# Social Monitoring Report

Project Number: 36353-01
July 2010

# VIE: Greater Mekong Subregion Southern Coastal Corridor (Regional)

## Traffic Baseline Survey Report

Prepared by SMEC International Pty Ltd

In association with China Engineering Consultants Inc
Bachkhoa Engineering Consultants Company Ltd
SMEC Vietnam JSC

For the Ministry of Transport, Socialist Republic of Viet Nam



Asian Development Bank

MINISTRY OF TRANSPORTATION

MY THUAN PROJECT MANAGEMENT UNIT

Grant No. 0095 – VIE(SF)

Contract No. 4207/ PMUMT-HDTV

# TRAFFIC BASELINE SURVEY REPORT

## GMS SOUTHERN COASTAL CORRIDOR PROJECT CONSULTING SERVICES

**For Project Implementation of the ADB and AusAID Funded Sections**

**31 July 2010**


SMEC INTERNATIONAL PTY LTD

IN ASSOCIATION WITH

CHINA ENGINEERING CONSULTANTS INC

BACHKHOA ENGINEERING CONSULTANTS COMPANY LTD

SMEC VIETNAM JSC

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| AASHTO | Association of State Highway and Transportation Officials |
| ADB | Asian Development Bank |
| AL | Axle load |
| CBTA | Cross Border Transport Agreement |
| DDIS | Detailed Design, Implementation and Supervision Consultant |
| GMS | Greater Mekong Subregion |
| GoV | Government of Vietnam |
| h | hour |
| IRI | International roughness index |
| km | kilometer |
| m | meter |
| M&E | Monitoring and evaluation |
| OCC | Occupancy |
| O-D | Origin-destination |
| PMU-MT | My Thuan Project Management Unit |
| PPTA | Project preparation technical assistance |
| RTC | Road traffic count |
| SCCP | Southern Corridor Coastal Project |
| | tons |
| TOR | Terms of reference |
| VND | Vietnam Dong |
| VOC | Vehicle operating cost |
| VR | Roughness value |
| WTC | Waterway traffic count |

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# MAIN REPORT

# A. INTRODUCTION

The Greater Mekong Sub-region Southern Coastal Corridor Project (GMS-SCCP) aims to promote economic growth by strengthening connectivity and transportation conditions in the Greater Mekong Sub-region. The project development objective is to reduce transport times and costs, and to induce more efficient movement of passengers and goods within the project area and between GMS countries. The planned outputs of the project are: (a) road and bridge improvements to enable unrestricted passenger and freight transport; (b) construction of border facilities; (c) HIV/AIDS and trafficking awareness and prevention in project roads; (d) road safety programs during construction; and (e) capacity building.

The need to conduct baseline surveys is indicated in project documents including the following:

a. Loan agreement specifically Item 23, Schedule 5, which requires that baseline data be collected within 18 months of the Effective Date, with a second survey to be conducted upon Project completion and a third survey to be conducted five (5) years after Project completion to establish Project impact - The baseline and subsequent surveys shall draw on data collected during Project preparatory activities and data collected from traffic and travel surveys, household socioeconomic sample surveys, participatory rapid appraisals and secondary data from government sources.

b. Terms of reference (TOR) of SMEC International Pty Ltd (Australia), in cooperation with BAECCO, as Detailed Design, Implementation and Supervision (DDIS) Consultant specifically Item 33, which states that the Consultant will conduct socio-economic and baseline surveys as well as resettlement and environmental surveys.

The Monitoring and Evaluation (M&E) Framework that was approved by the Asian Development Bank (ADB) provides that baseline surveys be carried so that results could be used during the end-of-project evaluation prior to project completion and the impact evaluation five years after project completion. It also provides the key indicators for measuring Project performance. Two major baseline surveys are required for this Project. One is a traffic baseline survey to measure „before' project condition of roads based on engineering and economic indicators. Another is a socio-economic baseline survey focusing on the socio-economic conditions of target project beneficiaries.

This report covers the traffic baseline survey, which is based on the survey design that was approved by the My Thuan Project Management Unit (PMU-MT), and subsequently confirmed by the ADB. The report is organized in six (6) sections, as follows:

Section A (Introduction) – This section provides the background for conducting the baseline survey.

Section B (Objectives) – This section enumerates the objectives based on the approved TOR for this survey.

Section C (Scope of Work) – The specific types of traffic survey and the general location of survey areas are briefly described in this section.

Section D (Methodology) – Described in this section is the methodology for data collection for each of the survey types.

Section E (Findings and Analysis) - Discussed in this section are the findings and analysis against key performance indicators as described in the approved Results Framework.

Section F (Challenges) – Based on the findings are some challenges toward completing the Project and achieving planned outcomes and results, also as described in the Results Framework.

## B. OBJECTIVES

The approved TOR describes the general objective of the traffic baseline survey as that of establishing „before' GMS-SCC Project conditions in selected road sectors, and of travel patterns of targeted direct beneficiaries. The specific objectives are:

a. To determine the road and traffic conditions in selected road sectors before the start of construction or improvements; and

b. To determine „before' Project conditions with respect to the movement of people and goods and how these affect the economic activities of target beneficiaries.

A third objective, which is to ascertain the economic viability of planned road construction or improvement based on engineering indicators, has been relegated in the meantime due to resource constraints, but will be taken up during the final evaluation of this Project.

## C. SCOPE OF WORK

Eight (8) specific types of traffic survey were conducted covering road sectors NH63, NH80 and TL7, the road stretch from Thu Bay to Ca Mau and from Xa Xia to Ha Tien, and the existing water way transport system along the Trem river and Xeo Ro river (**Figure C-1**). The coverage of each traffic survey type is listed below.

| Type of Traffic Survey | Coverage |
|---|---|
| Road traffic count survey | NH63 and NH80 |
| Water way traffic count survey | Tac Cau and Xeo Ro |
| Vehicle occupancy survey | NH63 and NH80 |
| Origin-Destination survey | NH63 and NH80 |
| Axle load survey | NH63 and TL7 |
| Travel time survey | Thu Bay to Ca Mau<br>Xa Xia to Ha Tien. |
| International roughness index survey | Thu Bay to Ca Mau<br>Xa Xia to Ha Tien |
| Vehicle operating cost survey | NH63 and NH80. |

Data collection was done from January 2001 and February 2010, which is close to the Lunar New Year holidays when the traffic volume is relatively higher compared to other months. This is considered a positive factor as survey data is expected to be closer to the design volume. However, the survey is generally constrained by limited resources such that actual data collection for each traffic survey type was carried out for only up to three (3) days. The water traffic count survey in particular included only the number of vessels plying the regular

routes. The volume of cargo and number of passengers were not recorded. It is therefore not possible to identify transport patterns and variations across weeks or across months.

# D. METHODOLOGY

The survey proper was conducted in January and February 2010. Four (4) methodologies for primary data collection were adopted depending on the traffic survey type. These are: (a) personal interviews using pre-designed and field-tested survey questionnaires; (b) focus group discussion attended by drivers, passengers and transport laborers and using guide questions; (c) key informant interviews of transport operators and individual owners of selected vehicle types using pre-designed question guides; and (d) direct measurements including direct counting. Primary data is supplemented by secondary data from past studies and reports including the ADB-Small Scale Technical Assistance Report and the ADB-Project Preparation Technical Assistance (PPTA) Report covering different sections along QL80, QL63 and Kien Giang TL7. Secondary data from the Regional Road Management Union No. 7 of the Ministry of Transport are used as well.

Before actual data collection commenced, PMU-MT issued Dispatches No. 360 and 361/ PMU-MT-KTKT to the Provincial Peoples Committee, Public Security Department, Department of Transport of both Kien Giang and Ca Mau Provinces to inform them of the planned survey activities and to solicit their support to the survey teams. Survey activities were coordinated with local officials. All logistical requirements for the survey --- facilities for survey stations, measuring instruments and equipment, policemen support, supervisors and surveyors, data collection instruments --- were prepared. Supervisors, surveyors and other survey staff attended a training activity, which included practical exercises on data collection and measurements. Altogether, the survey mobilized at least 170 field staff consisting of supervisors, experts, surveyors and policemen.

In general, the data collection procedures are in accordance with existing standard procedures of the Government of Vietnam (GoV), and international standards such as those used by the American Association of State Highway and Transportation Officials (AASHTO). Data collection covered up to three (3) shifts, as follows:

| | From | To |
|---|---|---|
| Shift 1 | 0600 h | 1400 h |
| Shift 2 | 1400 h | 2200 h |
| Shift 3 | 2200 h | 0600 h |

More detailed procedures for each type of traffic survey are described from **Section D-1** to **Section D-8**.

Data entry was done in the field immediately after collection of each data set. Survey data were inputted using working table formats in MS Excel to facilitate the preparation of analytical tables.

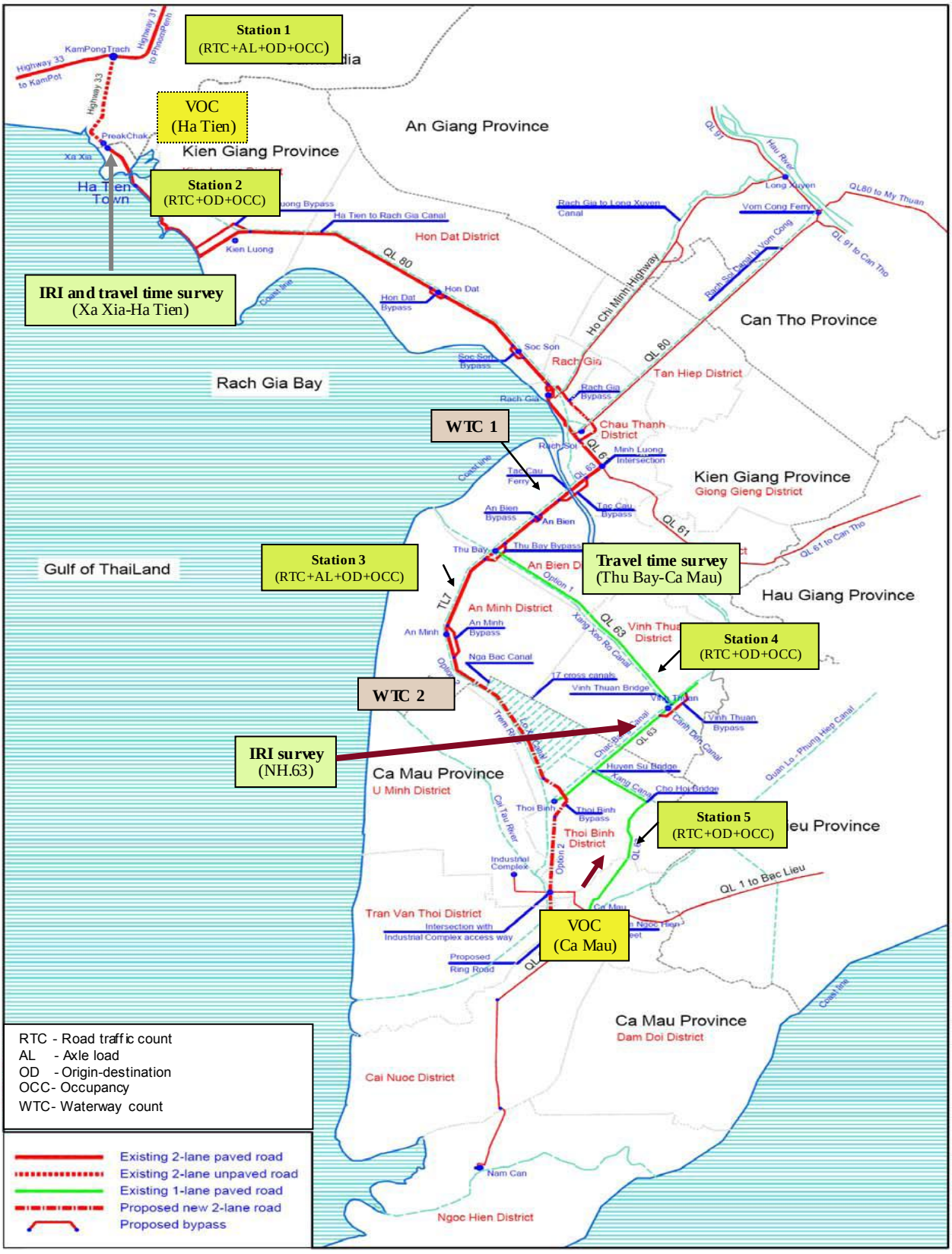



Figure C-1 Traffic baseline survey map

## D.1 Road traffic count

The objective of the road traffic count is to determine the number of vehicles passing a specified road sector and road direction. Direct counting was done for eight (8) types of vehicle, and these are:

| | |
|---|---|
| Type 1 | Motorcycles |
| Type 2 | Cars (Seating capacity of ≤ 7) |
| Type 3 | Minibus (Seating capacity of > 7 and ≤ 25) |
| Type 4 | Bus (Seating capacity of > 25) |
| Type 5 | Light trucks (≤ 2.5 tons) |
| Type 6 | Medium trucks (> 2.5 tons, 2 axles) |
| Type 7 | Heavy trucks (3 axles) |
| Type 8 | Trucks (≥ 4 axles, tractors) |

Covered by the road traffic count are two (2) traffic directions for each of five (5) locations (see **Figure C-1**) for up to three (3) days and up to three (3) shifts each day, as follows:

| Location | No. of Data Collection Days | No. of Shifts Per Day |
|---|---|---|
| Cross border | 3 | 2 |
| Xa Xia to Ha Tien | 3 | 2 |
| Thu Bay to Nga Bac | 3 | 2 |
| Nga Bac to Ca Mau | 3 | 2 |
| Thu Bay to Vinh Thuan | 2 | 2 |
| | 1 | 3 |

The results of the road traffic count are presented in **Section E.1**.

## D.2 Waterway traffic count

At the time of the survey, water transport to and from Ca Mau remains a popular means of conveyance for people and goods. The river runs parallel to the roads that are planned for construction or rehabilitation. The objective of the water way traffic count, therefore, is to determine the volume of traffic along the waterways. Water traffic count includes ships and canoes for cargoes only, ships and canoes for passengers only, small boats and motorized canoes used for cargoes and passengers, barges, and other non-motorized water transport facilities. Each type was classified according to length, as follows:

| | |
|---|---|
| Type 1 | ≤ 7 m |
| Type 2 | > 7m, ≤ 10 m |
| Type 3 | > 10 m |

Covered by the water traffic count were two (2) stations --- one each in Tac Cau and Ca Mau (see **Figure C-1**). The number of vessels plying from Tac Cau to Ca Mau and vice versa were gathered for three (3) days and up to three (3) shifts each day as shown on the next page. This survey has a total of 448 records. The results are presented in **Section E.2**.

| Location | No. of Data Collection Days | No. of Shifts Per Day |
|---|---|---|

| | | |
|---|---|---|
| Tac Cau | 2 | 2 |
| | 1 | 3 |
| Ca Mau | 2 | 2 |
| | 1 | 3 |

### D.3 Vehicle occupancy survey

In this survey, the number of people in passenger vehicles was counted to determine the total number of passengers per trip for each type of passenger vehicle, and the average number of passengers calculated later. The data collection points are the same locations as that of the road traffic count survey (see **Figure C-1**), as shown below. The single data collection shift is from 08h to 16h. This survey resulted in a total of 650 records. The results are discussed in **Section E.3**.

| Location | No. of Data Collection Days | No. of Shifts Per Day |
|---|---|---|
| Cross border | 2 | 1 |
| Xa Xia to Ha Tien | 2 | 1 |
| Thu Bay to Nga Bac | 2 | 1 |
| Nga Bac to Ca Mau | 2 | 1 |
| Thu Bay to Vinh Thuan | 2 | 1 |

### D.4 Origin-destination survey

Done immediately after the road traffic count survey, the origin–destination survey was carried out to determine the travel pattern of vehicles and persons. With the assistance of traffic policemen, randomly selected vehicles were stopped and the passengers were interviewed. It was conducted in the same five (5) locations (see **Figure C-1**) as that of the traffic count survey, but only for the 08h to 16h shift and for two (2) days. A total of 650 records was tabulated. These are presented and discussed in **Section E.4**.

### D.5 Axle load survey

The axle load survey was conducted for trucks only. Done also with assistance from policemen, the survey involved weighing the load of the axis and recording the weight in a tally sheet. The survey was done in two (2) locations in Xa Xia and Thu Bay (see **Figure C-1**) for two (2) days and in the 08h to 16h shift. Some 60 trucks of various kinds were weighed at the Xa Xia border station, and 52 at the Thu Bay survey station. The findings are discussed in **Section E.5**.

### D.6 Travel time survey

The objective of the travel time survey is to determine the efficiency of a route with respect to its ability to carry out traffic relative to other routes through the use of sufficiency rating or congestion indices, providing input to capacity analysis of road way segment, evaluating the effectiveness of traffic operation improvement and other necessary parameters for analysis

work. This survey was carried out along the Xa Xia to Ha Tien sector and the Thu Bay to Ca Mau sector (see **Figure C-1**) for cars, motorcycles, trucks and buses. There are 5 replications for each segment, 3 during the peak hours and 2 during the off peak hours. The distance covered in these sectors are shown below.

| Location | No. of Data Collection Days | Distance Covered |
|---|---|---|
| Xa Xia to Ha Tien | 2 | 4.3 km |
| Thu Bay to Ca Mau | 2 | 87.0 km |

The survey adopted the "moving vehicle method" whereby a car traveled along the road section while the surveyors counted the traffic on the opposite side, the traffic that overtook the survey car, and the traffic that the survey car overtook. The average speed of the car was calculated using the data collected. The results of the travel time survey are discussed in **Section E.6**.

### D.7 International roughness index (IRI) survey

Measurements covering two (2) road sections --- Xa Xia to Ha Tien and Tac Cau Ferry to Ca Mau sector --- to calculate roughness index was carried out to enable a comparison of pavement roughness „before' and „after' the project as it affects both vehicles and ride quality. The measurements were done in 3 replications for each 500 m stretch following the standard procedures set out in Standard 22TCCN277-01 of GoV. A profile bean was used to measure IRI in calibrated sections, while a reactive bump instrument (Romdas) was used to determine the roughness value (VR). The Romdas was installed in a Toyota pickup, which ran at a speed of 40 km/h. At the time of measurement, the front and rear wheel pressure of the vehicle was 2.5 kgf/ $cm^2$.

Calculations were made based on the following relationship between IRI and roughness value (VR) at 40 km/h:

$$y = -0.0000000030x2 + 0.0003379301x + 0.7029288392$$

where:
y = IRI in m/km
x = Roughness value (VR) ( m/km) / counts/km

The results of the measurements and calculations are discussed in **Section E.7**.

### D.8 Vehicle operating cost (VOC) survey

This survey required a minimum sample size of ten (10) each of vehicle operators (5 for public passenger vehicles including tourist bus and 5 for cargo trucks) and of vehicle owners (5 for private cars and 5 for private motorcycles) for each province, or a total of forty (40) interviews. However, the number of interviews exceeded the minimum totaling 131 altogether. The breakdown of these interviews is shown on the next page. The results of the VOC survey are discussed in **Section E.8**.

By province 131

| | | |
|---|---|---|
| Kien Giang | 75 | |
| Ca Mau | 56 | |
| By type of vehicle | | 131 |
| Vehicle operators | | |
| Passenger vehicles | 34 | |
| Cargo vehicles | 50 | |
| Vehicle owners | | |
| Private cars | 20 | |
| Private motorcycles | 27 | |

# E. FINDINGS AND ANALYSIS

In this section, the findings are presented and compared with performance indicators as shown in the Results Framework that is presented in **Annex A**.

## E.1 Road traffic count survey

Performance indicator: Traffic on improved roads increased by 40 percent from baseline [2009] within 2 years of project completion.

Findings:

a. In general, the percentage share of motorcycles is 92 percent of the total traffic based on direct physical count, and about 80 percent in PCU equivalent. The share of cars and mini buses is about 2 percent, while the buses account for only about 0.25 percent of the total traffic flow. In Station 5 (Thu Bay to Vinh Thuan), the number of buses constitutes approximately 1 percent, while the percentage share of buses in the remaining stations is only 0.1 percent. The light and medium trucks account for 2 percent on the average. There are no heavy trucks of 3 axles in Station 3 (Thu Bay to Nga Bac), Station 4 (Nga Bac to Ca Mau), and Station 5 (Thu Bay to Vinh Thuan), while it is 0.1 percent and 0.2 percent respectively in Station 1 (at cross border) and Station 2 (Xa Xia to Ha Tien).

b. At the cross border, the average PCU is recorded at 1754 with motorcycles taking the highest share of almost 70 percent, followed by other vehicles (bus with capacity of under 25 seats and trucks of under 2.5 tons) at 12 percent (see **Table E.1.1**). Less than 10 percent of the total is each shared by mini buses (2.9 percent), cars (6.2 percent) and trucks of more than 2.5 tons (9.3 percent).

Table E.1.1 Comparative average daily traffic for various vehicle types, 5 locations, 2009

| Parameter | Motorcycles | Cars | Mini Bus | Truck, > 2.5 tons | Other | TOTAL |
|---|---|---|---|---|---|---|
| At cross border | | | | | | |
| Average PCU per day, all days | 1221 | 109 | 51 | 287 | 86 | 1754 |
| % PCU share, all days | 69.6% | 6.2% | 2.9% | 16.3% | 4.9% | 100.0% |
| Average PCU per day, peak hours | 146 | 13 | 8 | 24 | 12 | 203 |
| % PCU share, peak hours | 11.2% | 9.9% | 21.7% | 13.2% | 44.0% | 10.8% |

| Parameter | Motorcycles | Cars | Mini Bus | Truck, > 2.5 tons | Other | TOTAL |
|---|---|---|---|---|---|---|
| Xa Xia to Ha Tien | | | | | | |
| Average PCU per day, all days | 1582 | 48 | 39 | 148 | 48 | 1864 |
| % PCU share, all days | 84.9% | 2.6% | 2.1% | 2.5% | 7.9% | 100.0% |
| Average PCU per day, peak hours | 168 | 13 | - | 9 | - | 190 |
| % PCU share, peak hours | 9.6% | 20.3% | - | 11.6% | - | 9.2% |
| Thu Bay to Nga Bac | | | | | | |
| Average PCU per day, all days | 2200 | 36 | 134 | 187 | 101 | 2659 |
| % PCU share, all days | 82.8% | 1.4% | 5.1% | 7.0% | 3.8% | 100.0% |
| Average PCU per day, peak hours | 227 | 1 | 6 | 10 | 2 | 245 |
| % PCU share, peak hours | 9.6% | 2.4% | 3.4% | 4.9% | 2.0% | 8.5% |
| Nga Bac to Ca Mau | | | | | | |
| Average PCU per day, all days | 3022 | 105 | 165 | 106 | 219 | 3617 |
| % PCU share, all days | 83.5% | 2.9% | 4.6% | 2.9% | 6.0% | 100.0% |
| Average PCU per day, peak hours | 275 | 10 | 8 | 10 | 12 | 315 |
| % PCU share, peak hours | 9.2% | 15.6% | 14.3% | 8.2% | 4.4% | 15.2% |
| Thu Bay to Vinh Thuan | | | | | | |
| Average PCU per day, all days | 2063 | 126 | 152 | 192 | 415 | 2947 |
| % PCU share, all days | 70.0% | 4.3% | 5.2% | 6.5% | 14.1% | 100.0% |
| Average PCU per day, peak hours | 180 | 4 | 3 | 8 | 26 | 221 |
| % PCU share, peak hours | 8.4% | 3.7% | 2.1% | 3.5% | 12.6% | 10.7% |

*Note: Please see Annex B1 to B5 for more details.*
*Source: Traffic Baseline Survey, 2010*

c. The peak traffic hours vary across stations as shown below, but are generally from 14h to 19h, with some showing two peak traffic hours or without any pronounced peak hours at all.

| | |
|---|---|
| At cross border | 14h to 18h |
| Xa Xia to Ha Tien | 07h to 12h and 16h to 19h (**Figure E1.1**) |
| Thu Bay to Nga Bac | 07h to 11h and 14h to 19h |
| Nga Bac to Ca Mau | 07h to 12h and 14h to 18h |
| Thu Bay to Vinh Thuan | No pronounced peak hours |

d. Based on PCU equivalent, the proportion of traffic during peak hours ranges from 8.5 percent (Thu Bay to Nga Bac) to 15.2 percent (Nga Bac to Ca Mau). There is a considerable shift in the distribution during the peak hours with other vehicles taking the highest share of 44.0 percent, followed by mini buses (21.7 percent) as shown in the Xa Xia to Ha Tien sector. The lowest share is for cars (9.9 percent), although this is slightly higher than its share during the average of

two shifts. The average number of vehicles during the peak hours in terms of PCU is about 200 PCU/h. The highest is in Station 4 (Nga Bac to Ca Mau), which is over 300 PCU/h.

e. Aside from the direct count and the PCU equivalent and percentage share of vehicles, the fluctuation coefficient of daily traffic against the 3-day average is calculated as well. The fluctuation coefficient of the highest number of vehicles compared to the 3- day average is about 1.05 - 1.10. In Station 3 (Thu Bay to Nga Bac), Station 4 (Nga Bac to Ca Mau) and Station 5 (Thu Bay to Vinh Thuan), the number of cars per day is more than the number of vehicles at Station 1 (Xa Xia border) and Station 2 (Xa Xia to Ha Tien) by 1.5 to 2 times. The numbers of vehicles that cross through the Xa Xia border gate is very low. The details for the five (5) data collection points are shown in **Annex B1 to B5**.

f. If GMS-SCCP is to achieve its target of 40 percent increase in traffic over baseline, the average PCU per day must be in the range of 2500 to 5500 within 2 years of project completion. This will be ascertained through another traffic survey during the final evaluation that is planned toward the end of 2014.

Figure E.1.1 Distribution of traffic per hour within a day, cross border, 2009

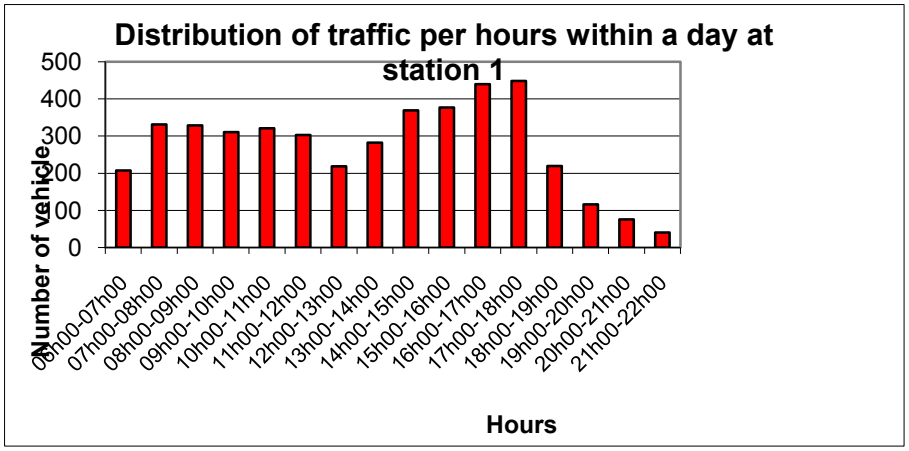



Figure E.1.2 Distribution of traffic per hour within a day, Xa Xia to Ha Tien, 2009

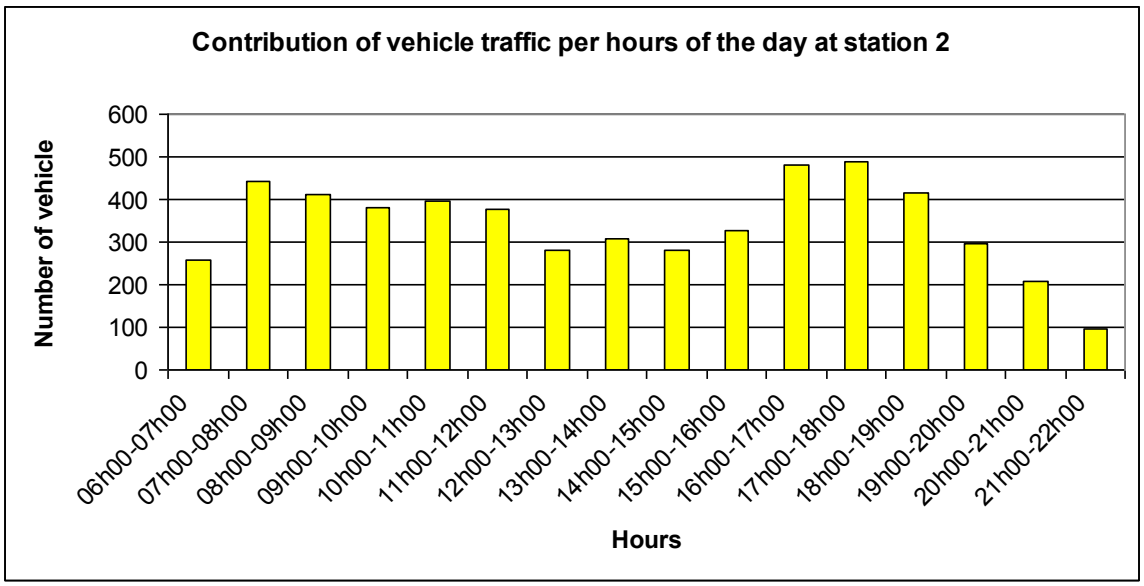


Figure E.1.3 Distribution of traffic per hour within a day, Thu Bay to Nga Bac, 2009

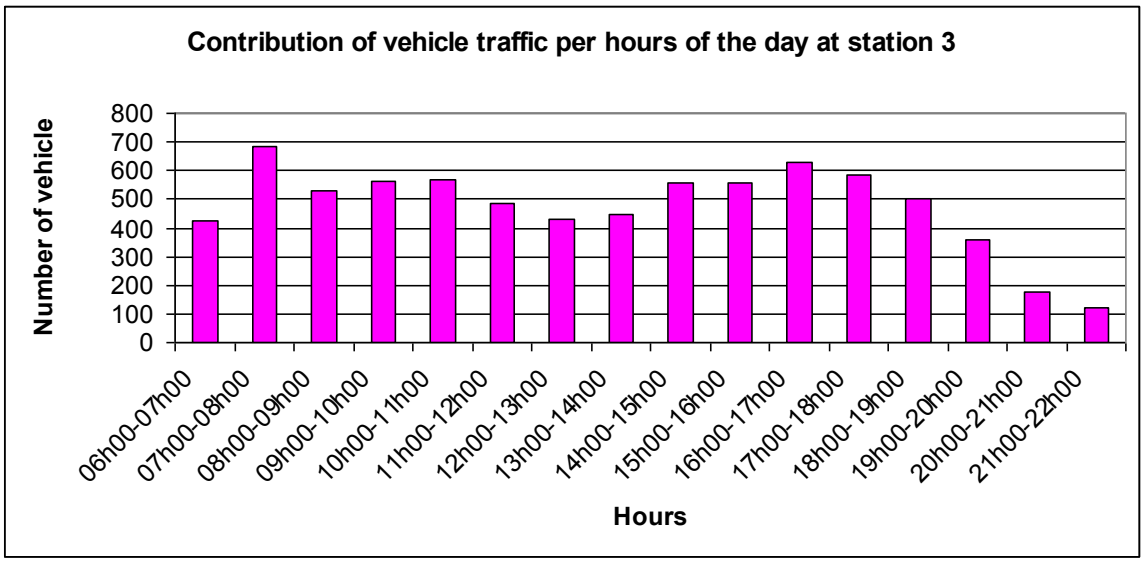



Figure E.1.4 Distribution of traffic per hour within a day, Nga Bac to Ca Mau, 2009

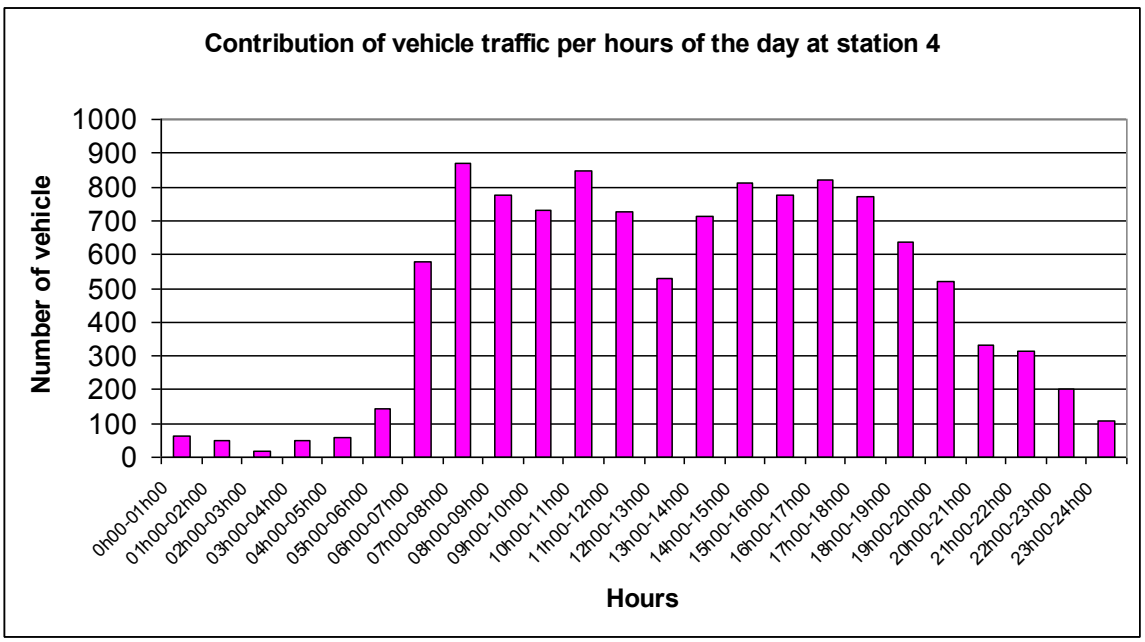
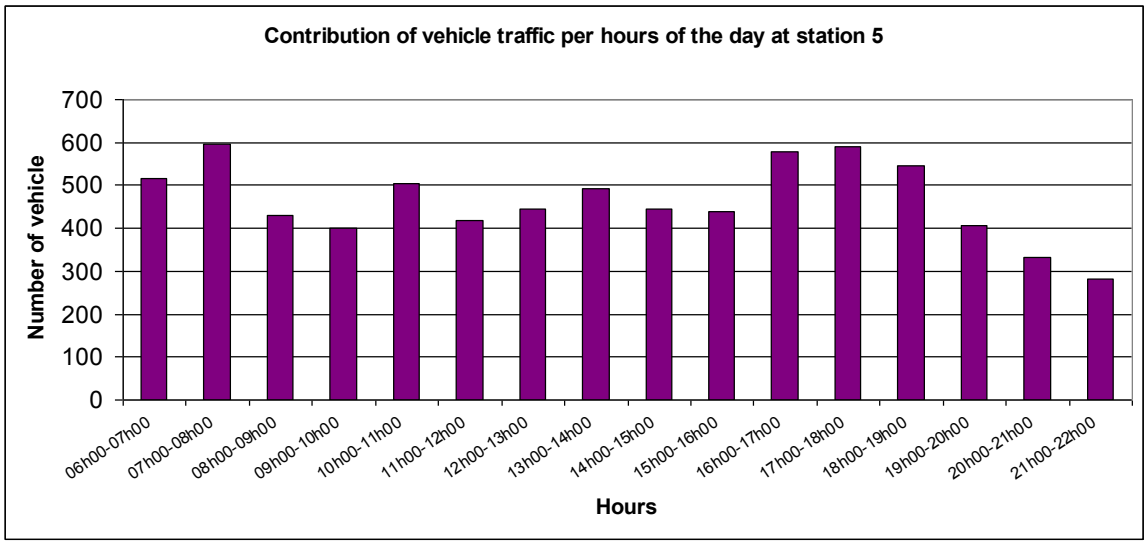


Figure E.1.5 Distribution of traffic per hour within a day, Thu Bay-Vinh Thuan, 2009




**Road traffic count, 2005 and 2009**:

A comparison of traffic count done by SMEC during this survey and by ND Lea at the end of 2005 during project preparation for this project was made for 04 stations --- at the cross border, Thu Bay to Nga Bac, Nga Bac to Ca Mau, Thu Bay to Vinh Thuan. From 2005 to 2009, the average number of vehicles (all types) has increased by about 9 percent per year, motorcycles by 11 percent per year and other engine vehicles by 8 percent per year. At the Thu Bay to Nga Back station, the average rate of growth is 15 percent per year mainly due to the 17 percent per year growth rate in motorcycle traffic. At the Nga Bac to Ca Mau station, the average rate of growth is over 30 percent per year, with that for motorcycles reaching 36 percent per year. At the Thu Bay Vinh Thuan station, the rate of growth of engine vehicles (excluding motorcycles) is 27 percent per year due to some road improvement and relatively high house construction in Ca Mau City. In all 4 stations, the average rate of growth vehicles is about 21 percent per year, of which motorcycle increased by 23 percent per year. The rate of growth of number of vehicles acceding to the PCU is estimated at about 19 percent per year, mainly due to the increase of two-wheel motorcycles. The rate of growth in freight and passenger transport is relatively low (**Figure E1.6** and **Table E1.2**).

The goods and passenger transport activities on the road via the Xa-Xia international border gate between Cambodia and Viet Nam is very low and its appears to be ineffective due to lack of a good road link between the commercial and tourism areas of the two countries. The traffic volume along the coastal corridor in the south is expected to increase at a rapid pace when the roads are completed.

Figure E1.6 Number of PCU (06h-20h) in 2005 and 2009

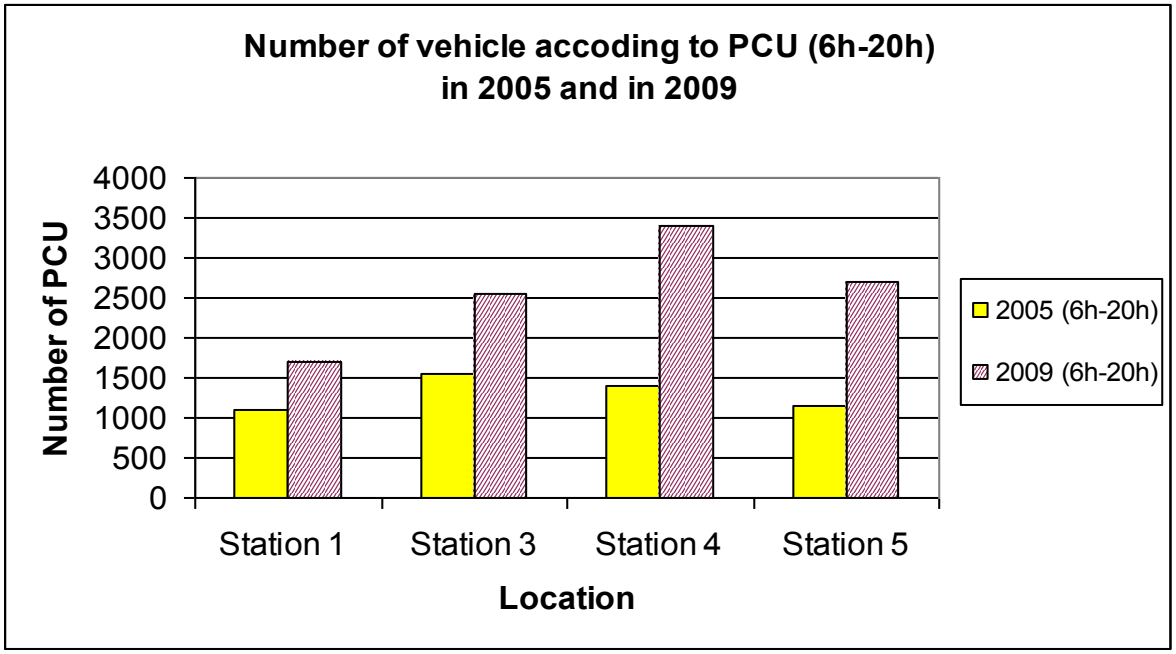


Table E1.2 Average growth rate of daily traffic volume at 4 locations, 2005 and 2009

| Location of Station | Average Number of Vehicles Per Day | | | | Total for Engine Vehicles (excluding motorcycles) | | | | Total for Motorcycles | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2005 | 2009 | % Increase | Annual Growth Rate (%) | 2005 | 2009 | % Increase | Annual Growth Rate (%) | 2005 | 2009 | % Increase | Annual Growth Rate (%) |
| Based on physical count (6h-20h) | | | | | | | | | | | | |
| Cross border | 2796 | 3963 | 42% | 9% | 223 | 308 | 38% | 8% | 2573 | 3963 | 54% | 11% |
| Thu Bay to Nga Bac | 4032 | 7043 | 75% | 15% | 238 | 265 | 11% | 3% | 3793 | 7043 | 86% | 17% |
| Nga Bac to Ca Mau | 3170 | 9852 | 211% | 33% | 323 | 379 | 17% | 4% | 2847 | 9473 | 246% | 36% |
| Thu Bay to Vinh Thuan | 2983 | 6803 | 128% | 23% | 193 | 497 | 58% | 27% | 2790 | 6306 | 126% | 23% |
| **Total** | **12981** | **27661** | **113%** | **21%** | **977** | **1449** | **48%** | **10%** | **12003** | **26785** | **130%** | **23%** |
| PCU equivalent (6h-20h) | | | | | | | | | | | | |
| Cross border | 1088 | 1704 | 57% | 12% | 316 | 515 | 63% | 13% | 772 | 1189 | 54% | 11% |
| Thu Bay to Nga Bac | 1559 | 2553 | 64% | 13% | 421 | 440 | 5% | 1% | 1138 | 2113 | 86% | 17% |
| Nga Bac to Ca Mau | 1399 | 3402 | 143% | 25% | 544 | 560 | 3% | 1% | 854 | 2842 | 233% | 35% |
| Thu Bay to Vinh Thuan | 1155 | 2704 | 134% | 24% | 318 | 812 | 156% | 26% | 837 | 1892 | 126% | 23% |
| **Total** | **5200** | **10363** | **99%** | **19%** | **1599** | **2327** | **46%** | **10%** | **3601** | **8036** | **123%** | **22%** |

*Sources: 2005 – PPTA Report, ADB, 2005*
*2009 – Traffic baseline survey, 2010*

**Road traffic count, 2005 to 2007**

Secondary data on road traffic is also available from the Regional Road Management Union No. 7 of the Ministry of Transport, and these are presented in **Table E1.3** and **Table E1.4**.

a. Location 1: QL63 – Km 110+000 – Traffic along QL63 has significantly increased over a 3-year period especially for freight and passenger transportation (cars and small buses). Based on PCU equivalent, the growth of traffic for trucks from 2005 to 2007 is 70 percent per year, the largest traffic growth compared to other vehicle types such as motorcycle, car and bus. It shows the development of freight transportation in the survey area. The traffic growth for cars and buses is relatively high at about 38 percent per year, and that for motorcycles at about 20 percent per year.

Table E1.3 Traffic growth based on physical number of vehicles, 2005 to 2007

| Location | | Motorcycle, Bike, Pedicab | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2005 | 2006 | 2007 | % Increase/(Decrease) | | | Growth Index 2005-2007 |
| | | | | | 2005 - 2006 | 2006 - 2007 | 2005 - 2007 | |
| QL 63 | 110+000 (LT. 79+000) | 6,358 | 10,926 | 8,798 | 72% | 81% | 38% | 18% |
| QL 80 | 13+900 | 53,543 | 76,968 | 56,404 | 44% | 73% | 5% | 3% |
| | 18+950 | 53,222 | 78,192 | 59,035 | 47% | 76% | 11% | 5% |
| | 55+500 | 7,759 | 10,476 | 8,036 | 35% | 77% | 4% | 2% |
| Location | | Car, Minibus, Bus | | | | | | |
| | | 2005 | 2006 | 2007 | % Increase/(Decrease) | | | Growth Index 2005-2007 |
| | | | | | 2005 - 2006 | 2006 - 2007 | 2005 - 2007 | |
| QL 63 | 110+000 (LT. 79+000) | 186 | 374 | 355 | 101% | (5%) | 91% | 38% |
| QL 80 | 13+900 | 3,125 | 3,228 | 2,773 | 3% | (14%) | (11%) | 0% |
| | 18+950 | 3,113 | 3,265 | 2,812 | 5% | (14%) | (10%) | 0% |
| | 55+500 | 877 | 1,279 | 1,253 | 46% | (2%) | 43% | 20% |
| Location | | Cargo Vehicle | | | | | | |
| | | 2005 | 2006 | 2007 | % Increase/(Decrease) | | | Growth Index 2005-2007 |
| | | | | | 2005-2006 | 2006-2007 | 2005-2007 | |
| QL 63 | 110+000 (LT cũ 79+000) | 88 | 257 | 278 | 93% | 8% | 217% | 78% |
| QL 80 | 13+900 | 2,172 | 2,528 | 2,180 | 16% | (14%) | 0% | 0% |
| | 18+950 | 2,204 | 2,544 | 2,422 | 15% | (5%) | 10% | 5% |
| | 55+500 | 733 | 1,428 | 1,055 | 95% | (26%) | 44% | 20% |

*Source: Regional Road Management Union No. 7, Ministry of Transport*

c. Location 2: QL80 – Km13+900 –Traffic growth for motorcycles and trucks is relatively low at about 2 percent per year, while that for passenger transportation (car, bus) is almost unchanged. The traffic growth for freight

transportation is extremely low at about 4 percent per year compared to traffic growth in QL63.

d. Location 3: QL80 – Km18+950 - Traffic growth is this sector is similar to that of Location 2 (QL80 – Km13+900). For motorcycles and trucks, it is relatively low at about 5 percent per year, unchanged for cars and buses, and at 8 percent per year for freight transportation.

e. Location 4: QL80 – Km55+500 – Along this sector, traffic for freight transport has been growing at a relatively faster pace of 33 percent per year from 2005 to 2007 compared with other vehicles at Location QL80. Traffic for passenger transport has been growing at an average of 19 percent a year. Traffic for motorcycles and bicycles has been low at only 3 percent a year.

Table E1.4 Traffic growth based on PCU equivalent, 2005 to 2007

| Location | | Motorcycle, Bike, Pedicab | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | % Increase/(Decrease) | | | Growth Index 2005-2007 |
| | | 2005 | 2006 | 2007 | 2005-2006 | 2006-2007 | 2005-2007 | |
| QL 63 | 110+000 (LT. 79+000) | 1,757 | 3,140 | 2,541 | 79% | (19%) | 45% | 20% |
| QL 80 | 13+900 | 13,328 | 19,165 | 13,910 | 44% | (27%) | 4% | 2% |
| | 18+950 | 13,255 | 19,464 | 14,720 | 47% | (24%) | 11% | 5% |
| | 55+500 | 2,022 | 2,775 | 2,125 | 37% | (23%) | 5% | 3% |
| Location | | Car, Minibus, Bus | | | | | | |
| | | | | | % Increase/(Decrease) | | | Growth Index 2005-2007 |
| | | 2005 | 2006 | 2007 | 2005-2006 | 2006-2007 | 2005-2007 | |
| QL 63 | 110+000 (LT. 79+000) | 285 | 577 | 546 | 102% | (5%) | 92% | 38% |
| QL 80 | 13+900 | 5,364 | 5,592 | 4,938 | 4% | (12%) | (8%) | 0% |
| | 18+950 | 5,343 | 5,631 | 4,995 | 5% | (11%) | (17%) | 0% |
| | 55+500 | 1,635 | 2,255 | 2,312 | 38% | 2% | 41% | 19% |
| Location | | Cargo Vehicle | | | | | | |
| | | | | | % Increase/(Decrease) | | | Growth index 2005-2007 |
| | | 2005 | 2006 | 2007 | 2005-2006 | 2006-2007 | 2005-2007 | |
| QL 63 | 110+000 (LT. 79+000) | 189 | 498 | 546 | 164% | 10% | 189% | 70% |
| QL 80 | 13+900 | 3,976 | 4,802 | 4,302 | 21% | (10%) | 8% | 4% |
| | 18+950 | 4,051 | 4,828 | 4,717 | 19% | (2%) | 16% | 8% |
| | 55+500 | 1,025 | 2,315 | 1,814 | 126% | (22%) | 77% | 33% |

*Source: Regional Road Management Union No. 7, Ministry of Transport*

The distribution of vehicles by type along road sectors is an important index in calculating the cross-section of roads, module parameters of roads, or reinforced roadside calculations in the future. These are presented in **Table E1.5** below.

Table E1.5 Distribution of vehicles by type based on PCU, 2005 to 2007

| Year | Location | | Number of Vehicles | | | | % Distribution | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Motor, Bike | Car, Bus | Truck | TOTAL | Motor, Bike | Car, Bus | Truck |
| 2005 | QL63 | 110+000 (LT79+000) | 1,757 | 285 | 2,541 | 4,583 | 38 | 6 | 55 |
| | QL80 | 13+900 | 13,328 | 5,364 | 13,910 | 32,602 | 41 | 16 | 43 |
| | | 18+950 | 13,255 | 5,343 | 14,720 | 33,318 | 40 | 16 | 44 |
| | | 55+500 | 2,022 | 1,635 | 2,125 | 5,782 | 35 | 28 | 37 |
| 2006 | QL63 | 110+000 (LT79+000) | 3,140 | 577 | 546 | 4,263 | 74 | 14 | 13 |
| | QL80 | 13+900 | 19,165 | 5,592 | 4,938 | 29,695 | 65 | 19 | 17 |
| | | 18+950 | 19,464 | 5,631 | 4,995 | 30,090 | 65 | 19 | 17 |
| | | 55+500 | 2,775 | 2,255 | 2,312 | 7,342 | 38 | 31 | 31 |
| 2007 | QL63 | 110+000 (LT79+000) | 8,798 | 498 | 546 | 9,842 | 89 | 5 | 6 |
| | QL80 | 13+900 | 56,404 | 4,802 | 4,302 | 65,608 | 86 | 7 | 7 |
| | | 18+950 | 59,035 | 4,828 | 4,717 | 68,580 | 86 | 7 | 7 |
| | | 55+500 | 8,036 | 2,315 | 1,814 | 12,165 | 66 | 19 | 15 |

*Source: Regional Road Management Union No. 7, Ministry of Transport*

From 2005 to 2007, motorbikes and bikes constitute the majority of vehicles that ply the QL63 and QL80 road sectors ranging from 38 percent to 89 percent. The trucks make up the second most important type ranging from 6 percent to 44 percent of the total number of vehicles. The least are the cars and buses, which comprise from 7 percent to 31 percent of the total.

## E.2 Water traffic count survey

Performance indicator: Based on the results framework, water traffic is not an indicator of performance. However, it had been included in the traffic baseline survey given the perceived influence of GSM-SCCP road improvements on water traffic from the Nga Bac-Ca Mau station to the Tac Cau (Xeo Ro) station.

Findings:

As discussed earlier, the water traffic count is limited to the number of vessels plying to and from the Nga Bac-Ca Mau station and Tac Cau (Xeo Ro) station due to resource constraints. The results are presented in **Table E2.1** and **Figure E2.1** and **Figure E2.2**. The salient findings include:

a. At station 3 (TL7), there are about 150 light and medium trucks that travel every day. There are about 100 goods ships that their length>10m and about 20 goods barge (not including 160 engine boat with carrying agricultural products or other small cargo) travel on the waterway that parallel to TL.7 on Trem river. After coastal corridor in the south is completed, estimating over 25% of goods volume will be transported by road instead of by waterway. Regarding passenger transport, waterway has a dominant role in meeting the needs of passengers traveling to far areas. The number of passenger ships is about 15 units.

b. Boats, canoes with engine for travel, agricultural products transport, going to school etc. are major means of transport and take the great rate of the total means of waterway in this place.

Table E2.1 Water traffic by vessel type, Ca Mau to Nga Bac and Xeo Reo stations, 2009

| Vessel Type | Ca Mau-Nga Bac (6h-22h) | | Ca Mau-Nga Bac (24h) | | Xeo Ro (6h-22h) | | Xeo Ro (24h) | |
|---|---|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Cargo vessels & motor boats | 104 | 100.0 | 129 | 100.0 | 226 | 100.0 | 304 | 100.0 |
| ≤ 7m | 4 | 3.8 | 2 | 1.6 | 15 | 6.6 | 10 | 3.3 |
| > 7m, ≤10m | 13 | 12.5 | 12 | 9.3 | 77 | 34.1 | 82 | 27.0 |
| >10m | 87 | 83.7 | 115 | 89.1 | 134 | 59.3 | 212 | 69.7 |
| Passenger vessels & motor boats | 14 | 100.0 | 15 | 100.0 | 16 | 100.0 | 21 | 100.0 |
| ≤ 7m | 1 | 7.1 | 0 | 0.0 | 3 | 18.8 | 2 | 9.5 |
| > 7m, ≤10m | 8 | 57.1 | 10 | 66.7 | 10 | 62.4 | 18 | 85.7 |
| >10m | 5 | 35.8 | 5 | 33.3 | 3 | 18.8 | 1 | 4.8 |
| Engine vessels & canoes | 159 | 100.0 | 168 | 100.0 | 259 | 100.0 | 346 | 100.0 |
| ≤ 7m | 111 | 69.8 | 118 | 70.2 | 121 | 46.7 | 88 | 25.5 |
| > 7m, ≤10m | 39 | 24.5 | 41 | 24.4 | 91 | 35.1 | 152 | 43.9 |
| >10m | 9 | 5.7 | 9 | 5.4 | 47 | 18.2 | 106 | 30.6 |
| Barges | 17 | 100.0 | 22 | 100.0 | 18 | 100.0 | 24 | 100.0 |
| ≤ 7m | 6 | 35.3 | 6 | 27.3 | 7 | 38.9 | 11 | 45.8 |
| > 7m, ≤10m | 2 | 11.8 | 4 | 18.2 | 1 | 5.6 | 1 | 4.2 |
| >10m | 9 | 52.9 | 12 | 54.4 | 10 | 55.5 | 12 | 50.0 |
| Other (without engine) | 20 | 100.0 | 33 | 100.0 | 11 | 100.0 | 13 | 100.0 |
| ≤ 7m | 17 | 85.0 | 30 | 90.9 | 10 | 90.9 | 12 | 92.3 |
| > 7m, ≤10m | 3 | 15.0 | 2 | 6.1 | 1 | 9.1 | 1 | 7.7 |
| >10m | 0 | 0.0 | 1 | 3.0 | 0 | 0.0 | 0 | 0.0 |
| ALL VESSEL TYPES | 314 | 100.0 | 367 | 100.0 | 530 | 100.0 | 708 | 100.0 |
| ≤ 7m | 139 | 44.3 | 156 | 42.5 | 156 | 29.4 | 123 | 17.4 |
| > 7m, ≤10m | 65 | 20.7 | 69 | 18.8 | 180 | 34.0 | 254 | 35.9 |
| >10m | 110 | 35.0 | 142 | 38.7 | 194 | 36.6 | 331 | 46.7 |

*Source: Traffic baseline survey, 2010*

Figure E2.1 Frequency of vessels, all types, Nga Bac-Ca Mau station (24h), 2009

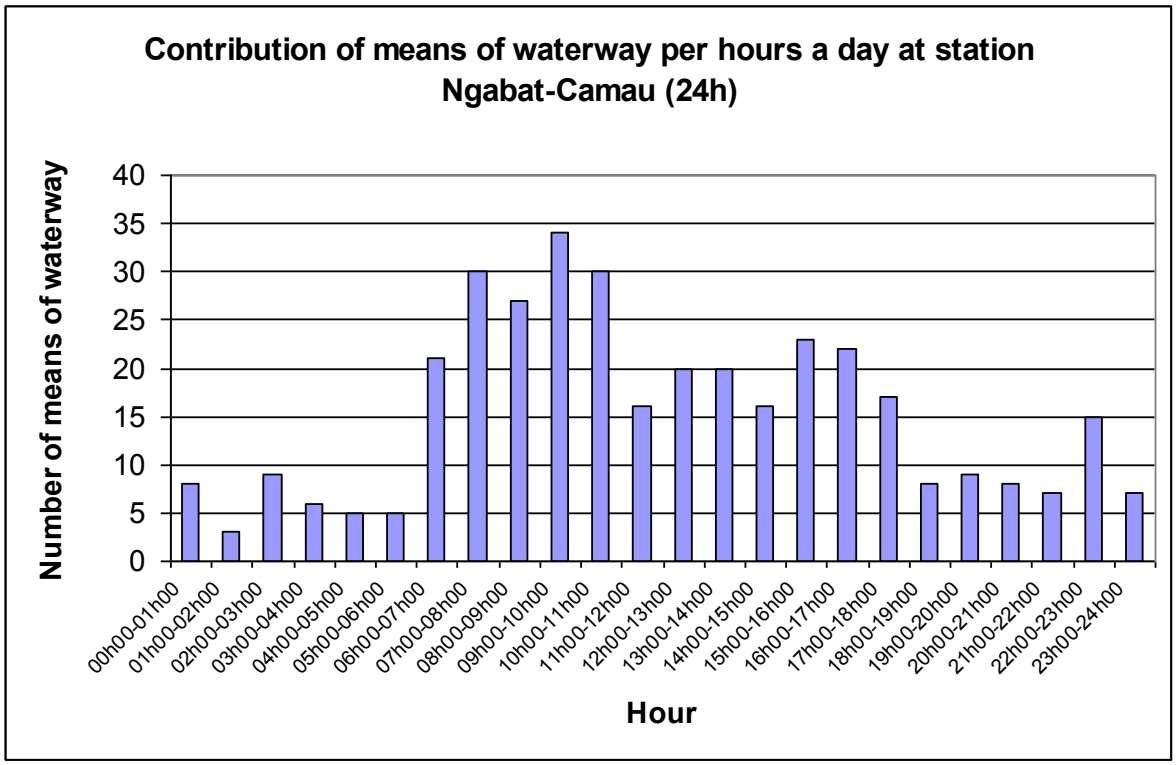
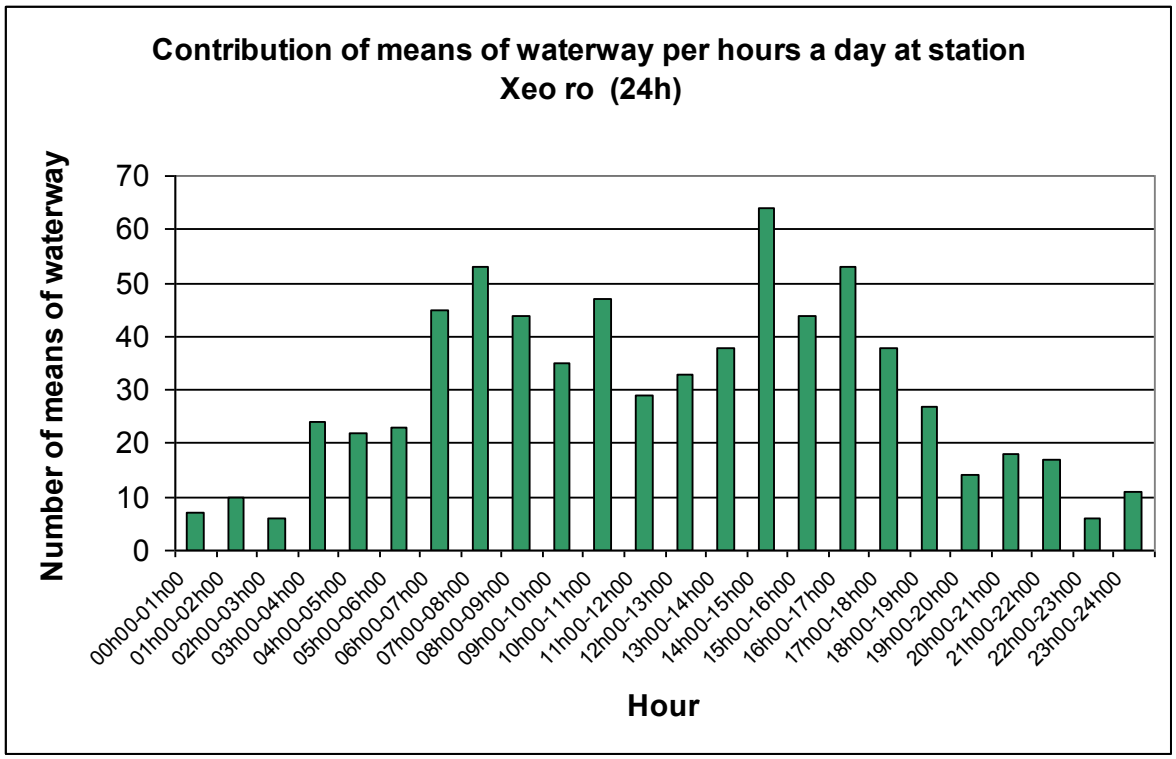



Figure E2.2 Frequency of vessels, all types, Xeo Ro station, 2009



## E.3 Vehicle occupancy survey

Performance indicator: Although vehicle occupancy is not an indicator of performance based on the results framework, it was included in the survey to determine if improved roads have any influence on the efficient use of vehicles. The vehicle occupancy survey gathered data on the number of passengers per trip and per type of vehicle to determine the vehicle occupancy rate, which is calculated as the number of vehicles over the number of passengers per trip. The average occupancy rate was taken for three types of vehicle, namely, cars, mini buses and buses. The results are shown in **Table E3.1**.

Findings:

a. Cars appear to be the most common type of passenger vehicle that crosses the border during the 08h to 16h shift, and this was confirmed during a focus group discussion attended by local people. The average occupancy rate is just a little over 50 percent. In all stations, the average occupancy rate ranges from a low of 30 percent (Nga Bac to Ca Mau station) to a high of 57 percent (Xa Xia to Ha Tien and Thu Bay to Vinh Thuan stations) (**Table E3.1**).

Table E3.1 Average occupancy rate by type of vehicle, 08h to 16h, 5 stations, 2009

| Station/ Vehicle Type | Total Number of Vehicles Surveyed (number of vehicles) | Total Design Capacity (number of passengers) | Total Passenger Count (number of passengers) | Average Occupancy Rate (%) |
|---|---|---|---|---|
| Station 1: At cross border | | | | |
| 1. Car | 9 | 64 | 35 | 55% |
| 2. Mini bus | 5 | 56 | 25 | 45% |
| 3. Bus | 1 | 46 | 44 | 96% |
| Station 2: Xa Xia to Ha Tien | | | | |
| 1. Car | 10 | 47 | 27 | 57% |
| 2. Mini bus | 7 | 56 | 17 | 30% |
| 3. Bus | 4 | 166 | 81 | 49% |
| Station 3: Thu Bay to Nga Bac | | | | |
| 1. Car | 4 | 28 | 17 | 61% |
| 2. Mini bus | 65 | 1447 | 1199 | 83% |
| 3. Bus | 3 | 79 | 44 | 56% |
| Station 4: Nga Bac to Ca Mau | | | | |
| 1. Car | 46 | 212 | 64 | 30% |
| 2. Mini bus | 52 | 901 | 417 | 46% |
| 3. Bus | 2 | 58 | 6 | 10% |
| Station 5: Thu Bay to Vinh Thuan | | | | |
| 1. Car | 44 | 213 | 122 | 57% |
| 2. Mini bus | 34 | 512 | 266 | 52% |
| 3. Bus | 40 | 1589 | 1004 | 63% |
| Average of Station 1 to Station 2 | | | | |

| Station/ Vehicle Type | Total Number of Vehicles Surveyed (number of vehicles) | Total Design Capacity (number of passengers) | Total Passenger Count (number of passengers) | Average Occupancy Rate (%) |
|---|---|---|---|---|
| 1. Car | 13 | 111 | 62 | 56% |
| 2. Mini bus | 12 | 112 | 42 | 38% |
| 3. Bus | 5 | 125 | 88 | 70% |
| Average of Station 3 to Station 5) | | | | |
| 1. Car | 94 | 453 | 203 | 45% |
| 2. Mini bus | 151 | 2860 | 1882 | 66% |
| 3. Bus | 45 | 1726 | 1054 | 61% |

*Source: Traffic Baseline Survey, 2010*

b. There is only one observation for buses at the cross border, which validates the lowest share of buses (2.9 percent based on PCU equivalent) in the road traffic count. With the limited number of buses crossing the border, it is reasonable to maximize occupancy for each trip. This is observed at 96 percent.

c. For mini buses, it appears that those plying the Thu Bay to Nga Bac sector are better off with occupancy rate at 83 percent, compared to those at the other sectors where the rates are from 30 percent (Xa Xia to Ha Tien) to 52 percent (Thu Bay to Vinh Thuan).

d. The relatively low occupancy rate in general is likely due to the poor road network and poor bus service system, which makes the waterway system a better alternative for moving people and goods.

e. The expectation is that improved border facilities would hasten tourism and trade between the two countries, at the same time boost economic activities and subsequently, improve the occupancy rate for road transport vehicles. These will be assessed during the end-of-project evaluation.

## E.4 Origin-destination survey

Performance indicator: Travel pattern and vehicle flow through the origin-destination (O-D) survey are not indicators of performance based on the results framework. Their inclusion is due to a presupposition that travel patterns would change as new roads are constructed or as existing roads are improved.

Findings:

The O-D survey required interviewing drivers and passengers and collecting data on where their trip originated (origin) and where they are headed to (destination) as well as on travel patterns. This survey adopted the zoning and zone codes used in past studies, and these are listed in **Table E4.1** below and shown in **Figure E4.1**.

Table E4.1 Origin–destination traffic zones

| Zone | District, Province | Zone | District, Province | Zone | District, Province |
|---|---|---|---|---|---|
| 1 | Rạch Giá | 22 | Châu Đốc | 43 | Vĩnh Lợi |
| 2 | Hà Tiên | 23 | An Phú | 44 | Sóc Trăng |
| 3 | An Biên | 24 | Châu Phú | 45 | Kế Sách |
| 4 | An Minh | 25 | Châu Thành | 46 | Long Phú |
| 5 | Châu Thành | 26 | Chợ Mới | 47 | Mỹ Tú |
| 6 | Giồng Riềng | 27 | Phú Tân | 48 | Mỹ Xuyên |
| 7 | Gò Quao | 28 | Tân Châu | 49 | Thạnh Trị |
| 8 | Hòn Đất | 29 | Thoại Châu | 50 | Vĩnh Châu |
| 9 | Kiên Hải | 30 | TịnhBiên | 51 | Hậu Giang |
| 10 | Kiên Lương | 31 | Tri Tôn | 52 | Vĩnh Long |
| 11 | Phú Quốc | 32 | Cần Thơ | 53 | Trà Vinh |
| 12 | Tân Hiệp | 33 | Vị Thanh | 54 | Bến Tre |
| 13 | Vĩnh Thuận | 34 | Châu Thành | 55 | Tiền Giang |
| 14 | Cà Mau | 35 | Long Mỹ | 56 | Đồng Tháp |
| 15 | Cái Nước | 36 | Ô Môn | 57 | Long An |
| 16 | Đầm Dơi | 37 | Phụng Hiệp | 58 | BRVT |
| 17 | Ngọc Hiển | 38 | Thốt Nốt | 59 | Đồng Nai |
| 18 | Thới Bình | 39 | Vị Thủy | 60 | HCM |
| 19 | Trần Văn thời | 40 | Bạc Liêu | 61 | Rest of Vietnam |
| 20 | U Minh | 41 | Giá Rai | 62 | Cambodia |
| 21 | Long Xuyên | 42 | Hồng Dân | 63 | Thailand |

**Vehicle flow for all vehicles**

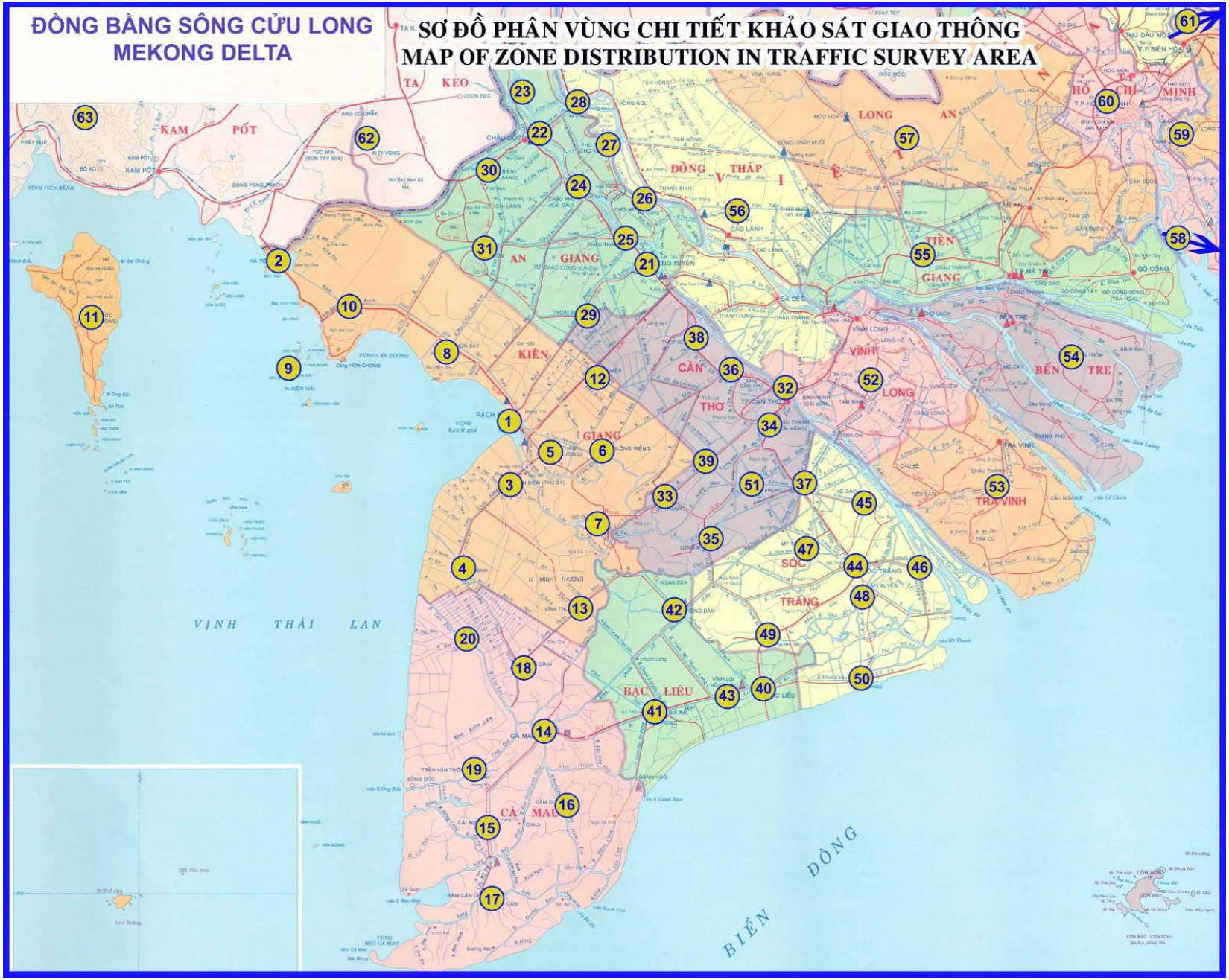
a. The O-D matrix covering 638 vehicles of various types is shown in **Annex D1** and summarized in **Table E4.2** below. Observations in 11 zones account for about 92 percent of the total observations. The top five (5) popular origins/destinations are Ca Mau (22.0 percent), Ha Tien (13.2 percent), Rach Gia (12.1 percent), An Minh (11.4 percent) and Thoi Binh (11.1 percent). Ca Mau appears to be the most popular origin/destination despite the poor road network probably due to the presence of an industrial zone in that province. Altogether, five zones (HCM, An Bien, Chau Thanh, Cambodia, Long Xuyen) account for almost 11 percent of the total observations. These are also considered influence areas of GMS-SCCP, thus, improvements in vehicle flow are expected when the project is completed.

Table E4.2 – Proportion of vehicles going to/coming from zone origin/destination ranked by importance, all vehicles, 2009

| Zone Number | Zone Area | Ratio |
|---|---|---|
| Zone 14 | TP Cà Mau | 22.0% |
| Zone 2 | Hà Tiên | 13.2 % |
| Zone 1 | Rạch Giá | 12.1 % |
| Zone 4 | An Minh | 11.4 % |
| Zone 18 | Thới Bình | 11.1 % |
| Zone 13 | Vĩnh Thuận | 10.5 % |
| Zone 60 | TP HCM | 3.9% |
| Zone 3 | An Biên | 3.3% |
| Zone 5 | Châu Thành | 2.2% |
| Zone 32 | Cần Thơ | 1.4% |
| Zone 62 | Cambodia | 0.6 % |
| Zone 21 | Long Xuyên | 0.4% |

*Source: Annex D1*

Figure E4.1. Map of O-D zones in survey area



b. There are origin/destination zones with observations that are about twice higher than in 2005. These are the zones with large intra-city, town or district movement in Kien Giang and Ca Mau. There is also vehicle flow to Cambodia. Given the pace of development in Kien Giang and Ca Mau recent years, it is expected that the local economy would be more progressive when the the GMS-SCCP road improvements are completed.

**Vehicle flow for passenger vehicles**

**Annex D2** shows the O-D matrix for 318 passenger vehicles covered by the 2010 survey, while a summary is presented in **Table E4.3** below. Out of the total observations, close to 94 percent are confined in 12 zones. The top six (6) popular origins/destinations --- Ca Mau (24.5 percent), Rach Gia (16.5 percent), An Minh (11.6 percent), Thoi Binh (11.3 percent), Ha Tien and Vinh Thuan (9.0 percent each) --- account for about 82 percent.

Table E4.3 – Proportion of vehicles going to/coming from zone origin/destination ranked by importance, passenger vehicles, 2009

| Zone Number | Zone Area | Ratio |
|---|---|---|
| Zone 14 | TP Cà Mau | 24.5% |
| Zone 1 | Rạch Giá | 16.5 % |
| Zone 4 | An Minh | 11.6 % |
| Zone 18 | Thới Bình | 11.3 % |
| Zone 2 | Hà Tiên | 9.0 % |
| Zone 13 | Vĩnh Thuận | 9.0 % |
| Zone 60 | HCMC | 4.6% |
| Zone 3 | An Biên | 3.1 % |
| Zone 5 | Châu Thành | 2.2 % |
| Zone 32 | Cần Thơ | 0.9 % |
| Zone 62 | Cambodia | 0.6 % |
| Zone 21 | Long Xuyên | 0.3% |

*Source: Annex D2*

**Vehicle flow for trucks**

Some 320 observations in 26 zones were collected for the O-D survey for trucks, and these are presented in **Annex D3.** The summary in **Table E4.4** below shows the 14 zone areas that comprise almost 95 percent of the total observations for trucks. Five important zone areas --- Ca Mau, Ha Tien, Vinh Thuan, An Minh Thoi Binh --- make up 71 percent of the total.

Table E4.4 – Proportion of vehicles going to/coming from zone origin/destination ranked by importance, trucks only, 2009

| Zone Number | Zone Area | Ratio |
|---|---|---|
| Zone 14 | TP Cà Mau | 19.4% |
| Zone 2 | Hà Tiên | 17.3 % |
| Zone 13 | Vĩnh Thuận | 12.0 % |
| Zone 4 | An Minh | 11.3 % |
| Zone 18 | Thới Bình | 10.9 % |
| Zone 1 | Rạch Giá | 7.7 % |

| Zone Number | Zone Area | Ratio |
|---|---|---|
| Zone 3 | An Biên | 3.4 % |
| Zone 60 | HCMC | 3.3% |
| Zone 40 | Bạc Liêu | 2.5 % |
| Zone 5 | Châu Thành | 2.2 % |
| Zone 32 | Cần Thơ | 1.9 % |
| Zone 10 | Kiên Lương | 1.5% |
| Zone 62 | Cambodia | 0.6 % |
| Zone 21 | Long Xuyên | 0.5% |

*Source: Annex D3*

**Vehicle flow: 2005 and 2009**

A similar survey was carried out in 2005 under the ADB's PPTA for the GMS-SCCP. The survey covered 16 zones and all vehicle types. The results of that survey are shown in **Annex D4.** The vehicle flow in ten (10) zone areas (**Table E4.5**) makes up about 92 percent of the total observations. It could be noted that the travel pattern is concentrated in the Rạch Giá, Ho Chi Minh City and Cần Thơ zones. At that time, the flow of vehicles going to Cambodia is practically *nil*. It appears that this has slightly improved even prior to GMS-SCCP implementation, with significant improvements expected when project implementation is completed.

Table E4.5 – Proportion of vehicles going to/coming from zone origins/destinations ranked by importance, all vehicle types, 2005

| Zone Number | Zone Area | Ratio |
|---|---|---|
| Zone 1 | Rạch Giá | 41.1% |
| Zone 60 | HCMC | 10.7 % |
| Zone 32 | Cần Thơ | 7.4 % |
| Zone 12 | Tân Hiệp | 5.5 % |
| Zone 3 | An Biên | 7.4 % |
| Zone 13 | Vĩnh Thuận | 6.0 % |
| Zone 4 | An Minh | 5.5% |
| Zone 21 | Long Xuyên | 4.6% |
| Zone 2 | Hà Tiên | 2.5 % |
| Zone 14 | Cà Mau | 1.4% |

*Source: Annex D4*

## E.5 Axle load survey

Performance indicator: Axle load is not an indicator of performance in GMS-SCCP, but its measurement had been included given the actual axle loads that normally breach the threshold, thus, negatively affecting the longer sustained use of improved roads.

Findings:

a. The results of the axle load weight survey are shown in **Table E5.1** and **Table E5.2**.

b. The average axle load along the Xa xia is about 11 tons, with the highest observation at 21 tons (**Table E5.2**). At Station 3, there are only trucks with axle load of lesser than 10 tons. The number of light and medium trucks accounts for most of the total truck traffic volume.

c. The ESAL calculation shows a low rate per truck. However, the incidence of overload is rather high and the overload rates are relatively high as well ranging from 33 percent (Xa Xia to Ha Tien) to 108 percent (Thu Bay to Nga Bac) (**Table E5.1**).

Table E5.1 - ESAL result and overload estimates, 2009

| No. | Road Sector/Direction | ESAL | Total Load (kg) | Average Design Load (kg) | Overload Ratio |
|---|---|---|---|---|---|
| 1 | Xa Xia – Ha Tien sector | 0.3581 | 5,759 | 3663.793 | 1.572 |
| 1.1 | Xa Xia to Ha Tien | 0.4555 | 8,536 | 6403.833 | 1.333 |
| 1.2 | Ha Tien to Xa Xia | 0.2607 | 6,981 | 5014.667 | 1.392 |
| 2 | Thu Bay – Nga Bac sector | 0.0307 | 4,426 | 2300.154 | 1.924 |
| 2.1 | Thu Bay to Nga Bac | 0.0312 | 4,587 | 2203.750 | 2.081 |
| 2.2 | Nga Bac to Thu Bay | 0.0302 | 4,265 | 2396.559 | 1.780 |

*Source: Traffic Baseline Survey, 2010*

Table E5.2 – Results of axle load survey, 2 locations, 2 days and 2 shifts per day, 2009

| Station | No. of Vehicles Surveyed | Total Axle Load (ton) | Average Axle Load Per Vehicle (ton) | Highest Axle Load Observation (ton) | Load Axis of < 5 tons | | Load Axis of 5 to 10 tons | | Load Axis of >10 tons to 15 tons | | Load Axis of > 15 tons | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | No. of Trucks | Rate (%) | No. of Trucks | Rate (%) | No. of Trucks | Rate (%) | No. of Trucks | Rate (%) |
| Station 1 | | | | | | | | | | | | |
| 1st day | 19 | 194,900 | 10,258 | 16,62 | 12 | 63% | 12 | 63% | 2 | 11% | 5 | 26% |
| 2nd day | 18 | 150,940 | 8,385 | 20,74 | 5 | 28% | 6 | 33% | 3 | 17% | 3 | 17% |
| Total | 37 | | | | 17 | | 18 | | 5 | | 8 | |
| Station 2 | | | | | | | | | | | | |
| 1st day | 35 | 147,660 | 8,433 | 7,70 | 26 | 74% | 9 | 26% | 0 | 0% | 0 | 0% |
| 2nd day | 25 | 114,080 | 9,456 | 8,40 | 15 | 60% | 10 | 40% | 0 | 0% | 0 | 0% |
| Total | 60 | | | | 41 | | 19 | | 0 | | 0 | |

*Source: Traffic Baseline Survey, 2010*

## E.6 Travel time survey

Performance indicator: Reduced travel time due to improved roads and construction of new roads is an expected outcome of GMS-SCCP, although this is not explicitly stated in the Results Framework. Savings from travel time per trip are expected to optimize the use of transport vehicles, at the same time enable travelling passengers to make productive use of these.

Findings:

a. The results of travel time measurements are shown in **Table E6.1**. The average travel time for one direction from Xa Xia to Ha Tien, a 4-km stretch, ranges from 7.4 to 8.3 minutes. This translates to driving speed of only 16 kph.

b. For one direction of the 85-km stretch from Thu Bay to Ca Mau, travel time ranges from 150 to 156 minutes. This is equivalent to a speed of between 33 to 34 kph.

c. The space mean of vehicles in one direction is also low ranging from 28.9 kph at the Xa Xia to Ha Tien road sector, to 35.5 kph at the Thu Bay to Ca Mau road sector.

d. Vehicle density is likewise low at 5 vehicles per km along the Thu Bay to Ca Mau stretch, and 10 vehicles per km along the Xa Xia to Ha Tien stretch.

e. Poor road pavement conditions coupled with poor vehicle conditions account for poor performance in travel time. Improving the road network is expected to significantly increase travel time. This will be ascertained during the final evaluation when a similar survey will be conducted.

Table E6.1 Results of travel time survey, 2009

| No | Survey Section | Length (km) | Hourly Volume of Vehicles [V] | | Average Travel Time [T] | | Space Mean [S] of Vehicle in One Direction | |
|---|---|---|---|---|---|---|---|---|
| | | | $V_n$ (no./h) | $V_s$ (no./h) | $T_n$ (min) | $T_s$ (min) | $S_n$ (km/h) | $S_s$ (km/h) |
| I | **SECTION THU BAY - CA MAU** | | | | | | | |
| | Total for two directions | | 381.00 | | 305.38 | | 34.91 | |
| | Average for one direction | 85.0 | 184 | 197 | 149.56 | 155.82 | 35.48 | 34.33 |
| 1 | Segment 1: Ca Mau - Giao Khau | 14 | 299 | 324.5 | 23.3 | 23.9 | 35.6 | 35.20 |
| | | | 281 | 339 | 22.99 | 23.72 | 36.54 | 35.41 |
| | | | 320 | 310 | 23.50 | 24.06 | 35.74 | 34.91 |
| | | | 295 | | 23.50 | | 34.45 | |
| 2 | Segment 2: Giao Khau - Vinh Thuan | 32 | 141 | 171.5 | 52.0 | 48.5 | 39.0 | 39.70 |

| No | Survey Section | Length (km) | Hourly Volume of Vehicles [V] | | Average Travel Time [T] | | Space Mean [S] of Vehicle in One Direction | |
|---|---|---|---|---|---|---|---|---|
| | | | $V_n$ (no./h) | $V_s$ (no./h) | $T_n$ (min) | $T_s$ (min) | $S_n$ (km/h) | $S_s$ (km/h) |
| | | | 125 | 158 | 50.60 | 50.87 | 37.94 | 37.74 |
| | | | 152 | 185 | 48.53 | 46.14 | 39.56 | 41.61 |
| | | | 145 | | 56.79 | | 39.56 | |
| 3 | Segment 3: Vinh Thuan - Thu Bay | 39 | 112 | 95.0 | 74.3 | 83.4 | 31.9 | 28.2 |
| | | | 113 | 93 | 64.89 | 88.45 | 36.06 | 26.46 |
| | | | 111 | 97 | 83.62 | 78.4 | 27.98 | 29.85 |
| | | | 113 | | 74.26 | | 31.51 | |
| II | SECTION XA XIA - HA TIEN | | | | | | | |
| | Total for two directions | | 634.00 | | 15.75 | | 30.64 | |
| | Average for one direction | | 338 | 296 | 7.43 | 8.32 | 32.40 | 28.90 |
| 1 | Xa Xia - Ha Tien | 4 | 282 | 291 | 7.49 | 8.24 | 32.04 | 29.13 |
| | | | 373 | 300 | 7.97 | 8.40 | 30.11 | 28.57 |
| | | | 360 | | 6.83 | | 35.14 | |

*Note: Subscript n: From Ca mau, Xa Xia; s: From Thu Bay, Ha Tien*
*Source: Traffic Baseline Survey, 2010*

## E.7 IRI survey

Performance indicators: That the IRI for improved Xa Xia to Ha Tien road sector also improves over baseline [2009] and complies with GoV IRI standard of ≤ 3.0 m/km at final inspection and before acceptance from contractor; and

That the IRI for the new Thu Bay to Nga Bac road sector complies with GoV IRI standard of ≤ 2.2 m/km at final inspection and before acceptance from contractor.

Findings:

a. Based on measurements, the results of IRI estimates for NH80 (Xa Xia to Ha Tien) and NH63 (Tac Cau Ferry to Ca Mau) are shown in **Table E7.1** on the next page.

b. For the Xa Xia to Ha Tien road sector that is for improvement under GMS-SCCP, the mean IRI for various road segments ranges from 3.9 m/km to 6.1 m/km. All IRI estimates are higher than the GoV standard (≤ 3.0 m/km) by a range of 30.0 percent to 103.0 percent.

Table E7.1 Average segment IRI, Xa Xia to Ha Tien and Tac Cau Ferry to Ca Mau, 2009

| No. | Road Segments | Mean IRI (m/km) | Road Segments | Mean IRI (m/km) |
|---|---|---|---|---|
| | NH80 (Xa Xia to Ha Tien) | | NH63 (Tac Cau Ferry to Ca Mau) | |
| 1 | km 211 + 100 ÷ Km 211 + 600 | 3.9 | km 5+400 -:- Km 21+500 | 2.9 |
| 2 | km 211 + 600 ÷ Km 212 + 000 | 5.4 | km 21+500 -:- Km 29+500 | 4.6 |
| 3 | km 212 + 000 ÷ Km 212 + 300 | 4.5 | km 29+500 -:- Km 42+500 | 4.3 |
| 4 | km 212 + 300 ÷ Km 212 + 600 | 5.0 | km 42+500 -:- Km 54+000 | 3.8 |
| 5 | km 212 + 600 ÷ Km 213 + 300 | 5.8 | km 54+000 -:- Km 56+500 | 4.5 |
| 6 | km 213 + 300 ÷ Km 213 + 600 | 5.0 | km 56+500 -:- Km 74+000 | 4.0 |
| 7 | km 213 + 600 ÷ Km 214 + 300 | 4.5 | km 74+000 -:- Km 88+300 | 6.4 |
| 8 | km 214 + 300 ÷ Km 215 + 000 | 6.1 | km 88+300 -:- Km 103+000 | 5.4 |
| 9 | km 215 + 000 ÷ Km 215 + 500 | 5.4 | km 103+00 -:- Km 110+000 | 4.8 |
| | GoV standard for improved roads | ≤ 3.0 | GoV standard for new roads | ≤ 2.2 |

*Source: Traffic Baseline Survey, 2010*

c. For the Thu Bay to Nga Bac road sector that is for construction, the mean IRI for various road segments along the Tac Cau Ferry to Ca Mau sector ranges from 2.9 m/km to 6.4 m/km. These observations are also higher than the GoV standard (≤ 2.2 m/km) by a range of 31.8 percent to 190.9 percent.

d. In order to meet final inspection and acceptance requirements for all road improvements and construction under GMS-SCCP, the same measurement procedures to estimate IRI will have to be carried out by the DDIS Consultant.

## E.8 Vehicle operating cost survey

Performance indicator: Passenger and freight vehicle operating costs reduced by an average of 30 percent, in real terms, within 5 years of Project completion.

Findings:

a. The findings are based on key informant interviews --- 34 operators of passenger vehicles, 50 operators of cargo transport vehicles, 20 individual car owners and 27 individual motorcycle owners --- or a total of 131 respondents. Some 75 respondents are in Ha Tien-Kien Giang, and 56 are in Ca Mau. The results are summarized in **Table E8.1**.

b. Most of the vehicles covered by the survey are below 5 years old on the average, except for the buses in the Ha Tien-Kien Giang area and for most of the truck types.

c. Except for motorcycles, the average mileage per year is generally higher in the Ca Mau area than in the Ha Tien-Kien Giang area, which could be explained by the distance to the major commercial and service areas. A comparison of average mileage for selected vehicle types is shown in **Table E8.2**.

Table E8.1 Average vehicle operating costs per year by type of vehicle, Ha Tien-Kien Giang area and Ca Mau area, 2009

| TT | Type of Vehicle | Average Age of Vehicle (year) | Average Mileage (km) | Average Fuel Cost (1000 VNĐ) | Average Oil Cost (1000 VND) | Replacement Tire (1000 VND) | Average Maintenance Cost (1000 VND) | Average Driver Wage (1000 VND) | Volume of Cargo/ Passengers (ton/pas.) | Other Cost (1000 VND) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Ha Tien-Kien Giang Area** | | | | | | | | | | |
| 1 | Car | 4.7 | 28240 | 54232 | 2112 | 5667 | 10840 | 26880 | - | 1836 |
| 2 | Mini bus | 3.8 | 45400 | 87780 | 3240 | 7471 | 14400 | 34650 | 4240 | 11400 |
| 3 | Bus | 8 | 72000 | 249400 | 13152 | 78250 | 37500 | 44400 | 13600 | 25500 |
| 4 | Motorcycle | 3 | 12109 | 4777 | 707 | 258 | 764 | - | - | 412 |
| 5 | Truck | | | | | | | | | |
| | <2.5 t | 3.4 | 21600 | 46980 | 2415 | 6917 | 9200 | 27943 | 191 | 1824 |
| | >2.5t ≤5t | 6.7 | 31200 | 65126 | 5057 | 12000 | 3800 | 32571 | 960 | 18000 |
| | >5t ≤10t | 7.2 | 34260 | 93984 | 6247 | 18333 | 14400 | 54000 | 1833 | 22800 |
| | >10t | 6.5 | 49800 | 162778 | 10560 | 35000 | 56000 | 60000 | 2496 | 28080 |
| **Ca Mau Area** | | | | | | | | | | |
| 1 | Car | 2 | 31400 | 57798 | 5316 | 6517 | 21600 | 26640 | 930 | 5733 |
| 2 | Mini bus | 4.9 | 92880 | 18720 | 12480 | 10414 | 21800 | 50250 | 7932 | 28080 |
| 3 | Bus | 4.6 | 72750 | 24480 | 27300 | 87000 | 45600 | 54120 | 16500 | 43560 |
| 4 | Motorcycle | 4 | 13400 | 4900 | 695 | 250 | 860 | - | - | 540 |
| 5 | Truck | | | | | | | | | |
| | <2.5 t | 3.7 | 54857 | 89486 | 9171 | 7286 | 14229 | 41000 | 343 | 15771 |
| | >2.5t ≤5t | 3.5 | 68308 | 116446 | 10985 | 18000 | 15877 | 52708 | 946 | 16292 |

*Source: Traffic Baseline Survey, 2010*

Table E8.2 Comparative average mileage per year by vehicle type, Ha Tien-Kien Giang and Ca Mau areas

| Vehicle Type | Ha Tien-Kien Giang | | | Ca Mau Area | | |
|---|---|---|---|---|---|---|
| | Total Mileage [km] | Average Age [years] | Average Mileage [km/year] | Total Mileage [km] | Average Age [years] | Average Mileage [km/year] |
| Car | 28,240 | 4.7 | 6,000 | 31,400 | 2.0 | 15,700 |
| Mini bus | 45,400 | 3.8 | 12,000 | 92,880 | 4.9 | 19,000 |
| Bus | 72,000 | 8.0 | 9,000 | 72,750 | 4.6 | 16,000 |
| Motorcycle | 12,109 | 3.0 | 4,000 | 13,400 | 4.0 | 3,400 |
| Truck | | | | | | |
| < 2.5 t | 21,600 | 3.4 | 6,400 | 54,857 | 3.7 | 15,000 |
| ≤ 5.0 t | 31,200 | 6.7 | 4,700 | 68,308 | 3.5 | 20,000 |

*Source of basic data: Table E8.1*

d. The annual average operating cost in most vehicle types is higher in Ca Mau area than in the Ha Tien-Kien Giang area --- by 21.6 percent for cars, by 4.3 percent for motorcycles, by 85.6 percent for the ≤ 2.5t trucks, and by 68.6 percent for the ≤ 5t trucks. However, the annual average operating cost per km is lower (except for cars), which seems to show that vehicles in the Ca Mau area are more cost-efficient (**Table E8.3**).

Table E8.3 Comparative operating cost by vehicle type, Ha Tien-Kien Giang and Ca Mau areas

| Vehicle Type | Ha Tien-Kien Giang | | | Ca Mau Area | | |
|---|---|---|---|---|---|---|
| | Average Mileage [km/year] | Average Operating Cost [1000 VND/year] | Average Operating Cost [VND/km] | Average Mileage [km/year] | Average Operating Cost [1000 VND/year] | Average Operating Cost [VND/km |
| Car | 28,240 | 101,600 | 3,600 | 31,400 | 123,600 | 3,940 |
| Mini bus | 45,400 | 158,900 | 3,500 | 92,880 | 141,700 | 1,530 |
| Bus | 72,000 | 448,200 | 6,225 | 72,750 | 282,100 | 3,880 |
| Motorcycle | 12,109 | 6,900 | 570 | 13,400 | 7,200 | 540 |
| Truck | | | | | | |
| < 2.5 t | 21,600 | 95,300 | 4,410 | 54,857 | 176,900 | 3,220 |
| ≤ 5.0 t | 31,200 | 136,600 | 4,380 | 68,308 | 230,300 | 3,370 |

*Source of basic data: Table E8.1*

## E.9 Cross border processing time

Performance indicator: Cross border processing times for passengers and freight approximate the times agreed in accordance with the GMS-CBTA.

Findings:

a. At the time of the survey, observed processing time was not in accordance with any systematic procedures that are typical along cross borders. Data gathering was therefore non-systematic as well, depending largely on discussions with the local people, drivers and passengers as well as on direct observations by surveyors.

b. The most common vehicles that cross the border are motor bikes of people living close to the border, 4-7 seating capacity cars carrying people with business between two countries, and medium trucks as well. However, the number of vehicles is not large because of very limited trading activities and the poor condition of roads that negatively impact on trade.

c. According to drivers, most trucks do not cross the border. Instead, goods are transported to the area, are stored in warehouses for a limited time, and then are moved across the border later. Key informants estimate that about 10 percent of vehicles cross the border, while the remaining 90 percent stop at nearby warehouses to unload cargo for storage. The daily average volume of goods transported across the border is estimated at 100-200 tons. Since Xa Xia is not the main border of the country, the gate closes at 21h. Vehicles are allowed circulation only during the day time.

d. It takes an average of 15 to 20 minutes of processing time per vehicle to check-in at the border gate.

e. At the border area, transportation charges for goods are mainly based on the agreement between the owner of cargoes and the transport operator. In general, these are higher than the prescribed charges based on a GoV decision for cargo transport.

## F. CHALLENGES

The road condition in the Project area is generally poor as evidenced by:

a. Relatively low road traffic count vis-à-vis the popularity in use of the water way system for moving goods and people;
b. Existence of relatively fewer „good' vehicles;
c. IRI estimates that are way above the standards set by GoV;
d. Inefficient use of vehicles as shown by the relatively low vehicle occupancy rate;
e. Generally high vehicle operating cost especially for trucks, which add up to the cost of goods paid by consumers;
f. Travel pattern that is limited by the availability of better roads;
g. Cross border processing time that is based on non-systematic processing procedures, which also influence the cost of goods paid by consumers.

The above could be viewed as challenges in the implementation of GMS-SCCP. The success of GMS-SCCP will be measured in terms of the key performance indicators and targets set out in the Results Framework, and against baseline data from this traffic survey and the socio-economic survey. These measurements will be done at the end of implementation when a final evaluation is carried out, and within 5 years from project completion when an impact evaluation is done by Government.

These are challenges to PMU-MT as implementing agency for GMS-SCCP, and to the DDIS Consultant that is tasked with providing technical support and supervision during construction works.

# ANNEXES

## Design and Monitoring Framework

| Design Summary | Performance Targets/Indicators | Data Sources/Reporting Mechanisms | Assumptions and Risks |
|---|---|---|---|
| **Impact**<br>Promotion of economic growth in the project area and GMS by strengthening connectivity with neighbouring countries and increasing competitiveness | • Average per capita income in project-affected provinces will reach the national average within 5 years of project completion<br>• Total trading volume between Cambodia and Viet Nam will double 5 years after project completion | • National and regional economic data and statistics<br>• International trade statistics<br>• Baseline and ex-post surveys of household income levels in project affected areas<br>• Project completion report and benefit monitoring and evaluation | **Assumption**<br>• GMS CBTA is fully implemented |
| **Outcome**<br>Reduce transport times and costs, and induce more efficient movement of passengers and goods within the project area and between GMS countries | • Reduction in passenger and freight vehicle operating costs by an average of 30 percent, in real terms, within 5 years of project completion<br>• Traffic on improved roads increases by 40 percent from 2008 baseline within 2 years of project completion<br>• Cross border processing times for passengers and freight approximate the times agreed in accordance with the GMS-CBTA<br>• IRI of improved Xa Xia to Ha Tien road sector improves over baseline and [2009] and complies with GoV IRI standard of ≤ 3.0 m/km at final inspection and before acceptance from contractor<br>• IRI of new Thu Bay to Ca Mau road sector complies with GoV IRI standard of ≤ 2.2 m/km at final inspection and before acceptance from contractor<br>• Road traffic accident reduced from baseline [2009] within 2 years of project completion | • Baseline traffic and transport cost data<br>• Traffic counts at border crossings and strategic points in the transport network<br>• Customs statistics<br>• Field surveys and interviews of road transport operators and road users | **Assumptions**<br>• GMS CBTA is implemented at pilot sites<br>• Reciprocal operating permits are granted to commercial passenger and goods vehicles<br><br>**Risks**<br>• Harmonized cross border inspection are not implemented effectively |

| Design Summary | Performance Targets/Indicators | Data Sources/Reporting Mechanisms | Assumptions and Risks |
|---|---|---|---|
| **Outputs**<br><br>1. Completion of the road and bridge improvements enabling unrestricted passenger and freight transport | 1.1 In Viet Nam, improve:<br>• 4 km of QL80 between Xa Xia and Ha Tien<br>• Transport corridor from Thu Bay to Nga Bac and from Nga Bac to Ca Mau [km 170+909 to km 209+445]<br>1.2 In Viet Nam, construct 70 bridges<br>1.3 Finalization, approval and implementation of resettlement plans and environmental management plans without delays | • Resettlement monitoring reports<br>• Civil works bid evaluation and award of contract reports<br>• Monthly and quarterly progress reports<br>• Project completion report | **Assumptions**<br><br>• Procurement processes ensure bidders are qualified<br>• Quality management and cost control of<br>• civil works are effective<br>• Provincial authorities have the capacity to<br>• Manage resettlement, environmental management, and social action plans<br><br>**Risks**<br>• Insufficient number of bids are received from qualified, eligible bidders<br>• Delays in completion of procurement or resettlement delay start of construction |
| | 1.4 Civil works contracts awarded within 9 months of invitation for bids<br>1.5 Unexploded ordinance cleared prior to start of civil works<br>1.6 Completion of civil works contracts on schedule, in compliance with conditions of contract, and all defects rectified by end of defects liability period | | • Increased construction and resettlement costs reduce the scope of work achievable within the Project<br>• Contractors fail to perform as required<br>• Increased number and severity of road accidents |
| 2. Border facilities constructed | 2.1 In Viet Nam, construct border facilities at Xa Xia. | | |
| 3. HIV/AIDS and trafficking awareness and prevention programs completed on the project road | 3.1 All vulnerable groups and contractor personnel have participated in HIV/AIDS and trafficking awareness and prevention programs<br>3.2 Road safety audits undertaken during detailed design and road safety awareness programs undertaken during construction period | | |

| Activities and Milestones | Inputs | | |
|---|---|---|---|
| **Viet Nam**<br>1.1 Selection of detailed design and construction supervision consultant<br>**Target**: Begin Q4, 2007 and complete Q3, 2008 – ADB component<br>**Target**: Begin Q4, 2007 and completed Q3, 2008 – Republic of Korea<br>1.2 Preparation of detailed designs and bidding documents<br>**Target**: Begin Q4, 2008 and complete Q4, 2009 – ADB Component<br>**Target**: Begin Q4, 2008 and complete Q4, 2009 – Republic of Korea<br>1.3 Bidding for civil works contractors<br>**Target**: Begin Q4, 2009 and complete Q4, 2010– ADB Component<br>**Target**: Begin Q2, 2009 and complete Q4, 2010 – Republic of Korea<br>1.4 Civil works for road and bridges<br>**Target**: Begin Q4, 2010 and complete Q4, 2016 – ADB Component<br>**Target**: Begin Q1, 2010 and complete Q4, 2015 – Republic of Korea<br>1.5 Implement resettlement plans and project specific gender strategy<br>**Target**: Begin Q4, 2009 and complete Q2, 2010 | Consulting services<br><br><br><br><br>Civil works | $ 9.8 million<br>$ 4.5 million<br><br><br><br>$ 75.0 million<br>$ 15.7 million<br>$ 45.5 million<br><br>$ 64.4 million | Government of Australia<br>Government of Republic of Korea<br><br>ADB<br>Government of Australia<br>Government of Republic of Korea<br>Government of Viet Nam |
| 2.1 Civil works for cross-border facilities<br>**Target**: Begin Q4, 2010 and complete Q4, 2012 | | | |
| 3.1 Implement HIV/AIDS and trafficking awareness and prevention programs<br>**Target**: Begin Q4 2010 and complete Q4 2016 | | | |
| 4.1 Project monitoring and evaluation<br>**Targets:** Initial baseline survey within 18 months of loan effectiveness<br>Second survey immediately prior to project completion<br>Third survey to be conducted 5 years after project completion | | | |

*Source: PAM, ADB, June 2009, except for the target dates for ADB component of activities and milestones and the inputs, which are based on recent developments.*

## Road traffic count survey results, cross border (Station 1), 2009

| Type of vehicle / Parameters | Motor-cycle | Car ≤7 seats | 7 seats <Minibus ≤25 Seats | 25 seats < Bus | Light truck <2.5 Tons | Med truck2 axles, >2.5 Tons | Heavy truck 3 axles | Heavy truck ≥4 axles + tractor vehicle | Total |
|---|---|---|---|---|---|---|---|---|---|
| Physical vehicles average of daily (6h-22h) | 4069 | 109 | 32 | 4 | 50 | 82 | 41 | 0 | **4388** |
| Rate % of vehicle (6h-22h) | 92.7% | 2.5% | 0.7% | 0.1% | 1.1% | 1.9% | 0.9% | 0.0% | *100%* |
| The average number of vehicle in three days in PCU (6h-22h) | 1221 | 109 | 51 | 11 | 75 | 164 | 123 | 0 | **1754** |
| Rate % of vehicle in PCU (6h-22h) | 69.6% | 6.2% | 2.9% | 0.6% | 4.3% | 9.3% | 7.0% | 0.0% | ***100%*** |
| Peak-hours number of vehicles | 487 | 13 | 5 | 1 | 6 | 12 | 0 | 0 | **524** |
| Rate % number of vehicle in peak hours (6h-22h) | 11% | 10% | 22% | 13% | 12% | 13% | 0% | 0% | **11%** |
| Peak-hours number of vehicles in PCU | 146 | 13 | 8 | 3 | 9 | 24 | 0 | 0 | **203** |
| Rate % number of vehicles in peak hours in PCU (6h-22h) | 11.2% | 9.9% | 21.7% | 12.5% | 12.0% | 13.2% | 0.0% | 0.0% | **10.8%** |
| Fluctuation coefficient of daily vehicles in comparison with average of 3 days | 1.06 | 1.20 | 0.72 | 1.85 | 1.00 | 1.11 | 1.05 | 0.00 | **1.07** |
| Fluctuation coefficient of daily vehicles in comparison with average of 3 days in PCU | 1.06 | 1.20 | 0.72 | 1.85 | 1.00 | 1.11 | 1.05 | 0.00 | **1.07** |

*Source: Traffic BaselineSsurvey, 2010*

## Road traffic count survey results, Xa Xia to Ha Tien (Station 2), 2009

| Type of vehicle / Parameters | Motor-cycle | Car ≤7 seats | 7 seats <Minibus ≤25 Seats | 25 seats < Bus | Light truck <2.5 Tons | Med truck2 axles, >2.5 Tons | Heavy truck 3 axles | Heavy truck ≥4 axles + tractor vehicle | Total |
|---|---|---|---|---|---|---|---|---|---|
| Physical vehicles average of daily (6h-22h) | 5274 | 48 | 25 | 1 | 30 | 57 | 11 | 0 | **5446** |
| Rate % of vehicle (6h-22h) | 96.9% | 0.9% | 0.5% | 0.0% | 0.5% | 1.0% | 0.2% | 0.0% | **100%** |
| The average number of vehicle in three days in PCU (6h-22h) | 1582 | 48 | 39 | 3 | 45 | 114 | 34 | 0 | **1864** |
| Rate % of vehicle in PCU (6h-22h) | 84.9% | 2.6% | 2.1% | 0.1% | 2.4% | 6.1% | 1.8% | 0.0% | **100%** |
| Peak hour number of vehicles | 561 | 13 | 0 | 0 | 0 | 3 | 1 | 0 | **578** |
| Rate % number of vehicle in peak hour (6h-22h) | 10% | 20% | 0% | 0% | 0% | 5% | 7% | 0% | **10%** |
| Peak hour number of vehicles in PCU | 168 | 13 | 0 | 0 | 0 | 6 | 3 | 0 | **190** |
| Rate % number of vehicles in peak hour in PCU (6h-22h) | 9.6% | 20.3% | 0.0% | 0.0% | 0.0% | 4.9% | 6.7% | 0.0% | **9.2%** |
| Fluctuation coefficient of daily vehicles in comparison with average of 3 days | 1.11 | 1.34 | 1.42 | 0.00 | 0.61 | 1.07 | 1.32 | 0.00 | **1.11** |
| Fluctuation coefficient of daily vehicles in comparison with average of 3 days in PCU | 1.11 | 1.34 | 1.42 | 0.00 | 0.61 | 1.07 | 1.32 | 0.00 | **1.11** |

*Source: Traffic Baseline Survey, 2010*

## Road traffic count survey results, Thu Bay to Nga Bac (Station 3), 2009

| Type of vehicle / Parameters | Moto-cycle | Car ≤7 seats | 7 seats <Minibus ≤25 Seats | 25 seats < Bus | Light truck <2.5 Tons | Med truck2 axles, >2.5 Tons | Heavy truck 3 axles | Heavy truck ≥4 axles + tractor vehicle | Total |
|---|---|---|---|---|---|---|---|---|---|
| Physical vehicles average of daily (6h-22h) | 7333 | 36 | 84 | 8 | 54 | 94 | 0 | 0 | **7609** |
| Rate % of vehicle (6h-22h) | 96.4% | 0.5% | 1.1% | 0.1% | 0.7% | 1.2% | 0.0% | 0.0% | **100%** |
| The average number of vehicle in three days in PCU (6h-22h) | 2200 | 36 | 134 | 20 | 81 | 187 | 0 | 0 | **2659** |
| Rate % of vehicle in PCU (6h-22h) | 82.8% | 1.4% | 5.1% | 0.8% | 3.0% | 7.0% | 0.0% | 0.0% | **100%** |
| Peak hour number of vehicles | 755 | 1 | 4 | 0 | 1 | 5 | 0 | 0 | **766** |
| Rate % number of vehicle in peak hour (6h-22h) | 10% | 2% | 3% | 0% | 2% | 5% | 0% | 0% | **10%** |
| Peak hour number of vehicles in PCU | 227 | 1 | 6 | 0 | 2 | 10 | 0 | 0 | **245** |
| Rate % number of vehicles in peak hour in PCU (6h-22h) | 9.6% | 2.4% | 3.4% | 0.0% | 2.0% | 4.9% | 0.0% | 0.0% | **8.5%** |
| Fluctuation coefficient of daily vehicles in comparison with average of 3 days | 1.08 | 1.13 | 1.38 | 0.63 | 0.95 | 1.09 | 0.00 | 0.00 | **1.08** |
| Fluctuation coefficient of daily vehicles in comparison with average of 3 days in PCU | 1.08 | 1.13 | 1.38 | 0.63 | 0.95 | 1.09 | 0.00 | 0.00 | **1.09** |

*Source: Traffic Baseline Survey, 2010*

## Road traffic count survey results, Nga Bac to Ca Mau (Station 4), 2009

| Type of vehicle / Parameters | Motor-cycle | Car ≤7 seats | 7 seats <Minibus ≤25 Seats | 25 seats < Bus | Light truck <2.5 Tons | Med truck 2 axles, >2.5 Tons | Heavy truck 3 axles | Heavy truck ≥4 axles + tractor vehicle | Total |
|---|---|---|---|---|---|---|---|---|---|
| Physical vehicles average of daily (6h-22h) | 10072 | 105 | 103 | 6 | 136 | 53 | 0 | 0 | **10475** |
| Rate % of vehicle | 96.2% | 1.0% | 1.0% | 0.1% | 1.3% | 0.5% | 0.0% | 0.0% | **100.0%** |
| The average number of vehicle in three days in PCU (6h-22h) | 3022 | 105 | 165 | 15 | 204 | 106 | 0 | 0 | **3617** |
| Rate % of vehicle according to PCU | 83.5% | 2.9% | 4.6% | 0.4% | 5.6% | 2.9% | 0.0% | 0.0% | **100%** |
| Rate % number of vehicle (6h-22h) of total vehicles (24h) | ***94%*** | ***84%*** | ***78%*** | ***56%*** | ***81%*** | ***86%*** | ***0%*** | ***0%*** | ***94%*** |
| Rate % number of vehicle (6h-22h) of total vehicles (24h) according to PCU | ***94%*** | ***84%*** | ***78%*** | ***56%*** | ***81%*** | ***86%*** | ***0%*** | ***0%*** | ***92%*** |
| Peak hour number of vehicles | 915 | 10 | 5 | 0 | 8 | 5 | 0 | 0 | **943** |
| Rate % number of vehicle in peak hour (24h) | 9% | 9% | 5% | 0% | 6% | 10% | 0% | 0% | **9%** |
| Peak hour number of vehicles in PCU | 275 | 10 | 8 | 0 | 12 | 10 | 0 | 0 | **315** |
| Rate % number of vehicles in peak hour in PCU (24h) | 9.2% | 15.6% | 14.3% | 0.0% | 44.4% | 8.2% | 0.0% | 0.0% | **15.2%** |
| Fluctuation coefficient of daily vehicles in comparison with average of 3 days | 1.03 | 0.93 | 1.02 | 0.83 | 0.92 | 0.96 | 0.00 | 0.00 | **1.03** |
| Fluctuation coefficient of daily vehicles in comparison with average of 3 days in PCU | 1.03 | 0.93 | 1.02 | 0.83 | 0.92 | 0.96 | 0.00 | 0.00 | **1.02** |

*Source: Traffic Baseline Survey, 2010*

## Road traffic count survey results, Thu Bay to Vinh Thuan (Station 5), 2009

| Type of Vehicle / Parameters | Moto-cycle | Car ≤7 seats | 7 seats <Minibus ≤25 Seats | 25 seats < Bus | Light truck <2.5 Tons | Med truck 2 axles, >2.5 Tons | Heavy truck 3 axles | Heavy truck ≥4 axles + tractor vehicle | Total |
|---|---|---|---|---|---|---|---|---|---|
| Physical vehicles average of daily (6h-22h) | 6876 | 126 | 95 | 74 | 152 | 95 | 1 | 0 | **7419** |
| Rate % of vehicle (6h-22h) | 92.7% | 1.7% | 1.3% | 1.0% | 2.1% | 1.3% | 0.0% | 0.0% | **100%** |
| The average number of vehicle in three days in PCU (6h-22h) | 2063 | 126 | 152 | 186 | 229 | 190 | 2 | 0 | **2947** |
| Rate % of vehicle in PCU (6h-22h) | 70.0% | 4.3% | 5.2% | 6.3% | 7.8% | 6.4% | 0.1% | 0.0% | **100%** |
| Peak hour number of vehicles | 600 | 4 | 2 | 8 | 4 | 4 | 0 | 0 | **622** |
| Rate % number of vehicle in peak hour (6h-22h) | 8% | 4% | 2% | 10% | 3% | 3% | 0% | 0% | **8%** |
| Peak hour number of vehicles in PCU | 180 | 4 | 3 | 20 | 6 | 8 | 0 | 0 | **221** |
| Rate % number of vehicles in peak hour in PCU (6h-22h) | 8.4% | 3.7% | 2.1% | 9.8% | 2.8% | 3.5% | 0.0% | 0.0% | **10.7%** |
| Fluctuation coefficient of daily vehicles in comparison with average of 3 days | 1.09 | 1.12 | 1.06 | 1.01 | 1.21 | 0.84 | 0.00 | 0.00 | **1.09** |
| Fluctuation coefficient of daily vehicles in comparison with average of 3 days in PCU | 1.09 | 1.12 | 1.06 | 1.01 | 1.21 | 0.84 | 0.00 | 0.00 | **1.08** |

*Source: Traffic Baseline Survey, 2010*

## Water traffic count, 2009

| Station | Cargo Vessels & Motor Boats | | | Passenger Vessels & Motor Boats | | | Engine Vessels % Canoes | | | Barges | | | Other (without engine) | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length ≤ 7m | 7m<length ≤10m | Length >10m | Length ≤ 7m | 7m<length ≤10m | Length >10m | Length ≤ 7m | 7m<length ≤10m | Length >10m | Length ≤ 7m | 7m<length ≤10m | Length >10m | Length ≤ 7m | 7m<length ≤10m | Length >10m | |
| Ca mau- Nga bac (6h-22h) | 4 | 13 | 87 | 1 | 8 | 5 | 111 | 39 | 9 | 6 | 2 | 9 | 17 | 3 | 0 | **316** |
| *Rate %* | *1.27%* | *4.22%* | *27.56%* | *0.21%* | *2.64%* | *1.48%* | *35.16%* | *12.46%* | *2.96%* | *2.01%* | *0.63%* | *2.85%* | *5.49%* | *0.95%* | *0.11%* | |
| Ca mau- Nga bac (24h) | 2 | 12 | 115 | 0 | 10 | 5 | 118 | 41 | 9 | 6 | 4 | 12 | 30 | 2 | 1 | **367** |
| *Rate %* | *0.55%* | *3.28%* | *31.42%* | *0.00%* | *2.73%* | *1.09%* | *32.24%* | *11.20%* | *2.46%* | *1.64%* | *1.09%* | *3.28%* | *8.20%* | *0.55%* | *0.27%* | |
| Ca mau- Nga bac (22h-6h) | 0 | 0 | 30 | 0 | 0 | 0 | 14 | 1 | 0 | 0 | 1 | 6 | 6 | 0 | 0 | **58** |
| *Rate %* | *0.00%* | *0.00%* | *51.72%* | *0.00%* | *0.00%* | *0.00%* | *24.14%* | *1.72%* | *0.00%* | *0.00%* | *1.72%* | *10.34%* | *10.34%* | *0.00%* | *0.00%* | |
| Xeo ro (6h-22h) | 15 | 77 | 134 | 3 | 10 | 3 | 121 | 91 | 47 | 7 | 1 | 10 | 10 | 1 | 0 | **531** |
| *Rate %* | *2.82%* | *14.49%* | *25.28%* | *0.63%* | *1.94%* | *0.50%* | *22.77%* | *17.19%* | *8.78%* | *1.25%* | *0.19%* | *1.94%* | *1.94%* | *0.25%* | *0.00%* | |
| Xeo ro (24h) | 10 | 82 | 212 | 2 | 18 | 1 | 88 | 152 | 106 | 11 | 1 | 12 | 12 | 1 | 0 | **708** |
| *Rate %* | *1.41%* | *11.58%* | *29.94%* | *0.28%* | *2.54%* | *0.14%* | *12.43%* | *21.47%* | *14.97%* | *1.55%* | *0.14%* | *1.69%* | *1.69%* | *0.14%* | *0.00%* | |
| Xeo ro (22h-6h) | 1 | 18 | 42 | 0 | 1 | 0 | 1 | 26 | 17 | 0 | 0 | 5 | 1 | 0 | 0 | **112** |
| *Rate %* | *0.89%* | *16.07%* | *37.50%* | *0.00%* | *0.89%* | *0.00%* | *0.89%* | *23.21%* | *15.18%* | *0.00%* | *0.00%* | *4.46%* | *0.89%* | *0.00%* | *0.00%* | |
| The highest number of the means of waterway | | | | | | | | | | | | | | | | |
| Ca mau- Nga bac (6h-22h) | 3 | 11 | 89 | 1 | 6 | 7 | 126 | 40 | 13 | 5 | 0 | 12 | 9 | 1 | 0 | **323** |
| Xeo ro (6h-22h) | 9 | 64 | 170 | 2 | 17 | 1 | 87 | 126 | 89 | 11 | 1 | 7 | 11 | 1 | 0 | **596** |
| Fluctuation coefficient of daily means of waterway in comparison with average of 3 days (6h-22h) | | | | | | | | | | | | | | | | |
| Ca mau- Nga Bac | 0.75 | 0.83 | 1.02 | 1.5 | 0.72 | 1.50 | 1.14 | 1.02 | 1.39 | 0.79 | 0.00 | 1.33 | 0.52 | 0.33 | 0.00 | **1.02** |
| Xeo ro | 0.60 | 0.83 | 1.27 | 0.60 | 1.65 | 0.38 | 0.72 | 1.38 | 1.91 | 1.65 | 1.00 | 0.68 | 1.06 | 0.75 | 0 | **1.18** |
| Peak hour number of means waterway | | | | | | | | | | | | | | | | |
| Ca mau- Nga bac | 0 | 3 | 11 | 1 | 2 | 1 | 11 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | **34** |
| *Rate % of total* | 0% | 18% | 12% | 100% | 22% | 33% | 10% | 11% | 17% | 0% | | | | | | **11%** |
| Xeo ro | 3 | 10 | 27 | 0 | 3 | 0 | 8 | 9 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | **68** |
| *Rate % of total* | 12% | 11% | 14% | 0% | 23% | 0% | 7% | 8% | 7% | 14% | 33% | 0% | 10% | 0% | 0% | **10%** |

*Source: Traffic baseline survey, 2010*

## O-D matrix for all types of vehicle, 2009

| Zone | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 20 | 21 | 22 | 31 | 32 | 40 | 41 | 44 | 58 | 59 | 60 | 61 | 62 | TOT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | 18 | - | 32 | - | - | - | - | - | 12 | 28 | 1 | 1 | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | 1 | 94 |
| 2 | 2 | 37 | - | - | - | 1 | - | 5 | - | - | 7 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | 5 | - | 1 | 59 |
| 3 | - | - | 1 | 10 | - | - | - | - | - | 4 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 18 |
| 4 | 19 | 2 | 11 | 2 | 6 | - | 1 | - | - | 4 | 4 | - | - | - | - | 1 | 1 | - | - | - | 1 | - | - | - | - | 3 | 4 | - | 59 |
| 5 | - | 4 | - | 8 | - | - | - | - | - | 1 | 5 | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - | 20 |
| 6 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 7 | 1 |  | - | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 8 | - | 3 | 1 | 1 | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 7 |
| 10 | - | 8 | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 10 |
| 12 | - | 1 | - | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | 4 |
| 13 | 15 | - | 1 | 1 | 1 | 1 | - | 1 | - | 22 | 14 | 2 | - | - | 1 | - | - | - | - | 1 | 3 | 1 | 1 | - | 1 | 3 | - | - | 69 |
| 14 | 19 | 7 | 7 | 12 | - | - | - | - | 1 | 6 | 7 | - | 1 | - | 39 | - | 2 | 4 | 1 | 2 | - | - | - | 1 | - | 1 | - | - | 110 |
| 15 | 1 | - | - | 1 | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 17 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 18 | - | - | 1 | - | - | - | - | - | - | - | 90 | - | - | 1 | 2 | - | - | - | - | 2 | - | - | - | - | - | 2 | 1 | - | 99 |
| 20 | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 21 | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 22 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 24 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 32 | 3 | 4 | - | 1 | - | - | - | - | - | 3 | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 13 |
| 33 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 40 | - | 1 | 1 | 4 | - | - | - | - | - | 1 | 2 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 10 |
| 41 | - | - | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | 4 |
| 44 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 54 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 56 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 57 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 58 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 59 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 60 | - | 13 | - | 10 | - | - | - | - | - | 5 | 5 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 35 |
| 61 | - | 1 | - | 1 | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 62 | - | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| TOT | 60 | 109 | 24 | 87 | 8 | 2 | 1 | 6 | 2 | 65 | 171 | 4 | 3 | 1 | 43 | 1 | 3 | 5 | 1 | 5 | 8 | 1 | 2 | 1 | 1 | 15 | 5 | 4 | 638 |

*Source: Traffic baseline survey, 2010*

## O-D matrix for passenger vehicles, 2009

| Zone | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 13 | 14 | 15 | 16 | 18 | 21 | 22 | 31 | 32 | 40 | 44 | 58 | 60 | 61 | 62 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | 5 | - | 17 | - | - | - | - | - | 10 | 25 | 1 | - | - | - | - | - | - | 1 | - | - | - | - | - | 58 |
| 2 | 1 | 9 | - | - | - | - | - | 2 | - | - | 6 | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 | 20 |
| 3 | - | - | 1 | 7 | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 9 |
| 4 | 15 | 1 | 6 | - | 5 | - | 1 | - | - | 1 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | 4 | - | 37 |
| 5 | - | 3 | - | 3 | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | 1 | - | - | - | - | - | 8 |
| 6 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 7 | - | - | - | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 8 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 10 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 3 |
| 12 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 | - | - | - | - | 2 |
| 13 | 13 | - | 1 | - | - | 1 | - | - | - | 5 | 5 | - | - | - | - | - | - | 1 | - | 1 | - | 2 | - | - | 29 |
| 14 | 16 | 5 | 3 | 3 | - | - | - | - | 1 | 1 | 2 | - | 1 | 16 | 1 | 2 | 1 | 1 | - | - | 1 | 1 | - | - | 55 |
| 15 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 18 | - | - | - | - | - | - | - | - | - | - | 52 | - | - | 1 | - | - | - | - | - | - | - | 1 | 1 | - | 55 |
| 20 | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 21 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 22 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 32 | - | 1 | - | - | - | - | - | - | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| 33 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 41 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 |
| 44 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 59 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 60 | - | 6 | - | 5 | - | - | - | - | - | 5 | 4 | 1 | - | - | - | - | - | - | - | - | - | - | - | 1 | 22 |
| 61 | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 62 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| TOTAL | 46 | 37 | 11 | 37 | 6 | 1 | 1 | 2 | 1 | 28 | 101 | 2 | 1 | 17 | 1 | 3 | 1 | 2 | 2 | 2 | 1 | 7 | 5 | 3 | 318 |

*Source: Traffic baseline survey, 2010*

## O-D matrix for trucks, 2009

| Zone | 1 | 2 | 3 | 4 | 5 | 6 | 10 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 20 | 21 | 22 | 32 | 40 | 41 | 59 | 60 | 62 | TOT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | 13 | - | 15 | - | - | - | - | 2 | 3 | - | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 35 |
| 2 | 1 | 28 | - | - | - | 1 | 3 | - | - | 1 | - | - | - | - | - | - | - | - | 1 | - | - | 4 | - | 39 |
| 3 | - | - | - | 3 | - | - | - | - | 4 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | 9 |
| 4 | 4 | 1 | 5 | 2 | 1 | - | - | - | 3 | 2 | - | - | - | - | 1 | 1 | - | - | 1 | - | - | 1 | - | 22 |
| 5 | - | 1 | - | 5 | - | - | - | - | 1 | 4 | - | - | - | - | - | - | - | - | 1 | - | - | - | - | 12 |
| 7 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 8 | - | 2 | 1 | 1 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 6 |
| 10 | - | 6 | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 7 |
| 12 | - | 1 | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 13 | 2 | - | - | 1 | 1 | - | 1 | - | 17 | 9 | 2 | - | - | 1 | - | - | - | - | 3 | 1 | 1 | 1 |  | 40 |
| 14 | 3 | 2 | 4 | 9 | - | - | - | - | 5 | 4 | - | - | - | 23 | - | 1 | 2 | 1 | - | - | - | - | - | 54 |
| 15 | - | - | - | 1 | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 17 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 18 | - | - | 1 | - | - | - | - | - | - | 38 | - | - | 1 | 1 | - | - | - | 2 | - | - | - | 1 |  | 44 |
| 21 | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 24 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 32 | 3 | 3 | - | 1 | - | - | - | - | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | 9 |
| 40 | - | 1 | 1 | 4 | - | - | - | - | 1 | 2 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 10 |
| 41 | - | - | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 54 | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 56 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 57 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 58 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 60 | - | 7 | - | 5 | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 13 |
| 61 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 62 | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| TOTAL | 14 | 72 | 13 | 50 | 2 | 1 | 4 | 1 | 37 | 70 | 2 | 2 | 1 | 26 | 1 | 2 | 2 | 3 | 6 | 1 | 1 | 8 | 1 | 320 |

*Source: Traffic baseline survey, 2010*

## O-D matrix for all types of vehicle, 2005

| | Rạch Giá [1] | Hà Tiên [2] | An Biên [3] | An Minh [4] | Châu Thành [5] | Tân Hiệp [12] | Vĩnh Thuận [13] | Cà Mau [14] | Long Xuyên [21] | Cần Thơ [32] | HCM [60] | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rạch Giá [1] | 10 | 4 | 134 | 173 | 39 | 246 | 123 | 23 | 107 | 203 | 263 | **1398** |
| Hà Tiên [2] | 6 | 0 | 3 | 1 | 1 | 4 | 3 | 0 | 12 | 17 | 22 | **77** |
| An Biên [3] | 167 | 1 | 28 | 3 | 1 | 4 | 10 | 3 | 4 | 1 | 20 | **249** |
| An Minh [4] | 124 | 0 | 7 | 0 | 2 | 2 | 0 | 0 | 1 | 2 | 8 | **148** |
| Châu Thành [5] | 3 | 0 | 2 | 7 | 1 | 8 | 3 | 3 | 0 | 3 | 7 | **38** |
| Tân Hiệp [12] | 72 | 4 | 1 | 1 | 0 | 0 | 7 | 1 | 0 | 0 | 0 | **89** |
| Vĩnh Thuận [13] | 139 | 0 | 5 | 0 | 2 | 2 | 5 | 0 | 1 | 5 | 17 | **188** |
| Cà Mau [14] | 13 | 0 | 1 | 0 | 3 | 1 | 0 | 0 | 1 | 2 | 4 | **27** |
| Long Xuyên [21] | 135 | 6 | 12 | 2 | 0 | 0 | 5 | 13 | 0 | 0 | 0 | **175** |
| Châu Đốc [22] | 28 | 1 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | **32** |
| Cần Thơ [32] | 197 | 27 | 12 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | **253** |
| Thốt Nốt [38] | 14 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **19** |
| Vĩnh Long [52] | 33 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **34** |
| Đồng Tháp [56] | 19 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | **22** |
| BRVT [58] | 15 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | **19** |
| HCM [60] | 238 | 28 | 22 | 15 | 1 | 0 | 36 | 15 | 0 | 0 | 0 | **357** |
| TOTAL | **1311** | **85** | **240** | **213** | **52** | **274** | **204** | **65** | **130** | **235** | **347** | **3292** |

*Source: ADB-PPTA Report, 2006*

# APPENDIX

# PHOTO DOCUMENTATION

# THE TRAINING

BAECO's officer conducting the training for surveyors

Surveyors in attendance

Hands-on and field test before starting actual survey works

# TRAFFIC COUNT SURVEY

Traffic count at Xa Xia and Hà Tiên stations

Traffic count at Thứ Bảy station

Traffic count at Vĩnh Thuận and Cà Mau stations

# AXLE LOAD AND O-D SURVEY


Taking axle load weight with support from policemen and transport surveyors


Interview of passengers


Interview of drivers

# TRAVEL TIME SURVEY AND IRI TEST



Travel time survey at Xa Xia – Ha Tien section



IRI test at QL63 section

IRI test at Ha Tiên section