

**Prospect of Using Rail-Plus-Property Model for Transit Financing in China:
Based on Comparative Case Studies of Shenzhen and Hong Kong**

**A Thesis Presented to the Faculty of Architecture and Planning
COLUMBIA UNIVERSITY**

**In Partial Fulfillment
of the Requirements for the Degree
Master of Science in Urban Planning**

by

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May 2016

Abstract

Hong Kong, as a special administrative region of China, has utilized the rail-plus-property (R+P) model, as a special form of value capture strategy, to successfully finance its railway development and operation. Hong Kong Mass Transit Railway (MTR) Corporation becomes one of the very few profitable railway companies in the world. MTR has also been cooperating with the Shenzhen government to implement the R+P model in financing Shenzhen's subway expansion. This is considered the first experimentation of R+P model in mainland China. The objective of this paper is to shed light on the prospect of using R+P model in China by conducting comparative case studies of Shenzhen and Hong Kong. The two case cities are selected to give a comparative picture of how R+P model works. The comparison will focus on how the model works in the two cities given different urban contexts and regulation frameworks. The paper will conclude with policy implications and recommendations for the possibility and challenges of applying R+P model in other Chinese cities.

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1. Introduction

China has experienced rapid urbanization over the last several decades. Since marketization of the land market in the 1990s, there has been a trend of suburbanization in many Chinese cities with residents moving into the outskirts of cities and living in newly built residential apartments. This suburbanization trend has led to increased rate of urban sprawl and consequently increased demand for automobiles for commuting and access to various sources in the city center. Not surprisingly, the total number of automobiles has been rising at an astonishing speed and this has caused many problems to urban development, such as traffic congestion and air pollution. For example, Beijing, as the capital city of the country, is famous for its severe traffic congestion during peak hours even for its highways. And Harerbin, a northeastern city, suffered a smog crisis last year which shows the severity of the air quality challenges that China has been facing.

As a response to resolving such challenges, China has been adopting nationwide transit-prioritized transportation policies to reduce current automobile usage and discouraging people who do not have a car from buying a car. Among many strategies initiated by the government, TOD becomes more and more popular. However, transit financing has been one of the biggest challenges that China is facing. China has experienced a fiscal decentralization process since 1978 and the current tax-sharing system between the central and local governments shifts the

funding responsibility to the local level. To obtain more revenue, local governments set up local government financing platforms (LGFPs) to help reduce financing pressure and land transfer fees have been a major source of revenue for urban transportation development. Nevertheless, such financing mechanism may not be sustainable and local governments are facing increasing pressure on transit financing.

Hong Kong, as a special administrative region of China, has utilized rail-plus-property (R+P) model, as a special form of value capture strategy, to successfully finance their railway development and operation. Hong Kong Mass Transit Railway (MTR) Corporation becomes one of very few railway companies that are profitable. In the recent years, MTR has been cooperating with the Shenzhen government to implement R+P model in financing the city's subway expansion. This is considered the first experimentation of R+P model on transit financing in mainland China.

The objective of this paper is to shed light on the prospect of using R+P model in China by conducting comparative case studies of Shenzhen and Hong Kong. The two case cities (one in mainland China and one as special administrative region in China) are selected to give a comparative picture of how R+P model works. The comparison will focus on how the model works in the two cities given different urban contexts and regulation frameworks. The paper will conclude with policy implications

and recommendations for the possibility and challenges of applying R+P model in other Chinese cities.

2. Literature Review

There are four parts for this literature review. The first part will briefly discuss the public financing in China to lay out the contextual background. The second part will have an overview of the concept of value capture. Next, as TOD is considered to be closely related to value capture, the concept of TOD will be discussed briefly. The last section will touch on the interaction between PPPs and value capture, because the R+P model often involves both public and private participation or cooperation.

2.1. Public Financing in China

China's fiscal context is much different than that of the Western countries partly because of its law on property ownership. For example, China does not have a property tax system similar to that of the United States. Man (2011) gave a brief overview of local public finance in China. The article discussed the country's fiscal decentralization and local tax structure and argued that the sale of land development rights has been a major source of revenue for Chinese local governments for urban development.

In addition, China has a unique land market that the local governments rely on to generate fiscal revenue. Xiao (2014) explained the operational details of land quota market in China and the strategies local governments use to generate more quota. Although the land quota system established by the central government can to some extent control local governments' strong interests of land conversion, transportation financing in China would still mostly likely rely on land transfer sales. Furthermore, Tao et al. (2010) explored different land leasing strategies used by local governments and found out that more than 75% of the land was leased through closed-door negotiation with private developers and the rest through more transparent ways such as auction, bidding and listing.

While the local governments in U.S. can have high borrowing capacity, the local governments in China are not allowed to borrow from the financial market by law and thus they have been relying on local government financial platforms (LGFPs) to finance their urban infrastructure development. Lu et al. (2013) wrote a working paper on the origin and functions of LGFPs and potential risks of using such financing tools. They pointed out the severe revenue and expenditure mismatches at the local government level and using LGFPs is subject to the volatility of the real estate market.

2.2. Value Capture in General

While motor fuel tax has been one of the major revenue sources for transportation development, its financing capacity is weakening and the government may need to come up with alternative financing strategies. One of the popular ways is through value capture. Zhao et al. (2012) discussed a variety of value capture strategies, such as land value tax, tax increment financing and special assessments, and then evaluated them based on four criteria. The paper's major conclusion is to encourage all levels of governments to take advantage of a bundle of value capture instruments as replacement revenue sources.

According to Medda (2012), accessibility is an important factor in land value capture, because it can induce increases in land value and then some or all of these increases in land value due to increase in accessibility can be captured to recover the capital costs of a transport investment.

Medda (2012) categories land value capture mechanisms into three broad categories – betterment tax, accessibility increment contribution and joint development. Betterment tax means levying a tax on land value added by public transport investment. Its targeted group is the group of people who benefit from a range of aspects such as reduced pollution and congestion through improved transportation system. The logic behind charging such tax is that the additional value generated by the transport investment should be shared among all citizens rather

than specific private individuals (Batt 2001). One of the examples is the business rate supplement charged across the greater London area.

The second category is accessibility increment contribution (AIC) that refers to strategies that earmark future revenues to finance current transport expenditures. The government often uses various financial instruments to raise capital, such as general obligation bonds. One popular example of AIC is tax increment financing which is commonly used in urban redevelopment and transportation projects. However, it is important to note that it is not only necessary for such projects to generate revenue sufficient to cover costs, but also to be economically sustainable with positive net present value (Dye and Sundberg 1998).

The third category is joint development which means residential and commercial property development close to transit stations, for the mutual benefits of both public and private interests. Such mechanisms are often used in the context of transit-oriented development which emphasizes the importance of using the land around transit stations for mixed-used and high-density development (Robert Cervero et al. 2004)

In addition to the above classification approach, land value capture strategies can also be classified into just two categories – taxation based land capture strategies and development based value capture strategies (Olajide 2015). Taxation based land value capture strategies often impose taxes and fees on existing

developments in transit development areas, such as tax increment financing, special assessments, land value taxes, betterment charges, impact fees and station connection fees. Development value capture mechanism often needs the involvement of the government in development on land near transit stations. Some examples include land sales, air rights sale, land lease agreement and land adjustment.

There are several key factors for effective implementation of land value capture strategies. First of all, it is essential to have an established property tax system to finance public transport through land value capture strategies. Developed countries like US and UK have mature property tax system and therefore it is administratively feasible and easy to implement many value capture mechanisms. However, it is also noteworthy that in such established system, it is relatively hard to create a new tax system to implement innovate financing strategies (Boyd 2011). In addition, while developed countries have mature property tax systems, many developing countries do not have such tax systems in place, and need to rely on other mechanisms to capture the additional land value created by transport investment (Salon and Shewmake 2011). One alternative is to lease or sell land near public transport or to grant development rights in areas served by public transport. One essential condition for this alternative is that the transit development company needs to have the capability to buy or lease land at very low cost. Another alternative

is to create a public-private partnership to finance transportation development. The challenge is to effectively negotiate with private companies and come up with plans to serve both the public and private interests (Salon and Shewmake 2011).

Secondly, enabling compact development provides a favorable condition for land value capture, because the increased development density can facilitate transportation development and promote surrounding economic activities (Rybeck 2004). With higher density of property within transit development zones, there would be higher population density within these areas. Having higher population density is a favorable condition to generate larger traffic flow, which in turn provides the traffic needs for the transport investment. At the same time, with a larger volume of traffic flows, there would be more customers for the businesses located near transit stations, promoting surrounding economic activities. One way of achieving this is through value capture in the form of split rate tax (Rybeck 2004). In particular, the tax rate on assessed building values would be higher than that on assessed land values, so that developers would build more on relatively more expensive land.

Thirdly, in a larger view, it is important for the government to coordinate land using planning and economic development with public transit development (Salon and Shewmake 2011). When designing a transportation investment plan, the government may need to change existing zoning codes or come up with new zoning policies to support transit development. For example, in order to encourage compact

development, the government needs to allow high floor-area ratio in the transit development area, in addition to other tax policies such as split rate tax discussed earlier. Secondly, economic development should also be considered accordingly. The government may attract more businesses to the development zone by offering various tax incentives. With more economic activities around transportation facilities, the adjacent property value would increase substantially and thus allowing more value to be captured to pay for transport investment.

In addition, as discussed earlier, land value capture strategy essentially relies on the increased property value generated by transport investment. Many literatures quantitatively examined the effects of public transit on property values. Some of the studies and their key findings are listed in the table below. In general, public transportation development has a positive impact on surrounding property value.

Literature	Place	Key Findings
Gibbons and Machin (2005)	London	1 km reduction in distance to train stations would lead to an increase in residential property value of at least 1.5% in price
Bae et al (2003)	Seoul	Additional 1 km to subway line 5 leads to a 3% decrease in price
Cervero and Murakami (2009)	Hong Kong	Property within walking distance of certain stations has a price premium between 4.7% to 15.7%
Wang (2010)	Shanghai	Compared to residential properties within 1 to 1.5 km of rapid transit line 8, the prices of residential properties within 0.5 km of stations increase by 7.2 percent due to the impact of rapid transit system stations.
Zheng and Kahn (2008)	Beijing	An increase of 10% in distance from urban subways reduces housing prices by 0.8% to 1.6%

Gibbons and Machin (2005) used a quasi-experimental method and estimated that a 1km reduction in distance to train stations in London would lead to an increase in surrounding residential property value of at least 1.5% in price. Wang (2010) studied Shanghai rapid transit line 8 using hedonic price models, and found out that compared to residential properties within 1 to 1.5 km of rapid transit stations, the prices of residential properties within 0.5 km of stations increase by 7.2 percent due to the impact of rapid transit system stations. Cervero and Murakami (2009) explored the case of Hong Kong and found out that property within walking distance of certain stations had a price premium between 4.7% to 15.7%. Zheng and Kahn (2008) found out that in Beijing, an increase of 10% in distance from urban subways reduces housing prices by 0.8% to 1.6%. In addition, Bae et al (2003) found that in Seoul,

additional 1km to subway line 5 leads to a 3% decrease in price. All these studies demonstrate that in general, transit development can increase the value of surrounding property value.

2.3. Transit-Oriented Development and Value Capture

While China has a highly transit-prioritized transportation policy and transit-oriented development (TOD) becomes a popular concept and practice nationwide, the country is still in the process of learning how to successfully implement TOD taking into consideration of local contexts. Mu et al. (2012) summarized from literature the pre-conditions that a city needs to fulfill in order for effective TOD implementation and used a case study of a Chinese city, Dalian, to see the city's status of satisfying the commonly identified conditions.

As TOD and value capture is closely related, these conditions are also relevant when adopting R+P model in different cities. Xueming's (2010) study compared the general contextual differences between U.S. and China with respect to TOD design. Major differences lie in aspects such as population density, urban spatial structure and land use intensity. Cervero et al. (2009) used modeling to study the effects of TOD on ridership in Hong Kong's R+P model and found that the combination of R+P model and appropriate TOD would increase weekly ridership by

about 35,000. This study sheds light on the possible positive interactions between TOD and use of value capture strategies.

2.4. Public-Private Partnership and Value Capture

As value capture strategies, such as R+P model, often involves PPPs, it is also important to understand the interaction between PPPs and value capture strategies. In the context of China, the country has been exploring new financing mechanisms for urban transit development. Among others, PPPs becomes more and more popular. While the practice of PPP model is not very common and successful in U.S., it seems to work well in Asia and particularly in China (Phang 2007). De Jong et al. (2010) discussed the use of PPP model in the Chinese context by illustrating through seven Chinese case studies. Their research approach is to first discuss the pre-conditions that scholars believe countries need to satisfy for effective implementation of PPP and then evaluate whether China met these requirements.

Chang (2013) also conducted a study on the feasibility of using PPP model in China, through a case study analysis on Beijing's No.4 Metro Line. This study is from the perspectives of contract negotiation, revenue sharing and risk allocation and the main conclusion is that the public sector may save up to about one third of the initial investment through PPP model and the private partners may earn a profit with a high risk due to the immature legal system in China. From this research result, we can see that the PPP model may be a useful tool for the Chinese government to finance its

transportation investment. But when learning from the PPP practices from the U.S., we may need to take into account the current legal framework in China and be cautious about whether the interests of private investors can actually be supported and protected by law.

3. Methodology and Data

This paper will use an approach of comparative case studies. The data gathered for this research comes from secondary sources which are publicly available, such as government policy documents, company's publications, news articles as well as relevant existing literature and reports from research institutes.

Two case studies are chosen (i.e., Shenzhen Metro and Hong Kong MTR) to give a comparative picture of how R+P model works in different urban contexts and regulation frameworks. Hong Kong MTR's practice of rail-plus-property model has been widely recognized as a highly successful financing mechanism for transit development. Almost every transit system in the world is in financial crisis with the exception of the Hong Kong railway system. Hong Kong's special identity, a special administrative region of China, makes this case study particularly relevant to evaluate how the Hong Kong model can be modified and applied in other Chinese cities with different contexts and regulations. Shenzhen, a fast growing Chinese city, has been

cooperating with Hong Kong MTR to experiment R+P model in its Longhua Metro Line and it has been successful. Due to the different regulatory frameworks between Hong Kong and Shenzhen, the Hong Kong model needs to be modified. This case study will analyze the how the model is currently working in Shenzhen and what are the challenges forward.

4. Comparative Analysis

In this section, a comparative analysis of Shenzhen and Hong Kong on the implementation of the rail-plus-property model is conducted. First, I will give an overview of the public transit and the metro companies in Hong Kong and Shenzhen. Then I will discuss the urban contexts of both cities and operation performance of Hong Kong MTR and Shenzhen Metro. The core part of this section is the comparative analysis of funding and regulatory frameworks as well as the business models.

4.1. Public Transit and Metro Companies in Hong Kong and Shenzhen

Hong Kong is one of the world's most densely populated cities with an area of 1,104 km² and more than seven million people. Its public transportation is provided by the Hong Kong MTR Corporation. It was established in 1975 to construct and operate a railway system to provide fast and reliable public transportation for the

people of Hong Kong. The Hong Kong government was its sole shareholder until the year 2000—when the government sold 23% of issued shares to the private sector via initial public offering. In 2007, the MTR merged with Kowloon-Canton Railway Corporation to better serve the public transportation needs of Hong Kong citizens. The railway service provided by the MTR mainly covers the Hong Kong Island, Kowloon, and the New Territories¹. As of 2014, the MTR has a total route length of 220.9 km, 2,106 rail cars, and 87 metro stations, with 1,350 station shops.

Shenzhen's railway development and operation are mainly under the responsibility of Shenzhen Metro Group Company established in 1998. There are five subway lines that are currently in operation with a total route length of 178 km. The subway lines that are operated by Shenzhen Metro are lines 1,2,3, and 5, with the line 4 operated by MTR (Shenzhen) Corporation. There are 116 stations that are managed by Shenzhen Metro. It is projected that after the additional three lines 7, 9 and 11 are in operation approximately by the end of 2016, the total route length will increase to 285 km.

¹ Please refer to the appendix for the complete subway map of Hong Kong.

4.2. Urban Context

As mentioned earlier, Hong Kong is one of the world's most densely populated cities, with very limited urban land and more than seven million people. But what makes it such a dense city? One major factor is its geographic characteristics (Freemark 2010). The majority part of Hong Kong are mountains and parks and this landscape characteristic makes Hong Kong people live and work only in limited zones, thus making Hong Kong a very densely populated city around the world. For example, although New Territories share the largest piece of Hong Kong's land, the residential and commercial areas are most concentrated in the southern part of the Kowloon Peninsula and northern part of Hong Kong Island.

This is further backed by the population density data. The table below shows Hong Kong's population density by three main areas – Hong Kong Island, Kowloon and New Territories. The land population density on average is 6,544 people/km² and the differences between the three areas are significant. As we can see, Kowloon has the highest population density followed by Hong Kong Island and New Territories, and a further analysis based on densities of District Council Districts² show that the four districts with the highest densities are all within Kowloon. The larger upper areas

² Please refer to the Appendix.

in the New Territories and the southern part of Hong Kong Island have relatively very low population densities.

Hong Kong's Population Density*			
Area	Year		
	2001	2006	2011
Hong Kong Island	16 775	15 915	15 924
Kowloon	43 201	43 033	44 917
New Territories	3 526	3 748	3 870
Land total	6 237	6 352	6 544

Source: 2011 Hong Kong Population Census

**Unit: Number of persons per km²*

Because of high urban density, land value in Hong Kong is very high compared to many other Chinese cities. Every piece of land in Hong Kong is extremely valuable, especially the land near transit stations. Thus, there is sufficient property value for the MTR to capture to pay for its transit development. In addition, there is no suburb in this small island city, which makes the railway system highly accessible to the majority of people in Hong Kong. This in turn leads to high subway ridership. Consequently, the high ridership boosts the economic activities around the stations because it brings a large number of people in and out of stations, where many commercial businesses are located.

Shenzhen, in contrary, has a lower density than Hong Kong. According to the data from the Sixth National Population Census as shown in the table on the right, Shenzhen's average population density is 5201 people/km². However, Hong Kong's population density in

Population Density in Shenzhen, 2010		
Zone	Population	Density*
Citywide	10357938	5201
Luofu Zone	923423	11726
Futian Zone	1318055	16756
Nanshan Zone	1087936	5877
Baoan Zone	4017807	7059
Guangming Zone	481420	3097
Longgang Zone	2011225	2945
Pingshan New Zone	309211	1852
Yantian Zone	208861	2798

Source: 6th National Population Census

**Unit: Number of people per km²*

2011, as mentioned earlier, was about 6544 people/km², which is much higher than that of Shenzhen. It is noteworthy that, similar to Hong Kong, the population densities of different zones in Shenzhen vary significantly. While the average density is 5,201 people/km², the highest two are 16,756 people/km² for Futian Zone and 11,726 people/km² for Loufu Zone. The four zones in the middle and Western part of the city, including Luofu Zone, Futian Zone, Nanshan Zone and Baoan Zone have the highest densities while the densities of the East are much lower.

4.3. Operational Performance

The MTR's railway system currently has an average number of about 5.4 million weekday passengers. The average number of passengers has increased from about 2.5 million in 2005 to more than 5 million in 2015. In fact, more than 90% of people in Hong Kong rely on public transportation for motorized trips. This increasing trend of subway ridership partly demonstrates the MTR's success as an effective railway operator to provide convenient public transportation and reduce automobile dependence. The railway fares range from about HK\$4.5 to 50.5, depending on distance traveled. The MTR system's average fare has remained stable, around HK\$8 from 2010 to 2014. This is very cheap compared to the standard single-trip subway fare of \$2.75 in New York City and from £1.5 up to £6.9 in London. On a comparative scale, the fare change has been considerably lower than the Hong Kong payroll index but in line with the consumer price index.

Shenzhen Metro's fare charge is also distance-based, with a starting price of ¥2. For additional ¥1, a passenger can travel for another 4km, 6km or 8km based on different distance ranges as shown in the table below. This fare standard lowers the travelling cost for people with long travel distance. The average subway fare remains around ¥2.6 over the past few years and this is much cheaper to the average price of HK\$8 of the Hong Kong MTR trips. However, Hong Kong MTR has an amazingly

high farebox recovery ratio of about 185%, defined as the ratio of fares over operating expenses. This ratio ranks among the world's highest.

Shenzhen Subway Fare for Single Trips	
Distance Range (km)	Additional Distance (km) per ¥1
4 to 12	4
12 to 24	6
Over 24	8

Source: Shenzhen Metro

Note: the starting fare for the first 4 km is ¥2.

In terms of financial status, the Hong Kong MTR has better standing than Shenzhen Metro. MTR has a very strong cash position. Remarkably, receipts from operating activities (\$HK15.4 billion) and property development (HK\$9.2 billion) are the major cash contributors, with few government subsidies and no net borrowings in 2014. More than half of the cash is used to finance capital expenditure and pay for interest and dividends. In addition, due to high profit-generating capability and low borrowing levels, the MTR's net debt-to-equity ratio remains fairly low. The net debt-to-equity ratio decreased from about 12% in 2013 to 7.6% in 2014. On the contrary, Shenzhen Metro has a debt to asset ratio of 54.9% which suggests that the company may rely too much on borrowing.

From the operation's perspective, the MRT achieves an incredibly high performance level on several aspects. In the first half of 2015, the train service

delivery rate, passenger journeys on-time rate, and train punctuality rate were all 99.9%. In comparison, while there is lack of data showing the overall operation performance of Shenzhen railway services, the available data on Line 4 which is operated by MTR Corporation Shenzhen (MTRSZ) indicates that the operation performance of railway services on Line 4 is of very high standard. As we can see from the table below, the passenger-journeys on-time rate and train service delivery rate are both 100% and its train punctuality rate is 99.9%.

Operation Performance of Line 4 in Shenzhen, 2014	
Passenger journeys on time	100%
Train punctuality	99.9%
Train service delivery	100%

Source: MTR Shenzhen

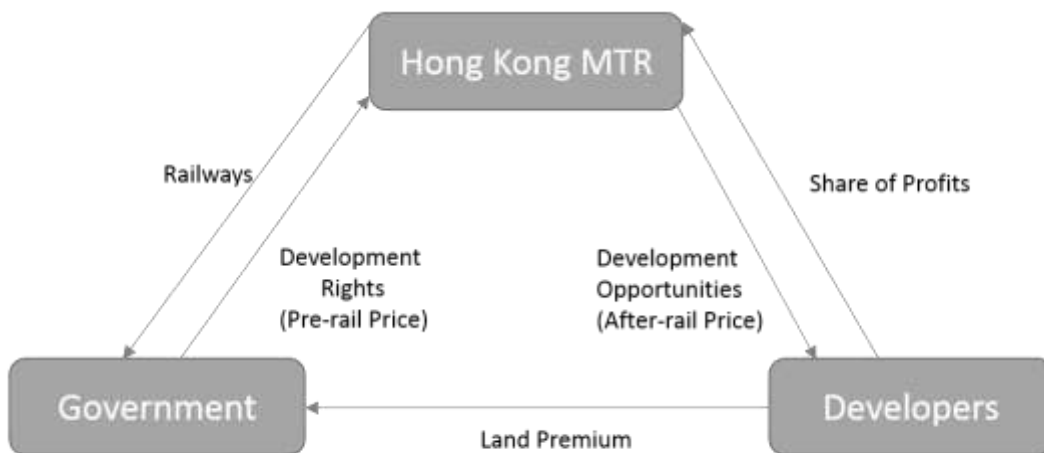
4.4. Rail-Plus-Property Model

After an overview of Hong Kong MTR and Shenzhen Metro’s operational performance, this section discusses the financing strategies for their transit development and operation. We will first evaluate the funding and regulatory framework of both cities’ rail-plus-property models and then discuss the details of the funding sources which are essentially their business portfolios.

4.4.1. Funding and Regulatory Framework

Hong Kong

According to the Basic Law of Hong Kong Special Administrative Region, all land is owned by Government (except for the land on which St. John's Cathedral Church stands). Land can be leased for different uses for a period of time at a premium with a set of lease conditions. After 1997, land is normally leased for a term of 50 years. So the government can lease the land in order to gain revenue.



Source: Cervero and Murakami (2009) and Hong Kong MTR

The diagram above shows the relationships among different parties in the rail-plus-property model. As discussed earlier, the land value in Hong Kong is extremely high due to its limited space. The government lowers costs of obtaining land development rights for MTR. In fact, there is a special agreement between the MTR and the government. The government grants MTR the development rights at pre-rail

prices, and then MTR offers development opportunities to private developers at an after-rail price. The logic behind this approach is clear - after railways are developed, the price of land adjacent to the railway will skyrocket and so the difference between pre-rail and after-rail prices is substantial. The land premium would be returned to the government, which is a major shareholder of MTR. In essence, the government grants the MTR land development rights at a very low cost and the profit margin from this value capture mechanism would be high enough to cover major railway development costs. In addition, the local land use law also supports the property development around train stations. For example, to promote efficient land use and encourage dense urban development, a floor-area ratio of 10 is allowed in certain districts with a mix of residential and transportation facilities.

Hong Kong Network Extension Projects in 2014				
Line	Completion (2014)	No of Stations	Route Length (Km)	Type of Funding
Island Line Extension	100%	3	2.7	Capital Grant
South Island Line	82%	5	7	Rail plus Property
Kwun Tong Line	72%	2	2.6	Rail plus Property
Express Rail Link	66%	1	26	Service Concession
Shatin to Central Link	27%	10	17	Service Concession

Source: Hong Kong MTR Annual Report 2014

The summary table above shows the detailed information about recent network extension projects in Hong Kong, including the type of funding used. As we can see, two out of five projects (i.e. South Island Line and Kwun Tong Line) are funded through the rail-plus-property mechanism, while the Island Line Extension is

funded through capital grant and the rest two are funded through service concessions which are essentially public-private partnerships.

Shenzhen

The land ownership policy in mainland China is similar to that of Hong Kong but with some differences. While the sole owner of land in Hong Kong is the government, owners of land in mainland China are either the state or rural collectives. However, during urban sprawl, the local governments can take the rural land and transform it into urban land by compensating rural collectives. Urban land, although publicly owned, can be leased to private entities for development through auction, bidding and listing. The length of land lease period depends on development purposes. In particular, land can be leased to private entities for residential, industrial and commercial development for 70, 50, and 40 years respectively.

In addition, there are two major differences between Shenzhen and Hong Kong regarding the land regulation policies. First, as Hong Kong has been running with its land leasing policy for a long time and its lease term is with easy renewal, land owners can almost treat leased land as private property, even though they only have land use rights. Therefore, they have a very secure expectation on what the land can be used for and investors have strong confidence in their investment and expectation on long term profits. However, in mainland China, the land market has only existed for about 20 years and so investors would have much less confidence

due to the much less mature land leasing system. Secondly, While the Hong Kong government can directly grant land development rights at pre-rail price to MTR, the mainland Chinese land regulation law requires that the land lease process has to go through a bidding process. Consequently, in such process, the Shenzhen Metro may not get the land at all or at a desirable price. Therefore, it is important to recognize that these differences between the two land leasing systems pose challenges when applying the R+P model in mainland China.

Shenzhen Metro Projects and Costs			
Phase	Lines	Length (Km)	Cost (Billion)
Phase I	No.1	17.4	10.7
	No.4	4.0	
Phase II	No. 1	23.4	68.8
	No. 2	35.8	
	No. 3	41.7	
	No. 5	40.0	
Phase III	No. 6,7,8,9,11	NA	81.2*

Source: Shenzhen Metro

** The total cost of ¥81.2 billion is only for the lines 7, 9, and 11 which are currently under construction.*

Note: All numbers are rounded up to the second decimal point.

The development path of the Shenzhen subway lines has three major phases, as summarized in the table above. The first phase is for construction of Line 4 (4 km) and the first stage of Line 1 (17.4 km). The total construction costs are about 10.7 billion (CNY). The second phase involves extension of Line 1 (23.4 km), Line 2 (35.8 km), Line 3 (41.7 km) and Line 5 (40 km), with total costs of about 68.8 billion (CNY).

The third phase, which is the most current phase, is for 5 lines, namely Line 6, 7, 8, 8 and 11 and the total costs are approximately 81.2 billion (CNY).

As we can see, the construction costs are enormous especially for the second and third stage of subway development. How does Shenzhen Metro pay for such huge amount of costs? Shenzhen Metro takes different approaches to finance the construction for different phases and so it has been an evolving process as Shenzhen Metro accumulates more experience especially when learning from the Hong Kong MTR.

The table below shows the financing strategies that Shenzhen Metro used to finance three phases of subway development. During the first phase, the funding mainly comes from government funding (70%) and bank loan (30%). The banks loans are obtained from a group of banks with an interest rate 10% lower than the market benchmark interest loan rate. At this stage, Shenzhen Metro had not yet started to implement the concept of rail-plus-property model from Hong Kong MTR.

Shenzhen Metro's Funding Strategies for Different Construction Phases		
Phase	Funding Structure	
	Government Support	Others
Phase I	Government Funding (70%)	Bank Loan
Phase II	Government Funding (50%) (Land Development Rights through Bidding & Direct Transfer of Land Development Rights)	BOT/BT Bank Loan
Phase III	Government Funding (50%) (Direct Transfer of Land Development Rights)	BT Diversified Leverage

Source: Shenzhen Metro

Only from the second phase onwards, rail-plus-property model started to take shape in Shenzhen. The government funding support percentage decreased from 70% to 50%. In addition, this 50% government support does not mainly come from the government revenue, but takes the form of granting land development rights at low costs to Shenzhen Metro. It is clear that in such way, Shenzhen started to imitate Hong Kong MTR's practice. However, as discussed earlier, there is one major legal challenge in this adaptation process – the mainland Chinese leasing law requires a bidding process before the Shenzhen government can lease land to private entities. Under such legal restriction, Shenzhen Metro may end up not winning the bid or encounter huge costs to obtain the lease land.

To overcome such challenge, Shenzhen government creates and attaches special conditions for potential bidders. In this way, it maximizes the chances for Shenzhen Metro to eventually win the bid at a low price. But Shenzhen Metro still

need to pay the upfront land leasing fees to the government. Then the government would later return this leasing payment to Shenzhen Metro and this would be the government funding for subway development.

However, such funding process is not efficient enough and therefore at the later stage of the second phase, Shenzhen government starts to finance the subway construction by directly transferring the land development rights to Shenzhen Metro as a form of investment, in order to smoothen the funding process. There are at least two major advantages of this approach. First, it greatly reduces the financial burden of Shenzhen Metro because there is no need to pay for the upfront land leasing fees. Secondly, by removing the bidding process, it allows Shenzhen Metro to get the land development rights at low costs without any uncertainty. This improved financing strategy is used for all subway-related projects during the second phase, except for some projects, as such Qianhai and Shexikou.

In addition to the changes on the aspect of government funding, it is noteworthy that Shenzhen Metro also cooperates with Hong Kong MTR to invest in the construction of Metro Line 4 Phase II, under a build-operate-transfer (BOT) agreement with the Shenzhen municipal government. This strategic arrangement allows experimentation of the rail-plus-property model under the guidance of the Hong Kong MTR.

In the third phase of the subway construction, the Shenzhen government fully applies the method of using land development rights as direct investment to support Shenzhen Metro while the total equivalent percentage of government funding is still capped at 50%. When there is still lack of funding after using this approach, the government injects its own municipal funding into the projects.

In addition, there are two other major improvements on the funding mechanism. First, all the lines that are currently under construction (i.e. lines 7, 9, 11) are under build-transfer (BT) agreement which involves large central government companies. These companies set up local project companies in Shenzhen and are responsible for additional fund raising and construction of the subway lines. The major advantage of such approach is to take advantage of the technical and management skills of these large central government companies. The total funds raised by these companies are about 49.5 billion (RMB). In order to lessen the financial pressures of Shenzhen Metro, there is an agreement that the repayment of funds to these central-government companies can be in installments. In fact, by the end of 2015, Shenzhen Metro has successfully paid back about 31.1 billion (RMB) to three companies under BT agreement.

4.4.2. Business Model

Hong Kong's Business Model

The MTR's financing model is essentially R+P development, which aims to capture the land and property value around subway stations. According to the MTR's 2014 annual report, value capture essentially consists of three major parts: station commercial businesses, property development, and property rental and management businesses. In addition to the profits from transport operations (HK\$7 billion), the major profit contributors are station commercial businesses (HK\$4.5 billion), property development (HK\$4.2 billion), and property rental and management businesses (HK\$3.4 billion). The overall operating margin before depreciation, amortization, and variable annual payment reaches its highest point of 38.4% in 2014.

For station commercial businesses, the total revenue, operating costs, profits, and margin are presented in the table below. The operating margin of 89.6% is very high and makes station commercial businesses a crucial part of the value capture model.

Station Commercial Businesses	
Total Revenue	HK\$4,963 million
Operating Costs	HK\$515 million
Operating Profits	HK\$4,448 million
Operating Margin	89.60%

Source: Hong Kong MTR Annual Report 2014

The station commercial businesses include retail, advertising, telecommunication services, and others. The station retail businesses generate the highest revenues, followed by advertising and telecommunication services. For all four types, the revenues have been steadily increasing from 2010 to 2014, which demonstrates a healthy revenue-generating capacity.

The second major contributor is property development. The MTR offers tenders to private companies to develop a wide range of property. There are many residential, retail, and other property development activities around large subway stations such as the LOHAS Park and Austin stations. The total profit from property development was HK\$4,216 million in 2014.

Property rental and management businesses are the MTR's third major profit contributor. The total revenue, operating costs, profits, and margins are presented in the table below. The performance is similar to that of the station commercial businesses. Both sectors have operating profits much higher than costs, yielding a high margin of nearly 90%.

Property Rental and Management	
Total Revenue	HK\$4,190 million
Operating Costs	HK\$747 million
Operating Profits	HK\$3,443 million
Operating Margin	88.20%

Source: Hong Kong MTR Annual Report 2014

The value of the MTR's investment properties has increased from around HK\$45 billion to HK\$64 billion in 2014, and the net rental revenue also increased from HK\$2,018 million to HK\$3,222 million in 2014. The property under the MTR's management covers a wide range of types, including residential, office, retail buildings, and car parks.

Shenzhen's Business Model

In the case of Shenzhen, Metro Group Property Development Branch was established in 2007 with a dedicated role to develop property along subway lines. It has developed a successful business line which includes land reserve, bidding, design, construction as well as marketing. The businesses mainly include construction of affordable housing, commercial housing and other buildings such as hotels. For affordable housing construction, the property development branch started to deliver by installments 22,000 affordable housing units under several projects such as Tanglang and Shekou from the end of 2013 onwards. Commercial housing projects are along many railway lines such as lines 1, 2, 3, 5, which are under railway Phase II construction and lines 7, 9, 11, which are under railway Phase III construction. Examples of other types of projects include the Metro Scientific and Technological Building which is a mixed-use project that has a five-star hotel.

In addition to property development, Shenzhen Metro is also active in property management which is under the responsibility of Shenzhen Metro Property Management Development Company founded in 2006 as a subsidiary of Shenzhen Metro Group. Its businesses include property management of affordable and commercial housing, office buildings, large transit hubs, rolling stock depots, railway stations, as well as providing consulting services. The Property Development Company has grown fast since its inception. Its operating revenue increased significantly from about 7 million in 2006 to about 200 million in 2012, and its total property management areas increased dramatically from 330,000 m² to about 5,730,000 m².

The third business category is station commercial businesses which are under the responsibility of Resources Development Branch of Shenzhen Metro Group. It rents commercial space both on the ground and underground, offers advertising opportunities to companies, and provide telecommunication services. One famous example of the station commercial business is the Link City project which is an underground commercial district connecting the Shopping Park station and Convention & Exhibition Center station. Along this district locates commercial shops providing a variety of products including clothes, electronics, coffee and food. Link City becomes an essential part of the larger Futian central business district and is one of the country's most successful underground business districts.

In addition, the advertising businesses are conducted to cover both ground and underground space, through many channels like news magazines, station advertising, car handle advertising as well as outdoor advertising. Furthermore, for the communication services, Shenzhen is the first city in the country to have full coverage of Wifi connection in all Shenzhen stations and trains, and data services are also provided for residential and office buildings and hotels around the subway stations.

Business Model Comparison

After introducing the business models of Hong Kong MTR and Shenzhen Metro, let's take a further look at the similarities and differences between their business portfolios. For an easy comparison, businesses are divided into five major categories, namely station commercial business, property development, property rental, property management and consulting businesses, as shown in the table below.

Business Portfolio Comparison			
Section	Sub-Category	Hong Kong	Shenzhen
Station Commercial Business	Retail	√	√
	Advertising	√	√
	Telecommunication	√	√
Property Development	Affordable Housing	×	√
	Commercial Housing	√	√
	Office Buildings	√	√
	Hotels	√	√
Property Rental	Retail (Shopping Malls)	√	√
Property Management	Affordable Housing	×	√
	Commercial Housing	√	√
	Office Buildings	√	√
	Hotels	√	√
Consulting Businesses	Local	√	√
	International	√	×

Source: Shenzhen Metro and Hong Kong MTR Annual Report 2014

For station commercial businesses, both Hong Kong and Shenzhen are active in providing retail, advertising and telecommunication services. For property development, while both develop commercial housing, office buildings and hotels, Hong Kong is less active in affordable housing construction. As mentioned earlier, it is quite remarkable that the property development branch of Shenzhen Metro started to deliver by installments 22,000 affordable housing units under several projects such as Tanglang and Shekou. This raises the concern of the Hong Kong public on how the Rail-plus-Property model can really benefit the low income population and some worry that it may even make the situation worse (Suzuki et al. 2015). As a matter of fact, Hong Kong has a dedicated agency, Housing Authority, which has the

responsibility of providing affordable housing. Consequently, the difference in the property management business lies also in the affordable housing. In addition, as for the property rental business, both Hong Kong and Shenzhen focus on retail space rental in large shopping malls.

Another major difference is the geographic scope on provision of their consulting services. As we know, Hong Kong MTR serves as a global example on its operation and management of its public transit, thus MTR has the capability of providing consulting services as well as doing investment for not only cities in mainland China but also in many other countries. This not only provides Hong Kong MTR with the opportunities to gain more revenues from a variety of channels, but also gives it the chances to accumulate more operation and management skills, through these global experiences.

The table below presents Hong Kong MTR's major global business presence. Beyond China, MTR's businesses are extended to many big cities around the world, such as London, Stockholm, Melbourne and Sydney. For example, in London, MTR formed a joint venture in 2007 with Arriva to provide rail services for London Overground under an operations and maintenance agreement, and more recently, under another operations and maintenance agreement in 2014, to provide railway services for the London Crossrail starting from May 2015.

Hong Kong MTR's Global Business Presence				
Area	City	Year	Types	Activities
Mainland China	Beijing	2006	PPP O&M	Metro Lines 4 &14 Daxing Line
	Shenzhen	2004	BOT	Longhua Line
	Hangzhou	2012	PPP	Metro Lines 1
International Presence	London	2007	O&M	London Overground
		2014	O&M	Crossrail
	Stockholm	2008	O&M	Stockholm Metro
		2008	NA	MTR Stockholm
		2013	NA	Intercity Express
	Melbourne	2009	O&M	Melbourne Metro
Sydney	2014	PPP	Procurement	
		O&M	North West Rail Link	

Source: Hong Kong MTR

As we can also see from this table, in Mainland China, MTR has investments in Beijing, Shenzhen and Hangzhou. In Beijing, Hong Kong MTR has a joint venture with Beijing Capital Group and Beijing Infrastructure Investment company. Under a public-private partnership agreement, the joint company, Beijing MTR Corporation is responsible for investing and operating Metro Lines 4 and 14. It also provides through-train services which connect Metro Line 4 and the Daxing Line under an operations and maintenance agreement. In Shenzhen, under build-operate-transfer agreement, MTR Corporation (Shenzhen) Limited was established in 2004 with responsibilities of Longhua Line Phase II construction as well as operation of the entire Longhua line for 30 years. In addition, In Hangzhou, MTR also formed a joint

venture with Hangzhou Metro Group in 2012 under a public-private partnership agreement for construction and operation of Metro Line 1.

On the contrary, while Shenzhen Metro has some consulting business in other Chinese cities, it does not have any international business. It only provides consulting services to about four other Chinese cities – Nanning in Guangxi Province, Shangrao in Jiangxi Province, Neijiang in Sichuan Province and Fuoshan in Guangdong Province. In all the four cities, Shenzhen Metro acts as a corporate consultant to give advice on operation and management of large transit hubs, including Nanning Eastern Transit Hub, Shangrao Transit Hub, Neijiang Transit Hub as well as Fuoshan Transit Hub. For instance, in the case of Nanning Eastern Transit Hub, the Property Management Branch of Shenzhen Metro provided consulting services to Nanning Real Estate Development Company to ensure a smooth opening of the Eastern Hub.

5. Conclusions and Discussion

After the comprehensive comparison of the rail-plus-property model applications between Hong Kong and Shenzhen, this section presents main conclusions and policy implications.

5.1. Performance of Shenzhen Metro and Hong Kong MTR

The rail-plus-property model works effectively in Hong Kong, and Shenzhen has made significant progress and success in adapting the Hong Kong model into local application through three different phases. In particular, we see that the Shenzhen municipal government started to grant land development rights to Shenzhen Metro through the official bidding process and then slowly moved into the approach of using land development rights as direct government investment into Shenzhen Metro.

In addition, from the perspective of the business model, both Shenzhen Metro and Hong Kong MTR have diversified portfolios not only in the real estate development but also in other areas. Both portfolios generally cover property development, rental and management as well as providing consulting services. The two major differences are that Shenzhen Metro seems to have been more active in the affordable housing market than Hong Kong MTR, and Hong Kong MTR's business has an international presence in many other countries such as Australia

and the United Kingdom, while Shenzhen Metro's business is only limited to mainland China.

5.2. Challenges Faced by Shenzhen Metro

Shenzhen Metro encounters many challenges when learning from Hong Kong MTR's practice. Hong Kong's high urban density, which is a result of its highly limited urban space and concentrated urban population living and working zones, forms a virtually perfect environment for implementing the rail-plus-property model by creating considerable potential land premium to capture through the model. On the contrary, while Shenzhen's urban density is high in the middle and western part of the city, it has a lower density in the eastern area and this would largely limit the potential implementation of the rail-plus-property model on a city-wide scale.

In addition, as discussed, the differences in regulatory framework between Shenzhen and Hong Kong pose challenges as well especially in terms of land leasing policies and general property rights. However, as Shenzhen's is one of the nation's most innovative cities, it has the privilege with the support from the central government to experiment regulatory and policy reforms to overcome such challenges.

5.3. Key Conditions for Implementation of Rail-Plus-Property Model

Based on the Hong Kong MTR and Shenzhen Metro's practice, we can summarize some key conditions on successful application of the rail-plus-property model, and these are essential conditions for China to apply such model in other mainland cities.

First of all, a city's urban context is the first thing to check. The urban density of the whole city or certain targeted areas should be high enough so that there is enough future value to capture in order to cover the subway development costs. On top of it, a transit-oriented development approach would greatly increase the value to be captured because when railway ridership increases the land and property around the railway lines would increase.

Secondly, the regulatory framework needs to be reformed to support the implementation of the rail-plus-property model. Ideally, it should smoothen the transfer process of land development rights, lower any transaction costs within such process and more importantly have a comprehensive legal framework to protect the rights and interests of private partnership companies so that they have more incentives to invest in subway development and operation.

Last but not least, through the comparative analysis of the business models of both Shenzhen and Hong Kong MTR, we can see that it is essential to have a

structural and diversified business portfolio to generate enough profits to pay for railway development.

5.4. Critical Review of Rail-Plus-Property Model

While the R +P model has many advantages, it is essential for the government to understand its disadvantages as well. This section will briefly summarize the model's main advantages and then discuss in details its major disadvantages, as shown in the table below.

R+P Model: Major Advantages & Disadvantages	
Advantages	Disadvantages
Provision of Significant Funding Utilization of Land Premium Potential Profitability Management Expertise	Many Conditions on Implementation Equity Issues Opportunity Costs Investment Risk in Real Estate

The R+P model mainly has four advantages. First, it provides significant funding for railway development and operation. As discussed earlier, there are huge profits realized from the real estate sector and other businesses. Second, the model takes advantage of the large land premium to partly subsidize railway construction. Third, there is potential profitability. However, making a transportation system profitable may not necessarily be good and this will be discussed in details in the following paragraph on disadvantages of the model. Last but not least, by using this

model, it is more likely to bring in management expertise suitable for construction, operation and maintenance due to its profit-driven nature.

However, the R+P model has several major disadvantages that the government needs to be aware of. First, there are many conditions for this model to work and some key conditions have been discussed in details in the previous section. The point is that not all cities can use this model to finance its public transit and it is important for the government to pre-check the conditions of a specific city before applying the model.

Second, there are equity issues involved. Although the model is profitable, but it is not necessarily good. As discussed earlier, one condition for this model to work is to have high population density. But this selection criterion will leave out the people in the suburbs with low density. Then the government needs to provide subsidies on transportation in suburbs to serve these people. It is crucial to understand that transit development has public externality. Due to its public nature, financial sustainability does not mean that it has to be profitable and providing subsidies does not mean that it is not financially sustainable. So it is not necessary that all transit development should be fully covered by user fees or through a business portfolio as we see in the cases of both Hong Kong and Shenzhen. Furthermore, the goal of providing access to the people in as many areas as possible is much more important than making profits itself. Therefore, the government should really understand the importance of

building citywide access rather than put efforts into making a transportation system profitable. And even if it is profitable, the government should think about the use of the profits in areas beyond transportation development such construction of affordable housing.

Third, there is an opportunity cost when the government provides land development rights at low cost to the MTR rather than to developers directly. This is the opportunity cost to the government, because the cost reduction provided to the MTR could have been used for other public purposes. It is important to emphasize here that the government is responsible for providing a wide range of public services beyond public transportation. The government could use the revenue from sale of land development rights to subsidize some social welfare programs such as providing affordable housing or subsidizing education. Therefore, by offering land development rights to the MTR deprives the government of the flexibility on budget usage, and this would also give the MTR the opportunity to make decent profits to please its shareholders rather than the general public.

Lastly, there is also investment risk involved in the real estate business. The unpredictable pattern of the real estate market will pose significant risks when applying the R+P model. If the real estate market is healthy, the model may work very well. However, when a real estate bubble bursts, this may create disastrous losses.

5.5. Recommendations

Last but not least, based on the conclusions above, I would like to make some recommendations on implementing the rail-plus-property model in mainland Chinese cities.

First, when promoting the rail-plus-property model, it might be good to start on a small scale and then expand if desirable. This strategy applies to two situations. If a city is not sure whether this model would work, it is good to start off with a specific subway line or even just a portion of a line to allow a try-and-error process. Another situation is that urban density and transit ridership are only high at a certain part of the city. In this case, it is reasonable that the rail-plus-property model works only for limited areas because it is not necessary and often hard to meet all conditions to implement it city-wide.

Secondly, the government should lessen its involvement in some aspects of the model implementation such as the operation and management of subway lines. This is because what lies in the core of the success story of Hong Kong MTR is the profit-driven mindset which is normally a characteristic of a private company. In essence, the philosophy of the rail-plus-property model relies on the capability of generating revenue from a thoughtfully-designed business portfolio which mainly relies on the real estate sector. Having less government intervention and injecting more private blood would help implement the model.

Adding on to the second suggestion, the metro company responsible for subway development and operation should keep the public especially investors well-informed. This covers many aspects such as constantly publishing reports on key operational performance and financial information. Shenzhen Metro's published reports are much less transparent and provide much less information than those of Hong Kong MTR. Timely publication of such information is crucially important not only because private investors need it but also because it can be served as a data base for other cities to research on and create potential partnerships.

5.6. Prospect of Using Rail-Plus-Property Model in Other Chinese Cities

Some other mainland Chinese cities, such as Beijing, Shanghai and Guangzhou, do have the potential to adopt the rail-plus-property model by learning from the experiences of both Hong Kong and Shenzhen.

First of all, the urban densities of these large mainland Chinese cities are high enough to create considerable value to be captured. And the public transit systems of Beijing and Shanghai are very extensive and this forms the bases to take advantage of transit-oriented development approach to further increase the potential value to be captured by generating huge amount of public transit riders.

Secondly, Shenzhen's success story so far sets an extremely useful example for the other mainland Chinese cities especially in terms of legal framework. As

Shenzhen's success continues to grow, the central government can further create regulations and laws based on Shenzhen's practice in order to support other cities to apply the rail-plus-property model. Shenzhen Metro can provide consulting services to the cities that are new to the model and even to follow Hong Kong MTR to form joint venture partnerships with other cities' local governments and metro companies to promote the rail-plus-property model.

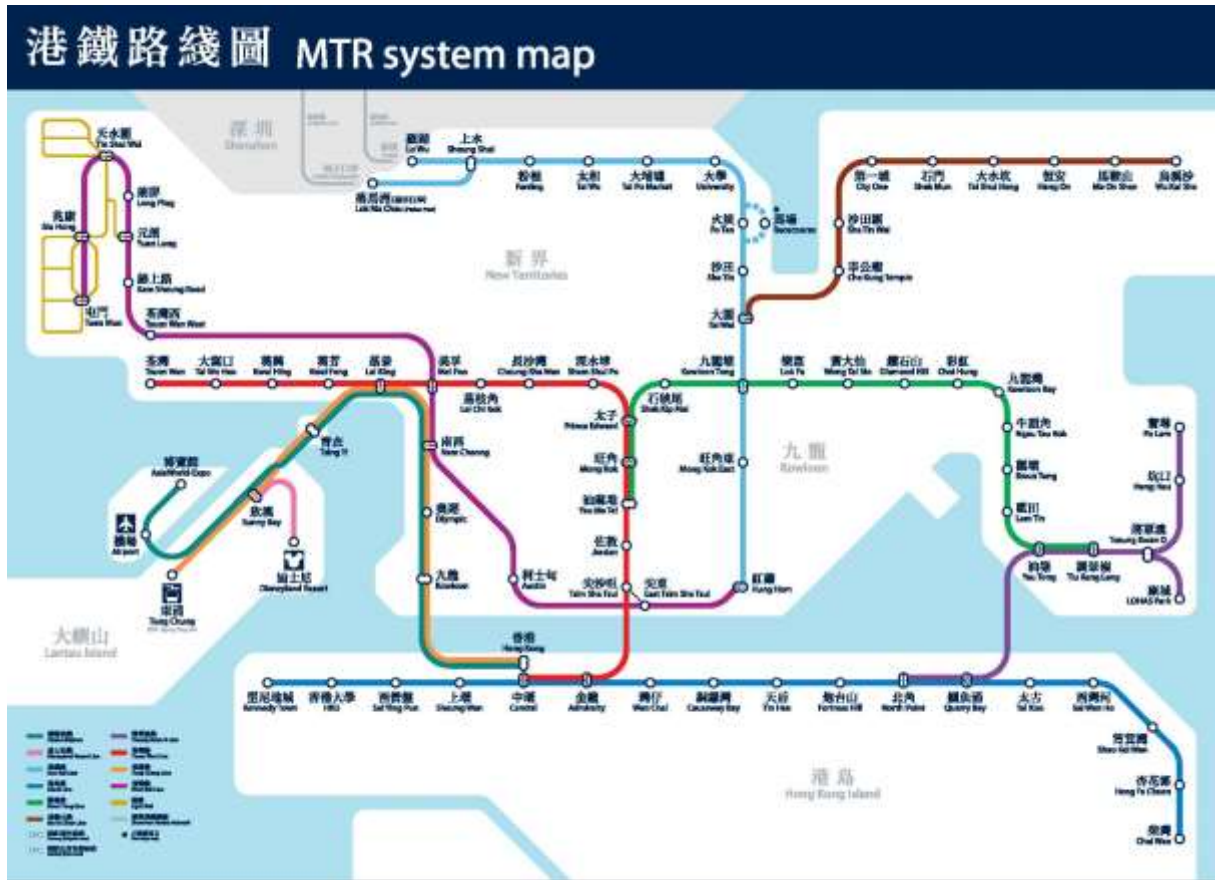
Finally, in terms of portfolio building and management, both Hong Kong and Shenzhen can provide valuable guidance to other cities on how to build a structural and diversified business portfolio to generate profits to pay for subway development.

5.7. Overall Concluding Remarks

As the financial pressure for China's local governments is increasing, traditional financial mechanisms, like land transfer and local government financial platforms, seem to have limited capacity to provide sufficient funds to pay for urban transportation development. The rail-plus-property model, one type of land value capture finance, becomes an alternative financing strategy. By a comparative study approach, this thesis has evaluated the implementation of such model in both Hong Kong and Shenzhen, in addition to an analysis of the both cities' urban context and the operational performance of the two cities' metro companies.

This paper has also summarized the main challenges faced by Shenzhen Metro when imitating Hong Kong MTR' practice, and the key conditions on effective implementation of the rail-plus-property model in other mainland Chinese cities. Based on this study, rail-plus property model has a great potential to help many more Chinese cities to finance its railway development and operation. However, the government needs to be aware of the model's major disadvantages including equity problems. In light of all the challenges and issues discussed and depending on the urban context and development strategies of different cities, extensive application of the rail-plus-property model may still have a long way to go.

Appendix



Source: Hong Kong MTR

Population Density by District Council District, 2001, 2006 and 2011

District Council District	Population Density (number of persons per km ²)		
	2001	2006	2011
Hong Kong Island			
Central and Western	21 137	20 102	20 057
Wan Chai	16 986	15 788	15 477
Eastern	33 147	31 664	31 686
Southern	7 482	7 083	7 173
Sub-total	16 775	15 915	15 924
Kowloon			
Yau Tsim Mong	40 932	40 136	44 045
Sham Shui Po	37 772	39 095	40 690
Kowloon City	38 059	36 178	37 660
Wong Tai Sin	47 810	45 540	45 181
Kwun Tong	49 861	52 123	55 204
Sub-total	43 201	43 033	44 917
New Territories			
Kwai Tsing	21 578	22 421	21 901
Tsuen Wan	4 566	4 679	4 918
Tuen Mun	5 919	6 057	5 882
Yuen Long	3 242	3 858	4 178
North	2 184	2 055	2 228
Tai Po	2 287	2 156	2 181
Sha Tin	9 157	8 842	9 173
Sai Kung	2 535	3 135	3 368
Islands	498	783	807
Sub-total	3 526	3 748	3 870
Land total	6 237	6 352	6 544

Source: 2011 Population Census Office

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