



Faculty of Architecture and Society
Master of Science in Urban Planning and Policy Design
A.Y.2011/2012

Thesis Project
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SUSTAINABLE URBAN TRANSPORT ASSESSMENT
Evaluation opportunities for Asia cities: The case of Hanoi

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July, 2012

Acknowledgements

I would like to thank my supervisors, Prof. Carolina Pacchi, for her significant support and guidance throughout the duration of this research. Without her valuable advices, this thesis will not be possible. I also extend my thanks to my friend Mr. Conan Dynes and my fiance Mr. Anton Knoll who supported me in any respect during the completion of the project.

Abstract

Hanoi, the capital of Vietnam, is experiencing a rapid urbanization and boom in personal motorized transport after the introduction of Doi Moi policy in the early 1990s. Like many other cities in developing countries, Hanoi currently is facing severe urban transport problems such as traffic congestion and air pollution which is leading to serious health implications and significantly higher accident rates. Various discussions have happened and counter measures have been introduced to search for a better solution. However the current city transport situation is marginalized with transport policies focusing on congestion relief which often results in more road space available for the privileged private car owners. International experience shows that car-based urban transport is not a sustainable development path. Thus, the study aims to outline Hanoi's current transportation status and issues rising from a motorcycle-dominated urban transport, reviews the present regulatory framework regarding the bus transportation and an evaluation of the contribution of some 'major' land-uses in the study area which leads to several transportation problems. The assessment of sustainable urban transport in Hanoi city will be evaluated based on various sustainability approaches as a methodology to analyze and reconstruct current problems. At the heart of this research approach is the integration of land-use and transport planning, together with the promotion of non-motorized and greener modes of transportation such as walking, cycling or public transport in order to reach a sustainable urban transport. This study looks to enhance knowledge on the role that sustainable urban transport can provide to support current city transport's challenges and forward urban policies and practices to manage the challenges ahead.

Key words: land-use and transport, traffic congestion, Hanoi, sustainable urban transport, urban policies.

Astratto

Hanoi, la capitale del Vietnam, sta vivendo una rapida urbanizzazione e un boom nei trasporti privati a motore, dopo l'introduzione della politica Doi Moi, nei primi anni '90. Come molte altre città nei Paesi in via di sviluppo, Hanoi deve attualmente affrontare seri problemi di trasporto urbano, come traffico e inquinamento dell'aria, che sta causando gravi implicazioni nella salute e un tasso di incidenti in significativa crescita. Ci sono stati diversi dibattiti e sono state introdotte varie misure per cercare soluzioni migliori. Nonostante ciò, l'attuale situazione di trasporti urbani rimane marginale rispetto a politiche dei trasporti che si concentrano sulla diminuzione del traffico, che spesso portano ad aumentare lo spazio stradale per i privilegiati proprietari di automobili private. L'esperienza internazionale dimostra che sistemi di trasporto urbano che privilegiano l'automobile non rappresentano un percorso di sviluppo sostenibile. Quindi, questo studio mira a delineare l'attuale stato dei trasporti di Hanoi e le problematiche risultanti da un sistema di trasporti urbano dominato dai motocicli, nonché presentare una panoramica della presente struttura normativa riguardo ai trasporti pubblici (autobus) e una valutazione delle conseguenze dei principali land-uses nell'area di studio, che causano gravi problemi nei trasporti. Lo studio di un sistema sostenibile di trasporti urbani nella città di Hanoi sarà valutato sulla base di vari approcci di sostenibilità, come metodologia per analizzare e ricostruire le cause delle problematiche attuali. Al centro dell'approccio di questa ricerca c'è l'integrazione di land-use e pianificazione dei trasporti, insieme alla promozione di modi di trasporto non a motore e più verdi, come muoversi a piedi, in bicicletta o con i trasporti pubblici, in modo da avere trasporti urbani più sostenibili. Questo studio cerca di accrescere la consapevolezza sul ruolo che possono avere i trasporti urbani sostenibili nel fronteggiare le attuali sfide riguardo ai trasporti urbani e verso politiche urbane e pratiche per gestire queste sfide nel futuro.

Parole chiave: land-use e trasporti, traffico, Hanoi, sistema di trasporto urbano sostenibile, politiche urbane.

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ABBREVIATIONS

BRT	Bus Rapid Transit
CBD	Central Business District
HAIDEP	Comprehensive Urban Development Program in Hanoi Capital City
HPC	Hanoi People's Committee
JBIC	Japan Bank of International Cooperation
JICA	Japan International Cooperation Agency
LRT	Light Rapid Transit
MOC	Ministry of Construction
MOT	Ministry of Transport
NMT	Non-Motorized Transport
MRT	Mass Rapid Transit
PTA	Public Transport Agency
PMU	Project Management Unit
TRAMOC	The Transport Management Center
UMRT	Urban Mass Rapid Transit
WB	World Bank

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55. TONKIN — Hanoi — Rue Paul-Bert



Img.1 The French colonial period in Hanoi downtown
Source: <http://www.flickr.com/photos/13476480@N07/>



Img.2 Hanoi in the morning after the Paris Peace Accords, 1973
Source: <http://www.flickr.com/photos/vb5g/5228008086/>



Img.3 Hanoi from above 1
Source: <http://www.skyscrapercity.com/showthread.php?t=1476934>



Img.4 Hanoi from above 2
Source: <http://www.skyscrapercity.com/showthread.php?t=1476934&page=2>



Img.5 August revolution square – The formal and informal city
Source: <http://www.skyscrapercity.com/showthread.php?t=1476934>



Img.6 One of the "Hanoi's new town"- the Manor
Source: <http://www.skyscrapercity.com/showthread.php?t=870728&page=5>



Img.7 The new residential area Trung Hoa-Nhan Chinh
Source: Author



Img.8 The common Vietnamese "tube house"
Source: <http://www.skyscrapercity.com/showthread.php?t=1476934>



Img.9 The social inequality
Source: Author



Img.10 Living under the bridge
Source: Author



Img. 11 Traffic at "Nga Tu Vong" flyover
Source: Author

CHAPTER I

TOWARD SUSTAINABLE TRANSPORT DEVELOPMENT

1.1 INTRODUCTION

Transport is a fundamental human need. The economy efficiency of cities and their citizens are directly affected by the performance of their urban transport system. Recently, rapid economic growth in urban areas has driven considerable growth in the demand for transport of both people and goods. This has led to a massive increase of private vehicles in many cities around the world and has put a high pressure on urban transport systems. Motorcycles and cars are filling streets and make the traffic conditions difficult or even chaotic. Traffic congestion which is experienced almost every day in many cities of developing countries has been a serious problem for the local authorities and government.

Like many other cities in developing countries, Hanoi-capital city of Vietnam is also suffering severe traffic congestion due to its rapid urbanization and motorization since the early 1990s. It is observed during peak hours (from 7:00 to 9:00 and from 17:00 to 17:00) almost every day at bottlenecks of all main corridors leading to the city centre, especially some main corridors around or leading to Dong Da District and the urban core of Hanoi. One can see a huge volume of people traveling on the corridors in the direction leading to the city centre in the morning and in the opposite direction, out from the city centre, in the afternoon. This situation is not only greatly reduces the effectiveness of all social activities, impedes economic development, but also destroys the living quality of inhabitants in the city and creates a polluted environment.

Recently, the concern about how to relieve traffic congestion and improve mobility and accessibility for Hanoi city has been raised by local and foreign academics, professionals, and decision-makers. In this regard, many counter measures have been applied by local authorities such as: expanding the existing road network; building new roads, flyovers and underpasses; road intersection reorganization; enforcing traffic laws; applying traffic signals; improving the operation of the current public transport system. However, the reality of the absence of a connection between transport and land-use planning together with unsustainable urban development policies has not significantly improved the problem. Congestion and pollution problems are meanwhile still seriously increasing in the city. This challenge can only be met with a new approach to sustainable urban transport.

In this way, the purpose of the following research is to consider and arrive at a rational and sustainable urban model – toward an approach of sustainable urban transport development. This

thesis uses the study case of Hanoi, and takes in to account the experience of other cities' famous transport-policy initiatives. The research aims to evaluate sustainable urban transport development in Hanoi city by assessing a specific neighborhood in which high traffic congestion is an issue. Based on an analysis of accessibility indicators and a thorough assessment of current land-use and transport planning, with their connection to the master plan of Hanoi city, this thesis will makes a proposal of a policy program to improve the current condition with concern toward a sustainable urban transport development. The thesis structure is organized in three chapters following:

The first chapter: "Toward sustainable transport development" provides a basic review of sustainable development, sustainable urban transport development, a close review on Urban transport sustainability within a Vietnamese context, and explain how a sustainable development concept is understood by different stakeholders and policy makers.

The second chapter: "An overview of Hanoi city" provides an overview of current Hanoi city development in terms of sustainable transport development and occupation and functionality of the territory in order to establish comparison points to other Asian cities. The chapter aims to provide a clear picture of the transportation situation in Hanoi, examines transportation master plans, characteristics and outlook of urban transportation and its forthcoming challenges. Bus transportation service is outlined and its scheme and issues of regulatory framework are examined.

The third chapter: "Urban transport sustainable assessment in Dong Da District, a specific area of Hanoi is selected in order to study it in-depth, analyse its urban structures in term of land uses, occupation and accessibility. The development of urban sustainable transport is evaluated in the study area from composed analysis elements to comprehend the current city development and then is followed with a guideline of a proposed solution and spatial strategies. This chapter focuses on responses to urban planning strategies. This guideline will be sent to the Vietnamese authorities and recommends the adoption of its proposals with regulatory improvements for the promotion of an intergrated approach to public transportation.

1.2 PROBLEM DEFINITION AND RESEARCH HYPOTHESIS

1.2.1 Problem definition

1.2.1.a Traffic congestion

During the 1990s, a few years after 'Doi Moi' period, Hanoi went through a significant metamorphosis changing from a city of walking and cycling to a city of personal motorized transport with the main choice as the motorbike – Simultaneously the base urban development of the city changed from one in which people live and work in the same place to a city in which residences are separated further from workplaces. These changes have resulted in an enormous increase of traffic movement in the city with a large increase number of motorbikes. "*Hanoi currently presents itself as an unique urban center in the world which more than 80% the travel demand of urban residents served by motorcycles*"¹. The popular belief behind motorized transport is a faster commute, to do more business, be more dynamic and as a result make more money. In addition, personalized

¹ Ieda, Hitoshi, (2010), *Sustainable Urban Transport in an Asian Context* – Page: 292

motorized transport maybe considered more convenient than walking, cycling or public transport. Consequently, streets in Hanoi have become overcrowded and at rush hour traffic becomes a complete standstill. The traffic mix of mainly motorcycles, bicycles and cars is an outstanding characteristic of Hanoi's urban transport system. Commuters waste time and fuel and the city suffer from unacceptably high air pollution.

Besides that, the poor urban infrastructure of the city is also bringing the traffic system to the brink of collapse. The report by the Asian Green City Index shows that Hanoi's transport infrastructure ranks below average among other Asian city in fig.1 *The local road network stand at 7% of the land area which is exceptionally sparse (compared to almost 25% in many US cities, about 15% in most European cities and 11% in China's large cities)*². The radial axes and ring road systems are poorly developed which has just formed 3-4 lanes in the inner city, suburb ring roads are very low condition. External transport and national transport coming from different directions have to pass through the center of the city and therefore contribute to overloading and inner city congestion. In addition, the city does not have a developed public transport network such as metro, bus, rapid transit or trams and the most of the streets are bi-directional and narrow. At the same time, *the road expansion is restricted by severely high costs of resettlement which constitute over 80 percent of the project cost for many city projects*³. Thus the current traffic problems in the city put a lot of pressure on decision makers and administration of the city.

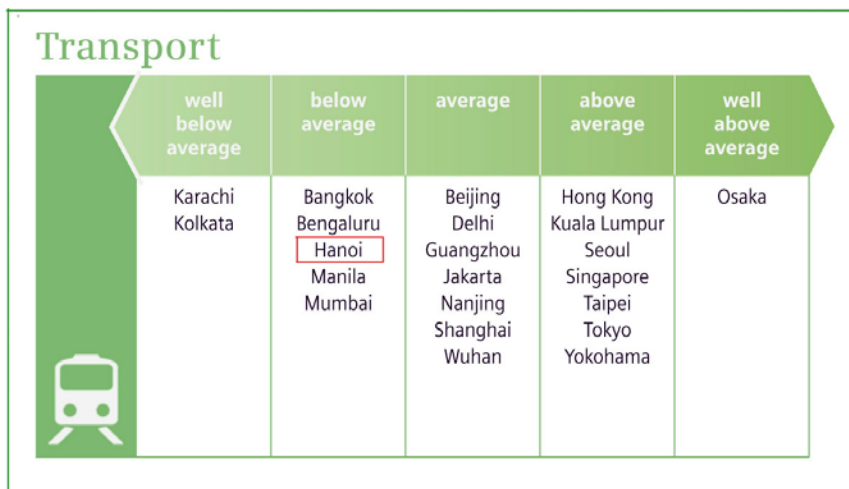


Fig.1 Transport infrastructure in selected Asian cities

Source: Asian city's transport system report - Asian Green City Index - Available at:

<http://www.siemens.com/press/pool/de/events/2011/corporate/2011-02-asia/asian-gci-report-e.pdf> Last access: Tuesday 21 February, 2012

² World Bank report no: 39434-VN, (2007), Project appraisal document on a proposed credit in the amount of SDRr 108.8 million to the socialist republic of Vietnam for a Hanoi urban transport development project - Page: 11

³ The same 1

1.2.1 b Air pollution

The Hanoi Department of Natural Resources and Environment published a report on Hanoi's environment in 2011, which shows that the capital city's air quality is reducing because of the rapid growth of the number of motorcycles and cars. Vehicles discharge many types of exhaust fumes into the environment, including carbon oxide (CO), nitrogen dioxide (NO₂), particulate matter (PM), especially PM₁₀, sulphur dioxide (SO₂), Suspended Particulate Matter (SPM) and volatile organic compounds (VOCs). Dr. Hoang Duong Tung, director of the Environmental Observation Centre, has said that the dust concentration in many areas in Hanoi has exceeded standards⁴. Pollution at traffic hubs and construction sites is at very high levels. The majority of crossroads leading to the city center have very high dust concentrations, especially on Kim Lien, Giai Phong, Phung Hung, Nguyen Trai roads (see detail chapter III). The Fig.2 clearly shows the deterioration of the air quality in Asian cities which the majority of the cities in the chart are cities with high vehicular usage. The level of Hanoi's air quality in the figure shows with three exceeded standards: SO₂, SPM and PM₈. Thus the city and the policy makers need urgent sustainable measures in order to guarantee a suitable urban environment for human development and their needs.

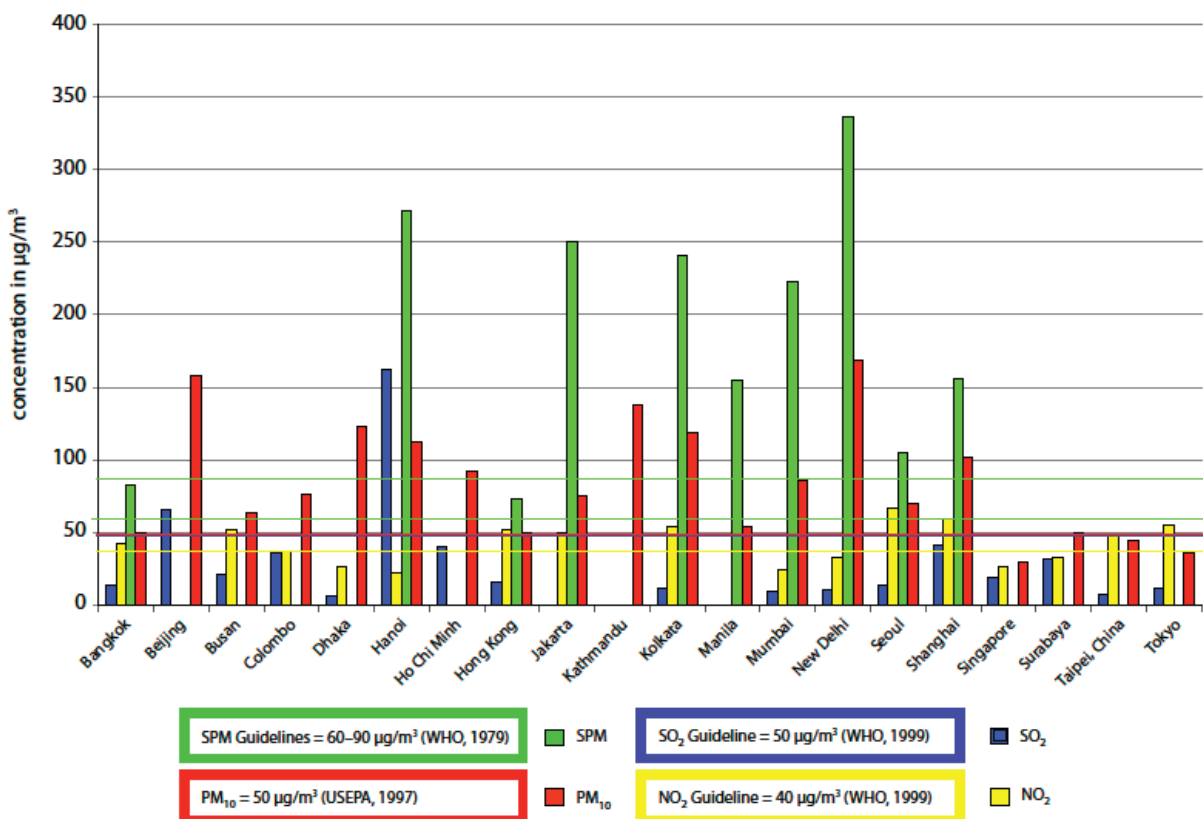


Fig.2 Average annual air pollution concentrations in selected Asian Cities

Source: Huizenga, C., Ajero M., and Fabian H., (2005) Introduction into Urban Air Quality in Asia: Status, Impact and its Management. Clean Air Initiatives for Asian Cities - Page 12

⁴ Vietnamese Standards on Environment dated 27/12/1993 issued by Vietnam National Assembly and the promulgation decree for implementation has been signed on 10/1/1994 by the Chairman.

1.2.2 Research Hypothesis

1.2.2.a Unsustainable urban development policies.

In 1986 the 6th Congress of the Vietnamese Communist party decided to transform Vietnam's economic system from a centrally planned economy to a market-oriented economy⁵. This has changed the face of most cities in Vietnam. Urbanization occurs spontaneously at a large-scale without an appropriate strategical plan that has resulted in immense problems in the big cities like Hanoi or Ho Chi Minh City. With a population of 6.5 (2010) million people, Hanoi accounts for 7.51 percent of the country's population, with an annual growth rate in the urban area of 5,5% and in the total urban region 3,2%⁶ Vietnamese authorities have admitted that population growth will exceed the available residential space in the city. This leads to the environmental emergency caused by the occupation and exploitation of natural resources within the peripheral city. Also the accelerated population growth because of illegal and fragmental urban settlements, have not taken into account any sustainable development criteria. In the transport sector, there are many examples of ineffective transport policies or even if transport policies were implemented as it was planned, core problems were not tackled effectively. Policy makers were unable to say whether the policies implemented succeeded as planned as the implementations were not assessed. Besides that, there is also an absence of sustainable elements in urban transport policy. The city master plan strategy was developed under highly optimistic assumptions about the city's future and was not tested in pilot projects. Finally, the results have been plans that were seldom realizable.

1.2.2.b Absence of the connection between transport planning and policy planning.

Starting from the Renovation Period in the 80's, the Hanoi region, together with the rest of Vietnam is under a rapid change in urbanization. However, rapid urbanization, together with the lack of integration of transport and land use planning, has exceeded the development of industry and infrastructure. Although there were several Master Plans performed the non-integrated planning approach and the inheritance of the urban management system typical of socialist countries led to many challenges. For example, the Construction Master Plan for Hanoi in 1998 approved by the Prime Minister (by Decision No 108/1998/QĐ-TTg) built a comprehensive urban transport network comprising of a Public Transport System based on urban railway system. However, difficulties due to the lack of horizontal coordination among bureaucratic agencies, finally it took nearly 10 years to get a definitive approval for the basic orientations of the urban transportation sector.

In addition since the late of 90s, various new urban areas have been developed in surround Hanoi's urban fringe with mainly lack of social infrastructure i.e. clinics, kindergartens and schools. As a result, the inhabitants are forced to travel into the city and thus overload the road infrastructure with the increased the traffic demand.

⁵ It has been common for most of Vietnamese as 'Doi Moi' period

⁶General Statistics office of Vietnam, Trends in population growth in Hanoi during 1918 -2010, http://www.gso.gov.vn/default_en.aspx?tabid=491 last access: Monday, 28 May 2012

1.3 RESEARCH PROPOSAL AND METHODOLOGY

1.3.1 Objective

1.3.1.a Main Objective

The thesis's main objective is to look for sustainable urban transport solutions for Hanoi city by assessing and judging the urban transport sustainability current transport system of a specific areas in Hanoi. The evaluation is made by a system of indicators and indexes which is built up from different urban sustainable planning approaches. The analyzed issues is based on various city's characteristic related with population, land use activities, social, environmental and urban development in order to deep in its urban transport issues, situations and trends. Afterwards, an examination the successful programs from among the country's best performing cities.

1.3.2.b Specific objectives

- To search for urban transport design criteria and master plan policies that act in response to sustainable urban transport development.
- To create a composed indicators system of sustainable urban transport by addressing transport and land-use planning issues and proposes sustainable urban transport evaluation and responses in relation to current phenomena.
- To reduce the motorcycle dominated pressures on natural conditions, improving quality of life and the ecosystem.

1.4.2 Research Methodology

Evaluation the sustainability of Hanoi's urban transport will be based on the creation of composed sustainability urban transport indicators as a methodology to analyze and reconstruct current problems. Beginning with a literature review, a design system of indicators will be used for evaluating the level of urban transport sustainability in specific neighborhood district of Hanoi urban area. Through the recognition of existing published material and demonstrating the limits and potentials of the available data, qualitative and quantitative information is used in order to analyze the proposed indicators and indexes. In the same way a review of the literature about concept of sustainable urban transport and its progress in Asia cities is made. The study also interviews relevant city governmental bodies, donor agencies and private firms and discuss the regulatory improvements recommended. As shown in the following chart, the Methodology of the research is based on the assessment of urban transport sustainability which is developed in sequences, starting from the problem definition to the proposal.

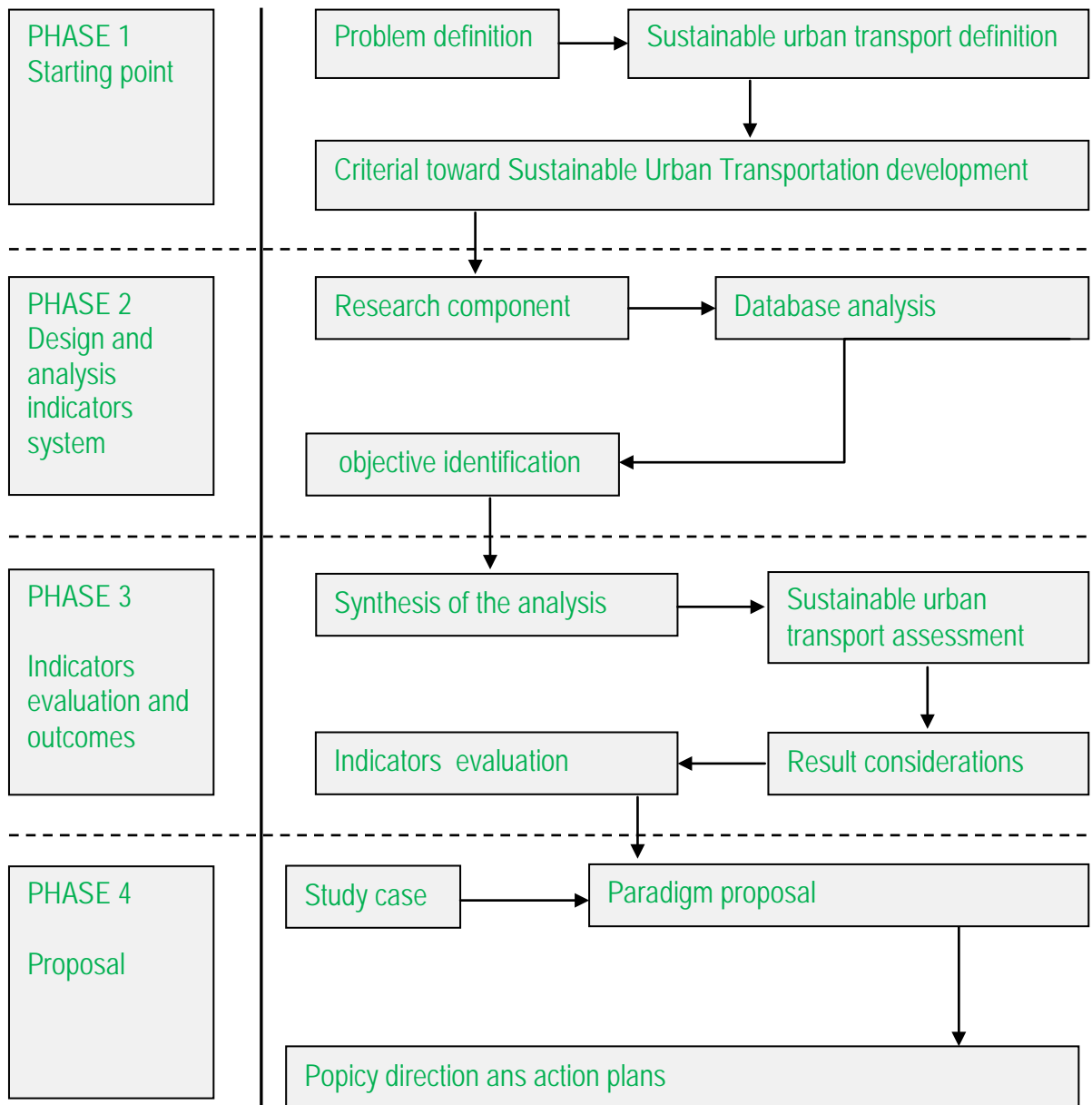


Fig.3 Research Methodology



Img.12 Tokyo Walking Street

Source: Asian Green City Index - Available at: <http://www.siemens.com/press/pool/de/events/2011/corporate/2011-02/asia/asian-gci-report-e.pdf> Last access: Tuesday 21 February, 2012

1.4 A GAZE AT ASIAN CITIES

1.4.1 What is happening in Asian Cities?

According to the United Nations Population Division, the percentage of Asian population living in urban areas has grown from 32% in 1990 to 42% in 2010. By 2026, an estimated half of Asians will be city dwellers. For the last five years there were 37 new million urban residents per year, or more than 100,000 people per day. This rapid urbanization has caused numerous problems for many Asian cities. Among 27 Megacities in the world, 56% are located in Asia, namely: Bangkok, Beijing, Delhi, Dhaka, Jakarta, Osaka, Karachi, Kolkata, Lahore, Manila, Mumbai, Metro Tokyo, Seoul, Shanghai, and Teheran⁷. McKinsey and Co⁸, a Global consultancy institute, predicts that by 2025, China alone will have 221 cities with more than a million inhabitants. In contrast Europe currently has just 25.

The growth rate of urbanization in Asia is said to be almost the same as the growth rate of slum⁹. In the 32nd ARCASIA Council Meetings of Asian Urban and Architects Forum The 16th(ARCASIA) with the theme: "Asian Cities of the 21st Century" mentioned more than 25% of Asia's urban population living in slums due to distribution of Poverty and the disparity in income. This seems continue to be the most critical issues standing in the way of a prosperous future for Asian cities.

In term of urban form, Asian cities today have significantly different characteristics from those of Europe and North America. They are not an acceleration of urban sprawl like in United State, where the higher classes prefer more exclusive housing conditions farther from downtown centres. Or in

⁷ Ieda, Hitoshi, (2010), *Sustainable Urban Transport in an Asian Context* – Page : Preface VII

⁸ http://www.mckinsey.com/features/urban_world last access: Wednesday 14, February 2012

⁹ The same 7

Europe with a dense network of cities has created such high density large mega city regions¹⁰ like in London, Berlin or Paris. And in opposite diffuse cities with low density population such as the Veneto region of Nord-East Italy. In Asia the process of exodus from the country to cities is still in progress and cities are expanding at the edges¹¹. Artificial settings in cities and nature are not always clearly separated; some open spaces or streets are often traditionally regarded as sacred place where animistic gods are worshiped. Borders between urbanized areas and rural areas do not look like clear lines. It can easily find nature anywhere in the city and also observe urban houses developed in agricultural fields at the same time. This typical example of the weak governance in land-use control in Asia however might be considered as an appropriate factor to improve the natural aspect of sustainability in the cities.

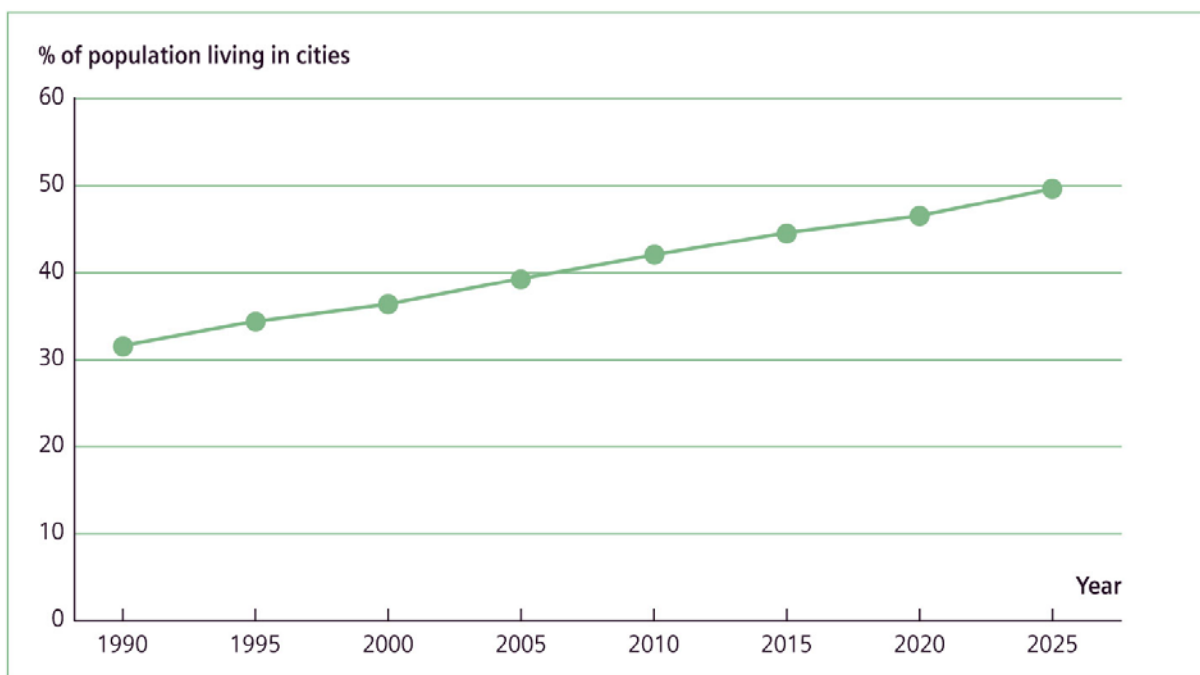


Fig.4 Urban population in Asia from 1990 – 2025 Source: United Nations Population Division

¹⁰ Serie of anything between 10 and 50 cities and towns, physically separate but functionally networked, clustered around one or more larger central cities, and drawing enormous economic strength from a new functional division of labour.

¹¹ Balducci, Alessandro, (2007), Position Paper - Page: 3



Img.13 Along Wangjiamatou Lu (王家码头路)

Source: photo by 唐颖 (Tang Ying)

1.5.2 Urban planning development in Asia

In Asian cities context, it is a fact that many new urban development projects are based on outdated planning theory and compromise with the power of greed and profit. It is the image of the current modern cities quickly appear everywhere in China, Thailand or India. In the last half century, urban development in most countries has faced the destruction of the environment and vernacular social life like never before. Many social and cultural problems are one of the main challenges in urban planning development. The question of how to develop quality of urban space needs urgently a new planning strategies approach. People eager to an urban planning which brings modern diversity moral justice and happiness for everyone. Therefore, sustainable urban development deserves to become a proposition and receive more attention of (inter)national politics.

1.5 URBAN PLANNING FRAMEWORK

1.5.1 Vietnam's Urban and Regional Planning management system

Urban planning is also referred to as urban development planning and urban construction planning. In Vietnam it is an essential tool for spatial arrangement of land use in cities and urban areas. The government uses it as a spatial expression of social economic development strategies and policies. The role of spatial planning has become more important in the period when Vietnam changed from

a centrally planned economy to a market oriented economy in 1986. There were various forms of spatial planning, practiced in the Northern part of Vietnam since 1954. These are divided into three linked categories described in the following:

- *Regional planning*: is identifying potential development, resource and force, driving the development of a region, its urban and its settlement system.
- *City master planning*: is made from the layout of spatial structure and guidelines for urban development for 15-20 years in long term and 5-10 years in short term.
- *Detailed planning*: is determining the land use of specific urban areas.

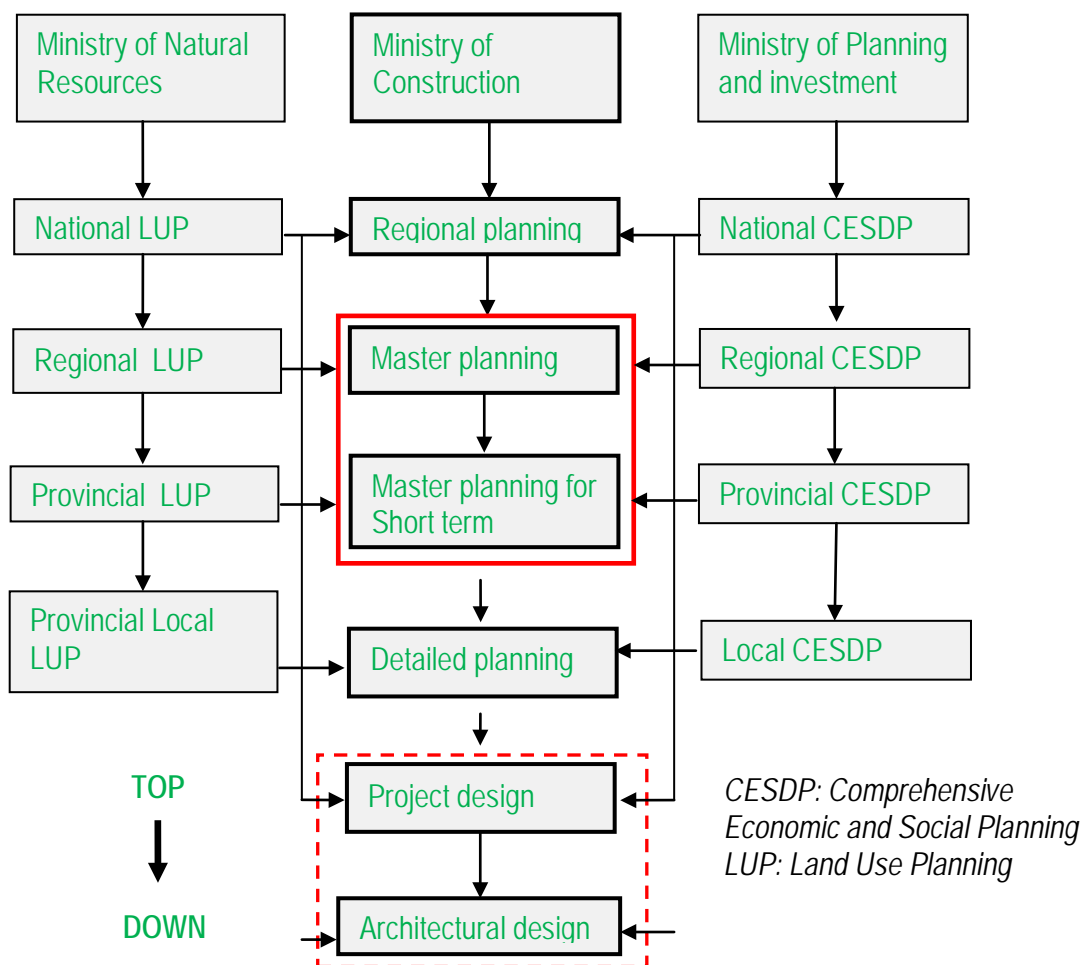


Fig.5 Urban and regional planning system in Vietnam

Sources: Urban and Rural Development Network – Country profile Vietnam available at: <http://urdn.tu-berlin.de/activities/country-profiles/vietnam.php> last access: Monday, 02 July 2012

On 17 August 1994, Government Decree 91/CP set out a general framework for managing Urban Planning of Vietnam's cities, followings are the establishment and approval of it:

- "Urban development must be based on urban plans approved by competent state authorities.

- *Urban plans must be set up by professional organization recognized by the state, and subject to all standards and rules issued by the state. Approved urban plans are legal basis for managing urban areas, implementing construction programs, preparing annual, short term – long term plans for urban development.*
- *Approved urban plans must be informed to the public and subjected to necessary adjustments during implementation process to conform to practical development.*
- *City master plans define the guidelines for urban development, infrastructure and living environment.*
- *Detailed plans are under the guidelines of city master plans and provide the basis for all constructions including housing, public buildings, park, infrastructure factories, ec. Approved detailed plans are the basis for setting up investment projects choosing and approving construction local and issuing planning certificates, deciding on land allocation and issuing building permissions.”¹²*

Planning certificates and building permissions are two approaches for urban development control in Vietnam cities. Planning certificates are documents stipulating what developers have to follow when preparing investment of a construction project.

1.5.2 Urban development Objective

In January 2001, the Ministry of Construction (MOC) put forward the following objectives for urban development in Vietnam.

- *Decreasing densities in urban areas of large cities and increasing peri-urban densities, possibly through development of satellite cities.*
- *Relocating polluting factories from inner cities to outer areas through tax incentives and regulation.*
- *Stemming squatter settlement through formulation and enactment of construction standards and enforcement of codes.*
- *Improving provision of urban services.*
- *Implementing measures to increase supply of urban housing*
- *Reducing loss of prime agricultural land resulting from poorly managed peri-urban development.”¹³*

1.6 SUSTAINABLE DEVELOPMENT TRENDS AND CHALLENGES

1.6.1 Sustainable Development (SD)

1.6.1.a What is Sustainable Development ?

There are multiple efforts to define SD, however the most well know is definition of SD of the World Commission on Environment and Development (WCED) also known as the Brundtland Commission in 1987:

“Sustainable Development is the development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs”.

Besides that, there are exiting variations of SD definition which is presented in the table below:

¹² *Urban and Rural Development Network – Country profile Vietnam available at: <http://urdn.tu-berlin.de/activities/country-profiles/vietnam.php> last access: Monday, 02 July 2012*

¹³ *The same 12*

VARIATION OF SUSTAINABLE DEVELOPMENT'S DEFINITION

NAME	DEFINITION	DATASOURCE
Bruntland report	Meeting the needs of the present generation without compromising the ability of future generations to meet their needs	World Development Report 1987
SustainLane	Maintaining standards of living and structural preparedness to meet the environmental challenges of an uncertain future	U.S. Census Bureau, Surveys & Interviews
United Nation	The integration of economic, social and environmental issues in decision and policy making	National public available data
World Bank	No explicit definition, but implicitly defined by a selection of indicators used to measure sustainability	Self-reported data on website with city member enrollment
OECD	Competitive green growth as defined through considerations of urban form, lifestyle and energy sources	Various development and multilateral agencies
Siemens	Acting responsibly on behalf of future generations to achieve economic, environmental and social progress	National statistics, local city authorities, national environmental bureaus
Yale - Columbia	Society's capacity to improve its environmental Performance over time	WHO; Experts from Yale and Columbia
National Bureau of Economic Research	Greenness as defined by household carbon emissions	Chinese statistical yearbooks

Tab.1 Variation definition of sustainable development

Source: The Urban Sustainability Index: A New Tool for Measuring China's Cities - Page: 39

One of very important step in the move toward urban sustainability was marked at European Sustainable Cities and towns first conference in in Aalborg- Denmark, May 1994. The main object of the conference was the discussion and final issue of the "*Charter of European Cities and Towns: toward Sustainability*" The Charter embraces an ecosystem approach to urban management and states, the responsibility of European cities and towns for many of the environmental problems facing mankind. SD cannot be achieved without local communities, governments and citizens. "*Local government is close to where environmental problems are perceived and closest to the citizens and shares responsibility with governments at all levels for the well-being of humankind and nature. Therefore, cities and towns are key players in the process of changing lifestyles, production, consumption and spatial patterns*". Sustainability is described as a "*Creative, Local, Balance-*

Seeking Process extending into all areas of local decision-making". So that each city has to find its own individual path towards sustainability.

The Charter has defined three achievements for SD are *"social justice, sustainable economies, and environmental sustainability"* and that our natural capital such as atmosphere, soil, water and forests...are limiting factors for economic development in the cities. Urban economies should give priority to:

- *"Investments in conserving the remaining natural capital, such as groundwater stocks, soil, habitats for rare species;*
- *Encouraging the growth of natural capital by reducing our level of current exploitation, such as of non-renewable energy;*
- *Investments to relieve pressure on natural capital stocks by expanding cultivated natural capital, such as parks for inner-city recreation to relieve pressure on natural forest;*
- *Increasing the end-use efficiency of products, such as energy-efficient buildings, environmentally friendly urban transport"*.

Social equity is considered to be precondition to the achievement of sustainability, as the *"inequitable distribution of wealth both causes unsustainable behavior and makes it harder to change"*. The Charter advocates the development of urban system sustainability indicators on which to base policy making systems. City and town signatories of the Charter recognize that they cannot export problems into the larger environment or the future and seek equitable regional interdependencies. Ecologically transport and the decrease of enforced mobility are also given a lot of priority. Emphasis is placed on the stabilization and reduction of greenhouse gases into the atmosphere and the prevention of ecosystem toxification. The local authority signatories of the Charter are prepared to reorganize cities and towns for sustainability and ask for sufficient powers and a solid financial base.

Another significant movement toward ST was In 1992, the leaders of 179 countries gathered in Rio de Janeiro for the United Nations Earth Summit to finalize a global action plan for sustainable development, called Agenda 21. In this document, they recognized that because *"so many of the problems and solutions being addressed by Agenda 21 have their roots in local activities, the participation and cooperation of local authorities will be a determining factor in fulfilling its objectives."*

While mostly part of Agenda 21 requires the active involvement of local authorities, Chapter 28 specifically addresses local government and calls for a consensus of local authorities on a Local Agenda 21. The implementation of Agenda 21 was intended to involve action at international, national, regional and local levels. Some national and state governments have legislated or advised that local authorities to take steps to implement the plan locally, as recommended in Chapter 28 of the document. These programs are often known as 'Local Agenda 21' or 'LA21'. For example, in the Philippines, the name is 'Philippines Agenda 21' (PA21). SD in local Agenda 21 is defined as :

“Sustainable development, therefore, is a program of action for local and global economic reform—a program that has yet to be fully defined. The challenge of this new program is to develop, test, and disseminate ways to change the process of economic development so that it does not destroy the ecosystems and community systems (e.g., cities, villages, neighborhoods, and families) that make life possible and worthwhile. No one fully understands how, or even if, sustainable development can be achieved; however, there is a growing consensus that it must be accomplished at the local level if it is ever to be achieved on a global basis.

At the local level, sustainable development requires that local economic development supports community life and power, using the talents and resources of local residents. It further challenges us to distribute the benefits of development equitably, and to sustain these benefits for all social groups over the long term. This can only be achieved by preventing the waste of ecological wealth and the degradation of ecosystems by economic activities.”¹⁴

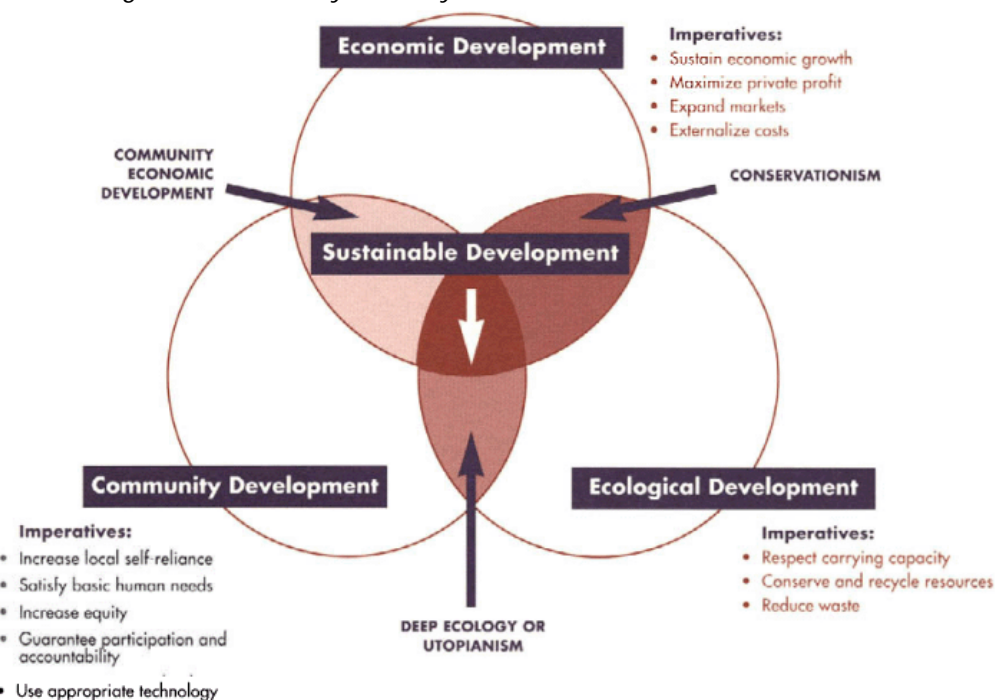


Fig.6 The sustainable development challenge
 Source: *The Local Agenda 21, Planning Guide – Page 17*

“There are always three distinct development processes under-way at the local level—economic development, community development, and ecological development. Each of these processes has its own distinct imperatives”...

“Sustainable development is a process of bringing these three development processes into balance with each other. The implementation of a sustainable development strategy therefore involves negotiation among the primary interest groups (stakeholders) involved in these three development processes. Once an Action Plan for balancing these development processes is established, these stakeholders must each take responsibility and leadership to implement the plan.”

The task of mobilizing and technically supporting Local Agenda 21 in these communities has been led by the International Council for Local Environmental Initiatives (ICLEI) and national associations of local government. Now, with the further support of the International Development Research

¹⁴ *The Local Agenda 21, Planning Guide – Page 16*

Centre and the United Nations Environment Programme, ICLEI is able to present the first worldwide documentation of Local Agenda 21 planning approaches, methods, and tools in this *Local Agenda 21 Planning Guide*.

Summary of the Main Urban Dimension of Agenda 21

A. Promote sustainable construction industry activities.

Encourage greater use of local natural materials and greater energy efficiency in design and material; strengthen land use controls in sensitive areas; encourage self help schemes.

B. Provision of adequate shelter for all.

Adopt/strengthen national shelter strategies, including legal protection against unfair eviction from homes or land; provide shelter for the homeless and the urban poor; seek to reduce rural urban drift by improving rural shelter; introduce resettlement programs for displaced persons; develop multinational cooperation to support the efforts of developing countries.

C. Develop sustainable energy and transport systems in human settlements.

Develop and transfer technologies which are more energy efficient and involve renewable resources; improve urban transport systems

D. Encourage human settlement planning and management in disaster prone areas.

Promote a culture of safety; develop pre-disaster planning; initiate post – disaster reconstruction and rehabilitation planning

E. Ensure integrated provision of environmental infrastructure; water, sanitation, drainage and solid waste management.

Introduce policies to minimize environmental damage; undertake EIAs; promote policies to recover infrastructure cost, while extending services to all households; seek joint solutions where issues cross localities.

F. Promote sustainable land use planning and management

Develop national land inventory and classification systems; create efficient and accessible land markets, with land registers; encourage public private partnership in managing the land resource; establish appropriate forms of land tenure; develop fiscal and land use planning solutions for a more rational and environmentally sound use of the land resource, promote access to land for the urban poor; adopt comprehensive land use strategies; encourage awareness of the problem of unplanned settlements in vulnerable areas.

G. Improve human settlement management

Improve human settlement management. Improve urban management; strengthen urban data systems; encourage intermediate city development

H. Meet the urban health challenge

Develop municipal health plans; promote awareness of primary health care; strengthen environmental health services; establish city collaboration network, improve training; adopt health impact and EIA procedures.

Summary of the main urban dimensions of Agenda 21 (1992)

1.6.1.b Sustainable development indicators

The Commission's European Sustainable Cities Report (EC 1996a) recognizes the need for sustainability indicators as a tool for quantifying sustainability performance. In order to prove we are moving toward ST and that sustainability is coherent with the policy goal. There is a need of measuring it. The World Bank defines indicators as performance measures that aggregate information into a usable form and highlighting. The indicator system provides a useful tool for policy making and for assessing policy implementations. Indicators quantify and simplify information about complex phenomena, they are distinct statistics and primary data, even though they are often presented in statistical or graphical form.

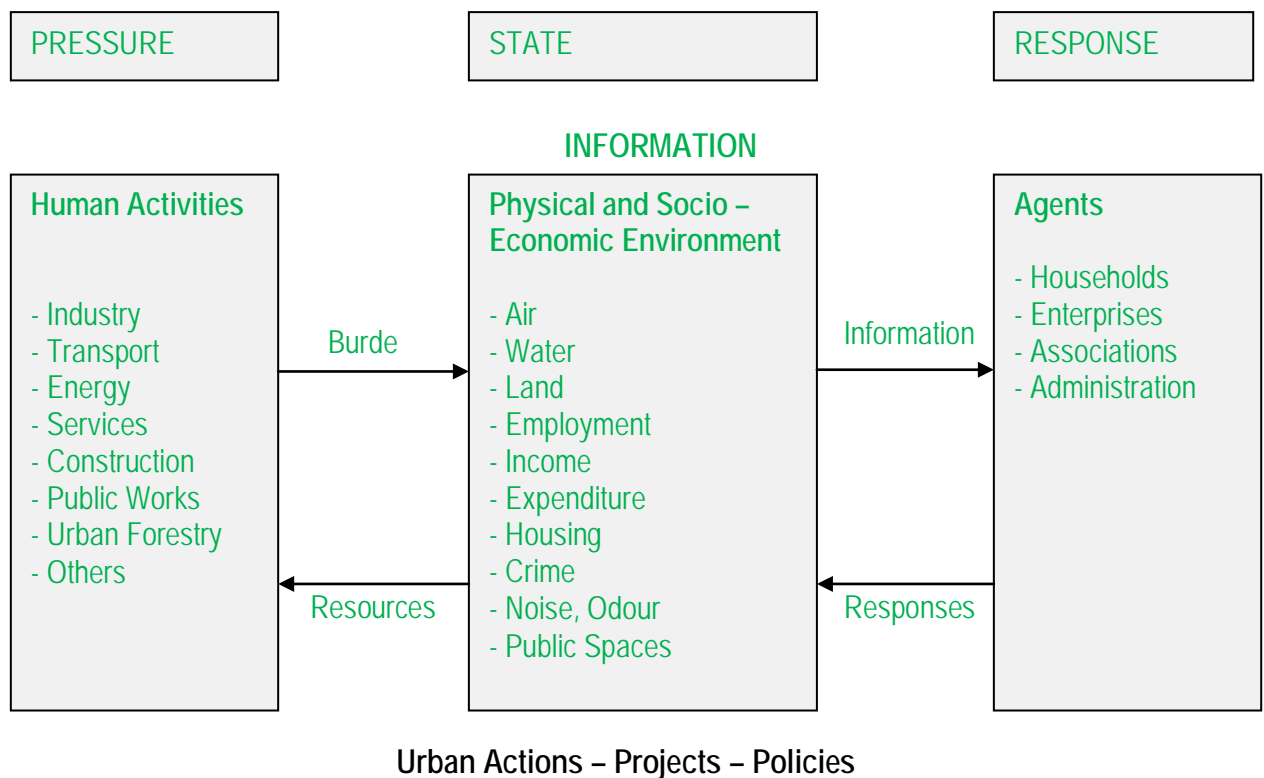


Fig.7 A Conceptual Framework for Urban sustainability Performance Indicators

Source: Mega, Voula and Pedersen, Jørn, (1998), Urban Sustainability Indicators – Page: 14 - Available at: <http://eurofound.europa.eu/pubdocs/1998/07/en/1/ef9807en.pdf>

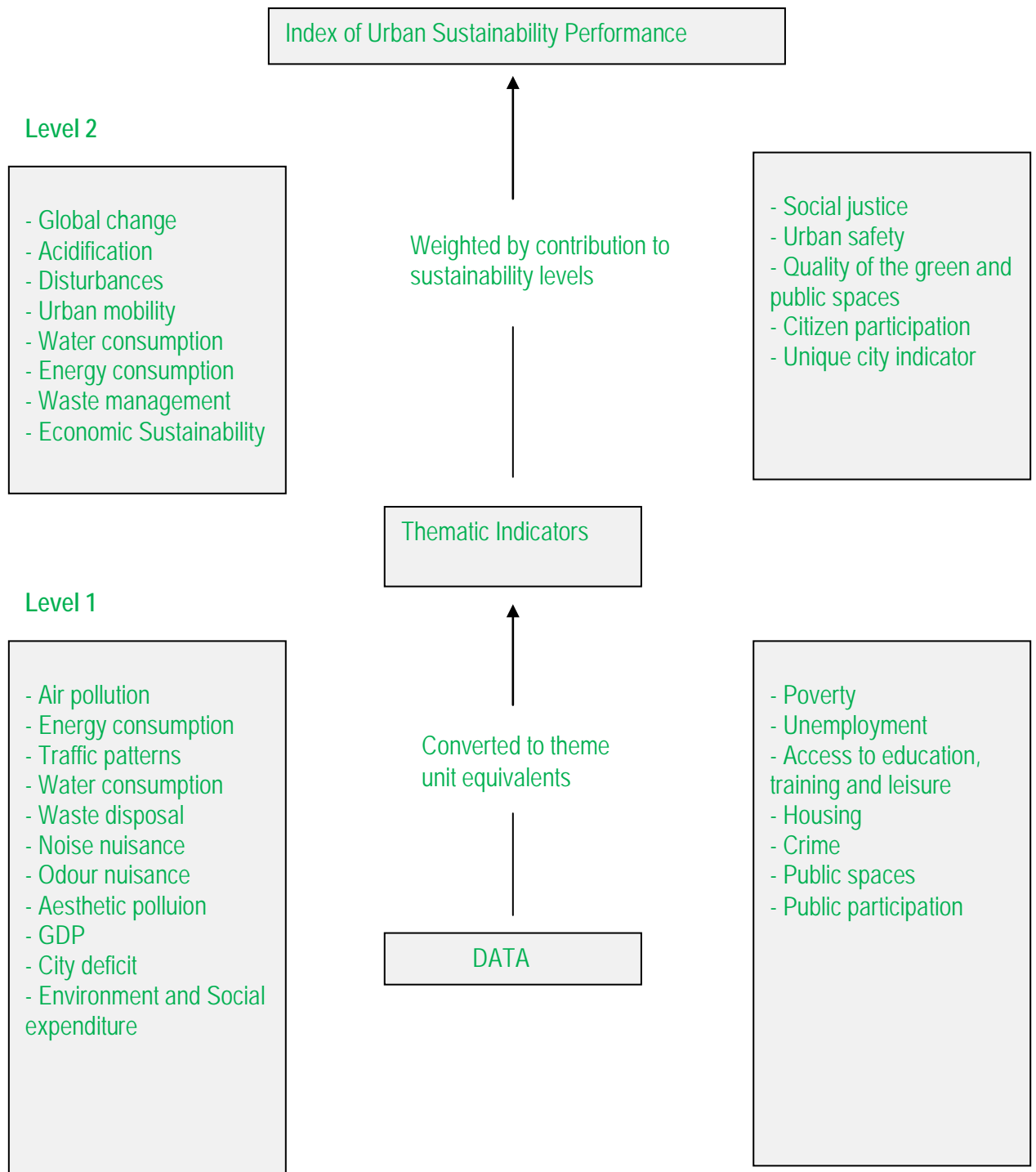


Fig.8 Construction of an Indicative Index of Urban Sustainability Performance

Source: Mega, Voula and Pedersen, Jørn, (1998), Urban Sustainability Indicators – Page: 15 - Available at: <http://eurofound.europa.eu/pubdocs/1998/07/en/1/ef9807en.pdf>

1.6.1.c Toward an ecological city

"The term "eco-city" refers to the quality of urban environment which enhance the well – being of citizens and society through integrated urban planning and management that harness the benefits

of ecological systems and protect and nurture these assets for future generations"¹⁵. The initiation of this movement was well known in the International Conference of the United Nations on "Cities and sustainable development" held in Rio de Janeiro, Brazil in 1992 and afterward The Organization for Economic Co-operation and Development issued a formal program called "ecological city" is marked by the Summit of the United Nations in 1996.

The concept of „eco-city“ has strong impact from the idea of an “Urban Ecology” initially emerged from the late nineteenth century under the name of Garden City, launched by Sir Ebenezer Howard. The concept of garden cities comprising planned and self-contained communities surrounded by greenbelts as well as carefully balanced areas of residences, industry, and agriculture. This is an urban planning scheme aim to address the problems of polluted urban environment at the start of the modernization process and immediately became a widespread movement in the European Community and the industrialized world; it was seen as an effective tool to solve urban environmental problems which are consequences of the industrialization process. The idea has had profound influence on ecological urban development all over the world and provided indispensable groundwork for the evolution of the “eco-city” concept.

In the middle of 1970s after the first oil crisis, an U.S non – profit organization named “Urban Ecology” was established with an addressing the importance of compact urban structure and other planning approaches in order to save energy and resources. Urban Ecology organized the first international conference on eco-city in Berkeley, California in 1990. Until 2006, there were five more international conferences about Eco-city was organized in different city in the world, from Australia, Senegal, Brazil, China to India which defines the concept of eco-city as a goal to “rebuild cities in balance with nature”. Similarity, the Australia Urban Ecology organization is "eco-city is a city ensure balance with nature" or more specifically, the settlement allows the residents living in the physical conditions of life but only minimal use of natural resources. In view of the construction design of sustainable eco-city, spread, low-density urban areas, is converted into a network of residential high-density urban areas or on average size limits are separated by green space. Most people live and work within walking and cycling. One of Urban Ecology's founders, Richard Register argued in his influential book published 2002 named: *Ecocities: Building Cities in Balance with Nature*. He advocates more density at closer proximity, because when the distance between destinations goes up, so less energy use, waste, land-use. Thus, "urban ecology" refers to the living conditions of urban of which the object of interest is the ecological environment, and "ecological Urban" is an urban meet these criteria about conditions and quality of ecological environment, and "ecological urban planning" is urban planning methods aims to achieve the criteria of high quality of life, towards the sustainable urban development. The planning guidelines of ecological urban can be summarized under the following aspects: architectural work, biodiversity, transportation, industrial and urban economy.

¹⁵ (Suzuki, H., Dastur, A., Moffatt, S., Yabuki, N., Maruyama H., (2010), *Eco² Cities – Ecological Cities as Economic Cities*, Page:17)

1.7 SUSTAINABLE URBAN TRANSPORT DEVELOPMENT

1.7.1 The definition of Sustainable Urban Transport Development (SUTD)

There are multidimensional meanings and concept of sustainability in urban transport. Adapting the Brundtland Commission Report's definition of "sustainability development" sustainable transportation can be defined as "a set of transport activities together with relevant infrastructure that collectively does not leave problems or costs for future generations to solve or bear"¹⁶. Or "Sustainable Mobility is the ability to meet society's need to move freely, gain access, communicate, trade and establish relationships without sacrificing other essential human or ecological values, today or in the future"¹⁷.

More formal definitions have been advanced by a variety of publications, most notably from the World Bank, European Union Council's Ministers of Transport or the U.S. Transportation Research Board's "Towards a Sustainable Future". Sustainable urban transportation of the of the European Union Council's Ministers of Transport is defined as:

"Allows the basic access and development needs of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations.

- *Is affordable, operates fairly and efficiently, offers a choice of transport mode, and supports a competitive economy, as well as balanced regional development.*
- *Limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and uses non-renewable resources at or below the rates of development of renewable substitutes, while minimizing the impact on the use of land and the generation of noise"*¹⁸.

By World Bank, conceptually:

- *sustainable urban transport is transport that serves the common vision of an urban region's economic and social development. In practical terms, sustainable urban transport focuses on easing access and mobility for people to reach work, services, resources, and each other.*
- *Sustainable urban transport needs to provide access for all groups in society in a manner that is within the environmental carrying capacity of a region and is affordable to both the providers and users of transport systems. Sustainable urban transport provides for smooth movement of goods within cities.*
- *Sustainable urban transport is an essential precondition to maintain and improve the quality of life and to increase the well-being of its citizen".*

In order to accomplish these concepts of SUTD in rapid growth of Asian cities context with different structure compared to those in European and America, there is a need of new approaches to land use planning. An Effective sustainable urban transport system will support economic growth and has the potential to act as a catalyst in the development process.

¹⁶ Asian Clean Air Initiatives, (2010), Sustainable Urban Transport in Asia, Making the Vision a Reality – Page 24 Available at: <http://www.wri.org/publication/sustainable-urban-transport-asia>

¹⁷ George C. Eads, The Sustainable Mobility Project (SMP)- Transport and Sustainability Seminar

¹⁸ European Conference of Ministers of Transportation, ECMT (2004), Assessment and Decision Making for Sustainable Transport, Organization of Economic Coordination and Development (www.oecd.org) – Available at www.internationaltransportforum.org/europe/ecmt/pubpdf/04Assessment.pdf.

1.7.2 Urban transport sustainability in Vietnamese context

In Vietnam, the first official reference to the term of "sustainable development" (Phát triển bền vững) appears in 2001. During the 9th National Congress of the Communist Party of Vietnam, several policies were approved referring to this concept in general purpose:

- "- fast and sustainable economic growth*
- Stable improvement of the living standards of the people*
- External economic relation enhancement*
- Human resource development and job creation*
- Hunger eradication and poverty reduction*
- external economic relation enhancement"¹⁹*

However In the urban transport sector, there is no clear definition of a sustainable urban transportation system was defined. *"It is rather a strategy plan, or better, it gives orientations for the general steps that should be followed"*²⁰. The legal frame for the development of the transport system in Hanoi is given In the Decision No.90/2008/QĐ-TTg approved by the Prime Minister there are two main measures are indicated:

- Investment in the development of a road network.*
- Development of a mass transit system (with the goal to raise the passenger ratio to around 35-45 % by 2020)*

As a consequence, urban transport planning Vietnam in the past years focused on improving the road network and the development of a mass transit system as a long-term goal. However, the current traffic issue in the city is becoming increasingly important and put a lot of pressure on decision makers, meanwhile the time it takes for the projects to reach the goal is still slow in realization. Although this decision had to be updated due to the expansion of Hanoi in August 2008, otherwise it still stands as the legal frame for all stakeholders who are in charge to develop the transportation system.

According to Transport-Development and Strategy Institute, the public organization under Ministry of Transportation (TDSI) has not yet clear definition for sustainable planning in Vietnam. However it was expressed that sustainability means decreasing pollution, providing an attractive and comfortable public transport network, and working on the accessibility and inter-connection between the different means of transport. Besides this, it was expressed by Transportation Engineering Design Incorporation (private organization linked with the Ministry of Transportation (TEDI) that the improvement of the Public Transport System is essential in order to reach the goal of sustainability and reduce gas emissions. As expressed by Hanoi Public Transport Management and Operation Center, under the department of Transport (TRAMOC), the current strategy of sustainable urban development in Hanoi is not only the focus on long-term projects for the metro and dedicated bus lanes but also the development and improvement of the current bus network. This is not only a basic short-term and midterm goal, but also necessary in order to develop important projects like

¹⁹(http://www.cpv.org.vn/cpv/Modules/News_English/News_Detail_E.aspx?CN_ID=413221&CO_ID=30180#tBAtAMWp3TAC (last accessed Friday, 9 March 2012).

²⁰ Musil, Clement and Molt, Christiane, (2010), *Building Transportation System in Hanoi: Between emergency and constraints*, Page: 134

the urban railway line that will be completed in the future. In addition, the Ministry of Transportation (MOT) recognizes in a concept paper SUTD as following:

“The development of sustainable urban transport is base on a process which ensures the balance between the social economic development objectives and the environment protection. Sustainable Urban Transport is an integral part of the wide urban sustainable development; it depends on the process of planning and urban development, and has a direct impact on the cities’ sustainable development. The proposed approach includes economical, environmental and social aspects which are combined with the previous definition. Economically, sustainable urban transport must first establish a transportation system to support better economic development of the city, improve the mobility and strive to reduce displacement cost. Environmentally, sustainable urban transport has to minimize pollution and socially ensure the right to travel of all the citizens. Accordingly, the transport planning will focus on sustainable development criteria, development of public transport modes, the control and restraint of the increase in private vehicles, the control of traffic in the core and central urban areas, with a priority to centre axes, expressways and ring roads.”²¹

From this overview of how sustainable urban transport is understood in Vietnamese context, it is clear that there is no existing concept of “a livable city”. The idea of reducing the travel distance by developing city promoting mixed – use quarters, walk able streets or the use of bicycles – aspects which one can find easily in European cities as well as other Asian cities. This issue is hardly discussed in the Vietnamese context with still very strong influence by the central system and politically driven mechanisms, large number of recommendations and orientations.

1.7.3 Criteria and responses towards urban transport sustainability

It is significant to have a system of indicators for urban transport sustainability in order to assessment how transport is becoming sustainable or to enact policies to strengthen sustainability. Indicators can help to examine the current sustainability level and to support the planning and implementation of sustainable urban transport policies and investments. The performance of the transport system will be assessment and define through a system of indicators. In the following figure is the guideline of major transport challenges’ indicators, the selection of indicators for the assessment process is based on the elements which will help to have a more sustainable urban transport model.

²¹ <http://www.hids.hochiminhcity.gov.vn/Hoithao/phat trien benvung/vuvantaibogvt.pdf> (paper written in Vietnamese).

Pillars of SUTD	Criteria for achieved SUT	Individual indicator	Possible strategies or action plan
Accessibility	<ul style="list-style-type: none"> - Allow basic access for everyone. - Offer choices of Transport mode. - Reduce travel distance - Reduce time lost by traffic congestion 	<ul style="list-style-type: none"> - Travel time lost per person or per kilometer per day. - access to public facilities (Percentage of Public Bus users) - Access to urban services. -public transport index (travel time, The quality level of public Bus services) - Road density (km per km²) - Walking and cycling facilities distant/time to public transport. - Traffic volume (km traveled by road) 	<ul style="list-style-type: none"> - creation of condition for accessibility to public transport - Provide rational urban transport infrastructural system in local and urban scale - High density with mix land used, promote walk able street or use bicycle.
Safety	<ul style="list-style-type: none"> - Low rates of accidents and deaths, injuries, or hospitalization related to Traffic accidents. 	<ul style="list-style-type: none"> - Road traffic fatalities (no.per 1000people) - Underlying predictive indicators map out the kinds of accidents and their causes, the victims (drivers, passengers, pedestrians/ cyclists or bystanders) 	<ul style="list-style-type: none"> -Basic road safety law - Strick licensing qualification. - strick traffic enforcement
Environment	<ul style="list-style-type: none"> - High air quality, days exceeding health limits, 	<ul style="list-style-type: none"> -Days exceeding limits, concentrations Predictive indicators include emissions factors for each vehicle/fuel Combination, total emissions, fuel quality, and consumption. 	<ul style="list-style-type: none"> - Basic air quality laws standards for fuel quality. - Emissions standards on view or existing vehicles -Procedures for stopping polluting cars or curtailing
Economic	<ul style="list-style-type: none"> - Comfort and efficient from the aspect of economy. 	<ul style="list-style-type: none"> - Expenditure on road infrastructure - Transport fuel consumption -Transport household budget share 	<ul style="list-style-type: none"> - Transport industry profitability. - Reduce Transport cost

Tab. 2 System of indicators for assessment urban transport sustainability

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CHAPTER II

AN OVERVIEW OF HANOI CITY

2.1 AN OVERVIEW OF HANOI CITY

2.1.1 The natural and socio-economic background

2.1.1.a The Terrain

Hanoi is an urban area situated at the Red River Delta and the capital of the Socialist Republic of Vietnam. It is located at latitudes 20°530' - 21°23' N and longitudes 105°44' - 106°02' E, in the Northern part of the country. In 2008 the Hanoi's administrative boundaries were extended to include the neighboring province of Ha Tay and four others districts and communes that formerly belonged to the provinces of Vinh Phuc and Hoa Binh - Fig.9. Upon this expansion, the territory of the capital reached 3,300 km² (3.6 times the size of the previous area). Hanoi absorbed wide areas of agricultural land that now constitute two-thirds of its territory. This expansion also included a doubling of the official population of the capital city from 3.2 to 6.4 million inhabitants. The Hanoi Capital Region currently is an area covering Hanoi and ten urban districts, surrounded by five satellite towns and thirteen townships. Hanoi city is considered not only the political and cultural centre but also the economic and demographic center of the whole region.



Fig.9 Hanoi's administrative boundaries after expansion in August, 2008

Source: based on Hanoi administrative Map <http://www.hanoi.gov.vn/web/guest/diachihanoi/-/vcmsviewcontent/UxV0/1001>
last access: Wednesday 21 March, 2012 – Graphic by Author

On the 2nd September, 1945 the Democratic Republic of Vietnam took over the power from the French army and declared Hanoi its capital. The newly independent nation went through the First Indochina War (1945- 1954), followed by the Vietnam War (1962-1975). The de-urbanization policy of government during the war years limited both the physical and demographic growth of the city.²² Nevertheless by 1961, Hanoi's total population had already reached almost one million. The city's inhabitant (population did not see an extraordinary growth rate) was not to increasing for several decades, because of two main reasons: continued control on rural to urban migration, and the economic hardship of the 1980s because of the wars. After 1986 and early 1990s, after the launch of a set of policies known as the "Doi Moi" (renovation) policies, urban population increased substantially. From then on, the city's populations grew at an annual rate of approximately 3% and reach 2.9 million by 2001²³. Currently, most of this new population is rural migrants migrating from surrounding provinces.

Year	Population In Metropolitan region	Area	Density (people per km ²)
1954	53.000	152km ²	348
1961	91.000	584km ²	155
1978	2.500.000	2.136km ²	1.170
1991	2000.000	924km ²	2.164
1999	2.672.000	924km ²	2.891
2001	2.812.000	924km ²	3.043
2009	6.448.000	3.344km ²	1.928

Tab.3 Hanoi's Area and Population Changes during 55 years

Source: Hanoi Portal-Hanoi Department of Information and Communication

<http://www.hanoi.gov.vn/web/guest/diachihanoi/-/vcmsviewcontent/UxV0/1102> last access: Tuesday 27 March,2012

The city of Hanoi is primarily flat terrain with the ground elevation is 5 to 20m above sea level. However, the northern and northwestern mountainous areas stand from 20 to 400m above sea level. Land in Hanoi is raised by Red River's silt, thus the inner city is spotted by a wide range of lakes and lagoons. In addition, Hanoi was a city of marshes and rivers, which was formed by half land and half water, according to its ancient map.

2.1.1.b Population concentration and density level

The location of the population in the territory is marked with a remarkable high density in inner area and a much lower density in the periphery area. In the city, the average density stands at 9287 people/ km², however some districts density reaches up to 35.341 people/ km² in the DongDa district or 33.662 people/ km² in the Hoan Kiem district. Meanwhile, in outskirting districts the average density is 1.375 people/ km² with the lowest density in Bavi district at 584 people/ km².

²² Dam Trung Phuong, (2005), *Do thi Viet nam (Vietnam urban development)* - Page: 77, 78

²³ Hanoi Portal-Hanoi Department of Information and Communicatio <http://www.hanoi.gov.vn/web/guest/diachihanoi/-/vcmsviewcontent/UxV0/1102> last access: Tuesday 27 March,2012

Some others suburban districts in the East and the West of the city like Soc Son and My Duc, the density are less than 1,000 people /km². Tab.3.

Provincial Cities /Districts	Wards	Area (km ²)	Population	Density (people per Km ²)
10 Urban Districts (Quận)				
BaDinh	14	9,224	228.352	24.756
CauGiay	8	12,04	147.000	12.209
DongDa	21	9,96	370.117	35.341
HaiBaTrung	20	14,6	378.000	25.890
HaDong	17	47,917	198.687	4.147
HoanKiem	18	5,29	178.073	33.662
HoangMai	14	41,04	216.277	5.269
LongBien	14	60,38	170.706	2.827
TayHo	8	24,00	115.163	4.798
ThanhXuan	11	9,11	185.000	20.307
Subtotal	145	233,56	2.169.258	9.287
1 Town				
SonTay	15	113,474	181.831	1.047
18 Rural Districts (Huyện)				
BaVi	31 + town	428,0	250.000	584
ChuongMy	30 + 2 towns	232,9	271.761	1.167
DanPhuong	15 + 1 town	76,8	124.900	1.626
DongAnh	23 + 1 town	182,3	276.750	1.518
GiaLam	20 + 2 towns	114,0	205.275	1.800
HoaiDuc	19 + 1 town	95,3	188.800	1.981
MeLinh	16 + 2 towns	141,26	187.536	1.327
MyDuc	21 + 1 town	230,0	167.700	729
PhuXuyen	26 + 2 towns	171,1	181.500	1.061
PhucTho	25 + 1 town	113,2	154.800	1.367
QuocOai	20 + 1 town	136,0	146.700	1.078
SocSon	25 + 1 town	306,51	254.000	828
ThachThat	22 + 1 town	128,1	149.000	1.163

ThanhOai	20 + 1 town	129,6	142.600	1.100
ThanhTri	15 + 1 town	98,22	241.000	2.453
ThuongTin	28 + 1 town	127,7	208.000	1.628
TuLiem	15 + 1 town	75,32	240.000	3.186
UngHoa	28 + 1 town	183,72	193.731	1.054
Subtotal	399 + 22 towns	3.110,91	4.279.682	1.375
Toatal	559 + 22 towns	3.344,47	6.448.940	1.928

Tab.4 Administrative units in urban and suburban areas (2009)

Source: Hanoi Portal-Hanoi Department of Information and Communication <http://www.hanoi.gov.vn/web/guest/diachihanoi/-/cmsviewcontent/UxVO/1102> last access: Tuesday 27 March, 2012

In 1987 the removal of restrictions on private sector involvement in trade and transportation was announced in Vietnam together with Decree No.10, which encouraged individual agricultural production. The Decree came into force in April 1988. As one of the most important policies in the agricultural sector, it had an instant effect by increasing farming productivity. Meanwhile, it made the issue of labor surplus in the rural areas more obvious than ever before²⁴. Resolution No. 4 of the Council of Ministers (Hoi Dong Bo Truong) was issued in July 1988 which aimed at adjusting the policy restricting population movement to the urban areas, which had been enforced by the government since 1964. These changes affected many aspects of Vietnamese society, but perhaps none of them more obvious and disturbing than migration which had started substantially in the early 1990s. The table below shows the difference of population concentration between inner city's districts and peri-urban's districts. Historically the rate of population growth in the urban area had remained just slightly higher than that of the suburban area as marked by the year 1978 and 1996. However this difference is significant over 15 years due to the migration from peri-urban districts and from other provinces to inner city of Hanoi as well as the expansion of the urban boundary of the city. Therefore, the percentage of Hanoi's population living in its urban districts has significantly changed from 31% in 1978 to 54% in 2002²⁵.

²⁴ Dam Trung Phuong, (2005), *Do thi Viet nam (Vietnam urban development)* - Page: 102

²⁵ Hanoi statistical office, (2002), *Hanoi statistical year book 2002* - Page: 10 - 142

Year	Population (000 persons)			% of Total	Annual growth rate (%)		
	Urban	Peri-urban	All		Urban	Peri-urban	All
1918	-	-	70.0	20.0	-	-	-
1955	160.0	370.0	530.0	30.2	-	-	6.9
1978	769.7	1692.3	2462.0	31.3	7.1	6.8	-0.1
1996	1150.3	1247.3	2397.6	48.0	2.3	-1.7	2.8
2002	1521.3	1325.8	2847.1	53.4	5.5	0.9	3.2

Tab.5 Trends in population growth in Hanoi during 1918 -2002

Source: Hanoi statistical office, (2002), Hanoi statistical year book 2002 - Page: 10 - 142

2.1.1.c Economic and Administration

Economy

Hanoi's economy has grown significantly over the past decade.

- 1991 – 2000 recorded annual growth rates of 9%-12,5%
- 2001 -2005 recorded annual growth rates of 10% - 11%
- 2006-2010 stands at 5,7% ²⁶

While Hanoi is only home to 7% of Vietnam's population, it contributes 12.5% of the national GDP. Hanoi's gross output of industry is also relatively low, representing only 13% of the country's total output (compared to 25% for Ho Chi Minh City-HCMC) in 2008. Hanoi is indeed a less industrialized region than HCMC. As can be expected from a capital city, the proportion of the population working in the government sector is relatively high, representing 9% of the province's workforce (compared to 6% in HCMC). Currently the city's development is mostly attributed to fast-paced industrialization led by the public sector and Foreign Direct Investment (FDI). The fastest growing sector of Hanoi's economic growth comes from FDI. In 2008, Hanoi received close to US\$18.8 billion from FDI, accounting for 7% of the total investment in Vietnam. Local and foreign tourists also have made significant contribution to the growth of city as well. Besides that, Industrial production value grew the fastest among economic sectors, reaching 14, 5% - 15, 5% growth rates per year.²⁷

Administration

After its expansion, the number of vice-party secretaries, members of the People's Council and People's Committee and deputy directors of departments increased. Hanoi currently has approximately 20 directors and 160 deputy directors of specialized departments. In August 2008, the city had 8133 government employees. The figure raised to 8839 by September, 2009, an increase of 706 people. Over one year after the capital city expanded, beginning in August 2008,

²⁶ Dam Trung Phuong, (2005), *Do thi Viet nam (Vietnam urban development)* - Page: 156

²⁷ General statistical office Vietnam, (2010), *completed census results of the Economy and Housing census (1 CD-ROM)*

Hanoi has an additional 700 government employees, very far from its permitted level. *Hanoi Portal- Hanoi Department of Information and Communication – last access: 21- 03-1012*

2.1.2 The constituent elements of Hanoi City

2.1.2.a Geographical location

The formation and development of ancient Hanoi's urban spatial structure has been strongly influenced from its geographical position. Located at the cultural interference of two great philosophical thoughts in the feudal period which are Confucianism derived from China and Buddhism from India. The city lay on the major trade routes in Southeast Asia. Thus, it developed as a bridge between East Asia (Japan, China) and South – Asia. China's ambitious expansion and the needs for cultural expansion of India, together with demand for economic exchange between the two biggest Asian civilizations were the exogenous factors making Hanoi an attractive place leading to it becoming a key point in the flow of international trade in South-East Asia.

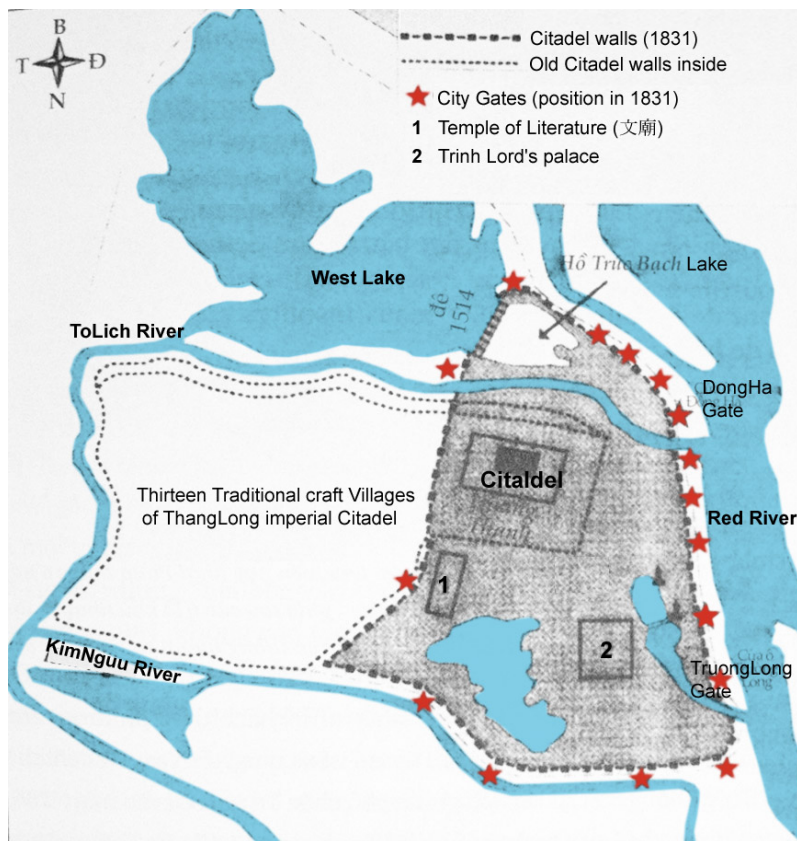


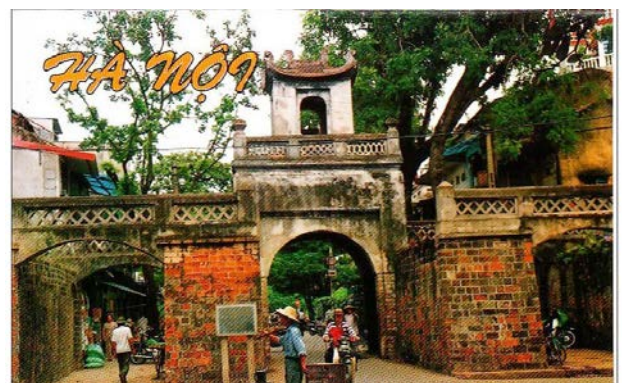
Fig.10 ThangLong imperial Citadel's position diagram and its City-gates in 1831

Source: Papin, Philip, (2001), Histore de Hanoi, translated into Vietnamese by Mac Thu Huong) - Page: 141

Since the IX century the city of Hanoi has already located at its current position. In the "Histore de Hanoi" Philip Papin has described its location as the intersection of the Red River and the To Lich River. Even with many historical changes and time the current position of the city still shows clearly this feature. Before its present expansion the Old Quarter was an area surrounded by three rivers: the Red River in the East, the West and the South are surrounded by To Lich River and Kim Nguu River, the Northern part of the city is dominated by the huge West Lake (Fig.10). Due to this dense

network of rivers and lakes, the waterway system of the city was well developed. Thang Long²⁸ became the economical, political and cultural center of the whole country for many centuries until the Nguyen Dynasty was established and moved the capital to Hue in 1802. After being occupied by the French in 1873 and passed to them ten years later, it became the capital of the whole of Indochina in 1887, and from then the city has remained the political centre of Vietnam.

In the feudal period, urban spatial structure was remarkably characterized by the surrounding craft villages and commercial wards in the inner city. These wards were specialized in particular trade, such as silk, bamboo, jewellery, ceramics, garments, footwear, embroidery, metallurgy, etc. The name of each street was referred to the product sell or produce there²⁹. For example HangTre - bamboo street, HangBac - silver street, HangMa - Paper votive burning street... In each of these commercial lines, craftsmans or merchants were connected to different communities and some of those were even self-contained communities. This concept of a self-contained community or village within the city led to an urban structure of an organic relationship between the handicraft villages where commercial activities and trade played a significant role. In this period, markets were also an important element in spatial urban structure providing a bridge from suburban craft villages to urban commercial trade wards the largest being those at the gate surrounding the citadel. The imperial city in 1831 had sixteen gates around it, nine gates opening to the Red River and seven gates to the trade area (Fig.10). Outside of each gate was a market (Img.14). This network of markets between the inner city and the surrounding countryside area is where people exchanged food and commodities. ThangLong became a market center of handicraft products made in the surrounding villages³⁰.



Img.14 A market at the city gate - O Quan Truong beginning of 19century and its current time
Source: <http://www.flickr.com/photos/13476480@N07/sets/72157626059949229/>

2.1.2.b The influence of Eastern philosophy in the urban structure

The urban structure not only reflects the dynamic development of the forces of production, but also a philosophical content of the social culture background of communities³¹. Generally, the thought

²⁸ Thăng Long (昇龍, "Rising Dragon") was the former name of Hanoi during Ly Dynasty (1010-1397)

²⁹ The street names nowadays still reflect these specializations, although few of them remain exclusively of their original commerce.

³⁰ Papin, Philip, (2001), *Histoire de Hanoi*, translated into Vietnamese by Mac Thu Huong) - Page: 141

³¹ Dam Trung Phuong, (2005), *Do thi Viet nam (Vietnam urban development)* - Page: 48

and life-style of eastern Asian were primarily developed from three major philosophies, namely Confucianism, Daoism, and Buddhism. Confucianism emphasizes personal ethnics and social responsibilities of human beings towards the society as a whole. Its emphasis on human relationship caused profound influence on the social structure of most East Asian countries. Daoism establishes the underlying philosophy and man-nature relationship of people in eastern Asia, and it has tremendous influence on Asian value systems and life-style. Originating in India, Buddhism blended very well with both Daoism and Confucianism in its basic philosophy, and has become one of the most popular religions in east Asia.

The conception of eastern philosophy from ancient times taught a harmonic relationship between people and nature in a physical, physiological and psychological way, where everything is in one undivided system (everything under the heavens). In other words, the universe is a harmony of *TamTai* – three elements: Sky-Earth-Human. This is the starting point of Confucianism and Daoism. During the development process from ancient times to today, *TamTai* theoretically has deeply influenced Vietnamese culture. Planning in architecture and in an urban context is always in harmony with nature, local climate and human beings, which is a concept of Feng Shui.

Feng Shui -風水: a magical city planning

風 *phong* : wind 水 *thủy*: water

Feng Shui, the science, researchs the influence of wind (direction), air (direction) and water (circuit) on human life. It is the art of choosing an auspicious site to build structures (from tombs to entire cities) in the landscape in order to achieve harmony with the universe and detect and acquire energy resources of the land. Its principle is according to the view of “*everything under the heaven*”³², the cosmological rules governing all activities, behavior and expression including how the spatial structure should be created between the macroscopic and the microscopic world.

“*Wind and water*” Feng Shui not only referred to the actual elements themselves, but also the invisible energy of the magnetic direction. Feng Shui’s ambition is to structure together the relationship between the natural and social environment. The relationship between the landscape and built environment (for the living, and in Asian cultures, just as importantly for the dead) was carefully choreographed. The symbolic of cosmological forces in Feng Shui was not merely ritualistic but led to an appreciation of the topographical features of any locality.

Tied to Feng Shui are numerous myths about the uniqueness of Asian architectural and planning practices, such as the vaunted marriage of water and city or sometimes the legends attached to the founding of cities. Basically many of the “*Feng Shui’s rule*” follow a common-sense logic: proximity to an upstream flowing river course (supplying clean water, minerals, seafood and prosperity through transportation and communication links), protection from cold northerly winds and malignant spirits (by way of mountains, hills or trees) and a south-facing platform or high ground (to have ample access to light and air and protection from flooding).

³² Shannon, Kelly, (2010), *Asiatic Urbanity – a Precursor to Landscape Urbanism?* Published in *OASE Journal for Architecture* issue: 80 – Page: 126

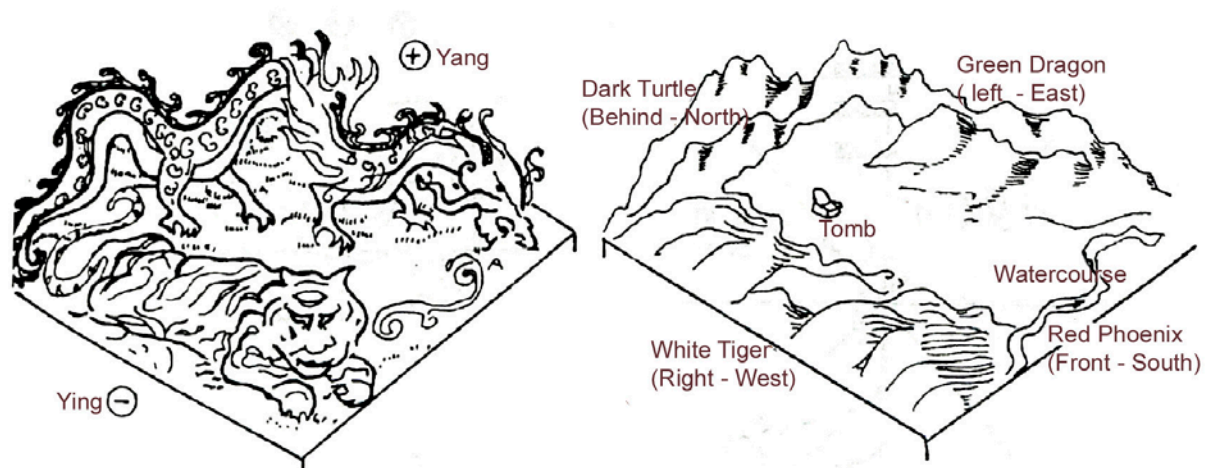


Fig.11 Illustration one of the idealistic Feng Shui' diagram

Source: Dam Trung Phuong, (2005), *Do thi Viet Nam (Vietnam urban development)* - Page: 55

Geomancy (also referred as astrobiology) connected to Feng Shui is a complex ordering system combining three religions Confucianism, Taoism and Buddhism. Geomancers analyses the morphological and spatial of the 'cosmic breath' in the surface features of the earth. They used the magnetic compass to distinguish the dynamic powers of specific places and their relation to heavenly bodies. The forms of hills and the directions of watercourses, the outcome of moulding influences of wind and water, the heights and forms of buildings, and the directions of roads and bridges are all very important factors which help geomancers in order to determine an auspicious place.

Feng Shui is not simple as a method or system to be replicated. In a particular moment in time, in very specific contexts, it was an important aspect of an overall cosmology that was very much related to a hierarchical (Confucian) ordering of men and men's relation to the larger world.

FengShui in ancient Hanoi's urban structure

"Feng Shui illustration of West lake area³³, the chart illustrates the 12 staff patterns, attributed to Yang-Yin song. It exhibits some of the characteristics of an ideal geomantic site according to the 'coiled up' pattern. The site is protected, particularly from the north and west, by a sinuous range of hills. It is also nourished by small streams that combine to flow through an opening to the south, the region from which beneficent influences radiate"³⁴

³³ See detail West lake area in the Fig.13

³⁴ Shannon, Kelly, (2010), *Asiatic Urbanity – a Precursor to Landscape Urbanism?* Published in *OASE Journal for Architecture* issue: 80 – Page: 126

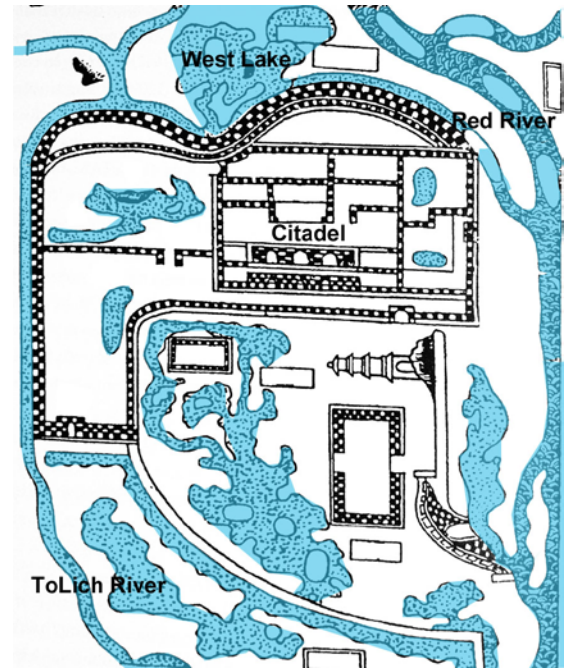
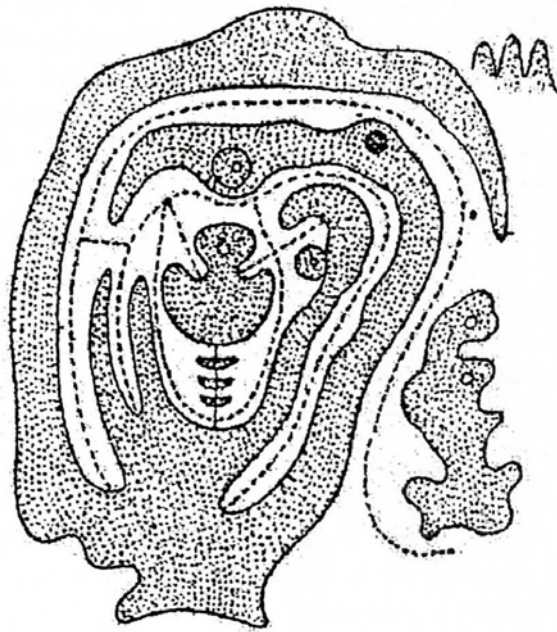


Fig.12 The 9th Century Feng Shui Illustration of Hanoi's West lake area (left)

Fig.13 The map of Hanoi in 1770 (right)

Source: Papin, Philip, (2001), *Histoire de Hanoi*, translated into Vietnamese by Mac Thu Huong) - Page: 43,135

"DaiLa³⁵ citadel, the former capital of Gao Wang, is in the very heart of the universe. The position evokes that of soaring dragon and stalking tiger, in the centre of the four directions, convenient for the development of the nation. This area is large and flat, high and bright, the population is not suffering from floods and darkness, and everything is in full prosperity. After investigating all lands of Vietnam, this place is actually the gathering venue of people from across the nation, the most appropriate place for eternal capital positioning. I want to take the most advantage from placing the capital here, what do you think, the court mandarins?"³⁶ former King Ly Cong Uan (974 – 1028) - said in a royal letter to seek mandarins' opinions about moving the royal citadel from Hoa Lu (now is Ninh Binh province) to Dai La – Hanoi.

2.1.2.c Water element in the urban structure

Historically, Hanoi's water paradigm was one of the integration of different factors, forces and aspects of life and adaptation and a certain degree of accommodation of the forces of nature³⁷. The relation of urbanization to water holds a privileged position in the millennium old city. Hanoi is spatially structured by water, in the form of the mighty Red River, To Lich River, Kim Nguu River and numerous lakes surrounding the city. The Red River was historically a lucrative trade route to China. The river is 1149km long with 510km flows in Vietnamese territory. In the dry season the Red River's water level stands just 1,5m but in the wet season it reaches to 14,13m. Due to the

³⁵ Former name of Hanoi

³⁶ Edict on the Transfer of the Capital (遷都詔) is the edict written by King Ly Thai To and was issued on the spring of 1010 to transfer the capital of Dai Co Viet from Hoa Lu to Dai La trong *Thơ văn Lý Trần, Hà Nội*, NXB Khoa học xã hội 1997, tập I trang 229

³⁷ Hanoi water urbanism, <http://vietnam-studio.blogspot.co.at/> last access: Monday 25 June,2012

pressures of urbanization process, there is an unfortunate disappearance of water bodies in Hanoi area (filling of lakes for land speculation, encroachment along canals, rivers and lakes), resulting in the decreased capacity for water retention of the city and the whole region, a loss of public space and an increased vulnerability of flooding.

2.2 HANOI'S URBAN TRANSPORT MASTERPLAN AND CHALLENGES

After the French War and the August revolution³⁸, from 1954 to July 2011, Hanoi has 7 times changes its administrative boundary and master plan adjustment. Among the major changes was the large territorial expansion in 1978 to encompass over 2136 km². The boundaries of Hanoi were then redrawn in 1991 in a smaller territory with 924km². In 2008, the administrative boundaries of Hanoi were once again extended to include the neighboring province of Ha Tay and 4 communes of Vinh Phuc and Hoa Binh provinces. The territory of the capital after expansion reached 3,344 km² with a population of 6,4 million people. This enlargement served to reaffirm the status of the capital city of Vietnam both at the national and regional scale. The new territory is expected to contribute to economic and functional development of the city by encouraging investment (including Official Development Aid (ODA) and Foreign Direct Investment (FDI)) and allowing the expansion and modernization of the region's infrastructure network. *The new territory is also expected to help accommodate the city's demographic growth and distribute the population outside of the overcrowded urban core. The so-called "New Hanoi" is expected to become the centre of politics, education, science, economics, and international exchanges of the whole region*³⁹. The exact intentions for the future of the New Hanoi will be revealed with the release of the Master Plan for 2030 and Vision for 2050. This document has prepared since 2009 by an American – Korean consortium Posco-Perkins and Eastman-Jina (PPJ), associated with the Vietnam Institute of Architecture, Urban and Rural Planning (VIAP). Following, two recent Hanoi's masterplan will be review with focusing on its longterm transport master planning.

2.2.1 Hanoi Masterplan from 1998 to 2005 vision to 2020

The general planning adjustment of Hanoi from 1998 to 2005 vision to 2020 was approved by the Prime Minister on 20 June, 1998 in Decision No.108/1998/QĐ-TTg. The profile of Master Plan scheme was afterward evaluated by Ministry of Construction and than validation and publication.

In following are the main content of the Decision approving the Hanoi's general plan:

- The structure of spatial planning is included Hanoi and other urban centers around the provinces of Ha Tay, Vinh Phuc, Bac Ninh and Hung Yen from a radius of 30-50 km. Hanoi will be developed on the both sides of Red River.
- The population is estimated for the whole Hanoi Urban area in 2020 will reach number of 4.5 to 5 million people, in the center of Hanoi City will be 2.5 million.

³⁸ The August Revolution refers in Vietnamese as 'Cách mạng tháng Tám' also called the August General Uprising (in Vietnamese is *Tổng Khởi Nghĩa*) by the Indochinese Communist Party, is a rebellion in Vietnam.

³⁹ Hanoi Masterplan to 2030 vision to 2050's main objectives, available at: <http://hanoi.org.vn/planning/archives/36/comment-page-1/#comment-1458> last access: Friday 22 June, 2010

- Limited development area are the Red River of the South area which will be controlled from number of 92.000 inhabitants in 1998, and will be decreased to 80.000 inhabitants in 2020. The Red River of the North area will slight changed from 70.000 in 1998 to 1 million people in 2020.
- Land use planning : Land use criteria is estimated around 100 m² per person, for transportation is 25 m² per person, for parks and green areas is 18 m² per person and for public service is 5 m² per person.

The Decision (No.108/1998/QD-TTg) gave also orientations to the Capital of Vietnam in order to build a comprehensive urban transport network, which comprises a Public Transportation System based on urban railway tracks. However, due to the difficult and time planning process in Vietnam, it took nearly 10 years to get a definitive approval for the basic orientations of the urban transportation sector. This approval was eventually given through the Prime Minister's Decision No 90/2008/QD-TTg based on the comprehensive urban development programme for Hanoi Capital City (referred as HAIDEP project) and advised the future urban development strategy for Hanoi city. Japan International Cooperation Agency (JICA) was conducted the HAIDEP project from 2005-2007, which placed Urban Mass Rapid Transit (UMRT) as one of the main component.

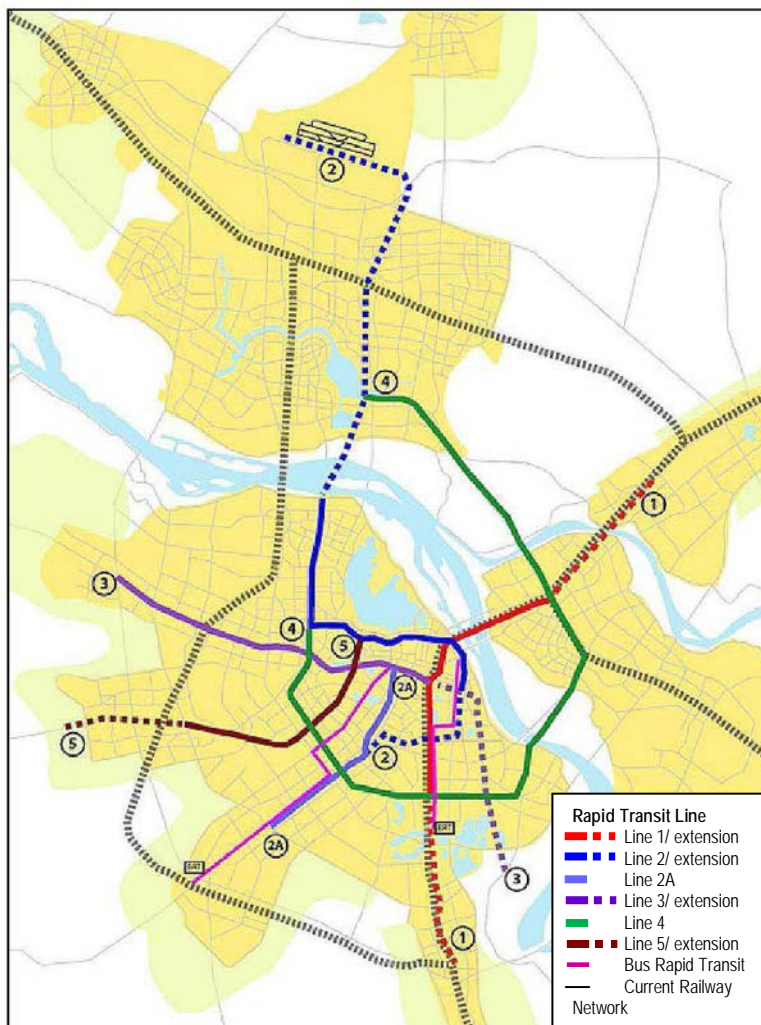


Fig.14 Rapid Transit Network until 2020 - Based on the Decision No 90/2008/QD-TTg

Source: Musil, Clement and Molt, Christiane (2010), Building Transportation System in Hanoi: Between emergency and constraints – Page:138

HAIDEP has established the master plan for urban development strategy for the whole Hanoi City and conducted pilot projects including a detailed development plan for new downtown at the northern part of Hanoi City. However, the project didn't include any concrete district development vision and methods for the realization of the development plan having UMRT as a core. Moreover, station vicinity development plan as the traffic node and measures to regulate neighboring local development and to guide it were not considered in the pilot project.

2.2.2 Recent Hanoi Masterplan development oriented to 2030 vision to 2050: the Great Hanoi project.

On 1st August, 2008 Vietnam's National Assembly decided to expand Hanoi territory to 3.344 km² with number of 6,448 million inhabitants. Following in 2009, a group of three foreign consultants: Perkins Eastman (the United State), Posco E&C and Jina companies (the Republic of Korea) together with The Vietnam Institute for Architecture, Urban and Rural Planning (VIAP) were specified to work on the new expanded Hanoi Master Plan after winning the competition hold by Vietnamese authority. According to their plan, the Hanoi construction Masterplan oriented 2030 vision to 2050 will be developed in the model of an urban cluster with the West Lake-Ba Vi axis and five satellite urban areas which will be connected by a modern transport system, link to the national and regional transport networks. The green corridors will be developed in the area lying between the Day and the Tich Rivers (Fig.15) encompassing central and southern part of Hanoi's territory. The consultants referred their design is based on the basic principle of creating a public green space near the city, protecting high-yield farming and flood prone areas and creating stronger links among urban, suburban and rural areas. It is expected to help preserve the region's natural and cultural heritage of Hanoi region.

Said Bradford Perkins, chairman of Perkins Eastman: *"Old centers and historic buildings will be an important basis for Ha Noi to become the most original of cities...Our important idea is creating a live document permitting flexible changes and living with those changes"*

The plan has been submitted three times to the government for consideration. In the plan, the PPJ proposed development of Hanoi's expanded central urban area to include two regions, one surrounding the old capital city originally divided by the Red River and the other expanding towards Ring road No. 4 (Fig.15). The ring road 4 is designed to facilitate transport within the Hanoi capital region or metropolitan area, which includes the old Hanoi capital city and the six surrounding provinces of Bac Ninh, Hai Duong, Hung Yen, Ha Nam, Hoa Binh and Vinh Phuc. It is expected to be built in 2012 and completed before 2020.

The urban centre will be the country's administrative, political, economic and cultural hub, it is expected to reach a population of 3.7 million with the total areas for urban construction of 45,300ha by 2020 and 4.6 million inhabitants and 55,200ha by 2030, respectively. In the urban centre, the inner city ring road 2 to the Nhue River, where new urban wards with high-quality and modern culture, service and shopping centres will be developed. The five satellite urban areas of Hoa Lac, Son Tay, Xuan Mai, Phu Xuyen and Soc Son, will each have specific functions, with the purpose of sharing the burden with the urban centre in terms of housing, training, industry and services.

Population in the five satellite areas is expected to be 0.7 million and the total areas for construction about 24,300 ha by 2020 and about 1.3-1.4 million and 35,200 ha by 2030.

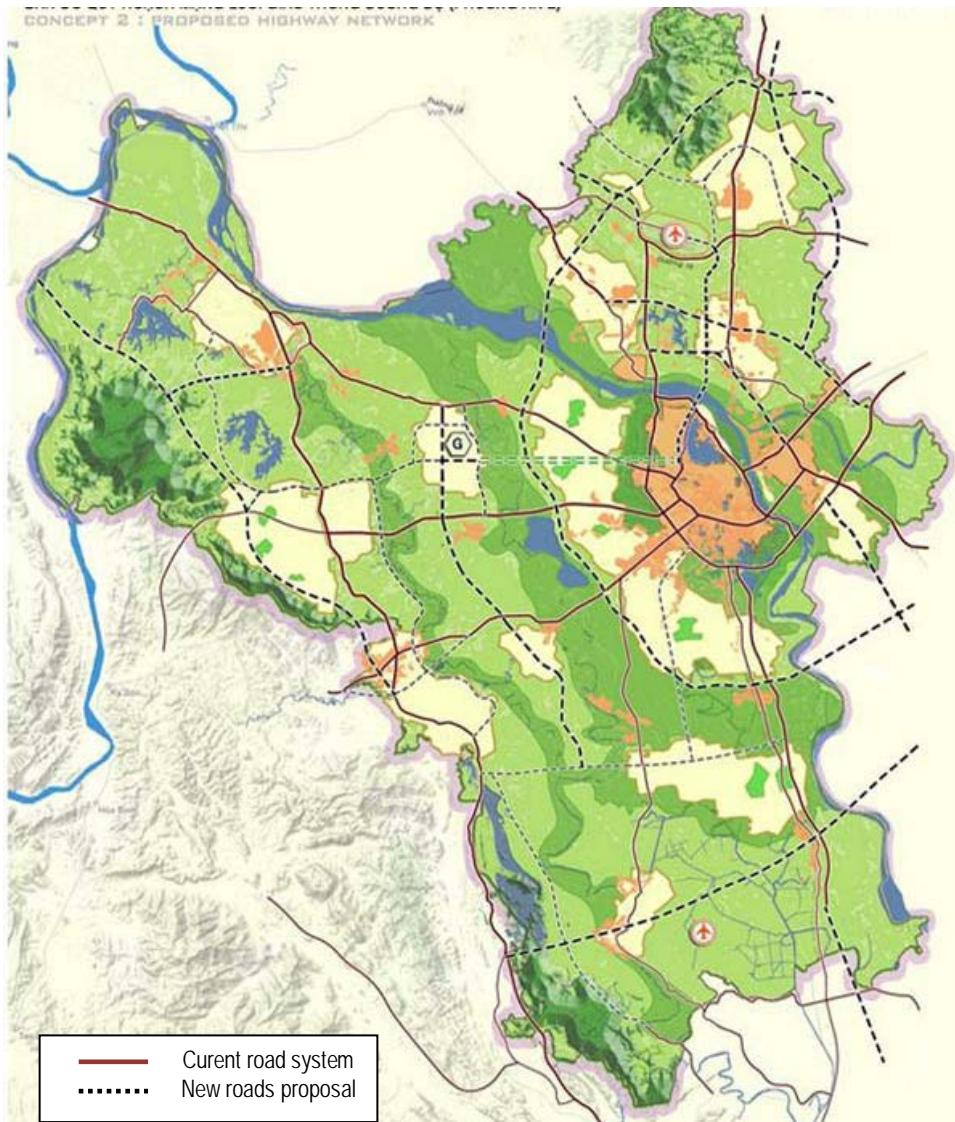


Fig.15 Proposed highway network for new Hanoi masterplan

Source: *Hanoi Masterplan to 2030 vision to 2050* available at: <http://hanoi.org.vn/planning/archives/36/comment-page-1#comment-1458> last access: Friday 22 June,2010

Regarding housing development, the minimum average housing area per capita will be at least 30 km² in the urban area and 25km² in the rural area by 2030. In the inner city, living conditions in residential wards and old buildings will be improved with control on construction density and the number of floors in buildings. There will be more public works, green trees and technical infrastructure.

According to the plan, university campuses will be built in the suburbs and the system of universities and colleges in the inner city will be restructured, with a maximum 300,000 students. Additionally, areas for the construction of kindergartens, primary and secondary schools will be increased by rezoning industrial areas and relocating agencies to the suburbs. Medical establishments where

highly contagious diseases are treated will also be moved to the suburbs. Existing hospitals and medical facilities in the inner city will be improved to serve the community in accordance with current regulations and standards.

As it was mentioned above, the Decision Decision No 90/2008/QĐ-TTg produced the framework and the main orientation for urban transportation and the public transportation development until 2020. However, since Hanoi has expanded its administrative territory, the capital therefore is obliged to prepare a new Construction Master Plan. Within this planning document the main orientations and all the transportation projects which had yet started up would be integrated in the future Hanoi Capital Construction Master Plan to 2030 and Vision to 2050. The first six rapid transit metro lines (Fig.14) that are already being studied will be kept by the new Master Plan. In addition, the plan of the current bus public transport carried out by The Transport Management Center (TRAMOC) and the Department of Transport (DOT) will be reviewed and adapted to the new city shape.

2.3 CURRENT STATUS OF URBAN TRANSPORTATION

2.3.1 Urban form characteristics and mobility

2.3.1.a Urban form characteristics, an overview and general considerations

From literature review, there is a close relationship between the urban centre, employment density and population density. *A centre is best identified by the clearly higher employment density than the surrounding area*⁴⁰. Because of quite different size of its administrative areas, Hanoi districts are ranging from 5 km² (Hai Ba Trung district) to more than 400 km² (Ba Vi district), thus urban centers identification for Hanoi will mainly depend on employment density figure, rather than its employment figure. An illustration of the Hanoi job distribution is presented in Fig.16, Hanoi's centers have employment density higher than 500 jobs per km². As the figure of Hanoi's employment centers identified lie next to core area. Employment density decreases from Hanoi centers to suburban areas. In addition to job distribution, the population distribution in Hanoi in Fig.17 also shows clearly its monocentric urban form. In general, with its existing Monocentric urban forms, Hanoi has itself many advantages provide planners with easier function of public transport by designing radial network. Nonetheless, monocentric urban form also can result in high congestion levels and lead to negative environmental consequences.

⁴⁰ McDonald, John F. (1987), *The identification of urban employment sub centers* page 242 – 258

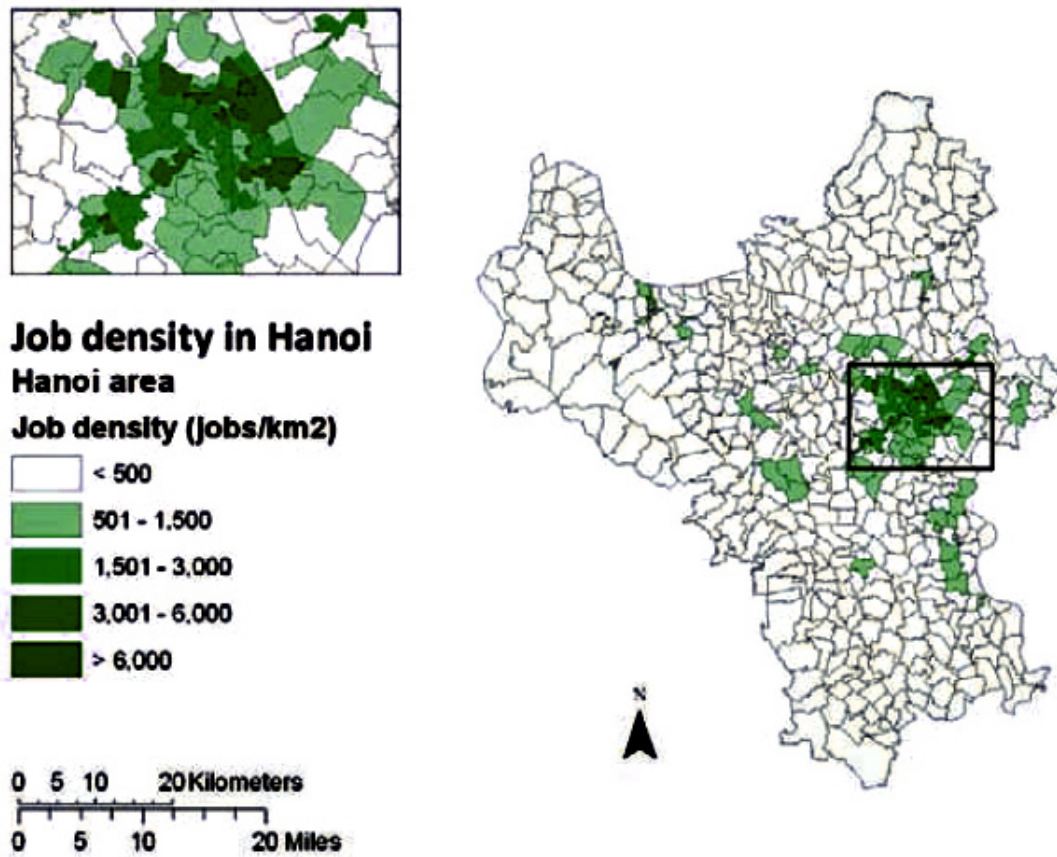


Fig.16 Job density in Hanoi districts

Source, Pham thi hong ha, (2011), *Assesing accessibility for the Randstad metropolitan area in the Netherlands: learning lessons for Asian megacities* – Page:8



Fig.17 Population distribution in Hanoi

Source, Pham thi Hong Ha - Page 9

Fig.18 shows population density gradients in Hanoi and various selected Asian cities in which previously experienced high traffic congestion. As it is presented, Hanoi has quite high density level in the urban core areas relative to just about 160 people per hectare in Jakarta. Hanoi's gradient however shows slightly flatter in outer-city districts compared to density gradients of Beijing, Bangkok and Jakarta; *this indicates that Hanoi has a less-concentrated central business district than those cities*⁴¹

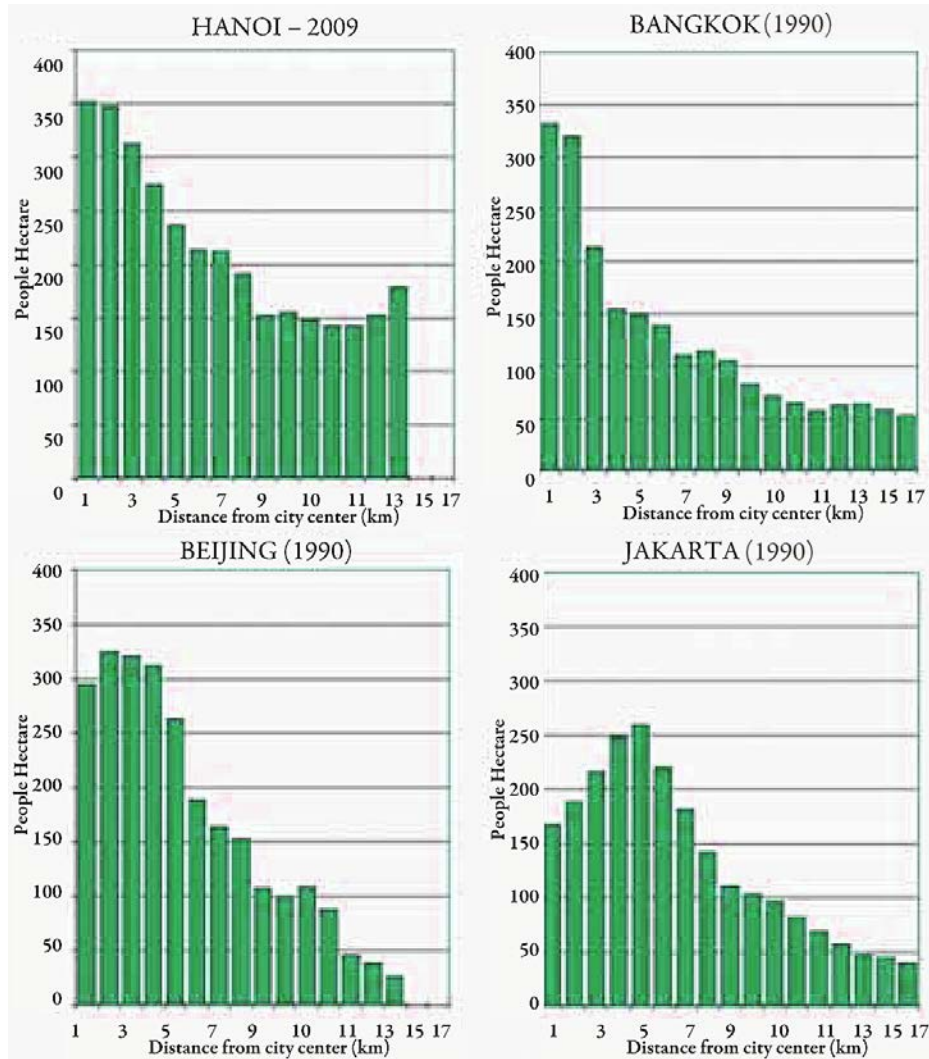


Fig.18 Population density gradients in Hanoi and selected comparator cities

Source: World Bank Document, (2011), Vietnam Urbanization Review, Technical Assistance Report –Page: 154-155

2.3.1.b Mobility

According to series of detailed survey and studies the Average travel speed in major Asian cities carried out by Japan Bank for International Cooperation (JBIC), The average travel speed in Hanoi is proximate 20km/h as illustrated in Fig.19. It is slightly higher than Jakarta, Kuala Lumpur or Tokyo. However, in the next few years when the share of four-wheeled vehicle soars further, the situation will become worse and the city will face up with chaotic traffic congestion as like in Manila or Bangkok⁴².

⁴¹ World Bank Document, (2011), Vietnam Urbanization Review, Technical Assistance Report –Page: 154-155

⁴² JBIC Research Paper No. 4 page 12

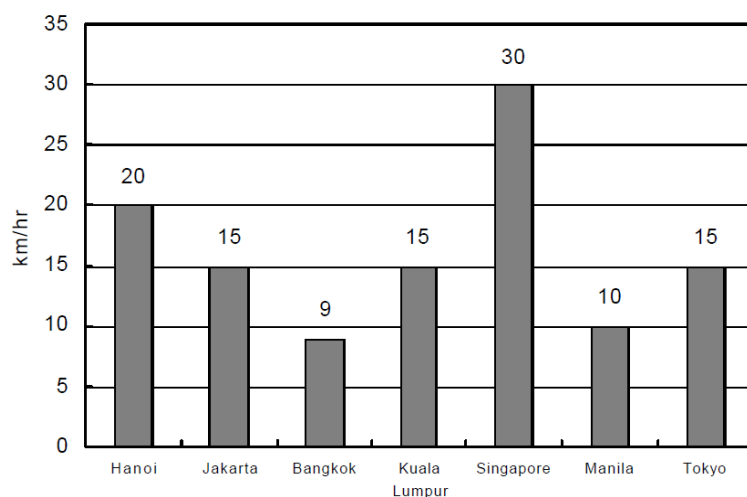


Fig.19 Average Travel Speed in Major Asian Cities

Source: JBIC Research Paper No. 4 - page 12

Following to a surveys and studies by ALMEC cooperation, average commuting times in Hanoi is around 18 minutes, compare to 15 minutes in Da Nang, and 20 minutes in Ho Chi Minh City⁴³. (These commute times may have increased since the surveys were completed, because of rapid urban growth and increase in personal vehicle ownership in both motorcycles and cars). The reason to explain for still remaining low commuting times in Hanoi is the high dominant of motorcycles in urban transport (estimated 80,8% of inhabitants are motorcycles owners - Hanoi transport modal split (2008)⁴⁴ (Tab.6). Hanoi urban transport management and operation centre). The other reason is the characteristic of mixed land use in neighborhoods of Hanoi, which result in the close proximity of many of the day-to-day trips individuals typically make. In addition, the typical prevalence of shop-houses model in most of the city in Vietnam, where many people live just above or behind their stores. These reasons are mainly contributing to still remain low average commuting time in Hanoi. However the level of mobility in the absence of adequate mass transit is only possible because there is still a low level of car ownership. Nevertheless, the number of cars is expected to increase substantially in coming years because of the increase of capital incomes per inhabitant.

2.3.2 Hanoi's Transportation Network system

2.3.2.a Radial Road Network (Fig.20)

Located in the center of Red River Delta, Hanoi Metropolitan area is at the convergence of strategic National Highways such as NH1N, NH1S, NH5, NH18, NH6, NH32, NH2, NH3, Thang Long-Noi Bai and Lang-Hoa Lac Expressway. These roads establish a network of radial linkages between Hanoi and other economic and residential hubs. Over the last few years, a number of projects aimed at renovating and upgrading the Hanoi road network and its surrounding provinces. Following are various key radial corridors:

⁴³ These data are taken from the substantial household surveys undertaken by ALMEC, in 2008 for Da Nang, 2004 for Hanoi, and 2002 for Ho Chi Minh City.

⁴⁴ Hanoi urban transport management and operation centre – TRAMOC
http://tramoc.com.vn/file_download/1235358776_305.pdf Last acces: Tuesday 3 July, 2012

Lao Cai – Haiphong/Ha Long Corridor: The NH5, NH2, Noi Bai-Viet Tri Expressway and NH 18 forms a corridor linking Lao Cai (and Kunming) to Hanoi and to ports of Hai Phong and Cai Lan. Currently, NH5 has been improved to four lanes which resulted in the reduction of travel time. NH18 is being improved by constructing additional two lanes. Expressways connecting Noi Bai – Ha Long, Sai Dong-Dinh Vu (Hai Phong) are being planned.

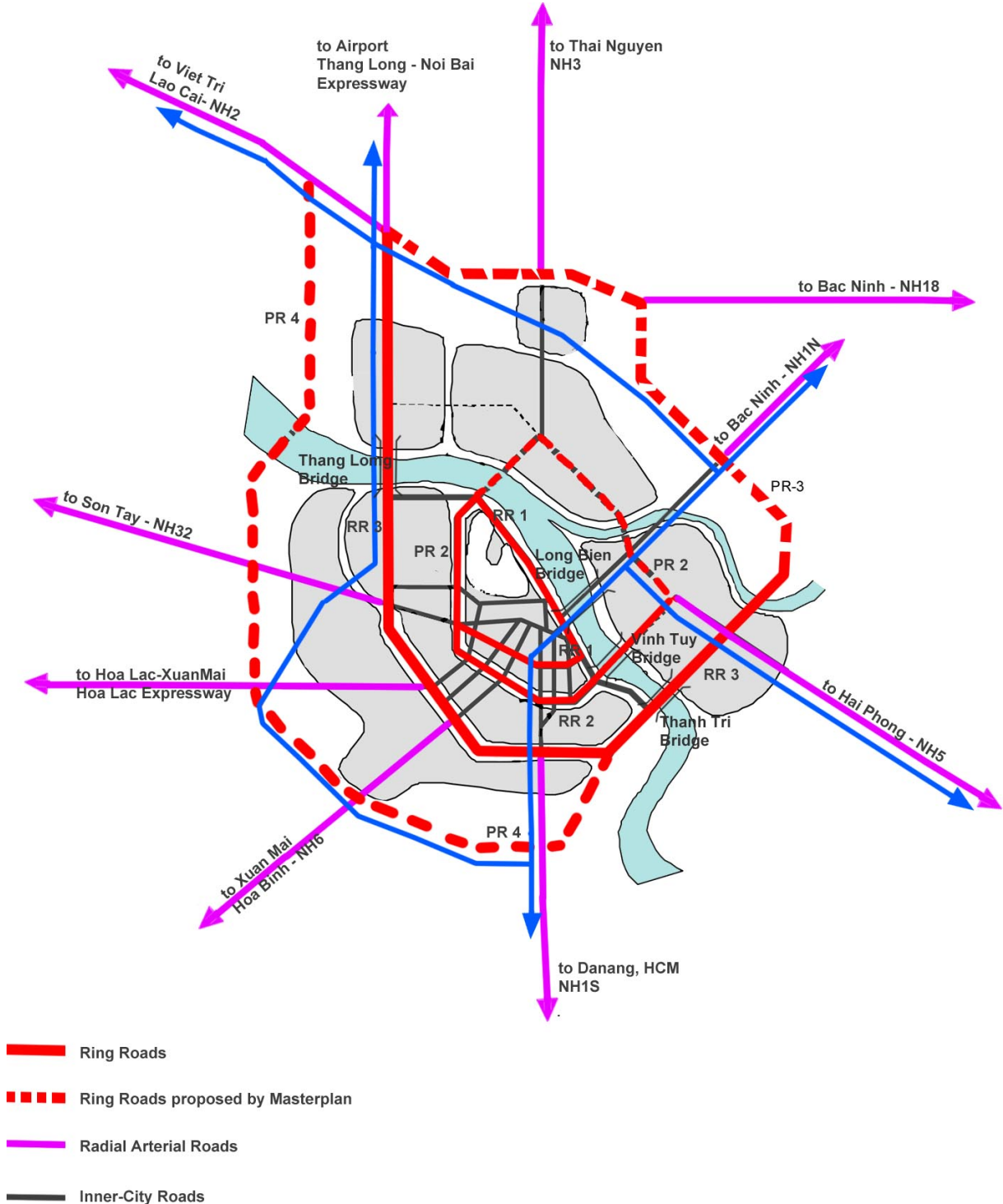


Fig.20 Hanoi's Transportation Network system
 Source: Hanoi Master plan 2020, JBIC Research Paper No. 4 - page 12 – Graphic by Author

NH1N: This corridor connects Hanoi with Dong Dang border gate of Lang Son province and this is a key link between Vietnam and China. The newly constructed segment (4 lanes) runs in parallel with the current route to connect with Dong Bridge, and to connect with NH5 at RR3 junction (Thanh Tri Bridge).

NH1S: To ease existing traffic volume on this route, construction of an expressway section from Cau Gié-Phap Van was completed. This section is about 1200-2000 meters northward of NH1S. Ha Noi-Ninh Binh expressway is also starting to be constructed.

NH6: This route links Hanoi and northwestern provinces including the largest power plant of Vietnam in Hoa Binh (70 km from Hanoi). NH 6 is being upgraded and expanded in which the section from Nga Tu So to Ba La will become six lanes.

NH3: This is an arterial road which links Ha Noi to Northern provinces. A parallel expressway to Thai Nguyen will be planned, and will start at the conjunction with proposed ring roads 4-PR4 in the north of Hanoi.

NH32: It links the northwest region to the western part of Hanoi. The road surface is degraded, particularly the section from Trung Ha Bridge to Lao Cai. The section from Cau Giay-Cau Dien is being upgraded to 4 lanes. The Dien-Son Tay section is still narrow and is in bad condition.

Lang-Hoa Lac Expressway: This expressway links Hanoi with urban areas of Mieu Mon-Xuan Mai-Hoa Lac-Son Tay.

2.3.2.b Ring Road System (Fig.20)

The master plan for metropolitan Hanoi for 2020 was approved by the Prime Minister in the Decision No 90/2008/QĐ-TTg in 2080 provides orientation for transport network of Hanoi with four ring roads as follows:

Ring Road 1 (RR1): RR1 is planned as two major urban roads: one run east-west (from Nguyen Khoai-Kim Lien-O Cho Dua-Cau Giay) and the other running along the right bank of Red River. The rest of the section from Cau Giay to Red River is overlapped with RR2 north.

Ring Road 2 and Proposed Ring Road 2 (RR2 and PR2): RR 2 has the following alignment: Minh Khai down to Nga Tu Vong-Nga Tu So-Lang road-Cau Giay-Buoi-Lac Long Quan-Nhat Tan Dyke and crosses Hong River at the proposed Nhat Tan Bridge. PR2 is being planned from Vinh Ngoc, Dong Hoi, Dong Tru, NH 5, and again crosses Hong River at Vinh Tuy Bridge and joins Minh Khai slope to form a circle.

Ring Road 3 and Proposed Ring Road 3 (RR3 and PR3): RR 3 starts from the north via Thang Long-Noi Bai-Mai Dich-Thanh Xuan-Phap Van-Thanh Tri Bridge-Sai Dong the rest of the section is PR3. The RR3 will initially play as a provincial road but will become a major artery of urban road in the near future. At present, RR3 is open to traffic, which includes the section from Noi Bai-Thang Long Bridge-NH32-Tranduy Hung with the length of 23 km featuring 4 and 2 lanes for motorized and non-motorized vehicles, respectively. Construction work for the section from Phap Van-Sai Dong (including Thanh Tri Bridge) is featured with 6 lanes. The section of Cau Chui-Dongtru Bridge-

Vinh Ngoc is now being prepared for construction. Work on the section Mai Dich-Phap Van has been postponed due to lack of funds and resettlement problems.

Proposed Ring Road 4: Start from the south of Phuc Yen town- crossing the Red River at Dai Mach commune (the area between Hanoi and Phuc Yen town), running parallel with outside part of Road 70 to Ha Dong town and along the north of Ngoc hoi station. From this point, it is proposed to connect with PR3.

2.3.2.c Network of Local Roads

Hanoi has a general developed street system in the central districts including the central business district - Hoan Kiem, and the administrative district - Ba Dinh. However, in other urban districts the road system is often short and narrow, "*among the total roads in the urban area nearly 70% of the existing roads are less than 11m of width, there are many paths even less than 5m wide*"⁴⁵. Moreover, *the road network is exceptionally sparse which is less than 7% of the land area (relative to almost 25% in many US cities, about 15% in most European cities and 11% in China's large cities)*⁴⁶. Since there are very few public transportation services available at new housing areas as well as along less developed secondary arterial and local roads, most of the travel demand generated from the areas are mechanized (motorcycle) and use the major arterial roads connecting to the central area, generating heavy traffic volumes on those major roads.

2.3.2.d Railway Network (Fig.20)

Hanoi features a regional rail network that presently forms a radial network with Hanoi as its focal point. This railway network is described as follows:

Hanoi – Ho Chi Minh (runs parallel with NH1S): The railroad connecting Hanoi and Ho Chi Minh City runs from the North to the South through 20 provinces and cities with a total length of 1730 km. This railroad has recently received an investment from the state including construction of bridges, top floor structure, locomotives and signals.

Hanoi – Lao Cai (runs parallel with NH2): The railroad connecting Hanoi and Ho Kieu in Lao Cai goes through 4 provinces and a number of industrial parks such as Viet Tri, Lam Thao, Bai Bang, and Lao Cai Apatite mining zone. Total length of the route is about 300 km.

Hanoi – Thai Nguyen: This route connects Hanoi to Go Dam Industrial Park, Thai Nguyen metallurgy zone, coal mine of Hong Mountain and Cam village. The section from Hanoi to Quan Trieu is 75 km long and the section from Gia Lam to Luu.

Hanoi – Lang Son (runs parallel with NH1N): The railroad from Hanoi to Lang Son, province lays nears the border gate of China runs through the whole province.

Hanoi – Hai Phong (runs parallel with NH5): This route connects Hanoi and Hai Phong City. The total length is 102 km.

Ring Rail: Rail ring road of Hanoi includes two branches: eastern railroad and western railroad. The eastern railroad is already finish. Meanwhile the western part which starts from Bac Hong along the

⁴⁵ Pandolfi, Laurent, (2001), *Une terre sans prix: Réforme foncière et urbanisation au Viêt-Nam, Hà Nội, 1986-2000*. Paris, IFU/Université Paris 8. Page 313

⁴⁶ World Bank Document, (2007) Report No.: 43457 Hanoi Urban Transport Development Project, Available at: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2008/05/05/000160016_20080505151313/Rendered/PDF/4345708127107.pdf, last access: Fiday 6 July, 2012

Hanoi-Lao Cai corridor, running through Thang Long Bridge, Kim No, Phu Dien, outer fringe of Ha Dong to join with North-South trunk road at Ngoc Hoi is still under construction.

2.3.2.e Inland Waterway Transport

Hanoi has an active Inland Waterway Transport system. The bases of this network are the following rivers:

Red River: Hong River is the largest river in the North, starting from Van Nam of China and leading to sea at the estuary of Balat. The Hanoi section is from Thuong Cat to Van Phuc, 47 km long and is 500-700 meters wide, 3.5-5 meters during the dry season and 7-9 meters deep during the rainy season.

Duong River: Duong River is the connection of Hong River and Thai Binh River. It is 68 km long, and the section running through Hanoi is 37 km long. This section features several bends and sandbars. Depth during the dry season is 1.2-1.5 m; and the width of river is 40-50 m.

Cau River: A section of the Cau River runs through Hanoi from Ca Lo confluence to Cong River. Average width of the river is 150 m and depth during the dry season is 1.2-1.5m.

Cong River: The section of Cong River in Hanoi is about 12 km long, and two kilometers from Da Phuc Bridge to Cau confluence is useable for waterway transportation. This section is 90-100 m wide and 1.2-1.8 meters deep during the dry season.

Key ports are including Hanoi Port, Khuyen Luong Port on Red River; Duc Giang Port and Go Diem Port on Duong River.

2.3.3 Transport characteristic and current traffic trends

2.3.3.a Significant number of motorcycles ownership

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 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.

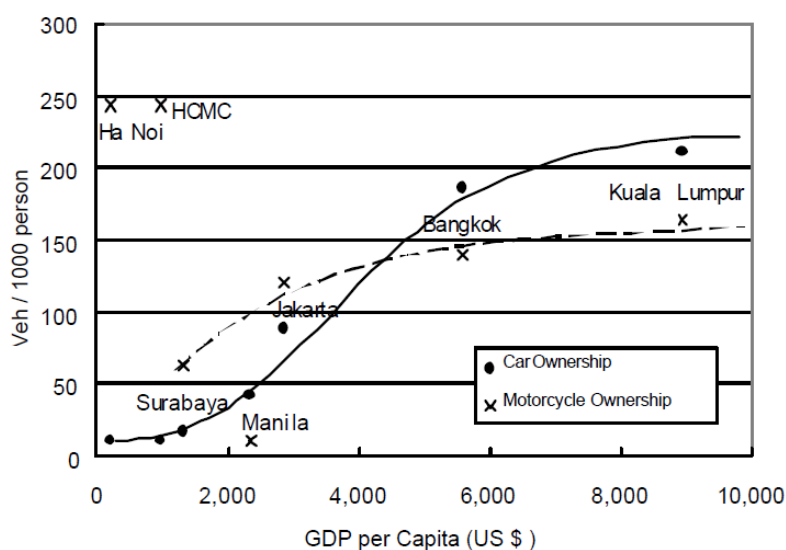


Fig.21 GDP per Capita and Vehicle Ownership

Sources: JBIC research number 4 - Page 7

Accordingly to the Hanoi transport modal split by Hanoi urban transport management and operation centre (TRAMOC) in 2008, the modal share of motorcycle among other vehicles is estimated at 80,8%. Although the shares of car is still low, remained at number of 4.0%.

	Modal Split
Buses	10,7%
Tourist buses	1,8%
Cars and mini vans	4,0%
Motorbikes	80,8%
Bicycles	2,5%
Light trucks	0,2%

Tab.6 Hanoi transport modal split (2008)

Source: http://tramoc.com.vn/file_download/1235358776_305.pdf

2.3.3.b Increasing number of motor vehicles

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. As it is presented in the Tab.6, the number of registered motor vehicles increased from 2.363 in 1986 to 47.261 in 1995 at an average annual growth rate of 33.5 %.

Year	Car	Van	Bus	Truck	Other	Total registered
1986	902	1	122	1.408	2.363	2.363
1987	1.469	2	224	2.810	5.379	5.379
1988	1.843	3	310	4.113	7.664	7.664
1989	2.798	154	597	7.548	12.822	12.822
1990	3.750	537	957	9.603	19.815	19.815
1991	6.502	1.016	1.568	12.564	29.737	29.737
1992	8.190	1.048	1.875	13.323	35.094	35.094
1993	10.051	1.175	2.243	14.198	39.061	39.061
1994	11.541	1.355	2.647	15.506	42.701	42.701
1995	12.581	1.441	2.848	18.097	47.261	47.251

Tab.7 Number of Registered motor Vehicles in Hanoi from 1986-1995

Source: JICA, 1997, *The Master plan of Urban Transportation for Hanoi City of Vietnam* – Page: 24.

Following the data of TRAMOC in 2004⁴⁷, there were nearly 400 motorcycles per 1000 inhabitants and 12 cars per 1000 inhabitants, though these data are now exceeded by far. In 2009, Hanoi had nearly 3.7 million motorcycles and 302 000 registered cars while its administrative territory had expanded in 2008⁴⁸. The examination of the modal split (Fig.22) shows that currently motorcycles are used for more than 80% of urban trips, 11% use public transport and 4% by car. In 1995, bicycle accounted 47% of travel and remaining only 3% in 2008. The figure obviously indicates the growing number of motorcycles, while showing only a weak increase of the number of cars. Thus, the increasing number of motorcycles combined with the arrival of cars consequences two most undesirable result: congestion and pollution.

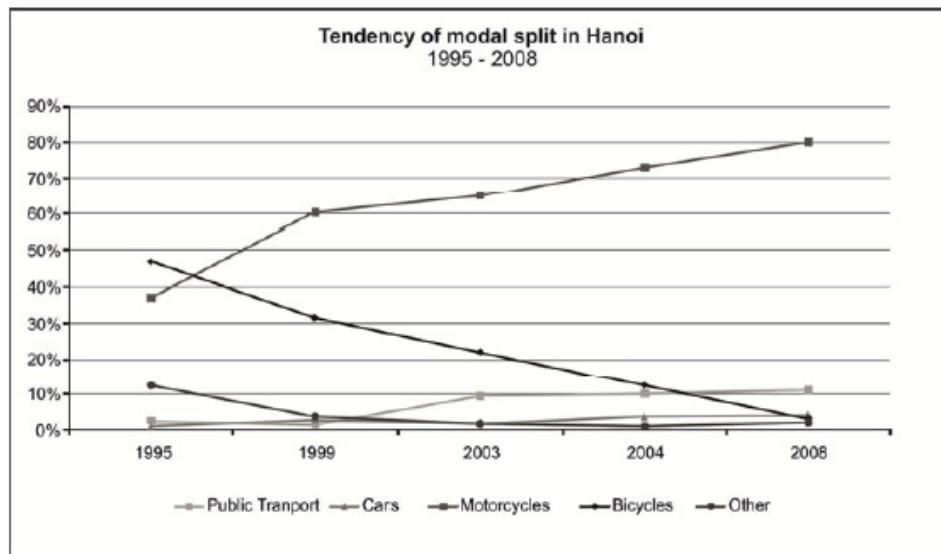


Fig.22 Tendency of modal split in Hanoi (1995-2008)

Source: Graph by Musil, Clement – Building Transportation System in Hanoi: Between emergency and constraints. P 128)

2.3.3.c Increasing traffic volume and congestion

As it was mentioned earlier, Hanoi extended its administrative boundary from an area of 924 km² to 3,344 km² in 2008, as the result increasing number of migration from rural areas to the urban area and emerging relocation needs by urban redevelopment from downtown to suburbs. At the same time, several suburban centers were developed to relocate the centralized function of the existing urban centers. Thereby, much larger travel demand with longer average travel distances was expected.

Currently, traffic congestion has become one of the most urgent problems, especially in the city centre. Although there are several Master Plans for Hanoi on transportation sector, such as building new railway, highways or subways within the city, nevertheless bus is still remain the main public transport mode and the most common private transport are motorcycles. Besides that, the poor road conditions and the lack of maintenance, seriously affecting the efficiency of the city's

⁴⁷ Concerning by means of transport registered, it's difficult to get accurate data in Hanoi. This is taken from Tramoc in 2004 (for the modal comes from the survey implemented at the end of year 2003).

⁴⁸ Since August 2008, Hanoi has got an area of 3,344 km² (previously 924 km²) and its population is 6.4 million inhabitants

transportation system and adversely impacting urban environmental quality. Consequence, many bottlenecks in the city core and around the city have formed.

2.4 AN OVERVIEW OF HANOI PUBLIC TRANSPORTATION

2.4.1 Hanoi's Public transportation

Hanoi's public transportation in the past was significant. In early 1900s, the capital of Vietnam was well known for its tramway and trolley bus service. In 1960 the city started the bus service with 28 urban routes. In the early 1980's the whole city has around 500 vehicles, carrying around 50 million passengers per year. Nevertheless, in the post *Đổi Mới* period, public transportation has started to collapse, in 1997 the number of routes has been reduced to 13, and the capacity has fallen to 7 million passengers per year⁴⁹. There are several reasons to explain this change: firstly it comes from the fact that subsidies to the Hanoi Bus Company dried up as a part of the general economic restricting program. Secondly, after the disintegrating of Soviet Union, spare parts from the former suppliers became less available and required hard currency payments. Moreover, the motorcycle market was liberalized and the people were dissatisfaction with the low level of the old public transportation system. As a result, people turn away from public services and providing their own transportation mode.



*Img.15 Hanoi Tramway and Trolley Bus before *Đổi Mới* period*

Source: Fotostream von manhhai, <http://www.flickr.com/photos/13476480@N07/> last access: Monday 2 July,2012

Since 2000, with the support of the German cooperation CIM and the decentralized cooperation led by Ile de France Region, Hanoi urban transport management and operation centre -TRAMOC (founded in 1998) carried out two international projects, namely Asiatrans and Ecotrans (co-funded by European Union). During this time bus operator companies have been reorganized through Transerco holding company (which is now the main bus operator in Hanoi). Currently Hanoi has five public transport modes as presented below:

Public bus: Inner-city service is provided by the Transerco holding 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.

Cyclo-Xeom: Cyclos are run by the private sector, mainly individuals. Cyclo is a popular mode for short distance trip. However, there is no statistical data on the number of cyclos.

⁴⁹ JBIC research number 4 - Page 28

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.

2.4.2 Relevant Authorities in Public Bus transport sector

The Decision No.3385QD/PC-VT of Ministry of transportation (MOT) issued on 23rd December, 1996 provides the comprehensive regulations on Bus Public Passenger Transportation (BPPT). In total, there are five entities involved in BPPT service delivery; namely:

- Ministry of Transportation (MOT) in charge in approves a BPPT project proposed by Transport and Urban Public Works Service (TUPWS) or Transport Department after written comments from the People's Committee of provinces and cities.
- People's Committee of a province or a city instruct and guide BPPT operators, in conformity with the laws, by determining fare rates, opening and closing bus routes, approval of operation schedule, regulating compensation for the loss.
- TUPWS or Transport Department under each People's Committee fully responsible to MOT and Chairman of People's Committees of provinces and cities
- Management and Operation Center for Public Transportation (MOCPT) under each TUWPS or Transport Department responsible for supervising the performance of contracts signed between the MOCPT and BPPT organizations, especially implementation of the regulations on bus routes, operation schedule, and service quality and fare level.
- Operators.

In case of Hanoi capital city, Ministry of Planning and Investment (MPI), Hanoi Authority for Planning and Investment (HAPI) assess and authorize the capital investment of approved projects.

2.4.3 Hanoi's Public transport challenges

As it was stressed, the Decision No 90 produced the framework and the main orientation for urban transportation and the public transportation development until 2020. However, since Hanoi has expanded its administrative territory in August 2008. The city was required to prepare a new Construction Master Plan for the new expanded territory. The first six rapid transit metro lines that are already being studied will be kept by the new Master Plan. As it was presented in the Fig.14-page: 38, the main rapid transit lines include also the BRT lines and their extension until 2020. Additionally, the Tab.7 gives an overview of the rapid transit lines which are being studied. Until now, there are 27 km from the Line No 1, 13 km from the Line No 2A, 1, 2 km from the Line No 2, 12 km from the Line No 3 and 29 km from the BRT line are currently being examined.

Beyond some technical aspects, some main challenges can be analysis as followings:

- According to the Department of Transport (DOT) assumption, the whole plan implementation would reach nearly 9 billion USD. This cost is immense, and thus Vietnamese authorities must attract investors and need the international organizations's assistance in order to finance, design, build and operate this comprehensive Public Transport System. As a result, there will be various domestic and foreign stakeholders involved. The increasing number of stakeholders involved is accompanied by a number of obstacles. Because of different Project Management Methodologies; the unbalanced knowledge between foreigners and local

engineers, the increasing competition between subcontractors or other private engineering companies. Or even if the plan will be in realization, the problem of how could this large system will be financed is still remained.

- Delays in the transport infrastructure implementation are quite common in the Hanoi. The example of the Kim Liên-Ô Chợ Dừa boulevard was delayed are mainly caused by the “land clearance process”. Therefore, for a metro line implementation, land acquisition problems would also provoke increasing expenses, which would force the Vietnamese authorities to attract other investors and would increase the number of stakeholders. Even if there was an investor, all budgets are not settled: material prices increase (due to inflation) and the technical option (elevated, underground or on ground) can also be changed. Beside the issues of several stakeholders, the Vietnamese authorities and implementation agencies have to coordinate in order to provide efficiency. But in order to get a sustainable urban transport system, not only coordination but also integration from the policies to the construction phases and the operation is needed.

Network	Lines*	Way	Length (in km)	Number of stations	Construction	Donor / Investor	Implementation agency	Proposition for Commercial operation	Estimated cost (in million USD)
MRT LRT	Line No1	Ngọc Hồi - Yên Viên	27	16	Elevated	Japanese ODA	Ministry of Transport / Vietnam Railway Administration	Phase 1: 2015 Phase 2: 2017	Phase 1 ≅ 1 000 Phase 2 ≅ 500
	Line No2	Nam Thang Long - Tran Hung Dao - Thượng Đình	17,2	15	Elevated and Underground	Japanese ODA	Metro Rail Transport Project Board / Hanoi People's Committee	Project 1: 2016 Project 2: 2018	Project 1 ≅ 1 200 Project 2 ≅ 700
	Line No2A	Cát Linh - Hà Đông	13	13	Elevated	Chinese Investment	Ministry of Transport / Vietnam Railway Administration	2013	≅ 550
	Line No3	Nhổn - Ga Hà Nội - Hoàng Mai	21	20	Elevated and Underground	French ODA (and Asian Development Bank and European Investment Bank)	Metro Rail Transport Project Board / Hanoi People's Committee	Phase 1: 2015 Phase 2: 2017	Phase 1 ≅ 1 100 Phase 2 ≅ 600
	Line No4	Ring (link between lines 1,2,3 & 5) Đông Anh/Sai Đông/Vinh Tuy/Thanh Xuân/Bưởi/Từ Liêm	53,1						
BRT	Line No5	Nam Hồ Tây - Ngọc Khanh - Lang Hòa Lạc	33,5	22	Elevated and Underground	Korean investment	Ministry of Transport / Vietnam Railway Administration	Phase 1: 2013 Phase 2: 2017	Phase 1 ≅ 574 Phase 2 ≅ 653
	Line No1	Ba La - Nguyen Trai - Khuat Duy Tien - Lang Ha - Kim Ma	13	every 350 - 500 m	On ground	World Bank	HUTDP Project Management Unit / Hanoi People's Committee	2011	≅ 65 (for the BRT basic infrastructure)
	Line No2	Vinh Quynh - Giai Phong - Dai Co Viet - Pho Hue - Hang Bai	10,9		On ground	World Bank	HUTDP Project Management Unit / Hanoi People's Committee		
	Additional BRT Line	Soc Son - Dong Anh - Kim No - Me Linh - Vinh Yen	33,9						

Tab.7 Infrastructure plan for the Hanoi Public Transport System
Based on Du an phat trien giao thong do thi (HUTDP), 11-2007 Decision No.90 (07-2008)
Source: Clement Musil and Christiane Molt (2010), Building Transportation System in Hanoi. - Page 140

Appendix 1: Institutional arrangement in the transportation sector in Vietnam

Planning and Policy	Roads	Railways	Inland Water	Ports/ Shipping	Air Transportation
Planning and Policy					
Multimodal	MOT	MOT	MOT	MOT	MOT
Sectoral	General Road Administration (GRA), reports to MOT	Vietnam Railways Corporation (VRC), reports to MOT	Vietnam Inland Waterway Administration (VIWA), report to MOT	Vietnam National Maritime Bureau (VINAMARINE), report to MOT	Civil Aviation Administration of Vietnam (CAAV), reports to MOT
Regulation: Technical					
Safety, Standards	GRA	VRC	VIWA	VINAMARINE	CAAV
Licensing	Drivers licensing by Traffic Police	Train/Locomotive Operator, by VRC	Vessel Pilots licenses by VIWA	Seafarers registration by VINAMARINE	Pilots and aircraft technicians licensed by CAAV
Registration	Motor vehicles registered by Traffic Police	Vietnam railway Administration	VIWA registers & inspects vessels	Vietnam Maritime Register, under VINAMARINE	CAAV registers & inspects aircrafts
Regulation: Economic					
Entry & Competition	VEC for Toll roads, LGU's for bus operators	Monopoly: VRC	Most barges are private for own-use; otherwise VIWA	Shipping services from VINAMARINE	CAAV
Pricing	Fares on public transport set by	VRC set fares, subject to Ministry of Finacial	VIWA sets river fees; subject to MOF	Fees, air fares, charges subject to MOF approval	Fees, domestic economy air fares, charges subject to MOF

	respective Peoples Committees (PCs)	(MOF) approval	approval; PC's sets port charges		approval
Program Management					
Investment	MOT, MPI	MOT, MPI, MOF	MOT, MPI, MOF	MOT, MPI, MOF	MOT, MPI, MOF
Programmin g	MOF	MOF	MOF	MOF	MOF
Infrastructure Delivery					
Construction	PMU's under MOT and under GRA	Track infrastructure, to be spun off to VNRA	Ports and channels by Project management Unit (PMU)'s under VIWA	Minor ports by VINAMARINE	By 3 Regional Airport Corporations, under CAAV
Concessioning	Vietnam expressway Corp. (VEC)	In theory VRC	No single agency	No single agency	By 3 Regional Airport Authorities
Service Delivery					
Public Users	Private cars, trucks, motorbikes	None	Bancas and small craft	Bancas and small craft	Private aircraft
Basic Law	MOT Decision No.3525/1998/QDBGTVT ; No.3030-QD-BGTVT	Vietnam Railway Law No. 35/2005/QH11	Decision No.23/2004/QH11-15 June 2004	Maritime Code of Vietnam (June 1990) as amended by Resolution No.51/2001-QH10-2001	PM Decision No.267/2003/QD-TTg on 19 Dec-2003; No.08/2006/L-CTN (July 2006)
Enforcement	Traffic Police	VNRA/VRC	VIWA River Management Stations	Vietnam Marine Police	Vietnam Air Traffic Management under CAAV

Tab.8 Institutional arrangement in the transportation sector in Vietnam.

Source: World Bank Document, (2011), Vietnam Urbanization Review, Technical Assistance Report – Page:133

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CHAPTER III

URBAN TRANSPORT SUSTAINABLE ASSESSMENT IN DONG DA DISTRICT

3.1 STUDY AREA DEFINITION

3.1.1 Study area selection

For the sustainable urban transport assessment in Hanoi, it is selected a specific neighborhood in the city in which almost all the main radial roads leading to city centre pass through and contributing a severe traffic congestions at the bottlenecks during the peak hour. The evaluation of the urban transport sustainability in the selected research area will be taking into account sustainability criteria established in the first chapter.

In this way, the study area of Dong Da district is chose base on its key position. Located at the South-gateway of the city, the district lies next to administrative district - Ba Dinh at the North and centre bussiness district (CBD)- Hoan Kiem at the North-East. It is observed during peak hours (from 7:00 to 9:00 and from 17:00 to 19:00) at traffic bottlenecks (Fig.23) which formed from the intersection of the main radial roads leading to the urban core and the second ring road. One can see a huge volume of people traveling in the direction leading to the city centre in the morning and in the opposite direction, out from the city centre, in the afternoon.

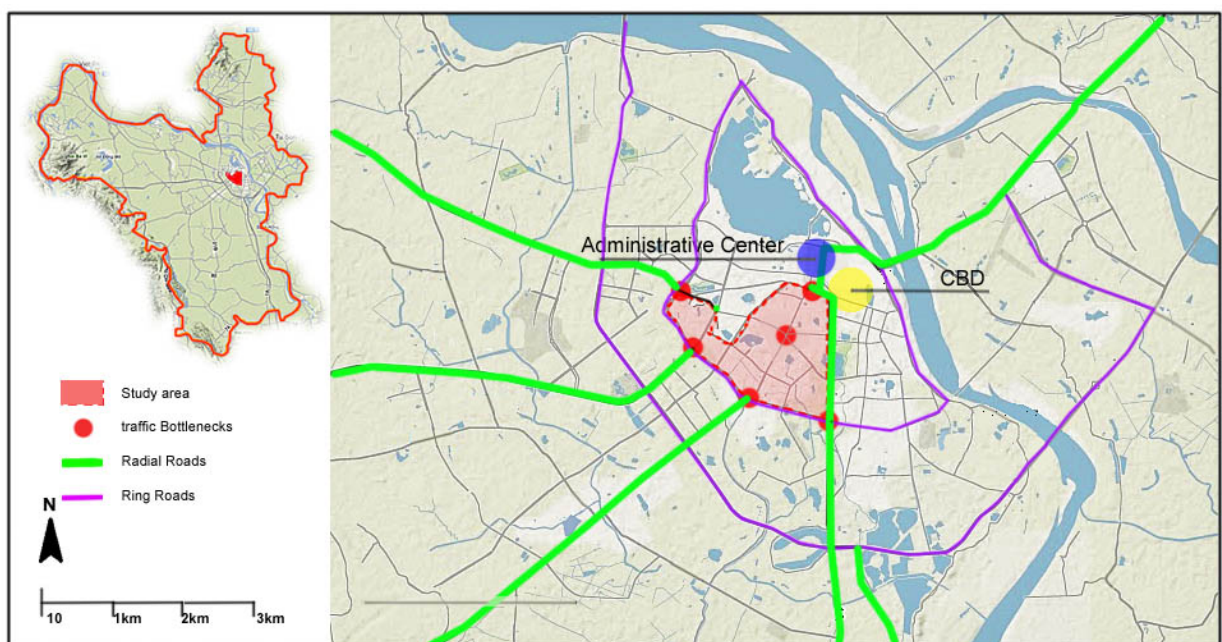


Fig.23 General and specific location of study area

Source: Google Map – Graphic by Author

In general, Dong Da terrain is relatively flat. During the urbanization process in the late of XIX and early XX century, many ponds and swamps in the area was filled. At the present, there are still remaining few large lakes such as: Kim Lien, Dong Da, Xa Dan and Van Chuong Lake.

Within the study area, which covers a population of 370.117 inhabitants⁵⁰, it can be found the formal city, the informal city, large university areas, high concentration of population in residential areas with very high density level and various commercial centers such as: Chua Boc, Cat Linh, Cau Giay.

3.1.2 Population occupation and density level

Dong Da district has a total area of 9, 96 km² with a population of 370.117 inhabitants, It has the second highest population among other urban districts. The average density level of the district reaches up to 35,341 people/ km² ranks the highest density level of the whole city.

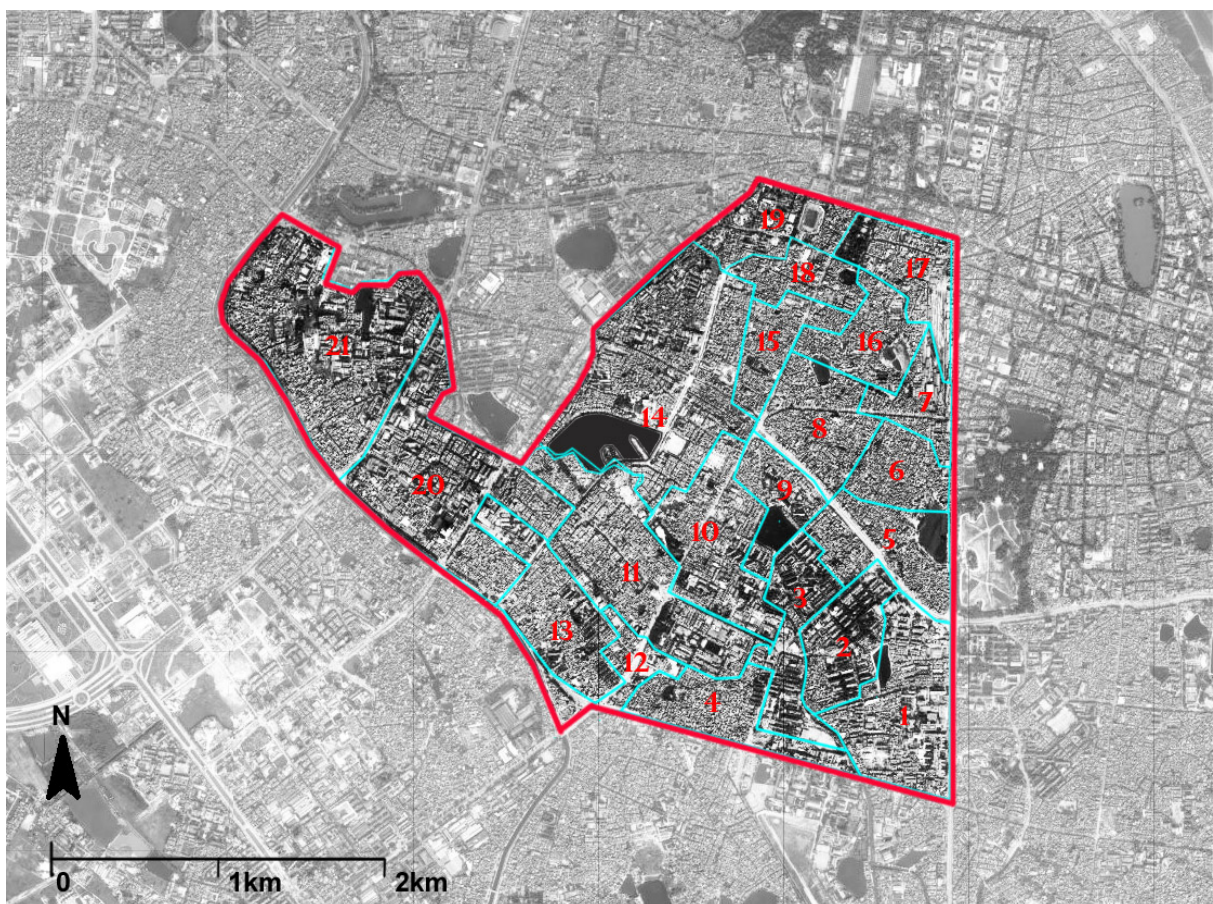


Fig.24 Administrative wards of DongDa District

Source: Google Map – Graphic by Author

The whole district has 21 administrative wards. Each of these administrative wards has different internal structure, number of inhabitants, shapes, forms and dimensions. That is explained due to their various land uses activities, functions and configuration in the space. For example, research units 20, 21 are presented of activities related to specialized education, offices, residential houses

⁵⁰ See Tab.3 – Page 30

and building. This part is dynamic in economical, social and cultural terms. Research units 2, 3, 10 are characterized by its high density of old apartment building which were built during the period of self-production⁵¹. Its regular housing blocks have suffered a lot of transformations through their development process, in terms of functions but without changing its building forms and its former urban structure. Research units 4, 5, 6, 8, 11, are presented a homogeneous socio – economic fabric, residential activities with local scale. These areas are also characterized by its high density and low height building, the residential neighbourhoods are distinguished by common “tube house” where living and commercial activity are at one place.

Ward	Area(km ²)	Population	Density (people per km ²)	ID
Phuong Mai	0.6	18154	30257	1
Kim Lien	0.34	14098	41465	2
Trung Tu	0.42	13519	32188	3
Khuong Thuong	0,33	10010	33367	4
Phuong Lien	0.45	14921	33158	5
Trung Phung	0.23	14599	63474	6
Kham Thien	0.19	10123	53279	7
Tho Quan	0.29	16772	57834	8
Nam Dong	0.41	16056	39161	9
Quang Trung	0.42	11400	27143	10
Trung Liet	0.76	21668	28511	11
Nga Tu So	0,23	11000	47826	12
Thinh Quang	0.46	17164	37313	13
O cho Dua	1.17	329267	33561	14
Hang Bot	0,31	16876	54439	15
Van Chuong	0.33	16463	49888	16
Van Mieu	0.29	11010	37966	17
Quoc Tu Giam	0.19	8401	44216	18
Cat Linh	0,36	13340	37056	19
Lang Ha	0.95	25369	26704	20
Lang Thuong	1.23	19967	16233	21

Tab.10 Research unit's area and population occupation

Source: General Statistics Office Vietnam (2001), Completed census results of the Population and Housing Census 1.4.1999. Whole country. Hanoi. [1 CD-ROM]

As it is presented in the Fig.25, the higher density level in the in the study area has marked in the research units which is closer to the city center than the others. Besides that, it also can be noticed

⁵¹ 1976 to1986 (after the Vietnamese war and before the Doi Moi-renovation period)

that the lower density level of Lang Thuong ward (ID-21) Quang Trung ward (ID-10) and Trung Liet (ID-11) is because of the high concentration of Universities, Colleges and Schools in these areas.

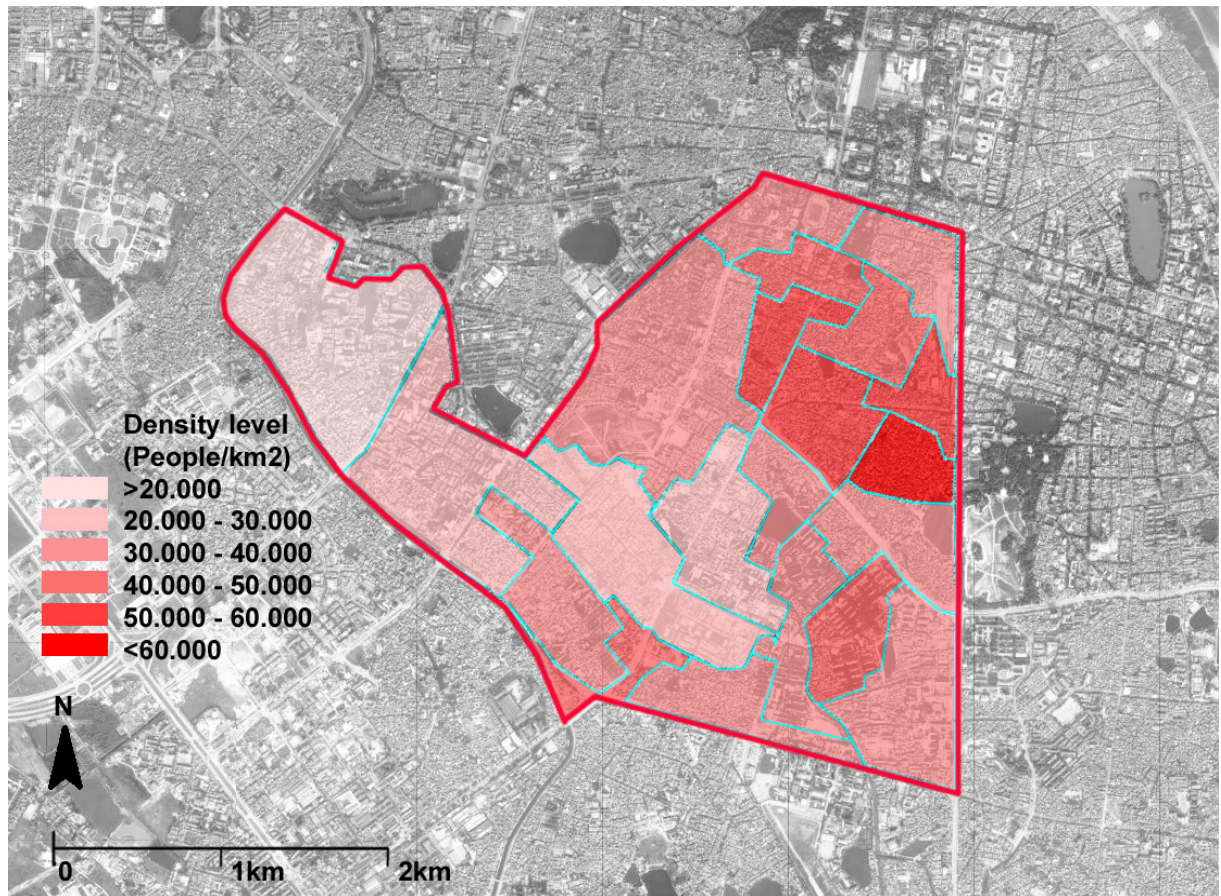


Fig.25 Density level of the research units

Source: Google Map – Graphic by Author

3.1.3 Land-use activities

The following figure show mainly urban land uses in research area regarding its urban activities (commerce, industry, residence, public facilities, leisure facilities, education...). As it is presented on the map, the main activities developed give a result of a land type classification according to their functions, potentiates and needs. In this way, land type in the study area is recognized as high residential and educational activities. The commercial activity is concentrated proximately around research units 12, 13, and 11. Through the land uses figure, it contributes to the analysis of the social economic fabric of the study area and establishes the existing traffic flows within the research area.

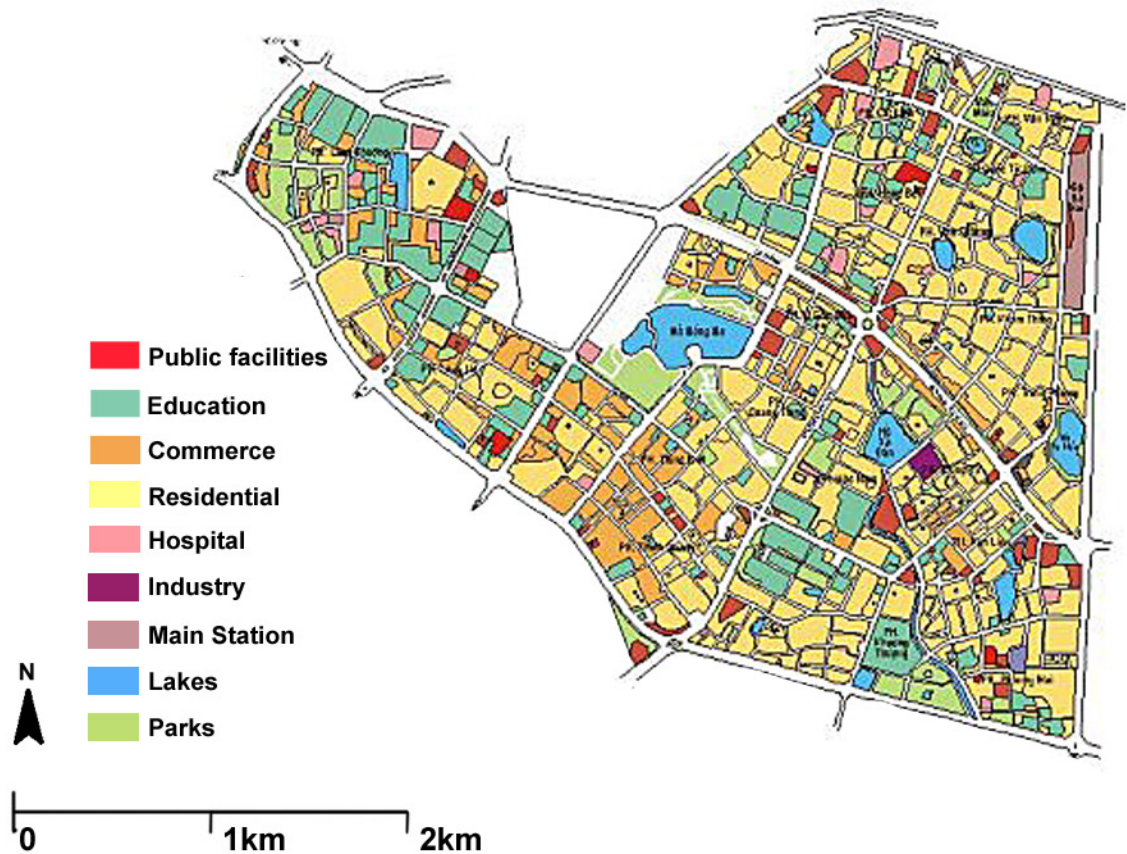


Fig.26 Urban land-use map

Source: Hanoi department of architecture and urban planning web portal: <http://qhkthn.gov.vn/index.php/dnh-hung-ptkg-khu-vc-ni-do.html> last access: Monday 9 July, 2012

3.2 ACCESSIBILITY COMPONENT EVALUATION

3.2.1 Sustainable transport assessment based accessibility analysis

Mobility and accessibility are two important implications for transport planning. If Mobility often refers to actual movements along the network or the ease to travel from one place to another place, than "accessibility is defined as the ease to reach goods, services, activities and destinations, which are altogether called opportunities, in the other way, access is the goal of most transport activity⁵²". Mobility is considered to represents the infrastructure, while accessibility is a reflection of the relation between land use and transport. Thus, mobility - based planning tends to evaluate transport system performance based largely on traffic speeds and so favors automobile-oriented transport improvement. Meanwhile, accessibility-based planning considers other impacts and options, including improvements to alternative modes, incentives to change travel behavior, and more accessible land use. As a result, accessibility recently has been used as a performance indicator to assess sustainable transport development. Good accessibility supplies good exchanges of goods and people, which play an important role in economic sectors. On the perspective of environmental

⁵² Litman, Todd, (2012), *Evaluating Accessibility for Transportation Planning: Measuring people's ability to reach desired goods and activities* – Page: 3

protection, good accessibility is reducing energy used, less pollution and less other environmental problems. Moreover, better accessibility can help people to join in more social activities, which are necessary parts of their daily lives. Overall, accessibility-based analysis therefore expands the range of possible solutions to transport problems, which can lead to better solutions. By measuring accessibility component, the level of sustainable urban transport is partly evaluated.

Defining Accessibility:

- *Refers to the ease of reaching goods, services, activities and destinations, which together are called opportunities.*
- *Potential for interaction and exchange. For example, grocery stores provide access to food. Libraries and the Internet provide access to information. Paths, roads and airports provide access to destinations and therefore activities (also called opportunities).*
- *potential (opportunities that could be reached)*
- *Activity (opportunities that are reached). Even people who don't currently use a particular form of access may value having it available for possible future use, called option value. For example, motorists may value having public transit services available in case they are unable to drive in the future.*

Source: Litman, Todd, (2012)

As it is presented in the Tab.10, how transport is evaluated affects planning decisions. For example, when transport is evaluated based on vehicle travel condition (traffic speeds, congestion delay time and so on) the policy guide line will lead to improve the transport system. If mobility based analysis (movement of people and goods) than public transport service improvements are the best solution. When transportation is evaluated based on accessibility (people's ability to reach goods, services and activities), than not only transportation improvement options (roadway, rideshare and public transport), but also other chooses such as: improved walking, cycling conditions, more accessible land use patterns to reduce travel distances, telecommunications and delivery services that substitute for physical travel. In the other way, mobility-based planning places automobiles at the center of the transport system. Meanwhile, accessibility-based paradigm places people at the center. Thus, mobility-based planning leads to car-based urban transport, and there fore it is not a sustainable development path, neither with respect to urban functions not to the environment. Only accessibility-based planning and public transport can assure mobility together with good conditions for walking and cycling, mixed use development to keep walking and cycling attractive. *These are the most environmentally friendly transport modes.*⁵³

⁵³ Petersen, R., (2004), *Land use planning and urban transport*, Eschborn, Germany, GTZ – Page: 3

	Vehicle Travel	Mobility	Accessibility
Definition of Transportation	Vehicle travel	Person and goods movement	Ability to obtain goods, services and activities
Measurement Units	Vehicle miles	Person-miles and ton-miles	Trips, generalized costs
Modes considered	Automobile and truck	Automobile, truck and transit	Automobile, truck, transit, cycling and walking
Common indicators	Vehicle traffic volumes and speeds, roadway Level of Service, costs per vehicle-mile, parking convenience	Travel distance and speeds, road and transit Level of Service, cost per person-mile, travel convenience	Quality of available transportation choices. Distribution of destinations. Cost per trip
Consumer benefits considered	Maximum motor vehicle travel and speed	Maximum personal travel and goods movement	Maximum transport choice and cost efficiency
Consideration of land use	Treats land use as an input, unaffected by transportation decisions	Recognizes that land use can affect travel choice	Recognizes that land use has major impacts on transportation
Favored transportation improvement strategies	Roadway and parking facility improvements to increase capacity, speed and safety	Transportation system improvements that increase capacity, speeds and safety	Management strategies and improvements that increase transport system efficiency and safety
Transportation Demand Management (TDM)	Generally considers vehicle travel reductions undesirable	Supports TDM strategies that improve personal and freight mobility	Supports TDM whenever it is cost effective

Tab.11 Comparison of three common perspectives used to measure transportation.

Source: Litman, Todd, (2012), Evaluating Accessibility for Transportation Planning: Measuring People's Ability to Reach Desired Goods and Activities – Page: 4

There are many factors affect directly to accessibility, including mobility (physical movement), the quality and affordability of transport options, transport system connectivity, mobility substitutes, and land use patterns⁵⁴. Besides that, there are also various types of accessibility analysis as well as perspectives such as, describes factors that affect people's ability to reach destinations and discusses evaluation methods, and describes options for improving access and so on. However, no single evaluation method can evaluate all accessibility factors; various overlapping methods reflect

⁵⁴ *Litman, Todd, (2012), Evaluating Accessibility for Transportation Planning: Measuring people's ability to reach desired goods and activities – Page: 6*

different impacts, scales and perspectives. In this part, a system of indicator is made based on urban road network connection, local road density, social accessibility, public transport network and station accessibility, bicycle and pedestrian paths available in order to evaluate accessibility component for Dong Da district. Each of indicator will be evaluated the current situation under a sustainable perspective which introduced in the first chapters.

Indicator	Objective	Policy direction
Urban road network connection	Analyze urban road network connection between study area and the whole territory. Recognized traffic bottlenecks within research area.	Improve and expand the urban road network density in order to give a full coverage into the territory.
Local road network density	evaluate local road network density in the territory	Improve and expand the local road network density in order to give a full coverage within the study area
Social accessibility	<ul style="list-style-type: none"> -Analyze population flows generated by the different urban activities and its accessibility - Analyze how unsuitable land use planning contributes to traffic congestion. 	<ul style="list-style-type: none"> - Integrate land-use and transport planning in order to promote better accessibility to services, open spaces and city center. - Relocate of some major-landuses which contribute greatly to traffic congestion.
Quality of available transportation choices	Analyze the supply and relation between the current public transport network and inhabitants.	Improve the public transport networks and integrated with bicycle and pedestrian paths.
Station accessibility	Analyze accessibility to the public transport system stations by evaluate the amount of population and the economical activities that have access in a certain limit of distance to stations	Improve public transport system and sustain its competitiveness in order to reduce the unnecessary use of private motor vehicles.
Bicycle and pedestrian paths network	Analyze the supply and current bicycle and pedestrian paths network.	Increase the bicycle and pedestrian paths by promoting less unsustainable mobility and to promote alternative modes of transport for short distances.

Tab.12 A design of indicator system for accessibility component evaluation

Source: by Author

3.2.2 Urban road network connection

Based on its key position, the study area lies at the convergence of all most all important national highways (NH) which include NH1S (to Da Nang and Ho Chi Minh Cit), NH6 (to northwestern provinces), Lang-Hoa Lac Expressway (to industry areas and Xuan Mai) and NH32 (to northwest region). However, due to very low condition as well as unfinished segment of the RR2 and RR3, external transport and national transport coming from different directions have to pass through the city center. Therefore it contributes to traffic saturated inner city area and one of the reason leads to the formation of traffic bottlenecks withing the boder of the research district. As it is presented in the Fig.27, traffic bottlenecks TB1, TB2, TB3, and TB4 are formed by two traffic flows between RR2 and NH1S, NH6, Hoa Lac Expressway and NH32. Especially, TB5 is created by the external of NH1S to the heart of the urban core.

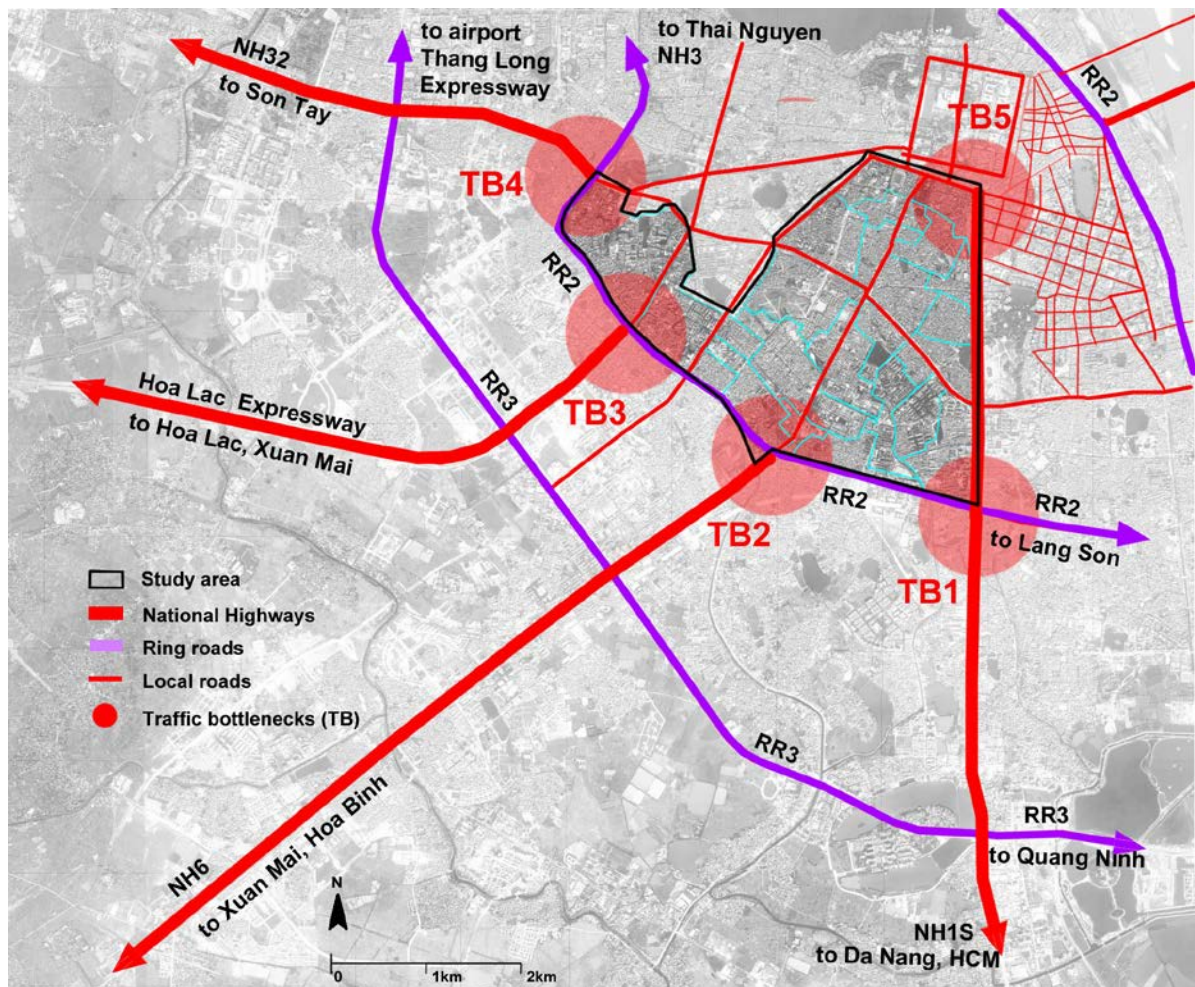


Fig.27 Urban road network connection

Source: by Author

3.2.3 Local road network density

As it was mentioned in the previous chapter, *Hanoi density network is exceptionally sparse*⁵⁵ (less than 7% of the land area, relative to almost 25% in many US cities, about 15% in most European

⁵⁵ World Bank Document, (2007) Report No.: 43457 Hanoi Urban Transport Development Project, Available at: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2008/05/05/000160016_20080505151313/Rendered/PDF/4345708127107.pdf, last access: Fiday 6 July, 2012

cities and 11% in China's large cities). The figure below illustrate different density pattern of between research area, the Hanoi CBD, and two other Asian cities: Bangkok and Singapore in which have similar development process as Hanoi⁵⁶ and experiencing high traffic congestion. Example of Bangkok is chose for its Asian middle-income city group with transport policy focusing mainly on building more roads to cope with rapid motorization. Meanwhile Singapore is characterized for high-income Asian group share a "history of having strongly curtailed motorization for a significant period at an early stage by maintain bus-based public transport usage at a high level until mass transit became affordable"⁵⁷.

By analysis, an proximately evaluation can be given that at the high density of the local road network is tend to associated to the development of urban scale activities, such as commercial, culture or international activities. Furthermore, it is important to point out that the areas which have higher road network density are more dynamic by their spatial distribution and mixture of activities than those with specialized functions which present disperse networks and are located in an isolated way.

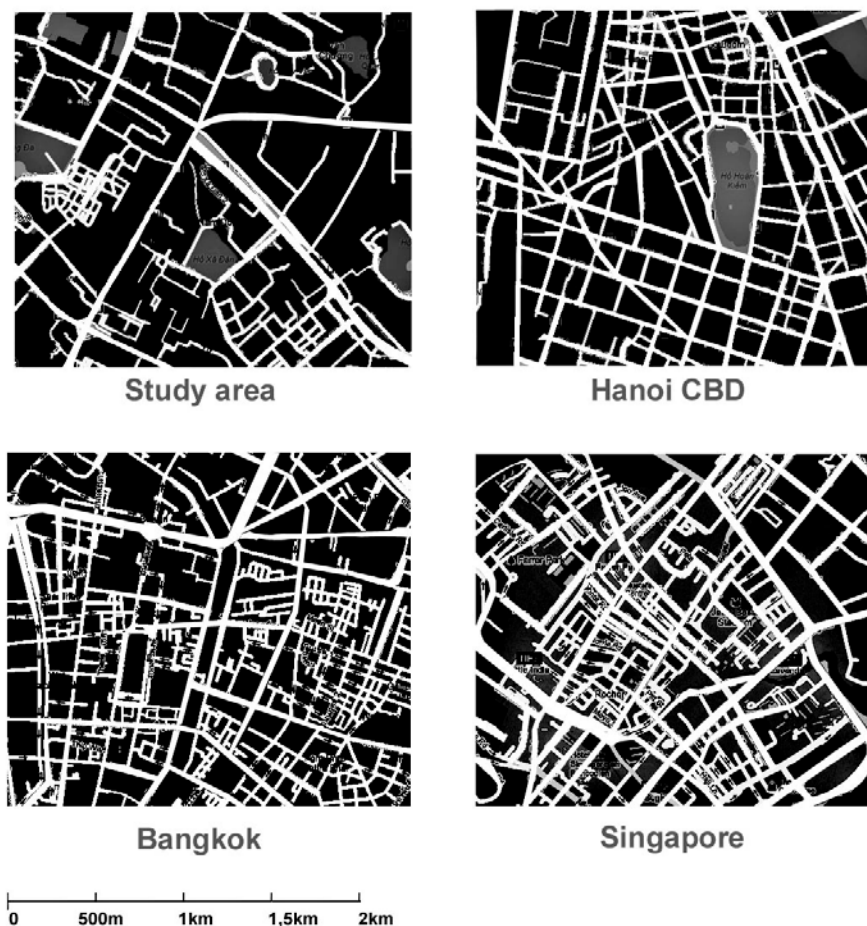


Fig.28 Comparison of road density in Study area, Hanoi CBD, Bangkok and Singapore

Source: Google map – Graphic by Author

⁵⁶ Were colonized by western countries during 19th century to early half of 20th century and independence after the World War II

⁵⁷ Barter, Paul A., (2004), A Broad Perspective on Policy Integration for Low Emission Urban Transport in Developing Asian Cities – Page: 4

3.2.3 land-use pattern and accessibility

Taking into account that one of the major challenges of sustainable urban transport is the actual social inequality. The land-use pattern and accessibility gives an analysis how the different kinds of population flows are related to the actual transportation provision, public facilities concentration and distances traveled to access to the different services. In this way the analysis is intended to draw the actual situation respecting the population flows. In order to indeed in the analysis, it is necessary the identification of the current land-use surrounding the research area.

According to the Department of Civil Engineering, the city now has around 196 *new urban areas* (Khu do thi moi) have been built in the urban fringe, especially in the West and South of the city center. At present, there are proximate 13 new urban areas (in total area of 586 ha) has been put to use. These areas have attracted large number of inhabitants out from the city centre for living while most social activities are still happening inside the city centre.

New urban areas	Area (ha)	Population (people)	Construction start (year)	Construction end (year)	ID
Linh Dam	100 ha	25.000	1997	2007	1
Dai Kim	27 ha	8.036	2007	2011	2
Dinh Cong	35 ha	16.520	1999	2007	3
TrungHoa-NhanChinh	30 ha	15.000	2003	2007	4
TrungYen-YenHoa	70 ha	20.000	2004	2012	5
CauGiay	87,79 ha	27.000	2005	2010	6
MyDinh I-II	47 ha	17.000	2004	2011	7
MoLao-LangVietKieu	42	15.000	2005	2012	8
VanQuan	61	14.000	2003	2007	9
TrungVan	15,6 ha	10.000	2004	2008	10
PhungKhoang	36 ha	5.000	2007	2011	11
Xala resident project	20 ha	12.000	2009	2012	12
CauBuou	16 ha	3.000	2008	2011	13

Tab.13 New urban areas

Source: Author synthesize from each new urban area's web portal

Most of these new urban areas are recognized that still lacking of mainly key services such as education, social and infrastructure. For example Dai Kim urban area with a population of nearly 8.000 people but only one plot of land planned for building administrative headquarter. Linh Dam new urban areas which including Bac Linh Dam and Linh Dam peninsula area have proximate 25.000 inhabitants but there are no land planned for office administration, medical and school. Trung Hoa - Nhan Chinh, has a population of up to 18,000 people but only two kindergartens, a primary school, a school and a junior high school education. Moreover, public transport which is just limited bus lanes operate at certain times of the day and many areas have not yet connected to the urban core by bus service. As a result of lacking infrastructure and social services, there is

significant increasing traffic demand between those areas and the city center. The uneven distribution of this land-uses activity has great contributed to high traffic congestion problem in the city.

District	Number of offices	Total number of labour	Business enterprises	
			No.of enterprise	Total labour
Ba Dinh	1.279	98.976	5.608	9.840
Hoan Kiem	464	23.028	12.196	22.030
Hai Ba Chung	265	12.986	9.583	15.414
Hoang Mai	133	6.493	4.702	7.707
Dong Da	367	18.913	9.567	15.235
Thanh Xuan	175	8.055	4.705	7.397
Cau Giay	175	11.717	4.186	7.994
Tay Ho	177	2.730	3.700	5.949
Soc Son	252	6.266	6.596	10.353
Dong Anh	250	5.465	8.884	18.132
Gia Lam	115	3.054	5.158	9.297
Long Bien	229	1.573	10.317	18.594
Tu Liem	312	5.255	6.449	12.472
Thanh Tri	396	1.539	6.517	9.289

Tab.14 Number of unit and labour in administration offices and business enterprises

Source: Hanoi Statistics Office, (2003), Completed census results of the Population and employment. [1 CD-ROM]

According to research data in 2003 of Hanoi Statistic Office, in the urban core (HoanKiem district considered as business district) there are 464 administration offices with 23.028 staffs and 12.196 business enterprises with total labor of 22,030 people; Ba Dinh district (considered as administration district) has 1.279 administration offices with 98,976 staffs in total, and 5,608 enterprises with total labor of 9.840 people. Briefly, all most of social activities in Hanoi are happening in the city centre while many newly built residential areas are located in the urban fringe districts. This land-use pattern combination with short, narrow roads in the city have contributed to serious traffic congestion. As it is presented in Fig.29 the traffic flows shows the high intensity relation between these new residential areas, the administrative district and the center business district.

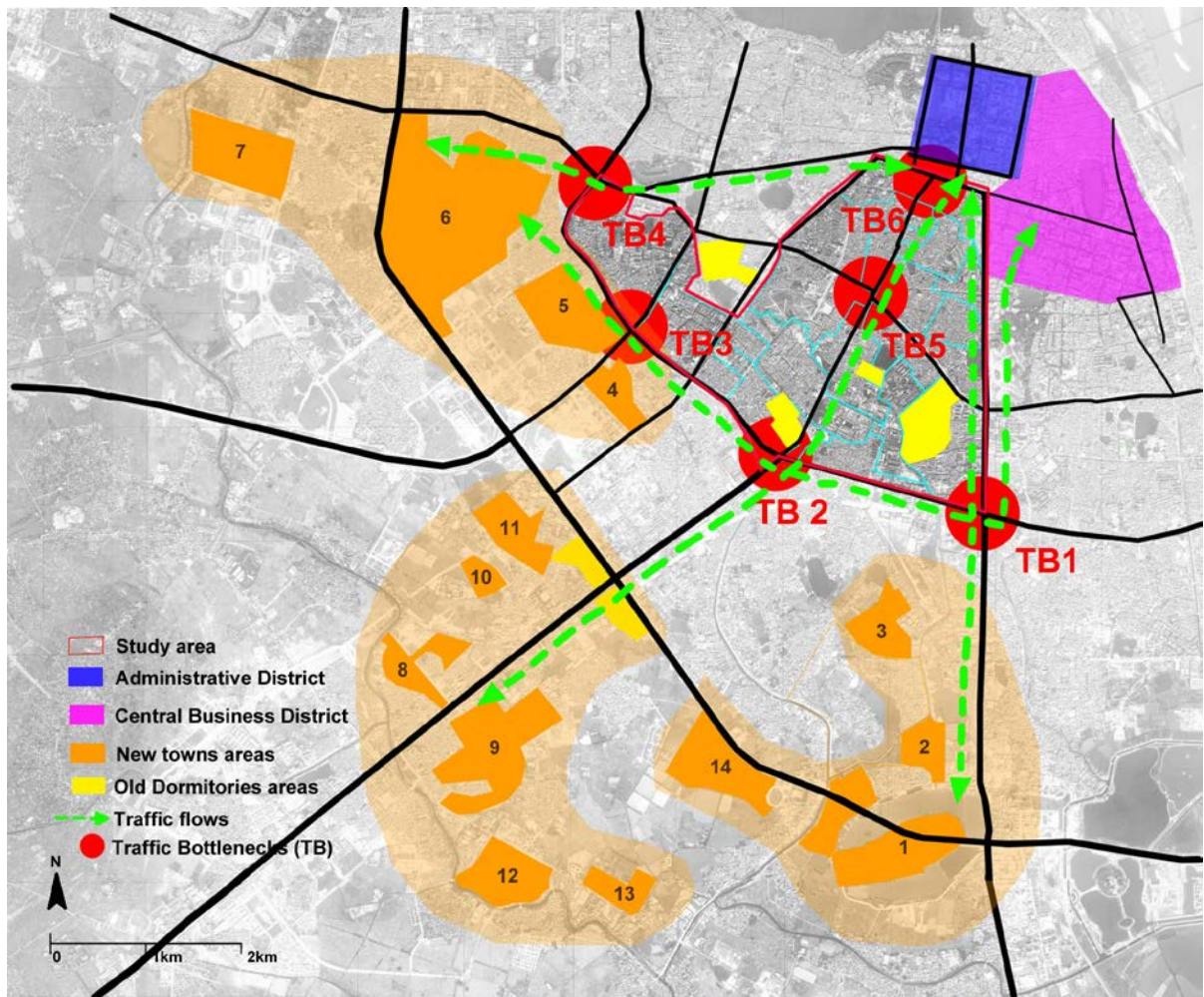


Fig.29 New residential area concentration and the contribution of traffic flows

Source: Author

Further more, according to the Brief Report of Construction Master Plan for Hanoi Region in 2008, Hanoi has more than 30 hospitals at national level, more than 60 universities, colleges and vocational colleges with proximately 550,000 students in total which account for about 50% of the number of universities, colleges and hospitals in the whole nation. Most of them are located within the city centre and uneven distributed. Bach Mai area (next to research unit 1)⁵⁸ where located three big universities (Polytechnics, Construction, and Economics University) has proximate 70,000⁵⁹ students and a group of hospitals including Bach Mai hospital ar. Next to this areas, research units 4, 10, 11 are home of five other big universities (Water resources, Trade union, Banking academy, Finance and Marketing, and National Academy of Public Administration). This high concentration of educational activity within the study area and two other groups of Universities, Colleges located just around the RR3 are contributing to high traffic demands inner city area.

⁵⁸ See detail *Administrative ward Map*, Fig.24 – Page 60

⁵⁹ Hanoi Statistics Office, (2003), *Completed census results of the Population and employment*. [1 CD-ROM]

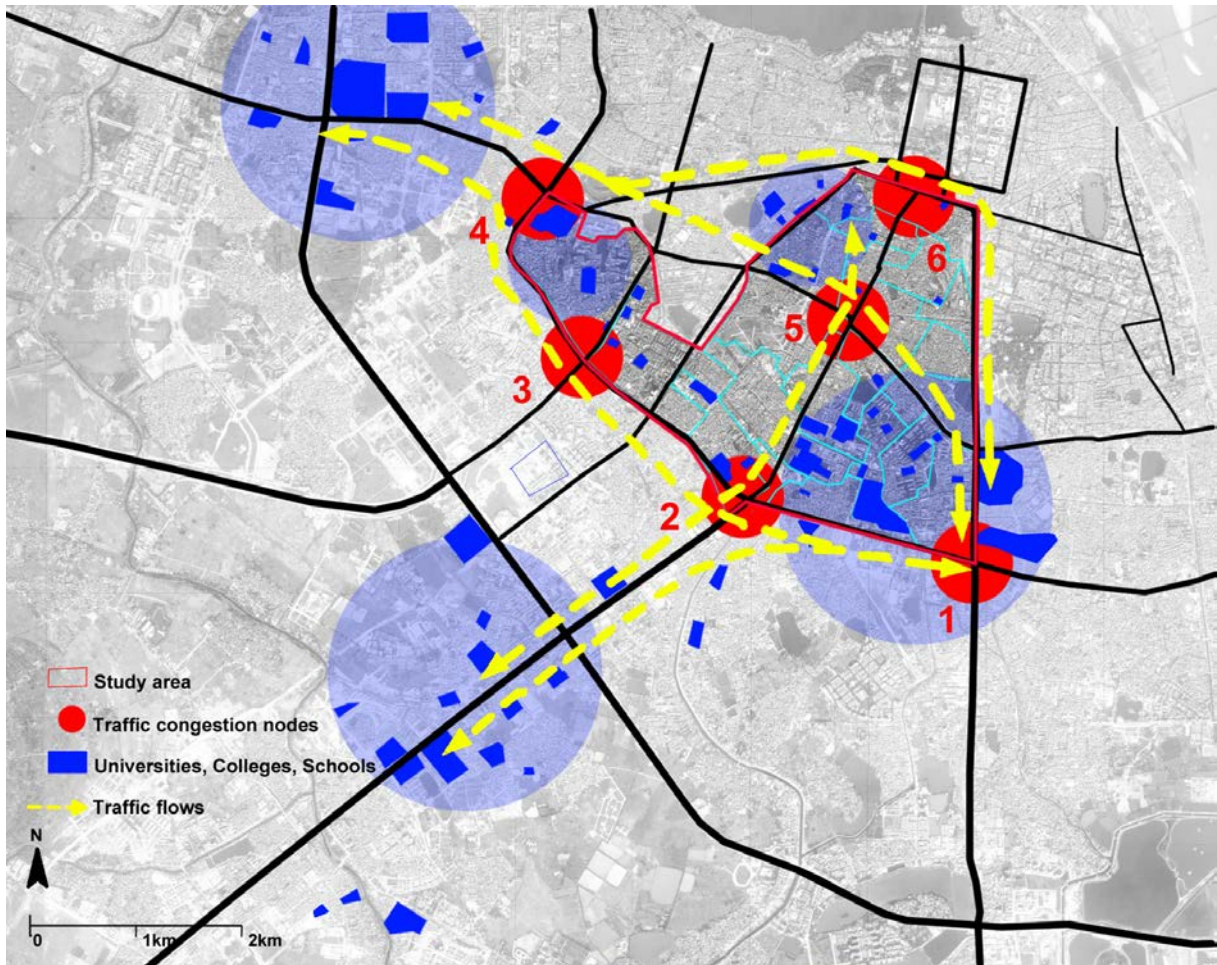


Fig.30 Educational traffic flows

Source: Author

3.2.4 Quality of available transportation choices and station accessibility

This part will concentrate on the analysis of the current supply of public transport services in the research area. As it was stressed in the second chapter, bus are the main public transport mode within the study area, one can be found some other modes such as, Taxi and Cyclo-Xeom. However, Taxi fares are still too high for general public, and Cyclos are small system, run by the private setor, mainly individuals. The calculation of the length of the regular public bus within area covered 31km length, with 52 stations accessibility.

The next figure shows the actual lines of the system which is indicated in red lines, the points represent the stations location. According to the Tramoc policies, the recommended distance with the stations proximate 300m. Each station has to supply a ratiom of 300m in each part of the station. According to the demand and supply of public transport system, it is identified some areas which is low intensity or not covered accessible to bus stations within buffer of 300m

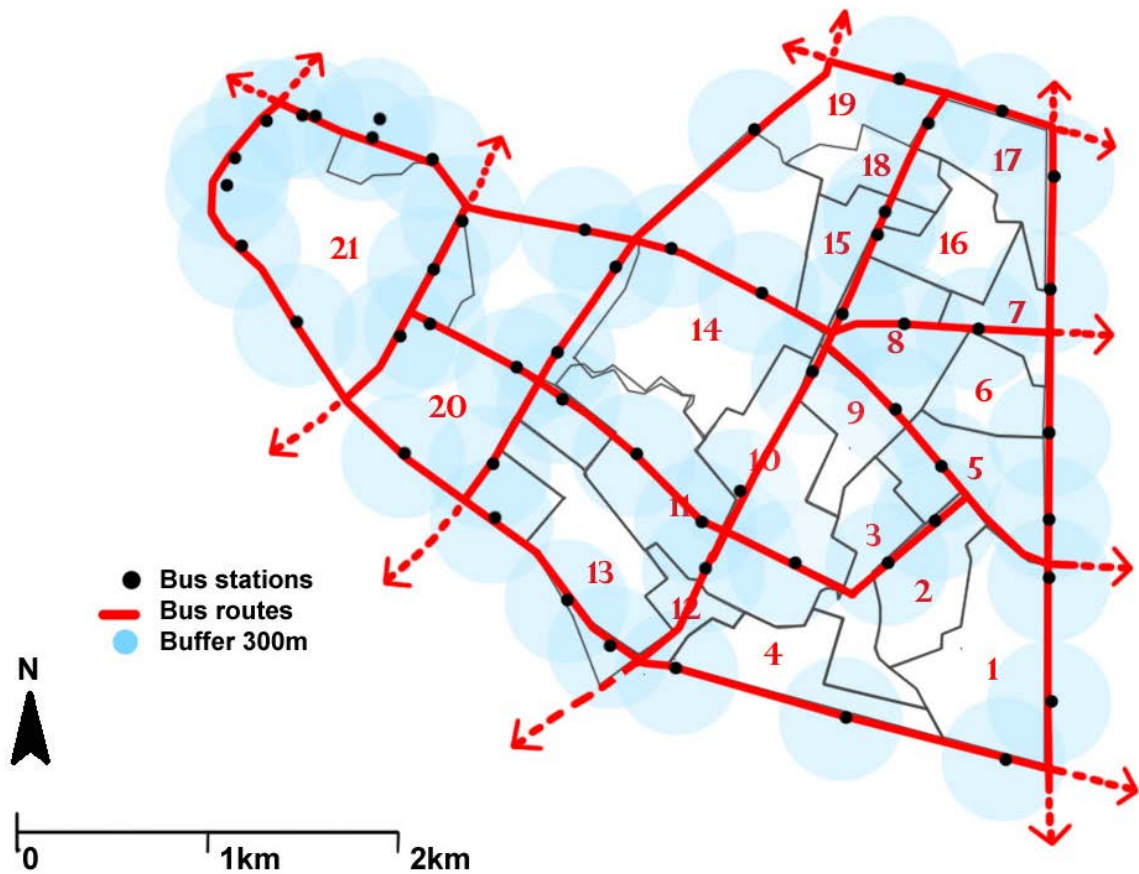


Fig.31 Bus stations accessibility
Source: based TRAMOC's bus-route map

3.2.6 Bicycle and pedestrian paths network

Occupied carriageway and sidewalk for parking is common in Hanoi. Sidewalks are all used either as motorbike parking lots, or restaurants. The shops overflow their entrance portals and spill onto the pavements, competing with the pedestrians. Mix of traffic between, car, bicycle, and motorbikes in addition are another outstanding characteristic of urban transport.



Img.16 Sidewalk is occupied for parking
Source: Internet



Img.17 a mixed traffic road

3.3 ASSESSEMENT SUSTAINABLE TRANSPORT LEVEL

3.3.1 Congestion level and evaluation

According to the analysis made in the previous part, through the indicators and mapping support, it is realized that the general transport situation of research area is severe traffic congestion. This part will evaluate each of road segments and provide a proximate quality rating according to the current level of congestion as following:

No Congestion	😊😊
Migrate	😊
Crowded	😞
Very Crowded	😞😞
Severe	😞😞😞
Very Severe	😞😞😞😞

Tab.15 The proximate levels of traffic congestion

There are 15 road segments which are currently suffering traffic congestion within the research area are selected for evaluation. Based on the field observations on Monday 11 June until Wednesday 13 June, 2012 together with the comparison between traffic count data carried out by TRAMOC in the same peak ours, road intensity calculation, six grades of congestion level were proposed by author for evaluation of congestion in the current situation. In this way, the level aims to establish the necessary actions to realize in order to proposal strategies reducing traffic congestion and programs achieveing sustainable urban transport.



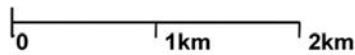
Traffic Bottleneck 5



Traffic Bottleneck 3



Traffic Bottleneck 1



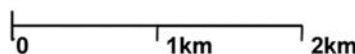
Traffic Bottleneck 5



Traffic Bottleneck 3



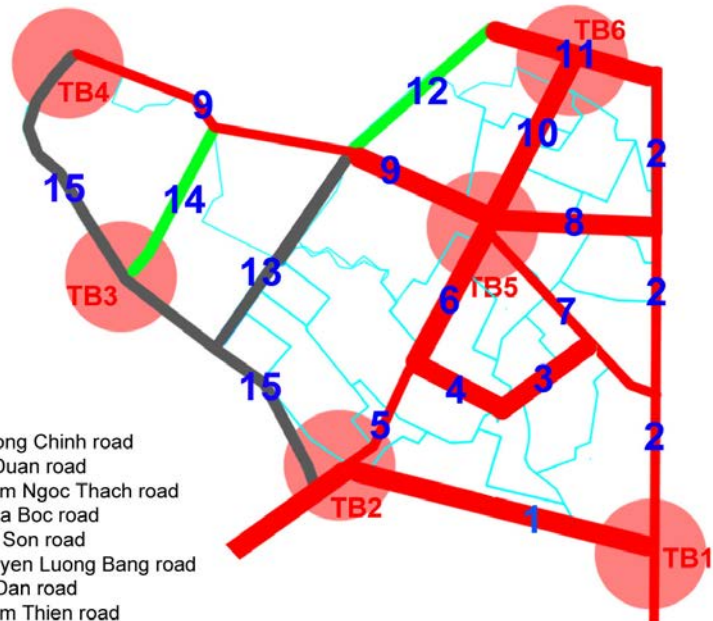
Traffic Bottleneck 1



- 1: Truong Chinh road
- 2: Le Duan road
- 3: Pham Ngoc Thach road
- 4: Chua Boc road
- 5: Tay Son road
- 6: Nguyen Luong Bang road
- 7: Xa Dan road
- 8: Kham Thien road
- 9: La Thanh road
- 10: Ton Duc Thang road
- 11: Nguyen Thai Hoc road
- 12: Giang Vo road
- 13: Lang Ha road
- 14: Nguyen Chi Thanh road
- 15: Lang road

- No Congestion
- Migrate
- Crowded
- Very Crowded
- Severe
- Very Severe

MORING - WAY IN



MORING - WAY OUT

- 1: Truong Chinh road
- 2: Le Duan road
- 3: Pham Ngoc Thach road
- 4: Chua Boc road
- 5: Tay Son road
- 6: Nguyen Luong Bang road
- 7: Xa Dan road
- 8: Kham Thien road
- 9: La Thanh road
- 10: Ton Duc Thang road
- 11: Nguyen Thai Hoc road
- 12: Giang Vo road
- 13: Lang Ha road
- 14: Nguyen Chi Thanh road
- 15: Lang road

- No Congestion
- Migrate
- Crowded
- Very Crowded
- Severe
- Very Severe

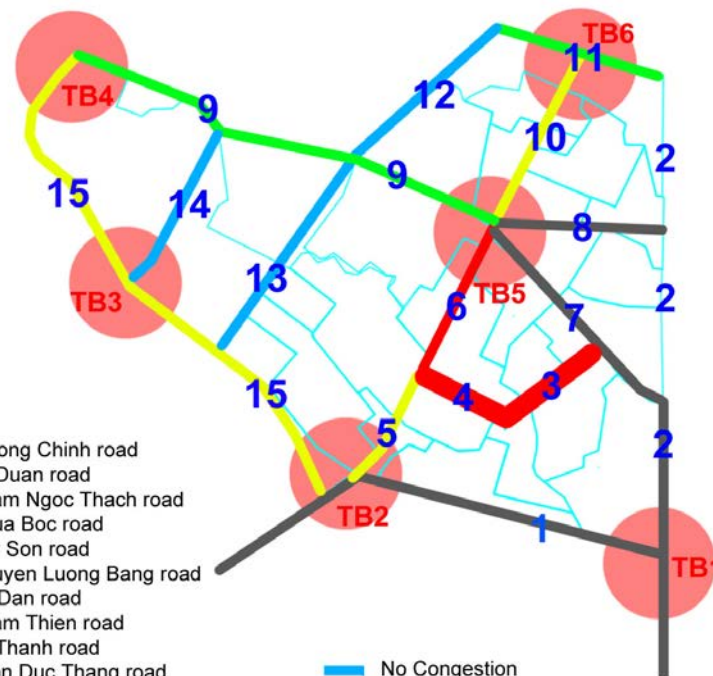


Fig.32 The proximate levels of traffic congestion in the morning way in and out the city centre



Traffic Bottleneck 6



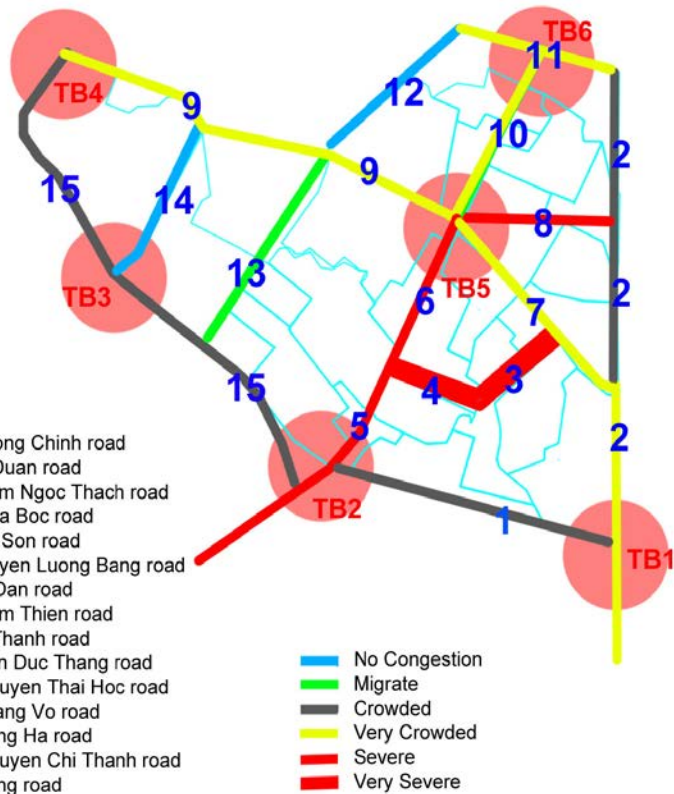
Traffic Bottleneck 2



Traffic Bottleneck 1



0 1km 2km



AFTERNOON - WAY IN



Traffic Bottleneck 6



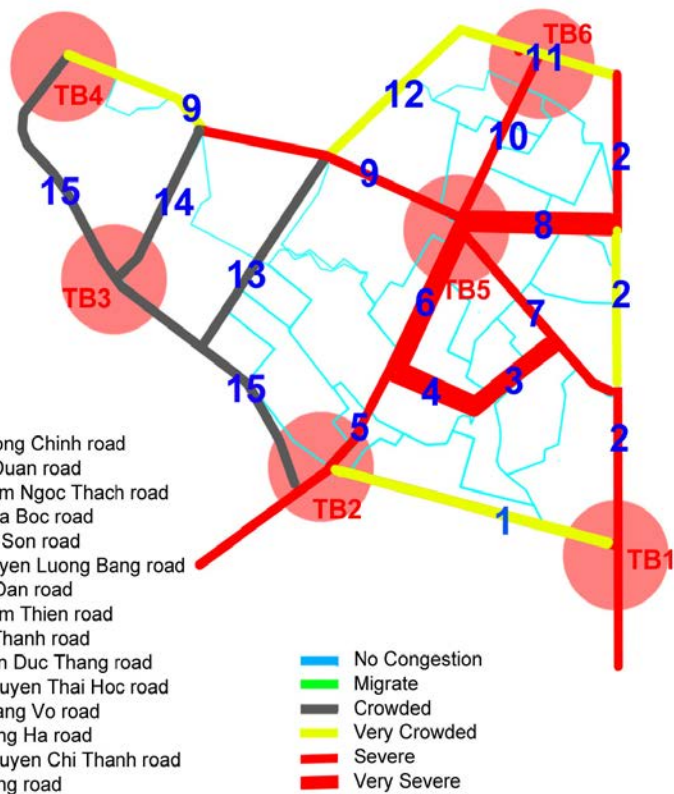
Traffic Bottleneck 2



Traffic Bottleneck 1



0 1km 2km



AFTERNOON - WAY OUT

Fig.33 The proximate levels of traffic congestion in the afternoon way in and out the city centre

Roads	ID	Morning Way-in	Morning Way-out	Afternoon Way-in	Afternoon Way-out
Truong Chinh	1	☹☹☹☹	☹	☹	☹☹
Le Duan	2	☹☹☹	☹	☹☹	☹☹☹
Pham Ngoc Thach	3	☹☹☹☹	☹☹☹☹	☹☹☹☹	☹☹☹☹
Chua Boc	4	☹☹☹☹	☹☹☹☹	☹☹☹☹	☹☹☹☹
Tay Son	5	☹☹☹	☹☹	☹☹☹	☹☹☹
Nguyen Luong Bang	6	☹☹☹☹	☹☹☹	☹☹☹	☹☹☹☹
Xa Dan	7	☹☹☹	☹	☹☹	☹☹☹
Kham Thien	8	☹☹☹☹	☹	☹☹☹	☹☹☹☹
La Thanh	9	☹☹☹	☺	☹☹	☹☹☹
Ton Duc Thang	10	☹☹☹☹	☹☹	☹☹	☹☹☹
Nguyen Thai Hoc	11	☹☹☹☹	☺	☹☹	☹☹
Giang Vo	12	☺	☺☺	☺☺	☹☹
Lang Ha	13	☹	☺☺	☺	☹
Nguyen Chi Thanh	14	☺	☺☺	☺☺	☹
Lang	15	☹	☹☹	☹	☹

Tab.16 The proximate result of traffic congestion levels of each road segments

Source: Field observations from 11 June to 13 June, 2012

The research result reveals that study area attracts quite a lot of trips in the morning the way in to the city and the way out of city in the afternoon. After each road segments characterization, it can be noted how some roads have more problems regarding to traffic congestion than others. Those road segments close to traffic bottlenecks 5 present the highest level of traffic congestion.

3.3.2 Where is Hanoi at the Transport development path?

Using the research and observation on the evolution of Asian cities in recent decades, National University of Singapore transport expert Paul Barter developed a city typology of transport development paths in 2004 (Fig.34). Following, Barter's research presents two different transport development pathways for most of developing Asian cities which are characterized as:

- The development path in which avoids extreme traffic saturation problems. A central policy element of this path is slowing down of the motorisation process. This is a significant factor in promoting public transport to be built up, even as incomes increased. Hong Kong, Singapore and Seoul are best example of this transport development path way. Those cities "experienced at an early stage of having strongly motorization dominant, which reach around 150 vehicles per 1000 people. However, the traffic probem was solved successfully by maintain bus-based public transport usage at a high level until mass transit became

affordable⁶⁰. Public transport is well-suited to high urban densities and slowed motorization allowed these cities to generally avoid extreme traffic congestion problems with very high level of accessibility

- The other transport development path way can be seen at those middle-income Asian cities like Kuala Lumpur, Taipei and Bangkok. Those cities try to cope with rapid motorization mainly through high investment in transport infrastructure, especially roads. Car and motorcycle ownership has been able to reach high levels before substantial mass transit systems were in place. Public transport's mode share meanwhile dropped to low level. As it is showed in the figure, those cities have become 'traffic-saturated', and very difficult to develop public transport or non-motorized transport because buses without priority on-road are worse affected by congestion than cars or motorcycles.

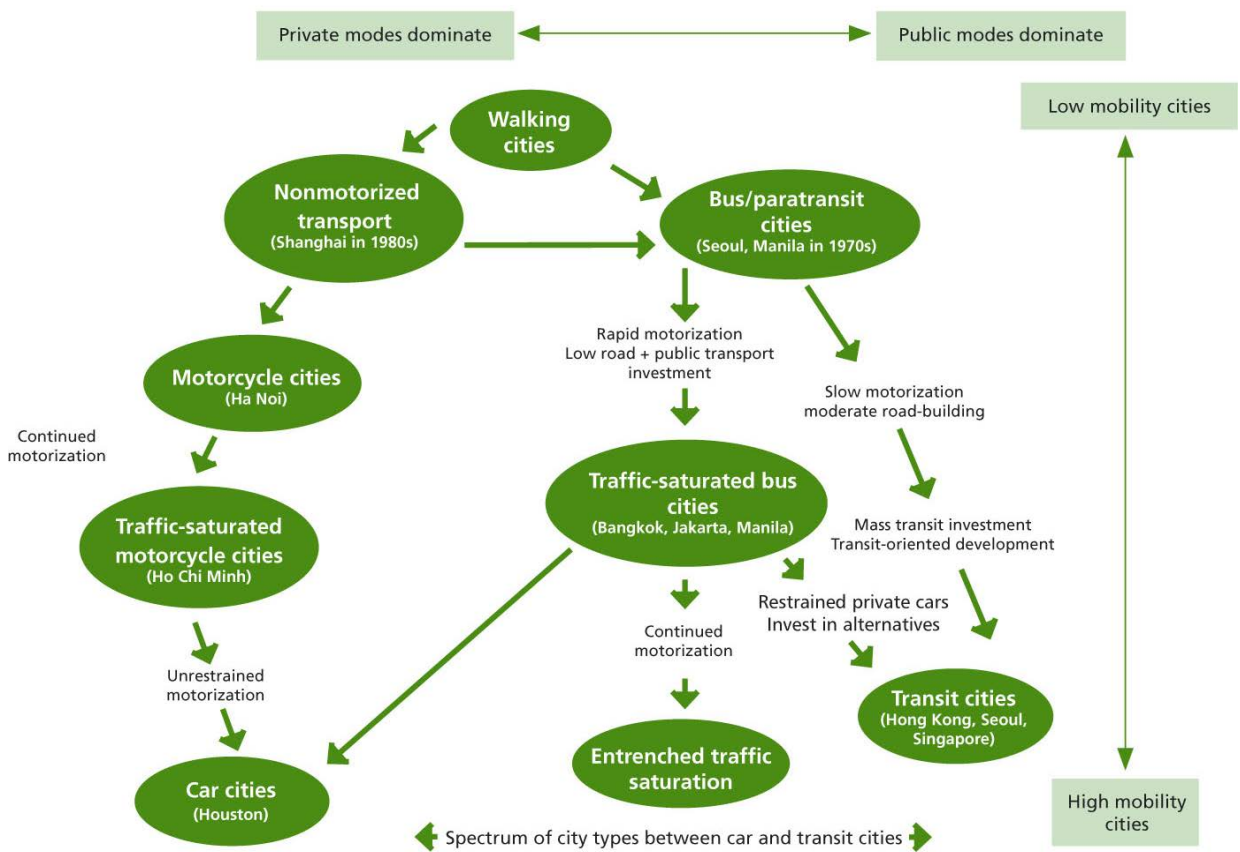


Fig.34 Barter's City Typology and Transport Development Paths

Source: Barter, Paul A., (2004), a Broad Perspective on Policy Integration for Low Emission Urban Transport in Developing Asian Cities – Page: 6

Note: The model shows intended or potential transport development paths for developing cities

Barter's typology and transportation paths also conclude that in most of Asian cities, high economic growth periods are often associated with the rapid establishment and expansion of transport

⁶⁰ Barter, Paul A., (2004), a Broad Perspective on Policy Integration for Low Emission Urban Transport in Developing Asian Cities – Page: 4

infrastructure systems. Therefore, city's transport decisions made at these times are significant critical because they will lock the city into a certain transport development path. Hanoi's transport development path way clearly shows this feature. The city has been dominated by non – motorized transport until the late of 1980s after "renovation-Doi Moi" period. Afterward, the period starting from early 1990s to 2000s with a rocket increasing of economic sector, the city quickly turns to motorcycles transport just after 10 years of development process. Based on this typology Hanoi can assess its position and the travel direction to decide following "*Bangkok's unhappy trend unless serious steps are taken to slow motorization and to slow the rate of increase in vehicle use in order to buy time to enhance the alternatives to private vehicles*"⁶¹.

As it was stressed in the second chapter, Prime Minister's Decision No 90/2008/QĐ-TTg, in order to build a comprehensive urban transport network, which comprises a Public Transportation System based on urban railway tracks. By this Decree Hanoi seems to wish to take the same path as Hongkong, Singapore or Seoul. Even if congestion is present problem, and mainly caused by individual vehicles, the shift to the car has not taken place yet. Besides that the realization of an integrated Public Transportation System could be seen as a guarantee of sustainable urban transport as well as an indispensable condition. In the following part, the Public Transportation System of Singapore which is very famous by its high integrated level will be chosen as the best Asian practices of sustainable transport development based on transit system.

3.4 CASE STUDY OF SINGAPORE

3.4.1 Singapore's urban transport system

3.4.1.a Singapore in Brief

The transportation planning, development and management of Singapore since the early 1970s provides a valuable experience for researchers and city authorities. Singapore is one of very few major cities in the world that are able to maintain a smooth traffic flow within the city area at any time of the day. After about four decades of strong economic growth, with commercial activities increasing, Singapore is still able to maintain an efficient land transport system, and keep its urban transportation under control. It is noted that while the major concern of the Singaporean authorities in formulating transportation – related policies were basically economically driven, the results have had significant positive social and environmental impacts with respect to efficient travel, transport energy consumption and vehicle emissions.

Adopting an integrated comprehensive city land-use and transportation planning, and systematic implementation in close adherence to the master development plan, the Singaporean government has successfully developed an efficient land transportation system which has been a key factor in the nation's healthy economic growth in the last 40 years.

3.4.1.b the history of public transport in Singapore

In early 1990s Singapore's most of means of transport were horse carriages, rickshaws, electric trams or tiny Chinese run buses known as "mosquitoes"⁶². *By 1955, the services of Singapore*

⁶¹ The same 60

⁶² Cervero, Robert, (1998), *The Transit Metropolis: an Global Inquiry* – Page: 157

*Traction Company (STC) (formed in 1925) together with the Chinese bus companies were plagued because of operational difficulties, poor management and labor unrest*⁶³. By the mid of 1970s the private Chinese companies were merged into the system of state – controlled enterprises. Singapore Bus Service (SBS) was introduced in 1973. The second bus company Trans Island Bus Service (TIBS) was formed in 1982 in order to provide competition in the bus industry. In 1987, the first urban trains started running, being operated by a newly formed Singapore Mass Rapid Transit (SMRT) Corporation. In 2001, when the concept of multi-modal operation of bus and train services was being promoted, SMRT Corporation became the first multi-modal operator. It acquired TIBS to establish SMRT Buses Ltd, which became a sister company of SMRT Trains Ltd. SBS also renamed itself as SBS Transits Ltd. Besides that, the first urban rail system (know as Mass Rapid Transit (MRT) system) was formed in 1983. The trains first started running in 1987. SMRT Corporation was appointed to run the North-South and the East-West Lines, meanwhile SBS transit ltd was appointed to run the full underground driverless North East Line (NEL). Among these three lines there are four major train interchange stations where commuters can transfer and connect between the central business district, major new towns, industrial estates, the port and the airport.

3.4.1.c Current public transport scenario

This part based on "*Singapore land transport statistics in Brief*"⁶⁴ Appendix 5

In Southeast Asian context, Singapore boasts an impressive roadway system of 1,059 km of paved roads and 161 km of grade-separated expressways. The current public transport system comprises 16,309 buses operation on 342 routes with 4,591 bus stops; 3 heavy urban rail lines which are in total 129.9 km long with 84 stations; 3 light rail lines with 28.8 km long and with 33 stations; 26,073 taxis are operated by 7 taxi companies. By a judicious combination of land-use and transport planning, public transport is accessible to a large part of the population. The modal split shows the high percentage of Public transport uses (bus, train and taxi) which is at 63% (2004) during the peak periods (i.e. mainly journey to/from work) and 58% for the whole day.

The Public Transport Council has no direct operating subsidies from the government. The fares, advertisement and rental revenues need to cover operating and maintenance expenditure and depreciation. However, government funds the capital cost of public transport infrastructure. In the bus sector, government funds the construction of bus infrastructure of interchanges/termini, bus shelters and priority measures, such as bus lanes and bus signals. Under the government's vehicle ownership policy of managing the growth of vehicles to manageable levels, would-be-owners of vehicles need to take part in an electronic public auction to bid for the right to own one (called the Certificate of Entitlement, COE- thus the buses also need this certificate because, from the land transport policy point-of-view, they all occupy road space, and all contribute to congestion). The two bus companies are exempt from obtaining COEs for the purchase of new buses. For trains, the government funds the construction of the track, the stations, the control centre, the depots and the

⁶³ Jeremy YAP, (2005), *Implementing Road and Congestion Pricing - Lessons from Singapore*, paper presented in Workshop on *Implementing Sustainable Urban Travel Policies in Japan and other Asia-Pacific Countries* – Page: 3

⁶⁴ Singapore Land Transport Authority web portal, statutory board under the Ministry of Transport <http://www.lta.gov.sg> last access: Monday 2 July, 2012

purchase of the first set of operating assets such as trains. For purchasing of the second set of operating assets at the end of the useful life of the first set, the companies need only to meet the historical costs, with the government financing the inflation cost.

The public transport operations are not subsidized by the government, however realize the importance of public transport, the government still funds public transport infrastructure, which is considered as sunk costs which will not be recoverable. Such a policy helps to ensure the viability of public transport companies run commercially.

The Rapid Transit System (RTS)

The backbone of Singapore's public transport system is a rail-based public transport. Presently Rail Transit System (RTS) network comprises the Mass Rapid Transit (MRT) and Light Rail Transit (LRT). In the city area RTS is underground while outside of the city the system runs on elevated tracks. The Government has spent over \$13 billion to build up 138km of rail network. Another \$20 billion have been committed to expand the coverage of the RTS by more than 50% to 215km (for Circle Line, Downtown Line and the Boon Lay Extension to the East West-line EWL).



By 2020, the RTS network will have double expanding from 138km to 278km (Fig.35). This estimated will increase RTS density from 31km per million people today to 51km per million people by 2020. This is comparable to Western cities like New York and London, and surpassing in Hong Kong and Tokyo. Within the Central Area, commuters will be able to access an RTS station within 400m, or five minutes of walking on average.

The Government has given in-principle approval to implement the following lines by 2020 at a budget of about \$20 billion:

- Thomson Line (TSL) (27km, 18 stations) by 2018 – This will serve the additional public transport demand along the north-south corridor. The projected developments in the north and northeast regions. The line will improve accessibility along the corridor and help relieve crowding on the existing North South Line (NSL).

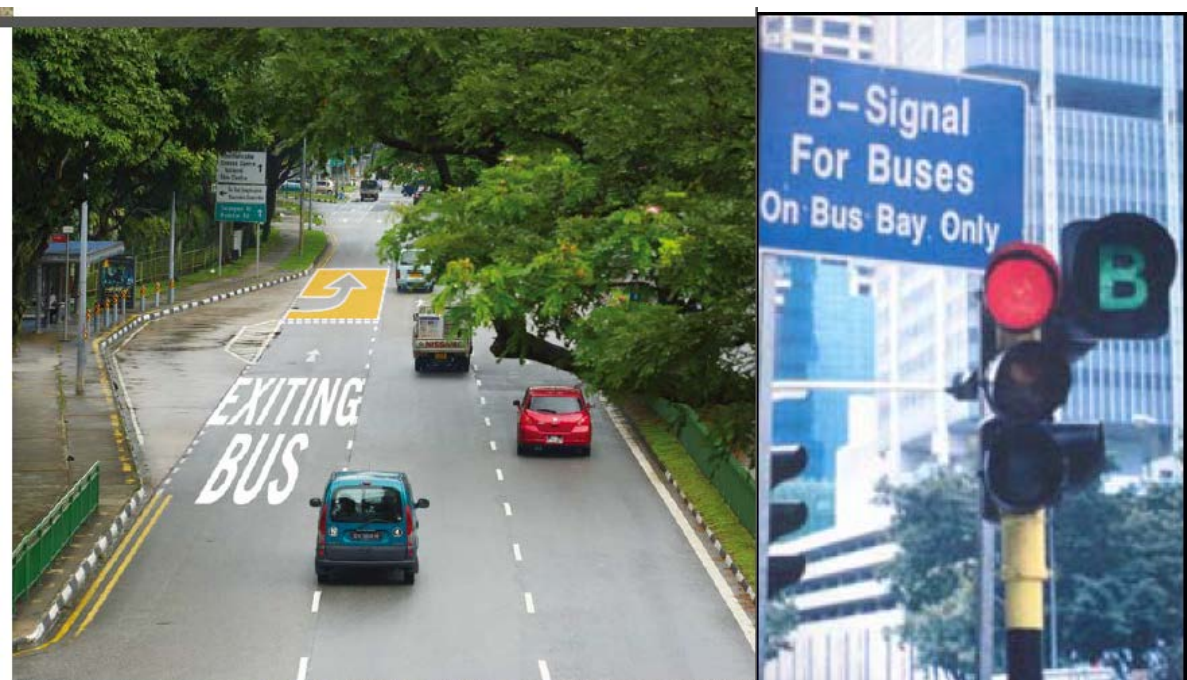
Fig.35 Singapore Rail Transit System

- **Eastern Region Line (ERL) (21km, 12 stations) by 2020** – This will provide residents of housing estates along East Coast corridor not currently served with direct RTS access to the key employment centers in CBD, Marina Bay and Changi Area.
- **Tuas Extension to the East West Line (EWL) (14km, five stations) by 2015** – This will improve public transport and support employment growth in the Jurong Industrial Estate (JIE), especially for areas beyond the Boon Lay Extension.
- **North South Line (NSL) Extension (1.0km, one station) by 2015** – This will improve accessibility to new developments proposed in the Marina Bay area, such as the new cruise terminal and Gardens by the Bay.

The Bus System

As mentioned above, Singapore's basic bus services are provided by two operators, SMRT Buses Ltd and SBS Transit which operate a total of 342 routes with a fleet size of 3,199 (2010). The service includes express and rapid lines, premier services, night services and supplementary services that are operated by the other bus operators, provide additional capacity during peak hours.

To facilitate their movements, several measures are put in place to give the buses more priority on the roads. This includes the 'B' signals at junctions, which will come before the green light for other vehicles, thus giving buses a 'head start' and allows them to filter across lanes. In addition, controlling cameras have been installed on the streets to take photographs of bus lane violations. This has helped against motorists from encroaching into bus lanes and keep lanes clear during peak hours. By June 2008, there are 150km of bus lanes and 23km of full-day bus lanes (FDBL) in the city. Such right of way for buses has improved bus speeds, especially with FDBL which has improved bus speeds more than 16%.



Img.18 Priority Bus lanes and Bus priority measures
 Source: Internet

To keep pace with rising commuter expectations, bus stops are equipped with shelters to provide shade and shelter from inclement weather. In some cases, covered walkways have been provided to link bus stops to adjacent buildings. Some pedestrian overhead bridges are also provided with shelters for the comfort of bus commuters. In consideration of the hot and humid climate, the bus interchanges are built today with air-conditioned facilities.

Taxis

Presently, existing about 26,073 taxis serving with an average of about 0.9 million trips per day compared to 2 million trips with MRT and 3, 2 million trips with Bus. Taxis are operated by seven taxi companies: Comfort Transportation, City Cab, SMRT Taxis, Trans-Cab Services, Premier Taxis, SMART Automobile and Yellow-top Cab, as well as a small number of individual driver-owners.

To further improve taxi services and optimize usage, a few measures were introduced in 1996. A Global Positioning System (GPS) was used to improve radiophone service to better match demand and supply. This was further complemented by the introduction of Share-a-Cab scheme at some taxi stands for passengers. These measures have helped to achieve faster customer request response times, shorter waiting times at taxi stands and overall better utilization of taxis. In September 1998, taxi fares were deregulated, allowing the taxi companies to set their own fares. This provides more flexibility for operators to respond to changes in market conditions, to implement differential pricing to balance supply and demand at different times of the day, and to introduce and set prices for innovative services.

3.4.2 Initiative urban transport policies

3.4.2.a Land-use planning initiatives

Land use planning plays a key role in creating a sustainable transport network in Singapore. Planning has strong influence on the need for travel and even the mode of travel of most Singaporeans. Because of its limited land resources, since independence in 1959 Singapore has actively expropriated land to obtain public land for public facilities, promote city redevelopment, and catalyzes new development. Today, about 90 percent of land is owned by the city-state. The city thus has strong authority over urban development plans and their implementation⁶⁵.

High density development strategies

Land-use planning in Singapore has been an important step in maintaining the environment quality and supporting sustainable development. In order to optimize land use, Singapore promotes high-density development not only for businesses and commercial activities, but also for residential structures. Thus, high density development has transfer into greater use of public transportation as major business, commercial and residential areas are very well connected to an integrated public transportation network. Singapore's Urban Redevelopment Authority within the Ministry of National Development is in charge of urban planning and promotes Singapore's policy of high-density

⁶⁵ (Suzuki. Hiroaki - *Eco² Cities, Ecological Cities as Economic Cities*-Page: 195)

development. For example, the central business district of Singapore has floor area ratios up to 13. Ongoing development near Marina Bay next to the central business district aims to produce high-density, mixed use development with floor area ratios up to 20. Marina Bay will be more than a commercial center. It will also offer housing, shops, hotels, recreational facilities, and community zones such as green areas and open spaces.

Integration of land-use and transport planning

In Singapore, integration of land use with various transport modes is demonstrated strategically in the formulation of the Concept Plan (Fig.36). The Concept Plan which guides Singapore's development over the next 40-50 years is also a major tool to ensure there is sufficient land to meet long-term population and economic growth while providing a good quality living environment. In the recent review in 2001, the integrated planning approach set out a better mix of employment and residential uses with the intention to reduce the need to travel. Besides that, as part of a national economic development strategy, Singapore has embraced Scandinavian planning principles that interconnect the central core with master-planned new towns by radial corridors. Its structure plan called Constellation Plan (Fig.37) provides opportunities for people to work away from the city centre and nearer their homes. It cuts traffic congestion in the Central Area, especially during peak periods. From plan view, it appearances of a constellation of new towns which orbit the central core, interspersed by protective greenbelts and interlaced by high capacity, high-performance rail transit⁶⁶.

Singapore's new towns approach is independent with specialized functions that interact and depends upon other new towns. Some satellite centers are primarily industrial estates, some are predominantly dormitory communities, and most are mixed-use areas. Most of residents of master – planned new towns work outside of their area. Therefore, commuters need radial corridor to connect their new town to Singapore's Central Business District. Also, the dispersal of mixed land uses along corridors has created two way travel demand and spread travel need more throughout the day.

The MRT which is backbone of Singapore's public transportation system together with buses and LRT are well connected to network routes at interchange stations and serve local areas. The integration of the MRT, LRT, and bus networks helped boost public transportation's share in all transportation modes (including taxis) to 63 percent in 2004, although this represented a decline from 67 percent in 1997 that was attributable to the growing use of private cars⁶⁷. Because the transportation system has been integrated into high-density development areas with sizable populations, it has been possible to maintain the financial viability and high-quality service of the system. Therefore, people are well satisfied with public transportation.

⁶⁶ Cervero, Robert, *Land Use as an end - Transport as a means*, Available at: <http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/RobertCervero.pdf> last access: Sunday 8 July, 2012

⁶⁷ Suzuki, H., Dastur, A., Moffatt, S., Yabuki, N., Maruyama H., (2010), *Eco² Cities – Ecological Cities as Economic Cities* – Page: 197

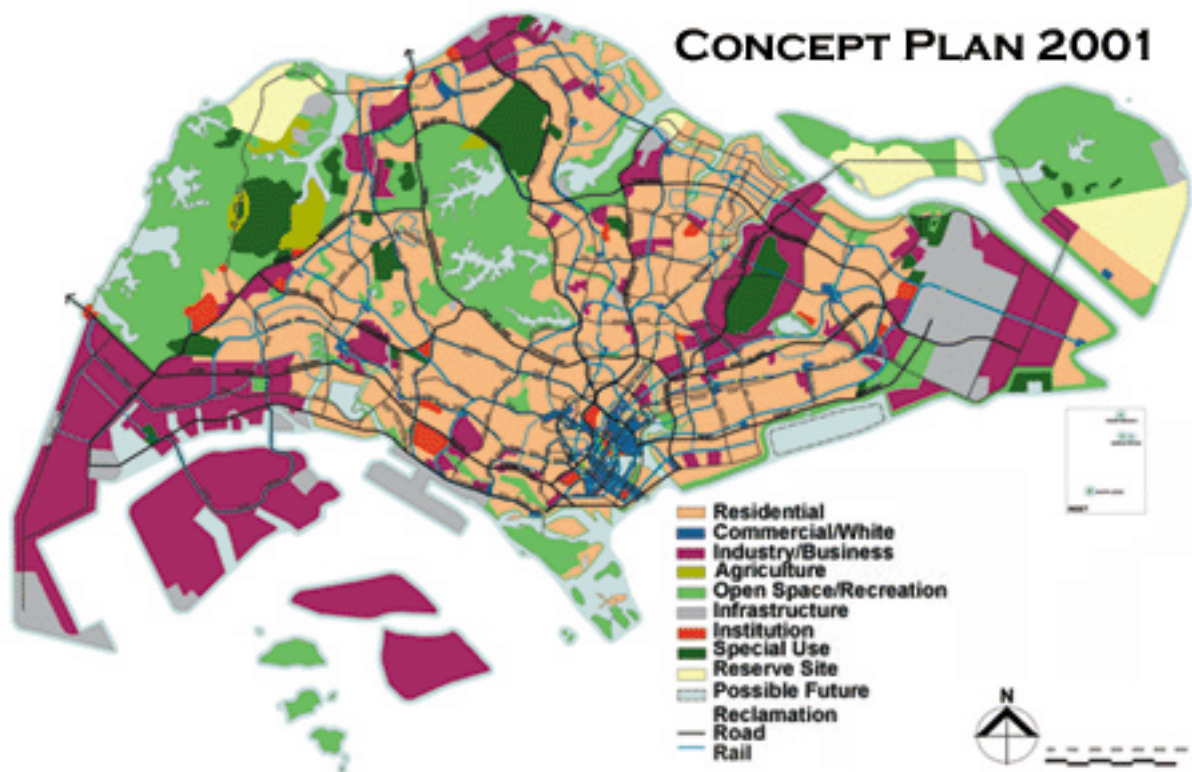


Fig.36 Singapore Concept Plan 2001

Source: Singapore Urban Redevelopment Authority, <http://www.ura.gov.sg/> last access: Monday 2 July, 2012



Fig.37 Transit oriented development (TOD)

Source: Cervero, Robert, *Land Use as an end - Transport as a means*, Available at: <http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/RobertCervero.pdf> last access: Sunday 8 July, 2012

Another result of centralized planning has led to number of Master plan-new towns, which linked together by the new MRT like *pearls on a necklace*⁶⁸. Most of new towns are centered around an MRT with the highest densities level. These nodes of employment, housing and other commercial and social activities are guaranteeing maximum accessibility by public transport. Complementing this integration of rail services and new towns has been a series of draconian measures taken to restrain automobile and provide commuter with greater convenience, accessibility and comfort.



Img.19 An integrated transport facility with commercial development

Source: Jeremy YAP, (2005), *Implementing Road and Congestion Pricing - Lessons from Singapore* – Page: 5

3.4.2.b Transit initiatives

Providing high quality public transport system

By making public transport your other car

In order to making public transport as a choice mode, Singapore provides an attractive public transport system and considers as the cornerstone of Singapore's land transport strategy. To encourage people not to use their cars for work trips but travel by public transport, Singapore promotes a public transport system that is fast, efficient, comfortable, affordable and convenient. Currently the public transport mode share stands at 63%.

To achieve the target modal split, Singapore continues to expand the rail network, the backbone of the public transport system. Given its larger carrying capacity, high travel speed and predictability of arrival and departure times, only rail system can meet the transport



⁶⁸ The same 65

needs of heavy corridors for a compact city like Singapore. Complementing the rail system is the bus network. Although buses compete for road spaces, facilitate their movements on the roads using various bus priority schemes to improve their service standards for the benefit of the commuters. In addition, the improvements to other aspects such as air-conditioning of bus interchanges and providing more covered link ways to bus stops to enhance the service quality of the bus system.

Building a comprehensive road network and maximizing its capacity

A comprehensive and efficient road network is an essential criteria in order to sustain economic activities and to provide better connectivity for all Singaporeans. Good connectivity provides motorists a wider choice of routes and help distribute traffic flows, thus benefiting not only private transport, but also public transport such as buses and taxis. To serve the increased travel demand arising from economic development, new roads have been built while existing roads widened over the years. Apart from expanding the road network to make it more comprehensive, Singapore also leverage on intelligent transport systems to maximize their network capacity.

3.4.2.d Demand management initiatives

Demand management is an important component of Singapore's overall transportation strategy. Because of its limited land capacity, it is not able to continue to expand the road network to meet unrestrained vehicle growth and usage. Thus, demand management was recognized early with land transport strategies calling for aggressive management of travel demand which take two main forms: managing the ownership of vehicles and its use.

The restraint of vehicle ownership is managed through the high upfront vehicles ownership costs or restriction on the actual growth of the vehicles population. The former type includes the custom duties and vehicle registration fees, while the latter is managed through a Vehicle Quota System. The other aspect of demand management is the restraint of vehicle usage through the charge on motorists based on the quantity, place or time of the use of their vehicles. Generally, the more one uses his car the more one has to pay. The road pricing schemes, petrol tax, diesel duty, and parking charges are measures in this category. This strategy has been successful in managing traffic on roads and restrict growth rate of vehicles.

Vehicle Ownership Restraint

In 1990, In order to solve the problem of rapid growing vehicle ownership the Government of Singapore decided to introduce the Vehicle Quota System (VQS). The quota is allocated through tenders, which are organized twice a month. Anyone who wishes to register a new vehicle has to bid for a license in the public tender. This license is called the Certificate of Entitlement (COE) and valid for 10 years. All vehicles, except emergency vehicles (ambulances, fire engines) are required to possess the VQS. However, as a consequence of VQS, the price of cars in Singapore is much higher compared to other countries and Singaporean who wishes to own a car need to invest heavily upfront on a car but afterward can drive as much as they can. Thus, VQS alone is not enough to reduce people from using cars excessively. Recognizing this trend is not sustainable, the

government of Singapore reviewed and lowered the upfront ownership cost in a bid and introduce another system necessary to control vehicle usage on the roads.

Vehicle Usage Restraint

The concept of road pricing is an important integral part of Singapore demand management strategy. Singapore started its road pricing system in 1975 with a manual paper-based system that was applicable during the morning peak period only for entry into a specific geographical zone. After three decades of evolution, the system has transformed into an electronic version that operates more extensively in terms of geographical and time zone. Road pricing allows motorists to be more aware of the cost of congestion they impose on other people every time they use their vehicles. Road pricing will encourage motorists to carefully plan their trips and consider public transport alternatives. With more extensive road pricing, the city can keep the crucial arterial roads and expressways linking the economic centers relatively smooth flowing, while sustaining a higher car population.

A. Area Licensing Scheme (ALS)

The Area Licensing Scheme (ALS) was first introduced in June 1975. The original concept of the ALS was to discourage the wide spread use of cars for commuting into the most congested parts of the Central Business District (CBD) is termed the Restricted Zone (RZ). This was the first urban traffic congestion pricing scheme to be successfully implemented in the world⁶⁹. Under ALS, motor required to purchase and display an area license on their vehicle when entering the RZ during the hours of operation. The area licenses can be purchased from post offices, petrol stations and with the same license for a day, vehicles could make multiple daily trips into the RZ. When a vehicle is spotted entering the RZ without a valid license, the police will note down the registration number of violating vehicle and send via post to owner of the vehicle.

Under Area Licensing Scheme, the use of public transport for the journey to work in the RZ rose sharply from 33% before the ALS to about 70% by 1983⁷⁰. In Jan 1994, the ALS was extended to the whole day between 7:30 am and 6:30 pm to achieve a better utilization of the RZ road network throughout the day and allow for a higher volume of traffic to be carried without congestion. The ALS had effectively control congestion in the RZ and it had successfully maintained the traffic flows within RZ during the morning and evening peak hours despite an increasing vehicle population from about 100,000 in 1975 to 230,000 in 1994⁷¹.



⁶⁹ Cervero, Robert, (1998), *The Transit Metropolis: an Global Inquiry* – Page: 158

⁷⁰ Jeremy YAP, (2005), *Implementing Road and Congestion Pricing - Lessons from Singapore* – Page:9

⁷¹ The same 69

Img.20 Typical gantry at entry point into RZ and Symbol of RZ

B. Road Pricing Scheme (RPS)

Following the success of the ALS, a similar manual pricing system called the Road Pricing Scheme (RPS) was introduced progressively in the 1990s to six locations along congested sections on three expressways to manage the morning peak hour traffic from 7:30am to 9:30am on Mondays to Fridays. Under the RPS, vehicles with the whole-day ALS license could be used at the RPS gantries as well. The intention of the RPS was to help spread traffic to other times and alternative routes. The RPS resulted in better traffic distribution between the expressways that lead into the Central Business District (where traffic congestion is developing) and the parallel arterial roads during the morning peak hours. It also led to better utilization of these roads after the morning peak.



Img.21 RPS gantry along the expressway

Source: Jeremy YAP, (2005), Implementing Road and Congestion Pricing - Lessons from Singapore – Page: 10

C. Electronic Road Pricing (ERP)

In reality both the ALS and RPS worked well particularly in the city as well as along. However, both two schemes have limitations regardless the number of times motorists enters the RZ. This is not a true reflection of the cost of driving to time and congestion levels. Therefore, in the late 1980s, Singapore started to look for a more flexible road pricing scheme. The new scheme should have merits over the ALS in term of ease of payments, be flexible enough to enable price changes in accordance with varying traffic conditions and be complemented with an effective enforcement framework that is less labor demanding. Above all, it has to be a reliable system that the motorists have confidence in. After 10 years of planning, testing and preparation, the Electronic Road Pricing (ERP) system was launched in September 1998. The ERP marked the next era of Singapore road pricing strategy.

The new system electronically collects fees from drivers through in-vehicle units installed in cars that enter designated areas of the city center during certain periods of peak traffic. The system has

several price options depending on road types (arterial and highway) and periods. Higher prices are applied during the most congested times. The main objective of ERP scheme is to charge vehicles for their using road spaces and at time where and when they cause congestion. The ERP system works on the rationale of optimal average speeds. Therefore, the main difference between ERP and the earlier ALS / RPS is the pay-when-you-use principle which is vastly different from the old scheme where charges are on a per license basis regardless of the number of times that motorists enter the RZ or passes the expressway gantries.



Img.22 Electronic Road Pricing Gantry

Source: Internet

3.4.3 Learning from Singapore

3.4.3.a Governance, Stakeholders and Sustainable Urban Transport (SUT)

Experiences from Singapore shows the significant role of Governance as required for acquaintance of a sustainable urban transport development. From environmental regulations, Singaporean government sets emission limits and clean air goals and safety measures (including driver education, traffic laws, and vehicle safety standards). Other important policies which can be noticed here for example: increase access, including congestion pricing, road pricing, vehicles registration fee and so on.

SUT requires good governance, consistent political support and well coordinated of administrative structures and processes. A great challenge in most of Asian countries in general and specific in Hanoi case is too weak governance which being decay by corruption and as a consequence is present a disarray transport system.

Nevertheless, governance is just a first step; to strengthen the sustainability of the urban transport system requires the involvement of all stakeholders in a structured manner and full access to information for all groups. For stakeholder participation in SUT planning and implementation to function well, it is important that information on the status of urban transport systems and efforts to improve it are collected on a regular basis and made available to all local stakeholders. Transport services in the cities will continue to be delivered by a mix of actors in the formal and informal sector. Regulators need to assess whether and how actors in the informal sector interact with the

formal sector. Financing will be required for actors providing motorized transport services. Access to financing is easier for transport providers in the formal sector.

3.4.3.b Integrated Approach

Experience from Singapore shares an idea of the crucial criteria for achieving a sustainable urban transport system by integrated urban transport system. An integrated public transport system will be able to attract more people and as a result, public transport will be the choice mode by the majority of the urban population. Only public transport can assure mobility in large cities. And only by preserving good conditions for walking and cycling it is possible to maintain a satisfactory level of urban quality. Therefore, the goal of a sustainable urban transport also might be reached, the accessibility and mobility in the city would be enhanced and provided to all citizens, who would not only benefit from an improvement in terms of transport, but also in terms of air quality, and thus quality of life.

3.4.3.c Sustainable urban development Strategies

- *Land-use planning*: The case study of Singapore's sustainable strategies give an idea to land-use planning for sustainable transport by reducing the need to travel and the trip distances, support walking, cycling, public transport, restrict car. Experience of Singapore also poses the unsustainable strategies of many Asian cities (Bangkok, Manila, Jakarta) which is planning approaches are still generally toward increasing infrastructure, supply new roads, subways, and flyovers rather than invest in sustainable policy such as : reducing demand by suitable land-use planning or shifting modes of transport and improved mass transit options.

- *Density*: Density plays a crucial role in the accessibility and mobility patterns in Singapore. Singapore high density level has a close knit urban fabric and hence bringing together various activities in a lesser radius. This help to reduce the lengths of the trips and, in many cases, also affects the modal split. When the destinations are close, people would prefer to use alternative faster modes wherever available. Dense and mixed use development helps to keep walking and cycling attractive. These are the most environmentally friendly transport modes

- *Non-motorized Transport (NMT)*: It has been proven in Singapore's case that providing proper infrastructure for NMT would encourage people in using this mode and hence increase modal shares.

- *Public Transport (PT)*: People are prone to use public transport in cities where it is accessible, comfortable and attractive. The prioritization of public transport is a factor for success in Singapore. Promoting non-motorized transport and public transport are evidently a huge factor of success in an effort to reduce motorized modal shares.

3.4.3.d New Policy Initiatives

Transport Demand Management (TDM), which discourages unnecessary private vehicle use and encourages more environmentally friendly modes of transport. Important benefits can be achieved through the implementation of adequate regulatory and economic instruments: traffic organization, low emission zones (LEZ), vehicle registration fee, vehicle quota, vehicle purchasing tax, fuel tax, road user pricing, parking fees and so on.

SUMMARY OF SINGAPORE'S URBAN TRANSPORT POLICY INITIATIVES

MEETING THE DIVERSE NEEDS OF THE PEOPLE	
SECTION	INITIATIVES
EXPANDING BARRIER FREE ACCESSIBILITY	<ul style="list-style-type: none"> - All existing and new MRT stations will have at least one barrier free access for persons with disabilities or impairments. Additional lifts will be installed at selected MRT stations by end 2011 so that these stations will have at least two barrier free access routes - 40% of public bus fleet will be wheelchair-accessible by 2010. We will work towards having all public buses to be wheelchair accessible by 2020 - Implement \$60 million programme to ensure pedestrian walkways, access to MRT stations, taxi and bus shelters and all public roads will be barrier free by 2010
ASSISTING LOW-INCOME GROUPS	<ul style="list-style-type: none"> - Targeted help for the needy through Government assistance such as Workfare Income Supplement Scheme (WIS) and community help, including public transport vouchers
FACILITATING CYCLING	<ul style="list-style-type: none"> - Provide more and better bicycle parking facilities at MRT stations and bus interchanges from 2009 - Allow foldable bicycles on trains and buses on a trial basis from March 2008 - Implement safety signs along commonly used cycling routes such as Thomson and West Coast from March 2008
SUPPORTING ENVIRONMENTAL OBJECTIVES	<ul style="list-style-type: none"> - Achieve 7% improvement in energy consumption per capita for the land transport sector by 2020 - Adopt Euro IV standards for all diesel vehicles and work with taxi and bus operators to consider cleaner technologies or fuels e.g. CNG - Promote the use of cleaner and more energy efficient vehicles, and review Green Vehicle Rebate (GVR) scheme regularly to ensure its relevance - Use recycled waste materials for road resurfacing works and road pavement construction - Adopt environmentally sustainable practices in design and construction of road and rail infrastructure to minimise noise and impact on environment - Study impact of traffic noise and mitigating measures
ENGAGING THE COMMUNITY	<ul style="list-style-type: none"> - Launch Community Outreach Programme in March 2008 to better engage the community on land transport policies and plans

Tab.17 Meeting the diverse needs of the people

Source: Singapore Ministry of Transport, Land transport masterplan – a people centred land transport system, last access: Tuesday 26 June, 2012

MAKING PUBLIC TRANSPORT A CHOICE MODE	
SECTION	INITIATIVES
BUS AND RAIL SERVICES	<ul style="list-style-type: none"> - LTA to be central bus network planner by 2009 - Implement fully integrated distance-based through-fares by 2009 - Introduce an integrated season pass by December 2008 to allow unlimited travel on both train and basic bus services - Greater bus priority on the roads <ul style="list-style-type: none"> • Extend bus lanes from 120km to 150km and full day bus lanes from 7.6km to 23km by June 2008 • Make it mandatory for motorists to give way to buses existing bus bays by end 2008 • Implement signal priority for buses at junctions starting with a pilot by end 2008 - Gradually open up basic bus service market to allow competition for the market - Encourage premium and innovative basic bus services - Consider Government funding for provision of common facilities for bus services - Double RTS network from 138km to 278km by 2020. Implement the following new lines: <ul style="list-style-type: none"> • North-South Line Extension by 2015/17 • Tuas Extension by 2015 • Thomson Line by 2018 • Eastern Region Line by 2020 - Enhance capacity on existing RTS by increasing train frequency <ul style="list-style-type: none"> • Revise Operating Performance Standards to prescribe minimum train headways • Invest in additional trains and modification to signaling system and infrastructure to allow trains on NSEW line to operate at higher frequency - Introduce greater contestability in RTS industry by shortening licence period for future RTS operating licences - Review rail financing framework to support the expansion of the rail network - Install Platform Screen Doors at above-ground MRT stations by 2012
PT TRAVEL INFORMATION	<ul style="list-style-type: none"> - Implement integrated Public Transport Journey Planner with basic map features by July 2008 - Provide integrated real-time bus arrival information at bus stops via SMS and various mobile platforms progressively from July 2008 - Implement Integrated Multi-Modal Travel Information System
INTEGRATION BETWEEN TRANSPORT NODES AND DEVELOPMENTS	<ul style="list-style-type: none"> - Double the number of covered pedestrian overhead bridges (POBs) from 192 today to 384 by end 2010 i.e. 86% of current POBs - Build more air-conditioned bus interchanges integrated with RTS stations and retail/commercial activities: <ul style="list-style-type: none"> • Boon Lay Bus Interchange by 2009 • Clementi Bus Interchange by 2011 • Develop another five integrated interchanges at Serangoon, Bedok, Jurong East, Marina South and Joo Koon over next 10 years in tandem with re-development
TAXI SERVICES	<ul style="list-style-type: none"> - Refine taxi QoS to ensure greater taxi availability during peak periods through phone booking - Set up a common call booking telephone service for taxis by July 2008

Tab.18 Making public transport a choice mode

Source: Singapore Ministry of Transport, Land transport masterplan – a people centred land transport system, last access: Tuesday 26 June, 2012

MANAGING ROAD USAGE	
SECTION	INITIATIVES
ENHANCING EFFECTIVENESS OF ERP & PARKING POLICY	<ul style="list-style-type: none"> - Use 85th percentile speed measurement method to determine if ERP rate changes are necessary from July 2008 - Implement revised ERP rate structure from July 2008 - Introduce new gantries along the Singapore River to more effectively manage congestion within the city area from July 2008 - Study relevant technology for ERP II - Allow supply of parking spaces to reduce over time with the application of new parking standards, while leaving the market to optimise the use of parking spaces through pricing
REVIEWING OWNERSHIP MEASURES	<ul style="list-style-type: none"> - Reduce vehicle ownership costs - Reduce vehicle population growth rate to 1.5% per annum from Quota Year 2009 for three years
EXPANDING ROAD NETWORK AND IMPROVING ROAD SAFETY	<ul style="list-style-type: none"> - Implement Marina Coastal Expressway by 2013 - Implement North-South Expressway by 2020 - Study implementation of Singapore Underground Road System - Study feasibility of reversible flow scheme on suitable stretches of expressways that show tidal traffic flow - Enhance pedestrian safety with installation of new safety devices e.g. intelligent road studs at pedestrian crossings and personal electronic device for elderly pedestrians - Increase motorist and pedestrian safety with new traffic calming measures e.g. Your Speed Sign, Advance Road Markings and Traffic Calming Markings - Provide more rain shelters for motorcyclists along expressways, from 32 today to 70 by end 2009
LEVERAGING ON TECHNOLOGY	<ul style="list-style-type: none"> - Expand J-Eyes and EMAS from 509 cameras today to 1,049 cameras by 2013 - Introduce Parking Guidance System from March 2008 - Introduce more timely broadcast of traffic news & host education programmes on radio channels. Study feasibility of setting up traffic radio channel - Allow payment of ERP charges by credit cards by mid 2008 - Allow use of contactless smartcards in ERP IUs by end 2008

Tab.19 Managing road usage

Source: Singapore Ministry of Transport, Land transport masterplan – a people centred land transport system, last access: Tuesday 26 June, 2012

APPENDIX 2: SINGAPORE LAND TRANSPORT STATISTICS IN BRIEF

GENERAL INFORMATION	2009	2010
Total Population ('000)	4,988	5,077
Singapore Residents ('000)	3,734	3,772
Labour Force ('000)	3,030	3,136
Total Visitor Arrivals ('000)	9,681	11,642
GDP (\$million, current price)	257,600	303,652
Per Capita GDP (\$)	51,656	59,813
Land Area (square km)	710.3	712.4

Data source: Department of Statistics, Singapore (www.singstat.gov.sg)

ROAD LENGTH (Km)	2009	2010
Expressways	161	161
Arterial Roads	627	634
Collector Roads	521	535
Local Access Roads	2,046	2,047

ROAD LANE (Km)	2009	2010
Expressways	1,059	1,059
Arterial Roads	2,931	2,938
Collector Roads	1,492	1,526
Local Access Roads	3,365	3,372

ROAD & TRAFFIC FACILITIES	2009	2010
Number of Flyovers	114	114
Number of Vehicular Bridges	213	213
Number of Directional Gantries	170	167
Number of Traffic Lights	2,080	2,127
Number of ERP Gantries	66	69

PEDESTRIAN FACILITIES	2009	2010
Number of Pedestrian Bridges	480	484
Number of Pedestrian Underpasses	54	54
Number of Footbridges	28	29
Covered Linkways (km)	22	22
Number of Street lightings	95,200	96,400

RAPID TRANSIS SYSTEM (RTS)	2009	2010
Total MRT Length Built (km)	118.9	129.9
Total LRT Length Built (km)	28.8	28.8
Number of MRT Stations	73	84
Number of LRT Stations	33	33

COMMUTER FACILITIES	2009	2010
Number of Bus Interchanges	22	22
Number of Bus Terminals	13	15
Number of Bus Stops	4,581	4,591
Number of Taxi Stands/Stops	232	255

MOTOR VEHICLE POPULATION	2009	2010
All Vehicles	925,518	945,829
Private Cars	497,116	511,125
Other Cars	82,255	86,621
Taxis	24,702	26,073
Buses	16,023	16,309
Goods & Other Vehicles	158,207	157,541
Motorcycles	147,215	148,160

MOTOR VEHICLE REGISTRATION	2009	2010
Number of vehicles new registered	88,938	61,018
Number of vehicles de- registered	58,102	40,707
Total number vehicles of transferred	81,100	105,315

PUBLIC TRANSPORT CAPACITY	2009	2010
Average Fleet and Routes in Operation		
Average Bus Fleet Operated	3,393	3,475
Number of Bus Routes in Operation	339	342
Average Daily Vehicle-Kilometres Travelled		
MRT ('000 train-km)	49.4	55.4
Bus ('000 bus-km)	849.4	839.7

PUBLIC TRANSPORT UTILISATION	2009	2010
Average Daily Ridership ('000 passenger-trips)		
MRT	1,782	2,069
LRT	90	100
Bus	3,047	3,199
Taxi	860	912
Average Trip Distance		
MRT (km/passenger-trip)	11.0	10.3
LRT(km/passenger-trip)	2.1	2.1
Bus (km/passenger-trip)	5.2	4.8
Taxi (km/engaged trip)	9.0	9.3

PUBLIC TRANSPORT JOURNEYS	2009	2010
Average Daily Passenger-Journeys ('000)	3,618	3,841
Average Journey Distance (km)	9.7	9.8

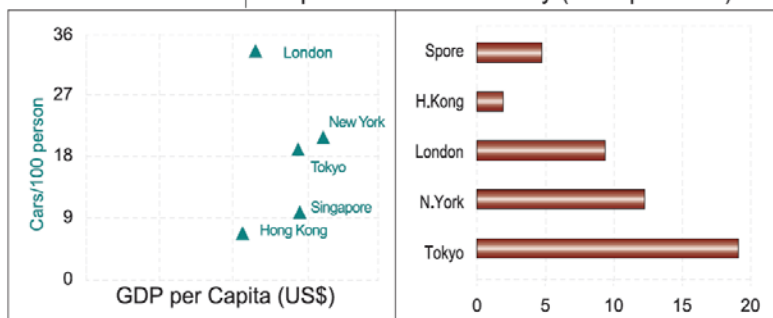
ROAD TRAFFIC CONDITIONS	2009	2010
Average Daily Traffic Volume		
Entering the City	278,400	293,300
Average Speed during Peak Hours (km/hour)		
Expressways	62.0	62.3
Arterial Roads	27.9	28.0

ROAD ACCIDENT CASUALTIES	2009	2010
Fatalities	183	193
Injuries	10,748	11,065

Data source: Department of Statistics, Singapore (www.singstat.gov.sg).

APPENDIX 3: COMPARISON WITH SELECTED CITIES

[12] Number of Cars/100 persons Road density (km/square km)



Data sources:

Transport Department, MTR Corporation, Transport International Holdings, Hong Kong (2010);

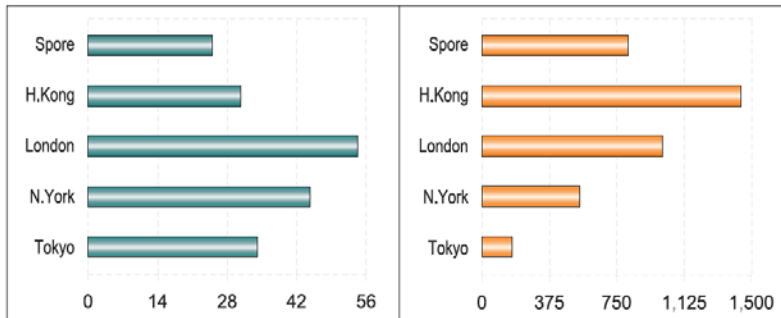
Transport for London, United Kingdom (2010);

MTA New York Transit, APTA, USA (2009);

Tokyo Metropolitan Government, TOEI, Tokyo Metro, Japan (2009);

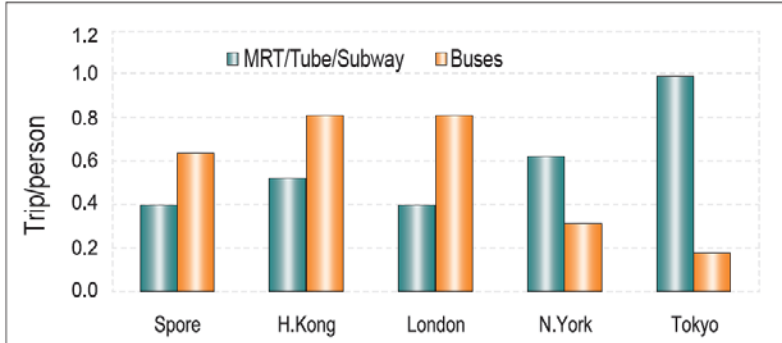
World Bank 2011 World Development Indicators.

[13] MRT length(km)/million persons Public bus fleet/million persons

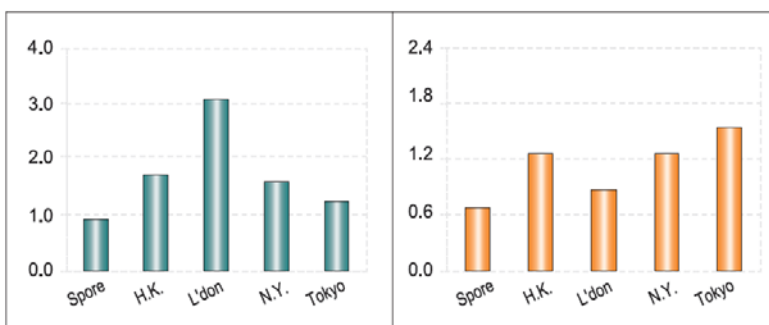


The MRT system is compared with MTR in Hong Kong, London Tube, Subways in New York City and Tokyo. The public bus fleet in Hong Kong includes Franchised Buses and Public Light Buses.

Average Daily Public Transport Trips per Person



[14] Average MRT Fare (\$\$/pax-trip) Average Bus Fare (\$\$/pax-trip)



3.5 AN APPROPRIATE TRANSPORT POLICIES FOR HANOI CITY

3.5.1 Specific objectives and policies directions

In order to go in depth into the strategies and programs needed to achieve better sustainable urban transport (SUT), it is proposed a set of policies according to the problems and opportunities identified. In this way, the different action policies are converted into opportunities to solve the collective problems identified. The policies identification is focused on improving land-uses planning strategies and the urban transport infrastructure, as a result environmentally quality benefiting the citizens and different target groups.

3.5.2 Strategies and programs

3.5.2.a The Intergration approach

The integration of transport and land-uses planning

"Without acknowledgement of the interactions between land use planning, urban growth and transport development, nos sustainable transport system will emerge"⁷².

The movement of people is created by the relocation from one specific land-use to another one at a certain time of the day. The trips are made because people need to carry out their activities and travel demand depends on people's activity. Therefore, the fundamental of transport planning is that how to make people do not like traveling, thus reduce need to carry out their activities. Recently, urban planners have realized that transport and land-use are two key elements for managing travel demand. The transport and urban planning integration contributes directly to reduce the amount of travel, as a result is the reduction of traffic congestion. Besides that, it also gives orientation to the reduction of private vehicle use and thus, accounts the improvement of urban environment

"There are two main streams in the integration of land-use and transport which are mixed land-uses and relocation of some major land-uses such as hospitals, offices for example out of the city centre"⁷³. Mixed land-uses priority approaches is to integrating different land uses and building types in order to create vibrant, pedestrian-friendly and diverse communities. Meanwhile relocation by moving some major land uses to the edges of the cities, and so Central Business District remains its typically consumer and business services only. City centers by the way still attract high volumes of transport; however major share trips are divided to suburb areas. Thus, land-use relocation can help to reduce traffic demands to center areas and achieve better mixed land-uses and as a consequence traffic congestion can be reduced.

Many cities in the world have provided good practice examples, where integration of land uses and transport in planning can result in a reduction of car use, improved public transport use, walking and cycling and reduce traffic congestion and thus achieve better quality of life. The study case of above

⁷² Petersen, R., (2004), *Land use planning and urban transport*, Eschborn, Germany, GTZ
http://www.imtt.pt/sites/IMTT/Portugues/Planeamento/GestaoMobilidade/DocumentsReferencia/Documents/Sustainable%20Transport%20Sourcebook/Module_2a.pdf last access: Thursday 5 July, 2012

⁷³ The same 72

part has mentioned the decentralization's strategy of commercial activities to regional centers and sub-regional centers to relieve congestion in the Central Business District of Singapore. As the result, the city provides the opportunity to work closer to home and minimize travel expenses and time.

In summary, In order to achieve better SUT for Hanoi city, the objectives here are to reduce the traffic demand (and develop Transit Oriented Development), to give priority to mixed land-use approaches, to provide and reserve land for transport infrastructure through planning tools and planning policies which are set in the following action plan:

- *Integrated and strategic approach rather than a sartorial planning approach, which led to an unsynchronized development of urban development and transportation network.*
- *Concerning the urban railway network, this integration shall create benefits by providing a high quality and effective public transport service maximizing value of land use along the corridors and surrounding the stations.*
- *By improving the environmental quality, living conditions and socio-economic activities. This integration can be reached using the Transport Oriented Development concept, in order to reduce the traffic demand.*
- *Requires a different approach to urban design and new policies supporting mixed-use in neighborhoods. For numerous new urban areas (Khu đô thị mới) are developed in Hanoi which until now there is a lack of mainly social, infrastructure. Need urgently a framework in order to improve infrustruture. Stakeholders who are in charge to manage Public Transport sector in the city have to adapt themselves to the fast change of urban shape and thus provide public service where the people are.*
- *The land issue. "Land Clearance" and "land acquisition" are the procedures, which delay and interfere with the infrastructure building. Clearly, this problem is related to a severe lack of management of the land use and the capacity of the administration to get enough Right-of-Way in order to develop efficient PTS. This issue runs for a while now and the debate reaches also the land legal framework and the resettlement policies framework.*

The Integration of different transport modes

The integration of different transport which facilitates the passenger's transfer from one means of transport to another (or to the same means of transport but into a different transit network) plays an important role in the successful of any transport system. In Hanoi, the integration of different transport modes is particularly important, as it requires the integration of different lines and different technologies. As the rapid transit lines (LRT/MRT/BRT) request heavy infrastructure construction and they are irremovable, while the bus network will become a complementary network (and the most flexible one), which would connect with this main rapid transit network. The reorganization of bus lines would be a priority. This would follow two objectives:

- First, reducing duplicated bus lines and facilitating the connection and accessibility between bus stops and future MRT/LRT/BRT stations.

- Secondly, different transport mode integration is obviously needed at the intersection of two lines of the same means of transport. This connection will be fail if the ways between two stations are too long or too difficult, and if paths are poorly marked. The transit points might thus become the weak points within the network.

The Integration of participating bodies in transportation sector

In Hanoi, the Hanoi Metropolitan Rail Transport Project Board (HRB) is Project Management Unit (PMU) for MRT line 2 and line 3 was placed under the direct responsibility of the Hanoi Peoples Committee (HPC) and detached from the Department of Transport (DOT), the authority which traditionally is in charge of the transportation management. However, not only HRB, Vietnam railway also in charge in MRT line 1 and line 4, meanwhile DOT in charge of managing the road, bus network and the BRT project. Until now, the skeleton of the rapid transit line looks like a collage of various projects proposed by various donors (private, public, bilateral, multilateral, with different objectives and requirements of multiple funding) and different modes of public transport are managed by different authorities, therefore placed in a competitive situation. This seam contradicts the principle of an efficient integrated network. To ensure a smooth integration of the future network and to optimize travel modes in Hanoi, it is clear that the establishment of a PTA, responsible for all modes of travel is required. TRAMOC could eventually undertake this task because of their experience on the bus network and its ability to conduct international projects. For this, substantial efforts must be devoted to personnel training, reorganization and clear definition of powers of the future authority, including the operational phase.

The Integration of fare and tariff

The integrated fare can be understood is the fare for the whole network, which should be cheaper than the sum of each line ticket. This allows decreasing transfer line costs. As a result, integrated fare is an asset for the public transport network and attracts more passengers. The increase of the number of passengers can increase and improve the service and also the establishment of a new pricing intended for users with low incomes (for example students or unemployed people).

3.5.2.b High density level

*"Density is a good initial indicator of a transit-friendly urban form"*⁷⁴. Density affects travel behavior through its impact on the distance between destinations as well as on the number of destinations that can be reached by active modes and transit. Density is a good initial indicator of transit friendly urban form. High density urban form structures automatically limit the space for cars, and passenger can be served by public transport, walking or cycling. When there are many jobs and households in a given area, transit becomes more viable and provides the "critical mass" needed to support retail development⁷⁵. Cities with high density, as Hanoi, often consider the density a problem rather than a benefit. Many planners seek to reduce rather than maximize density. While certainly too much density as tends to occur in urban slums, and which characterizes many of Hanoi's older urban fabrics can detract considerably from quality of life, too little density can as well. For Hanoi it is vital

⁷⁴ The same 72

⁷⁵ Geertman, Stephanie, (2010) *Hanoi at Cross-Roads: Streets for People or for Cars?*

to examine the densities in the inner city and in the new areas developing in the suburbs. An assumption is that the inner city needs lower densities than at present, and the new areas need more density to be livable and encourage walking.

3.5.2.c Manage automobile ownership and use

Automobile - based urban transport is out of reach of most Hanoians. Private car and motorbikes ownership increases at high rates leads to overload of existing roads, congestion, and environmental degradation of urban space.

Hanoi need urgently take decisions to discourage private car use and improve the public transport system, firstly by upgrading bus systems and latter by building or expanding urban rail systems. Transport demand is first managed alongside supply, and projects are centered on traffic restraint and the greater use of public transport. No longer is road traffic capacity automatically expanded in response to demand forecasts.

3.6 A SET OF PROGRAM FOR DONGDA DISTRICT

After establishing the urban management strategy formular, this part will give a proposed the following strategies and program in the study area:

3.6.1 Improve Accessibility

Urban decentralization

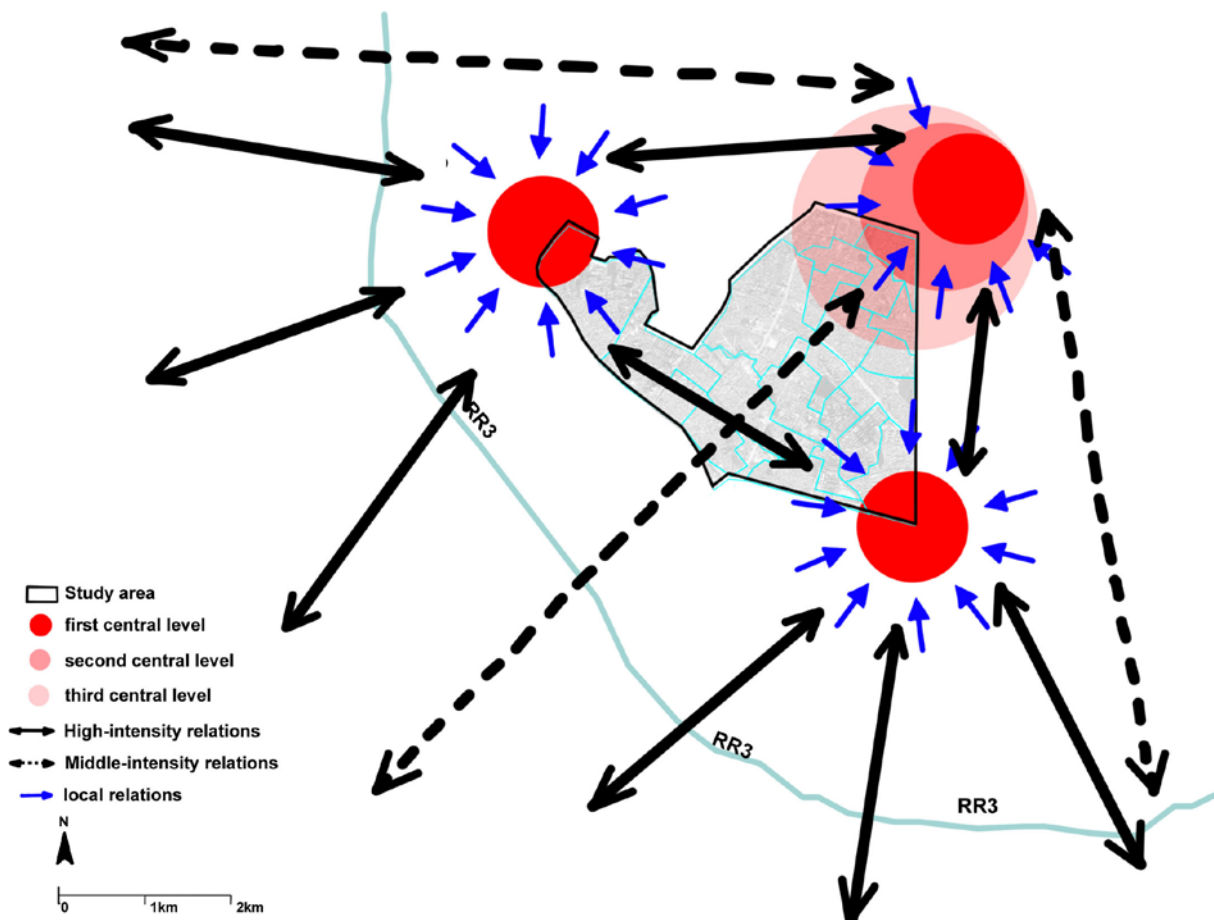


Fig.39 Urban decentralization scheme

Strategies:

- Redefinition of the urban centralities with specialized functions into a hierarchical network.
- Promotion of urban patterns which have better mixed-uses, creating better conditions for the development of local activities in order to attract more people in the local scales
- Territorial balance and vitality of the socio-economic fabric in an integral way with the residential and employment concentration areas.

3.6.2 Improve quality

Improve transport system, create livable places and social integration

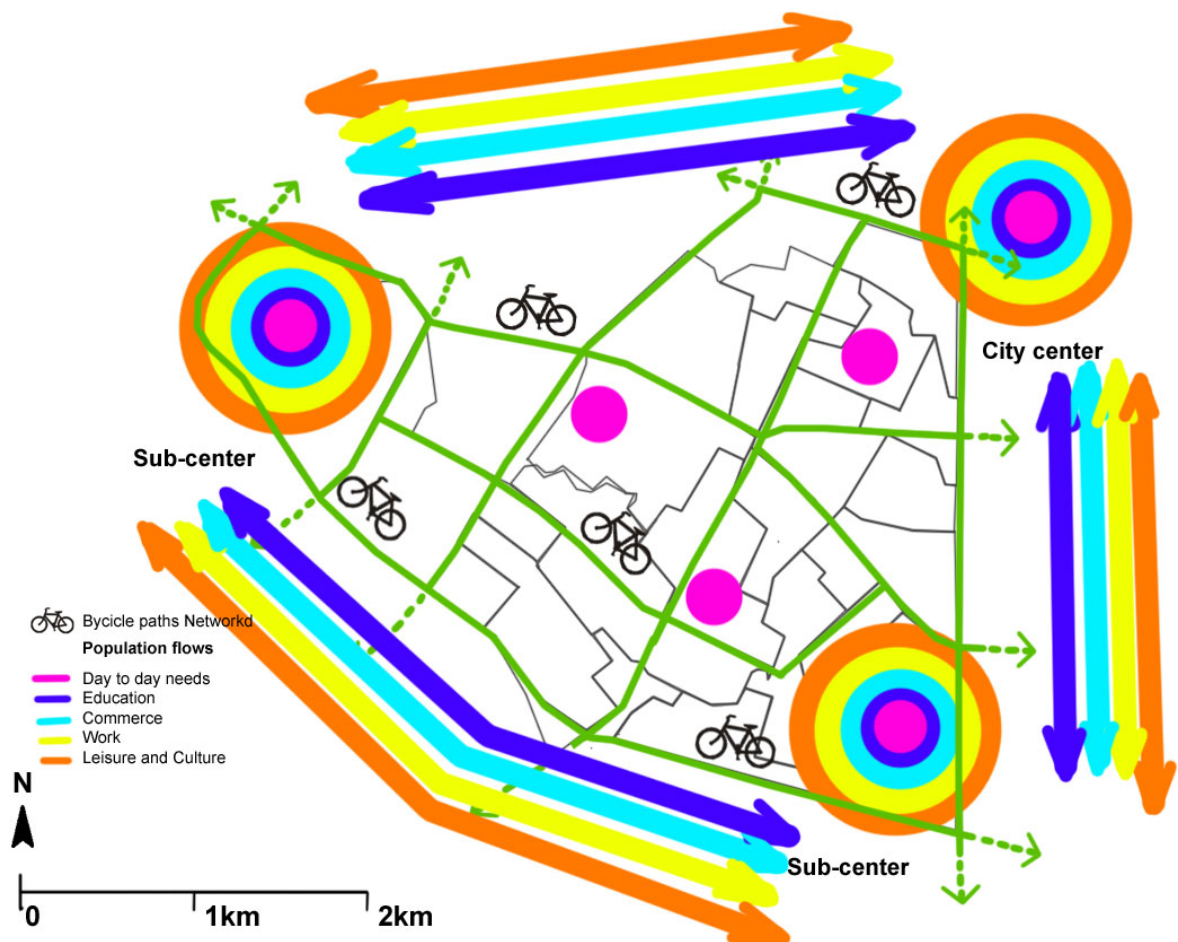


Fig.40 Improve transport system, create livable places and social integration

Strategies:

- Creation of alternative transport systems, reducing the need of motorized transport
- Improve pedestrian accessibility and use of public transport in order to reduce movements
- Strengthen social accessibility through the creation of event spaces within urban territory
- Covered of urban services in marginalized areas

3.6.3 Improve Efficiency Density shift

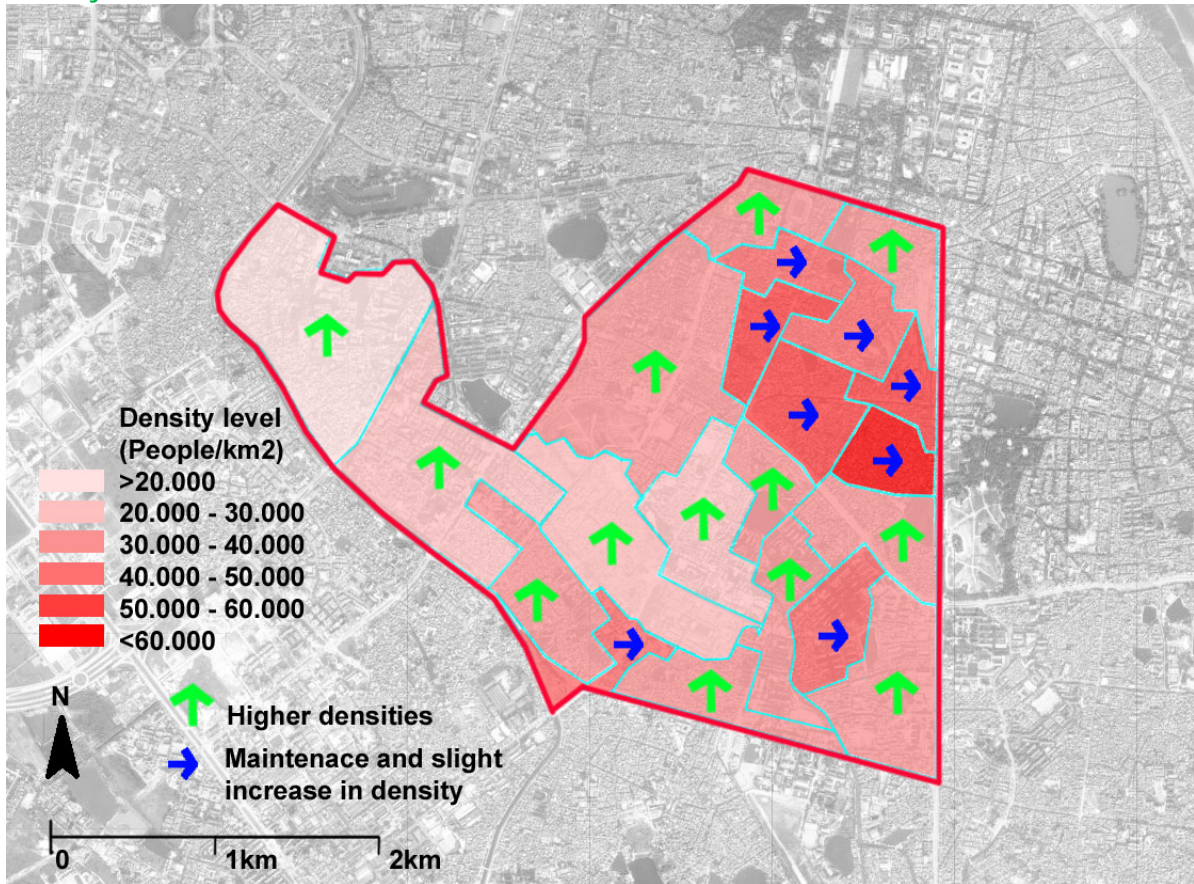


Fig. 41 Density shift

Strategies:

- Achieve compact settlements in order to increase density level
- Conformation of continuous urban and local road network

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CONCLUSION

The current traffic situation of Hanoi has been showed the risk of becoming completely paralyzed by traffic congestion. The city is facing very serious challenges of a saturated urban transport system. One of the targets of this study is attempt to show that the issue of congestion is not only due to an increase or variation of the number of private vehicles, but also is due to the consequences of un-integrated transport and land-use planning and un-sustainable transport policies. Although beyond the selected neighborhood where almost of main radial roads leading to city centre pass through and contributing a severe traffic congetions at the bottlenecks during the peak hour. The contribution of some selected land uses to the traffic congestion at these points was evaluated and traffic volume was used as an indicator to evaluate the traffic congestion level.

The study also introduced the difference between the concept of sustainable urban transport and its implementation in the Vietnamese context. The current planning for a public transportation network of the city in the future seems to be the solution that not only solves the current transportation issues, but also improves current environmental conditions. However, the issue of integration exposes the limitation of the current management in charge to develop a public transport network. The failure of integration of a public transport system would lead to a tremendous financial loss that would burden generations of Hanoians who will have to pay for the reimbursement of such heavy equipment, in one way or the other, as users or administered through the payment of taxes.

Besides that, the research addressed that integration between land-use and transport planning for Hanoi should have a higher consideration by city administration and policies makers in order to improve accessibility, mobility, social equality as well as to keep a healthy environment for Hanoi people. Integrated land-use and transport planning would contribute to a reduction in traffic congestion by reducing total travel length, travel time, fuel consumption; encourage people to shift to using green modes of transport like cycling, walking, and the bus instead of using private motorcycles and lead to a healthier urban environment. The relocation of some major land uses which contributes to overcrowded might be another solution. Relocation can help these organizations have a better chance to build new offices with good infrastructure, modern facilities as well as a good environment. The continuous search to maximize accessibility, efficiency, mobility and minimizing environmental emissions need to be done by public administrations and society. This is how current city planning should deal to achieve the perfect combination of transport, environmental and land use policies in balance with economic development.

Therefore, the existing urban and transport planning should be reconsidered by the city administration and urban planners in order to create integrated actions, which are a more viable response to city needs and urban sustainability. It is not necessary to restart with a new process and disregard the current urban land-use planning, but to work in a comprehensive way, rethinking some suitable policies toward sustainable criteria. This work should happen with better coordination between the different institutions and community.

It is also important to note that accessibility analysis is only estimated based on current land-use activities and is not obtained from directly measured data. The other limitation of the study is related to a lack of data, e.g. the road density network was drawn from a totally digitized source based on google maps.

The following lessons can be drawn from the research and summarized as follows:

- In order to achieve an increase in accessibility of more sustainable transport, the public transport network must be implemented first
- Integration between transport and land-use planning is a key to achieving a better sustainable urban transport.
- Hanoi, as a representative of a monocentric urban form is having problems of high congestion levels in the city centre. Both jobs and labour force are concentrated in the city centre and thus public transport accessibility is much higher than rural and suburban areas. These factors can lead to more and more people moving to the city centre. As a result congestion, pollution and other environmental as well as economic and social problems occur. Polycentric urban form is one option might solve the problem.
- Density level and mix-land use will shape the accessibility level, which can have impacts on transport in general. In a high density and mix-land use area travel time is often smaller than in a low density and unique function use area.

In conclusion, current urban transport planning and management has a mission to the expected future transport model of the city. It requires a series of strategies and requalification programs capable of responding to social, spatial and environment problems. On the other hand, the search for a sustainable urban transport can be achieved through a more critical interest in the current transport condition of the city.

CONCLUSION

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