8 URBAN TRANSPORTATION

8.1 Existing Conditions and Issues

1) Overview

The urban transportation system of Hanoi is primarily composed of both urban and inter-city roads. Although there are railways, inland waterways, and airports, they are largely for inter-city and regional transportation services. Urban transportation services are mostly provided by private transportation which is characterized by a dominating presence of motorcycles, a fast-growing number of cars, and decreasing number of bicycles. Public transportation services are composed of bus, taxi, xe om (motorcycle taxi), and cyclo (pedicab). However, their share in urban transportation is low.

The urban transportation situation in Hanoi is unique and has few comparisons with the experiences of other cities in the world. In compact developed urban areas with high population density, a large number of motorcycles meet major portions of transportation demands of the people who own motorcycle at substantially high rate as compared to relatively low income level. Under the current setting of urban structure and with abundant motorcycles, mobility and accessibility of the people are very high and more or less door-to-door movements are made possible in a short travel time.

However, the situation has been changing quickly day by day. In addition to the constant increase in motorcycle ownership, the number of cars has been steadily increasing. Changes in the mix of traffic, slow progress in roads development, undisciplined driver attitude and lax enforcement are becoming more and more obvious in worsening traffic scene in the city. Although bus transportation has been gradually expanded, the impacts are still limited.

2) Transportation Infrastructure

Hanoi's transportation infrastructure is characterized by various weaknesses for roads, railways, and water transportation. The road network is still inadequate in terms of density, connectivity, and technical standards, except those in the urban core. The availability of roads is particularly low in suburban areas where roads are not only inadequate but also improperly configured. Due to the existence of bottlenecks and missing links, the existing network is unable to effectively distribute traffic, causing traffic congestion in many locations. The weakness in the main road net work has also resulted in inter-city traffic passing through the city center, creating unnecessary conflicts.

The design standards of main roads vary by section. A mixture of substandard and overscale sections also spoils the efficient use of road space.

The delay in land acquisition and resettlement is also becoming increasingly serious, hampering the smooth implementation of road projects, especially in the urban and fringe areas.

The existing railway does not contribute in easing urban transport problems, and instead brings about rather negative impacts on land use along the route and traffic at crossings. The railway is built with a single track and an at-grade system, running through congested urban areas, while the right-of-way has been encroached by illegal construction.

Inland water transportation facilities are also poorly provided. While inland water transportation has yet to shoulder some of the urban transportation demand, it has the potential to contribute significantly to transportation services.

Meanwhile, Hanoi has several airports located within reasonable distances from the city center. However, Noi Bai is the only one provided with adequate facilities both for international and domestic services, and the Gia Lam and Bac Mai airports are neither used for civil aviation nor for urban development activities.

Figure 8.1.1 Comparison of Road Coverage Ratios Among Selected Asian Cities

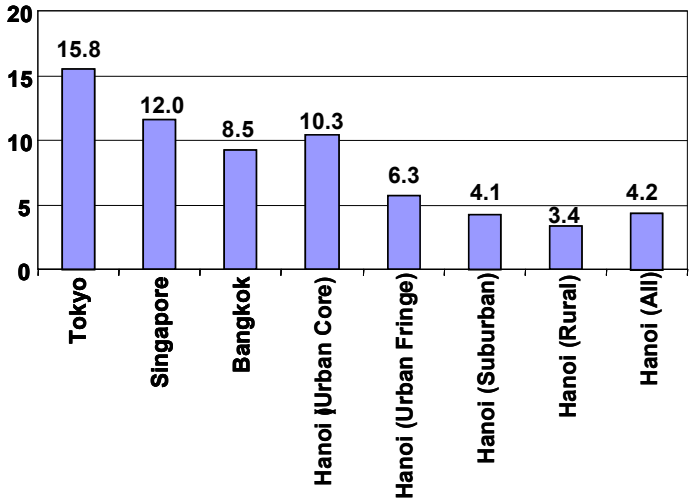


Figure 8.1.2 Deficient Primary Road Sections in Hanoi's Urban Areas

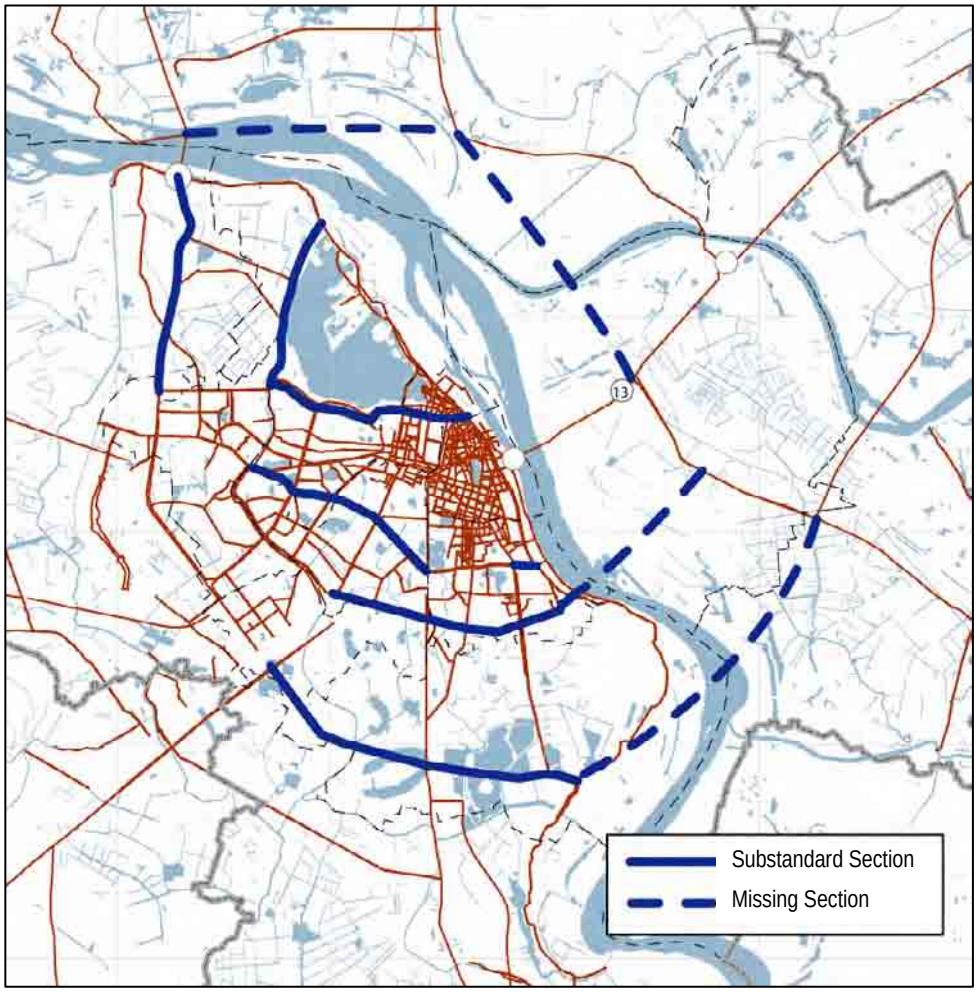
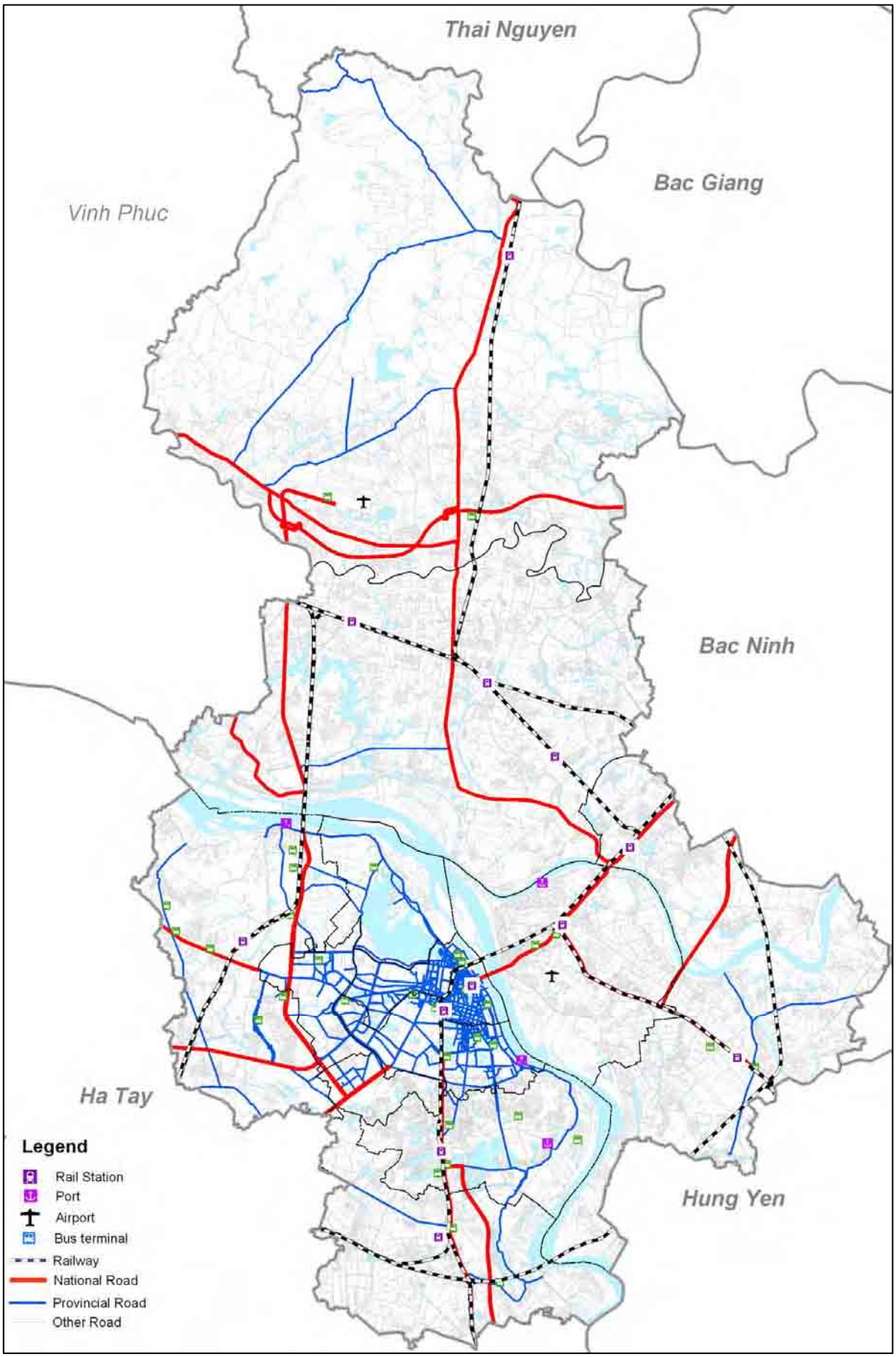


Figure 8.1.3 Transportation Network in Hanoi, 2005



3) Traffic Management

(1) Overview

Traffic management in Hanoi is a weak point in urban transportation which limits the effective use of road space, as well as the improvement of safety and amenity levels. Road users, including motorists (cars and motorcycles), bicyclists, and pedestrians, do not strictly observe traffic rules, and enforcement is lax. A lack of proper facilities and infrastructure is also observed. While existing traffic management measures consist of traffic signals, monitoring systems, traffic regulations, traffic controls, and traffic flow schemes, they are rudimentary and rely on simple technology, although centralized traffic monitoring exists to some extent. Transportation demand management (TDM) is limited, as well.

(2) Signal Systems

A total of 160 signals exist in Hanoi. Some are area traffic control (ATC) signals connected to the central computer system at the Traffic Control Center located on Hang Bai Street.

Two ATC systems coexist in Hanoi. The first ATC system was constructed from 1996 to 2000 during a French ODA project which had two (2) phases. Thirty-five (35) signals were installed in Phase 1, while another 70 were installed in Phase 2. The number of ATC signals was later reduced to 96 as some signals were removed when the one-way system was introduced. The construction of the new ATC system under a World Bank-funded project, entitled “Vietnam Urban Transport Improvement and Development Project,” has just finished, but it is not yet operational pending connection with the existing system. The project includes the installation of signals at 78 sites and pedestrian crossing signals at 10 locations, as well as the replacement of signal poles and heads at 21 sites. There are another 10 signals operating in a stand-alone mode. They either do not require centralized control or are not compatible with the existing ATC system.

While traffic signals contributed to regulating traffic flow along main roads, it is still common to see both drivers and pedestrians not observing the signals.

(3) Parking

Presently parking spaces are primarily sidewalks and road spaces; off-road parking facilities are limited and have small capacity. Parking facilities are also not generally available at residences. In addition, the responsibility for providing parking spaces is not well defined and there is also no clear policy in terms of parking standards or operations.

Parking on sidewalks blocks pedestrian movement.

On-road parking limits road capacity and blocks vehicle traffic.

With the prevalence of motorcycles, parking capacity is in general sufficient, although some areas already experience congestion. However, because of the projected shift to car usage, Hanoi will significantly not have the capacity to deal with parking demands. This will result in heavy side friction along roads and long queues to wait for parking spaces.

(4) Pedestrian Facilities and Environment

In Hanoi sidewalks are important space for pedestrians, roadside activities, and for landscape. Most of the arterial roads have been provided with roadside facilities such as sidewalks, street plantings, and street lighting. Missing segments are rare. In the central business district or CBD (Ba Dinh, Hoan Kiem, Hai Ba Trung, and Dong Da), sidewalk coverage is high, at 80% or more (see Table 2.5.1). However, it is noted that in the urban fringes (Tay Ho, Thanh Xuan, Cau Giay, Hoang Mai, Long Bien, and Tu Liem), sidewalk coverage is generally less.

Most sidewalks have a width of 4m or more. The existing types of pavements are mainly asphalt and concrete. Installation of colored bricks has been implemented especially in the city center. The quality of sidewalks, however, is not satisfactory. There are cracks and gaps. Their surfaces are uneven. Some are narrow and some are wide, while some have curbs and others have none.

With the absence of proper parking facilities, sidewalks are very often turned into parking lots. Moreover, businesses and other unauthorized activities have occupied sidewalk space, thereby obstructing the smooth flow of pedestrians. Even in certain cases, motorcycles run on sidewalks. The blockage of sidewalks forces pedestrians to use the carriageway – which is very hazardous and creates side friction, impeding the smooth flow of traffic.

Electric posts and cables along streets are often negative landscape elements. There are many open-type electric posts and cables all over the city, and the development of underground electric wire systems in limited to some sections only in the CBD.

(5) Traffic Control

(a) One-way System

The one-way system is adopted on some road sections in the Ancient Quarter and French Quarter for different reasons. It is necessary and effective in the Ancient Quarter because its roads are narrow and cannot accommodate two-way traffic adequately. Except for Hang Ngang and Luong Van Can, one-way streets do not form a pair. On the other hand, roads in the French Quarter follow a grid pattern, which is suitable for one-way pairs. Hence, several road sections in the north-south direction are one-way roads.

(b) Truck Ban

The truck ban is imposed in areas within Ring Road No. 2 mainly for trucks and partly for buses.

(c) Traffic Enforcement

Traffic enforcement is handled mainly by the Traffic Police and the Transport Inspectorate. Supporting them are other organizations such as the local police (district and ward/commune ones), as well as volunteers and

self-regulating groups. The Traffic Police with a total staff of 650 controls traffic to ensure safe and smooth traffic flow in general as well as during major social/political events. They also patrol the city on the lookout for the following:

(i) Violations that lead to traffic congestion such as driving on the opposite direction on one-way streets; running a red light; parking in banned areas, etc;

(ii) Violations that lead to traffic accidents such as speeding, overloading, oversized loading, running on the wrong lane, etc;

(iii) Illegal car/motorcycle race; and,

(iv) Non-helmet use on roads where helmet use is mandatory.

Table 8.1.1 Sidewalk Conditions in Hanoi's Urban Areas

Well-paved sidewalks shaded by trees with wide-spreading branches and abundant greeneries are a truly welcome sight.

District	Road Length[1)] (km)	Sidewalk Length (km)	Ratio of Sidewalk to Road (%)
Ba Dinh	59	48	81
Hoan Kiem	68	58	85
Hai Ba Trung	62	53	85
Dong Da	51	41	80
Tay Ho	34	15	44
Thanh Xuan	28	20	71
Cau Giay	47	26	55

Sources: HAIDEP Study Team, TUPWS road inventory.
1) Includes all provincial roads listed in the TUPWS road inventory.

Electric posts and cables spoil the streetscape.

Sidewalks used as parking lots or shops.

4) Public Transportation System

(1) Overview

Public transportation in Hanoi contains two fundamentally different systems. One is an organized system with large vehicles in fleet operation on fixed routes, and the other is an area-oriented system with smaller vehicles operated as individual units and geared toward individual passengers. Fleet operation at present consists of one mode, i.e a well-organized bus system planned and run by the city.

“Individual operation” consists of three different modes: (i) the unofficial but thriving motorcycle taxis (xe om), (ii) the traditional bicycle rickshaws (cyclo) now largely phased out at least in the city center, and (iii) the widespread and well-functioning taxi system, recently including a low-priced mini-taxi model.

(2) Historical and Policy Context

In the period after the more than 30 years of conflict that Vietnam endured during three Indo-China wars, traffic congestion was hardly a priority in Hanoi. Public transportation was provided as a basic service to a population that lacked private means, and in a monopolistic situation, bus and tram operations did not have to compete with private modes to attract passengers.

The Doi Moi policy, launched at the Communist Party’s sixth National Congress in 1986, influenced all sectors in Vietnam – not least urban transportation. In the period between the third Indochina war in 1979 and the implementation start of Doi Moi in 1989, practically all motorized travel in Hanoi used public transportation. Ridership was declining, with the tramway system (inherited from the French) eventually dwindling away partly because of the unavailability of spare parts during the embargo period. Around 1989 everything changed. The collapse of public transportation was sudden and in a few years ridership went from about 40 million per year to almost nothing. This, in combination with a mushrooming motorcycle ownership, led to the strange situation where Hanoi found itself with the lowest public transportation usage and the highest percentage of private transportation usage in all Asian capitals.

Reasons for the collapse are several: (i) subsidies to the Hanoi Bus Company dried up as part of the general economic restructuring program, (ii) spare parts from former suppliers in the disintegrating Soviet bloc became less available and required hard currency payments, and (iii) the motorcycle market was liberalized. To this can be added (iv) the population’s dissatisfaction with the service levels that the old public transportation system provided. In a market economy that means people with a choice will provide their own transportation.

For more than ten years, the situation seemed to develop its own direction and to establish Hanoi firmly as a non-transit city. The market for public transportation remained insignificant, while motorization in the form of private motorcycles grew steadily, leading to growing traffic problems.

Taking such warnings seriously the national government launched a new policy for major urban areas in Vietnam, Hanoi and Ho Chi Minh City (HCMC) which stipulated that public transportation be made the pillar of urban transportation systems. Ambitious targets were formulated for the modal split, indicating that 25-30% of trips in 2010 and 50-60% in 2020 should be carried by public transportation

In 2002, Hanoi launched a policy aimed at a very substantial improvement of the almost extinct bus system. New bus routes were established, the vehicle fleet was expanded, and bus shelters and passenger information schemes were introduced. The result of this new policy in Hanoi has been truly spectacular. If the public transportation collapse of 1989 was severe, the revival since 2002 has been beyond expectations. In 2002, ridership was back at the mid-1980 level and the year after it was more than three times as high as during the peak year of 1980 for bus transportation. According to plans, bus ridership in 2005 will reach an almost unthinkable 350 million trips or about six times the 1980 level.

(3) Bus System

(a) Route Network and Services

The bus network consists of 41 routes (as of February 2005) and extensions are planned. Four of the routes are circular and three are concentrated in the city center. The network offers good coverage and accessibility since most people are able to get to their destination with one transfer only. However, the performance of the different bus routes appears to vary considerably. While some routes carry high numbers of passengers (on one route 1,200 passengers per bus per day which is well above the breakeven level), others are underutilized. There is also no diversification in terms of route types, such as express buses with limited stops versus local buses with frequent bus stops.

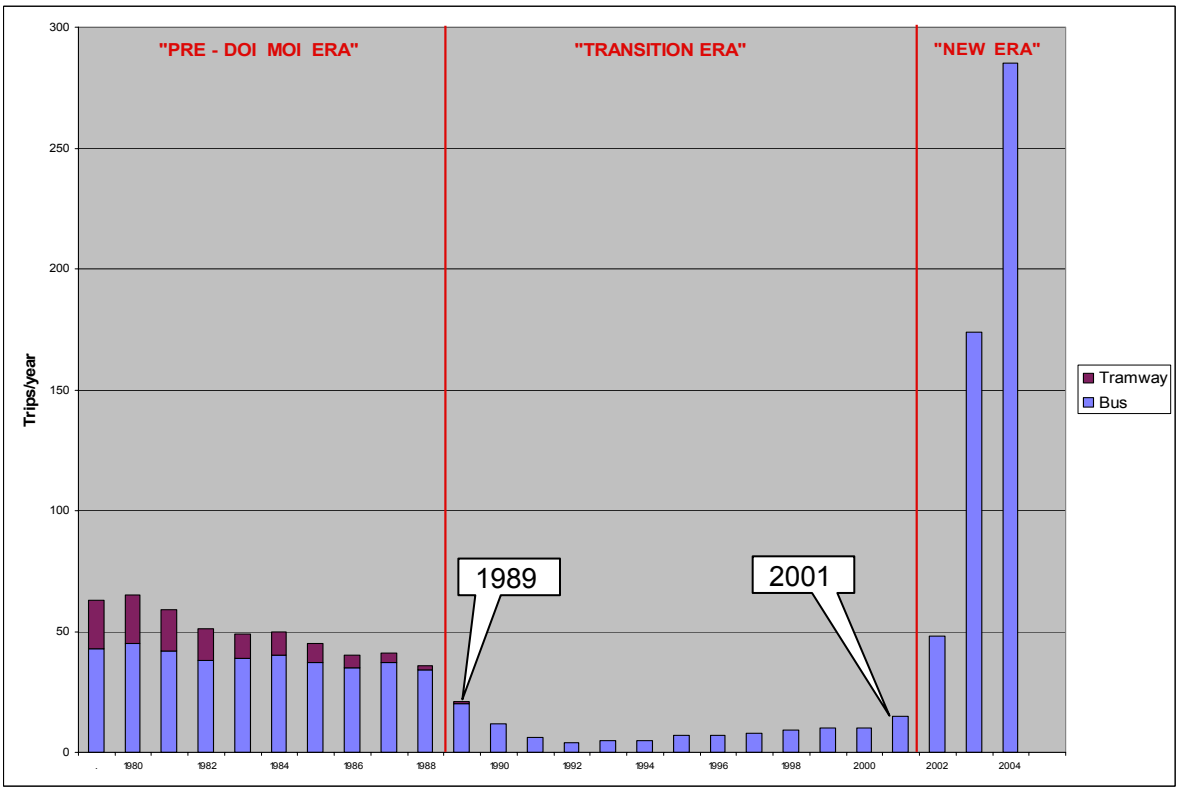
The route network is operated during most of the day or from 05:00 to 21:00, and there are no extra peak period routes. The headway of service varies between 5 and 20 minutes on different routes and is highest during peak hours. Regularity and punctuality are of high priority and timetables for each route have recently been produced. The route network comprises 778km and is operated by a total of 680 buses of various sizes and brands. Figure 8.1.6 shows the roads now covered with bus routes.

(b) Bus Administration

Public transportation in Hanoi was originally a service provided directly by the city administration in a monopolistic form. After some limited diversification, the city is now back in that situation. Hanoi's public transportation sector is monitored by the Transport Management and Operation Center (TRAMOC) which was set up in 1998 as a unit under Hanoi's TUPWS. TRAMOC was authorized to manage the bus network (routing, bus stops, and terminals) and to study and initiate regulations, standards, and other institutional documents related to public transportation in Hanoi. Its role was to coordinate the government subsidy for bus operators. It was thus intended to function as a public transportation authority (PTA) and was to some extent modeled on the RATP in Paris and the Bangkok Mass Transit Authority. However, its creation resulted in some friction since it overlapped with the functions of other TUPWS units.

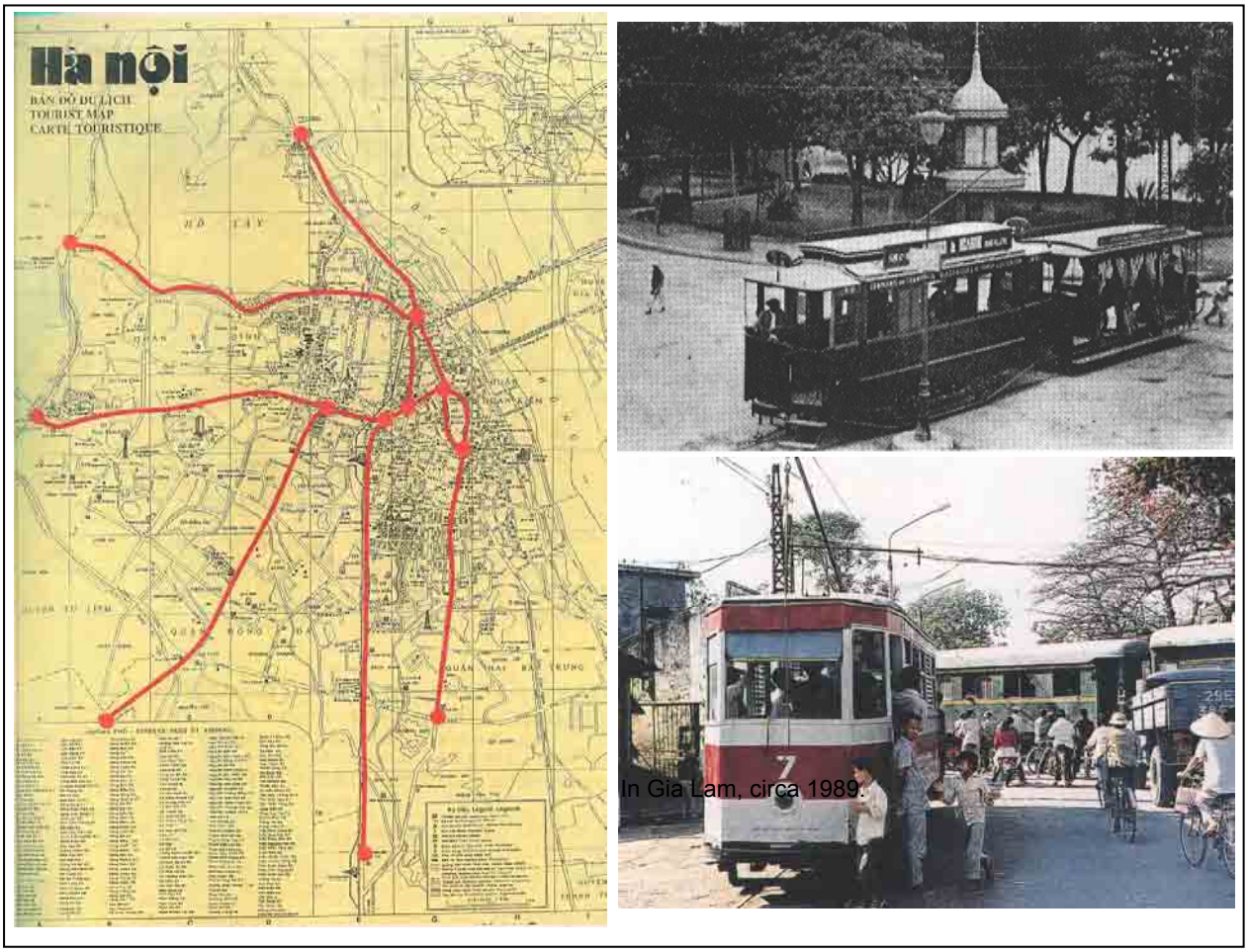
The bus route network is operated by the Transport and Service Corporation (TRANSERCO) which was formed in 2001 in a merger of four bus companies. It then became the only urban bus service provider in Hanoi. In August 2004, TRANSERCO was restructured to become the parent of a conglomerate comprising 10 member companies, nine subsidiaries, and four joint ventures. The Hanoi People's Committee (HPC) now manages TRANSERCO.

Figure 8.1.4 Public Transportation Ridership in Hanoi, 1979 - 2005



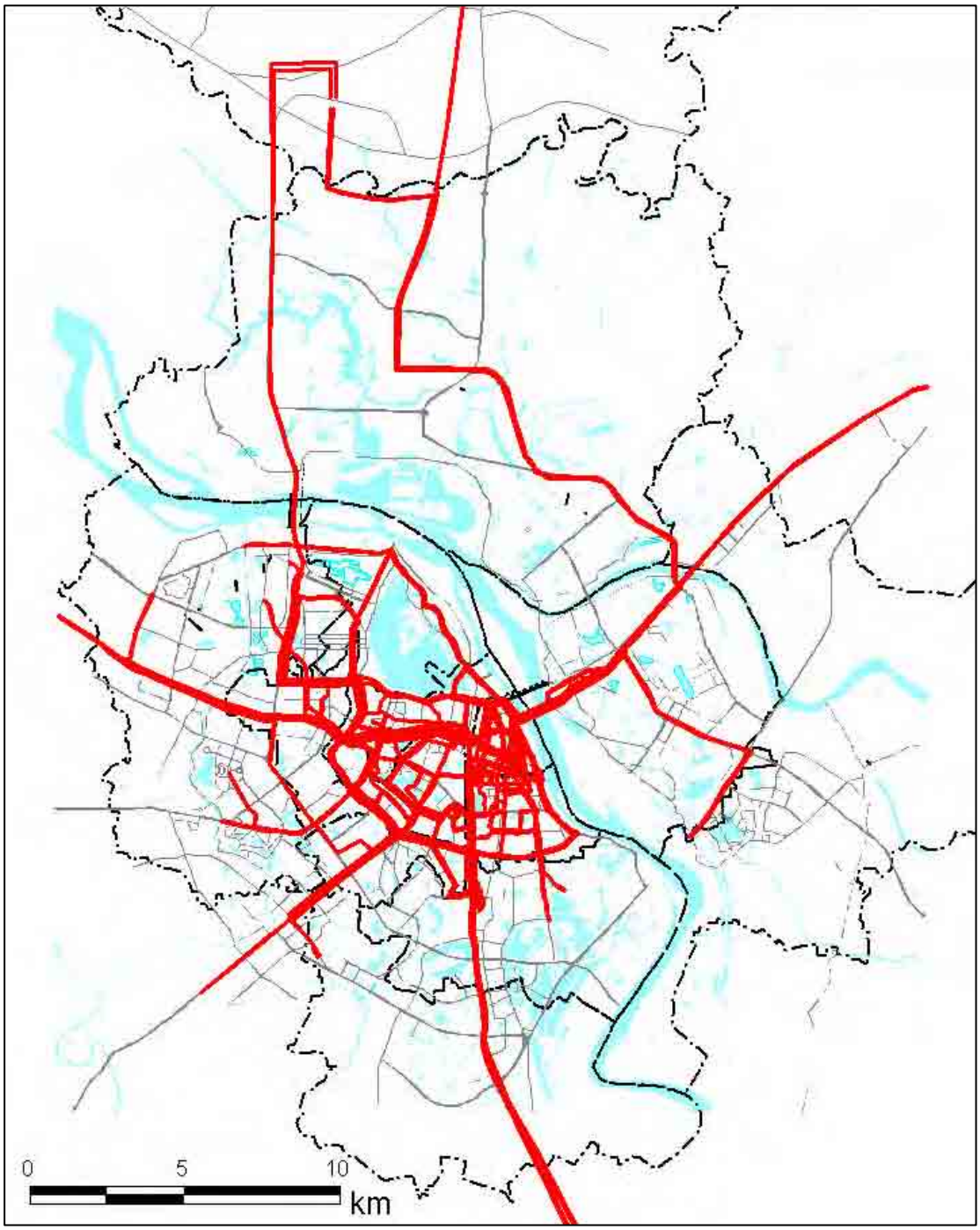
Source: VUTAP, HAIDEP.

Figure 8.1.5 Old Tramway Network in Hanoi



In Gia Lam, circa 1989.

Figure 8.1.6 Roads in Hanoi City Covered by Bus Routes, 2005



Source: TRANSERCO.

Bus transportation.

Bus stop.

Kim Ma bus terminal.

TRANSERCO can be described as a holding company, with the bus companies under it reportedly remaining as separate units under its monitoring. TRANSERCO in effect has a monopoly on urban public transportation but has expanded its activities into various business areas. At present, six new bus routes are in the process of being assigned to private operators, something which would seem to change TRANSERCO's monopoly to a little extent.

Both TRAMOC and TRANSERCO are controlled by the city government; TRAMOC as a regulating body under TUPWS and TRANSERCO as a strong and expanding industrial group directly under HPC.

(c) Bus Stops and Terminals

In the reformed bus system, buses stop only at designated stops which have a reasonable distance between them. All bus stops are now in the process of being given names as in the case of well-planned European or Japanese cites. This is an important feature of an organized public transportation system since it:

(i) provides a structural identity to the system,
(ii) reduces disturbances to other traffic,
(iii) reduces operating costs,
(iv) contributes to bus punctuality and trip regularity, and,
(v) facilitates future passenger surveys.

Bus stops are, to a large extent, provided with functional shelters and are used for advertising purposes which generates income. Many stops have good passenger information in the form of route maps and route descriptions. Bus route maps and timetables can be purchased and are displayed at many bus stops. TRANSERCO has established a web site with information on bus routes, bus stops, and timetables.


Bus stop with information and advertising

There are at present eight (8) major bus terminals in Hanoi, as shown in Table 8.1.2. Luong Yen terminal which was opened in October 2004 serves not only buses but also trucks. At present, it is not as busy as the other bus terminals, but it is planned to replace Long Bien bus terminal in the near future, according to TRANSERCO.

(d) Bus Fare System

The fare system is based on a single trip fare of VND 2,500 and a monthly pass which is discounted to reward frequent travelers. The monthly pass comes in two different price classes: (i) priority passengers (ie pupils and students) and (ii) nonpriority passengers. Passes can be issued for three different travel possibilities (ie valid on one, two, or all routes). Hence, there are six different types of monthly passes ranging from VND 15,000 to VND 60,000.

Monthly passes are kept affordable in order to commit people to public transportation. However, the price is now considered too low and an increase is planned. Monthly tickets must be applied for and, in the case of priority passengers, confirmation is

required from the schools. Initially, counterfeits appeared but present technology is fairly secure.

The principle of a flat fare which applies for single trips in Hanoi has its pros and cons. The flat fare system is easy to use and attractive to passengers, and the fare collection is simple which may reduce leakage. A distance-related system, on the other hand, corresponds better to production costs and does not penalize short trips or transfers, which can be an obstacle to a rational route network design (for example trunk line-feeder line). However, since the emphasis in Hanoi is to promote monthly cards, and since the network is homogeneous, these disadvantages seem manageable.

Overall, the present fare system is clear and logical and has a relevant technical standard. Possible development directions in the future could be the introduction of zone fares and smart card technology.

Table 8.1.2 Physical and Operational Conditions of Bus Terminals, 2005

Characteristic \ Terminal Name		Gia Lam	Phia Nam	My Dinh	Ha Dong	Luong Yen	Nguyen Tuan	Kim Ma	Nam Thang Long
Area(m^2)		14,440	26,400	34,000	4,000	9,000	3,600	3,570	9,000
Operating Time		4:30~ 19:00	24 hours	4:00 ~ 19:00	5:00 ~ 22:00	24 hours	7:30 ~ 17:00	5:00 ~ 22:00	5:00 ~ 22:30
Finance (VND bil/yr)	Revenue	5.5	-	-	5.9	2.7	-	-	-
	Expenditure	-	-	-	-	2.3	-	-	-
No. of Staff		96	140	81	60	100	36	11	16
No. of Bus Routes	Interprovincial	85	110	59	24	9	10	-	-
	TRANSERCO	3	12	4	8	-	8	11	6
Parking Space (m^2)	Interprovincial Bus	8,000	18,800	15,600	3,100	3,140	2,000	-	-
	TRANSERCO Bus	800	497	12,800	120		1,150	700	6,000
	Taxi	-	364	300	-	200	-	90	0
	Car	-	-	-	-	100	-	90	0
	Motorcycle	400	192	-	-	-	-	200	120
Terminal Facilities	Management office	✓	✓	✓	✓	✓	✓	✓	✓
	Ticket office	✓	✓	✓	✓	✓	✓	✓	✓
	Waiting room	✓	✓	✓	✓	✓		✓	✓
	Shop	✓	✓	✓	✓	✓			
	Toilet	✓	✓	✓	✓	✓	✓	✓	✓
	Lighting	✓	✓	✓	✓	✓	✓	✓	✓
	Drainage	✓	✓	✓	✓	✓	✓	✓	✓
	Maintenance facility		✓	✓		✓	✓		✓
	Refueling facility		✓	✓		✓	✓		
Roof on Bus Berth		No roof	Partially covered	Partially covered	No roof	Partially covered	No roof	No roof	No roof

Source: HAIDEP Study Team.

(4) Supplementary Modes of Urban Public Transportation

There are mainly three types of supplementary public transportation services in Hanoi today: (i) the widespread and well-functioning taxi system, (ii) the unofficial but thriving motorcycle taxis ("xe om"), and (iii) the traditional bicycle rickshaws ("cyclos") now largely phased out at least in the city center.

The modern taxi system started to appear in Hanoi only about 1994 when otherwise only cyclos were available. A taxi company started this service which could be ordered by telephone only, and that was monitored by a radio control center. The new system became very successful and soon followers arrived in the market. Today, Hanoi has a very extensive and well-functioning taxi system using meters and with several types of taxi cars available from large vans to small micro-taxis, carrying about 57,000 passengers a day.

The taxi will certainly remain in Hanoi as in any other modern city. The taxi system will continue to develop along commercial lines. There is not much cause for government intervention other than general regulations regarding safety, registration procedures, and fare meter inspection.

The xe om (motorcycle taxi) probably started to appear in Hanoi after the introduction of the Doi Moi liberalization policy in 1989. This started two trends; the decline of the bus services and the simultaneous, almost explosive, growth of motorcycles. When motorcycle owners offered people a ride for a fee it was a new phenomenon that was not foreseen but one that fulfilled a demand. Technically, this was an illegal practice and offers were made discreetly. However, at that time scores of small businesses started to establish and the xe om sector eventually became tolerated although never formally approved.

The number of xe om in Hanoi today is unknown for many reasons. One, this is not a full-time occupation for many but a way to get an occasional extra income. Very subjective estimates are available; one (from a usually well-informed source) is that there may be 50,000 - 100,000 of them. If that is correct and if each xe om carries 1 - 2 passengers a day at, say, VND 10,000, then the daily turnover of the sector could be in the range of half a billion VND. (HAIDEP HIS recorded 74,000 xe om trips, or about 25% of bus ridership, are 30% higher than taxi, and which would indicate a similar daily turnover.)

Hanoi still has large areas with narrow alleys where buses cannot penetrate and where walking distances to the nearest street and bus stop can be substantial. In such areas, the xe om sector could continue to fulfill a useful role and act as a supplement and a feeder to regular public transportation. For peak-hour trips into the central area, however, xe om is likely to be less of an alternative as public transportation develops reliable and fast services and as travel speed in the street becomes reduced.

The xe om may remain in Hanoi for quite some time unless a radical policy change is introduced, since the market is undoubtedly there. The likely scenario for the future is that xe om will have a reduced impact on the urban transportation system.

The cyclo is the oldest individual type of public transportation in Hanoi that is still in existence. Lambros (a small van) are now all but extinct in the city. Cyclos fulfilled an important role not only for passenger transportation but also for the transportation of various household goods within enclaves with limited access. As late as 1993, cyclo ridership was higher than bus ridership.

It is evident that the cyclo is already outdated as a substantial provider of urban transportation. Its future for a few registered drivers lies mainly in the tourist industry. Also, at least for some time, they may continue to provide a service in enclaves without roads.



(Above left to right) Cyclo ferrying tourists in the French Quarter, as an alternative transportation mode, and for carrying goods

5) Current Government Initiatives

The MOT has prepared the *Hanoi Transportation Development Master Plan for 2020* with the cooperation of HPC as well as relevant ministries and agencies, and submitted the same to the government for approval. The plan emphasizes the importance of infrastructure and public transportation development, that is:

(i) To develop transportation infrastructure system in integration especially with the urban development plan, the residential allocation plan, the public utility development plan, and others.

(ii) To ensure that by 2020 land for transportation infrastructure, including mobile and static traffic, must cover 20-25% of urban land (applied to urban districts in accordance with the Prime Minister's Decision 108/1998/QD-TTg).

(iii) To focus on public transportation development so that public transportation will shoulder 30% and 55 - 60% of travel demand by 2010 and 2020, respectively.

(iv) To develop a justifiable road map, say five years and yearly, to overcome critical problems in urban transportation investments, which is one of the most important components in the national infrastructure development plan.

At present, there are a number of undertakings by various transportation agencies (see Table 8.1.3).

6) Main Issues

While development and improvements in urban transport infrastructures and management have been undertaken by the Government, it seems speed of increase and changes in demands is much faster than the supply.

Challenges facing Hanoi in urban Transportation are acute. While the city must accelerate the progress of unfinished and immediate tasks including infrastructure to remove bottlenecks, improvement of enforcement and traffic management capacities, and enhancement of social awareness on safety and traffic rules, tackling future large impacts on urban transportation requires much larger efforts of the society as a whole. The city is required to attend to both short-term solutions and long-term strategies in the most effective manner. Main issues on urban transportation in Hanoi are as follows:

Table 8.1.3 Ongoing Government Projects on Transportation Sector

Sector	Responsible Agency	Project Name	Scope	Funding	Status	Outline
Road, Rail, IWT, Seaport, Airport	MOT	5-Year plan 2006-2010	Whole Country	GOV	2006-2010	• Standardization of NHs • Standardization of main rails • New Yen Vien-Pha Lai-Ha • Long-Cai Lan Line Construction • Urban railway in Hanoi, • HCMC • Standardization of main • river routes • 24 hours operation system
Road	PMU5, MOT	Updating the Vietnam Rural Transport Development Strategy	Whole Country	GOV	-2006	• Rural Transport • Development Plan
		Hanoi Urban Transport Development Project (HUTDP)	Hanoi	WB	-2020	• BRT Component • Road Component • Institutional Strengthening Component
	HPC	Hanoi Urban Transport Projects in Hanoi (TIDP)	Hanoi	JBIC	1999-	• Nga Tu Vong Flyover • Kim Lien Underpass • Nga Tu So Flyover • Huu Hong Dyke Road & • South Thang Long Bridge Junction • Kim Lien-O Cho Dua Road • Nam Trung Yen • Resettlement Area
	Thang Long, MOT	Red River Bridge Construction Project	Thanh Tri	JBIC	Ongoing	• Thanh Tri Bridge
	Thang Long, MOT	Nhat Tan Bridge Construction Project	Nhat Tan	JBIC	Proposed	• Nhat Tan Bridge
	HPC	Long Bien Bridge Rehabilitation Project	Long Bien	French ODA	Request	• Long Bien Bridge • Rehabilitation
Rail	HPC	Hanoi pilot urban railway construction project (Nhon-Hanoi Station)	Hanoi	France, AFD, ADB, European Investment Bank	2006-2010	• Railway:Nhon-Hanoi Station
Traffic Management, Traffic Safety	TS-PMU, NTSC	M/P on traffic safety	Whole Country	JICA	Request	• Traffic safety master plan
	NTSC	VRSP	Whole Country, NH1,NH 51	WB	2006-2010	• 5 Year Plan • Program Implementation • Research and development • Human Resource • Development • Institutional Development
	TUPWS, DTP	The project for Capacity Building of Human Resources of Traffic Safety in Hanoi	Hanoi and neighboring areas	JICA	2006-2009	• Research and development • Human Resource • Development
Road Maintenance	MOT, VRA	TAs for road maintenance	Whole Country	JBIC, Finland, ADB, WB	2003-2010	• National Road Management System • National Bridge • Management System

Source: "The 11th transport partnership meeting" presentation material (JBIC, 2005).
Note: TS-PMU: Traffic Safety Projects Management Unit.

(a) **Infrastructure Provision:** The provision of transportation infrastructure, particularly roads, is critical. Since road development requires large areas of lands and resettlement, the establishment of alternative mechanisms to facilitate the process is of paramount importance. Road development should not be regarded simply as transportation infrastructure development per se but rather as an integral part of urban development undertaking.

(b) **Traffic Management:** While infrastructure provision is currently too slow to meet the rapidly increasing demand, the use of available capacities in the most efficient manner will become more and more important in the future. To achieve this, there is a need not only to provide traffic management facilities but also to strengthen capacities to manage traffic, operate the system, and enhance the awareness of road users on traffic rules and safety.

(c) **Public Transportation:** The revival of public transportation services and riding habit of the people has experienced initial success with the introduction of improved bus services. However, the city needs to accommodate much larger demand on capacities and higher quality of services to meet the policy target. In addition to further expansion and improvement of bus services, it is also necessary to start looking into the development opportunities of mass rapid transit system.

(d) **Transportation Planning:** As the city grows larger and demand diversifies, the requirements for transportation planning become more complex, the capacity for transportation planning needs to be strengthened with particular regard to transportation planning database, methodology, project preparation and evaluation, prioritization, implementation, and funding strategy, among others. Integrated planning with land-use and urban planning is also important.

(e) **Funding:** The establishment of stable funding sources and mechanisms is critical to sustain transportation sector development. Since government budget and ODA are limited, it is necessary to seek opportunities to expand funding sources through user charges, value capture, domestic borrowing, etc.

8.2 Urban Transportation Planning Direction

1) Analysis of Demand-Supply Gap in Basic Transportation Network

(1) Methodology

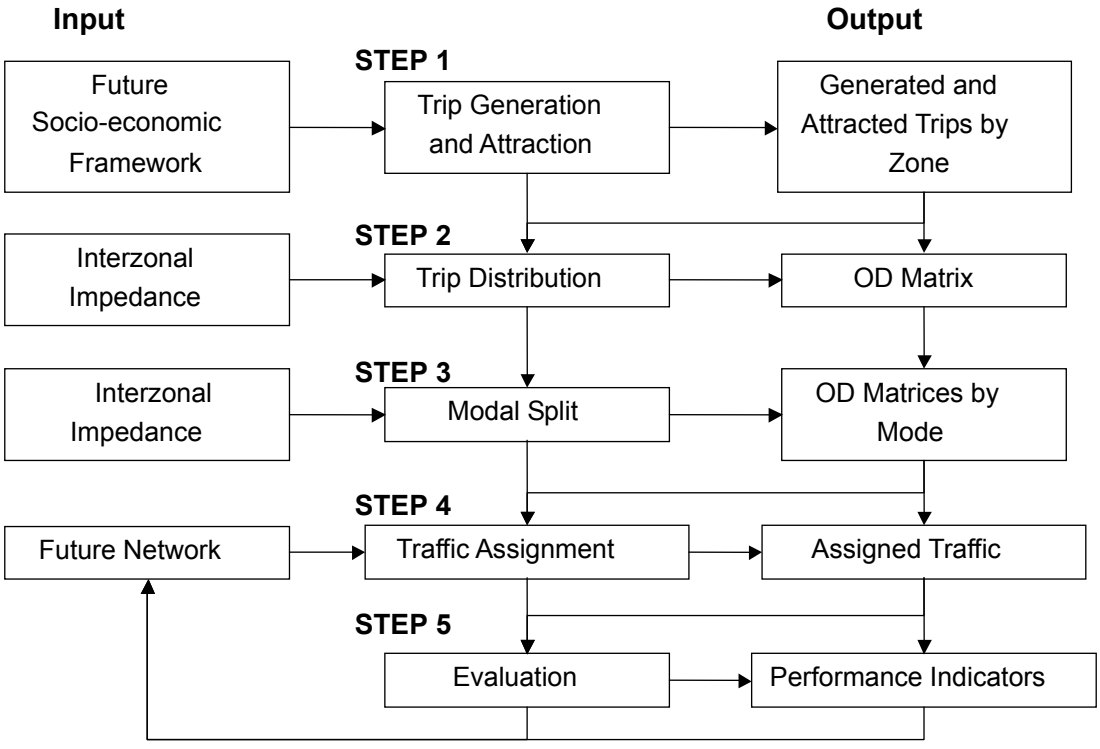
In transportation planning for the fast-growing large urban areas, an important aspect that must be made clear is to analyze the demand-supply gap in transport infrastructure and service provision, especially basic transportation network comprising main roads and public transportation routes and services. The basic transportation network must be developed in a way that the demand is satisfied effectively and in an integrated manner with land use to promote envisioned urban development.

In this exercise, the following methodologies were employed:

(a) **STRADA Model:** The conventional four-step model using JICA STRADA1 (System for Traffic Demand Analysis) was adopted for the demand forecast. The steps are: (i) Trip Generation and Attraction Model – to estimate the number of trips generated by and attracted to each zone; (ii) Trip Distribution Model – to estimate the number of trips traveling between zones; (iii) Modal Share Model – to estimate the number of trips made using different transport modes; and (iv) Traffic Assignment Model – to estimate the number of trips on the road by different transportation modes (see Figure 8.2.1).

(b) **Basic Traffic Data:** The demand forecast model has been worked out for urban and interprovincial transportation. Input data for urban transportation were gathered from the results of HIS and related surveys (cordonline survey, screen line survey, etc.), while those for interprovincial transportation were based on the results of the roadside and riverside surveys which TDSI recently conducted.

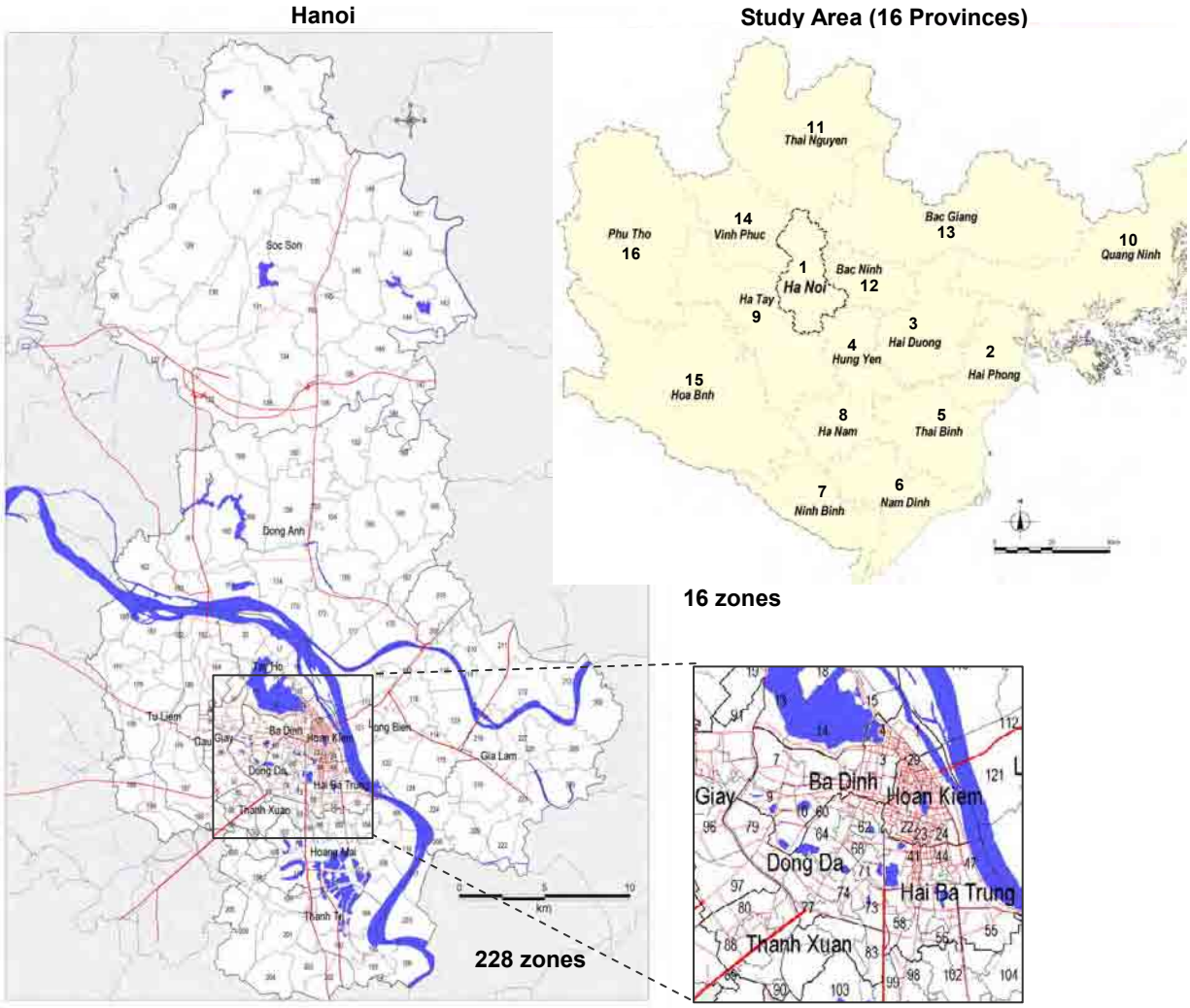
Figure 8.2.1 Transportation Demand Forecast Procedure



Source: HAIDEP Study Team.

[1] JICA STRADA is a computer software developed by JICA for application in transport demand analysis and assignment.

Figure 8.2.2 Zoning of HAIDEP Study Area



(c) **Socio-economic Framework and Data:** Input data on socio-economy and land use was estimated in the HAIDEP urban planning and development subsector study which was then interpreted in a way as that would fit the requirement of the transportation model.

(1) Future Urban Transportation Demand Characteristics

The characteristics of urban transportation demand are as follows:

(a) **Total Demand:** The future traffic demand in the recommended scenario of urban growth case was estimated using travel demand forecast models. Based on the HIS, the total travel demand in Hanoi in 2005, including walking, was 11 million trips and it is expected to increase to 18 million trips (1.67 times) by 2020. Excluding walking, total demand will be 13 million trips by 2020.

(b) **Trip Generation/Attraction:** It is expected that future trip generation/attraction will still concentrate in the urban core area but the ratio is forecasted to decrease from 43.5% to 31.2%. Likewise, the ratio in urban fringe will decrease from 28.9% to 27.8%. Due to the planned industrial development, the ratio in rural area, especially at Dong Anh, is estimated to increase rapidly from 17.3% to 26.2%.

(c) **Trip Distribution:** The total demand of 13 million trips was distributed over the study area which resulted in a high concentration in the urban core (still 26% of total) and

within broadly classified areas. Average trip length[2] will become longer from the existing 5.5km to about 7.4km in 2020, which is still shorter when compared to other mega cities in Southeast Asia.[3]

(d) **Modal Share:** Future modal share due to the changes in vehicle ownership was examined. Results showed that the future modal share of travel by car would increase from 3.6% to 19.5% as the ratio of car-owning households in the study area increases from 1.6% to 20%. As for public transportation, the rate will increase from 6.7% to 14.5%. The share of public transportation in 2020 will grow to 24.0% if UMRT is fully developed as proposed, and further to 30% if TDM measures are adopted (see Table 8.2.3). Results show that the future modal share of car will not decrease much.

(e) **Travel Demand by Purpose and Time:** At the master planning stage, travel demand was forecasted by day, but at the more detailed stage, traffic demand in peak hours will be estimated. Traffic volumes during peak hours usually depend significantly on travel purposes. Regarding current travel purposes and modes, the share of public transportation (bus) is still insignificant (7%), although 12% of “to school” trips are already done by bus. On the other hand, cars and trucks have a significant rate of 11% for “at work” trips, while the one in total is still low (2%). Current peak hour of travel is from 7:00 am to 8:00 am, with a peak ratio of 16%. There are three peak periods in a day (7:00 - 8:00 am, 11:00 am - 12:00 nn, and 5:00 - 6:00 pm), with “to home” trips from school being concentrated on the noon peak.

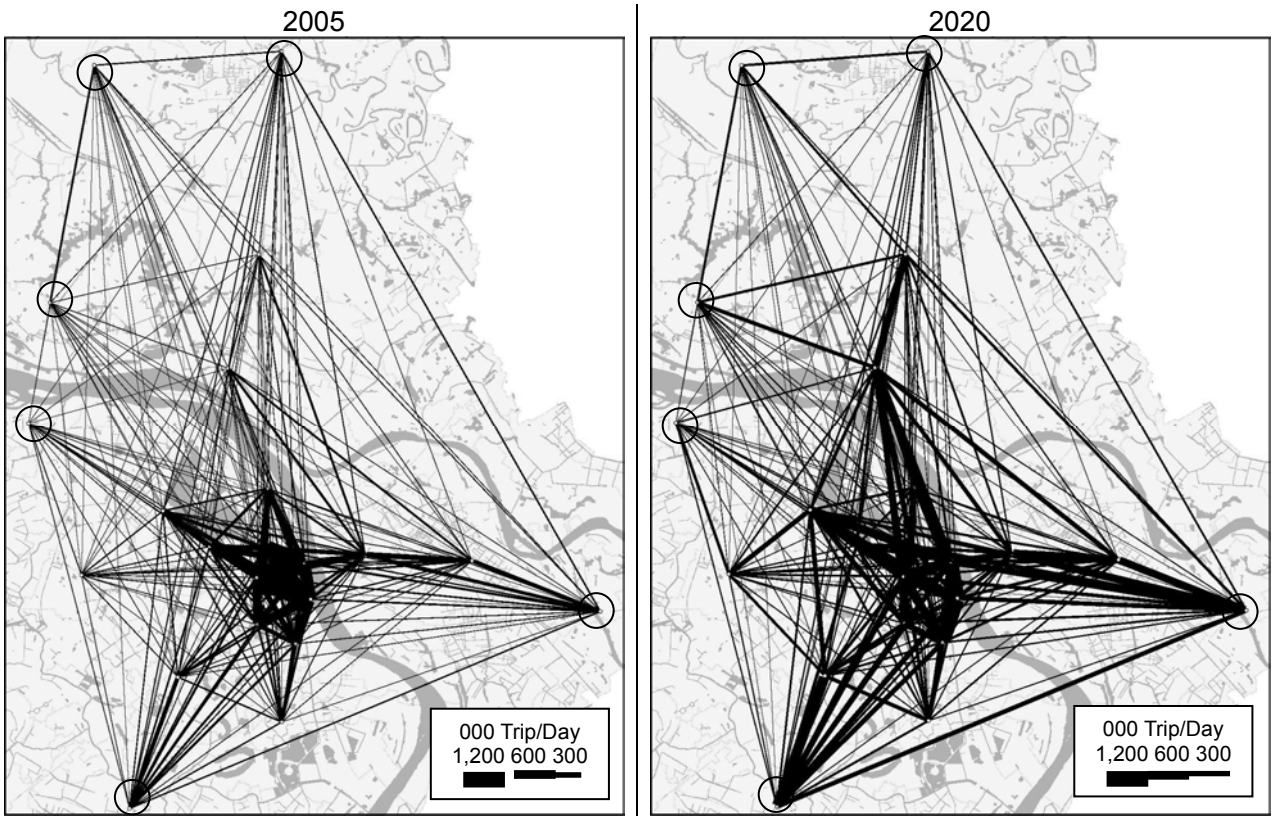
[2] Excluding intrazonal trips.
[3] Present average trip length in Metro Manila is about 10km.

Table 8.2.1 Trip Generation and Attraction by District, 2005 and 2020

District		Total Trips (000) (Generated+Attracted)		Growth (2005-2020)	
		2005	2020	%/Year	Ratio
Urban Core	Hoan Kiem	1,392	1,744	1.5	1.25
	Hai Ba Trung	1,632	2,155	1.9	1.32
	Dong Da	1,635	2,349	2.4	1.44
	Ba Dinh	1,148	1,522	1.9	1.33
	Subtotal/Average	**5,807**	**7,771**	**2.0**	**1.34**
Urban Fringe	Tay Ho	535	915	3.6	1.71
	Thanh Xuan	828	1,286	3.0	1.55
	Cau Giay	811	1,300	3.2	1.60
	Hoang Mai	755	1,924	6.4	2.55
	Long Bien	934	1,661	3.9	1.78
	Subtotal/Average	**3,863**	**7,086**	**4.1**	**1.83**
Sub Urban	Tu Liem	865	2,085	6.0	2.41
	Thanh Tri	498	1,098	5.4	2.20
	Subtotal/Average	**1,363**	**3,183**	**5.8**	**2.34**
Rural	Soc Son	662	1,526	5.7	2.31
	Dong Anh	881	2,184	6.2	2.48
	Gia Lam	769	1,670	5.3	2.17
	Subtotal/Average	**2,312**	**5,380**	**5.8**	**2.33**
Hanoi City Total		**13,344**	**23,421**	**3.8**	**1.76**

Source: HAIDEP Study Team

Figure 8.2.3 Trip Distribution, 2005 and 2020



Source: HAIDEP Study Team.

Table 8.2.2 Distribution of 2005 Demand (Excluding Walk Trips)

Unit: '000 trips/day

		1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	Urban Core	1,915	158	22	333	346	16	43	18	12	8	3	29	23	2,925
2	Long Bien	134	517	40	46	29	3	6	7	3	5	2	17	22	832
3	Dong Anh	22	39	680	2	6	1	0	0	0	11	4	2	4	771
4	Tu Lim	335	46	1	599	63	7	14	13	13	6	2	5	5	1,108
5	Thanh Tri	349	29	5	65	522	21	29	4	3	4	1	8	6	1,046
6	NR 1 (South)	16	3	1	5	18	0	8	0	1	3	1	3	2	62
7	NR 6 (Ha Dong)	42	4	0	13	27	5	214	7	3	3	1	1	3	322
8	Hoa-Lac	16	7	0	13	5	1	6	195	4	0	0	0	0	247
9	NR 32	12	2	1	8	3	1	3	5	120	0	0	1	0	157
10	NR 2 (Vinh Phuc)	7	5	12	9	4	3	4	0	0	265	1	1	4	315
11	NR 3 (North)	2	1	4	0	1	1	0	0	0	1	0	2	1	14
12	NR 1 (Bac Ninh)	11	31	2	3	5	2	2	0	0	1	1	0	5	64
13	NR 5 (East)	21	27	3	6	8	1	1	0	1	5	4	4	2	83
	Total	2,881	871	772	1,103	1,036	63	331	248	160	313	19	73	76	7,945

Source: HAIDEP Study Team.

Table 8.2.3 Distribution of Future Demand, 2020 (Excluding Walk Trips)

Unit: '000 trips/day

		1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	Urban Core	1,724	153	164	427	398	69	54	39	25	33	5	91	64	3,246
2	Long Bien	195	1,067	84	53	56	17	9	6	3	10	4	32	40	1,577
3	Dong Anh	226	82	1,433	92	38	3	11	9	7	68	7	16	4	1,996
4	Tu Lim	417	51	55	1,136	85	15	38	37	22	23	3	18	13	1,913
5	Thanh Tri	423	50	30	93	985	59	61	13	6	14	2	12	15	1,763
6	NR 1 (South)	56	10	2	13	52	0	24	2	4	7	3	11	1	185
7	NR 6 (Ha Dong)	82	12	12	54	79	13	400	24	9	4	0	5	2	697
8	Hoa-Lac	56	10	11	50	21	4	21	300	17	3	0	2	2	496
9	NR 32	32	4	13	25	8	1	10	22	210	3	0	2	2	333
10	NR 2 (Vinh Phuc)	42	16	65	38	11	12	8	4	4	563	2	4	13	781
11	NR 3 (North)	5	2	9	2	2	5	1	0	1	1	0	3	1	32
12	NR 1 (Bac Ninh)	35	63	9	12	15	9	5	2	1	3	0	0	3	156
13	NR 5 (East)	62	78	12	23	17	1	4	1	4	9	2	4	2	218
	Total	3,355	1,596	1,900	2,018	1,768	208	645	460	314	741	27	200	161	13,393

Source: HAIDEP Study Team.

Table 8.2.4 Future Traffic Demand and Modal Share

Mode		2005		2020				With UMRT and TDM	
				Without UMRT		With UMRT			
		No	%	No.	%	No.	%	No.	%
Bicycle		1,579	25.3	374	3.8	372	3.8	370	3.8
MC		3,396	63.2	5,777	58.7	5,206	52.9	4,622	46.9
Car		227	3.6	1,921	19.5	1,555	15.8	1,554	15.8
Public Transport'n	UMRT					1,188	12.1	1,484	15.1
	BRT					423	4.3	529	5.4
	Bus	420	6.7	1,426	14.5	753	7.6	940	9.5
	Subtotal	420	6.7	1,426	14.5	2,364	24.0	2,952	30.0
Truck		69	1.1	350	3.5	350	3.5	350	3.5
Total		6,321	100.0	9,848	100.0	9,848	100.0	9,848	100.0

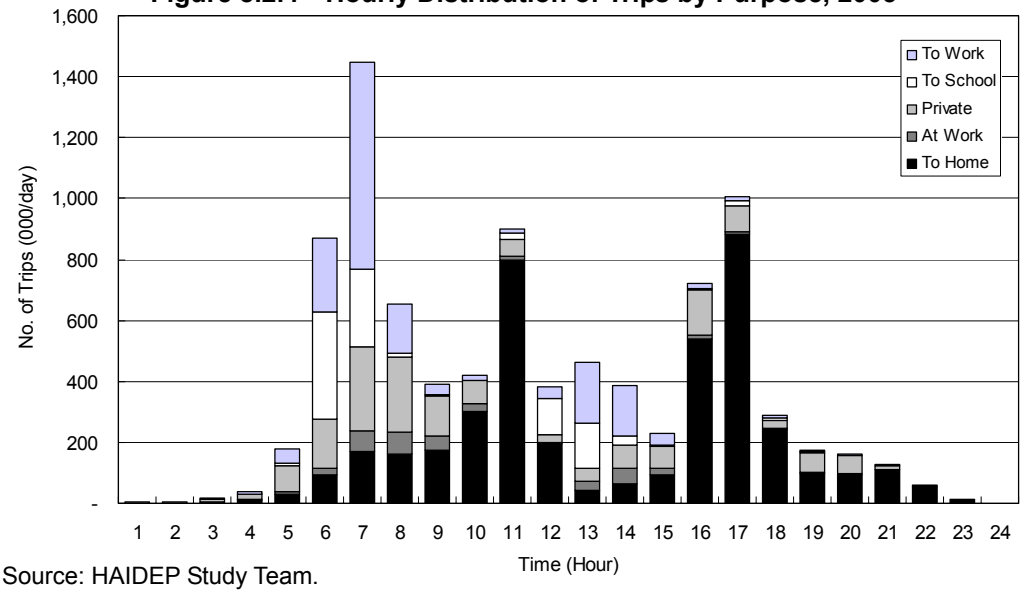
Note: Trips inside Hanoi only.

Table 8.2.5 Composition of Travel Demand by Purpose and by Mode, 2005

Travel Mode		Composition of Mode (%)					
		To Work	To School	Private	At Work	To Home	TOTAL
Private	Bicycle	24.1	58.9	29.5	20.6	36.5	34.4
	M/C (driver)	65.7	16.0	54.5	58.0	48.8	50.1
	M/C (passenger)	3.8	13.4	8.1	3.1	7.1	7.0
	Car	1.4	0.2	2.1	6.5	0.9	1.4
	Truck	0.4	0.0	0.2	4.4	0.2	0.5
	Subtotal	95.4	88.6	94.4	92.6	93.5	93.4
Semi-public	Taxi	0.1	0.0	0.4	0.8	0.1	0.2
	Cyclo/M.Cyclo	0.1	0.0	0.0	0.1	0.0	0.0
	Xe Om	0.3	0.5	1.3	0.5	0.6	0.6
	Private Bus	0.9	0.4	1.0	2.0	0.7	0.8
	Subtotal	1.3	0.9	2.7	3.4	1.5	1.7
Public	Bus	2.9	9.2	2.6	2.9	4.5	4.3
	Rail	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	3.0	9.2	2.6	2.9	4.5	4.3
Others		0.4	1.4	0.2	1.1	0.6	0.6
Total		100.0	100.0	100.0	100.0	100.0	100.0

Source: HAIDEP Study Team.

Figure 8.2.4 Hourly Distribution of Trips by Purpose, 2005



Source: HAIDEP Study Team.

(2) Demand-Supply Gap

Future traffic demand was assigned on two scenarios for the future transportation network, namely: (i) “do nothing” scenario, referring to the existing network, and (ii) “do-something” scenario, referring to the existing network plus ongoing and committed projects as shown in Table 8.2.6 and Figure 8.2.5. The assigned traffic demand was analyzed in three ways: (i) by corridor, (ii) by area, and (iii) by road section. For the corridor analysis, 14 mini-screen lines were set (see Figure 8.2.6), while in the area analysis the study area was classified into 5 areas, i.e. urban core, southern, western, eastern, and northern urban areas.

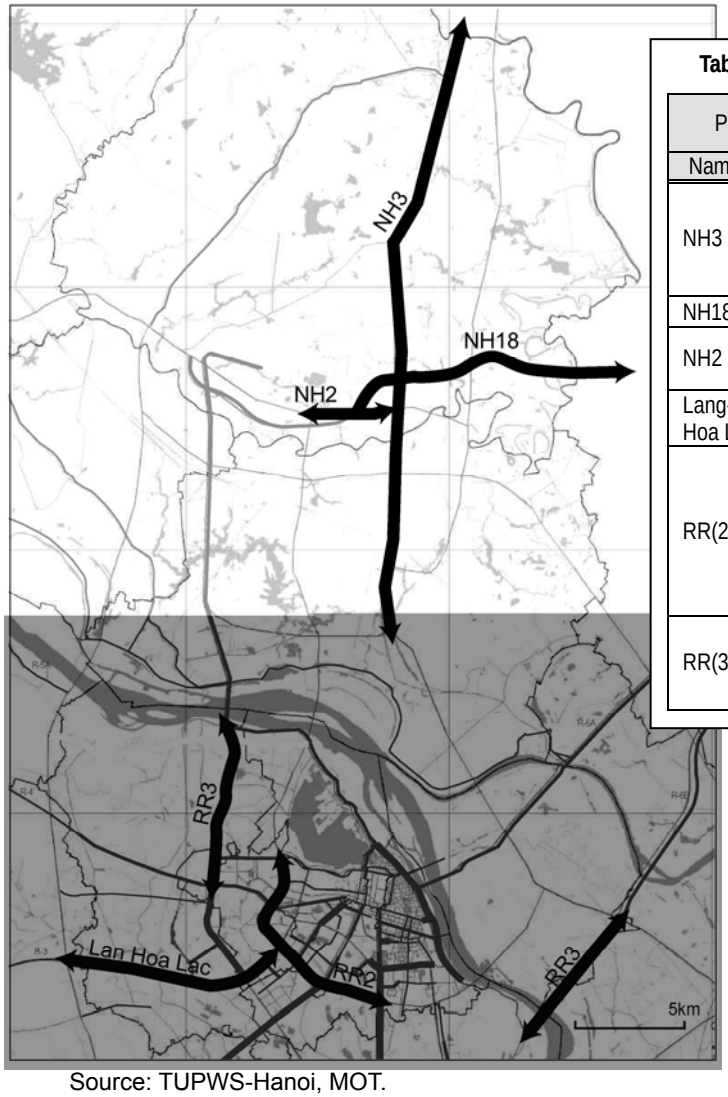
(a) **Demand-Supply Gap by Corridor:** The comparison of demand and supply (road capacity) by some screenlines were conducted by adopting mini-screen lines. Traffic

volumes crossing each screen line were compared with the total capacity of the corridor at the screen line including major and minor roads (see Figure 8.2.5). The results of this analysis are summarized in Table 8.2.7. According to the result, the traffic volume in 2020 was estimated over the capacity at many mini-screens, especially at the ones in the east and the south and across the Red River.

(b) **Demand and Supply Gap by Area:** The comparison of demand and supply by area is conducted by area. Table 8.2.8 shows the result and according to this, the demand is exceeded the existing supply at all areas. The biggest gap in terms of amount is at North area and the one in volume/capacity (V/C) ratio is at East area.

(c) **Demand and Supply Gap by Road Section:** Results of traffic assignment on the "do-something" network scenario (where ongoing projects initiated by the government are completed) show that under the traffic demand in 2020, there will still be many congested roads (i.e. traffic volume will exceed the capacity of the roads), if there is no additional infrastructure development (see Table 8.2.9 and Figure 8.2.7).

Figure 8.2.5 Location of Ongoing and Committed Projects

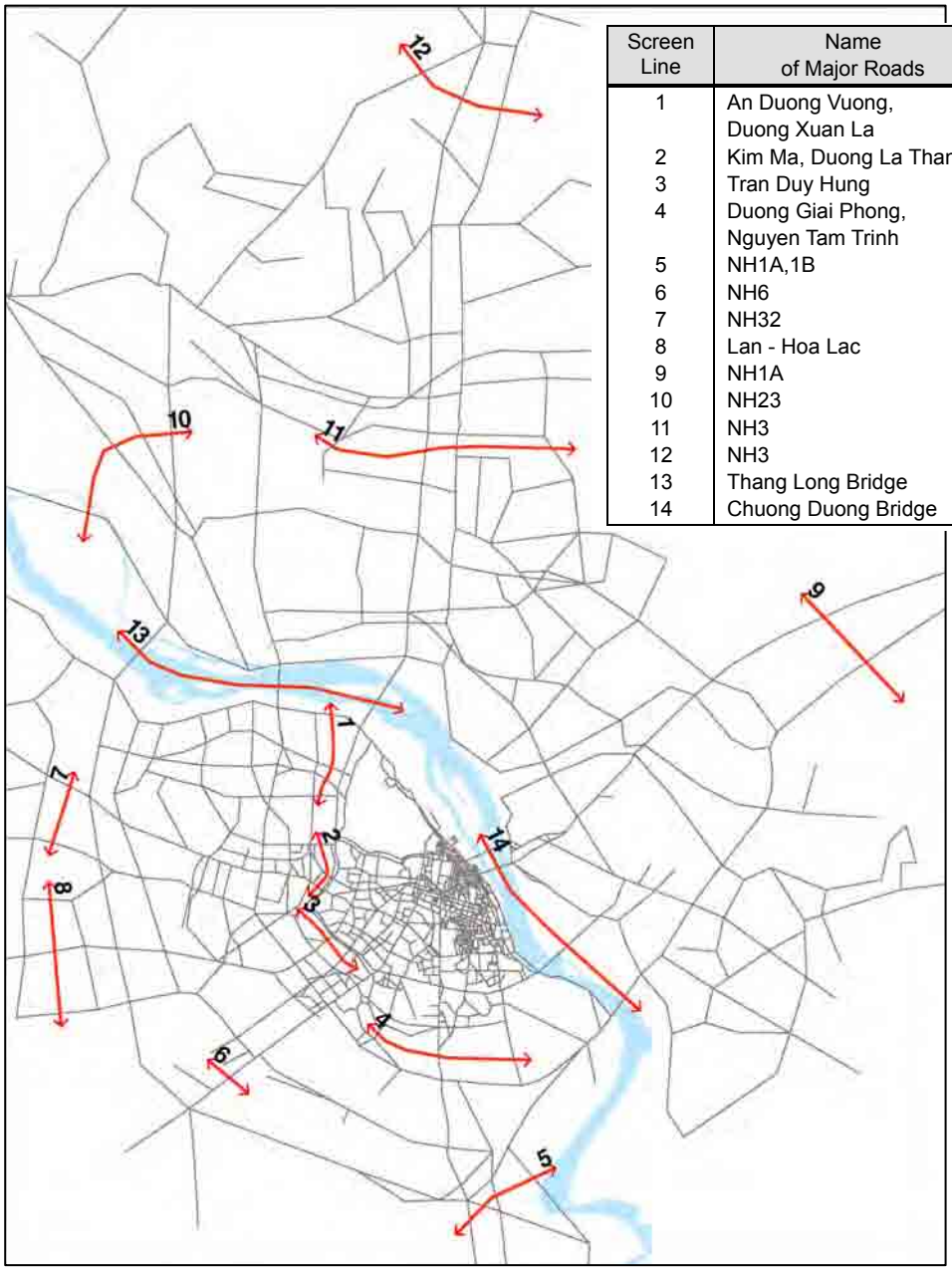


Source: TUPWS-Hanoi, MOT.

Table 8.2.6 List of Ongoing and Committed Projects

Project Description		Length (km)	ROW (m)	No. of Lanes
Name	Section			
NH3	NH3 Up-grade North	16.6	35	4
	NH3 Up-grade South	6.0	35	4
NH18	NH2-Dong xuan	5.1	40	6
NH2	NH18-NH3	2.1	35	4
	NH3-Xuan Non	2.8	35	4
Lang-Hoa Lac	RR2-RR4	8.3	40	6
RR(2)	DHQV - Cau Giay	2.2	35	4
	Cau Giay - Nga Tu So	4.1	35	4
	Nga Tu So - Nga tu Vong	2.3	35	4
RR(3)	Tu Liem Section	6.2	40	6
	Thanh Tri 2/2	2.4	40	6
	Thanh Tri - NH5	3.2	40	6

Figure 8.2.6 Mini-screenlines for Demand-Supply Analysis



Screen Line	Name of Major Roads
1	An Duong Vuong, Duong Xuan La
2	Kim Ma, Duong La Thanh
3	Tran Duy Hung
4	Duong Giai Phong, Nguyen Tam Trinh
5	NH1A,1B
6	NH6
7	NH32
8	Lan - Hoa Lac
9	NH1A
10	NH23
11	NH3
12	NH3
13	Thang Long Bridge
14	Chuong Duong Bridge

Source: HAIDEP Study Team.

Table 8.2.7 Results of Mini-screen Line Analysis

SL	2005 Do Nothing Network				Do Something Network, 2020			
	No. of Links	Capacity (PCU000)	Volume (PCU000)	V/C Ratio	No of Links	Capacity (PCU000	Volume (PCU000	V/C Ratio
1	5	124	43	0.35	5	124	94	0.76
2	4	164	76	0.47	4	164	194	1.19
3	6	336	132	0.39	6	336	284	0.85
4	6	204	91	0.44	6	204	263	1.29
5	5	215	47	0.22	5	215	206	0.96
6	2	154	43	0.28	2	154	87	0.57
7	2	57	21	0.36	2	57	49	0.86
8	3	76	13	0.17	3	76	48	0.63
9	2	111	58	0.53	2	111	140	1.26
10	3	56	15	0.26	3	56	53	0.95
11	5	145	47	0.32	5	177	205	1.16
12	3	64	13	0.20	3	96	37	0.39
13	1	64	60	0.93	1	64	232	3.62
14	2	86	146	1.69	3	197	368	1.87

Source: HAIDEP Study Team.
1) See Figure 8.1.6 for locations of the mini-screenlines.

Table 8.2.8 Results of Area-based Demand and Supply Analysis

Area	2005 Do Nothing Network				Do Something (Committed) Network, 2020			
	Highway Length (km)	Capacity (PCU*km) 000/Day	Volume (PCU*km) 000/Day	V/C Ratio	Highway Length (km)	Capacity (PCU*km) 000/Day	Volume (PCU*km) 000/Day	V/C Ratio
Urban Core	238.9	6,305	3,568	0.57	238.9	6,666	6,656	1.00
South	172.3	4,892	1,886	0.39	176.5	5,351	5,819	1.09
West	291.9	8,369	2,512	0.30	296.1	8,939	8,864	0.99
East	199.4	4,506	2,275	0.50	203.6	4,965	7,247	1.46
North	440.8	9,198	2,678	0.29	445.0	10,751	11,234	1.04
Total	1,166.8	28,606	11,426	0.40	1168.5	30,360	34,251	1.13

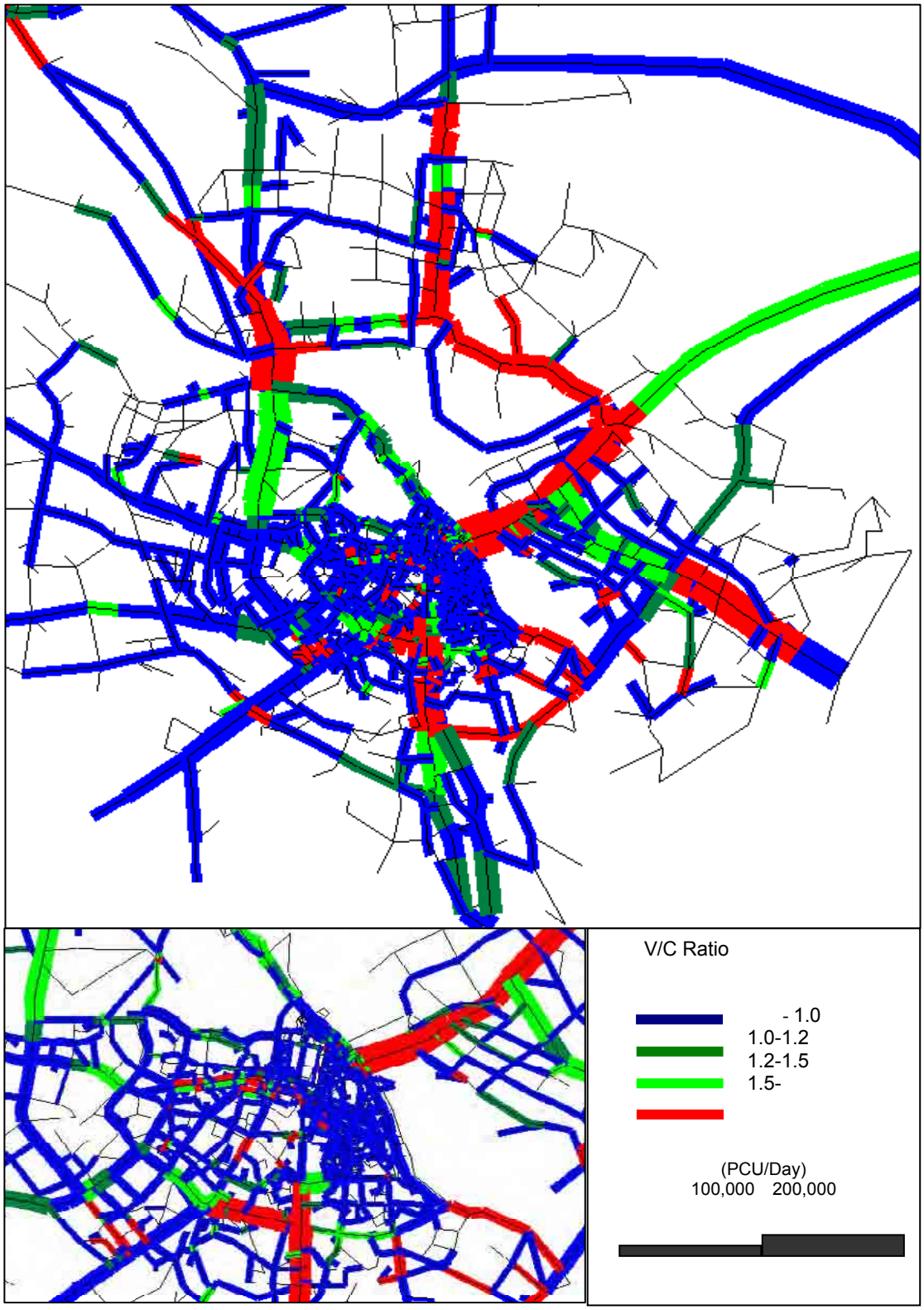
Source: HAIDEP Study Team.

Table 8.2.9 "Do-Something" Network Performance

Volume/Capacity Ratio (VCR)	Total Length		Total Traffic (PCU-km)	
	Km	%	000	%
- 0.5	224	9.4	460	0.9
0.5 - 1.0	1,027	43.1	11,500	22.7
1.0 - 1.5	404	16.9	8,400	16.6
1.5 - 2.0	217	9.1	5,290	10.4
2.0 - 2.5	127	5.3	3,840	7.6
over 2.5	383	16.0	21,150	41.7
Total	2,387	100.0	50,720	100.0

Source: HAIDEP Study Team.

Figure 8.2.7 Traffic Assignment on "Do Something" Network



2) General Planning Principles

Transportation infrastructure is the foundation of urban development, as development takes place along, and is greatly affected by, transportation facilities such as roads, urban railway, and terminals. Roads also provide important space for urban utilities, such as water supply, drainage, electricity, and telecommunications, as well as venue for the people's varied activities, opportunities for disaster prevention, and improved landscape. Efficient transportation is also critical in linking Hanoi to international gateways for trade and tourism, and at the same time to integrate it with the provinces in the region thereby creating synergy from the growth and development being experienced in both areas. Key principles to remember in urban transportation development are as follows:

(a) **Establish effective intermodal transportation system and logistics services that are competitive in international/regional trade and passenger travel:** Since Hanoi's growth and development are becoming increasingly connected with the competitive global marketplace and the international community, transportation infrastructure and services in international gateways, such as Hai Phong and Cai Lan for maritime transportation and Noi Bai for air transportation, as well as connecting roads, railways, and inland waterways, must be continuously upgraded to ensure seamless and effective movement of people and goods.

(b) **Develop efficient and high-quality public transportation system:** The future urban transportation of Hanoi must be based on a public network. It must be attractive and competitive enough to encourage the people to shift from private transportation use. The public transportation system must have a good combination and network of urban railway, bus rapid transit, ordinary buses of different sizes offering various services, taxis, etc. Urban development must likewise be integrated with public transportation development to enhance accessibility, safety, and environment.

(c) **Establish effective management system:** Effective management of traffic and transportation infrastructure, including proper maintenance, traffic control, parking management, safety improvement, pollution control, pedestrian safety, among others, is critical in optimizing available, expensive infrastructure. While it is expected that traffic congestion would increase mainly due to increases in the ownership and use of private cars, more drastic measures to manage transportation demand may also have to be introduced such as higher vehicle registration fees, area licensing, road pricing, etc. Increasing the capacity to provide funds as well as to address resettlement issues must also be seriously attended to.

3) Planning Principles for Main Transportation Modes

(1) Roads

Roads are the most important and fundamental infrastructure. They provide space for traffic and various activities in urban areas, determine the growth directions and patterns of urban areas, and contribute to the improvement of landscape and disaster prevention. Roads are also important to link Hanoi the global market through the international port gateways of Hai Phong and Cai Lan, as well as through the international cross-border gateways with China and Laos. To achieve this, NH1, NH5, NH18, NH2-NH70, NH3, and NH32 must be upgraded. Key principles to be considered are as follows:

(a) **Segregate interprovincial and urban traffic:** Interprovincial traffic must be segregated from urban traffic to prevent heavy traffic from passing through the city.

Adequate interface between these two types of traffic must be provided at the peripheries of urban areas along RR4 which will be an access-controlled, semi-expressway provided with interchanges/flyovers at major intersections.

(b) **Establish clear ring and radial road systems:** Urban roads must be developed in a hierarchical manner, i.e. primary, secondary, and tertiary, wherein the primary and secondary road networks must be in good condition. The primary road system, comprising clearly defined ring roads (1, 2, 3, and 4) and radial roads (R1: Duong Giai Phong, R2: Duong Nguyen Trai, R3: Duong Lang - Hoa Lac, R4: Duong Xuan Thuy, R5A: Duong Nghi Tam - Duong Au Co, R5B: new road, R6A: NH1A, R6B: NH1A bypass, R7: Duong Nguyen Khoai, and R8: Duong Tam Trinh), must be completed. The secondary road network should likewise be developed to distribute traffic to all urban areas efficiently.

(c) **Establish more effective mechanism for at-grade road development:** Tertiary and lower-level roads must likewise be developed based on detailed local plans and together with urban development control measures. Developers must provide roads or road space as specified in the plan. The integrated approach is also important to effectively secure lands for infrastructure and resettlement.

(2) Rail Transportation

The potential roles of railway in Hanoi manifest in three ways. One, it forms the backbone of the public transportation system by providing efficient and high-quality services. Two, it promotes a more effective urban growth and land use through the integrated development of transportation and urban development. Three, it functions as an efficient link between Hanoi and the international gateways. Rail transportation development is a critical determinant of the future urban growth and the realization of a public transportation-based city. Key principles to be considered are as follows:

(a) **Define clearly the role and capability of Vietnam Railway:** VR in Hanoi has the potential to contribute to inter-city and urban transportation services. However, these two services are often contradictory in large urban areas due mainly to the differences in the nature of their services and required operation[4], although the opportunity to use VR for urban services is definitely large.

(b) **Develop an urban mass rapid transit (UMRT) network:** A network of urban mass rapid transit (UMRT) comprising the urban sections of VR, urban rail, and BRT must be developed to provide the city with a core public transportation system offering high-quality services and integrating all major urban areas and activity centers.

(c) **Establish sustainable mechanism to develop UMRT network:** UMRT requires a large amount of investment and a lengthy period of time before it is realized. It must be developed as a network with good coverage and in integration with efficient feeder services. Strategies for an integrated development, strategic funding, and phased development must be made clear to sustain the development of the envisioned network.

[4] Urban transportation services can limit the operation of inter-city services and vice versa. Hence before completing the ring route and while traffic demand is still moderate, the lines can be shared by both urban and inter-city transportation services.

(3) Bus Transportation System

Bus is and will be the most important mode of public transportation system in Hanoi. Although urban rail is expected to play a major role in the future, the coverage will be limited and many corridors and areas will remain unserved because it requires lengthy time and huge costs for construction of such system. Bus also provides important feeder services for urban rail. Key planning principles are as follows:

(a) **Develop integrated and attractive bus system:** Bus services must be developed as an integrated network to provide convenient services between origins and destinations, comprising various types of modes and services including BRT, express buses, air-conditioned buses, minibuses, etc. The services must also be attractive and competitive to encourage a shift from private transportation.

(b) **Establish a sustainable bus operation and management system:** The initial success of bus operation in Hanoi may not guarantee further successes in the future when more bus units need to be managed and wider areas have to be covered. Besides, people demand improved services at affordable prices. Hence sustainable bus operation and management systems must be established.

(c) **Provide adequate environment for private sector to invest in public transportation services:** An effective way to improve bus services is providing fair competition among operators. Since Hanoi needs expanded and diversified bus services, providing opportunities for new investors to offer such services in a competitive manner must be considered.

(4) Traffic Management and Safety

Effective traffic management is important not only to ensure smooth circulation and safe vehicular traffic but also to improve the amenity and safety of pedestrians, roadside residents and activities. The restricted use of road space also enhances the landscape and the city's image. As car ownership is expected to increase sharply in the future while road development is expected to be limited, managing the demand for private transportation will become a more serious concern. Key principles to consider are as follows:

(a) **Enhance people's awareness of the need for traffic discipline and the efficient use of road space:** Many traffic accidents in Vietnam are caused by human error, principally due to lack of discipline or disregard for basic traffic rules. Social awareness of road traffic safety issues must be enhanced by all means.

(b) **Establish an effective traffic management system:** Good traffic management is most fundamental in ensuring efficient flows of traffic, effective use of available facilities, as well as orderly, safe, and comfortable activities on the road space.

(5) Inland Waterways

Inland waterways using channels of the Red River system currently being used mainly for transporting construction materials can play much more important role if navigation conditions are improved and modern facilities are provided. Opportunities include transport of containers, and river cruise for tourism. Main aspects to be considered are as follows:

(a) **Develop stable navigation channels and modern ports:** For further effective use of the Red River, stable navigation of vessels and ports with modern facilities must be provided.

(b) **Establish inland waterway transportation (IWT) services:** The Red River can offer ample opportunities for new types of services and activities, such as river cruises, ferry services, and recreational activities, when infrastructures are adequately provided.

4) Target Indicators for Improvement

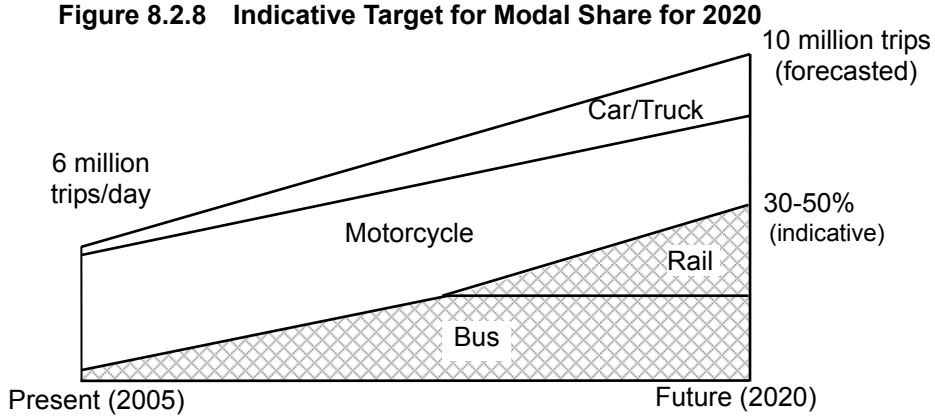
Although the modal share of public transport for 2020 at 30% is still low compared to the current MOT master plan (at 50%), HAIDEP considers the 30% target more realistic. Even to attain this target, tremendous efforts will be needed. To raise this 30% target further to 50%, for instance, very strong demand management measures may be necessary.

Table 8.2.10 Estimated Modal Shares by 2020

Mode		No. of Trips[1)] (000)	%
Bicycle		370	3.8
Motorcycle		4,622	46.9
Car		1,554	15.8
Public Transportation	UMRT	1,484	15.1
	BRT	529	5.4
	Bus	940	9.5
	Subtotal	2,952	30.0
Truck		350	3.5
Total		9,848	100.0

1) Including trips within Hanoi.

Figure 8.2.8 Indicative Target for Modal Share for 2020



Source: HAIDEP Study Team.

5) Strategies

(1) Enhancement of Citizen's Mobility and Accessibility

To provide the Hanoi's citizen with enough mobility and accessibility is one of the primary objectives of HAIDEP urban transport master plan. The minimum requirement for HAIDEP is to maintain and to further improve the relatively good traffic condition at present. Table 8.2.11 summarizes the road network performance of HAIDEP which was estimated by the HAIDEP demand forecast model and was interpreted to be one of the targets of HAIDEP master plan.

Table 8.2.11 Estimated Road Network Performance of HAIDEP

	2005	2020		
		Do-Something (Committed) Network	HAIDEP Network	
			With UMRT	With UMRT & TDM
Average Travel Speed (km/h)	26.0	9.4	22.0	35.2
Average Volume/ Capacity Ratio	0.40	1.13	0.69	0.52

Note: Hanoi City only.

Also important is the enhancement of inter-modality. As UMRT development proceeds, a number of transfers inevitably occur with other UMRT lines and feeder modes of transport at stations. To ensure smooth transfers and boarding/alightings at transport modes, including UMRT stations, necessary spaces and facilities should be developed.

(2) Enhancement of Traffic Management and Safety

Infrastructure is expensive and requires proper management and operation. Traffic management is hence essential not only for the efficiency of traffic but for safety, comfort and urban environment. Particularly in relation to road safety, the current worsening situation is unacceptable. It is already a national issue, not solely for Hanoi. Improving safety situation is one of the major targets of HAIDEP and is reflected in various components of the plan.

(3) Management of Sustainable Growth and Harmonization with Urban Environment

Hanoi's rapidly growing population and economy have strong impacts on urban development. Transport infrastructure and services have very close and complicated interactions with urban development. The transport network proposed by HAIDEP has been worked out in close reference with the urban development and land use plan of HAIDEP. It is one of the major targets of HAIDEP urban transport master plan to lead and guide the directions of urban development of Hanoi City in accordance with the HAIDEP land use plan

Environmentally, the HAIDEP urban transport master plan is expected to curtail NO_x and CO_2 emission in 2020 by about 16% and 31%, respectively. This is also one of the major targets of HAIDEP.

(4) Funding

Implementation of transport projects can be realized only when required financial resources are secured. As analyzed earlier, however, there is a sheer lack of fund at present.

It is evident that an investment level of 1 - 2% of GRDP on transport infrastructure is insufficient to cope with the rapid economic growth, which inevitably entails a considerable modal shift from motorcycle to car. Moreover, the backlog of transport infrastructure development is already huge at present.

Although the investment level seems usually to be 2 - 3% of GRDP in most countries, some rapidly growing cities have invested around 10% of GRDP on transport infrastructure as seen in Bangkok (Thailand) and Salvador (Brazil).In these cities, transport infrastructure was strategically developed to attract FDI.

To maintain a high economic growth of 11% a year as planned, an investment equivalent to 4 - 5% of GRDP would be required in Hanoi, taking into account the poor infrastructure

stock at present. Table 8.2.12 summarizes the estimate of budget envelope for transportation infrastructure for low and high cases.

The low and high cases assume 2.5% and 4.5%, respectively, of the total GRDP of the period 2006 - 2020. The total amount would be US$ 4.1 and 7.4 billion for the low and high cases, respectively.

Therefore, it is imperative to increase the funding capacity of the government by diversifying the financial resources. Aside from the existing funding mechanism stated above, there are two (2) basic approaches:

- Private sector participation, and
- Economic measures (TDM).

The former is possible only when the project entails revenue. This is applicable to some HAIDEP proposed projects such as Ring Road 4 and UMRT lines. This could include such items as joint ventures for property developments, particularly at government land sites where multimodal interchanges are located, suppliers on credit/leasing for rolling stocks and privatizations of operations as well as for the maintenance of the UMRT system.

Table 8.2.12 Possible Budget Envelope for Transportation Subsector

Year	GRDP	Possible Investment		Five-year Total	
	US$ million	2.5%	4.5%	2.5%	4.5%
2005	4,301	108	194	108	194
2006	4,774	119	215		
2007	5,299	132	238		
2008	5,882	147	265	743	1,338
2009	6,529	163	294		
2010	7,247	181	326		
2011	8,045	201	362		
2012	8,930	223	402		
2013	9,912	248	446	1,253	2,255
2014	11,002	275	495		
2015	12,213	305	550		
2016	13,556	339	610		
2017	15,047	376	677		
2018	16,702	418	752	2,111	3,799
2019	18,540	463	834		
2020	20,579	514	926		
Total (06-20)	-	4,106	7,392	4,106	7,392

Source: HAIDEP Study Team.

8.3 Regional Perspectives

1) Overview

Because of Hanoi's significant role as a growth center and the focal point for various functions, its urban development and transportation have been strongly affected by changes in the northern region's own development and transportation. While most of the main transportation corridors originate or end in Hanoi, the city is heavily dependent on international gateways such as the seaports in Hai Phong and Quang Ninh provinces. At the same time, the management of Hanoi's urban growth is also affected by the regional spatial policy which promotes the development of satellite cities and urban areas in the Hanoi metropolitan area. Hence Hanoi's urban transportation must be planned within a regional perspective.

There are at present two plans for Hanoi and its surrounding areas—the regional transportation plan prepared by MOT and the HMA plan which is currently being prepared by MOC's NIURP which also incorporates the MOT plan. In the HAIDEP these plans were studied to come up with the orientation for the regional transportation network development. HAIDEP's contribution is to estimate the future transportation demand and analyze the demand-supply gap of the existing plans.

2) Traffic Demand

Interprovincial traffic of both passengers and freight has become increasing significantly (see Table 8.3.1). Between 1999 and 2005, the growth rate of interprovincial transportation was 22.2% for freight and 11.8% for passenger. Freight traffic particularly through inland waterways was high, at 46.7% of the total.

Both passenger and freight traffic are distributed to and from Hanoi. Main passenger traffic flows include between Hanoi on one hand and Quang Ninh, Hai Phong, Nam Dinh, Bac Ninh, and Ha Tay on the other.

Those of freight are between Hanoi on one hand and Hai Phong, Quang Ninh, Ha Tay, and Vinh Phuc on the other. Freight traffic flows between Hai Phong and Quang Ninh, and between Vinh Phuc and Quang Ninh are also notable (see Figure 8.3.1). Major freight items carried on interprovincial transportation are construction materials and coal, although the share of manufacturing goods has gradually increased (see Table 8.3.2).

Passenger and freight volume in interprovincial transportation in 2020 is estimated to be 876,900 passengers and 415,800 tons, respectively.

3) Road Network

(1) MOT Plan

In the MOT transportation master plan, major improvements on and developments of primary roads, including expressways and national highways, are proposed for implementation by 2020 (see Table 8.3.5 and Figure 8.3.2). Main projects included in the plan are as follows:

(i) Development of six expressways with a total length of 694km before 2020, including:

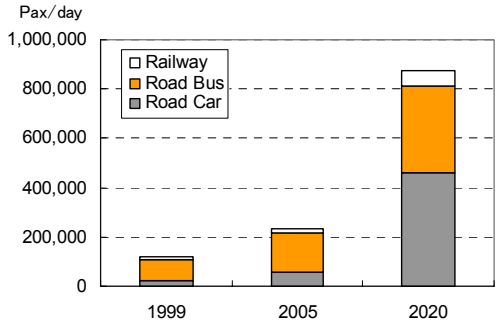
- Eastern North-South Expressway (Lang Son - Thanh Hoa, 190km),
- East-West Expressway (Noi Bai - Ha Long - Mong Cai, 320km),
- Hanoi - Viet Tri-Doan Hung - Lao Cai Expressway (124km),

Table 8.3.1 Modal Share of Interprovincial Transportation to/from Hanoi

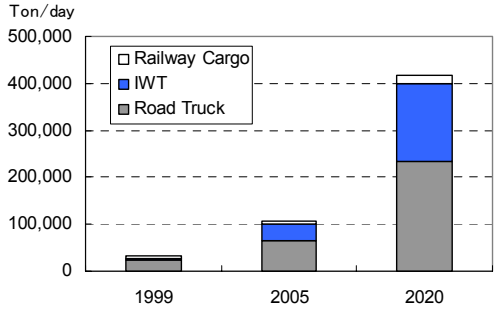
		1999		2005		2020		Growth Rate (1999-2005) (%)	Growth Rate (2005-2020) (%)
		No.	%	No.	%	No.	%		
Passenger (Pax/day)	Road (Car)	19,913	17	59,014	25	460,362	52	19.8	14.7
	Road (Bus)	86,999	74	154,846	67	350,164	40	10.1	5.6
	Railway	11,356	10	17,627	8	66,378	8	7.6	9.2
	Total	118,268	100	231,487	100	876,904	100	11.8	9.3
Cargo (Ton/day)	Road (Truck)	24,390	77	66,003	63	232,253	56	18.0	8.7
	IWT	3,495	11	34,795	33	167,225	40	46.7	11.0
	Railway Cargo	3,667	12	4,481	4	16,352	4	3.4	9.0
	Total	31,552	100	105,280	100	415,830	100	22.2	9.6

Source: HAIDEP Study Team (refer to VITRANSS 1999, TDSI 2005, and Traffic Demand Forecasting 2020).

Passenger Traffic



Cargo Traffic



Source: HAIDEP Study Team.

Table 8.3.2 Main Types of Interprovincial Freight in Hanoi

Rank	1999		2005	
	Tons/day (000)	%	Tons/day (000)	%
1.Coal	34	45	43	17
2.Sand, Stone	16	22	113	44
3.Cement	7	10	32	12
4.Manufacturing Goods	5	7	25	10
5.Fertilizer	4	5	5	2
6.Paddy	3	3	15	6
7.Petroleum	2	3	10	4
8.Steel	2	3	8	3
9.Others	2	2	7	3
Total	75	100	258	100

Source: HAIDEP Study Team (Freight Survey), VITRANSS (1999)

Table 8.3.3 Import and Export Throughput at Hai Phong Port

	US$ Mil.		2004/ 2000
	2000	2004	
Import	148	461	3.1
Export	79	267	3.4
Total	226	727	3.2

Source: Hai Phong Statistical Office.

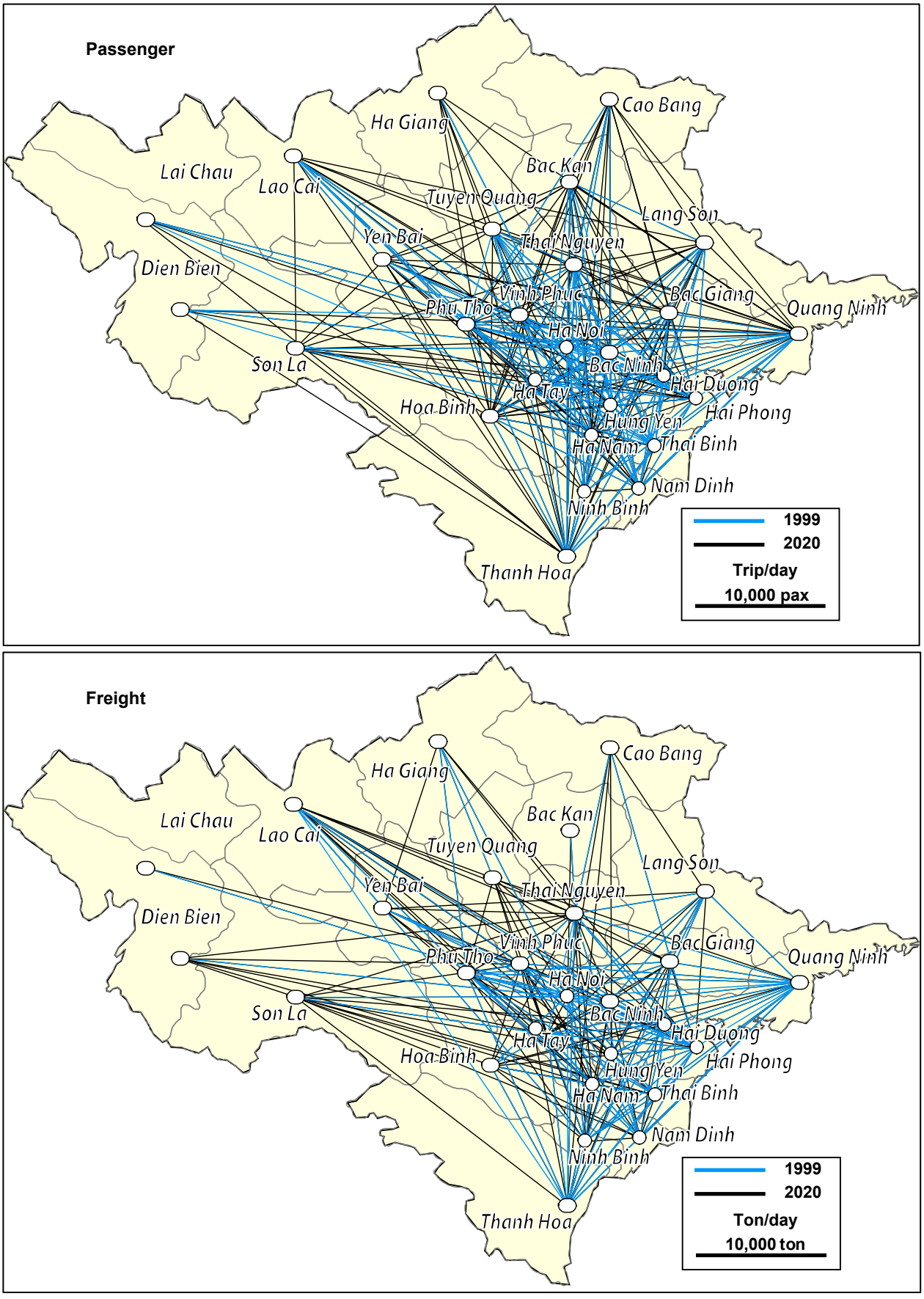
Table 8.3.4 Estimated Modal Share of Interprovincial Transportation in the Study Area

Passenger	1999		2005		2020	
	000/ day	%	000/ day	%	000 /day	%
Road (Car)	22	13	73	24	534	54
Road (Bus)	137	79	219	71	399	40
Railway	13	8	16	5	64	6
Total	173	100	308	100	997	100

Freight	1999		2005		2020	
	Tons/day (000)	%	Tons/day (000)	%	Tons/day (000)	%
Road(Truck)	39	43	116	41	372	42
IWT	43	48	160	56	480	55
Railway	8	9	9	3	26	3
Total	90	100	285	100	878	100

Source: VITRANSS (1999), TDSI (2005), HAIDEP Study Team.

Figure 8.3.1 Interprovincial Traffic Distribution in the Study Area



Source: HAIDEP Study Team.

- Hanoi - Thai Nguyen (ongoing, 65km),
- Hanoi - Hai Phong (105km), and
- Lang - Hoa Lac - Hoa Binh Expressway (80km).

(ii) A total of 1,491km of national roads for upgrading of their technical standards, as well as widening and improvements, and includes NH2, NH3, NH6, NH10, NH18, NH21, NH23, NH38, and NH39.

(iii) A new ring road for Hanoi with a total length of 320km.

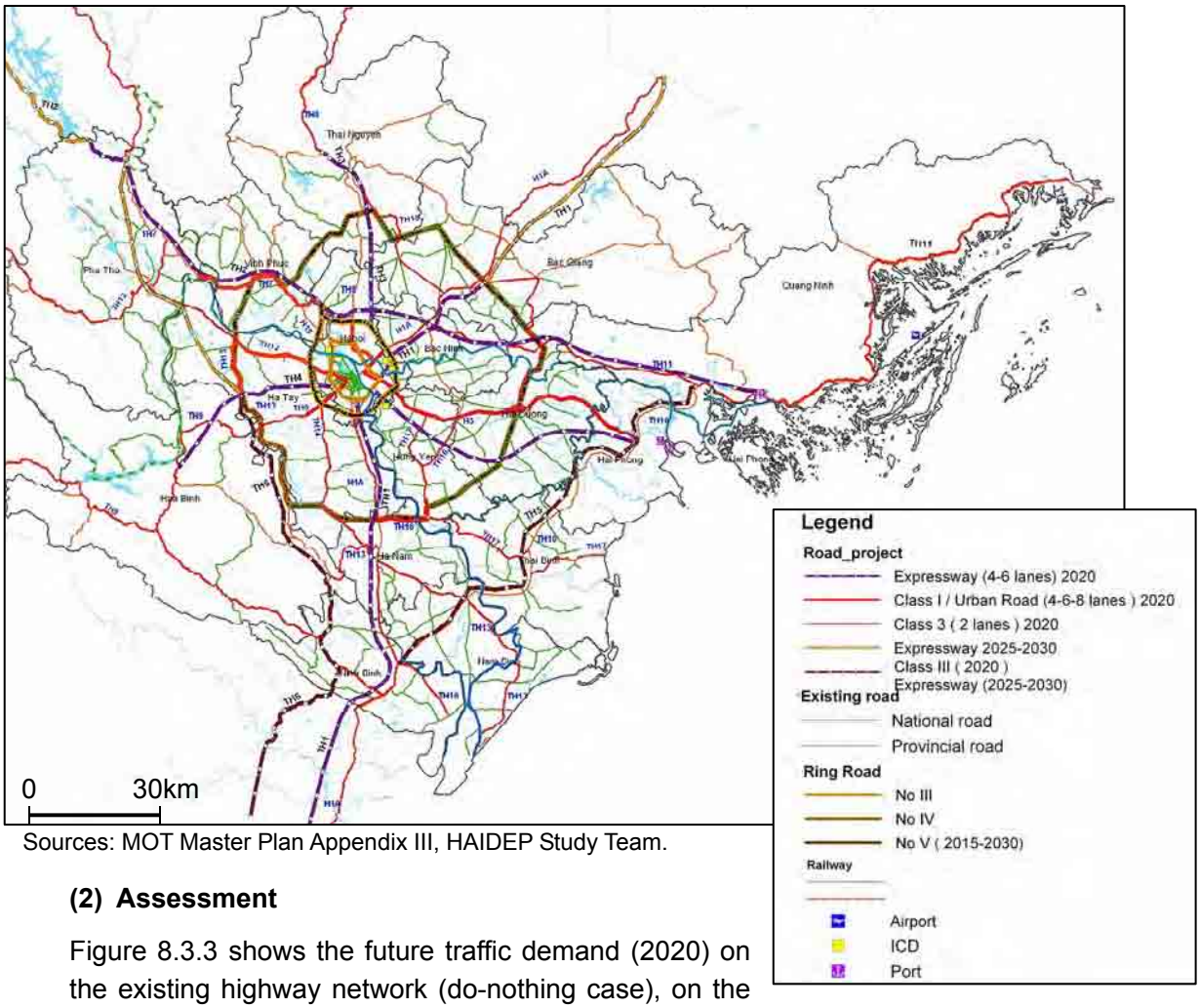
(iv) The investment required for primary roads proposed for development by 2020 is US$ 5.58 billion of the total cost of US$ 6.99 billion for the whole network.

Table 8.3.5 MOT Master Plan Projects (Roads)

	Project Name	Length (km)		Type of Work[1)]	Project Cost (USD mil.)			EIRR (%)	Construction Schedule
		Total	HAIDEP Study Area		Cons-truction	ROW	Total		
A. Expressway									
TH01	Eastern North-South expressway (LangSon-ThanhHoa)	325	190	N	532	133	665	13.0	-2020
TH02	Noi Bai – Ha Long – Mong Cai	320	320		896	224	1,120	25.4	
-01	- Noi-Bai – Bac Ninh	35	35	N	98	25	123		-2010
-02	- Bac Ninh – Ha Long	110	110	N	308	77	385		2011-2020
-03	- Ha Long – Mong Cai	175	175	N	490	122	612		2020-
TH03	Hanoi–Viet Tri–Doan Hung–Lao Cai (Hanoi – Doang Hun section)	124	124	N	347	87	434	18.7	-2015
TH04	Hanoi - Thai Nguyen	65	65	N	182	46	228	14.7	2005-2015
TH05	Hanoi – Hai Phong (to DinhVu ferry boat)	105	105	N	294	74	368	47.0	2005-2013
TH06	Lang – Hoa Lac – Hoa Binh	80	80		224	56	280	17.7	
-01	- Lang – Hoa Lac	30	30	N	84	21	105		2010-2013
-02	- Hoa Lac – Hoa Binh	50	50	N	140	35	175		2015-2020
TH07	Ninh Binh – Hai Phong – Quang Ninh	160	160	N	448	112	560	13.6	2021-
TH08	Western North-South expressway	1,370	120	N	504	126	630	13.8	2021-
B. Major National Road									
TH09	NH2	317	119	W	117	29	146	46.1	2006-2010
TH10	NH3	343	114	W	117	29	146	27.4	2011-2015
TH11	NH6	494	126	W	378	94	472	16.9	2016-2020
TH12	NH10	230	187	N/W	228	57	285	18.8	2016-2020
TH13	NH18	309	309	N/W	147	37	184	20.3	2011-2015
TH14	NH32	404	147	W	124	31	155	8.5	2021-
C. Other National Road									
TH15	NH 21	210	210	W	170	43	213	21.9	2011-2015
TH16	NH21B	58	58	W	46	12	58	3.6	2021-
TH17	NH23	27	27	W	27	13	40	53.9	2006-2010
TH18	NH38	85	85	W	116	29	145	29.9	2006-2010
TH19	NH39	109	109	W	216	54	270	23.2	2011-2015
D. Regional Ring Road									
TH20	Hanoi Ring Road Number V	320	320	N/W	480	110	590	32.3	2015-2030
Total		5,455	2,975		5,593	1,396	6,989	-	-

Source: MOT Master Plan Appendix III, HAIDEP Study Team.
N= new, W= widening.

Figure 8.3.2 MOT Road Network Plan



Sources: MOT Master Plan Appendix III, HAIDEP Study Team.

(2) Assessment

Figure 8.3.3 shows the future traffic demand (2020) on the existing highway network (do-nothing case), on the MOT highway network master plan, and on the HAIDEP highway network master plan.

The HAIDEP Study Team evaluated the components of the present MOT master plan and the findings are as follows:

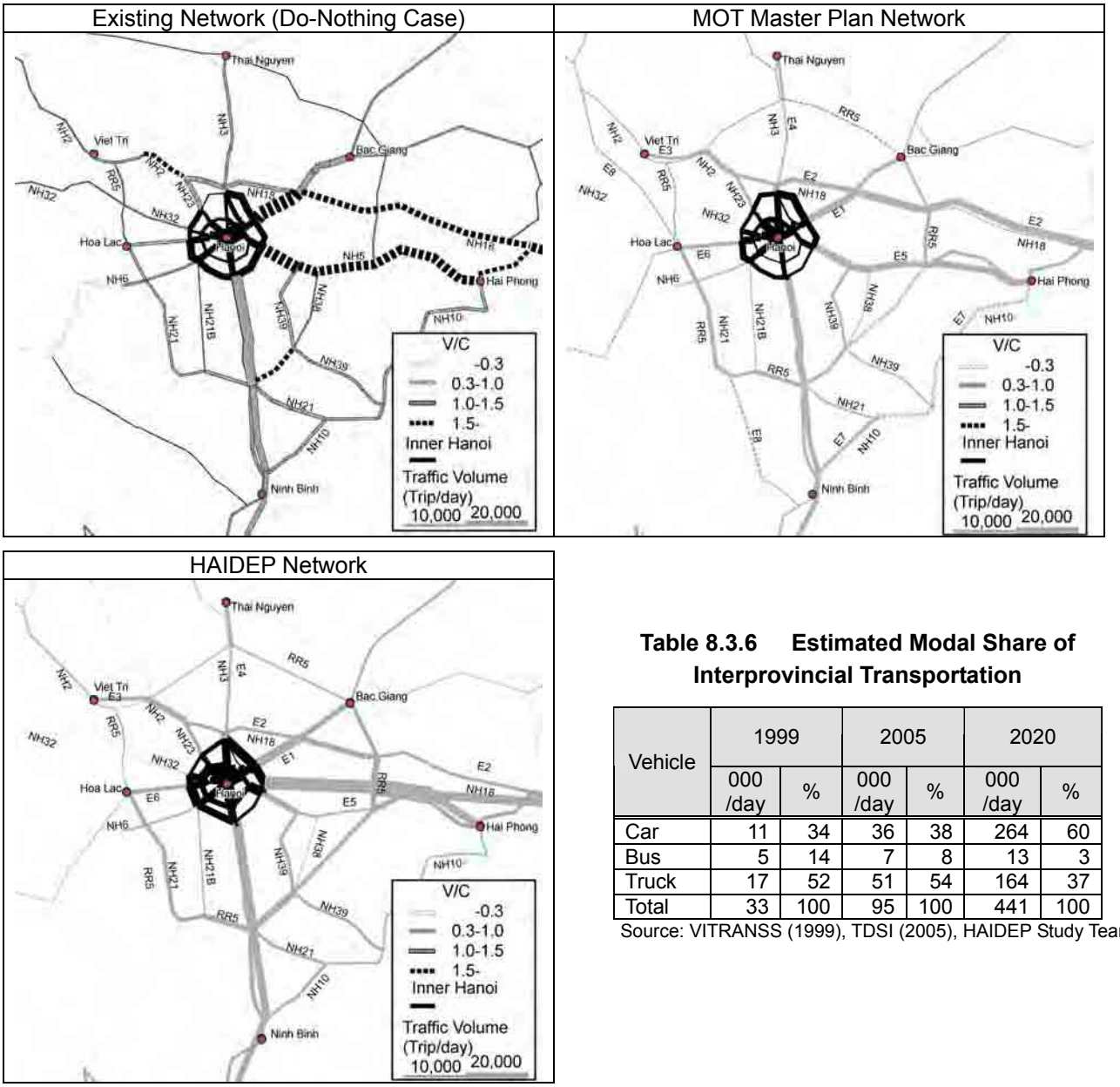
(i) The project components suggested by MOT are sufficient and match HAIDEP's regional development strategies and estimated travel demand by 2020. HAIDEP basically endorses the master plan of MOT.

(ii) Some projects, such as the Ninh Binh - Hai Phong - Quang Ninh Expressway, the western North-South Expressway (Doan Hung - Chon Thanh), NH32, and NH21B, are suggested for development after 2020 because the travel demand before that year will not be sufficient to warrant such infrastructures in light of their economic evaluation.

(iii) The two expressways going to the east from Hanoi, i.e. Noi Bai – Ha Long Expressway and Hanoi – Hai Phong (Dinh Vu) can be integrated into one expressway in the light of estimated future demand.

(iv) Project costs had to be re-calculated by the Study Team, especially those of the road projects. It was estimated that the cost of most projects could be lower than those estimated by MOT.

Figure 8.3.3 Future Traffic Volume on Various Networks



Source: HAIDEP Study Team.

Table 8.3.6 Estimated Modal Share of Interprovincial Transportation

Vehicle	1999		2005		2020	
	000 /day	%	000 /day	%	000 /day	%
Car	11	34	36	38	264	60
Bus	5	14	7	8	13	3
Truck	17	52	51	54	164	37
Total	33	100	95	100	441	100

Source: VITRANSS (1999), TDSI (2005), HAIDEP Study Team

4) Railway Network

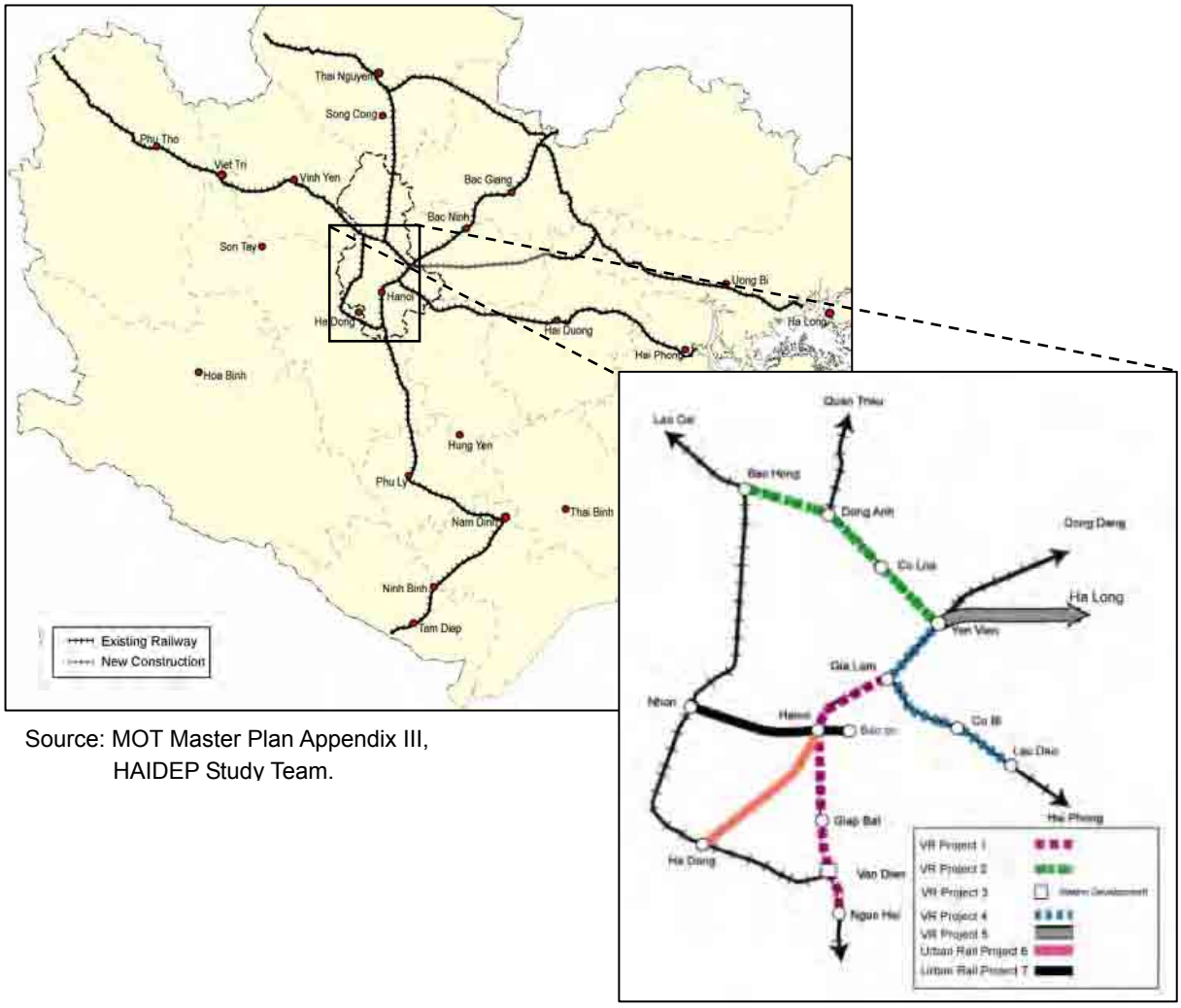
MOT in its transportation master plan identified seven major projects including the upgrading projects for existing track infrastructure in the Hanoi area, an upgrading project for Van Dien Station, an upgrading and new construction project for the Yen Vien - Ha Long section, and two development projects on urban railway in Hanoi (see Table 8.3.7 and Figure 8.3.4). From the master plan it is not quite clear why VR would like to be involved in developing urban railway at this stage, as it would require a deviation from its normal role of providing inter-city transport. The proposed projects are limited in their scope and lack any evaluation or feasibility details. However, their importance has been noted. The HAIDEP master plan for railway incorporates these schemes in its proposals, albeit in different form, and in some cases not in their entirety. While the MOT master plan proposes a rail network around Hanoi City, the HAIDEP master plan reviewed and revised the MOT plan.

Table 8.3.7 MOT Master Plan Projects (Railway)

Project No.	Project Description	Length (Km)	Estimated Cost (VND bil.)	Year of Execution	Investment Capital Source/ Budget				
					State	Local	ODA	BOT or Other	Govt. Bond/ Invest. Stock
Inter-city Railway		41,71	12,875						
1	Elevated railway from Gia Lam – Ngoc Hoi, including Hanoi and Giap Bat stations	19.71	10,080	2005-2012	x		x	X	
2	By-pass at Co Loa – Bac Hong – Yen Vien Bac (Eastern Ring Road)	11.00	820	2005-2009	X				(x)
3	Building station of Ngoc Hoi (passenger terminal); Improving Gia Lam and Yen Vien stations	0.00	1,755	2005-2008	X				(x)
4	Belt Railway: Yen Vien – Co Bi Station – Lac Dao Station	11.00	220	Before 2010	x				(x)
5	Yen Vien- Ha Long	128.0 /40.0	4,000						x
Urban Railway		25.88	11,160						
5	Key axis of urban railroad from Hanoi – Ha Dong	12.88	4,895	2005-2010	x		X	X	(x)
6	Urban railway: Bac Co – Hanoi Station – Nhon (Hanoi Station – Nhon section)	13.00	6,265	2005-2012	x		X	X	
Vietnam Railway Total			24,035						

Source: MOT Master Plan Appendix III.

Figure 8.3.4 Location of MOT Master Plan Projects (Railway)

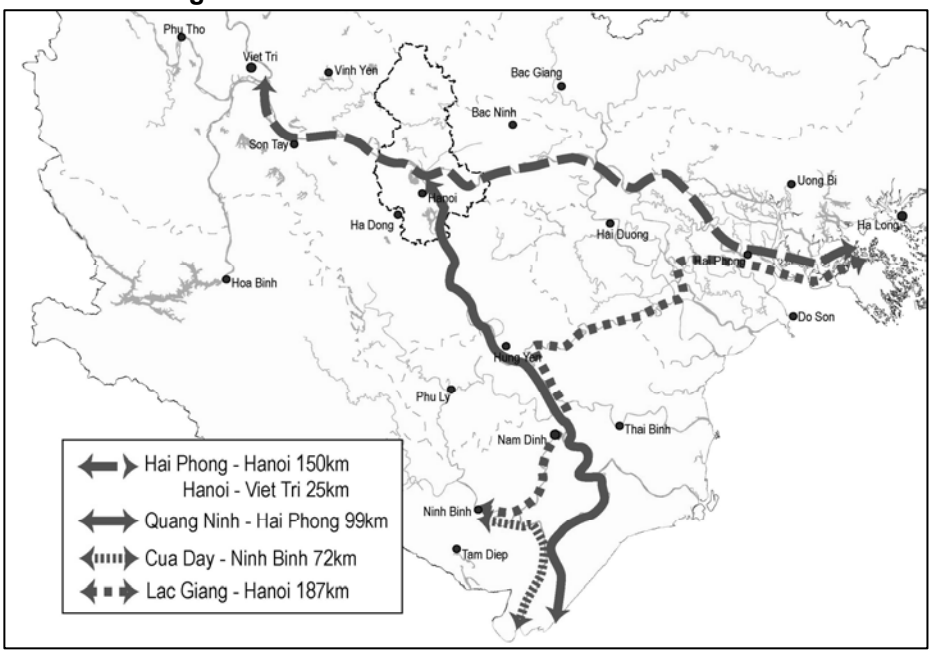


Source: MOT Master Plan Appendix III, HAIDEP Study Team.

5) Inland Waterway Transportation

In the study area, the inland waterway system is somewhat the same with that of the northern region (see Figure 8.3.5). The study area has two major river systems—Red River and Thai Binh River, which flow to the South China Sea.

Figure 8.3.5 IWT Corridors in the Red River Delta



Source: Red River Inland Waterway Transport System (JICA 2003).

(1) Existing IWT Condition in Red River Delta

The Red River delta has eight primary waterways ranging from Class 1 to Class 6. Their combined length is 1,426.5km. Aside from these, the delta has substandard waterways with a total length of 2,676km, out of which 2,332km can accommodate traffic. Most waterways in the Red River delta are natural rivers and are largely dependent on hydrological changes. Minimum widths range from 30m and 60m, while minimum depths vary from 1.5m to 2m. The difference in water levels between dry and rainy seasons is from 5m to 7m (10m has been reported in some sections).

During the rainy season, water flows are strong while during the dry season, channel depth is limited and curve radius is small, causing difficulties in navigation. There are also warps, the locations of which change according to the flooding conditions and making complicated channelling situations for navigation.

(2) IWT Demand and Future Development Plan

According to the “Red River Inland Waterway Transport System” (JICA 2003), the characteristics of future demand and plans for inland waterways are as follows:

(i) In the future, the share of construction materials will increase significantly. Currently, they account for 38% of the daily demand of 8 million tons on inland waterways. Other freight items include coal (33%), cement (13%), and others. The total tonnage is 22% of the current total freight demand (ton-km) in the Hanoi region.

(ii) It is estimated that in 2020, 80% of vessels will be in the range of 100 - 300 dwt. At present, there are 440,000 ton-vessels (50 million dwt), 60% of which belong to the 50

- 300 dwt group. In addition, river cruises and container transportation are expected to add to the potential demand on this sector.

(iii) The transfer of the existing Hanoi Port, including coal storage, to Khuyen Luong and its conversion into a tourism port (waterfront with beautiful landscape) is suggested in this study. The relocated Hanoi Port will exclusively handle construction materials and containers. Project costs for the proposed port system (see Figure 8.3.7) are estimated to be US$ 154 million.

Figure 8.3.6 Estimated Traffic Volumes on Major Inland Waterways, 2020

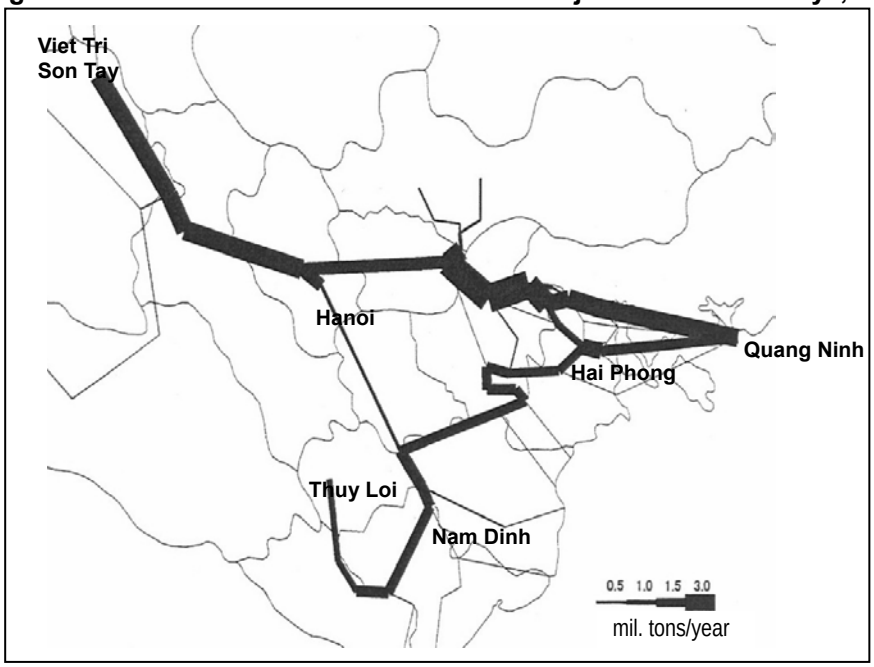
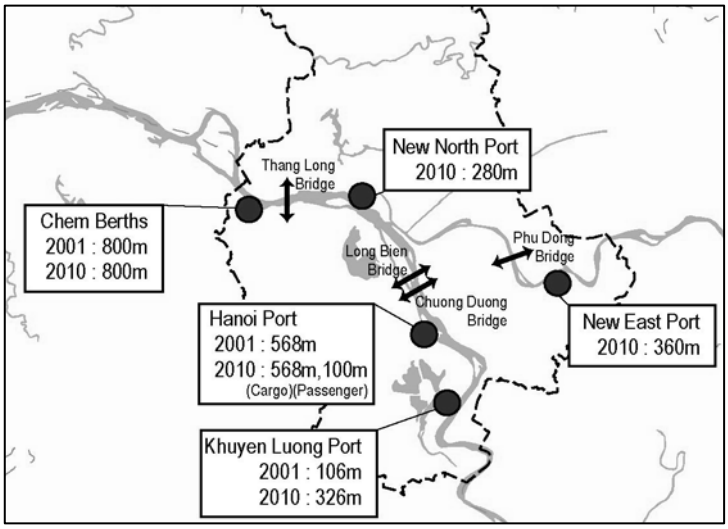


Figure 8.3.7 Proposed Inland Waterway Ports in Hanoi



Source: Red River Inland Waterway Transport System (JICA 2003).

6) Air Transportation

In the study area, there are two international airports--Noi Bai and Cat Bi (Hai Phong), while there are six under the Northern Airport Authority (Noi Bai, Vinh, Dien Bien, Na San, Cat Bi, and Dong Hoi). In the future, Quang Ninh and Gia Lam airports are planned for improvement and operation.

Airports in the study area share 95% of the total capacity of airports in the north (see Table 8.3.8) or 34% of the country's total. The Noi Bai International Airport can receive 4 million passengers per year and can accommodate B747s. Its five-year plan for the 2006 - 2010 period sets a target of 12 million passengers per year. Noi Bai has enough reserved land and the appropriate conditions to accommodate 50 - 60 million passengers a year, according to the Civil Aviation Authority of Vietnam (CAAV). Therefore, a new international airport will not be required, at least by 2020.

Table 8.3.8 Existing Capacity of Airports in the Study Area

Airport	Grade (Aircraft Size)	Capacity (pax/year)	2004 (passengers)
Northern Airport Authority (6 airports) - share (%)		4,240,000 100	3,851,093
Airports in Study Area (2 airports) - share (%)		4,020,000 95	3,656,432
1. Noi Bai	4E /(B747)	4,000,000	3,648,361
2. Cat Bi	4E /(A320)	20,000	8,071

Source: CAAV.

Table 8.3.9 Development Plan for Noi Bai International Airport

Airports	Current	2010	2020
1. Capacity - Passengers (mil.) - Cargo (000 tons)	 4 160	 12 260	 20 - 24 750
2. Runway (m)	3,200 x 45 -	3,800 x 45 -	3,800 x 45 4,000 x 60
3. Terminal (units)	1	2	8
4. Maximum Aircraft Size			Boeing 747-400

Source: CAAV.

7) Recommendations

The study area has been expanding economically and demographically and this will continue into the future. HAIDEP in coordination with key government agencies has formulated an orientation for future development in the region and this forms the basis of the proposed regional transportation development plan.

Presently transportation demand in the study area is not very high and the present transportation infrastructure which has been developed and improved in the last decade has been sufficient, although there are areas that need to be improved. However, it is projected that growth in the region will dramatically increase interprovincial transportation demand for passenger and freight up to 2020, increasing the loads of all transportation modes, including road, rail, IWT, and airports by 300% to 400% by 2020. The present regional transportation network would not be able to cope with such level of traffic, which would then pose as an obstacle to the development and competitiveness of the region.

The MOT has prepared a regional transportation master plan of the study area, which was reviewed based on the regional development goals and the projected transportation demand in the region. As a result of the review, HAIDEP basically endorses the proposals of MOT. The project components suggested by MOT are sufficient and match HAIDEP's regional development strategies and estimated transportation demand by 2020. However, there are proposed modifications to the MOT master plan, particularly for regional road and rail projects.

For regional road projects, the HAIDEP proposal calls for an expressway network forming radial corridors in six directions with Hanoi as the focal point, and additional north-south corridors in the western and eastern parts of the study area. The primary road network would be upgraded and expanded. Moreover, to support regional connectivity and to provide a bypass from Hanoi, a regional ring road is proposed. The HAIDEP road network is similar to the MOT road network, but with the following recommended modifications:

(i) The two expressways going to the east from Hanoi, i.e. Noi Bai - Ha Long Expressway and Hanoi - Hai Phong (Dinh Vu), can be integrated into one expressway in the light of the estimated future demand.

(ii) Due to very limited demand, the expressway link from Ha Long to Mong Cai is not retained, since the existing highway could be upgraded to cater to the demand.

(iii) The implementation schedule of the following expressways is proposed to be delayed for about 5 years, viz: Lang Son - Thanh Hoa Expressway; Hanoi - Thai Nguyen Expressway, and Lang - Hoa Lac - Hoa Binh Expressway.

The HAIDEP regional rail network recommends the transformation of the present Hanoi-centric regional rail network into one that radiates in six directions around a regional ring rail. The change is proposed in the context of coordinating regional rail development with the urban and transportation development of Hanoi, as it is the present hub of inter-city rail services in the northern region.

HAIDEP has proposed in its urban transportation master plan a network of urban mass rail transit, which could replace the passenger function of the present inter-city rail system within Hanoi. The proposed urban/suburban services in the MOT master plan are integrated into the HAIDEP UMRT system plan.

Due to the limitations in operating frequent train services within Hanoi, it is necessary to gradually shift inter-city train operations to outside of Hanoi. It is thus recommended that the eastern ring rail segment be completed to create a regional ring rail to obviate the need for inter-city operation within Hanoi and to enhance regional connectivity. Furthermore, existing rail links outside of Hanoi would be upgraded.

IWT will play a significant role in the regional freight transportation, especially to support construction and industrial activities. In addition to the efforts of the Government of Vietnam to maintain and upgrade IWT channels, key port developments are proposed. In 2003, JICA conducted an IWT master plan for the region and recommended the following: (i) transfer existing Hanoi Port including coal storage to Khuyen Luong; (ii) convert existing Hanoi Port into a tourism port (waterfront with beautiful landscape); and, (iii) construct new ports to exclusively handle construction materials and containers. HAIDEP likewise recommends these projects.

Air traffic has been greatly increasing, sparked by economic development and the tourism industry. MOT has laid out a plan to expand Noi Bai Airport's capacity by firstly adding/expanding terminal capacity and in the long term adding another runway. HAIDEP likewise proposes this strategy. In addition, HADIEP also recommends the improvement of airport access by providing rail service between the Hanoi CBD and Noi Bai Airport. This function is incorporated into the HAIDEP proposal for UMRT 2.

8.4 Urban Transportation Master Plan Framework

1) Components of Transportation Master Plan

The Urban Transportation Master Plan is an important part of the Urban Master Plan because of the interactive impacts of the two. Transportation development and the availability of transportation services affect land use and growth of urban areas, while urban development requires an adequate provision of transportation infrastructure and services. Therefore, it should always be noted that the transportation master plan is an integrated part of the urban master plan and that the former must address the following basic urban development issues:

(i) Transportation development must comply with the overall goal of realizing a mass-transit-based society.

(ii) Transportation development must lead the growth of urban areas in the most effective manner.

(iii) Transportation development must contribute to the improvement of the urban environment and amenity by mitigating traffic congestion, improving walking conditions, enhancing the landscape, and strengthening disaster preparedness.

The HAIDEP Urban Transportation Master Plan therefore sets a comprehensive approach to the development of urban transportation in an integrated and coordinated manner. Development goals and objectives were made clear, while a set of strategies to achieve the objectives of each subsector component, including roads, public transportation, and traffic management, were formulated.

2) Overall Transportation Network Plan

The HAIDEP urban transportation network (Figure 8.4.1) was developed based on a review and a modification of the proposed MOT network plan. The main points of the modification or adoption of the MOT network master plan are as follows:

(i) Harmonization with future urban structure, land-use plan, and development of network plan.

(ii) The supply of road space is in accordance with the network development strategy based on road hierarchy and level of demand.

(iii) The HAIDEP master plan retains the basic concept of the MOT master plan, such as the use of radial and circumferential (ring) roads as network core.

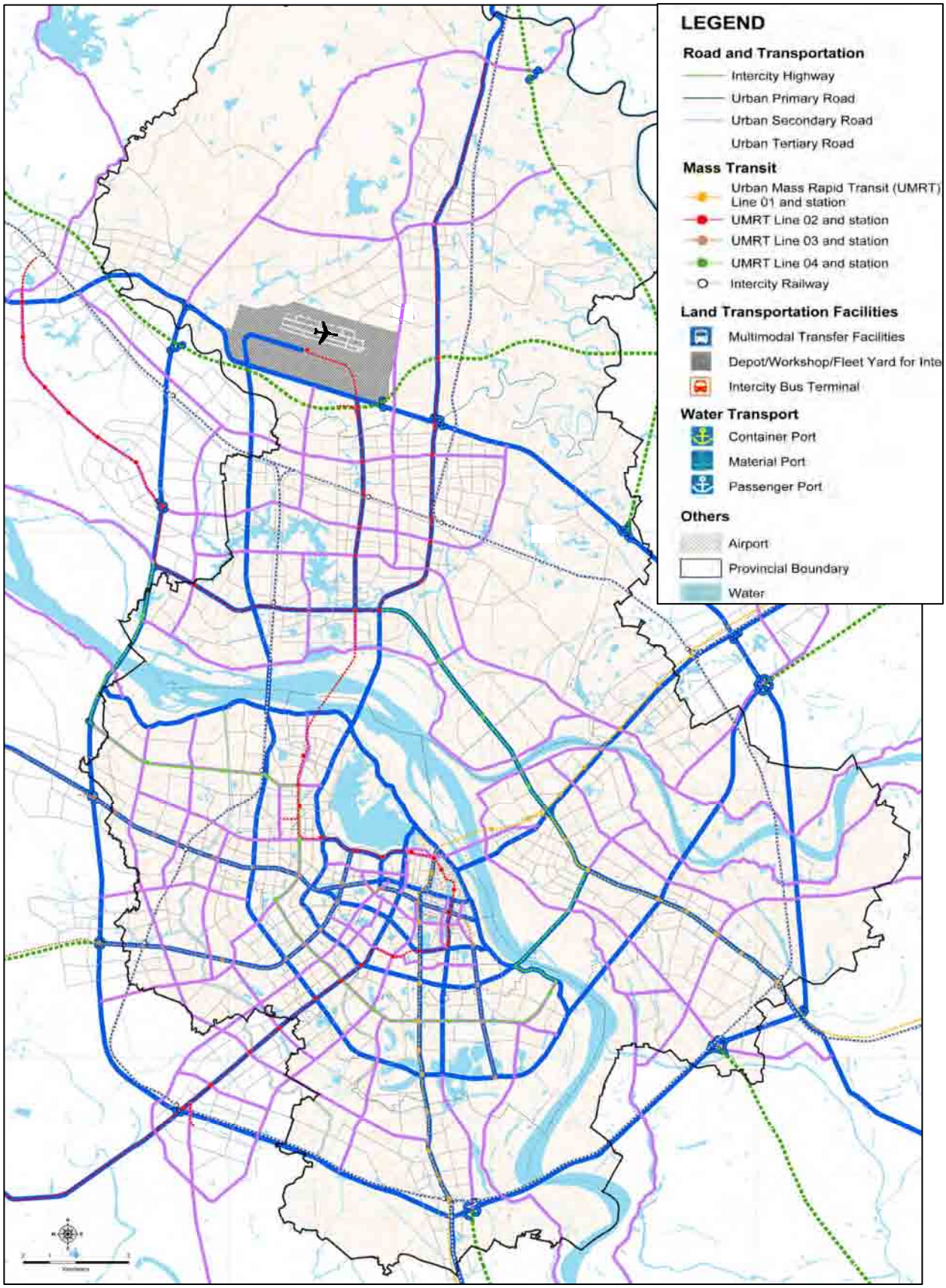
(iv) Coordination of the highway network with public transportation development.

(v) Use of existing and future road space for the most efficient modes of transportation, such as PBT or BRT.

(vi) Prioritization of the CBD and immediate improvement of the urban environment.

(vii) Fully taking account of potential development areas and their need for efficient transportation systems, both public and private.

Figure 8.4.1 HAIDEP Urban Transportation Network



Source: HAIDEP Study Team.

8.5 Urban Road Network

1) Basic Network Planning Principles

A proper road network contributes to the efficient development of an urban area. Since road network would play an essential role in various urban activities, road network plan should be developed base on comprehensive view such as area potential, land use condition and space and environmental conditions besides the transport plan. HAIDEP road network plan has principally taken into account network pattern, road hierarchy, and road density in the process of developing the road network plan.

(1) Basic Network Configuration

Network patterning is as known effective method in network planning. The HAIDEP road network adopts the ring and radial-plus-grid patterns because of the existing road network and land-use characteristics are suitable for the pattern.

(2) Functional Hierarchy of Roads

To develop a proper road network, a systematic and hierarchical functional classification is necessary. The hierarchical classification of functions is composed of expressways, urban primary roads, secondary roads, and tertiary roads.

(a) **Urban Primary Road System:** The urban primary road system services the major portions of trips entering and leaving urban areas as well as the majority of throughway travel that wants to bypass the city center. In addition, significant intra-urban travel, such as between CBDs and outlying residential areas, between major urban core communities, or between major suburban centers, is served by urban arterials. For the proposed road network, the urban primary road is divided into major arterial system and minor arterial system. The major arterial system forms a significant framework linking up with the regional primary road network, while the minor arterial system provides trunk linkages between district centers and other subcenters.

(b) **Urban Secondary Road System:** The urban secondary road system interconnects with and augments the urban primary road system. It provides services to travels with moderate trip lengths at a somewhat lower level of travel mobility than primary roads. This system also distributes travel to geographic areas that are smaller than those identified with those of higher road systems. Secondary roads must serve not only vehicular traffic but also various transportation and nontransportation activities.

(c) **Urban Tertiary Road System:** The urban tertiary road system aims to provide access to areas located along the roads and to serve not only vehicular traffic but also nonmotorized vehicle and pedestrian traffic as well as roadside nontransportation activities. Some urban streets that have commercial frontage serve fairly substantial volumes of traffic. However, this traffic is of terminal in nature; thus, it does not provide movement throughout the area.

(3) Road Density

Table 8.5.1 Example of Target Road Density in Urban Area

Land Use	Target Road Density (km/km^2)
Residential	4
Commercial	6
Semi-Industrial	2
Industrial	1

Source: Ministry of Construction, Japan.

Road density is a key index of the road network's appropriateness for keeping a balance with land-use conditions. Target road densities corresponding to types of land use (see Table 8.5.1) have been introduced in various existing manuals. The HAIDEP urban road network plan also took into account road density in harmony with HAIDEP's proposed urban development plan especially the land-use plan.

(4) Urban Road Design Standards/Guidelines

(a) Typical Cross-sections

The proposed highway design standards for the master plan basically follow the Vietnamese standards (22 TCN-273-01), which were developed based on those of the American Association of State Highway and Transportation Officials (AASHTO) (see Table 8.5.2).

Table 8.5.2 Vietnamese Cross-section Standards[1)]

Classification	Design Speed (km/h)	Lane Width (m)	Median (m)	Shoulder (m)		Sidewalk (m)		Road Category in Vietnam Standards
				Left	Right	Walkway	Planted Strip	
RR4[2)]	80-100	3.75	6.00	1.0	2.5-3.0	1.75-3.00	3.00	Expressway
Urban Primary	60-80	3.50-3.75	2.0-5.0	2.5(6lanes) 1.0(4lanes)	3.0(6lanes) 2.0-3.0(4lanes)	1.75-3.00	3.00	Urban arterials
Urban Secondary	40-60	3.00-3.50	2.0-5.0	1.0(4lanes) -	1.5-2.5(4lanes) 1.5-2.5(2lanes)	1.75-3.00	2.00	Urban collectors
Tertiary Road	40-60	3.00-3.50	-	-	1.5-2.5	1.75-3.00	2.00	Local urban streets

1) The application of the road categorization indicated in Vietnam's standards to HAIDEP's road classification is based on their similarities in functions. Left shoulder width is combined with median width.
2) Since RR4 is an access-controlled expressway, parallel service roads must be provided.

In reality, however, it is often difficult to secure sufficient space for roads in urban areas due to resettlement problems and high compensation costs. Therefore, planning of road cross-sections must balance these constraints and the space requirements of roads according to function, because road space is not merely for vehicle traffic but also for pedestrian traffic, landscape improvement, and as space for various activities (see Table 8.5.3 and Figure 8.5.1).

Table 8.5.3 Typical Cross-sections of Proposed Roads

Function	Lane Width (m)	Median (m)	Shoulder (m)[1)]	Sidewalk[2)]		Remark
				Walkway	Planted Strip	
Ring Road 4	3.75	6.00	2.50	2.00	3.00	ROW=50m
Urban Primary	3.50	2.00	2.00	2.00	3.00	ROW6 lanes=33.5m
Urban Secondary	3.25	2.00	2.00	2.00	2.00	ROW 4 lanes=27m
Tertiary Road	3.00	-	2.00	1.50	2.00 (0.00)	ROW 2 lanes=15m

Source: HAIDEP Study Team.
1) Shoulder widths must consider roadside parking and lanes for motorcycles and bicycles.
2) Sidewalk width must consider roadside land use/activities, maintenance, landscape, etc.

Figure 8.5.1 Concept of Cross-section Planning based on Road Functions

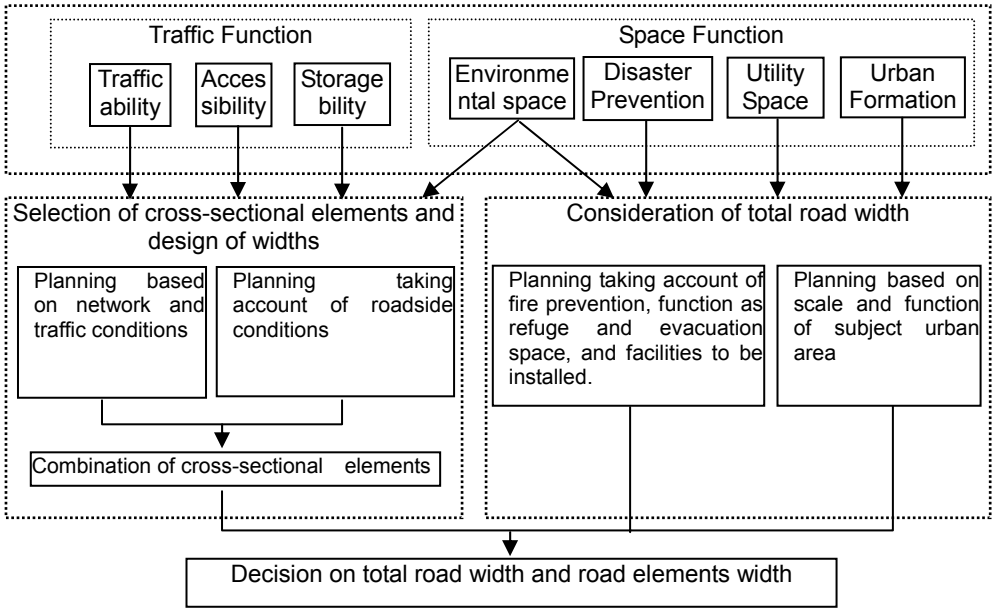
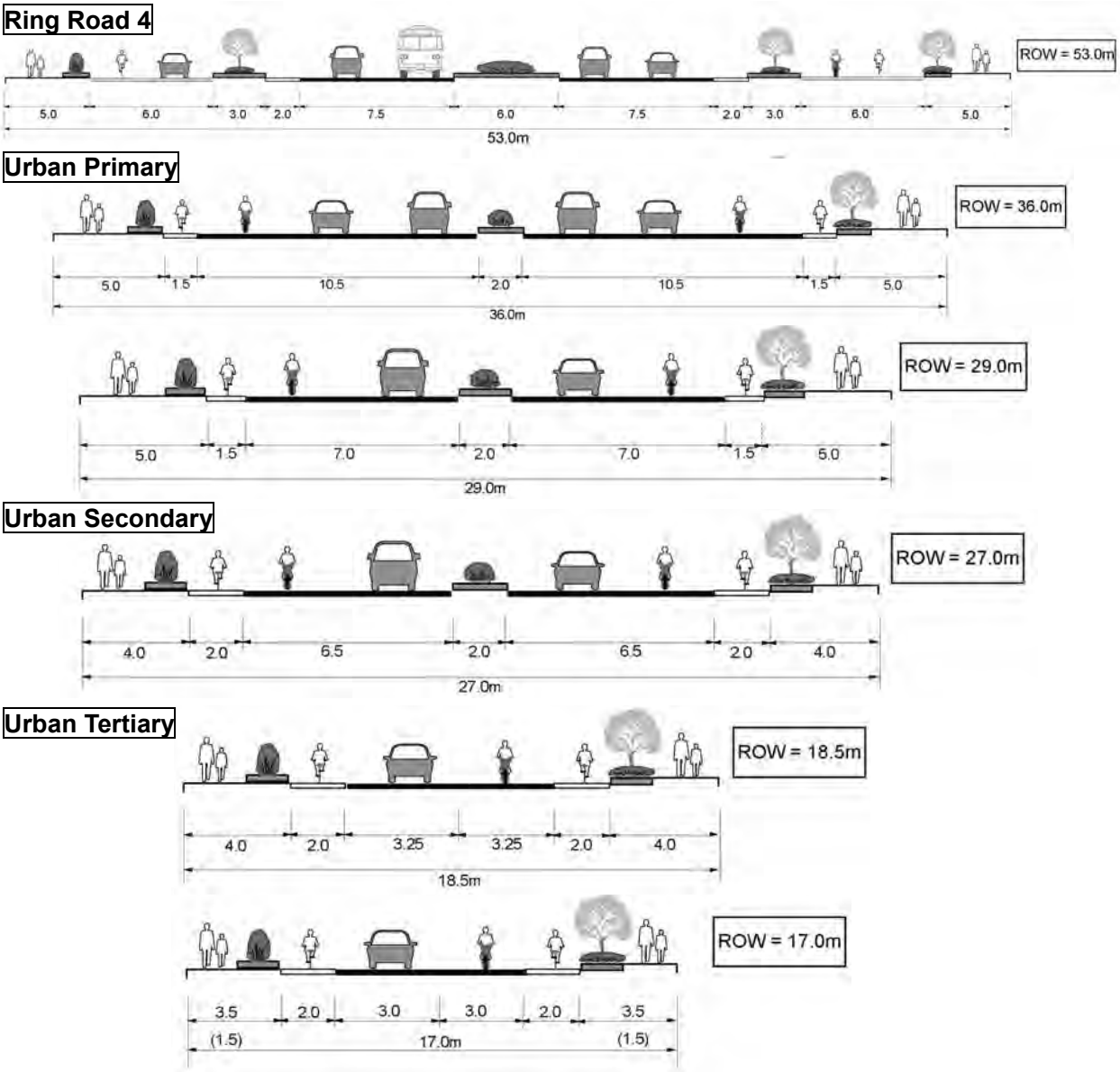


Figure 8.5.2 Typical Cross-sections in the HAIDEP Road Master Plan



(b) Design Speed

Design speed is the maximum speed for safe travel that can be maintained for a specified section of a road. The design speed is determined with respect to the terrain, adjacent land use, type of road, and the design speed of adjoining sections. The design speed will directly affect many geometric elements, like the horizontal and vertical alignments, sight distance, provision of super elevation, etc.

Other features, such as lane width and shoulder width, are also influenced by design speed. However, it is demonstrated scientifically that lane width has the largest effects on running speeds and comfortability levels. Therefore, HAIDEP selected and proposed design speeds within the permissible range of the Vietnamese standards (see Table 8.5.4).

Table 8.5.4 Design Speeds in Urban Areas

Category or Class	Design Speed (km/h)					
	20	40	60	80	100	120
Ring Road 4				● — ●		
Primary Road			● — ●			
Secondary Road		● — ●				
Tertiary Road		●				

Source: HAIDEP Study Team.

(c) Types of Intersections

When two roads have four or more lanes, excluding turning lane and speed change lane, intersecting each other, the intersection should be grade-separated, except where an at-grade intersection is allowable judging from the traffic volume on the intersection, traffic safety condition, road network composition, interval between intersections, and topography.

In selecting the appropriate type of intersection, both traffic operation and economic aspects should be considered. Then, too, the road network's hierarchy should be taken into account in accordance with a road's trafficability and accessibility (see Table 8.5.5).

Table 8.5.5 Types of Crossing Structure

Crossing	Typical Arrangement
1. Expressway and Expressway	• Interchanges in all cases.
2. Expressway and Primary/Secondary	• Normally interchanges, but no access where interchange spacing is too close.
3. Primary and Primary	• Normally grade separations.
4. Primary and Secondary Secondary and Secondary	• Normally intersections, but grade separations can be justified where capacity limitation causes serious delays, injury and fatality rates are high, and costs would be lower than an intersection.

Source: HAIDEP Study Team.

2) Proposed Urban Road

Figure 8.5.2 illustrates the proposed HAIDEP road network master plan which consists of eight (8) radial and four (4) ring roads. The radial roads are NH1 north and south, NH5 (Hai Phong), NH3 (Thai Nguyen), NH2 (Vinh Phuc), NH32 (Phu Tho), Hoa Lac Highway, and NH6 (Hoa Binh). While the HAIDEP, as well as the MOT, master plan includes four (4) ring roads, none of them at present has been completed.

The HAIDEP master plan elaborates the planned ring road system. However, RR4 is proposed as a new alignment in line with the HAIDEP urban land-use plan. The main function of the HAIDEP RR4 will be as interface between inter- and intracity road network systems around the future urban areas in Hanoi.

The proposed HAIDEP road network may best be described by area, namely: urban center districts in the south of the Red River, new urban districts in the east of the Red River, and the northern districts of Dong Anh and Soc Son.

(1) Primary Road Network

(a) **Urban Center Districts (Hoan Kiem, Hai Ba Trung, Tay Ho, Ba Dinh, Dong Da, Thanh Xuan , Cau Giay, Tu Liem and Thanh Tri – 9 districts):** The urban primary network plan should follow the development concept of the existing MOT network master plan which adopts radial and circumferential roads. This is also consistent with the existing road network and ongoing urbanization. However, a few changes are proposed, e.g. RR4 should be on a separate alignment from RR3 in Thanh Tri District. These changes are aimed at promoting a more effective urban development in that corridor.

(b) **New Urban Districts (Long Bien and Gia Lam):** Dense urbanization has sprawled in the hinterlands along NH1 and NH5, where agriculture is the main land use. Recent economic expansion has increased urbanization pressure in this area. Thus, the proposed road network is expected to play a major role in promoting smooth urbanization here, including the redevelopment of the existing airport area. The configuration of the local access and distributor road network within this area is proposed to be a grid pattern, linking it to the primary network of ring roads and radial routes and the three bridges crossing the Red River.

(c) **Northern Districts (Dong Anh and Soc Son):** Presently, there are three primary routes running north-south and east-west in these areas, i.e. Hanoi-Noi Bai Expressway, NH3 in the north-south direction, and NH18 and NH2 in the same corridor. In the north, Hanoi is linked to Noi Bai International Airport, which is located in Soc Son District. The land use in the area is mostly agriculture. Urban development, including industrial estates, is limited to the national highway corridors. Based on the existing land-use pattern, the proposed urban plan separates urban areas and central areas. Thus the road network system should be coordinated with the proposed urban plan to provide a local access and distributor road network in a grid pattern for the future urban areas.

(2) Secondary Road Network

(a) **Urban Center Districts (Hoan Kiem, Hai Ba Trung, Tay Ho, Ba Dinh, Dong Da, Thanh Xuan , Cau Giay, Tu Liem and Thanh Tri – 9 districts):** The urban secondary roads are planned to complement the urban primary and interdistrict roads mainly to ensure continued mobility on the whole urban road network. Major planned urban secondary roads in this area comprise supplementary ring and radial roads between the primary ring and radial roads such as RR2.5 and RR3.5.

(b) **New Urban Districts (Long Bien and Gia Lam):** The configuration of the local access and distributor road network within this area is proposed to be a grid pattern, linking it to the primary network. The major planned urban secondary road is located on the dyke along the Hong and Duong rivers, serving as the circumferential road in the area.

(c) **Northern Districts (Dong Anh and Soc Son):** Based on the existing land-use pattern, the proposed urban plan separates urban areas and central areas. Thus the urban secondary road system should be coordinated with the proposed urban plan to provide future urban areas with a local access and distributor road network in a grid pattern with the urban primary road system.

(3) Tertiary Roads

Tertiary roads are basically planned and constructed as an integrated component of urban development rather than from the transportation planning viewpoint.

(4) Intersections

Eighteen (18) intersections, mainly on RR4, will require interchanges. On the other hand, 24 intersections, mainly on RR2 and RR3, will require grade separations (see Figure 8.5.4).

(5) Major Bridges

Seven (7) bridges are proposed as part of the road network (see Table 8.5.6). The proposed bridges were identified by considering the network configuration, land-use plan, and construction costs.

Table 8.5.6 Proposed Bridges in the HAIDEP Master Plan Network

Name	Length (km)	No. of Lanes	Remark
RR4 West	2.0	4	Hong River
Nhat Tan	4.0	6	Hong River
Vinh Tuy	3.1	6	Hong River
Thanh Tri	2.0	6	Hong River
RR4 South	4.4	4	Hong River
Dong Try	0.6	6	Duong River
RR4 East	1.0	4	Duong River

Figure 8.5.3 Proposed HAIDEP Road Network (figure to be replaced)

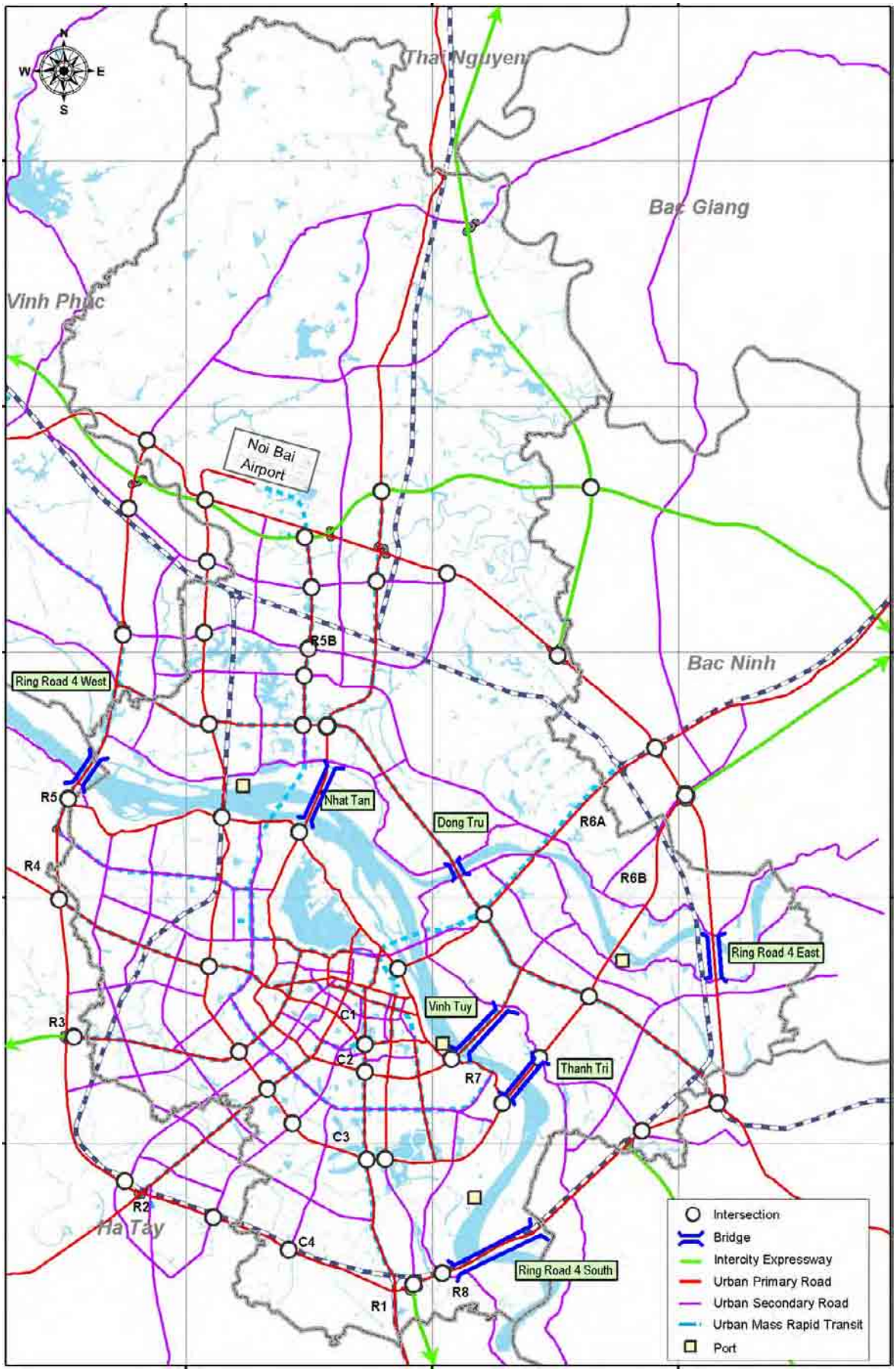
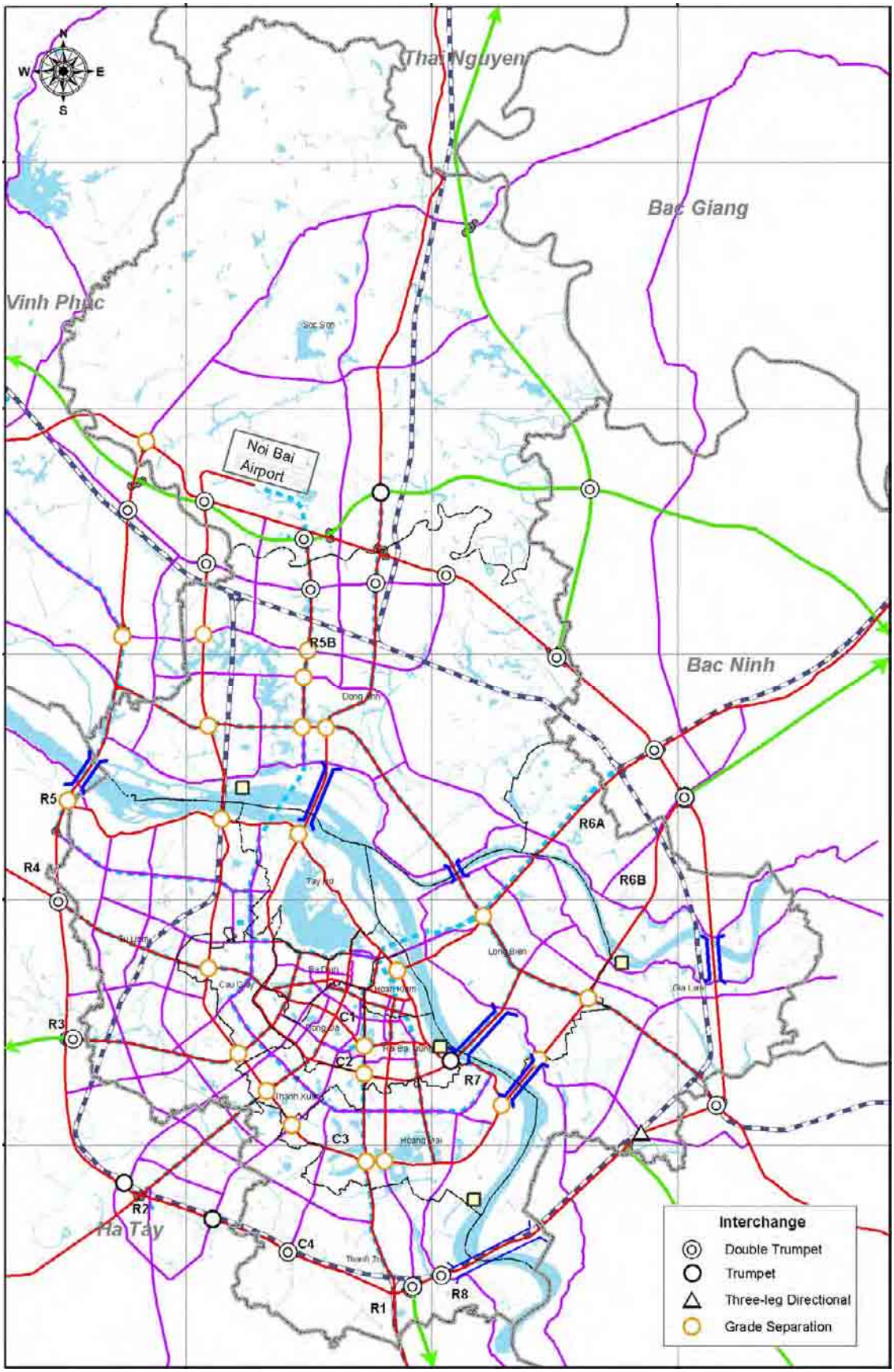


Figure 8.5.4 Types of Interchange on the Proposed Road Network



3) Proposed Road Projects

(1) Road Projects

The categories of road projects covered here are urban primary and secondary roads as well as expressways. Urban primary and secondary roads form the most basic framework for guiding normal urban development. These networks will also be an important space for the future development of railway, viaducts, or underground structures for railway and PBT (priority bus transit). Thus they deserve one of the highest priorities in the master plan. Project details are listed in Table 8.5.7 and illustrated in Figure 8.5.5.

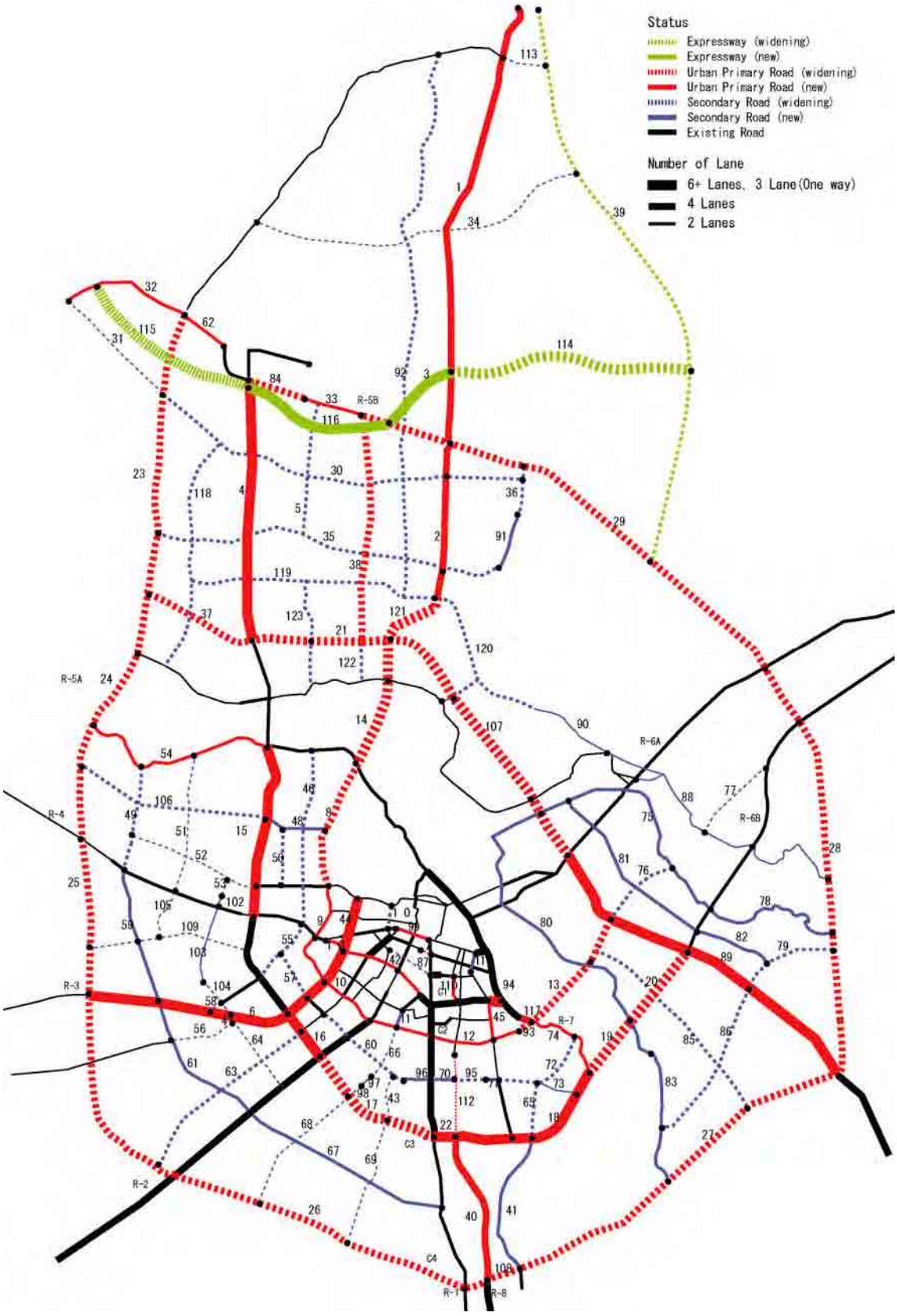
Table 8.5.7 Urban Road Projects in Hanoi

Package Code	Project Description			Distance (km)	No. of Lanes	Total Project Cost (mil. US$)
	ID	Name	Section			
1	1	NH3	NH3 Up-grade North	16.61	4	1,079
	2	NH3	NH3 Up-grade South	5.57	4	
	3	NH18	NH2-Dong xuan	2.92	6	
	6	Lang-Hoalac	RR2-RR4	8.33	6	
	9	RR(2)	DHQV - Cau Giay	2.15	4	
	10	RR(2)	Cau Giay - Nga tu so	4.10	4	
	11	RR(2)	Nga tu so - Nga tu Vong	2.26	4	
	15	RR(3)	Tu Liem Section	6.21	6	
	19	RR(3)	Thanh Tri 2/2	2.41	6	
	20	RR(3)	Thanh Tri - NH5	6.10	6	
	114	NH18	NH3-NH3 Expressway	8.89	6	
2	7		Giang Vo-Ton Duc Thang	0.52	4	206
	87		Hao Nam-Duong Le Duan	2.06	2	
	99		Nguen Thai Hoc	1.37	4	
	100		Duong Hoang-Kim Ma	0.80	4	
3	14	R5B	Nhat Tan brigde	5.30	6	499
	121	R5B	Nhat Tan bridge - NH3	3.71	6	
4	8	RR(2)	Phu Xa - HQV road	4.13	4	98
5	12	RR(2)	Nga tu Vong - Ng. Khoai	3.20	4	151
	93	RR(2)	Ng. Khoai	0.55	4	
	117	R(7)	RR2-Nguen Khoai	0.58	6	
6	13	RR(2)	Ng Khai-(Vinh tuy)-NH5	4.76	6	356
7	16	RR(3)	Khuat Duy Tien Section 1/2	2.09	6	356
	17	RR(3)	Khuat Duy Tien Section 2/2	5.19	6	
8	18	RR(3)	Thanh Tri 1/2	5.97	6	102
	22	RR(3)	NH1A-NH1A new	0.90	6	
9	107	RR(3)	NH3-NH1	8.50	6	145
10	21	RR(3)	NH3-Noi Bai road	6.62	6	151
	23	RR(4)	Noi Bai - TL North	12.00	4	
11	24	RR(4)	TLN - TLS (Hong River)	2.95	4	229
	25	RR(4)	TLS - Lang Hoa Lac	9.84	4	
12	26	RR(4)	Lang Hoa Lac - NH 1	20.76	4	186
	108	RR(4)	NH1 - Dike Road	2.14	4	
13	27	RR(4)	Dike Road - NH5	13.63	4	530
	28	RR(4)	NH 5 - NH1	15.25	4	
14	29	RR(4)	Nhat Tan - Noi Bai	17.59	4	155
	33	RR(4)	Nhat Tan-Noi Bai	2.14	4	
	62	RR(4)	NH2	1.88	4	
	84		Noi Bai Airport-Noi Bai TL Road	2.20	4	
15	32	NH2	RR4-NH23	4.67	4	35
16	34		R35-Xuan Giang	12.46	2	28
	113		NH3-NH3 Expressway	1.62	2	
17	35		Dong Anh -RR4	12.59	4	60
	36	NH3	Bypass (expressway) south 1/2	1.88	4	
	91		Bypass(expressway)South 2/2	2.15	4	
18	37		RR4-Bac Thang Long Road	4.09	4	21
19	119		North Thang Long - NH3	9.02	4	106
	120		NH3- exiaring NH3	6.34	2	
	90		Duong Bridge - existing NH3	5.87	2	
20	118		RR4- Dyke Road	8.52	4	292
	4		Noi Bai - TL	9.35	6	
	5		Van Tri- RR4	4.71	4	
	123		Dyke Road - Van Tri	3.90	4	
	38		RR3 - Noi Bai	8.02	6	
	122		Dyke Road- RR3	1.50	4	
21	39	NH3	Bypass (expressway) North	21.50	4	131
22	41		RR3-RR4	5.19	4	21
23	40	R8	RR3 - RR4	5.51	6	41
24	44		Thuy Khue Road-RR2	3.32	6	51
25	46	RR(2.5)	Dike Road - NH32	6.23	4	175
	48	R(4.5) a	R2 - R3 (east-west)	2.27	4	
	50		Hoang Quoc Viet-Xuan Dinh	2.07	4	
26	49	RR(3.5)	Dike Road - R4	3.83	4	430
	51		Dike Road - NH32	5.00	2	
	52		RR3-RR3.5	4.87	2	
	53		Hoang Quoc Viet-Stadium	0.63	2	
	54	R5A	Dike Road Extension	7.20	4	
	102		Stadium 1/3	0.65	2	
	106		RR3-RR4	7.14	4	

Cont'n of Table 8.5.7 Urban Road Projects in Hanoi

Package Code	Project Description			Distance (km)	No. of Lanes	Total Project Cost (mil. US$)
	ID	Name	Section			
27	55	RR(2.5)	H.Quoc Viet - Lang Cot	2.46	4	152
	57	RR(2.5)	H.Quoc Viet - Trung Kinh Ha	1.88	4	
28	58		Lang Hoa Lac - Stadium	0.50	4	240
	59	RR(3.5)	R4 - R2.5	4.87	4	
	103		Stadium 2/3	2.79	2	
	104		Stadium 3/3	1.55	2	
	105		NH32-R3.5	1.81	2	
	109		RR3-RR4	5.58	2	
29	42		Cau Giay - Kim Lien	5.03	4	260
	101		Duong La Thanh	0.75	4	
30	47		Lang Hoa Lac -RR2.5	0.32	2	257
	56		Lang Hoa Lac - RR3.5	2.33	2	
	61	RR(3.5)	R2-R3	5.51	4	
	63	R(2.5)	R3 - R4	7.14	4	
	64		Lang Hoa Lac-NH6	3.18	2	
31	43	R(1.5)	RR2.5-RR3	1.62	2	270
	60	RR(2.5)	Nhan Chinh - R8 1/5	3.76	4	
	66	R(1.5)	RR2-RR2.5	2.07	2	
	96	RR(2.5)	Nhan Chinh-R8 2/5	1.10	4	
	97	R(1.5)	RR2-RR2.5	0.45	2	
	98	R(1.5)	RR2-RR2.5	0.65	2	
32	67	RR(3.5)	NH1-NH5	7.76	4	139
	68	R(1.5)	R3 - R4	5.26	2	
	69		RR3-RR4	4.67	2	
33	65		RR2.5-RR3	2.14	4	308
	70	RR(2.5)	Nhan Chinh - R8 3/5	0.84	4	
	71	RR(2.5)	Nhan Chinh - R8 5/5	0.51	4	
	72	RR(2.5)	Nguyen Tam Trinh Road-Tran Khanh Du Road	3.63	4	
	73		Vinh Hung-RR3	1.75	4	
	74	R7	Nguyen Khoai-Thanh Tri	3.31	4	
	95	RR(2.5)	Nhan Chinh-R8 4/5	1.03	4	
	112		Pho Truong Dinh-NH1A	2.90	2	
34	75		NH 1A new-Dong Tru Bridge	9.02	4	57
	76		NH5-R391	2.77	4	
	81		Dike Road -NH1A New	6.62	4	
35	78		NH 1A new-RR4	5.51	4	41
	79		RR4-NH5	3.70	4	
	82		NH1A New-R321	2.92	4	
36	80		Dong Tru Bridge-RR3	11.55	4	54
37	83		RR3-RR4	6.42	4	58
	85		RR2-RR4	4.48	4	
	86		R390-NH5	6.11	4	
38	77		Dike Road-NH1	3.31	2	23
	88		NH 1A-RR4	9.87	2	
39	89	NH5	Nguyen Van Cu Road-RR4	10.79	6	103
40	45		RR1-RR2	1.45	4	89
	94	RR(1)	Lung Yen	0.55	6	
	110		Tran Nhan Tong-Duong Dai Co Viet	1.01	4	
	111		Tran Tien-Le Van Huu	0.70	4	
41	92		RR2-North Ring Road	19.79	4	120
42	30		RR4- Phuc Yen	13.77	4	53
	31	RR(4)	NH2-RR4	4.74	2	
43	115	NH18	NH2-Noi Bai TL	7.07	6	140
	116	NH18	NH2-Noi Bai TL	5.42	6	
				621.00		7,993

Figure 8.5.5 Urban Road Projects in Hanoi



Source: HAIDEP Study Team.

(2) Road Project Packages

In the HAIDEP Urban Transportation Master Plan, road projects are packaged by corridor and by area to maximize their respective benefits. Each project package proposed in the master plan is described below (see Table 8.5.8 and Figure 8.5.6).

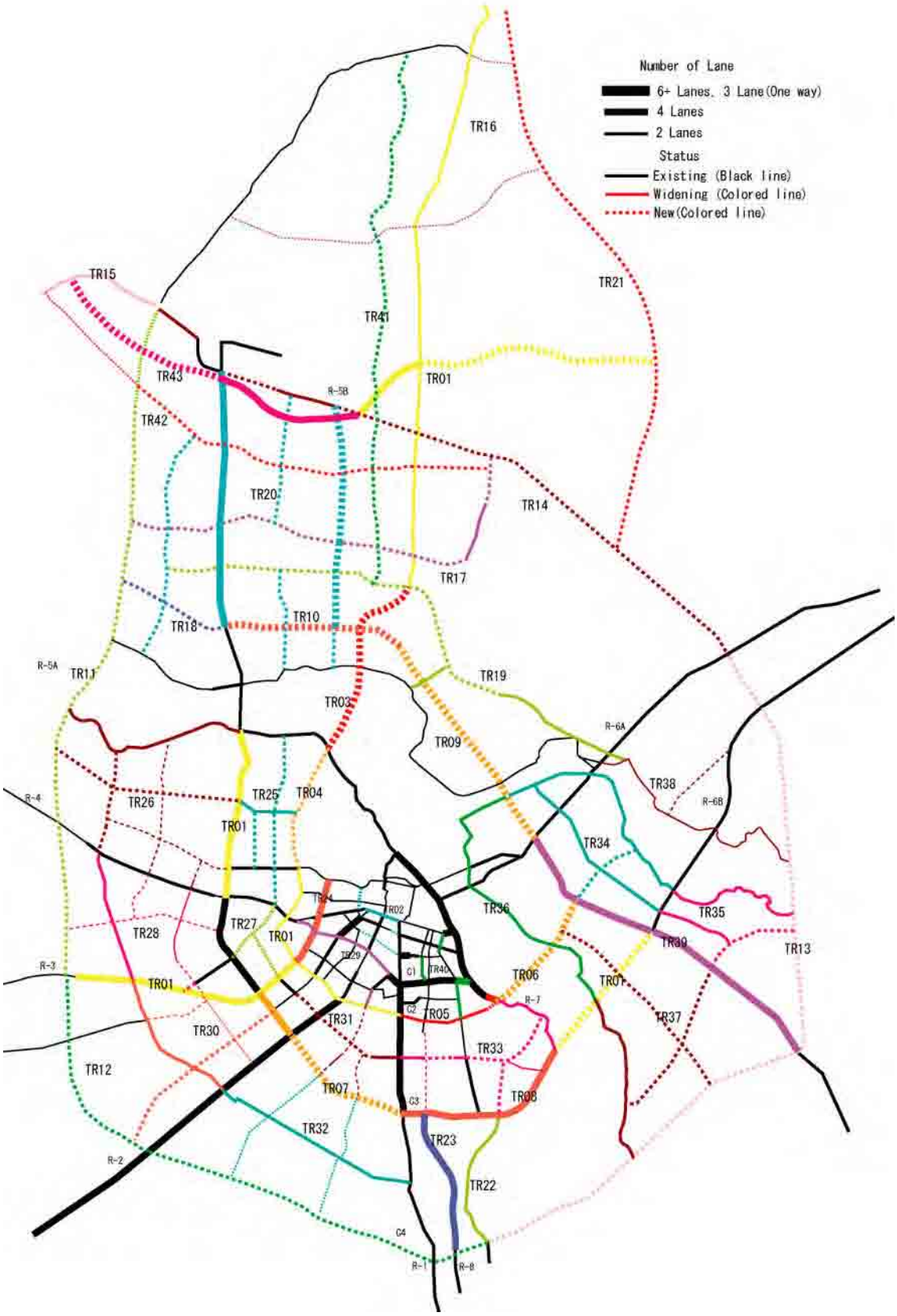
Table 8.5.8 Project Package Descriptions, Costs, and ROW Shares

Project	Description	Cost (US$ mil.)	ROW Share in Cost (%)
TR-01	Consists of ongoing road projects such as NH2, NH3, NH18, RR2, and RR3.	1,079	64
TR-02 CBD Central Area Upgrade	Will enhance the primary and secondary networks' functions in the CBD. The east-west road network will especially be improved with the development of missing links such as: 1. Giang Vo-Ton Duc Thang: 0.52km, 4 lanes (primary road). 2. Nguyen Thai Hoc: 1.37km, 4 lanes (primary road). 3. Hao Nam-Le Duan: 2.06km, 2 lanes (secondary road). 4. Hoang Quoc Viet-Kim Ma: 0.8km, 4 lanes (part of RR2, primary road). (1–3: These 3 sections are connected to 3 radial roads ie R-1,R-2, and R-3.)	206	96
TR-03 RR2 (Nhat Tan bridge and viaduct)	Part of RR2 connecting the northern and southern areas of the Hong River through Nhat Tan Bridge. This project will connect CBD with the new urban area in western Ho Tay and that in northwestern Dong Anh, and further link with NH3 toward northern provinces. Total length: 9.0 km (4.0km for bridges) 6 lanes (primary road).	499	12
TR-04 RR2 (CBD west section)	Part of RR2 along Ho Tay, running from Nhat Tan Bridge (TR-03) to the CDB. Total length: 4.13km, 4 lanes (primary road).	98	85
TR-05 RR2 (CBD south section)	Consists of RR2 south and the widening of a short road section connecting Nguyen Khoai to RR2. This project will connect the important radial road R-1 (NH1A) with RR1, as well as the CBD south of Hanoi with the new urban area in Long Bien District through TR-06. Total length: 3.75km, 4lanes (part of RR2, primary road).	151	89
TR-06 RR2 (Vinh Tuy bridge section)	Aims to form RR2 and to connect the eastern and western areas of the Hong River through Vinh Tuy Bridge, which is under construction. The project includes viaducts and a bridge. Total length: 4.76km, 6 lanes (primary road).	356	6
TR-07 RR3 (southwest section: Khuat Duy Tien road)	Aims to complete RR3 in the southwest. Phase 1 will be completed by end of 2006. It connects the new national administrative center (Hoa Lac) and the national union sport center with southern Hanoi. It also connects 2 important radial roads: Hoa Lac Expressway (R-3) and NH6 (R-2). Total length: 6.11km, 6 lanes, primary road.	356	83
TR-08 RR3 (southeast section: Thanh Tri, NH1A - NH1A new)	Aims to complete RR3 in the southeast. It connects 3 important radial roads, ie NH6 (R-2), NH1A (R-1), and Phap Van-Cau Gie Expressway (R-8), as well as the old Thanh Xuan urban village with the new urban district of Hoang Mai. After this section is completed, then the Thanh Tri Bridge project can become more effective. Total length: 6.64km/ 6 lanes, primary road.	102	67
TR-09 RR3 (northeast section: NH1A - NH3 including Dong Tru bridge)	Aims to complete RR3 in the northeast as an extension of NH5. It will connect 2 radial roads: NH1A (R-6A) and NH3. It connects new urban Long Bien district with new urban village Dong Anh south (Vinh Ngoc). Total length: 9.27km/ 6 lanes. Primary road.	145	35
TR-10 RR3 (north section: NH3 to Thang Long-Noi Bai road)	Aims to complete RR3 in the north. It connects 2 important radial roads R-5B (Nhat Tan bridge – RR2 expanding) and Thang Long-Noi Bai road. It also connects Thang Long north IZ with NH5 to Hai Phong port. Total length: 5.95km/ 6 lanes, primary road.	151	44
TR-11 RR4 (northwest section: Phuc Yen/Noi Bai to Lang-Hoa Lac expressway)	Aims to complete RR4 in the west. This project intents to connect new urban village Me Linh (Vinh Phuc) with Thanh Noi, An Khanh new urban villages and Hoa Lac high-tech IZ, and also to connect expressway Noi Bai-Viet Tri with NH2, NH32 (R-4) and Lang-Hoa Lac Expressway (R-3). Total length: 25.41km (including Thuong Cat bridge)/ 4 lanes . Primary road.	229	27
TR-12 RR4 (southwest section: Lang-Hoa Lac exp. to Phap Van – Cau Gie expressway)	Aims to complete RR4 in the southwest. The project will connect high-tech Hoa Lac IZ with the south of Ha Dong town and new urban village Tu Hiep (Thanh Tri), it links Lang-Hoa Lac Expressway (R-3) with NH6 (R-2), NH1A (R-1), Phap Van-Cau Gie expressway (R-8). Total length: 19.92km/ 4 lanes. Primary road.	186	48
TR-13 RR4 (southeast section: R-8 to NH1A)	Aims to complete RR4 in the southeast. This project intents to connect new urban areas: Van Giang, Nhu Quynh and Tu Son. It also intents to link 4 main radial roads: NH1A new (R-8), NH5, NH1A new (R-6B), NH1A (R-6A). After completion, It will also take place as the bypass of NH1A. Total length: 25.38km/ 4 lanes, primary road.	530	20
TR-14 RR4 (north section: NH1A to Thang Long-Noi Bai	Aims to complete north section and ending RR4 that links Tu Son new urban village to Noi Bai. It connects some important national arterial roads: NH1A (R-6A), Dong Anh-Thai Nguyen expressway, NH3, as an extension of RR2 (R-5B) and Thang Long-Noi Bai road.	155	51

Project	Description	Cost (US$ mil.)	ROW Share in Cost (%)
road)	Total length: 30.07km/ 4 lanes. Primary road.		
TR-15 NH2 west	An inter-city road connects the urban center of Hanoi and the satellite city of Viet Tri. It creates a continuous section which links from Laocai to Noi Bai, Cai Lan port. Total length: 9.37km/ 4 lanes. Primary road.	35	56
TR-16 East-West highway north of Hanoi	An east-west highway in the north of Hanoi City connects provincial road 35 to NH3 and then to expressway Dong Anh-Thai Nguyen, seeing as east-west corridor of Soc Son district. Total length: 10km/ 2 lanes, secondary road.	28	50
TR-17 East-West highway north of Hanoi	An east-west highway in the north of Hanoi City inside RR4 connects Dong Anh town with new urban village and tourism Van Tri area and also connecting some of vertical artery roads of Dong Anh district, Total length: 15.54km/ 4 lanes, primary road.	60	60
TR-18 Northwestern east-west highway of Hanoi	An east-west highway in the northwest of Hanoi City connects RR4 and Noi Bai – Thang Long road, seeing as the extension road of RR3 and also playing as an important road of the Thang Long north IZ. Total length: 2.55km/ 4 lanes, primary road.	21	35
TR-19 Northeastern east-west highway of Hanoi	An east-west highway in the northeast of Hanoi City connects the north Thang Long area and Duong bridge via NH3, it also cuts through The Greenery Corridor (HAIDEP MP proposal) in north-east area of Hanoi. Total length: 21.2km/ 2-4 lanes, secondary road.	106	76
TR-20 North-South highway north of Hanoi	A north-south highway in the north of Hanoi City connects RR3 and dyke road with Noi Bai international airport, along with UMRT development. It also connects the new urban Soc Son village with the CBD area. Total length: 36.0 km/ 4-6 lanes, primary and secondary road.	282	58
TR-21 North-south expressway	A north-south expressway parallels to NH3. It connects the capital Hanoi to Thai Nguyen city (from RR4 to Thai Nguyen) Total length: 15.83km (Hanoi area)/ 4 lanes, expressway.	131	34
TR-22 North-south road south of Hanoi	A north-south road in the south of Hanoi capital connects RR3 with RR4 (parallel to Phap Van-Cau Gie expressway and NH1A). It seems to be a road which depress of traffic volume for NH1A and Phap Van-Cau Gie expressway. Total length: 4.83km/ 6 lanes, primary road.	21	75
TR-23 North-South expressway	A north-south expressway (upgrade of NH1A). Total length: 4.18km/ 4 lanes, expressway.	41.3	85
TR-24 West corridor: Thuy Khe-RR2	The west corridor designated as radial road 3 (R-3). It intents to connect new urban villages in the south-west of Hanoi to Ho Tay park and tourism area. Total length: 3.32km/ 6 lanes, primary road.	51	90
TR-25 NH32 north corridor (inside RR3)	Consists of primary and secondary roads in the north of NH32 and east of RR3, these are located at and seeing as the main road system of new urban village Ho Tay west. In which, the section dyke road-Hoang Quoc Viet is a part of RR2,5. Total length: 8.7km/ 4 lanes, primary and secondary roads.	175	91
TR-26 NH32 north corridor (outside RR3)	Consists of primary and secondary roads in the north of NH32 and west of RR3, these are located at and seeing as the main road system of new urban area of Thang Long south. In which, the section Lien Mac-NH32 is a part of RR3,5. Total length: 20.71km/ 4 lanes, primary road & 4.26km/ 2 lanes, secondary road.	430	90
TR-27 Lang-Hoa Lac north corridor (inside RR3)	Consists of primary and secondary roads north of Lang-Hoa Lac expressway and east of RR3, seeing as the main road system of new urban villages of Trung Hoa & Dich Vong. In which, the section Hoang Quoc Viet-Lang Cot is a part of RR2,5. Total length: 4.31km/ 4 lanes, primary road.	152	96
TR-28 Lang-Hoa Lac north corridor (outside RR3)	Consists of primary and secondary roads in the north of Lang-Hoa Lac expressway and west of RR3, serving as the main road system of two new urban villages, Me Tri and My Dinh, the national sport complex, and the National Assembly House. The section from R-4 to R-3 is part of RR3.5. Total length: 4.76km/ 4 lanes, primary road & 3.05km/ 2lanes, secondary.	240	93
TR-29 CBD southwest area upgrade	This aims to enhance the southwest of the CBD road system. The project is aimed to upgrade the main road system which is located at Dong Da district where population is highest of the City. Total length: 6.55km/ 4 lanes, primary road.	260	96
TR-30 NH6 north corridor	Consists of primary and secondary roads in the north of NH6. This is main road system which locates at a part of Thanh Xuan and south of Tu Liem district. Total length: 11.73km/ 4 lanes, primary road & 2.91km/ 2lanes, secondary road.	257	91
TR-31 NH6 south corridor (inside RR3)	Consists of primary and secondary roads in the south of NH6 and east of RR3. This is the main road system of the west Hoang Mai, east of Thanh Xuan district and new urban village Dinh Cong. In which, the section from Nhan Chinh to R-1(NH1A) is a part of RR2,5. Total length: 7.68km/ 4 lanes, primary road & 1.1km/ 2lanes, secondary road.	270	96
TR-32	Consists of primary and secondary roads in the south of NH6 and outside RR3. This is the main	139	87

Project	Description	Cost (US$ mil.)	ROW Share in Cost (%)
NH6 south corridor (outside RR3)	road system of the west Thanh Tri and the Linh Dam, Tam Hiep new urban area. In which, the section from R-2 to R-1 is a part of RR3,5. Total length: 13.02km/ 4 lanes, primary road & 1.35km/ 2 lanes, secondary road.		
TR-33 NH1A east corridor (inside RR3)	Consists of primary and secondary roads in the east of NH1A and north of RR3. This is the main road system of Hoang Mai district, new urban Den Lu village, Yen So park and harmonize lake. Total length: 12.16km/ 4 lanes, primary road & 2.9km/ 2 lanes, secondary road.	308	93
TR-34 NH5 northwest corridor	Corridor is located in the northwest of NH5. This is the major road system of the north east of Long Bien district which will be planned to be the most development area of the district with 2 new urban villages: Duc Giang, Viet Hung; and also 4 IZs: Sai Dong A,B, Duc Giang-Cau Duong. Aim to connect NH1A (R-6A) with NH1A new (R-6B) and the segment road of Vinh Tuy bridge extension. Total length: 14.2km/ 4 lanes, primary road.	57	63
TR-35 NH5 corridor east of Hanoi	Corridor is located in the east of NH5. This project is located in the north-east of Gia Lam district. In which, its roads intent to connect with the center of Gia Lam district and Van Giang town of Hung Yen province. At present, here is the agricultural area, far away of the City center. However, this area will be developed to grow into the new IZ Phu Thuy and new container port Phu Dong. Total length: 6.74km/ 4 lanes, primary road.	41	61
TR-36 NH5 corridor east of Hanoi (inside RR3)	Corridor is located in the southwest of NH5 and inside RR3. It is parallel to the left dyke road of Red river, that is connected the City center up to Bat Trang, Kieu Ky craft villages and the new urban village VanGiang. This area has 2 new urban areas too Thach Cau and Bo De and Ha Nel IZ, Gia Lam airport. Total length: 13.07km/ 4 lanes, primary road.	54	78
TR-37 NH5 corridor east of Hanoi (outside RR3)	Corridor is situated in the southwest of NH5 and outside RR3. This package continues of the TR-36, TR-35 and having the same function to develop the whole Gia Lam, Long Bien district area. A part from that, it function is to joint RR2, RR3 and RR4, seeing as the depression road of NH5. Total length: 11.9km/ 4 lanes, primary road & 3.05km/ 2 lanes, secondary road.	58	61
TR-38 NH1 corridor east of Hanoi	A corridor connects the NH1A, NH1A new and RR4.This project intents to upgrade the left dyke road of Duong river, seeing as the trunk road of north Gia Lam district. Along this road, there are IZ and transshipment railway station of Yen Vien, there also locates some historical vestiges: Phu Dong, Ninh Hiep. Total length: 7.46km/ 2 lanes, secondary road.	23	52
TR-39 Southeast highway (NH5)	The south-east highway to Hai Phong city (expanding of NH5). Total length: 10.79km/ 6 lanes, National trunk road (a part of Kunming-Hai Phong East-West corridor.	103	76
TR-40 CBD southeastern area upgrade	This project will improve the southeast of the CBD road system. Most is upgraded primary road system which belongs to Hai Ba Trung district. It is the second crowded population and commercial activity area of Hanoi capital. The project intents to connect CBD area of Hoan Kiem,Hai Ba Trung with RR2 and the south area of residential area of Hoang Mai district. Total length: 0.55km/ 6 lanes & 3.16/ 4 lanes, primary road.	89	92
TR-41 North-south highway north of Hanoi	This project intends to connect Dong Anh new urban area to RR4 and to continue extension to Hanoi border. It also the trunk road of Dong Anh, Soc son district, seeing as the connection road of new urban Soc Son village to CBD area of city. Total length: 19.79 km/ 4 lanes, secondary road.	120	75
TR-42 West highway north of Hanoi	The project is seeing as the major trunk road of the new urban Dong Anh north area and Phuc Yen town. It al so support to the inter city transport from Hanoi to Vinh Phuc. Total length: 13.77km/4 lanes, primary road. & 4.74km/ 2 lanes, secondary road.	53	52
TR-43 West highway north of Hanoi	This section is a part of expressways: Noi Bai-Ha Long and Noi Bai-Viet Tri. Its main function is the same as TR-42's; however, it is part of the international east-west corridor of Kunming-Ha Long. Total length: 12.49km/ 6 lanes, expressway.	140	61

Figure 8.5.6 Location of Proposed Project Packages



Source: HAIDEP Study Team.

4) Requirement for Lands

By 2020 the increase in ROW to secure arterial road networks in Hanoi City is estimated to be 12km^2, based on the HAIDEP Urban Transportation Master Plan.

In general, land and compensation costs will be a major problem in implementing urban road improvement projects. In implementing the HAIDEP road projects, the share of land and compensation in the total project cost is estimated at 64%, showing that planning should take into account not only budget disbursement schedules for physical construction, land, and compensation, but also the necessary period for expropriating land and properties such as buildings.

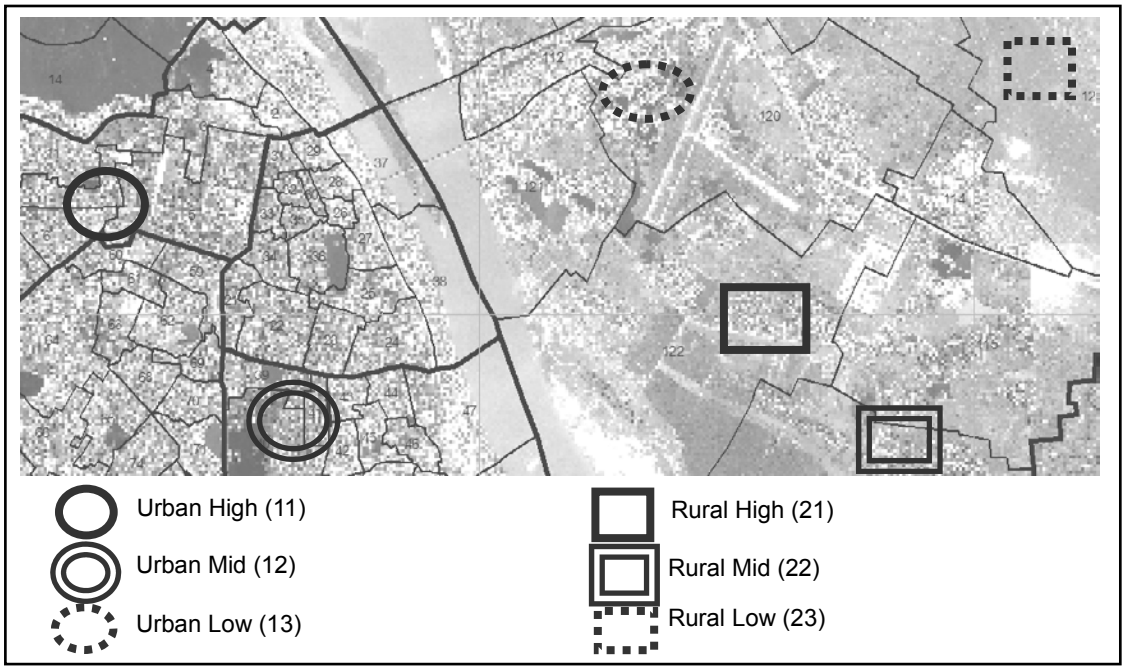
Table 8.5.9 shows the unit prices for land acquisition and compensation which are categorized based on Decision 199/2004/QD-UB, dated 29 December 2004. Figure 8.5.7 shows the typical locations of variously priced land plots.

Table 8.5.9 Land Acquisition and Compensation Costs

Unit: US$/m^2

Expenditure Item	Urban Area			Rural Area (Agriculture)		
	High (11)	Middle (12)	Low (13)	High (21)	Middle (22)	Low (23)
Land Acquisition	1,500	1,000	500	300	150	50
Compensation	340	260	190	125	75	25

Figure 8.5.7 Categories of Urban and Rural Land



Source: HAIDEP Study Team.

The compensation price for each land category was estimated based on the density of roadside buildings and the unit cost of buildings, as shown in tables 8.5.10 and 8.5.11.

Table 8.5.10 Compensation Costs for Urban Land

	Density of Roadside Buildings (%)	Unit Cost (US$/$m^2$)	Compensation Cost (US$/$m^2$)
High (11)	90	125	337
Mid (12)	70	125	262
Low (13)	50	125	187

Table 8.5.11 Compensation Costs for Rural Agricultural Land

	Density of Roadside Buildings (%)	Unit Cost (US$/$m^2$)	Compensation Cost (US$/$m^2$)
High (21)	50	125	125
Mid (22)	30	125	75
Low (23)	10	125	25

Source: "Study of Housing Development for Low-Income People in Urban Areas and Concentrated Industrial Parks," Ministry of Construction, for unit cost.

Note: Number of floors was assumed to be 3 in urban areas and 2 in rural areas.