

Promoting Public Transport for Sustainable Urban Development in Hanoi

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Abstract: Public transport is a civilized transport mode, saving time and travel costs for residents, reducing the amount of personal vehicles in traffic, solving traffic congestion of the city, reducing air pollution and saving fuel energy. In early 2000, the Hanoi People's Committee has advocated focusing on developing the public transport network with the target set is to increase triple public transport rate. The public transport only accounts for 10% of the motor vehicles, and Hanoi's bus service meets about 10% on travel needs of people, transporting more than 1 million passengers per day. The bus service is expected to meet 13% of people's travel demand in 2014 and targeting to meet 25% of demand in 2020. This paper is to present (i) the trend of transport mode change in Hanoi, (ii) public transport development in Hanoi, and (iii) some recommendations to promote public transport for sustainable urban development in Hanoi.

Keyword: Transport Mode, Transport Mode Change, Public Transport, Public Bus Service

1. THE NECESSARY OF RESEARCH

After the expansion from August 1, 2008, the total area of Hanoi is 3.345 km², or 3.6 times the size of the previous area. Hanoi becomes the largest city of Vietnam managed by Central government among with four other cities. Currently the Hanoi has 30 administrative divisions of the district levels, including 1 town, 12 districts and 17 town-districts. The population of Hanoi is currently 7.327 million people, double in comparison with the old Hanoi and ranks the second in population of Vietnam. Population density of Hanoi is 2,059 people per km² in 2012; and 2,204 people per km² in 2013, ranked the second in Vietnam, and distributes unevenly among district level administrative units. The city's population grew at an annual rate of approximately 2.8%. Currently, most of this new population is rural migrants migrating from surrounding provinces (GSO, 2013).

GDP per capita of Hanoi increase from 1.697 USD/ person in 2008 to 2.257 USD/ person in 2012, and achieved approximately 2.600 USD/person in 2013. The growth rate of Hanoi in 2013 is 8.25%, relatively higher than the whole country of 5.5%. Hanoi nowadays is the centre of culture, politic, economic, commerce and tourism in the North of Vietnam.

The expansion of the city area by three times, together with the increase of population by two times has put more impacts to the traffic system of Hanoi. Hanoi is facing a significant increase of the personal vehicles. The problems of traffic congestion arise, the emission from private vehicle increases significantly as well as urban air population is worse. Estimated cost lost for fuel consumption and labor in Hanoi was up to 600 million USD per year (Phan Duy Toan, 2012), and thousands of tons of CO₂ from vehicles were emit into the atmosphere. In addition, traffic congestion also has negatively impact on the health of people as increase the risk of lung disease and heart attack. Encouraging public transport use is the reasonable and economic solution for Hanoi to limit personal vehicle. Currently public transport in Hanoi mainly is public bus service. However, Hanoi's bus service only meets about 10% on travel needs of the people (Tramoc,

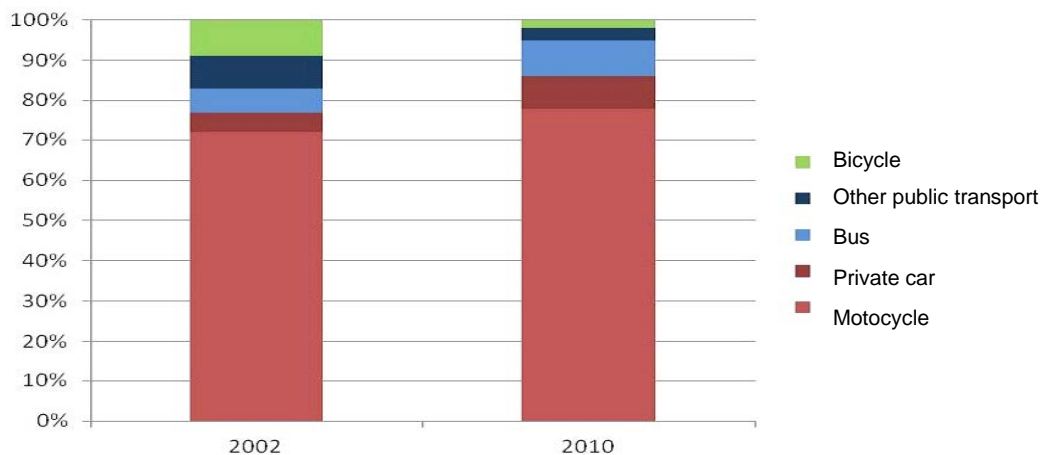
2014). Therefore, it is needed to study the trend of transport mode change in Hanoi, current situation of public transport development and recommendations to encourage and develop the public transport in order to attract people to use, helping to limit personal vehicles and to reduce pollution and congestion, contributing to the sustainable and green urban development.

2. RESEARCH WORK AND METHODOLOGY

The research work is based on qualitative method by collecting second data in the field of public transport in Hanoi, collecting relevant documents from Ministry of Transport (MOT), Hanoi Public Transport Management and Operation Centre (TRAMOC), and other resources from relevant offices. The research makes qualitatively an assessment and analysis of transport mode change situation, public transport development situation in Hanoi, and makes some recommendations for promoting public transport development in Hanoi. The research also applies simulating method, learning experience from public transport development of other urban in the world such as Japan, Taiwan, Malaysia, Beijing etc.

3. THE TREND OF TRANSPORT MODE CHANGE IN HANOI

Hanoi traffic systems are diversified, including public transportation such as bus, taxi and private transportation such as motorcycles, cars, pedicabs (or cyclo), bicycles. In particular cyclo often served to tourists. Hanoi is also the focal point of railway system and the largest airline in the North. Along with the increase in population, traffic vehicles in Hanoi are also increasing rapidly and the diversity of species. Currently, the city manages more than 4.3 million vehicles. With the increasing population and private vehicles, Hanoi is facing a significant increase of the personal transportation. The lane becomes narrower, difficult traffic conditions, even chaotic, problems of traffic congestion arose.



Source: TRAMOC 2002, Molt C. 2010, adopted from Le Thi (2012)

Figure 1. Split of transport mode change

From 2002 to 2010, there is a change between different types of means. Percentage of motorcycle riders increased, bicycles decreased significantly, buses increased. However, the type of traffic and other public tends to decrease significantly. High rate of motorized vehicles leading to a number of problems such as environmental pollution, traffic accidents, traffic congestion, reduce the quality of life of urban residents. The road is always crowded by vehicles that have divided the city into isolated areas with the remaining areas.

Bicycle, electric bicycle, electric motor-bicycle are used more in recent year. Especially electric bikes and sport bicycle are used increasingly among teenagers and elders. This type of

vehicle will be helpful in saving energy and non-emission. However, there are not any data or research about these vehicles, including sport bicycles.

Table 1. Structure of transport modes in Hanoi

Year 1980			Year 2000			Currently		
Bike	Car, Motorcycle	Public transport	Bike	Car, Motorcycle	Public transport	Bike	Car, Motorcycle	Public transport
80%	5%	15%	65%	>30%	<5%	2-3%	87-88%	10%

Source: <http://vnmedia.vn/> dated 9 August 14

Table 2. Hanoi transport modal split (2008)

	Modal split
Buses	10.7%
Tourist buses	1.8%
Cars and mini vans	4.0%
Motorbike	80.8%
Bicycle	2.5%
Light trucks	0.2%

Source: Le Thi, 2012

Hanoi was the city of bicycle and public transport until the late of 1980's. In 1986 with the economic reforms of *Đổi Mới* and the city was experienced impressive economic growth (between 7% and 8% per year since the early 2000s), many urban citizens were able to afford and use motorcycles and cars.

- Decade 80-90: Electric cars and bicycles are vehicles primarily.
- In the mid 1990s, the operation of Hanoi traffic shift from bicycles to motorcycles
- Between 2000, Hanoi is a city depends on motorcycles

The number of motor vehicles: According to the Hanoi Department of Transportation, in 2010, motorcycles accounted for 78% of the total number of vehicles. In 2011, there are about 4.1 million vehicles of which 3.7 millions are motorcycles and motorbikes, and nearly 380 thousands are cars. At the end of 2013, the total number of vehicles in Hanoi is 5,128,907 vehicles, of which 4,660,314 are motorcycles and 486,593 are cars (Xuan Tung, 2013). Hanoi accounts for about 1/6 the amount of cars, and 1/8 the amount of motorcycles in comparison with the total number of vehicles in the whole country (Ha Tran, 2012). Motorcycles increased by 13%/ year, averaging 600 motorcycles/1000 population. The average growth rate of vehicle of Hanoi is about 10 - 15% per year.

Table 3. Number of motorcycles and automobiles circulating in Hanoi

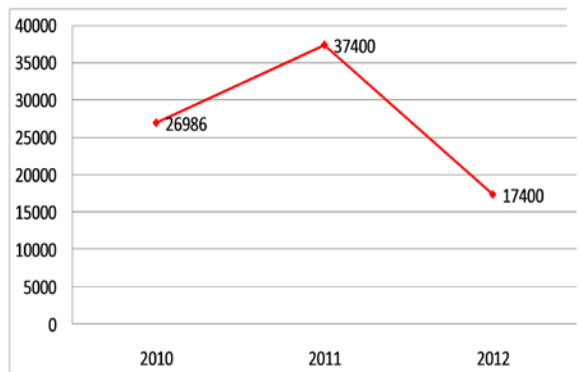
Target	2009	2010	2011	2012	2013
Number of circulating motorcycles	3,700,000	3,740,000	3,700,000	4,236,034	4,660,314
Number of automobile traffic	302,000	368,214	395,200	432,600	486,593
Number of newly registered cars		26,986	37,400	17,400	

Source: <http://tienphong.vn;> <http://ashui.com;> <http://24h.com.vn>

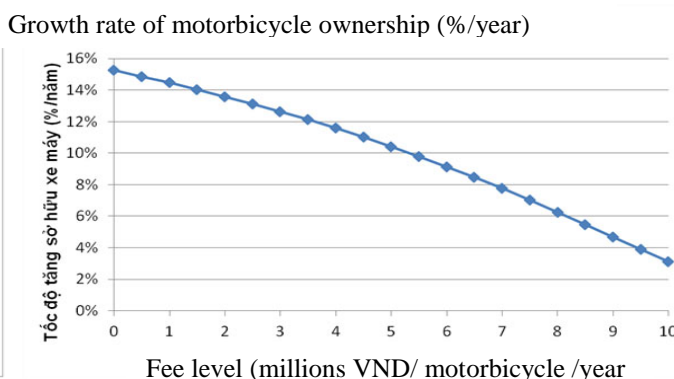
The percentage of personal vehicle ownership: Personal vehicle ownership rate, especially motorcycles has increased rapidly. In 2006, 84% of households owned a motorcycle in which over 40% of households had 2 or more motorcycles. To date almost 90% of families have motorcycles. Although the percentage of car ownership is still low, at about 2% of the total population, but this figure is growing rapidly, and becomes a risk of traffic congestion in some areas. With economic growth rate of 8.25% by the year of 2013, and 1.5 times higher than the growth rate of the whole country, it can be expected to lead to further increases owned personal vehicles as motorcycles, cars, etc., as having the better economic life.

01 January 2012, Hanoi raised the registration fee to register new cars by 20%, the number of new registered cars decreased significantly by 62.5% compared with 2011 (as figure 2). So after almost 2 years of raising registration fees for new cars, together with the number of policies limiting personal vehicles plus the economic downturn, the number of newly registered cars Hanoi continued to decline strongly in 2013. The same effect on motorcycle ownership in

figure 3 shows as the fee of motorcycle circulating increases, the growth rate of motorcycle ownership will reduce significantly.

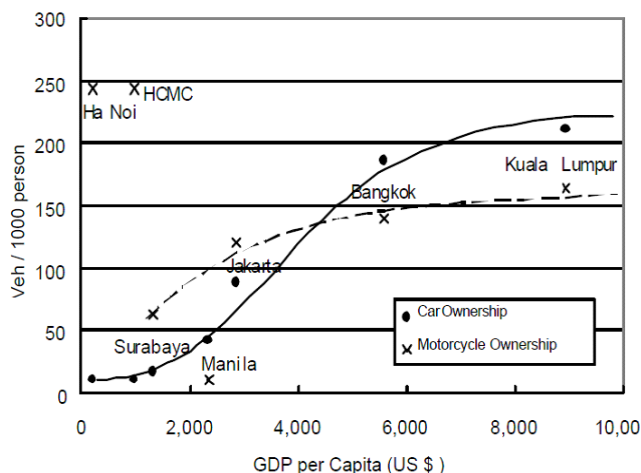


Source: Data from table 2
Figure 2. Number of new cars registered in Hanoi

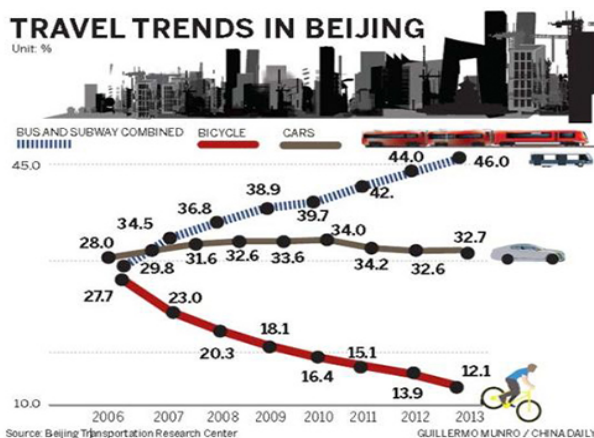


Source: Vu Anh Tuan, 2013
Figure 3. Calculated impact of circulating motorcycle fee

Car ownership in Hanoi has still been very low number. On contrary, motorcycle ownership is extremely high in comparison with other Asian cities. As in the figure 4 below shows as every 4 Hanoians, one will own a motorcycle. Thus, the very heavy traffic in the city center comes from the high percentage of motorcycles and the greatest danger is the further increase of private cars, which use a lot of road space.



Sources: Houtrans, Almec Co. JBIC research
Figure 4. GDP per capita and vehicle ownership



Source: Trang Linh, 2014
Figure 5. Travel trends in Beijing

Beijing is developing as "a giant" with increasing population pressure. The Beijing population grew from 13.6 millions in 2000 to 21.1 millions in 2013. By the end of 2013, Beijing had owned 17 metro railway routes with a total length of 462km and 277 stations. According to the statistic of Center for Transportation Research of Beijing, passenger transport capacity has reached 3.2 billions passenger pax in 2013.

Public bus system in Beijing is also developing rapidly, becoming one of the most crowded urban transport systems of the whole country. By the end of 2013, the city has 785 bus routes, including the districts, towns in the city center and suburbs. Annual passenger capacity of public bus has reached 7.8 billions people. According to the Beijing Public Transport Holdings, there were more than 4.63 billions people using public buses in 2013.

Although public buses are encouraged for short distances (within 10 km) and the subway for longer trips, but many passengers were riding the subway because of low ticket prices. Statistics from the center also pointed out that in 2013, 32.7% of passengers use the metro to travel the distance for about 10km and about 60% of passengers to travel less than 16km. According to the Beijing Subway Group, since July 2013, passenger volume per day reached 11.5 millions people. Passengers in the peak hours accounted for 45% of total daily.

Source: Trang Linh (2014), "Beijing: solving overload issues of public transport", <http://vovgiaothong.vn/giao-thong-quoc-te/bac-kinhgiai-bai-toan-qua-tai-giao-thong-cong-cong/3731>

Due to the poor road infrastructure, and the absence of mass rapid transport systems, most of city center social activities have based on motorcycle transportation. Traffic congestion is particularly severe in morning and afternoon peak hours. With the trend of vehicle mode change, as the number of private vehicles increase rapidly, infrastructure has not kept in pace with economic growth, the development of public transport, firstly especially the bus system, will be reasonable and economic option to reduce traffic congestion and environmental pollution caused by vehicle emission.

4. PUBLIC TRANSPORT DEVELOPMENT IN HANOI

4.1 Over View of Hanoi Socio – Economic Development

Population Growth: According to the Master Plan of Hanoi Socio-economic 2020-2030, the population size is about 7.9 to 8.0 million people in 2020, and approximately 9.2 million people in 2030, of which people living in urban areas are more than 6.3 million, nearly 3.1 million in rural area. Until then, Hanoi is a multi-polar and multi-center urban with five satellite urban clusters. With the population growth above, the transport demand will also increase rapidly.

Economic Growth: The average growth rate of the city's GDP reached 10.38% per year in the period 1996 – 2000 and 8% per year in the period 2000-2013. Average GDP per capita of Hanoi increased from 915 USD in 1990 to 2,200 USD in 2011 and 2,700 USD per capita in 2013. Estimated average GDP per capita will increase to 3,300 USD by the year 2015 and reaches to 5,300 USD by year 2020, and 11,000 USD by year 2030. Many other key indicators such as exports, industrial development, services, tourism, have steadily increased each year. By 2020, the urbanization rate will reach 54 - 55%. The rapidly economic development of Hanoi, on the one hand, is the motivation to attract workers from other places, on the other hand, increasing travel needs of every citizen every day. Demand for motorcycles and automobiles increases and for bicycles reduces.

Increase of Road Network: The total length of the road network in Hanoi by the end of 2011 is 7,365km compared to 6,240km in 2005. In previous years, the road length of Hanoi only increased from 5 to 10km each year. However, after Hanoi has been expanded, overall road length increases. By the year 2015, the length of the road network in Hanoi is estimated about 7,400km. Annual estimation, road network increases about 2%-3%, particularly peripheral areas, and contributes to the increase of daily transport demand. Presently Hanoi has about 583 routes. The road network in Hanoi remains inadequate in terms of density, connectivity, and technical standards; except those in the urban core. The weakness in the main road network has results in inter-city traffic passing through the City Center; creating unnecessary conflicts. In addition, the delay in land acquisition and resettlement is also becoming increasingly serious, hampering the smooth implementation of road projects, especially in the urban and fringe areas.

Land planning for transport infrastructure: by the year 2020, Hanoi will have a complete and modern transportation network. The land for infrastructure systems transport is approximately 13,800 ha as minimum, achieves 15% of the total land area of the city.

4.2 Public Transport Development

Currently the main public transport in Hanoi includes Public bus – inner city service is provided by Transerco (Hanoi Transport Service Company); Private bus - private bus companies mainly serve inter - provincial with long haul routes; Taxi - roughly half of the taxis are owned by the public Hanoi Tourist Car Company, and the balance by private operators. Taxi fares are still too high for the general public; and Train - Vietnam National Railways has several lines which

originate from inner Hanoi. But the government prohibits daytime operations throughout the inner city to prevent high traffic congesting at the intersection with the local roads. Presently, public transport of Hanoi is mainly public bus service.

Public Bus Service: In the past 10 years, Hanoi has focused on developing rapid bus network, operating efficiently; the amount of bus users is increasing rapidly. A forecast to the year 2020, between 30-50% of traffic participants is to use public transport. The number of passengers has increased 30 times in 8 years, from 12 millions in 2000 to over 400 millions in 2008, and estimation of 500 millions in 2013.

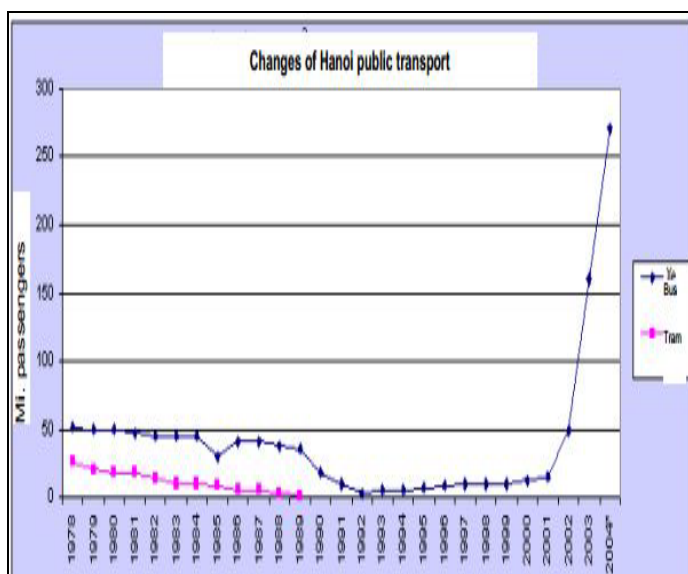
Table 4. Volume of passengers

Unit: million passengers/pax year

Period	1978-1990	1991-1999	2000	2001	2004	2005	2006	2007	2008	2010	2013 (estimated)
Quantity	50	10	12	15.2	285.3	300	305	360	400	420	500

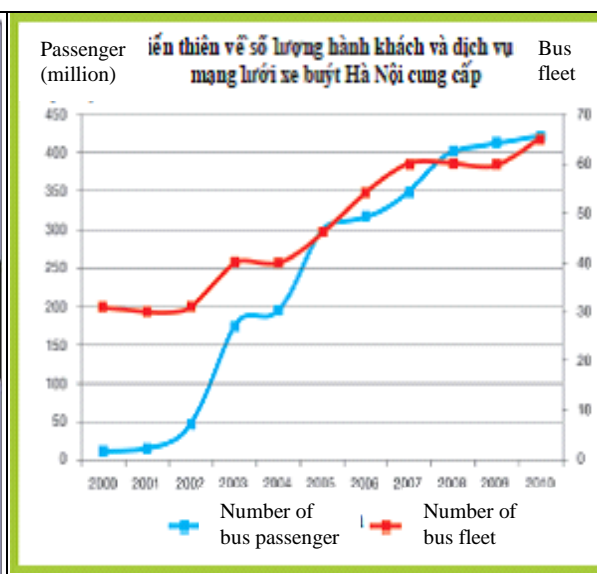
Source: <http://vietnam.vnnet.vn/vnp/vi-vn/30/48766>; <http://mt.gov.vn> 11/3013

The average growth rate of passenger volume was about 2.3% per year in the period of 2004 - 2006, and 5% per year in the period of 2007 – 2010. First 6 months of 2013, Transerco bus system has transported over 202.5 million passengers, accounting for over 90% of bus users of the city, revenues reaching 2,042 billion VND, equivalent to 110% of target and 10% increase compared to the same period in 2012.



Source: IMV Study Team

Figure 4. Passengers using bus and tram 1978-2004



Source: Transerco, 2013

Figure 5. Changes in number of bus passenger and bus fleet of Hanoi

In the year of 2014 bus service is expected to meet 13% of demand for travel people, and 15% of demand in 2015. Bus service is expected to reach 2.14 million passengers per day in the period 2011 - 2015 and 2.73 million passengers per day in the period 2016 - 2020. By the year of 2020, bus service will meet 25% of the travel needs of the population. The total of public passenger transport will reach 2.23 million passengers per day in the period 2011-2015 and 3.62 million passengers per day in the period 2016-2020 (Transerco, 2014).

The Network of Bus Routes: Currently, Hanoi has 94 bus routes, including 74 subsidized bus routes, 13 non-subsidized routes in the inner city. In addition, Hanoi also opens 7 bus routes nearby to the provinces to develop economic and cultural exchanges between Hanoi with satellite urban. Whole city has total of 76 originals & destinations for the bus routes. It is expected that in the period 2016-2020, there will be 98 routes.

Table 5. Number of bus routes over the years

	2008	2009	2010	2013	Current
Total routes	65	77	82	86	94
Subsidized bus routes				67	74
Non - subsidized bus routes				12	13
7 bus routes nearby to the provinces				7	7

Source: <http://www.baomoi.com/Xe-buyt-di-mot-lan-se-biet/141/7104585.epi>;
<http://vietnam.vnnet.vn/vnp/vi-vn/30/48766/print/default.aspx>

In 2012, Transerco (Transport Service Company of Hanoi) replaced 102 new buses of 6 routes, bought 36 new cars. A total of 1,308 buses of which 406 vehicles (account for 31%) have less than 5 years of operation; 464 vehicles (account for 36%) have the operation from 5-9 years and 438 vehicles (33%) have more than 9 years of operation (Vu Anh Tuan, 2012). In 2013, there are over 1,400 buses, transported over 1.1 million passengers per day. Every day, there are more than 10,000 buses ready to serve customers on the route (MOT, 2014).

Table 6. The number of buses over the years

	2010	2012	2013
Total number of buses	1,254	1,308	More than 1,400
Average growth rate (%)	-	2,1%	7,0%

Source: <http://hanoimoi.com.vn/Tin-tuc/Xa-hoi/570889/nam-2013-ha-noi-co-the-co-them-10-tuyen-xe-buyt-duoc-tro-gia>; <http://www.baomoi.com/Xe-buyt-di-mot-lan-se-biet/>

By 2015, Transerco will replace 400 old buses; an annual replacement average is 100 to 150 buses to enhance the quality of services. The buses being replaced were old vehicles invested from period of 2002-2005, and were about to end of the operation (Transerco, 2014). In particular, in the period of 2013-2015, Transerco implements a pilot study of using 16 seat mini buses for the development of feeder routes from the alley to the bus routes in the main streets, strengthening buses to transport students, offering the full-serve monthly ticket for officers and employees working in industrial parks, export processing zones etc.

Electronic smart cards are widely used in many countries around the world. In Asia, this smart card is also extremely popular in South Korea, Singapore, Japan etc., in order to synchronize the mode of transport, ensuring quick interaction and security. However, in Vietnam, this electronic smart card is considered to be relatively new. According to the report of the Department of Transportation Hanoi, the number of passengers used monthly bus tickets in Hanoi is about 70% of the total passengers on the whole network. In 2008, Transerco Hanoi piloted using smart card for the bus route 32 (Nhon - Giap Bat). This plan went bankrupt shortly because the electronic smart card was used for only one route, not for the whole network that cause inconvenience to users. The pilot application of bus smart card will contribute to increasing the efficiency of bus operations and create convenience for passengers. Previously, ticket sale, executive management and monitoring means of public passenger transport are mainly implemented by manual work that consume a lot of time to manage ticket sales and make financial statement. In addition, the use of paper tickets is very difficult for control and supervision and easy to be printed fake. Therefore, the application of electronic smart card system will bring in many benefits and economic efficiency, reduce losses and replace outdated and costly printed ticket system.

Common Shortcomings: Bus service has grown rapidly, operating 5 ~ 30 minute/trip, from 5h00 - 22h35 minutes, works all day in the week, in order to serve the maximum travel of Hanoi. The stops were added parking and more logical layout. The distance of the point has been shortened, build more shelters. In the framework of projects to improve public transport in Hanoi (TRAHUDII), Hanoi has piloted using intelligent electronic ticket system for public passenger transport by bus. Routes and flows increased 2.4 times and the number of cars increased 4 times and bus passengers increased more than 30 times, buses will be expected to meet 13% travel needs of the people in 2014, contributing to reduce congestion and traffic accidents. Due to asynchronous development of infrastructure and by people's consciousness,

public transport use is not high. Density of vehicles means uneven, mainly focused on the urban routes.

4.3 URMT & BRT in the Near Future

UMRT - Urban Mass Railways Transit: 8 UMRT routes are expected to form the transportation backbone of the city, which is integrated with bus and other public transportation modes, and to promote socio-economic development of neighboring areas of the station. According to the General Construction Plan of Hanoi Capital City till 2030 with a Vision to 2050 approved by the Prime Minister on the Decision No. 1259/QĐ-TTg dated 26 July 2011, a vision for development of Hanoi is to towards “A Green – Cultural – Civilized – Modern City”. In the future, 8 urban railway routes with a total length of 284 km and 6 elevated routes, together with more 9 express bus routes will improve market share of passenger transport by public transport to 25%. Currently, 3 lines of 8 routes are under construction.

BRT - Bus Rapid Transit: The first BRT of Hanoi is Kim Ma - Yen Nghia with 14 km under construction and will be put into operation in the second quarter of 2015. Total investment of the project including infrastructure construction, shelters, and facilities is \$ 49 million by loans from the World Bank and Vietnam contribute counterpart funds by the clearance costs. BRT speed is from 10km/hour (at the intersection) to 50 km/hour. Average speed of BRT is 22km/hour compared with the average speed of conventional bus of less than 15 km/hour, not to mention the congestion time. So transport by BRT is much better than conventional bus.

An urban bus system is to serves immediate needs of travel and reduces traffic jams and pollution. And an urban mass railways transit system towards the suburbs, linking satellite towns, meets the long-term and sustainable development goals in the future. And if these satellite cities have the large scale, a mini-bus system from (to) apartment buildings to (from) the railway station will meet travel demand.

5. SOME RECOMMENDATIONS TO PROMOTE PUBLIC TRANSPORT IN HANOI

The future urban transportation of Hanoi must be based on a public transport network. It must be attractive and competitive enough to encourage the people to shift from private transportation use. The public transportation system must have a good combination and network of UMRT (Urban Mass Rapid Transit), but rapid transit (BRT), ordinary buses of different sized offering various services, taxis, etc. Urban development must likewise be integrated with public transportation development to enhance accessibility, safety, and environment.

Recommendations toward public transport development such as bus and metro services

It is needed to establish and study the policy framework for developing urban transportation; developing public passenger transport modes with large volume and high speed to meet the target of increasing the share of public passenger transport by the year of 2020 to about 35% - 45% of the total travel demand of the city and reducing the share of motorcycle to 30 %.

Improving and developing the bus route network as well as developing bus infrastructure; applying the advanced infrastructure models (original & destination, hubs, exclusive lanes, bus shelters and transport access); developing synchronously and reasonably parking lot areas and transport infrastructure accessible to residential areas in order to increases bus transport capacity and improve bus service quality; paying special attention on bus services, priority lane for elders, children and disable people.

Innovating ticket system flexible, diversified, advanced with reasonable price to ensure the convenience to users, as well as easy to control and manage revenue. Using popular tickets in general, inter-routes tickets, electronic tickets etc. in order to organize the link between different transport modes.

Organizing effectively traffic demand adjustment through controlling the ownership percentage and use of personal vehicles, especially motorcycles and cars; regulating specific policies on the role and limitation of motorcycles in urban traffic and economic and social activities; establishing specific policy on priority road use among different modes such as buses, motorcycles, cars, bikes (for example, to build separate lanes for bus rapid transit)

Propagating people the benefits and advantages of public transport; modernizing technology management, applying informative technology to monitor and operate system and advanced passenger information.

Recommendations toward development policies

Having appropriate policies to limit and eventually to reduce the increasing number of personal transport vehicles, especially the number of motorcycles in traffic; radically collecting road fee for motorcycles issued from the beginning of year 2013; increasing fee, registration fee and premium with personal vehicles.

Encouraging the use of electric bicycles that reduces motorcycle daily use for minimizing environmental pollution, especially moving in short distances less than 10 km; to encourage the use of electric bicycles for the connection points to the public transport in long distances more than 10 km by constructing electric bicycle parking lot at connection points, and public transport intersections, providing charging stations at public parks and public electric bicycle rental service with cheap price.

Encouraging all economic sectors to participate in the transport infrastructure construction and public passenger transport through measures such as effective mechanisms and policies for managing and funding, tax incentives and price support; encouraging public and private investment cooperation (Public Private Partnership - PPP)

Strengthening the capacity and responsibility of local government agencies at all levels and functional offices in urban management, planning management and implementation;

CONCLUSION

Popular experience shows that sustainable transport development in the most effective way is the development of public transport system to alternate private vehicles. Currently, two types of the most popular public transport in the world are buses and trains. Some cities combine these two traffic mode into a decentralized traffic system: high-speed train connecting the satellite cities, and the international airport to downtowns, together with bus service in the inner city.

The main feature of Hanoi is relatively small urban area; transport infrastructure is constraint and the city develops rapidly with high population density. Therefore, the development of public transport is to toward the direction of modern with affordable cost, safety, environmental impact minimization and energy saving; application of advanced transportation technologies, especially for multi-modal transport; rapid innovation of transport means; improving the quality of transport services; and developing rapidly transport service system will help increase the demand for public transport. The policy that limits personal vehicles also encourages increases of demand for public transport, help reduce traffic congestion, environmental pollution and save energy.

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