3.5 Red River Bridge

1) General

RR4 will cross the Red River at a location approximately 5km upstream of the existing Thang Long Bridge. The river width is approximately 2km between the dykes on Hanoi side and on Noi Bai side. The characteristics of the Red River were studied based on the available data. The Red River bridge for RR4 is designed as a PC box girder bridge adopting cantilever construction method which is similar to the Thang Tri Bridge which is under construction in the downstream of Red River.

2) Conditions of Red River

Based on the "Nhat Tan Bridge and Approach Construction Project Feasibility Study Executive Summary," below are the navigation clearances adopted for the other bridges over the Red River (see Table 3.5.1).

Table 3.5.1 Navigation Clearances for Bridges over Red River

Name of Bridge	Water Level (m)	Vertical Clearance (m)	Navigation Width (m)	Status
Thang Long	11.12	10.00	80.0	Existing
Long Bien	10.34	4.63	80.0	Existing
Chuong Duong	10.34	7.74	80.0	Existing
Thanh Tri	12.50	10.00	80.0	Under Construction
Yen Lenh	8.05	10.00	80.0	Ha Nam Province, Constructed
Tan De	5.70	10.00	80.0	Nam Dinh Province, Constructed

Source: Nhat Tan Bridge and Approach Construction Project Feasibility Study Executive Summary.
Note: Levels are based on the National Level System.

The National Standard TCVN 5664-1992 specifies that the navigation width and vertical clearance from the high water level for the rivers of Grade 1 shall be 80m and 10m respectively.

The records of the highest water level of the Red River are summarized in Table 3.5.2. The record shows the highest water level exceeded +14.0m in 1971 and whose flood spilled over the dike. The height of the existing dikes is +12.0m to +14.0m. The highest water level of +13.41m is adopted similar to Nhat Tan Bridge.

Based on the available data, the river bed is changing every year through erosion, scouring, sedimentation, dredging, etc. The changes of river bed of Red River are shown in Figure 3.5.2. According to the data, it seems that sedimentation tends to occur in the middle of the river while erosion and scouring occurs in both sides of the river. Since the river bed changes frequently, it is very difficult to define the exact location of the navigation channel. However, it can be presumed that large vessels will travel along the shores since the middle part is much shallower than both sides.

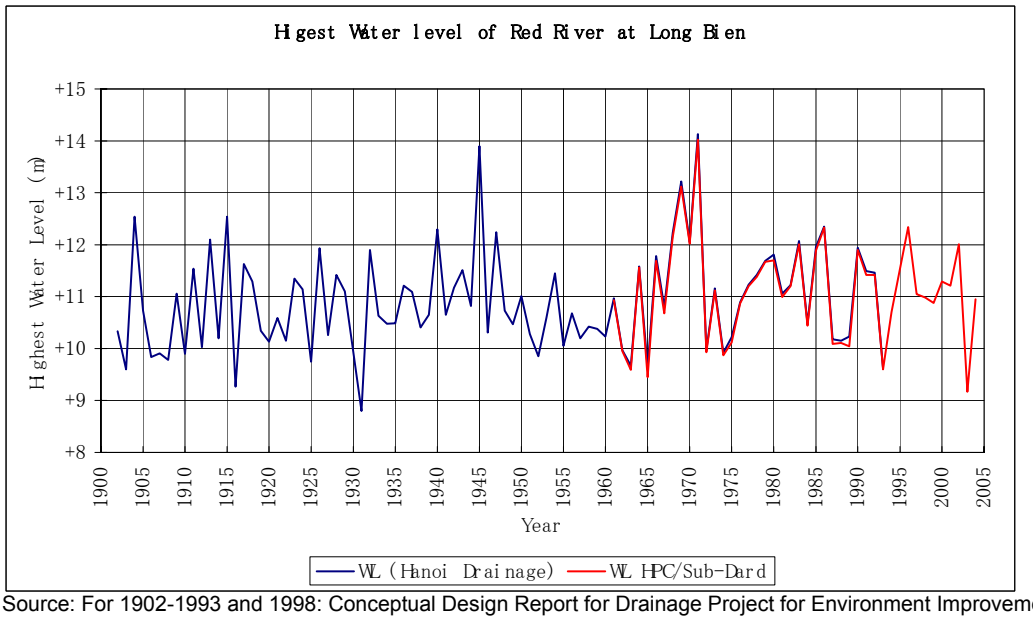
Table 3.5.2 Annual Highest Water Level in Red River

Annual Highest Water Level in Red River at Long Bien

Year	WL (Hanoi Drainage)	WL HPC/Sub-Dard	Year	WL (Hanoi Drainage)	WL HPC/Sub-Dard	Year	WL (Hanoi Drainage)	WL HPC/Sub-Dard
			1941	+10.65		1981	+11.06	+10.99
1902	+10.33		1942	+11.17		1982	+11.22	+11.20
1903	+9.60		1943	+11.51		1983	+12.07	+12.01
1904	+12.54		1944	+10.82		1984	+10.48	+10.44
1905	+10.73		1945	+13.90		1985	+11.96	+11.89
1906	+9.84		1946	+10.31		1986	+12.35	+12.33
1907	+9.91		1947	+12.24		1987	+10.13	+10.09
1908	+9.78		1948	+10.73		1988	+10.15	+10.11
1909	+11.06		1949	+10.47		1989	+10.23	+10.04
1910	+9.90		1950	+11.01		1990	+11.94	+11.90
1911	+11.54		1951	+10.28		1991	+11.48	+11.42
1912	+10.03		1952	+9.85		1992	+11.48	+11.42
1913	+12.10		1953	+10.60		1993	+9.62	+9.60
1914	+10.20		1954	+11.45		1994		+10.70
1915	+12.54		1955	+10.05		1995		+11.54
1916	+9.27		1956	+10.68		1996	+12.43	+12.34
1917	+11.63		1957	+10.20		1997		+11.05
1918	+11.29		1958	+10.42		1998		+10.98
1919	+10.34		1959	+10.38		1999		+10.88
1920	+10.13		1960	+10.73		2000		+11.29
1921	+10.59		1961	+10.97	+10.93	2001		+11.21
1922	+10.15		1962	+9.97	+9.95	2002		+12.01
1923	+11.35		1963	+9.67	+9.59	2003		+9.17
1924	+11.14		1964	+11.58	+11.56	2004		+10.95
1925	+9.75		1965	+9.63	+9.45			
1926	+11.93		1966	+11.78	+11.69			
1927	+10.26		1967	+10.80	+10.68			
1928	+11.42		1968	+12.23	+12.15			
1929	+11.10		1969	+13.22	+13.12			
1930	+9.93		1970	+12.05	+12.02			
1931	+9.80		1971	+14.13	+14.02			
1932	+11.00		1972	+9.97	+9.93			
1933	+10.83		1973	+11.18	+11.12			
1934	+10.48		1974	+9.92	+9.87			
1935	+10.49		1975	+10.22	+10.12			
1936	+11.21		1976	+10.89	+10.87			
1937	+11.09		1977	+11.23	+11.20			
1938	+10.41		1978	+11.42	+11.38			
1939	+10.65		1979	+11.69	+11.67			
1940	+12.30		1980	+11.81	+11.79			

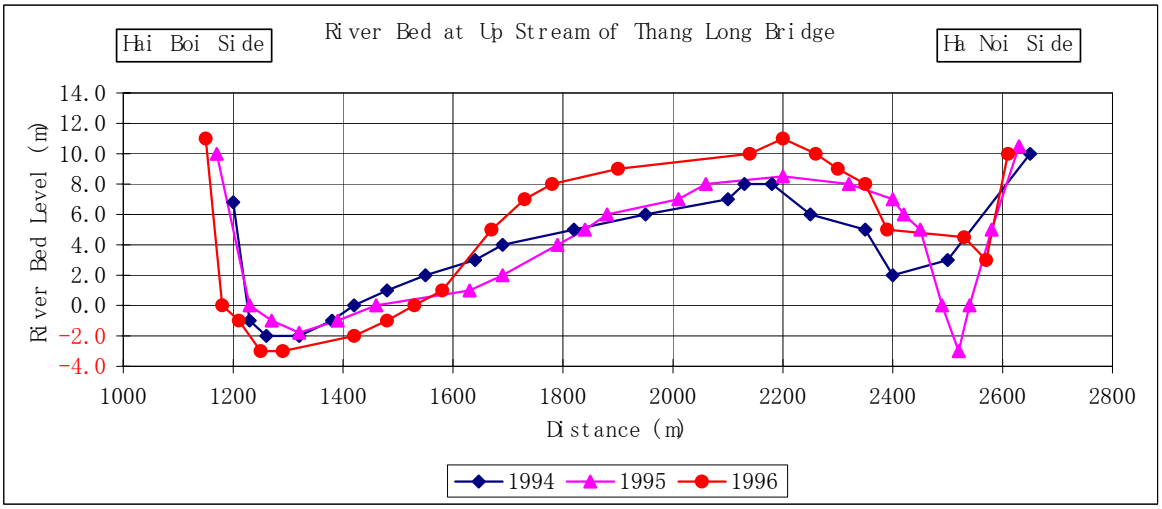
Source: For 1902 to 1993 & 1996, Conceptual Design Report for Drainage Project for Environment Improvement in Hanoi - Second Stage, p.3-13 (data from 1961-2004 are shown for reference) For 1961 to 2004, Attached table to a letter of Hanoi Sub-Department for Dyke Management and Flood Prevention Control No. 140/CCDD-QL dated 29th April 2005.

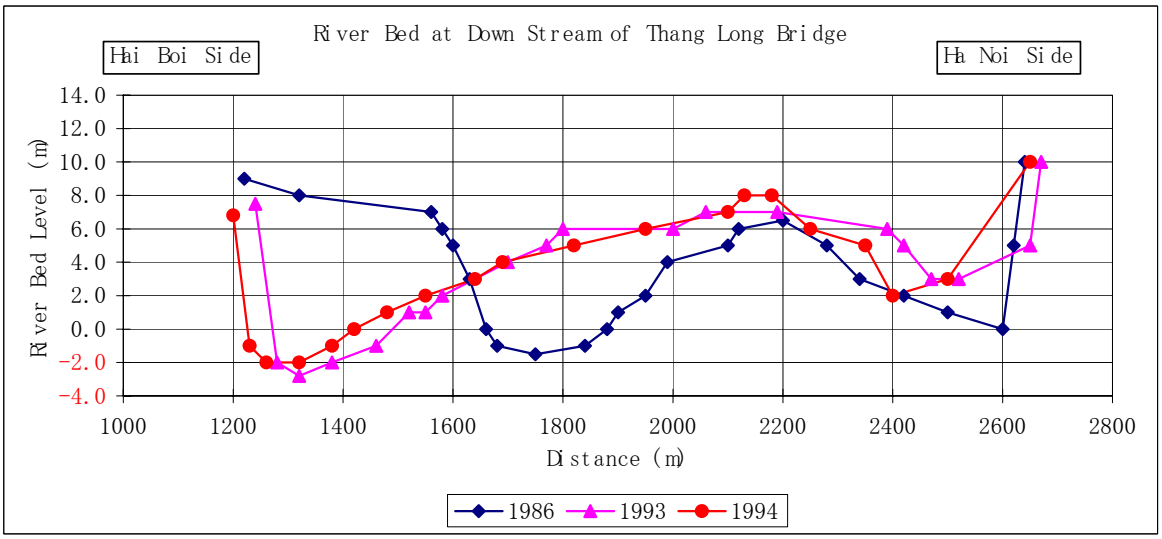
Figure 3.5.1 Highest Water Level of Red River

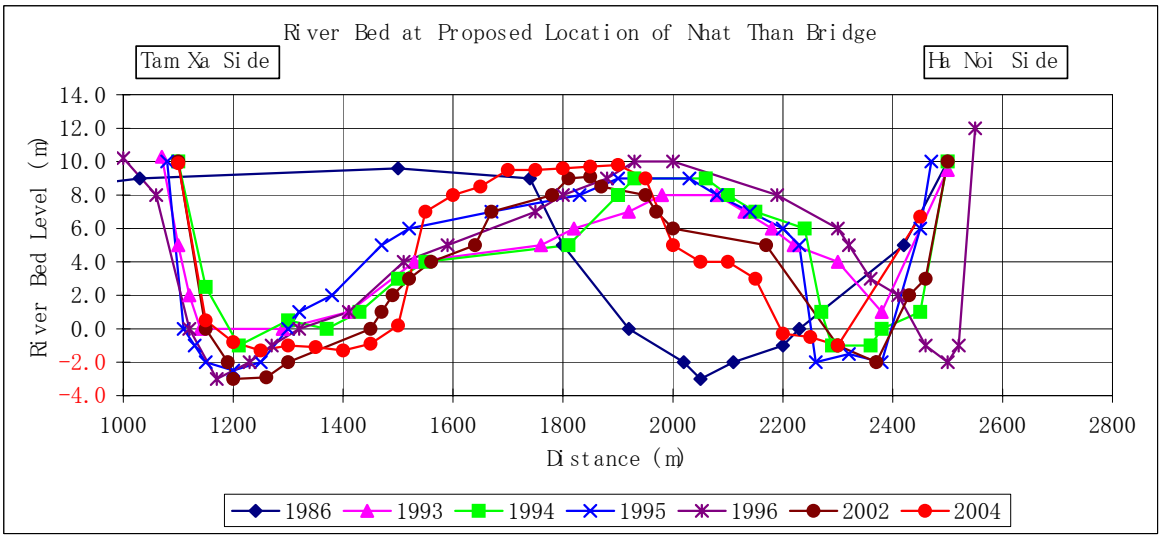


Source: For 1902-1993 and 1998: Conceptual Design Report for Drainage Project for Environment Improvement in Hanoi. For 1961-204Attached Table to a letter of Hanoi Sub-department for Dyke Management and Flood Prevention Control No.140/CCDD-QL dated 29th April 2005.

Figure 3.5.2 River Bed of Red River







Source: "Nhat Tan Bridge and Approach Construction Project Feasibility Study Exective Summary"

3) Design Consideration

Considering the navigation width of 80m, the span of the Red River Bridge for RR4 shall be 120m is a 6 span continuous (70m + 4 @ 120m + 70m) pre-stressed concrete box-girder bridge with cantilever construction similar to Thang Tri Bridge Proposed herein.

The general arrangement plan of the Red River Bridge for RR4 is shown in Figure 3.5.3. The river width is taken as the distance between the dikes in both sides. The land within the dikes in Noi Bai side is exposed in the aerial photo used as base map for the plan, but another aerial photo probably taken during the rainy season shows that the water does cover that area.

The height clearance from the high water level is taken as 10m as specified in the National Standard TCVN 5664-1992. The high water level is taken as +13.41m.

Since the river bed changes frequently, the stability of the bridge foundation is an important factor. Steel pipe sheet pile foundation is proposed. Furthermore, erosion protection mat of large stones shall be laid around the piers. Fender-piles shall also be provided in order protect the piers from collision of vessels.

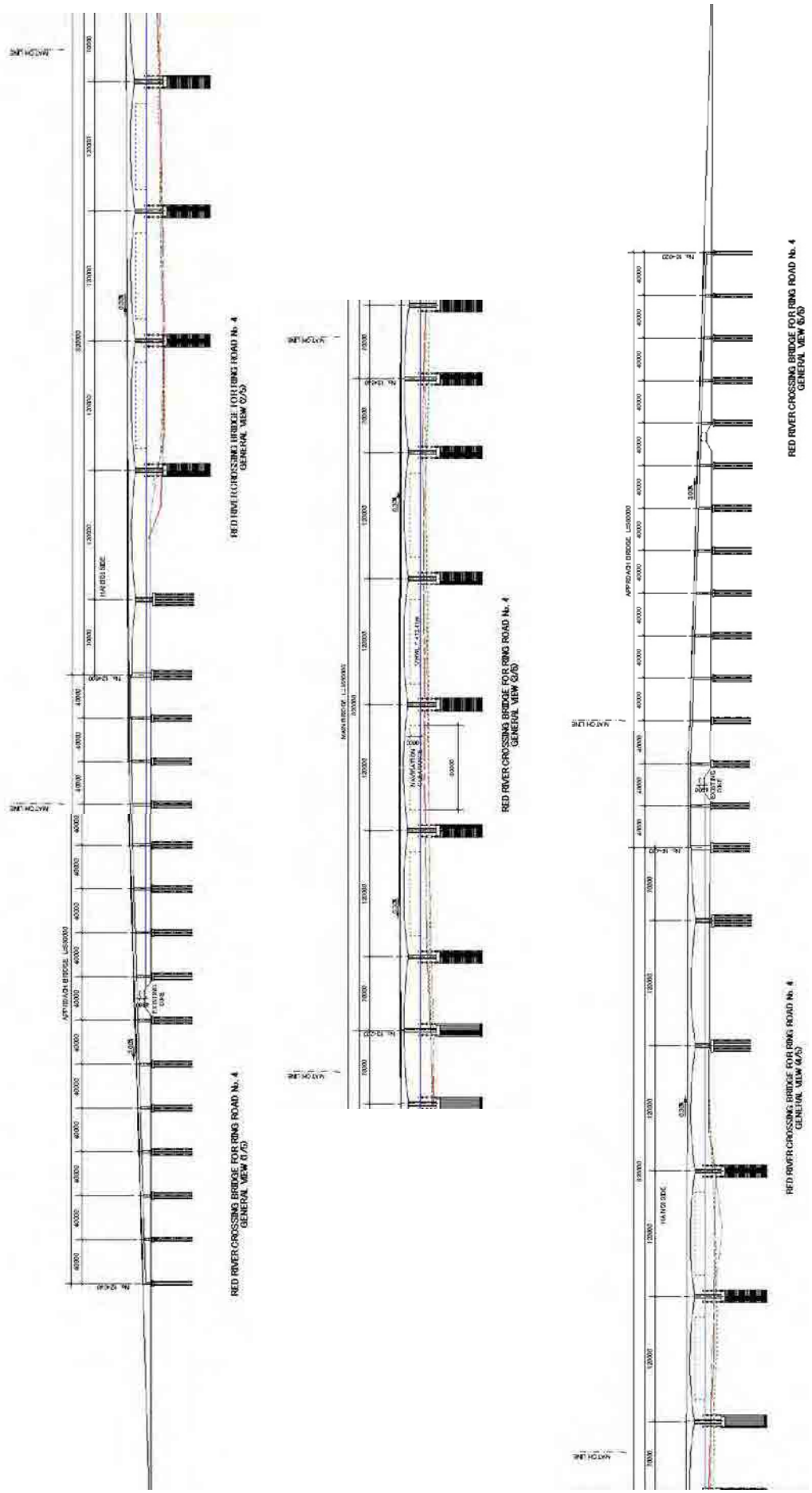
The general view of the bridge is shown in Figure 3.5.4 and typical cross-sections are shown in the succeeding figures.

The construction sequence of cantilever method is estimated to take 24 months.

Figure 3.5.3 Plan for the Red River Bridge for RR4

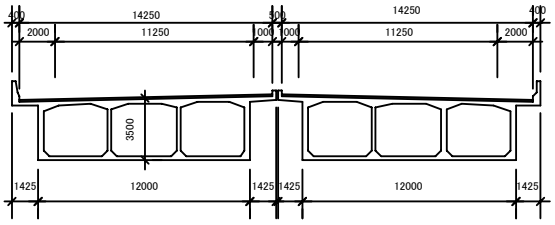
Source: HAIDEP Study Team

Figure 3.5.4 Profiles of the Red River Bridge for RR4

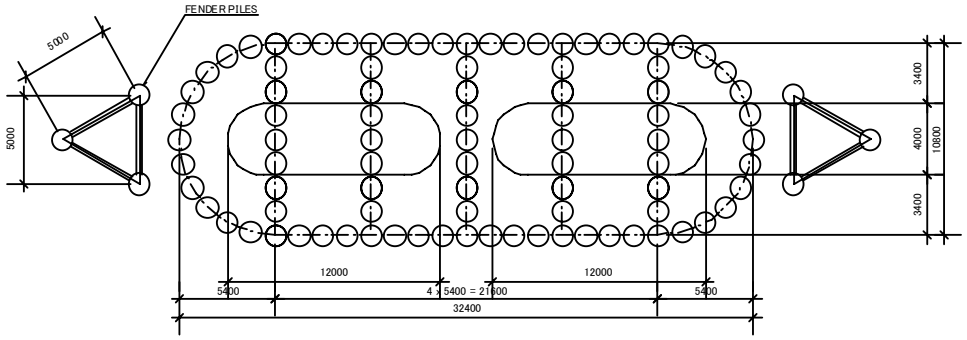


Source: HAIDEP Study Team

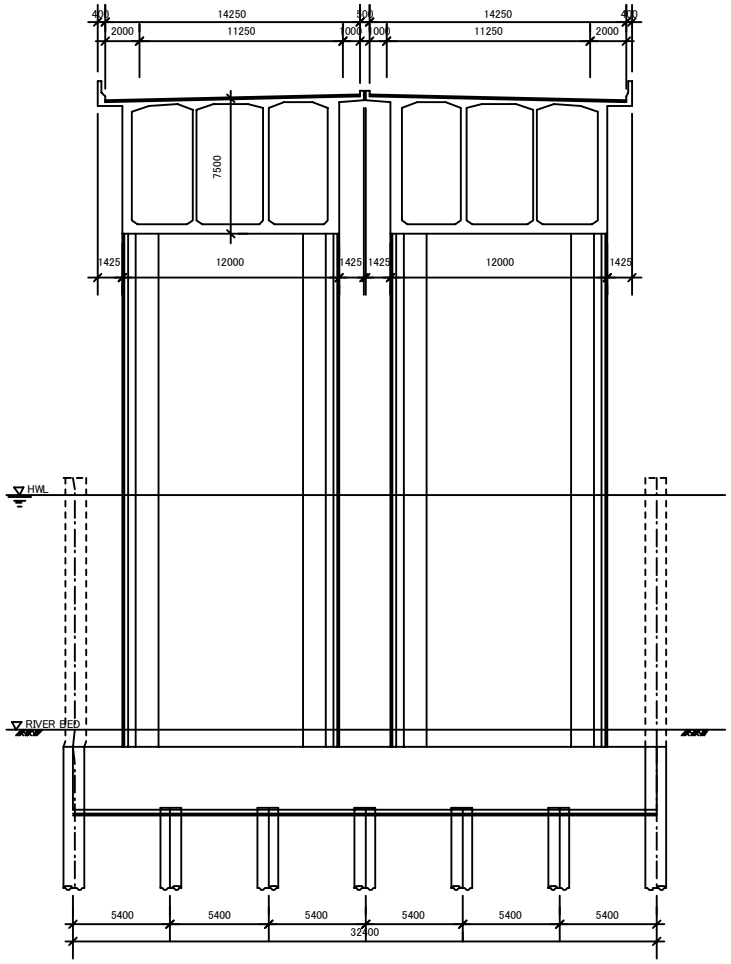
Figure 3.5.5 Structural Arrangement of the Red River Bridge for RR4 (1/3)



TYPICAL SECTION OF GIRDER AT MID SPAN



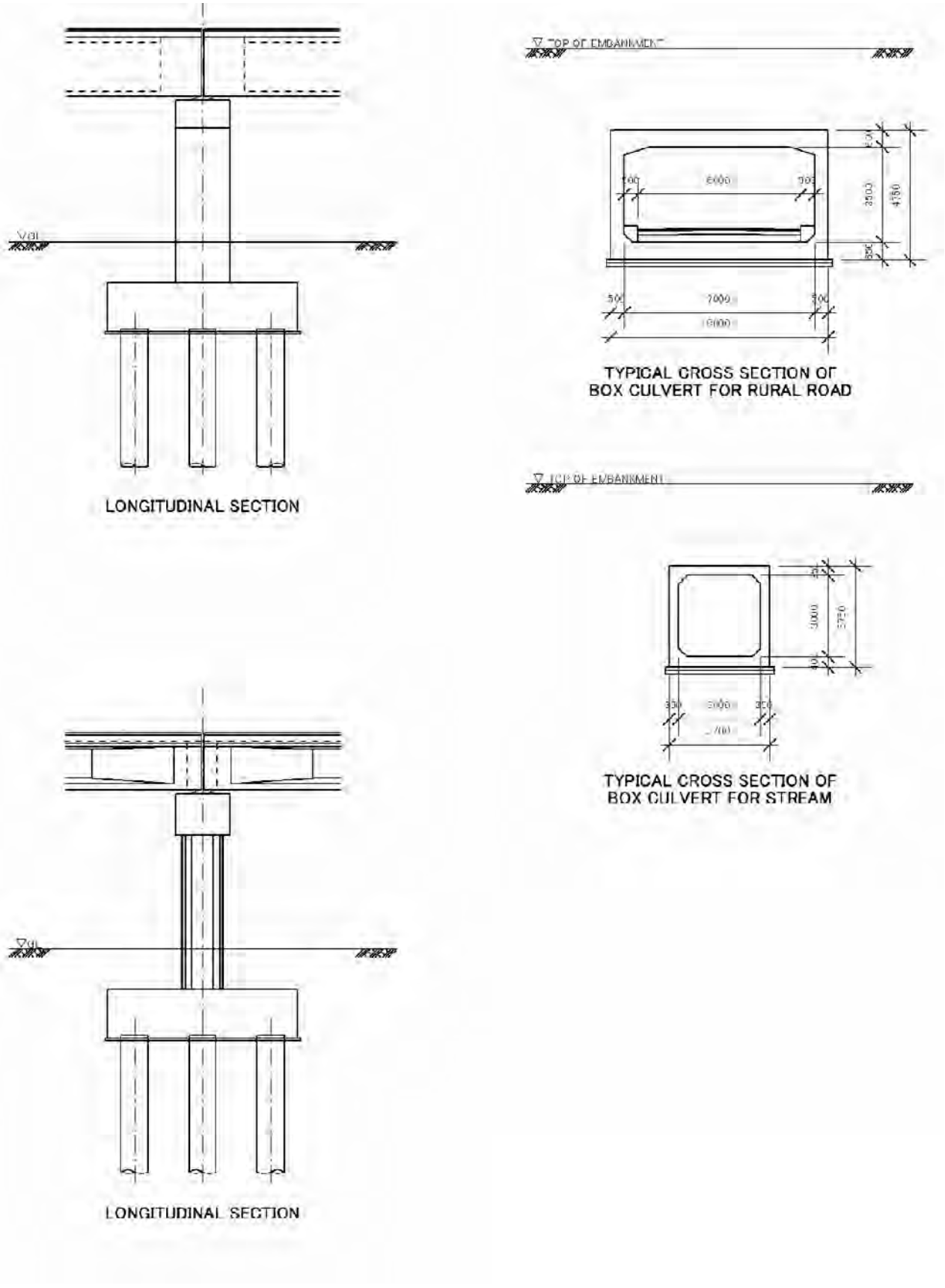
FOUNDATION ARRANGEMENT



TYPICAL SECTION OF PIER

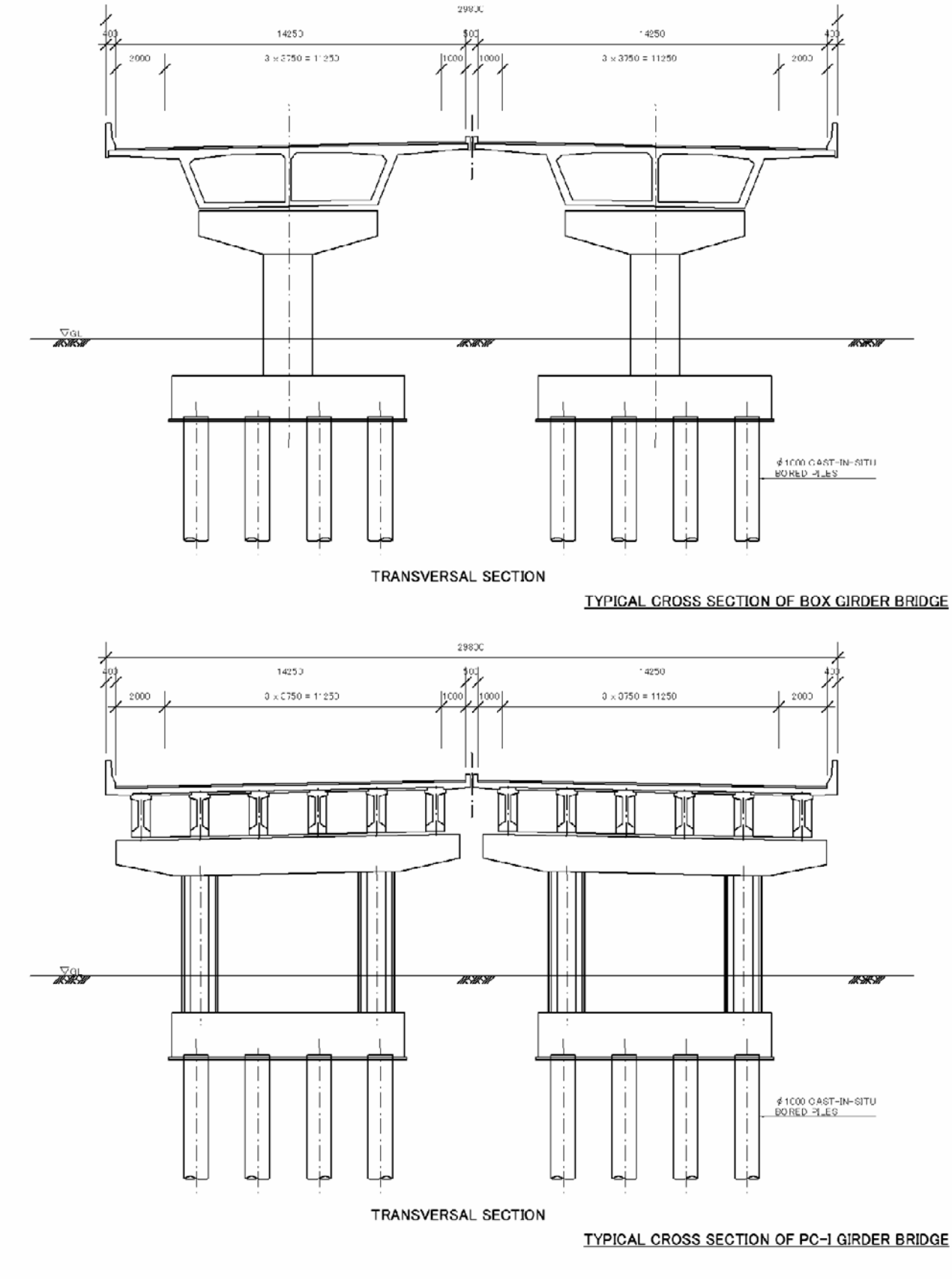
Source: HAIDEP Study Team

Figure 3.5.6 Structural Arrangement of Red River Bridge for RR4 (2/3)



Source: HAIDEP Study Team

Figure 3.5.7 Structural Arrangement of Red River Bridge for RR4 (3/3)



Source: HAIDEP Study Team

3.6 Operation and Maintenance Plan

1) General

The current situation of the operation and maintenance for roads and bridges in Hanoi, which are classified into three, namely national roads, city roads, and special roads, is done through private organizations including BOT.

National roads are managed by the MOT, and the city roads are maintained by Hanoi Authority, using public executing corporations. Special roads are managed by the company or the BOT bodies, using the collected toll as resources. Table shows the outline of the jurisdictions, the executing body and the fund resources by road jurisdiction

Table 3.6.1 Outline of the Existing Operation and Maintenance System

Road Classification	Jurisdiction	Execution	Fiscal Resource
National Roads	MOT	Contract out basis	State budget
City Roads	Hanoi authority	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: HAIDEP Study Team.

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

A proper maintenance system is required to extend the life span of the Red River Bridge for RR4. Moreover, since the bridge will be tolled it will thus require a toll collection system. Considering these conditions, it is assumed that the operation and maintenance organization will be established under Hanoi Authority and that the operation will be self-financing as much as possible.

(1) Maintenance Works

Maintenance works are classified into three types:, 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 the year or at certain intervals annually.

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.

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 calamities. It is impossible to foresee the frequency, but such maintenance requires immediate action.

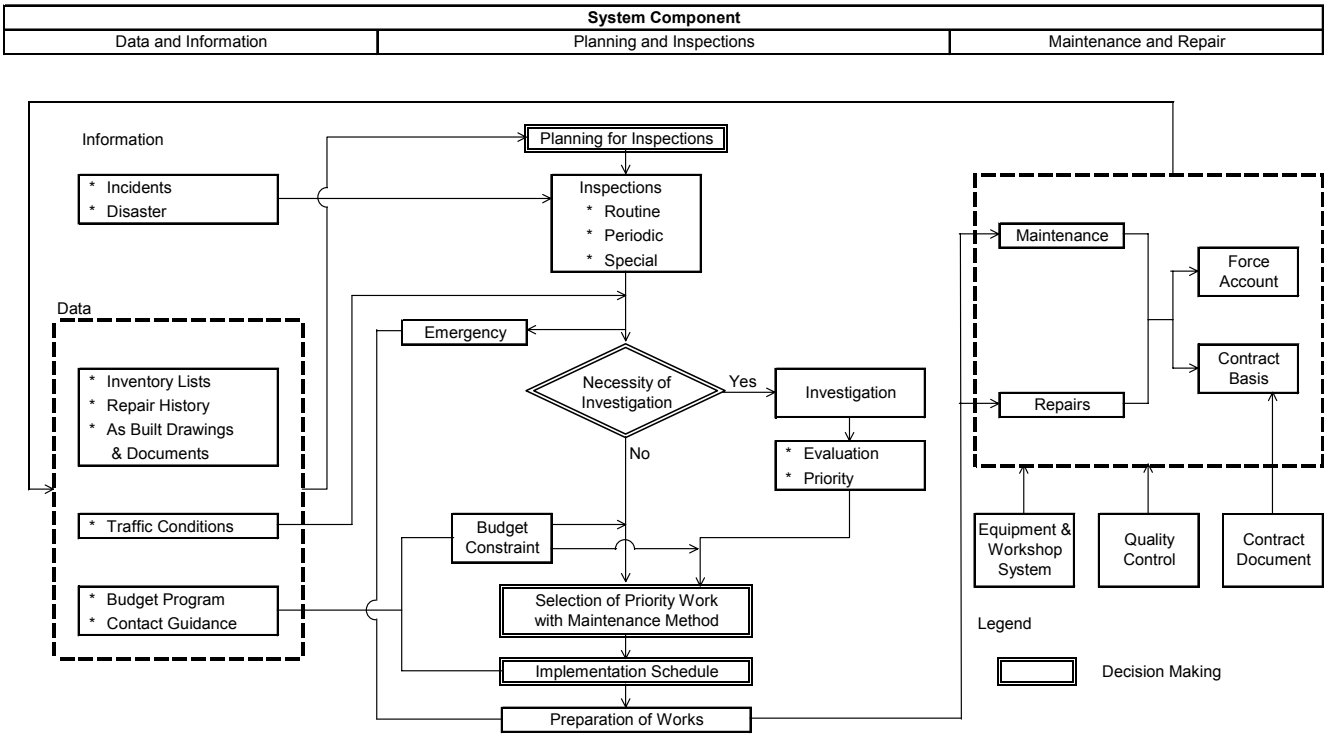
Table 3.6.2 summarizes typical activities of each type of maintenance work. Figure 3.6.1 shows the general flow chart of the recommended overall maintenance works.

Table 3.6.2 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: HAIDEP Study Team

Figure 3.6.1 General Flow Chart of Maintenance Works



Source: HAIDEP Study Team.

(2) Toll Operation

In case operation of a toll system on the Red River Bridge will be undertaken, tit is assumed to apply an open toll system with barrier-type toll collection. The Red River Operation and Maintenance Unit will operate the toll collection works and expand the toll facilities.

Redesign of controls and facilities should be taken into account in the case of toll road. The closed system will levy toll from all users allowed to access and egress from toll road over the entire stretch. The open system would typically toll medium to long distance users, while to some extent, depending on the location of toll gates, would exempt short-distance users.

4 COST ESTIMATION AND IMPLEMENTATION SCHEDULE

4.1 Methodology

The guidelines for the cost estimation for the public works in Vietnam are explained in various documents listed below.

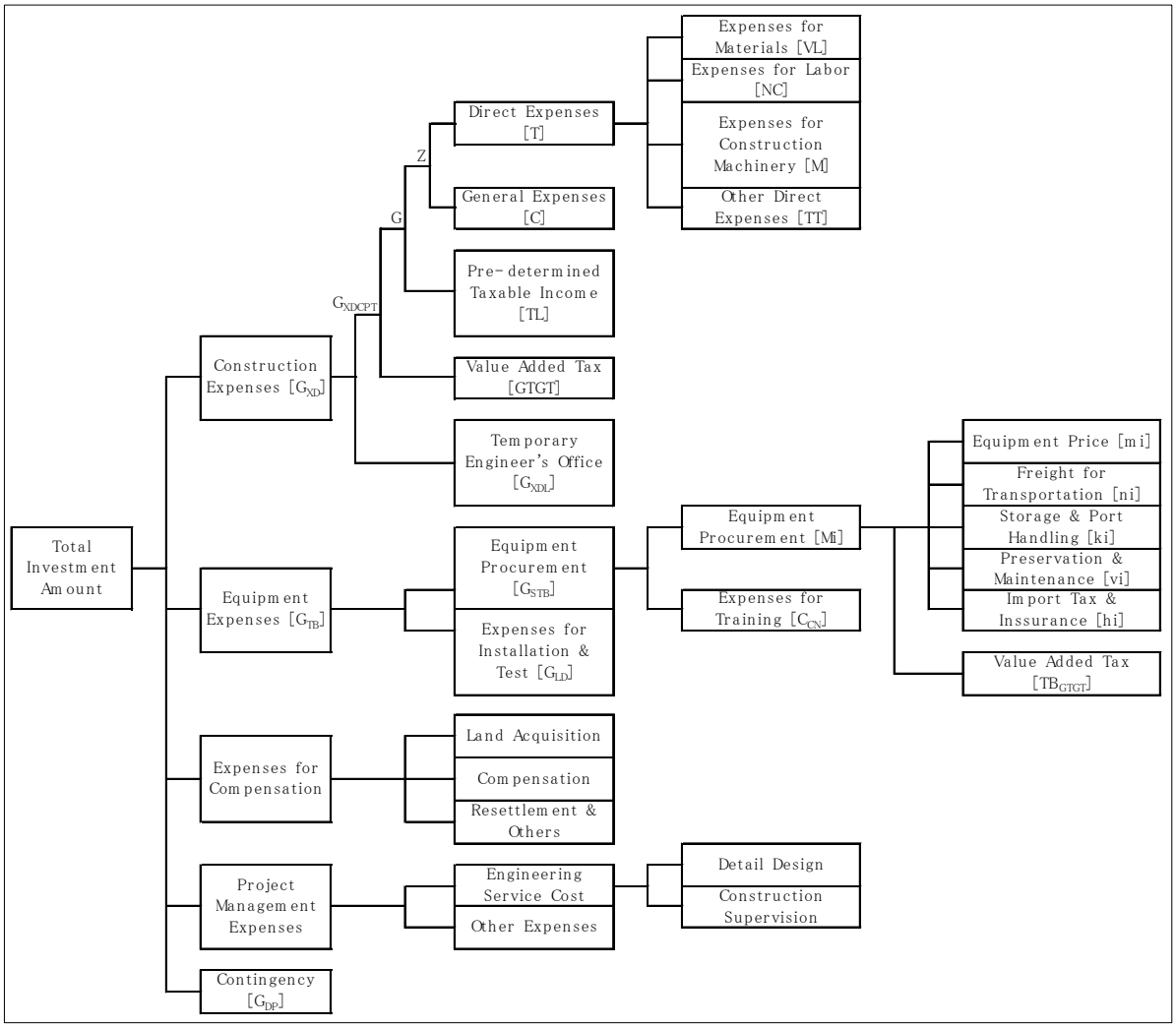
Table 4.1.1 Guidelines for Cost Estimation in Vietnam

No.	Title	Date
Circular 04/2005/TT-BXD	Guiding the formulation and management of expenses of investment projects on construction of works	2005/04/01
Decree No. 26/CP	Temporarily Regulating The Salary in Enterprises	1993/05/23
Circular 03/2005/TT-BXD	Guiding the Adjustment of Cost Estimates of Capital Construction Works	2005/03/04
Circular 16/2005/TT-BXD	Guiding the Adjustment of Work Construction Cost Estimates	2005/10/13
Decree No. 16/2005/ND-CP	On Management of Investment Projects on the Construction Works	2005/02/07
Decision No. 24/2005/QD-BXD	Decision on Promulgation of Estimate Norms for Construction Projects – Part of Construction	2005/07/29
Decision No. 24/1999/QD-UB	Decision on Promulgation of Unit Price in Capital Construction in Hanoi City	1999/05/15
Decree No. 118/2005	Readjusting the Minimum Wage Level	2005/09/15
Decree No. 158/2003/ND-CP	Detailing the Implementation of the Value Added Tax Law and the Law Amending and Supplementing a Number of Articles of the Value Added Tax Law	2003/12/10
DECREE No. 03/2006/ND-CP	Providing for Provisions on Minimum Wages of Vietnamese Employees Working for Foreign Invested Enterprises, Foreign Agencies and Organizations and Foreign Individuals based in Vietnam	2006/01/06
Decree No. 233-HDBT	Regulations on Labor for Enterprises with Foreign Owned Capital	1990/06/22
Decree No. 204/ND-CP	Regarding Salary System for Public Servants, Officials and Military Force	2004/12/14
Decree No. 155/2004/ND-CP	Amending and Supplementing a Number of Articles of the Government's Decree No. 41/2002/ND-CP of April 11, 2002 on Policies towards Laborers Redundant due to the Restructuring Enterprises	2004/08/10
Decree No. 41/2002/ND-CP	On Policies towards Laborers Redundant due to the Restructuring of State Enterprises	2002/4/11

Source: Various sources

The system of the cost estimation for the construction works in Vietnam can be summarized as follows.

Figure 4.1.1 Cost Estimation Process in Vietnam



Source: Circular No. 04/2005/TT-BXD (1 April 2005).

The calculation methodology for the construction cost specified in the Circular No. 04/2005/TT-BXD (Apr. 1, 2005) of the Ministry of Construction is summarized in Table 4.1.2.

The guidelines of cost estimation in Vietnam are adopted in principle, while some adjustment was made considering that the proposed projects is taken to be for international tender. For example, regarding the minimum wage of labors, Decree 118/2005 issued on September 15th 2005 indicates that minimum wage is 350,000 VND per month, while Decree No. 03/2006/ND-CP issued on 6th January 2006 specifies 870,000 VND per month for Vietnamese employees working for foreign agencies and organizations and foreign individuals based in Vietnam. Moreover, the adjustment rate specified in the Circular No. 16/2005/TT-BXD issued on 13th October 2005 does not seem to cover the recent sharp increase of the fuel cost for the construction equipment.

Therefore, the basic costs i.e. labor costs, material costs and equipment costs are estimated based on the latest market survey.

The composition of the basic costs is shown in Figure 4.1.2.

Table 4.1.2 Calculation Method for Construction Cost

No.	Expense Item	Method of Calculation	Result
1	Direct Expenses		
	1 Material expenses	$\Sigma Qj \times D_{jvl} + CL_{vl}$	VL
	2 Labor expenses	$\Sigma Q_j \times D_{jnc} + (1 + K_{nc})$	NC
	3 Construction machine expenses	$\Sigma Q_j \times D_{jm} + (1 + K_{mtc})$	M
	4 Other direct expenses	1.5% x (VL + NC + M)	TT
	Total direct expenses	VL + NC + MM + TT	T
2	General Expenses	P x T	C
	Cost estimates for construction	T + C	Z
3	Pre-determined taxable income	(T + C) x prescribed rate	TL
	Value of pre-tax cost estimates for construction	(T + C + TL)	G
4	Value added tax	$G \times T^{XD}_{GTGT}$	GTGT
	Value of after-tax cost estimates	G + GTGT	G_{XDCPT}
	Expenses for building of make-shift houses in construction sites for accommodation and construction management	G x prescribed rate x $(1 + T^{XD}_{GTGT})$	G_{XDLT}

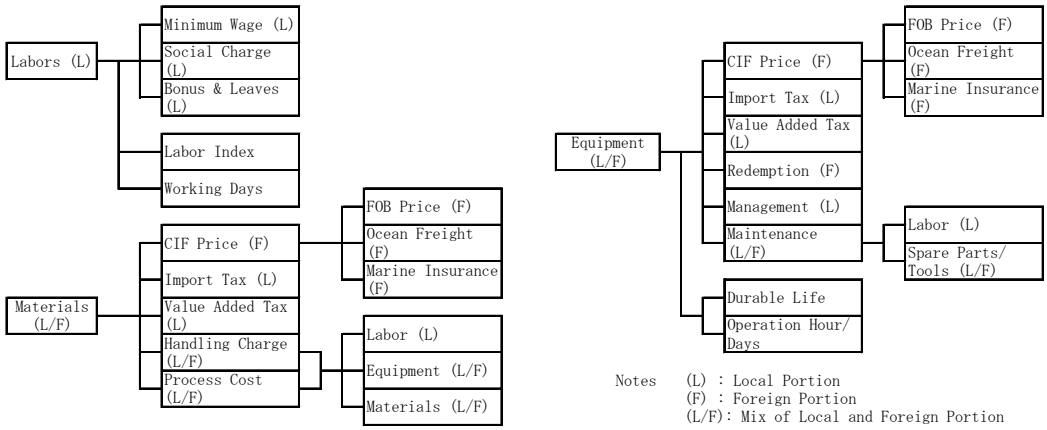
Q_j : The volume of construction job No. j
D_{jvl}, D_{jnc}, D_{jm} : Expenses for materials, labor, construction machines in the construction unit price of construction job No. j
K_{nc} : Labor adjustment co-efficient (if any)
K_{mtc} : Construction machine expense adjustment co-efficient (if any)
P : Norm for general expenses (%) provided for in Table 2
TL : Pre-determined taxable income provided for in Table 2
G : Pre-tax value of cost estimates for construction of principal works, auxiliary works and make-shift works in service of construction
G_{XDCPT} : After-tax value of cost estimates for construction of principal works, auxiliary works and make-shift works in service of construction
CL_{vl} : Difference of material quantities (if any)
T^{XL}_{GTGT} : Value added tax rate prescribed for construction job
G_{XDLT} : Expenses for building make-shift house in construction sites for accommodation and construction management
Z : Price of construction cost estimate.

Norms of General Expenses and pre-determined Taxable Income

No.	Type of work	General expenses P	Pre-determined taxable income
1	Civil works	6.0%	5.5%
2	Industrial works	5.5%	6.0%
3	Traffic works	5.3%	6.0%
4	Irrigation works	5.5%	5.5%
5	Technical infrastructure works	4.5%	5.5%

Source: Circular 04/2005/TT-BXD issued on Apr. 1, 2005 (Ministry of Construction)

Figure 4.1.2 Composition of Basic Costs



Source: HAIDEP Study Team

The costs are composed of foreign currency portion and local currency portion. The foreign currency portion is generally the CIF (Cost, Insurance and Freight) price of imported goods and materials. The local currency portion includes import tax, value added tax, domestic handling and transportation costs, local process costs, overhead and local sales and market costs, profits of local firms, etc. Imported equipment and materials used except for the domestic handling and transportation, local process, overhead, etc. are deemed to be part of the foreign portion.

The proportion of the foreign and local currency will be estimated based on the following principle.

Table 4.1.3 Foreign and Local Currency Portion

Foreign Currency Portion	Local Currency Portion
1. Wages of foreign personnel 2. Overheads and profits of foreign firms 3. CIF price of imported equipment, materials and supplies	1. Wages of local personnel 2. Overheads and profits of local firms 3. Import tax, value added tax 4. Local components of equipment, materials & supplies

Source: HAIDEP Study Team

Both foreign and local components will be expressed in US$ converted by the adopted exchange rate of US$ 1.00 =16,000 VND (as of June 2006).

Indirect costs, i.e. general expenses, contractor's profits (described as pre-determined taxable income in the guidelines), and temporary engineer's office (described as expenses for building of make-shift houses in construction sites for accommodation and construction management) are calculated by the percentage specified in the Circular 04/2005/TT-BXD of April 1, 2005.

4.2 Basic Costs

(1) Labor Cost

The labor cost is estimated based on the minimum wage of 870,000 VND/month specified in Decree No. 03/2006/ND-CP issued on 6th January 2006. The daily wages of classified labors considering the workable days, allowances, social charges, etc. are calculated as shown in Table 4.2.1.

Table 4.2.1 Labor Cost

Labor Cost

1 US $ = 16,000 VND = 115.00 yen

National Holidays	=	8 days/year		
Work Days/Week	=	5.5 days/week	=	(7 weekdays-Sunday-0.5 Saturday)
Annual Paid Work Days	=	279 days	=	365 days / 7 days x Weekly Work Days – National Holidays
Annual Rainy Days	=	50 days/year	=	Daily Precipitation of 10mm and more (assumed)
Annual Workable Days	=	242 days	=	[(365/7) week x Weekly work days / 365] x [(365-Holidays)/365] x [1-(Annual Rainy Days/365)] x 365 days
Minimum Daily Wage	=	43,140 VND/day 2.70 US$/day	=	870,000 VND/month x 12 month / Annual Workable days
Leave (Paid Holidays)		1.00 month/year		
Bonus		1.00 month/year		

Day work	Night Work	Total
75.00%	25.00%	100.00%
1.00	1.5	2.50
75.00%	37.50%	112.50%

Basic Daily Wage	=	Min. daily Wage x Labor Cost Index
Basic Monthly Salary	=	(Basic Daily Wage Annual Paid Work Days) / 12 Months
Allowances (overtime)	=	[Day Work (%) x 1.00 + Night Work (%) x 1.50 – 100%] x Basic Monthly Salary
Leave (Paid Holidays)	=	1.0 x Basic Monthly Salary
Bonus	=	1.0 x Basic Monthly Salary
Social Charge		10.0 % x (Basic Monthly Salary x 12 + Leave + Bonus)
Annual Cost Paid by the Employer	=	(Basic Monthly Salary + Allowances) x 12 Months + Leave + Bonus + Social Charge
Daily Labor Cost for Estimate	=	Annual Cost Paid by Employer / Annual Workable Days

Item No.	Description	Labor Cost Index	Basic Daily Wage	Basic Monthly Wage	Allowances (overtime) 12.50%	Leave (Paid Holidays)	Bonus	Social Charge 10.00%	Annual Cost Paid by Employer	Daily Labor Cost for Estimate
			US$/day	US$/month	US$/month	US$/year	US$/year	US$/year	US$/year	US$/day
L002	Foreman	1.80	4.68	113.00	14.13	113.00	113.00	175.16	1,926.72	7.96
L003	Operator	1.30	4.51	81.61	10.20	81.61	81.61	126.49	1,391.43	5.75
L004	Driver	1.20	3.24	75.33	9.42	75.33	75.33	116.77	1,284.43	5.31
L005	Carpenter	1.40	3.78	87.89	10.99	87.89	87.89	136.23	1,498.57	6.19
L006	Re-Bar Worker	1.30	3.51	81.61	10.20	81.61	81.61	126.49	1,391.43	5.75
L007	Masonry	1.50	4.05	94.16	11.77	94.16	94.16	145.95	1,605.43	6.63
L008	Blaster	1.70	4.59	106.72	13.34	106.72	106.72	165.42	1,819.58	7.52
L009	Welder	1.60	4.32	100.44	12.56	100.44	100.44	155.69	1,712.57	7.08
L010	Painter	1.40	3.78	87.89	10.99	87.89	87.89	136.23	1,498.57	6.19
L011	Mechanic	1.40	3.78	87.89	10.99	87.89	87.89	136.23	1,498.57	6.19
L012	Electrician	1.30	3.51	81.61	10.20	81.61	81.61	126.49	1,391.43	5.75
L019	Unskilled Worker	1.30	3.51	81.61	10.20	81.61	81.61	126.49	1,391.43	5.75
L020	Unskilled Labor	1.00	2.70	62.78	7.85	62.78	62.78	97.31	1,070.43	4.42
L021	Diver	1.90	5.13	119.27	14.91	119.27	119.27	184.87	2,033.57	8.40
L022	Captain	2.50	6.75	156.94	19.62	156.94	156.94	243.26	2,675.86	11.08
L023	Officer Crew	2.00	5.40	125.55	15.69	125.55	125.55	194.60	2,140.58	8.85
L024	Common Crew	1.50	4.05	94.16	11.77	94.16	94.16	145.95	1,605.43	6.63
L030	Foreign Expert									

Minimum Wage
Decree No. 03/2006/ND-CP Hanoi, 06 January 2006
Providing for Provisions in Minimum Wages of Vietnamese Employees Working for Foreign Invested Enterprises, Foreign Agencies and Organizations and Foreign Individuals based in Vietnam

Effective from 01 February 2006
Minimum Wage

No.	Area	VND/month
1	Districts of Hanoi and Ho Chi Minh City;	870,000
2	Suburb Districts of Hanoi, Ho Chi Minh City; districts of Hai Phong City, Ha Long City of Quang Ninh Province, Bien Hoa City of Dong Nai Province, Vung Tau City of Baria-Vung Tau Province, Thu Dau Mot Town and Districts of Thuan An, Di An, Ben Cat and Tan Uyen of Binh Duong Province;	790,000
3	Other Areas	710,000

The minimum wages provided for in Article 1 under this Decree are used as a basis for establishing a salary scale, payroll ledgers and allowances; for determining salary levels to be stated under a labor contract; and for the implementation of other regime.
The lowest salary paid to workers who have undergone industrial training (including the on-the-job training provided by enterprises) should be at least 7% higher than minimum wage that is higher than those of minimum wages provided for in Article 1 under this Decree.

REGULATIONS ON LABOR FOR ENTERPRISES WITH FOREIGN OWNED CAPITAL
(Issued with Decree No. 233-HDBT of the Council of Ministries dated 22 June 1990.)
CHAPTER VIII Social Insurance
Article 46
Every month, each enterprise shall pay a contribution to social insurance in a sum equivalent to (10) per cent of the amount of total wages and salaries paid to its employees. This sum shall be applied as follows:

1. Two per cent to the local labor office for the purpose of unemployment benefits.
2. Eight per cent to the social insurance fund established and administered jointly by the representative of the sickness, labor accidents, occupational diseases (including leave taken and medical expenses); pregnancy, maternity and childcare; and burial and funeral expenses (for those who die during the term of employment).

(2) Material Costs

For the material costs, many information were gathered and compared with the price in Japan to comprehend the tendency of prices. The comparison of the costs for major materials is summarized in the following table.

Table 4.2.2 Comparison of Major Material Cost

Items		Unit	Market Rate (VND)			(US$)	(J. Yen)	Comparison with Japanese Rate Cost (¥)	(%)	Remarks
Diesel Oil		ltr	7,900			0.49	57	66	86.0	
Gasoline		ltr	11,000			0.69	79	91	86.9	
Electricity		kWh	528	~	1,661	0.07	8	16	50.6	
Water Supply		m^3	3,500			0.22	25	216	11.6	
Telecommunication		min	400			0.03	3	3	96.6	
Reinforcing Bars	SD295A	t	7,330,000	~	8,095,000	482.03	55,434	58,000	95.6	
	SD390A	t	7,480,000	~	8,095,000	486.72	55,973	62,000	90.3	
Steel Round Bars		t	7,130,000	~	7,480,000	456.56	52,505	58,000	90.5	
Structural Steel (S shapes)		t	7,980,000	~	8,180,000	505.00	58,075	77,000	75.4	
Structural Steel (shapes)		t	7,280,000	~	7,680,000	647.50	53,763	68,000	79.1	
Steel Pipes	Ø 38.1	m	8,714	~	15,159	0.75	86	73	117.1	
	Ø 42.2	m	10,571	~	16,857	0.88	99	96	103.0	
	Ø 48.1	m	12,095	~	19,286	0.98	113	110	103.0	
Portland Cement		t	780,000			48.75	5,606	8,400	66.7	
Coarse Aggregates		m^3	94,000			5.88	676	2,900	23.3	
Fine Aggregates		m^3	115,000			7.19	827	2,900	28.5	
Ready-Mix Concrete	M150	m^3	415,780	~	458,580	27.32	3,142	8,700	36.1	18-8-25
	M200	m^3	458,580	~	524,000	30.71	3,531	8,900	39.7	21-8-25
	M250	m^3	484,040	~	557,000	32.53	3,741	9,250	40.4	24-8-25
	M300	m^3	514,620	~	623,810	35.58	4,091	9,900	41.3	30-8-25
	M350	m^3	539,000	~	671,429	37.83	4,350	10,800	40.3	36-8-25
	M400	m^3	571,000	~	788,571	42.49	4,886	11,250	43.4	40-8-25
Stone		m^3	80,000			5.00	575	3,000	19.2	
Gravels		m^3	80,000	~	110,000	5.94	683	2,900	23.5	
Crushed Stones		m^3	100,000	~	125,000	7.03	809	1,900	42.6	
Sand		m^3	30,000	~	70,000	3.13	359	2,700	13.3	
Concrete Pipes	Ø 300	m	75,600	~	107,000	5.71	656	3,215	20.4	
	Ø 400	m	117,000	~	133,000	7.81	898	3,985	22.5	
	Ø 600	m	220,000	~	251,000	14.72	1,693	9,794	17.3	
	Ø 800	m	437,000	~	466,000	28.22	3,245	16,749	19.4	
	Ø 1000	m	596,000	~	726,000	43.31	4,751	26,132	18.2	
	Ø 1500	m	1216,000	~	1,483,000	84.34	9,700	48,305	20.1	
	Ø 2000	m	1938,000	~	2,112,000	126.56	14,555	83,051	17.5	
Lumber		m^3	1300,000	~	1,500,000	87.50	10,063	37,000	27.2	
Lumber		m^3	5800,000	~	7,500,000	415.63	47,797	80,000	59.7	
Lumber		m^3	14,700,000	~	16,000,000	959.38	110,328	140,000	78.8	
Plwood		m^3	64,140			4.01	461	549	83.9	
Plwood		m^3	87,000			5.44	625	824	75.9	
Paint		kg	1,980	~	85,227	2.73	313	600	52.2	
Alkyd paint		kg	15,000	~	20,000	1.09	126	490	25.7	
Road Marking Paint		kg	11,700			0.73	84	135	62.3	
Asphalt		t				370.00	42,550	27,000	157.6	
Asphalt 60/70		t	4,720,000			295.00	33,925	27,000	125.6	
Alkali Emulsion Asphalt		t	3,300,000			206.25	23,719	45,000	52.7	
Acid Asphalt Emulsion		t	2,864,000			179.00	20,585	45,000	45.7	
Traffic Sign Board	▽ 700	each	215,782			13.49	1,551	4,400	35.2	▽ 800
Traffic Sign Board	▽ 900	each	348,725			21.80	2,506	7,280	34.4	▽ 800
Traffic Sign Board	Ø 700	each	304,600			19.04	2,189	7,980	27.4	Ø 600
Traffic Sign Board	Ø 900	each	526,200			32.89	3,782	13,190	28.7	Ø 600
Traffic Sign Board		m^2	787,000			49.19	5,657	44,000	12.9	
Traffic Sign Poles	Ø 90mm x 3.5m	each	314,000			19.63	2,257	8,980	25.1	Ø 60.5mm x 3.5m
Traffic Sign Poles	Ø 113.5mm x 3.5m	each	434,500			27.16	3,123	16,880	18.5	Ø 76.3mm x 3.5m
Interlocking Blocks 112.5x225x60	Gray	m^2	56,564			3.54	407	2,600	15.6	
Interlocking Blocks 112.5x225x60	red,yellow	m^2	80,817			5.05	581	2,600	22.3	
Interlocking Blocks 112.5x225x60	green	m^2	90,495			5.66	650	2,600	25.0	
Interlocking Blocks 130x130x60	Gray	m^2	55,132	~	69,125	3.88	447	2,600	17.2	
Interlocking Blocks 130x130x60	red,yellow	m^2	80,817	~	98,750	5.61	645	2,600	24.8	
Interlocking Blocks 130x130x60	green	m^2	90,495	~	110,600	6.28	723	2,600	27.8	
Pathway Paving Blocks		m^2	70,000	~	80,000	4.69	539	11,200	4.8	
Bentonite		kg	1,600			0.10	12	22	52.8	
Galvanized Iron Pipe	Ø 20	m	14,919			0.93	107	229	46.9	
	Ø 25	m	20,593			1.29	148	320	46.3	
	Ø 32	m	25,829			1.61	186	425	43.7	
	Ø 40	m	32,343			2.02	232	485	47.9	
	Ø 50	m	41,854			2.62	301	670	44.9	
	Ø 65	m	59,251			3.70	426	958	44.5	
	Ø 80	m	69,564			4.35	500	1,148	43.6	
	Ø 100	m	99,314			6.21	714	1,648	43.3	
PVC Pipe	Ø 16 x 2.29 m	each	13,182			0.82	95	179	52.9	
	Ø 20 x 2.29 m	each	14,545			0.91	105	216	48.3	
	Ø 25 x 2.29 m	each	26,818			1.68	193	313	61.7	
HDPE	Ø 40/30	m	9,640			0.60	69	163	42.5	
	Ø 50/40	m	13,180			0.82	95	200	47.4	
	Ø 65/50	m	16,850			1.05	121	294	41.2	
	Ø 105/80	m	35,380			2.21	254	626	40.6	
	Ø 130/100	m	40,470			2.53	291	887	32.8	
	Ø 195/150	m	91,720			5.73	659	1,640	40.2	
Bricks	200x105x60	each	850			0.05	6	180	3.4	210x100x60
Brick CN 50	200x200x50	each	770			0.05	6	760	0.7	200x200x60
Concrete Block	200x105x60	each	5,638			0.35	41	490	8.3	
Concrete Block	200x105x60	each	3,480			0.22	25			
Concrete Hollow Block	200x105x60	each	3,000			0.19	22	100	21.6	390x190x100
Concrete Hollow Block	200x105x60	each	4,546			0.28	33	195	16.8	390x190x190
Glass	4.5mm	m^2	50,000			3.13	359	950	37.8	

Source: Various sources

(3) Equipment Cost

Most of the construction equipment is imported. The equipment operation cost, basically consists of depreciation cost, operator or driver cost and fuel cost. The equipment depreciation costs shall be estimated from the basic equipment costs, considering the import tax, value added tax, standard operation hours, standard working days, resumption rate, repair and maintenance rate and annual management rate. The hourly (or daily) equipment depreciation costs are calculated using the following equation:

$$DP = BP \times \left(\frac{RD + MT}{DY} + MN \right) \times \frac{1}{SO}$$

Where:

DP: Hourly (or Daily) equipment depreciation cost
BP: Basic equipment cost = CIF price + Import tax + VAT
RD: Redemption rate = 1 – Resumption rate
MT: Maintenance and repair rate
MN: Annual management rate
DY: Durable years
SO: Standard annual operation hours (or days)

The CIF prices of the equipment are taken as the equipment cost of Japan in accordance with “Construction Equipment Depreciation Cost” issued by the Japan Construction Mechanization Association, and 10% import tax and 10% value added tax was added for the basic equipment cost. Redemption rate, durable years and standard operation hours (or days) are taken as the same as in Japan, while maintenance and repair rate, and annual management rate are reduced to 75% and 50% respectively of those used in Japan to reflect the difference in personnel expenditure.

The hourly (or daily) equipment operation costs are calculated by adding the operator/driver cost and the fuel consumption cost to the above depreciation costs.

The operation costs for major equipment are summarized in the Table 4.2.3.

Table 4.2.3 Major Equipment Operation Cost

Item	Unit	Operation Cost (US$)	Components (%)	
			Foreign	Local
Bulldozer 15t	hr	50.30	52.9	47.1
Bulldozer 21t	hr	72.50	54.6	45.4
Backhoe hydraulic crawler 0.1m^3	day	90.70	54.5	45.5
Backhoe hydraulic crawler 0.35m^3	hr	23.40	55.7	44.3
Backhoe hydraulic crawler 0.60m^3	hr	40.00	56.7	43.3
Clamshell crawler Hydraulic 0.6m^3	hr	41.80	55.6	44.4
Clamshell crawler Mechanical 0.8m^3	hr	66.40	49.8	50.2
Concrete Breaker 20kg	day	1.02	65.4	34.6
Motor Grader 3.1m	Hr	35.60	51.0	49.0
Road Roller macadam 10~12t	Hr	27.70	48.8	51.2
Tire Roller 8~20t	Hr	26.50	49.2	50.8
Vibration Roller combined 3~4t	Hr	15.20	49.4	50.6
Tamper and Rammer 60~110kg	day	11.30	63.3	36.7
Vibration compactor 100~110kg	day	12.30	62.6	37.4
Crawler Crane Hydraulic 40~45t	hr	69.60	51.2	48.8
Crawler Crane Hydraulic 50~55t	hr	83.40	51.3	48.7
Truck Crane Hydraulic 15-16t	hr	37.80	52.7	47.3
Truck Crane Hydraulic 20t	hr	40.50	52.8	47.2
Truck Crane Hydraulic 50t	hr	96.70	53.4	46.6
All Casing Excavator Crawler Ø 1500max	hr	386.00	53.5	46.5
Diaphragm Wall Excavator Lateral Rotation Type 630-1500mm	hr	401.00	53.5	46.5
Dump Truck Diesel 10t	hr	27.70	51.0	49.0
Concrete Mixer Truck 4.4~4.5m^3	hr	28.30	53.9	46.1
Concrete Pump Vehicle (Piping) 90-100m^3 / hr	hr	62.40	56.1	43.9
Concrete Pump Vehicle (Boom) 90-110m^3 / hr	hr	67.60	55.6	44.4
Grout Pump 15~30Ltr/min	day	12.40	52.0	48.0
Asphalt Finisher Crawler 2.4~4.5m	hr	70.70	52.3	47.7
Electric Welder 500A	day	1.80	50.8	49.2
Generator 100kVA	day	107.00	60.4	39.6
Air Compressor 3.5~3.7m^3 / min	day	41.80	59.3	40.7
Submerged Pump Ø 100mm 3.7kW	day	5.20	45.6	54.4
PC Bridge Canti Lever Construction Operation Wagon W=17m	day	423.00	60.1	39.9

Source: various sources

4.3 Productivity and Quantities

The productivity of works was determined referring the Decision No. 24/2005/QD-BXD "Decision on Promulgation of Estimate Norms for Construction Projects – Part of Construction" issued by Ministry of Construction on July 29, 2005, as well as the "Cost Estimation Standard for Civil Works" and "Cost Estimation Standard for Public Architectural Works" both issued by the Ministry of Land Infrastructure and Transport of Japan for the year 2005.

The quantities are roughly estimated from the preliminary design drawings prepared in this prefeasibility study.

4.4 Indirect Costs

Indirect costs are as specified in the Circular 04/2005/TT-BXD (April 1, 2005) of Ministry of Construction.

(a) **Other Direct Expenses:** This is 1.5% of the direct cost (sum of labor, materials and equipment) which is defined as to cover water pumping, mud dredging, tests of materials, movement of labor and construction equipment to and within construction sites, labor safety and protection of the environment for laborers and protection of surrounding environment.

(b) **General Items:** This is 6.0% of the total direct cost which covers expenses for production management in construction sites, expenses for management and administration staffs, expenses for temporary construction in construction sites and other expenses.

(c) **Pre-Determined Taxable Income (Contractor's Profit):** This is 5.5% of the sum of total direct cost and general items which will be the profit of the contractor.

4.5 Other Costs

In addition to the construction cost, the Project cost shall include the following expenses specified in the Circular 04/2005/TT-BXD (April 1, 2005) of Ministry of Construction.

Table 4.5.1 Other Costs to be Included in the Project Cost

Expense	Content	Remark
Expenses for Compensation	1. Expenses for compensation for houses, architectural objects and crops on land, etc. 2. Expenses for resettlement related to compensation and ground clearance boards 3. Expenses for land use such as lent rents during the time of construction 4. Expenses for investment in technical infrastructure (if any)	
Project Management Expenses	1. Expenses for general management of projects 2. Expenses for performing compensation and ground clearance work under the responsibility of investors 3. Expenses for performing evaluation or verification of designs, total cost estimates and cost estimates for construction of works 4. Expenses for complication of dossiers of invitation for participation in bidding, dossiers of invitation for bids, analysis and evaluation of bids 5. Expenses for construction supervision, construction survey and equipment installation 6. Expenses for expertise and certification of quality conformity of works 7. Expenses for pre-acceptance test, financial settlement and conversion of investment capital 8. Expenses for project formulation 9. Expenses for selection of architectures (if any) 10. Expenses for construction survey and design 11. Loan interest paid by investor during the construction period under credit contract or loan agreement (for ODA funded projects) 12. Expenses for the State steering committee and the State council for test and acceptance 13. Expenses for international quality registry 14. Expenses for observation of works, deformation (if any) 15. Start-up working capital for production 16. Expenses for fuel, energy and labour for the process of load and non-load trial operation (for production and business projects) 17. Expenses for work insurance 18. Expenses for audit, verification and approval of financial settlement and other expenses	10-15% of the total construction cost
Contingency Expenses	Those set aside for arising volumes, inflation elements and unforeseeable jobs in the process of project implementation	Not greater than 15% of the sum including the total construction cost, compensation and project management cost.

Source: HAIDEP Study Team

For the project management cost, 7.5% was taken as the engineering cost for the design and the construction supervision.

For contingency, 10% was taken as physical contingency which does not include price escalation.

4.6 Estimated Cost for RR4

1) Project Package Costs

The RR4 is divided into six sections, as follows:

(i) Package 1: NH1 – NH6 (Stn. No.32 to No.44+850)

(ii) Package 2: NH6 – Red River Approach (Stn. No.17 to No.32)

(iii) Package 3-a: Red River Crossing (Stn. No.12+600 to No.14+460)

(iv) Package 3-b: Red River Approach Hanoi Side (Stn. No.14+460 to No.17)

(v) Package 3-c: Red River Approach Noi Bai Side (Stn. No.10 to No.12+600)

(vi) Package 4: Red River Approach - NH-2 (Stn. No.0-500 to No.10)

The estimated costs for each package are summarized in tables 4.6.1 to 4.6.6.

Table 4.6.1 Package 1 Project Cost

(2) – 1 Package 1 (NH-1 – Red River) St. No. 32 to No. 44+850

Item No.	Description	Unit	Quantity	Unit Rate			Amount			Remarks
				Component (%)		Total (US$)	Component (US$)		Total (US$)	
				Foreign	Local		Foreign	Local		
2-01	Embankment Road	m	12,145.00	33.6	66.4	4,370.00	17,839,731.00	35,241,653.71	53,073,650.00	
2-02	Red River Crossing Bridge	m	0.00	56.6	43.4	73,700.00	0.00	0.00	0.00	
2-03	Red River Approach Bridge	m	0.00	48.1	51.9	26,200.00	0.00	0.00	0.00	
2-04	Box Girder Bridge (2x14.25m wide x 40m span)	M	650.00	48.4	51.6	23,200.00	7,294,472.65	7,785,527.38	15,080,000.00	
2-05	PCI Girder Bridge (2x14.25m wide x 33m span)	M	55.00	46.9	53.1	19,400.00	500,809.23	566,190.78	1,067,000.00	
2-06	Box Culvert 7.0m x 3.0m	M	168.00	40.6	59.4	3,580.00	244,195.15	357,388.48	601,440.00	
2-07	Box Culvert 3.0m x 3.0m	M	392.00	38.5	61.5	1,460.00	220,323.28	351,996.98	572,320.00	
2-08	Intersection with NH No. 2	each	0.00	44.3	55.7	7,040,000.00	0.00	0.00	0.00	
2-09	Intersection with NH No. 23	each	0.00	34.9	65.1	3,160,000.00	0.00	0.00	0.00	
2-10	Intersection with NH No. 32	each	0.00	35.0	65.0	2,970,000.00	0.00	0.00	0.00	
2-11	Intersection with Duang Lang - Hoa Lac Road	each	0.00	35.0	65.0	2,970,000.00	0.00	0.00	0.00	
2-12	Intersection with NH No. 6	each	1.00	35.4	64.6	2,180,000.00	772,596.51	1,407,403.49	2,180,000.00	
2-13	Intersection with NH No. 1	each	1.00	34.5	65.5	3,030,000.00	1,045,826.29	1,984,173.71	3,030,000.00	
	General Items	LS	1.00				1,675,077.25	2,861,660.07	4,536,264.60	6.00%
	Temporary Engineer's Office	LS	1.00				295,930.31	505,559.95	801,406.75	1.00%
A	Total Construction Cost						29,885,847.37	51,056,233.98	80,942,081.35	
	Total Construction Cost Components						36.9%	63.00%	100.00%	
B	Land Compensation	LS	1.00	0.0	0.0		0.00	0.00	0.00	
C	Engineering Cost (A x 7.5%)	LS	1.00	0.0	0.0		0.00	0.00	6,070,656.10	7.50%
D	Contingency (A+B+C x 10%)	LS	1.00	0.0	0.0		0.00	0.00	8,701,081.35	10.00%
	Total Project Cost								95,714,011.20	

Source: HAIDEP Study Team

Table 4.6.2 Package 2 Project Cost

(2) - 2 Package 2 (NH-1 - Red River) St. No. 17 to No. 32

Item No.	Description	Unit	Quantity	Unit Rate			Amount			Remarks
				Component (%)		Total (US$)	Component (US$)		Total (US$)	
				Foreign	Local		Foreign	Local		
2-01	Embankment Road	m	1472000	33.60	66.40	4,370.00	21,622,136.01	42,713,638.75	64326400.00	
2-02	Red River Crossing Bridge	m	000	56.60	43.40	73,700.00	0.00	0.00	0.00	
2-03	Red River Approach Bridge	m	000	48.10	51.90	26,200.00	0.00	0.00	0.00	
2-04	Box Girder Bridge (2x14.25m wide x 40m span)	m	280.00	48.4	51.6	23,200.00	3,142,234.37	3,353,765.64	6,496,000.00	
2-05	PCI Girder Bridge (2x14.25m wide x 33m span)	m	0.00	46.9	53.1	19,400.00	0.00	0.00	0.00	
2-06	Box Culvert 7.0m x 3.0m	m	224.00	40.6	59.4	3,580.00	325,593.54	476,517.98	801,920.00	
2-07	Box Culvert 3.0m x 3.0m	m	392.00	38.5	61.5	1,460.00	220,323.28	351,996.98	572,320.00	
2-08	Intersection with NH No. 2	each	0.00	44.3	55.7	7,040,000.00	0.00	0.00	0.00	
2-09	Intersection with NH No. 23	each	0.00	34.9	65.1	3,160,000.00	0.00	0.00	0.00	
2-10	Intersection with NH No. 32	each	1.00	35.0	65.0	2,970,000.00	1,038,846.56	1,931,153.45	2,970,000.00	
2-11	Intersection with Duang Lang - Hoa Lac Road	each	1.00	35.0	65.0	2,970,000.00	1,038,846.56	1,931,153.45	2,970,000.00	
2-12	Intersection with NH No. 6	each	0.00	35.4	64.6	2,180,000.00	0.00	0.00	0.00	
2-13	Intersection with NH No. 1	each	0.00	34.5	65.5	3,030,000.00	0.00	0.00	0.00	
	General Items	LS	1.00				1,643,278.82	3,045,493.57	4,688,198.40	6.00%
	Temporary Engineer's Office	LS	1.00				290,312.59	538,037.20	828,248.38	1.00%
A	Total Construction Cost						29,317,982.22	54,335,104.56	83,653,086.78	
	Total Construction Cost Components						35.00%	65.00%	100.00%	
B	Land Compensation	LS	1.00	0.0	0.0		0.00	0.00	0.00	
C	Engineering Cost (A x 7.5%)	LS	1.00	0.0	0.0		0.00	0.00	6,273,981.51	7.50%
D	Contingency (A+B+C x 10%)	LS	1.00	0.0	0.0		0.00	0.00	8,992,706.83	10.00%
	Total Project Cost								98,919,775.12	

Source: HAIDEP Study Team

Table 4.6.3 Package 3-a Project Cost

(2)-3 Package 3-a (Red River Crossing Main Bridge No. 12+600 to No. 14+460

Item No.	Description	Unit	Quantity	Unit Rate			Amount			Remark
				Component (%)		Total (US$)	Component (US$)		Total (US$)	
				Foreign	Local		Foreign	Local		
2-01	Embankment Road	m	0.00	33.6	66.4	4,370.00	0.00	0.00	0.00	
2-02	Red River Crossing Bridge	m	1,860.00	56.6	43.4	73,700.00	77,649,913.58	59,432,086.40	137,082,000.00	
2-03	Red River Approach Bridge	m	0.00	48.1	51.9	26,200.00	0.00	0.00	0.00	
2-04	Box Girder Bridge (2x14.25m wide x 40m span)	m	0.00	48.4	51.6	23,200.00	0.00	0.00	0.00	
2-05	PCI Girder Bridge (2x14.25m wide x 33m span)	m	0.00	46.9	53.1	19,400.00	0.00	0.00	0.00	
2-06	Box Culvert 7.0m x 3.0m	m	0.00	40.6	59.4	3,580.00	0.00	0.00	0.00	
2-07	Box Culvert 3.0m x 3.0m	m	0.00	38.5	61.5	1,460.00	0.00	0.00	0.00	
2-08	Intersection with NH 2	each	0.00	44.3	55.7	7,040,000.00	0.00	0.00	0.00	
2-09	Intersection with NH 23	each	0.00	34.9	65.1	3,160,000.00	0.00	0.00	0.00	
2-10	Intersection with NH 32	each	0.00	35.0	65.0	2,970,000.00	0.00	0.00	0.00	
2-11	Intersection with Duang Lang - Hoa Lac Road	each	0.00	35.0	65.0	2,970,000.00	0.00	0.00	0.00	
2-12	Intersection with NH 6	each	0.00	35.4	64.6	2,180,000.00	0.00	0.00	0.00	
2-13	Intersection with NH 1	each	0.00	34.5	65.5	3,030,000.00	0.00	0.00	0.00	
	General Items	LS	1.00				4,658,994.81	3,565,925.18	8,224,920.00	6.00%
	Temporary Engineer's Office	LS	1.00				823,089.08	629,980.12	1,453,069.20	1.00%
A	Total Construction Cost						83,131,997.49	63,627,991.71	146,759,989.20	
	Total Construction Cost Components (%)						56.6	43.4	100.00	
B	Land Compensation	LS	1.00	0.0	0.0		0.00	0.00	0.00	
C	Engineering Cost (A x 7.5%)	LS	1.00	0.0	0.0		0.00	0.00	11,006,999,19	7.50%
D	Contingency (A+B+C x 10%)	LS	1.00	0.0	0.0		0.00	0.00	15,776,698.84	10.00%
	Total Project Cost								173,543,687.23	

Source: HAIDEP Study Team

Table 4.6.4 Package 3-b Project Cost

(2)-4 Package 3-b (Red River Approach Bridge Hanoi Side) No. 14+460 to No. 17

Item No.	Description	Unit	Quantity	Unit Rate			Amount			Remark
				Component (%)		Total (US$)	Component (US$)		Total (US$)	
				Foreign	Local		Foreign	Local		
2-01	Embankment Road	m	1,980.00	33.6	66.4	4,370.00	2,908,412.32	5,745,448.69	8,652,600.00	
2-02	Red River Crossing Bridge	m	0.00	56.6	43.4	73,700.00	0.00	0.00	0.00	
2-03	Red River Approach Bridge	m	560.00	48.1	51.9	26,200.00	7,057,360.05	7,614,639.97	14,672,000.00	
2-04	Box Girder Bridge (2x14.25m wide x 40m span)	m	0.00	48.4	51.6	23,200.00	0.00	0.00	0.00	
2-05	PCI Girder Bridge (2x14.25m wide x 33m span)	m	0.00	46.9	53.1	19,400.00	0.00	0.00	0.00	
2-06	Box Culvert 7.0m x 3.0m	m	56.0	40.6	59.4	3,580.00	81,398.38	119,129.49	200,480.00	
2-07	Box Culvert 3.0m x 3.0m	m	56.0	38.5	61.5	1,460.00	31,474.75	50,285.28	81,760.00	
2-08	Intersection with NH 2	each	0.00	44.3	55.7	7,040,000.00	0.00	0.00	0.00	
2-09	Intersection with NH 23	each	0.00	34.9	65.1	3,160,000.00	0.00	0.00	0.00	
2-10	Intersection with NH 32	each	0.00	35.0	65.0	2,970,000.00	0.00	0.00	0.00	
2-11	Intersection with Duang Lang - Hoa Lac Road	each	0.00	35.0	65.0	2,970,000.00	0.00	0.00	0.00	
2-12	Intersection with NH 6	each	0.00	35.4	64.6	2,180,000.00	0.00	0.00	0.00	
2-13	Intersection with NH 1	each	0.00	34.5	65.5	3,030,000.00	0.00	0.00	0.00	
	General Items	LS	1.00				604,718.73	811,770.21	1,416,410.40	6.00%
	Temporary Engineer's Office	LS	1.00				106,833.64	143,412.74	250,232.50	1.00%
A	Total Construction Cost						10,789,599.62	14,483,883.28	25,273,482.90	
	Total Construction Cost Components (%)						42.7	57.3	100.00	
B	Land Compensation	LS	1.00	0.0	0.0		0.00	0.00	0.00	
C	Engineering Cost (A x 7.5%)	LS	1.00	0.0	0.0		0.00	0.00	1,895,511.22	7.50%
D	Contingency (A+B+C x 10%)	LS	1.00	0.0	0.0		0.00	0.00	2,716,899.41	10.00%
	Total Project Cost								29,885,893.53	

Source: HAIDEP Study Team

Table 4.6.5 Package 3-c Project Cost

(2)-5 Package 3-c (Red River Approach Bridge Noi Bai Sai Side) No. 10 to No. 12+600

Item No.	Description	Unit	Quantity	Unit Rate			Amount			Remark
				Component (%)		Total (US$)	Component (US$)		Total (US$)	
				Foreign	Local		Foreign	Local		
2-01	Embankment Road	m	2,040.00	33.6	66.4	4,370.00	2,996,546.02	5,745,448.69	8,652,600.00	
2-02	Red River Crossing Bridge	m	0.00	56.6	43.4	73,700.00	0.00	0.00	0.00	
2-03	Red River Approach Bridge	m	560.00	48.1	51.9	26,200.00	7,057,360.05	7,614,639.97	14,672,000.00	
2-04	Box Girder Bridge (2x14.25m wide x 40m span)	m	0.00	48.4	51.6	23,200.00	0.00	0.00	0.00	
2-05	PCI Girder Bridge (2x14.25m wide x 33m span)	m	0.00	46.9	53.1	19,400.00	0.00	0.00	0.00	
2-06	Box Culvert 7.0m x 3.0m	m	0.0	40.6	59.4	3,580.00	0.00	0.00	0.00	
2-07	Box Culvert 3.0m x 3.0m	m	0.00	38.5	61.5	1,460.00	0.00	0.00	0.00	
2-08	Intersection with NH 2	each	0.00	44.3	55.7	7,040,000.00	0.00	0.00	0.00	
2-09	Intersection with NH 23	each	0.00	34.9	65.1	3,160,000.00	0.00	0.00	0.00	
2-10	Intersection with NH 32	each	0.00	35.0	65.0	2,970,000.00	0.00	0.00	0.00	
2-11	Intersection with Duang Lang - Hoa Lac Road	each	0.00	35.0	65.0	2,970,000.00	0.00	0.00	0.00	
2-12	Intersection with NH 6	each	0.00	35.4	64.6	2,180,000.00	0.00	0.00	0.00	
2-13	Intersection with NH 1	each	0.00	34.5	65.5	3,030,000.00	0.00	0.00	0.00	
	General Items	LS	1.00				603,234.36	812,051.59	1,415,208.00	6.00%
	Temporary Engineer's Office	LS	1.00				106,571.40	143,462.45	250,020.08	1.00%
A	Total Construction Cost						10,763,118.97	14,488,909.11	25,252.028	
	Total Construction Cost Components (%)						42.6	57.4	100.00	
B	Land Compensation	LS	1.00	0.0	0.0		0.00	0.00	0.00	
C	Engineering Cost (A x 7.5%)	LS	1.00	0.0	0.0		0.00	0.00	1,893,902.08	7.50%
D	Contingency (A+B+C x 10%)	LS	1.00	0.0	0.0		0.00	0.00	2,714,593.02	10.00%
	Total Project Cost								29,860,523.21	

Source: HAIDEP Study Team

Table 4.6.6 Package 4 Project Cost

(2) – 6 Package 4 (Red River – NH-2) No. 0-500 to No. 10

Item No.	Description	Unit	Quantity	Unit Rate			Amount			Remark
				Component (%)		Total (US$)	Component (US$)		Total (US$)	
				Foreign	Local		Foreign	Local		
2-01	Embankment Road	m	10,020.00	33.6	66.4	4,370.00	14,718,329.00	29,075,452.47	43,787,400.00	
2-02	Red River Crossing Bridge	m	0.00	56.6	43.4	73,700.00	0.00	0.00	0.00	
2-03	Red River Approach Bridge	m	0.00	48.1	51.9	26,200.00	0.00	0.00	0.00	
2-04	Box Girder Bridge (2x14.25m wide x 40m span)	m	340.00	48.4	51.6	23,200.00	3,815,570.31	4,072,429.71	7,888,000.00	
2-05	PCI Girder Bridge (2x14.25m wide x 33m span)	m	140.00	46.9	53.1	19,400.00	1,274,787.12	1,441,212.89	2,716,000.00	
2-06	Box Culvert 7.0m x 3.0m	m	224.00	40.6	59.4	3,580.00	325,593.54	476,517.98	801,920.00	
2-07	Box Culvert 3.0m x 3.0m	m	0.00	38.5	61.5	1,460.00	0.00	0.00	0.00	
2-08	Intersection with NH 2	each	1.00	44.3	55.7	7,040,000.00	3,119,817.83	3,920,182.16	7,040,000.00	
2-09	Intersection with NH 23	each	1.00	34.9	65.1	3,160,000.00	1,103,331.79	2,056,668.21	3,160,000.00	
2-10	Intersection with NH 32	each	0.00	35.0	65.0	2,970,000.00	0.00	0.00	0.00	
2-11	Intersection with Duang Lang - Hoa Lac Road	each	0.00	35.0	65.0	2,970,000.00	0.00	0.00	0.00	
2-12	Intersection with NH 6	each	0.00	35.4	64.6	2,180,000.00	0.00	0.00	0.00	
2-13	Intersection with NH 1	each	0.00	34.5	65.5	3,030,000.00	0.00	0.00	0.00	
	General Items	LS	1.00				1,461,445.78	2,462,547.80	3,923,599.20	6.00%
	Temporary Engineer's Office	LS	1.00				258,188.75	435,050.11	693,169.19	1.00%
A	Total Construction Cost						26,074,443.25	43,935,645.14	70,010,088.39	
	Total Construction Cost Components (%)						37.2	62.8	100.0	
B	Land Compensation	LS	1.00	0.0	0.0		0.00	0.00	0.00	
C	Engineering Cost (A x 7.5%)	LS	1.00	0.0	0.0		0.00	0.00	5,250,756.63	7.50%
D	Contingency (A+B+C x 10%)	LS	1.00	0.0	0.0		0.00	0.00	7,526,084.5	10.00%
	Total Project Cost								82,786,929.52	

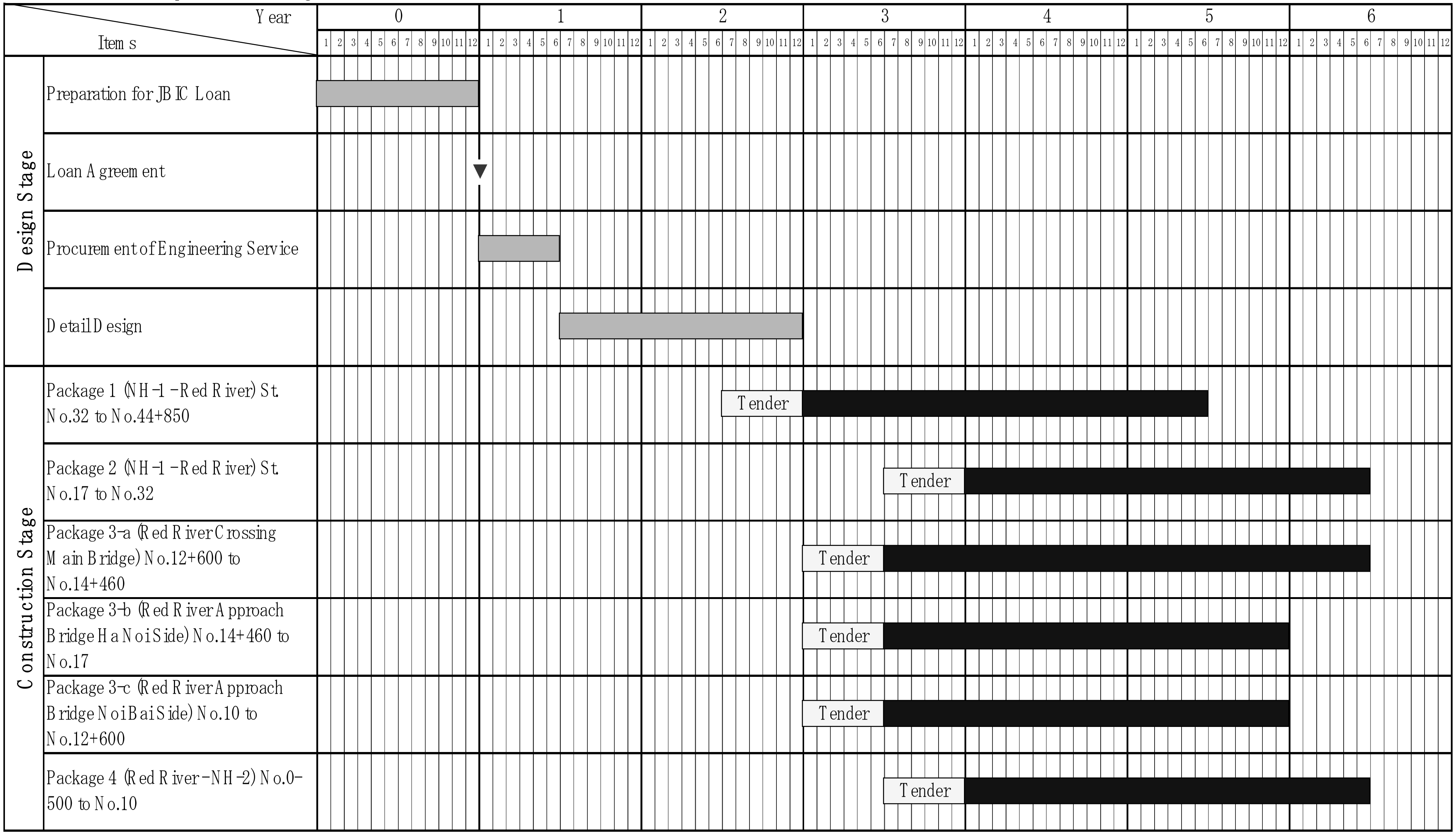
Source: HAIDEP Study Team

2) Construction Schedule

Based on the scope of works of each package, the project construction schedule is envisioned (see Figure 4.6.1).

Figure 4.6.1 Construction Program for RR4 West Section

RING ROAD No.4 Implementation Programme



Source: HAIDEP Study Team

3) Operation and Maintenance Cost

The operation and maintenance costs for RR4 are estimated below.

Table 4.6.7 Operation and Maintenance Cost for RR4

Aspect	Item			Frequency	Cost
1. Operation	1-1 Toll Booth[1] (US$/mo)				22,800
	1-2 Electricity Consumption for Street Lights (US$/mo)				28,477
2. Maintenance	2-1 Inspection	1. Daily Patrol (US$/day)		Daily	44
		2. Periodical Inspection (US$/Inspection)		Once a year	100
		3. Emergency Inspection (US$/Inspection)		Every 10 years	100
	2-2 Cleaning	4. Road Surface[2] (US$/wk)		Once a week	998
		5. Bridges and Culverts (US$/yr)		Once a year	3,168
		6. Road Facilities[3] (US$/yr)		Once a year	1,943
		7. Drainage (US$/Cleaning)		Twice a year	47,980
	2-3 Repair Works (US$)	1. Road	a. Pavement	Every 10 years	7,212,011
			b. Embankment	Every 20 years	576,052
			c. Guardrail	Every 10 years	21,169
			d. Traffic Signs	Every 20 years	9,251
			e. Street lights	Every 5 years	40,210
			f. Road Markings	Every 10 years	31,346
		2. Bridges	a. Slab	Every 20 years	15,594
			b. Expansion Joint	Every 25 years	501,428
			c. Shoe	Every 50 years	471,240
			d. Parapet	Every 20 years	2,207
			e. Substructure	Every 20 years	823
			f. Fender Piles	Every 10 years	2,816

Source: HAIDEP Study Team

1) For staff and electricity consumption.
2) Including footpaths and bridges.
3) Including guardrails, parapets, traffic signs, street lights, traffic signals, etc.

5 INITIAL ENVIRONMENT AND RESETTLEMENT EXAMINATION

5.1 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 (RR4 mainly includes high-elevation ground section). 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 (especially the Red River) for bridge construction could lead to future serious 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:

(i) 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.

(ii) 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).

(iii) 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.

(iv) 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.

(v) 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 and economic considerations in mind as well as distance of transport.

(vi) 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.

(vii) Temporary earth settlement basins will be provided at locations where runoff may occur during construction. After construction, such drains will be refilled.

(viii) 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.

(ix) 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. Grass and plants along the high slope along RR4 may serve as greeneries for the area and the city.

(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 and absorption of pollutants by areas not previously subject to flooding. Irrigation flows of paddy fields are a critical element in crop production of the vast cultivation area, where RR4 supposed to run through. 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 will have adverse impact on river flow and river banks and should be monitored. Sites for such materials will be subject for approval 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 in the project area.

(c) Mitigation

The following water quality mitigation measures will be employed:

(i) 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.

(ii) 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.

(iii) Toilet facilities for construction workers will, at the minimum, be pit privies that are regularly serviced and maintained.

(iv) Solid waste disposal will be handled in consultation with local authorities to protect surface water and groundwater resources.

(v) 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. It is expected that there will be no impact on rare or endangered plants and animal species (if any).

(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:

(i) 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.

(ii) 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 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.

(iii) Most of the naturally occurring animal species have long been lost to the immediate area. 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.

(iv) 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 to meet Vietnam air quality standards.

(c) Mitigation

The following air quality mitigation measures will be utilized:

(i) 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.

(ii) Emissions control equipment will be installed on batch plants; trucks carrying material that may generate dust will be covered.

(iii) Exposed construction access roads and sites will be watered on a set schedule depending upon weather conditions.

(iv) Proper maintenance of diesel equipment and curtailment of unnecessary idling will be practiced to help control emissions.

(v) 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.

(vi) 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 Levels

(a) Construction Period

Noise impacts during construction will result mainly from the operation of heavy machinery, including concrete mixing plants and stone crushing screening plants, and building material transport vehicles. 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:

(i) 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.

(ii) 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.

(iii) 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

(iv) 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.

(6) Impact on Land Use

RR4 will clearly delineate the study area into two parts. One is the inside of RR4 which will become high-density urban area, and the other is the outside, the future less populated suburban area. Thus, the RR4 will be a distinctive landmark dividing the city.

(a) Residential Area Development

RR4 will improve overall transport service in the city and adjoining provinces. 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).

(b) 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 will be located along the Ring Road 2. This will stimulate the peoples' consumption life and small shops in the downtown will be curtailed.

(c) Industrial Development

The RR4 will provide freer location choice for the industries inside of Hanoi and adjoining provinces.

(7) Split of Communities

The communities and economic activities shall be separated in different degrees.

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 500m 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.

(8) Cultural Property

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

5.2 Preliminary Survey of Land Acquisition and Resettlement

1) Institutional Framework

(1) Legal Framework 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, specifying land rights and management (Land Law dated 10 December 2003). 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 the Land Law, the Prime Minister, ministries (MONRE, MARD, MOC, and MOF), and provincial people's committees will issue instructive documents focusing on land-use rights.

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

(i) Land allocation: This can be achieved through proper registration procedures and application for land rights use.
(ii) Lease or rent of land: This allows individuals or organizations to rent land.
(iii) Inheritance: Transfer of land rights use of parents to family or siblings.
(iv) Land mortgage: Transfer of land rights to another person through mortgage.

(2) Land Recovery

(a) Land Valuation

Land valuation is contained in Decree No. 188/2004/ND-CP issued on 16th November 2004 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 decisions from the Hanoi Peoples' Committee, Communiqué by MOF, affirming the execution of Decree 197/2004/ND-CP (regarding compensation and resettlement support in cases of land recovery). The Hanoi 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, MOF and the Government Office.

Laws on land and resettlement are further supplemented by decrees to strengthen or amend the existing laws. Decree Nos. 188 and 17 state: "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."

(b) Compensation System and Subsidies

Regulations on compensation are specifically contained in the most recent laws (Decree 188, Decree 197, and Decree 17. The scope of compensation covers the following areas:

(i) Compensation for loss of land and housing structure

(ii) Compensation for loss of property associated with land development

(iii) Subsidy for livelihood and production activities of relocates

(iv) Subsidy for loss or change of jobs and other removal costs

Table 5.2.1 Relevant Legal Documents on Land and Resettlement

Application	Policy	Remarks
Land Allocation Land Use Rights and Comprehensive Regulations on Relocation ond Resettlement	Constitution in 1992 Land Law 2003-23/03 Decree 188/2004/ND-CP-16/11/04 Decree 197/2004/ND-CP-03/12/04 Decree 22/1998/ND-CP-24/04/1998 Decree 17/2006/ND-CP-27/01/06 Decree 56/QD-UB-02/06/2000 Decision 109/ QD-UB-26/06/06 Circular 116/TT-BTC-17/12/04	House ownership right and land use right The state to perform land management work Land adjustment, land lease procedures Land price Land use right registration procedures
Land Valuation and Compensation	Decree 22/1998/ND-CP-24/04/98 Decree 17/2006/ND-CP-27/01/06	Compensation, support and resettlement procedures
House Valuation	Decision 26/QD-UB-18/02/05 Decision 106/QD-UB-20/07/05 Decision 199/QD-UB-29/12/04 Decision 05/QD-UB-17/01/02	Properties valuation
Subsidies and Other Allowances	Document 2742/UB-NNDC-04/07/2005 Document 3490/ UB-NNDC-12/08/05	Especially reserved for RR1 (Kim Lien-O Cho Dua)

Source: various sources

(3) HAIDEP Policy on Land Acquisition and Resettlement

The above institutional framework by the Government of Viet Nam (GOV) is a prerequisite to implement the project. Basically, the HAIDEP 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 ROW.

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

(a) 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.

(b) 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 each religion's requirement.

(c) 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.

Table 5.2.2 Scale of Impacts of Land Acquisition for West-RR4 (Estimation)

Sections	NH1-NHL6		Nh6-Thuong Cat Bridge		Thuong Cat Bridge-Viaduct		Thuong Cat Bridge-NH2		Total	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Households	40	45	70	130					110	175
Population	240	270	420	780					660	1,050
Area (1000m²)	1,028		1,200		411		840		3,749(c)	

Source: HAIDEP Study Team
Notes: (a) Engineering study, (b) Original line of HAIDEP
(c) Estimation by aerophotograph in 2002: Out of total area for ROW, (including viaduct), 1% is houses, garden and pond area, 0.8% is alluvial deposit from Red River.

6 IMPLEMENTATION STRATEGY

The proposed strategy to implement RR4 West is to utilize private sector participation. This chapter discusses the issues and recommendations in adopting a PPP strategy to RR4 West.

6.1 Issues in Implementing PPP in Vietnam

The following are key three issues to be considered when implementing a PPP project in Vietnam.

(i) Country Risk/Economy Level
(ii) PPP Regulatory Framework
(iii) Uncertainty in Demand Forecast

1) Country Risk / Economy Level

The country rating is a starting point in assessing the viability of private financing in developing countries. The rating of Vietnam, as illustrated in Table 6.1.1, is Ba3 as of July by the Moody's country rating for the long term government bond in foreign currency. This is below the speculative grade, at which procurement of private financing in foreign currency should usually require a considerable guarantee and support from both the government and multilateral financial institutions such as World Bank and ADB.

The current GDP per capita of the country is just over 3,000 USD, which implies the low affordability of transportation users.

Table 6.1.1 Country Risk and Economy Level of Vietnam

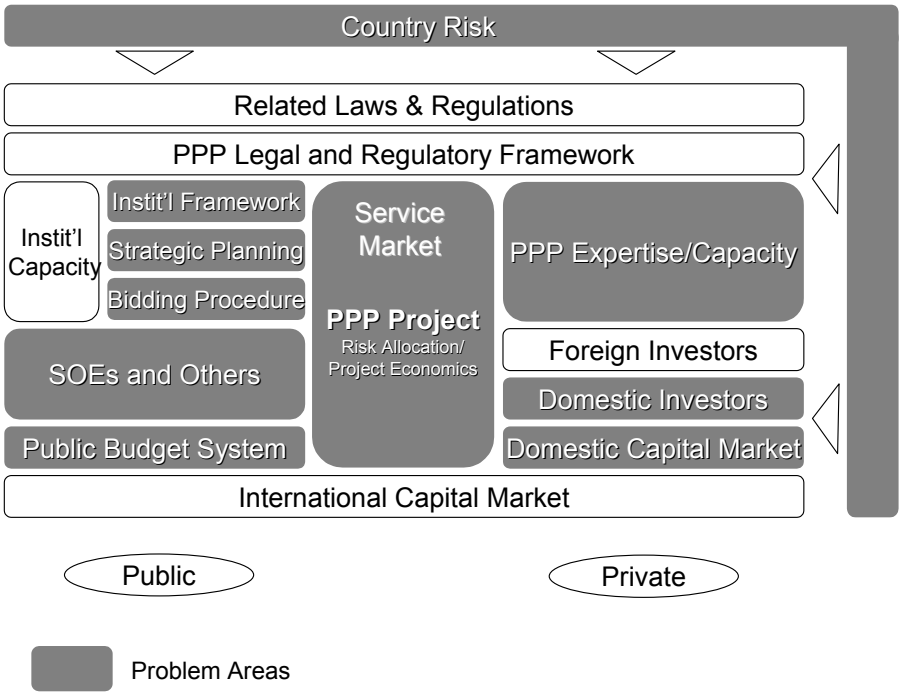
Country	Country Rating (Moody's 2006.7.21)	GDP / Capita (US$ in 2005, IMF
Taiwan	Aa3	27,572
China	A2	7,204
Korea	A3	20,590
Malaysia	A3	11,201
Thailand	Baa1	8,319
Vietnam	**Ba3**	**3,025**
Philippines	B1	4,923
Indonesia	B1	4,458

Source: HAIDEP Study Team
Note: Aaa>Aa>A>Baa>Speculative>Ba>B>Caa>Ca>C (1>2>3)

2) PPP Framework

It is essential for a country to prepare a comprehensive PPP framework when a PPP project is implemented. A preliminary assessment was conducted to evaluate the PPP framework of Vietnam. The areas assessed as problematic are illustrated in Figure 6.1.1.

Figure 6.1.1 Problem Areas in PPP Framework



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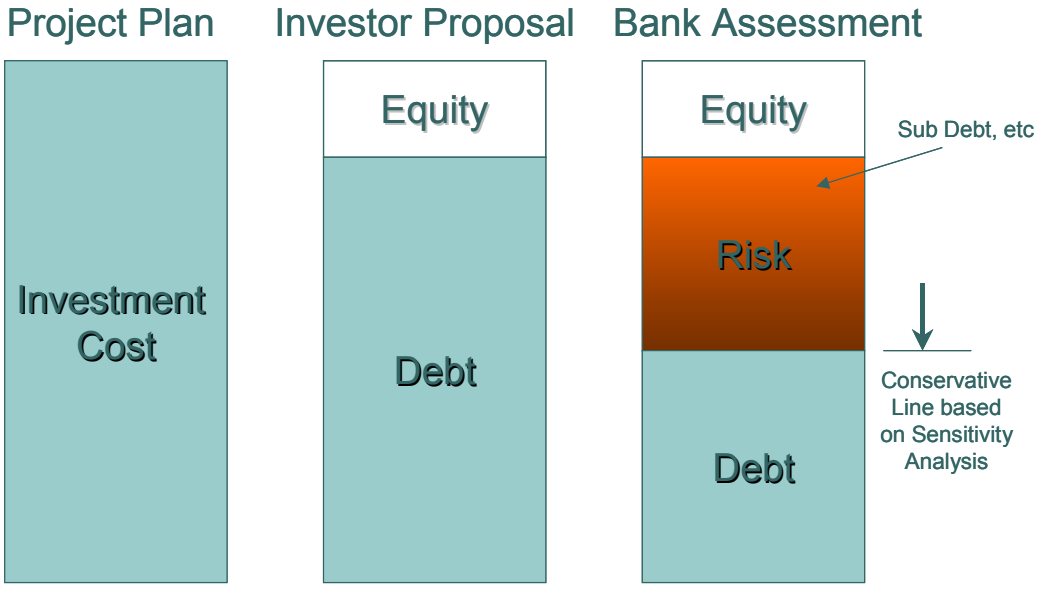
Source: HAIDEP Study Team

3) Uncertainty in Demand Forecast

When the viability of a PPP project in transport sector is discussed, uncertainty in demand forecast is always the most critical issue to address. As illustrated in Figure 6.1.2, the bank always evaluates the project risks of the investor's proposal quite conservatively. When the extent of uncertainty is great, considering that the project has no historical build-up of existing demand, a conservative line of risk assessment may not be determined, thus the viability of financing may turn negative.

Figure 6.1.2 Uncertainty in Demand Forecast



Source: HAIDEP Study Team

6.2 PPP Options to Choose From

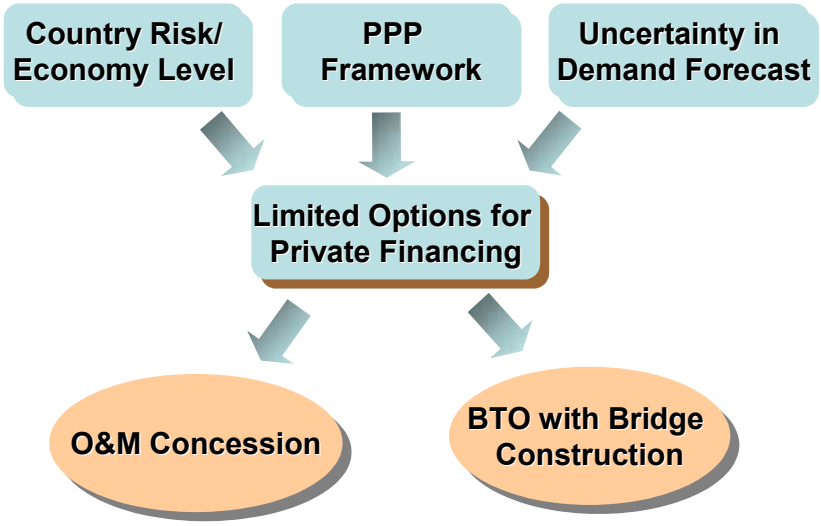
Due to several critical issues discussed above and also to the uncertainty in the demand growth, there are very limited options for private financing when implementation of a PPP project in Vietnam is considered.

There are basically two options to choose from for the implementation of the RR4 project as illustrated in Figure 6.2.1:

- **Option 1:** Operation and Maintenance Concession
- **Option 2:** Bridge Construction, Operation and Maintenance Concession

Option 1 is a risk minimum approach to the private sector and involves no capital investment by the private sector except for limited toll related facilities such as toll booths and telecommunication facilities. Option 2 is a BTO concession with only the bridge construction and the toll related facilities to be shouldered by private investor.

Figure 6.2.1 Limited Options for Private Financing

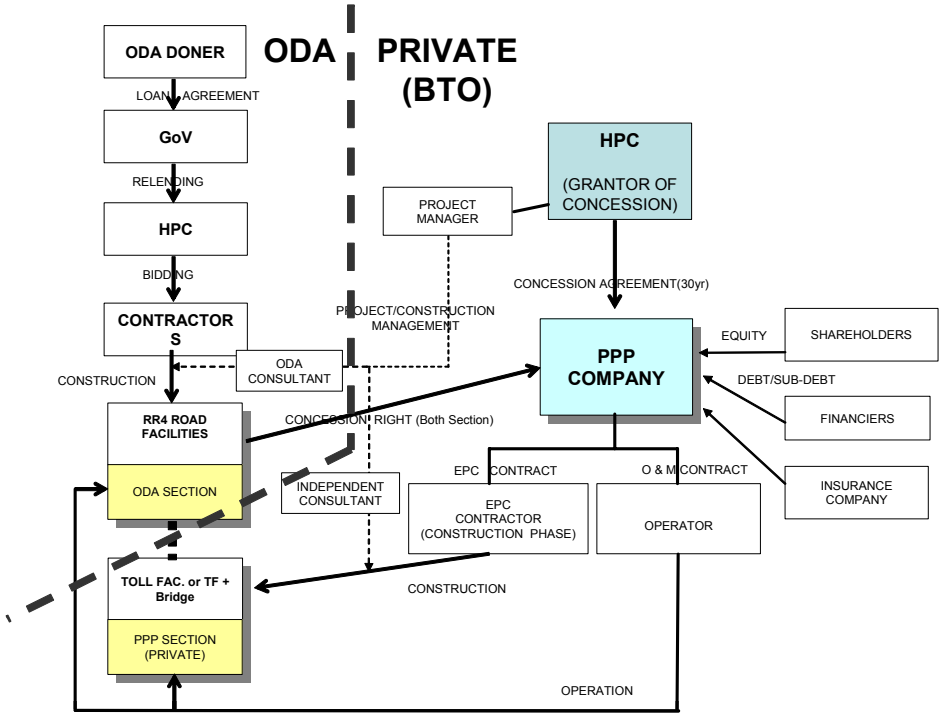


Source: HAIDEP Study Team

Since there is limited potential for private financing in the implementation of the RR4, the project shall need to procure funding from various sources. Figure 6.2.2 shows a potential PPP scheme which utilizes ODA funding for the construction of the basic infrastructure of the RR4. This hybrid PPP model shall have two different components. 1) Basic road infrastructure construction by ODA funding and Operation and maintenance of a toll road with a limited capital investment such as toll facilities 2) and possibly the construction of the Red River Bridge to be financed and managed by the private sector.

The basic road infrastructure shall be built on the basis of conventional ODA procurement with competitive bidding and its use right (concession) shall be given to the PPP company who then shall maintain and operate the whole RR4 as a toll road to recoup its investment.

Figure 6.2.2 Possible Hybrid PPP Structure



Source: HAIDEP Study Team

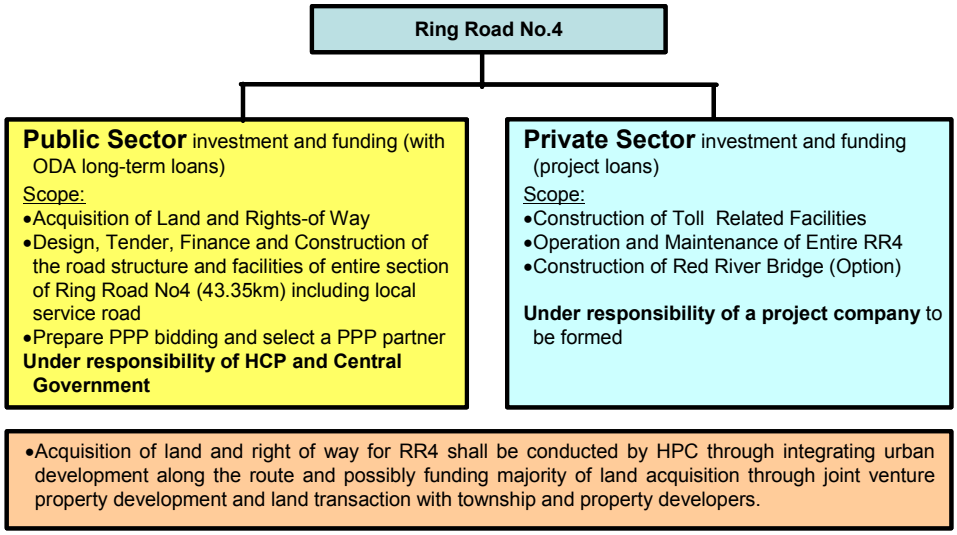
1) Option 1: Operation and Maintenance Concession

The operation and maintenance concession shall require the private sector to share relatively limited risks of the project such as the capital investment of the toll related facilities and the operation and maintenance responsibility of RR4 as a toll road. The private sector will also have the right to collect toll and recover its investment from their revenue stream.

Figure 6.2.3 shows the risk sharing between HPC and the private sector where; HPC shall prepare ODA funding, conduct land acquisition and right of way, manage the design, tender, construction, funding of the entire RR4 facilities on the conventional ODA basis, prepare PPP bidding and select a PPP partner. On the other hand, the private sector shall prepare proposal, participate in the PPP bidding, form a special purpose vehicle for the project, design, construct and finance the related toll facilities, maintain and operate the whole RR4 as a toll road during the concession period.

Acquisition of land and right of way for RR4 shall be conducted by HPC through integrating urban development along the route and possibly funding majority of land acquisition through joint venture property development and land transaction with township and property developers

Figure 6.2.3 Risk Sharing Between Public and Private Sectors



Source: HAIDEP Study Team

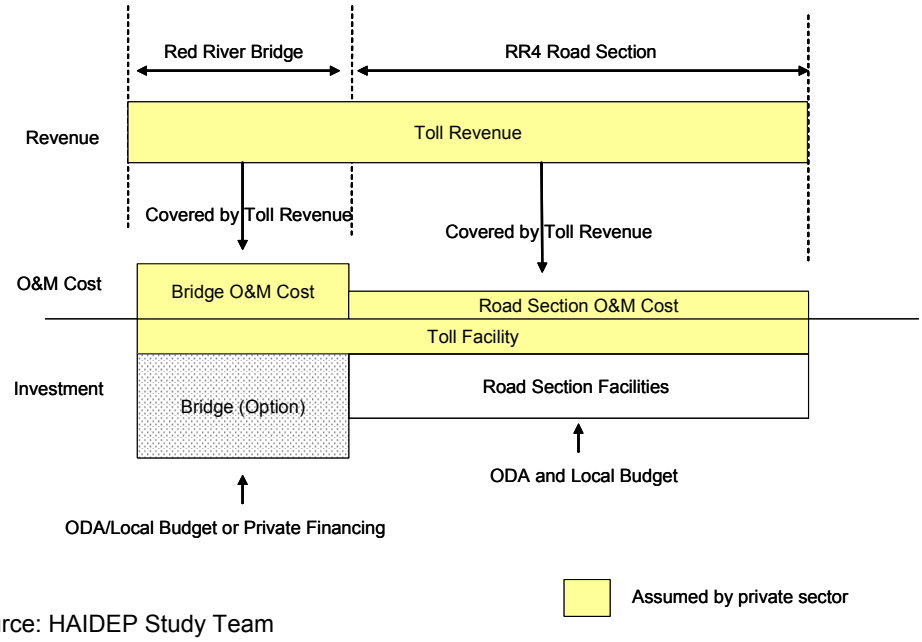
2) Option 2: Construction of Bridge, Operation and Maintenance Concession

The basic structure of this concession is same as the Operation and Maintenance Concession (Option 1) except that the private sector shall additionally shoulder the capital investment to construct the Red River Bridge section of the RR4. Financial viability of this concession shall be assessed through the financial evaluation of the later section of this report.

3) Funding Structure

Figure 6.2.4 shows the funding structure of the PPP scheme where the O&M cost for both the Red River Bridge section and the road section shall be covered by the toll revenue and the capital investment to construct the related toll facilities shall be recouped by the toll revenue. On the other hand, the entire RR4 facilities shall be constructed using both the ODA funding and the HPC's local budget with the construction of the Red River Bridge remaining as an option.

Figure 6.2.4 Funding Structure



Source: HAIDEP Study Team

4) Implementation Schedule

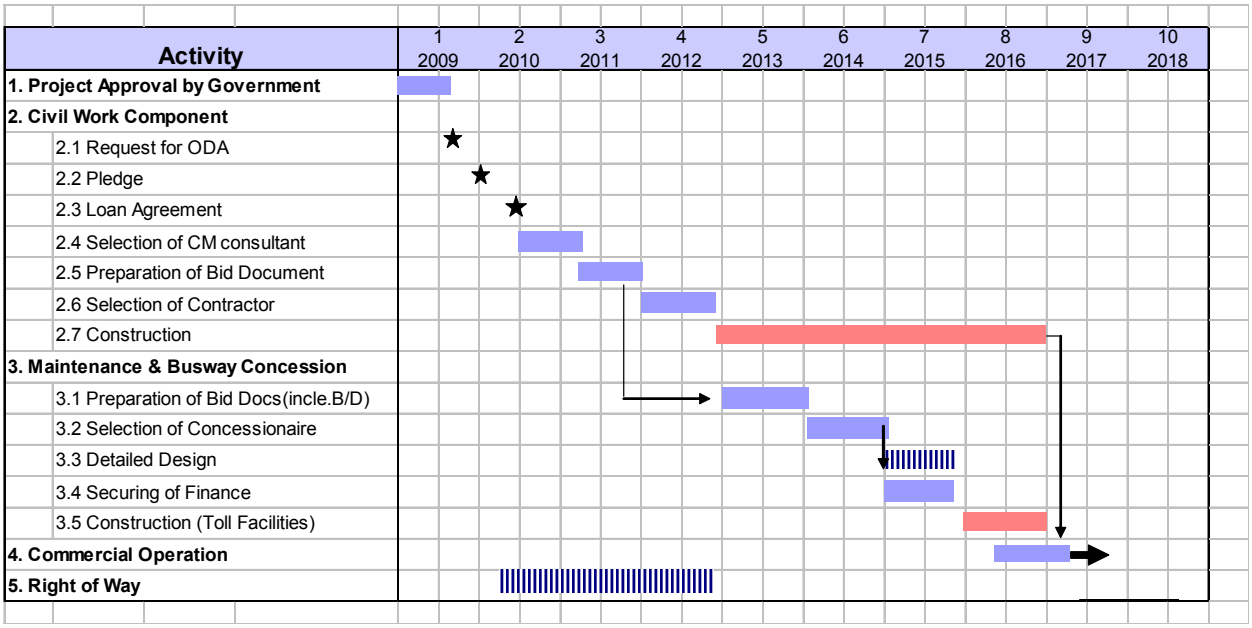
The normal and mandatory stages on which the project will go through to use ODA funds are as follows:

(i) Preparation of the feasibility study;
(ii) Evaluation of the study and inclusion of the project in the lending agency's portfolio;
(iii) Appoint a consultant to carry out the basic engineering design and
(iv) Preparation of detailed design, bill of quantities, and firm cost estimates;
(v) Preparation of bid documents, followed by bidding, evaluation and award;
(vi) Actual construction of the civil works and installation of necessary equipments;
(vii) Testing and commissioning;
(viii) Commencement of operation

On the basis of the contemplated hybrid PPP structure, the construction of the entire RR4 facilities shall be implemented following the above described ODA procurement procedure. As Figure 6.2.5 illustrates, this ODA procurement shall require at least five years from the inception of the project to conduct the official feasibility study by HPC and inclusion of the project in the lending agency's portfolio.

The PPP bidding shall be prepared in parallel with the ODA procurement so that both the ODA procurement for the basic road infrastructure and the selection of the PPP partner will be synchronized to meet the targeted commencement of commercial operation for RR4. It would require eight to nine years from the inception to the commercial operation.

Figure 6.2.5 Implementation Schedule



Source: HAIDEP Study Team

6.3 Recommendations

The following strategies are recommended:

(i) The target year for the commencement of road operation shall be delayed by several years instead of the year 2013 as planned in the HAIDEP Master Plan based on the following considerations:

- Evaluated economic benefit and the result of financial evaluation
- Lead time required for ODA funding

(ii) The PPP scheme should be used for implementing the project since the result of the financial evaluation supported the viability of private sector participation.

(iii) Initial investment and construction of the bridge over the Red River may be shouldered by the private sector (Option 2).

(iv) A thorough analysis should be made to implement the hybrid structure of ODA funding and private sector financing since it is a completely new scheme in the Vietnamese environment.

7 PROJECT EVALUATION

7.1 Traffic Demand Forecast and Analysis

1) Methodology

RR4 West is new a route, thus transport demand forecast must be based on transport demand generation. The demand forecast model has been worked out for urban and inter provincial transportation with the input data for urban transportation derived from the result of HIS and other related surveys (cordon line survey, screen line survey, etc.), while those for inter-provincial transportation were based on the results of traffic surveys which TDSI recently conducted (JICA-The follow-up study of VITRANSS, 2005).

The conventional four step model using JICA-STRADA (System for Traffic Demand Analysis) was adopted as the platform for demand forecast. The four-step model follows the following set of steps:

(i) Trip generation and attraction (estimate of the number of trips generated by and attracted to each zones);
(ii) Trip distribution (estimate of the number of trips traveling between zones)
(iii) Modal share (estimate of the number of trips made using different transport modes); and
(iv) Traffic assignment (estimate of the number of trips per transport link). Details of the demand forecast methodology is described as a Technical Report of HAIDEP.

2) RR4 as a Toll Road

RR4 West is planned to be a tolled expressway, thus usage of RR4 West will be strongly dependent on the level of toll fee considering the proposed HAIDEP road network, there would be several competing alternatives to RR4 West, so charging too high would reduce the traffic utilizing RR4 West.

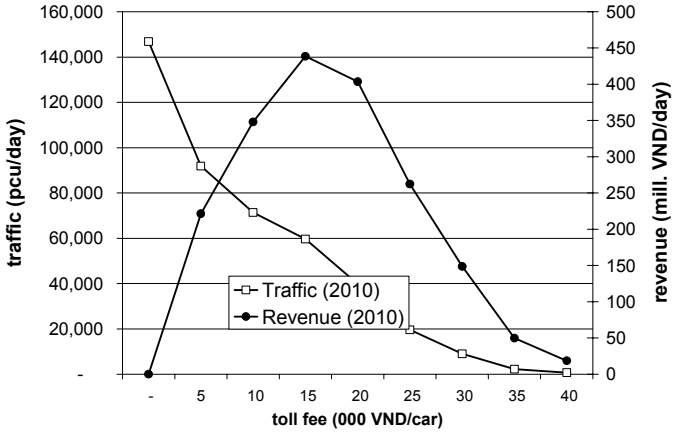
The changes in traffic levels with respect to changes in toll levels would have strong implications to revenue levels, consequently revenue generation is a key strategy in the sustainable implementation of RR4 West.

There are basically two methods of charging tolls, that is using a distance based toll fee (i.e. VND/veh-km) or using a flat charge (i.e. VND/veh). Each has advantages and disadvantages, the selection of system will be based on several factors, such as the nature of ridership, ease of operation, and others. For RR4 West the flat charge system is selected, because it is estimated to yield higher revenues than the distance base system, plus a flat charge system is much easier to operate and will require fewer toll booths. Different classes or types of vehicles are charged different scales of the toll rates and the assumption is as follows:

(i) Class 1(motorcycle) = 0.5 x toll fee
(ii) Class 2 (automobile) = 1.0 x toll fee
(iii) Class 3 (bus) = 1.5 x toll fee
(iv) Class 4 (truck) = 3.0 x toll fee

Traffic and revenue for RR4 West for a flat toll system is shown in the Figure 7.1.1 and Figure 7.1.2.

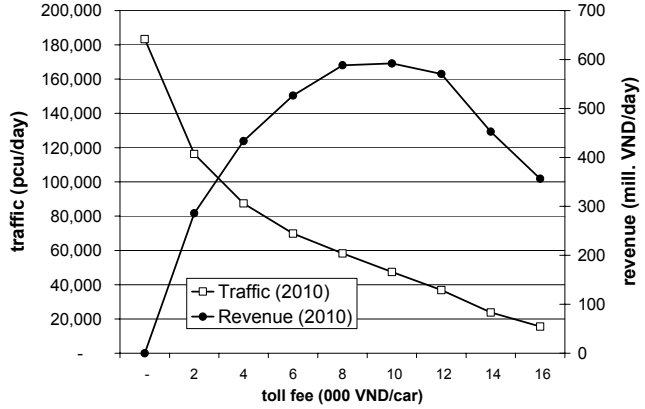
Figure 7.1.1 RR4 Traffic and Revenue, With Flat Toll, 2010



Toll Rate (000 VND/pcu)	Traffic (pcu/day)	Revenue (mill. VND/day)
0	234,667	0
5	161,154	944
10	139,245	1,619
15	121,977	2,137
20	102,034	2,392
25	84,895	2,503
30	70,447	2,489
35	56,971	2,303
40	41,665	1,898

Source: HAIDEP Study Team
Note: Traffic is defined in this figure as the number of vehicles in pcu that will use RR4 West, regardless of distance traveled

Figure 7.1.2 RR4 Traffic and Revenue, With Flat Toll, 2010

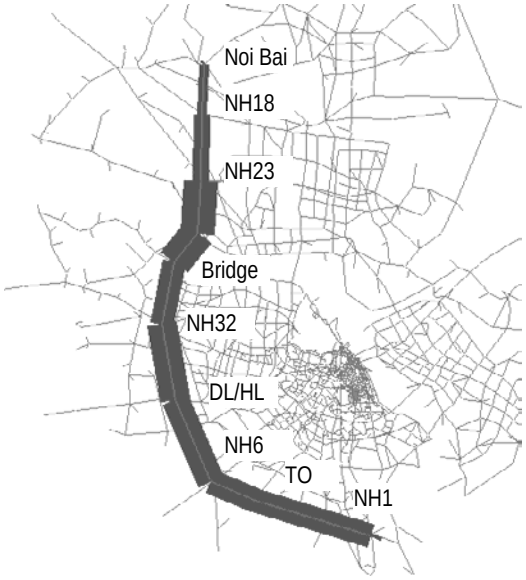


Toll Rate (000 VND/pcu)	Traffic (pcu/day)	Revenue (mill. VND/day)
0	183,331	0
2	116,262	286
4	87,457	433
6	69,860	526
8	58,288	588
10	47,443	592
12	36,874	571
14	23,794	453
16	15,597	356

Source: HAIDEP Study Team
Note: Traffic is defined in this figure as the number of vehicles in pcu that will use RR4 West, regardless of distance traveled

Considering the case of a non-tolled and a tolled RR4 West (assuming revenue maximizing toll), the traffic along RR4 West is illustrated in Figure 7.1.3 and Figure 7.1.4. The segment with the highest demand is the bridge section, where if without toll fee the V/C ratio would be nearly 1. If the revenue maximizing toll is applied, V/C ratio of the bridge section would be around 0.6.

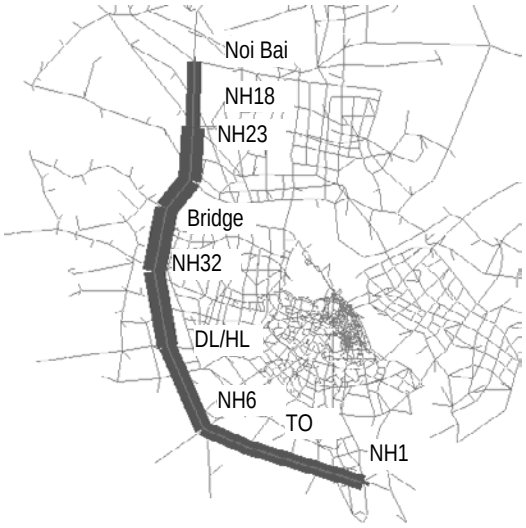
Figure 7.1.3 RR4 West 2020 Traffic Without Toll



Section	Segment Traffic (pcu/day)	V/C
Noi Bai-NH18	7,521	0.11
NH18-NH23	26,848	0.38
NH23-Bridge	67,532	0.96
Bridge-NH32	39,209	0.56
NH32-DL/HL	52,885	0.75
HL-NH6	49,249	0.70
NH6-TO	44,038	0.63
TO-NH1A	39,057	0.55
Average	43,466	0.62

Source: HAIDEP Study Team

Figure 7.1.4 RR4 West Section 2020 Traffic With Toll (25,000 VND/pcu)



Section	Segment Traffic (pcu/day)	V/C
Noi Bai-NH18	1,602	0.02
NH18-NH23	18,977	0.27
NH23-Bridge	41,866	0.59
Bridge-NH32	38,675	0.55
NH32-HL	35,927	0.51
HL-NH6	31,215	0.44
NH6-TO	23,068	0.33
TO-NH1A	21,990	0.31
Average	28,358	0.40

Source: HAIDEP Study Team
Note: 25,000 VND/pcu toll is revenue maximizing toll for 2020

7.2 Economic Evaluation

1) Methodology and Assumptions

RR4 was evaluated from the economic point of view, by comparing the economic benefit brought about by the project and the economic cost required for construction, maintenance and operation of the project. This cost-benefit analysis is made through called comparison of “with and without” the project.

Economic cost is defined as the value of goods and services consumed for the implementation of the project, which is obtained by modifying the financial cost estimated by engineers.

The economic benefit of a project is the savings on transportation cost attributable to the implementation of the project. Main factors of transportation cost are the vehicle operating cost (VOC) and the travel time cost (TTC). Below are two ways of measuring the economic benefit, according to the selection of the base network.

(1) Plus Case

The base network is the present network.

The present network is assumed to be maintained in the future without implementing any other projects than the project to be evaluated. The economic benefit is defined as the decreased transportation cost by the addition of the project to the network.

(2) Minus Case

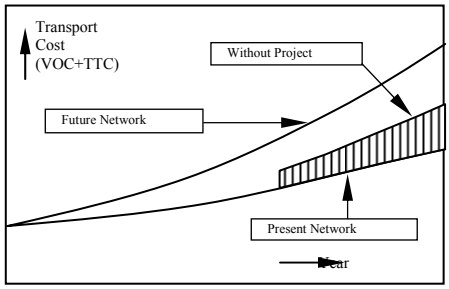
The base network is the Master Plan network.

The Master plan projects are assumed to be implemented as the planned schedule. The economic cost is defined as the increased transportation cost by eliminating the project from the network.

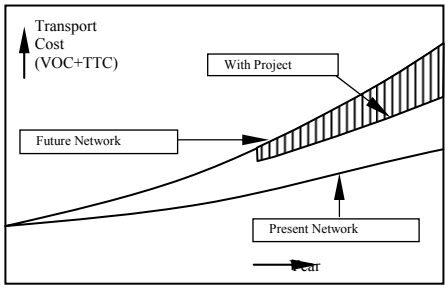
The benefits of both cases are generally different and then the resultant internal rates of return (IRRs) are different. In this analysis, the latter case (Minus Case) is applied because the subject project, RR4 was selected amongst the many projects proposed in the HAIDEP Master Plan, with a precondition that the other projects should also be implemented according to the recommended schedule. The minus case will generally result in an IRR lower than the plus case. Therefore, as shown in Figure 7.2.1 it is safer to adopt the minus case.

Figure 7.2.1 Definition of Economic Benefit of Project

(1) Benefit of Project (Plus Case)



(2) Benefit of Project (Minus Case)



Source: HAIDEP Study Team

2) Economic Cost

The financial cost of the project stated in the proceeding chapter was converted to economic cost, by taking the following procedure.

(i) The financial cost includes taxes such as VAT and import duties of 13 to 21% of the construction cost. All the taxes are excluded from the economic cost.

(ii) According to the annual statistical report, recent unemployment rate in Hanoi is 6.8%. Under such situation, the shadow wage rate (SWR) is estimated at 0.91 using the Haveman's formula:

SWG = (Wage Rate in market) x (1.25 - Unemployment Rate / 0.2)

= (Wage Rate in market) x 0.91

This factor is multiplied to the unskilled labor cost which is included in the construction cost in order to duly evaluate the economic value of unskilled labor force.

(iii) The financial cost allows for 10% contingency, half of which is regarded as a physical contingency and the other half is price contingency. The economic cost takes only the physical contingency and the price contingency is excluded.

As shown in Table 7.2.1, estimated economic cost of each package corresponds to 83% to 89% of the financial cost.

Table 7.2.1 Financial and Economic Cost of RR4

(US$ million)

Item	Financial Cost							Economic Cost	Economic /Financial
Package	Construction Cost			Engineering	Contingency	Land Cost	Total		
		Tax	Unskilled						
Package 1	80.9	10.5	2.8	6.1	8.7	38.1	133.8	117.3	0.88
Package 2	83.7	10.9	2.9	6.3	9.0	61.3	160.2	143.1	0.89
Package 3a	146.8	30.8	3.7	11.0	15.8	0.0	173.5	130.5	0.75
Package 3b	25.3	3.3	0.9	1.9	2.7	2.4	32.3	27.1	0.84
Package 3c	25.3	3.3	0.9	1.9	2.7	0.0	29.9	24.7	0.83
Package 4	70.0	9.1	2.5	5.3	7.5	26.2	109.0	94.7	0.87
Total	431.9	-	-	32.4	46.4	128.0	638.7	537.5	0.84

Source: HAIDEP Study Team

Following the implementation program stated in the preceding chapter, annual investment amounts were estimated as shown in Table 7.2.2. The year 2007 is scheduled for fund-raising inclusive of international loan borrowing. Land acquisition will start in 2008 and will take thee years. Detail design work will be done in 2008-2009. Construction will take four years from 2010-2013. The project road will open in the mid-2013

Table 7.2.2 Investment Schedule of RR4 in Economic Cost

(US$ million)

Cost Item	2008	2009	2010	2011	2012	2013	Total
Land Acquisition	51.2	64.0	12.8				128.0
Detail Design	3.3	7.6					10.9
Construction			79.7	119.6	159.4	39.9	398.6
Total	54.5	71.6	92.5	119.6	159.4	39.9	537.5

Source: HAIDEP Study Team

3) Economic Benefit

Economic benefit is defined as the savings in vehicle operating cost (VOC) and travel time cost (TTC) brought about by the implementation of a project. For taking this approach, unit VOC and TTC were estimated. The unit VOC was estimated for the representative vehicles. Their characteristics are set as shown in Table 7.2.3. For those vehicles, financial and economic cost were estimated by cost components such as (1) fuel cost, (2) lubricant cost, (3) tire cost, (4) repair cost, (5) depreciation cost, (6) capital opportunity cost, (7) overhead cost, and (8)crew cost.

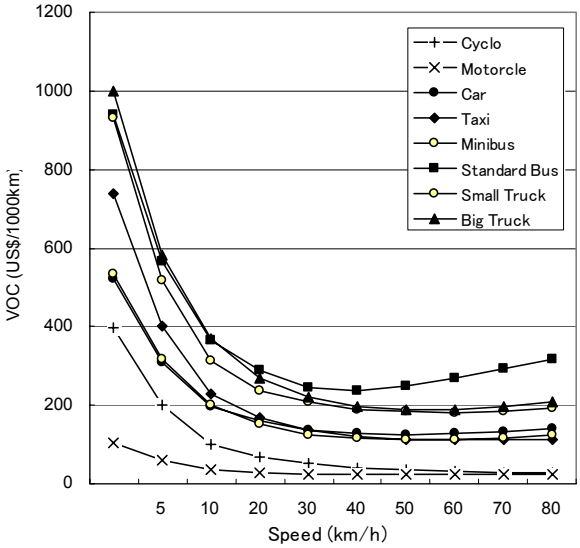
The results were aggregated and expressed as a function of travel speed. The unit VOCs of main vehicle types were estimated as shown in Figure 7.9.1. The VOCs become smaller as travel speeds increase. Around 40kph the “economic speed” is reached, wherein the VOC is at the minimum level. At higher speeds, the VOCs likewise become higher, mainly because consumption rates of fuel and tires become larger beyond the economic speed.

Table 7.2.3 General Characteristics of Representative Vehicles

No.	Vehicle Type	Representative Model	No. of Tires	Fuel Type	Vehicle Cost		Annual Operation (km)	Annual Hour Usage (h)
					Financial[1)]	Economic[2)]		
1	Bicycle	(Local)	2		40	36	1,500	150
2	Cyclo	(Local)	3		60	55	9,000	90
3	Motorcycle	Honda, Suzuki	2	Gasoline	909	909	7,500	326
4	Bike Taxi	Honda, Suzuki	2	Gasoline	1,031	909	18,000	783
5	Car	Matsuda, Toyota	4	Gasoline	1,031	16,667	33,000	1,650
6	Taxi	Kia, Suzuki, Hyundai	4	Gasoline	26,250	12,000	60,000	3,000
7	Lambro	(Local)	3	Gasoline	16,360	191	60,000	3,333
8	Mini Bus	Transinco	4	Diesel	210	27,273	75,000	4,167
9	Standard Bus	Daewoo, Samco	4	Diesel	30,600	55,682	75,000	4,167
10	Articulated Bus	Volvo (imported)	6	Diesel	204,000	95,238	75,000	4,167
11	Small Bus	Hyundai	4	Gasoline	10,774	9,603	45,000	1,800
12	Big Truck	Isuzu	4	Diesel	23,970	21,364	90,000	3,000
13	Container Truck	Hino	10	Diesel	67,779	31,643	120,000	4,000

Source: HAIDEP Study Team
1) Includes vehicle registration cot, from dealer interviews.
2) Excludes VAT, consumption tax, import tax and registration cost

Figure 7.2.2 Unit Vehicle Operating Cost by Travel Speed



Source: HAIDEP Study Team

The unit TTCs were estimated for passengers by each mode based on their income. According to the results of home interview surveys, monthly income distribution by transportation mode as shown in Table 7.2.4 were in the range of 1.81 million VDN for bicycle users and 3.85 million VND for car users. Hourly TTC or value of time can be estimated by dividing them by monthly working time (168 hours). However, they represent the value of time while working and then, can not be applied to travel time directly.

Travel time for business purpose can be considered as the time value and travel time for going to work and returning from work place to home is assumed to be worth a half of the time value at work. No value is given to travel time for other purposes. Thus, average value of travel time is obtained by multiplying the share of business trip and "to work" trip for each mode. It is further assumed that the value of travel time would increase at the same rate of the GRDP per capita growth (8.87% per annum).

Table 7.2.4 Unit Travel Time Cost (Value of Time)

Item	Monthly Income (1000 VND)	Bicycle	MC	Car	Bus	All
Household Composition by Income Group (%)	500	3.1	0.3	0.0	2.4	1.3
	1,50	45.1	15.1	0.4	29.0	20.6
	2,500	39.2	39.5	6.4	43.2	34.7
	3,500	7.0	30.7	37.2	19.6	25.4
	4,500	5.6	14.4	56.0	5.9	18.0
Monthly Average	(1,000 VDN)	1,811.0	2,601.0	3,858.0	2,072.0	2,411.0
Hourly Average	(1,000 VDN)	10.8	15.5	23.0	12.3	14.4
Trip Composition by Purpose (%)	At Work	3.4	6.5	25.3	3.8	5.6
	To / From Work	14.8	27.7	20.4	14.5	21.1
VOT at Trip in 2005	(1,000 VDN)	2.0	5.3	10.5	2.3	3.8
VOT at Trip in 2020	(1,000 VDN)	6.9	18.7	37.0	8.0	13.5

Source: HAIDEP Study Team.

Since an OD traffic assignment on a network gives traffic volumes by type of vehicles and their speed for every link, total VOC and TTC spent for daily traffic in the whole network are obtained using the unit VOCs and TTCs. Accordingly, the economic benefit of a project is estimated as the difference of total costs in "with project" case and "without project" case. Table 7.2.5 shows the annual economic benefit generated by the RR4 in the two benchmark years of 2010 and 2020.

Table 7.2.5 Economic Benefit of RR4

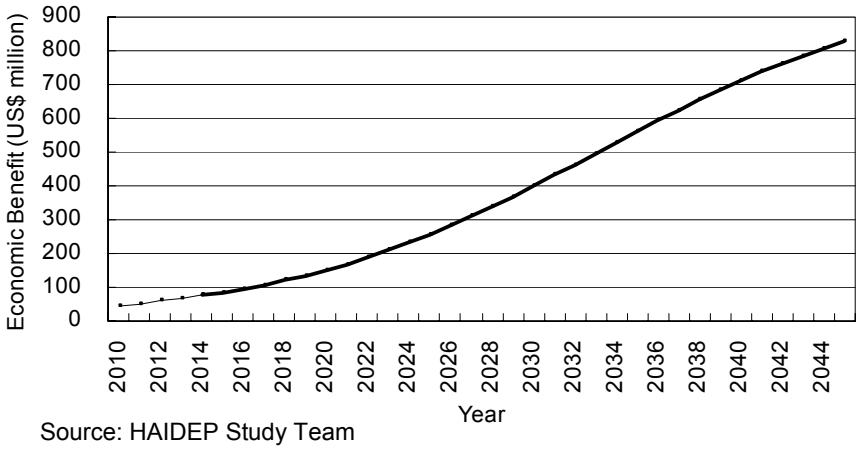
(US$ million)

Year	Benefit Source	Motorcycle	Car	Bus	Truck	Total
2010	VOC Savings	6.6	5.7	3.6	25.8	41.7
	TTC Savings	16.2	15.3	11.1	-	42.6
	Total Benefit	22.8	21.0	14.7	25.8	84.3
2020	VOC Savings	11.1	8.1	8.4	33.6	61.2
	TTC Savings	66.3	105.6	45.6	-	217.5
	Total Benefit	77.4	113.7	54.0	33.6	278.7

Source: HAIDEP Study Team.

Total economic benefit will grow about 3.5 times in ten years from 2010 to 2020 due to a rapid increase of traffic volume on the RR4. However, the rapid increase will not continue for a long time because the capacity of the Ring Road is limited. If the traffic volume is extrapolated beyond 2020, it will reach the daily capacity of 6 lane access controlled highway, 120,000 pcu before 2040. It may be reasonable to consider, after the road is fully saturated, the economic benefit will be gradually levelling off. For this reason, the increasing trend of benefit was fitted to a logistic curve as shown in Figure 7.2.3.

Figure 7.2.3 Trend of Annual Economic Benefit of RR4



Source: HAIDEP Study Team

4) Economic Evaluation

Table 7.2.6 shows the evaluation result of comparing the economic cost and benefit and calculating indicators of an internal rate of return (IRR), net present value (NPV) and B/C ratio. The last two were calculated using the discount rate of 12% which was widely used in Vietnam as a capital opportunity rate.

The economic IRR is 18.6% which is much higher than the threshold of 12%, which clearly shows the project is economically feasible. The B/C ratio is estimated at over 2.0 and the NPV is almost same as the project cost. Table 7.2.7 is the cash flow of the cost and the benefit stream.

Table 7.2.6 Evaluation Indicator of RR4

Indicator	Unit	Value
E-IRR	%	18.6
NPV	US$ million	505.1
B/C	-	2.06

Source: HAIDEP Study Team.

Table 7.2.8 shows a result of the sensitivity analysis done by changing cost and benefit. The EIRR goes below 12.0 only when about half of benefit is lost. The project will still feasible be even if the cost doubles. (The EIRRs are below 12% where shaded). Thus, the economic viability of the project is very stable.

As the result, the project is concluded economically feasible. However, this kind of arterial roads project will usually imply EIRR higher than 20%. In this sense, opening in 2013 may be slightly premature. If the project completed in 2020 by postponing the schedule 7 years, the EIRR will be remarkably improved to 27.2%. In any case, the ROW should be acquired in advance. Otherwise, the route area will be built up soon and land acquisition will become impossible or very costly even if possible.

Table 7.2.7 Cash Flow of Economic Coat and Benefit of RR4

(US$ million)

Year	Capital Cost	Maintenance Cost	Operation Cost	Economic Benefit	Net Cash Flow	EIRR (%)
2008	54.46				-54.46	
2009	71.62				-71.62	
2010	92.52				-92.52	
2011	119.57				-119.57	
2012	159.43				-159.43	
2013	39.86	-	2.49	33.22	-9.13	-
2014		0.66	5.63	75.07	68.78	-
2015		0.66	6.35	84.71	77.70	-
2016		0.66	7.16	95.46	87.65	-
2017		0.66	8.06	107.42	98.71	-
2018		0.66	9.05	120.67	110.97	-2.3
2019		1.75	10.15	135.32	123.41	1.8
2020		0.66	11.36	151.43	139.41	5.0
2021		0.66	12.68	169.08	155.74	7.4
2022		0.66	14.13	188.34	173.56	9.4
2023		0.66	15.69	209.24	192.89	10.9
2024		1.75	17.38	231.79	212.65	12.2
2025		0.66	19.20	255.99	236.13	13.2
2026		0.66	21.13	281.79	260.00	14.1
2027		0.66	23.18	309.11	285.27	14.8
2028		0.66	25.34	337.83	311.83	15.4
2029		1.75	27.58	367.79	338.46	15.9
2030		0.66	29.91	398.82	368.25	16.3
2031		0.66	32.30	430.68	397.72	16.7
2032		0.66	34.73	463.12	427.73	17.0
2033		0.66	37.19	495.88	458.04	17.3
2034		1.75	39.65	528.68	487.28	17.5
2035		0.66	42.09	561.23	518.48	17.7
2036		0.66	44.49	593.26	548.11	17.8
2037		0.66	46.84	624.52	577.02	18.0
2038		0.66	49.11	654.77	605.00	18.1
2039		1.75	51.29	683.82	630.78	18.2
2040		0.66	53.36	711.50	657.48	18.3
2041		0.66	55.33	737.69	681.70	18.4
2042		0.66	57.17	762.29	704.46	18.4
2043		0.66	58.89	785.26	725.71	18.5
2044		1.75	60.49	806.58	744.33	18.5
2045		0.66	61.97	826.24	763.62	18.6

Source: HAIDEP Study Team

Table 7.2.8 Sensitivity Analysis of Economic Evaluation of RR4

Conditions		Change in Cost			
		Base	20% up	40% up	60% up
Change in Benefit	Base	18.6	16.9	15.6	14.5
	20 down	16.5	15.0	13.8	12.9
	40down	14.2	12.8	11.8	10.9
	60down	11.3	10.1	9.1	8.4

Source: HAIDEP Study Team

7.3 Financial Evaluation

1) Methodology and Approach

The project of RR4 was financially evaluated with the purpose of examining the profitability of the project and looking for a possibility to apply a PPP scheme Public and Private Partnership (PPP) to this project. The analysis was done by comparing cost and revenue, taking these two steps.

In the first step, the cost-revenue cash flow was estimated at 2006 price without considering inflation, in the same way as done the economic evaluation. The evaluation indicators derived from the cash flow are expressed in real term and therefore suggestive to compose a PPP scheme. Here, tax payment is also disregarded.

In the second step, after planning the PPP scheme, another cash flow simulation was conducted under a set of realistic assumptions on fund raising, terms of loan and inflation i.e. price escalation etc. In this simulation, cash outflow includes the tax payment and then depreciation cost is necessary to be accounted in the operating cost. Main purpose of this analysis is to examine if a financially sound operation can be expected under the planned scheme. In addition, how the profit implied to be gained from in the project will be distributed among main stakeholders analyzed using the simulation results. It should be noted that all the variables and indicators here are expressed at current price and is different from those in the first step.

2) Capital Cost

Financial cost estimated in a preceding chapter is capital cost needed for initial investment which is summarized in Table 7.3.1. The annual investment amounts in Table 7.3.2 are estimated following the same proportion as used in the economic evaluation, which was assumed based on the proposed implementation schedule. The first stage sections of RR4 is planned to open in the mid-2013 in the schedule.

Table 7.3.1 Financial Cost of RR4 Project

(US$ million)

Item Package	Const Cost	Land Cost	Engineering 7.5%	Contingency 5.0%	Total Cost
Package 1	80.94	38.1	6.1	8.7	133.8
Package 2	83.65	61.3	6.3	9.0	160.2
Package 3a	146.76	0.0	11.0	15.8	173.5
Package 3b	25.27	2.4	1.9	2.7	32.3
Package 3c	25.25	0.0	1.9	2.7	29.9
Package 4	70.00	26.2	5.3	7.5	109.0
Total	431.87	128.0	32.4	46.4	638.7

Source: HAIDEP Study Team

Table 7.3.2 Investment Schedule of RR4 in Terms of Financial Cost

(US$ million)

Cost Item	2008	2009	2010	2011	2012	2013	Total
Land Acquisition	51.2	64.0	12.8				128.0
Detail Design	3.9	9.1					13.0
Const			99.5	149.3	199.1	49.8	497.7
Total	55.1	73.1	112.3	149.3	199.1	49.8	638.7

Source: HAIDEP Study Team

3) O&M Cost

The annual operating and maintenance costs were calculated according to the O&M cost estimation method stated in Table 7.3.3, which was set up basically following the precedent of Phy My Bridge.

Table 7.3.3 Standard Operation and Maintenance Cost

Operating Cost			7.5% of gross revenue
Maintenance Cost	Routine Maintenance	Road Section	3.0% of construction cost every year
		Bridge Section	0.6% of construction cost every year
	Periodic Maintenance	Road Section	5.0% of construction cost every 5th year
		Bridge Section	5.0% of construction cost every 5th year and 13.0% for overhauling every 15th year

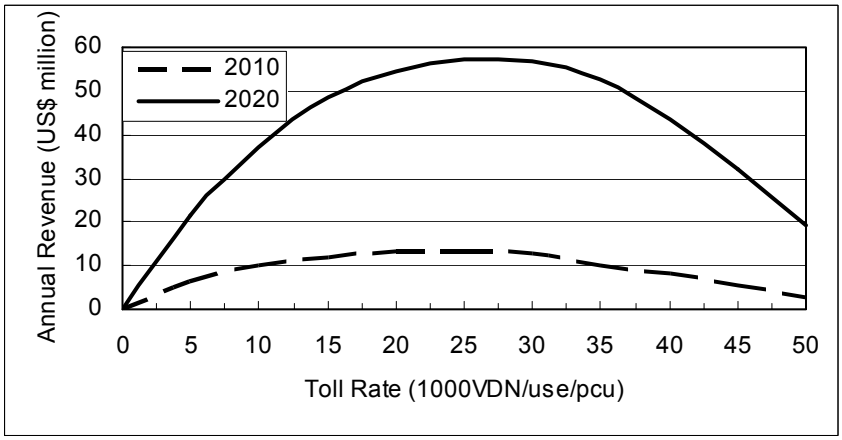
Source: HAIDEP Study Team

4) Revenue

Annual revenue of a toll road is estimated as the summation of the product of the demand (traffic volume) and the toll rate. The demand will become the maximum when the road is free of charge and the demand will become less as the toll rate rises higher. If the toll is zero, the revenue is zero and if the toll rate is infinitely high, the revenue is also zero because of no demand. Thus, the revenue will draw a concave and have a peak point at a certain toll rate.

Based on the results of demand forecast under various toll rates, the revenue of RR4 was estimated to change as drawn in Figure 7.3.1, reaching the peak at around VDN 20,000 per use per one passenger car unit (PCU) in 2010 and at around VDN 26,000 per use in 2020. This shift of the toll rate maximizing the revenue is partly because of change in users' time value stated in the previous section and partly because of change in traffic congestion in the road network.

Figure 7.3.1 Toll Rate and Annual Toll Revenue



Source: HAIDEP Study Team

The revenue-maximizing toll rate is not necessarily the optimum rate. From the users' standpoint, apparently the cheaper, the better. On the other hand, the operator or investor of the project want to maximize the revenue. Practically, a toll rate should be politically determined by compromising different interests.

As a prevailing consensus, the toll rate should be lower than the economic benefit

accruing to a toll road user. The estimated economic benefit of using a toll road for 10 km distance is in the range of VDN 15,000 to VDN 23,000 in 2010. Therefore, the revenue-maximizing toll rate of VDN 20,000 is slightly higher than the benefit in 2010. In general, the economic benefit becomes larger annually because the average time value becomes higher and traffic congestion in the road network becomes more serious. In year 2020, the benefit will exceed VDN 30,000, which is larger than the revenue maximizing toll rate of VDN 26,000 in the year.

Based on the analysis mentioned above, the toll rate of RR4 is assumed in this analysis at a flat rate of VDN 10,000 per PCU in 2010 and by raising the rate 10% per annum, at VDN 26,000 in 2020. If multiplying the rate by PCU of each vehicle type, the toll rates are as shown in Table 7.3.4. The RR4 is scheduled to open in the mid-2013 and then the toll rates at the opening were calculated by interpolation. The toll rate for bus will be applied to inter-city buses and private buses because no city buses will be operated on RR4.

Table 7.3.4 Recommended Toll Rate of RR4

Toll Rate	2010	2013	2020
Car	10,000	13,000	26,000
Bus	25,000	33,000	65,000
Truck	30,000	39,000	78,000
Motorcycle	5,000	6,000	13,000

Source: HAIDEP Study Team

The toll revenue in 2010 will be US $ 13.5 million under the toll rate of VDN 10,000 per PCU if the RR4 is open and in 2020 it will be US$ 63.2 million and then annual revenue in the opening year is US$ 21.0 (Table 7.3.5).

Table 7.3.5 Annual Revenue of RR4

(US$ million)

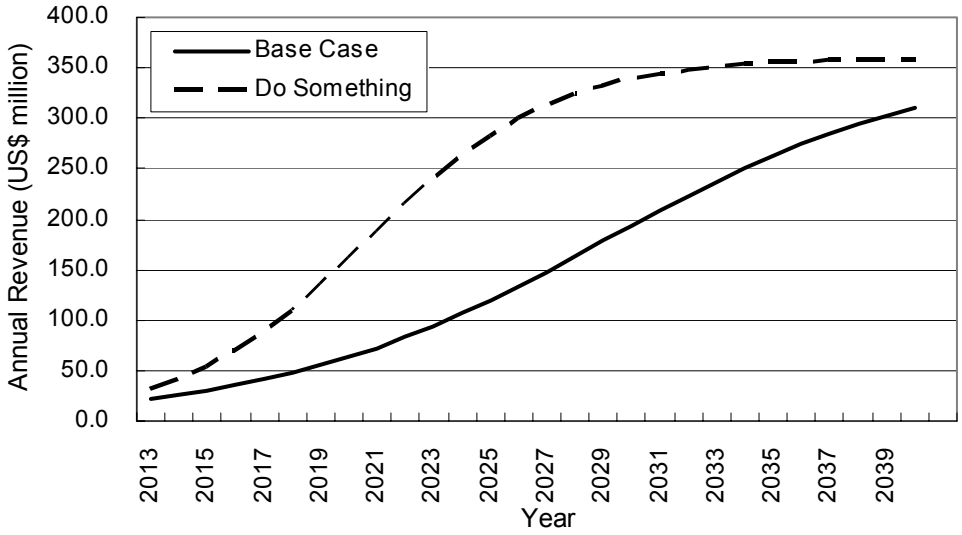
Toll Rate	2010	2013	2020
VND 10,000/use	13.5	-	36.9
VDN 13,000/use	-	21.0	-
VND 26,000/use	-	-	63.2

Source: HAIDEP Study Team

According to the estimated revenue, it will grow very rapidly even though it is expressed in real term (at 2006 price) without inflation. It is not rational, however, to consider that revenue will continue to grow in such a high speed beyond 2020 because the capacity of the RR4 is limited. Therefore, the revenue was extrapolated not exponentially, but by applying a logistic curve as illustrated in Figure 7.3.2.

The base case assumes that all the projects recommended in the HAIDEP Master Plan are implemented as scheduled. However, if no projects are implemented except on-going and committed projects (This case is called “Do something Case”), the RR4 will have more demand and then the revenue will be much higher at US$ 102.3 million (1.6 times of the base case).

Figure 7.3.2 Estimation of Annual Revenue of RR4



Source: HAIDEP Study Team

5) Project Evaluation

(1) Cash Flow at Constant Price

Comparing the cost and the revenue, the financial cash flow is shown in Table 7.3.6, assuming the project life was 30 years after opening in 2013. The financial internal rate of return (FIRR) was calculated to be 9.5% in the real term. Actually a certain percentage of inflation shall be added to this in the nominal cash flow. According to the FIRR in the right-most column of the table, the FIRR value will not improve even if the project life is made longer.

The FIRR at 9.5% in the real term is in a moderate level as a toll road project. If the average capital opportunity is 12%, which is widely used in feasibility studies in Vietnam, the project RR4 is not financially feasible. Under the discount rate of 12%, the net present value (NPV) is negative because the FIRR is lower than the threshold. The B/C ratio is also lower than 1.0 as shown in Table 7.3.7.

However, these indicators shows the RR4 is profitable enough to be implemented as a public investment project using a low-interest ODA loan or under a PPP scheme, partially inviting private fund. The project will expectedly be operated in a sound cash flow.

As stated in Figure 7.3.3, the base case assumes that all the projects proposed in the HAIDEP Master Plan are to be implemented as scheduled. Among the projects, there are more or less competing ones against the RR4. Without implementing such competing projects, the indicators for the financial evaluation of RR4 will be improved.

A new case called “Do Something” Case is defined as using such a network where no new projects are included other than on-going projects and committed projects. Under the “Do Something” Case, the FIRR of RR4 becomes 14.7% and the NPV is US$157.8 million, (Table 7.3.7). If the network includes no new projects, RR4 is judged highly feasible. Thus, the financial feasibility is significantly affected by other projects which are competing against the RR4.

Table 7.3.6 Financial Net Cash Flow of RR4

(US$ million)

Year	Investment	Maintenance	Operation Cost	Revenue	Net Cash Flow	Cumulative Cash Flow	FIRR
2008	55.1				-55.1	-55.1	
2009	73.1				-73.1	-128.2	
2010	112.3				-112.3	-240.5	
2011	149.3				-149.3	-389.8	
2012	199.1				-199.1	-588.9	
2013	49.8		0.8	11.0	-39.6	-628.5	
2014		11.2	1.9	25.7	12.6	-615.9	
2015		11.2	2.3	30.1	16.6	-599.3	
2016		11.2	2.6	35.1	21.3	-578.0	
2017		11.2	3.1	40.8	26.6	-551.4	
2018		36.7	3.6	47.4	7.1	-544.2	-
2019		11.2	4.1	54.8	39.6	-504.7	-
2020		11.2	4.7	63.2	47.3	-457.4	-
2021		11.2	5.4	72.5	55.9	-401.4	-
2022		11.2	6.2	82.9	65.5	-335.9	-
2023		36.7	7.1	94.2	50.5	-285.5	-
2024		11.2	8.0	106.5	87.3	-198.1	-
2025		11.2	9.0	119.6	99.5	-98.6	-1.6%
2026		11.2	10.0	133.6	112.4	13.8	0.2%
2027		11.2	11.1	148.1	125.9	139.7	1.7%
2028		54.0	12.2	163.1	96.9	236.5	2.5%
2029		11.2	13.4	178.4	153.8	390.4	3.7%
2030		11.2	14.5	193.6	167.9	558.3	4.6%
2031		11.2	15.7	208.7	181.9	740.2	5.4%
2032		11.2	16.8	223.4	195.4	935.6	6.1%
2033		36.7	17.8	237.4	182.9	1118.6	6.6%
2034		11.2	18.8	250.8	220.8	1339.4	7.1%
2035		11.2	19.7	263.2	232.3	1571.7	7.6%
2036		11.2	20.6	274.8	243.0	1814.7	8.0%
2037		11.2	21.4	285.3	252.8	2067.5	8.3%
2038		36.7	22.1	294.9	236.1	2303.6	8.6%
2039		11.2	22.8	303.5	269.5	2573.1	8.8%
2040		11.2	23.3	311.1	276.6	2849.7	9.0%
2041		11.2	23.8	317.8	282.8	3132.6	9.2%
2042		11.2	24.3	323.8	288.3	3420.9	9.4%
2043		54.0	24.7	328.9	250.2	3671.1	9.5%

Source: HAIDEP Study Team

Table 7.3.7 Financial Evaluation of RR4 at 2006 Constant Price

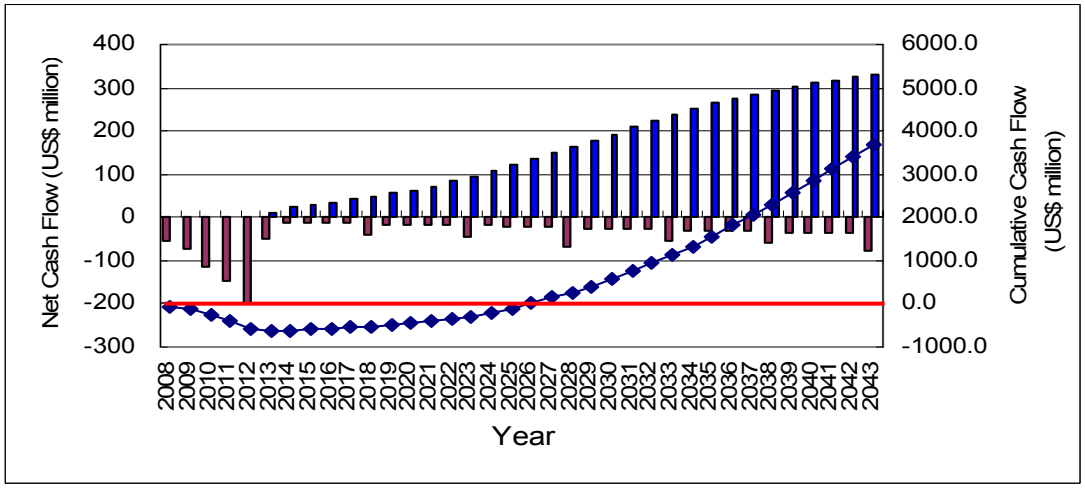
Indicator	Unit	Base Case	Do-Something Case
FIRR	%	9.5	14.7
NPV	US$ million	-124.1	157.8
B/C	-	0.73	1.33

Source: HAIDEP Study Team

Figure 7.3.3 illustrates the cash flow of both cases. The cumulative cash flow will change to positive in 14th year after opening for the base case and 9th year for the “Do Something” Case. It should be noted that these are the cash flows of the entire project RR4 in the real term which are different in definition from the cash flow stated in the next section.

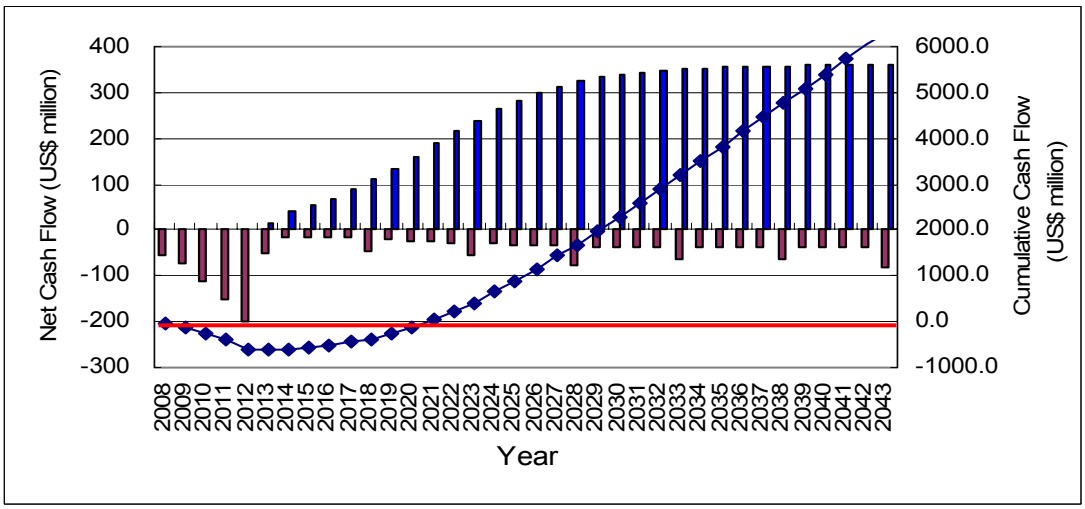
Figure 7.3.3 Financial Net Cash Flow of RR4

(1) Base Case



Source: HAIDEP Study Team

(2) Do Something Case



Source: HAIDEP Study Team

(2) Cash Flow at Current Price

In case the project is implemented under a BOT scheme, the profit of the project will be shared by the special project company (SPC) which operates the project and represents an investor group, the Government and a financing group. Here, the profitability of the project is analyzed focusing on the investor's standpoint. For this purpose, the income statement and the cash flow are forecasted in current price, taking inflation, interest payment, tax payment and then depreciation of assets, into consideration

Main assumptions for the analysis are as follows.

(i) Domestic inflation rate is assumed at 4.2%, taking the average in the past 5 years.

(ii) The project is financed with the SPC's own capital equivalent to 30% of the total investment inclusive of interest payment during construction period and the other 70% with a long-term loan.

(iii) The terms of the loan are 8.0% of annual interest rate and 25 years of repayment with grace of construction period.

(iv) The corporate income tax is 30%.

(v) Depreciation period is 30 years for infrastructure and 10 years for toll collection equipment.

(vi) Financial costs are assumed as follows:

(vii) Arrangement fee: 0.5% of loan amount at commitment

(viii) Commitment fee: 0.3% annually on outstanding loan amount

(ix) Agent fee is regarded as included in annual operating cost.

Based on these assumptions, a nominal cash flow of the project was tabulated and the project FIRR and Equity FIRR were estimated based on the defined net cash flow as shown in Table 7.3.8.

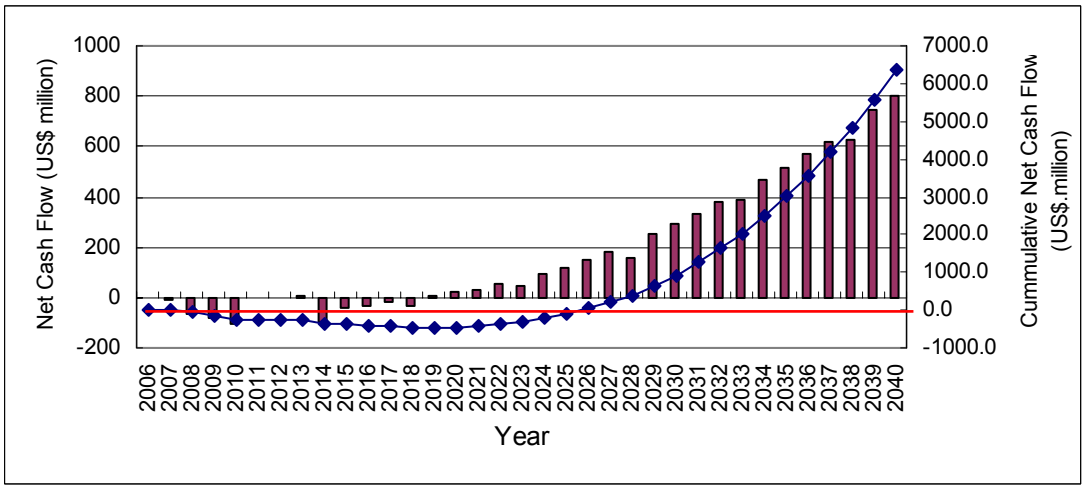
Table 7.3.8 Definition of Cash Flow for Project FIRR and Equity FIRR

FIRR	[A] In-Flow	[B] Out-Flow	[C] Net Cash Flow
Project FIRR	• Net income after tax • Depreciation • Interest paid	• Investment	[A] – [B]
Equity FIRR	• Cash in hand • Residual value after project life	• Paid-up Capital	[A] – [B]

Source: HAIDEP Study Team
Note: Cash in hand is calculated as net income after tax plus depreciation minus loan repayment and interest payment.

The project FIRR in the base case is estimated at 12.4% based on the net cash flow of the project shown in Figure 7.3.4. On the other hand, the Equity IRR is 13.9%, slightly higher than the project FIRR because the assumed interest rate is lower than the project FIRR. Again, it should be noted that these IRRs are nominal under annual inflation of 4.2%.

Figure 7.3.4 Cash Flow of RR4 at Current Price (Base Case)



Source: HAIDEP Study Team

As shown in the profit/loss statement of selected years, annual losses of net income before tax will continue in the first five years of 2014 to 2018 and the cumulative deficit will reach the maximum of US$ 213 million in 2018. The cumulative net income will turn to positive in 2024, 11th year after operation. Even though a huge amount of profit can be expected in the end, the deficit in the early stage will make the project hard to implement

by a BOT scheme. In order to invite a private capital to this project, some contribution of the public sector will be needed.

Table 7.3.9 Profit and Loss Statement at Current Price (Base Case)

(US$ Million)

Item	2015	2020	2025	2030	2035	2040
Revenue	43.5	112.4	261.5	519.7	868.0	1260.1
Expenditure						
Maintenance Cost	11.7	14.4	17.7	21.8	26.7	32.8
Operation Cost	3.3	8.4	19.6	39.0	65.1	94.5
Depreciation	18.4	18.4	16.5	16.5	16.5	16.5
Operating Income	10.1	71.2	207.7	442.5	759.7	1116.2
Interest Payment	45.8	36.3	26.7	17.2	7.6	0.0
Net Profit before Tax	-35.6	34.9	181.0	425.4	752.1	1116.2
Corporate Tax	0.0	10.5	54.3	127.6	225.6	334.9
Net Profit after Tax	-35.6	24.5	126.7	297.8	526.5	781.4
(Repayment)	23.8	23.8	23.8	23.8	23.8	0.0

Source: HAIDEP Study Team

The nominal FIRR is mainly affected by inflation rate and interest rate. Table 7.3.10 shows a result of sensitivity analysis by changing these two factors. Both the project IRR and the equity IRR became higher as the inflation rate became higher. The nominal IRR is almost higher than that at constant price.

The project IRR is hardly affected by the interest rate by its definition while the equity IRR becomes lower under higher interest rate. If the interest rate is higher than the project IRR, the equity IRR is lower than the project IRR

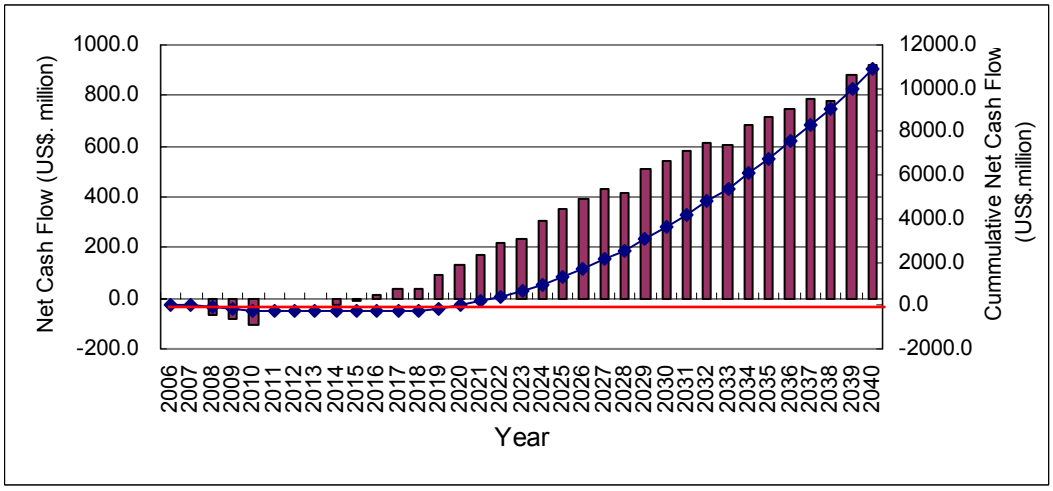
Table 7.3.10 FIRR in Cash Flow at Current Price (Base Case)

FIRR	Annual Inflation Rate (%)				
	0.0	3.0	4.2(Base)	6.0	8.0
Project IRR (%)	8.1	11.1	12.4	14.3	16.4
Equity IRR (%)	8.1	12.3	13.9	16.2	18.7
FIRR	Interest Rate of Loan (%)				
	4.0	8.0(Base)	10.0	12.0	14.0
Project IRR (%)	12.3	12.4	12.4	12.5	12.5
Equity IRR (%)	15.2	13.9	13.3	12.7	12.1

Source: HAIDEP Study Team

If no transport project is newly implemented except on-going project and committed projects (called “Do something” case), the financial return is significantly improved as seen in the previous section. In the “Do something” case, the project IRR is 17.3% and the equity IRR is 20.5%. Under this condition, net income before tax is negative only in the first two years on 2014 and 2015 and the cumulative loss will become the maximum of US$ 25 million in 2015, which will be covered by 2017 (Figure 7.3.5). The equity IRR is high enough to attract the private sector.

Figure 7.3.5 Cash Flow of RR4 at Current Price (Do Something Case)



Source: HAIDEP Study Team

The profit of the project RR4 itself are distributed among three players, SPC, the Government and the financier group. Their net present values are estimated using the discount rate of 12%. Here, the Government does not contribute to the capital investment and only collects corporate tax. The result is shown in Table 7.3.11. In the base case, most part of the profit will go to the financier group and SPC will get a share of only 11%. The distribution under the "Do something" case seems reasonable.

Table 7.3.11 Profit Sharing of RR4

Entity	Base Case		Do Something	
	NPV (US$ million)	%	NPV (US$ million)	%
SPC	110.4	10.9	555.9	34.2
Government	161.4	16.0	329.1	20.3
Financier	739.4	73.1	739.4	45.5
Total	1011.1	100.0	1624.3	100.0

Source: HAIDEP Study Team

(3) Equity IRR Under PPP Scheme

Possible PPP schemes have been previously investigated in Chapter 6. Among them, the most simple and easiest scheme may be "Operation and Maintenance Contract" where all the capital investment is shouldered by the public sector and when completed, the Government gives a concession of operation and maintenance of the toll road to a private company. This scheme is apparently feasible to the operating company if the contract is made based on the O&M cost plus a reasonable profit. The Government has to finance and cover all the cost including the deficit in the early stage. Instead, all the profit generated in the long future belongs to the government.

Another PPP scheme is to share the capital cost. The private sector constructs the bridge over the Red River and its approaches while the public sector is responsible to construct the road section. In this case, the SPC (private sector) shares US$ 235.7 million, 37% of the total and the Government shares US$ 403 million 63%.

If the SPC obtains all the revenue and shoulders all the operating and maintenance cost during the concession period (30 years), the equity IRR is extremely high at 27.8% and NPV is US$ 391 million in the base case. In the "Do something" case, the equity IRR is

39.5% and NPV is US$ 809 million. Profit and loss in selected years is shown in Table 7.3.12.

Table 7.3.12 Profit and Loss Statement by PPP Scheme (Base Case)

(US$ Million)

	2015	2020	2025	2030	2035	2040
Revenue	43.5	112.4	261.5	519.7	868.0	1260.1
Expenditure						
Maintenance Cost	11.7	14.4	17.7	21.8	26.7	32.8
Operation Cost	3.3	8.4	19.6	39.0	65.1	94.5
Depreciation	6.7	6.7	6.0	6.0	6.0	6.0
Operating Income	21.8	82.8	218.1	453.0	770.1	1126.7
Interest Payment	13.7	10.9	8.0	5.1	2.3	0.0
Net Profit before Tax	8.0	72.0	210.1	447.8	767.9	1126.7
Corporate Tax	2.4	21.6	63.0	134.3	230.4	338.0
Net Profit after Tax	5.6	50.4	147.1	313.5	537.5	788.7
(Repayment)	7.2	7.2	7.2	7.2	7.2	0.0

Source: HAIDEP Study Team

As this PPP scheme brings unreasonably high profit to the SPC, the accruing profit should be distributed to the SPC and the Government at a proper percentage or the concession should be terminated when the cumulative profit of the SPC reaches some level. Table 7.3.13 shows the relation between the equity IRR and the concession period.

Table 7.3.13 Concession Period and Equity IRR

Concession Period After Opening (Years)	Equity IRR (%)
3	-6.0
4	7.6
5	16.8
6	22.0
7	26.8
8	30.3
9	32.8
10	34.6
15	38.4
20	39.2
30	39.5

Source: HAIDEP Study Team

6) Conclusion

(i) The analysis in the base case revealed that FIRR is not high enough to implement the project by a BOT scheme.

(ii) A PPP scheme will make the project financially feasible. If the Government shoulders more than a half of the capital cost, the profit will be large enough to be shared by both sectors.

8 CONCLUSION

Role of Ring Road 4: Ring Road 4 West will function as an important bypass of Hanoi CBD to minimize through inter-provincial traffic entering and congesting the city center and it also aims to link key urban areas in the vicinity of Hanoi. RR4 West also plays a strategic function as the boundary of urban development in the west to prevent excessive urban sprawling. It is recommended that the RR4 will be aligned within a 15-20km radius from the city center to be effective, thus RR4 West starts from NH2 in Noi Bai in the north and ending in NH1A in Thanh Tri in the south for a total of 45.35km, traversing the boundaries of Hanoi, Vinh Phuc, and Ha Tay provinces.

Required Technical Standards: High performance standards are needed for RR4 to properly and adequately function, thus it is proposed the RR4 West will be developed as an expressway (i.e. high speed and full access control), with a four-lane divided cross-section. The median is to be widened to accommodate additional two lanes in the future. Furthermore, frontage roads will be provided to facilitate access along the corridor.

The RR4 West is to be built at-grade on embankments, which allows road boxes to be constructed for local roads to cross RR4 West. Interchanges will be provided at intersections with primary arterials in six locations. The alignment will also cross over the Red River, where a 1.86km bridge is needed.

Resettlement: The RR4-West will involve limited resettlement numbering some 200 households, most of whom are low-income. Land acquisition will amount to 375ha which is mostly agriculture land and only very limited residential land.

Investment Costs: The RR4 West is estimated to cost US$ 639 million, which covers construction, engineering, contingency and land, including US$ 235 million for the bridge. Land cost is US$ 128 million or 20% of project cost. It is estimated that construction of the RR4 West will require around 3.5 years. To operate and maintain RR4 West would require approximately US$30 million/year on average.

Operation of RR4 as a Tolled Expressway: It is proposed that RR4 West will be operated as an open-system (i.e. flat charge) tollway, and the toll be set to maximize revenues, which is 25,000 VND/car by 2020. Under this toll scheme (in 2020), total users of RR4 West would be around 85,000 pcu/day; and, the average section traffic would be about 30,000 pcu/day resulting to a V/C ratio of 0.4. The busiest segment is the Red River Bridge with traffic of nearly 40,000 pcu/day and a V/C ratio of 0.6.

Economic and Financial Viability: Economic evaluation of the RR4 West concluded that the project is economically viable with EIRR = 18.6%; NPV = US$505.1M; and B/C = 2.06. On the other hand, financial evaluation of RR4 West showed that the project is not viable enough with FIRR at constant price = 9.5% against a widely used benchmark in Vietnam of 12%.

Implementation Strategy: In this context, a Public Private Partnership scheme wherein the public sector shoulders more than half of the construction cost would be workable. There are two options that can be considered: (i) Operation & Maintenance (O&M) Concession; and, (ii) Build-Transfer-Operate (BTO) Concession. The O&M concession involves minimal risks to the private concessionaire, where its investment would only be the toll facilities, while RR4 West will mostly be funded by the government. In the BTO scheme, the private concessionaire will build the Red River bridge segment plus toll

facilities, while the government will cover the rest of RR4. Upon completion, the concessionaire will then operate the entire RR4 West. Under the BTO Scheme, the concessionaire handles 37% of the project cost and if the concessionaire retains all toll revenues, the equity IRR is extremely high at 27.8% assuming a 30 year concession. Thus a mechanism for the public sector to receive a portion of the revenues, or a mechanism to shorten concession period once a reasonable profit is attained is recommended.

Considering the limited budget of the public sector, it is recommended that ODA funding be tapped to cover for, or at least augment public sector funding for its share in the RR4 West project cost. Meanwhile, land acquisition is proposed to be covered by Hanoi People's Committee (in both options).

Next Step: As a final note, it is not at all unexpected that RR4 West would have low financial viability as road infrastructures are rarely financially viable without some form of government support, especially in developing countries. It is important that this should not deter from the recognition of the critical role RR4 West plays in not only the development of urban Hanoi but also of the northern region, and schemes for implementing the RR4 West despite its low financial returns have been proposed. It is therefore the recommendation of this prefeasibility study that RR4 West be moved to the next stage by conducting a full feasibility study and to lay the groundwork for its implementation.