessed at <http://www.themalaymailonline.com/malaysia/article/johari-no-more-subsidy-for-proton-after-rm1.1b-rd-reimbursement#2hdGemrCVOkWQhe7.97>

²³⁵ <http://www.mybsn.com.my/content.xhtml?contentId=147>

²³⁶ Chow, M. “Govt still subsidising fuel prices, says Treasury sec-gen”, *Free Malaysia Today*, 30 October 2017, accessed at <https://www.freemalaysiatoday.com/category/nation/2017/10/30/govt-still-subsidising-fuel-prices-says-treasury-sec-gen/>

²³⁷ Aris, N. “Is fuel being subsidised on the quiet, asks Rafizi”, *Free Malaysia Today*, 1 May 2018, accessed at <http://www.freemalaysiatoday.com/category/nation/2018/05/01/is-fuel-being-subsidised-on-the-quiet-asks-rafizi/>

²³⁸ “Malaysia sets aside 3 billion ringgit to finance fuel subsidies”, *Reuters*, 7 June 2018, accessed at <https://www.reuters.com/article/us-malaysia-politics-subsidy/malaysia-sets-aside-3-billion-ringgit-to-finance-fuel-subsidies-idUSKCN1J30AB>

²³⁹ “A citizen’s guide to energy subsidies in Malaysia”, The International Institute for Sustainable Development, 2013: pp. 4.

Tolls and Congestion Pricing

Tolls and congestion pricing are other means to curb vehicle use as well as discourage the use of central trunk routes. Tolls are a simpler and more dated method – with pricing tiers based on vehicle weight. As heavier vehicles cause more damage, they are tolled more to cover maintenance costs of roads. These prices, however, are relatively stable only being adjusted every few months or years. Congestion pricing is more dynamic – in that the price changes by the hour. It provides commuters with “an incentive to reduce their peak period trips and use travel alternatives, such as ridesharing and non-motorized transport.”²⁴⁰ This helps alleviate peak congestion and ideally encourages commuters to shift to public transport.

Tolls, like fuel subsidies, have been used to score political points in Malaysia. When then opposition, Pakatan Harapan, announced popularist policies to remove tolls and reinstate fuel subsidies embattled Prime Minister Najib Razak criticised the plan citing increased congestion and air pollution.²⁴¹ Less than three months later he changed his position criticising tolls.²⁴² Both parties are aware of the benefits of discouraging driving and are able to criticise one another for facilitating driving. To appease voters, however, they tend towards making driving cheaper.

Congestion charging has also been handled with political approval in mind. The Federal Territories Minister, Khalid Abdul Samad, said of congestion pricing and residents of Kuala Lumpur, that he was reluctant to “punish them with fines” until alternative transport options were implemented.²⁴³ This despite the city’s substantial public transport network. It is worth noting how congestion pricing is framed as a punishment and a fine. As we will see from the example of Stockholm, this is far from the truth. Additionally, there is the presupposition that congestion pricing will result in people choosing alternative modes of transport.

There is little evidence to support the idea that motorists change modes as a result of congestion charging. While evidence is lacking many believe it to be an effective deterrent to driving: seeing it as a direct threat, the parking industry pooled its resources to successfully fight the congestion pricing proposal put forward by Mayor Michael Bloomberg in 2008.²⁴⁴

While congestion charging may not shift drivers away from their cars it does effectively address congestion. There are still several benefits to be gained from vehicles flowing more freely such as reduced emissions and economic benefits stemming from less time wasted. Few methods for alleviating congestion have lasting effects – increasing road capacity merely induces additional demand while installing bus or bike lanes may even increase congestion for drivers (while moving more travellers through the same area). Congestion pricing, however, seems to provide lasting benefits.

Congestion pricing has proven particularly effective in Stockholm. The city has several key bridges which are choke points and easily charged. While the idea faced substantial opposition when first proposed it won public support after an initial trial proved successful. When put to a

²⁴⁰ Litman, T. “Generated Traffic and Induced Travel Implications for Transport Planning”, Victoria Transport Policy Institute, November 2011, pp. 26.

²⁴¹ Razak, R. “Removing tolls and upping petrol subsidy will increase pollution, says Najib”, *The Malaysian Insight*, 3 December 2017, accessed at <https://www.themalaysianinsight.com/s/25751/>

²⁴² “Najib’s rhetoric against tolls a pre-election ploy, claims PKR” *Malaysiakini*, 27 February 2018, accessed at <https://www.malaysiakini.com/news/413594>

²⁴³ Bavani, M. “KL to impose congestion charges on motorists only after improving public transport”, *The Star*, 17 October 2017, accessed at <https://www.thestar.com.my/metro/metro-news/2018/10/17/kl-to-impose-congestion-charges-on-motorists-only-after-improving-public-transport/>

²⁴⁴ Flamm, M. and Geiger, D. “Uber and Lyft crushed taxis—is the commercial parking industry next?”, *Crain’s New York Business*, 21 February 2018, accessed at <http://www.crainsnewyork.com/article/20180221/FEATURES/180219923>

referendum most residents supported paying for something which had previously been free. Not only had they changed their opinion on congestion pricing but, when polled, most said they had always supported the initiative despite statistical evidence to the contrary.²⁴⁵ This is because congestion pricing reduces congestion and improves travel times. It does this by diverting traffic – either to different routes or to different times. Just as roads have latent trips which would occur if the capacity increased there are also numerous road users who would divert their trips if capacity decreased or the price increased.

Parking

The previous disincentives have focused on vehicles in motion. Cars, however, spend 95% of their existence stationary.²⁴⁶ Where they are stored is a vital question for cities as it affects how attractive and equitable, they are. Parking which is free or priced below the value of the land is, essentially, subsidised land cities provide to wealthier residents which encourages them to drive more and compromise the safety and wellbeing of others.

Cheap or free parking facilitates cars. “As long as parking is abundant, and priced low or is free, commuters will have little incentive to consider mass transit”.²⁴⁷ In Amsterdam in 2016, I paid €28 for six hours of parking. This is appropriate pricing as the abundant public transport coupled with fantastic pedestrian and cycling infrastructure renders cars obsolete. This makes Amsterdam one of the greatest tourist destinations. If parking were cheaper, the city would be congested and unpleasant undermining the experience of the city. Yet this is precisely what occurs in most other cities. The fee of occupying public space, especially on the streets of the city, should at the very least make driving more expensive than public transport. Ideally, it should be so expensive that the it is unaffordable and the streets can be returned to the residents and visitors of the city.

Many people, however, consider parking a necessary component of cities and do not appreciate what is sacrificed in its provision. “The demand for parking and its enshrinement as a right in public opinion, and, often, in law, has resulted in more sprawl, less pedestrian safety, incentivizing driving, traffic congestion, pollution, and most of all, a reduction of the space available for the much more essential uses of housing and transit.”²⁴⁸ Parking affects land use patterns and space available for housing. When developers are forced to provide parking minimums, they must alter plot ratios to ensure there is storage capacity for stationary vehicles. This contributes to housing scarcity and drives up property prices.

Some business owners believe parking is essential to provide access to their businesses. What often happens, however, is drivers park for extended periods of time – sometimes for the whole day while they are at work. Rather than facilitating access to local businesses this restricts access. Pedestrian infrastructure facilitates a flow of people. As more people pass by a business so commerce increases. Good parking management should facilitate the rotation of vehicles – this will be examined shortly.

²⁴⁵ Eliasson, J. “How to solve traffic jam”, TED Helvetia, September 2012, time - 07:33. Accessed at https://www.ted.com/talks/jonas_eliasson_how_to_solve_traffic_jams

²⁴⁶ Morris, D. “Today’s cars are parked 95% of the time”, *Fortune*, 13 March 2016, accessed at <http://fortune.com/2016/03/13/cars-parked-95-percent-of-time/>

²⁴⁷ Badami, M. “Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step”, *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 47.

²⁴⁸ Baranda, B. “Less Parking, More City: How Mexico City Became a Leader in Parking Reform” in *Sustainable Transport*, No 29, New York, 2018, pp. 14.

Under-priced parking also results in “cruising” – cars driving in circles looking for parking and contributing to congestion. In a review of 16 studies from 11 cities examining cruising in CBDs 30% of traffic was comprised of vehicles looking for cheap parking.²⁴⁹ These vehicles not only contribute to congestion but to air and noise pollution as well. Clearly parking needs to be carefully managed and appropriately priced.

Parking Management and Pricing²⁵⁰

Parking availability shapes mobility choices. An oversupply of cheap parking incentivises driving while a well-managed supply of parking encourages walking, cycling, and public transport – especially in city centres. Parking saturation usually transpires to be “a demand management problem, and the right policy can modify driving patterns towards a more sustainable vision and calmer streets.”²⁵¹ Correctly pricing parking to reflect its value and direct its use. Parking needs to reflect the value of the land: in city centres it ought to be charged progressively to encourage a high turnover of parking spaces. Ideally, it should push motorists to alternative modes of transport.

To be well-managed parking must be well-measured – an audit on available parking is a first step. Many cities do not even know how much space is dedicated to vehicle storage. When these numbers are known they can be illuminating as they reflect the values of the city. Pertinent questions for cities may be how much space is given to parking in relation to education or healthcare. Furthermore, in coming years the value, necessity, and use of parking may change. Self-driving cars will likely spend far more time in rotation and less time stationary. The veracity of this assertion warrants further investigation – as does the question of how parking can be repurposed to better serve us in future. It is up to cities to regulate parking for the best interests of all residents – whether motorists or not. Cities generally have more direct control over on-street parking. The do, however, have indirect influence over off-street parking. These will be examined in turn.

On-street

On-street parking is some of the most valuable land in a city. The importance of parking vis-à-vis parking is often overstated while its actual value is rarely captured by the city. “In many cities, on-street parking charges are too low as they fail to reflect the social cost of parking provision, which includes cruising and loss of open space.”²⁵² By controlling the pricing and scarcity of on-street parking cities can discourage driving and encourage alternative mobility. To do this, however, such parking must be controlled and managed by the city rather than outsourced to third parties. When parking is outsourced the city is limited in what it can do with parking spaces and how it charges or controls such spaces. This will be illustrated shortly in Case Study 4.

As parking, the land may generate revenue for the city but requires substantial investment and enforcement. Parking must be under regular surveillance, fines and summons must be followed up, vehicles must be clamped and towed. These hefty costs cut deeply into the profitability of on-street parking. Cities may reap greater benefits by repurposing parking.

Repurposing this land may yield substantial benefits. Turning parking spaces in bus or bicycle lanes may improve mobility and increase the numbers of people moving through the area.

²⁴⁹ Shoup, F. “Cruising for Parking”, *Access Magazine* Vol 1., No. 30, UC Berkley, 2007, pp. 17.

²⁵⁰ There are guides available for best practice: <https://www.parking.org/2016/01/26/tpp-2015-06-parking-management-for-smart-growth/>

²⁵¹ Baranda, B. “Less Parking, More City: How Mexico City Became a Leader in Parking Reform” in *Sustainable Transport*, No 29, New York, 2018, pp. 14.

²⁵² *Rethinking Urban Sprawl: Moving Towards Sustainable Cities (Policy Highlights)*, Organisation for Economic Cooperation and Development (OECD), Paris, 2018, pp. 13.

This may not directly generate revenue for the city but it will improve wellbeing and the local economy. Removing parking may also allow for wider pavements with space for trees and gardens. This has positive effects on air and noise pollution and may increase property values. This could generate greater revenue for the city via property taxes.

In some situations, on-street parking cannot be completely removed. There are incremental steps cities can take. Perpendicular parking can be transformed into parallel parking. This yields several benefits. Firstly, it will open space for pedestrian infrastructure to be expanded. Secondly, it will remove roughly 50% of all on street parking. This increases parking's scarcity and value while making other modes of transport more attractive. Further, this places the burden of providing parking on the private sector: where it belongs. It is not a city's responsibility to provide infrastructure that can only be accessed by some residents – usually, the wealthiest residents. With this in mind, attention now turns to off-street parking.

Off-street

Off-street parking is mostly controlled by the private sector. Cities influence off-street parking by regulating parking minimums and maximums in zoning codes. “Minimum parking requirements in new developments encourage car ownership and use, as they decrease the total costs of owning a car and making urban car trips. They may also discourage infill development, as they drive up building costs.”²⁵³ Parking minimums affect both commercial and residential developments and perpetuate car use. In residential developments they elevate construction costs which are then borne by residents – often even if they are not motorists.

“Many cities, particularly in America, generously subsidise driving by forcing developers to provide lots of parking spaces.”²⁵⁴ Cities looking to discourage car use in favour of safer, more sustainable mobility need to re-evaluate parking regulations. One direct method is to remove minimums and enforce maximums. Developers should be able to choose how few parking spaces to provide while the city places a limit on the maximum. These measures have been successfully implemented in Mexico City.²⁵⁵

By controlling the availability and affordability of vehicle storage cities can influence urban mobility and modal share. This requires assertive leadership and the ability to make and enforce unpopular decisions for the long-term benefit of all residents. The following case study shows what happens in the absence of such leadership.

²⁵³ Ibid., pp. 13.

²⁵⁴ “How to stop the decline of public transport in wealthy countries”, The Economist, 23 June 2018, accessed at <https://www.economist.com/leaders/2018/06/23/how-to-stop-the-decline-of-public-transport-in-rich-countries>

²⁵⁵ Baranda, B. “Less Parking, More City: How Mexico City Became a Leader in Parking Reform” in *Sustainable Transport*, No 29, New York, 2018, pp. 14.

Case Study 4 – Jalan Padang Belia

Brickfields is one of the oldest areas in Kuala Lumpur replete with considerable cultural and historical heritage. It is a Transit Oriented Development (TOD) and home to KL Sentral Station. Despite this, several streets are dominated by cars and pedestrians are forced into traffic as sidewalks are occupied by illegally parked vehicles, inadequate or simply absent.

Warongs (informal restaurants) are part of Malaysian culture and offer an alternative to the prevailing mall culture. On Jalan Padang Belia are several popular warongs which provide important employment opportunities. However, they occupy the sidewalk leaving no space for pedestrians. Pedestrians walk among motorised vehicles, which use most of the public space. This is especially a concern as Brickfields includes high numbers of visually impaired people who frequent the area.



Figure 27: Blind people are forced into the road throughout the day.

Beside these warongs are parking bays. When traffic subsides in the evenings, the parking is reclaimed by the warongs who place tables in the street creating a lively streetscape. Removing the restaurants would open the sidewalk, however, it would be a substantial loss for the community. Given the option of removing small businesses or repurposing parking spaces, it is the parking which should be repurposed. Parking is not of historical, cultural, or economic value to the community.

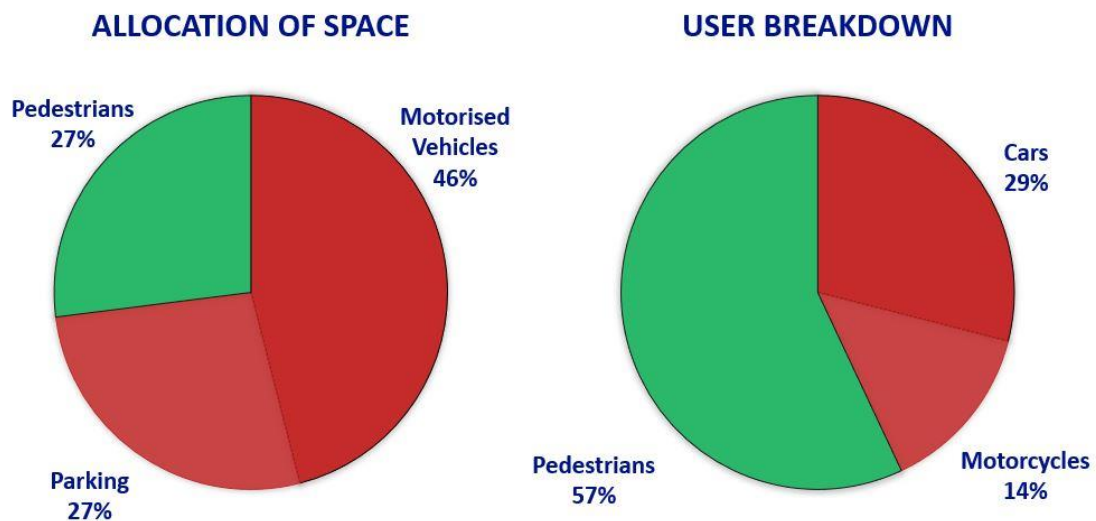


Figure 28: The warongs begin placing tables on the parking spaces as soon as drivers begin leaving after work in the evenings.

Figure 29: The street is lively at night and an important part of the community.

Project Proposal

Think City proposed repurposing these parking bays to provide a safe way for pedestrians to access this street. In preparation, 21 Hours of traffic surveys were conducted across three weeks. These detailed vehicles, their passengers, and the demographics of pedestrians. This revealed that 57% of the people accessing the street were pedestrians. The space allocated to pedestrians, however, was 27% of the available right of way. The project aspired to redistributed public space more equitably in favour of the most vulnerable users, namely pedestrians.



The project was designed to have three stages: a single day demonstration, a pilot (employing tactical urbanism), and a permanent intervention. The demonstration was conducted to gather feedback from the community. Pending its success— an absence of pronounced traffic or safety concerns – the project was to be piloted for three-months.



Figure 30: A preliminary drawing showing a low-cost interim intervention to provide safe pedestrian passage.

The principal stakeholders were: Think City – my employer who sponsored the research and would fund necessary materials. Dewan Bandaraya Kuala Lumpur (DBKL) – city hall

Rukun Tetangga – the local residents association, representing the interests of residents and local businesses.

Malaysian Association for the Blind (MAB) – Brickfields has many visually impaired people, numerous blind businesses, and several blind associations. The high numbers of visually impaired people who live, learn, and work in the area constitute a unique community requiring particular attention.

Yayasan Wilayah Persekutuan (YWP) – a private organisation (with numerous government ties) to whom parking management has been outsourced to. They have in turn outsourced the duties to Vista Summerose.²⁵⁶

Demonstration

Traffic cones were placed in the early morning securing the parking bays. Clear signage directed pedestrians into the safe corridor. Data was collected and opinions on the design gathered. Vehicle and pedestrian traffic was observed and compared to previous data.

²⁵⁶ Chen, G. “Clauses in DBKL parking contract being scrutinised”, *The Star*, 26 May 2018, accessed at <https://www.thestar.com.my/metro/metro-news/2018/05/26/clauses-in-dbkl-parking-contract-being-scrutinised/>



Figure 31: The path was clear for pedestrians for most of the day. The uneven surface on the right side of the street caused many pedestrians to walk in the road.

Discontinued

The project faced little opposition from community members and most people interviewed expressed positive sentiments – especially from the blind community. Traffic counts indicated a slight increase in the number of people accessing the street and no notable problems arose. All the criteria for the project to move to the three-month pilot were met.

However, the pilot never happened. The cause was the cost of the project. While Think City were able to cover the expense of the materials the principal cost was the compensation for “lost revenue” from the parking.

The deal with the city was such that they must pay YWP for the full value of the parking for the three months of the pilot. The full value of the parking assumed that every parking space was full for the nine hours that parking is charged. Additionally, it assumes that every parking space changes vehicle every 59 minutes (the first hour is the most expensive under the current fee structure). The resulting cost for the three months was many times the expense of the materials required.²⁵⁷

Throughout the 21 hours of preparatory traffic counts not one person was seen to pay for their parking on the digital parking machines. I proposed DBKL look at average parking rates on that machine for a day, week, or month to establish a baseline for a fair compensation to YWP. The proposal was deemed politically naïve as powerful politicians were involved.

²⁵⁷ 12 parking bays X RM3 per hour X 9 hours per day X 20 days per month X 3 months = RM19 440 (USD 4656).

With the change in government in May 2018 the contract with YWP was fallen under scrutiny as it was signed without open tender.²⁵⁸ YWP, which was a private company, has several prominent UMNO members²⁵⁹ in its management board and board of trustees – particularly Datuk Seri Tengku Adnan Tengku Mansor (UMNO secretary-general) who was also the Federal Territories Minister when the contract was awarded. He is currently under investigation for the sale of 171.7ha of Kuala Lumpur worth RM 4.28 billion (USD 1 billion) without open tender to YWP.²⁶⁰

MP, Lim Lip Eng, challenged the outsourcing saying “collecting parking fee is the basic fundamental duty of a local government.”²⁶¹ Sadly, Kuala Lumpur’s local government did not collect or control parking in the city. This caused an escalation in costs that rendered the project on Jalan Padang Belia unfeasible.



Figure 32: A father and his young daughter are separated from traffic by the cones.

²⁵⁸ Jay, B and Adnan, A. “Why no open tender for lucrative DBKL contract, asks Kepong MP”, *New Straits Times*, 18 May 2018, accessed at <https://www.nst.com.my/news/nation/2018/05/370790/why-no-open-tender-lucrative-dbkl-contract-asks-kepong-mp>

²⁵⁹ UMNO: the coalition who ruled Malaysia for 60 years until May 2018.

²⁶⁰ Radhi, N. and Sarabatin, M. “MACC report lodged against Ku Nan over land sale worth RM4.28 billion”, *New Straits Times*, 16 May 2018, accessed at <https://www.nst.com.my/news/nation/2018/05/369990/updated-macc-report-lodged-against-ku-nan-over-land-sale-worth-rm428>

²⁶¹ Chen, G. “DBKL’s lucrative parking contract questioned” *The Star*, 19 May 2018, accessed at <https://www.thestar.com.my/metro/metro-news/2018/05/19/dbkls-parking-contract-questioned-mp-collection-of-fees-should-be-halted-pending-review-of-matter/>

Chapter 7: Conclusion

From the outset, this dissertation has examined cities as systems. No part of a system can be understood in isolation. The focus has always been on transportation. Transportation choices, however, affect and are affected by a range of variables. These include but are not limited to provision of infrastructure, public health, land use planning, and taxes. In many cities these variables have culminated in cars being the dominant mode of mobility.

In so doing they have made other modes of transportation less attractive or viable – creating a feedback loop through which they have perpetuated their own necessity. The ambition of this paper was to demonstrate that this was not inevitable. Proactive policies can reverse this trend making public and active mobility viable and attractive. This would reduce many of the threats posed by cars while making cities safer, healthier, and more liveable.

This dissertation began by examining the costs of cars for cities and their residents. These costs were divided into economic, social, and environmental. Some of the drawbacks of cars fell into all three categories. Congestion, for example, results in losses in productivity but also loss of quality of life as well as unnecessary emissions. Others were purely economic: cars require expensive infrastructure to be built and maintained, much of the network already exists, thus cities find themselves in a situation of path dependency. This is difficult and expensive to escape from.

Other implications of cars primarily affected social structures. The negative consequences for the elderly are restricted mobility, social isolation, and reduced activity. Children become reliant on adults to navigate city spaces which hinders their independence. To expand on this idea attention turned to a case study of SJK Vivekananda – a school near KL Sentral Station in Kuala Lumpur and the poor pedestrian infrastructure. Focus here was not merely on appropriate infrastructure but how to leverage several organisations in the private and public sector to achieve effective governance.

Environmentally, cars and their supporting infrastructure require substantial energy to make and maintain. This is before any consideration of how they are fuelled. This all contributes to climate change – a threat we can no longer ignore, the implications of which fall outside the scope of this paper.

Chapter 3 picked up on these environmental concerns but moved from the global scale to that of cities. Cars have serious implications our health and wellbeing. Air pollution may contribute to climate change in the medium term; in the immediate term it is cutting lives short and causing an array of diseases for millions of people. Noise pollution, on the other hand, is contributing to increased stress, loss of productivity, and ultimately a loss in quality of life. Noisy and polluted cities do not make physical activity attractive. The consequences of sedentary lifestyles are become common knowledge. While many people acknowledge this, many cities do not have the space or appeal to encourage everyday exercise. What can be done about this?

Attention then turned to commonly suggested yet ineffectual solutions. Usually when people experience congestion and limited mobility, they demand increased road infrastructure – additional lanes, alternative routes, etc. This however has been shown to merely induce additional drivers keeping congestion at a constant. Motorists have been shown to be like a gas which expands to fill infrastructure to its capacity.

Others have recommended “smart city” technological developments to increase vehicular throughput. This is effectively adding capacity digitally. It falls into the same trap of inducing demand and will only encourage additional drivers. The advantages of this, however, are that more people can move through a region without new physical infrastructure. This can be extremely useful built-up urban centres. Unfortunately, it perpetuates dependency on cars and does nothing to mitigate other negatives like emissions.

For this people have praised the development of electric and autonomous vehicles. While electric vehicles reduce emissions *in* cities, they merely cause emissions at the point of power generation. They also do nothing to increase safety and are still susceptible to generating congestion. Autonomous vehicles certainly tick many boxes and improve safety. Their convenience, however, may in turn exacerbate urban sprawl while maintaining class divisions and inequitable urban forms.

Clearly, better alternatives are needed to encourage people to choose public or active mobility options. The discussion began at the city scale looking at land use planning. The urban form is shaped by and shapes mobility choices. Urban sprawl encourages car use and car use encourages urban sprawl. To break this cycle, cities need to plan and legislate for denser neighbourhoods which serve the needs of their residents. Mixed-use communities place goods, services, and employment opportunities closer to where people live. Transit oriented development, together with polycentric planning, places development around accessible transit nodes. When their planning methodologies are coordinated cities can make public and active mobility more attractive than driving.

The biggest threat to safe and pleasant access to public transport comes from dangerous road design. Design is a broad and detailed topic, much of which fell outside of the scope of this paper. The principal takeaway, however, was that streets which prioritise vehicle speed compromise pedestrian safety. Traffic calming, done correctly, vastly improves pedestrian safety and can actually improve vehicle flow. When this is coordinated with adequate pedestrian infrastructure safety becomes less of a concern. At this point, accessibility and the appeal of walking or cycling comes to the fore. All of this is only meaningful, at a city scale, if there is an integrated network of public transport.

Public transport includes mass transit from rail, BRT, and buses through to semi-private transport like ridesharing and taxis, and right down to bike-sharing. Discussions of integration began with the sharing and accessibility of information – both for operators and users. But integration goes beyond this to physical integration, the ability to change modes seamlessly, and to move on a continuous and uninterrupted route across the city.

This is dependent on coordinated and collaborative governance. Here we examined a cautionary case study examining the Sunway BRT in Kuala Lumpur. There were shortfalls at multiple levels from poor planning and integration with other public transport to apparent conflicts of interest with the private sector. The result is a costly and underutilised project which has given BRTs a poor reputation in Malaysia.

In addition to enticing motorists to change modes they must pay the cost of their negative externalities. For decades, wealthy residents have not paid the true cost of their private transport and in some cases have even received indirect and direct subsidies. Vehicular taxes at the point of sale are one way to discourage driving and can be taken further by increasing licencing fees – particularly in urban centres. While this discourages vehicle ownership, fuel taxes, tolls, and congestion charging discourage vehicle use. In Malaysia, however, fuel has been directly subsidised for decades. This is an easy way to win favour with the electorate, however, the opportunity costs are substantial. Likewise, with road tolls, with politicians changing their stance according to public opinion.

Finally, attention turned to vehicle storage. As cars are principally stationary how they are stored is extremely important. Parking which is free or below market value incentivises driving and is an indirect subsidy to wealthier residents whose mode of mobility compromises the liveability of the city. By correctly pricing or removing on-street parking cities can disincentivise driving – especially in city centres. Through careful zoning, the abolition of parking minimums and the establishment of parking maximums cities can improve the urban form and change mobility choices.

Ultimately, it is the coordination of all of the above. Cities need to encourage active mobility by providing safe and accessible infrastructure. Public transport needs to be attractive and well-integrated. Finally, motorists need to pay for the negative externalities of their vehicles. This is possible but it requires political will, assertive leadership, clean, and innovative governance.

Further Research

This dissertation has touched on many interesting matters which fell outside of its scope. While some of these have seen precursory research, others have not had the opportunity to be investigated in adequate detail. The following are areas of interest which would serve as useful points of departure for further research.

Ridesharing

The consequences of ridesharing, specifically on-demand services such as Uber or Didi, on public transport. Whether such services complement or compete with public transport? Whether riders would have taken a private car, public transport, or simply not made the trip at all? Whether these services discourage car ownership and use or whether they merely perpetuate car-oriented development? Finally, what effect does ridesharing have on parking demand?

Bike-sharing

Bike-sharing has changed substantially with the advent of dockless bicycle networks. Companies such as Mobike and ofo provide cities with free infrastructure with the hopes of generating revenue from rides and data. Many cities – ranging from Singapore to Melbourne – have struggled with the industry. Others, such as Beijing, have benefitted massively. What policies and regulations are required to encourage responsible business practices and partnerships between operators and cities? What infrastructure is a prerequisite and what infrastructure needs to be developed subsequently? What role does bike-sharing have to play in getting people to underutilised public transport and off overcrowded networks? Can bike-sharing contribute to more inclusive and equitable cities?

Parking

Parking is a problem for cities as it occupies some of the most valuable land while yielding little return on investment. More research is needed on the effects of parking maximums and parking fees consummate with land value. Further, there are questions regarding the fate of parking as we move towards self-driving vehicles which may dramatically reduce demand for vehicle storage in city centres. What alternative uses can be found for parking? How can parking be reimaged and repurposed to serve all city residents not just motorists? What mechanisms can cities develop to identify and reclaim unnecessary parking?

Bibliography

Academic Articles

1. Badami, M. "Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step" in *Economic & Political Weekly*, Vol. XLIV no 33, 2009, pp. 43-51.
2. Basner, M. *et al.* "Auditory and non-auditory effects of noise on health", *The Lancet*, Vol. 383, 2014, pp. 1325-1332.
3. Bhalla, K. *et al.* "A Risk-Based Method for Modelling Traffic Fatalities", *Risk Analysis* 27 (1), 2007, pp. 125-136.
4. Clark, C. *et al.*, "Association of Long-Term Exposure to Transportation Noise and Traffic-Related Air Pollution with the Incidence of Diabetes: A Prospective Cohort Study", *Environmental Health Perspectives* 125.8, 2017.
5. Cupples, J. and Ridley, E. "Towards a Heterogeneous Environmental Responsibility: Sustainability and Cycling Fundamentalism", *Area*, Vol. 40, No. 2 (Jun., 2008), pp. 254-264.
6. Chin, V. *et al.* "Unlocking Cities: The impact of ridesharing in Southeast Asia and beyond", The Boston Consulting Group, Kuala Lumpur, 2017.
7. Davies, R. "The spatial formation of the South African city", *GeoJournal*, Volume 2, 1981, pp. 59-72.
8. Degen, M. and García, M., "The Transformation of the 'Barcelona Model': An Analysis of Culture, Urban Regeneration and Governance" in *International Journal of Urban and Regional Research*, Volume 36.5, 2012.
9. Ghee, L. K. "A Review of Adult Obesity Research in Malaysia", *The Medical Journal of Malaysia*, Vol 71, June 2016.
10. Hamilton-Baillie, B. "Towards shared space", *Urban Design International* 13(2), 2008.
11. Hodson, M. and Marvin, S. "Can cities shape socio-technical transitions and how would we know if they were?", *Research Policy*, 39, 2010.
12. Hong, C. *et al.* "Living near major roads and the incidence of dementia, Parkinson's disease, and multiple sclerosis: a population-based cohort study", *Lancet*, 389, 2017.
13. Job, R. *et al.* "Traffic Accidents are a Political Issue" in *Medical Journal of Australia* 151 (6), 1989, pp. 356.
14. Kumar, G. *et al.* "Burden of out-of-pocket expenditure for road traffic injuries in urban India", *BMC Health Services Research* 12:285, 2012.
15. Ming, O. K. and Fong, J. "The SUNWAY Bus Rapid Transit (BRT) Line: Lessons for The Future", Penang Institute, February 2016.
16. Moody, S. and Melia, S. "Shared space: Research, policy and problems", *Proceedings of the Institution of Civil Engineers - Transport*, 167 (6), 2014.
17. Oudin, A. *et al.* "Association between neighbourhood air pollution concentrations and dispensed medication for psychiatric disorders in a large longitudinal cohort of Swedish children and adolescents", *BMJ Open*, 2016.
18. Pharaoh, T. and Russell, J. "Traffic Calming Policy and Performance: The Netherlands, Denmark and Germany", *The Town Planning Review*, Vol. 62, No. 1, 1991.

19. Rao, V. L. “Effects of Urban Heat Island on Air pollution Concentrations”, *International Journal of Current Microbiology and Applied Sciences*, Vol. 3., No. 10, 2014.
20. Raz, R. et al., “Autism Spectrum Disorder and Particulate Matter Air Pollution before, during, and after Pregnancy: A Nested Case–Control Analysis within the Nurses’ Health Study II Cohort”, *Environ Health Prospect*, Vol. 123, 2015.
21. Sharma, A., Kumar P., “A review of factors surrounding the air pollution exposure to in-pram babies and mitigation strategies”, *Environment International*, Vol. 120, 2018, pp. 262.
22. Shoup, F. “Cruising for Parking”, *Access Magazine* Vol 1., No. 30, UC Berkley, 2007.
23. Sul, J. “Korea’s 95% reduction in child Traffic Fatalities: Policies and achievements”, *Korea’s Best Practices in the Transport Sector (15)*, The Korea Transport Institute, Seoul, 2014.
24. Sunyer, J. et al. “Association between Traffic-Related Air Pollution in Schools and Cognitive Development in Primary School Children: A Prospective Cohort Study”, *PLOS Medicine*, Vol. 12., No. 3., 2015.
25. Zhang, X. “The impact of exposure to air pollution on cognitive performance”, *Proceedings of the National Academy of Sciences*, Vol. 115., No. 37., 2018.

Unpublished

1. Campbell, A. and Robinson, C. “Dying while walking: Interrogating media coverage of pedestrian deaths in the United States”, University of Tennessee, 2018 – unpublished report, accessed at http://mediad.publicbroadcasting.net/p/wpln/files/dying_while_walking_wbn_presentation_final.pdf
2. Henao, A. “Impacts of Ridesourcing – Lyft and Uber – on Transportation including VMT, Mode Replacement, Parking, and Travel Behavior”, A Doctoral Dissertation Defence, University of Colorado Denver, 2017.
3. Martin-Buck, F. “Driving Safety: An Empirical Analysis of Ridesharing’s Impact on Drunk Driving and Alcohol-Related Crime”, UT Austin, 2016 – unpublished report, accessed at <http://frankmartinbuck.com/Ridesharing%20and%20Alcohol-Related%20Crime%20by%20Frank%20Martin-Buck.pdf>

Books

1. Anderson, J. *et al.*, “The Promise and Perils of Autonomous Vehicle Technology” in *Autonomous Vehicle Technology: A Guide for Policy Makers*, Rand Corporation, Santa Monica, 2016.
2. Downs, A. *Stuck in Traffic: Coping with Peak-Hour Traffic Congestion*, Brookings Institution, 1992.
3. Jacobs, J. *The Death and Life of Great American Cities*, Vintage Books, New York, 1961.
4. Lafferty, R.A. *Interurban Queen*, Berkley Publishing Corporation, 1970.
5. Milne, R and Mauzy, D. *Malaysian Politics Under Mahathir*. Routledge, New York, 1999.
6. Whitelegg, J. *Transport for a Sustainable Future – The Case for Europe*, Belhaven Press, 1993.

Organisation Publication

1. Allen, H. “Bus Reform in Seoul, Republic of Korea”, *Global Report on Human Settlements*, Nairobi, 2011.

2. Allen, M. et al. “Global Warming of 1.5°C: Summary for Policy Makers”, Intergovernmental Panel on Climate Change, Incheon, The Republic of Korea, 2018.
3. Baranda, B. “Less Parking, More City: How Mexico City Became a Leader in Parking Reform” in *Sustainable Transport*, No 29, New York, 2018.
4. Collier, P. et al. *Accessing Opportunities: Policy decisions for enhancing urban mobility*, International Growth Centre, London, 2018.
5. Francke, E. et al. “Mobilising Private Investment for Bus Rapid Transit systems: The case of Metrobus, Mexico City”, CTS Embarq, Mexico City, 2012.
6. Kim, I. “2030 Seoul Plan”, *The Seoul Institute*, Seoul, 2015.
7. Ming, O and Fong, J. “The Sunway Bus Rapid Transit Line: Lessons for the Future”, Penang Institute, Penang, 2016.
8. Nugent, C. *et al*, “Noise in Europe 2014”, European Environment Agency, Luxembourg, 2014.
9. Sander, G. et al. “Malaysian Economic Monitor: Transforming Urban Transport”, The World Bank, Washington, 2015.
10. Serge, S. and Gerald, O. “The 3V Framework: Maximizing Economic Opportunities in TOD Station Areas by Matching Place, Node, and Market Potential Values”, The World Bank, Washington, DC, 2016.
11. Sharul, A. “Updates on BRT Initiatives in Malaysia”, Land Public Transport Commission, 2014.
12. Tolley, R. “Good for Business: The benefits of making streets more walking and cycling friendly”, Heart Foundation South Australia, 2011.
13. UNICEF, “Corporate Social Responsibility Policy in Malaysia”, UNICEF, Kuala Lumpur, 2012.
14. Welle, B. et al. *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths*, World Resources Institute, Washington, 2018.
15. Williams, M. *Thrive 2: Health and Wellbeing in the City We Need*, United Nations University, Kuala Lumpur, 2016.
16. Williams, S. et al. *Cities Alive: Designing for urban childhoods*, Arup, London, December 2017.
17. Yusoff, M. et al. “The Value of Statistical Life in Fatal Injury Among Drivers and Riders in Malaysia Conjoint Analysis Method”, Malaysian Institute of Road Safety Research, Internal Report No.130, 2013.
18. *Assembly: Civic Design Guidelines*, Centre for Active Design (CfAD), New York, 2018.
19. *Global Status Report on Road Safety: Time for Action*, World Health Organisation, Geneva, 2009.
20. *Global Street Design Guide*, National Association of City Transportation Officials (NACTO) and Global Designing Cities Initiative (GDCI), Island Press, New York, 2016.
21. “Impact of Chronic Disease in Malaysia” – a supplementary report to *Preventing Chronic Diseases: a vital investment*, World Health Organisation, 2005.
22. *Pedestrians First: Tools for a Walkable City*, Institute for Transportation and Development Policy (ITDP), New York, 2018.
23. *Rethinking Urban Sprawl: Moving Towards Sustainable Cities (Policy Highlights)*, Organisation for Economic Cooperation and Development (OECD), Paris, 2018.
24. *State of Global Air 2018*, Health Effects Institute (HEI), Boston, 2018.
25. *TOD Standard*, Institute for Transportation and Development Policy (ITDP), New York, 2017.

Government Publications

1. Ahamad, Z. *Planning for Transit Oriented Development in Malaysia*, Federal Department of Town and Country Planning, 2014.
2. Litman, T. “Generated Traffic and Induced Travel Implications for Transport Planning”, Victoria Transport Policy Institute, 2011.
3. Litman, T. “Parking Management - Strategies, Evaluation and Planning”, Victoria Transport Policy Institute, 2013.
4. Manan, M. et al. “Traffic Calming Scheme Around the Vicinity of School”, Malaysian Institute of Road Safety Research, 2009.
5. Norlen, M. et al. “An Overview of Road Traffic Injuries Among Children in Malaysia and Its Implication on Road Traffic Injury Prevention Strategy”, Malaysian Institute of Road Safety Research, 2011.
6. Twaddell, H. et al. *Guidebook for Measuring Multimodal Network Connectivity*, U.S Department of Transportation, Federal Highways Administration, Washington, 2018.
7. *Health Facts 2016*, Ministry of Health Malaysia: Planning Division (Health Informatics Centre), 2016.
8. *Highway Capacity Manual*, Transportation Research Board, National Academy of the Sciences, 2000.
9. *Manual for Streets 2: Wider Application of the Principles*, The Chartered Institute of Highways and Transportation, London, 2010.
10. *National Health and Morbidity Survey 2015; Volume 2: Non-Communicable Diseases, Risk Factors & Other Health Problems*, Ministry of Health, Kuala Lumpur, 2015.
11. “Taking Action for Child Friendly Places: First Steps”, City of Belfast, 2016.
12. “WSDOT’s Congestion Measurement Approach: Evaluating System Performance”, Washington State Department of Transportation, Washington, 2011.

Newspaper Articles and Online Publications

1. Abas, A. “800 SPAD staff to fill vacancies in RTD”, *New Straits Times*, 24 May 2018, accessed at <https://www.nst.com.my/news/nation/2018/05/372696/800-spad-staff-fill-vacancies-rtd>
2. Aldane, J. “Parking presents new market for urban innovation”, *Cities Today*, 22 June 2018, accessed at <https://cities-today.com/parking-presents-new-market-for-urban-innovation/>
1. Annuar, A. “Treasury: Putrajaya still paying a few hundred millions in fuel subsidies”, *Malay Mail*, 30 October 2017, accessed at <https://www.malaymail.com/s/1498803/treasury-putrajaya-still-paying-a-few-hundred-millions-in-fuel-subsidies>
2. Aris, N. “Is fuel being subsidised on the quiet, asks Rafizi”, *Free Malaysia Today*, 1 May 2018, accessed at <http://www.freemalaysiatoday.com/category/nation/2018/05/01/is-fuel-being-subsidised-on-the-quiet-asks-rafizi/>
3. Barron, J. “Lounge in Them. Dash Through Them. But Don’t Call Them Parks.”, *The New York Times*, 13 July 2018, accessed at <https://www.nytimes.com/2018/07/13/nyregion/lounge-in-them-dash-through-them-but-dont-call-them-parks.html>
7. Bavani, M. “Few takers for multi-level parking in Brickfields”, *The Star*, 12 October 2017, accessed at <https://www.thestar.com.my/metro/metro-news/2017/10/12/few-takers-for-multilevel-parking-in-brickfields-shoppers-continue-to-doublepark-along-little-indias/>

8. Bavani, M. "KL mayor: No more clamping of vehicles in the city... for now" *The Star*, 26 May 2018, accessed at <https://www.thestar.com.my/news/nation/2018/05/26/kl-mayor-no-more-clamping-of-vehicles-in-the-city-for-now/>
9. Bavani, M. "KL to impose congestion charges on motorists only after improving public transport", *The Star*, 17 October 2017, accessed at <https://www.thestar.com.my/metro/metro-news/2018/10/17/kl-to-impose-congestion-charges-on-motorists-only-after-improving-public-transport/>
10. Bavani, M. "Monuments to failure", *The Star*, 9 January 2017, accessed at <https://www.thestar.com.my/metro/community/2017/01/09/from-monuments-to-failures-automatic-street-toilets-a-taj-mahal-inspired-food-court-a-sophisticated-f/>
11. Bavani, M. "Security fencing gives a 'trapped' feeling", *The Star*, 20 February 2017, accessed online at <http://www.thestar.com.my/metro/community/2017/02/20/security-fencing-gives-a-trapped-feeling-pedestrians-find-dbkls-safety-measure-to-deter-snatch-thiev/>
12. Bernama, M. "'Journey Planner' app to help KL public transport users", *Free Malaysia Today*, 22 March 2018, accessed at <https://www.freemalaysiatoday.com/category/nation/2018/03/22/journey-planner-app-to-help-kl-public-transport-users/>
13. Ceritalah, K. R. "What Malaysia's MRT can learn from Indonesia's BRT", *South China Morning Post*, 23 November 2018, accessed at <https://www.scmp.com/week-asia/opinion/article/2174635/what-malysias-mrt-has-learn-indonesias-brt>
14. Chelvi, S. "Two men and a woman claim trial to insulting Najib on Facebook", *The Sun Daily*, 18 August 2017, accessed at <http://www.thesundaily.my/news/2017/08/18/two-men-and-woman-claim-trial-insulting-najib-facebook-updated>
15. Chen, G. "Clauses in DBKL parking contract being scrutinised", *The Star*, 26 May 2018, accessed at <https://www.thestar.com.my/metro/metro-news/2018/05/26/clauses-in-dbkl-parking-contract-being-scrutinised/>
16. Chen, G. "DBKL's lucrative parking contract questioned" *The Star*, 19 May 2018, accessed at <https://www.thestar.com.my/metro/metro-news/2018/05/19/dbkls-parking-contract-questioned-mp-collection-of-fees-should-be-halted-pending-review-of-matter/>
17. Chow, M. "Govt still subsidising fuel prices, says Treasury sec-gen", *Free Malaysia Today*, 30 October 2017, accessed at <https://www.freemalaysiatoday.com/category/nation/2017/10/30/govt-still-subsidising-fuel-prices-says-treasury-sec-gen/>
18. D'Agostino, M. *et al.* "How Ride-Hailing Could Improve Public Transportation Instead of Undercutting It", *Good*, 5 July 2018, accessed at <https://www.good.is/articles/lyft-uber-reducing-public-transit-use>
19. De Jong, F. "Parks and bicycles were lifelines after Mexico City's earthquake", *CityLab*, 28 September 2017, accessed at <https://www.citylab.com/environment/2017/09/parks-and-bicycles-were-lifelines-after-mexico-citys-earthquake/541320/>
20. Flamm, M. and Geiger, D. "Uber and Lyft crushed taxis—is the commercial parking industry next?", *Crain's New York Business*, 21 February 2018, accessed at <http://www.crainsnewyork.com/article/20180221/FEATURES/180219923>
21. Godwin, R. "Sonic doom: how noise pollution kills thousands each year", *The Guardian*, 13 July 2018, accessed at <https://www.theguardian.com/lifeandstyle/2018/jul/03/sonic-doom-noise-pollution-kills-heart-disease-diabetes>
22. Gonzalez, T. "TSU Researchers: Pedestrian deaths are misunderstood, in part because of police and journalists", *Nashville Public Radio*, 27 June 2018, accessed at

- <http://www.nashvillepublicradio.org/post/tsu-researchers-pedestrian-deaths-are-misunderstood-part-because-police-and-journalists#stream/0>
23. Huong, T., “Car sales to jump with big savings from zero GST”, *The Star*, 20 May 2018, accessed at <https://www.thestar.com.my/news/nation/2018/05/20/car-sales-to-jump-with-big-savings-from-zero-gst/>
 24. Ishikawa, A. “Los puentes peatonales no sirven, pero seguimos construyéndolos”, *The Huffington Post* (Mexican edition), 27 August 2018, accessed at https://www.huffingtonpost.com.mx/armando-pliego-ishikawa/los-puentes-peatonales-no-sirven-pero-seguimos-construyendolos_a_23510217/
 25. Jacobson, P. “‘Gas’ vs. ‘Liquid’ Models for Traffic”, *Los Angeles Times*, 14 May 1997, accessed at http://articles.latimes.com/1997-05-14/local/me-58478_1_freeways-capacity-traffic
 26. Jay, B and Adnan, A. “Why no open tender for lucrative DBKL contract, asks Kepong MP”, *New Straits Times*, 18 May 2018, accessed at <https://www.nst.com.my/news/nation/2018/05/370790/why-no-open-tender-lucrative-dbkl-contract-asks-kepong-mp>
 27. Kimmelman, M. “A Streetcorner Serenade for the Public Plaza”, *The New York Times*, 31 May 2013, accessed at <http://www.nytimes.com/2013/06/02/arts/design/a-prescription-for-plazas-and-public-spaces.html>
 28. Lai, A. “MRT Corp says Rafizi got it wrong, RM21bil for both Phase 1 and 2 of SBK Line”, *New Straits Times*, 18 December 2016, accessed at <https://www.nst.com.my/news/2016/12/197743/mrt-corp-says-rafizi-got-it-wrong-rm21bil-both-phase-1-and-2-sbk-line>
 29. Lim, I. “PAS manifesto pledges cheaper homes, interest-free loans for first car”, *Malay Mail*, 19 March 2018, accessed at <https://www.malaymail.com/s/1601681/pas-manifesto-pledges-cheaper-homes-interest-free-loans-for-first-car>
 30. Lombardo, D. “Court ruling opens door to lawsuits over unsafe roads”, *Times Union*, 13 June 2018, accessed at <https://www.timesunion.com/news/article/Court-ruling-opens-door-to-lawsuits-over-unsafe-12991504.php>
 31. Murray, C. “What would cities look like if they were designed by mothers?”, *The Guardian*, 27 August 2018, accessed at <https://www.theguardian.com/commentisfree/2018/aug/27/architects-diversity-cities-designed-mothers>
 32. Morris, D. “Today’s cars are parked 95% of the time”, *Fortune*, 13 March 2016, accessed at <http://fortune.com/2016/03/13/cars-parked-95-percent-of-time/>
 33. Rackard, N. “Cities Without Ground: A Guide to Hong Kong's Elevated Walkways”, *Arch Daily*, 28 March 2013, accessed at <https://www.archdaily.com/352543/cities-without-ground-a-hong-kong-guidebook>
 34. Radhi, N. and Sarabatin, M. “MACC report lodged against Ku Nan over land sale worth RM4.28 billion”, *New Straits Times*, 16 May 2018, accessed at <https://www.nst.com.my/news/nation/2018/05/369990/updated-macc-report-lodged-against-ku-nan-over-land-sale-worth-rm428>
 35. Razak, R. “Removing tolls and upping petrol subsidy will increase pollution, says Najib”, *The Malaysian Insight*, 3 December 2017, accessed at <https://www.themalaysianinsight.com/s/25751/>
 36. Rosli, L. “Subang Jaya takes green city lead”, *New Straits Times*, 7 November 2015, accessed at <https://www.nst.com.my/news/2015/11/subang-jaya-takes-green-city-lead>

37. Selva, M. "Steep fares keep passengers away", *The Star*, 29 April 2016, accessed at <https://www.thestar.com.my/metro/community/2016/04/29/steep-fares-keep-passengers-away-lukewarm-response-to-brt-service-even-during-peak-hours/>
38. Speirs, J. "Cape Town's Public Transport – the political obstacles to a unified smart card", IGLUS, 28 July 2016, accessed at <http://iglus.org/cape-towns-public-transport-the-political-obstacles-to-a-unified-smart-card/>
39. Speirs, J. and Fadzil, F. "Pollution in KL comparable to Beijing", *Malaysiakini*, 6 June 2018 accessed at <https://www.malaysiakini.com/letters/428243>
40. Tong, L. C. "Road accidents: Can Liow Tiong Lai and SPAD buck up?", *Free Malaysia Today*, 21 June 2017, accessed at <http://www.freemalaysiatoday.com/category/opinion/2017/06/21/road-accidents-can-liow-tiong-lai-and-spad-buck-up/>
41. Wells, H. "Urban sprawl triples public service costs, says OECD", *Cities Today*, 18 June 2018, accessed at <https://cities-today.com/urban-sprawl-triples-public-service-costs-says-oecd/>
42. "Bike-sharing firm ofo ceases operations in Malaysia after one year", *The Straits Times*, 22 August 2018, accessed at <https://www.straitstimes.com/asia/se-asia/biking-sharing-firm-fo-ceases-operations-in-malaysia-after-one-year>
43. "Bodmin residents back 'shared space' scheme", *Road Safety GB*, 10 August 2015, accessed at <http://roadsafetygb.org.uk/news/n-a-4512/#comments>
44. "Dr M: SPAD, Pemandu, Jasa and MPN among agencies to be abolished", *The Star*, 23 May 2018, accessed at <https://www.thestar.com.my/news/nation/2018/05/23/dr-m-spad-to-be-abolished/>
45. "Freelance photog (sic) claims trial to insulting PM on FB", *The Star*, 8 December 2017, accessed at <https://www.thestar.com.my/news/nation/2017/12/08/freelance-photog-claims-trial-to-insulting-pm-on-fb/>
46. "How to stop the decline of public transport in wealthy countries", *The Economist*, 23 June 2018, accessed at <https://www.economist.com/leaders/2018/06/23/how-to-stop-the-decline-of-public-transport-in-rich-countries>
47. "Importance of using pedestrian bridges", *The Hindu*, 24 October 2016, accessed at <http://www.thehindu.com/todays-paper/tp-in-school/Importance-of-using-pedestrian-bridges/article12562834.ece>
48. "It's a design flaw, says urban planner", *The Star*, 20 February 2017, accessed at <https://www.thestar.com.my/metro/community/2017/02/20/its-a-design-flaw-says-urban-planner/>
49. "Johari: No more subsidy for Proton after RM1.1b R&D reimbursement", *Malay Mail*, 24 May 2017, accessed at <http://www.themalaymailonline.com/malaysia/article/johari-no-more-subsidy-for-proton-after-rm1.1b-rd-reimbursement#2hdGemrCVOkWQhe7.97>
50. "KL's liveability drops in survey; pollution and crime blamed", *Malay Mail*, 13 March 2018, accessed at <https://www.malaymail.com/s/1597493/kls-liveability-drops-in-survey-pollution-and-crime-blamed>
51. "Malaysia sets aside 3 billion ringgit to finance fuel subsidies", *Reuters*, 7 June 2018, accessed at <https://www.reuters.com/article/us-malaysia-politics-subsidy/malaysia-sets-aside-3-billion-ringgit-to-finance-fuel-subsidies-idUSKCN1J30AB>
52. "MRT is Najib's gift to Malaysia, says minister", *The Malay Mail*, 17 July 2017, accessed at <http://www.themalaymailonline.com/malaysia/article/mrt-is-najibs-gift-to-malaysia-says-minister#ZDpFeLqKHM52ELkx.97>

53. “Najib launches BRT-Sunway line”, *The Borneo Post*, 10 June 2012, accessed at <http://www.theborneopost.com/2012/06/10/najib-launches-brt-sunway-line/>
54. “Najib's rhetoric against tolls a pre-election ploy, claims PKR”, *Malaysiakini*, 27 February 2018, accessed at <https://www.malaysiakini.com/news/413594>
55. “Petrol Price Breakdown”, *The Automobile Association*, 10 April 2018, accessed at <https://www.aa.co.za/insights/petrol-price-breakdown>
56. “PKR leader: MRT not a gift, it's the government's duty”, *Malaysiakini*, 18 July 2017, accessed at <https://www.malaysiakini.com/news/388894>
57. “PM2.5 Technology Already Available in the Country”, *The Rakyat Post*, 26 October 2015. Accessed online at <http://www.therakyatpost.com/news/2015/10/26/pm2-5-technology-already-available-in-the-country/>
58. “Reimagining Public Transport in San Clemente”, *Lyft Blog*, 10 October 2016, accessed at <https://blog.lyft.com/posts/reimagining-public-transit-in-san-clemente>
59. “Report erection-killing noise pollution to EPA – Ampaw to Kwasiwukrom wives”, *Ghana Web*, 11 August 2018, accessed at <http://mobile.ghanaweb.com/GhanaHomePage/NewsArchive/Report-erection-killing-noise-pollution-to-EPA-Ampaw-to-Kwasitwikrom-wives-675995>
60. “Saving the Colosseum: Restoration work begins on Rome's crumbling ancient monument”, *CBS News*, 23 December 2013, accessed at <https://www.cbsnews.com/news/restoration-work-begins-on-romes-aging-colosseum/>
61. “Stop, thief! Malaysia's PM is about to steal an election”, *The Economist*, 10 March 2018. Accessed at <https://www.economist.com/news/leaders/21738363-american-officials-say-he-already-stole-millions-taxpayers-malaysias-pm-about-steal>
62. “Tilting the playing field: How Malaysia's next election will be rigged”, *The Economist*, 8 March 2018, accessed at <https://www.economist.com/news/asia/21738415-thanks-wildly-uneven-size-constituencies-it-takes-more-votes-elect-opposition-mp>
63. “What a litre of petrol would cost in South Africa without government's steep taxes”, *Business Tech*, 8 August 2018, accessed at <https://businesstech.co.za/news/energy/264015/what-a-litre-of-petrol-would-cost-in-south-africa-without-governments-steep-taxes/>
64. “Why the MRT is failing to reach its ridership target”, *Malaysiakini*, 30 October 2018, accessed at <https://www.malaysiakini.com/letters/449804>
65. “Woman killed in KK mishap”, *Daily Express*, 3 April 2018, accessed at <http://www.dailyexpress.com.my/news.cfm?NewsID=123859>

Video

1. Calthorpe, P. “7 Principles for Building Better Cities”, TED Vancouver, April 2017, time - 12:40. Accessed at https://www.ted.com/talks/peter_calthorpe_7_principles_for_building_better_cities
2. Eliasson, J. “How to solve traffic jam”, TED Helvetia, September 2012, time - 07:33. Accessed at https://www.ted.com/talks/jonas_eliasson_how_to_solve_traffic_jams
3. Mintzer, M. “How kids can help design cities” TEDxMileHigh, November 2017, time – 3:40. Accessed at https://www.ted.com/talks/mara_mintzer_how_kids_can_help_design_cities#t-355561