TA 4050-VIE: Preparing Kunming-Haiphong Transport Corridor Project

The Economic and Financial Study for the Kunming-Haiphong Expressway Project (Hanoi-Lao Cai)

Final Report

November 2005

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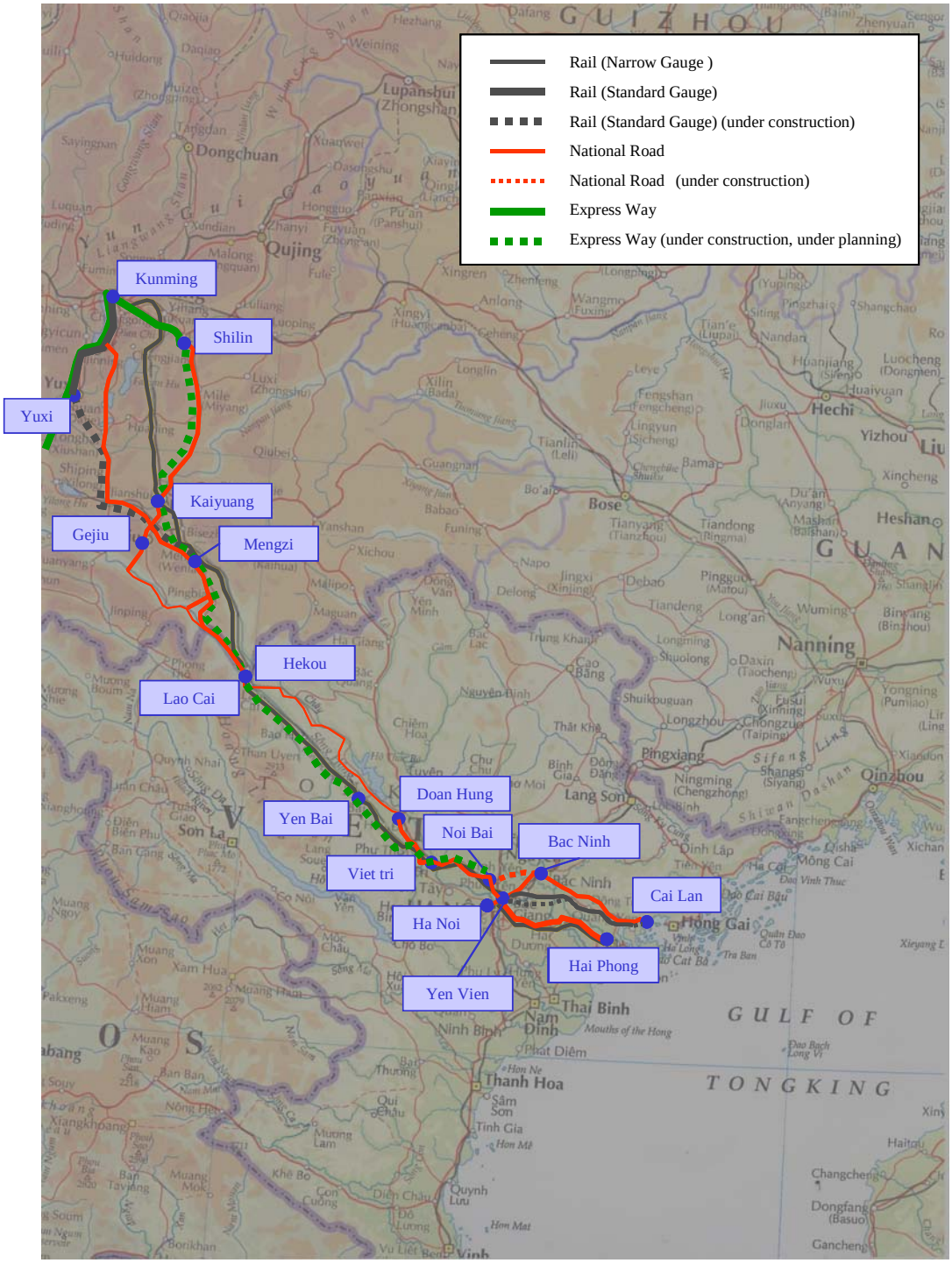
Project Map


Rail (Narrow Gauge)
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Viet tri
Cai Lan
Ha Noi
Hai Phong
Yen Vien
GULF OF
TONGKING

Preface

1. The first phase of Technical Assistance (TA); TA 4050-VIE: Preparing Kunming - Haiphong Transport Corridor Project was completed on December 2003. This report recommended that road option is the most important transport mode and the Expressway project between Hanoi and Lao Cai is the first priority.

2. After this recommendation, the Government of Viet Nam and ADB had agreed to investigate more detail economic benefit and financial viability before putting the expressway project forward with detail design. In compliance with the request from the Government of Viet Nam and ADB, the team for the study was organized led by Dr.Shin-ichi ISHI (Nomura Research Institute) and the consultants had mobilized at PMU-5, Ministry of Transport in Viet Nam since February 2005. The team consisted of diligent and diversified specialists with transport planners, engineers, economists and financial specialists including Vietnamese and Chinese.

3. It seem to me that the expectation from the parties concerned and people living in the project area is getting increased. I always received the expectation for the expressway with economic benefit and social improvement whenever I visited the Provincial Governments in the project area.

4. The team had more thoroughly field survey for route selection as well as interviews for the beneficiaries to identify the benefit and disadvantage to be avoided within the corridor including Kunming area in Yunnan Province China and eleven provincial governments in Viet Nam.

5. Consequently the process undertaken to identify the economic benefit and financial viability has been developed taking into account the voices form the governments, firms and people in the project area. Through field survey and interview, we found the huge potential of economic and social development in the future and now we are convinced that the expressway will not only develop the project area but also open up the opportunity for the people living in the rural area, where is one of the poorest area in Viet Nam.

6. This corridor is not local/domestic corridor but international. Connecting two capital cities with National capital Hanoi in Viet Nam and Provincial capital Kunming in China (that is also the gateway for GMS in China) will promote interchange goods, products, passenger, traffic and information in the future. Also Haiphong and Cai Lan ports have a potential to be gateway for the ocean freight to/from Kunming in the future with much of expectation from beneficiaries not only Viet Nam but also in Yunnan province.

7. I am convinced that this project will accelerate to open the potential in the project area and bring a number of opportunities for development and brightness for the people living in the area. I hope this report would be helpful for the decision makers to put the expressway project forward.

The Team Leader of TA 4050-VIE: the economic and financial study for the Kunming – Haiphong expressway project (Hanoi – Lao Cai)

Shin-ichi ISHII

石井伸一

Currency Equivalents

(as of July 2005)

$1 = 15,850 VDN
1 VDN = $0.000063

$1 = 8.2 RMB(CNY)
1 RMB(CNY)=$0.1220

Abbreviation

AADT	Average Annual Daily Traffic
ADB	Asian Development Bank
ADF	Asian Development Fund
AIDS	Acquired Immune Deficiency Syndrome
AP	Affected Person
ASEAN	Association of South East Asian Nations
BECOM	
BOT	Build – Operate – Transfer
DWT	Dead Weight Tonnage
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EM	Ethnic Minority Group
EMDP	Ethnic Minority Development Plan
FDI	Foreign Direct Investment
FIDIC	International Federation of Consulting & Engineering
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GMF	Greater Mekong sub-region
GOV	Government of Vietnam
GRT	Gross Registered Tonnage
HDI	Human Development Index
HH	Household
HIV	Human Immunodeficiency virus
HDM	Highway Design and Maintenance
ICD	Inland Clearance/Container Depot
IFC	International Finance Corporation
IP	Industrial Park
IT	Information Technology
IWT	Inland Waterway Transport
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
KHTC	Kunming-Haiphong Transport Corridor
LOS	Level of Service
MARD	Ministry of Agriculture and Rural Development
M&E	Monitoring and Evaluation

MOET	Ministry of Education and Training
MOI	Ministry of Industry
MOSTE	Ministry of Science, Technology and Environment
MOT	Ministry of Transport
MOF	Ministry of Finance
MOU	Memorandum of Understanding
MPI	Ministry of Planning and Investment
MWSR	Major Water Supply Reservior
NGO	Non-governmental Organization
NR	National Road
NTSC	National Transport Safety Committee
OCR	Ordinary Capital Resources
ODA	Official Development Assistance
O&M	Operation and Maintenance
PC	People's Committee
PCU	Passenger Car Unit
PDOT	Provincial Department of Transport
PMU	Project Management Unit
PMU5	Project Management Unit No.5
PMU18	Project Management Unit No. 18
PPC	Provincial People's Committee
PPMU	Provincial Project Management Unit
PPP	Public-private Partnership
PR	Provincial Road
PRC	People Republic of China
PSP	Private Sector Participation
ROW	Right-of-Way
RMU	Road Management Unit
R&R	Resettlement and Relocation
RRMU	Regional Road Management Unit
RS	Resettlement Site
RTU	Rural Transport Unit
SCF	Standard Conversion Factor
SDZ	Special Development Zone
SOE	State Owned Enterprise
SWKP	Scott Wilson Kirkpatrick and Partners
TA	Technical Assistance
TEDI	Transport Engineering and Design Institute
TEU	Twenty-food Equivalent Unit
VAT	Value Added Tax
VINAMARINE	Vietnam National Maritime Bureau
VIWA	Vietnam Inland Waterway Authority
VND	Vietnam Dong
VOC	Vehicle Operation Cost
VR	Viet Nam Registration
VRC	Vietnam Railways Corporation
VRA	Vietnam Road Administration
IBRD	International Bank for Reconstruction & Development
WBRTP2	World Bank Rural Transport Project 2
WTO	World Trade Organization

Executive Summary

Executive Summary

INTRODUCTION

1. The technical assistance (TA4050-VIE) was approved for $1 million on 18 December 2002. The Government of Vietnam approved the TA on 22 April 2003. The purpose of the TA is to assist the Government to prepare a Project to upgrade the Kunming-Haiphong transport corridor (the Corridor) over the sections in Viet Nam. The Project will strengthen the regional infrastructure network and will also improve the domestic transportation system connecting Hanoi with the northern provinces. The improved transport network will not only enhance access to Lao Cai Province, which is among the poorest in Viet Nam and has a number of ethnic minorities, but will also open up opportunities for growing trade and investment in the region.

2. The TA is implemented in two phases. The first phase examined the pre-feasibility and viability of improvements in roads, railways or inland waterways to select the optimum transport mode for the Kunming-Haiphong Transport Corridor. The second phase will undertake detailed feasibility study for the selected transport mode.

3. The first phase of the TA study covered the following major activities: (i) review the present condition of the Kunming-Haiphong transport network; (ii) evaluate the viability of the road, railway, and inland waterway options from the point of view of technical, environmental, social, resettlement, economic and financial analyses, and submit to ADB and the Government a set of recommendations on the optimum mode and phasing; and (iii) assess the preliminary social, environmental, and resettlement impacts of the road, railway and inland waterway options.

4. The first phase report was completed in December 2003 and submitted to ADB and the Government of Vietnam. This report has concluded that roads are the most important mode and 'Limited Access Toll Expressway between Lao Cai and Hanoi (Noi Bai)' is the first priority from the viewpoints of improvement of mobility for the people living in the project area, lesser environmental and social impact, better economic benefit and the financial viability. The report also concludes that the upgrading of existing railway between Hanoi and Lao Cai is a viable option for consideration as a secondary priority. The Government of Viet Nam selected both project options.

5. The proposed expressway with about 260km between Hanoi (Noi Bai) and Lao Cai is fully access controlled. From Lao Cai at the border to PRC, 2 lanes expandable to 4 lanes expressway alignment follows the west bank of the Red River through the gently undulating terrain to Yen Bai. From Yen Bai the proposed expressway with 2 lanes expandable to 4 lanes will follow the existing rail alignment or National Road No.32C up to Viet Tri. From Viet Tri, the proposed expressway will have a new alignment with 4-6 lanes up to Hanoi.

6. The project cost for the expressway was estimated at $565 millions with 2-lane from Lao Cai to Viet Tri and 4-lane from Viet Tri to Noi Bai including facilities (5% of civil works cost) and supervision cost (7% of civil works cost and equipment cost). This cost estimate is derived from the average unit cost of expressways under ADB expressway projects in People's Republic of China (PRC). More investigation for the cost estimation should be taken into consideration if the study takes a progress to the next step.

7. The government of Viet Nam is generally in agreement of borrowing ADB-OCD for the Hanoi – Lao Cai expressway project. However prior to the processing, the Ministry of

Transport is requested by the Ministries concerned to Justify rationale and verify that cost for the expressway can be recovered. Therefore the Government of Viet Nam expected ADB to undertake the economic and financial study as soon as possible.

8. This report specifies initial engineering design from the field surveys and assesses economic benefit and financial viability on the Hanoi-Lao Cai section of the Kunming-Haiphong Expressway Project as the second phase of the study for Preparing Kunming – Haiphong Transport Corridor Project. The report delivers:

(a) initial engineering specifications of the Kunming-Haiphong Expressway (Hanoi-Lao Cai section) and updated cost estimate for the Project;
(b) detailed forecast of traffic volume of the Expressway;
(c) appropriate toll level of the Expressway;
(d) Economic Internal Rate of Return (EIRR) of the Project and its sensitivity analysis;
(e) Financial Internal Rate of Return (FIRR) of the Project and its sensitivity analysis;
(f) projected financial statements under the appropriate toll level;
(g) project beneficiaries and their benefits; and
(h) recommendation to the Government of Viet Nam.

PROFILE FOR THE PROJECT AREA

9. The KHTC interconnects a string of population and economic centers in Yunnan Province of PRC and the Northern Vietnam with a combined population of about 24.5 million, and a combined GDP of about USD 22.7 billion, and connects these to the ports of Haiphong and Cai Lan in Vietnam. The ports in Vietnam are significantly closer to Kunming than Fangcheng port in Guanxi Province is, which is the nearest port in PRC seen from Kunming. From a logistics point of view, Haiphong and Cai Lan ports potentially provide shippers in Yunnan with a channel for rapid shipment of containerized cargoes and other products that depend on fast access to the global markets. Seen from the Northern Vietnam, the KHTC could provide not only the large market of Yunnan Province but also a foothold on the huge hinterland markets of the Southwest of PRC.

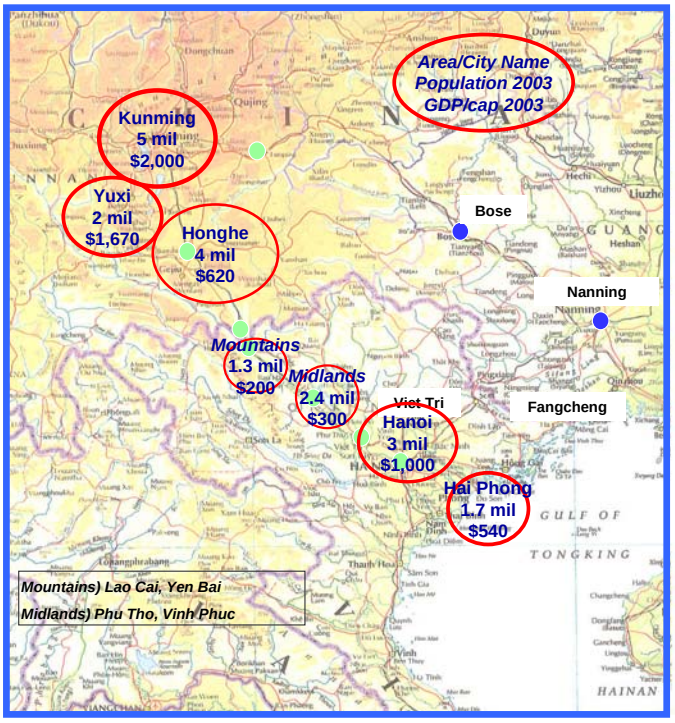
Table 1: Status Quo between KHTC in 2003

Provinces/ Prefectures	Population (thousand)	Population density (person/ha)	Employed labor (thousand)	GDP (mill USD)	GDP per capita (USD)
Total of Projected Region of Vietnam	13,393	4.24	7,116	6,924	517
Mountains	1,352	0.91	713	277	204
Midlands	2,446	4.98	1,304	743	304
Plains	9,595	8.19	5,100	5,904	615
Total of Projected Region of Yunnan	11,091		6,442	15,797	1,424
Kunming	5,008	2.32	2,849	81,401	1,976
Yuxi	2,067	1.35	1,278	28,647	1,679
Honghe	4,016	1.29	2,315	20,703	625
Corridor Total	**24,484**		**9,431**	**22,721**	**928**

Source) Nomura Research Institute
Note) Mountains: Lao Cai; Yen Bai
Midlands: Phu Tho; Vinh Phuc
Plains: Hanoi; Bac Ninh; Hai Duong; Hung Yen; Quang Ninh; Haiphong

10. Project related regions in the North Vietnam include Lao Cai, Yen Bai, Phu Tho, Vimh Phuc, Hanoi, Bac Ninh, Hai Duong, Hung Yen, Quang Ninh, and Haiphong. The consultant team categorize Lao Cai and Yen Bai to "*Mountains*", Phu Tho and Vinh Phuc to "*Midlands*", and Hanoi, Bac Ninh, Hai Duong, Hung Yen, Quang Ninh and Haiphong to "*Plains*". The regions have 13.3 million populations accounted for 16.6% of the total population of Viet Nam in 2003. Total of the regions' GDP amounted to VND 107.3 trillion with the share of 17.7% of the country, and GDP/capita also stood at USD 517 in the range of USD 198 at Lao Cai to USD 1,011 at Hanoi.

Figure 1: GDP and Population on the Projected Area



11. With respect to socio-economic background of Yunnan Province, the economy concentrates on the resource-based industries such as processing of tobacco and food, processing of non-ferrous metals, steel processing, fertilizer, hydroelectric industry, and so on, which are based on abundant of diverse natural resources in Yunnan. Regarding the trade structure of Yunnan, generally speaking, primary goods such as natural ores, agricultural products, and processed goods using such kind of natural resources like a fertilizer and metals are exported, while natural resources like copper ore, iron ore, and aluminum ore which are mainly used for metallic smelting and processing, and equipments are imported based on its industry structure and comparative advantage..

12. Concerning to socio-economic background of Vietnam, Vietnam has a comparative advantage on labor-incentive industries such as agriculture and light industries that mainly focus on assembly and export. While the secondary and the tertiary industries occupy majority share of GDP, more than half of labor force, applying for 55.1% in 2003, work in the primary sector. It implies that there are abundant sources of labor force to the industry sector, especially in the rural area. On the other hand, the country is still industrializing country. As for the trade structure of Vietnam, generally speaking, primary goods such as natural resources, agricultural products, and light industries' products are exported to the world, while intermediate goods for assembly and export again and

finished goods for domestic consumption are imported from overseas, based on its comparative advantage.

13. Social and economic cooperation between PRC and Vietnam has developed extremely over a wide field from cargo movement to human traffic since the late of 1990's. Trade amount between the two has increased from USD 1.3 billion in 1999 to USD 4.6 billion in 2003. Yunnan and Vietnam are also closely connected each other even now on. Yunnan procures natural resources such as ore and minerals from Vietnam, smelt, refine and process them in Yunnan, and then export processed products again to Vietnam. At the same time, Vietnam procures fertilizer from Yunnan, make vegetables and fruits, and export to Yunnan. These facts prove that Vietnam and Yunnan have mutual supplement economic relationship through the border trade. The KHTC surely would facilitate and enhance such kind of mutual supplement relationship and a division of labor.

TRAFFIC DEMAND FORECASTING

14. Future Traffic Demand is estimated in the sum of:

1). Natural Growth Traffic

The traffic volume increases in accordance with GDP growth (function of Population, Gross Domestic Products and GDP per capita, using elasticity 2 and 1.0-1.5 for passenger and cargo respectively)

2). Generated traffic

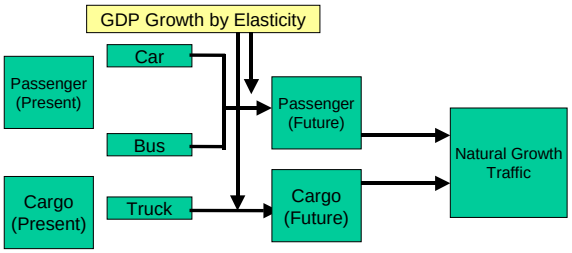
The expressway provides completely new service. Huge travel time reduction from 9h to 4h between Hanoi and Lao Cai generates completely new traffic.

3). Diverted Traffic (International)

- Divert cargo flow from Kunming – Guanzhou routes to Kunming – Haiphong route.

Figure 2: Concept of Forecasting Methodology

a) Natural Growth



b) Generated Traffic

Traffic volume Jumpes up by new service level (Taking existing study into consideration, case study by interviews to the authority)

c) Diverted

Interviews with authorities and beneficiaries in Yunnan Province

15. The consultant team executed traffic counting to collect current traffic volumes for the corridor. Compared to the Phase I study of the Kunming–Haiphong transport Corridor, the traffic counting was more thorough in terms of the number of stations from Hanoi to Lao Cai. At this study, the team has conducted the counting at 6 stations with 2 in Hanoi (Noi Bai) – Viet Tri, 2 in Viet Tri – Yen Bai, 1 in Yen Bai – Lao Cai and 1 on NH 18. They are:

- Station at KM11, NH 2 from Noi Bai to Viet Tri together with station at KM 19, NH 23 for traffic data for Ha Noi – Viet Tri section
- Station at T junction Co Tiet on NH 32C and station at Phu Ninh, KM79, NH 2 generated data for Viet Tri – Yen Bai section
- Station at Yen Binh T junction, NH 70 represented for the section Lao Cai –Yen Bai because NH 4 D is under upgrading.
- 1 representative for NH 18 (This counting result is conducted for only reference)

Table 2: Daily average vehicle flow by section in 2005 (Unit: PCU)

	Type of vehicle	PCU	Hanoi- Viet Tri	Viet Tri - Yen Bai	Yen Bai - Lao Cai
PAX	Tourist car/ Jeep	1	2,933	1,860	175
	Small coach (<25 seats)	2	2,693	1,339	139
	Big coach (>=25 seats)	2.5	2,026	1,146	94
	Motorbike/Lambretta	0.3	6,049	5,047	786
FREIGHT	Light truck (<2.5 tone)	2	1,722	1,270	69
	Medium truck (>2.5 tone, 2axles)	2	4,251	2,155	355
	Heavy (3 axles)	2.5	1,904	1,488	117
	Very Heavy (>3 axles)	3	1,233	615	30
	Container	3	1,325	219	3
	Other	1	149	83	4
	Total PCU		24,284	15,221	1,772
	Total PCU without Motorbike/Lambretta		18,235	10,174	986

Source) Traffic counting by Transport surveyors of the consultant team

16. The team analyzed the relation between toll rate and traffic demand. The team conducted interview for drivers about potential use of Expressway by 3 toll options.

- Options 1: expressway toll rate is 1.5 time in comparison to Highway toll
- Option 2: expressway toll rate is double to Highway
- Option 3: expressway toll rate is triple to Highway

The following table represents potential ratios of using the expressway from interviews to about 200 drivers and passenger with each section.

Table 3: Potential of modal split to the Expressway by toll rate

	HN - VT	VT- YB	YB - LC
1.5 times	60%	80%	90%
2 times	50%	60%	85%
3 times	30%	50%	80%

Note) HN=Ha Noi, VT=Viet Tri, YB=Yen Bai, LC=Lao Cai

17. According to the result, the traffic demand of the section between Hanoi – Viet Tri is very cost sensitive while that of Yen Bai – Lao Cai is not cost sensitive. This is

consistent with the observation that while there are other route options for the Hanoi-Viet Tri section, Yen Bai – Lao Cai section has no other significant route. Potential modal split to the expressway is gradually reduced with higher toll rates. It is considered that benefit of travel time reduction for traffic over the section between Yen Bai and Lao Cai would be substantial enough to use the expressway because of its long location from Hanoi.

18. We calculated the generated traffic and international container traffic between Kunming and Haiphong. The following tables are the result of traffic demand forecasting for the expressway with three toll options.

Table 4: the result of traffic demand forecasting for the expressway

Option 1

		2005	2015	2025	2035
Daily Traffic (PCU)	Hanoi - Viet Tri	11, 147	31, 859	69, 838	131, 347
	Viet Tri - Yen Bai	8, 365	24, 186	53, 331	100, 848
	Yen Bai - Lao Cai	947	2, 767	6, 110	11, 517
International Traffic*		24	59	134	202
Ratio of International Traffic	Hanoi - Viet Tri	0. 22%	0. 19%	0. 19%	0. 15%
	Viet Tri - Yen Bai	0. 29%	0. 24%	0. 25%	0. 20%
	Yen Bai - Lao Cai	2. 53%	2. 13%	2. 19%	1. 75%

NOTE: * International Traffic passes through all the section between Hanoi - Lao Cai

Option 2

		2005	2015	2025	2035
Daily Traffic (PCU)	Hanoi - Viet Tri	9, 293	26, 559	58, 221	109, 490
	Viet Tri - Yen Bai	6, 280	18, 154	40, 032	75, 686
	Yen Bai - Lao Cai	896	2, 616	5, 778	10, 889
International Traffic*		24	59	134	202
Ratio of International Traffic	Hanoi - Viet Tri	0. 26%	0. 22%	0. 23%	0. 18%
	Viet Tri - Yen Bai	0. 38%	0. 32%	0. 33%	0. 27%
	Yen Bai - Lao Cai	2. 68%	2. 26%	2. 32%	1. 86%

NOTE: * International Traffic passes through all the section between Hanoi - Lao Cai

Option 3

		2005	2015	2025	2035
Daily Traffic (PCU)	Hanoi - Viet Tri	5, 585	15, 959	34, 986	65, 775
	Viet Tri - Yen Bai	5, 237	15, 138	33, 382	63, 106
	Yen Bai - Lao Cai	844	2, 466	5, 446	10, 260
International Traffic*		24	59	134	202
Ratio of International Traffic	Hanoi - Viet Tri	0. 43%	0. 37%	0. 38%	0. 31%
	Viet Tri - Yen Bai	0. 46%	0. 39%	0. 40%	0. 32%
	Yen Bai - Lao Cai	2. 84%	2. 39%	2. 46%	1. 97%

NOTE: * International Traffic passes through all the section between Hanoi - Lao Cai

Note: Hanoi – Viet Tri Section is assumed to be in operation in 2010, Viet Tri – Yen Bai Section and Yen Bai – Lao Cai sections are assumed to be in operation in 2013.

Options 1*: If expressway* ***toll rate is 1.5 times to Existing Highway****, 60 %, 80% and 90% of Natural Growth traffic in the section of Hanoi-Viet Tri, Viet Tri-Yen Bai and Yen Bai respectively, use the Expressway*

Option 2*: If expressway* ***toll rate is 2 times to Existing Highway****, 50 %, 60% and 85% of Natural Growth traffic in the section of Hanoi-Viet Tri, Viet Tri-Yen Bai and Yen Bai respectively, use the Expressway*

Option 3*: If expressway* ***toll rate is 3 times to Existing Highway****, 30 %, 50% and 80% of Natural Growth traffic in the section of Hanoi-Viet Tri, Viet Tri-Yen Bai and Yen Bai respectively, use the Expressway*

Source: Projected by the Consultant Team in line with Investment Plan from 2008 – 2012

Initial Alignment and Cost Estimation for the Expressway

19. To determine number of lanes on each section, traffic volume in each section has to be taken into consideration. The team has an tentative criteria for determination on number of lanes:

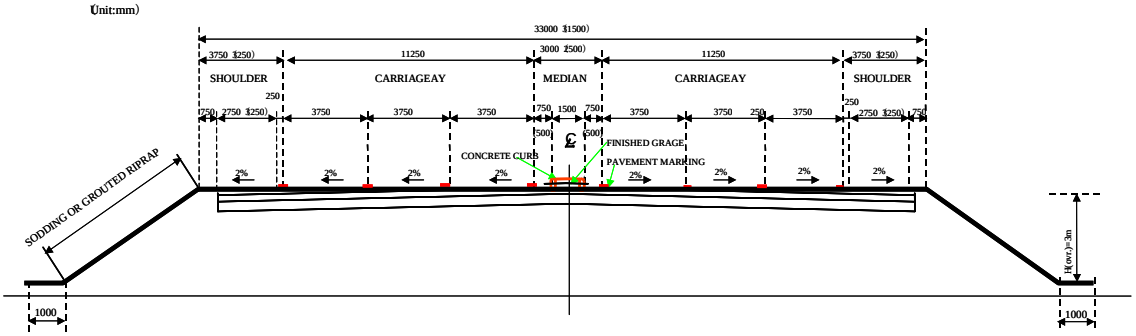
Traffic Volume (PCU)		
Over 40,000	====	6 lanes
20,000 – 40,000	====	4 lanes
Under 20,000	====	2 Lanes

20. Based on traffic demand forecasting with each section (Hanoi – Viet Tri, Viet Tri – Yen Bai, Yen Bai – Lao Cai), technical Specifications recommended for each section are:

Section 1 (Hanoi – Viet Tri) : 4 lanes expandable to 6 lanes.
Section 2 (Viet Tri – Yen Bai) : 4 lanes expandable to 6 lanes.
Section 3 (Yen Bai – Lao Cai) : 2 lanes expandable to 4 lanes
Based on the Vietnamese standards, the team developed the technical specification.

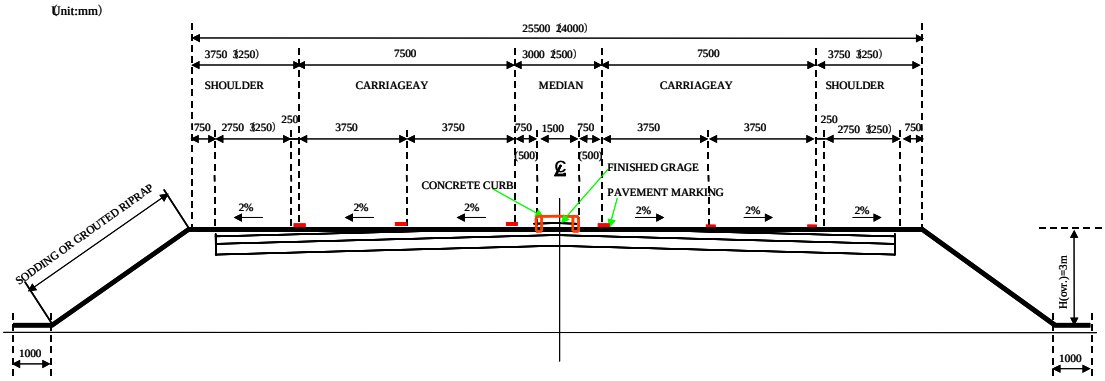
21. Regarding Hanoi – Yen Bai sections (Section 1 & Section 2), 4 lanes expandable to 6 lanes is consist of 3 (2.5) m of Median, 3.75m of two (three) lanes and 3.75m of shoulder in each way. Total width of road including Median, Carriageways and shoulders but excluding grouted riprap is 33m. The height of expressway is three meters from the ground. Required width for land acquisition is about 50m including buffer area outside of carriageway and shoulder. 4 lanes construction starts with two lanes in both sides and will expand to 6 lanes in the future .

Figure3: Technical Specification for Noi Bai – Viet Tri and Viet Tri – Yen Bai



22. Regarding Yen Bai – Lao Cai (Section 3), 2 lanes expandable to 4 lanes is consist of 3 (2.5) m of Median, 3.75m of one (two) lanes and 3.75m of shoulder in each way. Total width of road including Median, Carriageways and shoulders but excluding grouted riprap is 25.5m. The height of expressway is three meters as well as previous case. Required width for land acquisition is about 40m including buffer outside of carriageway and shoulder. There are two ways to start construction. One is starting with 2 lanes on one side and the other case is construction starts with one lanes in both sides and expand to 4 in the future. The two lanes on one side case are cheaper in terms of initial construction cost but a little bit difficult to expand fitting the first 2 lanes. One lane in both sides case is easy to expand from the technical point of view. But the cost may be almost the same as starting with full 4 lanes.

Figure 4: Technical Specification for Yen Bai – Lao Cai



23. The Team conducted several field surveys to find necessary public works such as replacement of existing provincial and rural road to flyover bridges/underpass to maintain local accessibility, viaducts in valleys, bridge and tunnels for the expressway.

24. The whole Project is a 256 km long with 53.4km of Noi Bai – Viet Tri, 64.6km of Viet Tri – Yen Bai and 138km of Yen Bai – Lao Cai. Total number of interchanges is 16 and service area is 4. There are a number of flyover bridges in Noi Bai- Vie Tri Section with 10, Viet Tri – Yen Bai and Yen Bai – Lao Cai with 5 each. There are a lot of underpasses in the section of Viet Tri – Yen Bai and Yen Bai – Lao Cai. All Viaducts and Tunnels are in the section of Yen Bai – Lao Cai.

Table 5 : Result of Alignment for the expressway

	Total	Noi Bai – Viet Tri	VietTri - YenBai	YenBai -Laocai
Total length (km)	256.0	53.4	64.6	138
Road Surface Width (m)	-	33	33	25.5
Number of Lane	-	6	6	4
Number of Interchanges	16	5	4	7
Number of Service Area	4	0	1	3
Number of Flyover Bridge	20	10	5	5
Number of Underpass	89	12	33	44
Number of River Bridge	59	7	7	45
Number of Viaduct	5	0	0	5
Number of Tunnel	4	0	0	4

25. Regarding cost estimation, the team accumulates (A) Major construction with Earth work, Pavement, Shoulder, Median, Drainage system, Bridges, Replacement of existing roads with Overpass & Underpass, Interchanges, Service Areas, Viaducts, Tunnels, Guardrail, Lightning and safety such as signing, marking, fencing, maintenance & management house, toll station, stopping area etc. based on alingment with major cross section, (B) Other expenditure with Mine Clearance, Resettlement and Rehabilitation, survey, design and supervision (8% of Major construction), (C) Contingency with physical (10% of the sum of (A)Major construction and (B)Other expenditure) and Cost escalation (10% of the sum of (A)Major construction and (B)Other expenditure).

26. The grounds for the estimates are Government Decrees, Ministry Decree, Circulars and Decisions and other relevant Papers such as Norms for Capital Construction Cost Estimation by MOC (Ministry of Transport), - Price Table for Equipment Shift (Ministry of Construction).

27. The team tried as much as possible to estimate accurately. For instance, to estimate earthwork cost we have assumed the executing agency to buy the same volume to the remaining (just shortage) after using soil coming from cutting hilly section. Other major facilities such as Median, Drainage system, Bridges, Overpass & Underpass, Interchanges, Viaducts, Tunnels, Guardrail, Lightning and safety are taken over the existing case in Viet Nam. At the end, unit prices range from 2.1 in the section of Yen Bai – Lao Cai to 2.8 in Hanoi – Vie tri, . Total cost of the project $ 620 millions with $ 147.7 millions of Ha Noi – Viet Tri, $ 177.3 millions of Viet Tri – Yen Bai and $ 295 million of Yen Bai-Lao Cai Section .

Table 6: Summary of Cost Estimation

No	Section	Million VDN	Million USD	Unit Price (Million USD/km)
1	Hanoi - Viettri 53.40km	2,342,865	147.7	2.8
2	Viettri - Yenbai 64.60km	2,811,620	177.3	2.7
3	Yenbai - Laocai 137.99km	4,679,354	295.0	2.1
	Total 256km	9,833,839	620.0	2.4

Notes

1., 2. : 4 lanes construction with 6 lanes Right of Way / Land Acquisition

3. : 2 lanes construction with 4 lanes Right of Way / Land Acquisition

Investment Plan

28. The team tentatively determined for the allocation of fund through discussion with the Government and ADB. The following table shows that Start with first two years for the section of Noi Bai – Viet Tri after completion of Noi Bai – Viet Tri will follow other sections.

Table 7: TENTATIVE ANNUAL INVESTMENT

Section	Total Cost for the First Phase Construction		2008	2009	2010	2011	2012
	1000000VND	$1000UD	$1000UD	$1000UD	$1000UD	$1000UD	$1000UD
HaNoi VietTri 53.40 km	**2,342,865**	147,722	73,861	73,861			
VietTri YenBai 64.60 km	**2,811,620**	177,277			59,092	59,092	59,092
YenBai LaoCai 137.99 km	**4,679,354**	295,041			98,347	98,347	98,347
TOTAL	**9,833,839**	**620,040**	**73,861**	**73,861**	**157,440**	**157,440**	**157,440**

Notes:

1. **Figures in bold** are taken from table 4.2

2. The the 1st phase construction is assumed as follows:
- Section HaNoi VietTri: 6 lanes Row, 4 lanes Construction - Period of construction: 2008-2009
- Section VietTri YenBai: 6 lanes Row, 4 lanes Construction - Period of construction: 2010-2012
- Section YenBai LaoCai: 4 lanes Row, 2 lanes Construction - Period of construction: 2010-2012

3. Should the Annual Investment of this Base case do not fit with fund allocated, one can develop another more relevant construction phasing scenario.

Economic Internal Rate of Return

29. . The main economic benefits considered in the evaluation are: (i) savings in vehicle operating costs (VOCs) and (ii) passenger and freight time savings. While the improvement in safety should be significant, we did not succeed in acquiring a usable accident data. Therefore, this was not included in the quantitative analysis.

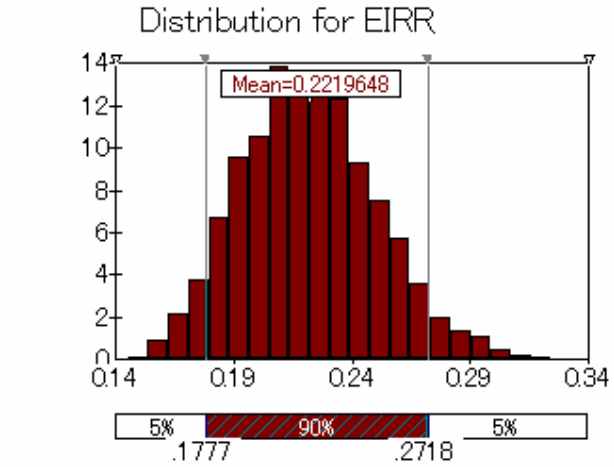
30. In order to make a with/without comparison for the expressway and the existing roads, the designed traffic volume and the length of the sections were identified as follows. Most of the savings in distance occurs in the YenBai-LaoCai section, where the existing highway is in an extremely poor condition. Also, in order to take the physical limitation of the roads into consideration, it is assumed that both the existing highways and the proposed Expressway can allow only up to twice the designed traffic volume.

Table 8 : Comparison of the Existing Highway and the Proposed Expressway

		lanes	designed traffic volume	Length
Hanoi-VietTri	Highway No.32	2	9,000 PCU/day	
	Highway No.2	2	9,000 PCU/day	
	Total Existing	-	18,000 PCU/day	53.4 km
	Proposed Expressway	4	48,000 PCU/day	53.4 km
VietTri-YenBai	Highway No.32c	2	8,000 PCU/day	
	Highway No.2+No.70	2	9,000 PCU/day	
	Total Existing	-	17,000 PCU/day	70.0 km
	Proposed Expressway	4	48,000 PCU/day	64.6 km
YenBai-LaoCai	Highway No.70	2	6,000 PCU/day	
	Total Existing	-	6,000 PCU/day	174.9 km
	Proposed Expressway	2	10,000 PCU/day	137.9 km
Total	Existing Highway			293.0 km
	Proposed expressway			256.0 km

31. The economic internal rate of return (EIRR) was calculated for a period of 2007-2034. The EIRR is estimated to be 22.0% for the base case. It is well above the ADB's cut off rate of 12 percent. This was subjected to a sensitivity test using a Monte Carlo simulation, in order to determine its robustness, changing the capital investment and the traffic volume. As shown, the results are extremely robust, and it is unlikely that even the combination of the worst scenarios would bring the figure down below 12%.

Figure 5: Sensitivity Analysis



Financial Analysis

32. The Ministry of Finance have allowed the toll level on the express ways to be 1.5 times to twice the level of the national Highways[1]. Also, considering the fact that this is an international expressway, the compatibility of the toll level to the Chinese counterpart would also be important. While the toll level for toll roads in China differ from area to area, the proposed toll rate for an Expressway in Southern Yunnan is set at about 0.35 Yuan/km in 1999 for passenger vehicles[2], which is equivalent to 632 VND/km. This closely resembles twice the level of existing Vietnamese National Highway, and is consistent with the decree by the Ministry of Finance. Based on this observation, the analysis will use the following level of toll for the base case of the analysis :

Table 9 Proposed Toll Rates for the Project Expressway
(VND/km, 2005 prices)

Type of vehicle	Proposed Toll (VND/km)
Tourist car/ Jeep	667
Small coach (<25 seats)	1,000
Big coach (>=25 seats)	667
Motorbike/Lambretta	667
Light truck (<2.5 tone)	1,000
Medium truck (>2.5 tone, 2axles	1,467
Heavy (3 axles)	2,667
Very Heavy (>3 axles)	2,667
Container	5,333
Other	667

33. The financial statements indicate that the project will be profitable from it's partial opening in 2012, and will continue to increase its profits during the project period. The expressway shows an acceptable working ratio well below 20% throughout its operation. It also has sufficient debt service coverage ratio well above 1.2, which shows its financial sustainability.

34. The FIRR for the whole project is 10.8 percent before corporate tax, and 8.7 percent after corporate tax. This is way above the weighted average cost of capital (WACC) of 6.0%. FIRR for the owner is 20.1 percent before tax, and 16.5 percent after tax. Sensitivity analysis using a Monte Carlo simulation shows that the project FIRR is likely to remain above the WACC even for unusually unlikely unfavorable conditions. While the project FIRR will be most significantly affected by cost overruns, and then the lower traffic demand, these are unlikely to damage the financial viability of this project.

[1] Circular No. 90-2004-TT-BTC
[2] ADB 1999, *Proposed Loan: Southern Yunnan Road Development Project*, RRP PRC 30081, Asian Development Bank, Manila, p. 31 Table 4.

Figure 6: Distribution for Project FIRR/H34

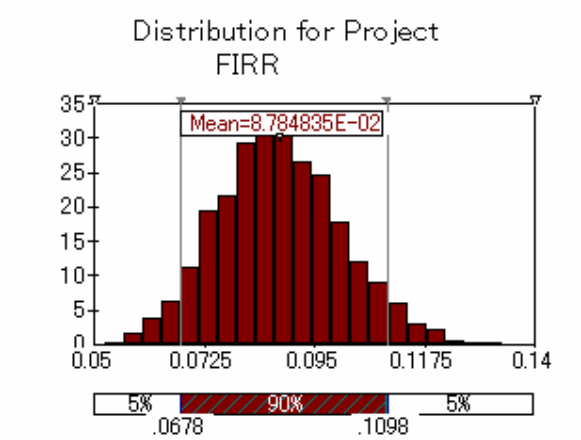
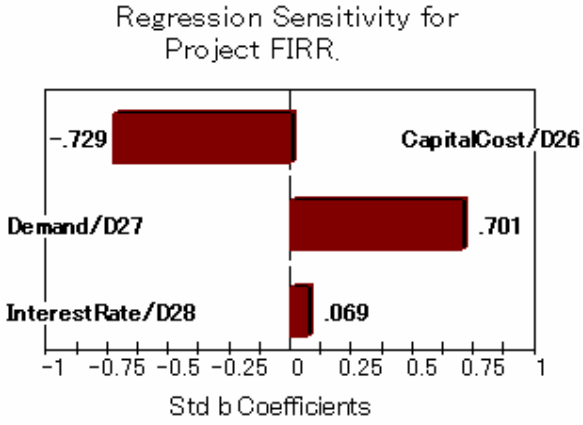


Figure 7: Regression Sensitivity for Project FIRR/H34



35. The impact of the toll level on the FIRR and EIRR was evaluated. While increased toll can bring more toll revenue, it will drive people away from using the Expressway. With fewer users, the economic benefit of the project will suffer.

36. As shown in the table 6-10 and the figure, EIRR rapidly declines as the toll increases, and it falls below the social discount rate of 12% when the toll is over 4 times the current rate. Therefore, toll level higher than 4 times the current level will make the project unfeasible. On the other hand, a toll of 1000 VND/km (toll level of the current national highways) yields a project FIRR lower than the WACC of 6.0%, making the project financially not viable.

37. The figure suggests that as a project, the Expressway can safely rest in the toll range of 2,000-4,000 VND/km. The optimal level of toll would be around 3,000 VND/km, about three times the current national highway level. This will yield a lower economic benefit of 17.9%, although it will be well over the cut off rate of 12%. Other social concerns, such as poverty reduction issues, should be considered in determining the level.

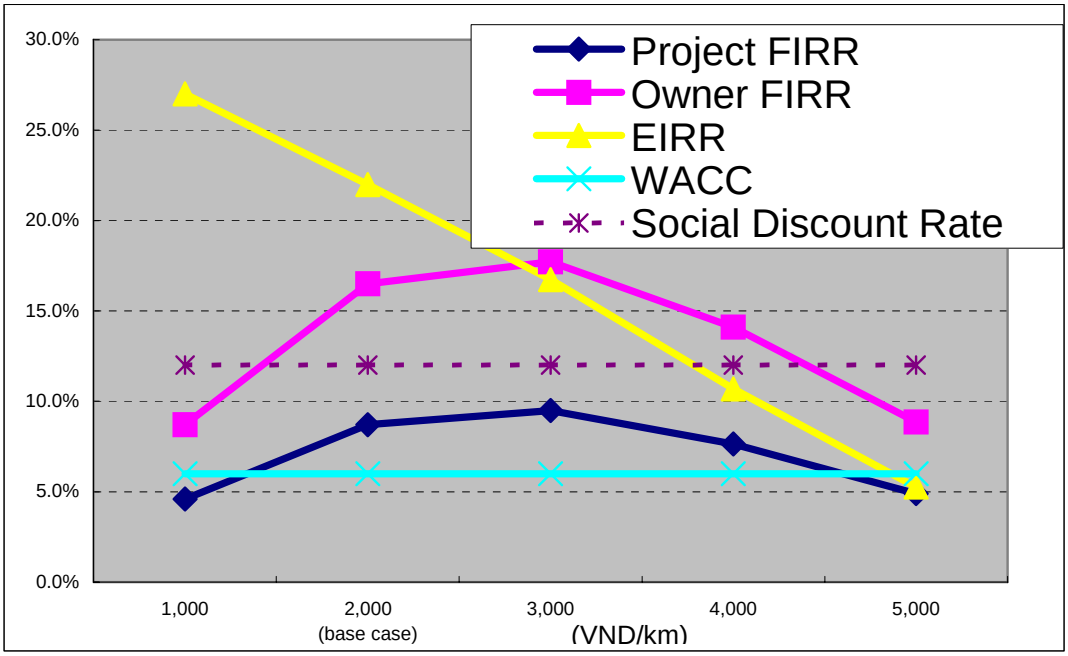
38. The current simulation assumes that the toll level can go up every year in line with the CPI increase. In reality, this may not be possible, due to political issues. In such

cases, it may be best to start from a slightly higher toll level than the current base case (say, 2,500 VND/km), and maintain that level for several years. This requires further study.

Table 10 Sensitivity of FIRR and EIRR to Toll Level

	Average Toll (2005 VND/ km)				
	1,000	2,000 (base case)	3,000	4,000	5,000
Project FIRR	4.6%	8.7%	9.5%	7.6%	4.9%
Owner FIRR	8.7%	16.5%	17.7%	14.1%	8.8%
EIRR	27.0%	22.0%	16.7%	10.7%	5.3%
WACC	6.0%	6.0%	6.0%	6.0%	6.0%
Social Discount Rate	12.0%	12.0%	12.0%	12.0%	12.0%

Figure 8 Sensitivity of FIRR and EIRR to Toll Level



Conclusion

39. The expressway will connect Hanoi to Kunming with 8.5 hours and Halphong to Kunming with 10 hours respectively. The project generates enough revenue to recover all the loan within 15 years and FIRR is higher than Interest Rate of OCR. The project also beings about $ 500 million of net economic benefit. The project is economically and financially viable. We recommend the Government and ADB to proceed with next step.

Chapter 1. Background and Relevant Findings

Chapter 1. Background and Relevant Findings

1.1. Background

40. This report specifies initial alignment over the section of Hanoi – Lao Cai of Kunming–Haiphong Expressway Project and the project cost estimation. It also identifies qualitative economic benefit and assesses financial viability under ADB-OCR borrowing with the appropriate result of toll analysis. Before we start this report, we need to review the technical assistance (TA4050-VIE) and the last study regarding the Kunming-Haiphong Transport Corridor.

41. The technical assistance (TA4050-VIE) was approved for $1 million on 18 December 2002. The Government of Viet Nam approved the TA on 22 April 2003. The purpose of the TA is to assist the Government to prepare a Project to upgrade the Kunming-Haiphong Transport Corridor (KHTC) over the sections in Viet Nam. The Project will strengthen the regional infrastructure network and will also improve the domestic transportation system connecting Hanoi with the northern provinces. The improved transport network will not only enhance accessibility to Lao Cai Province, which is among the poorest in Viet Nam and has a number of ethnic minorities, but will also open up opportunities for growing trade and investment in the region.

42. The TA 4050-VIE is implemented in two phases. The first phase examined the pre-feasibility and viability of improvements in roads, railways or inland waterways to select the optimum transport mode for the Kunming-Haiphong Transport Corridor. The second phase will undertake detailed feasibility study for the selected transport mode.

43. The first phase of the TA study covered the following major activities: (i) review the present condition of the Kunming-Haiphong transport network; (ii) evaluate the viability of the road, railway, and inland waterway options from the point of view of technical, environmental, social, resettlement, economic and financial analyses, and submit to ADB and the Government a set of recommendations on the optimum mode and phasing; and (iii) assess the preliminary social, environmental, and resettlement impacts of the road, railway and inland waterway options.

44. The first phase report was completed in December 2003 and submitted to ADB and the Government of Viet Nam. This report has concluded that roads are the most important mode and 'Limited Access Toll Expressway between Lao Cai and Hanoi (Noi Bai)' is the first priority from the viewpoints of improvement of mobility for the people living in the project area, lesser environmental and social impact, better economic benefit and the financial viability. The report also concludes that the upgrading of existing railway between Hanoi and Lao Cai is a viable option for consideration as a secondary priority. After receiving the first phase report, the Government of Viet Nam determined to execute both project options.

45. The proposed expressway is a 260km distance between Hanoi (Noi Bai) and Lao Cai with fully access controlled. From Lao Cai at the border to PRC, 2 lanes expandable to 4 lanes expressway alignment follows the west bank of the Red River through the gently undulating terrain to Yen Bai. From Yen Bai the proposed expressway with 2 lanes expandable to 4 lanes will follow the existing rail alignment or National Road No.32C up to Viet Tri. From Viet Tri, the proposed expressway will have a new alignment with 4-6 lanes up to Hanoi.

46. The project cost for the expressway was estimated at $565 millions with 2-lane from Lao Cai to Viet Tri and 4-lane from Viet Tri to Noi Bai including facilities (5% of civil works cost) and supervision cost (7% of civil works cost and equipment cost). This cost estimate is derived from the average unit cost of expressways under ADB expressway projects in People's Republic of China (PRC). More investigation for the cost estimation should be taken into consideration if the study takes a progress to the next step.

47. The government of Viet Nam is generally in agreement of borrowing ADB-OCR (Ordinary Capital Resources) for the Hanoi – Lao Cai expressway project. However prior to the processing, the Ministry of Transport in Viet Nam is requested by the Ministries concerned to justify rationality and verify that investment cost for the expressway can be recovered. Therefore the Government of Viet Nam expected ADB to undertake the economic and financial study as soon as possible.

1.2. Scope of the Study (TOR)

48. The expressway project complies with not only inviting economic benefit but also better access to social services for the people living in the project area. ADB has promoted the cross border facilitation on GMS (Greater Mekong Sub-region) and its strategy includes reducing the poverty, improve industrial development and removing transport barriers and cost. The expressway is expected to enhance to promote pro-poor economic growth, contribute regional development in GMS, alleviate congestions in populated area in confusion with motorbikes and automotives, reduce travel time and vehicle operation cost, improve road safety, facilitate private sector involvement and improve access of the poor to markets and social services.

49. ADB has called for the consultant team for the economic and financial study consisting of the team leader of the first phase study, economic and financial specialist, transport surveyor and engineers. The team mobilized in Hanoi and started the study since middle of February 2005.

50. Expected Outputs of the consulting service are:

(a) Initial engineering specifications of the Kunming-Haiphong Expressway (Hanoi-Lao Cai section) and updated cost estimate for the Project

(b) Detailed forecast of traffic volume of the Expressway

(c) Appropriate tolls level of the Expressway

(d) Economic Internal Rate of Return (EIRR) of the Project and its sensitivity analysis

(e) Financial Internal Rate of Return (FIRR) of the Project and its sensitivity analysis

(f) Projected financial statements under the appropriate toll level

(g) Project beneficiaries and their benefits; and

(h) Recommendation to the Government of Viet Nam.

51. Terms of Reference (TOR) for the economic and financial study on the Kunming-Haiphong Expressway Project (Hanoi-Lao Cai section) are prepared as below. The economic and financial study is to be carried out in accordance with ADB's Operations Manual.

(i) make a field survey of the project expressway and the project relevant places such as the ports in Guangxi Province, PRC and tourlist spots in PRC and Viet Nam, interview the concerned government agencies and potential project beneficiaries including cargo forwarders, agricultural and fishery companies, and tourist agencies, and collect the concerned statistics, data and information from them;

(ii) undertake necessary surveys at suitable locations in case that enough statistics and data for the study are not collected;

(iii) specify socio-economic frame indicating the socio-economic situation in the project area, analyze trend of the socio-economic development in the future, and estimate the future traffic demand for the expressway, particularly natural growth, diverted traffic, and generated traffic;

(iv) make a field survey in the possible routes, (a) along the existing railway and (b) along National Road No.32C for the Yen Bai-Viet Tri section of the Expressway, and recommend an appropriate route of the section;

(v) draw preliminary alignment of the Expressway on maps in the scale of 1:10,000 or 1:5,000 (the consultant team has agreed with MOT for using maps in the scale of 1:50,000 during the study);

(vi) propose the initial engineering specifications of the expressway including design speed, number of lanes, locations of interchanges, and cross-border facilities, base on field survey and the above traffic demand forecaset, and reestimate the project cost;

(vii) recommend concept and design of the electronic tolling system adaptive to traffic regulations and enforcement in Viet Nam;

(viii) analyze impact of toll level on traffic volume by vehicle classification;

(ix) calculate EIRR of the Project and make its sensitivity analysis in line with ADB's economic evaluation, indicate relationship between EIRR and toll level, and assess the economic viability of the Project;

(x) identify beneficiaries of the Project, and estimate benefits of the representative cases on the major beneficiaries (agriculture, fishery, trade and tourism sectors) as well as accessibility on the public services for the people living in the project area;

(xi) calculate FIRR of the Project and make its sensitivity analysis in line with ADB's financial evaluation, indicate relationship between FIRR and toll level, and assess the financial viability of investment for the Project and the sustainability of investment;

(xii) recommend appropriate toll level based on EIRR and FIRR analyses above, and propose possible financing plans including ADB's Ordinary Capital Resources, cofinance from other donors, and private sector finance, so that EIRR can be higher than 12% and FIRR can be higher than Weighted Avarage Cost of Capital;

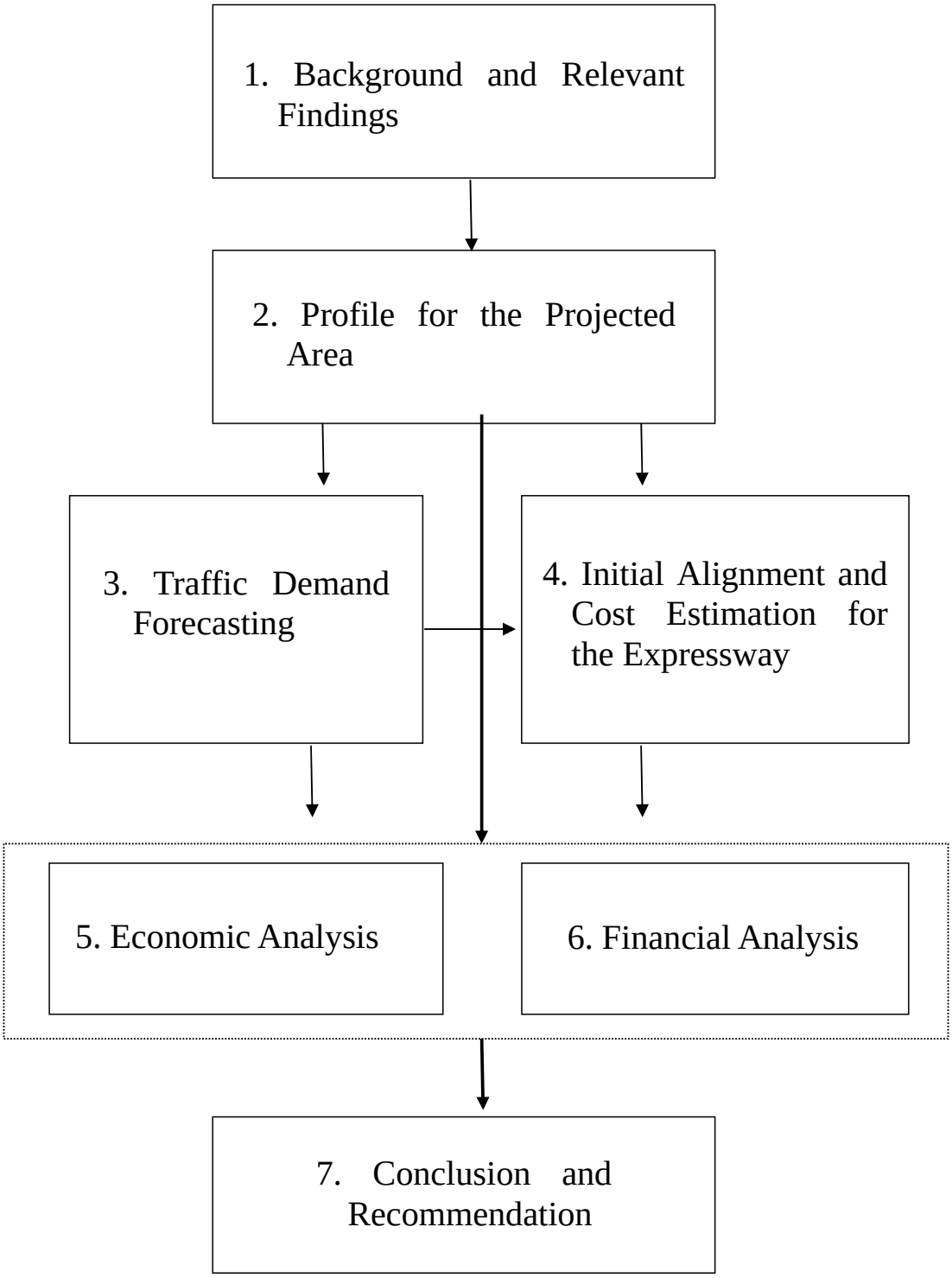
(xiii) prepare a projected financial statements of the Project (income statement, balance sheet, and cash flow statement) under the most recommendable toll level, and assess financial sustainability of the project expressway in terms of debt service coverage ratio and working ratio;

(xiv) present major outputs of the study at a tripartite meeting with ADB and the Government of Viet Nam, and discuss the economic and financial vialibility of the Project; and

(xv) submit copies of a final report to ADB and the Government of Viet Nam after the tripartite meeting.

The study flow is presented in the next page.

Figure 1- 1: Study Flow



1.3. Relevant Findings in Viet Nam

52. Firstly, the consultant team started to undertake the field surveys and make interviews for the ten provincial governments over the projected area initiating the Vinh Phuc Province, Yen Bai Province and Lao Cai Province, that are just on the way of the projected expressway alignment.

53. Department of Transport in Vinh Phuc Province (Viet Tri) introduced to the team that more factories have been established and industrial parks will be developed in Vinh Phuc Province. Therefore the number of car and truck along the NH2 (National Highway No 2) will be increased and congested in near future. They addressed that the Provincial Government expects the expressway project and already took it into account for the master planning of the province.

54. Department of Transport in Yen Bai Province provided the consultant team with local transport planning including the road projects and regional development plan to facilitate the expressway project. The provincial government also provided the team with the planed location of the bridge for the railway project over the section in the west bank of the Red River. The team is in deep consideration with the new alignment for the railway project in the west bank of the Red River. Yen Bai province is eager to construct the expressway to open up the opportunity for enabling the local people to access the lager market as Hanoi. For example, there are a number of natural and wild resources for the ecological tourism and green tourism in Yen Bai Area, which may attract the people living in the urban area.

55. On the other hand, the government of Viet Nam has approved the plan of upgrading NH70 (National Highway No70) to a full 2-lane. Original plan was a 4-lane expansion from poor 2 lanes. The change of the decision of the central government makes all provinces along the KHTC take the expressway project between Hanoi and Lao Cai into their Master Plans for building new transportation network in the provincial area. Another major road project is ' So called Ho Chi Min road ' which will pass through nationwide from North to South of Viet Nam

56. Lao Cai Province and Yunnan Province have signed some important agreement concerning the truck traveling regulation and the Kim Thanh Bridge. The Chinese and Vietnamese trucks can be allowed traveling each other within the designated area. In case of the Vietnamese trucks, they can travel up to near Kunming (within Hong He Prefecture)

57. Tourist Bureau in SAPA has been conducted inbound tourist survey. It researches detailed origin of inbound tourist. The tables below are deliverable from SAPA Tourist Bureau and indicate sharp increase on tourist from China.

Table 1- 1: Inbound Tourists to SAPA

Table. Inbound tourists to SAPA

Origin / Yaer	1998	1999	2000	2001	2002	2003
Domestic	23,327	27,286	46,936	58,591	64,668	100,000
International	4,900	7,960	13,990	18,420	26,020	28,000
(Chinese)	860	1,280	2,720	4,380	5,670	8,124
Total	28,227	35,246	60,926	77,011	90,688	128,000

Source : Statistics from Department of tourism - SAPA

Table. Inbound tourists to SAPA (Ratio of each Origin)

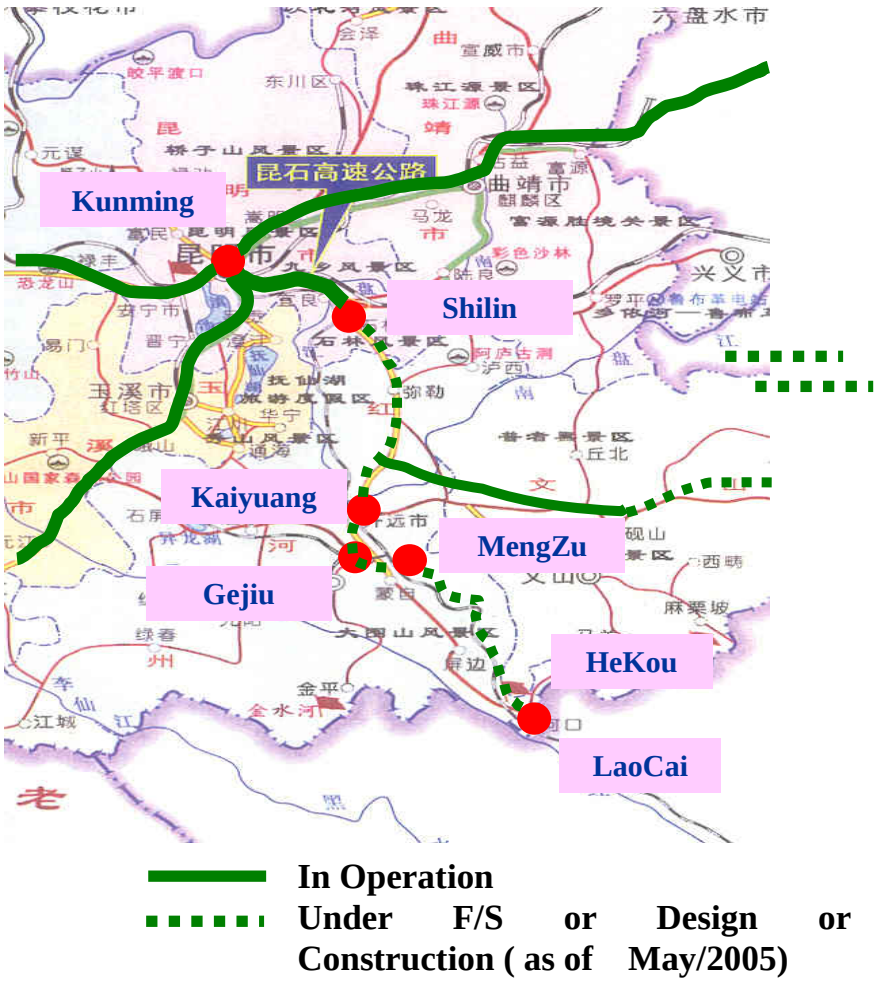
Origin / Yaer	1998	1999	2000	2001	2002	2003
Domestic	82.6%	77.4%	77.0%	76.1%	71.3%	78.1%
International	17.4%	22.6%	23.0%	23.9%	28.7%	21.9%
(Chinese)	3.0%	3.6%	4.5%	5.7%	6.3%	6.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source : Statistics from Department of tourism - SAPA

1.4. Relevant Findings in China (Yunnan Provinces)

58. Planning Division, Yunnan Provincial Department of Communications (YPDC) introduced progress of the Kunming-Hekou Expressway Project. The expressway is split into four sections: (a) Kunming-Shilin, (b) Shilin-Mengzi, (c) Mengzi-Xinxian, and (d) Xinxian-Hekou. The Kunming-Shilin section (79 km) was completed with RMB 3.8 billion. It was designed to Class 1 specification, having six lanes and 100km/h of design speed. Feasibility study for the Shilin-Mengzi section (183 km) was completed, and commencement of construction is expected within 2004 with cost estimate of RMB 6.4 billion. It was designed to Class 2 specification with four lanes and 100 km/h of design speed. Feasibility study for the Mengzi-Xinxian section (84 km) was completed and waiting for approval within 2004. The estimated cost is RMB 5.24 billion. Feasibility study for the Xinxian-Hekou sections (61 km) was also completed and waiting for approval within 2004. The estimated cost is RMB 3.54 billion. The Mengzi-Xinxian and the Xinxian-Hekou sections will be designed to Class 3 specification with 80 km/h of design speed. It is projected that the whole Kunming-Hekou Expressway will be in operation within 2007. After completion of the expressway, travel time will be reduced from 9 hours to 4 hours. Drastic reduction of travel time is expected to generate new traffic and promote diverted traffic.

Figure 1- 2: Expressways in Yunnan Province along the corridor



59. The construction cost of each section is as follows,

1. Kunming – Shilin :
74km, 6 lanes, RMB 3.8billion($456million)
Unit Cost $6.2million/km

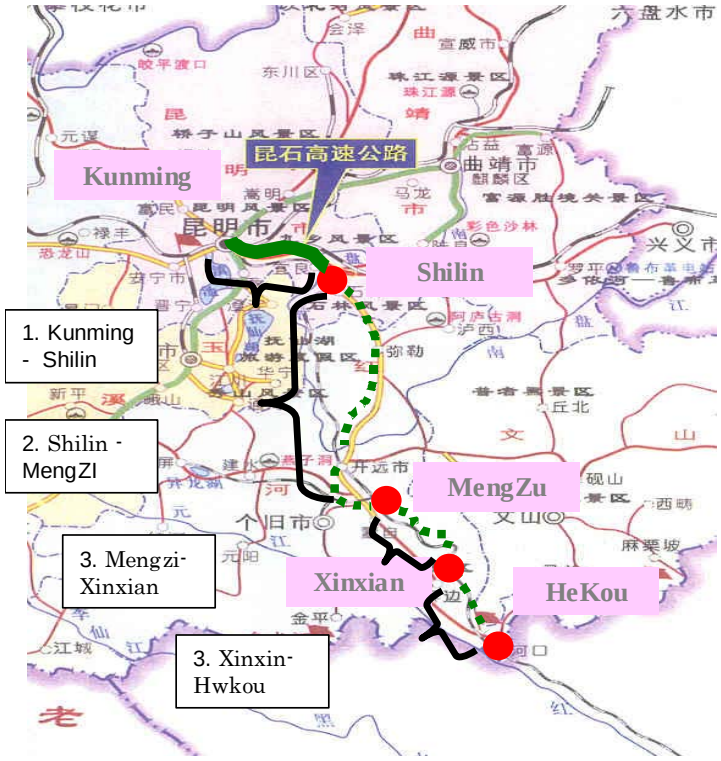
2.Shiling-Mengzi :
183km, 4 lanes, RMB 6.4billion($786million)
Unit Cost $4.3 million/km

3.Mengzi-Xinxian :
84km, 4 lanes, RMB 5.24bil($629million)
Unit Cost $7.5million/km

4.Xinxian-Hekou :
61km, 4 lanes, RMB 3.54billion($424million)
Unit Cost $7.0million/km

Unit costs are relatively expensive with mountainous and steep terrain. Chinese Government assesses these expressway projects are economically and financially viable expects future traffic demand with 39,000PCU/day in 2026 between Shiling and Mengzi, 30,000PCU//day in 2030 between Mengzi and Hekou.

Figure 1- 3: Detail of Kunming – Hekou Expressway



60. Passenger and Cargo Division, Transport Administration Bureau, YPDC introduced statistics of travel and trade between PRC and Viet Nam. The number of travelers is about 47,000 from PRC to Viet Nam and about 27,500 from Viet Nam to PRC. Volume of cargoes is about 414,000 tons from PRC to Viet Nam and about 311,500 tons from Viet Nam to PRC. PRC exports house apparatus, chemical, timber, food and medicine, and imports seafood. Different types of coal are exported and imported between PRC and Viet Nam. Increase in the importing volume of seafood, fresh fruits, coal, and iron are expected after the project.

61. A new capital city is under construction with planning of merger of Mengzi, Gejiu and Kaiyuan cities in Yunnan Province. The city will receive about 300,000 people from the Chongqing area who will be resettled under the San Xiao Dam Project. This new city construction is expected to generate new traffic.

62. One of the five major forwarders in Kunming advised that the current Kunming-Haiphong route is not so used for import from and export to Viet Nam, due to poor condition of roads in Viet Nam, slow custom control at the border, and required transshipment at the border town. The handling volume is very small (60 TEU per month). The main items for export to Viet Nam are leather, honey and commodities, and those for import from Viet Nam are seafood, food for animals, and fruits. The used route for the trade with Viet Nam is road and railway transport between Kunming and Beihai Port and maritime transport between Beihai Port and Hanoi/Haiphong Port. Therefore, the forwarder expects the Kunming-Haiphong Expressway Project to provide a new route for trade with Viet Nam. The existing Kunming-Haiphong Railway is not used for transporting cargoes to and from Viet Nam, because transport cost is high. It is highly expected that trading port could be shifted from Beihai Port to Hanoi/Haiphong Port.

63. One of the major air cargo forwarders in Yunnan Province handles 70,000 tons per year at Kunming Airport. Machine and equipment are imported. Flowers, fruits and cigarettes produced in Yunnan Province are exported to South Korea, Japan and Taiwan. Seafood in Myanmar is transported by inland waterway in Myanmar and by truck in PRC, and it is distributed to many places in PRC by air. Seafood is not carried from Viet Nam at present. The air cargo forwarder expects the Kunming-Haiphong Expressway Project to explore a new import route from Viet Nam.

64. Kunming Railway Bureau, YPDC introduced the Kunming-Hekou Railway (460 km) with the narrow gauge. The capacity is very low due to steep and small radius curve in the track alignment. It takes about 17 hours by train from Kunming to Hekou with very slow speed due to topographical reason. The passenger service has stopped since July 2003 due to low safety, low traffic demand, and high maintenance cost. Before close of the passenger service, the average passenger traffic was only 7,800 per year. Many tourists use Hanoi-Nanning-Kunming route. While freight handling volume jumped 500,000 tons in 2000 to 800,000 tons in 2003, the Hekou-Kaiyuan section carries only 100,000 tons in 2003. Under the Railway Development Plan toward 2020, a project for construction of a new Yuxi-Mengzi link with the standard gauge is being evaluated, as part of the Singapore-Kunming Railway Link.

65. According to Department of Agriculture, Yunnan Provincial Government, export amount of the agricultural products in Yunann Province such as vegetables, crops, coffee, mushrooms and others has been increased. They are exported to Japan through Guangxi Port and to South Korea through Beihai Port. If the expressway connects Kunming to Haiphong Port, the exported volume and amount in Yunann Province is expected to increase. On the other hand, it is also expected that seafood, tropical fruit, and rice could be imported from Viet Nam. At present, the bilateral trade volume between Yunnan and Viet Nam is very small due to the restricted cross-border operation. A

streamlined cross-border processing is a key issue to increase bilateral trade between Yunnan and Viet Nam.

66. Fangcheng, Qinzhou, and Beihai are three major ports in Guangxi Province. A total of throughput for the three ports in 2003 is 20 million tons. Fangcheng Port is one of the national key ports in PRC and biggest one among the three ports. Fangcheng Port mainly functions import of iron ore, which is transported to southwest and middle China by railway, and export of non-metal ore, oil product, coal, and paper materials. Qinzhou Port imports grains, petroleum and chemical oil, and exports sugar that is a major product in Guangxi Province. Beihai Port is mainly used for passenger travels, and also imports and exports container cargoes. The existing throughput capacity of the three ports is below the required capacity. Guangxi Communications Department is promoting the costal development strategy to further develop the three ports. Under the strategy, a coastal expressway connecting three ports is constructed, and a new terminal for iron ore (capacity: 200,000 tons) at Fangcheng Port is constructed. Further, the sea is deepened to increase throughput capacity so that larger vessels can call at. These projects will be completed in 2005 to 2007. The throughput capacity will be improved to 30 million tons for Fangcheng Port, 10 million for Qinzhou Port, and 5 million for Beihai Port.

1.5. International container cargo flow to/from Yunnan Province

67. From the interview with one of the major forwarding company for the maritime transport especially for the container handling, regarding container cargo flow, ports of Guangdong Province are major container route from Kunming to outside (International trade) with handling more than 95% of container to/from Kunming. Shenzhen port is used for trade to/from North America/Europe. Guangzhou ports (Wanpo, Sehkou etc) are used for trade to/from Asian countries

68. Haiphong port is positioned for the gateway for Taiwan, because there is no direct shipping route between Taiwan and China mainland. It is noted by the said forwarder that handling volume is about 100 containers (TEU)/month. Most of containers are transported to ports in Guangzhou province with 1,600km from Kunming, because there are many and diverse direct shipping routes to foreign countries with high frequency.

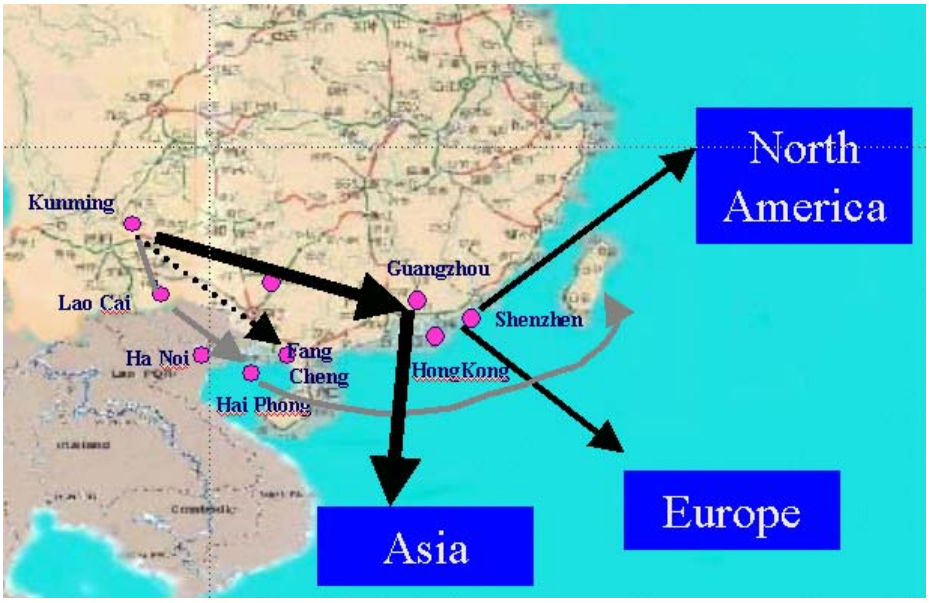
69. About 90% of these containers are transported by rail with 6days from Kunming to Guangzhou. The remaining 10% of containers are by truck with only 46hours and RMB 1,700($200) for only partially completed with 1,000km expressway charge excluding transportation cost. Shippers in Kunming, Yunnan Province expect strongly the expressway to connect Haiphong port directly. Because there are many direct routes to Asian countries and high frequency attracting shippers.

70. Before started the study, the team thought that ports in Guangxi Province might be major international route to/from Kunming. However ports in Guangxi Province are major route for bulky cargo such as iron ore, minerals and coal, but it is realized that ports in Guangzhou Province are major route for international container cargo. The ports in Guangxi province deal with relatively smaller number of container than those of Guangzhou province.

71. The team considered that if the expressway would connect ports of Haiphong and Cailan with 850km, travel time and cost reduction would be tremendous being compared from the route of Kunming – Guangzhou ports (1,600km). This fact will

facilitate the shipper in Yunnan Province to use the ports of Haiphong and Cailin with the Hanoi – Lao Cai expressway project.

Figure 1- 4Cargo Flow to/from Kinming



Chapter 2. Profile for The Project Area

Chapter 2. Profile for The Project Area

2.1. Overview of KHTC

72. The Kunming-Haiphong Transport Corridor (KHTC) is recognized by Viet Nam and PRC as a strategic asset that enables accelerated economic growth based on bilateral trade and transit traffic via the ports in Haiphong and Cailan. The vision of the Kunming-Haiphong Transport Corridor project is to upgrade transport infrastructure that helps securing future economic development along the entire corridor by fostering increased efficiency in transport and sustained economic growth based on tighter economic integration.

73. The KHTC interconnects a string of population and economic centers in Yunnan Province of PRC and the Northern Viet Nam with a combined population of about 24.5 million, and a combined GDP of about $ 22.7 billion (Table 2-1), and connects these to the ports of Haiphong and Cailan in Viet Nam. The ports in Viet Nam are significantly closer to Kunming than Fangcheng port in Guanxi Province is, which is the nearest port in PRC seen from Kunming. From a logistics point of view, Haiphong and Cailan ports potentially provide shippers in Yunnan with a channel for rapid shipment of containerized cargoes and other products that depend on fast access to the global markets. Seen from the Northern Viet Nam, the KHTC could provide not only the large market of Yunnan Province but also a foothold on the huge hinterland markets of the Southwest of PRC.

Table 2- 1 : Status Quo between KHTC in 2003

Provinces/ Prefectures	Population (thousand)	Population density (person/ha)	Employed labor (thousand)	GDP (mill USD)	GDP per capita (USD)
Total of Projected Region of Vietnam	13,393	4.24	7,116	6,924	517
Mountains	1,352	0.91	713	277	204
Midlands	2,446	4.98	1,304	743	304
Plains	9,595	8.19	5,100	5,904	615
Total of Projected Region of Yunnan	11,091		6,442	15,797	1,424
Kunming	5,008	2.32	2,849	81,401	1,976
Yuxi	2,067	1.35	1,278	28,647	1,679
Honghe	4,016	1.29	2,315	20,703	625
Corridor Total	**24,484**		**9,431**	**22,721**	**928**

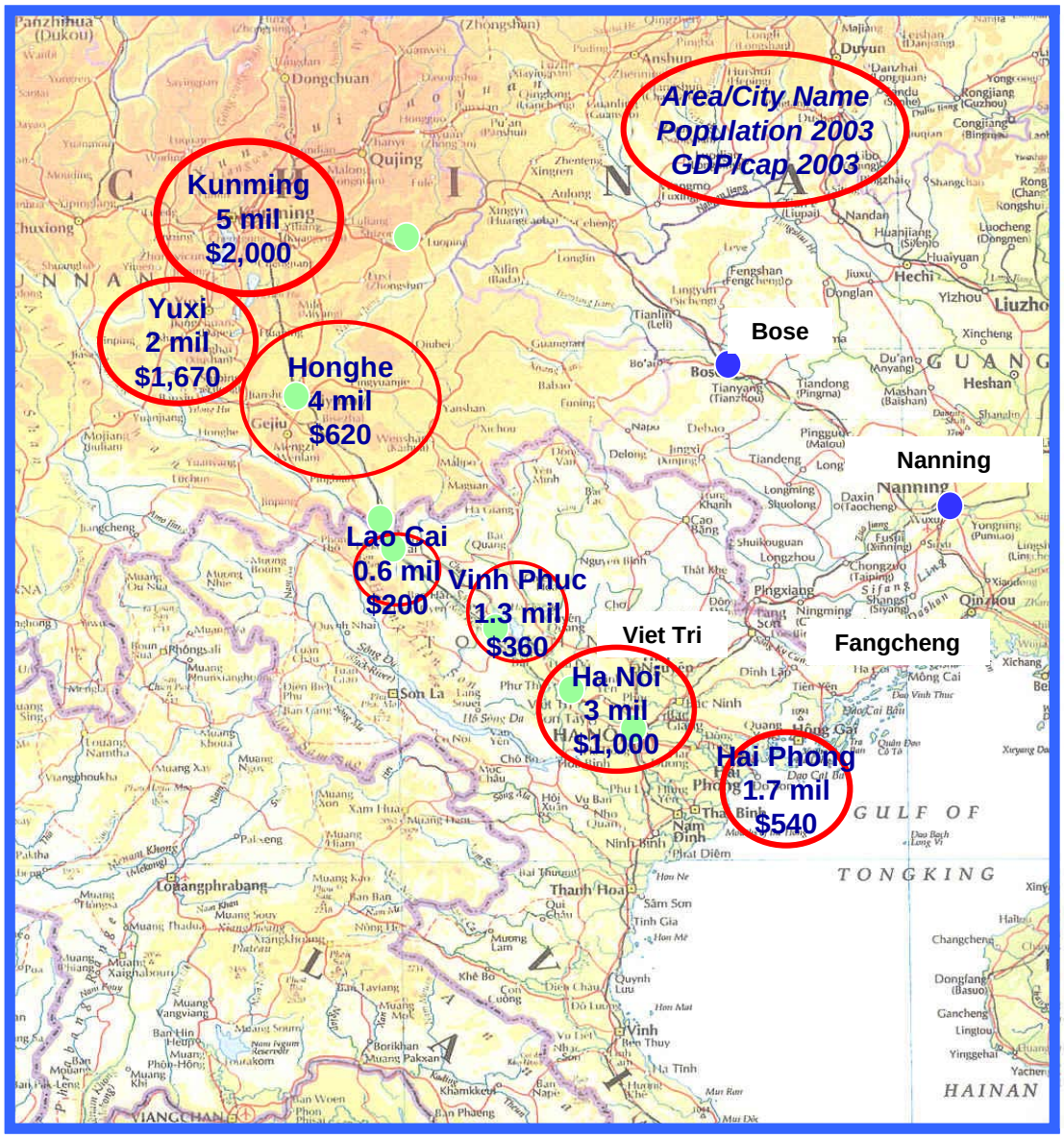
Source) Nomura Research Institute

Note) Mountains: Lao Cai; Yen Bai

Midlands: Phu Tho; Vinh Phuc

Plains: Hanoi; Bac Ninh; Hai Duong; Hung Yen; Quang Ninh; Haiphong

Figure 2- 1 : Distribution Map of Population and Per/capita GDP in 2003



Source) The consultant team

74. Figure 2-1 and Table 2-2 illustrate that on the Yunnan Province side, the related prefectures and city consist of Kunming, Yuxi, and Honghe. Their total population amounts to 11.1 million by 25.3% of the total provincial population and Kunming is the capital city with 5 million population and expected to be one of the center of the Southwest China including Guanxi and Sichuan Province. Actually, Kunming and Yuxi have relatively industrialized economy based on the accumulation of resource-based industry like processing of tobacco and food, processing of non-ferrous metals, steel processing, fertilizer, hydroelectric industry, and apply for 53.0% of total prefecture GDP. As a result, GDP/capita reach to $ 1,976 on Kunming, $ 1,679 on Yuxi, and $ 625 on Honghe, which are relatively higher than the Northern Viet Nam.

Table 2- 2 : Yunnan Status Quo Related with the Corridor in 2003

Prefectures	Population (thousand)	Population density (person/ha)	Employed labor (thousand)	GDP (mill. RMB)	GDP per capita (USD)
Kunming	5,008	2.32	2,849	81,401.2	1,976
Yuxi	2,067	1.35	1,278	28,647.4	1,679
Honghe	4,016	1.29	2,315	20,702.7	625
Total of Projected Region	**11,091**		**6,442**	**130,751.3**	**1,424**
(Share/Province)	**25.3%**		**27.4%**	**53.0%**	**208.2%**
Province Total	***43,756***	***1.11***	***23,533***	***246,529.0***	***684***

Source) Yunnan Statistical Yearbook 2004
Note) Excange Rate: USD 1=RMB 8.277 (2003)

75. The project area in the North Viet Nam include Lao Cai, Yen Bai, Phu Tho, Vimh Phuc, Hanoi, Bac Ninh, Hai Duong, Hung Yen, Quang Ninh, and Haiphong. The consultant team categorize Lao Cai and Yen Bai to "*Mountains*", Phu Tho and Vinh Phuc to "*Midlands*", and Hanoi, Bac Ninh, Hai Duong, Hung Yen, Quang Ninh and Haiphong to "*Plains*". The regions have 13.3 million populations accounted for 16.6% of the total population of Viet Nam in 2003. Total of the regions' GDP amounted to VND 107.3 trillion with the share of 17.7% of the country, and GDP/capita also stood at $ 517 in the range of $ 198 at Lao Cai to $ 1,011 at Hanoi (Table 2-3).

76. Within the three categories, *Mountains* have the lowest population with 1.3 million people who are mostly engage in agriculture especially forestry and the lower GDP/capita of $ 204. Many ethnic minorities live in the region and majorities are still under the poverty line because of the lack of enough equipped infrastructures. In fact, Inhabitants around these regions are characterized by the presence of important ethnic minorities, which account for more than half of the population in Yen Bai province and two thirds in Lao Cai province. National highway 70 and the railway along with the Red River are the only transport infrastructures that access to the center, however they are in poor condition. On the other hand, there is a plenty of tourist attractions, especially ethnic cultures and handicrafts, and Sapa in Lao Cai is absolutely one of the major tourist spots in Viet Nam for foreigners (Figure 2-2).

77. The situation of *Midlands*, which has 2.4 million populations with the GDP/capita of $304, is quite similar to *Mountains*, however gradual industrializing and suburbanizing spread from Noibai and Hanoi are ongoing. Agriculture still dominates the regions with rice cultivation in the plains, and cassava, maize, soybean, and tea on the hillside. Transport network in this regions are relatively well developed, but old at present. Viet Tri is the main urban center with 131,000 inhabitants and a kind of transport hub of road, railway, and inland waterways (Figure 2-2).

78. *Plains* include a dynamic economic area, so called Northern Economic Triangle that consists of Hanoi, Hai Duong, Haiphong and Quang Ninh. The annual growth rate of industrial gross output of the Northern Economic Triangle reaches to 17.2% per year. Current reforms in business environment and opportunities created by trade liberalization will further improve the past achievement of the region. As a result, this region has most advanced economy with the GDP/capita of $ 615. And the rapid urbanization is proceeding especially around Hanoi and Haiphong so that total population in this region amounts to 9.6 million. Regarding transport network, this region are quite improved including upgraded National highway 5, rehabilitated Haiphong port, and newly built Cailan port. Traffic congestions have become social issues particularly along with national highway 5 and Chuong Bridge (Figure 2-2).

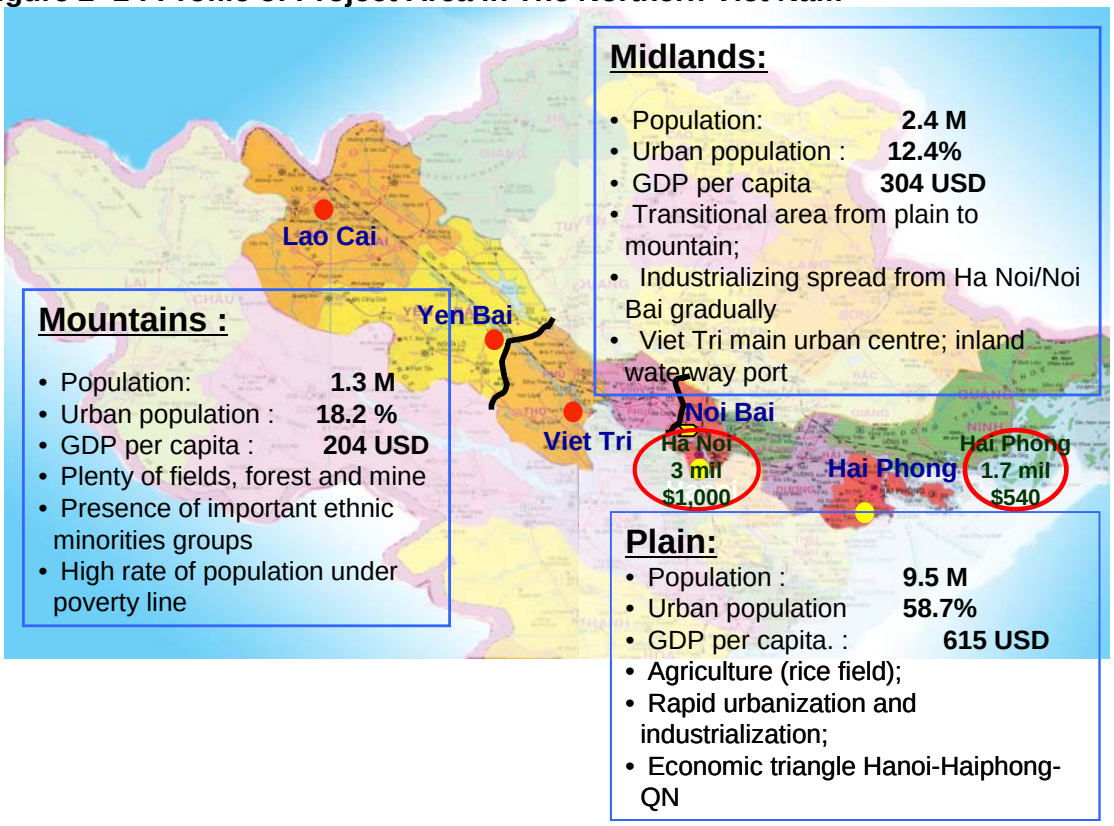
Table 2- 3 : The Northern Viet Nam Status Quo Related with the Corridor in 2003

Provinces	Area (*) (thousand ha)	Population (thousand)	Population density (person/ha)	Employed labor (thousand)	GDP (bill. Dong)	GDP per capita (USD)
Mountains	**1,494**	**1,352**	**0.91**	**713**	**4,289**	**204**
Lao Cai	806	639	0.79	338	1,963	198
Yen Bai	688	713	1.04	375	2,326	210
Midlands	**491**	**2,446**	**4.98**	**1,304**	**11,530**	**304**
Phu Tho	354	1,303	3.68	660	5,127	254
Vinh Phuc	137	1,143	8.34	644	6,402	361
Plains	**1,172**	**9,595**	**8.19**	**5,100**	**91,563**	**615**
Ha Noi	**92**	**3,007**	**32.65**	**1,599**	**47,135**	**1,011**
Bac Ninh	80	977	12.15	552	5,483	362
Hai Duong	165	1,689	10.25	936	9,997	382
Hung Yen	92	1,112	12.05	561	5,685	329
Quang Ninh	590	1,056	1.79	579	8,679	530
Haiphong	152	1,754	11.52	873	14,584	536
Total of Projected Region	**3,157**	**13,393**	**4.24**	**7,116**	**107,382**	**517**
(Share/country)	**9.6%**	**16.6%**	**172.7%**	**17.0%**	**17.7%**	**107.1%**
Country Total	***32,930***	***80,902***	***2.46***	***41,900***	***605,586***	***483***

Source) Statistical Yearbook 2003, Regional Statistical Yearbooks 2003

Note) Excange Rate: USD 1=VND 15509. 6 (2003)

Figure 2- 2 : Profile of Project Area in The Northern Viet Nam



79. On Vietnamese side, there is no expressway so far. Current road network between Hanoi and Lao Cai is very poor, and the condition is so bad generally. Actually, Lao Cai is about 300km from Hanoi taking 8 to 9 hours trip by passenger car and Yen Bai is 117km from Hanoi with 3 to 4 hours by passenger car. Table 2-4 indicates major development and investment projects along the KHTC. Road projects out of this table

are only National Highway projects or provincial roads project. These projects are expected to improve domestic accessibility of the project area.

Table 2- 4 : Major infrastructure projects, 2001 - 2005

Billion dong

Major development and investment projects	**Provinces**	Capacity	Construction duration	Total investment in 2001 – 2005
Highway number 5 (Km0 - Km47, Km62-Km106)	Hanoi Haiphong	91 km	1999-2003	363.0
Highway number 18:rehabilitation and improvement (Noi Bai - Chi Linh, Bai Chay -Bac Luan)	Hanoi Quang Ninh	237 km	1999-2004	2,348.0
Bai Chay bridge	Quang Ninh	800 m	1999-2005	1,311.0
Cailan port	Quang Ninh	2.8 mil.tons/y	1998-2004	965.0
Noi Bai international airport improvement	Hanoi	4.6 mil. pas.	1996-2004	580.0
Red river interland water way improvement (Hanoi sections)	Hanoi		2003-2005	750.0
Haiphong port improvement, phase 2	Haiphong	8 mil. tons/y	2001-2004	1,772.3
Hanoi inner-city railway	Hanoi	19.5 km	2004-2009	150.0
Pho Moi bridge	Lao Cai	276 m	1999-2002	41.0
Highway number 18 (Mong Duong-Mong Cai)	Quang Ninh	117 km	2000-2003	76.4
Hanoi - Pho Lu railway	Hanoi Lao Cai	280 km	2000-2003	182.0
Road 2C (Vinh Phuc- Tuyen Quang)	Vinh Phuc Tuyen Quang	58 km	2001-2003	82.0
Road 32 (Tam Nong - Yen Bai)	Yen Bai	77 km	2001-2004	95.0
Road 34 (remained sections)		70 km	2001-2005	200.0
Road 37 (Yen Bai 70km, Son La 20km)	Yen Bai Son La	90 km	2001-2005	130.0
Road 4D (Lai Chau 75km, Lao Cai 35km)	Lai Chau Lao Cai	110 km	2001-2005	100.0
Co Tiet - Hien Luong road	Phu Tho		...-2003	70.0
Landing line B18 in the Noibai international airport	Hanoi	3,000 m	2001-2003	430.0

Source) 2001 - 2005 Socio-Economic Development Plan approved by the National Assembly

2.2. Socio-Economic Background of Yunnan Province in China

80. The People's Republic of China (PRC) has been the fastest growing economy in the world during the past two decades. In February 2000, the Government of PRC adopted a long-term strategy for the development, which is called for the Western Development Strategy. The Strategy is defined as comprising five autonomous regions, six provinces, and one municipality with the status of a province. It consists of the Tibet Autonomous Region, Ninxgxia Hui Autonomous Region, the Xinjiang Uygur Autonomous Region, The Inner Mongolia Autonomous Region, the Guangxi Zhuang Autonomous Region, Sichuan province, Guizhou province, Yunnan province, Shaanxi province, Gansu province, Qinghai province, and the municipality of Chongquing. In 1999, this region contained 28.8% of PRC population but accounted for only 15.8% of its GDP. The Western Region cannot achieve the economic growth rate of the Eastern Region, even over a long period. That is why the Government decided to invest in the Western Region to reduce the income differential both with the Eastern Region and within the Western Region, and also to allocate resources in the best possible way.

81. Yunnan Province, one of the major western region's provinces, has a total area of 394,000 sq.km accounting for 4.1% of China's total land territory and ranking the 8th in China. Yunnan is respectively bordering Myanmar in the west and Laos and Viet Nam in the south. It implies that Yunnan is linked with the ASEAN countries by land, hence, could be a major transportation hub of the forthcoming China-ASEAN free trade area. And total population in Yunnan stood at 43.75 million in 2003, of which the 25 ethnic nationalities take up over 14 million, with the Yi nationality the largest population, 4.47 million and other ethnic groups with a population respectively exceeding 1 million including the Bai Hani, Zhuang and Dali.

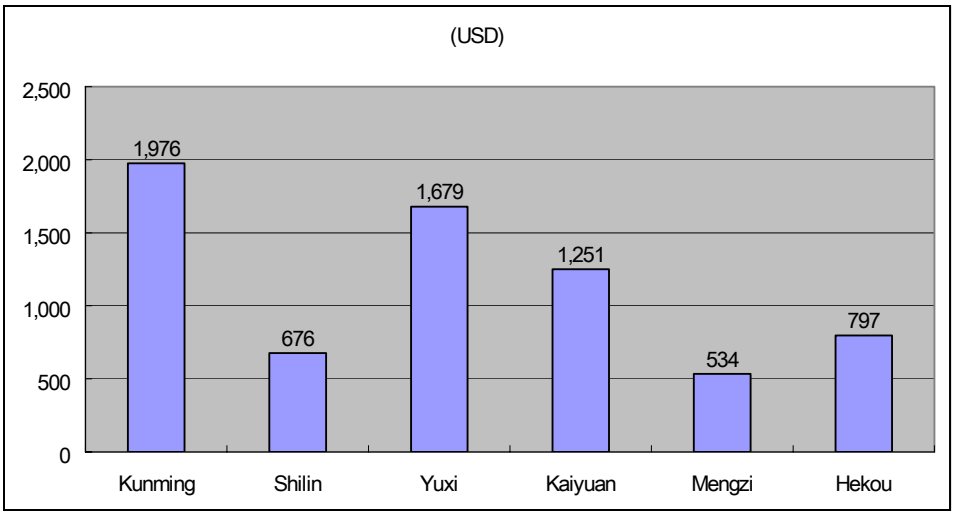
82. While the population in Yunnnan grew slowly in the past decade, Kunming, where is the capital of Yunnan province, has faced on the rapid urbanization. The population of Kunming has increased from 4,499 thousands in 1995 to 5,008 thousands in 2003 with the average growth rate of 13.9%. Other than Kunming, more than 75% people still live in rural area along with the corridor. Moreover, over 80% people engage in agriculture. (See Appendix 2A1.1.)

83. Due to the restriction of its geological conditions and the transport capacity, Yunnan as a whole, a mountainous and frontier province, is still an under developed region in China. Of the 128 countries (cities, districts) in Ynnnan, 76 are state-level impoverished ones. On the other hand, the economic power in Yunnan has been remarkably strengthened and the construction pace has been accelerated recently thanks to the Western Development Strategy. The GRP of the whole province reached RMB 246.5 billion in 2003, an increase of 10.4% over the previous year. Accompanied with the rapid regional economic grow, GRP/capita has also increased, and reached to $ 684 in 2003 as the whole province[3], which is about 17% up compared with 2001.

84. Seen from Figure 2-3 showing GRP per capita by prefectures and cities, GRP of Kunming stands at $ 1,976, which is about 3 times as the whole GDP. Yuxi ($ 1,679), Kaiyuan ($ 1,251) are also improved well. And some cities or industrial district are over $ 3,000 such as Hongta ($ 6,003), Wuhua ($ 4,179), Panlong ($ 3,690), where major SOEs are located. However, quite many cities along with the corridor, especially where ethnic minorities live, are still under the poverty line as mentioned above. Therefore living standard improvements by means of developing infrastructure are strongly expected to reduce poverty. (See Appendix 2A1.2.)

[3] The country GDP/capita in 2003 is $ 1019.

Figure 2- 3 : GRP/capita in 2003 Related With the Corridor

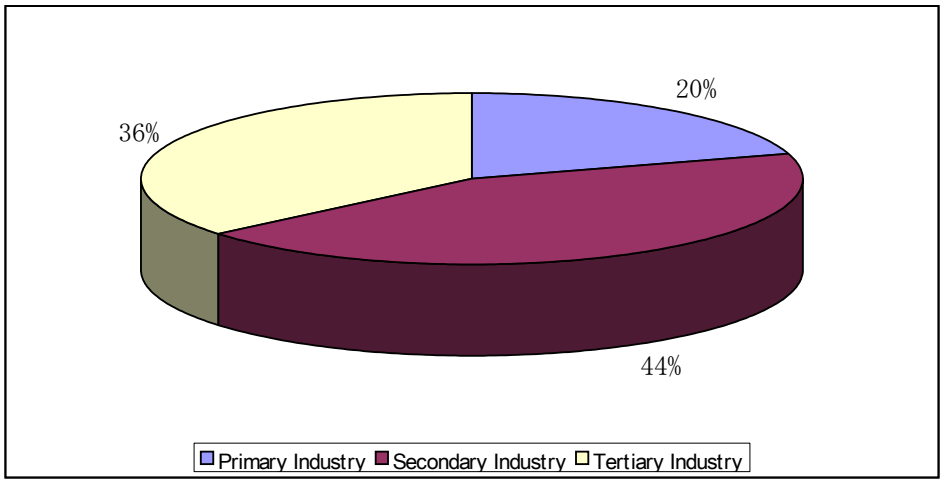


Source) Yunnan Statistical Yearbook 2004

85. As for the industry structure in Yunnan Province, the leading sector in 2003 is the secondary (Manufacturing) sector with 44% of the total output, following the tertiary (Commercial and Service) industry with 36% and the primary (Agriculture) industry with 20% (Figure 2-4). The economy concentrates on the resource-based industries such as processing of tobacco and food, processing of non-ferrous metals, steel processing, fertilizer, hydroelectric industry, and so on, which are based on abundant of diverse natural resources in Yunnan. The tobacco industry is the biggest in Yunnan. Actually, supported by the development strategy of the provincial government, Yunnan has identified tobacco, biological resources, mining, electricity, and tourism as “Five Pillar Industries”. These industries are mostly traditional and mainly lead by SOEs (State Owned Enterprises), therefore the state sector is still strong in this region. Hi-tech industries occupy relatively small share so far, there is a need and movement for industrial restructuring with transiting much more value added industries. An important field of hi-tech industry in Yunnan is biotechnology, medicine; IT related products, new material and environmental products.

86. Comparing with another two industries, the tertiary industries has kept higher growth rate mainly because of consumption expansion and tourism development. Especially, within the tertiary industry, the tourist industry is most significant in Yunnan. The share of the industry’s output in GRP has increased from 7.6% in 1998 to 12.8% in 2003. Famous tourist places In Yunnan Province are as follows; Kunming, Shilin, Lijiang, Gorge, Dali, Tengchong, Ruili, Jianshui, Xishuangbanna, Dequin, and so on. Kunming, called for the ‘Spring City’ is absolutely the center of tourism and transport hub in Yunnan Province Yunnan has invested substantially in building the infrastructure for its tourism industry, it has the largest number of star grade hotels in western China. Enjoying the benefits from the Chinese accession to WTO and gradually implementation of the free trade agreement with ASEAN countries with China, the tourist industry must expand steady and Kunming could be a gateway to GMS countries.

Figure 2- 4 : Structure of GRP by Economic Sector in 2003



Source) Yunnan Statistical Yearbook 2004

87. While the secondary and the tertiary industries occupy majority share of GDP, more than half of labor force, applying for 72.1% in 2003, work in the primary sector. Even in Kunming, more than half of labor force dealt with the primary sector. It implies that there are abundant sources of labor force to the industry sector, especially in the rural area.

88. Regarding the trade structure of Yunnan, primary goods such as natural ores, agricultural products, and processed goods using such kind of natural resources like a fertilizer and metals are exported, while natural resources like copper ore, iron ore, and aluminum ore which are mainly used for metallic smelting and processing, and equipments are imported based on its industry structure and competitive advantage. Border trade is an important part of Yunnan's foreign trade. After 2001 when PRC was affiliated with WTO, the trade of Yunnan Province has been strongly expanded. Foreign trade amounted to $ 2.7 billion in 2003, of which exports were $ 1.7 billion and imports were 1.0 billion respectively (Table 2-5).

Table 2- 5 : Total Values of Import and Export in Yunnan Province

(USD 10,000)

	Total Value of Imports and Exports	Balance	Total Exports	Growth Rate	Total Imports	Growth Rate
1994	134,406	47,626	91,016		43,390	
1995	189,609	53,487	121,548	33.5%	68,061	56.9%
1996	192,220	27,042	109,631	-9.8%	82,589	21.3%
1997	193,698	40,750	117,224	6.9%	76,474	-7.4%
1998	190,329	44,423	117,376	0.1%	72,953	-4.6%
1999	165,967	40,919	103,443	-11.9%	62,524	-14.3%
2000	181,283	53,749	117,516	13.6%	63,767	2.0%
2001	198,906	49,918	124,412	5.9%	74,494	16.8%
2002	222,635	63,295	142,965	14.9%	79,670	6.9%
2003	266,767	68,549	167,658	17.3%	99,109	24.4%

Source) Yunnan Statistical Yearbook 2004

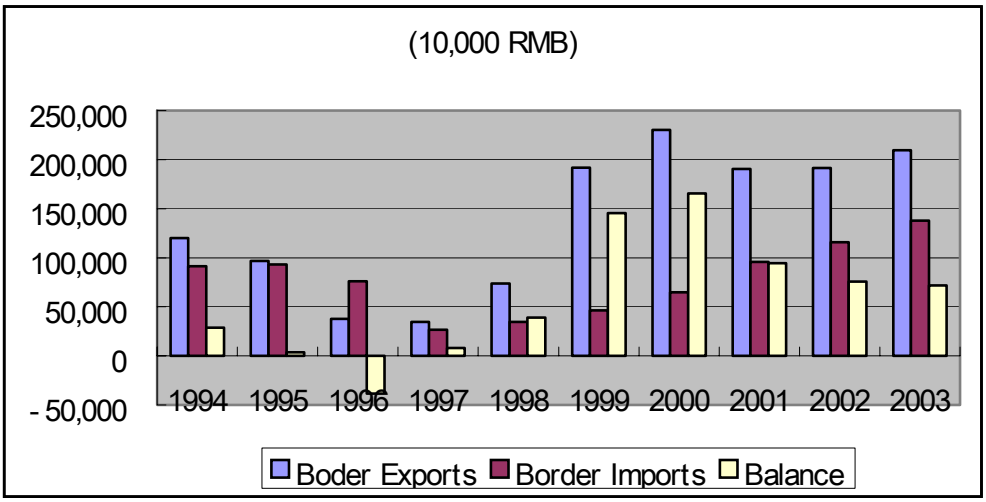
89. ___In 2003 the top ten exports were inorganic chemical elements, oxide and halogen (10.3% of total exports by value), fertilizer (8.1%), tin (6.8%), tobacco (5.8%),

fresh and frozen vegetables (4.8%), metallic salts (2.6%), lead (2.5%), aluminum (2.3%). With respect to export countries and regions, particular characteristic in Yunnan is border trade based on its geographical features and thanks to gradual implementation of the free trade agreement with ASEAN and China. The biggest export partner in 2003 was Myanmar (21.3%). Viet Nam stood at the 3rd biggest (11.5%) and Thailand where is not directly connected but is closely linked through Lao at the 5th biggest (4.6%). As a whole, exporting to ASEAN countries has been growing recently. Hong Kong (14.1%) is not only a final destination but also a transit point with consolidated to North America and EU. (See Appendix 2A1.3.2)

90. Accompanied with the expansion of consumption and production in Yunnan, imports are also increasing. The top ten imports were copper ore (20.6% of total exports by value), iron ore (10.1%), sulfur and pyrite (7.1%), log (6.8%), other metallic ore (4.0%), sawn wood (3.8%), spare parts of railway locomotive (3.5%), machinery for printing and binding books (3.1%), copper (2.7%), aluminum ore (2.4%). In terms of import countries and regions, they are more diverse compared to export although major partners includes linked countries since Yunnan import a dazzling variety of natural ores and heavy equipments for processing. As a result, import partners in 2003 were as follows: Myanmar (13.7%); Hong Kong (10.3%); Germany (10.3%); Canada (6.0%); Australia (5.7%); Chile (4.8%); Indonesia (4.7%). Viet Nam was the 11th biggest import country so far. (See Appendix 2A1.3.4)

91. Border trade is an important part of Yunnan's foreign trade. The amount of border trade has been increasing since 2001 (Figure 2-5). If physical conditions like transport infrastructures and soft conditions such as a free trade agreement and standardizing trade procedures are improved, Yunnan could be not only a foothold on the large domestic market of the southwest PRC seen from neighborhood countries but also a gateway toward that of GMS and ASEAN countries seen from PRC.

Figure 2- 5 : Total Value of Border Trade in Yunnan Province

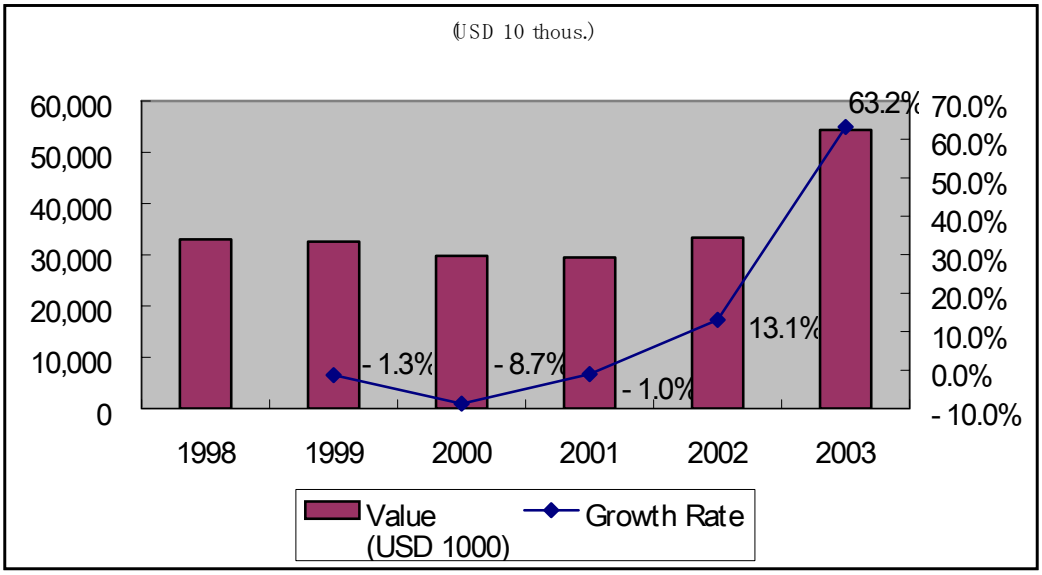


Source) Yunnan Statistical Yearbook 2004

92. With respect to foreign direct investment (FDI) to Yunnan Province, Figure 2-6 shows that Yunnan has called relatively lower amount of FDIs compared to the coastal provinces in PRC while it has been recovered recently with the amount of $ 5.4 billion in 2003. Main investing countries and regions are Hong Kong, Thailand, Singapore, and Taiwan mostly in the form of medium and small size investments. Main reasons of lower investment level are that it has geographical disadvantage of exporting

to overseas, relatively worse business environment inclusive of infrastructures and smaller domestic market than the coastal provinces. Moreover, its industrial structure and cluster lean to sunset industries as mentioned before. Thus, not only improving business environments both of hard and soft side but also industrial restructuring like gradually shifting to advanced and higher value added industries would be required.

Figure 2- 6 : Total Amount of Contracted Foreign Direct Investment

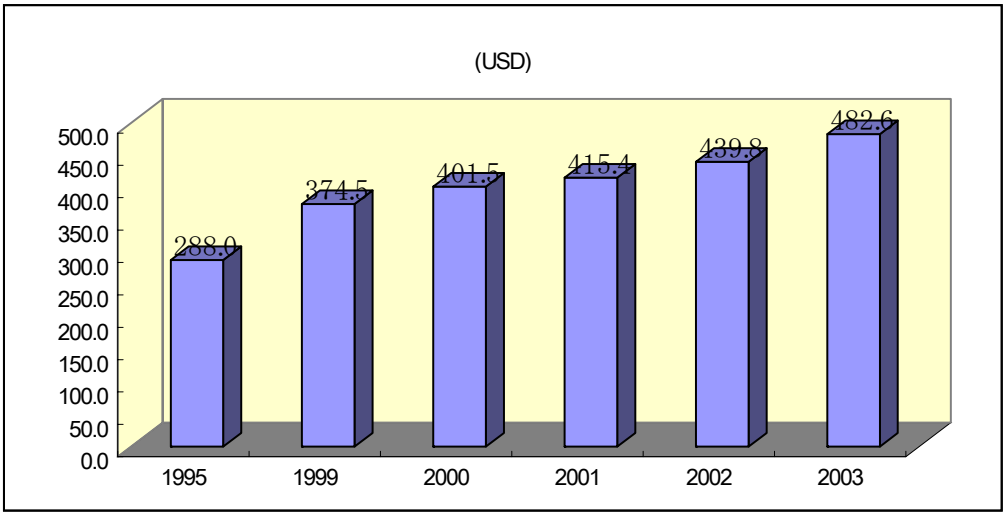


Source) Yunnan Statistical Yearbook 2004

2.3. Socio-Economic Background in Viet Nam

93. The economy in Viet Nam has grown rapidly, and growth of 7.1% was recorded in 2003 supported by strong consumption and investment. Domestic demand grew by 9.4%, and total investment by 15.8%, it means the domestic market keeps swelling. Accompanied with the rapid economic expansion, GDP/capita has also increased, and almost reached to $ 500 in 2003 as the nationwide, which is about 30% up compared with 1999 (Figure 2-7).

Figure 2- 7 : GDP/Capita in Viet Nam



Source) General Statistical Office, Statistical Yearbook 2003

94. With opening the economy in compliance with the Bilateral Trade Agreement with the US, the Trade and Investment Agreement with Japan, ASEAN Free Trade Area (AFTA) commitments[4], and WTO accession, trade has been increasing extremely with the total amount of $ 9.8 billion in 1994 to $ 45.4 billion in 2003. Trade liberalization helps boosting total export revenue by 20.8% to $ 20.1 billion in 2003. At the same time, the strong growth in imports is the result of higher demand from private consumption and from industry for capital goods and intermediate goods including construction materials. As a result, the trade deficit widened $ 3.0 billion in 2002 to $ 5.1 billion $ in 2003 (Table 2-6).

[4] Actually, tariffs on 700 imported items from ASEAN members were reduced further from July 2003 as part of the implementation of AFTA commitments, with the ultimate target of achieving 0-5% tariffs on ASEAN imports by 2006.

Table 2- 6 : Foreign Trade Turnovers

(Mill-USD)

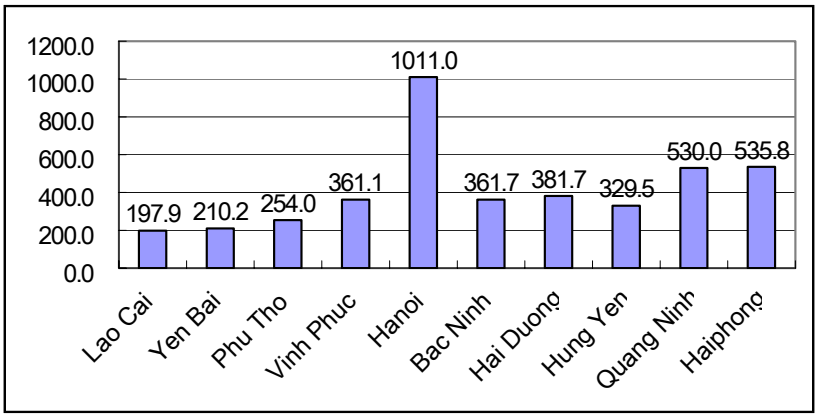
	Total	Trade Balance	Export	Import
1994	9,880.1	-1,771.5	4,054.3	5,825.8
1995	13,604.3	-2,706.5	5,448.9	8,155.4
1996	18,399.5	-3,887.7	7,255.9	11,143.6
1997	20,777.3	-2,407.3	9,185.0	11,592.3
1998	20,859.9	-2,139.3	9,360.3	11,499.6
1999	23,283.5	-200.7	11,541.4	11,742.1
2000	30,119.5	-1,153.5	14,483.0	15,636.5
2001	31,247.0	-1,189.0	15,029.0	16,218.0
2002	36,451.7	-3,039.5	16,706.1	19,745.6
Prel. 2003	45,402.9	-5,050.9	20,176.0	25,226.9

Source) General Statistical Office, Statistical Yearbook 2003

95. While the population grew slowly in the past decade, the urbanization has developed rapidly in Viet Nam. For example, the urban population in Viet Nam has increased by more than 4.0% averagely in the past decade and the urban population has accounted for 25.8% of the nationwide population in 2003 comparing with 20.4% in 1994. And the population of Hanoi has also increased from 2,431 thousands in 1995 to 3,007 thousands in 2003, and Hai Phong 1,608 thousands in 1995 to 1,754 thousands in 2003. The urbanization brings about boosting domestic demand. And the faster urbanizations of large cities are progressing, the more new infrastructure and urban services are being required also in Viet Nam such as the construction of housing, the installation of urban services, and development of transportation systems.

96. Steady economic growth contributes to reduce the number of households in poverty by 300,000 to 1.4 million. This is measured by the national poverty standard, which puts households below the poverty line if they have consumption spending of less than VND 80,000-150,000 per person per month that equals to VND 960,000-1,800,000. The broad improvement in living standard was largely the result of job creation by the private sector and further commercialization of agriculture. The rural poverty rate fell to about 36% in 2002 from about 45% in 1998. However, the Northwest region is still the poorer region, especially GRP/Capita in Lao Cai, Yen Bai and Phu Tho is under $ 300 (Table 2-8). Broad improvements including development of infrastructure are required.

Figure 2- 8 : GRP/Capita in 2003 Related With the Corridor at Current Prices



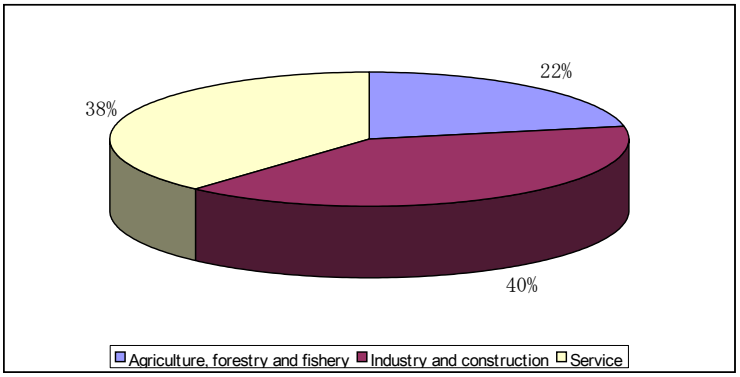
Source) Laocai, Yen Bai, Phu Tho, Vinh Phuc, Hanoi, Bac Ninh, Hai Duong, Hung Yen, Quang Ninh, Haiphong Statistical Year Book 2003

97. Regarding the industry structure in Viet Nam, industry and service sectors are the main source of growth accounting for nearly 80% of GDP. The industry and construction sector (40.0% of GDP), which covers manufacturing, mining, construction, and utilities and is most rapidly developed sector within the three sectors, grew by 17.3% in 2003. Within this sector, the GDP of the domestic private and foreign-invested subsectors grew faster than the state-owned subsector. In other word, the main driven force for rapid growth and development in this sector is private and foreign-invested subsectors, export-oriented enterprises so called. In Northern Economic Triangle Area including Hanoi, Hai Duong, Hai Phong, and Quang Ninh, heavy industries like steel and shipbuilding industries are develop around Hai Phong, light industries such as textile, footwear, and wooden product industries, and also machinery industry are developed between Hai Phong and Hanoi along with the corridor. Actually, the annual growth rate of industrial gross output of the Northern Economic Triangle Area reached 17.2 percent per year while the industrial gross output of two emerging provinces which consist of Vinh Phuc and Bac Ninh increased by more than 50 percent per year over 2000 - 2003 period.

98. The service sector (38.2% of GDP) grew by 12.3% in 2003[5] driven mainly by wholesale, retail sales, transport, postal and tourism services. Since the living standard in Viet Nam has been greatly improved especially in large cities, the domestic consumption would keep high growth. Tourist industry must be significant in terms of acquisition of foreign currency, the ripple effect and further development of the transport corridor. The easing of visa requirements for tourists from Japan and Korea was a factor for promoting an upsurge in tourists from these countries. And Chinese can visit Viet Nam without visa due to the agreement between two countries. It would also help to facilitate tourist industry and the border trade.

99. The agriculture, forestry, and fisheries sector (21.8% of GDP) improved in 2003 with the growth rate of 7.1%, largely due to higher export prices for coffee and rubber, and an expansion of fisheries subsector. Several important agriculture products for export have secured a foothold on the world market, such as rice, coffee, aquatic products, cashew nuts, and rubber. Moreover, based on the abundant in natural resources in Viet Nam, exporting crude oil and minerals are also increasing. Overall, the primary sector in Viet Nam actually has a competitive advantage as a whole, while the agricultural production restructuring should be accelerated.

Figure 2- 9 : Structure of GDP by Economic Sector in 2003



Source) General Statistical Office, Statistical Yearbook 2003

100. While the secondary and the tertiary industries occupy majority share of GDP, more than half of labor force, applying for 55.1% in 2003, work in the primary

[5] The outbreak of SARS in the country and in the region more widely hurt services, particularly in April and May, though they rebounded in the second half of the year.

sector (Table 2-7). It implies that there are abundant sources of labor force to the industry sector, especially in the rural area. On the other hand, the country is still industrializing country.

Table 2- 7 : Structure of Labor Force by Economic Sector in 2003

(Mil. pers.)

	Total	Agriculture	%	Manufacturing and Mining	%	Others	%	Unemployed	%
1999	37.7	24.1	63.9%	3.3	8.8%	8.6	22.8%	1.7	4.5%
2000	38.4	24.3	63.3%	3.4	8.9%	9	23.4%	1.7	4.4%
2001	39.4	24.5	62.2%	3.5	8.9%	9.7	24.6%	1.7	4.3%
2002	41.2	23.3	56.6%	4.5	10.9%	12.7	30.8%	0.7	1.7%
2003	41.9	23.1	55.1%	4.9	11.7%	13.2	31.5%	0.7	1.7%

Source) Asian Development Bank, Key Indicators

101. As for the trade structure of Viet Nam, primary goods such as natural resources, agricultural products, and light industries' products are exported to the world, while intermediate goods for assembly and export again and finished goods for domestic consumption are imported from overseas, based on its competitive advantage. In 2003, the top ten exports were crude oil (18.9% of total exports by value), textiles and garments (18.3%), footwear (11.2%), seafood (10.9%), rice (3.6%), wood and wooden product (2.8%), coffee (2.5%), computer and related products (2.0%), rubber (1.9%) handy craft and art products (1.8%), which together accounted for three forth of total exports. While primary goods apply for the majority of export, computer and related products is ranked as the eighth position since some foreign companies such as Cannon invest in such field. Those kinds of investment contribute to advancing technology level and fertilizing industrialization in Viet Nam. In terms of export partner countries, the US has become the biggest market for Viet Nam's exports overtaking Japan, accounting for 19.5% of all exports thanks to the Bilateral Trade Agreement with the US. Japan (14.4%), China (8.6%), Australia (7.0%), Singapore (5.1%) are also main export countries. (See Appendix 2A2.3.2)

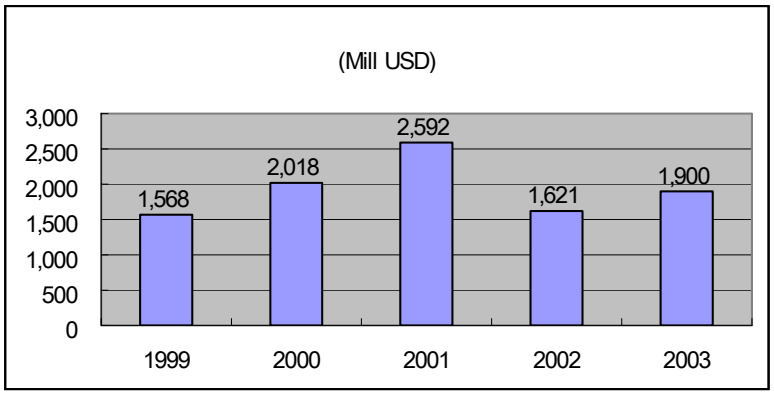
102. The strong growth in imports is the result of higher demand from private consumption and from industry for capital goods and intermediate goods including construction materials. In 2003, the top ten imports were mechanical parts (21.2%), petroleum (9.6%), textile materials and leather materials (8.1%), steel products (6.6%), computer and related products (3.9%), plastic in primary form (3.1%), fertilizers (2.5%), automobile Parts (2.3%), chemical products (1.8%), motorbike parts (1.2%). Especially, Imports of mechanical parts and computer and related products are rapidly expanding with the growth rate of more than 40%. With respect to import partner countries and regions, China has become the biggest market for Viet Nam's imports overtaking Japan as well in 2003 from the fifth biggest in 2001, due to the extremely industrial development and the attainment to "the World Factory". Japan (11.9%), Taiwan (11.6%), Singapore (11.4%), Korea (10.4%) are also main import countries. (See Appendix 2A2.3.4)

103. With respect to foreign direct investment to Viet Nam, although the amount of FDI sharply decreased in 2002 because of the bird flu and SARS, FDI commitments are on gradually recovering stage in 2003 reaching to $ 1.9 billion (Figure 2-10) in response to an greatly improved investment climate and business environment. Table 2-8 indicates major foreign direct investment (FDI) countries in 2003 were Taiwan (20.4%), Korea (18.0%), The UK (16.9%), China (7.2%), Japan (6.2%), Hong Kong (6.2%), Australia (5.8%), USA (3.4%), especially Taiwan and Korea were strong pulling power mainly driven by small and medium enterprises. And the amount of FDI of China has also increased recently and pushed up its position from 8th biggest in 2002 to 4th biggest in 2002. The registered capital during 2002-2003 amounted to $ 213.2 million, which applies for 51.6% of the total registered capital during 1988-2003.

104. In terms of invested industry field, majorities are light industry ($ 582.8 million, 30.4%) such as textile, footwear, furniture, and seafood, and heavy industry such as electric parts, plastic, and IT product ($ 556.1 million, 29.0%). It means Viet Nam has a competitive advantage against labor-intensive industries which mainly focus on assembly and export. However, the invested fields are gradually expanding from light and heavy industry to IT and software industries which are much more capital-intensive and intelligence-intensive.

105. The Advantages as an invested country are based on abundance of relatively cheap and diligent labor forces, and stability of political environment. In addition of those points, investors think Viet Nam could have a strong potential of export foothold not only for the US, EU, and Japan that are traditional export destinations but for ASEAN countries that are huge emerging markets thanks to implementation of AFTA step by step. To keep and develop these advantages and to attract much more FDIs, further improvements in investment climate and business environment will be required by mean that the government would take a much improved and consistent FDI facilitating policy, amend trade procedures and practices with global standards, develop supporting industries for electric, automobile, motorbike, and so on to procure parts within the country.

Figure 2- 10 : Foreign Direct Investment Licensed in 1999-2003



Source) General Statistical Office, Statistical Yearbook 2003

Table 2- 8 : Foreign Direct Investments by Country and Region

(Mill USD)

	2002	Share	2003	Share
Taiwan	312.4	20.1%	389.6	20.4%
Korea	267.3	17.2%	344.4	18.0%
The UK	155.0	10.0%	323.3	16.9%
China	74.8	4.8%	138.4	7.2%
Japan	102.0	6.5%	119.5	6.2%
Hong Kong	179.1	11.5%	119.1	6.2%
Australia	10.0	0.6%	111.0	5.8%
USA	142.7	9.2%	65.8	3.4%
Total	1,557.7	100.0%	1,914.3	100.0%

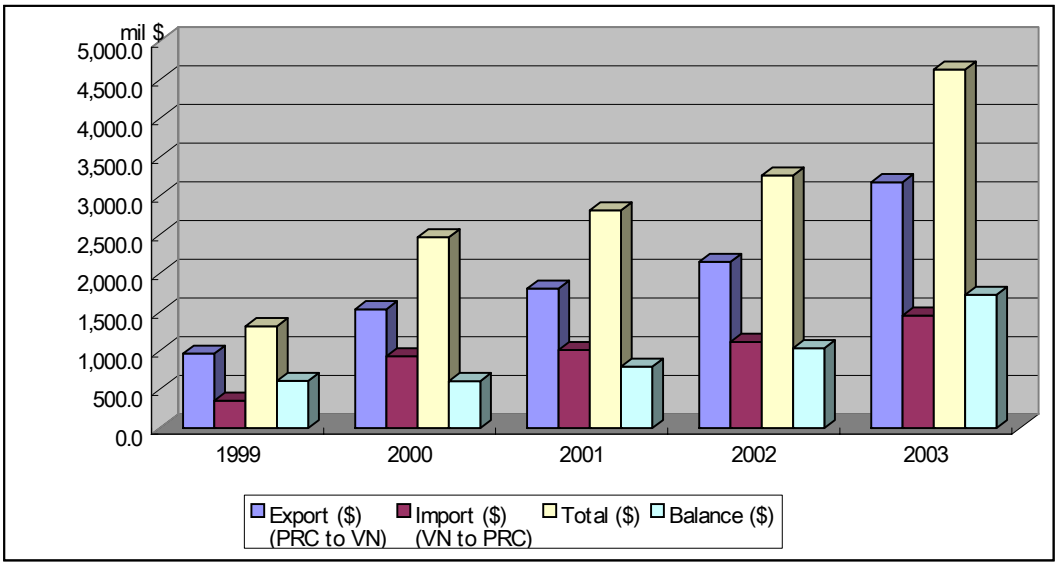
Source) Ministry of Planning and Investment

2.4. Socio-Economic Relationship Between PRC (Yunnan) and Viet Nam

2.4.1 Socio Economic Relationship Between PRC and Viet Nam

106. Social and economic cooperation between PRC and Viet Nam has developed extremely since the late of 1990's, as a result of several positive happenings such as the relatively stable political relationship between PRC and Viet Nam through marking off the boundaries, the Chinese accession to WTO, and the China-ASEAN rapprochement recently. Trade amount between two has increased from $ 1.3 billion in 1999 which is consist of $ 1.0 billion import (PRC to Viet Nam) and $ 0.3 billion export (Viet Nam to PRC) to $ 4.6 billion which is consist of $ 3.2 billion import and $ 1.4 billion export. It means more than 3 times trade expansion has achieved within recent 5 years. Remarkably, in 2003, import and export grew by 47.9% and 30.5% so that total trade amount also marked by 42.0% up (Figure 2-11).

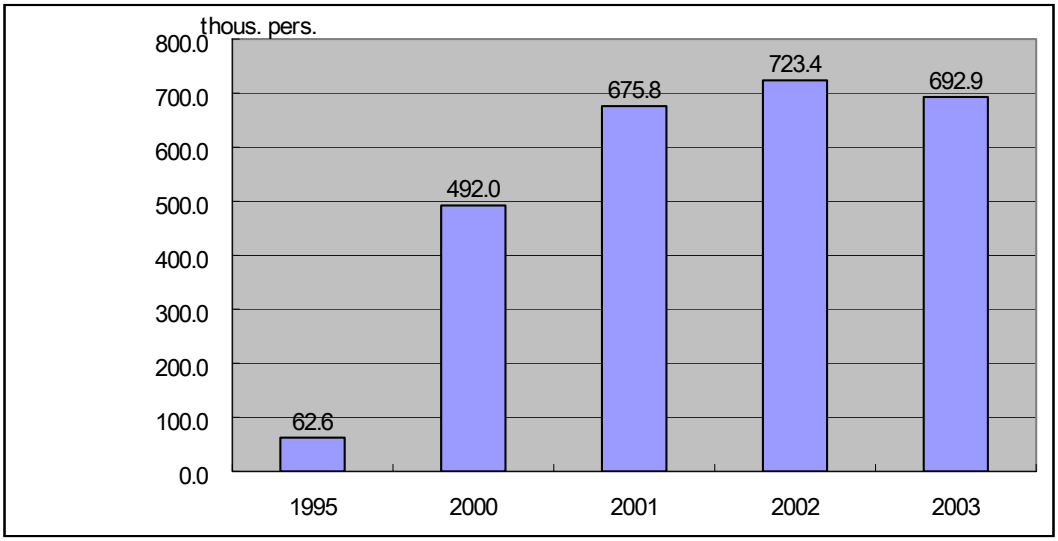
Figure 2- 11 : Trade Amount Between PRC and Viet Nam



Source) China Statistical Yearbook 2004

107. In addition to developing cargo movement, passenger traffic between two countries has also increased rapidly (Figure 2-12). Actually, the number of Chinese visitors to Viet Nam has increased from 62.6 thousand in 1995 to 692.9 thousand in 2003. As a result, Chinese visitors make up 28.5% of total foreign visitors. For China who develops its economy and increases income rapidly in the past decade, Viet Nam comes to be not only a significant business partner but also a close and attractive tourist destination.

Figure 2- 12 : Number of Chinese Visitors to Viet Nam



Source) General Statistical Office, Statistical Yearbook 2003

2.4.2 Socio Economic Relationship Between Yunnan and Viet Nam

108. As mentioned before, with respect to the industry structure, Yunnan is outstanding in the primary goods such as tobacco and minerals, and the heavy chemical industry goods like steel processing and chemicals (fertilizer) while Viet Nam is excel in the primary goods consist of vegetables, fruits, seafood, crude oil, rubber, minerals, and so on, and the light industry goods such as textile and footwear.

109. Based on these industry structures, look through the trade data through Lao Cai provided by Border gate economic management unit of Lao Cai. The border trade has been growing steady from $ 125.8 million in 2002 to $ 282.2 million with around 2.4 times expansion within the recent three years. Since the railway almost reaches to its capacity in particular, trade amount through the road border has rapidly increased from $ 49.7 million in 2002 to $ 151.0 million in 2004 with the average growth rate of over 80%. It also implies that road improvement or newly construction is required.

Table 2- 9 : Lao Cai Border Trade

		Total	Road Border	Growth Rate	Railway Border	Growth Rate
2002	Export ($) (VN to Yunnan)	30,260,738	19,837,517		10,423,221	
	Import ($) (Yunnan to VN)	95,551,322	29,885,871		65,665,451	
	Total ($)	**125,812,060**	**49,723,388**		**76,088,672**	
	Balance ($)	-65,290,584	-10,048,354		-55,242,230	
2003	Export ($) (VN to Yunnan)	52,040,732	34,876,716	75.8%	17,164,016	64.7%
	Import ($) (Yunnan to VN)	100,727,699	31,162,021	4.3%	69,565,678	5.9%
	Total ($)	**152,768,431**	**66,038,737**	**32.8%**	**86,729,694**	**14.0%**
	Balance ($)	-48,686,967	3,714,695		-52,401,662	
2004	Export ($) (VN to Yunnan)	66,415,565	43,429,693	24.5%	22,985,872	33.9%
	Import ($) (Yunnan to VN)	215,767,517	107,607,176	245.3%	108,160,341	55.5%
	Total ($)	**282,183,082**	**151,036,869**	**128.7%**	**131,146,213**	**51.2%**
	Balance ($)	-149,351,952	-64,177,483		-85,174,469	

Source) Border Gate Economic Management Unit of Lao Cai

110. Looking over the trade commodity's structure between Viet Nam and Yunnan Province, main exports from Viet Nam to Yunnan in 2004 are agriculture products ($ 20.8 million), ore ($ 17.7 million), rubber ($ 13.1 million), consumer products like plastic furniture and footwear ($ 6.1 million), and seafood ($ 5.8 million). On the other hand, main imports from Yunnan to Viet Nam in 2004 are fertilizer ($ 58.1 million), chemical products ($ 37.3 million), equipment and machine ($ 34.1 million), metal products ($ 29.3 million), and tobacco ($ 13.7 million).

111. It implies that based on the fact that the consumption standards are being developed, needs for good quality products are ripe and the construction boom is also coming in Yunnan, Viet Nam provides processing agricultural and seafood which are relatively higher added value products for export market, and rubber for materials of new buildings, and supply oil and minerals for the traditional heavy and chemical industry sector as well. And Viet Nam also faces on the living standard improvement and the rushing new buildings, so that Yunnan increases supply of metal products and chemicals in response to the demands for them used for construction and also provide fertilizer for the traditional agriculture sector. Thus, Yunnan procures natural resources such as ore

and minerals from Viet Nam, smelt, refine and process them in Yunnan, and then export processed products again to Viet Nam. At the same time, Viet Nam procures fertilizer from Yunnan, make vegetables and fruits, and export to Yunnan. These facts prove that Viet Nam and Yunnan have mutual supplement economic relationship through the border trade. The KHTC surely would facilitate and enhance such kind of mutual supplement relationship and a division of labor.

2.5. Socio-Economic Issues on the Projected Area

112. As mentioned before, many ethnic minorities live in the northern Viet Nam, especially accounting for 50.4% in Yen Bai and 66.9% in Lao Cai respectively. According to interview surveys with local governments with the corridor, the Consultant team found that not many ethnic minorities live on the west side of the red river, where are planned to be the new expressway alignment.

113. Viet Nam government has tackled many projects on the poverty reduction. It is reported that the significant progress on it has been made in the past years, however the results are not equal among the regions and groups. Poverty rates are still high among the peoples living in the remote area where has the difficulty in accessing the transport and communication.

114. Trafficking of women and children is also a problem in Viet Nam, particularly to China. Some Vietnamese women have been forced to marry with Chinese men. Prostitution is also developed along the border. Consequently, HIV infections have increased for the past years.

115. There are some national parks, protected forests and extensive mixed deciduous forest with rich wildlife. However, the new expressway following the proposed alignment, negative impacts are seldom anticipated. In addition, expressway and the feeder network could facilitate the tourism in such area.

116. The project could bring both positive as well as negative impacts on social, environment. However, the expressway following the proposed alignment can minimize the deep cutting, and landslips or landslides. If proper slope stabilization could minimize soil erosion, existing slope stabilization in the Chinese section of the corridor should be considered as an adaptation to the Vietnamese side.

117. All the interviewees of provincial governments expect that the expressway and the feeder networks will harmonize the industrialization and the urbanization in and inter provinces. They would not only improve the living standards through better accessibility to markets and creating new jobs but also encourage investments both from domestic and foreign investors so that provide further opportunities.

118. With respect to facilitating the cross-border trade, although the cross-border movement of goods and people are greatly improve under the implementation of the GMS Cross-Border Transport Agreement supported by ADB, a number of nonphysical barriers are still remained. They include followings.

- The impossible for vehicles to enter the other country directly (Yunnan truck cannot enter to Viet Nam, for example)
- The restrictions on the entry of motor vehicles, often causing costly and time-confusing transshipment
- Different standards pertaining to vehicle size, weight, and safety requirements, and driver qualifications
- Inconsistent and difficult formalities related to custom procedures, inspections, clearances, and assessment of duties

119. The followings are remained social issues to be settled in the next detailed design phase.

- Detailed environmental assessment
- Detailed social impact assessment
- Detailed resettlement plan inclusive of land acquisition

図表目次

Chapter3. Traffic Demand forecasting

Chapter3. Traffic Demand forecasting

3.1. Introduction

120. Traffic demand has been robust due to strong economic growth during last decade. Based on the strong correlation between the economic conditions and the transport demand, future transport demand is forecasted based on future trend of major socio-economic indicators. Kunming-Haiphong transport corridor consists of multiple transport modes, namely road, rail and inland waterway. According to the interviews with the Department of Communication in Yunnan Province and Kunming Railway Bureau, passenger railway between Kunming and Hekou (meter gauge) has been suspended since 2003, with no plan to re-start. Only cargo train service exists. Plans for a new railway with standard gauge does exist between Kunming and Gejiu, but there are no plans to extend it to Hekou. In Yunnan province, the long-distance transport within the corridor is tending to be served by expressway bus service. Inland waterway service is not practical for mid-long distance transport because it is cannot provide stable service during the whole year.

121. Regarding multimodal analysis, the team also met and discussed with VRC (Viet Nam Railway Corporation) to collected data from Railway stations as well as analyzed the case study of NH 5 (National Highway No.5). Before NH 5 was upgraded, railway dominated the passenger transport market between Ha Noi and Haiphong. However, the situation has changed when the LOS (Level of Service) for coach/Buses improved significantly due to the increased frequency by using upgraded NH 5. This also led to a sharp increase in the generated traffic demand, as well as a drastic switch of passengers from railway to coach or bus.

122. We could expect an even further shift from rail if the expressway would provide better transport service than railway in terms of speed, time saving and frequency as well as comfortable transport service with modern bus/coaches. This report does not attempt any detailed forecast of railway traffic demand because of insufficient data source and time constraint. Consequently, we have assumed that modal split between rail and road would remain the same as it is. This assumption will lead to a conservative estimate for road traffic, since it will undercount the shifted traffic from railway.

123. The team focuses on road transport. Models for demand forecast follow the steps (Figure 3-1), a) Natural Growth Traffic b) Generated traffic and c) Diverted traffic. Consequently, future traffic demand can be estimated in the combination of:

a) Natural Growth Traffic

The traffic volume increases from baseline traffic in accordance with economic growth. We call this traffic volume ' Natural Growth Traffic'. Natural growth traffic may be divided into several types of traffic such as Passenger Car/ Coach/Truck, Passenger/Cargo and purposes for traffic etc. In general, passenger traffic Growth rate is higher than that of cargo in developing countries. We also have baseline traffic by types of vehicles. Taking these into account, the team forecasts the future traffic by applying different growth rates for passenger vehicles and freight vehicles. Passenger vehicles include car, small and large coaches and motorbike. Freight vehicles include various types of trucks and ocean container. Natural growth traffic in the future will be estimated by sum of passenger traffic and cargo traffic in the future.

b) Generated traffic

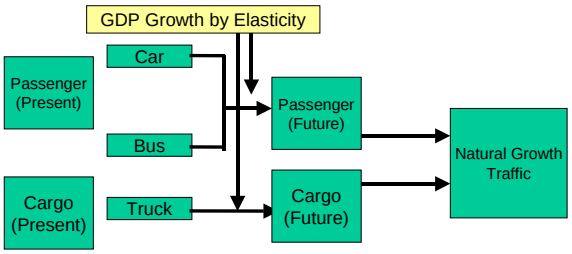
The expressway provides a completely new service. Drastically reduced travel time generates new traffic. In other cases, we have often observed soaring traffic volume immediately after an expressway came into operation. This phenomenon is likely to be explained by the industrial and tourism development initiatives along the new expressway, and also the pent-up demand that had been suppressed due to the lack of adequate transport.

c) Diverted Traffic

It is likely that there will be significant diverted freight traffic to/from Kunming–Guangdong ports (Wanpo, Guangzhou and Shenzhen) routes to the new Kunming – Haiphong/Cailan route, due to significant reduction in travel time and cost. However not all cargo flow can be diverted to Kunming–Haiphong/Cailan route. Routes and frequency of service for Haiphong and Cailan ports are limited to several Asian countries, and they lack long hauling with North America and Europe. In order to estimate the diversion ratio for freight traffic volume related to international trade to/from Yunnan, we relied on interviews with potential shippers in the Yunnan province.

Figure 3- 1 : Concept of Forecasting Methodology

a) Natural Growth



b) Generated Traffic

Traffic volume Jumpes up by new service level (Taking existing study into consideration, case study by interviews to the authority)

c) Diverted

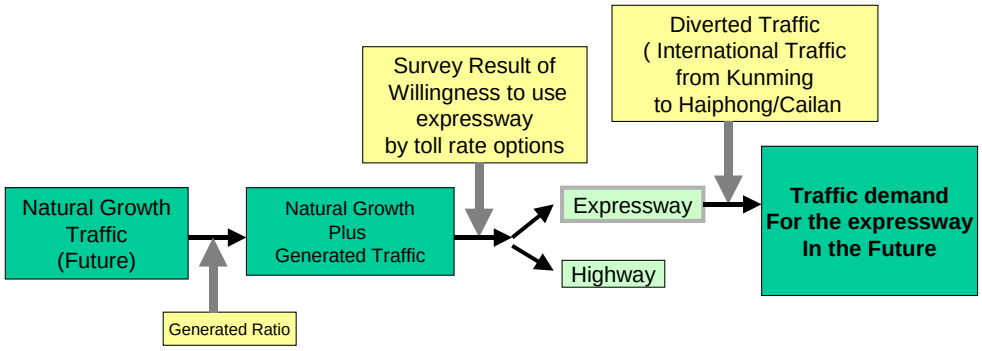
Interviews with authorities and beneficiaries in Yunnan Province

124. The team estimated the Natural Growth Traffic and Generated traffic as domestic traffic over the section in Viet Nam. The estimate is based on the current traffic volume statistics and traffic counts, which include the cross-border international traffic. The team could not acquire international traffic volume across the border in Origin and Destination base, which made it difficult to separate the international traffic from domestic traffic. For our purposes, however, this is not terribly significant. The estimate based on the existing statistics (which includes international traffic) will naturally reflect the international traffic as well. The only issue would be that we were not able to take generated international traffic into consideration in this report. This omission will also result in a more conservative estimate of future traffic demand, since it may miss potential generated traffic in the future.

125. Not all of these traffic volumes will use the expressway. Some would use the existing roads. The choice would depend on the balance of service level and the toll

rate. The consultant team asked the potential users of the road about their willingness to use the expressway based on various toll levels. On the other hand, Diverted traffic is different from Natural Growth and Generated traffic. Diverted traffic to/from Kunming to Guangdong ports is international traffic and has to use the whole section of the Hanoi – Lao Cai expressway. Consequently, future traffic demand for the expressway is estimated the following flow (Figure 3-2).

Figure 3- 2 : Traffic Forecasting Methodology for the expressway



3.2. Natural Growth Traffic

3.2.1 Baseline traffic

126. The consultant team executed traffic counting to collect current traffic volumes for the corridor. Compared to the Phase I study of the Kunming–Haiphong transport Corridor, the traffic counting was more thorough in terms of the number of stations from Hanoi to Lao Cai. At this study, the team has conducted the counting at 6 stations with 2 in Hanoi (Noi Bai) – Viet Tri, 2 in Viet Tri – Yen Bai, 1 in Yen Bai – Lao Cai and 1 on NH 18. They are:

- Station at KM11, NH 2 from Noi Bai to Viet Tri together with station at KM 19, NH 23 for traffic data for Ha Noi – Viet Tri section
- Station at T junction Co Tiet on NH 32C and station at Phu Ninh, KM79, NH 2 generated data for Viet Tri – Yen Bai section
- Station at Yen Binh T junction, NH 70 represented for the section Lao Cai –Yen Bai because NH 4 D is under upgrading.
- 1 representative for NH 18 (This counting result is conducted for only reference)

The table 3-1 shows the result of traffic counting on PCU base.

Table 3- 1 : Daily average vehicle flow by section in 2005 (Unit: PCU)

	Type of vehicle	PCU	Hanoi- Viet Tri	Viet Tri - Yen Bai	Yen Bai - Lao Cai
PAX	Tourist car/ Jeep	1	2,933	1,860	175
	Small coach (<25 seats)	2	2,693	1,339	139
	Big coach (>=25 seats)	2.5	2,026	1,146	94
	Motorbike/Lambretta	0.3	6,049	5,047	786
FREIGHT	Light truck (<2.5 tone)	2	1,722	1,270	69
	Medium truck (>2.5 tone, 2axles)	2	4,251	2,155	355
	Heavy (3 axles)	2.5	1,904	1,488	117
	Very Heavy (>3 axles)	3	1,233	615	30
	Container	3	1,325	219	3
	Other	1	149	83	4
	Total PCU		24,284	15,221	1,772
	Total PCU without Motorbike/Lambretta		18,235	10,174	986

Source) Traffic counting by Transport surveyors of the consultant team

3.2.2 Growth rate for GDP per capita

127. GDP per capita in Viet Nam increased to 4,153 million VND in 2003 from 1.999 million VND in 1990 (constant price as of 1994). The average growth rate during 1990 – 2003 is 5.8%. Long term forecast of GDP is difficult. Although Viet Nam started with low GDP per capita (around $500), it has industrialized rapidly, resulting in an economy that is quickly expanding. The country also successfully reduced the population growth to 1.4% by 2005, which is further expected to decrease as low as 1.2% in the near future. Furthermore, analysis by the IBRD and EIU, as well as the experience of the neighboring ASEAN countries in the past years indicate that it is possible for Viet Nam to continue stable and strong growth. After taking these fact into consideration, the consultants have assumed the GDP per capita growth rate in Viet Nam would be average 5.4 %; 5% and 4% for the period in 2005 -2015; 2016-2025 and 2026 – 2038 respectively.

3.2.3 Elasticity for of the Vehicle Growth rate compared to GDP per capita

128. The consultant team also analyzed the number of vehicle registered in the region as well as the whole country based on the data collected from VR (Viet Nam Registration) and NTSC (National Transport Safety Committee). The table 3-2 shows that the vehicle ownership in the corridor area has sharply increased and much higher than GDP growth rate, including truck. We could assume the number of car ownership as of road transport demand. We could expect much higher growth rate for car ownership, if the ratio of car and truck ownership in Viet Nam is still very low at present time but expected to grow rapidly. If we calculate the elasticity for growth rate of car ownership and GDP per capita, they are at least 3 to at most 7 except the case of coach/bus in 2003.

Table 3- 2 : Number of Vehicle register in the Project Area

Type of vehicle	Year	1999	2000	2001	2002	2003	2004
Car	Number of Vehicle	16,069	20,151	28,674	36,305	48,424	60,358
	Growth rate		25%	42%	27%	33%	25%
Coach/bus	Number of Vehicle	4,582	5,469	9,219	7,068	13,307	15,345
	Growth rate		19%	69%	-23%	88%	15%
Truck	Number of Vehicle	15,327	18,245	34,661	42,333	54,396	62,159
	Growth rate		19%	90%	22%	28%	14%

Source) VR and Transport Surveyor

129. The consultants also reviewed and assessed the historical growth rate of traffic volume in the Project Area with AADT in PCU (Passenger Car Unit) provided by VRA (Viet Nam Road Administration). The statistic of NH 2 shows that the traffic in general has considerably increased for the past years with average growth rates of 18% for passenger Vehicle and 22% for freight vehicle (Table 3-3).

Table 3- 3 : ADDT Growth Rate at KM15, NH 2 Ha Noi – Viet Tri

Type	Year						Average growth Rate
	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	
Passenger Vehicle	19%	15%	10%	43%	7%	13%	18%
Freight Vehicle	51%	12%	4%	60%	-1%	5%	22%

Source) VRA data and calculation from surveyor

130. There are other existing reports that attempt to estimate the same elasticity, such as Road Strategy Study carried by SWKP (Scott Wilson Kirkpatrick and Partners), WBRTP2 (World Bank Rural Transport Project 2), and ADB T.A No VIE 3455. SWKP estimate the elasticity to growth rate of GDP per capita to be 1.6 to 2.0 for passenger transport, 1.0 to 1.5 for freight and 2.5 for motorcycles. Although we stated that traffic demand is robust and growth rate of car ownership is very high, it is unlikely to continue forever. Applying this high elasticity for the long term would induce the risk of over-estimating the demand. Taking all these into consideration, the consultant team has applied the elasticity of 2.0 for passenger and elasticity of 1.5 reducing to 1.0 for freight against GDP per capita growth as showed in the table 3-4.

Table 3- 4 : Summary Table of elasticity and GDP Growth

Type of Vehicle	2005 - 2015		2016 - 2025		2026 -	
	Elasticity	GDPP growth (%)	Elasticity	GDPP growth (%)	Elasticity	GDPP growth (%)
Passenger	2	5.4	2	5	2	4
Freight	1.5		1.2		1	

131. Applying these elasticity and GDP growth rates per capita to the baseline traffic, we have made the final estimates. In 2025, vehicle flows are estimated as 140,000 for Hanoi – Viet Tri, 91,000 for Viet Tri – Yen Bai and 11,000 for Yen Bai – Viet Tri respectively (Table 3-5). The traffic volume for Motorbike/Lambretta is significant, and

dominates the share of the traffic volume. This is natural, since the number of motorbikes is already high in the existing traffic. The expressway, however, does not allow motorbikes. In order to take the huge demand represented by the motorbike into account, we assumed that a certain percentage of the motorbike demand would convert into automobiles in order to take advantage of the expressway. This will be further explained in the latter section of this chapter (See 3.6.Motorbike/Lambretta issues).

Table 3- 5 : the result of Natural Growth Traffic

Projected PCU volume for Section 1(Hanoi-Viet Tri)

	Type of vehicle	PCU	2005	2015	2025	2035
PAX	Tourist car/ Jeep	1	2,933	8,179	21,213	45,797
PAX	Small coach (<25 seats)	2	2,693	7,509	19,475	42,046
PAX	Big coach (>=25 seats)	2.5	2,026	5,651	14,656	31,642
PAX	Motorbike/Lambretta	0.3	6,049	16,869	43,754	94,461
FREIGHT	Light truck (<2.5 tone)	2	1,722	3,752	6,720	9,947
FREIGHT	Medium truck (>2.5 tone, 2axles)	2	4,251	9,262	16,587	24,553
FREIGHT	Heavy (3 axles)	2.5	1,904	4,149	7,429	10,997
FREIGHT	Very Heavy (>3 axles)	3	1,233	2,686	4,810	7,120
FREIGHT	Container	3	1,325	2,888	5,171	7,655
FREIGHT	Other	1	149	325	582	862
	Total PCU		**24,284**	**61,269**	**140,399**	**275,081**

Projected PCU volumefor Section 2 (Viet Tri-Yen Bai)

	Type of vehicle	PCU	2005	2015	2025	2035
PAX	Tourist car/ Jeep	1	1,860	5,187	13,455	29,048
PAX	Small coach (<25 seats)	2	1,339	3,733	9,683	20,904
PAX	Big coach (>=25 seats)	2.5	1,146	3,195	8,288	17,893
PAX	Motorbike/Lambretta	0.3	5,047	14,074	36,505	78,812
FREIGHT	Light truck (<2.5 tone)	2	1,270	2,767	4,956	7,336
FREIGHT	Medium truck (>2.5 tone, 2axle	2	2,155	4,696	8,411	12,450
FREIGHT	Heavy (3 axles)	2.5	1,488	3,242	5,806	8,595
FREIGHT	Very Heavy (>3 axles)	3	615	1,339	2,398	3,550
FREIGHT	Container	3	219	477	855	1,265
FREIGHT	Other	1	83	180	322	477
	Total PCU		**15,221**	**38,892**	**90,678**	**180,328**

Projected PCU volume for Section 3 (Yen Bai-Lao Cai)

	Type of vehicle	PCU	2005	2015	2025	2035
PAX	Tourist car/ Jeep	1	175	488	1,265	2,730
PAX	Small coach (<25 seats)	2	139	388	1,006	2,172
PAX	Big coach (>=25 seats)	2.5	94	261	676	1,460
PAX	Motorbike/Lambretta	0.3	786	2,193	5,688	12,279
FREIGHT	Light truck (<2.5 tone)	2	69	151	270	400
FREIGHT	Medium truck (>2.5 tone, 2axle	2	355	773	1,384	2,049
FREIGHT	Heavy (3 axles)	2.5	117	256	458	678
FREIGHT	Very Heavy (>3 axles)	3	30	65	117	173
FREIGHT	Container	3	3	7	12	17
FREIGHT	Other	1	4	10	17	25
	Total PCU		**1,772**	**4,590**	**10,893**	**21,984**

Note:
GDP per capita growth rate from 2005-2015: 5.4%
GDP per capita growth rate from 2016- 2025: 5.0%
GDP per capita growth rate from 2026- 2038: 4.0%
Elasticity for passenger vehicle: 2
Elasticity for freight from 2005-2015: 1.5
Elasticity for freight from 2016-2025: 1.2
Elasticity for freight from 2026-2038: 1

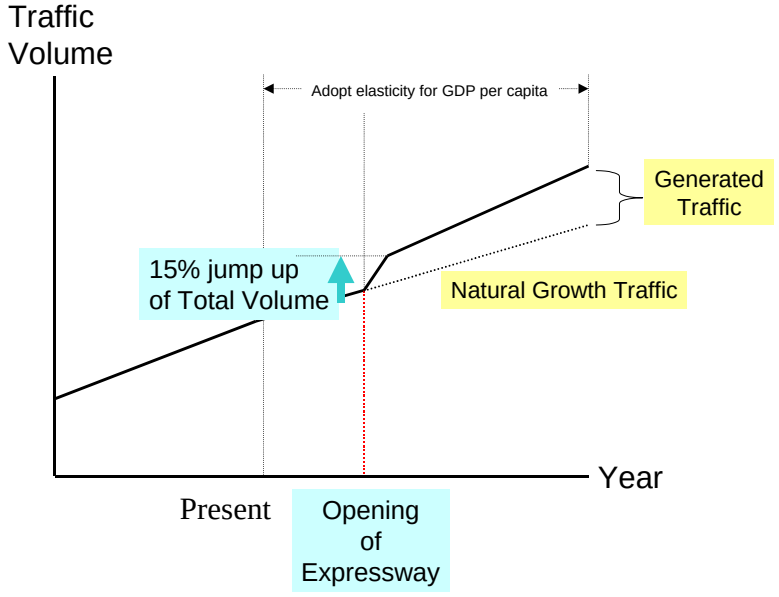
3.3. Generated Traffic

132. The expressway is expected to provide a drastically higher level of service compared with existing highways and railway. Journey time of the existing highway over the section between Kunming and Haiphong is estimated to be about 18 hours by passenger car with a distance of 850km. This travel time is expected to be shorter to 14 hours, resulting in a four hours journey time reduction after the completion of Kunming – Hekou expressway in 2008. After completion of Hanoi – Lao Cai expressway, the travel time of Kunming - Haiphong will be further reduced to 10 hours.

133. As mentioned, the expressway, which controls access and levies tolling, will provide an absolutely different level of service for passenger and freight. Higher level of service will eventually give rise to soaring traffic volume. The question is when and how much it would be generated. The team has considered various possibilities for generated traffic for the corridor based on existing cases of upgrading Highways in Viet Nam.

134. The team also reviewed existing studies concerning upgrading highways. It is estimated by BCEOM (France) in "Some methodologies of project analysis" that new Highway could generate from 10-15% total traffic demand (for new road 15%; 10% for upgraded road). As we mentioned high average traffic growth rate of 22 % on NH 2 from 1998 – 2004, we can expect higher growth rate than the elasticity '2' for GDP per capita, which accounts for 10.8% of annual growth rate between 2005 and 2015. However if we adopt higher generated growth rate, the risk for inaccuracy of future traffic demand increases. The consultant team is prudent to select the generated ratio to avoid overestimation. Consequently, the team determined to add a 15% increase of natural traffic growth as ' Generated Traffic' for the whole section after expressway is in operation.

Figure 3- 3 : Concept for estimating generated traffic



135. The assumptions for opening of the expressway are:

1) Hanoi –Viet Tri is in operation in 2010

2) Viet Tri – Yen Bai and Yen Bai – Lao Cai are in operation in 2013

Compared with natural growth traffic, vehicle flows are increased to 161,000 from 140,000 for Hanoi – Viet Tri, to 104,000 from 91,000 for Viet Tri – Yen Bai and to 13,000

from 11,000 for Yen Bai – Lao Cai in 2025 respectively (Table 3-6).

Table 3- 6 : The result of Total Traffic including Generated traffic

Projected PCU volume for Section 1(Hanoi-Viet Tri)

	Type of vehicle	PCU	2005	2015	2025	2035
PAX	Tourist car/ Jeep	1	2,933	9,405	24,395	52,667
PAX	Small coach (<25 seats)	2	2,693	8,635	22,397	48,352
PAX	Big coach (>=25 seats)	2.5	2,026	6,498	16,855	36,388
PAX	Motorbike/Lambretta	0.3	6,049	19,399	50,317	108,631
FREIGHT	Light truck (<2.5 tone)	2	1,722	4,315	7,728	11,439
FREIGHT	Medium truck (>2.5 tone, 2axles)	2	4,251	10,651	19,075	28,236
FREIGHT	Heavy (3 axles)	2.5	1,904	4,771	8,544	12,647
FREIGHT	Very Heavy (>3 axles)	3	1,233	3,089	5,532	8,188
FREIGHT	Container	3	1,325	3,321	5,947	8,803
FREIGHT	Other	1	149	374	669	991
	Total PCU		24,284	70,459	161,458	316,343

Projected PCU volumefor Section 2 (Viet Tri-Yen Bai)

	Type of vehicle	PCU	2005	2015	2025	2035
PAX	Tourist car/ Jeep	1	1,860	5,966	15,473	33,405
PAX	Small coach (<25 seats)	2	1,339	4,293	11,135	24,040
PAX	Big coach (>=25 seats)	2.5	1,146	3,675	9,531	20,577
PAX	Motorbike/Lambretta	0.3	5,047	16,185	41,981	90,634
FREIGHT	Light truck (<2.5 tone)	2	1,270	3,182	5,699	8,436
FREIGHT	Medium truck (>2.5 tone, 2	2	2,155	5,401	9,672	14,317
FREIGHT	Heavy (3 axles)	2.5	1,488	3,728	6,677	9,884
FREIGHT	Very Heavy (>3 axles)	3	615	1,540	2,758	4,082
FREIGHT	Container	3	219	549	983	1,455
FREIGHT	Other	1	83	207	370	548
	Total PCU		15,221	44,726	104,279	207,378

Projected PCU volume for Section 3 (Yen Bai-Lao Cai)

	Type of vehicle	PCU	2005	2015	2025	2035
PAX	Tourist car/ Jeep	1	175	561	1,454	3,140
PAX	Small coach (<25 seats)	2	139	446	1,157	2,498
PAX	Big coach (>=25 seats)	2.5	94	300	778	1,679
PAX	Motorbike/Lambretta	0.3	786	2,522	6,541	14,121
FREIGHT	Light truck (<2.5 tone)	2	69	173	310	460
FREIGHT	Medium truck (>2.5 tone, 2	2	355	889	1,592	2,356
FREIGHT	Heavy (3 axles)	2.5	117	294	526	779
FREIGHT	Very Heavy (>3 axles)	3	30	75	135	199
FREIGHT	Container	3	3	8	13	20
FREIGHT	Other	1	4	11	20	29
	Total PCU		1,772	5,278	12,527	25,282

Note:
GDP per capita growth rate from 2005-2015: 5.4%
GDP per capita growth rate from 2016- 2025: 5.0%
GDP per capita growth rate from 2026- 2038: 4.0%
Elasticity for passenger vehicle: 2
Elasticity for freight from 2005-2015: 1.5
Elasticity for freight from 2016-2025: 1.2
Elasticity for freight from 2026-2038: 1

Jump up ratio is 15 % of Natural Growth Traffic in operation year

3.4. Traffic demand for the expressway by toll options

136. We also conducted interviews to passengers and drivers at the counting station. These interviews were conducted for identifying the appropriateness of toll level for the expressway, since the willingness for use of the expressway is likely to depend on toll level.

137. To determine toll option for the interview, the team collected the cases of the expressway toll rates in Yunnan Province. The representative toll rates for the expressway in Yunnan Province are 3.2 – 5.7 cents/ km with passenger car, 8.4 – 15.3 cents/km with medium truck and 21.6 – 35.3 cents/km with container. These rates are almost 1.5 to twice level as in Viet Nam (Table 3-7, Table 3-8).

138. The team managed to obtain important facts about modal split for the expressway and existing highway. After the completion of Yuan – Mohe expressway (Yuanjiang – Mohe) in Yunnan Province, regardless levying double rate of current toll in Viet Nam, more than 80% of existing traffic has shifted to the expressway. It is considered that the expressway provides much better service for the toll rates. It also provides sufficient benefit to cover toll rate with 5 hours travel time reduction from 7 hour to 2hours compared with the existing highway.

Table 3- 7 : Toll Rate of the expressways in Yunnan Province (Cents/km)

	Min	Max
1. Under 1 ton or 10 seats	3.2	5.7
2. Over 1 ton to 3 tons	4.7	8.9
3. Over 3 tons or under 30 seats	7.4	10.5
4. 3 tons to 6 tons	8.4	15.3
5. Over 31 seats	13.7	19.5
6. Over 6 tons to 9 tons	15.3	23.7
7. Over 9 tons to 12 tons	18.4	29.5
8. Over 12tons	21.6	35.3

Source) Site Visit in Yunnan Province in 2005

Table 3- 8 : Toll Rate on existing Highway in Viet Nam

	VND for 30km	Unit Toll (VND/ km)	Unit Toll (Cents/ km)
Tourist car/ Jeep	10,000	333	2.1
Small Coach(less than 25 seats)	15,000	500	3.2
Big coach(equal or more than 25 seats)	10,000	333	2.1
Motorbike/ Lambretta	10,000	333	2.1
Light truck(less than 2.5 tones)	15,000	500	3.2
Medium truck(more than 2.5 tones, 2 axies)	22,000	733	4.6
Heavy truck(3 axies)	40,000	1,333	8.4
Very Heavy truck (more than 3 axies)	40,000	1,333	8.4
Container	80,000	2,667	16.8
Other	10,000	333	2.1

Source) Ministry of Finance in Viet Nam

139. The team conducted interviews with drivers concerning potential use of the expressway under 3 toll options.

- Options 1: expressway toll rate is 1.5 time in comparison to Highway toll
- Option 2: expressway toll rate is double to Highway
- Option 3: expressway toll rate is triple to Highway

The following table represents potential ratios of using the expressway from interviews to about 200 drivers and passenger with each section.

Table 3- 9 : Potential of modal split to the Expressway by toll rate

	HN - VT	VT- YB	YB - LC
1.5 times	60%	80%	90%
2 times	50%	60%	85%
3 times	30%	50%	80%

Note) HN=Ha Noi, VT=Viet Tri, YB=Yen Bai, LC=Lao Cai

140. According to the result, the traffic demand of the section between Hanoi – Viet Tri is very cost sensitive while that of Yen Bai – Lao Cai is not cost sensitive. This is consistent with the observation that while there are other route options for the Hanoi-Viet Tri section, Yen Bai – Lao Cai section has no other significant route. Potential modal split to the expressway is gradually reduced with higher toll rates. It is considered that benefit of travel time reduction for traffic over the section between Yen Bai and Lao Cai would be substantial enough to use the expressway because of its long location from Hanoi.

141. By using these sets of ratios, the team has estimated Average Daily Traffic on the expressway. The following table (Table 3-10) shows that Average Daily Traffic reaches 97,000PCU, 83,000PCU and 11,300PCU in 2025 with the section of Hanoi – Viet Tri, Viet Tri – Yen Bai and Yen Bai – Lao Cai respectively in the case of Option 1, and 80,000PCU, 63,000PCU and 11,000PCU with the case of Option 2, and 48,000PCU, 52,000PCU and 10,000PCU with the case of Option 3.

Table 3- 10 : Average Daily Traffic on the Expressway by three tolls Options

Unit: PCU

Year	Option 1(60, 80, 90%)			Option 2 (50, 60, 85%)			Option 3 (30, 50, 80%)		
	HN-VT	VT-YB	YB-LC	HN-VT	VT-YB	YB-LC	HN-VT	VT-YB	YB-LC
2005	14,571	12,177	1,595	12,142	9,133	1,507	7,285	7,610	1,418
2010	26,567	19,431	2,563	22,139	14,573	2,420	13,283	12,144	2,278
2013	35,091	29,626	3,923	29,243	22,220	3,705	17,546	18,517	3,487
2015	42,275	35,781	4,750	35,230	26,836	4,486	21,138	22,363	4,222
2020	63,752	54,443	7,295	53,127	40,832	6,890	31,876	34,027	6,485
2025	96,875	83,423	11,274	80,729	62,567	10,648	48,437	52,140	10,022
2030	135,141	117,289	15,975	112,618	87,967	15,088	67,571	73,306	14,200
2035	189,806	165,902	22,754	158,172	124,427	21,490	94,903	103,689	20,226

Note: Hanoi – Viet Tri Section is assumed to be in operation in 2010, Viet Tri – Yen Bai Section and Yen Bai – Lao Cai sections are assumed to be in operation in 2013.These years are painted with yellow in the column.

***Options 1**: If expressway **toll rate is 1.5 times to Existing Highway**, 60 %, 80% and 90% of Natural Growth traffic in the section of Hanoi-Viet Tri, Viet Tri-Yen Bai and Yen Bai respectively, use the Expressway*

***Option 2**: If expressway **toll rate is 2 times to Existing Highway**, 50 %, 60% and 85% of Natural Growth traffic in the section of Hanoi-Viet Tri, Viet Tri-Yen Bai and Yen Bai respectively, use the Expressway*

***Option 3**: If expressway **toll rate is 3 times to Existing Highway**, 30 %, 50% and 80% of Natural Growth traffic in the section of Hanoi-Viet Tri, Viet Tri-Yen Bai and Yen Bai respectively, use the Expressway*

Source: Projected by the Consultant Team in line with Investment Plan from 2008 – 2012

3.5. Diverted Traffic

142. Before starting the study, the team thought that port competition with Fangcheng, Qinzhou, Beihai ports in Guanxi Province, that are 1,150km to/from Kunming, has to be taken into consideration. However according to the interview for shippers and freight forwarders in Yunnan Provinces, Ports of Guangdong Province are major container route from Kunming to outside (International Trade). Shenzhen port is used for trade to/from North America/Europe. Guangzhou ports (Wanpo, Sehkou etc) are used for trade to/from Asian countries. Fangcheng, Qinzhou, Beihai ports are used mainly for bulky cargo such as iron ore, coal and minerals but very few containers.

143. Shenzhen and Guangzhou ports are located about 1,600km from Kunming. However there are many direct shipping routes to foreign countries with sufficient frequency. This is the major reason for shippers to use Shenzhen and Guangzhou ports. About 90% of these containers are transported by rail, which takes 6 days from Kunming. The remaining 10% of containers are transported by truck with only 46 hours. But the transport cost of 20-foot equivalent container to Shenzhen and Guangzhou ports are RMB 8,000 by rail and RMB 12,000 by truck. It is also requested additional RMB 1,700 ($200) for a 1,000km of partially completed Expressway. Expressway cost (toll) will increase if the whole section from Kunming to Guangdong province is completed.

144. Due to high transportation cost to the ports, Shippers in Kunming, Yunnan Province expect the Hanoi – Lao Cai expressway to provide direct access to Haiphong/Cailan ports, since they are aware that Haiphong port, which is the nearest port to/from Kunming with only 850km, has many direct routes to Asian countries with enough frequency.

145. Regarding Diverted Traffic (International), the team estimated only cargo movement. The container traffic will use the whole section of Hanoi – Lao Cai expressway that would comparatively account for a little bit larger share of Yen Bai – Lao Cai section.

146. The estimation process is as follows,

1) Container throughput in tonnage for the future is projected by Ministry of Railway (Kunming Railway bureau) and Ministry of Communication in China. Converted tonnage to Twenty Foot Equivalent Unit (TEU) by conversion ratio of 20 tons per TEU.

2) According to the interviews to major shippers in Yunnan province, 10% of container is transported by truck at present. 10% of above-mentioned forecasted TEU would be potential container for Kunming – Haiphong.

3) Candidate container cargo is bound for Asian countries because there is no direct route to North America /Europe in Haiphong/Cailan ports. According to the interviews to major shippers in Yunnan province, 90% of container to/from Kunming is bound for Asian countries.

4) Major shippers indicates if the Hanoi – Lao Cai expressway is completed, about 30% of container could be diverted from Kunming – Guangdong to Kunming – Haiphong/Cailan.

5) Co-efficient of conversion ratio for PCU from container truck are three.

Table 3- 11 : Estimation flow and result of container truck diverted from Kunming – Guangdong route to Kunming – Haiphong/Cailan route

	2005	2015	2025	2035
A. Container Throughput TEU (=20foot)	213,000	530,000	1,205,556	1,816,667
B. Modal Split to Truck (A*10%)	21,300	53,000	120,556	181,667
C. Two 20TEU = 40 FEU (40foot) = Heavy Truck	10,650	26,500	60,278	90,833
D. C×90%(ASIA)×30% (Diverted)	2,876	7,155	16,275	24,525
PCU per Day	24	59	134	202

147. The result shows very small amount of container truck. We think this volume is less than expected. But due to constraint of data collection and other transport projects such as railways for port connectivity, we did not have any choice of standing at safety side to stay away from overestimation. We determined to hand over more detailed consideration to the next step.

3.6. Motorbike/Lambretta issues

148. Roads in Viet Nam are flooded with motorbikes. 24.9%, 33.2% and 44.4% of total traffic volume in Hanoi-Viet Tri, Viet Tri – Yen Bai and Yen Bai-Lao Cai respectively are motorbike/Lambretta. Motorbikes are major transport mean for the people in Viet Nam. Some of them would like to own their car. But car prices in Viet Nam are far from average income. The team also considered some of them to shift to public transport.

Table 3- 12 : The Share of Motorbike/Lambretta to all traffic

Current PCU volume by Types of Vehicle for Section 1(Hanoi-Viet Tri)

Type of vehicle	PCU	2005	2005Share
Motorbike/Lambretta	0.3	6,049	24.9%
Passenger Vehicle		13,701	56.4%
Freight Vehicle		10,584	43.6%
Total PCU		24,284	100.0%

Current PCU volume by Types of Vehicle for Section 2(Viet Tri-Yen Bai)

Type of vehicle	PCU	2005	2005Share
Motorbike/Lambretta	0.3	5,047	33.2%
Passenger Vehicle		9,392	61.7%
Freight Vehicle		5,829	38.3%
Total PCU		15,221	100.0%

Current PCU volume by Types of Vehicle for Section 3(Yen Bai-Lao Cai)

Type of vehicle	PCU	2005	2005Share
Motorbike/Lambretta	0.3	786	44.4%
Passenger Vehicle		1,194	67.4%
Freight Vehicle		579	32.6%

149. Before we conclude the traffic demand, we needed to determine the converted ratio from motorbike/Lambretta to passenger car. We can assume that only a part of Motorbike/Lambretta will switch to passenger cars. In order to make the estimate

conservative, we assumed that 10% of motorbikes/Lambretta shift to passenger cars. This is also assumed to gradually increase from 5 % to 10% in 2015. After 2015, we assume that it would saturate.

Table 3- 13 : Shifted number from Motorbikes to passenger car (PCU)

(Unit : PCU)

		2015	2025	2035
Option 1	HN -VT	1, 164	3, 019	6, 518
	VT - YB	1, 295	3, 358	7, 251
	YB -LC	227	589	1, 271
Option 2	HN -VT	970	2, 516	5, 432
	VT - YB	971	2, 519	5, 438
	YB -LC	214	556	1, 200
Option 3	HN -VT	582	1, 510	3, 259
	VT - YB	809	2, 099	4, 532
	YB -LC	202	523	1, 130

3.7. Conclusion

150. These assumptions lead to the future expressway traffic demand with 35,000 to 70,000 PCU in the section of Hanoi - Viet Tri, 33,000 to 53,000 PCU in Viet Tri - Yen Bai and about 6,000 PCU in Yen Bai - Lao Cai in 2025 respectively (Table 3-14).

151. International traffic of container truck movements accounts for only a few percent of Yen Bai – Lao Cai section traffic and mostly less than 0.3 percent of total traffic of Hanoi – Viet Tri and Viet Tri – Yen Bai section. This result comes from very limited scope for estimation with international freight flow to/from Kunming in Yunnan Provinces.

152. In practical terms, we could expect much higher international traffic volume, such as passenger traffic for tourism and freight traffic for local trade between North Viet Nam and Yunnan Province. According to the interviews to the authorities in Yunnan and Lao Cai Province, free pass agreements for the residents in the border area have gradually promoted mutual interchange of passenger and freight. If the FTA (Free Trade Agreement) between two countries were established, these cross-bordering interchange of passenger and freight would increase rapidly. The accurate estimate of the future demand would require a continued effort to obtain more accurate traffic demand in the future.

153. However this report is aimed to provide necessary information for the decision makers to assess the economic and financial viability for the Hanoi – Lao Cai expressway. The team always assumed much more conservative traffic demand forecasting to avoid overestimation and misleading results.

Table 3- 14 : the result of traffic demand forecasting for the expressway

Option 1

		2005	2015	2025	2035
Daily Traffic (PCU)	Hanoi - Viet Tri	11, 147	31, 859	69, 838	131, 347
	Viet Tri - Yen Bai	8, 365	24, 186	53, 331	100, 848
	Yen Bai - Lao Cai	947	2, 767	6, 110	11, 517
International Traffic*		24	59	134	202
Ratio of International Traffic	Hanoi - Viet Tri	0. 22%	0. 19%	0. 19%	0. 15%
	Viet Tri - Yen Bai	0. 29%	0. 24%	0. 25%	0. 20%
	Yen Bai - Lao Cai	2. 53%	2. 13%	2. 19%	1. 75%

NOTE: * International Traffic passes through all the section between Hanoi - Lao Cai

Option 2

		2005	2015	2025	2035
Daily Traffic (PCU)	Hanoi - Viet Tri	9, 293	26, 559	58, 221	109, 490
	Viet Tri - Yen Bai	6, 280	18, 154	40, 032	75, 686
	Yen Bai - Lao Cai	896	2, 616	5, 778	10, 889
International Traffic*		24	59	134	202
Ratio of International Traffic	Hanoi - Viet Tri	0. 26%	0. 22%	0. 23%	0. 18%
	Viet Tri - Yen Bai	0. 38%	0. 32%	0. 33%	0. 27%
	Yen Bai - Lao Cai	2. 68%	2. 26%	2. 32%	1. 86%

NOTE: * International Traffic passes through all the section between Hanoi - Lao Cai

Option 3

		2005	2015	2025	2035
Daily Traffic (PCU)	Hanoi - Viet Tri	5, 585	15, 959	34, 986	65, 775
	Viet Tri - Yen Bai	5, 237	15, 138	33, 382	63, 106
	Yen Bai - Lao Cai	844	2, 466	5, 446	10, 260
International Traffic*		24	59	134	202
Ratio of International Traffic	Hanoi - Viet Tri	0. 43%	0. 37%	0. 38%	0. 31%
	Viet Tri - Yen Bai	0. 46%	0. 39%	0. 40%	0. 32%
	Yen Bai - Lao Cai	2. 84%	2. 39%	2. 46%	1. 97%

NOTE: * International Traffic passes through all the section between Hanoi - Lao Cai

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Chapter 4. Initial Alignment and Cost Estimation for the Expressway

Chapter 4. Initial Alignment and Cost Estimation for the Expressway

4.1 Introduction

154. The purpose of engineering study is to identify physical viability of the expressway with initial alignment, technical specification and more accurate cost estimation. In the first phase of VIE: 4050 Preparing Kunming – Haiphong Transport Corridor completed December in 2003, the proposed expressway was as follows:

(1) A limited access toll expressway from Lao Cai to Noi Bai with 260km alignment
(2) From Lao Cai to Yen Bai, 2 (expandable to 4) lanes expressway alignment follows the proposed new railway alignment along the west bank of the Red River through the gently undulating terrain.
(3) From Yen Bai to Viet Tri, 2 (expandable to 4) lanes will follow the existing rail alignment.
(4) From Viet Tri to Noi Bai, 4(expandable to 6) lanes, will follow the similar alignment with proposed plan be the Government of Viet Nam with the expressway standard.

155. The project cost for the expressway was estimated at $565 millions with 2-lane from Lao Cai to Viet Tri and 4-lane from Viet Tri to Noi Bai including facilities (5% of civil works cost) and supervision cost (7% of civil works cost and equipment cost).

156. The above alignment was proposed by deskwork based on geographical maps and interviews with authorities concerned but sufficient field survey. This cost was estimated by similar expressways analysis on ADB financed project in China and Sri Lanka.

157. Tanking these into consideration, this chapter describes initial alignment with technical specification and cost estimation through detailed field survey for the project area. The provincial government assisted the team providing with useful information in local area such as road projects and candidate interchanges. The deliverables we have created at this report is different from the Phase 1 report. Particularly we change route alignment in the section between Yen Bai – Viet Tri because we found that there is not enough space to the expressway with a part of the east bank of the Red River along existing railway after field survey. We also revised the number of lanes and cost estimation from the proposed access controlled expressway in the phase 1 report based on traffic demand forecasting.

4.2 Technical Specification

4.2.1 Technical Specification Review

158. In general term, Technical specification consists of a) Design speed, b) Road width including lane width and number of lanes, c) Median, d) Shoulder stripe, e) Maximum Gradient. There is no actual case of technical specification for a long distance of more than 200km expressway in Viet Nam. According to existing study, Viet Nam has already proposed the technical standard for the expressway by taking other countries' cases such as China, Japan, Russia, USA and France, into consideration (Table 4-1).

159. Design speeds are varying from expressway's configuration and alignment. Configuration and alignment are depending on geographical feature, topography,

bridges over rivers, viaducts through mountain valleys and tunnels. In general, they classify several types of geographical feature with ‘Plan’, ‘Hilly’ and ‘Mountainous’. Based on the international standards as above-mentioned countries, design speeds are normally 100km/hour and 80km/hour in ‘Plan/ Hilly’ area and in ‘Mountainous’ area respectively.

Table 4- 1 : Proposed Vietnamese Technical Specification TCVN 5729-97 Kunming – Haiphong corridor Expressway

Item	Unit	Sections OF **Expressway**			Equivalent international Standards ***for same design speed***									
		NoiBai airport VietTri (NH2)	VietTri – Yen Bai (NH37)	YenBai – LaoCai (China)	CHINA JIJ 001- 94/97		JAPAN		URSS		USA AASHTO - 94		FRANCE	
		Expressway type B			Expressway		Expressway- Type 1 Rural areas		Type 1b - National & Pan-Federation roads		Arterial/Trunk road		Expressway	
Topographic condition/ Class		**Plain**	Hilly	Montai-nous	Hilly	Montai-nous	Level areas nous	mountainous areas Class 3	Hilly	Mountain-oust	Hilly	Mountai-nous	Class III	Class IV
* Design Speed	km/h	100	100	80	100	80	100	80	100	80	100	80	100	80
* Road width	m	25.5	25.5	24.0	24.5/26	23/24.5	27.5/28.5	23.0	27.5	27.5	24.6	24.6	26.5	23.5
* Lane width	m	3.75	3.75	3.75	3.75	3.75	3.5/3.75	3.5	3.75	3.75	3.6	3.6	3.5	3.5
*Number of lanes	lane	4	4	4	4	4	4	4	4	4	4	4	4	4
* Median	m	3	3	3	2.5/3.5	2/2.5	4.5 + 1.5	3 + 1	>5	>5	>3	>3	6	3
- Separation strip	m	1.5	1.5	1.5	1.5/2	1.5	4.5	3.0						
- Safety strip	m	2x0.75	2x0.75	2x0.5	2(0.5/0.75)	2(0.25/0.5)	2x0.75	2x0.5	2x1	2x1	>2.4	>2.4		
* Shoulder strip	m	3.75	3.75	3.25	3.5/3.75	3/3.5	2.5 +1.25	1.75 + 0.75	3.75	3.75	3 – 3.6	3 – 3.6	3.25	3.25
- Safety strip	m	3	3	2.5	2.75/3	2.5/2.75	1.25	0.75	> 0.75	> 0.75	>2.4	>2.4		
- Sodding strip	m	0.75	0.75	0.75	0.75	0.5/0.75	2.50	1.75						
* Minmum hoizontal radius	m	450	450	240	400	250	400	280	400-600	250-300	435	250	425	
- Crest	m	6,000	6,000	3,000	6,500	3,000	6,500	3,000	10,000	1500/3000	10,500	4,900	6,000	3,000
- Sag	m	3,000	3,000	2,000	3,000	2,000	3,000	2,000	5,000	1000/2000	5,100	3,200	3,000	2,200
* Maxim gradient	%	5	5	6	4	5	3 – 6	4 – 7	5	6	4 – 6	5 – 7	5	6
* Sight distance	m	160	160	100	160	110	160	110	200	150	205	139	160	105

160. These technical specifications are very similar each other. For example, the number of lanes is at least four with 23meter to 28meter road widths. Medians are 2.5-6.0 meters, shoulder strips are 3.0 to 3.75, Minimum horizontal radiuses for Plan/Hilly and Mountainous are 450/460 to 400meter.Max gradients are 4-7%. The Vietnamese standard proposed follows these specifications.

4.2.2 Criteria for consideration of lane number

161. To determine number of lanes on each section, the team considered traffic volume in the future. In general term, traffic velocity has a positive relation with traffic volume. If traffic volume exceeds design capacity on the road, velocity would be slower as congestion increases.

162. Traffic volume (flow) is not distributed during 24hours on a per hour basis. It is likely to be a couple of congested hours and peak times. It may be true that there are congested day and week such as long holiday or New Year holiday.

163. We need to define design capacities for traffic volume level. Design capacity has to be considered as planning criteria for appropriate traffic volume where traffic flow can be streamlined smoothly. In general, one-lane carriage way affords to handle more than 15,000 PCU (Passenger car unit) but with often congested. This volume level is not desirable for planning.

164. We have to state that the expressway has to be at least a 4-lanes in terms of technical specification and level of service. If many velocities of cars use 2-lanes (one way one lane), relatively high-speed passenger cars may have to keep pace just following slow truck. To avoid such unfavorable case and to keep higher level of service compared with existing roads, 4 lanes with one way 2 lanes would be desirable. But there is some contrived ways to improve level of service although only 2-lanes (one way one lane) is affordable. It is often executed as an idea to set up passing lane with 2-3 km in every 20-30km.

165. On the other hand, we have to avoid over-specification for collapsing of financial viability. If the technical specification would be much higher than expected traffic volume for a long time, financial risk would increase. To take these into account, the team recommends the expressway to have enough capacity to handle traffic flow smoothly but not financially over-specification. So, the team has recommended an tentative criteria for determination on number of lanes as follows,

Traffic Volume (PCU)		No. of lanes
Over 40,000	====	6 lanes
20,000 – 40,000	====	4 lanes
Under 20,000	====	2 Lanes

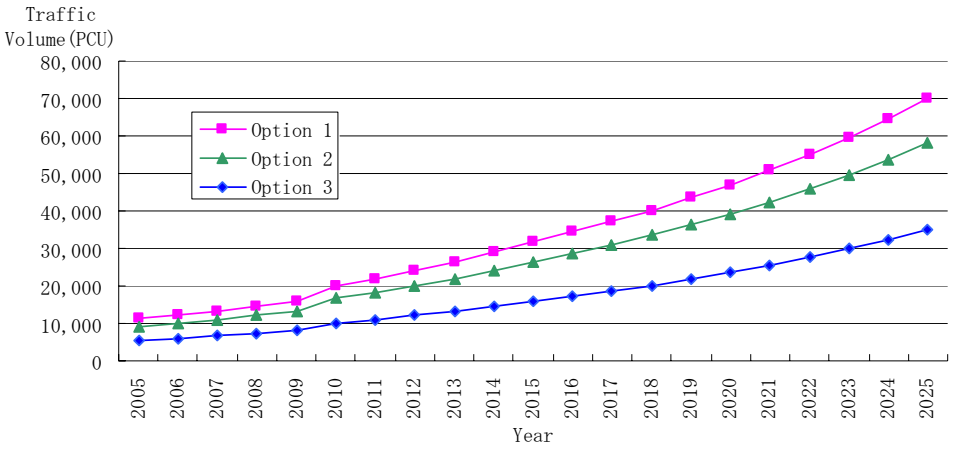
4.2.3 Consideration for number of lanes

166. Taking above mentioned criteria into account, the consultant team has investigated appropriate number of lane for each section:

Section 1 : Noi Bai – Viet Tri
Section 2 : Viet Tri – Yen Bai
Section 3 : Yen Bai – Lao Cai

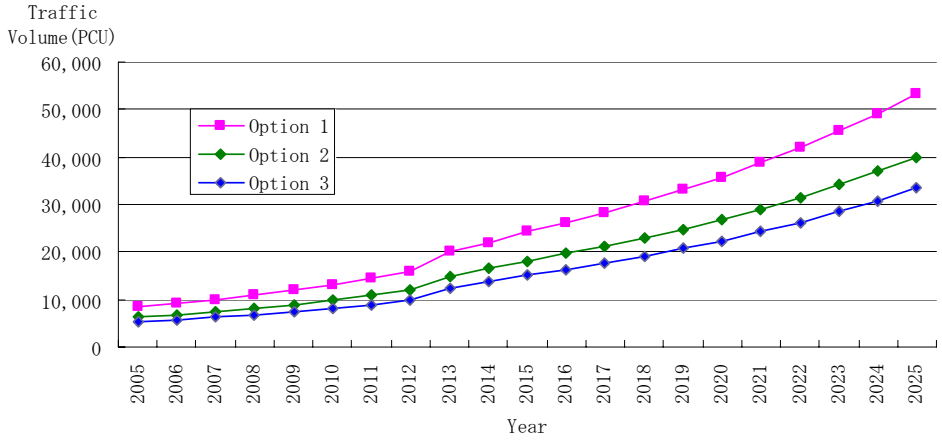
167. Firstly the team analyzed traffic volume in the future by three toll options (see Chapter3, 3.4). At this analysis, we eliminate option 3 from analysis because 3 times toll to existing highway is not possible according to the interviews to the authorities concerned. Noi Bai – Viet Tri section will generate high traffic volume with strong demand. It reaches 20,000PCU/day at earliest case, option 1, in 2011 and 2012 at option 2. It also reaches 40,000PCU/day at earliest case, option 1, in 2018, 2021 at option 2. Regarding initial engineering specification, the team recommends that the section 1 should start with 4 lanes and then expands it to 6 lanes until around 2018-21.

Figure 4- 1: Traffic Demand forecasting in Noi Bai – Viet Tri



168. Viet Tri – Yen Bai section will also generate high traffic volume. It reaches 20,000PCU/day at earliest case, option 1, in 2014 and 2017 at option 2. It also reaches 40,000PCU/day at earliest case, option 1, in 2022, 2025 at option 2. Regarding initial engineering specification, the team recommends that the section 2 should start with 4 lanes and then expands it to 6 lanes until around 2022-25.

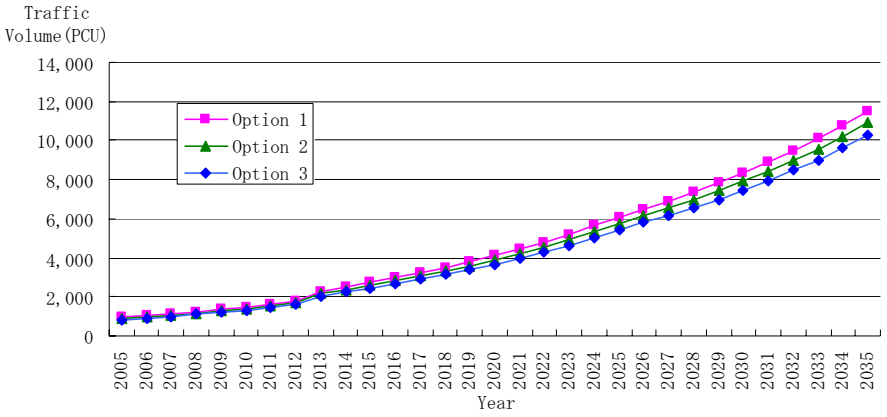
Figure 4- 2: Traffic Demand forecasting in Viet Tri – Yen Bai



169. Yen Bai – Lao Cai Section will generate low traffic volume. It reaches 3,000PCU/day around 2015, 6,000PCU/day around 2025. In 2035, about 30 years later,

it is expected to reach 10,000PCU/day. This result is because of low initial volume for estimation. But traffic of this section is not cost sensitive so that little difference among option1, 2 and 3. The team could not estimate by taking regional development effect and cross-border facilitation into account. So this estimation may be up warded by further study. Our conclusion is that regarding initial engineering specification, the section 3 should start with 2 lanes expandable to 4 lanes but expansion year must be confirmed by further study in the next phase.

Figure 4- 3: Traffic Demand forecasting in Yen Bai – Lai Cai



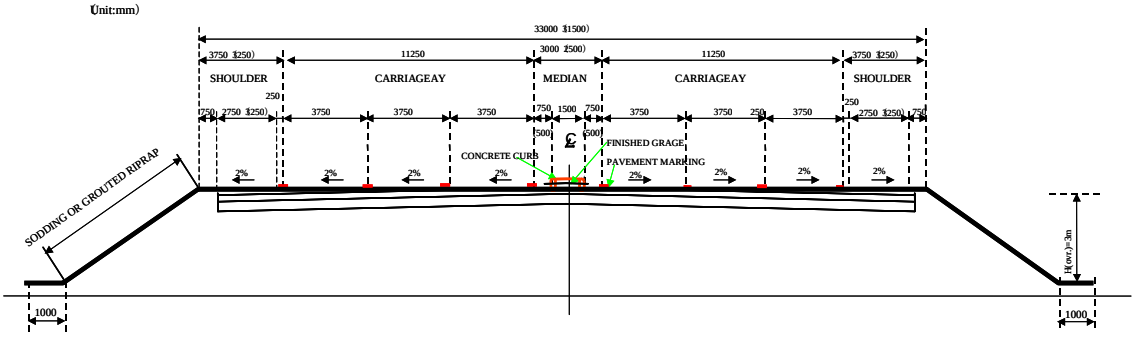
4.2.4 Technical Specification

170. Technical Specifications recommended for each section are:

Section 1 (Hanoi – Viet Tri) : 4 lanes expandable to 6 lanes.
Section 2 (Viet Tri – Yen Bai) : 4 lanes expandable to 6 lanes.
Section 3 (Yen Bai – Lao Cai) : 2 lanes expandable to 4 lanes
Based on the Vietnamese standards (Table 4-1), the team developed the technical specification.

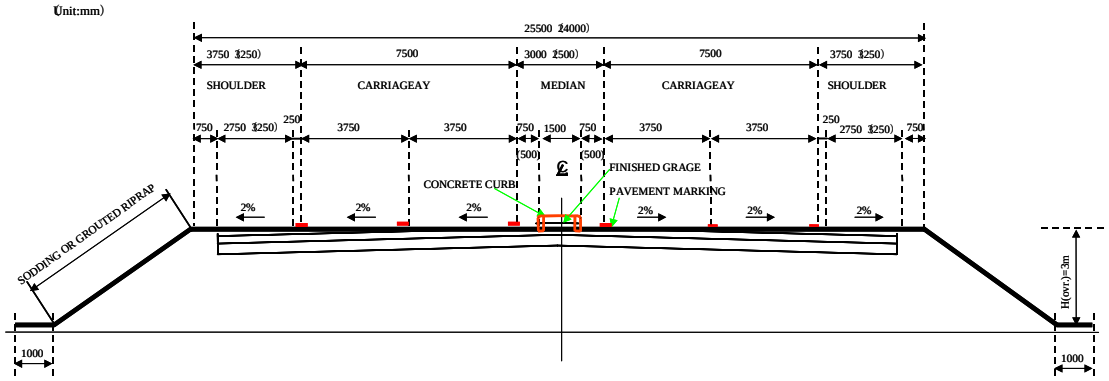
171. Regarding Hanoi – Yen Bai sections (Section 1 & Section 2), 4 lanes expandable to 6 lanes is consist of 3 (2.5) m of Median, 3.75m of two (three) lanes and 3.75m of shoulder in each way. Total width of road including Median, Carriageways and shoulders but excluding grouted riprap is 33m. The height of expressway is three meters from the ground. Required width for land acquisition is about 50m including buffer area outside of carriageway and shoulder. 4 lanes construction starts with two lanes in both sides and will expand to 6 lanes in the future (Figure 4-4).

Figure 4- 4 Technical Specification for Noi Bai – Viet Tri and Viet Tri – Yen Bai



172. Regarding Yen Bai – Lao Cai (Section 3), 2 lanes expandable to 4 lanes is consist of 3 (2.5) m of Median, 3.75m of one (two) lanes and 3.75m of shoulder in each way. Total width of road including Median, Carriageways and shoulders but excluding grouted riprap is 25.5m. The height of expressway is three meters as well as previous case. Required width for land acquisition is about 40m including buffer outside of carriageway and shoulder. There are two ways to start construction. One is starting with 2 lanes on one side and the other case is construction starts with one lanes in both sides and expand to 4 in the future. The two lanes on one side case are cheaper in terms of initial construction cost but a little bit difficult to expand fitting the first 2 lanes. One lane in both sides case is easy to expand from the technical point of view. But the cost may be almost the same as starting with full 4 lanes (Figure 4-5).

Figure 4- 5: Technical Specification for Yen Bai – Lao Cai



4.3. Selection of Expressway route alignment

4.3.1 Procedure and methodology for selecting route alignment

173. Alternative alignments for each expressway corridor were established and evaluated to select the most appropriate alignment in accordance with the following procedure:

Step-1: Preparatory Work

Field reconnaissance was undertaken along the expressway corridor to identify available public space and control points. To assess land use and urban development condition and to have an idea for possible alignment, Topographic maps (scale 1:50,000) and other bigger section maps are examined.

Step-2: Identification of Available Public Space

All available public spaces within the corridor such as roads, Provincial & National Road (PNR), rivers and government lands were identified based on the activities in STEP-1.

Step-3: Identification of All Control Points

All control points within the corridor were identified based on the activities in STEP-1 and plotted on the 1/50,000 topographic maps.

Step-4: Establishment of Alternative Alignment

Based on the findings of STEP-2 and STEP-3 and TOR request, several alternatives alignments were established, focusing on the maximum utilization of public spaces.

Step-5: Study on Connection with Related Expressways, National Road (NR) and Provincial Road (PR)

An alignment of related expressway, NR, PR, which are to be connected with the expressway, was roughly researched and a location of an interchange was selected.

Step-6: Establishment of Evaluation Criteria

Evaluation factors and indexes were selected and weight of each was determined.

Step-7: Preparation of Data Needed for Evaluation

Preliminary engineering study was conducted for each alternative alignment in order to prepare data for evaluation.

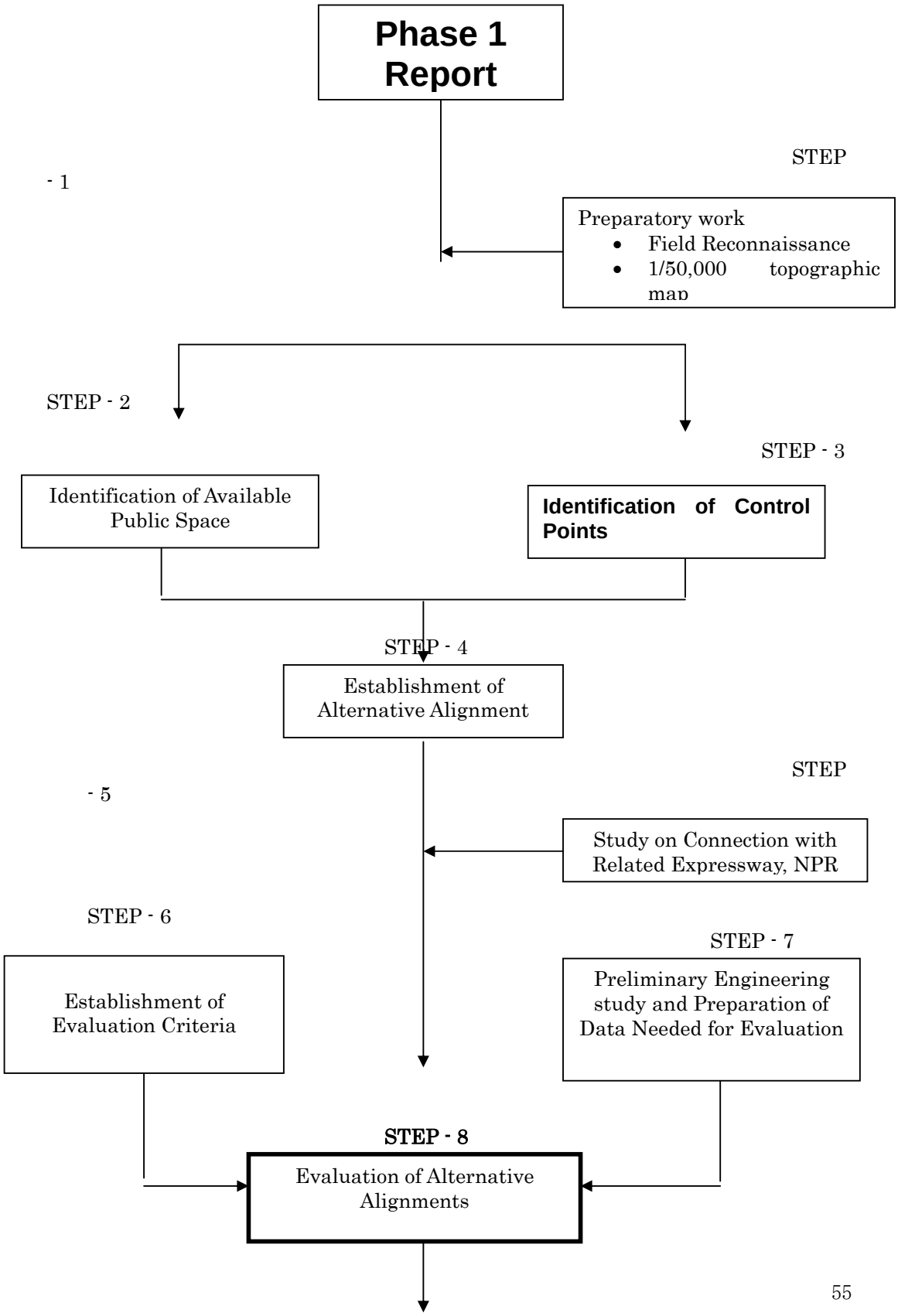
Step-8: Evaluation of Alternative Alignments

Each alternative alignment was rated in accordance with evaluation criteria and its ranking was determined.

Step-9: Selection of Most Appropriate Alignment

Based on the ranking as well as planning/engineering judgment, the most appropriate alignment was selected.

Figure 4- 6 : PROCEDURE FOR SELECTING MOST APPROPRIATE ROUTE ALIGNMENT



STEP - 9

Selection of Most Appropriate Alignment

4.3.2 Control Points

174. The team has classified control points into two depend upon degree of difficulty to relocate or demolish. We classified facilities, buildings and premises as follows:

Control points: Class – A

The relocation cost for those facilities, buildings and premises makes the expressway project much more expensive. Therefore, we do not think these facilities; buildings and premises cannot be replaced to other places. We call this category as 'class – A' including church, mosque, temple, chapel and other historic site, cemetery, military zone, permanent building more than 5 stories, hospital, Major Water supply Reservoir (MWSR) and National Reserve Park etc. We need to avoid these class-A control points definitely.

- Church, mosque and temple, chapel, historic site
- Cemetery
- Military zone
- Permanent buildings of more than 5 stories
- Hospital
- MWSR water reservoir
- National reserve Park

(The team has avoided passing through the above facilities)

Control points: Class – B

Class B control points is basically shall not be replaced. It includes factories, School, Permanent building of 3 to 4 stories and public market. An alignment must be planned to avoid these as much as possible.

- Factories
- Schools
- Permanent buildings of 3 to 4 stories
- Public markets

4.3.3 Methodology for developing alternative alignments

175. Basic principles for developing alternative alignments were as follows:

- Public spaces such as public roads, river banks, Provincial & National Road (PNR), ROW (Right of Way) and other available public lands shall be utilized to a maximum extent to avoid social problems associated with resettlement, to minimized ROW acquisitions costs and to attain smooth implementation.
- Control points classified as class A shall not be affected.

176. All control points along an expressway corridor and public spaces, which can be utilized for an expressway, were plotted on the topographic maps (scale 1/50,000) to develop alternative alignments. An alignment of a related expressway was studied to determine an appropriate interchange site. Based on above studies, alternative alignments were surveyed/investigated.

177. A preliminary engineering study was undertaken for each alternative alignment. Based on the above materials, rough costs both for construction and ROW

acquisition/compensation were estimated and other data as shown below were also attained:

- Route length
- Land ownership (private or public) along an expressway
- Land areas to be acquired
- Number of residential houses squatter shanties
- Number of commercial building, factories, warehouses and gasoline station
- Number of schools
- Number of permanent buildings of 2 or 3 stories
- Section length, which passes through residential areas.

4.3.4 Selecting interchanges and service areas

178. To select inter changes, the team conducted deskwork, field survey and interviews to Provincial Department of Transport to hear about their requests to the expressway. Basically, the expressway accommodates long distance trip so that the number of interchange should be controlled with every 15 – 20 km. Our criterions are

- Should be developed in the intersection with the existing National Highways and major provincial roads
- Consider the accessibility of populated area such as city center, town and village
- Coordination and harmonization of local development by interviews for the Provincial government
- After determined the interchanges, service areas shall be placed based on the consideration of appropriateness by taking the location of interchanges into account.

179. The team recommends the following 16 interchanges.

Table 4- 2 : selected interchanges

No	Station	Interchange description
1	Km 0+000	1. Starting point at Km 8+450 of NR.2, near NoiBai airport.
2	Km 7+400	2. Intersection with PR 317 from VinhYen to Dai lai resort & Xuan Hoa Industrial zone
3	Km 23+600	3. Intersection with NR 2C from VinhYen to TamDao resort
4	Km 38+800	4. Intersection with PR 311 from VinhYen to Lap Thach. Industrial zone
5	Km 53+400	5. Intersection with Km71+100 of NR.2 to VietTri, DoanHung TuyenQuang
6	Km 62+500	6. Intersection with Ho Chi Minh Expressway
7	Km 74+000	7. Intersection with NR No.32Cfrom YenBai to VietTri
8	Km 93+750	8. Intersection with PR 323 linking districts HaHoa, YenLap and SongThao of PhuTho province.
9	Km 118+000	9. Intersection with with NR No37 linking ThaiNguyen, TuyenQuang, YenBai, SonLa… provinces

10	Km 145+000	10. Intersection with PR linking districts both sides of Hong river through Van Yen bridge, close with Mau A town, capital of VanYen district.
11	Km 159+900	11. Intersection with PR 151 going close with Hong river, linking Lao cai and Yen Bai cities, crossing the river at Trai Hut Ferry, Km 160
12	Km 191+950	12. Intersection with NR.279 linking Lai chau, SonLa, LaoCai, HaGiang, TuyenQuang, BacCan,... provinces and crossing Hong river at TanAn bridge, near with Km 192 of the Expressway.
13	Km 224+600	13. Intersection with PR No151 linking LaoCai (through NR 4E) and YenBai cities. Near of Pho Lu bridge on NR 4E.
14	Km 238+100	14. Intersection with PR to PomHan, Cam Duong, vast industrial and mining zone
15	Km 247+250	15. Intersection with NR 4D from LaoCai city to SaPa resort and beyond, to LaiChau province
16	Km 253+000	16. Kim Thanh Economy & Industrial zone at VietNam - China border

Note) NR= National Road, PR=Provincial Road

180. The team conducted the interview survey to the provincial government. The provincial government of Phu Tho resquested 7 interchanges within the province (from Km 7 to Km 45) in the interview meeting with the team. However as the minimum distance between interchanges 15km, the team had selected the 3 interchanges with No.2 (intersection with PR.317 at Km7+400), No.3 (intersection with NR.2 at Km 23+600) and No.4 (intersection with PR.311 at Km 38+800). Yen Bai and Lao Cai province had no objection with the consultant's proposal (Table 4-2).

181. The team had proposed three small service areas with fuel filling and small repair station, restaurant and bathroom for relatively long distance between interchanges. Road users can seek for all kind of services in existing towns along the expressway through interchanges. so service areas are not necessarily located at many places. The three service areas are located at Km139 + 000, around 6 km far from Interchange No. 10, Km174 + 200, around 14. 30 km far from Interchange No. 11, Km 205 + 500, around 13.55 km far from Interchange No. 12

4.3.5. Result of Alignment Selection

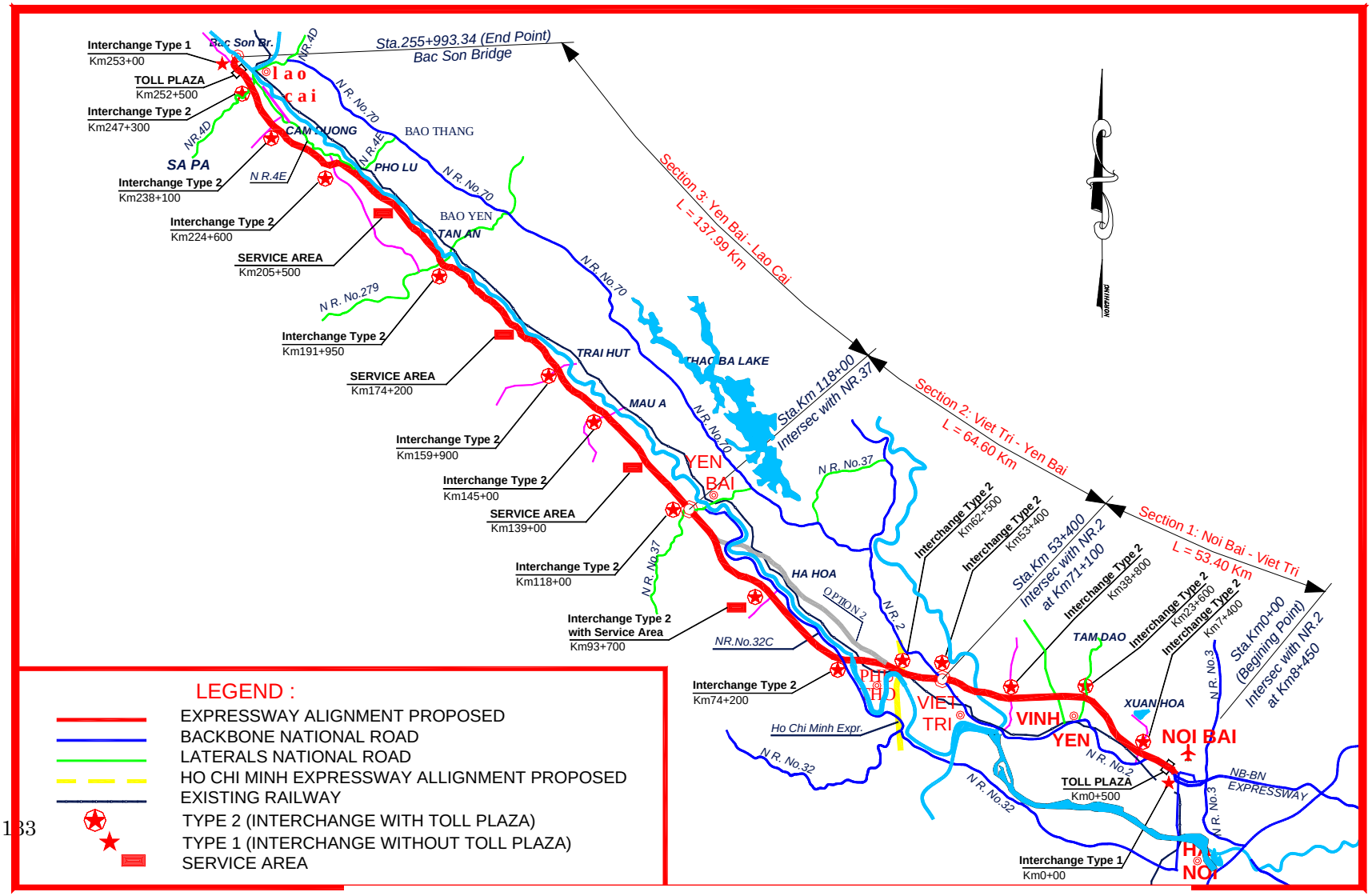
182. The Team conducted several field surveys to find necessary public works such as replacement of existing provincial and rural road to flyover bridges/underpass to maintain local accessibility, viaducts in valleys, bridge and tunnels for the expressway.

183. The whole Project is a 256 km long with 53.4km of Noi Bai – Viet Tri, 64.6km of Viet Tri – Yen Bai and 138km of Yen Bai – Lao Cai. Total number of interchanges is 16 and service area is 4. There are a number of flyover bridges in Noi Bai- Vie Tri Section with 10, Viet Tri – Yen Bai and Yen Bai – Lao Cai with 5 each. There are a lot of underpasses in the section of Viet Tri – Yen Bai and Yen Bai – Lao Cai. All Viaducts and Tunnels are in the section of Yen Bai – Lao Cai (Table 4-3, Figure 4-7).

Table 4- 3 : Result of Alignment for the expressway

	Total	Noi Bai – Viet Tri	VietTri - YenBai	YenBai -Laocai
Total length (km)	256.0	53.4	64.6	138
Road Surface Width (m)	-	33	33	25.5
Number of Lane	-	6	6	4
Number of Interchanges	16	5	4	7
Number of Service Area	4	0	1	3
Number of Flyover Bridge	20	10	5	5
Number of Underpass	89	12	33	44
Number of River Bridge	59	7	7	45
Number of Viaduct	5	0	0	5
Number of Tunnel	4	0	0	4

Figure 4- 7 : Proposed Initial Alignment for the Expressway

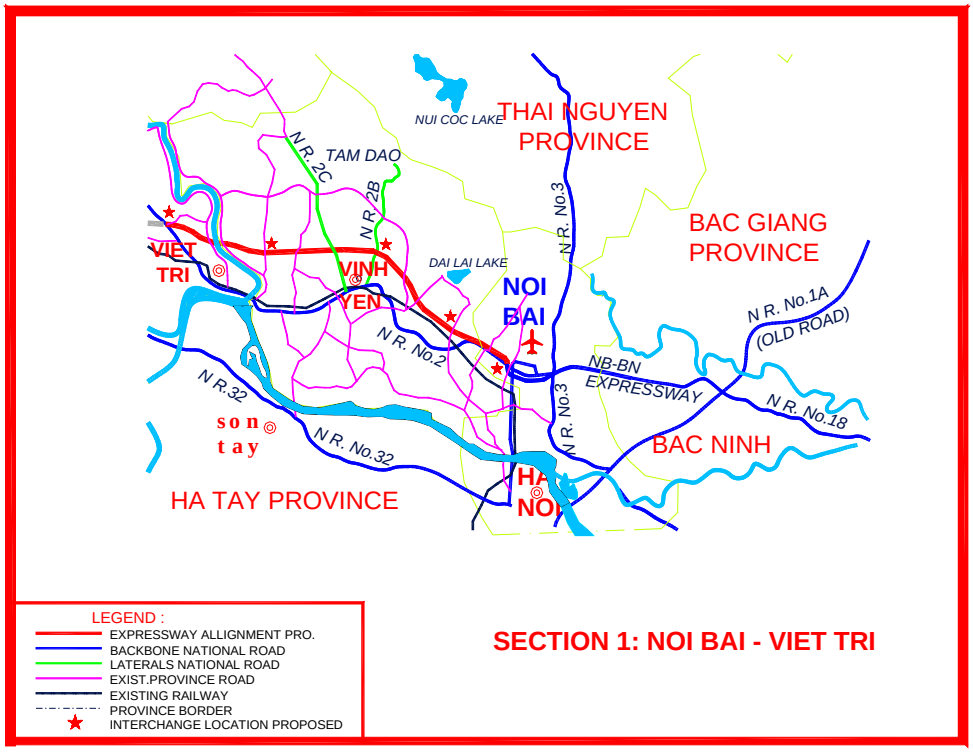


(1) Section 1: NoiBai-VietTri, 53.4 Km long

184. Starting by Km 8+450 of National Road (NR) 2, the expressway goes through parallel with NR2 to west direction, after crossing Ca lo river (Km 5+800), turns to North-West direction, crossing Provincial Road (PR) 317 (Km 7+400), PR317B two km far from NR2, PR 314 four (4) Km far from NR2 (Km 20+500), turns left to west direction at North of Dinh Mountain crossing NR2B at Kim Long commune (Km 28+500), PR 310 at An Hoa commune (Km32), PR 21 at Xuan Quang commune (Km 39).

185. Section from Km 10 to Km 40 complies with Vinh Yen province Master Plan. The alignment crosses PR 306 and Lo river (km 46+100) at Hung Lo commune, NR2 at Km 71 +100, (Km 53 +400 of expressway), north of Hung Temple historic site.

Figure 4- 8 : Proposed Initial Alignment of Hanoi – Viet Tri Section



(2) Section 2: VietTri- YenBai 64.6 Km long

186. The alignment crosses Provincial Road (PR) 310 at Tien Tien commune (Km 56), the railway to Bai Bang Paper Milling Fabric (km58+900), PR325 and future Ho Chi Minh expressway at Ha Thach commune, PR 315 at Van Lung commune (Km 65+500). From this, there are 2 options following East or West bank of Hong River (Figure 4-9).

West Bank option:

The alignment crosses Hong river at a narrowest section at Song Thao commune then turns to North-West direction, runs parallel with the Red river and NR 32C through Son Nga commune (Km 78), Dong Cam (Km 82), Van Lang (Km 92), Bang Gia (Km 95), Xuan Ang (Km 100), Hien Luong (Km 105), Minh Quan (Km 110), Hop Minh (Km 115), crosses NR 37 at Tran Thanh commune (Km 118).

East bank option:

From Km 65 to Tri Tien commune (Km 72), Yen Noi (Km 77), PR 312 (Km 79), a PR of Chinh Cong commune (Km 86+ 200), PR 314 at Am Ha commune (Km 92), Phu Khanh commune (Km 98), Dan Thuong (Km 103), crosses Hong river at Lien Phuong commune (Km 106 + 700), then joins West option at Km 110.

Preference is made to the West Bank option (see table: Comparison for West Bank and East Bank Options)

187. Length is almost the same as West 44.7km vs. East 43.5km. The construction costs are almost the same. However resettlement cost of West is lower than East. East side where more populated. New bridges across Hong River are necessary for West Bank Option, but not always necessary for East Bank Option. West Bank Option will develop west side of Hong River and improve connectivity between both sides. After taking these points into account, the team recommend ' West Bank' Option for promoting and helping development for the west bank (Table 4-4, Figure 4-10).

Table 4- 4 : Comparison for West Bank and East Bank
Section Viet Tri - Yen Bai

Main construction items	Unit	West	East
Underpasses for rural roads	Each	29	12
Flyovers for local roads	Each	1	20
Interchanges	Each	2	2
Culverts	Each	22	21
Small bridges	Each/m	4/60	6/96
Medium bridges	Each/m	1/50	2/100
Large bridges	Each/m	2/1050	1/950
Bridge crossing railway	Each	Combined with Hong river bridge	1
Length	Km	44.7	43.5
Comments		1. Due to railway runs right at the toe of the dike of Red river that is narrowest at this location, the bridge crossing Red River & the flyover-crossing railway can be combined in one unique bridge of 750m long. 2. Location of bridge crossing	1. A Red River bridges of 950m long and a bridge-crossing railway need to be constructed separately. 2. The bridge crossing Red River is 8 Km and 70 Km far from Van Phu and Phong Chau bridges respectively

		Red River is more rational: nearly in the middle of the two existing bridges crossing Hong river (48 Km and 30 Km far from Van Phu and Phong Chau bridges respectively).	

Figure 4- 9 : East bank and west bank options between Viet Tri and Yen Bai

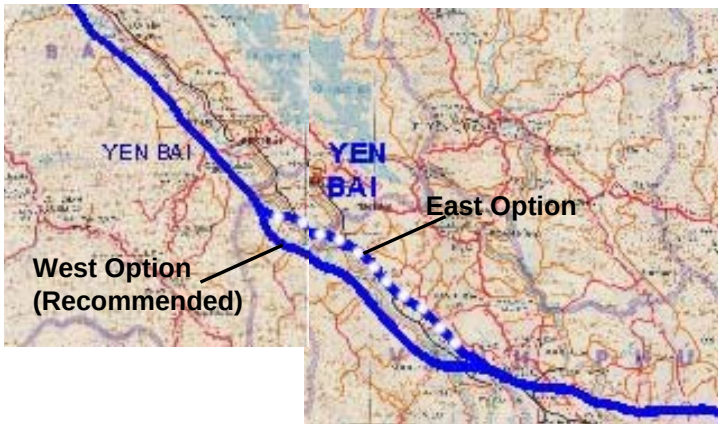
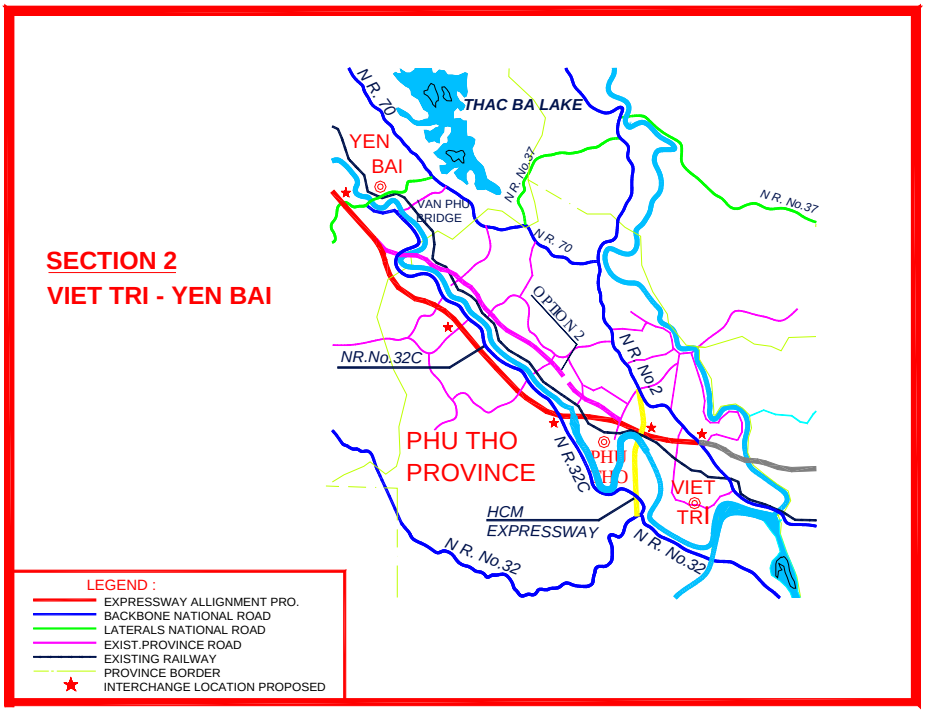


Figure 4- 10 : Proposed Initial Alignment of Viet Tri – Yen Bai Section

SECTION 2

VIET TRI - YEN BAI



(3) Section 3: YenBai – LaoCai, 138 Km long

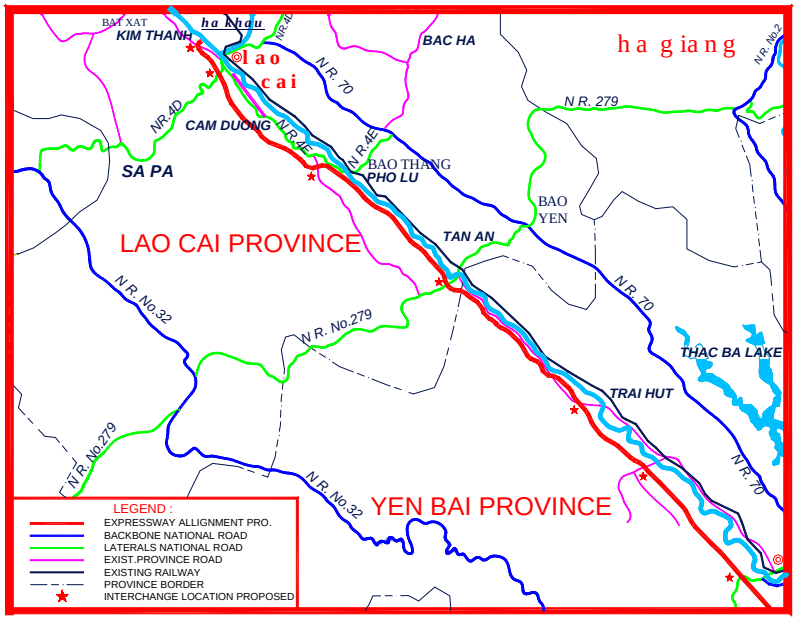
188. From NR 37, the expressway runs through Tri Tien commune (Km 122), Quy Mong (Km 130), Xuan Ai (Km 135), Thia river at Yen Hop commune (Km 140), then runs closely with Hong river, meets the PR to Van Yen bridge (km 145) crossing Hong river to Mau A town on West bank, Thac river at Tan Hop commune (Km 151), Gianh and Hut rivers (Km 188), crossing PR 151 (Km 160) to Trai Hut ferry boat.

189. The alignment continues between Hong river and mountains of Chau Que Ha commune (Km 170), Chau Que Thuong (Km 177), Tan An (Km 187), meets PR 279 (Km 192) crossing Hong river to Pho Rang, Tan Thuong commune (Km 193).

190. There will be three tunnels of 350m, 400m, and 300m long at Km 156 + 600, Km 157 + 300, and Km 202 + 950 respectively at Cam Con commune. Then the Expressway crosses Nhu river (Km 211), Son Ha commune (Km 277), passes a tunnel of 500m long (Km 253 + 250), meets PR 157 to Tang Loong industrial/mining zone and to NR 4E going Pho Lu.

191. It runs parallel with NR4E, crosses Cam Duong-Pom Han (Km 238), NR 4D (Km 247). From Km 249, there will be two options to Kim Thanh bridge (Km 254 + 050) or Bac Son/ Quang Kim bridge (Km 255 + 993) at the PRC border. Both options have not much difference and the selection of which is at the discretion of the two Governments.

Figure 4- 11 : Proposed Initial Alignment of Yen Bai – Lao Cai Section



APPENDIX

4.4. Cost Estimation and Project Implementation plan

4.4.1 Cost Estimates

192. Construction will be implemented into two phases. The first phase is assumed to cover the following scope:

- Section 1 Hanoi –VietTri:
  6 lanes ROW/land acquisition, 4 lanes pavement construction

- Section 2 VietTri – YenBai:
  6 lanes ROW/land acquisition, 4 lanes pavement construction

- Section 3 YenBai – LaoCai:
  4 lanes ROW/land acquisition, 2 lanes pavement construction

These are the scope of cost estimating of this report.

193. The second phase, which are expanding to 6 lanes pavement from 4 lanes over the section on Ha Noi – Yen Bai, and to 4 lanes pavement from 2 lanes over the section of Yen Bai – Lao Cai. The construction of the second phase will bring the expressway to its full status: However the second phase construction was not included in the scope of cost estimating.

194. For the first phase, land acquisition is assumed to be done for full lane of 6 lanes with Ha Noi – Yen Bai and 4 lanes with Yen Bai – Lao Cai. Regarding earthwork and pavement, there are two technical options for construction of Sections 3 (Yen Bai – Lao Cai).

(1) 2 lanes in one side case: to construct the first 2 lanes in one side of the separation strip (the median) with the following advantage and disadvantage
- Minimizes investment in the first phase of construction
- Causes additional volume of work in the 2nd phase of construction (the completion phase) due to removal part of temporary shoulder, ditch, slope protection...
- No separation for the 2 traffic directions:

(2) 2 lanes in both sides case: to construct the first 2 lanes both side of the median with the following advantage and disadvantage
- Investment in the first phase of construction is higher than 2 lanes in one side case.
- Nearly no additional volume of work
- Traffic safety is insured by the separation strip

The team considered above two technical options carefully and determined to adopt 2 lanes in one side case because of low traffic volume for the section.

195. Regarding cost estimation, the team accumulates (A) Major construction with Earth work, Pavement, Shoulder, Median, Drainage system, Bridges, Replacement of existing roads with Overpass & Underpass, Interchanges, Service Areas, Viaducts, Tunnels, Guardrail, Lightning and safety such as signing, marking, fencing, maintenance & management house, toll station, stopping area etc. based on alingment with major cross section, (B) Other expenditure with Mine Clearance, Resettlement and Rehabilitation, survey, design and supervision (8% of Major construction), (C) Contingency with physical (10% of the sum of (A)Major construction and (B)Other

expenditure) and Cost escalation (10% of the sum of (A)Major construction and (B)Other expenditure).

196. The grounds for the estimates are Government Decrees, Ministry Decree, Circulars and Decisions and other relevant Papers such as Norms for Capital Construction Cost Estimation by MOC (Ministry of Transport), - Price Table for Equipment Shift (Ministry of Construction).

197. The team tried as much as possible to estimate accurately. For instance, to estimate earthwork cost we have assumed the executing agency to buy the same volume to the remaining (just shortage) after using soil coming from cutting hilly section. Other major facilities such as Median, Drainage system, Bridges, Overpass & Underpass, Interchanges, Viaducts, Tunnels, Guardrail, Lightning and safety are taken over the existing case in Viet Nam. At the end, unit prices range from 2.1 in the section of Yen Bai – Lao Cai to 2.8 in Hanoi – Vie tri, . Total cost of the project $ 620 millions (Table 4-5) with $ 147.7 millions of Ha Noi – Viet Tri (Table 4-5,4-6), $ 177.3 millions of Viet Tri – Yen Bai (Table 4-5,4-7) and $ 295 millions of Yen Bai-Lao Cai Section (Table 4-5, 4-8).

Table 4- 5 : Summary of Cost Estimation

No	Section	Million VDN	Million USD	Unit Price (Million USD/km)
1	Hanoi - Viettri 53.40km	2,342,865	147.7	2.8
2	Viettri - Yenbai 64.60km	2,811,620	177.3	2.7
3	Yenbai - Laocai 137.99km	4,679,354	295.0	2.1
	Total 256km	9,833,839	620.0	2.4

Notes

1., 2. : 4 lanes construction with 6 lanes Right of Way / Land Acquisition

3. : 2 lanes construction with 4 lanes Right of Way / Land Acquisition

198. To confirm justification of the cost estimation, Following are some cost estimates of other Projects being implemented in Vietnam for comparison/reference, namely:

- The actual unit cost for the Hanoi – Bac Ninh highway with 4 lanes which is expandable to 6 lanes was **$ 1.08 million /km** as of June 2002
- Tran Hung Dao Boulevard from Lao Cai to Cam Duong, 10km long, 3.75m*4 lanes (15 m carriageway and 10m lane for non – motorized vehicle) is **40 billion VND/km ($2.36 million /km)**

Table 4- 6 : Cost Estimation for Hanoi (Noi Bai) - Viet Tri

No	Items	Price(VND)	Price(USD)
A	**Construction = A1 + A2**	**1,681,208,617,597**	**106,003,566**
A1	**Main construction**	**1,571,223,007,100**	**99,068,753**
	Earthwork	**404,223,210,000**	**25,487,082**
	Pavement	**247,642,500,000**	**15,614,355**
	Shoulder	**60,386,188,500**	**3,807,470**
	Median	**10,457,268,600**	**659,352**
	Drainage system	**53,632,840,000**	**3,381,658**
	Bridges	**346,781,000,000**	**21,865,236**
	Overpass & Underpass	**147,700,000,000**	**9,312,780**
	Interchange	**120,000,000,000**	**7,566,240**
	Viaduct	**0**	**0**
	Tunnel	**0**	**0**
	Guardrail	**36,400,000,000**	**2,295,093**
	Lighting	**10,500,000,000**	**662,046**
	Transport safety*1	**133,500,000,000**	**8,417,442**
A2	**Other construction = 7% A1 *2**	**109,985,610,497**	**6,934,813**
B	**Other expenditures**	**271,179,329,408**	**17,098,399**
1	Mine Clearance	9,078,000,000	**572,386**
2	Resettlement and Rehabilitation	117,480,000,000	**7,407,349**
3	Survey, Design and Supervision (8%)	144,621,329,408	**9,118,664**
C	**Contingency**	**390,477,589,401**	**24,620,393**
1	Physical =10% (A+B)	195,238,794,700	**12,310,196**
2	Cost/Escalation =10% (A+B)	195,238,794,700	**12,310,196**
	Total cost = A+B+C	**2,342,865,536,406**	**147,722,358**
	Total cost per km	***43,873,886,450***	**2,766,336**
	Construction cost per km	**31,483,307,446**	**1,985,086**

*1 : signing, marking, fencing, maintenance and management house, toll station, stopping areas…

*2 mobilisation, demobilisation, constructor facilities, temporary works…

Note: 6 lanes land acquisition, 4 lanes construction

Table 4- 7 : Cost Estimation for Vie Tri - Yen Bai

No	Items	Price	Price(USD)
A	**Construction=A1+A2**	**2,043,519,603,457**	**128,847,794**
A1	**Main construction**	**1,909,831,405,100**	**120,418,499**
	Earthwork	**560,414,201,000**	**35,335,180**
	Pavement	**332,150,250,000**	**20,942,704**
	Shoulder	**80,001,124,500**	**5,044,223**
	Median	**15,180,741,600**	**957,175**
	Drainage system	**79,203,088,000**	**4,993,905**
	Bridges	**346,792,000,000**	**21,865,895**
	Overpass & Underpass	**148,750,000,000**	**9,378,970**
	Interchange	**150,000,000,000**	**9,457,785**
	Viaduct	**0**	**0**
	Tunnel	**0**	**0**
	Guardrail	**25,840,000,000**	**1,629,261**
	Lighting	**10,000,000,000**	**630,519**
	Transport safety * 1	**161,500,000,000**	**10,182,882**
A2	**Other construction = 7% A1 * 2**	**133,688,198,357**	**8,429,295**
B	**Other expenditures**	**299,496,768,277**	**18,883,840**
1	Mine clearance	9,660,000,000	**609,081**
2	Resettlement and Rehabilitation	116,280,000,000	**7,331,675**
3	Survey, Design and Supervision (8%)	173,556,768,277	**10,943,084**
C	**Contingency**	**468,603,274,347**	**29,546,327**
1	Physical =10% (A+B)	234,301,637,173	**14,773,163**
2	Cost/Escalation =10% (A+B)	234,301,637,173	**14,773,163**
	Total cost = A+B+C	**2,811,619,646,080**	**177,277,961**
	Total cost per km	***43,523,523,933***	**2,744,241**
	Construction cost per km	**31,633,430,394**	**1,994,548**

＊1 :signing, marking, fencing, maintenance and management house, toll station, stopping areas…

＊2 :B30mobilisation, demobilisation, constructor facilities, temporary works…

Note: 6 lanes land acquisition, 4 lanes construction

Table 4- 8 : Cost Estimation for Yen Bai - LaoCai

No	Items	Price	Price(USD)
A	**Construction=A1+A2**	**3,461,583,800,370**	**218,258,743**
A1	**Main construction**	**3,235,125,047,075**	**203,980,134**
	Earthwork	**973,563,845,000**	**61,384,855**
	Pavement	**350,586,112,500**	**22,105,050**
	Shoulder	**69,863,070,375**	**4,404,985**
	Median	**0**	**0**
	Drainage system	**116,608,519,200**	**7,352,365**
	Bridges	**266,653,500,000**	**16,812,956**
	Overpass & Underpass	**40,900,000,000**	**2,578,815**
	Interchange	**210,000,000,000**	**13,240,857**
	Viaduct (5 units/1350m)	**354,375,000,000**	**22,343,946**
	Tunnel (4 units/1550m)	**465,000,000,000**	**29,319,041**
	Guardrail	**27,600,000,000**	**1,740,227**
	Lighting	**15,000,000,000**	**945,776**
	Transport safety * 1	**344,975,000,000**	**21,751,260**
A2	**Other construction = 7% A1 * 2**	**226,458,753,295**	**14,278,609**
B	**Other expenditures**	**437,878,240,030**	**27,608,967**
1	Mine Clearance	11,039,200,000	**696,040**
2	Resettlement and Rehabilitation	137,990,000,000	**8,700,504**
3	Survey, Design and Supervision (8%)	288,849,040,030	**18,212,423**
C	**Contingency**	**779,892,408,080**	**49,173,542**
1	Physical =10% (A+B)	389,946,204,040	**24,586,771**
2	Cost/Escalation =10% (A+B)	389,946,204,040	**24,586,771**
	Total cost = A+B+C	**4,679,354,448,480**	**295,041,253**
	Total cost per km	***33,908,365,569***	**2,137,980**
	Construction cost per km	**25,083,940,582**	**1,581,585**

＊1 :signing, marking, fencing, maintenance and management house, toll station, stopping areas…

＊2 :mobilisation, demobilisation, constructor facilities, t+B69mporary works…

Note: 4 lanes land acquisition, 2 lanes construction

4.4.2 Project implementation

199. The team tentatively determined for the allocation of fund through discussion with the Government and ADB. Table 4-9 shows that Start with first two years for the section of Noi Bai – Viet Tri after completion of Noi Bai – Viet Tri will follow other sections. This allocation is used for the financial viability analysis in Chapter 6.

Table 4- 9 : TENTATIVE ANNUAL INVESTMENT

Section	Total Cost for the First Phase Construction		2008	2009	2010	2011	2012
	1000000VND	$1000UD	$1000UD	$1000UD	$1000UD	$1000UD	$1000UD
HaNoi VietTri 53.40 km	**2,342,865**	147,722	73,861	73,861			
VietTri YenBai 64.60 km	**2,811,620**	177,277			59,092	59,092	59,092
YenBai LaoCai 137.99 km	**4,679,354**	295,041			98,347	98,347	98,347
TOTAL	**9,833,839**	**620,040**	**73,861**	**73,861**	**157,440**	**157,440**	**157,440**

Notes:

1. **Figures in bold** are taken from table 4.2

2. The the 1st phase construction is assumed as follows:
- Section HaNoi VietTri: 6 lanes Row, 4 lanes Construction - Period of construction: 2008-2009
- Section VietTri YenBai: 6 lanes Row, 4 lanes Construction - Period of construction: 2010-2012
- Section YenBai LaoCai: 4 lanes Row, 2 lanes Construction - Period of construction: 2010-2012

3. Should the Annual Investment of this Base case do not fit with fund allocated, one can develop another more relevant construction phasing scenario.

図表目次

Chapter 5. Economic Analysis

Chapter 5. Economic Analysis

200. The quantitative economic analysis, EIRR (Economic Internal Rate of Return), was conducted in 2005 constant prices in dong (VND). As with the FIRR (Financial Internal Rate of Return) calculation, the investment cost excludes contingencies and financial costs. A shadow exchange rate of 1.05 was applied to the foreign currency portion of the capital cost (50% of the total) in order to convert the foreign currency portion into domestic economic price.

201. The main economic benefits considered in the evaluation are: (i) savings in vehicle operating costs (VOC) and (ii) passenger value of time (VOT) savings. While the improvement in safety should be significant, we did not succeed in acquiring a usable accident data. Therefore, this was not included in the quantitative analysis.

202. In order to make a with/without comparison for the expressway and the existing roads, the designed traffic volume and the length of the sections were identified as follows(Table 5-1). Most of the savings in distance occurs in the YenBai-LaoCai section, where the existing highway is in an extremely poor condition. Also, in order to take the physical limitation of the roads into consideration, it is assumed that both the existing highways and the proposed Expressway can allow only up to twice the designed traffic volume.

Table 5- 1 : Comparison of the Existing Highway and the Proposed Expressway

		lanes	designed traffic volume	Length
Hanoi-VietTri	Highway No.32	2	9,000 PCU/day	
	Highway No.2	2	9,000 PCU/day	
	Total Existing	-	18,000 PCU/day	53.4 km
	Proposed Expressway	4	48,000 PCU/day	53.4 km
VietTri-YenBai	Highway No.32c	2	8,000 PCU/day	
	Highway No.2+No.70	2	9,000 PCU/day	
	Total Existing	-	17,000 PCU/day	70.0 km
	Proposed Expressway	4	48,000 PCU/day	64.6 km
YenBai-LaoCai	Highway No.70	2	6,000 PCU/day	
	Total Existing	-	6,000 PCU/day	174.9 km
	Proposed Expressway	2	10,000 PCU/day	137.9 km
Total	Existing Highway			293.0 km
	Proposed expressway			256.0 km

203. The following assumptions were used for the VOC savings

1. Since there are no comparable expressways in Vietnam, the parameter for the VOC calculations were determined using the

results from similar projects in China[6]. The VOC savings mentioned in the referred project is shown in Table.

Table 5- 2 : Unit VOC for Southern Yunnan Road Development Project
(1999 Yuan per Vehicle)

Level of Congestion	Car/ Minibus	Large Bus	Small Truck	Medium Truck	Large Truck	Trailer
Expressway						
0	72.79	160.77	91.07	132.16	158.12	210.82
0.1	73.41	162.81	92.09	133.95	160.4	213.87
0.2	73.99	164.86	93.1	135.79	162.75	217.01
0.3	74.53	166.95	94.09	137.67	165.18	220.24
0.4	75.04	169.06	95.07	139.59	167.68	223.57
0.5	75.55	171.22	96.05	141.56	170.26	227.02
0.6	76.07	173.45	97.04	143.57	172.95	230.6
0.7	76.64	175.77	98.07	145.62	175.76	234.34
0.8	77.29	178.21	99.14	147.74	178.7	238.27
0.9	79.26	185.14	101.39	155.1	184.17	245.57
1	88.96	209.86	110	176.28	196.36	261.81
1.1	89.53	211.87	111	178.12	198.6	264.81
1.2	90.11	213.87	112.01	179.96	200.85	267.8
1.3	90.68	215.88	113.01	181.8	203.1	270.8
1.4	91.26	217.88	114.01	183.64	205.34	273.79
Class III Road						
0	98.42	203.35	117.36	193.83	213.73	284.97
0.1	99.44	206.44	118.88	196.93	216.92	289.23
0.2	101.25	211.39	121.18	202.33	221.51	295.35
0.3	104.15	218.5	124.51	210.41	227.71	303.62
0.4	108.61	228.35	129.25	221.79	235.93	314.58
0.5	115.35	241.74	135.94	237.41	246.73	328.58
0.6	125.35	259.79	145.33	258.58	260.9	347.86
0.7	153.81	318.88	174.92	327.8	307.54	410.05
0.8	168.46	353.33	191.82	367.19	335.4	447.2
0.9	188.03	399.22	214.4	419.71	372.28	496.38
1	215.44	463.38	246.04	493.21	423.56	564.75
1.1	216.46	466.78	247.8	496.49	426.75	569
1.2	217.47	470.17	249.57	499.77	429.94	573.26
1.3	218.49	473.57	251.33	503.05	433.14	577.52
1.4	219.51	476.96	253.1	506.33	436.33	581.77

Source: ADB 1999.

[6] ADB 1999, *Proposed Loan: Southern Yunnan Road Development Project*, RRP PRC 30081, Asian Development Bank, Manila, p. 31 Table 4.

2. VOC consists mainly of fuel savings, tire savings, labor cost savings (of maintenance and driver/assistants), and vehicle depreciation through aging and use. Judging from the prevailing prices in the region, while the fuel cost and the vehicle cost is slightly higher in Viet Nam, the labor cost is lower. These two factors will more or less offset each other, which makes it likely that the overall unit VOC in Viet Nam is slightly higher than the Southern Yunnan figure, although not by much. It is very unlikely that using the Chinese figure would result in an over-estimation of the VOC savings. Therefore, the team has considered it acceptable to use this figure.

204. The second portion of the savings comes from savings in travel time. Value of time was derived from GDP per capita ($ 600), which was converted into a hourly income assuming an 190 hour labor per month and the composition of the labor force against the total population (52.6%)[7]. In order to adjust for difference in value of time for users of different vehicles, income factor was applied[8]. VOT of the driver and assistance for each vehicle is excluded, since they are taken care of in the VOC calculation. VOT for cargo was not considered, since they are generally insignificant and also because of lack of reliable data.

Table 5- 3 : VOT Unit cost and Number of Passengers for Each Vehicle Type

	Type of vehicle	GDP/labor hour (VND)	Income factor	VOT/ Passenger /hour	No. of Passengers
PAX	Tourist car/ Jeep	7,929	1.8	14,272	2
PAX	Small coach (<25 seats)	7,929	1	7,929	15
PAX	Big coach (>=25 seats)	7,929	1	7,929	21
PAX	Motorbike/ Lambretta	7,929	1.2	9,515	0
FREIGHT	Light truck (<2.5 tone)	7,929	1	7,929	0
FREIGHT	Medium truck (>2.5 tone, <	7,929	1	7,929	0
FREIGHT	Heavy (3 axles)	7,929	1	7,929	0
FREIGHT	Very Heavy (>3 axles)	7,929	1	7,929	0
FREIGHT	Container	7,929	1	7,929	0
FREIGHT	Other	7,929	1	7,929	0

Source: EIU 2005, TEDI 2003.

205. The calculation of VOC and VOT savings consists of three parts; the savings incurred by the converted traffic onto the new Expressway, the savings incurred by the generated traffic on the new Expressway, and the savings incurred on the existing national highways (caused by the reduction in congestion due to the diverted traffic onto the new Expressway). Of these three, this study focuses on the first two, and omits the savings incurred on the existing national highways. The reason is that since the existing highways (especially the section Hanoi-Viet Tri) are saturated as of 2010, and even after the initial reduction due to the expressway, it will revert back to its full capacity in a few years, making the amount of savings quite small.

206. The demand forecast in Chapter 3 estimated that there will be an additional 15% of traffic will be generated due to the new Expressway. It would have been simple if one could treat this additional 15% as the generated traffic. This figure, however, focuses on

[7] EIU 2005, *EIU Country Forecast Vietnam,* EIU, London, pp. 10-11.
[8] TEDI 2003, *Draft Final Report Pre F/S on "Gie - Vinh Expressway Project",* TEDI, Hanoi. (in Vietnamese)

the potential demand, which does not take into account of the physical constraint of the existing highways. Based on the assumed demand increase, the existing highways will have 2.5 times the designed traffic volume without the 15% generated traffic, which is unlikely to fit onto the road infrastructure. This study assumes that the maximum physical limit of a road will be twice the designed traffic volume. Therefore, there will be unrealized pent-up demand that will go onto the new Expressway, which should also be treated as generated traffic, in addition to the 15% purely generated traffic. Therefore, the calculation of the converted PCU and generated PCU are made using the following steps for each vehicle types for every year;

1. Calculate the PCU on the existing National highways **WITHOUT** the new Expressway, taking into account of the physical limit of the road (twice the designed traffic volume would be the maximum traffic volume).

2. Calculate the PCU on the new Expressway, based on the potential demand and the split between existing highway/new expressway that was determined in Chapter 3.

3. Calculate the PCU on the existing National highways WITH the new Expressway, also considering their physical limitation.

4. Converted PCU = (PCU on existing highway WITHOUT Expressway) – (PCU on existing highway WITH Expressway)

5. Generated PCU = (PCU on Expressway) – Converted PCU

207. These PCU figures are converted into number of vehicles, and the unit costs for VOC and VOT are applied. The length difference between the highway and the Expressway is also taken into account.

208. The figures are transformed into domestic economic cost, assuming a shadow rate of 1.05. It is also assumed that 50% of the capital costs would be imported.

209. Other assumptions are as follows;

1. Motorbikes will not be allowed on the Expressway. However, it is likely that as the economic condition of Vietnam improves, many motorbike users will switch from bikes to passenger cars. In order to take this into account, it is assumed that 10% of the forecasted motorbikes will switch into passenger cars. This will gradually increase from 5% initially in the opening year.

2. The toll rate remains constant in real terms.

3. Annual routine maintenance are estimated at 90 million VND/km (2005 price) at the time of opening, and assumed to increase at 2 percent annually in real terms. The level has been estimated from the records of various expressways. Also, the maintenance cost for Vietnam's national highways are 15 million VND/km as of 2005. Higher grade of the road will justify the cost difference. Operational costs are assumed to be equal to the maintenance cost.

4. Periodic large-scale overhaul is assumed to be undertaken roughly every 10 years. This will require 5% of the original capital costs, excluding resettlement cost, survey & design, and interest during construction.

Table 5- 4 : Economic Internal Rate of Return
(billion 2005 VND)

Year	Econoomic Cost			Economic Cost			Net
	Capital Cost	O&M	Total Cost	VOC Savings	Time Savings	Total Benefits	Economic Benefit
2007	117		117			0	- 117
2008	940		940			0	- 940
2009	1,201		1,201			0	- 1,201
2010	2,046	15	2,061	633	42	675	- 1,386
2011	2,046	15	2,061	634	35	669	- 1,392
2012	2,046	15	2,061	630	29	659	- 1,402
2013	0	78	78	1,458	180	1,639	1,561
2014	0	79	79	1,581	195	1,776	1,696
2015		81	81	1,821	213	2,034	1,954
2016		75	75	1,887	199	2,087	2,012
2017		76	76	2,043	183	2,227	2,150
2018		78	78	2,153	166	2,319	2,241
2019		79	79	2,373	147	2,520	2,440
2020		81	81	2,505	126	2,630	2,549
2021		453	453	2,661	102	2,763	2,310
2022		84	84	2,819	98	2,917	2,833
2023		86	86	2,907	98	3,005	2,919
2024		88	88	3,111	99	3,210	3,122
2025		89	89	3,336	100	3,436	3,346
2026		91	91	3,527	100	3,628	3,536
2027		93	93	3,657	110	3,767	3,674
2028		95	95	3,746	126	3,872	3,777
2029		97	97	3,859	144	4,004	3,907
2030		99	99	4,029	164	4,193	4,094
2031		472	472	4,245	186	4,431	3,959
2032		103	103	4,383	210	4,592	4,490
2033		105	105	4,495	232	4,726	4,622
2034	- 1,210	107	- 1,104	4,624	257	4,881	5,984
						EIRR=	22.0%
						NPV (12%) =	5,544

210. Based on these assumptions, the economic internal rate of return (EIRR) was calculated for a period of 2007-2034. The EIRR is estimated to be 22.0 % for the base case. (see table) It is well above the ADB's cut off rate of 12 percent. Most of the benefits come from the VOC savings. Net present value (NPV) of the project using the social discount rate of 12% yields 5,544 billion VND.

211. Although this extremely high level of EIRR makes it unlikely that this would collapse under any adverse condition, the EIRR estimate was subjected to similar calculation as those of the FIRR. Several conditions that may affect the economical viability of the project were tested, to determine their robustness. The conditions that are

tested were increase in capital cost, decrease in demand, increase in interest rate, change in toll, and delay in construction (i.e. opening of the road).

Table 5- 5 : Sensitivity Analysis

	EIRR
Base	22.0%
10% increase in Capital Cost	20.4%
10% decrease in demand	19.9%
1percentage point increase in interest rate	22.0%
Halving of the toll (with changed demand)	27.0%
1 year delay	19.7%
Combination of cost, demand interest & delay	16.7%

212. Since lowering the toll increases the people using the expressway, it increases the benefits gained by the use of the expressway. 1 year delay has the most effect, since many would fail to enjoy the expressway's benefits earlier in the project's life. Due to the nature of economic benefits, interest rate has no effect. Other factors do have an adversary effect, each bringing down EIRR by 1.6 to 2.1 percentage point. None, however, brings the project FIRR below the social discount rate of 12%

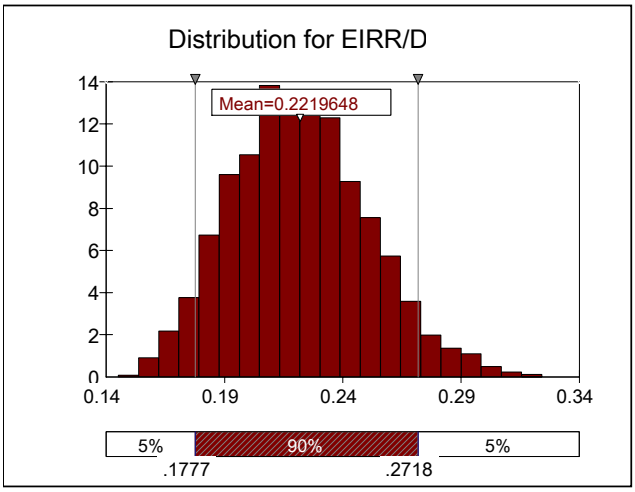
213. The combined effects of these adversary effects (except toll reduction) are also checked. The EIRR comes down to 16.7%, still well above 12%, making it a valuable project to pursue.

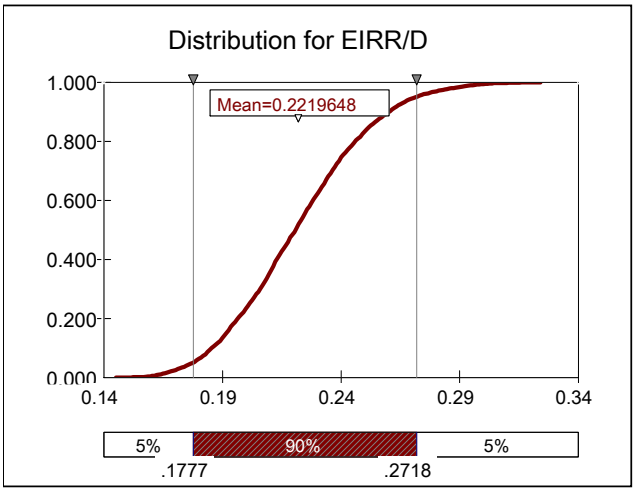
214. . In order to understand the impact of several conditions in more detail, a Monte Carlo simulation was undertaken. Three conditions were tested: changes in the capital cost (plus/minus 25%), and changes in the traffic demand (plus/minus 25%). It is assumed that each of the factors will have a triangular distribution. This distribution was chosen since a normal distribution would include a tail that would include cases that are practically impossible, such as negative demand or negative interest rate. Change in toll, and delays in construction could not be tested in a similar manner, due to the model construction.

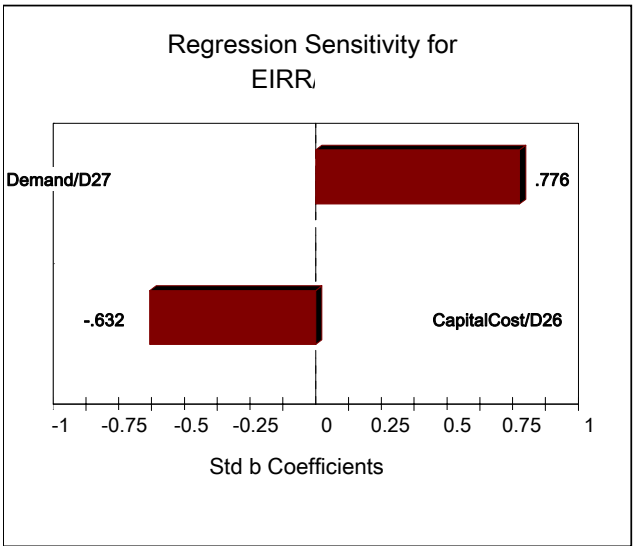
215. . The result is shown in the figure. EIRR will remain above 17.7 % more than 95% of the time, even under very wide range of changes in the important conditions. It hardly ever approach 12%, which shows the project's economic viability. From the regression sensitivity, It can be seen that the changes in the capital cost affects the EIRR most significantly. Demand's contribution is half or that from the capital cost increase.

Figure 5- 1 : Distribution for EIRR

Simulation Results for
EIRR







Summary Information	
Workbook Name	KHTCmodel2.xls
Number of Simulations	1
Number of Iterations	5000
Number of Inputs	2
Number of Outputs	4
Sampling Type	Latin Hypercube
Simulation Start Time	2005/11/4 18:46
Simulation Stop Time	2005/11/4 18:50
Simulation Duration	00:04:06
Random Seed	630618626

Summary Statistics			
Statistic	Value	%ile	Value
Minimum	14.5%	5%	17.8%
Maximum	32.4%	10%	18.6%
Mean	22.2%	15%	19.2%
Std Dev	2.9%	20%	19.6%
Variance	0.00082932	25%	20.1%
Skewness	0.299692326	30%	20.6%
Kurtosis	2.907663956	35%	21.0%
Median	22.1%	40%	21.3%
Mode	19.1%	45%	21.7%
Left X	17.8%	50%	22.1%
Left P	5%	55%	22.4%
Right X	27.2%	60%	22.8%
Right P	95%	65%	23.2%
Diff X	9.4%	70%	23.6%
Diff P	90%	75%	24.0%
#Errors	0	80%	24.6%
Filter Min		85%	25.2%
Filter Max		90%	26.0%
#Filtered	0	95%	27.2%

Sensitivity			
Rank	Name	Regr	Corr
#1	Demand / D27	0.776	0.771
#2	CapitalCost / $D	-0.632	-0.601
#3			
#4			
#5			
#6			
#7			
#8			
#9			
#10			
#11			
#12			
#13			
#14			
#15			
#16			

図表目次

Chapter 6. Financial Analysis

6.1. Scope of the Financial Analysis

216. Within the Kunming-Haiphong Transport Corridor (KHTC), the current study focuses on the portion between Hanoi and Lao-Cai. This portion of the project consists of a 256 km high grade expressway. The section between Lao Cai and Yen Bai (137.9 km) will be 2 lanes, with a right of way for 4 lane configuration to accommodate later expansion. The section between Yen Bai and Hanoi (118.0 km) will have 4 lanes, with a right of way for a 6 lane configuration. The Hanoi-Viet Tri section will be implemented in 2 years (excluding the detailed design period of 2 years), and the Viet Tri-Lao Cai section will also be implemented in about 3 years after the completion of the Hanoi-Viet Tri section.

217. This chapter deals with the financial evaluation of the project. First, the analysis will deal with the issue of tolls. Sufficient toll is required to maintain revenue, but an overpriced toll will lead to lower demand. Based on the level of toll, the analysis will move on to the financial performance, based on pro forma financial statements for the first several years of operation, in order to determine the financial viability, and the project's ability to fulfill the financial covenants, as well as its ability to service its debts. Finally, the analysis will deal with the issue of financial internal rate of return (FIRR). FIRR will be tested for sensitivity against several key figures.

6.2. Toll Analysis

218. Vietnam, as of 2005, does not have a comparable expressway to analyze the level of toll. The national highways are tolled, although the quality of the road is significantly lower than the proposed expressway. The toll is set by the Ministry of Finance decree, which is currently set at about 333 VND/km for passenger cars and 1,333 VND for heavy trucks. The following table repeats the one shown in Chapter 3.

Table 6- 1 : Current Toll Level on National Highways

Type of vehicle	oll (VND for 30km sectior	Toll (VND/km)
Tourist car/ Jeep	10,000	333
Small coach (<25 seats)	15,000	500
Big coach (>=25 seats)	10,000	333
Motorbike/Lambretta	10,000	333
Light truck (<2.5 tone)	15,000	500
Medium truck (>2.5 tone, 2axles	22,000	733
Heavy (3 axles)	40,000	1,333
Very Heavy (>3 axles)	40,000	1,333
Container	80,000	2,667
Other	10,000	333

Source: Ministry of Finance

219. As mentioned, there are no Expressways in Vietnam at the moment. With their higher standards, as well as cost, it is justifiable to charge a higher level of Toll. The Ministry of Finance have allowed the toll level on the express ways to be 1.5 times to

twice the level of the national Highways[9]. Also, considering the fact that this is an international expressway, the compatibility of the toll level to the Chinese counterpart would also be important. While the toll level for toll roads in China differ from area to area, the proposed toll rate for an Expressway in Southern Yunnan is set at about 0.35 Yuan/km in 1999 for passenger vehicles[10], which is equivalent to 632 VND/km. This closely resembles twice the level of existing Vietnamese National Highway, and is consistent with the decree by the Ministry of Finance. Based on this observation, the analysis will use the following level of toll for the base case of the analysis (Table 6-2):

Table 6- 2 : Proposed Toll Rates for the Project Expressway
(VND/km, 2005 prices)

Type of vehicle	Proposed Toll (VND/km)
Tourist car/ Jeep	667
Small coach (<25 seats)	1,000
Big coach (>=25 seats)	667
Motorbike/Lambretta	667
Light truck (<2.5 tone)	1,000
Medium truck (>2.5 tone, 2axles	1,467
Heavy (3 axles)	2,667
Very Heavy (>3 axles)	2,667
Container	5,333
Other	667

6.3. Financial Performance

220. Pro forma financial statements (profit and loss statement, cash flow statement, and balance sheet) for the project expressway were prepared for 2007 to 2020. This period covers the whole construction period, and 3 years of partial operation (Hanoi-Viet Tri) plus 6 years of full operation (Hanoi-Lao Cai). All projections are in current prices. Inflation is set at 4.38% throughout the period, while VND is expected to depreciate against the USD at about 4-4.5% annually until 2009, and then more or less depreciates at less than 1% each year after that. These macroeconomic figures are based on the forecasts of the Economic Intelligence Unit[11].

221. The assumptions used in the financial statements are as follows;

1. The Construction cost for the whole project is assumed to be 10,455.1 billion VND (2005 price), including contingencies and interest during construction. The cost breakdown, which is explained in Chapter 4, is shown in the table. The construction will be undertaken in 2 phases; Hanoi-VietTri section in 2008-2009, and VietTri-LaoCai section in 2010-2012.

2. The project cost is estimated to be about 50% local currency and 50% foreign currency (table).

[9] Circular No. 90-2004-TT-BTC
[10] ADB 1999, *Proposed Loan: Southern Yunnan Road Development Project*, RRP PRC 30081, Asian Development Bank, Manila, p. 31 Table 4.
[11] EIU 2005, *Country Forecasts: Vietnam*, Economist Intelligence Unit, London.

3. 72% of the total project cost is assumed to be financed by ADB's LIBOR based OCR loan and loans from other sources. The nominal amount of the loan is $ 512.8 million , which will be a 25 year loan with 5 years grace period. There will be two loans for each of the 2 phases, $ 112.3 million and $ 400.5 respectively. The interest rate is LIBOR 10year swap rate (4.49%) plus 0.6% spread, which is 5.09%. The remaining portion is assumed to be financed by the Vietnam Government in the form of a grant.

Table 6- 3 : Project Cost for Proposed Hanoi-LaoCai Expressway
(billion VND, million USD)

	Hanoi-VietTri 53.4 km	VietTri-LaoCai 202.5 km	Total (2005 price) 255.9 km	Total (2005 mill. USD)	Total (current) 255.9 km
Construction Period	2008-2009	2010-2012			
Main Construction	157.1	5,145.0	6,716.2	423.7	6,716.2
Other Construction	11.0	360.1	470.1	29.7	470.1
Mine Clearance	0.9	20.7	29.8	1.9	29.8
Land Acquisition and Resettlement	11.7	254.3	371.8	23.5	371.8
Survey and Design	14.5	462.4	607.0	38.3	607.0
Contingencies (20%)	39.0	1,248.5	1,639.0	103.4	1,639.0
Total	234.3	7,491.0	9,833.8	620.4	9,833.8
Interest during Construction	85.9	444.7	530.6	33.5	627.7
Total Cost	320.2	7,935.7	10,364.5	653.9	10,461.5
Total Cost (million USD)	20.2	500.7	653.9		

Table 6- 4 : Currencies for Capital Investment
(billion VND, million USD)

	Foreign Currency	Local Currency	Total (2005 price)
Main Construction	3,761.1	2,955.1	6,716.2
Other Construction	0.0	470.1	470.1
Mine Clearance	8.9	20.8	29.8
Land Acquisition and Resettlement	0.0	371.8	371.8
Survey and Design	303.5	303.5	607.0
Contingencies (20%)	814.7	824.3	1,639.0
Total	4,888.2	4,945.6	
			0
Interest during Construction	265.3	265.3	530.6
Total Cost	5,153.5	5,211.0	10,364.5
Total Cost (million USD)	325.1	328.8	653.9
Composition	49.7%	50.3%	100.0%

4. Demand will follow the estimates in Chapter 3. However, due to the rapid increase of demand, it is expected that the physical capacity of the expressway will be exhausted quickly, after which no additional vehicles can use the expressway. In order to take this into account, it is assumed that the demand will saturate with a daily traffic of 96,000 vehicles for the Hanoi-YenBai section, and 20,000 vehicles for the YenBai-LaoCai section. This figure corresponds to twice the designed traffic volume for each

section (Hanoi-YenBai: 48,000 PCU/day, YenBai-LaoCai: 10,000 PCU/day).

5. Motorbikes will not be allowed on the Expressway. However, it is likely that as the economic condition of Vietnam improves, many motorbike users will switch from bikes to passenger cars. In order to take this into account, it is assumed that 10% of the forecasted motorbikes (vehicle base) will switch into passenger cars. This will gradually increase from 5% initially in the opening year.

6. The toll rate is set at the level explained at section 5.2. It is assumed that the toll will increase along with the general inflation. Therefore, the toll level remains constant in real terms.

7. Annual routine maintenance are estimated at 90 million VND/km (2005 price) at the time of opening, and assumed to increase at 2 percent annually in real terms. The level has been estimated from the records of various expressways. Also, the maintenance cost for Vietnam's national highways are 15 million VND/km as of 2005. Higher grade of the road will justify the cost difference. Operational costs are assumed to be equal to the maintenance cost.

8. Periodic large-scale overhaul is assumed to be undertaken roughly every 10 years. This will require 5% of the original capital costs, excluding resettlement cost, survey & design, and interest during construction.

9. Depreciation is calculated as 30 years straight-line depreciation, with 10% residual value.

10. At this point, the operator of this expressway has not been clarified. It may be operated by a public entity that does not have to pay corporate taxes. In this simulation, however, it is assumed that the operating entity will pay corporate tax or equivalent, at a rate of 28%.

222. The financial statements indicate that the project will be profitable from it's partial opening in 2010, and will continue to increase its profits during the project period.

223. Two informative ratios to assess the financial viability are included at the bottom of the financial statements: Working ratios and Debt service coverage ratio (DSCR). The working ration shows the ratio of O&M compared to the revenue, which demonstrates whether the project can cover its own costs. There is no absolute criterion, but a working ratio over 20 percent is often considered to be signs of a possible cost overrun. In this project, the ratio is well below that level, showing that the project can comfortably pay for its own operation.

224. DSCR shows the revenue compared to the debt service (principle repayment and interest). A DSCR below 1 shows a possibility of default, which would be unacceptable. DSCR too close to 1 (below, say, 1.2) would show that a slight fluctuation in revenue might cause the project to default. Here again, there are no absolute criteria, but DSCR around 2 should be quite safe, since the project would be able to meet its obligation even when the revenue halves for some reason. The project shows viability in this respect, too.

Table 6- 5 : Projected Financial Statement of Hanoi-LaoCai Expressway
(billion VND, nominal terms)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
INCOME STATEMENT														
Toll Revenue	-	-	-	307	353	406	900	1,040	1,203	1,355	1,526	1,718	1,936	2,181
O&M	-	-	-	19	20	21	112	119	126	122	130	139	148	157
Overhaul	-	-	-											
Operating Revenue	**-**	**-**	**-**	**288**	**333**	**385**	**789**	**922**	**1,077**	**1,232**	**1,395**	**1,580**	**1,788**	**2,024**
Depreciation	-	-	-	50	50	50	216	216	216	216	216	216	216	216
Interest	-	-	-	86	86	86	382	381	379	377	370	362	354	344
Profit (before tax)	**-**	**-**	**-**	**151**	**197**	**249**	**191**	**325**	**482**	**639**	**809**	**1,002**	**1,219**	**1,464**
Tax (28%)	-	-	-	42	55	70	53	91	135	179	227	280	341	410
Profit (after tax)	**-**	**-**	**-**	**109**	**142**	**179**	**137**	**234**	**347**	**460**	**583**	**721**	**877**	**1,054**
				109	251	430	567	801	1,148	1,609	2,192	2,913	3,790	4,844
CASH FLOW STATEMENT														
Cash Inflows														
Operating Income	-	-	-	109	142	179	137	234	347	460	583	721	877	1,054
Depreciation	-	-	-	50	50	50	216	216	216	216	216	216	216	216
Net CF from operations	-	-	-	159	192	230	353	450	563	676	798	937	1,093	1,270
Equity	141	281	638	512	629	747	0	0	0	0	0	0	0	0
ADB/other Loan	0	844	844	1,942	1,942	1,942	0	0	0	0	0	0	0	0
Subtotal cash inflows	**141**	**1,125**	**1,482**	**2,773**	**2,955**	**3,148**	**706**	**899**	**1,125**	**1,352**	**1,597**	**1,873**	**2,186**	**2,539**
Cash Outflows														
Construction Cost	141	1,125	1,482	2,454	2,571	2,688	0							
Loan Repayment					0	0	29	32	137	151	166	183	201	221
Subtotal cash outflows	**141**	**1,125**	**1,482**	**2,454**	**2,571**	**2,688**	**29**	**32**	**137**	**151**	**166**	**183**	**201**	**221**
Net Cash Flow		**0**	**0**	**319**	**384**	**459**	**676**	**867**	**988**	**1,201**	**1,431**	**1,691**	**1,985**	**2,318**
Opening Cash		0	0	0	319	703	1,163	1,839	2,706	3,694	4,895	6,325	8,016	10,001
Closing Cash		0	0	319	703	1,163	1,839	2,706	3,694	4,895	6,325	8,016	10,001	12,319
BALANCE SHEET														
Current Asset	0	0	0	319	703	1,163	1,839	2,706	3,694	4,895	6,325	8,016	10,001	12,319
Fixed Asset	141	1,266	2,749	5,202	7,773	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461	10,461
Accumulated Depreciation						50	266	482	697	913	1,128	1,344	1,560	1,775
Net Fixed Asset	141	1,266	2,749	5,202	7,773	10,411	10,195	9,980	9,764	9,549	9,333	9,118	8,902	8,686
Total Assets	**141**	**1,266**	**2,749**	**5,521**	**8,476**	**11,574**	**12,034**	**12,686**	**13,458**	**14,443**	**15,658**	**17,133**	**18,903**	**21,005**
Loan		844	1,688	3,630	5,571	7,513	7,483	7,451	7,314	7,163	6,996	6,814	6,612	6,391
Equity Capital	141	422	1,061	1,573	2,202	2,949	2,949	2,949	2,949	2,949	2,949	2,949	2,949	2,949
Retained Earnings	0	0	0	319	703	1,112	1,602	2,286	3,196	4,332	5,713	7,371	9,342	11,665
Total Liability and Equi	**141**	**1,266**	**2,749**	**5,521**	**8,476**	**11,574**	**12,034**	**12,686**	**13,458**	**14,443**	**15,658**	**17,133**	**18,903**	**21,005**
PERFORMANCE INDICATORS														
Working Ratio				6.2%	5.7%	5.1%	12.4%	11.4%	10.5%	9.0%	8.5%	8.1%	7.6%	7.2%
DSCR				3.3	3.9	4.5	1.9	2.2	2.1	2.3	2.6	2.9	3.2	3.6

6.4. Financial Internal Rate of Return

225. The financial rate of return (FIRR) for the project expressway is based on similar estimates with the financial performance analysis in the last section. There are, however, several distinctive assumptions:

1. The FIRR calculation is base on constant 2005 prices, excluding contingencies. It covers a period of 2007-2034, from the initial project to the end of the loan repayment. The FIRR is calculated both for the project as a whole, and for the owner.

2. The FIRR is calculated both before and after corporate tax.

3. Operation and maintenance costs exclude depreciation.

4. The residual value in 2034 is assumed to be the remaining value after depreciation, which is 10 percent of the total capital cost excluding the land and relocation cost, plus the full cost of the land and relocation costs (which do not depreciate).

5. Toll rates are assumed to remain constant in real terms.

226. Based on these assumptions, the FIRR for the whole project is 10.8 percent before corporate tax, and 8.7 percent after corporate tax. FIRR for the owner is 20.1 percent before tax, and 16.5 percent after tax (table 6-6).

227. The project FIRR represents the rate of return for the project, without the effects of borrowing and repayment. By looking at the project in this way, it would be possible to understand the pure profitability of the project, without being confused by obscure financing arrangement. It should be compared with the Weighted Average Cost of Capital (WACC), in order to assess whether the money is used efficiently. Owner FIRR takes into account the financing arrangement, such as loans. It reflects the actual financial condition for the owner. The difference between the project FIRR and the owner FIRR reflects the leverage provided by the ADB and other loans.

228. Weighted Average Cost of Capital (WACC) was calculated for comparison with the FIRR figures. It is assumed that 72% of the project cost is procured by ADB and other loan, and the remaining 28% will come from grants from the government of Vietnam.

229. The cost of the project's equity is estimated using the capital asset pricing model. The risk-free rate is taken as 8.2% based on the prevailing rate of 15 year government bonds. Since the 5 year bonds command higher yield than the 15 year bonds at the moment, it was not possible to derive a premium for the 25 year loan, although the yield structure suggests that the 25 year yield would not be much off. The market risk premium for Viet Nam is taken as 11% based on the average return on listed companies in Viet Nam. The equity beta for the project is estimated to be 1.04 based on the listed highway operators in Thailand. This results in a risk premium of 11.4% and a nominal cost of equity of 19.6%. The other assumptions are domestic inflation rate of 4.4%, foreign inflation rate of 1%, and a tax rate of 28%. As shown in Table 6-7, WACC for the project is 6.0%. The project and owner FIRR compares favorably with the WACC.

Table 6- 6 : Financial Internal Rate of Return (Project FIRR)

Year	Capital Cost	O&M	Total Cost	Total Revenue	Net CF	Tax	Net CF after Tax
2006	0		0		0		0
2007	117		117		- 117	0	- 117
2008	917		917		- 917	0	- 917
2009	1,172		1,172		- 1,172	0	- 1,172
2010	1,996	15	2,011	269	- 1,742	34	- 1,776
2011	1,996	15	2,011	267	- 1,744	42	- 1,786
2012	1,996	15	2,011	295	- 1,716	51	- 1,767
2013	0	78	78	626	548	37	511
2014	0	79	79	693	614	61	553
2015		81	81	768	687	86	601
2016		75	75	828	753	109	644
2017		76	76	893	817	133	684
2018		78	78	964	886	157	729
2019		79	79	1,040	961	183	778
2020		81	81	1,123	1,042	211	831
2021		442	442	1,212	770	140	631
2022		84	84	1,309	1,225	272	953
2023		86	86	1,414	1,328	305	1,023
2024		88	88	1,528	1,440	341	1,099
2025		89	89	1,651	1,562	380	1,182
2026		91	91	1,752	1,661	412	1,249
2027		93	93	1,860	1,767	446	1,322
2028		95	95	1,976	1,881	482	1,399
2029		97	97	2,099	2,002	520	1,483
2030		99	99	2,231	2,132	560	1,572
2031		460	460	2,372	1,912	502	1,409
2032		103	103	2,522	2,419	649	1,771
2033		105	105	2,603	2,499	675	1,824
2034	- 1,181	107	- 1,074	2,690	3,764	702	3,063
				FIRR=	10.8%		8.7%

Table 6- 7 : Weighted Average Cost of Capital (WACC)

	Cost	Weight	Tax adjusted nominal cost	Real Cost	Composite Cost
Vietnam Government Grant (equity)	19.6%	28%	19.6%	14.59%	4.1%
ADB Loan- OCR	5.09%	72%	3.66%	2.64%	1.9%
				WACC=	6.0%

Table 6- 8 : Financial Internal Rate of Return (Owner FIRR)

Year	Capital Cost	O&M	Total Cost	Total Revenue	Net CF	Tax	Net CF after Tax
2006	0		0		0		0
2007	117		117		- 117	0	- 117
2008	235		235		- 235	0	- 235
2009	532		532		- 532	0	- 532
2010	427	83	510	243	- 267	34	- 301
2011	524	80	604	267	- 337	42	- 379
2012	622	77	700	295	- 405	51	- 456
2013	0	364	364	626	262	37	225
2014	0	354	354	693	339	61	278
2015		410	410	768	357	86	271
2016		398	398	828	430	109	321
2017		390	390	893	503	133	370
2018		384	384	964	580	157	423
2019		378	378	1,040	663	183	479
2020		372	372	1,123	751	211	540
2021		727	727	1,212	486	140	346
2022		363	363	1,309	946	272	674
2023		359	359	1,414	1,055	305	749
2024		356	356	1,528	1,171	341	830
2025		354	354	1,651	1,297	380	918
2026		352	352	1,752	1,400	412	989
2027		351	351	1,860	1,510	446	1,064
2028		350	350	1,976	1,626	482	1,144
2029		350	350	2,099	1,749	520	1,229
2030		350	350	2,231	1,880	560	1,320
2031		711	711	2,372	1,661	502	1,158
2032		353	353	2,522	2,169	649	1,520
2033		297	297	2,603	2,306	675	1,632
2034	- 1,181	300	- 881	2,690	3,572	702	2,870
				FIRR=	20.1%		16.5%

230. Several conditions that may affect the financial viability of the project were tested, to determine their robustness. The conditions that are tested were increase in capital cost, decrease in demand, increase in interest rate, change in toll[12], and delay in construction (i.e. opening of the road) (table 6-9).

231. Of these adversary conditions, setting the toll at the national highway level (i.e. half the toll of the base case) has the most significant effect. The decrease in toll increases demand for the expressway, but they are not enough to make up for the lost revenue. It brings the project FIRR to 4.6%, which is much lower than the WACC. Other

[12] Of the factors, capital cost and traffic levels were tested for 10% changes, while the toll level was tested under the assumption that it would not be raised to the level of the base case, remaining at the current highway toll level. This is due to the nature of tolls. Although Circular No. 90-2004-TT-BTC has allowed toll levels to become the level used in the base case, there is a possibility that the political climate would force it to remain at the current national highway level (which is half the toll level used in the base case). Therefore, the likely scenario is tested.

factors do have an adversary effect, each bringing down the project FIRR by 0.5 to 1 percentage point. None, however, brings the project FIRR below WACC[13].

232. The combined effect of these adversary effects (except toll reduction) was also checked. Toll reduction was not included, since it is clear that halving the toll alone would render the project unfeasible, and combining it with other bad scenarios would not yield any interesting results. The FIRR comes down to 6.7%, and the owner FIRR to 10.5%. This makes the project still above WACC, making it worthwhile to pursue. Owner FIRR is only slightly above the long-term government bond level, although it is still acceptable.

Table 6- 9 : Sensitivity Analysis

	Project FIRR	Owner FIRR
Base	8.7%	16.5%
10% increase in Capital Cost	7.9%	13.6%
10% decrease in demand	7.9%	14.8%
1percentage point increase in interest rate	8.8%	15.9%
Halving of the toll (with changed demand)	4.6%	8.7%
1 year delay	8.2%	14.7%
Combination of cost, demand interest & delay	6.7%	10.5%

233. In order to understand the impact of several conditions in more detail, a Monte Carlo simulation was undertaken. Three conditions were tested: changes in the capital cost (plus/minus 25%), changes in the traffic demand plus/minus 25%), and changes in the interest rate (3% to 7.18%) It is assumed that each of the factors will have a triangular distribution. This distribution was chosen since a normal distribution would include a tail that would include cases that are practically impossible, such as negative demand or negative interest rate. The range of plus/minus 25% was used (as opposed to 10% in the sensitivity analysis), since the whole point of a Monte Carlo simulation is to allow the inclusion of a much higher deviation with very low probability. While a 10% deviation is often used in such simulations, there is no guarantee that it will not deviate any further. The Monte-Carlo simulation allowed to include such cases, which this study took advantage of.

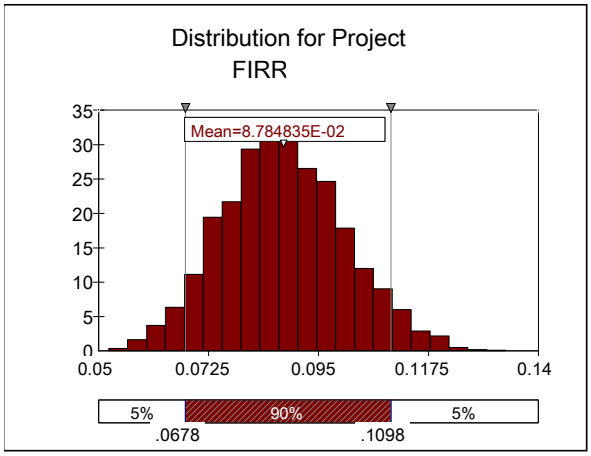
234. The change in toll and delays in construction were not included in the Monte carlo simulation as both factors are limited by the model construction. in addition, it is clear that halving the toll level will render the project unfeasible. This factor is part of the policy decision.

235. The Motecarlo simulation results of the remaining three factors: increase in capital cost, decrease in demand, and increase in interest rates are shown in figure 6-1. The Project FIRR will remain within 6.8 percent to 11.0 percent range with 90% confidence, even under very wide range of changes in the important conditions. The lower end still manages to be above the WACC, which shows the project's financial viability. From the regression sensitivity, it can be seen that the changes in the capital cost affects the FIRR most significantly, followed by the changes in demand. Increase in the interest rate affects the project FIRR positively, due to the tax benefits of the interest payment, although in reality, this will be cancelled out by an equal increase in the WACC.

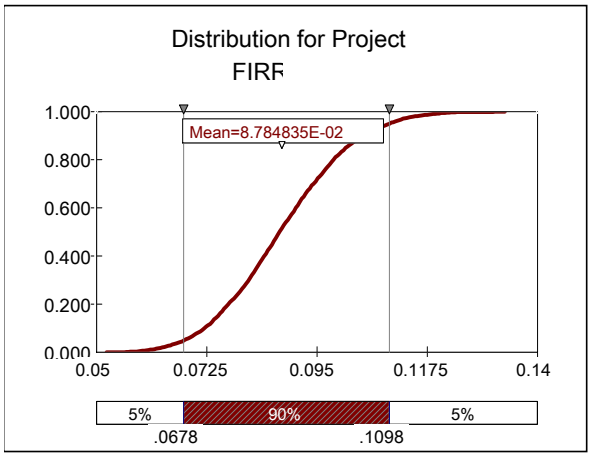
[13] Project FIRR, when the interest rate is increased, actually goes up due to the tax benefits from the higher interest payment. However, the increased interest rate will also lead to a higher cost of capital, raising the WACC. Therefore, the overall effect is the same. It should not be interpreted as increased debt service improving project viability.

Figure 6- 1 : Monte Carlo Simulation for Project FIRR

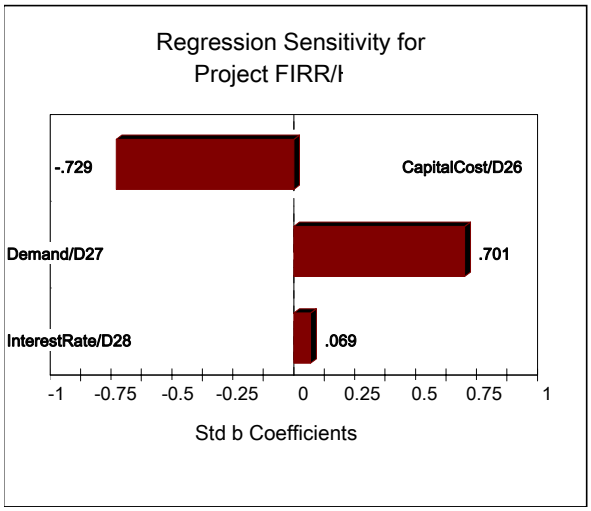
Simulation Results for
Project FIRR



Summary Information	
Workbook Name	HTCmodel2.xls, finecon2.x
Number of Simulations	1
Number of Iterations	5000
Number of Inputs	6
Number of Outputs	7
Sampling Type	Latin Hypercube
Simulation Start Time	2005/11/4 19:26
Simulation Stop Time	2005/11/4 19:32
Simulation Duration	00:05:40
Random Seed	701701822



Summary Statistics			
Statistic	Value	%ile	Value
Minimum	5.2%	5%	6.8%
Maximum	13.3%	10%	7.2%
Mean	8.8%	15%	7.5%
Std Dev	1.3%	20%	7.7%
Variance	0.000158401	25%	7.9%
Skewness	0.177183088	30%	8.1%
Kurtosis	2.839949452	35%	8.3%
Median	8.7%	40%	8.4%
Mode	8.5%	45%	8.6%
Left X	6.8%	50%	8.7%
Left P	5%	55%	8.9%
Right X	11.0%	60%	9.1%
Right P	95%	65%	9.2%
Diff X	4.2%	70%	9.4%
Diff P	90%	75%	9.6%
#Errors	0	80%	9.8%
Filter Min		85%	10.1%
Filter Max		90%	10.5%
#Filtered	0	95%	11.0%



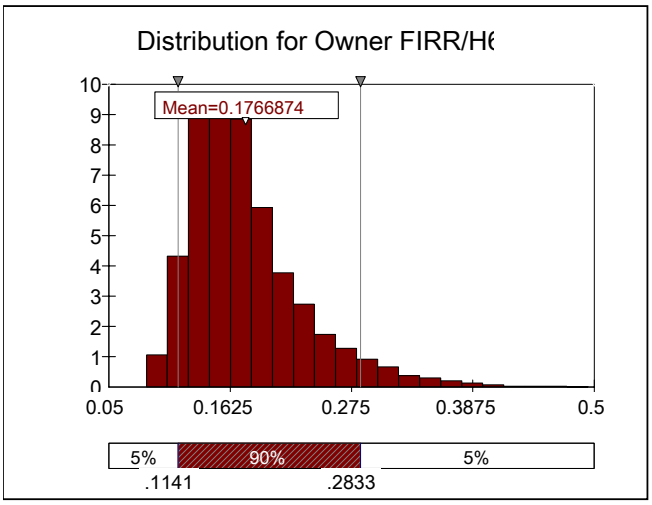
Sensitivity			
Rank	Name	Regr	Corr
#1	CapitalCost / $D	-0.729	-0.695
#2	Demand / D27	0.701	0.663
#3	InterestRate / $I	0.069	0.076
#4	CapitalCost / $I	0.000	0.004
#5	Interest Rate / $	0.000	-0.031
#6	Traffic Demand /	0.000	-0.003
#7			
#8			
#9			
#10			
#11			
#12			
#13			
#14			
#15			
#16			

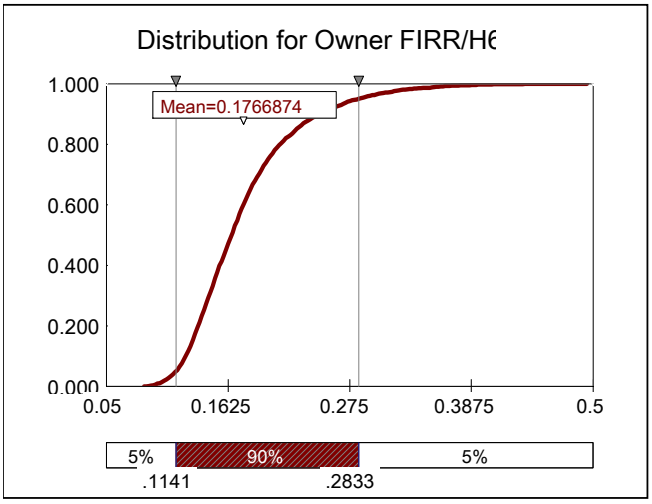
236. The same Monte Carlo simulation was undertaken for the Owner FIRR. As shown in figure 6-2, the distribution of the Owner FIRR is not symmetrical. This is because the lower end is cut off by the debt service, so to say. Since the debt service is

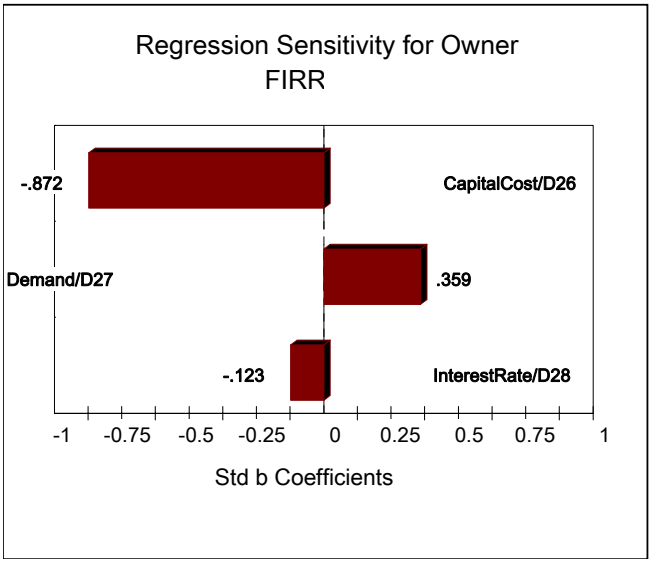
similar, it will occupy a larger share of the project cash flow when the profitability of the project is low, thereby affecting the rate of return significantly, while it has little effect when the project is prosperous. The distribution stays within 11% to 28% in 90% of the time, which is an acceptable level.

237. Here also, the changes in the capital cost affects the FIRR most significantly, followed by the changes in the traffic demand. Increase in the interest rate affects the owner FIRR negatively as expected, because it would mean increased interest payment for the owner. However, the interest rate does not contribute so much to the overall result. For the owner, it would be the utmost importance to control the capital costs in order to ensure the profitability of the project.

Figure 6- 2 : Monte Carlo Simulation for Owner FIRR







Summary Information	
Workbook Name	HTCmodel2.xls, finecon2.x
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Number of Iterations	5000
Number of Inputs	6
Number of Outputs	7
Sampling Type	Latin Hypercube
Simulation Start Time	2005/11/4 19:26
Simulation Stop Time	2005/11/4 19:32
Simulation Duration	00:05:40
Random Seed	701701822

Summary Statistics			
Statistic	Value	%ile	Value
Minimum	8.5%	5%	11.4%
Maximum	49.4%	10%	12.3%
Mean	17.7%	15%	13.0%
Std Dev	5.3%	20%	13.4%
Variance	0.002810813	25%	14.0%
Skewness	1.422598333	30%	14.5%
Kurtosis	5.824390617	35%	15.0%
Median	16.6%	40%	15.5%
Mode	18.2%	45%	16.0%
Left X	11.4%	50%	16.6%
Left P	5%	55%	17.1%
Right X	28.3%	60%	17.7%
Right P	95%	65%	18.3%
Diff X	16.9%	70%	19.1%
Diff P	90%	75%	19.9%
#Errors	0	80%	21.1%
Filter Min		85%	22.5%
Filter Max		90%	24.6%
#Filtered	0	95%	28.3%

Sensitivity			
Rank	Name	Regr	Corr
#1	CapitalCost / $D	-0.872	-0.890
#2	Demand / D27	0.359	0.367
#3	InterestRate / $I	-0.123	-0.118
#4	CapitalCost / $D	0.000	0.004
#5	Interest Rate / $	0.000	-0.018
#6	Traffic Demand /	0.000	0.007
#7			
#8			
#9			
#10			
#11			
#12			
#13			
#14			
#15			
#16			

238. The impact of the toll level on the FIRR and EIRR was evaluated. While increased toll can bring more toll revenue, it will drive people away from using the Expressway. With fewer users, the economic benefit of the project will suffer.

239. As shown in table 6-10 and figure 6-3, EIRR rapidly declines as the toll increases, and it falls below the social discount rate of 12% when the toll is over 4 times the current rate. Therefore, toll level higher than 4 times the current level will make the project unfeasible. On the other hand, a toll of 1000 VND/km (toll level of the current national highways) yields a project FIRR lower than the WACC of 6.0%, making the project financially not viable.

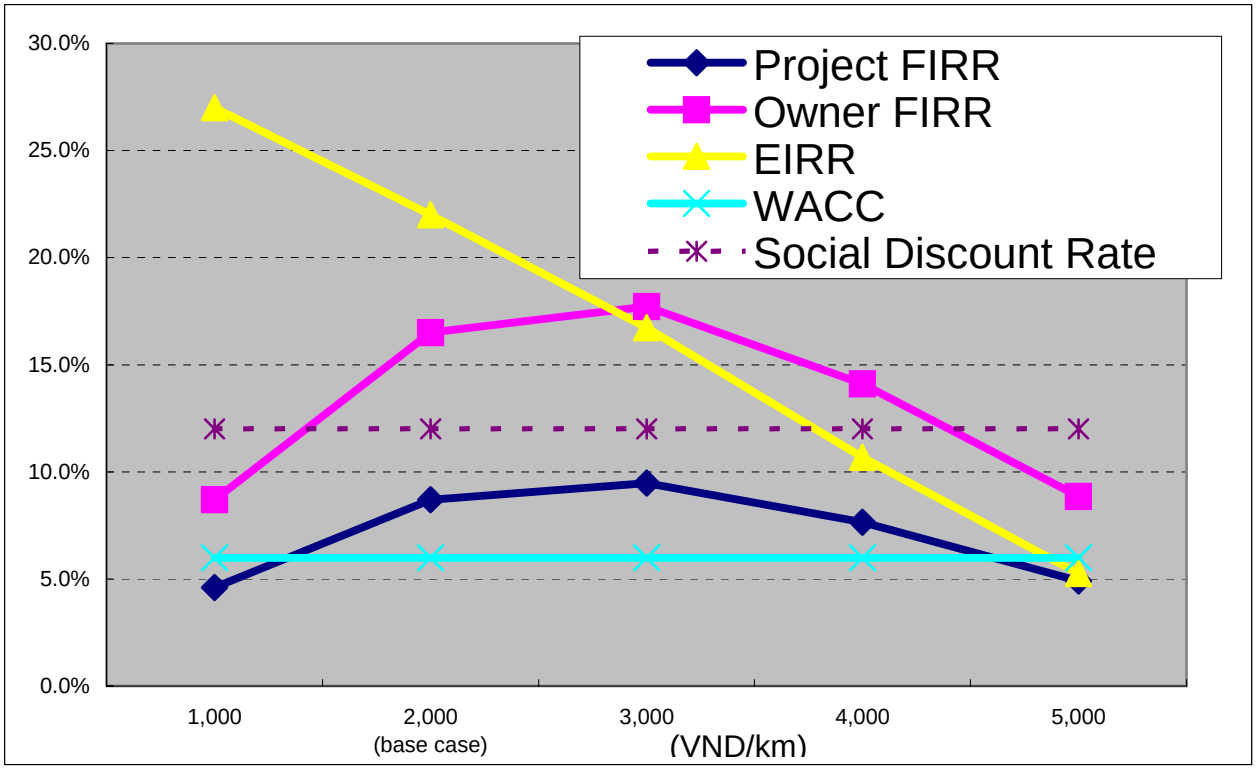
240. Figure 6-3 also suggests that as a project, the Expressway can safely rest in the toll range of 2,000-4,000 VND/km. The optimal level of toll would be around 3,000 VND/km, about three times the current national highway level. This will yield a lower economic benefit of 17.9%, although it will be well over the cut off rate of 12%. Other social concerns, such as poverty reduction issues, should be considered in determining the level.

241. The current simulation assumes that the toll level can go up every year in line with the CPI increase. In reality, this may not be possible, due to political issues. In such cases, it may be best to start from a slightly higher toll level than the current base case (say, 2,500 VND/km), and maintain that level for several years. This requires further study.

Table 6- 10 : Sensitivity of FIRR and EIRR to Toll Level

	Average Toll (2005 VND/ km)				
	1,000	2,000 (base case)	3,000	4,000	5,000
Project FIRR	4.6%	8.7%	9.5%	7.6%	4.9%
Owner FIRR	8.7%	16.5%	17.7%	14.1%	8.8%
EIRR	27.0%	22.0%	16.7%	10.7%	5.3%
WACC	6.0%	6.0%	6.0%	6.0%	6.0%
Social Discount Rate	12.0%	12.0%	12.0%	12.0%	12.0%

Figure 6- 3 : Sensitivity of FIRR and EIRR to Toll Level



図表目次

Chapter 7. Conclusion and Recommendation

Chapter 7. Conclusion and Recommendation

242. The project will connect on Hanoi – Kunming and Haiphong – Kunming in about 8.5 hours and 10 hours, respectively, by passenger car. The result of financial analysis denotes the project generates enough money to recover the entire loan within 15 years after started the construction. This result indicates the expressway project is financially viable and also very good result in terms of the hurdle rate of ADB-OCR.

243. It is also expected to invite sufficient economic benefit to the projected area. We would expect the project to bring economic vitality to the poorest area. Accumulated economic benefit is expected to reach at about $500million during 27 year's project term. We could expect sufficient return of economic benefit depending on the simulation result of Economic Internal Rate of Return (EIRR).

244. The team has concluded that the expressway project between Hanoi – Lao Cai is economically and financially viable. It will open the poorest area and provide better accessibility. We must refer to the completion of major expressway network, including Kunming – Hekou, of Yunnan Province, which will be opened in 2008. Huge travel time and cost reduction from Kunming to Hekou, located at the adjacent to Lao Cai, can be easily thought. The Hanoi – Lao Cai expressway project must be connected to the Yunnan Expressway network to strengthen Kunming – Haiphong transport corridor.

245. The consultant team did very hard work to finalize the report. But we would like to recommend continuous effort to collect much more accurate data and information with the next steps. They are:

1) Origin and Destination (OD) traffic flow data. The team tried to estimate traffic demand for the future by creating Origin and Destination table at present and in the future. But the data form the authority and transport companies are very limited and not consistent. The team has to obtain data by conducting with the actual counting on the roadside along the corridor and estimate it in very primitive method. The team would like to recommend continuing further study for the traffic demand forecasting in the future.

2) Concerning trade data and information, the team encountered a number of inconsistencies with format and classification of items of goods and industry category. Particularly the team recommends harmonizing customs data format within each country. Cross border facilitation is also strongly recommended to facilitate trade between both countries.

3) The alignment of the expressway comes from field survey with over one hundred and thirty points. But a 256km of the expressway is very long to investigate thoroughly and need to conduct much more detail survey to finalize route and design. There is not large bridge and viaduct for the expressway but many local and regional roads to be replaced with flyover.

4) The proposed specification of Nos. of lane are 4 lanes between Hanoi and Yen Bai, 2 lanes between Yen Bai and Lao Cai for the first phase of construction and should be expanded to 6 lanes and 4 lanes respectively in accordance with the Traffic volume increase. However if financial capability is sufficient in the future, it is desirable to start with at least 4 lanes with the full section. Because the

team supposes the expressway traffic with diversity of velocity with the mixture of passenger car, coach and truck. To make most use of expressway to induce practical travel time reduction, a multiple lanes is requested with overtaking way and carriageway for smoother traffic flow.

246. Viet Nam does not have much experience for the expressway construction and management. A 256km of access controlled toll expressway is almost the first experience for the Government of Vietnam. In this regards, not only organizing appropriate entity to execute the project but capacity building of the entity is highly requested for proceeding with next step.

The consultant team

Dr. Shin-ichi Ishii	Team Leader
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Mr. Duan Pham Van	Highway Engineer in Viet Nam

Appendix