

**Rapid Transit: A Case Study of Tianjin BRT and the Problem
Solving Towards Hamilton LRT**

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Abstract

As the main mode of urban public transit, rapid transit, represented by BRT and LRT, has proven its great advantages in sustainable development. However, problems about money and route planning during the construction and operation of Hamilton LRT have troubled the city a lot. So, the problem solving, based on the construction and operation of Tianjin BRT, will be set in this thesis to help solve these problems.

Key words: urban public transit; rapid transit; BRT; LRT; PPP; consultation

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1 Introduction

Climate change has been a significant threat to the sustainable development of human society, and urban public transit should become an important contributor to reduce greenhouse emission. As an important part of urban infrastructures, the development of urban public transit can effectively alleviate traffic congestion. Also, urban public transit can promote the sustainable development of a city. With the development of technology, rapid transit, mainly represented by BRT (Bus Rapid Transit) and LRT (Light Rail Transit), has gradually become the main mode of urban public transit.

The rapid transit mode in Tianjin is BRT, while in Hamilton the rapid transit mode is LRT. For the latter, problems about money and route planning have become major obstacles to its development.

In order to solve these problems effectively, this thesis analyzes the construction and operation of Tianjin BRT, and puts forward corresponding solutions towards Hamilton LRT, including PPP and public consultation.

2 Theoretical Basis

2.1 Public Goods

Public goods are the embodiment of public interests, involving a range of public affairs. Erik Robert Lindahl, a financial scientist, put forward the concept of public goods in *Die Gerechtigkeit der Besteuerung* (Lindahl, 1919), creating a precedent for public goods theory. Paul Anthony Samuelson defined the concept of public goods in *The Pure Theory of Public Expenditure* in 1954, which was a milestone, laying a solid foundation for the formation and development of public goods theory (Samuelson, 1954). In his article, Samuelson not only put up with the meaning of

public goods, he also made a distinction between public goods and private goods in essence, and provided a theoretical model of the provision of public goods.

For the main body of provision, the question is whether public goods are provided by a single subject, such as the government, private companies or other social organizations, or by the combination of the government, private companies and social organizations. Singularized provision pattern of public goods is rare, and there are multiple modes of provision coexistence in a particular social context. The government can directly provide public goods, or take an indirect way, such as authorizing private companies and offering financial subsidies to private companies. The needs of the public tend to diversify, and provision modes tend to change as well. In this case, the government should give full play to its guiding role so that the government itself, private companies and social organizations can actively participate in the provision of public goods, the harmonious development can be achieved, and the needs of the public can be met.

The process of providing public goods is not static, in the early stage of provision, planning is needed, and human resources should be coordinated as well, also budget is essential to this stage. When providing public goods, the relationship between the public, money and other things should be properly organized so as to make the provision system open, fair and impartial. In the latter stage of provision, monitoring and maintenance are necessary so as to achieve the desired results and maximize the realization of the needs of the public.

According to the scope of public goods, they can be divided into national public goods, regional public goods and urban public goods (Sun, Study on the Marketization of Urban Public Goods, 2001). However, public goods are not fixed – they may change in a certain period of time or under certain conditions.

Rapid transit is an important part of urban public transit, and the construction period is quite long, so generally it will be under the management of the government.

2.2 Public Service

Public service refers to measures and activities offered by the government, private companies and social organizations in the provision of public goods. In the process of providing public service, the government plays a leading role. Essentially, public service is to meet the needs of the public, and to undertake social resources for public welfare. Public service is, on the one hand, passenger-oriented, which means the public should actively take the initiative to participate in the practice of public service. On the other hand, public service is to correctly handle the relationship between the public and the government: the government should provide public service so as to form a benign interaction with the public. Public service is not accidental – for a long time, public service has undergone a process of continuous development and evolution, from the beginning of the spontaneous action by civil organizations, to the practice of non-governmental, ethnic and religious organizations, and gradually evolves into the functions and responsibilities under the auspices of the government. The main body of public service is diversified, and the space and scope of public service are diversified as well. The reason why public service can be practiced and developed is the existence of public goods. Meanwhile, public service is based on morality and charity, the ultimate goal of which is to achieve the needs of the public. The importance of providing public service includes establishing a structure and improving relevant mechanisms, and ultimately, it is possible to achieve equalization of public service within the whole society.

As for the provision of public service. Firstly, the main body of providing public service is not a profit sector. In order for the nonprofit sectors to give full play to their advantages, the government should give the nonprofit sectors a certain degree of autonomy. The government should use policies, tax and other tools to constantly rationalize the relationship between the government and the nonprofit sectors, and the government itself should provide critical public service. Meanwhile, the government should strengthen the monitoring to the nonprofit sectors in the provision of public service so as to realize the interests of the public; Secondly, institutions such as hospitals, public schools, research institutes and other public institutions should be given

full play to the role of providing public service, since their functions are to provide public service. The government should strengthen the management to such institutions through the performance appraisal. For institutions that are not financially funded by the government, appropriate financial subsidies should be given. The quality of public service, the use of funds and the progress of providing public service to all public institutions should be open to the public on a regular basis so as to ensure the transparency; Finally, the government and private companies should cooperate moderately. Some special public service, such as medical care, are monopolistic, so, if all of them are handed over to private companies, then issues such as corruption will lead to the damage to the interests of the public. Therefore, the government should cooperate with private companies to provide public service through the form of diversified cooperation such as outsourcing contracts and franchising. Appropriate competition is beneficial, which will enable both the government and private companies to innovate and improve the quality of public service so as to achieve the goal of meeting the interests of the public.

In the construction and operation of rapid transit, public service can be provided by the government, private companies, or social organizations. Therefore, the government is not a single provider of public service. Public service requires the participation of other sectors, because they have a certain advantage in providing public service: they can provide new vitality for the provision of public service.

In the early stage of the construction and operation of rapid transit: the development of public service. The establishment of a scientific and effective mechanism for public service is a prerequisite to ensure the efficiency. The government or organizations that provide public service should analyze specific issues according to the interests of the public, combining with the political, economic and cultural development, and assess the environment so as to build a reasonable public service system, establish a reasonable public service operational mechanism and develop a detailed planning program. There should be step-by-step implementations so as to improve the efficiency and ensure the gradual implementation. And it is important to have a

standby plan in the development of public service so as to adequately prepare for the post-operational mechanism.

In the medium stage of the construction and operation of rapid transit: the implementation of public service. In the implementation process, the provision of public service should be based on the principles of fairness and efficiency. Public infrastructures should be improved, and technologies should be used to strengthen technological innovations. Meanwhile, it is necessary to effectively regulate the progress of the implementation of public service, the purpose of which is to assess whether ongoing public service has achieved its goal or not. If there is a deviation from public service objectives, promptly correction should be made so as to ensure the smooth progress of public service. In addition, in the implementation process, the expenditure of financial funds is also an important control content, which should be strictly implemented and allocated in accordance with the budget. Any individual or organization is not allowed to use financial funds privately, or use the money in the transfer between different projects, the purpose of which is to ensure the realization of public service and to protect the interests of the public, otherwise the development of public service will be adversely affected.

In the medium stage of the construction and operation of rapid transit: the establishment of sound monitoring mechanisms. The quality of public service should be monitored in two aspects: whether it is fair or not and whether it is valid or not. The mechanism of internal and external monitoring should be established under relevant policies, and the accountability system should be established as well. The medias should play the role of monitoring, and the government should listen to opinions from the public and carry out all-round monitoring through questionnaires, hearings and hotlines.

In the late stage of the construction and operation of rapid transit: the evaluation of public service policies. The quantifiable indicators should be set. Also, issues in the provision of public service should be analyzed and summarized so as to accumulate experience and avoid inefficiency.

3 Overview of Rapid Transit

3.1 BRT

3.1.1 Definition

Urban traffic is closely related to people's lives. The rapid development of urbanization has seen the increasing travel demand, and the environmental pollution brought by the large number of private cars need to be treated seriously as well. As one of the main mode of rapid transit, BRT should be highly developed so as to continuously promote the sustainable development of the whole society.

BRT (Bus Rapid Transit) is a bus-based public transit system designed to improve capacity and reliability compared with conventional buses. Typically, BRT has dedicated lanes to BRT buses, and BRT buses will be given priority at intersections when interacting with other traffic. BRT aims to combine the capacity and speed of subway with the flexibility and low cost of conventional buses.

BRT can save money and time of construction and operation, protect the environment, increase the speed and improve the quality of public service, and play a positive role in promoting the development of urban public transit. BRT has some similar aspects with rail transit, such as carrying capacity, speed and exterior, but the investment of which is much less than rail transit. The cost of construction and operation of BRT is one-tenth of rail transit, and the investment of constructing 1 kilometer of rail transit can be used to construct 10 to 20 kilometers of BRT (Guo, Xu, & Chen, Development of BRT at Home and Abroad, 2008). Many cities have had their own BRTs, such as Beijing, Guangzhou, Curitiba and Bogota.

3.1.2 Functions

Guide the development of other modes of urban public transit. BRT can be used as a guide to the development of conventional buses, rail transit and other modes of urban public transit through expanding the scope and ensuring the efficiency of urban public transit.

Be a supplement to rail transit. BRT and rail transit can be integrated so as to save money as well as space. Compared with BRT, the cost of rail transit is relatively high, so, BRT can be used as an alternative way to extend traffic. For example, in the junctions of urban and rural areas, rail transit can carry most passengers, while BRT plays a role of supplement, which can effectively reduce the cost of the construction and operating of urban public transit.

Play the bedding role for the future construction of rail transit. For cities with a general degree of economic development, the cost of building rail transit can be very high, then BRT lanes can be used to lay the groundwork for future construction of elevated or ground transit. Some cities are not large in size, and the construction of rail transit is not necessary, so it is more economical to construct BRT as an alternate system. Therefore, BRT plays a forward-looking role in urban planning, which can avoid wasting funds and resources to some extent.

Contribute to the sustainable development of urban public transit. BRT can save more money than rail transit, and BRT can carry more people than conventional buses, also, BRT is more environmentally friendly than private cars. Therefore, BRT should be fully developed so as to improve urban public transit network, achieve a dynamic balance among a variety of urban public transit, and continuously promote the sustainable development of urban public transit.

Reduce the financial burden of the government. Developing BRT can reduce the investment in urban public transit and play a positive role in the long-term development of a city. Firstly, the cost of the construction and operating of BRT is relatively low; Secondly, the use of eco-technologies in BRT can not only protect environment, but also save the cost of fuel; Thirdly, the

low cost of investment in BRT can lead to chain effects: the public can save travel expenses, and more people will be attracted to use urban public transit rather than private cars, which can indirectly reduce the cost of traffic congestion.

Promote cultural development and enhance the attractiveness of a city. BRT can play a positive role in the spatial layout and land planning of a city, the construction and operation of which can not only solve various traffic issues in the development of a city, but also promote the construction of urban public transit network. BRT has the characteristics of large capacity, fast speed and high utilization rate of land resources, the lanes, buses and stations of which also reflect the characteristics of a city, thus enhancing the attractiveness of a city and promoting the diversification of urban culture.

3.1.3 Typical Examples

3.1.3.1 Beijing BRT

The capital city of China, Beijing, is the first city in China to have BRT. At present, developing BRT has become the main trend in the development of urban public transit in Beijing. The reasons are listed as follows: Firstly, although rail transit in Beijing is developed, but conventional urban public transit does have some issues, such as the inconvenient transfer; Secondly, the peak hours always cause traffic congestion and other issues; Thirdly, Beijing is in urgent need of developing large-capacity urban public transit, and BRT can help a lot in meeting the passenger demand, making full use of land resources and forming a seamless network among subway and conventional buses.

In December 2004, the first BRT Lane in Beijing was officially operated. In 2005, the total length of this lane was 16 kilometers, with 17 stations. In 2008, the length of Beijing BRT reached 200 kilometers with three main lanes (Wang & Xiao, 2011).

Figure 1 Map of Beijing BRT



*From <http://environmentalresearchweb.org/blog/2009/09/update-from-beijing-1.html>

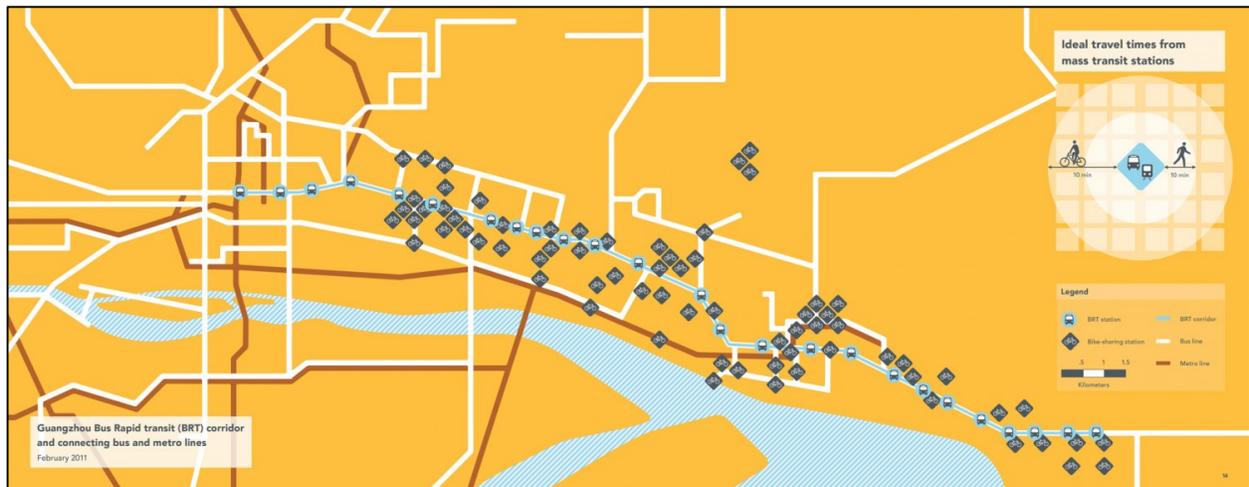
- Management agency: Beijing Public Transit Co., Ltd
- Bus types: Iveco compressed natural gas BRT bus and Neoplan diesel BRT bus
- Single articulated BRT buses with LED screens, electric lift boards, air conditioning and priority seats (Zhai, 2011)
- Island platforms, with specialized staff to maintain order
- Convenient transfer hubs between BRT, subway, and loop buses (Guo, Xu, & Chen, Development of BRT at Home and Abroad, 2008)
- Adjustment of departure interval based on traffic: during peak hours, every minute; other time, two to three minutes
- Discount on fares when using city card and student card

3.1.3.2 Guangzhou BRT

Guangzhou Zhongshan Road BRT was officially operated in February 2010 after 14 months' construction. As the largest single-lane BRT in Asian (Xiong, 2011), Guangzhou BRT has improved the commercial and residential accessibility, the traffic condition, and the vitality of land along

BRT lanes, and the construction of infrastructures along BRT lanes has greatly improved the urban environment (Tan, 2010).

Figure 2 Map of Guangzhou BRT



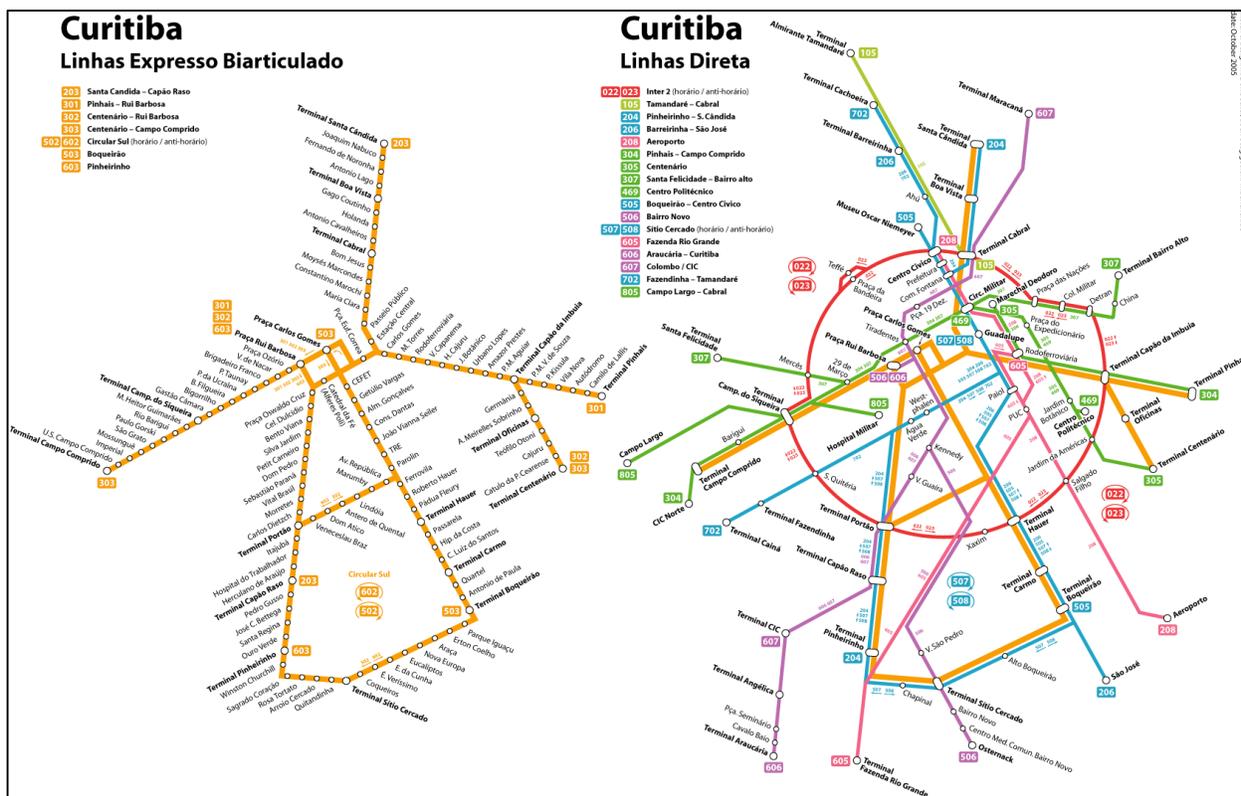
*From <https://visual.ly/community/infographic/transportation/guangzhou-bus-rapid-transit-corridor>

- Multi-function lanes with colored concrete, suitable for both BRT and conventional buses
- High capacity BRT buses using liquefied petroleum gas and low exhaust technologies
- Bike lanes and bike parking lots in every BRT station for transfer
- Platforms are built on the center of BRT lanes, with manual ticket booths and automatic card machines
- “Buy before board”, so that the operational capacity and efficiency of BRT can be greatly improved (Zhao J. , 2012).
- Discount with monthly ticket (Lee & Jiang, 2011)

3.1.3.3 Curitiba BRT

Curitiba is the most prosperous city in Brazil. Curitiba BRT was planned in 1972, and many countries have been inspired by the uniqueness, advanced design and comfortable public service of Curitiba BRT.

Figure 3 Map of Curitiba BRT



*From https://en.wikipedia.org/wiki/Rede_Integrada_de_Transporte

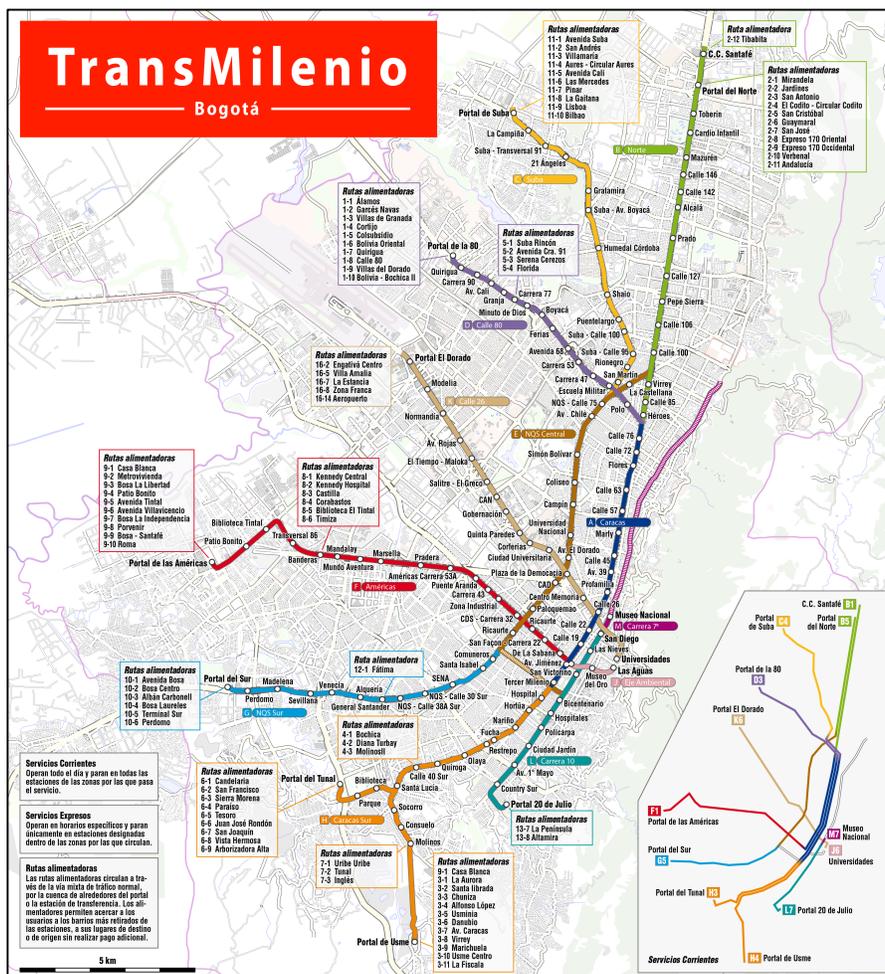
- Construction principles: Make full use of land resources; Use large capacity and fast BRT buses to ensure the operational efficiency and satisfy the high-density passenger demand in Downtown Curitiba; Improve the construction of infrastructures; Save money.
- Management agency: Curitiba municipal government and other private companies. The loans of private companies are guaranteed by the government. A total of 10 private companies are responsible for BRT maintenance. BRT fares are decided and monitored by Curitiba Bus Authority.
- One loop lane with five radial lanes. Each main lane is divided into three parallel lanes, and the central lane is for BRT buses only. The government encourages the full use of land resources between BRT lanes and other lanes.
- Red double articulated BRT bus using diesel
- Cylindrical BRT stations, the unique design of which can improve the operational efficiency, protect passengers, and become a beautiful scenery of Curitiba.

- The departure interval is one minute.
- Environmental protection. More than 70% of the public have chosen to travel by urban public transit, especially BRT, instead of driving private cars.

3.1.3.4 Bogota BRT

Bogota is the capital city of Columbia, and it is also the largest city in that country. Bogota has invested nearly \$ 1 billion to improve the construction of public infrastructures, including BRT, which was officially operated in 2000.

Figure 4 Map of Bogota BRT



*From <http://www.citymetric.com/transport/what-bus-rapid-transit-and-why-doesn-t-every-city-want-one-2362>

- Use red articulated buses with the combination of double-doors and single-door. According to speed, BRT buses are divided into express, regular and regional buses.
- BRT stations are located on the center of BRT lanes so as to facilitate the acceleration and deceleration of BRT buses. Complete infrastructures, including sidewalks, crossings and so on.
- GPS and other intelligent devices reporting information to the dispatch center every 6 seconds.
- As part of the municipal infrastructures supported by the government, Bogota BRT is under the monitoring of the government, and private companies can have the franchise through competitive bidding. The way to obtain money is raising funds, with financial subsidies given by the government.
- Third party organizations involved. The biggest feature of Bogota BRT is the establishment of a management company called TransMilenio, which monitors the construction and operation of Bogota BRT, and also maintains BRT buses, BRT lanes and other issues.

3.2 LRT

LRT (Light Rail Transit) is a kind of rapid transit based on electrically powered light rail vehicles that operated on a track in a segregated, right of way. They are designed to deliver rapid, reliable and safe public service.

With higher capacity than other urban public transit, LRT will carry passengers in reserved transit lanes separated from regular traffic. Vehicles will be low floor with multiple entrances that are accessible to customers with all levels of mobility.

As two different kinds of rapid transit, LRT and BRT are very similar in many aspects such as stations and operational mode. However, the major difference is that BRT is more like conventional buses, using single or double-decker and bi-articulated buses and bus lanes so as to

ensure the high efficiency and low construction fee, while LRT is more like conventional rail transit – several cabins with fixed tracks.

3.3 Revelations

Rapid transit has characteristics of convenience, punctuality, accessibility, comfort and so on, which are conducive to the construction of urban public transit network and can promote the intensive use of land resources as well as the rapid development of economy.

As for revelations. Firstly, pay attention to the quality of public service. The construction and operation of facilities should be focused on, and the quality of public service should be improved as well, which are key factors to ensure the success of rapid transit. So, in the process of construction and operation, improving the quality of public service should be set as a main goal; Secondly, the rational use of funds. The biggest feature of rapid transit, compared with conventional urban public transit, is that the construction cost is relatively lower. If the operation process is managed by private companies, the financial burden of the government will be greatly reduced. So, developing rapid transit as the main mode of urban public transit is an effective way to save money; Thirdly, the flexible combination of different facilities of rapid transit. Many cities have adopted a combination of loop and radial lanes, which is based on the city's basic urban planning and lane conditions. Rapid transit should combine with other urban public transit so as to promote the formation of urban public transit network.

4 Tianjin BRT

4.1 Gangcheng Avenue BRT

Overall Development Plan of Tianjin (2005-2020) aims to "give priority to the development of urban public transit, rationally guide the development of private cars, optimize urban public

transit network, create a friendly environment for bicycles and pedestrians, improve the efficiency of traffic, and make a modern integrated urban transit system consisting of rail transit and buses". Meanwhile, in the 12th *Five Year Plan*, the government also gives much priority to the development of urban public transit.

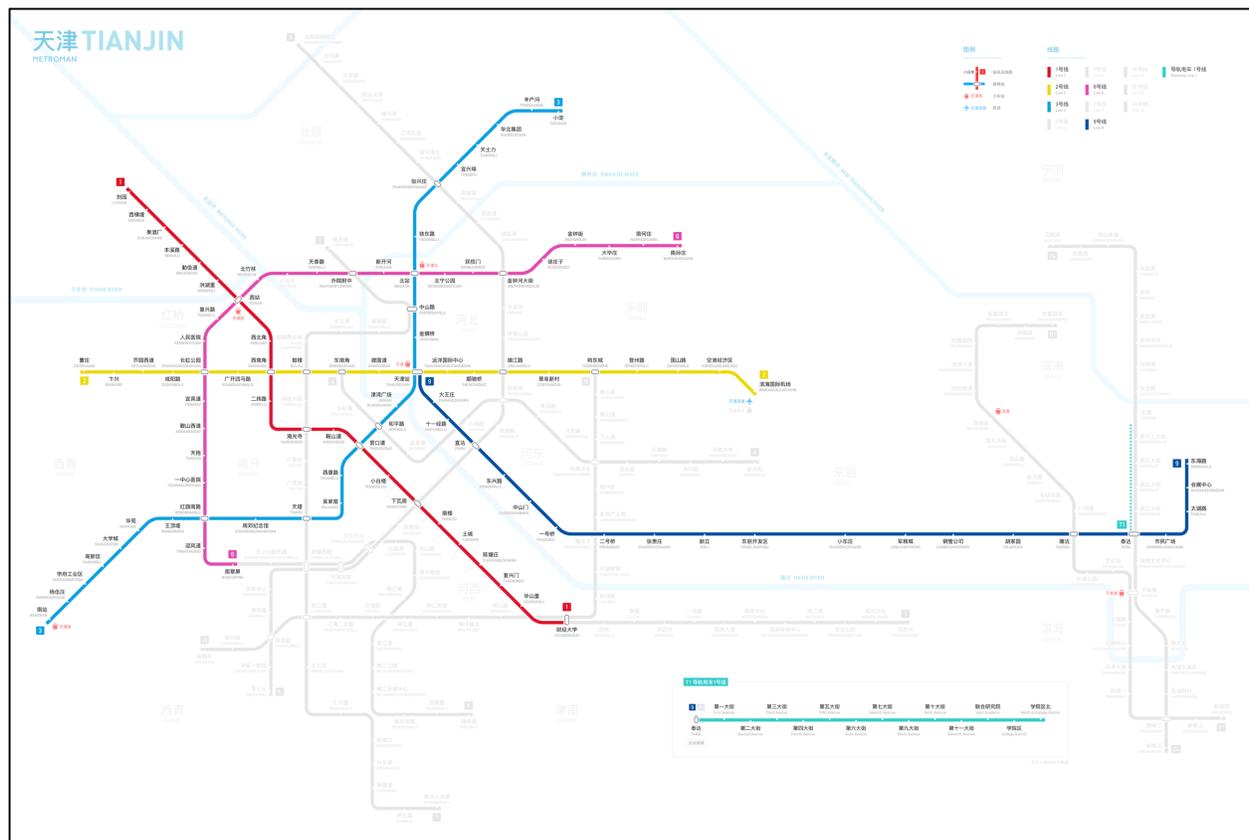
Gangcheng Avenue BRT is the first BRT lane in Tianjin, the successful construction and operation of which have promoted Tianjin into the "rapid transit era".

At present, with the development of regional integration, Tianjin is under constant development. The city scale is expanding, people are enjoying better living standards, and traffic demand is increasing significantly. Tianjin is ideally located in the heart of Bohai Bay, with the largest port in northern China and a large amount of land resources. Advantages of the location of Tianjin are obvious – it is an important bridge to communicate east and west, and it also plays a key role in promoting the economic and trade development of Northeast Asian. So, it is necessary to put urban public transit as a priority to develop, use scientific planning to improve urban public transit network, strengthen the construction of urban public transit infrastructures, and use high-quality public service to solve the increasingly serious traffic congestion.

Gangcheng Avenue is located in Tianjin Binhai New Area, the total length of which is about 19 kilometers. As the main lane in the central and western regions of Binhai New Area, Gangcheng Avenue plays a key role in strengthening the construction of urban public transit network in Binhai New area, which also promotes the investment environment and strengthens the relationship between Downtown Tianjin and Binhai New Area. Around Gangcheng Avenue there are many industrial parks such as Binhai High-tech Zone and Airport Logistics Processing Zone, and some residential areas as well. However, the employees who work in these zones mainly live in Downtown Tianjin and other areas such as Tanggu and Zhongxin Ecological City, so, in order to meet the travel needs of employees and residents, and promote the sustainable development of these industries, a rapid transit lane with fast speed and large capacity so as to connect all these industries and residential areas to the transfer hub is a must.

Gangcheng Avenue BRT is planned and constructed by the Tianjin municipal government, monitored by Tianjin Public Transit and Port Administration, and operated by Tianjin Public Transit Group. Tianjin BRT not only serves the public, but also becomes an important symbol of the modernization of Tianjin. Using Gangcheng Avenue BRT as a test lane can provide a good opportunity for Tianjin to improve traffic conditions and give priority to the development of urban public transit.

Figure 5 Map of Tianjin BRT



*From https://en.wikipedia.org/wiki/Tianjin_Metro

- Intelligent management system: Monitored by the dispatch center; Optoelectronic and wireless communication technologies; GPS; LED screens on BRT buses and in BRT stations (Cao & Bai, Brief Introduction of Gangcheng Avenue BRT in Binhai New Area, Tianjin, 2011).
- Diesel-electric hybrid buses

- The departure interval is 5 minutes, which will be shortened according to passenger demand.
- Dedicated channels will be set for disabled people.
- Staff responsibility system

4.2 Necessities

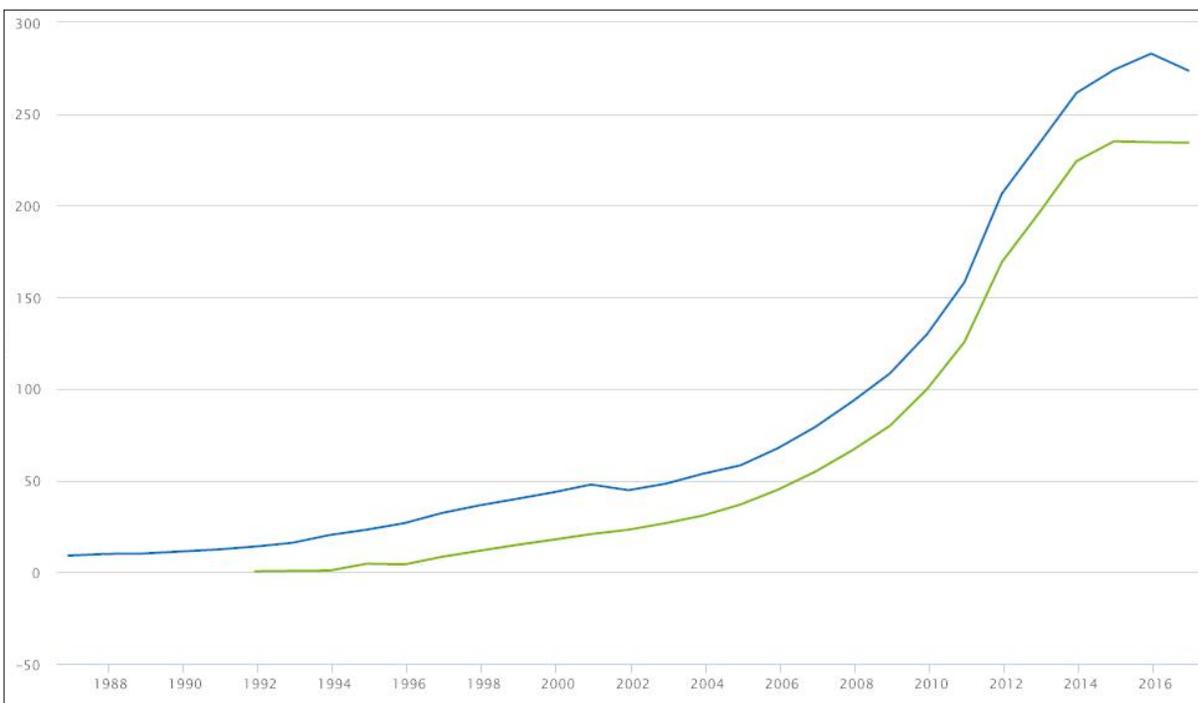
Urban development strategies. Due to the rapid economic and social development, public service in Tianjin has diversified and modernized. The development of motorization and the process of regional integration in Tianjin are accelerating, making an urgent request for the improvement of urban public transit network and the expansion of city scale. At present, the development space of Downtown Tianjin is far from meeting the development of urban public transit and economy. Therefore, the government has come up with detailed plans emphasizing the strengthening of the construction of urban public transit infrastructures so as to ease the traffic pressure.

Bus priority policy. According to *Overall Development Plan of Tianjin (2005-2020)*, the bus priority policy should be implemented so as to establish and improve urban public transit network and further optimize bus lane layout.

Improve traffic conditions. The current issues facing traffic development in Tianjin are listed as follows: Firstly, urban public transit fares are relatively high, which is also one of the main factors determining whether the public chooses urban public transit or not. At present, the conventional bus fare is fixed, and the long-distance bus fare and the subway fare are based on the number of stations. A large number of the public does not choose to take urban public transit to travel due to high fares, which requires the construction of low cost, high efficiency and high capacity urban public transit, such as BRT. And the government should encourage social funds to participate in the construction and operation of BRT so as to save cost and promote the continuous development of urban public transit; Secondly, the traffic pressure of Tianjin is growing. At

present, Tianjin is in the fast development of motorization. If not give priority to the development of urban public transit and control the number of private cars, not only will land resources be wasted, but congestion will become increasingly serious as well. Meanwhile, exhaust emission has caused serious pollution to the atmosphere.

Figure 6 Changes of the Total Number of Civilian Cars and Private Cars in Tianjin



*From <http://d.qianzhan.com>; The blue line represents the total number of civilian cars in Tianjin; The green line represents the total number of private cars in Tianjin. The unit is ten thousand.

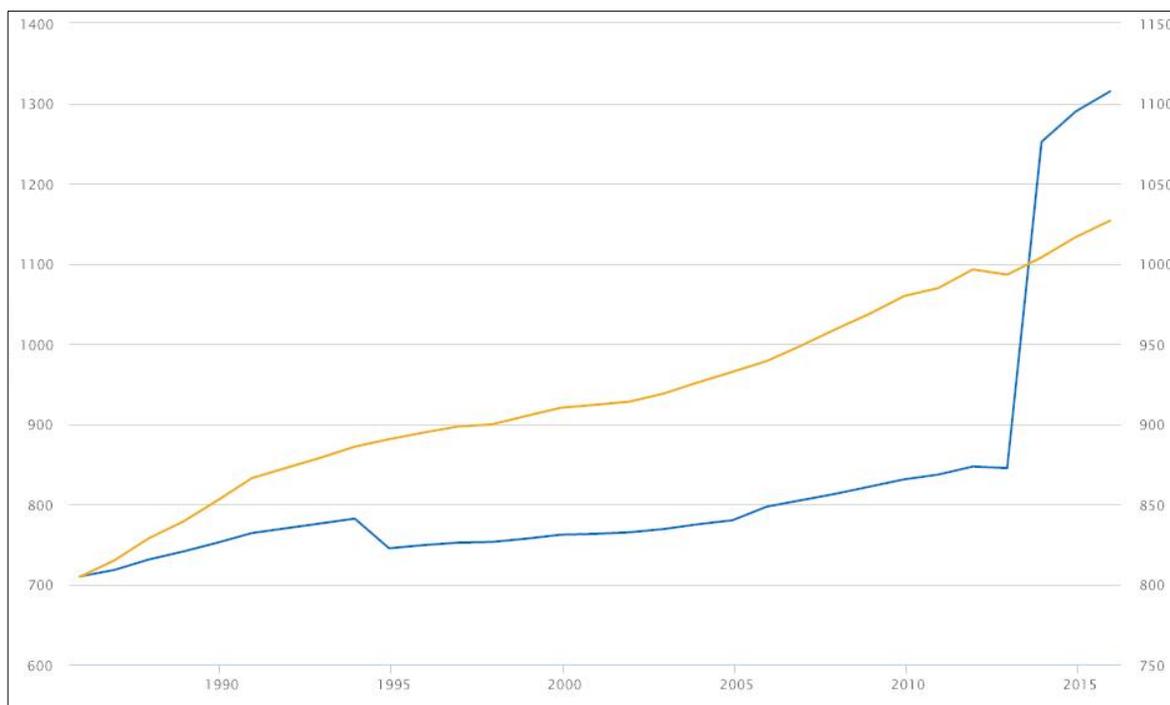
Thirdly, urban public transit infrastructures are imperfect. At present, conventional urban public transit in Tianjin is under construction and improvement, but the transit network between conventional urban public transit and BRT has not be formed yet. There is an urgent need to increase the investment to the construction of urban public transit infrastructures, such as standard sidewalks, bike lanes, additional transit hubs and parking lots so as to meet the travel needs of the public and provide the public with better public service.

4.3 Feasibilities

Economic development. The rapid economic development of Tianjin began in Yuan Dynasty, which was about 700 years ago. At that time, the economic development in Tianjin mainly relied on salt industry, and the prosperity of salt industry promoted the development of Tianjin and surrounding areas, laying a good foundation for the further economic development of Tianjin. At present, Tianjin has become one of the most economically developed cities in China, the economy of which has maintained a good momentum of development. The aerospace, petrochemical, equipment manufacturing and other pillar industries in Binhai New Area lead the industrial development and promote the upgrading of industrial structure in Tianjin.

Population and traffic. Under normal circumstances, if one person travels three times a day, and the population of a city is 500,000, then the daily travel volume of this city is about 1,500,000 (Deng, Chen, & Ding, 2010). The population of Tianjin is more than 1,500,000, which means the daily travel volume is more than 4,500,000. BRT is a necessity in Tianjin to meet the needs of large-scale traffic. It has been expected that from 2000 to 2020, the daily travel volume of Downtown Tianjin will increase by more than 30%, from 9,456,800 to 12,648,800 (Ma, Cao, & Fan, 2007). With the diversified development of urban traffic, urban public transit has also become more diversified. Under normal circumstances, the choice of the public is largely based on their travel distance and travel destinations. If the distance is far, or the time is urgent, or there are convenient parking lots near destinations, they may choose to drive; If there is perfect urban public transit and perfect public service, the public will choose the nearby urban public transit to travel. So, the use of BRT will not only save travel cost for the public, the convenient and comfortable public service of which can also meet their travel needs.

Figure 7 Changes of the Population and Its Density in Tianjin



*From <http://d.qianzhan.com>; The blue line and the left figures represent the population density of Tianjin, and the unit is per square kilometers; The yellow line and the right figures represent the population of Tianjin, and the unit is ten thousand.

Utilization of land resources and traffic conditions. Tianjin is rich in land resources, but there are only 32,937 hectares for traffic, accounting for only 2.76% of the total land resources. Therefore, land resources available for urban public transit are limited, and how to use the limited resources to create unlimited value is a big question to be considered. With the economic development and the continuous improvement of living standards of the public, Tianjin has more and more urban public transit, and more and more people in Tianjin is willing to choose urban public transit to travel.

The overall traffic development plan. The planning of Tianjin urban public transit will put rapid transit as the main mode to build a diversified urban public transit network. From the second half of 2013, traffic lanes in Tianjin started to be modified, and in the next three years until 2016, there were a bigger urban public transit network in Downtown Tianjin, with the length of 194

kilometers, which can be used by more than 85% of the conventional urban public transit. Through the improvement of lanes such as the flatness, all kinds of buses will increase speed, thus saving a lot of time for the public, providing passengers with better public service, and gradually transferring the way the public travel from driving private cars to using urban public transit. In the next five years from 2018 to 2023, there will be two BRT lanes on the basis of the construction and operation of the 228-kilometer urban public transit network (Hou, 2013).

4.4 Functions

Gangcheng Avenue BRT is consistent with the layout of Tianjin to some extent, and it can realize the traffic accessibility between Binhai New Area and western regions. Gangcheng Avenue BRT is advanced in the aspects of lane width, isolation facilities and load capacity, and it can make full use of land resources and save money.

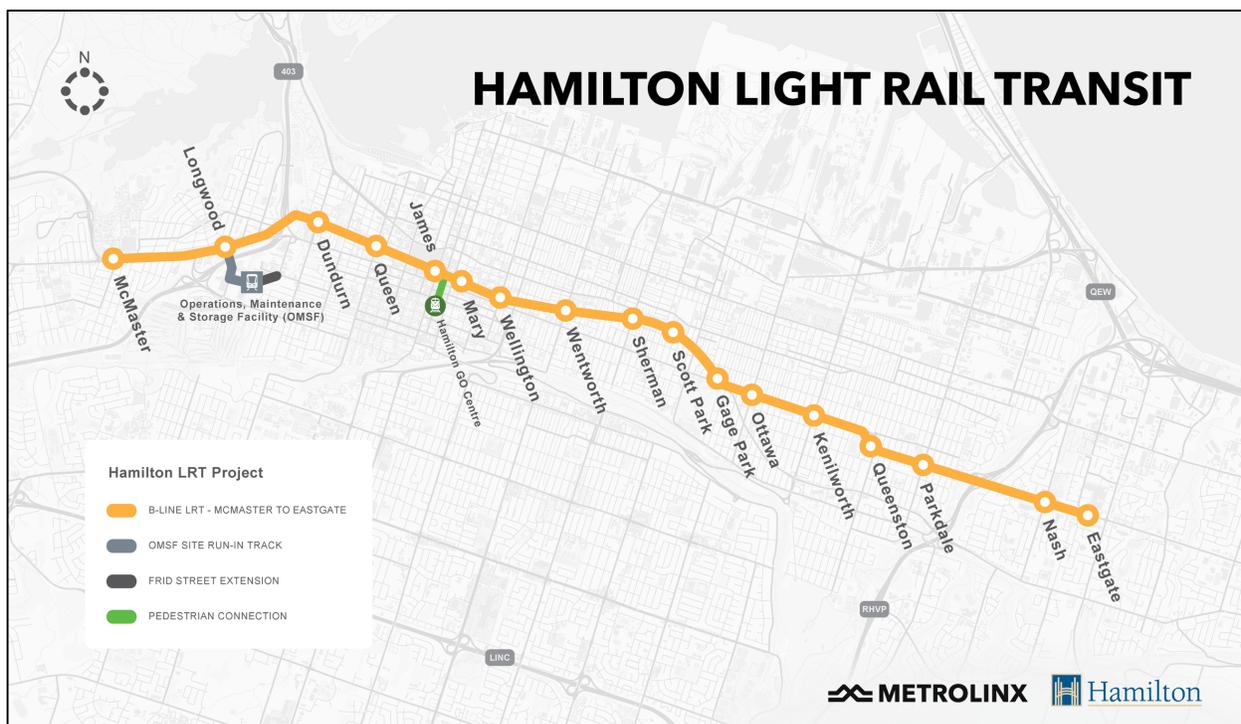
Gangcheng Avenue BRT can optimize the investment environment in Binhai New Area and support the development of functional zones such as aerospace and oil industries, and it can also provide public service for employees and residents (Gao, 2012).

Gangcheng Avenue BRT plays a demonstration role in the construction of trans-regional transit network. It is the first rapid transit in Tianjin, the construction, operation, and relevant management mechanisms of which are very important, and it also plays an important role in the future development of urban public transit in Tianjin.

5 Hamilton LRT

5.1 Why Hamilton

Figure 8 Map of Hamilton LRT



*From http://www.metrolinx.com/en/projectsandprograms/transitexpansionprojects/hamilton_lrt.aspx

LRT was chosen by the province for Hamilton because, of the two rapid transit options studied, it generated the most transit and economic benefits. *Metrolinx Benefits Case* (Metrolinx, 2010) concluded that while LRT was a more expensive option compared to BRT, it promised \$850 million in transit user benefits and another \$144 million in investment and development. BRT, by comparison, promised roughly half those benefits. A report from the Canadian Urban Institute says that LRT will bring economic uplift to Hamilton, including more tax assessment along the route, generating more tax dollars for Hamilton because of a "LRT premium" on nearby properties.

Located at the western corner of Lake Ontario, Hamilton is positioned uniquely as the western center of the Greater Golden Horseshoe, and functions as a western gateway to GTA. Hamilton is well positioned to exploit its geographical proximity to Toronto, the largest business center in Canada, particularly considering the proposed electrification of the GO Lakeshore Line and improved travel experience for the estimated 92,000 commuters that travel between Toronto

and Hamilton. The B-line rapid transit in conjunction with the GO Lakeshore improvements will provide Hamilton with strong transit-oriented commuting options as well as provide the opportunity to revitalize the city as an attractive, dynamic, and environmentally sound community for people and businesses to visit, work and live.

An investment in rapid transit is also an important piece of the city's plan to rejuvenate the urban core and support its economic and cultural transition. Hamilton's traditional and pedestrian friendly street grid, combined with its stock of heritage and older buildings, waterfront and escarpment topography, make for an urban fabric that is well-suited to a transit-oriented and sustainable lifestyle. Given these natural and historic characteristics, Hamilton is well positioned to attract and accommodate the significant growth expected in the Greater Toronto Area over the next 25 years. A higher-order transit corridor will connect key activity centers, destinations, and link key areas of future economic development. However, such an investment must be made within the context of an overall strategy where a transit investment alone is not sufficient to fully capitalize on this advantage. Together with appropriate city planning and economic development initiatives, rapid transit can play an important role in the transition to a knowledge-based and sustainable community and economy.

Hamilton has made an effort to ensure all plans and strategies are pro-active in enhancing the city as a successful urban center. Hamilton is in the process of updating its economic development strategy. The strategy will target multiple areas of city-building, including business development, community revitalization, and attracting a 21st century labor force. A rapid transit line could contribute to all of these goals. Aside from the obvious community and quality of life impacts, an investment in rapid transit also fits particularly well with the approach to infrastructures for innovation, which will link the existing and future nodes of research and technology commercialization in Hamilton. By facilitating such linkages along the city's primary east-west corridor, an investment in rapid transit is likely to enhance the attractiveness of the city to potential developers who will benefit from the marketability and increased demand for

prospective development sites along the corridor. Overall, a rapid transit lane has the potential to generate many synergies with other complementary initiatives in Hamilton.

5.2 Objectives

Hamilton Rapid Transit Initiative has several broad objectives in conjunction with MoveOntario 2020 and Metrolinx RTP, including: increase transit ridership; put pedestrians and transit first in planning the corridor by enhancing the streetscape and creating a more pedestrian-friendly environment; improve the city's business, tourism and development appeal; provide effective connections to neighboring transit systems in Brantford, Burlington and so on.

In addition to these broad objectives, the proposed enhancements to the rapid transit network, beginning with the implementation of rapid transit service along the B-Line corridor, also aim to achieve more specific goals, including: promote new development and investment along its key corridors and at strategic nodes; support opportunities to redevelop and intensify existing developments; support and revitalize existing and future development areas such as McMaster University, West Hamilton Innovation Park and Downtown Hamilton, and businesses; provide a choice of travel modes that support and inter-connect to each other at both a local (trails, cycling, walking) and inter-regional level (GO); improve access to key activity centers such as recreation and sporting facilities, arts center and convention center; achieve local and regional environmental objectives; promote a sustainable community.

5.3 Problems

Money. Hamilton has received \$1 billion from the provincial government for rapid transit, but this amount of money is for LRT only. However, the construction and operation of LRT will inevitably update some hardware of other modes of urban public transit, such as electronic and transfer systems, so, how to get extra money for these necessities is a rather urgent issue

LRT route planning. The LRT route is along Main Street in the western and eastern portions, but in between, it goes down King Street. As for the mountain and other areas of Hamilton with HSR only, the construction of LRT routes can cost a lot of time and money, so, there should be a standard to decide the necessity of adding extra LRT routes.

6 Problem Solving

6.1 PPP (Public – Private – Partnerships)

What is PPP? During the process of cooperation between the public sectors and private sectors, sources from private sectors participate in the provision of public goods and public service, so that the functions of the public sector can be achieved, and private sectors can also benefit.

BOOT (Build – Own – Operate – Transfer) is a typical mode of PPP: an agreement is set between the government and private companies, and private companies will be given a certain degree of autonomy to raise money, operate a project and get income, and risk will be shared with the government, then the government will own the project in the end.

Tianjin municipal government has signed a 36-million CAD BOOT agreement with Tianjin Binhai New Area Construction & Investment Group Co., Ltd and a French heavy industry called LOHR to further develop Tianjin BRT.

In Canada, the federal conservative government under Stephen Harper in Canada solidified its commitment to P3s with the creation of a crown corporation, P3 Canada Inc., in 2009. At lower levels of government P3s have been used to build major infrastructure projects like transit systems, such as Viva Rapid Transit and Ontario Highway 407, and to build public buildings such as schools. So, the construction of Hamilton LRT could follow this pattern, which means using P3s

to raise money, operate Hamilton LRT and get income, and share risk with the government, finally the government will own Hamilton LRT.

6.2 Public Consultation

Public consultation is a regulatory process. Its main goals are to improve the efficiency, transparency and public involvement in large-scale projects. It usually involves notification, consultation and participation.

In order to make the route planning, Tianjin Transportation Group Co., Ltd, Tianjin Rail Transit Group Co., Ltd and Tianjin People 's Congress have united to accept public consultation and supervision, adopt public opinion so as to maximize the benefits of Tianjin BRT.

As for Hamilton, a public information center can be established so that community members and a diverse group individuals can attend to learn about new developments to the project, to consider the challenges and opportunities that might arise from the implementation of LRT and to provide input into the decision-making.

7 Conclusion

Rapid transit is an important part of urban public transit, and it plays an important role in the sustainable development of a city. Tianjin and Hamilton are in different stages of developing rapid transit: the former will further optimize the existing BRT lane and speed up the construction and operation of new BRT lanes so as to gradually develop its urban public transit network; the latter is still in the planning stage, but the experience from Tianjin BRT will help better develop Hamilton LRT.

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