2.1.3 Motorization and Transport Demand

1) Motorization Trends in Study Area

Hand in hand with economic growth, motorization has been making steady progress across the country; especially the increase in the ownership of motorcycles during the last 3-4 years has been significant. In 2002, while the number of cars was only 66,000, that of motorcycles was more than 2 million (refer to Table 2.1.13). This high rate of motorcycle ownership is extremely different from other cities in Asia where relatively high rates of motorcycle ownership were also noted (refer to Table 2.1.14 and Figure 2.1.12).

This unique process of motorization has brought about various impacts on the urban transport scene and the life of the people in the city. For example:

(1) Almost all households own private transport, making mobility of the people and accessibility to needed services high but at the same time keeping the development of public transport very low.

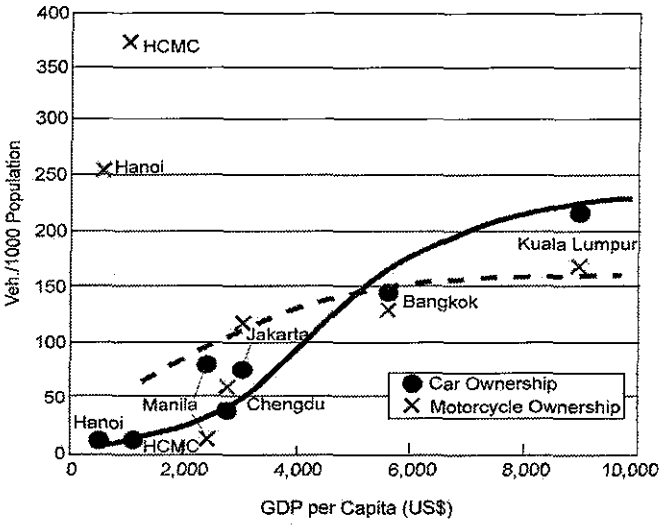
(2) No city in the world has experienced this process to such level as HCMC is experiencing it, making the future direction of urban transport uncertain.

Table 2.1.13 Number of Vehicles and Ownership Level in HCMC

		1996	1998	2000	2001	2002
No. of Vehicles ('000)	Motorcycle	1,056	1,334	1,900	1,969	2,040
	4-wheel vehicles	96	118	131	144	158
	- Car	-	-	55	61	66
	- Bus	-	-	23	24	25
	- Truck	-	-	35	41	48
	- Others	-	-	16	18	19
Growth Rate (%/year)	Motorcycle	-	12.4	19.3	3.6	3.6
	4-wheel vehicles	-	10.9	5.4	9.9	9.7
Ownership Level (000/000 persons)	Motorcycle	222	269	368	373	377
	4-wheel vehicles	20	24	25	27	29

Source: Traffic Police Department

Figure 2.1.12 Relationship between Vehicle Ownership and GDP per Capita



Source: Study Team

Table 2.1.14 Vehicle Ownership in Selected Asian Cities

City (Country)	Jakarta (Indonesia)	Manila (Philippines)	Bangkok (Thailand)	*Singapore*	Hanoi (Vietnam)	HCMC (Vietnam)	Chengdu (China)
Year	1994	1996	1993	1993	2001	2002	2000
No. of vehicles ('000)							
- Motorcycle	1,084	73	1,105	120	951	2,040	166
- Car	681	806	1,147[1)]	322	36	66	134
- Other 4-wheel veh.	487	142	291	142	62	92	
No. per 000 population							
- Motorcycle	118	8	136	41	334	377	54
- Car	74	85	142	110	13	12	43
- Other 4-wheel veh.	53	15	36	48	24	17	
Population (mil.)	9.2	9.5	8.1	2.9	2.8	5.4	3.1

Source: Culled from various reports
[1)] including buses

2) Overall Demand Characteristics

Travel Demand

The Household Interview Survey (HIS) conducted for the HOUTRANS in 2002 showed that the total transport demand in the study area was estimated to be 19.1 million trips *(excluding walking but including bicycle) a day, with HCMC accounting for 13.4 million trips.* Total demand increased in the last five years at an average annual growth rate of 8.4%. The estimate made by the DFID-MVA Study conducted in 1996 on the total travel demand in HCMC was 8.2 million trips a day, while the HOUTRANS HIS data was 13.3 million trips a day. The annual growth rate for the study population was 1.9 in the same period, which resulted in significant increases in trip rates in HCMC, from 1.7 to 2.5 (trips/day/person).

The high growth is attributed to the sharp increase in motorcycle ownership due to compounded reasons including population increase, enhanced affordability[8], and lax control on the ownership and use of motorcycle. Because of these, the trip rate (average number of trips made by a person a day) increased significantly from 1.7 to 2.5 (refer to Table 2.1.15).

Table 2.1.15 Total Travel Demand in the Study Area[1)]

	HCMC			Adjoining Areas	Study Area
	1996	2002	Growth Rate (%/yr)	2002	2002
Population (000)	4,839[1)]	5,410	1.9	2,244	7,653
No. of Trips/day (000)	8,229	13,383	8.4	5,678	19,060
Trip Rate (No. of trips/day/person)	1.70	2.47	6.5	2.53	2.49

Source: 1996 HCM Transport Survey (MVA) and 2002 HOUTRANS HIS
[1)] Excluding walk trips

Trip Rate

In spite of Vietnam's relatively low income level compared to counterpart cities in Southeast Asia, its trip rate is significant. In 2002, the trip rate of HCMC was as high as that in developed cities (refer to Table 2.1.16).

Trip rate was further analyzed in relation to other aspects including gender, age, household income, occupation, vehicle ownership, and access to vehicles. The results are briefly as follows:

(1) Trip rate by gender was different especially for the age bracket of workforce covering 20 to 60 years. For example, the trip rate of a 30- to 50-year-old male was nearly four, while that of a female was less than three (refer to Figure 2.1.13).

(2) Trip rate of people belonging to higher-income households was higher. Trip rate of those from lower-income households (less than VND 800,000 per month) was slightly more than two which was about 70% of that of wealthy households (refer to Figure 2.1.14).

(3) Trip rate by occupation varied, too. Low rates were observed for students, housewives and the unemployed (refer to Figure 2.1.15).

(4) Trip rate was quite different depending upon the availability of personal vehicles. Those who owned cars had the highest trip rate of more than four followed by motorcycle owners (3.9) and bicycle owners (2.7). Those who did not own any vehicle showed a very low trip rate of 1.8 (refer to Figure 2.1.16).

[8] In addition to increase in income level, the price of motorcycles decreased drastically, especially during the last three years.

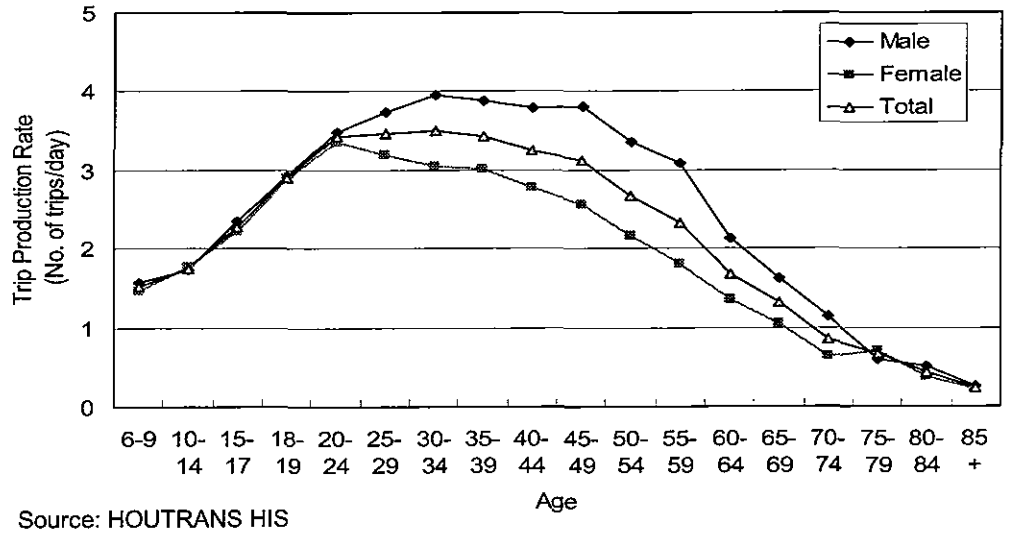
Table 2.1.16 Comparison of Trip Rate among Cities

	Year	Population (000)	Trip Rate	
			Including Walk	Excluding Walk
HCMC (Vietnam)[1)]	2002	7,693	3.0	2.5
Ha Noi (Vietnam)	1996	1,200	2.6	2.0
Manila (Philippines)[1)]	1996	13,565	2.2	1.8
Jakarta (Indonesia)[1)]	2002	21,594	1.7	1.1
Kuala Lumpur (Malaysia)[1)]	1998	2,000	2.5	n.a
Bangkok (Thailand)	1995	n.a.	2.3	n.a
Chendu (China)	2001	3,090	2.6	1.8
Tokyo (Japan)[1)]	1998	34,000	2.3	n.a
Munich (Germany)	n.a	n.a	2.9	n.a
(Netherlands average)	n.a	n.a	3.6	n.a
(USA average)	n.a	n.a	3.9	n.a

Sources: Vietnam, Manila, Jakarta, Kuala Lumpur, Bangkok, Chengdu: JICA Studies
Tokyo: Tokyo Metropolitan Region Transport Planning Consultant
Munich, Netherlands USA: JICA – Cairo Regional Area Transport Study

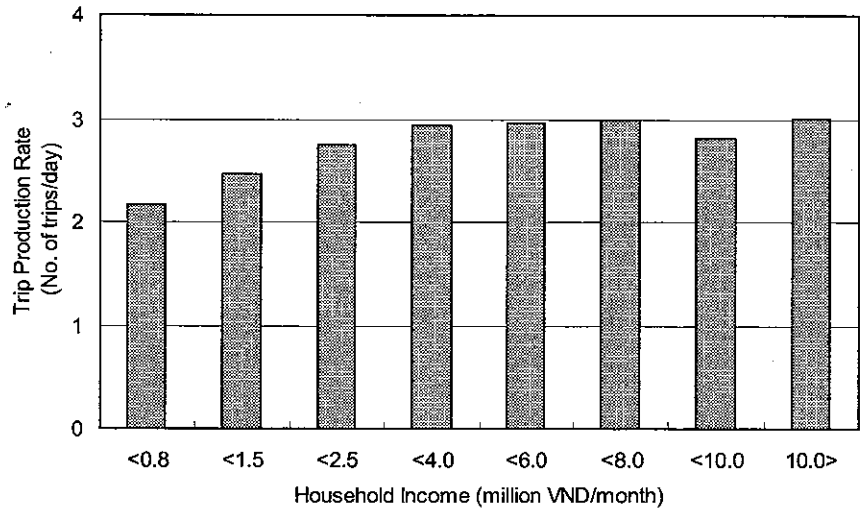
[1)] covers thr metropolitan area

Figure 2.1.13 Trip Production Rate by Gender and Age (Excluding Walking)



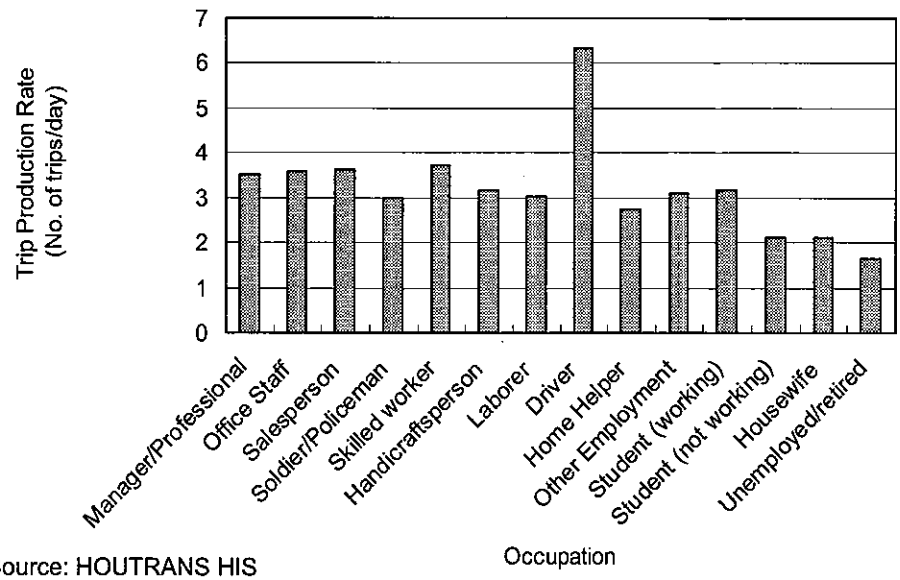
Source: HOUTRANS HIS

Figure 2.1.14 Trip Production Rate by Household Income (Excluding Walking)



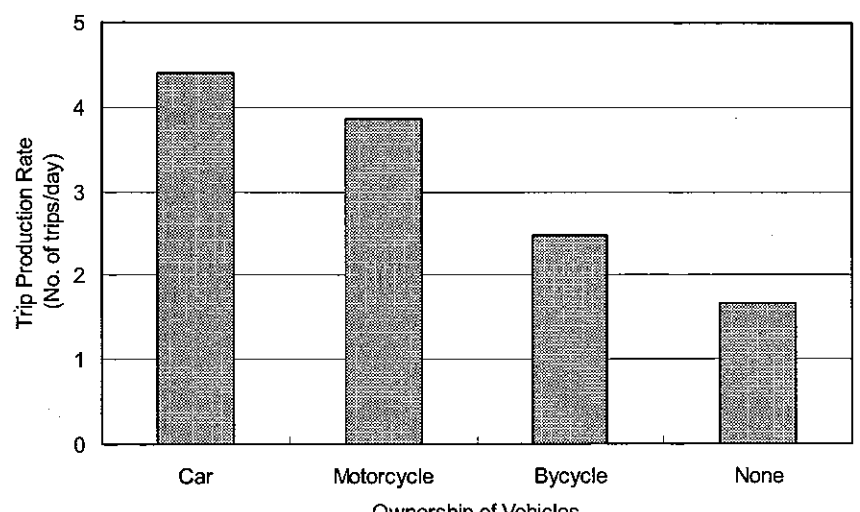
Source: HOUTRANS HIS

Figure 2.1.15 Trip Production Rate by Occupation (Excluding Walking)



Source: HOUTRANS HIS

Figure 2.1.16 Trip Production Rate by Personal Vehicle Ownership (Excluding Walking)



Source: HOUTRANS HIS

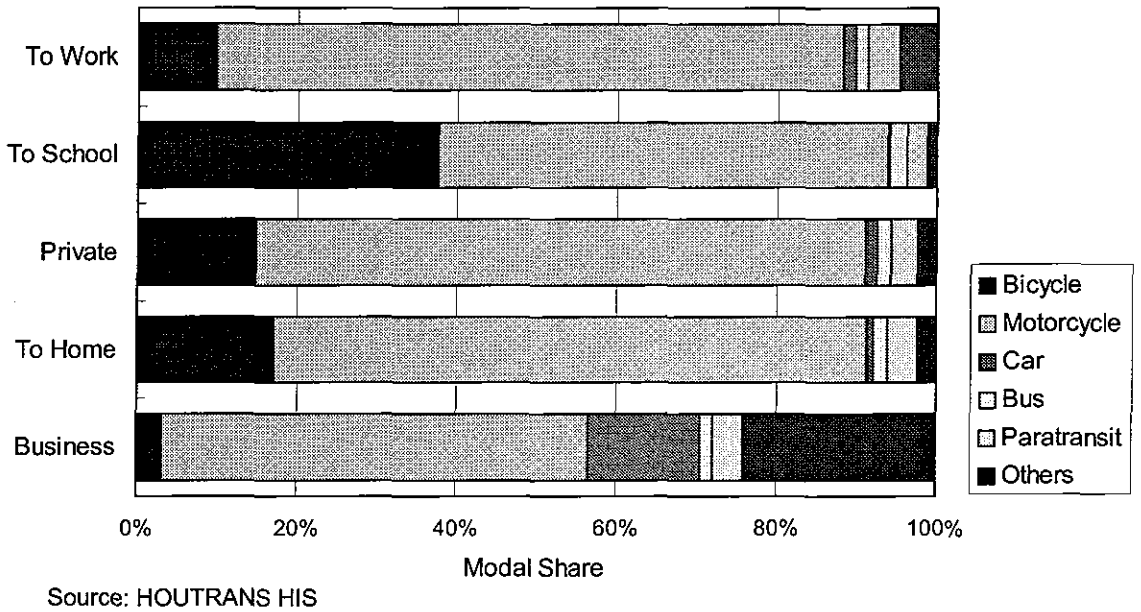
Modal Share and Purpose

Of the total demand of 19.3 million trips, 75% were made by motorcycle (63% by drivers and 12% by pillion passengers), followed by bicycle at 17%. Public transport including para-transit shared 5.6% of which bus, including lambro, contributed only 1.7% (refer to Table 2.1.17).

The modal share, however, was fairly different by travel purpose. "To work" trips were made by motorcycles (76.2%), whereas "to school" trips were done by bicycles (38.3%), motorcycles (32.0%) and shared motorcycles (13.0%). "Business" trips were also made by motorcycles (58%), but those of cars (9.3%) and trucks (16.1%) were also notable. Public transport modes were not popular for all-purpose trips (refer to Table 2.1.18 and Figure 2.1.17).

Bicycles were mainly used for "private" and "to school" trips followed by "to work" trips. Motorcycles were mainly for "private" and "to work" trips, while shared motorcycles were for "private" and "to school" trips. Taxis were used mainly for "private" and "business" trips because of the relatively low fare and good availability. Cyclo and xe om were mostly for "private" trips. Buses including lambro were used for "private", "to work" and "to school" trips (refer to Table 2.1.20).

Figure 2.1.17 Modal Share by Purpose (Excluding Walking)



Source: HOUTRANS HIS

Table 2.1.17 Total Demand by Mode, 1996 and 2002

Travel Mode		No. of Trips (000/day)					Share (%)			
		1996	2002			2002/ 1996 (HCMC)	1996	2002		
		HCMC	HCMC	Adjoining Area	STUDY AREA		HCMC	HCMC	Adjoining Area	Study Area
Private	Bicycle	2,633	1,813	1,497	3,310	0.69	32	13.6	26.4	17.4
	M/C (driver)	5,267	8,781	3,126	11,907	1.98	64	65.6	55.1	62.5
	M/C (passenger)		1,649	653	2,302			12.3	11.5	12.1
	Car	82	166	67	233	2.02	1	1.2	1.2	1.2
	Truck	-	132	84	216	-	-	1.0	1.5	1.1
	Subtotal	7,982	12,542	5,426	17,968	1.57	97	93.7	95.6	94.3
Para-transit	Taxi	-	47	4	51	-	-	0.4	0.1	0.3
	Cyclo/M.Cyclo	-	120	6	127	-	-	0.9	0.1	0.7
	Xe Om	-	137	24	160	-	-	1.0	0.4	0.8
	Private Bus	-	206	161	367	-	-	1.5	2.8	1.9
	Subtotal	-	511	195	705	-	-	3.8	3.4	3.7
Public	Bus/lambro	165	282	44	326	1.71	2	2.1	0.8	1.7
	Rail	-	0	0	0	-	-	0.0	0.0	0.0
	Ferry	-	7	3	9	-	-	0.1	0.0	0.0
	Subtotal	165	289	47	336	1.75	2	2.2	0.8	1.8
Others		82	41	10	51	0.52	1	0.3	0.2	0.3
Total (excluding walking)		8,229	13,383	5,678	19,060	1.63	100	100.0	100.0	100.0
Walking		-	2,542	1,378	3,919	-	-	16.0	19.5	17.1
Total (including walking)		-	15,924	7,055	22,980	-	-	100.0	100.0	100.0

Source: DFID-MVA for 1996 data and HOUTRANS HIS for 2002 data.

Table 2.1.18 Travel Demand by Purpose and Mode in the Study Area, 2002

Travel Mode		No of Trips (000/day) by Purpose					
		To Work	To School	Private	Business	To Home	TOTAL
Private	Bicycle	351	611	758	18	1,573	3,310
	M/C (driver)	2,637	448	3,119	199	5,503	11,907
	M/C (passenger)	186	375	613	11	1,117	2,302
	Car	45	3	68	46	71	233
	Truck	38	0	30	91	56	216
	Subtotal	3,258	1,438	4,587	365	8,320	17,968
Semi-public	Taxi	3	0	19	6	23	51
	Cyclo/M.Cyclo	10	4	49	6	58	127
	Xe Om	8	5	68	2	77	160
	Private Bus	107	31	38	9	182	367
	Subtotal	128	41	173	23	340	705
Public	Bus/lambro	45	31	98	15	137	326
	Rail	0	0	0	0	0	0
	Ferry	1	0	1	0	6	9
	Subtotal	46	32	100	15	143	336
Others		11	3	8	5	24	51
Total (excluding walking)		3,444	1,513	4,868	408	8,828	19,060
Walking		352	371	1,306	20	1,871	3,919
Total (including walking)		3,796	1,884	6,174	428	10,699	22,980

Source: HOUTRANS HIS

Table 2.1.19 Composition of Travel Demand of Purpose by Mode, 2002

Travel Mode		% Composition of Mode					
		To Work	To School	Private	Business	To Home	TOTAL
Private	Bicycle	10.2	40.4	15.6	4.3	17.8	17.4
	M/C (driver)	76.6	29.6	64.1	48.9	62.3	62.5
	M/C (passenger)	5.4	24.8	12.6	2.7	12.7	12.1
	Car	1.3	0.2	1.4	11.2	0.8	1.2
	Truck	1.1	0.0	0.6	22.4	0.6	1.1
	Subtotal	94.6	95.0	94.2	89.6	94.3	94.3
Semi-public	Taxi	0.1	0.0	0.4	1.4	0.3	0.3
	Cyclo/M.Cyclo	0.3	0.2	1.0	1.4	0.7	0.7
	Xe Om	0.2	0.4	1.4	0.5	0.9	0.8
	Private Bus	3.1	2.1	0.8	2.3	2.1	1.9
	Subtotal	3.7	2.7	3.6	5.6	3.9	3.7
Public	Bus/lambro	1.3	2.1	2.0	3.6	1.5	1.7
	Rail	0.0	0.0	0.0	0.0	0.0	0.0
	Ferry	0.0	0.0	0.0	0.1	0.1	0.0
	Subtotal	1.3	2.1	2.0	3.8	1.6	1.8
Others		0.3	0.2	0.2	1.1	0.3	0.3
Total (excluding walking)		100.0	100.0	100.0	100.0	100.0	100.0

Source: HOUTRANS HIS

Table 2.1.20 Composition of Travel Demand of Mode by Purpose, 2002

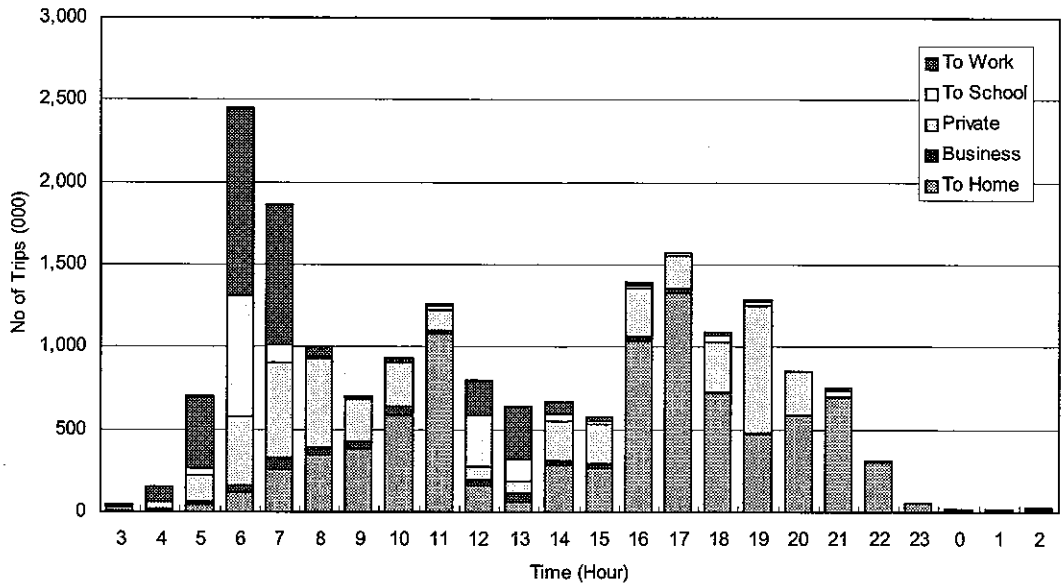
Travel Mode		% to each mode					
		To Work	To School	Private	Business	To Home	TOTAL
Private	Bicycle	10.6	18.5	22.9	0.5	47.5	100.0
	M/C (driver)	22.1	3.8	26.2	1.7	46.2	100.0
	M/C (passenger)	8.1	16.3	26.6	0.5	48.5	100.0
	Car	19.4	1.5	29.1	19.6	30.4	100.0
	Truck	17.8	0.1	13.7	42.3	26.2	100.0
	Subtotal	18.1	8.0	25.5	2.0	46.3	100.0
Semi-public	Taxi	6.5	0.9	36.3	10.9	45.5	100.0
	Cyclo/M.Cyclo	8.2	2.9	38.6	4.6	45.8	100.0
	Xe Om	5.0	3.4	42.1	1.3	48.2	100.0
	Private Bus	29.0	8.5	10.5	2.5	49.5	100.0
	Subtotal	18.2	5.8	24.6	3.2	48.3	100.0
Public	Bus/lambro	13.8	9.6	30.1	4.5	41.9	100.0
	Rail	14.5	0.0	57.6	0.0	27.9	100.0
	Ferry	11.7	1.6	15.1	5.1	66.5	100.0
	Subtotal	13.8	9.4	29.7	4.6	42.6	100.0
Others		22.0	5.8	15.9	9.0	47.3	100.0
Total		18.1	7.9	25.5	2.1	46.3	100.0
Walking		9.0	9.5	33.3	0.5	47.7	100.0
Total (including walking)		16.5	8.2	26.9	1.9	46.6	100.0

Source: HOUTRANS HIS

Daily Demand Pattern

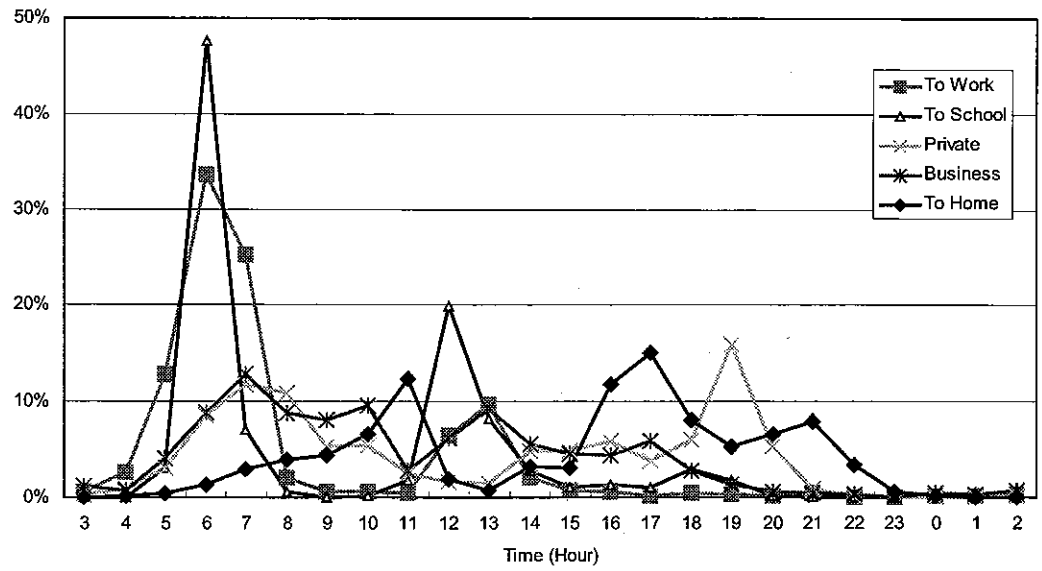
Hourly distribution of the demand varied by hour. As in other cities in Southeast Asia, there were three peaks: in the morning, midday and late afternoon. The morning peak (6-7am) showed the sharpest and highest concentration of 13% which was attributed to "to work" and "to school" trips. The second peak was somewhat between 4 to 8 pm with 7-8% concentration and was attributed to "to home" trips between 4 and 6 pm and "to school" trips between 6 and 7 pm. The third peak was seen between 11 and 12 noon due to "to home" trips (refer to Figure 2.1.18 and Figure 2.1.19).

Figure 2.1.18 Hourly Distribution of Trips by Purpose (Excluding Walking)



Source: HOUTRANS HIS

Figure 2.1.19 Hourly Distribution of Trips by Purpose -Ratio- (Excluding Walking)



Source: HOUTRANS HIS

Travel Time

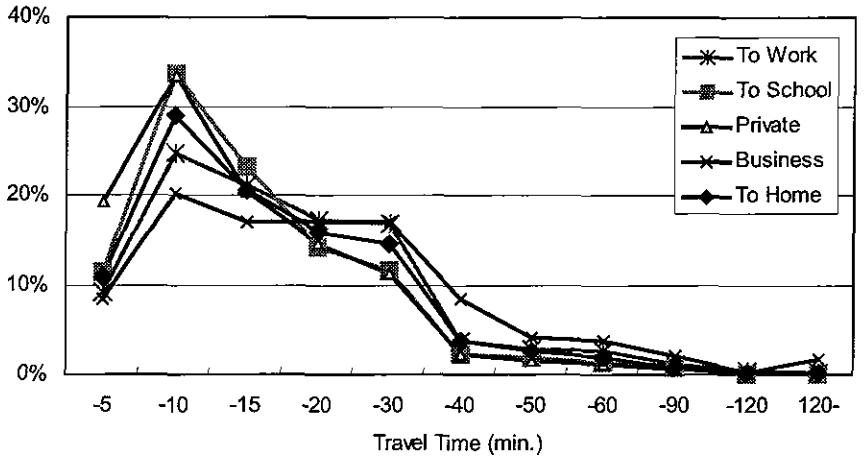
(1) Average Travel Time: Average travel time of the entire trips in the study area was 17 minutes and more than 60% of trips took less than 15 minutes. Only 9% spent more than 30 minutes. The peak for distribution of trips was 5-10 minutes regardless of purpose (refer to Table 2.1.21 and Figure 2.1.20).

Table 2.1.21 Average Travel Time by Purpose (Excluding Walking)

Trip Purpose	Average Travel Time (min.)	% of 'less than 15 min. trip'	% of 'more than 30 min. trip'
To Work	20.1	55.8	10.2
To School	16.2	69.0	5.5
Private	16.6	68.6	6.5
Business	28.7	40.9	23.9
To Home	18.4	61.6	9.0
TOTAL	18.3	62.5	8.6

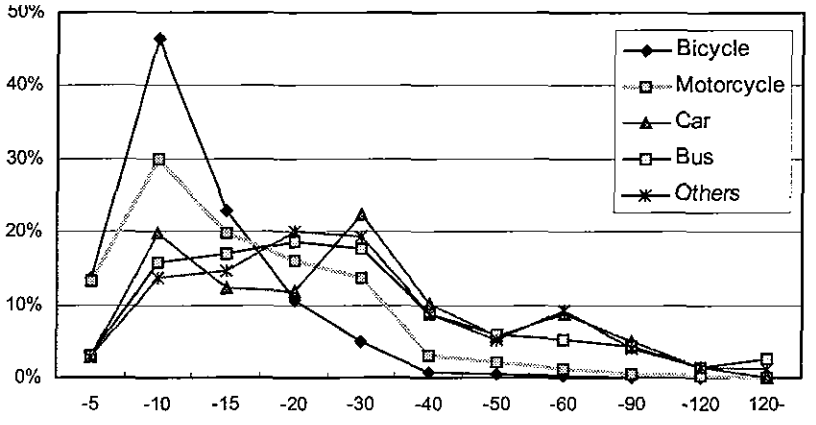
Source: HOUTRANS HIS

Figure 2.1.20 Distribution of Travel Time by Purpose (Excluding Walking)



Source: HOUTRANS HIS

Figure 2.1.21 Distribution of Travel Time by Transport Mode



Source: HOUTRANS HIS

(2) Travel Time by Area: Accessibility varied by area of residence. Residents in urban and rural areas tended to travel shorter distances than those residing in suburban areas, except very special areas like Nha Be which is surrounded by rivers (refer to Figure 2.1.22 and Table 2.1.22).

(3) Comparison of Travel Time by Intra and Interdistrict Trips: Average travel time of intradistrict trips was not so different by area, while that of interdistrict trips was longer in suburban and rural areas. In other words, there was a large gap in travel time between intra and interdistrict trips in suburban and rural areas (refer to Table 2.1.22).

Figure 2.1.22 Average Travel Time by Traffic Zone

Source: HOUTRANS HIS
[1] Origin-based excluding walking.

Table 2.1.22 Average Travel Time of Intra and Interdistrict Trips by Purpose[1) 2)] (Minutes)

Study Area			To work			To school			Private			Business			To home			Total		
			Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total	Intra	Inter	Total
HCMC	Inner Core	District 1	12	23	18	12	20	16	12	24	17	13	33	27	13	24	22	13	24	21
		District 3	14	24	21	14	21	17	14	20	17	19	28	25	15	25	22	15	24	21
		District 4	12	23	20	12	22	18	11	21	17	13	47	40	11	27	18	11	25	19
		District 5	12	22	18	11	21	15	12	23	18	15	29	26	12	23	20	12	23	19
		District 6	14	26	20	13	24	17	14	28	19	12	32	26	14	23	19	14	25	19
		District 10	10	19	17	10	18	14	11	18	15	11	28	25	11	25	22	11	23	19
		District 11	10	30	24	10	22	17	10	20	16	17	28	25	10	24	18	10	25	19
		Phu Nhuan	10	25	22	10	21	17	10	20	16	11	25	23	11	22	17	10	23	18
		Sub-Total	**12**	**24**	**20**	**12**	**21**	**16**	**12**	**22**	**17**	**14**	**32**	**27**	**12**	**24**	**20**	**12**	**24**	**19**
	Inner Fringe	District 8	12	23	18	11	23	17	11	20	16	14	28	24	11	23	14	11	22	16
		Binh Thanh	12	24	20	11	20	15	11	26	18	13	39	30	12	28	17	12	26	18
		Tan Binh	14	26	21	13	23	17	13	23	17	14	35	26	14	27	19	14	26	19
		Go Vap	12	34	27	12	32	19	11	30	19	14	28	24	12	27	18	12	30	20
		Subtotal	**13**	**26**	**21**	**12**	**23**	**17**	**12**	**24**	**17**	**14**	**35**	**27**	**12**	**27**	**17**	**12**	**26**	**18**
	Emerging Peripheral	*Thu Duc*	*15*	*29*	*20*	*13*	*30*	*17*	*13*	*30*	*16*	*16*	*42*	*29*	*14*	*32*	*22*	*14*	*32*	*20*
		District 12	14	32	22	13	27	18	12	24	15	16	31	27	13	27	16	13	28	18
		Binh Chanh	15	22	17	12	22	16	12	21	16	16	30	24	13	30	17	13	24	17
		District 2	15	33	24	14	31	19	15	30	20	17	36	29	15	32	20	15	32	21
		District 7	14	27	20	12	27	18	11	23	16	13	84	62	13	29	21	13	29	20
		District 9	13	29	22	13	25	19	11	28	16	15	42	30	13	31	16	12	29	18
		Subtotal	**15**	**28**	**20**	**13**	**26**	**18**	**12**	**24**	**16**	**16**	**42**	**30**	**13**	**30**	**19**	**13**	**28**	**18**
	Sub-urban	Hoc Mon	14	40	29	11	48	23	13	50	27	20	49	42	14	36	18	13	43	24
		Nha Be	14	28	23	12	30	19	14	40	24	19	33	24	14	34	18	14	33	21
		Subtotal	**14**	**38**	**28**	**11**	**42**	**22**	**13**	**47**	**26**	**19**	**45**	**35**	**14**	**35**	**18**	**13**	**40**	**23**
	Rural	Cu Chi	16	61	26	13	54	17	13	69	21	15	49	23	16	57	18	15	62	20
		Can Gio	13	45	17	13	56	15	13	58	26	22	40	29	13	54	14	13	53	18
		Subtotal	**16**	**59**	**24**	**13**	**54**	**16**	**13**	**65**	**22**	**18**	**44**	**26**	**15**	**56**	**17**	**15**	**60**	**20**
HCMC Subtotal			**13**	**27**	**21**	**12**	**24**	**17**	**12**	**25**	**17**	**15**	**35**	**28**	**13**	**26**	**19**	**13**	**26**	**19**
Adjoining Area	Satellite Urban	Thu Dau Mot	15	26	16	14	41	15	12	33	12	17	44	27	14	34	15	13	34	15
		Bien Hoa	18	40	19	14	37	15	13	37	15	17	44	21	15	38	17	15	38	17
		Tan An	12	34	15	13	15	13	11	27	14	17	60	48	12	30	17	12	32	16
		Subtotal	***17***	***35***	***18***	***14***	***34***	***15***	***13***	***34***	***14***	***17***	***48***	***26***	***15***	***35***	***17***	***14***	***36***	***16***
	Sub-urban	Thuan An	17	35	21	14	27	18	14	25	17	15	26	19	15	33	18	15	29	18
		Di An	13	30	17	13	29	17	11	25	13	16	109	54	12	27	17	12	31	17
		Subtotal	**15**	**32**	**19**	**13**	**28**	**17**	**12**	**25**	**16**	**15**	**69**	**37**	**14**	**30**	**17**	**14**	**30**	**18**
	Rural	Long Thanh	13	36	19	14	22	14	14	26	15	12	50	29	14	31	15	14	33	16
		Nhon Trach	13	45	14	13	26	13	10	33	13	12	80	24	11	35	14	12	36	14
		Can Giuoc	12	65	24	11	34	12	12	38	18	17	57	28	12	29	13	12	45	16
		Can Duoc	11	72	21	13	36	14	11	66	17	13	-	13	11	33	12	11	59	15
		Chau Thanh	11	38	20	12	29	14	11	39	21	8	-	8	12	33	13	12	38	17
		Thu Thua	14	65	20	16	15	16	16	27	18	45	-	45	15	16	15	15	29	17
		Ben Luc	12	29	15	12	14	13	12	27	17	18	49	38	12	24	14	12	28	15
		Duc Hoa	12	31	15	12	21	13	12	25	13	10	63	22	12	42	13	12	30	14
		Tan Tru	13	46	16	15	12	15	15	28	17	12	-	12	14	20	14	14	33	15
		Subtotal	**12**	**44**	**18**	**13**	**24**	**14**	**12**	**33**	**16**	**14**	**52**	**28**	**13**	**30**	**14**	**13**	**36**	**15**
Adjoining Subtotal			**15**	**40**	**18**	**13**	**27**	**15**	**13**	**31**	**15**	**16**	**54**	**28**	**14**	**32**	**16**	**14**	**34**	**16**
TOTAL			**14**	**28**	**20**	**13**	**24**	**16**	**12**	**25**	**17**	**15**	**37**	**28**	**13**	**26**	**18**	**13**	**27**	**18**

Source: HOUTRANS HIS

[1)] Intradistrict trips are those completed within a district, while interdistrict trips are those moving between two districts.

[2)] Excluding walk trips.

3) Demand by Area

Trip Generation/Attraction

(1) Trip Generation/Attraction by District: The characteristics of trip generation and attraction by area/district are as follows (refer to Table 2.1.23).

a) Districts 1, 6, Binh Thanh, Tan Binh, and Binh Chanh had large demand in terms of total number of generated/attracted trips.

b) The number of "to work" / "to school" trips was much higher in attraction than those in generation in the inner core of HCMC, including Districts 1, 3, and 5, and some emerging peripheral areas, such as Districts Thu Duc and 7. The number of "to work" / "to school" trips was higher in generation in the inner fringe and some emerging peripheries, including Districts 8, Binh Thanh, Tan Binh, Go Vap, and 9. This showed that there was a large amount of commuting trips from the inner fringe and emerging peripheries to the inner core and some districts where large factories are located.

c) Moreover, there was high demand for trips categorized as "others" (private, business, etc.) in the inner core.

(2) Trip Generation/Attraction by Type of Facility: In Ho Chi Minh City and surrounding areas, about 47.4% of trips were generated and attracted from/to residences. Besides, offices, educational and commercial facilities were significant places that produced trip demand (refer to Table 2.1.24).

Table 2.1.23 Trip Generation/Attraction by Type of Facilities (Excluding Walking)

Type of Facility	Generation		Attraction	
	No of Trips (000)	%	No of Trips (000)	%
Residential	9,041	47.4	9,019	47.3
Office	2,933	15.4	2,923	15.3
Industrial/Warehouse	242	1.3	224	1.2
Educational	2,057	10.8	2,168	11.4
Commercial	2,096	11.0	2,100	11.0
Recreational	551	2.9	552	2.9
Medical/Welfare	186	1.0	186	1.0
Restaurant	599	3.1	528	2.8
Others	1,355	7.1	1,360	7.1
TOTAL	19,061	100.0	19,061	100.0

Source: HOUTRANS HIS

[1] 'Others' includes undefined facilities; moreover, it may include answers from respondents who do not want to reveal their specific destinations.

(3) Share of Intradistrict Trip Rate by District: One of the typical characteristics in the study area was the high rate of intradistrict trips (refer to Table 2.1.25).

a) The rate was higher in the rural areas such as Cu Chi and Can Gio in HCMC and provincial rural and suburban districts.

b) "To school" and "private" trips had high rates of intradistrict trips, while "to work" and "business" trips had lower rates of intradistrict trips.

Table 2.1.24 Trip Generation/Attraction by District (Excluding Walking)

Study Area			Generation (Number of Trips:000)						Attraction (Number of Trips:000)					
			To Work	To School	Pri-Vate	Busi-ness	To Home	Total	To Work	To School	Pri-Vate	Busi-Ness	To Home	Total
HCMC	Inner Core	District 1	124	66	212	39	720	1,160	336	112	373	42	300	1,163
		District 3	104	49	127	17	368	665	145	94	153	18	241	651
		District 4	96	32	120	14	145	408	69	19	86	14	226	414
		District 5	99	48	160	20	488	816	183	114	251	25	271	845
		District 6	134	53	255	18	479	939	143	49	344	17	395	949
		District 10	121	47	128	13	363	672	124	79	193	14	255	665
		District 11	101	51	111	9	195	468	83	28	109	7	236	463
		Phu nhuan	87	38	78	8	154	365	57	30	66	8	193	354
		Subtotal	**868**	**383**	**1,190**	**139**	**2,913**	**5,493**	**1,140**	**525**	**1,576**	**145**	**2,117**	**5,503**
	Inner Fringe	District 8	192	66	305	10	296	868	117	38	202	10	481	849
		Binh Thanh	222	104	310	32	448	1,116	151	83	248	26	606	1,114
		Tan Binh	290	123	302	29	602	1,346	261	97	301	27	682	1,367
		Go Vap	142	63	156	11	284	655	93	60	134	11	348	647
		Subtotal	**845**	**356**	**1,072**	**82**	**1,630**	**3,985**	**623**	**278**	**885**	**73**	**2,117**	**3,976**
	Emerging Peripheral	Thu Duc	104	50	186	32	393	764	146	74	206	30	299	755
		District 12	83	33	97	8	171	391	73	24	86	5	202	390
		Binh Chanh	186	72	324	15	413	1,011	182	50	243	16	518	1,009
		District 2	38	21	47	4	87	197	32	17	43	3	110	207
		District 7	49	19	67	5	119	260	70	16	56	6	125	272
		District 9	85	44	129	6	146	409	54	29	108	6	221	417
		Subtotal	**546**	**239**	**849**	**70**	**1,329**	**3,033**	**558**	**210**	**743**	**66**	**1,474**	**3,050**
	Sub-urban	Hoc Mon	85	32	75	6	125	324	47	24	57	6	185	319
		Nha Be	23	13	29	4	46	116	15	8	21	4	64	112
		Subtotal	**108**	**45**	**105**	**11**	**172**	**440**	**63**	**32**	**78**	**9**	**249**	**430**
	Rural	Cu Chi	82	45	100	4	211	441	69	42	91	6	232	440
		Can Gio	19	13	24	3	44	103	18	12	17	2	52	102
		Subtotal	**101**	**57**	**123**	**7**	**254**	**544**	**87**	**54**	**109**	**8**	**284**	**542**
	HCMC Subtotal		**2,469**	**1,080**	**3,339**	**309**	**6,299**	**13,495**	**2,470**	**1,098**	**3,391**	**302**	**6,242**	**13,501**
Adjoining Area	Satellite urban	Thu Dau Mot	66	31	179	15	236	527	64	33	192	13	234	536
		Bien Hoa	278	113	475	36	768	1,670	299	114	468	35	750	1,665
		Tan An	48	25	62	6	138	279	55	25	78	6	117	281
		Subtotal	**392**	**168**	**716**	**57**	**1,142**	**2,476**	**418**	**172**	**737**	**54**	**1,101**	**2,482**
	Sub-urban	Thuan An	61	32	114	8	164	379	64	23	86	10	181	364
		Di An	65	32	83	8	175	364	75	29	90	10	158	363
		Subtotal	**126**	**64**	**197**	**16**	**339**	**743**	**139**	**53**	**176**	**20**	**339**	**726**
	Rural	Long Thanh	99	31	140	7	207	484	76	30	138	8	241	493
		Nhon Trach	40	21	68	3	118	250	47	20	63	3	114	247
		Can Giuoc	55	21	71	2	118	266	45	21	60	2	136	264
		Can Duoc	56	32	70	0	125	282	50	30	65	1	136	282
		Chau Thanh	33	19	48	1	64	165	22	17	33	1	93	166
		Thu Thua	23	14	44	0	66	147	24	13	38	0	70	145
		Ben Luc	50	22	72	7	113	264	48	21	59	4	129	262
		Duc Hoa	74	33	80	2	156	345	65	29	75	3	171	343
		Tan Tru	27	9	21	1	50	108	25	9	19	1	54	108
		Subtotal	**457**	**201**	**614**	**23**	**1,017**	**2,312**	**403**	**190**	**550**	**23**	**1,145**	**2,311**
	Adjoining Subtotal		**975**	**433**	**1,527**	**96**	**2,498**	**5,530**	**960**	**414**	**1,462**	**98**	**2,585**	**5,519**
Total			**3,444**	**1,513**	**4,866**	**405**	**8,797**	**19,025**	**3,429**	**1,512**	**4,853**	**399**	**8,827**	**19,021**

Source: HOUTRANS HIS

Table 2.1.25 Demand Characteristics

Type of Area/District			Total No. of Generated/Attracted Trips (000/day)	Ratio for Intra District Trip (%)			
				To Work	To School	Private	Business
HCMC	Inner core	District 1	2,323	26	42	40	29
		District 3	1,316	29	40	40	31
		District 4	822	33	52	49	22
		District 5	1,660	27	35	37	19
		District 6	1,888	43	62	56	31
		District 10	1,337	26	33	32	18
		District 11	931	32	55	44	33
		Phu Nhuan	719	24	39	41	16
		Subtotal	**10,996**	**25**	**35**	**37**	**23**
	Inner Fringe	District 8	1,717	54	65	63	27
		Binh Thanh	2,229	40	58	63	37
		Tan Binh	2,713	46	67	65	48
		Go Vap	1,303	42	66	63	31
		Subtotal	**7,961**	**46**	**64**	**64**	**39**
	Emerging peripheral	Thu Duc	1,519	56	63	74	54
		District 12	781	60	77	74	31
		Binh Chanh	2,020	65	68	68	45
		District 2	404	52	79	70	43
		District 7	533	44	63	62	31
		District 9	826	58	67	74	44
		Subtotal	**6,082**	**58**	**68**	**71**	**46**
	Sub-urban	Hoc Mon	643	53	77	72	25
		Nha Be	227	47	73	70	70
		Subtotal	**870**	**52**	**76**	**71**	**43**
	Rural	Cu Chi	881	85	95	90	61
		Can Gio	205	90	96	83	69
		Subtotal	**1,086**	**86**	**95**	**89**	**64**
HCMC Subtotal			**26,996**	**44**	**58**	**58**	**35**
Adjoining Area	Satellite Urban	Thu Dau Mot	1,063	85	93	94	67
		Bien Hoa	3,336	91	98	95	85
		Tan An	559	81	95	73	27
		Subtotal	**4,958**	**89**	**97**	**92**	**74**
	Sub-urban	Thuan An	742	76	83	78	52
		Di An	727	74	80	78	53
		Subtotal	**1,469**	**75**	**82**	**78**	**52**
	Rural	Long Thanh	977	84	97	90	54
		Nhon Trach	497	89	99	92	83
		Can Giuoc	530	86	96	84	70
		Can Duoc	564	88	96	92	73
		Chau Thanh	331	79	95	77	100
		Thu Thua	292	86	99	84	100
		Ben Luc	526	85	90	72	44
		Duc Hoa	688	93	92	92	50
		Tan Tru	216	94	99	92	100
		Subtotal	**4,623**	**87**	**96**	**87**	**61**
	Adjoining Subtotal		**11,049**	**86**	**94**	**88**	**67**
Total			**38,045**	**56**	**68**	**67**	**43**

Source: HOUTRANS HIS

Distribution of Demand

Overall distribution of demand of residents was characterized with a high rate of travel demand within the same types of areas. About 90% of total trips generated in rural districts and satellite urban areas were attracted within the same types of areas, while there were relatively high rates in trips generated in the inner fringe and attracted in the inner core or generated in the suburbs of HCMC's adjoining areas and attracted in satellite urban areas (refer to Table 2.1.26). More detailed description in each origin-destination (OD) pairs showed the characteristics by area and briefly explained as follows (refer to Figure 2.1.23 to Figure 2.1.27):

(a) OD pairs with the highest travel demand were between neighboring districts, i.e. Binh Thanh - District 1, District 6 - Binh Chanh District, District 8 - District 5, and District 1 - District 5.

(b) "To work" and "to school" trips were generated in the inner fringe and emerging peripheries and attracted in Districts 1, 5, and 6 of the inner core, and Thu Duc District.

(c) "Private" trips were relatively dispersed in the whole inner core compared to "to work" and "to school" trips.

(d) "Business" trips were mostly generated and attracted in the inner core.

Distribution of "to work" and "to school" trips attracted in District 1 were mostly generated from within the inner core and inner fringe areas. Trips attracted in the districts of Binh Chanh, 5, and Tan Binh were from the western part of the study area, while those attracted in Thu Duc District were from the eastern part.

Table 2.1.26 Overall Demand Distribution in the Study Area

Origin \ Destination		HCMC					Adjoining Area			Outside Study Area	Total
		Inner Core	Inner Fringe	Emerging Peripheral	Sub-urban	Rural	Satellite Urban	Sub-urban	Rural		
HCMC	Inner Core	3,858	1,053	434	41	18	31	16	32	11	5,493
	Inner Fringe	1,087	2,572	228	40	14	19	7	9	11	3,985
	Emerging Peripheral	405	244	2,202	53	6	22	42	56	3	3,033
	Suburban	45	44	52	281	10	1	3	2	1	440
	Rural	18	16	7	9	488	2	1	0	1	544
Adjoining Area	Satellite Urban	27	19	23	1	3	2,267	39	95	3	2,476
	Suburban	16	11	47	3	1	48	610	0	6	743
	Rural	36	10	54	2	1	88	1	2,116	4	2,312
Outside Study Area		11	9	2	0	2	3	7	2	0	36
Total		5,503	3,976	3,050	430	542	2,482	726	2,311	40	19,061

% to Total		HCMC					Adjoining Area			Outside Study Area	Total
		Inner Core	Inner Fringe	Emerging Peripheral	Sub-urban	Rural	Satellite Urban	Sub-urban	Rural		
HCMC	Inner Core	20.2	5.5	2.3	0.2	0.1	0.2	0.1	0.2	0.1	28.8
	Inner Fringe	5.7	13.5	1.2	0.2	0.1	0.1	0.0	0.0	0.1	20.9
	Emerging Peripheral	2.1	1.3	11.6	0.3	0.0	0.1	0.2	0.3	0.0	15.9
	Suburban	0.2	0.2	0.3	1.5	0.1	0.0	0.0	0.0	0.0	2.3
	Rural	0.1	0.1	0.0	0.0	2.6	0.0	0.0	0.0	0.0	2.9
Adjoining Area	Satellite Urban	0.1	0.1	0.1	0.0	0.0	11.9	0.2	0.5	0.0	13.0
	Suburban	0.1	0.1	0.2	0.0	0.0	0.3	3.2	0.0	0.0	3.9
	Rural	0.2	0.1	0.3	0.0	0.0	0.5	0.0	11.1	0.0	12.1
Outside Study Area		0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Total		28.9	20.9	16.0	2.3	2.8	13.0	3.8	12.1	0.2	100.0

% to Origin Total		HCMC					Adjoining Area			Outside Study Area	Total
		Inner Core	Inner Fringe	Emerging Peripheral	Sub-urban	Rural	Satellite Urban	Sub-urban	Rural		
HCMC	Inner Core	70.2	19.2	7.9	0.7	0.3	0.6	0.3	0.6	0.2	100.0
	Inner Fringe	27.3	64.5	5.7	1.0	0.3	0.5	0.2	0.2	0.3	100.0
	Emerging Peripheral	13.3	8.0	72.6	1.7	0.2	0.7	1.4	1.9	0.1	100.0
	Suburban	10.3	10.0	11.9	64.0	2.3	0.3	0.7	0.4	0.1	100.0
	Rural	3.4	2.9	1.3	1.7	89.7	0.4	0.2	0.0	0.3	100.0
Adjoining Area	Satellite Urban	1.1	0.8	0.9	0.0	0.1	91.5	1.6	3.8	0.1	100.0
	Suburban	2.2	1.5	6.3	0.4	0.1	6.5	82.2	0.0	0.8	100.0
	Rural	1.5	0.4	2.4	0.1	0.0	3.8	0.0	91.5	0.2	100.0
Outside Study Area		30.5	23.9	5.7	1.2	6.4	8.7	18.6	4.4	0.6	100.0
Total		28.9	20.9	16.0	2.3	2.8	13.0	3.8	12.1	0.2	100.0

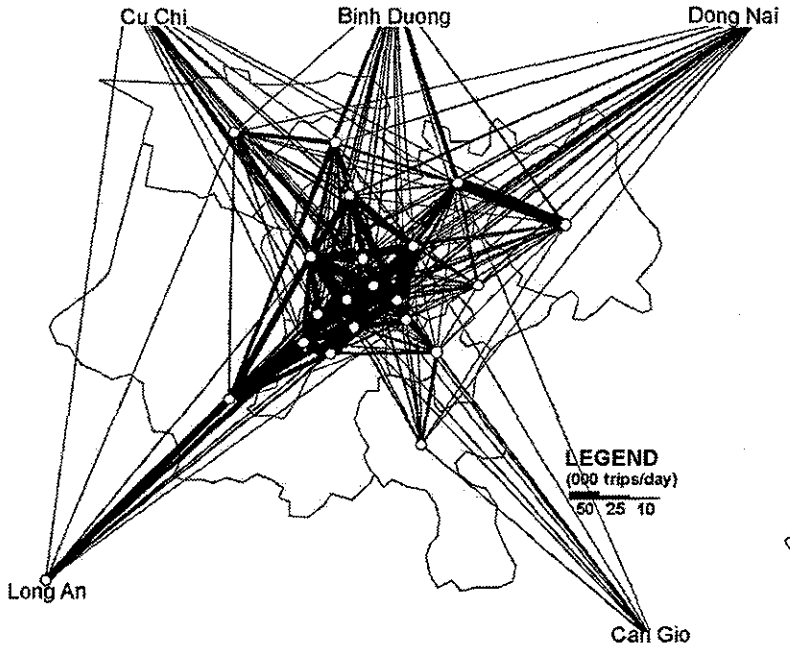
% to Destination Total		HCMC					Adjoining Area			Outside Study Area	Total
		Inner Core	Inner Fringe	Emerging Peripheral	Sub-urban	Rural	Satellite Urban	Sub-urban	Rural		
HCMC	Inner Core	70.1	26.5	14.2	9.5	3.3	1.2	2.2	1.4	28.1	28.8
	Inner Fringe	19.7	64.7	7.5	9.3	2.5	0.8	1.0	0.4	26.9	20.9
	Emerging Peripheral	7.4	6.1	72.2	12.3	1.1	0.9	5.8	2.4	6.3	15.9
	Suburban	0.8	1.1	1.7	65.4	1.8	0.1	0.4	0.1	1.2	2.3
	Rural	0.3	0.4	0.2	2.2	89.9	0.1	0.2	0.0	3.6	2.9
Adjoining Area	Satellite Urban	0.5	0.5	0.8	0.1	0.5	91.3	5.4	4.1	8.3	13.0
	Suburban	0.3	0.3	1.5	0.7	0.2	2.0	84.0	0.0	14.1	3.9
	Rural	0.6	0.3	1.8	0.4	0.2	3.5	0.1	91.6	11.0	12.1
Outside Study Area		0.2	0.2	0.1	0.1	0.4	0.1	0.9	0.1	0.5	0.2
Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: HOUTRANS HIS

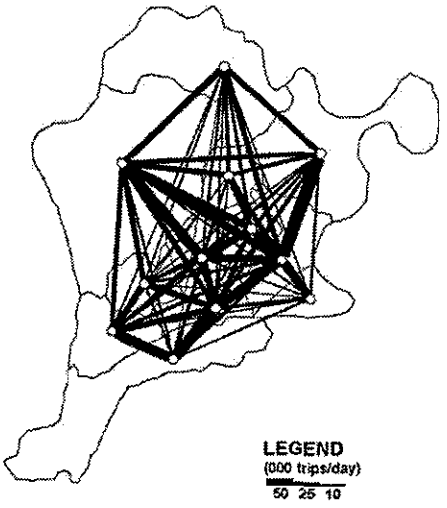
Figure 2.1.23 Distribution of Travel Demand (Excluding Walking)

All Purposes

Between Districts in the Study Area



Within 12 Urban Districts

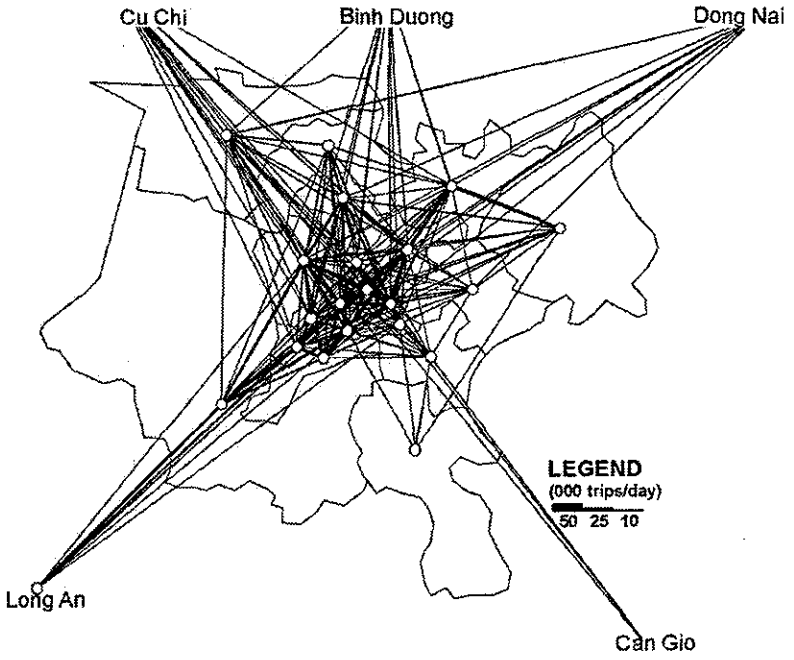


Source: HOUTRANS HIS

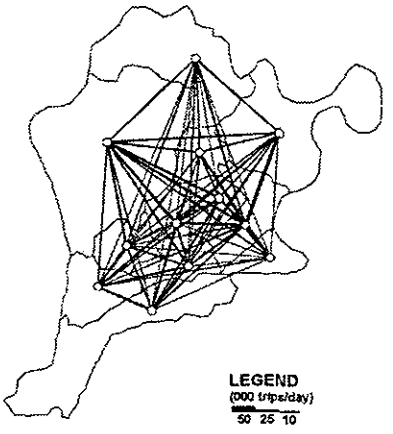
Figure 2.1.24 Distribution of Travel Demand (Excluding Walking)

To Work

Between Districts in the Study Area



Within 12 Urban Districts

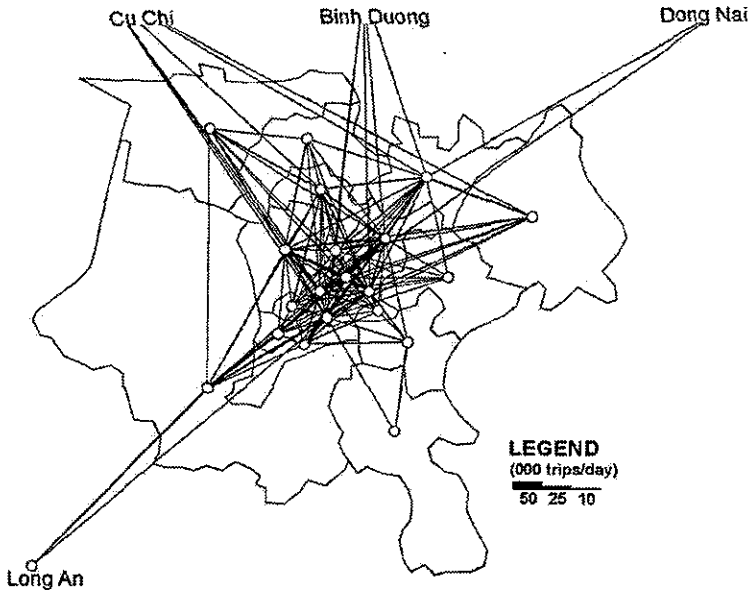


Source: HOUTRANS HIS

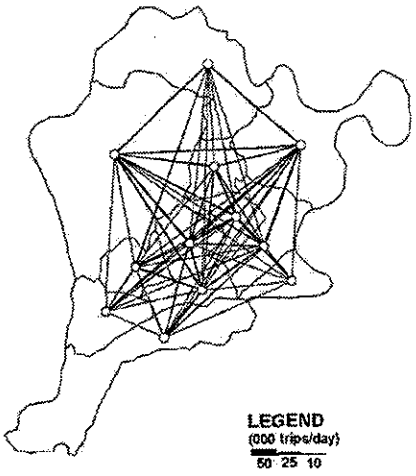
Figure 2.1.25 Distribution of Travel Demand (Excluding Walking)

To School

Between Districts in the Study Area



Within 12 Urban Districts

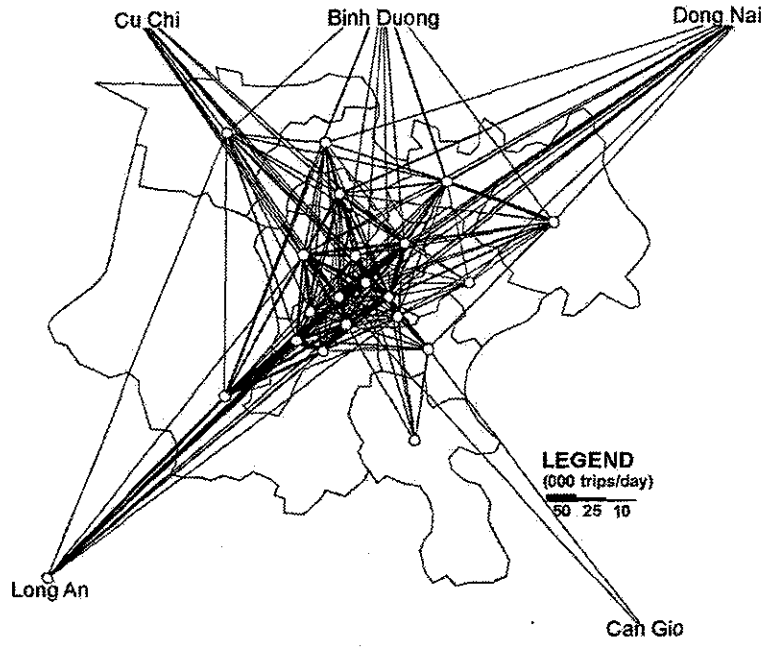


Source: HOUTRANS HIS

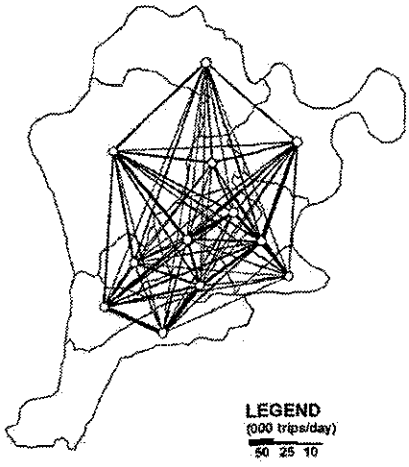
Figure 2.1.26 Distribution of Travel Demand (Excluding Walking)

Private

Between Districts in the Study Area



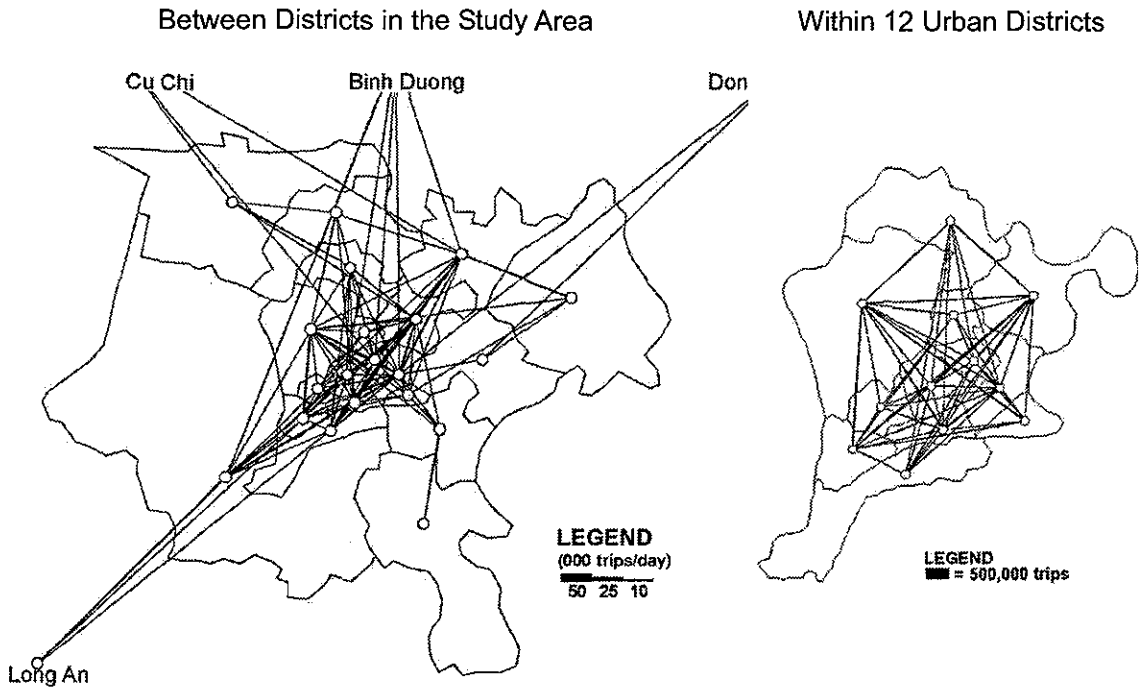
Within 12 Urban Districts



Source: HOUTRANS HIS

Figure 2.1.27 Distribution of Travel Demand (Excluding Walking)

Business



Source: HOUTRANS HIS

2.2 Main Transport Components

2.2.1 Transport Infrastructure

Various modes of transport with connections to vital national trunk highways, a group of ports, an international airport, and a railway serve the study area. As the study area becomes the country's economic hub, the efficiency of these transport modes linking it to the hinterlands increasingly becomes crucial. Roads within the study area are virtually the only urban transport mode, while river transport and railway are still very limited.

1) Road Network

Overall Situation: The national roads in the study area are being upgraded. But it generally lacks a provincial road network and corresponding facilities. Roads are generally narrow and surface conditions are poor. Existing basic road network in urbanized areas was built during the French colonial period and still features a grid pattern. Although they are commonly well laid out, many sections have uneven standards.

Aggravating this are the aging bridges that, notwithstanding their insufficient design loads and narrow carriageways, still accommodate heavy container trucks. The road network absolutely lacks network quantity and quality in a rapidly urbanizing setup. A lack of road infrastructure including river bridges constrains urban growth in the south and the east.

Road Classification and Hierarchy Setting

(1) Administrative Classification: According to Decree No. 167/1999/ND-CP dated 06/11/1999 on land transport management, land transport network should be divided into six networks, as follows:

National Road Network: Composed of main roads, which are very important for economic, political, cultural, and social development, and national security, these are:

- Roads that connect the capital city with other cities under central government management and with provincial administrative centers.
- Roads leading to international borders and major industrial zones.
- Roads that connect more than three provincial administrative centers which play important roles in the economic, political and cultural aspects of the regions.

Provincial Road Network: Composed of trunk roads within a province, and centrally run cities including those roads connecting administration centers with district administration centers as well as roads linking provincial administration centers with each other.

District Road Network: Composed of roads that connect district administrative centers with commune administrative centers as well as those that connect district administrative centers with each other.

Commune Road Network: Composed of roads that connect commune administrative centers with hamlets and roads being used for public transport.

Urban Road Network: Composed of roads within urban areas.

Road Network for Specific Use: Composed of internal roads or roads for specific use such as the transport of goods and people of an agency or business and private company, etc.

Administration of the national road located within NH-1A has been transferred to HCMC. Sidewalks within HCMC are under the jurisdiction of their respective districts.

(2) Decision Makers on Road Classification: The following are the proper deciding authorities on road network classification:

- National road network: Minister of the MOT.
- Provincial road network: Chairman of the Provincial People's Committee (PPC) or cities under central management with the approval of the MOT minister.
- Urban road network: Chairman of the PPC with the approval of the ministers of the MOT and the Ministry of Construction (MOC).
- District road network: Chairman of the PPC.
- Commune road network: Chairman of the district PC.
- Organizations or individuals decide on the road network for specific use after the Chairman of the PPC officially agrees.

Decision on classification of provincial and/or district road networks shall be reported by the Chairman of the PPC to the Minister of the MOT, while that on commune road network will be reported by the Chairman of the district PC to the Chairman of the PPC.

(3) Functional Classification: There are two road standards in Vietnam, namely Road Standard TCVN 4054-98 and Specification for Road Design 22 TCN-273-01.

Based on technical class, design speed and required number of lanes, roads excluding expressways are classified into five grades in accordance with Road Standard TCVN 4054-98 as shown in Table 2.2.1. The relationship between road category and function is also described in this standard.

On the other hand, Specification for Road Design 22 TCN-273-01 divides the road network into two areas: urban area and rural area. Based on traffic volume, roads are classified into five grades in rural areas and four grades in urban areas.

In rural areas, the relationship between road function and administration is manifested in how national, provincial, and local roads correspond with arterial, collector and local roads, respectively (refer to Table 2.2.2).

In urban areas, each category is defined clearly by its function. But it is difficult to identify functional classification with administrative classification because roads are under the jurisdiction of the city (refer to Table 2.2.3).

Table 2.2.1 Road Classification in TCVN 4054-98

Category	Technical Class	Design Speed $V_{designed}$, km/h	Required Number of Lanes	Main Functions
I	80 and 60	80 and 60	6	Link big economic, political, and cultural centers
II			4	
III			2	
IV	60 and 40	60 and 40	2	Link local economic, political, and cultural centers and is also linked with the main trunk road or expressway
V	40 and 20	40 and 20	2 or 1	Link with goods centers and residential areas

Source: MOT, TCVN 4054-98

Table 2.2.2 Classification of Roads in Rural Areas in 22 TCN-273-01

Category	Traffic Volume (PCU/day)	Functional Classification	Technical Classification			Management Classification
			Level	Rolling	Mountains	
Expressway	> 25000	Super high-class highway for high-speed traffic with controlled access and quick travel time, providing transport service between large important cities.	120 100	100 80	80 60	National Road
I	≥ 15000	Highways generally providing direct service between cities and important economic, political, and cultural centers. Partial controlled access highway; ≥ 4 lanes	110 100	90 80	70 60	National Road
II	≥ 6000	Highways providing direct service between big economic, political, and cultural centers. Roads connecting them to the category I or expressway – 2 lanes	100 80	80 60	60 40	National Road
III	≥ 1000	Roads providing direct service between several towns and local economic, political, and cultural centers. Roads connecting them to the arterial network and expressways.	80 60	60 40	50 30	National or Provincial Road
IV	≤ 200 – 1 lane > 200 – 2 lane	Local roads providing direct service between districts, cooperatives, etc.	60 40	40 30	30 20	Local Road

Source: MOT, TCN 273-01

Table 2.2.3 Classification of Urban Highways in 22 TCN-273-01

Category	Traffic Volume (vehicle/day)	Functional Classification	Technical Classification
Expressway	50000 – 70000	For transport service with uninterrupted high-speed traffic and shortened travel time between main areas of the city, between cities and large industrial zones near cities, between cities and air/sea ports.	80 – 100
Urban Arterials	5000 – 50000	For transportation within cities, linking various large population centers, industrial areas, city centers, railway stations, seaports, stadiums, and national roads outside cities.	60 – 80
Urban Collectors	10000 – 20000	Linking housing areas to urban arterials.	40 - 60
Local Urban Streets	-	For communication within city districts and linking district roads and roads outside districts.	40 - 60

Source: MOT, TCN 273-01

Hierarchy Setting

No clear definition of road network from a functional viewpoint currently exists in the study area. Road classification is an important factor in road network planning. Since urban and rural areas have different fundamental characteristics in terms of population density, land use, road density, travel patterns, and their relationships, different road classification systems need to be worked out for both rural and urban areas.

Existing Road Network

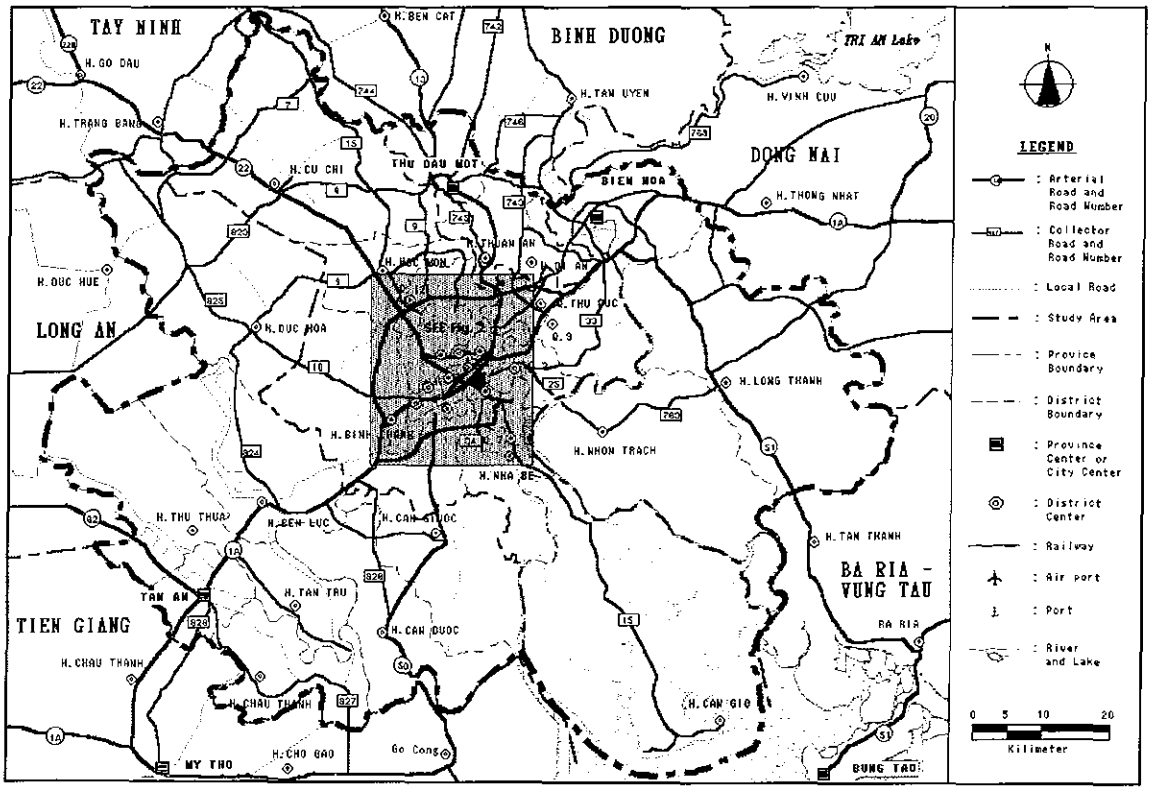
Regional Road Network: National roads generally lead to and out of HCMC and they cover main directions. However, the traffic from Vung Tau, where an important port in southern Vietnam is located, has no direct access to HCMC because there is no bridge exists across Saigon River up to Hoa An Bridge near Bien Hoa. Also, National Highway 1A which was constructed as a half bypass to avoid the city center, insufficiently fulfills its functions as a bypass.

The provincial road network in the study area is poor and does not efficiently link the district centers to each other, or the district centers to the national roads. Vehicles are forced to detour or use local side roads entailing longer transit distances. However, some local roads are directly connected to national roads.

Urban Road Network: The existing road network in urban areas is shown in Figure 2.2.2. Generally, it is unbalanced and has no proper functional road hierarchy. Urban roads are concentrated in inner-city districts. Although districts 1, 3, and 5 have well-articulated roads, there are few major roads in the areas between the city center and the National Highway (NH) 1A. Major roads radiate from the city center, with no lateral links such as ring roads.

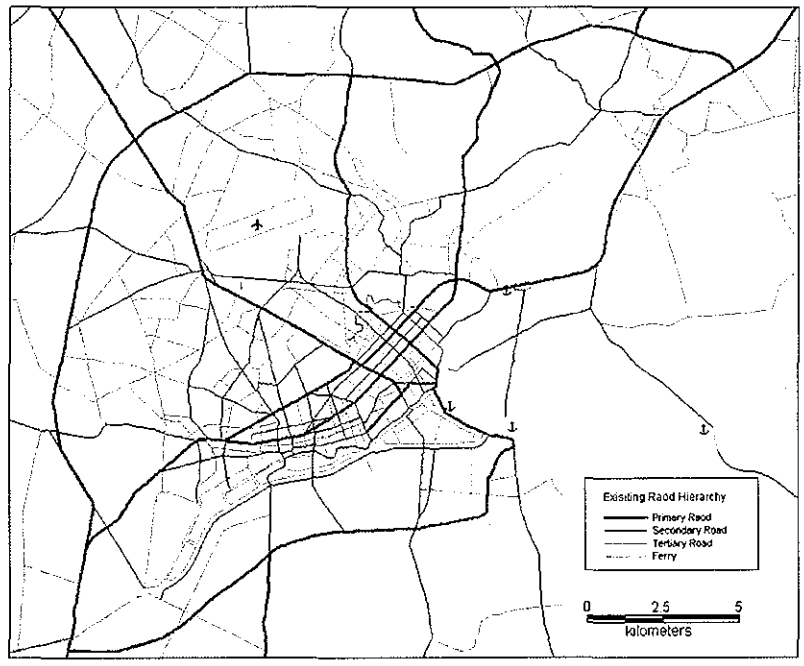
There is a limited number of bridges across the Saigon River and other canals in the south, and the road network beyond Saigon River is poorly provided.

Figure 2.2.1 Existing Road Network in the Study Area



Source: Study Team

Figure 2.2.2 Existing Road Network in Urban Areas



Source: Study Team

(4) Road Length: Adjoining provinces also lack roads, especially in Dong Nai and Long An (refer to Table 2.2.4). Provincial roads are mostly developed around provincial centers.

Table 2.2.4 Road Length by Function in Provincial Area

Province	Dong Nai		Binh Duong		Long An	
Area	1,102km^2		232km^2		1,651km^2	
National Road	55km	(31%)	30km	(32%)	67km	(28%)
Provincial Road	120km	(69%)	63km	(68%)	176km	(72%)
Total	175km	(100%)	93km	(100%)	243km	(100%)

Source: Road Inventory of each Province

Road lengths by functional classification in HCMC are shown in Table 2.2.5. Total length of roads in HCMC is about 1,245km. Primary roads account for 15%, secondary roads for 27% and other roads for 59% in HCMC. Total length of both primary and secondary roads has high percentages, and reach nearly half of the total length of the roads in HCMC.

Table 2.2.5 Road Length by Function in HCMC

Unit: km

	Primary [1) 2)]		Secondary[1)]		Tertiary[1)]		Others		Total	
Inner Core	31.9	(9%)	72.9	(21%)	89.7	(26%)	151.7	(44%)	346.2	(100%)
Inner Fringe	17.9	(5%)	51.5	(14%)	123.1	(33%)	179.8	(48%)	372.3	(100%)
Emerging Peripheral	100.8	(34%)	73.3	(25%)	55.3	(19%)	64.4	(22%)	293.7	(100%)
Suburban	10.2	(13%)	51.6	(65%)	17.6	(22%)	n.d.	n.d.	79.4	(100%)
Rural	20.1	(13%)	81.1	(53%)	46.6	(30%)	5.5	(4%)	153.3	(100%)
Total	180.9	(15%)	330.5	(27%)	332.3	(27%)	401.3	(32%)	1245.0	(100%)

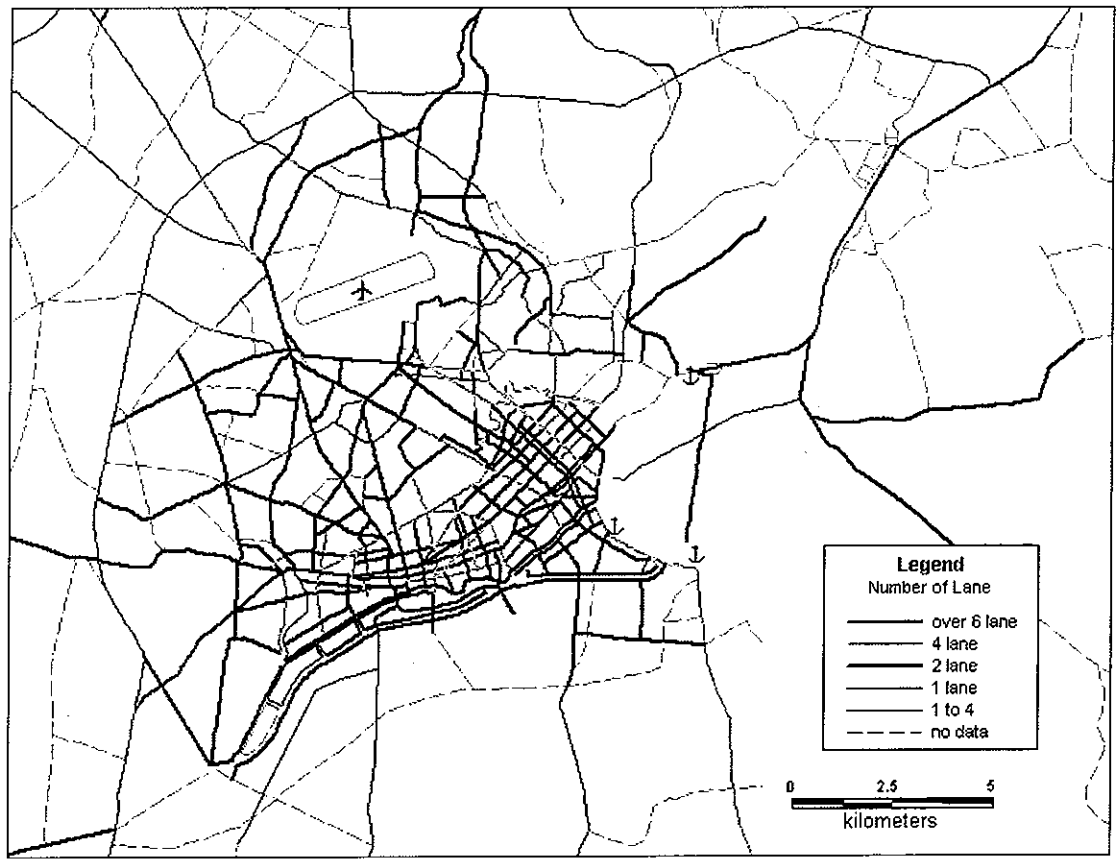
Source: TUPWS

[1)] Functional classification is tentative and corresponds to those shown in Figure 4.2.2.

[2)] Primary roads include former national roads among major roads selected by the TUPWS.

(5) Number of Lanes: Two-lane roads prevail in urban areas. Many one-lane roads exist between urbanized areas and the NH1A, especially in Phu Nhuan and Binh Thanh districts (refer to Figure 2.2.3). Such situation hampers the development of bus routes.

Figure 2.2.3 Number of Lanes in Urban Areas[1)]



Source: TUPWS
[1)] Excluding national roads.

(6) Road Width: The present two-lane roads have less than 15m width (refer to Figure 2.2.4). This constricts most roads to have narrow carriageway, narrow shoulders or to have no footpath. It is difficult to increase the number of lanes due to difficulty in land acquisition.

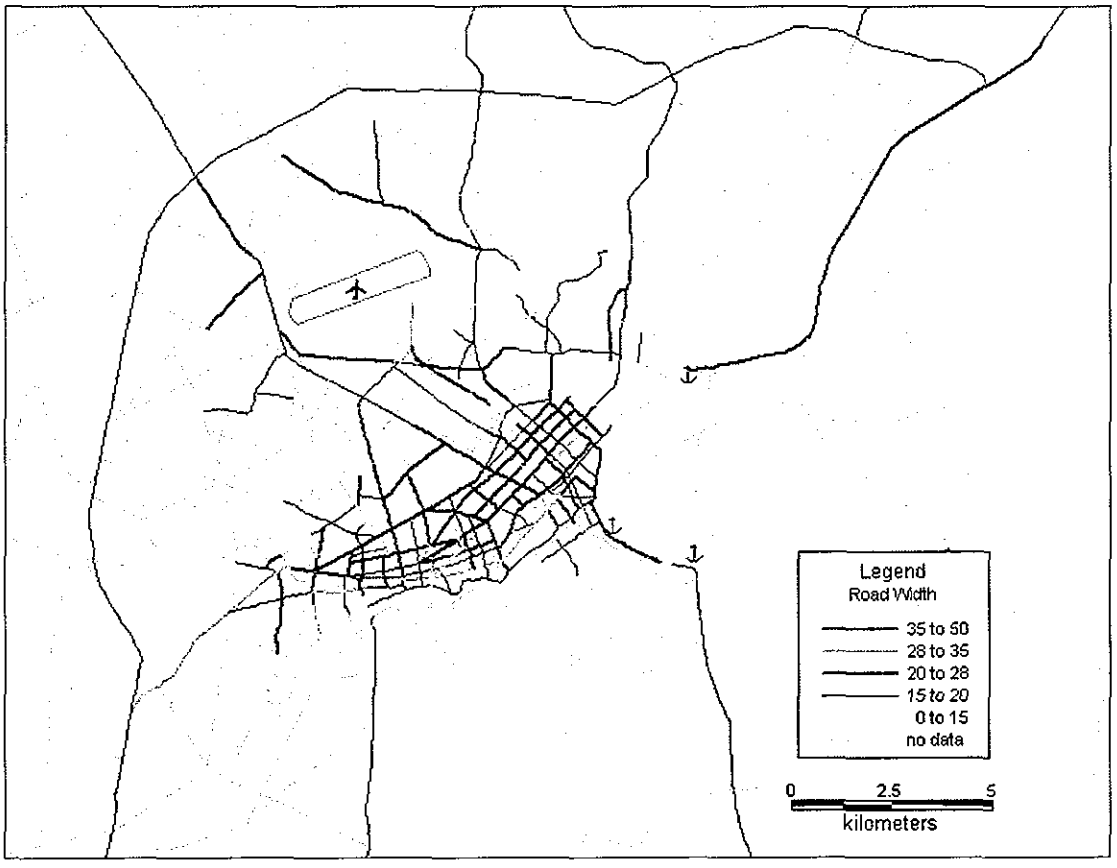
(7) Road Network Density (RND): RND significantly varies by area (refer to Figure 2.2.5). While average road density in the study area is 0.56km/km^2, those in the inner core, inner fringe, emerging peripheral, suburban and rural areas are 7.39km/km^2, 2.40km/km^2, 0.41km/km^2, and 0.48km/km^2, respectively.[9]

(8) Road Area Occupancy (RAO): RAO is an indicator showing occupancy of roads in an area (refer to Figure 2.2.6). While it is extremely low in the study area (0.6%), RAO in the inner core is 11.9%, followed by 2.9% in the inner fringe, 0.4% in the emerging peripheral and suburban areas, and 0.2% in the rural area.

[9] Population density of the same areas are 408.8, 177.7, 19.3, 13.3, and 2.8 persons/ha, respectively.

(9) Road Surface Type: Most of the national roads are paved with asphalt concrete (AC) or double surface treatment (DBST), while other roads in the rural areas are often unpaved. For example, in Binh Chanh District, earth roads constitute 42% of all roads (refer to Figure 2.2.7). On the other hand, in HCMC, almost 90% of all roads are either AC or DBST. An exception is Cu Chi where earth roads are still 42% of the total (refer to Table 2.2.6).

Figure 2.2.4 Road Width in Urban Areas[1)]



Source: TUPWS
[1)] Excluding national roads.

Table 2.2.6 Road Surface Type in HCMC

(%)

Area	AC	DBST	Gravel	Earth
Inner Core	85.5	14.4	0.0	0.1
Inner Fringe	74.4	24.9	0.1	0.6
Emerging Peripheral	42.8	42.9	0.5	13.7
Suburban	15.3	62.0	3.5	19.2
Rural	11.4	51.7	0.0	36.9
Total	57.2	31.9	0.3	10.6

Source: TUPWS

Figure 2.2.5 Road Network Density in Focal Areas

District Name	Density[1]
Dist. 1	9.41
Dist. 3	7.82
Dist. 4	4.61
Dist. 5	12.88
Dist. 6	6.58
Dist. 10	6.22
Dist. 11	6.20
Phu Nhuan Dist.	5.16
Inner Core	**7.39**
Dist. 8	2.66
Tan Binh Dist.	2.20
Binh Thanh Dist.	2.67
Go Vap Dist.	2.23
Inner Fringe.	**2.40**
Dist. 2	0.49
Thu Duc Dist.	0.54
Dist. 9	0.36
Dist. 7	0.73
Dist. 12	0.51
Binh Chanh Dist.	0.35
Emerging Peripheral	**0.41**
Hoc Mon Dist.	0.69
Nha Be Dist.	0.26
Suburban	**0.48**
Cu Chi Dist.	0.54
Can Gio Dist.	0.05
Rural	**0.24**
All District	**0.56**

Source; TUPWS
[1] km/km^2

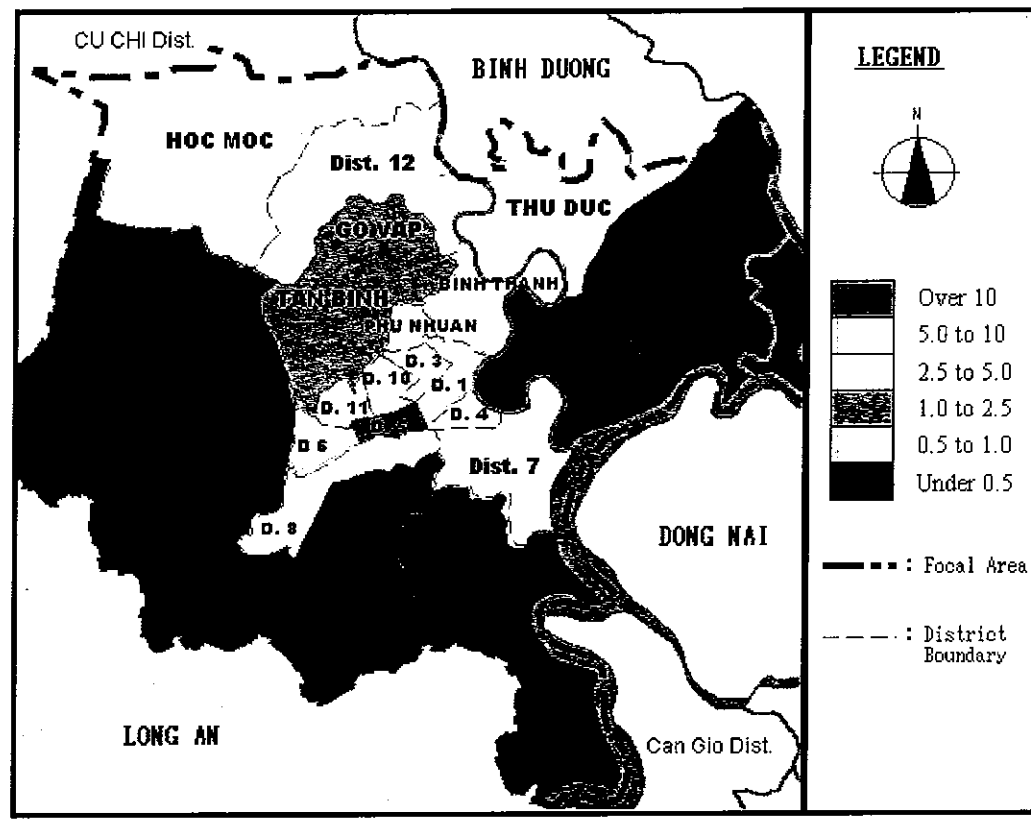
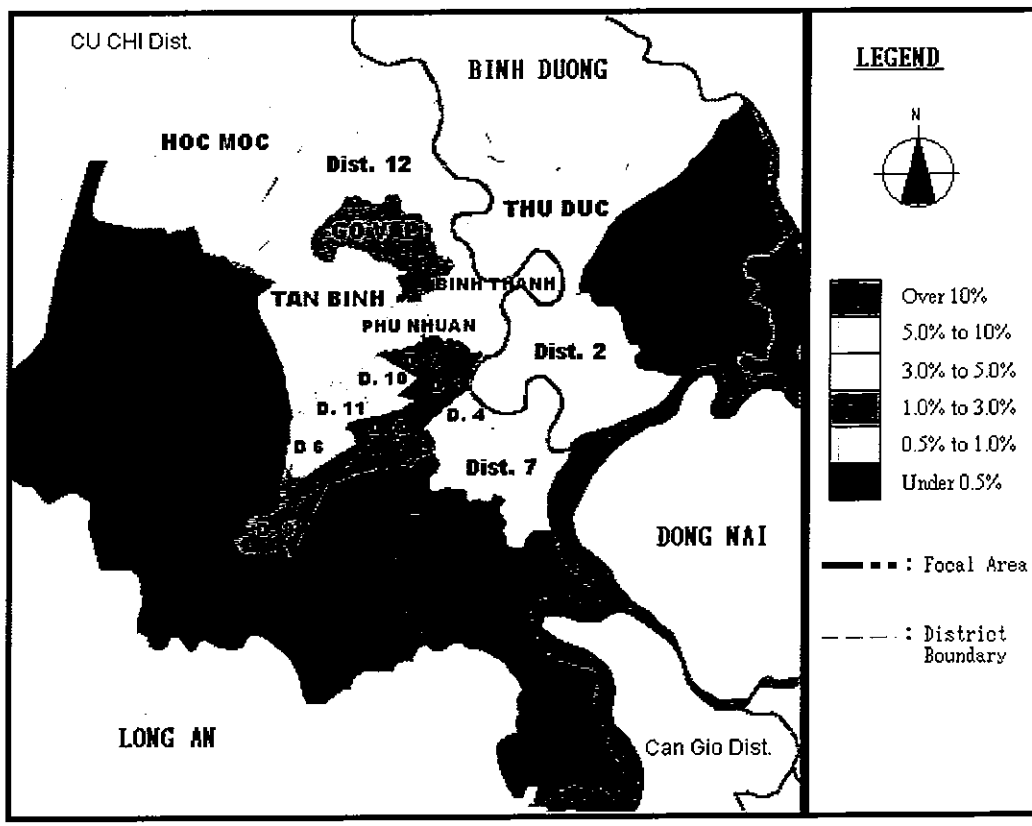


Figure 2.2.6 Road Area Occupancy in Focal Areas

District Name	Occupancy[1]
Dist. 1	17.6%
Dist. 3	12.9%
Dist. 4	6.2%
Dist. 5	23.1%
Dist. 6	9.7%
Dist. 10	9.7%
Dist. 11	8.8%
Phu Nhuan Dist.	6.3%
Inner Core	**11.9%**
Dist. 8	2.6%
Tan Binh Dist.	3.0%
Binh Thanh Dist.	3.3%
Go Vap Dist.	2.7%
Inner Fringe..	**2.9%**
Dist. 2	0.5%
Thu Duc Dist.	0.6%
Dist. 9	0.4%
Dist. 7	0.8%
Dist. 12	0.7%
Binh Chanh Dist.	0.3%
Emerging Peripheral	**0.4%**
Hoc Mon Dist.	0.6%
Nha Be Dist.	0.2%
Suburban	**0.4%**
Cu Chi Dist.	0.4%
Can Gio Dist.	0.0%
Rural.	**0.2%**
All District	**0.6%**

Source: TUPWS
[1] Road area / district area.



(10) Road Surface Condition: In the provinces national roads are mostly in good condition, while other roads are generally in poor condition. Even in HCMC, road surface conditions are not always satisfactory. About 13% of the surface is in bad condition, which is more significant in the inner fringe and emerging peripheral areas (refer to Figure 2.2.8 and Table 2.2.7).

While roads in the province are relatively in good condition, other roads are generally in bad condition. Therefore, puddles are often formed on uneven surfaces during the rainy season. Twenty-five percent (25%) of roads in Cu Chi District are deteriorating.

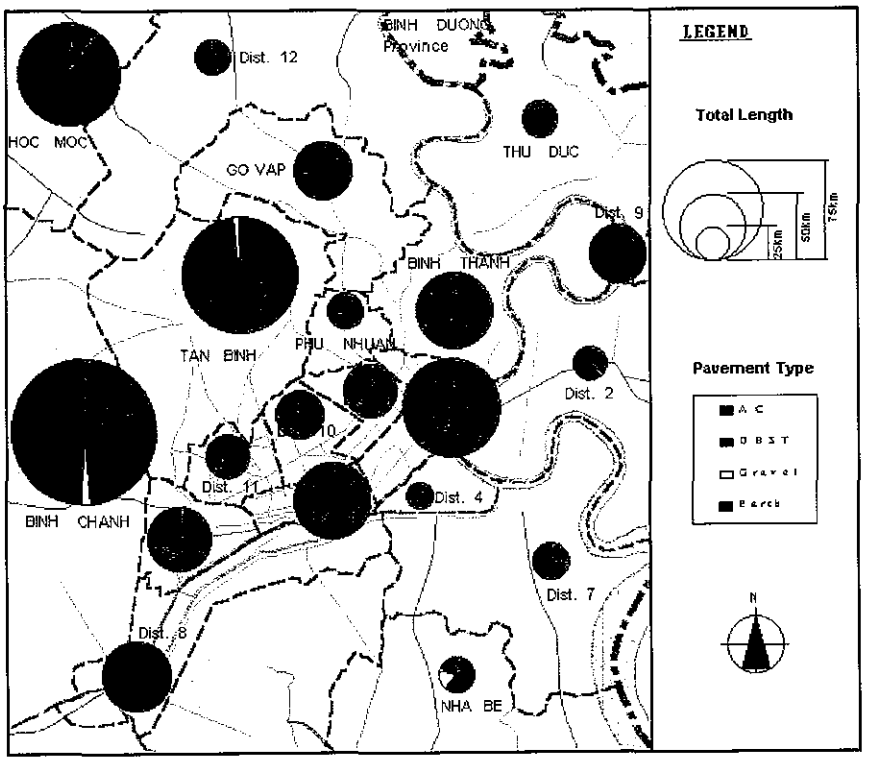
Table 2.2.7 Road Surface Condition in HCMC

District Name	Surface Conditions (% to total by area)			
	Good	Fair	Bad	Unknown
Inner Core	10.3	81.1	8.1	0.5
Inner Fringe	18.2	63.9	16.9	1.0
Emerging Peripheral	2.6	62.1	21.6	13.7
Suburban	57.4	34.9	7.7	0.0
Rural	21.8	67.4	7.7	3.2
Total	24.6	59.1	12.7	3.6

Source: TUPWS

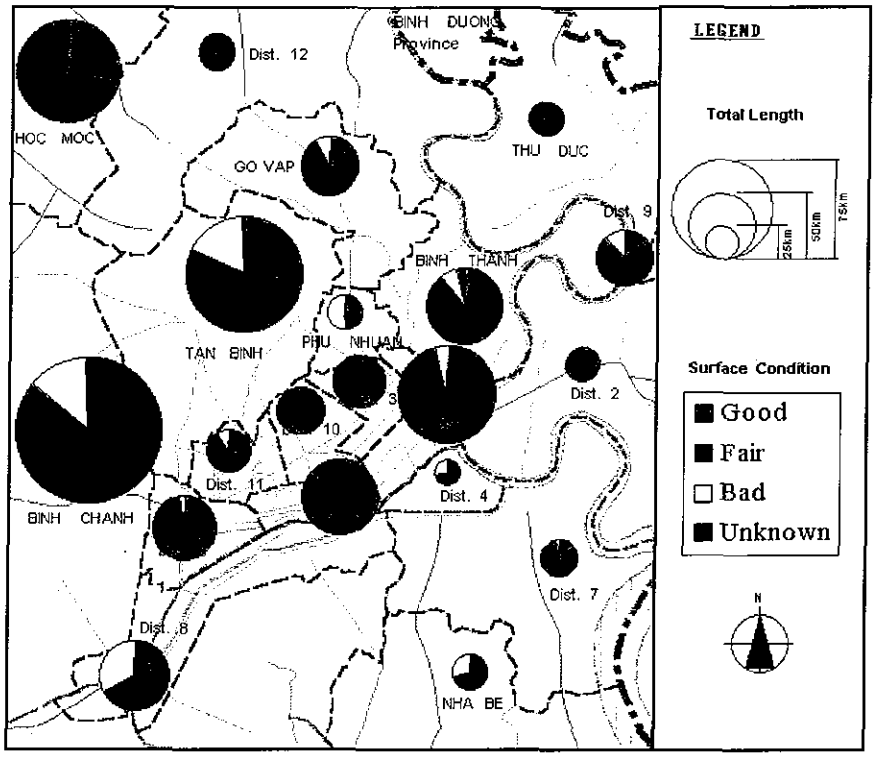
On the contrary, roads with good or fair condition occupy over 90% in the focal planning area. In particular, roads with bad condition are fewer than 5% in five new districts. On the other hand, roads with bad condition are worse than average in the inner-city districts. Deterioration is particularly conspicuous in districts 8, Phu Nhuan and Tan Binh. It seems that roads in the inner-city districts are becoming obsolete (refer to Figure 2.2.8).

Figure 2.2.7 Road Surface Type in Urban Areas



Source: TUPWS

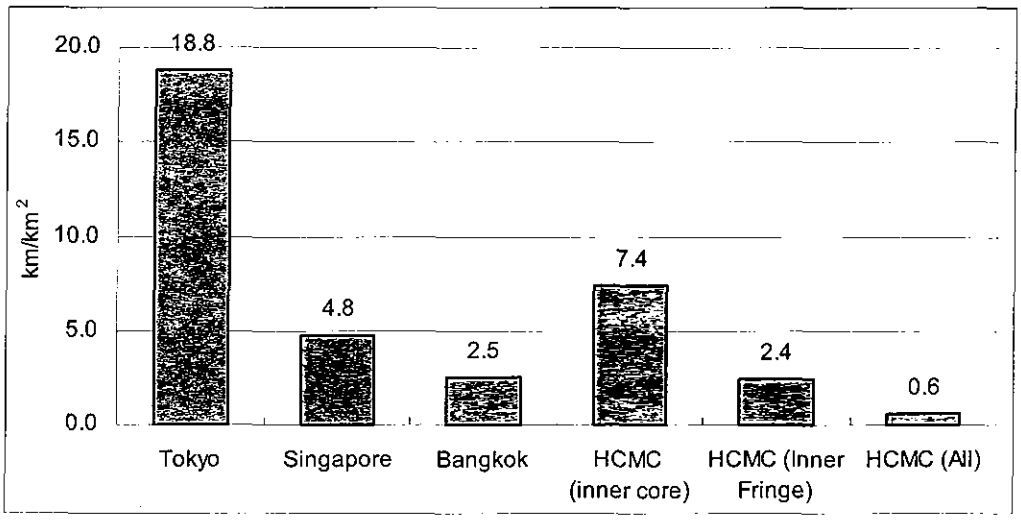
Figure 2.2.8 Road Surface Condition in Urban Areas



Source: TUPWS

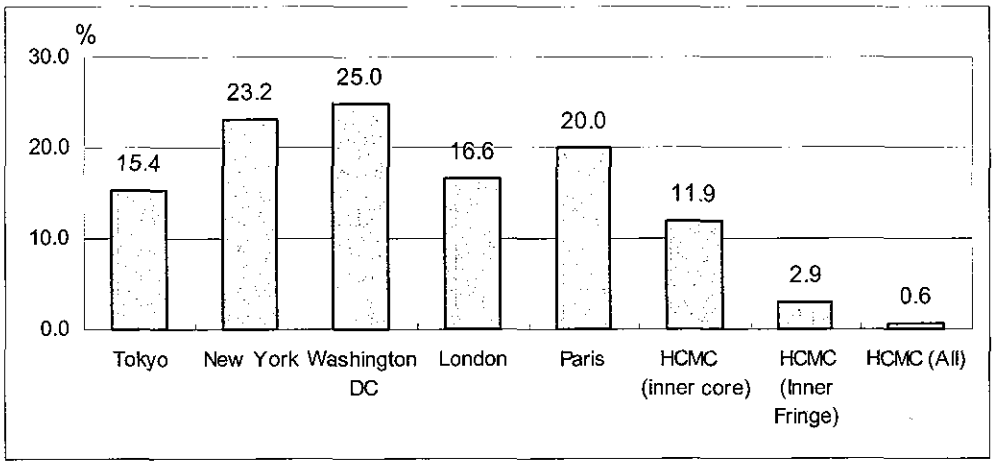
(11) Comparison of Road Network Density and Road Area Occupancy with Overseas Cities: When the availability of roads in HCMC was compared with other cities in the world, the result showed that the inner core areas of HCMC have a relatively good level of road network and road area, compared with e.g. Bangkok and Singapore (refer to Figure 2.2.9 and Figure 2.2.10). However, the availability of roads in the city as a whole is extremely low, compared to the latter two cities. Absolute lack of roads in the peripheral areas is obvious.

Figure 2.2.9 Comparison of Road Network Density



Source: Culled from various sources.

Figure 2.2.10 Comparison of Road Area Occupancy



Source: Culled from various sources.

2) Road Development and Maintenance

(1) Responsibilities for Management and Maintenance of Roads: Regulations on investment in and construction of roads are stipulated in Government Decree No. 52/1999/ND-CP dated 8 July 1999 and Amendment No. 6/2/2000/ND-CP. In these laws national roads and city roads are characterized as follows:

National Road: In general, management and maintenance of national roads fall under the jurisdiction of the MOT. The Project Management Units (PMUs) under the MOT are the implementing agencies for ODA, city-funded and BOT (build-operate-transfer) projects. The Road Management Divisions under the MOT is responsible for national road maintenance. The HCMC and its surrounding areas lie within the territory of the MOT's Road Management Division No.7.

City Road: City road projects are implemented by three types of PMUs: the PMU under the HCMC People's Committee (PC), the PMU under the Transportation and Urban Public Works Services (TUPWS), and the PMU under the Transport Management Unit (TMU). Selection of the PMUs depends on project scale. The PMU under the HCMC PC manages large-scale projects such as loan projects while the PMU under the TMU manages other small-scale projects including improvements. On the other hand, the PMU under the TUPWS was established for a WB project. After completion of the WB project, this agency will be integrated into the PMU under the TMU.

Maintenance of city roads falls under the jurisdiction of the TMU of the Urban Transport Management Department of the TUPWS. The following public corporations implement road maintenance:

a. Saigon Traffic Management Company
b. Bridge-Ferry Management Company
c. Urban Environment Management Company
d. Waste Processing Company
e. Tree-Park Management Company
f. Urban Water Drainage Management Company
g. Public Lighting Management Company

Roads and bridges are managed by the Saigon Traffic Management Company and the Bridge-Ferry Management Company, respectively. While these companies are responsible for routine and urgent maintenance, periodic maintenance is contracted out through bidding under the TMU. The Saigon Traffic Management Company is divided into 21 districts which conduct actual maintenance works, except for Can Gio District which is divided into six branch offices. The company has equipment and skills for maintenance, and is organized to maintain the roads by themselves.

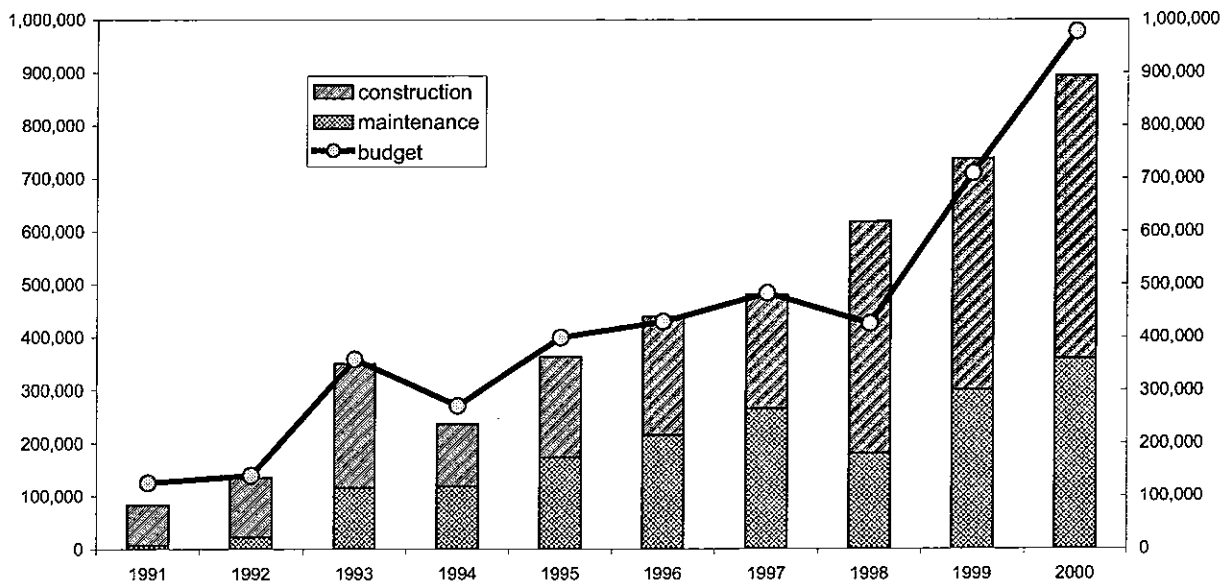
The procedure to formulate a maintenance program is as follows: Based on an annual budget notified by the Director of the TUPWS, Saigon Traffic Management Company reviews the requests from each branch office and adjusts the plan within the budget. The plan is finalized with approval of the TUPWS. Maintenance works are carried out in accordance with the plan, which is modified monthly based on the actual situation.

Annual budget for road maintenance in 2000 was VND 359 billion, which covered only 40% of the requirement.

(2) Road Sector Budget: Budgets and actual expenditure on road developments are almost balanced every year. Maintenance costs shared half of the budget until 1997. Construction rather than maintenance was prioritized due to poor infrastructure. The road budget and its actual disbursement between 1996 and 2000 are shown in Figure 2.2.11. In 2000 the expenditure was within the budget whereas in 1998 expenditure significantly exceeded the budget.

While the budget for the road sector has increased since 1998, maintenance cost has been stable with a marginal growth rate. This was a result of Decision 108/1998/TTg dated 20 June 1998, which stipulated the improvement of road network density up to 20% in HCMC, obviously showing the prioritization of construction over maintenance due to poor infrastructure.

Figure 2.2.11 Road Budget and Expenditure (1996-2000)



Source: TUPWS

(3) Condition and Improvement of Road Inventory Data: Road inventory data needs to be improved. Road inventory data are owned by the Urban Transport Maintenance Unit under the Transport Management Department for road maintenance purposes. Road inventory consists of spreadsheets and drawings by district. Spreadsheets include road names, beginning/ending points, road lengths, pavement widths, pavement areas, pavement types, surface conditions, and construction years (after 1996 only). Drawings consist of two sheets, which include renewal dates, road names, code numbers, beginning/ending points, road lengths, width of pavements and footpaths, pavement areas, pavement types, pavement structures, surface conditions, sketch maps, alignments, typical cross-sections, traffic volumes, traffic signals, traffic signs, markings, and construction years. However, most of the drawings sheets are blank.

Format of drawings are appropriate. Road classification and alignment, typical cross-section, width of each parameter, and pavement structure are left blank. Completion of inventory data, although requiring time and expenditure, is therefore necessary. In addition, data are required to be updated through periodic inspection to document the actual road condition.

(4) Road Geometric Standard and Typical Cross-section: Specification for Road Design 22 TCN-273-01 was published with reference to the (American Association of AASHTO and the ASEAN Highway Standards. The specification comprises not only geometric standards for roads but also those for drainage, pavement, road management facilities, as well as guidelines for drawing preparation excluding footpath width.

Minimum sight distance is defined by design speed, its location, and so on. Also, minimum curve radius and superelevation vary by design speed and location.

Typical cross-sections mainly consist of travel ways and shoulders. Travel way is expressed in the relationship with territory and design speed. Shoulder is expressed in the relationship between design speed and the annual average daily traffic (AADT).

In additional, bicycle lanes are provided if traffic volume exceeds 500 bicycles/h during the peak hour. Lane width is generally 1.5m for the first 1000 units of peak-hour traffic and an additional 1m for each additional 1,000 units.

The pavement is normally crowned at the centerline and the pavement slopes down to either edge at a cross-fall rate of 2% for AC; 2-3% for DBST and 3-6% for gravel and earth road.

Table 2.2.8 Minimum Sight Distance Values

Design Speed	Decision Sight Distance for Avoidance Maneuver (m)				
(km/h)	A[1]	B[2]	C[3]	D[4]	E[5]
20	45	95	90	110	140
30	50	110	105	120	155
40	60	130	120	130	175
50	75	160	145	160	200
60	95	205	175	205	235
70	125	250	200	240	275
80	155	300	230	275	315
90	185	360	275	320	360
100	225	415	315	365	405
110	265	455	335	390	435
120	305	505	375	415	470

Source: TUPWS
[1] Avoidance Maneuver A: Stop on rural road.
[2] Avoidance Maneuver B: Stop on urban road.
[3] Avoidance Maneuver C: Speed/ path/ direction change on rural road.
[4] Avoidance Maneuver D: Speed/ path/ direction change on suburban road.
[5] Avoidance Maneuver E: Speed/ path/ direction change on urban road.

Table 2.2.9 Summary of Geometric Standards

Design Speed (km/h)		20	30	40	60	80	100	110	120
Maximum Superelevation (%)	Rural	6	6	6	7	8	9	9	9
	Urban	6	6	6	6	6	6	6	6
Minimum Radius (m)[1]	Rural	14	31	55	129	230	375	477	630
	Urban	14	31	55	135	252	438	561	756
Max. Grade (%)		9	8	7	6	5	4	3	3

Source: TUPWS
[1] Minimum radius is calculated value.

Table 2.2.10 Summary of Cross-section

Design Speed (km/h)		20	30	40	50	60	70	80	90	110	110
Lane Width (m)	Rural	-	3.0	3.0	3.0	3.5	3.5	3.5	3.5	3.5	3.75
	Urban	3.0	3.0	3.0	3.5	3.5	3.5	3.75	3.75	3.75	3.75
Carriageway Width (m)	Rural	3.5	6.0	6.0	6.0	7.0	7.0	7.0	7.0	7.0	7.5
	Urban	6.0	6.0	6.0	7.0	7.0	7.0	7.5	7.5	7.5	7.5

Source: TUPWS

Table 2.2.11 Shoulder Width for Highways

Design Speed	AADT					
(km/h)	>14000	>6000	2000-6000	400-2000	400-100	<100
110	3.0	-	-	-	-	-
100	3.0	3.0	-	-	-	-
90	3.0	3.0	-	-	-	-
80	3.0	3.0	2.5	-	-	-
70	2.5	2.5	2.5	2.0	-	-
60	2.5	2.5	2.5	2.0	2.0	-
50	2.5	2.0	2.0	1.5	1.5	-
40	-	-	1.5	1.5	1.5	-
30	-	-	-	1.5	1.5	-
20	-	-	-	-	1.5	1.5

Source: TUPWS

(5) Construction Cost: Based on ODA projects, information on unit construction cost prevailing in HCMC and its environs was gathered (refer to Table 2.2.12).

(6) Maintenance Cost: Information on maintenance cost for typical work in HCMC and its environs was gathered (refer to Table 2.2.13). The table represents a typical two-lane road, which is assumed to have an 8m-wide pavement.

Table 2.2.12 Cost of Road Construction

Item	Unit	Cost	Remark
1. Embankment	$/cu.m	8.53	
2. Pavement	$/sq.m	30.45	
3. Drainage			
1) Pipe culvert	$/m	333.00	Dia.1.0
2) Box culvert	$/m	1223.00	W3.0xH2.0
3) U-ditch	$/m	134.00	
4. Sidewalk	$/sq.m	11.33	
5. Concrete curb			
1) Median	$/m	5.46	
2) Sidewalk	$/m	17.97	
6. Miscellaneous			
1) Lighting	$/nr	3,416.67	Double
2) Lighting	$/nr	2,600.00	Single
3) Traffic signal	$/location	56,000.00	
4) Guardrail	$/m	47.34	
7. Sand pile	$/m	5.00	
8. Retaining wall			
1) Gravity type	$/m	517.50	W2.0xH3.0
2) Reversed T-shape	$/m	3,315.60	including cofferdam and piles
9. Bridge	$/sq.m	950.00	
10. Pedestrian bridge	$/sq.m	570.00	
11. Revetment	$/sq.m	100.27	including cofferdam

Source: TUPWS

Table 2.2.13 Unit Cost of Typical Road Maintenance Work

Item	Unit	Cost
1. Routine		
1) Pot Hole	US$/km	1,536
2) Lighting	US$/km	8,760
3) Others (Markings, drainage, etc.)	US$/km	230
2. Periodic		
1) Overlay	US$/km	38,400
3. Other		
4. Electricity charges	VND/kwh	1,000
5. Personnel cost including allowance/subsidy	Month/VND	3,000,000

Source: TUPWS

3) Other Road Facilities

Bus Terminals

There are eight bus terminals in HCMC. Three of them are terminals for intra-city buses while the other five are for buses connecting HCMC and other provinces and/or cities. Most were constructed before 1975. Interprovincial/inter-city buses are operated to connect HCMC with other major cities in almost all provinces from north to south Vietnam. Due to an undeveloped railway system, buses connecting provinces and/or cities have become very important transport means to carry passengers and goods. These buses as well as inner-city buses depart and arrive at the five inter-city bus terminals located within HCMC's central area.

Except Ben Thanh Terminal (intra-city、District 1) and Cho Lon Terminal (intra-city and inter-provincial /inter-city, Dis.5), the other six terminals are located relatively far from the city center. A new terminal building and bus bays are now being constructed in the area of Mien Dong Bus Terminal. Both Ben Thanh Terminal and Cu Chi Terminal will be relocated and will have new buildings and facilities. The preliminarily identified problems and issues are as follows:

a) Each terminal has a limited area and capacity, considering the number of buses that are operated, and almost all terminals lack bus bays.

b) Roads surrounding existing bus terminals are always crowded and form bottlenecks. Improvement of road network and traffic control surrounding the terminals is needed.

c) Considering the current urban growth in the surrounding areas, existing bus terminals in HCMC will become obstacles to urban development in the near future. Relocation of existing bus terminals should be studied.

d) In existing bus terminals, size, design and layout of facilities are insufficient and inadequate. In order to secure smooth flow and security of vehicles and users, improvement of existing bus terminals, including facilities, is needed.

e) The TUPWS is in charge of the study, design, and construction of bus terminals in HCMC, while the MOCPT under the TUPWS is in charge of the management and the operation of bus terminals and bus vehicles, bus stops and waiting sheds (shelters). These agencies are responsible for attending to the above issues.

Table 2.2.14 Bus Terminals in HCMC

Name of Bus Terminal	Location	Function (Service)
Can Giuoc	District 8	Intracity Interprovincial HCMC-Long An)
Mien Tay	Binh Chanh District	Intracity Interprovincial ((HCMC-Can Tho, Vinh Long, Long Xuyen, Chau Doc, Rach Gia)
Mien Dong	Binh Thanh District	Intracity Interprovincial (HCMC-Ha Noi, Hue, Da Nang, Hai Phong, Qui Nhon, Nha Trang, Phan Rang, Phan Thiet, Buon Ma Thuot, Vung Tau, Da Lat)
An Suong	Hoc Mon District	Intracity Interprovincial (HCMC-Tay Ninh)
Cho Lon	District 5	Intracity Interprovincial (HCMC-Tien Giang, Bien Tre, My Tho)
Ben Thanh	District 1	Intracity
Cu Chi	Cu Chi District	Intracity
Hoc Mon	Hoc Mon District	Intracity

Source: Study Team

Parking Facilities for Cars, Motorcycles and Bicycles

There is hardly any publicly constructed parking area for cars and motorcycles in the city. The number of vehicles, particularly cars, is increasing rapidly. Many cars park on narrow roads because of inadequate parking areas developed in the city. However, some main roads with multiple lanes and wide widths in the central districts (districts 1, 4, and 5) have spaces for on-road parking.

Building owners and persons who run businesses provide parking area for cars and motorcycles for employers or customers either within a building site, in the building itself or on the sidewalk near the business location.

There are also business people who, with permission from the district office, operate a parking facility for profit by providing parking space for motorcycles on sidewalks or within an area owned by another person.

In terms of usage of parking, 25% of car users park their cars on roadsides or places other than parking spaces because of inadequate parking areas provided by both the public and private sectors in HCMC (refer to Table 2.2.15). This practice tends to aggravate traffic jams and becomes one of the causes of traffic accidents.

Although motorcycles are mostly parked within parking spaces, these parking areas are mainly on sidewalks and/or road shoulders, which disturb smooth pedestrian flow, particularly of tourists in the central districts. Since many sidewalks are literally cut off by parked motorcycles, pedestrians have to walk on the street which is a traffic safety risk.

Most parking usage in the central area is paid per use and by the users themselves. There are few cases where companies shoulder the parking fees of their employees. Average parking fee is about VND 1,000 for bicycles, VND 2,000 for motorcycles, and VND 10,000 for cars (refer to Tables 2.2.15 and 2.2.16).

Table 2.2.15 Parking Areas and Average Parking Fees

Parking Area	Car			Motorcycle			Bicycle		
	No. [1]	%	Ave. Fee (VND)	No.	%	Ave. Fee (VND)	No.	%	Ave. Fee (VND)
Road	89	25.0	3,400	90	8.6	732	4	2.6	1,625
Parking Lot	135	37.9	12,216	758	72.5	2,260	137	87.8	958
Inside House	79	22.2	4,591	126	12.0	1,156	11	7.1	1,000
Others	53	14.9	9,310	72	6.9	1,250	4	2.6	1,333
Total	356	100	9357	1046	100	2,080	156	100	986

Source: HOUTRANS Private Mode Users' Interview Survey
[1] Number of respondents.

Table 2.2.16 Parking Payment Style

	No. of Sample	%
Payment Mode		
Monthly	130	17.0%
Per Use	612	80.0%
Others	23	3.0%
Total	765	
Payment Source		
Company	752	97.0%
Drivers themselves	23	3.0%

Source: HOUTRANS Parking Users' Interview Survey

Pedestrian Facilities/Bridge

Pedestrian facilities are generally inadequate except in the central areas. Pedestrian traffic signals are few and markings for crossings are not sufficiently provided nor enforced.

There is only one pedestrian bridge existing in the city and this is located across Duong Dien Bien Phu Street which runs through Binh Thanh District.

However, the number of pedestrians is expected to increase in HCMC when people shift transportation mode from motorcycle to bus. Development of road crossing facilities, such as pedestrian bridges and underpasses, will be necessary to ensure pedestrian safety and smooth traffic flow.

4) Transport Projects

Projects under Local Funding

There are several documents on local transport projects. They vary depending on sources. They are as follows:

(i) Urban Traffic Congestion Prevention Project in the Capital City of Hanoi and HCMC, MOT, June 2002

(ii) Key Projects Planned in the Period 2000-2005, TDSI

(iii) Implementation Plan for Key Transportation Projects, 2000-2005, TUPWS

(iv) Main Projects up to 2005, TUPWS

(v) Road-bridge Projects under Construction, TUPWS

(vi) Projects List 2002, TUPWS

(vii) Project List and Planned Capital for Key Projects up to 2010, TUPWS

(viii) Program against Traffic Congestion in HCMC, 2001-2005, TUPWS

Ongoing projects are concentrated along canals. Since the Japan Bank for International Cooperation (JBIC)-funded East-West Highway will be implemented with access control, the improvement, upgrading and grade separation of existing roads are being conducted prior to the project. Planned projects are located outside of the central area and mainly consist of widening and upgrading of existing roads. Planned projects are mostly located towards the north and the west, and are particularly concentrated in Than Binh District.

In rural areas of HCMC and the provinces, there are some planned projects but few ongoing ones. Among ongoing projects funded locally, a major one is the widening of NH1 from HCMC to Trung Luong including the construction of a bypass through Tan An town and Tan An Bridge, which is implemented by the MOT's PMU-1.

5) Projects for ODA Funding

There are four ODA road projects in the study area, with only one new construction project which is a loan from the JBIC. Other projects are improvements or upgrading of existing roads. They are briefly as follows:

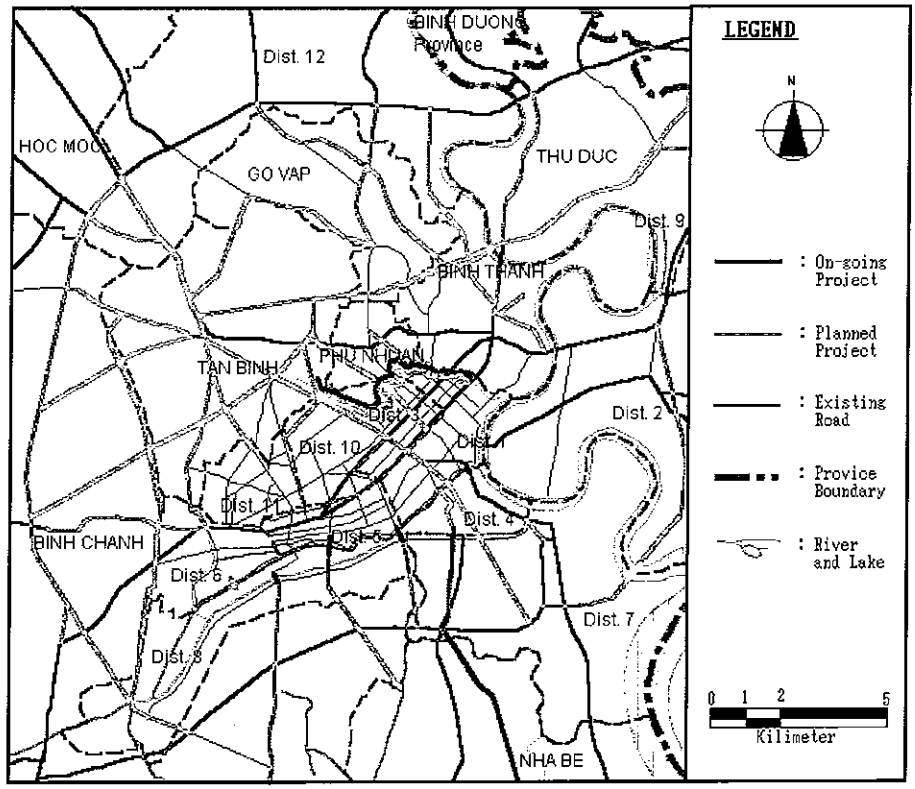
(1) HCMC East-West Highway Project (JBIC): This project includes the construction of a tunnel under the Saigon River and an expressway linking it with National Highway (NH) 1A. This directly connects the central area with Saigon River where development has been taking place. The project is implemented under the HCMC PC's PMU .

(2) Urban Transport Improvement Project (World Bank): This project consists of the improvement of intersections, widening around intersections, as well as installation of traffic signals and area control facilities. In addition, technical assistance on strengthening the TUPWS and the Traffic Police is included. This project is implemented under the TUWPS' PMU.

(3) Trans-Asia Highway (ADB): This project involves the upgrading of Asia Highway No.1, which leads to Cambodia with an overall length of 80km. The section in Vietnam is made up of NH3 and NH22. This project is implemented under the MOT's PMU-My Thuan.

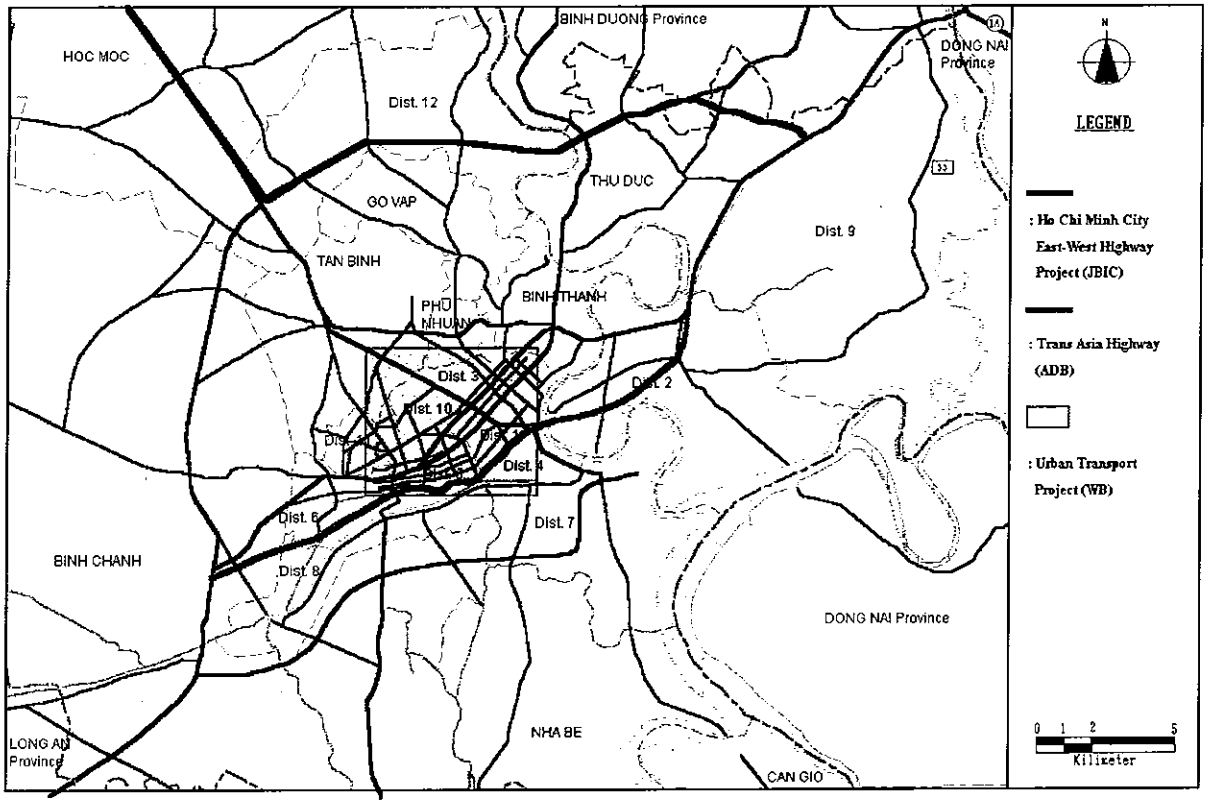
(4) The Project for Construction Bridges in Mekong Delta Area (Japan's Grant Aid): This project comprises new construction or replacement of 21 bridges and procurement of 17 bridges for 17 provinces in southern Vietnam with the objective of securing safety in and improving the rural areas. Four bridges are located on provincial roads and district roads in the study area. This project is implemented under the MOT's PMU 18.

Figure 2.2.12 Location of Locally Funded Projects



Source: Study Team

Figure 2.2.13 Location of ODA Projects



Source: Study Team

6) Current Issues

Lack of Hierarchy within Unclear Classification of Road

Road network has not been clearly configured in HCM metropolitan area. While administrative classification is established, functional classification is not clear.

In urban area, road network lacks adequate hierarchy, too. There is little consistency on roads, i.e. cross sections of roads are not homogenous in terms of number of lane and road width. Some major roads are composed of two routes of one-way road.

Lack of Roads in Emerging Urban Areas

While the road network in the urban central area is well developed in terms of road density and road occupancy, the network outside of the urban central area is poor. Especially in the area between NH1 and the urban central area, where population has recently increased very rapidly, road development is not catching up with rapid urban expansion.

Roads in Rural Areas

In the rural areas, the national roads are well developed due to foreign-funded projects such as the Asian Development Bank (ADB)-assisted NH22. Lower level roads are generally underdeveloped and with low density. Most roads have narrow widths and no pavement. Traffic flow in rural areas, therefore, heavily depends on the national roads.

2.2.2 Traffic Management

1) Road Traffic Flow Operation

Classification of Areas

In general the focus area of the study can be divided into four separate areas, namely: (i) central area, (ii) outer central area, (iii) suburbs, and (iv) outer city / rural areas (with bypasses, NH1, etc. and other less attractive roads).

The entire study area is criss-crossed by rivers. However, bridge/ferry crossing points are limited. The current situation by area is described briefly as follows:

Central Area: The central area (districts 1 and 3) has generally been developed with relatively good road infrastructure with about 6% of land allocated to roads and transport-related uses. There are wide boulevards and closely spaced interconnecting roads. Many of the roads operate in one direction and, in general, the road network is able to cope with the existing traffic demand. In the north of the area (north of Nguyen Thi Minh Khai) there are fewer and narrower roads but they are also used by through traffic resulting in more dense traffic conditions. The area is prone to temporary congestions due to momentary obstructions, particularly during peak periods.

Outer Central Area: The area is surrounded by built-up areas approximately delineated by the Saigon River, Ben Nghe Canal, Tan Son Nhat Airport, and Binh Chanh District. The area has been developed with insufficient road network in terms of density and road width which causes difficulties in coping with current levels of traffic. At present, four-wheeled vehicles, including trucks, constitute a small proportion of the total traffic flow.

Suburban Area: New development has been taking place as the city expands. This area includes old established centers around which development has taken place. Most of the

areas are separated from the urbanized city area by water/river.

Outer City Areas: It is noted that clusters of developments are planned in the outer areas and rural areas. In many cases, there is no definite plan that improvements will be made on existing roads.

General Traffic Flow Characteristics: HCMC is getting congested, suffering from traffic problems which, however, are different from those experienced in other major urban areas in the world. While in most cities, traffic normally comes to a standstill or forms long queues, in HCMC, queues develop in some areas but the dense stream of motorcycles continues to flow fluidly along with other two-wheeled vehicles, albeit slowly. Queuing normally happens only to four-wheeled vehicles.

However, while the general characteristics of motorcycle traffic contribute in minimizing delays and maximizing the use of road space, there are many undesirable aspects. They include violation of regulations, unsafe and dangerous driving that interrupt flow and result in additional stress to other road users.

Pedestrians are also adversely affected by dense motorcycle streams. In general, traffic streams do not stop for the sake of pedestrians.

Photo 2.2.1 Dense Stream of Motorcycles

Source: taken by the Study Team

Traffic Operation along Links: Along two-lane roads, two- and four-wheeled vehicles move in the same traffic stream. The Road Traffic Law[10] stipulates that light vehicles must run in the rightmost lane while motor vehicles take the left lane.

In general, traffic flow along links is efficient but is interrupted by vehicles traveling in the wrong direction. Four-wheel vehicles generally observe traffic rules. Violations are commonly caused by two-wheeled vehicles which often use the wrong side of carriageways in attempts to cross major traffic streams or due to stopping or starting on the opposite side of a road.

One-way Streets: Traffic laws provide one-way traffic flow along an inner-city road or its peripheries. This provides for a wider lane and can generally offer separate lanes for two- and four-wheeled vehicles. One-way traffic also effectively removes conflicts between opposing traffic streams and reduces junction conflicts.

Junction Layout and Operation: The four main junction types categorized by their operating characteristics are: T-junctions, roundabouts, signalized junctions, and merge/diverge junctions. Many junctions or intersections are constructed without adequate traffic engineering design, which results in large conflicting areas and traffic flow conflicts.

Comments relating to the layout of junctions and operation of junctions are provided below. In addition to the points raised for specific junction types, there is a lack of continuity through the junction like restricted exit width and exit not aligned with entry.

T-junctions: Typical junction forms are T-junctions and crossroads which are the simplest form of junction when two roads join. The general traffic rules require vehicles to give way to the right unless one is on the priority road (Article 22 of Road Traffic Law). The general characteristics of existing junctions are:

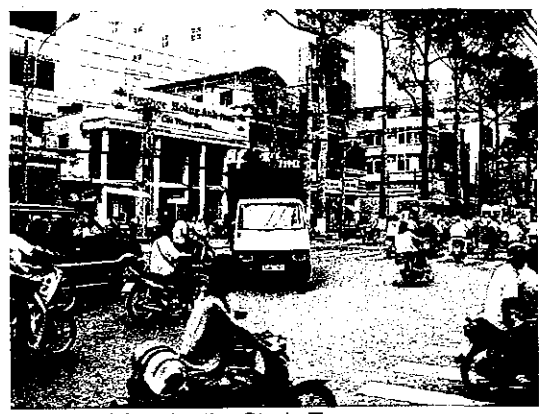
Layout

- Many junctions are formed by intersection of roads without traffic engineering design.
- Priorities are not defined on the approach arms.
- Irregular curb layouts.
- Uneven widths of traffic lanes on opposing sides of the junction and within the junction.
- Large undefined areas with irregular traffic streams.
- Junctions on major roads not appropriate to class of road.
- Design does not relate to traffic volume for major new roads.
- Relies on traffic taking evading action to avoid collisions.
- Greater problems for four-wheeled vehicles crossing dominant stream of two-wheeled vehicles.

Operation

- Traffic enters in a free-for-all manner.
- System works on a first-come first-served basis.
- Motorcycles take shortest or least congested route through the junction.
- Multiple paths of crossing vehicles increase congestion and risk, and reduce capacity.

Photo 2.2.2 Free-for-all Movement of Vehicles at Intersection



Source: Taken by the Study Team

Roundabouts: The main observations relating to roundabouts are summarized as follows:

Layout

- Many roundabouts are formed by adding a central island.
- Large unregulated areas which allow irregular traffic streams.
- Irregular curb layouts.
- Traffic engineering design is minimal.
- Priorities are not defined on the approach arms.
- The central island is often not well located to effectively guide vehicles to form a regular traffic stream.
- The central island is often too small to encourage regular traffic stream.
- Motorcycles take shortest route to avoid circulating around the island and disrupting traffic streams conforming to the required traffic movement.
- Greater problems for four-wheeled vehicles crossing dominant stream of two-wheeled vehicles.

Operation

A central island is created around which all traffic circulate in a counter-clockwise direction. The main objective is to remove crossing conflicts and require vehicles to merge and diverge from the circulating flow.

- Traffic enters in a free-for-all manner.
- System works on a first-come first-served basis and priority rule is ignored.
- Relies on traffic taking evading action to avoid collisions.
- Motorcycles take shortest route to avoid circulating around the island, thereby disrupting traffic streams conforming to the required traffic movement.

It is perceived that, although larger traffic areas give more capacity, a more regulated stream will be more efficient, resulting in fewer conflicts.

Photo 2.2.3 Large Traffic Areas with Many Conflicting Points

Source: Taken by the Study Team

Signalized Junctions:

Layout

Conflicts between opposing traffic streams are regulated by traffic lights which define the use of the junction for conflicting movements.

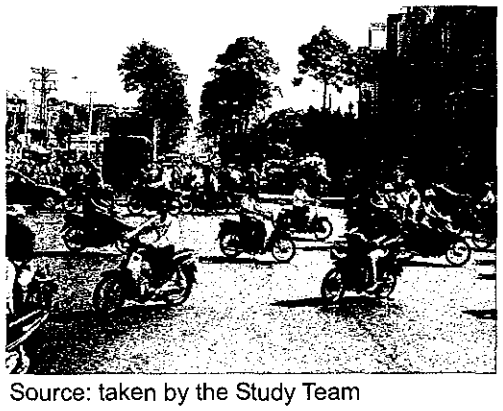
- Evidence of poor maintenance with older signals either not working or are faulty.
- Signal aspects are dim and the signal displayed is not clear.
- Signal timings are not related to traffic demand.
- Manual operation of signals by police with assistance from Youth Volunteers.
- Traffic signals installed without modification of layout to reflect new mode of operation.
- Modern traffic engineering principles, such as lane widening, not applied.
- Lack of left turn pockets results in delays to through traffic movements.
- Layout of junction not optimized for traffic signal control, i.e. corner radii and location of stop line.
- Limited use of left turn filters.

Operation

Conflicts between opposing traffic streams are regulated by defining separate time periods for opposing streams.

- Four-wheeled vehicles generally observe the signals.
- Widespread violation by two-wheeled vehicles encroaching forward of the stop line.
- Widespread violation of red signals by two-wheeled vehicles – particularly for vehicles turning right.
- Left turn movements cut across opposing traffic stream.
- Vehicles turning left (two- and four-wheeled) take any available route creating multiple conflicts and unregulated traffic stream which disrupt the opposing traffic stream.
- Two-wheeled vehicles encroaching forward of the stop line impedes the traffic stream with the ROW through the junction.
- Four-wheeled vehicles turning right cross the stream of two-wheeled vehicles.

Photo 2.2.4 Traffic Conflict between Four-wheeled Vehicles and Motorcycles



Source: taken by the Study Team

Merge / Diverge:

Layout

On one-way streets and at junctions with limited turning movements, it is possible to eliminate direct conflicts so that different vehicle streams can merge without direct conflict. While the principles are mainly applied for major urban roads with limited access, the principles can also be applied for gyratory schemes within the urban area to minimize conflicts and create "free flow" traffic conditions. While some junctions operate using these principles, few have been specifically designed / engineered to operate in this manner and, in general, to operate in a similar manner with priority junctions.

Operation

At junctions where turning movements are limited and on one-way roads, direct conflicts are avoided.

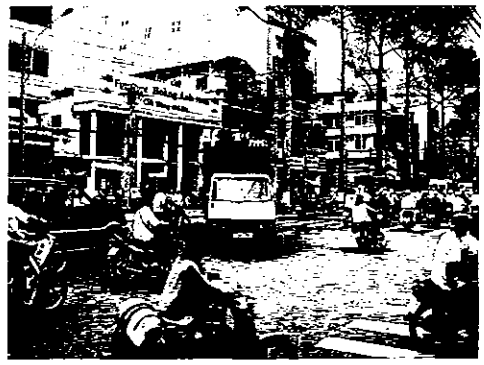
- First-come first-served basis.
- Operate most efficiently for two-wheeled vehicles.

Left turning is allowed at intersections except in 19 intersections. Priority rule (priority for through traffic over left-turning traffic stipulated in the Road Traffic Law), however, is not observed and dangerous conflicting situations often arise between through and left-turning traffic.

Photo 2.2.5 Dense Motorcycle Stream

Source: taken by the Study Team

Photo 2.2.6 Traffic Conflict between 4-wheel Vehicles and Motorcycles



Source: taken by the Study Team

Truck Ban: Decision No. 5736/QN-UB-NCVX on adjustments to peak hours and prohibited trucks together with their coverage areas in HCMC, dated 9 December 1996, regulates the traffic of specific trucks inside the city's ring road during peak hours. Duration and target were expanded with Decision No. 4554/QD-UB, dated 11 November 2002, whereby truck movements are controlled on some routes within HCMC.

2) Traffic Management Facilities

Signal Systems

A total of 341 traffic signals are currently in operation in HCMC (refer to Figure 2.2.14). They are of different types made by more than seven manufacturers and are roughly classified into three groups: old signals installed more than 30 years ago; new signals recently installed; and French ATC (area traffic control) signals. In addition, another type of

ATC signal is being planned and will be added under the Vietnam Urban Transport Improvement Project (VUTIP) funded by the WB. The variety of signal make and the mixture of old and modern ones have created non-uniformity in signal design. Layout and appearance of signals also vary greatly among types. Additional signals are planned (refer to Figure 2.2.15).

Closed Circuit TV (CCTV) System

In addition to the CCTV system which comprise eight cameras introduced in District 5 together with the French ATC system (see Section 3.1 for description), there are several CCTV cameras installed at key intersections in District 1. However, they are not intended for traffic monitoring purposes.

Signs, Markings and Chatter Bar

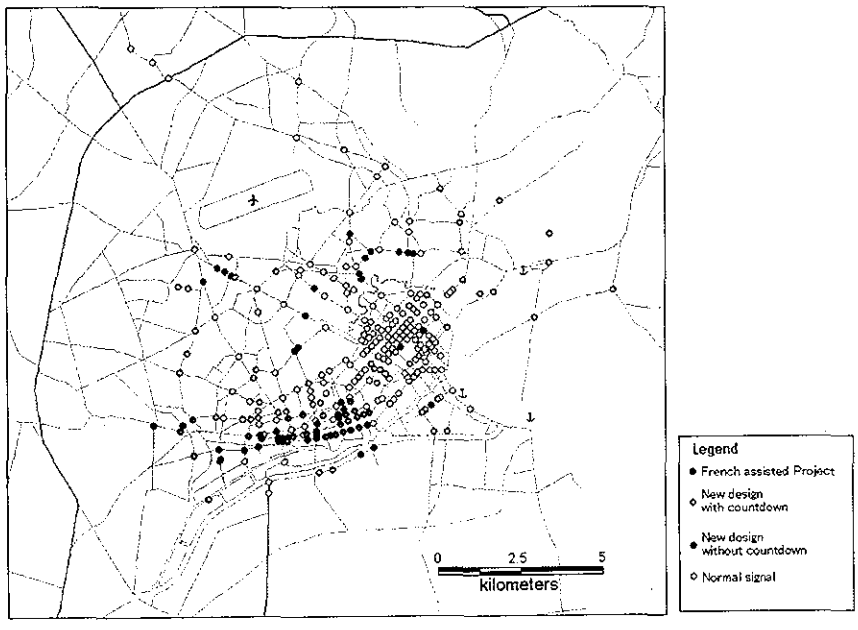
Generally speaking, traffic signs are well installed. But there are still signs installed at inadequate locations, or the intention of some signs is not clear. Compared with traffic sign, pavement markings need more improvement. Some of the markings are already worn out and need re-application (refer to Photo 2.2.7). Observation implies that the quality of the markings is not high enough to meet the standards of developed countries in terms of whiteness and amount of glass beads. Layout of the markings, particularly location of stop line, is not adequate in many places. There are also variations of design with different spacing for pedestrian crossings. It is doubtful whether the varieties of marking designs used are properly understood by road users.

Chatter bars are not common in HCMC. However, a new type of chatter bar with solar cell and flashing LED light has already been used to delineate the center line along Le Loi Street.

Intersection Improvement

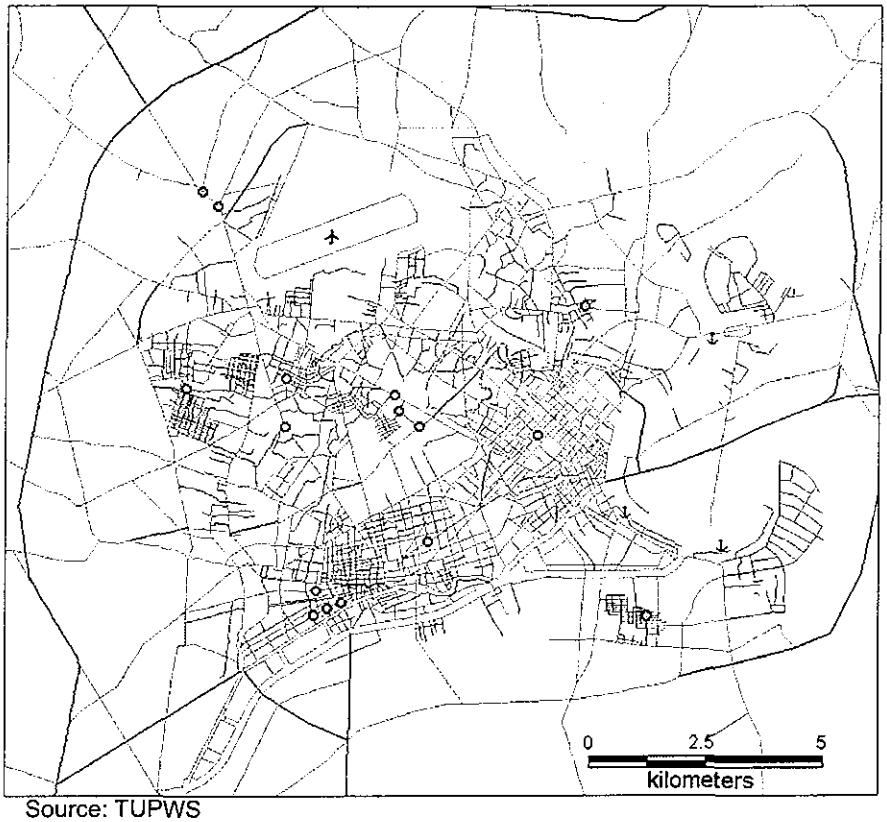
Recognizing the deficiency of intersection design and the necessity of intersection improvement, the traffic management unit of the TUWPS is undertaking improvement work along intersections as shown in Figure 2.2.16.

Figure 2.2.14 Intersections with Traffic Signals



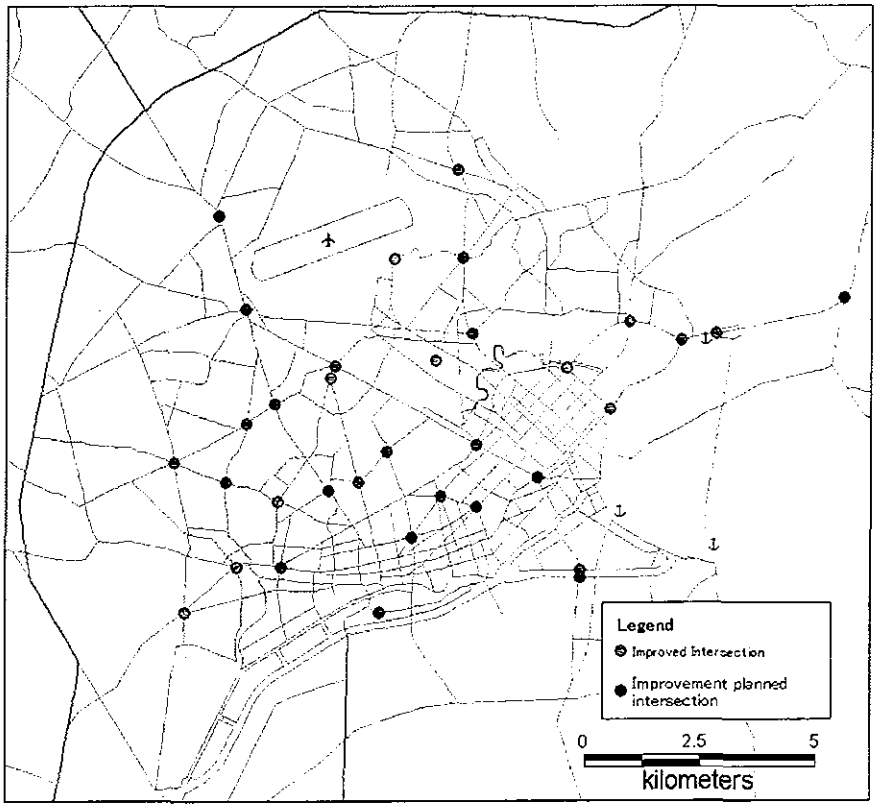
Source: TUPWS

Figure 2.2.15 Additional Intersections Planned for Signalization



Source: TUPWS

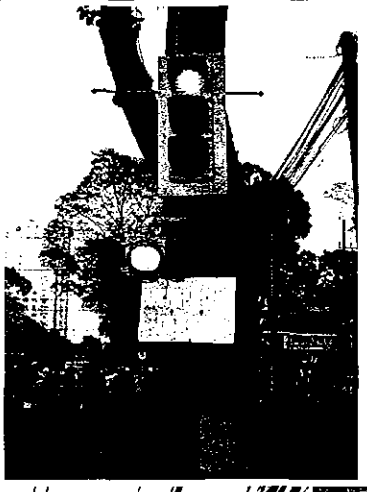
Figure 2.2.16 Location of Intersection Improvements

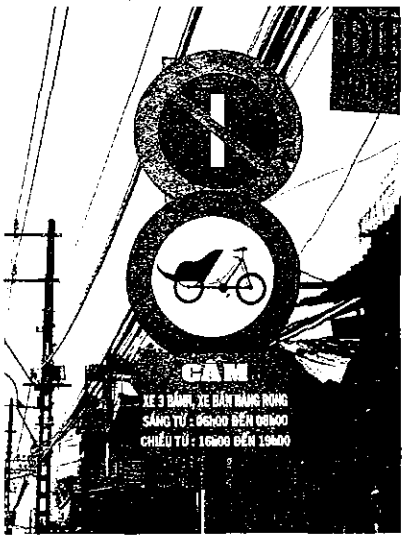


Source: TUPWS

Photo 2.2.7 Traffic Signals and Signs





Source: Taken by the Study Team