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Sustainable Transportation in an Urbanized World: A Comparative Analysis on the Public
Transportation Systems of Hong Kong and Shanghai

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Abstract

Road infrastructure is still dominating the most land use in China, the ADB (2008) estimates that by 2020, roads will account for 90 percent of land used by transport infrastructure (6). But China is also expanding their metro and light rail extensively, more than most countries. In 1989, the country only had three metro lines and by 2008, it had reached 36 urban rail transport lines. By examining cities that successfully use private investment for transportation, this paper aims to prove that costly, large-scale investment on public transit is the best option for future development. In essence, this funding method could be applied on a grander, national scale or even to smaller less-populated cities. As in North America, China is still catering to the demand-side of the automobile and should place more emphasis and control over how the country's infrastructure develops to best serve today's population, as well as future generations.

Both of these coastal mega-cities have managed their urban transport system quite differently; Hong Kong is deemed a success story for private owned transport while Shanghai, still considered a transportation role model, struggles to cope with an ever increasing demand and publicly funded infrastructure. By researching and analyzing the three finance methods: public, private or public-private partnerships this paper will compare and contrast these two cities in hopes of determining why Hong Kong has a more successful public transit; whereas Shanghai does not.

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Chapter I: Introduction

Throughout history, human civilization has been in a process of 'citification', a concept that is now climaxing in the 21st century, with cities in developing countries being at the forefront of this socio-economic transformation. The current rate of urban growth in Third World countries is unprecedented and poses a potential serious problem for local and national governments in providing basic services and infrastructure to ensure the health and safety of all. There are now over 400 cities across the globe with over 1 million inhabitants, of which 27 are "mega-cities", defined as massive cities with over 10 million inhabitants (Moavenzadeh & Markow 2007:1).

Most First World countries have reached an urbanization rate of 85 percent, and some experts predict that developing countries will match this by 2100, as they are experiencing the urbanization process at an increasingly rapid rate. During the industrialization revolution, Europe's growth rate averaged .5 percent per year; in contrast, less-developed countries (LDCs) have dwarfed this figure with an average growth rate of 2.5 to 3 percent per year (Ghosh 1984:27). Moreover, due to their speed of growth, uncontrolled and unplanned urban growth will have an overwhelmingly greater impact on LDC's in the near future. As a result, the effects of urbanization in LDCs are much more amplified as compared to their First World city counterparts.

Thus, urbanization presents daunting planning challenges for LDCs, particularly in such areas as water supply, energy, sewer systems, and transportation. Developing countries invest a total of \$200 billion a year in new infrastructure, an average of 4 percent of their national output (Wu 1999:2264). New or improved public transportation infrastructure is being supported in these countries but it is often poor and inadequate; despite the fact that a functioning urban transport system makes

access to employment and other facilities more accessible. Providing mass transit at reasonable rates is becoming a major service problem for LDC cities, as they cannot readily follow in the footsteps of Western urban planning, which has focused on the automobile and the construction of more roads.

Given this situation, the solution may lie in a unique plan for each city, tailored to its own specific needs and resources. Throughout the world, reliable transportation is considered to be a main element for city life to function smoothly. And yet, its complexity has become one of the hardest infrastructural systems to manage. The World Bank (1975) has highlighted the importance of reliable transportation for decades, stating "urban transport can provide the mobility and accessibility needed to integrate [rural] newcomers into the urban economy... (3). The general consensus of many authors tend to emphasize the great potential of transportation infrastructure, pinpointing that development of essential transport infrastructure is a core element for sustained economic growth and even poverty reduction. As cities become the world's reality, it is important that we study, analyze and understand urban issues, specifically on how to facilitate the population's daily commuting.

In the West, the vast majority of people use some form of motorized vehicle to commute to and from work, including automobiles, buses, and motorcycles. This exacerbates transportation problems, such as traffic congestion, increased travel time, air and noise pollution. The developing world's middle-class is steadily growing, and as it does so, many people upgrade from non-motorized (walking or cycling) to motorized modes of transportation, thereby significantly increasing pollution. It is becoming extremely important that cities across the globe switch to more sustainable and efficient means of transportation, like rail.

The aim of this paper is to prove that costly, large-scale urban infrastructure investment focused

on sustainable public transit is the best option for future urban development. By examining the role of the automobile and the primary funding methods of public transit - privatization, state-owned enterprises and public-private partnerships - this thesis compares and contrasts the public transportation systems of Shanghai and Hong Kong: Hong Kong is a showcase for public transportation; all its buses and trains are privately owned and are able to make a profit. Shanghai is also becoming a transportation role model for the rest of mainland China, as the government of this city has gone to great lengths to improve infrastructure and services. Accordingly, this thesis addresses the following central question: what is the more affordable and sustainable method of funding public transportation in an urbanized area?

Part I: The Role of Infrastructure

The World Development Report declared that “infrastructure has an indispensable, positive role in development” (Wu 1999:2264). The provision of infrastructure is a lengthy process involving financing, construction and maintenance. Most importantly, these improvements can have a beneficial effect on increasing households’ real income and quality of life.

Infrastructure policy has attracted increased interest by experts across the globe, but no more so than in developing countries. As a society grows, the need for infrastructure becomes more and more apparent as it supports the overall development of the community, the region and the entire country. Infrastructure encompasses both physical and organizational structures that include facilities and associated services such as roads, water supply, energy, and sewer systems. It is widely accepted that "countries with very strong physical infrastructure can maintain dense populations in comfort and can move people, goods and information swiftly and at low cost; countries with weaker infrastructure,

whether developed or developing, cannot" (Ascher & Krupp 2010:1). Efficient and good quality roads, railways, ports, and airports support primary economic sectors such as agriculture, industry, mining and tourism. Transportation infrastructure acts as a link between the workers and the economy, enabling the people to travel longer distances to their place of employment with greater ease.

Both, rich and poor countries alike, struggle to maintain and operate their infrastructure. This is because it is a costly investment, requiring financial capital, materials and man power. Developing countries have even greater difficulties in providing this to its citizens, and consequentially, funding is often supplemented by developed countries in the form of aid or loans. "In particular, the high rates of urban growth experienced in places like Asia will require huge investments in infrastructure if cities ... are to perform their various production and service activities in a manner consistent with the principles of sustainable development" (Arimah 2005:1346). Research has shown that transportation infrastructure plays a key role in development because it facilitates the production of goods and services and transports workers to and from work; thus directly impacting the economy.

Such being the case, great emphasis is placed on infrastructure investment, based on the assumption that it boosts economic growth and supports social objectives. The European Commission believes that "investment in infrastructure can contribute to the achievement of the Millennium Development Goals, as it leads to improved access to services like health and education, generates employment and enhances a country's ability to trade while reducing the costs of goods and services. Good infrastructure also makes it easier for economic actors to do business and helps to improve environmental conditions" (EC 2012). Cities need to make this investment, if they are to provide the basic services that stimulate economic growth.

In particular, road infrastructure conditions can play a vital role in defining transport and traffic conditions for a city, and a region. In developing countries, the transport infrastructure and services are at a much lower quality than Western standards. The roads are not paved or well-maintained, and pathways for pedestrians are often neglected. Due to this underdevelopment, most developing countries rely on non-motorized means of transportation, particularly the bicycle but also, rickshaws, animal carts or walking. Because of its immense popularity in Asian cities, some of Chapter Two and Three will address the role of bicycles in the case study cities.

Part II: Creation of Urban Transportation Infrastructure

Across the world urban transport infrastructure and services have been implemented primarily by using methodologies that originated in industrialized countries during the 1950's, which were then transferred to the developing world. The majority of people in the First World have come to see transportation services as rights because they facilitate social living. As a result, the quantity and quality of physical infrastructure are among the most crucial characteristics defining development, especially in urban centres. The results of this Western model have been widely disappointing, as rapid urbanization and unbalanced economic growth generate chaotic urban expansion. Such planning methods accentuate unfair distribution of accessibility, and environmental inequities, which will be more fully explored in this paper's Literature Review.

Many reasons exist for being concerned about urban transport conditions, such as low accessibility, poor public transit supply, traffic accidents, inconvenience, pollution, and road congestion. In developing countries these conditions are more notable, as most have inadequate infrastructure for the bulk of the population, particularly the vulnerable sectors of society, such as the

poor or the disabled. The primary factor constraining the capacity of all levels of government to provide adequate infrastructure is finance. While the issue of low investment in transportation infrastructure is not new, it should not be overlooked because of the potential social and economic benefits, as well as the potential profitability.

There is a general observation that investments in urban transportation infrastructure will help alleviate economic, environmental and social impacts. Some have argued that development of essential transport infrastructure is a core element for sustained economic growth and poverty reduction on a national level. Overall, the research has shown that there is a general positive correlation between investment in infrastructure and poverty alleviation; there are no documented cases where a country or city has invested in infrastructure while poverty expanded. The World Bank correlates a one percent increase in gross domestic product with a one percent increase in infrastructure stock across all countries (Wu 1999:2264). This is why transportation is such a difficult issue to deal with; it must balance the needs of the entire population, regardless of class or income, while also trying to recoup initial costs and make a profit in order to maintain and operate it. More recently, there has also been an elevated sense that the environment be considered, as well as preserved.

Part III: Sustainable Urban Transportation

Sustainability is a fairly recent term used in the development arena. The most widely cited definition of 'sustainable development' is from the Brundtland Commission Report (1987): "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (Jing et al 2010:1). Transport is a powerful tool for economic growth, but it is also a major contributor to the world's energy and environmental problems.

In many ways, environmentalists, engineers, social scientists have sought ways in which to reduce the negative impacts of a transportation system, most often centred on the private automobile.

It is important to be specific about the term 'sustainable transportation', as there can be varying definitions. The description that best suits the purpose of this paper comes from the European Union Council of Ministers who states that a 'sustainable transport system' is one that:

1. Allows the basic access and development needs of individuals, companies and society to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations.
2. Is affordable, operates fairly and efficiently, offers a choice of transport mode, and supports a competitive economy, as well as balanced regional development
3. Limits emissions and waste within the planet's ability to absorb them, uses renewable resources or below the rates of development of renewable substitutes, while minimizing the impact on the use of land and the generation of noise (Williams 2005:3).

An efficient, affordable and sustainable public transportation is one of the missing links to easing the burden of urban population in LDC's. Transportation in a sustainable society should be efficient, clean and safe. "There should be favourable and excellent coordination of the relationship between transport decisions, urban planning and land utilization" (Jing et al 2010:12). It should also nurture social and environmental well-being and growth for all, including less-advantaged groups. Generally, it is argued that mass public transit may be the best way to achieve a sustainable city. Nonetheless, some cities are coming up with different innovative ideas to address their transportation issues, such as a trolley bus system, separate bus lanes, trucking restrictions, multi-story parking

structures, or pedestrian or biking pathways.

Part IV: Public Transportation in Chinese Cities

Chinese cities are quite literally bursting at the seams. The year 2011 marked a milestone in China's very long history; for the first time, more people now live in cities and towns than in the countryside. The country's estimated 690 million urban dwellers presently account for 51.3 percent of the total population of 1.35 billion. Even more impressive is the fact that China achieved this milestone in only two decades; in 1978 the level of urbanization was just 20 percent and has climbed steadily ever since (Heikkila 2007:65). Along with expanding older cities, new cities are also appearing across China, some growing to mega-city status; hence why the sheer size of these mega-cities is pushing the limits of a city's capacity to support its population base. The importance of strategic urban planning is becoming detrimental to the success of China's economy and modernization.

Rapid urbanization and motorization have also contributed to the mass migration from the rural areas to the cities, and the arrival of these newcomers is testing the capacity of its cities' infrastructure. This increase of people and cars is creating urban sprawl and an automobile culture, adding to the urban issues of traffic congestion, air pollution, and longer travel time. Such rapid urbanization has increased the demand for basic infrastructure and the need for new funding mechanisms.

Providing mass transit at reasonable rates is becoming a major service problem for Chinese cities, as they cannot necessarily follow in the footsteps of Western suburbia, which catered to the automobile and provided more roads. Economically speaking, the West has continued to satisfy the ever-growing demand of cars, placing the emphasis on offering more supply (roads), and not on trying to affect the demand. China, on the other hand, has committed to improving urban infrastructure, even

though many experts believe that construction continues to lag behind the rate appropriate to the country's growth in urbanization as noted above. Even though government investment at the local and national level continues to rise steadily, it has yet to match the demand.

China has emulated many other countries by supporting investment in transportation infrastructure, whether it is for small-scale walking and cycling paths or large-scale investments such as subway, rail and road improvements. Such initiatives have the potential to help developing countries integrate into the global economy, or in the case of China, maintain its status one of the largest market economies in the world.

As previously mentioned, LDC's are absorbing the bulk of the worlds' population, requiring immense coordination and immediate attention. In China, the mass migration of the rural population to urban settings is testing the capacity of its cities' viability. Under present conditions, public transportation is failing to expand in proper relation to urban growth, leaving a large percentage of people without adequate services; again, those who are usually already the most marginalized.

Part V: Chapter Outline

This thesis is structured in the following manner: Chapter Two presents a literature review, surveying the academic writing on the issues surrounding transportation in urban areas. It is through this literature review that the pertinent research questions germane to this thesis are identified in specific reference to China. The methodological approach for the research undertaken is also described in this chapter, including data collection techniques and sources of information.

Chapter Three will examine two case study cities: Shanghai and Hong Kong, as they relate to the research question. The paper investigates how each city has developed and funded its

transportation system, while considering their respective historical background and structural layout. Relevant data related to the core issues are explained, including the rate of urbanization and motorization, as well as the funding strategies used and policies implemented.

Chapter Four then compares and analyzes both cities and discusses the significance of the findings from Chapter Three. The final chapter, Chapter Five, will conclude with an evaluation of the original research question and lessons learned to facilitate the development of other cities, both in developing and developed countries alike.

Chapter II: Literature Review

Support in investment in transportation infrastructure is widely accepted, whether it is for small-scale walking/biking paths or large-scale investments such as light rail, subway and road improvements. The argument, as mentioned earlier, is that infrastructure investment can boost economic growth and support social objectives. Many of the authors I have read tend to emphasize the great potential of transportation infrastructure, some specifying that development of essential transport infrastructure is a core element for sustained economic growth and poverty reduction.

Secondly, the vast majority of the literature used as reference blames the over-usage of private automobiles as one of the main issues in urban transportation, as they account for traffic congestion, long transit times, air pollution and health problems. Despite these major disadvantages, people still feel they have a right to purchase an automobile, mainly because it remains a symbol of wealth as well as a facilitator of travel. This, however, is usually not the case in large-cities, and definitely not the case in mega-cities like Shanghai. As a solution to this problem, some researchers advocate for more green-friendly automobiles, but cities such as Hong Kong have long realized the car will remain a major deterrent to quality of life in dense urban living areas, and are promoting a more sustainable approach, one that includes rail, coordinated buses, and bicycles.

The great debate on this subject, however, converges on the issue of who should be responsible for providing public transit. Deficits in this sector are not normally charged to the user, but to the taxpayer. This raises questions on equality; why would the poorer class, who may not even use such services, also be held responsible for its financing?

Despite such challenges, awareness is growing that alternative sources of revenue may be a

viable option for sustainable, effective, affordable transit. It is generally held that public transportation is the best option to achieve such goals. Some believe that public transportation and its infrastructure should be entirely state-owned; others support privatization and still others support a public-private partnership. Each of these options comes with their own set of pros and cons, and we will examine more closely these various initiatives in the third section of this paper.

Part I: Transportation Infrastructure Creates Equity and Alleviates Poverty

Transportation connects us to our employment, and without proper and affordable means to travel, one could say that a person's rights are actually being violated: "Everyone has the right to work, to free choice of employment, to just and favourable conditions of work and to protection against unemployment" (UN 2012). In line with this type of reasoning is the argument that public transportation infrastructure can lift people out of poverty as they gain greater access to modes of travel to pursue their economic goals. The World Bank, along with other organizations, has concluded that "transport may become a binding constraint on both economic growth and social development and inclusion, along with increased negative impacts on health and on the environment" (WB 2011). It supports client countries and cities in their effort to develop urban transport policies and projects to tackle these issues. In this sense, these factors are all elements that are inter-related and should be accorded equal importance.

In his article, *Equity, Social Justice, and Sustainable Urban Transportation in the Twenty-First Century*, Jean Mercier (2009) proposes that "one of the most important equity and social justice challenges governments and [urban planners] face is urban land-use and transportation issues" (145). He argues that there is a "bundle of tangled elements" that are interdependent and strongly related to

one another, including: land-use, transportation, environment, health, and equity. To facilitate urban development, each of these elements should be taken into consideration equally. An example of this correlation is the holistic view adopted by Arup, the consulting firm responsible for designing the new city of "Dongtan" in Shanghai:

Planning was an exercise in integrated thinking - "integrated urbanism" ...
Transportation was considered at the same time as health care, because in the big picture, one affects the other: the more walking and the less air pollution, the healthier the people and the lower the health-care costs. Similarly, if internal-combustion engines are banned, Dongtan's office buildings will save on air conditioning: workers won't mind opening windows to cool down their offices if traffic noise is absent and the air is clean... (Mercier 2009:148-149).

In other words, Mercier sees urban planning as "design sensitive", and how we build our urban areas has "important consequences on other factors, particularly health, the environment, and social equity" (149), and in the long-term affects the economy. For instance, it could decrease the labour pool due to severe national health crises, as well as cost government more in health care. This is actually occurring in China now; as pollution is at its all-time high, there is a concomitant increase in the national cancer rate.

Authors Kim and Nangia (2010) support the claim that increased investment in the transport sector, particularly roads has the greatest effect on poverty reduction. "It has been shown that an efficient road network increases access to services and economic opportunities, facilitates domestic market integration, lowers the cost of production and transportation, and allows healthy competition both domestically and internationally" (110).

Conversely, other scholars such as Ascher and Krupp (2010) counter this idea by asserting that a need to expand physical infrastructure does not directly engage the issues of poverty alleviation and equity (35). To them, it is more a distributional matter, as well as a matter of who will bear the burden

and reap the benefits; the poor often being the ones absorbing the brunt of infrastructure weakness. In this regard, the World Bank and Asian Development Bank have long advocated that the greater the infrastructure investment, the higher the returns of economic growth and equity advantages for the lower-classes. However, Ascher and Krupp (2010) also argue that stronger infrastructure does not necessarily mean that low-income people will be better off, particularly in regards to the private sectors' involvement, simply because they run the risk of excluding the poor from access due to unaffordable user fees. They also point out that while infrastructure investment may increase the productivity of the poor and alleviate poverty, it has yet to prove if it accomplishes these goals more effectively than other targets for investment, such as health care or education (22-23).

Mercier (2009) also point out that private modes of transportation are related to equality between the rich and poor. He argues that cars have come to represent social status, being inclusive to some but exclusive to others. He sees the automobile as “an ego-enhancing medium, one that disrupts the balance between the public and the private sphere” (150). It is a fact that the use of a private vehicle isolates individuals; not only removing themselves from public space, but also reducing public space in lieu of private space. People who do not own a car are disadvantaged in cities dominated by the automobile culture, where cars rule the road. Their options are reduced to non-motorized means or public transit which may result in more limited options to gain their livelihood. Mercier (2009) estimates that as many as one-third of adults in industrialized cities do not own or drive a car (150). Governments, as well as society as a whole, need to recognize that a significant portion of people do not use a car, and should therefore be properly compensated proportionately equally as those who do drive cars.

Part II: Urban Transportation and the Private Automobile

The cause of urban transportation issues is often placed on the high use of private automobiles. Several authors (e.g. Kennedy et al 2005; Mercier 2009) agree that the current global trend of automobile usage is unsustainable and negatively impacts quality of life. This viewpoint underscores the underlying fear that the world's natural resources will not support urban transportation in developing countries if they follow the Western urban growth formula. The automobile culture requires high consumption of oil, adding to pollution, and subsequent health problems. Automobiles take up road space, they cause noise pollution, and there never seems to be enough parking space. Thus arises a second debate surrounding future urban transport; what should be the role of automobile be versus that of more environmentally friendly modes of transport, such as better public transit, or designated streets for walking and biking? This section will first look at some of the literature that discredits the automobile; why it should not be used as it is not the most efficient, nor convenient way to travel. This section will also give consideration to what governments can do to discourage the (Western) automobile culture.

As globalization integrates countries around the world, Third World nations are rapidly developing. In the meantime, their populations, once poverty-stricken, are becoming increasingly demanding modern consumers. Accordingly, the UN-Habitat estimates that the share of autos in the developing world will rise dramatically in the near future, from 25 percent in 1995 to 48 percent in 2050 (Marcotullio 2006:121). Asia is of particular interest, as this region has absorbed a large share of the world's growing number of motorized vehicles. One study in particular points to an 'infrastructure bottleneck' in Asia, meaning that the rate of motorization is occurring at a much higher rate than the growth of roads, or even public transit infrastructure (Marcotullio 2006:122). China's demand for

urban transportation, including cars, motor bikes, buses, trains and even taxis, is growing substantially. The country's transportation fleet is projected to expand from 16 to 94 million vehicles between in the next 10 years (Dixon et al 2011:775). Along Chinese coastal cities, such as Shanghai, the annual population growth is 4 to 6 percent, combined with an increase of 20 to 30 percent for vehicles (Shen 1997:549). Even though these cities continue to grow at such a staggering pace, the road network is not being built quickly enough to handle the increase.

It is widely believed that urban transport systems in developing countries cannot be based primarily on cars, due to the lack of worldwide resources, as well as the potential effects on the environment and health. Mercier (2009) estimates that in many urban regions, at least 75 percent of trips are made by gasoline-fuelled private automobiles which will soon be inconsistent with global sustainability. This is particularly true when you consider that North America, with about 5 percent of the world's population, uses about 40 percent of the world's transportation energy (146). To put this into a proper perspective, Mercier states that in comparison Asia currently only uses 10 percent of worldwide transportation energy (p.152)! With such staggering statistics, one begins to fully appreciate the meaning of 'unsustainable transportation'; if China and the rest of Asia were to follow the Western style of urban development, then there would be an ecological catastrophe unmatched in human history.

North America has had the luxury of space in its urban development scheme; our answer to urban transport has generally been to build more and more roads, creating our massive urban sprawl. Economically speaking, we have continued to satisfy the ever-growing demand, focusing on offering more supply (roads), and not on trying to affect the demand (cars). This formula of growth has caused the current traffic issues we now face, specifically congestions and pollution.

In contrast, recent attempts in some large Chinese cities have aimed to manipulate the supply and demand by introducing automobile restrictions (i.e. limited licenses, and various taxes). While this may alleviate some automobile congestion, it does not address any long term solutions. Most urban transportation infrastructure has focused on servicing the use of cars; however, in cities such as Shanghai, the roads were first built to accommodate non-motorized vehicles, which in turn cause major problems for today's urban planners.

To complicate matters further, the Chinese government has been promoting the automobile industry as a driving force for national economic development. This means that there is a growing middle-class that is able to purchase a car: “In 1994, the central government declared the automobile industry a key catalyst for economic growth” (Zacharias 2002:310). This policy was supported with joint ventures between foreign automakers and local suppliers and assembly plants. The new automobile market exploded and the government greatly increased its funding for inter-city highways to support the booming car industry; thus the national economy. The end result of this declaration and partnerships over the past two decades has been mega-transport infrastructure projects, featuring the construction of countless elevated highways, building intricate metro systems, and designating numerous pedestrian-only streets. With such transport infrastructures in place, it behooves people living in urban areas to realize that just because they have the means to purchase a car does not make it the best mode of travel. Regardless, the automobile has invaded Chinese culture and is making its way into every corner of the country.

Overall, the government has taken some initiatives to cope with this issue. Over the past 26 years, China has seen an increase of over 300 percent of circulation on its highway system, and the

ratio of private vehicles to total vehicles increased from 6.8 percent in 1980 to 78.2 percent by 2006. This transport system consumes 35 percent of China's crude oil usage and has been a major source of greenhouse gas emission (ADB, 2008: 1). The irony behind this is the inevitable truth is that oil will eventually run out, putting a hypothetical expiry date on the fuel-operated automobile.

Another obvious contradictory development is that the Chinese government currently uses the automobile industry to push its national economic agenda. In the beginning of 2009, China overtook the U.S. to become the largest automobile market in the world, with sales reaching almost 14 million. The following year, both automobile production and automobile sales reached 18 million, including 13.8 million passenger cars, most of which were used domestically (Chen & Zhao 2013:39). This has had severe consequences for urban planners as they deal with a government that supports "going green" but in practice is still more concerned with national economic growth. This incompatible policy will increase the level of motorization and the demand for transportation facilities in China, especially in the coastal region. The Chinese environmentalist Qing Shen (1997) proposes that these policies require a close examination in terms of changes in travel behaviour, and how government at various levels should respond to them (589). Chapter Three will look at how a city's governments, such as Shanghai and Hong Kong, have handled this issue and how it relates back to a matter of equality.

Improved accessibility is the most direct measure of the positive effects of a new transport system. For example, a new suburban highway exit ramp could relieve traffic congestion for a small population but investment in a rail link could be more accessible to a greater number of people. Nonetheless, the focus of infrastructure remains on roads in both developing and developed countries; and due to the rapid pace of motorization, mobility and accessibility are declining rapidly. Conditions

of local demand far exceed the capacity of facilities, and the incompatibility of urban structure with increased motorization and limited management needs to be given top consideration by responsible officials. The developing world should learn from the developed countries in regards to the roles of new technologies, particularly in terms of the forms of institutional management and the long-term consequences of different effective policies toward the automobile (Ye et al 2010:554). All cities should look to those deemed successful to learn how to structure and transform their own transportation system.

Another aspect to take into consideration is the usage of the bicycle and how it can be incorporated into the transportation plan. It is estimated that in some Chinese cities there is still a very high percentage of the population dependent on bicycles as their major means of transportation. This reality should be featured prominently in urban development plans, where there is a proven demand in the market for this kind of transportation. There are approximately 6.3 million bicycles in Shanghai, and the trend continues to grow (Rongfang & Guan 2005:66). These high numbers of bicycles is a clear indication of people's desire and understanding that owning an automobile does not necessarily save time or money. The benefits of the bicycle are that it is an environmentally friendly way to travel; it promotes health and well-being for the individual; and is affordable for the user and less-costly to accommodate for the government.

However, the bicycle has come under attack in the past few years in China, as many local governments are instituting plans and policies to reduce the presence of bicycles in their cities. For example, in Guangzhou local leaders apparently perceive the bicycle as a hindrance to modern traffic management.....that it is backward, a remnant of the socialist years (Zacharias 2002:311). Cyclists are

being encouraged to switch to public transport, in an effort to reduce traffic accidents and fatalities. Overall, however, the increase in automobiles has been accompanied with a decrease in public transit and bicycle usage, as well as a decrease in the number of people walking as their main means for commuting (Pan et al 2009:278). People are clearly beginning to abandon their current mode of travel, switching to the automobile instead.

While China has established such proactive traffic laws that highlight smarter policies and detailed plans to move towards a sustainable transport sector, the fact remains that 98 percent of vehicles are still powered by fossil fuels (Dixon et al 2011:788). The government continues to support the automobile industry but has yet to provide any incentive for them to begin to mass produce and market more eco-friendly electric or hybrid cars. This has resulted in the country becoming increasingly dependent on importing petroleum. In Chinese cities where the urban density is so high, public transit needs to be at the forefront of development plans in order to curb air pollution and save on gas (natural resources) which is a major contributor to the pollution.

Part IV: Funding Urban Public Transportation

Infrastructure investment may be easy to support in theory but, like most aspects of development, it is more difficult in practise. The question almost always boils down to 'Who's going to pay for it?' Funding infrastructure is a costly investment, and no government has the means to provide unlimited infrastructure to satisfy the wants of the whole country. The choice of funding can have significant distributional impacts that must be taken into account during the decision-making process. Even though many consider rail to be the most sustainable and efficient urban means of transportation, the high construction costs of metro and light rail, typically \$50 - \$100 million per kilometre, limits the

extent and speed of their development” (ADB, 2008: 11). This raises the question: what criteria should society and governments use to judge the best way to provide infrastructure?

All countries, regardless of political and economic factors, have great financial difficulties in building and maintaining infrastructure. Three main funding options exist: state-owned, private, and public-private partnerships. The most general argument is that the public sector is inefficient and fiscally irresponsible, while the private sector is deemed greedy and predatory. Partnerships between the private and public sector may solve some issues, such as relieving corruption, but they are also deemed to have lower success rates than other funding streams. The remainder of this section will examine each funding option in order to better understand the development of each city in the case study.

State-owned enterprises

Adequate infrastructure has come to be seen as a right that should be provided by the governments and has come to require a significant portion of national and local budgets. The World Bank estimates that central governments provide the bulk of infrastructure financing as 90 per cent of financial flows for infrastructure is channelled through government agencies (Arimah 2005:1347). This over-reliance on government to finance infrastructure has resulted in a number of inefficiencies. First, SOEs fail to meet the needs of the poor as the infrastructure fails to extend to their areas. A second inefficiency is that SOEs fail to make a profit; "user charges barely cover the cost of service delivery, payment collection systems are inefficient, rates of default are often high and service provision is characterized by an elaborate system of subsidies" (Arimah 2005:1347). This dependency issue feeds the lack of incentive to expand services if it already runs a deficit. These inefficiencies

have resulted in huge financial losses, inadequate maintenance and backlog in the provision of infrastructure.

In the SOE model the government funds the infrastructure through tax revenues, by diverting funds from other sources in the budget, or by procuring a loan. These methods have their own nuances and risks. In the chapter, *Distributional Implications of Alternative Financing of Physical Infrastructure Development*, authors Ascher and Krupp (2010) provide a detailed analysis of each of these SOE funding methods. One method of SOE funding diverts money from other social programs as a means to pay for the up-front cost of construction. The other method assumes that users of the road will not have to pay a user fee or toll since the cost is already accounted for in their taxes. If the revenue for roads or other infrastructure comes from an increase in general taxes, then the burden of cost is spread amongst all, whether they use it or not (50-51). Governments can also introduce new taxes that are directly related to road use, thus making the users responsible for this service. One example of such a policy is a fuel or an automobile tax where one must pay when purchasing. In 1985, a new earmarked tax was launched nationwide in China, and has since become an important and stable source of funding. It is the only earmarked tax within China's taxation system and legal mechanism of financing urban construction (Wu 1999:2270). With this kind of tax system in place the poor or non-users do not suffer an added burden; taxes can be spent on other social programs like health or education.

Tax revenue is often insufficient to fund an entire infrastructure project and thus needs to obtain funding through other means. Governments can also choose to borrow money to fund an infrastructure project. In many cases they borrow from outside sources, either borrowing directly from foreign

commercial banks or by selling long-term bonds to foreign investors. To obtain the investment, the government must demonstrate its creditworthiness, and agree to undertake policy reforms that increase private-sector participation. These conditional terms help to lower the risk for the foreign investor, but in the end, it is the foreign lender that bears the majority of risk under this type of financing (Ascher & Krupp 2010:51-57). The exception to this being if the private investor goes bankrupt and the government is left to pay for the remainder of the project or abandon it entirely.

Some authors argue for the provision of transportation infrastructure by SOEs because when projects are private sector led, the facilities are produced at a substantially sub-optimal social level. He calls this phenomena "market failure, that is when an infrastructure facility is regarded as being a public good where exclusion of individuals from its consumption is not feasible while the long-run marginal costs of servicing an additional user are negligible ... Highways, local streets and feeder roads, as well as forms of mass-transit, are typical examples" (Banister 1995:18). In other words, the private sector cannot recover the initial financial capital nor maintain the facilities due to a lack of revenue from their inability to enforce excludability.

Other benefits to SOEs include the fact that they are more likely to partake in long-term risks, unlike the private sector. They also prove more reliable because government cannot go bankrupt or simply terminate contracts (Mu et al 2011:802). There have been noted incidents where a private company building infrastructure has gone bankrupt and the government ends up assuming responsibility for the unfinished project.

A downside to public ownership is that their failures are often blamed on lack of resources, political landscape and the amount of corruption, and/or conflict in the country. As Boardman and

Vining (2008) determine, there has been extensive evidence that, in a wide variety of jurisdictions, large governments' infrastructure projects have often been way over budget (150). If there is no transparency, a government can abuse its position, for example overstaff the project, contract friends or families, or gain political influence. Such misuses usually means the final cost is over budget, and the burden falls on the people.

Privatization

Over the past 25 years countries across the globe have reduced their share of state owned infrastructure. During the 1980s debt crisis international financial institutions such as the World Bank and the International Monetary Fund made privatization a condition for economic assistance, in effort to relieve budget constraints of the developing countries (Auriol & Picard 2008:77). Developed countries, like the United States and Britain, began to switch to this modality as well; privatization becoming the centrepiece for urban transportation policy under the Reagan and Thatcher administrations. The switch to private-sector participation was meant to meet pent-up demand, as well as ensure accountability, monitoring and management in the provision of infrastructure. In recent years, it has proved difficult for most developing countries in Asia to tap into private infrastructure projects (McCawley 2010:16). Unfortunately, there have been only a modest number of success stories in private-owned transit systems. Two particular cities, Hong Kong and Tokyo have proven that privatization is a viable and profitable option; both cases relying heavily on property development to generate profits.

Securing private sector investment in the transport sector could allow public funds to be better allocated to other priorities. According to the World Bank, at least 80 percent of all urban bus services

around the world are privately owned and operated (Moavenzadeh & Markow 2007:82). Increasingly, cities are issuing concessions for the private provision of urban transport infrastructure, including light rail, roads, and subways. Cities are becoming facilitators of public transit provision and moving away from ownership and operation, and if done properly can benefit both parties; the private and the public.

Privatization has produced some successes but also many failures. Quite simply, the experience of many countries has not met the high expectations that the private sector was supposed to relieve. Some authors remain optimistic, believing that privatization along with the associated failures and monopolies, that low quality, inefficient infrastructure is better than none at all (Auriol & Picard 2008:79).

The ADB (2008) road sector expert has advanced three reasons for the modest progress in road construction. First, governments have not defined their policy or needs, often leaving the private sector to identify projects. Secondly, many people have expected toll roads to be profitable without government support, but this has rarely proved to be the case (China is deemed a 'special case'). Thirdly, it has proved difficult to introduce promised tariffs and tariff increases in a sector where roads have become to be regarded as free (13) or as already paid for through taxes.

A major argument for private involvement is that the profit motive and competition in the private sector may ensure a commercial orientation in infrastructure (Wu 1999:2282). Even though privatization has its downfalls, it is “clear that private construction and maintenance of public roads produced better results where there was adequate competition and effective measures for enforcing contracts” (ADB 2008:13). When privately-owned transportation is successful, it is considered the better option due to the overall lower cost and superior quality.

In the book, *Urban Transit: The Private Challenge to Public Transportation*, Charles Lave proposes that "private ownership and competition may be able to do some good things for the industry by way of reducing deficits and increasing efficiency, but it might be too much to expect of them ... to inherit the 'problems' of declining ridership and public preference for the auto" (Keeler 1986:128). While I would also argue that private investment can be beneficial to public transportation, an investor should only enter into this line of business by accepting all the responsibility of his investment, which would include promoting and advertising public transportation in the hopes of increasing ridership and preference, and thus profit. Robert Cervero (2010) believes that private profiteering and smart growth of the public realm can be mutually reinforcing, highlighting some 'success stories' of private financing of metro systems in cities such as Hong Kong and Tokyo (166). Indeed, the normative view of private involvement is that it is beneficial, it increases productivity, enhances political independence, economic rationality, efficiency, dynamism and innovation.

Critics of privatization note their unwillingness to accept all responsibility over such a long time frame. The private sector has become reluctant to invest in infrastructure because infrastructure policy is fraught with political uncertainty in many countries. Regulatory policies are unclear and changeable, depending on the political and social climate. The ADB concludes that for privatization to be successful, there must be "major reforms in policy environment – including, for example, more reliable policies and regulatory arrangements, better tariff policies, and improved contract enforcement procedures" (McCawley 2010:17). Authors such as Weiping Wu (1999) do not foresee China allowing private companies to own the entire infrastructure construction market, stating: "Private interests may be better utilized in the areas of infrastructure operation and maintenance, with public transit being a

prime candidate” (2280). As a socialist government, China will still play a key role in creating the rules of the game.

Public-Private Partnerships

The concept of “public-private partnerships” (PPPs) is a long-term, arm's length contractual relationship between a government and the private sector. During the past two decades, many developing countries have entered into such contracts to provide infrastructure and services, such as the water, telecommunications and transportation sectors. These arrangements, while favoured, are nonetheless complex. “They require careful design, preparation, appraisal, procurement, contracting, and vigilant oversight if they are to succeed” (Burgess 2010:20). In many PPP cases, the private sector undertakes the construction of the infrastructure; thereafter, the private contractor can either charge a user fee to recover costs, or the government can pay for the fees.

Worldwide experience identifies a broad range of partnerships including; Build-Own-Operate, Build-Operate-Transfer, Build-Transfer-Operate, and Design-Build-Finance-Operate. Each of these kinds of partnerships can have different outcomes; their effectiveness depending on how they were implemented and where they were carried out. Build-Own-Operate is where ownership of infrastructure, from beginning to end, remains with private investors indefinitely. Build-Operate-Transfer (BOT) is the most common model used because it is arguably more efficient than the public sector; however, BOT is the most difficult to implement. In this model, the private sector builds the infrastructure (i.e. road) and operates it for a certain period of time to recoup costs (i.e. toll booth). At the end of this period, the government would purchase the road, and take over maintenance and operations, while users would no longer be required to pay a fee. Throughout the duration of this

contractual period, there would be no change in taxes or the availability of social programs, which helps to lower the associated risk with undertaking the project. (Ascher & Krupp 2010:58-60). The final two, Build-Transfer-Operate or Design-Build-Finance-Operate, is when ownership is transferred from the private sector to the public authority upon completion of the facility, and it remains with the public authority throughout the contract. “The private sector interest is based solely on the contractual rights to operate the facility and receive revenues from doing so, rather than owning the physical assets” (Ascher & Krupp 2010:57). Other modalities include maintenance management contracts, turnkey, operate, maintain or rehabilitate-operate-transfer concessions (ADB 2008:34).

Throughout much of Asia, private participation for road infrastructure has been equated with major Build-Operate-Transfer (BOT) toll roads. This form often targets dense areas where traffic is greatest, in cities or along major inter-city corridors, to ensure a profit. Looking ahead, the ADB aims to both improve the BOT process and to extend the type of modalities that are applied. Three key points are recommended from the ADB study. First, governments must prepare the proper environment for privatization, and a sound legal framework and a predictable regime are essential. Institutions may need to be restricted with the objective of controlling privatization in public interest; as well as creating a regulatory body that is separate from vested interests. Second, governments must identify priority projects which will require an independent feasibility study, one that focuses on traffic and tariff policy, project staging, network integration issues, risk allocation, finance and implementation issues. Finally, government support should be defined up front as a maximum so that the private sector can prepare realistic bids (ADB 2008:13-14). City governments in Shanghai and Hong Kong have implemented most aspects of the ADB plan and have shown remarkable success.

Many authors support private-public partnerships, arguing that all the evidence in relation to public transit favours more private involvement, with the role for public agencies more likely being one of coordination, not operation. Besley and Hall (1998) claim that some private-public partnerships have been more successful than others in past infrastructure projects but that it can be difficult to measure the benefits between cities. Accordingly, the challenge has been to "gear urban finances so that the public sector triggers private development and in turn is financed by it" (405).

Yet there are still some authors like Boardman and Vining (1989), who completed a study of 500 large industrial firms in competitive markets found that mixed public/private firms were generally less efficient and less profitable than private companies, and often performed worse than state-owned firms (405). Private firms may have lower production costs due to economies of scale, but private production can raise overall transaction costs due to the bidding process, negotiating, and be subject to monitoring. "Studies have shown that in other inter-organizational contexts with conflicting goals, the result is often high contract bargaining costs, opportunistic behaviour by one or both sides, failure to achieve goals and partnership dissolution" (Boardman & Vining 1989:152). They analyzed different options for governments to avoid high transaction costs and failure.

Part IV: Revisiting the Research Question

Road infrastructure is still dominating the most land use in China, the ADB (2008) estimates that by 2020, roads will account for 90 percent of land used by transport infrastructure (6). But China has also been able to expand their metro and light rail extensively; in 1989, China only had three metro lines totalling 50km (two in Beijing and one in Tianjin). By 2008, it had reached 36 urban rail transport lines with a total length of 1,500 km (11). Examining cities that successfully use private investment for

transportation could be applied on a grander, national scale or even to smaller less- populated cities. As in North America, China is catering to the demand-side of the automobile and should place more emphasis and control over how the country's infrastructure develops to best serve today's population, as well as future generations.

Both of these coastal mega-cities have managed their urban transport system quite differently; Hong Kong is deemed a success story for private owned transport while Shanghai struggles to cope with an ever increasing demand and publicly funded infrastructure. Using the three finance methods mentioned in the section above, I will compare and contrast these two cities in hopes of determining why Hong Kong has a successful public transit; whereas Shanghai does not. What has been China's investment strategy for building infrastructure and has this been the case for Shanghai and Hong Kong? How has the historical fact that the transportation infrastructure in cities such as Shanghai was first built to accommodate non-motorized vehicles? What funding method has each city implemented? Are they profitable?

Chapter III: Case Study of Shanghai and Hong Kong

Part I: China's Infrastructure

After the founding of the People's Republic of China in 1949, the government adopted a state-centric and top-down approach to infrastructure development. Due to its social and economic structure, citizens were seldom given permission to travel for leisure and most lived within walking distance from work; thus, the demand for transport infrastructure was extremely low. Under Communism, the State was responsible for “the entire life-cycle, that is, from planning, finance, design, construction, maintenance and operation” (Mu et al 2011:794). This SOE approach worked fairly well for the first few decades, especially for the expansion of the national railway. However, as authors Mu et al. (2011) note, after years of living in a command economy with lack of performance evaluation, the infrastructure had low productivity, poor accountability, low efficiency, lack of financial return, and continuous growth in traffic demand (794).

Since 1979, China has transitioned to a more open market economy; its cities having experienced radical change during this economic and social transition. Throughout this reform era, the provision of urban infrastructure was deemed critical in attracting foreign investment to the Special Economic Zone and coastal cities (Wu 1999:2270). This trend of increased government spending on infrastructure has continued into the new millennium, the proportion of national expenditure on public transit increased from 10.2 percent in 2003 to 16.2 percent in 2009. (Peng et al, 37). With its exploding population and urbanization, the demand for transportation has never been higher in China and the government struggles to match it, even though investment is high and infrastructure is growing at a substantial rate. Peoples travel patterns have changed as enterprise-based housing disappears; for the

first time, citizens can choose where they want to live and work (Shen 1997:598), and also now travel for leisure.

Developing countries infrastructure projects is often funded or supplemented by developed countries in the form of aid or loans. The World Bank's (1994) World Development Report found that infrastructure investment in developing countries averages about 50 per cent of total government investment, or approximately 4 per cent of national GDP. The municipality should also contribute to infrastructure projects on average to 3 to 4 percent. In China, the national investment for road infrastructure is rated one of the highest in the world. In 2008, the government announced that well over half of a stimulus package, amounting to over \$850 billion would be devoted to infrastructure (McCawley 2010:9). The ADB (2009) compares Asian infrastructure quality with that of the world, a score of one is considered underdeveloped and seven is deemed extensive and efficient by international standards. In this study, China ranked above the global average (3.8) with a score of 4.1, while Hong Kong is at the top of the list, scoring 6.4 (McCawley 2010:12).

National policy has been promoting a 'people-centred' development concept, which emphasizes the movement of people rather than the movement of vehicles. It also calls for developing a "resource-saving and environmentally-friendly" society in line with the national CO2 intensity target of a 40-45 percent reduction by 2020 (WB 2013). Given these goals, Chinese cities have an opportunity to plan the development of their cities in a way that minimizes the need for individual travel and directs a large share of investment towards the development of safe, clean and affordable public transport systems. To seize this opportunity and help turn this policy direction into reality, the Government of China and the World Bank have been strengthening their partnership to support sustainable urban transport.

An urban planner must be diligent and truly appreciate his art form when designing urban infrastructure; not only do they have to consider the logistics, and the politics; they must also consider their target audience and how and why they travel. Cities consist of many social and economic classes, and the issue becomes how to service all fairly. China has used all three funding streams in the past to fund public transport infrastructure, and continues to use some form of private investment. Writers such as Liu & Guan (2005) conclude that “Chinese metropolitan areas should pursue a multimodal transportation anchored by well-integrated mass transit services such as bus, metro, and light rail, supplemented by taxi and jitney bus services, due to the high population density, clusters of residential locations, and relatively low overall income level. They then argue that private automobile ownership should be restricted (58). The following section examines the two case study cities and how they have managed to become global role models for their urban transport systems.

Part II: Shanghai

For centuries, Shanghai has been the coveted pearl of the orient, acting as an important economic centre to the world. Often dubbed “The Head of the Dragon” for sitting at the mouth of the Yangtze River Delta, it is the largest mega-city in China with the biggest international port on the west Pacific Coast, making it well-located and easy to access. The cities urbanization level reached 84.5 percent by the end of 2005, while the national level was only 42.9 percent (Yin et al 2011:610). The density of the urban core is one of the best illustrations of urban land use and funding schemes. It has 19 districts and an area mass of 6,340 square kilometres, its downtown population densities reach as high as 50,000 people per kilometre (km). In comparison, Hong Kong is 34,000 per km; New York is 27,000 per km. In 1978 the population was a modest 6.5 million, and has grown an average of 5.1

percent per year and reached 16.5 million in 2008 (Yin et al 2011:610). This makes it one of the fastest growing cities in the world and is the most densely populated cities in China and the world. The illustration below (Fig. 1) shows the rapid urbanization of Shanghai from the 1950s to 2000s, and how the increase in population has expanded the built-up urban areas.

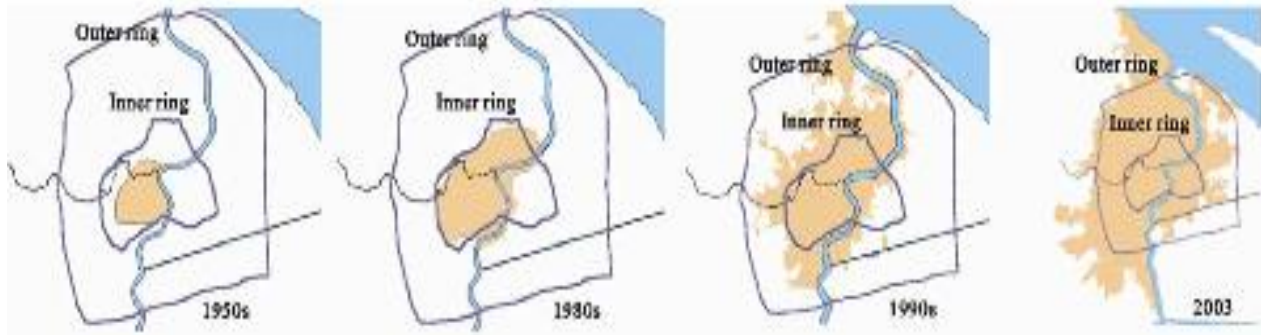


Figure 1: Expansion of urban built-up areas in Shanghai (Ye et al 2010:558).

As proposed by Shen (1997), Shanghai needs to further modernize its infrastructure, expand its physical capacity, and create new economic activities (592). Its development has been hampered by insufficient investment in infrastructure which has led to severe traffic congestion, housing shortages, and environmental pollution (Fu 2007:220). This has led other authors to believe that the available supply of transport infrastructure in Shanghai will be insufficient to meet demand for the next 10 to 15 years (Shen 1997:595). Even though it has taken long-term, progressive measures to improve its infrastructure, it cannot match the population growth and the increased use of the automobile.

Urban Transportation Infrastructure

In the past, roughly 86 percent of Shanghai's revenue was remitted to the central government, leaving its infrastructure and development starved of capital throughout the Maoist era (Wu 1999: 2276). This left the local government with very little discretionary income and as a result infrastructure investment suffered. During its initial growth state (1979-1990), when China opened its economy,

many restrictions on urban development were removed, especially for mega-cities. Since the major development of Pudong in the early 1990s, the land use in Shanghai has expanded from the west of the Huangpu River to the east, from the central district (area within the inner ring) of the city to the periphery district (area between the inner ring and the outer ring). (See Fig. 1). It has focused on the expansion of rail in conjunction with buses, as well as reducing the role of the automobile. The progress made over the past decade to renew the city's infrastructure is amazing and offers an example of the potential such reforms and actions can have.

During the 1990s, more than US \$10 billion was invested in transportation infrastructure for bridges, highways and the metro system in Shanghai alone (Zacharias 2002:309). At the beginning of the reform period, the Shanghai Urban Construction Investment and Development Company was created to help mobilize, allocate and manage these funds. Even though this was a state-owned company, it still had some autonomy in the decision process and worked alongside the private sector. This initiative is in compliance with the ADB plan to improve private involvement, which recommends a separate institution to oversee the process in the name of public interest.

Also during this period, there was a rapid increase in privately financed toll roads, which became the model for using private investment to finance highway construction around China. The involvement of private investment considerably accelerated highway construction in Shanghai. By the end of 2005, some 70 percent of highways linking every major destination in the Yangtze Delta had been built with private capital. In 2003, the Shanghai Fuxi Investment Company became the first fully private company to invest in large scale infrastructure projects (Hook et al 2006:20). According to this BOT contract, the company will generally be responsible for the investment and financing,

construction, and operation of the highway for 25 years before the highway is returned to the government.

In addition, other policy changes were used by the Shanghai government to help fund urban infrastructure. “First municipal authorities have increased user charges for some infrastructure services including bus fares, gas supplies, water, wastewater discharge and municipal sanitation services. Secondly ... by leasing land...Thirdly, the city has set up separate transport and energy funds in municipal revenue collection” (Wu 1999:2277). The profit from such increases and from ear-marked taxes all offer assurance that there's money to access should the private sector fail.

Shanghai has also experimented with different financing mechanisms in the new Pudong district, where the famous Pearl Tower is found. Unlike other industrial districts that receive municipal funding for infrastructure construction, Pudong, to a large extent has had to raise its own funding through bank loans, foreign capital and other non-state channels (Wu 1999:2277). Another innovative policy used in part to fund the subway line was 'donations' from enterprises. Their fundraising was successful, and after 20 years of high speed development, Pudong is one of the major urban nodes in Shanghai. The city is still facing many serious traffic challenges in regards to its ever-growing population, most of whom are middle-class. The local government has unambiguously placed sustainable development as a key component of its strategic goals; however recent trends in transport have headed in the opposite direction. The city has witnessed a dramatic and rapid increase in the number of motor vehicles owned, and is presently trying to contain the growth. According to Shanghai Comprehensive City Transportation Planning Institute, from 1995 to 2000, the number of registered vehicles grew from 555,430 to 2,015,700 (Pan et al 2009:98). More recently, the Shanghai Statistics

Bureau (2011) estimates a total vehicle ownership of over 3.1 million. While there was a sharp increase in the late 1990's, the number of cars has levelled off due to local government regulations. The growth of vehicle ownership in Shanghai is staggering but is even worse in Chinese cities that don't have such strict policies.

Back in 1994, Shanghai was the first city to adopt a policy limiting car ownership by using a bid-auction mechanism for vehicle registration (Peng et al, 38). In an attempt to control the number of cars, the Shanghai government has placed restrictions on car sales by auctioning off only 9,000 license plates per month. Earlier this year, cost hit an all-time high when the final bid was for approximately US \$13,300, which can be more than the cost of a domestic car (Automotive News 2013). Despite its unpopularity, the policy appears to be effective overall. Shanghai generates an estimated US \$5 billion annually as direct income from the licensing policy (Chen & Zhao 2013:39). The demand is high enough that people are willing to pay the exorbitant fee, and it provides government with a stable source of income that is reportedly channelled into support for transportation.

A downfall to this policy is that it raises a question of equality; should the automobile be a luxury for the rich who are the only ones that can afford such fees? Is there a better way to issue licenses? Until recently, Shanghai was the only city on mainland China that imposed a license quota, which made many people (from Shanghai) feel that the policy was unfair because it makes them pay more than residents of other cities to enjoy the same freedom of driving (Chen & Zhao 2013:45). To further complicate the situation, Shanghai residents have devised of ways to beat the system. They are obtaining non-local licenses from other jurisdictions at a much lower cost. This policy eased traffic congestion to some extent and generated large revenue to spend on infrastructure but failed to reduce

the number of cars on the road as car owners simply obtained their licenses elsewhere (Chen & Zhao 2013:40). While many citizens complain, others still believe that Shanghai's policies should also restrict vehicle usage to accompany the license auction policy, as is the case of Hong Kong which will be discussed in the next section.

Shanghai represents a great example of how urban infrastructure can result in a better quality of life and an economic increase. It wasn't until the 1990s that there was a drive towards modernization, and a boost in infrastructure investment; the government even declaring a new historical period of growth. This investment gave Shanghai an entirely new look, and benefited all sectors, particularly since foreign direct investment rose to US \$11.7 billion in 2004. Throughout this period, there was an astonishing US \$275 billion invested in all types of fixed asset formation in Shanghai alone.

Infrastructure development was the key to this reform, and as a result, over 40 projects were completed, including: four bridges and three tunnels crossing the Huangpu River, multiple expressways and an elevated road network circling the central districts, and three railway transit lines. The following table, taken from the Shanghai Statistical Yearbook shows the comparison of urban infrastructure development in 1990 and 2004 (Fu 2007:221). The table shows how an injection of financial capital that is well-planned can result in a dramatic increase in all sectors.

Table 1: Comparison of Urban Infrastructure Development, 1990-2004

<i>Item</i>	<i>1990</i>	<i>2004</i>
Road area (m ² per capita)	2.3	12.3
Rail transition (km)	0	125
Living area (m ² per capita)	6.6	14.2
Green Area (m ² per capita)	1	10
Wastewater treatment rate (%)	0	65.3

The author Gao Guo Fu (2007) attributes Shanghai's modest success in infrastructure

development to four key factors: a stable and sustainable master plan for urban infrastructure in line with overall city development strategy, a major shift in mindset towards investment options, rationalization of debt financing for infrastructure construction by effectively controlling associated risks, and the elimination of any monopoly in infrastructure investment and finance (226). One of the most prominent transformations in the city has been the improvements made to the public transit sector.

Public transportation

Shanghai was designated to play a strategic international role in finance and trade for China, which is when urban construction greatly accelerated. “Two magnificent bridges now connect the west and east sides of the Huangpu River, an elevated freeway circles the central district, a new subway that conveniently links major shopping and entertainment centres, and hundreds of newly constructed high-rise office and apartment buildings”(Shen 1997:59). Its subway is now one of the most rapid growing in the world and the city’s public transportation system carries 5.13 billion passengers annually.

According to the Shanghai Municipal Transportation and Port Authority (2009), the average daily number of passengers that use public transportation is 14.047 million (Jing et al 2010:6). Shanghai has an advanced and comprehensive rail transportation network, including ten metro lines and a maglev train, most of which were extensively renovated in recent years. The total length of rail transportation lines is about 363km with a total of 232 stations. According to the Shanghai Metro Group and United Nations Environmental Programme (2009) Shanghai’s transportation is also supported by a vast bus system, many of which are privately owned, that includes 16,400 buses and 991 routes (Jing et al 2010:6).

Authors such as Qing Shen (1997) argue that investment in bus services in Shanghai is

characterized by a diminishing return to scale. Bus fares are low, which mean profits are low and results in a lack of incentive to improve the services, as well, requires large subsidies from government (593). Since road congestion is such an issue, the quality and efficiency of bus services declines as the level of traffic congestion increases. Subways are an attractive alternative due to their speed and ability to quickly and effectively move dense crowds.

One of the main issues developers have in Shanghai is the lack of land availability. This has a lot to do with how the city was historically structured for non-motorized vehicles. As a result, the World Bank estimates that only 9 percent of urban area is composed of road surface; compared to London at 25 percent or Los Angeles at 40 percent (Zacharias 2002:310). “Transformation from a transportation infrastructure designed for low level motorization to one suitable for high level motorization is fundamentally conditioned by the life-cycles of various elements of the urban system” (Shen 1997:593). In other words, expanding the urban transportation system is a long process that has many political, economic, and social constraints. For example, dense residential areas make it unseemly to relocate that many people in order to expand the road network.

According to the Shanghai Urban Transportation 11th Five-year Plan, the optimization and improvement of urban transportation in Shanghai should seize three main components: the optimization of structure, the improvement of market mechanisms and the improvement of management styles. The Municipal Transportation and Port Authority believes this Plan should focus on the idea of “people-oriented, convenient transportation,” which is “environment-friendly, information-oriented” (Jing et al 2010:7). At the same time, it needs to combine predictability of operations, and short-term goals and long-term plans. The main goals of the plan must be built while taking into great consideration, the

consequences to the environment and society.

Part III: Hong Kong

Dating back over two thousand years, Hong Kong has served as a major Oriental coastal city and economic centre, particularly to its colonizer, Great Britain. The government's website now boasts it as "Asia's World City" (HK Gov. 2012) and it is quickly becoming the service hub for China in regards to education, finance, and economic investment. Many citizens of Hong Kong now consider their city a bridge between business and culture steeped in history.

Like Shanghai, Hong Kong is also experiencing an influx of immigrants, causing their populations to swell. With a total population of 7.1 million people, living can be as dense as 34,000 people per square kilometre (Tang & Lo 2008:564). It is a city that is highly noted for its successful public transport system that accounts for as much as 90 percent of daily commuting. The largest private company, the Mass Transit Railway (MTR) carries over 2.2 million passengers every day and the government is still trying to increase this percentage (Phang 2007:515). The map in Figure 2 shows how Hong Kong's structure is unique as it consists of an integrated urban network that spans across several small islands. Due to its hilly landscape and numerous surrounding islands, it has only a relatively small portion of usable land, with a total land mass area of 1104km. This reality creates major complications for urban planners as they have a limited amount of space to work with.



Figure 2: Map of Hong Kong and Rail Lines (Tang & Lo 2008:564).

Urban Transportation Infrastructure

Since the 1990s, the government of Hong Kong has invested up to HK \$70 billion expanding the road network by 30 percent (Tang & Lo 2008:572). In 2000, it renewed its commitment to urban infrastructure, particularly rail transport, by investing HK \$200 billion over a fifteen year-period (Laquian 2005:181). One of the major projects during this period was the Country Park Motorway that strategically linked southern China to Hong Kong. The expressway provides better access to container ports and the airport, and consists of “twin three lane tunnels, 12 major bridge structures, seven pedestrian/vehicular underpasses, 10 major retaining walls, a 22-lane toll plaza, the four-level Au Tau Interchange, and construction on large scale embankments across soft and weak soils” (Telford 2009:89). This \$930 million project took just three years to complete and was done so through a BOT agreement between private investors and the governments of China and Hong Kong.

The city’s physical characteristics, combined with its expanding population, have led the government to use available land effectively and adopt more rigid policies. The Hong Kong government has long realized that ownership of a private automobile is not be a sustainable option for

their city and blames it for encouraging the negative aspects of urbanization, including urban sprawl, traffic congestion, and increased pollution. In fact, the government has created many policies that deter ownership and usage, making it more a luxury for the wealthy. “In 1974, Hong Kong introduced a first registration tax on the purchase of a vehicle that was set at 15 percent of the cost-insurance-freight value” (Laquian 2005:80). They even experimented with an “area-licensing” scheme in the early 1980's that effectively had a device that recorded time spent on the road and then charged the user a fee. This was extremely unpopular with citizens and it was discarded after a few years. More recent initiatives include an almost identical program; however, the difference is that a fee is now charged to enter the downtown districts using a “smart card” (Laquian 2005:273). A smart card is attached to the front windshield and deducts a certain amount every time the user enters the downtown core.

Unlike most governments, the Hong Kong government has gone to extreme lengths to keep the encroaching automobiles at bay. For example, new private cars in Hong Kong are subject to a staggering first registration tax, ranging from 35 percent to 100 percent of the cost of vehicle (Tang & Lo 2008:566). Along with the limited number of parking spaces, the high garage and parking costs discourages the use of private automobiles on a daily basis. Car owners should also expect to pay exorbitant fuel taxes, in 2002, fuel tax was almost eight times higher than the total sum of federal and state tax in the United States.

These policies have been effective; in 1995, Hong Kong residents owned 285,457 cars and by 2000 it had only increased to 332,379, a dramatic difference to Shanghai's automobile growth (Cullinane, 22). Due to the limited land space, this impact is still quite noticeable and is increasing the environmental awareness of residents, as the air pollution index continues to reach record breaking

levels.

Public transportation

Hong Kong's public transportation is considered by many as a showcase; a system that is profitable, efficient, and accessible. Authors like Shen (1997) praise it as an example where transportation pricing and regulations are used creatively and effectively for the benefits of the society as a whole (603). As a result, people in these densely populated cities benefit from motorization (i.e. speed, affordability) and, at the same time, the negative impacts of motorization are minimized (i.e. congestion, air pollution). It has major economic impacts on the city employing hundreds of people and transporting millions daily.

The mass transit rails are highly reputable for their successful construction and operation; all of which are operated in accordance with commercial principles; and are thus, found on the Hong Kong Stock Exchange (Tang & Lo 2009:300). Authors Tang & Lo (2008) argue that the experience of Hong Kong strongly suggests that proper transport and land development policies are essential for the healthy development of an efficient public transport system. Furthermore, that it is a prime example of how safe, efficient and customer-friendly services can be operated by self-sustained private companies (574).

There are three distinct periods of Hong Kong's modern public transport. In 1979, the government published the first 'White Paper' on the internal transport system, establishing the central transport objective of maintaining and improving the mobility of people and goods. It concluded that this objective would be best met by an integrated, multi-model system in which passenger transport was given top priority, and be based on three principles: improvement of the road, expansion and

improvement of public transport and more economic use of the road system (Tang & Lo 2008:566). This resulted in the construction of the Mass Transit Railway (MTR) for urban transport and Kowloon Canton Railway (KCR) for sub-urban areas, both built under an SOE model. Believing that an off-street, efficient rail was the backbone of urban transport, the government prevented direct competition with the trains. Buses were restricted so that half the current number could run parallel to the MTR, that the fare be comparable, and that no new routes from the New Territories could travel to Tsim Sha Tsui, the central commercial district, or cross the harbour to Hong Kong Island.

The second 'White Paper' was published in 1990, and added to the Transport Board's original objective of the mobility of people and goods, that investment in infrastructure was “necessary to support economic growth and to meet the social, commercial and recreational needs of the community” (Tang & Lo 2008:567). During this phase, the MTR and KCR networks were expanded to include the development of new lines, like the Tseung Kwan O Line, and the KCR West and East rail. Unlike its precedent, this second White Paper relaxed the restrictions against buses and eased them back into the competitive market.

Up until the 1990s, there were only two bus companies, China Motor Bus (CMB)¹ and Kowloon Motor Bus (KMB) that had been granted the exclusive franchise rights to run bus services in the area. New franchised bus routes were tendered and awarded to Citybus to operate on Hong Kong Island, and Lantau Bus Company Limited to operate services on Lantau Island. Due to the competitive environment, bus operators improved services, including upgrade of the bus fleet complete with air-conditioning, improved headways, installation of covered bus stops, and onboard passenger

1 New World First Bus replaced CMB in 1998.

information facilities (Tang & Lo 2008:568). This second paper also reinforced the role of other means of transport, such as non-franchised buses and public light bus services, particularly to assist during peak hours and in areas that do not necessitate provision of higher capacity modes.

It wasn't until 2000, that the two major rails (MTR and KCR) were privatized through share issue privatization (SIP). SIP is a method where some or all of the government's stakes are sold to investor(s) through a public share offering. Along with Singapore's Mass Rapid Transit operator, these are the only two instances of urban rail SIPs (Phang 2007:514). Under this arrangement, the government remained the majority shareholder and with the sale of 20 percent of the company, it managed to raise more than HK \$10 billion while retaining majority control (Phang 2007:516).

The most recent strategic document, called "Hong Kong Moving Ahead" set a goal to increase the proportion of rail-based public transit journeys to 50 percent by 2016, a significant jump from the 33 percent user rate in 1997 (Tang & Lo 2008:568). The market had once again become saturated with competing bus franchises, so other policies against public buses were recommended in this report to encourage citizens to switch to rail. Bus operators had to rationalize their routes and reduce the number of bus stops along some busy corridors as a means to alleviate traffic congestion. Ironically, there were no efforts to reduce the quantity of private cars on the road, which has averaged 10 percent of travel since 1997. In other words, despite the government's efforts to convert bus riders to rail, they made no policy to encourage the switch from car to rail.

Chapter IV: Analysis Discussion

In the past, China has been able to adjust to great social and economic transition, and is currently in the midst of doing so with modern, sustainable methods of transportation. Its recent urban transition is definitely a historic event of global importance because it can help the world create new strategies on how to cope with high urbanization and motorization. With its socialist history, China may be in a better position to manage mass amounts of people than most other countries. Many of the strict policies would be met with great resistance in the West and in developing countries that don't have the same financial flexibility as China. China has broken away from the global mainstream way of providing infrastructure to its citizens. Instead of relying solely on government funding, it seeks new and innovative options to disperse the burden of cost, with a particular emphasis on the inclusion of the private sector. As this paper has shown, their approach has been successful overall; China has been able to build major infrastructure projects in record time.

Its highway system had been significantly underfunded and over the past two decades it has improved it to above global standards. Now, with an adequate road network, the government has switched its focus to the creation of rail infrastructure. Rail has become the new top priority for China on a national scale and it has constructed high-speed rail that connects many of the major artery cities like Shanghai and Beijing. In urban settings, governments are also turning their attention from the automobile to public transit, both rail and buses.

By analyzing dense mega-cities like Shanghai and Hong Kong this paper set out to prove that costly, large-scale infrastructure investment focused on sustainable public transit is the best option for long-term urban development. Building rail infrastructure can range in cost from \$450 million to \$2 billion per kilometre, depending on if people need to be relocated to accommodate construction, or on what the natural landscape consists of. It is indeed a costly investment that has yet to prove its viability

globally. However, cities such as Hong Kong and Shanghai are evidence that urban rail-based transit can be a successful business that meets the needs of the city and of the environment.

One of the first things to note is that the structural layout of Shanghai and Hong Kong are quite different and should be taken into consideration when comparing these two cities. Shanghai has taken the form of central city cores surrounded by urban nodes; whereas Hong Kong is based on a regional system of cities linked together economically and socially in a coherently integrated network (Laquian, 2005:382). The decision of whether bus or rail should be the main public carrier is an important consideration, and needs to be considered on a case by case basis. With different geographical restrictions, each city must analyze its own strengths and weaknesses, coping with the latter while emphasizing the former. Cities must also consider, what are the local economic and social conditions? What are the needs of the city? The fact that both of these cities have an updated blue print for its development is evidence that the government comprehends that needs and circumstances change. As discussed, the Hong Kong White Papers (1979 & 1990) and the more recent Hong Kong Moving Ahead Paper (2000) have some stark differences between them which shows that the government is flexible and basing their infrastructure construction and policies on a trial and error basis.

The main contrast between the two cities public transportation is the primary source of funding. Research has indicated that public transit is likely to be more cost-effective when it is subject to user charges based on marginal costs of supply and willingness to pay (Wu 1999:2280). In other words, the lower the cost of public transit, the more likely the user rate is higher. As shown in the case of Shanghai, the main source of revenue is from the higher user charges which could explain why it has yet to reach high user rates as in Hong Kong. User charges are more affordable in Hong Kong because they subsidize public transit by also charging the private auto for road usage. Such a policy promotes equity because it sustains that road infrastructure is not a public good, and that fees for all users is necessary to ensure efficient use of infrastructure and to discourage wasteful consumption. Automobile

fees not only help create equity by dispersing the cost but it also delays people from purchasing a personal automobile. In North America, it is common to see youth purchasing an older car; however, this is seldom seen as a priority for Asian youth. This cultural practise reduces the number of cars on the road in cities like Hong Kong.

Hong Kong is a particularly unique case study for several reasons. It may be considered an extreme example, in that many favorable conditions exist for privately operated transit services, such as high population density, compact development, low car ownership, and relatively high income. But what truly distinguishes Hong Kong from other cities is the related transportation policies that the government implements. Transport and land use policies play an important role in the city's ability to effectively manage and control traffic; extremely rigid policies restricting car ownership are also a vital component in the cities strategic plan.

First, urban land is under public ownership, so the government is often in a much stronger position to implement land use strategies as an approach to achieve desired transport outcomes (Pan et al 2009:278). In the case of Hong Kong, property development is a key form of revenue that pays for a portion of the original infrastructure. Robert Cervero (2010) states that the differences between land values with and without rail services are substantial enough to cover the cost of infrastructure (173). In essence, the developer buys the rights to lease land at a 'before' rail cost and then leases it to a third party at an 'after' rail cost. In most cases, this transit-oriented development (TOD) is able to pay for the upfront cost of infrastructure construction before the rail is even open.

TODs dense style of living, cluttered around a rail station greatly reduces emissions and addresses the European Union Council of Ministers definition of a 'sustainable transport system' (Williams 2005:3). Many people would live within 15 minutes from the station and walk or cycle to and from. For those that lived beyond that, systematic and efficient buses should be implemented to complement the rail. This style facilitates compact development, paradoxically still allowing for the

suburban space and small community feel that some have come to desire within a big city.

The second reason Hong Kong's urban transportation is deemed successful is because it thinks and treats the automobile differently. Hong Kong and Shanghai both have fairly strict automobile restrictions that charge large fees to consumers, for both their ownership and usage. These policies have greatly stunted automobile usage. In comparison to cities like Beijing, that has significantly more cars on the road, one can see how such harsh automobile policies go hand in hand with transit-oriented development and a sustainable city.

To implement such unpopular policies requires a strong government that discourages the automobile culture, as in the case of Hong Kong. Such policies are quickly becoming a common option used by governments to control traffic congestion and amass funds to finance other infrastructure projects. Policies must also be diverse to be effective. The license auction for example is insufficient by itself and should be combined with other policies, like fuel tax and toll booths or smart cards. Tang and Lo (2008) feel the success of new mass transit railway projects is very much dependent on the underlying transport policies that help secure a healthy environment for their operation and development (575). Other policies, not discussed in this paper should also look at incentive policies for those who switch to more eco-friendly cars that are not gas-operated. This will contribute to a city's overall goal to become sustainable while still providing local economic benefits by maintaining an auto industry. As mentioned earlier, even though China's total energy consumption is comparatively lower than North America's, it is still not a realistic option for China's future. The sheer size of its population makes this scenario unrealistic for China and the developing world in general.

An individual's optimal choice based on the private automobile and road network, compared to the systems' optimal choice are in direct conflict with one another. The automobile consumes private space while simultaneously occupying public space, and when millions of people decide this is their

best option, there can be devastating repercussions. Without effective policy control, the outcome looks like many of today's cities: chaotic and congested. It is not the optimal choice for the system as a whole or for all individuals. This is why new policies and planning are essential for improving traffic issues. Change of this calibre is extremely difficult to implement, as individuals strongly oppose fees and as a result politicians succumb to these individuals' desires fearing that they will not be re-elected. However, politicians and individuals need to think long-term for their community, not solely what will benefit them in the present. The fact is that people, anywhere in the world, will loathe and resist new policies that cost them money but in five or ten years, it would become a common practise that is part of everyday life. Cities can transition from the automobile culture into a public transportation culture or even pedestrian/cyclist based culture as many large cities have proven, such as Tokyo, Amsterdam, Curitiba, and Singapore. Hong Kong's high public transit user rate of 90 percent did not happen haphazardly; it was the result of a complex set of regulations and controls. These policies are difficult to implement; hence the relevance of urban design as a tool for manipulating certain outcomes.

When comparing North America to Asia there are some stark differences in our urban history. North American cities are relatively new and were like working with a blank canvas when they were built; whereas Asian cities date back much further and need to deal with how roads were historically built for non-motorized vehicles, including narrow bicycle and cart paths. One could argue that Asia has a disadvantage in this regard because creation of urban infrastructure becomes more costly and difficult as other social factors need to be considered. Developing countries should thus look to China's national and urban transportation system for their own future development. Cities like Hong Kong and Shanghai deal with millions of people living in compact and dense spaces which is more comparable to the developing world cities situation, not like the urban sprawl experienced in North America.

Conclusion

Urbanization should be regarded as a well-choreographed dance, seamlessly moving people and goods in a timely and ordered fashion. Jean Mercier (2009) described it as “design sensitive” meaning that urban planning has various consequences on our quality of life. After 50 years of living in an automobile culture, we are seeing that it is not a sustainable option for future development.

“Sustainable development seeks to preserve environmental quality, whether for less advantaged populations, future generations, or for the sake of Mother Earth itself – while pursuing opportunities for economic advancement, all leading to an improved quality of life” (Moavenzahed & Markow 2007:15). Rail has the capability to move large amounts of people efficiently and effectively, at a cost that is affordable to the consumer and profitable to the owner. Buses, whether public or private, should be applied in tandem with rail transit.

The goal of this paper was to research the effects of the three primary sources of funding for urban infrastructure; privately-owned, state-owned enterprises, and public-private partnerships. Having completed this research I've come to the conclusion that public-private partnerships (PPPs) are the most optimal funding choice, not only for urban growth but also for national growth. Both of the cities examined in this essay have populations in the millions but the same scheme could be applied on a smaller or larger scale, where applicable. As in Shanghai and Hong Kong, any smaller city or country would have to complete a non-biased study of its current geographical layout, any existing infrastructure that could be used and land-use around designated areas.

In an urban setting, rail provides an alternative to the automobile; while on a larger, national scale high-speed rail can provide valid competition to the airline industry. In both regards, it reduces emissions and fuel consumption, making it a valid sustainable choice. Each funding stream has its strengths and weaknesses but public transit should incorporate all stakeholders; the government, the private sector and individuals alike.

Many of the authors I have researched concluded that PPPs are the most efficient method, but at the same time recommends that the government have a limited role. However, the case of Hong Kong and to some extent Shanghai proves that an active government involvement can be beneficial, if not necessary. In urban settings, people need to adopt a new attitude and realize that owning a private vehicle is considered a privilege and is not necessarily the best mode of transportation in such a condensed living space. When provided with a more efficient and affordable option, the public will respond with patronage.

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