10.4 Vehicle Operating Costs

10.4.1 Background

1) Vietnam's Economic Context

In common with most Communist countries Vietnam's economy was, prior to 1986, run on the basis of Soviet style central planning. However, the failure of this system forced Vietnam to abandon it and introduce the policy of renovation (*Doi moi*), which was formally adopted in 1986. This involves a shift to a socialist market economy. The shift is still underway but is probably now irreversible. In consequence the economy is still in a state of evolution.

In addition to *doi moi* there has, over recent years, been a move to lessen dependence on the former Communist block. Trading links have been opened up with the non-Communist world. This has led to the replacement of goods from the Communist world, with goods from non-Communist countries. It has also led to economic growth, which has created more disposable income, and inward investment from capitalist countries and expatriate Vietnamese.

2) The Structure of the Vehicle Market

These changes have lead to major changes in the vehicle market in Vietnam, particularly for light vehicles and motorcycles. The major growth in motorcycles has been almost exclusively through motorcycles imported from Japan, particularly those produced by Honda. These machines are now being assembled in Vietnam, and it seems likely that most of the Vietnamese market will, in the near future, be supplied by locally assembled motorcycles.

Although the car and light truck market in Vietnam is very small, there has been major interest in the market from international car manufacturers. Already 11 international manufacturers have set up 13 joint ventures to assemble vehicles in Vietnam, and others are seeking approval for similar joint ventures. The companies include Japanese, Korean, German, French and American based manufacturers. These proposals would provide assembly capacity which would be an order of magnitude higher than the current demand in Vietnam. It is likely, therefore, that international vehicle manufacturers see Vietnam as a base from which to produce vehicles for export to adjacent countries. Vietnam's relatively low labor costs, high level of education and political stability are factors which make it an attractive manufacturing base. In view of the above it seems likely that the vast majority of the Vietnamese market for cars, light trucks and mini busses will be supplied by locally assembled vehicles.

It is understood that vehicles assembled in Vietnam, are currently made mainly from imported parts, with locally made parts comprising only some 5% of the total. However, the manufacturers have agreed to increase the share of locally manufactured parts and these are expected to comprise 60% of the total within 6 years. In consequence soon after 2000 the Vietnamese motorcycle and light 4 wheeled vehicle market will be served by vehicles for which the majority of their value will be added within Vietnam.

The cheapest source of supply for buses and medium and large trucks is currently Russia and Eastern Europe and the vast majority of these vehicles on Hanoi's roads come from that source. However, the Japanese heavy truck and bus manufacturers Hino have in February 1996 agreed to set up a joint venture to assemble trucks and busses in Hanoi. The market for these vehicles, therefore, may well change towards domestic assembly.

The vast majority of bicycles are imported from China. Importation is understood to be generally by means of smuggling to avoid import taxes. This is particularly attractive for bicycles since they can be transported on minor cross boarder routes which have no customs controls. It seems unlikely that local manufacturers will be able to compete with mass produced Chinese bicycles.

3) The Tax System

The tax system in Vietnam is complicated and subject to change. In particular there are high taxes on imported goods, with a wide range of rates dependent on whether the goods are imported built up, as complete sets of parts, or as incomplete sets of parts which are completed by locally manufactured parts. Such high tariffs are typical of a planned communist economy, but are likely to be reduced as the market economy evolves. The World Bank has recommended that the taxation system should be simplified, but it is not clear whether this recommendation will be acted on.

The import tax system for vehicles is particularly complex. For example for cars tax rates range from 5% to 200% in 5 bands dependent on whether the vehicle is imported complete, as parts, or includes locally produced parts. For motorcycles the import tax for incomplete kits has recently been increased from 10% to 30% as opposed to 60% for complete machines. This is strange since it may discourage local parts production and assembly.

4) The Banking System

The banking system in Vietnam is also in the early stages of evolution. The main domestic bank is Vietcombank. A number of foreign banks have also established branches in Hanoi.

Loans are available from the Vietcombank for the purchase of vehicles. For loans in Vietnamese Dong (VND), interest rates are around 21% per annum. However the interest rate for loans in US$ is 9.5% per annum. Not surprisingly almost all loans are in US$. It should be noted that the US$ is universally accepted in Hanoi.

It is understood that the vast majority of Vietnamese do not use banks for depositing savings or for loans for the purchase of consumer goods. Vehicles, particularly motorcycles, are perceived as a way of storing savings since their rate of depreciation is relatively low.

5) Vehicle Types

The Masterplan Study is primarily concerned with urban Hanoi. Analysis of traffic count data on the screen line through Hanoi suggests a vehicle use composition as follows:

Table 10-4-1 All Over Mode Share in Hanoi

Mode	Mode Share (%)
Bicycle	35
Motorcycle	57
Bus	1
Car	3
Truck	1

In consequence both motorcycle and bicycle are extremely important modes of transport, while 4 or more wheeled vehicles are relatively unimportant. The calculation of vehicle operating costs for each of these vehicle types is described in the following sections. All costs are expressed at 1995 prices.

10.4.2 Bicycle Operating Costs

1) Capital Costs

The cost of new bicycles was ascertained from a survey of bicycle shops in Hanoi. Prices for the basic Forever, Phoenix and Mini Chinese manufactured bicycles range from 0.55 million VND to 0.70 million VND, with a rounded average of 0.60 million VND. These machines are considered to be typical of the bicycle population of Hanoi.

It is extremely difficult to estimate the life of a bicycle. For the purposes of this study we have assumed a 10 year life. Amortization over this life at an annual interest rate of 9.5% gives an annual financial cost of 95,600 VND.

2) Running Costs

Maintenance costs for bicycles are very difficult to determine since the vast majority of the maintenance is undertaken by the owner. Since the machines are mechanically simple, maintenance is very easy and cheap, also tiers and inner tubes can be cheaply patched to give a relatively long life. In view of the above it was assumed that the maintenance cost for bicycles is insignificant.

3) Distance Related Operating Costs

In order to calculate distance related operating costs it was assumed that 50% of the annual cost would be allocated to distance in accordance with World Bank practice for cars. It was assumed that the annual distance operated would be 4,000 Km, that is 11 Km per day. Since there is effectively no taxation on bicycle costs, the economic and financial operating costs are the same. These are as follows:

- Economic Cost - 11.94 VND/Km

- Financial Cost - 11.94 VND/Km

4) Time Related Operating Costs

In order to calculate time related operating costs it was assumed that 50% of the annual cost would be allocated to time in accordance with World Bank practice for cars. It was assumed that the annual time operated would be 400 hours, that is 1.1 hours per day which implies an average running speed of 10 Km/Hr. Since there is effectively no taxation on bicycle costs, the economic and financial operating costs are the same. These are as follows:

- Economic Cost - 119.45 VND/Hr
- Financial Cost - 119.45 VND/Hr

10.4.3 Motorcycle Operating Costs

1) Capital Costs

By far the most popular new motorcycle in Hanoi is the Honda Dream 100cc. The cost of Honda Dream motorcycles was ascertained from a survey of motorcycle shops in Hanoi. The price is 24.6 million VND. This includes import tax at 30% for machines assembled in Vietnam from imported parts.

For the purposes of this study it was assumed that this model will have a 10 year life. Amortization over this life at an annual interest rate of 9.5% gives an annual financial cost of 3,917,947 VND.

2) Running Costs

Running costs were determined mainly through the experience of the counterpart staff, most of whom own motorcycles. These costs are summarized in Table 10-4-2.

Table 10-4-2 Motorcycle Running Costs

Item	Cost VND	Interval Kms	Source
Oil Change	18,000	1,500	Counterpart Experience
Tires (2)	80,000	15,000	Counterpart Experience
Maintenance Labor	120,000	15,000	Counterpart Experience
Maintenance Parts	7,075	1,000	Previous Studies
Insurance	25,000	Annual	Vietnam Insurance Company
Petrol	11,375	100	Counterpart Experience - Petrol 3,500 VND/ Lt

3) Distance Related Operating Costs

In order to calculate distance related operating costs it was assumed that 50% of the annual cost would be allocated to distance in accordance with World Bank practice for cars. Based on counterpart experience it was assumed that the annual distance operated would be 7,500 Km, that is 21 Km per day. Taking account of the 30% Import Tax and the 3% tax on petrol, the economic and financial operating costs are as follows:

- Economic Cost - 349.10 VND/Km
- Financial Cost - 412.69 VND/Km

4) Time Related Operating Costs

In order to calculate time related operating costs it was assumed that 50% of the annual cost would be allocated to time in accordance with World Bank practice for cars. Based on the average running speed in Hanoi of 20 Km/Hr the annual distance operated would be 375 hours, that is just over 1 hour per day. Economic and financial costs were calculated using the same assumptions as for the distance related costs. These are as follows:

- Economic Cost - 4,018.41 VND/Hr
- Financial Cost - 5,290.60 VND/Hr

10.4.4 Car Operating Costs

1) Capital Costs

To ascertain car operating costs a meeting was held with Vietnam Motors Corporation (VMC) who have assembled a wide range of car types in Vietnam for the last 4 years. They are likely to be typical of the future Vietnamese car market. They quoted prices for the following cars:

Table 10-4-3 Car Purchase Price

Model	Price (million VND)
KIA Pride GTX	161
MAZDA 323	300
MAZDA 323 moi	305
MAZDA 626	400
BMW 320i	610
BMW 525i	738

It is difficult to predict the future mix of car types to be used in Hanoi, however experience suggests that the following mix might be appropriate:

25% - Budget car as KIA
50% - Mid-range car as MAZDA
25% - Luxury car as BMW

Using the above mix a most likely capital cost of 376 million VND was calculated.

As part of the National Transport Sector Review (NSTR) the Transport Economic Science Institute (TESI) developed vehicle operating costs for Vietnam. Their research showed that the average life of a car in Vietnam is 10 years. Amortization over this life at an annual interest rate of 9.5% gives an annual financial cost of 59,923,900 VND.

2) Running Costs

Running costs were determined from costs quoted by VMC, interviews with garages, an

interview with the Vietnam Insurance Company (VIC) and counterpart experience. Running costs were calculated for the average car mix which was assumed for estimating capital costs. These costs are summarized in Table 10-4-4.

Table 10-4-4 Car Running Costs

Item	Cost VND	Interval Kms	Source
Oil Change	61,200	4,500	VMC
Tires (4)	600,000	45,000	VMC
Maintenance Labor	500,000	4,500	Garage Survey
Maintenance Parts	108,217	1,000	Previous Studies
Insurance	80,000	Annual	Vietnam Insurance Company
Petrol	42,120	100	VMC - Petrol 3,900 VND/ Lt

3) Distance Related Operating Costs

In order to calculate distance related operating costs it was assumed that 50% of the annual cost would be allocated to distance in accordance with World Bank practice. Based on the TESI research it was assumed that the annual distance operated would be 15,000 Km, that is 42 Km per day. Taking account of the 40% Import Tax and the 3% tax on petrol the economic and financial operating costs are as follows:

- Economic Cost - 2,121.95 VND/Km
- Financial Cost - 2,704.92 VND/Km

4) Time Related Operating Costs

In order to calculate time related operating costs it was assumed that 50% of the annual cost would be allocated to time in accordance with World Bank practice. Based on the average running speed in Hanoi of 20 Km/Hr the annual distance operated would be 750 hours, that is just over 2 hours per day. Economic and financial costs were calculated using the same assumptions as for the distance related costs. These are as follows:

- Economic Cost - 28,535.19 VND/Hr
- Financial Cost - 39,949.26 VND/Hr

10.5.5 Bus Operating Costs

1) Capital Costs

Hanoi Bus Company (HBC) currently operate KAROSA buses. The current price for these vehicles without import tax is 700 million VND. In the NSTR, TESI estimated that the life of these vehicles is 12 years. Amortization over this life at an annual rate of 9.5% gives an annual economic cost of 100,231,400 VND.

2) Running Costs

HBC were unable to provide any information on operating costs. In consequence the operating costs were based on the TESI data supplemented by current oil, fuel,

insurance and crew wage data. Maintenance and tire costs were indexed to 1995 based on the KAROSA capital price index from 1992 to 1995 of 1.55. These costs are summarized in Table 10-4-5.

Table 10-4-5 Bus Running Costs

Item	Cost VND	Interval Kms	Source
Oil Change	31,500	100	TESI + Current Oil Price
Tires (6)	2,364,134	40,000	TESI
Maintenance	23,178	100	TESI
Insurance	400,000	Annual	Vietnam Insurance Company
Fuel	94,500	100	TESI - Derv 2,700 VND/ Lt
Crew (1.5)	3,846	Staff/Hour	TESI - Current Wage Rates

3) Distance Related Operating Costs

In order to calculate distance related operating costs it was assumed that 85% of the annual cost would be allocated to distance in accordance with World Bank practice. Based on the TESI research it was assumed that the annual distance operated would be 32,000 Km, that is 88 Km per day. Taking account of the 30% Import Tax and the 3% tax on fuel and a 15% allowance for overheads based on the TESI research, the distance related economic and financial operating costs are as follows:

- Economic Cost - 5,153.46 VND/Km
- Financial Cost - 5,979.70 VND/Km

4) Time Related Operating Costs

In order to calculate time related operating costs it was assumed that 15% of the annual cost would be allocated to time in accordance with World Bank practice. Based on the TESI research it was assumed that the annual productive running time would be 1,800 hours, that is just under 5 hours per day. Time related economic and financial costs were calculated using the same assumptions as for the distance related costs. These are as follows:

- Economic Cost - 17,440.81 VND/Hr
- Financial Cost - 20,259.82 VND/Hr

10.4.6 Truck Operating Costs

1) Capital Costs

While trucks are relatively unimportant within urban Hanoi, they will form a significant proportion of traffic on National Roads in rural Hanoi and on the Hanoi Ring Roads. This traffic will generally be inter-urban in nature.
The NSTR found that the most representative truck type on the National Road Network was the MAZ 16 tonne gross vehicle weight (GVW) medium truck. In consequence this vehicle was taken as the representative truck. NSTR economic capital costs were calculated at 1992 prices. To adjust these to 1995 prices the same index as for the

KAROSA bus was used, that is 1.55. This gives a 1995 economic capital cost of 294.9 million VND.

In the NSTR, TESI estimated that the life of these trucks is 10 years. Amortization over this life at an annual interest rate of 9.5% gives an annual economic cost of 46,947,400 VND.

2) Running Costs

Running costs were based on the TESI data supplemented by current oil, fuel, insurance and crew wage data. Maintenance and tire costs were derived from the TESI values by applying the KAROSA capital price index from 1992 to 1995. These costs are summarized in Table 10-4-6.

Table 10-4-6 Truck Running Costs

Item	Cost VND	Interval Kms	Source
Oil Change	31,500	100	TESI + Current Oil Price
Tires (6)	2,364,134	40,000	TESI
Maintenance	29,668	100	TESI
Insurance	400,000	Annual	Vietnam Insurance Company
Fuel	94,500	100	TESI - Derv 2,700 VND/ Lt
Crew (1.5)	3,846	Staff/Hour	TESI - Current Wage Rates

3) Distance Related Operating Costs

In order to calculate distance related operating costs it was assumed that 70% of the annual cost would be allocated to distance in accordance with World Bank practice. Based on the TESI research it was assumed that the annual distance operated would be 20,000 Km, that is 55 Km per day. Taking account of the 20% Import Tax and the 3% tax on fuel and a 10% allowance for overheads based on the TESI research, the distance related economic and financial operating costs are as follows:

- Economic Cost - 3,880.39 VND/Km
- Financial Cost - 4,236.69 VND/Km

4) Time Related Operating Costs

In order to calculate time related operating costs it was assumed that 30% of the annual cost would be allocated to time in accordance with World Bank practice. Based on the TESI research it was assumed that the annual productive running time would be 800 hours, that is just over 2 hours per day. Time related economic and financial costs were calculated using the same assumptions as for the distance related costs. These are as follows:

- Economic Cost - 25,720.20 VND/Hr
- Financial Cost - 29,242.75 VND/Hr

10.4.7 Summary of VOCs

Table 10-4-7 below shows the summary of VOCs in terms of financial and economic costs, and by distance and time related costs.

Table 10-4-7 Summary of Operating Costs

Vehicle Type	Distance Related Cost (VND/Km)		Time Related Cost (VND/Hr)	
	Economic	Financial	Economic	Financial
Bicycle	11.94	11.94	119.45	119.45
Motorcycle	349.10	412.69	4018.41	5290.60
Car	2121.95	2704.92	28535.19	39949.26
Bus	5153.46	5979.70	17440.81	20259.82
Truck	3880.39	4236.69	25720.20	29242.75

Note: Table Values at 1995 Prices

Assuming running speeds of 12.5Km/h for bicycle, 25.0Km/h for motorcycle, 30Km/h for passenger car, bus and truck, the economic 1.0 Km VOCs of each mode were calculated as shown in Fig. 10-4-1. The VOC of a bicycle is less than 1/120 and that of a motorcycle is less than 1/5 of the passenger car VOC. The share of time related portion varies between 44% in bicycle and 10% in truck.

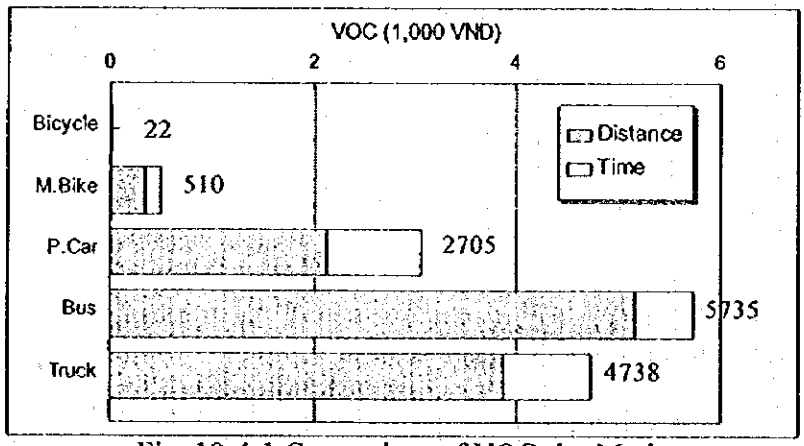


Fig. 10-4-1 Comparison of VOCs by Mode

Table 10-4-8 shows the estimated trip end and VOC total in 1995. The share of bicycle trip is almost half of the total trips, however their operating cost occupies only 1% of the total. While 1.6% of truck trip occupies 34% of the total VOC.

Table 10-4-8 Trip End and VOC by Mode

Mode	Trips		Annual VOC	
	Trips/day	(%)	(M.VND)	(%)
Bicycle	1,085,047	48.2	34.4	1.0
M.cycle	840,546	37.3	1,310.5	39.9
Bus	249,672	11.1	633.1	19.3
P.Car	40,364	1.8	190.9	5.8
Truck	36,479	1.6	1,112.6	33.9
Total	2,252,108	100.0	3,281.5	100.0

CHAPTER 11 ROAD NETWORK DEVELOPMENT

11.1 Road Network Planning Policy

11.1.1 Present Network Pattern

The road network in the built-up area of Hanoi city is characterized by several radial roads which are portions of national highways passing through the city, and two partial inner ring roads which function inefficiently especially the first one. The second ring road has a low capacity. The central area of the French Quarter has sufficient street density and together with the Ancient Quarter are basically out of the main road development plan for cultural, social and environmental preservation. Transport problems in these two special areas are considered in different schemes concentrating on traffic management procedures and public transport systems.

Other surrounding urban areas lack the minimum required street density and do not have a planned street network. These areas are considered partially in the development plan at the level of the primary streets and in connection to the main arterials of the network. As these areas are mostly characterized by living quarters with heavy population density, more plans for road construction schemes will face social problems regarding resettlement and compensation. Providing new living facilities with a relocation plan for resettlers in the newly developed cities in the suburbs of Hanoi is an important task to be done before increasing the street density in the built-up areas.

Rural districts in Hanoi city are connected with the urban area mainly through the national highways which are mostly in fair condition but without sufficient lanes for motorized and non-motorized traffic, especially near the built-up area. Smaller district roads are in general unpaved with insufficient width and some of these roads are impassable during the rainy season. Most of the alignments of these roads are dictated by topographical characteristics and they often follow the embankments of water courses. The present condition of the rural road network can not support any of the development plans established either for rural areas or for new urbanization.

11.1.2 Concept and Objectives of Development Plan

The road development plan is designed to be as realistic as possible with minimum activities in the central and urban areas of the city inside Ring Road 2 and to develop the main transport infrastructure in suburban areas based on the future land-use planning of the city. The general objectives and planning concept of the road development plan in Hanoi city can be set out as follows:

(1) To help in realizing the targets of the national, regional, urban and rural economic and social development plans.
(2) To enlarge and enforce the physical foundation of the transport infrastructure in the city to cope with the requirements of the future urban economic growth by providing reliable and high quality transport services.
(3) To guide the urban growth in the planned direction and to realize an orderly land-use plan and urban development.

(4) To alleviate traffic congestion in built-up areas and to ensure safe and punctual transport.
(5) To promote the effective use of land with poor accessibility and physical constraints, and to provide easy access to new development areas.
(6) To consider the harmony and balance between different transport modes, and the environment and cultural heritage of Hanoi.

11.1.3 Targets of the Plan

In view of the above mentioned objectives of the road development plan, the targets are set out as follows:

(1) To complete a major road network which meets the following requirements.
- The network should provide connections to most of the areas in the city
- The network should support the socioeconomic development of the city
- The network should consist of continuous roads with river-crossing facilities without stub connections except for short stretches in special cases.
- All components of the road network should be maintained at an acceptable level-of-service, V/C less than 1.5.
- The component roads should be well distributed over the city according to the transport demand.

(2) To minimize required works in urban areas, and apply only management plans for the roads of the central and ancient areas.
- In addition to minimizing the financial burden required for resettlement schemes and compensations in the transport system investments, Hanoi has a special environmental and cultural nature which should be preserved by limiting the network requirements in the urban area to only some minor improvement works and applying road management procedures to improve the network efficiency.

(3) To increase the serviceability and efficient usability of the existing facilities.
- Although the road network in many areas is adequate, it does not function efficiently. Applying some improvements and management measures can improve the level-of-service and the traffic flow without major construction works. A certain ROW should be kept for the subsequent sections of a street, bottlenecks within the present built-up area should be dissolved, and missing links should be completed.

(4) To provide and support an efficient public transport system.
- The road network should support efficient public mass transport systems which cover most of the areas by means of bus routes integrated with a commuting railway transport system which will reduce the dependency on private transport.

(5) To develop a transport infrastructure system in the suburban corridor as a belt area for the future land-use expansion plans.
- The outer ring road (Ring Road 3) and other assisted roads will serve the transport system of the city in many directions. It will help in alleviating the traffic volumes in the central area by handling the through traffic, and will serve the urbanization plans in new cities in the Hanoi Urban Development Corridor.

11.1.4 Planning Procedure

The procedure used in the planning is summarized in Fig. 11-1.1. The pattern, function and characteristics of the present transport network were investigated through different road and traffic surveys to identify the major problems in the transport system of the city. The forecast future transport demand was also used to establish the planning concept and policy and to identify the future traffic volume on the road network.

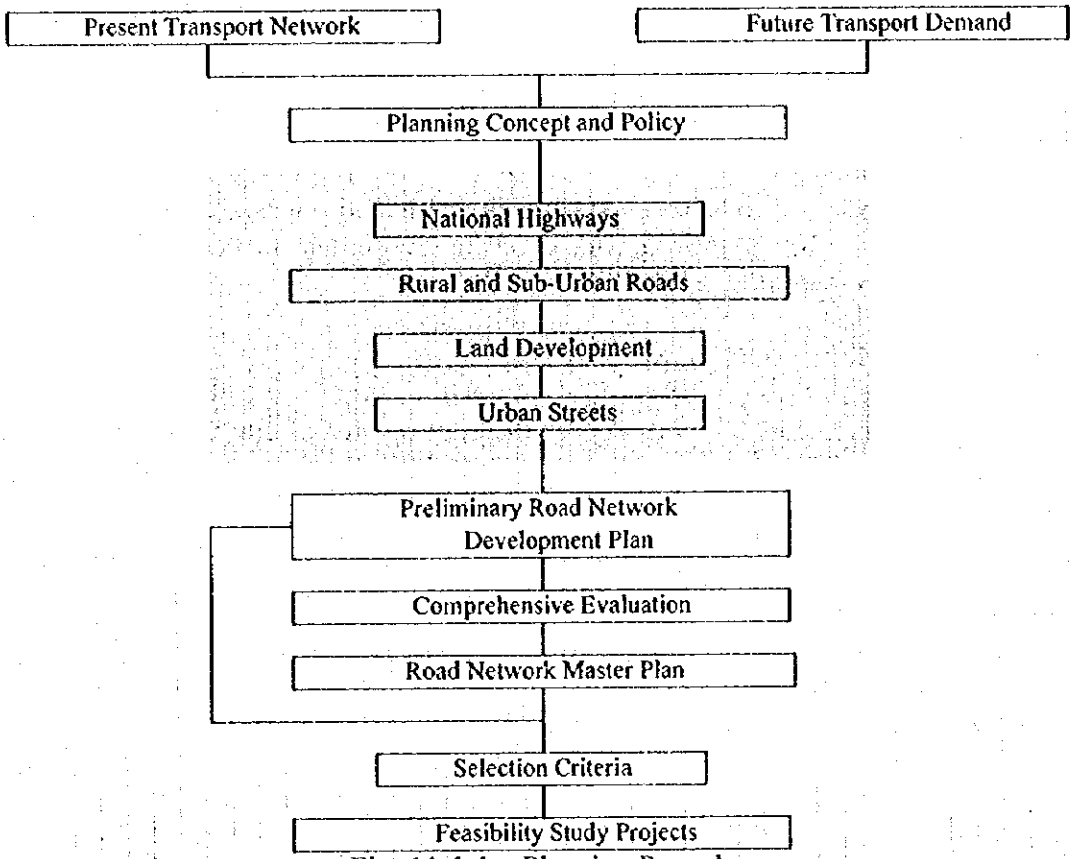


Fig. 11-1-1 Planning Procedure

The preliminary road development projects were formulated based on the objectives, targets, policy and planning concept taking into consideration the land-use plan and on-going or committed projects with several alternative schemes. Projects were classified into groups depending on their function and authorities in-charge. Land development projects are included in order to solve the population-growth and resettlement problems so that the urban street network can be improved.

All the projects were subject to comprehensive evaluation, individually and in packages, from the technical, social, economic, financial and environmental points of view, along with the political and institutional implications. Based on the evaluation results, selected projects formulate the transport development plan or the Transport Master Plan - 2015" for Hanoi city. In the meantime, criteria were established to select the project(s) subject to the feasibility study stage.

11.1.5 Road Network Requirements

To meet the future transport demand and to efficiently support the socioeconomic growth and development plans, the minimum requirements of the road network can be identified as follows:

(1) Urban Street Network

All streets in the built-up area used for 4-wheel vehicles, with a width over 6 meters should have the following minimum requirements:

- Paved all-weather roads
- Good Condition
- Carriageway: a) to balance road capacity with land acquisition requirements
  b) to provide wide streets in low-settlement areas
- Permanent bridges in good condition

(2) Sub-Urban and Rural Road Network

The minimum requirements for roads outside the built-up area of urban Hanoi are stated as follows:

a. National Highways in Hanoi City:
   - Paved all-weather roads
   - Good Condition
   - Carriageway: 4-8 lanes motorized + 2 lanes non-motorized
   - Permanent bridges in good condition
b. TUPWS Provincial Roads and District Roads:
   - Paved all-weather roads in fair condition
   - Minimum width of carriageway: 5 m paved + 2 x 1 m shoulder
   - Permanent bridges in fair condition

11.2 Road Network Projects

The developed road network projects are presented into groups based on their function and authorities in-charge. The road projects of the development plan are classified into the following groups depending on the main type of work items:

(1) Road Improvement Projects
- Pavement Rehabilitation
- Pavement Construction
- Carriageway Widening
- Road Upgrading
- Expressway Upgrading

(2). Road Construction Projects
- New Carriageway Construction
- New Road Construction
- New Expressway Construction

(3) Structure Projects
- Bridge Construction
- Bridge Widening
- Bridge Rehabilitation
- Interchange Construction
- Tunnel Construction

To summarize the components and characteristics of each road project, a project profile was prepared for each of the road projects, as included in Appendix B. These contain the following information:

- Description
- Location
- Project Components
- Objective and Benefits
- Target Year Traffic Volume
- Work Items
  Rough Cost Estimation (Direct Construction Cost, Land Acquisition and Compensation, Engineering Design and Supervision)
  Economic Evaluation Parameters (Benefit/Cost Ratio: B/C)
- Priority Ranking
- Implementation Program
- Project Layout & Detailed Map

The following sections provide a brief description for each scheme. Fig. 11-2-1 shows the main road projects planned in the rural, suburban and urban areas of Hanoi city and a list of the projects is presented in Table 11-2-1.

11.2.1 National Highways [Projects Group: A]

Seven national highways, which are basically the responsibility of the Ministry of Transport and Communications (MOTC), pass mainly in a radial pattern through the

study area of Hanoi City. Three of these highways, NH-1A, NH-1B and NH-5, are currently subject to improvement projects funded by different international financing institutions.

The other national highways are generally substandard and do not meet the minimum requirements established in this plan to cope with the future transport demand. Projects related to existing and newly-constructed national highways and expressways are included in this group.

A01 National Highway 2 Improvement Project

This highway extends west to the Chinese border at Lao Cai and is used mainly for trade activities with China and to connect northern and western provinces with Hanoi. It passes by the international airport at Noi Bai and a new industrial and export processing zone (EPZ). From that point the new national NH-18 extends east to the international seaport of Haiphong. The traffic demand forecast for the Hanoi section of the highway in the year 2015 is more than 75,000 motorcycles and 16,000 large-size vehicles per day in addition to the flow of bicycles and passenger cars.

The existing highway width ranges between 8m and 14m with a shoulder width of 2-3m. The highway width is planned to be widened to four motorized lanes and two non-motorized lanes for the 5.5 Km length in Hanoi City. A typical cross section for the widening scheme is shown in Fig. 11-2-2.

A02 National Highway 3 Improvement Project

This highway is extended north of Hanoi to southern China to handle the increasing traffic demand to northern provinces. The future transport demand forecast shows a very important role to be played by this road due to its strategic location to connect several future development areas with Hanoi.

Based on the future high demand and the highway network characteristics, the road is proposed to be widened to six motorized lanes for the first and second segments (A0201 and A0202) of 11.5 Km close to urban Hanoi and up to the planned RR-3. The other two segments (A0203 and A0204), with a length of 21 Km, will be widened to four motorized lanes. In addition, two non-motorized lanes will be provided over all the length as shown in Fig. 11-2-3.

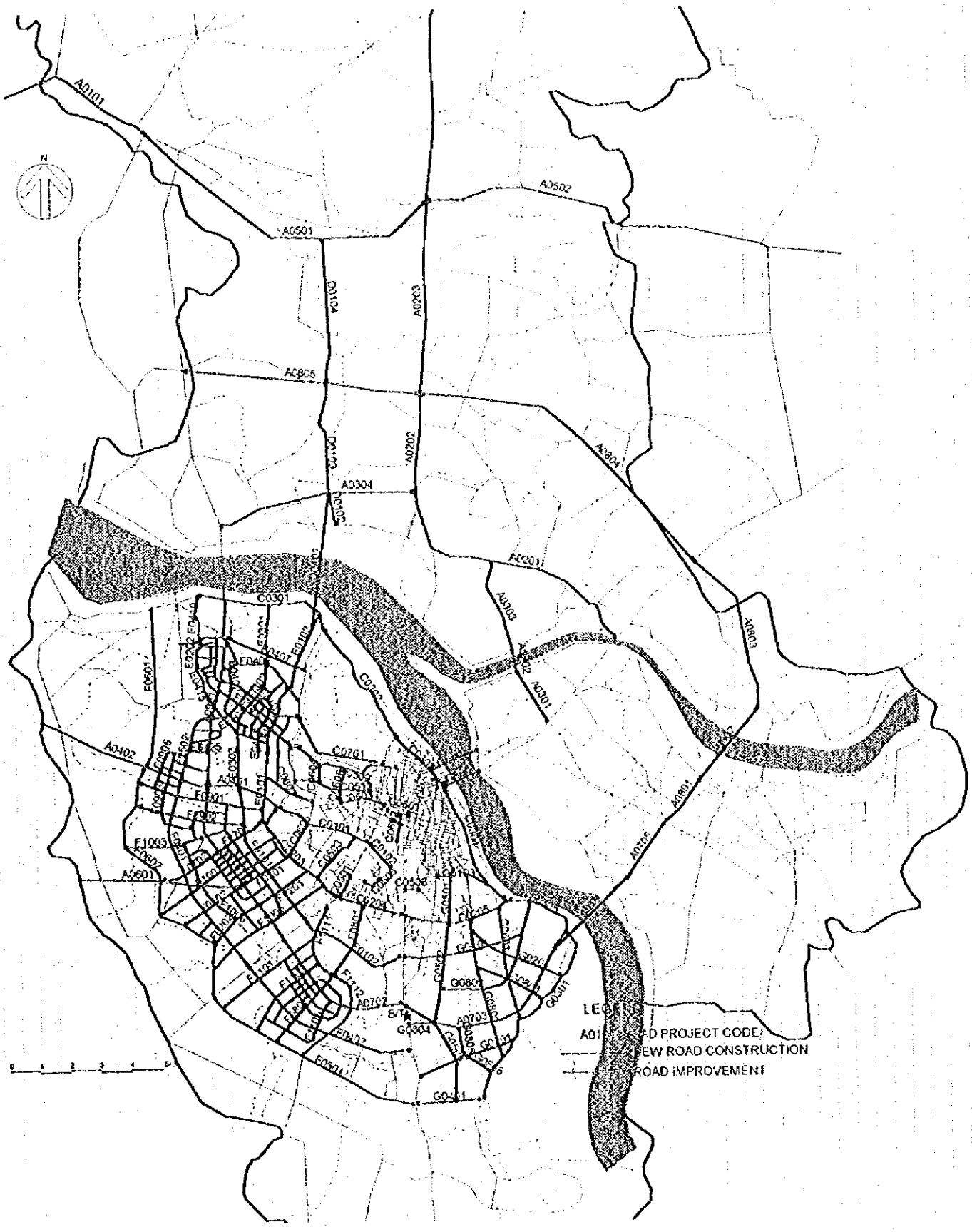


Fig. 11-2-1 Road Network Projects in Hanoi City

Table 11-2-1 Road Network Projects (1)

Code	Sub-Proj.	Project Name	MV Lanes	Length [km]	Cost [b. VND]
A	NATIONAL HIGHWAYS			147.525	13,663.7
A01	National Highway 2 Improvement Project			5.500	96.6
	A0101	Noi Bai Expressway - Hanoi Boundry	4	5.500	96.6
A02	National Highway 3 Improvement Project			32.500	648.8
	A0201	NH 1B - DA 4	6	9.000	223.6
	A0202	DA 4 - RR3	6	2.500	60.9
	A0203	RR 3 - NH 18	4	6.000	104.4
	A0204	NH 18 - Hanoi Boundry	4	15.000	259.9
A03	National Highway 5 Extension Construction Project *			10.700	637.0
	A0301	NH 1B - Duong Bridge [1]	6	1.900	110.0
	A0302	Duong Bridge [1]	6	0.550	330.2
	A0303	DA 7 [Upgrading]	6	1.250	30.6
	A0304	DA 4 [Upgrading]	6	7.000	166.3
A04	National Highway 32 Improvement Project			8.500	427.1
	A0401	RR 2 - RR 3	6	2.500	238.2
	A0402	RR 3 - Hanoi Boundry	6	6.000	188.9
A05	National Highway 18 Construction Project *			18.000	299.5
	A0501	Noi Bai Expressway - NH 3	4	7.000	116.8
	A0502	NH 3 - Hanoi Boundry	4	11.000	182.7
A06	Lang Hoa Lac Expressway Construction Project *			2.750	113.1
	A0601	RR 3 - Hanoi Boundry	6	2.750	113.1
A07	South Ring Road 3 Construction Project *			19.525	4,797.7
	A0701	NH 32 - NH 6	8	5.750	333.8
	A0702	NH 6 - NH 1A	8	4.900	284.2
	A0703	NH 1A - Thanh Tri Bridge	8	4.125	241.2
	A0704	Thanh Tri Bridge	6	2.500	3,808.0
	A0705	Thanh Tri Bridge - NH 5	8	2.250	130.6
A08	North Ring Road 3 Construction Project *			28.800	4,570.7
	A0801	NH 5 - Duong Bridge [2]	6	1.750	80.2
	A0802	Duong Bridge [2]	6	2.300	3,360.0
	A0803	Duong Bridge [2] - NH 1B	6	5.750	263.8
	A0804	NH 1B - NH 3	6	11.000	501.8
	A0805	NH 3 - Noi Bai Expressway	6	8.000	364.9
A09	Noi Bai Expressway Upgrading Project			21.250	2,073.3
	A0901	NH 32 - Thang Long Bridge	6	6.250	855.3
	A0902	Thang Long Bridge - RR 3	8	6.300	847.5
	A0903	RR 3 - Noi Bai Airport	6	8.700	370.5
B	RURAL ROADS			363.200	1,784.9
B01	Road Improvement Project in Soc Son District		2	155.300	757.7
B02	Road Improvement Project in Dong Anh District		2	56.200	277.2
B03	Road Improvement Project in Tu Liem District		2	25.000	121.1
B04	Road Improvement Project in Gia Lam District		2	82.700	404.4
B05	Road Improvement Project in Thanh Tri District		2	43.900	217.2
B06	Bridge Rehabilitation Project in Hanoi Rural Districts		2	0.100	7.3
C	URBAN ROADS			100.125	10,454.9
C01	Ring Road 1 Improvement Project			6.500	967.9
	C0101	Cau Giay St. - Ton Duc Thang	4	3.300	682.7
	C0102	Ton Duc Thang - Kim Lien	4	1.200	114.9
	C0103	Hue - Minh Khai	4	2.000	170.3
C02	Ring Road 2 Improvement Project			17.000	2,340.1
	C0201	Nhat Tan - Buoi	4	4.200	210.2
	C0202	Buoi - NH 32	4	2.200	284.2
	C0203	NH 32 - NH 6	4	4.200	488.3
	C0204	NH 6 - NH 1A	4	2.400	506.6
	C0205	NH 1A - Red River Dike	4	4.000	850.8
C03	Red River Dike Improvement Project			19.300	1,626.9
	C0301	Noi Bai E'way Ramp - Nhat Tan	4	5.600	181.2
	C0302	Nhat Tan - Thanh Nien	4	4.300	560.8
	C0303	Thanh Nien - Chuong Duong Br.	4	2.400	175.1
	C0304	Chuong Duong Br. - RR 2	4	3.800	597.3
	C0305	RR 2 - RR 3	4	3.200	112.5
C04	Urban Street Improvement Project			29.400	117.9
C05	Urban Street Width Adjustment Project			9.935	1,784.3
	C0501	Tay Son	25m	0.500	86.9

Table 11-2-1 Road Network Projects (2)

Code	Sub-Proj.	Project Name	MV Lanes	Length [km]	Cost [b. VND]
	C0502	Dao Duy Tu	7m	0.030	2.5
	C0503	Kim Ma	21m	1.275	372.5
	C0504	Thai Ha	14m	0.130	22.9
	C0505	Chua Boc	14m	0.300	27.1
	C0506	Thanh Nhan	10m	0.500	51.0
	C0507	Nguyen Khuyen	24m	0.470	120.9
	C0508	Thuy Khe	10m	0.120	11.1
	C0509	Hoang Ha Tham	10m	3.500	567.7
	C0510	Nguyen Binh Khiem	8m	0.030	1.8
	C0511	Hai Ba Trung	15m	0.080	13.3
	C0512	Doi Can	14m	3.000	506.7
C06	Urban Street New Construction Project *			11.490	2,636.2
	C0601	Station Tunnel	2*4m	1.500	656.5
	C0602	Linh Quang - Cho Kham Thien	2	1.025	226.1
	C0603	Yen Lang Drain	2	2.815	437.8
	C0604	Lieu Giai Extension - North	4	0.590	206.3
	C0605	Lieu Giai Extension - South	4	1.825	638.0
	C0606	Nui Truc Extension	4	1.060	370.6
	C0607	South Thang Long - Buoi Road	4	2.675	100.9
C07	West Lake Parkway Construction Project *			3.900	281.6
	C0701	Ho Tay East / West	4	3.900	281.6
C08	Hanoi Interchange Construction Project *			2.600	700.0
	C0801	RR 2 / NH 32 I/C	4	0.600	179.0
	C0802	RR 2 / NH 6 I/C	4	0.500	131.9
	C0803	RR 2 / NH 1A I/C	4	1.000	314.1
	C0804	Chuong Duong Bridge I/C	4	0.500	74.9
C09	Hanoi Bridge Capacity Increase Project			1.300	654.9
	C0901	New Chuong Duong Bridge	4	1.300	654.9
D	HANOI NORTH DEVELOPMENT AREA			300.130	7,353.7
D01	Dong Anh Highway Construction Project *			12.100	4,010.2
	D0101	Dong Anh Bridge	6	2.500	3,808.0
	D0102	(Dong Anh Bridge + DA 4) Approach	6	1.250	37.1
	D0103	DA 4 - RR 3	6	3.600	71.4
	D0104	RR 3 - NH 18	6	4.750	93.6
D02	Dong Anh New City Road Network *			53.690	631.9
	D0201	Collector Roads	4	28.720	444.0
	D0202	Feeder Roads	2	23.780	165.6
	D0203	Non-motorized Roads		1.190	22.3
D03	Soc Son New City Road Network *			59.460	686.7
	D0301	Collector Roads	4	30.320	468.7
	D0302	Feeder Roads	2	27.890	194.6
	D0303	Non-motorized Roads		1.250	23.4
D04	Gia Lam New City Road Network *			127.870	1,457.4
	D0401	Collector Roads	4	63.120	975.7
	D0402	Feeder Roads	2	62.140	432.8
	D0403	Non-motorized Roads		2.610	48.9
D05	North Thang Long New City Road Network *			47.010	567.5
	D0501	Collector Roads	4	26.670	412.3
	D0502	Feeder Roads	2	19.230	134.4
	D0503	Non-motorized Roads		1.110	20.8
E	NEW CBD ROAD NETWORK			73.400	1,567.7
E01	Ring Road 2 North Extension Project *			7.800	422.4
	E0101	RR 2 - New CBD	6	2.500	221.9
	E0102	New CBD Segment	6	2.300	86.7
	E0103	New CBD - Dike Road	6	3.000	113.8
E02	South Thang Long Road Project*			1.890	87.4
	E0201	Buoi - RR 3	6	1.890	87.4
E03	New Ring Road 2 Project *			6.200	179.7
	E0301	Dike Road - New CBD	4	1.900	57.1
	E0302	New CBD Segment	4	3.150	89.5
	E0303	New CBD - NH 32	4	1.150	33.0
E04	New CBD Road Network			52.010	740.5
	E0401	Collector Roads	4	27.760	476.8

Table 11-2-1 Road Network Projects (3)

Code	Sub-Proj.	Project Name	MV Lanes	Length [km]	Cost [b. VND]
	E0402	Feeder Roads	2	22.790	226.1
	E0403	Non-motorized Roads		1.460	37.6
E05	Ring Road 3.5 Project *			5.500	137.7
	E0501	RR 2 Ext. - RR 3	4	3.000	75.4
	E0502	RR 3 - NH 32	4	2.500	62.3
F	HANOI URBAN DEVELOPMENT CORRIDOR			199.995	3,611.7
F01	New Ring Road 2 Project *			8.625	285.1
	F0101	NH 32 - NH 6	4	5.000	165.4
	F0102	NH 6 - NH 1A	4	3.625	119.7
F02	Lang Ha - Ha Dong Road Project *			5.500	146.9
	F0201	RR 2 - RR 3	4	2.000	64.0
	F0202	RR 3 - Ha Dong	4	3.500	82.9
F03	Lang Hoa Lac Expressway Construction Project *			1.750	112.1
	F0301	RR 2 - RR 3	6	1.750	112.1
F04	Ring Road 3.5 Project			13.250	283.7
	F0401	NH 32 - NH 6	4	7.000	148.4
	F0402	NH 6 - NH 1A	4	6.250	135.3
F05	Provincial Road 70 B (413) Upgrading Project			7.500	158.7
	F0501	Ha Dong - NH 1A	2	7.500	158.7
F06	Nhue River Road Project			13.760	127.6
	F0601	Red River Dike - NH 32	2	5.880	57.0
	F0602	NH 32 - Ha Dong Rd.	2	7.880	70.5
F07	Me Tri Road (to Ba Vi E'way)			4.250	84.4
	F0701	RR 2 - RR 3	4	1.750	45.1
	F0702	RR 3 - Nhue River	4	2.500	39.3
F08	Bach Ma Airport Road			5.350	112.7
	F0801	RR 2 - RR 3	4	3.250	80.0
	F0802	RR 3 - Rd. 70B (413)	4	2.100	32.7
F09	Xuan La New City Road Network *			18.920	311.3
	F0901	Collector Roads	4	8.900	201.0
	F0902	Feeder Roads	2	9.480	94.0
	F0903	Non-motorized Roads		0.540	16.2
F10	Yen Hoa New City Road Network *			101.060	1,660.2
	F1001	Collector Roads	4	47.570	1,074.5
	F1002	Feeder Roads	2	50.630	502.2
	F1003	Non-motorized Roads		2.860	83.4
F11	Dai Kim New City Road Network [1] *			20.030	329.1
	F1101	Collector Roads	4	9.430	213.0
	F1102	Feeder Roads	2	10.030	99.5
	F1103	Non-motorized Roads		0.570	16.6
G	HANOI SOUTH DEVELOPMENT AREA			48.250	1,632.4
G01	New Ring Road 2 Construction Project *			5.580	184.6
	G0101	NH 1A - Dike Road	4	5.580	184.6
G02	Linh Nam Road			3.250	88.1
	G0201	RR 2 - Dike Road	4	3.250	88.1
G03	Red River Dike			7.500	217.6
	G0301	RR 3 - RR 4	4	7.500	217.6
G04	Ring Road 4 South			2.250	43.9
	G0401	NH 1A - Dike Road	4	2.250	43.9
G05	Mai Dong Road			7.630	659.3
	G0501	RR 1 - RR 2	4	1.500	414.7
	G0502	RR 2 - RR 3	4	2.750	179.4
	G0503	RR 3 - RR 4	4	3.380	65.2
G06	Minh Khai Extension			4.000	80.7
	G0601	RR 2 - Dike Road	4	4.000	80.7
G07	Ring Road 3.5			2.400	46.8
	G0701	NH 1A - Dike Road	4	2.400	46.8
G08	South Road Network			15.640	311.3
	G0801	RR 2 - Dike Road	4	6.000	113.2
	G0802	Mai Dong - Linh Nam	4	3.000	75.3
	G0803	G0801 - Dike Road	4	2.380	37.2
	G0804	NH 1 - RR 3	4	0.880	19.8
	G0805	NH 1 - RR 3	4	2.380	47.4
	G0806	RR 3.5 - Dike Road	4	1.000	18.4

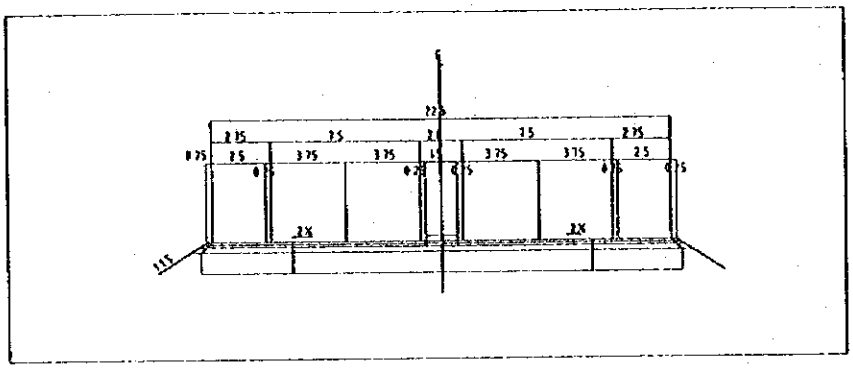


Fig. 11-2-2 Typical Cross Section of NH-2 Widening Scheme

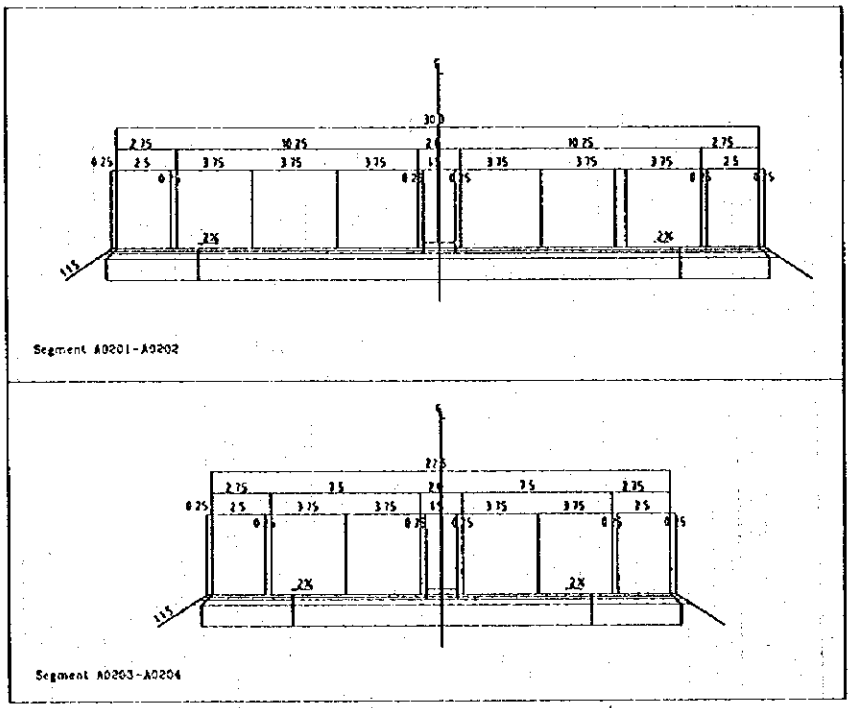


Fig. 11-2-3 Typical Cross Section of NH-3 Widening Scheme

A03 National Highway 5 Extension Construction Project

The existing NH-5, which extends to the port city of Haiphong, starts at the junction with NH-1B in Hanoi city. The road is under improvement works at present to increase its number of lanes and level-of-service. Extending the route to meet NH-3 north of the Red River will add a strong northern arterial in the road network of Hanoi. The road will handle most of the heavy traffic from NH-3 and will directly connect development areas in the two districts Gia Lam and Dong Anh.

The required length of the proposed 6-lane road is about 10.0 km, of which an existing 8.0 km road will require upgrading works. In addition, a 550m bridge over the Duong River is also required.

A04 National Highway 32 Improvement Project

The carriageway width of this important road varies from 5.5m to 12m with many roadside commercial activities at its beginning west of Hanoi urban area. The road handles heavy traffic at present and will serve the future extension of the city to the west where several development projects are planned.

As for the resettlement of the roadside dwellers, there is a plan to provide a relocation area to solve the resettlement problem so the widening project of the road can be implemented. In addition to the two non-motorized lanes of the road, the two segments with a length of 8.5 km between the second ring road and the boundary of Hanoi, are planned to accommodate six motorized lanes.

A05 National Highway 18 Improvement Project

The highway starts at the Noi Bai International Airport and terminates at Bac Luan border gate. It is an important trunk road in the highway network in the northern region and connects the planned northern Hanoi industrial zones to a deep seaport and to China.

The road at present is sub-standard, unpaved and new alignments is required for many segments. A feasibility study to upgrade and improve the road alignment was carried out. and as a result, the section in Hanoi City was recommended to be constructed as a 2-lane highway before the year 2001 with another 2-lane carriageway to be constructed before the year 2013.

A06 Lang Hoa Lac Expressway Construction Project

The proposed technology and university city to be constructed west of Hanoi at Ba Vi will be connected with Hanoi by this new expressway with a 30 Km length and 6 motorized lanes. The Hanoi-section of the road will enable the formation of industrial zones and new urban areas in the region west of Hanoi as a part of the plan to limit its urban population. Ba Vi is expected to serve as the first hi-tech zone for manufacturing plants and satellite town with an area of 1,800 ha and it would accommodate the National University of Hanoi and a folk culture and tourism village. It is planned to be developed in three phases up to the year 2020.

A-07 South Ring Road 3 (RR-3) Construction Project

All the studies and plans on the transport and land-use planning of Hanoi City have strongly recommended the construction of a third ring road around the city to alleviate the existing traffic problems and to support the future development and urbanization schemes outside the built-up area. The southern sections of this ring road shows high priority ranking for the implementation in early stages. The road will strengthen the national highway network in the area by connecting the radial highways south and north of the river without crossing the city.

This section of the ring road includes the Thanh Tri Bridge which will provide another

urgent and strategic crossing facility over the Red River to extend the development to the southern and eastern areas on the periphery of the city. Fig. 11-2-4 shows different options for the planned bridge.

A08 North Ring Road 3 (RR-3) Construction Project

The extension of the RR-3 to the northern zones of the city to the area of Noi Bai International Airport and the new EPZ projects will promote the socioeconomic and development growth of the city in general and of the rural and northern parts in particular. This proposed alignment, with a width of six lanes for motorized and two lanes for non-motorized traffic, has the advantage of decentralizing the city activities by expanding the area of development to rural districts far away from the built-up area of urban Hanoi.

The planned alignment for the northern sections of RR-3 is to pass between the city built-up area north of the Red River and the airport area which is covered laterally by NH-18. This alignment is to support the industrial development areas and to handle the present heavy traffic volumes and future high transport demand. In addition, the road will serve the truck terminal and cargo distribution center planned to be at the railway station near Dong Anh. Several industrial development projects and new urbanized centers will be served by the road.

A09 Noi Bai Expressway Upgrading Project

This is the only expressway at present in northern Vietnam. It is planned to serve as a part of the third ring road of the city which is expected to handle high traffic volumes in the future. The existing expressway requires widening and upgrading works to function not only as an expressway to the Noi Bai International Airport but a strategic ring road to serve the bypassing traffic and the newly developed industrial and residential areas in the two districts of Soc Son and Dong Anh.

The width of 27m at present should be increased to accommodate 6-8 lane sections for motorized vehicles in addition to two lanes for non-motorized traffic. In addition, the access to the expressway should be controlled at designated locations with management and safety facilities.

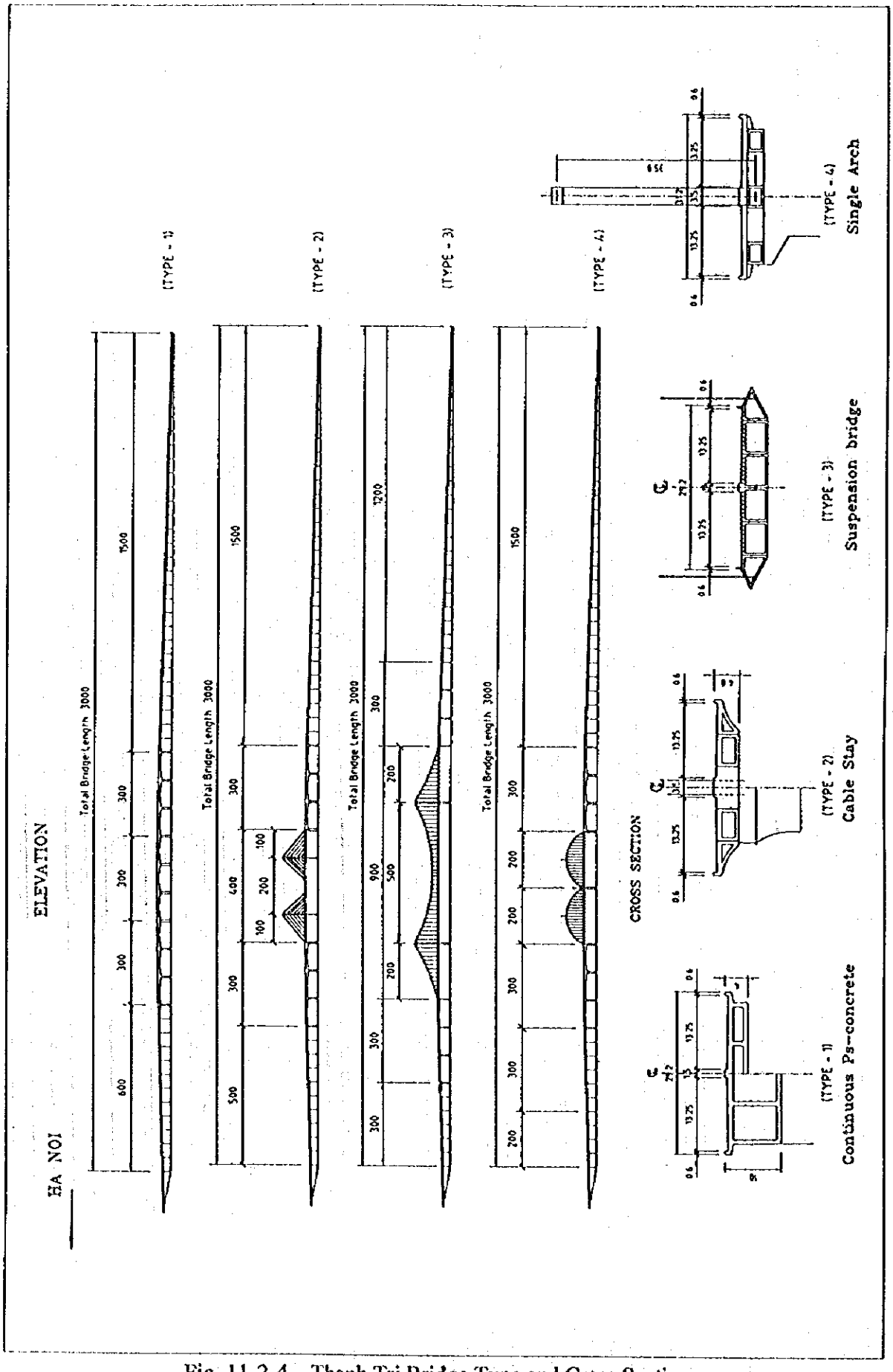


Fig. 11-2-4 Thanh Tri Bridge Type and Cross Sections

11.2.2 Rural Hanoi [Projects Group: B]

Roads under TUPWS and District jurisdiction in the five rural districts of Hanoi City are in general substandard with high rate of unpaved roads. To connect all villages and to support the socioeconomic development in rural areas, these roads should be upgraded and improved to meet the minimum requirements of rural roads so they can be used for 4-wheel vehicles under all weather conditions. Priority selection of sub-project roads in each district was determined, as explained in section 11.4, based on the parameters of population coverage and cost per population of each road, while the implementation program was based on the annual district budget for road improvement projects.

To efficiently carry out the required road rehabilitation and improvement tasks as well as the construction of new carriageways, equipment supply and training center projects are also required.

B-1: Road Improvement Project in Soc Son District

Soc Son District, in which the international airport is located, has the longest road network compared with other rural districts in Hanoi City. More than half of its roads, however, are either substandard, unpaved or in bad conditions to handle four wheel vehicle traffic.

With the high future socioeconomic development potential of the district, upgrading the road network is an important task to meet the expected demand. In total, Soc Son has about 155 Km, out of 227 Km of district roads, which require improvement works to provide an all-weather paved rural road network in the district.

B-2: Road Improvement Project in Dong Anh District

Dong Anh District is located just north of the built-up area of Hanoi City and is considered as the natural extension of the city to the north. Projects of industrial areas and a satellite city are planned to be implemented in the district. The rate of roads in good condition in the district is the lowest when compared with other rural districts in Hanoi.

The transport plan gives a high rate of new roads in the district to cope with the future high transport demand. In addition, the existing rural roads should also be improved to strengthen the network and to promote rural and regional development in the district. Required improvement and upgrading works will cover the length of sub-standard or bad condition roads in the district which is about 56 Km.

B-3: Road Improvement Project in Tu Liem District

To limit the socioeconomic activities in central Hanoi, a new CBD area is planned to be located in this district. In addition, new expressways and trunk roads to connect Hanoi with new urbanized areas in Ba Vi and other centers will pass also through the district which will give it a high share of new roads in the transport plan of Hanoi. Development

of the rural road network is also an important task to meet the future demand. Only a total length of about 25 Km, out of 115 Km of district roads, requires up-grading and improvement works in the district.

B-4: Road Improvement Project in Gia Lam District

The district is recording fast growth in developing both its agricultural and industrial sectors as it moves into the next century. The urbanization process in the district has gathered new momentum in the last few years. Plans for new towns and industrial areas have been formulated and the road network in the district should be developed also to promote and realize the socioeconomic plans.

The improvement of NH-5, which connects Hanoi with the international seaport at Haiphong and passes through the district, gives Gia Lam an important role as a trading center in the economic development. About 83 Km of roads require improvement works to provide a well developed rural road network in the district.

B-5: Road Improvement Project in Thanh Tri District

The transport network in the district is being developed at present especially with the construction of the southern sections of the RR-3 and the new Thanh Tri Bridge over the Red River to handle the south/east and south/north heavy traffic out of the central areas of Hanoi. The district is the smallest in terms of area, population and road length when compared with other rural districts in Hanoi. Its location, however, just south to urban Hanoi, gives it a strategic dimension as the gateway to the south of the country. About 44 Km of district roads in the district are required to be improved to upgrade the rural road network.

B-6: Bridge Rehabilitation Project in Hanoi Rural Districts

Most of the bridges on the road network in rural areas are substandard and in a bad and deteriorated condition. In addition, they lack the required width to allow the use of 4-wheel vehicles. Rehabilitation, up-grading and improvement works for some of these bridges is included in most of the road improvement projects in each district. Other bridges are grouped together in one rehabilitation project to cover the whole city. Bridges which are required to be rehabilitated are ten bridges in total in which five bridges are located in Soc Son, three bridges in Dong Anh and one bridge in each of Gia Lam and Thanh Tri districts. The total length of the ten bridges to be rehabilitated is only 93m which can be implemented under one package project.

11.2.3 Urban Roads [Projects Group: C]

The concentration of all socioeconomic activities of Hanoi City in the urban built-up area is putting more pressure on the road network in the city. With the high transport demand forecast in the future, the problem will have larger dimensions. Some areas have a high enough rate of streets while others have very low rates. Constructing new streets, and even widening the existing streets, in the built-up area is not an easy task as it is required to solve the problem of compensation and resettlement of affected people. In this road development plan, the urban road projects concentrate on management and minor improvement schemes for main arterials in the first stage and constructing some new links in later stages. In the meantime, developing the road network together with new urbanized centers in suburban unpopulated areas has more emphasize in order to cope with the population growth and to alleviate the concentration in the built-up area.

C01 Ring Road 1 (RR-1) Improvement Project

This old-dike road is called as a ring road but actually it does not function in the network as a ring road as some sections are impassable for four-wheel vehicles and the other sections are composed of a narrow single-carriageway with many junctions and heavy roadside commercial activities. A short section of the road, however, is very wide with a road-reserve width of about 60m. Widening the whole length of the road to this width is not feasible considering the size of the resettlement problem and the fact that it functions only as a secondary road.

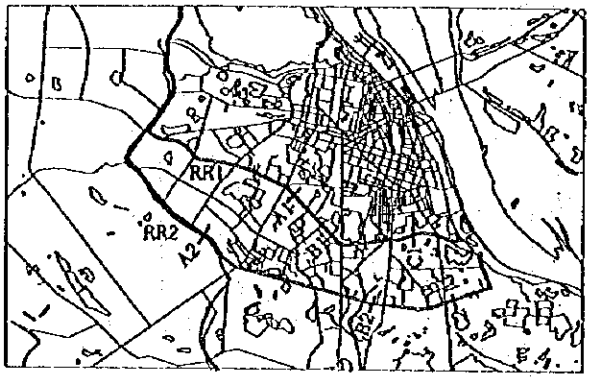
With other development in the network, the road is not expected to handle high traffic volumes in the future. A width of 30m is adopted for the improvement scheme of the three segments of this road to provide a dual carriageway which should be implemented in later stages after providing new centers for resettlement. In order to improve the function of the road, junctions and access to the main carriageway should be minimized to main locations only. Required junction improvements are mainly considered under the management measures of signalization and channelization without grade-separation schemes.

Fig. 11-2-5 shows the variation in the existing cross section width at different locations for the two ring roads RR-1 and RR-2 while Fig. 11-2-6 presents the planned widening and improvement scheme for each segment of the RR-1.

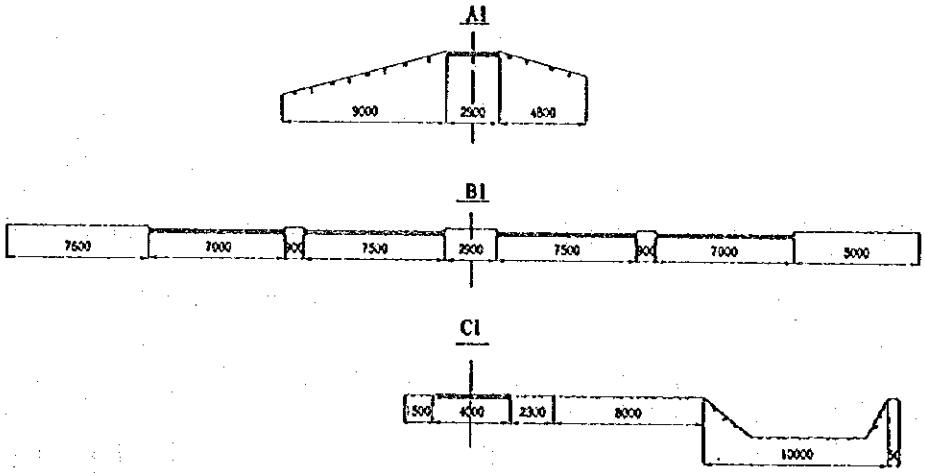
C02 Ring Road 2 (RR-2) Improvement Project

The road is one of the important roads in the network at present as it functions as a primary distributor and urban bypass for through traffic and handles heavy traffic volumes with high rate of large-size vehicles especially for trucks. In future, the road will continue to handle heavy traffic volumes especially on its southwestern sections. It will be the boundary road between the existing built-up are of Hanoi and the new development corridor at its suburbs The existing single carriageway, with different widths as shown in Fig. 11-2-5, is not adequate to accommodate the existing traffic and there is an urgent need to provide a new separated or additional carriageway for the whole length of the road to be a dual carriageway road with special lanes for non-

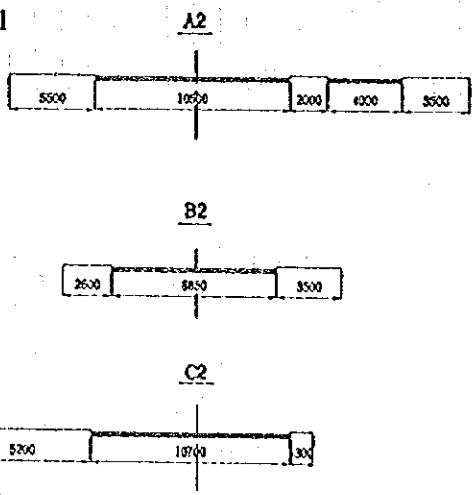
motorized vehicles.



Existing Ring Roads in Hanoi



Cross Sections of RR-1



Cross Sections of RR-2

Fig. 11-2-5 Existing Cross Section of Ring Roads 1 and 2

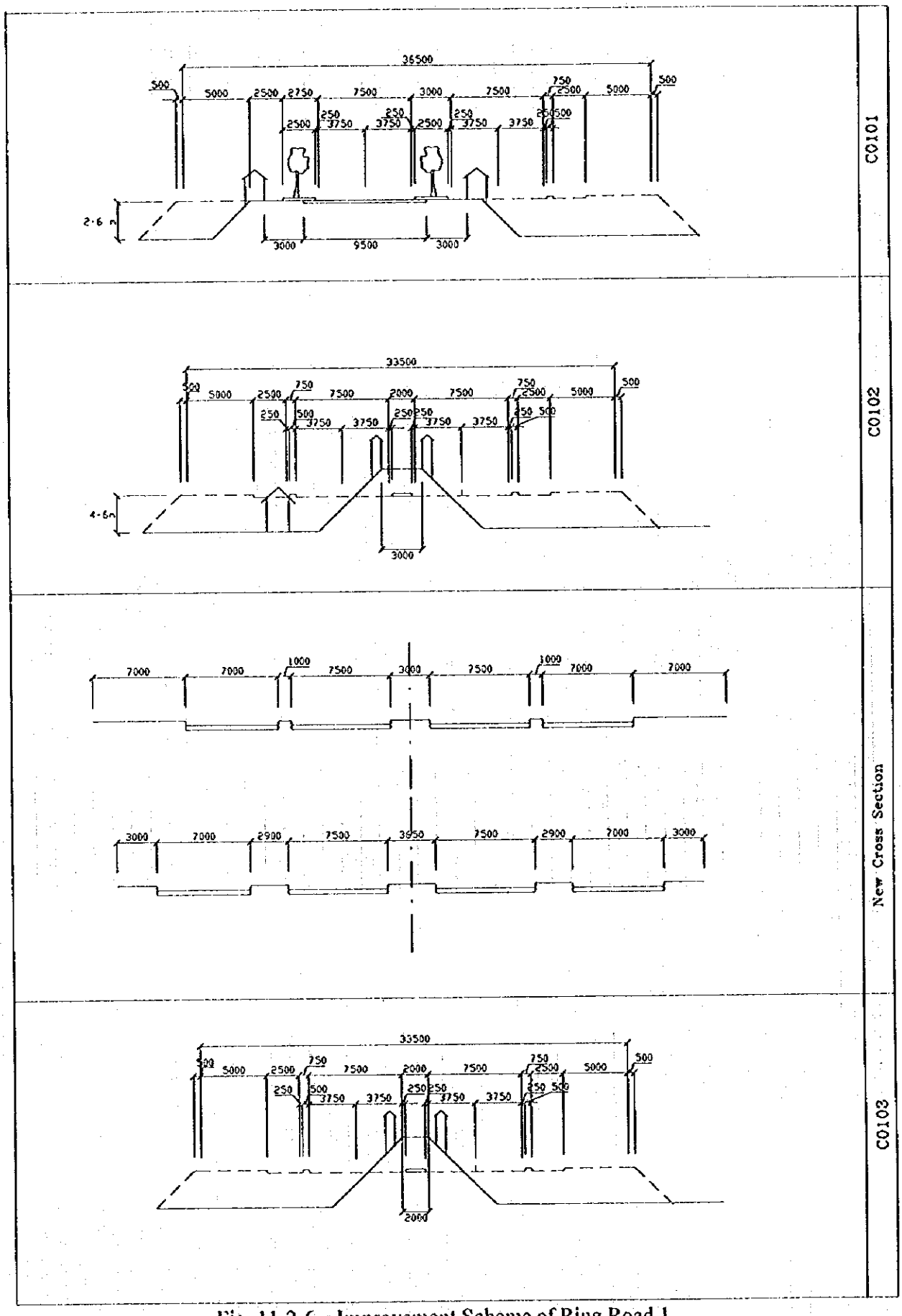


Fig. 11-2-6 Improvement Scheme of Ring Road 1

Western sections of the road are important to promote the development of a new CBD for Hanoi to the west, to control the urban population and preserve the existing city environment. Other southern sections are handling heavy through traffic which is expected to be increased by the improvement of NH-5 which connects Hanoi and northern provinces to the seaport of Haiphong.

Improvement schemes of the road are divided into five segments and the alignment and cross section of the new carriageway are presented in Fig. 11-2-7. On the other hand, junction improvements are included in Project C08 in which grade separation schemes are planned to be implemented in integration with the road widening project.

C03 Red River Dike Improvement project

The existing ROW of some sections of this road allows for provision of a 4+2 L divided road which can handle the heavy traffic flow with a higher safety level. It functions as a primary road for through traffic and for the movement of large-size vehicles between north and south and to the other side of the Red River.

The northern sections of the road are important to promote development of northwestern areas of the city as well as the development of the West Lake for tourism activities. Central sections pass the main business areas of the old city which are characterized by high density of roadside commercial activities. Southern sections of the road handle heavy traffic volumes of trucks which are expected to be increased by the construction of the Thanh Tri Bridge over the Red River as a part of the new RR-3.

As the road embankment is a part of the Red River Dike, improvement works of the road should be designed in such a way to provide more strength to the dike taking into consideration the hydrological and environmental factors. Upgrading the whole length of the road will provide a dual carriageway with lanes for non-motorized traffic as a safe and efficient arterial in the street network of the city.

Fig. 11-2-8 shows an improvement plan for widening the road cross sections at five segments of the road.

C04 Urban Street Improvement project

Based on the data from the urban street inventory, streets with a minimum width of over six meters which allow four-wheel two-way traffic and in bad or fair condition are included in this project which aims to keep the urban street network under the minimum requirements of the plan. A total length of about 30 Km of streets having an area of over 280,000 m^2 requires surface improvement and pavement works. In addition, and as a sidewalk condition survey was not conducted, the sidewalks of these streets, with an area of 201,000 m^2, should also be improved to allow the smooth movement of pedestrians.

This project is not considered as a development project for the future road network and it should be included in a comprehensive maintenance program covering the existing and newly developed roads in order to keep the network in a more efficient condition.

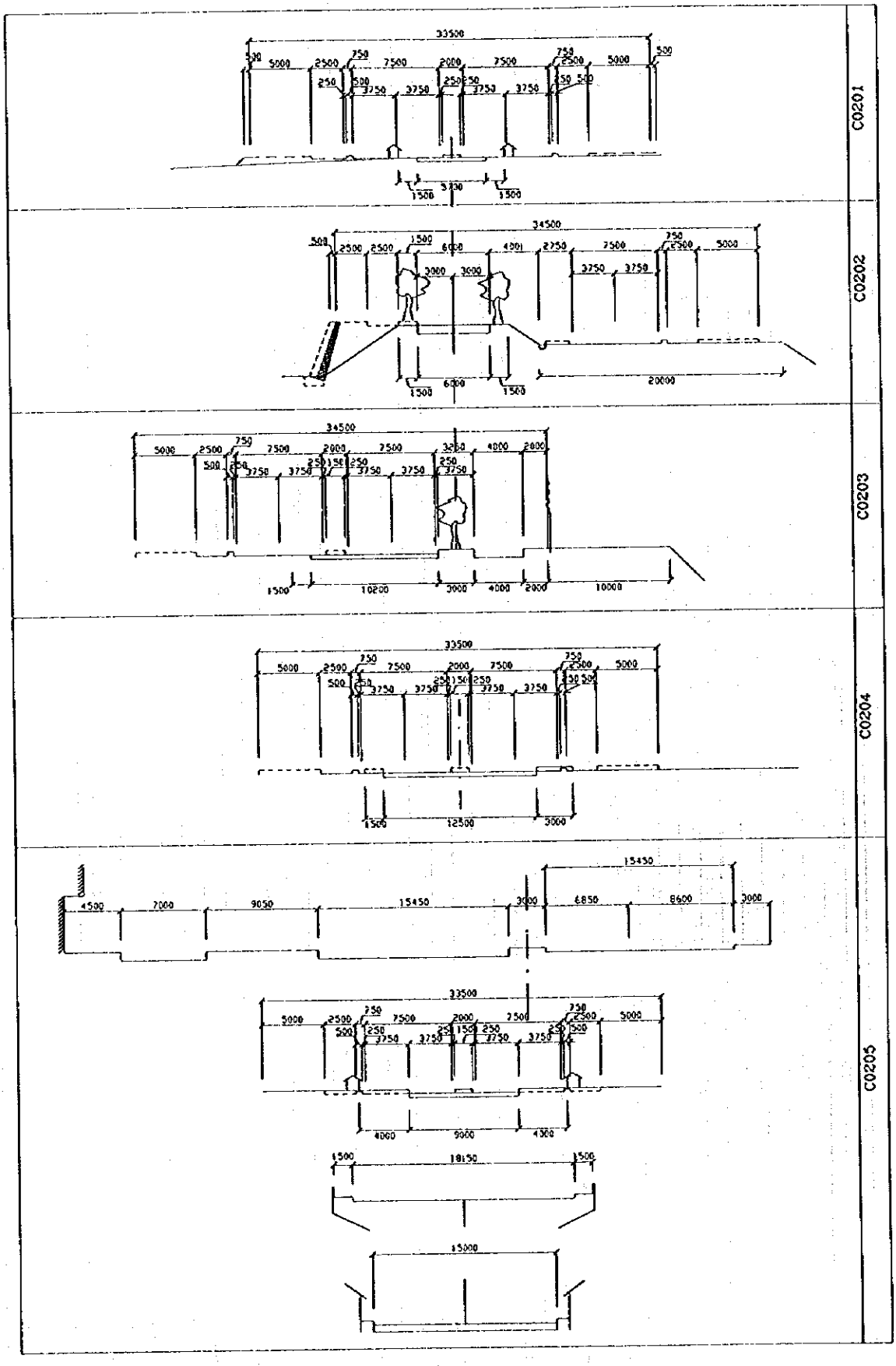


Fig. 11-2-7 Improvement Scheme of Ring Road 2

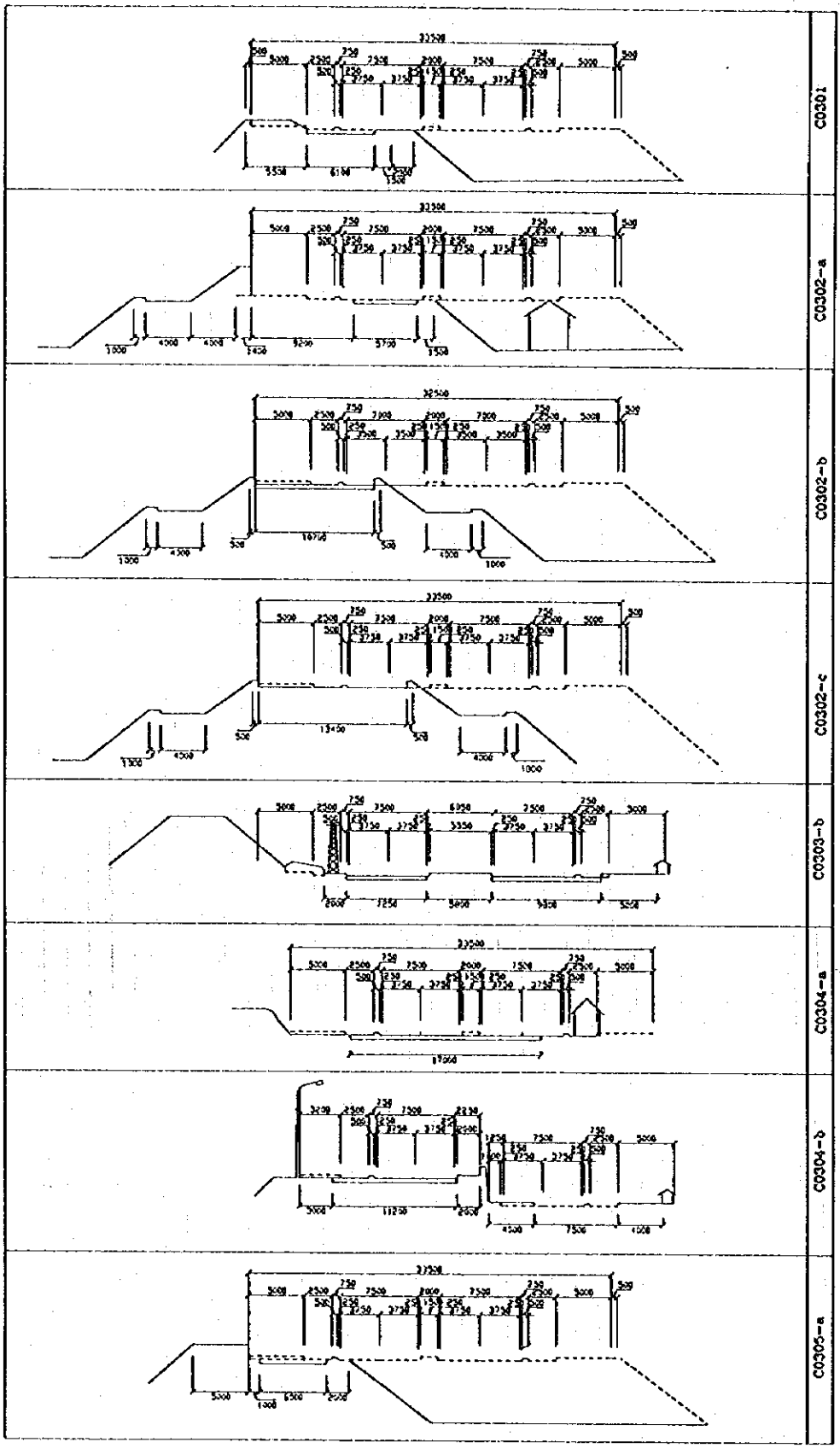


Fig. 11-2-8 Improvement Scheme of Dike Road

C05 Urban Street Width Adjustment project

The existing of bottlenecks at some locations and width variation at others decrease to a large extent the assumed capacity and function of the street network. A survey was conducted in the built-up area of Hanoi to investigate the size of the problem of bottleneck streets. Excluding the data collected for RR-1 and RR-2 in which 1,251 houses and shops should be cleared, fifteen locations of bottlenecks with a total number of 2,019 houses and shops should be cleared in order to ease traffic congestion and increase capacity of streets. Most of these areas, which cause constant traffic jams, are occupied by old houses and shop-houses built either legally or illegally due to encroachment and require the preparation of relocation and compensation schemes.

C06 Urban Street New Construction project

To provide the minimum required main streets to some areas and to connect some links in the urban street network, a total number of six new streets were found to be required. These schemes, however, are face the resettlement problem which will put their implementation in the later stage of the plan especially with the moderate traffic volumes to be handled by these streets in the future. New construction schemes for smaller streets locally required for living quarters at a district level are not considered in this plan which concentrates on the main links of the network.

C0601 Station Tunnel: The purpose of this tunnel is to provide a non-interrupted access for vehicles between the east and west sides of Hanoi Railway Station. This scheme depends mainly on the plans regarding the future function and area of the station as well as the grade separation of the existing railway lines.

C0602 Linh Quang - Cho Kham Thien Street: The area on the west side of Hanoi Railway Station is very large with few streets for four-wheel vehicular access. The minimum which can be achieved is the construction of this road to open the area for more development, as it is located in the center of the city. In the future more streets can be provided in a comprehensive plan for land development.

C0603 Yen Lang Drain Street: The drain has a wide ROW with a substandard road at some sections. The drain cross-section is planned to be improved. In the meantime, the drain provides the best alignment to the elevated light railway section before going underground at the city center. Constructing this road will provide an alternative to the extension of NH-6 to the city center which is narrow at present with high congestion rate as it handles the heavy traffic volume between Hanoi and Ha Dong.

C0604 Lieu Giai Extension (North): The mid-section of Lieu Giai street is upgraded to a dual carriageway with a width of 21 meters in addition to 12m for sidewalks. The north extension of the street will provide a north-south link in an area which has few links to serve local traffic. It will also function as an extension of a primary road for through traffic to western and northern areas of the city.

C0605 Lieu Giai Extension (South): The southern extension of this street will be connected to the beginning of the new Lang Hoa Lac Expressway between Hanoi and

the new satellite city at Ba Vi. Without constructing this section of the road, it will not cope with its assumed function as an expressway-extension road to the western areas of the city center. The existing narrow unpaved road is characterized by heavy commercial and residential activities which require a relocation scheme before implementing the road.

C0606 Nui Truc Extension: The purpose of this road is to also provide a north - south access in Ba Dinh district which lacks the existence of such roads. This road will function as an alternative for other roads in the central area for the access to the West Lake and western areas and as a local road for living quarters in the area. Space for such a road is partially available at present and should be preserved for future construction of the road.

C0607 South Thang Long - Buoi Road: This road has an important function to connect the existing built-up area with the new development areas west of the West Lake. It will strengthen the network an east-west arterial together with Kim Ma street. A bridge over the To Lich river is already constructed but other sections west of the river face some land acquisition problems.

C07 West Lake Parkway Construction Project

With the expected high transport demand in the future between the existing CBD and new urbanized areas in the west, an additional east/west arterial road will be required. Taking into consideration the existing high population density in the area, there is no available space for such road without causing a huge resettlement problem. Even the widening of the existing two east/west streets in the area, i.e. Thuy Khue and Hoang Hoa Tham, is facing the resettlement problem for the roadside socioeconomic activities.

The only reasonable way to avoid the resettlement problem in the heavy populated area is to provide a parkway on the southern undeveloped shore of the West Lake with special specification and environmental considerations. The beautiful landscape of lakes in Hanoi can be found where roads are directly surrounding the lake, such as at Hoan Kiem Lake and the southeast corner of the West Lake, which give access to all people to enjoy the lake. The parkway will open the southern part of the lake to all Hanoi people and will add more beauty to the city if implemented in full integration with the other landscape characteristics. A proposed typical cross section is shown in Fig. 11-2-9.

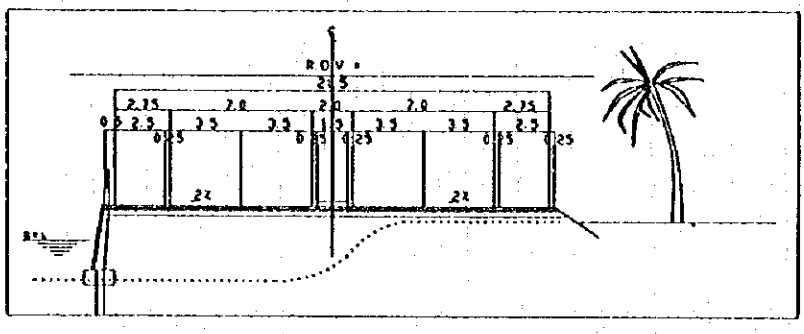


Fig. 11-2-9 West Lake Parkway Cross-Section

C08 Hanoi Interchange Construction Project

Interchange projects for the development plan of the road network are those which are required to increase the capacity and efficiency of the network. In the urban area inside the RR-2. Such structure projects are basically avoided in accordance with the preservation plans of Hanoi. The only structure projects in this area are the tunnel to be constructed under Hanoi Station (C0601) and the Chuong Duong Interchange project (C0804) which will not have any negative impact on the city. Other projects include three grade-separation schemes on RR-2 at its intersections with the national highways.

The RR-2 is serving at present as the main ring road for through traffic movements outside the central area of Hanoi. It intersects with several national highways at-grade which causes traffic congestion and dangerous conflict points especially for turning movements during the peak hours. Providing grade-separation schemes at these intersections will improve the flow of traffic and will provide a high safety level for road-users. The three locations of the planned grade separation schemes under this project are at the intersections of RR-2 with each of the national highways NH-32, NH-6 and NH-1A.

Due to the anticipated problems of securing the required right of way for multi-directional interchanges which provide separation ramps for several turning movements, only simple schemes are planned to grade-separate the through traffic flow. The implementation of this project is connected to and mainly depends on the improvement project of RR-2 (C02), as the grade separation schemes will require wider road widths to accommodate the interchange ramps which can not be provided within the present road width. The grade-separation project is composed of the following sub-projects:

C0801 RR-2 / NH-32 Interchange: At this location, a 4 lane overpass with a total length of 540m is proposed to handle the through traffic of NH-32 over both RR-2 and To Lich River as shown in Fig. 11-2-10

C0802 RR-2 / NH-6 Interchange: This national highway has enough width outside RR-2 to accommodate interchange ramps but due to the limited width of its extension (Tay Son street), a 4 lane underpass is proposed in this plan. The underpass will handle the through traffic of NH-6 under RR-2 as shown in Fig. 11-2-11

C0803 RR-2 / NH-1A Interchange: The existing intersection is handling heavy traffic volumes either for the turning movements or through traffic. Therefore, the interchange at this location is planned to contain an overpass for NH-1 through traffic and an underpass for RR-2. The at-grade intersection will be utilized for the turning traffic as shown in Fig. 11-2-12 (a) and (b).

C0804 Chuong Duong Bridge Interchange Project

The Chuong Duong bridge is the only bridge for motorized vehicles crossing the Red River adjacent to the central area of urban Hanoi and handles high traffic volumes. The bridge end at Hanoi's Hoan Kiem side is at present causing severe and dangerous conflict points in three areas. The first conflict point is at the uncontrolled T-junction on

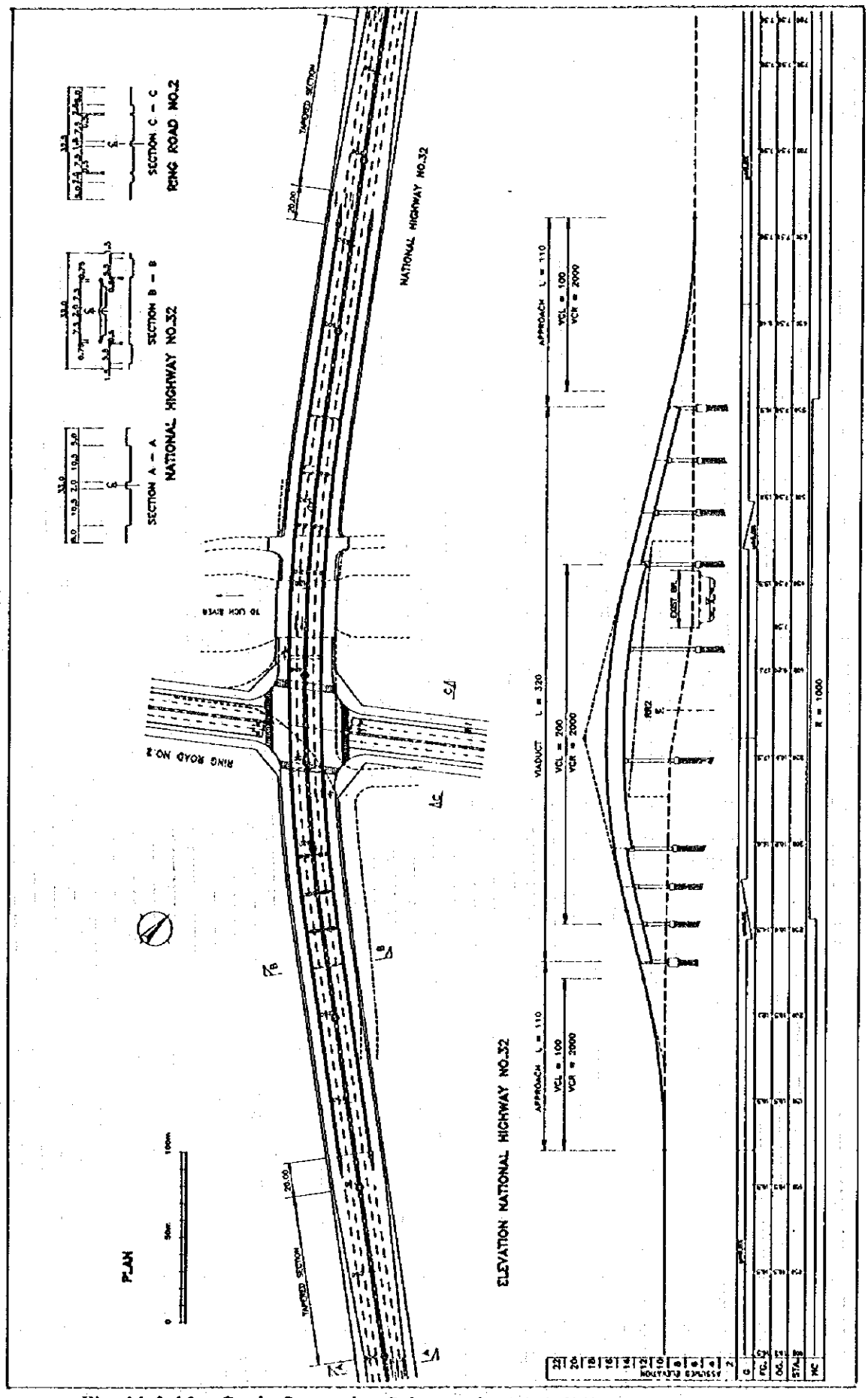


Fig. 11-2-10 Grade-Separation Schemes for RR-2 / NH-32 Interchange

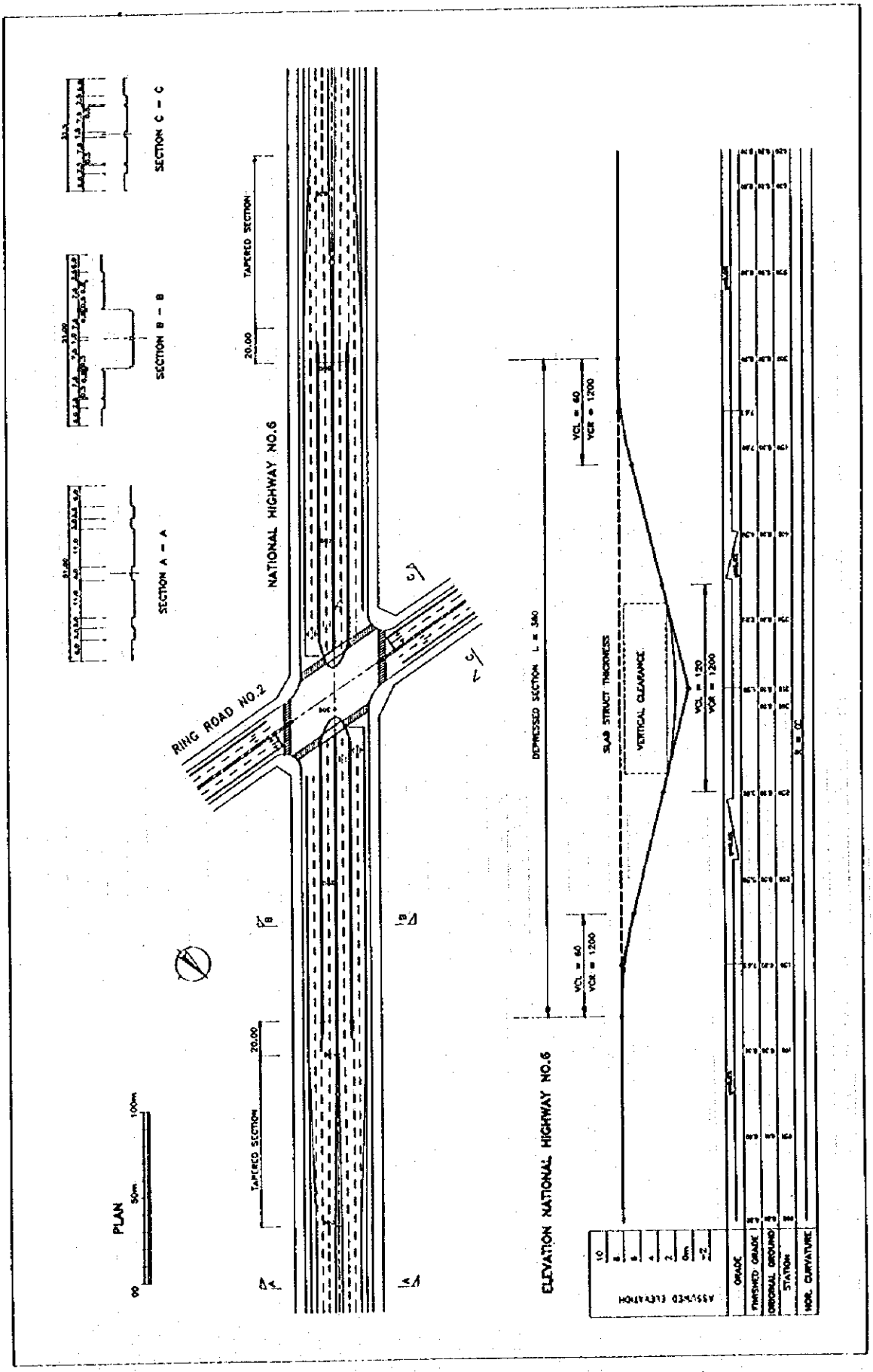


Fig. 11-2-11 Grade-Separation Scheme for RR-2 / NH-6 Interchange

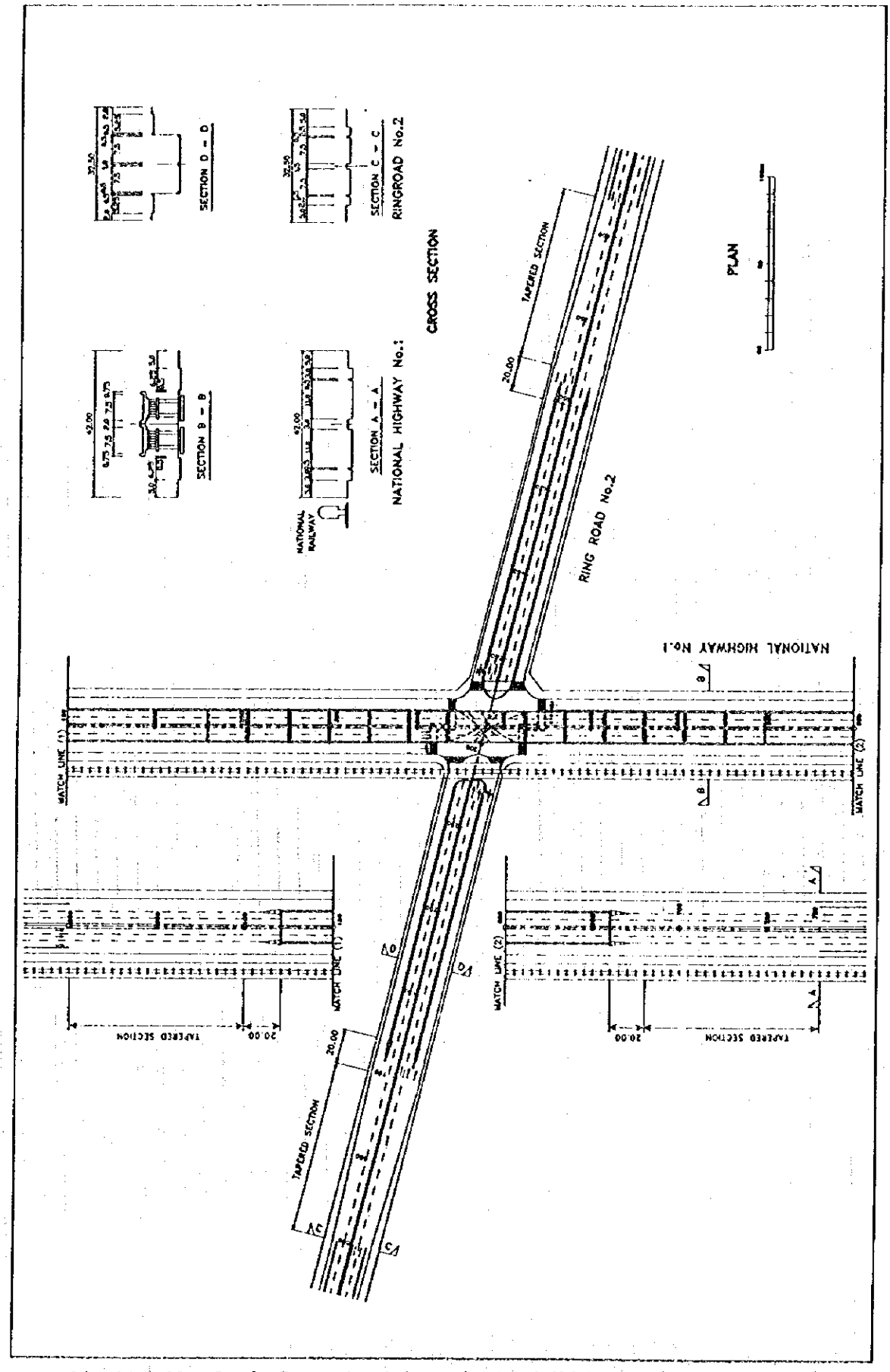


Fig. 11-2-12 Grade-Separation Scheme for RR-2 / NH-1A Interchange (Plan)

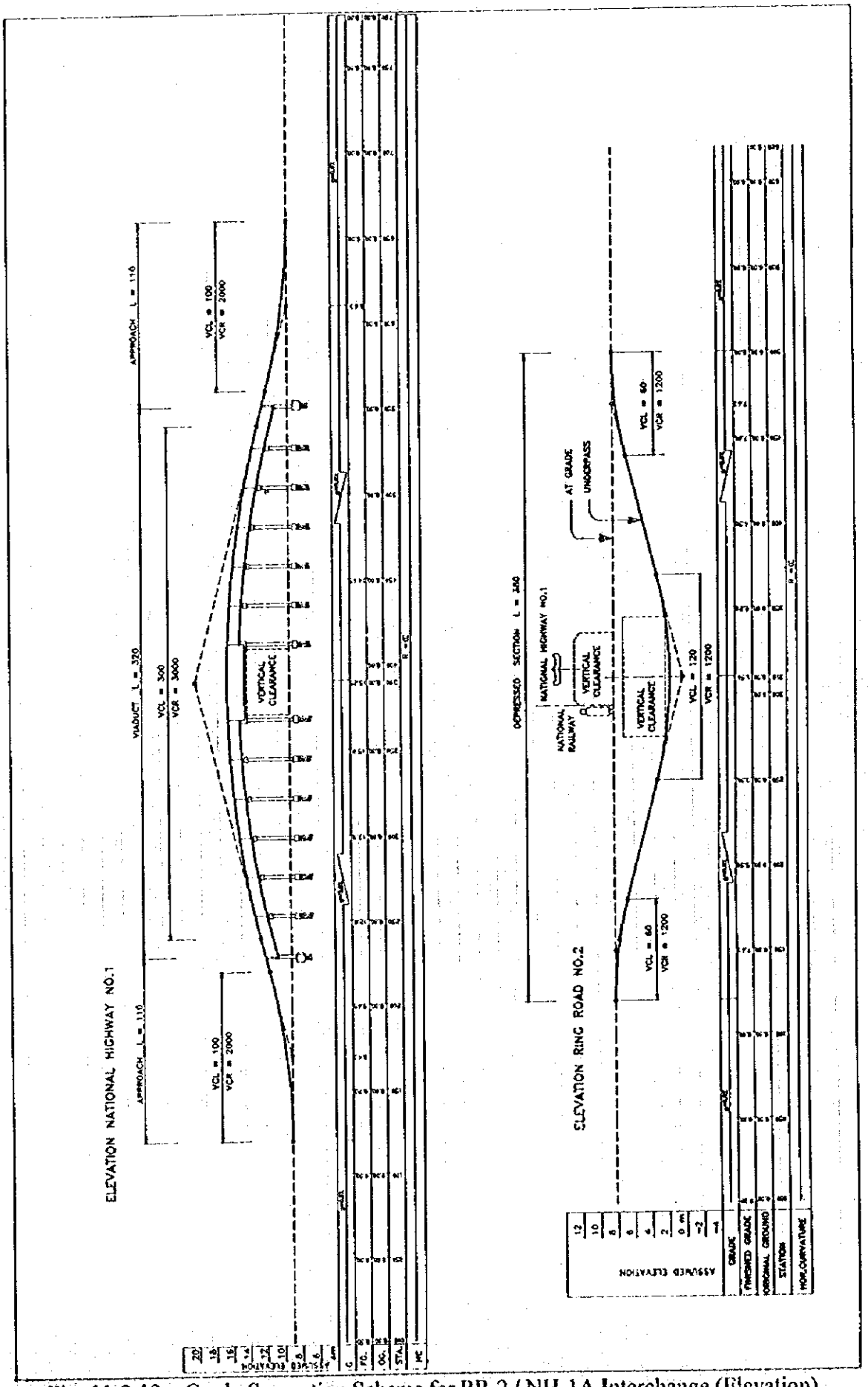


Fig. 11-2-12 Grade-Separation Scheme for RR-2 / NH-1A Interchange (Elevation)

the bridge level between inbound traffic from the north and outbound traffic from the south. This area is actually facing more conflict between motorcycles and 4-wheel vehicles. The other two points are on the street level at the two ramps of the bridge between through traffic on the Dike Road and bridge traffic.

The original design of the bridge provided for an interchange at the western end but its construction did not materialize due to lack of funds. With the high increase in the traffic volumes on the bridge, which handles also high share of the truck movements across the Red River, the concept of separating the different movements of bridge and street traffic at this location has become an urgent issue for both traffic and safety considerations.

To eliminate the two conflict points at the street level, another two ramps are planned at the middle of the square as shown in Fig. 11-2-13 for the interchange layout while Fig. 11-2-14 presents its elevation and plan. A channelization and management plan to improve the traffic condition at this critical location should be applied either individually or under a comprehensive scheme to improve the dike road to a dual carriageway road with segregated lanes for motorized and non-motorized traffic.

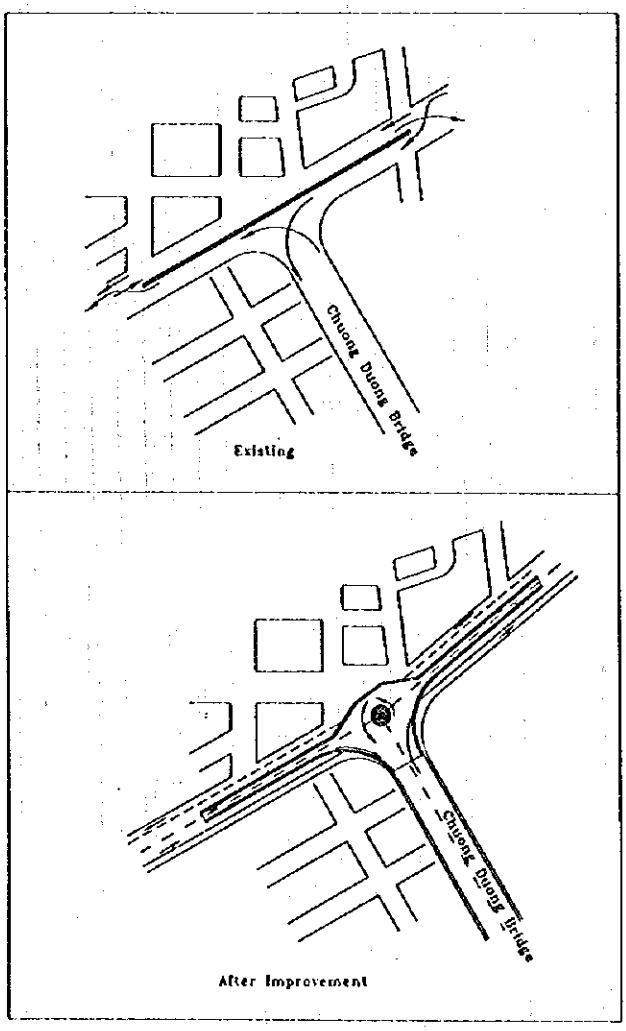


Fig. 11-2-13 Chuong Duong Bridge Intersection Improvement Scheme

C09 Hanoi Bridge Capacity Increase Project

The two bridges over the Red River adjacent to the central area of the city have insufficient capacity to cope with the river-crossing transport demand requirements in the future. There are two other bridges at Thanh Tri and Dong Anh included in the plan but the future increasing demand requires more crossing facilities especially at the central area of the city. The Chuong Duong bridge has limited capacity through its two lanes for 4-wheel vehicles and another two lanes for motorcycles. An initial inspection was undertaken on the bridge and Fig. 11-2-15 shows an elevation and cross sections of the bridge which has the following characteristics:

Bridge Dimensions:

Length: 854 m river portion + 266 m land portion = 1,120 m
Width: 2 x 4 m sidewalk + 2 x 2.5 m curb lane + 8 m carriageway = 21 m

Present 4-Wheel Vehicular Average Traffic Volume/Day:

Passenger car	4,800	28%
Van	4,700	27%
Bus	1,000	6%
Truck	6,600	39%
Total	17,100	100%

Bridge Condition:

- Piers are in good condition and can handle heavy loads
- Truss members and plate girders look in a quite sound condition
- Deck slabs have many repair signs of honey-combs and look weak
- Major rehabilitation works are those required for the slabs and floor

Design Criteria:

- Vietnam Engineering Standards

On the other hand, the Long Bien bridge is reaching the end of its life and is used at present for non-motorized traffic in addition to its main function as a railway bridge. The future of the Long Bien bridge as a railway bridge or for any other purposes is subject to the railway plan of the Vietnam National Railway (VNR).

C0901 New Chuong Duong Bridge Project

Four different alternatives were studied to increase the capacity of the Red River crossing facilities at the central area of the city.

(1) To utilize the Chuong Duong Bridge exclusively for 4-wheel vehicles and to provide a new bridge for 2-wheel traffic beside the Long Bien Bridge.
(2) To provide a new bridge for both 2-wheel and 4-wheel vehicles beside the Long Bien Bridge.
(3) To provide a new bridge for both 2-wheel and 4-wheel vehicles beside the Chuong Duong Bridge.
(4) To replace the Long Bien Bridge by a new one which can accommodate double-track for railway lines and a deck-floor for vehicular traffic.

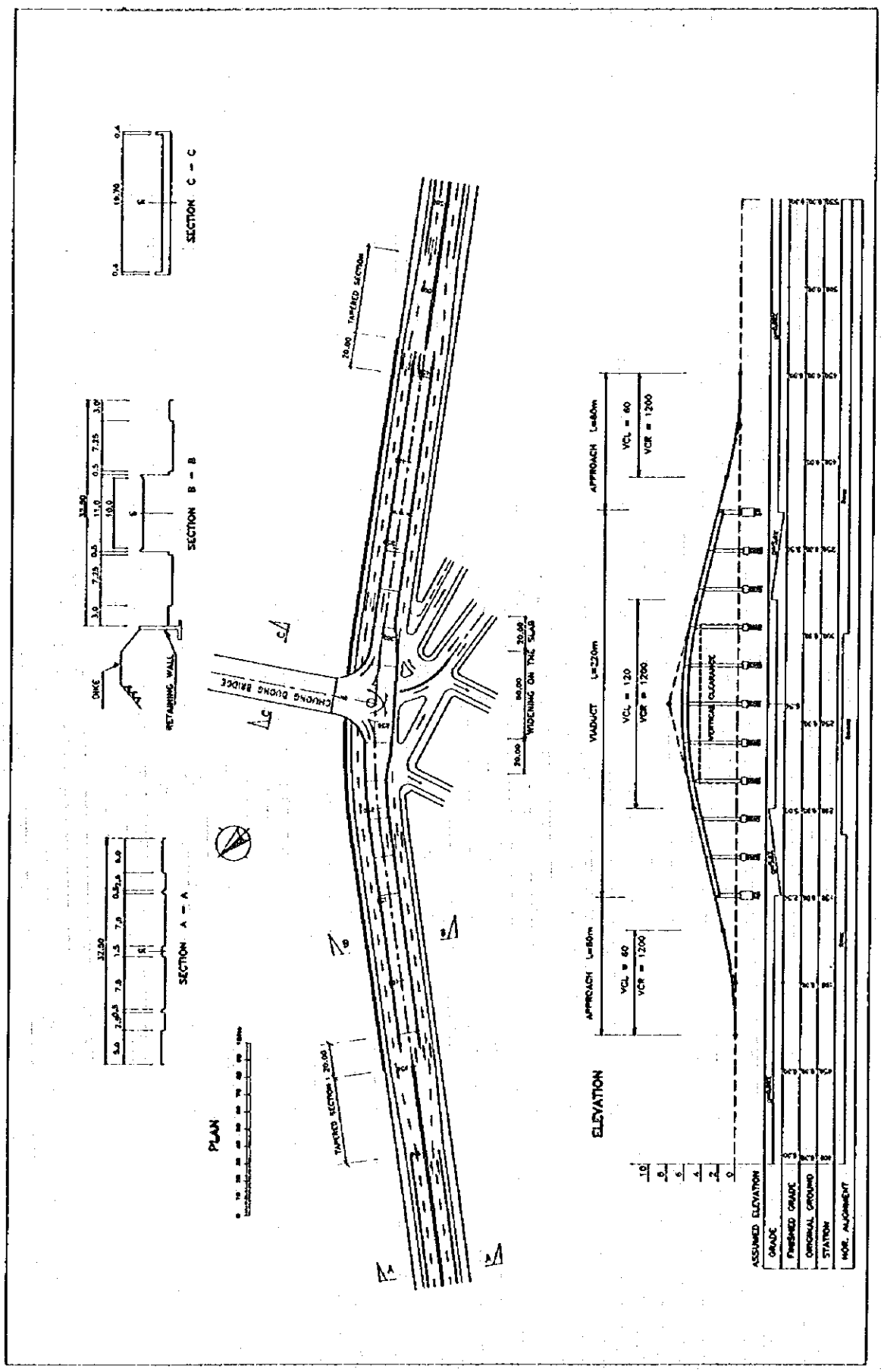


Fig. 11-2-14 Chuong Duong Interchange

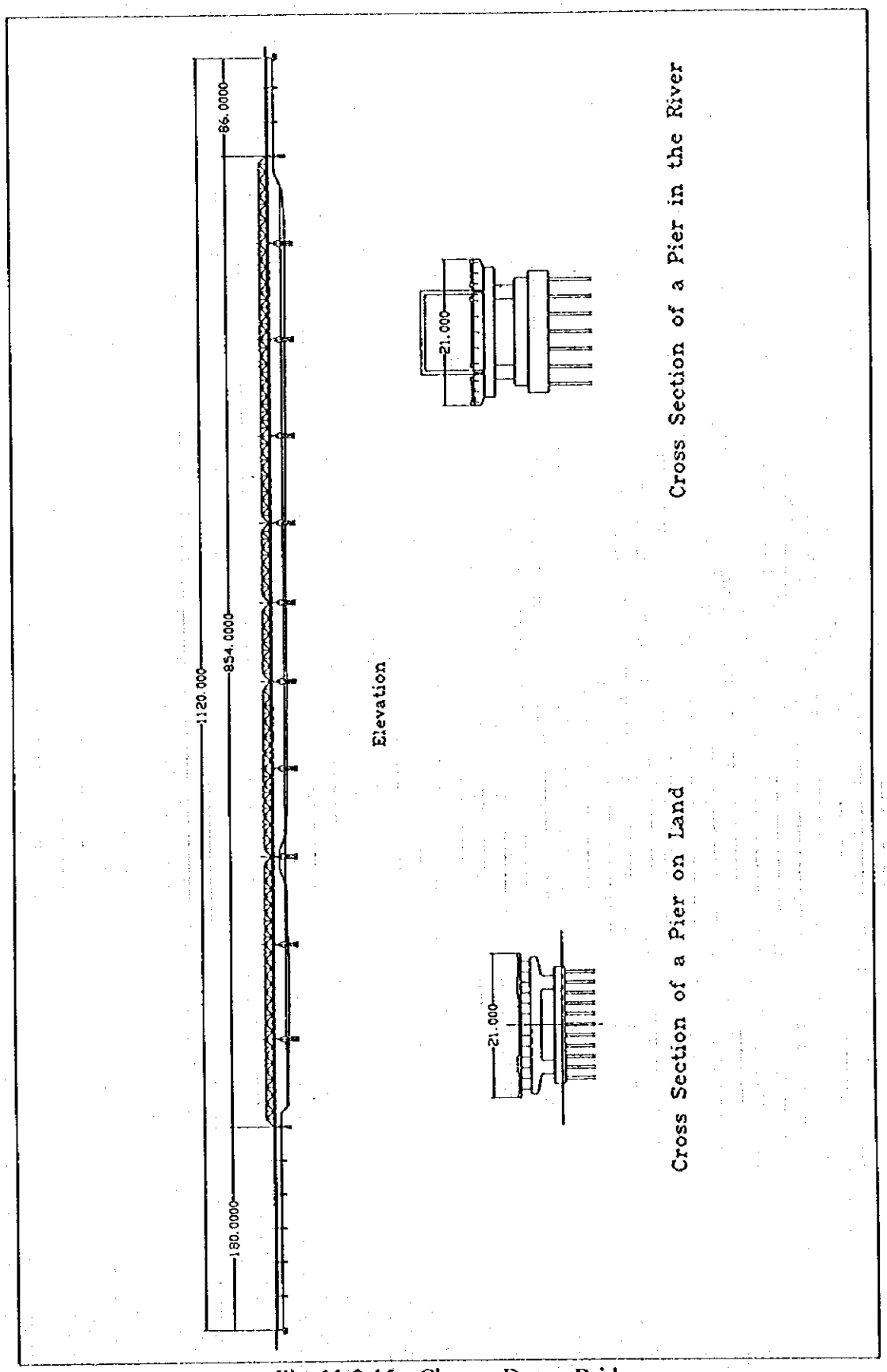


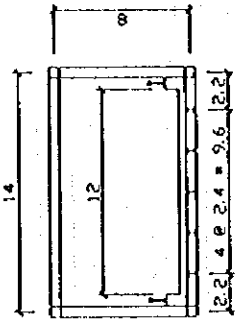
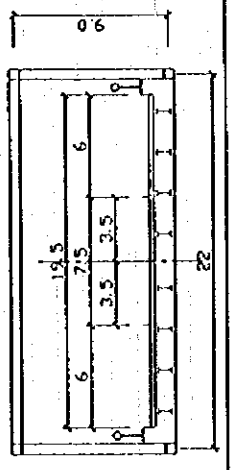
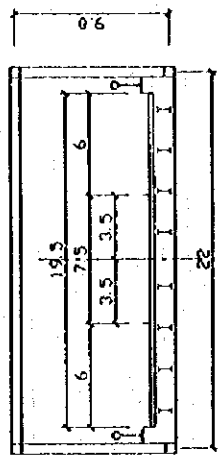
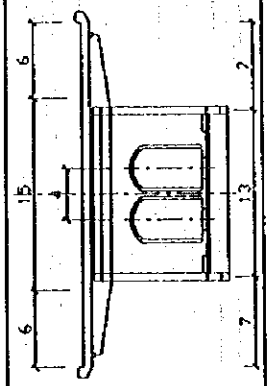
Fig. 11-2-15 Chuong Duong Bridge

As shown in Table 11-2-2 of the comparative bridge cost-comparison between the four alternatives, the cost of the first alternative is the lowest compared with the other three alternatives, however, it is close to the cost of Alternative 3 in which all types of the vehicular traffic can be handled. Considering that the usability of Alternative 1 is limited only to the 2-wheel traffic, it was recommended that Alternative 3 to be adopted in the transport plan of the city. This bridge will have a minimum length of about 1,300 meters and the estimated cost does not include any required interchanges at its ends.

The second alternative has the merit of dividing the vehicular traffic crossing the river into two separate locations to decrease the possibility of any concentrated congested situations at one location, but it has a considerably higher cost than the adopted alternative with about a 400m increase in its length.

The fourth alternative would serve the railway traffic as well as the vehicular traffic and would not only to solve the transport problem in Hanoi but would provide a crossing of the Red River for VNR. It is subject to the national railway plan and it requires a huge budget and a more comprehensive study should be carried out to investigate its viability.

Table 11-2-2 Alternatives of Chuong Duong Bridge/Long Bien Bridge

ALTERNATIVE	Long Bien Location L = 1690 m	Total Cost	Chuong Duong Location L = 1300 m	Total Cost
1		534.6 BVND		—
2		854.8 BVND		—
3		—		654.9 BVND
4		2026 BVND		—

11.2.4 Area Development Road Network [Projects Group: D to G]

The suburban areas of Hanoi outside the RR-2 are planned to partially accommodate new urbanized centers at the RR-3 corridor as an extension for the decentralization of the built-up area of the city. The road network plan would provide the required primary road network including collector, feeder and non-motorized roads as a part of the infrastructure of such development projects for their smooth implementation and promotion. The road area for each network is about 25% of the total area and the length of each type of road was calculated based on the function of each area. Providing an efficient suburban road network first for land development schemes will also support the resettlement programs of improving the urban street network in later stages.

D Hanoi North Development Area

This area is located north to the Red River and includes four urbanized centers at Dong Anh, Soc Son, Gia Lam and North Thang Long. In addition to the road network of each new city. The other main road development projects in the area are those of Dong Anh new bridge and highway.

D01 Dong Anh Bridge and Highway

The future forecast high transport demand north of the built-up area of Hanoi shows the need to construct another bridge over the Red River in the near future. There are two road bridges at present which are not enough to meet the future expected transport demand. Although the traffic volume on the existing Thang Long bridge does not show congestion at present, the limited capacity of the four lane bridge will not cope with the future traffic volume.

The planned Thanh Tri bridge (Project A0704) at RR-3 south of urban Hanoi will handle through traffic mainly on the national highway network. The proposed Dong Anh bridge has another function as it is required to connect the western areas of Hanoi with the new urbanized and industrialized centers north of city.

The bridge is planned to directly connect NH-18 and the industrialized area of Noi Bai to RR-2 and the new land development areas west of the city to integrate the committed socioeconomic development plans in the two areas outside urban Hanoi. Fig. 11-2-16 presents alternatives for the proposed bridge. Other segments of the highway, which is planned to accommodate six lanes for motorized traffic and two lanes for the non-motorized traffic, are those to connect the bridge to the north with both of RR-3 and NH-18 just south to the Noi Bai International Airport.

E New CBD Road Network

The New CBD of Hanoi is planned to be located south of the Thanh Long Bridge and west of the West Lake and to contain mainly commercial and residential areas in addition to the business activities resulting from the increasing economic potential of the city. In addition to the internal road network, most of the planned roads in the new CBD are to connect it with the existing built-up areas of the city either through east-

west arterials or circular roads. The main road projects in the area are as follows.

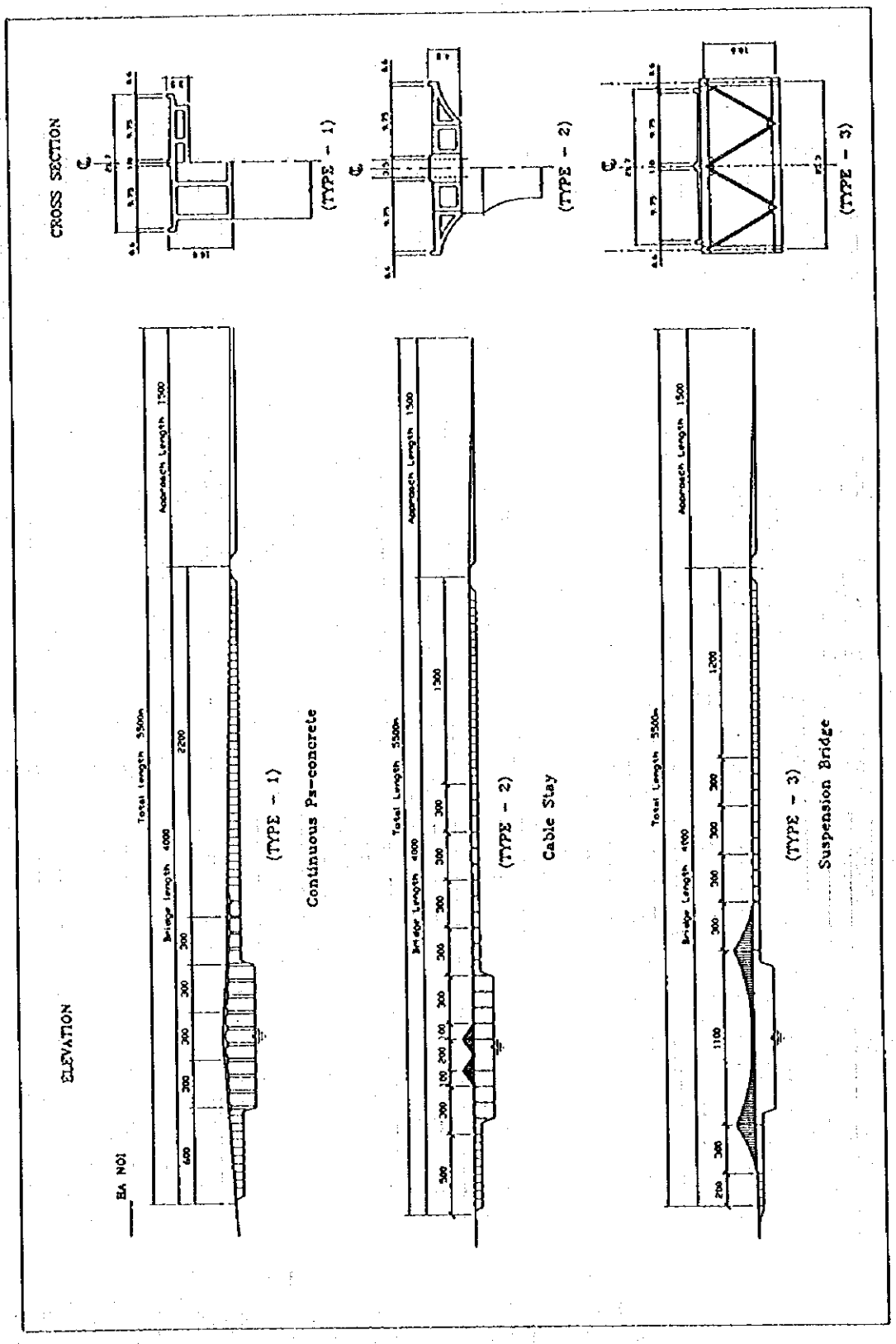


Fig. 11-2-16 Dong Anh Bridge

E01 Ring Road 2 North Extension Project

The area west of the West Lake is planned to be one of the future urbanized centers in the suburban areas of Hanoi to alleviate the centralization of the socioeconomic activities inside the city. The area has no main road network at present with a width of about 3 km in average between the West lake and RR-3. This road will provide an arterial road to the area and its locational alignment is integrated with the planning scheme and the development activities in the area. The road will handle the increasing traffic demand in the area and can be implemented in the early stages of the plan as the widening of RR-2 faces resettlement problems which will require time to be solved. The northern end of the road is connected to the planned Dong Anh Bridge over the Red River.

E02 South Thang Long Road

The purpose of this road is to provide an additional connecting road from the built-up area of Hanoi to Thang Long Road inside the center of the newly developed urbanized area. The road will promote the rapid development of the area which is expected to accommodate different socioeconomic activities. In addition, it will serve the high east - west transport demand and provide direct connection to the international airport. The road has a length of about 3.5 Km and is planned to accommodate six lanes for motorized traffic and two lanes for non-motorized traffic.

E03 New Ring Road 2

To facilitate the land development projects in the suburban areas of Hanoi City, a well-planned road network should be provided. As RR-3 is planned to function as an expressway for through traffic, a main street to handle the local traffic in the suburban areas is required to be located between the existing RR-2 and the planned RR-3. Such main street will support the roadside commercial areas and backside residential activities and development projects.

The street is planned in the new CBD to accommodate six lanes for motorized traffic, to be four lanes in other segments, and two lanes for non-motorized traffic. Additional reserved area is also required to provide other transport facilities such as parking or bus lanes. It will be extended up to the Red River south of Hanoi.

F Hanoi Urban Development Corridor

The urban development corridor of future Hanoi extends from the south Thang Long area up to NH-1A South of Hanoi. The northern part of the corridor is occupied by the new CBD and several other urbanized areas are to be located along RR-3 to absorb the expected growth of population.

The corridor has a very large area and is served by many planned primary roads either extended circular roads around the city or new radials such as the Lang Hoa Lac Expressway (the urban segment of the project A06) and Lang Ha - Ha Dong road. A total of about 200 Km of different road classes is planned to cover the needs of

development in the area.

F02 Lang Ha - Ha Dong Road

The NH-6 between Hanoi and the highly populated town of Ha Dong is at present handling the highest traffic volume when compared with other radials and national highways in Hanoi City. Provision of a parallel alternative is required to cope with the future demand in this direction.

The road will help also in supporting the land development plans in the southwestern areas of Hanoi and will improve the ribbon-development pattern of NH-6. It will also alleviate the congestion and improve the traffic conditions on the narrow extension of NH-6 [Tay Son street] in Hanoi urban area as it will handle a considerable portion of the traffic passing through this area at present.

The first segment of road to connect RR-2 with RR-3 is being designed at present for early implementation.

G Hanoi South Development Area

The area extending from NH-1A up to the Red River south of Hanoi, is characterized by large areas of lakes and ponds in which the development of urbanized centers is not an easy task. It can be utilized for different economic activities if it is provided with a well planned road network. A total of about 50 Km of roads under eight main projects are planned either on a radial or circular basis to cover the area.

11.3 Future Road Network Assessment

Road network development projects in the master plan include improvement, upgrading and rehabilitation projects as well as new construction projects. The improvement projects cover the urban and rural areas of the city, while the new construction projects are mainly in the suburban and rural areas in accordance with the concept and policy of the plan to minimize the resettlement problem as a result of constructing and widening urban streets.

Road improvement projects in the urban area can be assessed in terms of the street area rate and street density rate in which the population is also taken into consideration. Fig. 11-3-1 shows considerable improvement in the street area rate of three out of the four districts of urban Hanoi. The fourth district of Hoan Kiem originally had a high rate of about 23%. Dong Da district will triple its street area but will still have the lowest rate of 10% compared with about 3% at present.

The other three districts will exceed the limit of 10%. The total street area rate of urban Hanoi will be about 13%. Taking the district population into consideration, the district of Dong Da is the only district showing a value lower than 1.0. The street density, in total, will reach the level of about 1.3. Major construction and improvement projects in the built-up area are planned to be implemented after preparing land development schemes in the suburban areas to accommodate resettlement.

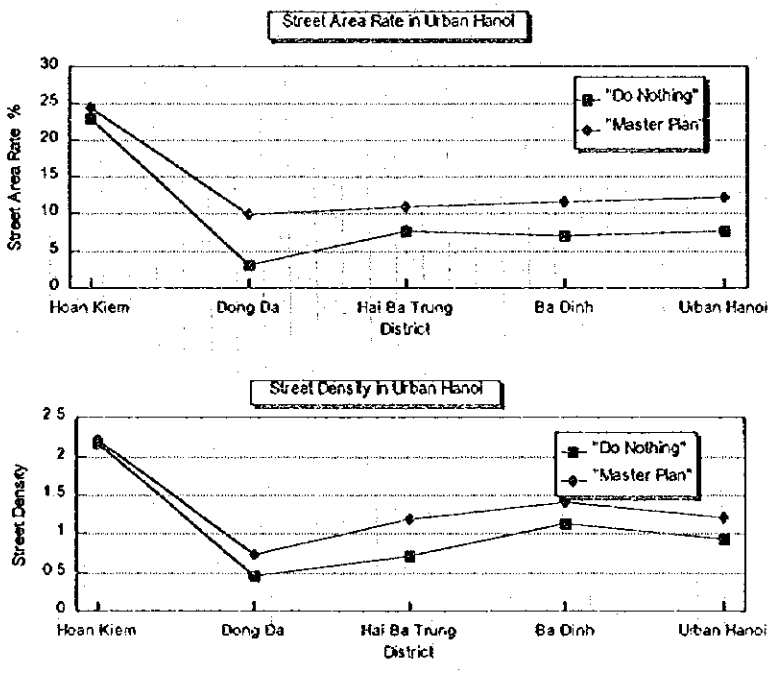


Fig. 11-3-1 Urban Street Area Rate and Density

Roads in suburban and rural areas of Hanoi show a considerable increase in road length in all of the five rural districts. Soc Son in the north has the lowest increase of about 30% of the existing road length as shown in Fig. 11-3-2.

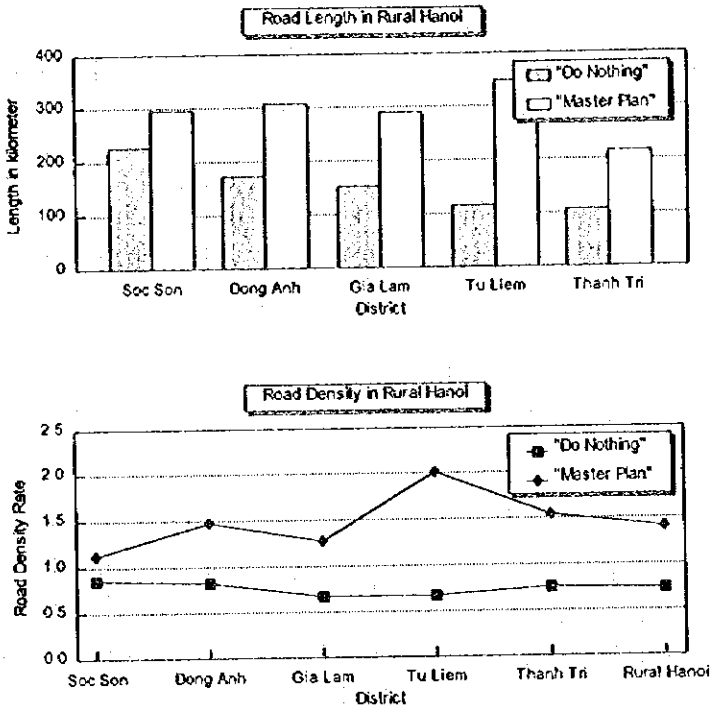


Fig. 11-3-2 Rural Road Length and Density

Tu Liem district, west of urban Hanoi, where most of the new land development projects are located, will triple its area with the highest increase compared with the other districts. The other three districts of Thanh Tri, Dong Anh and Gia Lam will almost double their road length.

The road density rate, which is usually lower in rural areas than in urban areas, will improve significantly for the district of Tu Liem (from 0.66 to 2.01), due to several urea development projects, and is followed be Thanh Tri (from 0.76 to 1.54) and Dong Anh (from 0.82 to 1.48).

The other two districts of Gia Lam and Soc Son will have the rates of 1.27 and 1.11 respectively compared with 0.67 and 0.86 at present. In total, the average rate for the five Hanoi rural districts will increase from 0.74 to a high value of 1.4.

11.4 Cost Estimation

To economically evaluate the viability of the road projects and in to establish a financially based implementation schedule, both economic and financial costs were estimated based on data collected and applied in the country for similar projects. Considering the type of each sub-project, the cost estimation procedure utilizes the material, labour and unit work item cost to establish the construction direct cost, which is added to the land acquisition and compensation as well as the engineering design and supervision cost, to produce the financial cost of each sub-project. Next, the economic cost used for the economic evaluation is determined by deducting different unaccounted costs from the financial cost.

11.4.1 Project Type

The total length of urban streets, national highways and rural district roads in Hanoi city at present is about 960 Km. The road network development projects in the plan of the urban transport system in Hanoi city covers a total of about 1,230 Km of which about 490 Km are under improvement, upgrading and rehabilitation works and 740 Km for new construction schemes. The total number of the road and related structure projects in the plan is 53 projects which can be administratively classified in the following three groups:

A:	National Highway	9 Projects
B:	Rural Hanoi	6 Projects
C-G:	Urban and Suburban Hanoi	38 Projects

These projects are composed of 27 segments or sub-projects for the national highways, 86 sub-projects for roads in rural areas and 104 sub-projects for urban and suburban roads. Structure projects include the construction of three long-span bridges over the Red River and two bridges over the Duong River, as well as small bridges on new roads, and the rehabilitation of 11 bridges in urban and rural areas. In addition, four interchanges are required in the existing built-up area of the city together with grade-separation schemes for expressways in suburban areas. The road projects also include the development of the road networks in eight newly planned urbanized centers located in the suburban and rural areas of Hanoi.

The appendices of this report present the description and profile, including the work items, for each of the road projects. The basis of calculating the project cost for road and bridge improvement and construction projects depends on the type of works involved in each of the projects which varies from one project to another. The project types, are classified as presented in Table 11-4-1, while Fig. 11-4-1 shows the typical cross section for each project type.

Table 11-4-2 gives the types of structure projects used for roads and Fig. 11-4-2 shows the typical cross sections of these structures. Types, components and work items of other projects are presented in their respective project profiles.

Table 11-4-1 Type of Road Projects

Seq. No.	Code	Cross Section	Remarks
Widening			
1	WO2	5m	2x2.5+2x1.0
2	WO4	1.5+11.0+1.5	2x2.0+2L
3	WO6	1.5+12.0+1.5	2x3.0+2L
4	WO8		2x4.0+2L
5	W60		60m
New Construction			
1	NC2L	2+1L	Red River Dike to NH6
2	NC4	4+2L	
3	NC6	6+2L	
4	NC4L	4+2L	West Lake Side
5	NC4S	2.0+1L+10.0m+1L+2.0	RR-2 to North Ext.

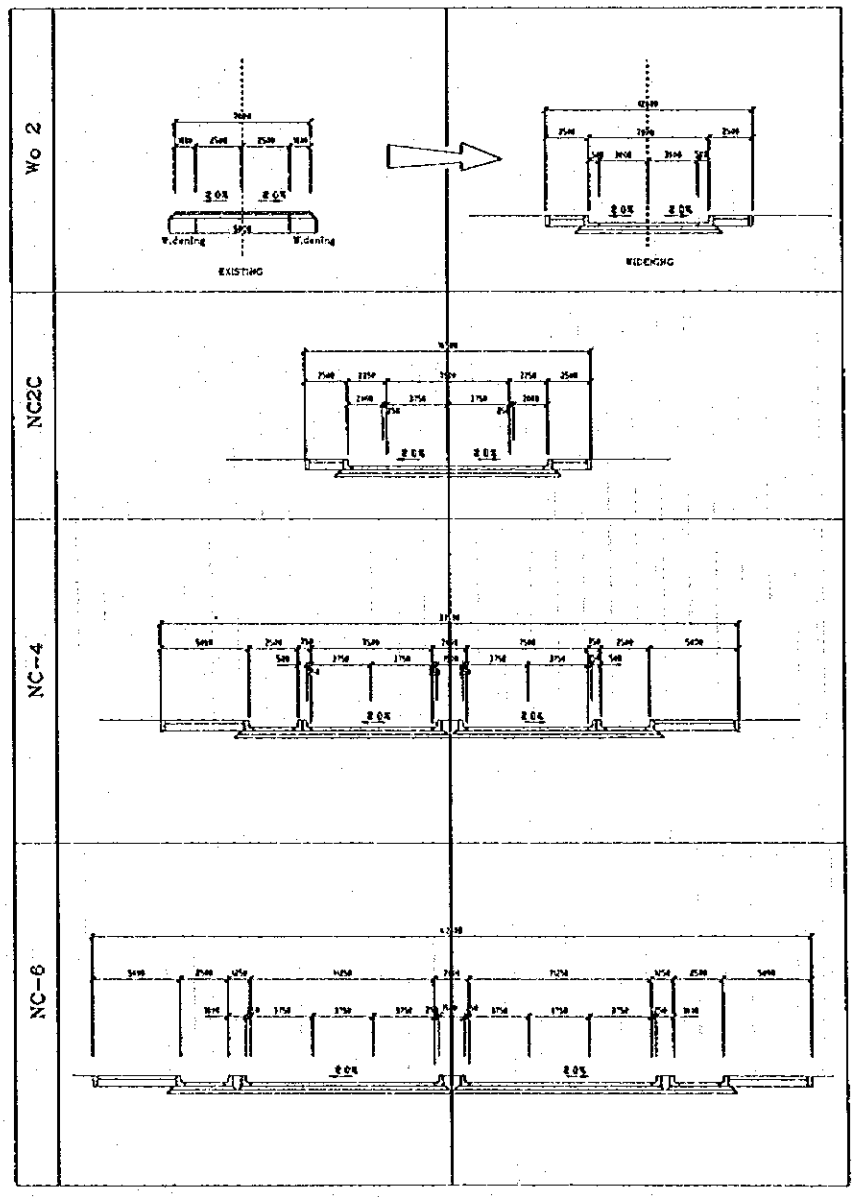


Fig. 11-4-1 Typical Road Cross Sections

Table 11-4-2 Type of Structure Projects

Seq. No.	Code	Cross Section	remarks
Interchange			
1	FLO2	2L	Includes bridge
2	FLO2S	2L	Flyover only
3	UNP2	2L	Underpass
Bridge Widening			
1	WOB4	2.0+2L	Existing 2 lane
2	WOB6	2x2.0+2L	Existing 2 lane
3	WOB8	2x3.0+2L	Existing 2 lane
Bridge Construction			
1	NCB2	5.0m+2.0m	Rural Road
2	NCB4	2x2.0+2L	Rural Road
3	NCB6	2x3.0+2L	Rural Road
4	NCB8	2x4.0+2L	Rural Road
Tunnel			
1	TC2	5.0m+2.0m	Station tunnel

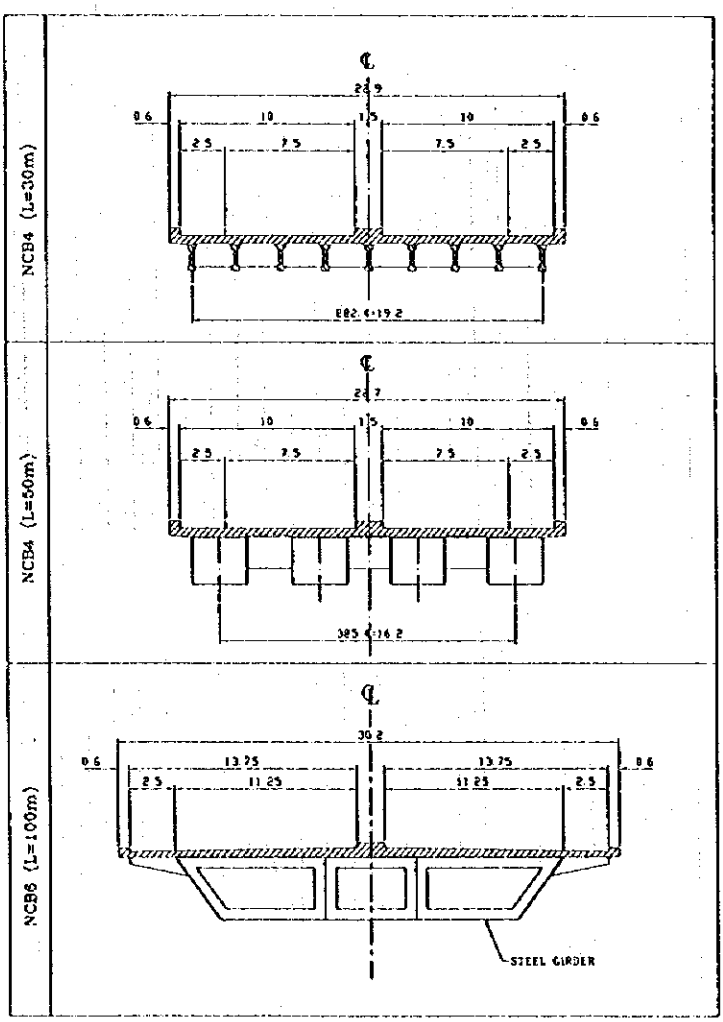


Fig. 11-4-2 Typical Structure Cross Sections

11.5.2 Basic Cost Elements

To estimate the construction cost of the different projects included in the Masterplan, the work items of each project type were defined for each project and sub-project, and a survey was done to collect the basic cost elements of the work items.

In order to simplify works for the cost estimation procedure, unit work per kilometer, or per each construction unit, of roads and bridges and other different construction projects were estimated based on the design standards applied in Vietnam and the typical cross sections shown in Section 11.4.1.

The construction works involve the use of labour, material and machinery for which the basic unit costs were obtained from the available different resources. The following data sources were utilized:

- Machinery Operating Cost, MOC, January 1994.
- Construction Unit Cost, 1736/QDUB, HPC, 1994.
- Announcement on Adjustment of Construction Unit Cost, HPC, May 30, 1995.
- Announcement on Readjustment of Construction Unit Cost, HPC, November 27, 1995.
- Law of Labour, Salary and Social Insurance, Part 1 & 2, HCMC Publisher, 1994.

In addition, the costs applied in similar construction projects carried out through international bidding under similar circumstances were used as reference and for calibration purposes.

(1) Labour Cost

Estimation of the labour cost is estimated based on the average hourly and annual wage as well as the different allowances and dividing the total by the actual number of net working days.

The net working days in Vietnam is calculated based on the number of the national holidays, Sundays and rainy days in which the field work can not continue based on the average rainfall data of the last ten years in Hanoi. Table 11.5.3 shows that the monthly average net working days is 19.4 day/month.

Table 11-4-3 Net Working Days

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Calendar	31	28	31	30	31	30	31	31	30	31	30	31	365
Sunday	5	4	4	5	4	4	5	4	4	5	4	5	53
N. Holiday	2	4	0	1	2	0	0	0	1	0	0	0	10
Rain Day	1	2	2	3	8	9	11	12	10	4	2	2	66
Work Day	23	18	25	21	17	17	15	15	15	22	24	24	236

Table 11-4-4 gives the local labor rate for international joint venture construction projects based on the minimum monthly salary of US$ 50 and Table 11-4-5 shows rates deducted from labor cost to calculate the economic labor cost.

Table 11-4-4 Local Labor Rate

Qualification	Min. Salary Coefficient	Basic Salary	Allowance & Benefits		Monthly Salary
			Mobilization	Others	
Engineer	4.66	2,563,000	220,000	1,217,425	4,000,425
Foreman	4.60	2,530,000	220,000	1,201,750	3,951,750
Skilled Labor	3.73	2,051,500	220,000	974,463	3,245,963
Driver	2.98	1,639,000	220,000	778,525	2,637,525
Equip. Operator	2.33	1,281,500	220,000	978,713	2,110,213
Semi-skilled Lab.	1.04	1,122,000	220,000	532,950	1,874,950
Unskilled Lab.	1.78	979,000	220,000	465,025	1,664,025

Notes:

1. The Monthly wage is based on 19 days/month and 8 hr/day
2. The Minimum Salary Coefficient is based on Decree No 26/CP dated on May 23rd, 1993 by the Government for the minimum salary of 50 USD
3. The Mobilization Allowance is 40% of Minimum Salary, based on Circular letter No. 03/KT-BXD dated on March 30th, 1994, by the MOC (Ministry of Construction)
4. Other Allowance Salary is 47.5% of Basic Salary and includes:
   * 15% affixed Allowance (Subsidy for Production Instability)
   * 12.5% Bonus
   * 4% Contract Expenses to the worker
   * 5% Social Insurance
   * 2% Trade-Union Fee
   * 2% Health Insurance
   * 7% Classification Upgrade Fee

Table 11-4-5 Labour Cost Deducted Rates

Qualification	Monthly Salary (VND)	Total Tax (VND)	% of Tax
Engineer	4,000,425	580,170	14.50
Foreman	3,961,750	568,525	14.35
Skilled Labour	3,245,963	353,789	10.90
Driver	2,637,525	207,505	7.87
Equip. Operator	2,110,213	102,043	4.84
Semi-skilled Labour	1,874,950	67,495	3.60
Unskilled Labor	1,664,025	46,403	2.79

(2) Equipment Cost

The hourly cost of machinery and equipment to be used in the construction woks of the projects is estimated based on the expenses of initial price, depreciation, parts consumption, maintenance and operation of other similar projects being carried out in Vietnam. Deductions from the equipment financial cost are 25% of fuel cost and 7% of lubricant cost as presented in Table 11-4-6 while the financial cost is stated in Table 11-4-7 including the foreign and local portions.

Table 11-4-6 Fuel Tax

Item	Unit	Foreign [USD]	Local Portion [VND]		Total [VND]
			Financial	Economic	
Diesel Oil	lt	0.119	1,691	941	3,000
Electricity	kwh	0.000	1,000	800	1,000
Lubricant	lt	0.714	12,146	10,746	20,000

Table 11-4-7 Equipment Cost

DESCRIPTION	BASE COST (USD)	OP LF	RES. (%)	ANUAL OP HR	DEPRECIATION USD/H	INTEREST USD/H	TYRES COST USD/SET	TYRES LIFE HOUR	TYRE COST USD/H	FUEL/POWER HP	RATE l/HP/H	USD/H	F. COST VDN/H	E. COST VDN/H	LUBRICANT USD/H	F. COST VDN/H	E. COST VDN/H	HOURLY OP. COST FOREIGN (US$)	LOCAL FINANCIAL (VDN)	LOCAL ECONOMIC (VDN)	TOTAL FINANCIAL (VDN)	LP (%)
Backhoe/Loader 1m3	96,000	6	10	2,000	7.20	2.38	2,000	2,000	1.00	85	0.1	1.01	14,374	7,999	0.18	3,097	2,740	16.09	33,283	23,388	210,263	15.8
Backhoe/Loader 0.7m3	77,000	6	10	2,000	5.78	1.91	2,000	2,000	1.00	70	0.1	0.83	11,837	6,587	0.15	2,551	2,257	13.13	27,070	18,990	171,482	15.8
Asphalt Plant 50t	645,000	6	10	2,000	48.38	16.01	0		0.00	270	500	0.00	500,000	400,000	2.50	42,511	37,611	100.69	866,455	536,767	1,774,032	37.6
Concrete Plant 25m3	254,000	6	10	2,000	19.05	6.31	0		0.00	60	60	0.00	60,000	48,000	0.08	1,336	1,182	36.84	103,172	82,651	508,455	20.3
Power Broom	25,000	6	10	2,000	1.88	0.62	1,200	2,000	0.60	65	0.08	0.62	8,793	4,893	0.14	2,368	2,095	4.98	15,279	10,283	70,023	21.8
Bulldozer 300HP	287,000	6	10	2,000	21.53	7.12	0		0.00	300	0.14	5.00	71,022	39,522	0.64	10,931	9,671	50.41	189,643	119,345	724,105	23.4
Bulldozer 200HP	229,000	6	10	2,000	17.18	5.68	0		0.00	200	0.14	3.33	47,348	26,348	0.43	7,288	6,448	39.48	184,084	136,354	618,351	29.8
Bulldozer 140HP	125,000	6	10	2,000	9.38	3.10	0		0.00	140	0.14	2.33	33,144	18,444	0.30	5,101	4,513	22.13	92,581	66,426	336,002	27.6
Bulldozer 78HP	90,000	6	10	2,000	6.75	2.23	0		0.00	78	0.14	1.30	18,466	10,276	0.17	2,842	2,515	15.50	68,438	50,494	238,986	28.6
Tow Compactor	40,000	6	10	2,000	3.00	0.99	0		0.00	35	0.09	0.37	5,027	2,964	0.07	1,275	1,128	6.39	12,739	9,802	84,022	16.4
Steel Roller 8-12t	47,000	6	10	2,000	3.53	1.17	0		0.00	80	0.09	0.86	12,173	6,773	0.17	2,915	2,579	7.83	22,832	15,547	108,975	21.0
Steel Roller 30HP	28,000	6	10	2,000	2.10	0.70	0		0.00	30	0.07	0.25	3,551	1,976	0.06	1,093	967	4.37	9,256	6,633	57,293	16.2
Tire Roller 10-15t	84,000	6	10	2,000	6.30	2.09	0		0.00	90	0.09	0.96	13,697	7,622	0.19	3,279	2,901	13.32	30,812	21,592	177,280	17.4
Vibrating Roller 10t	113,000	6	10	2,000	8.48	2.81	1,300	1,500	0.87	140	0.13	2.17	30,776	17,126	0.30	5,101	4,513	20.53	57,592	39,011	283,472	20.3
Crawler Crane 45t	613,000	6	10	2,000	45.98	15.22	0		0.00	230	0.12	3.28	46,672	25,972	0.49	8,381	7,415	92.51	156,020	114,160	1,173,585	13.3
Truck Crane 100t	775,000	6	10	2,000	58.13	19.24	2,700	2,000	1.35	280	0.12	4.00	56,818	31,618	0.60	10,203	9,027	118.13	194,671	142,765	1,494,054	13.0
Truck Crane 25t	248,000	6	10	2,000	18.60	6.16	2,200	2,000	1.10	150	0.12	2.14	30,438	16,938	0.32	5,466	4,836	39.46	76,752	54,452	510,813	15.0
Truck Crane 10t	190,000	6	10	2,000	14.25	4.72	2,200	2,000	1.10	95	0.12	1.36	19,277	10,727	0.20	3,462	3,063	30.16	54,034	38,826	385,813	14.0
Excavator 0.8m3	92,000	6	10	2,000	6.90	2.28	0		0.00	130	0.12	1.86	26,380	14,680	0.28	4,737	4,191	15.86	47,533	32,003	221,287	21.5
Excavator 0.5m3	65,000	6	10	2,000	4.88	1.61	0		0.00	90	0.12	1.29	18,263	10,163	0.19	3,279	2,901	11.13	33,141	22,343	155,568	21.3
Motor Grader 12ft	113,000	6	10	2,000	8.48	2.81	2,100	2,000	1.05	130	0.09	1.39	19,785	11,010	0.28	4,737	4,191	19.08	75,534	56,010	285,381	26.5
Motor Grader 10ft	92,000	6	10	2,000	6.90	2.28	2,000	2,000	1.00	110	0.09	1.18	16,749	9,316	0.24	4,008	3,546	15.73	63,902	24,985	236,936	27.0
Crawler Loader 1.8m3	109,000	6	10	2,000	8.18	2.71	0		0.00	135	0.12	1.93	27,394	15,244	0.29	4,919	4,352	17.99	50,267	33,959	248,203	20.3
Wheel Loader 1.7m3	80,000	6	10	2,000	6.00	1.99	1,400	2,000	0.70	120	0.12	1.71	24,350	13,550	0.26	4,373	3,869	14.25	41,900	27,960	198,653	21.1
Concrete Mixer 6m3	122,000	6	10	2,000	9.15	3.03	2,000	2,000	1.00	270	0.08	2.57	36,526	20,326	0.58	9,838	8,704	22.26	68,133	46,445	313,641	21.8
Asphalt Finisher 3.7m	120,000	6	10	2,000	9.00	2.98	0		0.00	60	0.13	0.93	13,190	7,340	0.13	2,186	1,934	18.43	35,141	23,086	227,829	14.8
Diesel Hammer 2.5t	295,000	6	10	2,000	22.13	7.32	0		0.00	120	0.12	1.71	24,350	13,550	0.26	4,373	3,869	44.67	77,312	56,291	568,688	13.6
Concrete Pump Car	136,000	6	10	2,000	10.20	3.38	2,000	2,000	1.00	270	0.06	1.93	27,394	15,244	0.58	9,838	8,704	23.70	61,500	43,362	322,206	19.1
Dump Truck 4m3	107,000	6	10	2,000	8.03	2.66	1,900	2,000	0.95	270	0.09	2.89	41,091	22,866	0.58	9,838	8,704	19.91	68,534	45,670	287,539	23.8
Dump Truck 7m3	72,000	6	10	2,000	5.40	1.79	1,200	2,000	0.60	220	0.09	2.36	33,482	18,632	0.47	8,016	7,092	13.85	53,357	35,211	205,697	25.9
Truck 15t	100,000	6	10	2,000	7.50	2.48	2,000	2,000	1.00	360	0.09	3.75	53,267	29,642	0.75	12,763	11,283	19.97	82,491	54,102	302,191	27.3
Truck 12t	90,000	6	10	2,000	6.75	2.23	2,000	2,000	1.00	290	0.09	3.11	44,135	24,560	0.62	10,567	9,349	17.75	69,526	45,768	264,822	26.3
Truck 7t	59,000	6	10	2,000	4.43	1.46	1,100	2,000	0.55	185	0.09	1.98	28,155	15,668	0.40	6,741	5,964	11.47	44,614	29,406	170,758	26.1
Asphalt Distributor	68,000	6	10	2,000	5.10	1.69	1,200	2,000	0.60	170	0.09	1.82	25,872	14,397	0.36	6,194	5,480	12.63	43,267	28,838	182,170	23.8
Water Tank 8m3	90,000	6	10	2,000	6.75	2.23	1,200	2,000	0.60	190	0.09	2.03	28,916	16,091	0.41	6,923	6,125	16.07	50,663	34,075	227,422	22.3
Earth Oager 0.45	60,000	6	10	2,000	4.50	1.49	1,400	2,000	0.70	120	0.12	1.71	24,350	13,550	0.26	4,373	3,869	11.36	38,606	25,323	163,515	23.6
Launching Device																		36.26	132,941	119,647	531,763	25.0
Pontoon																		0.00	157,000	141,300	157,000	100.0
Tow Boat																		0.00	201,000	180,900	201,000	100.0
Soil Compactor 7.5HP																		0.00	45,100	40,590	45,100	100.0
Compressor 600cfm																		0.00	151,000	135,900	151,000	100.0
Cutter/Bender																		0.00	14,700	13,230	14,700	100.0
Generator 100KW																		0.00	42,000	37,800	42,000	100.0
Hydraulic Jack 100t																		0.00	25,000	22,500	25,000	100.0
Hydraulic Jack 500t																		0.00	35,700	32,130	35,700	100.0
Morter Mixer																		0.00	35,700	32,130	35,700	100.0
Grout Pump																		0.00	77,700	69,930	77,700	100.0
Water Pump 150m3/h																		0.00	22,000	19,800	22,000	100.0
Water Pump 60m3/h																		0.00	9,400	8,460	9,400	100.0
Water Tank(Towed)																		0.00	9,500	8,550	9,500	100.0
Concrete Vibrator																		0.00	19,900	17,910	19,900	100.0
Concrete Breaker																		0.00	250,000	225,000	250,000	100.0
Breaker (Heavy)																		0.00	30,000	27,000	30,000	100.0
Breaker (Light)																		0.00	27,500	24,750	27,500	100.0
Pneumatic Breaker																		0.00	72,000	64,800	72,000	100.0
Wagon																		0.00	100,000	90,000	100,000	100.0
Welding Machine 100KW																		0.00	30,000	27,000	30,000	100.0
Concrete Mixer 0.3m3																		0.00	50,000	45,000	50,000	100.0
Concrete Saw																		0.00	50,000	45,000	50,000	100.0
Van																		0.00	16,545	14,891	16,545	100.0
Sparying Equipment																		0.00	4,000	3,600	4,000	100.0

(3) Material Cost

The market prices of purchase materials used in the project construction are summarized for the main materials as presented in Table 11-4-8. To calculate the economic cost of materials, 5% of sales tax was deducted from local materials. The imported materials was estimated by CIF without import Tax, as for present international tenders.

Table 11-4-8 Summary of Material Cost (1)

DESCRIPTION	PER UNIT		SALES TAX (%)	PRICE PER UNIT			PROVISION OF FOREIGN PORTION (%)
				FOREIGN	LOCAL COST		
				(US$)	FINANCIAL (VND)	ECONOMIC (VND)	
Additive	1.00	Kg	5.0	1.09	0	0	100.0
Aggregate(A)	1.00	CUM	5.0	0.00	100,000	95,000	0.0
Aggregate(B)	1.00	CUM	5.0	0.00	60,000	57,000	0.0
Angle Steel	1.00	Kg	5.0	0.52	0	0	100.0
Asphalt	1.00	Kg	5.0	0.22	0	0	100.0
Bamboo Pile	1.00	Lm	5.0	0.00	2,000	1,900	0.0
Bearing Pad	1.00	Each	5.0	275.00	0	0	100.0
Boulder	1.00	CUM	5.0	0.00	70,000	66,500	0.0
Calcium Carbide	1.00	Kg	5.0	0.59	0	0	100.0
Cement	1.00	Kg	5.0	0.03	770	732	30.0
Clay	1.00	Kg	5.0	0.00	20,000	19,000	0.0
Coarse Aggregate	1.00	CUM	5.0	0.00	100,000	95,000	0.0
Coarse Sand Mix	1.00	CUM	5.0	2.18	36,000	34,200	40.0
Concrete Post	1.00	Each	5.0	7.27	120,000	114,000	40.0
Control Box	1.00	Pcs	5.0	200.00	0	0	100.0
Crashed Aggregate	1.00	CUM	5.0	0.00	120,000	114,000	0.0
CV Cable 14A	1.00	LM	5.0	1.73	0	0	100.0
Earth Royalty	1.00	CUM	5.0	0.00	1,200	1,140	0.0
Expansion Joint	1.00	LM	5.0	105.30	0	0	100.0
Filler	1.00	Kg	5.0	0.00	300	285	0.0
Fine Aggregate	1.00	CUM	5.0	0.00	90,000	85,500	0.0
Form Lumber	1.00	CUM	5.0	0.00	1,300,000	1,235,000	0.0
Gauge Pile	1.00	Lm	5.0	16.58	273,600	259,920	40.0
Glass Bead	1.00	Kg	5.0	1.82	0	0	100.0
Guard Rail	1.00	Lm	5.0	77.27	0	0	100.0
Lamp HH-400	1.00	Pcs	5.0	30.91	0	0	100.0
Luminaire HWY	1.00	Pcs	5.0	154.00	0	0	100.0
Marking Paint	1.00	Kg	5.0	5.45	0	0	100.0
Nail and Hardware	1.00	Kg	5.0	0.00	8,000	7,600	0.0
Oxygen	1.00	Bottle	5.0	2.73	0	0	100.0
Paint Red	1.00	Sqm	5.0	1.82	0	0	100.0
Paint White	1.00	Sqm	5.0	2.27	0	0	100.0
PC PILE 40x40	1.00	Lm	5.0	1.93	31,860	30,267	40.0
PC T-Beam 24mI	1.00	Each	5.0	4032.87	66,542,400	63,215,280	40.0
PC T-Beam 24mE	1.00	Each	5.0	4077.35	67,276,200	63,912,390	40.0
PC T-Beam A	1.00	Each	5.0	1880.25	31,024,200	29,472,990	40.0
PC T-Beam B	1.00	Each	5.0	1106.80	18,262,200	17,349,090	40.0
PC T-Beam C(9m)	1.00	Each	5.0	848.29	13,996,800	13,296,960	40.0
PC T-Beam D(35m)	1.00	Each	5.0	5389.93	88,933,800	84,487,110	40.0
PC T-Beam E(35m)	1.00	Each	5.0	5250.69	86,636,400	82,304,580	40.0
Pinned Bamboo	1.00	Each	5.0	0.00	8,000	7,600	0.0
Plate Steel	1.00	Kg	5.0	0.55	0	0	100.0
PVC D200	1.00	Lm	5.0	7.73	0	0	100.0

Table 11-4-8 Summary of Material Cost (2)

DESCRIPTION	PER UNIT		SALES TAX (%)	PRICE PER UNIT			PROVISION OF FOREIGN PORTION (%)
				FOREIGN	LOCAL COST		
				(US$)	FINANCIAL (VND)	ECONOMIC (VND)	
Rail	1.00	Kg	5.0	0.00	27,000	25,650	0.0
RCPC D0.5m	1.00	Lm	5.0	9.02	148,800	141,360	40.0
RCPC D0.75m	1.00	Lm	5.0	17.60	290,400	275,880	40.0
RCPC D1.0m	1.00	Lm	5.0	27.60	455,400	432,630	40.0
RCPC D1.2m	1.00	Lm	5.0	39.24	647,400	615,030	40.0
RCPC D1.5m	1.00	Lm	5.0	63.09	1,041,000	988,950	40.0
RCPC D2.0m	1.00	Lm	5.0	123.64	2,040,000	1,938,000	40.0
Reflectonizing Stud	1.00	Each	5.0	13.64	0	0	100.0
Reinforcing Bar G40	1.00	Kg	5.0	0.51	0	0	100.0
Reinforcing Bar G60	1.00	Kg	5.0	0.49	0	0	100.0
Round Steel	1.00	Kg	5.0	0.68	0	0	100.0
Sand	1.00	CUM	5.0	0.00	90,000	85,500	0.0
Scaffold	1.00	Ton	5.0	1087.42	0	0	100.0
Sheet Pile	1.00	Lm	5.0	16.15	0	0	100.0
Sod	1.00	SQM	5.0	0.00	4,500	4,275	0.0
Soda	1.00	Kg	5.0	0.00	10,000	9,500	0.0
Stabilizer	1.00	Pcs	5.0	61.82	0	0	100.0
Steel Pipe D125	1.00	Kg	5.0	0.64	0	0	100.0
Steel Pipe D140	1.00	Kg	5.0	0.73	0	0	100.0
Steel Pipe D600	1.00	Kg	5.0	0.64	0	0	100.0
Steel Pole	1.00	Each	5.0	47.27	0	0	100.0
Steel Tube	1.00	Kg	5.0	1.09	0	0	100.0
Thermoplastic Paint	1.00	Kg	5.0	2.73	0	0	100.0
Tie Wire/Spacer	1.00	Kg	5.0	0.73	0	0	100.0
Timber	1.00	CUM	5.0	0.00	7,500	7,125	0.0
Timber 1/24	1.00	CUM	5.0	0.00	2,000,000	1,900,000	0.0
Traffic Sign A	1.00	Each	5.0	40.91	0	0	100.0
Traffic Sign B	1.00	Each	5.0	105.45	0	0	100.0
Traffic Sign C	1.00	Each	5.0	18.18	0	0	100.0
Traffic Sign D	1.00	Each	5.0	109.09	0	0	100.0
Traffic Sign D900	1.00	Each	5.0	52.73	0	0	100.0
Traffic Sign E	1.00	Each	5.0	54.55	0	0	100.0
Traffic Sign Triangle	1.00	Each	5.0	29.09	0	0	100.0
Tree H1.2m	1.00	Each	5.0	0.00	50,000	47,500	0.0
Water	1.00	CUM	5.0	0.00	1,500	1,425	0.0
Waterproofing	1.00	SQM	5.0	0.68	0	0	100.0
Welding Rod	1.00	Kg	5.0	0.68	0	0	100.0

(4) Direct Cost by Work Item

The costs for major work items were calculated from the standard productivity for each item and the labor, equipment and material costs. The following Table 11-4-9 shows the summary of estimated costs of major work items by foreign and local currency portions, and by financial and economic costs.

Table 11-4-9 Direct Cost by Work Item (1)

Description	Unit	Financial Cost		Economic Cost	Total Financial	Total Economic	For-eign
		Foreign USD	Local VND	Local VND	VND	VND	(%)
Agg. Base Course	CUM	0.80	123,605	116,695	132,353	125,444	6.6
Agg. Subbase	CUM	0.80	75,538	71,042	84,286	79,790	10.4
Asphalt Mixing	Ton	2.61	20,862	16,785	49,559	45,482	57.9
Asphalt Paving	Ton	1.37	6,240	4,723	21,301	19,784	70.7
Asphalt Surface	TON	16.45	140,410	126,108	321,346	307,044	56.3
Auxiliary Sign	Each	63.43	57,877	43,612	755,552	741,287	92.3
Binder	CUM	37.38	316,578	284,199	727,795	695,417	56.5
Boundary Block	LM	1.87	26,319	23,289	46,844	43,814	43.8
Bridge 24.6m	SQM	1,024.48	8,214,367	7,331,293	19,483,600	18,600,526	57.8
Bridge Excavation	CUM	3.63	36,551	29,702	76,428	69,579	52.2
Catch Basin	Each	85.97	1,141,471	1,007,976	2,087,173	1,953,679	45.3
Catch Basin A	Each	27.08	737,959	688,386	1,035,845	986,272	28.8
Clearing & Grubbing	SQM	0.11	533	382	1,744	1,594	69.5
Concrete A	CUM	15.39	460,406	435,455	629,651	604,700	26.9
Concrete B	CUM	13.98	424,140	401,020	577,875	554,755	26.6
Cover for C.Basin	Each	22.28	105,402	91,566	350,501	336,666	69.9
Curb & Gutter	LM	6.76	123,031	111,916	197,390	186,275	37.7
Day Works	Km	3,444.85	15,682,098	11,977,487	53,575,460	49,870,849	70.7
Drainage P1200	LM	55.21	819,253	753,222	1,426,555	1,360,524	42.6
Embankment	CUM	5.45	34,654	26,093	94,637	86,077	63.4
Equip. Backfill	CUM	0.29	24,928	21,083	28,063	24,218	11.2
Erection Scaffold	Ton	728.10	1,369,470	1,160,522	9,378,620	9,169,671	85.4
Guard Rail	LM	78.71	30,653	27,839	896,467	893,652	96.6
Information sign	Each	125.24	185,471	164,460	1,563,056	1,542,045	88.1
Kilometer Post	Each	9.28	332,064	308,163	434,195	410,295	23.5
Lean Concrete	CUM	11.25	363,106	342,951	486,811	466,656	25.4
Lighting	Set	817.02	702,259	543,576	9,689,529	9,530,845	92.8
Marker Posts	Each	7.03	52,441	46,631	129,795	123,985	59.6
Median	SQM	0.99	29,232	23,684	40,137	34,589	27.2
Overhead Sign Frame	Each	5,958.29	20,438,673	16,928,181	85,979,811	82,469,319	76.2
PC Slab 6m	Each	47.15	236,931	209,936	755,526	728,531	68.6
Pavement Marking	Sqm	3.44	11,866	10,604	49,703	48,442	76.1
Pile Drive 40x40	LM	21.65	88,023	73,708	326,210	311,895	73.0
Pile Splice 40x40	Each	27.02	139,834	125,316	437,056	422,539	68.0
Piling 12m	Each	310.02	1,574,644	1,373,021	4,984,862	4,783,239	68.4
Planting	Each	0.04	57,595	53,970	57,985	54,361	0.7
Primet Coat	Ton	239.64	1,116,876	944,871	3,752,916	3,580,911	70.2
RDWY Excav	CUM	1.43	6,876	4,915	22,647	20,687	69.6
Reflect Pave. Stud	Each	17.19	28,132	21,887	217,222	210,977	87.0
Regulation Sign	Each	68.88	210,317	186,602	967,942	944,227	78.3
Reinforcing G40	Ton	546.21	1,771,546	1,598,088	7,779,856	7,606,398	77.2
Reinforcing G60	Ton	524.79	1,964,693	1,760,917	7,737,383	7,533,607	74.6
Removal of Curb	LM	0.84	4,241	3,057	13,470	12,286	68.5
Safety Devices	Km	79,030.21	55,687,104	46,072,413	925,019,392	915,404,701	94.0
Shoulder	Cum	0.95	148,340	140,034	158,839	150,532	6.6
Sidewalk	SQM	2.74	28,093	24,754	58,256	54,917	51.8
Sodding	SQM	0.92	22,124	18,413	32,245	28,534	31.4
Steel Railing	LM	27.82	144,623	129,308	450,668	435,353	67.9
Stone Masonry	CUM	7.20	324,513	299,902	403,673	379,063	19.6
Structure Backfill	CUM	0.39	35,012	29,652	39,260	33,900	10.8
Structure Concrete A	CUM	19.80	575,136	540,778	792,943	758,586	27.5
Structure Concrete B	CUM	18.67	538,782	506,234	744,155	711,606	27.6

Table 11-4-9 Direct Cost by Work Item (2)

Description	Unit	Financial Cost		Economic Cost	Total Financial	Total Economic	For-eign
		Foreign USD	Local VND	Local VND	VND	VND	(%)
Structure Excavation	CUM	2.20	9,399	6,666	33,544	30,811	72.0
Structure L Concrete	CUM	15.89	426,014	399,023	600,756	573,765	29.1
Subgrade Preparation	SQM	0.11	6,009	4,954	7,195	6,139	16.5
Tack Coat	Ton	239.64	1,116,876	944,871	3,752,916	3,580,911	70.2
Temp. Work-1	LS	53,151.63	100,098,586	84,718,077	684,766,499	669,385,990	85.4
ThermoPav Marking-W	Sqm	5.46	19,832	17,755	79,892	77,815	75.2
ThermoPav Marking-Y	Sqm	5.92	19,832	17,755	84,997	82,920	76.7
Warning Sign	Each	45.24	210,317	186,602	707,902	684,187	70.3

(5) Indirect Cost

To estimate the economic cost of each project for the purpose of economic evaluation, it is required to deduct the indirect cost from the financial cost. The indirect cost is the cost which can not be accounted for, as having been incurred in the performance of a specific item of work. It consists of such items as the office overhead, profits and other taxes and fees incurred by the contractor during the construction. It also includes the expenditures for temporary facilities, transportation, preparing and removing heavy machinery, construction of plants and power facilities, provision of preventive measures, field supervision and general administration.

(6) Unit Cost by Road Type

All the sub-project roads were classified into 40 types, and the standard quantities of work items were estimated based on the standard cross sections. The financial and economic costs for each road type were calculated from these quantities and unit costs and by multiplying the indirect percentage of about 40%. A summary for the construction cost breakdown for each road type is given in Table 11-4-10.

(7) Engineering and Supervision Cost

The engineering design and supervision cost is estimated based on the assumption that the projects are subject to international bidding. The ratio of 12% of the sum of the direct and indirect construction costs, which is applied in other similar projects in Vietnam, was adopted in the cost estimation procedure, and was assumed to be equal in both the local and foreign portions. This ratio is divided as 5% for the detailed engineering design and 7% for the construction supervision.

(8) Right-of-Way Acquisition and Compensation Cost

The right-of-way acquisition cost was estimated based on the officially published land prices for the different classified categories and the location of land in Hanoi City for each of the urban, suburban and rural areas. Land in urban and suburban areas is categorized into four grades while rural land has three grades. The applied procedure to calculate the land acquisition and compensation for the affected houses and shops cost is completely based on the official figures applied in Hanoi City projects.

Table 11-4-10 Unit Cost by Road Type (1)

Per Meter Cost (Unit Million VND)

	Work Items	Unit	Unit Cost VND	Arterial Road		Collector Road			Feeder /Feeder		Ring Road No. 3				Lang Hoa Lac	Sub Urban Road					Urban Road		
											South Section		Noi Bai	North		New Construction		Widening			New Construction		
				No. 1	No. 2	No. 1	No. 2	No. 3	No. 1	No. 2	New	Wid.g	Wid.g	New	E'way	4 Lane	6 Lane	2 to 4	2 to 6	1 to 2	8 Lane	6 Lane	4 Lane
											8 Lane	8 Lane	4 to 6	6 Lane	8 Lane								
	Financial Per Meter Cost																						
1	Clearing & Grubbing	LM	2,650	187	163	127	114	93	58	42	228	156	49	136	188	102	122	54	74	13	158	131	107
2	Removal Existing Curb	LM	20,770	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	955	42	0	0	0
3	Embankment	LM	63,640	4391	3818	2959	2641	2132	1305	923	11201	1591	2355	8400	8400	4391	5346	2682	3309	0	7191	5887	4773
4	Roadway Excavation	LM	34,580	0	0	0	0	0	0	0	0	0	519	0	0	0	0	249	0	145	0	0	0
5	Subgrade Preparation	LM	12,660	968	741	570	468	418	241	165	1013	1013	551	798	798	386	481	386	91	152	677	544	424
6	Subbase Course	LM	120,000	1991	1666	1253	1145	857	414	235	3206	3206	1973	2909	2909	983	1253	983	1519	353	1660	1282	976
7	Base Course	LM	189,000	2841	1956	1625	765	1068	357	244	3638	3638	2442	3202	3202	1238	1238	620	1531	325	2202	1650	1200
8	Prime Coat	LM	5,339,000	299	246	187	176	160	80	48	294	294	219	283	283	176	176	176	235	48	251	198	139
9	Tack Coat	LM	5,339,000	101	80	64	59	53	27	16	198	198	149	187	187	59	59	59	80	16	166	133	91
10	Asphalt Concrete	LM	504,000	5897	4798	2782	2661	1935	968	509	6623	7127	4788	6350	6350	3478	4657	3478	4657	726	4874	3851	2671
11	Center Median	LM	42,810	86	64	43	21	0	0	0	139	139	107	107	107	32	39	32	39	0	32	32	32
12	Separate Strip	LM	42,810	128	128	43	43	0	0	0	257	257	43	214	214	0	0	0	0	0	86	21	21
13	Curb & Gutter	LM	241,000	2410	2410	1928	1928	482	482	482	3374	3374	1446	2410	2410	482	482	482	482	482	2892	1928	1928
14	Sidewalk	LM	144,800	2027	2027	1738	1448	1448	869	724	2172	2172	0	0	0	0	0	0	0	869	1448	1448	1448
15	Drainage	LM	593,970	1188	1188	1188	1188	1188	1188	1188	1198	1188	0	0	0	0	0	0	0	1188	1188	1188	1188
16	Catch Basin	LM	2,335	187	187	93	93	93	58	58	187	187	0	0	0	0	0	0	0	444	187	187	93
17	Road Safety Devices	LM	1,357,000	1357	1357	679	679	679	339	339	1357	1357	1357	1357	1357	1357	1357	679	1357	339	1357	1357	679
18	Stone Masonry	LM	652,290	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	Sodding	LM	56,040	0	0	0	0	0	0	0	405	405	405	405	405	405	405	405	405	0	405	405	405
20	Plantation	LM	87,800	351	439	263	263	176	176	176	351	351	88	176	176	0	0	0	0	0	176	176	176
21	Bridge Construction	LM	16,000,000	0	0	0	0	0	0	0	0	0	1747	0	4480	0	0	0	0	0	0	0	0
22	Boundary Block	LM	59,000	118	118	118	118	118	118	118	118	118	0	0	0	118	0	0	0	118	118	118	118
23	Shoulder	LM	189,000	0	0	0	0	0	0	0	0	0	1021	1021	1021	771	771	771	771	0	0	0	0
24	Metal Beam Guard Rail	LM	1,296,900	0	0	0	0	0	0	0	0	0	2594	2594	2594	0	0	0	0	0	0	0	0
	Total			24.53	21.39	15.66	13.81	10.90	6.68	5.27	35.95	26.77	21.85	30.55	35.08	13.98	16.38	10.85	15.51	5.26	25.07	20.53	16.47
	Economic Per Meter Cost																						
1	Clearing & Grubbing	LM	2,422	171	149	116	104	85	53	39	208	143	45	125	172	93	111	50	68	12	144	120	98
2	Removal Existing Curb	LM	18,944	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	871	38	0	0	0
3	Embankment	LM	57,834	3994	3473	2692	2402	1939	1187	839	10188	1447	2142	7641	7641	3994	4862	2257	3010	0	6541	5354	4341
3	Roadway Excavation	LM	31,587	0	0	0	0	0	0	0	0	0	474	0	0	0	0	227	0	133	0	0	0
5	Subgrade Preperation	LM	10,802	826	632	486	400	356	205	140	864	864	470	681	681	329	410	329	78	130	578	464	362
6	Subbase Course	LM	113,599	1885	1577	1186	1084	811	392	223	3035	3035	1868	2754	2754	930	1186	930	1438	334	1571	1213	924
7	Base Course	LM	179,134	2692	1854	1541	725	1012	339	231	3448	3448	2314	3035	3035	1173	1173	586	1451	308	2087	1564	1138
8	Prime Coat	LM	5,094,301	285	234	178	168	153	76	46	280	280	209	270	270	168	168	168	224	46	239	188	132
9	Tack Coat	LM	5,094,301	97	76	61	56	51	25	15	188	188	143	178	178	56	56	56	76	15	158	127	87
10	Asphalt Concrete	LM	481,569	5634	4585	2658	2543	1849	925	486	6328	6809	4575	6068	6068	3323	4450	3323	4450	693	4657	3679	2552
11	Center Median	LM	36,893	74	55	37	18	0	0	0	120	120	92	92	92	28	33	28	33	0	28	28	28
12	Separate Strip	LM	36,893	111	111	37	37	0	0	0	221	221	37	184	184	0	0	0	0	0	74	18	18
13	Curb & Gutter	LM	227,429	2274	2274	1819	1819	455	455	455	3184	3184	1365	2274	2274	455	455	455	455	455	2729	1819	1819
14	Sidewalk	LM	136,501	1911	1911	1638	1365	1365	819	683	2048	2048	0	0	0	0	0	0	0	819	1365	1365	1365
15	Drainage	LM	566,477	1133	1133	1133	1133	1133	1133	1133	1133	1133	0	0	0	0	0	0	0	1133	1133	1133	1133
16	Catch Basin	LM	2,186	175	175	87	87	87	55	55	175	175	0	0	0	0	0	0	0	415	175	175	87
17	Road Safety Devices	LM	1,342,895	1343	1343	671	671	671	336	336	1343	1343	1343	1343	1343	1343	1343	671	1343	336	1343	1343	671
18	Stone Masonry	LM	593,742	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	Sodding	LM	49,590	0	0	0	0	0	0	0	358	358	358	358	358	358	358	358	358	0	358	358	358
20	Plantation	LM	82,313	329	412	247	247	165	165	165	329	329	82	165	165	0	0	0	0	0	165	165	165
21	Bridge Construction	LM	15,040,000	0	0	0	0	0	0	0	0	0	1642	0	4211	0	0	0	0	0	0	0	0
22	Boundary Block	LM	55,184	110	110	110	110	110	110	110	110	110	0	0	0	110	0	0	0	110	110	110	110
23	Shoulder	LM	179,116	0	0	0	0	0	0	0	0	0	967	967	967	731	731	731	731	0	0	0	0
24	Metal Beam Guard Rail	LM	1,292,828	0	0	0	0	0	0	0	0	0	2586	2586	2586	0	0	0	0	0	0	0	0
	Total			23.04	20.10	14.70	12.97	10.24	6.27	4.96	33.56	25.24	20.71	28.72	32.98	13.09	15.34	10.17	14.59	4.98	23.45	19.23	15.39

Table 11-4-10 Unit Cost by Road Type (2)

Per Meter Cost (Unit Million VND)

	Work Items	Unit	Unit Cost VND	Urban Road					C-1			C-2					C-3						
				New	Widening																		
				2 Lane	2 to 4	2 to 6	2 to 8	2 to 2	C-1-1	C-1-2	C-1-3	C-2-1	C-2-2	C-2-3	C-2-4	C-2-5	C-3-1	C-3-2a	C-3-2bc	C-3-3	C-3-4a	C-3-4b	C-3-5
	Financial Per Meter Cost																						
1	Clearing & Grubbing	LM	2,650	90	107	98	57	12	53	81	66	68	49	37	44	44	50	48	47	15	44	4	66
2	Removal Existing Curb	LM	20,770	0	42	42	42	42	0	0	0	0	0	62	42	42	0	0	0	42	0	62	0
3	Embarkment	LM	63,640	3373	5155	4709	827	573	5091	2982	3221	403	636	0	0	0	7217	6911	7859	0	0	0	9546
4	Roadway Excavation	LM	34,580	0	249	249	249	249	363	454	411	181	124	367	353	353	313	340	243	574	353	1131	187
5	Subgrade Preparation	LM	12,660	222	665	532	424	209	475	437	437	437	373	399	424	424	437	437	437	196	424	414	430
6	Subbase Course	LM	120,000	362	1660	1282	976	562	1187	947	947	947	1014	1084	947	947	947	947	947	1040	947	994	947
7	Base Course	LM	189,000	643	2202	1650	1106	643	1331	1191	1191	1168	1160	1314	1191	1191	1191	1191	1191	1196	1191	1191	1191
8	Prime Coat	LM	5,339,000	96	251	198	139	96	139	139	139	139	123	152	139	139	139	139	139	144	139	139	139
9	Tack Coat	LM	5,339,000	64	166	133	91	64	48	48	48	48	43	51	48	48	481	48	48	48	48	49	48
10	Asphalt Concrete	LM	504,000	1885	4874	3851	2671	1885	2056	2056	2056	2056	1876	2238	2056	2056	2056	2056	2056	2177	2056	2056	2056
11	Center Median	LM	42,810	0	32	32	32	0	0	32	32	32	32	32	32	32	32	32	32	0	32	0	32
12	Separate Strip	LM	42,810	0	86	21	21	0	11	21	21	21	21	21	21	21	21	21	21	11	21	21	21
13	Curb & Gutter	LM	241,000	482	2892	1928	1928	482	1928	1928	1928	1928	1928	1205	1928	1928	1928	1928	1928	1687	1928	1928	1928
14	Sidewalk	LM	144,800	724	1448	1448	1448	724	1448	1448	1448	1448	1086	724	1448	1448	1448	1448	1448	1086	1267	1260	1448
15	Drainage	LM	593,970	1188	1188	1188	1188	1188	1188	1188	1188	1188	1188	594	1188	1188	1188	1188	1188	1188	1188	1782	1188
16	Catch Basin	LM	2,335	58	187	187	93	58	105	234	187	82	128	47	93	93	58	128	93	70	117	70	82
17	Road Safety Devices	LM	1,357,000	339	1357	1357	1357	339	679	679	679	679	679	679	679	679	679	679	679	679	679	679	679
18	Stone Masonry	LM	632,290	0	0	0	0	0	0	0	0	0	6323	0	0	0	0	0	0	0	0	0	0
19	Sodding	LM	56,040	405	405	405	405	405	807	505	505	101	0	0	0	0	606	606	606	0	0	0	606
20	Plantation	LM	87,800	176	176	176	176	176	88	176	176	176	88	88	44	176	176	176	176	88	176	88	176
21	Bridge Construction	LM	16,000,000	0	0	0	0	0	0	0	0	0	1578	0	0	1302	0	0	0	0	0	0	0
22	Boundary Block	LM	59,000	118	118	118	118	118	118	118	118	118	118	59	118	118	118	118	118	118	118	118	118
23	Shoulder	LM	189,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Metal Beam Guard Rail	LM	1,296,900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total			10.39	23.26	19.60	13.35	7.82	17.11	14.66	14.80	11.22	18.57	9.15	10.79	12.23	19.08	18.44	19.26	10.36	10.73	11.98	20.89
	Economic Per Meter Cost																						
1	Clearing & Grubbing	LM	2,422	54	98	90	52	11	48	74	61	62	45	33	40	40	46	44	43	14	40	4	61
2	Removal Existing Curb	LM	18,944	0	38	38	38	38	0	0	0	0	0	57	38	38	0	0	0	38	0	57	0
3	Embarkment	LM	57,884	3068	4689	4283	752	521	4631	2712	2930	367	579	0	0	0	6564	6286	7148	0	0	0	8683
4	Roadway Excavation	LM	31,587	0	227	227	227	227	332	415	375	165	114	335	322	322	286	311	222	524	322	1033	171
5	Subgrade Preparation	LM	10,802	189	567	454	362	178	405	373	373	373	319	340	362	362	373	373	373	167	362	353	367
6	Subbase Course	LM	113,599	532	1571	1213	924	532	1123	896	896	896	960	1026	896	896	896	896	896	985	896	941	896
7	Base Course	LM	179,134	609	2087	1564	1048	609	1261	1129	1129	1107	1100	1245	1129	1129	1129	1129	1129	1134	1129	1129	1129
8	Prime Coat	LM	5,094,301	92	239	188	132	92	132	132	132	132	117	145	132	132	132	132	132	138	132	132	132
9	Tack Coat	LM	5,094,301	61	158	127	87	61	46	46	46	46	41	48	46	46	458	46	46	46	46	46	46
10	Asphalt Concrete	LM	481,569	1801	4657	3679	2552	1801	1965	1965	1965	1965	1791	2138	1965	1965	1965	1965	1965	2080	1965	1965	1965
11	Center Median	LM	36,893	0	28	28	28	0	0	28	28	28	28	28	28	28	28	28	28	0	28	0	28
12	Separate Strip	LM	36,893	0	74	18	18	0	9	18	18	18	18	18	18	18	18	18	18	9	18	18	18
13	Curb & Gutter	LM	227,429	455	2729	1819	1819	455	1819	1819	1819	1819	1819	1137	1819	1819	1819	1819	1819	1592	1819	1819	1819
14	Sidewalk	LM	136,501	683	1365	1365	1365	683	1365	1365	1365	1365	1024	683	1365	1365	1365	1365	1365	1024	1194	1188	1365
15	Drainage	LM	566,477	1133	1133	1133	1133	1133	1133	1133	1133	1133	1133	566	1133	1133	1133	1133	1133	1133	1133	1699	1133
16	Catch Basin	LM	2,186	55	175	175	87	55	98	219	175	77	120	44	87	87	55	120	87	66	109	66	77
17	Road Safety Devices	LM	1,342,895	336	1343	1343	1343	336	671	671	671	671	671	671	671	671	671	671	671	671	671	671	671
18	Stone Masonry	LM	593,742	0	0	0	0	0	0	0	0	0	5937	0	0	0	0	0	0	0	0	0	0
19	Sodding	LM	49,590	358	358	358	358	358	714	447	447	89	0	0	0	0	536	536	536	0	0	0	536
20	Plantation	LM	82,313	165	165	165	165	165	82	165	165	165	82	82	41	165	165	165	165	82	165	82	165
21	Bridge Construction	LM	15,040,000	0	0	0	0	0	0	0	0	0	1483	0	0	1224	0	0	0	0	0	0	0
22	Boundary Block	LM	55,184	110	110	110	110	110	110	110	110	110	110	55	110	110	110	110	110	110	110	110	110
23	Shoulder	LM	179,116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Metal Beam Guard Rail	LM	1,292,828	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total			9.70	21.81	18.38	12.60	7.36	15.95	13.72	13.84	10.59	17.49	8.65	10.20	11.55	17.75	17.15	17.89	9.81	10.14	11.31	19.37

(9) Contingency Cost

In general, the contingency costs are divided into physical contingency and price contingency. The physical contingency is reserved to cover any physical factors such as the discovery of unexpected obstacles under unusual conditions that interrupt the continuation of the work. As in similar projects in Vietnam, the physical contingency was considered as 10% of the direct cost of each project. Price contingency, on the other hand, which is reserved for the escalation in prices as a result of inflation during the construction period, was not considered in the cost estimation procedure as it is usually included in the financial analysis of the projects.

11.4.3 Project Cost

Table 11-4-11 presents the project total economic and financial cost with the breakdown for each segment. The financial cost includes the direct construction cost, engineering design and supervision cost as well as the land acquisition and compensation cost.

Table 11-4-11 Cost by Project Segment (1)

No.	Section	Length	Financial Cost				Economic Cost
			Direct Cost	E/S	Compen-sation	Total	
		(Km)	(M.VND)	(M.VND)	(M.VND)	(M.VND)	(M.VND)
A0101	Noi Bai Expressway - Hanoi Boundary	5.50	59,675.0	7,161.0	29,720.3	96,556.3	92,367.5
A0201	NH 1 - DA 4	9.00	139,590.0	16,750.8	67,215.2	223,556.0	214,282.4
A0202	DA 4 - RR 3	2.50	38,775.0	4,653.0	17,500.0	60,928.0	58,352.0
A0203	RR 3 - NH18	6.00	65,100.0	7,812.0	31,516.4	104,428.4	99,858.8
A0204	NH18 - Hanoi Boundary	15.00	162,750.0	19,530.0	77,641.4	259,921.4	248,497.4
A0301	NH 1 - Duong Bridge	1.90	31,122.0	3,734.6	75,178.0	110,034.6	107,821.5
A0302	Duong Bridge	0.55	294,800.0	35,376.0	0.0	330,176.0	310,365.5
A0303	DA 7 Upgrading	1.25	19,387.5	2,326.5	8,848.6	30,562.6	29,274.6
A0304	DA 4 Upgrading	7.00	108,570.0	13,028.4	44,652.8	166,251.2	159,038.4
A0401	RR 2 - RR 3	2.50	49,000.0	5,880.0	183,321.6	238,201.6	234,281.6
A0402	RR 3 - Hanoi Boundary	6.00	93,060.0	11,167.2	84,708.0	188,935.2	182,752.8
A0501	Noi Bai Expressway - NH 3	7.00	97,860.0	11,743.2	7,192.3	116,795.5	109,817.9
A0502	NH 3 - Hanoi Boundary	11.00	153,780.0	18,453.6	10,426.3	182,659.9	171,695.1
A0601	RR 3 - Hanoi Boundary	2.75	96,470.0	11,576.4	5,019.9	113,066.3	106,598.3
A0701	NH32 - NH 6	5.75	206,712.5	24,805.5	102,234.2	333,752.2	317,265.8
A0702	NH 6 - NH 1	4.90	176,155.0	21,138.6	86,886.4	284,180.0	270,130.7
A0703	NH 1 -Thanh Tri Bridge	4.13	148,293.8	17,795.3	75,064.7	241,153.7	229,326.5
A0704	Thanh Tri Bridge	2.50	3,400,000.0	408,000.0	0.0	3,808,000.0	3,579,520.0
A0705	Thanh Tri Bridge - NH 5	2.25	80,887.5	9,706.5	40,024.7	130,618.7	124,167.5
A0801	NH 5 - Duong Bridge [2]	1.75	53,462.5	6,415.5	20,287.3	80,165.3	76,578.5
A0802	Duong Bridge [2]	2.30	3,000,000.0	360,000.0	0.0	3,360,000.0	3,158,400.0
A0803	Duong Bridge [2] - NH 1	5.75	175,662.5	21,079.5	67,063.5	263,805.5	252,020.3
A0804	NH 1 - NH 3	11.00	336,050.0	40,326.0	125,434.7	501,810.7	479,265.1
A0805	NH 3 - Noi Bai Expressway	8.00	244,400.0	29,328.0	91,176.5	364,904.5	348,507.7
A0901	NH32 - Thang Long Bridge	6.25	167,312.5	20,077.5	667,878.2	855,268.2	843,298.2
A0902	Thang Long Bridge - RR 3	6.30	168,651.0	20,238.1	658,656.6	847,545.7	835,479.9
A0903	RR 3 - Noi Bai Airport	8.70	190,095.0	22,811.4	157,561.1	370,467.5	359,359.3
C0101	Cau Giay - Ton Duc Thang	3.30	56,463.0	6,775.6	619,476.0	682,714.6	678,057.6
C0102	Ton Duc Thang - Kim Lien	1.20	17,592.0	2,111.0	95,214.4	114,917.4	113,358.4
C0103	Hue - Minh Khai	2.00	29,600.0	3,552.0	137,152.0	170,304.0	167,750.4
C0201	Nhat Tan - Buoi	4.20	47,124.0	5,654.9	157,405.3	210,184.2	206,844.3
C0202	Buoi - NH 32	2.20	40,854.0	4,902.5	238,400.8	284,157.3	281,200.5
C0203	NH32 - NH 6	4.20	38,430.0	4,611.6	445,258.8	488,300.4	485,760.3
C0204	NH 6 - NH 1	2.40	25,896.0	3,107.5	477,607.2	506,610.7	504,809.8
C0205	NH 1 - Red River Dike	4.00	48,920.0	5,870.4	796,012.0	850,802.4	847,352.8
C0301	Noi Bai E'way Ramp - Nhat Tan	5.60	106,848.0	12,821.8	61,501.4	181,171.2	172,515.8
C0302	Nhat Tan - Thanh Nien	4.30	79,292.0	9,515.0	471,983.1	560,790.1	553,999.6
C0303	Thanh Nien - Chuong Duong Br.	2.40	24,864.0	2,983.7	147,297.6	175,145.3	173,505.6
C0304	Chuong Duong Br. - RR 2	3.80	40,774.0	4,892.9	551,623.2	597,290.1	594,310.9
C0305	RR 2 - RR 3	3.20	66,848.0	8,021.8	37,652.5	112,522.2	106,787.8
C0501	Tay Son	0.50	6,675.0	801.0	79,376.5	86,852.5	86,382.1

Table 11-4-11 Cost by Project Segment (2)

No.	Section	Length	Financial Cost				Economic Cost
			Direct Cost	E/S	Compen-sation	Total	
		(Km)	(M.VND)	(M.VND)	(M.VND)	(M.VND)	(M.VND)
C0502	Dao Duy Tu	0.03	234.6	28.2	2,234.7	2,497.4	2,480.3
C0503	Kim Ma	1.28	17,021.3	2,042.6	353,424.9	372,488.7	371,289.2
C0504	Thai Ha	0.13	1,735.5	208.3	20,986.2	22,929.9	22,807.6
C0505	Chua Boc	0.30	4,005.0	480.6	22,573.2	27,058.8	26,776.6
C0506	Thanh Nhan	0.50	6,675.0	801.0	43,498.0	50,974.0	50,503.6
C0507	Nguyen Khuyen	0.47	6,274.5	752.9	113,884.8	120,912.2	120,470.0
C0508	Thuy Khe	0.12	1,602.0	192.2	9,314.9	11,109.1	10,996.2
C0509	Hoang Hoa Tham	3.50	46,725.0	5,607.0	515,366.3	567,698.3	564,405.4
C0510	Nguyen Binh Khiem	0.03	234.6	28.2	1,489.9	1,752.7	1,735.5
C0511	Hai Ba Trung	0.08	1,068.0	128.2	12,122.7	13,318.9	13,243.6
C0512	Doi Can	3.00	40,050.0	4,806.0	461,859.0	506,715.0	503,892.6
C0601	Station Tunnel	1.50	457,900.0	54,948.0	143,632.0	656,480.0	625,709.1
C0602	Linh Quang - Cho Kham Thien	1.03	10,649.8	1,278.0	214,203.2	226,130.9	225,281.4
C0603	Yen Lang Drain	2.82	29,247.9	3,509.7	405,001.7	437,759.3	435,426.3
C0604	Lieu Giai Extension - North	0.59	9,717.3	1,166.1	195,383.2	206,266.6	205,493.5
C0605	Lieu Giai Extension - South	1.83	30,057.8	3,606.9	604,363.4	638,028.1	635,636.6
C0606	Nui Truc Extension	1.06	17,458.2	2,095.0	351,027.5	370,580.7	369,191.6
C0607	South Thang Long - BuoiRoad	2.68	44,057.3	5,286.9	51,564.8	100,908.9	97,403.6
C0701	Ho Tay East / West	3.90	86,200.0	10,344.0	185,094.0	281,638.0	275,845.4
C0801	RR 2 - NH32 I/C	0.60	159,840.0	19,180.8	0.0	179,020.8	168,279.6
C0802	RR 2 - NH 6 I/C	0.50	117,760.0	14,131.2	0.0	131,891.2	123,977.7
C0803	RR 2 - NH 1 I/C	1.00	280,480.0	33,657.6	0.0	314,137.6	295,289.4
C0804	Chuong Duong Bridge I/C	0.50	66,880.0	8,025.6	0.0	74,905.6	70,411.3
C0901	Chuong Duong Br. (Reh.for4-whe	1.21	480,000.0	57,600.0	0.0	537,600.0	505,344.0
C0902	Long Bien Br.(Reh. for 2-wheelers)	1.69	630,000.0	75,600.0	0.0	705,600.0	663,264.1
D0101	Dong Anh Bridge	2.50	3,400,000.0	408,000.0	0.0	3,808,000.0	3,579,520.0
D0102	Dong Anh Bridge ~ DA 4	1.25	20,475.0	2,457.0	14,182.8	37,114.8	35,658.8
D0103	DA 4 ~ RR 3	3.60	58,968.0	7,076.2	5,393.6	71,437.8	67,244.5
D0104	RR 3 ~ NH18	4.75	77,805.0	9,336.6	6,504.5	93,646.1	88,113.3
D0201	Collector Roads	28.72	377,093.6	45,251.2	21,609.8	443,954.6	415,648.2
D0202	Feeder Roads	23.78	438,253.2	52,590.4	23,008.3	165,600.0	155,664.0
D0203	Non- motorized Roads	1.19	18,754.4	2,250.5	1,307.7	22,312.7	20,899.9
D0301	Collector Roads	30.32	398,101.6	47,772.2	22,813.7	468,687.5	438,801.1
D0302	Feeder Roads	27.89	462,666.6	55,520.0	24,290.0	194,600.0	182,924.0
D0303	Non- motorized Roads	1.25	19,700.0	2,364.0	1,373.7	23,437.7	21,953.7
D0401	Collector Roads	63.12	828,765.6	99,451.9	47,493.4	975,710.9	913,499.8
D0402	Feeder Roads	62.14	963,111.6	115,573.4	50,563.4	432,800.0	406,832.0
D0403	Non- motorized Roads	2.61	41,133.6	4,936.0	2,868.2	48,937.8	45,839.3
D0501	Collector Roads	26.67	350,177.1	42,021.3	20,067.3	412,265.7	385,979.7
D0502	Feeder Roads	19.23	411,226.2	49,347.1	21,589.4	134,400.0	126,336.0
D0503	Non- motorized Roads	1.11	17,493.6	2,099.2	1,219.8	20,812.6	19,494.9
E0101	RR 2 - New CBD	2.50	53,475.0	6,417.0	161,964.0	221,856.0	217,768.0
E0102	New CBD Segment	2.30	49,197.0	5,903.6	31,578.8	86,679.5	82,918.5
E0103	New CBD - Dike Road	3.00	64,170.0	7,700.4	41,969.5	113,839.9	108,934.3
E0201	Buoi - RR 3	1.89	46,361.7	5,563.4	35,442.5	87,367.6	83,853.7
E0301	Dike Road - New CBD	1.90	29,754.0	3,570.5	23,797.0	57,121.4	54,887.0
E0302	New CBD Segment	3.15	49,329.0	5,919.5	34,298.6	89,547.1	85,842.7
E0303	New CBD - NH 32	1.15	18,009.0	2,161.1	12,833.8	33,003.8	31,651.4
E0401	Collector Roads	21.41	281,113.3	33,733.6	161,983.8	476,830.7	455,729.0
E0402	Feeder Roads	22.79	135,372.6	16,244.7	74,454.9	226,072.2	215,607.1
E0403	Non -motorized Roads	1.29	20,330.4	2,439.7	14,851.3	37,621.3	36,089.8
E0501	RR 2 eXt. - RR 3	3.00	41,430.0	4,971.6	28,993.1	75,394.7	72,269.9
E0502	RR 3 - NH32	2.50	34,525.0	4,143.0	23,650.0	62,318.0	59,714.0
F0101	NH32 - NH 6	5.00	82,350.0	9,882.0	73,213.8	165,445.8	158,893.8
F0102	NH 6 - NH 1	3.63	59,703.8	7,164.5	52,830.0	119,698.2	114,948.0
F0201	RR 2- RR 3	2.00	32,940.0	3,952.8	27,152.4	64,045.2	61,424.4
F0202	RR 3 - Ha Dong	3.50	57,645.0	6,917.4	18,308.6	82,871.0	78,284.6
F0301	RR 2- RR 3	1.75	61,390.0	7,366.8	43,333.4	112,090.2	107,974.2
F0401	NH 32 - NH 6	7.00	115,290.0	13,834.8	19,285.5	148,410.3	139,237.5
F0402	NH 6 - NH 1	6.25	102,937.5	12,352.5	19,980.8	135,270.8	127,080.8
F0501	Ha Dong - NH 1	7.50	100,125.0	12,015.0	46,520.3	158,660.3	151,604.3
F0601	Red River Dike - NH32	5.88	45,981.6	5,517.8	5,537.3	57,036.7	53,678.0
F0602	NH32 - Ha Dong Road	7.88	61,621.6	7,394.6	1,511.1	70,527.3	66,026.2
F0701	RR 2 - RR 3	1.75	23,362.5	2,803.5	18,943.1	45,109.1	43,462.7
F0702	RR 3 - Nhue River	2.50	33,375.0	4,005.0	1,895.2	39,275.2	36,923.2
F0801	RR 2 - RR 3	3.25	43,387.5	5,206.5	31,371.0	79,965.0	76,907.4

Table 11-4-11 Cost by Project Segment (3)

No.	Section	Length	Financial Cost				Economic Cost
			Direct Cost	F/S	Compen-sation	Total	
		(Km)	(M.VND)	(M.VND)	(M.VND)	(M.VND)	(M.VND)
F0802	RR 3 - Rd.70B (413)	2.10	28,035.0	3,364.2	1,311.4	32,710.6	30,734.9
F0901	Collector Roads	8.90	116,857.0	14,022.8	70,155.1	201,035.0	192,263.1
F0902	Feeder Roads	9.48	56,311.2	6,757.3	30,971.2	94,039.7	89,686.5
F0903	Non -motorized Roads	0.54	8,510.4	1,021.3	6,716.8	16,248.5	15,607.4
F1001	Collector Roads	47.57	624,594.1	74,951.3	374,975.3	1,074,521.0	1,027,636.0
F1002	Feeder Roads	50.63	300,742.2	36,089.1	165,408.2	502,239.4	478,990.2
F1003	Non -motorized Roads	2.86	45,073.6	5,408.8	32,926.0	83,408.5	80,013.1
F1101	Collector Roads	9.43	123,815.9	14,857.9	74,337.9	213,011.7	203,717.5
F1102	Feeder Roads	10.03	59,578.2	7,149.4	32,768.0	99,495.6	94,889.8
F1103	Non -motorized Roads	0.57	8,983.2	1,078.0	6,562.2	16,623.4	15,946.7
G0101	NH 1 - Dike Road	5.58	91,902.6	11,028.3	81,714.6	184,645.5	177,333.5
G0201	RR 2 - Dike Road	3.25	43,387.5	5,206.5	39,503.4	88,097.4	85,039.8
G0301	RR 3 - RR 4	7.50	156,675.0	18,801.0	42,169.7	217,645.7	204,205.7
G0401	NH 1 - Dike Road	2.25	37,057.5	4,446.9	2,373.5	43,877.9	40,929.5
G0501	RR 1 - RR 2	1.50	24,705.0	2,964.6	387,042.0	414,711.6	412,746.0
G0502	RR 2 - RR 3	2.75	45,292.5	5,435.1	128,630.5	179,358.1	175,754.5
G0503	RR 3 - RR 4	3.38	55,668.6	6,680.2	2,874.7	65,223.5	60,791.4
G0601	RR 2 - Dike Road	4.00	65,880.0	7,905.6	6,927.4	80,713.0	75,471.4
G0701	NH 1 - Dike Road	2.40	39,528.0	4,743.4	2,501.0	46,772.4	43,627.4
G0801	RR 2 - Dike Road	6.00	80,100.0	9,612.0	23,464.3	113,176.3	107,531.5
G0802	Mai Dong - Linh Nam Road	3.00	49,410.0	5,929.2	19,998.0	75,337.2	71,406.0
G0803	G0801 - Dike Road	2.38	31,773.0	3,812.8	1,599.8	37,185.6	34,946.5
G0804	NH 1 - RR 3	0.88	11,748.0	1,409.8	6,666.0	19,823.8	18,995.9
G0805	NH 1 - RR 3	2.38	39,198.6	4,703.8	3,466.3	47,368.8	44,250.0
G0806	RR3.5 - Dike Road	1.00	16,470.0	1,976.4	0.0	18,446.4	17,136.0

11.5 Priority of Road Projects

To prioritize the road projects, major schemes were grouped in inter-related packages, as presented in Table 11.6.1, and evaluated considering the following five aspects;

- Benefit scale
- Cost performance
- No. of beneficiaries in terms of car users
- No. of beneficiaries in terms of passengers
- Project status

The rural road improvement projects (Group B) were evaluated based on the following deferent view points:

- Population coverage
- Population/cost rate
- land use activities

Each of the evaluation items was converted to a priority rank by applying the following method which is based on the concept shown in Fig. 11-5-1.

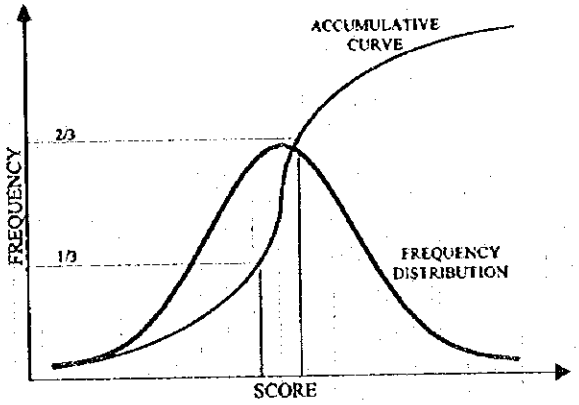


Fig. 11-5-1 Priority Ranking

In this concept, the scores of the evaluation items are considered to be distributed in the shape of a normal distribution curve, and the first 1/3 group projects were given the priority rank 1, the second group projects were given 2, and the third group 3, so that all the three groups will have the same area under the distribution curve..

11.5.1 Major Schemes Priority

(1) Benefit Scale

To represent the effect by a project, the annual benefit of a project is derived from the VOC deference (saving) between "Do-nothing Case" and "With a Project Case" in the year 2015. The benefit scale means a positive impact to the traffic flow.

Table 11-5-1 Project Packages

PACK-AGE	PROJECT ELEMENTS	COST(B.VND)	
		FINANCIAL	ECONOMIC
A02	A0201 A0202 A0203 A0204	527.3	507.1
A03	A0301 A0302 A0303 A0304	637.0	606.5
A04	A0401 A0402	427.1	417.0
A05	A0101 A0501 A0502	396.0	373.9
A06	A0601	113.1	106.6
A07	A0701 A0702 A0703 A0704 A0705	4,797.7	4,520.4
A08	A0801 A0802 A0803 A0804 A0805	4,570.7	4,314.8
A78	A0701 A0702 A0703 A0704 A0705 A0801 A0802 A0803 A0804 A0805	9,368.4	8,835.2
A09	A0901	855.3	843.3
C01	C0101 C0102 C0103	967.9	959.2
C02	C0203 C0204 C0205	1,845.7	1,837.9
C03	C0301 C0302 C0303 C0304 C0305	1,626.9	1,601.1
C05	C0501 C0502 C0503 C0504 C0505 C0506 C0507 C0508 C0509 C0510 C0511 C0512	1,784.3	1,775.0
C61	C0601	656.5	625.7
C62	C0602	226.1	225.3
C63	C0603	437.8	435.4
C64	C0604	206.3	205.5
C65	C0605	638.0	635.6
C66	C0606	370.6	369.2
C67	C0607	100.9	97.4
C07	C0701	281.6	275.8
C09	C0901 C0902	1,243.2	1,168.6
D01	D0101 D0102 D0103 D0104	4,010.2	3,770.5
E01	E0101 E0102 E0103	422.4	409.6
E02	E0201 E0202 E0203	87.4	83.9
E03	E0301 E0302 E0303 F0101 F0102	464.8	446.2
E04	E0401 E0402 E0403 E0404 E0405 E0406 E0407 E0408 E0409 E0410 E0411 E0412 E0413 E0414 E0415 E0416 E0417 E0418 E0419 E0420 E0421 E0422 E0423 E0424 E0425 E0426	740.5	707.4
E05	E0501 E0502 F0401 F0402	421.4	398.3
F02	F0201 F0202	146.9	139.7
F03	F0301 F0302	112.1	108.0
F05	F0501	158.7	151.6
F06	F0601 F0602	127.6	119.7
F07	F0701 F0702	84.4	80.4
F08	F0801 F0802	112.7	107.6
F09	F0901 F0902 F0903 F0904 F0905 F0906 F0907 F0908	311.3	297.6
F10	F1001 F1002 F1003 F1004 F1005 F1006 F1007 F1008 F1009 F1010 F1011 F1012 F1013 F1014 F1015	1,660.2	1,586.6
F11	F1101 F1102 F1103 F1104 F1105 F1106 F1107 F1108 F1109 F1110 F1111 F1112	329.1	314.6
G01	G0101	184.6	177.3
G02	G0201	88.1	85.0
G03	G0301	217.6	204.2
G04	G0401	43.9	40.9
G05	G0501 G0502 G0503	659.3	649.3
G06	G0601	80.7	75.5
G07	G0701 G0805	94.1	87.9
G08	G0801 G0802 G0803 G0804 G0806	264.0	250.0

The annual benefits were calculated from the deference in vehicle-km and vehicle-hr, of the two cases mentioned above, multiplied by the distance related and time related vehicle operating costs for each of the five vehicle types. The benefit derived from the vehicle-km saving was considered to occur for 24 hrs, while the benefit form time saving was considered to occur only in the 3 peak hours in a day. The daily benefit was

expanded to the annual benefit multiplying by 365 days.

(2) Cost Performance

The benefit scale will increase when a project scale becomes larger, so that another index to show the cost performance of a project is selected for the project prioritizing. In the standard evaluation process, the B/C, which shows the cost performance of a project, is defined as the sum of the discounted benefits divided by the sum of the discounted cost over the project life. However it is affected by the investment schedule and no schedule is fixed at this stage.. Therefore, a single year B/C ratio in 2015 calculated from the annual benefit of a project compared with its amortized cost was applied for this purpose. Amortized capital cost values were calculated by the following formula, assuming a discount rate of 12% p.a. and a project life of 20 yeas.

$$p = P \times \frac{r}{(1-(r+1)^{-n}}$$

where, p: Amortized capital
P: Principal
r: interest
n: term

A small scale project in the demand intensive area may have high cost performance, however its impact on all the road network may be small. On the other hand, a large scale project such as the construction of a new highway may have large impact but rather low cost performance comparing with a small scale project. Therefore, a project should be evaluated from both aspects.

Fig. 11-5-2 shows the scattered graph of the project packages by the B/C on the X-axis and the benefit scale on the Y-axis.

Project E02, the South Tang Long Road has the highest B/C and high benefit, while A78, the combination of Ring Road 3 south and north sections has the highest benefit but a rather low B/C. E05, Ring Road 3.5, and E03, New Ring Road 2 have high benefit and B/C.

(3) No. of Beneficiaries in Terms of Traffic Volumes

The economic impacts are calculated based on the VOCs of each of the five traffic modes, and the distance related VOC of a truck is almost 11 times higher than that of a motorcycle, reflecting the higher purchase and operating cost. Therefore, another view point of the number of beneficiaries will give a deferent project priority. The average of the total PCUs for the five modes for the project links was selected to represent the number of Beneficiaries.

(4) No. of Beneficiaries in Terms of Passengers

The number of beneficiaries in terms of passengers will give a different project priority.

Based on the international standard, PCU of a bus and a truck were assumed to be 2.0 and 2.5 respectively, however the passengers in a bus and a truck are 24.09 and 1.18, respectively and a bus transports 20.4 times more passengers than a truck on a vehicle bases and 25.5 times on a pcu bases. This index gives the magnitude of the impact of each project link to passengers.

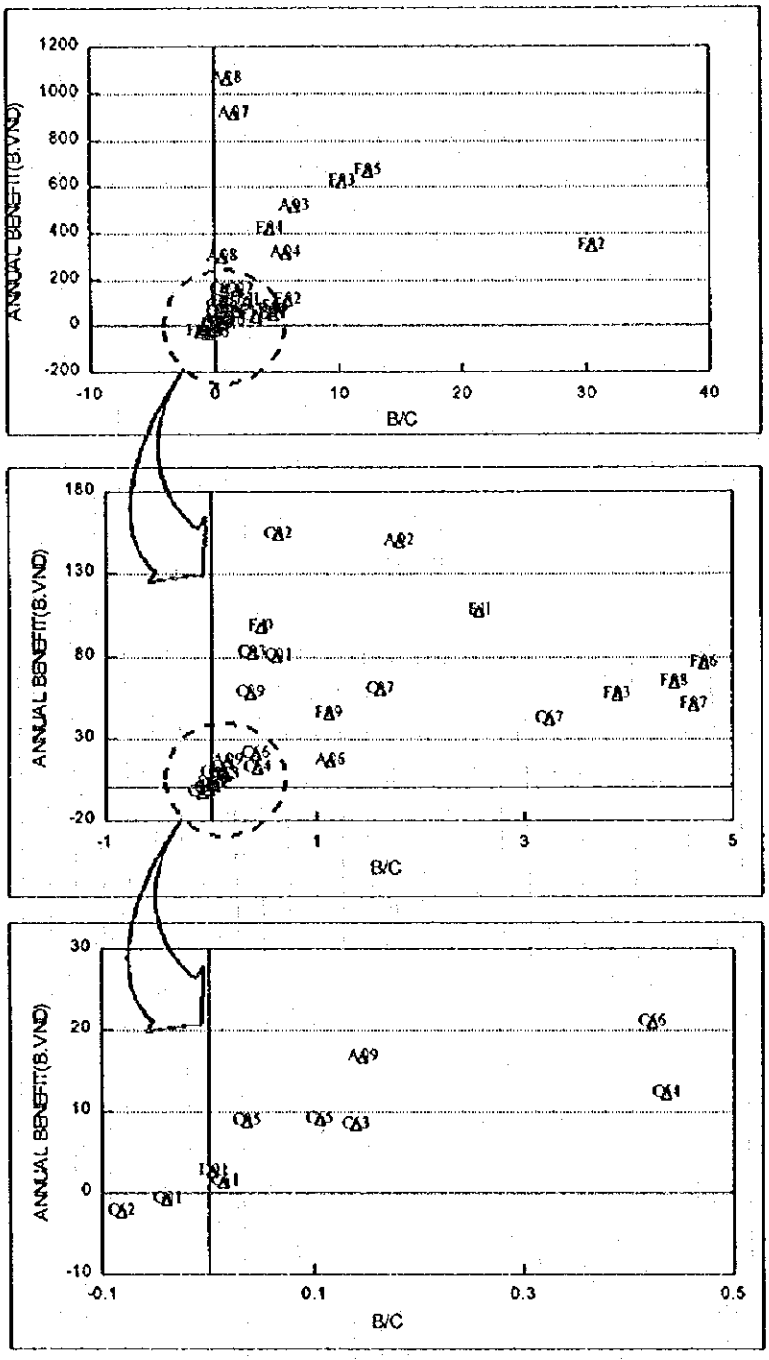


Fig. 11-5-2 Annual Benefit and B/C of Road Project Package

(5) Project Present Status

On-going projects or projects which are already approved and committed by the government for implementation have the higher ranking priority. The second rank is given to high potential road projects for which feasibility studies are finished or are being carried out. Roads which are still only in the planning stage were given a low priority score.

(6) Priority Ranking

For the purpose of prioritization, the economic indicators of the project packages are presented in Table 11-5-2 in terms of benefits estimated, cost - benefit ratio and the traffic volumes in PCUs and number of passengers. Based on the ranking procedure, the total ranking scores were categorized into the three priority levels of A, B and C which basically represent the average of the scores, ranging from 1 to 3, given to the five different parameters as shown in Table 11-5-3.

(7) Program Implementation Ranking

The above priority ranking established groups of projects to be implemented in each of the three programs A, B and C. Internal prioritization of projects in each program, divided into the three sub-ranks of 1, 2 and 3, is established here to facilitate the three implementation programs especially in regard to the financial resources and budget allocation. Table 11-5-3 presents the results of the Program Implementation Ranking which is based mainly on the socioeconomic impact of each project during its program period.

Table 11-5-2 Indicators of Project Packages

Project Package	Benefit	B/C	Traffic Volume						
			Bi (Unit)	Mb (Unit)	Bs (Unit)	Pc (Unit)	Tk (Unit)	Total (pcu)	Total (Trip)
A02	149.4	1.8	71	296	87	26	74	495.1	1878
A03	514.7	6.3	56	422	81	32	98	582.4	1999
A04	311.0	5.6	459	840	17	36	48	579.7	2059
A05	0.0	0.0	181	237	37	30	46	344.4	1184
A06	16.2	1.1	77	191	2	14	3	105.9	421
A07	913.3	1.5	133	539	34	30	77	492.1	1551
A08	295.6	0.5	44	159	17	13	49	230.4	604
A09	16.4	0.2	284	650	57	23	85	629.7	2178
D01	2.4	0.0	41	309	73	34	62	440	1676
C01	79.8	0.6	396	688	8	46	79	584.7	1718
C02	154.0	0.6	425	778	3	11	48	497.9	1666
C03	81.8	0.4	83	265	4	7	36	209.4	577
C05	8.6	0.0	267	490	7	5	10	271.1	1091
C61	1.2	0.0	111	120	1	13	1	86.8	338
C62	0.0	0.0	60	217	4	0	18	136.1	444
C63	8.2	0.1	315	548	4	26	47	410.4	1285
C64	12.0	0.4	64	109	1	4	10	82.9	257
C65	8.9	0.1	29	106	7	8	19	110	323
C66	20.9	0.4	241	856	0	12	0	341.1	1486
C67	42.1	3.2	259	1591	37	29	60	808	3176
C07	59.3	1.6	273	296	3	0	0	176.7	743
C09	57.6	0.4	61	65	1	1	2	45.8	174
D06	0.0	0.0	1	1	1	1	1	6.1	21
G01	0.0	0.0	130	332	19	25	130	526.6	1095
G02	3.2	0.3	158	520	18	17	56	396.4	1263
G03	1.0	0.0	25	65	8	5	21	100.5	269
G04	0.1	0.0	36	139	27	48	140	504.5	917
G05	1.3	0.0	160	335	10	38	89	429	993
G06	2.9	0.3	38	108	3	6	38	150.8	296
G07	0.0	0.0	38	139	5	5	17	110.6	340
G08	0.0	0.0	58	135	4	3	13	101.4	330
E01	0.0	0.0	275	802	73	51	77	712.6	2679
E02	341.2	30.4	150	331	9	5	19	214.8	785
E03	614.7	10.3	247	505	26	45	176	762.6	1671
E04	414.7	4.4	172	259	3	4	14	174.3	614
E05	662.3	12.4	102	386	9	10	14	209.4	820
F02	106.3	5.7	338	752	26	39	35	505.5	1928
F03	56.0	3.9	140	291	4	13	13	182.8	664
F05	0.0	0.0	100	501	9	3	7	218.8	950
F06	75.6	4.7	34	128	2	2	1	57.1	250
F07	49.6	4.6	276	608	16	14	14	346.2	1424
F08	63.9	4.4	87	214	2	5	7	116.8	442
F09	44.5	1.1	47	119	3	4	8	79.8	279
F10	97.9	0.5	35	103	4	6	9	77.9	265
F11	107.6	2.6	54	174	5	7	17	127.9	411

11.5.2 Rural Road Improvement Program

The projects B01 to B05 contain several sub-projects of road improvement in each of the 5 rural districts in Hanoi city. No reliable traffic data was available for assessing the benefits of the rural road improvements. In consequence it was decided to rank these by means of a population served to cost ratio, since traffic and benefits will be highly

correlated with the population in the road's catchment area.

Table 11-5-3 Project Package Priority

Project Package	Score					Priority Rank	Program Rank
	Benefit Scale	B/C	Veh.	Trip	Status		
A02	3	3	3	3	1	A	A-2
A03	3	3	3	3	1	B	B-2
A04	3	3	3	3	1	B	B-2
A05	1	1	2	2	2	C	C-2
A06	2	2	1	1	3	A	A-2
A07	3	2	3	3	3	A	A-1
A08	3	2	2	2	1	C	C-2
A09	2	2	3	3	1	C	C-3
D01	1	1	3	3	1	C	C-1
C01	3	2	3	3	1	C	C-2
C02	3	2	3	3	1	B	B-2
C03	3	2	2	2	2	A	A-3
C05	2	1	2	2	3	A	A-3
C61	1	1	1	1	1	C	C-2
C62	1	1	1	2	1	C	C-3
C63	2	2	2	3	1	C	C-3
C64	2	2	1	1	1	C	C-3
C65	2	1	1	1	1	A	A-3
C66	2	2	2	3	1	B	B-3
C67	2	3	3	3	3	A	A-2
C07	2	3	2	2	1	C	C-2
C09	2	2	1	1	3	B	B-1
G01	1	1	3	2	3	B	B-2
G02	1	2	2	2	3	B	B-3
G03	1	1	1	1	3	C	C-3
G04	1	1	3	2	3	B	B-3
G05	1	1	3	2	3	C	C-3
G06	1	2	2	1	3	B	B-3
G07	1	1	1	1	3	B	B-3
G08	1	1	1	1	3	C	C-3
E01	1	1	3	3	3	A	A-2
E02	3	3	2	2	3	A	A-1
E03	3	3	3	3	3	B	B-1
E04	3	3	2	2	3	B	B-1
E05	3	3	2	2	3	C	C-3
F02	3	3	3	3	3	B	B-2
F03	2	3	2	2	3	B	B-2
F05	1	1	2	2	3	C	C-3
F06	2	3	1	1	3	C	C-3
F07	2	3	2	3	3	B	B-3
F08	2	3	1	1	3	B	B-3
F09	2	2	1	1	3	C	C-2
F10	3	2	1	1	3	C	C-1
F11	3	3	1	1	3	C	C-1

For each of the 5 rural districts, schemes were ranked in descending order of population to cost ratio. The ranking is shown in Tables 11-5-4 (a) to (e). Based on the priority order and the budget, road improvements were packaged into four 5 year plan periods. Based on this priority ranking, the scheduling programs of the rural road improvement are graphically presented as shown in Fig. 11-5-3.

Table 11-5-4 Rural Road Improvement Program - Soc Son District

Link Code	Road Name	Length (m)	Carriage-way Width(m)	Shoulder Width(m)	Br.length (m)	Dependency	ROW Cost bil.VND	Rd.Imp.Cost bil.VND	Br.Imp.Cost bil.VND	Eng.Cost bil.VND	Total Cost bil.VND	Population Coverage	Pop/Cost	Pop/Km	IEE	Land-Use	Rank	Implemeting Program
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
SS-126	Trung Gia - Tan Hung	2,300	6	2		NH-3	0.013	9.9		1.2	11.1	17,877	1,610	7,773	D	A	1	Short
SS-129	Xuan Son - Yen Tang	5,000	5-7	2-3		NH-3	0.029	21.5		2.6	24.1	25,962	1,077	5,192	D	A	2	Term
SS-130	Yen Tang - Tan Hung	2,300	5	2		SS-129	0.027	9.9		1.2	11.1	14,926	1,343	6,490	D	A	3	
SS-109	Duc Hoa - Xuan Ky	3,600	4-6	0.5-1.5		SS-110	0.050	15.5		1.9	17.4	18,577	1,067	5,160	D	A	4	
SS-114	National Road 2-Phu Cuong	2,000	4-6	1-2		NH-2	0.028	8.6		1.0	9.7	9,961	1,031	4,981	D	A	5	
SS-112	Hong Ky - Nam Son	3,000	5 - 6	1.5 - 2		SS-1	0.041	12.9		1.5	14.5	14,760	1,019	4,920	D	A	6	
SS-116	National Road 3 - Mai Dinh	3,000	4-6	1-2		NH-3	0.055	12.9		1.5	14.5	12,262	845	4,087	D	C-I-R-V	7	
SS-118	National Road 3- Hong Ky	4,000	6	2-2.5		NH-3	0.023	17.2		2.1	19.3	15,455	801	3,864	D	A	8	
SS-121	Noi Phan - Xuan Ky	3,000	4-6	0.5-2		NH-3	0.059	12.9		1.5	14.5	12,262	845	4,087	D	A	8	
SS-110	Duong Huyen - Tien Tao	9,000	6	2		NH-3	0.111	38.7		4.6	43.5	34,270	789	3,808	D	C-I-R	9	
	Sub-Total	37,200					0.436	160.0	0.0	19.2	179.6	176,312	981	4,740				
SS-107	Da Hoi - Thanh Son	3,000	4-5	1-2		SS-111	0.028	12.9		1.5	14.5	11,169	772	3,723	D	A	1	Medium
SS-101	35 Road - Hien Luong	4,000	5	2		SS-120	0.062	17.2		2.1	19.3	14,751	763	3,688	D	A	2	Term
SS-106	Cho Trau - Do Tan	3,000	4-4.5	1-1.5	10	SS-111	0.028	12.9	0.8	1.6	15.4	11,169	727	3,723	D	A	3	
SS-127	Xuan Bach - Bac Ha	2,500	4.5-5	1		SS-101	0.019	10.8		1.3	12.1	8,384	692	3,354	D	A	4	
SS-123	Thai Phu - Dac Tai	7,000	4-7	0.5-2		NH-2	0.103	30.1		3.6	33.8	23,031	681	3,290	D	A	5	
SS-113	Mieu Tho - Dan Tao	3,000	4-6	0.5-2	10	SS-110	0.041	12.9	0.8	1.6	15.4	9,770	635	3,257	D	A	6	
SS-128	Xuan Duong - Xuan Tai	1,600	4-4.5	0.5-1	60	SS-2	0.012	6.9	4.5	1.4	12.8	7,306	572	4,566	D	A	7	
SS-102	35 Road - Minh Phu	3,000	4-6	0.5-2.5		SS-1	0.022	12.9		1.5	14.5	8,149	563	2,716	D	A	8	
SS-120	National road3- Airport	11,000	9-10	2-3		NH-3	0.000	47.3		5.7	53.0	28,416	536	2,583	D	A	9	
	Sub-Total	38,100					0.315	163.9	6.1	20.4	190.7	122,145	640	3,206				
SS-119	National Road 3 - Duc Hoa	4,000	4.5-6	1-1.2		NH-3	0.062	17.2		2.1	19.3	9,770	506	2,443	D	A	1	Long
SS-122	Nui Doi - Dong Bac	7,000	4.5 -7	1 -2.5		SS-113	0.061	30.1		3.6	33.8	16,696	494	2,385	D	A	2	Term
SS-103	35 Road - Phu Ha, Minh Tri	3,500	4	1		SS-1	0.061	15.1		1.8	17.0	8,149	480	2,328	D	A	3	
SS-104	Ap Vuong - An Tao	4,500	4 - 5	1		NH-3	0.144	19.4		2.3	21.9	10,381	475	2,307	D	A	4	
SS-115B	National Road 2- Xuan Hoa	4,000	5-7	1.5 -3		NH-2	0.015	17.2		2.1	19.3	8,801	457	2,200	D	A	5	
SS-108	Duc Hoa - Kim Lu	3,000	4-6	0.5-1.5		SS-110	0.035	12.9		1.5	14.5	6,315	436	2,105	D	A	6	
SS-125	Thang Tri - Minh Phu	5,000	4-6	0.5-2.5		SS-102	0.037	21.5		2.6	24.1	8,149	338	1,630	D	A	7	
SS-124	Thang Tri - Dong Do	11,000	4-5	1-2	8 - 4	SS-115	0.102	47.3	0.9	5.8	54.1	16,937	313	1,540	D	A	8	
SS-105	Cau river dike	38,000	4 - 6	1 - 2		SS-126	0.441	163.4		19.6	183.4	24,208	132	637	D	A	9	
	Sub-Total	80,000					0.957	344.1	0.9	41.4	387.4	109,406	282	1,368				
	Total	155,300					1.708	668.0	7.0	81.0	757.7	407,863	538	2,626				

Table 11-5-4 Rural Road Improvement Program - Dong Anh District

Link Code	Road Name	Length (m)	Carriage-way Width (m)	Shoulder Width(m)	Br.length (m)	Dependency	ROW Cost bil.VND	Rd.Imp.Cost bil.VND	Br.Imp.Cost bil.VND	Eng.Cost bil.VND	Total Cost bil.VND	Population Coverage	Pop/Cost	Pop/Km	IEE	Land-Use	Rank	Implementing Program
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
DA-105	Dong Quan - Viet Hung	1,000	6.5	2.5		NH-3	0.003	4.3		0.5	4.8	23,826	4,944	23,826	D	A	1	Short Term
DA-108	National Road 3 - Tam Xa dike	1,000	6.5	2.5		NH-3	0.006	4.3		0.5	4.8	17,662	3,663	17,662	D	A	2	
DA-1B	Nguyen Khe - Trai Lon B-2	1,000	5-7	1-3		NH-3	0.015	4.3		0.5	4.8	10,342	2,141	10,342	D	I	3	
DA-115	Cho Boi - Van Noi pagoda	3,000	6.5	2.5		NH-3	0.014	12.9		1.5	14.5	20,726	1,433	6,909	D	A	4	
DA-107	National Road 3 - Xuan Canh	1,200	6.5	2.5		NH-3	0.007	5.2		0.6	5.8	7,998	1,372	6,665	D	A	5	
DA-103	Thuy Lam - Van Ha	3,000	6.5	2.5	35	DA-102	0.010	12.9	2.6	1.9	17.4	18,866	1,086	6,289	D	A	6	
DA-113	Van Noi - Bac Hong	3,000	6.5	2.5		DA-3	0.009	12.9		1.5	14.5	17,688	1,224	5,896	D	A	7	
	Sub-Total	13,200					0.065	56.8	2.6	7.1	66.6	117,108	1,759	8,872				
DA-116	Viet Hung - Ngoc Hoi	4,000	6.5	2.5	12~30	DA-103	0.012	17.2	3.2	2.4	22.9	19,035	833	4,759	D	A	11	Medium Term
DA-112	Mai Chau - National Road 23	2,000	6.5	2.5		DA-5	0.004	8.6		1.0	9.6	7,991	829	3,996	D	A	12	
DA-120	Duong river dike	12,000	6.5	3.5		NH-3	0.041	51.6		6.2	57.8	34,020	588	2,835	D	A	13	
	Sub-Total	18,000					0.057	77.4	3.2	9.7	90	61,046	676	3,391				
DA-114	Van Noi - Kim Chung	6,000	6.5	2.5		DA-110	0.017	25.8		3.1	28.9	16,487	570	2,748	D	I	21	Long Term
DA-111	Manh Lung - National Road 23	3,000	6.5	2.5		DA-5	0.006	12.9		1.5	14.5	7,991	553	2,664	D	A	22	
DA-109	National Road 3 - Bac Hong	3,500	6.5	2.5		NH-3	0.022	15.1		1.8	16.9	9,282	548	2,652	D	A	23	
DA-104	Luong Quy - Calo river dike	4,000	6.5	2.5		DA-1	0.018	17.2		2.1	19.3	9,282	481	2,321	D	A	24	
DA-118	Ca Lo river dike	8,500	6	3		NH-3	0.049	36.6		4.4	41.0	12,684	309	1,492	D	A	25	
	Sub-Total	25,000					0.112	107.6	0.0	12.9	120.6	55,726	462	2,229				
	Total	56,200					0.234	241.8	5.8	29.7	277.5	233,880	843	4,162				

Table 11-5-4 Rural Road Improvement Program - Tu Liem District

Link Code	Road Name	Length (m)	Carriage-way Width(m)	Shoulder Width(m)	Br.length (m)	Dependency	ROW Cost bil.VND	Rd.Imp.Cost bil.VND	Br.Imp.Cost bil.VND	Eng.Cost bil.VND	Total Cost bil.VND	Population Coverage	Pop/Cost	Pop/Km	IEE	Land-Use	Rank	Implementing Program
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
TL-101	Cau Dien - Nga Tu Canh	2,100	4.5-5	1-1.5		TL-1	0.074	9.0		1.1	10.2	23,522	2,316	11,201	D	R	1	Short
TL-102	Cau Noi- Cau Dien	2,500	5.5	1-1.5		TL-1	0.046	10.8		1.3	12.1	23,522	1,937	9,409	D	R	2	Term
TL-103	De Quai Dong Ngac-Thuy Phuong	2,200	5.5	1-1.5		TL-9	0.030	9.5		1.1	10.7	14,920	1,398	6,782	D	R	3	
	Sub-Total	6,800					0.151	29.3		3.5	33.0	61,964	1,880	9,112				
TL-107	Nhan Chinh - Truong Cong An	3,500	4.5	1-1.5		TL-8	0.081	15.1		1.8	17.0	20,281	1,194	5,795	D	V	1	Medium
TL-110	Thuong Cat - Liem Mac - Thuy Phuong	7,000	5.5	1-1.5		TL-103	0.097	30.1		3.6	33.8	26,261	777	3,752	D	R	2	Term
	Sub-Total	10,500					0.177	45.2		5.4	50.8	46,542	916	4,433				
TL-106	Me Tri - Dai Phat Thanh	2,700	3.5-5	1-1.5		TL-8	0.075	11.6		1.4	13.1	7,180	549	2,659	D	R-I	1	Long
TL-104	De Quai Xuan La - Xuan Dinh	5,000	5.5			TL-9	0.116	21.5		2.6	24.2	8,833	365	1,767	D	R	2	Term
	Sub-Total	7,700					0.190	33.1		4.0	37.3	16,013	430	2,080				
	Total	25,000					0.518	107.6		12.9	121.0	124,519	1,029	4,981				

Table 11-5-4 Rural Road Improvement Program - Gia Lam District

Link Code	Road Name	Length (m)	Carriage-way Width(m)	Shoulder Width(m)	Br.length [m]	Dependency	ROW Cost bil.VND	Rd.Imp.Cost bil.VND	Br.Imp.Cost bil.VND	Eng.Cost bil.VND	Total Cost bil.VND	Population Coverage	Pop/Cost	Pop/Km	IEE	Land-Use	Rank	Implementing Program
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
GL-101B	Co Bi - Da Ton -2	1,200	4.5 - 6	1-2	20	NH-5	0.020	5.2	1.5	0.8	7.5	26,948	3,582	22,457	D	V	1	Short Term
GL-104B	Doc Van - Trung Mau-2	1,500	4.5	1-2		GL-1	0.035	6.5		0.8	7.3	18,141	2,480	12,094	D	A	2	
GL-107	Keo - Kim Son dike	600	4	1-2		GL-7	0.017	2.6		0.3	2.9	5,918	2,021	9,863	D	A	3	
GL-112	Nam Xa	8,500	3	1-2		GL-1	0.313	36.6		4.4	41.3	44,752	1,083	5,265	D	A	4	
GL-109	Sui - Kien Thanh	1,470	5.5 - 6	1-2		NH-5	0.018	6.3		0.8	7.1	7,595	1,074	5,167	D	A	5	
GL-101C	Co Bi - Da Ton -3	2,700	4.5 - 6	1-2		GL-101B	0.045	11.6		1.4	13.0	10,914	837	4,042	D	V	6	
GL-110	Viet Hung - Giang Bien	3,500	4	1-2		NH-1B	0.097	15.1		1.8	17.0	10,868	639	3,105	D	R	7	
	Sub-Total	19,470					0.543	83.9	1.5	10.2	96.2	125,136	1,301	6,427				
GL-108	Viet Hung - Phu Thi	6,600	5	1-2	3	NH-1B	0.121	28.4	0.2	3.4	32.2	20,173	627	3,057	D	R-I	11	Medium Term
GL-111	Le Mat	2,000	4	1-2		NH-5	0.055	8.6		1.0	9.7	5,936	613	2,968	D	R	12	
GL-103B	Pho Bo - Hoi Xa-2	2,150	4	1-2		GL-101A	0.059	9.2		1.1	10.4	6,267	605	2,915	D	A	13	
Gl-6	Long Bien -Xuan Quang	11,400	5	1.5		NH-1B	0.210	49.0		5.9	55.1	22,201	403	1,947	D	V	14	
	Sub-Total	22,150					0.446	95.2	0.2	11.4	107.3	54,577	509	2,464				
GL-105	Phu Thi - Duong Quang	4,000	3	1-2	6 + 19.2	GL-2	0.147	17.2	1.9	2.3	21.5	8,414	391	2,104	D	A	21	Long Term
GL-7	Duong left dike	18,500	5-6	-		NH-1B	0.255	79.6		9.6	89.4	20,851	233	1,127	D	R-I	22	
GL-106	Le Chi - Keo	4,100	3	1-2		GL-7	0.151	17.6		2.1	19.9	8,610	433	2,100	D	A	23	
Gl-8	Duong right dike	14,500	5-6	-		NH-1B	0.200	62.4		7.5	70.1	14,947	213	1,031	D	A	24	
	Sub-Total	41,100					0.753	176.8	1.9	21.4	200.9	52,822	263	1,285				
	Total	82,720					1.742	355.9	3.6	43.1	404.4	232,535	575	2,811				

Table 11-5-4 Rural Road Improvement Program - Thanh Tri District

Link Code	Road Name	Length (m)	Carriage-way Width(m)	Shoulder Width(m)	Br.length (m)	Dependency	ROW Cost bil.VND	Rd.Imp.Cost bil.VND	Br.Imp.Cost bil.VND	Eng.Cost bil.VND	Total Cost bil.VND	Population Coverage	Pop/Cost	Pop/Km	IEE	Land-Use	Rank	Implementing Program
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
TT-105	Khuong Dinh	1,000	3.5-5	1.5		TT-103	0.039	4.3		0.5	4.9	7,417	1,528	7,417	D	R	1	Short Term
TT-106	Ngoc Hoi	2,000	3.5-5	1.5		NH-1A	0.062	8.6		1.0	9.7	6,476	668	3,238	D	V	2	
TT-107	Nhan Vinh	3,000	3.5-5	1.5		TT-113	0.074	12.9		1.5	14.5	26,869	1,850	8,956	D	A	3	
TT-7B	Hong River dike-2	3,000	3.5	-		TT-5	0.082	12.9		1.5	14.5	18,184	1,251	6,061	D	A	4	
TT-101	Bang Liet	3,000	3.5-5	1.5	20	NH-1	0.059	12.9	1.5	1.7	16.2	16,843	1,041	5,614	D	A	5	
TT-102	Dai Tu	1,800	3.5-5	1.5		TT-3	0.069	7.7		0.9	8.7	8,852	1,018	4,918	D	V	6	
	Sub-Total	13,800					0.383	59.3	1.5	7.3	68.5	84,641	1,236	6,133				
TT-108	Nhi Chau	3,000	3.5-5	1.5		NH-1	0.059	12.9		1.5	14.5	14,484	998	4,828	D	A	1	Medium Term
TT-114	Yen Nguu	1,100	3.5-5	1.5	35	NH-1A	0.021	4.7	2.6	0.9	8.2	7,991	975	7,265	D	A	2	
TT-115	Nhan Hoa - Sieu Quan	2,500	3.5-4	1.5		TT-107	0.058	10.8		1.3	12.2	11,664	960	4,666	D	A	3	
TT-116	Yen My	1,000	3.5	-		TT-9	0.032	4.3		0.5	4.8	3,847	793	3,847	D	V	4	
TT-117	Yen My - Van Phuc	2,500	3.5-5	-		TT-116	0.058	10.8		1.3	12.2	8,053	663	3,221	D	A	5	
TT-110	Tan Trieu	2,000	3.5-5	1.5		TT-8	0.035	8.6		1.0	9.7	6,262	648	3,131	D	V	6	
TT-113	Vinh Quynh	4,500	3.5-5	1.5		TT-106	0.138	19.4		2.3	21.9	13,546	619	3,010	D	A	7	
	Sub-Total	16,600					0.400	71.5	2.6	8.9	83.4	65,847	790	3,967				
TT-103	Dinh Cong	2,700	3.5-5	1.5		TT-3	0.104	11.6		1.4	13.1	7,417	566	2,747	D	R	1	Long Term
TT-109	Ta Thanh Oai	4,500	3.5-5	1.5		TT-1	0.078	19.4		2.3	21.8	11,664	535	2,592	D	A	2	
TT-112	Van Phuc	2,300	3.5-5	1.5		TT-2	0.033	9.9		1.2	11.1	5,239	471	2,278	D	A	3	
TT-104	Duyen Ha	4,000	3.5-5	1.5		TT-112	0.037	17.2		2.1	19.3	5,239	271	1,310	D	V	4	
	Sub-Total	13,500					0.252	58.1	0.0	7.0	65.3	29,559	452	2,190				
	Total	43,900					1.035	188.9	4.1	23.2	217.2	180,047	829	4,101				

Note : IEE: Initial Enviroment Examination
D : No negative impact
A : Agricutural area
I : Industrial area
V : Village
R : Residential area
C : Commercial area

Impelementing Program
Short-Term : 1996-2000
Medium- Term : 2001-2005
Long-Term : 2006-2015

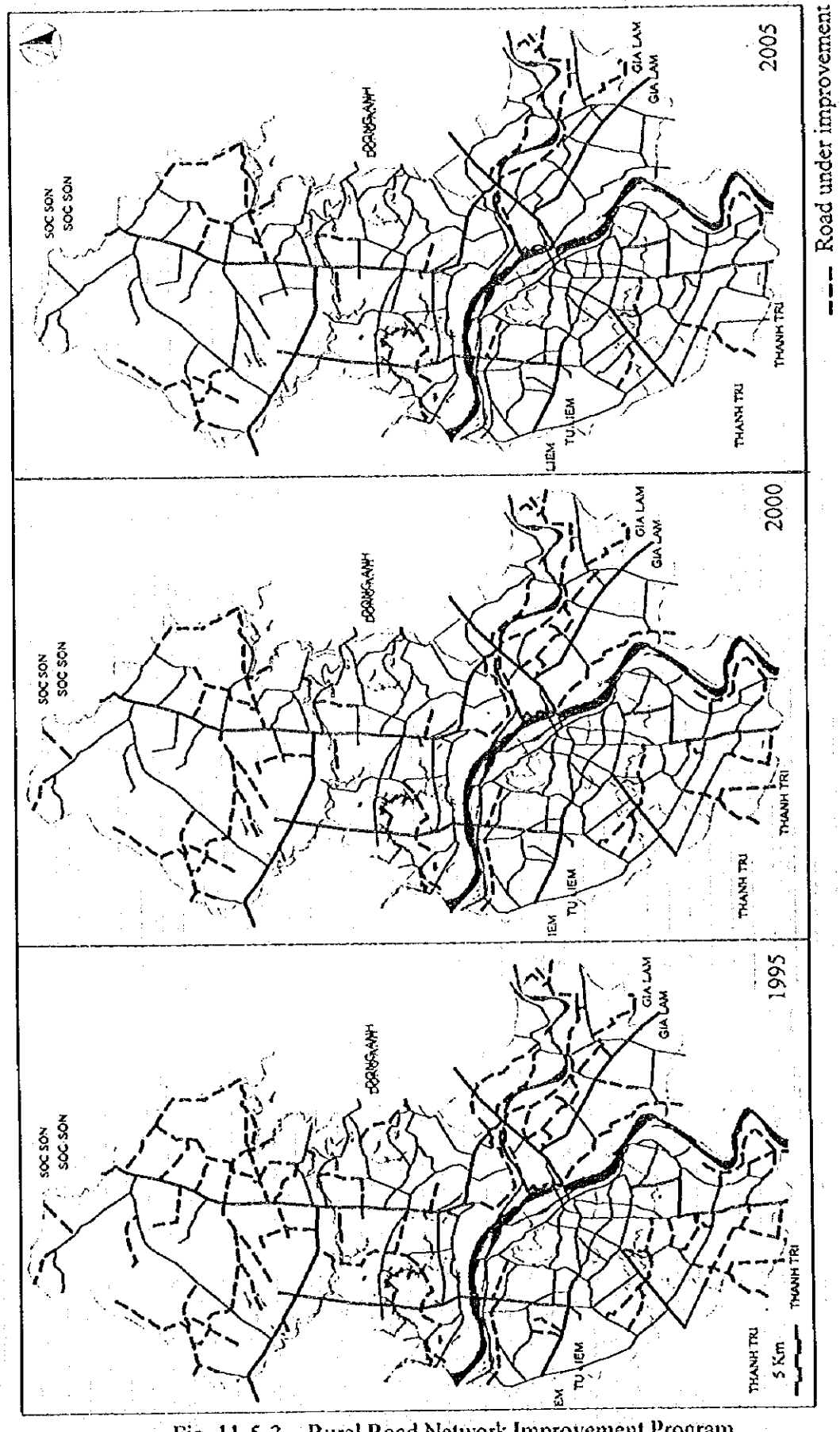


Fig. 11-5-3 Rural Road Network Improvement Program