SOCIALIST REPUBLIC OF VIETNAM
CUU LONG CORPORATION FOR INVESTMENT, DEVELOPMENT AND PROJECT MANAGEMENT OF TRANSPORT INFRASTRUCTURE (CUU LONG CIPM)

THE PREPARATORY SURVEY ON TRUNG LUONG – MY THUAN EXPRESSWAY PROJECT IN VIETNAM

FINAL REPORT

FEBRUARY 2013

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.

MARUBENI CORPORATION

KRI INTERNATIONAL CORP.

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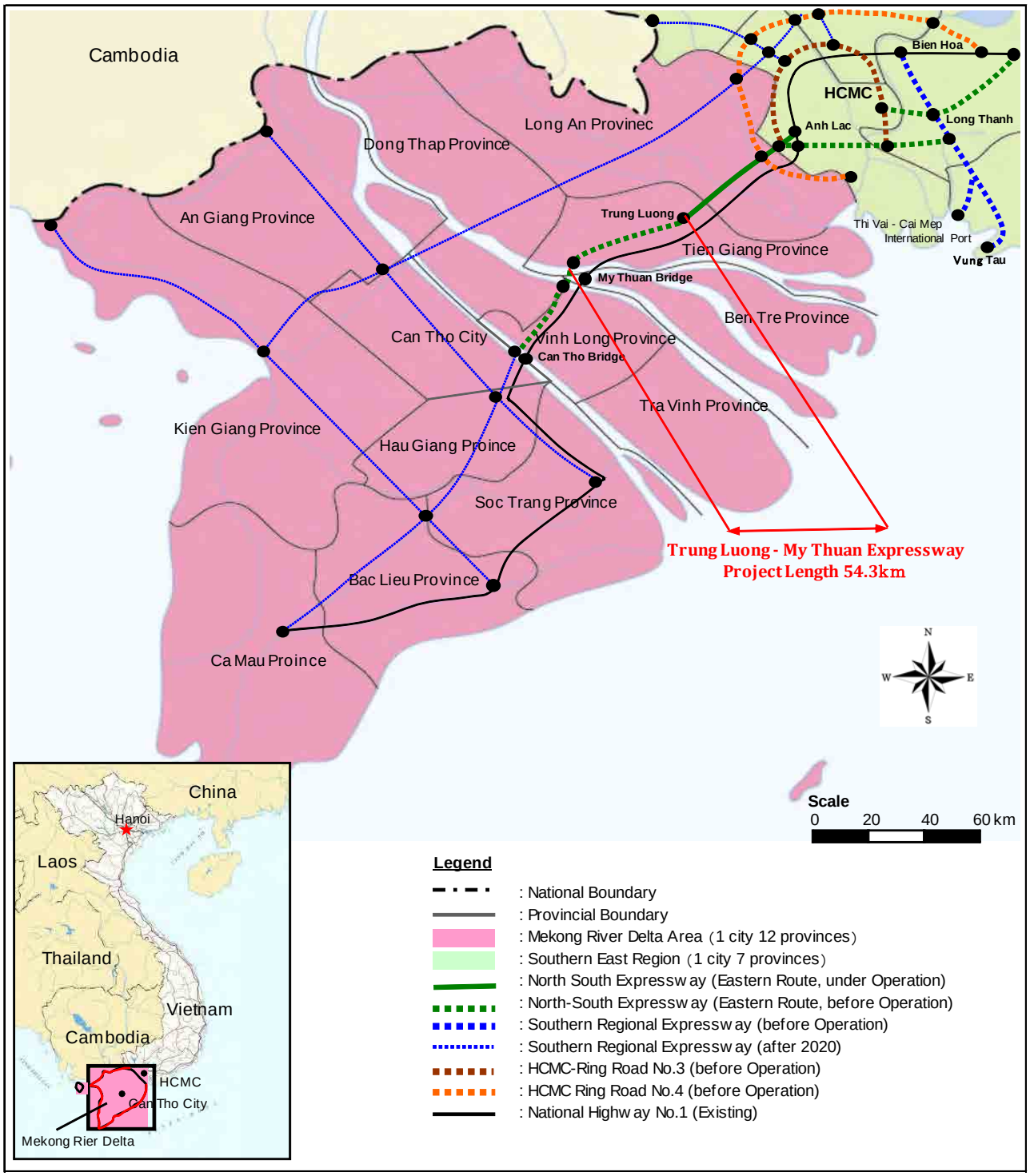

LOCATION MAP

EXECUTIVE SUMMARY

INTRODUCTION

The Trung Luong - My Thuan Expressway Project is a part of the Ho Chi Minh City (HCMC) – Can Tho (CT) Expressway and prioritized to be completed before 2015 for the development of the region in Southern Vietnam according to the detailed plan of the North-South Expressway (Eastern) approved by the Prime Minister in the Decision No.140/QD-TTg dated on January 21, 2010.

The JICA Preparatory Survey on Trung Luong (TL)–My Thuan (MT) Expressway Project (the JICA Survey) was commenced at the end of August 2011 based on the Minutes of Meeting (M/D) exchanged between JICA and BEDC in July 2011.

The objectives of the JICA Survey are as follows:

- To evaluate the private investment possibility for TL–MT Expressway Project (the Project) and propose a profitable build-operate-transfer (BOT)/public-private partnership (PPP) scheme; and
- To prepare draft term sheets for BOT contract and Government Guarantee and Undertaking (GGU).

On November 4, 2011, however, Bank for Investment and Development of Vietnam (BIDV)/BIDV Expressway Development Company (BEDC) requested the return of two concessions, namely the BOT project of TL–MT Expressway and Toll Collection Rights of Ho Chi Minh (HCM)-TL Expressway to the Ministry of Transport (MOT) by letter No. 1105/CV-BIDV. Due to the absence of the project implementation organization/counterpart of the JICA Survey, JICA decided the suspension of the JICA Survey. For earlier resumption of the JICA Survey, the Government of Vietnam (GOV) assigned Cuu Long Corporation for Investment, Development and Project Management of Transport Infrastructure (CIPM), who was the authorized project implementing agency for My Thuan–Can Tho Expressway, as implementing agency to study the implementation mechanism of the Project. Subsequently, the GOV requested JICA to resume the JICA Survey on February 23, 2012. After consideration of the project situation and importance, JICA agreed to resume the JICA Survey and kick-off over the resumption was held on June 6, 2012.

(from Chapter 1 Introduction and Chapter 2 Background and Necessity of the Project)

PRESENT STATUS OF BOT/PPP PROJECT AND EXISTING PROJECT SCHEME

This chapter, firstly, presents i) the recent reforms and developments in legal framework and regulatory procedures for foreign investment promotion, secondly, ii) issues on best practices for private investment promotion in infrastructure and present law for BOT/PPP scheme, and lastly, iii) present investment environment for BOT/PPP expressway projects.

As for the present situation of the Project, it is confirmed that, after BEDC determined the return of its concession to MOT, MOT assigned Cuu Long CIPM to study and propose the implementation of the Project by integrating two sections (Trung Luong-My Thuan section and My Thuan-Can Tho section) as one expressway. However, Cuu Long CIPM, as of July 2012, still does not have a concession right over TL-MT Expressway Project. Cuu Long CIPM's company profile and financial plan for the Project was presented based on the interview with Cuu Long CIPM and the related documents.

(Chapter 3 Present Status of BOT/PPP Project and Chapter 4 Existing Project Scheme)

UPDATED TRAFFIC DEMAND FORECAST

Traffic demand forecast was updated based on the supplemental traffic surveys (traffic count and origination and destination (OD) survey) and referring to other studies. The results of the traffic demand forecast by BEDC F/S, Ministry of Economy Trade & Industry (METI)/ Japan External Trade Organization (JETRO) study, and the JICA Survey were compared per passenger car unit (PCU) in 2020 is shown below.

Unit: PCU

Section	Year 2020								
	BEDC F/S			METI/JETRO Study			JICA Survey		
	NH1A	Ex-way	Total	NH1A	Ex-way	Total	NH1A	Ex-way	Total
Trung Luong-Cai Lay	23,242	62,088	85,330	41,010	39,119	80,129	41,903	31,387	73,290
Cai Lay - My Thuan	33,756	45,969	79,725	25,746	29,460	55,206	41,275	22,400	63,675
My Thuan - Can Tho	14,600	38,756	53,356	24,536	23,657	48,193	42,741	21,013	63,754

Although the preconditions and the methodology are different for each study, the forecast on expressway by the JICA Survey is comparatively similar with the METI/JETRO study. The total volume of NH1A and the expressway is not so much different in the studies. However, there is a difference on the diversion ratio of the traffic from NH1A to the expressway between the JICA Survey and BEDC F/S, which might come from different precondition of time value (resistance by toll) that has a trend to go lighter corresponding increase of income in future.

(from Chapter-5 Traffic Demand Forecast)

PROJECT PLAN

Phase-wise construction plan

Based on the updated traffic demand forecast, the required number of lanes is calculated at 6-lane in design year 2037, which is 20 years after starting operation, in accordance with the American Highway Capacity Manual. To reduce the initial investment cost, 4-lane construction in initial stage is recommended and the timing of widening is proposed around 2032 when level of service reaches level C.

Review of Detailed Design

Since the project expressway is specified as the highest classified road with design speed of 120 km/h and 4-lane traffic (6-lane in future), safety and a high degree of comfort of facilities for drivers are required. And also, for the project feasibility, a cost reduction is considered necessary. Accordingly, review of the detailed design (the D/D) was carried out in order to improve safety of the expressway and to reduce the construction cost.

In the highway design, ten design alternatives were examined, and finally eight design alternatives were proposed to apply for the D/D. The 0.3% longitudinal slope will be maintained at reverse superelevation section and change to the direct connection type of deceleration lane at interchange/parking area/service area, etc. In the bridge design, six design alternatives were examined, and finally three design alternatives were proposed to apply for the D/D including bridge type changes and design for 4-lane expressway, etc. In the soft soil treatment design, four design alternatives were examined, and finally two design alternatives were proposed to apply for the D/D including application of vacuum consolidation method (VCM), and prefabricated vertical drain (PVD) instead of deep cement mixing (DCM). As a result of the review of D/D, the construction cost can be reduced to VND 1,292 billion (with VAT) in total.

Updated Project Cost

The project cost is updated and estimated at VND 25,222 billion including civil work cost, the initial O&M and ITS cost, SPC establishment cost, land acquisition cost, physical contingency, VAT, and price escalation, etc., as shown:

Unit: VND billion

No.	Item	JICA Survey (2011 Q2)
I.	Construction Cost	14,815
II.	Land Acquisition and Resettlement	2,267
III.	Project Management Cost	51.8
IV	Consulting Services Cost	780.3
V	Other Cost including SPC Establishment Cost	723.8
VI	Value Added Tax (VAT)	1,573
VII	Contingency (Price and Physical)	5,011
Total Project Cost		**25,222**

Draft O&M Plan

O&M plan of the TL-MT Expressway including implementation structure plan, organization, staffing, and vehicle of expressway management center, etc., was prepared referring to the actual O&M works of HCMC-TL Expressway. As for the ITS plan, it is proposed referring to the ITS standards by JICA, Vietnamese regulation, and the existing plan of ITS, etc. Furthermore, Greater HCM Area Expressway O&M Corporation is recommended to be established to cover O&M for expressways in Southern Vietnam taking into account the economic efficiency and convenience of users in terms of O&M services.

Review of Social and Environmental Consideration

The environmental impact assessment (EIA) for the Project has been originally implemented by BEDC. The EIA Report was approved on October 27, 2008 (Decision No. 2140/QD- BTNMT) by Ministry of Natural Resources and Environment (MONRE). In the JICA Survey, the validity of the existing EIA Report and its compliance with the requirements of the JICA Guidelines for Environmental and Social Considerations was confirmed basically. Regarding the land acquisition and resettlement, the status and progress of activities by the compensation council under the Provincial Level People's Committee was also confirmed.

(from Chapter-6 Project Plan)

ECONOMIC ANALYSIS

As a result of the economic analysis, economic internal rate of return (EIRR) is calculated at 15% which exceeded the social discount rate of 12%. Together with fairly sufficient ratio of cost/benefit and economic net present value, the project is proved to have sufficient socio-economic benefits for its implementation.

(from Chapter-7 Economic Analysis）

SELECTION OF PROJECT SCOPE AND SCHEME

Financial Analysis for base case of TL-MT Expressway

This chapter argues the project feasibility and investment rational, which consists of both profitability and risk analysis. First, preliminary screening is conducted only by profitability criteria for various project structures. Then, the prudent risk-return analysis follows to conclude the investment decision.

Regarding the profitability criteria, project internal rate of return (Project IRR) is used by calculating the revenue and costs throughout the project period. In TL-MT Expressway Project, the Project IRR is as low as 3.4% if toll rate is VND 1000/km/pcu and 5.2% if toll rate is VND 1300km/pcu. Considering the hurdle rate of approximately 15%, which is often required by private sector investors, TL-MT Expressway Project is not feasible as a stand-alone BOT project. In order to improve the profitability, various options are proposed as follows:

Financial Analysis for Various Options

The evaluation results of some options were introduced as follows:

- Option-1: Construction only of TL - Cai Be section and adding the revenue from NH1A toll plazas (both Can Tho Bridge and My Thuan Bridge), with subsidy for land acquisition costs.

  Project IRR is calculated at 5.6% (VND 1000/km/pcu) and 7.4% (VND 1300/km/pcu).

- Opion-2: Construction of the whole section of TL-MT, integration of all revenue from HCM-TL, TL-MT Section, and NH1A toll plazas with subsidy for land acquisition costs.

  Project IRR is calculated at 6.4% (VND 1000/km/pcu) and 7.8% (VND 1300/km/pcu).

- Opion-3: Construction only of TL - Cai Be section, integration of all revenue from HCM-TL, TL-MT Section, and NH1A toll plazas with subsidy for land acquisition costs.

  Project IRR is calculated at 9.3% (VND 1000/km/pcu) and 11.1% (VND 1300/km/pcu).

- Opion-4: Construction only of TL - Cai Lay section, integration of all revenue from HCM-TL, TL-MT sections, and NH1A toll plazas with subsidy for land acquisition costs.

  Project IRR is calculated at 13.4% (VND 1000/km/pcu) and 16.2% (VND 1300/km/pcu).

- Opion-5: Construction only of TL - Cai Lay section, integration of all revenue from TL-MT Section and from NH1A toll plazas with subsidy for land acquisition costs.

  Project IRR is calculated at 10.8% (VND 1000/km/pcu) and 13.4% (VND 1300/km/pcu).

- Opion-6: Construction only of TL - Cai Lay section, integration of all revenue from HCM-TL, TL-MT sections, and NH1A toll plazas by adding new establishment of KM1953+200 with subsidy for land acquisition costs.

  Project IRR is calculated at 15.3% (VND 1000/km/pcu) and 17.7% (VND 1300/km/pcu).

Among the various options mentioned above, Options 4 and 6 achieve the hurdle rate of approximately 15%. However, after the in-depth risk analysis, it was concluded that TL-MT Expressway even under the assumption of Options 4 and 6 structures are difficult to be implemented as BOT project. In the risk analysis, various issues were discussed including the prospective security packages and government guarantee and undertaking (GGU) for traffic risk, toll risk, foreign exchange risk, etc. Among them, the interface risk to public funded construction is one of the most difficult issues. In order to avoid such risks, it is further proposed that the construction of the expressway will be done by public sector, possibly by public fund. Moreover, it is proposed that the private sector investor participate only to O&M and other minor investment and O&M concession scheme. As a result of comparison between this O&M concession scheme and the Option 4 in terms of both project profitability and risk management, the O&M concession scheme could have an advantage as follows: i) it is possible to secure expected level of project profitability, ii) it is possible to avoid and effectively manage/mitigate those project risks which were recognized as difficult to be managed by the private sector, and iii) financial burden of the government for project life cycle could be lesser.

(from Chapter-8 Selection of Project Scope and Scheme)

SECURITY PACKAGE

Security package is defined as an aggregation of promises and risk allocation in order to: i) strengthen the business sustainability of SPC by appropriately allocating project risks among the related parties and ii) securing loan credit by setting various security charges on project related rights and assets. In order to implement the proposed O&M concession scheme the following are proposed: i) necessary government guarantee, provision of subsidy, investor's guarantees and provisions, and ii) cash flow control mechanism, various security charges, and outline of step-in procedure.

In addition, outline of contract conditions are proposed in term sheet format (table format with bullet points) explaining major items such as subject of contract, contract method, contract period, and payment system about the concession contract to be entered into between MOT and SPC.

(from Chapter-9 Security Package)

PROJECT ASSESSMENT

There are project assessments to be made prior to implementation, during implementation and post implementation. The assessment prior to implementation is conducted in technical, financial, socio-environmental consideration, and organization/institutional aspects. As a result, although there are some issues to be solved it is assessed that the project would have sufficient viability for implementation. Monitoring method of SPC activities by the government is also proposed on the basis of Key Performance Indicator (KPI) during concession period.

(from Chapter-10 Project Assessment)

RECOMMENDATIONS ON INVESTMENT PROMOTION MEASURES FOR VIETNAM EXPRESSWAY PROJECTS

There are various project risks already existing in the expressway sector of Vietnam, together with its low sovereign rating risk and current fund deficiency in the government. Despite these disadvantageous conditions, the Vietnamese government has been reluctant to extend sufficient support to the project, thus, its aim to invite and materialize private sector investment from overseas in the expressway sector has been unsuccessful.

To solve this problem and to facilitate the investment in the expressway sector of Vietnam, the following three measures are proposed:

I. Limited assumption of project risks by private sector: Expressway facilities are to be constructed by the public side and the private sector will conduct O&M activities using the facilities possibly with small investment requirement by the private sector;

II. Simultaneous proposal of market tested risk covering measures together with back up funding for the risk coverage; and

III. Application of the "Waiting Room Approach": By commencing the construction of the expressway section of the public side first which precedes the construction of the private side, the private side could "wait and see" and verify the occurrence of major project risks, then could start its investment and construction.

(Chapter-11 Recommendations on Investment Promotion Measures for VN Expressway)

CONCLUSION AND RECOMMENDATIONS

Because TL-MT Expressway traverses the Mekong Delta area which is swampy, thus, costly and expected traffic level is not high enough to be able to recover such costly investment. Therefore, it is not likely to expect active participation of private sector investors to make a full scale investment in the Project. To this end, the O&M concession scheme proposed is for the public sector to construct the expressway facilities including the land acquisition. On the other hand, the private sector side will make additional investment of O&M related facilities to the above infrastructure, and use their expertise to provide O&M services to the entire expressway. This proposal is assessed to have the following advantages: (1) possibility of private sector investment is assumed high as the risk allocation is appropriate, (2) financial burden for Vietnamese government for the project life cycle is relatively lesser and could also lead to reinforcement of financial strength with Cuu Long CIPM, (3) could bring fair and considerable benefit to all related stakeholders, and (4) could become a stepping stone to materialize future integration of O&M functions of different expressway sections of the Greater Ho Chi Minh Region, and make possible the establishment of an integrated expressway O&M organization in the future. Moreover, this would ultimately seek for both economic efficiency and convenience of the expressway users.

The following recommendations are made to materialize the above proposals:

I. The Vietnamese government will fund and construct the entire expressway utilizing both state budget and donor funds. However, liability and repayment obligation of those funding must be separated from Cuu Long CIPM;

II. Cuu Long CIPM will procure funding on the counterpart fund for donor fund procurement by utilizing existing cash flow of HCM-TL Expressway and the toll revenue of MT and CT bridges; and

III. The Vietnamese government will continuously look for a potential investor from Japan for this Project on the basis of cooperation with the Japanese government. Moreover, as a representative case of a PPP project using Japanese donor fund, GoV will materialize the "Integrated O&M System for Greater Ho Chi Minh Regional Expressway Network" on the basis of a Vietnamese-Japanese strategic partnership.

(Chapter-12 Conclusion and Recommendations)

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LIST OF ABBREVIATIONS

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADB	Asian Development Bank
ANPR	Automatic Number Plate Recognition Camera
B/C	Cost Benefit Ratio
BEDC	BIDV Expressway Development Company
BIDV	Bank for Investment and Development of Vietnam
BOT	Build-Operate-Transfer
Cuu Long	Cuu Long Corporation for Investment, Development and Project Management of Transport Infrastructure
CIPM	
D/D	Detailed Design
DCM	Deep Cement Mixing Method
DDHV	Directional Design Hourly Volume
DEG	Diesel Engine Generator
DHV	Design Hourly Volume
DRVN	Directorate for Roads of Vietnam
DSRC	Dedicated Short Range Communication
ECA	Export Credit Agency
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
ENPV	Economic Net Present Value
EPC	Environmental Protection Commitment
EPC	Engineering, Procurement, and Construction
EPS	Expanded Polystyrene Form
ETC	Electric Toll Collection
F/C	Foreign Currency
F/S	Feasibility Study
GATE	Guarantee and Acquisition toward Tokyo market Enhancement
GDP	Gross Domestic Product
GGU	Government Guarantee and Undertaking
GRDP	Gross Regional Domestic Product
HAIDEP	The Comprehensive Urban Development Program in Hanoi Capital. City of the Socialist Republic of Vietnam
HCM	Highway Capacity Manual
HCMC	Ho Chi Minh City
HIV	Human Immunodeficiency Virus
HOUTRANS	The Study on Urban Transport Master Plan and Feasibility Study in HCM Metropolitan Area in the Socialist Republic of Viet Nam
IC	Interchange
IDC	Interest During Construction
IFI	International Financial Institution
IMF	International Monetary Fund
IOL	Inventory of Loss
ITS	Intelligent Transport System
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency

JPY	Japanese Yen
JVC	Joint Venture Consortium
KCI	Korean Consultants International
KPI	Key Performance Indicator
L/C	Local Currency
LEP	Laws on Environmental Protection
LOS	Level of Service
MCA	Multi-Criteria Analysis
METI	Ministry of Economy Trade & Industry
MONRE	Ministry of Natural Resources and Environment
MOT	Ministry of Transport
MPI	Ministry of Planning and Investment
NEXCO	Nippon Expressway Company Limited
NVR	Network Video Recorder
O&M	Operation and Maintenance
OBU	On Board Unit
OD	Origin and Destination
ODA	Official Development Aid
PIRR	Project Internal Rate of Return
PA	Parking Area
PC	Prestressed Concrete
PCU	Passenger Car Unit
PK	Package
PM	Prime Minister
PMU	Project Management Unit
PPP	Public and Private Partnership
PSIF	Private Sector Investment Finance
PVD	Prefabricated Vertical Drain
RAP	Resettlement Action Plan
RC	Reinforced Concrete
ROM	Road Management Office
SA	Service Area
SBV	State Bank of Vietnam
SEA	Strategic Environmental Assessment
SPC	Special Purpose Company
STRADA	System for Traffic Demand Analysis
TEDI	Transport Engineering Design Incorporation
TEDI South	Transport Engineering Design Joint Stock Incorporated South
TMS	Traffic Management System
TTC	Travel Time
UNCTAD	The United Nations Conference on Trade and Development
UPS	Uninterruptible Power System
USD	United States Dollar
VAT	Value Added Tax
VCM	Vacuum Consolidation Method
VITRANSS 2	The Comprehensive Study on the Sustainable Development of Transport System
VITRSNSS	The Comprehensive Study on the Sustainable Development of Transport System in Vietnam

VMS	Variable Message Signs
VND	Vietnam Dong
VOC	Vehicle Operation Cost
WIM	Weight in Motion

CHAPTER 1 INTRODUCTION

1.1 Background of the JICA Survey

In the transportation system in Vietnam, a road plays an important role. According to the transportation statistics of each mode of transport (road, railway, inland water transport, coastal and air services) in 2008, road transport accounted for 69.8% of all freight transport and 90.8% of all passenger transport. However, road network has not been developed sufficiently to accommodate the rapid increase of traffic demand generated by the recent economic growth in the country.

The Government of Vietnam (GOV) gives priority to transport infrastructure development as one of the most urgent subjects in "the 9th Socio-economic Development 5-year Plan (2011-2015)" in order to achieve a sustainable economic development under a rapid growth. Especially, as for the expressway, "Expressway Development Plan (master plan)" established by the Ministry of Transport (MOT) was approved by the Prime Minister in December 2008. In the master plan, the implementation plan of 39 sections (5873 km in total) of the expressway were established, and 2235 km, out of 5873 km, were planned to be completed before 2020.

In accordance with the status and development policy for the transport infrastructure development mentioned above, the Japan International Cooperation Agency (JICA) conducted “the Comprehensive Study on the Sustainable Development of Transport System in Vietnam” (VITRANSS 2) (November 2007-May 2010). This study aims to support the development of transport sector development master plan covering all transportation sectors in Vietnam. For the expressway development sector, VITRANSS 2 supported to formulate the “North-South Expressway Master Plan”, thus, a preliminary feasibility study was carried out.

As a result of the preliminary feasibility study conducted for VITRANSS 2, the financial cost for the development of North-South Expressway network was estimated at approximately USD 66 billion. Projects which implementation have been approved by GOV are estimated at approximately USD 12 billion, and most of the projects will need to be financed under the Official Development Assistance (ODA) from the Japanese government, the World Bank, ADB and so on. The remaining USD 54 billion is required to be secured from various financial sources. It will be hard to source all the funds from the public fund of GOV and ODAs therefore, it is strongly suggested to mobilize private sector participation and investment.

As an introduction to private sector investment, it is necessary to study a case of 100% private sector investment such as build-operate-transfer (BOT) and public-private partnership (PPP) schemes. VITRANSS 2 suggested the possibility to apply PPP for some projects, and emphasized a need for further detailed study in order to materialize a concrete business model of PPP and its practical implementation process.

In connection with the above, the GOV and each project implementing authority requested to JICA an assistance in supporting important expressway projects in the Southern Vietnam, such as Bien Hoa–Vung Tau Expressway Project, Can Tho–My Thuan Expressway Project, Trung Luong-My Thuan Expressway Project, Ho Chi Minh Ring Road No. 3 and No.4, by the development and application of PPP project scheme. As for Trung Luong-My Thuan Expressway Project, which is the target project in the preparatory survey (hereinafter referred to as the Project), it is important for sustainable development of Vietnam. Further, equal development within the southern region is essential, hence, connecting Ho Chi Minh City (HCMC) with its neighboring area, especially to Can Tho City, which is the center city of Mekong River Delta Region, is required by establishing an expressway to be able to serve as an industrial and economic corridor

The North-South Expressway (Eastern) is a priority in the master plan (Decision

No.1734/QD-TTg), and its detailed design plan was approved by the Prime Minister in the Decision No.140/QD-TTg dated January 21, 2010. The Project is a part of the North-South Expressway (Eastern) and is planned to be developed under a BOT scheme before 2015. A feasibility study (F/S) was approved by MOT in February 2008 (No. 343/QD-BGTVT), and the BIDV Expressway Development Company (BEDC) will stand as the BOT concessionaire, as approved.

Under the above circumstances, in the JICA Study on Measuring the Possibility of Private Investments in Expressway Project in Southern Vietnam, the Project is ranked as one of the high priority projects.

The BEDC and JICA made several preliminary discussions in order to identify priority projects in the field of the expressway sector and finally agreed to make preparation for the Project. Accordingly, JICA dispatched a mission on the Project to Vietnam from July 26 to July 30, 2011 in order to develop a scope and implementing arrangements for further survey by evaluating the feasibility of the Project, and finally the Minutes of Meeting (M/D) on the above JICA mission was signed between BEDC and JICA in July 2011.

Based on the M/D, JICA organized a survey team that consists of Nippon Koei Co., Ltd., Marubeni Corporation, and KRI International (hereinafter referred to as the JICA Survey Team) for the implementation of the Preparatory Survey on Trung Luong – My Thuan Expressway Project (hereinafter referred to as the JICA Survey).

However, on November 4, 2011, the Bank for Investment and Development of Vietnam (BIDV), who was assigned by the GOV to take the lead, together with several major groups to establish BEDC, requested the return of the concession to MOT through the letter No. 1105/CV-BIDV. Finally, GOV accepted the request. JICA decided to suspend the JICA Survey because the project owner/counterpart did not appear interested. To resume quickly the JICA Survey, GOV assigned the Cuu Long Corporation for Investment, Development and Project Management of Transport Infrastructure (Cuu Long CIPM), who is the authorized project implementation agency for My Thuan–Can Tho Expressway, as the same implementation agency to study the implementation mechanism of the Project. Then, GOV requested JICA to resume the survey on February 23, 2012. After consideration of the project situation and importance, JICA agreed to resume the JICA Survey and kick-off over the resumption was held on June 20, 2012.

1.2 Objectives of the JICA Survey

The objectives of the JICA Survey are as follows:

- To evaluate the possibility of private investment for the Project by confirmation of private investment environment, examination on the demarcation between public and private scopes, financial structure analysis, risk analysis, technical verification, and environmental and social considerations, menu proposal of government supports, market sounding study, and then proposed suitable BOT/PPP scheme; and
- To prepare draft term sheets for BOT contract and Government Guarantee and Undertaking (GGU).

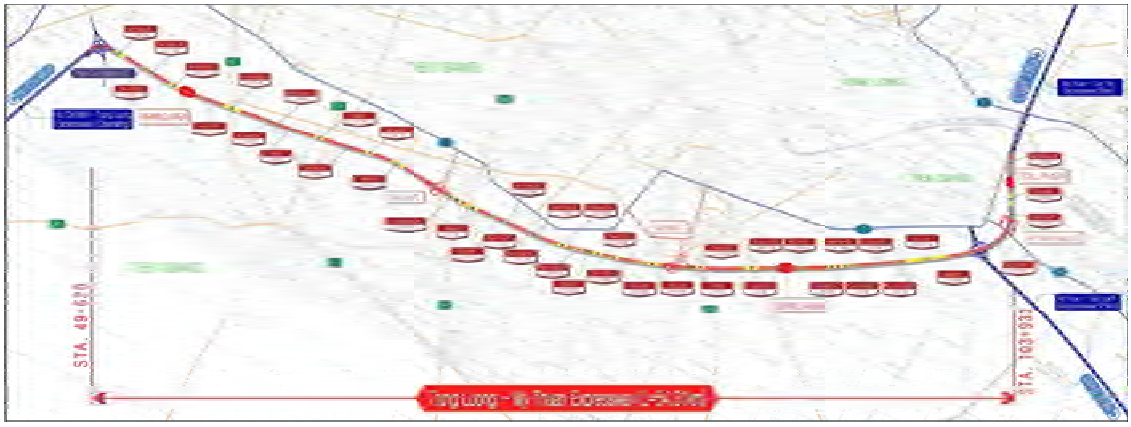
1.3 Scope of the Project

The target project is the Trung Luong–My Thuan Expressway located in Tien Giang Province of Mekong River Delta Area and the scope of the project includes construction, operation, and maintenance of the expressway.

1.4 Outline of the Project

The road section of 54.3 km from Trung Luong to My Thuan forms a part of the 150 km long HCMC–Can Tho Expressway. The expressway takes a route westward from HCMC in parallel with the existing National Highway (NH) 1A in the alluvium flat terrain of the Mekong River Delta crossing numerous water channels. The section from Trung Luong to My Thuan which was planned to be built as an extension to the first section from HCMC to Trung Luong has been operating since February 2010.

The route plan and the outline of the Project are shown in Figure 1.1 and Table 1.1, respectively.



Source: JICA Survey Team

Figure 1.1 Route Plan of the Project

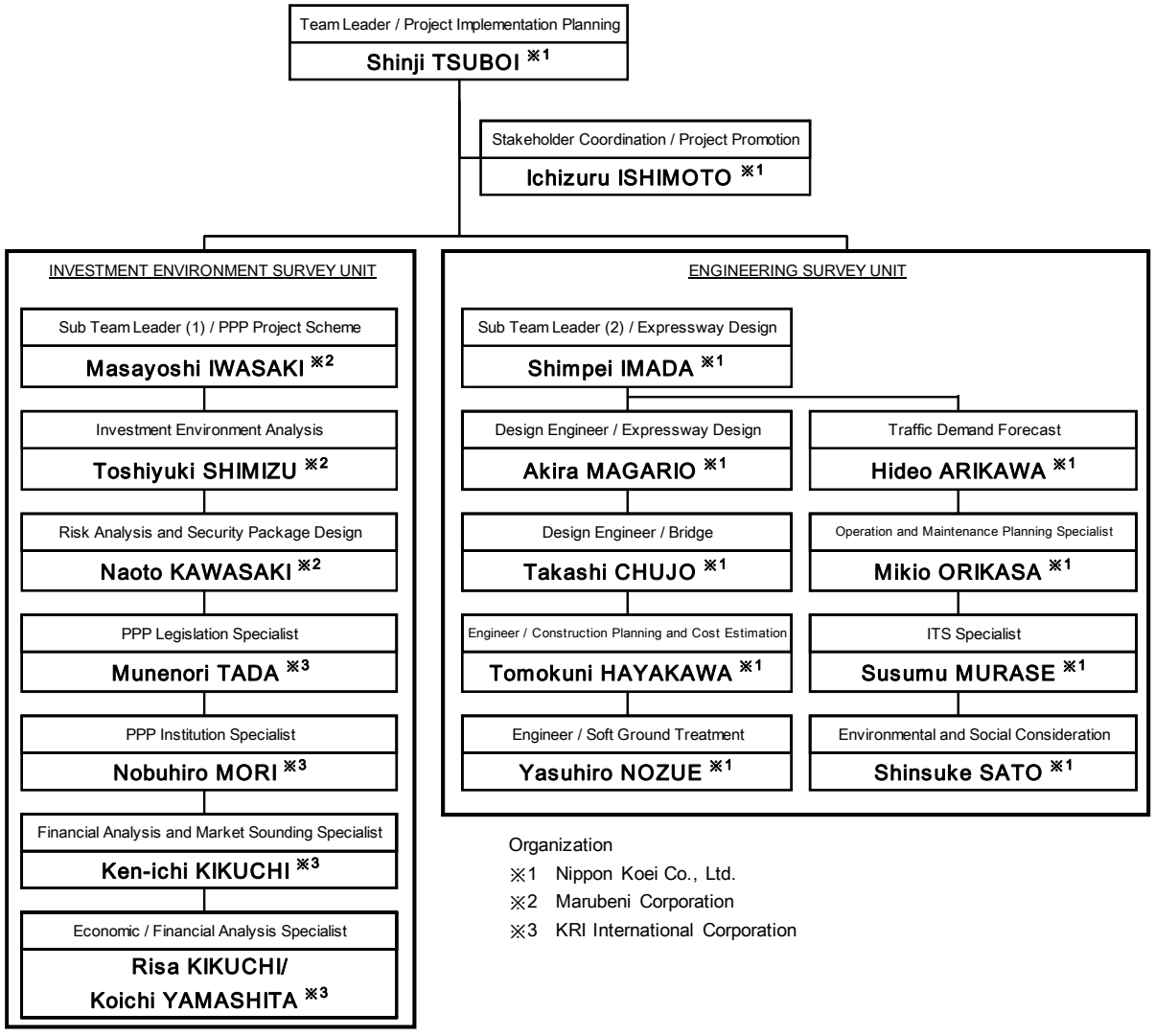
Table 1.1 Outline of the Project

Item	Description
Road Class	Expressway Class A (Design Speed 120 km/h)
Section and Length	Km 51+060～Km 103+700 (54.3 km)
Number of Lanes	4-lane at the initial stage
Road Width	25.5 m for embankment, 24.5 m for bridge
Major Structures/ Facilities	12.2 km (on the thruway) 4 Interchanges, 1 Intersection 1 toll barrier on thruway, 3 toll gates on interchange ramp-way 1 Service Area, 1 Parking Area
Forecasted Traffic Volume*1/	Vehicle/day 20,100 (2020), 33,446 (2030), 67,724 (2040)
	PCU/day 32,480 (2020), 50,853 (2030), 100,936 (2040)
Investment Cost (VND billion) *2/	VND 20,212 billion (VND 25,222 billion including price escalation)

Note: *1/ estimated under scenario as described in Chapter 6.1.3)
*2/ updated project cost (see Chapter 6.2.8)
Source: JICA Survey Team

1.5 Study Organization

The JICA Survey Team consists of the Investment Environment Survey Unit and Engineering Survey Unit under the Team Leader's management and supervision with 18 experts in total. Each unit has corresponding subteam leaders assigned, while the position of Stakeholder Coordination/Project Promotion is assigned for smooth implementation of the JICA Survey. The organizational chart of the JICA Survey Team is shown in Figure 1.2.



Source: JICA Survey Team

Figure 1.2 Organizational Chart of the JICA Survey Team

CHAPTER 2 BACKGROUND AND NECESSITY OF THE PROJECT

2.1 Present Socio-Economic Conditions of Vietnam

Real GDP annual growth rate has always been at the level of 7% to 8% from the year 2000 to 2007. It has been in the decreasing trend since 2008. Though in 2011, the growth has maintained at a level of 6% per annum. The first quarter of the year 2012 has recorded the growth rate of about 4% due to the down turn in the construction industry.

On the other hand, the importation of machinery parts and oil products which were once heated up by the rapid economic growth has slowed down considerably from the previous pace. With the recent increase of exports, the trade deficit of USD 10 billion level which has been continuing since 2007 has reduced the gap rapidly.

The foreign direct investment (FDI) has been active since 2007, and continuing to its high level of investment activities even in 2012. In terms of investor's country and region, Japan has been by far the most active country (it accounted for 77% of the approved investment amount as of May 20, 2012).

The consumer price index (CPI) in Vietnam has increased rapidly (the average of the year 2011 was 18.6%), but has been slowing down since then, and recorded 8.34% in May 2012 when compared with the same month of the previous year, which was the first one digit number recorded since October 2010.

Having a stabilized trend of CPI, the State Bank of Vietnam has lowered the discount rate, refinancing rate, and upper limit of the bank saving interest rate in succession and further reduction is expected towards the year end.

2.2 Present Condition of the Expressway Sector

Currently, GOV is pushing forward the expressway network development program to meet the increasing road traffic demand due to the rapid economic growth in the country. However, most of the on-going expressway projects depend on the development assistance agencies' funding, and counterpart funds strain the state finance. Accordingly, GOV expects to utilize private funds in future expressway projects.

Outline of the related expressway network development program is described below.

1) Expressway Network Development Master Plan

The present Expressway Network Development Master Plan was approved by the Prime Minister in Decision No.1734/QD-TTg dated December 1, 2008. In the plan, 39 sections (5753 km) were established and 19 sections (2115 km) including the Trung Luong - My Thuan - Can Tho Expressway were prioritized to be developed before 2020.

Outline of the Expressway Network Development Master Plan is shown in Table 2.1 and Figure 2.1.

Table 2.1 Outline of the Expressway Network Development Master Plan

Route/Region	Completed (as of 2008)	Before 2020 Prioritized Section	After 2020	Total
North-South Expressway (Eastern)	2 sections (70 km)	9 sections (886 km)	5 sections (985 km)	16 sections (1,941 km)
North-South Expressway (Western)			2 sections (1,321 km)	2 sections (1,321 km)
Northern Region	1 section (30 km)	6 sections (825 km)	4 sections (244 km)	11 sections (1,099 km)
Central Region			3 sections (264 km)	3 sections (264 km)
Southern Region	1 section (20 km)	2 sections (265 km)	5 sections (699 km)	8 sections (984 km)
Ring Road in Hanoi and Ho Chi Minh City		2 sections (139 km)	1 section (125 km)	3 sections (264 km)
Total	4 sections (120 km)	**19 sections (2,115 km)**	20 sections (3,638 km)	43 sections (5,873 km)
			39 sections (5,753 km)	
Project Cost (VND billion)	N/A	306,090	460,130	766,220

Source: Decision No.1734/QD-TTg dated December 1, 2008

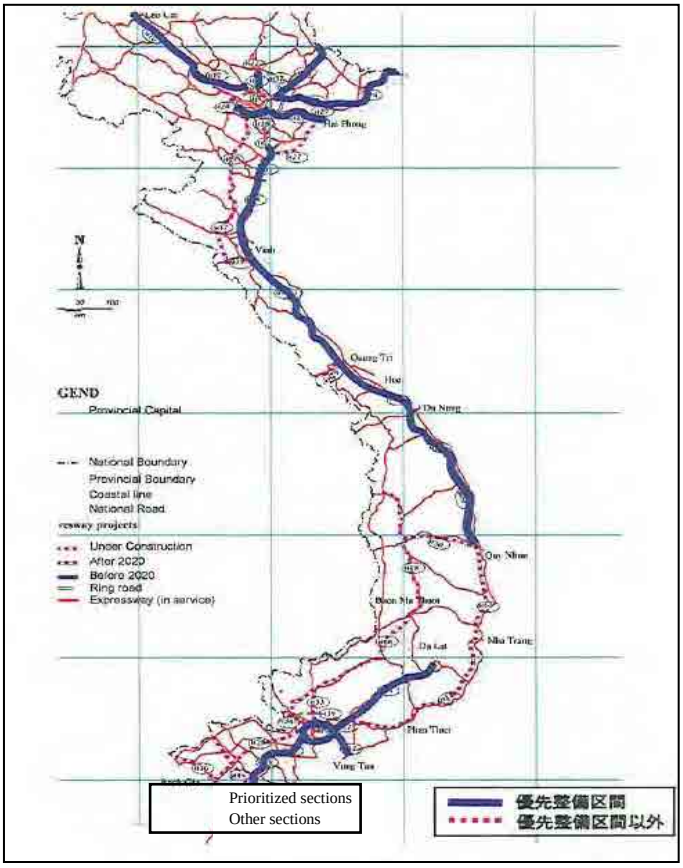


Figure 2.1 Expressway Network Development Plan

Source: Decision No.1734/QD-TTg dated December 1, 2008

2) Detailed Plan of the North-South Expressway (Eastern)

The North-South Expressway (Eastern) was prioritized in the master plan (Decision No.1734/QD-TTg), and its detailed plan was approved by the Prime Minister in Decision No.140/QD-TTg dated January 21, 2010. The Trung Luong-My Thuan-Can Tho Expressway was planned to be developed before 2015.

The detailed plan of the North-South Expressway (Eastern) is shown in Table 2.2.

Table 2.2 Detailed Plan of the North-South Expressway (Eastern)

No.	Section	Lenght (km)	Nos. of lane	Project Cost (VND in billion)	Finance	Project Owner	Status (July 2012)	Cost (VND in billion)		
								Short-term (-2015)	Medium-term (-2020)	Long-term (-2030)
1	Phap Van - Cau Gie (Widening)	30	6	1,350	N/A	VEC	F/S		1,350	
2	Cau Gie - Ninh Binh	50	6	9,650	SB,CB	VEC	Operation	9,650		
3	Ninh Binh - Thanh Hoa (Nghi Son)	121	6	25,289	PPP(WB)	PMU1/DRVN	F/S	25,289		
4	Thanh Hoa - Ha Tinh (Hong Ling)	97	4-6	19,852	PPP(WB)	PMU1/DRVN	F/S	19,852		
5	Ha Tinh - Quang Binh (Bung)	145	4	25,362	N/A	N/A	PF/S		10,145	15,217
6	Quang Binh - Quang Tri (Cam Lo)	117	4	12,051	N/A	N/A	PF/S		4,820	7,231
7	Quang Tri - Da Nang (Tuy Loan)	182	4	24,591	N/A	N/A	PF/S		24,591	
8	Da Nang - Quang Ngai	130	4-6	25,035	ODA(WB/JICA)	PMU85&1/ VEC	D/D	25,035		
9	Quang Ngai - Binh Dinh	170	4	29,750	N/A	N/A	PF/S		29,750	
10	Binh Dinh - Nha Trang	215	4	35,905	N/A	N/A	PF/S		35,905	
11	Nha Trang - Phan Thiet	226	4	35,708	N/A	N/A	PF/S	15,870		
12	Phan Thiet - Dau Giay	98	4-6	16,170	PPP	BITEXCO	F/S	16,170		
13	Dau Giay - Long Thanh	43	6-8	16,340	ODA(ADB/JICA)	VEC	U/C	16,340		
14	Long Thanh - Ben Luc	58	6-8	22,620	ODA(ADB/JICA)	VEC	D/D	18,096	4,524	
15	Ben Luc - Trung Luong (Widening)	37	8	14,970	N/A	Cuu Long CIPM	F/S	14,970		
16	Trung Luong - My Thuan - Can Tho	92	6	26,700	N/A	Cuu Long CIPM	D/D,F/S	26,700		
Total		1,811		341,343				187,972	130,923	22,448

Notes:F/S = Feasibility; PF/S = Pre-feasibility Study; D/D = Detailed Engineering Design; U/C = Under Construction, SB = State Budget; CB = Construction Bond; ODA = Official Development Assistance; BOT = Build-Operate-Transfer
(Source: Decision No.140/QD-TTg dated January 21, 2010)

3) Mekong Delta Transport Master Plan

The latest master plan on developing transportation system in the key economic region of Mekong River Delta by 2020 and orientation towards 2030 was approved by the Prime Minister in the Decision No. 11/2012/QĐ-TTg dated February 10, 2012 which is an updated version of the former PM's Decision No.344/2005/QD-TTg dated December 26, 2005.

The Trung Luong–My Thuan–Can Tho Expressway is prioritized to be constructed and other expressways are planned to be built one at a time in compliance with the overall development plan of the highway network and fund capacity. Planned expressways in Mekong River Delta are listed in Table 2.3 and shown in Figure 2.2.

Table 2.3 Planned Expressway in Mekong River Delta

No.	Section	Length (km)	No. of lanes
1	Trung Luong – My Thuan – Can Tho (North - South Expressway route in the east)	92 km	4-6 lanes
2	Can Tho - Ca Mau (North - South Expressway route in the east)	150 km	4 lanes
3	Ngoc Hoi – Chon Thanh - Rach Gia (North - South Expressway in the west)	864 km	4-6 lanes
4	Chau Doc (An Giang) - Can Tho - Soc Trang	200 km	4 lanes
5	Ha Tien (Kien Giang) - Rach Gia - Bac Lieu	225 km	4-lanes

Source: Prime Minister Decision No. 11/2012/QĐ-TTg dated February 10, 2012

Figure 2.2 Transport Master Plan in Mekong River Delta

Source: Prime Minister Decision No. 11/2012/QĐ-TTg dated February 10, 2012

2.3 Necessity of the Project

1) Geographical location of the Project

Southern Vietnam comprises the Southeastern Region containing HCMC and five provinces, and Mekong River Delta Region containing Can Tho City and 12 provinces.

The Southeastern Region has 14.9 million people or 17.0% of the country's population, as of 2011. About 39.2% of gross domestic product (GDP) in 2007 and 48.2% of foreign direct investment (FDI, accumulated 1988-2011) are produced in this region. The regional economic bloc is being developed remarkably by building industrial parks in HCMC and its neighboring areas which is spread to every direction with the development of major infrastructures such as seaports, roads, and airport.

On the other hand, the Mekong River Delta Region has about 17.3 million people. Around 53% of rice production and 58% of aquatic products compared with the whole country as of 2009 and 17.6% of GDP (2007) were recorded. This region has the potential to become an economic growth area due to its proximity to HCM metropolitan area and the existing abundant labour with relatively lower cost than in urban areas. However, the FDI still remains low at a level of 5.2% (accumulated 1988-2011) due to underdeveloped infrastructures.

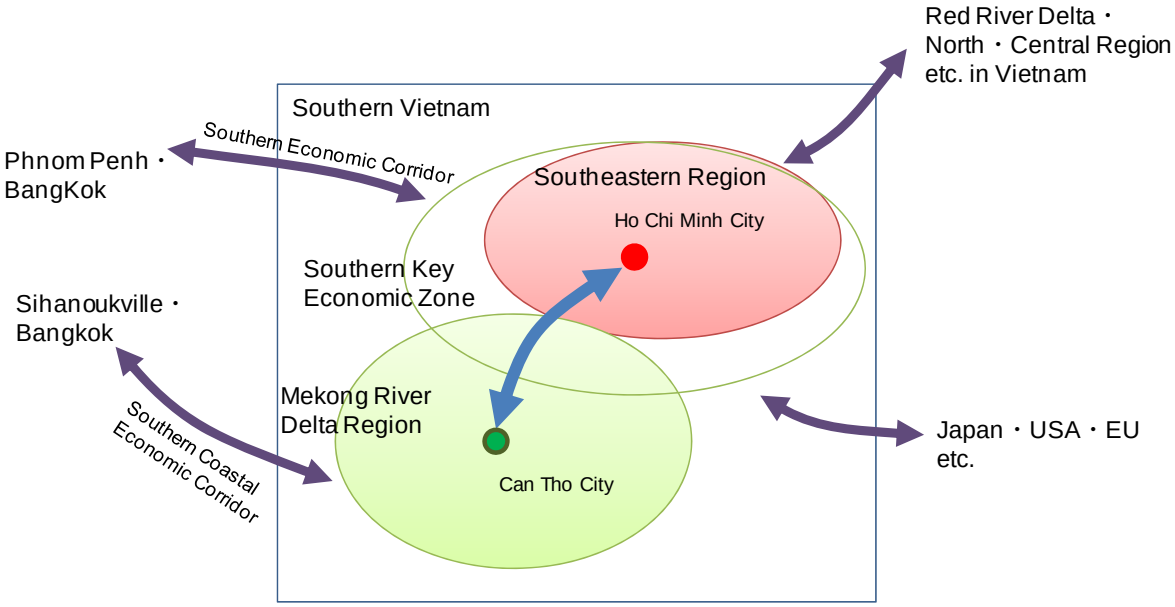


Figure 2.3 Economic Relations with Mekong River Delta Region

Source: JICA SurveyTeam

Recently, the Southeastern Region and the two provinces in Mekong River Delta Region, namely, the Long An Province and Tien Giang Province are called as the Southern Key Enonomic Zone, which became the major driving force of regional development in the field of economic growth, trade, consumer goods production, attraction of foreign investment, investments in industrial parks, and industrialization. In the Southern Key Economic Zone, the roads, ports, and airports transport infrastructures function as a national and international gateway which are currently being developed, and it is raising the interest of foreign investment.

In addition, the Southern Vietnam which belongs to the Greater Mekong Subregion is expected to have a dramatic economic growth due to its connection with Phnom Penh, Sihanoukville, and Bangkok by the Southern Economic Corridor and Southern Coastal Economic Corridor.

In order for Vietnam to achieve sustainable economic growth in the Greater Mekong Subregion, it is important to attain regional development to deepen the cooperation between the two regions in the Southern Vietnam, namely, Southeastern Region and Mekong River Delta Region, as well as realizing a well-balanced development to mitigate regional inequality. As economic and industrial corridors connecting the city center between the two regions, the Trung Luong–My Thuan Expressway Project which is part of the HCM–Can Tho Expressway is therefore, necessary to be given priority for construction to develop the region in Southern Vietnam.

2) Evaluation of the Project in the JICA Study on Measuring the Possibility of Private Investment in Expressway Projects in Southern Vietnam

In the Study on Measuring the Possibility of Private Investment in Expressway Projects in Southern Vietnam (June 2012 JICA), multi-criteria analysis (MCA) was adopted in order to assess the investment priority for five expressway projects (Bien Hoa-Vung Tau Expressway Project, Truong Luong-My Thuan Expressway Project, My Thuan-Can Tho Expressway Project, Ring Road No.3 Project, and Ring Road No.4 Project) in Southern Vietnam.

The criteria which were adopted in this analysis are as follows; financial feasibility/fiscal

support, readiness and risk, socio-economic benefits, regional development/contribution in sector plan, sector network role/importance in sector plan, national security/national integration, land acquisition, environmental impact/involuntary resettlement, impact export earnings, safety, project cost, and demand growth/ traffic volume.

Based on the MCA as shown in Tables 2.4 and 2.5, Trung Luong–My Thuan Expressway Project is the second investment priority among the five expressway projects in Southern Vietnam. Especially, it is highly evaluated in the points of regional development/contribution, land acquisition, environmental impact/involuntary resettlement, and demand growth/traffic volume.

Table 2.4 Investment Priority of Five Expressway Development Projects

Expressway	Score	Ranking
Bien Hoa - Vung Tau	65.5	1
Can Tho - My Thuan	51.4	3
My Thuan - Trung Luong	52.4	2
Ring Road 3 (HCMC)	50.7	4
Ring Road 4 (HCMC)	44.8	5

Source: The Study on Measuring the Possibility of Private Investment in Expressway Project in Southern Vietnam

Table 2.5 Evaluation of the Five Expressway Development Projects (MCA)

Multi-Criteria Analysis: Application to expressway projects in Southern Vietnam

	Project	Bien Hoa - Vung Tau				Can Tho - My Thuan				My Thuan - Trung Luong				Ring Road 3 (HCMC)				Ring Road 4 (HCMC)			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	Criteria	Score in words	Score	Weight (Average 10)	Score X weight/14.5	Score in words	Score	Weight	Score X weight/14.5	Score in words	Score	Weight	Score X weight/14.5	Score in words	Score	Weight	Score X weight/14.5	Score in words	Score	Weight	Score X weight/14.5
1	Financial feasibility/fiscal support	Med	5	15	5.2	Low	2	15	2.1	Low	2	15	2.1	Low	2	15	2.1	Low	0	15	0.0
2	Readiness and risk	Med	7	15	7.2	Med	5	15	5.2	Med	7	15	7.2	Low	3	15	3.1	Low	3	15	3.1
3	Socio-economic benefits	High	9	10	6.2	Med	4	10	2.8	Med	4	10	2.8	High	8	10	5.5	Med	5	10	3.4
4	Regional development/Contribution to GDP	**High**	**8**	10	**5.5**	**Med**	**7**	10	**4.8**	**Med**	**7**	10	**4.8**	**Med**	**7**	10	**4.8**	**Med**	**6**	10	**4.1**
5	Sector network role/ importance in sector plan	**High**	**9**	10	**6.2**	**High**	**8**	10	**5.5**	**Med**	**6**	10	**4.1**	**Med**	**7**	10	**4.8**	**Med**	**7**	10	**4.8**
6	National security/national integration	High	8	10	5.5	Med	4	10	2.8	Med	4	10	2.8	Med	4	10	2.8	Med	4	10	2.8
7	Land acquisition	Low	0	15	0.0	Low	0	15	0.0	Low	0	15	0.0	Low	0	15	0.0	Low	0	15	0.0
8	Environmental impact (a) /involuntary resettlement (b)	Med	5	15	5.2	Med	7	15	7.2	Med	6	15	6.2	Med	5	15	5.2	Med	4	15	4.1
9	Impact in export earnings	Med	7	10	4.8	Low	2	10	1.4	Med	4	10	2.8	Med	4	10	2.8	Med	4	10	2.8
10	Safety	Med	5	10	3.4	Med	5	10	3.4	Med	5	10	3.4	Med	5	10	3.4	Med	5	10	3.4
11	Project cost	High	10	10	6.9	High	10	10	6.9	High	10	10	6.9	High	10	10	6.9	High	10	10	6.9
12	Demand growth (a) /traffic volume (b)	High	9	15	9.3	High	9	15	9.3	High	9	15	9.3	High	9	15	9.3	High	9	15	9.3
	Total score (out of 100)				**65.5**				**51.4**				**52.4**				**50.7**				**44.8**

Note:
(1) Safety: Scored Med (5 points) for criteria as there are no information for all the projects
(2) Please refer to evaluation criteria table for scoring rules
(3) EIRR and FIRR for Trung Luong-My Thuan are unknown and were assumed at same level as the Can Tho - My Thuan project
Source: The Study on Measuring the Possibility of Private Investment in Expressway Project in Southern Vietnam

3) Effects on the Materialization of the Project

The following are the direct and indirect effects that can be expected from the development of the Project.

- ✓ Flow of people and goods between the Mekong Delta River Region and Ho Chi Minh City Metropolitan (Southeastern Region) will improve from the viewpoints of travel time saving and comfortability.
- ✓ The promotion of private sector investment including Japanese companies is expected to have an impact on the Mekong River Delta Region as an area with high potential economic growth. As a result, industrial development through industrial parks is progressed, thereby contributing to the creation of employment and poverty reduction.
- ✓ The residential houses located along the NH1A parallel to the expressway have become densely populated. This situation makes the area a danger zone because bicycles, motorbikes, and vehicles are mixed on the road, together with pedestrians crossing the roads at locations of towns and cities along the NH1A. By shifting heavy vehicles especially trucks to the expressway from NH1A, the safety of the NH1A will be improved. In addition, since travel distance and traffic congestion will be minimized, the load on the environment is reduced.
- ✓ In the economic analysis in this study, the economic internal rate of return (EIRR) is calculated at 15%, therefore, high socio-economic benefit is confirmed.
- ✓ The project does not have the possibility to be implemented after the detailed design due to lack of funds. For this project to be realized, two remaining projects on the HCM–Can Tho Expressway, namely, the Second My Thuan Bridge Project (promoted ODA STEP loan project through the METI Study) and My Thuan–Can Tho Expressway Project (PPP/BOT scheme planned by Cuu Long CIPM), are expected to be promoted.
- ✓ From the viewpoint of business with Japanese private investors, it is expected that a suitable service level and a more efficient operation and maintenance of Vietnam expressway will be provided. This may be realized through the "Expressway Project BOT/PPP Model" for the operation and maintenance over a period of time beginning from its construction, coupled with know-how and technology transfer of traffic control system, etc. that have been built in Japan. In particular, the strengthening of support towards the development of ITS such as toll collection system and establishment of the O&M company is essential. In addition, the Japanese know-how on O&M manuals, development of organizational structure, and development of human resources can be useful.
- ✓ In addition, BOT/PPP business model of the expressway is expected not only to meet the needed funds but also the promotion of an efficient and sustainable expressway.

4) Necessity of the Project

As mentioned in Section 2.2 or later, the necessity of the Project can be explained as follows:

- The project route expressway is prioritized to be developed before 2015 in accordance with the detailed design plan of North-South Expressway (Eastern) by PM Decision No.140/QD-TTg.
- High traffic demand is forecasted to be 34,000 vehicles per day in 2030 on the expressway that connects Can Tho City in the center of the Mekong River Delta Region that has high development potential and Ho Chi Minh City's largest commercial area in Vietnam. The socio-economic benefit is confirmed to be high (Economic IRR is 15%).
- Moreover, the necessity to execute the "Expressway Project BOT/PPP Model" from construction to operation and maintenance for a certain period is extremely high. This will contribute in the advancement of not only the increasing capital needs but also for

the efficient and sustainable expressway development in the future.

In this Survey, to evaluate the possibility for private investment in the Project, a detailed survey was carried out based on the results in the review of traffic demand forecast and review of project cost.

CHAPTER 3 PRESENT STATUS OF BOT/PPP PROJECT

3.1 Present Investment Environment

Significant capital requirements, long investment timeline, and fixed nature of assets make infrastructure investments unique. Infrastructure investments certainly requires the existence of commercial opportunities in host country markets as well as a transparent and stable policy framework made clear by the rule of laws. Investors duly think of whether their rights and responsibilities are well respected before committing funds to a project. This chapter presents firstly, i) the recent reforms and development of the legal framework and regulatory procedures for foreign investment promotion (3.1.1), secondly, ii) issues on best practices for private investment promotion in infrastructure (3.1.2) and present law for BOT/PPP scheme (3.1.3), and lastly, iii) present investment environment for BOT/PPP expressway projects (3.2).

3.1.1 Recent Reforms and Development

The legal system in Vietnam is socialist in nature. The laws in this country consist of i) laws and resolutions enacted by the National Assembly, ii) decree/resolution by the government, iii) decisions of the Prime Minister, iv) circulars from the ministry, and v) decisions of the minister.

The Enterprise Law and the Investment Law took effect in 2006 and provided a level playing field for all newly-established foreign investments and domestic enterprises in Vietnam. Under these new laws, there are several modes of investment that foreign investors can avail. Investors may choose i) limited liability company with single or with two/more members, ii) joint stock company, and iii) partnership. The most popular mode of investment is a joint stock company where a foreign investor jointly invests with local or other foreign partners.

The service sector such as retail/supermarket and maintenance businesses used to be restricted to a limited foreign share (49%), but such a restriction has been loosened in 2009 onwards. A 100% foreign share may be approved for services using new technology or system.

The Commercial Law in 2005 has a wide scope governing all profit-oriented activities. These are transactions involving sales or purchase of goods and services. The concept of goods is extended to cover all types of movable assets including future assets and assets attached to lands.

The Corporate Income Tax is legislated by the Law 14 (2008), Decree 124 (2008), and Circular 130 (2008). The standard tax rate applied to companies approved under the Enterprise Law, the Investment Law, and the State-owned Enterprise Law is 25%. Companies of oil and natural gas exploration pay corporate tax ranging from 32% to 50%. The Circular 130 applies preferential tax system (corporate tax of 10% or 20%) or tax reduction system (tax exemption during the first four years and a 50% reduction during five years after tax exemption period), depending on types and places of businesses. If a company accounts a successive cumulative loss for four years, a corporate tax exemption is automatically applied to the company.

The custom duty is legislated by Law 29 and circulars issued by the Ministry of Finance. Goods applied by preferential custom duty comprise i) those imported from countries having reciprocal trade agreements with Vietnam, ii) those imported from countries having multi or bilateral free trade agreements with Vietnam, and iii) particular goods such as electronics, parts, and automobiles. A Japan and Vietnam Economic Partnership Agreement was signed in 2010 that gave more preferential custom duty to goods imported from Japan. Vietnam is ready to apply a duty-free tax to about 88% of import value coming from Japan for ten years beginning 2010 onwards.

The law on infrastructure project can be traced back to Decree 78 on investment based on the BOT, build-transfer-operate (BTO), and build-transfer (BT) contracts enacted in 2007. Decree 78 is the first BOT Law stipulating the i) definition of BOT/BTO/BT schemes, ii) conditions and regulations required for state contribution and equity-debt ratio, iii) procedures from project preparation to implementation, and iv) incentives such as income tax and custom duties. The government enhanced Decree 78 with respect to the conditions and regulations of the state contribution, equity-debt ratio, and procedures and requirements (who does what). The Decree 108 is now called the new BOT Law (2009), which comprise the following sections; i) General Provisions, ii) Establishment and Announcement of Project Lists, iii) Selection of Investors for Contract Negotiation, iv) Project Contract, v) Procedures from the Issuance of Investment Certificates to Project Implementation, vi) Incentives and Investment Security for Investors and Project Enterprises, and vii) State management for Investment Projects for BOT/BTO/BT Schemes. In addition, the government issued the PPP Regulation (PM Decision 71) in 2010, which is not a law per se but a pilot regulation subject to amendment.

3.1.2 Issues on Best Practices for Private Investment Promotion in Infrastructure

Section 3.1.2 focuses the issues on best practice for private investment promotion in infrastructure. The United Nations Conference on Trade and Development (UNCTAD) issued a paper entitled "Best practices in strengthening investment in basic infrastructure in developing countries" in May 2011. The lessons learned from the best practices of private investment promotion in infrastructure prepared by UNCTAD are shown below.

Table 3.1 Best Practices for Private Investment in Infrastructure

Stage	Lessons
Laying the foundations for investment in infrastructure	● A strong legal and regulatory framework ● Empower high-level taskforce
Promoting and facilitating the entry of investors	● Secure quality at entry ● Ensure that contracts include issues over the project life span ● Help mitigate regulatory risks
Ensuring effective and efficient project implementation	● Monitor project implementation

Source: UNCTAD, Trade and Development Board

A strong legal and regulatory framework

As presented in Section 3.1.1, a legal and regulatory framework for investment promotion has been improved as a whole. The incentives and investment security for investors and project enterprises stipulated in the new BOT Law and PPP Regulation are based on other laws/resolutions/circulars. Nevertheless, coexistence of the new BOT Law and PPP Regulation implicates that the country is still in a transitional stage of improving the legal and regulatory framework for investment promotion in infrastructure. The major reason why investment in PPP infrastructure lagged behind in this country would be attributed to the fact that infrastructure investment is not profitable to entice private sector investment in infrastructure projects. In this sense, the government's role in investment facilitation will be extremely important particularly in respect to tariff setting, government contribution/guarantee for risk hedging, and transparent PPP processing. The lessons gained through the pilot projects shall be reflected into the new PPP Law that would replace the BOT Law in the near future.

Empower high-level taskforce

PPP project processing needs i) an efficient and effective coordination between the Ministry of Planning and Investment (MPI) (as a guiding agency) and line ministries (as implementing agencies) and ii) competent staff members for the entire PPP processing management (MPI) and those for ensuring quality at entry, bidding evaluation, and project implementation (line ministries). Technical assistance from donors and international organizations has been provided to both MPI and line ministries in order to strengthen institutional linkage between MPI and line ministries, and capacity of the relevant staff members so far. Nevertheless, the current status appears to be still behind the ultimate goal of ensuring high-level taskforce. The reason may be attributed to the absence of one organization which exclusively handles PPP processing. The so-called PPP Center would be the appropriate office to secure an efficient PPP processing with high-level taskforce.

Secure quality at entry

Project preparation corresponds to an entry of PPP processing. The PPP feasibility study is significant in determining the PPP modality suitable for a target project. PPP modality is classified into two variations, namely, on the basis of PPP contracts and on the extent of public involvement in a project. The former variation consists of BOT, BTO, and BT according to Decree 108 while the latter is largely divided into i) pure public expenditure, ii) subsidized, and iii) pure private investment.

The PPP feasibility study further requires analysis of major risks and fund sourcing. A risk analysis of market/demand, engineering/construction, and regulation is the decisive element for investment promotion. Infrastructure projects need a long-term lending institution with low interest rates. Nevertheless, financial markets in Vietnam are dominated by short-term lending institutions. Thus the PPP feasibility study requires a long-term lending fund from overseas markets.

Quality at entry means an extensive project feasibility study that covers a wide range of infrastructure projects under PPP, otherwise private sector would not be encouraged to invest their money. The government is requested to prepare the guidelines for the PPP feasibility study since there is no available manual to guide its preparation.

Ensure that contracts include issues over the project life span

Once the bidder met all the necessary requirements, negotiations will begin on a more specific terms of agreement. To do away with potential or future disagreements, which could result in a costly legal proceedings or renegotiation, or service disruption, it is important to ensure that all foreseeable issues will be included in the initial contract. Foreseeable issues depending on the nature of the project would be addressed as cited below.

1) Allocation of different risks between the investors and the government;

2) Capital requirements;

3) Level of user price;

4) Revenues to be paid to the government; and

5) Arrangements for transfer of assets to the government.

The issue of item number 1 above is sometimes difficult to arrange. For instance, it takes time to reach an agreement on government's guarantee for revenue reduction lower than the anticipated income. There seems to be no actual case to exemplify a revenue risk allocation in Vietnam so far. Level of user price has been a controversial issue too. Investors wish to raise the level of user price while government wants to keep the price level due to socio-economic

condition. Except for the basic human need (BHN) type of project such as rural water supply, the price of a revenue generating project such as expressway should be at a level to meet commercial viability.

Help mitigate regulatory risks

Regulatory risk is a threat associated with a change of laws or regulations governing industries and projects. The current regulatory framework does not spell out the regulatory mechanism, formula and process for rate adjustment, compensation for expropriation, and repatriation of profits. In addition, mechanisms for dispute resolution including arbitration and recourse to international disputes are not explicitly addressed in the regulatory framework. The government remains cautious because its guarantee to investors may result in significant future liabilities. The option to mitigate regulatory or political risks is to seek assistance from international organizations such as International Financial Corporation or the Multilateral Investment Guarantee Agency.

Monitor project implementation

Private investment in infrastructure is characterized by complex terms and conditions between the investor and the government. Positive outcome for the host country depends on the government efforts to monitor the project's progress and enforce agreements with infrastructure investors. In other countries, government can create an independent body for this purpose. Or government creates an independent evaluation committee and evaluates project performance and suggests areas of improvement. The Vietnamese government may follow the same approach.

3.1.3 Present Law for BOT/PPP Schemes

The following table shows the difference between the PPP Regulation (Decision 71) and the new BOT Law (Decree No. 108).

Table 3.2 Difference between Decision 71 and Decree 108

	Regulation on Pilot Investment under PPP (PM Decision 71)	Decree 108 on Investment in BOT, BTO, and BT Contracts
Business method	PPP	BO, BTO, and BT
State capital	Not exceeding 30% of the total project investment cost (Article 9) and included in the total investment cost (Article 2).	For urgent and important projects, not exceeding 49% of the total investment cost and is not included in the total project investment cost (Article 6).
Use of state capital	Auxiliary facilities, compensation cost, land acquisition, clearance, resettlement, and others.	Same as PM 71
Equity/debt ratio	30% equity and 70% debt of the total investment cost (Article 3).	For project capitalized at up to VND 1.5 trillion: not lower than 15% of the total investment cost. For project capitalized at more than VND 1.5 trillion: not lower than 15% of the capital up to VND 1.5 trillion and not lower than 10% of capital over VND 1.5 trillion (Article 5).
Investment area	Road, railway, urban transport, airport, water supply, power plant, hospital, and disposal treatment (Article 4). The underlined is the new investment area.	Road, railway, airport, water supply, power supply, and others.
Project portfolio and feasibility study	A list of projects is monitored and evaluated by MPI (Article 14). A feasibility report is submitted to PM to consult public participation and guarantee, and approved by MPI in cooperation with MOF (Article 18). Cost of a feasibility study is financed by the state (Article 6).	A list of projects is monitored and decided by the state agencies. PM may approve feasibility study of projects requiring investment of more than VND 1.5 trillion, land area of more than 200 ha (Article 12), and government guarantee (Article 40). A feasibility study is financed by private investor (Article 8).
Land acquisition		Compensation/land acquisition/resettlement costs to be financed by private sectors except for projects in Article 6 (Article 30).
Toll rate	To be determined based on costs, profits, users, the state policy, adjusting of toll rates to be noticed to the state agencies (Article 37)	Same as PM 71. The government supports the toll revenue (Article 34).
Preferential treatment	Preferential taxes for corporate income and import duties and exemption of land use fees for areas controlled by the state (Article 41).	Same as PM 71 (Article 38).

Source: JICA Survey Team

The difference between PM 71 and Decree 108 is summarized as follows:

1) State capital contribution is 30% at the maximum for PPP Regulation while the BOT Law allows state contribution to finance 49% of the investment cost at a maximum. Further state contribution is not included in the project investment cost in BOT projects.

2) The PPP Regulation does not allow private investors to apply the government guarantee while the BOT Law paves the way for government guarantee.

3) The PPP Regulation imposes a fixed equity-debt ratio (30:70) while the BOT Law gives a flexible ratio, 15% at the maximum depending on the scale of investment.

As a whole, the PPP Regulation appears not to be a business-friendly scheme compared to the new BOT Law. Further review of the PPP Regulation is needed from the viewpoint of private

fund mobilization.

The Decree 108 on BOT projects provides:

1) A competent agency guarantees loans, supply material, sell products, and fulfills other contractual obligations (Article 40);

2) A BOT enterprise is allowed to mortgage and pledge assets and land use rights. There may be difficulties in mortgaging land use rights with foreign lenders (Article 41); and

3) The government specifically provides the project company with the right to buy foreign currency for important projects (Article 42).

It is unclear whether these incentives stipulated in Decree 108 are practiced or not. An investor wishes to put into writing the incentives in a BOT contract. Nevertheless, there have been no actual cases of government guarantee payment for contractual obligations stipulated in Decree 108. Although Decree 108 allows a project enterprise to mortgage assets and land use right, the Land Law prohibits the grant of mortgage over land to foreigners. Investors need to convert revenue (VND) into foreign currency in order to repay international lenders, sponsors, and make payments to foreign contractors. However, the right to buy foreign currency has been virtually difficult because the procedure and timing of purchasing foreign currency are unknown and not supported by other regulations. The above incentives are deemed to be very significant for commercial profitability and operation of BOT enterprises. These incentives stipulated in Decree 108 are not legally supported.

3.2 Present Investment Environment for BOT/PPP Expressway Projects

3.2.1 Current Situation of Private Investment in Expressway Projects

To satisfy the rapid development of the economy and meet the urgent needs of transportation, building expressways is deemed by the government an important priority task for Vietnam. The establishment of the Vietnam Expressway Corporation (VEC) in 2004 and the opening of the first Ho Chi Minh City–Trung Luong Expressway on February 3, 2010 were two very important milestones.

Up to now, there has been only one road project in Ho Chi Minh City with international investors (South Korea's GS Engineering and Construction Company) being carried out in the BT form, this is the Tan Son Nhat–Binh Loi–Outer Ring Road. The construction began in June 2008 and the road is expected to be completed by 2013.

To attract private investment, since 2009, the government has granted a number of exceptional incentives to investors. In the case of the Hanoi–Hai Phong Expressway, (the first BOT expressway project in Vietnam), in addition to the right to collect toll fees for more than 30 years, the investor - Vietnam Infrastructure Development and Finance Investment Corporation, also has the right to collect toll fees on other roads that has not been built such as the National Highway No. 5, and has the sole rights to license advertising images/billboards along the expressway.

The Dau Giay – Phan Thiet Expressway is the first expressway project in the PPP model. It, was approved by the Prime Minister on July 13, 2010. Binh Minh Import Export Production and Trade Company[1] (Bitexco) and International Finance Corporation (IFC) were chosen to be the first two investors. In November 2011, an interview with Bitexco was conducted and the following are views on the project;

[1] Bitexco is the leading conglomerate in Vietnam with nation's tallest landmark in Ho Chi Minh City, "Bitexco Financial Tower" and the popular mineral water brand "Vital", which is also known as an active private investor in the infrastructure projects.

- Phan Thiet～Dau Giay Expressway is approximately 100 km with an initial capital expenditure of USD 850 million. This project is expected to be one of the PPP pilot projects. (However, this project was not included in the list of PPP pilot projects announced by the government in December 2011.)
- The hurdle rate of 15% for investment by Bitexco. Bitexco expects the government to provide Viability Gap Funding up to 30% of capex amount. Also, it is expected that the World Bank will provide US dollar loan, in which the Development Bank of Vietnam will convert the foreign currency to local currency.
- Bitexco expects not only revenues from toll fees, but also from the construction contract by involving its subsidiaries in the construction business.

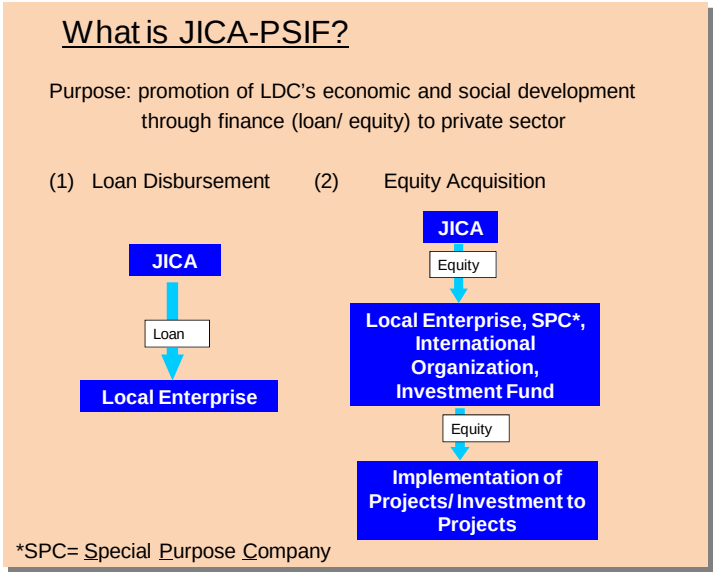
The list of private sector participated projects in road sector in Vietnam is provided in **Appendix A1.**

3.2.2 Necessity of Private Sector Investment Finance

In the formulation of the JICA's supported "North-South Expressway Master Plan", the necessary budget for the development of the North-South Expressway network was estimated at about USD 66 billion. Projects in which implementation has been approved by GOV are estimated at about USD 12 billion, and most of its financing will come from the official development assistance (ODA) of the Japanese government, the World Bank, ADB, and so on. The rest of USD 54 billion will be secured from various financial sources. It is therefore difficult that funding will only be supplied by public funds of the Vietnamese government and ODAs, it is strongly expected to mobilize private sector investment and the GOV has addressed the same policy.

To facilitate private sector investment in the sector, it is necessary to provide appropriate financing to the private sector based on the knowledge and experience of the country and the sector. In this context, JICA has a competitive advantage in providing JICA's Private Sector Investment Finance (PSIF) to the private sector based on its substantial knowledge and experience in the country and especially in the expressway sector.

JICA-PSIF is a financial support system to promote Least Developed Countries' (LDC's) economic and social development through finance (loan/equity) to private sector as illustrated in the following figure.



Source: JICA Survey Team

Figure 3.1 JICA-PSIF

(1) Project Facilitation for Foreign Investors

1) Implementation of PPP Preparatory Survey

Together with JICA-PSIF, JICA has a system called the "Preparatory Survey Scheme for PPP Infrastructure". The purpose of this JICA Survey is to promote the identification and preparation of PPP infrastructure projects that are candidates of JICA's ODA assistance including Japanese Yen Loan and PSIF.

JICA has two roles in the implementation of a PPP infrastructure project in developing countries, namely, the "Project Promoter" and the "Lender". This preparatory survey scheme is very important for JICA to play the role of the Project Promoter, as JICA has sector and policy expertise in the subject country and would play a coordinator role with relevant government agencies during the course of this PPP preparatory survey. This role is especially valuable as participation of foreign investors in the subject countries could be enhanced; hence, the country could enjoy various resources including financial which the foreign investors could bring about.

The following is the outline of the PPP Preparatory Survey Scheme:

<OVERVIEW>

- JICA has started PPP Feasibility Study support program in March 2010.
- JICA invites private companies to submit study proposals on PPP infrastructure. Selection is made by JICA and a third party committee.

1. Applicant

Private companies (registered in Japan) or their group, which intends to invest in PPP infrastructure after the study, is completed.

2. JICA's Support

Max. JPY 150 million (approx. USD 1.80 million) to cover part of the study costs.
(e.g., remuneration, travel costs, and other expenses.)

3. Selection

4. Targeted countries

All eligible countries of JICA ODA loan can be provided.

5. The eligible projects have to satisfy the following criteria:

Development effect:
The proposed projects should contribute to economic and social development, economic reconstruction, and economic stabilization of developing countries.
Possibilities of utilizing JICA ODA assistance:
The proposed projects should have possibilities that recipient governments would submit "ODA assistance requests" to the Government of Japan (GOJ). They should also be aligned to GOJ and JICA policies.
Types of Private Participation:
They should include construction as well as management (i.e., contract-out of operation or privatization of the completed projects is not eligible).

6. Eligible companies that can submit proposals

Companies that submit proposals should have a plan to participate in PPP projects as potential investors (Note: associations with consulting firms are possible).

7. Final products of the survey

Preparatory survey reports (feasibility study level).

8. Expected use of products

Like the ordinary JICA's Preparatory Surveys, the products are expected to be used by the recipient countries

- to consider the feasibility of the proposed projects
- as project documents for requesting Japan's ODA assistance

Note: Private concessionaires of the proposed projects will be solely selected by recipients (i.e., no linkage between selection of concessionaires after the study and selection of firms doing JICA studies.)

Source: JICA

Figure 3.2 Outline of PPP Preparatory Survey Scheme

2) Coordination with GOV

JICA has a mandate to contribute to the economic development of developing countries as a development agency. JICA has strong relationships of trust and networks with governments of

developing countries by providing continuous assistance in the form of technical assistance (TA) such as master plan, F/S, institutional reform, capacity building, and Japanese Yen-Loan. By the utilization of TA and ODA loan, JICA-PSIF is able to add more value to the projects. For example, as assistance to PPP infrastructure projects, JICA provides institutional and legal framework, if target countries lack the rules and regulations relating to PPP projects.

3) Coordination with Investors

JICA-PSIF shares project risks with private companies by participating in projects with equity investment in case of PPP infrastructure projects. JICA reduces performance risks of governments of developing countries by participating in negotiations with the government by policy recommendations or PPP policy planning. In addition, JICA monitors the overall implementation of major PPP projects. JICA could play a significant role as a coordinator when potential investors are Japanese.

4) Coordination with Other Stakeholders

JICA-PSIF could have a co-financing arrangement with other financing institutions such as the World Bank and ADB. JICA could play a catalytic role in orchestrating the loan syndication with various development agencies, international financial institutions, and commercial banks.

(2) Risk Sharing as Investor

1) Risk Sharing by Equity Investment

As described earlier, JICA-PSIF has a facility of equity investment. Although its equity injection is limited to one quarter of the total equity, JICA could share project risks with other private sector investors and could play an important role as project promoter by discussing with GOV and mitigating policy related risks and performance risks of government related agencies. JICA could also play an important role in facilitating discussions in the investor's consortium especially between the local investors and Japanese investors in order to from a working group in the consortium and start discussions with relevant government agencies to secure necessary government support and guarantees for the project before establishing a Special Purpose Company (SPC).

The following is the outline of PSIF- Equity Finance.

<TENTATIVE>
EQUITY FINANCE
- Investors

JICA invests in commercially viable projects (or fund)
e.g., PPP infrastructure project company (SPC), individual project sponsors (Japanese/non-Japanese, J/Vs or single entity)
- Share

JICA cannot take majority stakes.
- Exit Policy

Pre-arrangement of exit plan required for successful transition to sustainable private business.

Source: JICA

Figure 3.3 Outline of PSIF - Equity Finance

2) Provision of Expertise and Experiences in Vietnamese PPP and Expressway Sector

JICA has conducted the Comprehensive Study on Sustainable Development of Transport

System (VITRANSS 2) from 2007 to 2009, in which the expressway master plan in the country was conducted. Further, the expressway administration set up was reviewed and the PPP and privatization policies in the transport sector were reviewed likewise. JICA has experienced funding expressway projects such as the HCM–Long Thanh–Dau Giay Expressway and the Hanoi–Thai Nguyen Expressway. These are all relevant projects and important expertise and experiences can be applied in the implementation of the BV Expressway Project. JICA is in a strategic position to provide such expertise and experience for promoting and implementing the BV Expressway Project.

(3) Provision of Long-Term Soft Loan as Lender

1) Provision of an Ultimate Long-Term Soft Loan

JICA-PSIF loan has similar terms and conditions as to the Japanese ODA yen loan which are described in the following outline.

<TENTATIVE>

DEBT FINANCE

- Fixed rate (Base rate: GOJ bond plus)*, JPY-denominated*, Long Term (up to approximately 20 years) with grace period

Source: JICA

Figure 3.4 Outline of PSIF - Debt Finance

JICA-PSIF loan would help both domestic and foreign private sector for financing the project in the LDCs where long term and low interest rate of loan is not available. However, in most cases, these LDCs deal with critical funding source for a PPP infrastructure project. Unlike ODA loan, PSIF loan would not require sovereign guarantee from GOV and would be managed in the same manner as limited recourse project finance.

2) Impact of PSIF Loan

Impact of JICA-PSIF loan could be considerable as interest rate is very low (GOJ bond rate plus risk premium including foreign exchange depreciation risk) as compared to the current interest rate of long term commercial borrowing in Vietnam, which is 15 years tenor loan that is more than 15% per annum. Long term tenor (as much as 30 years including grace period) of PSIF loan would also offer good matching with long term investment recovery of expressway project. JICA PSIF loan has dual effects for both investor and government. Application of JICA PSIF loan would bring up project profitability for private investor, namely Equity IRR of the project, and at the same time from the view point of the government, it could reduce the amount of subsidy which the government would need to assume to make the project afloat.

3.2.3 Toll Collection Level for Expressway

Toll rates in Vietnam are principally consistent across the country. The Ministry of Transport (MOT) submits its request to the Ministry of Finance (MOF) for toll rate approvals and must justify any changes. There is no regulatory authority, other than the MOF, involved in the approvals. To date no automatic adjustment to toll rates has been applied; the MOT must take a separate application to the MOF every time it seeks an adjustment.

The authority to levy tolls, Circular No. 90/2004 of September 7, 2004 is the guiding legal document which sets the regime of road toll collection, payment, management, and use. The present fees of the vehicles are as follows:

Table 3.3 Present Toll Rates of Vehicles

No	Vehicles	Par value (VND/km)
1	Vehicle less than 12 seats, trucks under 2 tons and the public transport buses	1,000
2	Vehicle is from 12 to 30 seats, trucks of more than 2 tons and less than 4 tons	1,500
3	Vehicle of more than 31 seats, and trucks with loading capacity of more than 4 tons and less than 10 tons	2,200
4	Trucks of more than 10 tons and less than 18 tons, and freight cars by 20 feet container	4,000
5	Trucks of more than 18 tons, and freight car by 40 feet container	8,000

Source: Circular No.90/2004

As a regulator, the MOF would keep its authority to determine the toll rates because users' capacity to pay based on social consideration must be taken into account. Nevertheless, almost eight years have passed since the enactment (2004) of the Circular No. 90, the old user price should at least be reviewed and increased in consideration of GDP deflator and users' capacity to pay. The former (GDP deflator) is a simple adjustment to the estimation of the current toll rate provided that the deflator in 2004 is 100. The latter is derived from a mass survey conducted through an interview of sample users on their income (individual driver) and expressway expenses per month, or to what extent the expressway expenditure would affect the business turnover (truck companies).

As a matter of fact, the new rate of VND 1400/km was approved for the expressway project located in between Ninh Binh and Cau Gie in the north area of Vietnam. It is also reported that HCM City's People's Council recently approved two proposals to increase road service fees for vehicles passing through toll stations on Ha Noi, Kinh Duong, and Binh Trieu 2 highways.

On the other hand, the HCMC Department of Transport wants the People's Council to reduce toll fees on the 40 km between HCMC and Trung Luong because many vehicles, especially container trucks shifted to the National Highway 1 A, which results in traffic congestion along NH 1A. The HCMC Cargo Transport Association petitioned to the PM and the MOF to reduce the toll on HCMC-Trung Luong Expressway. The toll rate for a 40 ft container will be reduced by 25% to30 % after the PM's approval.

The above cases on toll rate increase or reduction only implies that toll fees of expressways vary depending on the vehicle size. Toll rate for the largest size of truck or container freight car is eight times bigger than that for vehicle under category 1. Container freight cars usually deliver goods in long distances; therefore, high toll rates could be a financial burden on transportation service companies. Variation of toll fees on expressway should be equally distributed between ordinary vehicles and large vehicles/trucks.

3.2.4 BOT/PPP Scheme

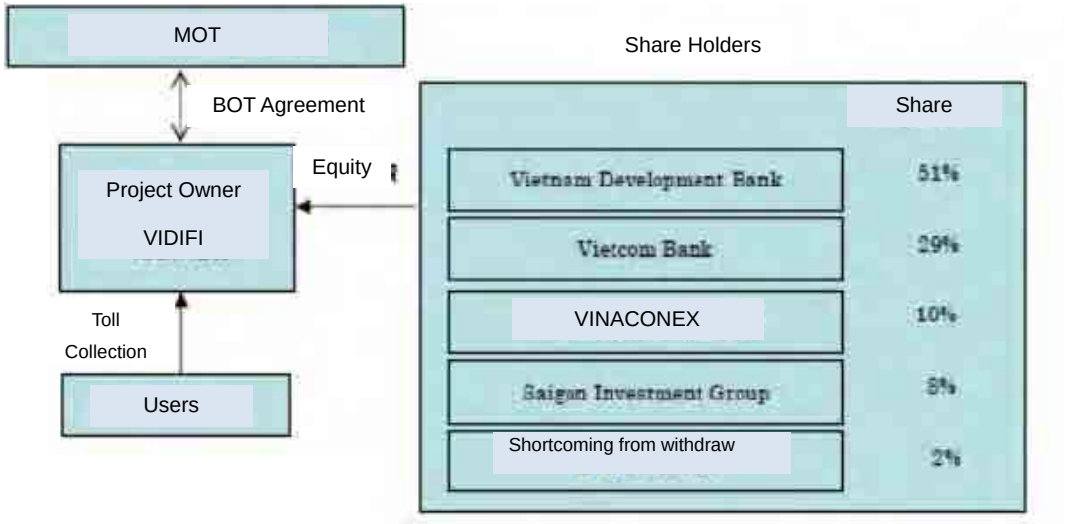
Current BOT/PPP schemes on road projects being practiced in Vietnam are illustrated as shown in Figure 3.5. Most of the shareholders of the project company are composed of state owned construction company, state owned developer, state owned bank, and so on, with no participation of foreign investors.

The Hanoi-Hai Phong Expressway project is a green field expressway project of 105 km in its extension with total investment cost of about 1.5 Billion USD. The project is now under construction by the concessionaire composed of Vietnam Development Bank (VDB) as a leading shareholder. Concession period is 35 year with development right along the expressway.

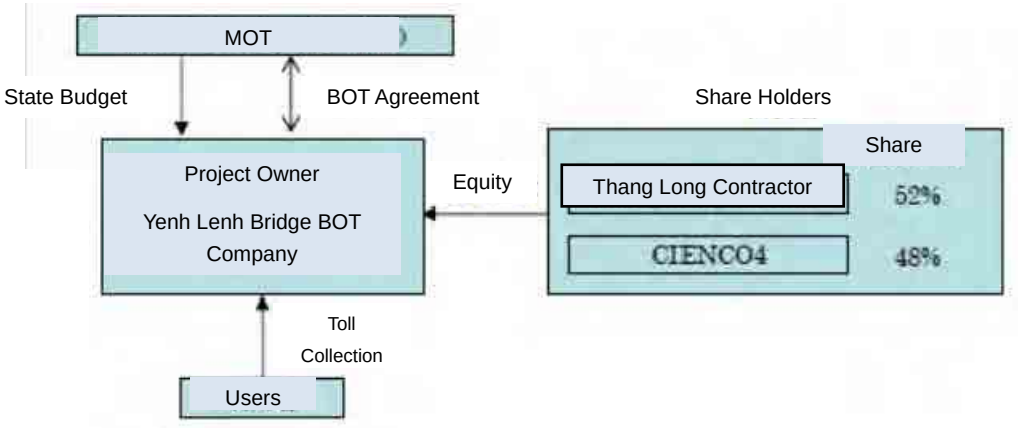
The Yenh Lenh Bridge BOT project is construction of a 2 km bridge on the National Highway 38 with project cost of about 18 Million USD. It is already under operation with toll collection since 2004. The concession period is 15 years and 7 months with land acquisition, construction of access road and toll collection facilities conducted by the government. The concessionaire shouldered only the construction of the bridge itself with total investment cost of 9.3 Million USD.

The NH2 Noi Bai-Vinh Yenh BOT project is an expansion project of the existing National Highway 2 (22km) with the concession period of 13 years and 7 months which is now under construction with the investment cost of about 46 Million USD.

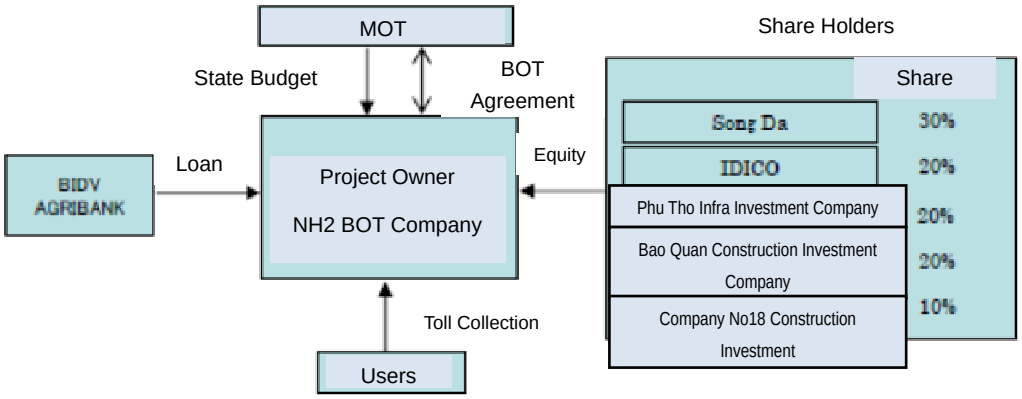
Besides these projects, there is the Improvement of An Suong-An Lac section of National Highway 1 A (near HCM City) which is an expansion project already under operation and started toll collection since 2005 with the investment cost of about 49 Million USD.



(Hanoi-Hai Phong Expressway Project)



（Yen Lenh Bridge BOT Project）



（NH2　Noi Bai – Vinh Yenh BOT Project）

Source：JICA Survey Team

Figure 3.5　Current BOT/PPP Schemes in Road Sector

CHAPTER 4 EXISTING PROJECT SCHEME

4.1 Present Situation of the Project

The BOT concession of this project was awarded to BEDC, but its parent company (BIDV) issued a withdrawal policy from development projects, thus, BEDC returned its concession to MOT. The concession was officially given to MOT based on the Prime Minister's Decision (PM Decision No.217/TTg-KTN) in February 2012. The same decision gave Cuu Long CIPM a role to study and propose an implementation plan for the project by integrating two sections (Trung Luong-My Thuan Section and My Thuan-Can Tho Section) to make it as one expressway. Thus, Cuu Long CIPM, as of July 2012, does not have a concession right over the Trung Luong-My Thuan Expressway Project.

The same PM decision also favored the return of toll collection rights of Ho Chi Minh-Trung Luong Section and those of NH1A gates including the My Thuan Bridge gate from BEC to MOT. As of July 2012, maintenance of Ho Chi Minh-Trung Luong Section was conducted by Directorate for Roads of Vietnam (DRVN), whereas operation including toll collection of the same section is being done by Cuu Long CIPM (actually by its subsidiary Company 715) on behalf of MOT.

4.2 On-going Discussion about BOT Contract between MOT and Cuu Long CIPM

As of July 2012, there are no on-going discussions such as BOT contract negotiation with relevant agencies. There is only one notice from MOT implying a possible direction of the project released from the Minister's office based on the kick off meeting held on May 15, 2012 between JICA and MOT about the resumption of the JICA PPP FS Study. The request contained a request on the resumption of the JICA study, possible loan extended to the project from JICA and ADB, and agreement of project implementation based on special mechanism (MOT NOTICE No.271/May 25, 2012/TB-BGTVT).

4.3 Profile of Cuu Long CIPM

MOT assigns Cuu Long CIPM to conduct a study on PPP schemes possible for the project in collaboration with JICA (and ADB as well). Cuu Long CIPM was established in July 2011 as a state (MOT) owned company, reorganized by three institutions, namely, the My Thuan PMU, Company 715, and Can Tho Company. The legal status of Cuu Long CIPM is provided by Decision No. 1589/QD-BGTVT dated July 20, 2011 and its operational charter is approved by Decision No. 1788/QD-BGTVT dated August 10, 2011.

The charter capital has a total amount of VDN 1,500 billion. Its fund sources comes from (i) own fixed assets (2.3%), (ii) charter capital of merged companies (4.4%), (iii) toll revenue from Can Tho Bridge (34.1%), and (iv) state budget allocation (59.2%).

Cuu Long CIPM's main business areas include (i) investment and development of infrastructure, (ii) project management, (iii) operation and maintenance of transport projects, and (iv) project concession (ownership). Specific projects of Cuu Long CIPM at present include the (i) operation of existing HCMC-Trung Luong Expressway, (ii) implementation (PIU) of Can Tho Bridge, and (iii) future rights of investing in the project as concessionaire.

The organization of Cuu Long CIPM is shown below. The headquarter office consists of 13 divisions under the General Director with 92 staff. The head office runs two dependable accounting units with 6 staff, and manages two subsidiary companies of Can Tho Bridge (184 staff) and Company 715 merged (127 staff) with a total number of 409 staff.

It seems that Cuu Long CIPM has less experience in constructing and managing expressways similar to the project. Cuu Long CIPM, however, budgetary arrangement seems secured since

the undertaking is decided by the GOV as a state institution, therefore, financial resources are provided timely whenever needed.

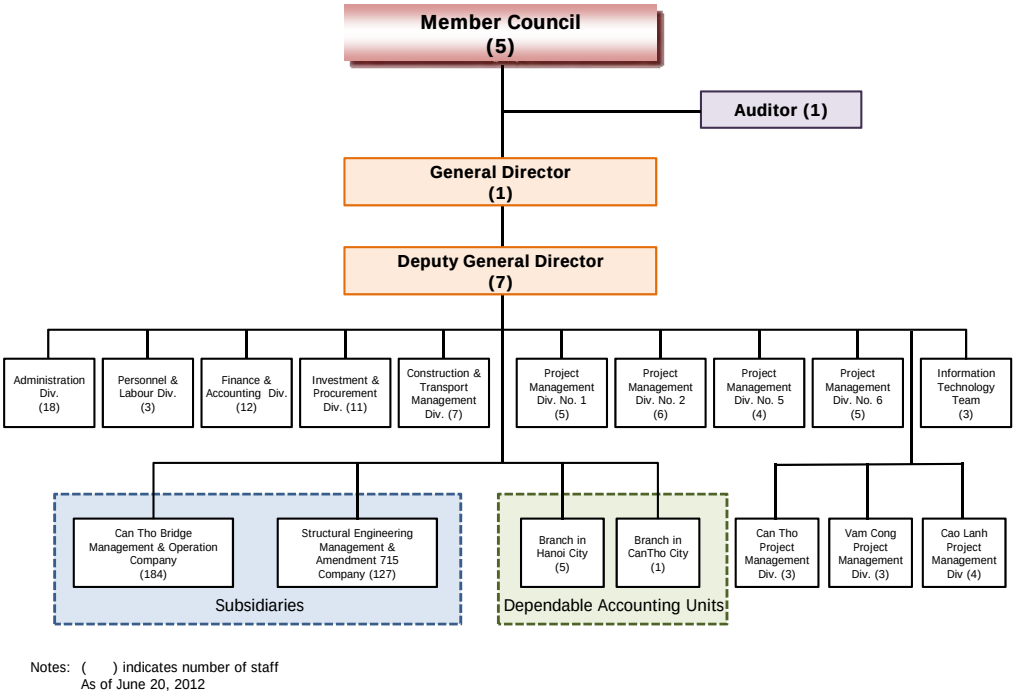


Figure 4.1 Organization of Cuu Long CIPM

4.4 Financial Plan for the Project

On April 13, 2012, a meeting was held in MOT to raise the capital of Cuu Long Corporation for Investment, Development and Project Management of Infrastructure (Cuu Long CIPM) for the construction of TL-MT Expressway. The meeting was attended by the minister, vice minister, relevant departments of MOT, the Vietnam Expressway Corporation Investment and Development (VEC), and the Cuu Long CIPM. The conclusion of the Minister was issued as Notice (SO193/TB-BGTVT).

The Cuu Long CIPM will review and update the entire record of the basic design and technical design of the project which was approved by the investor- BEDC, if necessary, consultants can be hired. The study will be conducted to cover issues including contents requested by the Finance Ministry, Ministry of Planning - Investment, State Bank to participate in the negotiation process on project financing.

A proposal was made seeking the Prime Minister's permission, that the fee coming from Ho Chi Minh City - Trung Luong Expressway, Can Tho Bridge Toll Station and My Thuan Bridge Toll Station from 2012 - 2015 will be used to implement the project. Also, the Department of Finance at MOT was instructed to draft a report to the Prime Minister to allow the sale of toll fee collection rights of Ho Chi Minh City - Trung Luong Expressway to increase the charter capital of Cuu Long CIPM.

As mentioned above, the financial plan for Cuu Long CIPM's equity contribution to the project is under study at MOT by using the sales of the toll fee collection right of HCMC – TL Expressway. The remaining amount is deemed to be financed through a BOT structure or ODA finance, but not yet decided. The cashflow projection and other financial analysis of the project will be conducted by assuming that Cuu Long CIPM will be fully paid in due time.

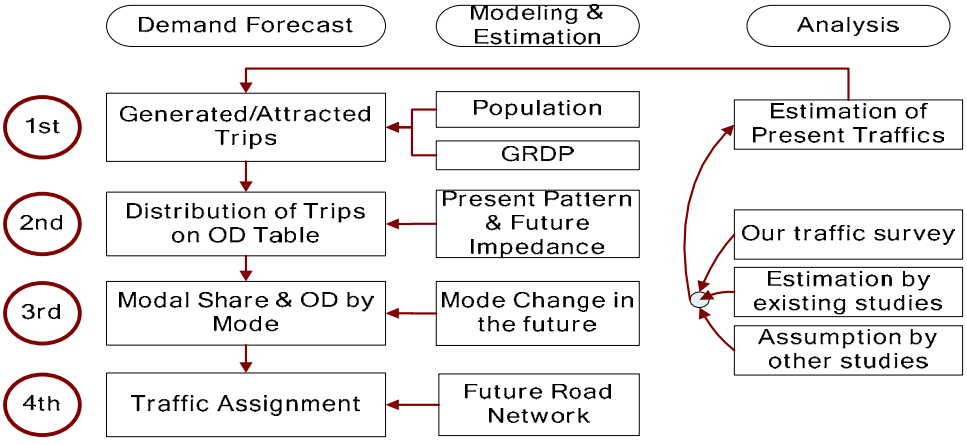
CHAPTER 5 TRAFFIC DEMAND FORECAST

5.1 Review and Methodology

In this expressway, the existing major reports and studies related to traffic demand forecast are as follows. and referred to by the following abbreviations:

- TEDI Study : The study of construction investment for the Trung Luong – My Thuan Expressway Project by the Transport Engineering Design Inc. in the year 2010;
- VITRANSS : The comprehensive study regarding the Sustainable Development of Transport System in Vietnam by JICA in the year 2010.
- METI & JETRO Study : Pre-feasibility Study on the expressway connecting Ho Chi Minh City in the southern district by Japan External Trade Organization in the year 2006; and
- HOUTRANS : The study on Urban Transportation Master Plan and Feasibility Study in Ho Chi Minh Metropolitan Area by JICA in the year 2004.

The basic flowchart for the demand forecast is the usual four step method as shown in the Figure 5.1. The four step method is usually applied in passenger trip analysis, but with this study, it is applied for vehicle trips since the objective of the demand forecast is the estimation of future traffic on the Trung Luong - My Thuan Expressway. Therefore, the modal split at the 3rd step is not directly calculated by some models of impedance, but it is considered by the shift of mode of vehicle types. The vehicle trips are then divided by vehicle types. Although the forecast by PCU is more precise in the region where traffic data has not been surveyed in detail, the forecast is carried out according to vehicle types because the result should be divided by some assumptions after the forecast in order to calculate the financial plan. Thus, some parts of this forecast are shown according to vehicle type but, they are not always correct in other regions since these were not surveyed in detail. These forecasted OD tables should not be used for the other regions even if the region is included in the table. This forecast focuses mainly on the expressway between Trung Luong and My Thuan, and the roads in Tien Giang Province.

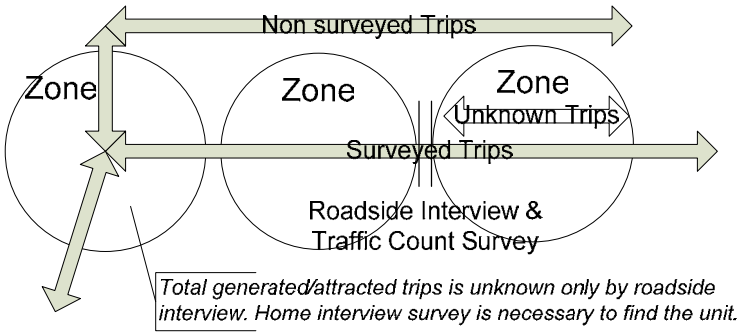


Source: JICA Survey Team

Figure 5.1. Demand Forecast Flow

The purpose of this expressway is to serve as trunk roads to reach other regions. If the focus is only on the function of national trunk roads, traffic demand can be estimated through economical connections between Mekong Delta and other parts of Vietnam. However, the expressway will have other functions as a by-pass for National Route 1 and the main axis of road networks in Mekong Delta. Some cities are located along Route 1 and the expressway can provide more mobility for residents and transfer of goods. Therefore, it will be necessary

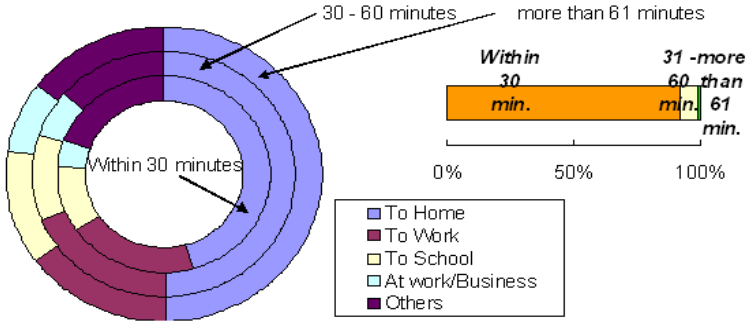
to estimate local demands. However, the demand forecasts of existing studies such as VITRANSS, which was conducted by JICA, or the TEDI study were made of traffic data gathered from the provinces. In those studies, the road section of this study is included in one traffic zone and the intra zone trips are estimated as zero. Although the JICA Survey Team need to divide this zone, which is estimated by zero trips for the analysis, there are some issues for the estimation by roadside interview surveys only, without household interview surveys because the traffic unit of generated/attracted trips is unknown in this region. Therefore, the JICA Survey Team estimated the present traffic units through the combination of other studies and the traffic survey under some assumptions. After estimating the present traffic and adjusting these based on the traffic survey, the future forecast is created.



Source: JICA Survey Team

Figure 5.2. Limits of Roadside Interview

Regarding the characteristics of traffic on the expressway, the difference between intra zone traffic and inter zone traffic should be paid attention to because the size and the purpose are quite different. The following figure shows the component ratio of trip generation in Hanoi in HAIDEP[2] by JICA, which is almost similar in any city and country. Commuting trips account for nearly 80%. The trip time by commuting is short which is almost within 30 minutes. The ratio of more than an hour is only 1.1%. Therefore, it is risky to estimate the traffic model only by inter zone trips because the unpredictability is high. In this study, the estimate of present traffic and the forecast are considered after assuming intra zone trips. However, the error in the estimate of intra zone trips might be unavoidable, which will be discussed in the next chapter.



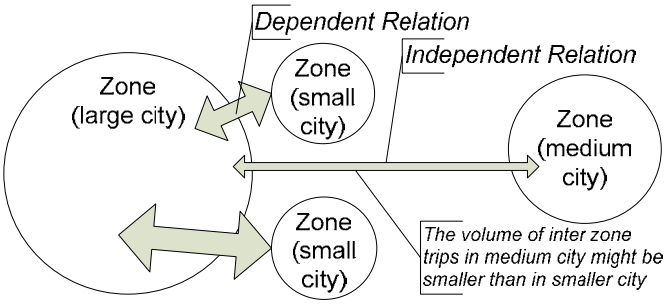
Source: HAIDEP 2005 by JICA

Figure 5.3. Trip Purpose & Time Distance

The generated volume of inter zone trips are not always in proportion to the size of the zone in terms of population even if intra zone trips depend on the size of the zone. Because the

[2] HAIDEP is the proposed program, "Hanoi Integrated Development and Environmental Program" by the JICA Study "The Comprehensive Urban Development Program in Hanoi Capital City of the Socialist Republic of Vietnam". Refer to the JICA study report.

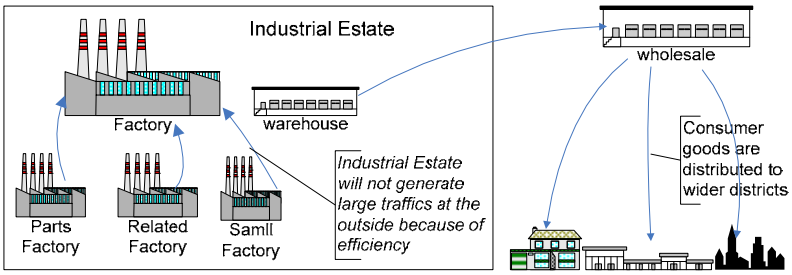
medium zone concentrates on the necessary urban functions in the zone under the process of growth, the traffic between larger zones and the medium zone will be a little bit more independent than a suburban satellite zone. This is also one reason that intra zone trips need to be assumed.



Source: JICA Survey Team

Figure 5.4. Image of Inter Zone Trips

Industrial estates will expect decrease traffic congestion since manufacturing companies focus on transporting their products/goods using the shortest route possible. Manufacturing products, except consumer product, are not transported among long distance districts. They also request the shortest transportation to ports.

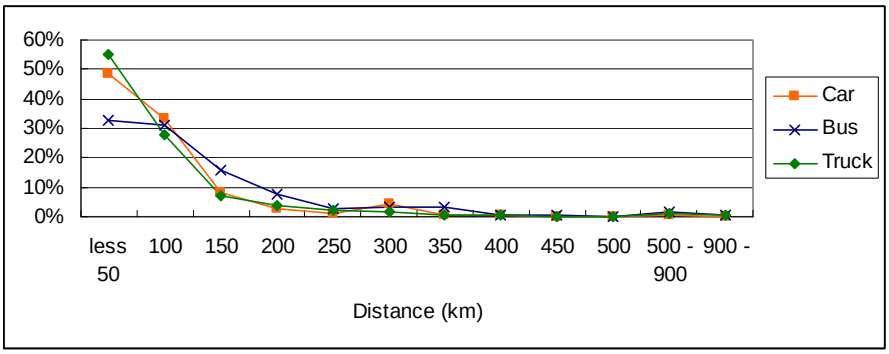


Source: JICA Survey Team

Figure 5.5. Freight Transportation Image

Agricultural products are also not transported directly between the supply and demand districts in an efficient system. Most efficient transportation systems are those from a hierarchical distribution center. Cargo is carried out to small centers, and then transferred to medium centers and finally to the large centers. In under-optimized systems, the cargo traffic may be decreasing even if the basic demand for cargo flow is annually increasing.

The conclusion above is based on the trip length distribution in the survey results found in VITRANSS by JICA. The trip length by cars and trucks quickly go down in longer distance travelled. Especially, the decline of the trip length of a truck is higher than a car. Hence, the focus should be on regional traffic. Under these considerations, the JICA Survey Team used the survey for the regional traffic analysis and the other existing surveys for wider national traffic. Further, since the assumption that new developments of urban areas and industrial estates in this region give direct impact of increasing traffic might have the risk of overestimation, the estimation and forecast are constructed by basic socio economic indices, which include new development. Although Figure 5.6 shows that the trip length by bus is longer, the consideration on conversion to air, rail and river from bus trip is not the main issue. This study takes up road transportation by vehicle.

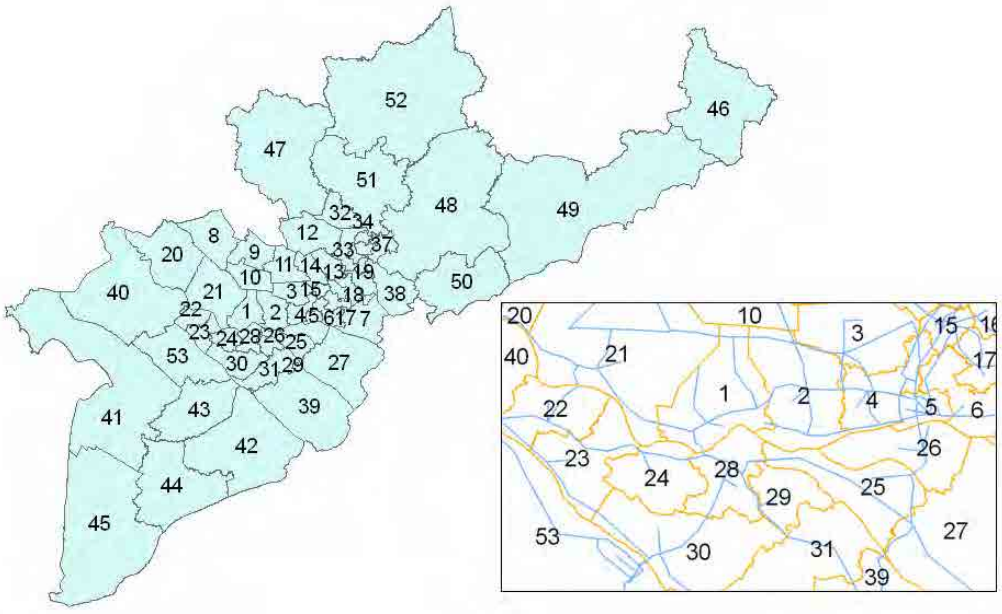


Source: VITRANSS by JICA 2008

Figure 5.6. Trip Distribution by Vehicle

Boundaries of the zones in this study are based on administrative boundaries and existing studies. In order to use administrative boundaries for traffic analysis, the aforementioned considerations described in the Section 5-1 are necessary. In case that a section between interchanges is located in one zone, the zone should be divided. Far districts are assumed to be large zones along the direction. A zone is defined by a geometric polygon.

In this study, traffic zones are defined as the following for the traffic origin-destination (OD) survey. But in the analysis, some zones are sometimes combined to larger zones for estimating and forecast. The traffic assignment number of centroids[3] shows the final analysis zone wherein it is composed of 63 zones, although 10 zones are located out of the study area.



Source: JICA Survey Team

Figure 5.7. OD Survey Zone

[3] Centroid in traffic analysis is the assumed point of generation/attraction of traffic although it is the geometric center of a plane figure in geometry. All traffic of the zones are assumed to come and go into the point. Although traffic are generated/attracted along roads, the simulation is still difficult except dynamic simulation which is sometimes used for small districts but is not usually applied to large districts because it requires large calculations. Each centroid is connected with real road networks by each dummy link on which traffic is ignored in the traffic analysis. Because of the connection with dummy link, the centroid of the zone can be located in any place in the traffic simulation map.

Table 5.1. Survey Zone & TEDI/VITRANSS Zone

Survey Code	Area	Zone In this study	District	TEDI	VITRANSS by JICA
1	Neighbor District	Tien Giang1	Huyen Cai Be	11	53
2		Tien Giang2	Huyen Cai Lay	11	53
3		Tien Giang3	Huyen Tan Phuoc	11	53
4		Tien Giang4	Huyen Chau Thanh	11	53
5		Tien Giang5	Thanh Pho My Tho	11	53
6		Tien Giang6	Huyen Cho Gao	11	53
7		Tien Giang7	Huyen Go Cong Tay, Thi Xa Go Cong, Huyen Go Cong Dong, Huyen Tan Phu Dong	11	53
8		Long An1	Huyen Tan Hung, Huyen Vinh Hung	8	52
9		Long An2	Huyen Moc Hoa	8	52
10		Long An3	Huyen Tan Thanh	8	52
11		Long An4	Huyen Thanh Hoa	8	52
12		Long An5	Huyen Thu Thua	8	52
13		Long An6	Huyen Duc Hue, Huyen Duc Hoa	8	52
14		Long An7	Huyen Ben Luc	8	52
15		Long An8	Thanh Pho Tan An	8	52
16		Long An9	Huyen Tan Tru	8	52
17		Long An10	Huyen Chau Thanh	8	52
18		Long An11	Huyen Can Duoc	8	52
19		Long An12	Huyen Can Giuoc	8	52
20		Dong Thap1	Huyen Hong Ngu,Thi Xa Hong Ngu, Huyen Tan Hong, Huyen Tam Nong, Huyen Thanh Binh	6	57
21		Dong Thap2	Huyen Thap Muoi, Huyen Cao Lanh, Thanh Pho Cao Lanh	6	57
22		Dong Thap3	Huyen Lap Vo	6	57
23		Dong Thap4	Huyen Lai Vung, Thi Xa Sa Dec	6	57
24		Dong Thap5	Huyen Chau Thanh	6	57
25		Ben Tre1	Huyen Mo Cay Bac, Huyen Cho Lach	3	54
26		Ben Tre2	Thanh Pho Ben Tre, Huyen Chau Thanh	3	54
27		Ben Tre3	Huyen Mo Cay Nam, Huyen Giong Trom, Huyen Ba Tri, Huyen Thanh Phu, Huyen Binh Dai	3	54
28		Vinh Long1	Thanh Pho Vinh Long, Huyen Long Ho	14	56
29		Vinh Long2	Huyen Mang Thit	14	56
30		Vinh Long3	Huyen Tam Binh, Huyen Binh Minh, Huyen Binh Tan	14	56
31		Vinh Long4	Huyen Tra On, Huyen Vung Liem	14	56
32	Ho Chi Minh City	Ho Chi Minh1	Huyen Cu Chi	12	51
33		Ho Chi Minh2	Huyen Hoc Mon, Huyan Binh Chanh	12	51
34		Ho Chi Minh3	Quan Go Vap, Quan 12	12	51
35		Ho Chi Minh4	Quan Binh Tan, Quan 6, Quan 8	12	51
36		Ho Chi Minh5	Quan Tan Binh, Quan Binh Thanh, Quan Phu Nhuan, Quan Tan Phu, Quan 1, Quan 3, Quan 4, Quan 5, Quan 10, Quan 11	12	51
37		Ho Chi Minh6	Quan Thu Duc, Quan 2, Quan 7, Quan 9	12	51
38		Ho Chi Minh7	Huyen Can Gio, Huyen Nha Be	12	51
39	Mekong Delta	Tra Vinh		13	55
40		An Giang		1	58
41		Kien Giang		8	59
42		Soc Trang		10	62
43		Hau Giang		7	61
44		Bac Lieu		2	63
45		Ca Mau		4	64
46	North East South	Ninh Thuan			44
47		Tay Ninh			47
48		Dong Nai			49
49		Binh Thuan			45
50		Ba Ria-Vung Tau			50
51		Binh Duong			48
52		Binh Phuoc			46
53	Mekong Delta	Can Tho		5	60
54	Other Viet Nam	Central Highlands			39 - 43
55		South Central Coast			34 - 38
56		North Central Coast			27 - 32
57		Northwest			23 - 26
58		Northeast			12 - 22
59		Red River Delta			01 - 11
60	Foreign Country	Cambodia			
61		Laos			
62		Thailand			
63		China			

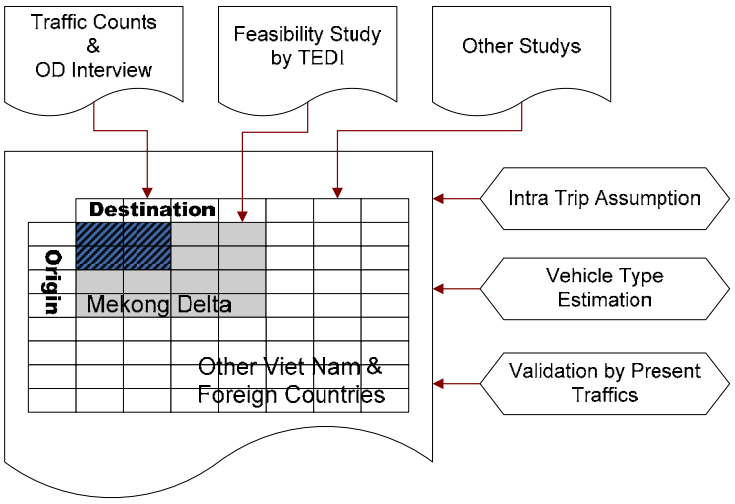
Source: JICA Survey Team

5.2 Estimate of Present Traffic

The approach in estimating present traffic is developed by the JICA Survey Team. The detail is described as follows. The approach is validated by the comparison between traffic survey results and the results of the estimated present traffic.

Because the OD interview survey does not cover all Mekong Delta and Vietnam, the JICA Survey Team need to estimate the present basic OD patterns through other studies. The traffic in this study area was described in some existing reports such as TEDI's Feasibility Study, VITRANSS by JICA, the METI & JETRO Study. The METI & JETRO Study estimates the traffic demand on the expressway between Trung Luong and My Thuan with a diversion model and the growth of the cross section volume therefore, OD tables were not referred to.

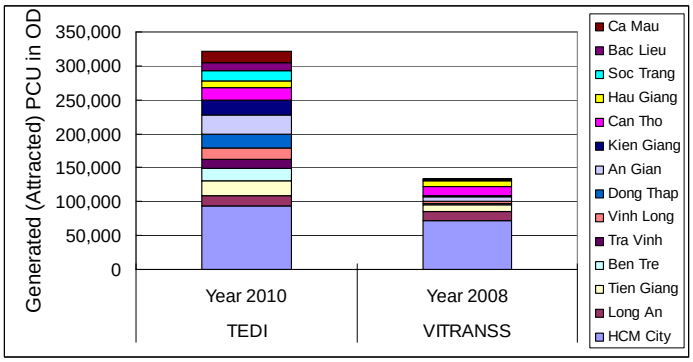
The OD tables by TEDI study were estimated by PCU and intra zone trips being zero. This being the case, it is not available to estimate section volume of traffic although it is the most recent data in Mekong Delta. Intra zone trips in OD tables in VITRANSS by JICA are also zero because they are made up of inter province trips, but the OD tables cover all of Vietnam. Therefore, the JICA Survey Team made the present basic OD tables as shown in the following figure. At first, the part in Mekong Delta OD tables fromVITRANSS were replaced by OD tables in the TEDI study. At the time, the composition ratio of vehicle type is referred by VITRANSS. The vehicle types in VITRANSS are composed of car, bus and trucks. Finally by this survey, these were divided into the detailed types. The OD table of motorcycle is assumed from the ratio of PCU.



Source: JICA Survey Team

Figure 5.8. Estimation Process of Present Traffic

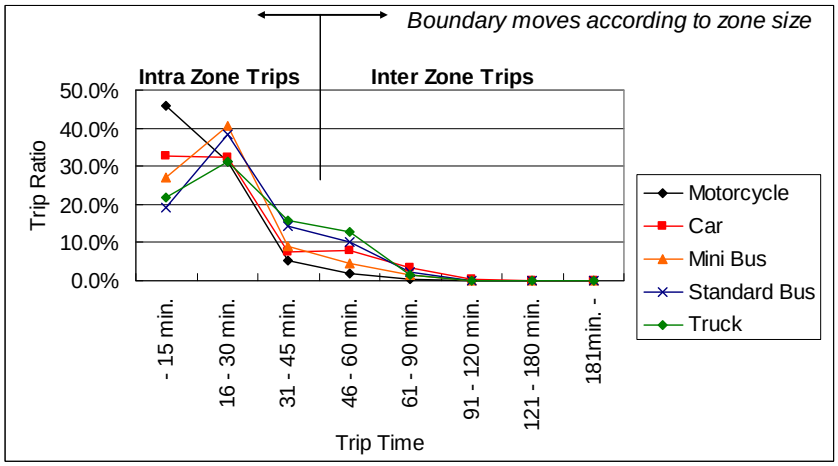
The comparison of generated/attracted PCU trips by province in the OD tables by the TEDI Study in 2010 and VITRANS Study JICA in 2008 is shown in the following. Although the difference of traffic volume looks very large in the two different years, the reason for this is the traffic study in TEDI might have included motorcycles and the VITRANSS conducted by JICA excluded it. Also, the traffic survey in VITRANSS was carried out before the opening of Can Tho Bridge and My Thuan Bridge. Therefore, the comparison should be processed without the PCU of motorcycle.



Source: TEDI F/S & VITRANSS by JICA

Figure 5.9. Comparison of Existing Studies

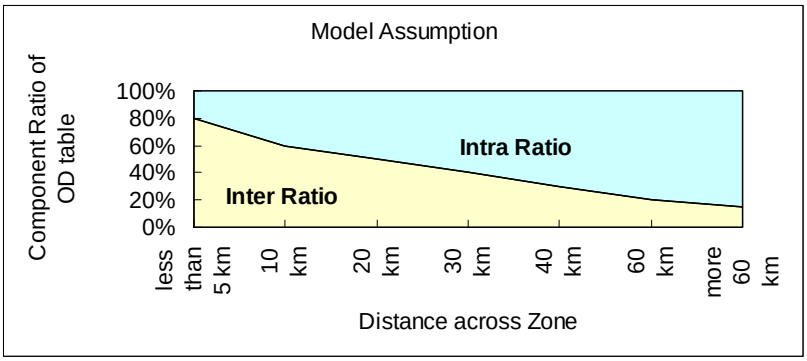
Before converting the combination of OD tables in the TEDI FS and the VITRANSS JICA Study to the zone system, the intra zone trips should be estimated because the zone system is composed of smaller zones than the province in Mekong Delta and these are necessary for the estimation of total trips as described above. However, there are no data in the existing reports and the traffic survey cannot likewise solve the ratio. In the Vietnam HAIDEP, which JICA conducted in 2005, it is useful to know that the distribution by trip length of generated/attracted trips include the intra zone trips. As shown in Figure 5.10 below, the boundary between intra zone and inter zone should be moved by the size of zone because the larger trips flow out to inter trips in the small zone and they become smaller in large zone.



Source: HAIDEP 2005 by JICA

Figure 5.10. Trip Distribution by Mode

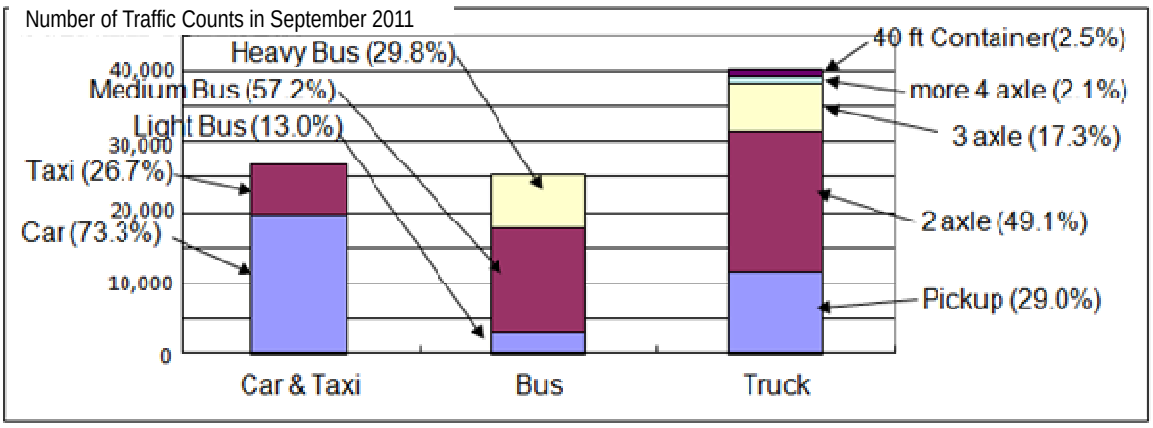
From the HAIDEP by JICA, the model, as shown in the following figure, is assumed by this study. Vehicle type is not considered in the model because the accuracy is not sufficiently large and only serves as a clue to divide intra zones of zero trips. So, the number of intra trips is assumed by inter trips and zone size. After estimating the intra zone trips, a temporary OD for motorcycle is prepared by assuming that the ratio is about 30% of other traffic PCU considering only short distance because there are no other data in past studies.



Source: JICA Survey Team

Figure 5.11. Ratio Assumption by Distance

The ratio of vehicle type is estimated by the traffic survey as shown in the Figure 5.11. Although the ratio is correct in Tien Giang Province where the traffic survey was carried out, it does not mean that the traffic in other provinces have the same ratio. But, the review of OD tables have no other choice but to accept the difference in the conversion from the existing OD tables by VITRANSS JICA study and the TEDI study to the OD tables for the study. Through the aforementioned process, the reviewed version of the existing OD tables can be prepared for comparison with the traffic survey. Therefore, it should be understood that traffic related with the other zones which were not surveyed in this study have some assumptions in estimating and forecasting OD tables.



Source: JICA Survey Team

Figure 5.12. Vehicle Number of Traffic Counts in September 2011

Subsequently, the OD tables in Tien Giang Province were estimated by the traffic survey. The traffic count survey and OD interview survey were carried out in September 2011 at the following stations as shown in Figure 5.13 below. In addition, the stations of the OD interview survey are categorized by the color red, and the 24-hour and 16-hour survey points are also indicated in different colors.

Red number: OD survey point, Blue number: Traffic count

Red circle: 24-hour survey, Blue circle: 16-hour survey

Source: JICA Survey Team

Figure 5.13. Traffic Survey Locations

The traffic volume per station is shown in the table below. Inter urban traffic is characterized by large number of trucks. Because the traffic on national road NH1A come down after My Thuan Bridge toward Can Tho, it is clear that traffic on the road in Tien Giang Province includes intra province trips and local destination trips. The PCU ratio of motorcycle is about 30% as described in the past study, so the previously mentioned assumption for comparison might be correct.

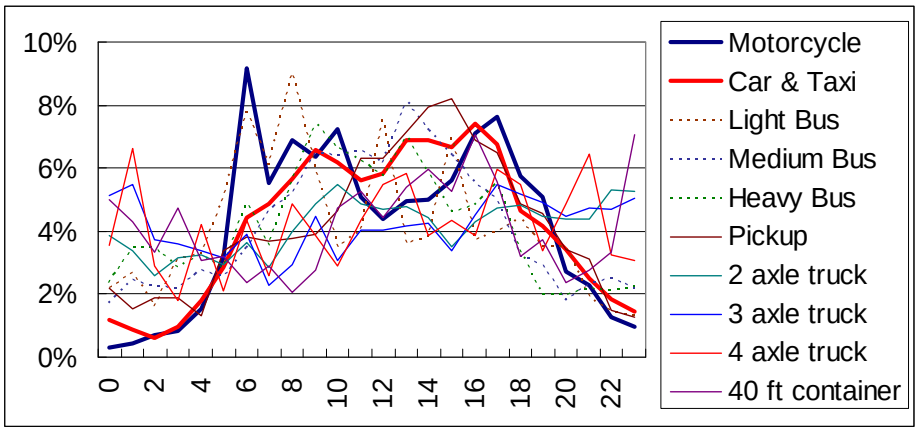
Table 5.2. Traffic Counts per Station for 16- or 24-hour Duration

Station	PCU					Number of Vehicle	
	Car & Taxi	Bus	Truck	Motor cycle	Total	All except Motorcycle	Motorcycle
1	429	991	770	708	2,898	1,250	4,724
2	252	428	981	780	2,441	949	5,207
3	2,278	4,734	6,063	3,070	16,145	7,446	20,473
(24hr) 4	1,264	4,874	6,084	6,166	18,388	6,924	41,116
(24hr) 5	6,442	13,355	17,775	47	37,619	20,569	319
6	659	732	1,751	2,714	5,856	2,026	18,101
(24hr) 7	5,191	13,445	16,613	3,449	38,698	19,468	22,999
8	4,198	11,373	11,479	3,432	30,482	14,477	22,890
9	672	1,509	2,135	1,157	5,473	2,530	7,718
10	3,635	7,730	8,345	3,760	23,470	11,478	25,078
11	1,663	2,318	3,860	3,991	11,832	4,957	26,612

Source: JICA Survey Team

Samples of OD interview survey are expanded per station, direction and vehicle type. Before the expansion ratio is calculated by traffic counts and number of samples, it is necessary to adjust the 16-hour survey to 24 hours. Traffic distribution per vehicle type on the 24 hour survey stations is shown in the Figure 5.14. Although traffic of cars and motorcycles have two

peak hours, both in the morning and in the evening, other vehicle types do not have such characteristics. The total ratio of the 16-hour traffic is selected for the adjustment factor rather than every hour or its peak ratio. The expansion factor is composed of multiplying the reciprocals of the sampling ratio and the 24-hour ratio by station, direction and vehicle type.



Source: JICA Survey Team

Figure 5.14. Hourly Distribution of Traffic in Survey

Table 5.3. Adjustment Factor for 16-hour Survey

Vehicle Type	16 hr./24 hr. Ratio	Vehicle Type	16 hr./24 hr. Ratio
Motorcycle	90.8%	Pickup	85.1%
Car & Taxi	88.4%	2 axle truck	70.2%
Light Bus	79.3%	3 axle truck	65.9%
Medium Bus	81.3%	4 axle truck	72.5%
Heavy Bus	77.4%	40 ft container	66.0%

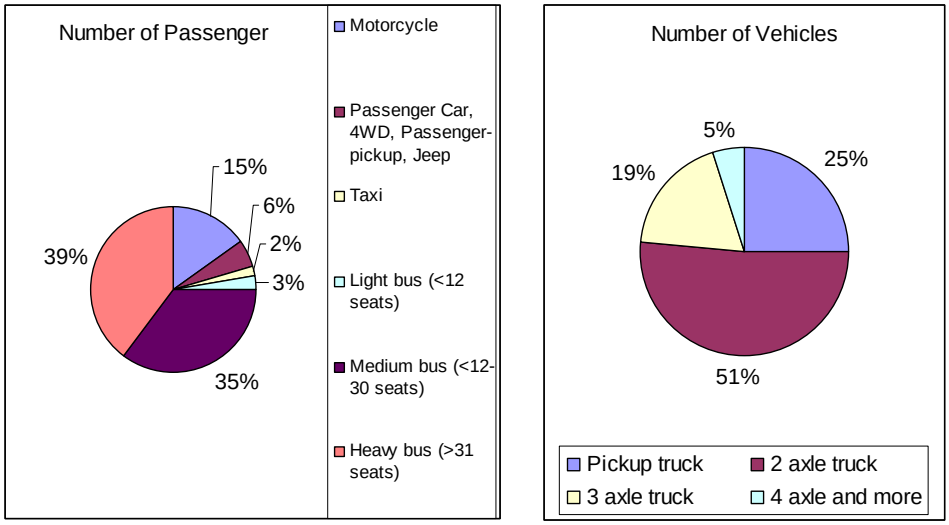
Source: JICA Survey Team

Ten kinds of OD tables are estimated. OD table with 63-zone x 63-zone by vehicle type is prepared based on the OD survey each survey station. Final OD table by vehicle type selects the largest number at the same origin-destination pair (i,j) position in OD tables made by survey station. The consolidation by selecting a larger number in each OD pair per vehicle type is based on the hypothesis that the larger number is the most probable number between the OD pair. Vehicles are grouped into 10 types as shown in the table since the maximum number for vehicle types that can be analyzed in STRADA is 10. STRADA is a traffic demand analysis software which was used to process that traffic data gathered and is the most popular traffic analysis tool in Vietnam. The sequence number of vehicle type is the same as what is shown in Table 5.4.

Table 5.4. Combined Vehicle Type Number

1	Motorcycle	6	Large Bus
2	Car	7	Pickup
3	Taxi	8	2 axle truck
4	Small Bus	9	3 axle truck
5	Medium Bus	10	4 axle truck and Container

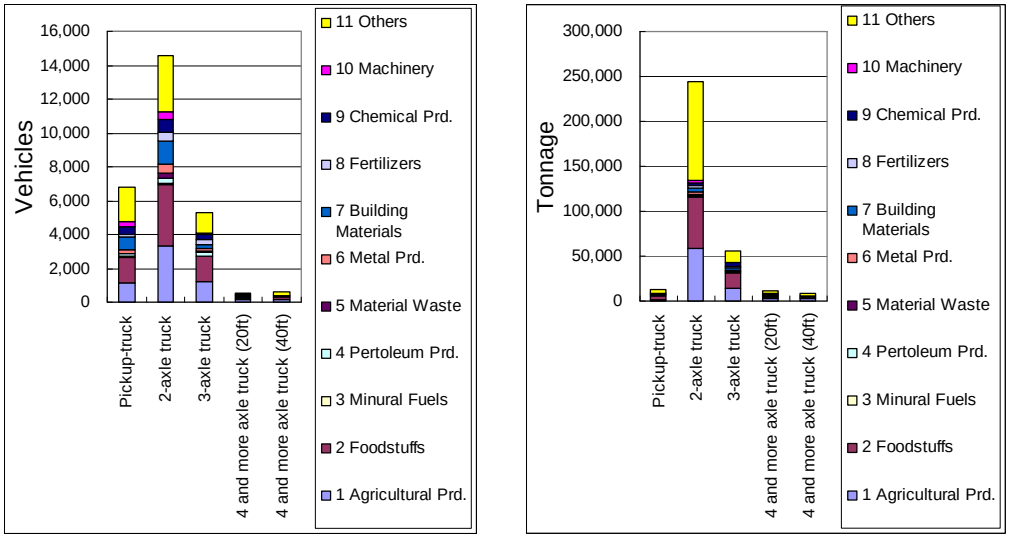
Source: JICA Survey Team



Source: JICA Survey Team

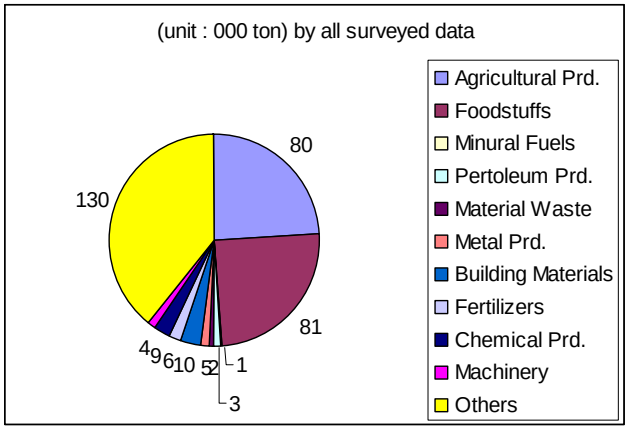
Figure 5.15. Combined Vehicle Types in the Traffic Survey

This study does not discuss the traffic flow of cargo due to lack of extensive research. The outline of surveyed cargo per vehicle type is shown in the Figure 5.16. In both cases of number and tonnage, 2-axle trucks mostly carry the cargo. The major commodities are agricultural products, live animals, foodstuffs and animal food in Tien Giang Province. Because the graph includes all survey stations, the total volume of the y-axis does not mean the section volume of traffic. For example, the tonnage at Station No.7, which was surveyed for 24 hours, accounts for 40% in the graph. The ratios are 4% at Station 4 on the national road NH1A and 12% at Station 5 at the exit from the expressway. This fact reveals that, at present, the utilization ratio of the expressway is 75% at the cross section, and the cargo through Trung Luong and Cai Lay is more than the traffic to Ho Chi Minh City. Empty truck ratio is about 30%. This ratio is relatively low, which is almost the same as Japan. Although the empty ratio by small truck as pickup for personal use generally accounts for 50%, it is reduced to about 35%. If this shows all trucks of non-biased samples, the transporter achieves efficient cargo transportation. Because there is a tendency that loaded trucks use toll roads more than empty trucks, trucks will be promising customers for the new toll road.



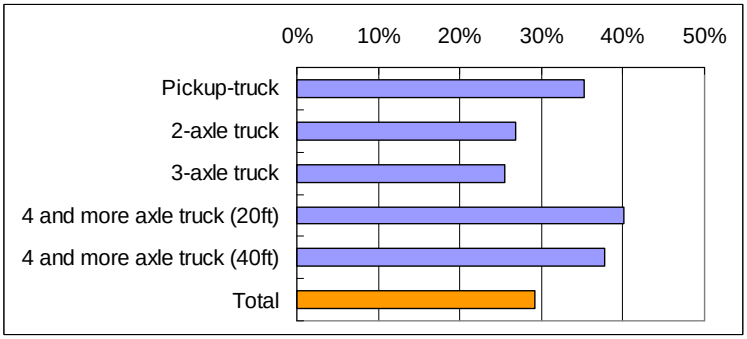
Source: JICA Survey Team

Figure 5.16. Commodity Type by Vehicle Type



Source: JICA Survey Team

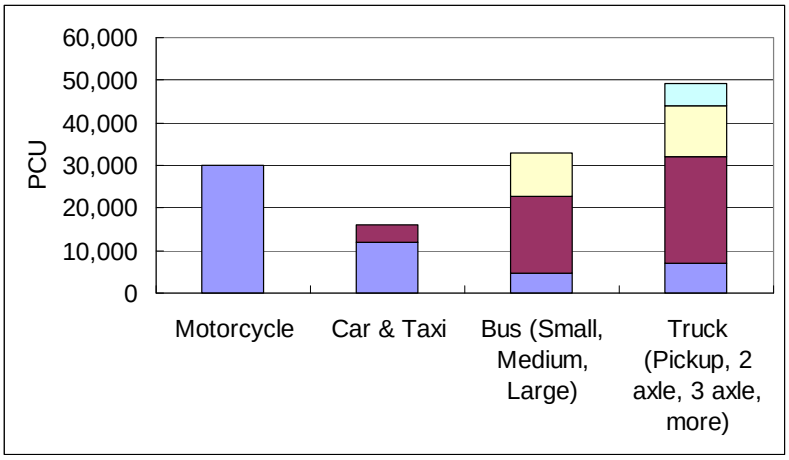
Figure 5.17. Weight of Commodity at Surveyed Station



Source: JICA Survey Team

Figure 5.18. Empty Truck Ratio

The total generated/attracted PCU in the final OD tables expanded from samples are shown in Figure 5.19. It is obvious, at a glance, that this OD table does not grasp the total generated/attracted trips of a zone. The roadside OD interview survey is not enough to estimate the present OD without extensive survey covering all of Mekong Delta and Ho Chi Minh City. Therefore, the above consideration and assumptions become important.

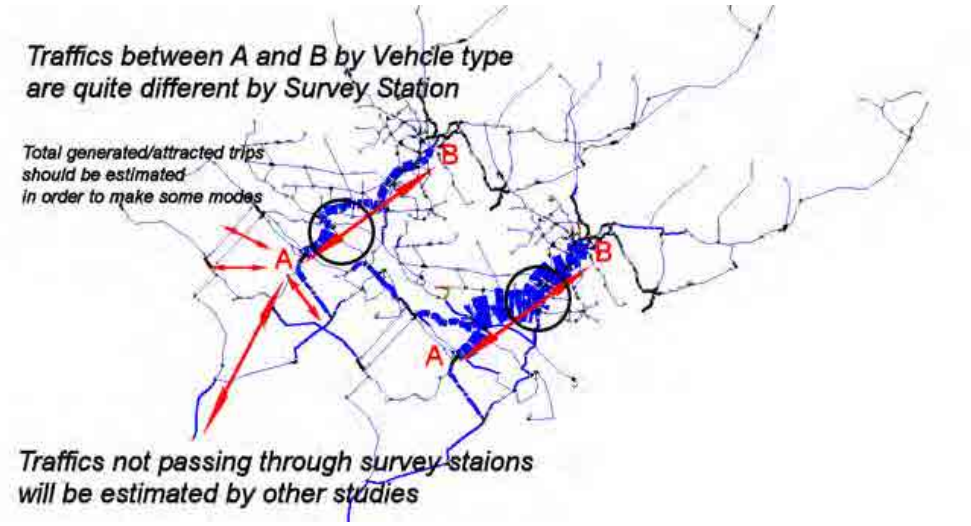


Source: JICA Survey Team

Figure 5.19. Total of Attracted/Generated PCU by Expanded Combined Survey Result

In order to better understand the methodology, the process of estimating as previously described above is reviewed hereunder:

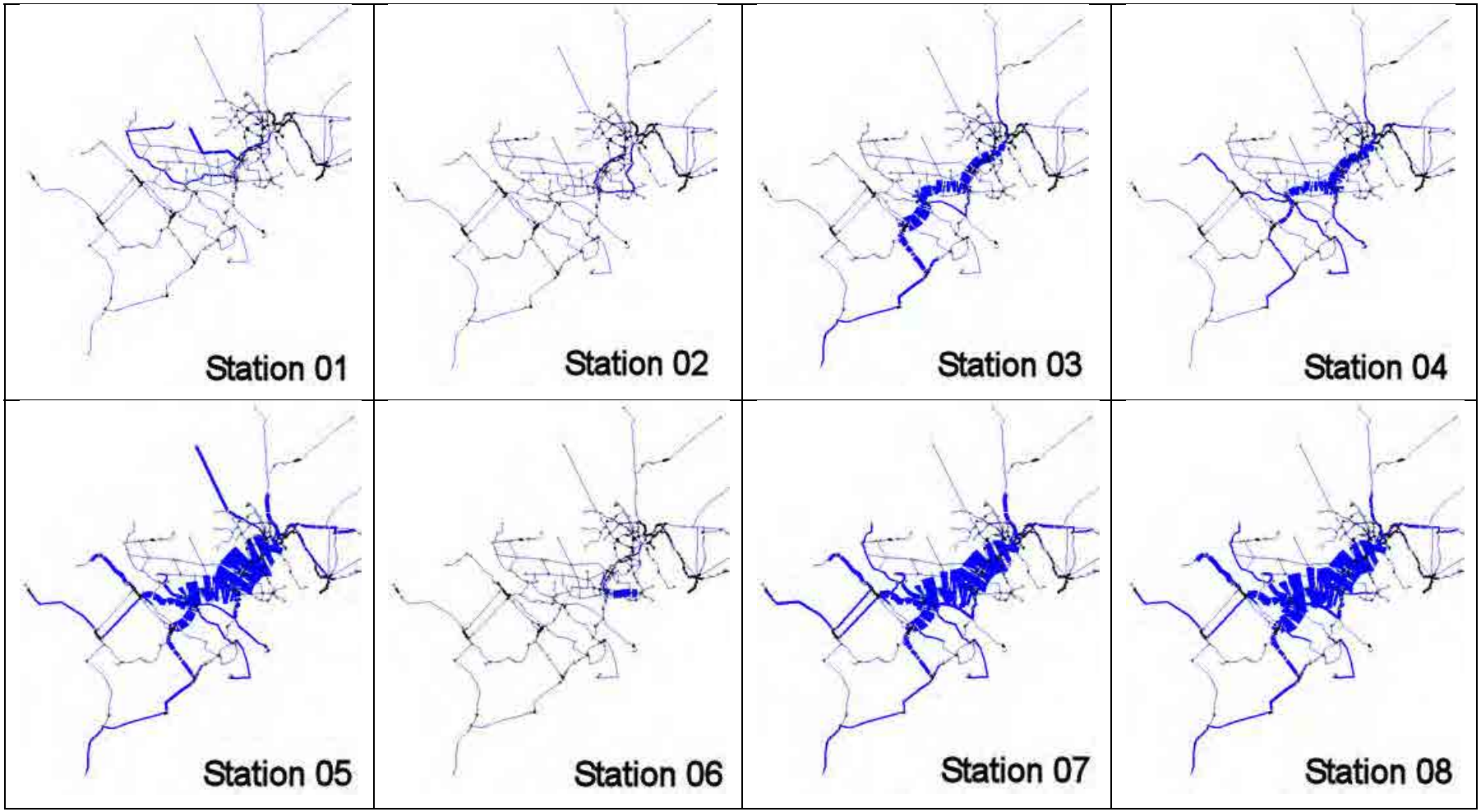
1) The traffic survey does not cover all of Mekong Delta and Ho Chi Minh City. The result covers the traffic that will only pass through Tien Giang Province.
2) Traffic volume between zones A and B by vehicle type per survey station are quite different even if the survey stations are located on the same road. Therefore, the traffic of OD pairs should be adjusted by these different results. It is termed as the expanded combination.
3) Other OD pairs not passing through the survey stations have to be estimated by other existing studies. Although the TEDI study and the VITRANSS are available, the units of traffic are quite different as PCU or Passenger Trips and the methodologies in estimating are different. Therefore, the combination of all studies includes different accuracies.
4) The estimate of generated/attracted model needs intra zone trips, but not any of the studies have focused on intra zone. Therefore, intra zone trip ratio needs to be estimated.



Source: JICA Survey Team

Figure 5.20. Review of Methodology

The next figure shows the expanded samples that were assigned on the road networks. The location where the traffic at the survey stations came from can be checked on the map. Traffic at Station 5 has a wider area than that of Station 4. The locations of stations 7 and 8 are near each other, but the details of the OD pair are different. Traffic at Station 3 between My Thuan Bridge and Can Tho Bridge are mostly generated or attracted along NH1A from the section between Ho Chi Minh and Can Tho.



Source: JICA Survey Team

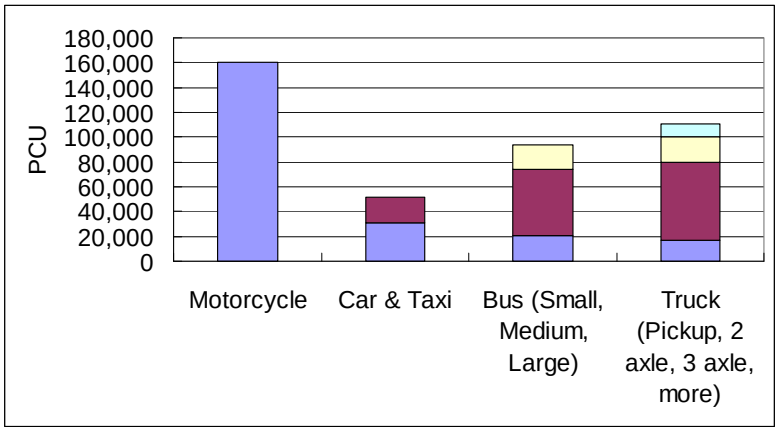
Figure 5.21. Traffic Assignment of Surveyed OD Pairs by Survey Station

The parts not covered by the survey found in the OD tables should be merged with the estimates above. The method used to merge them is that trips of OD pairs, which must go through the survey points, are accepted for merged OD tables, but larger trips in other OD pairs not passing through the survey points are selected after comparing the survey OD table with the estimated OD table. The OD pairs passing through the survey points are selected by traffic assignment of expanded survey OD tables.

The comparison of vehicle trips in the two OD tables proves that the estimates are approximately the same as survey results. But, for most part of those OD pairs, it uses rough numbers because the estimated OD tables come from existing data among provinces in the national level. The OD pairs that did not pass through our survey points are not accurate enough. Therefore, it is not recommended to use the final merged OD tables for other projects. In Tien Giang Province, the OD tables are validated through the surveys.

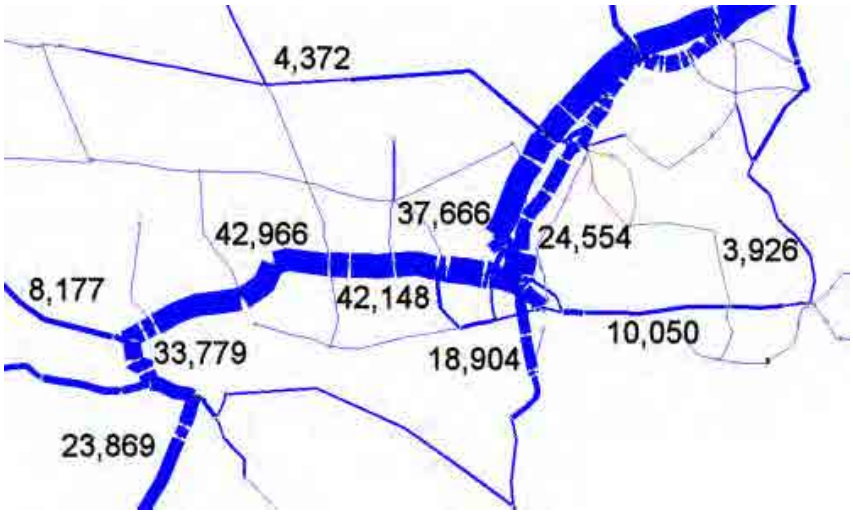
By adjusting the results of the traffic assignment of the present OD tables by vehicle to the traffic counts in the 11 survey stations, all traffic surveys are reflected in the present OD tables. Because the weight of passing traffic at survey stations are used for the adjustment, the present OD tables might have a little bias in the regions which did not cause so much traffic through the survey stations. However, the present OD is proper enough to traffic count and OD interview surveys on vehicle type and survey station are within less than 2% range.

As a result, the generated/attracted PCU in merged OD tables (present OD tables) are estimated as shown in Figure 5.22. The appropriateness of traffic assignment means the accuracy of the present OD tables.



Source: JICA Survey Team

Figure 5.22. Total of Attracted/Generated PC U in Merged OD Table

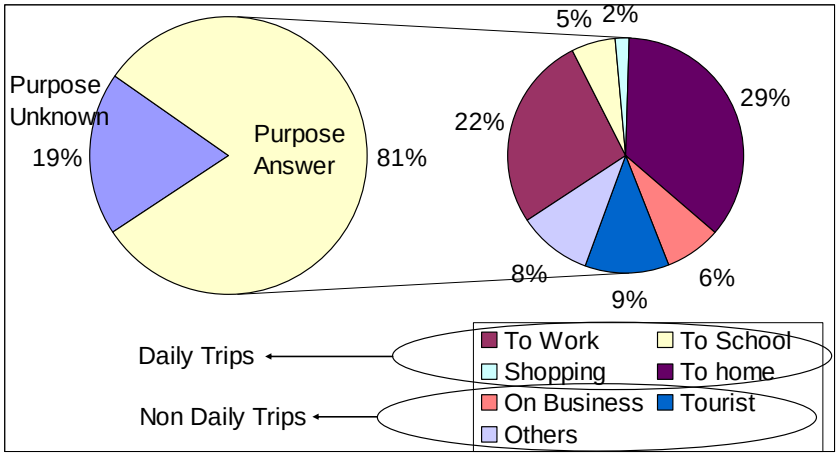


*) Blue line=Traffic Assignment Result, Number=Estimated 24 hour Traffics by the survey

Source: JICA Survey Team

Figure 5.23. Assigned Traffic & Traffic Counts for 24 Hours by PCU

With the final estimated merged present OD tables that are called the present OD tables below, a trip generation/attraction model is estimated. Because the present OD tables are not only made of the survey but also estimates and some assumptions, there might be a little bias. However, the bias will be homogenized in the forecasting process through socio-economic factors. There are two aspects for modeling generated/attracted trips such as daily traffic and non daily traffic. As shown in Figure 5.24, which are the answers of the drivers in the survey, most of the trips' purposes are commuting, going to school and coming back home. The trip distance of daily trips is short within one zone and neighboring zones. Although non-daily trips travel to farther zones, the share is low at about 23%.



Source: JICA Survey Team

Figure 5.24. Surveyed Purposes of Drivers Except Trucks

The unit of daily traffic should be constructed by population because people's behavior is not changed so much in the future. The number of times of commuting to and from the school does not increase. But as shown in Figure 5.25, the number of trips per person increases according to personal income in any city and country., Although the growth might come from the increase of social activity corresponding with the income level, the increase of ratio is not so drastic. The models of daily traffic are formulated as in model (1) below. Formula (1) is termed personal unit type in this study.

The number of long distance inter zone trips usually depends on the economic activities. In the second model (2), the GRDP (Gross Regional Domestic Product) per capita and population are considered variables. The coefficients of two variables should be positive because the inverse proportion is not adequate for the future forecast. This model is termed economic growth type in this study.

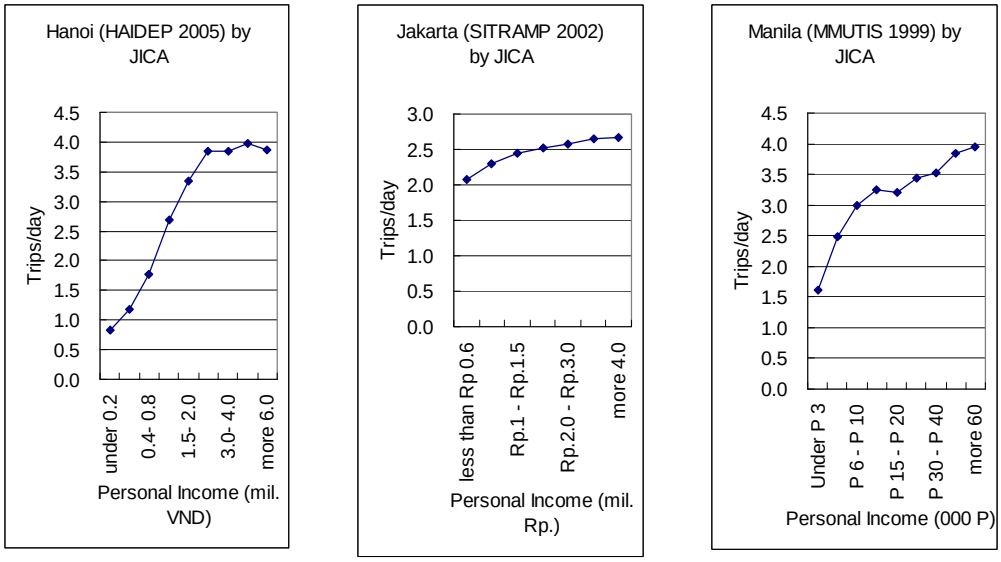
(1) Personal unit type

Trips = a x (k + m x Log-e(GDP per capita)) x Population + b

k + m x Log-e(GDP per capita) : Generated trips per person

(2) Economic growth type

Trips = a x (GRDP per capita) + b x (Population) + c



Source: JICA, as described in each graph

Figure 5.25. Growth of Person-Trips by Income Level

Each model is estimated with the present OD table as shown in the following table. The model type should not be selected only by correlation ratio, but with model (2) economic growth type, since it is better in terms of all vehicle types. Although the model type for motorcycle should be the personal unit type because it is used for commuting and daily activities, economic growth type is selected for the balance of the forecast. In case of vehicles for daily use, the coefficient of population is a little bit higher than for longer distance vehicles. All models include intra zone trips, which are estimated in the section above. Therefore, the intra zone ratio is assumed to be the same in the future.

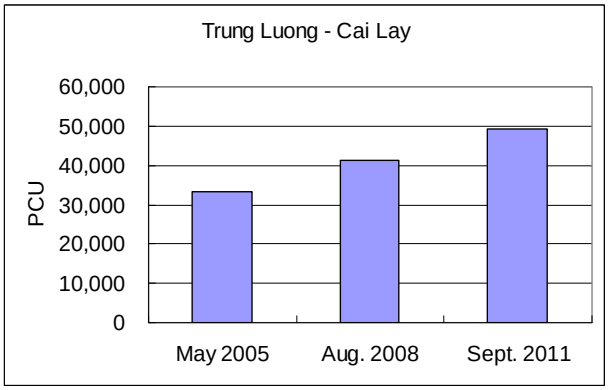
Table 5.5. Generated/Attracted Model (Unit VT) by Vehicle Type

Vehicle Type		a*(k+m*LN(GDP p.c.)*Pop + b			a*GDP p.c + b*Pop + c			
		a	b	R2	a	b	c	R2
1	Motorcycle	0.6231	4758.30	0.29	551.957	0.00560	969.62186	0.54
2	Car	0.4980	121.11	0.43	42.093	0.00055	-189.082	0.68
3	Taxi	0.3055	112.41	0.40	21.365	0.00036	-45.846	0.63
4	Small Bus	0.0127	41.65	0.64	11.269	0.00020	-42.174	0.75
5	Medium Bus				25.566	0.00046	-136.430	0.80
6	Large Bus				8.751	0.00014	-27.440	0.76
7	Pickup	0.9568	118.95	0.43	17.319	0.00024	-8.079	0.65
8	2 axle truck				37.270	0.00053	-118.367	0.69
9	3 axle truck				9.539	0.00014	-25.509	0.71
10	4 axle more				3.790	0.00003	-11.514	0.58
		*) personal unit type			*) economic growth type			

*) GDP p.c.=GRDP per capita, Pop=Population
**) Personal unit type is not adequate for long trip type, so some vehicle types are not estimated by the model.

Source: JICA Survey Team

But, this model might have some differences from real traffic because OD tables, which are validated only in Tien Giang, are based on other existing studies in most parts. Low volume traffic in regions far from Tien Giang in other studies might affect the coefficients of the models. Adjustment is recommended in the comparison of the growth between real traffic and estimated traffic by model. As shown in Figure 5.26, the growth of traffic on NH1A between Trung Luong and Cai Lay is a little bit larger than that of the model. Therefore, it is considered in the forecast.



Source: TEDI & JICA Survey Team

Figure 5.26. Traffic Survey Result

Traffic count survey and roadside OD interview survey for this study are carried out at the stations previously described from September 13-15 in 2011. Although this study might admit the sampling ratio is insufficient to satisfy statistical significance, the complement of pre-studies by using the most recent real data and the adjustment to traffic counts by present traffic assignment achieves the present traffic estimate. However, the OD pattern of motorcycles is assumed by traffic counts.

Table 5.6. Number of OD Samples by Station

Station	Traffic Counts	Samples of OD Interview	Sampling Ratio
1	5,974	750	12.6%
2	6,156	428	7.0%
3	27,919	1,115	4.0%
4	48,040	1,237	2.6%
5	20,888	723	3.5%
6	20,127	616	3.1%
7	42,467	1,841	4.3%
8	37,367	1,434	3.8%
Total	208,938	8,144	3.9%

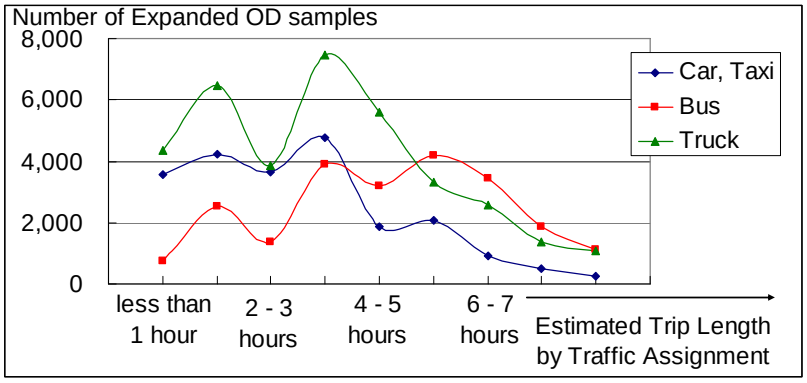
Source: JICA Survey Team

Table 5.7. Number of OD Samples by Vehicle Type

	Vehicle Type	Traffic Counts	Samples of OD Interview	Sampling Ratio
1	Motorcycle	135,829	555	0.4%
2	Car	17,008	2,230	13.1%
3	Taxi	3,705	126	3.4%
4	Small Bus	2,540	116	4.6%
5	Medium Bus	11,745	1,458	12.4%
6	Large Bus	6,195	798	12.9%
7	Pickup	8,562	630	7.4%
8	2 axle truck	15,918	1,550	9.7%
9	3 axle truck	5,752	515	9.0%
10	Container	1,684	166	9.9%
	Total	208,938	8,144	3.9%

Source: JICA Survey Team

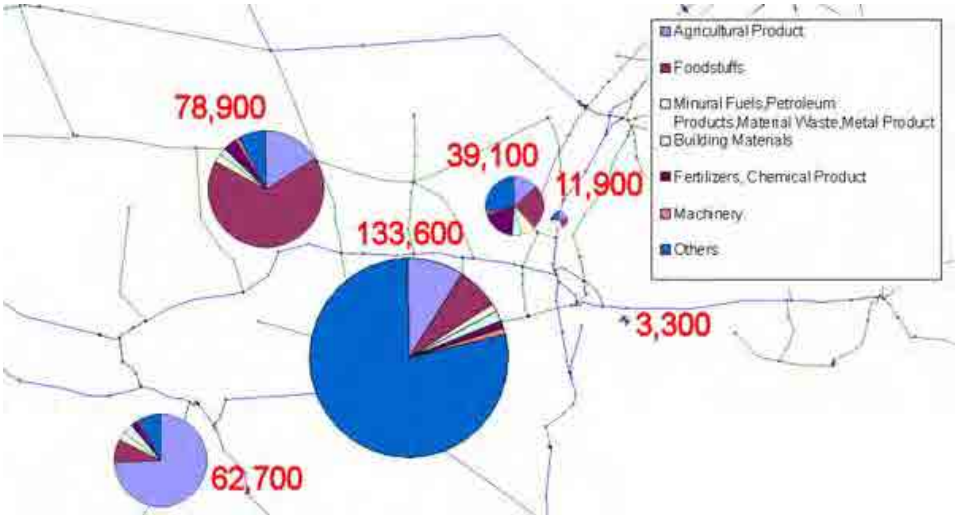
In view of the distribution of trip length, the sampling looks unbiased because the survey covers both local and long-distance trips as shown in Figure 5.27. The trip lengths of buses are usually longer than trucks and cars in inter urban traffic.



Source: JICA Survey Team

Figure 5.27. Number of Expanded OD Samples by Trip Length

The OD patterns by commodity type are not discussed in the present estimates made, although they might be useful for future forecast. Because commodity along NH1A varies in tonnage and ratio, it is judged that commodity data from the roadside interview is biased. However, vehicle trips by trucks are acceptable because the interview data are not so much different along the route.

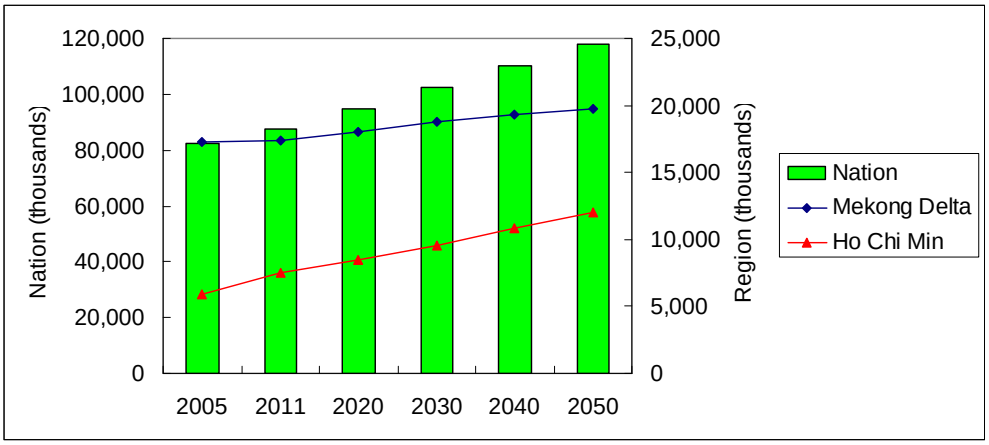


Source: JICA Survey Team

Figure 5.28. Surveyed Expanded Tonnage by Commodity Type

5.3 Future Forecast

The United Nations (UN) forecast the population in all of Vietnam to be 118 million by 2050. This study uses the forecast conducted by UN for the framework which is used for the total population in all provinces. Although some other studies forecast the future population by province, the following future population is forecasted by the JICA Survey Team because this study needs the forecast of detailed zones in Mekong Delta. After existing studies are reviewed and updated, the present estimate in 2011 and long-range forecasts are built up by the survey zone. In this region, urban region attracts more population from rural regions, and finally, Ho Chi Minh City absorbs the social migration. As a result, the growth ratio of Ho Chi Minh City is high. Population in Mekong Delta is also seen to rise in the future. The forecast method is mainly constructed through the growth of the share of population.



Source: JICA Survey Team

Figure 5.29. Future Population

The following table of long-range forecast is combined to the province from the survey zone. Although some provinces might have their development plans in relation to the population increase, it will be balanced by facing the competition among provinces because total population in all Vietnam is not much fluctuated. In this study, the reorganization of the administrative districts was not considered, so the zone boundary is based on the September 2011 data.

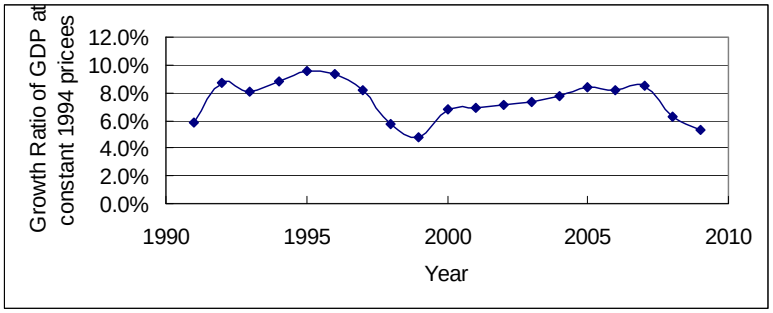
Table 5.8. Future Population Framework

Unit: x 1,000

Province	2011 (Estimated)	2020	2030	2040	2050
Tien Giang	1,683	1,754	1,822	1,879	1,924
Long An	1,410	1,456	1,497	1,527	1,545
Dong Thap	1,619	1,686	1,752	1,806	1,850
Ben Tre	1,261	1,303	1,340	1,367	1,383
Vinh Long	1,070	1,108	1,141	1,166	1,182
Tra Vinh	1,080	1,123	1,164	1,197	1,223
An Giang	2,334	2,427	2,515	2,587	2,642
Kien Giang	1,717	1,785	1,850	1,903	1,943
Soc Trang	1,308	1,360	1,410	1,450	1,481
Hau Giang	766	797	826	850	868
Bac Lieu	693	720	746	768	784
Ca Mau	1,219	1,268	1,314	1,351	1,380
Can Tho	1,212	1,290	1,373	1,454	1,531
Ninh Thuan	568	592	615	634	650
Tay Ninh	1,048	1,092	1,134	1,169	1,198
Dong Nai	2,159	2,250	2,337	2,410	2,468
Binh Thuan	1,274	1,328	1,379	1,422	1,457
Ba Ria-Vung Tau	1,022	1,107	1,201	1,296	1,392
Binh Duong	933	972	1,010	1,041	1,067
Binh Phuoc	837	873	906	935	957
Ho Chi Minh	7,476	8,443	9,583	10,790	12,066

Source: JICA Survey Team

In 2010, the nominal GDP per capita in Vietnam reached US$1,174. A GDP per capita over US$1,000 means the beginning of a quick growth of national development and personal improvement of standards of living in the future. The growth ratio is still high, although it was recently pushed down due to the effect of the world economy in a few years. GDP will be from 5% to 6% growth ratio in the future and it will slow down to about 4.5%. Under this consideration, the future GDP is forecasted.

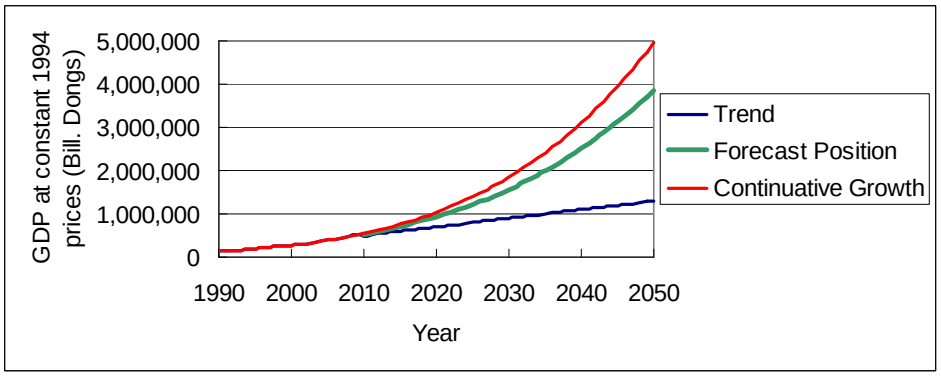


Source: General Statistics Office of Vietnam

Figure 5.30. Growth Ratio of GDP in Vietnam

The following Figure 5.31 shows the linear trend of GDP and the continuous upward trend of the growth ratio of GDP. The continuous increase of the growth ratio is estimated by assuming a linear trend. The forecasted position is set in the middle of 70% between two trends because at least it can be realized for more than 5 times. Although there are some possibilities to increase more, the minimum achievement was selected in order to avoid overestimation of traffic forecasts.

The minimum achievable point is over the present Thailand and China, and accesses to nearly the same as Malaysia on all average people in the nation. The figure does not include the possibility to find any new natural resources as oil and gas, so it might increase more.



Source: JICA Survey Team

Figure 5.31. Future Forecasted GDP

The forecast of GRDP per province is revised with the total national GDP and statistics data trend of the General Statistics Office of Vietnam. The GRDP per zone is not forecasted in this study because a province is a unit of economic statistics. A province is considered a forecast unit. In the TEDI study, the share of this region is extraordinarily high in the future framework as Mekong Delta and Ho Chi Minh City account for 67% of the nation except

North East South region by 2020. Although the GRDP in this region actually has the highest share in Vietnam, it will be distributed nationwide through the development of Red River Delta, coastal region and so on. The VITRANSS Study by JICA forecasted the share will be 40% in the year 2030. In this study, it is assumed that the share will be 50% in 2050. After estimating the framework of Mekong Delta and North East South region, the GRDP per province is forecasted. This result per province is used to forecast zones.

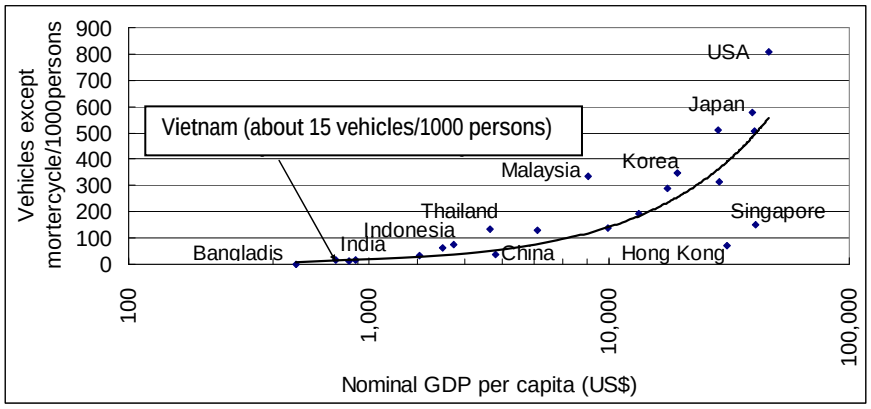
Table 5.9. Future GRDP Framework at 1994 Constant Prices

Unit: VND Billion

Province	2011 (Estimated)	2020	2030	2040	2050
Tien Giang	14,640	17,197	23,163	32,434	41,144
Long An	10,734	14,798	19,728	27,323	34,249
Dong Thap	10,065	13,994	18,856	26,391	33,491
Ben Tre	10,453	13,311	17,750	24,586	30,816
Vinh Long	8,397	10,477	13,989	19,410	24,376
Tra Vinh	8,107	11,255	15,126	21,120	26,733
An Giang	16,202	22,494	30,224	42,212	53,407
Kien Giang	20,028	24,960	33,542	46,847	59,257
Soc Trang	12,284	15,368	20,660	28,847	36,502
Hau Giang	6,730	8,252	11,090	15,495	19,602
Bac Lieu	7,796	10,814	14,528	20,308	25,683
Ca Mau	15,573	20,432	27,453	38,325	48,498
Can Tho	18,517	21,943	30,283	43,543	56,800
Ninh Thuan	2,215	3,082	4,151	5,810	7,380
Tay Ninh	6,478	9,012	12,135	16,985	21,564
Dong Nai	17,879	24,877	33,504	46,911	59,515
Binh Thuan	4,253	5,919	7,969	11,158	14,164
Ba Ria-Vung Tau	39,156	58,269	81,969	120,099	159,807
Binh Duong	6,454	8,977	12,095	16,926	21,493
Binh Phuoc	2,351	3,274	4,405	6,173	7,827
Ho Chi Minh	161,756	226,962	334,022	510,644	707,433

Source: JICA Survey Team

The future demand by vehicle type was forecasted by using the present pattern method after applying the generated/attracted trip model to socio-economic factors. Because the accuracy of the existing data will not be high enough to forecast ten vehicle types in 63 zones, the converted results to PCU units are better in order to understand traffic demand. And the forecast does not guarantee lesser traffic volume in Tien Gian Province. In the process of applying the model of generated/attracted trip, the modal shift from motorcycle to passenger car is assumed because the diffusion of car quickly increases at the stage when the GDP is over US$2,000 per capita as shown in Figure 5.32. Since this is estimated to happen in 2020, it is assumed that about 10% of motorcycles will be replaced by cars within the next 30 years. Although the ratio may be higher in reality, a sudden reduction of motorcycles in the formula should be avoided. The forecast does not presume catastrophic changes even when motorcycles disappear on the roads. In case that the demands for cargo transportation increase, trucks in larger sizes will be used, but it cannot be forecasted in the data.



Source: UN, National Accounts Main Aggregates Database & IRF, World Road Statistics 2010

Figure 5.32. Car Ownership by GDP per capita

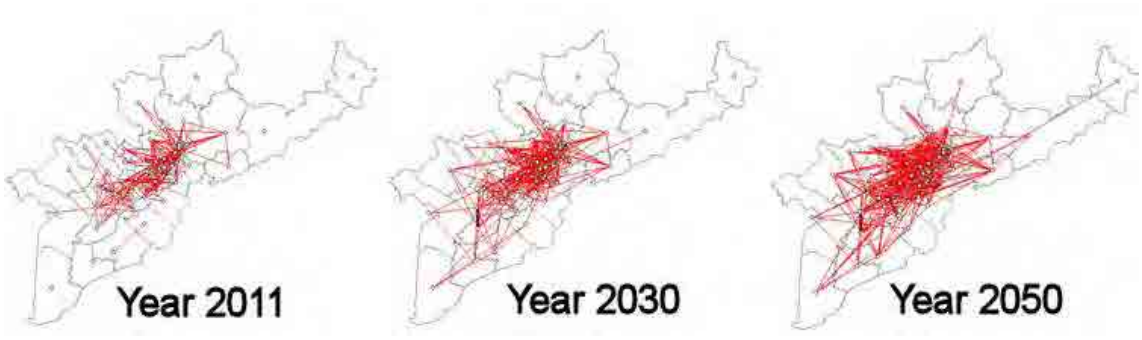
In the process of estimating the future generated/attracted vehicle trips by traffic models, the result values cannot be directly calculated by the models. After the estimation in 2011 and the forecast in the future years are calculated, the growth ratio by the model is applied to the present generated/attracted trips in the present OD tables. The reason for this is that the present OD tables are not estimated directly by the detailed surveys in all of Mekong Delta, and the generated/attracted trips in the provinces that were not surveyed were not validated. Future OD tables are forecasted in the following Table 5.10. Because the traffic in this table is mainly related with the road network between Trung Luong and Can Tho, trips along the road are larger than in other areas. For example, although generated/attracted trips in Can Tho or Ho Chi Minh are larger than what is found in the table, they should be surveyed separately by other methods such as roadside interview or household interview surveys. These surveys are out of the scope of this study.

Table 5.10. Forecasted Future Traffics related with the study area

Unit: PCU/day

Province	Year 2011	Year 2020	Year 2030	Year 2040	Year 2050
Tien Giang	60,100	89,200	145,800	228,800	337,700
Long An	50,600	90,000	152,900	246,400	368,200
Dong Thap	20,600	34,200	55,500	85,300	124,400
Ben Tre	17,600	27,400	44,000	67,300	97,800
Vinh Long	19,300	29,800	48,400	75,300	110,600
Tra Vinh	6,000	9,000	13,400	18,800	25,800
An Giang	8,100	11,700	16,400	21,400	27,700
Kien Giang	5,800	8,400	12,300	17,000	22,800
Soc Trang	4,100	5,900	8,600	11,800	15,900
Hau Giang	5,500	8,000	12,300	17,900	25,100
Bac Lieu	1,900	3,000	4,700	7,000	9,800
Ca Mau	5,000	7,400	11,100	15,800	21,800
Can Tho	25,300	36,700	56,300	82,400	116,600
Ho Chi Minh & North East South	187,300	295,300	464,400	693,500	996,400
Others	2,900	4,900	8,200	13,500	20,900
*) Traffics related with road network between Trung Luong - Can Tho					

Source: JICA Survey Team



Source: JICA Survey Team

Figure 5.33. Desired Line by Future Forecast

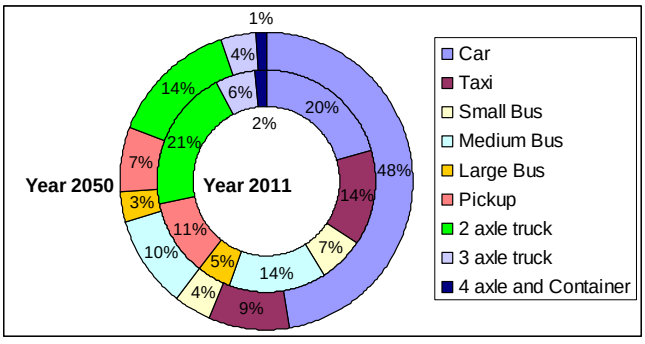
In the process of the forecast, the PCU by zone is accumulated by vehicle type. OD tables by vehicle type are estimated by the models. The following table shows the total number of vehicle trips in forecasted OD tables, which are outputs to 'aod' format for the STRADA. Because they are estimated by the growth as a result of calculation by model, the capacity to reproduce for the forecast by other methodologies depends on the estimated present OD tables. Therefore, the detailed part of each OD table by vehicle type may not have the accuracy to be validated. However, the future traffic assignment will achieve the necessary level for financial evaluation because traffic assignment by the estimated present OD tables is appropriate for traffic surveys. In the future, there is almost no doubt that passenger cars will account for about half of the traffic in this region.

Table 5.11. Forecasted Vehicle Trips by Vehicle Type

Unit: Vehicle trip

Type of Vehicle	Year 2011	Year 2020	Year 2030	Year 2040	Year 2050
Motorcycle	534,900	795,300	1,172,400	1,596,900	2,084,100
Car	30,800	66,100	142,000	298,900	540,700
Taxi	20,900	32,100	49,300	70,900	98,100
Small Bus	10,300	16,000	24,900	36,100	50,300
Medium Bus	21,600	34,300	53,800	79,500	111,700
Large Bus	7,700	11,700	19,000	27,400	38,200
Pickup	16,700	25,700	39,400	56,900	78,800
2 axle truck	31,400	49,700	78,000	115,400	162,100
3 axle truck	8,500	12,900	20,700	30,400	42,400
4 axle and Container	2,600	3,700	6,000	9,200	13,100

Source: JICA Survey Team



Source: JICA Survey Team

Figure 5.34. Forecasted Vehicle Trip Ratio (Except Motorcycle)

Induced traffic volume, which is generated through the improvement of the convenience of a road, and new traffic volume, which is generated by the new development along the new road, is not included in the forecast. Although the gravity model is better than the present pattern

method in order to estimate induced traffic, the generated/attracted trips of each zone should be surveyed by household interviews for estimating gravity coefficients. Personal unit type proposed in the process of modeling is one methodology for the gravity model, however, it was not found to be applicable to the present traffic.

Additionally, there might be some possibilities of new urban or industrial developments in some districts connected to the expressway. If these are developed in the future, additional developed traffic will be generated. However, the developments in Can Tho City will not affect the traffic flows to Ho Chi Minh because each city has an independent economic sphere. Although the increase of tourism has some impact to traffic volume, it can be assumed that these are included in the growth of GRDP. The increase in holidays/vacations may bring about growth in traffic, but it cannot be forecasted.

5.4 Traffic Assignment

Traffic volume on the road network will be simulated with the use of STRADA, which is a traffic assignment program. STRADA is widely used in JICA projects and related countries for traffic analysis.

For traffic assignments, some conditions, in addition to traffic OD tables and road network, are necessary according to the regulations in Vietnam, one of them is PCU (passenger car unit). In Vietnam, the following conditions are provided by the Highway Design Manual.

Table 5.12. Passenger Car Equivalent Factors

Terrain	Type of vehicles					
	Bicycle	Motorbike	Car	Trucks of 2 axles and mini bus with less than 25 seats	Truck of more than 3 axles and large bus	Trailer and bus with trailer
Flat and rolling	0.2	0.3	1	2	2.5	4
Mountainous	0.2	0.3	1	2.5	3	5

Source: Highway Design Manual TCVN 4054: 2005

A flat tariff for toll gate is regulated by the Ministry of Finance through Circular No.90/2004/TT-BTC dated July 9, 2004. Distance tariff is basically 1,000 VND/km. Some letters (No.77/BC-BTC) from MOF to the Premier on July 28 2009, the proposal (No.4895/BGTVT-TC) from MOT to the Premier on August 15, 2011 and the proposal (No.6321/BKHDT-CSTDDT) from MPI to the Premier on September 21, 2011 recommend the following distance tariffs by vehicle type.

Table 5.13. Flat Tariff on Toll Gate in National Highway

Type of vehicle	Regulated toll rate (VND)
Motorcycle (* this toll is not charged until now)	1,000
< 12 seats vehicle	10,000
12 – 30 seats bus	15,000
> 30 seats bus	22,000
Light truck (weight<4 tones)	15,000
Medium truck (weight= 4 - 10 tones)	22,000
Heavy truck (weight=10 - 18 tones)	40,000
Special truck (trailer>18 tones)	80,000

Source: Circular 90/2004/TT-BTC Year2004

Table 5.14. Distance Tariff on Toll road (HCM-TL Expressway)

Type of vehicle	Proposed toll rate (VND/km)
Motorcycle	- can not use toll -
Car (< 12 seats), Truck (<2tons), mass transit bus	1,000
Car (12-30 seats), Truck (2-4 tons)	1,500
Car (> 30 seats), Truck(4 - 10 tons)	2,200
Truck (10-18 tons, and 20ft container)	4,000
Truck (>18 tons and over 40ft container)	8,000

Source: MOF etc. as above

Ferry charges vary by location and company, and do not depend on the length of the river. Therefore, the JICA Survey Team assumed the next charge for traffic assignment based on some of the sample data.

Table 5.15. Assumption of Ferry Charge in Mekong Delta

Unit: VND

	Type of vehicle	Cao Lanh Da Nghai	My Loi Vam Cong	Ham Luong Co Chien
1	Motorcycle	4,000	2,000	5,000
2	Car	20,000	12,000	28,000
3	Taxi	20,000	12,000	28,000
4	Small Bus	20,000	12,000	28,000
5	Medium Bus	30,000	22,000	42,000
6	Large Bus	45,000	35,000	70,000
7	Pickup	20,000	12,000	28,000
8	2 axle truck	30,000	22,000	42,000
9	3 axle truck	45,000	35,000	70,000
10	Container	75,000	60,000	98,000

Source: JICA Survey Team

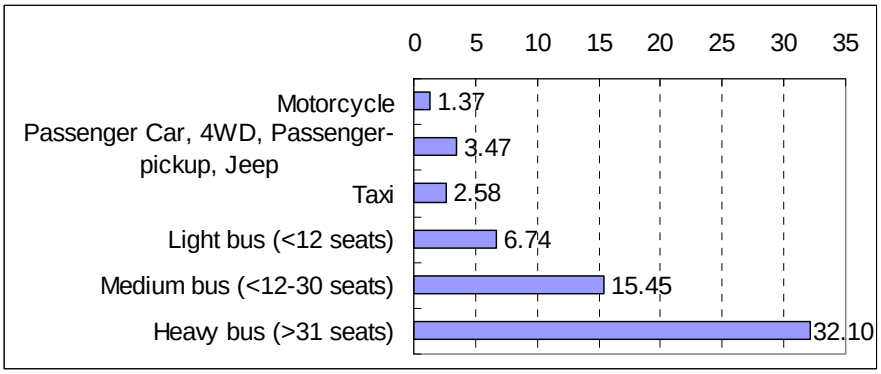
Time value is one of the most important factors in forecasting traffic demand because drivers select either a toll road or arterial road if there is any benefit by using the toll road. The toll charge is converted to time distance in the traffic assignment, and the time value is a denominator to divide toll charge of the toll road. There are mainly two ways to estimate time value; one way is to estimate it from the wage and another way is to build it up by logit model from the data of real users of toll roads. In this study, the following table by ADB is referred to in order to estimate time value because the basis, by which it is estimated by wage, is clearly shown in the table. Although time value is changed depending on the trip purpose, only the difference by vehicle type is considered. The time value of trucks is estimated based on the ratio of time value between passenger cars and trucks, which was estimated by Asian Development Bank since it is difficult to get the time value by wage.

Table 5.16. Time Value

Passenger time/2007	Motorcycle	Car	Small bus	Large bus
Work time(USD/hr)	0.43	1.47	0.43	0.43
Non-work time(USD/hr)	0.13	0.44	0.13	0.13
Percentage work time (%)	30	30	25	25
Average pass. Time costs (USD/hr)	0.22	0.75	0.21	0.21
Shadow wage rate adjustment	0.85	1	0.85	0.85
Econ pass time (USD/hr)	0.19	0.75	0.17	0.17
Passenger occupancy	2	3	10	28
Total passenger time (USD/hr)	0.37	2.25	1.74	4.88
Average (USD/hr)	0.66	3.95	3.07	8.59

Source: ADB Express Network Development Plan Project, 2008

In the table above estimated by ADB, the average number of passengers by vehicle type is different from the survey. Therefore, the time values are re-calculated according to the average passengers by following the result. The future time value is estimated under the consideration that this should be proportional to the GDP per capita because the resistance by toll will be lighter according to the increase of income level. This is shown in the following Table 5.17. Time value is at present price because it is compared with the present toll charge.



Source: JICA Survey Team

Figure 5.35. Average Passengers in 2011

Table 5.17. Future Time Value

Unit: VND/hour

Type of vehicle	2011	2020	2030	2040	2050
Motorcycle	6,200	8,500	12,300	17,200	23,300
Car	63,600	87,600	126,200	176,700	239,400
Taxi	47,300	65,100	93,900	131,400	178,000
Small bus	28,700	39,500	56,900	79,600	107,900
Medium bus	65,700	90,500	130,400	182,600	247,300
Large bus	136,600	188,000	270,900	379,300	513,900
Small truck	43,900	60,500	87,200	122,000	165,300
Big truck	82,100	113,000	162,800	228,000	308,900
Container Truck	144,700	199,100	287,000	401,800	544,400

Source: JICA Survey Team

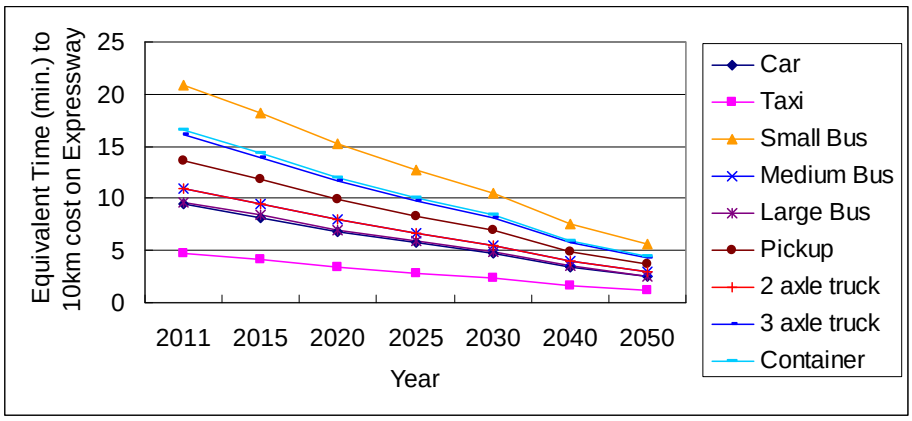
Table 5.18. Converted Value into Minutes/VND

Unit: Minutes/1000 VND

Type of vehicle	2011	2020	2030	2040	2050
Motorcycle	9.68210	7.03482	4.88043	3.48594	2.57301
Car	0.94294	0.68509	0.47529	0.33949	0.25058
Taxi	0.47147	0.34254	0.23764	0.16974	0.12529
Small Bus	2.09249	1.52030	1.05472	0.75336	0.55608
Medium Bus	0.72623	0.52764	0.36606	0.26147	0.19299
Large Bus	0.43935	0.31922	0.22146	0.15818	0.11676
Pickup	1.36547	0.99208	0.68826	0.49161	0.36287
2 axle truck	0.73101	0.53111	0.36847	0.26319	0.19427
3 axle truck	0.73101	0.53111	0.36847	0.26319	0.19427
Container	0.41473	0.30132	0.20904	0.14932	0.11021

Source: JICA Survey Team

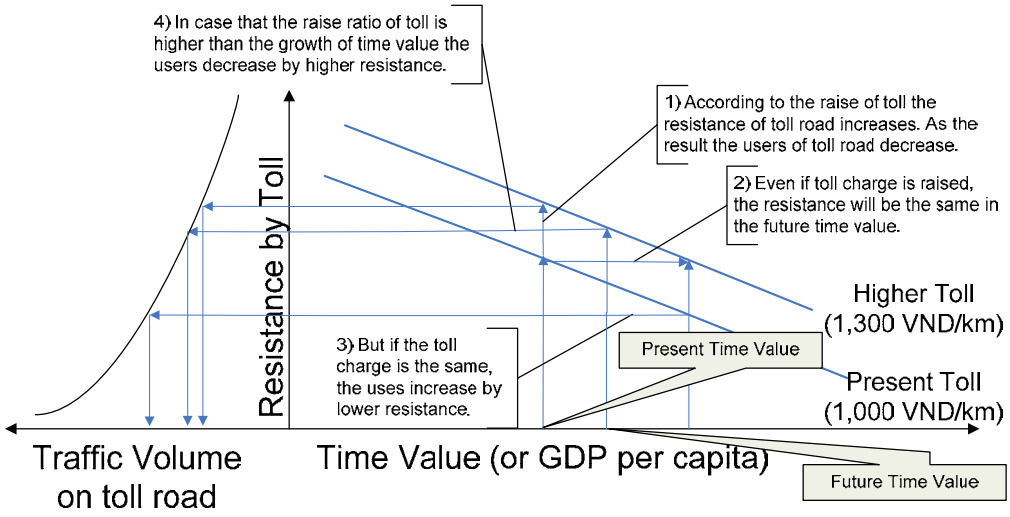
On the expressway, the tariff that the toll charges for a distance of 10 km can be converted to time-distance (min.) based on the tariff table above. For example, when a passenger car runs on a 10-km toll road, the driver has to pay VND 10,000 according to the above regulation. The charge is equivalent to 9.4 minutes in the year 2011. If the driver of passenger car can reduce his travel time by more than 9.4 minutes by using the toll road, then he will use the toll road. In case however that his travel time is reduced by less than 9.4 minutes, he will select an arterial road. The decision prices are different by vehicle type. The time-distance by cost will decrease according to the growth of GDP per capita. Thus, in the future, it will be easier to select the toll road for various kinds of vehicle type. These are shown in the following Figure 5.36.



Source: JICA Survey Team

Figure 5.36. Time Distance by 10-km Toll

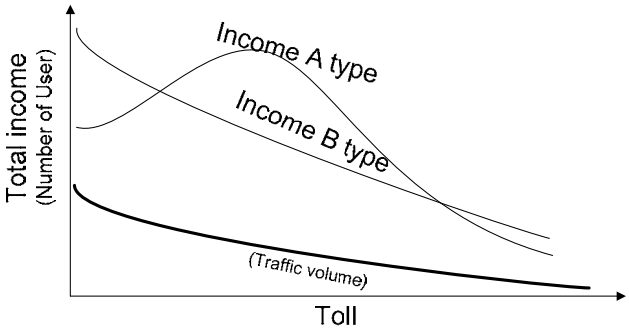
In traffic assignment, the toll charge should be at present price because toll is converted to time distance by time value. According to the increase of time value, the converted time distance of the link decreases. Even if raising the toll charges is planned in the project, it must be considered only in the financial plan after traffic assignment because the model of traffic assignment utilizes only the time distance not affected by a price index. Therefore, the sensitivity analysis of the toll rate must be referred to after the future toll charges are reduced to the present value if the rise of the toll charge in the future is assumed in the financial plan. In case that the increase ratio of the toll is higher than the growth ratio of the time value at present price, the traffic demand will decrease by a longer time distance. Although there is a possibility to increase the resistance on toll roads due to the rise of the toll by the above regulation is higher than the growth of time value, the traffic assignment should be carried out by standard methods at present price. If the effect of the resistance is needed, it would be better to use sensitivity analysis of toll charges at present price.



Source: JICA Survey Team

Figure 5.37. Relations between Toll and Traffic Volume and between Toll and Time Value

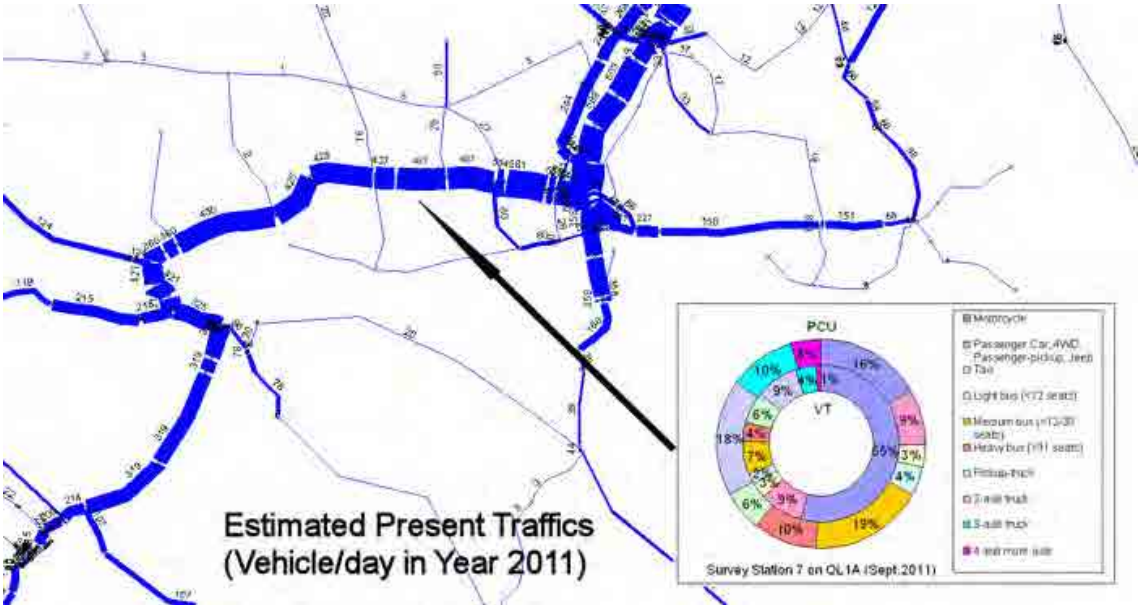
Generally, traffic demands on toll roads fall off in proportion to the increase in toll charge. As the result of higher toll per vehicle brings higher income in total, there is the maximized point in total income as shown by income type A in Figure 5.38. In the case of a larger reduction ratio of traffic demand, the cheaper the toll is, the larger the total income comes as shown by income type B in the figure. The difference is caused by the relationship between time value and the toll, and it depends also on the network of roads. The total income should be examined by financial analysis, not by traffic demand analysis.



Source: JICA Survey Team

Figure 5.38. Relation Between Toll & Income

The network for traffic assignment is properly validated by the present simulation. The traffic volumes are usually shown by PCU in Vietnam, but the next figure shows vehicle trips assigned by OD table in the year 2011. The number of vehicle trips is different from PCU by the mixture of motorcycles and large vehicles. Although the results are shown by PCU in the following sections below the figure, real vehicle trips are also important for financial and economical analysis. Thus, the details should be referred to the link volume on STRADA. It is to be noted that each link volume pointed out by STRADA means PCU.

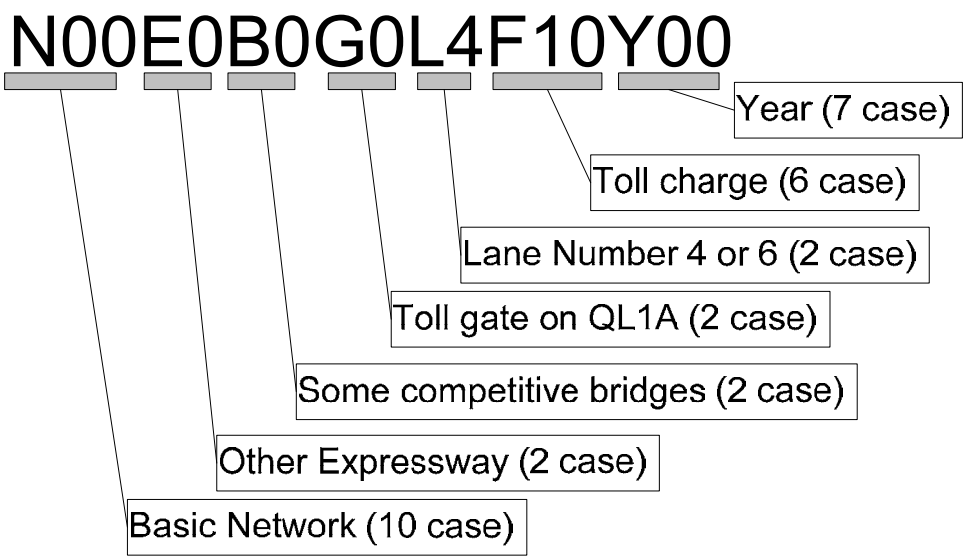


Note: In this network, the toll of the expressway between HCM and TL is free

Source: JICA Survey Team

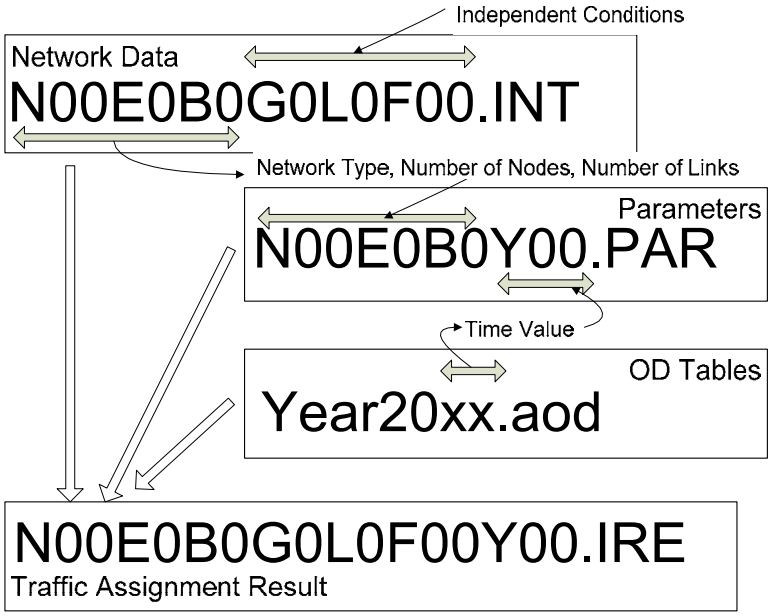
Figure 5.39. Estimated Present Vehicle Trips

Traffic assignments in the future are identified by the case name, which is defined as the following characters. The combination of characters show the network, toll gate on NH1A, number of lanes, toll charge and the year. The total number of combinations is 6,720 cases. Therefore, not all results can be described in this report, but they are saved in the IRE format of STRADA. Major typical forecasts are reported in the next paragraph.



Source: JICA Survey Team

Figure 5.40. Traffic Assignment Case

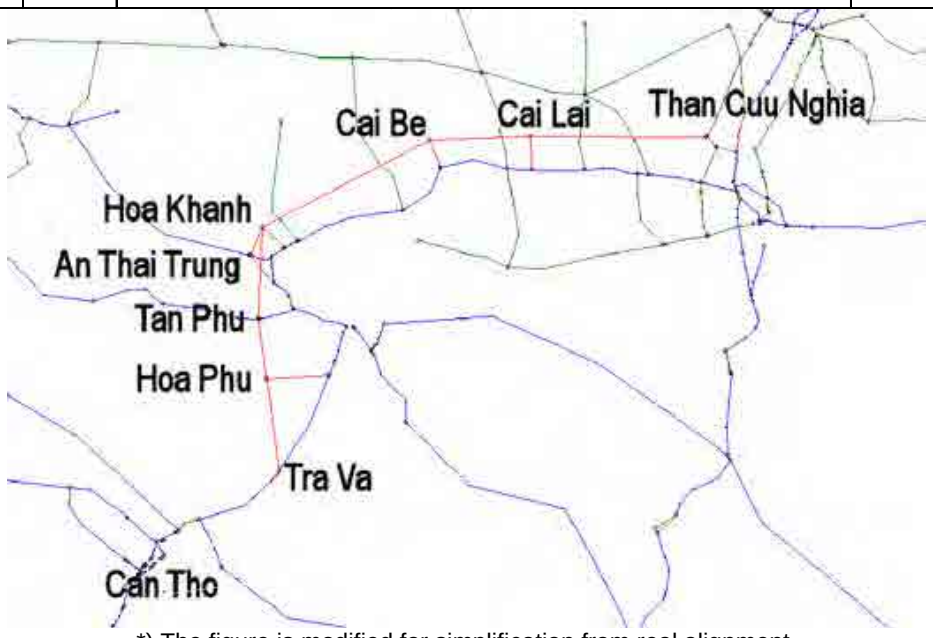


Source: JICA Survey Team

Figure 5.41. Traffic Assignment Parameter Set for STRADA

Table 5.19. Case by Basic Construction Plan

Basic Network	Case	HCMC -Than Cuu Nohja	Than Cuu Nohia - Cai Lay	Cai Lai IC	Cail Lai - Cai Be	Cai Be IC	Cai Be - Thai Trung	An Thai Trung IC	Route 1 Connection (Existing My Thuan Bridge)	Thai Trung & 2nd My Thuan Bridge	2nd My Thuan - Can Tho (Extension)
Until My Thuan Bridge	N01	O	X	X	X	X	X	X	X	X	X
	N02	O	O	X	O	X	O	O	O	X	X
	N03	O	O	O	O	O	O	O	O	X	X
	N04	O	O	X	O	O	O	O	O	X	X
	N05	O	O	O	O	X	O	O	O	X	X
	N06	O	O	O	O	O	X	X	X	X	X
	N07	O	O	X	O	O	X	X	X	X	X
	N08	O	O	O	X	X	X	X	X	X	X
Extension to Can Tho	N09	O	O	O	O	O	O	O	X	O	O
	N10	O	O	X	O	O	O	O	X	O	O



*) The figure is modified for simplification from real alignment.

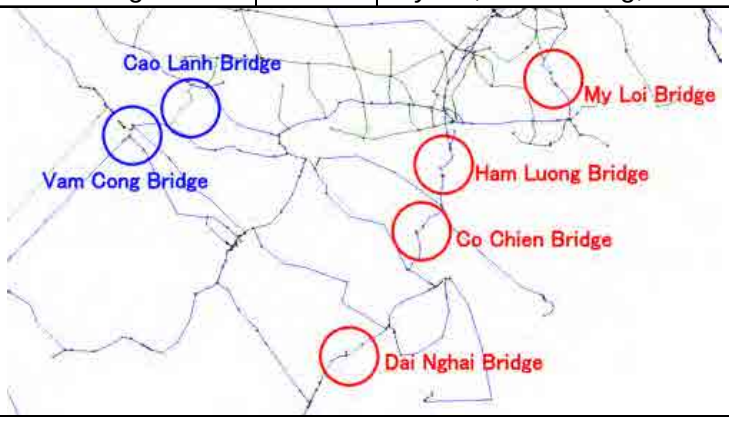
Source: JICA Survey Team

Table 5.20. Case by Other Expressway

Other Expressway	Case	Memo
Without Expressways & North Bridges	E0	
With Other Expressways & North Bridges	E1	including (with Cao Lanh Bridge and Vam Cong Bridge)
 Without Other Expressway (E0)		 With Other Expressway (E1)

Source: JICA Survey Team

Table 5.21. Case by Bridge

Some competitive bridge	Case	Memo
Without Bridge in South Region	B0	
With Bridges in South Region	B1	My Loi, Ham Luong, Co Chien, Dai Nghai
		

Source: JICA Survey Team

Table 5.22. Case by Toll Gate on NH1A

Toll Gate on QL1A	Case
Without Toll Gate on QL1A	G0
With Toll Gat on QL1A	G1

Source: JICA Survey Team

Table 5.23. Case by Lane Number

Lane Number	Case
4 Lanes (Trung Luong - Can Tho)	L4
6 Lanes (Trung Luong - Can Tho)	L6

Source: JICA Survey Team

Table 5.24. Case by Toll Rate

Toll Charge	Case	Memo
1000 VND/km	F10	by Passenger car (Different by Vehicle Type)
1300 VND/km	F13	30% up
1600 VND/km	F16	60% up
2000 VND/km	F20	Twice
2500 VND/km	F25	2.5 times
3000 VND/km	F30	3 times

Source: JICA Survey Team

Table 5.25. Forecasted Year

Year	Case
Year 2011	Y11
Year 2015	Y15
Year 2020	Y20
Year 2025	Y25
Year 2030	Y30
Year 2040	Y40
Year 2050	Y50

Source: JICA Survey Team

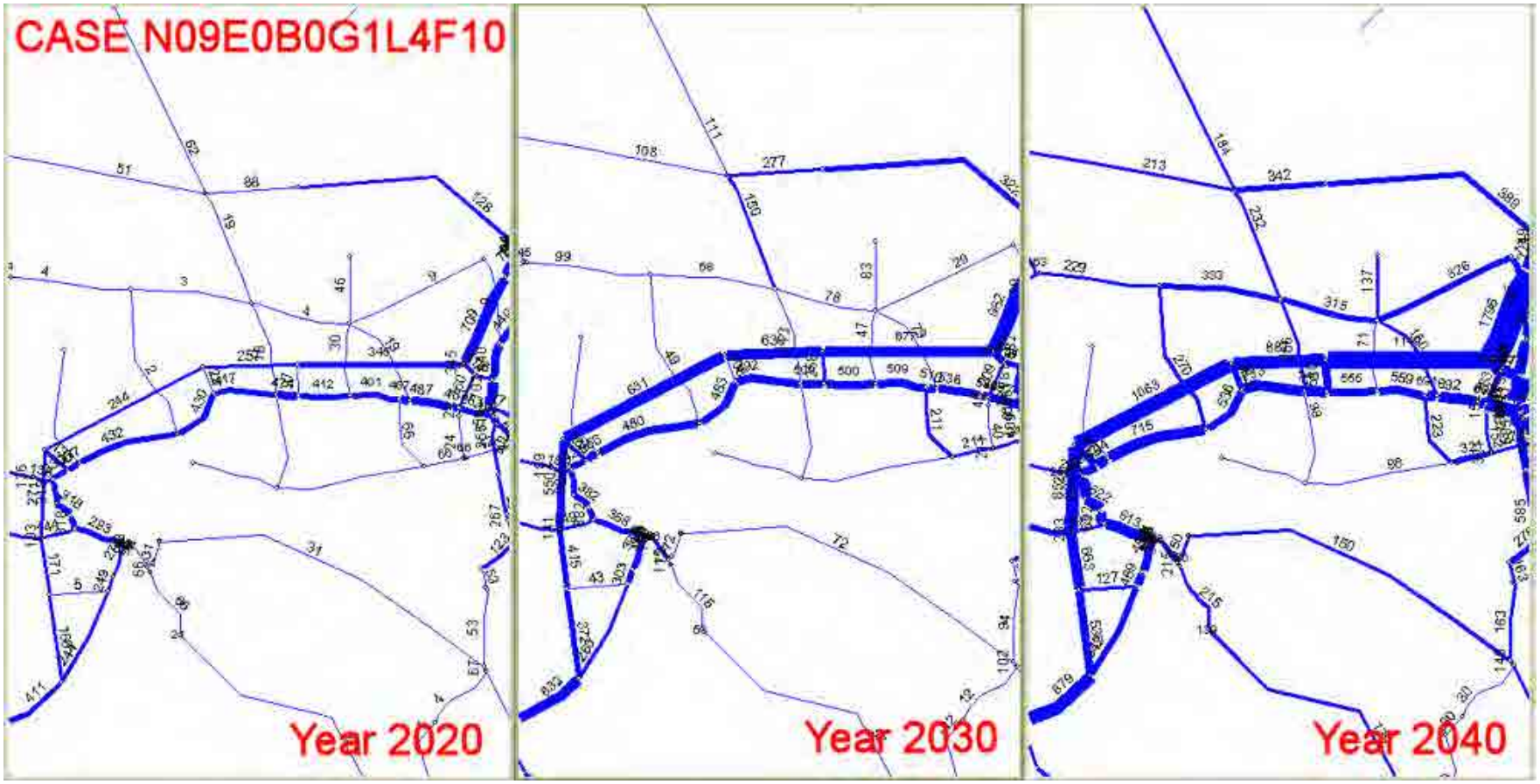
Traffic assignment is carried out through an incremental method with 10 stages. After each vehicle is divided by 10, the number is assigned on the minimum path of road network. The minimum path is changed by vehicle type and assigned stage. Because the speed of each road is set to QV formula by PCU, the basic result is accumulated by PCU. According to the result by vehicle type, the PCU is converted to vehicle trips after the traffic assignment for financial analysis, but the vehicle trips are not shown in the figures.

According to the increase of time value and the slowdown in congested NH1A, the demand for the expressway will increase in the future as shown in the succeeding figures. However, it is inferred that the major converting factor from arterial roads to toll roads is the rise in time value. This is because a national road is not so much crowded even in the future, although provincial roads in this region will surely be crowded.

Although the demand is increasing by the year, the opening of a parallel north road might push down the demand. The undesirable effect does not look so much on traffic assignment however, it is to be noted that OD tables are estimated mainly by the survey in Tien Giang Province and a large part of simulated traffic on the parallel north road is made of local traffic. Therefore, all traffic on the north road is not the direct cause of the increase of the expressway without competitive roads. If induced traffic generated by new bridges is added to the traffic demand, the north road will be competitive on the additional traffic.

The next figures show the results by traffic assignment under two different conditions. One is that there are no other competitive roads and bridges, and another is that there are other expressways and bridges. Therefore, the former is advantageous for the expressway between Trung Luong and Can Tho, and the latter is disadvantageous. The unit of the number in the figures is 100 PCU.

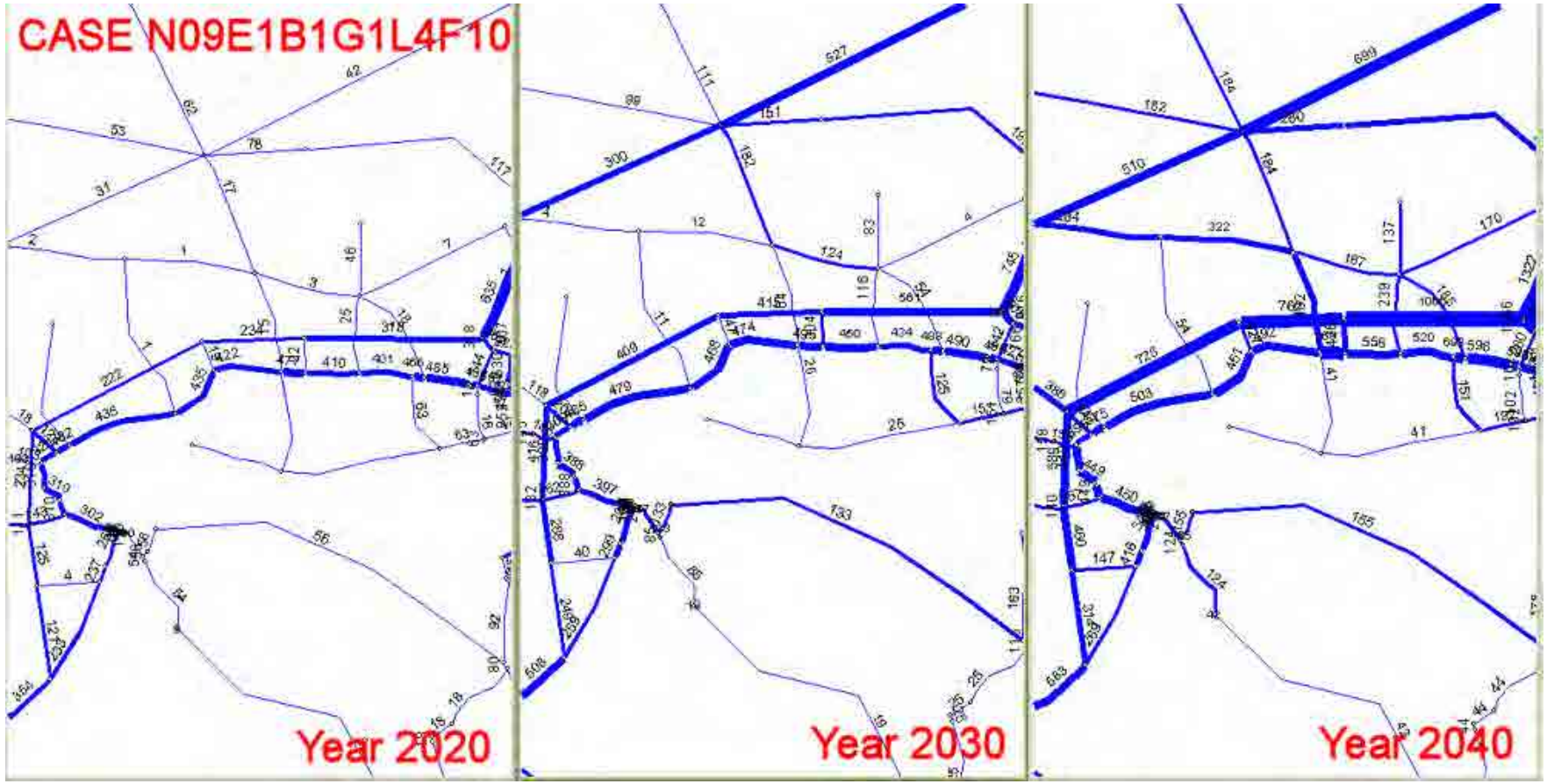
The following samples are not the final results and do not mean recommended cases. These are images of traffic volumes. All results should be referred to the 6,720 cases.



*) Case without the parallel north road

Source: JICA Survey Team

Figure 5.42. Traffic Assignment (PCU) by Case N09E0B0G1L4F10

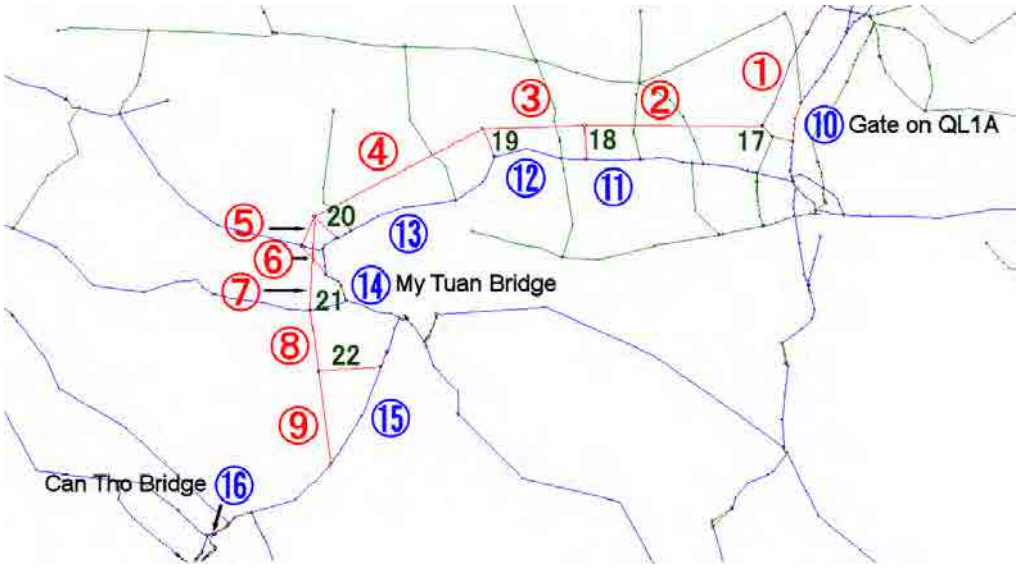


*) Case with the parallel north road

Source: JICA Survey Team

Figure 5.43. Traffic Assignment (PCU) by Case N09E1B1G1L4F10

In all cases, traffic by link and vehicle type are forecasted, and the following points are used for financial analysis. Not all tables can be shown in this report because the size is huge, but the following table is a sample. Although 10 vehicle types are forecasted in the table, a certain level of range might be considered because the accuracy depends on the traffic survey in 2011 and the correlations in the model.



Note: Points from No.17 to No.22 mean IC traffic, but in case that other expressway is connected at No.20, it includes other traffic from the connected road.

Source: JICA Survey Team

Figure 5.44. Selected Points for Financial Analysis

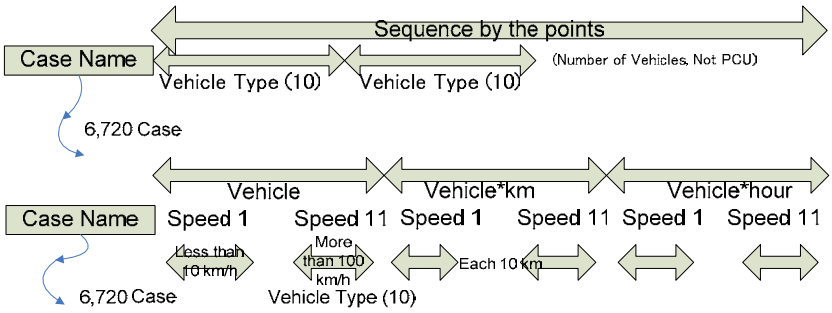
Table 5.26. Forecasted Vehicle Trips at Point 2 by Case N09E0B0G1L4F10 (One of the Most Advantageous Cases)

Vehicle Trip	Year 2011	Year 2015	Year 2020	Year 2025	Year 2030	Year 2040	Year 2050
Car	1,300	2,980	6,780	12,220	15,750	32,720	61,510
Taxi	500	740	950	1,160	1,430	1,810	2,050
Small Bus	0	130	240	230	470	930	1,480
Medium Bus	650	1,830	3,560	5,740	6,670	10,000	15,540
Large Bus	520	970	1,690	2,920	3,260	4,490	6,990
Pickup	650	990	1,660	1,940	3,140	5,630	7,400
2 axle truck	870	1,970	3,930	6,140	7,610	11,960	17,800
3 axle truck	150	610	1,010	1,340	1,710	3,500	5,910
Container	60	170	280	300	510	990	1,860
Total	4,700	10,390	20,100	31,990	40,550	72,030	120,540

Source: JICA Survey Team

Ref.) The forecast in year 2050 might be a little overestimated because it has almost the same traffic volume as the bypass of the national Route 1 near Tokyo in Japan in the year 2007. The flat tariff of the bypass is about VND 50,000.	

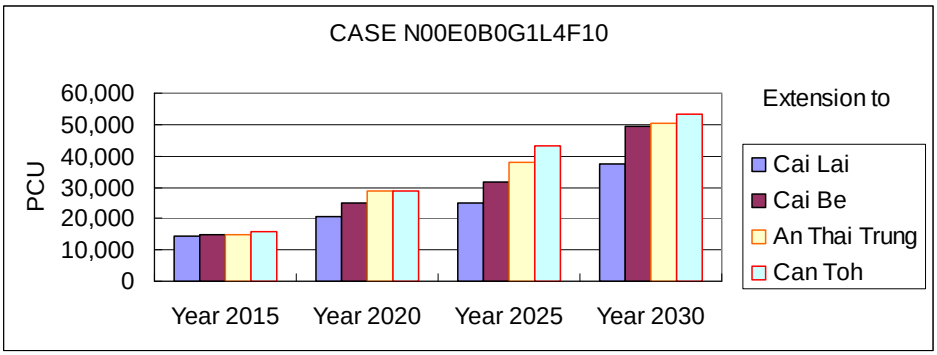
*) Reference: The following is the format of outputs in all cases.



Source: JICA Survey Team

Figure 5.45. Output Format of All Cases

In most cases, the traffic volume at a cross section increases according to the extension of the expressway. The volumes at point 2 by extension case are shown in the following Figure 5.46. Although the demand is not always proportional to the extension because of the change of capacity on the network affected by the congestion of other roads brings some strange path between OD pairs, the convenience of networks attracts traffic demand.



Source: JICA Survey Team

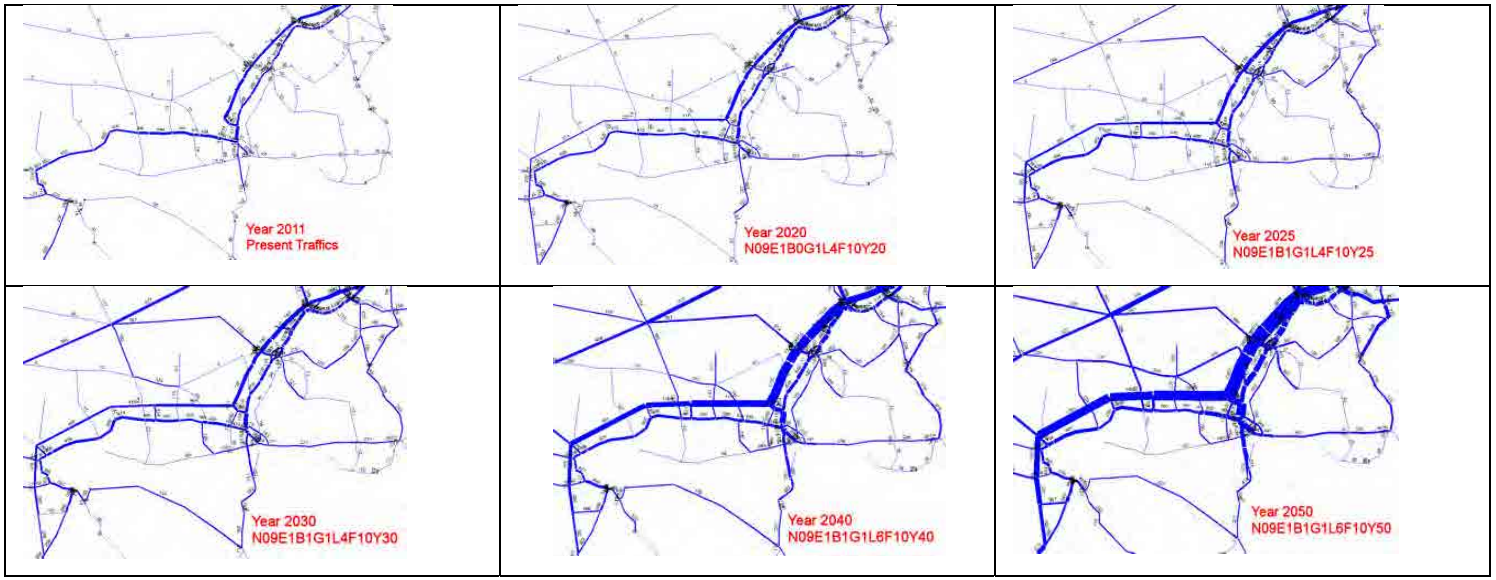
Figure 5.46. Increase of Traffic at Point 2 by Extension

The next table and figures show one of scenarios in which the expressway between Trung Luong and Can Tho has been completed with four lanes in 2020 and the parallel north road is also opened and the expressway will be widened to six lanes after year 2030.

Table 5.27. Assigned Forecasted PCU on Expressway under Sample Scenario

Year	Year 2015	Year 2020	Year 2025	Year 2030	Year 2040	Year 2050
Case	N03E0B0G1L4F10Y15	N09E1B0G1L4F10Y20	N09E1B1G1L4F10Y25	N09E1B1G1L4F10Y30	N09E1B1G1L6F10Y40	N09E1B1G1L6F10Y50
Than Cuu Nohia - Cai Lay	17,200	31,300	44,300	56,100	131,100	197,600
Cail Lai - Cai Be	9,700	22,700	34,100	41,500	106,900	168,500
Cai Be - An Thai Trung	7,500	21,300	33,500	40,900	96,700	158,000
Hoa Khanh - Tan Phu	-	23,200	33,300	41,600	61,000	115,000
Tan Phu - Hoa Phu	-	12,600	20,600	28,800	45,800	97,300
Hoa Phu - Tra Va	-	12,300	18,800	24,900	30,200	62,200
Completed Section	Trung Luong - My Thuan	Trung Luong - Can Tho (4 lanes)			Trung Luong - Can Tho (6 lanes)	
Other Expressways	Not yet	Completed				
Other Bridges	Not yet		Completed			

Source: JICA Survey Team



Source: JICA Survey Team

Figure 5.47. Traffic Assignment (PCU) by Sample Scenario

Finally, on traffic demand forecast, the results by BEDC FS, JETRO and this study are compared in the table. Although the preconditions and the methodologies are different in every study, all results show the growth of traffic volume between Trung Luong and Can Tho. The forecast on expressway in this study is comparatively similar with the report by JETRO, but the total volume of NH1A and the expressway is not so much different from the forecast by BEDC FS. Therefore, it is acceptable enough that this study reaches an adequate conclusion.

Table 5.28. Comparison with Other Studies

PCU	Year 2020					
	BEDC F/S		METI & JETRO		This Study (N09E0B0G1L4F10)	
	NH1A	Ex-way	NH1A	Ex-way	NH1A	Ex-way
Trung Luong - Cai Lay	23,242	62,088	41,010	39,119	41,236	34,514
Cai Lay - My Thuan	33,756	45,969	25,746	29,460	43,194	24,352
My Thuan - Can Tho	14,600	38,756	24,536	23,657	27,406	17,145

PCU	Year 2030					
	BEDC F/S		METI & JETRO		This Study (N09E0B0G1L4F10)	
	NH1A	Ex-way	NH1A	Ex-way	NH1A	Ex-way
Trung Luong - Cai Lay	41,154	93,392	56,567	67,751	50,047	67,657
Cai Lay - My Thuan	60,932	74,200	37,226	49,657	48,041	63,056
My Thuan - Can Tho	36,804	48,759	34,519	41,418	30,469	41,527

Source: BEDC F/S, JETRO, and JICA Survey Team

CHAPTER 6 PROJECT PLAN

6.1 Project Outline

6.1.1 Trung Luong – My Thuan (TL-MT) Expressway Project

The TL-MT Expressway (the Project) is a part of HCM-Can Tho Expessway. The Project starts from Than Cuu Nghia IC, the end limit of the operational HCM-Trung Luong Expressway. It then ends at the intersection of Bac My Thuan and NH1A, which is near My Thuan Bridge. The Project, which is only intended for cars, is 54.3 km long with its width separated to accommodate 4-lane traffic (6-lane in the future), and is suitable for a design speed of 120 km/h.

About 2.5 km of the total alignment is parallel to that of NH1A toward the west direction, before reaching the intersection with Bac My Thuan. Three interchanges namely, Cai Lay, Cai Be and An Thai Trung ICs are planned on the expressway, including a service area and parking area as resting facilities. As discussed in Section 6.2.1, the Project includes Than Cuu Nghia IC. An outline of the Project is shown in Table 6.1.

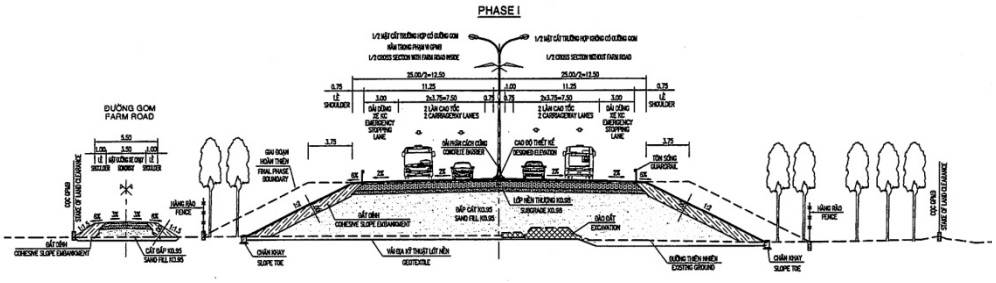
Table 6.1. Outline of the Project

	TL-MT Expressway
Section	Km 49+620 to Km 103+993
Road Class	Expressway Class A
Design Standard	TCVN5729(1997)
Design Speed	120 km/h
Road Width (Number.of Lane)	25.5 m (4):First Stage 33.0 m (6):Completion Stage
Length	54.3 km (100%)
Embankment Bridge	42.1 km (77.5%) 12.2 km (22.5%)
Interchange/Intersection	Than Cuu Ngia IC (Km 50+428), Cai Lay IC (Km 68+550),Cai Be IC (Km 83+520),An Thai Truong IC (Km 100+750), Bac My Thuan Intersection (Km 103+700)
Service Area/Parking Area	SA (Km 89+000),PA (Km 56+050)
Toll Gates	Thruway (Km 102+980); Interchange: Than Cuu Ngia IC, Cai Lay IC, Cai Be IC, An Thai Truong IC

Source: JICA Survey Team

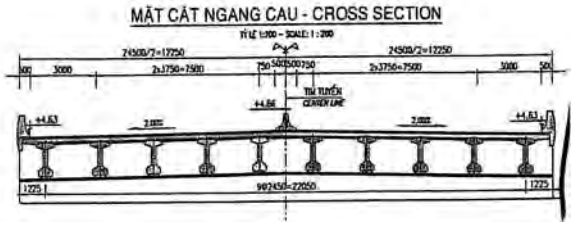
Typical Cross Section

Typical cross sections of the embankment and bridges are shown in Figure 6.1 and 6.2, respectively. The embankment section is designed for a 4-lane traffic with a width of 25.5m, and a slope of 1:2. The road is planned to be widened to a 6-lane (indicated in broken lines in Figure 6.1) in the future. Its right-of-way is measured 10 m from the edge of the future 6-lane. At some sections, farm roads with width of 5.5 m are constructed within the right of way. The typical cross section of the bridge shows a width of 24.5 m, which is intended for 4-lane traffic.



Source: JICA Survey Team

Figure 6.1. Typical Cross Section (Embankment Section)



Source: JICA Survey Team

Figure 6.2. Typical Cross Section (Bridge Section)

6.1.2 Natural Conditions

The following natural condition surveys were executed for the detailed design (D/D).

1) Topographical Survey

Topographical investigation includes survey of plan and profile, and cross section of main road, interchange, service area and parking area, and bridge and box/pipe culverts which were considered in the D/D.

2) Hydrological Survey

Meteorological data such as rainfalls, rainfall intensities, air temperature, and wind speed were collected. Hydrological survey was executed for the design of embankment, bridge and culvert, and for calculating the high water level.

3) Material Survey

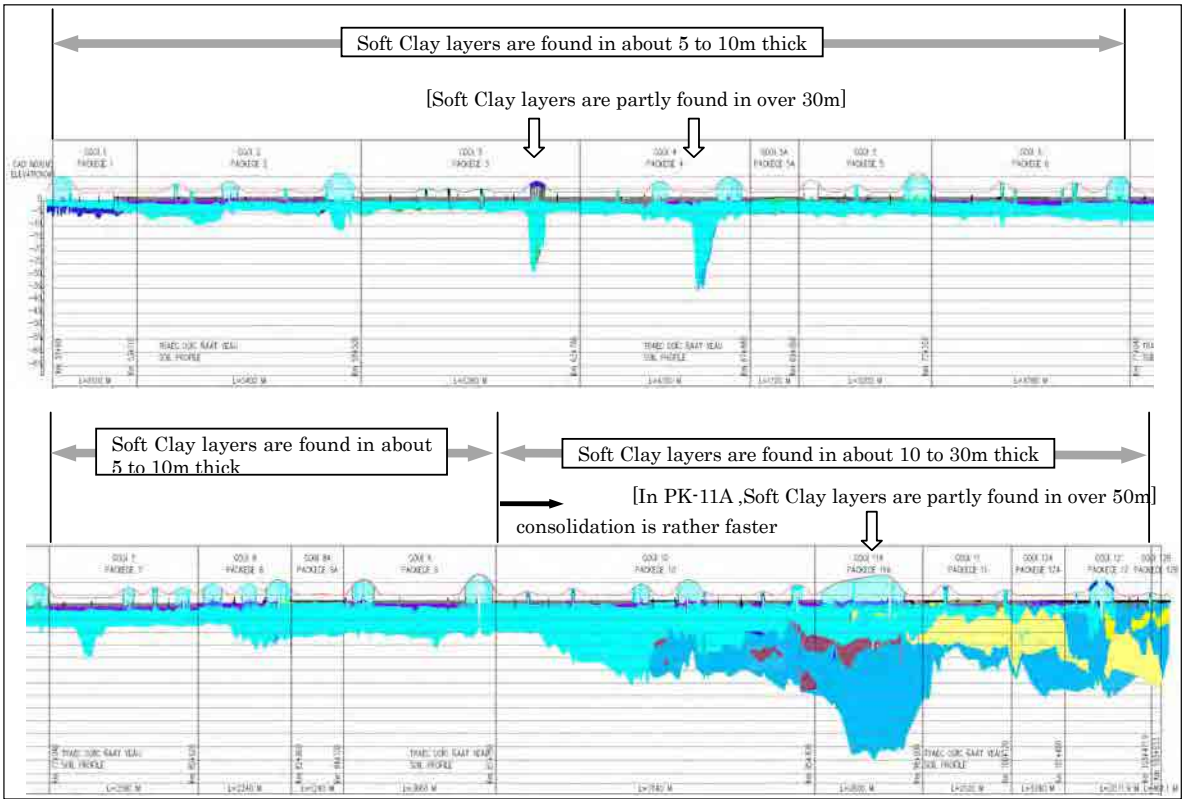
Survey of construction material sources including investigation, sampling of construction materials, and laboratory tests were executed for the design of earthworks, concrete structures and pavement.

4) Geological Survey

Geological survey was executed for the design of earthworks, bridge, flyover, culvert on soft ground, and pavement in the D/D.

Construction site investigation and laboratory test were carried out in each construction package in order to establish the design criteria for the expressway. Site investigations were planned referring to the Vietnam Standards (22TCN259, 262, 263-2000). Boring survey and standard penetration test (SPT) were mainly carried out as part of site investigation. The results reveal the existence of a 2 m thick surface soil layer K (inhomogeneous clay layer, soft); soft clay layer (including some organic and sand, very soft) exist at elevations ranging from about 5 to 10 m and is partly over 30 m thick; at the end part of the expressway, sand layer of about 5 to 10 m thick is found at the mid-depth of the ground. Subsequently, a 5 m to 10 m thick soft clay layer "1c" is found (see Figure1.1.1). At the point of consolidation characteristics, analysis parameter Cv is set about 0.2 to 0.4 (cm^2/s) in the starting sections of

packages PK-1 to PK-9, and about 0.4 to 0.7 in the end section of PK-10 to PK-12, based on laboratory test results. Therefore, consolidation settlement in PK-10 to PK-12 will occur faster than in PK-1 to PK-9.



Source: JICA Survey Team

Figure 6.3. Soil Profile

6.1.3 Phase-wise Construction Plan

(1) Phase-wise Construction Plan in F/S and D/D

In the F/S, the required number of lanes was evaluated in accordance with TCVN5729-97 and also referring to the Highway Capacity Manual, as shown in Table 6.2 below.

Table 6.2. Required Number of Lane in the F/S

Standard		Year 2010	Year 2020	Year 2025	Year 2030
Traffic Volume (PCU/day)		45,464	57,036	76,034	97,355
Number of lanes based on TCVN5729-97		4	4	6	8
Highway Capacity Manual	4-lane	LOS C	LOS D	LOS F	-
	6-lane	-	-	LOF C/D	LOS D/E

Note: LOS: Level of Service
Source: Feasibility Study Report

Accordingly, 4-lane expressway construction in phase-1 and widening to 6-lane after 2020 was proposed and approved by MOT.

Based on this plan, in the D/D stage, 4-lane expressway was designed, and a land acquisition is being implemented for the area of future widening to 6-lane. Moreover, PC box girder superstructure and foundations of simple span bridges, including super-tee girder bridge, etc., are designed for 6-lane in phase-1, taking into account the technical difficulties of widening. However, investment cost for widening in phase-2 is not considered in the D/D.

(2) Review of Phase-Wise Construction Plan

1) Traffic Volume for Determination of the Required Number of Lanes

In the survey, the required number of lanes is reviewed considering the updated traffic demand forecast described in Chapter 5 of this report. The traffic volume considered for the determination of the required number of lanes is estimated based on the realistic scenarios of road network development in the Mekong River Delta, as shown in Table 6.3 below.

Table 6.3. Annual Average Daily Traffic (vehicle/day)

Vehicle Type	2017	2027	2032	2037	2047
Car	4,171	13,394	18,130	26,493	43,452
Taxi	830	1,291	1,446	1,775	1,840
Small Bus	174	345	580	1,071	1,308
Medium Bus	2,395	4,816	5,847	7,621	10,553
Large Bus	1,227	2,462	2,834	3,490	4,646
Pickup	1,321	2,027	2,763	4,326	5,927
2 axle truck	2,891	5,263	6,632	9,130	12,284
3 axle truck	596	1,085	1,580	2,748	4,909
Container	185	329	489	788	1,600
Total	**13,790**	**31,012**	**40,301**	**57,442**	**86,519**

Note:
1) Traffic volume at Trung Luong – Cai Lay section
2) Scenario of road network development in the Mekong River Delta
   - Opening to traffic of TL-MT Expressway in 2017
   - Extension to Can Tho in 2020
   - Completion of HCM Highway Route in 2025
   - Completion of bridges (Co Chien, Dai Nghai) along NH60 in 2035
3) The above results differ from those in Tables 5.27 and 5.28 of Chapter-5 since a different road network scenario is applied in said chapter.

Source: JICA Survey Team

2) Standards to be Applied

In order to ensure proper level of service of the expressway and determine the appropriate investment scale, the required number of lanes is estimated and compared using various standards including TCVN5729-97, Japanese Road Structure Ordinance and Highway Capacity Manual.

a) Vietnam Standard TCVN5729-97

The required number of lanes is calculated in accordance with TCVN5729-97 as follows:

< Section 4.5 in TCVN5729-97>

$N_{lk} = N_k/N_{tk}$

Where:

N_{lk}: required number of lanes per direction

N_k : the 30^{th}-50^{th} highest hourly volume of the year (vehicle/hour/heavy direction)

$N_k = K \times N_{tbnam}$

of which:

N_{tbnam} : Annual average daily traffic (AADT) per direction

In case K is not anticipated,

K = 0.13 for the 50^{th} highest hourly volume

K = 0.15 for the 30^{th} highest hourly volume

N_{tk} : design traffic capacity (vehicle/hour/lane)

$N_{tk} = Z \times N_{ttmax}$

of which:

N_{ttmax} : traffic capacity for expressway (2,000 vehicle/hour/lane)

Z: volume to capacity ratio

Z = 0.77 for rolling-mountainous areas

Z = 0.55 for flat areas

The 30^{th} highest hourly volume is widely used as basis for design. For calculating the 30^{th} highest hourly volume per heavy direction (N_k), two factors namely, "K", the ratio of hourly traffic volume to AADT, and "D", heavy direction ratio, are required to be estimated:

"K" can be estimated using the following empirical formula for the design of expressways in Japan. Since there is no annual observation data for the planned expressway;

$K= (a \times Q_p+b)/Q_{12} \times 100$

Where: a, b: coefficient factors for converting the peak-hour volume to the 30^{th} highest hourly volume

Area	a	b
Urban	1.12	20.4
Plain (applied)	1.06	167.5
Hilly	1.01	377.6

Q_p: peak-hour volume (both directions) (vehicle/hour)
Q_{12}: daytime 12 hours volume (both directions) (vehicle/12 hours)

	Volume
Q_p	1,248 vehicle/hour
Q_{12}	13,153 vehicle/12 hours

Based on traffic count result at the end point of HCM-Trung Luong Expressway
Source: JICA Survey Team

Accordingly, "K" is estimated as: (1.06x1,248+167.5)/13,153) = 11.3%.

It is noted that this K factor is used for all evaluated years although it generally becomes smaller as the AADT increases.

D-value is defined as the ratio of traffic volume of heavy direction to the total traffic volume at peak hour. It is calculated as 56.7% based on the result of actual traffic count conducted in the survey at the end point of Ho Chi Minh-Trung Luong Expressway.

Peak Hour	PCU/hour each direction		Total (PCU/hour)	D-value (%)
	To Tieng Giang from HCM	To HCM from Tien Giang		
13h00 - 14h00	909	1,190	2,099	56.7% (=1,190/2,099)

Source: JICA Survey Team

From the above conditions, the required number of lanes for each specific year is determined as shown in Table 6.4 below.

Table 6.4. Required Number of Lanes Calculated According to TCVN5729-97

Year	AADT (vehicle/day)	N_k *1/ (vehicle/hour /direction)	N_{tk} (vehicle/hour /lane)	N_{lk} (lane/ direction)	Number of Lanes for both directions
2017	13,790	886	1,100	2*2/	4
2027	31,012	1,992	1,100	2	4
2032	40,301	2,589	1,100	3	6
2037	57,442	3,690	1,100	4	8
2047	86,519	5,559	1,100	6	12

Note:
*1/ N_k = Annual Average Daily Traffic (AADT) x K(%) x D(%)
*2/ minimum number of lanes each direction is two for expressway
Source: JICA Survey Team

b) Japan Road Structure Ordinance

Although the Japan Road Structure Ordinance provides that it is ideally desirable to determine the number of lanes based on the traffic capacity of the road and the designed hourly volume, such method is not realistic in view of accuracy. This is realized as the traffic capacity of the road varies depending on its lane width, lateral clearance, road side conditions etc., while the designed daily volume is estimated in consideration of trends of area development and future vehicle traffic volume. Accordingly, the number of lanes is not determined from traffic capacity, actual structure and traffic conditions on the road, but from the standard design traffic volume obtained assuming a standard road structure and traffic conditions.

The number of lanes is obtained by dividing AADT by the standard design traffic volume per lane. The result of calculation in the specific year is shown in Table 6.5 below:

Table 6.5. Required Number of Lanes Calculated According to Japan Road Structure Ordinance

Year	AADT (vehicle/day)	Standard Design Traffic Volume*1/ (vehicle/day/lane)	Number of Lane for both directions*2/
2017	13,790	12,000	4*3/
2027	31,012	12,000	4
2032	40,301	12,000	4
2037	57,442	12,000	6
2047	86,519	12,000	8

Note:

*1/ 12,000 vehicle/day/lane for class-1 of type-1 (expressway with design speed 120 km/h)
*2/ Number of Lanes = AADT/Standard Design Traffic Volume
*3/ minimum number of lanes each direction is two for expressway
Source: JICA Survey Team

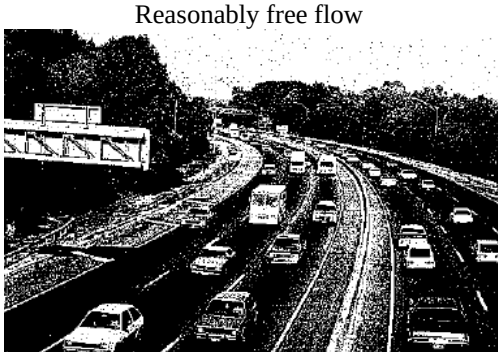
c) Highway Capacity Manual (HCM)

The HCM defines the quality of traffic service under specific traffic demands by means of a level of service. The levels of service range from A (least congested) to F (most congested), and the general definitions and images under operation for each level of service are shown below.

Level of Service A
Free flow

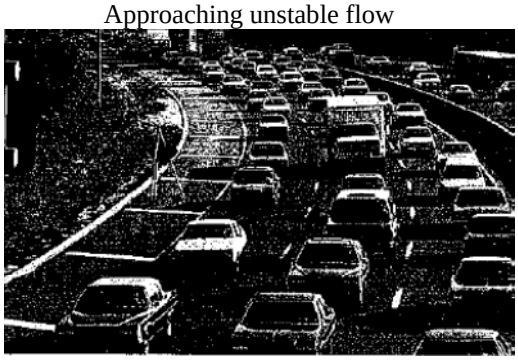
Level of Service B
Reasonably free flow

Level of Service C
Stable flow



Level of Service D
Approaching unstable flow

Level of Service E
Unstable flow



Level of Service F
Forced or breakdown flow

Source: HCM

The formula for calculating the number of lanes in the D/D stage is as follows:

$N = SF/(c \times (v/c) \times f_w \times f_{HV} \times f_p)$

Where:

N: number of lanes per direction

SF = AADT x K x D/ PHF

SF: Service Flow (vehicle/h/heavy direction)

AADT: Annual Average Daily Traffic (vehicle/day)

K: Ratio of hourly traffic volume to AADT (%)

D: Ratio of traffic volume of heavy direction to the total traffic volume at peak hour (%)

PHF: Peak Hour Factor

c: Traffic Capacity (2000 pcu/h/lane for expressways with design speed of 110 km/h)

v/c_i: volume to capacity ratio of Service Level i

f_w: adjustment factor on lane width and lateral clearance

f_{HV}: adjustment factor on heavy vehicle

f_p: adjustment factor on drivers (daily driver or weekend driver)

The required number of lanes in accordance with the level of service from A to D is shown in Table 6.6, and adjustment factors and ratios are summarized in Table 6.7.

Table 6.6. Required Number of Lanes Calculated According to HCM

Year	AADT (vehicle/day)	Number of Lanes (both direction)			
		LOS-A	LOS-B	LOS-C	LOS-D
2017	13,790	4	4	4*1/	4*1/
2027	31,012	8	6	4	4
2032	40,301	10	6	4	4
2037	57,442	14	10	6	6
2047	86,519	20	14	10	8

Note: *1/apply minimum the number of lanes
Source: JICA Survey Team

Table 6.7. Adjustment Factors and Ratios

Factor	K	D	PHF	v/c	f_w	f_{HV} *1/	f_p
Value	11.3%	56.7	0.95	0.35~0.93	1.0	0.81~0.85	1.0

Note: *1/ estimated based on the ratio of trucks and buses of the traffic demand forecast for each evaluated year
Source: JICA Survey Team

d) Summary of the Results

Calculation results for the required number of lanes by each standard are summarized Table 6.8 below.

Table 6.8. Summary of Required Number of Lanes

Standard		2017	2027	2032	2037	2047
TCVN5729-97		4	4	6	8	10
Japan Road Structure Ordinance		4	4	4	6	8
Highway Capacity Manual	LOS-A	4	8	10	14	20
	LOS-B	4	6	6	10	14
	LOS-C	4	4	4	6	10
	LOS^D	4	4	4	6	8

Source: JICA Survey Team

From the above studies on methodology and design policy of each standard, HCM is recommended to be applied in determining the required number of lanes in the Project, from viewpoints of high flexibility. In such case, the project owner/designer can choose the level of service. Moreover, HCM is realized as a suitable method for projects under private investment.

3) Proposed Required Number of Lanes and Widening Plan by HCM

a) Design Target Year

Setting of the design target year depends on characteristics and importance of the route. However, setting the design target year ahead by 20 years is considered as a practical limit in road planning, which is generally made considering a span of about 20 years. Hence, the period of 20 years is widely used as a basis for design, and is a common policy in TCVN5729-97, Japan Road Structure Ordinance and AASHTO.

Accordingly, in the Project, 2037 will be set as the design year, which is 20 years after the opening of the expressway to traffic in 2017.

b) Selection of Design Level of Service

It is required to select the design level of service to determine the value of v/c, which is necessary for calculating the number of lanes. However, HCM contains no recommendations for the applicability of the levels of service in highway design. Therefore, AASHTO (Geometric Design of Highways and Streets 2004) recommendations are applied. According to AASHTO, the guideline for the selection of design levels of service is as shown in table below.

Table 6.9. Guidelines for the Selection of Design Levels of Service

Functional Class	Rural level	Rural rolling	Rural mountainous	Urban and suburban
Freeway	B	B	C	C
Arterial	B	B	C	C
Collector	C	C	D	D
Local	D	D	D	D

Source: AASHTO

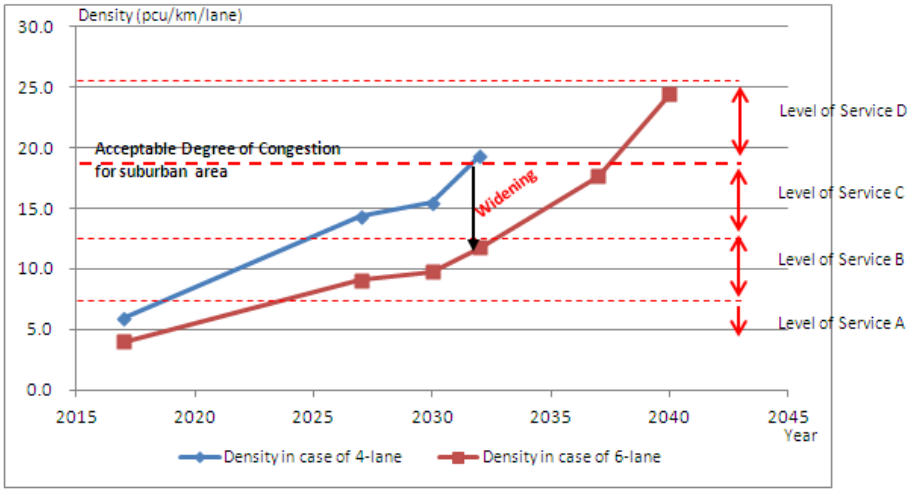
Currently, the TL-MT Expressway passes through rural level areas at the Mekong River delta. However, taking into consideration the area, which can be reached within 1 hour from HCM City. Future development plans such as industrial zones along the expressway,

will serve as suburban of HCM metropolitan in the future.

Accordingly, the level of service C is recommended to be applied in determining the number of lanes for the TL-MT Expressway. This issue shall be discussed between the project owner (concessionaire) and the government.

c) Proposed Required Number of Lanes and Widening Plan

A six-lane expressway is adequate to ensure a level of service C in the design target year of 2037. To evaluate the operation condition up to 2037, the traffic density which defines the number of vehicles per unit length of the expressway is examined. Figure 6.4 shows the relationship between the density and time (year) for both 6-lane and 4-lane cases.



Source: JICA Survey Team

Figure 6.4. Density in Cases of 4-Lane and 6-Lane Expressway

As for the acceptable degree of congestion, it is required that the density be kept less than 18.7 pcu/km/lane in the case of a level of service C. The following table is the criteria for density at each level of service.

Level of Service	A	B	C	D	E	F
Density (pcu/km/lane)	≤7.50	≤12.4	≤18.7	≤26.1	≤41.7	>41.7

Source: HCM (converted from US Customary unit to Metric unit)

Figure 6.4 shows that the operation will be implemented under a level of service A until 2023, service level B until 2032, then service level of C until 2038.

In order to reduce the initial investment cost, the construction of a 4-lane expressway in its phase-1 stage is considered. The operation under the 4-lane case will be suitable until 2032 when it is near to reaching the level of service C. Then, widening of road to a 6-lane would be required. However, the effective phase of construction shall be evaluated from the viewpoint of the project feasibility.

Figure 6.4 also indicates that widening to 8-lane or other route expressways, or other transportation means such as railway are necessary in 2040, in case that traffic volume would increase as forecasted beyond the design year period.

6.2 Review of D/D

6.2.1 D/D Carried Out by the Vietnamese Side

a) Obtained Documents/Information

In the BOT scheme by BEDC, the F/S was carried out by TEDI in 2010 (BEDC F/S). Based on the said F/S, the joint venture of Korean Consultants International (KCI) and TEDI South shall carry out the project's D/D. The contents of the obtained D/D reports is listed in Table 6.10.

Table 6.10. Contents of D/D reports

Volume I	1 Topographic and Hydrographic Survey Report 2 Soil Investigation Report
Volume II	1 Design Report 2-1 Drawing (Highway Design) 2-2 Pavement Design Report 2-3Geotechnical Treatment Report 2-4Hydrological Calculation 2-5Box Culvert Calculation 3-1Drawing (Bridge Design) 3-2Strutural Analysis 3-3Calculation
Volume III	1 Cost Estimate 2 Quantity Calculation

Source: D/D

The above documents were prepared for each of the 12 packages and six sub-packages. These consist of four interchange packages, one intersection package and one section under alternative study. In total, the project is divided into 18 packages.

Although Than Cuu Nghia IC is excluded from the scope of the D/D by KCI+TEDI South, it is considered as Package 0 (PK0) in the JICA Survey,.

The location, length and road facility for each package are summarized in Table 6.11.

Table 6.11. Contract Packages for TL-MT Expressway Project in D/D

Package		Station	Length (m)	Road Facility
1	PK0	Km49+620～Km51+060	1,440	Than Cuu Nghia IC
2	PK1	Km51+060～Km53+110	2,050	
3	PK2	Km53+110～Km58+500	5,390	PA
4	PK3	Km58+500～Km63+780	5,280	
5	PK4	Km63+780～Km68+100	4,320	
6	PK5A	Km68+100～Km69+160	1,060	Cai Lay IC
7	PK5	Km69+160～Km72+260	3,100	
8	PK6	Km72+260～Km77+040	4,780	
9	PK7	Km77+040～Km80+620	3,580	
10	PK8	Km80+620～Km82+860	2,240	
11	PK8A	Km82+860～Km84+100	1,240	Cai Be IC
12	PK9	Km84+100～Km87+760	3,660	
13	PK10	Km87+760～Km95+400	7,640	SA
14	PK11A	Km95+400～Km98+000	2,600	Viaduct (L=2.6km)
15	PK11	Km98+000～Km100+120	2,120	
16	PK12A	Km100+120～Km101+400	1,280	An Thai Trung IC
17	PK12	Km101+400～Km103+471.90	2,071.9	Toll Gate(Thruway)
18	PK12B	Km103+471.90～Km103+933	461.1	Bac My Thuan Intersection
Total			54,331	

Source: D/D

b) Progress of D/D and Schedule

D/D of PK8A (Cai Be IC) is scheduled to be complete in the beginning of December 2011, while PK12A (An Thai Trung IC) and PK12B (Bac My Thuan Intersection) is scheduled by the end of December 2011.

As for PK11A, the original design of its embankment section was designed. Since deep soft soil layer was observed and residual settlement was a concern, a viaduct was proposed by the D/D Consultants. At present, pre-basic design has been completed.

As for PK0 (Than Cuu Nghia IC), a trumpet type IC was the original design. However, it was changed to a clover-leaf type taking into consideration the request from Tien Giang Peoples Committee. Its D/D has not yet commenced while the plan and profile drawings at pre-basic design level were already prepared.

6.2.2 Scope of Review of D/D

Since the expressway project is specified to be of a highest class road with design speed of 120 km/h with a 4-lane (6-lane in the future) road, emphasis on safety and confort features are required. Moreover, the project feasibility is expected to increase considering the private investment scheme. Therefore, the JICA Survey Team reviewed the D/D in order to improve safety of the expressway and reduce the construction cost.

Based on the review result, the JICA Survey Team technically examined design alternatives, which have possibility of improvement in the design and reduction in construction cost. Consequently, the preliminary cost was estimated. Finally, taking into account the cost benefit by comparing the alternatives with the original design, alternative designs to be proposed in this study were determined. Furthermore, the cost of these final proposals was considered in the updated construction cost.

It is noted that detailed structural analysis and other items for design proposals are required by

the D/D consultants. The project owner will then decide whether to adopt or not the proposal, based on the detailed examination results.

6.2.3 Highway Design

6.2.3.1. D/D carried out by BEDC

(1) Documents/Information Received

a) Reports and Drawings

Review of D/D was conducted based on the reports and drawings related to highway design obtained in the beginning of November 2011, are shown in **Table 6.12**

Table 6.12. Composition of D/D Reports Related to Highway Design

Volume I	1 Topographic and Hydrographic Survey Report 2 Soil Investigation Report
Volume II	1 Design Report 2-1 Drawing(Highway Design) 2-2 Pavement Design Report 2-3 Geotechnical Treatment Report 2-4 Hydrological Calculation 2-5 Box Culvert Calculation

Source: JICA Survey Team

b) Site Reconnaissance

Site reconnaissance was carried out mainly for the location of planned interchanges and bridges.

(2) Progress and Schedule of the D/D

The following information was obtained from the Consultants who are carrying out the D/D.

a) Modification of location of Cai Be IC (PK8A)

Location of Cai Be IC was moved 3 km to end side in order to connect with Provincial Road No.869 as requested by Tien Giang Province.

b) Planning of An Thai Trung IC (PK12A)

An Thai Trung IC is a interchange intended to serve only the direction going Cai Be, through a partial cloverleaf type interchange connected with National Highway No. 30. It will be removed when a full width four-leg interchange connecting An Huu-Cao anh Expressway on the beginning point side is constructed in the future.

c) Study of viaduct on soft ground section around the Co Co River (PK11A)

The study to modify the embankment structure to serve as viaduct (L = 2.6 km) around the Co Co River (Km95+400-Km98+000) was executed due to the existence of deep soft ground layer and large subsidence as indicated in the geological survey result. Conclusion however has not been reached by MOT as of end of November 2011.

d) Design of Than Cuu Nghia IC (PK0)

Than Cuu Nghia IC is out of scope of the D/D. It is noted however that TEDI-S has

prepared the schematic plan and profile of the structure.

6.2.3.2. Design Standards and Policy Conditions

(1) Design Standards

The following standards were applied in the D/D:

a) Highway Design Standards

TCVN5729:1997(Expressway Specification for Design) was applied as expressway design standard. The geometric design criteria based on said standard is summarized in **Table 6.13.**

As for road crossing and frontage road (Farm Road), TCVN4054:2005(Highway Specification for Design) is applied.

b) Drainage design criteria

TCVN5729(1997) was applied for the expressway.

c) Pavement design criteria

22TCN211:2006 was applied for the design of flexible pavement (asphalt concrete) while TCN233 was applied for rigid pavement (cement concrete)

d) Traffic safety facility design criteria

22TCN237 and 22TCN331were applied for traffic signs and pavement markings.

e) Lighting design criteria

TCXDVN259 was applied for the lighting design.

Table 6.13. Geometric Design Criteria for Expressway

	Design Element		Type/Value	Reference
1	Expressway Classification Expressway Type A		 Grade 120	 TCVN5729
2	Terrain		Flat	TCVN5729
3	Design Speed (km/h)		120	TCVN5729
4	Cross-Sectional Elements	Number of Travelled Way	4	D/D
		Formation Width (m)	25.5	D/D
		Travelled Way Width(m)	2 x 7.5	TCVN5729
		Outer Shoulder Paved Width (m)	3.0	TCVN5729
		Outer Shoulder Earthen Width (m)	1.0	TCVN5729
		Median Width (m)	1.0	TCVN5729
		Median Marginal Strip (m)	0.75	TCVN5729
		Crossfall of Roadway (%)	2.0	TCVN5729
		Slope of Earthworks Fill	 V : H = 1:2.0	 D/D
5	Sight Dist.	Stopping Sight Distance (m)	230	TCVN5729
6	Horizontal Alignment	Horizontal Curve		
		Desirable Minimum Radii of Horizontal Curve (m)	1000	TCVN5729
		Absolute Minimum Radii of Horizontal Curve (m)	650	TCVN5729
		Superelevation (Se)		TCVN5729
		Maximum Se for Desirable Min. Radius (%)	5.0	TCVN5729
		Maximum Se for Absolute Min. Radius (%)	7.0	TCVN5729
		Minimum Radii w/o Superelevation (m)	>4000	TCVN5729
		Transition Curve		
		Minimum Length for Desirable Min. Radius (m)	210	TCVN5729
		Minimum Length for Absolute Min. Radius (m)	150	TCVN5729
7	Vertical Alignment	Maximum Grade-Up (%)	4.0	TCVN5729
		Maximum Grade-Down (%)	5.5	TCVN5729
		Critical Maximum Length of Grades For 4.0 % (m)	 600	 TCVN5729
		Minimum Length of Grade (m)	300	TCVN5729
		Vertical Curve		
		Minimum Length of Vertical Curve (m)	100	TCVN5729
		Minimum Radius of Crest Curve (m)		
		Absolute Minimum Radius (m)	12000	TCVN5729
		Desirable Minimum Radius (m)	17000	TCVN5729
		Desirable Radius (m)	20000	TCVN5729
		Minimum Radius of Sag Curve (m)		
		Absolute Minimum Radius (m)	5000	TCVN5729
		Desirable Minimum Radius (m)	6000	TCVN5729
		Desirable Radius (m)	12000	TCVN5729
8	Lateral Clearance (m) Vertical Clearance (m)		Travelled width 4.75	TCVN5729 TCVN5729

Source: JICA Survey Team

(2) Design Policy/Conditions in D/D

Design Policy

The expressway will run through the Mekong River delta region; therefore its topography is flat with an average elevation of around 1 m. It is composed of an embankment and bridge for the whole section, which is on soft soil based on the location's geological features. Highway design was executed considering the influence of flood and tidal level, and soft ground. Moreover, a cost reduction plan to minimize embankment volume was adopted as shown in **Table 6.14.**

Table 6.14. Cost Reduction Plan

	Cost Reduction Plan
1	Reduction of elevation of embankment and bridge by application of minimum convexity vertical curve radius.
2	Reduction of elevation of embankment by applying 0% gradient.
3	Reduction of elevation of embankment by adopting overpass (flyover) method
4	Reduction of volume of embankment by applying the minimum width of medial strip

Source: JICA Survey Team

6.2.3.3. Items Reviewed

Horizontal and vertical alignment of the expressway, location and type of interchanges, location and type of service area/parking area, and location and number of lanes of toll gates were reviewed based on the obtained result of D/D.

(1) Horizontal Alignment of Expressway

Elements of the horizontal alignment were followed in the F/S, but some sections were changed due to the terrain conditions such as waterways. Designed elements of the horizontal alignment of the TL-MT Expressway are shown in **Appendix A2-1.** Minimum horizontal curve radius is 1500 m and minimum length of transition curve is 565.7 m in case a clothoid parameter of 160 m is adopted. These design values satisfy the criteria.

(2) Vertical Alignment of Expressway

Elements of the vertical alignment were decided based on the elevation of waterway/road, which crosses the expressway, and embankment height of expressway on soft ground. Design elements of the vertical alignment of the TL-MT Expressway are shown in **Appendix A2-2.** Maximum grade is 3%, while minimum convex and concave vertical curve is 12,000 m and 5198 m, respectively. These design values satisfy the criteria.

Moreover, the lowest embankment height was decided based on the high-water level (probability 1%) in consideration with superelevation, wave height, and freeboard (safe height) in case the road is to be widened to six lanes.

Therefore, the proposed height on center line becomes 3.46 m to 3.78 m, based on the high-water level of 2.11 m to 2.43 m. Meanwhile, the lowest embankment height is at 3.0 m to 3.5 m.

(3) Loction and Type of Interchange/Intersection

Four interchanges and one intersection were planned in this project. Location and type of interchange/intersection are summarized in **Table 6.15**. An Thai Trung IC will be removed in

the future when a new cloverleaf interchange is constructed at the 3 km point on the Cai Be IC side. Planned interchanges and intersections are shown in Table 6.15 below.

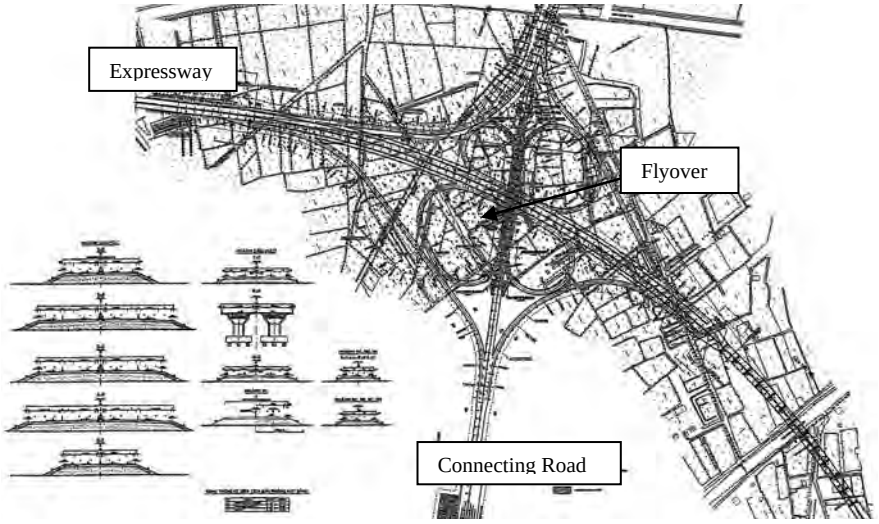
Table 6.15. Location and Type of Interchange/Intersection

No.	Interchange	Station (Package)	Interval (Km)	Type	Rampway		Remarks
					Design Speed	Minimum Radius	
1	Than Cuu Nghia IC	Km50+428 (PK0)	18.122	Cloverleaf	V= 40, 60 km/h	R= 60m	Constructing in Phase1
2	Cai Lay IC	Km68+550 (PK5A)	14.970	Trumpet	V= 40 ,60 km/h	R= 60 m	Constructing in Phase 1
3	Cai Be IC	Km83+520 (PK8A)	17.230	Trumpet	V= 40 ,60 km/h	R= 60 m	Construction in Phase1
4	An Thai Trung IC	Km100+750 (PK12A)	2.950	Partial Cloverleaf	V= 40, 50 km/h	R= 130 m	Constructing in Phase 1 Removal at Phase2
5	Bac My Thuan Intersection (Connecting with NH1A)	Km103+700 (PK12B)		At grade Intersection Roundabout			Construction in Phase 1

Source: TL-MT D/D

a) Than Cuu Nghia IC (Km50+428, PK0)

- The Than Cuu Nghia IC had been planned in the F/S as a 3-leg trumpet type. However, it was changed to a 4-leg cloverleaf type to be later connected to the Long Giang industrial zone. A plan of the Than Cuu Nghia IC is shown in **Figure 6.5**
- In the interchange section of expressway, the horizontal radius is 2000 m and gradient is 2%.
- Design speed of rampway is 40 km/h and 60 km/h for minimum horizontal curve of 75 m and 250 m respectively, while maximum gradient is 2.5%.
- The connecting road passes over and connects to the expressway, through on and off ramp way with convex vertical curve. Hence, weaving is formed on the section to avoid any unsightly feature.
- Toll gates were planned to the north side and south side of the connecting road.
- Design of Than Cuu Nghia IC was not included in the D/D. However. its schematic plan and profile were prepared by TEDI-S.

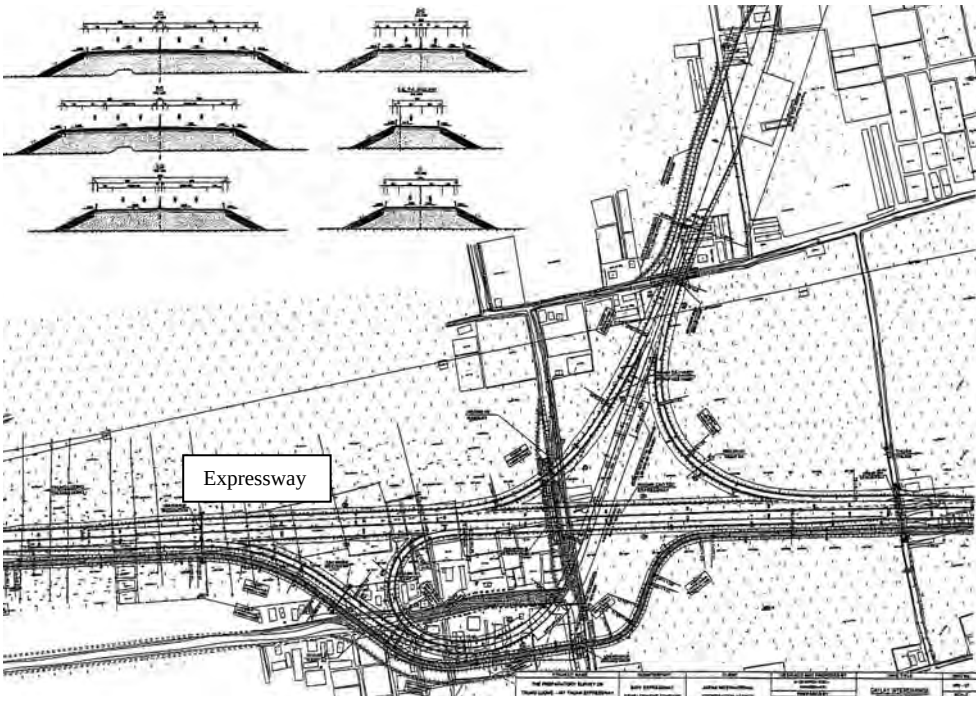


Source: TEDI South

Figure 6.5. Plan of Than Cuu Nghia IC

b) Cai Lay IC (Km68+550: PK5A)

- The Cai Lay IC was planned as a single trumpet type interchange linked with NH1A through a connecting road. A plan of the Cai Lay IC is shown in **Figure 6.6** below.
- In the interchange section of expressway, horizontal alignment is straight with level gradient (0%).
- Design speed of rampway is 40 km/h and 60 km/h for a minimum horizontal curve of 64.5 m and 135 m, respectively. Its maximum gradient is 4%.
- Location of toll gate was planned to be at the boundary of rampway and connecting road.

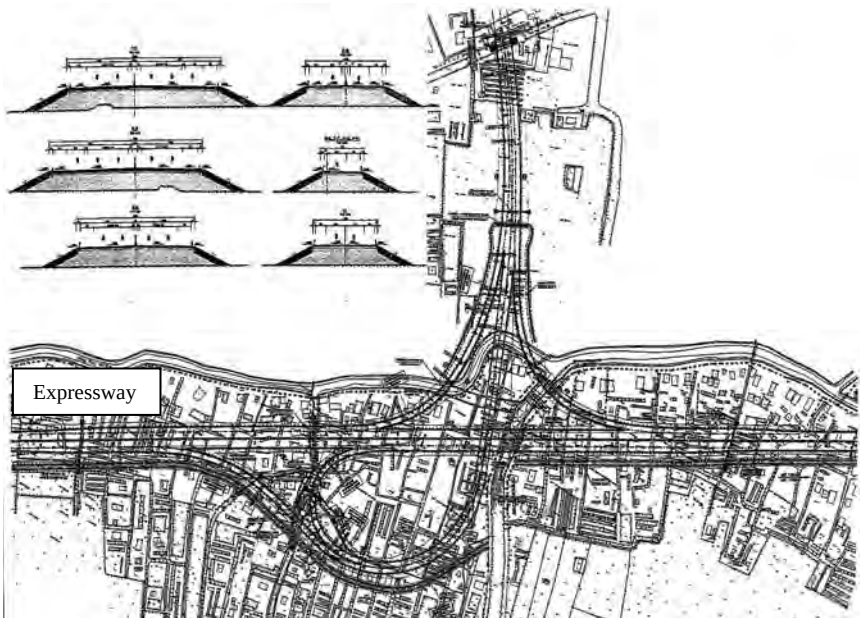


Source: TL-MT D/D

Figure 6.6. Plan of Cai Lay IC

c) Cai Be IC (Km83+520:PK8A)

- The Cai Be IC was planned as single trumpet type interchange linked with NH1A through a connecting road. A plan of the Cai Be IC is shown in **Figure 6.7** below.
- In the interchange section of expressway, horizontal alignment is straight with level gradient (0%).
- Design speed of rampway is 40 km/h and 60 km/h for a minimum horizontal curve of 70 m and 133 m, respectively. Its maximum gradient is 4%.
- Location of the toll gate was planned to be at the boundary of the rampway and connecting road.

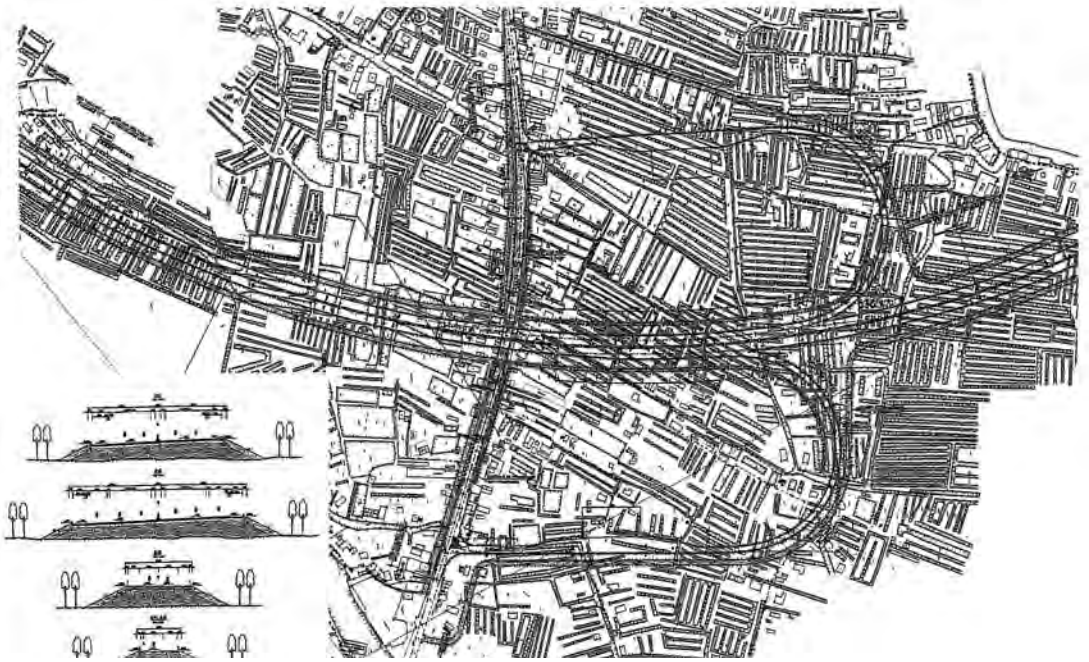


Source: TL-MT D/D

Figure 6.7. Plan of Cai Be IC

d) An Thai Trung IC (Km100+750:PK12A)

- The An Thai Trung IC was planned as a partial cloverleaf type connected with NH30. A plan of the An Thai Trung IC is shown in **Figure 6.8**
- In the interchange section of the expressway, horizontal alignment is 1500 m and gradient is level (0%).
- Design speed of rampway is 40 km/h and 60 km/h for a minimum horizontal curve of 133 m. Its maximum gradient is 1.8%.
- The connecting road passes over the expressway, linked with rampways at the at-grade intersections before and after the convex vertical curve. Therefore it is undesirable in view of safety. The interchange scale is also large as the interval of two intersections is 550 m.
- Moreover, use of the interchange is expected to be inconvenient as it takes time to reach the other side of the expressway from the road side, near the expressway along NH30.
- The toll gates were planned to be provided on each rampway.
- An Thai Trung IC will be removed when the new cloverleaf junction connecting An Huu-Cao Lanh Expressway is constructed in the future, at the 3 km point on the Cai Be IC side.

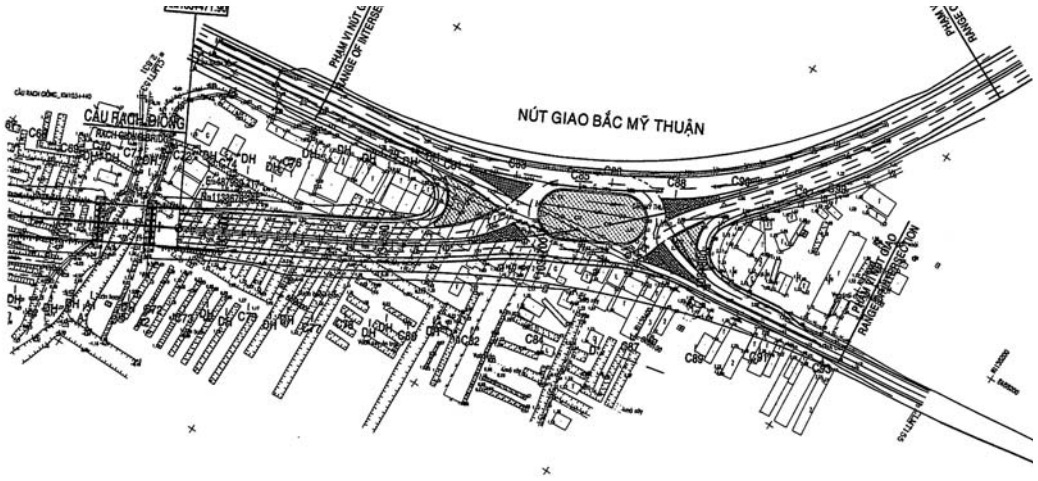


Source: TL-MT D/D

Figure 6.8. An Thai Trung IC

e) Bac My Thuan Intersection (Pk12B : Km103+700)

- The Bac My Thuan intersection is at-grade intersection of roundabout type with four legs connecting with NH1A. It is located at the end point of the TL-MT Expressway. A plan of the Bac My Thuan intersection is shown in **Figure 6.9** below.
- Expressway will pass over this intersection as grade-separation when expressway extend to Can Tho side in the future.



Source: TL-MT D/D

Figure 6.9. Bac My Thuan Intersection

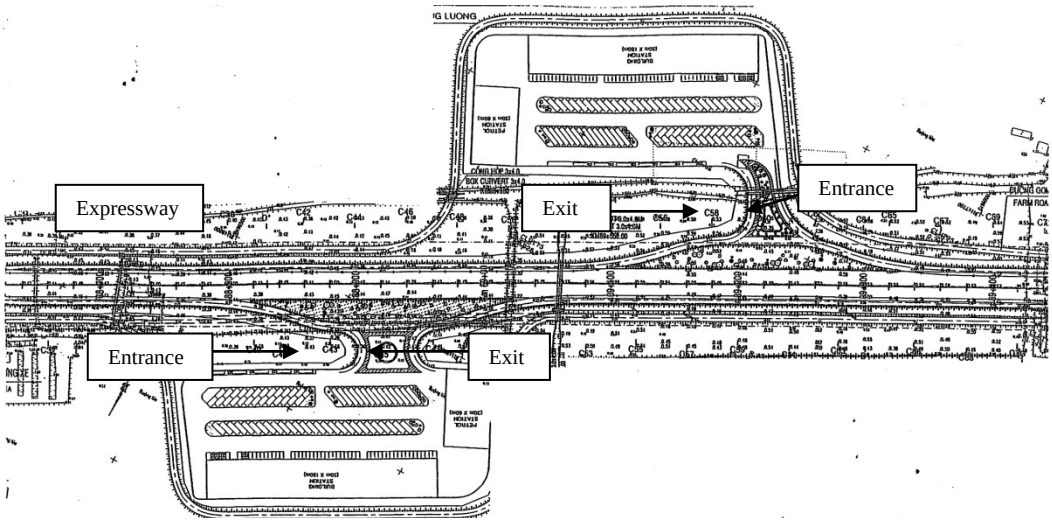
(4) Location and Type of Service Area and Parking Area

a) Service Area (Km89+000:PK10)

- A service area (SA) consists of up and down tracks, and are located between Cai Be IC and An Thai Trung IC. A plan of the SA is shown in **Figure 6.10** below.
- In the interchange section of the expressway, its horizontal alignment is straight and

gradient is level (0%).

- The layout poses risks because the entrance and exit to parking lots are close. Moreover, the traffic flow lines will cross each other in the parking lot.

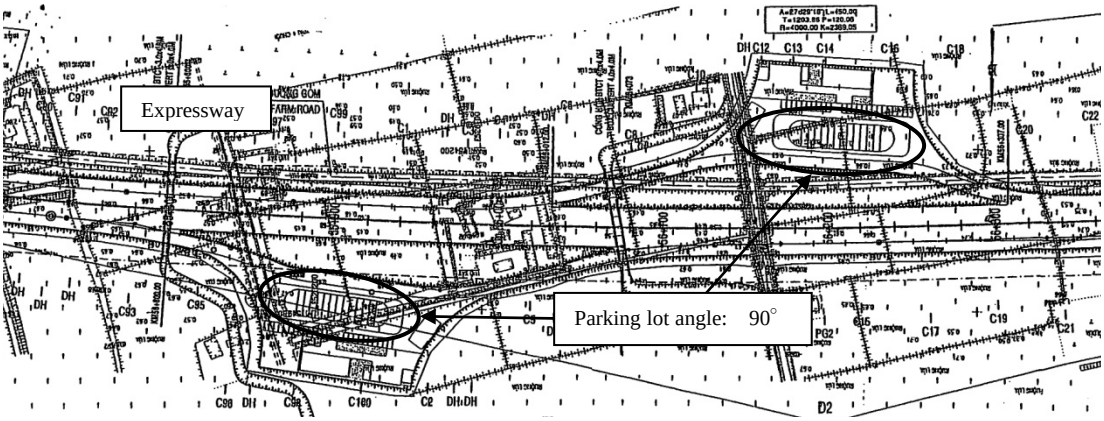


Source: TL-MT D/D

Figure 6.10. Plan of SA

a) Parking Area (Km56+050:PK2)

- A parking area, as shown in **Figure 6.11,** consists of up and down tracks, and is located between Than Cuu Nghia IC and Cai Lay IC. .
- On the interchange section of the expressway, its horizontal alignment is 4000 m and gradient is level (0%).
- The parking method for large cars is front-in and back-out, and parking angle is 90°; therefore, it is dangerous and difficult to park ,and requires a large space.



Source: TL-MT D/D

Figure 6.11. Plan of Parking Area

(5) Location and Number of Toll Gate Lanes

The number of toll gate lanes is calculated based on the forecasted traffic volume shown in **Table 6.16**. This was reviewed based on the updated traffic demand forecast in the survey discussed in Section 6.3.4.3.

Table 6.16. Number of Toll Gate Lanes

	Expressway	Interchange				
	(Km102+980)	Than Cuu Nghia IC (North:Km1+570) (South:Km1+570)		Cai Lay IC (Km1+640)	Cai Be IC (Km16+600)	An Thai Trung IC (Ramp Km0+215,0+845)
Entrance	5	North:5	South:5	3	3	2
Exit	5	North:5	South:5	3	3	3

Source: D/D Consultants

6.2.3.4. Proposed Change in Highway Design

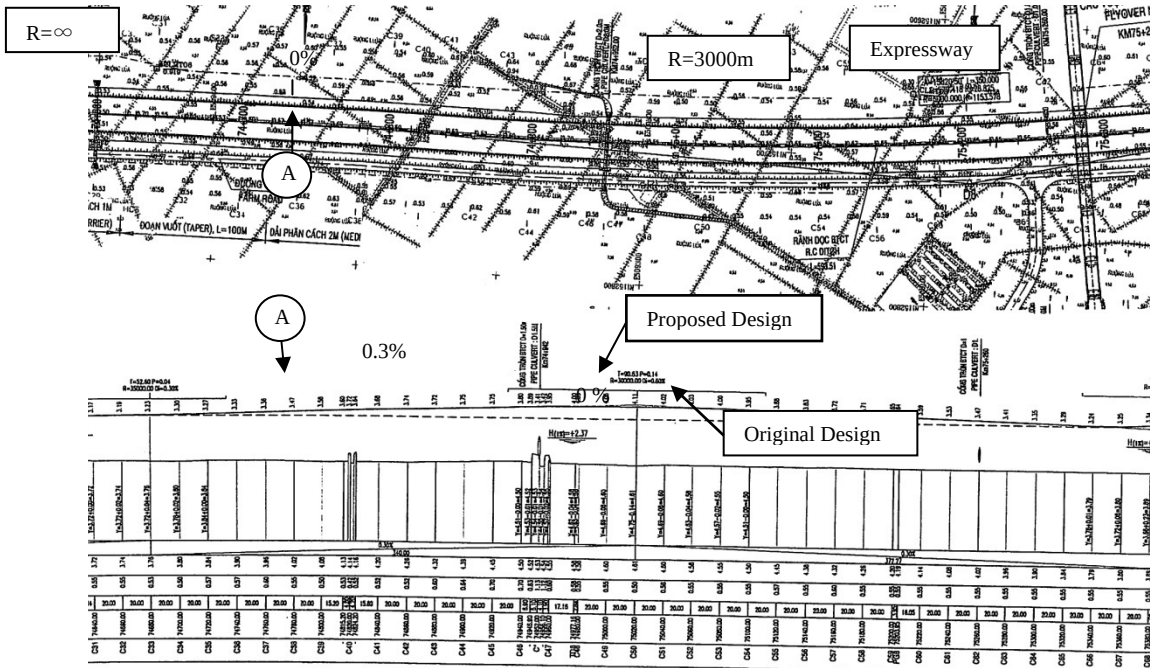
As a result of the review of D/D, the design scheme items such as the alignment, cross section element, interchange, service area, drainage and pavement were proposed for the improvement of safety and to reduce cost. Such changes are discussed below.

Among these proposals, some items with large cost-effectiveness are shown in the drawings attached as appendices.

(1) Safety Improvement

a) Application of 0.3% longitudinal slope at superelevation change section

- There is a point superelevation 0% and longitudinal slope 0%, where horizontal alignment changes from radius smaller than 4000 m (superelevation +2%) to straight (superelevation -2%) in the original design.
- It is dangerous to drive a car at these sections due to the requirements for drainage slope.
- Application of a 0.3% longitudinal slope, which is possible at superelevation change section, was proposed.
- A 0.3% longitudinal slope was applied at sections Km 74+680 – Km 75+388, Km 99+460 – Km 99+959 and Km 101+320 – Km 101+880. For reference, plan and profile of Km 74+680-Km 75+388 is shown in **Figure 6.12**.

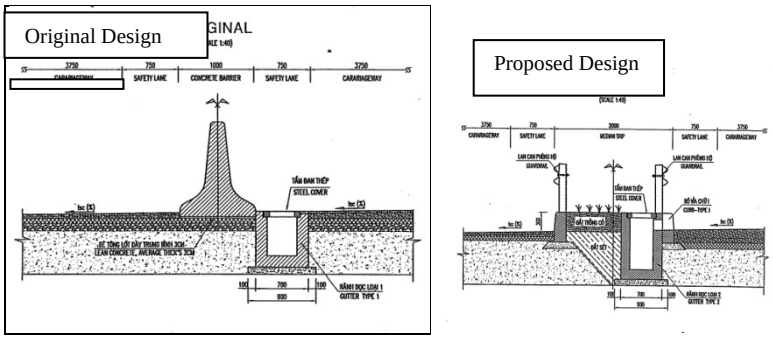


Source: JICA Survey Team

Figure 6.12. Plan and Profile of Km 74+680 – Km 75+388

b) Installation of drainage ditch inside median strip at superelevation section

- Drainage ditch with grating cover is installed in the marginal strip (safety lane) outside the median strip in the original design.
- It is dangerous for cars driven at high speed to pass near the drainage ditch. It is also necessary to restrict vehicles from using the inner lane during maintenance and cleaning.
- Widening of median strip to 2 m and the installation of drainage ditch within this median strip were proposed.
- Drawings of the original and proposed design of drainage ditch are shown in **Figure 6.13.**

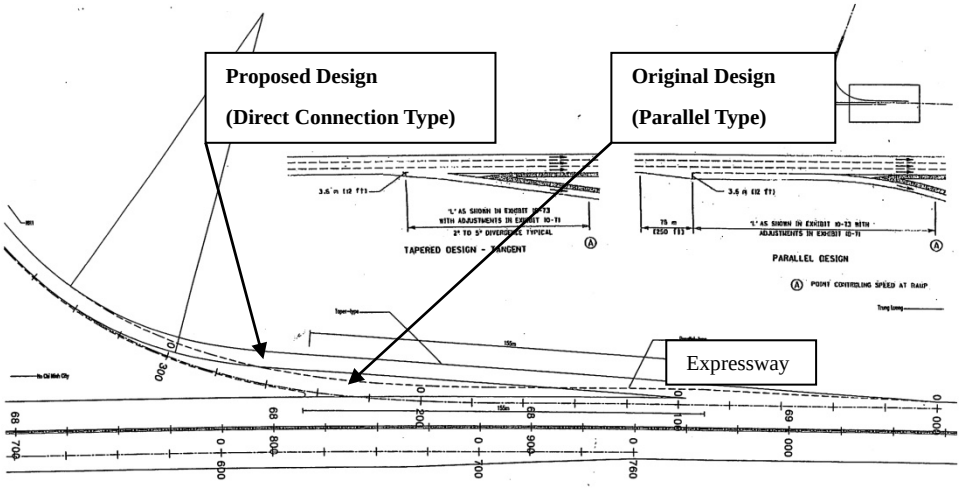


Source: JICA Survey Team

Figure 6.13. Original and Proposed Design of Drainage Ditch

c) Modification to direct connection type of deceleration lane

- A parallel type design was adopted as deceleration lanes of interchange, service area and parking area in D/D.
- Cars will be driven on a straight path instead of swerving to the deceleration lane.
- Direct connection type was proposed in consideration of safe and easy driving.
- Tapered section of direct connecting type is longer than the parallel type according to the AASHTO (2004) design standard , and direct connecting type is located further outside than the parallel type.
- Drawing showing the original and proposed design of deceleration lane is shown in **Figure 6.14** below**.**



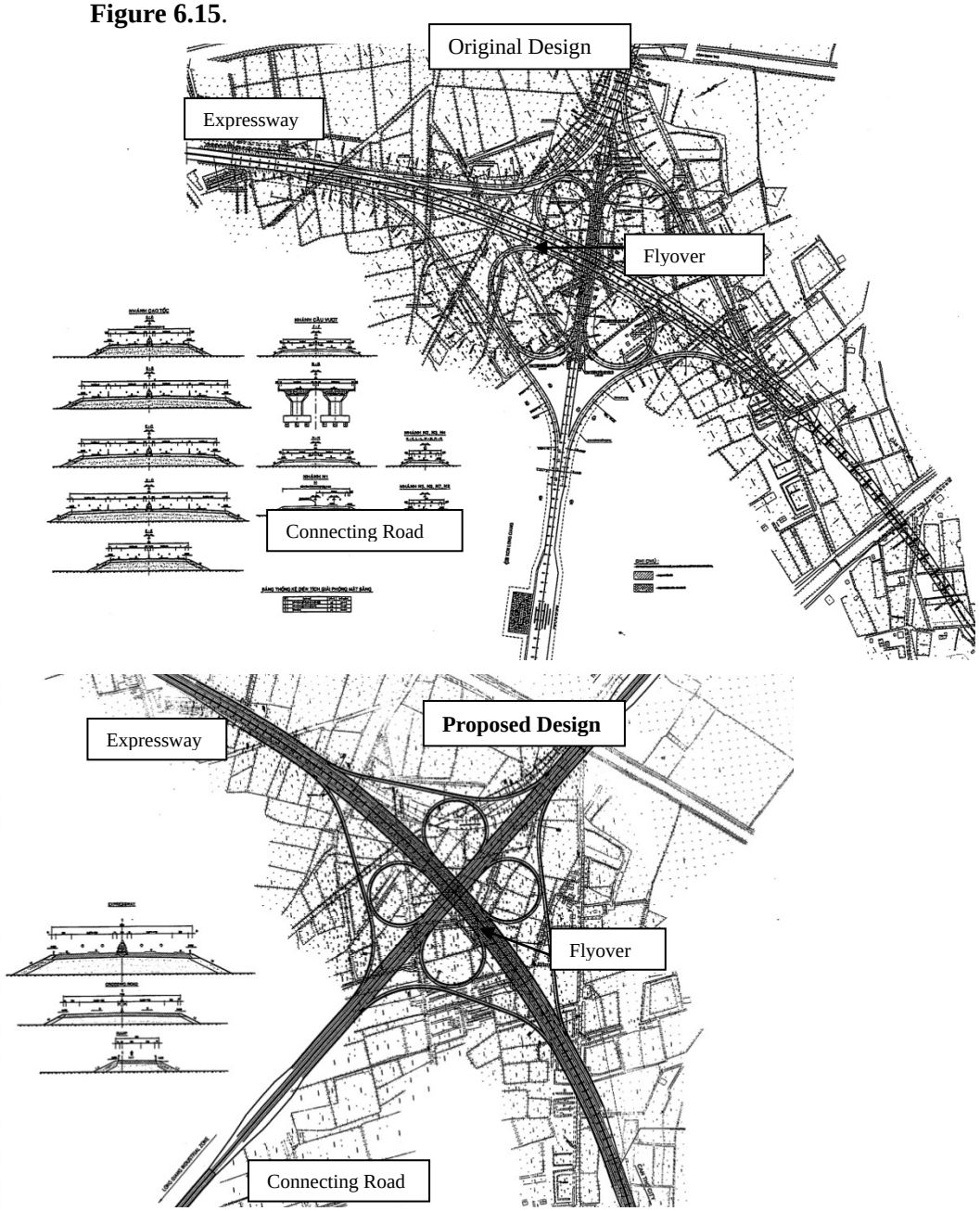
Source: JICA Survey Team

Figure 6.14. Original and Proposed Design of Deceleration Lane

d) Modification to expressway over connecting road at IC

Than Cuu Nghia IC

- In the original design, weaving is formed between the nose position of the rampway in the convex vertical curve of the connecting road to pass over the expressway. Moreover, the nose position in the original design is not easily seen from a driver.
- Consequently, it was proposed that the expressway should pass over the connecting road in order to avoid defects in the original design.
- As a result, the influence of weaving is limited since the vertical curve radius becomes bigger, and a collector-distributor road is provided outside the expressway.
- A drawing showing the original and proposed design of Than Cuu Nghia IC is shown in **Figure 6.15**.

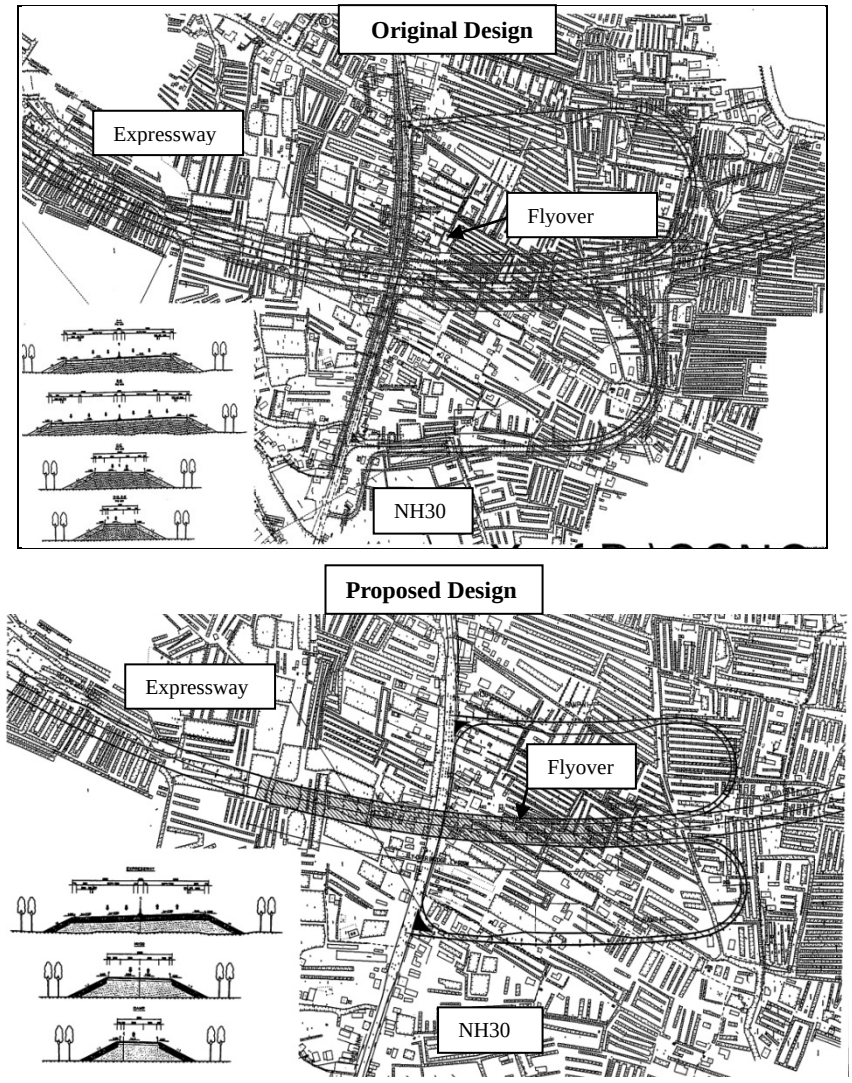


Source: TL-MT D/D (upper figure), JICA Survey Team (lower figure)

Figure 6.15. Original and Proposed Design of Than Cuu Nghia IC

An Thai Trung IC

- The original design is undesirable on a safety viewpoint. Moreover, the interchange scale is large considering that the distance between two intersections is 550 m. It may also cause inconvenience to travelers because it will take a longer time to reach the other side of the expressway from the place near the expressway along NH30.
- Thus, it was proposed that the expressway should pass over the connecting road in order to avoid the defects in the original design. Moreover, vertical alignment of connecting road becomes flat compared to the original design.
- As a result, scale of the interchange was reduced since the distance between two intersections was shortened to 300 m. Access from the road side of connecting road becomes easier.
- Drawing showing original and proposed design is shown in Figure 6.16 below.



Source: TL-MT D/D (upper figure), JICA Survey Team (lower figure)

Figure 6.16. Original Design and Proposed Design of An Thai Trung IC