18.2 Road

18.2.1 General

The Preliminary design of the road network in the New CBD should be based on the geometric design standards of highways in the Vietnam prepared by the Ministry of Construction. There are the Vietnam Technical Design Specification for Urban street and Open Square Road for the Urban Roads (cord: 20TCN - 104 - 83) and Highway Design Standards (TCVN 4053 - 85) for the rural roads.

Vietnamese specification were carefully studied and compared with "A Policy on Design and Streets "1994, American Association of State Highway and Transportation Officials (AASHTO) and the road Standard Ordinance of Japan. As a result of comparing the three design standards and guidelines, the adopted references for this study are the guideline of AASHTO, and the Vietnamese Technical Design Specification. Likewise, Japanese standards were also adopted as a secondary reference.

The basic design criteria for road design are based on the projected traffic volume on the network to determine the number of traffic lanes, roadway and intersection geometric characteristics, roadway structural design and horizontal and vertical alignment. Assignment results for present and future traffic volumes are shown in Fig. 18-2-1. The applied design criteria for this study are only the basic items so that more detail items need to be examined for each individual.

18.2.2 Road Classification

4 classes of roads are considered in which specific standards are established to specify each of various elements. There are as follows:

(1) Urban Arterial Road

Urban Arterial Road are planned as two types of road which are the main road of the New CBD connecting to Buoi and Thon Dong and the extension of Ring Road No.2. These roads will be designed as six-lane motorized two-lane non-motorized carriageways divided by a center median and separate edge strip and side walk.

The width of sidewalk with planning area will be 7m and a separate strip between motorized lane and non-motorized lane will be designed as mount-up type and have a 3.0m width. This can be used as a bus stop lane to cut off the separate strip. The necessary road right of way width to accommodate the proposed design would be 66.5m for the Urban Arterial Road No.1 and 57.5m for Urban Road No.2, as shown in Fig. 18-2-2.

(2) Urban Collector Roads

The Urban Collector Roads are planned with three road widths different for access service and traffic circulation within residential neighborhoods and the commercial are. They differ from the arterial system in that facilities on the collector system may

penetrate the area of ultimate traffic destinations.

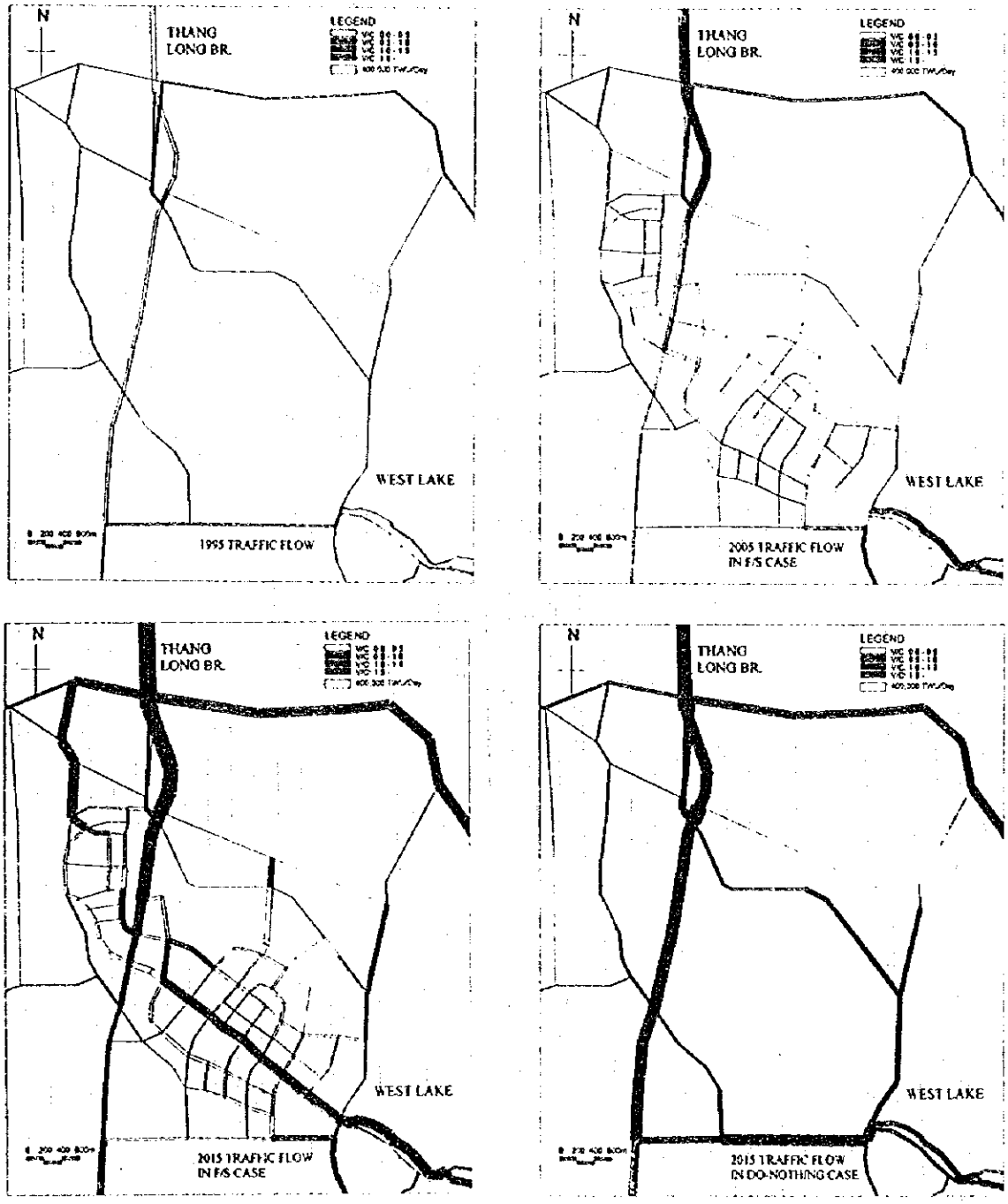


Fig. 18-2-1 Traffic Volumes on New CBD Road Network

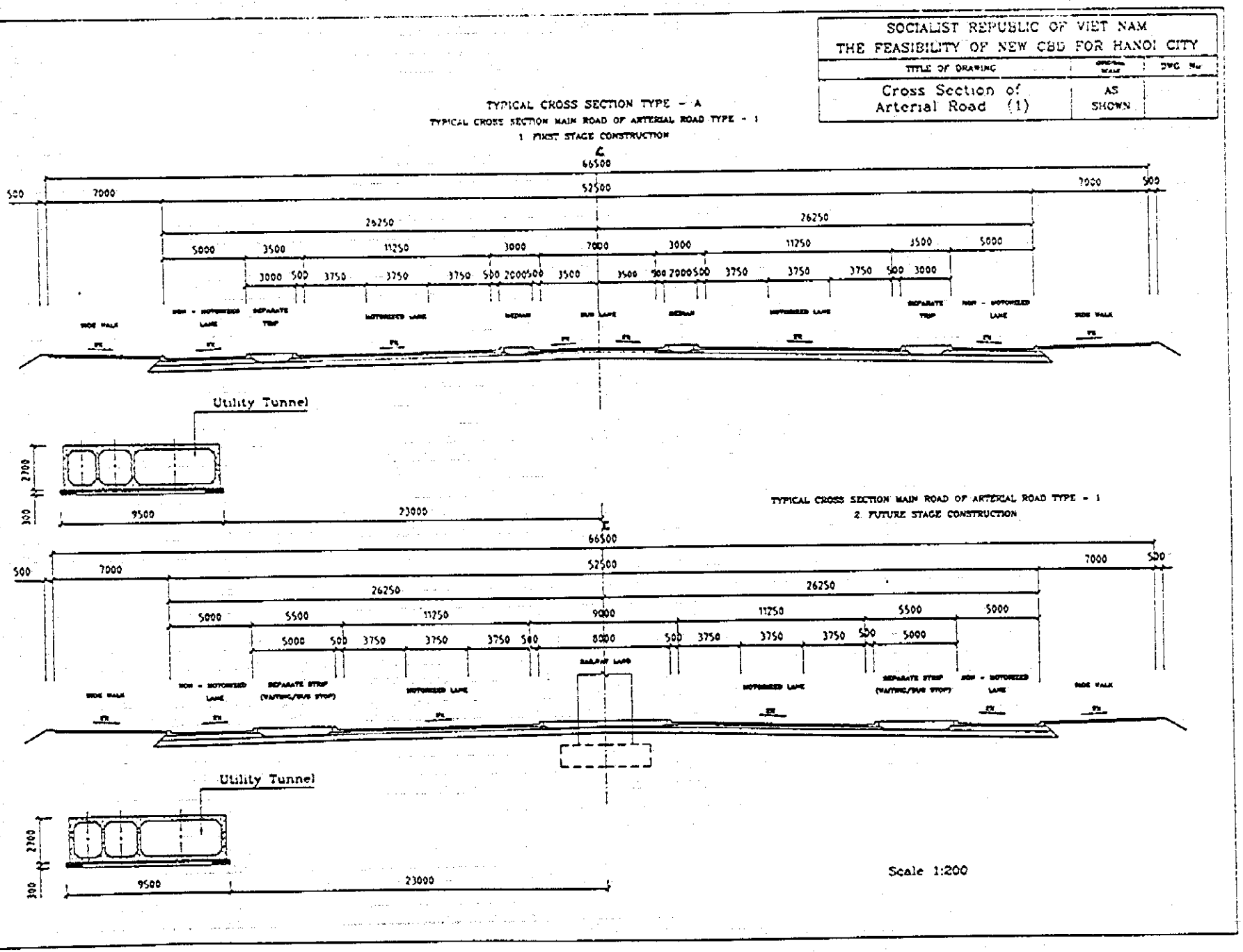


Fig. 18-2-2 Standard Road Cross Section

Type one (C) and type two (D) roads would form the main street inside the New CBD and type three roads (E) would form the boundary of the new CBD ad existing housing area and divided the residential blocks. Type one and two roads would have a center median, but type three roads would not have a center median. The sidewalk width for these roads would be 6.0 - 5.0m and the parking lane width would be 2.5m. The necessary road right of way width to accommodate the proposed design would be 44.0m to 31.0m.

(3) Promenade

A promenade is planned for the access road to the New CBD central railway station. This would be either 30m-60m wide pedestrian road or the urban collector road type with a carriageway width of 29m and two walkways 15.5m wide.

(4) Feeder Road

Feeder roads are required to provide viability and serviceability for the New CBD commercial center and residential area. The urban local road system serves the functions which are not carried out by the higher systems.

18.2.3 Cross Section and Geometric Design Standard

Typical cross section of the each roads are shown in Appendix 19A. The width of lane, median and bicycle lane are as specified on the Vietnam standard. To determine the appropriate geometric designs standard the Vietnamese, AASHTO and Japanese standards were composed. From this comparison a suitable set of geometric design standards were developed. These are shown in Appendix 18A on comparison with the three standards mentioned above.

18.2.4 Crossing Criteria

The planning of grade separated interchanges should be kept within the dictated by the construction limits for each crossing facility. The construction limits for each facility are as follows:

1) Road: Vertical clearance of roads should be more then 4.80m with allowance for two of overlay for future maintenance.
2) Railway: Vertical clearance of railway should be more than 6.0m.
3) River/Creek: The rivers in the new CBD area are not used for navigation because they are primarily for irrigation and drainage. Therefore, clearance between high water level and the bear soffit should be at least 1.50m.

18.2.5 Structure Design Criteria

1) Earth Work/Gradient of Slope

The topographic features of the New CBD are generally flat and the rise and fall of the land is only 1.0m - 2.0m. According to the construction plan, it is necessary to raise the

development area by more than 1.0m for drainage discharge and as a countermeasure for flooding. Therefore, embankment slopes will occur at the boundary of the New CBD and the existing residential area. The construction of New CBD will start with the access roads. The embankment slopes of those roads and the boundary have to be protected.

Embankment materials are planned to be dredged sandy soil from the Red River. The filling height of New CBD will be a maximum of 1.0m - 2.0m. Therefore, the study applied the embankment gradient 1: 1.5 based on the Vietnamese standard.

2) Slope Protection

Slope protection will principally be by planting. Retaining walls will be used only in the case where necessary, due to difficulty of land acquisition or unstable soil conditions.

18.2.6 Road Alignment

1) Basic Concept

Road horizontal and vertical alignment was designed using 1:2,500 scale topographic maps based on the land use plan in New CBD.

Road alignments design should be considered to harmonize with the New CBD area and match adjacent agricultural and residential areas. It should also provide for the safe traffic flow and pleasant drive. The road alignments in the New CBD were designed using established design criteria for the road characteristics. The following items were considered on road alignment design:

- Combination of alignment and continuation
- Arterial road (type A and B) and collector road No.1 (type C) were designed to be composed of straight lines, curves and transition curves.
- Collector roads No.2 and No.3 (type D and E) and feeder roads designed to be composed of straight lines, curves and intersection with feeder roads.
- Traffic safety design for non-motorized traffic should be undertaken around intersection areas.
- Vertical alignment design is subject to the filling plan, land condition of outer New CBD area and drainage discharge plan. Maximum vertical gradient for flyover sections were less than 5% on consideration with the motorcycle performance.
- Alignment of feeder road is designed to consider the following aspects:
  - * Straight line length applied should not exceed 20 to 30 times of road width.
  - * Design of feeder road considers not only the traffic function of car but also pedestrians safety.
  - * Alignment of roads is arranged to avoid direct connections with main streets.
  - * Intervals of feeder roads are planned to be at least 500m apart, and to avoid concentrations of traffic.

The designed roads comprise 22 main roads (arterial and collector roads), 2 walkways (promenade) with a total length of 34.170m. A summary of the designed roads in the

New CBD for each road classification is presented in Table 18-2-1, while the alignment plan is shown in Fig. 18-2-3.

Table 18-2-1 Designed Roads

Road Class	Route Number	Length (m)
Arterial Road	A - 1, B - 1	4,046
Collector Road No.1	C - 1 - 3	9,656
Collector Road No.2	D - 1 - 6	6,686
Collector Road No.3	E - 1 - 11	12,330
Subtotal		32,718
Walkway	H - 1 - 2	1,447
Total		34,165

Feeder roads, with a length of about 25 Km, are designed mainly for the calculation of project cost, so no detailed designs were made for the feeder roads.

2) Horizontal and Vertical Alignment Design

The summary of Alignment Design is shown in Table 18-2-2.

The elements of horizontal alignment used for main roads are straight line, curve line (R = 100m - 1,000m) and transition curve (A = 150 - 450).

In the vertical alignment design of the land fill plan of the New CBD, the surrounding residential areas and road on 2 to 3m high land fill (embankment) and drainage were considered. The natural slope of the land is 0.05% - 0.1% from North to South. For flyovers a maximum gradient of 9% was selected to cater for 2 wheelers traffic. Additional flyovers are planned for bicycle and pedestrian traffic.

Table 18-2-2 Summary of Alignment Design

A: Constitution of Horizonal Alignment			
Item	Element	Length	Rate (%)
Arterial Road Type A & B	Straight	2,298	64.8
	Circular Curve	871	24.6
	Clothoid Curve	377	10.6
	Sub-Total	3,546	100
Collector Road (1) Type C	Straight	4,266	44.2
	Circular Curve	2,776	28.7
	Clothoid Curve	2,615	27.1
	Sub-Total	9,657	100
Collector Road (2) Type D	Straight	4,993	74.7
	Circular Curve	1,693	25.3
	Clothoid Curve	0	0
	Sub-Total	6,686	100
Collector Road Type E	Straight	8,449	68.5
	Circular Curve	3,880	31.5
	Clothoid Curve	0	0
	Sub-Total	12,329	100
B: Radias of Curve			
Item	Radias (m)	Length	Rate (%)
Arterial Road Type A & B	1,500=>R>=1,000	640	36.6
	1,000>R>= 500	1,110	63.4
	500>R>= 150	0	0
	150>R>= 100	0	0
	Sub-Total	1,750	100
Collector Road (1) Type C	1,500=>R>=1,000	453	8.4
	1,000>R>= 500	3,328	61.7
	500>R>= 150	1,610	29.9
	150>R>= 100	0	0
	Sub-Total	5,391	100
Collector Road (2) Type D	1,500=>R>=1,000		0
	1,000>R>= 500	1,222	72.2
	500>R>= 150	471	27.8
	150>R>= 100	0	0
	Sub-Total	1,693	100
Collector Road Type E	1,500=>R>=1,000	220	5
	1,000>R>= 500	1,905	12.9
	500>R>= 150	2,052	46.2
	150>R>= 100	266	6
	Sub-Total	4,443	100
C: Vertical Alignment			
Item	Verticle Grade	Length (m)	Rate(%)
Item Arterial Road Type A & B	0.0<= g <=0.3	3,676	90.9
	0.3< g <=0.5	370	9.1
	0.5< g <=1.0	0	0
	1.0< g <=2.0	0	0
	2.0< g <=5.0	0	0
	Sub-Total	4,046	100
Collector Road (1) Type C	0.0<= g <=0.3	8,037	83.2
	0.3< g <=0.5	370	3.8
	0.5< g <=1.0	0	0
	1.0< g <=2.0	0	0
	2.0< g <=5.0	1,249	12.9
	Sub-Total	9,656	100
Collector Road (2) Type D	0.0<= g <=0.3	5,957	89.1
	0.3< g <=0.5	330	4.9
	0.5< g <=1.0	275	4.1
	1.0< g <=2.0	25	0.4
	2.0< g <=5.0	100	1.5
	Sub-Total	6,687	100
Collector Road Type E	0.0<= g <=0.3	13,579	98.6
	0.3< g <=0.5	100	0.7
	0.5< g <=1.0	75	0.5
	1.0< g <=2.0	24	0.2
	2.0< g <=5.0	0	0
	Sub-Total	13,778	100

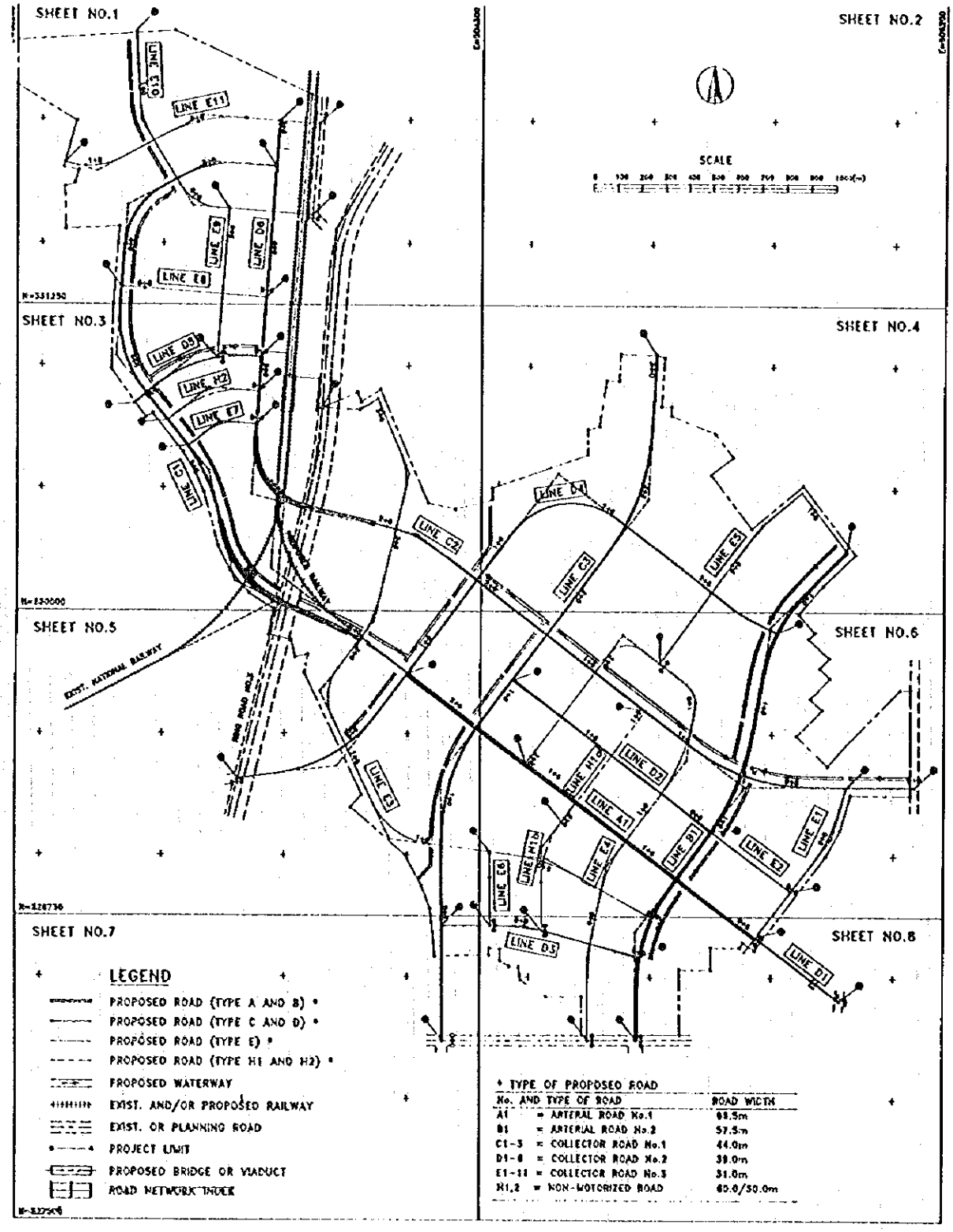


Fig. 18-2-3 Road Alignment Plan

18.2.7 Pavement Design

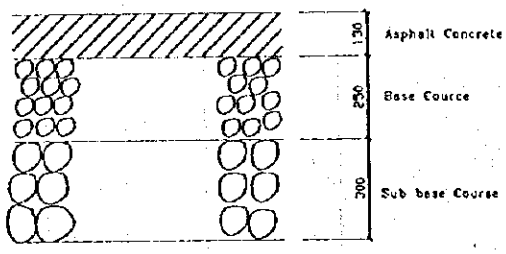
Pavement design in Vietnam is specified in the Standard on Design Procedure of Flexible Pavement 22tcn - 211 - 93, MOT. According to the Vietnamese standard, the design of pavement thickness is calculated by the deflection method using the elastic modulus of pavement material and a wheel load.

This method has some problems as there is no available data for the elastic modulus of the pavement material, therefore, this study applied "The Guideline of Asphalt Pavement" of the Japan Road Association. The pavement design condition is shown in the Table 18-2-3. The pavement structures of each road class is shown in Fig. 18-2-4

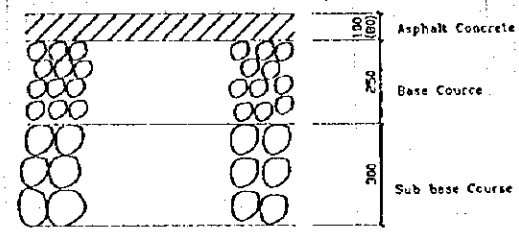
Table 18-2-3 Pavement Design Condition

Description	Arterial Road (type A and B)	Collector Road (type C, D and E)	Feeder Road (type F and G)
Design California Bearing Ratio (CBR Value)	More than 6	More than 6	More than 6
Traffic Volume for Big Bus and Truck	1,000-3,000 V/D/One Direction	250-1,000 V/D/One Direction	100-250 V/D/One Direction
Equivalent Pavement Thickness	More than 28	More than 21	More than 16
Class of Traffic	C	B	A

1) Arterial Road (Class - C, Bus, truck 1,000 ~ 3,000 ADT, 1-way, TA = 29.75 > 28.0



2) Collector Road (Class - B, Bus Truck 250 ~ 1,000 ADT, 1-way), TA = 26.45 (24.45) > 21.0



3) Feeder Road (Class A, Bus, Truck 1.00 ~ 250 ADT, 1-way), TA = 18.25 (17.25) > 16.0

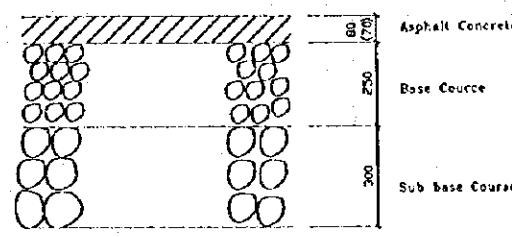


Fig. 18-2-4 Pavement Structure

18.2.8 Drainage Design

1) Classification and Function

The Drainage facilities of surface water are classified as road surface, slope and adjoining land drainage. The function of those facilities is as follows:

Road surface water discharge facility
Surface water is collected by the concrete curb and discharged by the catch basin at shoulder or center median.

Slope face water discharge facility
Collection and discharge water uses side ditch at berm and toe of the slope.

Road adjoining land discharge facility
Rainfall on the adjoining is discharged by means of a ditch at the boundary of road and road crossing structure (reinforced concrete pipe culvert or reinforced concrete box culvert).

2) Drainage Design

Design of surface water discharge facility is calculated using the probable rainfall intensity and allowable discharge area.

(1) Design year for discharge facility
Rainfall intensity for calculation of design discharge volume is applied as classified below:

- Road Surface Water — 3 years probability rainfall intensity
- Slope Face Water — 3 year probability rainfall intensity
- Road Adjoining land — 5 years probability rainfall intensity

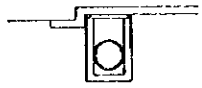
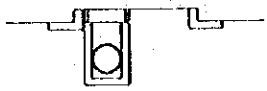
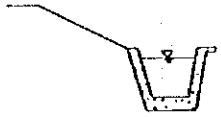
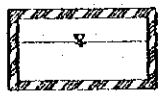
(2) Rainfall Intensity
Rainfall intensity is shown in Table 5-3-3 in Chapter 5.

(3) Calculation of Design Discharge Volume
Design discharge volume is calculated applying empirical and theoretical formula in Vietnam.

(4) Planning of Road Crossing Structure
In case of design discharge volume of 3-20 QM/SEC, Reinforced Concrete Box Culvert (RCBC) should be applied. Details of RCBC is shown in Drawing No.58 to No.61. In case of design discharge volume less than 3 QM/SEC, a RCPC with a minimum diameter of 600mm should be applied.

(5) Drainage Structure
The type of discharge facility based on design criteria and standard of Vietnam is shown in Table 18-2-4.

Table 18-2-4 Type of Drainage Structure

Classification of Drainage Structure		Type	
Drainage structure of road surface and	Shoulder	Cerb and inlet	
	Center Median	Cerb and inlet	
	Toe and Top of shoulder	Side ditch (Rip rap)	
Drainage structure of road adjacent area	Design ditch Volume 3~20 m³/IDC	Reinforced Concrete box culvert	
	Design ditch volume less than 3m³/IDC	Reinforced Concrete pipe culvert	

18.2.9 Road Safety Devices

Safety facilities are important considering Hanoi's traffic conditions. Marking and Signs of international standards are necessary.

1) Segregation of MV and NMV

Physical barriers for segregation of motorized and non-motorized vehicles are required to provide safety for road users.

Arterial Road:
The width of MV Lane was determined considering the width of bus stop.

Collector Road:
Type 1, 2 with segregation of MV and NMV
Type 3 without center median.

2) Parking Lane

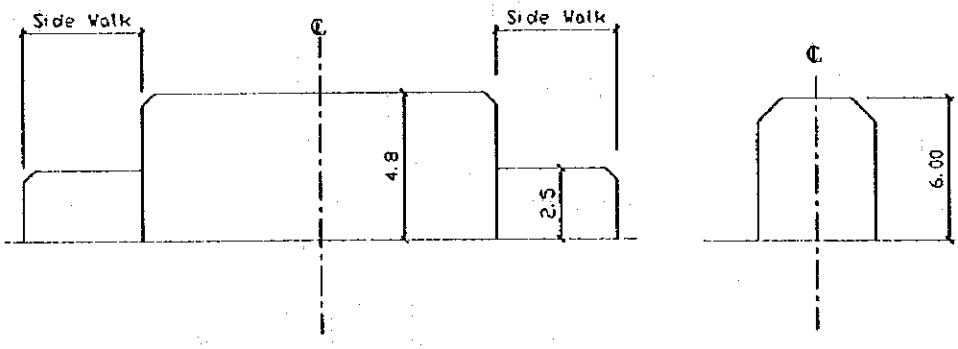
A parking lane is located beside the NMV Lane. Along Arterial Road, no parking lane is installed, as it is in the central area of the New CBD. Instead, parking space will be allocated off street within each block. The width of parking lanes is based on the Vietnamese Standard.

18.3 Viaduct/Bridge

18.3.1 Design Criteria

1) Clearance Limit

The applied standard clearance limit for road and railway structures is shown in Fig. 18-3-1.



(a) Road (a) Railway

Fig. 18-3-1 Clearance Limit of Road/Railway

2) Under Clearance of Bridge

Clearance under the bottom of superstructures and design flood level will be more than the minimum values shown in Table 18.3.1. Under clearance of bridge is shown in Fig. 18-3-2.

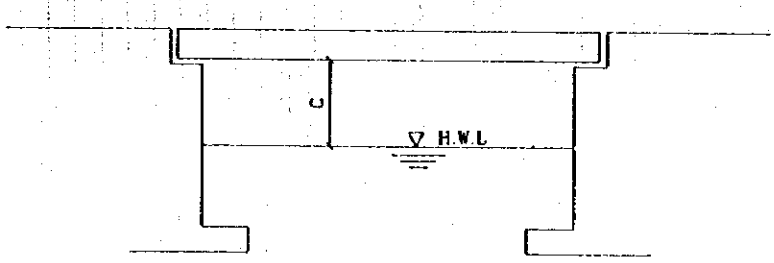


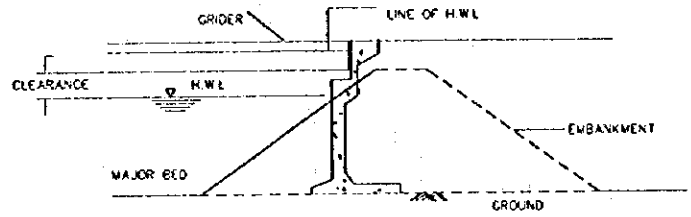
Fig. 18-3-2 Under Clearance of Bridge

Table 18-3-1 Minimum Clearance

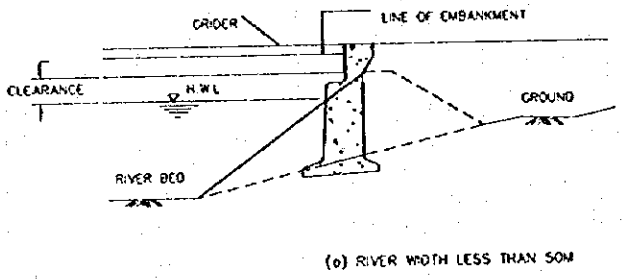
	Design Flood Discharge (m/sec)	Clearance (m)
1	Less than 200	0.6
2	200 - 500	0.8
3	500 - 2,000	1.0
4	2,000 - 5,000	1.2
5	5,000 - 10,000	1.5
6	More than 10,000	2.0

3) Location of Abutments

Abutments should be located at the place where the abutment does not disturb the stream flow, as illustrated in Fig 18-3-3. Abutments should be located at a place where clearance is more than 2.5m.



(a) River Width more than 50m



(b) River Width less than 50m

Fig. 18-3-3 Abutment and River Width

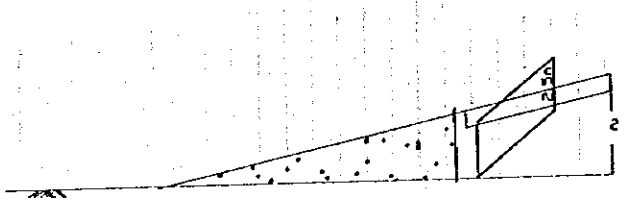


Fig. 18-3-4 Abutment of Viaduct

4) Loading

Structures would be designed to carry the following loads and forces:

1) Dead load;
2) Live load;
3) Impact or dynamic effect of the live load;
4) Wind load; and
5) Effect of the earthquake.

- The dead load will consist of the weight of the entire structure including the roadway, sidewalks and other public utility services

- The live load will consist of the weight of vehicles and pedestrians. The loads being adopted in this feasibility study are from the standard of Vietnam. There are five standard classes of loading: H.10, H.13, H.30, XB80, and X60 shown in the Fig. 18-3-5 and Fig. 18-3-6 and the criteria car line H.30 in the case of the standard is used.

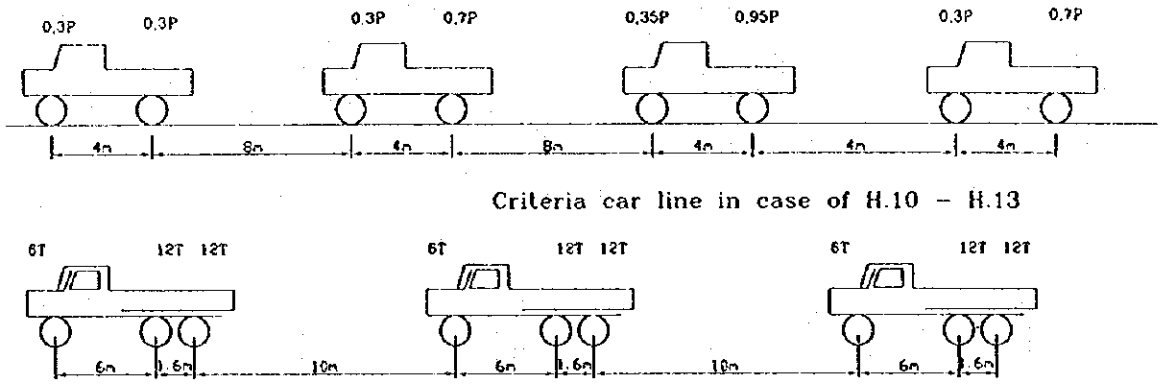


Fig. 18-3-5 Criteria Car Line

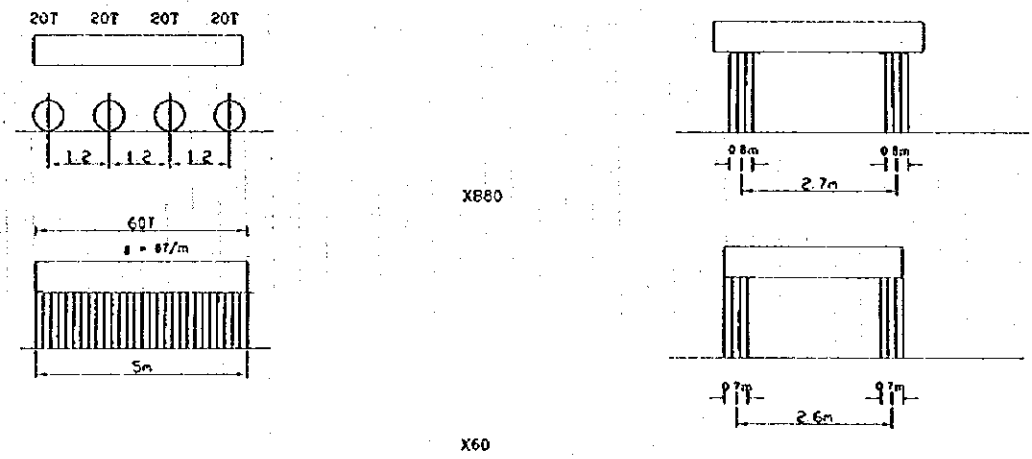


Fig. 18-3-6 Standard Classes of Loading

5) Effect of Earthquake

Design should be based on Earthquake - Resistant design.

18.3.2 Super Structure

1) Bridge type and Span length

Selection of the type of Bridge and Span length is shown the Fig. 18-3-7.

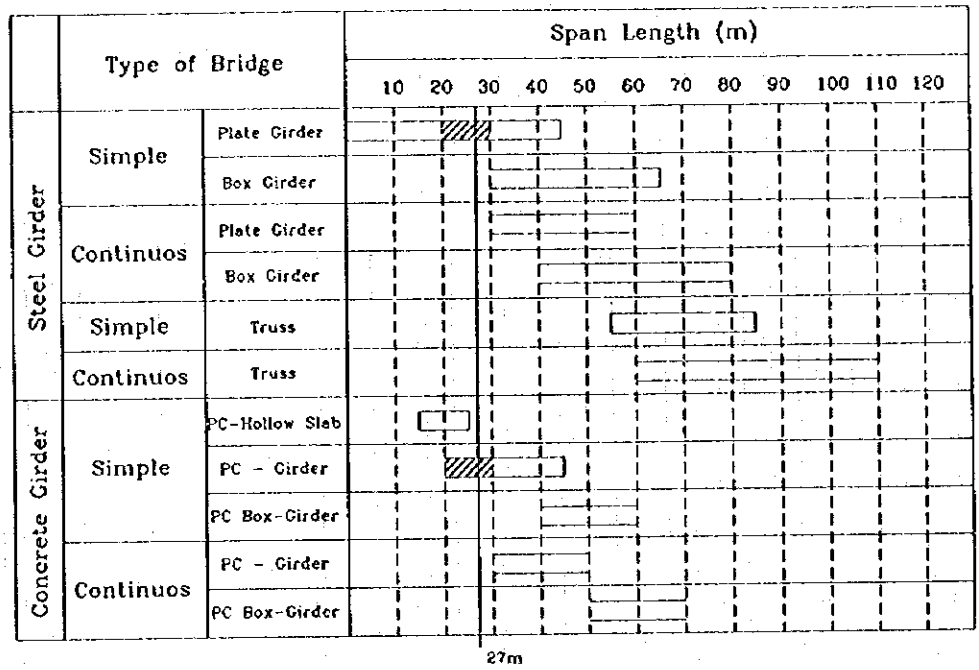


Fig. 18-3-7 Type of Bridge and Span Length

2) Standard of Bridge Width

The flyover width applied in this study consists of the road width only.

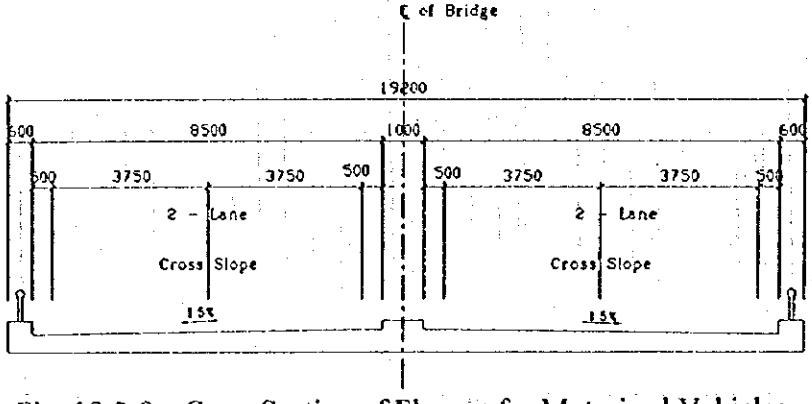


Fig. 18-3-8 Cross Section of Flyover for Motorized Vehicles

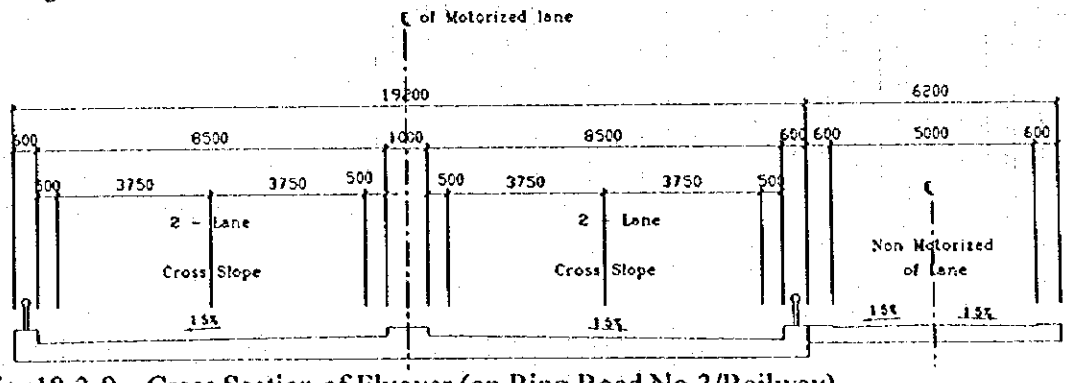


Fig. 18-3-9 Cross Section of Flyover (on Ring Road No.3/Railway)

The flyover width applied in this study consists of the roadway width (Motorized lane) and bicycle way width (non Motorized lane) on one side of the bridge (See Fig. 18-3-9). For crossing of RR-3 over railway lines.

3) Girder Arrangement

An example of concrete girder (PC Girder) is shown in Fig. 18-3-10.

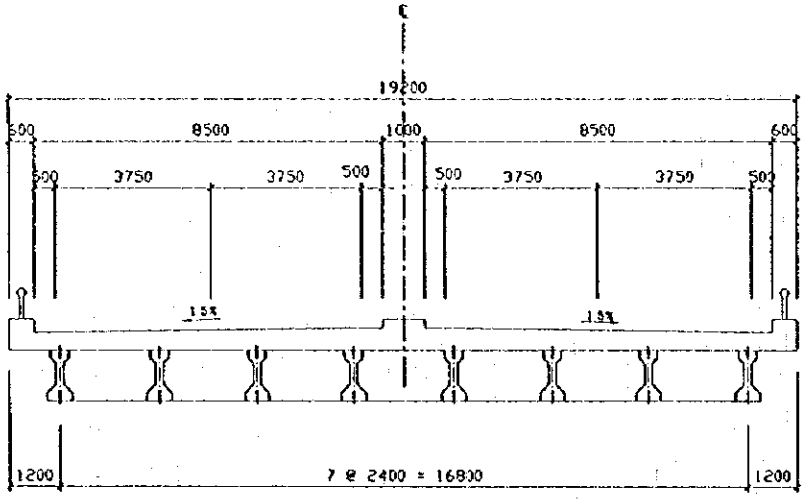


Fig. 18-3-10 Concrete Girder

An example of steel girder is shown in Fig. 18-3-11.

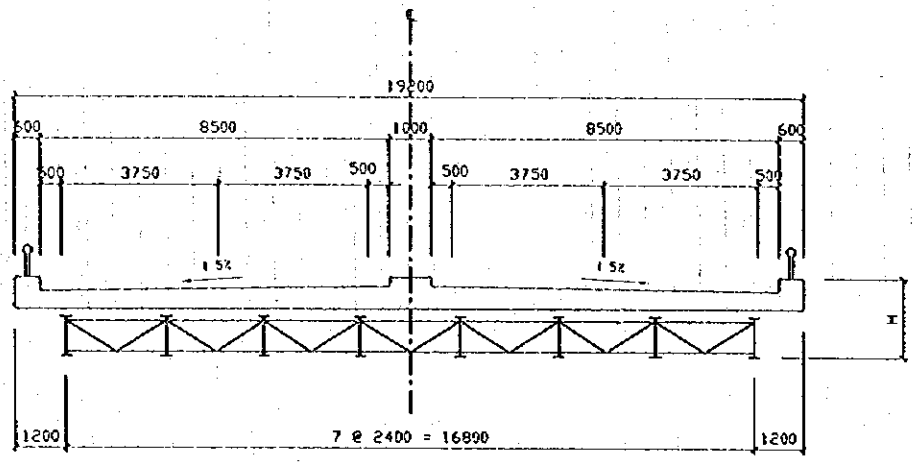


Fig. 18-3-11 Steel Girder

4) Girder Height and Span Length

Comparison of girder heights and span length for Precast Concrete (PC) and Steel is shown in Fig. 18-3-12.

- PC-Girder
  PC-girders were assumed to be cast in compliance with the building schedule in a casting yard provided with molding facilities for straight girder and curved girder.

The standard girder would be 27m in length having a cross section of 1.37m in height and 0.6m in width.

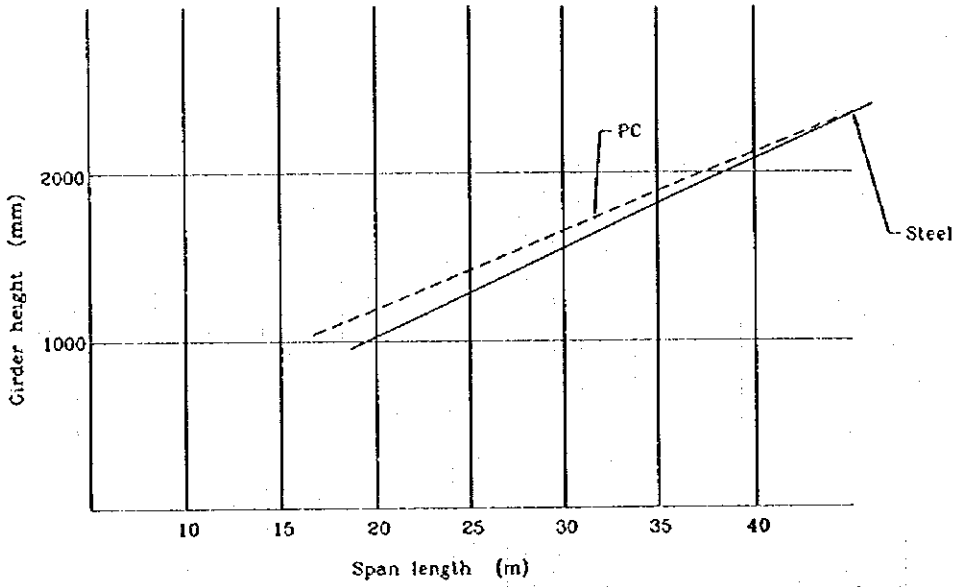


Fig. 18-3-12 Relation Between Girder Height and Span Length

- Steel Girder
  Steel girders were assumed to be applied on the sections when long spans are needed for the crossings over road and railway lines, where the erection of the pier is affected. The steel girder would be a simple girder, or continuos girder with three spans. The height of the girder would range from 1.6m to 1.8m and its maximum length would vary from 30m for a simple girder to 45m for a continuos girder. Long span girders made of steel would be built at sections where the bridge crosses over a road (RR-3).

18.3.3 Sub-Structure

The Sub-structure would consist of abutments, pier and foundations. Fig.18-3-13 and 18-3-14 show the applicable substructure types in accordance with the required structural height of a bridge. The selection of substructure types is based not only on specified figures but also on the following considerations:

- Reinforced concrete structures;
- The cross section of pier column on the road is circular or rectangular in shape with no restricted conditions;
- Non sliding of the back fill materials behind abutment structure is considered in the selection of the abutment type to avoid the approach settlement;

The abutment used would be a RC (Reinforced Concrete) reversed - T - type abutment as shown in Fig. 18-3-13. As for the piers, RC (Reinforced Concrete) pier 2.0 m^2 were selected as a standard size considering that economy is important, as shown in Fig. 18-3-14.

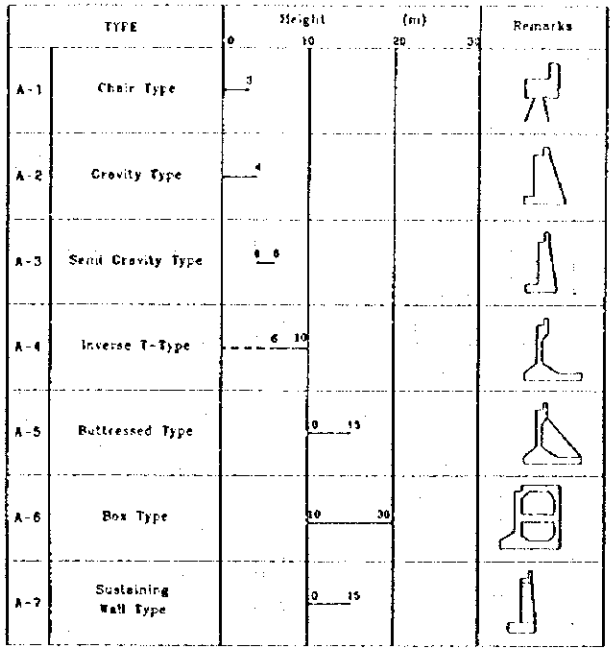


Fig. 18-3-13 Applicable Types of Abutment

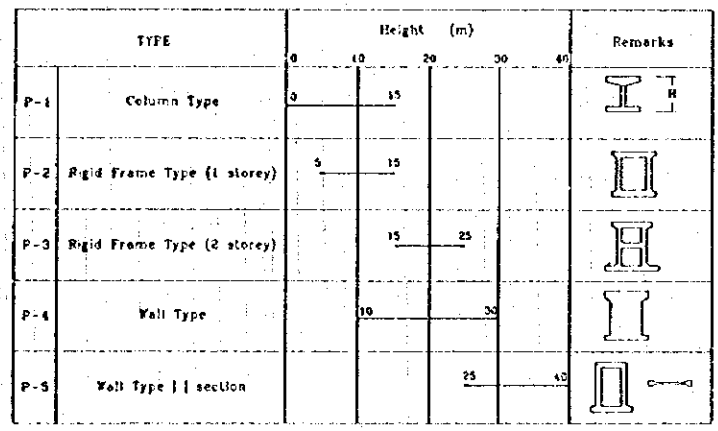


Fig. 18-3-14 Applicable Types of Pier

18.3.4 Type of Foundation Work

Table 18-3-2 shows the applicable foundation types in accordance with the required effective depth to sustain the upper structures. The following are considered in selecting the foundation type:

- Possible construction depth is studied in consideration of soil conditions.
- The advantageous type is considered for works above water e.g. reverse circulation drill pile; and
- The prefabricated pile types are advantageous when the bearing stratum is within a shallow range.

Table 18-3-2 Applicable Types of Foundation

TYPE			DEPTH (m) 0 10 20 30 40 50 60 70 80 90 100	Usable Dia. (m)	Soil Condition: Clayey	Soil Condition: Sandy	Remarks
F-1	Spread Foudation		0 10	--	○	○	
F-2	RC Pile	Driven Pile	5 15 25	0.3-0.5	△	△	
F-3	PC Pile	Driven Pile	18 30 40	0.35-0.5	△	△	
F-4	Steel Pipe Pile	Driven Pile	20 60	0.5-0.8	○	○	
F-5	Cast in Place w/ Casing	Cast in Place Pile	10 30 40	1.0-1.2	--	△	
F-6	Earth Auger	Cast in Place Pile	10 30	1.0-1.5	○	×	
F-7	Reverse Circulation Drill	Cast in Place Pile	25 60 90	1.0-1.2	○	×	
F-8	Shinso Pile	Cast in Place Pile	10 25	2.0-5.0	—	—	
F-9	Open Caison	Caisson	5 55 70	—	—	—	
F-10	Pneumatic Caison	Caisson	10 30	--	—	—	

Note:
○ Applicable
△ Considerable
× Not Applicable

Typical Soil Boring Log

The results of the borehole survey undertaken by the Study Team are shown in Fig. 18-3-15. The boreholes were 40m in depth. Based on the study, foundation piles would be driven to 30 meters

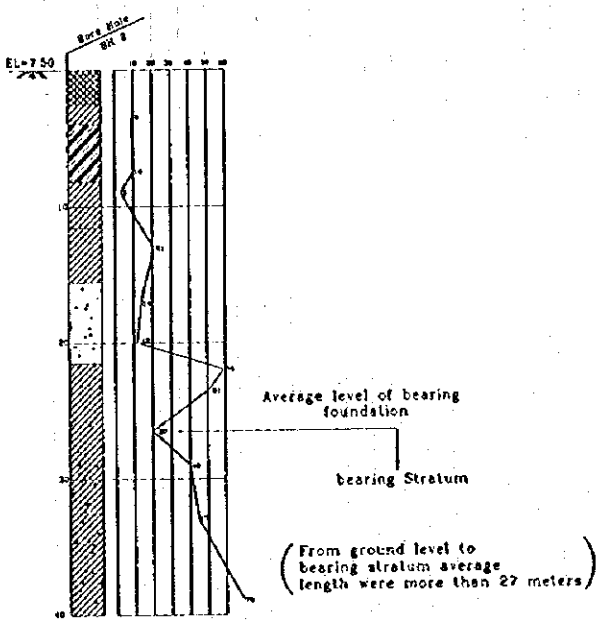


Fig. 18-3-15 Results of Soil Investigation

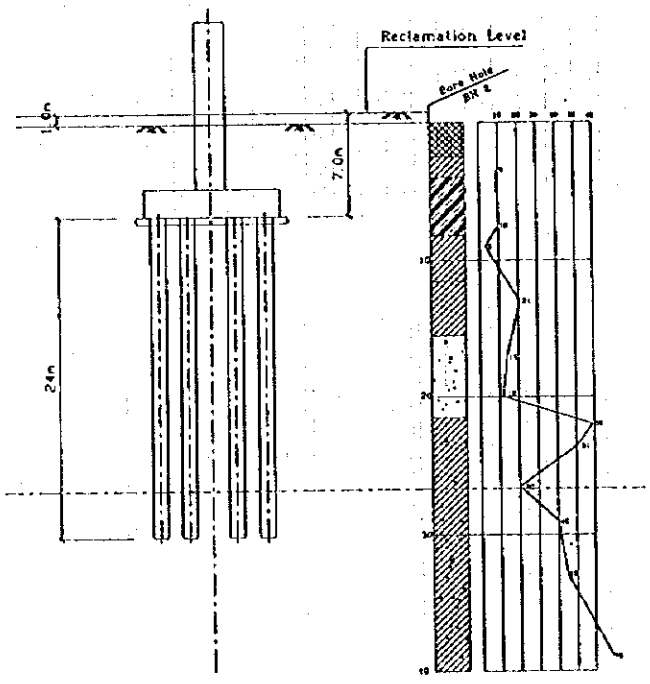


Fig. 18-3-16 Foundation Piles

18.4 Utilities

18.4.1 Water Supply

It is planned that the living conditions in the CBD will be much improved compared to the average situation in the old Hanoi City. Accordingly, the daily maximum water consumption rate per person should be estimated at a high level. The water demand of the New CBD is estimated as follows.

Table 18-4-1 Water Demand of New CBD

	Population/Employees	Unit	Water Demand
Domestic Water Consumption	165,000	325 l/c/d	53,625 m³/day
Commercial Water Consumption	375,000	130 l/c/d	48,750 m³/day
Total	-	-	102,375 m³/day

Based on this water demand the max. diameter of water supply pipes is estimated as 1m. It is proposed that the water supply for the New CBD is from the water supply company which operates under the administrative direction of HPC, and the distributing reservoir would be provided by that company. The land for the two distributing reservoirs which are proposed in the ongoing JICA Study are proposed in the New CBD, as the land for administrative facilities. The distribution of water supply pipe lines is shown in Fig. 18-4-1. Where Common Utility Duct (CUD) exists, the pipe is installed inside the CUD.

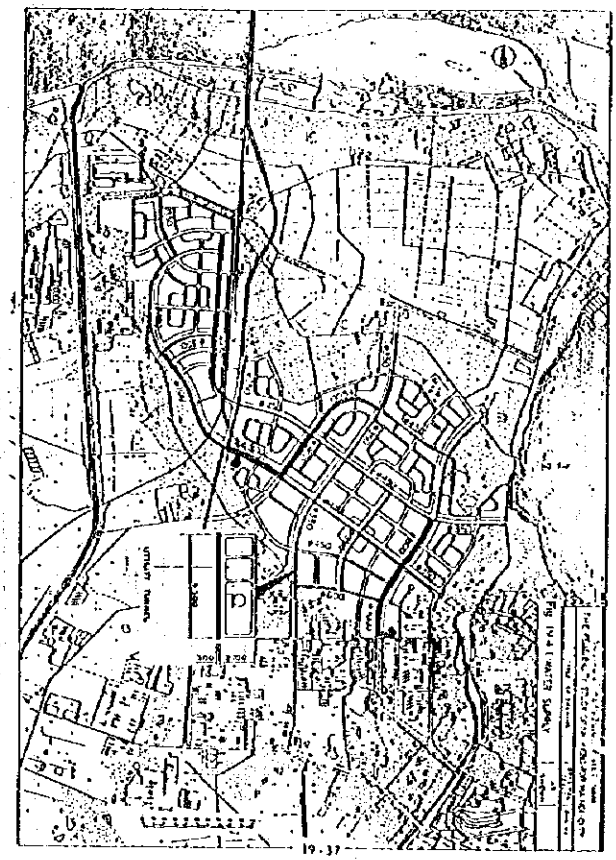


Fig. 18-4-1 Water Supply Plan

- Sewerage Disposal

Based on the water demand, the capacity of the sewerage treatment plant is estimated at 130,000 m^3/day. The land needed for the sewerage treatment plant is estimated at approximately 9 ha and its location is indicated in Fig. 18-4-2. The maximum diameter of sewer pipe is estimated as 1.2m. The distribution of sewer pipe is shown in Fig. 18-4-2. Where CUD exists, the pipe would be installed inside the CUD.

18.4.2 Electric Power Supply

It is proposed that the electric power supply system in the New CBD would be provided by the distribution company under the control of the Ministry of Energy. the power demand of the New CBD is estimated at 600MW, based on the projected population and number of employees and assuming 2,5 KW per household, 1,200KW/ha office floor. The lands for the two sub-stations are proposed in New CBD as are the land for administrative facilities. And area of about 3 ha would be allocated for one sub-station.

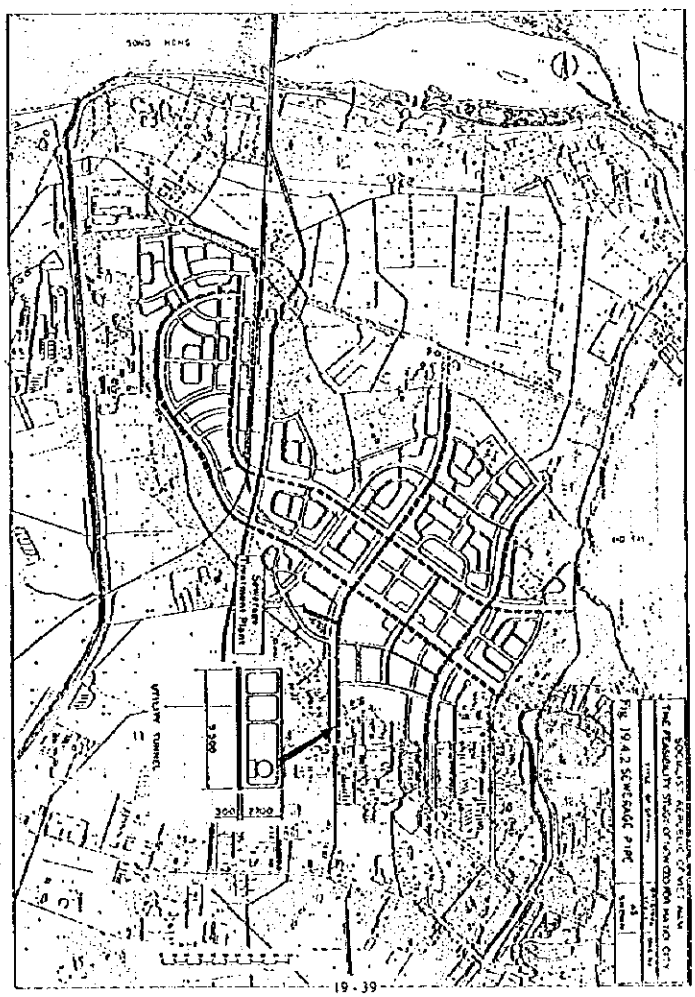


Fig. 18-4-2 Sewerage Pipes

18.4.3 Common Utility Duct (C.U.D)

CUD is a duct located under the street and provides a space for installing water supply pipes, sewer pipes, electric power lines, telephone lines and other services. It also provides space for maintenance work for those utilities.

Usually the dimension of the inner space is designed not only for the existing demand but also for the future demand. The main objective of the CUD is to avoid the repeated digging of the road surface for the repair work and future additional installation work which disturb the road traffic. The Japanese Standard for installing CUD was applied in this study. The distribution of the CUD is as shown in Fig.18-4-3.

In this study the site of the CUD was determined to allow for installation of the largest dimension of each utility. In the Detailed Design Study the site of the CUD must be adjusted to take account of the estimated demand of each location to reduce the construction cost.

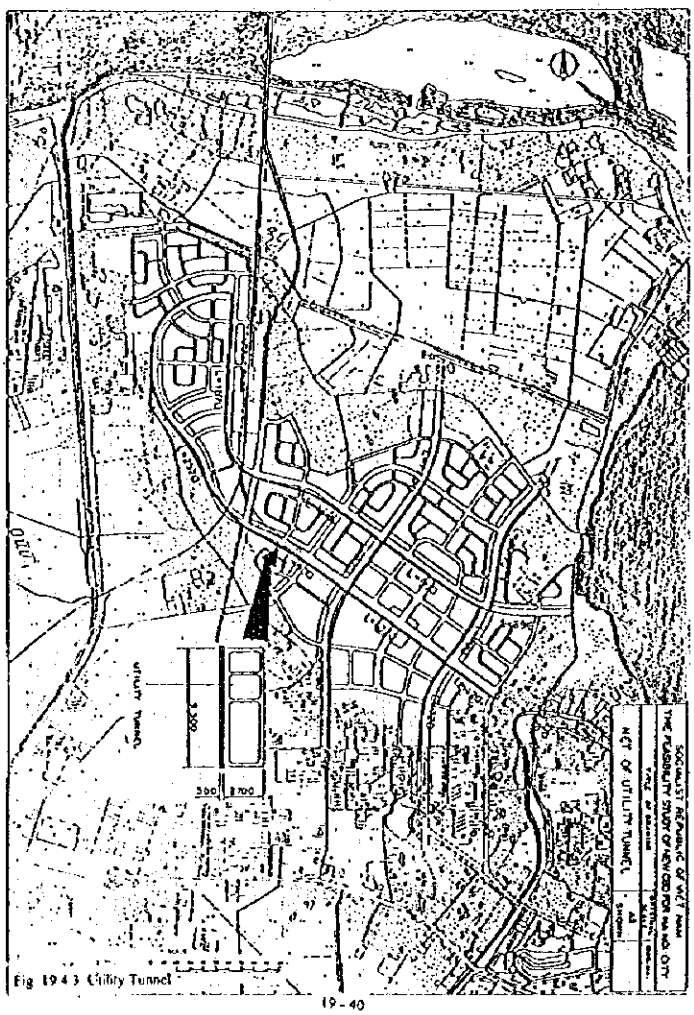


Fig. 18-4-3 Utility Tunnel

(1) Design Criteria

(a) Dimension of Space

The minimum internal height shall be 2.1m, with 0.1m slab concrete for footpath having 0.75m width, 0.2m for lighting space at the top and 1.8m clearance for inspection works.

(b) Covering

The minimum coverings shall be 2.5m from the ground surface to the top slab, to secure a space for other underground pipies.

(c) Alignment

The horizontal alignment put under the sidewalk center line of the utility tunnel is put in the center of road. Vertical Alignment is almost the same as the profile of road. The grade would be more than 0.2%.

(d) Distance of Boundary

The minimum lateral clearance from the road boundary shall be 1.0m.

(e) Design Loading

Design of loading is shall be as follows;

- Under the sidewalk Loading for crowd of people 500kg/m^2
- Surcharge loading 1.0 ton/m^2

(2) Structure and Equipment

The utility tunnel is assumed to contain the following utilities;

● 50 line	Telephone	Φ70
● 50 line	Electric	Φ60
● 1 pipe	Water Supply	D = 1000 (max)
● 1 pipe	Sewage Pipe	D = 1200 (max)

The Necessary width is assumed from above conditions and the standard cross section of the utility tunnel is shown in Fig. 18-4-4

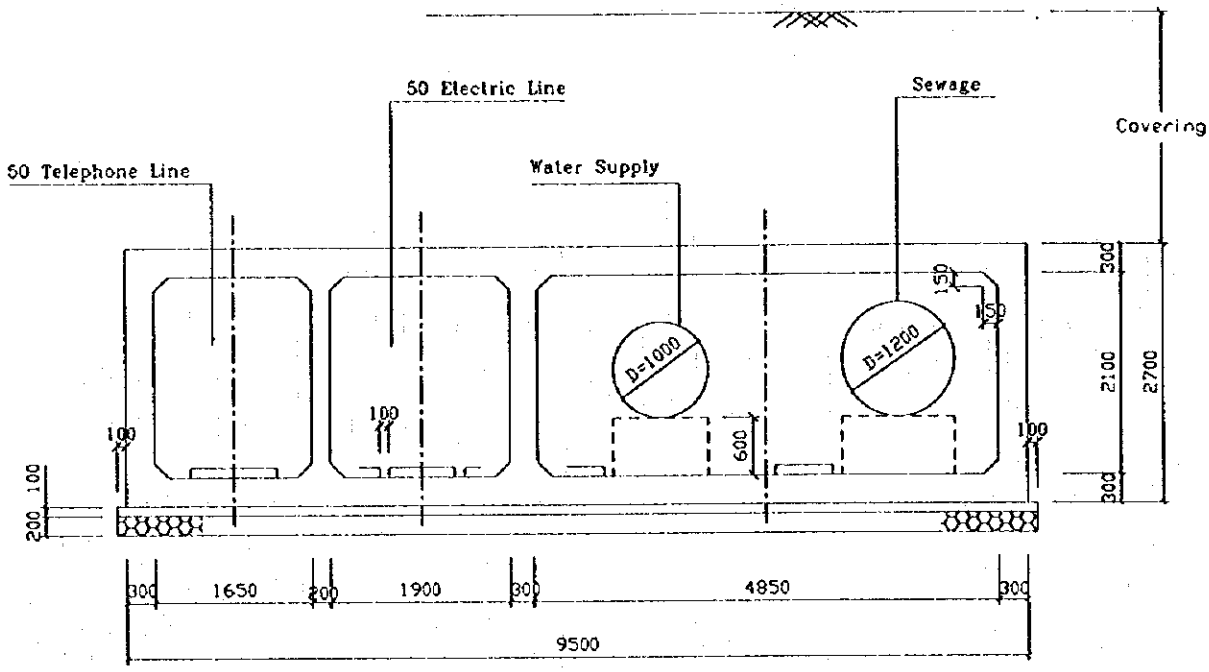


Fig. 18-4-2 Cross Section of Utility Tunnel

Water proof coating by sheet waterproofing is necessary for the outside of the utility tunnel. The items of equipment for the utility tunnel are as follows:

A. Ventilation mouth;
B. Forced-Ventilation;
C. Drainage - pit; and
D. Lighting;

Expansion joints for long tunnel would be necessary at regular intervals.

3) Quantity

Quantity of Utility Tunnel is shown in Table 18-4-2

Table 18-4-2 Quantity of Utility Tunnel

	Item	Unit Quantity	First Stage		Second Stage		Third Stage		Total Quantity
			Length (m)	Quantity	Length (m)	Quantity	Length (m)	Quantity	
1	Reinforcement	1,715kg/m	7,880	13,514,200	2,270	3,893,050	4,320	7,408,800	24,816,050kg
2	Concrete	9,895m³/m	7,880	77,973	2,270	22,462	4,320	42,746	143,181
3	Lean Concrete	0.97 m³/m	7,880	7,644	2,270	2,202	4,320	4,190	14,036
4	Foundation Fill	1.94 m³/m	7,880	15,287	2,270	4,272	4,320	8,381	27,940
5	Excavation	97.80 m³/m	7,880	770,664	2,270	222,006	4,320	422,496	1,415,166
6	Back Fill	69.20 m³/m	7,880	545,296	2,270	157,084	4,320	298,944	1,001,324

4) Construction Cost

Construction cost of Utility Tunnel is shown in Table 18-4-3

Table 18-4-3 Construction Cost of Utility Tunnel

Unit:VND

	Item	Unit Cost	First Stage		Second Stage		Third Stage		Total Cost
			Quantity	Cost	Quantity	Cost	Quantity	Cost	
1	Reinforcement	11,800	13,514,200	159.47	3,893,050	45.94	7,408,800	87.42	292.83
2	Concrete	1,192,800	77,973	93.01	22,462	26.79	42,746	50.99	170.79
3	Lean Concrete	897,400	7,644	6.86	2,202	1.98	4,190	3.76	12.6
4	Foundation Fill	55,500	15,287	0.85	4,272	0.24	8,381	0.47	1.56
5	Excavation	174,000	770,664	134.10	222,006	38.63	422,496	73.51	246.24
6	Back Fill	77,000	545,296	41.99	157,084	12.10	298,944	23.02	77.11
	Total Cost			436.28		125.68		239.17	801.13

18.5 Execution Work Plan

18.5.1 Basic Concept for Construction Schedule

The New CBD would have an area of about 590 ha. The construction works in this area as shown below:

Table 18-5-1 Work Volume of New CBD Development

Item	Volume
Roads	55.7km
Reclamation	422ha
Utilities	14.4km
Green Belt	8.52km
Park	45.6ha
Flyovers	842m
Water Pipe	21km
Sewage Pipe	21km

The construction work would be implemented in three stages as follows:

- Stage - 1 202 ha of Commercial and Residential
- Stage - 2 206 ha to the east of RR No.3; and
- Stage - 3 184 ha to the west of RR No.3.

The construction work of each stage would be implemented in one package contract. The development work would commerce on 1998 with one and a half year of preparatory work such as design and survey. This would be followed by construction which would complete on 2005. The construction work of each stage is shown in Fig. 18-5-1 Detail of quantities is shown in Appendix (for Construction Quantity)

18.5.2 Stage Construction

Work items and quantities by construction stage are shown in Table 18-5-2

Table 18-5-2 Quantity for Construction Stage

No.	Work Item	Unit	First Stage	Second Stage	Third Stage	Total	Remarks
1	Road Construction	m	16,895 (70.196ha)	22,036 (53.852ha)	16,750 (44.049ha)	55,681	168.097ha
2	Reclamation	ha	115.604	159,764	146,941	422,309	
3	R.C Box Culvert	m	288	589.5	438.0	1,315.5	
4	Utility	m	7810	227.0	4,320	14,400	
5	Structure	m	-	-	842.2	842.2	
6	Green Belt	m	3,660	1,780	3,380	8,520	
7	Park	ha	28.7	8.3	8.0	45.6	
8	Disposition Area	ha	5.3	-	-	5.3	
9	Parking	ha	6.24	-	-	6.24	
10	Water Supply	m	10,560	5,100	5,400	21,060	included 6ha
11	Sewage Pipe	m	10,560	5,100	5,400	21,060	included 6ha
12	Power supply	ha	3	0	0	3	
13	Telecommunication	ha	3	0	0	3	

The area for each construction stage is shown in Fig. 18-5-1.

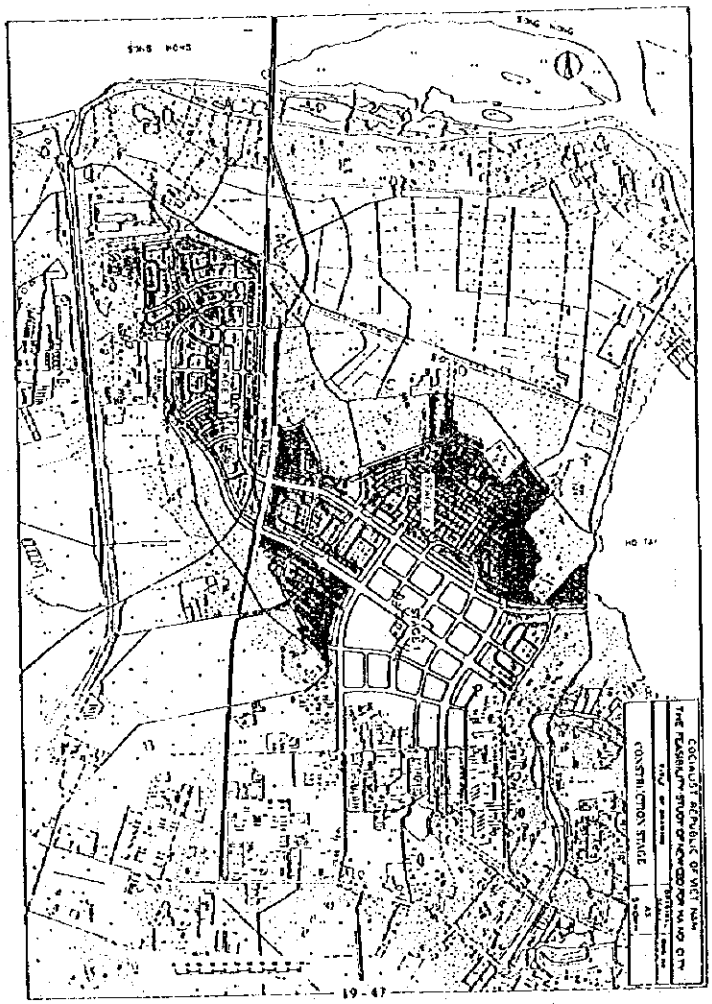


Fig. 18-5-1 Construction Stage

18.6 Construction Cost

The construction cost of each work item is summaries on the following tables. Item for road and cost are shown as below:

Table 18-6-1 Construction Cost

Item	Quantity	Total Cost (MVND)
Road		
Arterial Road No.1	1,890m	46,359
Arterial Road No.2	2,300m	49,192
Collector Road No.1	8,960m	140,316
Collector Road No.2	6,370m	87,980
Collector Road No.3	12,080m	131,668
Feeder Road No.1	10,816m	70,442
Feeder Road No.2	11,975m	60,343
COMB Collector/walkway	550m	10,959
Walkway W=60m	410m	5,311
Walkway W=30m	330m	3,400
Ground Total	55,681m	605,970
Viaduct		
North Side Viaduct	402.0m	73.103
South Side Viaduct	440.2m	76.497
Total	842 2m	149.600
Utility Tunnel	14,400m	801,130
R.C Box/Pipe Culvert	220.0m	60.190
Reclamation	422,309ha	268.75

Table 18-6-2 Land Acquisition Cost for Utility Facilities

Item	Area (ha)	Total Cost (MVD)
Water Supply Reservoir	6	13,200
Sewage Treatment Plot	6	13,200
Power Supply Sub Station	3	6,600
Telecommunication Facilities	3	6,60
Total	18	39,600

Table 18-6-3 Construction Cost of New CBD

No.	Work Item	First Stage (BVND)	Second Stage (BVND)	Third Stage (BVND)	Ground Total (BVND)	Remarks
1	Road Construction	256.75	204.84	163.24	624.83	
2	Reclamation	219.06	216.43	204.07	639.56	
3	R.C Box Culvert	7.50	15.34	11.40	34.24	
4	Utility Tunnel	293.73	122.39	142.97	559.09	L = 10.050
5	Structure	0.00	0.00	149.71	149.71	2-Flyover
6	Green Belt	63.84	31.05	58.96	153.85	
7	Park	22.63	12.37	11.01	46.01	
8	Disposition Area	116.03	0.00	0.00	116.03	
9	Parking	11.74	0.00	0.00	11.74	6.24 ha
10	Water Supply	40.81	12.58	13.26	66.65	Included land purchase
11	Sewage Pipe	44.65	13.26	13.28	71.19	included land purchase
12	Power Supply	6.60	0.00	0.00	6.60	land purchase
13	Telecommunication	6.60	0.00	0.00	6.60	land purchase
	Total	1,089.94	628.26	767.90	2,486.10	

Note: Road Area: 1st Stage 70.196ha
2nd Stage 53.8523ha
3rd Stage 44.490ha

The total project cost is estimated at 4,043 BVND including land acquisition cost of 1,259 B.VND assuming the average stipulated price of 212,000 VND/m^2 and

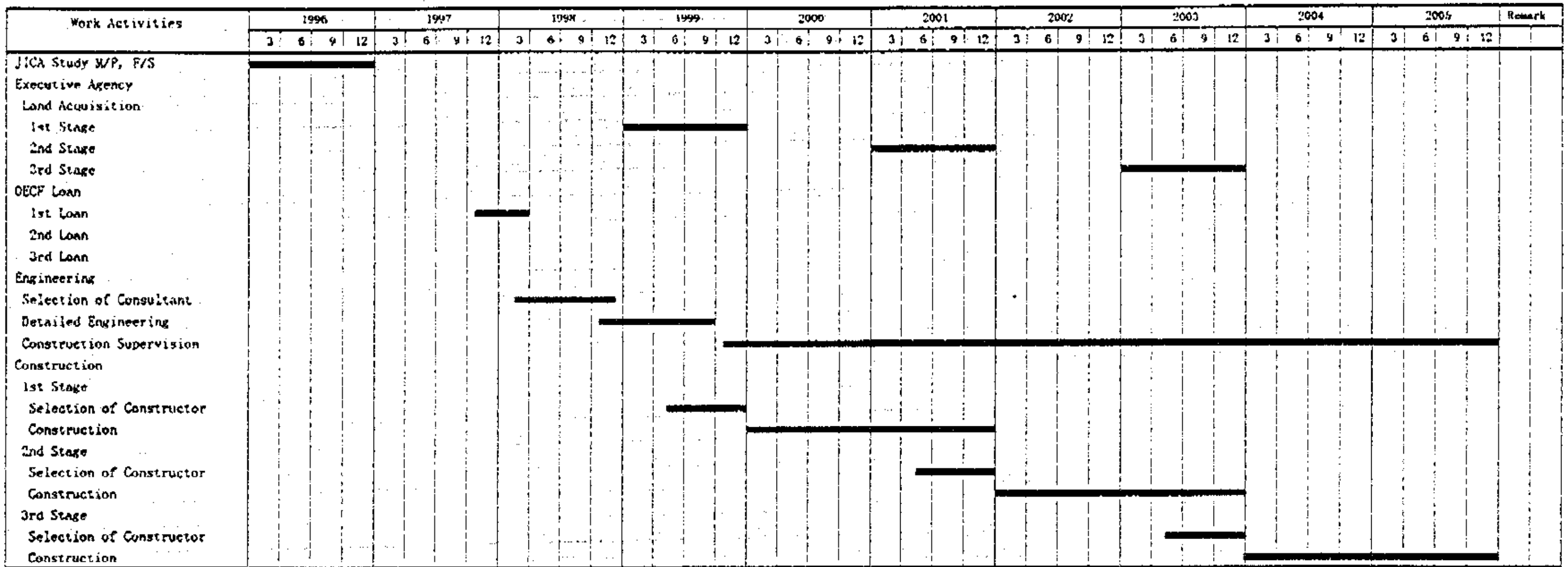
Engineering Cost of 298 BVND (12% of the total cost). As the financial costs by work item are adjusted to the contract costs in the on-going project in Vietnam, 10% of indirect cost and another 10% of contingency cost components are included in these costs.

Next to the reclamation (15.8%) and road construction costs (15.5%), the utility tunnel requires also high initial construction cost of 13.8% of the total cost, but it will decrease the maintenance costs of the different utilities in the future. It will provide a better visual environment and modern city image for the New CBD without the need for electricity and telecommunication poles along the streets. It will eliminate the need for excavation works for the maintenance of pipes imbedded under the road surface.

18.7 Implementation Schedule

A general implementation scheme, presented in Table 18-7-1, was prepared for the different tasks and activities required to realize the project. As the financing system of the project is a main factor for the smooth implementation, the plan takes into account the period required for loan arrangement and procedures up to the end of 1997. The consultant selection stage will require most of 1998 and the detailed engineering design, for the whole project, is planned to be carried our during the 1999 together with the land acquisition of the first stage. The construction activities for each stage will required two years after a period of about 6-7 months for the selection of contractors. All the construction works will end by 2005.

Table 18-7-1 Implementation Scheme and Annual Cash Requirement



Annual Cash Requirement	1996–1997	1998	1999	2000	2001	2002	2003	2004	2005	Remark
1. Engineering Cost										
D/D 118.0 BVND		35.8	83.5							
C/S 165.3 BVND			7.2	28.7	28.7	28.6	28.6	28.6	28.6	
Total Eng 283.3 BVND		35.8	90.7	28.7	28.7	28.6	28.6	28.6	28.6	
2. Construction Cost										
1st Stage 1,081.3 BVND				436.0	653.9					
2nd Stage 518.8 BVND						251.3	377.0			
3rd Stage 761 BVND								307.2	460.7	
Total of Con. 2,361.1 BVND				436.0	653.9	251.3	377.0	307.2	460.7	
3. Land Acquisition Cost										
1st Stage 423.7 BVND			423.7							
2nd Stage 464.9 BVND					464.9					
3rd Stage 370.3 BVND							370.3			
Total of L.Ac. 1,25839 BVND			423.7		464.9		370.3			
4. Total of Project Cost										
4,043.3 BVND		35.8	514.4	464.7	1147.5	279.9	775.9	335.8	489.3	

18.8 Implementation Organization

18.8.1 Functions Expected

(1) To Establish Road Network

The outskirts of the central Hanoi will be faced with the traffic congestion due to poor road facilities. Because of the limit of TUPWS budget for road construction it is expected that the development corporation mentioned in the precedent chapter would be able to develop the road and railway network in the development area. The development area spreads from Xuan La to Dai Kim, therefore most of the area which will be congested in future is included in the development area, with the exception of the bridges across the Red River.

(2) To develop residential areas to accommodate one million citizens

Due to the population control policy and the continuing growth of Hanoi, the pressure of population growth on the outskirts of Hanoi will be high. It is expected that around one million population will reside in this area. Without well planned and well coordinated development, the area will be become a disorganized sprawl.

(3) To control other developers activities in the development of area in HUDC

Investment in real estate development itself would be welcome so as to cover the shortage of development fund, as long as the developers follow the guidelines of the master plan. One of the most important functions of the development corporation is to make the land use master plan four HUDC and to force developers to follow the plan.

(4) To establish funds for the development of Hanoi urban infrastructure.

As a result of the HUDC development, transportation and other infrastructure will be facilitated in the HUDC. In addition of that, large amounts of inflow of profit are expected. This inflow must be utilized for the development of Hanoi urban infrastructure. One of tasks of the development corporation is to keep profits inside and to use the money effectively for improvement of urban infrastructure.

18.8.2 Similar Organizations in Foreign Countries

(1) France

European countries have no national level development corporation. There are local development corporations and the French Etablissement Public pour l'Amenagement de La Defense (hereafter EPAD) is well known.

EPAD was established in 1958 for 30 years as a limited public organization to develop the La Defense area which is located 4 km west of Paris. EPAD was managed by a self-supporting accounting system including urban infrastructure construction. The exception to this rule was subway construction and expressway construction to connect

to the remainder of Paris. EPAD was authorized to undertake city planning, land acquisition, project planning, construction, sales and community activities, but without subsidy. EPAD was required to compensate all investment by development profit. Finally it is understood that EPAD maintained a reasonable amount of surplus.

In response to this business environment, development was executed in cooperation of EPAD and private investors. The investment of EPAD was 12 billion French Francs and private investments in the La Defense area were 42 billion Francs until 1981.

Cooperation scheme is shown in Table 18-8-1.

Table 18-8-1 Cooperation Scheme of EPAD and Private Developers

Activity	Executing Entity
Land Acquisition	EPAD
City Planning and Land Development	EPAD
Building Construction	Private Developers

The development for 760 ha, of which business area was 160 ha. it has taken more than 30 years and the largest number of employees was recorded around 500.

(2) United Kingdom

Docklands, fours corridors in east London of 2,200 ha. along the River Thames. The area was disused docks and public utility sites such as gas and electricity plants. The unemployment rate of male economically active in parts of this area was reported 30 %, and that areas' economic and social structure had become depressed. The UK Government decided that high priority should be given to revitalizing the area. London Docklands Development Corporation (LDDC) was established in 1981. LDDC is a corporation under control of the Government. The Development of the Environment scheme for LDDC was similar to EPAD. Difference is LDDC receives a Government subsidy but EPAD not (see Table 18-8-2). Its objective was to create development opportunities by providing the infrastructure necessary to stimulate development. LDDC is the planning authority for its area. In some areas LDDC purchased or leased much of the land which was sold to developers after infrastructure had been provided.

Table 18-8-2 Cooperation Scheme of LDDC and Private Developers

Activity	Executing Entity
Land Acquisition	LDDC
City Planning and Land Development	LDDC
Building Construction	Private Developers

Major funding source of LDDC is Government subsidy and sales of land for development. Major expenditures were land acquisition, reclamation and drainage and transportation. The Profit Loss Statements of LDDC of 1987/88 are shown in Table 18-8-3.

Table 18-8-3 Profit Loss Statement of LDDC of 1987/88

(unit: million pounds sterling)

Revenue *	
Government Subsidy	116
Sale of Land	100
Revenue Total	216
Expenditure	
Land Acquisition Cost	23
Reclamation and Drainage Construction	33
Road and Railway Construction	36
Environmental Costs	7
Donation Costs to the Community	5
Administration Expenses (including market survey)	14
Expenditure Total	118
Profit (Loss)	98

Note: * 1988/89 figure

No building revenue and also no cost are seen in the PL statements. It is because the private sector constructed the buildings. Accumulative investment up to March 1988 of LDDC was 404 million pounds sterling and that of the private sector was 4,400 million pounds, which was around 10 times to the public sector investments. In another words the public investment induced 10 times investment from the private sector. Investment was not only British by local but also from the countries particularly North America and Japan. Indeed by far the largest project in the area, the canary wharf office development, was undertaken by a North American developer.

(3) Singapore

The Housing and Development Board (HDB) is public housing authority. The activities of HDB continue to expand and HDB now cover the following areas:

Housing:	Construction/Maintenance/Rental/Sale
Commercial/Industrial:	Construction/Maintenance/Rental/Sale
Land Development:	Road and Other Infrastructure Construction/Railway System Construction/Operation
Land Management:	Management of Government owned Reserved Area for Housing Development

HDB originally did not allow private sector developments but this is gradually changing. Now the private sector can join HDB to construct commercial units. HDB is expanding its activities from distributor of rental houses to developer of land. In the planning of Sengkang Town, land use assignment, transport facilities and infrastructure development are highly integrated.

The PL Statements for 1994/95 are shown in Table 18-8-4 and the BS for 1994/95 is shown in Table 18-8-5.

Table 18-8-4 Profit Loss Statement of HUD of 1994/95

(unit: thousand Singapore Dollars)

Items	Amount
Operating Surplus (Deficit) from Housing Activities	
Sale of Flats	(340,092)
Rental of Flats	(119,574)
Mortgage Financing	9,798
Upgrading of Flats	(241,927)
National Housing	(45,849)
Total of Operating Surplus (Deficit) from Housing Activities	(737,644)
Operating Surplus (Deficit) from Other Activities	
Rental of Commercial Properties	210,682
Rental of Industrial Properties	216,811
Sale of Commercial Properties	37,140
Rental of Land	(44,243)
Car Parks	(5,683)
Markets and Hawker Centers	(8,170)
Total of Operating Surplus (Deficit) from Other Activities	510,490
Deficit from Normal Operations	(227,150)
Gain from Disposal of Protected Properties	727,116
Release of Asset Revaluation Reserve	441,742
Net Surplus before Government Grant	941,708
Government Grant	23,157
Net Surplus after Government Grant	964,865
Transfer to Capital Gains Reserve	(964,865)

Table 18-8-5 Balance Sheet of HDB of 1994/95

(unit: thousand Singapore Dollars)

Items	Amount
DEBTOR	
Capital and Reserves	
Capital Account	2,457,836
Capital Gains Reserve	2,817,477
Asset Revaluation Reserve	10,273,269
Total of Capital and Reserves	15,558,582
Term Loans Payable	24,916,893
Total of Debtor	40,475,475
CREDITOR	
Current Assets	
Properties for Sale	579,252
Stocks of Building Materials	63,471
Loans Receivable within 12 Months	968,302
Sundry Debtors and Prepayments	444,021
Cash and Deposits with Banks	267,370
Total of Current assets	2,322,416
Less Current Liabilities	
Loan Payable within 12 Months	1,316,793
Sundry Creditors, Provisions and accruals	2,975,913
Amount due to Subsidiaries	679
Government Grant Received in Advance	320,755
Total of Current Liabilities	4,614,140
Net Current Liabilities	(2,291,724)
Total of Creditor	40,475,475

Normal operations produced a deficit and this was compensated by gain from disposal of properties and release of the asset revaluation reserve. It is not normal management

as the deficit of the net current liabilities is seen in the BS.

The population housed in HDB flats were 86 % of total estimated resident population in Singapore (3 million). It is a very high figure. It is easily understandable that house rental pricing might be set in favor of the to lessee but not lessor so as to achieve this figure.

It must understood that the said compensation is seen in the PL as HDB's effort "to provide affordable housing of a high quality" (referred from "mission statement" of HDB) at a reasonable rent.

Their major fund source was a Term Loan (see Table 18-8-5), of which 99.6 % was a Government loan. Total employees were 7,986 as at 31 March 1995, of which 3,212 was technical staff.

(4) Japan

Japanese Government established the Housing Development Corporation whose name was later changed to Housing and Urban Development Corporation (HUDCJ) in 1955. The paid up capital as of March 31, 1992 was 106 billion Japanese Yen, invested by central and local government.

HUDCJ activities cover housing construction, housing management, housing reconstruction and reform, urban development, urban renewal, railway and public facilities construction, and the development of national parks.

Fund sources to support these activities are mainly from government soft loans. The HUDCJ funds breakdown as of 31 March, 1992 was government loans 64.5 %, bank loans 20 %, bonds 15 % and capital investment 0.5 %. HUDCJ started from housing construction and housing rental services, and then expanded to urban development.

18.8.3 Organization Proposed and Necessary Conditions

(1) Funding

LDDC receives government subsidy. The other three organizations do not receive subsidy but HDB and HUDCJ enjoy soft loans. The history of EPAD from its start in 1958 until 1979 shows the difficulty of development without sufficient funds.

HUDC development corporation (hereafter DC) can not expect to receive national soft loans. The only promising source of loans for DC seems to be an foreign soft loan. The proposed organization should easily formulate an acceptable OECF loan, directly and possibly in a package.

The foreign soft loan can not cover all of expenses, especially land acquisition money i.e. compensation money, which may be a large amount. A foreign soft loans are prohibited from lending any money for land acquisition or compensation. The DC must have high credit power to borrow money from banks. Collateral for loans is not enough

(see any BS attached in Chapter 20). The nature of such loans is short term. The only feasible solution seems to be secured by the National Government.

(2) Priority Buying Right

The organizations aforementioned have the right to develop their area in monopoly. This is a very important factor to develop land effectively and comprehensively. The DC has to be formulated with acceptable priority right for buying land.

(3) High Productivity

As shown in Chapter 20, Financial Evaluation, the FIRR of the HUDC project was calculated as 16 %. Sensitivity analysis shows a 4% of FIRR when construction costs increase 20 % and sale decrease 20 %. Weighted cost of Capital of HUDC requires 5.9% interest, therefore 4% FIRR means that the DC can not survive. The DC should have a small permanent staff and utilize the services of outside experts on consultancy bases.

(4) Non profit and tax exemption

Development is done for public interest. The profit which comes from the development must be utilized for the next development. In this context it is natural that the DC should have right of tax exemption.

As shown in Chapter 20, Economic and Financial Evaluation, 20 % of estimate errors of costs and revenue will loose almost of all profits. Profits is definitely necessary to continue improvement of transport network in Hanoi. Japanese National Railway company (JNR) had continued to loose money in the long time. JNR was divided and reformed to private companies. After it was divided business men who had worked as presidents in big private companies were assigned to the presidents. Private companies after divided are growing smoothly.

1) The First Alternative (Development Cooperation established by HPC and MOC)

It would be ideal for HPC and MOC to establish the Development Corporation and to employ staff who are highly experienced in real estate, land development and financial business, and let them manage the company. However, there are also some difficulties. The biggest obstacle is the shortage of operating funds aforementioned during the developing period.

2) The Second Alternative (Control Authority)

An alternative organization is a control authority of private developers. There are many applications from foreign developers who hope to develop land in Hanoi. HPC would establish a control authority, and this authority would offer land for development and select the highest bidder of the qualified developers. In this manner HPC can develop land under the HUDC development master plan and collect money for the necessary infrastructure improvement. This process is easy to start but progress depends on

developers' demand. Profitable land may attract many applicants but land in a bad development condition would not attract them.

3) The Third Alternative (Entrusted Partner)

The other alternative organization is a mixture of the above alternatives. In this case HPC would selects one private developer group as the partner and establish a joint venture development company. HPC would give the joint venture the privilege of developing of HUDC in accordance with the HUDC development master plan and profits would be share. HPC would invest money received from soft loan and entrust this company to develop HUDC. This is a promising option. However, the developments success depends on the developer's demand and capability.

CHAPTER 19 ENVIRONMENTAL IMPACT ASSESSMENT

19.1. Present Environmental Condition of Tu Liem district (New CBD areas)

19.1.1 Socio-economic Environment

The borders of each commune in Tu Liem District are defined in Fig. 19-1-1 and the proposed new CBD is shown in Fig. 19-1-2.

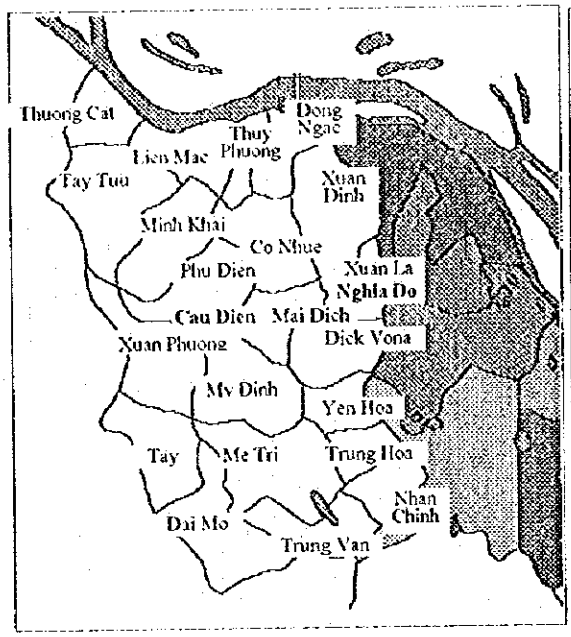


Fig. 19-1-1 Distribution of commune

Fig. 19-1-2 Location of New CBD

Current land use conditions are shown in Fig. 19-1-3. However, only a few of these areas are registered with the Registration Department. These are shown in Table 19-1-1.

Table 19-1-1(1) List of land usage of Nghia Do Town

Industrial Land		Public office Land		Military Land	
Name	Area (m^2)	Name	Area (m^2)	Name	Area (m^2)
Mill Workshop	1,560	Mountain Culture Center	5,410	Housing of Military Production Bureau	7,880
Foods and Crops Tu Liem D13	934	Collective Quarter of Mail Post of Tu Liem Dis	-	Housing of Bureau of Material	3,146
Plastic Goods Factory	1,393	Medicine Collective Quarter of Tu Liem Dis	1,832	Housing of Bureau of Fuel and gas	1,845
Wine Factory	4,617	Training College of Tourist	6,533	Ba Dinh Army	3,842
Fuel Factory	5,055	High school	5,316		
Survey Co. No.1	3,750	CQ of Vietnam Scientist Inst.	11,751		
		Aspect Quality Inst.	55,551		

Table 19-1-1(2) List of land usage of Co Nhue Commune

Table 19-1-1(2) List of land usage of Co Nhue Commune

Industrial Land		Public office Land		Military Land	
Name	Area (m^2)	Name	Area (m^2)	Name	Area (m^2)
Enterprise of Concrete production	23,274			Head -quarter of Air-Defence A26	4,750
Enterprise of Architecture of Mo TC	5,546				

Table 19-1-1(3) List of land usage of Xuan La Commune

Industrial Land		Public office Land		Military Land	
Name	Area (m^2)	Name	Area (m^2)	Name	Area (m^2)
Interior Decoration Co	1,208	People Committee of Xuan La Commune	3,555	Army Engineering Units	6.697
Chemical Fertilizer Corp.	5,421	Sanitarium of Ministry of Industrial	8,203	Command Fleet	3,323
		Technical Training College B	1,580	Transport Fleet No.2	8,656
		Le Cuong Publisher	2,230	The Fleet NO	40,509
		Secondary School of Xuan La Commune	4,772	Transport Dept.	2,204
		Training Arelives College	2,223	Residency of	1,845
				Economic Police	3,023

Table 19-1-1(4) List of land usage of Xuan Dinh Commune

Industrial Land		Public office Land		Military Land	
Name	Area (m^2)	Name	Area (m^2)	Name	Area (m^2)
Bridge Construction Co No.11	-	Technical Training of Transportation College	3,510	Central Service Co.Q164	28,776
Bridge Construction Co No.7	-	Thang Long Project Management Unit	3,510	Ware House N80-Home front service Dept.	8,289
Plastic Factory	-	The Secondary school of Xuan Dinh Commune	29,420	Field Artillery Battalion (Transportation)	7,440
Management Thang Long Bridge Co	-	The High school of Xuan Dinh Commune	9,326	Head Quarter of Artillery (Residency)	7,498
Knitted goods factory	-	The Secondary	5,129	Company No.246	6,715
Construction Co Thang Long Bridge Copr	-	People committee of Xuan Dinh Commune	3,224	Artistic Federation of Home Front service Dept.	
		Child care center of Xuan Dinh Commune	3,240	Army Corps No.379	8,151
				Home Front Service K80 (Re)	4,986
				Residency of X20 and K212	6,707
				Mapping House 1 (Military)	3,022
				Residency of K8013-Home Front service Dept.	6,410

- : unknown

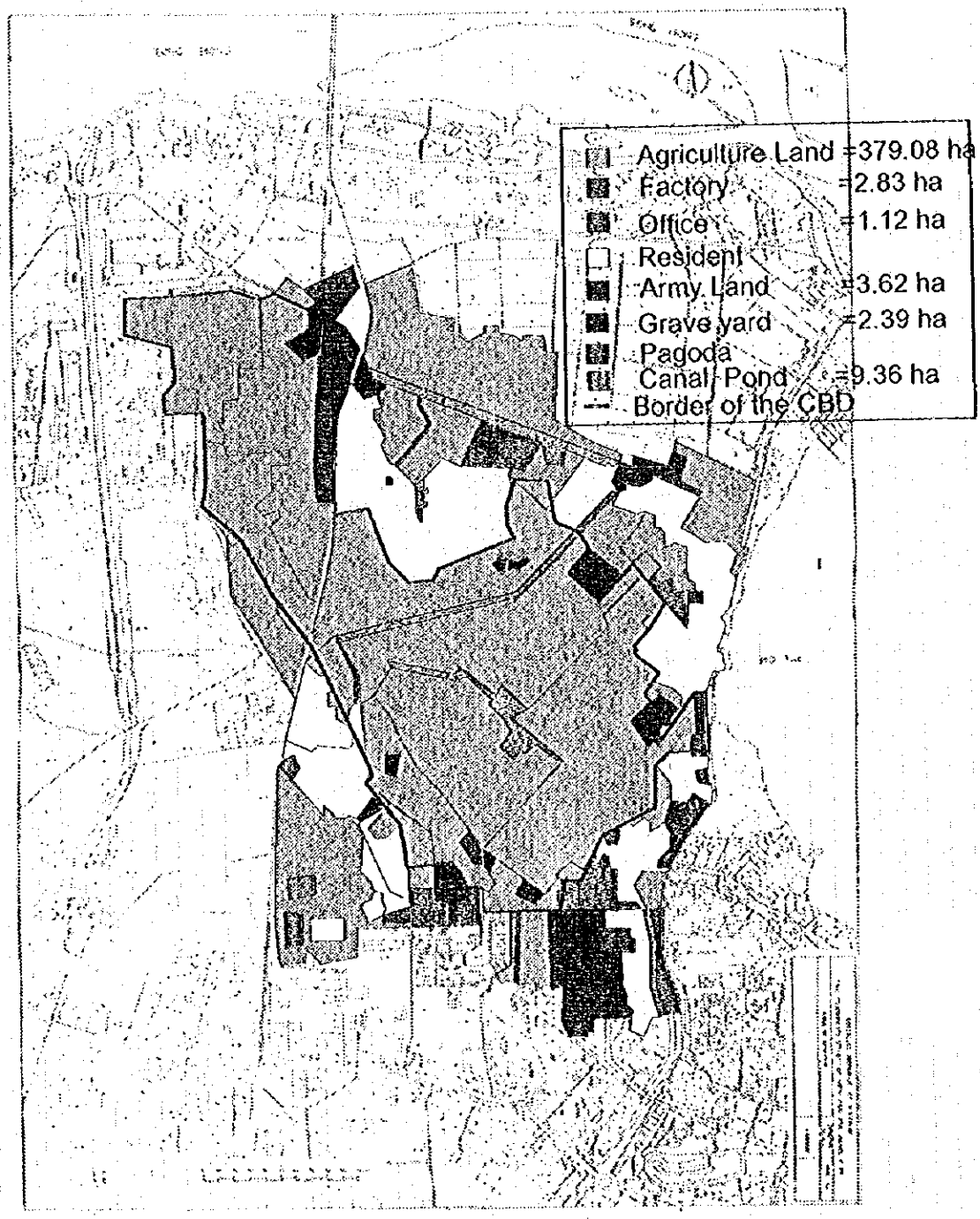


Fig. 19-1-3 Current land use conditions

(1) Population

Population and labor structure in Tu Liem District are shown Table 19-1-2.

Table 19-1-2 Population and labor structure in Tu Liem

Commune and town	Total Pop. (person)	Population		Total Household	Natu. Pop. Growth	Population Density(p/km2)	Labor Force	Breakdown	
		Male	Female					Agricultu	Non-
Xuan La	6833	3377	3456	[5]1780	8.13	3016	2800	683	2117
Xuan Dinh	13870	7064	6806	3260	6.27	2366	5825	2472	3353
Co Nhue	14946	8079	6867	2758	0.96	2757	5948	1623	4325
Dong Ngac	15113	7165	7948	2895	1.91	14920	6256	742	5514
Nghia Do town	11693	5830	5863	2270	9.06	9851	4794	130	4664
Nghia Tan town	13622	6636	6986	2392	0.95	13718	5693		5693
Minh Khai	8926	4814	4112	1980	5.52	9925	3757	2534	1223
Phu Dien	9100	4409	4691	2260	11.26	8228	3620	2968	652
Mai Dich	12654	5967	6687	2490	4.05	12383	5251	950	4301
My Dinh	7993	4019	3974	1805	3.12	7840	3365	2025	1340
Thuy Phuong	6640	3366	3274	1380	1.04	6610	2762	362	2400

Situation survey in May 1995

(2) Economy

Tu Liem is the agricultural district which provides foodstuff for the whole of Hanoi city. In recent years, the average food production volume in the whole district is as follows: 32,000 tones of rice; 300 tones of flowers; and 2,000-3,000 tones of green vegetables and fruits. In general, the agricultural production values of the cultivated land are up to 30,000,000VND per hectare. Fig. 19-1-4 shows its details of land use for the communes in the CBD area such as Xuan La, Xuan Dinh, Co Nhue, Dong Ngac and the whole of Tu Liem district excluding them.

The average annual income per capita is 330,000VND, while for agricultural workers it is 203,000 VND. However recent loss of land for development has caused farmers to give up mono-production of rice crops. Many farmers have expanded their cultivated areas for high profit crops such as fruits, vegetables and flowers and their incomes have increased. The range of products has also increased rapidly, making a better ecology and environment for people's health. For instance, Xuan Dinh is famous for poultry farming and flower planting. On the other hand, traditional handicraft villages have been also developed are follows: garments at Co Nhue; cookies at Xuan Dinh; and pottery at Dong Ngac.

In recent years, the commercial and service network has grown rapidly owing to the open policy. Many shops have appeared along all the main roads in the living quarters. In addition, non-state-owned enterprises and companies have increased in number, therefore they have generated more income for themselves and increased the Government income. Small industries and their numbers of employees are shown in Fig. 19-1-4.

(3) Cultural and Public Facilities

There are many legends about Tu Liem District which have been passed down from the

Ly dynasty. Some pagodas, temples and communal houses for the worship of national heroes previously existed in the district. These cultural and historical properties were certificated by the Government. Some villages have their own cultural house to improve the cultural life of the local people. In each village, there are small and old cemeteries located among the commune and fields. Numbers of cemeteries and monuments are shown in Fig. 19-1-4.

(4) Education

There are many professional colleges and institutes in the district. These were built about 30 years ago, therefore some of them were modernized in recent years. This district is a working center for scientists and professors. Concerning school education, each village has primary schools and secondary schools. However these schools are still small and teaching facilities are poor. Numbers of pupils are shown in Fig. 19-1-4. There is only one high school in Xuan Dinh which was repaired recently. Kindergartens are located in large living quarters. However, there are not enough kindergartens in villages or communes and there are not any yards for children to play.

(5) Medical System

There are 2 large hospitals, one is in Mai Dich which belongs to the Ministry of the Interior and the other is in Co Nhue. There is a medical center for the district in My Dinh which has 200 beds and 29 docters, assistants and nurses. Each village has a clinic as shown in Fig. 19-1-4.

(6) Water Supply

Water supply for some areas such as Nghia Do, Nghia Tan and Mai Dich is provided from the municipal water supply system of the Mai Dich and the Yen Phu water treatment plants. Mai Dich water treatment plant has capacity of 60,000m^3/day and Yen Phu has capacity of 40,000m^3/day. However, they are also supposed to provide water for the urban area. Therefore, most of the communes in the district are using water from the wells dug by themselves. Some offices, enterprises, schools and other major buildings with demand for large volumes of water have their own bore hole wells. People in villages are still consuming rainwater and water from their deep well.

(7) Waste and Wastewater

The Hanoi Urban Environment Company is responsible for the collection of waste generated in Nghia Do, Nghia Tan and other areas. Most of the domestic wastewater is discharged into lakes and ponds without any treatment. However, some houses have their own septic tanks. As regards the drainage system, its drainage rests largely on the agricultural irrigation system. In some centralized construction sites adjacent to the inner urban area, canal and sewer systems have been built with investment from municipalities so that the irrigation system can be used separately for agricultural purposes.

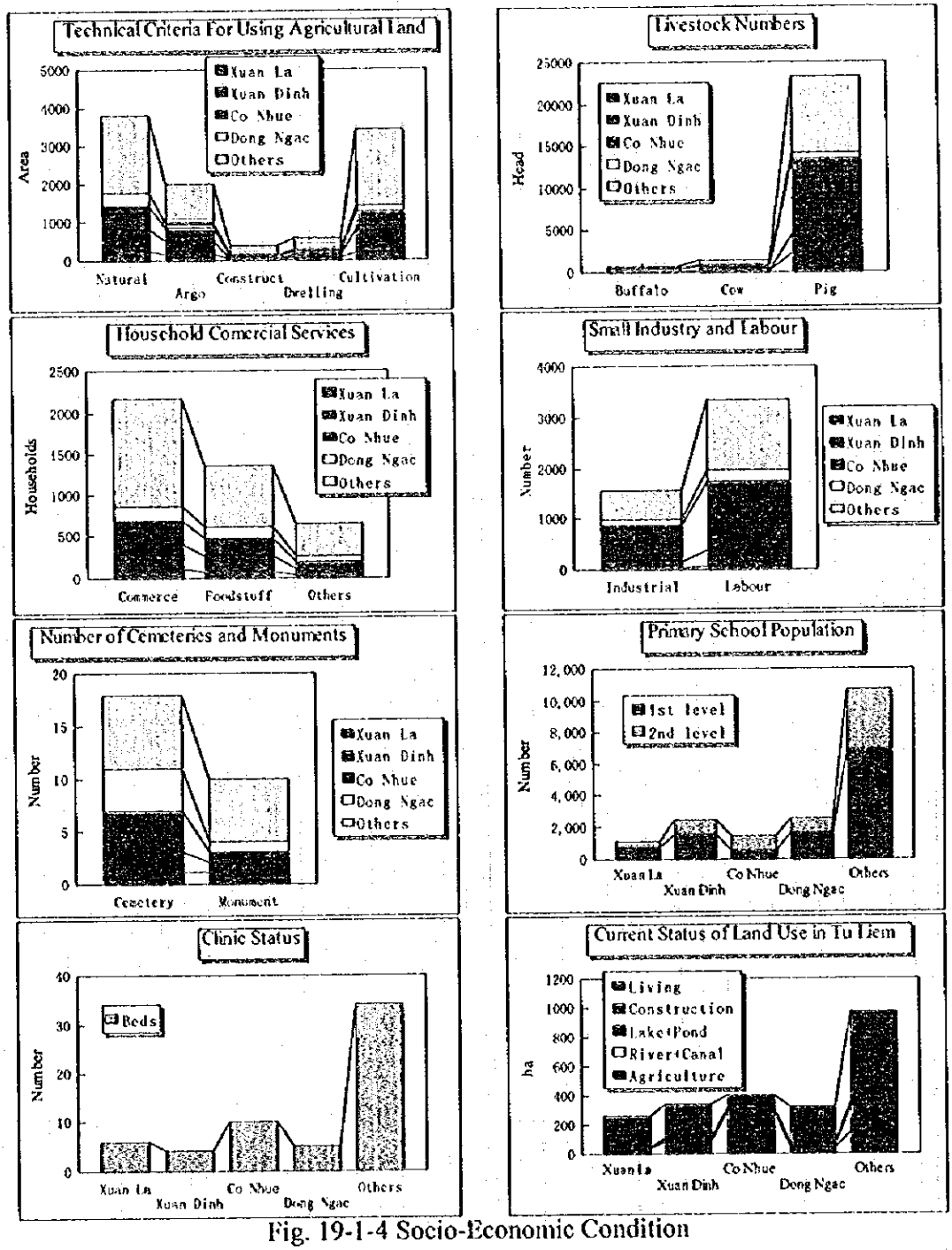


Fig. 19-1-4 Socio-Economic Condition

19.1.2 Natural Environment

(1) Hydrological situation

In Tu Liem District, there are simple local networks of drainage, two major lakes such as Nghia Do Lake and Quan La Lake, and a canal system which have the function of

irrigation and rain water drainage for the area. The canal which receives water from the West Lake is the most important. Most of the canals are connected to the Nhue River, some of water is initially discharged into the To Lich River, but everybody flows into Nhue river .

- The Nhue River: starts from Lien Mac gate at Red River and its length is 76km. The function of Nhue river are irrigation and drainage. The total area of irrigation is about 700km^2 of agricultural fields and the drainage area is 1075km^2. This study area is, therefore, in the catchment area of the Nhue River. The main drainage canals in the area are Xuan La and Xuan Dinh canals.
- Nghia Do Lake: is 4.7ha in area, has an average depth 2.5m and volume about 117,500m^3. It receives some sewage discharged from the Nghia Do living quarter. Its self-purification functions are sufficient to ensure that its water quality is not significantly polluted.

Water quality in the district compared with the agricultural water standard of Japan is shown in Table 19-1-3. The Standard is for the desirable maintenance level as irrigation water and shows allowable limits of concentration which will not cause damaged.

Table 19-1-3 Water quality in To Liem district

Substance	Standard Value for Agriculture	Red River	Nhue river (Lien Mac Gate)	Xuan Dinh Canal	West Lake	To Lich River
pH	6.0-7.5	6.5-7.8	7.7-7.9	-	6.8-8.15	7.2
COD	6 mg/l or less	2.4-21.1	20-61	-	10-35	-
SS	100 mg/l or less	140-1790	137-705	68	82-105	60-350
DO	5 mg/l or more	4.2-7.5	5.8-6.5		4-5.5	0.5-7
T-N	1 mg/l or less	-	-	-	-	-
	NH_4^+	(0.015-0.21)	0.1-1.0	4	0.5-4.5	0.6
	NO_2^-	(0.004-0.27)	< 0.1	0.1	0.4-1.1	1.2
	NO_3^-	(0.4-1.2)	0.05-0.1	0.1	0.2-1.85	
EC	0.3 mmho/cm or less	-	-	-	-	-
As	0.05 mg/l or les	-	-	-	-	-
Cu	0.02 mg/l or less	-	-	-	-	-
Zn	0.5 mg/l or less	-	-	-	-	-
Heavy Oil	2 l/a or less	-	-	-	-	-
Light Oil	5 l/a or less	-	-	-	-	-

(2) Flora and fauna

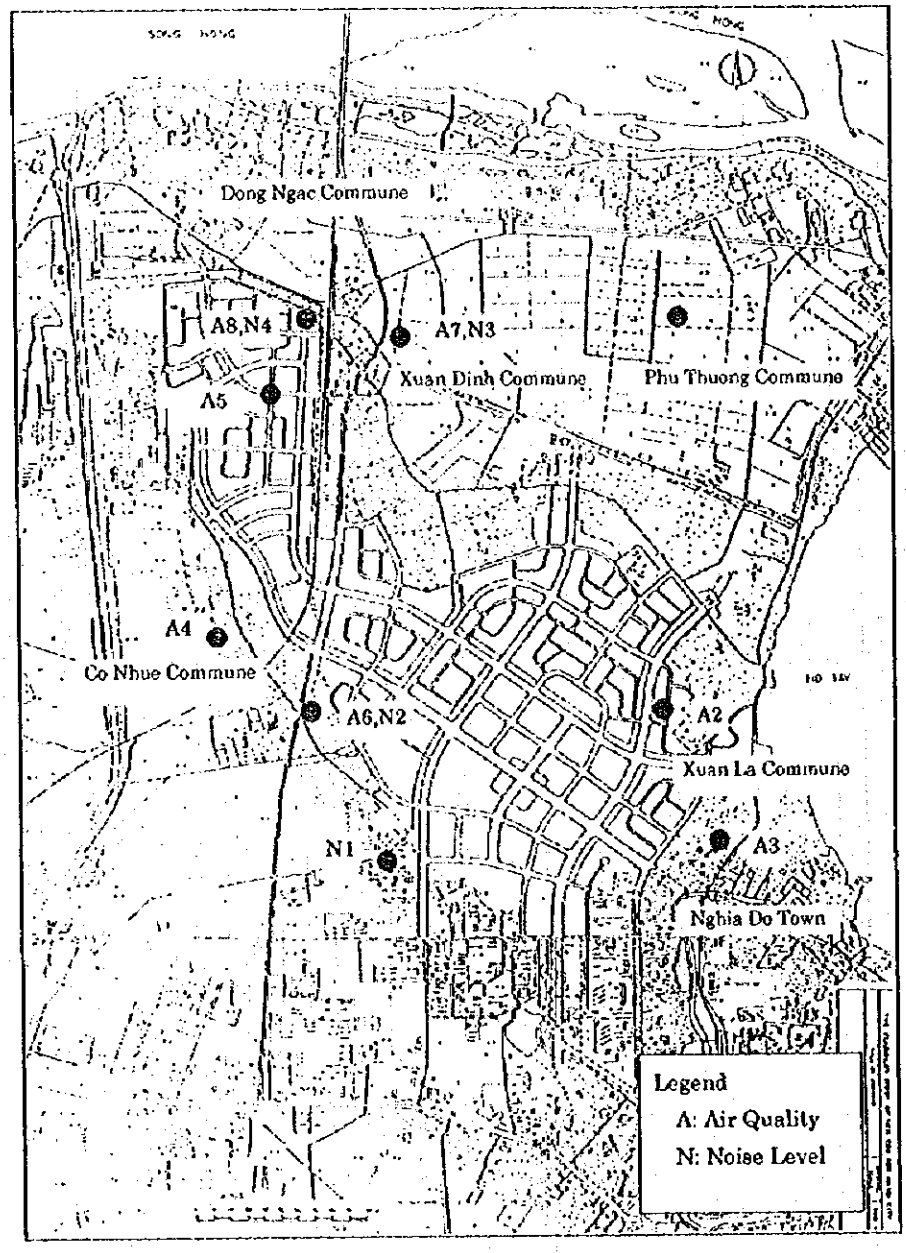
The CBD area mainly comprises existing paddy fields. Therefore, flora is mainly paddy rice and no rare plants exist. Also no rare animals exist in the paddy fields. Although some types of pheasant and partridge inhabited the area in the past, they are thought to have become extinct. Therefore, the construction of the CBD will have little effect on the flora and fauna.

19.1.3 Environmental Pollution

(1) Air Pollution

With regard to the existing air condition in the project area, a monitoring survey was carried out and compared with the Vietnamese Standard. The objective of the study was

to investigate and analyze the existing air pollution levels in the project area, and on the basis of these to appraise the method of estimating air pollution level in the future. The following 8 air quality monitoring locations were chosen after consideration of the existing village and road locations. The sites of these are shown in Fig. 19-1-5. The survey period of each location was 1 day between from 5 August and 9 August 1996.



A1 : Phu Thuong Commune (as background location where is the same of the last one) , Aug. 5
A2 : in Xuan La Commune, Aug. 5
A3 : in Nghia Do Commune, Aug. 5
A4 : in Co Nhue Commune, Aug. 5
A5 : in Dong Ngac Commune (Gach Hamlet), August 5
A6 : on roadside of South Thang Long - Noi Bai Highway through Co Nhue Commune, Aug.7
A7 : on roadside of South Thang Long - Noi Bai Highway through Dong Ngac Commune, Aug. 8
A8 : under railway viaduct through Dong Ngac Commune, Aug. 9

Fig. 19-1-5 Location for Monitoring of Air Quality and Noise Level

The monitored substances were Carbon Monoxide(CO), Nitrogen Dioxide(NO_2), Sulfur Dioxide(SO_2), Suspended Particulate Matter(SPM) and Lead(Pb). Hourly meteorological data, including temperature, humidity, atmosphere pressure, wind speed and wind direction were measured at each location for the monitoring period. The monitoring results are summarized in Table 19-1-4 and Fig. 19-1-6.

Table 19-1-4(1) Air quality monitoring results 24-hours average values

Date	Monitoring Locations	Pollutant concentration(mg/m³)				
		CO	SO^2	NO^2	SPM	Pb
Aug 5	A1	2.89	0.001	0.026	0.183	
Aug 5	A2	4.27	0.009	0.037	0.196	
Aug 5	A3	2.53	0.003	0.014	0.257	
Aug 5	A4	4.53	0.009	0.033	0.193	
Aug 5	A5	4.57	0.047	0.032	0.249	
Aug 7	A6	3.67	0.092	0.010	0.516	0.0043
Aug 8	A7	5.13	0.029	0.006	0.494	0.0057
Aug 9	A8	5.20	0.027	0.004	0.386	0.0046
Average value		4.10	0.027	0.020	0.309	0.0048
Standard values (TCVN5937-1995)		5.00	0.300	0.100	0.200	0.0050

Table 19-1-4(2) Air quality monitoring results 1-hour value

Date	Monitoring Locations	Pollutant concentration(mg/m³)				
		CO	SO^2	NO^2	SPM	Pb
Aug 5	A1	3.42	0.007	0.038	0.230	
Aug 5	A2	6.81	0.034	0.066	0.231	
Aug 5	A3	3.12	0.013	0.041	0.321	
Aug 5	A4	7.14	0.022	0.048	0.234	
Aug 5	A5	5.59	0.015	0.064	0.364	
Aug 7	A6	4.36	0.122	0.013	0.601	0.0050
Aug 8	A7	5.67	0.041	0.010	0.581	0.0085
Aug 9	A8	5.61	0.034	0.007	0.418	0.0052
Average value		5.22	0.047	0.036	0.370	0.0062
Standard values (TCVN5937-1995)		40.00	0.500	0.400	0.300	

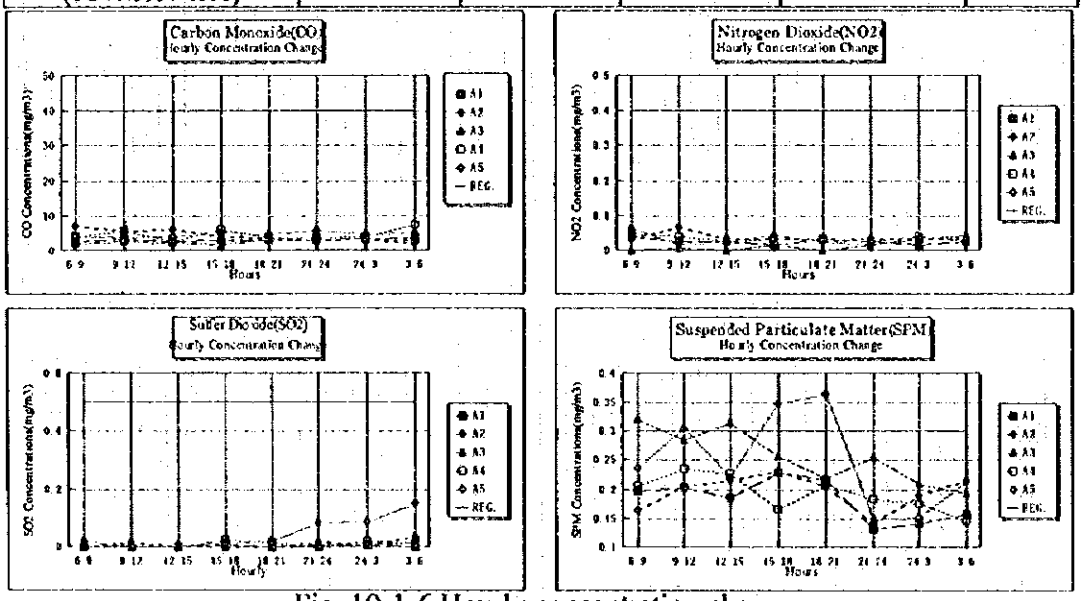


Fig. 19-1-6 Hourly concentration change

- Carbon Monoxide(CO): CO concentrations were low. CO concentrations at 3 locations in the communities(A2,A3,A4) were as follows: maximum 1-hour values were in the range 3.12 to 7.14mg/m^3 and lower than the Vietnamese Standard(40mg/m^3); 24-hour mean values were in the range 2.53 to 4.53mg/m^3 and lower than the Standard(5mg/m^3); CO concentration at the other 4 roadside locations(A5,A6,A7,A8) were as follows: maximum 1-hour values were in the range 4.38 to 5.67mg/m^3. 24-hours mean values were in the range 3.67 to 5.20mg/m^3 and nearly equal to the Standard. These values were the same inside and at the roadside.
- Nitrogen Dioxide(NO_2): NO_2 concentrations are also very low. NO_2 concentrations at all 8 locations in the communities were as follows: maximum 1-hour values were in the range 0.007 to 0.066mg/m^3 and lower than the Vietnamese Standard(0.400mg/m^3); 24-hour mean values were in the range 0.004 to 0.037mg/m^3 and lower than the Standard(0.100mg/m^3). The values at roadside locations tended to be smaller than those of inside, therefore, the emission gas from vehicles does not have much affect in air pollution.
- Sulfur Dioxide(SO_2): SO_2 concentrations are also very low. Concentrations at all 8 locations in the communities were as follows: maximum 1-hour values were in the range 0.007 to 0.150mg/m^3 and lower than the Vietnamese Standard(0.500mg/m^3); 24-hour mean values were in the range 0.001 to 0.092mg/m^3 and lower than the Standard(0.300mg/m^3).
- Suspended Particulate Matter(SPM): SPM concentrations at 4 locations in the communities were as follows: maximum 1-hour values were in the range 0.230 to 0.321mg/m^3 and nearly equal to the Vietnamese Standard(0.300mg/m^3); 24-hour mean values were in the range 0.183 to 0.257mg/m^3 and a little higher than the Standard(5mg/m^3). SPM concentration at the other 4 roadside locations were as follows: maximum 1-hour values were in the range0.364 to 0.601mg/m^3 and higher than the Standard; 24-hour mean values were in the range 0.249 to 0.516mg/m^3 and also higher than the Standard. The values at the roadside were higher than those of inside, which may be due to the traffic.
- Lead(Pb): Pb concentration at the 4 roadside locations were as follows: 24-hour mean values were in the range 0.0043 to 0.0057mg/m^3 and nearly equal to the Standard(0.0050mg/m^3).

Between 80% and 90% of vehicles on the South Thang Long-Noi Bai Highway are motorcycles, and about a half of them seems 2-stroke engines. The maximum hourly traffic volumes are high, being in the range 1400 to 2700. However, NO_2 concentration at the roadside are low, which is due to the following characteristics of 4-stroke engines of motorcycles. Though the 4-stroke engines has 4 processes of intake, compression, explosion and exhaust independently, intake and exhaust of the 2- stroke engines are done at same time. For that reason, mixed air of fuel is sucked up and a part of them is let out directly. As a result of this mixed air let up, volume of Hydro-Carbon(HC) in emission gas is 4-7 times compared with 4-stroke engines. However, as combustion temperature of 2-stoke engines is low, emission of Nitrogen oxides are quite few compared with 4-stroke engines.

(2) Noise

Regarding the existing noise condition in the project area, a monitoring survey was carried out and compared with the Vietnamese Standard. The objective of the survey was to investigate and analyze the relationship between noise level and traffic volume in the project area, and on the basis of these to appraise the method of predicting the noise level in the future. The monitoring locations of noise levels were as follows: N1-in the living quarter, N2 and N3-on the roadside of the South Thang Long-Noi Bai Highway; and N4-under the elevated railway. These locations are shown in Fig. 19-1-5. The survey period of each location was from 06:00 to 24:00 between 5 August and 9 August 1996. The traffic volume was counted and classified at the same time.

The monitoring results are summarized in Table 19-1-5. The values at N1 met the Vietnamese Standard, however, these of the other locations were high and failed to meet the Standard.

Table 19-1-5 Average values of noise level and hourly volume of vehicles

		Leq	L50	Average Hourly Volume of Vehicles			
				Mot.Cycle	Pass.Car	L.Truck	H.Truck
N1	Day-time	52.9	48.9	-	-	-	-
	Nigh-time	49.9	45.9	-	-	-	-
N2	Day-time	78.0	72.5	1849	317	140	9
	Nigh-time	72.4	68.4	451	24	97	26
N3	Day-time	74.0	68.5	1219	265	172	8
	Nigh-time	67.7	64.5	194	66	58	9
N4	Day-time	71.5	67.6	496	77	73	5
	Nigh-time	67.3	63.4	83	1	62	0

- Prediction Method: the prediction of noise impact caused by vehicle transportation in the future is performed by the following process. For the noise calculations, the noise level L50 based on the prediction method of the Acoustical Society of Japan(AJS) is used.

The prediction method of the ASJ is as follows:

$$L_{50} = Lw - 8 - 20\log_{10} l + 10\log_{10}(\pi\, l/d \tanh 2\pi\, l/d) + \alpha\, d + \alpha\, i$$

where:

L_{50}	Median of traffic noise level (dBA)
Lw	Average power level of noise a vehicle(dBA)
l	Distance from sound source (m)
d	Average interval of vehicle (m) d = 1000 V/N
V	Average running speed (km/hour)
N	Traffic volume (Vehicle/hour)
α d	Adjustment factor of diffraction
α i	Adjustment factor of various causes

There is no data available on the investigation of noise made by each type of vehicle in the City. However, noise levels of 5 motorcycles were investigated in the first stage of the study. At a result, the noise power ratio of a motorcycle to a car in Japan was calculated as approximately 1/2.5; the noise power level of motorcycles is 93dB, that for

the cars in Japan is 97dB. In this case, the noise power ratio of a large vehicle to a small car is assumed as 8, by reference to the ratio of old large vehicles in Japan. Therefore, the measured noise value and calculated noise value along the highway can be compared. The power level formula used is as follows.

$$Lw = 65.1 + 20 \log_{10}V + 10 \log_{10}(0.4\, a_0 + a_1 + 8.0\, a_2)$$

a_0: Ratio of motorcycle
a_1: Ratio of small vehicle
a_2: Ratio of large vehicle $\quad a_0 + a_1 + a_2 = 1.0$

The data used was selected from measuring points in the above-mentioned investigation of the Noi Bai Highway. Noise levels were estimated by classifying 3 types from each traffic volume. The calculated noise level is compared with the surveyed noise level in Table 19-1-6. The result shows that the calculated values are smaller than the measured values. The cause of the difference is estimated to be the frequent use of the horns of vehicles on the roads of Hanoi City.

Table 19-1-6 Comparison between measured level and calculated level (1)

Locations	Time	Average Hourly Traffic Volume			Noise Level(dB)	
		Motorcycle	Small car	Large car	measured	calculated
N2	Day	1849	457	9	72.5	61.1
N3	Day	1219	437	8	68.5	59.5

The last survey proved that noise made by the horns of motorcycles is about 105-108dB at peak level. Then, for the reference, assuming that about a half of the vehicles are sounding horns, and altering the coefficient of the above-mentioned formula as follows, the calculated values approach the actual measured values quite closely, as shown in Table 19-1-7. This result shows that the improvement of traffic flow is able to achieve considerable noise reduction.

$$Lw = 65.1 + 20 \log_{10}V + 10 \log_{10}(5.2\, a_0 + 5.5\, a_1 + 9.2\, a_2)$$

Table 19-1-7 Comparison between measured level and calculated level (2)

Locations	measured level	calculated level
N2	72.5 dB	70.1dB
N3	68.5 dB	68.8 dB

19.1.4 Selection of Environmental Evaluation Items

Environmental Evaluation Items were selected in accordance with Table 19-1-8. The evaluation are after completion and during construction where necessity. Environmental criteria are basically the Vietnamese Standard, where this is not available the Japanese Standard is used.

Table 19-1-8 Selection Results

Environmental items		Evaluation		Grounds
Socio-economic Environment				
1	Resettlement	○	After completion	About compensation for paddy field and changing occupation will be needed.
2	Economic activities	-		Greater part of the proposed site is paddy field.
3	Traffic and public facilities	-		Greater part of the proposed site is paddy field.
4	Split of communities	-		Greater part of the proposed site is paddy field.
5	Cultural property	-		Valuable cultural properties do not exist.
6	Water right	-		Situation of water right is unknown.
7	Health and sanitation	-		Refuse collecting system exist.
8	Waste	○	After completion	About waste disposal
9	Hazards	-		There is no factor in the site.
Natural Environment				
10	Topography and geology	-		Valuable topography and geography do not exist.
11	Soil erosion	-		There are not woods or sloping land the proposed site
12	Groundwater	○	After completion	About rain recycle system
13	Hydrological situation	-		There are not major rivers and lakes in the proposed site.
14	Coast and sea area	-		There is no sea area.
15	Flora and fauna	-		Valuable flora and fauna do not exist in the proposed site
16	Climate	-		Construction of high buildings is not planned.
17	Landscape (Greenery)	○	After completion	About greenery
Environmental Pollution				
18	Air pollution	○	Under construction	About dust under construction
			After completion	About pollutants concentration from traffic
19	Water pollution	○	Under construction	About muddy water when raining
			After completion	About household wastewater and rainwater
20	Soil contamination	○	Under construction	About treatment of waste dump
21	Noise and vibration	○	Under construction	About construction equipment working
			After completion	About predicted level from traffic
22	Ground subsidence	-		Large amount of groundwater will not be pumped, although there is weak ground.
23	Offensive odors	-		There are no factors of producing offensive odors.

19.2 Environmental Impact and Evaluation

In order to create an attractive urban environment, it is necessary not only to secure amenities such as urban comfort and convenience, but also to pay attention to promoting a sound material cycle in the area and reducing the load on the air, water and land.

A new town in the suburbs requires an attractive urban environment, thought high quality treatments are necessary. The environmental impact of a new urban area like the new CBD may seem to be small, however it is necessary to promote the development for harmony with the natural characteristics such as habitat, greenery and water environment.

19.2.1 Socio - economic Environment

(1) Resettlement

The new CBD development will avoid dense residential areas. However, some houses and shops along the current roads will need to be demolished and their residents resettled. It is important to consult the affected inhabitants and to ensure that their living conditions are the same after resettlement. Farmers who work the paddy fields will need compensating for their loss of income and/or relocation to alternative agricultural areas. Also graves on the development area will need to be relocated and appropriate compensation will needed to be paid where appropriate. Compensation rates are described on the above-mentioned Decision 2951/QD-UB. However, difference between the Decision prices and the actual prices may be large. In consequence the following prices are assumed for each development stage.

Table 19-2-1 Compensation Price

Stage	1st Stage	2nd Stage	3rd Stage	Total
Compensation Price (B.VND)	1737.1	1933.7	1658.7	5329.5

(2) Waste

No incineration plant is planned in the CBD, therefore household waste and excretions need to be collected and treated by the Hanoi Environment Company(URENCO). The future volume of household waste will amount to be about 140ton/day (200,000people × 0.6m/(person・year)/365days × 0.42ton/m^3=138ton/day). The composition of the current waste in Hanoi consists mainly of organic materials which are able to be used as organic fertilizer, and the other materials which are able to be recycled. Dumping of refuse on the roads is a problem for sanitation in Hanoi City. Recently a composting plant has been constructed in Cau Dien, which can processes 30,000m^3 of waste and produce 7,500ton of organic fertilizer. It is essential that the inhabitants are conscious of the need to avoid such dumping on the new CBD, therefore there should be a clearly defined system for rubbish collection and disposal.

19.2.2 Natural Environment

(1) Groundwater

Generally speaking, large cities become very hot in summer time due to the heat-island phenomenon where the high temperature is shaped like island. Increasing artificial thermal emission, ill-ventilated urban shape and land-surface covered with concrete and buildings cause city heating. Water and greenery are precious refrigerant sources and important elements to maintain ecosystem, to protect scenery and to improve the heat environment of the city. In urban areas it has been necessary to provide good drainage networks to avoid flooding. However, because areas where rain can not penetrate into the ground have increased, many problems such as dry soil and falling the groundwater levels have been caused in the cities. To cope with these problems, the bottom of canals, parks, greenbelts and pavements in the CBD should be designed so that matter can penetrate into the ground.

(2) Greenery

Plants such as trees and shrubs greenery have environmental improvement functions such as the absorption of CO_2, purification of air, encouraging water circulation on the land and mitigation of deteriorating urban condition. Greenbelts water are indispensable to make wind paths which bring fresh air into the city. In the CBD, more than 20% of area would comprise parks, greenbelts and street-trees, this green infrastructure aims to mitigate the heat-island phenomenon and to course harmony with the ecosystem. However, it is necessary that the selected trees are in harmony with the local environment. This provides a continuation from the surrounding environment and an inheritance of local color, and is also effective as expression of local characteristics.

19.2.3 Environmental Pollution

(1) Air pollution

1) Under construction

The area surrounding the CBD is mainly a residential district. Air pollution during construction will be caused by dust from construction work. Therefore, countermeasures should be provided such as establishment of dust-proofing fences and sprinkling water when necessary.

2) After completion

The prediction of pollutant concentration caused by vehicle transportation in the future is calculated using the following process. A 1-hour concentration in the case of transverse wind and parallel wind by Plume model is used as the prediction method. The prediction formula is as follows:

a. In case of transverse wind (as line source model)

$$C(x) = (2/\pi)^{1/2} \cdot (Q_1/U\ \sigma_z) \cdot \exp(-He^2/2\ \sigma_z^2)$$

where, U : Average wind speed (m/sec)
Q_L : Emission intensity of pollutant (mg/m·s)
He : Effective emission source height (m)
σ_z : Width of diffusion in vertical direction

b. In case of parallel wind

$$C(y)=Q/(\pi U \sigma_y \sigma_z)\cdot\exp(-y^2/2\sigma_y^2)\cdot\exp(-He^2/2\sigma_z)$$

where, Q : Emission intensity of pollutant (mg/m) $Q=\Delta x\cdot Q_L$
$\sigma_y(x)$: Width of diffusion in horizontal direction $x=\Delta x\cdot i$
$\sigma_z(x)$: Width of diffusion in vertical direction $x=\Delta x\cdot i$

$$C(y)=\Sigma\, Q/(\pi U \sigma_y(\Delta xi)\sigma_z(\Delta xi))\cdot\exp(-y^2/2\sigma_y(\Delta xi)^2)\cdot\exp(-He^2/2\sigma_z(\Delta xi)^2)$$

where, i : i =1,n (n=50)
Δx : Δx=10m

Emission concentrations in 2015 are expected to reduce from the present levels due to vehicle exhaust gas regulation and the improvement of vehicle efficiency. Today, the concentration of vehicle exhaust gas is thought to be higher than that of Japan, however, it is assumed that the future condition of Hanoi will be close to the present one of Japan. Therefore, the current emission coefficients for Japan are used. However, regarding motorcycle emissions the coefficient of NO_2 maybe disregarded and that of CO is assumed as 20% of that for car in accordance with the Vietnamese Emission Standard. Using the Pasquill-Gilfford Chart of width of diffusion, the air stability percentage B,D,E were calculated. The wind speed is taken as 2.5m/s which is the average wind speed for Hanoi, and height of emission source is assumed as the 1m as the roads are at grade. Prediction sections were divided into 2; main road; said cutting ring roads. Hourly traffic volume, ratio of each vehicle type and speed are specified as follows:

- Hourly traffic volume: peak hourly traffic volume is assumed to be the daily traffic on the future network multiplied by 0.08 as a peak hourly coefficient.
- Ratio of each vehicle type: the values are disaggregated to daily traffic volumes classified by vehicle type.
- Speed: speeds are assumed to match design speeds.

The above calculation conditions are shown in Table 19-2-2.

Table 19-2-2 Calculation conditions of Air Pollution

Description		Main Road of Arterial Road			Ring Road(No.2)		
		Bus+H.Truck	Car+L.Truck	M.cycle	Bus+H.Truck	Car+L.Truck	M.cycle
Hourly Traffic Volume		184	368	5160	691	733	6800
Emission Coefficient	NO_2	1.900	0.226		2.410	0.196	
(g/km/unit)	CO	1.660	0.769	0.596	1.960	1.230	0.596
Emission Intensity	NO_2	0.097	0.023		0.463	0.040	
(mg/m/sec)	CO	0.085	0.079	0.854	0.376	0.250	1.126
Total. Emission Int.	NO_2	0.12			0.5		
(mg/m/sec)	CO	1.02			1.75		

The future concentrations are caused by the roads and background concentrations. The calculation results are as shown in Table 19-2-3 and Fig. 19-2-1. Beyond the border, concentration of CO is in the range 3.04-3.32mg/m3, that of NO_2 is in the range 0.044-

0.131mg/m^3 and meet the Standard respectively.

Table 19-2-3 Calculation results at border between road and housing site

Locations	Substances	Concentration in the future (mg/m^3)		Background Concentration(mg/m^3)
		Trans. Wind	Parallel. wind	
Main road	CO	3.084-3.176	3.035-3.049	3.00
	NO_2	0.050-0.061	0.044-0.046	0.04
Ring road	CO	3.164-3.319	3.073-3.114	3.00
	NO_2	0.087-0.131	0.061-0.071	0.04

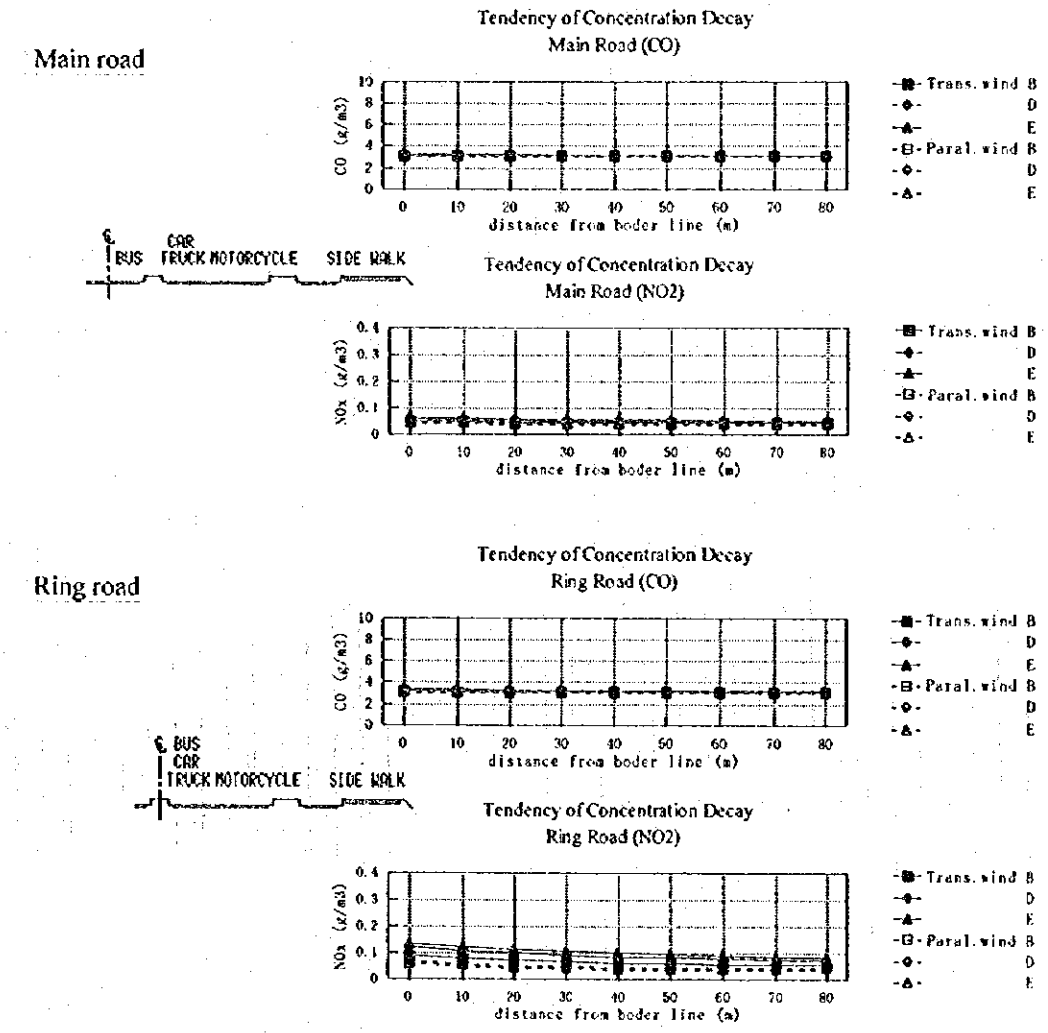


Fig. 19-2-1 Distribution of pollutant level

(2) Water Pollution

1) Under construction

Construction of the new CBD is planned to be divided into three stages. Therefore, to cope with the impact caused by muddy water on the paddy fields which will not be

developed until later, the order of the development will be planned from the side of the lower reaches. Muddy water, including bentonite slurry will be used during pile construction, therefore, it is necessary to treat with the surplus water properly to avoid pollution of the rivers. With regard to muddy water caused by rain during construction, it is necessary to avoid impacts on paddy fields and canals around the site to establish temporary drains and sedimentation pools.

2) After completion

Volume of waste effluents from a residential population of 200,000 and an employed population 400,000 is about 114,000m^3 per day. At present in Hanoi, this waste water discharges into drainage rivers without treatment. If this volume of wastewater were discharged, the drainage river condition would deteriorate more. The Nhue River is used for irrigation and the surroundings of the CBD are vast paddy fields. Affects caused by urban wastewater are as follows: (1) damage to crop growth; (2) contamination of crops; (3) damage to agricultural facilities; and (4) contamination-caused illness. Therefore a wastewater treatment plant with activated sludge process must be established in the CBD to treat water prior to release into the river. However, rainwater drainage system must be separated from the sewage system and rainwater is planned to discharge directly into the river. Concentration of COD in the river is currently fairly high. In order to irrigate using the treated water in the future, it will be necessary to manage cultivation properly, for example by adjustment of fertilizer, drying up the soil against concentration of Nitrogen using brief monitoring because quality of treatment water changes seasonally and hourly.

(3) Soil Pollution

The proposed site is paddy field and not contaminated. Waste dumps produced by construction of foundation piles will be used for land reclamation on the site and aggregates such as sand and gravel will be imported from the Red River. Therefore, soil contamination will not occur on the site. However, production plants are not planned in the CBD and the above-mentioned drainage system will not affect the paddy fields on the outskirts of the CBD.

(4) Noise

1) Under construction

Regarding earthworks and foundation works which will affect the environs, noise produced by construction equipment is predicted. The prediction point is the edge of the site. The relationship between main construction equipment and distance are shown in Fig. 2.2.2. As a prediction method, construction equipment is properly allocated and each noise level is synthesized as follows.

$$L = 10\log_{10}(10^{L1/10} + 10^{L2/10} + \cdots + 10^{Ln/10})$$

Calculation conditions and results are shown in Table 19.2.4. Although the Vietnamese Standard for construction is still not enacted, noise levels caused by construction equipment will not meet the Noise Standard. Where housing developments or dwellings

are localised close to the site, therefore, it is necessary to establish a noise barrier along the borderline of the site, to reduce impact.

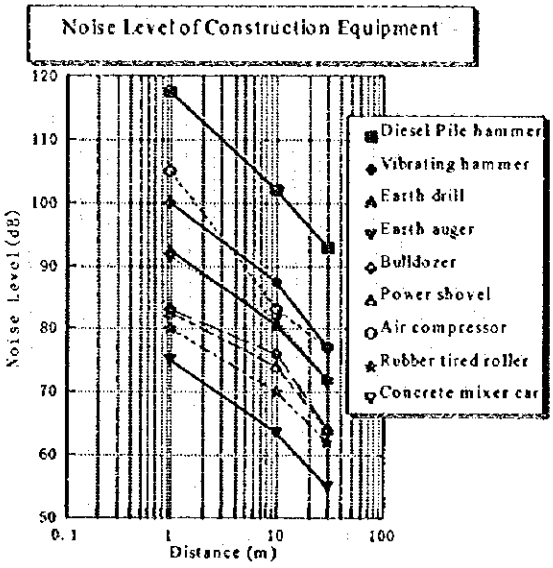


Fig. 19-2-2 Noise level of construction equipment

Table 19-2-4 Calculation condition and result

Name	Noise Level(dB)	Distance(m)
(Diesel Pile hammer)	(93)	30
Vibrating hammer	77	30
Earth drill	72	30
Earth auger	63	10
Bulldozer	78	5
Power shovel	78	5
Air compressor	77	30
Rubber tired roller	73	5
Concrete mixer truck	82	10
Total Noise level	86 dB	

Regulatory Standards for construction in Japan
85dB at borderline of the site
Prohibition Items:

2) After completion

Noise Power levels in 2015 are expected to reduce from the present level due to the regulatory standards for vehicle noise and improvement of vehicle efficiency. Today, the vehicle noise is assumed to be slightly higher than that in Japan, however it is assumed that the future conditions in Hanoi will be close to the present ones in Japan. Therefore, although the formula of power level is based on the ASJ, the term for motorcycles is added in the formula. In addition, as it is expected that the future traffic will flow more smoothly owning to improvement of roads in the project area, the rise in coefficients caused by horn use is disregarded.

$$Lw = 65.1 + 20 \log_{10} V + 10 \log_{10}(0.4\, a_0 + a_1 + 4.4\, a_2)$$

Using the above power level formula, the distribution of noise level L_{50} in 2015 was calculated. Prediction sections are divided into 2; main roads; and arterial ring roads. Hourly traffic volumes, vehicle type proportions and speed were assumed to be the same as in the case of the air pollution calculations.

The above calculation conditions are shown in Table 19-2-5.

Table 19-2-5 Calculation conditions of Noise

Location	Daily Traffic Volume	Peak Hourly Traffic Volume	Traffic Volume (unit)					Velocity (km/hour)
			Motorcycle	Car	L.Truck	H.Truck	Bus	
Main Road	71,400	5712	5160	-	-	-	-	25
			-	96	272	24	160	60
Ring Road	26,300	2104	6800	-	-	-	-	25
			-	336	397	35	656	40

Using these data, the results of calculation predicted using the ASJ are shown in Fig. 19-2-3. Leq is about L_{50} plus 2-3dB.

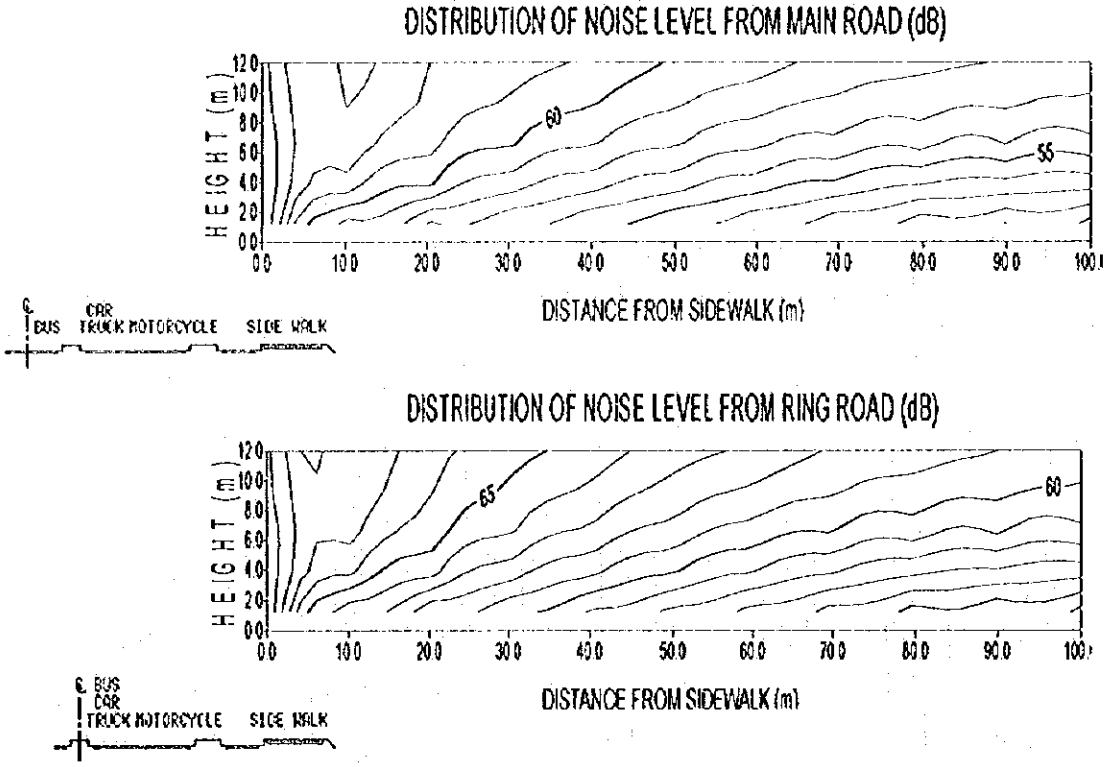


Fig. 19-2-3 Distribution of Noise Level

In the above Fig.s, the boundary between the roadside and private areas are assumed to be located 7-10m from the curbstone. The noise standard in residential areas is 65dB in daytime, therefore noise from the main roads is within the standard but that from the ring road is equal to the standard. With continued traffic growth after 2015, the noise levels will exceed the Standard. Therefore, as a countermeasure will be needed to reduce the noise. To achieve this, a low earth barrier with shrubs for landscaping in the separate strip is recommended, with a height in proportion to the traffic volumes.

(5) Vibration

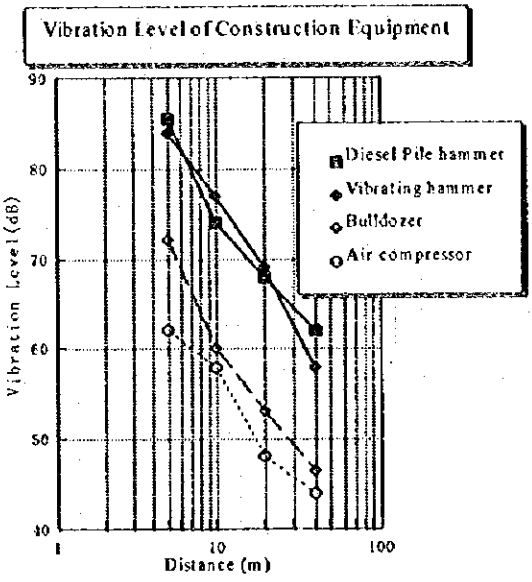
1) Under construction

Regarding earthworks and foundation works which will affect the environs, vibration produced by construction equipment is predicted. The prediction point is the border of the site. The relationship between main construction equipment and distance are shown in Fig. 19-2-4. In relation to a prediction method, construction equipment is properly allocated and each vibration level is synthesized as follows.

$$L = 10\log_{10}(10^{L1/10} + 10^{L2/10} + \cdots + 10^{Ln/10})$$

Calculation conditions and result are shown in Table 19-2-6. Although the Vietnamese Standard for construction are still not enacted, the vibration level caused by construction equipment will meet the Vibration Standard.

Table 19-2-6 Calculation condition and result



Name	Vibration Level(dB)	Distance (m)
(Diesel Pile hammer)	(93)	30
Vibrating hammer	63	30
Bulldozer	72	5
Air compressor	46	30
Total Noise level	73 dB	

Regulatory Standards for construction in Japan
75dB at borderline of the site
Prohibition Items:
Night time, Holiday and etc.

Fig. 19-2-4 Vibration level of construction equipment

2) After completion

Regarding the Main roads and the Ring road, road traffic vibration levels are predicted in addition as noise levels. As a prediction model, the following formula is defined by the Ministry of Construction in Japan for at grade road is used.

$$L_{10} = a \cdot \log(\log Q^*) + b \cdot \log V + c \cdot \log M + d + \alpha\sigma + \alpha f - \alpha l$$

where, L_{10} : Vibration level which is upper value of 80% range (dB)

Q^* : Equivalent traffic per one lane during 500sec (unit/500sec/lane)

$Q^* = 500/3600 \cdot 1/M \cdot (Q_1 + 13Q_2)$

Q1 : Hourly traffic volume of small vehicle (unit/hour)

Q2 : Hourly traffic volume of large vehicle (unit/hour)

V : Average running speed (km/h)

M : Number of whole lanes

$\alpha\sigma$: Adjustment factor for flat characteristics of pavement (dB)

$\alpha\sigma = 18\log\sigma$ (concrete pavement σ =5mm)

αf : Adjustment factor of soil proper vibration (dB)

$f = 8.4N^{1/3}$ f:soil proper frequency (Hz), N:Average N value (surface-10m)

$f \geqq 8$Hz : $\alpha f = -20\log f$, 8Hz$>f \geqq$ 4Hz : $\alpha f = -18$, 4Hz$>f$: $10\log f - 24$

αl : Value of decay by distance (dB) $\alpha l = \beta \cdot \log(r/5+1)/\log 2$

$\beta = 0.06L_{10}' - 1.6$ (clay soil)

a, b, c, d : Constant a = 65, b = 6, c = 4, d = 35 (at-grade road)

Although the establishment of traffic condition is the same as that for noise, motorcycles are disregarded because of the affect is extremely small. Calculation results of the vibration level at the border between roads and housing sites are shown in Table 19-2-7. These values are equal to the threshold of human being and meet the Vietnamese Standard ($0.054m/s^2$=75dB).

Table 19-2-7 Calculation results at border between roads and housing site

Locations	Hourly traffic conditions			Vib. Level (dB)
	Small vehicle volume(U)	Large vehicle volume(U)	Av. Speed(km/h)	
Main road	368	184	60	50.0
Ring road	733	691	40	54.2

CHAPTER 20 ECONOMIC AND FINANCIAL EVALUATION

The financial and economic viability of the New CBD project will be examined in this Chapter. However, the New CBD project in Xuan La area is a part of Hanoi Urban Development Corridor (HUDC). The conclusion of the transport master plan is that all the HUDC be developed in accordance with the Master Plan to lighten the future transport burden in the present built-up area, and to maintain better living standard, and the New CBD project in Xuan La will not be enough to accommodate the estimated future population and work forces. All the HUDC would be well developed to meet the future land demand. Therefore, the preliminary financial and economic viability of HUDC will also be examined for reference based on the information obtained from the preliminary design of the New CBD Development.

20.1 Premises

20.1.1 Project Schedule

The HUDC project consists of four sub projects. They are:

- New CBD Development Project;
- New CBD Annex Development Project;
- Yen Hoa Development Project; and
- Dai Kim Development Project.

Each project was divided to a few development packages, for example New CBD Development Project was divided three packages, Yen Hoa Development Project four and Dai Kim Development Project two excluding New CBD Annex Development Project which consisted of a package.

The development schedule is shown in Table 20-1-1.

Table 20-1-1 Project Schedule

Work Package	199x			200x								201x									
Year	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
New CBD No.1			C	C	S	S	S																
New CBD No.2					C	C	S	S	S														
New CBD No.3							C	C	S	S	S												
New CBD Annex														C	C	S	S	S					
Yen Hoa No.1											C	C	S	S	S								
Yen Hoa No.2													C	C	S	S	S						
Yen Hoa No.3							C	C	S	S	S												
Yen Hoa No.4									C	C	S	S	S										
Dai Kim No.1																C	C	S	S	S			
Dai Kim No.2																		C	C	S	S	S	

Note: C means Construction
S means Selling

20.1.2 Land Price

The compensation cost of rice paddy in this area was considered at around 50,000 VND/m^2 (4.5US$/m^2) based on the HPC stipulations. Farmers in the area (New CBD, Yen Hoa and Dai Kim), however, expected to sell by around 880,000 VND/m^2 (80US$/m^2) based on the interview survey undertaken by the Study Team. The average land productivity in agriculture area is reported at 3,000 VND/year, therefore this figure equivalents to the almost double of the total land productivity for the infinite years. In this analysis 880,000 VND/m^2 was adopted for cost of compensation in the market price.

The land with infrastructures and without infrastructures are quite difference. The land selling price is estimated based on the market price of lands in the urbanized area. The selling price was estimated from the same survey data. Residents of Cau Giay, O Cho Dua, O Cau Den and Yen Phu (areas scattered along the boundary of the 4 central districts) gave a selling price of 5,750,000 VND/m^2 (523 US$/m^2), which is 6.5 times of the price of land without infrastructure. The land selling prices by land use adopted in this study are shown in Table 20-1-2.

Table 20-1-2 Land Selling Price and Space by Usage

Land Use	Price (M.VND/m^2)	Area (ha)	Selling Amount (BVND)
Hospital	1.6	5.5	88.0
School	1.6	48.1	769.4
Park	0.0	53.3	0.0
Greenbelt	0.0	29.9	0.0
Promenades	0.0	4.9	0.0
Road	0.0	168.1	0.0
Parking Space	2.4	4.7	112.3
Sewerage Treatment Plant	0.0	9.2	0.0
Administrative Facilities	2.4	14.2	340.1
Convention Center	1.6	8.3	132.6
Office/Shop	8.0	29.5	2,484.8
Office/Residence	6.4	31.1	1,182.1
Shopping Center	4.8	18.5	397.9
High Density Residence Area	6.4	55.7	3,562.2
Medium Density Residence Area	5.6	111.4	6,239.5
Total		592.4	15,308.9
Average Selling Price (VND/m^2)			2,584,200

20.1.3 Capital and Liabilities

It was assumed that the development body would not be a private firm but a non-profit public entity. The paid up capital was assumed to be 10 B.VND. A finance from a foreign soft loan was assumed to cover 70% of the total investment and the other 30 %, together with funds to cover cash flow, was assumed to be foreign private bank finance in a short time base for one year. Loan conditions assumed are shown in Table 20-1-3.

Table 20-1-3 Loan Condition

Lender	Loan Period	Interest Rate	Note
Soft Loan*	30 Years**	2.7% p.a.	Loan for Construction
Soft Loan*	30 Years**	2.3% p.a.	Loan for Engineering Service
Bank	1 Year	7.0% p.a.	US Dollar Interest

Note: * request 10% deposit
** including 10 years grace period.

It was also assumed that a 10 % deposit of loan would be requested as a guarantee fee. A 10% of the amount of the foreign soft loan was added to the first year (1998) investment and the same amount was returned in the last year (2008 or 2019) of the project evaluation period. No guarantee money were considered for other bank loans.

20.1.4 Currency Unit

All money terms including cost of foreign portion are expressed in Vietnam Dong (VND).

20.2 Financial Analysis

20.2.1 Financial Costs and Revenues

(1) Financial Costs

The disbursement schedule of the investment is shown in Table 20-2-1. The interest payment starts after 10 years from when the loan agreement become effective. The inflation effect is not considered. The interest rate of borrowing money and deposit from Banks are fixed at 7 % p.a. and 5 %, respectively. The interest rate of the long term soft loan is also fixed at 2.7 % p.a. for construction or 2.3 % p.a. for engineering. Taxes arising from land rates and any corporate tax are not considered in the cost.

Table 20-2-1 Disbursement Schedule of the Financial Investment

(unit : BVND)

Year	New CBD Project		HUDC Project	
	Investment	Operation Cost	Investment	Operation Cost
1998	35.8	3.6	35.8	3.6
1999	1,827.8	7.2	1,827.8	7.2
2000	464.7	7.2	464.7	14.4
2001	2,616.3	7.2	2,616.3	14.4
2002	279.9	125.2	3,078.2	132.4
2003	2,064.3	101.6	4,137.6	108.8
2004	335.8	141.7	4,837.8	148.9
2005	489.3	118.1	3,514.5	125.3
2006	0.0	113.1	4,131.0	369.9
2007	0.0	108.0	2,778.5	302.4
2008	0.0	108.0	3,057.5	593.8
2009	0.0	0.0	5,583.4	232.9
2010	0.0	0.0	3,576.5	494.4
2011	0.0	0.0	3,764.7	210.5
2012	0.0	0.0	2,037.4	415.0
2013	0.0	0.0	1,221.9	307.3
2014	0.0	0.0	835.9	272.4
2015	0.0	0.0	1,090.7	315.6
2016	0.0	0.0	748.4	161.9
2017	0.0	0.0	0.0	362.7
2018	0.0	0.0	0.0	165.0
Total	8,113.9	840.9	49,338.6	4,758.8

Operation cost is consisted of administration expenses and sales expenses. Administration expenses were calculated under the following assumptions:

a) Indirect expenses would be the same amount as personnel expenses.
b) Average monthly salary would be 2 million VND.
c) Number of employees would be 75 at start and increase to 300 in two years and then it will be fixed.

Sales expenses were assumed as 5 % of realized sales.

(2) Revenue

Revenue comes from the sales of land. Sale of the land was assumed to be completed in three years after the completion of construction. The revenue schedule during

project period is shown in Table 20-2-2.

Table 20-2-2 Revenue Schedule (Financial Analysis)

(unit : BVND)

Year	New CBD Project	HUDC Project
1998	0.0	0.0
1999	0.0	0.0
2000	0.0	0.0
2001	0.0	0.0
2002	2,360.6	2,360.6
2003	1,888.4	1,888.4
2004	2,690.7	2,690.7
2005	2,218.6	2,218.6
2006	2,117.6	7,109.4
2007	2,016.6	5,760.4
2008	2,016.6	11,587.8
2009	0.0	4,370.6
2010	0.0	9,600.2
2011	0.0	3,922.2
2012	0.0	8,012.5
2013	0.0	5,857.4
2014	0.0	5,160.0
2015	0.0	6,024.4
2016	0.0	2,949.1
2017	0.0	6,965.0
2018	0.0	3,012.0
2019	0.0	3,012.0
Total	15,309.1	92,501.3

20.2.2 Profit Loss Statement (PL) and Balance Sheet (BS)

(1) New CBD Development

The cash balance is shown in Fig. 20-2-1. The first revenue accrued in 2002, the 4th year from the start and the largest cumulative loss which is 5,579 BVND occurs in the year 2001. After 8 years of continued loss, it turns to profit. The PL of 2008, which is the final year of the project shows a cumulative profit of 5,985 BVND.

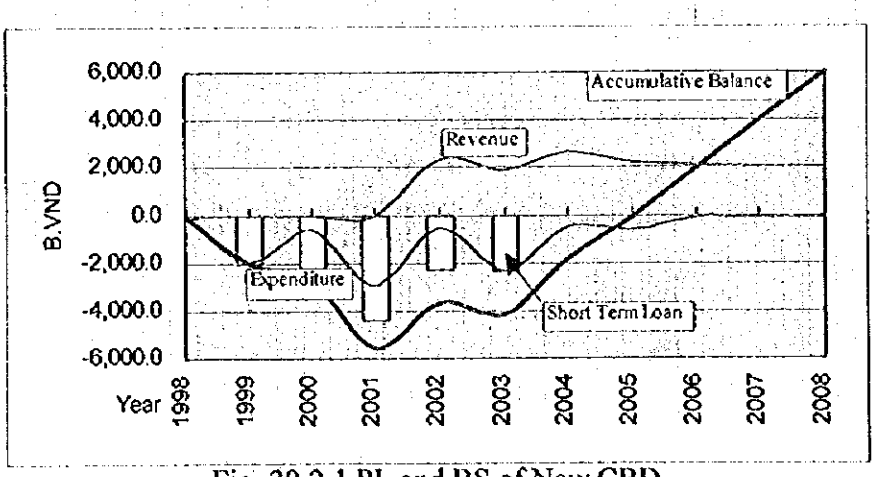


Fig. 20-2-1 PL and BS of New CBD

This surplus can be funded to the development of the railway between the North Thanh Long area and Central Hanoi via the New CBD area. The cash flow table (CF)

shows borrowings of 4,400 BVND which correspond to the cumulative loss of 5,579 BVND. The conclusion from the PL pro forma is that the project is promising if the executing body has enough bank credit to borrow 4,400 BVND, in spite of total assets are 2,802 BVND at the same time. The PL, the CF and the BS are shown in Table 20-2-3..

(2) HUDC Development

The largest cumulative loss occurs in 2005 and the amount is 11,868 BVND. Short term loan in relation to that loss is 9,000 BVND and the largest amount of the short term loan will be 11,500 BVND at 2007. It turns to a profit after 9 years from the start. The BS for 2019, the last year of this project, shows a 49,428 BVND surplus. A part of this surplus can be utilized for the railway development along RR No.3. Fig. 20-2-2 illustrates movements of revenue, expenditures, accumulated PL and amounts of short term loan. It is clear from Fig. 20-3-2 that the project scale is very big but project itself is sound if the organization can cope with such a long term deficit as mentioned in above. The PL, the CF and the BS of project are shown in Table 20-2-4..

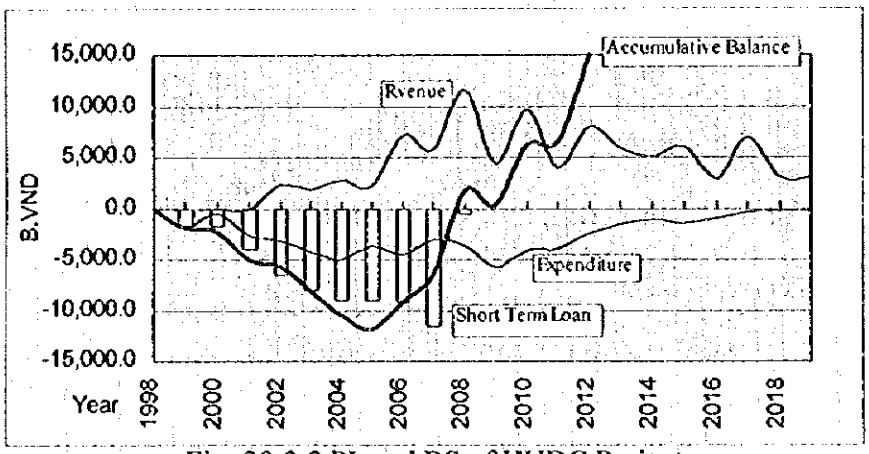


Fig. 20-2-2 PL and BS of HUDC Project

Table 20-2-3 Profit and Loss Statement (New CBD)

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Profit and Loss Statement											
Revenue	0.0	0.0	0.0	0.0	1,539.1	1,231.3	1,754.3	1,446.5	1,380.7	1,314.8	1,314.8
Sales of Developed	0.0	0.0	0.0	0.0	2,360.6	1,888.4	2,690.7	2,218.6	2,117.6	2,016.6	2,016.6
Land											
Expenses											
Total of Expenses	46.4	1,975.0	625.9	2,931.5	566.1	2,330.4	477.5	607.4	113.1	108.0	108.0
Engineering &	35.8	90.7	464.7	682.6	279.9	405.6	335.8	489.3	0.0	0.0	0.0
Construction											
Land Acquisition	0.0	1,737.1	0.0	1,933.7	0.0	1,658.7	0.0	0.0	0.0	0.0	0.0
Sales Expenses	0.0	0.0	0.0	0.0	118.0	94.4	134.5	110.9	105.9	100.8	100.8
Administration	3.6	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
Expenses											
Soft Loan Interest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short Term Loan Interest	7.0	140.0	154.0	308.0	161.0	164.5	0.0	0.0	0.0	0.0	0.0
Ex Business Revenue	0.0	0.0	0.0	0.0	89.7	0.0	110.7	80.6	100.2	95.4	95.4
Interest Receivable	0.0	0.0	0.0	0.0	89.7	0.0	110.7	80.6	100.2	95.4	95.4
Profit (Loss) before Tax	-46.4	-1,975.0	-625.9	-2,931.5	1,884.2	-442.0	2,323.8	1,691.7	2,104.7	2,004.0	2,004.0
Dividend	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cumulative Profit (Loss)	-46.4	-2,021.4	-2,647.3	-5,578.8	-3,695.6	-4,138.6	-1,815.8	-125.1	1,978.7	3,981.6	5,984.6
Cash Flow Table											
Cash Inflow											
Capital & Deposit											
Capital Investment	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deposit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan											
Soft Loan	35.8	90.7	464.7	682.6	279.9	405.6	335.8	489.3	0.0	0.0	0.0
Short Term Loan	100.0	2,000.0	2,200.0	4,400.0	2,300.0	2,350.0	0.0	0.0	0.0	0.0	0.0
Sales	0.0	0.0	0.0	0.0	2,360.6	1,888.4	2,690.7	2,218.6	2,117.6	2,016.6	2,016.6
Ex Business Revenue	0.0	0.0	0.0	0.0	89.7	0.0	110.7	80.6	100.2	95.4	95.4
Cash Inflow Total	145.8	2,090.7	2,664.7	5,082.6	5,030.2	4,644.0	3,137.2	2,788.5	2,217.8	2,112.0	2,112.0
Cash Outflow											
Deposit											
Deposit	97.2	0.0	0.0	0.0	48.0	0.0	57.8	0.0	0.0	0.0	0.0
Repayment											
Soft Loan Repayment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short Term Loan Repayment	0.0	100.0	2,000.0	2,200.0	4,400.0	2,300.0	2,350.0	0.0	0.0	0.0	0.0
Expenses	46.4	1,975.0	625.9	2,931.5	566.1	2,330.4	477.5	607.4	113.1	108.0	108.0
Dividend	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0
Cash Outflow Total	143.6	2,075.0	2,625.9	5,131.5	5,014.1	4,630.4	2,886.3	608.4	114.1	109.0	109.0
Cash on Hand/in Banks	2.2	15.7	38.8	-48.9	16.1	13.6	250.9	2,180.0	2,103.7	2,003.0	2,003.0
Cumulative Cash on Hand/in Bank	2.2	17.9	56.7	7.8	23.9	37.5	288.4	2,468.4	4,572.1	6,575.1	8,578.1
Balance Sheet											
Assets											
Current Assets											
Cash on Hand and in Banks	2.2	17.9	56.7	7.8	23.9	37.5	288.4	2,468.4	4,572.1	6,575.1	8,578.1
Property											
Land	0.0	1,737.1	1,737.1	2,802.3	2,107.4	3,592.4	2,818.9	2,045.4	1,327.0	663.5	0.0
Liabilities and Capital Surplus (Deficiency)											
Paid-up Capitals	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Soft Loan	35.8	126.5	591.2	1,273.8	1,553.7	1,959.3	2,295.1	2,784.4	2,784.4	2,784.4	2,784.4
Short Term Loan	100.0	2,000.0	2,200.0	4,400.0	2,300.0	2,350.0	0.0	0.0	0.0	0.0	0.0
Surplus (Deficiency)	-143.6	-381.5	-1,007.4	-2,873.7	-1,732.4	-689.4	802.2	1,719.5	3,104.7	4,444.2	5,783.7

Table 20-2-4 Profit and Loss Statement (HUDC) (1)

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Profit and Loss Statement											
Revenue											
Sales of Developed Land	0.0	0.0	0.0	0.0	2,360.6	1,888.4	2,690.7	2,218.6	7,109.4	5,760.4	11,587.8
Expenses											
Total of Expenses	39.4	1,835.0	479.1	2,630.7	3,210.6	4,246.4	4,986.7	3,639.8	4,500.9	3,080.9	3,651.3
Engineering & Construction	35.8	90.7	464.7	682.6	404.4	696.1	1,755.3	1,459.8	1,508.6	1,029.9	1,291.7
Land Acquisition	0.0	1,737.1	0.0	1,933.7	2,673.8	3,441.5	3,082.5	2,054.7	2,622.4	1,748.6	1,765.8
Sales Expenses	0.0	0.0	0.0	0.0	118.0	94.4	134.5	110.9	355.5	288.0	579.4
Administration Expenses	3.6	7.2	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Soft Loan Interest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Payment											
Short Term Loan Int.	0.0	122.5	122.5	273.0	455.0	560.0	630.0	630.0	644.0	805.0	35.0
Payment											
Ex Business Revenue											
Interest Receivable	0.0	0.5	1.2	1.2	12.1	3.1	19.5	4.1	30.5	4.0	372.8
Profit (Loss) before Tax	-39.4	-1,834.5	-477.9	-2,629.5	-838.0	-2,354.9	-2,276.5	-1,417.2	2,639.0	2,683.5	8,309.3
Dividend	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
Profit (Loss) of this Year	-39.4	-1,834.5	-477.9	-2,629.5	-838.0	-2,354.9	-2,276.5	-1,417.2	2,639.0	2,683.5	8,309.3
Cumulative Profit (Loss)	-39.4	-1,873.9	-2,351.8	-4,981.3	-5,819.3	-8,174.1	-10,450.6	-11,867.8	-9,228.8	-6,545.3	1,764.0
Cash Flow Table											
Cash Inflow											
Capital & Deposit											
Capital	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deposit	97.2	0.0	0.0	0.0	274.8	0.0	57.8	0.0	177.7	0.0	152.4
Loan											
Soft Loan	35.8	90.7	464.7	682.6	404.4	696.1	1,755.3	1,459.8	1,508.6	1,029.9	1,291.7
Short Term Loan	0.0	1,750.0	1,750.0	3,900.0	6,500.0	8,000.0	9,000.0	9,000.0	9,200.0	11,500.0	500.0
Sales	0.0	0.0	0.0	0.0	0.0	2,360.6	1,888.4	2,690.7	2,218.6	7,109.4	5,760.4
Ex Business Revenue	0.0	0.5	1.2	1.2	12.1	3.1	19.5	4.1	30.5	4.0	372.8
Cash Inflow Total	143.0	1,841.2	2,215.9	4,583.8	7,191.3	11,059.8	12,721.0	13,154.6	13,135.4	19,643.3	8,077.3
Cash Outflow											
Deposit											
Deposit	97.2	0.0	0.0	0.0	274.8	0.0	57.8	0.0	177.7	0.0	152.4
Repayment											
Soft Loan Repayment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short Term Loan Repayment	0.0	0.0	1,750.0	1,750.0	3,900.0	6,500.0	8,000.0	9,000.0	9,000.0	9,200.0	11,500.0
Expenses	35.8	1,827.8	464.7	2,616.3	3,196.2	4,232.0	4,972.3	3,625.4	4,486.5	3,066.5	3,636.9
Dividend	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
Cash Outflow Total	133.0	1,827.8	2,214.7	4,366.3	7,371.1	10,732.0	13,030.1	12,625.4	13,665.2	12,267.5	15,290.3
Cash on Hand and in Banks	10.0	13.4	1.2	217.5	-179.7	327.8	-309.1	529.1	-529.8	7,375.8	-7,213.0
Cumulative Cash on Hand in Banks	10.0	23.4	24.6	242.1	62.4	390.1	81.1	610.2	80.4	7,456.2	243.2
Balance Sheet											
Assets											
Current Assets											
Cash on Hand and in Banks	10.0	23.4	24.6	242.1	62.4	390.1	81.1	610.2	80.4	7,456.2	243.2
Property											
Land	0.0	1,737.1	1,737.1	2,802.3	4,781.2	8,049.0	10,358.0	9,856.6	10,423.5	10,171.7	9,219.1
Liabilities and Capital Surplus											
Paid-up Capitals	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Soft Loan	35.8	126.5	591.2	1,273.8	1,678.2	2,374.3	4,129.6	5,589.4	7,098.0	8,127.9	9,419.6
Short Term Loan	0.0	1,750.0	1,750.0	3,900.0	6,500.0	8,000.0	9,000.0	9,000.0	9,200.0	11,500.0	500.0
Surplus (Deficiency)	-35.8	-126.0	-589.5	-2,139.5	-3,344.6	-1,945.2	-2,700.5	-4,132.6	-5,804.0	-2,010.0	-467.3

Table 20-2-4 Profit and Loss Statement (HUDC) (2)

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Profit and Loss Statement											
Revenue											
Sales of Developed Land	4,370.6	9,600.2	3,922.2	8,012.5	5,857.4	5,160.0	6,024.4	2,949.1	6,965.0	3,012.0	3,012.0
Expenses											
Total of Expenses	5,816.3	4,070.9	3,975.2	2,452.4	1,529.2	1,108.3	1,406.3	910.3	362.7	165.0	165.0
Engineering & Construction	987.2	1,296.4	1,365.4	437.8	1,221.9	835.9	1,090.7	748.4	0.0	0.0	0.0
Land Acquisition	4,596.2	2,280.1	2,399.3	1,599.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sales Expenses	218.5	480.0	196.1	400.6	292.9	258.0	301.2	147.5	348.3	150.6	150.6
Administration Expenses	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Soft Loan Interest	33.8	33.4	33.0	124.8	122.8	120.8	139.2	137.1	198.5	195.9	333.8
Payment											
Short Term Loan Int.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Payment											
Ex Business Revenue											
Interest Receivable	12.2	320.6	411.4	776.4	888.7	1,296.7	1,619.2	1,917.9	2,282.7	2,492.1	2,922.8
Profit (Loss) before Tax	-1,433.6	5,849.9	358.3	6,336.4	5,217.0	5,348.4	6,237.2	3,956.8	8,885.1	5,339.0	5,769.7
Dividend	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Profit (Loss) of this Year	-1,433.6	5,849.9	358.3	6,336.4	5,217.0	5,348.4	6,237.2	3,956.8	8,885.1	5,339.0	5,769.7
Cumulative Profit (Loss)	330.4	6,180.3	6,538.6	12,875.1	18,092.0	23,440.4	29,677.6	33,634.4	42,519.5	47,858.5	53,628.3
Cash Flow Table											
Cash Inflow											
Capital & Deposit											
Capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deposit	252.8	124.2	0.0	0.0	128.7	0.0	8.9	0.0	4.5	0.0	0.0
Loan											
Soft Loan	987.2	1,296.4	1,365.4	437.8	1,221.9	835.9	1,090.7	748.4	0.0	0.0	0.0
Short Term Loan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sales	11,587.8	4,370.6	9,600.2	3,922.2	8,012.5	5,857.4	5,160.0	6,024.4	2,949.1	6,965.0	3,012.0
Ex Business Revenue	12.2	320.6	411.4	776.4	888.7	1,296.7	1,619.2	1,917.9	2,282.7	2,492.1	2,922.8
Cash Inflow Total	12,840.0	6,111.8	11,376.9	5,136.4	10,251.8	7,990.0	7,878.8	8,690.7	5,236.3	9,457.1	5,934.7
Cash Outflow											
Deposit											
Deposit	252.8	124.2	0.0	0.0	128.7	0.0	8.9	0.0	4.5	0.0	0.0
Repayment											
Soft Loan Repayment	81.6	81.6	81.6	325.9	325.3	324.7	361.9	361.3	496.5	495.9	862.4
Short Term Loan Repayment	500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Expenses	5,835.7	4,089.9	3,993.8	2,562.8	1,637.6	1,214.7	1,531.2	1,032.9	546.7	346.5	484.4
Dividend	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cash Outflow Total	6,671.1	4,296.8	4,076.4	2,889.7	2,092.6	1,540.4	1,903.0	1,395.3	1,048.7	843.4	1,347.9
Cash on Hand and in Banks	6,168.9	1,815.1	7,300.5	2,246.7	8,159.2	6,449.6	5,975.8	7,295.5	4,187.6	8,613.7	4,586.9
Cumulative Cash on Hand in Banks	6,412.1	8,227.1	15,527.6	17,774.3	25,933.5	32,383.1	38,358.9	45,654.3	49,841.9	58,455.6	63,042.5
Balance Sheet											
Assets											
Current Assets											
Cash on Hand and in Banks	6,412.1	8,227.1	15,527.6	17,774.3	25,933.5	32,383.1	38,358.9	45,654.3	49,841.9	58,455.6	63,042.5
Property											
Land	12,274.2	11,264.7	12,352.7	9,184.2	6,591.5	3,998.9	2,399.3	1,199.7	0.0	0.0	0.0
Liabilities and Capital Surplus											
Paid-up Capitals	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Soft Loan	10,325.2	11,540.0	12,823.8	12,935.7	13,832.3	14,343.5	15,072.3	15,459.4	14,962.9	14,467.0	13,604.6
Short Term Loan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surplus (Deficiency)	8,351.0	7,941.8	15,046.5	14,012.7	18,682.7	22,028.5	25,675.9	31,384.6	34,869.0	43,978.6	49,427.9

20.2.3 Financial Internal Rate of Return (FIRR)

(1) New CBD Development

Residual value in 2008 is zero after sold out of land attached and the FIRR is 22% (see Table 20-2-5). Sensitivity analysis for up to 20% cost increase and a 20% decrease of sales was undertaken. The results are shown in Table 20-2-6. Based on the assumptions, the average rate of interest becomes 4,8 % per annum (see Table 20-2-7). The case of 20 % of cost increase and 20 % of sales decrease, shows 7 % of FIRR. It means that all cases were above the minimum requirement of IRR (4.8 %).

Table 20-2-5 FIRR of New CBD Development

(unit: BVND)

No.	Year	Cost	Revenue	Net Revenue	NPV
1	1998	39.4	0.0	-48.5	-48.5
2	1999	1,835.0	0.0	-1,857.6	-1,772.5
3	2000	471.9	0.0	-630.4	-574.0
4	2001	2,623.5	0.0	-2,858.9	-2,483.8
5	2002	405.1	2,360.6	1,904.5	1,578.9
6	2003	2,165.9	1,888.4	-351.3	-277.9
7	2004	477.5	2,690.7	2,203.7	1,663.3
8	2005	607.4	2,218.6	1,599.4	1,151.9
9	2006	113.1	2,117.6	2,004.5	1,377.6
10	2007	108.0	2,016.6	1,908.6	1,251.6
11	2008	108.0	2,016.6	1,908.6	1,194.2
				Net Present Value :	3,060.8
				At Discount Rate of	0.048
				Financial IRR:	0.16

Table 20-2-6 Sensitivity Analysis of New CBD Development

(unit: %)

Decrease of Sales	Cost Increase (Times to Standard Case)		
(Times to Standard Case)	1.0	1.1	1.2
1.0	22	18	15
0.9	18	14	11
0.8	14	10	7

Table 20-2-7 Weighted Cost of Capital of New CBD Case

(unit: %)

Item	Amount (BVND)	Ratio to the Total (%)	Interest per Annum	Weighted Cost of Capital
Soft Loan (construction)	1,829.8	20.4	2.7	0.55
Soft Loan (engineering)	119.3	1.3	2.3	0.03
Short Term Loan (yearly)	7,005.9	78.3	7.0	5.48
Total	8,955.0	100.0		6.06

(2) HUDC Development

The FIRR shows 16 % (see Table 20-2-8) and the residual value at 2019 was zero because the land would all be sold. Sensitivity analysis for up to 20 % cost increase and 20 % of decrease of sales were undertaken. The result are shown in Table 20.3.7. The average rate of interest of the HUDC case became 5,9 % per annum (see Table

20.3.8). The reason why the average rate of interest of HUDC development case is lower than that of the New CBD development case is that in HUDC case the revenue of the first project could partly cover land acquisition costs for the second project and this fund raising scheme would be continued, but in the New CBD development case it could not be covered by the other project, then part of short term loan will become larger. These cases which could not cover the minimum requirement of IRR (5.9%) were a case of a 20 % cost increase and a 20 % sales decrease.

Table 20-2-8 FIRR of HUDC Development

(unit: BVND)

No.	Year	Cost	Revenue	Net Revenue	NPV
1	1998	48.5	0.0	-48.5	-48.5
2	1999	1,857.6	0.0	-1,857.6	-1,794.1
3	2000	637.6	0.0	-637.6	-594.7
4	2001	2,866.1	0.0	-2,866.1	-2,582.1
5	2002	3,261.5	2,360.6	-900.9	-783.9
6	2003	4,320.2	1,888.4	-2,431.8	-2,043.6
7	2004	4,996.2	2,690.7	-2,305.5	-1,871.2
8	2005	3,651.6	2,218.6	-1,433.0	-1,123.3
9	2006	4,500.9	7,109.4	2,608.5	1,974.8
10	2007	3,080.9	5,760.4	2,679.5	1,959.2
11	2008	3,651.3	11,587.8	7,936.5	5,604.6
12	2009	5,771.5	4,370.6	-1,400.9	-955.5
13	2010	4,026.6	9,600.2	5,573.6	3,671.5
14	2011	3,931.4	3,922.2	-9.2	-5.9
15	2012	2,313.9	8,012.5	5,698.6	3,501.5
16	2013	1,392.9	5,857.4	4,464.5	2,649.4
17	2014	974.4	5,160.4	4,186.0	2,399.2
18	2015	1,253.6	6,024.4	4,770.8	2,640.9
19	2016	760.2	2949.1	2,188.9	1,170.3
20	2017	1,195.3	6,965.0	5,769.7	2,979.2
21	2018	702.3	3,012.0	2,309.7	1,151.8
22	2019	17.3	3,012.0	2,994.7	1,442.4
				Net Present Value :	19,342.2
				At Discount Rate of	0.035
				Financial IRR:	15.26%

Table 20-2-9 Sensitivity Analysis of HUDC Development

(unit: %)

Decrease of Sales	Cost Increase (Times to Standard Case)		
(Times to Standard Case)	1.0	1.1	1.2
1.0	16	13	10
0.9	13	10	7
0.8	9	6	4

Table 20-2-10 Weighted Cost of Capital of HUDC Case

(unit: %)

Item	Amount (BVND)	Ratio to the Total (%)	Interest per Annum	Weighted Cost of Capital
Long Term Loan(construction)	11,384.6	23.5	2.7	0.63
Long Term Loan(engineering)	797.7	1.6	2.3	0.04
Short Term Loan(yearly)	36,330.0	74.9	7.0	5.24
Total	48,512.3	100.0		5.91

20.3 Economic Analysis

20.3.1 Definition of Economic Costs and Economic Benefits

(1) Economic Costs

Economic construction costs were calculated for several cases of construction works and these costs were compared with their financial costs. Using this procedure, 0.94 was obtained as the Standard Conversion Factor (SCF) from financial costs to economic costs. All economic costs were estimated by applying this conversion factor.

Table 20-3-1 Disbursement Schedule of Economic Costs

(unit: BVND)

Year	New CBD Project	HUDC Project
1998	37.0	37.0
1999	1,724.9	1,724.9
2000	443.6	450.4
2001	2,466.1	2,472.9
2002	380.8	3,018.0
2003	2,036.0	3,991.6
2004	448.9	4,687.5
2005	571.0	3,421.4
2006	106.3	4,230.8
2007	101.5	2,896.1
2008	101.5	3,432.2
2009	0.0	5,467.3
2010	0.0	3,826.7
2011	0.0	3,736.7
2012	0.0	2,305.3
2013	0.0	1,437.4
2014	0.0	1,041.8
2015	0.0	1,321.9
2016	0.0	855.6
2017	0.0	340.9
2018	0.0	155.1
2019	0.0	155.1
Total	8,417.6	51,006.6

(2) Economic Benefits

1) General Description

The economic benefits of the HUDC (including New CBD project) project were divided to:

A. Increase of land productivity,
B. Vehicle Operating Cost (VOC) savings and
C. Facility cost savings.

2) Increase of Land Productivity

Land productivity differences between different land uses is difficult to measure. In this study, it was assumed that market price of land represented productivity of land.

The Profit and Loss (PL) Statement of HUDC shows that total sales of land until 2018 will be 92,501.1 BVND and the total price of purchased land will be 31,935.3 BVND. Also the PL Statement of the New CBD (see Table attached at the end of this chapter) gives total sale of 15,309.0 BVND and total land acquisition costs 5329.5 BVND. Based on these data, the value added rate included in the selling price is 0.652 for the New CBD project and 0.655 for HUDC (Table 20-3-2).

Table 20-3-2 Value Added Rate of Land Development

	New CBD Project	HUDC Project
Total of Land Sale (BVND)	15,309.0	92,501.1
Total of Land Acquisition Costs (BVND)	5,329.5	31,953.3
Difference of Sale and Acquisition (BVND)	9,979.9	60,547.8
Value Added Rate in Selling Price	0.652	0.655

The Increase of land productivity was assumed and is shown in Table 20-3-3, by multiplying the value added rate of the selling price by the sales of land.

Table 20-3-3 Increase of Land Productivity

(unit: BVND)

Year	New CBD Project	HUDC Project
1998	0.0	
1999	0.0	
2000	0.0	
2001	0.0	
2002	1,539.1	1,546.2
2003	1,231.3	1,236.9
2004	1,754.3	1,762.4
2005	1,446.5	1,453.2
2006	1,380.7	4,856.6
2007	1,314.8	3,773.1
2008	1,314.8	7,590.0
2009	0.0	2,862.7
2010	0.0	6.288.1
2011	0.0	2,569.0
2012	0.0	5,248.2
2013	0.0	3,836.6
2014	0.0	3,379.8
2015	0.0	3,946.0
2016	0.0	1,931.6
2017	0.0	4,562.1
2018	0.0	1,972.8
2019	0.0	1,972.8
Total	9,981.5	54,500.0

3) Vehicle Operating Costs (VOC) Savings

The difference of VOC of "with New CBD construction project case" and "without New CBD construction project case" is the VOC saving of the New CBD construction project. VOC savings of HUDC construction project can be calculated in the same way. In the both cases, the VOC savings beyond the master plan target year of 2015 are fixed to the value in 2015, because of uncertainty of the traffic demand beyond the target year.

Table 20-2-4 VOC Savings

(unit: BVND)

Year	New CBD Project	HUDC Project
1998	0	0
1999	0	0
2000	9.2	0
2001	25.6	0
2002	56.5	40
2003	87.4	49.9
2004	114.1	144.9
2005	132.1	175.6
2006	181.6	285.3
2007	221.9	319.8
2008	309.0	357.9
2009	355.8	399.9
2010	415.1	446.1
2011	474.4	496.9
2012	508.3	552.9
2013	542.2	614.4
2014	602.9	682.1
2015	663.7	756.4

4) Facility Cost Savings

New CBD was planned to accommodate 165,000 population in a total 167 ha of residential area, which means a high net population density of 988 persons/ha. If this area was left to take its own course, this 165,000 population will spread and would need more land. The New CBD development provides highly intensive infrastructure to support the lives of the large population, and if these population resides individually, the more investment for the infrastructure will be needed to maintain the same level of living standard. Therefore, the difference of infrastructure development costs of the lower density land and the New CBD can be considered as a social benefit.

Here, we assume the double land for the lower density land development case. Some infrastructure will require the investment in proportion to the land area, and some will not have any relation with land area size. Facility development costs to cover this double size land area of the New CBD were estimated as shown in Table 20-3-5.

Table 20-3-5 Facility Construction Costs in the Case of Same Population scattered in a Double Size Area

(unit: BVND)

Work Item	New CBD Development Cost	Double Size Area Dev. Cost	Facility Cost Saving
Road	572.30	772.60	200.30
Reclamation	252.7	505.3	252.60
R. C. Box Culvert	56.60	62.20	5.60
Utilities	501.00	551.10	50.10
Structure Construction	140.70	140.70	0.00
Green Belt	138.80	152.80	14.00
Park	43.20	86.50	43.30
Disposition Area	109.00	109.00	0.00
Parking Area	11.00	11.00	0.00
Water Supply Facilities	334.90	368.50	33.60
Sewage Pipe	15.8	17.40	1.60
Power Supply	339.2	373.10	33.90
Telecommunication	301.3	331.40	30.10
Total	2816.6	3,481.50	664.90

The rate of increase of cost for the double size development in the case of the New CBD Development is 1.236 (3481.5 / 2816.6) and net increase is 0.236 (1.236 - 1). The facility cost savings of HUDC were estimated applying this rate of net increase of costs to original construction costs. The annul facility cost savings of the New CBD and HUDC developments are summarized in Table 20-3-6. Summary of economic benefits in the said manner are shown in Table 20-3-7..

Table 20-3-6 Facility Cost Savings

(unit: BVND)

Year	New CBD Development	HUDC Development
1998	8.4	8.4
1999	21.4	21.4
2000	109.7	109.7
2001	161.1	161.1
2002	66.1	95.4
2003	95.7	164.3
2004	79.2	414.3
2005	115.5	344.5
2006	0.0	356.0
2007	0.0	243.1
2008	0.0	304.8
2009	0.0	233.0
2010	0.0	306.0
2011	0.0	322.2
2012	0.0	103.3
2013	0.0	288.4
2014	0.0	197.3
2015	0.0	257.4
2016	0.0	176.6
2017	0.0	0.0
2018	0.0	0.0
2019	0.0	0.0
Total	657.1	4,107.2

Table 20-3-7 Summary of Economic Benefits

(unit: BVND)

Year	New CBD Development			HUDC Development		
	Land Produc-tivity Increase	VOC Savings	Facility Cost Savings	Land Produc-tivity Increase	VOC Savings	Facility Cost Savings
1998	0.0	0	8.4	0.0	0	8.4
1999	0.0	0	21.4	0.0	0	21.4
2000	0.0	0	109.7	0.0	9.2	109.7
2001	0.0	0	161.1	0.0	25.6	161.1
2002	1,539.1	40.0	66.1	1,546.2	56.5	95.4
2003	1,231.3	49.9	95.7	1,236.9	87.4	164.3
2004	1,754.3	144.9	79.2	1,762.4	114.1	414.3
2005	1,446.5	175.6	115.5	1,453.2	132.1	344.5
2006	1,380.7	285.3	0.0	4,856.6	181.6	356.0
2007	1,314.8	319.8	0.0	3,773.1	221.9	243.1
2008	1,314.8	357.9	0.0	7,590.0	309.0	304.8
2009	0.0	399.9	0.0	2,862.7	355.8	233.0
2010	0.0	446.1	0.0	6,288.1	415.1	306.0
2011	0.0	496.9	0.0	2,569.0	474.4	322.2
2012	0.0	552.9	0.0	5,248.2	508.3	103.3
2013	0.0	614.4	0.0	3,836.6	542.2	288.4
2014	0.0	682.1	0.0	3,379.8	602.9	197.3
2015	0.0	756.4	0.0	3,946.0	663.7	257.4
2016	0.0	756.4	0.0	1,931.6	663.7	176.6
2017	0.0	756.4	0.0	4,562.1	663.7	0.0
2018	0.0	756.4	0.0	1,972.8	663.7	0.0
2019	0.0	756.4	0.0	1,972.8	663.7	0.0
Total	9981.5	8347.7	657.1	54500	7354.6	4107.2

Note: VOC savings continue to produce same amount of benefit as 2016 until 2035.

20.3.2 Economic Internal Rate of Return

Road improvement project can not produce enough VOC savings in short term. Considering project life and decrease of benefits by the discounted rate, a 30 year project period was adopted in this study.

Land development project can not produce benefits after selling land. Productivity of land is condensed in land price itself. Buyer of land decides to buy that land after he calculates the productivity of land in long run.

This project is the mixed project of road improvement and land development. In order to coordinate two different type of projects we adopted the following benefit calculation procedure.

a) Benefit calculation of land stops at the year when land has been sold out, but it continues no benefit no cost operation until the 30th year from the start of construction.
b) Benefit of roads continues until the 30th year from the start of construction.
c) Residual value of roads does not count due to the value has been included in the selling price of land.

1) New CBD Development

Two type of EIRR was examined in this section. First is EIRR of transport benefits and second is EIRR of land development project.

This project starts in 1998 and terminates in 2008. Investment starts from 1998 and terminates in 2005. Recovery of the land development project starts from 2002 and ends in 2008, but recovery of the road development projects ends in 2035.

(a) EIRR of Transport Cost Savings

Construction costs of roads are only considered for cost items. Benefits are also limited to VOC savings. The economic cash flow is shown in Table 20-3-8. The EIRR becomes 57.71 %. It means New CBD project is viable as a road development project.

(b) EIRR of Land Development

EIRR of land development includes VOC savings. EIRR of this project reaches 17.30 % (see Table 20-3-9). Net Present Value (NPV) by 12 % of discount rate is 2,146 BVND. These figure assure economic viability of the New CBD development project.

The sensitivity analysis of up to a 20 % cost increase and a 20 % benefit decrease also examined (see Table 20-3-10). Even at the worst case (20 % cost increase and 20 % benefit decrease) a 9 % of EIRR were calculated. This means that a high economic return is assured over a wide range of input assumptions.

Table 20-3-8 Economic Cash Flow by VOC Saving

Unit: B.VND

Year	VOC Savings	Costs	Net Reve.	NPV (12%)
1998	0.00	23.43	-23.43	-34.38
1999	0.00	47.56	-47.56	-61.42
2000	0.00	119.529	0.00	0.00
2001	0.00	79.686	0.00	0.00
2002	40.02	104.355	40.02	35.73
2003	49.91	69.57	49.91	39.79
2004	144.85	159.453	144.85	103.10
2005	175.63	106.299	175.63	111.62
2006	285.32	0.00	285.32	161.90
2007	319.83	0.00	319.83	162.04
2008	357.90	0.00	357.90	161.90
2009	399.85	0.00	399.85	161.49
2010	446.06	0.00	446.06	160.85
2011	496.93	0.00	496.93	160.00
2012	552.90	0.00	552.90	158.95
2013	614.44	0.00	614.44	157.71
2014	682.07	0.00	682.07	156.31
2015	756.35	0.00	756.35	154.76
2016	756.35	0.00	756.35	138.18
2017	756.35	0.00	756.35	123.38
2018	756.35	0.00	756.35	110.16
2019	756.35	0.00	756.35	98.36
2020	756.35	0.00	756.35	87.82
2021	756.35	0.00	756.35	78.41
2022	756.35	0.00	756.35	70.01
2023	756.35	0.00	756.35	62.51
2024	756.35	0.00	756.35	55.81
2025	756.35	0.00	756.35	49.83
2026	756.35	0.00	756.35	44.49
2027	756.35	0.00	756.35	39.72
2028	756.35	0.00	756.35	35.47
2029	756.35	0.00	756.35	31.67
2030	756.35	0.00	756.35	28.27
2031	756.35	0.00	756.35	25.25
2032	756.35	0.00	756.35	22.54
2033	756.35	0.00	756.35	20.13
2034	756.35	0.00	756.35	17.97
2035	756.35	0.00	756.35	16.04
				NPV=3042.15
				EIRR=57.71%

Table 20-3-9 Economic Cash Flow of New CBD Development

(unit: BVND)

Year	Increase of Land Productivity	VOC Savings	Facility Cost Savings	Ben Total	Costs	Net Benefit.	NPV (12%)
1998	0.0	0.0	8.4	8.4	37.0	-28.6	-42.0
1999	0.0	0.0	21.4	21.4	1,724.9	-1,703.5	-2,199.8
2000	0.0	0.0	109.7	109.7	443.6	-333.9	-379.4
2001	0.0	0.0	161.1	161.1	2,466.1	-2,305.0	-2,305.0
2002	1,539.1	40.0	66.1	1,645.2	380.8	1,264.4	1,128.9
2003	1,231.3	49.9	95.7	1,376.9	2,036.0	-659.1	-525.4
2004	1,754.3	144.9	79.2	1,978.4	448.9	1,529.5	1,088.6
2005	1,446.5	175.6	115.5	1,737.6	571.0	1,166.6	741.4
2006	1,380.7	285.3	0.0	1,666.0	106.3	1,559.7	885.0
2007	1,314.8	319.8	0.0	1,634.6	101.5	1,533.1	776.7
2008	1,314.8	357.9	0.0	1,672.7	101.5	1,571.2	710.7
2009	0.0	399.9	0.0	399.9	0.0	399.9	161.5
2010	0.0	446.1	0.0	446.1	0.0	446.1	160.9
2011	0.0	496.9	0.0	496.9	0.0	496.9	160.0
2012	0.0	552.9	0.0	552.9	0.0	552.9	158.9
2013	0.0	614.4	0.0	614.4	0.0	614.4	157.7
2014	0.0	682.1	0.0	682.1	0.0	682.1	156.3
2015	0.0	756.4	0.0	756.4	0.0	756.4	154.8
2016	0.0	756.4	0.0	756.4	0.0	756.4	138.2
2017	0.0	756.4	0.0	756.4	0.0	756.4	123.4
2018	0.0	756.4	0.0	756.4	0.0	756.4	110.2
2019	0.0	756.4	0.0	756.4	0.0	756.4	98.4
2020	0.0	756.4	0.0	756.4	0.0	756.4	87.8
2021	0.0	756.4	0.0	756.4	0.0	756.4	78.4
2022	0.0	756.4	0.0	756.4	0.0	756.4	70.0
2023	0.0	756.4	0.0	756.4	0.0	756.4	62.5
2024	0.0	756.4	0.0	756.4	0.0	756.4	55.8
2025	0.0	756.4	0.0	756.4	0.0	756.4	49.8
2026	0.0	756.4	0.0	756.4	0.0	756.4	44.5
2027	0.0	756.4	0.0	756.4	0.0	756.4	39.7
2028	0.0	756.4	0.0	756.4	0.0	756.4	35.5
2029	0.0	756.4	0.0	756.4	0.0	756.4	31.7
2030	0.0	756.4	0.0	756.4	0.0	756.4	28.3
2031	0.0	756.4	0.0	756.4	0.0	756.4	25.2
2032	0.0	756.4	0.0	756.4	0.0	756.4	22.5
2033	0.0	756.4	0.0	756.4	0.0	756.4	20.1
2034	0.0	756.4	0.0	756.4	0.0	756.4	18.0
2035	0.0	756.4	0.0	756.4	0.0	756.4	16.0
						NPV=	2,146.0
						EIRR=	17.30%

Table 20-3-10 Sensitivity of New CBD Development measured by EIRR

(unit: %)

Decrease of Benefit (Times to Standard Case)	Increase of Cost (Times to Standard Case)		
	1.0	1.1	1.2
1.0	17	15	13
0.9	15	13	11
0.8	12	11	9

2) HUDC Development

This project starts in 1998 and terminates in 2019. Recovery of the land development project starts from 2002 and ends at 2019, but recovery of the road development projects ends at 2035. The EIRR of this project is 10.65 % (see Table 20-3-11). The Net Present Value assuming a 12 % of discount rate is -1,405 B.VND and it turns

positive at a 10 % discount rate.

Table 20-3-11 Economic Cash Flow of HUDC Development

(unit: BVND)

Year	Increase of Land Productivity	VOC Savings	Facility Cost Savings	Ben Total	Costs	Net Revenue.	NPV (12%)
1998	0.0	0.0	8.4	8.4	37.0	-28.6	-42.0
1999	0.0	0.0	21.4	21.4	1,724.9	-1,703.5	-2,199.8
2000		9.2	109.7	118.9	450.4	-331.5	-376.7
2001		25.6	161.1	186.7	2,472.9	-2,286.2	-2,286.2
2002	1,546.2	56.5	95.4	1,698.1	3,018.0	-1,319.9	-1,178.5
2003	1,236.9	87.4	164.3	1,488.6	3,991.6	-2,503.0	-1,995.4
2004	1,762.4	114.1	414.3	2,290.8	4,687.5	-2,396.7	-1,705.9
2005	1,453.2	132.1	344.5	1,929.8	3,421.4	-1,491.6	-947.9
2006	4,656.6	181.6	356.0	5,194.3	4,230.8	963.5	546.7
2007	3,773.1	221.9	243.1	4,238.0	2,896.1	1,341.9	679.8
2008	7,590.0	309.0	304.8	8,203.9	3,432.2	4,771.7	2,158.5
2009	2,862.7	355.8	233.0	3,451.5	5,467.3	-2,015.8	-814.1
2010	6,288.1	415.1	306.0	7,009.2	3,826.7	3,182.5	1,147.6
2011	2,569.0	474.4	322.2	3,365.7	3,736.7	-371.0	-119.5
2012	5,248.2	508.3	103.3	5,859.8	2,305.3	3,554.5	1,021.8
2013	3,836.6	542.2	288.4	4,667.2	1,437.4	3,229.8	829.0
2014	3,379.8	602.9	197.3	4,180.0	1,041.8	3,138.2	719.2
2015	3,946.0	663.7	257.4	4,867.1	1,321.9	3,545.2	725.4
2016	1,931.7	663.7	176.6	2,772.0	855.6	1,916.4	350.1
2017	4,562.1	663.7	0.0	5,225.8	340.9	4,884.9	796.8
2018	1,972.8	663.7	0.0	2,636.5	155.1	2,481.4	361.4
2019	1,972.8	663.7	0.0	2,636.5	155.1	2,481.4	322.7
2020	0.0	663.7	0.0	663.7	0.0	663.7	77.1
2021	0.0	663.7	0.0	663.7	0.0	663.7	68.8
2022	0.0	663.7	0.0	663.7	0.0	663.7	61.4
2023	0.0	663.7	0.0	663.7	0.0	663.7	54.8
2024	0.0	663.7	0.0	663.7	0.0	663.7	49.0
2025	0.0	663.7	0.0	663.7	0.0	663.7	43.7
2026	0.0	663.7	0.0	663.7	0.0	663.7	39.0
2027	0.0	663.7	0.0	663.7	0.0	663.7	34.9
2028	0.0	663.7	0.0	663.7	0.0	663.7	31.1
2029	0.0	663.7	0.0	663.7	0.0	663.7	27.8
2030	0.0	663.7	0.0	663.7	0.0	663.7	24.8
2031	0.0	663.7	0.0	663.7	0.0	663.7	22.2
2032	0.0	663.7	0.0	663.7	0.0	663.7	19.8
2033	0.0	663.7	0.0	663.7	0.0	663.7	17.7
2034	0.0	663.7	0.0	663.7	0.0	663.7	15.8
2035	0.0	663.7	0.0	663.7	0.0	663.7	14.1
						NPV=	-1404.9
						EIRR=	10.65%

These figures assure the economic viability of the HUDC project but its return is lower than the New CBD development project.

Sensitivity analysis of up to a 20 % cost increase and a 20 % benefit decrease was undertaken (see Table 20-3-12). The worst case (20 % cost increase and a 20 % benefit decrease) gives an EIRR of 1%. This is lower than for the New CBD development project.

Table 20-3-12 Sensitivity of HUDC Development measured by EIRR

(unit: %)

Increase of Benefit (Times to Standard Case)	Increase of Cost (Times to Standard Case)		
	1.0	1.1	1.2
1.0	11	8	6
0.9	8	6	4
0.8	5	3	1

20.3.4 Conclusion from Economic and Financial Evaluation.

The new CBD development shows a little better performance than that of total HUDC development case. This indicates that the our site selection of the first project (New CBD area) was correct.

Both cases, the New CBD development case and total HUDC development case show economic and financial viability. However, both show vulnerability to a 20 % cost increase and a 20 % sale decrease case. Fluctuation of the sale price will be unavoidable. However, it is necessary to reduce the error range of cost estimates. Cost estimates within a 10 % error range are required in order to avoid considerable risk.

A key factor of these projects is creditability of the executing body. The project scale should be restricted by credit given by international private banks.

The big profits produced from these projects will be usable for further development.

CHAPTER 21 CONCLUSIONS AND RECOMMENDATIONS (THE FEASIBILITY STUDY)

The financial and economic evaluations of the feasibility study on New CBD development in Xuan La area showed the high financial return of 5,466.1 B.VND in terms of the accumulative surplus in the last year of the project in 2008. The economic return shows also sufficiently high figures with NPV of 3,218.0 B.VND, B/C of 3.06 and EIRR of 18.3%.

The New CBD development together with building control in the present built-up area will contribute to the traffic condition improvement in the central Hanoi. It will reduce trips in the central Hanoi by 30% in the year 2015.

The environmental impact assessment indicated almost no negative impact on the natural and social environment, except for affect on the farmers earning most of their income from paddy fields in the study area. Some 4,500 households will be compensated and new job opportunities will be created in the New CBD area, where some 165,000 residents and 375,000 employees are expected in the year 2015.

Because of financial viability of the New CBD Project, the infrastructures in Xuan La area can be developed without additional public funds from HPC, and it also will contribute to the improvement of the HPC/TUWPS public funds source. The expected net surplus arisen from the New CBD development can be invested to the development of the public transport modes of railway and bus terminals.

The feasibility study concludes that the New CBD project is financially and economically viable, will contribute to the improvement of the living and business environment of the urban population and has less negative environmental impact than individual developments.

However, the development of only New CBD area will not be sufficient to accommodate the future increase of office demand as well as house demand. In this line, all of Hanoi Urban Development Corridor (HUDC) projects shall be carried on. The New CBD development in Xuan La must be the first step in the HUDC plan. It is recommended that the project be started immediately.

A New Development Body is necessary to develop land in a systematic and comprehensive way. The Study Team proposed three alternatives for the Development Body, which are: a development corporation established by HPC and MOC; a control authority of private developers established by HPC; and an entrusted development company guided by HPC. All three alternatives would be guided by the HUDC development master plan and controlled by HPC.

It is recommended that HPC should set up a committee to study the organization of the development body as soon as possible. Subsequently a development body should be established to initiate the New CBD project. The body will be fully responsible for the development.

The preliminary financial analysis of HUDC project shows 43,170.8 B.VND of the

accumulative surplus in the assumed last year of the project in 2018. It exceeds the total required investment under the TUPWS responsibility. Therefore, it is recommended that HPC or the new development body should begin a feasibility study on all the HUDC area prior to the commencement of the construction of Ring Road No.3.

It is also recommended that HPC/MOC should begin a feasibility study of the HUDC development to establish the HUDC development master plan.

APPENDICES

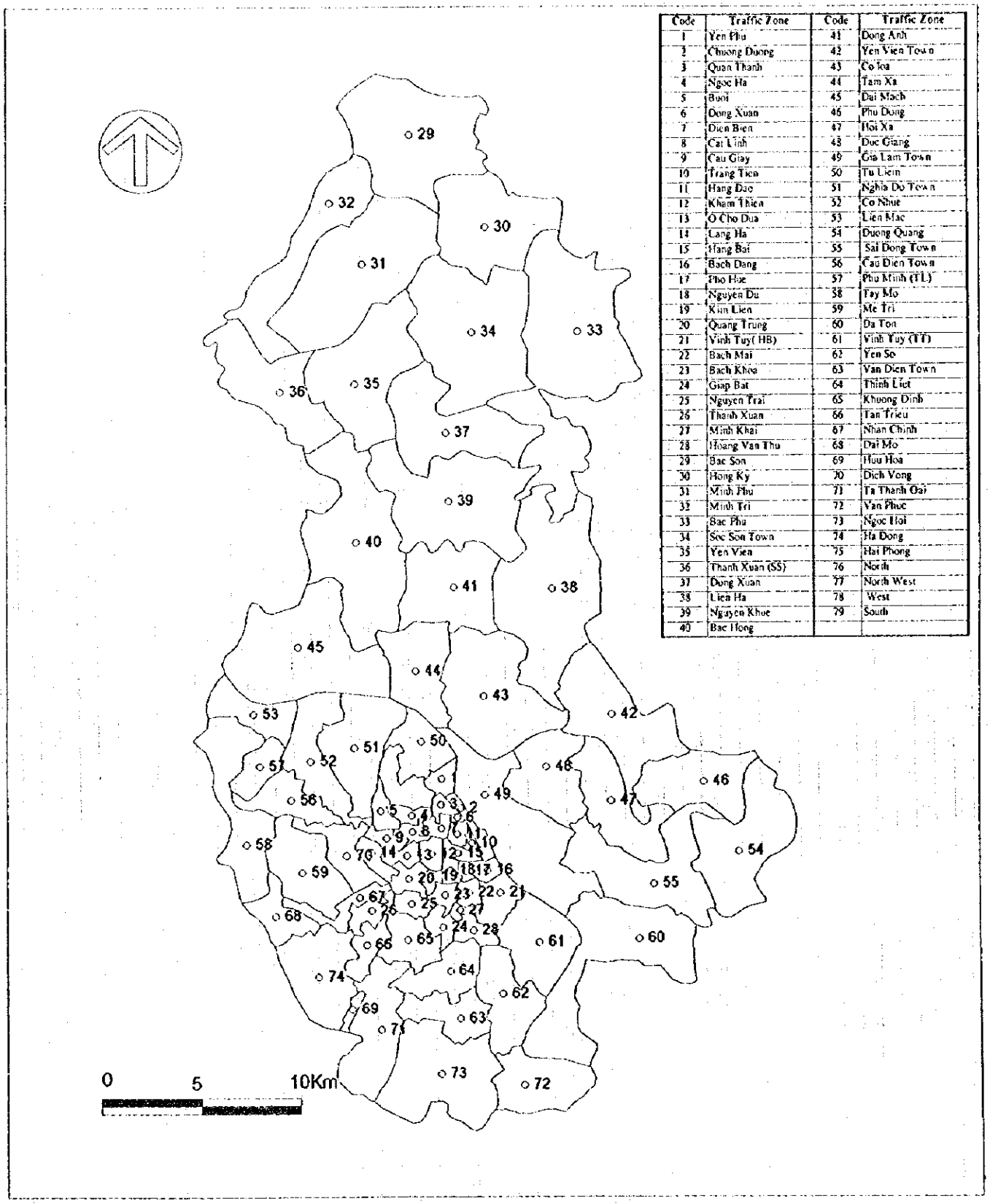
APPENDIX A
ZONING SYSTEM

Aggregated Zone and Traffic Zone System

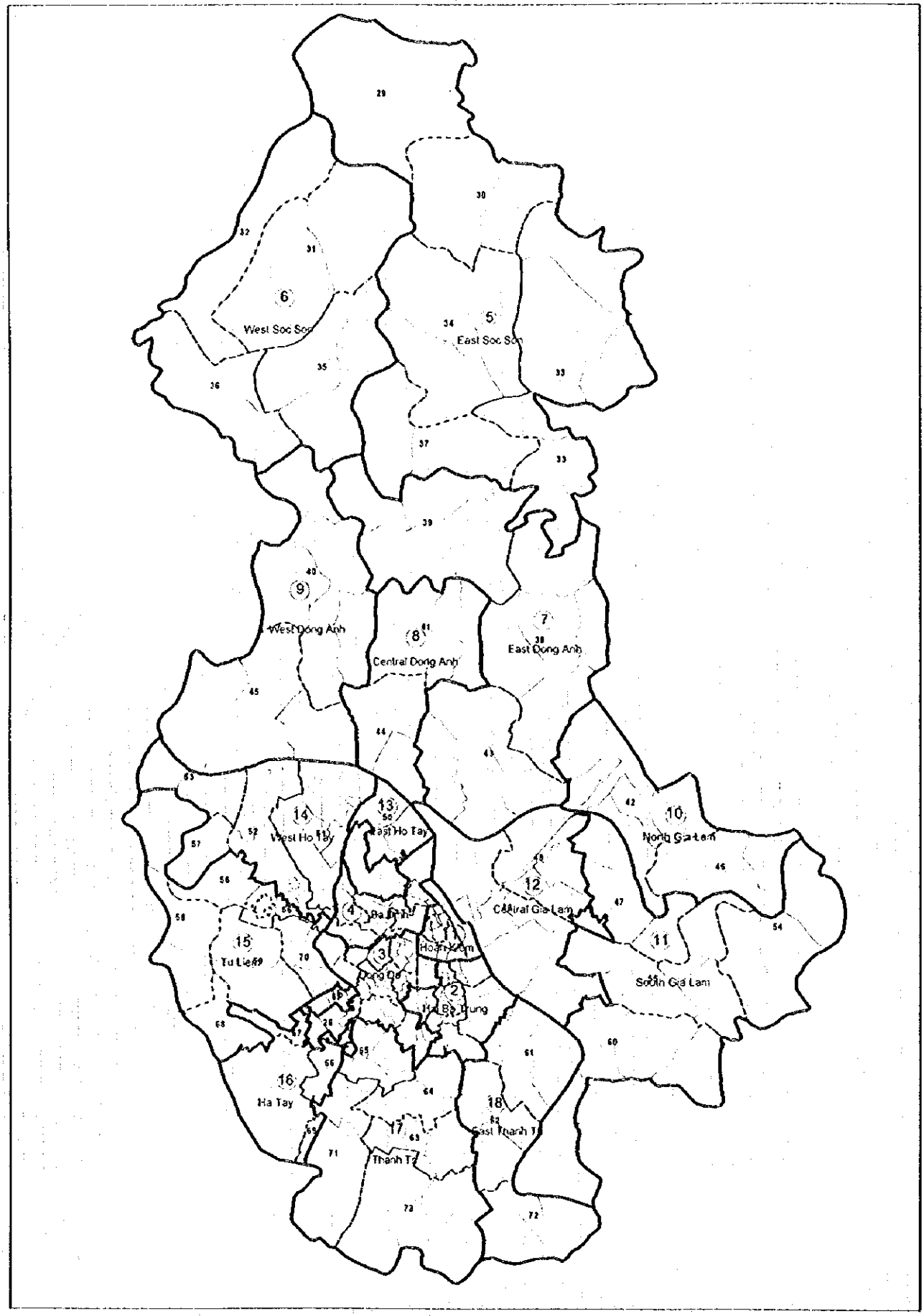
Intergrated Zone		Traffic Zone		Name of	Intergrated Zone		Traffic Zone		Name of
No.	Name	No.	Name	Phuong/Xa	No.	Name	No.	Name	Phuong/Xa
1	Hoan Kiem	2	Chuong Duong	Phuc Xa			19	Kim Lien	Phuong Lien
				Phuc Tan					Kim Lien
				Chuong Duong					Trung Tu
		6	Dong Xuan	Dong Xuan			20	Quang Trung	Nam Dong
				Hang Ma					Quang Trung
		10	Trang Tien	Ly Thai To					Trung Liet
				Trang Tien					Thinh Quang
		11	Hang Dao	Hang Buom			24	Giap Bat	Tuong Mai
				Hang Dao					Phuong Liet
				Hang Bo					Giap Bat
				Cua Dong			25	Nguyen Trai	Khuong thuong
				Hang Bac					Nguyen Trai
				Hang Gai			26	Thanh Xuan Bac	Thuong Dinh
				Hang Trong					Thanh Xuan(dd)
				Hang Bong					Thanh Xuan Bac
		15	Hang Bai	Tran Hung Dao					Kim Giang
				Cua Nam	4	Ba Dinh	1	Yen Phu	Yen Phu
				Phan Chu Trinh			3	Quan Thanh	Truc Bach
				Hang Bai					Quan Thanh
2	Hai Ba Trung	16	Bach Dang	Bach Dang					Trung Truc
				Pham Dinh Ho			4	Ngoc Ha	Thuy Khue
				Dong Mac					Ngoc Ha
		17	Pho Hue	Ngo Thi Nham			5	Buoi	Buoi
				Bui Thi Xuan					Cong Vi
				Dong Nhan			7	Dien Bien	Dien Bien
				Pho Hue			8	Cat Linh	Doi Can
		18	Nguyen Du	Nguyen Du					Kim Ma
				Le Dai Hanh					Cat Linh
		21	Vinh Tuy(hb)	Thanh Luong			9	Cau Giay	Giang Vo
				Vinh Tuy(hb)					Cau Giay
				Mai Dong	5	East Soc Son	29	Bac Son	Bac Son
		22	Bach Mai	Cau Den			30	Hong Ky	Hong Ky
				Thanh Nhan					Trung Gia
				Bach Mai			33	Bac Phu	Tan Hung
				Quynh Mai					Bac Phu
				Quynh Loi					Xuan Giang
		23	Bach Khoa	Bach Khoa					Viet Long
				Phuong Mai					Duc hoa
				Dong Tam					Kim lu
		27	Minh Khai	Minh Khai					Xuan Thu
				Truong Dinh			34	Soc Son Town	Phu Linh
		28	Hoang Van Thu	Hoang Van Thu					Tan Minh
				Tan Mai					Soc Son Town
3	Dong Da	12	Kham Thien	Van Mieu					Tien Duoc
				Quoc Tu Giam			37	Dong Xuan	Dong Xuan(ss)
				Hang Bot					Mai Dinh
				Kham Thien	6	West Soc Son	31	Minh Phu	Nam Son
				Van Chuong					Minh Phu
				Tho Quan			32	Minh Tri	Minh Tri
				Trung Phung			35	Yen Vien	Hien Ninh
		13	O Cho Dua	O Cho Dua					Yen Vien
				Thanh Cong					Quang Tien
		14	Lang Ha	Lang Thuong			36	Thanh Xuan(ss)	Tan Dan
				Lang Ha					Thanh Xuan(ss)

Aggregated Zone and Traffic Zone System (cont.)

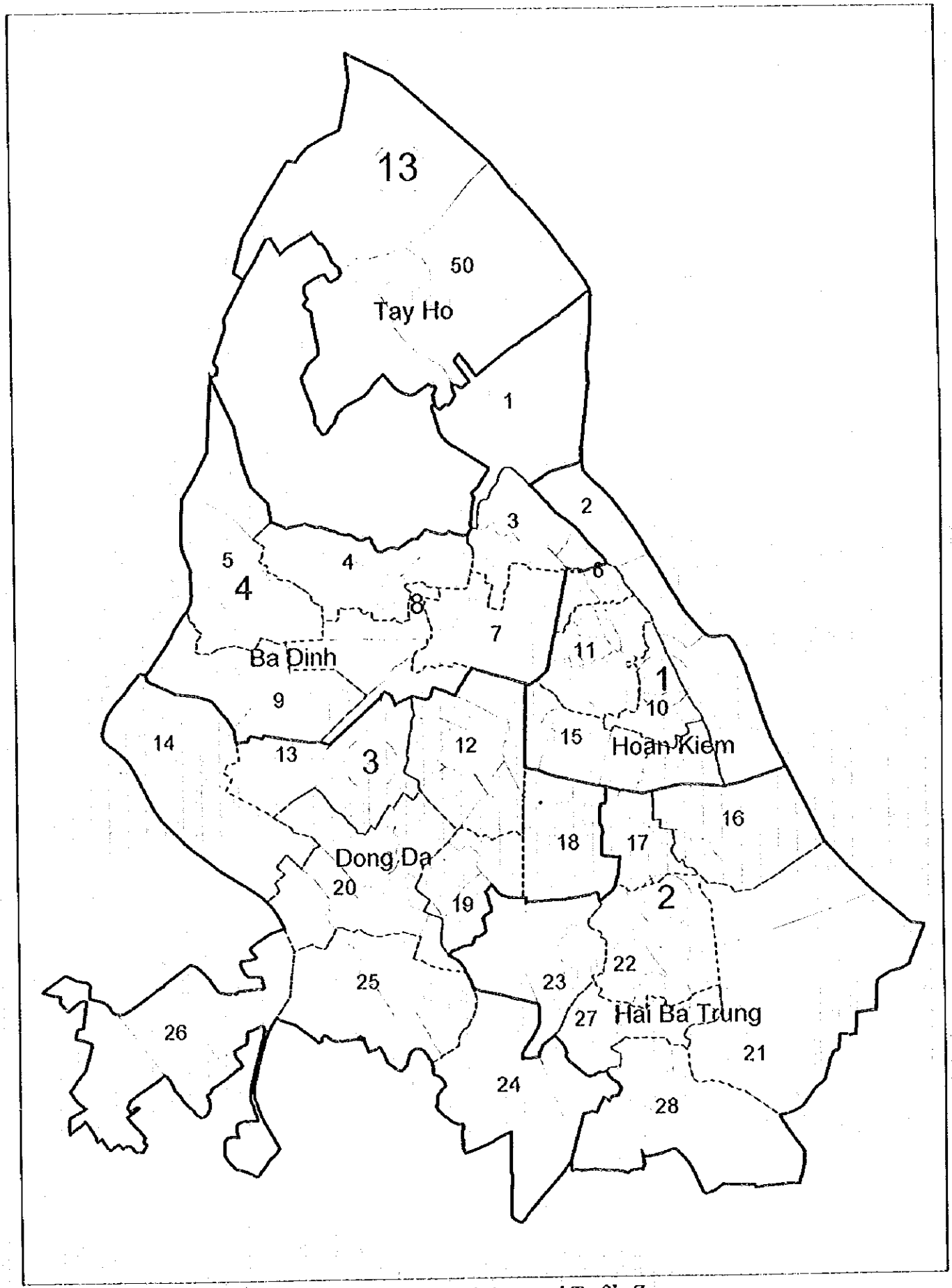
Intergrated Zone		Traffic Zone		Name of	Intergrated Zone		Traffic Zone		Name of
No.	Name	No.	Name	Phuong/Xa	No.	Name	No.	Name	Phuong/Xa
7	Fast Dong Anh	38	Lien Ha	Thuy Lam			49	Gia Lam Town	Ngoc thuy
				Lien Ha					Cu Khoi
				Van Ha	13	Fast Ho Tay	50	Tu Liem	Tu Liem
				Viet Hung					Nhat Tan
				Duc Tri					Quang An
		39	Nguyen Khue	Phu Do	14	West Ho Tay	51	Nghia Do town	Phu Thuong
				Phu Minh(ss)					Xuan La
				Xuan Non					Xuan Dinh
				Nguyen Khue					Nghia Do town
		43	Co Loa	Co Loa			52	Co Nhue	Thuy Phuong
				Mai Lam					Dong Ngac
				Dong Hoi					Nghia Tan
				Xuan Canh					Co Nhue
8	Central Dong Anh	41	Dong Anh	Uy No			53	Lien Mac	Thuong Cat
				Dong Anh					Lien Mac
				Tien Duong			57	Phu Minh(tl)	Phu Minh(tl)
		44	Tam Xa	Vinh Ngoc	15	Tu Liem	56	Cau Dien town	Cau Giay Town
				Tam Xa					Cau Dien Town
9	West Dong Anh	40	Bac Hong	Van Noi					Mai Dich
				Nam Hong			58	Tay Mo	Tay Tuu
				Bac Hong					Xuan Phuong
		45	Dai Mach	Kim Chung					Tay Mo
				Dai Mach			59	Me Tri	My Dinh
				Vong La					Me Tri
10	North Gia Lam	42	Yen Vien Town	Duong Ha			68	Dai Mo	Dai Mo
				Ninh Hiep			70	Dich Vong	Dich Vong
				Dinh Xuyen					Yen Hoa
				Viet Hung					Trung Hoa
				Yen Vien Town	16	Ha Tay	67	Nhan Chinh	Trung Van
				Yen Thuong					Nhan Chinh
		46	Phu Dong	Phu Dong			66	Tan Trieu	Tan Trieu
				Trung Mau			69	Huu Hoa	Huu Hoa
11	South Gia Lam	47	Hoi Xa	Co Bi			74	Ha Dong	Ha Dong
				Hoi Xa	17	Thanh Tri	63	Van Dien Town	Tu Hiep
				Giang Bien					Van Dien Town
		54	Duong Quang	Le Chi					Tam Hiep
				Kim Son			64	Thinh Liet	Dinh Cong
				Phu Thi					Thinh Liet
				Duong Quang			65	Khuong Dinh	Dai Kim
		55	Sai Dong Town	Sai Dong Town					Khuong Dinh
				Dang Xa			71	Ta Thanh Oai	Thanh Liet
				Duong Xa					Ta Thanh Oai
				Trau Quy			73	Ngoc Hoi	Vinh Quynh
				Thach Ban					Ngu Hiep
		60	Da Ton	Bat Trang					Ngoc Hoi
				Kim Lan					Lien Minh
				Dong Du					Dai Ang
				Da Ton	18	East Thanh Tri	61	Vinh Tuy(tl)	Tran Phu
				Van Duc					Linh Nam
				Kieu Ky					Thanh Tri
12	Central Gia Lam	48	Duc Giang Town	Gia Thuy					Vinh Tuy(tl)
				Duc Giang Town			62	Yen So	Yen My
				Thuong Thanh					Yen So
		49	Gia Lam Town	Gia Lam Town			72	Van Phuc	Van Phuc
				Bo De					Dong My
				Long Bien					Duyen Ha



Code	Traffic Zone	Code	Traffic Zone
1	Yen Phu	41	Dong Anh
2	Chuong Duong	42	Yen Vien Town
3	Quan Thanh	43	Co loa
4	Ngoc Ha	44	Tam Xa
5	Buoi	45	Dai Mach
6	Dong Xuan	46	Phu Dong
7	Dien Bien	47	Hoi Xa
8	Cat Linh	48	Duc Giang
9	Cau Giay	49	Gia Lam Town
10	Trang Tien	50	Tu Liem
11	Hang Dao	51	Nghia Do Town
12	Kham Thien	52	Co Nhue
13	O Cho Dua	53	Lien Mac
14	Lang Ha	54	Duong Quang
15	Hang Bai	55	Sai Dong Town
16	Bach Dang	56	Cau Dien Town
17	Pho Hue	57	Phu Minh (TL)
18	Nguyen Du	58	Tay Mo
19	Xuan Lien	59	Me Tri
20	Quang Trung	60	Da Ton
21	Vinh Tuy(HB)	61	Vinh Tuy (TT)
22	Bach Mai	62	Yen So
23	Bach Khoa	63	Van Dien Town
24	Giap Bat	64	Thinh Liet
25	Nguyen Trai	65	Khuong Dinh
26	Thanh Xuan	66	Tan Trieu
27	Minh Khai	67	Nhan Chinh
28	Hoang Van Thu	68	Dai Mo
29	Bac Son	69	Huu Hoa
30	Hong Ky	70	Dich Vong
31	Minh Phu	71	Ta Thanh Oai
32	Minh Tri	72	Van Phuc
33	Bac Phu	73	Ngoc Hoi
34	Soc Son Town	74	Ha Dong
35	Yen Vien	75	Hai Phong
36	Thanh Xuan (SS)	76	North
37	Dong Xuan	77	North West
38	Lien Ha	78	West
39	Nguyen Khue	79	South
40	Bac Hong		



Map of Aggregated Zone and Traffic Zone



Map of Aggregated Zone and Traffic Zone