7 ECONOMIC EVALUATION AND IMPLEMENTATION STRATEGY

7.1 Economic Evaluation

1) Methodology and Assumptions

The Project is evaluated from the economic perspective, following a prevailing method of the cost-benefit analysis, in which the project cost and benefit are measured in economic price and compared through the project life. Economic cost is the initial investment cost and maintenance cost of the Project.

Economic benefit of the Project is defined as the savings in VOC and TTC attributable to the project. This benefit is the most direct one and comparatively easy to quantify. The benefit is estimated through "with-and without" comparison of traffic assignment on the network under all master plan components would be completed.

The project would generate other economic benefits such as decrease of traffic accidents, improvement in passengers' comfortability and contribution to regional development in the long run. However, these benefits are difficult to measure and tend to be an arbitrary estimate, even they can be measured. For this reason, economic benefit is limited to the most direct ones to make the analysis safer.

Durable life of a transportation project is usually very long, that is, 50 to 60 years if it is properly maintained. On the other hand, economic project life is considered much shorter than the physical life, that is, 25 to 35 years because the facility soon becomes outdated and uneconomical due to rapid innovation. Therefore, this Ring Road No.2 project will apply economic project life 30 years after commencement of operations.

2) Economic Cost

Economic cost is defined as a net consumption of goods and service for implementation of the project. In order to estimate this economic cost of the Project, the initial cost and the maintenance cost stated in the previous chapter, which are measured in financial cost, need to be converted to costs in economic price. According to the Ho Chi Minh City East West Highway Feasibility Study conducted by JICA, economic cost is estimated from its financial cost by multiplying 0.5 with land related cost and 0.85 with the remaining cost. These values are adapted to this study.

Table 7.1.1 shows the financial and economic cost by project component and cost element. Total economic cost is 798 million, or 78.9% of the financial cost. In the same manner, maintenance cost was converted into economic price

Table 7.1.1 Financial and Economic Cost by Project Component

(1) Financial Cost (US$ Million)

	DD Cost	Construction	ROW Cost	Total Cost
Ring Road No.2 (East)	64	490	72	626
Ring Road No.2 (Southwest)	12	96	52	160
Flyover	3	24	34	62
Provincial Road 25	12	96	10	118
Secondary Road	4	32	10	46
Total	96	738	178	1,012

(2) Economic Cost (US$ Million)

	DD Cost	Construction	ROW Cost	Total Cost
Ring Road No.2 (East)	54	417	36	507
Ring Road No.2 (Southwest)	11	81	26	118
Flyover	3	21	17	40
Provincial Road 25	11	81	5	97
Secondary Road	4	27	5	36
Total	82	628	89	798

Source: Study Team

3) Economic Benefit

The unit VOC and TTC used for calculating economical benefits are shown in Table 7.1.2 and Table 7.1.3. Detail information is described in the technical report. By applying these unit costs to assigned traffic volume and summing VOC and TTC on each link, aggregate transportation cost was estimated as shown in Table 7.1.4 for the Ring Road No.2 project. Economic benefit is the difference of the aggregate costs between "without project" case and "with project" case, which will expectedly amount to 277 Million US$ (as annual total) in 2010 and 298 Million US$ in 2020.

The benefits by the Ring Road No.2 project in 2010 and 2020 are comparatively close. This is because many M/P components are assumed to complete in the study area by 2020 and then relative importance of the Ring Road No.2 Project will be less significant.

Table 7.1.2 Unit VOC by Mode

(US$/000km)

Speed (Km/hour)	Motor -cycle	Car	Bus
5	97.8	231.5	416.7
10	56.2	137.5	257.6
20	34.3	87.7	172.3
30	26.8	70.5	140.2
40	22.3	60.6	122.0
50	20.1	56.2	120.8
60	19.7	56.1	128.6
70	19.9	57.4	140.8
80	20.3	59.7	156.1

Source: Study Team

Table 7.1.3 Unit TTC by Mode

(US$/Hour)

	2002	2010	2015	2020
Motorcycle	0.48	0.98	1.31	1.74
Car	0.57	1.29	1.74	2.36
Bus	0.48	0.98	1.31	1.74

Source: Study Team

Table 7.1.4 Economic Benefit in Benchmark Year

(US$ Million/year)

			Motorcycle	Car	Public Transport	Total
2010	Without Case	VOC	1,591	1,781	252	3,624
		TTC	1,498	1,323	1,726	4,548
		Total	**3,090**	**3,105**	**1,978**	**8,172**
	With Case	VOC	1,543	1,744	246	3,533
		TTC	1,429	1,278	1,654	4,362
		Total	**2,972**	**3,022**	**1,901**	**7,895**
	Benefit	VOC	48	38	6	92
		TTC	69	45	71	185
		Total	**117**	**83**	**77**	**277**
2020	Without Case	VOC	568	1,493	491	2,552
		TTC	938	1,835	5,919	8,692
		Total	**1,507**	**3,328**	**6,410**	**11,244**
	With Case	VOC	541	1,450	487	2,479
		TTC	870	1,747	5,851	8,468
		Total	**1,412**	**3,197**	**6,338**	**10,947**
	Benefit	VOC	27	43	4	73
		TTC	68	88	68	224
		Total	**95**	**131**	**72**	**298**

Source: Study Team

4) Cost-benefit Flow and EIRR

Table 7.1.5 shows the summary of the economic evaluation. According to this result, the Ring Road No.2 project shows **29.4%** of EIRR and Table 7.1.6shows the economic cash flow over the project period for calculating economic internal rate of return (EIRR).

Table 7.1.5 Summary of Economic Evaluation of Ring Road No.2 Project

EIRR	(%)	29.4
NPV	Million US$	908.1
B/C	-	3.12

Source: Study Team

Table 7.1.6 Cash Flow of Economic Cost and Benefit

Year	Cost (US$ mil)			Benefit (US$ mil)	Present Value at 12%	
	Capital	O&M	Total		Cost	Benefit
2005	16.2		16.2		14.5	
2006	69.2		69.2		55.2	
2007	120.3		120.3		85.6	
2008	170.1		170.1		108.1	
2009	249.0		249.0		141.3	
2010		4.4	4.4	277.0	2.2	140.3
2011		4.4	4.4	279.0	2.0	126.2
2012		4.4	4.4	281.0	1.8	113.5
2013		4.4	4.4	283.0	1.6	102.1
2014		4.4	4.4	285.0	1.4	91.8
2015		8.6	8.6	287.1	2.5	82.5
2016		4.4	4.4	289.1	1.1	74.2
2017		4.4	4.4	291.2	1.0	66.7
2018		4.4	4.4	293.3	0.9	60.0
2019		4.4	4.4	295.4	0.8	54.0
2020		4.4	4.4	297.5	0.7	48.5
2021		8.6	8.6	299.7	1.2	43.6
2022		4.4	4.4	301.8	0.6	39.2
2023		4.4	4.4	304.0	0.5	35.3
2024		4.4	4.4	306.2	0.5	31.7
2025		4.4	4.4	308.3	0.4	28.5
2026		4.4	4.4	310.6	0.4	25.7
2027		8.6	8.6	312.8	0.6	23.1
2028		4.4	4.4	315.0	0.3	20.8
2029		7.5	7.5	317.3	0.4	18.7
2030		4.4	4.4	319.6	0.2	16.8
2031		4.4	4.4	321.9	0.2	15.1
2032		4.4	4.4	324.2	0.2	13.6
2033		8.6	8.6	326.5	0.3	12.2
2034		4.4	4.4	328.8	0.1	11.0
2035		4.4	4.4	331.2	0.1	9.9
2036		4.4	4.4	333.6	0.1	8.9
2037		4.4	4.4	335.9	0.1	8.0
2038		4.4	4.4	338.4	0.1	7.2
2039		8.6	8.6	340.8	0.2	6.5
Total	624.8	156.8	781.6	10,115.5	427.5	1,335.5

Source: Study Team

5) Sensitivity Analysis

Sensitivity analysis is made by changing the initial/maintenance cost upward and economic benefit downward. The result is shown in Table 7.1.7 considering the social discount rate is set to 12%, the Ring Road No.2 project will remain economically feasible even if the cost increases over 30% and benefit decreases under 30%.

Table 7.1.7 Sensitivity Analysis by Changing Cost and Benefit

		Cost Increase			
		0% up	10% up	20% up	30% up
Benefit Decrease	0% down	**29.4**	**27.4**	**25.8**	**24.3**
	10% down	**27.2**	**25.4**	23.8	22.4
	20% down	**25.0**	23.3	21.8	20.5
	30% down	22.6	21.1	19.7	18.5

Source: Study Team

7.2 Implementation Strategy

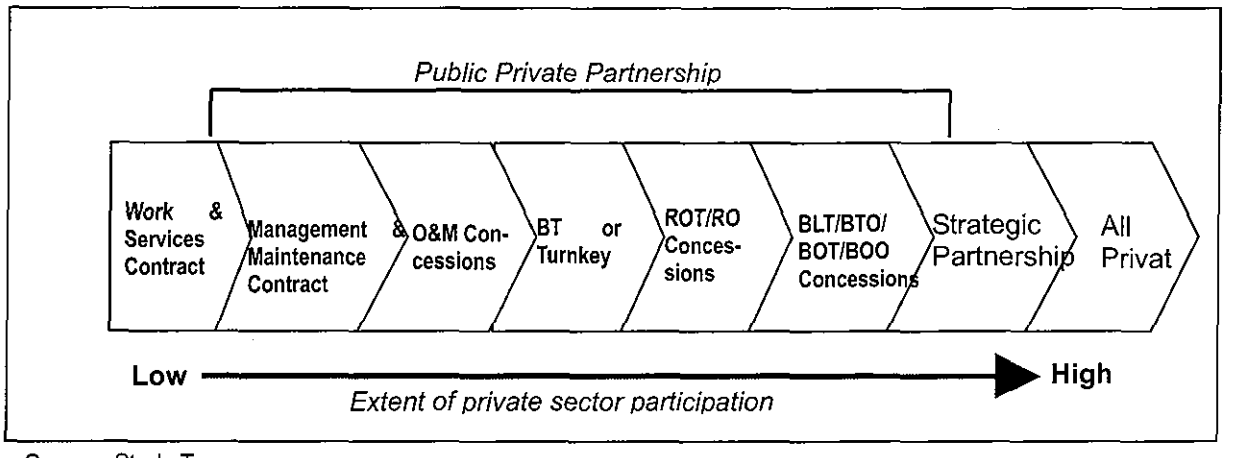
1) *Exploring the PPP Track*

(1) PSP Modality

When considering private sector participation (PSP), several variations or models can be contemplated – ranging from the simple work and management contract through the strategic equity partnership between private and public sector (see Figure 7.2.1). BOT is a complicated model of PSP which requires a comprehensive regulatory framework streamlined for private financing, and high-level expertise at various stages.

The factor conditions of Vietnam have to be taken into account in deciding which PSP model or variant to adopt for the RR2 Project.

Figure 7.2.1 PPP Modality



Source: Study Team

(2) Constraints to PSP in Vietnam

There are three issues to be considered when implementing a PSP project in Vietnam, viz.: country risk or macro-economic factors, regulatory framework, project uncertainty.

a) Country Risk

The country rating is a starting point in assessing the relative difficulty of private financing *in developing countries. Vietnam's rating, as listed in Table 7.2.1, is B1 (as of 2003.2.21)* by the Moody's country rating. This is below the speculative grade, at which procurement of private financing in foreign currency would usually entail guarantee and support from the government as well as multilateral financial institutions (such as the World Bank and the ADB).

The current gross domestic product (GDP) per capita of the country is just over US$ 2,000, which implies a low affordability of transportation users.

Table 7.2.1 Country Risk Assessment of Vietnam

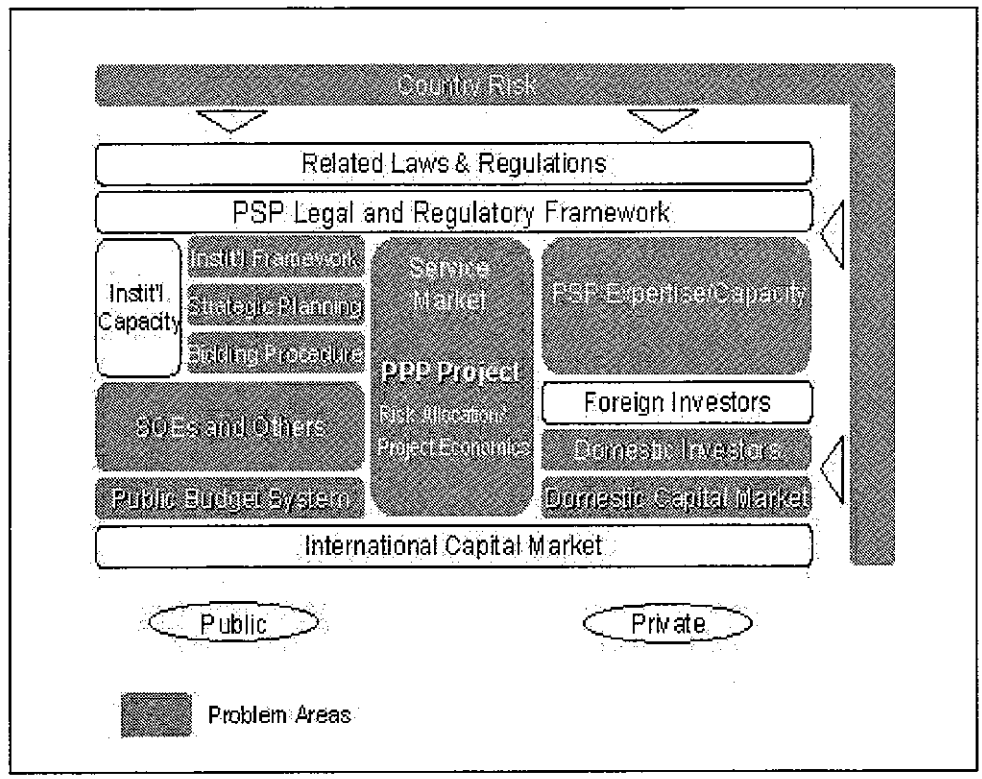
Country	Country Rating (Moody's 2003.2.21)	GDP/Capita (in US$, 2002 est.)
Taiwan	Aa1	17,119
Korea	A3	19,265
China	A3	4,671
Malaysia	Baa1	8,825
Thailand	Baa3	6,575
Philippines	Ba1	3,963
Vietnam	B1	2,072
Indonesia	B3	2,969

Source: Moody's Country Rating
Note: Aaa>Aa>A>Baa>Speculative>Ba>B>Caa>Ca>C; 1>2>3

b) Framework for PSP

It is essential for a country to prepare a comprehensive PSP framework when a public-private partnership (PPP) project is implemented. A preliminary assessment was conducted to evaluate the suitability of PSP for Vietnam. The areas assessed as problematic are illustrated in Figure 7.2.2

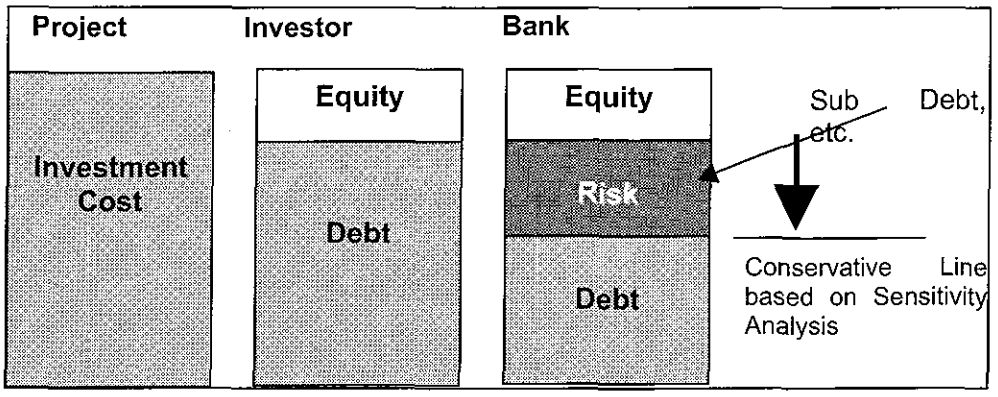
Figure 7.2.2 Problem Areas in PSP Uncertainty in Demand Forecast



Source: Study Team

When the viability of a PSP project in the transport sector is examined, uncertainty in demand forecast is at the top of a lender's concerns. As illustrated in Figure 7.2.3 the bank always evaluates the project risks of the investor's proposal conservatively. When the extent of uncertainty is great, as 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 would tend to be negative. Demand forecasts for "green field" projects, especially rail projects, are usually suspect.

Figure 7.2.3 Uncertainty in Demand Forecast



Source: Study Team

(3) Limited Options for Private Financing

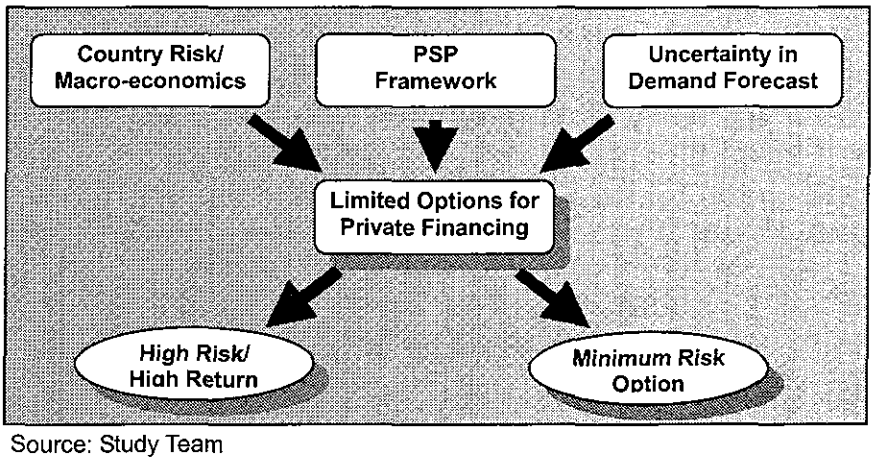
Due to those critical issues discussed above, it can be concluded that there is very little opportunity for private financing in Vietnam. A lender or investor can either be risk averse, or risk taker (as illustrated in Figure 7.2.4):

- Option 1: High risk/high return
- Option 2: Minimum risk

Option 1 is chosen by a lender or investor when the profitability of the project is sufficiently high enough to compensate for the high risk surrounding the project. Such is the case for the Phu My Hung's Saigon South project.

Option 2 is a risk minimization approach where uncertainty in demand forecast is assumed by the public sector to make private financing more feasible. A Build-Transfer or Build-Lease-Transfer contractual structure is adopted in this case.

Figure 7.2.4 Limited Options for Private Financing



Source: Study Team

(4) Formulation and Evaluation of Options for RR2

a) Formulation of the Options

From the four basic options, it is possible to combine those features that will make the RR2 Project acceptable from the private and public viewpoints. The project structure will

depend on how the project rates against nine factors, as shown in Figure 7.2.5, and the assessment shown in table Table 7.2.2

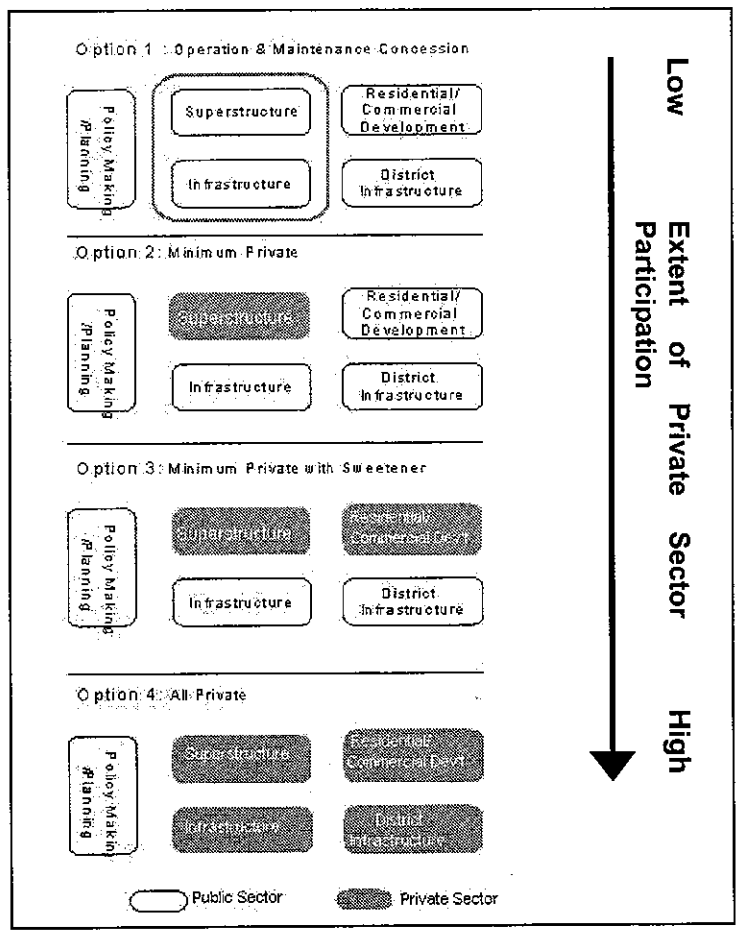
A summary of the features of each implementation options is shown in Table 7.2.3 . Finally, the resulting options were then evaluated against seven issues (see Table 7.2.4): Necessity for Reform, Creation of Competition, Bankability, Magnitude of Government Burden, Certainty in Risk Transfer, Difficulty in Implementation, and Regional Development Impact.

As a result of the evaluation, option 1 (O&M Concession), and option 3 (Minimum Private) got similar scores. Option 1 is superior in terms of: (a) reform needs, (b) risk transfer, and(c) difficulty in implementation; whereas option 2 rated higher in terms of: (a) creation of competition, and (b) bankability.

The result of the evaluation casts some doubts on the reported PSP structure for the Phu My bridge project, as a stand-alone project.

The main features of each implementation options for RR2 East Section are illustrated in Table 7.2.2

Figure 7.2.5 Basic Options for PSP



Source: Study Team

Table 7.2.2 Formulation of Implementation Options for RR2 East Section

Criteria	Option 1: O&M Concession	Option 2: Minimum Private	Option 3: Min. Private w/Sweetener	Option 4: All Private
1. Private Sector Risk	Private: RR2 O&M concession, Bus operation Public: Construction of entire RR2 and busway including Phu My bridge, ROW	Private: Pavement, tolling, facilities, lighting facilities, etc.; BOT concession, Bus operation Public: Phu My bridge n and RR2 road structure, ROW	Same as Option2 plus: Opportunity for commercial/ residential development for Private Sector	All Project Elements are implemented by Private Sector: UMRT Line 1 Commercial/Residential Development District Infrastructure Development
2. Freedom in Operation	Work to specification	Fare setting with Public	Freedom of commercial/ residential development	Large freedom in operation
3. Clear Risk Allocation	Clear risk allocation against specification by the contract	Relatively clear risk allocation by BOT concession contract	Uncertainty in commercial/ residential development	Uncertainty in realization
4. Investment Recovery	No significant investment by Private	By toll revenue	Toll revenue and proceeds from commercial/ residential development	Proceeds of various development in long run
5. Finance	Private: No significant financing Public: ODA and public budget	Private: Project finance Public: ODA and public budget	Private: combination of project finance and private equity Public: ODA and public budget	All Private
6. Implementation Setup	Conventional setup	Conventional setup	Regional development authority to control development	Regional development authority to control development
7. ODA	All the investment may be financed by ODA	Significant infrastructure investment covered by ODA. Combination of ODA with PPP concession.	Significant infrastructure investment covered by ODA. Combination of ODA with PPP concession	None
8. Consistency with Current System	Possible under current system	Small modification	Small modification	Possible under current system
9. Regional Development Impact	Minimal impact	Small	Relatively significant	Large

Source: Study Team

Table 7.2.3 Summary of Features of Alternative Options for RR2

PSP Options	Public Sector	Private Sector
1. O& M Concession	- Ring Road 2 including Phu My bridge from ODA; ROW from budget)	- RR2 O&M Concession (short-term, toll-free) - Bus route operation concession
2. Minimum Private	- Phu My bridge and RR2 Road by ODA; ROW from budget	- Pavement, Tolling Facilities, Lighting Facilities, etc. under BOT concession (Toll Road) - Bus Route Operation concession
3. Minimum private with Sweetener	- Same as Option 2	- Same as Option 2, plus: - Concession of related residential & commercial development
4. All Private	- Role of regional or toll development authority	- Same as Option 3, plus: - All residential and commercial development along the corridor - District infrastructure development

Source: Study Team

Table 7.2.4 Evaluation of Implementation Options for RR2

Issue / Options	1 Reform Needs	2 Creation of Competition	3 Bankability	4 Government Burden	5 Risk Transfer	6 Difficulty in Implement ation	7 Regional Dev't Impact	Overall Rating
1: O&M Concession	4	3	3	1	4	4	3	21
2: Minimum Private	3	4	4	2	3	3	2	21
3: Min. private w/Sweetener	3	3	3	3	2	2	3	19
4. All private	4	1	1	4	2	2	4	18

Source: Study Team

Note: 4 – Most preferable; 3 – Preferable; 2 – Some Problems; 1 - Critical

(5) Preferred PSP Option for RR2

As previously derived, the preferred PSP option for RR2 east section is either O&M concession or minimum private.

In contrast, the Phu My bridge section has been reported to have been awarded on a BOT structure to a consortium of: Ha Noi Construction Corp, Construction Investment and Development Co., Chau Thoi Concrete Company 620 (a subsidiary of CIENCO 6), Thanh Danh Construction and Trading Company, and HCM City Infrastructure Development Joint-Stock Company. A feasibility of the project has been reportedly completed and construction is scheduled to begin early 2005 for completion in 2007[1].

The features of the BOT scheme for the Phu My Bridge are summarized in Table 7.2.5

Table 7.2.5 Features of the Phu My Bridge Project

Condition	Value/ Type	Remarks
1. Investment cost	120 Mil. US$	As stated in the document
2. O&M cost	As stated in the document	Fee collection cost: 7.5%/yr of total collection As stated in the document
3. Concession period	30 yeas	
4. Debt/Equity structure	70:30	
5. Loan term	25 years	Project finance with support of MLFIs
6. Loan interest	8.0%	Project finance with support of MLFIs
7. Corporate tax/ incentive	Same as F/S	
8. Project structure	FDI JV BOT	
9. Toll level	Same as F/S	

Source: Phu My Bridge Feasibility Study

The project has been reviewed as a FDI JV BOT structure, rather than the claimed BOT concession, in order to make the assessment in line with the international standard.

The result is shown on Table 7.2.6 .In order to attain the profitability level of 20% for the equity portion and a Loan-life Coverage Ratio above 2.0 for a transport sector project with high uncertainty in demand forecast, the project will need (in 2020) more than three times the traffic volume stated in the bid document. That volume is beyond the planned capacity of the bridge (6 lanes).

[1] Viet Nam News, February 11, 2004

Table 7.2.6 Result of the Assessment of Phu My Bridge BOT

Case	PCUs/day in 2020	Remarks
1. Bid Document	37,000	4 lanes (excluding non-motorized lanes) with capacity: 84,000
2. HOUTRANS estimate	61,000	6 lanes with capacity: 120.000
3. Necessary Traffic	114,000	6 lanes

Source: Study Team

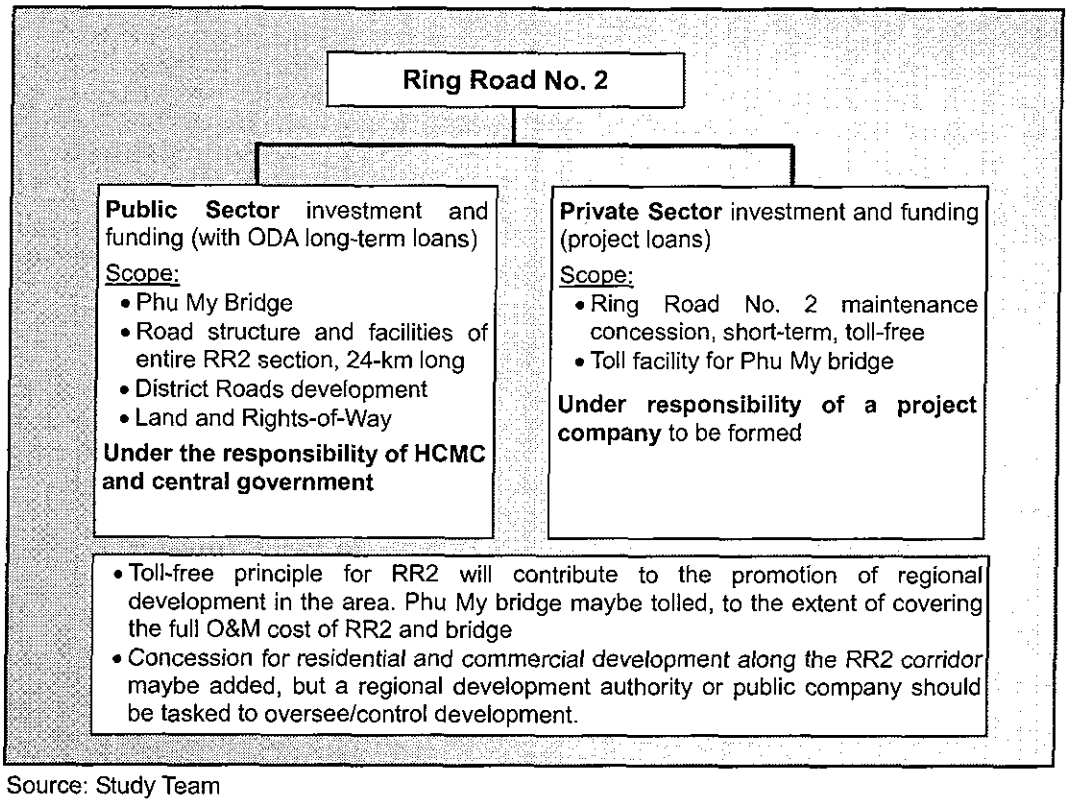
Since the viability of the Phu My Bridge by itself is doubtful, the bridge has better chances of realization if combined with the RR2 east section.

The recommended implementation structure is depicted in Figure 7.2.6 in which the construction of all the road elements of the RR2 east section will be under the public sector, while the operation and the maintenance aspects will be under the private sector.

Only the Phu My Bridge will be tolled to generate sufficient funds to cover the cost of the following items:

- Maintenance costs of the RR2 east section

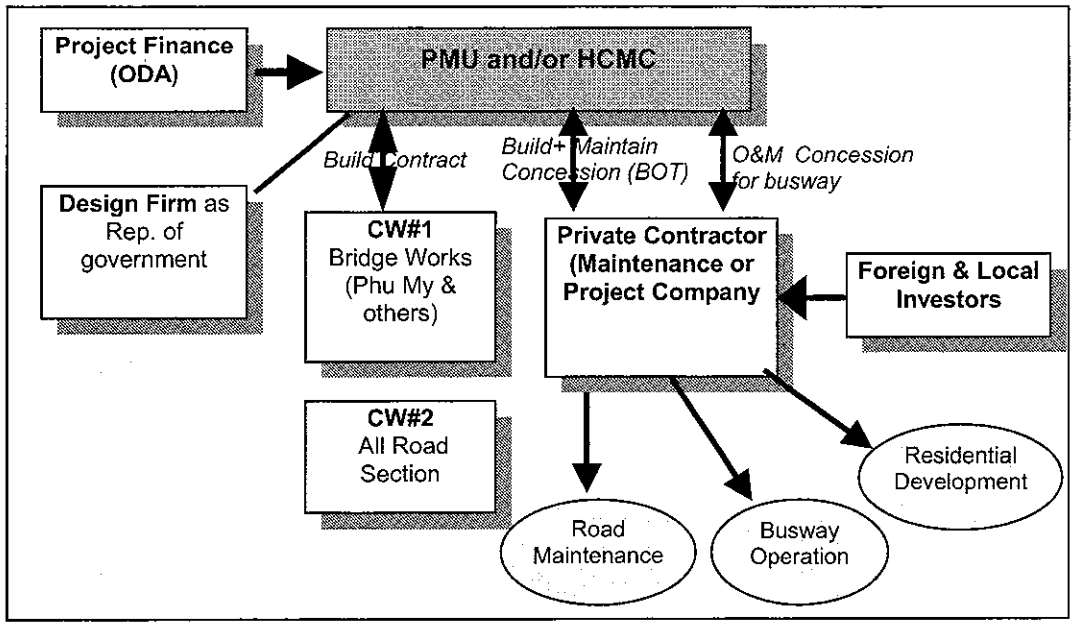
Figure 7.2.6 Preferred PSP Structure for RR2



Source: Study Team

Accordingly, it is recommended that a Project Management Unit be formed under the MOT from a financing viewpoint, or set up within the TUPWS under the HCM-PC with a focus on the urban development aspects of the project. It ceases to exist once the construction of the RR2 east section is completed. Either HCM-PC or a SOE, a regional development authority, will be created to become the project owner of the private concession. The contractual structure is depicted in Figure 7.2.7

Figure 7.2.7 Contractual Structure of RR2 East Section



Source: Study Team

a) **Other Implementation Issues**

Several issues have to be resolved in the implementation of the RR2 East Section Project, viz.:

Tolled or Toll Free?

The RR2 East Section Project is a thoroughfare in a relatively un-built section of the city and thus suitable for long-term regional development. For this reason, the road should not be tolled so that it becomes access-free from the land along the corridor. By constructing the road with public funds, the Government can gain a firm control over the orderly development of the area.

Commercial and Residential Development

As the area is not developed yet, a regional development authority or a publicly owned company should be established for orderly residential and commercial development of the area. A regional development master plan has to be adopted; and based on this plan, the complementary residential and commercial development may be packaged for tendering to the private sector.

Homework to be Done by the Public Sector

In preparing an international competitive bidding for the BOT concession of the RR2 East Section Project, a full-scale feasibility study, the bid document, and draft concession contract consistent with international business practices must be prepared by the public sector. Therefore, the necessary expertise has to be procured by the public sector. A big part of the expertise may have to be tapped externally, for which appropriate ODA technical assistances can be requested.

Coordination of ODA in the PPP Framework

It is critical to synchronize the construction of the RR2 road structure funded by the ODA fund with the selection of the private concessionaire so that the private sector investment could be made on time and the tolling operation for the Phu My Bridge and the busway operation can start together.

A construction manager for the entire project must be appointed to coordinate the ODA portion with the BOT concession.

Poor Profitability of the Bus Operation

The busway operation on the RR2 east section is not expected to be profitable. A source of subsidy must be secured, perhaps similar to the subsidy scheme currently applied on the bus modernization project. A more stable source is the toll revenue on Phu My Bridge. As stated earlier, an availability payment mechanism of the contracted amount may be applied so that a surplus cash flow could be used as a source to subsidize the busway operation.

7.3 Financial Options for Ring Road No.2 Development

1) Introduction

The financial viability of the Ring Road No.2 project is still vulnerable as it is described in the last section. However, there seems to be some potential profits from this project linking with other components of the development such as urban developments and so on. At this section, financial options for development and investment of the Ring Roard No. 2 project are examined quantitatively for the better implementation of the project.

2) Cash Flow in "Do-Nothing" Case

Cash flow of the project is estimated when there is no additional profit (revenue) from the RR2 project itself. Base on the estimation, the annual payment for the dept using the international donor fund like JBIC loan will be **47.7 million US$** assuming the interest rate is 3.0% and pay-back period is 30 years as shown in Table 7.3.1. Assuming that the annual budget for the infrastructure in the study area for this period is 100-200 million US$, this project itself might occupy 15-30% of the whole infrastructure budget. Therefore, additional revenue from this project should be accounted in order to evaluate the value of the RR2 project properly.

3) Financial Options

Considerable potential profit from the RR2 project are listed as follows:

a) Toll gate at Phu My Bridge

b) Land contribution in kind for development

c) Taxation on capital gain (fixed assets tax, urban planning tax, etc.)

d) Development corporation scheme (buying surrounding lands with low prices and selling them with high prices)

These policies are examined quantitatively and cumulatively to understand how much it can be decreased the annual payment for the debt of the project.

Table 7.3.1 Cash Flow of Financial Cost and Revenue - Do Nothing Case-

(US$ Mil.)

Year	Financial Cost			Total Balance
	Capital[1)]	O&M	Total	
2005	786.2		19.0	-792.3
2006			98.5	-798.3
2007			158.5	-804.0
2008			217.1	-809.6
2009			293.0	-814.9
2010		5.2	5.2	-844.6
2011		5.2	5.2	-875.2
2012		5.2	5.2	-906.6
2013		5.2	5.2	-939.1
2014		5.2	5.2	-972.4
2015		10.1	10.1	-1,011.7
2016		5.2	5.2	-1,047.3
2017		5.2	5.2	-1,083.9
2018		5.2	5.2	-1,121.7
2019		5.2	5.2	-1,160.5
2020		5.2	5.2	-1,200.6
2021		10.1	10.1	-1,246.7
2022		5.2	5.2	-1,289.3
2023		5.2	5.2	-1,333.2
2024		5.2	5.2	-1,378.4
2025		5.2	5.2	-1,425.0
2026		5.2	5.2	-1,472.9
2027		10.1	10.1	-1,527.2
2028		5.2	5.2	-1,578.3
2029		8.8	8.8	-1,634.4
2030		5.2	5.2	-1,688.6
2031		5.2	5.2	-1,744.5
2032		5.2	5.2	-1,802.1
2033		10.1	10.1	-1,866.2
2034		5.2	5.2	-1,927.4
2035		5.2	5.2	-1,990.5
2036		5.2	5.2	-2,055.4
2037		5.2	5.2	-2,122.3
2038		5.2	5.2	-2,191.2
2039		10.1	10.1	-2,267.0
total	786.2	184.5	970.7	-

Source: Study Team

[1)] Loan from international donor: no interest charge during construction

4) Toll Collection at Phu My Bridge

Based on the result of the demand forecasting, the estimated traffic volume at Phu My Bridge will be **87,000 PCU** per day in 2020 under the condition that toll fees for motorcycles, cars and buses (and trucks) are 3,000, 10,000 and 25,000 VND respectively. The revenue is estimated to **20.5 million US$** in 2020. The total balance will be remaining in negative figures as it is shown in in Table 7.3.2, and the annual payment for this project will be reduced to **27.0 million US$**. This means that only toll fee at the Phu My Bridge cannot compensate the costs of the RR2 project.

Table 7.3.2 Cash Flow of Financial Cost and Revenue – Toll Collection-

(US$ Mil.)

Year	Financial Cost			Revenue	Total Balance
	Capital	O&M	Total		
2005	786.2		19.0		-792.3
2006			98.5		-798.3
2007			158.5		-804.0
2008			217.1		-809.6
2009			293.0		-814.9
2010		5.2	5.2	19.8	-824.8
2011		5.2	5.2	19.9	-834.9
2012		5.2	5.2	19.9	-845.2
2013		5.2	5.2	20.0	-855.8
2014		5.2	5.2	20.1	-866.6
2015		10.1	10.1	20.1	-882.5
2016		5.2	5.2	20.2	-894.0
2017		5.2	5.2	20.3	-905.8
2018		5.2	5.2	20.4	-917.8
2019		5.2	5.2	20.4	-930.1
2020		5.2	5.2	20.5	-942.7
2021		10.1	10.1	20.6	-960.5
2022		5.2	5.2	20.6	-973.9
2023		5.2	5.2	20.7	-987.6
2024		5.2	5.2	20.8	-1,001.7
2025		5.2	5.2	20.9	-1,016.1
2026		5.2	5.2	20.9	-1,030.9
2027		10.1	10.1	21.0	-1,050.9
2028		5.2	5.2	21.1	-1,066.5
2029		8.8	8.8	21.2	-1,086.1
2030		5.2	5.2	21.2	-1,102.7
2031		5.2	5.2	21.3	-1,119.7
2032		5.2	5.2	21.4	-1,137.1
2033		10.1	10.1	21.5	-1,159.8
2034		5.2	5.2	21.5	-1,178.3
2035		5.2	5.2	21.6	-1,197.3
2036		5.2	5.2	21.7	-1,216.7
2037		5.2	5.2	21.8	-1,236.7
2038		5.2	5.2	21.8	-1,257.2
2039		10.1	10.1	21.9	-1,283.1
total	786.2	184.5	970.7	625.2	-

Source: Study Team

5) Land Contribution in kind for Development

Considering the idea of giving some development profits to the public, land acquisition and other land related costs could be compensated by increase of the land price, which is generated by development of the RR2 project, adopting some methods such as the land readjustment scheme. Here, as an example, land related costs (land acquisition cost, resettlement cost, etc.) are regarded as zero and the cash flows are calculated. This result says that even if all land related costs are compensated by the development profit, the total balance will still remain in negative and the annual payment will be **20.6 million US$**.

Table 7.3.3 Cash Flow of Financial Cost and Revenue – Toll Collection-

(US$ Mil.)

Year	Financial Cost			Revenue	Total Balance
	Capital	O&M	Total		
2005	662.1		19.0		-668.3
2006			57.1		-674.2
2007			117.2		-679.9
2008			175.8		-685.5
2009			293.0		-690.9
2010		5.2	5.2	19.8	-697.0
2011		5.2	5.2	19.9	-703.3
2012		5.2	5.2	19.9	-709.7
2013		5.2	5.2	20.0	-716.2
2014		5.2	5.2	20.1	-722.8
2015		10.1	10.1	20.1	-734.4
2016		5.2	5.2	20.2	-741.4
2017		5.2	5.2	20.3	-748.6
2018		5.2	5.2	20.4	-755.9
2019		5.2	5.2	20.4	-763.4
2020		5.2	5.2	20.5	-771.0
2021		10.1	10.1	20.6	-783.6
2022		5.2	5.2	20.6	-791.7
2023		5.2	5.2	20.7	-800.0
2024		5.2	5.2	20.8	-808.4
2025		5.2	5.2	20.9	-817.0
2026		5.2	5.2	20.9	-825.8
2027		10.1	10.1	21.0	-839.6
2028		5.2	5.2	21.1	-849.0
2029		8.8	8.8	21.2	-862.0
2030		5.2	5.2	21.2	-871.9
2031		5.2	5.2	21.3	-882.0
2032		5.2	5.2	21.4	-892.3
2033		10.1	10.1	21.5	-907.6
2034		5.2	5.2	21.5	-918.6
2035		5.2	5.2	21.6	-929.7
2036		5.2	5.2	21.7	-941.2
2037		5.2	5.2	21.8	-952.9
2038		5.2	5.2	21.8	-964.8
2039		10.1	10.1	21.9	-981.9
total	662.1	184.5	846.6	625.2	-

Source: Study Team

6) Taxation on Capital Gain

By the development of the RR2, the conversion of land use (e.g. from agriculture to residential) and increase of land price can be considered. When the land use is changed and the land price increases, the land related taxes will be changed and we can account that gain as a revenue from a development profit of the RR2 project. Based on the Land Law (24-L-CTN) that was enacted in 1993 and other land related public documents, taxes related land are as follows:

a) Land Use Tax (Land Assessment Tax)

b) Land Tax (Fixed Assets Tax)

c) Land Registration Tax

d) Land Use Conversion Tax

In addition to these taxes, urban planning tax (direct tax to the income) is considered newly for this excise. The assumption of this estimation is shown in Table 7.3.4.

Table 7.3.4 Assumption for Estimation of Taxation on Ring Road No.2 Project

Affected Area	500 m from the center line of RR2 (both side): 24.1 Km * 1 km^2 * 65%[1)] = 1,500 ha
Composition of Land Use	2002 (before development): - Developed Area (Resident, Commercial etc.): 25% - Agriculture: 65% 2020 (after development): - Developed Area (Resident, Commercial etc.): 55% - Agriculture: 35%
Land Price	Agriculture: 200,000 VND/m^2 Developed Area: 2,000,000 VND/m^2
Land Use, Land Registration and Land Use Conversion Tax[2)]	40% (land use tax/land use conversion tax) + 1% (land registration tax) = 41% of the land price
Land Tax (annual)	3,000 VND/m^2/year
Ratio of Land Related Tax for input to the RR2 Development	40%
Urban Planning Tax	1% of income of households in developed area
Population along RR2	2002: 1,148,000 2020: 3,311,000
Cost for Urban Development	300,000 VND/m^2

Source: Study Team

[1)] Agricultural area in 2020

[2)] At the timing of conversion from Agricultural land to residential/commercial/industrial

Table 7.3.5 shows the result of estimation of cash flow. For this calculation, urban development cost is included because the benefit (profit) of the urban development surrounded RR2 is calculated. Based on this analysis, the total balance in 30 years is still remaining in negative figures and the annual payment for dept will be **9.2 million US$**. However, comparing the amounts in the previous analyses, the value is reduced to the acceptable amount.

Table 7.3.5 Cash Flow of Financial Cost and Revenue – Taxation on Development-

(US$ Mil.)

Year	Financial Cost				Revenue			Total Balance
	Capital	O&M	Urban Dev.	Total	Tollgate	Tax	Total	
2005	662.1		6.2	25.2		8.2	8.2	-660.0
2006			5.9	63.1		8.2	8.2	-657.8
2007			5.7	122.9		8.2	8.2	-655.4
2008			5.6	181.3		8.1	8.1	-652.8
2009			5.4	298.3		8.1	8.1	-650.0
2010		5.2	18.1	23.4	19.8	20.5	40.3	-634.5
2011		5.2	5.0	10.2	19.9	8.1	28.0	-630.7
2012		5.2	4.8	10.1	19.9	8.2	28.1	-626.7
2013		5.2	4.7	9.9	20.0	8.2	28.2	-622.5
2014		5.2	4.5	9.7	20.1	8.3	28.4	-618.1
2015		10.1	4.4	14.4	20.1	8.4	28.5	-618.1
2016		5.2	4.2	9.4	20.2	8.5	28.7	-613.2
2017		5.2	4.1	9.3	20.3	8.6	28.9	-608.0
2018		5.2	3.9	9.2	20.4	8.7	29.1	-602.4
2019		5.2	3.8	9.0	20.4	8.9	29.3	-596.4
2020		5.2	3.7	8.9	20.5	9.0	29.5	-590.0
2021		10.1	3.5	13.6	20.6	9.0	29.6	-588.1
2022		5.2	3.4	8.7	20.6	9.0	29.7	-581.3
2023		5.2	3.3	8.5	20.7	9.0	29.8	-574.2
2024		5.2	3.2	8.4	20.8	9.0	29.8	-566.8
2025		5.2	3.1	8.3	20.9	9.1	29.9	-559.1
2026		5.2	3.0	8.2	20.9	9.1	30.0	-551.1
2027		10.1	2.9	13.0	21.0	9.1	30.1	-547.7
2028		5.2	2.8	8.0	21.1	9.1	30.2	-539.2
2029		8.8	2.7	11.5	21.2	9.1	30.2	-533.9
2030		5.2	2.6	7.8	21.2	9.1	30.3	-524.8
2031		5.2	2.5	7.7	21.3	9.1	30.4	-515.4
2032		5.2	2.4	7.7	21.4	9.1	30.5	-505.6
2033		10.1	2.3	12.4	21.5	9.1	30.6	-500.3
2034		5.2	2.3	7.5	21.5	9.1	30.6	-489.9
2035		5.2	2.2	7.4	21.6	9.1	30.7	-479.1
2036		5.2	2.1	7.3	21.7	9.1	30.8	-467.9
2037		5.2	2.0	7.3	21.8	9.1	30.9	-456.3
2038		5.2	2.0	7.2	21.8	9.1	30.9	-444.3
2039		10.1	1.9	12.0	21.9	9.1	31.0	-436.6
total	662.1	184.5	140.4	987.0	625.2	318.6	943.8	-

Source: Study Team

7) Development Corporation Scheme

Lastly, the development corporation scheme is considered. It is assumed that the development corporation will purchase the surrounded lands along RR2 in lower price before the development and sell them in higher price after the development. In this case, the increase of the land price excluding taxes is directly become the income of the development corporation.

Table 7.3.6 Cash Flow of Financial Cost and Revenue –Development Corporation-

(US$ Mil.)

Year	Financial Cost				Revenue				Total Balance
	Capital	O&M	Urban Dev.	Total	Tollgate	Tax[1)]	Urban Dev.	Total	
2005	662.1		6.2	25.2		2.4	19.9	22.2	-646.0
2006			5.9	104.4		2.5	19.2	21.7	-630.3
2007			5.7	164.3		2.7	18.5	21.2	-614.8
2008			5.6	222.7		2.8	17.9	20.8	-599.6
2009			5.4	298.3		3.0	17.3	20.3	-584.6
2010		5.2	18.1	23.4	19.8	3.2	58.5	81.5	-525.9
2011		5.2	5.0	10.2	19.9	3.4	16.2	39.4	-507.5
2012		5.2	4.8	10.1	19.9	3.6	15.6	39.1	-488.8
2013		5.2	4.7	9.9	20.0	3.8	15.1	38.9	-469.8
2014		5.2	4.5	9.7	20.1	4.0	14.6	38.6	-450.5
2015		10.1	4.4	14.4	20.1	4.2	14.1	38.4	-435.7
2016		5.2	4.2	9.4	20.2	4.5	13.6	38.3	-415.7
2017		5.2	4.1	9.3	20.3	4.7	13.1	38.1	-395.2
2018		5.2	3.9	9.2	20.4	5.0	12.7	38.0	-374.3
2019		5.2	3.8	9.0	20.4	5.2	12.3	37.9	-352.8
2020		5.2	3.7	8.9	20.5	5.5	11.9	37.9	-330.7
2021		10.1	3.5	13.6	20.6	5.6	11.5	37.7	-313.1
2022		5.2	3.4	8.7	20.6	5.8	11.1	37.5	-290.2
2023		5.2	3.3	8.5	20.7	5.9	10.7	37.3	-266.8
2024		5.2	3.2	8.4	20.8	6.0	10.3	37.1	-242.9
2025		5.2	3.1	8.3	20.9	6.1	10.0	37.0	-218.5
2026		5.2	3.0	8.2	20.9	6.2	9.6	36.8	-193.5
2027		10.1	2.9	13.0	21.0	6.3	9.3	36.6	-172.7
2028		5.2	2.8	8.0	21.1	6.4	9.0	36.5	-146.6
2029		8.8	2.7	11.5	21.2	6.5	8.7	36.4	-123.4
2030		5.2	2.6	7.8	21.2	6.6	8.4	36.2	-96.1
2031		5.2	2.5	7.7	21.3	6.7	8.1	36.1	-68.1
2032		5.2	2.4	7.7	21.4	6.8	7.8	36.0	-39.4
2033		10.1	2.3	12.4	21.5	6.9	7.6	35.9	-14.8
2034		5.2	2.3	7.5	21.5	6.9	7.3	35.8	15.4
2035		5.2	2.2	7.4	21.6	7.0	7.1	35.7	46.3
2036		5.2	2.1	7.3	21.7	7.1	6.8	35.6	78.1
2037		5.2	2.0	7.3	21.8	7.2	6.6	35.5	110.7
2038		5.2	2.0	7.2	21.8	7.2	6.4	35.4	144.3
2039		10.1	1.9	12.0	21.9	7.3	6.2	35.4	173.9
total	662.1	184.5	140.4	1,111.0	625.2	184.9	452.8	1,262.9	-

Source: Study Team

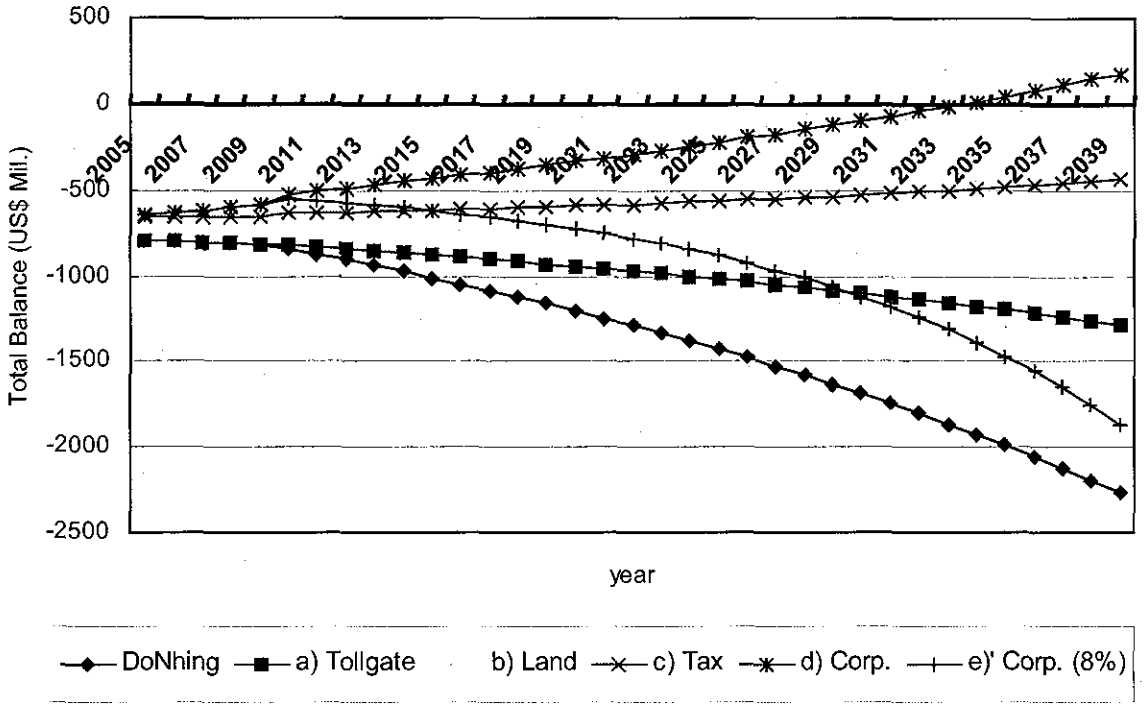
[1)] including land tax (annual) and urban planning tax in Table 7.3.4

According to this result, the total balance will be positive 24 years after the starting year of RR2. This means this project can be financially independent if this scheme is introduced. However, this result might be changed by the interest rate. Assuming that the investment is done by the private sector and the interest rate is 8%, the total balance will be negative in both cases, and annual payment will be 16.5 million US$.

8) Summary

The summary of the cash flow (total balance) of these examinations is illustrated in Figure 7.3.1. Based on this, the only financial independence can be obtained in the development corporation scheme, and but they can not sustain it if there is no international donor loan in 3% of the interest rate.

Figure 7.3.1 Total Balance by Each Scenario



Source: Study Team

8. CONCLUSION AND RECOMMENDATIONS

8.1. Conclusion

(1) The RR2 Project is composed of new road construction, road widening and grade separation of intersections. The total construction cost that will be required is approximately US$ 730 million. Seventy six percent (76%) of the cost will be invest in the construction of the 6-lane east section. Besides construction cost, land acquisition and compensation costs will add up to US$ 178 million.

(2) In spite of the large amount of investment, the economic viability of the project indicated an EIRR 17.4 % and a NPV US$ 908.1 million for 30 years' project life supported by the high traffic demand.

(3) PAPs of the RR2 Project will reach 11 thousand most of whom will be classified under the low-income group. The results of the questionnaire survey showed that there are varying options on resettlement, with cash compensation as not the only major solution

(4) RR2 is planned as a primary urban road with a 60 km/h design speed. The number of lanes of the east and south west sections is 6 lanes plus frontage roads, except for long span bridge sections. The long span bridge sections will be no frontage roads so as to optimize the project cost.

(5) In order to provide smooth traffic flows for both normal traffic and bus traffic, 8 lanes (6 lanes for normal traffic and 2 lanes for bus exclusive operation) will be more desirable. The project cost of the 8 lanes structures ;however, will be 15 to 20% higher than the cost of the 6 lanes. According to the economic sensitivity analysis, if this higher end cost may adversely impact the projects economic viability. Further detailed study into the Busway concept is therefore reccomended

(6) Busway on bus exclusive lanes shall be provided within the proposed 6 lane's ROW, in which case, some traffic congestion are expected on the normal traffic flows. But the congestion should be acceptable but will be dependent on governments objective and commitment to encourage the promotion of a fast and efficient public transport system along the transport corridor. Therefore in addition to this study of the, feasibility of RR2, further detailed study for modern busway system including bus operation and management system will be required before a final decision on whether to increase the number of lanes along the corridor.

(7) With the alignment of the new construction section (east section), there are two issues which are required to have further detail co-ordination with related project or agencies at the detail design stage. One is a port relocation project on the Phu My Bridge section and another is the water pipe line project between NH 1A and Hanoi Highways. These issues should be reviewed in some detail during the next phase of project development.

8.2. Recommendations

(1) Due to the limited resource of the national government, a PPP scheme should be introduced. Taking into consideration country risk, regulator framework and project uncertainty in Vietnam, the recommended implementation is that the construction of all the road elements of RR2 east section will be under the public sector, while the operation and maintenance aspects will be by the private sector.

(2) Completion of the ring road will increase the accessibility in the areas along the ring road as well as in the suburban areas. Following this, a rapid urban expansion is expected to occur. In order to avoid urban sprawl, it will be necessary to develop a secondary road network in the ring road corridor, but providing preference for primary road corridors as well as integrating road network planning and urban planning.

APPENDIX 1 EXAMINATION OF THE FUTURE WIDENING FOR EXISTING NORMAL AND SECTION RING ROAD NO.2

1. FURTHER STUDY OF RING ROAD NO.2

a) Excluding the project sections, which consists of the east and southwest sections, the existing lanes and cross-sections of RR2 lack uniformity. It is preferred that these sections be consistent with the project sections. Therefore, a 6-lane 2-frontage road including exclusive bus lanes, the same as those in the southwest section, will be finally proposed as the typical cross-section for these sections. However, the north section was upgraded in 2003 as part of the Asia Highway Project loaned by the Asian Development Bank, while the west section is under construction as a local BOT project. It would be difficult to immediately reconstruct the final stage of the RR2 due to the economic and social costs this will entail.

b) To enforce a strong public transport, it is proposed that an exclusive bus lane be secured in the first stage through minor improvement

c) Figure 1.1.1 to Figure 1.1.3 show the proposed typical cross-section by stage for other sections of RR2.

Table 1.1.1 Typical Cross-section of Other Sections of Ring Road No.2

Section	Road Width and No. of Lane			
	Existing	Ongoing or Planned	Improved	Proposed
North (NH1A)	38.6	-	38.6	52.5
	4+2(bike lane)	-		
West (NH1A)	10.0	28.2	6	6+2
	2	6		
South (Nguyen Van Linh)	25.5	120.0	36.5	
	4	6+4+2	6	

Note: Upper; Road width (m), Lower; Number of lane

Figure 1.1.1 Typical Cross-section of North Section of Ring Road No.2

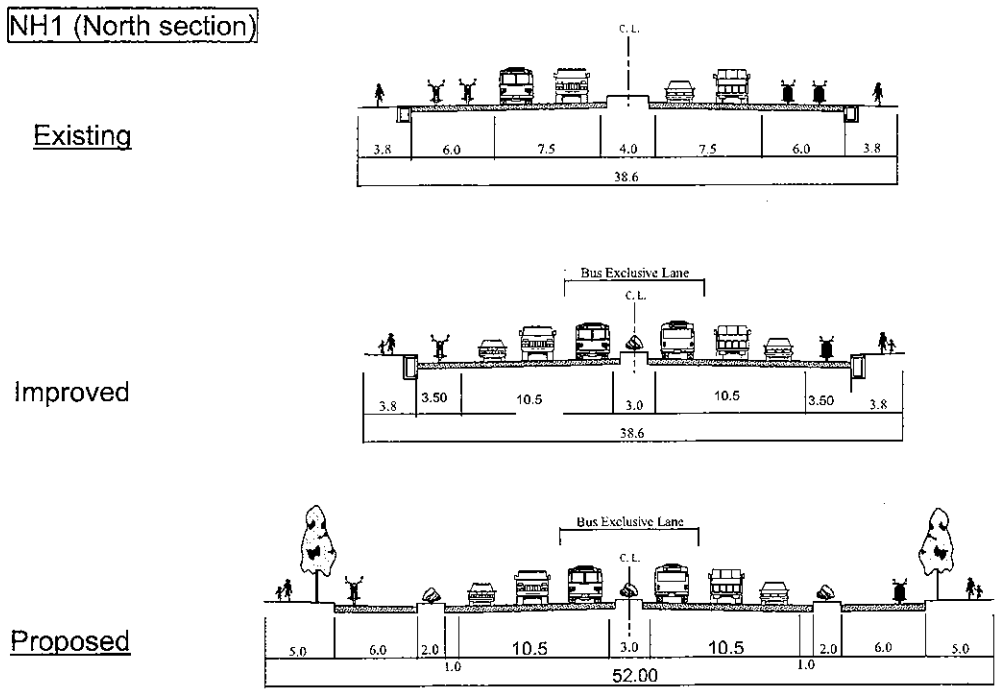


Figure 1.1.2 Typical Cross-section of West Section of Ring Road No.2

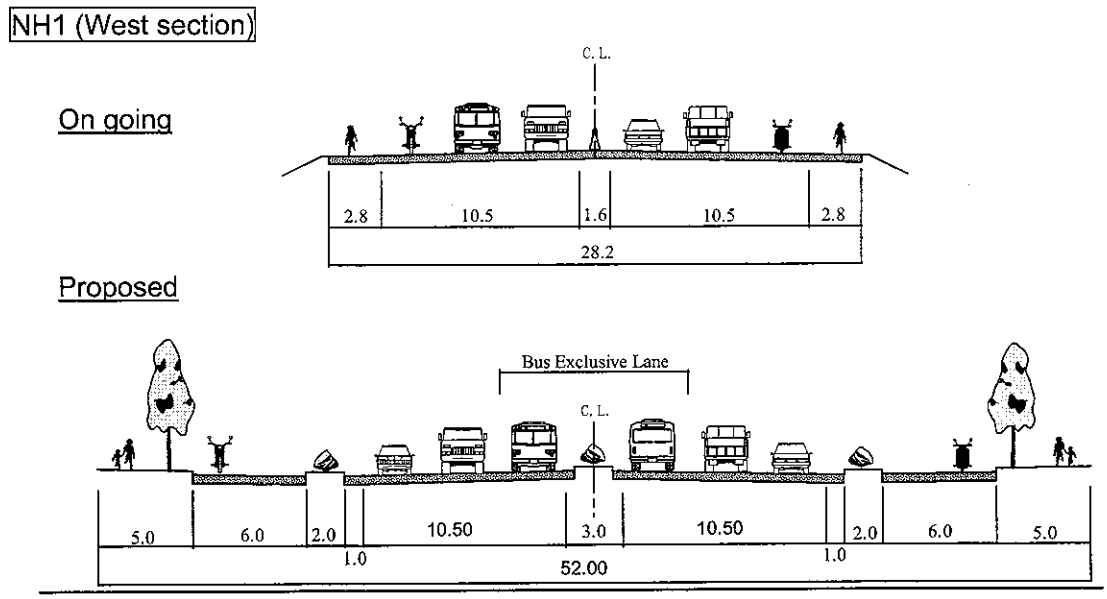
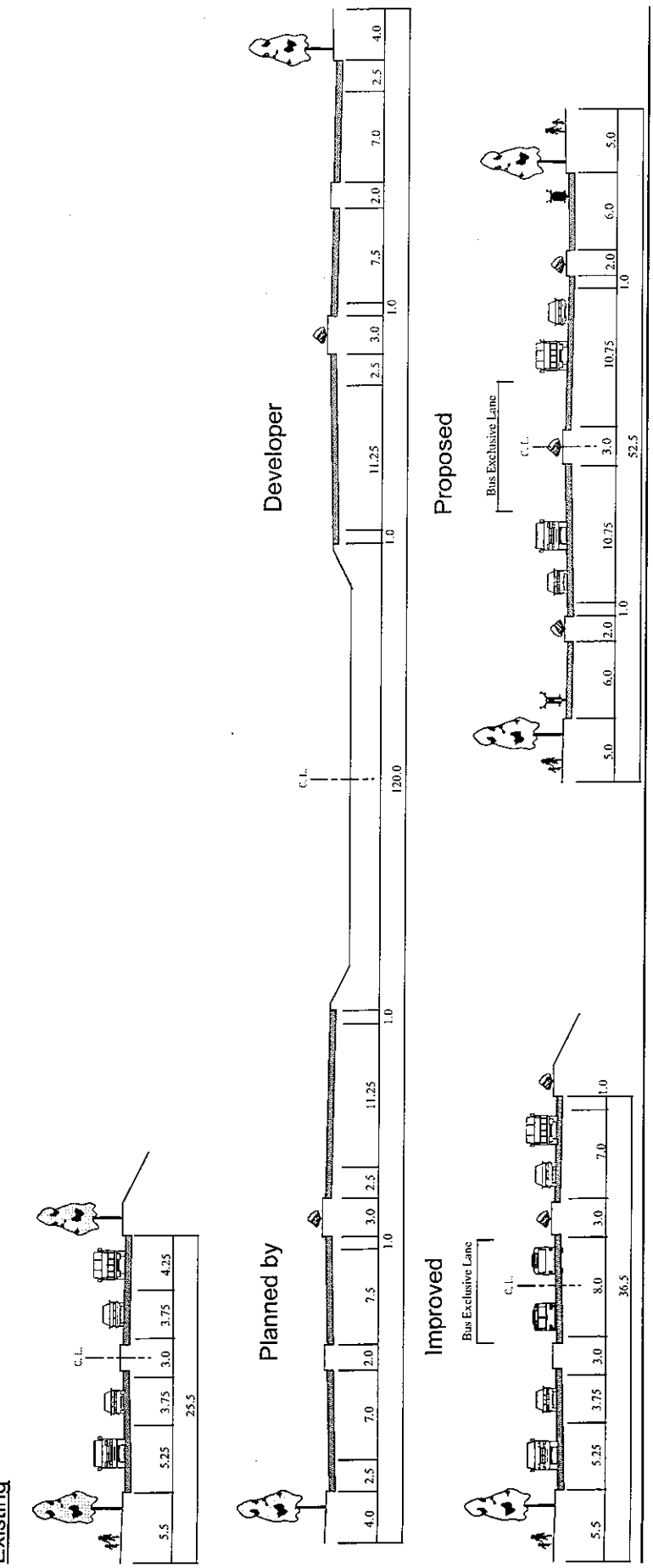


Figure 1.1.3 Typical Cross-section of South Section of Ring Road No.2



APPENDIX 2 DESIGN LOADINGS FOR BRIDGE AND ROAD STRUCTURES

The following design loads shall be considered for bridges and road structures from the Specifications for Bridge Design (22 TCN-272-01).

Permanent Load

1) Dead Load and Superimposed Dead Load
2) Earth Loads (Pressure, Surcharge)
3) Shrinkage and Creep
4) Differential Settlement
5) Static / Stream Pressure
6) Buoyancy

Load

1) Truck & Tandem Load with Impact
2) Lane Load without Impact
3) Centrifugal Force
4) Braking Force
5) Earthquake Effects
6) Wind Load
7) Temperature Effects
8) Erection Load
9) Floating Debris and Log Impact
10) Collision Force (Vehicle, Ship)

Permanent Loads

Permanent loads shall be calculated in accordance with Clauses 3.5. Dead loads shall include the weight of concrete, steel reinforcement, prestressing tendons, and any other embedded components, based on the following unit weights:

Table 2.1 Unit Weight of Materials

Category	Item	Unit	Value	Remarks
Dead load	Reinforced concrete	kN/m^3	24.5	
	Pre-stressed concrete	kN/m^3	24.5	
	Asphalt pavement	kN/m^3	22.0	
	Steel	kN/m^3	77.0	
	Compact sand	kN/m^3	19.0	
	Loose sand	kN/m^3	16.0	
Superimposed Dead load	Pavement	mm	75	
	Curb and Railing	kN/m	-	

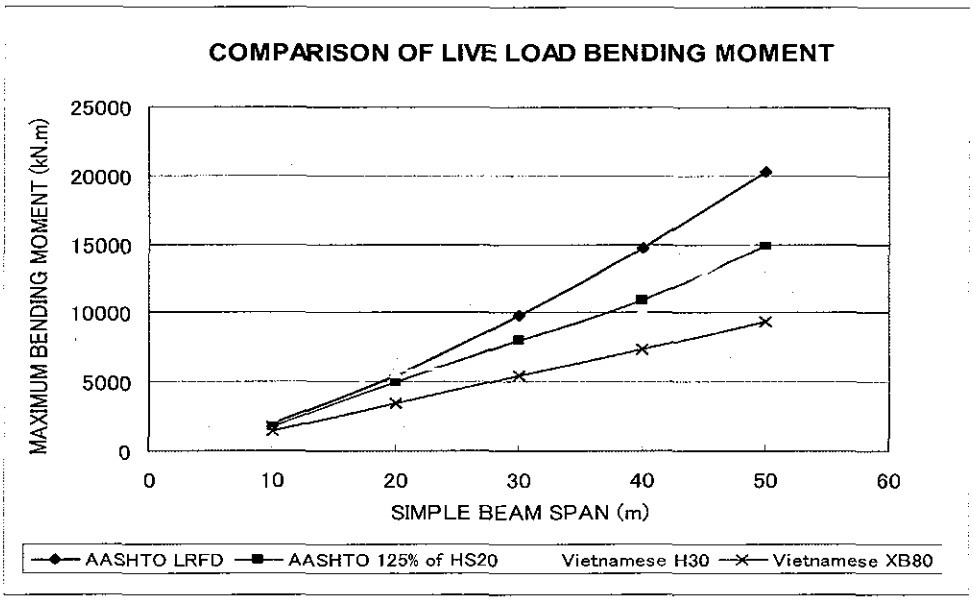
Live Loads

The new version of AASHTO 1998 (LRFD) has been adopted for recent transport *infrastructure projects in Vietnam and the Vietnamese Specifications* for Bridge Design were established based on AASHTO LRFD. For reference, a comparison of maximum bending moments due to HL-93 loading, 125% of HS20-44 and H30 and XB80 loading from Vietnamese Bridge Codes in 1979 was made for a range of simply supported spans.

The results of this analysis showed that AASHTO HL-93 is more critical than 125% of HS20-44 and is also significantly greater than H30 loading for bridge with 20m or greater span except for bridges with a span smaller than 20m, which is not part of this project.

The above comments are for four (4) lanes of traffic for most of the project bridges except for XB80 loading which represents only one truck.

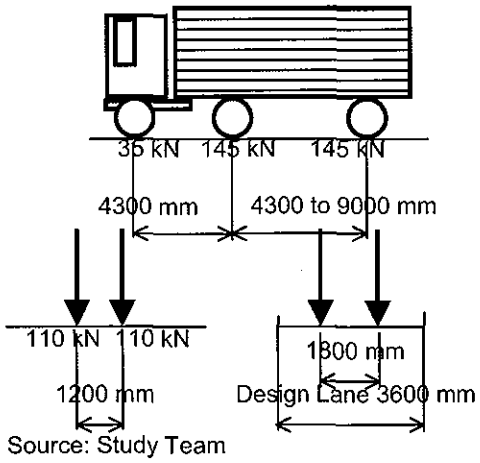
Figure 2.1 Comparison of Live Load Bending Moment by Span



In conclusion, HL-93 loading will be used as design live load for this study as shown below. However, structures shall be checked for XB80 loading as the effect of distribution load to individual beams may be greater than HL-93 loading.

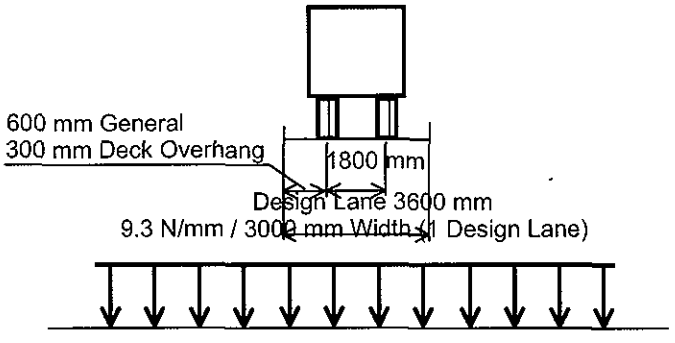
a) Live Load

Figure 2.2 Design Tandem



Source: Study Team

Figure 2.3 Design Lane Load



Source: Study Team

b) Dynamic Load Allowance (IM): The dynamic load allowances (IM) shall be considered for truck and tandem loads only.

Table 2.2 Dynamic load allowance

Component	Limit State	IM
Deck Joints	All Limit State	75 %
All Other Components	Fatigue & Fracture Limit State	15 %
	All Other Limit States	33 %

Source: Study Team

c) Combination of Live Loads

Case-1: m * [Truck Load (with IM) + Lane Load (without IM)]

Case-2: m * [Tandem Load (with IM) + Lane Load (without IM)]

m: Multiple presence factors as shown below

Number of Design Lanes	Multiple Presence Factor "m"
1	1.20
2	1.00
3	0.85
More than 3	0.65

d) Pedestrian Loading: Pedestrian loading of 3.0 KPa shall be applied to all sidewalks wider than 600mm and considered simultaneously with the vehicular design live load.

Horizontal Forces due to Traffic: The following horizontal loads due to vehicles shall be considered in accordance with Vietnamese specifications.

Horizontal Load	*Clause of Vietnamese Code* 22 TCN-272-01
Centrifugal forces	3.6.3
Braking forces	3.6.4
Vehicle collision forces	3.6.5.1

Water Loads

a) Longitudinal Forces: The effects of stream flow acting in the longitudinal direction of the substructures shall be calculated as follows:

$\rho = 0.514 * C_D * V^2$

Where: ρ = pressure of flowing water (KPa)

V = design velocity of water for serviceability and extreme event limit states

C_D = drag coefficient Type	C_D
Semicircular-nosed pier	0.70
Square-ended pier	1.40
Debris lodges against pier	1.40
Wedged-nosed pier with nose angle 90 deg. or less	0.80

b) Lateral Forces: For design purposes, the loads from stream flow shall include a component of forces normal to the longitudinal axis of the pier assuming an angle of skew of 10 deg. In accordance with AASHTO LRFD Clause 3.7.3.2, the lateral pressure shall be taken as:

$P = 0.514 * C_L * V^2$ (KPa)

Where: C_L = lateral drag coefficient

Angle θ, between direction of flow and longitudinal axis of pier	C_L
0	0.00
5	0.50
10	0.70
20	0.90
>= 30	1.00

The lateral force shall be taken as the product of the pressure and the area of the pier normal to the pier center line.

c) Buoyancy: Buoyancy shall be considered as an uplift force on all parts of the submerged substructure.

Wind Loads

The following are the design horizontal wind loads for conventional bridge structures. For long span or wind-sensitive structures, such as suspension or cable-stayed bridges, specific wind-climate studies and wind tunnel tests should be carried out to determine the wind effects.

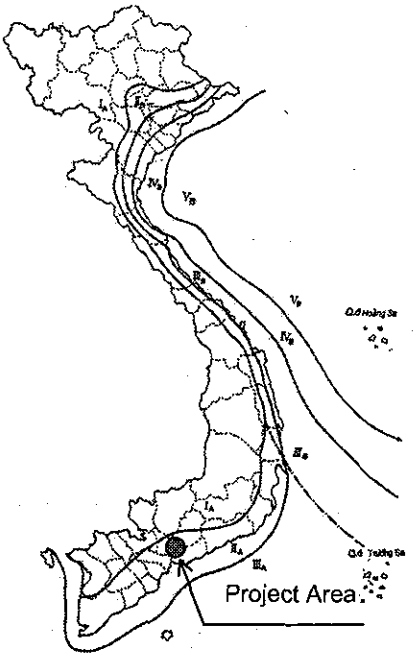
The design wind velocity, V, shall be determined from:

$V = V_B * S$

where:

V_B = *Basic 3 seconds gust wind velocity with 100* year return period appropriate to the Wind Zone in which the bridge is located, as specified in Table 4.3.6 Project area is classified as **Zone II** from Figure 4.3.5

Figure 2.4 Wind Zone Map



Source: Study Team

Table 2.3 Basic Gust Wind Velocity

Wind zone according to TCVN 2737-1995	V_B (m/s)
I	38
II	45
III	53
IV	59

Source: Study Team

S = Correction factor for up-wind terrain and deck height, as specified in Table 4.3.7

Table 2.4 Correction Factor for Up-Wind Terrain and Deck Height

Height of bridge deck above surrounding ground or water level (m)	Open country or open water	Wooded country or built-up areas, with trees or buildings up to a maximum height of about 10m	Built-up areas with buildings predominantly over 10m height
10	1.09	1.00	0.81
20	1.14	1.06	0.89
30	1.17	1.10	0.94
40	1.20	1.13	0.98
50	1.21	1.16	1.01

Source: Study Team

Wind loads shall be considered on structures in both horizontal (transversal and longitudinal directions) and vertical directions and on live load in accordance with the Specifications for Bridge Design (22 TCN-272-01).

Vessel Collision

The relationship between collision force and velocity is given below.

Ps = 1.2 * 105 * V * (DWT) 0.5

Where: Ps = equivalent static vessel impact force (N)

DWT = deadweight tons of vessel (Mg)

V = vessel impact velocity (m/s)

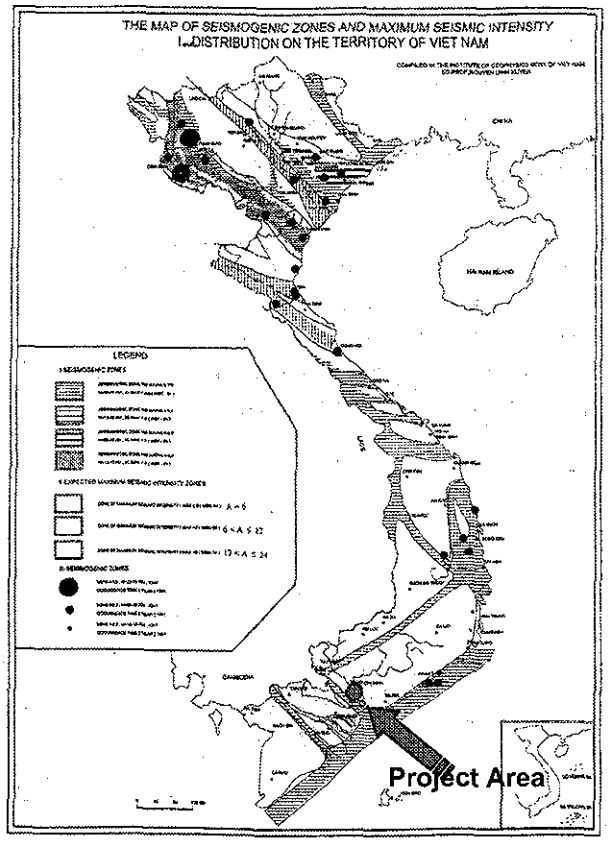
Vessels passing along the rivers are 20,000 DWT and 2,500 DWT for Sai Gon River and Cho Dem River, respectively, according to the existing feasibility study report. For river flow velocity, detailed investigation must be made further.

Earthquake Effects

The Mekong Delta area lies in the southern part of the Indochina peninsula to the southwest of the Pacific Rim seismic zones. This is a seismically inactive area, since there is no record of earthquake in Cambodia, South Vietnam, South Laos, Thailand, and Malaysia according to the International Seismic Center of Tokyo University.

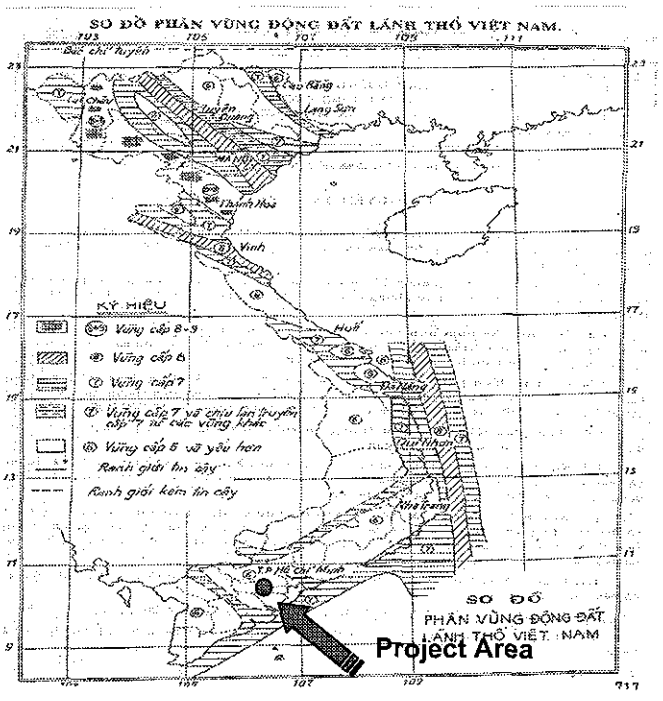
In addition, the Specifications for Bridge Design in Vietnam show the Seismic Intensity Map, as shown in Figure 4 and Figure 5 According to the Seismic Intensity Map (1979), the project area has an acceleration coefficient of 0.04 for seismic intensity 6, categorized as Seismic Zone 1.

Figure 2.5 Seismic Intensity Map (22 TCN-272-01)



Source: Study Team

Figure 2.6 Seismic Intensity Map (1979)



Source: Study Team

Table 2.5 Seismic Zones

Acceleration Coefficient	Seismic Zone	MSK – 64 class
A <= 0.09	1	Class <= 6.5
0.09 < A <= 0.19	2	6.5 < Class <= 7.5
0.19 < A <= 0.29	3	7.5 < Class <= 8

Source: Study Team

The SPT blowcount survey results showed the soft clays or silts were greater than 12m in depth from the natural ground surface in the project area, which corresponds to Soil Profile Type IV.

Table 2.6 Site Coefficients

Site Coefficient	Soil Profile Type			
	I	II	III	IV
S	1.00	1.20	1.50	2.00
Soil Conditions	Rock of any description, either shale-like or crystalline in nature, or Stiff soils where soil depth is less than 60m, and soil types overlying rock are stable deposits of sands, gravels, or stiff clays	Stiff cohesive or deep cohesionless soils where soil depth exceeds 60m and soil types overlaying the rock are stable deposits of sands, gravels, or stiff clays	Soft to medium-stiff clays and sands, characterized by 9.0m or more of soft to medium-stiff clays	Soft clays or silts greater than 12.0m in depth

Source: Study Team

The following seismic force shall apply to bridges of conventional slab, beam girder, box girder, and truss superstructure construction with spans not exceeding 150m. For other types of construction and bridges with spans exceeding 150m, appropriate studies should be made.

H = Csm * W

The elastic seismic response coefficient, Csm for the mth mode of vibration shall be taken as:

C_{sm} =	$1.2 * A * S / Tm^{2/3}$ <= 2.5 A	Other than cases below
	A * (0.8 + 4.0 * Tm)	*For soil profiles III and IV, and for modes other than the fundamental mode that have periods less than 0.3s*
	$3 * A * S / Tm^{4/3}$	In case period of vibration exceeds 4.0s

Where: Tm = period of vibration of the mth mode (s)

A = acceleration coefficient

S = site coefficient Table 6

Seismic effects for box culverts and buried structures need not be considered, except where they cross active faults.

Temperature Effects

a) Bearing and Expansion Joint Movements: Temperature effects shall be calculated in accordance with the Vietnamese Specifications for Bridge Design (22 TCN-272-01) 2001 using the following local temperature data extracted from TCVN 4088: 1985 for Ho Chi Minh City.

- Annual average temperature: 27.0 (Deg. C)
- Annual absolute maximum temperature: 32.1 (Deg. C)
- Annual absolute minimum temperature: 23.8 (Deg. C)
- Daily range for yearly average values: 4 – 5 (Deg. C)

The effective maximum and minimum bridge temperatures shall be assumed to be the same as the ambient temperature. Calculation for movements of expansion joints and bearings shall be based on a mean temperature of 27 degree Celsius and a temperature coefficient of $10 * 10^6$.

b) Temperature Gradient: The effect of temperature difference within the structure is a function of solar gain to the deck surface. The Vietnamese specifications give the following two gradient values for positive (top hotter) and negative (top colder) types:

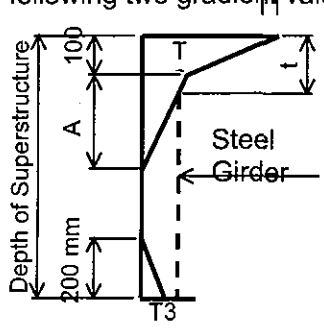


Table 2.7 Gradient Temperatures in Degree Celsius

Temperature Gradient Type	Concrete Deck with 100mm surface		
	T1	T2	T3
Positive	23	6	3
Negative	-7	-1	0

Source: Study Team

A = 300mm for closed concrete structures that are 400mm or more in depth. For shallower sections, 100mm less than the actual depth.

A = t – 100mm for steel superstructures (t = thickness of concrete deck)

Earth Pressure

The abutments shall be designed for earth pressure forces in accordance with *Vietnamese Specifications (22 TCN-272-01) Clause 3.11. For design purposes, the* embankment material shall be assumed to have the following properties:

Unit Weight of Backfill Soil	γ_D	19 kN/m^3
Friction Angle of Drained Soil	ϕ_f	30 degree
Coefficient of Active Pressure	Ka	0.33
At-rest Pressure Coefficient	Ko	0.50

Vehicle loads immediately behind the abutment wall will be transmitted through an approach slab supported off the abutment back wall. As the approach slab is 5m long, live load surcharge effects will not be transmitted to the abutment back or side walls (wing walls) and can be ignored in the design.

Bearing Friction

In the absence of known contact pressure, the following friction coefficient for bearings shall be taken as:

Loading	Bearing Type	
	Elastomeric	*PTFE*
Dead Load	0.05	0.05
Dead + Live Loads	0.05	0.04

The relieving effects of bearing friction shall be ignored.

Differential Settlement: For continuous deck, the superstructure shall be designed for differential settlement of 10mm between supports.

Construction Loads and Effects: The following construction loads shall be considered in the design of cantilever PC box girder bridge and cable-stayed bridge.

1) From traveler load
2) Incidental loading over the length of cantilever (5kN/m)
3) Concentrated load of 50 kN at the end of any cantilever
4) Uniform working load of 5 kN/m2 on slab

VOLUME 3: FEASIBILITY STUDIES

B: UMRT Line1 (East)

1 INTRODUCTION

1.1 Background and Objectives

1) Background

Like many of the major cities in developing economies of south east Asia, Ho Chi Minh metropolitan area, which comprises Ho Chi Minh City (**HCMC**) and its surrounding suburban areas and towns, is currently experiencing the problems of rapid urbanization of the city including peak hour traffic congestion, longer journey times, deterioration in quality of city life with a marked increase in road accidents and air pollution, with reduced public accessibility to urban services. Without positive intervention by government, the traffic situation within HCMC will in time adversely affect the rate of economic growth and overall development of the southern region of Vietnam in which HCMC plays a strategic role.

Like other similar major cities in Asia , the significant change in traffic conditions in HCMC during the last decade has been characterized by the rapid growth in the number of motorcycles and a reduction in that of pedal cycles. This factor, combined with a general deterioration in recent years of the quality and frequency of the urban public transport services has led to a phenomenal growth in motorcycles within the urban area. It has been estimated that currently the number of motorcycles operating daily within HCMC is approximately two (2) million, and if unchecked by authorities will continue to escalate at an ever increasing rate. A 1996 study estimated the number of person trips by motorcycles, bicycles and cars/taxis in HCMC to be 64%, 32% and 2% of the total daily trips, respectively. Public transport (mostly bus and lambro), accounted for only a two percent (2%) of the daily passenger trips. This statistic is in marked contrast to other major cities in the Asia region where the public transport is responsible for anywhere between thirty (30) and seventy (70) percent of the daily passenger trips within the urban area.

Thus the need for the immediate development of an efficient and affordable public transport system for HCMC has been recognized at the highest levels of local and central government which must as a matter of first priority not only to resolve urgent short-term public transport issues, but also to develop a coherent and viable long-term public transport strategy in concurrence with the 'transport master plan' for HCMC. The study team have identified a key component of the latter is the immediate development of the Urban Mass Rapid Transit **(UMRT)** Line 1 (East) project from Ben Thanh Market, central district to the rapidly developing suburb of Bien Hoa north east of HCMC.

2) Objective

The objective of this project study is to identify and develop an efficient public urban mass transit (UMRT) system for one of the most important transport corridors in the master plan study area forming the east-west transport corridor, with a route length of about twenty nine (29) km connecting HCMC's city center and Bien Hoa in Dong Nai province along the existing Hanoi Highway and National Highway No.1. To develop this mass transit system the study team has suggested a "step by step" approach or phased development strategy for the transport corridor.

For short- to medium-term development strategy the study team has suggested the

implementation of an efficient bus system including bus priority facilities such as bus lanes, busways and improved bus operations will be the priority.

While for the medium to long term, the system will be developed into urban rail, busway/bus lane and improved feeder bus operations.

The team has therefore recommended that this corridor be a pilot project and have also suggested that when this project has proven successful the concept of developing an efficient UMRT system can be replicated in other major transport corridors in the study area.

It cannot be stressed enough that the importance of both central and regional government to endorse and support this strategic approach to support the implementation of an efficient urban mass rapid transit (UMRT) system along the transport corridor as the study team believe without this government led initiative, the public transport ridership within HCMC cannot develop and commuter passenger satisfaction will continue to be low and the present proliferation of motorcycles within the urban area will continue unabated reducing traffic journey times within the city even further.

In addition unless the Government of Vietnam supports and endorses the project and provides financial support to the construction and operations, the public-transport-oriented urban system for greater Ho Chi Minh City will not develop and will become a major constraint in the economic development of the southern region of Vietnam.

1.2 Project Scope

1) Scope of Study

Outline: This study (F/S) examined the long-term feasibility of a mass rapid transit system as a development from the standard bus mode that is expected to initiated within HCMC in the short to medium term. In the medium to long term it is anticipated that a rail-based system needs to be introduced in a number of transport corridors within the city, as travel demand grows and when the capacity of road-based buses reaches saturation levels.

The study team has identified one specific corridor which should be developed as a pilot project namely, the Urban Mass Rapid Transit (UMRT) Line 1 (East) from Ben Thanh market to Bien Hoa was examined by the study team in some detail.

The output of the study has suggested that along this particular transport corridor, a combination of both fixed rail and busway transit technologies may be the most appropriate technology in matching the capacity of the urban mass rapid system with the predicted passenger ridership demand profile in 2020 and beyond.

Project Components: The study objective is to identify and develop an urban mass rapid transit project UMRT Line 1 (East), comprising urban rail, busway and modernized bus system on the east-west transport corridor initially between Ben thanh Market HCMC and Bien Hoa, Dong Nai. The project includes the following components:

(1) Formulation of a step-wise or phased development plan for an efficient mass transit system on the selected east-west corridor. The final system by 2020 will be:
- Urban Rail: Ben Thanh Market– Cho Nho (urban area, 13.7km)
- Busway: Cho Nho – Bien Hoa, Dong Nai (suburban area, 14.5km)
- Develop major multimodal Interchange stations along the route

(2) Establishment of a bus management model

(3) Study on the method of an integrated transport and urban development including a feeder routes to the UMRT system

Project Location: East-west corridor connecting between HCMC city center and the eastern satellite city of Bien Hoa, Dong Nai through the existing major road routes of Hanoi Highway and National Highway No.1 (refer to Figure 1.2.1).

Implementation Period: Development of bus lane and Busway transit system along existing highways in the short to medium term and urban rail and busway on a dedicated right of way along the transport corridor in the medium to long term.

2) Contents and Structure of the Study

This report on the feasibility of the development of UMRT Line 1(East) forms Volume Three of the output of the study on Urban Transport Master Plan and feasibility Study in Ho Chi Minh Metropolitan Area called **HOUTRANS.**

The report gives an overview of the current and future transport situation in HCMC and then focus on one of the proposed mass transit lines – from Ben Thanh Market (District 1 of HCMC) to Bien Hoa (Dong Nai province). The ridership and patronage demand for this route was forecast from 2010 to 2020, with due consideration to land use characteristics

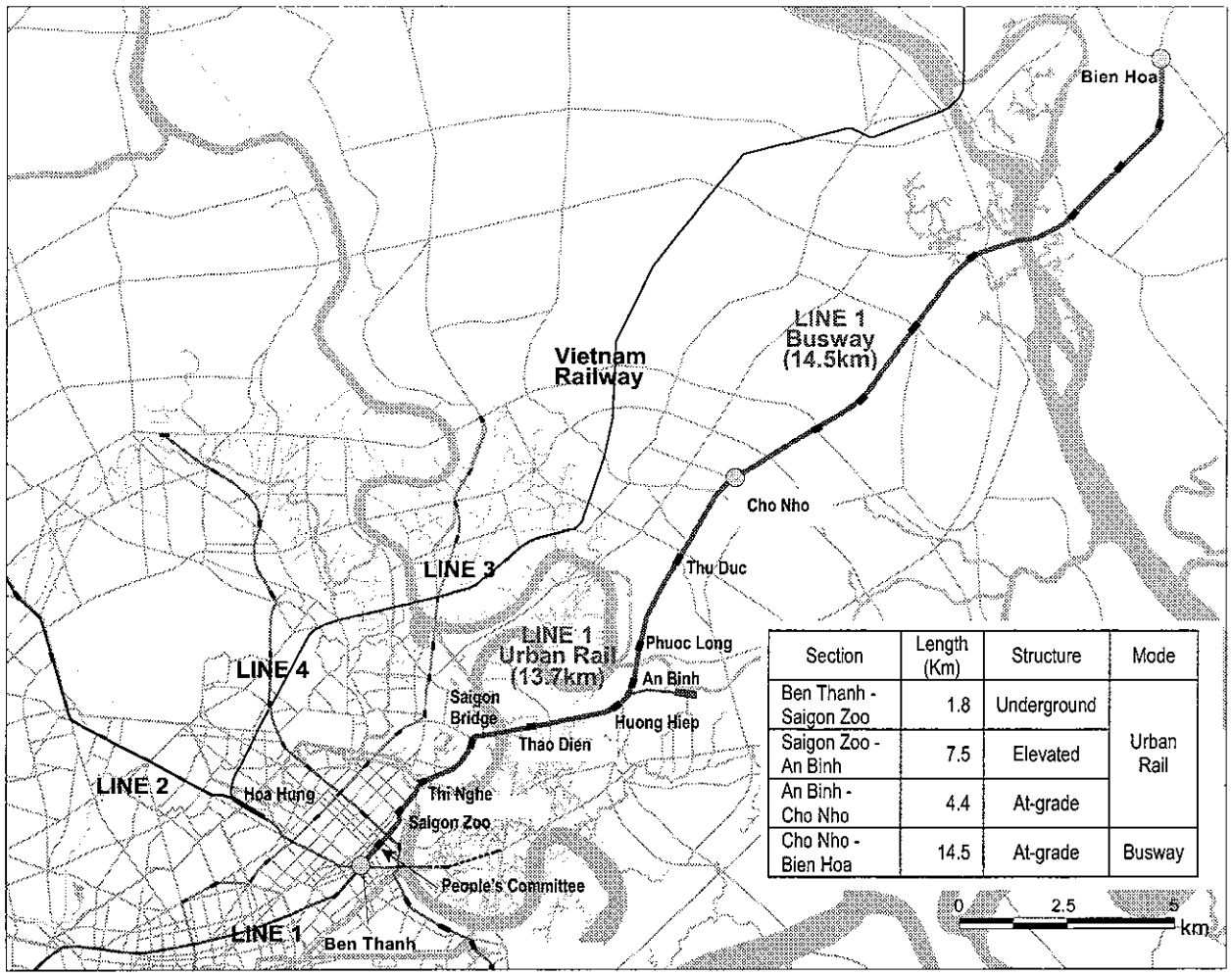
and evolving road and rail network in the study area.

The engineering aspects of the route were then examined in terms of horizontal and vertical route alignment and the corresponding requirements for tunnels, tunnel portal, viaducts stations and intermodal transport interchange facilities, depot, stabling & workshop facilities, rolling stock, and electrical and mechanical systems.

Project Implementation is amplified in terms of staging or phasing of the project development, time lines, division of private and public sector responsibilities, and organizational arrangements before, during and after construction.

In the penultimate section the report reviews the financial, economic, social, and environmental aspects of the project, the report ends with the conclusion and recommendations to assist in the development of the next stage of the UMRT Line 1 (East) project.

Figure 1.2.1 Location of UMRT Line 1 (East)



Section	Length (Km)	Structure	Mode
Ben Thanh - Saigon Zoo	1.8	Underground	Urban Rail
Saigon Zoo - An Binh	7.5	Elevated	
An Binh - Cho Nho	4.4	At-grade	
Cho Nho - Bien Hoa	14.5	At-grade	Busway

Source: Study Team

2 PROJECT AREA

2.1 Geographical Conditions

1) Project Area

The route of the Urban Mass Rapid Transit **(UMRT) Line 1** (East) for the HCMC-Bien Hoa Corridor is basically defined by existing geographical and right of way constraints, The transit corridor will follow the route of the existing Hanoi Highway and National Highway NH1A. This alignment should be further reviewed in more during the next stage of the corridor development to ensure a comprehensive transport plan for the corridor and should include consideration of the present highway situation, potential problems and issues, and development prospects of the corridor hinterland. It is understood such a development plan is currently under consideration by others. The study team would strongly suggest the contents of this study report be included into the corridor master plan strategy.

At this feasibility stage of the project the study team has based the planning the project corridor study on the HOUTRANS traffic zoning system as the various basic information data and indicators of socio-economy and traffic are readily available by zone.

The traffic zones to be included in the project area were basically selected from the area within 3-5km from Hanoi Highway, NH1A and the existing Vietnam Railway for comparison of the conditions. The project area for UMRT Line 1(East) includes five districts with 30 traffic zones and passes thru District 2, District 9 ,Thu Duc in HCMC, Di An in Binh Duong province and Bien Hoa in Dong Nai province. The relevant traffic zones are as shown in Figure 2.1.1.

2) Topography

The topographic characteristics of the transport corridor is that the land is almost flat. In addition the transport corridor is the shortest route connecting HCMC and the northern coastal areas. Therefore, the existing transport connections including the national highway and mainline VR inter-city railway toward northern Vietnam are developed along this corridor.

There are two major rivers, namely the Saigon River and Dong Nai River, flowing from the north to the south. These rivers divide the project area physically into three – HCMC's urban districts (Districts1, 3 and Binh Thanh), HCMC's eastern districts (Districts 2, 9 and Thu Duc) and Bien Hoa district in Dong Nai province. In addition to the main river network, there are also many small rivers and canals crisscrossing the transport corridor area.

3) Geotechnical

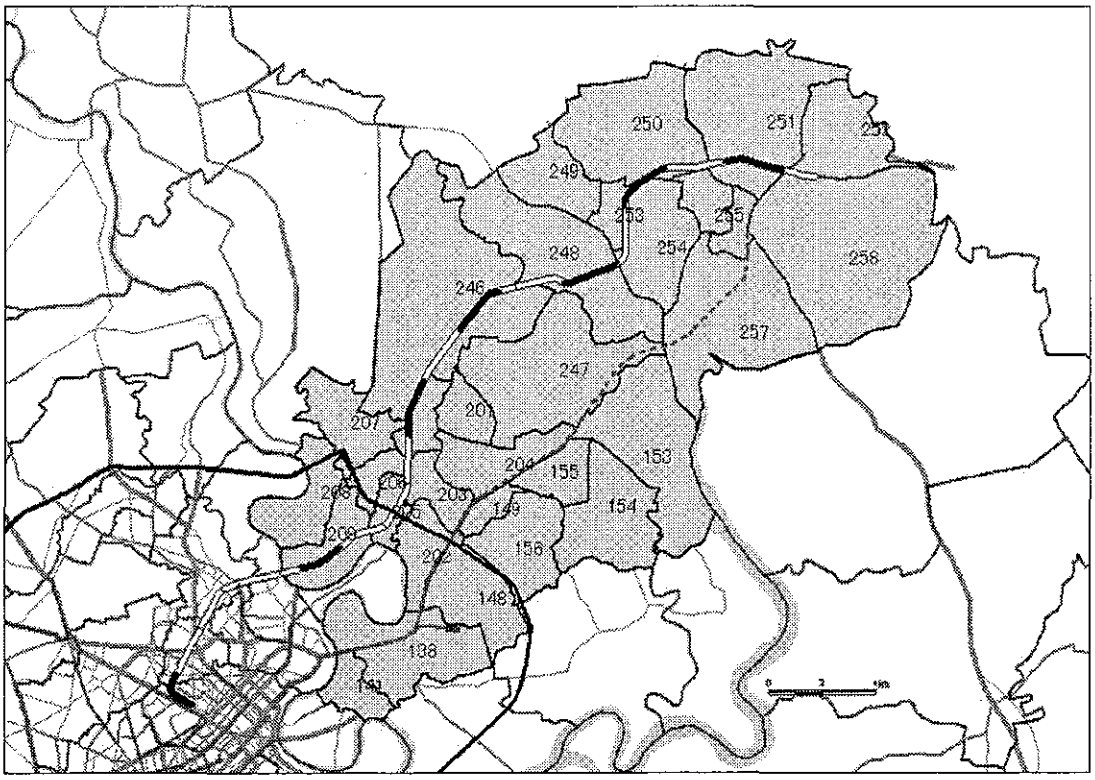
Although the transport corridor is between the Saigon and Dong Nai rivers, the project area has relatively good ground conditions with the possible exception of the areas running along the two major rivers. The team have identified areas with good soil and these are illustrated in Figure 2.1.2. During the next stage of the design a comprehensive geotechnical survey should be carried out in particular for the tunnel, viaducts and station sites. Areas of potential ground treatment or exceptional foundations such as the Saigon river crossing, the intersection of the tunnels with the future line 2 and the tunnel portal area near Saigon Zoo Station 3 should be studied in some detail.

4) Flood-prone Areas

Figure 2.1.2 also shows the areas prone to flooding as a result of heavy rains or incoming tide. The main areas susceptible to flooding caused by incoming tide are the riverside areas of Districts 2, 9 and Thu Duc. Floods do not, however, reach the areas along Hanoi Highway, NH1A and Vietnam Railway. Flooding due to heavy rains does not occur here.

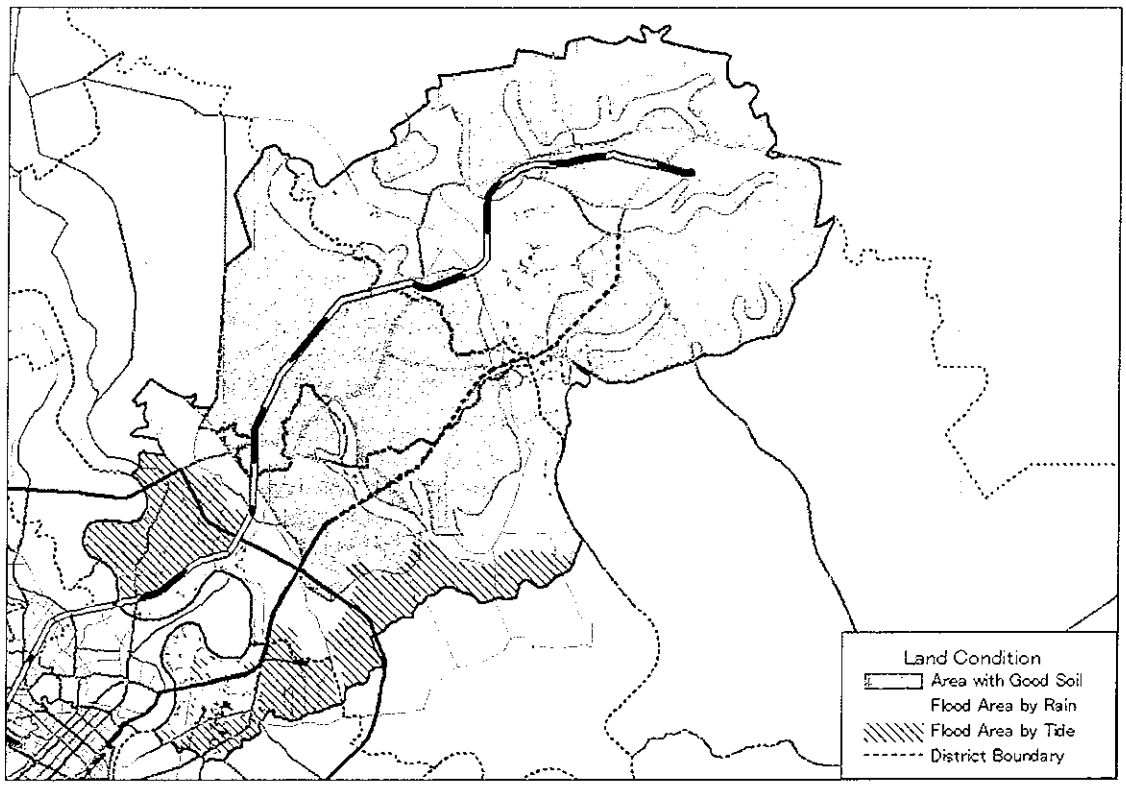
The team would suggest that during the next stage of project development a detailed hydrological study be carried out along the corridor in particular where the proposed transit alignment is at grade or underground, at station entrances and at the tunnel portal area near Saigon Zoo Station 3.

Figure 2.1.1 Project Area of UMRT Line 1 (East)



Source: Study Team

Figure 2.1.2 Land Condition along HCMC-Bien Hoa Corridor



Source: Study Team

2.2 Socio-economic Conditions

1) Demography

The demographic situation in the project area is shown in Table 2.2.1. The total population in the project area is approximately one (1) million, of which about half live in Bien Hoa City Dong Nai. At present, a relatively higher population density of around 100-250 persons/ha exists in the zones along Hanoi Highway, NH1A, NH1K, and the urban center of Bien Hoa City.

From output from other sections of the HOUTRANS, the population of the project area is estimated to increase to 2.1 million in 2020 with a high growth rate. In the last seven years, considerable high population increases were experienced in some zones of District 9 and Thu Duc, specifically the zones of 148, 156, 207, and 209 where Hanoi Highway and NH1k pass through.

It is also estimated that population growth will be significant in District 2 and Thu Duc, especially in the zones located along Hanoi Highway, NH1A and NH1K where rapid urban development is expected.

2) Workers and Students

Employment and school enrolment in the project area are approximately 500 thousand and 250 thousand, respectively.

At present, there is high daytime population, mainly of workers, in the zones where the district center is located, specifically in the zones of 138 in District 2, 204 in Thu Duc, 246 in Di An, and 257 in Bien Hoa City. Towards 2020, it is estimated that zones 149 in District

9 and 258 in Bien Hoa City will have high business opportunities.

The share of students and pupils in the daytime population is high in the zones of 203 in Thu Duc and 253 in Bien Hoa City. This is attributed to the large universities and colleges located in these zones. Towards 2020, it is expected that new educational institutions, such as universities and colleges, would be established in zones of 148 and 149 in District 9, 203 and 204 in Thu Duc, and 246 in Di An.

3) Household Income

Average monthly family income in the project area is about VND 2.25 million. District 9 has the highest at VND 2.56 million and Di An district the lowest at VND 1.61 million.

Table 2.2.1 Demographic Distribution along HCMC-Bien Hoa Corridor

District Name	Zone No.	Population (000)			Growth Rate (%/year)		Popultaion Density		Day/Night Population Ratio					
									2002			2020[1]		
		1996[2]	2002	2020[1]	1996[2]-2002	2002-2020[1]	2002	2020[1]	Employ-ment	Student	Total	Employ-ment	Student	Total
District 2	138	15	17	130	2.1	11.9	19	142	1.2	0.6	1.0	0.3	0.8	0.6
	141	15	19	96	3.2	9.6	60	313	0.7	0.4	0.7	0.3	0.5	0.5
	Total	**31**	**36**	**226**	**2.6**	**10.8**	**29**	**185**	**0.9**	**0.5**	**0.8**	**0.3**	**0.7**	**0.6**
District 9	148	19	49	79	16.9	8.2	95	153	0.7	0.7	0.8	0.8	2.0	1.1
	149	19	20	34	0.9	3.2	90	151	0.8	0.8	0.9	3.8	2.9	2.8
	153	16	15	34	-0.5	3.2	13	23	0.9	0.7	0.9	0.3	0.4	0.5
	154	16	12	38	-4.5	4.9	6	20	0.5	1.4	0.9	0.8	1.1	0.9
	155	22	13	29	-7.8	1.6	9	19	0.6	0.9	0.8	0.5	1.0	0.7
	156	18	26	91	6.1	9.3	19	64	0.5	0.8	0.7	0.6	2.3	1.0
	Total	**110**	**136**	**305**	**3.6**	**4.6**	**20**	**45**	**0.7**	**0.8**	**0.8**	**1.0**	**1.8**	**1.2**
Thu Duc District	201	17	20	55	2.7	6.8	52	145	1.1	0.8	1.0	0.6	0.5	0.7
	202	18	21	48	2.7	5.6	47	107	1.2	0.8	1.0	0.4	0.6	0.6
	203	39	46	75	2.7	3.7	113	185	1.3	2.6	1.5	0.6	5.0	1.5
	204	19	23	72	2.7	7.6	31	99	4.0	1.5	2.4	1.4	6.0	2.1
	205	22	22	35	-0.4	2.5	81	130	0.7	0.9	0.8	0.3	1.1	0.7
	206	15	16	32	1.1	4.3	63	125	0.7	1.1	0.9	0.3	1.4	0.7
	207	26	34	79	5.1	6.5	44	101	0.9	0.7	0.9	0.8	0.8	0.9
	208	15	19	43	3.3	5.9	27	62	1.1	0.7	1.0	0.4	0.7	0.6
	209	20	28	84	5.8	8.3	44	133	1.1	1.0	1.1	0.5	0.5	0.6
	Total	**191**	**228**	**523**	**3.0**	**5.7**	**50**	**114**	**1.3**	**1.3**	**1.2**	**0.6**	**2.1**	**1.0**
Di An District	246	-	63	154	-	5.1	18	48	1.6	1.2	1.3	1.0	3.0	1.4
	247	-	53	148	-	5.9	22	58	0.9	0.6	0.9	0.4	1.6	0.8
	Total	**-**	**115**	**302**	**-**	**5.5**	**20**	**52**	**1.3**	**1.0**	**1.1**	**0.7**	**2.3**	**1.1**
Bien Hoa District	248	-	55	95	-	3.1	32	46	0.8	0.7	0.9	0.4	0.6	0.6
	249	-	45	66	-	2.1	80	117	0.7	1.6	1.0	0.3	0.9	0.6
	250	-	41	55	-	1.7	23	33	0.8	0.7	0.9	0.3	0.7	0.5
	251	-	52	116	-	4.6	25	36	0.7	0.8	0.8	0.3	0.8	0.5
	252	-	65	96	-	2.1	64	94	0.9	0.9	0.9	0.8	1.1	0.9
	253	-	50	54	-	0.4	247	362	0.8	2.0	1.1	0.8	1.5	1.0
	254	-	34	60	-	3.2	41	60	0.7	1.1	0.9	0.8	0.7	0.9
	255	-	52	66	-	1.4	149	218	1.0	1.0	1.0	0.8	1.0	0.9
	256	-	35	42	-	0.9	143	210	0.9	1.0	1.0	0.2	0.8	0.5
	257	-	51	64	-	1.3	27	40	2.3	0.7	1.6	1.6	0.6	1.3
	258	-	27	30	-	0.5	8	12	1.9	0.4	1.2	4.2	0.5	2.7
	Total	**-**	**507**	**744**	**-**	**2.1**	**36**	**53**	**1.0**	**1.0**	**1.0**	**0.9**	**0.9**	**0.9**

1) Estimated by HOUTRANS study team
2) Source: HCM Transport Study (DfID-MVA)
3) Area excluding river area

Source: Study Team

2.3 Land Use and Environment

1) Existing Land Use

Industrial developments and mixed land use of residential, commercial and industrial establishments are distributed along the primary roads such as Hanoi Highway, NH1A, NH1K, and No.13. Land use proportion is roughly classified into three, namely: as of urbanized use (commercial/institutional, residential and industrial) at 35%, greenery and military at 15%, and agricultural at 50%. Land use characteristics by district are briefly as follows:

- Districts 2 and 9: Development in these two districts is limited only to areas along Hanoi Highway because the east side of these two districts is prone to flooding. In fact, 65% of their combined land area suffers from flooding.
- Thu Duc District: The urban area has been developed a long time ago because the district has good transport networksuch as Hanoi Highway, NH1A and NH13 surround this district, while the Vietnam Railway runs through the district center.
- Di An District: Rapid industrial development can be seen along NH1K which runs through the district.
- Bien Hoa City: northeast of HCMC lies Bien Hoa City with a population of 507,000. Bien Hoa is not only the capital of Dong Nai province; it is also a suburban centre and is characterized by extensive industrial estates (1,500ha) and military areas (3,630ha) spread out all over the city. Industrial activities in particular are the lifeline of the local economy of Bien Hoa.

2) *Environmental Conditions*

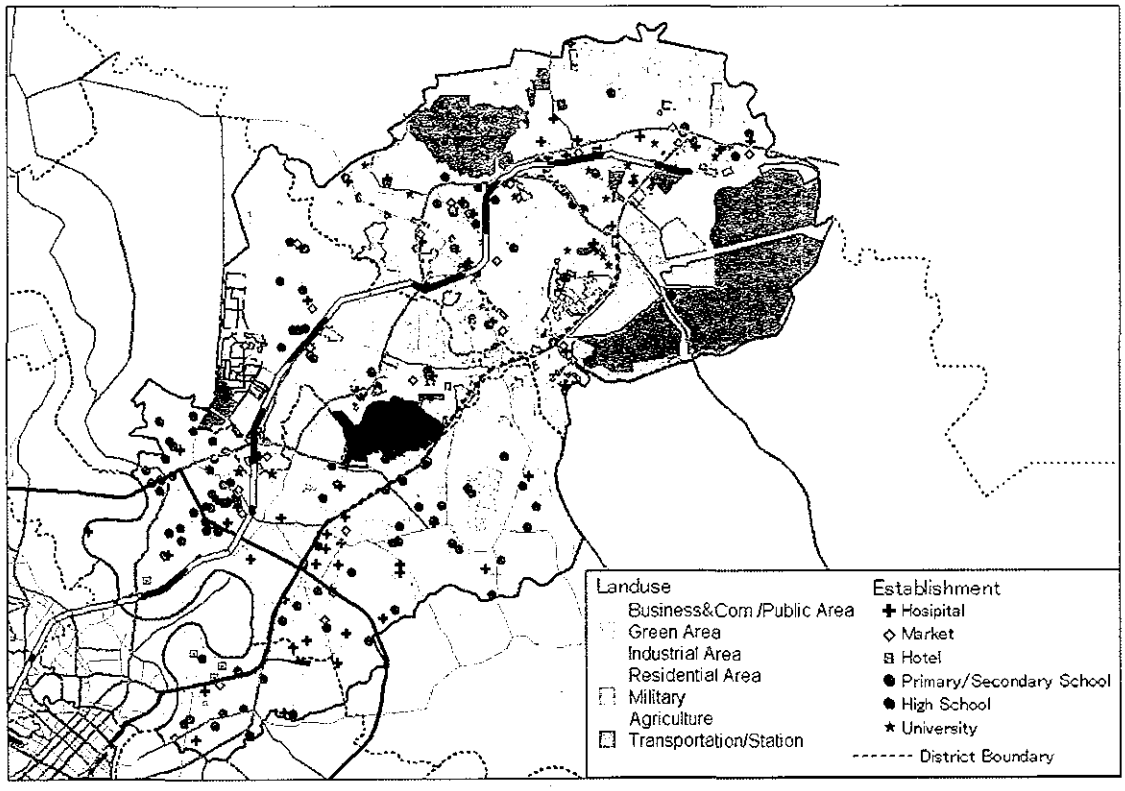
The environment in the project area varies widely from the highly urbanized to the suburban. Because the area is on well-drained land, there is no danger from flooding except perhaps in some sections of District 1.

The urbanized areas, such as District 1 and Bien Hoa, have unique social environment including social facilities, urban landscape and cultural properties.

In the suburban area, such as Districts 2, 9, and Thu Duc, the environment is partly socialized., in particular the roadsides are intensively used by people but in some hinterland areas, about 200m from the road, natural vegetation is in evidence.

No unique fauna and flora are found in the project area.

Figure 2.3.1 Existing Land Use along HCMC-Bien Hoa Corridor



Source: Study Team

3) Assessment of Urban Issues

As part of the HOUTRANS study, A Household Interview Survey (HIS) was conducted targeting 28,000 sample households in the study area. In this HIS, people were interviewed not only about their socio-economic profile and trip information but also about their opinion on and assessment of various aspects of urban growth and urban transport.

The residents in the project area assessed government efforts on city development. Table 2.3.1 presents the people's assessment of various urban issues. The results showed that generally the Government needs more effort on the aspects of transportation, security and safety. By area, the residents in the zones close to HCMC considered economic development and poverty alleviation more important than those in suburban zones. Transportation issues were rated by the residents, even by those who live far from the major routes of Hanoi Highway, NH1A and NH1K.

Table 2.3.2 shows the people's priority among various urban issues. The residents in the project area considered transportation, security and safety as important.

The survey results revealed that the residents in the project area care about, and expect more improvement in, transportation, security and safety.

Table 2.3.1 Assessment of Urban Issues by Traffic Zone along HCMC-Bien Hoa Corridor

District Name	Zone No.	Assessment on Urban Issue							
		Need More Effort[1)]							
		Economic Development	Poverty Alleviation	Public administ-ration Capacity	Transpor-tation	Land and housing	Urban services	Security and safety	Environmental protection
District 2	138	1	2	2	3	2	2	1	2
	141	1	2	1	5	2	1	1	1
	Total	**3**	**2**	**1**	**3**	**1**	**1**	**3**	**3**
District 9	148	1	3	2	5	1	2	1	2
	149	2	3	1	4	1	2	1	2
	153	2	2	2	5	1	1	1	1
	154	1	5	1	3	1	1	1	4
	155	2	4	1	4	1	1	3	2
	156	1	2	4	5	1	2	1	2
	Total	**3**	**2**	**1**	**4**	**1**	**1**	**4**	**1**
Thu Duc District	201	1	3	1	2	1	1	2	2
	202	3	3	1	3	1	1	3	3
	203	2	2	1	3	1	1	2	2
	204	1	3	1	3	2	1	1	4
	205	2	1	1	4	2	1	3	3
	206	2	2	4	4	1	1	2	1
	207	1	3	2	4	1	1	2	2
	208	1	2	3	4	1	1	4	2
	209	2	1	1	5	1	1	3	2
	Total	**2**	**2**	**1**	**4**	**1**	**1**	**2**	**2**
Di An District	246	1	2	1	4	2	1	1	3
	247	2	2	1	4	1	1	4	1
	Total	**2**	**1**	**1**	**4**	**1**	**1**	**3**	**3**
Bien Hoa District	248	1	1	1	5	1	2	3	1
	249	1	1	2	5	1	1	4	1
	250	1	1	1	5	1	1	2	2
	251	1	1	2	4	1	1	3	2
	252	1	2	1	4	1	2	2	2
	253	1	1	1	5	1	1	3	3
	254	1	1	1	5	1	2	3	1
	255	2	1	1	5	1	1	3	2
	256	2	1	1	5	1	1	4	1
	257	1	2	1	5	2	2	1	2
	258	1	3	1	5	1	1	5	1
	Total	**1**	**1**	**1**	**5**	**1**	**1**	**5**	**2**

1) % of respondents who considered issues needing efforts
1:-34%, 2:35-44%, 3: 45-54%, 4: 55-64%, 5: 65%+

Source: Study Team

Table 2.3.2 Importance of Urban Services by Traffic Zone along HCMC-Bien Hoa Corridor

District Name	Zone No.	Assessment on Urban Issue							
		Most Important[1]							
		Economic Development	Poverty Allevietion	Public administ-ration Capacity	Transpor-tation	Land and housing	Urban services	Security and safety	Environmental protection
District 2	138	1	2	1	2	1	2	3	2
	141	1	3	1	3	2	1	2	3
	Total	**1**	**2**	**1**	**4**	**1**	**1**	**1**	**3**
District 9	148	3	2	1	4	1	1	4	1
	149	4	3	1	3	2	2	1	1
	153	5	3	1	5	1	1	4	1
	154	4	1	1	4	1	1	4	1
	155	2	3	1	3	1	1	5	2
	156	2	3	1	4	1	1	3	1
	Total	**1**	**3**	**2**	**5**	**1**	**1**	**1**	**2**
Thu Duc District	201	5	2	1	3	1	1	5	1
	202	4	2	1	4	1	1	5	1
	203	3	2	1	3	1	1	5	2
	204	5	1	1	2	1	1	5	2
	205	5	2	1	2	1	1	5	2
	206	3	1	1	5	1	1	5	2
	207	2	1	1	5	1	1	4	3
	208	2	1	1	5	1	1	4	3
	209	2	1	1	5	1	1	5	3
	Total	**2**	**2**	**1**	**4**	**1**	**1**	**2**	**2**
Di An District	246	3	1	1	3	2	1	2	3
	247	3	1	1	5	1	1	3	2
	Total	**1**	**2**	**1**	**3**	**1**	**1**	**2**	**3**
Bien Hoa District	248	1	1	1	5	1	1	4	2
	249	1	1	1	4	1	2	5	1
	250	2	1	1	5	1	1	5	1
	251	1	1	1	4	1	1	5	2
	252	3	2	1	5	1	1	4	1
	253	2	1	1	5	1	1	4	2
	254	1	1	1	5	1	1	5	3
	255	2	1	1	5	1	1	4	3
	256	1	2	1	5	1	1	5	2
	257	1	2	1	5	2	1	3	3
	258	3	1	1	5	1	1	5	1
	Total	**1**	**2**	**1**	**5**	**1**	**1**	**3**	**2**

1) % of respondents who regarded issues highly critical
1:-34%, 2:35-44%, 3: 45-54%, 4: 55-64%, 5: 65%+

Source: Study Team

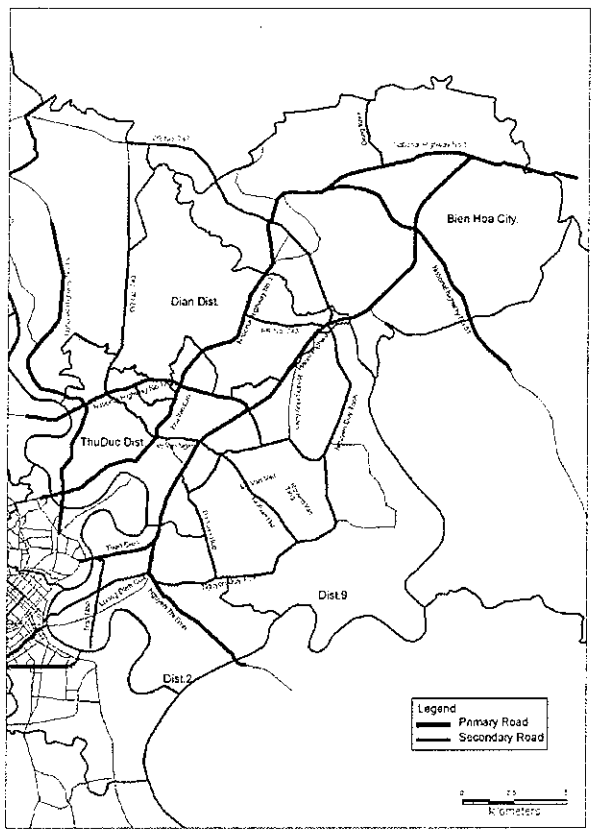
2.4 Transport and Traffic

1) Transport Network and Services

Road Network: The primary road network in the project area is of the radial-circumferential pattern, consisting of Hanoi Highway, NH1A and NH1K as shown in Figure 2.4.1. The density of primary and secondary roads that is defined in other sections of the HOUTRANS study is shown in Table 2.4.1 by zone. The present arterial road network is very limited in Districts 2 and 9. However, the HOUTRANS proposed a road network development plan which covers the project area and in accordance with its urban development and conditions.

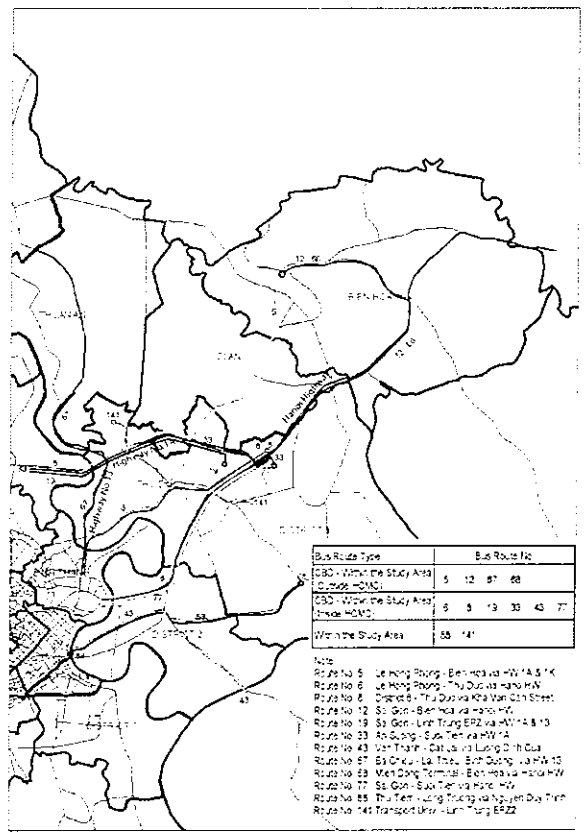
Bus Transport: The bus route network in the project area is shown in Figure 2.4.2. The bus route structure is classified into three types based on the route origin and destination of buses, namely: (1) HCM CBD – Within HCMMA (outside HCMC), (2) HCM CBD – Within HCMMA (inside HCMC), and (3) Within the Project Area. Thu Duc has the most convenient bus service among the five districts. There are four bus terminals and 10 bus routes within the district. Urbanization in Districts 2 and 9 has been limited to the areas along Hanoi Highway because of the districts' widespread susceptibility to floods especially in the eastern part. Therefore, the bus route network is not dense except along Hanoi Highway. Di An has no bus system and public transport demand is catered to only by xe om (motorcycle taxi). Likewise, Bien Hoa City has no bus system with routes and bus stops because there are convenient company and school buses in the city. Only lambro and xe om cater to intracity public transport demand.

Figure 2.4.1 Existing Road Network



Source: Study Team

Figure 2.4.2 Bus Route Network



Source: Study Team

Table 2.4.1 Road Conditions in the Project Area

District Name	Zone No.	Road Length (km)[1]		*Road Availability*[2]					
				% to Area		Length/pop. (km/mil.)			
						2002		2020[3]	
		2002	2020[5]	2002	2020[3]	Day Time	Night Time	Day Time	Night Time
District 2	138	6	14	1.3	6.6	357	347	183	106
	141	0	7	0.0	7.0	0	0	130	71
	Total	**6**	**21**	**1.0**	**6.7**	**200**	**167**	**160**	**91**
District 9	148	5	21	2.3	13.8	117	93	254	271
	149	0	3	0.0	5.6	0	0	30	85
	153	0	3	0.0	0.7	0	0	166	83
	154	0	9	0.0	1.3	0	0	267	241
	155	2	5	0.3	1.2	185	146	210	155
	156	0	10	0.0	2.0	0	0	115	115
	Total	**6**	**51**	**0.2**	**2.4**	**59**	**48**	**138**	**168**
Thu Duc District	201	4	3	2.0	3.1	181	184	85	60
	202	0	3	0.0	2.5	0	0	107	63
	203	5	10	2.7	6.7	70	106	94	140
	204	0	6	0.0	1.5	0	0	37	78
	205	0	2	0.0	4.0	0	0	103	68
	206	0	5	0.0	4.8	0	0	212	145
	207	1	6	0.4	2.7	29	26	91	79
	208	3	9	1.1	3.5	169	168	327	207
	209	4	10	1.2	4.7	146	155	185	118
	Total	**17**	**54**	**0.8**	**3.5**	**61**	**74**	**104**	**104**
Di An District	246	3	10	0.2	0.9	35	46	48	66
	247	18	30	1.7	3.6	398	347	265	203
	Total	**21**	**40**	**0.8**	**2.0**	**165**	**184**	**121**	**133**
Bien Hoa District	248	3	17	0.3	1.5	66	57	305	178
	249	5	9	2.2	3.4	120	115	208	130
	250	11	17	1.8	2.4	306	262	549	299
	251	0	12	0.0	1.2	0	0	194	107
	252	5	5	1.0	0.9	84	79	58	54
	253	2	5	2.6	4.5	38	42	84	84
	254	3	11	0.4	2.0	87	75	210	180
	255	0	3	0.0	1.4	0	0	57	52
	256	14	7	10.4	4.8	411	398	311	170
	257	8	17	1.0	1.9	102	163	211	265
	258	0	0	0.0	0.0	0	0	0	0
	Total	**51**	**102**	**0.8**	**1.4**	**100**	**101**	**154**	**138**

1) Estimated by HOUTRANS study team
2) Primary/secondary roads only, from HOUTRANS GIS
3) HOUTRANS Master Plan
Source: Study Team

National Railway: Vietnam National Railway (VR) runs through the project area However the study team noted the existing railway mainly caters to intercity traffic. therefore, local rail utilization is extremely low with only four trains daily at Bien Hoa Station, the largest among the four VR stations in the project area.

2) Mobility and Accessibility

Mobility: In most of the project area, motorcycle ownership among households is high, with more than 90% owning one or more motorcycles. It is only in some zones in Thu Duc and Di An where mobility is low, as shown in Table 2.4.2. Personal vehicle ownership is also high, with 60-70% of individuals owning vehicles. An alternative mode is also available for those without vehicles. Hence, the people's mobility is high compared with other major cities in Southeast Asia.

Accessibility: The residents in the project area take 26-37 minutes to make inter-district trips. Travel time for inter-district trips is in relation to the distance to the urban center of

HCMC. On the other hand, travel time for intra-district and intra-zone trips varies by district and zone. This means that accessibility to the urban center of HCMC depend only on the distance, while accessibility within districts and zones depends on the condition of the areas, transport network and services (refer to Table 2.4.3).

Table 2.4.2 Mobility and Accessibility of Residents in the Project Area

District Name	Zone No.	Vehicle Ownership of Household (%)				Mobility		Average Travel Time (min.)			
								Intra District		Inter District	Total
		Car	M/C: Multi	M/C: Single	Bicycle Only	Yes Own	Yes Alternative	Intra Zone	Inter Zone		
District 2	138	4	79	17	0	75	96	15	17	24	19
	141	1	73	24	1	68	93	13	11	30	19
	Total	**3**	**78**	**19**	**0**	**71**	**95**	**14**	**14**	**26**	**19**
District 9	148	5	69	25	2	67	71	10	16	27	19
	149	4	68	25	4	65	55	10	14	26	19
	153	3	40	51	6	65	64	9	18	32	14
	154	2	72	26	0	71	41	11	15	31	17
	155	6	60	30	4	70	78	12	18	33	22
	156	1	58	38	4	65	71	10	13	28	18
	Total	**3**	**63**	**31**	**3**	**67**	**66**	**10**	**15**	**28**	**19**
Thu Duc District	201	1	48	49	1	59	53	11	16	33	17
	202	0	37	51	12	62	36	8	12	26	11
	203	0	49	44	7	63	42	11	15	30	15
	204	0	65	33	1	65	62	13	15	28	18
	205	1	61	34	5	68	42	11	16	32	16
	206	0	54	38	9	73	59	12	16	22	15
	207	6	47	43	4	69	51	12	18	31	20
	208	7	54	34	5	75	64	13	18	29	19
	209	4	59	31	6	73	50	15	22	29	21
	Total	**2**	**52**	**40**	**6**	**67**	**50**	**12**	**16**	**30**	**18**
Di An District	246	2	47	39	11	65	76	12	18	33	16
	247	1	53	40	5	80	51	10	14	24	14
	Total	**2**	**49**	**39**	**9**	**72**	**64**	**12**	**15**	**33**	**15**
Bien Hoa District	248	0	55	41	4	61	65	11	20	28	15
	249	1	63	33	2	66	89	11	19	41	17
	250	1	69	24	6	62	71	10	16	47	15
	251	2	42	51	5	53	62	12	20	34	19
	252	2	59	37	2	57	52	11	16	33	13
	253	1	59	32	8	61	64	13	20	29	16
	254	3	52	38	6	62	62	10	19	47	19
	255	9	56	33	2	60	58	10	16	37	14
	256	3	58	33	6	62	55	10	16	22	14
	257	2	68	28	2	57	75	12	19	26	14
	258	6	51	39	4	72	55	11	16	50	17
	Total	**3**	**58**	**35**	**5**	**60**	**64**	**11**	**18**	**37**	**15**

1) Average speeds of other vehicles are as follows:
Car: peak-19.0km/h, off-peak-21.1km/h, Bus: peak-17.1km/h, off-peak-18.4km/h
Bicycle: peak-11.2km/h, off-peak-11.4km/h

Source: Study Team

3) Traffic Conditions

Traffic volume along primary roads is shown in Table 2.4.3. The heaviest traffic was observed along Hanoi Highway (140,504 vehicles/day with a volume/capacity [V/C] rate of 1.02). Followed by this, other primary roads, such as NH1A and NH1K, also account for certain traffic volume but V/C ratio is still below congestion level.

Table 2.4.3 Traffic Conditions in the Primary Roads in the Project Area

Location		No. of Vehicles (24 hours) in 2002						PCU	Conditions			
		Bicycle	M/C	Car	Bus	Truck	Total		Lane width (m)	Median	Capacity (PCU)	VCR
XL Hanoi	Thu Duc	2,336	121,060	5,155	4,363	7,590	140,504	57,535	22	Yes	56,430	1.02
QL 1a (rr2)	Thu Duc	3,392	69,495	2,141	2,568	7,460	85,056	40,504	31	Yes	83,700	0.48
QL 1k	Di An	7,022	73,564	1,002	968	771	83,327	20,984	11	No	23,510	0.89
QL 13	Thu Duc	6,569	75,514	2,708	3,254	5,412	93,457	39,163	16	No	41,040	0.95

Source: HOUTRANS Transport Surveys

The characteristics of trips made by district residents as obtained from the Household Interview Survey are briefly described as follows (see Table 2.4.4 and Figure 2.4.3):

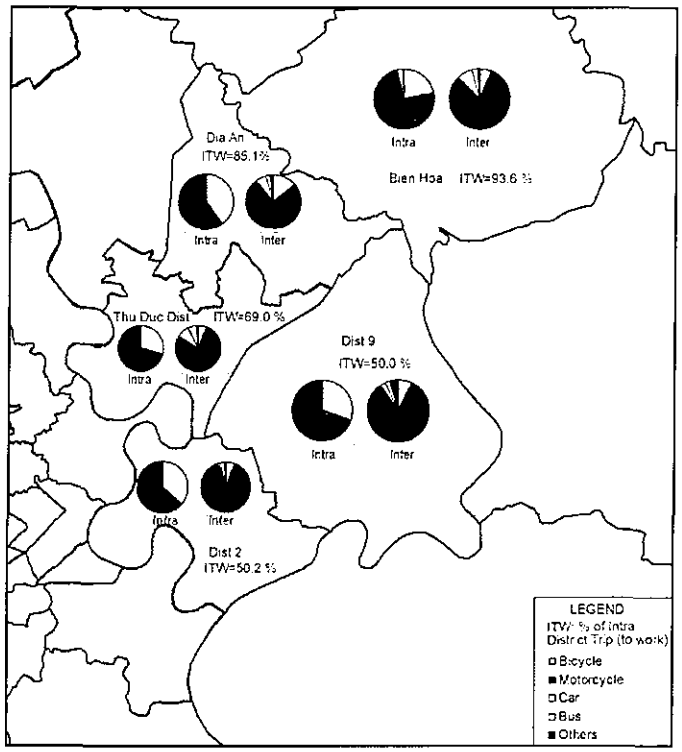
- The percentage of trips moving within the district has become larger in proportion to the distance from the CBD of HCMC. The percentage of work trips within the district in Bien Hoa reached more than 90%.
- Higher intra-district walk trips was recorded in Districts 2 and 9.
- Bicycle trips in Di An district was the highest among the five districts.
- Percentage of bus trips to/from Thu Duc district was more than double compared with that in other districts because Thu Duc has a convenient bus route network within the area.
- Regarding the question on the most important urban services, HIS respondents living in the project area answered 'more convenient public transport system', except in Thu Duc District.
- Intra-district trip distribution by district, illustrated in Figure 2.4.4, shows that in Thu Duc such trips were concentrated only in the east. This is because the rail runs through the district centre and the urbanized areas have developed in the east only.

Table 2.4.4 Intra-district Trip Distribution

Items			District 2	District 9	Thu Duc	Di An	Bien Hoa
Accessibility	% of trips moving within District	to Work	50.8	50.0	69.0	85.1	93.6
		to School	71.4	59.1	76.0	76.5	96.7
		Private	74.0	71.8	78.6	92.2	95.3
		Business	48.4	33.2	51.0	72.9	91.2
	Ave. Travel Time (min.)	Intra Dist.	14.7	11.7	13.5	12.2	13.9
		Inter Dist.	33.2	29.7	30.4	32.9	37.4
		Total	21.5	18.8	17.9	15.3	15.1
Total No. of Trips within the District	Total		423,616	660,800	1,037,286	669,800	2,963,392
	Walk		96,652	157,100	206,304	118,688	553,500
	% of Walk		22.8%	23.8%	19.9%	17.7%	18.7%
Modal Choice (%)	Intra District	Bicycle	36.7	30.3	29.4	40.3	22.1
		Motorcycle	62.4	68.6	68.8	58.8	73.7
		Car	0.3	0.2	0.2	0.1	0.6
		Bus	0.5	0.4	0.8	0.2	3.3
		Others	0.0	0.4	0.7	0.6	0.3
	Inter District	Bicycle	5.9	7.8	6.7	14.2	6.4
		Motorcycle	88.7	82.2	77.3	75.1	81.0
		Car	1.6	2.8	8.6	6.0	8.3
		Bus	2.8	2.8	5.8	2.5	2.8
		Others	1.0	4.4	1.6	2.3	1.5
Most Important Urban Services from Home Interview Survey			Public Transport	Public Transport	Education	Public Transport	Public Transport

Source: Study Team

Figure 2.4.3 Trip Characteristics

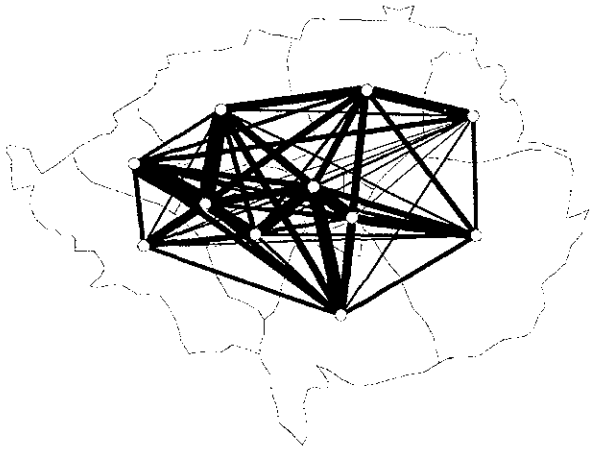


Source: Study Team

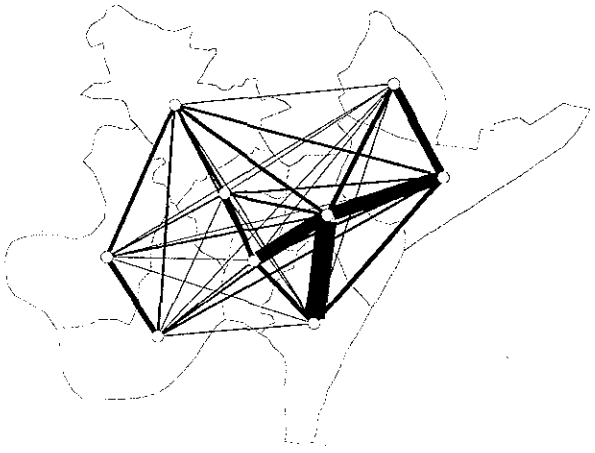
Figure 2.4.4 Intra-district Trip Distribution

Di An

Bien Hoa

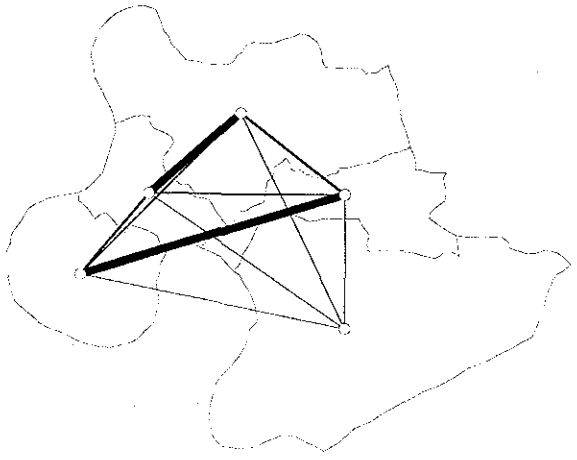


Thu Duc



District 9

District 2



Source: Study Team

4) Assessment of Traffic Conditions by Residents

Table 2.4.5 presents the results of the HOUTRANS HIS regarding the assessment of residents on their usual trip conditions. The results generally showed that most trips were assessed as bad by the residents. In particular, safety and travel conditions were highly considered as serious by residents in the project area.

Table 2.4.5 Assessment of Trips by Residents in the Project Area

District Name	Zone No.	Assessment (%: V.Good&Good/Bad&V.Bad)					% of Bad Trip[1]		
							Intra District		Inter District
		Travel Condition	Safety	Walking Condition	Roads Condition	PT Services	Intra Zone	Inter Zone	
District 2	138	16 / 25	25 / 36	34 / 14	24 / 29	30 / 38	1	8	5
	141	3 / 57	9 / 65	27 / 30	1 / 65	7 / 45	1	0	18
	Total	**7 / 43**	**9 / 60**	**32 / 20**	**10 / 47**	**14 / 49**	**1**	**4**	**12**
District 9	148	8 / 27	6 / 63	30 / 11	17 / 47	8 / 51	1	5	12
	149	25 / 21	0 / 96	52 / 2	9 / 12	35 / 41	1	1	1
	153	3 / 77	3 / 94	41 / 4	16 / 67	6 / 26	1	2	4
	154	3 / 11	3 / 86	17 / 8	22 / 39	8 / 52	2	19	32
	155	3 / 63	0 / 91	22 / 14	2 / 59	3 / 82	2	1	15
	156	35 / 31	0 / 82	54 / 17	9 / 49	7 / 59	0	0	2
	Total	**12 / 37**	**2 / 82**	**32 / 10**	**11 / 46**	**10 / 50**	**1**	**4**	**9**
Thu Duc District	201	5 / 41	11 / 55	30 / 24	13 / 52	15 / 34	3	5	22
	202	23 / 19	6 / 57	40 / 11	16 / 40	19 / 27	2	8	17
	203	22 / 32	6 / 68	37 / 18	13 / 51	7 / 36	3	4	15
	204	2 / 51	16 / 62	22 / 29	8 / 51	11 / 33	8	7	10
	205	7 / 46	7 / 67	30 / 20	9 / 63	16 / 37	4	5	9
	206	1 / 65	5 / 86	16 / 22	1 / 70	1 / 38	1	2	0
	207	2 / 62	6 / 79	20 / 24	9 / 65	8 / 46	2	2	3
	208	5 / 61	1 / 79	16 / 32	5 / 71	7 / 26	5	5	2
	209	2 / 55	1 / 81	10 / 35	4 / 63	17 / 30	3	6	4
	Total	**10 / 45**	**6 / 70**	**27 / 23**	**10 / 57**	**11 / 35**	**3**	**5**	**7**
Di An District	246	8 / 42	3 / 76	30 / 22	13 / 49	15 / 48	5	0	6
	247	4 / 59	3 / 82	32 / 8	11 / 56	8 / 37	0	1	1
	Total	**6 / 49**	**3 / 79**	**31 / 16**	**13 / 53**	**12 / 43**	**3**	**0**	**4**
Bien Hoa District	248	3 / 52	2 / 78	10 / 28	1 / 55	5 / 39	1	6	12
	249	6 / 33	0 / 65	23 / 13	6 / 38	9 / 28	1	2	3
	250	3 / 76	6 / 72	19 / 36	3 / 63	0 / 68	6	3	38
	251	12 / 40	9 / 63	38 / 13	10 / 42	5 / 51	2	4	8
	252	12 / 16	16 / 54	40 / 8	18 / 26	12 / 37	1	5	8
	253	6 / 61	2 / 77	26 / 25	0 / 67	8 / 47	2	6	0
	254	3 / 77	3 / 82	9 / 37	6 / 68	6 / 53	3	4	7
	255	11 / 41	5 / 72	20 / 33	9 / 59	8 / 57	2	8	20
	256	2 / 85	0 / 89	3 / 34	2 / 60	2 / 48	2	7	13
	257	11 / 57	1 / 88	17 / 29	11 / 65	2 / 76	3	13	30
	258	6 / 86	6 / 88	8 / 59	8 / 55	20 / 45	3	12	0
	Total	**7 / 52**	**5 / 73**	**22 / 26**	**7 / 53**	**7 / 50**	**2**	**6**	**13**

1) Ratio of trips which were assessed as "bad" or "very bad" from HIS

Source: Study Team

5) Identified Transport Problems and Issues

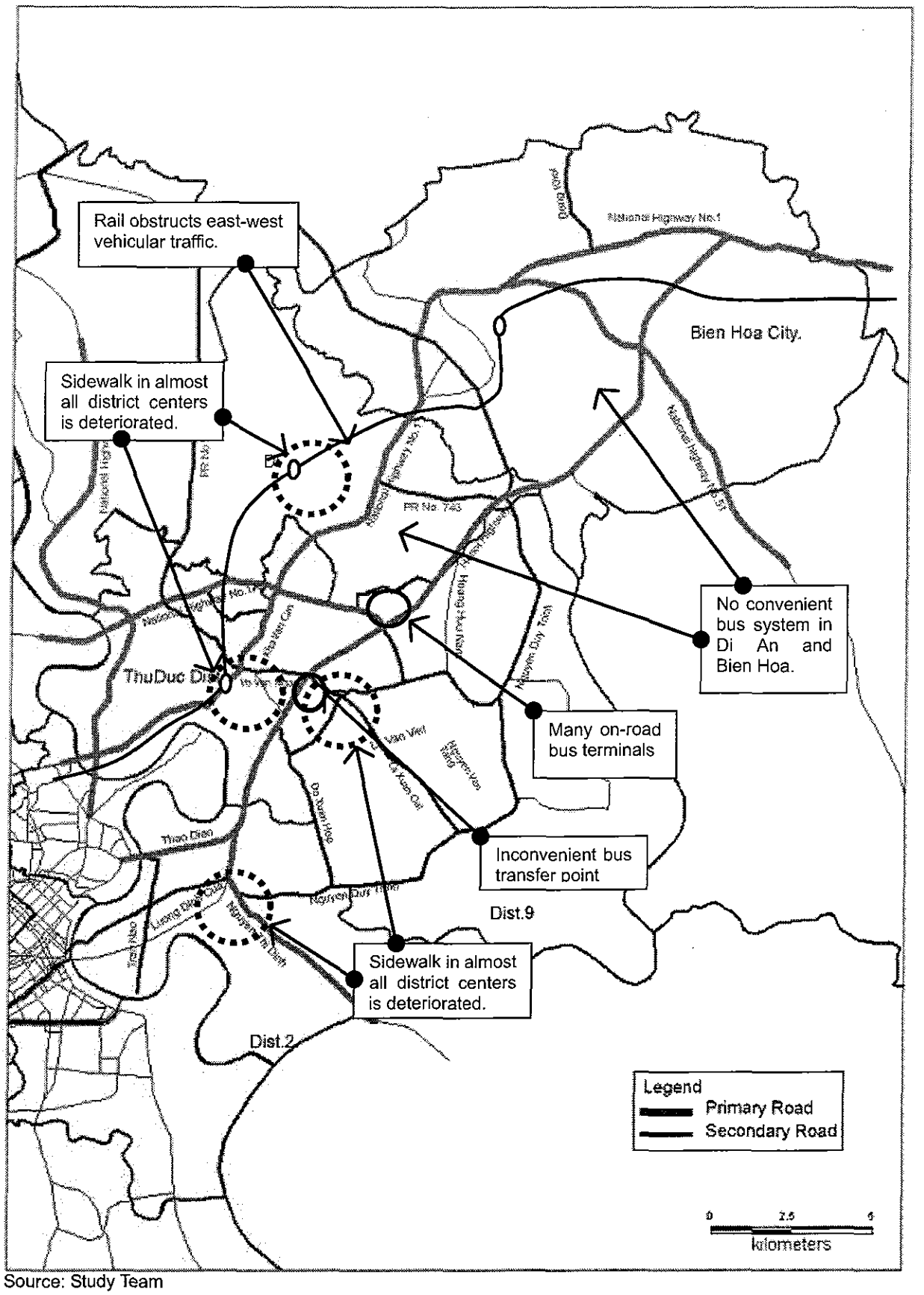
Based on the analysis and observation of the project area provided in the foregoing sections, its transport problems and issues were summarized by district, as shown in Figure 2.4.5.

Transport problems and issues were identified in terms of local road network/facilities, public transport system and pedestrian facilities. Illustrations were also rendered for better understanding.

Major findings in the project area are summarized below.

- Bus system only functions inside HCMC.
- Many on-road bus terminals can be observed in the area.
- Transfer passengers at transfer points are inconvenienced and uncomfortable because of the far distance between bus stops and the lack of shelters at many bus stops.
- There is no bus system outside HCMC, and only lambro and xe om can serve public transport demand.
- Vietnam National Railway at grade tracks are an obstacle for east-west vehicular traffic, especially in Thu Duc and Di An districts.
- Pedestrian environment, such as conditions of sidewalk in almost all district centres, is deteriorated except in Bien Hoa City.

Figure 2.4.5 Transport Problems and Issues along HCMC-Bien Hoa Corridor



Source: Study Team

2.5 Development Issues

In the project area, urban development is expected to expand significantly in the future. Bien Hoa City, in particular, will grow as a satellite city of the Ho Chi Minh metropolitan area. Thu Thiem in District 2 will develop as a high-density, suburban center. Extensive housing, commercial, business, and educational development will continue to accumulate along the two major routes of Hanoi Highway/NH1A and NH1K. Therefore, the linkage between HCMC's urban center and the areas along this corridor will become stronger.

It is clear then that a public mass transit system that can cater for the high potential transport demand in an efficient manner needs to be developed along this important transport corridor. In this context when the UMRT Line 1(East) transport will be developed. It will be necessary at the same time to provide a convenient and efficient feeder public transport services to and from the stations and busway stops along the corridor. Development directions for the local transport system are summarized in Table 2.5.1. This will be of particular importance at the terminal and multimodal interchange stations at Bien Hoa, Cho Nho, An Binh and Ben Thanh.

To maximize the efficiency of a mass transit system, urban development must be controlled and directed integrated. For one, urban sprawl must be regulated and integrated with the development of transport facilities in order to meet public transport capacity with demand along the transport corridor and meet the future needs and level of service expected by the traveling public from a fully integrated transport network in the HCMC metropolitan area.

Table 2.5.1 Summary of Development Issues on Local Transport

Items		HCM-Bien Hoa Urban Corridor				
		Emerg. Peripheral			Suburban	Satellite Urban
		District 2	District 9	Thu Duc	Di An	Bien Hoa
Area (ha)		3,972	9,365	4,351	5,742	13,667
Population (000)	Year 2002	109	160	228	115	507
	Year 2020	657	409	523	302	744
Urban Development Directions	Existing Conditions	Depends on HCM-CBD	Depends on HCM-CBD	Indust. & Edu. Center in HCM	Between HCM & Bien Hoa	Provincial Center
	Development Trend and Issues	Wide spread Flood-prone Area	Wide spread Flood-prone Area	East: Urbanized Area West: Flood-prone Area	No district center	Many industial & military area
	Development Strategies	Sub-CBD development	Provincial sub-center development	Convenient bus system	District center development	Strengthening as the provincial center
Identification of Transport Problems	Transport Demand	580,000 trips/day, 68% of total is intra-district	870,000 trips/day, 70% of total is intra-district	1,480,000 trips/day, 70% of total is intra-district	810,000 trips/day, 86% of total is intra-district	3,100,000 trips/day, 95% of total is intra-district
	Mobility	Well used water transport	Depends on Hanoi Hwy	Convenient bus system	No bus system	No bus system
	Accessibility	To work' trip to outside is unsatisfactory	Business' trip to outside is unsatisfactory	To school' trip to outside is unsatisfactory	Not bad	To school' trip to outside is unsatisfactory
	Transport Problems	Traffic enforcement, Traffic safety & Public transport	Traffic safety, Traffic enforcement, Road facilities & Public transport	Traffic safety & Traffic enforcement	Traffic management, Road facilities & Traffic enforcement	Traffic safety, Traffic enforcement, Road facilities & Traffic management
Major Transport System	Roads	Hanoi Hwy & E-W Hwy	Hanoi Hwy & RR2	Hanoi Hwy, HW1K, HW13 & RR2	Hanoi Hwy, HW1K, RR2 & RR3	Hanoi Hwy, HW1K, RR3 & RR4
	Public Transport	Line 1	Line 1& Busway	Line 1, 3, Busway & VR	Busway & VR	Busway & VR
Development Directions		Develop a new sub-CBD of HCMMA considering an urban environment	Develop a provincial sub-center with convenient public transport	Develop a transit oriented district	Develop a new district center with convenient public transport system	Develop a regional center based on the bus oriented transport system
Local Area Transport Measures	Feeder Bus Route from/to Transit/Busway	○	○	○	○	○
	Feeder Bus Route from/to Trunk Line	○	○	○	◎	○
	Feeder Bus Route within the District	○	○	○	◎	○
	Mode Interchange Area Development	○	◎	◎	○	◎
	Transit Mall Development			◎		
	Improvement of Road Facilities between Disrict Center and Trunk Road					
	Local Road Network Improvement within the District Center	○	○	○	○	○
	Local Road Network Development without Through Traffic	○	○	○	○	○
	Pedestrian Environment Improvement	○	○	○	○	○
	Park & Busride System	○	○	○	○	○
	Registered Xe om	○	○	○	○	○
	Water Transport Improvement	◎				○
	Bicycle Lane Network			○	○	○
	Strengthening the Traffic Management	○	○	○	○	○

Source: Study Team