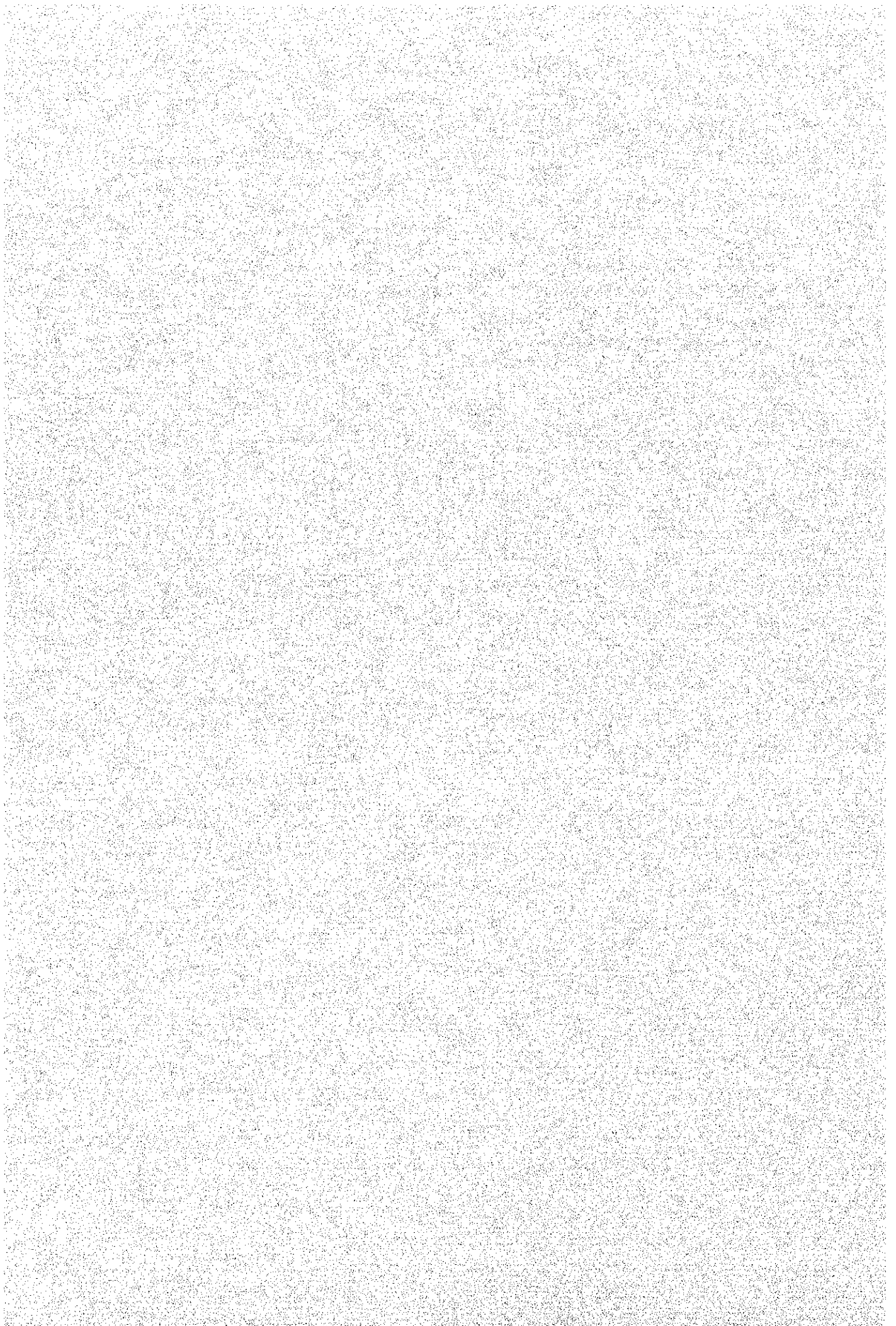


**CHAPTER 14**  
**PROJECT COST ESTIMATES**



## CHAPTER 14 PROJECT COST ESTIMATES

### 14.1 General

The estimate of the project cost was based on the results of preliminary engineering design, quantity take-off of each work item, and the studies on construction planning and method as described in the preceding chapters:

- Construction;
- Land Acquisition and Resettlement;
- Engineering and Supervisory Services; and
- Physical Contingency.

The basic premises in estimating preliminary cost are as follows:

- i) All the construction work will be executed by constructor(s) to be selected by international competitive bidding.
- ii) The unit cost of each cost component was determined based on the economic conditions prevailing in January 1998 (USD \$1.0 = 12,950 Dong).
- iii) Engineering services cost is assumed to be 3% of the construction cost.
- iv) Supervisory service cost is assumed to be 7% of construction cost.
- v) Physical contingency is estimated to be 10% of the total of construction cost, land acquisition and resettlement cost, engineering services cost and supervisory services cost.

The preliminary cost was estimated in financial cost.

### 14.2 Construction Cost

#### 14.2.1 Unit Cost of Construction Works

The unit cost of construction works were studied based on the material cost, equipment cost, labor cost, overhead and profit for chief work items. The analyzed unit costs were compared with current bid prices and adjusted as required to obtain the most realistic prices.

(1) Unit Cost of Labor

Table 14.2.1 shows the unit cost of labor applied in the construction cost estimate, which include such allowances as social benefits, insurance, etc. and are based on the eight-hour work per day.

**Table 14.2.1 Unit Cost of Labor**

(Man Hour)

Classification	Unit Cost per Day (Dong)
Senior Field Engineer	55,500
Junior Field Engineer	39,200
Foreman	90,500
Driver	27,300
Equipment Operator	29,300
Skilled Labor	83,700
Common Labor	18,100

(2) Unit Cost of Materials

Table 14.2.2 shows the unit cost of major construction materials. The cost of imported materials is based on the CIF Hai Phong including port handling and clearance charges and import duties. The cost of local materials is based on the market prices in Hanoi area.

**Table 14.2.2 Unit Cost of Major Material**

Description	Unit	Unit Cost (Dong)
Portland Cement	ton	900,000
Asphalt Cement	ton	2,400,000
Reinforcing Steel	ton	3,150,000
Prestressing Strand	kg	24,000
Gasoline	liter	4,600
Diesel4	liter	3,600
Fine Aggregate	ton	52,000
Coarse Aggregate	ton	54,000
Timber	cu.m	2,100,000

(3) Unit Cost of Equipment Operation per Hour

Table 14.2.3 shows the unit cost of hourly operation cost of major construction equipment. Foreign currency and local currency portions in unit cost cover:

F. C Portion: Ownership cost of equipment per hour used

L. C Portion: Fuel, lubricant oil and wage of operator per hour used.

**Table 14.2.3 Unit Cost of Hourly Equipment Operation**

(Cost in 1,000 VND per Hour)

Equipment	Capacity	Unit Cost	
		F. C Portion	L. C Portion
Bulldozer	21 ton	792	151
Dump Truck	11 ton	210	74
Back Hoe, Hydraulic	0.35 m <sup>3</sup>	250	97
Clamshell	0.6 m <sup>3</sup>	792	125
Tractor Shovel	1.4 m <sup>3</sup>	303	95
Flat Bed Truck	11 ton	208	78
Semi-Trailer	32 ton	474	119
Crawler Crane	40 ton	880	99
Truck Crane, Hydraulic	45 ton	495	97
Truck Crane, Hydraulic	16 ton	434	84
Pile Driver with Hammer	4.5 ton Ram weight	1,760	128
Pile Driver with Vibro-hammer	60 kw vibrohammer	1,120	76
Hydraulic Press-In	1,000 mm $\phi$	550	-
Reverse-Circulation-Drill without Bit	2,000 mm $\phi$	585	-
Three-Wing Bit	1,200 mm $\phi$	36	-
Slush Tank	30 m <sup>3</sup>	24	-
Motor Grader	3.1 m	358	94
Road Roller, Macadam	12 ton	275	83
Tire Roller	20 ton	239	87
Vibrating Roller	4 ton	270	76
Bituminous Spreader	5 m	984	82
Tank Truck with Sprinkler	6,500 lit	164	60
Concrete Plant	30 m <sup>3</sup> /hr	915	-
Transit Mixer	3.2 m <sup>3</sup>	178	73
Concrete Pump, Boom Type	110 m <sup>3</sup> /hr	1,210	100
Barge with 40 ton Crane	400 ton	1,260	70
Barge, Steel	300 ton	500	65
Tug Boat, Steel	200 PS	530	80
Erection Girder	32.5 m	380	-

(4) Direct Cost (DC)

Base cost consists of material, equipment and labour costs. Unit direct cost of each major construction work includes mobilisation and demobilisation cost (5% of base cost).

(5) Overhead Cost (OH)

Overhead was estimated as 5% of direct cost:

$$OH = DC \times 0.05$$

(6) Profit (P)

Contractor's profit was estimated as 5% of direct cost and overhead:

$$P = (DC + OH) \times 0.05$$

(7) Tax and Duty (TD)

Tax and duty were estimated as 5% of the total of direct cost, overhead and profit:

$$TD = (DC + OH + P) \times 0.05$$

(8) Unit Cost for Major Construction Work Items

Table 14.2.4 shows unit cost for major construction work items based on the cost estimate conditions mentioned above.

#### 14.2.2 Estimated Construction Cost

The summary of estimated construction cost by each construction package is shown in Table 14.2.5.

**Table 14.2.5 Summary of Estimated Construction Cost in 1998 Prices**

Package No.	Construction Package	Construction Cost (Million Dong)
1	Thanh Tri Bridge	2,419,000
2	Thanh Tri Section of SHTRR	788,613
3	Gia Lam Section of SHTRR	475,805
	Total	3,683,418

Note: SHTRR denotes Southern Section of Hanoi Third Ring Road.

See Appendix 6 for the breakdowns of estimated construction cost.

**Table 14.2.4 Unit Cost for Major Construction Work Items (Contract Cost)**

Item	Unit	Unit Cost (Dong)
<b>1. Earthwork</b>		
Embankment (Borrow Material)	cu. m	142,200
Treatment of Embankment Foundation	sq. m	482,000
<b>2. Pavement</b>		
Crusher-Run Subbase Course	cu. m	145,700
Stabilised Aggregate Base Course	cu. m	259,400
Asphalt Treated Base Course	ton	491,000
Asphalt Concrete Binder Course	ton	624,500
Asphalt Concrete Surface Course	ton	624,500
Asphalt Cement	ton	3,492,000
Concrete Sidewalk (t = 10 cm)	sq. m	462,000
<b>3. Orainage Structures and RC Box Culvert</b>		
Pipe Culvert (D = 0.8 m)	l. m	2,950,000
Pipe Culvert (D = 1.0 m)	l. m	3,923,000
Concrete U - Ditch, Covered	l. m	1,575,000
Inlet with Grating	each	5,343,000
RC Box Culvert 3.0 m (H) x 2.0 m (w)	l. m	14,400,000
RC Box Culvert, 3.0 m (H) x 3.0m (w)	l. m	24,120,000
RC Box Culvert, 5.0m (H) x 5.0m (w)	l. m	36,000,000
RC Box Culvert, 6.0m (H) x 7.0m (w)	l. m	67,630,000
<b>4. Bridges</b>		
PC I - Girder Bridge, with Foundation Piling	sq. m	10,500,000
<b>5. Miscellaneous</b>		
Sodding, Solid	sq. m	40,600
Vehicle Guardrail, Double, Blocked Type	l. m	792,000
Vehicle Guardrail, Standard	l. m	528,000
Fence Work	l. m	326,500
Concrete Curb	l. m	250,000
<b>6. Road Lighting and Signal</b>		
Street Lighting Pole, Single Type with Cabling	each	28,000,000
Traffic Signal	each	56,400,000
Traffic Signal Control Panel	each	221,500,000

### 14.3 Land Acquisition and Resettlement Cost

Land acquisition and resettlement cost is estimated based on the area of required land acquisition estimated in the preliminary engineering design and the estimated building areas and number of resettled families in the field investigations.

The summary of estimated land acquisition and resettlement cost by each package is shown in Table 14.2.6.

**Table 14.2.6 Summary of Estimated Land Acquisition and Resettlement Cost**

**Package 1: Thanh Tri Bridge**

Compensation Items		Costs (mill.VND)	Notes
Compensation	1) Land compensation	-	
Assets	4) Crops compensation	643	
Subsidy	7) Assistance for recovering	801	
Subtotal		1,444	
Administration costs		72	5% of the subtotal
Allowance		270	
Grand Total		<b>1,786</b>	

**Package 2: Thanh Tri Section of SHTRR**

Compensation Items		Costs (mill.VND)	Notes
Compensation	1) Land compensation	17,375	
	2) Houses compensation	34,065	Level II or III
	3) Other building compensation	7,859	
	4) Crops compensation	3,073	
	Subtotal	<b>62,372</b>	
Subsidy	5) Personal subsidy	2,160	
	6) Business or trade subsidy	198	
	7) Assistance for recovering	5,018	
	8) Assistance for moving	261	
Subtotal		<b>7,637</b>	
Compensation and subsidy total		70,009	
Infrastructure cost for the resettlement sites		18,855	
Administration costs		3,500	5% of the compensation and subsidy costs
Allowance		10,263	
Total		<b>102,627</b>	



Package 3: Gia Lam Section of SHTRR

Compensation Items		Costs (mill.VND)	Notes
Compensation	1) Land compensation	3,515	Level II or III Graveyard included
	2) Houses compensation	1,640	
	3) Other building compensation	346	
	4) Crops compensation	1,660	
	Subtotal	7,161	
Subsidy	5) Personal subsidy	144	
	6) Business or trade subsidy	4	
	7) Assistance for recovering	2,975	
	8) Assistance for moving	20	
	Subtotal	3,143	
Compensation total		10,304	
Infrastructure cost for the resettlement sites		1,290	
Administration costs		515	5% of the compensation and subsidy costs
Allowance		1,345	10 % of the above
Grand Total		<b>13,454</b>	

Note: SHTRR denotes Southern Section of Hanoi Third Ring Road.

#### 14.4 Estimated Project Cost

##### 14.4.1 Estimated Project Cost

The estimated Project cost in 1998 prices is shown in Table 14.4.1 together with the shares of foreign currency and local currency portions. The Project cost is expressed in term of financial cost by each construction package.

(1) Engineering and Supervision Services Cost

Engineering and supervision services cost was estimated at a total of 10 % of construction cost.

(2) Price and Physical Contingencies

Price contingency (price escalation) was not analyzed in the Study, since this will be analyzed in the framework of the preparation of implementation program to be submitted to the international financing agency. The Study Team adopted 10 % of physical contingency for all cost components (i.e. construction, land acquisition/resettlement and engineering/ supervision services).

**Table 14.4.1 Summary of Project Costs of Foreign Exchange and Local Currency  
in 1998 Prices**

**Package 1: Thanh Tri Bridge**

Unit: Million Dong

Description	Foreign Exchange	Local Currency	Total
(1) Construction	1,451,400	967,600	2,419,000
(2) Land Acquisition and Resettlement	0	1,786	1,786
(3) Engineering Services (3%)	50,799	21,771	72,570
(4) Supervision Services (7%)	118,531	50,799	169,330
(5) Physical Contingency (10%)	162,073	104,196	266,269
Total	1,782,803	1,146,152	2,928,955

**Package 2: Thanh Tri Section of SHTRR**

Unit: Million Dong

Description	Foreign Exchange	Local Currency	Total
(1) Construction	473,168	315,445	788,613
(2) Land Acquisition and Resettlement	0	102,627	102,627
(3) Engineering Services (3%)	16,561	7,097	23,658
(4) Supervision Services (7%)	38,642	16,561	55,203
(5) Physical Contingency (10%)	52,837	44,173	97,010
Total	581,208	485,903	1,067,111

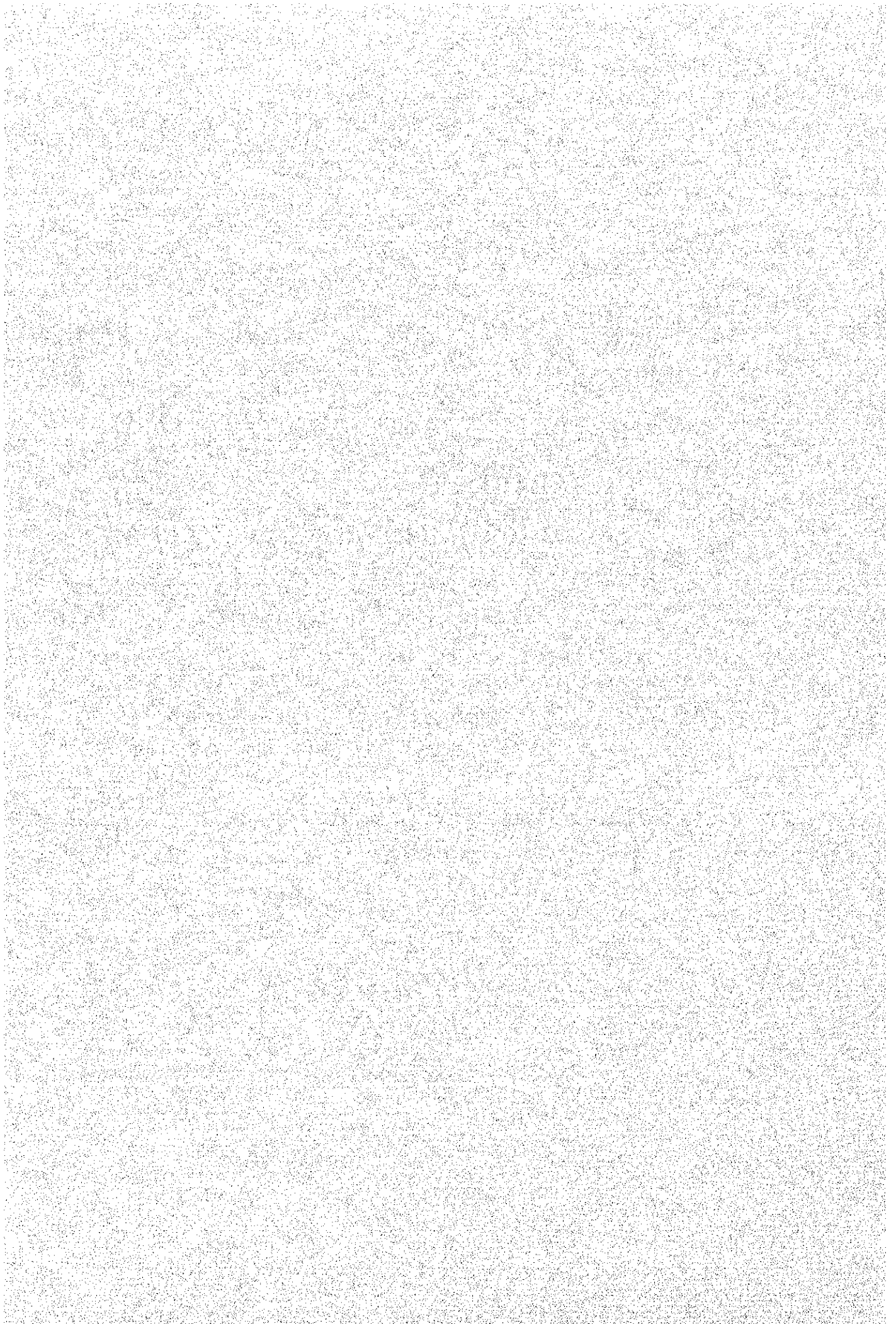
**Package 3: Gia Lam Section of SHTRR**

Unit: Million Dong

Description	Foreign Exchange	Local Currency	Total
(1) Construction	285,483	190,322	475,805
(2) Land Acquisition and Resettlement	0	13,454	13,454
(3) Engineering Services (3%)	9,992	4,282	14,274
(4) Supervision Services (7%)	23,314	9,992	33,306
(5) Physical Contingency (10%)	31,879	21,805	53,684
Total	350,668	239,855	590,523

Note: SHTRR denotes Southern Section of Hanoi Third Ring Road

**CHAPTER 15**  
**PROJECT IMPLEMENTATION PLAN**



## CHAPTER 15 PROJECT IMPLEMENTATION PLAN

### 15.1 Execution of the Project

#### (1) Executing Agency

Project Management Unit Thang Long (PMU Thang Long), Ministry of Transport (MOT) is the Project executing agency and responsible for the execution of the following tasks:

- Pre-construction Works
  - Engineering Services (Review of Feasibility Study and Detailed Design); and
  - Land Acquisition and Resettlement.
- Construction Works and Construction Supervision

The necessary land acquisition and resettlement within proposed right-of-way will be undertaken prior to the start of the construction works. The organization chart of the Ministry of Transport is shown in Figure 13.1.1.

#### (2) Procurement of Contractor(s)

Tender lot for the Project will be decided in consultation with the international financing agency. All times to be financed by the international financing agency shall be procured through international competitive bidding with pre-qualification in accordance with the guidelines of the international financing agency for procurement.

#### (3) Consulting Service for the Project

The selection and employment of the consultant for the consulting engineering (detailed design) and supervisory services shall be done in short-list method in accordance with the guidelines of the international financing agency.

#### (4) Budgetary Appropriation for the Project

Any portion of the Project cost not covered by the loan of the international financing agency are to be financed by the budget of the Government.

## 15.2 Project Implementation Time Schedule

### (1) Construction Package

To consider a large scale construction, the entire construction is divided into 3 packages, they are:

- Package 1: Thanh Tri Bridge;
- Package 2: Thanh Tri Section of Southern Hanoi Third Ring Road; and
- Package 3: Gia Lam Section of Southern Hanoi Third Ring Road.

### (2) Construction Time Schedule

Construction time schedules were prepared based on the actual work quantities, site conditions and practical and economical construction methods. Taking into account the scale of the construction and the urgency of the Project, the maximum construction period were set:

- Package 1: 4 years
- Packages 2 and 3: 2.5 years

As shown in Figure 15.2.1, the completion of the construction in all packages will be set at the same time of 48th month to attain optimum investment schedule.

### (3) Project Implementation Time Schedule

Project implementation time schedule was tentatively drawn up as shown in Figure 15.2.2.

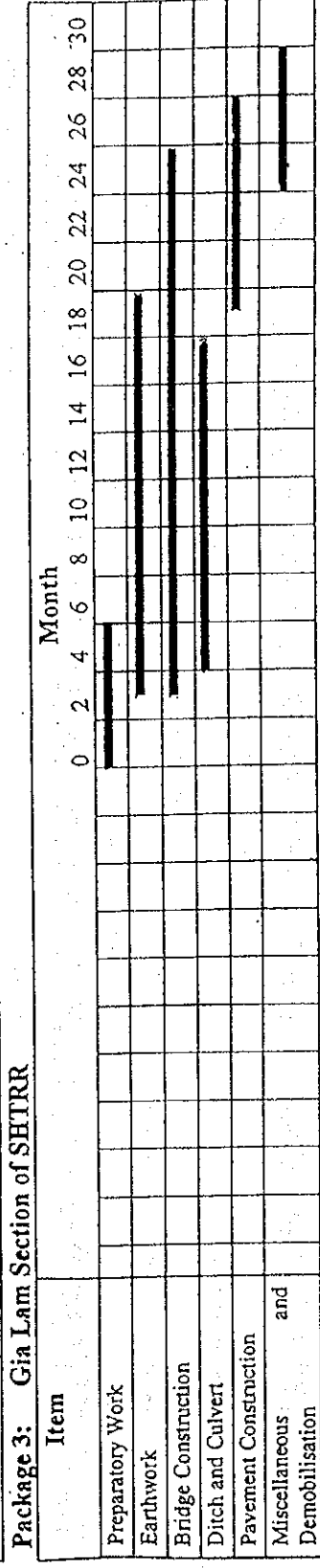
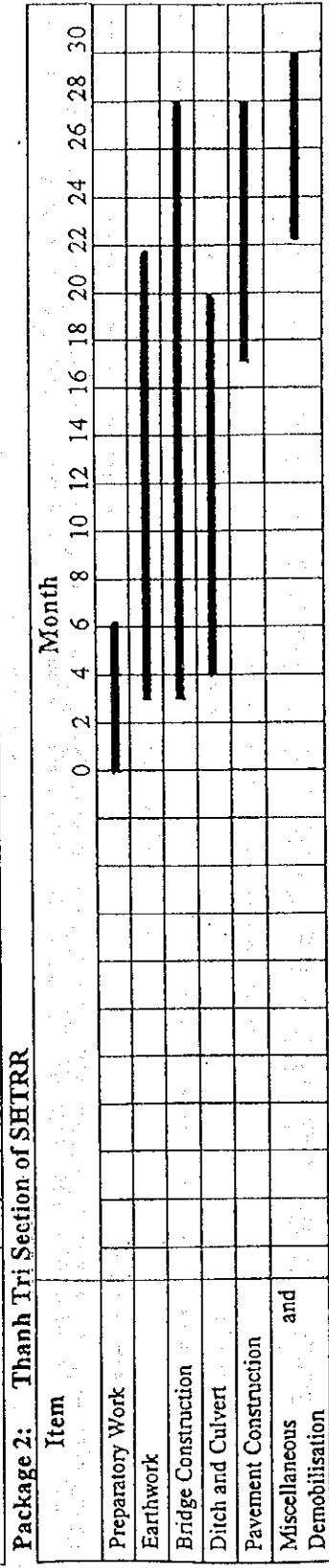
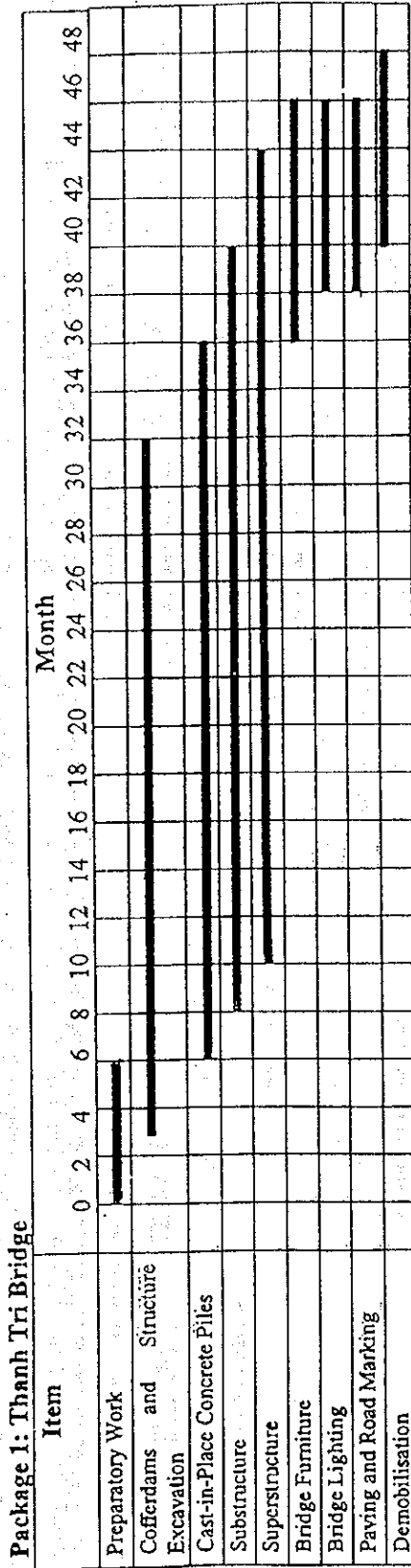


Figure 15.2.1 Construction Time Schedule

Description	1999	2000	2001	2002	2003
Detailed Design	■				
Package 1 :					
Land Acquisition and Resettlement	■	■ ■ ■			
Construction		■	■	■	■
Packages 2 and 3 :					
Land Acquisition and Resettlement		■	■ ■ ■		
Construction			■	■	■

**Figure 15.2.2 Project Implementation Time Schedule**

### 15.3 Estimated Project Cost and Annual Fund Requirement

#### (1) Estimated Project Cost

The summary of estimated Project cost in 1998 prices is shown in Table 15.3.1. The Project cost was expressed in term of financial cost by each construction package.

**Table 15.3.1 Summary of Estimated Project Cost in 1998 Prices**

Package No.	Construction Package	Project Cost (Million Dong)
1	Thanh Tri Bridge	2,928,955
2	Thanh Tri Section of SHTRR	1,067,111
3	Gia Lam Section of SHTRR	590,523
	Total	4,586,589

Note: SHTRR denotes Southern Section of Hanoi Third Ring Road.



(2) Estimated Annual Fund Requirement

A tentative disbursement schedule for the implementation of the Project was prepared as shown in Table 15.3.2.

**Table 15.3.2 Estimated Annual Fund Requirement**

<u>Implementation</u>	<u>Year</u>	<u>Financial Cost</u> (million Dong)
1st year	1999	123,517
2nd year	2000	361,329
3rd year	2001	1,054,047
4th year	2002	1,740,617
5th year	2003	1,307,079
Total		4,586,589

Note : Costs are in 1998 prices and no price contingency is included.

## **CHAPTER 16**

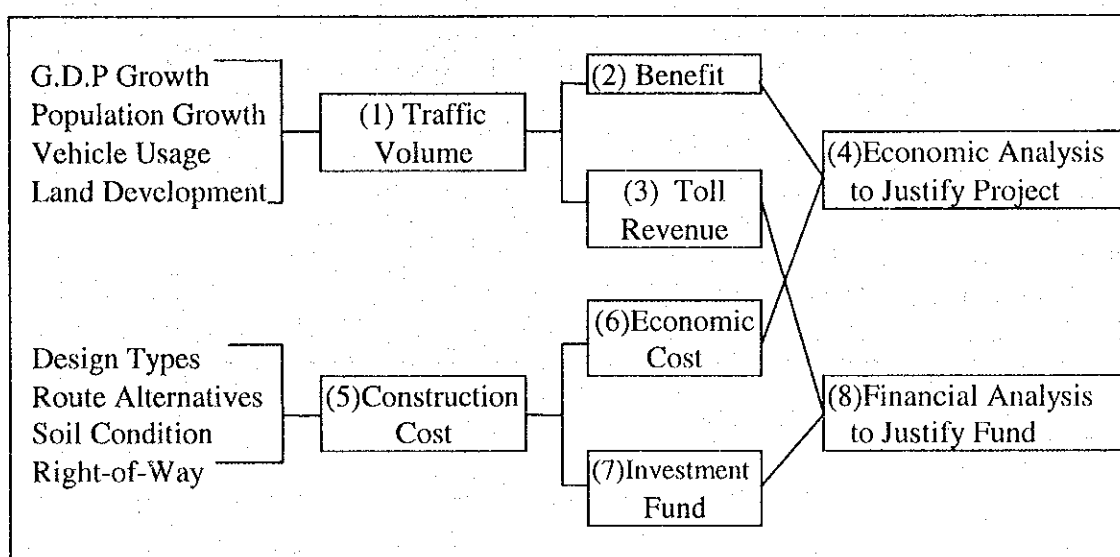
# **ECONOMIC AND FINANCIAL ANALYSIS**

## CHAPTER 16 ECONOMIC AND FINANCIAL ANALYSIS

### 16.1 General Explanation of Economic and Financial Analysis

Figure 16.1.1 shows outline of the relationship between economic analysis and financial analysis. Economic analysis will be made by comparison between economic cost and economic benefits to make sure the level of investment scale, or to know proper investment cost for the Project. Financial analysis will be undertaken after the Project is justified by the preliminary economic analysis.

**Figure 16.1.1 Diagram of Economic and Financial Evaluation Procedure**



### 16.2 Estimation of Economic Project Cost

The investment cost of the Project was estimated at 4,586,589 million Dong as explained in previous chapters:

- Highway and Interchange	1,390,860 Million Ding
- Thanh Tri Bridge	2,660,900 Million Dong
- Engineering and Supervision	405,175 Million Dong
- Land Acquisition and Resettlement	129,654 Million Dong
Total	4,586,589 Million Dong

To know whether the investment cost is feasible or unfeasible economically, the above cost which is estimated by market price has to be converted to the economic price. Because the cost calculated by market price does not express real value of resources. Resources to be used for the Project should be converted to actual money value.

Economic cost can be calculated by removing many distorted factors such as import taxes, regulation of minimum wage of unskilled labor, monopoly of land, foreign exchange rate fixed by the Government, etc. Table 16.2.1 shows the conversion result from market price to economic cost.

**Table 16.2.1 Conversion to Economic Cost from Financial Cost**

Unit: Million Dong

Items	Investment Costs In Market Prices	Foreign Portion	Local Portion					Overall Conversion Factor	Investment Costs in Economic Prices
			Tradable Goods	Non-tradable Goods	Skilled Labor	Unskilled Labor	Transfer (Tax)		
			1.004	1.004	0.996	0.985	0.300		
Hwy & Interchange	1,390,860	80 %	4 %	4 %	5 %	2 %	5 %	89 %	1,235,710
Thanh Tri Bridge	2,660,900	80 %	4 %	4 %	5 %	2 %	5 %	89 %	2,364,077
Engin.Supervision	405,175	80 %			15 %		5 %	90 %	365,042
Land Acquisition	129,654	0 %		100 %				100 %	129,135
<b>Total</b>	<b>4,586,589</b>								<b>4,093,964</b>
Routine Maintenance	27,520	0 %	2 %	3 %	0 %	90 %	5 %	27 %	7,429
Periodic Repair	4,587	0 %	5 %	3 %	2 %	80 %	5 %	29 %	1,329

Note: Routine maintenance cost is estimated at 0.6 % and Periodic maintenance cost at 0.1 % of the total investment cost.

Economic cost of capital investment is 4,093,964 million Dong which is about 11 % lower than market price. In the case of routine maintenance cost per year, 27,520 million Dong estimated by market price is calculated as 7,429 million Dong for economic cost.

This is because 90 % of the cost accounts for unskilled labor cost, and the real value rate (shadow wage rate) is used at 30 % to make the wage closer to the real value of worker. As economic costs express real value of resources to be used in the project, these figures are the ones to be compared with project benefits in the analysis.

The Project implementation period was assumed at 5 years which is the shortest period possible by efficient implementation. Table 16.2.2 shows the Project implementation period and cost allocation to 5 years for both financial cost and economic cost.

**Table 16.2.2 Yearly Allocation of Project Cost by the Term of Financial and Economic Analysis**

Unit: Million Dong

Project Implementation	Implementation Year	Allocation Ratio	Financial Cost	Economic Cost
1st year	1999	3 %	123,517	110,251
2nd year	2000	8 %	361,329	322,520
3rd year	2001	23 %	1,054,047	940,837
4th year	2002	38 %	1,740,617	1,553,665
5th year	2003	28 %	1,307,079	1,166,691
Total		100 %	4,586,589	4,093,964

Note: Cost at 1998 Price Ref. to Table 15.3.1 Estimated Annual Fund Requirement.

### 16.3 Estimation of Economic Benefit

#### 16.3.1 Road User and Road Benefits

Table 16.3.1 shows total benefits by the execution of the Project. Average driving speed is less than 30 km/h at present in the city of Hanoi. Main benefits by the execution of the Project are; (1) time cost saving of passenger, and (2) vehicle operating cost saving.

Increase of land productivity and utilization especially in the area located near the interchanges of the project, is a kind of benefit from the Project. This benefit will be considered in sensitivity analysis as a factor of benefit increase, because it is very hard to get appropriate data and to estimate the benefit.

**Table 16.3.1 Kinds of Benefit of the Project**

(1) Benefits of Driving Time Saving (or Time Cost Saving)
(2) Benefits of Driving Cost Saving (or Vehicle Operating Cost Saving)
(3) Benefits from Increase of Land Productivity
(4) Other Benefits;
1) Decrease of Traffic Accident
2) Increase of Comfortableness of traveling
3) Decrease of spoiling loss of agricultural products
4) Enhancement of Urban Development
5) Strengthening the Function as the Capital City
6) Decrease social cost by Improvement of Environments
7) Enhancement of Social Development
8) Integration of the Region

There are other measurable benefits listed in the table 16.3.1, such as decrease of traffic accident, and decrease of spoiling loss of agricultural products. But their amount is small compared with benefits mentioned above. They were not included in main economic internal rate of return (EIRR) calculation as benefit but were considered in sensitivity analysis.

### 16.3.2 Benefit -1: Passenger Time Cost Saving

Time cost saving can be obtained from the difference between with project and without project. With project, (a) driving speed becomes faster, and (b) driving distance becomes reduces less than without project.

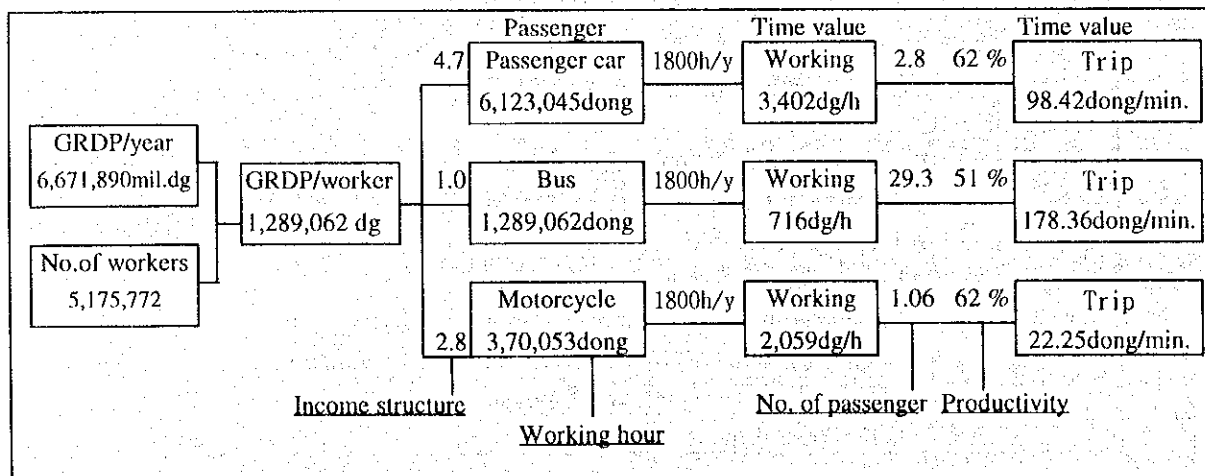
Passenger time value is a function of the wage rate and trip purpose. Figure 16.3.1 shows the method of measuring the value of saved time of passenger.

Time value was obtained step by step as shown in tables; a) Appendix Table A16.3.1, Gross Regional Domestic Product per Worker in the Study Area, b) Appendix Table A16.3.2, Income Structure in Study Area, c) Appendix Table A16.3.3, Working Time Value by the Type of Vehicle User, and d) Appendix Table A16.3.4, Time Value of Trips by Vehicle Types.

Thus following value unit was used for estimation of passenger benefit;

Time value per minute .....	Passenger car .....	98.42 Dong /minute
Time value per minute .....	Bus .....	178.36 Dong /minute
Time value per minute .....	Motorcycle .....	22.55 Dong /minute

**Figure 16.3.1 Transportation Time Value for Time Saving Benefit Calculation**



Appendix Table A16.3.5 shows each travel time when users move from origin to destination by using Project road (with project) and when users use ordinary street in the city (without project).

For example, there will be 28,386 vehicle-hour of passenger cars without project in year 2004(column (a)), but with project vehicle-hour is to decrease to 24,700 (column(e)) because of higher driving speed on the project road and / or of reducing driving distance by the project road. Therefore, the vehicle- hour saving is 3,686 (column (1)).

Table 16.3.2 shows the time saving benefit of passenger by kinds of vehicles calculated from Appendix Table A16.3.5. Increase of time value by the growth of GDP was not considered because all cost and benefit were compared based on present value for EIRR calculation.

### **16.3.3 Benefit -2: Vehicle Operation Cost Saving from Reducing Travel Distance**

Vehicle operation cost saving benefit is affected by many factors such as, (1) vehicle type, (2) running speed, (3) road conditions, (4) traffic conditions and others. Appendix Table A15.3.7 shows (1) running cost per vehicle - km, (2) fixed cost per vehicle - km. and (3) fixed cost per vehicle - hour by 6 types of vehicles. The unit vehicle operating cost was estimated based on the Appendix Table A16.3.6 Input Data for Unit Vehicle Operating Cost Calculation by Base Speed.

Table 16.3.3 shows vehicle operating cost per vehicle-km. These figure were calculated based upon previous tables. Seven vehicle types were classified into four types calculating from weight average using composition ratio of vehicle types based upon the result of traffic count survey.

Running cost of vehicle is determined by costs of, a) fuel, b) lubricant oil, c) tyre, d) spare parts, e) labor, and f) depreciation. Appendix table 16.3.8 shows the unit vehicle operating cost by running speed. Fixed cost of vehicles are determined by costs which are not related to travel distance; a) depreciation, b) interest, c) overhead cost, and d) crew costs.

**Table 16.3.2 Time Saving Benefit of Passenger by the Project**

Unit: Million dong

No.	Year	Time saving (vehicle-hour /day)				Passenger Time Saving Benefit / year			
		P.Car	Bus	Truck	M.cycle	P.Car	Bus	M.cycle	Total
						98.42	178.36	22.55	
1	2004	3,685	2,885	7,398	59,080	7,943	11,271	29,176	48,391
2	2005	4,139	3,220	8,049	63,216	8,921	12,578	31,219	52,718
3	2006	4,648	3,594	8,757	67,641	10,018	14,038	33,404	57,459
4	2007	5,219	4,011	9,528	72,376	11,250	15,666	35,742	62,658
5	2008	5,861	4,476	10,366	77,442	12,634	17,483	38,244	68,361
6	2009	6,582	4,995	11,278	82,863	14,188	19,511	40,921	74,620
7	2010	7,392	5,575	12,271	88,663	15,933	21,774	43,786	81,493
8	2011	8,826	5,909	13,142	85,383	19,024	23,081	42,166	84,270
9	2012	10,538	6,264	14,075	82,224	22,714	24,466	40,606	87,786
10	2013	12,583	6,639	15,074	79,181	27,121	25,934	39,103	92,158
11	2014	15,024	7,038	16,145	76,252	32,382	27,490	37,656	97,528
12	2015	17,938	7,460	17,291	73,430	38,664	29,139	36,263	104,067
13	2016	21,418	7,908	18,519	70,713	46,165	30,887	34,921	111,974
14	2017	25,574	8,382	19,833	68,097	55,121	32,741	33,629	121,491
15	2018	30,535	8,885	21,242	65,577	65,815	34,705	32,385	132,905
16	2019	36,459	9,418	22,750	63,151	78,583	36,788	31,187	146,557
17	2020	43,532	9,983	24,365	60,814	93,828	38,995	30,033	162,856
18	2021	50,061	10,482	25,583	58,564	107,902	40,944	28,922	177,768
19	2022	57,571	11,006	26,862	56,397	124,088	42,992	27,852	194,931
20	2023	66,206	11,557	28,206	54,311	142,701	45,141	26,821	214,663
21	2024	76,137	12,134	29,616	52,301	164,106	47,398	25,829	237,333
22	2025	87,558	12,741	31,097	50,366	188,722	49,768	24,873	263,363
23	2026	100,691	13,378	32,652	48,503	217,030	52,257	23,953	293,239
24	2027	115,795	14,047	34,284	46,708	249,584	54,870	23,066	327,521
25	2028	133,164	14,750	35,998	44,980	287,022	57,613	22,213	366,848

**Table 16.3.3 Estimation of Economic Vehicle Operating Cost**

Unit: Dong

Items	Passenger Car		Bus		Truck		M.Cycle
	Pas. Car	Van	Mid-Bus	L. Bus	M.Truck	H.Truck	M.Cycle
Running Costs/vehicle-km	1,656.51	1,137.08	1,369.21	3,544.46	2,006.43	2,781.66	280.38
Vehicle Component	0.84	0.16	0.67	0.33	0.89	0.11	1.00
Weighted	1,391.47	181.93	917.37	1,169.67	1,785.72	305.98	280.38
Running Costs/vehicle-km		1,573		2,087		2,091	280
Fixed Costs/vehicle-km	392.60	410.34	626.00	1,471.70	954.15	1,356.38	41.14
Vehicle Component	0.84	0.16	0.67	0.33	0.89	0.11	1.00
Weighted	329.78	65.65	419.42	485.66	849.20	149.20	41.14
Fixed Costs/vehicle-km		395		905		998	41
Grand total		1,968		2,992		3,090	321

Note: Base speed of passenger car and van are 45 km/h, and others 40 km/h



Driving speed will decrease year by year as traffic increases in the Study Area. Vehicle operating cost will increase, as vehicle speed decreases. Table 16.3.4 shows the set speed and vehicle operating cost by year and by vehicles.

**Table 16.3.4 Vehicle Speed and V.O.C for Calculation of V.O.C Saving**

Unit: Dong/vehicle-km

Vehicle Type	Project Road		Street			
	2004 - 2020		1998		2020	
	km / h	V.O.C	km / h	V.O.C	km / h	V.O.C
Passenger Car	70	1,932	30	2,923	20	3,396
Bus	60	2,517	25	3,186	18	3,459
Truck	60	3,026	25	4,150	18	4,581
Motor Cycle	50	327	25	357	18	383

Ref.: Appendix Table 16.8 Composite Unit of Vehicle Operating Cost

Table 16.3.5 shows road users benefit of vehicle operating cost from shorter distance. Driving distance on street by vehicle types are estimated based on origin and destination survey. Road user can save average 6.5 km by using project road.

**Table 16.3.5 Unit Vehicle Operating Cost Saving from Reduced Distance**

Unit :Dong/vehicle-km

Vehicle Type	Driving Distance by O.D (km)		Driving Distance (km)			V.O.C Saving	
			Street	Project	Saving	1998	2020
Passenger Car	25.8	24 %	18.37	12.3	6.07	17,751	20,623
Bus	27.3	26 %	19.44	12.3	7.14	22,751	24,700
Truck	28.6	27 %	20.37	12.3	8.07	33,477	36,953
Motor Cycle	23.9	23 %	17.02	12.3	4.72	1,685	1,808
Average	26.4	100 %	18.80	12.3	6.50		

Table 16.3.6 shows calculated result of vehicle operating cost saving benefit for project life. Vehicle operating cost saving benefits were estimated by multiplying unit V.O.C saving described in Table 16.3.5 with traffic demand. Benefits were assumed at the same amount after year 2020 when project road reaches to traffic capacity. The reason is that driving speed on street after year 2020 will not decrease less than 20 km/h for passenger car and 18 km/h for other vehicles by construction of some other transportation mode.

#### **16.3.4 Benefit - 3 : Vehicle Operating Cost Saving from Higher Design Standards**

V.O.C saving from higher design standards was estimated by the deference of driving speed between project road and ordinary street for 12.3 km. Table 16.3.7 shows the V.O.C saving by vehicles in year 1998 and 2020. This table was calculated by using table 16.3.4 "Vehicle Speed and V.O.C Saving for Calculation of the Benefit".

**Table 16.3.6 Vehicle Operation Cost Saving Benefit By Reduced Distance**

Unit: Million Dong

No.	Year	V.O.C.Benefits / Vehicle				V.O.C.Benefits by Driving Distance Saving				
		Pas.Car	Bus	Truck	Mo.Cycle	Pas.Car	Bus	Truck	Mo.Cycle	Total
1	2004	18,492	23,267	34,391	1,718	19,977	34,202	116,922	64,693	235,795
2	2005	18,619	23,354	34,546	1,723	24,036	36,734	126,257	66,198	253,224
3	2006	18,746	23,442	34,701	1,729	28,919	39,452	136,337	67,739	272,446
4	2007	18,874	23,529	34,857	1,734	34,795	42,372	147,222	69,314	293,702
5	2008	19,003	23,618	35,014	1,740	41,864	45,508	158,975	70,927	317,274
6	2009	19,133	23,706	35,172	1,745	50,370	48,876	171,668	72,577	343,490
7	2010	19,264	23,795	35,330	1,751	60,604	52,493	185,373	74,265	372,735
8	2011	19,396	23,884	35,489	1,756	71,202	54,338	193,562	69,705	388,808
9	2012	19,529	23,973	35,649	1,762	83,654	56,249	202,114	65,425	407,441
10	2013	19,662	24,063	35,809	1,768	98,283	58,227	211,042	61,407	428,960
11	2014	19,797	24,153	35,970	1,773	115,471	60,274	220,366	57,636	453,748
12	2015	19,932	24,244	36,132	1,779	135,665	62,394	230,101	54,097	482,257
13	2016	20,068	24,334	36,295	1,785	159,391	64,588	240,266	50,775	515,020
14	2017	20,206	24,426	36,458	1,790	187,265	66,859	250,881	47,657	552,662
15	2018	20,344	24,517	36,622	1,796	220,014	69,210	261,964	44,731	595,919
16	2019	20,483	24,609	36,787	1,802	258,491	71,643	273,537	41,984	645,655
17	2020	20,623	24,700	36,953	1,808	303,633	74,134	285,551	39,404	702,722
18	2021	20,623	24,700	36,953	1,808	303,633	74,134	285,551	39,404	702,722
19	2022	20,623	24,700	36,953	1,808	303,633	74,134	285,551	39,404	702,722
20	2023	20,623	24,700	36,953	1,808	303,633	74,134	285,551	39,404	702,722
21	2024	20,623	24,700	36,953	1,808	303,633	74,134	285,551	39,404	702,722
22	2025	20,623	24,700	36,953	1,808	303,633	74,134	285,551	39,404	702,722
23	2026	20,623	24,700	36,953	1,808	303,633	74,134	285,551	39,404	702,722
24	2027	20,623	24,700	36,953	1,808	303,633	74,134	285,551	39,404	702,722
25	2028	20,623	24,700	36,953	1,808	303,633	74,134	285,551	39,404	702,722

**Table 16.3.7 Vehicle Operating Cost Saving by Driving on 12.3 km Distance**

	Unit :Dong/Vehicle				
	Project Road	Street		V.O.C.Savings	
	2004-2020	1998	2020	1998	2020
Passenger Car	23,764	35,953	41,771	12,189	18,007
Bus	30,959	39,188	42,546	8,229	11,587
Truck	37,220	51,045	56,346	13,825	19,127
Motor Cycle	4,022	4,391	4,711	369	689

Table 16.3.8 is the result of calculation of V.O.C saving benefit by the Project.

**Table 16.3.8 Vehicle Operating Cost Saving Benefit from Higher Design Standard**

No.	Year	V.O.C. Benefit / Vehicle				V.O.C.Benefis by Driving Speed Difference				
		Pas.Car	Bus	Truck	M.Cycle	Pas.Car	Bus	Truck	M.Cycle	Total
		Unit: Million Dong								
1	2004	13,558	9,034	15,104	437	14,647	13,280	51,351	16,470	95,748
2	2005	13,801	9,176	15,329	450	17,816	14,433	56,023	17,282	105,553
3	2006	14,048	9,320	15,557	463	21,671	15,685	61,120	18,133	116,609
4	2007	14,299	9,466	15,788	476	26,361	17,046	66,680	19,027	129,114
5	2008	14,555	9,614	16,022	490	32,065	18,525	72,746	19,964	143,301
6	2009	14,816	9,765	16,260	504	39,004	20,133	79,364	20,948	159,449
7	2010	15,081	9,918	16,502	518	47,444	21,880	86,584	21,980	177,888
8	2011	15,351	10,074	16,747	533	56,353	22,919	91,342	21,155	191,768
9	2012	15,626	10,232	16,996	548	66,936	24,007	96,361	20,360	207,663
10	2013	15,905	10,392	17,249	564	79,505	25,146	101,656	19,596	225,903
11	2014	16,190	10,555	17,505	580	94,435	26,340	107,241	18,860	246,877
12	2015	16,480	10,720	17,765	597	112,169	27,590	113,134	18,152	271,045
13	2016	16,775	10,889	18,029	614	133,233	28,900	119,350	17,470	298,954
14	2017	17,075	11,059	18,297	632	158,252	30,272	125,908	16,814	331,247
15	2018	17,381	11,233	18,569	650	187,970	31,709	132,826	16,183	368,689
16	2019	17,692	11,409	18,845	668	223,269	33,214	140,125	15,575	412,183
17	2020	18,007	11,587	19,127	689	265,117	34,777	147,802	15,016	462,713
18	2021	18,007	11,587	19,127	689	265,117	34,777	147,802	15,016	462,713
19	2022	18,007	11,587	19,127	689	265,117	34,777	147,802	15,016	462,713
20	2023	18,007	11,587	19,127	689	265,117	34,777	147,802	15,016	462,713
21	2024	18,007	11,587	19,127	689	265,117	34,777	147,802	15,016	462,713
22	2025	18,007	11,587	19,127	689	265,117	34,777	147,802	15,016	462,713
23	2026	18,007	11,587	19,127	689	265,117	34,777	147,802	15,016	462,713
24	2027	18,007	11,587	19,127	689	265,117	34,777	147,802	15,016	462,713
25	2028	18,007	11,587	19,127	689	265,117	34,777	147,802	15,016	462,713

## 16.4 Economic Cost Benefit Analysis

### 16.4.1 Result of Economic Analysis

There are three methods for comparison of economic costs with economic benefits to select the optimum scales of the Project: i) EIRR, ii) net present values, and iii) cost

benefit ratio. Here, comparison of EIRR was adopted as indexes to prove investment feasibility.

The internal rate of return is the discounted rate in which total discounted present value of benefits equals to the total discounted present value of costs. The higher the internal economic rate of return, the higher the priority of the Project. If the internal rate of return turns out higher than the opportunity cost of capitals, that is 12 %, investment is proved to be feasible.

Table 16.4.1 shows comparison of economic cost with benefit at 12 % of opportunity cost of capital. As shown in the result below, total discounted benefit was bigger than total discounted cost proving that the scale of project is economically feasible.

- |   |                      |
|---|----------------------|
| (1) Benefit Cost Ratio discounted at 12 % | 1.12                 |
| (2) Net Present Value discounted at 12 %  | 329,449 million Dong |

Table 16.4.2 shows the result of the calculation of EIRR. Total cost before discounting is 4,286 billion Dong, while total benefits is 23,420 billion Dong. The benefit is 5.6 times more than the costs.

When both were discounted at 13.14 %, total costs and benefits were both 2,606 billion Dong. When discounted at 11 %, costs will be less than benefits. Whereas at the discount rate of 20 %, benefits will be less than costs. Thus the EIRR was found to be 13.14 %.

Appendix 16.4.1 shows the result of the calculation of EIRR of prestressed concrete cable stay main bridge alternative scheme. Economic cost of the construction cost of the alternative scheme is 4,546,513 million Dong which is 14 % (3,984,452 million Dong) higher than the base case of prestressed concrete box girder bridge. EIRR of prestressed concrete cable stay main bridge scheme was found to be 12.07 %.

The Project is judged both feasible, showing EIRR of 13.14 % and 12.07 %, higher than the opportunity cost of capital in Vietnam. The base case is recommendable for implementation as the higher priority project.

**Table 16.4.1 Cost Benefit Analysis for Investment Justification**

Unit : Million Dong

Benefit Cost Ratio: 1.12, Net Present Value: 329,450 Million Dong

year	Economic Cost		Benefits			Present Worth				
	Capital	Routine Operation	Total	Passenger Time	V.O.C Saving Distance	Design	Total	Discount Factor	Cost Mill.Dong	Benefit Mill.Dong
1	110,251		110,251					0.893	98,438	
2	322,520		322,520					0.797	257,111	
3	940,837		940,837					0.712	669,669	
4	1,553,665		1,553,665					0.636	987,382	
5	1,166,691		1,166,691					0.567	662,012	
6		7,382	7,382	48,391	235,795	95,748	379,934	0.507	3,740	192,486
7		7,382	7,382	52,718	253,224	105,553	411,495	0.452	3,339	186,139
8		7,382	7,382	57,459	272,446	116,609	446,514	0.404	2,981	180,340
9		7,382	7,382	62,658	293,702	129,114	485,474	0.361	2,662	175,067
10	1,321	7,382	8,702	68,361	317,274	143,301	528,936	0.322	2,802	170,303
11		7,382	7,382	74,620	343,490	159,449	577,559	0.287	2,122	166,034
12		7,382	7,382	81,493	372,735	177,888	632,116	0.257	1,895	162,248
13		7,382	7,382	84,270	388,808	191,768	664,846	0.229	1,692	152,366
14		7,382	7,382	87,786	407,441	207,663	702,890	0.205	1,510	143,825
15	1,321	7,382	8,702	92,158	428,960	225,903	747,021	0.183	1,590	136,478
16		7,382	7,382	97,528	453,748	246,877	798,153	0.163	1,204	130,196
17		7,382	7,382	104,067	482,257	271,045	857,369	0.146	1,075	124,871
18		7,382	7,382	111,974	515,020	298,954	925,948	0.130	960	120,410
19		7,382	7,382	121,491	552,662	331,247	1,005,400	0.116	857	116,734
20	1,321	7,382	8,702	132,905	595,919	368,689	1,097,513	0.104	902	113,776
21		7,382	7,382	146,557	645,655	412,183	1,204,395	0.093	683	111,478
22		7,382	7,382	162,856	702,722	462,713	1,328,291	0.083	610	109,773
23		7,382	7,382	162,856	702,722	462,713	1,328,291	0.074	545	98,012
24		7,382	7,382	162,856	702,722	462,713	1,328,291	0.066	486	87,511
25	1,321	7,382	8,702	162,856	702,722	462,713	1,328,291	0.059	512	78,134
26		7,382	7,382	162,856	702,722	462,713	1,328,291	0.053	388	69,763
27		7,382	7,382	162,856	702,722	462,713	1,328,291	0.047	346	62,288
28		7,382	7,382	162,856	702,722	462,713	1,328,291	0.042	309	55,615
29		7,382	7,382	162,856	702,722	462,713	1,328,291	0.037	276	49,656
30	1,321	7,382	8,702	162,856	702,722	462,713	1,328,291	0.033	290	44,336
	4,100,567	184,544	4,285,111	2,890,140	12,883,634	7,646,408	23,420,182	12.00%	2,708,390	3,037,839

**Table 16.4.2 Cost Benefit Analysis for Investment Justification**

Economic Internal Rate of Return: 13.14 % Unit : Million Dong

year	Economic Cost		Benefits			Present Worth			
	Capital	Routine Operation	Passenger Time	V.O.C Saving Distance	Design	Total	Discount Factor	Cost Mill.Dong	Benefit Mill.Dong
1 1999	110,251						0.884	97,450	
2 2000	322,520						0.781	251,975	
3 2001	940,837						0.691	649,704	
4 2002	1,553,665						0.610	948,329	
5 2003	1,166,691						0.540	629,446	
6 2004		7,429	48,391	235,795	95,748	379,934	0.477	3,543	181,180
7 2005		7,429	52,718	253,224	105,553	411,495	0.422	3,131	173,447
8 2006		7,429	57,459	272,446	116,809	446,514	0.373	2,768	166,356
9 2007		7,429	62,658	293,702	129,114	485,474	0.329	2,446	159,871
10 2008		7,429	68,361	317,274	143,301	528,936	0.291	2,549	153,960
11 2009	1,329	7,429	74,620	343,490	159,449	577,559	0.257	1,911	148,594
12 2010		7,429	81,493	372,735	177,888	632,116	0.227	1,689	143,748
13 2011		7,429	84,270	388,808	191,768	664,846	0.201	1,493	133,637
14 2012		7,429	87,786	407,441	207,663	702,890	0.178	1,320	124,880
15 2013	1,329	7,429	92,158	428,960	225,903	747,021	0.157	1,375	117,311
16 2014		7,429	97,528	453,748	246,877	798,153	0.139	1,031	110,788
17 2015		7,429	104,067	482,257	271,045	857,369	0.123	911	105,190
18 2016		7,429	111,974	515,020	298,954	925,948	0.108	806	100,414
19 2017		7,429	121,491	552,662	331,247	1,005,400	0.096	712	96,371
20 2018	1,329	7,429	132,905	595,919	368,689	1,097,513	0.085	742	92,986
21 2019		7,429	146,557	645,655	412,183	1,204,395	0.075	556	90,194
22 2020		7,429	162,856	702,722	462,713	1,328,291	0.066	492	87,923
23 2021		7,429	162,856	702,722	462,713	1,328,291	0.059	435	77,715
24 2022		7,429	162,856	702,722	462,713	1,328,291	0.052	384	68,692
25 2023		7,429	162,856	702,722	462,713	1,328,291	0.046	400	60,716
26 2024	1,329	7,429	162,856	702,722	462,713	1,328,291	0.040	300	53,667
27 2025		7,429	162,856	702,722	462,713	1,328,291	0.036	265	47,436
28 2026		7,429	162,856	702,722	462,713	1,328,291	0.032	235	41,928
29 2027		7,429	162,856	702,722	462,713	1,328,291	0.028	207	37,060
30 2028	1,329	7,429	162,856	702,722	462,713	1,328,291	0.025	216	32,757
	4,100,609	185,725	2,890,140	12,883,634	7,646,408	23,420,182	13.14%	2,606,824	2,606,824

## 16.4.2 Sensitivity Analysis

### (1) Summary

Table 16.4.3 shows possible change of EIRR by the degree of influence of future uncertainty at cost increase and benefit decrease of the Project in the case of base case.

Followings are the result of sensitivity analysis;

- Project is feasible even if the cost increases around 10 %;
- Project is feasible even if the benefit decrease around 10 %;
- Project is not feasible if the cost increase 15 %;
- Project is not feasible if the benefit decreases 15 %; and
- Project is not feasible if benefit decreases 10 % and cost increases 10 %.

**Table 16.4.3 Sensitivity Analysis of Economic Indicators**

Cost & Benefits	Increase & Decrease	EIRR	
1) Base Case		13.14 %	Feasible
2) Cost	10 % Increase	12.19 %	Feasible
	10 % Decrease	14.23 %	Feasible
	15 % Increase	11.76 %	Not Feasible
3) Benefits	10 % Decrease	12.09 %	Feasible
	15 % Decrease	11.54 %	Not Feasible
4) Cost Increase & Benefit Decrease	10 % Increase & Decrease	11.18 %	Not Feasible

### (2) Cost

When cost decreases by 10 %, EIRR becomes 14.23 %, which is the highest economic rate of return in the analysis.

### (3) Benefit

Benefit from the Project was assumed not to increase after year 2020, because the traffic using the Project facility is to reach to the road capacity in year 2020, 17 years after the beginning of operation. Even if projected road reaches to the capacity in year 2016, 13 years after the beginning of operation, EIRR still remained 12.24 % which is considered feasible.

(4) Social Benefit

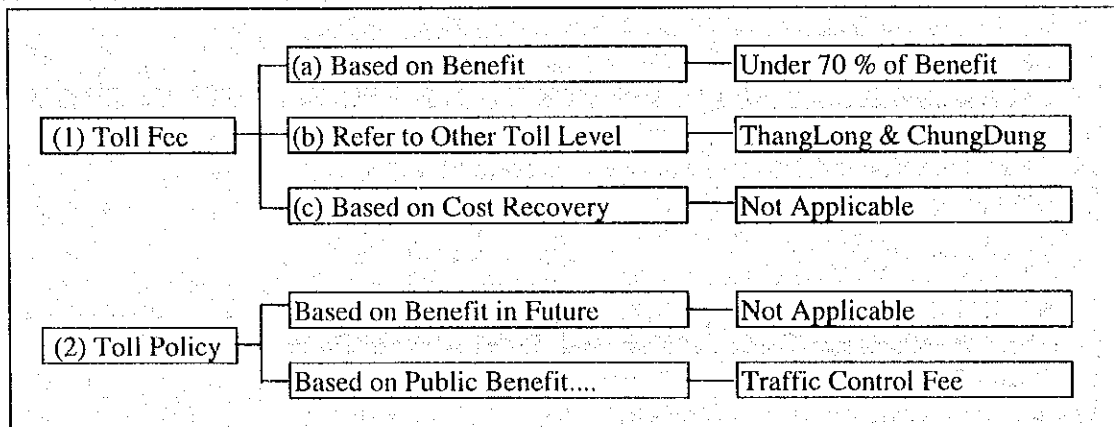
Decrease of traffic accident, and decrease of social cost such as noise and vibration, air pollution by adoption of higher design standard as well as vest increased benefit of the regional development are expected. Those benefits were not included here for EIRR calculation.

## 16.5 Estimation of Toll

### 16.5.1 Road User Charge

As explained in the Table 16.5.1, the level of toll fee can be decided in three ways, (a) based on the benefit, (b) in correspondence to other similar toll facilities, and (c) based on the cost recovery of investment fund.

**Table 16.5.1 Decision of Toll Level and Toll Policy**



Cost recovery based on toll(c) policy is usually used for private toll road managed by private company under the approval of fee by the government. Thanh Tri bridge and the ring road has such a high public nature as to use public fund. Accordingly level of toll fee has to be based on the benefit raised from the Project.

### 16.5.2 Toll Fee and Road Users' Benefit

Table 16.5.2 shows road users' benefits of passenger car, bus, truck and of motor cycle. Users' benefit of the Project consists from three items: 1) time cost saving of passenger, 2) vehicle operating cost saving from distance reduction, and 3) vehicle operation cost



saving from higher design standards.

Following unit data were used for the benefit calculation:

- 1) Driving speed on street : P.Car 30km/h, Bus,Truck and M.Cycle 25km/h in 1998  
P.Car 20km/h, Bus,Truck and M.Cycle 18km/h in 2020
- 2) Driving speed on the Project highway: P.Car 70km/h, Bus & Truck 60km/h,  
M.Cycle 50km/h
- 3) Time cost of passenger (Dong/minute): P.Car 98, Bus 178, M.Cycle 22

Time cost saving and V.O.C saving were measured by the difference between using 12.3 km on toll road and using 17 km – 20 km on city road by vehicle modes based on the traffic origin / destination survey. Appendix Table A16.3.5 gives the time saving when users use the toll road instead of the road network in the city.

**Table 16.5.2 Road Users' Benefit by One Trip in Years 1998 and 2020**

Unit: Dong/vehicle

Vehicle Type	Time Saving Benefit		Vehicle Operating Cost Saving Benefit				Total Road Users' Benefit	
			Distance Saving		Design Difference			
	1998	2020	1998	2020	1998	2020	1998	2020
P. Car	2,579	4,387	17,751	20,623	12,189	18,007	32,519	43,017
Bus	6,128	9,364	22,751	24,700	8,229	11,587	37,108	45,651
Truck	0	0	33,477	36,953	13,825	19,127	47,302	56,080
M.Cycle	588	946	1,685	1,808	369	689	2,642	3,443

Ref: Appendix Table 16.10 Unit Time Saving by Using Project Road

Level of toll fee must be less than users' benefit. Appendix table A16.5.1 shows present toll rate of Thang Long bridge including 15 km of Thang Long – Noi Bai highway. Table 16.5.3 shows the relation between users' benefit and present toll rate of Thang Long bridge.

**Table 16.5.3 Estimation of Toll Fee Balanced with Road Users' Benefit and with the Project**

Unit: Dong

Vehicle Type	1998			2020					
	Users' Benefit	Toll/B. Ratio	Thang Long Toll	Case 1			Case 2		
				Benefit	T/B. ratio	Toll	Benefit	T/B ratio	Toll
Passenger Car	32,519	36.9 %	12,000	43,017	36.9 %	15,874	43,017	70 %	30,112
Bus	37,108	57.9 %	21,480	45,651	57.9 %	26,426	45,651	70 %	31,956
Truck	47,302	48.3 %	22,840	56,080	48.3 %	27,079	56,080	70 %	39,256
Motor Cycle	2,642	37.8 %	1,000	3,443	37.8 %	1,308	3,443	70 %	2,410
Average	29,893	45.2 %	14,330	37,048	45.2 %	17,670	37,048	70 %	25,934

Ref: Appendix Table A16.5.1 Toll Rate of Thang Long Bridge and Thang Long – Noi Bai Highway

Toll on Thanh Tri bridge for 1998 was assumed to charge the same toll as Thang Long bridge since it is reasonable and realistic to charge of average toll of 45.2 % of users benefit.

Toll fee in future will increase as users' benefit increase in accordance with congestion increase in the city road. Therefore, following two cases of toll were used for estimation of revenue calculation.

Case 1: To keep the same toll benefit ratio at present average 45.2 % till year 2020

Case 2: To gradually increase from 45.2 % of benefit in year 1998 to 70 % in 2020

### 16.5.3 Toll Revenue

Toll revenues were calculated for Case 1 and Case 2. Yearly increase rate of toll from 1998 to 2028 are shown as bellow:

Vehicle	Case 1	Case 2
Passenger car	1.28 %	4.27 %
Bus	0.95 %	1.82 %
Truck	0.78 %	2.49 %
Motor Cycle	1.25 %	4.08 %
Average	1.07 %	3.16 %

Toll fee may increase based on increase of benefits up to year 2020. In 2020, traffic demand is estimated to exceed the capacity. Therefore after 2020, toll fee will have to be set at traffic control - based fee. It means some users of the toll road may be forced to leave by the raise of toll fee over 4 % with no relation to users' benefit.

Table 16.5.4 shows toll revenue multiplied by number of traffic based on the toll rate under the assumption explained above.

The toll collection system for the project road needs to be considered as a part of the ring road to be completed in the future. The project road was designed to build a barrier type toll gate on main highway, and to adopt a flat toll charge system.

Table 16.5.4 Toll Fee and Toll Revenue of the Project

No.	Year	Case 1 (Toll Charge 45% of Benefit from 1998-2020)										Case 2 (Toll increase from 45% of benefit in year 1998 to 70% in 2020)											
		Toll Fee(Dong/Vehicle)					Toll Revenue(Million Dong)					Toll Fee(Dong/Vehicle)					Toll Revenue(Million Dong)						
		Pas	Car	Bus	Truck	Mo.Cycle	Pas	Car	Bus	Truck	Mo.Cycle	Total	Pas	Car	Bus	Truck	Mo.Cycle	Total	Pas	Car	Bus	Truck	Mo.Cycle
1	1998	12,000	21,480	21,480	22,840	1,000	12,000	21,480	21,480	22,840	1,000	12,000	21,480	21,480	22,840	1,000	16,661	35,188	90,009	47,878	189,737		
2	1999	12,154	21,683	23,017	1,012	12,154	21,683	23,017	1,012	12,154	21,683	23,017	1,012	12,513	21,871	23,409	1,041	20,760	38,338	99,171	50,828	209,097	
3	2000	12,309	21,888	23,196	1,024	12,309	21,888	23,196	1,024	12,309	21,888	23,196	1,024	13,047	22,270	23,993	1,083	25,868	41,769	109,265	53,960	230,863	
4	2001	12,467	22,095	23,376	1,037	12,467	22,095	23,376	1,037	12,467	22,095	23,376	1,037	13,604	22,676	24,590	1,127	32,233	45,507	120,387	57,285	235,412	
5	2002	12,626	22,304	23,557	1,049	12,626	22,304	23,557	1,049	12,626	22,304	23,557	1,049	14,185	23,089	25,203	1,173	40,163	49,579	132,642	60,815	283,199	
6	2003	12,788	22,515	23,740	1,062	12,788	22,515	23,740	1,062	12,788	22,515	23,740	1,062	14,791	23,509	25,831	1,221	50,045	54,016	146,143	64,562	314,766	
7	2004	12,952	22,728	23,924	1,075	12,952	22,728	23,924	1,075	12,952	22,728	23,924	1,075	15,423	23,938	26,475	1,271	62,358	58,851	161,019	68,540	350,767	
8	2005	13,117	22,943	24,110	1,088	13,117	22,943	24,110	1,088	13,117	22,943	24,110	1,088	16,081	24,374	27,135	1,323	75,874	61,798	171,550	66,742	375,964	
9	2006	13,285	23,160	24,297	1,101	13,285	23,160	24,297	1,101	13,285	23,160	24,297	1,101	16,768	24,818	27,811	1,377	112,327	68,145	194,724	63,287	438,483	
10	2007	13,455	23,380	24,486	1,115	13,455	23,380	24,486	1,115	13,455	23,380	24,486	1,115	17,484	25,270	28,504	1,433	136,673	71,558	207,460	61,627	477,318	
11	2008	13,628	23,601	24,676	1,128	13,628	23,601	24,676	1,128	13,628	23,601	24,676	1,128	18,231	25,731	29,214	1,492	166,295	75,142	221,029	60,011	522,477	
12	2009	13,802	23,824	24,867	1,142	13,802	23,824	24,867	1,142	13,802	23,824	24,867	1,142	19,010	26,199	29,942	1,553	202,358	78,906	235,483	58,437	575,166	
13	2010	13,979	24,049	25,060	1,156	13,979	24,049	25,060	1,156	13,979	24,049	25,060	1,156	19,822	26,677	30,689	1,616	246,192	82,859	250,887	56,904	636,842	
14	2011	14,158	24,277	25,254	1,170	14,158	24,277	25,254	1,170	14,158	24,277	25,254	1,170	20,668	27,163	31,453	1,682	299,551	87,009	267,296	55,412	709,268	
15	2012	14,339	24,507	25,450	1,184	14,339	24,507	25,450	1,184	14,339	24,507	25,450	1,184	21,551	27,658	32,237	1,750	364,475	91,367	284,778	53,959	794,579	
16	2013	14,522	24,738	25,648	1,199	14,522	24,738	25,648	1,199	14,522	24,738	25,648	1,199	22,472	28,162	33,040	1,822	443,339	95,913	303,347	52,524	895,123	
17	2014	14,708	24,972	25,847	1,213	14,708	24,972	25,847	1,213	14,708	24,972	25,847	1,213	23,431	28,675	33,864	1,896	462,274	97,660	310,907	54,667	925,508	
18	2015	14,896	25,209	26,048	1,228	14,896	25,209	26,048	1,228	14,896	25,209	26,048	1,228	24,432	29,197	34,708	1,974	482,018	99,439	318,655	56,897	957,009	
19	2016	15,087	25,447	26,250	1,243	15,087	25,447	26,250	1,243	15,087	25,447	26,250	1,243	25,476	29,729	35,573	2,054	502,605	101,251	326,595	59,219	989,670	
20	2017	15,280	25,688	26,453	1,258	15,280	25,688	26,453	1,258	15,280	25,688	26,453	1,258	26,564	30,271	36,459	2,138	524,071	103,096	334,734	61,635	1,023,536	
21	2018	15,476	25,931	26,659	1,273	15,476	25,931	26,659	1,273	15,476	25,931	26,659	1,273	27,698	30,822	37,368	2,225	546,454	104,974	343,076	64,150	1,058,654	
22	2019	15,674	26,176	26,866	1,289	15,674	26,176	26,866	1,289	15,674	26,176	26,866	1,289	28,881	31,384	38,299	2,316	569,793	106,887	351,625	66,767	1,095,072	
23	2020	15,874	26,426	27,079	1,303	15,874	26,426	27,079	1,303	15,874	26,426	27,079	1,303	30,112	31,956	39,256	2,410	594,129	108,835	360,388	69,491	1,132,842	
24	2021	16,077	26,676	27,289	1,343	16,077	26,676	27,289	1,343	16,077	26,676	27,289	1,343	31,398	32,538	40,234	2,508	619,504	110,818	369,369	72,326	1,172,017	
25	2022	16,283	26,928	27,501	1,385	16,283	26,928	27,501	1,385	16,283	26,928	27,501	1,385	32,739	33,131	41,237	2,611						
26	2023	16,491	27,183	27,714	1,428	16,491	27,183	27,714	1,428	16,491	27,183	27,714	1,428	34,137	33,735	42,265	2,717						
27	2024	16,702	27,440	27,929	1,472	16,702	27,440	27,929	1,472	16,702	27,440	27,929	1,472	35,595	34,349	43,318	2,828						
28	2025	16,916	27,700	28,146	1,518	16,916	27,700	28,146	1,518	16,916	27,700	28,146	1,518	37,116	34,975	44,397	2,943						
29	2026	17,133	27,962	28,365	1,565	17,133	27,962	28,365	1,565	17,133	27,962	28,365	1,565	38,701	35,612	45,504	3,064						
30	2027	17,352	28,226	28,585	1,613	17,352	28,226	28,585	1,613	17,352	28,226	28,585	1,613	40,354	36,261	46,638	3,189						
31	2028	17,574	28,493	28,806	1,663	17,574	28,493	28,806	1,663	17,574	28,493	28,806	1,663	42,077	36,922	47,800	3,319						