CHAPTER 14 TRAFFIC MANAGEMENT PLAN

14.1 Introduction

The fundamental goals for traffic management are to provide a safer and move comfort above road transport system through engineering, enforcement, education and environmental enhancement. In the main traffic management aims to utilize and improve existing infrastructure to accommodate current and future traffic demand.

Recently, the World Bank submitted to Vietnam Government a plan to upgrade the Hanoi road network system to accommodate future traffic demand. The detail of the plan has been issued by the World Bank in the "Urban Transport Management Study Report".

The proposal submitted by the World Bank are separated into two following parts:

Part 1: Corridor /junction improvements (US$ 13.1 million) as follows:
- Cau Giay junction
- Tran Quang Khai corridor
- Le Duan corridor
- Tay Son corridor
- Bach Mai corridor

Part 2: Central area improvement (US$ 6.0 million) as follows:
- Ancient quarter
- French quarter (CBD)

14.2 Traffic Control

A summary of the traffic management scheme for Hanoi is shown Fig. 14-2-1. The traffic management scheme can be divided into two phases: Traffic control and road user control. As far as traffic control is concerned, separation of non motorized vehicles from motorized vehicles is the key issue in Hanoi.

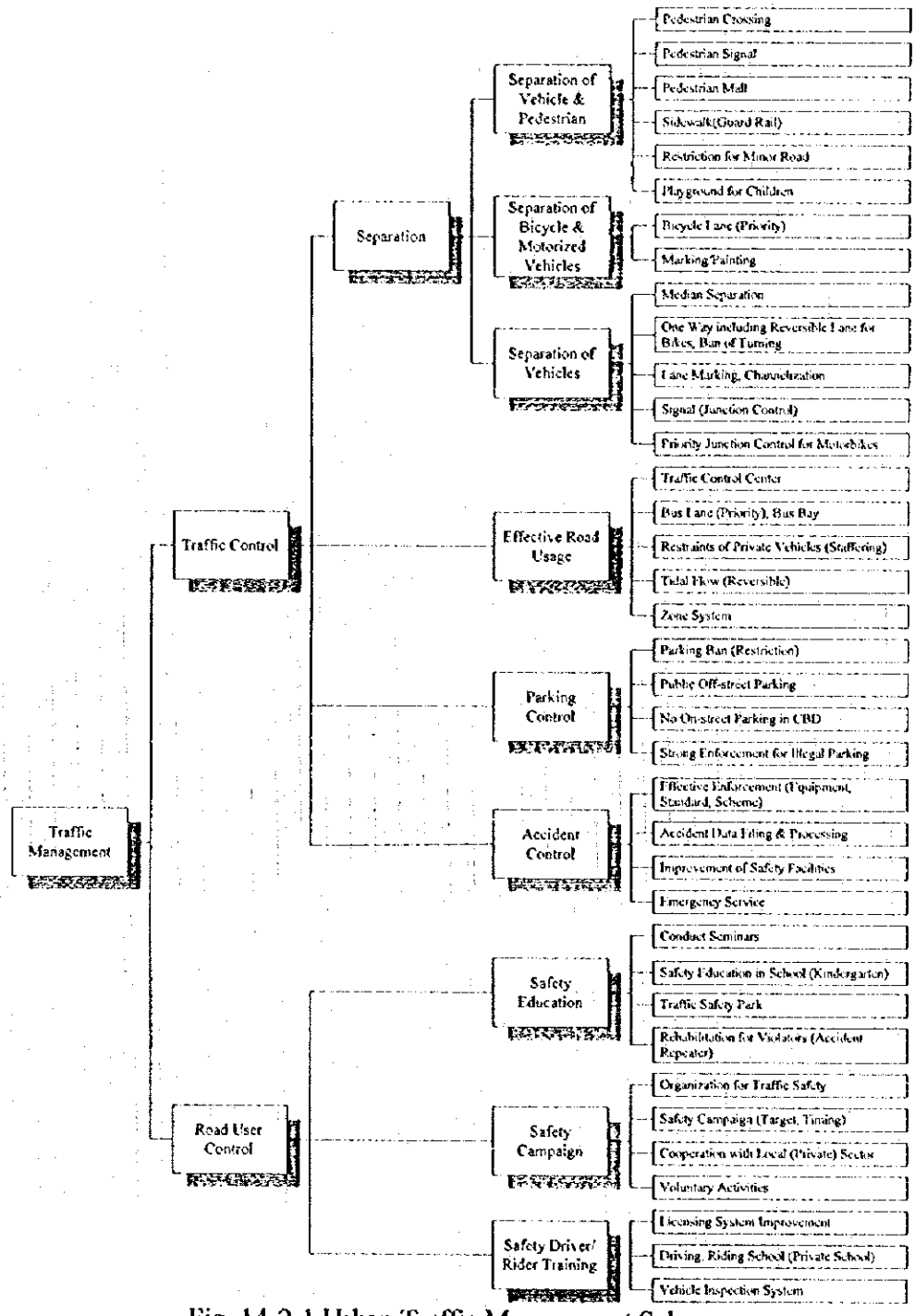


Fig. 14-2-1 Urban Traffic Management Scheme

14.2.1 Segregation of Motorized Traffic from Non-motorized Traffic (Bicycle)

The reduction of conflicts among road users is a key issue in obtaining smoother and safer traffic conditions. An easy but affective measure is to segregate motorized vehicles from non-motorized vehicle. In Hanoi, a very large volume of bicycles is observed on the streets. Their riders are generally unaware of traffic rules and regulations. Thus, motorcycles which are faster than bicycles, tend to use the middle of road hampering four wheel vehicle movement.

One of the basic and practical techniques in the traffic management scheme for Hanoi is a "Segregation System" which separates non-motorized and motorized traffic flows. And as the result, traffic capacity would be increased. The segregation of bicycle from motorized traffic could be applied on routes in French quarter (CBD) allocated as "one way streets". (Hue - Hang Bai, Ba Trieu for example). An irregular type of one way system where on-coming traffic is restricted to motorcycles (Pho Doi Can) is also effective.

This project is called the "Traffic Capacity Enhancement Program" (See J03, Appendix). It is to demonstrate effective road usage in one way streets to separate motorized and non-motorized vehicles. In this proposal, Pho Hue (1.9 km) and Le Duan (1.2 km) are the target routes. Through careful consultation with related agencies duplication with the World Bank proposal would avoided (Fig. 14-2-2 and 14-2-3).

Fig. 14-2-2 Selected Four Routes for Bicycle Lane Study

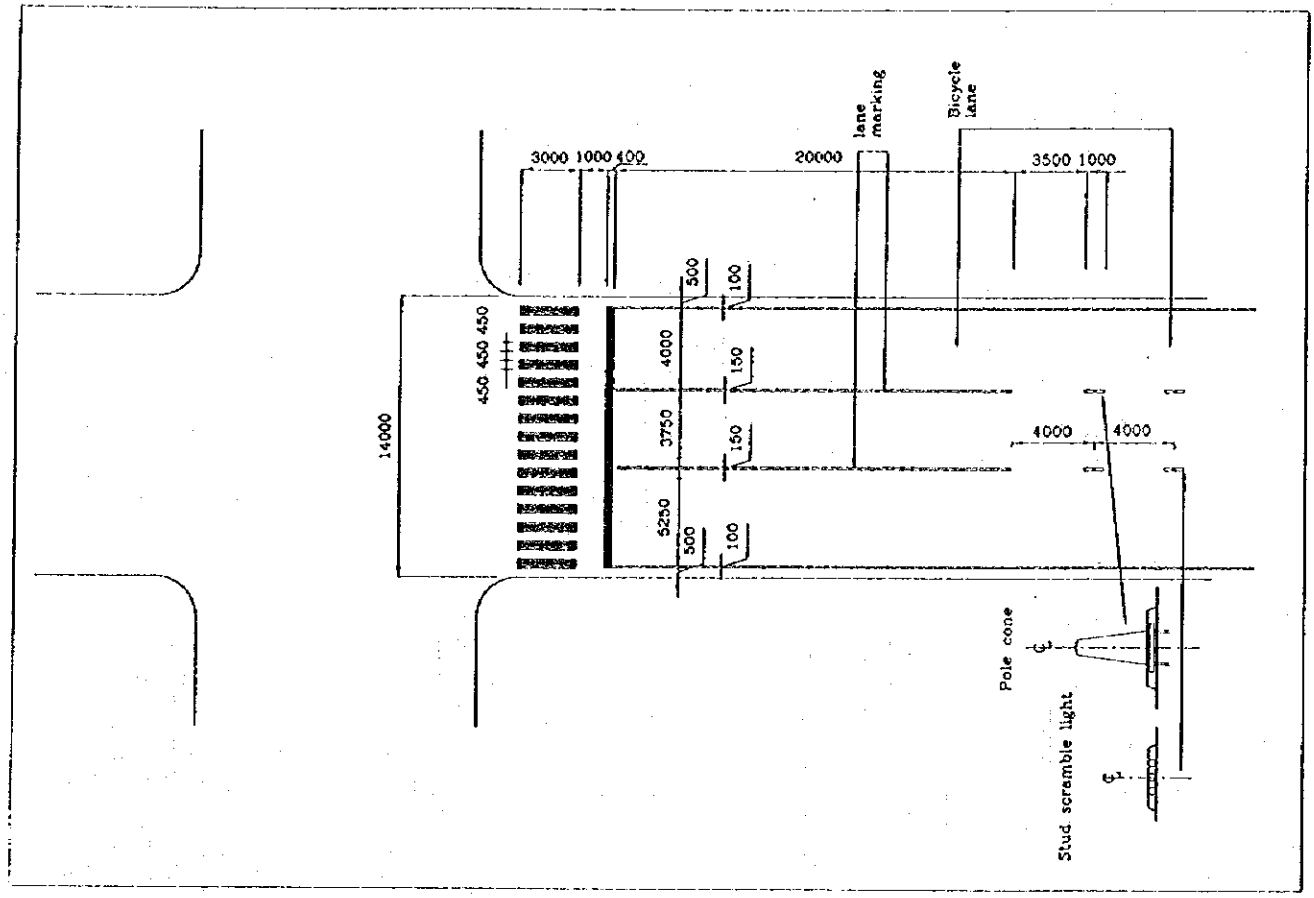


Fig. 14-2-3 Example of Bicycle Lane

The cost of creating the physical safety conditions for bicycles is minimal, consisting simply of painting the pavement and putting signs on many roads, erecting physical barriers and constructing bicycle lanes of a few meters wide with light weight bearing pavements.

14.2.2 Segregation of Pedestrian Traffic

Pedestrian behavior including many peddlers is unpredictable. They walk on the streets and not on pavements because most of time the pavement is hampered by street shops, parked motorcycles and poor maintenance of the pavement surface. For safer and smoother traffic, pedestrians should be segregated from other traffic.

For example, fences or guardrails separating sidewalks and the carriageway should be installed wherever pedestrian volumes are sufficiently high to justify the expense. Sidewalks should be improved much more to accommodate easy separators for pedestrians. Pedestrian safety facilities must be improved to ensure a safe pedestrian environment. Also, pedestrian crossing should be implemented. The zebra crossings should be at least 2m wide for the crossing pedestrian. Kerbs should be constructed along the road edge.

14.2.3 Traffic Restraint Scheme

In this report traffic restraint program is proposed (see project J01 Appendix) for the urgent implementation. Traffic coming into Old City Area should be restricted and non-motorized traffic would enjoy a smoother and less polluted environment. Although the projected sites in Old City Area overlap with the proposal by the World Bank, through careful consultation with related agencies project duplication would be avoided.

14.2.4 Installation of TV Cameras

To guarantee smoother traffic flow at intersections, appropriate monitoring of traffic movements is indispensable. In combination with the installation of the Traffic Control Center by French Government Aid, monitoring TV camera installation and staff training would be proposed (see J02, Appendix).

14.2.5 Revising Traffic Rules and Regulations

Since road users are very indifferent to the rules on the road, current traffic rules and regulations are not observed. As one of the crucial problems for safety, is that conflicts occur when four wheel vehicles intend to make a right turn. They have to change their position from the center (extreme left position in one way streets) to the right edge of the corner of the intersection. Due to this intersection maneuver which occurs at rather slow speed near to the intersection, vehicles moving straight on, particularly bicycles and motorcycles, are forced to merge with such intersecting vehicles. One of the treatments for this behavior, is that four wheel vehicles intending right turn should change their position at an earlier stage. Evasive turning behavior by four wheel vehicles and motorcycles should be prohibited at signalized intersections where crossing pedestrians are exposed at a dangerous situation.

Turning to right at red signal may increase traffic capacity but it also creates high risks for pedestrian who are trying to cross. Turning behavior at red signal should be prohibited . Passing should strictly be prohibited in all two lane roads and one way roads in the CBD area. Other regulations such as no turning, no right turn, and no lane changing are also extensively applied and observed.

Generally speaking, priority rules between vehicles/cycles and pedestrians are not necessarily observed and appreciated by the current traffic environment in Hanoi. To accommodate the current traffic situation, traffic rules and regulation should be amended. A project was proposed as J04, Appendix. In Table. 14-2-1, priority and basic technique in traffic management are described.

14.2.6 Parking

It would be better to regulate parking on one side of the (narrow) streets. Considering parking demand, off street parking space is not sufficient for four wheel vehicles (duration of parking time, purpose should be surveyed). Also the necessity for the development of truck of loading and unloading facilities away from the street should be recommended.

Table 14-2-1 Sustainable Traffic Control Scheme in Hanoi

Basic Techniques	Objectives				Elements
	Safety	Mobility	Environment	Energy	
Simplification	P	S			Turn regulation, bicycle lane (reserved lane), channelization, lane use control, median barrier, one way, vehicle ban, road marking, signal installation, parking control
Segregation	P	S	S		Bicycle lane, median barrier, pedestrian crossing, signal installation, cyclo-ban, vehicle ban (Old City)
Capacity Increase		P	S	S	One way, bicycle lane, cyclo ban, truck ban, traffic control center (TV camera installation)
Restraint	S	S	P	P	Vehicle ban, motorcycle priority road (lane), pedestrian mall (pedestrian and bicycle precinct)

Note. P: Primary
S: Secondary
Underlined elements are high priority

14.3 Safety Education

Traffic safety education in schools would be carried out more intensively as an important part of the general safety education incorporated in various subjects, ethic classes and related subjects such as science or social studies. The context of such education curricula would be provided by the Ministry of Education and Training (MOET) through the distribution of manuals to kindergartens, primary and secondary schools all over Hanoi.

The emphasis for the road safety authorities is with the development of posters, leaflets, kits, guidelines and games. Thus, MOET and MOCI play dominant role in the development of a curriculum which contain sections on road safety; curriculum support material; road safety policies and the adoption and integrating bicycle safety into the primary school curriculum. The education materials should be in Vietnamese, inexpensive, easily available, easy to follow, urban and rural in content, interesting and containing instructions, suitably designed for children from prep to year 6 or 7 (study of exercises done in foreign countries would be worthwhile).

Safety education may be conducted as a part of the normal school curriculum. Necessary steps should be taken to promote this with school teachers at the same time. Necessary information such as pamphlets or tabloid papers should be given to mothers at home as they are responsible for the good habit formation of children.

An extensive safety education program should be considered carefully because young children will grow up as the road users for tomorrow. The school system should devote a significant period to the teaching of collective and social skills, such as traffic education, in addition to imparting personal skills and knowledge. It might be feasible to introduce a certain subject in high schools which will include motorcycle riding, first aid, environmental conservation, community project management, and communications development. Given the increasing popularity of motorcycles, basic skill and knowledge should be given to those high school students.

The following list illustrates examples of traffic safety education programs in schools considering improvement of knowledge, attitude and behavior:

Primary Schools:

- To develop in children an awareness of dangers on the roads.
- To learn the road laws relating to pedestrians and bicycles.
- To develop in children the basic riding skills which will allow them to ride bicycles safely
- To learn how to ride safely behind on a motorcycle
- To make all children aware of the need to be courteous, considerate and careful in all traffic situations.
- To understand the effects of accidents on children and the sorts of behavior which can lead to accidents involving children such as dashing out into the road.

Secondary Schools:

- To develop skills involved in handling bicycles.
- To know and understand the road laws.
- To understand the main causes of accidents and how to prevent them.
- To develop good attitudes as a passenger and as a motorcycle rider.
- To develop a sense of responsibility when in charge of motorcycles in the near future.

Organization of child safety clubs sponsored by government or the private sector are also recommended. For example, children's traffic clubs seem to be useful when they motivate parents to teach their children correct traffic behavior on the roads. Also, safety club schemes stimulate young people's attitude on safety. Safety school patrol systems could be introduced to increase safety consciousness by school children. This introduces some courses of the program into the specific school curriculum.

Safety measures for children commuting to and from school, like designating of safer routes to school, encouragement of commuting in groups and distribution of reflective tags, are desirable. Also, playing safely at playgrounds would be included. Basic education at kindergarten and lower grades of primary schools are most effective.

In this aspect, a Traffic Park would be a useful tool for children to familiarize themselves with various simulated traffic situations. Traffic Parks either in Japan or in Singapore are a good example, where school children use the park in a series of road safety competitions (See Appendix Project J05).

Long-term benefits may be delivered from educating opinion leaders such as journalists and school teachers. This approach has special appeal where the educational infrastructure is still amenable to change as in Hanoi.

14.4 Campaign

Publicity campaigns are conducted through the media to emphasize traffic rules or publicize new or changed road rules. General road safety campaigns should also be conducted, most of which would be by government bodies and supported by the private sector. Non-governmental resources must be mobilized into supporting and sustaining governmental efforts to rationalize the traffic situation in Hanoi city. Community education campaigns take a specific road safety theme and publicize it through pamphlets, talks and media advertisements. Therefore, a close relationship with the media is indispensable.

Mass communications for road safety have included many different identified sources: national, state or provincial. To be persuasive, a campaign message should not take a position that is very deviant from the prevailing attitude in the target group.

Educational efforts to modify behavior must be in the context of an individual's background and culture. For example, it would be futile to teach young children to heed the sound of the horn in a city such as Hanoi where continuous, indiscriminate horn blowing is the rule. Therefore, careful consideration should be given in the selection of specific target for messages and audiences. Road safety campaigns are conducted to communicate information that inputs into the road users decision marking function and results in the modification of their behavior in a better and safer direction.

Scientifically developed publicity campaigns can be effective, particularly for the promotion of motorcycle safety. For example, motorcyclists may not understand the rules and regulations when they ride on streets. Road safety campaigns addressed to motorcyclists/drivers should differ from those directed at pedestrians with respect to all relevant factors (e.g., language use, media exposure and motivating appeals).Even such a simple thing as advising motorcyclists of the importance of safety, campaigns by means of newspapers and the TV are helpful. Great care is needed to ensure the proper design and conduct of campaigns.

Funds for safety campaigns will decide the choice. Organization of safety campaigns involves decisions on timing (seasonal or not), duration (not too short or too long as to bore the target group), sequence (simultaneous linked or staged), campaign design (as target and media) and choice of appeals and messages.

Overall, the traffic safety campaign must be undertaken by government as part of civic education. The private (business) and public sectors have the resources and willingness to share in this task. From time to time, private and public sector organizations have initiated their own efforts to help the education of motorists, motorcyclists, cyclists and pedestrians. The systematic presentation of slogans has been almost ignored in Hanoi; for example, only scattered campaign banners are observed along main thoroughfares.

It would be better to attempt to use an indirect approach by drawing the attention of road users to their responsibility to others in the expectation that they would apply the lessons to themselves.

Changes in accident figures before and after the campaigns will be the most important criterion but there are some practical difficulties. Assessing the effect of the campaign, it is necessary to conduct surveys and observations to provide information on changes in behavior patterns and attitudes. Even in cases where the campaign results do not come up to expectations, effective analysis enables profitable lessons to be drawn for the future. It is also important to choose an appropriate target group. It is necessary to praise the public through mass media to notice that safety and good manners could be obtained through their efforts.

An example of a highly needed publicity campaign would be that of educating the public about their problem behavior on road such as "honking the horn" or "disregarding traffic rules". The campaign aims to educate drivers/riders about the danger and unpleasantness caused by their daily misconduct. The effectiveness of altering this driving/riding behavior relies heavily on publicity to reduce the risks caused by themselves.

Following procedure is recommended:

- Formulate a strategy to improve the traffic safety campaign (education) consistent with existing social and economic constraints.
- Prepare a plan of a model road safety campaign to be effective to install road safety concepts among the general public as well as school children.
- Prepare the draft terms of reference for a feasibility study for the realization of the preceding strategies for better education and campaigns for road users.
- Formulate the strategy based upon the assessment of the strengths and weakness of the current system.
- Avoid a negative approach and an extreme fear arousal approach.

Example 1: " No Horn in Hanoi" Project .

There will be increased support for most of the penalties for driving/riding with a honking horn after the campaigns. The knowledge of these penalties will be widespread and people will gradually develop more comfortable and safer traffic attitudes without frequent horn use.

Example 2: Safety Video (Film) Production.

By nature, safety campaign videos (films) are rather boring. Contents should be carefully selected and processed. Local personalities who are familiar to the audience are preferable which makes the audience feel that this is their own problem. If the character is regarded in the light of himself or herself, the audience get very involved with the film.(Oshin, Doraemon or Disney's characters are good examples to be introduced). This video (film) will be the first completed in Vietnam, and the content would be rather general.

To use mass media in this concept, important issues are as follows:

(1) Effect of repetition:

Like TV commercials, repeated persuasion is important even if the spot is very limited.

(2) Effect of dramatization :
Instead of adopting a fear arousal approach, a cooperative approach would be preferable for dramatization.
(3) Measure public acceptance:
It is important to find out the affect of the campaign by measuring public acceptance. Appropriate measures should be introduced.
(4) Direction to implement behavior:
Within the propaganda, it is very important to specify the goal.

Before finalizing Video (film) making, the following issues should be borne in mind:

(a) Everyone should give as much thought to traffic considerations as they do the weather which means, after all, traffic is as much an inescapable part of their everyday lives.
(b) The seriousness of the losses due to traffic deaths and injuries are something that can not be quantified. Thus, the problem of traffic safety can not be overstated.
(c) Since we know that the incidence of traffic death or injury can not be reduced to zero, measures should be aimed at organizing and controlling traffic problems to reduce loss to a minimum.
(d) It should be emphased that if no action is taken at all, the traffic problem will literally strangle Hanoi due to accidents, congestion and air pollution.
(e) Technology transfer, especially software like safety education and campaigns are rather difficult since human behavior modification is externally induced. We should bear in mind the problems are peculiar to our situation in selecting the most appropriate solution.
(f) Get support from both the public and private sector because traffic safety can only be obtained through cooperation from several different directions. In this connection, organizations such as private organizations, private enterprise groups, parent-teacher associations would play important roles.
(g) A lot of work is short-term and unspectacular and difficult to publicize as rapid progress. But the process of building a solid foundation for the sound development of a safer transport system for Hanoi people is urgently needed. An example of a project profile is given the Appendix as J06.

Mass media, particularly TV broadcasts is an effective tool to transmit information and modify people's attitudes. In accordance with rapid income increase the audience for TV is growing in Vietnam. A recent survey shows that the most popular programs are films, particularly foreign ones, cartoons, sports, music and world news (Foreign films with more than 50% of viewers watching on all channels). Also, the number of advertising spots of TV has been increasing from an average of 8,067 spots in September, 1994 to 13,511 spots in June, 1996 (a 67% increase) (Vietnam Investment Review. August, 1996).

Using such TV spots for a safety campaign would be very attractive. Especially, a safety campaign for children should be inserted in between cartoon programs since parents think TV is an appropriate media for children. Adopting such cartoon heroes as Donald duck or Doraemon to transmit safety messages for children could be effective (Recently, the first officially approved 35,000 copies of the four comic stories, "Mickey and

Donald" in Vietnamese by Walt Diesney were quickly sold out. Apparently, children are waiting for their appearance on TV program) (Vietnam News. Sept. 5,1996). Images in advertisement using foreign ideas sometimes do not make sense to the Vietnamese. It means that they do not seem to fit the local culture. So, it might be better to use characters who are familiar to the Vietnamese.

Under Directive 36, it is clearly indicated that the prime ministries for traffic safety are MOCI, MOET and Authority of Broadcasting and Television Agencies, which decide what time should be provided for programs on traffic order and road safety.

Article II of Decree 36-CP reads as follows :

"The Voice of Vietnam Radio, the Vietnamese Television Station and the local radio and TV Station should reserve a proper time length for the popularization of traffic order and safety free of charge".

However, as the NTSC (National Traffic Safety Center) spent about one third of its total budget for weekly road safety campaigns in 1994, it would cost much more to implement a campaigns with quality contents with assistance from the private sectors. Although TV programs have formed a major part of safety campaigns, other media such as broadcasting, newspaper advertisements ad and publishing pamphlets also have to be thoroughly considered.

One of the issues would be to give priority to motorcycle traffic, because this form of transport is economical, convenient and environmental friendly. This would help to obtain sustainable transport in future. In order to promote motorcycle use, a campaign to catch public eyes should be programmed. This will allow best use to be made the capacity of currently available road network in CBD. Not only that, transition from motorcycle to four wheel vehicles would be considerably delayed. through public campaigns.

Another campaign to be considered at a later stage is to promote shift from private to public transport. However, the current poor service level of public transport should be improved beforehand. This type of public campaign would also be delayed for a future project.

14.5 Enforcement

Better and efficient traffic enforcement is a key factor to obtain smoother and safer traffic flow. As mentioned earlier, the current situation of traffic enforcement in Hanoi cannot accommodate increasing traffic demand. Recognizing the fact that enforcement forces are limited in numbers, it is necessary to put higher priority on enforcing rules and regulations in the more dangerous (congested) areas. It is a fact that certain types of driver/rider behavior will improve considerably if the police are present.

It should be ensured that each traffic enforcer is trained, disciplined, and worthy as a representative of government in direct and daily contact with the citizenry. For this purpose it should be required that enforcers take and pass a single, standard traffic management course and that they should subsequently be placed under a unified performance oriented monitoring and evaluation system. (For example, to handle traffic signal systems at local controllers, police officers may face the technical impact related to the operation. Minimum knowledge for signal operation should be provided to police officers).

Tentative Training Programs for law enforcers would include following aspects:

- Human, Vehicle and Flow Characteristics
- Traffic Laws and Regulations.
- Traffic Law Enforcement Techniques
- Traffic Signals.
- Intersection Control
- Traffic Accident Investigation
- Safety Facilities and Control

In order to decrease the pedestrian accidents to a minimum level, conflicts between vehicles and pedestrians should be reduced as much as possible. Appropriate traffic rules and regulations and their enforcement could be one of the tools for reducing such conflicts. The best method of education appears to be fair and strict enforcement and uniform application of traffic rules that confront the poor driving/riding syndrome. Large and well organized fleet operations should be encouraged to train and discipline their drivers.

Recently, the World Bank submitted a proposal to the Vietnam Government to implement traffic police enforcement. The aspects of this proposal are as follows:

(1) Equipment
(2) Training
(3) Technical assistance to improve the efficiency of the urban transport control (UTC) system

Beside of World Bank Project, a two way radio communication system for law enforcement and security application may be adopted in the Ministry of Interior (MOI) (1996/9/12, Vietnam News). At any rate, an upgrading of the traffic police officer quality is urgently needed in the Hanoi Traffic Police.

14.6 Data Base

It is strongly recommended that accident data should be collected and stored and that this information should be provided to related agencies who implement road conditions and safety facilities as well as to the general public. Divergence between related agencies should be carefully avoided at the minimum level. Instead of having a detailed report form, a simple but accurate data collection and processing procedure is urgently needed. Fig 14-6-1 is an example of accident data form. For the public, results would be conveyed by publication, mass-media and occasionally by road safety campaigns. At the same time, the results would be utilized as a basic database.

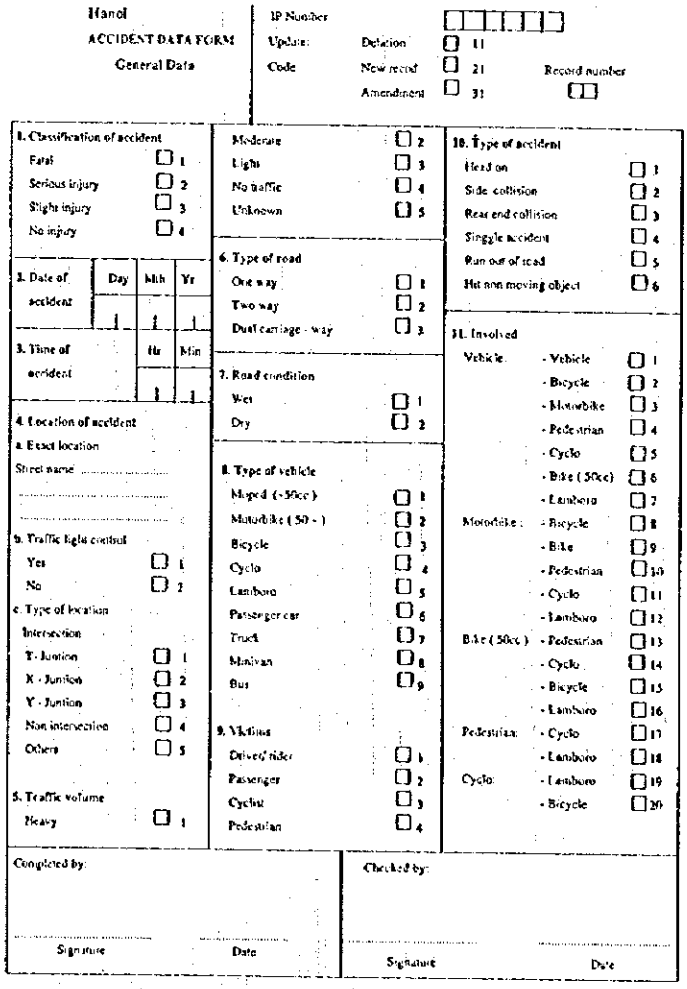


Fig. 14-6-1 Hanoi Accident Data Form

It is well known that various sanctions or points systems will improve driver's performance in terms of reduced traffic offenses, if the mechanism functions well. The accumulation of traffic offenses (or points) will threaten the possible loss of driver's license. A computerized data base system should be developed for this purpose.

In the near future such point demerit systems may be adopted on a trial basis in Hanoi. Also, a rehabilitation program for those drivers/riders who are suspended or disqualified would be considered at the same time.

14.7 Driver/ Rider Training

It is essential that drivers/riders should be given proper training (theoretical and practical) at the outset about how to drive or ride safely and how to behave while at the driving, since it is difficult to change driving/ riding habits once they have been formulated. In order to get a higher quality of training, highly qualified instructors are badly needed. Apart from the relatively rare check made by Ministry of Education and Training, there is almost no integrated training system at this moment (Careful study of how instructor training should be done is also needed). The initial step is to run courses for motorcycle license applicants to whom no proper instruction are given at present.

Special motorcycle instructor training could be provided by expertise firms such as Honda Motor Co., Japan. The course curriculum would be revised to reflect the traffic situation peculiar to Hanoi rural and urban areas. Once the initial development has been completed, the new courses could be tried on a small scale as a model case, and evaluated. Also a carefully designed publicity program should be organized to help the program promotion to appeal.

The basic requirement for 100cc class motorcycle rider may be the beginner course consisting of a 1 hour lecture and 1 hours practice. Practice training should emphasize braking and handling, while the lectures should primarily cover traffic rules, riding manners and how to avoid collision with other vehicles, particularly at intersections. A tentative project file is given on Appendix as J07.

14.8 Summary of Recommendations

14.8.1 Key Issues

As far as traffic management schemes are concerned, three key issues should be taken into consideration in careful manner namely:

(1) To obtain smoother traffic flow free from congestion.
(2) To obtain much safer traffic, and
(3) To obtain rapid and economical transport.

14.8.2 To maintain "Motorcycle oriented society"

Historically the bicycle has been used as the main transport system in Hanoi. People naturally transferred to motorcycles as a motorized bicycle. This transition has been natural but unique. Most Asian urban areas are dominated by four wheel vehicles and are confronted with socio-economic problem caused by congestion such as delay, air pollution and irritation. Bangkok is a good example.

To overcome such urban congestion in Hanoi it is necessary to consider controlling the switch to cars. in most others countries it is difficult to induce travelers to switch from cars, given their high level of confront and accessibility. However, in Hanoi there is little public experience of car use, therefore there is some expectation that people can be restrained from switching to car use.

Campaigning to promote motorcycle usage to establish the "Environment friendly city of Hanoi" will need cooperation from the public. It is recommended that international seminars or conferences should be held on "the Sustainable Transport System" related to environmental protection. It is worthwhile to have such seminars in Hanoi to stimulate not only delegates and experts from other countries but also people from related agencies.

Control of the increasing number of four wheel vehicles is another consideration. Priority for four wheel vehicles should be minimized by such measures as vehicle bans and pedestrian only zones. In future, with increased income, the number of four wheel vehicles will increase. Some measures to control the volume of four wheel traffic should be applied, before this occurs. The current infrastructure in Hanoi City is not able to accommodate heavier four wheel traffic volumes than now. A satisfactory mechanism to restrain these four wheel vehicles should be introduces as soon as possible.

If the motorcycle oriented society could be prolonged in Hanoi, this unique and sustainable pattern of future urban transport could be an example to the entire world. Motorcycle lanes on National Highways and route from Noi Bai Airport should be installed to prevent fatal accidents due to conflicts with four wheel vehicles. The special motorcycle lanes on Kualalumpur, Malaysia is an ideal example to study.

14.8.3 To Segregate Non-Motorized Traffic from Motorized Traffic.

In Hanoi, many bicycles and cyclos are enjoy free flow on the streets. Lane segregation exists but cyclists are indifferent to following rules. Introducing physical separation either by lane marking, studs and poles is strongly recommended to maintain orderly for bicycle flow. Cyclo routes should be designated.

14.8.4 To Improve Enforcement

Traffic enforcement is ad hoc and poorly conducted. Therefore, systematic and strict operation by the traffic police force would be desirable. Otherwise, road users will still be indifferent with traffic rules and regulations. Advanced equipment's for enforcing is also required.

14.8.5 To Provide Better Public Transport

One of the objective for a transport system in how fast people can reach the destination. Due to the expected population growth in Hanoi to operate comfortable and punctual bus services is one of the solutions. Optimum fare levels and frequent services are badly needed to satisfy passengers.
In addition, the renewal of pedestrian space like side walks or pavements would be an urgent requirement to accommodate the demand of public transport passengers who have to reach to their destination on foot. To give more priority for motorcycle is another measure to provide fact trips.

Fig. 14-8-1 illustrates the flow of safety program by both individual and administrative approach. Also Fig. 14-8-2 shows the process to formulate traffic ordinance in future. Related projects are referred on Appendix (J01 through J07).

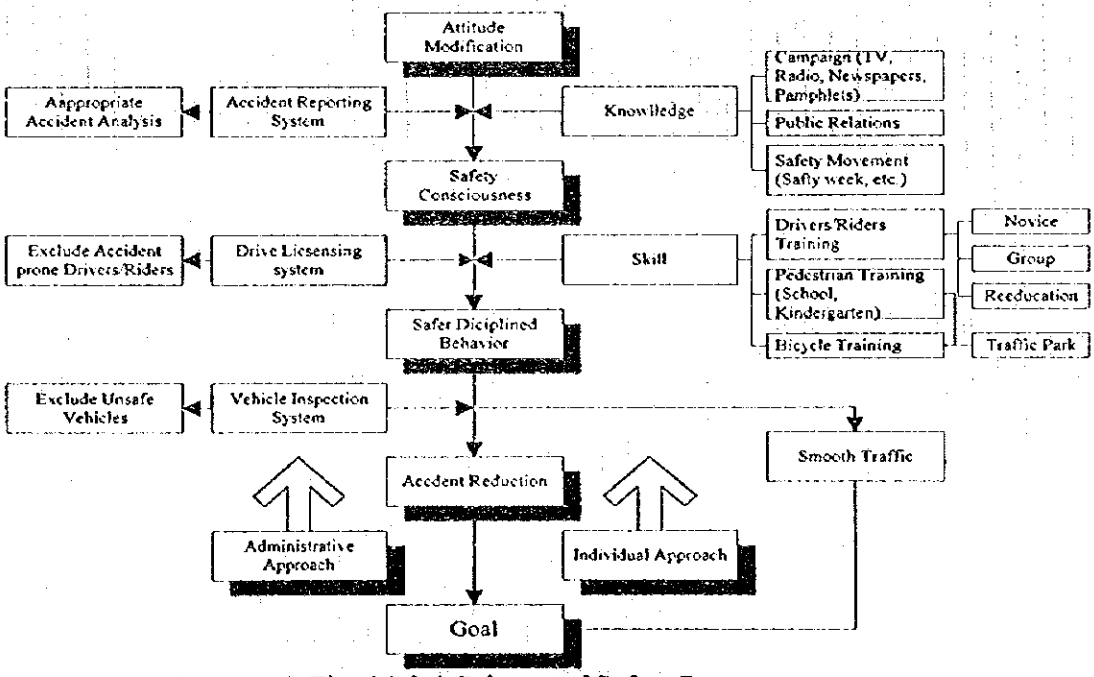


Fig. 14-8-1 Scheme of Safety Program

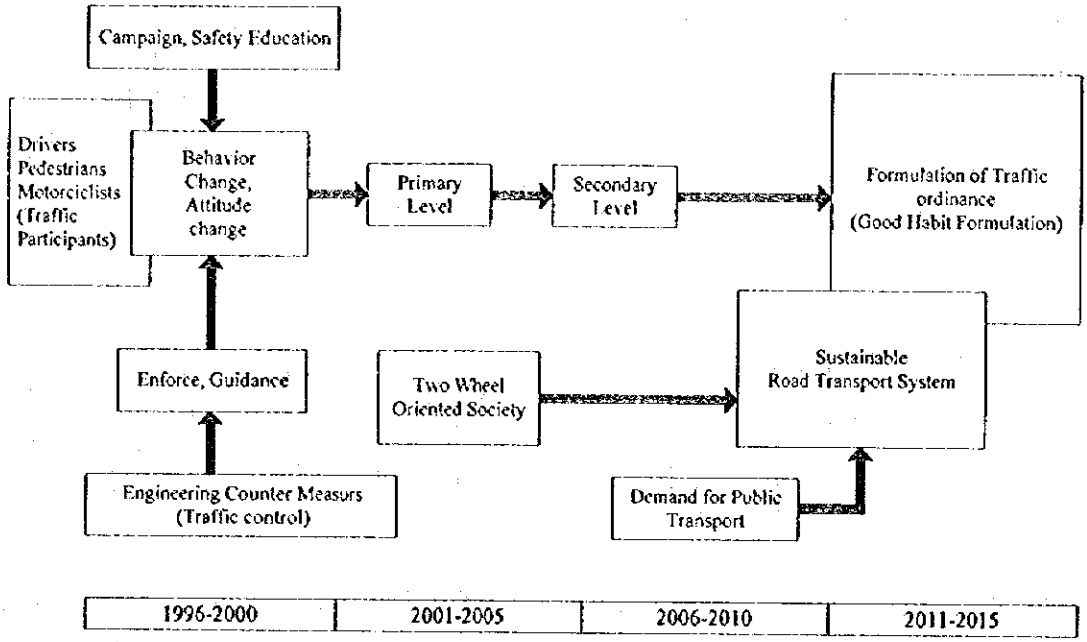


Fig. 14-8-2 Process to Obtain Sustainable Road Transport System in Future

CHAPTER 15 FREIGHT TRANSPORT PLAN

15.1 Present Situation

15.1.1 Introduction

In this Chapter we discuss mainly freight flows coming from and going outside of Hanoi City. The freight movement was examined based on three previous transport studies in northern Vietnam, which are: National Transportation Sector Review (NTSR), UNDP 1992; The Master Plan Study on the Transport Development in the Northern Part in the Socialist Republic of Vietnam (TDNV), JICA 1994; and Red River Delta Master Plan (RRDP), World Bank 1995.

The zoning system of these studies was based on the province structure. In 1992 Northern Vietnam consisted of 16 provinces but the present jurisdictions are 20 provinces. NTSR used a system of 17 zones (16 provinces and 1 outer zone). TDNV quoted NTSR domestic cargo volume projection. Fig. 15-1-1 shows 17 zone system. Freight movement was calculated using a 17 zone OD table. The study area of RRDP was different from the other two studies.

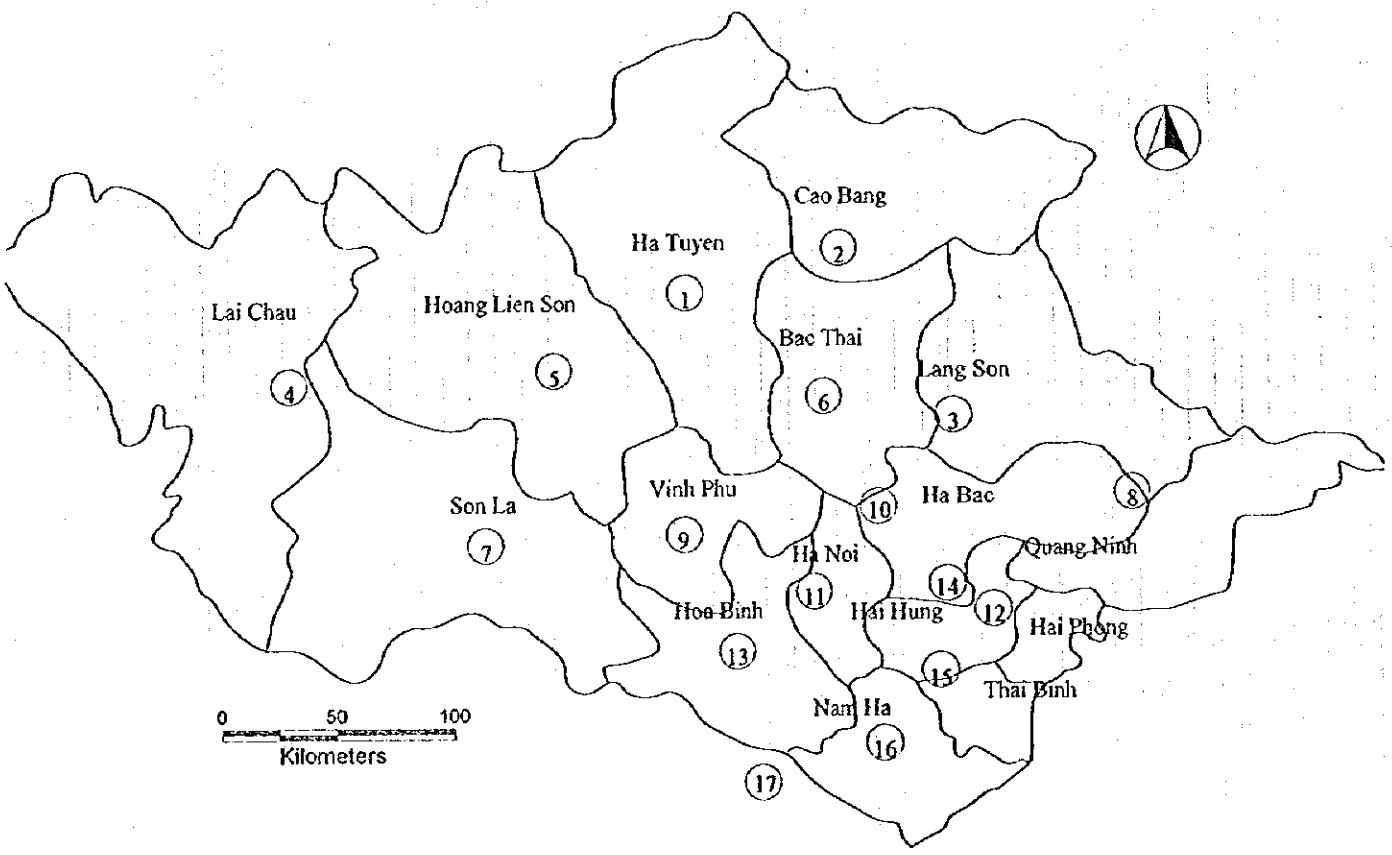


Fig. 15-1-1 A 17 Zone System of Northern Vietnam

15.1.2 Freight Flow in Hanoi City

The roadside traffic counts reported in Chapter 3 (see Table 15-1-1 rearranged) shows that 8.5% of the total PCUs (excluding walking trips) were trucks. It should be noted that the total PCUs included not only car, bus and truck but also bicycle, cyclo, motor cycle and other transport modes. Intra city traffics of trucks was discussed in Chapter 11 and then it is disregarded in this Chapter.

Table 15-1-1 Proportion of Trucks

	Vehicle Base	PCU Base
Truck (a)	15,001	37,502
All Transport (b)	1,148,940	439,656
Mix Rate (a)/(b)	0.013	0.085

15.2 Inter Province Commodity Flows

15.2.1 Freight by Transport Mode

NTSR reports commodity flows in 1991 and their projection to 2000 and 2010. The following analysis was done based on these data.

From data mentioned above, the tonnage of freight to a Hanoi destination, from a Hanoi origin and traveling through Hanoi was calculated and is shown in Table 15-2-1.

Table 15-2-1 Yearly Freight by Mode

unit: 1000tons)

Year	Movement	Water	Rail	Road	All Modes
1991	From Hanoi	98	129	1,106	1,333
	To Hanoi	1,356	388	3,081	4,825
	Via Hanoi	1,425	832	1,599	3,856
2000	From Hanoi	488	228	2,067	2,783
	To Hanoi	4,873	665	5,986	11,524
	Via Hanoi	2,721	1,758	4,320	8,799
2010	From Hanoi	864	586	7,899	9,349
	To Hanoi	8,568	1,705	22,884	33,157
	Via Hanoi	4,785	4,288	16,548	25,621

Source: NTSR, Analyzed by Study Team

The three modes transported 3,856,000 tons in 1991, which means 11,000 tons a day when 350 working days in a year is assumed. A 48% of this freight was transported into Hanoi city, 13 % out from Hanoi and 39 % passed through Hanoi.

A 62 % of rail freight was transported through Hanoi but only 28 % of roadway freight was transported through Hanoi. Inland waterways transported 50 % of their freight through Hanoi. These figures could be explained by nature of the transport modes and by the type of freight.

Based on the 1995 cordon line survey, proportion of through road freight was 23% compared with the 28% mentioned above. Shares of types of movements are set out in Table 15-2-2.

Table 15-2-2 Freight Movement Shares by Mode

Year	Movement	Water	Rail	Road	All Modes
1991	From Hanoi	0.034	0.096	0.191	0.133
	To Hanoi	0.471	0.288	0.532	0.482
	Via Hanoi	0.495	0.617	0.276	0.385
2000	From Hanoi	0.060	0.086	0.167	0.120
	To Hanoi	0.603	0.251	0.484	0.499
	Via Hanoi	0.337	0.663	0.349	0.381
2010	From Hanoi	0.061	0.089	0.167	0.137
	To Hanoi	0.603	0.259	0.483	0.487
	Via Hanoi	0.337	0.652	0.350	0.376

Source: NTSR, Analyzed by Study Team

The significant rates of increase are forecast for inland waterway transport to 2000

(12.2% p.a.) and roadway transport growth forecasts are significant after 2000 (16.1% p.a.). Railway transport is forecast to increase at a rate of 7.8 % p.a. before 2000 and 10.6 % p.a. after 2000 (Table 15-2-3).

Table 15-2-3 Forecast Annual Rate of Freight Growth by Mode and Movement

Movement	Water	Rail	Road	All Modes
From 1991 Till 2000				
From Hanoi	0.195	0.065	0.072	0.085
To Hanoi	0.153	0.062	0.077	0.102
Via Hanoi	0.075	0.087	0.117	0.096
All	0.122	0.078	0.088	0.097
From 2000 Till 2010				
From Hanoi	0.059	0.099	0.143	0.129
To Hanoi	0.058	0.099	0.144	0.111
Via Hanoi	0.058	0.093	0.144	0.113
All	0.065	0.106	0.161	0.128

Source: NTSR, Analyzed by Study Team

Shares by transport mode will be vary to some extent due to the unequal rates of increase of the transport modes (see Table 15-2-4), but in general

(1) Commodities carried out from Hanoi are mainly (around 85 %) transported by road transport, and inland waterway transport and railway transport contribute less than 10 % each.
(2) Commodities carried into Hanoi are mainly shared by roadway transport (65 %) and inland waterway transport (25 %). Railway transport is less than 10 %.
(3) For the transport of commodities through Hanoi, railway transport contributes much more at (20 %), road transport (50 %) and inland waterway transport (30 %).
(4) Road transport is forecast to increase its share while other two modes decrease their shares.

Table 15-2-4 Freight Forecast Shares by Mode and Movement

Year	Movement	Water	Rail	Road	All Modes
1991	From Hanoi	0.074	0.097	0.830	1.000
	To Hanoi	0.281	0.080	0.639	1.000
	Via Hanoi	0.370	0.216	0.415	1.000
	All	0.287	0.135	0.578	1.000
2000	From Hanoi	0.175	0.082	0.743	1.000
	To Hanoi	0.423	0.058	0.519	1.000
	Via Hanoi	0.309	0.200	0.491	1.000
	All	0.350	0.115	0.535	1.000
2010	From Hanoi	0.092	0.063	0.845	1.000
	To Hanoi	0.258	0.051	0.690	1.000
	Via Hanoi	0.187	0.167	0.646	1.000
	All	0.209	0.097	0.695	1.000

Source: NTSR, Analyzed by Study Team

15.2.2 Freight by Commodity and Transport Mode

Commodities handled by each transport were studied from various sources. Commodities carried by inland waterway transport are taken from NTSR, by railway transport from RRDP and by road transport from cordon line survey result of 1995.

Results are shown in Table 15-2-5.

Table 15-2-5 Commodities Shares by Mode (1991)

Unit(%)

Commodity Group	Inland Waterway	Railway	Road
Coal/Peat	60.6	27.0	0.0
Construction Materials	24.8	29.0	38.9
Fertilizer	1.9	17.0	0.0
Machinery/Manufact. Products	0.9	6.0	6.0
Ore	2.3	5.0	9.4
Foods	6.5	4.0	19.2
Petroleum Products	2.9	0.0	21.6
Consumer Goods	0.0	0.0	4.9
Others	0.1	12.0	0.0
Total	100.0	100.0	100.0

Source: NTSR, RRDP, Cordon line survey by the Team

From the figures in Tables 15-2-1 and 15-2-5 the volumes transported by each transport mode were calculated. It should be noted, when examining figures, that we used 1991 data for the 2000 and 2010 projections because no data is available to forecast changes of consumer preferences and the industrial structure. Due to this, the future projection may include some structural error.

For "To Hanoi" commodities, construction materials are recorded the largest volume commodity, followed by coal/peat, food and petroleum products. For "From Hanoi" commodities construction materials are the largest volume commodity followed by food and petroleum products. For "Via Hanoi" commodities the top groups are of construction materials and coal/peat. There are followed by of foods and petroleum products, and these groups will grow faster than the other commodities. (Table 15-2-6)

Table 15-2-6 Movement of Commodities (All Transport Modes)

('000 tons/year)

Items	From Hanoi			To Hanoi			Via Hanoi		
	1991	2000	2010	1991	2000	2010	1991	2000	2010
Coal/Peat	94	358	682	927	3,133	5,652	1,089	2,124	4,058
Const. Materials	491	991	3,457	1,648	3,298	11,521	1,216	2,865	8,868
Fertilizer	24	48	116	92	206	453	168	351	820
Machinery/Manuf	75	142	517	220	376	1,552	159	388	1,293
Ore	112	216	792	340	603	2,433	225	557	1,880
Foods	223	438	1,596	696	1,280	5,019	433	1,076	3,660
Petro. Products	242	460	1,731	704	1,194	5,191	386	1,012	3,713
Consumer Goods	54	101	387	151	239	1,121	78	212	811
Others	15	27	71	48	85	214	101	214	520

Source: NTSR, TDNV, RRDP, JICA cordon line survey

Road transport has a high contribution to cargo transport being 75 - 85 % of the total for "From Hanoi", 50 - 70 % for "To Hanoi" and 40 - 60 % for "Via Hanoi".

As for commodities transported, construction materials were the largest group. Foods and petroleum products were the next group. "To Hanoi" commodities were almost same as sum of "From Hanoi" and "Via Hanoi" commodities transported. No coal/peat was transported by the road transport mode (Table 15-2-7).

Table 15-2-7 Movement of Commodities (Road Transport Mode)

('000 tons/year)

Items	From Hanoi			To Hanoi			Via Hanoi		
	1991	2000	2010	1991	2000	2010	1991	2000	2010
Coal/Peat	0	0	0	0	0	0	0	0	0
Const. Materials	430	804	3,073	1,199	1,896	8,902	622	1,680	6,437
Fertilizer	0	0	0	0	0	0	0	0	0
Machinery/Manuf	66	124	474	185	292	1,373	96	259	993
Ore	104	194	743	290	458	2,151	150	406	1,556
Foods	212	397	1,517	592	936	4,394	307	829	3,177
Petro. Products	239	446	1,706	665	1,053	4,943	345	933	3,574
Consumer Goods	54	101	387	151	239	1,121	78	212	811
Others	0	0	0	0	0	0	0	0	0

Source: NTSR, JICA cordon line survey

Coal/peat, construction materials and fertilizer are the major commodities handled by railway transport. Due to nature of railway transport "Via Hanoi" cargoes exceeded "To Hanoi". The yard for transfer has important role.(Table 15-2-8)

Table 15-2-8 Movement of Commodities (Railway Transport Mode)

('000 tons/year)

Items	From Hanoi			To Hanoi			Via Hanoi		
	1991	2000	2010	1991	2000	2010	1991	2000	2010
Coal/Peat	35	62	158	105	180	460	225	475	1158
Const. Materials	37	66	170	113	193	494	241	510	1244
Fertilizer	22	39	100	66	113	290	141	299	729
Machinery/Manuf	8	14	35	23	40	102	50	105	257
Ore	6	11	29	19	33	85	42	88	214
Foods	5	9	23	16	27	68	33	70	172
Petro. Products	0	0	0	0	0	0	0	0	0
Consumer Goods	0	0	0	0	0	0	0	0	0
Others	15	27	70	47	80	205	100	211	515

Source: NTSR, RRDP

Inland waterway transport mainly carried bulk cargoes much as coal/peat and construction materials. "Via Hanoi" cargoes exceeded "To Hanoi" cargo volumes but no transfer point was expected due to the nature of waterway transportation. (Table 15-2-9)

Table 15-2-9 Movement of Commodities (Inland Waterway Transport Mode)

('000 tons/year)

Items	From Hanoi			To Hanoi			Via Hanoi		
	1991	2000	2010	1991	2000	2010	1991	2000	2010
Coal/Peat	59	296	524	822	2,953	5,192	864	1,649	2,900
Const. Materials	24	121	214	336	1,209	2,125	353	675	1,187
Fertilizer	2	9	16	26	93	163	27	52	91
Machinery/Manuf	1	4	8	12	44	77	13	24	43
Ore	2	11	20	31	112	197	33	63	110
Foods	6	32	56	88	317	557	93	177	311
Petro. Products	3	14	25	39	141	248	41	79	139
Consumer Goods	0	0	0	0	0	0	0	0	0
Others	0	0	1	1	5	9	1	3	5

Source: NTSR

15.3 Co Loa Railway/Truck Terminal Plan

Intra Hanoi commodity movement was reflected in the road network development plan, and inter province railway transport development and inter province inland waterway transport development are not within the scope of this study.

The freight transport plan focused on the control of large trucks and trailers coming in, going out or passing through the built up area of Hanoi. The list of proposals for implementing this plan is as follows:

(1) Truck terminal development plan to transfer commodities transported by large trucks and trailers to medium/small size trucks so as to control large truck and trailer flows in the build up area.
(2) Railway terminal development plan to transfer commodities transported by rail to medium/small size trucks and deliver to final destination to encourage more use of rail transport.
(3) Waterway port development plan to encourage more use of water transport.

In this section a railway terminal development plan and a truck terminal development plan are discussed and in the section 15.4 a waterway development plan is discussed. As for a truck terminal at least two terminals are required because large movements of cargo from east, north and south will be expected. One terminal may be located in north side of Hanoi and another in south, and both must be along RR No.3. One of both, north side of Hanoi (Co Loa) is planned to construct in this study period and another, south side, will be constructed after 2015.

15.3.1 Objectives

Objectives of Co Loa Railway/Truck Terminal project are;

a) to reduce trucking costs,
b) to reduce the volume of motor traffic by decreasing unorganized and overlapping transport,
c) to regulate the inflow of large trucks into the urban areas, and
d) to improve the efficiency of railway transport.

15.3.2 Nature of the Terminal

Terminals are classified (a) terminals to handle general cargoes and (b) terminals to handle specified cargo. The Co Loa terminal was considered as type (a), general cargo terminal.

The terminal is also planned to be constructed by public funds and operated by the public sector.

15.3.3 Commodities to be Handled

Foods and consumer goods were considered as the goods to be handled at this terminal.

In addition it was also assumed that 30 % of foods and consumer goods transported by railway and 10 % of these commodities transported by trucks/trailers would be reloaded at the terminal.

These assumption were applied to the figures in Tables 15-2-7 and 15-2-8 and we estimated 4,387 tons a day in 2005 and 17,788 tons a day in 2015 as the average handling cargo tonnage. (see Table 15-3-1)

Table 15-3-1 Commodities and Tonnage Planned to be Handled in the Co Loa Terminal

(unit ton/day)

Items/Year	1991	1995	2000	2005	2010	2015
From/To Railway	937	1268	1715	3408	6769	13448
From/To Trucks	280	361	465	979	2061	4340
Total	1217	1629	2180	4387	8830	17788

Source: NTSR, TDNV, RRDP, JICA Cordon Line Survey.

15.3.4 Functions

The terminal is required to serve the following five functions;

(a) reloading
(b) mixed loading
(c) storage
(d) packing and product assortment, and
(e) collecting and processing information

Emphasis is placed on (a) and (b) from the standpoint of the carriers' need to speed up transport and reduce transport cost, but (c), (d) and (e) are also required if the systemization of physical distribution is to be promoted.

15.3.5 Facilities

The main facilities are described first then the scale of each of the facilities is listed.

(1) Cargo-handling platforms

Cargo-handling platforms are the central facility of a terminal. Their function is to allow the sorting and reloading of cargo by destination from or onto small pickup/delivery trucks, large line trucks, and freight cars of railway. In general the platforms are rectangular in shape and have widths of 25-50 m and lengths of 50-200 m. The two longer sides are used as berths, with the trucks backing up to the platform.

Platform heights are the same height as the truck/freight car bed. Platform heights are generally 1.2m on freight car side, 1.3m on large (line) truck side and 1.1m on light (delivery) truck side.

The platforms would be partially covered by an overhang of 7-8m in order to protect workers and cargoes from rain.

(2) Warehouse

Since having a warehouse within the terminal premises is extremely effective for streamlining physical distribution, new terminals include warehouse as matter of course. This terminal also facilitates warehouses.

(3) Administration Building

The administration office controls the incoming and outgoing of line trucks and pickup/delivery trucks, supervise cargo handling and manages the various facilities in the terminal, as well as handling paperwork, and information and communication-related work.

(4) Facility Requirements

Data of four general terminals in Tokyo were collected and shown in Table 15-3-2 and facility requirements derived from these terminals are tabulated in Table 15-3-3.

Table 15-3-2 Outline of Facilities of General Terminals in Tokyo

Name	Keihin	Itabashi	Adachi	Kasai	Unit/ton	Remark
Location	Tokyo	Tokyo	Tokyo	Tokyo		
Total Space	22.3	11.6	11.3	18.5	0.001699	ha
No. of Berths	433	320	340	460	0.041413	
Space of Platforms	3.6	2.2	2.2	3.8	0.000315	ha
Handling Capacities	12,000	7,000	7,000	11,500		tons/day
Facilities						
Platforms	11	8	9	9	0.000987	
Total Space	36,242	22,200	22,178	37,959	3.162107	
Width	20-33.5	20-25	20-25	20-25		m
Height	1.3	1.1-1.3	1.0-1.1	1.0-1.2		m
Platform Office Space	3,110	1,611	2,638	3,310	0.284507	m2
Delivery Center	50,363	17,427	11,077	19,731	2.629280	m2
Space for Line Trucks	18,702	14,400	15,441	19,278	1.808560	m2
Space for Local Truck	18,163	10,186	9,548	12,960	1.356187	m2
Space for Operation of Trucks	72,163	35,437	29,024	41,653	4.754053	m2
Space for Parking	29,946	17,510	19,841	29,795	2.589120	m2
Administration Building	4	5	10	9		stories
Space of Land	3,457	1,723	1,429	2,987	0.255893	m2
Space of Building	15,156	8,025	7,973	9,715	1.089840	m2
(1) Administration Office	90	55	56	93	0.007840	m2
(2) Conference Room	153	125	130	152	0.014933	m2
(3) Short Sleeping Room	880	552	512	496	0.065067	m2
(4) Lodging	1,200	600	360	248	0.064213	m2
(5) Canteen and Tea Room	1,483	961	468	889	0.101360	m2
Firing Station	2,289	950	1,053	1,453	0.153200	m2
Truck Washing Facilities	1,945	750	518	966	0.111440	m2
Repair and Maintenance F.	2,588	1,450	0	0		m2
Weighting Machine for Truck	1	1	1	1		

The construction stage will be divided to two stages, the first stage construction aimed to accommodate the year 2005 demand, 4,400 tons/day, and the second the year 2015 demand, 18,000 tons/day. Total space after the 2nd stage construction would be 31 ha and number of berths 745. Details of requirements are listed in Table 15-3-3.

Table 15-3-3 Requirements of Co Loa Railway/Truck Terminal

Name	1st stage	2nd stage	Unit/ton	Remark
Total Space	7	31	0.001699	ha
No. of Berths	182	745	0.041413	
Space of Platforms	1.4	5.7	0.000315	ha
Handling Capacities	4,400	18,000		tons/day
Facilities				
Platforms	4	18	0.000987	
Total Space	13,913	56,918	3.162107	m2
Platform Office Space	1,252	5,121	0.284507	m2
Delivery Center	11,569	47,327	2.629280	m2
Space for Line Trucks	7,958	32,554	1.808560	m2
Space for Local Truck	5,967	24,411	1.356187	m2
Space for Operation of Trucks	20,918	85,573	4.754053	m2
Space for Parking	11,392	46,604	2.589120	m2
Administration Building				
Space of Land	1,126	4,606	0.255893	m2
Space of Building	4,795	19,617	1.089840	m2
(1) Administration Office	34	141	0.007840	m2
(2) Conference Room	66	269	0.014933	m2
(3) Short Sleeping Room	286	1,171	0.065067	m2
(4) Lodging	283	1,156	0.064213	m2
(5) Canteen and Tea Room	446	1,824	0.101360	m2
Firing Station	674	2,758	0.153200	m2
Truck Washing Facilities	490	2,006	0.111440	m2
Repair and Maintenance F.	900	2,200		m2
Weighting Machine for Truck	1	1		unit

15.3.6 Construction Plan

(1) Location

In order for a general railway/truck terminal to fulfill the objectives mentioned above, its location is a vital factor. The following conditions must be met:

a) That it be located at the perimeter of an existing urban area and moreover that it be in proximity to route trucking customers,
b) That it be close to the intersection of an inter-city arterial and a ring road surrounding an existing urban area in order to facilitate linkage between large trucks hauling freight between cities and small trucks that pick up and deliver cargoes inside cities,
c) That it be close to the railway yard,
d) That 31has. land can be obtained at a comparatively low cost, and
e) That harmony with the region's environment can be maintained and that employees can commute easily.

The Co Loa switch yard is located along the National Highway No.3 and the Ring Road No.3, and is close to Dong Anh town, one of growth point in Hanoi (see Fig. 15-3-1). The yard has 33has. including the Co Loa station. In addition there are warehouses mainly stocked construction materials and coal/peat along a side truck and a main line (Fig. 15-3-2).

The railway/truck terminal is planned on the site of the Co Loa switch yard.

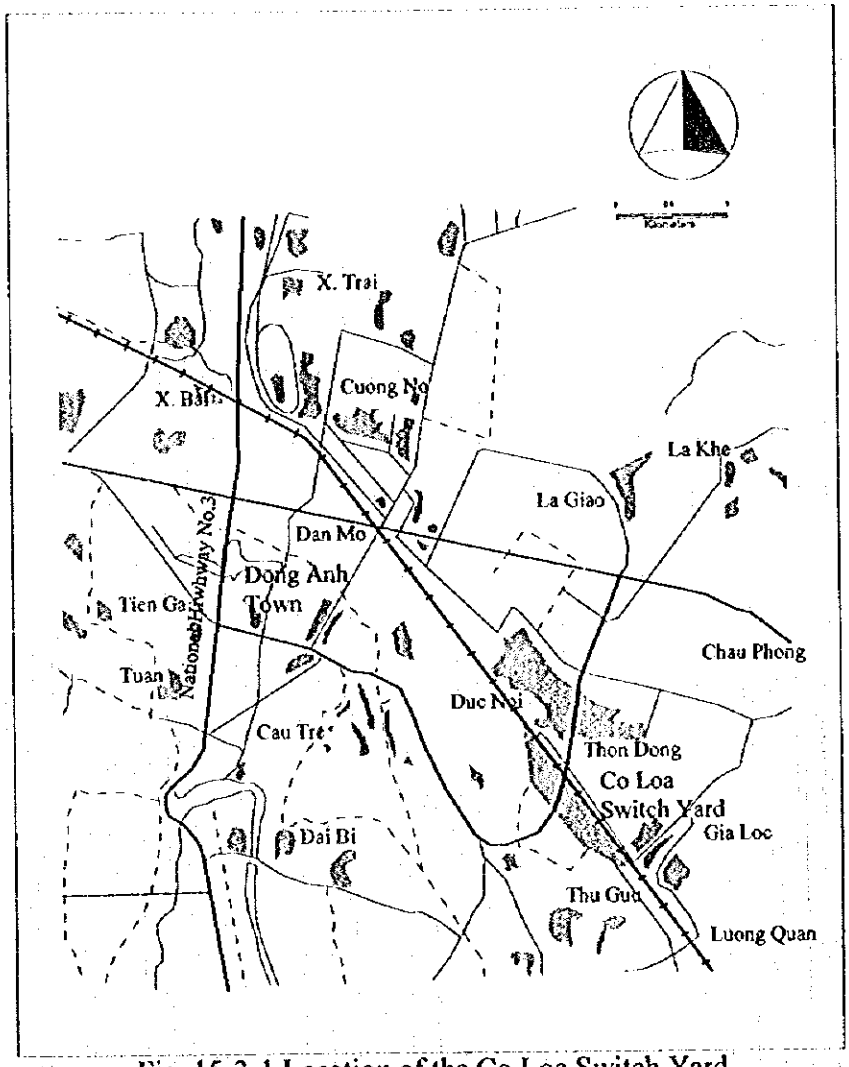


Fig. 15-3-1 Location of the Co Loa Switch Yard

(2) Plan

Total area of the Co Loa switch yard is 31has. as seen in Fig. 15-3-2. That space is coincident to land space required.

Fig 15-3-3 shows plan of standard component and Fig 15-3-4 shows standard cross section of truck/railway terminal. A side of platform is used for railway cargo and another side is used for trucks/trailers. A truck berth is used not only for line trucks/ trailers but also for medium/small trucks.

The terminal has access road to RR No.3 and NH No.3 of 32m width (4 lanes). Fig 15-3-5 shows total plan of the terminal and Table 15.3.4 shows estimated construction costs.

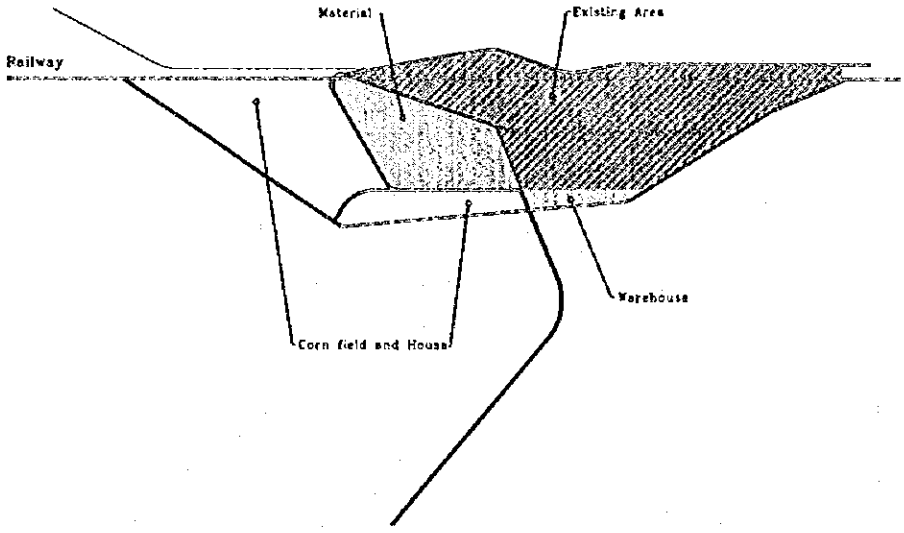


Fig. 15-3-2 Existing Land Use Plan

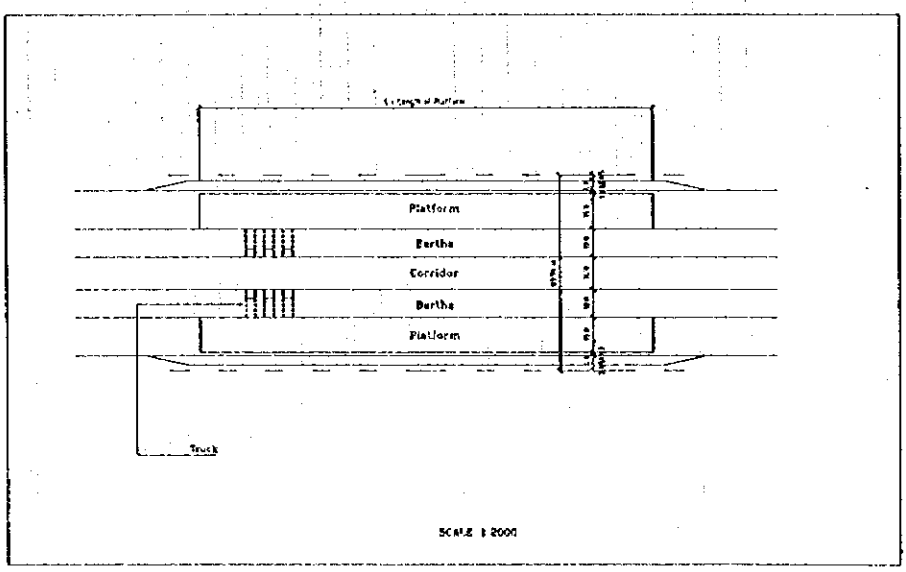


Fig. 15-3-3 Plan of Truck/Railway Terminal

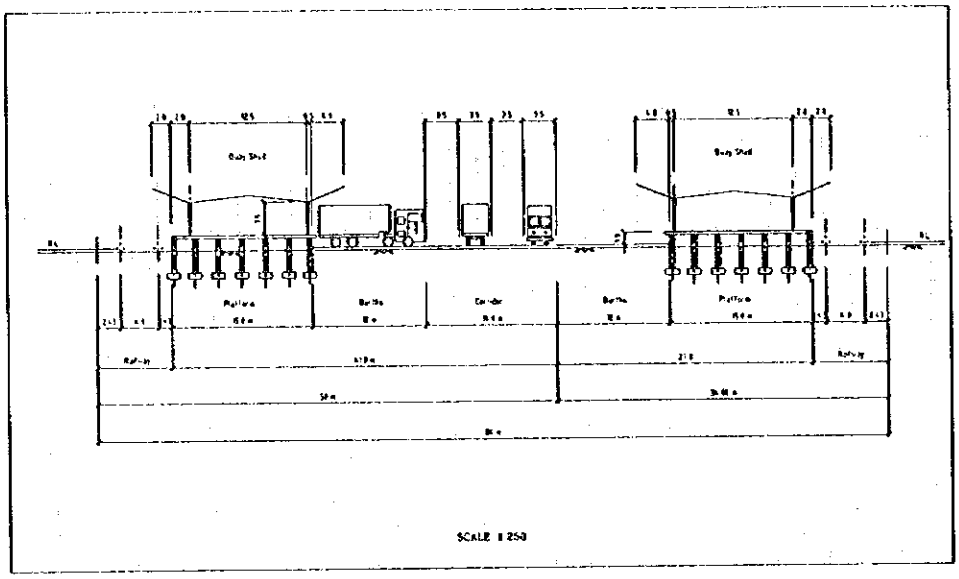


Fig. 15-3-4 Cross Section of Truck/Railway Terminal (A-A)

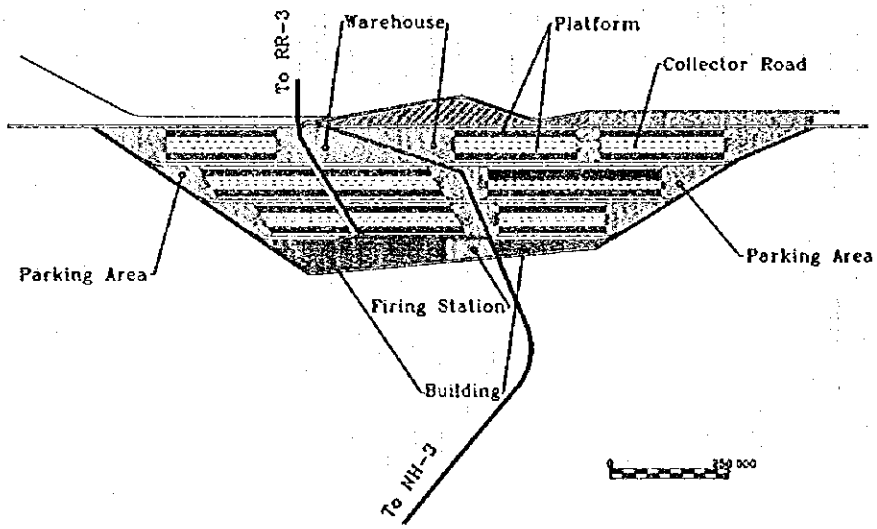


Fig. 15-3-5 Plan of Terminal

Table 15-3-4 Construction Cost of Truck/Railway Terminal

1st Stage

(M.VND)

	Item	Unit	Unit Cost	Quantity	Cost	Remarks
1	Clearing and Grubbing	m2	2,650	71,400	189.2	
2	Platform (Concrete)	m3	1,190,000	5,096	6,064.2	
3	Platform (Reinforcing)	kg	11,800	509,600	6,013.3	
4	Pavement of Berth/Corridor	m3	1,190,000	1,505	1,790.0	
5	Quay Shed of Platform	m3	1,100,000	21,840	24,024.0	
6	Pavement of Parking	m3	1,190,000	9,248	11,005.1	
7	Warehouse	m3	1,320,000	6,500	8,580.0	
8	Access Road	m	1,090,000	5,000	54,500.0	W = 30m
9	Building	m2	2,200,000	6,850	15,070	
10	Firing Station	m2	2,200,000	1,000	2,200	
11	Maintenance Station	m2	2,200,000	900	1,980	
	Total Cost				131,415.8	
	Total Length of Platform					L=260x4=1,040m
	Total Area of Platform					A=1040x15 =15,600m2
	Total Area of Berth					A=1,040x12 =12,480m2
	Total Area of Corridor					A=900x14 =12,600m2

2nd Stage

(M.VND)

	Item	Unit	Unit Cost	Quantity	Cost	Remarks
1	Clearing and Grubbing	m2	2,650	239,360	634.3	
2	Platform (Concrete)	m3	1,190,000	16,405.2	19,522.2	
3	Platform (Reinforcing)	kg	11,800	1,640,520	19,358.1	
4	Pavement of Berth/Corridor	m3	1,190,000	4,216.6	5,017.8	
5	Quay Shed of Platform	m3	1,100,000	70,308	77,338.8	
6	Pavement of Parking	m3	1,190,000	83,484	99,346.0	
7	Warehouse	m3	1,320,000	7,800	10,296.0	
8	Building	m2	2,200,000	12,770		
9	Firing Station	m2	2,200,000	1,758		
10	Maintenance Station	m2	2,200,000	1,300		
	Total Cost				266,334.8	
	Total Length of Platform					L=3,348m
	Total Area of Platform					A=3,348x15 =50,220m2
	Total Area of Berth					A=3,348x12 =40,179m2
	Total Area of Corridor					A=2,150x14 =30,100m2

15.4 Hanoi Port (Pha Den) Development Plan

15.4.1 Objectives

Objectives of Hanoi Port Development project are;

(a) to improve efficiency of inland waterway transport, and
(b) to reduce the volume of road traffic by increasing inland waterway efficiency.

15.4.2 Commodities to be handled

Coal/peat and construction materials were majority (85.5%) of goods to be transported by waterway. It was assumed that 80 % of these goods would be charged/discharged at the Hanoi port.

Applied this assumption to figures in Table 15-2-9, we obtained 11,912 tons a day in 2005 and 27,801 tons a day in 2015 as average handling cargo tonnage (see Table 15-4-1). This amount is too big to trust. Even so, increase of freight transported by waterways is supported. Coal comes from Quang Ninh province, cement from Hai Hung and gravel from Vinh Phu.

Table 15-4-1 Commodities and Tonnage Estimated to be Handled in the Hanoi Port

(unit ton/day)

Items/Year	1991	1995	2000	2005	2010	2015
Coal/Peat	1,957	3,759	7,220	9,576	12,702	16,848
Const. Materials	800	1,538	2,955	3,919	5,197	6,892
Others	468	902	1,737	2,305	3,060	4,061
Total	3,225	6,199	11,912	15,800	20,959	27,801

Source: NTSR

15.4.3 Facilities

(1) Berth Facilities

The Hanoi port consists of 8 berths. Among them berth No. 1 to No. 4 handle bagged cargoes, which are cement, wheat flour, rice, sugar, fertilizer and so on. The remaining four berths handle non bagged cargoes such as coal, sand and gravel. (See Table 15-4-1).

(2) Cargo Handling Equipment

There are four Goliath cranes and two crawler cranes.

(3) Storage

There are two storages, each has 3,450 m^2, and open storing space, 9,600 m^2 for bagged goods. Also there are five open spaces, total 19,400 m^2, for non bagged storage use.

15.4.4 Plan

Coal, gravel and cement are major cargo items. Open space is enough to store these commodities excluding cement. Major issue of the port at present is dredging and another major issue after increasing handling tonnage will be shortage of reloading equipment. Reloading and dredging are same nature of work. Equipment purchased can be used for loading/reloading and also for dredging.

The demand forecast based on NTSR gives bright future of inland waterway transport but actual figure shows nature of stagnant. For example, total yearly handling cargoes at Hanoi Port of 1995 was estimated as 2.2 million tons but actual handling tonnage was 1.1 million tons due to the report of port authority.

Considering some inaccuracy of the demand forecast, first step of the Hanoi port improvement does not include increase of berths but increase number of cranes from existing six to nine. Eight cranes are used in eight berths and reserved one is used for dredging purpose.

Table 15-4-2 Cranes Proposed to be Increased

Type	Unit Price (Million VND)	Number of Unit
45 tons Crawler Crane	6,750	3

CHAPTER 16 TRANSPORT MASTER PLAN

16.1 Master Plan Alternatives

16.1.1 Transport Network Alternatives

The following three master plan alternative networks are prepared to understand the effect by the alternatives on the transportation network in the Study Area. Each alternative networks are shown in Fig. 16-1-1 through Fig. 16-1-3.

Table 16-1-1 Master Plan Network Alternatives

Alternatives	Trunk Roads	Feeders and Collectors	Railway
Alternative 1	299.5Km	--	--
Alternative 2	299.5Km	214.9Km	--
Alternative 3	299.5Km	214.9Km	77.4Km

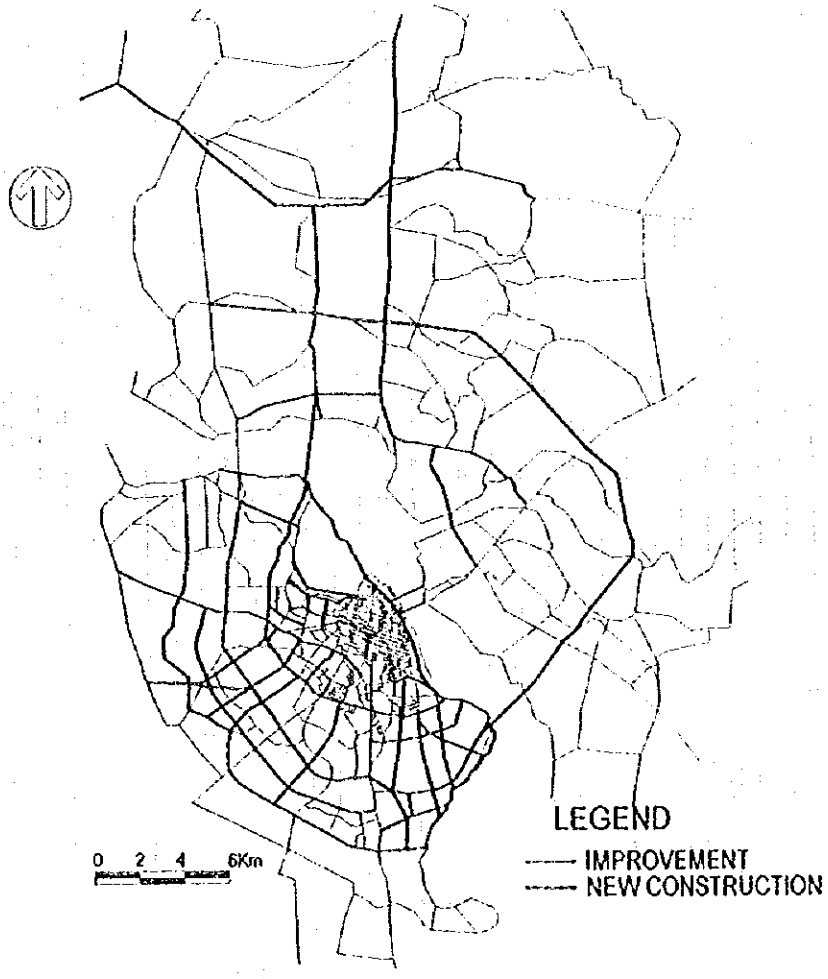


Fig. 16-1-1 Master Plan Network (Alternative-1)

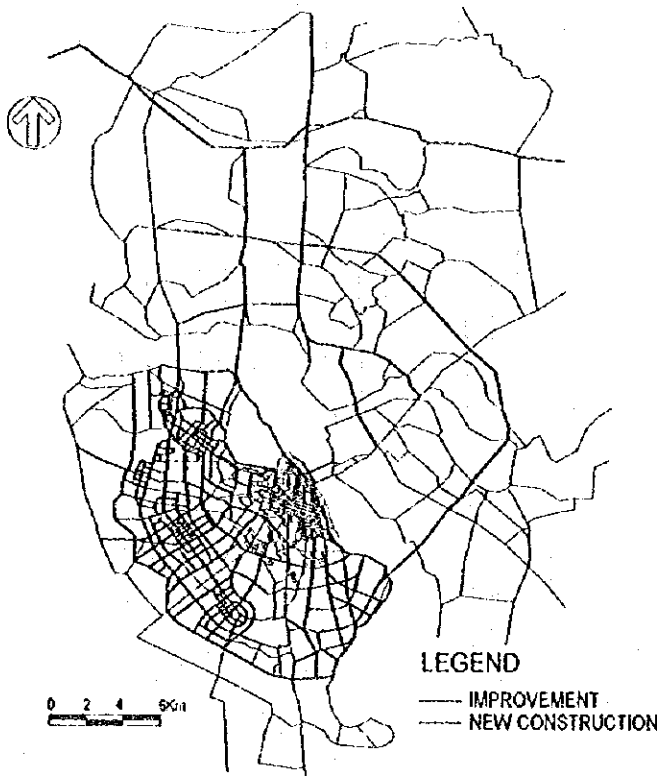


Fig. 16-1-2 Master Plan Network (Alternative-2)

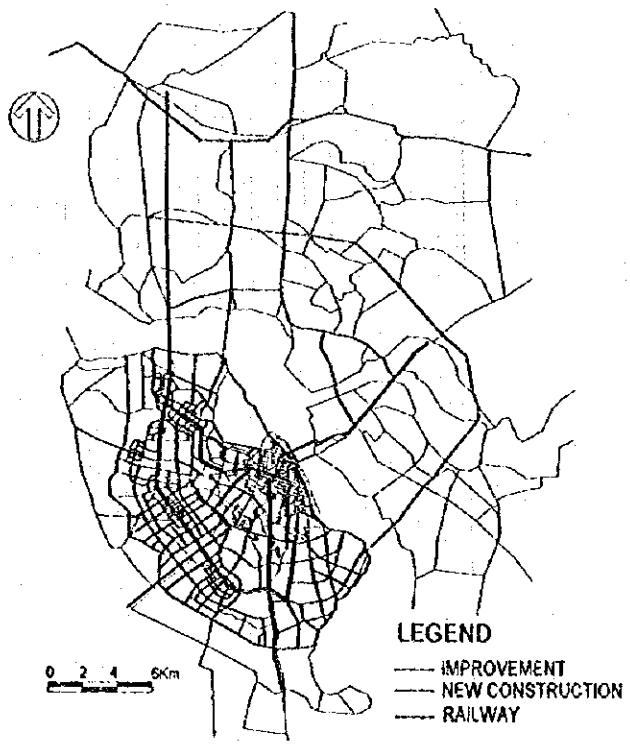


Fig. 16-1-3 Master Plan Network (Alternative-3)

In alternative-1, only main transport corridors such as Ring Road No.2 and No.3, main radial roads of National Highway No.6 and No.32, a new expressway to Ba vi New City, and National Highways of No.2, No.3 and No.18 in the present rural area will be developed. In alternative-2, in addition to the road networks in the alternative-1, feeder and collectors to form at least 500m blocks in the present sub-urban area are added. In alternative-3, in addition to the road network in the alternative-2, three railway networks of the present VNR lines along National Highway No.1 from Van Dien to Yen Vien, a new line from Noi Bai Airport to the city center via New CBD Development Area, and a new line from Ha Dong to city center via National Highway No.6 and Lang Ha st. are planned.

16.1.2 Evaluation of Alternatives

The vehicle operating cost (VOC) is calculated based on the traffic assignment result to the transportation networks for each alternative using OD matrices in the years of 1995 and 2015. Fig. 16-1-4 shows the comparison of the total annual VOC and Rail Operating Cost (ROC).

In 1995, the total VOC was 3,331 B.VND and if no improvement is implemented (Do-Nothing Case), it will increase to 16,711 B.VND or 5.1 times the present. However, if only the trunk road network is developed (Alternative-1), it will reduce to 12,225 B.VND, and if feeders and collectors are developed, in addition to the trunk roads (Alternative-2), it will reduce to 11,975 B.VND.

The railway system will reduce VOC more to 11,675 B.VND), however if ROC is added to VOC, the total of VOC and ROC will increase to 13,344 B.VND.

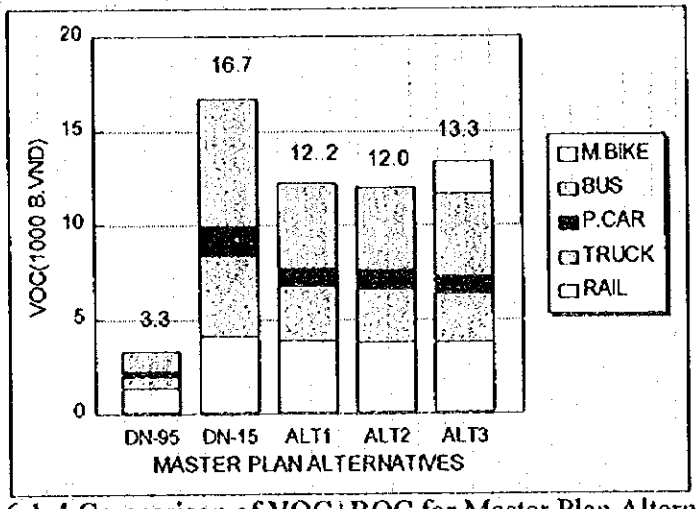


Fig. 16-1-4 Comparison of VOC+ROC for Master Plan Alternatives

Table 16-1-2 shows the single year benefit in the year 2015 derived from the VOC saving and the initial investment costs of each alternative. B/Cs were calculated dividing the annual benefits by the single year costs, converted from the total costs for the comparison purpose, applying the amortization capital values with a discount rate of 12% and an amortization period of 20 years.

Table 16-1-2 B/C of Master Plan Alternatives

Unit:B.VND

Description	Alternative-1	Alternative-2	Alternative-3
Annual Benefit(2015)	4,485.0	4,736.2	3,366.5
Cost Total	28,482.6	32,193.3	53,277.0
Single Year B/C	1.18	1.10	0.47

The alternative-1 has the higher B/C than the alternative-2, however the difference is small. If the initial investment reduces by only 4%, the B/C of the alternative-2 will have the same value of 1.18 as in the alternative-1.

The dense road network in the alternative-2 will have more indirect benefit, which were not calculated in the Table above. They are;

- Improvement of living environment, which will attract businesses and residents in the sub-urban area,
- Contribution to the effective and organized land use in the sub-urban area,
- Improvement of traffic function on trunk roads by providing networks for local traffic and by controlling frequent accesses

The alternative having the railway system has the lowest B/C among the alternatives, however it will reduce the traffic load on the road network. In our target year of 2015, the railway will not be able to serve for enough public transport passenger demand to be justified by the economic aspect, however a time when the railway will be needed as an urban transport mean and will be justified will come in a longer future. For that time, spaces to accommodate the future railway system should be reserved, and a line running throug the New CBD area from the existing Thang Long - Noi Bai line to the city center will be planned in the Master Plan.

16.2 Transport Master Plan

The all the transport master plan projects by the year 2015 are listed in Table 16-2-1, and Fig. 16-2-1 shows the location of these projects. After the preliminary study on the introduction of railway, a part of the line-1 from the central Hanoi to Bac Hong is decided to be implemented by the year 2015 to attract business and commercial activities to the sub-urban area and to preserve the city view in the present built-up area.

16.2.1 Traffic Demand on Master Plan Case

Fig. 16-2-2 and 16-2-3 show the traffic flows in 2005 and 2015 respectively. The road length having V/C of more than 1.5, which is considered as the maximum allowable limit, will increase to 85.4 Km or about 9% of the entire road length in the Study area in Do-Nothing Case in 2015, while no link will have V/C of more than 1.5 in the Master Plan case. About 94% of the road length has V/C of less than 0.5 at present and it will reduce to 61% in 2015 in Do-Nothing Case, while 88% of the entire road length will remain in the same range in the Master Plan case, which implies the Master Plan network will guarantee the almost same traffic condition as at present. Fig. 16-2-2 shows the road length with different V/C in the cases of Do-Nothing and Master Plan.

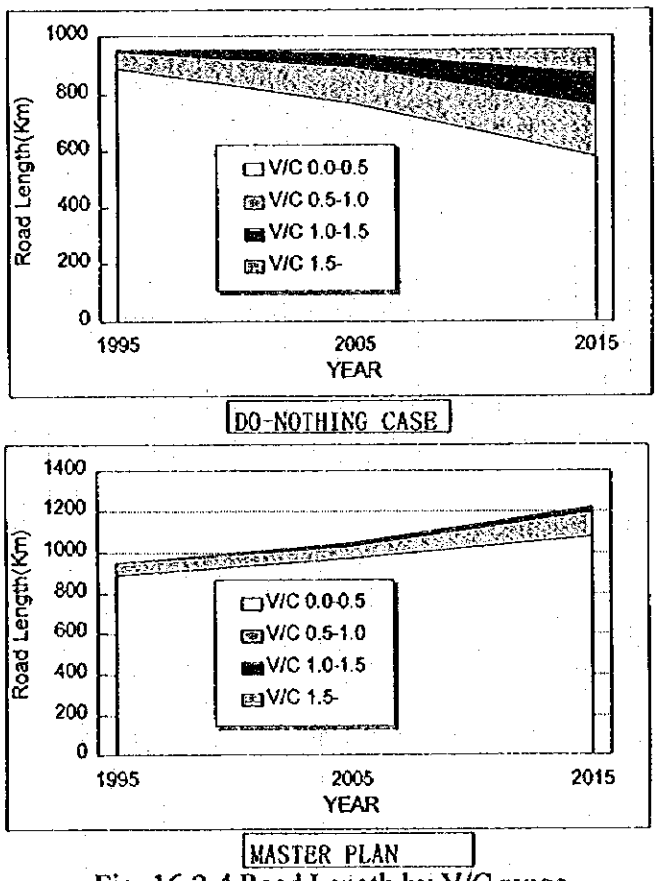


Fig. 16-2-4 Road Length by V/C range

Table 16-2-1 Master Plan Projects Implementation Schedule

Package	Project Name	Length (km)	Cost (b. VND)	Year 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
A	NATIONAL HIGHWAYS	132 525	12 445 7	
A01	National Highway 2 Improvement Project	5 500	96 6	
A02	National Highway 3 Improvement Project	32 500	648 8	
A03	National Highway 5 Extension Construction Project	10 700	637 0	
A04	National Highway 32 Improvement Project	8 500	427 1	
A05	National Highway 18 Construction Project	18 000	299 5	
A06	Lang Hoa Lac Expressway Construction Project	2 750	113 1	
A07	South Ring Road 3 Construction Project	19 525	4 797 7	
A08	North Ring Road 3 Construction Project	28 800	4 570 7	
A09	Noi Bai Expressway Upgrading Project	6 250	855 3	
B	RURAL ROADS IMPROVEMENT	363 200	1 784 9	
C	URBAN ROADS	73 625	10 991 9	
C01	Ring Road 1 Improvement Project	6 500	967 9	
C02	Ring Road 2 Improvement Project	17 000	2 310 1	
C03	Red River Dike Improvement Project	19 300	1 626 9	
C05	Urban Street Width Adjustment Project	9 935	1 764 3	
C0601	Station Tunnel	1 500	656 5	
C0602	Linh Quang - Cho Kham Thien	1 025	226 1	
C0603	Yen Lang Drain Road	2 815	437 8	
C0604	Lieu Giai Extension - North	0 590	206 3	
C0605	Lieu Giai Extension - South	1 825	638 0	
C0606	Nui Truc Extension	1 060	370 6	
C0607	South Thang Long - Buoi Road	2 675	100 9	
C07	West Lake Parkway Construction Project	3 900	281 6	
C08	Hanoi Interchange Construction Project	2 600	700 0	
C09	Hanoi Bridge Capacity Increase Project	1 300	654 9	
D	HANOI NORTH DEVELOPMENT AREA	300 130	7,353 8	
D01	Dong Anh Highway Construction Project	12 100	4,010 2	
D02	Dong Anh New City Road Network	53 090	631 9	
D03	Soc Son New City Road Network	59 460	688 6	
D04	Gia Lam New City Road Network	127 870	1,457 4	
D05	North Thang Long New City Road Network	47 010	567 5	
E	NEW CBD ROAD NETWORK	73 400	1 567 7	
E01	Ring Road 2 North Extension Project	7 800	422 4	
E02	South Thang Long Road Project	1 850	87 4	
E03	New Ring Road 2 Project	6 200	179 7	
E04	New CBD Road Network	52 010	740 5	
E05	Ring Road 3.5 Project	5 500	137 7	
F	HANOI URBAN DEVELOPMENT CORRIDOR	199 995	3,611 7	
F01	New Ring Road 2 Project	8 605	285 1	
F02	Lang Ha - Ha Dong Road Project	5 500	146 9	
F03	Lang Hoa Lac Expressway Construction Project	1 750	112 1	
F04	Ring Road 3.5 Project	13 250	283 7	
F05	Provincial Road 70 B (413) Upgrading Project	7 500	158 7	
F06	Nhue River Road Project	13 760	127 6	
F07	Mo Tri Road (to Ba Vi Expy)	4 250	84 4	
F08	Bach Ma Airport Road	5 350	112 7	
F09	Xuan La New City Road Network	18 920	311 3	
F10	Yen Hoa New City Road Network	101 060	1,600 2	
F11	Dai Kim New City Road Network (1)	20 030	329 1	
G	HANOI SOUTH DEVELOPMENT AREA	48 250	1,632 4	
G01	New Ring Road 2 Construction Project	5 580	184 6	
G02	Linh Nam Road	3 250	68 1	
G03	Red River Dike	7 500	217 6	
G04	Ring Road 4 South	2 250	43 9	
G05	Mai Dong Road	7 630	659 3	
G06	Minh Khai Extension	4 000	80 7	
G07	Ring Road 3.5	2 400	46 8	
G08	South Road Network	15 640	311 3	
H	RAILWAY PLAN	17 400	3,046 4	
H01	Hanoi - Noi Bai Line (Stage I)	17 400	3,046 4	
I	PUBLIC BUS TRANSPORT PLAN		2,637 5	
I01	Bus Fleet Enhancement		2 562 0	
I02	Bus Maintenance Center		22 0	
I03	Bus Terminal Project		53 5	
J	MANAGEMENT AND SAFETY PROJECTS		243 2	
K	FREIGHT TRANSPORT PROJECTS		404 5	
K01	Hanoi Ports Improvement Project		6 8	
K02	Truck Terminal Project		397 7	
	Total	1,208 5	45,724 7	

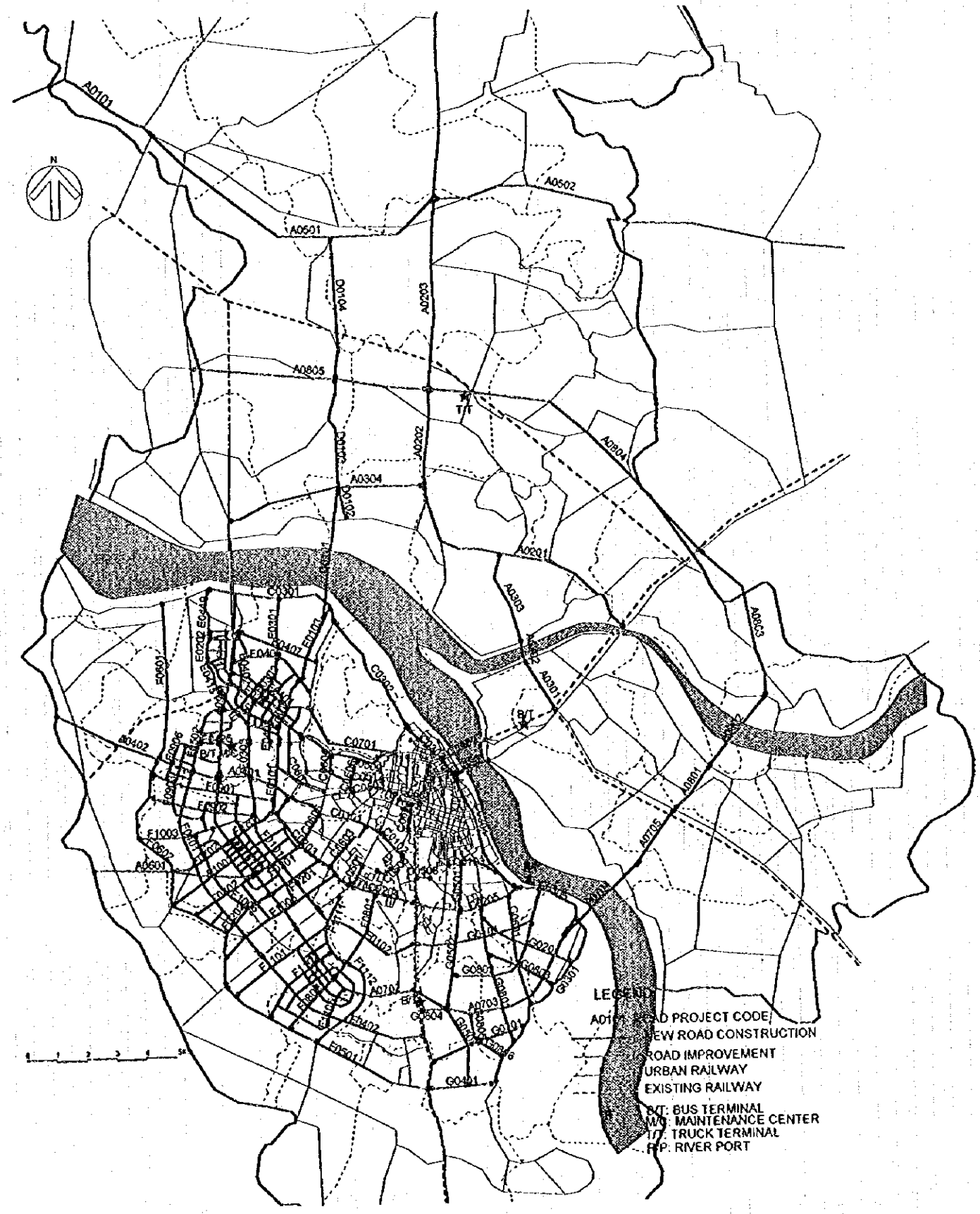


Fig. 16-2-1 Location Map of Master Plan Projects

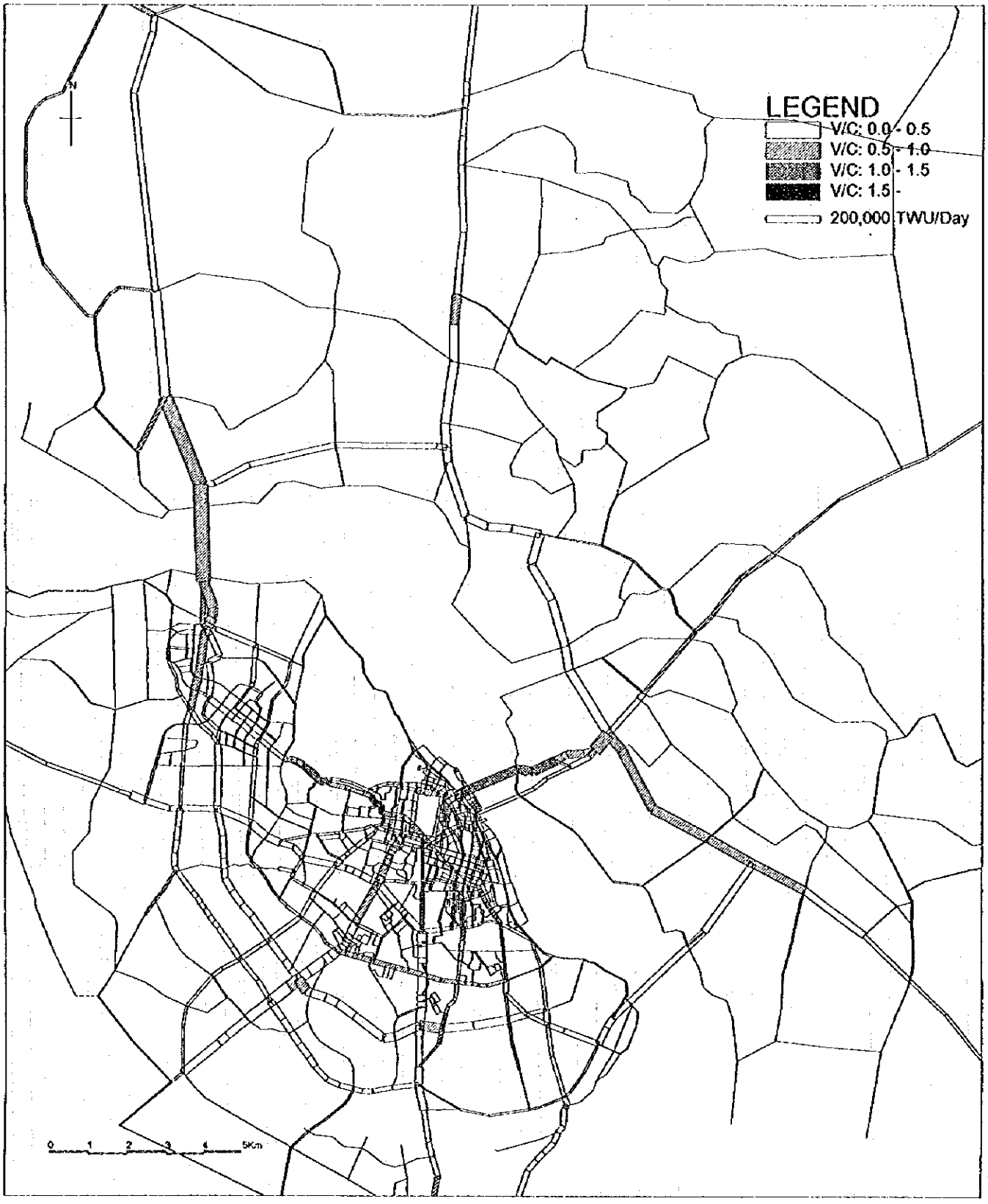


Fig. 16-2-2 2005 Traffic Flow assigned onto 2005 Master Plan Network

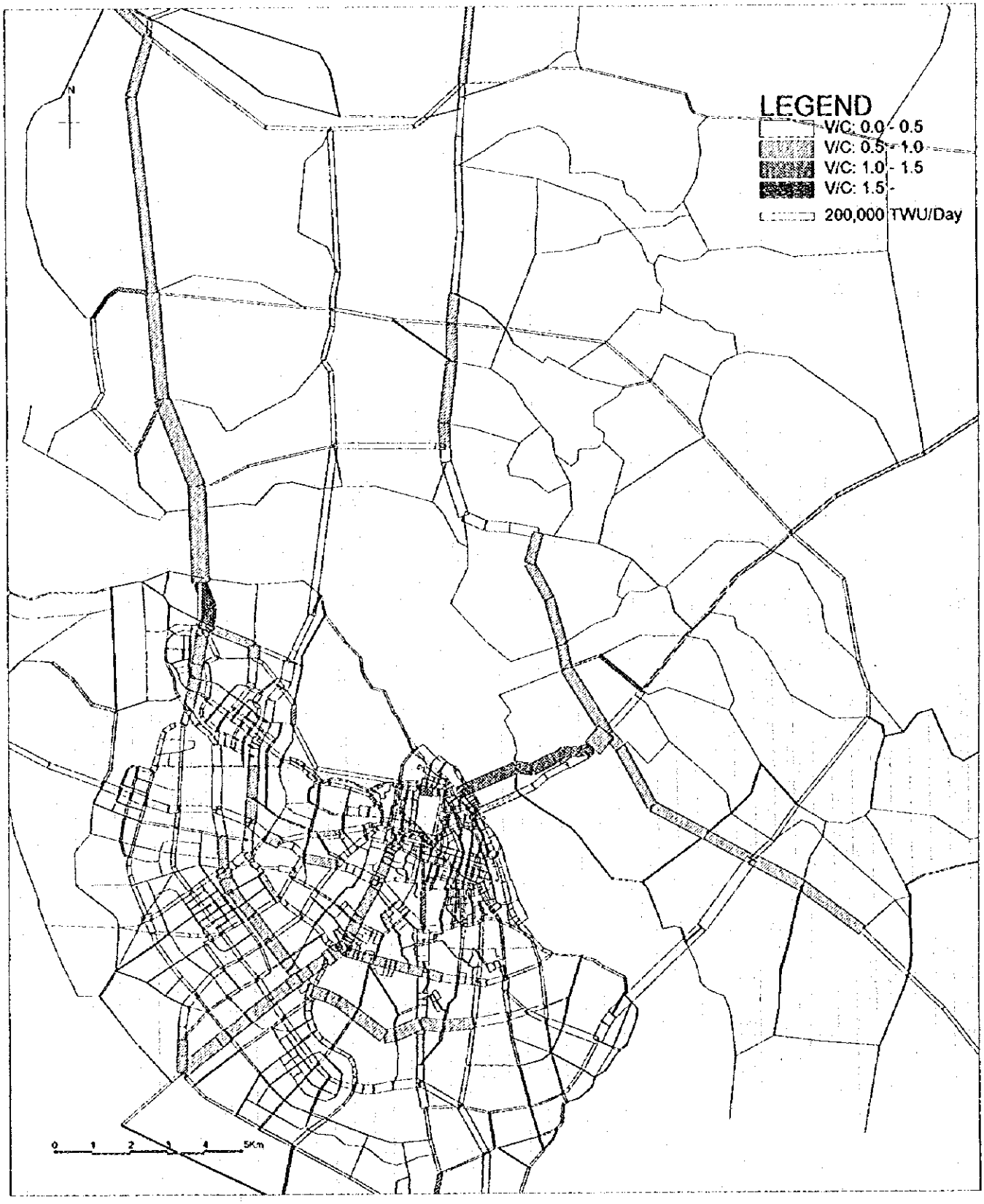


Fig. 16-2-3 2015 Traffic Flow assigned onto 2015 Master Plan Network

16.2.2 Required Investment for Master Plan

Table 16-2-2 summarizes the required investment by types of project and by investment period. Road development project cost is 86.1% of the total followed by the projects related to the public transport development is 12.4%.

Table 16-2-2 Cost Summary of Master Plan Projects

unit: B.VND

Project	1996-2000	2001-2005	2006-2015	Total
Road Development	6,080.8	12,009.4	21,298.1	39,388.3
MOTC	2,620.1	4,171.9	10,318.9	17,110.9
TUWPS	2,173.6	6,479.4	8,495.9	17,148.9
Road Development	1,875.0	4,663.1	5,431.3	11,969.4
Land Development	298.6	1,816.3	3,064.6	5,179.5
DPC	451.2	522.2	811.5	1,784.9
Others	835.9	835.9	1,671.8	3,343.6
Traffic Management	104.3	75.5	68.4	248.2
Public Transport Development	646.5	2,453.5	2,583.9	5,683.9
Bus	646.5	1,328.5	662.5	2,637.5
Fleet	642.1	1,285.7	634.2	2,562.0
Terminal & M.Center	4.4	42.8	28.3	75.5
Rail	0.0	1,125.0	1,921.4	3,046.4
Freight/Port Development	0.0	131.4	273.1	404.5
Total	6,831.6	14,669.8	24,223.5	45,724.9

The share of the required investment for the first r years from 1996 to 2000 is about 15% of the total and for the last 10 years is about the half, therefore the investment amount are distributed in proportion with the number of years.

Fig. 16-2-5 shows the accumulative investment and budget amounts for MOTC. The MOTC project cost total is 17,110.9 B.VND including 2 new bridges over the Red River and one paralleling with the existing Chuong Duong Bridge, is within the estimated budget for the next 20 years of 18,639.7 B.VND. In the first 10 years, the required investment will exceed the estimated budget, however, they will be balanced within 20 years.

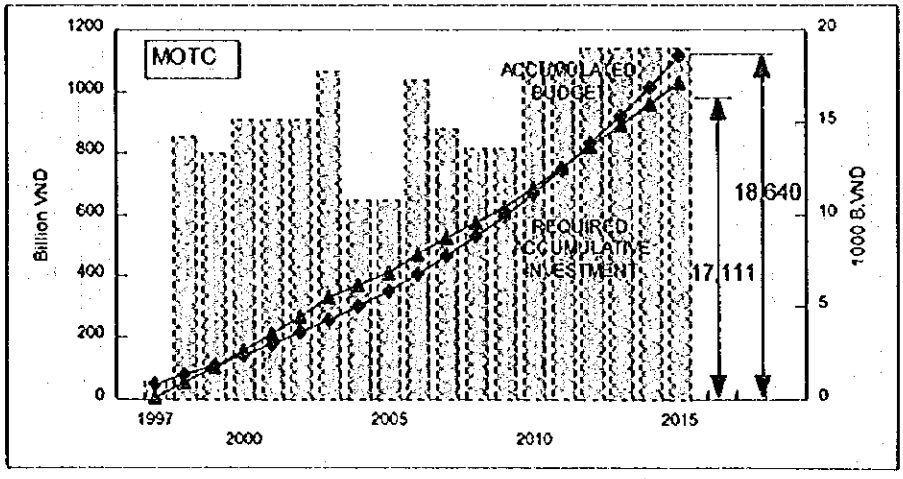


Fig. 16-2-5 MOTC Investment and Budget Schedule

Fig.16-2-6 shows the required investment and the estimated budget amounts of TUPWS. TUWPS road development project cost exceeds the estimated budget of 4,003.9 B.VND. Therefore, it is recommended that the projects related to the land development in the sub-urban area would be covered by the increase of land price caused by the infrastructure development. The projects which could be covered by the conventional budgeting system are;

- Ring Road No.1,
- Red River Dike Road improvement, and
- Width adjustment projects within the built-up area.

The estimated cost of the three projects are 4,379.2 B.VND, which almost equivalents to the TUPWS budget for 20 years.

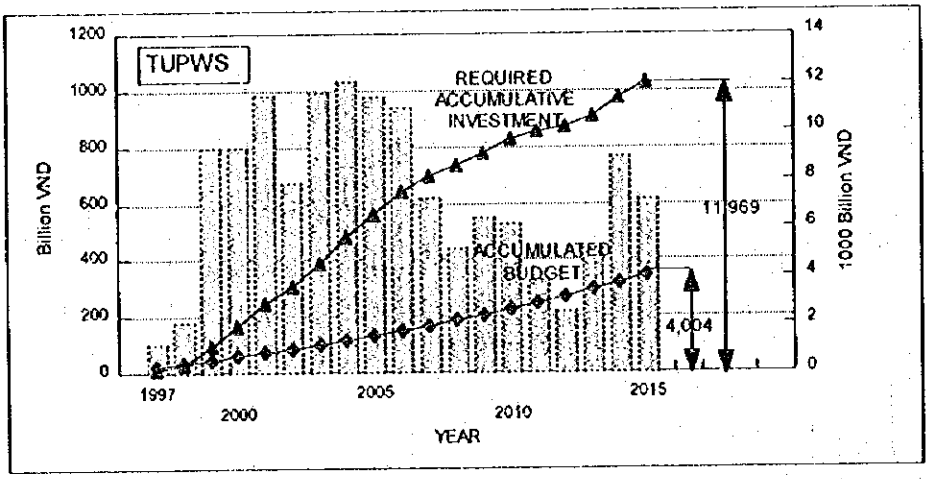


Fig. 16-2-6 TUPWS Investment and Budget Schedule

Fig. 16-2-7 shows the required investment and estimated budget by each district. The required investment in the four districts of Gia Lam, Dong Anh, Thanh Tri, and Tu Liem are almost same as the estimated budget based on the current expenditure, while that in Soc Son district exceeds about 8.0 times the present. However, the current expenditure in Soc Son district was about 1/4 of that in Dong Anh district despite of the 1.7 times and 3.3 times wider area than Dong Anh and Thanh Tri Districts respectively. The population are almost same.

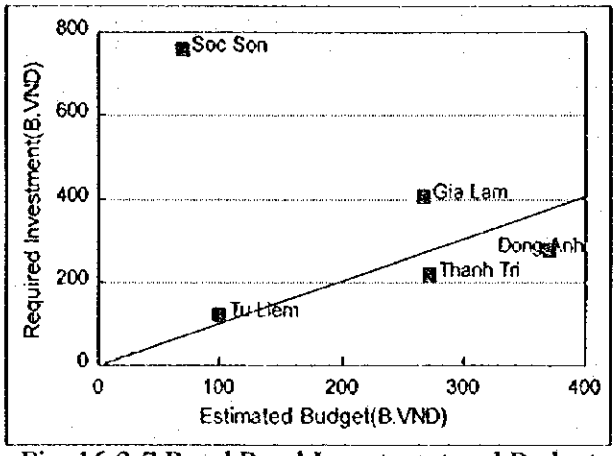


Fig. 16-2-7 Rural Road Investment and Budget

If the same level of budget as in Dong Anh District is invested in Soc Son District, the difference between required investment and the estimated budget will reduce to 2.0 times, and if the budget is prepared in proportion to the area, the budget will be almost equal to the required investment.

Public transport development requires 5,683.9 M.VND in the next 20 years, in which 2,562.0 M.VND or 45.1% are for the purchase of buses. If buses are operated in the financially viable situation, no public fund is needed for purchasing buses. They should be covered by the bus operators. The master plan proposed the introduction of Bus Holding Company to save bus purchase cost from public funds. To support their financial viability, it is recommended that the public sector should give some privileges such as tax exemption or reduction for importing buses, or business tax.

The investment for revenue generating facilities such as bus terminals, a bus maintenance center, truck terminals, a river port and a railway should be born by the facility operators, however these facilities will not generate sufficient revenue to cover all the costs or profit will be generated beyond the Master Plan target year. Therefore, it is proposed that at least the operating expense should be covered by the operations of individual facilities and the initial costs would be invested from the public funds.

16.3 Economic Evaluation of Master Plan

16.3.1 Methodology of the Evaluation

(1) General Evaluation Procedure

Fig. 16-3-1 shows the general procedure of the master plan evaluation. The master plan network consists of many project elements and the priority from the view point of the economic impact of each road project was studied by the single year evaluation to avoid the distortion by the implementation schedule.

The Master Plan evaluation will evaluate the total economic impact of all the Master Plan network under the condition that each project element will be implemented as proposed. Therefore, the networks and OD matrices for each year should be prepared to calculate VOCs for each year and for both Do-Nothing and Master Plan cases as shown in Fig. 16-3-1.

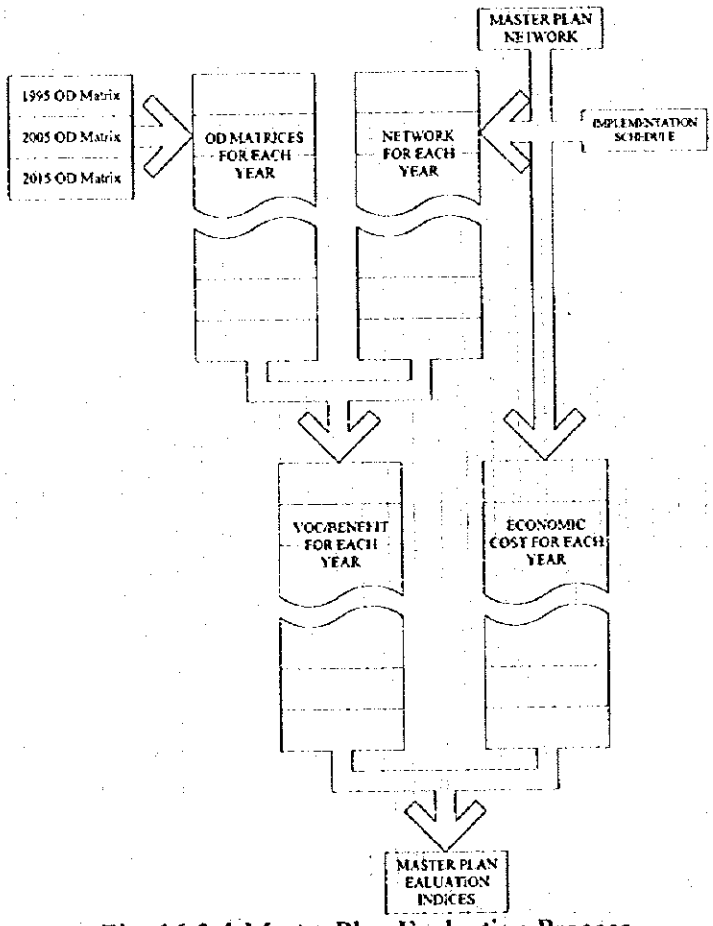


Fig. 16-3-1 Master Plan Evaluation Process

(2) Benefit of the Master Plan

The benefit of the master plan was calculated from the difference of VOCs in Do-Nothing and Master Plan cases in each year. To calculate VOCs for each 20 years from

1995 to 2015 in the both cases, OD matrices of the five modes of bicycle, motor bike, bus, passenger car and truck for the intermediate years were prepared by interpolating intermediate years using the annual growth rate between 1995 and 2005, and 2005 and 2015.

(3) Cost of the Master Plan

The economic costs of each project elements were allocated to each year from 1997 to 2015, and the annual investment costs of the master plan network for each year were calculated by totaling the project cost of each project element in each year.

16.3.2 Economic Evaluation Result of the Master Plan

Fig. 16-3-2 shows the annual VOCs both in Do-Nothing and Master Plan cases. The deference of VOCs in the hatched area are counted as the benefit.

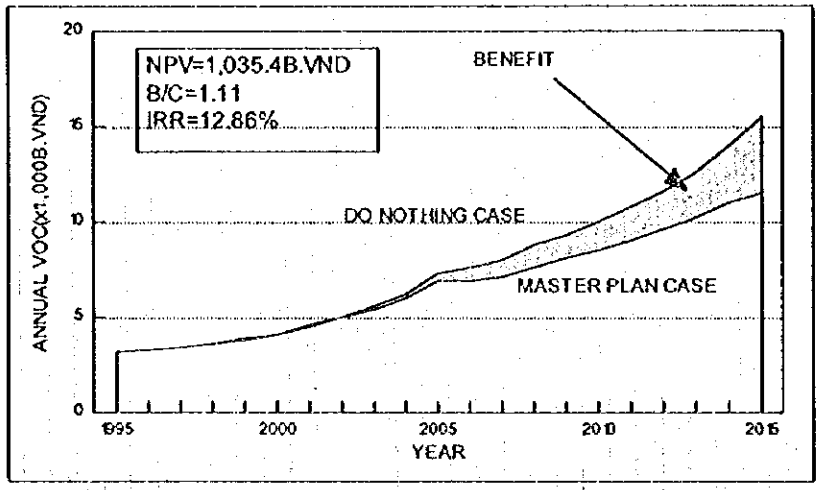


Fig. 16-3-2 Benefit of the Master Plan Network

All the project elements will end by the end of 2015. However, since the target year of the Study is 2015, the traffic demand and the network beyond 2015 are not prepared, despite the last project element will generate benefit after 2015. Therefore, the benefit beyond 2015 is assumed to have the same growth rate as in 2014/2015 and the master plan network was evaluated for the period of 30 years from 1996. The residual value was calculated assuming project life of 50 years, and the total of the residual values are counted as negative cost at the last year of the evaluation period (2025).

Table 16-3-1 shows the economic cash flow of the master plan network. Net Present Value (NPV) and Cost-Benefit Ratio (B/C) with a discount rate of 12% were calculated at 1,035.4 B.VND and 1.11. Economic Internal Rate of Return (EIRR) was calculated at 12.86.

Table 16-3-1 Economic Cash Flow of Master Plan Network

Unit: B.VND

Year		VOC		BENEFIT	COST	B-C
		Master Plan	Do-Nothing			
0	1995	3,180.0	3,180.0	0.0		0.0
1	1996	3,236.0	3,236.0	0.0	0.0	0.0
2	1997	3,378.0	3,379.9	1.9	850.8	-848.9
3	1998	3,597.9	3,614.8	16.8	962.1	-945.3
4	1999	3,838.0	3,849.0	11.0	1,090.5	-1,079.6
5	2000	4,116.8	4,118.3	1.5	1,625.2	-1,623.8
6	2001	4,480.6	4,590.7	110.2	1,519.0	-1,408.8
7	2002	4,962.4	5,011.8	49.4	1,464.6	-1,415.2
8	2003	5,351.7	5,545.6	194.0	1,488.1	-1,294.2
9	2004	5,946.8	6,195.2	248.3	1,367.0	-1,118.7
10	2005	6,880.5	7,283.2	402.8	1,152.7	-749.9
11	2006	6,856.5	7,623.6	767.2	2,073.7	-1,306.6
12	2007	7,103.2	8,028.6	925.5	1,947.8	-1,022.3
13	2008	7,617.1	8,766.2	1,149.1	1,961.3	-812.1
14	2009	8,061.7	9,331.0	1,269.4	1,686.0	-416.6
15	2010	8,529.9	10,000.7	1,470.8	2,215.2	-744.4
16	2011	8,966.2	10,799.8	1,833.6	2,009.7	-176.1
17	2012	9,587.2	11,571.3	1,984.1	1,885.9	98.3
18	2013	10,179.7	12,627.8	2,448.2	2,103.6	344.6
19	2014	11,017.3	14,024.2	3,007.0	2,185.2	821.7
20	2015	11,507.6	15,553.4	4,045.7	2,034.8	2,010.9
21	2016	12,019.9	17,249.3	5,229.4	0.0	5,229.4
22	2017	12,554.9	19,130.1	6,575.2	0.0	6,575.2
23	2018	13,113.7	21,215.9	8,102.3	0.0	8,102.3
24	2019	13,697.4	23,529.3	9,831.9	0.0	9,831.9
25	2020	14,307.1	26,094.8	11,787.7	0.0	11,787.7
26	2021	14,943.9	28,940.1	13,996.2	0.0	13,996.2
27	2022	15,609.0	32,095.6	16,486.6	0.0	16,486.6
28	2023	16,303.8	35,595.2	19,291.4	0.0	19,291.4
29	2024	17,029.5	39,476.4	22,446.9	0.0	22,446.9
30	2025	17,787.5	43,780.7	25,993.3	-7,067.2	33,060.5
	Total			159,677.1	24,555.9	135,121.2
						NPV=1,035.4
						B/C=1.11
						IRR=12.86

16.4 Environmental Evaluation

(1) Resettlement

Resettlement will occur due to construction of new roads and railways, and the improvement of roads and construction of terminals. In this master plan, new roads, widening of roads and terminals will entail the acquisition of land. Therefore, a feasibility study will be required for the resettlement of inhabitants displaced from these areas with consideration for their possible opinions.

(2) Economic activities

Since improvement of the road network and establishment a new railway will be promoted in the Hanoi City, household environment and production areas of business and industry will increase, and development of the whole city economy can be promoted. According to sound urban development, population and labor opportunity will be expected to increase. On the other hand, the economy of the site will be affected and the industries with small added value will cease operation. Therefore, it is necessary to promote the development of regional industry.

(3) Transportation and public facilities

Transport facilities will be planned such as bus and railway terminals. Therefore, the feasibility study needs to assess impact of these works. Meanwhile, traffic congestion and noise pollution during construction are expected, so construction planning will need prudent environmental consideration. Many public facilities such as schools, hospitals, churches exist along the roads. Therefore, countermeasures should be carried out in order to protect the environment.

(4) Cultural property

There are many cultural buildings everywhere in Hanoi City. It is necessary to promote a suitable plan according to the overlay on the proposed routes. Some of these buildings are along the route, but, they are not in the land acquisition areas.

(5) Waste

Waste expected in this study consists of waste dumps resulting from construction, particularly, much waste resulting from construction of bridge foundations and the road tunnel. Therefore, according to suitable control and treatment, it is desirable to use the waste effectively such as for filling in the at-grade road construction.

(6) Hydrological situation

Three new crossing are planned over the Red River, Dong Anh Bridge, Chuong Duong Bridge, Thanh Tri Bridge. Therefore, the feasibility study needs to assess the impact on the changes of water flow and riverbed under construction. In addition, it is desirable to assess the impact on the dredging of the Red River to provide sand and gravel for

construction.

(7) Landscape

It is necessary for improving the environment of Hanoi to consider greenery and individuality. The function of greenery in road planning is to improve the scenery, conserve the natural environment, enhance traffic safety, provide shade and prevent disasters. It is necessary for promoting greening activities, to select an arrangement and types keeping in mind the functions applied to the road and the region. It is important when aiming to improve the scenery to express the individuality of the area. To do this it is necessary to use materials from the region or associated with the region's history.

Concerning the roads of Hanoi, there are many new and old roads which are devoid of environmental consideration, particularly Thanh Xuan, Ngoc Khanh, and Cau Giay. However, many roads are still lined with large mature trees. A situation where trees will have to felled will occur in all the proposed routes. Therefore, scenic improvement should be sufficiently considered in the road improvement plan and environmental measures should also be taken such as replanting trees.

As regards circumstances in the inner city, roadside trees and trees in the park form a good environment with greenery. Therefore, it is necessary for the proposed elevated railway, to design the shape in harmony with the surrounding environment.

(8) Air pollution

As a result of the above-mentioned survey, although the traffic volume particularly of motorcycles was large, the concentration of air pollutants emitted by vehicles, except for SPM, were low. However, the growth of traffic volumes in the future will be expected to effect the atmosphere. Countermeasure for vehicles in use have not been undertaken yet, therefore, items which should be noted as countermeasures against air pollution are as follows.

1) Improvement of automobiles

Improvement of automobiles involves emission gas regulations applied both to new models and vehicles in use. It is important to strengthen regulations in the future. As for countermeasures for gasoline engines, the use of catalysts is effective for reduction of CO, HC, NOx. In addition, the use of electric controlled carburetors will reduce the volume of emission gas. In Thailand the installation of catalysts on new car of over 1,600cc has been required from Jan.1993. Also the promotion of the use of gasoline without lead and diesel oil with little sulfur by means of price incentives, has contributed to reduce the environmental load caused by increased fuel consumption.

2) Improvement of road structure

The concentration of automotive emissions decreases by diffusion as the distance from the road increases. Therefore, it is important to maintain distance between roads and dwellings by the establishment of buffer zones and greenbelts. Comparison of air

pollutants' concentration decay by distance under same traffic conditions applied to basic types of road structure are shown in Fig. 16-4-1 (receiver height 1.5m; wind direction transversal). In case where the height of the emission source is low, such as grade level, concentration on the roadside is high. Therefore, when the height of the emission source increases, diffusion is more effective. Use of barriers as countermeasures against noise and street trees will theoretically increase the emission height, and they are also effective for the diffusion of pollutants.

On the other hand, some plants are able to absorb and fix air pollutants. For instance, a 7m-wide greenbelt with trees on both sides has the ability to absorb 5% of NOx emitted from a traffic volume of 30,000 vehicles per day. Fig. 16-4-2 shows that a row of trees along a roadway has the effect of promoting diffusion by disturbing the air flow.

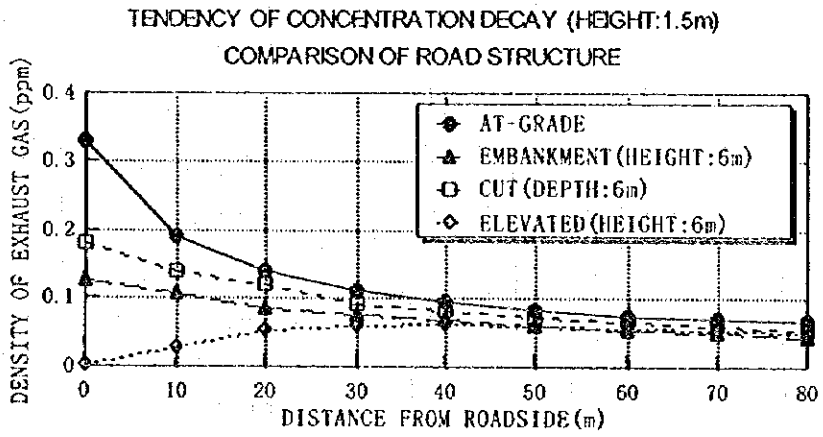


Fig. 16-4-1 Air pollutants concentration decay by distance

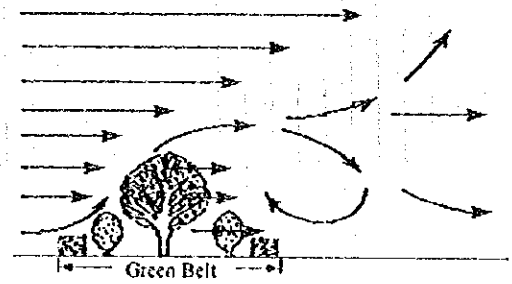


Fig. 16-4-2 Function of diffusion concerning greenbelt with trees

3) Improvement of traffic flow

It is particularly important for achieving air pollutant reduction to plan and maintain smooth and safe traffic flow. The relation between vehicle velocity and emission volume is shown in Fig. 16-4-3. As a result of the master plan, the combination of improvement of speed and control of unnecessary starting and stopping is expected to reduce the concentration of exhaust gas from vehicles. This will be especially effective for large diesel-engined vehicles. However, the growth of traffic volume in the future will counter this effect unless suitable measures are taken. Therefore, as mentioned above, it is necessary to promote such measures as exhaust gas regulations and traffic

demand management.

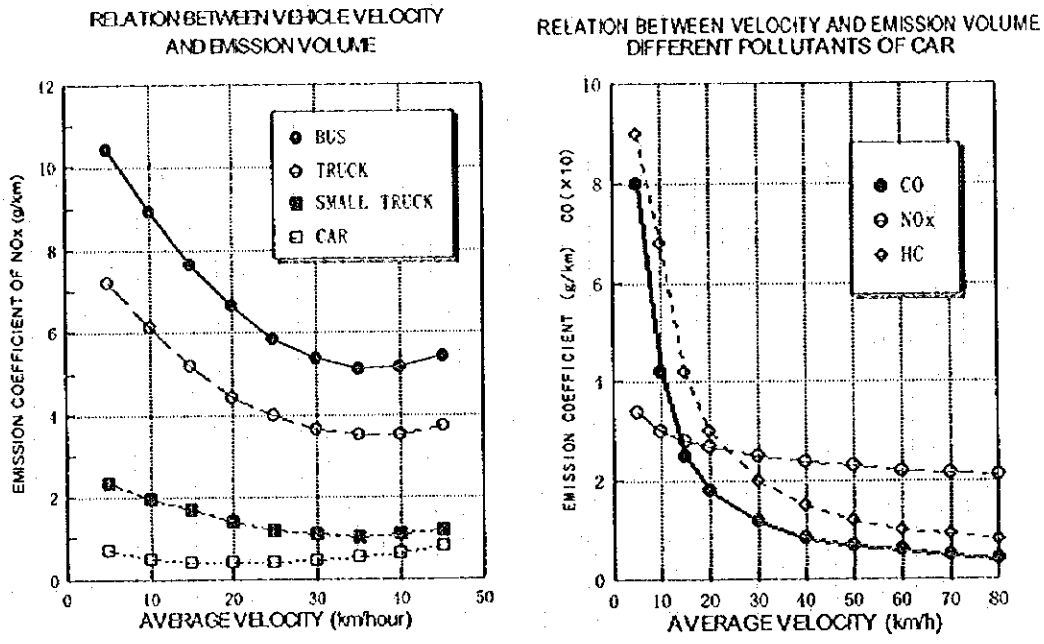


Fig. 16-4-3 Relation between Vehicle Velocity and Emission Volume

(9) Water pollution

As regards plan to build new bridges over the Red River, muddy water will be caused during construction of foundations. Therefore, it is necessary to do this work in a manner which minimizes water pollution. Treatment of surplus water including bentonite slurry will need undertaken during pile construction.

(10) Noise

Noise is one of the major factors resulting from traffic pollution in Hanoi City. Especially in the inner city, undisciplined use of bicycles, cyclos and motorcycles prevents smooth traffic flow, and the current traffic system and poor traffic manners cause frequent use of horns. In general, items which have to be noted when taking countermeasures against noise are as follows.

1) Road traffic

a. Strength of regulations

Traffic noise will rise on account of increasing traffic volumes in the future. Therefore, there is a need to strengthen the regulations and controls over the noise level from all vehicle contributing to road traffic noise. For instance, noise regulations applied to vehicles in Japan are shown in Table 16-4-1. It is important not only to strengthen the

Regulation, but also to restrict to the horn-use by means of smooth traffic flow.

Table 16-4-1 Particulars of noise regulation concerning vehicles in Japan (dB)

Type of vehicle	Acceleration running noise (dB)					Running noise (dB)	Exhaust noise (dB)
	1971	1976	1979	1982	2006?		
Two wheeled vehicles	84-86	83	78	75	73	74	99
Motorcycles	80-82	79	75	72	71	70	95
Small vehicle(Less than 10 person)	84	82	81	78	76	70	103
Large vehicle(Over 3.5ton, 200Hp)	92	89	86	83	82	80	107

b. Improvement of traffic flow

It is particularly important for achieving noise reduction to plan and maintain smooth and safe traffic. Steps to improve the road system are as follows: Dispersion and facilitating free movement of traffic by systematic improvement of roads; easing traffic congestion by improving intersections, and establishment of off-street parking. Improving the traffic control system makes the traffic flow more smoothly. In managing traffic demand, it is necessary to rationalize the transport of goods. In addition, a good traffic environment will be encouraged by various regulations such as area-licensing, a license-plate numbering system, emission regulation, and the promotion of use of mass-transit systems by providing areas where passengers can park their cars before boarding trains. On the other hand, large buses produce much noise and vibration compared with automobiles, therefore it is desirable that an express bus line is arranged with an alignment that is far from dwellings.

c. Countermeasure of road structure

When planning new roads, it is necessary to examine the following facilities and to try hard to preserve the environment.

Road structure: a comparison of noise decay by distance under the same traffic conditions for basic types of road structure is shown in Fig. 16-4-4. Receiver height is 1.2m; total hourly traffic volume is 6400; velocity is 60km/hour; ratio of large cars is 15%. In the case of an at-grade road, noise is higher and decay is smaller.

Environmental belt: a zone between the road and dwellings should provide barriers and greenery for aesthetic considerations, and to reduce noise, vibration and air pollution by assisting decay with distance.

Barriers: barriers between the sound source and receiver can be used effectively to reduce outdoor noise by diffraction. In the case of an elevated road, establishment of a 5m-barrier can reduce the noise level by 5-10dB at a height of 1-3m above ground level.

Low barriers: for at-grade roads in the city, establishment of high barriers is not recommendable from the functional point of view. Therefore, establishment of a low barrier such as about a 1m high-hedge will reduce the noise level by 2-3dB in an area 2-3m high behind it.

Porous asphalt pavement: asphalt pavement using porous materials will control the noise produced by tires and pavement and reduce reflected noise from the road surface. It is expected that the noise level will be reduced by about 3dB.

Elevated structure: impact noise will occur from vehicles and structural vibration due to traffic loading at expansion joints of the elevated road . An effective countermeasure is to reduce the expansion joint and make the road surface continuous. Therefore, it is necessary to select not a simple girder bridge but a multi-span continuous girder bridge, and to arrange the expansion joint far from dwellings.

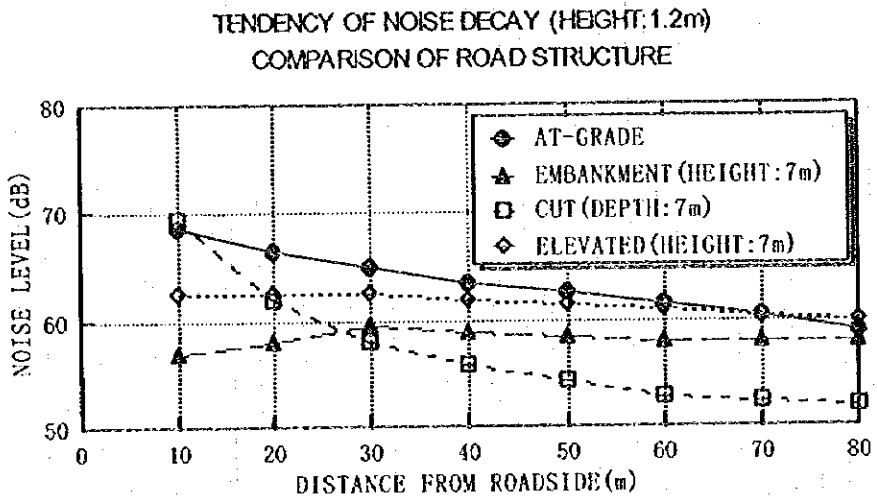


Fig. 16-4-4 Noise decay by distance (1.2m)

2) Countermeasures for railways

Countermeasures for railways are as follows; countermeasures against sound sources such as rail noise and structure-created sound; and countermeasures on land use planning. Particularly, countermeasures for sound sources are as follows; selection of car type with low noise; rail noise caused by wheels and rails will be reduced by barriers such as inverted L type barrier; structure-created sound will be reduced by selection of track type; and selection of long rail in order to reduce the impact at each joint of rails.

(11) Ground subsidence

Surface soil consists of clay and sand in Hanoi and numerous marshes formerly existed. Therefore, the possibility of subsidence is expected when constructing foundations and during tunneling. Especially, it is necessary when using the shield method in weak ground to fully consider surface subsidence. Factors affecting surface subsidence include geology, groundwater, overburden, tunnel section and method of execution of work. These items are shown in Fig. 16-4-5. Cautious execution of construction with field monitoring and subsidence control using injection grouting techniques which do not contaminate ground, are recommended.

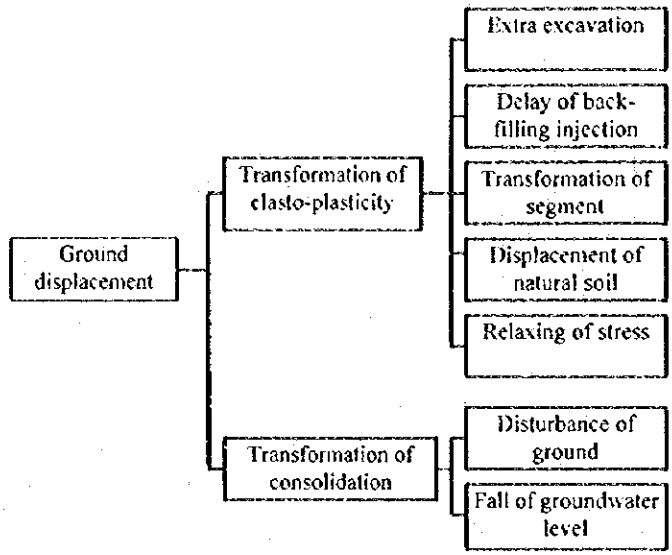


Fig. 16-4-5 Factors affecting ground displacement using shield tunnel method

Screening and Scoping for each Environmental Evaluation Items are summarized in Table 16-4-2, 16-4-3 respectively.

Table 16-4-1 Screening check List

Environmental items		Content	Evaluations	Remarks(Basis)
Socio-economic environment				
1	Resettlement	Resettlement by occupancy of proposed land (removal of rights of residence and land ownership)	YES/~~NO~~/~~UN~~	Residences exist in the project area.
2	Economic activities	Loss of a productive opportunity such as land, and change of economic structure	YES/~~NO~~/~~UN~~	Traffic and terminals will cause changes of the economic activities.
3	Traffic and public facilities	Influence of existing traffic such as congestion, accidents on schools and hospitals	YES/~~NO~~/~~UN~~	Hospitals and schools exist in the project area.
4	Split of communities	Split of communities by obstruction of traffic	~~YES~~/NO/~~UN~~	Split of community by construction will not occur.
5	Cultural property	Loss of cultural property and falling of value	YES/~~NO~~/~~UN~~	Important cultural properties exist.
6	Water right and right of common	Obstruction of fishing rights, water rights, common rights of forest	~~YES~~/~~NO~~/UN	The condition of establishment of water rights is unknown.
7	Health and sanitation	Deterioration of a hygienic environment by production of refuse and noxious insects	~~YES~~/NO/~~UN~~	Mass-refuse will not be produced.
8	Waste	Occurrences of waste dumps and solid waste	YES/~~NO~~/~~UN~~	Lots of waste dumps will be produced by construction.
9	Hazards	Increase of possibility of danger of landslide and accident	~~YES~~/NO/~~UN~~	No high slope is expected.
Natural environment				
10	Topography and geology	Change of valuable topography and geology by digging or fill	~~YES~~/NO/~~UN~~	Valuable topography and geography do not exist.
11	Soil erosion	Flow of surface soil by rainwater after land development and forest felling	~~YES~~/NO/~~UN~~	Forest and slanting surface do not exist in the project area.
12	Groundwater	Pollution by drainage or leach water by digging construction	~~YES~~/NO/~~UN~~	Ground water will not be pumped.
13	Hydrological situation	Change of flux and riverbed by reclamation and inflow of drainage	YES/~~NO~~/~~UN~~	Construction in rivers is planned.
14	Coast and sea area	Change of beach erosion and vegetation by a change of reclamation or sea condition	~~YES~~/NO/~~UN~~	There are no sea areas.
15	Flora and fauna	Breeding obstruction and extinction of species by a change of an inhabitable condition	~~YES~~/NO/~~UN~~	Habitat of valuable flora and fauna do not exist.
16	Climate	Change of temperature and wind conditions by the large-scale land development and architecture	~~YES~~/NO/~~UN~~	Large-scale felling and construction of high buildings is not planned.
17	Landscape	Change of topography by land development and harmonious obstruction by structural objects	YES/~~NO~~/~~UN~~	Landscape of important area with cultural properties exist.
Environmental Pollution				
18	Air pollution	Pollution by emission gas and dust from vehicles	YES/~~NO~~/~~UN~~	Impact by emission gas from increasing motor car use is anticipated.
19	Water pollution	Pollution by inflow of earth and sand and industrial water waste	YES/~~NO~~/~~UN~~	Constructions in rivers may contaminate.
20	Soil contamination	Pollution by dust and asphalt emulsion	~~YES~~/NO/~~UN~~	There will be no action which causes soil contamination.
21	Noise and vibration	Occurrence of noise and vibration by vehicles	YES/~~NO~~/~~UN~~	Impact by noise and vibration by vehicles is anticipated.
22	Ground subsidence	Subsidence by change of ground and fall of groundwater level	YES/~~NO~~/~~UN~~	There is weak ground, construction of tunnels will cause ground subsidence.
23	Offensive odors	Occurrence of exhaust gas and offensive odors	~~YES~~/NO/~~UN~~	There is no factors of producing offensive odors.
Comprehensive assessment: Is it necessary to implement on IEE or EIA for the development project ?			YES/~~NO~~/~~UN~~	

Note: UN: Unknown

Table 16-4-2 Scoping Check List

Environmental items		Evaluation	Grounds
Socio-economic Environment			
1	Resettlement	B	Resettlement will occur due to construction of new roads, railway and terminals.
2	Economic activities	B	Construction of new roads, railways and physical distribution terminal will cause changes of economic activities.
3	Traffic and public facilities	B	There is necessity of consideration for schools and hospitals in urban city.
4	Split of communities	D	Split of community will not occur.
5	Cultural property	B	Care should be paid in selecting subway route in Ancient City. There is possibility of discovering ancient relics in the suburbs.
6	Water right and right of common	C	Unknown
7	Health and sanitation	D	Large amounts of refuse will not occur.
8	Waste	B	Waste soil produced by construction of subway tunnel should be properly disposed of.
9	Hazards	D	Development on a sloping surface will not be planned.
Natural Environment			
10	Topography and geology	D	Valuable topography and geography do not exit.
11	Soil erosion	D	Large-scale changes of lands such as forest felling will not be planned.
12	Groundwater	D	Construction caused contamination of groundwater will not be planned.
13	Hydrological situation	B	Effect of construction of bridges and Dike Road improvement should be studied..
14	Coast and sea area	D	There is no sea area.
15	Flora and fauna	D	Valuable flora and fauna do not exist in The Study area.
16	Climate	D	Large-scale felling and construction of high building are not planned.
17	Landscape	B	Harmony with Ancient City and lakes should be considered.
Environmental Pollution			
18	Air pollution	B	Air pollution level my be lightened by traffic control and by the reduction of traffic congestion.
19	Water pollution	B	Constructions along existing canals may contaminate.
20	Soil contamination	D	There will be no action which causes soil contamination.
21	Noise and vibration	B	Traffic noise will be reduced by traffic control and restrictions of car use in urban area. Countermeasure should be studied for rail noise.
22	Ground subsidence	B	Construction such as subway tunnel and cut road will not be planned.
23	Offensive odors	D	There is no factors producing offensive odors.
Classification of evaluation: A- Serious impact will be anticipated. B- Impact will be more or less anticipated. C- Unknown (it is necessity of investigation) D- No impact will be anticipated.			

16.5 Overall Evaluation

The economic evaluation of the Master Plan network does not include both the indirect benefit arising from the land productivity caused by the infrastructure development related to public transport or freight, and the costs of these project elements other than road network development. However the costs, which were counted in the economic evaluation, cover 74.4% of all the Master Plan costs and the benefit, which will be derived from the increase of land productivity, will be much greater than VOC saving, and the calculated results from the VOC saving only and the costs directly related to this benefit show the sufficient economic return.

The indirect benefit of the Master Plan will include among others;

- The increase of the total land productivity caused by the effective land use and infrastructure development,
- The increase of convenience in person trip, which is not counted in VOC saving,
- The increase of safety by introducing traffic management measures,
- The improvement of living environment.
- Effect on the preservation policy to the buildings in the city's central area,
- Effect on the private car use control by encouraging public transport.

From the environmental aspects, the Master Plan projects will not affect the natural and social environment, except for the residents who are living in the sub-urban area at present. The social environment will be affected more by the rapid economic growth in the Study Area, and this transport Master Plan proposed various transport projects to cope with this social environment change. The project ideas to improve transportation network in the present built-up area without substitute lands will affect more residents and will cause more serious problems of resettlement. The individual developments encroaching to the present sub-urban agriculture area, without sufficient investment on public infrastructure development to support the residents living environment will damage the social and natural environment.

The total emission of NOx from MVs in all the study area will increase from 975.7 ton/year in 1995 to 14,049.2 ton/year or 14.4 times in Do-Nothing Case in 2015, and the Master Plan network will reduce it by 25%. Also CO from MVs will increase from 2,964.0 ton/year in 1995 to 30,661.7 ton/year or 10.3 times in 2015 in Do-Nothing Case, and the Master Plan network will reduce it by 20%. The Master Plan network will contribute to the improvement of air pollution in the Study Area.

It is noted that the emission of NOx from motorcycles are remarkably low, or almost negligible comparing to those from four wheel vehicles. Therefore, the priority on two wheel vehicles, proposed in the Master Plan, will contribute for the air pollution control policy.

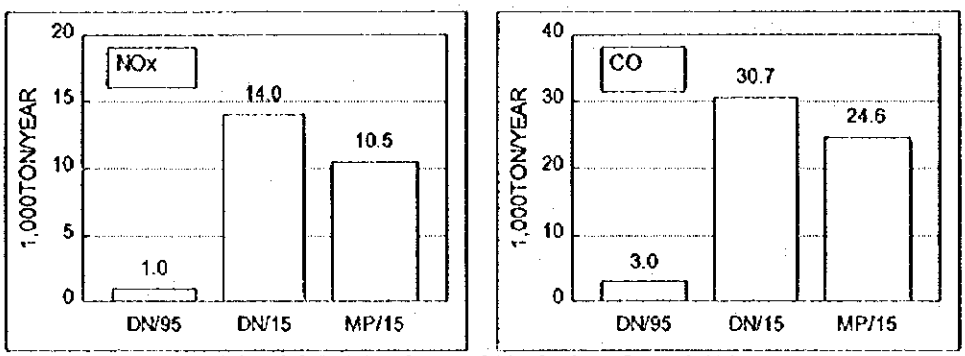


Fig. 16-3-3 Estimated Emission from MVs

The Master Plan network shows the sufficient economic return, large affirmative impact to the future transpiration condition such as the lower traffic load in the present built-up area or V/C improvement resulting in the travel speed increase in the entire road network in the Study area, and smaller negative impact to the environment than Do-Nothing condition.

16.6 Conclusion of the Master Plan

16.6.1 Conclusions

The Master Plan is economically viable and will serve for smooth traffic flow until 2015 providing that the Master Plan programs is implemented on schedule. It is concluded that the master plan should be implemented completely.

Among the master plan projects, the vital projects in the road network plan by phase are concluded as follows;

Table 16-6-1 Priority Projects by Phase

Period to Start	Code	Project	Cost(B.VND)
1996 - 2000	A02	National Highway No. 3 Improvement	648.8
	A07	South Ring Road No. 3 Construction	4,797.7
	C03	Red River Dike Improvement	1,626.9
	C0607	South Thang Long - Buoi Street	100.9
	E02	South Thang Long Road	87.4
2001 - 2005	A03	National Highway No. 5 Extension Construction	637.0
	A04	National Highway No. 32 Improvement	427.1
	C09	Hanoi Bridge Capacity Increase Project	654.9
	E03	New Ring Road No. 2 Construction	179.7
	E04	New CBD Road Network	740.5
2006 - 2015	A08	North Ring Road No. 3 Construction	4,570.7
	C08	Ring Road No.2 Improvement	2,340.1
	D01	Dong Anh Highway Construction	4,010.2
	F10	Yen Hoa New City Road Network	1,660.2
	F11	Dai Kim New City Road Network	329.1

Fig. 16-6-1 shows the planned program of these important project packages. The most urgent project among MOTC related projects are NH3 improvement and **RR-3 construction including Thanh Tri Bridge** construction. Roads/bridges belonging to MOTC are arterial and early implementation is desirable to support the economic growth in the Study Area. If the transport sector budget, which was assumed to be 2% of GDP and 10% of this amount in Hanoi area, is secured, the earlier execution using soft loans from foreign aids can be achieved.

The urgent project packages related to HPC/TUPWS are Dike Road - Ring Road No.2 and the projects related to New CBD area development. The Chong Duong bridge improvement and the projects related to HUDC follow. The dike road improvement will be implemented by the World Bank finance.

The most of the listed road projects other than those related to MOTC, are located at the sub-urban area surrounding the present built-up area. The road network in this area should be developed together with the comprehensive area development. The individual road development will not be efficient. The estimated budget of TUPWS, which is responsible for road development in Hanoi urban area, will not be sufficient to cover all the road development costs and the expected profit from the land development should be captured for this purpose. In addition to these reasons, as urbanization in the sub-urban area is progressing rapidly, the area development in the sub-urban area was

considered as **the most urgent priority project** and was adopted as a succeeding **Feasibility Study Project to the Master Plan Study.**

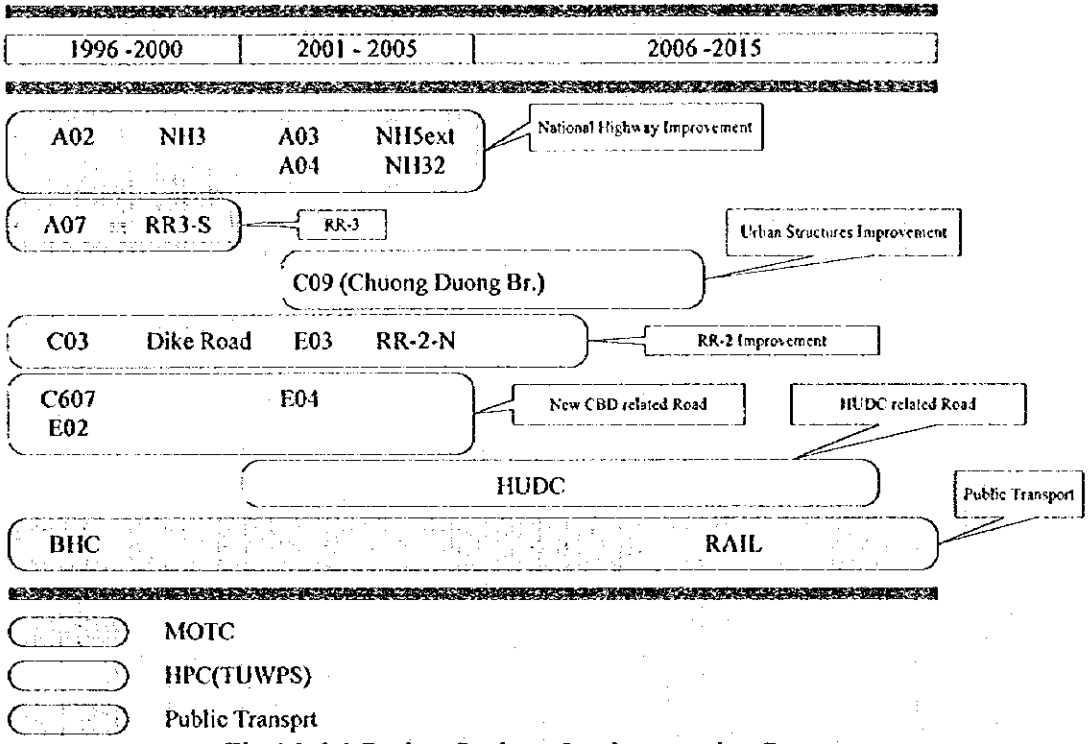


Fig.16-6-1 Project Package Implementation Program

All the sub-urban area should be well planned urgently, however, as the implementation organization and institution are not established yet, the most appropriate site in the sub-urban area was selected as the study area for the Feasibility Study, and in the course of the study and implementation of the first site, the operational practices will be fumbled. The financial analysis of the expected profit arisen form the land development will give ideas on the limitation to develop public and freight transport facilities other than road network, which also TUPWS is responsible for.

16.6.2 Recommendations

(1) Institutional Arrangement

To realize the proposed transportation master plan projects, the synopsis of the transportation master plan would be authorized by the Vietnam Government, and would be included in the City Master Plan. The necessary investment would also be considered in the five year plan. By these actions, the official guideline of the city development will be presented to the foreign assistance agencies and investors and will promote organized investment.

The appropriate law and regulations to secure Right of Way should be established to control the individual land development in the suburban area and to implement the urban street improvement project, which are scheduled in the later half of the master plan period.

(2) Promotion of Car Use Control

The private car use for commuting purpose shall be strongly controlled to avoid the traffic congestion on the main streets in the peak hours. Restriction of long time parking in the city center, and the introduction of one way and traffic cell system for four wheel vehicles, and road pricing system would be considered. At the same time, the introduction of the public transport system to provide the same level of convenience as private cars for those who would use their cars for the commuting purpose would be considered.

(3) Establishment of a System to Secure the Public Funds

The Master Plan estimated the available investment amount of TUPWS, based on the current budget, and proposed a system to capture the profit arising from the land development for the public funds. However, the introduction of another system to levy road users tax in the urban area should be taken into consideration. If only 41,000 VND/month is collected from all the registered motorcycles for the 20 years, the 20 years required investment of 12,697.6 B.VND for road network under TUPWS responsibility other than the road in the development area, bus terminals, a truck terminal and a river port can be covered.

(4) Development of Basic Information

The Master Plan was developed based on the socio-economic frames by traffic zone at present and in future, however reliable information even on the present population was not complied in HPC. All the information on the traffic condition used in the Master Plan were obtained from the surveys done by the Study Team or by SIDA, or from UNDP report. The information produced by Vietnamese agencies was not available.

These information is essential and indispensable for the better planning. The traffic flow in Hanoi is characterized by the large share of two wheel vehicles, and the different traffic indices from the other cities are needed to express the traffic flow. The efficient investment plan suitable for the flows having high share of two wheel vehicle will require more basic information on the present traffic condition than other cities.

In the report of "Viet Nam Urban Transport Management Study" sponsored by World Bank, the establishment of traffic management unit is proposed. The unit is expected to prepare and process the data base on traffic flow, which will be input continuously from the proposed Area Traffic Control (ATC) system, and it will be used for the future planning. The periodic or continuous survey system on the basic information together with the compilation and publication system should be developed to monitor the large scale social changes caused by the rapid economic growth.

(5) Development of Human Resources in Transport Planning Sector

Most of the road and transport network improvement projects, to cope with the increasing demand caused by the rapid economic growth, are planned or studied by foreigners. To cope with the increasing requirement on the studies and planning, the

human resources who are capable to process data base, to forecast demand, and to make plan should be developed.

(6) Establishment of a System to Assess the Traffic Load from Individual Development Plan

The individual development plans located at the Hanoi rural area mostly aim the self sustained development, having independent water supply, sewerage and waste disposal systems. However, transport demand for the commuting or freight demand to/from these development areas, or the transport network development to support these development plans are not considered in the plans. The external infrastructure development should be bone from the expected profit from these land development, and the authority should establish a system to assess the impact on the transport network from these individual development.

PART III

FEASIBILITY STUDY

CHAPTER 17 SITE SELECTION FOR FEASIBILITY STUDY

The master plan proposed the area development in the present suburban area surrounding the built-up area as the most urgent and priority transport project. However the area with the future development potential extends about 3,300 ha in the west to the south of Hanoi, which equivalents to almost 2/3 of the present built-up area. Therefore, the feasibility study will focus on the most promising site and will examine the development possibility socially, technically, financially and economically.

17.1 Transport Issues and Counter Measures

17.1.1 Population Increase

The transport master plan projected that the urban population increase in Hanoi would be 619,000 to 2005 and 657,000 between 2005 and 2015. The land use master plan has been approved by the Prime Minister. This proposes to control population in the built-up area 800,000, composed with 1,100,000 at present. The total population increase of 1,576,000 is 1.5 times the present population of urban Hanoi. This is a very large number.

Two types of population will migrate to on the outskirts of the Hanoi built-up area. These are population displaced due to the population control policy (300,000) and migration from outside Hanoi (1,276,000). To achieve the former population movement, high quality residential areas to attract migrants are required. Other large cities have many examples of population movements from the relatively low living standards of central city to superb where higher living standards can be enjoyed with same amount of costs as in the central area.

Migrants from rural areas tend to start their urban life in low quality areas near the centre, where they can live in cheap accommodation but enjoy the convenience of urban life. The first target area for them will be Tu Liem and a part of Thanh Tri. They may develop new residential areas as an extension of the residential areas in Dong Da District.

We propose that this population pressure should be catered by the orderly development of Tu Liem and West Thanh Tri.

17.1.2 Increase of Rural to Urban Transport Demand

Based on SIDA survey 1994 and the Study Team survey in 1995, the average monthly income per worker in build-up area was equivalent VND to 30.68 US$, and 21.04 US$ in the Hanoi rural area. Such a big income gap will induce young peoples from the rural area to migrate to urban Hanoi. This gap will become lager as Hanoi grows. In order to control this migration it is proposed that four towns be developed on the north side of the Red River. These would be industrial towns which would absorb workers from the rural area.

It is proposed that the capital city functions are to be sustained by population living on

the south side of the Red River. The development of Tu Liem and West Thanh Tri can provide accommodations for them.

17.1.3 Congestion at the Intersections of Ring Road No. 2 and Arterial Roads from Tu Liem and Thanh Tri

The increase of population in Tu Liem and Thanh Tri is unavoidable as mentioned in section 17.1.1. Based on simulation results, daily movements from Tu Liem and Thanh Tri to central Hanoi and vice versa will be 1.67 million in the Without New CBD case and 1.50 million in the With New CBD case in 2015. The difference of 0.17 million would be absorbed by newly created employment opportunity in the New CBD.

This large radial movement will cause traffic congestion. In particular the intersections between RR No. 2 and the arterial roads will be badly congested, because only three arterial roads exist. In order to cope with this movement, it is proposed that a dense network of roads should be constructed in Tu Liem and west Thanh Tri, and to connected to RR No. 2. This dense network will not only ease traffic congestion on the arterial roads but will facilitate orderly land development. (see Fig. 17-1-1)

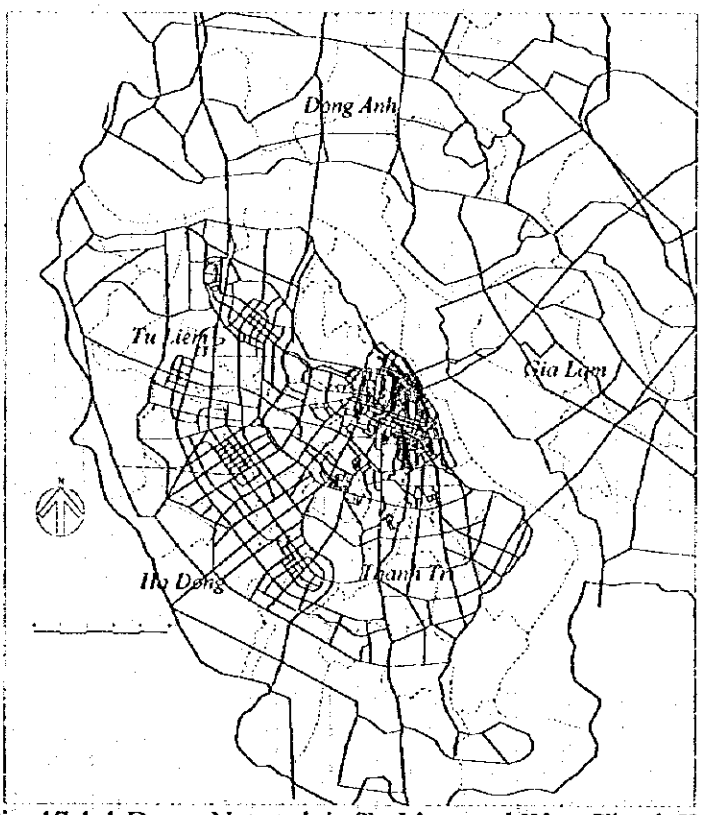


Fig. 17-1-1 Dense Network in Tu Liem and West Thanh Tri

17.1.4 Poor Road Network in Built-up Area

The built-up area, with the exception of the French quarter appears to have been developed without any city plan. Projects to reorganize the network have been undertaken but are not complete yet.
The main reasons why the works have not been completed are the difficulty of

resettlement of residents and the high construction cost caused by high compensation for their forced removal. Construction costs of the Duong De La Thanh widening project (32 meter width and 1,300 meter length) and the new road construction between NHs No. 6 and No. 32 penetrating Yen Hoa project (40 meter width and 5,000 meter length) are compared in terms of cost per meter, in Fig. 17-1-2.

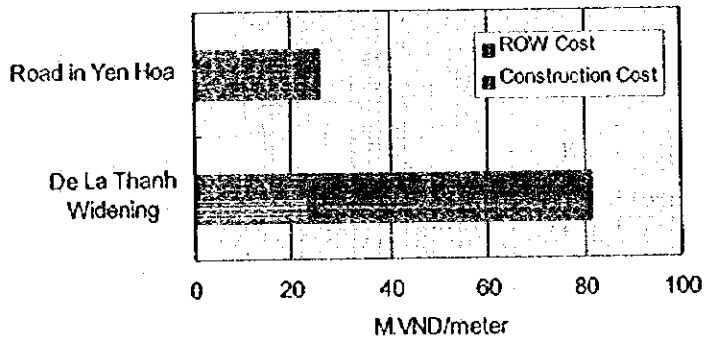


Fig. 17-1-2 Cost Comparison of Built-up Area and Suburbs Roads

The Study Team propose a policy of constructing a road network and to develop land outside Hanoi prior to the further development of the urban road network. This land development will provide land for population relocation and also the funding for compensation.

17.1.5 Increase of Passenger Cars

In the study period (1995 - 2015) we estimate that car ownership per person will increase by 3 times and, given the increase in population the number of cars will increase by more than 10 times. Based on this assumption, we formulated the master plan which forecast smooth traffic flow until 2015. The increase in number of passenger cars will, however, continue after study period. Therefore, at some future date Hanoi will face a traffic crisis.

We propose to preserve central Hanoi from motorization by constructing a modern city outside and to attract business activity, and to absorb motorized traffic. This proposal can mitigate the traffic crisis to a considerable extent.

17.1.6 Shortage of Budget

Total estimated of construction costs of road schemes for which TUPWS is responsible is 20,157.5 BVND during study period. The TUPWS budget, excluding ODA funds is expected to stay constant. Even including ODA funds, the average annual growth rate in the period of 1992 - 1995 was 5.3 %. If it is assumed that this growth rate continues until 2015, the total TUPWS transport sector budget would become 4,003.9 BVND. This means that TUPWS will face serious shortage of budget to construct road network proposed. The Study Team propose the system of return of development profits to pay for infrastructure construction expenses.

17.2 Hanoi Urban Development Corridor (HUDC) and Site for Feasibility Study

17.2.1 Location

The meaning of the development of Tu Liem and west Thanh Tri was discussed in the preceding sections. Fig. 17-2-1 shows the existing built-up area of Hanoi. The inner ring (boundary of the existing built-up area) has a diameter of 7 km and the outer ring (boundary of built-up area in 2015) has a diameter of 12.5 km.

HUDC should be located in this area between both rings and also be located on the west side of the Red River in order to avoid bridge capacity issues. It is self explanatory from these conditions that the three blocks remaining in west and south of Hanoi are promising sites.

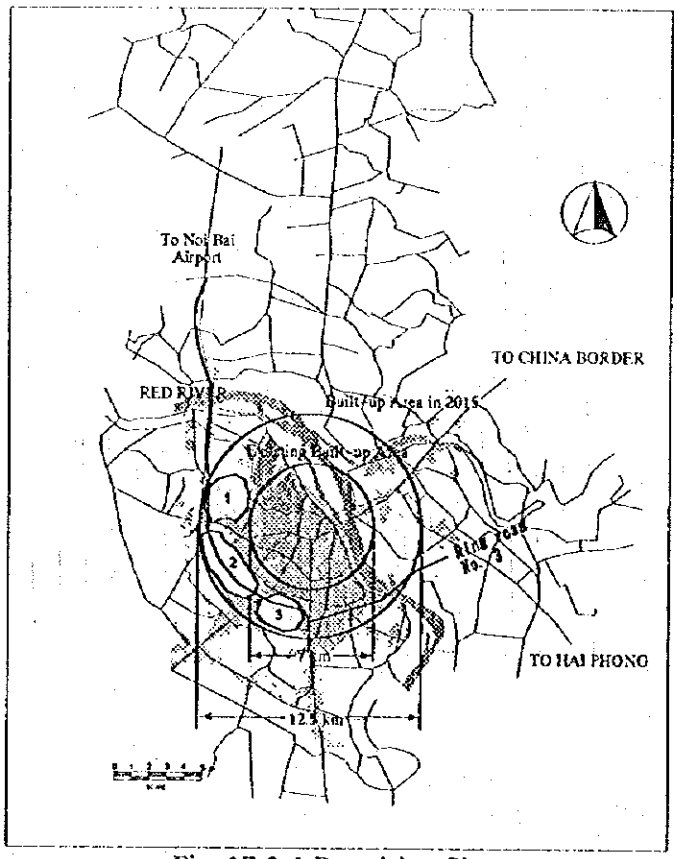


Fig. 17-2-1 Promising Sites

17.2.2 Overview of HUDC

HUDC will consist of three sites, Xuan La (site No. 1 in Fig. 17-2-1), Yen Hoa (site No. 2) and Dai Kim (site No. 3). The main attributes of these three sites are summarized in Table 17-2-1. The land use plan of HUDC is shown Fig. 17-2-2.

Table 17-2-1 Major Indicators of Three Sites of HUDC

Indicator	Xuan La	Yen Hoa	Dai Kim
Land Use (Grand Total, unit: ha)	592.2	1878.6	813.6
Public Use	346.1	868.6	360.9
Hospital	5.5	14.7	6.2
Education Facilities	48.1	84.2	34.4
Park	53.3	151.6	62.0
Greenbelt	29.9	84.2	34.4
Promenades	4.9	13.5	5.9
Roads	168.1	454.9	185.9
Parking Facilities	4.7	13.5	5.9
Sewerage Treatment Facilities	9.2	27.0	16.5
Administrative Facilities	14.2	25.1	9.6
Convention Center	8.3	0.0	0
Private Use	246.1	815.9	327.8
Office / Shopping	29.5	24.9	18.0
Office / Residence	31.1	24.9	18.0
Shopping Center	18.5	5.5	4.0
Residence	167.1	760.6	327.8
Water	0.0	194.1	125.0
Construction Costs (BVND)	2,996.4	8,299.5	3,642.1
Population (1000 person)	151	479	207

17.2.3 Selection of Feasibility Study Site

These three sites should be developed in future. Development of an 800,000 population area is, however, too big to start at once.

The first project must be on the site which has the highest probability of success. Three criteria were set to evaluate sites, as follows:

a) The Size of Site. In this evaluation demand is considered as the same if sites can provide the same conditions. If demand is the same the site of the smallest size is the the least risky site. From Table 17-2-1, it can be seen that Xuan La is the smallest.
b) Development Atmosphere. The site must be attractive for developers and their clients. The west side of the West Lake (Xuan La is included in this area) attracts many foreign investors at present. This area is widely understood to have a high potential of development.
c) Accessibility. All three sites are in Ring Road (RR) No. 3 corridor, but only Xuan La is connected RR No. 3 at present. The other two sites are located is areas where RR No.3 is still only at the planning stage.

It is clear that Xuan La should be the first site to be developed. Hereafter, the Xuan La development project is named the New CBD (Central Business District) development project.

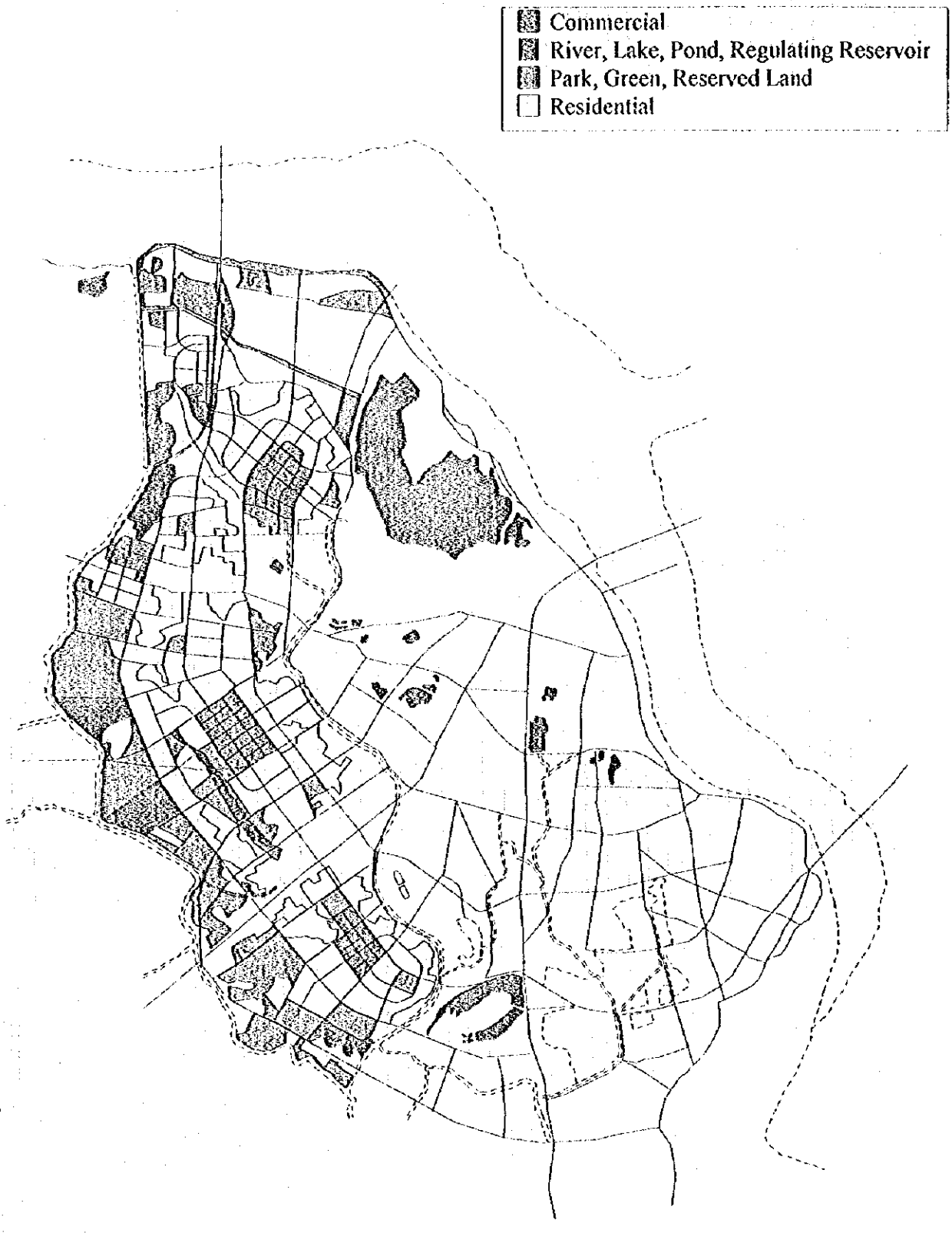


Fig. 17-2-2 Land Use Plan of HUDC

CHAPTER 18 NEW CBD DEVELOPMENT

18.1 City Plan

18.1.1 Development Concept

(1) Present Features in/around Proposed New CBD

The proposed New CBD area is located in the northwestern part of Hanoi City, and approximately 6 km distant from the old French Quarter. At present, the area and its environs are defined as a front for the "pushing force of urbanization" caused by the expansion of Hanoi City toward the northwest. This direction is favorable for the urban expansion because of the connection with Noi Bai International Airport and less inundation than the southern part of Hanoi.

In the agricultural area, the villages are surrounded with farmlands, mostly paddy fields. The villages are basically connected to arterial roads by narrow rural roads. At the front of urbanization, such as the area around proposed New CBD, roads are newly constructed without any proper planning.

Along these new roads, urbanization arises in the form of ribbon development because convenient access and basic infrastructure are available along this kind of road. This type of urbanization arises simultaneously even along rural roads. The inner area of these developments along newly constructed roads and rural roads does not have sufficient accessibility. Accordingly, a lot of unused/inconvenient lands are left behind the urban development.

In view of the above, development planning measures should be applied for the New CBD development, in order to avoid the undesirable urban expansion.

The boundary of the New CBD area is shown in Fig. 18-1-1. The area is approximately 592 ha, which includes the regulating reservoir proposed in "The Study on Urban Drainage and Wastewater Disposal System in Hanoi City" implemented by JICA and HPC in 1994. Most of the area is occupied by paddy fields, and is traversed by Ring Road No.3, a railway and a few rural roads and canals.

The area adjacent to the southern side of the New CBD is in the process of the above-mentioned ribbon development along National Highway 32, Ring Road No.3 and other rural roads. The north and east sides of the New CBD border to typical villages. Accordingly, the proposed New CBD area is about to be engulfed by the "pushing force of urbanization".

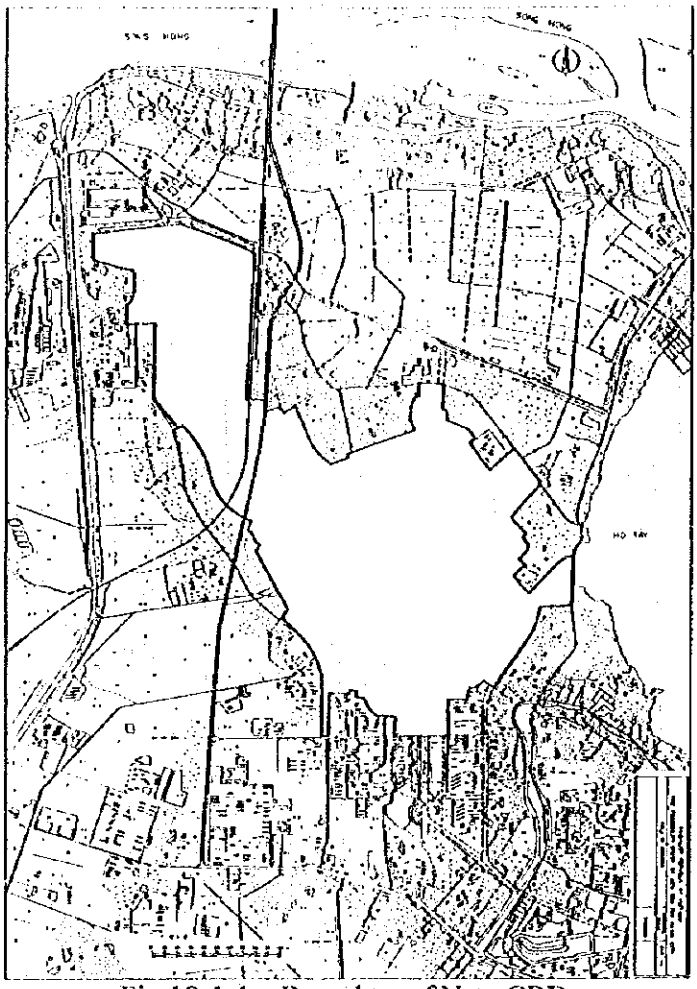


Fig.18-1-1 Boundary of New CBD

(2) Conceptual Plan for New CBD

The principal aim of the New CBD is to decentralize business/commercial activities in order to avoid excessive concentration in Hanoi old city in the near future. The policies for the New CBD project are as follows:

- Implementation of planning measures for the New CBD as an area wide development in order to cope with uncontrolled urbanization such as ribbon development;
- Creation of the New CBD to attract part of the business/commercial activities of Hanoi central area;
- Provision of space for the new business arising from the market economy system.
- Creation of work space to absorb the employment displaced from the agriculture sector because of the expansion of urbanization to the rural area due to economic growth; and
- Creation of high quality residential developments in terms of environment, accessibility and living amenity.

Fig. 18-1-2 shows the conceptual framework of the New CBD. It is located midway between Hanoi old city and Noi Bai International Airport, thus this main axis should be strongly improved by means of new/improved road and railway transport infrastructure.

Along this axis, two urban cores would be created; the New CBD and the New Sub CBD. The former would be formed emphasizing the business/commercial activities for the whole of the Hanoi region, and the latter would mainly accommodate domestic activities related to the New CBD and its environs, such as shopping, leisure facilities and administrative services. Both CBDs are centered on stations which are planned on the proposed new rail line.

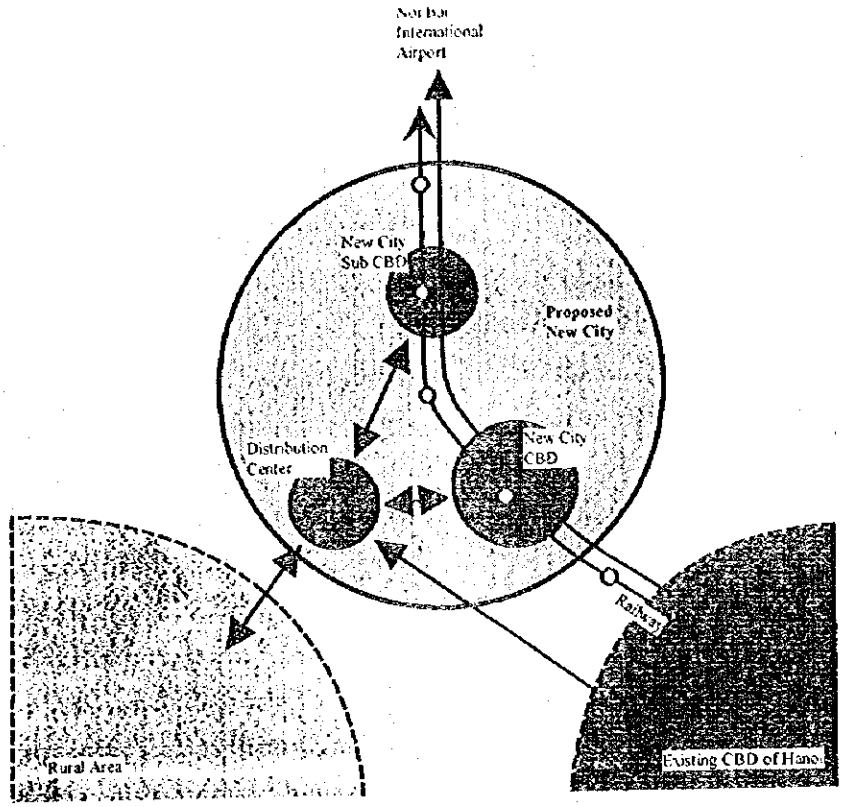


Fig. 18-1-2 Conceptual Plan of New CBD

Table 18-1-1 shows the proposed urban facilities which should be established in those two cores.

Table 18-1-1 Proposed Urban Facilities in New CBDs

New City CBD	New City Sub CBD
• Office Building • Convention Center • Hotel • Shopping Mall • General Hospital • High School	• Administrative Center • Office Building • Shopping Center • Service Industry

18.1.2 General Structure and Zoning

In the New CBD, there would be three ring roads running from north to south in parallel. Ring Road No.3 is the existing arterial road connecting Noi Bai International Airport and National Highway 32, and will be upgraded and extended in near future. Ring Road No.2 Extension and New Ring Road No.2 are proposed in this study.

As a key road of the New CBD, South Thang Long Road is planned to connect with those three ring roads, and furthermore to the old Hanoi city. The new rail line is proposed in the center of this arterial road, and the stations are planned at convenient intervals for the New CBD. The New CBD and New Sub CBD are formed centering on the major stations.

The New CBD's two cores and surrounding residential land would be neatly linked with arterial, major and minor roads in hierarchical road network system. District parks would be located adjacent to the CBDs, so as to provide useful space for the both residents and employees in and around the New CBD. The general structure and zoning for the New CBD is outlined in Fig. 18-1-3.

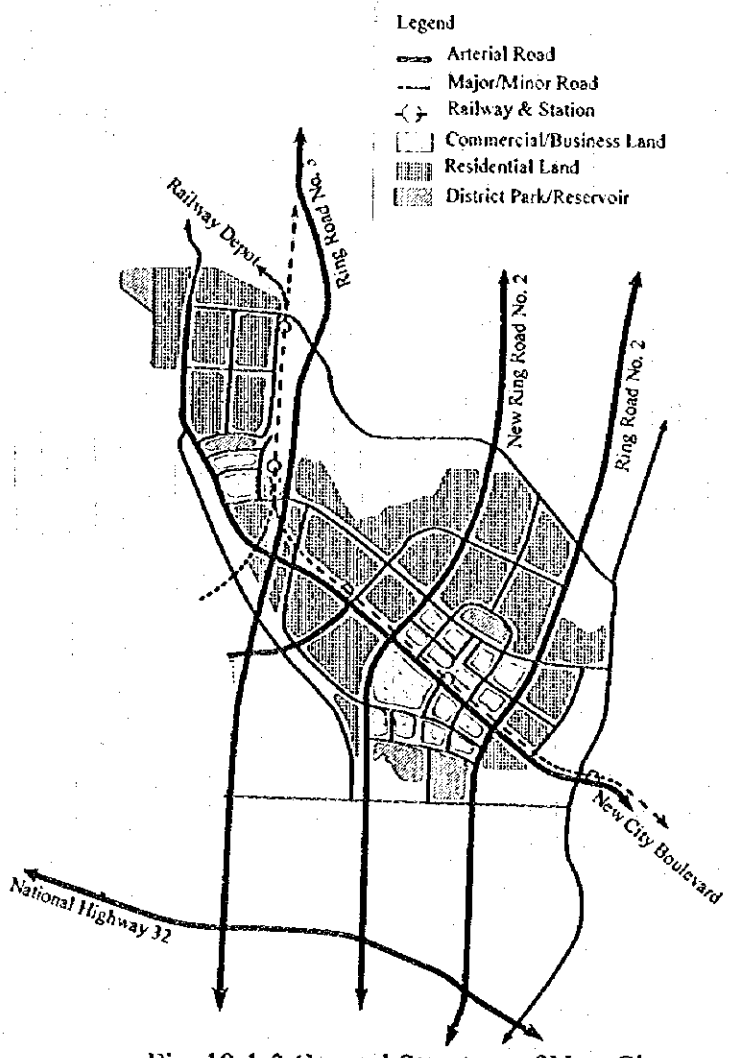


Fig. 18-1-3 General Structure of New City

18.1.3 Population and Employees Potential in New CBD

In accordance with the "General Structure and Zoning", it is proposed that the distribution of population and employees in the New CBD will be formulated as follows:

- Area:	592 ha
- Population:	165,000
- Population Density:	276 person/ha
- Employees:	375,000

18.1.4 Urban Space and Center for New CBD

The hierarchical urban structure, which should be established to unite each community in New CBD, is outlined in Fig. 18-1-4. Usually one urban district would consist of four neighborhoods (one neighborhood is based on the service area of an elementary school) while one city consists of urban districts. The New CBD hierarchically consists of following units:

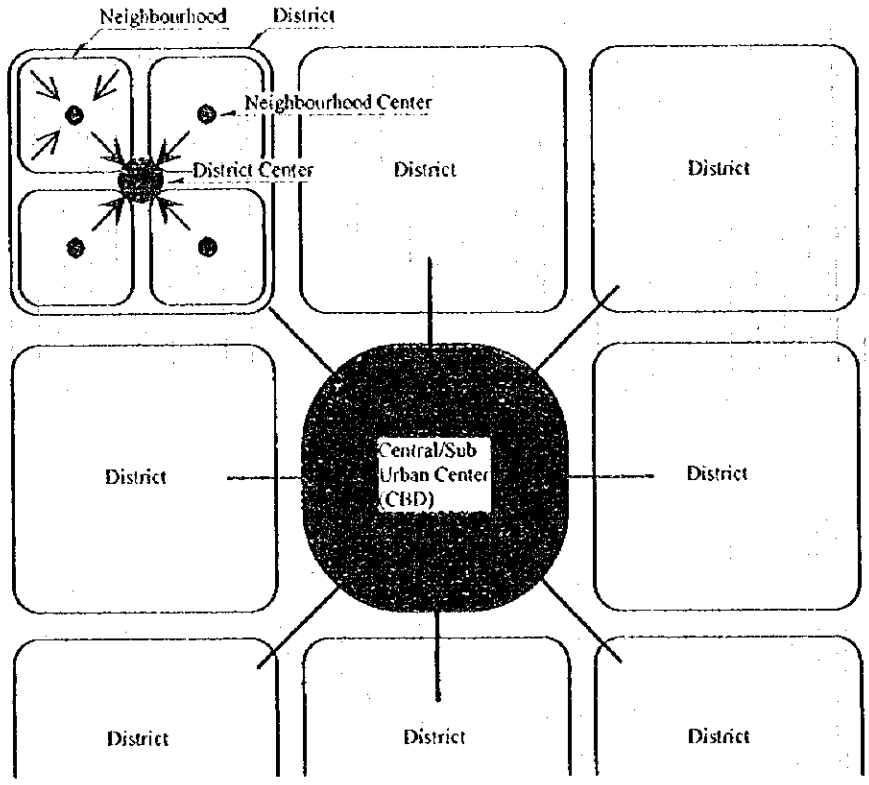


Fig. 18-1-4 Hierarchical Urban Space and Center

Urban centers will be located in accordance with the above mentioned space structure. A neighborhood is a basic unit (socially and physically) of the New CBD, with one neighborhood center serving the neighborhood. A district center will serve the neighborhood contained in the district. In the same manner, the CBD (as a central urban center) will serve the districts developed in the New CBD. The placement of major urban facilities in urban centers is proposed in Table 18-1-2.

Table 18-1-2 Placement of Urban Facilities

	Education	Medical	Commercial	Park
Neighborhood Center	• Kindergarten • Elementary School	• Clinic	• Shopping Mall • Super Market	• Neighborhood Park
District Center	• Secondary School	• Hospital	• Shopping Mall • Super Market	• District Park
CBDs	• High School	• General Hospital	• Shopping Center • Department Store • Bank	

18.1.5 Transport System

(1) Basic Policies

A hierarchical road network is proposed in the New CBD, so as to ensure against chaotic traffic flows and to support the space structure uniting the urban districts and neighborhoods as proposed in the preceding section. In other words, the arterial roads basically shape the districts while the major/minor roads shape the neighborhoods. The major/minor roads will manage the generated and attracted traffic within the districts. Connecting to the major/minor roads, the access roads will be allocated in the neighborhoods. The direct access from access roads to arterial roads is restricted as far as possible, so as to ensure the smooth traffic of the arterial roads.

The present conditions of traffic flows in urban streets seems to be dangerous with a mixture of vehicles, motorcycles, bicycles and other vehicles. However, the non-motorized lanes will be added to the arterial and major/minor roads in the New CBD to improve the traffic safety. As for the pedestrian space, sidewalks are planned on every road from arterial to access because of the safety, amenity and convenience.

(2) Hierarchical Road System

The hierarchical road system consisting of arterial, major/minor and access roads will be developed with the following standards.

Table 18-1-3 Standards for Road System

	Motorized Lane	Non-motorized Lane	Row (m)
Arterial Road	4 - 8	2	43 - 65
Major Road	4	2	36
Minor Road	4	-	28
Access Road	2	-	12 - 18

18.1.6 Parks and Greens Network

The systematic allocation of parks and greens is essential in the New CBD to create a favorable urban space and environment. Table 18-1-4 shows the types of park and green proposed in New CBD.

Table 18-1-4 Types of Park and Green in New CBD

	Area Standard	Function
Play Lot	0.25 ha	allotted within 250 m of service radius, for the use of infants
Neighborhood Park	2.0 ha	allocated within 500 m of service radius, for the use of neighborhood
District Park	4.0 ha	for the use of residents in district and employees in CBD
Greenbelt	-	to separate residential land from commercial/ business land, and provide a place of relaxation for employees and visitors in CBD
Promenade	-	to create the amenity for the shopping activities
Pedestrian Path	-	to make linkage among neighborhoods and greenbelt

However, those standard areas shown in above table will be applied synthetically, in consideration of the shape of the lot, road alignment and distribution of those areas as a whole. The unit area of open space (consisting of neighborhood park, district park and greenbelt) is planned at more than 4.0 m²/capita. The basic pattern of the parks and greens network in the New CBD is outlined in Fig. 18-1-5.

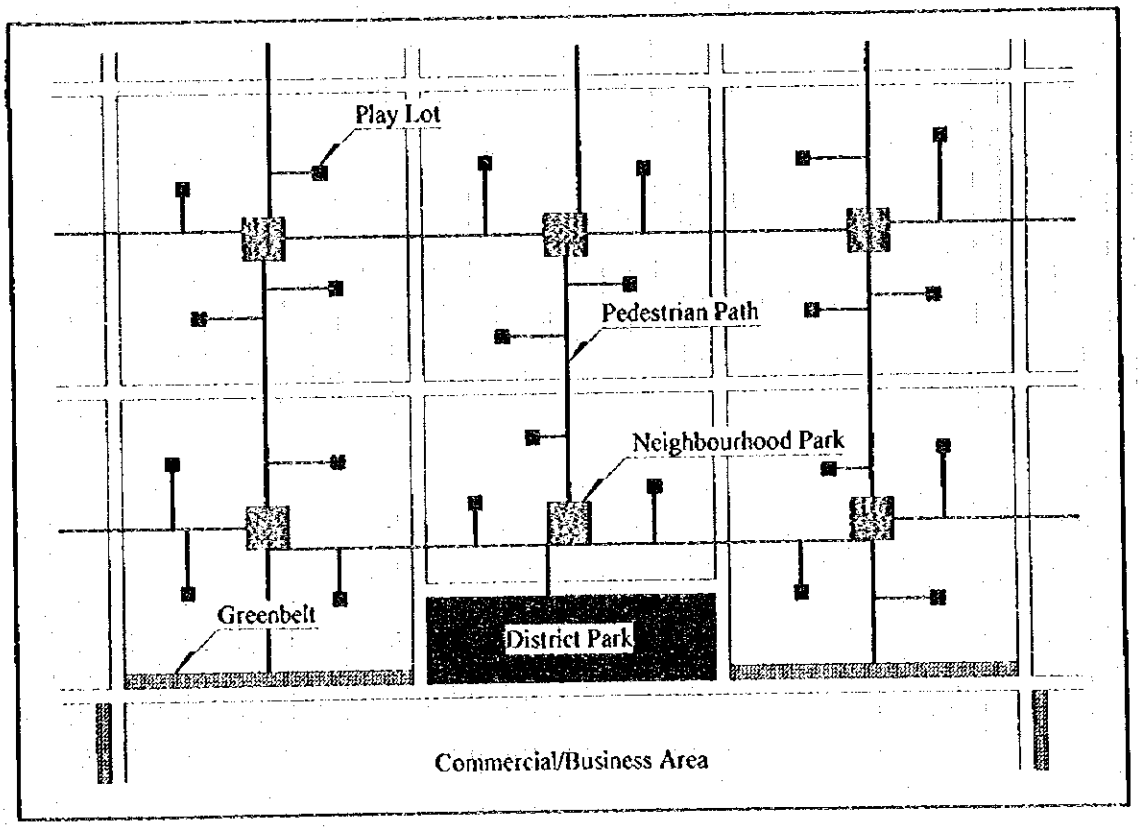


Fig. 18-1-5 Basic Pattern of Parks and Greens Network

18.1.7 Land Filling

The present ground elevation of the New CBD is from 4.9 m to 8.4 m. Judging from the topographical map, the average elevation is estimated at approximately 6.0 m. It is reported that part of this area was inundated to around 50 cm in depth by the flood in 1984. Accordingly, land filling should be planned about 1 m in thickness. Most of the fill materials will be obtained from the Red River beds.

18.1.8 Drainage

The area for the New CBD is located in the Nhue river basin. At present, the paddy fields are dominant in this area. There are several channels crossing the study area. These channels play an important role in the drainage of the basin and are also used as a water source for agriculture. The drainage system in New CBD is planned in accordance with "The Study on Urban Drainage and Wastewater Disposal System in Hanoi City" implemented by JICA and HPC in 1994. Fig. 18-1-6 (1) shows the existing channel system and the master plan, quoted from the above mentioned study. The alignment of channels in the mater plan is basically overlapped with the existing alignment.

From the viewpoint of urban development, however, the alignment of canals should be realigned in order to improve the urban landscape and prevent the garbage dumping from the residents, as well as to improve the drainage function. The channels are planned to be allocated within greenbelts which are allocated to enhance the urban environment in terms of the landscape and/or to form a buffer between residential and commercial/business lands. These channels will not be the agricultural use, because of the conversion from paddy fields to urban area. Runoff from the New CBD would be collected into sewers in the separate system and discharges to the channels in the greenbelts.

In the above mentioned master plan targeting the year 2010, a regulating reservoir (regulating water volume: 3,020,000 m^3) is planned adjacent to the Nhue river as shown in Fig. 18-1-6 (2). The implementation of this project is essential for the New CBD, because the flood control and drainage for the New CBD are based on the regulating reservoir.

However, the reservoirs are planned in the district parks of the New CBD taking the adjustment of project period of into consideration. These reservoirs will have important functions in terms of flood retarding in the New CBD and provision of places for relaxation. The capacity of the reservoirs is estimated by multiplying the drainage area by an unit volume. It is supposed that the unit volume is about 600 m^3/ha based on the rainfall of 5-year return period. The lands of reservoirs planned in the New CBD would be able to be converted to other land use when the regulating reservoir is constructed adjacent to the Nhue river. The wastewater would be collected into a separate sewer system and treated at a sewerage treatment plant which is planned in the New CBD

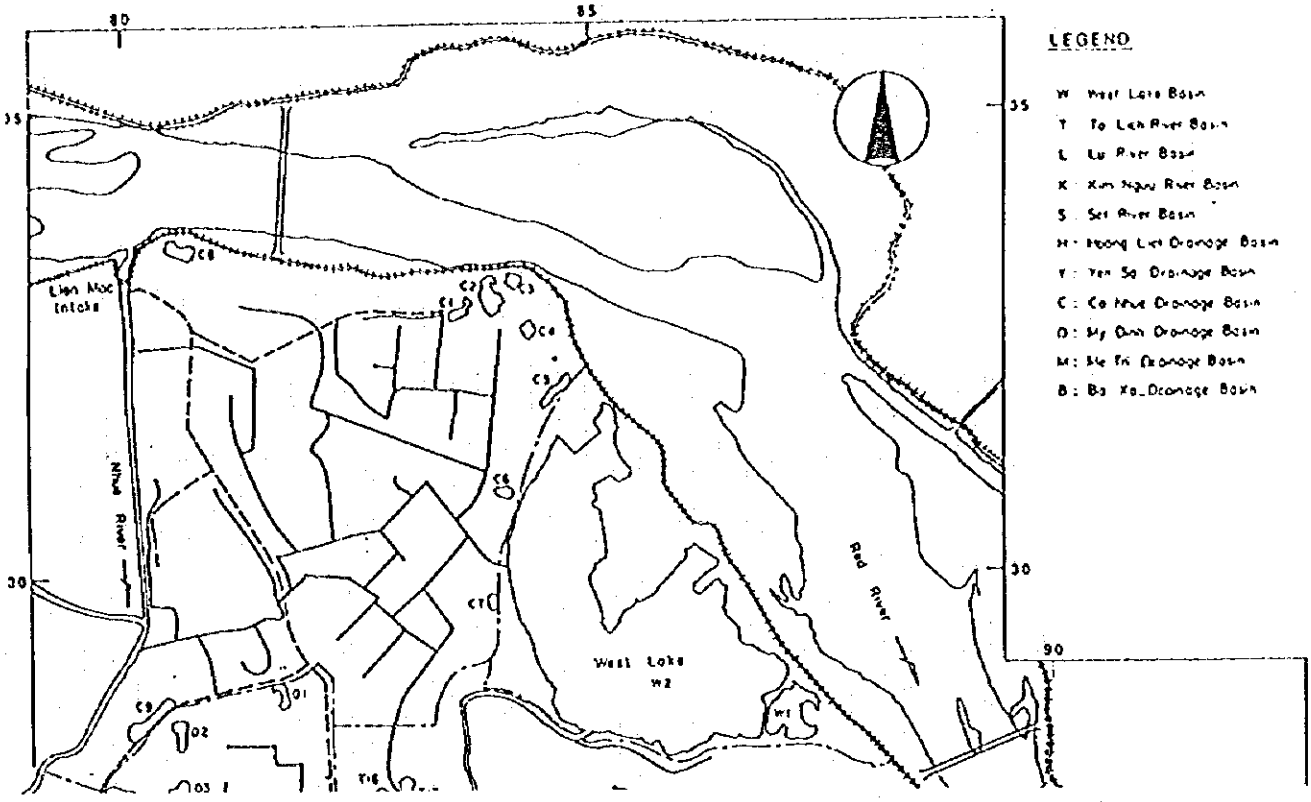
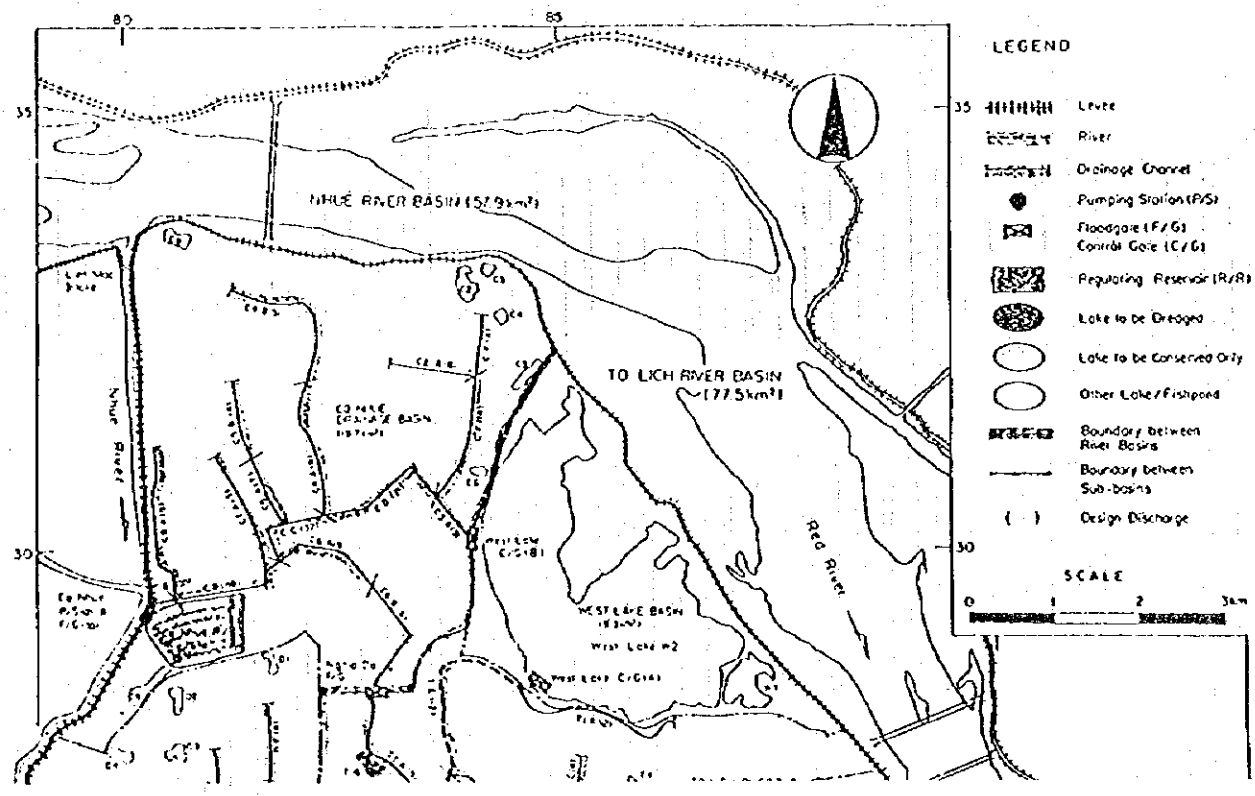


Fig. 18-1-6 (1) Existing Channel System in/around New CBD



Source: The Study on Urban Drainage and Wastewater Disposal System in Hanoi City/ JICA, 1994

Fig. 18-1-6 (2) Master Plan of Drainage System in/around New CBD

18.1.9 Land Use Plan of New CBD

(1) Land Use

The land use plan of the New CBD is formulated in accordance with the preceding sections. The framework of the land use plan is summarized as follows:

- High density residential land would be designated along South Thang Long Road and Ring Road No.3;
- Mixed land use (Residential and Commercial/business) would be designated in the New CBD within a walking distance from the station;
- Station plazas would be allocated at both the stations of the New CBD and the New Sub CBD; and
- Channels linking between reservoirs and existing channels in the surroundings would be aligned in the greenbelts.

The land use of the New CBD is outlined in Fig. 18-1-7 and Table 18-1-5.

Table 18-1-5 Land Use of New CBD

(Unit: ha)

Land Use	1st. Stage	2nd. Stage	3rd. Stage	Total	Percent -age	Remark
Public Use						
Medical (General Hospital)	5.50	0.00	0.00	5.50	0.9%	
Educational Facilities	9.06	24.91	14.12	48.09	8.1%	
Park	11.64	17.66	24.03	53.33	9.0%	
Green Belt	3.13	17.68	9.08	29.89	5.0%	
Promenades	3.30	0.00	1.55	4.85	0.8%	
Roads	70.20	53.85	44.05	168.10	28.4%	
Parking	4.68	0.00	0.00	4.68	0.8%	
Sewerage Treatment Plant	9.18	0.00	0.00	9.18	1.6%	
Administrative Facilities	0.00	2.70	11.47	14.17	2.4%	
Convention Center	8.29	0.00	0.00	8.29	1.4%	
Sub-total of Public Use	124.98	116.80	104.30	346.08	58.4%	
Private Use						
Office/Shopping	22.53	0.00	6.96	29.49	5.0%	
Office/Residence'	23.63	0.00	7.43	31.06	5.2%	
Shopping Center	13.32	0.00	5.15	18.47	3.1%	
Sub-total of Commerce/Business	54.98	0.00	19.54	79.02	13.3%	
High Density	13.62	13.23	28.81	55.66	9.4%	
Medium Density	4.12	75.65	31.65	111.42	18.8%	
Sub-total of Residential	17.74	88.88	60.46	167.08	28.2%	
Sub-total of Private Use	72.72	88.88	80.00	246.10	41.6%	
Total of Land Use	202.20	205.68	184.30	592.18	100.0%	

In the above table, the commercial/business land is calculated by the supper block. Access roads in the super blocks will be constructed by the land owners. As for the residential land, the access roads are excluded from the area. However, the lands for neighborhood and district centers, play lots, pedestrian paths, parking and associated paths, and greens are included.

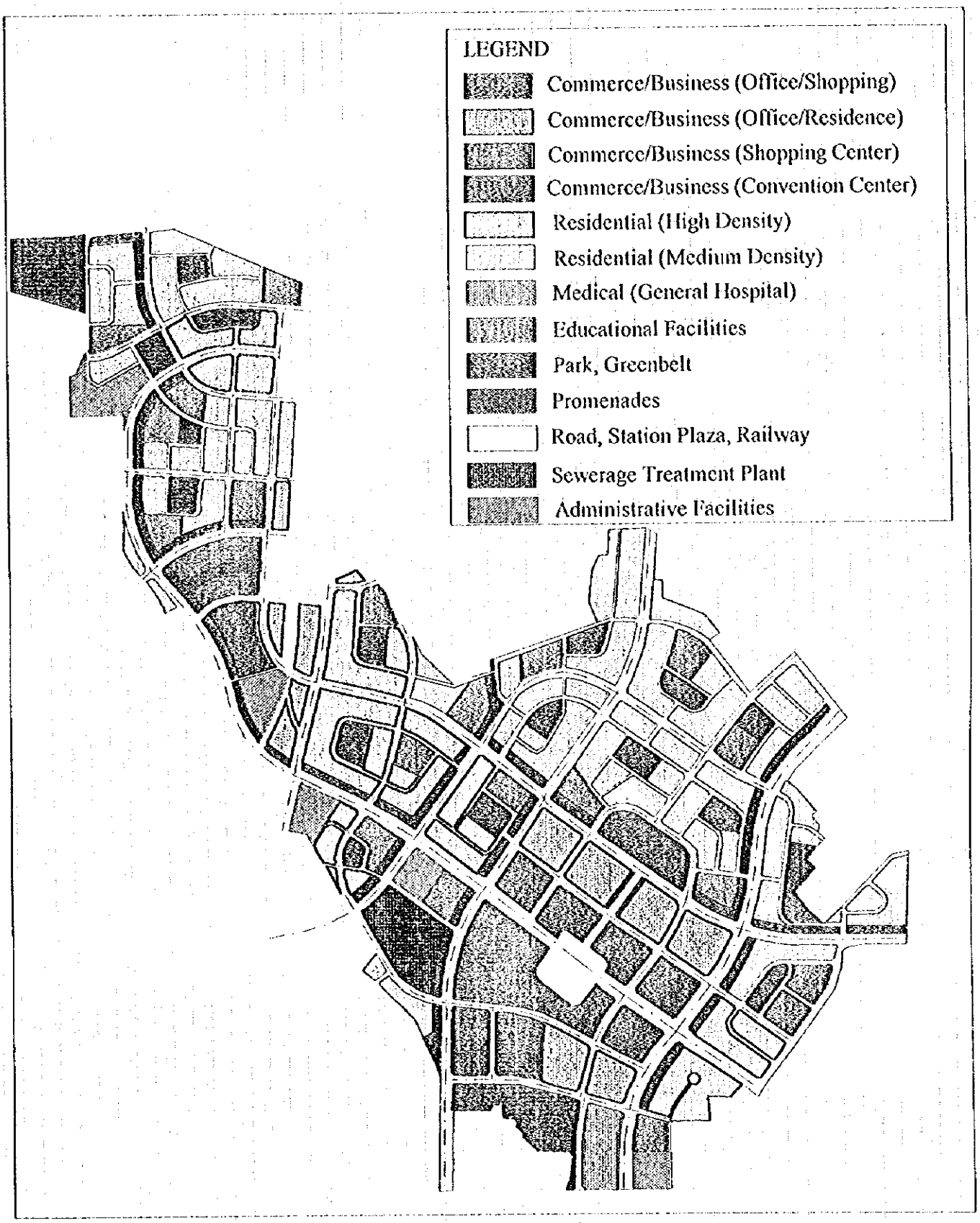
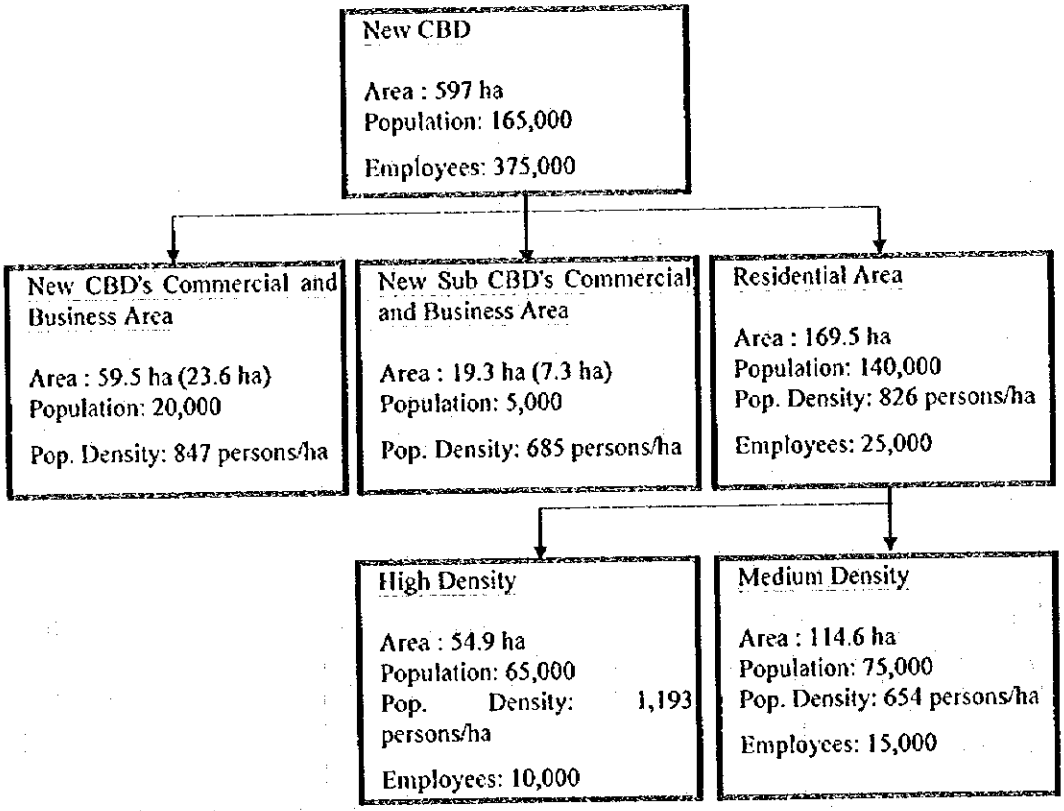


Fig. 18-1-7 Land Use Plan of New CBD

(2) Population and Employees potential in the New CBD

The proposed distribution of population and employees in the New CBD is shown in the following figure.



Notes: 1) Population density is estimated from the net area.
2) Figures in parenthesis show the area of lands for office/residence.

Fig. 18-1-8 Population and Employees in the New CBD

(3) Land Use Intensity

It is proposed that the New CBD and the New Sub CBD consist of lands for office/shopping, office/shopping/residence, shopping center, convention center, general hospital and a high school. The area of those CBDs is estimated at 79.0 ha of super blocks, excluding the lands for the general hospital and high school. In the CBDs, two types of office buildings are suggested; one is an office building combined with shops on lower floors, and the other is an office building combined with dwellings on the upper floors. These two types of building will be much higher than the others, therefore, the land use intensity for those two types of land use is elaborated in this section.

As for the residential land, however, the land use intensity is generally designed to assure the population in the New CBD.

Lands for Office Buildings

In accordance with the above mentioned employee potential in New CBDs, the land use

intensity is estimated as shown in Table 18-1-6.

The number of employees in the CBD is estimated at 350,000. It is supposed that 75 percent of those employees will work on the office floors of the office buildings and the rest will be the employees relating to the convention center, shops, general hospital and other service facilities. The unit floor area per employee is planned to 10 m²/capita.

Table 18-1-6 Land Use Intensity for Office Buildings

Description	Office Building Combined with Shops	Office Buildings Combined with Dwellings
Land for Office Buildings	29.5 ha	31.1 ha
Building Coverage Ratio	40 %	30 % (15 %) *1
Floor Area Ratio	880 %	350 %
No. of Floors per one Building	22 (2) *2	20 (17) *3

Notes:
*1 : percentage in parenthesis shows the ratio for the dwelling floors.
*2 : figure in parenthesis shows the no. of floors for shops.
*3 : figure in parenthesis shows the no. of floors for dwellings which accommodate the inhabitant of 25,000.

Residential Land

The residential areas are planned around the CBDs, the total area of those lands is estimated at 167.1 ha (net). There are two types of the land use; one is the high density residential land planned along South Thang Long Road and Ring Road No.3, and the other is the medium density residential land. The land use intensity of residential land is shown in Table 18-1-7.

Table 18-1-7 Land Use Intensity of Residential Land

Description	High Density	Medium Density
Residential Land	55.7 ha	111.4 ha
Building Coverage Ratio	20 %	20 %
Floor Area Ratio	360 %	200 %
No. of Floors per one Building	18	8 -12
Total of Inhabitants	67,000	74,000

Notes: average family size is estimated at 4.0, and average floor size is estimated at 30 m² per capita.