4.3 Examination of Typical Cross-section

1) Ring Road No.2

Ring road No.2 is planned to develop in the suburban fringe area encircling the urban center and high density urbanized areas in HCMC. Urbanization in HCMC has already expanded beyond the ring road, particularly the northern and southern sections. While east and west section of the proposed ring road has not been developed yet and waiting for the development of the infrastructure. Typical cross-section for the ring road therefore will be examined carefully taking into consideration both traffic and urban development functions. The traffic function will be further divided into for normal traffic and public transport (bus transport). Accordingly, the issues to design the typical cross-section are summarized in Table 4.3.1.

Table 4.3.1 Design Issues for Typical Cross-section for Ring Road No.2

Function	View points of examination
• Traffic function for normal traffic	✓ Balance between traffic demand and capacity ✓ Segregation of non-motorized vehicles ✓ Control of roadside parking
• Urban development function	✓ Provision of the frontage roads ✓ Sufficient space for pedestrian ✓ Environmental spaces (planting)
• Public transport (bus) function	✓ Provision of bus exclusive lanes (or priority) ✓ Position of the bus lanes, center side or outside, etc. ✓ Bus stop facilities
Overall issue: obeying Highway Design Standard.	

Source: Study Team

Traffic Demand and Number of Lanes:

The future traffic demand was predicted in the Master Plan Stage.

Table 4.3.2 shows the traffic volume in 2020 (when public transport shared 50% of the total), shown in average annual daily traffic (PCU/day). The peak rate was assumed at 8.0% for RR2, which will be located in the urban area. The possible capacity of one lane in a multiple lane road is generally 1,400 PCUs/hour.

As a result, the east and southwest sections will require 4 or 6 and 4 lanes, respectively. However, RR2 is planned to accommodate an exclusive bus lane. Therefore, 8 and 6 lanes were adopted for the Feasibility Study Stage.

Moreover, to provide accessibility, frontage road was installed on both sides.

Table 4.3.2 Traffic Volume in 2020 and Required Number of Lanes

Section		Traffic Volume in 2020		Required Number of Lanes
		(PCU/day)	(PCU/hour)	
E-1	NH1A-NH1K	100,567	8,593	6
E-2	NH1K-NH1A	115,660	9,349	6
E-3	NH1A-Long Thanh Rd.	77,246	7,353	6
E-4	Long Thanh Rd.-PR25	76,294	7,375	6
E-5	PR25-PR15	87,074	8,130	6
E-6	PR15-Nuyen Van Linh	73,443	7,746	6
SW-1	Nguyen Van Linh - East-West Highway	52,214	4,436	4
SW-2	EW Highway-NH1A	63,109	5,218	4

Source: Study Team

Frontage Road and Environmental Spaces:

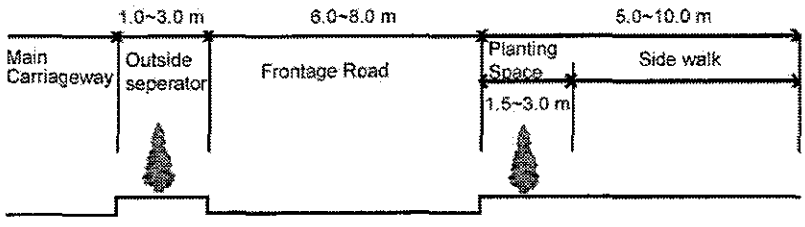
The function of the frontage road is to provide a space for non-motorized vehicles as well as for the vehicles approaching to the adjacent land use. Minimum width will be 6 to 7.3 meters for two vehicle lanes.

The environmental space includes outside separators, planting and sidewalk.

The width of the frontage road and environmental spaces will be differed depend upon the requirement from the land-use in the adjacent area. Higher density urban development may require wider side walk and bigger planting area will provide better urban amenity.

The proposed range of the widths are shown in Figure 4.3.1.

Figure 4.3.1 Width of Frontage Road and Environmental Space

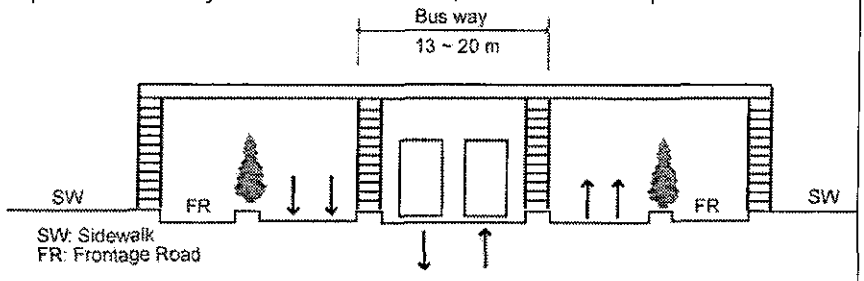
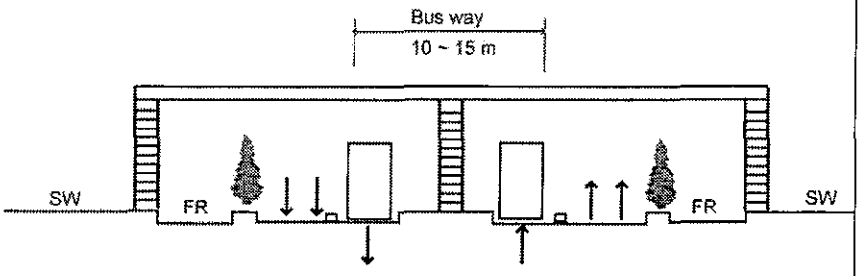
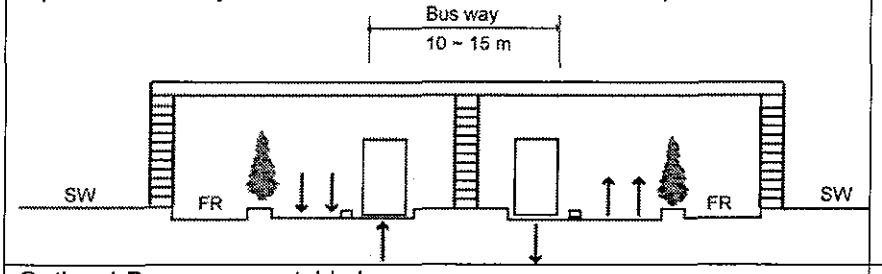
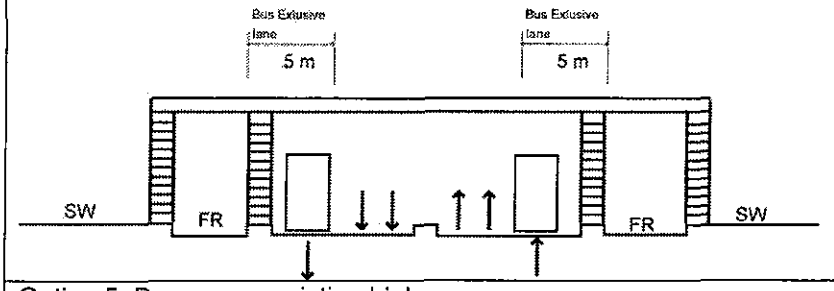
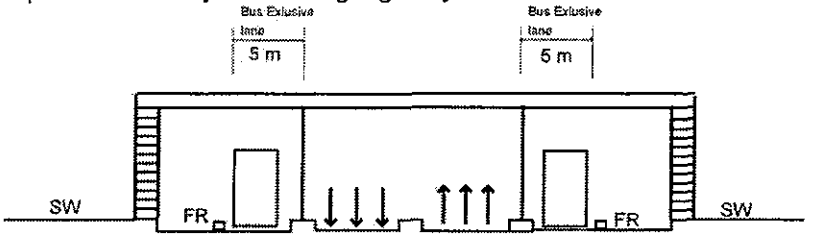


Source: Study Team

Option of the Busway:

In order to enhance a smooth bus operation, provision of the bus exclusive space will be required. Several options can be examined as shown in Table 4.3.3. From viewpoint of the operation, busway on the center lanes will be superior than the one on outside lanes or on frontage road. Also from the roadside land-use, center line bus way will have advantages. The center lane busway, however will required higher construction cost including cost for pedestrian bridges.

Table 4.3.3 Option of the Busway on Ring Road No.2

Option	Advantage and disadvantage
Option 1: Busway on the center lanes, outside Bus stop 	• Exclusive space for bus operation • No conflict with normal traffic • articulated high capacity bus fleet can be utilized • Wider busway space is required. • Pedestrian bridge at Busway stations
Option 2: Busway on the center lanes, median Bus stop 	• Less conflict with normal traffic • Minimum space for bus way • Small separator between normal lane and bus lane. • Special high capacity articulated high capacity bus fleet (left-side door) needed. • Pedestrian bridge required at stations
Option 3: Busway on the center lanes, median Bus stop, contra flow. 	• Alternative of the option 3, introduce a contra-flow to use a normal bus fleet. • Safety issue due to the contra operation.
Option 4:Busway on outside lanes 	• Minimum changes form normal cross-section structure • Pedestrian bridge will only required at bus stations otherwise crossing facility could be at grade • Conflict with slow traffic, strict enforcement will be required.
Option 5: Busway on existing highway 	• Maximum capacity for normal traffic • Mix with non-motorized vehicles, high risk of accident especially motorcycles. • Strict enforcement for illegal parking. • Pedestrian bridge will not indispensable if any crossing facility available nearby

Source: Study Team

If the bus demand will be extremely high, a closed busway operation system with the option 1 would be the most desirable option. Option 2 can provide second biggest capacity among the options considered, which will be the most suitable option for the ring road. However, it will be needed to carry out further detail study for bus network and operation system.

Additional Lanes for Busway:

Number of lanes required by future traffic demand would be 4 lanes to 6 lanes as mentioned before. Next issue to be studied is whether additional lanes for the bus operation discussed above will be economically viable or not.

Figure 4.3.2 is showing the alternative cross- section; 6 lanes with and without bus exclusive lanes for embankment and bridge section respectively.

Comparing construction costs between 8 lanes and 6 lanes, 6 lanes structure can reduce approximately 15 to 25% of 8 lanes' s cost. While operation benefit with bus exclusive lanes would not be higher than the cost reduced with bus exclusive lanes, because the traffic flows without bus exclusive lanes will be still maintained smooth conditions judging from the future traffic demand. In conclusion, 6 lane structures will be proposed for the elevated section with consideration for providing a dedicated Busway route on the at grade sections where practical. Moreover the proposed busway should be accommodated within proposed ROW, even though some traffic congestion may occur.

Table 4.3.4 Comparison of the Investment

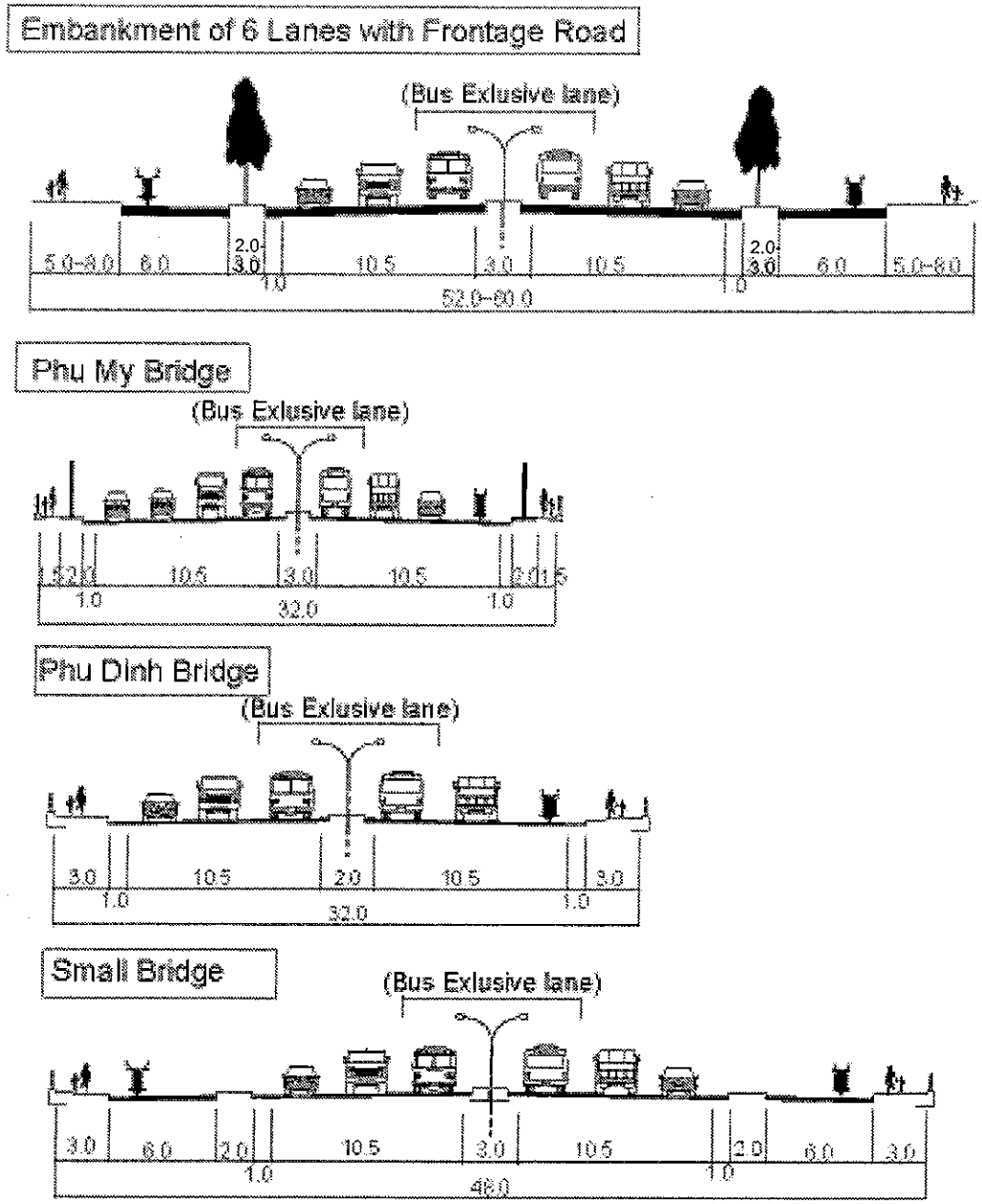
Structure	Length (km)	US$/m2	8 lanes		6 lanes		Difference (a-b)US$ Mil
			w (m)	Cost(a) US$ Mil	w (m)	Cost(b) US$ Mil	
At grade	18.7	125	60	140	52	122	20 (16%)
Elevated	4.3	1,200	34	175	27	140	36 (25%)
Phu My Bridge	2.5	2,000	40	200	32	160	40 (25%)
Total				515		422	93 (22%)

Source: Study Team

Design of Typical Cross-section of Ring Road 2:

Based on the discussion above, typical cross-sections for Ring Road No.2 are proposed as shown in Figure 4.3.2.Typical cross-section on the embankment consists of 6 lanes-dual carriageway, frontage roads and side walk including environmental space.

Figure 4.3.2 Typical Cross-section of Ring Road No.2



Source: Study Team

Width of the each element is indicated in the figure and some elements such as sidewalk and environmental space will have an option which area examined based on the roadside urban development. ROW of the proposed Ring Road No.2 therefore will be from 52.0m to 60m.

The minimum ROW of 50 meter should be reserved under this road project; however, additional ROW should be provided around urban developments along the proposed road.

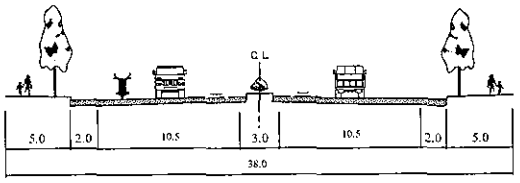
For long span bridge, minimum function will be provided in order to reduce the project cost. The proposed cross-section for Phu My bridge and Phu Dinh Bridge are also shown in Figure 4.3.2 while small bridge section will maintain main carriageways as will as frontage roads, except for reducing the width of side walk.

2) Typical cross-section for related roads:

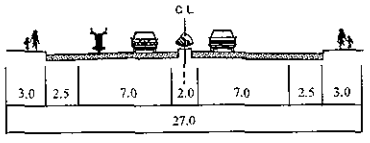
The typical cross-section for roads related with RR2 likewise followed the Master Plan. Based on an examination of cross-sectional elements, the proposed typical cross-sections are shown in Figure 4.3.3

Figure 4.3.3 Typical Cross-section of Related Roads

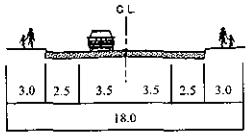
At grade Provincial Road No.25 (6 Lane)



At grade Secondary Road "B" (4 Lane)



At grade Secondary Road "A" (2 Lane)



Source: Study Team

4.4 Alignment Study

1) General

This chapter describes how to determine the vertical and horizontal alignment of the project roads including Ring Road No.2 East section and west- southern section, Provincial Road No.25 and other secondary roads. All the projects are planned in the sub-urban areas, where urban developments are scattered in the agriculture lands. The alignments, therefore, are determined to avoid or minimize the impact to the existing developments.

Two sections on the Ring Road No.2 - East section are examined through the comparative analysis of alternatives. Those are:

(1) Section from NH 1A to Hanoi Highway: main issue is coordination with water pipe line projects.

(2) Phu My bridge section: main issue is coordination with port operation and existing urban development.

2) Alignment of Ring Road No.2

(1) East Section (NH 1A to Hanoi Highway)

In the section from NH No.1A to Hanoi Highway in Thu Duc, there is no parallel road and the area is mostly marsh lands. However to determine the alignment, the following two issues will be taking into the consideration;

Where is the interchange between existing NH No.1 and proposed Ring Road No.2?

Coordination with the water pipe line project (HCM TUPWS).

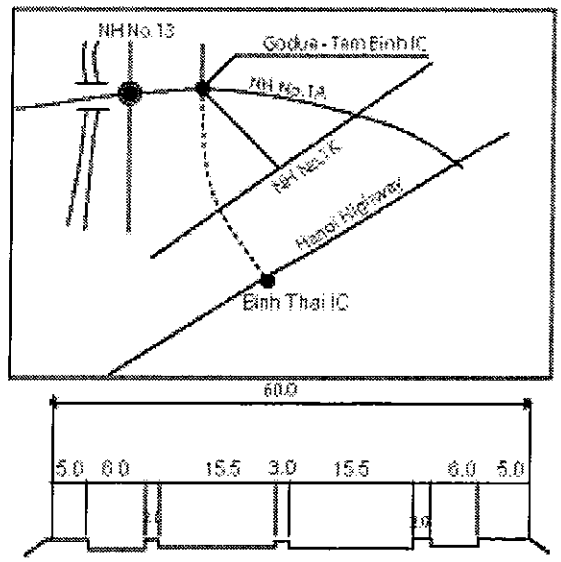
The water pipe line project implemented by HCM TUPWS is planned from Go Dua – Tam Binh interchange (NH No.1A) to Binh Thai interchange (Hanoi Highway) and is soon to start construction. Some of the section are resettled and cleared. The project includes dual carriageway with frontage road and proposed ROW of the project will be 60m.

In order to minimize social-economic impact from those infrastructure development will be minimised,it will be recommended that Ring Road No.2 be shared the ROW with the water line pipe project.

Another issue is location of the interchange between the Ring Road and NH No.1A

In order to assure the function of the Ring Road, NH No.1A and Ring Road No.1A should be connected directly (with direct ramp-ways). Basically three alternative interchange locations are examined as shown in Figure 4.4.2 Alt 1: interchange will be located on the west side of NH 13 interchange, providing smooth alignment as a ring road and less influence from the existing interchange; NH 13 and PR 743. Alt 2: location will be in between two existing interchanges and Alt 3 will be connected to the existing PR 743 interchange. (see Figure 4.4.1)

Figure 4.4.1 Proposed Water Pipe Line Alignment and Cross-section



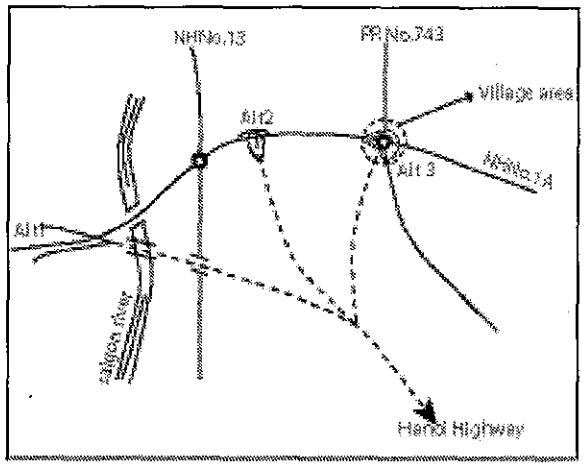
Source: Study Team

The comparison of the three alternative locations is show in Table 4.4.1

As mentioned in the overall evaluation. Alt 3: at the existing interchange between PR

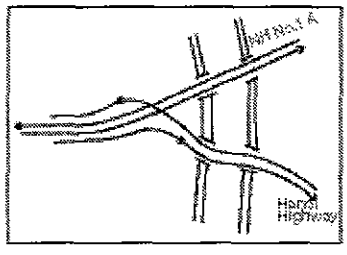
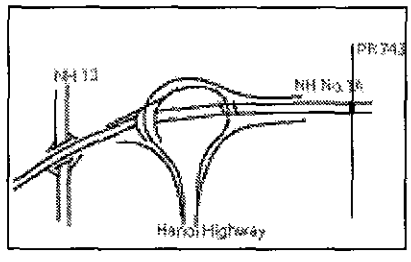
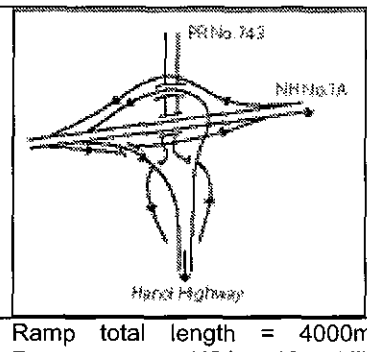
43 and NH No.1A, will have advantages than other alternatives, as long as the water pipe line project is going to implement smoothly including resettlement of the houses in the interchange area.

Figure 4.4.2 Alternative Interchange Location



Source: Study Team

Table 4.4.1 Comparison of Alternative Interchange Location

	Alternative 1	Alternative 2	Alternative 3
Interchange Configuration			
Project Cost	Ramp Total Length = 1000m Saigon River Bridge L= 350 m - Ramp = US$ 4 Mil. - Saigon River Bridge US$ 18 Mil. US$ 22 Mil. Land Cost 52mx2200x45 =US$ 5.1 Mil. Total US$ 27.1 Mil.	Ramp total length =3000m Ramp way US$ 12Mil. Land cost 52mx2000m x US$ 45 = 4.7 Mil. Total US$ 16.7 Mil.	Ramp total length = 4000m Ramp way US$ 16 Mil. Land cost Total US$ 16Mil.
Advantage and Disadvantage	-Smooth alignment for Ring Road directions. - Simple interchange configuration - Additional river bridge	- Minimum modification of the existing interchanges - Parallel to the water pipe line project road	- ROW can be shared with the water pipe line project. - Complicated interchange configuration - Coordination with the water pipe line project is indispensable.
Overall Evaluation	From view point from the optimization of the ROW usages for infrastructure development, Alt 3 will be recommended. However close coordination between the two projects is essential and design of the interchange will be done carefully.		

Source: Study Team

(2) East Section (Hanoi highway to Phu My Bridge).

There is no alternative alignment in this section, an optimum alignment will be selected avoiding or minimizing the effect to the existing developments scattered on the area. Outline of the proposed alignment will be discussed below.

Full – clover leaf type interchange will be provided between Ring Road No.2 and Hanoi Highway. After crossing Hanoi Highway Ring Road No.2 will passes through a plateau area where there is scattered development without a proper plan. In this section, some resettlement will be required, although the route tries to avoid several existing factories.

After the plateau area, the route locates in marshy area again and passes through orchards and meadows, crossing over a river at the tip of the river bend. The route intersects the planned Secondary Road at grade and crosses a Grade IV river through a bridge, and the direction changes southward.

Running parallel with the route on its west is a canal. Between the canal and the route, there are many housing areas. The route's vicinity covers cultivation ponds, coconut fields, mango orchards, paddy fields, and a meadow. The route passes over the planned primary road and forms an at-grade intersection with Hung Lo No.33.

Afterwards, the route passes through open space, such as cultivation ponds and the like.

The route then heads downward, but avoids developed lands by moving to the east before heading southwest curve radius. It then passes Provincial Road No.25.

This interchange is planned to be one quadrant type because it is located in an area where a river with a Grade VI level curves and Provincial Road No.25 is being considered for widening in the Master Plan. Though there are a lot of houses along Provincial Road No. 25, paddy fields dominate the landscape after crossing the river. The toll gate and toll facilities are planned to be located in the paddy fields.

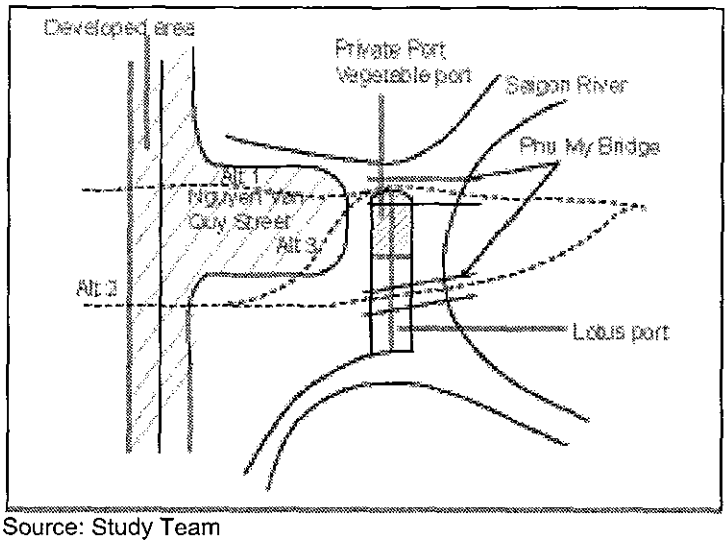
After crossing the river of Grade VI, the route traverses Saigon River, which has a navigation clearance of 220m laterally and 45m vertically.

(3) East section (Phu My Bridge).

Phu My Bridge is the biggest and most expensive structure in the Ring Road project. There is no development in the east side of Saigon river. However in the west side of the river, two port facilities; Lotus port and a private (SOE) port are constructed along the river bank and urban development has been expanded in the area where just behind of the ports. Moreover, many canals and rivers in the area are narrowing the route selection of RR2.

Basically three alternative routes can be examination as shown in Figure 4.4.3

Figure 4.4.3 Alternative Routes for Phu My Bridge



Source: Study Team

Alt 1 is passing through the north edge of the private port, minimizing the effect to the private port facilities and using Nguyen Van Quy street. Alt 2 in prepared to avoid the existing buildings along Nguyen Van Quy street, but over passing the Lotus port area. Alt 3 is a combination between Alt 1 and 2. Comparison of the three alternative is shown in Table 4.4.2 Alt 2 will be recommended as a desirable option based on the less social impact. But further coordination with Lotus port will be required.

Table 4.4.2 Comparison of Alternative Alignments for Phu My Bridge Section

	Alternative 1	Alternative 2	Alternative 3
Length (until Nguyen Van Linh Road)	4.27 km	4.45 km	4.54km
Number of building affected	- Factory: 13 - House: 200 - A part of private port	- House: 20 - Over passing Lotus port	- Factory: 2 - House: 40 - A part of private port
Advantage and Disadvantage	- Smooth alignment - Less impact to the port operation - Widening of existing road large influence to the existing urban development. - Blockade the mouth of a canal	- Smooth alignment - Minimum impact to the existing urban development - Over passing Lotus port, redevelopment of the port facilities will be required.	- Minimize the impact to the urban development and port facilities - Meandering alignment - Blockade the mouth of cannel.
Overall Evaluation	- Alternative 2 will be desirable judging from less impact to the existing urban development and smooth alignment. However further coordination with Lotus port including redevelopment of the facilities or relocation of the port will be significant. - Alt 3 will be have advantages of both Alt 1 and Alt 3. However meandering of the alignment with small curve radius will not be acceptable on the bridge approach section.		

Source: Study Team

Afterwards, the route passes over wetlands and over Provincial Road No.15 via a diamond-type flyover. Because there is a developed area consisting of a row of three-story buildings facing Provincial Road No.15 and residential areas behind this ROW, considerable resettlement is expected.

Next, the route passes over a river classified as Grade IV through a bridge and through the development area of Saigon South, intersecting with Nguyen Van Linh

Road in the ending point. The intersection with Nguyen Van Linh Road is planned at grade, because though the west section of Nguyen Van Linh Road becomes a part of Ring Road No.2, its north section becomes a secondary road with a few tall buildings constructed in the vicinity of the intersection. The shape of the intersection will be improved, with its north section crossing at right angles to the east, and the west direction as the main axis.

(4) Southwest Section

The southwest section is approximately 5.5km in total length, which includes Phu Dinh Bridge. Urbanization has advanced toward this area, and it is difficult to construct a new road passing through this area. It is better to widen the existing roads.

At the beginning point, the interchange with National Highway No.1A, which is semi-directional three-leg type, is planned. There are a substation and some factories around the interchange, and a few small factories will be affected by the widening of the interchange.

It advances toward the southwest from National Highway No.1A along the existing road, crossing Hung Vuong Road where a diamond-type flyover is planned. The elevated UMRT is planned on Hung Vuong Road, and it is arranged that the UMRT will pass over the flyover. From the beginning point, there is a vacant lot between the existing road and a hypermarket on the west side, as well as a small canal on the east side of the existing road. The route passes through these open spaces. Over the small canal, there are many small shops and houses on both sides of the existing road, and large-scale resettlements are expected on Hung Vuong Road.

Next, the planned road overpasses the East-West Highway via a diamond-type interchange. Land use in this section is almost the same as that of the previous section. Large-scale resettlements are expected here, too.

The route heads to the south along the existing road, passing over the river where the Phu Dinh Bridge is planned. A lot of factories are built along the existing road. However, the impact from widening is expected to be minimal because the factories have sufficient setback from the existing road.

After passing over Phu Dinh Bridge, the route advances toward the east-southeast along the existing road, and again crosses a river of Grade VI with the bridge. Finally, it reaches Nguyen Van Linh Road, where a diamond-type interchange is planned. In the northwest corner of the intersection with Nguyen Van Linh Road, there is a large aluminum factory. The route will avoid it; however, some low- story houses in the opposite side will be affected by the road widening.

3) Vertical Alignment Study of Ring Road No. 2

(1) East Section

There are a lot of bridges in the east section since it passes across marshlands including rivers. Table 4.4.3 shows the list of planned river bridges.

The planned minimum height was assumed to be the height at which the pavement can avoid flooding. It was assumed at 2.6m adding approximately 1.0m for pavement thickness and taking account of the lateral cross fall above H.W.L. for a hundred years' return period (1.55m+ND).

Table 4.4.3 List of Bridges in the East Section

No.	Station	Bridge Length (m)	River Grade	Clearance (m)		Remark
				Horizontal	Vertical	
1	Sta.1+503.312	30.0	-	-	0.5	
2	Sta.1+714.103	30.0	-	-	0.5	
3	Sta.2+483.210	30.0	-	-	0.5	
4	Sta.3+415.652	30.0	-	-	0.5	
5	Sta.4+650.500	30.0	-	-	0.5	
6	Sta.9+173.584	90.0	-	-	0.5	
7	Sta.10+256.000	340.0	IV	40.0	6.0	
8	Sta.11+535.022	150.0	VI	15.0	2.5	
9	Sta.14+455.000	160.0	VI	15.0	2.5	
10	Sta.15+790.363	150.0	VI	15.0	2.5	
11	Sta.16+305.500	341.5	VI	15.0	2.5	Including Flyover for Provincial Road No.25
12	Sta.18+471.417	160.0	VI	15.0	2.5	
13	Sta.20+540.000	2,440.0	I	220.0	45.0	Sai Gon River
14	Sta.22+931.906	160.0	VI	15.0	2.5	

Source: Study Team

(2) Southwest Section

The southwest section is originally in marshy areas, where the possibility of damage caused by flooding is high. Although the same concept as what the east section followed was preferred, it was difficult due to the presence of numerous low houses along the route. Therefore, the lowest planned height was 2.2m in this section to take account of access to and from houses.

Table 4.4.4 List of Bridges in the Southwest Section

No	Station	Bridge Length (m)	River Grade	Clearance (m)		Remark
				Horizontal	Vertical	
1	Sta.2+235.316	339.5	-	-	0.5	Including Flyover for Hung Vuong Road
2	Sta.4+610.000	530.0	V	40.0	7.0	Phu Dinh Bridge
3	Sta.5+832.325	85.5	VI	15.0	2.5	

Source: Study Team

4) Alignment of Related Roads

(1) Route Description

Provincial Road No.25

This route has approximately 5.6km in the total length, and is divided into two sections. From the beginning point, there was the newly constructed road of 10m in width (2 lane + one side sidewalk) where the widening as a premise was planned in the future. And, From the ending point, the factory is constructed along the road, which had already newly widened, and new road construction is a difficult under such the situation. Therefore, widening is basically assumed through whole line.

The beginning point is located on the intersecting with the East - West Highway.

Because Planned Primary Road to Long Thanh is adjacent to this intersecting, it is planned as an at-grade intersection, though it is preferable to plan the semi-directional three-leg type interchange in the consideration of the road classification and the number of lanes.

The bridge with 4 lanes parallel with existing bridge is planned to construct at, because there is newly constructed bridge with 2 lanes over the river of Grade IV. It is planned the intersection with former Provincial Road No.25, The affected houses are a few in this section, because the roadside is still developing for factories and houses.

Afterwards, it intersects with the river of Grade VI, and the bridge with two lanes is planned to construct between these bridges, because there are two bridges with 4 lane in totaling, which is laid in the old and new bridge. Next, the route cross under the Ring Road No.2 with one-quadrant type at Sta.4+702, and it connects with the access road. A considerable resettlement is assumed because the low-story houses are built along the route in this section.

Widening to 8 lanes is planned according to the future demand though it has already been widened to the Cat Lai Port in four lanes.

A lot of factories, which were set some distance back, are constructed along the existing road in this section. It is assumed that the houses will be affected only.

Secondary Road "A"

This route is approximately 5.0km in the total length. From the beginning point, it is planned to be new construction road from the viewpoint of the future road network. And, the route excluding the above section is basically planned as widening, because the land use along it is open space such as the cropland and so on.

The beginning point starts from the Ring Road No.2 with an at-grade intersection. The route goes to south by 500m in horizontal radius, it intersects with the existing road, and it reaches to Secondary Road "B" with an at-grade intersection. This section is located on the plateau, and there are a lot of low-story houses and small factories. Therefore, a considerable resettlement is assumed.

The route crosses over the river of Grade IV. There is an existing bridge, which is remarkably superannuated. Therefore, new bridge is planned to construct by side of the existing bridge. And, the route connects with the Planned Primary Road by at-grade. In this section, there are almost open space such as vacant lot, cropland and so on. It is assumed that the affected houses are a few.

The route reaches to Hung Lo No.33 with an at-grade intersection. It is assumed that the influence is less, though there are low-story houses in this vicinity.

Secondary Road "B"

This route is approximately 3.9km in the total length. The section where it passes through the built-up area is basically planned as the widening. And, the section excluding the above section is basically assumed to plan the new construction.

The beginning point is located on the Hanoi Highway where the UMRT is planned to pass through at the ground level. Therefore, the interchange with at-grade

intersection on flyover planned to cross over the Hanoi Highway. Avoiding inter-container deposit, the route passes through the south from the beginning point, and reaches to the residential area. In this residential area, there is an existing road, which has a widening plan of 25m in width, and it will be utilized for developing of this route. And, the route reached with Secondary Road "A" with at-grade intersection.

The land use in this section is almost swampy area excluding the vicinity of the beginning point where there are low-story houses and inter-container deposit along the Hanoi Highway and the residential area, which has originally widening plan also. Therefore, it is assumed that the resettlement is a few.

The route passes through the swampy area, and connects with Ring Road No.2 by at-grade. The paddy fields expand in this section excluding the vicinity of the intersection with Secondary Road "A", and it is assumed that the resettlement is a few.

(2) Vertical Alignment

Provincial Road No.25

The concept for the development of this route is basically widening of the existing road. Therefore, the vertical alignment follows running through on it. Table 4.4.5 shows the list of planned river bridges.

Table 4.4.5 List of River Crossing Bridge in Provincial Road No.25

No	Station	Bridge Length (m)	River Grade	Clearance (m)		Remark
				Horizontal	Vertical	
1	Sta.1+461.814	404	IV	40.0	6.0	
2	Sta.4+422.516	124	VI	15.0	2.5	

Source: Study Team

Secondary Road "A"

The proposed height is set as same as the existing ground level, because this route is located on the plateau, and the residential area was developed in the first half. On the other hand, there is the swampy area in the latter half of this route. Therefore, the minimum proposed height is assumed to be 2.3m above the sea level from the same viewpoint as the Ring Road No.2.

The river of Grade IV is located. Because the sluice is adjacent, the ship could not be passed substantially. Therefore, it is assumed the navigation clearance is not secured though. Table 4.4.6 shows the list of planned river bridges.

Table 4.4.6 List of River Crossing Bridge in Secondary Road "A"

No	Station	Bridge Length (m)	River Grade	Clearance (m)		Remark
				Horizontal	Vertical	
1	Sta.3+713.030	60	VI	-	0.5	Sluice is adjacent

Source: Study Team

Secondary Road "B"

The route is located on the plateau, and the residential area is developed. Therefore, the proposed height is set as same as the existing ground level. In other section, there is the swampy area in the latter half of this route. Therefore, the minimum proposed height is assumed to be 2.3m above the sea level from the same viewpoint as the Ring Road No.2. Table 4.4.7shows the list of planned river bridges.

Table 4.4.7 List of River Crossing Bridge in Secondary Road "B"

No	Station	Bridge Length (m)	River Grade	Clearance (m)		Remark
				Horizontal	Vertical	
1	Sta.1+910.780	20	-	-	0.5	
2	Sta.3+913.420	20	-	-	0.5	
3	Sta.4+082.740	20	-	-	0.5	
4	Sta.4+541.140	60	-	-	0.5	

Source: Study Team

4.5 Interchange and Intersection Plan

1) General

The types of road intersection are influenced by many factors, the most important of which are:

- Road classification
- Traffic volume
- Design speed
- Composition of traffic
- Adjacent land use
- Environmental considerations
- Economic considerations
- Safety
- Topography
- Relationship to other features of the highway system

2) Guideline for Type of Intersection

The table below offers a guide to the selection of the appropriate intersection. It is defined by grade separation including the interchange and the junction

Rural

	EW	NH	PR	OR
Expressway (EW)	1	2	4	5
National Highway (NH)		6	7	7
Provincial Road (PR)			8	8
Other Road (OR)				8

Urban

	EW	PY	SY	TY	OS
Expressway (EW)	1	3	4	5	5
Primary (PY)		6	6	7	7
Secondary (SY)			6	7	7
Tertiary (TY)				8	8
Others (OS)					8

Types of Intersection

(1) Grade-separation with access.

(2) Grade separation with access, but without access at low traffic volume.

(3) Grade separation with access, but without access where accessible grade separation spacing is too close.

(4) Grade separation without access, but with access to:

- Relieve congestion
- Serve high density traffic generators

(5) Grade separation without access.

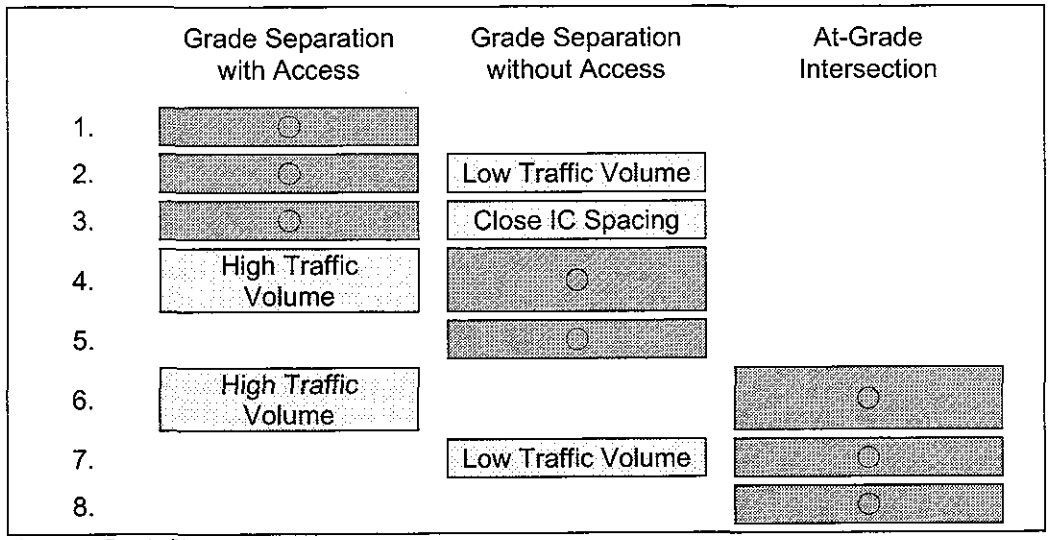
(6) At-grade intersection, but grade separation with access can be justified when:

- Capacity limitation causes serious delay
- Injury and fatality rates are high

(7) At-grade intersection, but grade separation without access at low traffic volume.

(8) At-grade intersection

Table 4.5.1 Types of Intersection



Source: Study Team

Traffic volume and road condition are on the subordinate road.

Types of At-grade Intersection

The table below summarizes the turning traffic volume for the design hour and the recommended at-grade intersection type.

Table 4.5.2 Volume of Turning Traffic

Turning Direction	Vehicles/hour		
	Simple	Auxiliary Lanes	Channelization
Right	30 <	30 - 60	< 60
Left	30 <	30 - 50	< 50

Source: Study Team

3) Location of Interchanges and Intersections

The locations and types of interchanges and intersections followed the system for intersections in the Master Plan. The more detailed locations and types are tabulated in table 4.5.1 and illustrated in Figure 4.5.2 The following 11 interchanges are proposed to be the scope of work, for which drawings were prepared under this Feasibility Study but excluding the plan and the profile for the east and southwest sections of RR2.

(1) National Highway No.1K

(2) Planned Primary Road (HCM-Long Thanh)

(3) Provincial Road No.15

(4) Provincial Road No.34

(5) Pham Hung Road

(6) National Highway No.50

(7) Provincial Road No.10

(8) Planned Primary Road (to Thu Duc)

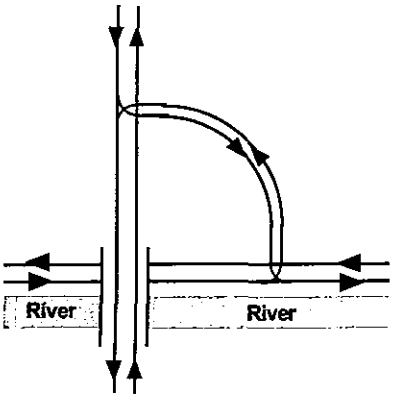
(9) Hung Lo No.14

(10) Provincial Road N0.16

(11) Ha Huy Giap Road

Based on the results of the engineering design, two interchanges the team proposed to adopt the one quadrant type as shown in Figure 4.5.1. Because one road runs parallel with the river, there is no space for a diamond-type interchange.

Figure 4.5.1 Illustration of One Quadrant-Type Interchange



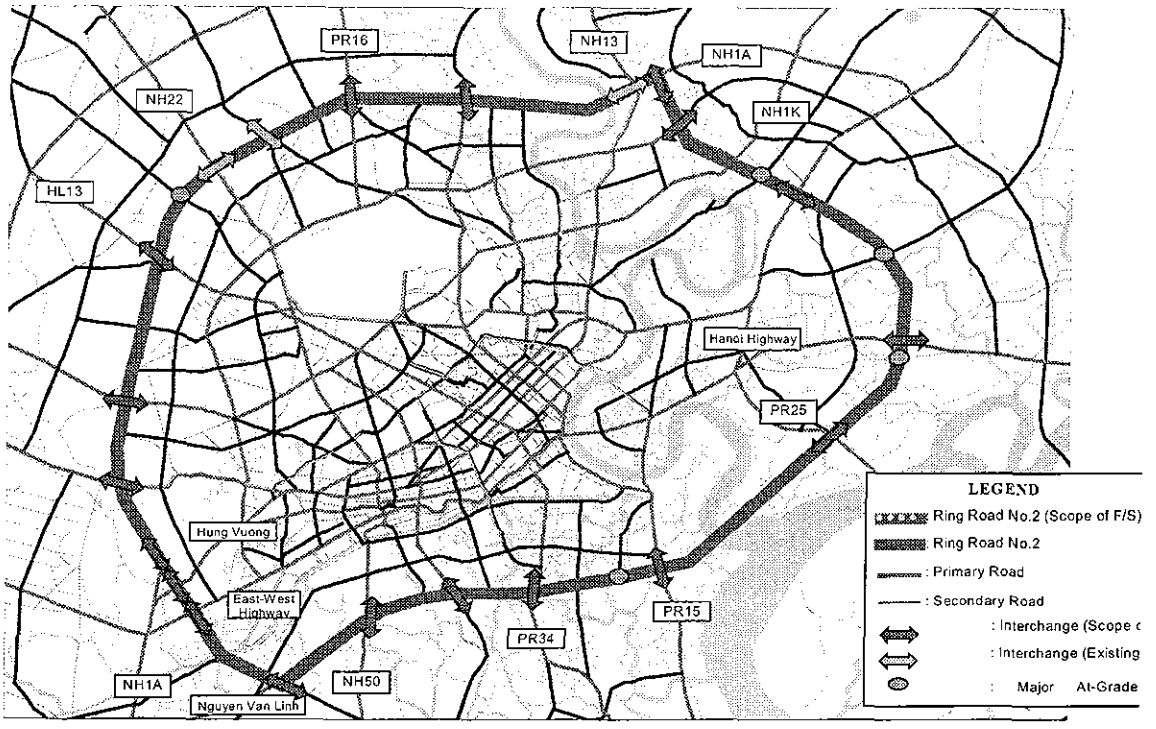
Source: Study Team

Table 4.5.3 Proposed Interchanges and Intersections for Major Crossings

Section	No	Station	Name of Crossing Road	Class[1]	Type of Crossing[2]	Type	No. of Road	Traffic Volume[3] (PCU/day)	No. of Lane of Crossing[1]	Remark
East	1	Sta.0+992	National Highway No.1A	P	B	Semi-directional ThreeLeg	3	74,699 88,264	6	
	2	Sta.2+650	Planned Primary Road	P/S	C	One Quadrant	4	48,656 58,370	4(P)/ 2(S)	River Condition
	3	*Sta.4+184*	*Vietnam Railway*	-	*B*	***Flyover***	-	- -	-	
	4	Sta.4+528	National Highway No.1K	P	C	Diamond	4	87,301 80,758	8/6	
	5	Sta.5+630	Planned Secondary Road	S	A	At-grade	4	39,018 94,887	4/2	
	6	Sta.6+599	Hanoi Highway	P	B	Full Clover	4	84,520 94,887	10	Crossing of UMRT
	7	Sta.7+323	Planned Secondary Road "A"	S	A	At-grade	4	20,976 74,816	2	
	8	Sta.9+916	Planned Secondary Road "B"	S	A	At-grade	4	35,382 67,664	4	
	9	Sta.12+631	Planned Primary Road (HCM-Long Thanh)	P	C	Diamond	4	57,991 67,664	6	
	10	Sta.13+147	Hung Lo 33 (HL33)	O	A	At-grade	4	10,053 66,134	2	
	11	Sta.16+176	Provincial Road No.25	P	B	One Quadrant	4	85,799 78,160	8/6	River Condition
	12	Sta.22+517	Provincial Road No.15	P	C	Diamond	4	48,757 78,160	4	
	13	Sta.23+730	Nguyen Van Linh (East)	P/S	A	At-grade	3	62,353 93,205	6+2[4]	
South	14	-	Provincial Road No.34	P	C	Diamond	4	53,245 76,122	4	*Connecting Hiep Phuoc Port*
	15	-	Primary Road (Pham Hung Road)	P/S	C	Diamond	4	32,791 54,086	4(P)/ 2(S)	
	16	-	National Highway No.50	P	C	Diamond	4	38,250 31,448	6/4	
Southwest	17	Sta.6+487	Nguyen Van Linh (West)	P/S	A	Diamond	4	30,085 42,074	6+2[4]	
	18	Sta.5+186	Existing Road	O	A	At-grade	4	22,550 66,434	2	
	19	Sta.3+036	East-West Highway	P	B	Diamond	4	67,272 67,572	6+4(F)	
	20	Sta.2+235	Hung Vuong	P	B	Diamond	4	58,376 67,572	8	UMRT-elevated
	21	Sta.1+000	National Highway No.1A	P	A	Semi-directional Three Leg	3	15,556 77,815	6	
West	22	-	Provincial Road No.10	P	C	Diamond	4	85,264 91,857	6	
	23	-	Planned Primary Road (To Thu Duc)	P	C	Diamond	4	33,341 87,937	4	
	24	-	Hung Lo No.13 (Le Trong Tan)	P	C	Diamond	4	43,529 59,983	6/4(M/P)	
	25	-	Provincial Road No.14 (Pham Van Hon Rd.)	S	A	At-grade	4	26,630 66,485	2	
North	26	-	National Highway No.22	P	B	Diamond	4	82,988 71,966	8/6	Already Constructed
	27	-	To Ky Road	S	C	Combined Diamond	4	35,177 83,013	4	Already Constructed
	28	-	*Provincial Road No.16* (Le Duc Tho Rd.)	P	C	Diamond	4	45,739 67,875	4	
	29	-	Thong Nhat Road	S	A	Diamond	3	16,196 69,817	2	
	30	-	Ha Huy Giap Road	P/S	C	Diamond	4	33,981 75,622	4	
	31	-	National Highway No.13	P	B	Diamond	4	73,801 88,264	6/4	Already Constructed

Source: Study Team
[1] P: Primary, S: Secondary, F: Frontage, O: Others
[2] A: At-grade, B: Flyover of Ring Road, C: Flyover of the crossing road
[3] Upper: Crossing road, Lower: Ring Road 2
[4] Future Stage

Figure 4.5.2 Locations of Interchanges and Intersections for F/S



Source: Study Team

4.6 Examination of Alternative Plans for Phu My and Phu Dinh Bridges

1) General

Materials for modern bridge construction are usually concrete (either reinforced or prestressed) or structural steel. Both materials are suitable for bridges except for long span bridges which require extremely high accuracy in construction, importation of large quantity of structural steel, and high periodic maintenance and inspection cost. No long span steel bridge exists in Vietnam.

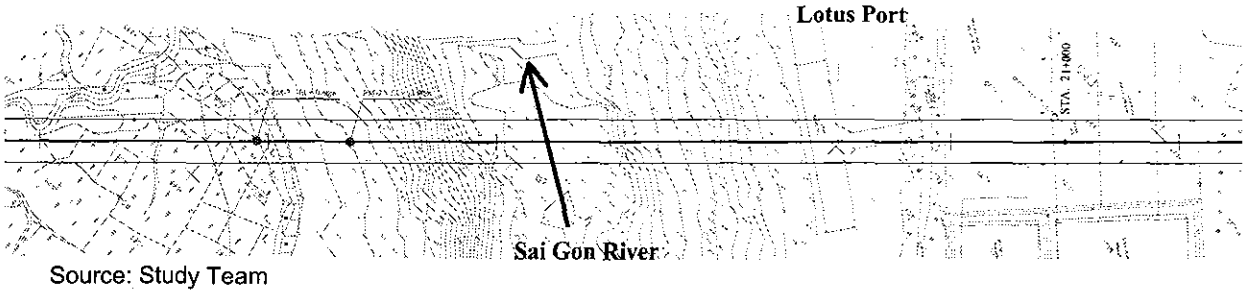
Although a long span bridge is of concrete, overseas labor and material will be required for special tasks such as prestressing and cable stay erection.

This chapter, therefore will describe the details of the two major project bridges of Phu My and Phu Dinh.

2) Conditions to be considered

Phu My Bridge

Figure 4.6.1 Location Map of Phu My Bridge



Source: Study Team

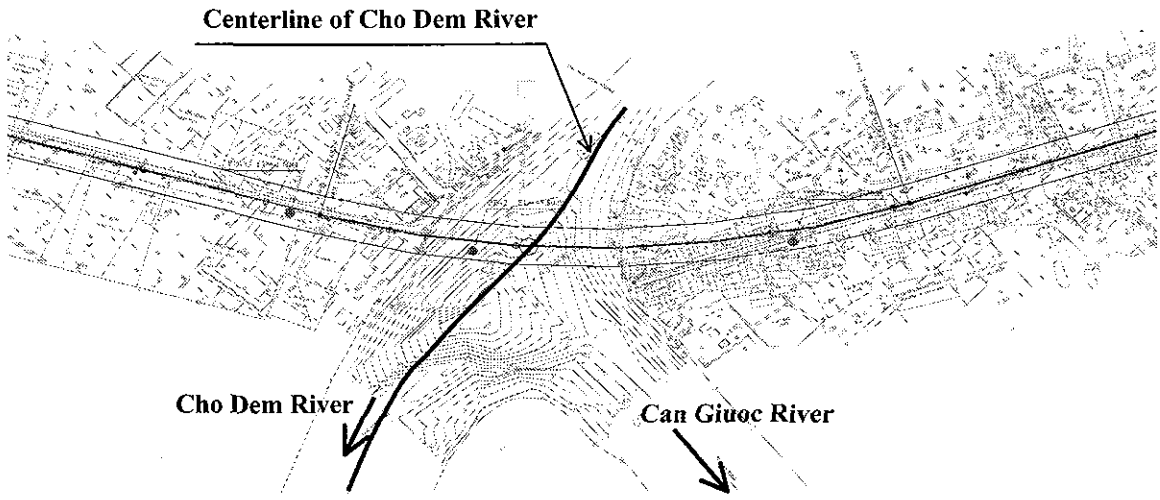
Phu My Bridge is located near the confluence of Sai Gon River and Nha Be River, and influenced by the ebb and flow of tide.

the location of piers in the river shall not obstruct river flow and the smooth passage of 20,000 DWT vessels.

The Lotus Port is on the right bank of Saigon River. However, since the transfer of this port to another place is planned in the near future and no discussion with relevant authorities was made, no restriction due to port facilities is considered for the approach bridge's pier arrangement in this study.

Phu Dinh Bridge

Figure 4.6.2 Location Map of Phu Dinh Bridge



Source: Study Team

Phu Dinh bridge is located near the confluence of Cho Dem River and Can Giuoc River and river flow direction is not constant even if its velocity is as low as 0.75 m/s, according to the existing feasibility study report.

The location of piers in the river shall not obstruct river flow and the smooth passage of 500 - 2,500 DWT vessels.

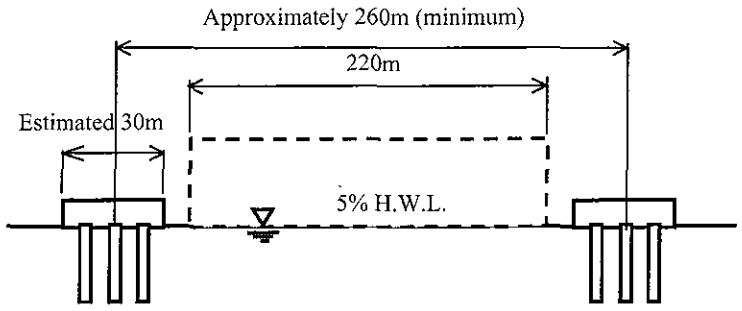
3) Comparison of Phu My Main Bridge Type

Determination of Main Span

As 20,000-ton vessels pass along the Saigon River, a minimum navigation clearance of 120m wide and 40m high from the 5% frequency high water level must be provided under the main bridge. Based on the Feasibility Study Report of Phu My Bridge, a navigation clearance of 220m wide and 45m high was approved by the MOT.

Considering the obstruction by bridge structure elements such as pile caps, a minimum main span over the navigation clearance will be approximately 260m.

Figure 4.6.3 Minimum Center Span for Phu My Bridge



Source: Study Team

Bridge Type Selection

As mentioned above, traditionally steel bridges are not normally used for long span bridges. Concrete bridge type by span is shown in Table 4.6.1 from previous practices. Three bridge types of cable-stayed PC girder and rigid frame PC box girder from the following table and extra dose PC girder, which is one type of rigid-frame box girder with external cables, have been selected for a bridge with 260m span.

Setting of Pile Caps

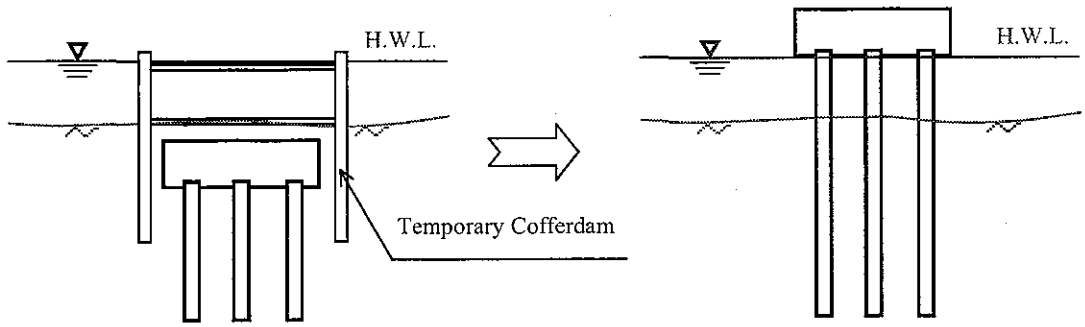
As to the pile caps of piers in the river, it is expected that it will not be cost-effective to embed pile caps under the riverbed that needs steel pipe pile cofferdam to excavate riverbed since river depth is 10m or greater. It is recommended that pile caps be set over the design high water level as shown in Figure 4.6.4 to assure visibility even in the rainy season to prevent vessel collision.

Table 4.6.1 Concrete Bridge Types by Span

Bridge Type			Span: 10	20	30	40	50	100	150	200	250	260	300
Simple Beam	*Pre-tensioned Precast*	Slab Type											
		T-Section											
	Post-tensioned Precast	T-Section											
		Composite I-Section											
	Cast-in-situ	Box Section											
Splice-Jointed Beam	Pre-tensioned Precast	Slab Type											
		T-Section											
	Post-tensioned Precast	T-Section											
		Composite I-Section											
Continuous Beam	Supporting Method from Ground	Box Section											
	Large-Scaled Movable Supporting Method	Box Section											
	Cantilever Erection Method	Box Section											
	Haunching Method	Box Section											
Rigid-Frame Beam	Cantilever Erection Method	Box Section											
		Box Section with Hinge											
Others	Arch Bridge												
	Cable-Stayed Bridge												
	Extradosed Bridge												

Source: Study Team

Figure 4.6.4 Setting of Pile Cap

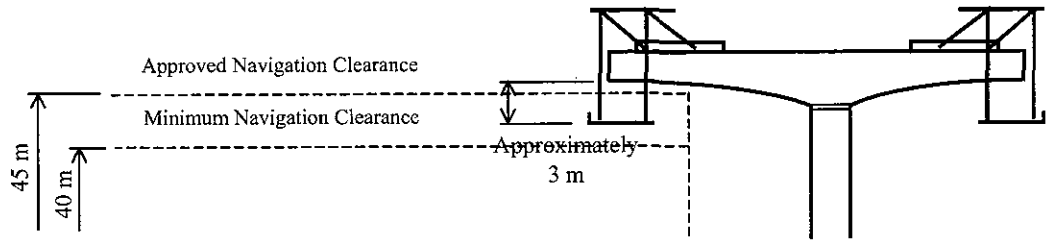


Source: Study Team

Clearance for Construction Equipment

All of these three alternatives require a form traveler when constructing the superstructure, which occupy approximately 3m below the soffit of the girder. However, since the approved vertical navigation clearance is 5m greater than the minimum requirement of 40m, the infringement to navigation clearance is deemed permitted only during construction. The proposed elevation of bridge is therefore determined in consideration of the approved navigation clearance only in this study. Discussion with the relevant authorities must be made for further study.

Figure 4.6.5 Required Clearance for Construction Equipment for Phu My Bridge



Source: Study Team

Comparison of Alternative Bridges

Comparison was made among the above three bridge types in terms of the cost of the approach bridge and the ease of construction. The approach bridge type and construction cost are studied in the next section. The results are summarized in Figure 4.6.7. In consideration of the very soft ground condition around the bridge's location and the provision of clearance below the girder soffit for maintenance works, the abutment height will be approximately 5m with soft ground treatment to prevent circular failure of embankment and considerable consolidation settlement.

In order to assure the required navigation clearance, rigid-frame PC box girder, which has much greater girder height, needs to be set at a higher elevation than the other two alternatives together with a longer approach bridge length.

Alternative –1 of cable-stayed bridge type was selected as the most appropriate in terms of economy and current bridge construction practices in Vietnam.

4) Comparison of Phu My Approach Bridge Type

Alternative Bridge Types

The approach bridge of Phu My Bridge has an average pier height of 25m (40m as the maximum) from the existing ground level to the bridge surface.

The following four alternatives, selected based on the previous practices in other projects for small and medium bridges in Vietnam, were compared with a 200m long bridge representing the approach bridge with an average pier height of 25m in terms of economy, ease of construction and aesthetic view.

Alternative-1: Prestressed Concrete I-Girder Bridge

3@33.0 = 99.0m, 3@33.0 = 99.0m totaling 198.0m

Alternative-2: Prestressed Concrete Super-Tee Girder Bridge

5@40.0 = 200.0m

Alternative-3: Prestressed Concrete Box-Girder Bridge

4@50.0 = 200.0m

Alternative-4: Steel I-Girder Bridge

5@40.0 = 200.0m

Foundation Type

The candidate foundation types are driving pile, cast-in-place reinforced concrete pile with reversed circulation drilling method and caisson as shown in Figure 4.6.6, since a very soft layer exists with about 10m to 25m in depth together with a SPT blow count of 0 – 1, and pile length will be 40m or greater.

The appropriate foundation type is cast-in-place reinforced concrete pile (reverse circulation drilling method) from the superstructure type, estimated pile length and especially the practices with similar soft ground conditions, since no detailed study was made.

Figure 4.6.6 Types of Foundation

Conditions for Selection				Foundation Type: Spread Foundation	Driven Pile: Reinforced Concrete Pile (RC Pile)	Driven Pile: Prestressed Concrete Pile (PC Pile)	Driven Pile: Steel Pile Pile	Driving Pile with Digging inside of Pile: PC Pile	Driving Pile with Digging inside of Pile: Steel Pile Pile	Cast-in-situ Concrete Pile: All Casing Work	Cast-in-situ Concrete Pile: Reversed Circulation Work	Cast-in-situ Concrete Pile: Earth Drill Work	Caisson: Oneumatic Cassion	Caisson: Open Caisson	Steel-Pipe-Sheet-Pile Well Method
Ground Conditions	Conditions up to bearing Stratum	Existance of Very Soft Layer in the Middle Layer		×	○	○	○	○	○	○	○	○	○	○	○
		Existance of Gravel Layer	Gravel Diameter: <= 50mm	○	△	△	○	○	○	○	○	○	○	○	○
			Gravel Diameter: 50 - 100 mm	○	×	△	△	△	△	○	○	△	○	○	△
			Gravel Diameter: 10 - 500 mm	○	×	×	×	×	×	△	×	×	○	△	×
	Conditions of Bearing Stratum	Depth up to Bearing Stratum	< 5 m	○	×	×	×	×	×	×	×	×	×	×	×
			5 - 15 m	△	○	○	○	○	○	○	△	○	○	○	△
			15 - 25 m	×	△	○	○	○	○	○	○	○	○	○	○
			25- 40 m	×	×	○	○	○	○	○	○	△	○	○	○
			40 - 60 m	×	×	△	○	△	○	△	○	×	△	○	○
			> 60 m	×	×	×	△	×	×	×	△	×	×	△	△
		Soil Conditions	Cohesive Soil (SPT>20)	○	○	○	○	○	○	○	○	○	○	○	○
			Sandy or Gravel (SPT>30)	○	○	○	○	○	○	○	○	○	○	○	○
		Inclination (0 > 30 deg.)		○	×	△	○	△	○	○	△	△	○	△	△
	Conditions of Ground Water	Ground Water Level is near Ground Surface		△	○	○	○	○	○	○	○	△	○	○	○
		Resurgent Water is large		△	○	○	○	○	○	○	○	△	○	○	○
		Artesian head water exist (h> 2 m)		×	○	○	○	×	×	×	×	×	△	△	○
		Water Velocity is greater than 3 m/min.		×	○	○	○	○	○	×	×	×	○	△	○
Structural Feature	Magnitude of Loads	Vertical Load is small (Span < 20 m)		○	○	○	○	○	○	○	○	○	×	△	×
		Vertical Load is medium (Span 20-50 m)		○	△	○	○	○	○	○	○	○	○	○	○
		Vertical Load is large (Span > 50 m)		○	×	△	○	△	○	○	○	△	○	○	○
		Horizontal Load is comparatively low against Vertical Load		○	○	○	○	○	○	○	○	○	△	△	△
		Horizontal Load is comparatively large against Vertical Load		○	×	△	○	△	○	○	○	○	○	○	○
	Suport System	Bearing & Friction		-	○	○	○	○	○	○	○	○	-		
		Friction only		-	○	○	○	△	-	○	○	○	-		
Construction Condition	Over Water	Water Depth < 5 m		○	○	○	○	△	△	△	○	△	△	△	○
		Water Depth > 5 m		×	△	△	○	△	△	△	○	×	△	△	○
	Narrow working Place			○	△	△	△	△	△	△	△	△	△	△	×
	Raking Pile Construction			-	△	○	○	×	△	△	×	×	-	-	-
	Environment	Need measure for noise & vibration		△	○	×	×	△	△	△	○	○	○	○	×
		Affect adjacent structures		○	○	×	△	△	△	○	○	○	△	△	△

○ : Suitable △ : Applicable × : Not Applicable

Source: Study Team

Comparison of Alternative Bridges

Figure 4.6.7 shows the results of comparison of four alternatives in terms of economy, ease of construction, aesthetic view, and use of Vietnamese resources.

Steel girders (Alternative – 4) have not been used in Vietnam recently and a small number of experienced workers will be employed for this project should this alternative be selected as appropriate. Moreover, in order to maximize the use of local materials and Vietnamese construction resources as mentioned in "Design Philosophy", concrete bridges are suitable. Therefore, this alternative was placed fourth (4th).

In conclusion, Alternative – 2 of Super-Tee Girder is recommended as the most appropriate.

Figure 4.6.7 Comparison of Alternatives for Approach of Phu My Bridge

Alternative	Side View	Cross Section	Comments	Priority
Prestressed Concrete I-Girder (Splice-Jointed)	6 @ 33000 = 198000		Practices: Many practices in VN Appearance: Not good Soffit apperance is bad Cost Index: 1.05 (US$ 1,753 /m2) Less maintenance cost	2
Prestressed Concrete Super-Tee Girder	5 @ 40000 = 200000		Practices: Practice in My Thuan Appearance: Slender Soffit appearance is good Cost Index: 1.00 (US$ 1,676 /m2) Less maintenance cost	1
Prestressed Concrete Box Girder	4 @ 50000 = 200000		Practices: Practices in VN Appearance: Slender Soffit appearance is good Cost Index: 1.30 (US$ 2,176 /m2) Less maintenance cost	3
Steel I-Girder	5 @ 40000 = 200000		Practices: Little practice in VN Appearance: Not good Soffit apperance is bad Cost Index: 1.03 (US$ 1,734 /m2) Expensive maintenance cost	4

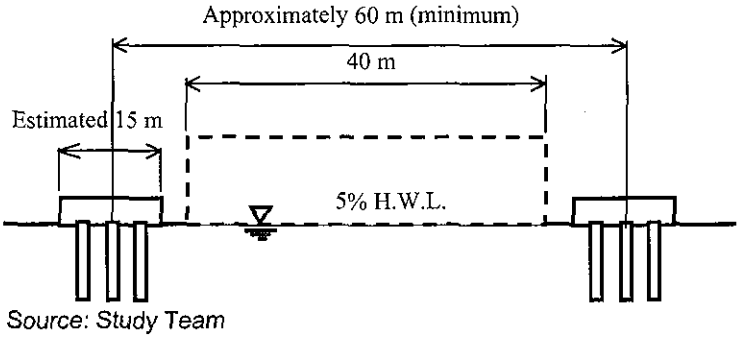
Source: Study Team

5) Comparison of Phu Dinh Bridge Type

Determination of Main Span

According to the existing Pre-Feasibility Study report, required navigation clearance of the Cho Dem River is 40m wide and 7m high for 500-2,500 DWT vessels. In consideration of the bridge elements such as pile caps, which are to be set above the design high water level as the embedment of pile caps under the riverbed is not cost-effective as described above for Phu My Bridge, a minimum span over the navigation clearance will be approximately 60m.

Figure 4.6.8 Minimum Center Span for Phu Dinh Bridge

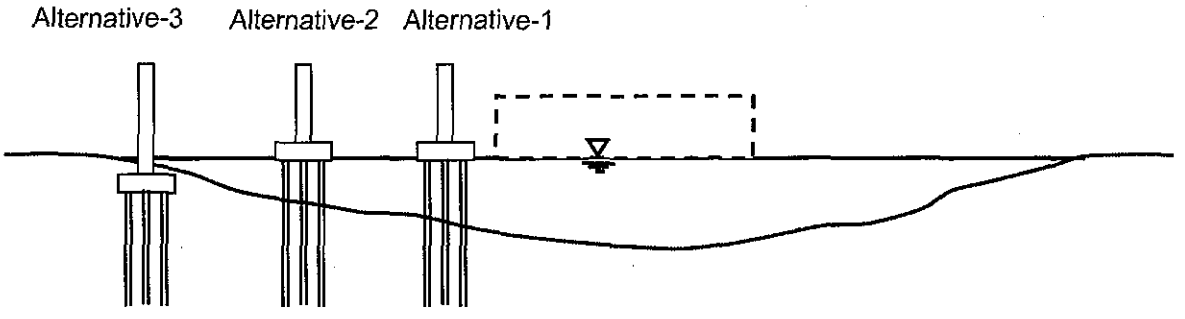


Source: Study Team

Alternative Types of Main Bridge

The alternatives of main bridge have been set out in terms of pier installation in the river, which needs high construction cost and obstructs river flow and smooth vessel passage. Each alternative main span is as follows:

Figure 4.6.9 Pier Arrangement Alternatives for Navigation Clearance (Phu Dinh Bridge)



Alternative	Outline	Span
Alternative - 1:	This alternative provides required navigation clearance as a minimum. Construction work in the river is necessary. This interferes with smooth passage of vessels along the river center line or requires steep skew angle of pier setting.	60m
Alternative - 2:	This alternative provides smooth passage of vessels. Construction work in the river is necessary.	90m
Alternative - 3:	This alternative provides smooth passage of vessels. This does not need construction work in the river, but it needs spreading of soil to allow working from the land.	120m

Source: Study Team

Bridge type for each main span alternative is a "Continuous PC Box Girder" with cantilever erection method as shown in Table 4.6.2.

Table 4.6.2 Bridge Type by Span from Previous Practices for Phu Dinh Bridge

Bridge Type			Span: 10 20 30 40 50 60 100 120 150 200 250 300
Simple Beam	Pre-tensioned Precast	Slab Type	
		T-Section	
	Post-tensioned Precast	T-Section	
		Composite I-Section	
	Cast-in-situ	Box Section	
Splice-Jointed Beam	Pre-tensioned Precast	Slab Type	
		T-Section	
	Post-tensioned Precast	T-Section	
		Composite I-Section	
Continuous Beam	Supporting Method from Ground	Box Section	
	Large-Scaled Movable Supporting Method	Box Section	
	Cantilever Erection Method	Box Section	
	Haunching Method	Box Section	
Rigid-Frame Beam	Cantilever Erection Method	Box Section	
		Box Section with Hinge	
Others	Arch Bridge		
	Cable-Stayed Bridge		
	Extradosed Bridge		

Source: Study Team

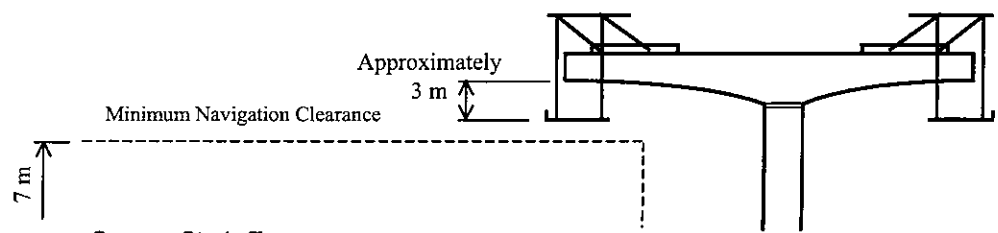
The rigid-frame type is not suitable for Phu Dinh Bridge with a small ratio of pier height to horizontally and rotationally restricted span, because expansion of superstructure is restricted to rotate and translate at the supports, which creates frequent critical stress to piers and foundations in normal times such as creep, shrinkage, daily and seasonal temperature changes.

Moreover, arch, cable-stayed and extra-dosed bridges are obviously not cost-effective for these center spans of 60m, 90m and 120m. These three types are excluded from the alternatives.

Clearance for Construction Equipment

These three alternatives need form travelers during construction because obstruction to vessel passage and river flow must be prevented even for a short period. The approved vertical navigation clearance is 7m excluding construction margin. Hence, the proposed elevation of bridge over the river must be determined. Form travelers must not occupy the navigation clearance even during construction.

Figure 4.6.10 Required Clearance for Construction Equipment for Phu Dinh Bridge



Source: Study Team

Approach Bridge Type

From the results of the comparison study for Phu My Approach Bridge Type, Super-Tee Girder is deemed suitable also for Phu Dinh Approach Bridge.

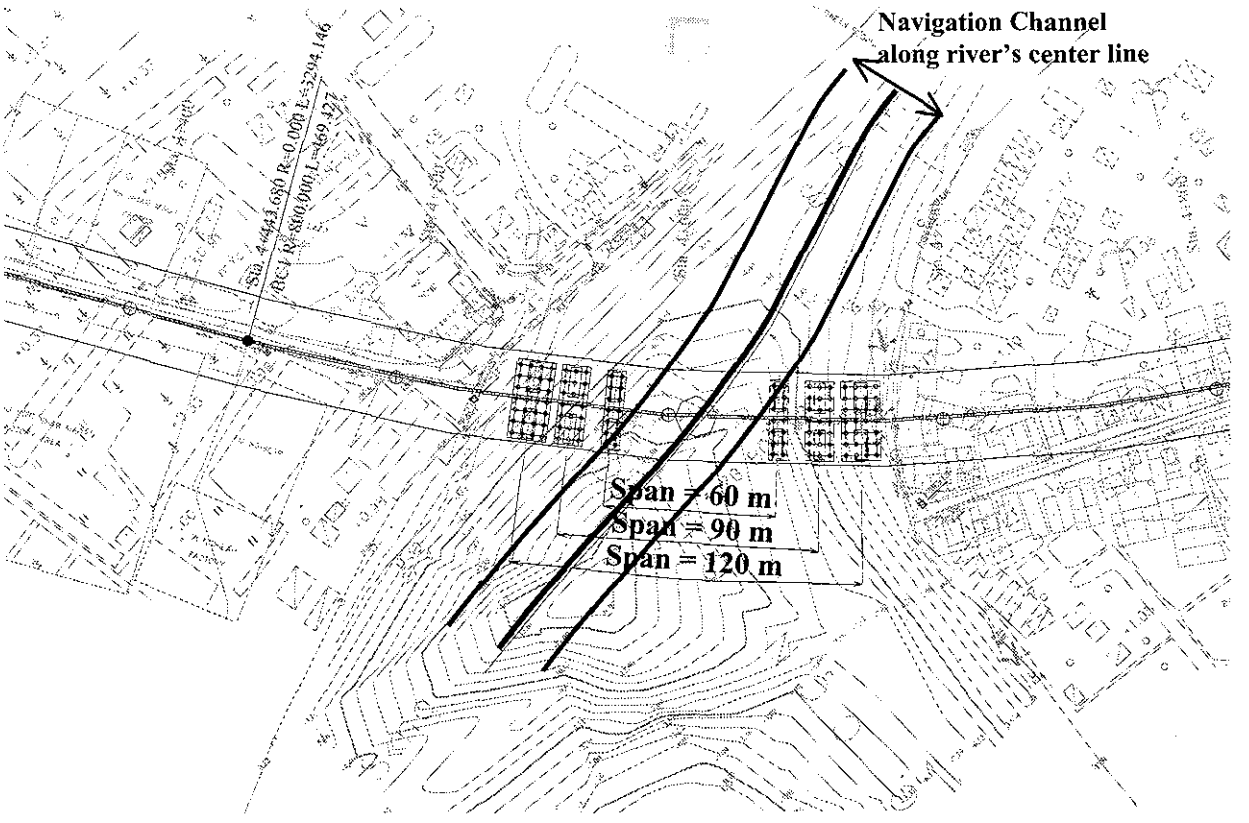
Comparison of Alternative Bridges

The results of the comparison for Phu Dinh Main Bridge are summarized in Figure 4.6.10

In consideration of the very soft ground condition around the bridge location and provision of clearance below the girder soffit for maintenance works, the abutment height will be approximately 5m with soft ground treatment to prevent circular failure of embankment and considerable consolidation settlement.

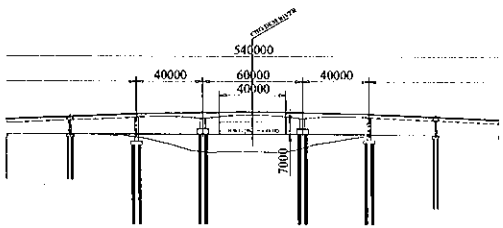
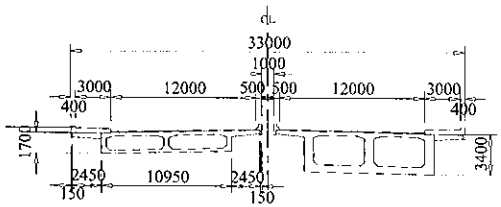
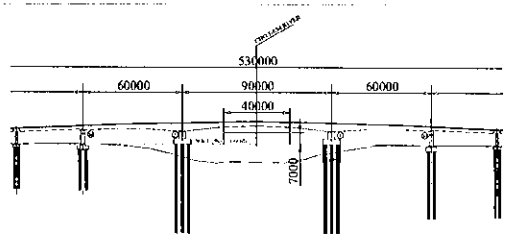
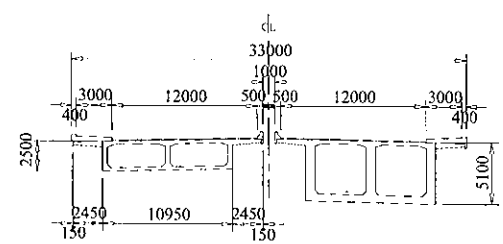
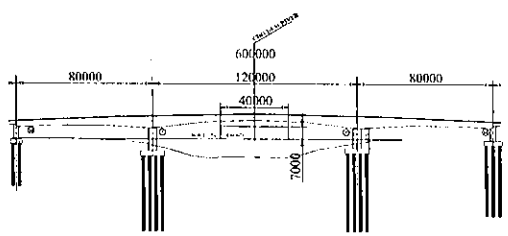
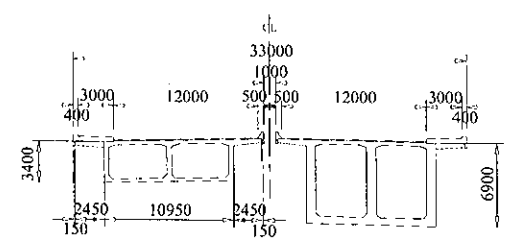
Although the Alternative – 1 is the most cost-effective among the three alternatives, it interferes with the smooth passage of vessels or needs setting of piers with steep skew angle, which shall be investigated based on the structural study, river flow analysis and discussion with the river authority. Therefore, Alternative – 2 with a 90m center span is recommended in terms of economy, ease of construction and less obstruction to river flow and smooth vessel passage.

Figure 4.6.11 Relationship between Piers and Navigation Channel along River's Center Line



Source: Study Team

Figure 4.6.12 Comparison of Alternatives for Phu Dinh Bridge

Alternative	Side View	Cross Section	Comments	Priority
Prestressed Concrete Continuous Box Girder with 60m center span	 Main Bridge = 140 m, Approach Bridge = 400 m Total Bridge Length = 540 m		Practices: Many practices in VN Piers are constructed very close to the navigation clearance and confluence of two rivers, which **prevents smooth passage of vessels along the river center.** Cost Index: 1.00 Main Bridge : 6.7 Million US$ Approach Bridge : 13.4 Million US$ Totaling : 20.1 Million US$	2
Prestressed Concrete Continuous Box Girder with 90m center span	 Main Bridge = 210 m, Approach Bridge = 320 m Total Bridge Length = 530 m		Practices: Many practices in VN Piers are constructed far from the river center, which **provides smooth passage of vessels along the river center.** Cost Index: 1.07 Main Bridge : 10.4 Million US$ Approach Bridge : 11.0 Million US$ Totaling : 21.4 Million US$	1
Prestressed Concrete Continuous Box Girder with 120m center span	 Main Bridge = 280 m, Approach Bridge = 320 m Total Bridge Length = 600 m		Practices: Many practices in VN Piers are installed along the river bank and can be constructed from the land. There is no obstruction to river flow. Cost Index: 1.34 Main Bridge : 16.0 Million US$ Approach Bridge : 11.0 Million US$ Totaling : 27.0 Million US$	3

Source: Study Team

4.7 Other Major Structures

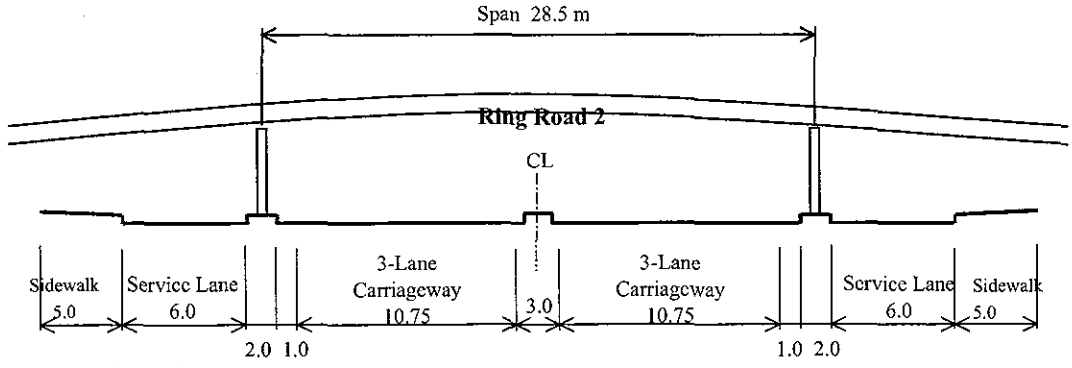
Appropriate structures are required on main highways to cross the small rivers and other roads. In addition, a lot of roads are planned to cross over main highways through structures to prevent split of communities and provide safe and smooth traffic.

This section describes the structure types for the above-mentioned structures for cost estimate.

1) Flyover Bridge

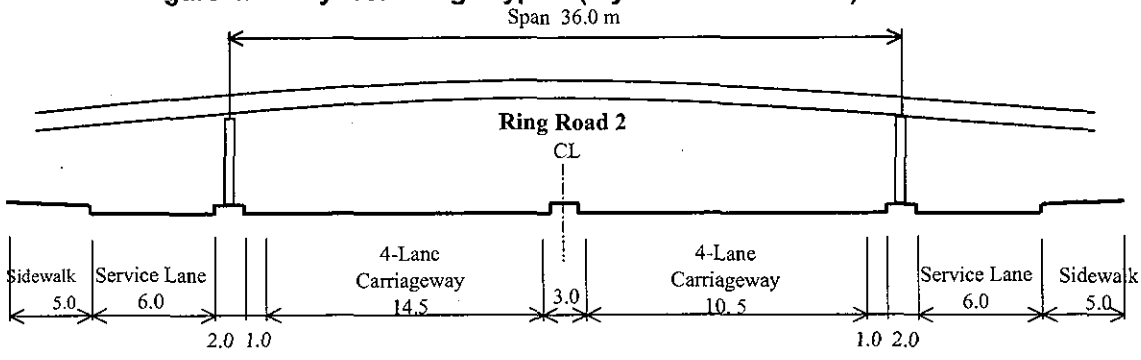
Bridge types are determined by span arrangement in consideration of local conditons. In this project, there are 11 flyover bridges over the highways (RR2) as shown in Figure 4.7.1 which are categorized into the following two types.

Figure 4.7.1 Flyover Bridge Type 1 (Flyovers No.4 – No.11)



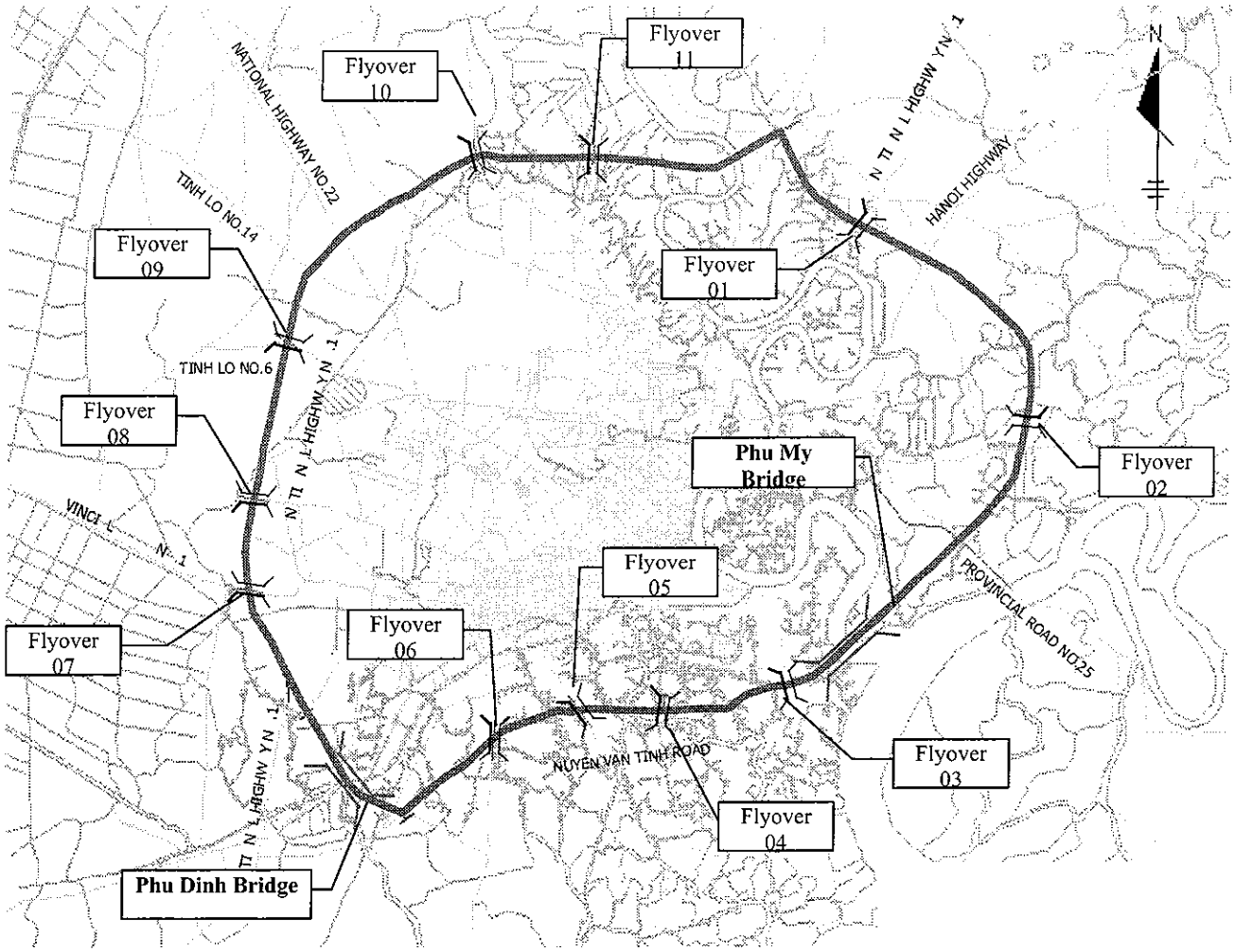
Source: Study Team

Figure 4.7.2 Flyover Bridge Type 2 (Flyovers No.1 – No.3)



Source: Study Team

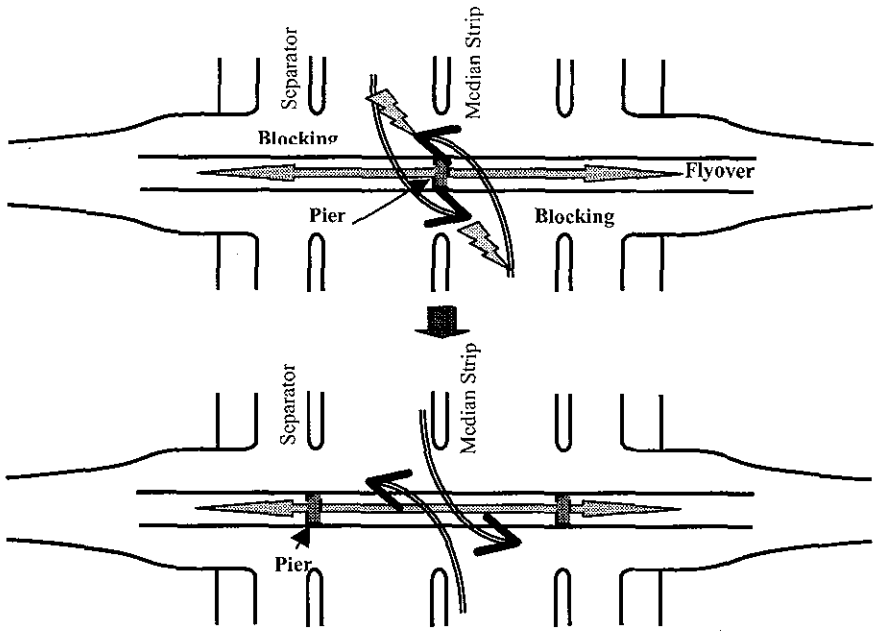
Figure 4.7.3 Location Map of Flyover Bridges over Ring Road No.2



Source: Study Team

Should any pier be installed in the raised median strip, it will cause traffic congestion due to the blockage of left-turning vehicles as shown in Figure 4.7.4 Hence, piers shall be installed in the separator between carriageway and service road to minimize the span of the flyover. In conclusion, the spans of flyover bridges over RR2 are 28.5m and 36.0m, respectively, for eight and three bridges, respectively.

Figure 4.7.4 Pier Installation of Flyover



Source: Study Team

For flyovers on RR2 over road crossings, a span of 28.5m used for almost all flyovers over RR2, is standard to allow efficient casting yard and construction operation, provided no restrictions, such as small river and road crossing, exist.

The bridge type is a super-tee girder for bridge with a span of 40m and smaller, and a PC box girder for bridge with a span exceeding 40m in consideration of economy and aesthetic appearance from the previous practices and study on Phu My approach bridge selection.

2) Structures for Small Rivers

Structure types crossing over the rivers are classified into pipe culvert, box culvert and bridge. In Vietnam, the structure types shown in Table 4.7.1 are standardized taking into account economy, ease of construction and especially ease of operation and maintenance works.

Table 4.7.1 Existing and Recommended Structure Types by Opening Width in Vietnam

Opening Width (m)	Structure Type
L <= 2.0	Pipe Culvert
2.0 < L<= 6.0	Box Culvert (1 to 2 Cells)
6.0 < L	Bridge

(Standard in Vietnam)

Opening Width (m)	Structure Type
L <= 2.0	Pipe Culvert
2.0 < L<= **10.0**	Box Culvert **(1 to 3 Cells)**
10.0 < L	Bridge

(Recommendation)

Source: Study Team

In this study, it was recommended that a box culvert be used for structure with an opening width of from 2 to 10m with maximum 3 cells in terms of economy and recent practices in other countries.

The bridge type is a super-tee girder for bridge with a span of 40m and smaller, and a PC

Box Girder for bridge with a span exceeding 40m as well as flyovers over RR2 as mentioned above.

As the project roads are highways with a high design speed, preferred road surface conditions must be provided to prevent accidents due to driving errors. Therefore, pile foundation is recommended to minimize differential settlement between embankment section and structure section due to consolidation in soft ground areas extensively seen in the project area.

4.8 Construction Method

This section describes the outline of construction sequence for selected Phu My and Phu Dinh main bridges and approach super-tee girder bridges.

1) Phu My Main Bridge: Cable-stayed Bridge

As piers including foundations are set in the river, they may be constructed by barge together with cranes and concrete batcher plant. These construction machinery and equipment must be arranged so that navigation clearance is assured even during construction.

The girder, towers and stay cables are constructed in sequence from the pier to the span center and side and form traveler. As the bridge width is as wide as 41m, one block length of girder construction must be determined in consideration of concrete production capacity, the effect of thermal stress of mass concrete, form traveler capacity and so on.

The outline of construction sequence is shown in Figure 4.8.1

2) Phu Dinh Main Bridge: Continuous PC Box Girder Bridge

As piers including foundations are set in the river, they may be constructed by the barge together with cranes and concrete batcher plant. These construction machinery and equipment must be arranged so that navigation clearance is assured even during construction.

The girders are constructed in sequence from the pier to the span center and side by form travelers. One block length of girder construction must be determined in consideration of concrete production capacity, the effect of thermal stress of mass concrete, form traveler capacity and so on.

The construction sequence is shown in Figure 4.8.2

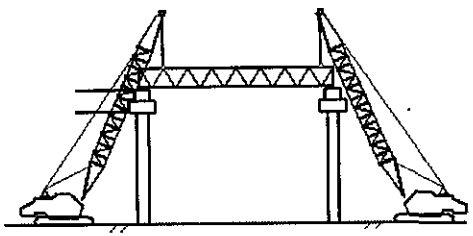
3) Approach Bridges: Super-Tee Girder Bridge

With regard to the construction method of Phu My approach bridge, it has a pier height of 40m as a maximum and it is considered impossible to erect girders to a position by cranes. As super-tee girders were constructed by temporary truss girder and hydraulic jacks as shown in Figure 4.8.3 for My Thuan Bridge, which has a maximum pier height of approximately 27m, it is recommended that the same method be used for spans with a pier height of 25m or smaller. For spans with greater pier height, erection girder method from one side to another will be used as shown in Figure 4.8.3

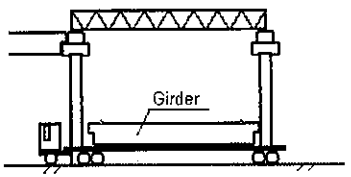
For Phu Dinh approach bridge, as it has an approximately 9m maximum pier height, it is deemed possible to construct girders by truck cranes.

Figure 4.8.1 Construction Sequence for Phu My Bridge

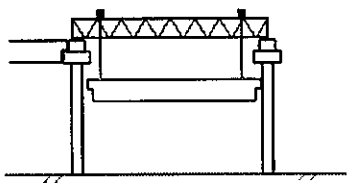
Step-1 : Fabricate erection truss girder on land and erect on adjacent piers



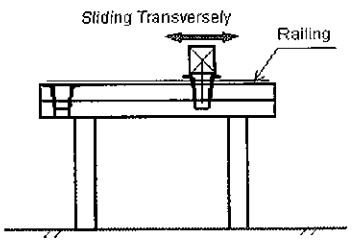
Step-2 : Transport a Super-Tee girder by a trailer under a span to be constructed



Step-3 : Erect a Super-Tee girder on piers by hydraulic jack



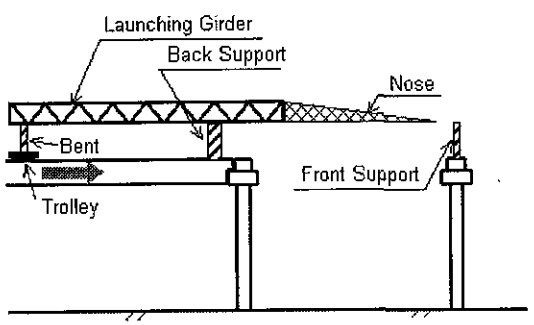
Step-4 : Slide a girder horizontally to a position and set on a bearing



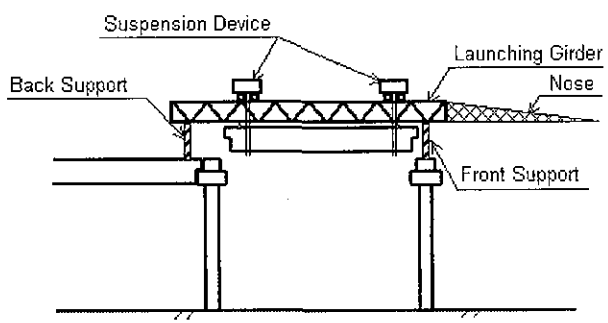
Source: Study Team

Figure 4.8.2 Construction Sequence for Phu Dinh Bridge

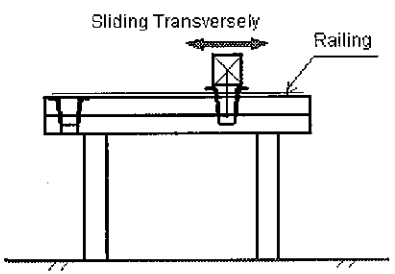
Step-1 : Fabricate Erection Girder and Drawn to an appropriate position



Step-2 : Fix the Erection Girder at Front and Back Support and Draw Girder to a position

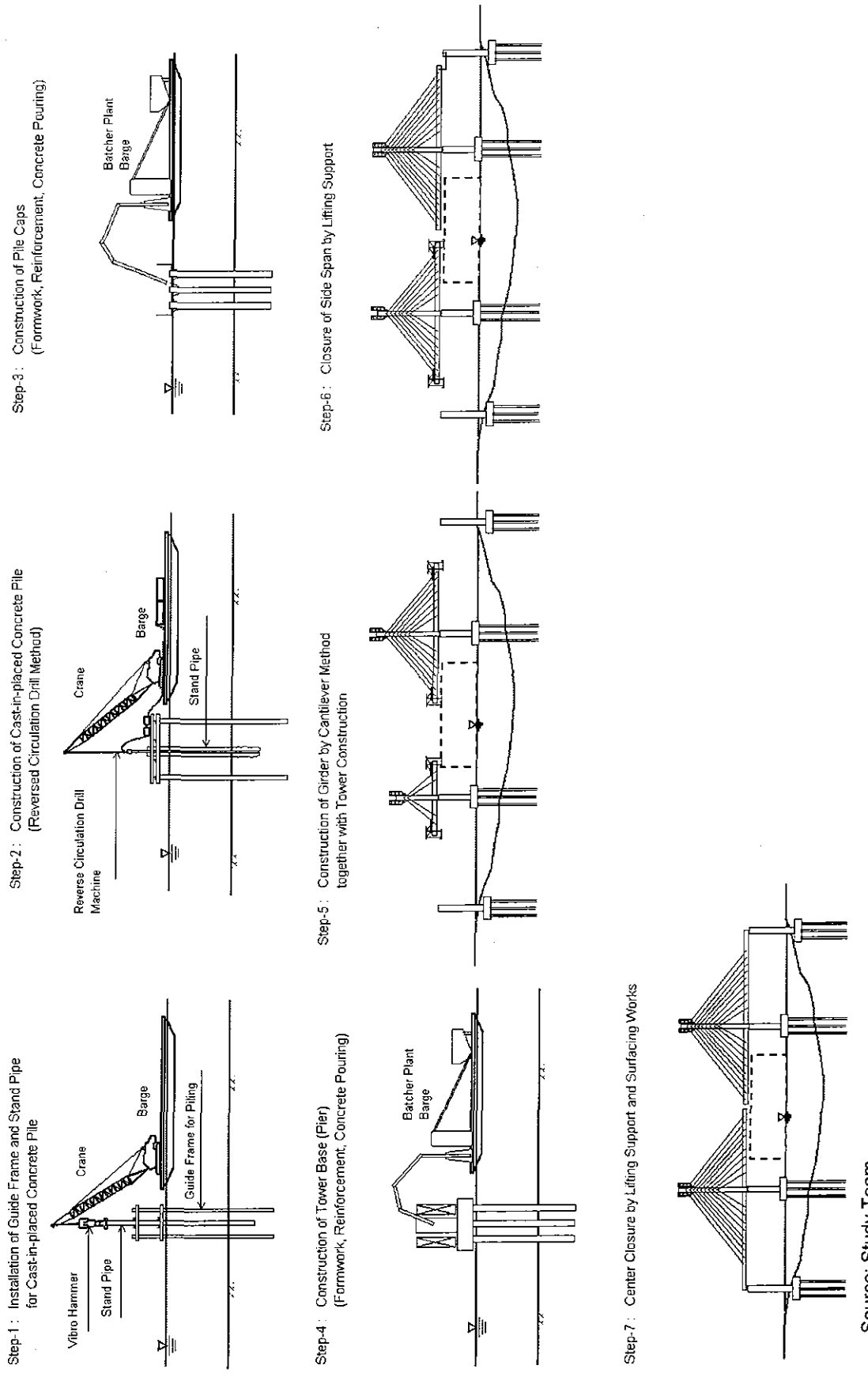


Step-3 : Slide a girder horizontally to a position and set on a bearing



Source: Study Team

Figure 4.8.3 Construction Sequence for Approach to Bridges



Source: Study Team

4.9 Operation and Maintenance Plan

1) General

The current situation of the operation and maintenance for roads and bridges in HCMC is greatly classified from the difference of jurisdiction into three; namely, the national roads, the city roads, the special roads such as the private organization including BOT.

The national roads are managed by the MOT, and the city roads are maintained by TUPWS of HCMC, using the public executing corporations. And, the special roads are managed by the company or the BOT bodies, using the collecting toll as the fiscal resources. Table 4.9.1 shows the outline of the jurisdictions, the execution body and the fiscal resources by the road jurisdiction

Table 4.9.1 Outline of the Existing Operation and Maintenance System

Road Classifications	Jurisdictions	Executions	Fiscal Resources
National Roads	MOT	Contract out basis	State Budget
City Roads	TUPWS, HCMC	Contract out based on the public corporations	Local Budget
Special Roads including BOT Projects	Private Company or BOT Bodies	Force account (partially contract out basis)	Toll Collections

Source: Study Team

On the other hand, this project are consists of a lot of components of which he East Section of Ring Road No.2 including Phu My Bridge where toll collection was required, the Southwest Section of Ring Road No.2 and Flyovers over National Highway No.1A and Nuyen Van Linh Road which is managed by the private company. And, these locations are wide-ranging.

An appropriate system of the operation and maintenance is examined in the consideration with such situation.

(1) Operation and Maintenance System

HCMC is assumed to be the implementing agency of this project to develop the Ring Road No.2 functionally and effectively as provided in the scope of work. And, it is preferable that HCMC basically executes the operation and the maintenance in the consideration of the toll levying system, the future road network, the future land use along the project road and so forth.

However, a proper and appropriate maintenance is required to extend its life span, since the Phu My Bridge is the large-scale bridge including the cable-stayed bridge. Moreover, the Phu My Bridge will be applied the toll levying system. Considering above conditions, it is assumed that the operation and maintenance organization will be established under HCMC and executes the operation and the maintenance of the Phu My Bridge based on the self-paying basis.

By considering of the combination many income resources such as the route development and so forth in addition with the toll collection with the development

method, which has a lot of options such as PPP (Public and Private Partnership), BOT, the Land Readjustment Method and alternative methods through the financial analysis, the sphere of activity and its fiscal resource are determined.

Here, it is assumed that the responsibility area of Operation and Maintenance Organization targets the E-5 Section only (See Main Text for the conclusion). The outline of the proposed system is shown in Table 4.9.2

Table 4.9.2 Proposed Operation and Maintenance System for Ring Road No.2 Project

Sections	Jurisdictions	Executions	Fiscal Resources
E-5 (from Provincial Road No.25 to No.15	The Operation and Maintenance Organization, HCMC	Force account (partially contract out basis)	Toll Collections and Other revenue
Other Sections	TUPWS, HCMC	Contract out based on the public corporations	Local Budget
Flyovers			

Source: Study Team

(2) Maintenance Works

Maintenance works are classified into three types: namely, routine, periodic and emergency. Routine maintenance is based on routine (daily) inspection of the condition of pavement, cut and fill slopes, drainage, bridges and other structures and facilities to monitor any defects and damage. The results of routine inspection will be promptly reported to the maintenance office for follow-up maintenance works to be undertaken either continually throughout a year or at certain intervals every year. And, according the routine maintenance plan, the clearing, mowing of grass and repairing are executed.

Periodic maintenance is based on detailed inspection performed at certain time intervals such as seasonally or yearly depending on the type and kind of facilities. It includes checking and testing the conditions of various structures and facilities. Defects and damage will be reported for repairs or remedies. And, according the periodic maintenance plan, the clearing, repairing and renewal are executed.

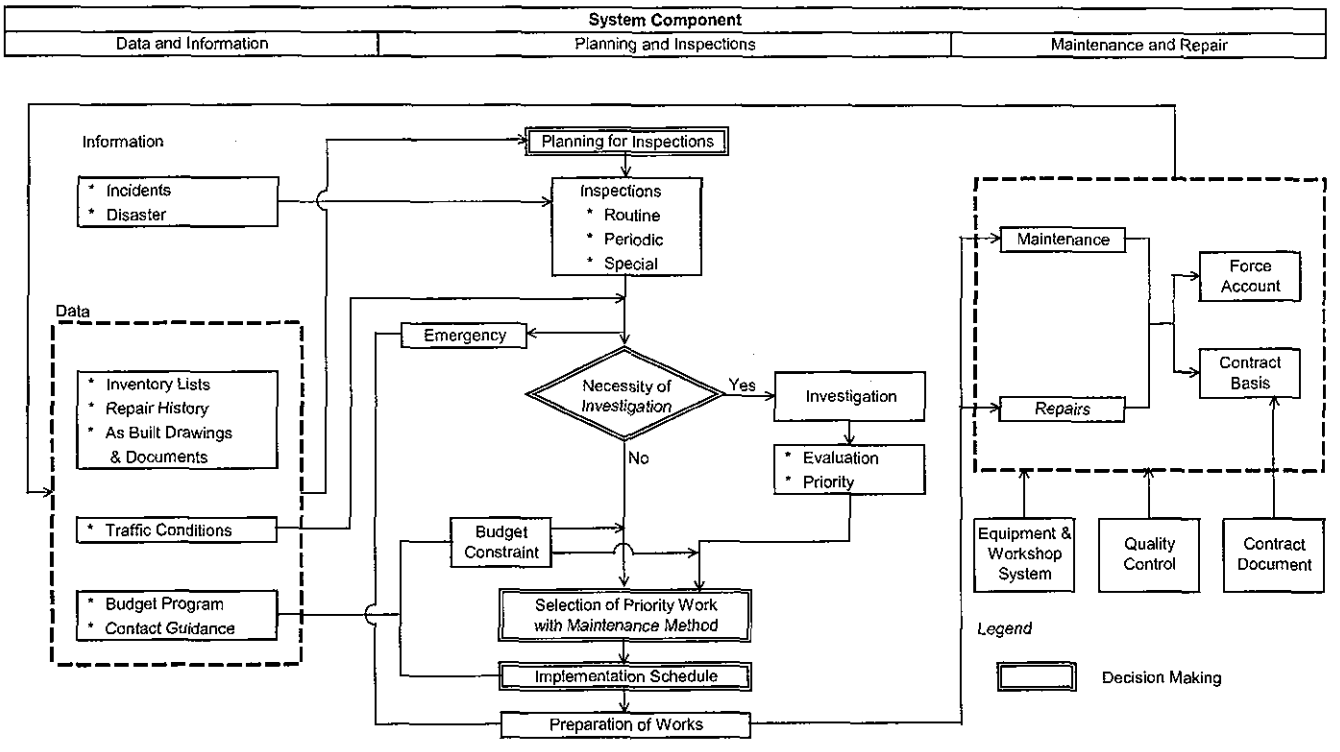
Emergency maintenance basically comprises works to restore road and road related facilities to their normal operating conditions after they are damaged by road accidents or natural causes. It is impossible to foresee the frequency, but such maintenance requires immediate action. Table 4.9.3 summarizes typical activities of each type of maintenance work. And, Figure 4.9.1 shows the general flow chart of the recommended overall maintenance works.

Table 4.9.3 Typical Maintenance Activities

Type	Activity
Routine	Inspection and patrol including removal of obstacles
	Clearing of road surface
	Clearing of ditches, culverts and bridges
	Vegetation control; Mowing and maintaining of plants
	Repair of traffic safety and management facilities
	Repair of devices and equipment including lighting facilities
	Pothole patching and crack sealing
	Repair of cut and fill slopes
Periodic	Inspection and test
	Renewal of traffic safety and management facilities
	Renewal of devices and equipment
	Overlay and re-pavement for bridges
	Replacement of expansion joints and bearing for bridges
	Repair of ditches, culverts and bridges
Emergency	Removal of debris or obstacles from natural causes
	Repair of damage caused by natural causes
	Repair of damage caused by traffic accidents

Source: Study Team

Figure 4.9.1 General Flow Chart of Maintenance Works



Source: Study Team

(3) Operation Works

The operation of the toll system on the Phu My Bridge will be undertaken the force account by the Phu My Operation and Maintenance Unit. The Phu My Bridge is

assumed to apply an opened toll system with barrier-type toll collection. The Phu My Operation and Maintenance Unit operate the toll collection works and expand the toll facilities. For example, the need for additional toll booth facilities will be reviewed based on actual traffic data collected after the opening of the Bridge.

(4) Toll System

Design controls and facilities should be taken into account in the case of toll road. The closed system will levy a toll from all users allowed to access to and egress from a toll road over the entire stretch, the open system may levy a toll not from short trip users but from medium and long trip users.

The Ring Road No.2 is designated to be not a toll road but a toll bridge, and accordingly toll will be levied only from road users who will cross the Saigon River on the bridge in the viewpoint of the beneficiaries should pay for the bridge, that is the open system. A barrier-type toll plaza on through traveled way is the most suitable for the Phu My Toll Bridge due to efficiency of toll operator and convenience of users. Moreover, the system is predominant and familiar in Ho Chi Minh City. The location of the toll plaza and the operation and maintenance office is proposed around Sta. 17+700. (See Main Text about the toll rates and Operation and Maintenance System)

5 COST ESTIMATION AND IMPLEMENTATION SCHEDULE

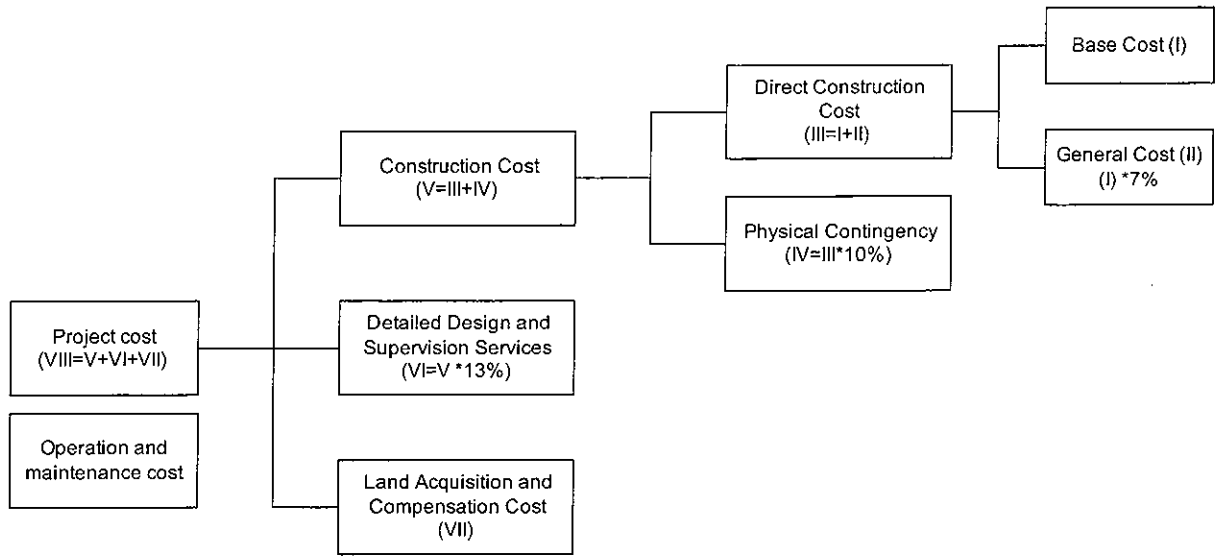
5.1 Composition of Project Cost and Preconditions

The project cost is consisted of construction cost, detailed design and supervision services, land acquisition and compensation cost. Construction cost includes direct construction cost and physical contingency.

The estimation cost of the each cost component was based on the result of preliminary engineering design, quantity of main work items and the following method.

Prevailing unit cost of ordinary construction work items was surveyed and selected to estimate the construction cost of the Project referring to ODA project executed around HCMC. Construction cost calculated based on these unit costs.

Figure 5.1.1 Project Cost Component



Source: Study Team

(1) Construction Cost

When the construction cost of each section was calculated, the following basic premises were required.

- All the construction work will be executed by constructor(s) to be selected by international competitive bidding.
- The exchange rate applies at the time of January, 2004 (US $ 1.0= \110.00 =15,500VND).

Because the general indirect cost was included in the above-mentioned construction unit cost, the breakdown of construction cost was assumed to be composed of the following two.

- Direct Construction Cost
- Contingency

The direct construction cost is the one built up by using the above construction unit cost. And, the contingency was assumed to be the one to expect 10% of the direct construction cost.

(2) Land acquisition, Compensation and Resettlement

The cost required for the land acquisition, compensation and resettlement is estimated in the Social Environment, which made the Resettlement Action Plan.

(3) Engineering Services

Engineering services including detailed design, construction supervision and the like is assumed to be 13% of the construction cost.

(4) Operation and Maintenance

The cost required for the operation and maintenance is estimated in the Operation and Maintenance Plan, which is described in next section.

(5) Project Cost

According to the above-mentioned, the estimated project costs are shown in Appendix. However, the project costs excludes the operation and maintenance Cost, Land Acquisition, Compensation and Resettlement Cost or interest during construction.

5.2 Construction Cost

Construction cost was estimated under the following work categories:

- Earthwork
- Soft ground treatment
- Retaining walls
- Pavement
- Drainage structure
- Bridges
- River bank and bridge protection
- Miscellaneous
- Toll facilities

The summary of the construction cost is shown in Table 5.2.1

Table 5.2.1 Summary of Construction Cost

	Ring Road No. 2 (East)	Ring Road No. 2 (Southwest)	Flyover	Provincial Road 25	Secondary Road	Total		
						Foreign	Local	Total
Earthwork[1]	49,477	13,841	1,815	10,319	5,452	62,134	18,770	80,904
Pavement	23,182	5,991	3,206	6,197	4,059	7,887	34,748	42,635
Bridge	290,632	48,872	11,615	53,266	9,435	142,768	271,052	413,820
Structure[2]	19,909	4,559	1,499	4,417	4,950	8,021	27,313	35,334
Others[3]	106,959	22,505	6,222	21,593	8,371	37,603	128,047	165,650
Total (construction cost)	490,158	95,768	24,357	95,792	32,267	258,412	479,930	738,342
Detailed design and supervision	63,721	12,450	3,166	12,453	4,195	70,549	25,436	95,985
Project cost	553,879	108,218	27,523	108,245	36,462	328,961	505,366	834,327

Source: Study Team

5.3 Estimated Cost of Land Acquisition and Resettlement

Range of Land Acquisition

The range of land acquisition is defined as the area within the right of way (ROW) of the project. The area includes all ROW of the ring road, two secondary roads, one provincial road, and 11 flyovers.

Unit Price for Compensation

Based on the current government rule, the following unit prices were adopted for this study.

Table 5.3.1 Assumed Unit Price for Compensation

Compensation Items	Base	Category	Unit Price	
Land	-Market Price of Land -Tenure -Range of K Coefficient (Decree 17/1999ND-CP, Decree 87-CP Aug. 17 1994)	Residential/ Commercial	1,000,000-2,000,000	VND/sq.m
		Agricultural (Perennial, Field)	500,000-700,000	VND/sq.m
		Agricultural (Paddy Field)	150,000-200,000	VND/sq.m
House	-Life Expectancy and Structure -Legal Status -Floor Area and Story	Grade1	By its scale	VND/structure
		Grade2	4,000,000	VND/structure
		Grade3	2,800,000	VND/structure
		Grade4, Temporary	2,000,000	VND/structure
Transition Allowance			5,000,000	VND/PAF
Inconvenient Allowance			1,000,000	VND/PAP
Utility Loss (water, electricity)			3,500,000	VND/PAF
On-time Resettlement Bonus			5,000,000	VND/PAF

Source: Study Team
PAP: Project Affected Person
PAF: Project Affected Family

Total Estimated Cost

Based on the above unit price, the total compensation cost is estimated in Table 5.3.2

Table 5.3.2 Estimated Cost for Land Acquisition and Resettlement

Unit: VND bil.

Project Component	East [1] (23.5km)	Southwest (5.0km)	Provincial Road 25 (5.6km)	Secondary Road A (5.0km)	Secondary Road B (3.8km)	Flyover 1-11	Total
Land Acquisition	937	653	135	77	51	402	2,255
Resettlement	20	41	1	4	2	51	119
Others	158	114	22	13	9	75	391
Total	1,115	808	158	94	62	528	2,765

Unit: US$ mil.

Total	72	52	10	6	4	34	178

Source: Study Team
[1] Land acquisition and resettlement cost from NH No.1 A to Hanoi Highway is not included. The cost will be covered by the water pipe line project.

5.4 Operation and Maintenance Cost

The operation and Maintenance costs are estimated by each component. In practice, there is a case with a difficult division of the expenses items because the operation works are cope with the maintenance works. For the cost estimation, the followings are mainly assumed;

(1) Routine Maintenance

- Inspection and patrol
- Pothole patching and crack sealing
- Repair of traffic safety and management facilities
- Repair of slope protections
- Clearing, vegetation control, electricity charges and others.

(2) Periodic Maintenance

- Overlay for roads in 6 years intervals
- Re-pavement for bridges in 20 years intervals
- Replacement of Expansion Joint and Bearing in 20 years intervals

(3) Operation

- Toll collection operations and management
- utility charges and other incidental costs for the toll collections and the operation and maintenance administration office

Based on the above assumptions, the operation and maintenance costs are estimated as shown in Table 5.4.1

Table 5.4.1 Maintenance and Operation Cost

Unit: USD

Section		Routine									Periodic	
		Maintenance				Operation				Total	Pavement Overlay	Bridge Rehabilitation
		Repair & Cleaning	Electricity	Others	Sub-total	Staff	Electricity	Transport	Sub-total			
Ring Road No.2	E-1	142,766	176,076	95,653	414,495					414,495	879,055	445,907
	E-2	153,957	161,184	94,542	409,683					409,683	606,745	506,583
	E-3	154,602	212,576	110,153	477,331					477,331	890,600	451,066
	E-4	66,969	116,800	55,131	238,900					238,900	618,200	147,763
	E-5	283,200	244,112	158,194	685,506	2,145,600	52,560	105,120	2,303,280	2,988,786	873,475	1,285,142
	E-6	39,676	45,552	25,568	110,796					110,796	186,220	124,432
	Total	841,170	956,300	539,241	2,336,711	2,145,600	52,560	105,120	2,303,280	**4,639,991**	3,854,295	2,960,893
	SW-1	99,985	115,632	64,685	280,302					280,302	414,555	324,790
	SW-2	86,975	148,000	69,893	302,868					302,868	583,966	256,145
	Total	186,960	261,632	134,578	583,170					**583,170**	998,521	580,935
Provincial Road No.25	PR-1	67,523	36,792	31,295	135,610					135,610	431,553	188,280
	PR-2	15,514	35,624	15,341	66,479					66,479	310,277	0
	Total	83,037	72,416	46,636	202,089					**202,089**	741,829	188,280
Secondary Road	SA-1	6,927	22,484	8,823	38,234					38,234	138,540	0
	SA-2	9,729	18,980	8,613	37,322					37,322	113,400	16,632
	SA-3	2,253	7,300	2,866	12,419					12,419	45,059	0
	Total	18,909	48,764	20,302	87,975					**87,975**	296,999	16,632
	SB-1	33,582	44,384	23,390	101,356					101,356	209,274	94,741
	SB-2	18,656	35,040	16,109	69,805					69,805	170,192	41,580
	Total	52,238	79,424	39,499	171,161					**171,161**	379,466	136,321
Flyover	FO-1	31,062	18,104	14,750	63,916					63,916	95,423	107,738
	FO-2	38,104	22,778	18,264	79,144					79,144	122,738	131,000
	FO-3	22,021	18,980	12,300	53,301					53,301	103,105	89,115
	FO-4	23,346	30,368	16,114	69,828					69,828	100,613	75,052
	FO-5	9,588	13,724	6,994	30,306					30,306	52,748	28,482
	FO-6	20,926	16,060	11,096	48,082					48,082	79,915	69,377
	FO-7	31,806	21,024	15,849	68,679					68,679	125,246	104,678
	FO-8	26,065	19,856	13,776	59,697					59,697	114,285	83,391
	FO-9	20,363	14,600	10,489	45,452					45,452	81,660	66,713
	FO-10	16,944	13,432	9,113	39,489					39,489	64,680	56,179
	FO-11	21,972	17,228	11,760	50,960					50,960	92,430	71,102
	Total	262,197	206,152	140,505	608,854					**608,854**	1,032,841	862,827
Remark		Per Annum									Every 6 years	Every 20 years

Source: Study Team

5.5 Implementation Schedule

The implementation plan is mainly consist of the implementation schedule and the implementation components of the Project including packaging, and the relationship is implication. In general, the implementation schedule of the Project are divided into the followings items:

- Fund Arrangement
- Procurement of a Consultant
- Preliminary and detailed Design
- Tender Processing
- Land Acquisition and Compensation
- Construction and Resettlement

To prepare the implementation plan of the Project, the following matters are should also be considered;

- Fiscal resources including loan agency
- Project cost for each package
- Target year for operations
- Financial and economic impact
- Construction time schedule and project contract and specification preparation.

Because the establishment of the implementation plan should inclusively consider the whole project including above items, which need a lot of adjustments. Therefore, the aim of the construction work time for main works that is basic for the construction time schedule is restricted to the description here. However, detailed design and tender processing are assumed to require 12 months and 6 months respectively.

To prepare the basic construction work time, the following matters are should considered;

- Project completion date
- Construction method
- Construction work efficiency
- Construction work volume
- Construction equipment
- Workable days

Considering above items, the main construction work time is assumed as follows;

- Earth works including ground settlement measures 2~3 years
- Flyovers and small bridges: 1.5 to 2 years

However, a more detailed examination is needed for the settlement of embankment though the earth works was assumed to be 3 years in consideration of past several projects in the HCMC.

The construction time schedule for each Phu My and Phu Dinh bridges was prepared based on the preliminary engineering design, the quantity of material and the construction method as shown in Table 5.5.1 and Table 5.5.2

Table 5.5.1 Construction Time Schedule for Phu My Bridge

Work Item	Month																		
	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36
Preparatory Work																			
Cofferdam and Excavation																			
Cast in place concrete Work																			
Substructrure																			
Superstructure																			
Bridge Furniture																			
Bridge lighting																			
Paving and Road Marking																			
Demobilization																			

Source: Study Team

Table 5.5.2 Construction Time Schedule for Phu Dinh Bridge

Work Item	Month														
	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28
Preparatory Work															
Cofferdam and Excavation															
Cast in place concrete Work															
Substructrure															
Superstructure															
Bridge Furniture															
Bridge lighting															
Paving and Road Marking															
Demobilization															

Source: Study Team

Table 5.5.3 shows the development timeline of the RR2 east section.

The schedule is premised on the use of ODA sources for part of, or the whole. This financing mode entails a minimum of two years lead time (likely to be more), before actual tendering or construction. However, in order to open to traffic by 2010, the fund arrangement have to be undertaken immediately and smoothly. Preparation of the feasibility study;

Table 5.5.3 Implementation Schedule for Ring Road No.2

	1	2	3	4	5	6	7	8	9
	2004	2005	2006	2007	2008	2009	2010	2011	2012
Project Approved by Gov									
Fund Arrangement and Procument of a consultan									
Detailed design									
Tender processing									
Construction									
Righ of way									
Commecial Operation								→	

Source: Study Team

6 INITIAL ENVIRONMENT AND RESETTLEMENT EXAMINATION

6.1 Initial Environmental Examination

1) Environmental Impact

(1) Topography, Geology and Soils

a) **Construction Period:** Some erosion during road construction is unavoidable and will occur as a result of runoff in areas of excavation and other earthworks. Failure to properly clean up and replant borrow areas, fill areas and spoils disposal areas would lead to erosion. Short- or long-term diversion of rivers for bridge construction could lead to future bank erosion unless properly designed and constructed.

b) **Operation Period:** Runoff from areas not properly resurfaced or re-vegetated would lead to erosion. Long- term diversion of major drainage courses or any significant alteration of surface water hydrology along the ring road would also lead to erosion.

c) **Mitigation:** The following soil erosion mitigation measures will be implemented:

- Borrow and fill areas will be excavated and filled utilizing best practice rehabilitation measures. Slope stability at cut faces will be maintained by "benching" and by installing erosion protection devices during construction such as silt barriers and sedimentation ponds. No arbitrary borrowing will be allowed. Topsoil will be stockpiled for later rehabilitation activities.
- An erosion protection plan will be developed and approved prior to construction. Approved borrow pit locations will be defined in construction tender documents. All borrow materials, solid wastes and temporary sewerage disposal sites will require prior approval of the national environmental management agency (MONRE or DONREs).
- Trees along borrow pit edges will be protected. Random movement of heavy machinery at excavation sites will be prevented. Large borrow areas will be replanted or transformed into ponds after consultation with local authorities.
- All cut slopes, embankments and other erosion-prone working areas will be stabilized while work is going on to the extent feasible. All earth disturbance areas will be stabilized within 30 days after earthwork has ceased at the site.
- Disposal of waste soil and rock, both the placement of the materials (not indiscriminate dumping) and rehabilitation methods will be carefully considered and planned as a part of the erosion protection plan. Placement areas will be selected with aesthetic considerations in mind as well as for economy and distance of transport.
- Spoil placements will be stabilized considering the type of material to be placed. Rehabilitation will include surface compaction as well as planting with vegetation types that have root systems that hold the soil in early stages, then with trees and larger vegetation at later stages.
- Temporary earth settlement basins will be provided at locations where runoff may occur during construction. After construction, such drains will be refilled.
- Temporary construction camps and storage areas will be designed to minimize land area required and minimize impacts on soil erosion. Use of abandoned establishments

for such activity will be encouraged.

- Maintenance of ring road slopes, cuts and embankments, such as watering, fertilizing, pest control, and replanting when needed, will be continued during operations. Maintenance of all such areas will be budgeted as part of regular ring road maintenance.

(2) Groundwater and Surface Water Quality

a) **Construction Period:** Alteration of natural drainage by new road construction can result in erosion as well as flooding in and absorption of pollutants by areas not previously subject to flooding. Irrigation flows of paddy fields are a critical element in crop production. Any interruption of these flows during construction or any permanent alteration of these flows would have a direct impact during the construction period. Local flooding could be caused by excessive watering or flushing of construction sites. Contamination can be caused by sewage from construction camps. Sand and gravel removal from river beds is not expected to have any adverse impact but will be monitored, and sites for such materials approved prior to construction. There is a possibility of groundwater contamination and surface water contamination from bridge construction. Surface water or groundwater may be contaminated by improper utilization or storage of construction materials, such as chemicals or petroleum products.

b) **Operation Period:** The principal impact during operation is expected to be surface water and groundwater contamination from rainfall runoff from the project area.

c) **Mitigation:** The following water quality mitigation measures will be employed:

- All toxic, hazardous or harmful construction materials including petroleum products will be managed to prevent entry to surface water or groundwater systems. Construction area drainage will be controlled through the preparation of settling basins and planted runoff areas.
- To maintain adequate flow in the irrigation system, drainage installations and piping (culverts, side drains, bridges) will be planned and designed based on hydrological studies and evaluations of irrigation flows. Contaminated road runoff will be separated from irrigation and drinking water by proper design of piping and drainage facilities wherever feasible.
- Toilet facilities for construction workers will, at the minimum, be pit privies that are regularly serviced and maintained.
- Solid waste disposal will be handled in consultation with local authorities to protect surface water and groundwater resources.
- Roadway runoff will be directed to detention and sedimentation basins or allowed to flow over grassed areas as long as such areas have adequate erosion protection.

(3) Flora and Fauna

a) **Construction Period:** Loss of vegetation and natural habitat will occur in the project area, including loss of various land types, orchards and other productive crops. There is expected to be no impact on rare or endangered plants and animal species.

b) **Operation Period:** No plant or animal impacts are expected during operation other than the effects from vehicle exhaust emissions.

c) **Mitigation:** The following are mitigation measures for minimizing impacts on flora and

fauna:

- Since soil erosion will occur in areas left without vegetation, stabilization by re-vegetation will be necessary. The use of fast-growing local grasses, shrubs and trees is recommended.
- Trees reduce erosion and noise, and they improve air quality by producing oxygen. There is consequently a large budget for green space landscaping. The re-vegetated roadside areas may also eventually provide a habitat for common species of small animals and birds. Replanting along the road will consist of a mix of local vegetation species similar to the mix and composition found locally. Consultation with biology/forest experts will be undertaken to confirm appropriate species for project landscaping. This will be made a part of the contractor's responsibility, to be estimated and budgeted as a construction cost. Plantings will be placed in the median strip, on embankments and slopes, on the inner areas of interchanges, and along the sides of the road.
- Most of the naturally occurring animal species have long since been lost to the immediate area, other than some common species of birds, small mammals and amphibians. However, every effort will be made to stop and reverse the steady decline in available habitat by avoiding established natural areas and providing an extensive landscaping budget to enhance buffer landscaping along the project corridor. Trees and other vegetation will not arbitrarily be felled outside of the ROW.

All lost vegetated and natural habitat will be offset by replanting an equivalent or larger area. The biology/forest experts will be consulted during preliminary design to ensure that this requirement is met.

(4) Air Quality

a) **Construction Period:** Dust from aggregate production, concrete mixing and construction traffic, and emissions from asphalt plants and heavy diesel equipment will affect air quality during the construction phase. Impacts will be confined to areas downwind from construction and materials processing sites.

b) **Operation Period:** The principal air quality impacts during operation will come from vehicle emission pollutants. Pollutants monitored will include CO, NOx, TSP, and total hydrocarbons (THC). The air quality projection model will be used to predict impacts during operation, including diffusion patterns, mass and concentrations of the pollutant source (i.e. vehicle emissions based on traffic forecasts), wind velocity patterns, and project lifetime. Baseline monitoring will be necessary to indicate that TSP, NOx and CO concentrations in the ambient air along the proposed alignment will meet Vietnam air quality standards.

c) **Mitigation:** The following air quality mitigation measures will be utilized:

- Asphalt plants and mixers will be sited as far away as possible (preferably a minimum of 200m downwind) from the nearest human settlement areas and other sensitive land use sites.
- Emissions control equipment will be installed on batch plants; trucks carrying material that may generate dust will be covered.
- Exposed construction access roads and exposed construction sites will be watered on a

set schedule depending upon weather conditions.

- Proper maintenance of diesel equipment and curtailment of unnecessary idling will be practiced to help control emissions.
- New residential projects, hospitals, health clinics, schools, and other sensitive land use construction will be prohibited within 60m of the edge of the ROW of the new road facilities.
- Vehicle emission pollutants will be reduced through integrated measures such as use of cleaner fuels, improved vehicle emissions controls, traffic demand management, and improved public transportation options.

(5) Noise Impacts

a) **Construction Period:** Noise impacts during construction will result mainly from the operation of heavy machinery, including concrete mixing plants and stone crushing and screening plants. In addition, a small amount of blasting in areas of rock excavation is expected. Noise intensities from these activities and equipment will range from 80 to 100 dB(A) at the source. Sustained noise levels during construction are expected to exceed 70 dB(A) at a distance of 200m from the source.

b) **Operation Period:** A predictive model will be used to forecast noise impacts, which will consider several factors including noise levels generated by various types of vehicles; operating speeds; period of assessment (the peak hour); traffic volume forecasts; distance from point source to noise receptor location; distance from baseline monitoring location; and attenuation factors regarding noise absorption, including other noise obstructions such as buildings and land forms.

c) **Mitigation:** The following noise mitigation measures will be applied :

- To reduce night-time disturbance from construction noise, construction activities within 500m of residences will be prohibited between the hours of 22:00 and 06:00.
- To help avoid the adverse impacts from noise during operation, new sensitive receptor construction (i.e. schools, hospitals, residential uses, etc.) will be prohibited within 60m of the edge of the highway or ROW.
- Additional surveys will be undertaken prior to or during preliminary design to determine noise impacts and develop appropriate abatement measures in consultation with those affected. Preliminary engineering design and projections of noise impacts based on adjusted traffic forecasts will be reviewed to determine whether any noise-sensitive areas will be affected
- Noise-sensitive locations identified in a subsequent survey will be the subject of design analyses to incorporate appropriate mitigation measures if needed. Solid masonry walls, cuts in the natural terrain, other types of noise barriers, and depression of the road below the surrounding surface are considered effective noise attenuation methods. Planting of vegetation screens should not be considered, by itself, as an effective method for alleviating serious impacts. The cost of these measures will be included as part of the final design cost estimate if needed.

2) Impact on Land Use

RR2 will clearly delineate the study area into two parts. One is the inside of RR2, the high-density urban area, and the other is the outside, the less populated suburban area. Thus, the RR2 will be a distinctive landmark dividing the city.

(1) Residential Development

RR2 will improve overall transport service in the city. This will lead to the expansion of residential development opportunity in the outskirts of the urban area. However, current residential development is based on the tiny lots in the rapidly sprawling areas. This resulted in the disordered suburban development. An appropriate land use plan prior to road development will be required. It is also necessary to integrate residential development with resettlement (see Section 5.3).

(2) Commercial Development

The shopping style of suburban residents will be different from the current one. Especially, the wives will go shopping fewer times per week on cars. Thus, many large-scale shopping centers, such as CORA or METRO, will be located along the Ring Road 2. This will stimulate the peoples' consumption life and small shops in the downtown will be curtailed.

(3) Industrial Development

HCMC already regulates large-scale industrial development. The RR2 will provide freer location choice for the industries outside of HCMC.

3) Social Impact

(1) Split of Communities

One of the explicit negative impacts on the society is found in the split of communities along the road widening section of RR2. Because the current ROW is less than 10m, both sides of the road can associate with each other. The new ROW, 55-60m, will make communication among residents on both sides difficult.

For the new construction section of RR2, the existing small roads will not be closed. For the road widening section, appropriate U-turns, pedestrian bridges or underpasses will be installed at every 1,000m section at the minimum.

Another mitigation measure lies in the arrangement of resettlement sites. The relocation sites should not only set back on the current site, but should be arranged in such a way as to keep each neighborhood on their respective sides of the road.

In addition, reorganization of local administrative boundaries such as *phuong* or *xa* will be necessary. School districts should be re-designed for school children not to pass the RR2.

(2) Cultural Property

No significant cultural properties were identified within the ROW. However, some may be found during the study development or construction.

(3) Religious Premises

Within the ROW, a few pagodas were identified. It is necessary to relocate them with certain considerations.

6.2 General Concept of Land Acquisition and Resettlement

1) Institutional Framework

(1) Legal Frame for Land Tenure

The rights to acquire and own properties are embodied in the 1992 Constitution which provides that citizens have the right to own a house and protect their properties. A more significant law which specifies land rights and management is contained in the Land Law, dated 15 October 1993 and amended on 2 December 1998. The Land Law is a comprehensive law on land administration which declares that the land belongs to the people, with the State as administrator, who has the authority to allocate and determine land usage. Article 27 of the Land Law provides the right of the State to recover the land for national or public benefit and provides compensation to affected families.

Based on these laws, access to land can be achieved through the following modes:

Land allocation: *This can be achieved through proper registration procedures and* application for land rights use.

Lease or rent of land: This allows individuals or organizations to rent land.

Inheritance: Transfer of land rights use of parents to family or siblings.

Land mortgage: Transfer of land rights to another person through mortgage.

(2) Land Valuation

Land valuation is contained in Decree No. 87/CP issued on 17 August 1994 by the Government. This law governs the compensation value of cost of land based on urban categories or zonal locations. Compensation on land is further supplemented by a decision from the Peoples' Committee, Communiqué 145/1998/TT-BTC, affirming the execution of Decree 22/1998/ND-CP, a policy that sets the regulation on calculating the coefficient K value for compensation of property. The People's Committee determines the coefficient K value as guided by the Ministry of Finance, in consultation with other government agencies such as the Ministry of Construction, the Ministry of Agriculture and Rural Development, the General Land Administration, and the Government Price Committee.

Laws on land and resettlement are further supplemented by decrees to strengthen or amend the existing laws. Decree 87 states: "The prices for urban land herein have been calculated based on average free market price. The free market price of land varies from city to city, from area to area in one city, and street front to street backside. It sets the minimum and maximum prices for, among others, payment of land use rights and compensation for categories of urban land recovered by the State."

Decision No. 302/TTg issued on 13 May 1996 by the Prime Minister provides for the adjustment of the value of K in Decree 87/CP dated 17 August 1994 and gives it a wider range, from coefficient K 1.2 to 3.6.

(3) Compensation System and Subsidies

Regulations on compensation are specifically contained in the most recent law, Decree 22/1998 (July 24) which provides more beneficial coverage on compensation compared to the former law (Decree 90). The scope of compensation covers the following areas:

- Compensation for loss of land and housing structure
- Compensation for loss of property associated with land development
- Subsidy for livelihood and production activities of relocates
- Subsidy for loss or change of jobs and other removal costs

Table 6.2.1 Relevant Legal Documents on Land and Resettlement

Application	Policy	Remarks
Land allocation, Land use rights and Comprehensive regulations on *relocation and* resettlement	Constitution 1992	Sets the rights to own a house and property,
	Land Law Oct. 1993	State is the Administrator of the land
	Residence Law of the State Council, (1991)	Protects property & defines the categories of property
	Decree No.04/2000 ND-CP (Feb 11,2000)	Regulates land adjustment, procedures for lease of land
	Decree No. 87/CP (Aug 17 1994)	
	Decree No. 38/2000/ND/CP (Aug. 23, 2000)	Sets price of land at free market value
	Decree 203 HDBT(Jan. 21, 1982)	
	Circular No. 145/1998 TT-BTC ((Nov. 4, 1998)	
	Decree 88/CP (Aug. 17 1994)	Procedure for certification of LUR Management & use of urban land
Land Valuation and Compensation	Decree 22/1998/ND-CP/ July 24, 1998 Decree 38/2000/ND-CP, Aug. 23 2001 Communiqué 115/2000/TT-BTC Nov. 4 1998 Decree 17/1999ND-CP Decision 71/2001/QD-UB,Aug. 29, 2001 Decree 87-CP Aug. 17 1994 Decision 05-UBQLDT Oct. 4 1995 Decision 302/TTG/Jan 5 1996	Signed at the central level
House Valuation	Decision 692 QD-UBTM May 4 19931996 Decision 38/2000/QD-UB-DT, Aug.26,1995 *Decision No. 5184-QCUT/KT*, Sept 11, Decision 5675/QD-UB-KT, Nov. 9, 1996 Decision No 05/QD-UB-QLDT	Determines the coefficient "K" factor of land and house Raised the coefficient from 1.2 to 3.6
Subsidies and other allowances	Decision 40/2001/QD-UB May 15,2001	Specifically for EWH Project

Source: Prepared by Study Team
Note: Laws – signed at central leveNNote:
Note: Party Chairman; Decrees - signed at ministry level, Prime Minister; Decision - signed at district level by the People's Committee.

2) HOUTRANS Policy on Land Acquisition and Resettlement

The above institutional framework by the Government of Viet Nam (GOV) is considered as a prerequisite to implement the project. Basically, the HOUTRANS Master Plan is prepared to minimize any resettlement through various measures. However, certain resettlement will be unavoidable in both urban and rural areas. Regardless of the project's financial sources, a project requires to observe GOV guidelines on resettlement. In addition, foreign-assisted projects should comply with each donor's guideline although the GOV is primarily responsible for resettlement.

The process of land acquisition, especially in the urban area, will take a long time and the HOUTRANS proposes a policy of resettlement as the following guidelines.

(1) Valuation and Compensation

Valuation and financial compensation should be based on the GOV's resettlement policy even for a foreign-assisted project. Along the process, the GOV requires, however, much

paperwork from the people, who, sometimes, do not have the readiness for it. Even the residents without appropriate legal certificates should be compensated in the same level as those with certificates.

Financial valuation on fixed assets should be fair by introducing an independent evaluator. *Compensation on other assets and intangible effects cannot be underestimated.*

At the same time, financial compensation is not always the best option: compensation in kind should also be prioritized for housing and production facilities. Production facilities include paddy fields, shops-cum-houses and backstreet workshops.

(2) Restoration of Social Environment

Neighborhood: *It is an undesirable idea to shuffle the neighbors in the resettled area. In* order to keep good neighborhood, a project should prepare its resettlement site as close as possible to the original site. Preferably within the same *phuong* or *xa*. At worst within the same district. Because residents are mutually supported in a non-monetized manner, this will support the PAPs' life. The most difficult task is finding an available resettlement site that is close to the project site.

On-site Business and Livelihood: Because many households are working at home, sometimes as an informal sector, living and working places cannot be simply separated. *Relocation of households may change their livelihood and lose their income opportunity in* unforeseen ways. It is necessary to prepare a Resettlement Action Plan (RAP) to accommodate existing business activities on site with the people's participation.

Accessibility to Social Facilities: Resettlement will change the accessibility to various facilities. Among them, the accessibility to elementary schools by children is important. If a new relocation site is far from the original school district, the RAP should prepare a school bus to allow elementary schoolchildren to continue attending their schools until all have graduated.

In addition, accessibility to primary health care facilities is also important. Many residents have family doctors with whom they have had long-term relationships. For the health of resettled people, including mental aspects, it is necessary to guarantee their accessibility to primary health care facilities by various measures.

Religion is also a significant factor in resettlement. Because some religious groups in HCM City have built communities for their members, the resettlement scheme should consider restoring such environment.

Relocation of facilities for worship, such as temples, churches and mosques, is usually problematic because all aspects of site, such as location, orientation and landscape, should be carefully examined based on the each religion's requirement.

(3) Social Status

The registration status of residents at project sites may risk their social status. Although some residents have been living at their current locations for decades, their registration status remains as 'unregistered' or 'temporary'. In some cases, people without permanent registration status are not eligible for full financial compensation. Thus, upon relocation, those without permanent registration should be provided with a stable residential status.

6.3 Identification and Response of PAPs

1) Project-affected Persons

Project-affected persons (PAPs) of the Ring Road 2 Project are those who have their residence or business premises within the project's right of way (ROW) and will be resettled if the project is implemented. The preliminary number of PAPs is shown in the table below.

Table 6.3.1 Provisional Count of the PAPs

Unit: Person

Project Component	Southwest (5.0km)	East (23.5km)	Provincial Road (25 5.6km)	Secondary Road A (5.0km)	Secondary Road B (3.8km)	FO1-11	Total
Identified PAPs	4,168	2,016	48	344	164	4,156	10,896

Source: Study Team

2) Response of PAP

To determine the profile of PAPs and solicit their opinions, the HOUTRANS conducted a questionnaire survey on 201 households randomly selected from the PAPs (Table 6.3.2). The results are shown in Table 6.3.2

Table 6.3.2 Project Components and Interviewees

Unit: Person

Component	Southwest				East (North)		Total
District	Binh Tan		8		Thu Duc		
Ward	An Lac	Binh Tri Dong	7	16	Linh Dong	Tam Binh	
Interviewee	69	20	57	4	35	16	201

Source: Study Team

The houses of 190 interviewees out of 201 are located by the roadside, while those of the rest were in the inner area.

3) Socio-economic Profile

Table 6.3.3 shows the social profile of the household heads of potential PAPs from the Ring Road 2 Project. The data shows that the household heads are mostly middle-aged, with 40% females. Their educational attainment is relatively low; only few received higher education.

Table 6.3.3 Social Profile of Household Heads of PAPs

Item	RR2	
	%	count
1-Gender		
Male	60.70	122
Female	39.30	79
Total	100.00	201
2a- Age		
Below 40	23.40	47
41-50	29.40	59
51-60	21.90	44
Above 60	25.40	51
Total	100.00	201
2b- Educational attainment		
Illiteracy	3.0	6
Elementary	31.8	64
Secondary	36.8	74
High School	21.9	44
Baccalaureate	0.5	1
Intermediate	1.5	3
Junior college + university	4.5	9
Total	100.0	201

Item	RR2	
	%	count
3-Marital Status		
Single	2.5	5
Married	90.5	182
Widower/widow	1.5	3
Divorce	3.0	6
Separated	2.5	5
Total	100.0	201
4-Religious affiliation		
Buddhist	69.7	140
Christian	2.0	4
Muslim	0.5	1
Others[1)]	27.8	56
Total	100.0	201
5-Ethnicity		
Vietnamese	98.5	198
Others[2)]	1.5	3
Total	100.0	201
6-Place of original residence		
Within HCMC	93.0	187
Outside HCMC[3)]	7.0	14
Total	100.0	201

Source: Study Team
Notes:
[1)] Others: None religion, Confucianism, Caodaism
[2)] Others: Khmer
[3)] Others: Northern provinces (Nam Dinh, Ninh Binh), Mekong River Delta (Bac Lieu, Long An), Southern Central Coast (Hue, Quang Ngai. Binh Thuan), Highland (Lam Dong)

Table 6.3.4 Opinions on Advantages and Disadvantages of Current Location

Item	RR2	
	%	count
20a- Advantages of current living place - priority 1		
Earning money	39.1	75
Security	32.8	63
Travel	13.0	25
Total of Household	84.9	192
20b- Advantages of current living place - priority 2		
Travel	33.3	47
Security	30.5	43
Earning money	15.6	22
Total of Household	79.4	141
20c- Advantages of current living place - priority 3		
Security	40.4	21
Community relation	23.1	12
Travel	19.2	10
Total of Household	82.7	52

Item	RR2	
	%	count
21a- Disadvantages of current living place - priority 1		
Running water	50.4	64
Inundation	29.1	37
Earning money	7.1	9
Total of Household	86.6	127
21b- Disadvantages of current living place - priority 2		
Running water	29.2	14
Pollution	25.0	12
Inundation	25.0	12
Total of Household	79.2	48
21c-Disadvantages of current living place - priority 3		
Running water	-	3
Inundation	-	2
Total of Household	-	8

Source: Study Team
Note: Shows only three highest values only.

The PAPs considered "earning money", "travel" and "security" the most important advantages of their current residences. On the other hand, the disadvantages are "running water" and "inundation".

Table 6.3.5 shows the economic situation of PAPs. The HCMC PC defines the poverty line as below a monthly income of VND 1.5 million. It also estimated that 1.1% of

households belong to the poor. Compared with the statistics, the household income is extremely low and more than 10% of households are considered poor.

Table 6.3.5 Economic Situation of PAPs

Item	RR2	
	%	count
11- Monthly household income		
Less than 1 M	6.2	12
1M-3M	47.7	92
3.1M-5M	22.3	43
5.1M-7M	9.8	19
7.1M-9M	7.3	14
9.1M-11M	2.6	5
Over 11M	4.1	8
Total	100.0	193*

12- Monthly household expenses		
Less than 1 M	13.9	28
1M-3M	69.2	139
3.1M-5M	12.4	25
5.1M-7M	4.0	8
7.1m-9M	0.5	1
9.1M-11M	0.0	0
Over 11M	0.0	0
Total	100.0	201

Item	RR2	
	%	count
13- Owe money		
Yes	16.4	33
No	83.6	168
Total	100.0	201

- Sources of debt		
State	63.6	21
Outsiders	21.2	7
Relatives	12.1	4
State + Outsiders	3.0	1
Total	100.0	33

* 8 households having no income information were in the case of none answer and of lonely elder household.

Source: Study Team

4) Opinions on the Project and Resettlement

Table 6.3.6 shows the awareness of the project by the PAPs. Interestingly, the project, especially the east section, was already known to the public at the time of the survey. However, the sources of information were unofficial. The Government should have disseminated project information more openly.

Table 6.3.6 Awareness of the Project

Item	RR2	
	%	No.
21-Awareness of Project		
Yes	67.2	135
No	32.8	66
Total	100.0	201
22-Sources of information		
Leaflet	1.4	2
Radio	0.7	1
Newspaper	10.2	15
Advertising	16.3	24
People around	56.5	83
Others[1]	14.9	22
Total	100.0	147

Item	RR2	
	%	No.
23-Advantages of project		
Decongest city traffic	23.3	51
Save time	23.3	51
Access to transport service	42.9	94
Others[2]	10.5	23
Total	100.0	219

[1] Others: Receiving information from the Ward People's Committee while doing the procedure of selling or purchasing land or seeing the officers conduct land survey.

[2] Others: Business will be better, price of land will increase, the current house becomes the front house, area will be more clean, modern and beautiful

Source: Study Team

Table 6.3.7 shows the preferred resettlement options by the potential PAPs. Because there are varying opinions on resettlement, cash compensation is not the only major solution, since a certain number of people also hope to move out to the suburbs. It is thus necessary to prepare many options for the PAPs.

Table 6.3.7 Desired Resettlement Options

Desired Resettlement Options	RR2	
	%	No.
1. Cash compensation and go back to former location	0.5	1
2. Cash compensation and find new house by self in HCMC (purchase or build house)	17.9	36
3. Cash compensation and rent house in HCMC	0.0	0
4. Compensation by provision of apartment at resettlement site within the urban area	3.0	6
5. Compensation by provision of apartment at resettlement site outside the urban area	0.5	1
6. Compensation by provision of land at resettlement site within the urban area	17.4	35
7. Compensation by provision of land outside the urban area	16.4	33
8. Not sure what to do	10.9	22
9. Depending on the government decision	1.5	3
10. Others	23.4	47
11. No answer	8.5	17
Total	100.0	201

Source: Study Team