

CHAPTER 4

TRAFFIC SURVEY

AND

ANALYSIS

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TRAFFIC SURVEY AND ANALYSIS

4.1 OVERVIEW

Urban transportation consists of the movements of both people and goods between various origins and destinations. These movements are made up from different modes of transportation with different purposes. Each of these movements is called as a “trip”. At the level of the metropolitan area, urban transportation is expressed as the aggregate of thousands or even millions of these individual’s trips. The net effect of these individual trips is the creation of vehicle and/or passenger trips over the transportation system in the area. These are the traffic flows that examined in this chapter.

To understand the nature of the transportation system in the metropolitan area, present characteristics of these urban traffic flows shall be determined through the trip related database, which are based on the socioeconomic characteristics. However, most of detailed data regarding vehicle and passenger trips or goods movements are only obtainable through traffic surveys and interviews. In this Study Area, there are no comprehensive traffic databases, nor any analytical reports except the “Urban Infrastructure Rehabilitation and Management Project” Report prepared by the World Bank in 1996. In addition significant increases of unregistered vehicles, especially motorcycles, have been observed throughout the Study Area in recent years.

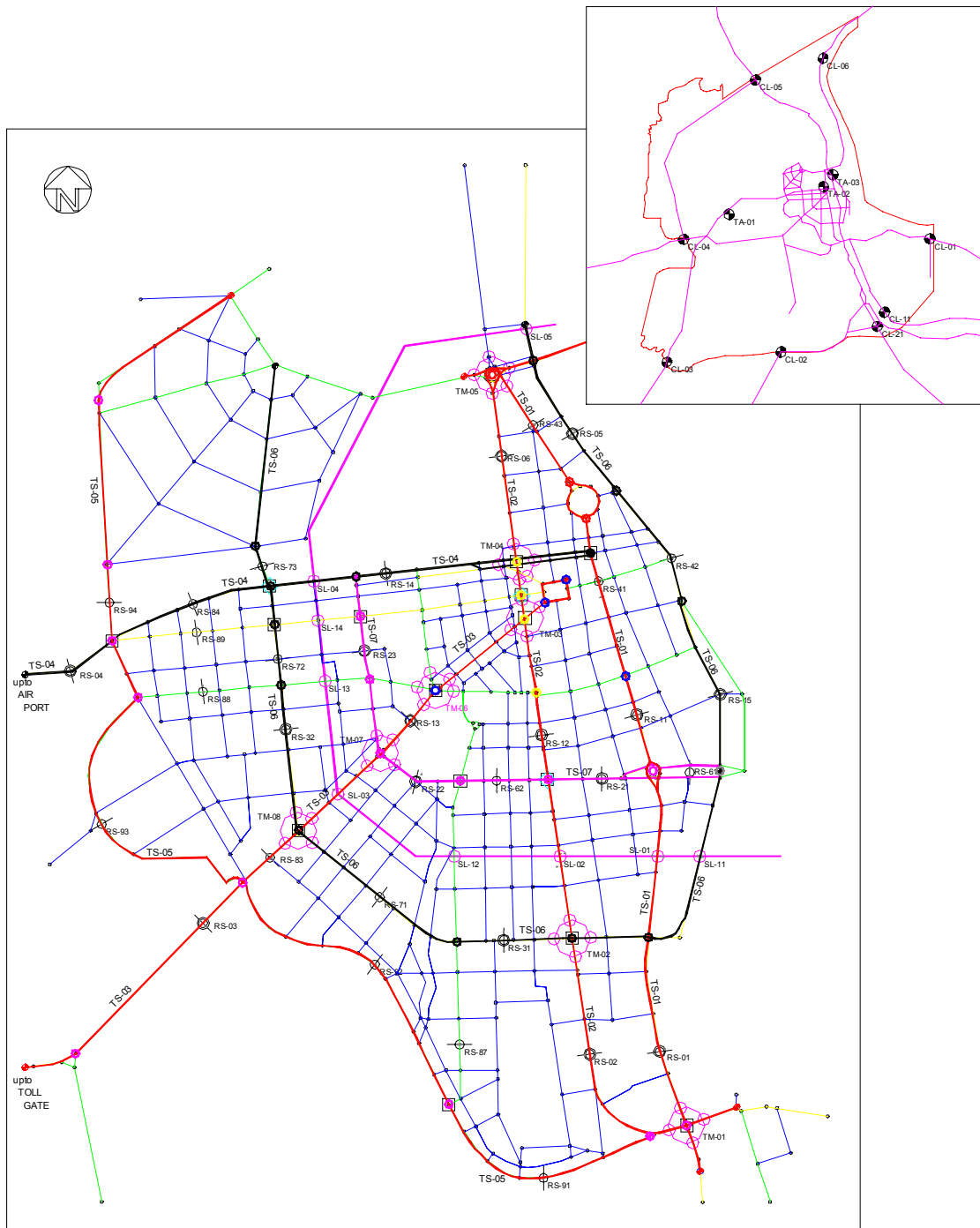
Under these circumstances, it is essential to establish the present actual condition of traffic flow throughout the Study Area, not only for preparing the Master Plan, but also for establishing the comprehensive traffic database. These data are utilized for the application of traffic demand forecasting models to evaluate the overall performance of existing and/or proposed transportation systems, and measure the degree of achievement of planned projects and/or alternatives thereafter. In addition, periodic updates of these data shall also provide an opportunity to monitor changes in socioeconomic and transportation system characteristics over time.

To achieve the above-mentioned objectives, fifteen (15) different types of traffic surveys and interviews were proposed and carried out throughout the Study Area in 2000 during the period from mid May through mid June, with a supplemental survey in mid August. Table 4.1-1 presents an outline of the traffic surveys and interviews while Figure 4.1-1 shows the location of survey stations.

Table 4.1-1 Outlines of Traffic Surveys

No.	Survey Item	Contents
(1)	Person Trip Survey (Household Interview)	6,000 households (76+3 sub-districts)*
(2)	Cordon Line Survey (Traffic Counts & OD Interview)	8 stations (24 & 15 hrs.)
(3)	Screen Line Survey (Traffic Counts)	9 stations (15 hrs.)
(4)	Roadside Traffic Volume Count	33 stations (24 & 15 hrs.)
(5)	Intersection Traffic Movement Count	8 stations (14 hrs.)
(6)	Travel Speed Survey	7 routes (3 x 3 times)
(7)	Commodity Movement Survey	30 companies & 3 terminals
(8)	Parking Condition Survey	3 areas & 5 blocks (2 hrs x 3 times)
(9)	Inter-Regional Terminal Passenger Interview	3 terminals (300 sample)
(10)	Bus and Taxi-Bus Owner/Driver Interview	5 terminals (100 sample)
(11)	Bus and Taxi-Bus Passenger Interview	5 terminals (300 sample)
(12)	Para Transit Driver Interview	5 terminals (500 sample)
(13)	Para Transit Passenger Interview	5 terminals (600 sample)
(14)	Bus/Taxi-Bus Terminal Traffic Count	5 terminals (14 hrs.)
(15)	Motorcycle Count (by Sample Marking)	9 stations

* 76 sub-districts belong to Municipality of Phnom Penh while 3 sub-districts belong to Kandal Province.



LEGEND

- TRAFFIC SURVEY STATIONS**
- Intersection Traffic Movement Counts (14 hrs.)
 - Roadside Traffic Volume Counts (24 & 15 hrs.)
 - Screen Line Survey (15 hrs.)
 - Cordon Line Survey (24 & 15 hrs.)
 - Travel Speed Survey
 - Inter-Regional Terminal Passenger Interview
 - Intersection Traffic Counts carried out by World Bank in 1995
 - Intersection Traffic Counts carried out by JICA Expert in 1999

Figure 4.1-1 Locations of Traffic Survey Stations (Urban Area)

The Study Area was divided into eighty (80) inner zones. Seventy-six (76) of these inner zones are the same as the MPP's sub-districts, one (1) is the Pochentong Airport area itself and the remaining three (3) inner zones are set into the adjacent area surrounded by the proposed Outer Ring Road in the Kandal Province. The rest of Cambodia outside the Study Area was divided into seven (7) outer zones along National Road No.1 to No.7 respectively. The Traffic Zones are shown in the Appendix 4.1

4.2 PERSON TRIP SURVEY

The person trip survey (household interview) was carried out to collect necessary data and information of trips made by each member of sampled households. These data are to be expanded according to the socioeconomic characteristics to describe and forecast individual trips. The survey form was designed to cover household and personal characteristics, as well as trip descriptions. Tables 4.2-1 and 4.2-2 present an outline and a brief summary of the survey. The details of the survey are given in Appendix 4.2

Table 4.2-1 Outline of Person Trip Survey

No.	Survey Item	Contents
(1)	Household Attributes	- Household Structure - Vehicle Ownership (Car, Motorcycle and Bicycle) - Monthly Household Income - Parking Space for Owned Car & Payment Method - Owned Car Information (Type & Age) - Address of Residence
(2)	Personal Attributes	- Gender & Age - Occupation & Sector - Driving License Hold - Place of Work / Study - Number of Daily Trips
(3)	Trip Descriptions	- Origin & Destination - Trip Purpose - Number of Sub Trips
(4)	Criteria for Selection of Present Mode (By Dry & Rainy Season)	- Transport Mode - Waiting Time - Travel Time - Trip Cost / Expense - Reason (Why Using That Mode)
(5)	Criteria for Selection of Proposed Mode	- Intention of Use - Expectation to the Service - Affordable Trip Cost - Acceptable Waiting Time

Table 4.2-2 Summary of the Person Trip Survey

Item	Figures
Estimated Population in the Study Area (Year 2000) ¹	1,152,309 (A)
Estimated Target Population (Aged 5 years +) [95.6% of (A)] ²	1,101,583 (B)
Sampled Individuals (Aged 5 years +)	18,817 (C)
Sampling Ratio of Individuals (%) [(C) / (B)]	1.71 (D)
Average Household Size (Person per Household)	5.69
Average Household Income (Thousand Riel per Month)	315
Average Vehicle Ownership per Household (Vehicle per Household)	(Car, Private Own & Company Own Total) 0.24 (Motorcycle) 1.22 (Bicycle) 0.54
Driving License Possession (%)	6.7

Figures 4.2-1, 2, 3, 4, 5 and 6 present a brief summary of the main topics and results of the survey.

¹ Estimated Population in the Study Area is described in the Chapter 3

² Target Population (Aged 5 years and above) is assumed to be 95.6%, which is base on the Population Census Data for Phnom Penh, of total Estimated Population in the Study Area.

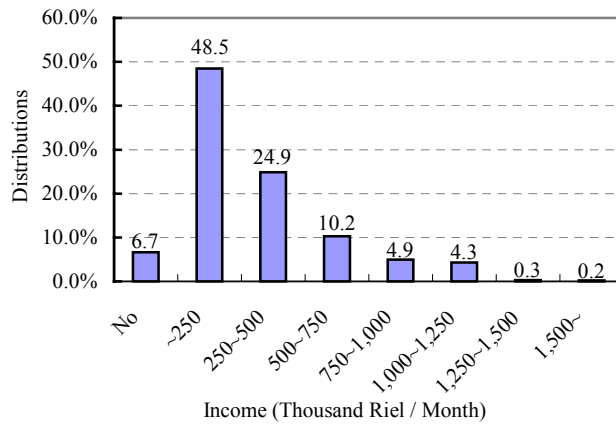


Figure 4.2-1 Household Attributes (Monthly Income)

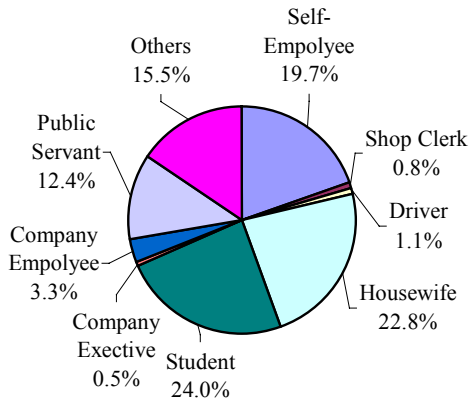


Figure 4.2-2 Personal Attributes (Occupation)

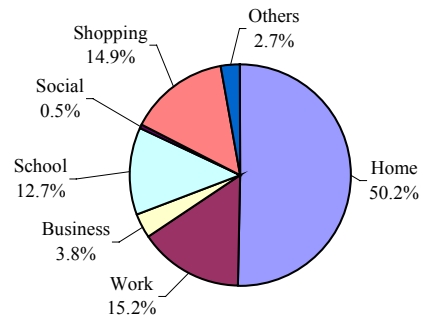
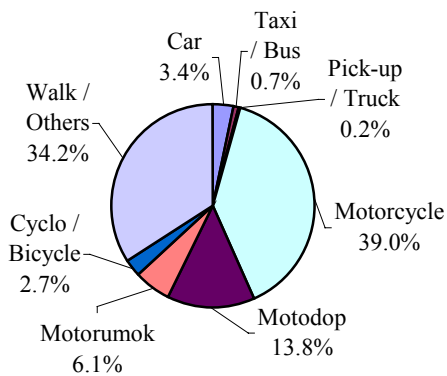
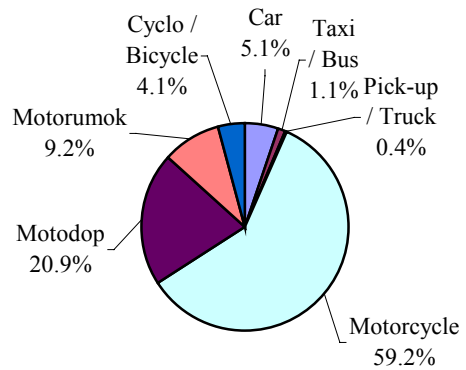


Figure 4.2-3 Trip Descriptions (Purpose)



(a) Including Walk/Others



(b) Excluding Walk/Others

Figure 4.2-4 Trip Descriptions (Present Trip Mode)

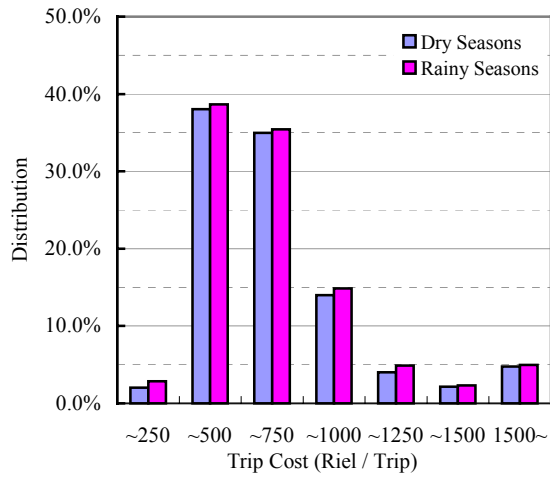


Figure 4.2-5 Trip Descriptions (Present Trip Time and Waiting Time)

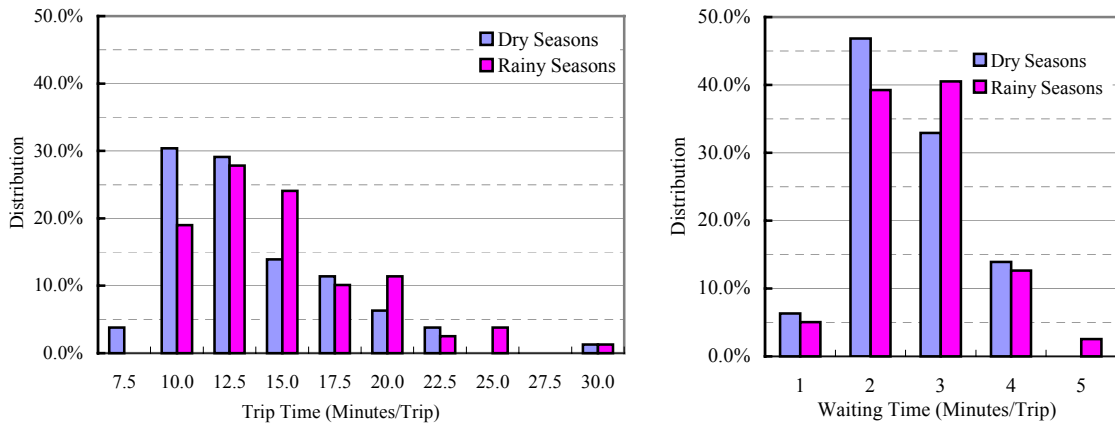


Figure 4.2-6 Trip Description (Travel Cost)
(Non Private Vehicle Users)

4.3 CORDON LINE SURVEY

A cordon line survey was carried out to check inbound and outbound traffic for the Study Area, and to determine the traffic demand between traffic zones within the Study Area (inner zone) and outside the Study Area (outer zone). Table 4.3-1~3 and Figure 4.3-1~2 present an outline and a brief summary of the survey. The details of the survey are given in Appendix 4.3.

Table 4.3-1 Outline of Cordon Line Survey

No.	Survey Item	Contents
(1)	Roadside OD Interview	- Time of Interview - Type of Vehicle - Number Plate (whether attached or not attached) - Origin & Destination - Trip Purpose - Number of Passengers (including Driver & Co-Driver) - Loading Rate (by quarters: Empty, 1/4, 1/2, 3/4, Full) - Loading Items
(2)	Classified Vehicle Counting	- Number of Through Traffic by 15 Minutes Intervals, By Type of Vehicles (10 categories) & Walker, and by Directions

Table 4.3-2 Vehicle Occupancy of Cordon Line OD Survey

No.	Mode	Sample	Passenger	Occupancy
1.	Passenger Car (including Station Wagon & 4WD)	1,121	4,489	4.00
2.	Taxi (Sedan Type Taxi with Yellow Line)	543	2,528	4.66
3.	Light Bus / Passenger Van (Mini Bus)	1,125	14,371	12.77
4.	Pick-up / Cargo Van	1,497	15,061	9.63
5.	Standard and Large Bus	289	5,345	18.56
6.	Large Truck, Tractor with Semi & Full Trailer	774	3,438	4.86
7.	Motorumok (Motorcycle Trailer)	1,551	12,577	8.11
8.	Motorcycle (including "Motodop" –Motorcycle Taxi)	8,139	15,020	1.85
9.	Cyclo (Tricycle Taxi)	13	19	1.46
10.	Bicycle	488	589	1.21
11.	Others (Tractor, Bicycle & Horse Trailer, etc.)	179	393	2.28
Total & Average		15,719	73,830	4.70

Note: Number of passenger is including driver/co-driver

Table 4.3-3(a) Sectional Summary of 24/12-hr Ratio & Peak Hour Ratio at 24-hr Stations

24-hrs Stations	Daytime 12-hr Traffic (A)	24-hr Traffic (B)	24/12-hr Ratio (B/A)	Peak Hour Traffic (C)	Peak Hour Ratio (C/A)	Peak Hour
CL-01	8,194	9,601	1.17	1,127	0.14	06:30~07:30
CL-02	4,474	5,180	1.16	526	0.12	07:30~08:30
CL-03	3,705	4,373	1.18	450	0.12	06:00~07:00
CL-04	15,891	19,412	1.22	1,842	0.12	06:15~07:15
CL-05	7,708	9,527	1.24	1,046	0.14	06:15~07:15
CL-06	5,530	6,339	1.15	615	0.11	06:30~07:30
Average	7,584	9,072	1.20	934	0.12	---

See Figure 4.1-1 for location of survey station. Unit of Traffic Volume: Passenger Car Units (PCU's)

Table 4.3-3(b) Sectional Summary of 15/12-hr Ratio & Peak Hour Ratio at 15-hr Stations

15-hrs Stations	Daytime 12-hr Traffic (A)	15-hr Traffic (B)	15/12-hr Ratio (B/A)	Peak Hour Traffic (C)	Peak Hour Ratio (C/A)	Peak Hour
CL-11	2,250	2,427	1.08	492	0.22	08:15~09:15
CL-21	3,700	4,024	1.09	624	0.17	06:30~07:30
Average	2,975	3,226	1.08	558	0.19	---

See Figure 4.1-1 for location of survey station. Unit of Traffic Volume: Passenger Car Units (PCU's)

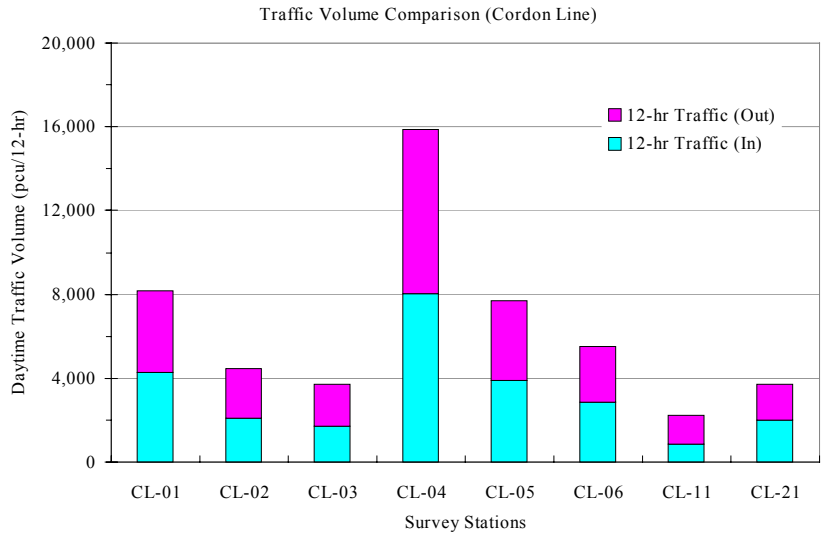


Figure 4.3-1 Daytime Traffic Volumes at Cordon Line Survey Stations (See Figure 4.1-1 for location of survey stations)

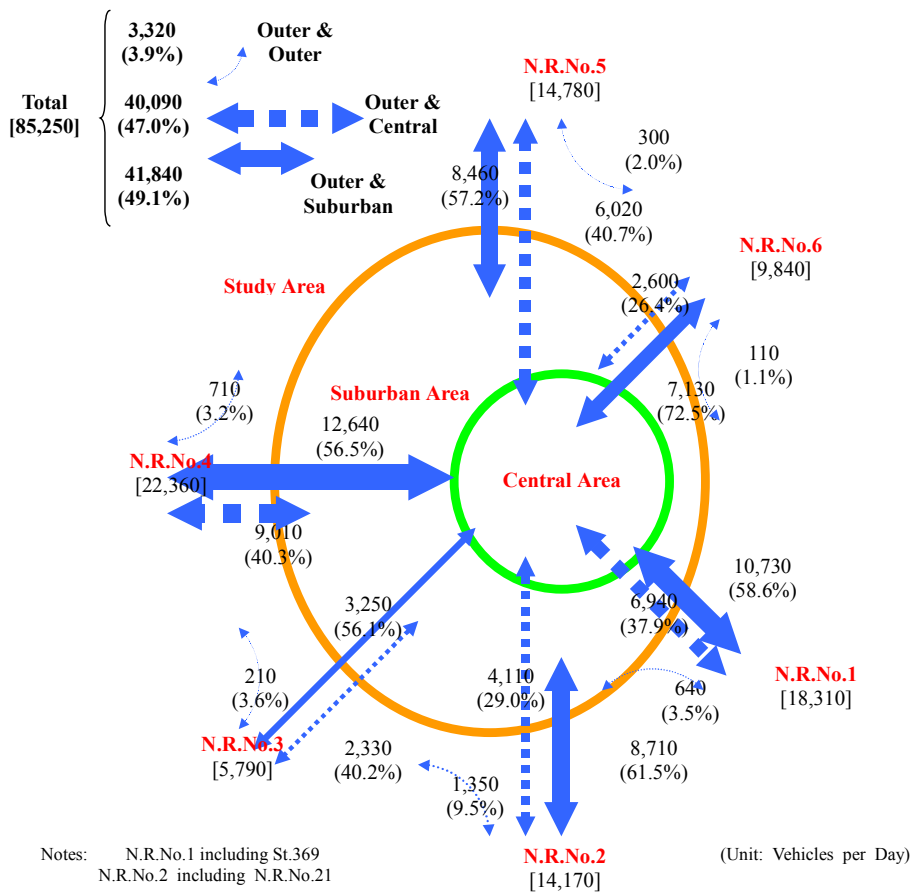


Figure 4.3-2 Flow Characteristics at Cordon Line Survey Stations (Vehicle Units)

4.4 SCREEN LINE SURVEY

A screen line survey was carried out at nine (9) stations along the main radial roads connecting central and suburban districts. Table 4.4-1 and Figure 4.4-1 present a brief summary of the survey. The details of the survey are given in Appendix 4.4.

Table 4.4-1 Sectional Summary of 15/12-hr Ratio & Peak Hour Ratio of Screen Line Stations

Stations	Daytime 12-hr Traffic	15/12-hr Ratio	15-hr Traffic	Peak Hour Ratio	Peak Hour Traffic	Peak Hour
SL-01	45,081	1.17	52,522	0.13	6,063	06:45~07:45
SL-02	40,086	1.15	45,910	0.12	4,848	07:00~08:00
SL-03	47,551	1.14	54,204	0.14	6,466	16:45~17:45
SL-04	55,045	1.13	62,409	0.13	7,092	06:45~07:45
SL-05	24,211	1.13	27,271	0.12	2,984	06:15~07:15
SL-11	19,037	1.10	20,848	0.15	2,762	06:15~07:15
SL-12	26,597	1.10	29,190	0.13	3,337	16:45~17:45
SL-13	28,986	1.14	33,088	0.13	3,675	07:00~08:00
SL-14	22,722	1.15	26,197	0.13	2,842	06:45~07:45
Average	34,368	1.14	39,071	0.13	4,452	---

See Figure 4.1-1 for location of survey station.

Unit of Traffic Volume: Passenger Car Units (PCU's)

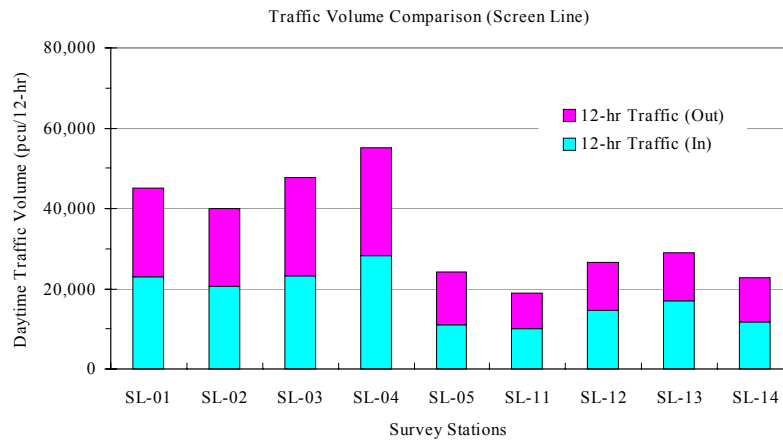


Figure 4.4-1 Daytime Traffic Volumes at Screen Line Survey Stations (See Figure 4.1-1 for location of survey station)

4.5 ROADSIDE TRAFFIC VOLUME COUNTS

Roadside traffic volume counts were carried out to monitor the comprehensive traffic volume tendency and its indicators, such as peak hours, directional factor, and volume by vehicle classifications. Thirty-three (33) stations in total were selected along major arterials. These survey locations were selected to cover the major traffic arterials. Some of the survey stations were selected to establish the traffic flow, which are not covered by the Screen Line Surveys conducted by Work Bank in 1995. Tables 4.5-1 (a) & (b), and Figures 4.5-1 (a) & (b) present a brief summary of the survey. The details of the survey are given in Appendix 4.5. Comparisons of the World Bank Data and data of this Study are shown in section 4.17.

Table 4.5-1(a) Sectional Summary of 24/12-hr Ratio & Peak Hour Ratio at 24-hr Stations

24-hrs Stations	Daytime 12-hr Traffic	24/12-hr Ratio	24-hr Traffic	Peak Hour Ratio	Peak Hour Traffic	Peak Hour
RS-01	48,572	1.17	56,843	0.14	6,559	07:30~08:30
RS-02	44,976	1.20	53,940	0.11	4,979	16:45~17:45
RS-03	36,553	1.30	47,415	0.13	4,837	06:15~07:15
RS-04	43,732	1.21	53,000	0.12	5,395	06:30~07:30
RS-05	20,332	1.25	25,414	0.12	2,489	07:30~08:30
RS-06	47,582	1.29	61,454	0.12	5,645	06:30~07:30
RS-11	20,668	1.19	24,648	0.12	2,500	09:30~10:30
RS-12	65,000	1.30	84,722	0.13	8,587	06:45~07:45
RS-13	43,864	1.19	52,120	0.10	4,496	06:30~07:30

RS-14	66,799	1.24	82,917	0.11	7,179	14:00~15:00
RS-15	29,390	1.21	35,425	0.13	3,336	16:30~17:30
RS-21	46,770	1.30	60,771	0.11	5,008	10:45~11:45
RS-22	72,341	1.19	85,899	0.14	9,982	07:00~08:00
RS-23	37,705	1.23	46,216	0.11	4,166	06:30~07:30
RS-31	77,219	1.21	93,053	0.13	9,752	16:45~17:45
RS-32	43,744	1.27	55,493	0.10	4,559	06:45~07:45
Average	46,578	1.23	57,458	0.12	5,592	---

See Figure 4.1-1 for location of survey station. Unit of Traffic Volume: Passenger Car Units (PCU's)

Table 4.5-1(b) Sectional Summary of 15/12-hr Ratio & Peak Hour Ratio at 15-hr Stations

15-hrs Stations	Daytime 12-hr Traffic	15/12-hr Ratio	15-hr Traffic	Peak Hour Ratio	Peak hr. Traffic	Peak Hour
RS-41	22,658	1.24	28,202	0.14	3,203	17:15~18:15
RS-42	27,576	1.13	31,229	0.12	3,357	06:45~07:45
RS-43	18,586	1.13	21,015	0.11	2,136	17:00~18:00
RS-61	34,900	1.27	44,286	0.12	4,157	18:30~19:30
RS-62	67,709	1.18	79,608	0.14	9,502	16:45~17:45
RS-71	38,020	1.16	43,957	0.10	3,851	08:30~09:30
RS-72	15,744	1.19	18,686	0.14	2,171	11:00~12:00
RS-73	61,130	1.13	68,814	0.12	7,139	06:45~07:45
RS-83	39,818	1.24	49,254	0.12	4,798	16:45~17:45
RS-84	30,431	1.14	34,737	0.13	3,843	06:30~07:30
RS-87	13,040	1.15	14,963	0.13	1,739	06:15~07:15
RS-88	52,645	1.18	62,173	0.12	6,060	16:45~17:45
RS-89	35,584	1.13	40,130	0.13	4,629	16:45~17:45
RS-91	8,844	1.12	9,864	0.12	1,065	06:15~07:15
RS-92	4,510	1.10	4,949	0.12	526	06:00~07:00
RS-93	5,561	1.14	6,354	0.11	592	16:15~17:15
RS-94	9,334	1.13	10,573	0.14	1,317	06:15~07:15
Average	28,594	1.17	33,458	0.12	3,534	---

See Figure 4.1-1 for location of survey station. Unit of Traffic Volume: Passenger Car Units (PCU's)

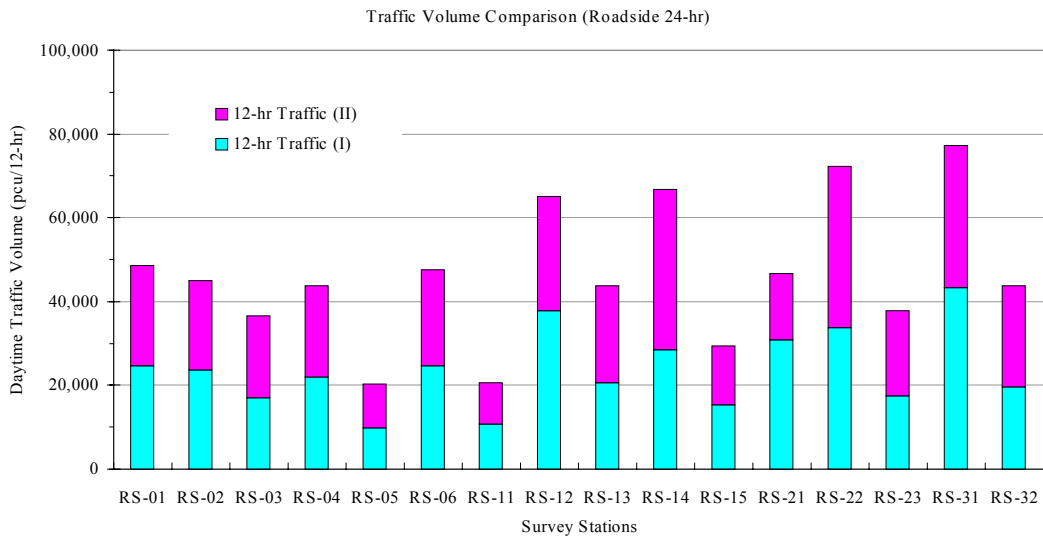


Figure 4.5-1(a) Daytime Traffic Volume at 24-hr Roadside Traffic Volume Count Stations³
(See Figure 4.1-1 for location of survey station)

³ 12-hr Traffic (I): in-bound traffic for radial roads, clockwise traffic for circular roads,
12-hr Traffic (II): out-bound traffic for radial roads, counter-clockwise traffic for circular roads

Mao Tse Toung and Sihanouk Boulevards, both circular roads, are the arterials that handle the highest traffic volume with as much as 10,000 vehicles per hour during the peak hour, followed by several radial roads, such as Monivong and Russian Boulevards, which handle as much as 7,000 to 8,600 vehicles per hour.

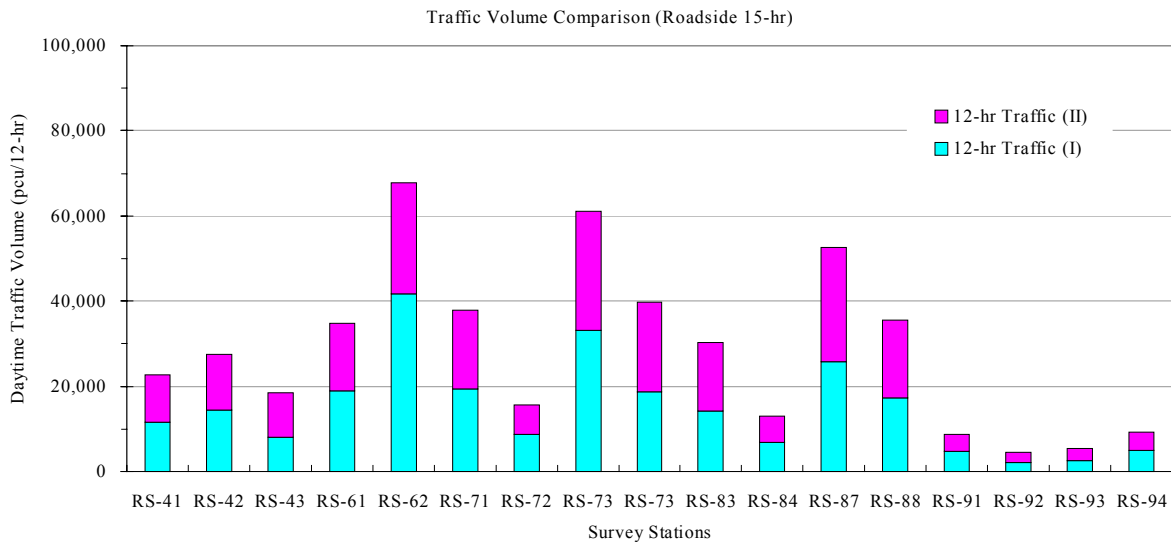


Figure 4.5-1(b) Daytime Traffic Volume at 15-hr Roadside Traffic Volume Count Stations⁴
(See Figure 4.1-1 for location of survey station)

4.6 INTERSECTION TRAFFIC MOVEMENT COUNTS

Intersection traffic movement counts were carried out to establish the necessary data and information for the further planning of improvements to the bottleneck points of the entire traffic flow in the Study Area. Eight (8) stations in total were selected in consideration of similar surveys conducted by the World Bank in 1995, to compare the traffic flow data. The intersections already covered by the surveys conducted by the JICA Expert to MPWT in 1999 were omitted. Table 4.6-1 presents a brief summary of the survey. The details of the survey are given in Appendix 4.6.

Table 4.6-1 Summaries of Intersection Traffic Counting Stations

Stations	Daytime 12-hr Traffic	Morning Peak Hour			Evening Peak Hour		
		Traffic	Ratio	Time	Traffic	Ratio	Time
TM-01	65,362	7,279	0.111	07:00~08:00	7,479	0.114	17:00~18:00
TM-02	58,366	6,122	0.105	07:00~08:00	6,899	0.118	18:00~19:00
TM-03	70,327	7,120	0.101	07:00~08:00	7,448	0.106	17:00~18:00
TM-04	106,565	12,459	0.117	07:00~08:00	10,682	0.100	17:00~18:00
TM-05	49,274	4,638	0.094	07:00~08:00	5,469	0.111	17:00~18:00
TM-06	73,705	6,975	0.095	07:00~08:00	7,992	0.108	17:00~18:00
TM-07	75,522	7,558	0.100	08:00~09:00	7,376	0.098	17:00~18:00
TM-08	62,585	7,289	0.116	07:00~08:00	6,527	0.104	16:00~17:00
Average	70,213	7,430	0.106	---	7,484	0.107	---

See Figure 4.1-1 for location of survey station.

Unit of Traffic Volume: Passenger Car Units (PCU's)

⁴ 12-hr Traffic (I): in-bound traffic for radial roads, clockwise traffic for circular roads,
12-hr Traffic (II): out-bound traffic for radial roads, counter-clockwise traffic for circular roads

4.7 TRAVEL SPEED SURVEY

A travel speed survey was carried out to establish the necessary data and information for the further analysis of the bottleneck points of the entire traffic flow in the Study Area. Seven (7) routes were selected to include all radial and circular arterial streets in the central districts of the Study Area. Table 4.7-1 presents a brief summary of the survey. The details of the survey are given in Appendix 4.7.

Table 4.7-1 Summary of Travel Speed Survey & Level of Service

Route	Street Name		Travel Speed/Level of Service					
			Direction	AM	Noon	PM	Average	
TS-01	Radial Roads	France / Norodom	N-bound	24.5 / C	28.2 / C	26.1 / C	26.3 / C	
			S-bound	24.4 / C	29.0 / C	22.7 / C	25.4 / C	
TS-02		Monivong	N-bound	21.4 / C	26.2 / C	22.3 / C	23.3 / C	
			S-bound	22.7 / C	26.3 / C	22.5 / C	23.8 / C	
TS-03		Radial Roads	Charles de Gaulle / Monireth	NE-bound	15.6 / D	20.4 / C	17.0 / D	17.6 / D
				SW-bound	18.1 / D	17.5 / D	17.3 / D	17.6 / D
TS-04	Confederation de la Russie		E-bound	28.2 / C	39.1 / B	28.5 / C	31.9 / B	
			W-bound	31.5 / B	37.2 / B	27.3 / C	32.0 / B	
TS-05	Circular Roads	Inner Ring Road	S/E-bound	19.0 / D	21.9 / C	20.5 / C	20.5 / C	
			W/N-bound	19.1 / D	21.1 / C	20.0 / C	20.1 / C	
TS-06		Kim Il Sung / Mao Tse Toung / Sisowath	S/E/N-bound	22.3 / C	29.8 / C	22.7 / C	24.9 / C	
			S/W/N-bound	23.9 / C	27.4 / C	21.7 / C	24.3 / C	
TS-07		Jawaharlal Nerhu / Sihanouk	S/E-bound	17.1 / D	24.2 / C	20.7 / C	21.0 / C	
			W/N-bound	19.4 / D	24.0 / C	18.1 / D	20.6 / C	

Unit: Speeds: km/h, Level of Service (LOS): A: >40, B: >30, C: >20, D: >15, E: >10, F: <10 (km/h)

4.8 COMMODITY MOVEMENT SURVEY

A commodity movement survey was carried out to collect the necessary data and information for estimating the present freight demand linked to the road sector in the Study Area. Thirty (30) major transports related companies / organizations were selected for interview on a random basis. Inter-regional terminals were also selected for additional interview to cover feeder movements of inter-regional transport. In addition, several international relief organizations based in the Study Area and operating their own fleets for relief activities were selected for interview. The interviews of these organizations showed that the contribution from relief agencies to the overall movement of commodities throughout the country was negligible and could be ignored. Table 4.8-1 and 4.8-2 present an outline and brief summary of the survey. The details of the survey are given in Appendix 4.8.

Table 4.8-1 Outline of Commodity Movement Survey

No.	Survey Item	Contents
(1)	Company Attributes	- Name & Address of Company - Category - Number of Fleet
(2)	Trip Informations	- Number Plate (if possible) - Number of Trip per Day - Origin & Destination - Trip Time - Loading Items - Loading Volume

Table 4.8-2 Summary of Commodity Movement Survey

Item	Figures
Estimated Number of Registered Freight Vehicles	11,100
Estimated Number of Registered Heavy Duty Equipment	310
Number of Sampled Vehicles & Equipment	599
Number of Total Trips	918
Sampling Ratio of Vehicles (%)	5.25
Trip Production Ratio (per vehicle, Gross)	1.53

4.9 PARKING CONDITION SURVEY

A parking condition survey was carried out to collect the necessary data and information for estimating parking demand and to establish the present parking situation, especially in the central districts, in the Study Area. This survey included an inventory survey, vehicle counting, and interviews at three (3) areas around the city markets, with five (5) adjacent blocks along the main streets. Table 4.9-1 and 4.9-2 present an outline and brief a summary of the survey. The details of the survey are given in Appendix 4.9.

Table 4.9-1 Outlines of Parking Condition Survey

No.	Survey Item	Contents
(1)	Inventory Survey	- Number of Parking Space - Fee (if charged)
(2)	Vehicle Counting	- Number of Parking Vehicles by Time, Type (6 categories), and Block
(3)	Interview	- Vehicle Type - Parking Style (off-street/on-sidewalk/on-street) - Payment Method & Amount Paid - Frequency of Parking - Distance to Destination - Trip Purpose - Reference Questions regarding Proposed Public Transport Service

Table 4.9-2 Summary of Parking Condition Survey

Item	Figures		
	Car	Motorcycle	Cyclo
Total Number of Observed Parking Spaces*	10x1x10=100	15x3x15=675	15x3x15=675
Total Number of Observed Vehicles (per 6 hrs)	619	3,322	1,829
Average Duration of Parking (minutes)	26.2	18.1	14.9
Average Occupancy (%)	45.0	24.8	11.2
Effective Number of Samples	550		
Sampling Ratio (%)	9.5		

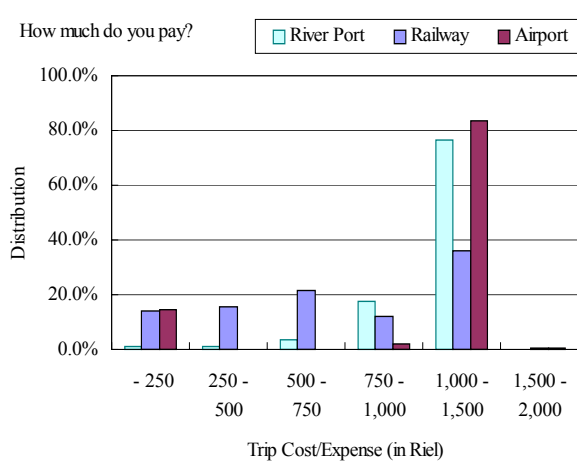
* (Number of Parking Space per Block) x (Number of Row of Parking) x (Number of Observed Parking Block)

4.10 INTER-REGIONAL TERMINAL PASSENGER INTERVIEW

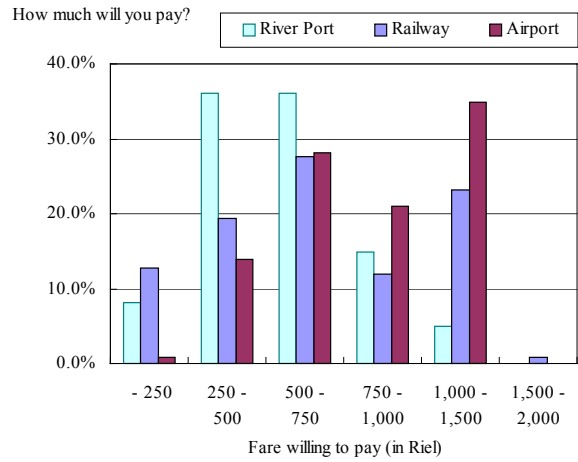
An inter-regional terminal passenger interview was carried out in order to establish the response of the inter-regional terminal users to the introduction of masstransit and/or regulation on para-transit operation and the impact on the present means of feeder transport. To obtain the characteristics of inter-regional public transport passengers, this interview was conducted at major inter-regional public transport mode interchange areas. These areas include the Ferry Port going to Akreiy Ksatr, the Railway Central Station and Pochentong International Airport. Table 4.10-1 and Figure 4.10-1 present an outline and a brief summary of the survey. The details of the survey are given in Appendix 4.10.

Table 4.10-1 Outlines of Inter-Regional Terminal Passenger Interview

No.	Survey Item	Contents
i.	Personal Attributes	- Gender & Age - Occupation & Sector - Driving License Hold - Place of Work / Study
ii.	Trip Descriptions	- Origin & Destination - Trip Purpose - Number of Sub Trips
	Criteria for Selection of Present Mode	- Transport Mode - Waiting Time - Travel Time - Trip Cost / Expense - Reason
	Criteria for Selection of Proposed Mode	- Intention of Use - Expectation to the Service - Affordable Trip Cost - Acceptable Waiting Time



(Present Trip Cost)



(Affordable Trip Cost)

Figure 4.10-1 Present and Proposed Trip Criteria (Inter-Regional Terminal Passengers)

4.11 TAXI-BUS OWNER & DRIVER INTERVIEW

A taxi-bus owner/driver interview was carried out in order to establish the response of the small-scale transport operators to the introduction of mass transit and/or regulation on para-transit operation and the impact on their present situations. To obtain the characteristics of bus and taxi-bus owner/driver, this interview was conducted at five (5) major bus and taxi-bus terminals and owners office. The five (5) major bus and taxi-bus terminals were Central Market, Dang Kao Market, Olympic Market, Orussey Market, and Chbar Ampav Market. Tables 4.11-1 and 4.11-2 present an outline and brief summaries of the survey. The details of the survey are given in Appendix 4.11.

Table 4.11-1 Outlines of Taxi-Bus Owner & Driver Interview

No.	Survey Item	Contents
i.	Owner Only	- Number of Owned Vehicles - Number of Employees
ii.	Owner / Driver	- Nature of Business - Area / Route of Operation - Frequency of Operation - Average Number of Passenger - Charge and Cost - Problems for Operation - Future Plan

Table 4.11-2 Brief Summaries of Taxi-Bus Owner & Driver Interview

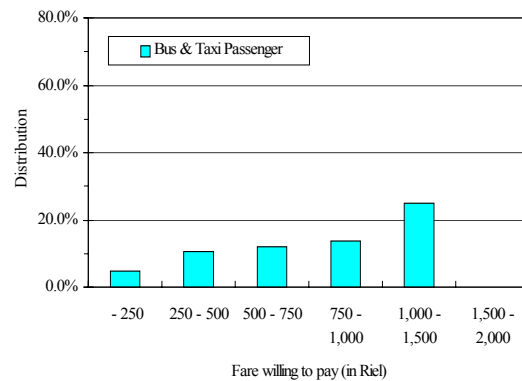
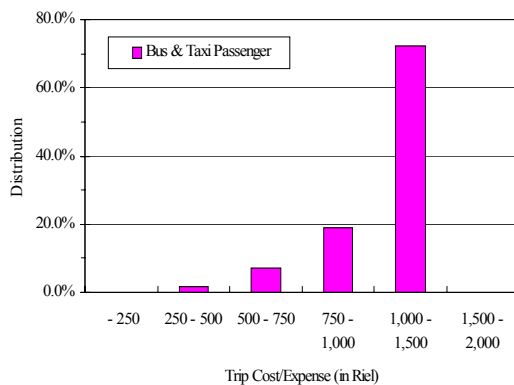
Items		Owner	Driver
Number of Sample		20	75
Nature of Business	(Primary)	40.0%	90.7%
	(Secondary)	60.0%	9.3%
Average Monthly Income	(Thousand Riel)	2,080	839
Average Monthly Expenditure	(Thousand Riel)	1,220	502
Usual Area of Operation	(Outside of the City)	65.0%	86.6%
	(Within the Suburb)	30.0%	6.7%
	(Within the CBD)	5.0%	6.7%
Possibility of Business Continuation	(Continue)	70.0%	29.3%
	(Quit)	5.0%	46.4%
	(No idea)	25.0%	25.3%

4.12 BUS AND TAXI-BUS PASSENGER INTERVIEW

A bus and taxi-bus passenger interview survey was carried out in order to establish the response of the bus and taxi-bus users to the introduction of masstransit and/or regulation on para-transit operation and the impact on their present situation. To obtain the characteristics of bus and taxi-bus passengers, this survey was conducted at five (5) major bus and taxi-bus terminals. These were Central Market, Dang Kao Market, Olympic Market, Orussey Market, and Chbar Ampaw Market. Table 4.12-1 and Figure 4.12-1 present an outline and a brief summary of the survey. The details of the survey are given in Appendix 4.12.

Table 4.12-1 Outlines of Bus and Taxi-bus Passenger

No.	Survey Item	Contents
i.	Personal Attributes	- Gender & Age - Occupation & Sector - Driving License Hold - Place of Work / Study
ii.	Trip Descriptions	- Origin & Destination - Trip Purpose - Number of Sub Trips
	Criteria for Selection of Present Mode	- Transport Mode - Waiting Time - Travel Time - Trip Cost / Expense - Reason
	Criteria for Selection of Proposed Mode	- Intention of Use - Expectation to the Service - Affordable Trip Cost - Acceptable Waiting Time



(Present Trip Cost) (Affordable Trip Cost)
Figure 4.12-1 Present and Proposed Trip Criteria (Bus & Taxi-Bus Passenger)

4.13 PARA-TRANSIT DRIVER INTERVIEW

A para-transit driver interview was carried out in order to establish the response of the para-transit drivers to the introduction of masstransit and/or regulation on para-transit operation and the impact on their present situations. To obtain the characteristics of para-transit drivers, this interview was conducted at five (5) major bus and taxi-bus terminals. These were Central Market, Dang Kao Market, Olympic Market, Orussey Market and Chbauv Ampao Market. Tables 4.13-1 and 4.13-2 present an outline and brief summaries of the survey. The details of the survey are given in Appendix 4.13.

Table 4.13-1 Outline of Para-Transit Driver Interview

No.	Survey Item	Contents
i.	Driver	- Nature of Job - Area / Route of Operation - Frequency of Operation - Average Number of Passenger - Charge and Cost - Problems for Operation - Future Plan

Table 4.13-2 Brief Summaries of Para-Transit Driver Interview

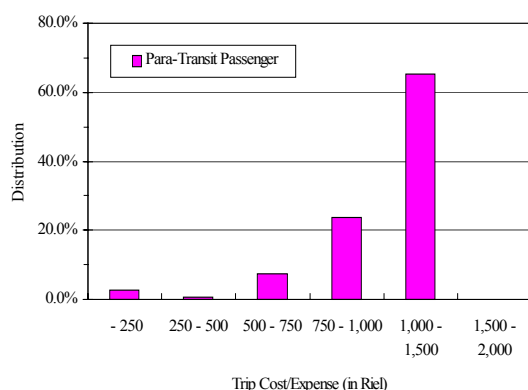
Items		Motodop	Cyclo	Motorumok
Number of Sample		450	50	25
Nature of Business	(Primary)	80.9%	82.0%	80.0%
	(Secondary)	19.1%	18.0%	20.0%
Average Monthly Income	(Thousand Riel)	296	213	390
Average Monthly Expenditure	(Thousand Riel)	146	96	208
Usual Area of Operation	(Outside of the City)	12.4%	0.0%	0.0%
	(Within the Suburb)	11.9%	14.0%	100.0%
	(Within the CBD)	75.7%	86.0%	0.0%
Possibility of Business Continuation	(Continue)	23.6%	28.0%	28.0%
	(Quit)	64.9%	56.0%	60.0%
	(No idea)	11.5%	16.0%	12.0%

4.14 PARA-TRANSIT PASSENGER INTERVIEW

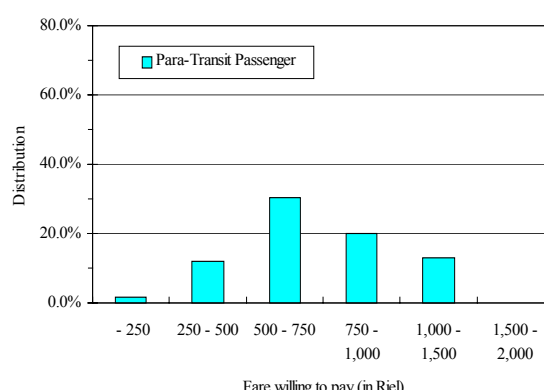
A para-transit passenger interview survey was carried out in order to establish the response of the para-transit users to the introduction of masstransit and/or regulation on para-transit operation and the impact on their present situation. To obtain the characteristics of para-transit passengers, this survey was conducted at five (5) major transport facilities, such as bus and taxi-bus terminals. These were Central Market, Dang Kao Market, Olympic Market, Orussey Market, and Chbauv Ampao Market. Table 4.14-1 and Figure 4.14-1 presents an outline and a brief summary of the survey. The details of the survey are given in Appendix 4.14.

Table 4.14-1 Outline of Para-Transit Passenger Interview

No.	Survey Item	Contents
i.	Personal Attributes	- Gender & Age - Occupation & Sector - Driving License Hold - Place of Work / Study
ii.	Trip Descriptions	- Origin & Destination - Trip Purpose - Number of Sub Trips
	Criteria for Selection of Present Mode	- Transport Mode - Waiting Time - Travel Time - Trip Cost / Expense - Reason
	Criteria for Selection of Proposed Mode	- Intention of Use - Expectation to the Service - Affordable Trip Cost - Acceptable Waiting Time



(Present Trip Cost)



(Affordable Trip Cost)

Figure 4.14-1 Present and Proposed Trip Criteria (Para-Transit Passengers)

4.15 BUS/TAXI-BUS TERMINAL TRAFFIC COUNTS

Bus/taxi-bus terminal traffic counts were carried out in order to establish the number of commercial vehicles and their passengers coming into and/or going out from the bus/taxi-bus terminals. To obtain the characteristics and/or relationship between small-scale public transport modes, such as bus and taxi-bus, and para-transit modes, such as motodop, cyclo, and motorumok, this survey was conducted at four (4) major terminals (6 survey points) in the central districts and adjacent district of the Study Area. Table 4.15-1 presents a brief summary of the survey. The details of the survey are given in Appendix 4.15.

Table 4.15-1 Summaries of Bus & Taxi-Bus Terminal Traffic Counts

Terminal Name		Daily Traffic (14 Hours)		Peak Hour Traffic		Peak Hour Ratio		Peak Hour	
		Vehicle	Passenger	Vehicle	Passenger	Vehicle	Passenger	Vehicle	Passenger
Bus									
Central Market South	In-coming	216	5,710	49	980	22.69%	17.16%	6:00-7:00	6:00-7:00
	Out-going	221	7,110	35	1,230	15.84%	17.30%	14:00-15:00	14:00-15:00
	Subtotal	437	12,820	65	1,560	14.87%	12.17%	6:00-7:00	6:00-7:00
Taxi-bus									
Central Market North	In-coming	1,633	14,415	242	2,337	14.82%	16.21%	8:00-9:00	9:00-10:00
	Out-going	1,621	13,904	251	2,035	15.48%	14.64%	9:00-10:00	9:00-10:00
	Subtotal	3,254	28,319	488	4,372	15.00%	15.44%	9:00-10:00	9:00-10:00
Olympic Market	In-coming	1,922	14,133	188	1,452	9.78%	10.27%	8:00-9:00	13:00-14:00
	Out-going	1,932	8,021	215	942	11.13%	11.74%	19:00-20:00	7:00-8:00
	Subtotal	3,854	22,154	333	2,206	8.64%	9.96%	16:00-17:00	7:00-8:00
Dang Kao	In-coming	1,389	12,248	169	1,682	12.17%	13.73%	13:00-14:00	13:00-14:00
	Out-going	1,346	13,014	143	1,768	10.62%	13.59%	8:00-9:00	8:00-9:00
	Subtotal	2,735	25,262	285	2,922	10.42%	11.57%	13:00-14:00	13:00-14:00
Chbar Ampauv 1	In-coming	960	8,674	138	1,452	14.38%	16.74%	6:00-7:00	6:00-7:00
	Out-going	904	6,687	121	1,362	13.38%	20.37%	6:00-7:00	6:00-7:00
	Subtotal	1,864	15,361	259	2,814	13.89%	18.32%	6:00-7:00	6:00-7:00
Chbar Ampauv 2	In-coming	577	5,283	83	643	14.38%	12.17%	6:00-7:00	10:00-11:00
	Out-going	568	5,380	69	764	12.15%	14.20%	6:00-7:00	11:00-12:00
	Subtotal	1,145	10,663	152	1,407	13.28%	13.20%	6:00-7:00	10:00-11:00
Total	In-coming	6,481	54,753						
	Out-going	6,371	47,006						
	Subtotal	12,852	101,759						
Grand total									
	In-coming	6,697	60,463						
	Out-going	6,592	54,116						
	Total	13,289	114,579						

4.16 MOTORCYCLE COUNTS

Motorcycle counts were carried out in order to establish the number of private motorcycles and motodops (motorbike taxis) given the lack of a registration system covering these vehicle classes as of May 2000. Motodops are categorized as a para-transit public transport mode. Nonetheless, motodops are the trunk public transport system in Phnom Penh due the lack of an alternative mass transit system. Conversely, the traffic problems in Phnom Penh, such as congestion along thoroughfares and roundabouts, are also attributed mostly to motodops. There is no official figure for the number of motodops being operated in Phnom Penh. It is therefore crucial to obtain the total number of motodops and to analyze their operational characteristics in order to improve not only traffic conditions but also the urban environment in the Study Area. Two methods, "Lump Sum" and "Break Down", were proposed after the failure of "Marking Sampling". Table 4.16-1 presents a brief summary of the survey. The details of the survey are given in Appendix 4.16.

Table 4.16-1 Estimated Numbers of Motorcycles

Method	Private	Commercial
Lump Sum (Registration Base)	72,000	33,000
	105,000	
Break Down (Person Trip Base)	216,500	23,000
	239,500	
(Ownership Base)	230,000	

Note: Registration basis number was judged to be not accurate enough to describe observed traffic volume

4.17 TRAFFIC VOLUME COMPARISONS AND DISTRIBUTIONS

Figure 4.17-1 presents traffic volume comparisons between 1995* and 2000 at major intersections and roundabouts in the central districts. The traffic volume counts carried out in October 1999 at three (3) intersections by the JICA Expert to MPWT were also utilized for this chart to cover omitted survey points in this Study. The details of the comparisons are given in Appendix 4.17.

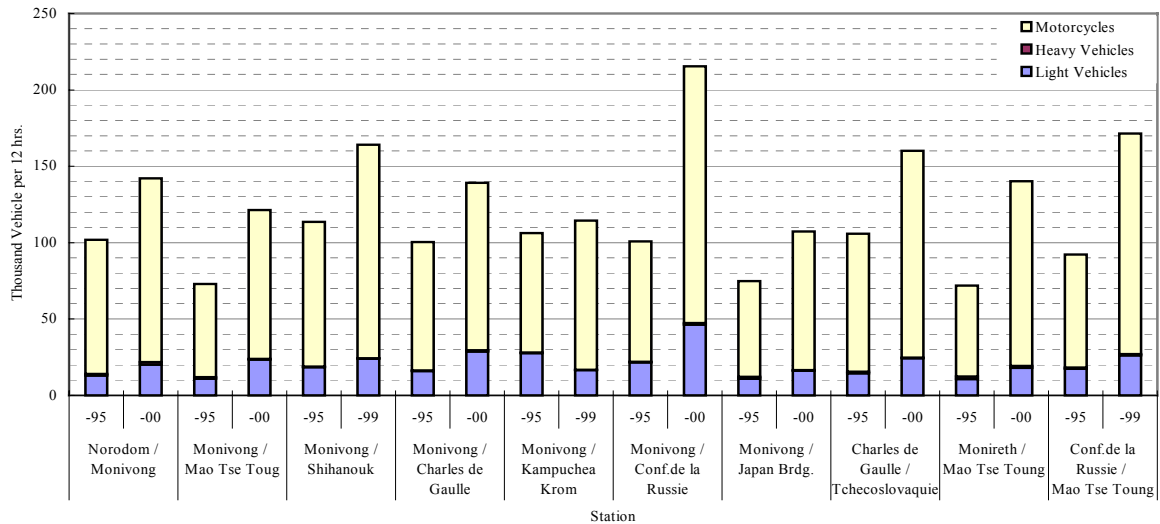
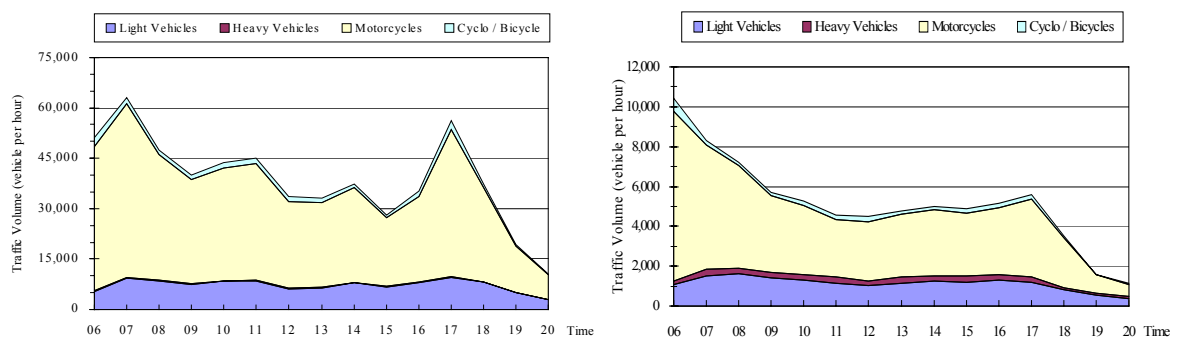


Figure: Inbound Traffic Total

Figure 4.17-1 Traffic Volume Comparisons at Major Intersections & Roundabouts

According to this comparison, the average traffic volume showed a 57% increase over the last 5 years. Light vehicles and motorcycles showed a 52% and a 59% increase respectively, while heavy vehicles showed a 15% decrease in same period.



Intra-City (Screen Line Total) Inter-City (Cordon Line Total)
Figure 4.17-2 Traffic Volume Distributions by Time and Mode

Generally, in the urbanized area, intra-city trips show two high peaks in the morning and before evening as well as two other relatively high peaks before and after lunchtime. At cordon-line stations, inter-city trips show a high peak in the early morning and a relatively high peak before evening with an average heavy vehicles share of around 5%. Most of these peaks for both intra-city and inter-city trips are mainly generated by motorcycle related traffic that shares around 70 to 80% of the total traffic volume according to the majority of the traffic counting stations.

* The 1995 data in the figure were converted from average daily traffic (ADT) to daytime 12-hr traffic volume by using 24/12-hr ratio described in the report of "Urban Infrastructure Rehabilitation and Management Program", World Bank in 1996.