3.4 Intersection Traffic Flow

Four hours traffic movements, two hours in the morning peak hours from 6:30 - 8:30 and two hours in the evening peak hours from 16:00 - 18:00 at 26 intersections are shown in Table 3-4-1. The highest flow is seen at the intersection No.4 having 7 legs, located at the city center, followed by the intersection No.18 and No.19, where the intersections are not signalized yet and traffic police officers are controlling traffic flow in the peak hours.

Table 3-4-1 Surveyed Intersections

No.	Location	Legs	4Hrs Trips	Remarks	No.	Location	Legs	4Hrs Trips	Remarks
401	Yen Phu-Hang Dau	5	106,126		414	D.Giai Phong - D.Truong Chinh int.	3	87,857	
402	Chuong Duong Bridge	7	179,201		415	Trung Tu - Ton That Tung cross	3	160,301	
403	Revolution Sq.	6	79,343		416	Nguyen Thai Hoc - Chu Van An int.	4	152,936	Signalized
404	Nga 5 Cua Nam	7	279,084	Signalized	417	O Cho Dua	5	222,044	
405	Le Van Huu int.	5	73,338		418	Tay Son - D.Chua Boc int.	4	269,727	
406	Hue-To Hien Thanh int.	4	122,912	Signalized	419	Nga Tu So	4	266,242	
407	O Dong Mac	4	83,328		420	P.Giang Vo - P.Lang Ha cross	4	221,557	
408	Minh Khai - Kim Nguu int.	6	89,189		421	P.Lang Ha - D.Lang int.	3	99,825	
409	O Cau Den	5	163,036	Signalized	422	D.Buoi - D.Nghia Do int.	3	96,125	
410	Dai La - Bach Mai int.	4	117,464		423	D.Buoi - P.Doi Can int.	3	56,085	
411	Yen Phu - Thanh Nien int.	5	74,392		424	O Cau Giay	6	165,496	
412	Tran Phu - Dien Bien Phu	4	154,372		425	QL32 - Nam Thang Long cross	3	102,582	
413	Le Duan - Dai Co Viet int.	4	262,080		426	NH1 - Ring Road No.3 cross	4	225,572	

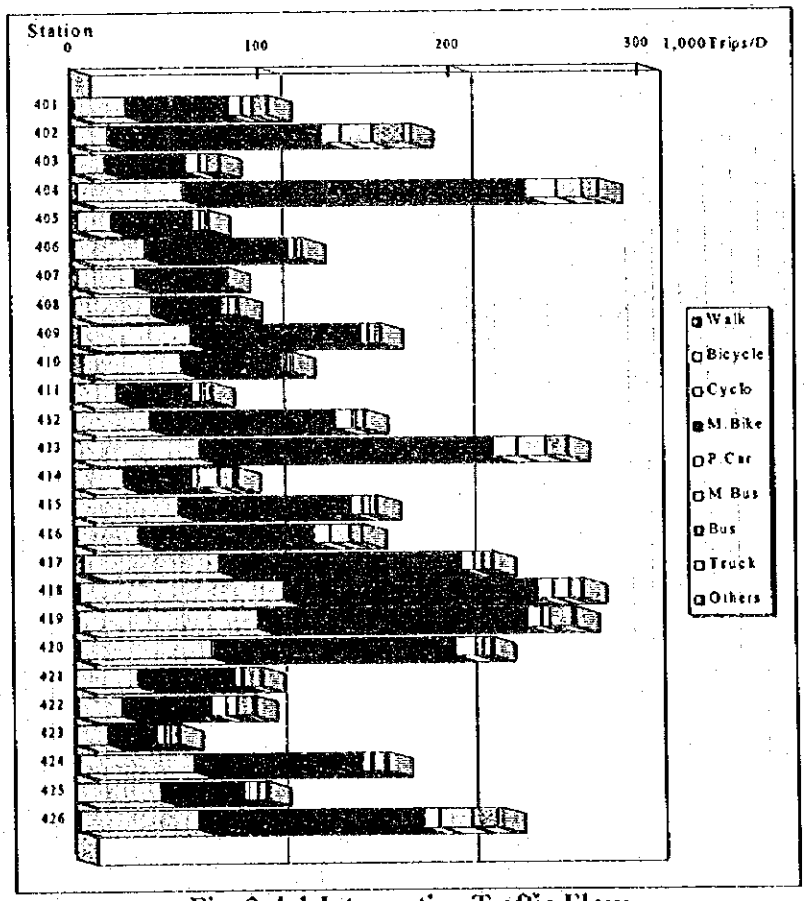
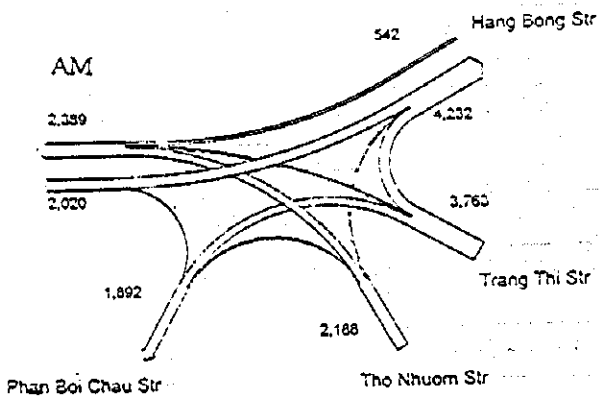


Fig. 3-4-1 Intersection Traffic Flow

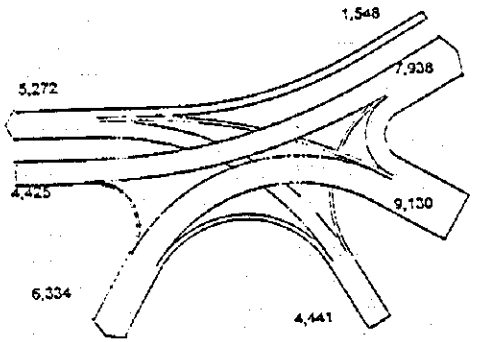
The high shares of 64.2% and 63.3% for motorcycle are seen at the intersections 404 and 412 respectively, and they are located at the city center. The high shares of 46.3%, 44.7% and 44.2% for bicycle are seen at the intersections 408, 410 and 425, located at the surroundings of the urban area. The high shares of 9.6% and 7.6% for passenger car are seen at the intersections 403, 422 and 423, at the west of the urban area.

The turning movements at the intersections having high traffic flows are given in Fig. 3-4-2.

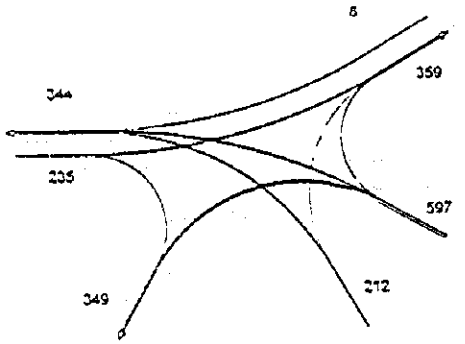
Intersection 404(A)



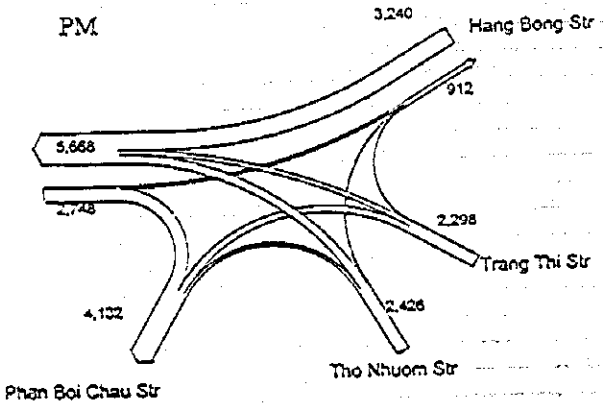
(Bicycle/Cyclo)

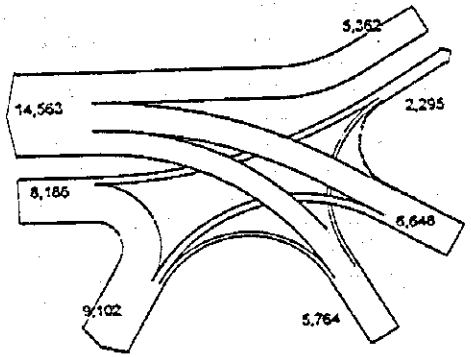


(Motorcycle)



(Car, Others)





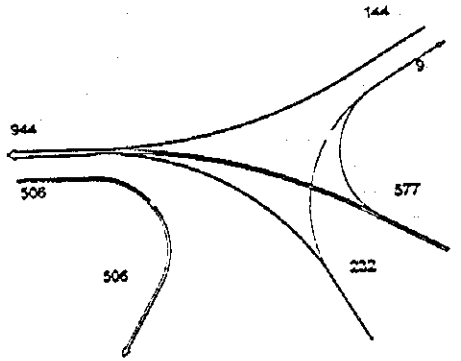


Fig. 3-4-2 Turning Movements (1)

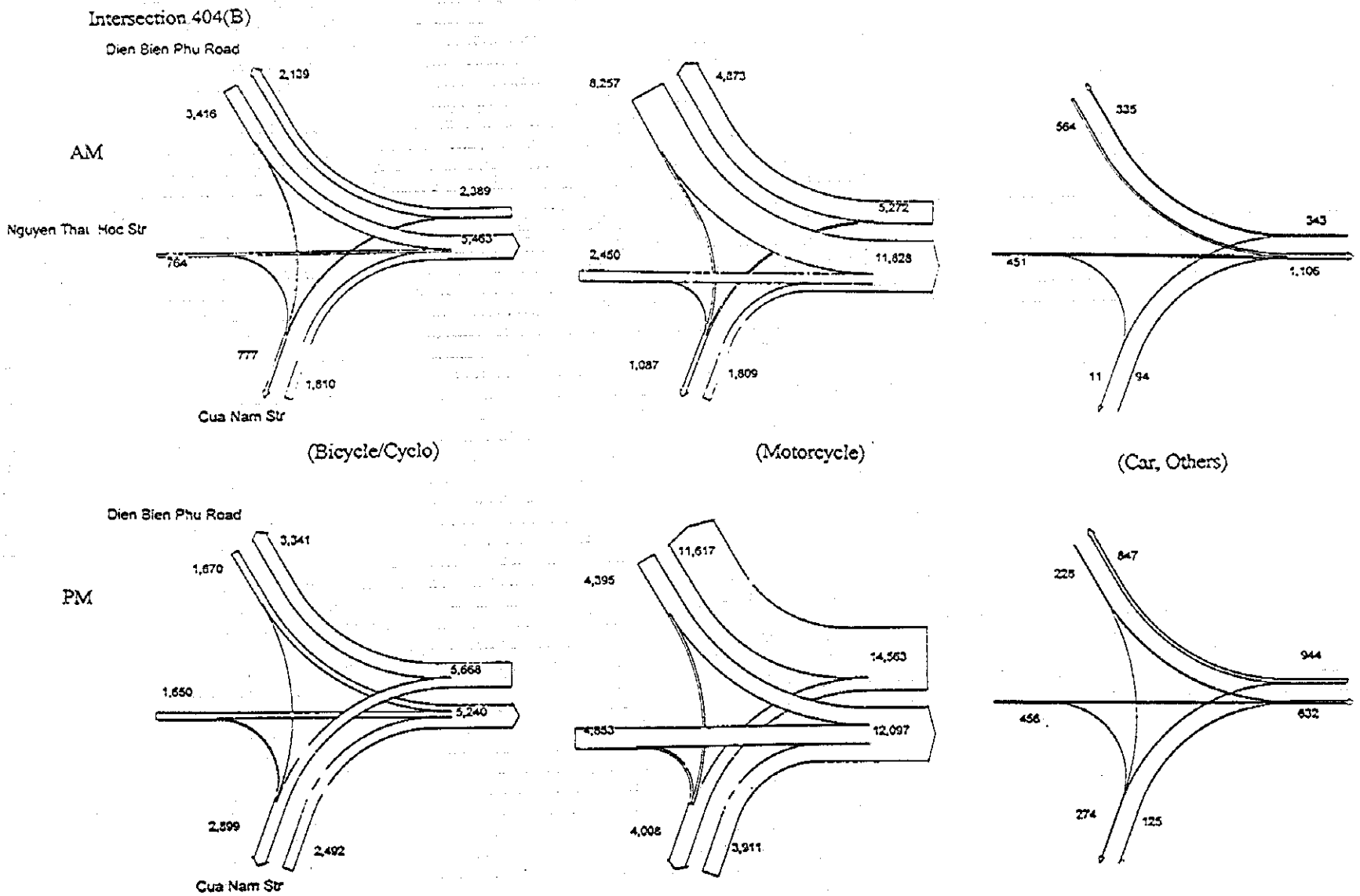


Fig. 3-4-2 Turning Movements (2)

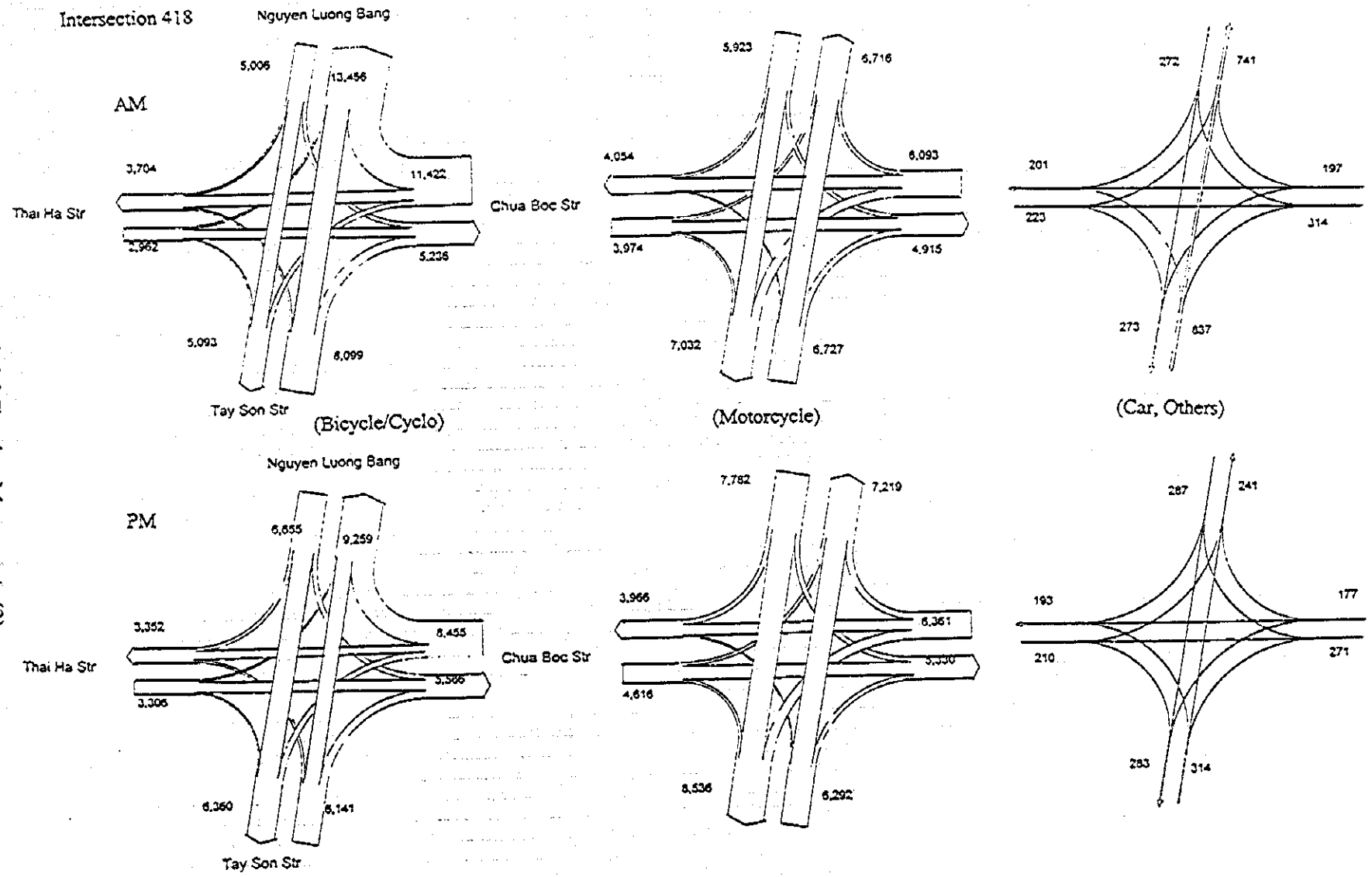


Fig. 3-4-2 Turning Movements (3)

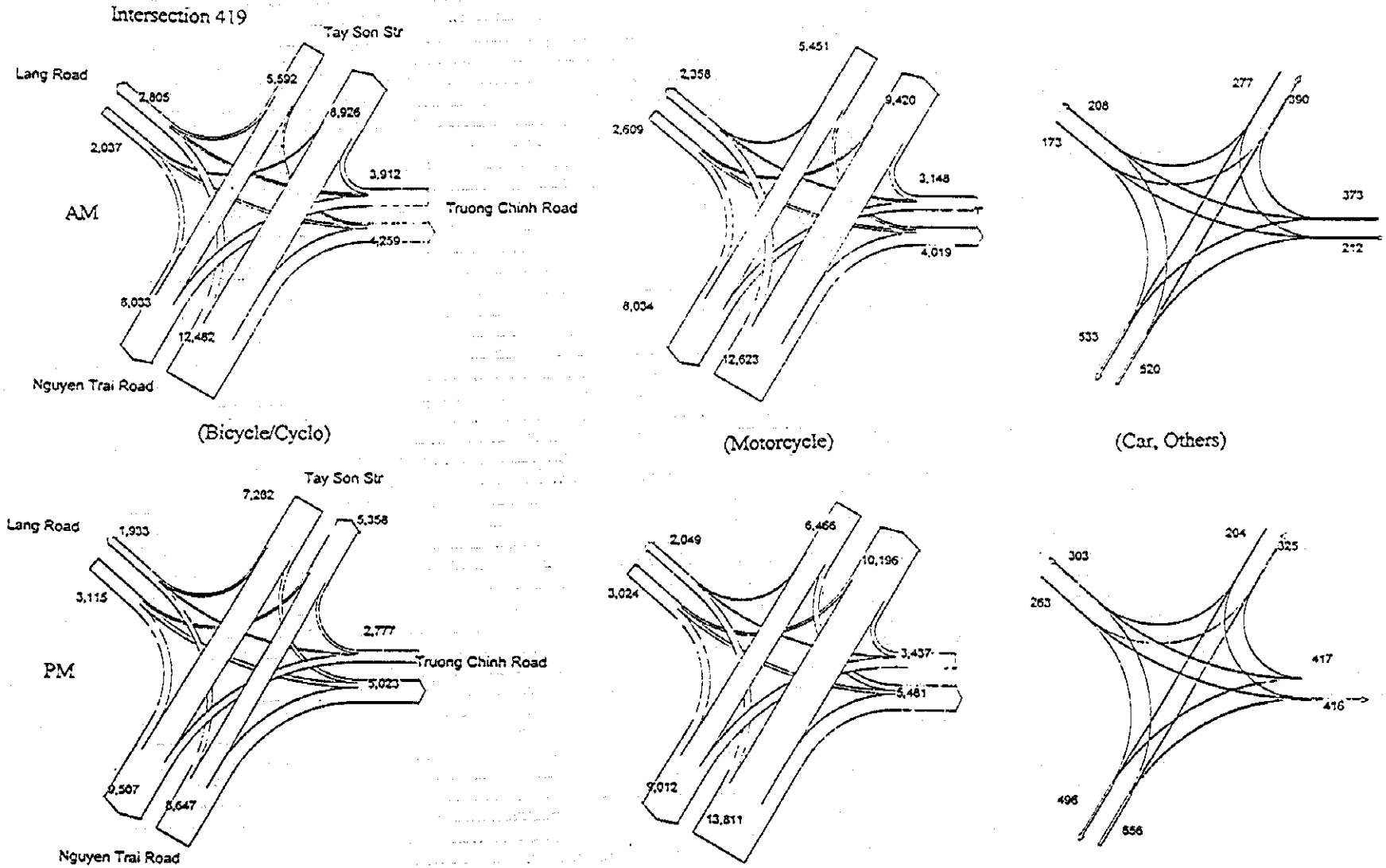


Fig. 3-4-2 Turning Movements (4)

3.5 Travel Time

The average travel speeds for bicycle, motorcycle and passenger car on 12 survey routes shown in Fig. 3-5-1 in morning and evening peak hours and an off peak hour are summarized in Table 3-5-1.

The routes from 1 through 6 are located in the urban area. The passenger car during the peak hour was about 20Km/h in the urban area, which is almost same as the respective speeds for motorcycle and is better than the speeds for bicycle on the same routes. The maximum speed of bicycle is 18.0 Km/h. The speeds on the route 3 and 4 in the evening peak hour are extremely low for all the modes.

Table 3-5-1 Travel Speed by Mode

Unit:Km/hr

Route	P.Car			M.Bike			Bicycle		
	AM	Off Peak	PM	AM	Off Peak	PM	AM	Off Peak	PM
1	21.2	22.0	21.4	19.3	22.7	19.4	11.4	13.2	12.7
2	28.7	32.6	30.0	21.8	25.6	22.4	16.6	18.0	15.0
3	20.1	29.3	18.7	16.9	19.7	13.7	11.3	10.9	9.5
4	20.0	23.5	16.1	20.0	23.5	16.1	8.6	8.8	8.5
5	19.5	24.1	18.0	22.2	26.5	20.4	12.1	13.0	10.6
6	27.5	28.6	23.8	22.0	25.0	20.2	13.7	13.4	13.0
7	28.8	30.3	26.9	--	--	--	--	--	--
8	26.8	34.6	32.3	21.9	26.8	22.0	13.3	13.6	13.2
9	66.1	65.0	59.0	--	--	--	--	--	--
10	46.7	65.2	--	--	--	--	--	--	--
11	49.7	--	--	--	--	--	--	--	--
12	44.0	53.2	--	--	--	--	--	--	--

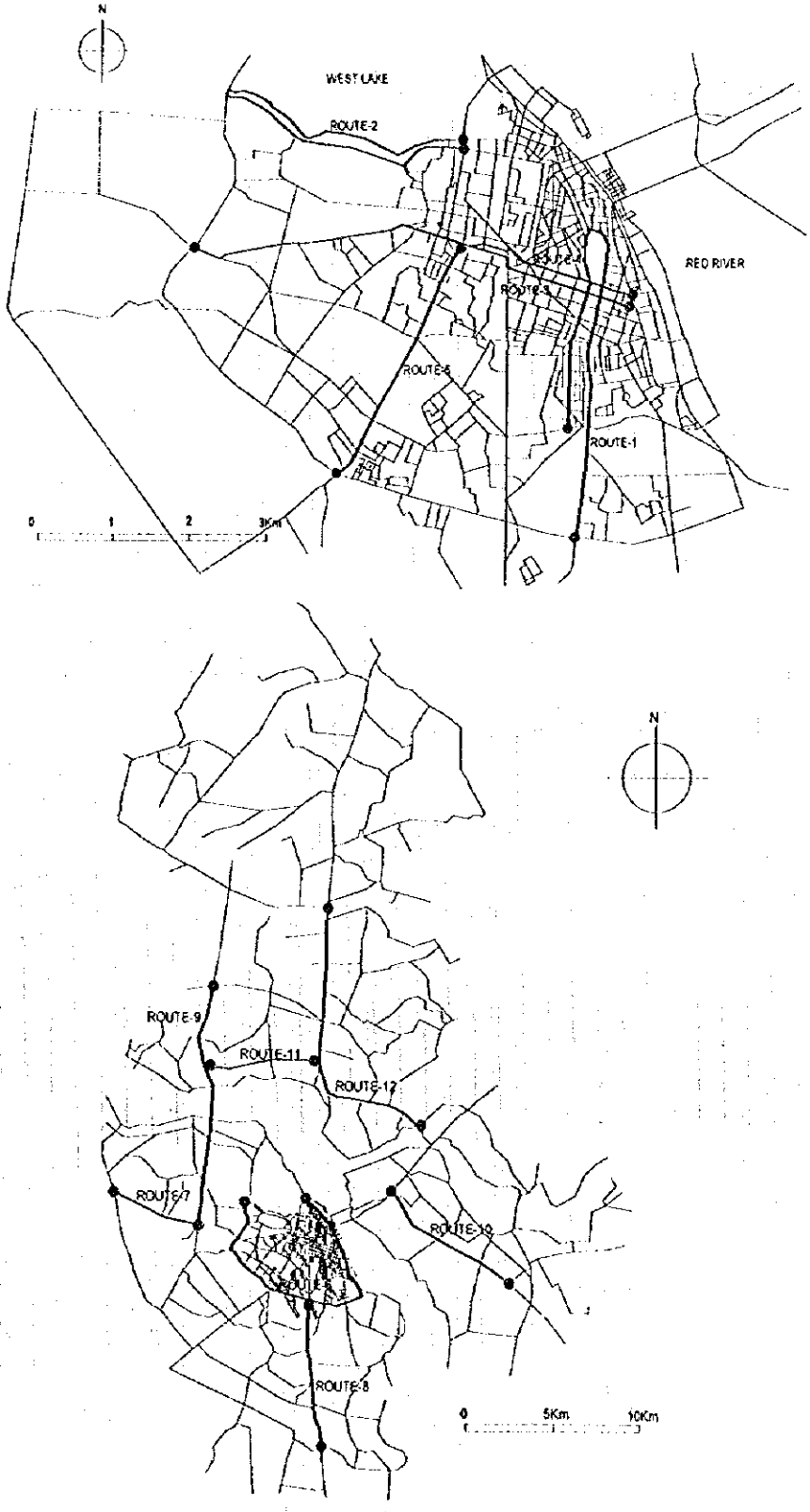


Fig. 3-5-1 Travel Time Survey Route

3.6 Inter Regional Transport

The road sector in the transport system of Vietnam has the highest share both for freight movement and passenger movement, as shown in Fig. 3-6-1.

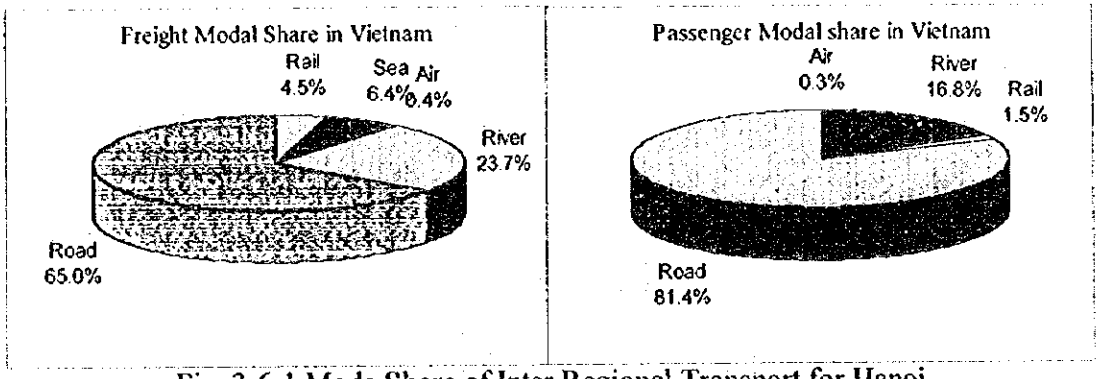


Fig. 3-6-1 Mode Share of Inter Regional Transport for Hanoi

About 65% of the freight tonnage lifted in the country was transported by the road in 1993, followed by inland-waterway transport with a share of about 24%. The share of the sea transport comes next with about 6% but it has the highest share when calculated in terms of ton-Km which indicates that long trips use sea transport.

The road sector has the highest shares for Hanoi trips, both for freight and passengers. Freight movement road has about a 85% share of land movements and for passenger movements road has more than 95%. This shows that roads are the main sector of transport in Hanoi. Inland-waterways handle about 13% of the freight movement and 5% of the passenger movements.

Fig. 3-6-2 presents the trend of freight volumes for Hanoi between 1985 and 1993, based on the general data available in the Statistical Yearbook of Vietnam, 1994. The growth in the freight movements for Hanoi over the years 1985 - 1993 shows an annual growth rate of 2.6% in tonnage lifted and a higher rate of about 11.2% in ton-Km.

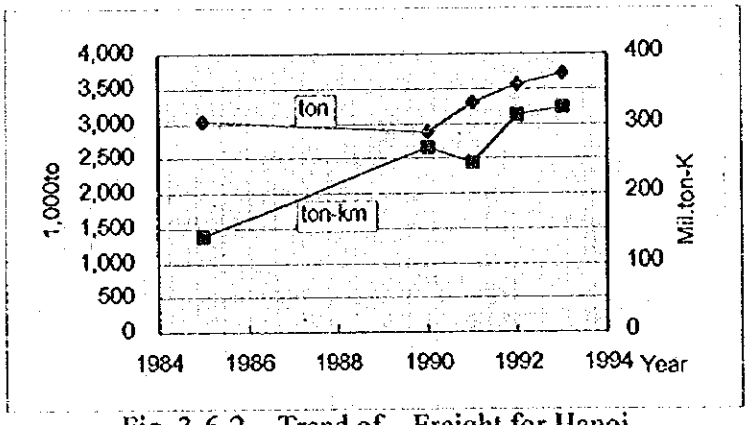


Fig. 3-6-2 Trend of Freight for Hanoi

CHAPTER 4 PUBLIC TRANSPORT

4.1 Public Transport Modes in Hanoi

There are four public transport modes currently available in Hanoi, which are listed in Table 4-1-1. Among the four public transport modes bus, taxi and cyclo are operated by the private sector while the train mode is by public sector. The very small share of public transport trips is an outstanding characteristic of Hanoi urban transport.

Table 4-1-1 Public Transportation Modes in Hanoi

Mode	Operated by	No. of Fleet 1995
Bus	Hanoi Bus Co.	177**
Taxi		400***
Cyclo	Private Sector	N/A
Train	(for reference)	

Note: * : before expansion, unlinked trip base
** : by interview
*** : by telephone survey

Hanoi Bus Company is an affiliated company under TUPWS. The company is the only operator for intra city bus services. It has 177 buses and operates 13 lines. TUPWS, also, has two companies for inter city bus services. South Passenger Transportation Company owns Giap Bat and Kim Ma (to be sold) bus terminals, and operates inter province lines to south and west. North Passenger Transportation Company owns Gia Lam bus terminal and operates inter province lines to east and north.

Private companies and bus owners operate their buses for inter province services. The majority of longhaul route services are private.

Within Hanoi, Vietnamese National Railway (VNR) operates several lines to Hai Phong, Bac Ninh, Thai Nguyen, Nam Dinh and Phuc Yen. From January 1, 1996 the Government prohibited daytime train operation in urban Hanoi area therefore all trains now stop either Giap Bat station or Gia Lam station, or at the newly opened station at the southern end of the Long Bien Bridge.

There are about 400 metered taxis in Hanoi. Around half of the vehicles belong to Hanoi Tourist Car Companies. The taxi fare system of these companies varies from US$0.75 for the first km and $0.46 per km afterwards to US$2.00 for the first 2km and US$0.67 per subsequent kilometer. Compared with other forms of transportation such as buses or lambrettas, taxi fares are still too high for general public use. Apart from the taxis of the Hanoi Tourist Car companies there are taxies owned by private persons. Their cars are old and poorly equipped, but they are in sharp competition with the company taxies due to cheaper fares. They charge US$0.20-0.25 per km or US$4.00-5.00 per hour.

Cyclo is a more popular mode of public transport than bus at present. Cyclo transport is generally for short distances. Fares are usually determined by negotiation. The majority of cyclo users are those who have no vehicle available such as aged or children.

4.2 Intra City Bus

4.2.1 Company Profile

Hanoi Bus Company (HBC) is the exclusive operator of intra city bus services. The company has 658 employees including 214 drivers and 103 conductors. HBC has a workshop with 135 mechanics. They own 177 buses as follows: 74 Karosa, 75 W50 IFA, 10 PAZ and 18 Hyundai. Details of these vehicles and employees are shown in Tables 4-2-1 and 4-2-2.

Table 4-2-1 Bus Fleet

Model	Number	Capacity person/bus	Average Age (year)
Karosa(Czech)	74	90	11
W50 IFA (E.Germany)	75	60	5
PAZ (Russia)	10	50	12
Hyundai (Korea)	18	24	1/2

Table 4-2-2 Composition of Employees

Profession	Numbers
Indirect Staff	94
Security Staff	46
Direct Staff	66
Mechanic	135
Driver of Pascucar	6
Driver of Truck	2
Driver of Bus	206
Conductor	103
Total	658

4.2.2 Bus Routes

Routes operated by HBC are shown in Table 4-2-3 and in Fig. 4-2-1 for the busiest routes No.1,2 and 3.

Bus lines are divided to two types. The majority of lines extend from the city center to suburban areas along major National Highways. NH No.1 (south bound) accommodates three routes, No.7, No.9 and No.11. NH No.6 has, also, three routes, No.1, No.2 and No.8. NHs No.1, No.5 and No.32 have each one route, routes No.10, No.12 and No.5/6, respectively. These ten routes cover all major radial arteries of Hanoi.

The remaining two routes have an intra city transport service nature. Route No.3 connects two inter city terminals and route No.4 connects Giap Bat bus terminal and city center.

Table 4-2-3 Bus Routes

No.	Name	Route Length (km)
1	Yen Phu - Ha Dong	13
2	Bac Co - Ha Dong	13
3	Giap Bat - Gia Lam	13
4	Long Bien - Duoi Ca	9
5	Phan Chu Trinh - Troi	17
6	Phan Chu Trinh - Phung	22
7	Kim Lien - Thuong Tin	18
8	Bac Co - Chuc Son	20
9	Long Bien - Cau Bieu	16
10	Bac Co - Yen Vien	12
11	Giap Bat - Kim Ma	8
12	Kim Lien - Trau Quy	17

Note: Other 30 buses are used as school/office/factory buses.

The bus network is badly marketed. There are no widely available bus route maps on timetables. Bus stops are often not welt defined routes and have no information about routes stopping at then such as route number, destination and frequency.

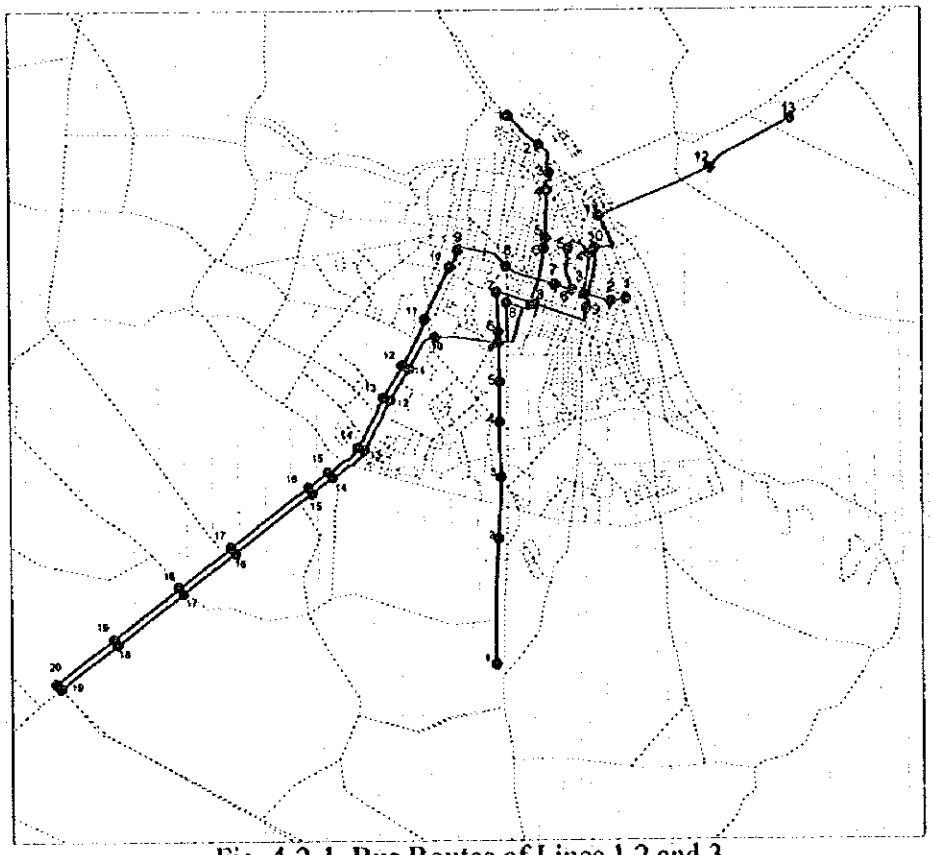


Fig. 4-2-1 Bus Routes of Lines 1,2 and 3

Characteristics of the routes are summarized in Table 4-2-4. The average number of passengers onboard in the peak hour is rages from 13 to 36. Routes along NH No.5 and No.6 have 30 passengers on average at peak hour. Another route which has high onboard passenger numbers is route No.3, which connects two inter city bus terminals.

Table 4-2-4 Characteristics of Route

Route	Dist (Km)	Fleet	Travel Time (Min.)	Peak Hour				Daily/ Pass.	Used Vehicles	Peak Av. Pass.	Peak Av. Load (%)
				Inter-val (Min.)	Freq. (Bus/ Hour)	Pass/ Bus	Pass/ Hour				
1	12.0	13	55	4.2	14.2	145.0	2,.56	17,136	Karosa	35.8	39.7
2	12.3	13	110	8.5	7.1	142.0	1,007	8,391	Karosa	35.2	39.1
3	13.0	19	110	5.8	10.4	131.0	1,358	11,314	Karosa	33.2	36.8
4	12.0	4	50	12.5	4.8	64.6	262	2,180	PAZ	13.1	26.2
5	17.0	5	60	12.0	5.0	60.6	253	2,104	W50 1FA	20.4	34.0
6	22.0	6	75	12.5	4.8	82.0	394	3,280	W50 1FA	25.3	42.2
7	18.0	3	70	23.3	2.6	69.0	177	1,479	W50 1FA	26.5	44.2
8	19.0	2	75	37.5	1.6	104.0	166	1,387	W50 1FA	24.9	41.5
9	18.0	2	70	35.0	1.7	53.0	91	757	W50 1FA	17.3	28.9
10	13.0	3	45	15.0	4.0	63.0	252	2,100	W50 1FA	13.9	23.2
11	8.5	4	60	15.0	4.0	15.5	62	517	Hyundai	6.1	25.3
12	735	2	75	37.5	1.6	82.0	131	1,093	Hyundai	30.1	125.2
Total	172.3	76				991.0	6,208	51,737			

The number of alighting and boarding passengers were counted by surveyors. The number of passengers carried was relatively consistent, and boarding and alighting passengers were concentrated at both ends of each line. The inter-stop loading for the routes 1, 2 and 3 are presented in Fig. 4-2-2. These observations suggested that much of the demand is long distance traffic between route terminal. (See Fig. 4-2-3).

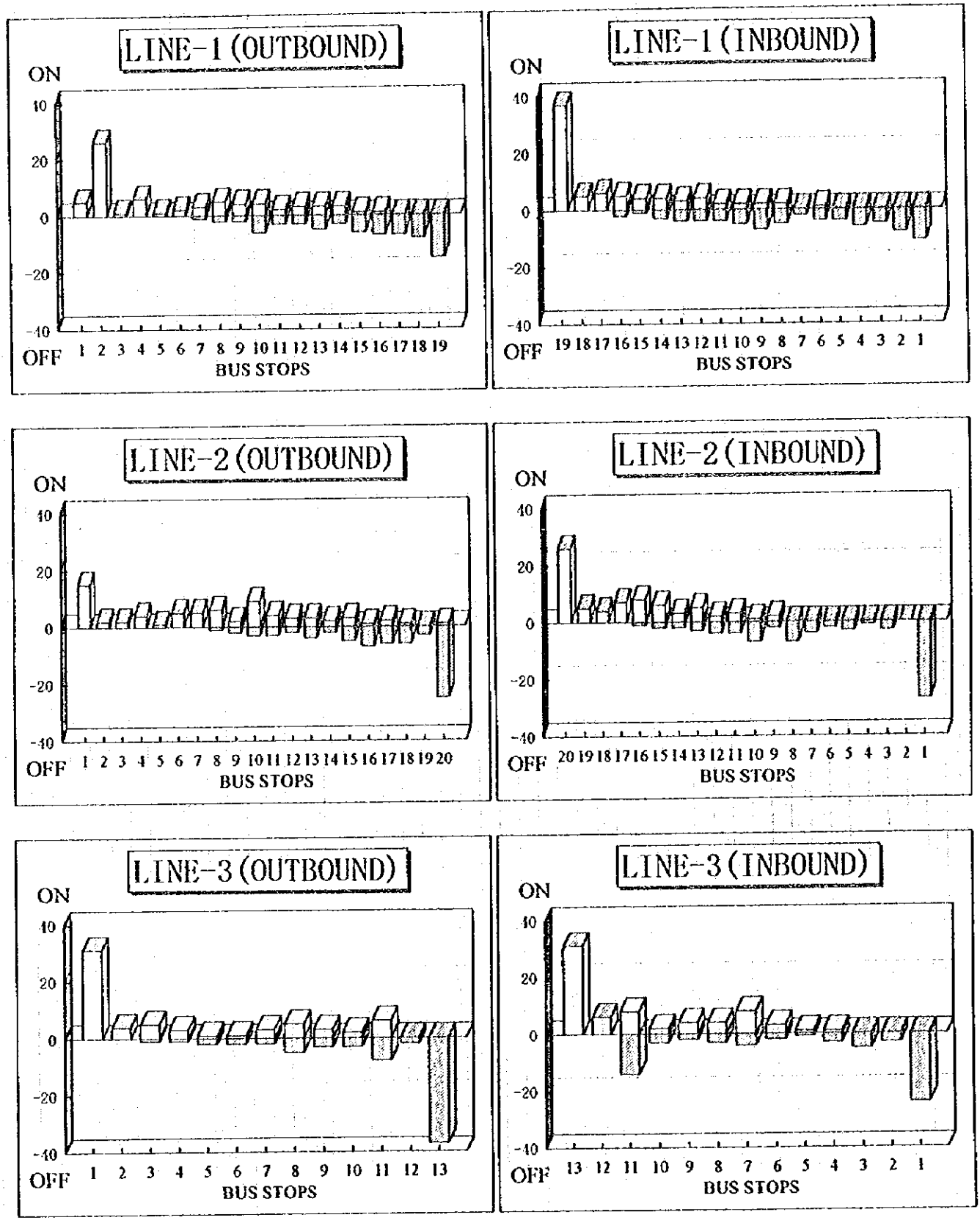


Fig. 4-2-2 Alighting/Loading Passengers

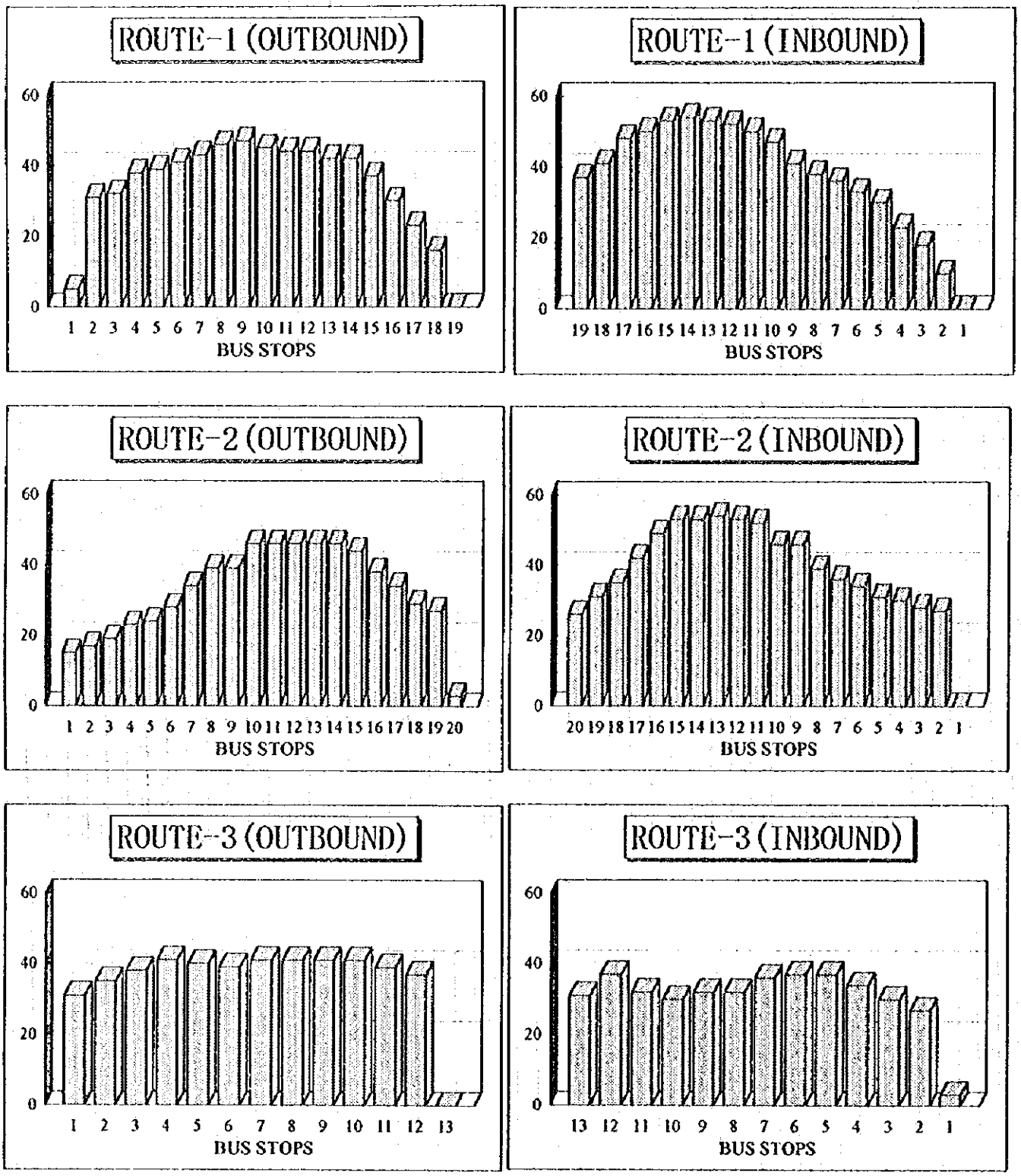


Fig. 4-2-3 Carried Passengers

4.2.2 Present Bus Passenger Characteristics

(1) Present Bus Passenger Attributes

Table 4-2-5 shows the passenger share by sex and age group for each mode. The share of female passengers comprises of lower share of about 40% of the total, despite the random sampling for each mode. The female passengers have the higher share of 53.7% for cyclo only, while male passengers have the highest shares for cars (92.4%) and motorcycle (74.3%). The share of male passengers for bus is also higher at 64.8% where for taxi use share is 75.2%.

Table 4-2-5 Mode by Age and Sex

Unit:%

Mode	Rail	Bicycle	Cyclo	M.Cycle	P.Car	M.Bus	Bus	Taxi	Total
Male									
0-10	3.3	3.8	1.2	0.0	0.0	0.5	1.8	0.0	1.4
11-20	16.7	19.5	12.7	21.2	4.2	15.9	19.9	11.9	16.4
21-30	10.0	11.5	12.7	30.4	21.8	17.7	15.7	18.3	17.5
31-40	14.4	8.8	8.5	16.2	34.5	10.5	13.5	31.2	14.8
41-50	10.0	3.8	6.6	6.5	17.6	5.5	7.5	9.2	7.3
51-	1.1	5.3	4.6	1.5	4.2	3.2	6.4	3.7	4.1
Total	55.6	52.7	46.3	75.8	82.4	53.2	64.8	74.3	61.4
Female									
0-10	3.3	6.9	1.5	1.2	0.8	0.5	3.2	0.0	2.4
11-20	18.9	18.7	14.7	10.0	3.4	9.5	13.5	10.1	12.8
21-30	7.8	9.5	11.2	8.1	2.5	20.0	6.4	10.1	9.9
31-40	10.0	8.8	12.0	5.0	6.7	10.5	9.6	1.8	8.5
41-50	1.1	1.9	7.7	0.0	4.2	4.5	2.1	3.7	3.2
51-	3.3	1.5	6.6	0.0	0.0	1.8	0.4	0.0	1.8
Total	44.4	47.3	53.7	24.2	17.6	46.8	35.2	25.7	38.6
Total									
0-10	6.7	10.7	2.7	1.2	0.8	0.9	5.0	0.0	3.8
11-20	35.6	38.2	27.4	31.2	7.6	25.5	33.5	22.0	29.2
21-30	17.8	21.0	23.9	38.5	24.4	37.7	22.1	28.4	27.4
31-40	24.4	17.6	20.5	21.2	41.2	20.9	23.1	33.0	23.3
41-50	11.1	5.7	14.3	6.5	21.8	10.0	9.6	12.8	10.5
51-	4.4	6.9	11.2	1.5	4.2	5.0	6.8	3.7	5.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The age distributions of bus passengers and car users show a quite different patterns (See Fig. 4-2-4). The young age group of 11 to 20 years old has the highest share of bus passengers, while the middle aged group of 31 - 40 years old has the highest in passenger car users. The age distributions of bus, cyclo and bicycles have the similar tendencies except for the high aged female passenger share in cyclo. The age distribution patterns of passenger car, taxi and motorcycle also show the similar tendencies except for the peak shift from the middle age group of 31 - 40 to the younger age group of 21 - 30 in motorcycle.

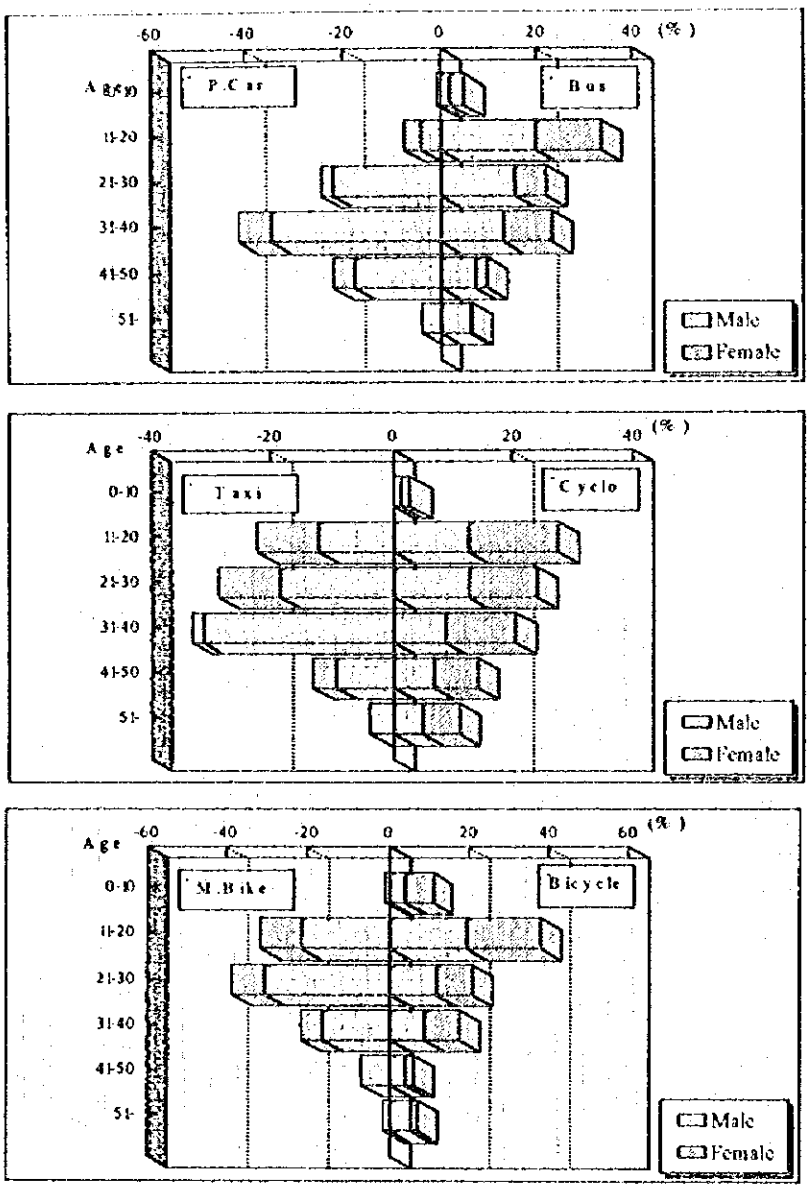


Fig 4-2-4 Age Distribution of Various Modes

(2) Occupation and Trip Purpose

Fig. 4-2-5 shows the occupation and trip purpose of the present bus passengers. Among occupations, students share is the highest at 21%, followed by worker (20%). The occupation distribution reflects the present bus fare system, which is 1,000 VND/ride with a monthly pass with the specially discounted price of 10,000 VND per month for students. However, among the trip purposes, the "to school" comprises of only 7.1% of the total, while the "other" purpose comprises of the highest share of 39.2%, followed by the "back home" purpose of 26.8%.

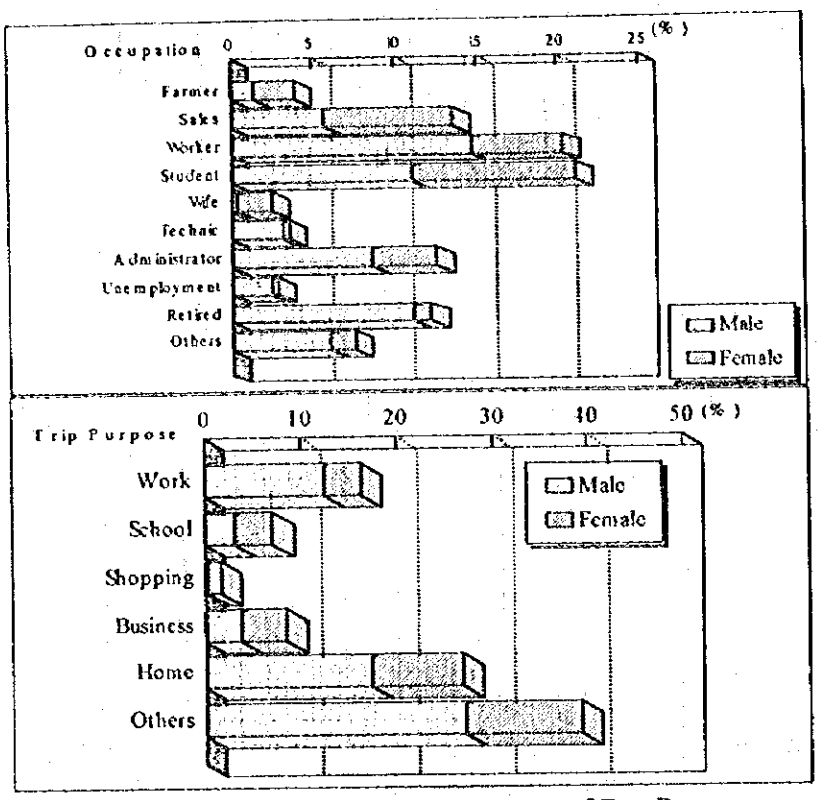


Fig. 4-2-5 Occupation and Trip Purpose of Bus Passengers

(3) Vehicle Ownership of Bus Passengers

Fig. 4-2-6 shows the comparison of vehicle ownership of bus passengers and car users. The bus passengers are characterized by high share of bicycle only owners, and by low share of motorcycle only owners. The owners of both bicycle and motorcycle use both passenger cars and buses. The car owners are very much captive to use passenger cars. The share of bus passengers having no vehicle is only 1.4%.

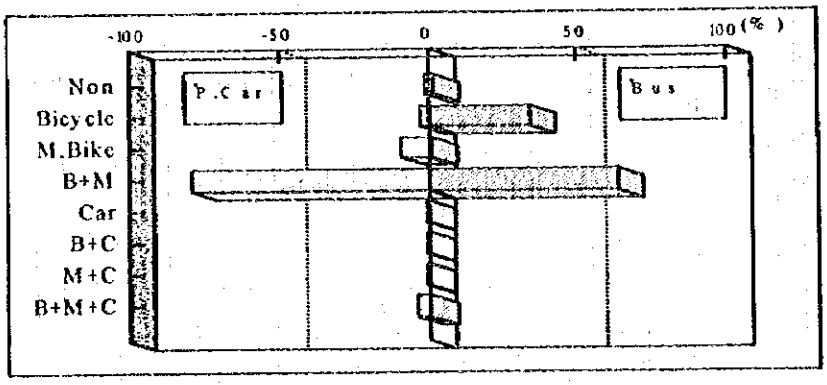


Fig. 4-2-6 Vehicle Ownership of Bus Passengers and Car Users

(4) End Trip Modes of Bus Passengers

Fig. 4-2-7 shows the end trip modes of bus passengers from the initial origins to bus stations or from bus stations to the final destinations. Almost 2/3 of bus passengers have no trip end modes, which means most of the bus passengers have their trip origins or destinations area within walking distance despite of the present coarse bus network, or that if bus services do not cover potential bus users walking area, they will select other modes.

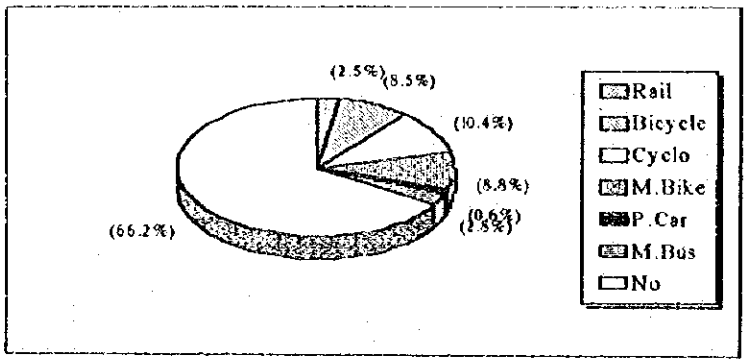


Fig. 4-2-7 End Trip Modes of Bus Passengers

(5) Bus Image for Non Bus Users and Bus Users

Fig. 4-2-8 shows the bus image for non bus users above and for bus users. For non bus users, the reason for not selecting bus of "No services" occupies the highest share in all the modes. Only about 10% of railway users think bus is more expensive than rail. About 15% of passenger car, motorcycle, and taxi users selected their modes by the travel time, and about 10% of cyclo users selected by frequency.

Conversely, for bus users, "cheap" is the best reason to select buses followed by "access" and "no other alternatives". The bus users who answered "no other alternatives" are either only bicycle or bicycle and motorcycle owners and always have a trip distance of more than 4 Km. No other deference in individual attributes such as sex, age, family income, and occupation are found for these group.

(6) Trip Distance

Fig. 4-2-9 shows the trip distance distribution of bus and bicycle passengers The share of bicycle passengers beyond 4 Km of trip distance is 18.4% , while 46.7% of bus passengers have trips distance beyond 4 Km.. However no such deference is found in bus passenger trip distance when compared with motorcycle or passenger car.

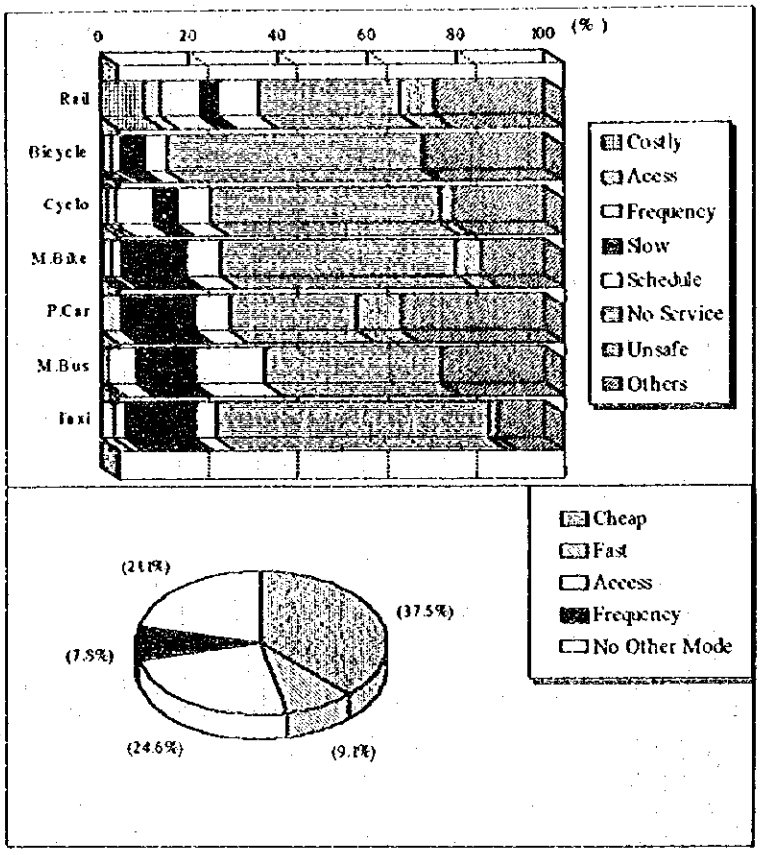


Fig. 4-2-8 Reasons Not To Use Bus and To Use Bus

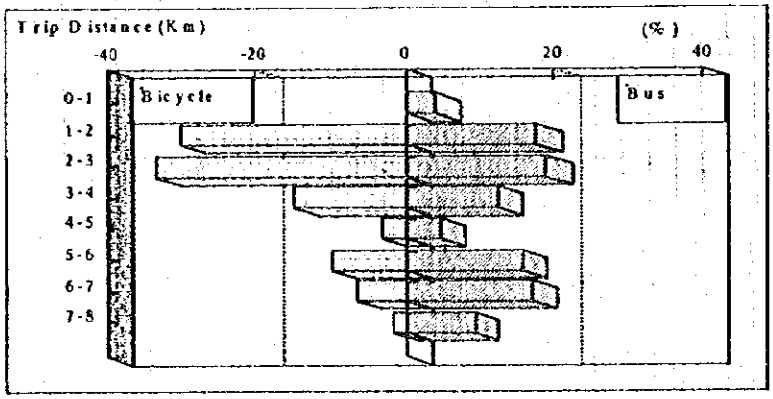


Fig. 4-2-9 Trip Distance of Bus and Bicycle Passengers

(7) Potential Public Transport Demand

A. Potential Demand from Other Modes

It is remarkable that many non bus users answered "no service" as the reason not to use bus at present, while the present bus passengers answered "cheap" and "good access" as reasons to use buses. Therefore, if public transport has a dense network and more frequent

services keeping the same fare level at present, there will be the possibility of attracting the other mode passengers back to public transport. However, car owners showed very captive tendencies to use passenger cars, and most of them are middle aged male passengers, who may be in the leading positions in the fields of economic and social activities. To discourage passenger car use and to encourage public transport use for these captive passengers is one of the big issues.

B. Demand from Longer Distance Trip

Some of passengers who have a trip distance of more than 4Km answered "no alternative" to the use of a bus at present. They are not in a specific category in terms of sex, age, occupation and income level. Therefore, the demand from new development areas located in suburban will increase in future.

C. Demand from the Transport Poor

The share of aged female bus passengers is very low at present and they seem to use cyclo. "Frequency" is characterized in cyclo passengers among reasons not to use bus, therefore there will be possibility to attract these passengers back to bus by more frequent services than at present.

4.3 Inter City Bus

4.3.1 Services

Two inter city bus companies under TUPWS operate inter city bus services. One is South Passenger Transportation Company, which serves lines bound for the south and west. The other is North Passenger Transportation Company, which serves lines bound for the north and east. Also, privately owned buses share this market, especially long haul. Details are set out in Tables 4-3-1.

Table 4-3-1 Departure (Arrival) at Inter City Bus Terminals

Terminal	Route	Trip/Day	Routes Less Than 5 Trips/Day
Giap Bat	Thanh Hoa	16	40 routes
	Vinh	8	Total: 62 Trips/Day
	Thai Binh	13	
	Nam Dinh	15	
	Ninh Binh	8	
	Ly Nhan	9	
Gia Lam	Hang Yen	10	43 routes
	Hon Gai	11	Total: 64 Trips/Day
	Tuyen Quang	7	
	Thai Nguyen	23	
	Bac Giang	31	
	Hai Phong	14	
	Sao Do	7	
	Hai Duong	11	
Kim Ma	Son Tay	11	20 routes
			Total: 26 Trips/Day
Giap Bat	Long distance route	11	

4.3.2 Terminals

South Passenger Transport Company operates from terminal (4ha) and Kim Ma Terminal (0.5ha). The company has decided to sell Kim Ma bus terminal. The North Passenger Transport Company operates from Gia Lam Terminal (2ha). Plans of the two bus terminals are set out in Figs. 4-3-1 and 4-3-2.

Unit: m

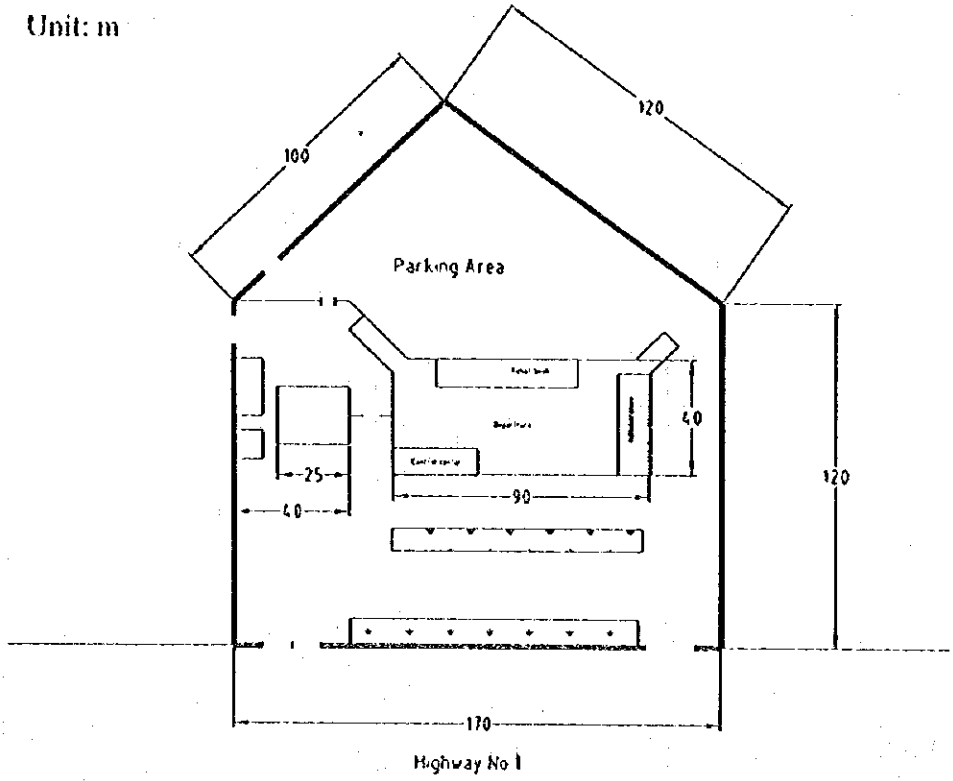


Fig. 4-3-1 Giap Bat Terminal

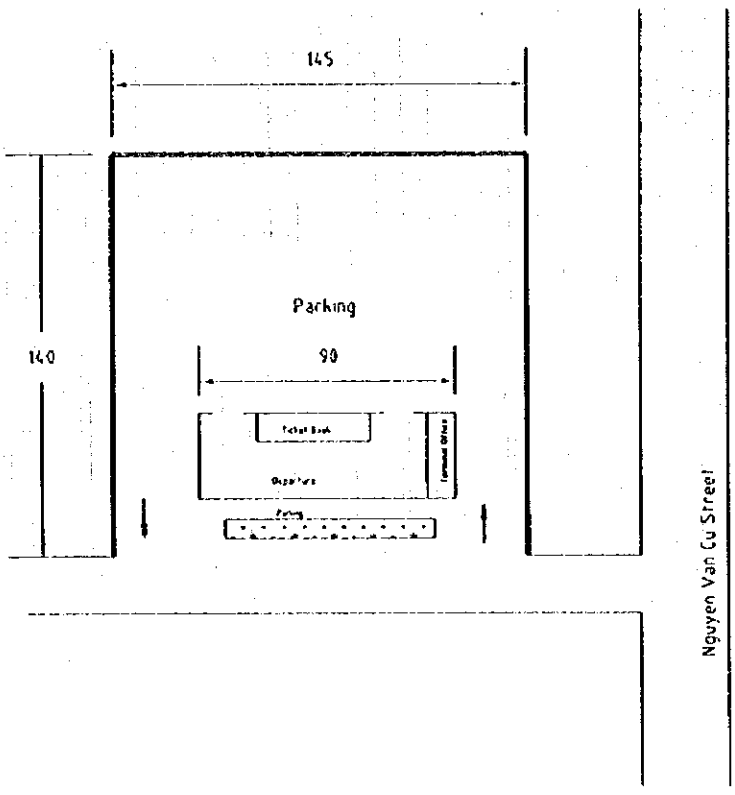


Fig. 4-3-2 Gia Lam Terminal

4.4 VNR Trains

The railway lines in the northern areas of the country intersect at Hanoi and are as follows:

1. Hanoi - Ho Chi Minh City	Length: 1,726 km
2. Hanoi - Hai Phong	102 km
3. Hanoi - Thai Nguyen	75 km
4. Hanoi - Lang Son	148 km
5. Hanoi - Lao Cai	283 km

The total length of the railway lines in Hanoi city is about 91km, mostly single track, of which 7 Km cross the urban area of the city with nine at grade crossings main streets. The following 11 stations serve the population in the total area of Hanoi City.

1. Trung Gia
2. Da Phuc
3. Dong Anh
4. Van Tri
5. Phu Dien
6. Yen Vien
7. Gia Lam
8. Long Bien
9. Hanoi
10. Giap Bat
11. Van Dien

Of these stations, Hanoi Station in central Hanoi, is the largest with an area of about 2.8 ha and a length of 800m. The layout of the station is shown on Fig. 4-4-1. At this station was the terminal for passenger trains prior to 1996. Now only night trains use this Station. Day trains from the south now terminate at Giap Bat while those from the north terminate at Gia Lam and Long Bien stations. There are two freight depots for Hanoi, one at Giap Bat 5km to the south and the other at Yen Vien 11km to the north.

The railway line through urban Hanoi is in a poor state. Over much of this length haphazard development has encroached on the right of way forcing slow operating speeds. In September 1996, VNR began a program to clear this obstruction. The long Bien Bridge over the Red River is in an extremely bad state of repair and its safety must be in doubt. These problems have been caused by temporary and unsatisfactory repairs after US bombing during the Vietnam War and insufficient maintenance. Speeds and train loading on the bridge are severely loaded

Table 4-4-1 Hanoi-Bound Railway Operation

Section	Pair of Freight Trains	Pair of Passenger Train	Total
Hanoi/Yen Bai/Lao Cai (Lao Cai Line)	3	6	9
Hanoi/Kep (Lang Son Line)	4	7	11
Hanoi/Bac Thai	1	2	3
Hanoi/Hai Phong	2	4	6
Hanoi/Thanh Hoa (Ho Chi Minh Line)	5	8	13

VNR operations are focused on long haul rather than commuter services. Since the government forbade train operation in daytime in Hanoi urban area, the railway no longer functions as commuter mode.

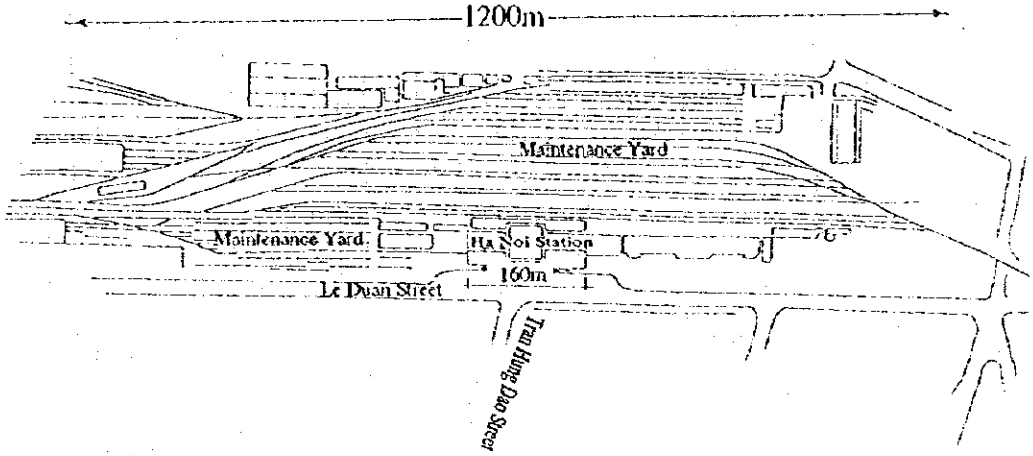


Fig. 4-4-1 Hanoi Station

4.5 River Transport

As the study area is characterized by the existence of many rivers and lakes, many small river harbors are found on both sides of the Red (Hong) River, Duong River and some other smaller rivers. These deal mainly with the transportation of bulk commodities from nearby provinces. There are four main harbors on the Red river in the Hanoi urban area three of which specialize in the transportation of coal, sand, gravel and other construction materials and the fourth one (Chuong Duong) serves the transportation of passengers only. The four main harbors are:

1. Nhat Tan
2. Chuong Duong
3. Hanoi Port (Pha Den)
4. Khuyen Luong

The lay out Hanoi Port is shown in Fig 4-5-1. During the months of the summer season from April to June, the low level of water in the rivers combined with large amounts of alluvium interrupts the navigation channels. During the flood season between July and August, on the other hand, the high level of water decreases the air draft under the existing bridges which also interrupts navigation. During the flood season, the water level in the Red river rises by up to 10 or 12m, while the ground level of Hanoi is only between 6.5 and 8.5m. The historic high flooding data of the Red river during the 1900's shows that the highest level of 14.13m occurred in August 1971 followed by the level of 13.90m in 1945. In the years between 1983 and 1986, the level was over 13.00m for three flooding seasons.

The general classification of the waterways at Hanoi city is by a the Vietnamese authorities based on the minimum depth of water as follows:

The Red River - South of Hanoi	Class I	more than 2.8m
The Red River - North of Hanoi	Class II	2.0 - 2.8m
The Duong River	Class III	1.5 - 2.0m

For the inland waterway transportation of passengers in Hanoi rivers, there are four main routes which are:

1. Hanoi - Viet Tri	Length:	75km
2. Hanoi - Hoa Binh		150km
3. Hanoi - Hai Phong		145km
4. Hanoi - Thai Binh		118km
Total Length		483km

As for the cargo river-transport routes in Hanoi, there are eight routes with a total length of 155 km administrated as follows:

State (MOT) Routes:	4 routes	length:	76 km
Hanoi City Routes:	4 routes	length:	79 km

The details of the boats operated on each of the routes are presented in Table 4-5-1. Most of the city-administrative boats are currently out of order.

Table 4-5-1 Waterways System in Hanoi

Route River	Length (km)	Annual Traffic by Boat Capacity					Out-of-Order
		<1t	1-10t	10-50t	50-100t	100-500t	
Hanoi City-Administrative Routes:							
Ca Lo River	32						
Nhue River	34		32				19
Ngu Luyen Khue River	4	15					4
Thiep River	6						6
State-Administrative Routes:							
Hong River	38					38	
Duong River	14					14	
Cau River	18				18		
Cong River	9			9			
Total	155	15	32	9	18	52	29

To upgrade and fully utilize the inland-waterway transport to meet the generated transport demand, the Red River Delta Master Plan (1995) recommended several development actions which are to be applied urgently. This includes the improvement of the navigation system by installing a computerized traffic control system, and the upgrading of the channel marking and the river ports. The fleet used at present requires modernization through the replacement of old tugs by shallow-draft powerful pushers and the development of tourist cruising facilities. An integrated transport system in the area, based on a management information system, for goods using more than one mode of transport, should be developed to increase the efficiency of the transport system in general.

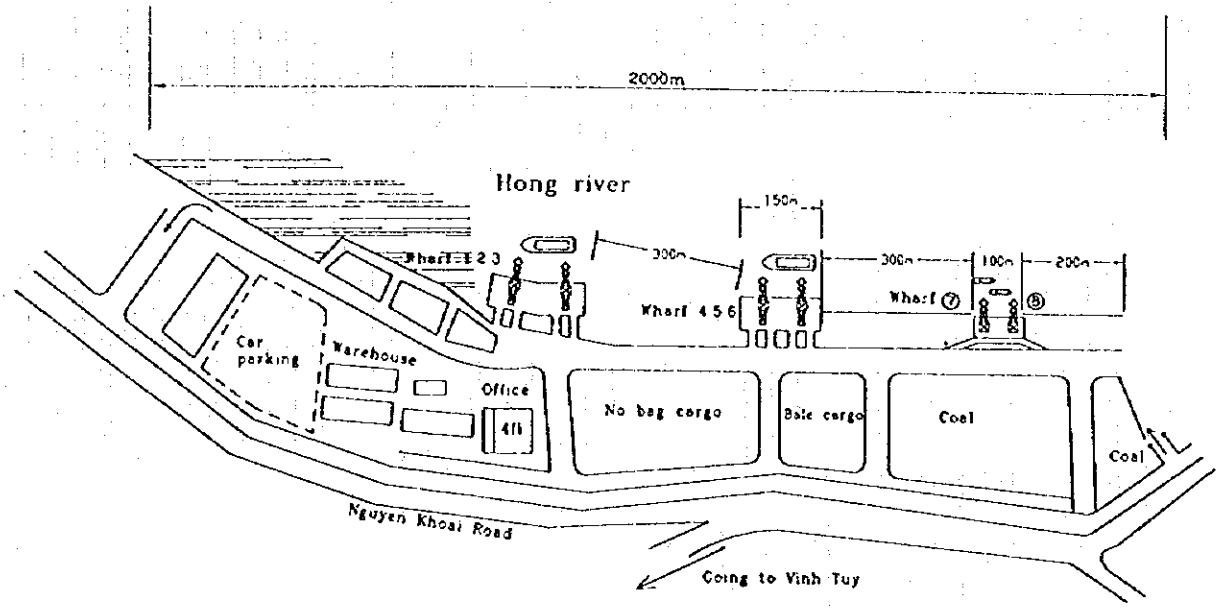


Fig. 4-5-1 Hanoi Port

4.6 Air Transport

In a total of 18 airports in Vietnam, Hanoi City has three airports. One of them is an international airport, the second is used for military and training purposes and for some unscheduled domestic flights, and the third is mostly out of operation. The Noi Bai airport which serves both the international and domestic flights to the capital Hanoi is located 45 Km to the north of the city center. The two other smaller airports are Gia Lam airport located to the east of urban Hanoi, and Bach Mai airport located to the south. Noi Bai international airport is expected to serve Hanoi as its international and domestic airport for the next 15 - 20 years. It has an area of 20 Km^2 and one main runway with the dimensions of 3,200m x 45m and another auxiliary runway of 1,000m x 23m. The terminal floor area is about 1,000 m^2 with a capacity of one million passengers annually.

Bases on the data from the Civil Aviation Administration of Vietnam (CAAV), the future air traffic forecast of the airport, as per the civil aviation master plan, is presented in Table 4-6-1

Table 4-6-1 Forecast Annual Air Traffic at Noi Bai International Airport

Year	Passenger (Passenger)			Cargo (Ton)		
	International	Domestic	Total	International	Domestic	Total
1995	538,895	921,546	1,460,441	6,600	15,600	22,200
2000	1,599,710	2,326,043	3,925,753	19,700	42,900	62,600
2005	2,482,088	3,985,348	6,467,436	43,600	73,100	116,700
2010	3,481,257	5,910,003	9,391,260	85,800	116,600	202,400
2015	4,981,000	7,234,000	12,215,000	150,800	171,600	322,400

The master plan conducted by CAAV to develop the Noi Bai international airport proposed the extension of the existing runway by 600m and the construction of a second runway of 3,200m x 45m south of the existing runway. Other major projects included in the plan are the construction of two connecting taxiways, new control tower, new aircraft maintenance hanger and new air terminal. Some of these projects are being implemented at present. The expansion of the airport, however, will require about 490 hectares of land acquisition which will result of the resettlement of more than 2,400 families.

CHAPTER 5 ENVIRONMENTAL CONDITION

5.1 Introduction

The environment is of special importance to the life of humans and other living creatures as well as to the economic, cultural and social development of the nation and mankind as a whole. In general, many developing countries formerly felt that environmental protection and development were incompatible and that to escape from poverty, their most pressing problem, priority had to be given to development, even at the cost of environmental destruction. Today, they address environmental problems, such as pollution in major cities, very seriously; the need to take account of environmental considerations in development projects is understood; and determined efforts are being made to tighten environmental laws and strengthen agencies charged with protecting the environment.

The items of Initial Environmental Examination (IEE), which have been chosen as a result of the report of the prior investigation are as shown below.

1) Socioeconomic environment
   a) Resettlement
   b) Economic activity
   c) Traffic and public facilities
   d) Split of communities
   e) Cultural property
   f) Water rights
   g) Waste
2) Natural environment
   a) Hydrological situation
   b) Landscape
3) Environmental pollution
   a) Air pollution(including field survey)
   b) Noise and vibration(including field survey)

5.2 Legislative System and Environment Standards

Vietnam attaches great importance to environmental protection, as a result of widespread forest destruction and human suffering caused by weapons such as defoliants during the Vietnamese war. Firstly environmental protection is mentioned as one of the assessed factors in the law of foreign capital; secondly there are legal regulations concerned with environmental protection, forest exploitation, mineral resources and petroleum, therefore environmental consideration has been specified in every field.

To cope with these problems, Vietnam enacted in December 1993, the Law on Environmental Protection, which lays down basic principles and a policy direction, and provides the basis upon which to implement a comprehensive environmental policy. The foreword of the Law on Environmental Protection is as follows; "In order to raise the effectiveness of state management and the responsibilities of the administration at all levels, of state agencies, economic and social organizations, units of the People's Armed Forces and all individuals with respect to environmental protection with a view to protecting the healthy environment and serving the cause of sustainable development of the country, thus contributing to the protection of regional and global environment;

Pursuant to Article 29 and Article 84 of the 1992 Constitution of the Socialist Republic of Vietnam; the "Law on Environmental Protection" provides for the protection of the environment."

5.2.1 Law/guidelines on environmental impact assessment

On account of the enactment of the Law on Environmental Protection, presentation of a report on Environment Impact Assessment (E.I.A) concerned with existing and new social activities is regulated as follows.

- Organizations and individuals when constructing, renovating production areas, population centers or economic, scientific, technical, health, cultural, social, security and defense facilities; owners of foreign investment or joint venture projects, and owners of other socioeconomic development projects, must submit E.I.A reports to the State Management Agency for Environmental Protection for appraisal.
- The result of the appraisal of E.I.A reports will continue to be one of the bases for competent authorities to approve the projects or authorize their implementation. The Government will stipulate in detail the formats for the preparation and appraisal of E.I.A reports and will issue specific regulations with regard to special security and defense establishments.
- The National Assembly will consider and make decisions on projects with major environmental impacts. A schedule of such types of projects will be determined by the Standing Committee of the National Assembly.
- On the other side, Organizations and individuals in charge of the management of economic activities which began operation prior to the promulgation of this law must submit an E.I.A report on their respective establishments for appraisal by the State Management Agency for Environmental Protection. Moreover, the utilization and exploitation of national gardens, natural preservation areas, areas of historical

and cultural values relics, and natural scenery must be permitted by the management body of the concerned branch.

(1) Organization of Environmental Administration

The Ministry of Science, Technology and Environment undertakes the integrated State management of environmental protection on a nation-wide scale and bears responsibility for the organization and direction of activities of environmental protection within its functions and duties. The Ministries, Ministerial ranking bodies and offices belonging to the Government, draft, manage and coordinate, according to their scope of responsibilities and in accordance with the provisions the Law on Environmental Protection. The People's Committees of provinces and cities under Central Government bear responsibilities for the implementation of state management on environmental protection. The provincial Departments of Science, Technology and Environment are responsible before the People's Committees of the provinces and cities under Central Government for the implementation of state management environmental protection in their localities.

(2) Projects Subject to the Environmental Impact Assessment

The work of appraising reports of assessment on environmental impact by ongoing projects and operating units is separated into two levels:

a. The Ministry of Science, Technology and Environment (MOSTE) appraise at the Central level. In certain cases, the Ministry of Science, Technology and Environment can empower a specialized branch to conduct the appraisal;
b. The local level is appraised by the provincial Departments of Science, Technology and Environment (DOSTE).

The classification of appraising power is recorded in Table 5-2-1

Table 5-2-1 Appraisal Decentralization of EIA-Report

Operating project and enterprises	MOSTE	DOSTE
Railway, Motor-way of grades 1,2,3	Over 50kms	Rest
Resettlement areas	Over 500 households	Rest
Hotel and business sectors	Large and medium scale	Small
total 41 items		

(3) Procedure for the Appraising of the Environmental Impact Assessment (EIA)

The investors, project managers or directors of the offices and enterprises have to conduct an assessment of environmental impact. The period of time for appraising a report of assessment of environmental impact can not be longer than 2 months from the date all related documents are received. For projects with the funds invested by a foreign organization, the period of time for appraisal must be the same as the period of time prescribed for issuing investment licenses.

The offices assigned with State management of environmental protection are responsible for the supervision of articles design and for conducting measures to protect the environment according to the suggestions of the Appraising Council. In addition, the State

offices are responsible for appraising reports of assessment on environmental impact. Where necessary, an Appraising Council will be set up. The composition of an Appraising Council includes scientists, managing officials, possibly the representatives of social organizations and ordinary people. The number of Council members cannot exceed 9. For instance, the procedure for the EIA is shown in Fig. 5-2-1.

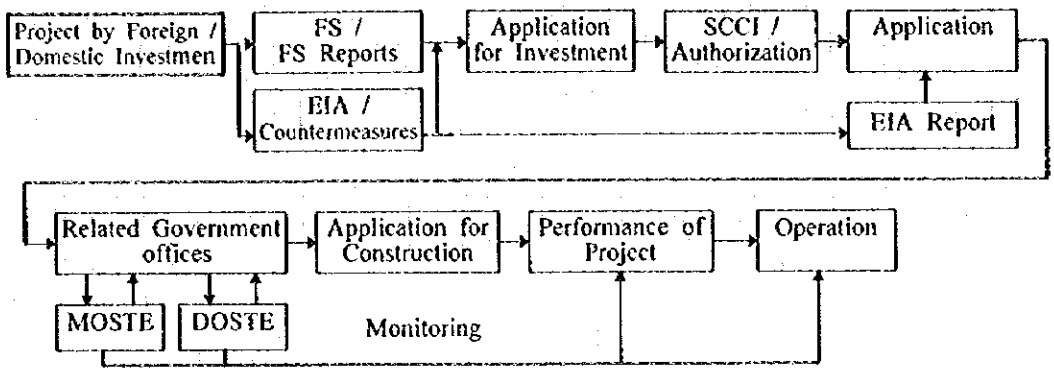


Fig. 5-2-1 Procedure for the Appraising of the EIA

(4) Penalties and Measures

In case of failure to meet the environmental standards, the organization or individuals concerned must take remedial measures within a given period of time as stipulated by the State Management Agency for Environmental Protection. Upon expiry of the stipulated time limit, if they still fail to meet the requirements of the State Management Agency for Environmental Protection, the latter will report to the higher State authority at the next level who will decide on the suspension of operation or other penalizing measures.

5.2.2 Environmental Standards

The items of the environmental standard in Vietnam are atmosphere, soil, water, noise and vibration. There were formally established in June of 1995. However, environmental standards in Vietnam are norms and permissible limits specified to serve as a basis for the management of the environment.

Environmental standards and items are as follows;

1) Air Quality

A. Ambient Air Quality Standard (TCVN 5937-1995)

Standard values of basic substances in ambient air are shown in Table 5-2-2. These are not stringent values compared with Japanese standards except for CO. The values for NO_2, SO_2 and SPM are almost double of the values for Japan.

Table 5-2-2 Ambient Air Quality Standard

Unit:mg/m^3

No.	Substance	Average 1h	Average 8h	Average 24h
1	CO	40	10	5 (4.3ppm)
2	NO_2	0.4	-	0.1 (0.05ppm)
3	SO_2	0.5	-	0.3 (0.11ppm)
4	Pb	-	-	0.005
5	O_3	0.2	-	0.06
6	SPM	0.3	-	0.2

Note: The sampling method and analysis to determine the parameter values was regulated in the corresponding TCVN(Vietnamese Standard)

CO: Carbon Monoxide, NO_2: Nitrogen Dioxide, SO_2: Sulfur Dioxide, Pb: Lead, O_3: Ozone, SPM: Suspended Particulate Matter

B. Emission Standard

All transportation modes operating on land, railway and water are not allowed to emit smoke, dust, oil and gas containing toxins exceeding the defined standards in to the surrounding environment. The Emission standard is shown in Table 5-2-3.

Table 5-2-3 Emission Standard for Vehicle

Unit: g/veh·km

Reference weight (RW)	A			B		
	CO	HC	Nox	CO	HC	NOx
RW<750	65	6.0	8.5			
750<RW<850	71	6.3	8.5	58		
850<RW<1020	76	6.5	8.5			
1020<RW<1250	87	7.1	10.2	67		20.5
1250<RW<1470	99	7.6	11.9	76		22
1470<RW<1700	110	8.1	12.3	84		23.5
1700<RW<1930	121	8.6	12.8	93		25
1930<RW<2150	132	9.1	13.2	101		26.5
2150<RW	143	9.6	13.6	110		28

Note: A; Gasoline vehicle B; Diesel vehicle
RW: Reference weight of empty vehicle -100kg
CO: Carbon monoxide, HC: Hydrocarbon, NOx: Oxide Nitrogen

Two wheel-vehicles have to obey emission standards as follows:

- Hydrocarbon(HC) less than 5g/veh·km
- Carbon Monoxide(CO) less than 12g/veh·km

The HC standard for two wheel vehicles is almost same as for small cars, while the CO standards is almost 1/6 of that foe small cars. In addition to the above standard, there are standards concerned with air quality as follows:

- Maximum allowable concentration of hazardous substances in ambient air (TCVN 5938-1995)
- Industrial emission standards-inorganic substances and dust (TCVN 5939-1995)
- Industrial emission standards-organic substances (TCVN 5940-1995)

2) Soil Quality

- Maximum allowable limits of pesticide residues in the soil (TCVN 5941-1995)

3) Water Quality

- Surface water quality standard (TCVN 5942-1995)

Standard values of basic substances in surface water are shown in Table 5-2-4. Beside the standard for surface water, there are related standards on water quality as follows;

- Coastal water quality standard (TCVN 5943-1995)
- Ground water quality standard (TCVN 5944-1995)
- Industrial wastewater discharged standard (TCVN 5945-1995)

Table 5-2-4 Surface water quality standard

Unit: mg

Substances	Classification	
	A	B
PH	5.5-8.5	5.5-9
BOD_5	<4	<25
COD	>10	>35
Dissolved Oxygen(DO)	≧6	≧2
Suspended Solid(SS)	20	80
Arsenic	0.05	0.1
Barium	1	4
Cadmium	0.01	0.02
Lead	0.05	0.1
Chrome(VI)	1.05	0.05
etc. total 31 substances		

Note: Column A is applied for surface water used as living water resource.
(but must be through regulated processing)
Column B is applied for surface water used for other purposes.
Water for agriculture and sea product breeding has its own regulation

4) Noise

- Noise Standard(TCVN 5949-1995)

The Vietnamese Standards are shown in Table 5-2-5. Values of noise in areas are not stringent, about 5-10dB higher than the Japanese Standard. According to the regulation, all vehicle owners have to ensure that the noise level and vibration do not surpass the stipulated levels. However, traffic noise is caused by the mass of vehicles. Therefore, to keep the noise level below the stipulated levels, road administrators need to apply countermeasures in road design, speed control, or vehicle type control. No practical effort has yet been made in Hanoi to do this.

Table 5-2-5 Noise Standard in areas

Unit: dBA

Areas	6 a.m. to 6 p.m.	6 p.m. to 10 p.m.	10 p.m. to 6 a.m.
Category I	55	50	45
Category II	65	60	50
Category III	70	65	55
Category IV	75	70	60
Category V	80	75	65

Note:

Category I : Areas that need quietness such as hospitals, kindergartens, schools, libraries, research institutes

Category II : Residential areas, hotels, offices

Category III : Business areas, surrounding areas 15 meters from the main traffic roads, markets, stations and bus stop.

Category IV: Handicraft and light industry manufacturing areas

Category V : Heavy industry manufacturing area where noise(background noise) in the area when the vehicle does not operate, is higher than the standard mentioned in the table above, the vehicle should not make the noise increase more than 5 dBA from the original noise level.

● Emission Standard

The Emission standard of noise and vibration is shown in Table 5-2-6.

Table 5-2-6 Noise Standard for Vehicle

Kind of Vehicle	Permitted noise	
	New vehicle	Old vehicle
2-wheel vehicle, engine under 125cc	79 (dBA)	92
2-wheel vehicle, engine over 125cc and 3-wheel motor vehicle	83	92
Tourist car under 12 seats	83	92
Light-lorry	84	92
Lorry and bus under 10,000cc	87	92
Lorry and bus over 10,000cc	89	92

5) Vibration

Acceleration of vibration of the whole body should not exceed the figures in Table 5-2-7.

Table 5-2-7 Permitted Vibration

Category	Permitted acceleration (m/s^2)		Permitted line acceleration (m/s^2)
	Vertical vibration	Horizontal vibration	
Category I	0.540 (95dB)	0.380	-
Category II	0.270 (89dB)	0.190	-
Category III	0.081 (78dB)	0.057	0.066
Category IV	0.054 (75dB)	0.038	0.045

Note: Category I : Vibration affects driver's seat in vehicles that often operate on bad roads.

Category II : Vibration affects driver's seat differently from Category I .

Category III: Vibration in industrial workshop, in surrounding areas,15 meters from the main traffic ways.

Category IV: Vibration in areas different from areas in Category III.

Vibration in each octave band is regulated as shown in Table 5-2-8.

Table 5-2-8 Vibration in each octave band

Octave band (Hz)	Permitted acceleration (m/s^2)		Permitted velocity (m/s)	
	Vertical vibration	Horizontal vibration	Vertical vibration	Horizontal vibration
1(0.7-1.4)	1.10	0.39	20×10^{-2}	6.3×10^{-2}
2(1.4-2.8)	0.79	0.42	7.1×10^{-2}	3.6×10^{-2}
4(2.8-5.6)	0.57	0.80	2.5×10^{-2}	3.2×10^{-2}
8(5.6-11.2)	0.60	1.62	1.3×10^{-2}	3.2×10^{-2}
16(11.2-22.4)	1.14	3.20	1.1×10^{-2}	3.2×10^{-2}
31.5(22.4-45)	2.26	6.38	1.1×10^{-2}	3.2×10^{-2}
63(45-90)	4.49	12.76	1.1×10^{-2}	3.2×10^{-2}

5.3 Environmental Condition in the Study Area

Hanoi City, which is the object area of this master plan, is located in a delta of Red River and is an ancient city which has been a capital since the 11th century. There are a large number of lakes which have poetic beauty and abundant historical architecture which was constructed in the French colonial era and before.

5.3.1 Socioeconomic Environment

(1) Resettlement

According to the current regulations, transfer of land to construct Urban Transportation Projects must be based on the following laws:

- Decree No.87/CP('94) of the Government stipulates the price table of kinds of land.
- Decree No.89/CP('94) of the Government provides for collecting the payment for land use and service fees by the Government.
- Decree No.90/CP('94) of the Government stipulates compensation for recovering land by the State for purposes of National defense and National and Public utility.

The certificate for transference of the right of land use which covers over 3 ha must be granted by the Prime Minister. The City People's Committee approve the transfer of the land use of less than 3 ha in area.

Hanoi People's Committee has stipulated the following:

- Decision No.2951/QD-UB('94) on Implementing of Decree No.87/CP of the Government stipulates the price table of kinds of land on Hanoi City.
- Decision No.3455/QD-UB('95) describes compensation for loss in cases where the State takes back the land to use for the national defense, for a security purposes, in the national interests and for public benefit in Hanoi City.

For the urban city land, the compensation is by replacing by new houses or money. In cases where the State cannot compensate by land replacement or the person whose land is recovered does not request, compensation is made by an estimated amount of the same kind. The Compensatory Council for Resettlement is presided over by the chairman of the People's Committee of each province or district, who has the responsibility to plan a compensation project for a particular case. Resettlement with compensation has been undertaken for the implementation of public projects in case of land acquisition. A problem is that resettlement causes the reduction of the income of the concerned inhabitants and the compensation is not enough for the construction of houses with the same standard as their former residences. In consequence most are forced to occupy residences of a lower standard.

The compensation for land is stipulated in regulations of the Vietnamese Government and the World Bank. In accordance with the Decision 2951/QDUB on the price escalation of land categories in Hanoi City, compensation for 1 m^2 of land is paid as shown in

Table 5-3-1.

Table 5-3-1(1) Price of land for agriculture and water surface for fishery

Unit USD/m2

Category	City and town's out-skirts Location	Application districts
1	1.40	Dich Vong, Co Nhue
2	1.12	Xuan Dinh, Xuan La, Phu Thuong, Dong Nagc
3	0.84	My Dinh, Thuy Phuong
4	0.63	None

Table 5-3-1(2) Price of housing land, constructed land
(not including area on the side of roads)

Unit USD/m2

Category	Housing Land: Con-struction Land	Housing Land: Construction Land	Application districts
1	2.73	1.91	Xuan Dinh, Xuan La, Phu Thuong, Dong Ngac
2	2.18	1.46	My Dinh, Thuy Phuong
3	1.73	1.18	None

Table 5-3-1(3) Price of housing land, constructed land
(not including land in the outskirts of city)

Unit USD/m2

Location (distance from street)	Catergory I		Catergory II		Catergory III	
	Housing Con -structed L	Other	Housing Con -structed L	Other	Housing Con -structed L	Other
Land with street frontage	76.36	60.91	52.73	42.73	29.10	22.73
From 2nd lot to 50m	48.18	38.18	32.73	25.46	19.10	14.55
From 50 to 100m	29.10	20.00	17.72	14.55	9.10	7.27
From 100 to 200m	14.55	10.91	9.10	7.27	4.55	3.64
Outside of 200m	None	None	None	None	None	None
within the district	Road No.32, No.69,South Thang Long Rd etc.		Xuan La - Xuan Dinh Road,Part of Road No.32		Part of Road No.69	

Table 5-3-1(4) Price of housing land, constructed land in the district for urban development

Unit USD/m2

Location (distance from street)	Sub-urban Community		Application districts
	Housing Land	Construction Land	
Land with street frontage	109.10	87.27	Dich Vong, Co Nhue, Xuan Dinh, Xuan La
From 2nd lot to 50m	76.36	60.91	
From 50 to 200m	52.73	41.82	
Over 200m	31.82	25.45	

Table 5-3-1(5) Compensation cost for own house (legal use)

Unit USD/m2

No.	Category	Compensation Cost
1	I Class Villas	107.27
2	II Class Villas	117.27
3	III Class Villas	136.36
4	IV Class Villas	187.82
5	I Grade Houses	87.27
6	II Grade Houses	77.27
7	III Grade Houses	60.00
8	IV Grade Houses	-
	First Class	39.55
	Second Class	47.73

Table 5-3-1(6) Compensation cost for removal of graves

Unit USD/m^2

No.	Grave Status	Compensation Cost
1	Unexhumed Earth Grave	54.55
2	Exhumed Earth Grave	36.36
3	Concrete Grave	72.72
4	Abandoned Grave	27.27

For instance, the procedures for the compensation are shown in Fig. 5-3-1.

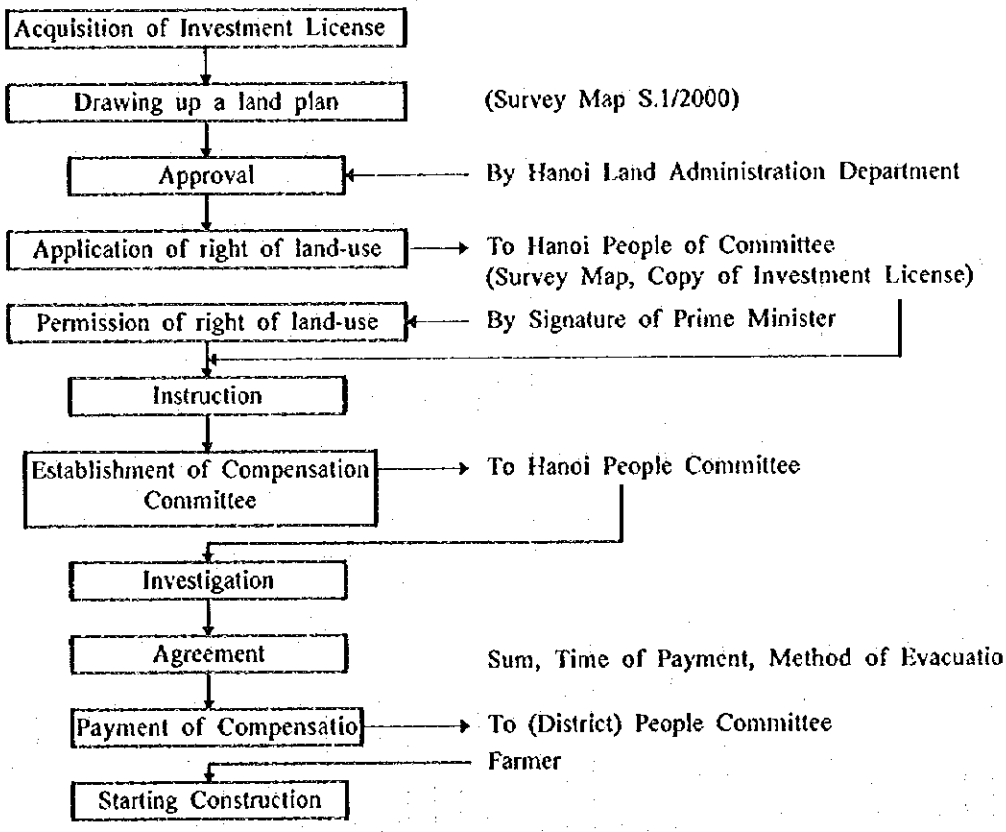


Fig. 5-3-1 Procedure for the compensation

(2) Economic Activity

After the long years of war and the period of economic difficulty, the Vietnamese Government has been pursuing the *doi moi* policy (economic renovation) since 1986. The *doi moi* policy allows the market economy in various sectors. The difference from the free market system is that market system is controlled by the State(Article 15 of the Constitution), and the State and the group enterprises play major roles in economic activities. The State does not allow private ownership of land and natural resources(Article 17 and 18), and the State promotes wise use of the environment and environmental protection(Article 29). The state gives the right of independent management to State enterprises and encourages joint ventures with foreign enterprise to introduce foreign technology and investment.

Currently the main industry of Vietnam is agriculture, where profits are smaller than those for other southeast Asian countries. In future, industrial growth caused by support

from advanced nations is expected, and the role of the Law on Environmental Protection will be very important in the prevention of environmental pollution from factories.

(3) Public Facilities

Public facilities such as institutions and hospitals are mainly concentrated in urban districts. However, parts of the universities are located in areas adjacent to the urban city and a university city is being developed in Ba Vi district as a project of the Nation. The locations of public facilities in Hanoi City are shown in Fig. 5-3-2.

(4) Communities

From 1979 to the end of 1991, Hanoi City consisted of the districts of Me Linh, Dan Phuong, Hoai Duc, Thach That, Phuc Tho, Ba Vi and Son Tay town. Most of Hanoi citizens are Kinh ethnic group, there were several small groups of the Muong ethnic group who have been settled in Ba Vi district for a long time. After 1991, the district was transferred to Vinh Phu and Ha Tay province, so now no ethnic group other than Kinh lives in Hanoi district at present.

(5) Cultural Property

Locations and distributions of the historical relics in Hanoi City are shown in Figure 5.3.3. These data have been collected from Ministry of Culture, Hanoi Science Institute, Institute of Archeology, Chief Architect Office and Hanoi Service of Culture. Areas where ancient relics have been discovered is abundance are shown in Table 5-3-2.

Table 5-3-2 Location of Historical Relies

District	Areas
Ba Dinh	Ngoc Ha village
Gia Lam	Trung Mau village
Dong Anh	Co Loa village, Dong Hoi village, Duc Tu village
Thanh Tri	Van Dien, Trieu Khuc village, Vinh Quynh village

(6) Solid Waste Collection and Disposal System

Hanoi City has a sanitation company in charge of solid waste disposal named "The Hanoi Environment Company(URENCO)", created by Hanoi people's Committee in 1960. URENCO deals with technical, financial, and administrative aspects for organizations concerned with solid waste management. The four enterprises under URENCO take the responsibility for waste collection activity. The collection is handled at night to collect waste at transfer points which is then taken by vehicles to landfill sites. The daily volume of domestic and street waste generated in Hanoi City is estimated about 3,000m^3. However the volume of domestic waste collected in Hanoi City is estimated about 1,293m^3/day and that of street waste is 522m^3/day. Therefore collected waste in Hanoi City is about 50% of the total waste.

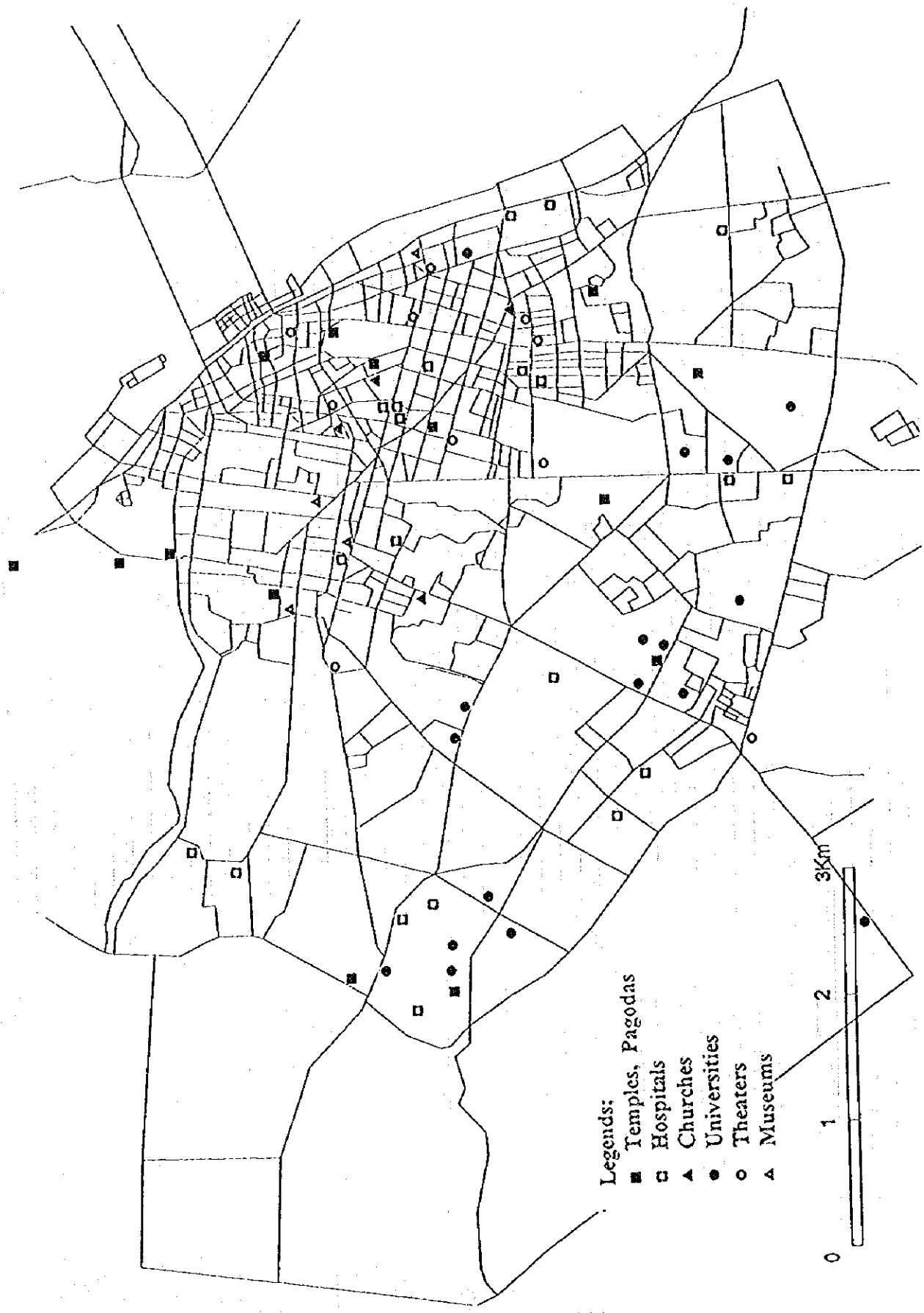


Fig. 5-3-2 Location of public facilities

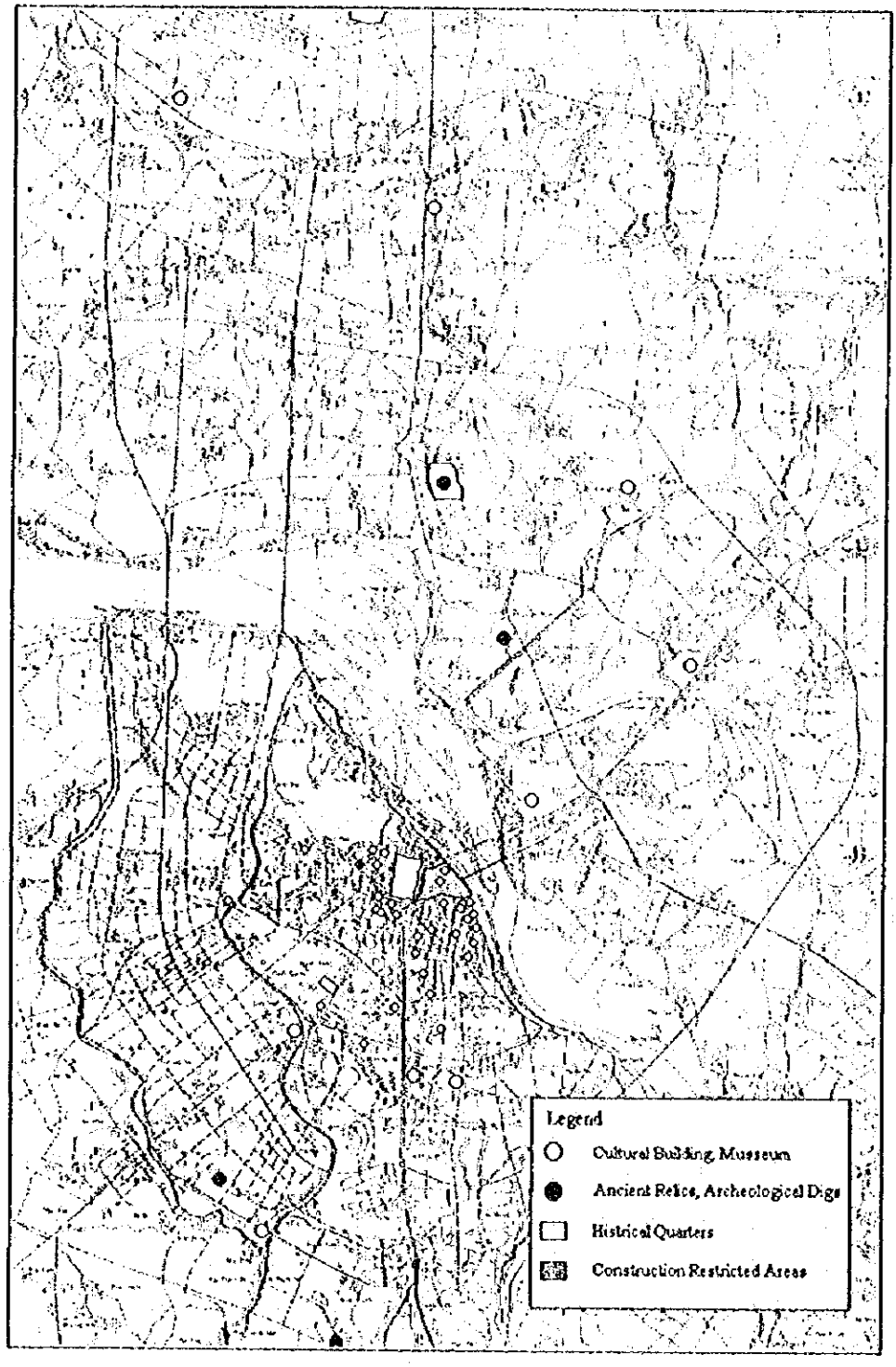


Fig. 5-3-3 Location of Ancient Relies

With regard to excrement, the company has a fleet of specialized vehicles with a capacity for collecting a maximum 120 tons/day, compared with the 180 tons produced daily. Much of the remaining amount is handled by farmers to use as fertilizer in the fields. Some of the remainder is dumped into lakes, rivers, canals and ponds without any control.

Most of collected refuse is now currently dumped in landfill sites at Me Tri which covers an area of 3.2ha. Since the landfill is surrounded by rice paddies and there is no control of the drainage water, it may cause pollution risks. There are several proposed landfill sites for the future such as Soc Son(50ha) which is planned to start in 1996. Tam Hiep (5ha) and Lam Du (23ha) are planned to be used until 2000.

5.3.2 Natural Environment

1) Topography and Geology

The topography of Vietnam is divided into the northern part, the central part and the southern part. Hanoi City which is located in the center of northern part and lies in the delta area which has been developed by the Red River. The altitude of the urban area is 6m to 9m in the northern part and 4m in the southern part. There are a lot of low lying areas which change to marsh during the rainy season, therefore they are underutilized areas.

Geologically Hanoi City lies on the alluvial plain of Red River's Delta. It consists of clay and silt in the upper 20m layer and sand in lower layers. The results of the soil survey by the Study Team are shown in Fig. 5-3-4.

The Red River Fault runs along the Red River in the vicinity of Hanoi City. According to the zoning map for earthquakes drawn up by the Institute of Geophysics, they anticipate that earthquakes with magnitude of a maximum 6.1-6.5 on the Richter Scale might occur in the future.

Hanoi City is located in the sub temperature monsoon latitude, therefore it has four seasons. The monsoon blows from northwest in winter and the wind blows from southeast in summer. It is warmer than 27° C and rainy from May to September. Table 5-3-3 shows the distribution of monthly average temperature, rainfall and wind velocity in Hanoi.

Table 5-3-3 Monthly average weather conditions in Hanoi

Month	1	2	3	4	5	6	7	8	9	10	11	12
Temperature (° C)	16.4	17.0	20.2	23.7	27.2	28.8	28.9	28.2	27.2	24.6	21.4	18.2
Rainfall (mm)	21	28	41	107	172	246	253	298	255	165	73	15
Wind velocity (m/s)	2.8	2.9	2.8	3.0	3.0	2.6	2.3	2.3	2.4	2.2	2.4	2.4

The rain intensity of Hanoi is shown in Table 5-3-4.

Table 5-3-4 Rain intensity of Hanoi

Repetitive cycles of year	1	2	5	10
Rain intensity (mm/hr)	54	64	75	84

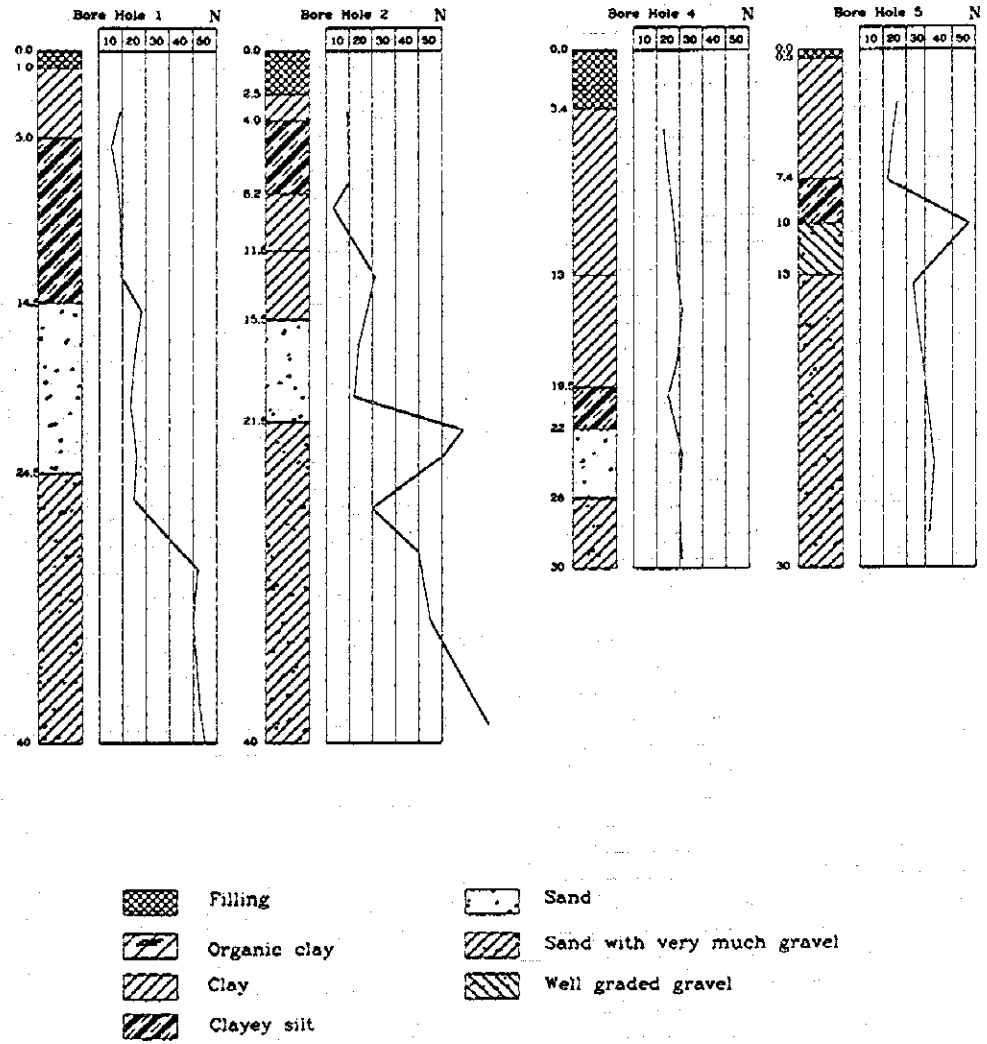
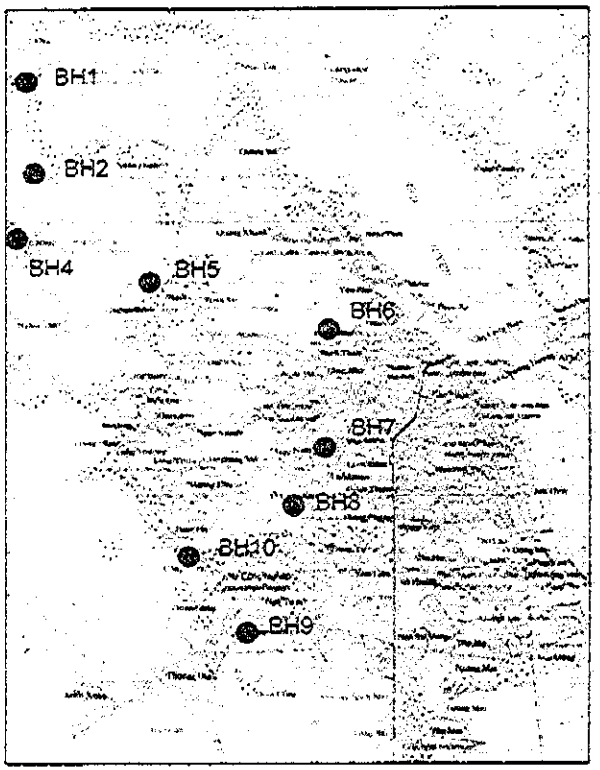
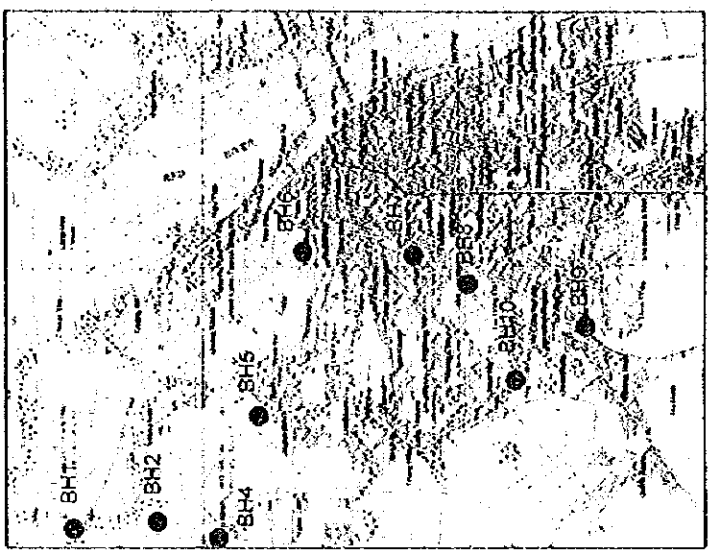


Fig. 5-3-4 (1) Geological Columnar Sections





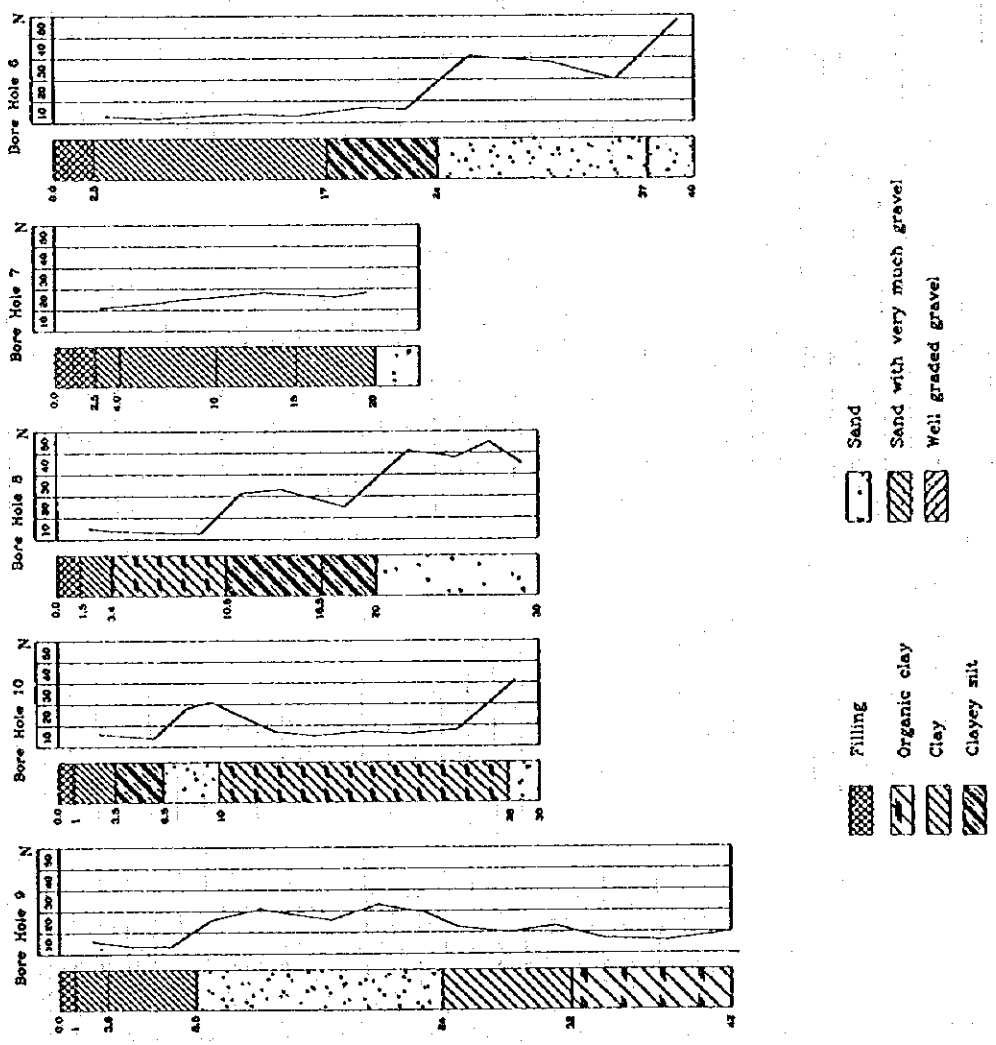


Fig. 5-3-4 (2) Geological Columnar Sections

2) Flooding

Natural disasters have occurred in the past, such as floods. In recent years, the climate and meteorology of Vietnam have changed and heavy rains and storms cause floods to in the streets in Hanoi City. In 1994, high rainfalls caused five heavy inundations of the Red River and Duong River systems and highest peak was recorded at 10.73m on 19th July. The storm also caused crop destruction. For example, in 1994, 15,533 ha of rice and vegetables were under water, and 2,918 ha of rice and 543 ha of vegetable were damaged by typhoons No.6 and No.7. The distribution of inundated areas in sub-urban is shown in Table 5-3-5. The distribution of inundated area within urban Hanoi is shown in Figure 5-3-5.

Table 5-3-5 Flooded Area in Sub-urban (1994)

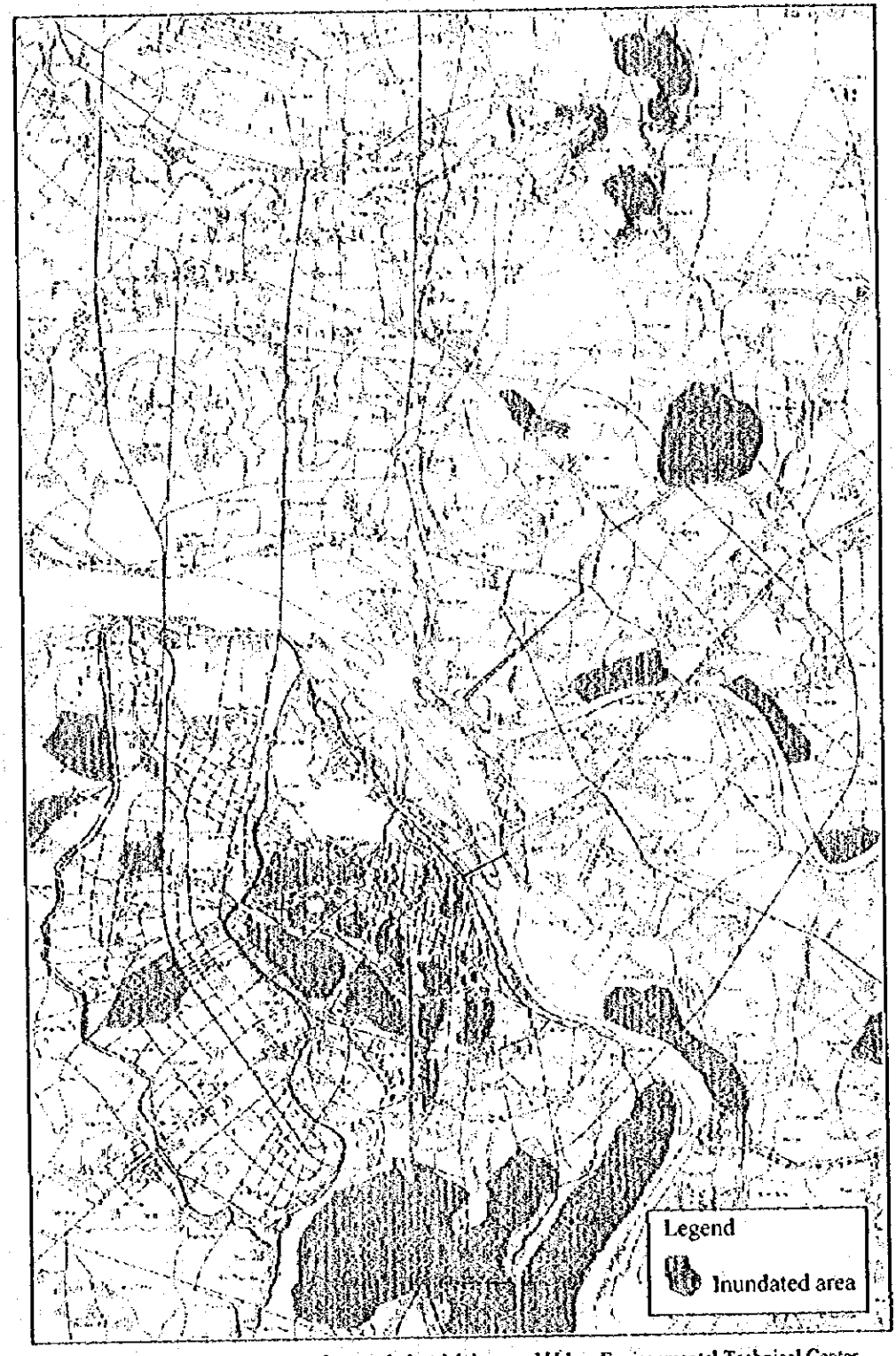
No	Districts	Flooded area (ha)	Flooded communities
1	Gia Lam	3,503	Trungmau, Phudong, Ninhhiep, Duongquang, Duongxa, Kimson, Dato, Chauqui, Dongdu, Cukhoi
2	Dong Anh	2,655	Kimchung, Kimlu, Donghoi, Vanha, Lienha, vietthung, Ductu Mailam
3	Thanh Tri	6,265	In whole area of district
4	Tu Liem	2,100	Conhue, Phudien, Maidich, Metri
5	Soc Son	1,010	Tanhuong, Bacphu, Kimlu, Xuangiang, Xuanphu, Vietlong

3) Rivers and Lakes

There are five rivers for drainage of wastewater within Hanoi City,

- The Red River: is the biggest which runs through Hanoi City. The flow of the river is considerable, varying from 350m^3/s to 22,000m^3/s. The mean water level is + 2.18m in dry season and +10.18m in rainy season. The Red River plays a very important role in irrigation and waterway transportation. SS is 140-1730mg/l, BOD is 0.2-3.6mg/l(Ha Noi) ,0.4-4.3mg/l(Son Ta), DO is 4.2-7.4mg/l, pH is 6.5-7.8.
- The To Lich River: is the longest of the drainage channels for Hanoi and receives all the discharged water from Hanoi City in the dry season. At present, the government is striving to transform and clean this stream. SS is 60-350mg/l, BOD_5 is 4-120mg/l, DO is 0.5-7.9mg/l
- The Kim Nguu River: receives a large volume of wastewater and has the highest of the degree of water pollution. SS(suspended solids) is 150-220mg/l, BOD_5 (Biochemical Oxygen Demand) is 50-140mg/l, DO(Dissolved Oxygen) is 0.5-1mg/l, pH(Hydrogen Ion Concentration) is 6.8-7.2. The largest industrial regions which are Vinh Tuy and Van Dien discharge wastewater into the Kim Nguu River.
- The Lu River: SS is 150-180mg/l, BOD_5 is 60-120mg/l, DO is 0.5-1.5mg/l
- The Set River: SS is 150-200mg/l, BOD_5 is 110-180mg/l, DO is 0.2-0.5mg/l

Hanoi has 20 lakes whose total area is 592 ha. These lakes have landscape, living, cultural, entertainment and climate-regulating functions. They also have rainwater-regulating, receiving and discharged water-treating and fish nursing functions. The difference in water levels in the lakes between the dry and wet seasons is generally 0.5-1m, but sometimes 1.5m. Therefore the rainwater regulating ability is relatively large.



Source: Industrial Area and Urban Environmental Technical Center

Fig. 5-3-5 Distribution of Inundated Area

The average depth of the lakes in Hanoi City is 2-3m. In general, the self cleaning ability of lake system is high. However, some lakes have been polluted seriously due to a large amount of discharged untreated water which drains into them. The high water level of the lakes is rising gradually because of silt accumulation which reaches a depth of 0.5-1m. Typical lakes are Giam, Van Chuong, Linh Quang, Bay Mau, Ba Mau.

- Giam, Linh Quang, Van Chuong, Thien Quang, Ngo Khanh, Truc Bach: These lakes are located up-stream of the drainage system. BOD_5 is 15-20mg/l, DO is less 5mg/l.
- Giang Vo, Thanh Cong, Bay Mau, Thanh Nhan etc.: These lakes are in a heavily polluted situation. BOD_5 is 10-15mg/l, DO is 5-7mg/l.
- Hoan Kiem, Thu Le, Dong Da : These lakes have a large storage capacity and little wastewater is discharged into them, therefore the water quality in these lakes is good.
- West (Tay): West lake has a large surface area(446ha). Little wastewater discharges into the lake, therefore the water quality is good. BOD_5 is 5.5-10mg, DO is over 6mg/l. However, the water quality at the lakeside deteriorates in due to inflow from Truc Bach lake which is heavily contaminated.

(2) Landscape

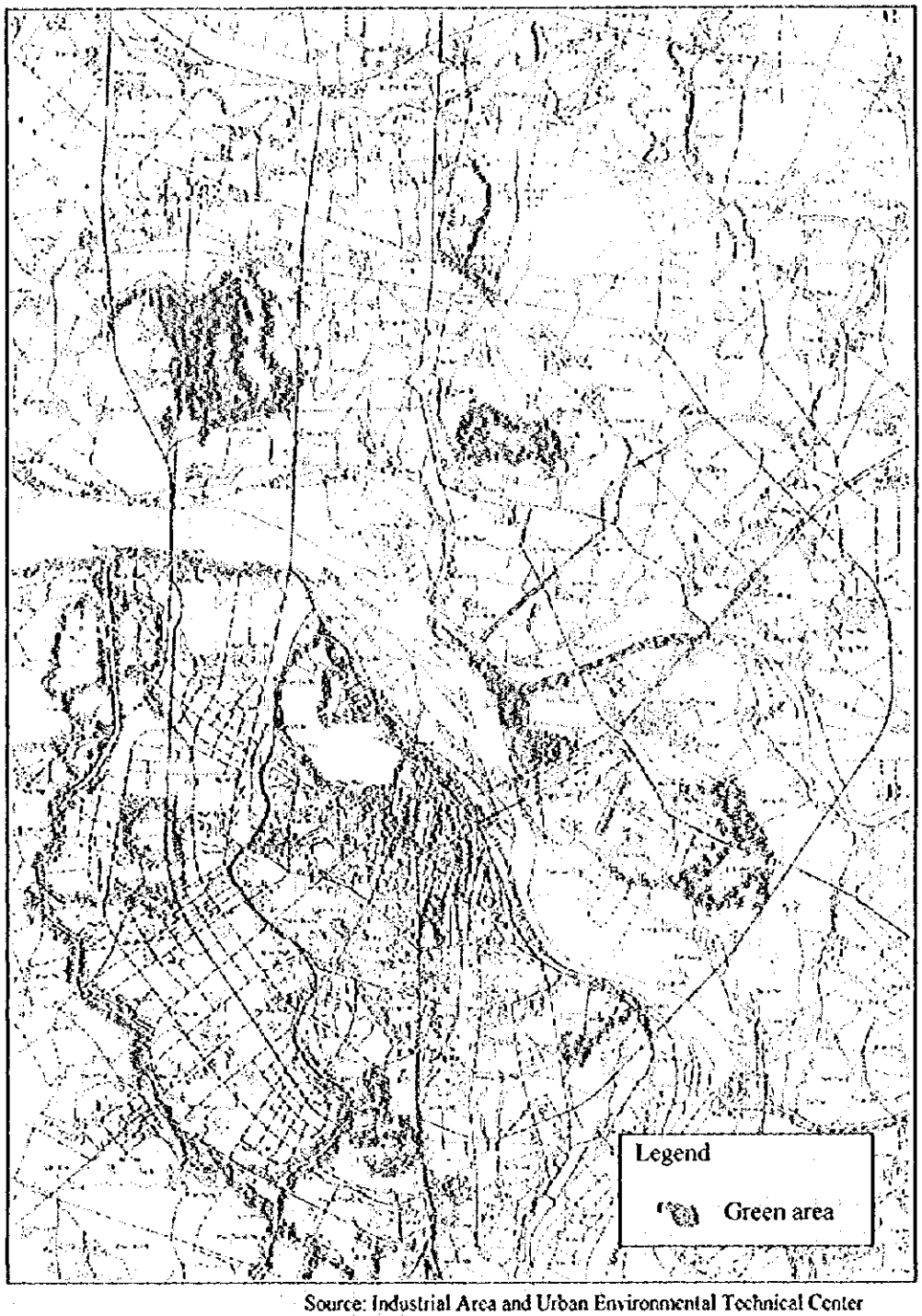
It is important to recover and protect areas with a precious landscape in Hanoi City. In Hanoi City there are several beautiful lakes surrounded by green trees and old buddhist temples such as Tay, Hoan Kiem and Bay Mau. These places provide recreation and relaxation for the citizens and are also tourist attractions. In addition the embassies quarter contains the Ho Chi Minh mausoleum, the Ho Chi Minh museum and the one-pillar pagoda, which are located in large streets with green trees and beautiful big villas of various appearances.

1) Natural landscape

Hanoi City lies in the northern part of Vietnam. The vegetation in Hanoi City belongs to the half-evergreen and lowland in type. At present, Hanoi has more than 150,000 trees including 20,000 aged trees planted in parks, public gardens or along streets. Specific kinds of trees can be found in different streets in Hanoi City. Roadside trees in Hanoi City include a large number of high evergreens such as Tamarind, Flamboyant and Mother-of -pearl. The distribution of green areas in the urban area and over the surrounding areas are shown in Fig. 5-3-6.

Conserved natural sites within Hanoi City and Sub-urban areas such as follows:

- Cau Dien Nurseries are located along the National Road No.32. They cover the cultivated area of 160,000m^2 for saplings and 600,000m^2 for flower trees.
- Soc Son Forest is located in Soc Son district with the area of 12,000,000m^2. This area belongs to the Hanoi Agricultural and Forest Office. Forest Management Department functions under Hanoi Agricultural and Forest Office.
- Co Loa and Den Sai are located in Dong Anh district with a forest of 850,000m^2.



Source: Industrial Area and Urban Environmental Technical Center

Fig. 5-3-6 Distribution of Green Area

- Hanoi Zoo, Bach Thao Garden : Management of parks, flower garden and green tree systems along the streets are undertaken by the Hanoi Zoo and Park and Tree Company which is under the control of Hanoi TUPWS.

2) Historical and Cultural landscape

The areas where construction of large projects may be restricted are to protect the historical and cultural landscape are as follows;

- Ba Dinh district: Ba Dinh square quarter and surrounding area
- Hanoi ancient street quarter: Limitation banded by Hang Dau Street, Phung Hung Street, Hang Bong-Hang Gai-Cau Go Street, Tran Quang Khai-Tran Nhat Duat Street
- Thang Long Rampart quarter

5.3.3 Environmental Pollution

Over recent years, there has been a sharp rise in the number of people and industries concentrated in Hanoi City, as well as a dramatic increase in the use of motorcycles. As a result steady environmental deterioration has occurred in the urban city.

(1) Present Air Quality

1) Factories

The atmosphere of many zones of Hanoi City has been polluted to a serious extent by toxic gases and by smoke dust. Based only on the influence of 110 industrial plants, enterprises with chimneys discharging gas and smoke dust, the atmosphere in 4 districts of the city proper has been polluted to the levels summarized in Table 5-3-6.

Table 5-3-6 Air pollution in Hanoi City proper

Locality	Density of the principal pollutants in the air			
	Dispersed dust	SO_2	CO_2	CO
Dong Da district. The most polluted area is Thuong Dinh industrial zone, Khuong Dinh, Thanh Xuan Bac, Thanh Xuan Nam, Nhan Chinh, Nguyen Trai quarters.	0.3-1 mg/m^3, a multiple 2-6 of the allowed level	0.15-0.3 mg/m^3, a multiple 3-6 of the allowed level	6-10 mg/m^3, a multiple 3-5 of the allowed level	2-5 mg/m^3, a multiple 1-2.5 of the allowed level
Hai Ba Trung district. The South-Eastern area of the district has the most air pollution, especially in such quarters as O Cau Den, Bach Khoa (near to Ba Nhat Enterprise) and the quarters located around the Wine Plant, Dong Xuan Textile Factory, 8-3 Textile Plant, Mai Dong Mechanical-Engineering Plant.	0.3-1 mg/m^3, a multiple 2-6 of the allowed level	0.15-0.5 mg/m^3, a multiple 3-10 of the allowed level	6-10 mg/m^3, a multiple 3-5 of he allowed level	5-10 mg/m^3, a multiple 0.5-2 of the allowed level
Ba Dinh district. is polluted by SO_2 in quarters near to the Hanoi Beer Factory, the Truc Bach Paper Factory and the Thuy Khue Leather Tennery. The level of other pollutants is approximately at the allowed level	0.15 mg/m^3, not polluted	0.5-0.15 mg/m^3, a multiple 1-3 of the allowed level	2 mg/m^3, not polluted	1 mg/m^3, not polluted
the Hoan Kiem district	not polluted			

2) Transportation

Transport is a great cause of atmospheric pollution in Hanoi. There are few cases where air pollution has been investigated where motorcycles are as dominant as they are in Hanoi City. In consequence the Study Team undertake a study of air pollution. The objective of the study was to investigate and analyze air pollution in Hanoi City, and based on this to appraise the effect caused by transportation. The air quality impacts from the transportation were compared by monitoring at all two stations at the same time; one in the most heavy traffic area in the urban city; the other is a background area in the suburbs, where no effect by traffic or factory pollution is expected. Monitoring locations of air quality are indicated in Fig. 5-3-7. The Pollution Station(PLS) was at roadside of Cau Nam Street and the Back Ground Station(BGS) was at Phu Thuong Commune in Tu Liem District. Ambient air quality was monitored from 5 January to 12 January 1996. The monitoring duration for each station was one week, from Monday to Sunday.

The Monitored substances were Carbon Monoxide(CO), Nitrogen Dioxide(NO_2), Sulfur Dioxide(SO_2) and Suspended Particulate Matter(SPM). Hourly meteorological data, including temperature, humidity, atmosphere pressure, wind speed and wind direction were measured at each station for the monitoring period. The monitoring results are summarized in Tables 5-3-7.

Table 5-3-7(1) Air monitoring results - 24-hours mean values

Date	Pollutant concentration(mg/m³)							
	CO		SO_2		NO_2		SPM	
	PLS	BGS	PLS	BGS	PLS	BGS	PLS	BGS
Monday 8th	1.99	0.93	0.105	0.027	0.013	0.002	0.443	0.090
Tuesday 9th	1.49	0.89	0.100	0.015	0.034	0.017	0.477	0.090
Wednesday 10th	3.59	1.16	0.096	0.056	0.039	0.025	0.526	0.095
Thursday 11th	2.67	1.01	0.089	0.062	0.058	0.062	0.580	0.058
Friday 5th	1.44	0.68	0.062	0.026	0.062	0.015	0.538	0.058
Saturday 6th	1.52	0.74	0.017	0.010	0.023	0.015	0.592	0.093
Sunday 7th	1.11	0.84	0.059	0.024	0.005	0.001	0.496	0.098
permission value	5.0		0.30		0.10		0.20	

B; PLS: Pollution station ,BGS: Background station

Table 5-3-7(2) Air monitoring results - one-hours mean values

Date	Pollutant concentration(mg/m³)							
	CO		SO_2		NO_2		SPM	
	PLS	BGS	PLS	BGS	PLS	BGS	PLS	BGS
Monday 8th	2.96	1.74	0.174	0.042	0.036	0.023	0.995	0.115
Tuesday 9th	3.96	1.49	0.165	0.030	0.049	0.029	0.852	0.136
Wednesday 10th	5.25	1.93	0.153	0.072	0.087	0.038	0.993	0.150
Thursday 11th	3.55	1.16	0.108	0.096	0.078	0.032	0.934	0.113
Friday 5th	2.87	0.90	0.108	0.039	0.095	0.048	0.852	0.176
Saturday 6th	3.53	1.69	0.042	0.026	0.055	0.024	0.915	0.156
Sunday 7th	1.92	1.02	0.126	0.048	0.015	0.009	0.976	0.160
permission value	40.0		0.50		0.40		0.30	

B; PLS: Pollution station ,BGS: Background station

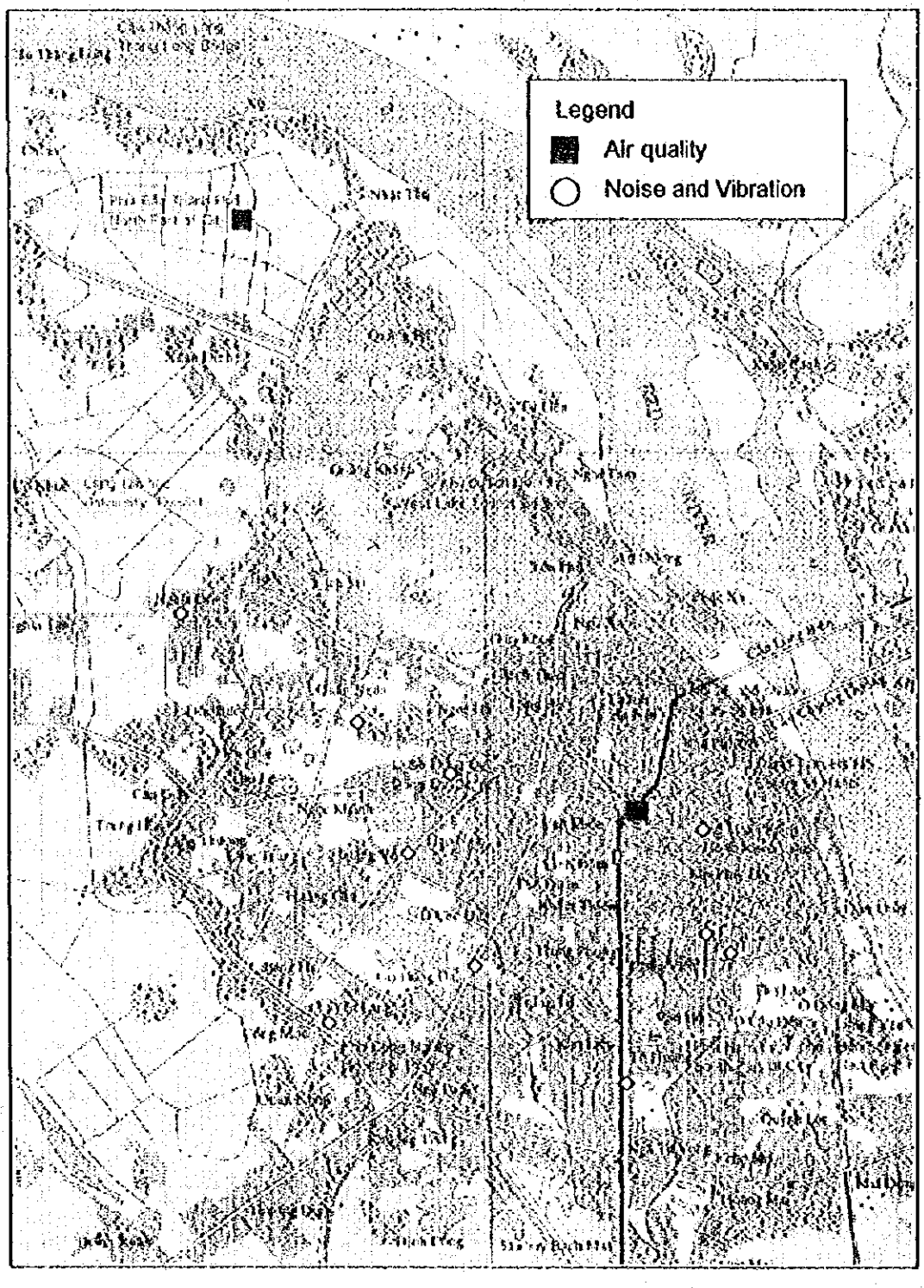


Fig. 5-3-7 Location for monitoring of air quality, noise and vibration

CO, NO_2 and SO_2 concentrations were very low compared with the Vietnamese Standard. Fig. 5-3-8 (1), (2), (3) show hourly concentration changes over a week. The hourly change of concentration over a week at the roadside does not correlate with the change in traffic volume, which may be due to factors other than vehicle emissions. SPM concentrations at the roadside were about three times as high as the Vietnamese Standard. Figure 5.3.8(4) shows the hourly concentration change over one week. The change of concentration at the roadside tended to be high in the daytime, which may be due to not only the traffic but also other urban activities.

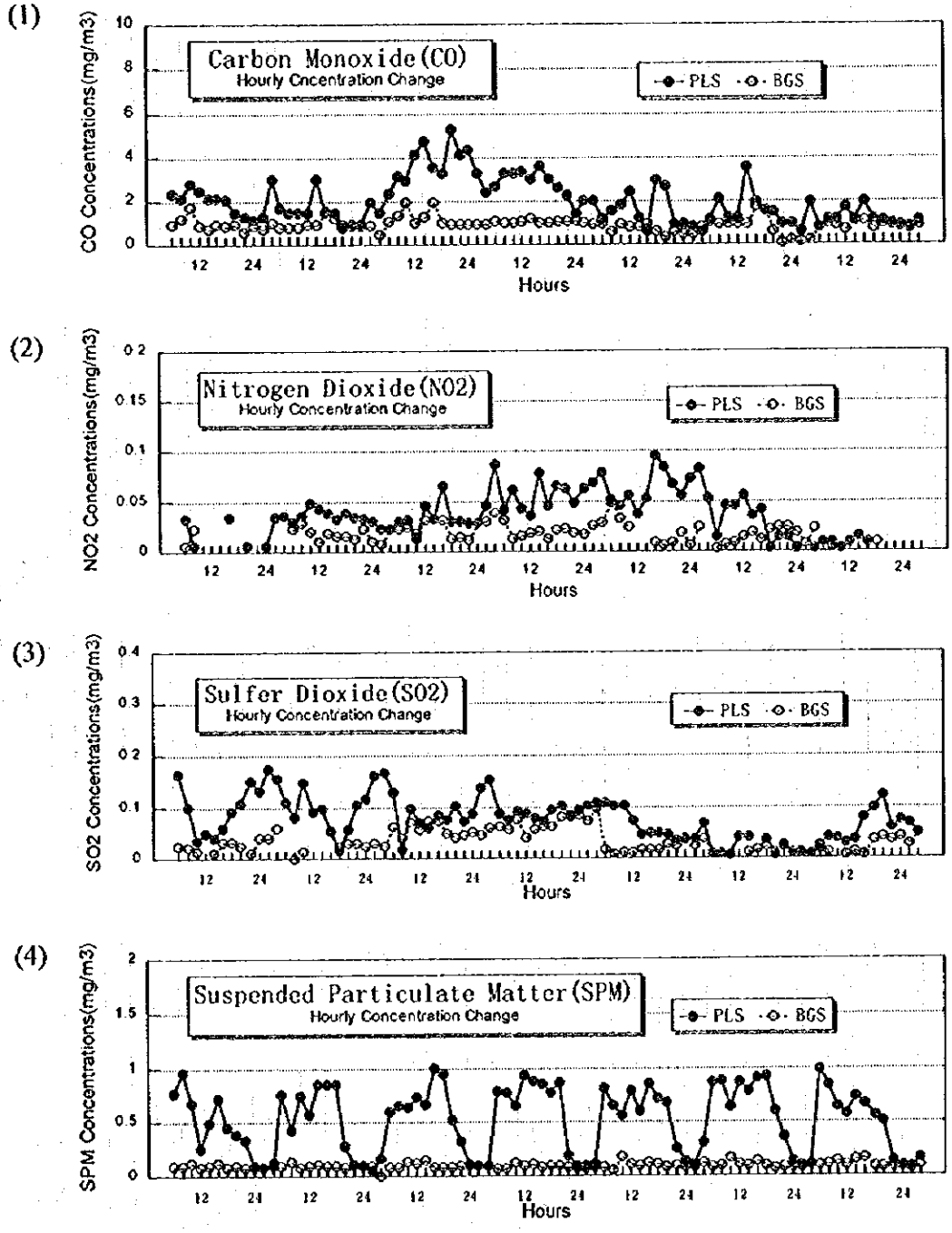


Fig. 5-3-8 Hourly Concentration Change

In general the concentrations of each substance at the roadside is higher than the background level, but there is no evidence to suggest that vehicles such as motorcycles caused the effect directly. However, the air pollution should be investigated continuously, since the air pollution needs to be regulated and controlled in view of the traffic volume and the consequent increase in exhaust gas emitted from vehicles.

Meteorological data during the survey period is shown in Table 5-3-8. The wind direction was from North-East to South-East at both stations, as shown in Fig. 5-3-9. Average humidity at PLS varied from 74% to 91% and that at Phu Thuong varied from 74% to 91%.

Table 5-3-8 Survey results of meteorological data

Locations	Times	Wind Speed(m/s)		Temperature(°C)		Humidity(%)	
		Max.	Average	Max.	Average	Max.	Average
Cua Nam (Pollution)	Man 8th	2.41	1.11	24.9	20.7	92.5	74.0
	Tue 9th	1.97	1.28	19.6	16.9	89.7	73.1
	Wed 10th	1.48	0.78	21.9	17.5	95.7	78.4
	Thu 11th	1.47	0.99	21.9	19.4	99.9	91.0
	Fri 5th	2.03	1.10	23.0	19.5	94.9	78.2
	Sat 6th	1.96	0.94	22.4	20.0	89.9	83.7
	Sun 7th	1.76	0.90	23.4	20.2	99.9	83.8
Phu Thuong (Background)	Man 8th	2.65	1.34	24.2	20.0	92.5	76.0
	Tue 9th	2.63	1.78	18.2	16.4	87.7	74.2
	Wed 10th	2.08	1.09	18.8	16.3	95.0	80.6
	Thu 11th	2.15	1.11	21.0	17.0	99.9	90.6
	Fri 5th	2.50	1.31	22.7	18.7	9.99	85.7
	Sat 6th	2.05	1.00	22.0	19.0	99.9	86.8
	Sun 7th	2.05	1.05	22.8	19.3	99.9	88.5

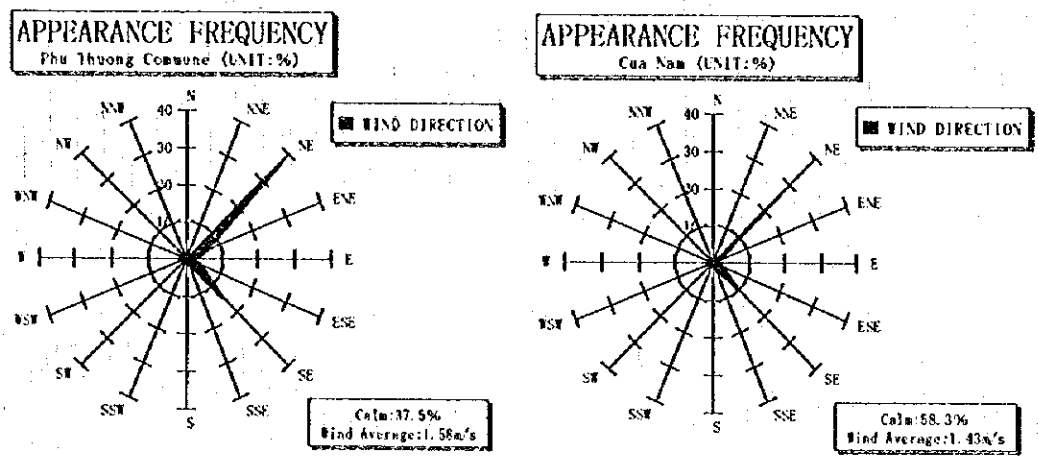
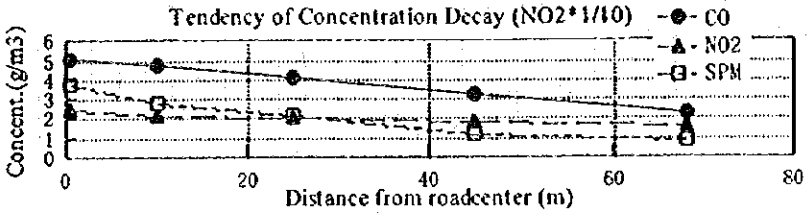


Fig. 5-3-9 Wind Direction during the survey period

Concerning concentrations of air pollutants emitted by road traffic vehicles, these tendency of distance decay using data announced officially are shown in Figure 5.3.10. These data were obtained at National road No.6 through Dinh District. Although the total concentration is added diffusion one to background one, it will reduce according to distance.



Source: Hydrometeorogical service of Vietnam

Fig. 5-3-10 Tendency of Concentration Decay

(2) Present Conditions of Noise and Vibration

Noise and vibration are major factors in traffic pollution in Hanoi. There are few cases where investigation of noise and vibration have been surveyed in urban transport conditions, where motorcycles are the majority of traffic such as in Hanoi City. In consequence the Study Team investigated the actual level of noise and vibration pollution in Hanoi City.

The objective of the study was to investigate and analyze noise and vibration in Hanoi City to appraise the effect caused by transportation. The degree of influence on noise and vibration caused by constantly running vehicles was examined to measuring noise and vibration levels. The traffic volumes classified by vehicle type, were counted at the same time as noise measurements were taken.

The 10 monitoring locations were selected as follows and they are shown in Fig. 5-3-7. Noise levels and Vibration levels were surveyed two times in each 10 minutes within each of the four hour periods as follows:

Table 5-3-9 Monitoring locations

Station	Name of Road	Direction	Lane	Width
1	Hue Street	One direction	2 lanes	7-8m
2	Ba Trieu Street	One direction	2 lanes	7-8m
3	Trang Thi Street	One direction	2 lanes	7-8m
4	Giai Phong Road	Two directions	4 lanes	28m
5	Giang Vo Road	Two directions	4 lanes	14-16m
6	Kim Ma Street	Two directions	2 lanes	7m
7	Doi Can Street	Two directions	2 lanes	7m
8	Nghia Do Street	Two directions	4 lanes	14m
9	Nguyen Luong Bang Street	Two directions	2 lanes	7-8m
10	Lang Road	Two directions	2 lanes	7-8m

(1) morning: (7:00-7:10,7:30-7:40,8:00-8:10,8:30-8:40)

(2) midday: (11:00-11:10,11:30-11:40,12:00-12:10,12:30-12:40)

(3) evening: (1600-16:10,16:30-16:40,17:00-17:10,17:30-17:40)

(4) mid night: (22:00-22:10,22:30-22:40,23:00-23:10,23:30-23:40)

Measuring locations of noise and vibration were 2-3m from the edge of the road. The microphone was set 1.2m above the ground. The traffic was classified into motorcycles, cars, light trucks and heavy trucks. Regarding the method of evaluation, Leq and L_{50} were used for noise levels, while L_{10} was used for vibration levels. The results of noise monitoring, vibration monitoring and traffic volume courts are summarized in Table 5-

3-10, Table 5-3-11 and Table 5-3-12 respectively.

Table 5-3-10 Mean values of Noise Level(dBA)

Time / Streets/Roads	7:00-9:00		11:00-13:00		16:00-18:00		22:00-24:00	
	Leq	L_{50}	Leq	L_{50}	Leq	L_{50}	Leq	L_{50}
a. Hue	75	72	77	73	78	74	71	67
b. Ba Trieu	73	69	75	70	75	72	67	63
c. Trang Thi	73	68	74	70	76	72	68	61
d. Giai Phong	79	77	76	73	77	75	72	66
e. Giang Vo	75	73	75	73	76	73	69	65
f. Kim Ma	78	74	79	75	79	74	69	64
g. Doi Can	78	72	75	70	74	71	70	61
h. Nghia Do	78	73	78	71	79	74	68	59
i. Nguyen Luong Bang	79	76	79	74	80	77	73	68
j. Lang Ha	77	72	77	72	79	73	72	65

Noise Levels at each measuring point were very high, Leq was in the range 73dBA to 80dBA, L_{50} was in the range 68 to 77dBA from 7:00 to 18:00. These values are 4 - 10dBA over than the Vietnamese Noise Standard. Noise Levels from 22:00 to 24:00 were as follows; Leq was in the range 67 to 73dBA, L_{50} was in the range 59 to 68dBA. These values are 4 - 13dBA over than the Noise Standard. Noise at night is still high at the roadside, indicating the influence of truck activity. There is a large difference between Leq and L_{50} at some points such as Doi Can and Nghia Do due to small traffic volumes. The Distribution of the maximum noise level in a day is shown in Fig. 5-3-10.

Table 5-3-11 Mean values of Vibration Level: L_{10}(dB)

Time / Streets/Roads	7:00-9:00	11:00-13:00	16:00-18:00	22:00-24:00
a. Hue	51	51	45	36
b. Ba Trieu	51	52	49	48
c. Trang Thi	47	45	46	45
d. Giai Phong	47	55	51	47
e. Giang Vo	51	54	51	51
f. Kim Ma	47	49	47	49
g. Doi Can	51	50	46	50
h. Nghia Do	47	50	49	45
i. Nguyen Luong Bang	47	51	51	51
j. Lang Ha	50	52	50	50

Vibration Levels L_{10} at each measuring point were not high, and were in the range 36dB to 55dB. The permitted Vibration Value in Vietnam is estimated by an the amplitude of acceleration, however, these monitoring values are sufficient for the standard. Since the vibration will be influenced by the uneven surfaces of the roads, the worst impact will be caused by heavy trucks activities on roads with bad surface conditions where high speeds are possible.

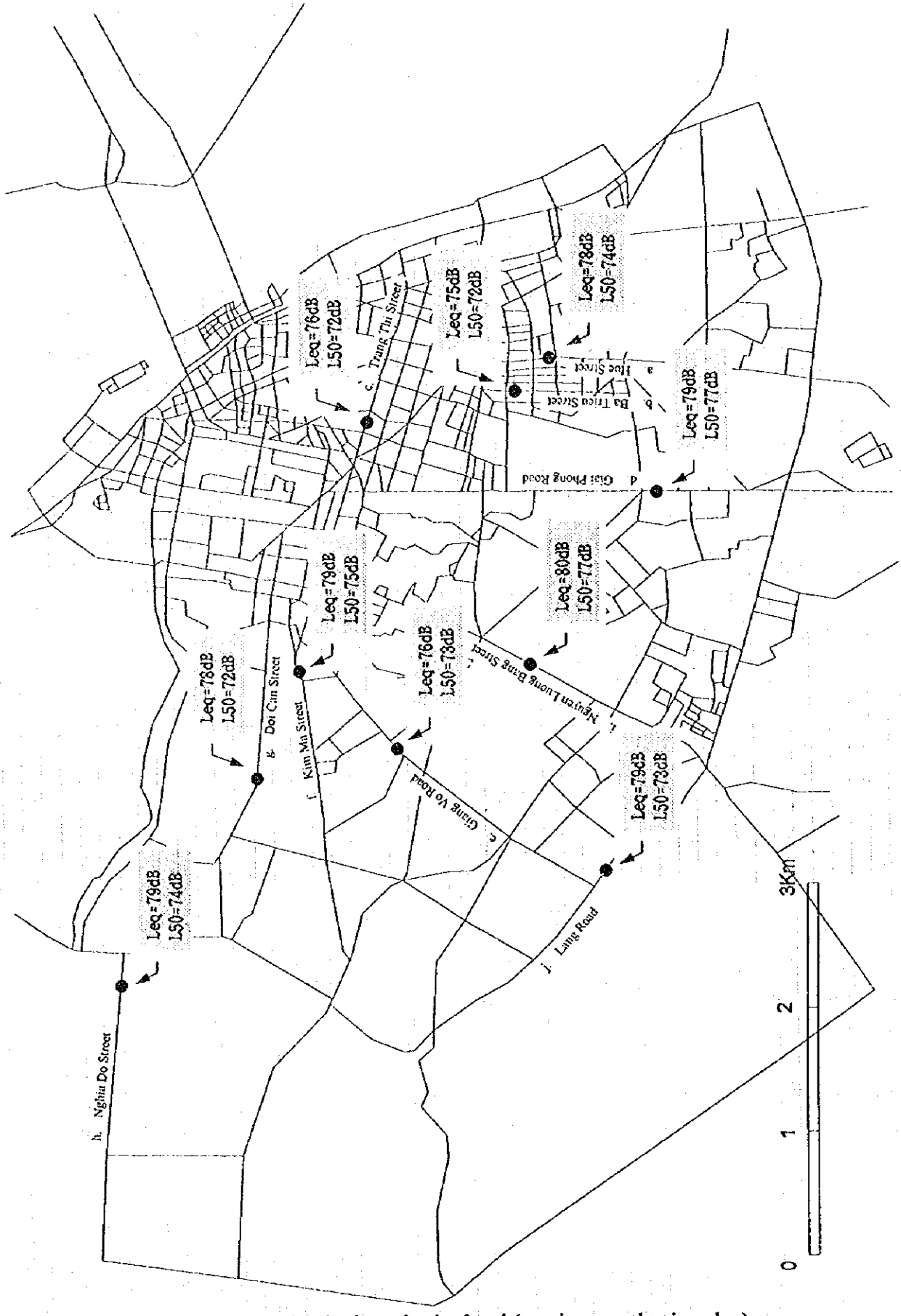


Fig. 5-3-10 Distribution of noise level (maximum value in a day)

Table 5-3-12 Hourly Traffic Volume

Streets/Roads	Time	Hourly Volume of Vehicles			
		M.cycle	P.Car	L.Truck	H.Truck
a. Hue	1: 7:00-9:00	4560	192	2	2
	2: 11:00-13:00	3579	204	32	0
	3: 16:00-18:00	4644	132	0	0
	4: 22:00-24:00	867	50	6	0
b. Ba Trieu	1: 7:00-9:00	2253	90	0	0
	2: 11:00-13:00	2873	146	12	0
	3: 16:00-18:00	4364	153	0	0
	4: 22:00-24:00	621	27	6	0
c. Trang Thi	1: 7:00-9:00	1287	224	0	0
	2: 11:00-13:00	1959	219	9	0
	3: 16:00-18:00	3564	228	0	0
	4: 22:00-24:00	450	42	5	0
d. Giai Phong	1: 7:00-9:00	7703	224	0	0
	2: 11:00-13:00	6161	219	9	0
	3: 16:00-18:00	9569	228	0	0
	4: 22:00-24:00	1332	42	5	0
e. Giang Vo	1: 7:00-9:00	8288	567	5	0
	2: 11:00-13:00	5214	387	123	2
	3: 16:00-18:00	7847	470	6	3
	4: 22:00-24:00	1086	158	39	9
f. Kim Ma	1: 7:00-9:00	4451	453	0	0
	2: 11:00-13:00	2724	354	41	0
	3: 16:00-18:00	4505	357	0	0
	4: 22:00-24:00	528	59	17	0
g. Doi Can	1: 7:00-9:00	2276	117	3	0
	2: 11:00-13:00	1583	68	9	0
	3: 16:00-18:00	2420	72	0	0
	4: 22:00-24:00	357	33	12	0
h. Nghia Do	1: 7:00-9:00	3084	269	42	2
	2: 11:00-13:00	1815	213	86	3
	3: 16:00-18:00	3183	386	102	2
	4: 22:00-24:00	254	23	23	6
i. Nguyen Luong Bang	1: 7:00-9:00	8364	294	8	0
	2: 11:00-13:00	5097	311	86	0
	3: 16:00-18:00	8225	308	0	0
	4: 22:00-24:00	1110	129	62	5
j. Lang Ha	1: 7:00-9:00	3356	167	47	3
	2: 11:00-13:00	2183	146	156	18
	3: 16:00-18:00	3429	219	102	14
	4: 22:00-24:00	408	36	74	21

Fig. 5-3-12 shows the distribution of noise levels at intersections in the urban city during the daytime. Noise at the roadsides where vehicles are running at constant speed in the urban city are 2-3 dBA lower than that at intersections. As mentioned above Leq is 77dB on Hue Street and 75dB on Ba Trieu Street, this is caused by engine noise at starting. In addition, there is no difference in the noise values at intersections with signals and without signals.

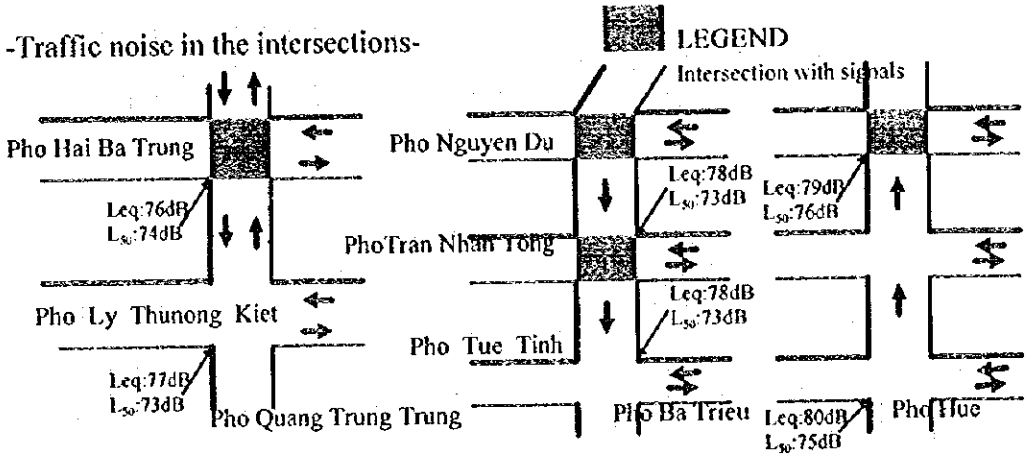


Fig. 5-3-12 Case of Noise Level in Intersections (13:00-14:00)

Fig. 5-3-13 shows the results of measurements of motorcycle noise in quiet areas. The noise becomes louder as the vehicle speed increases. The noise at starting is equal to that at 40km/h and horn noise is also high. The noise level of old cars at 40km/h is estimated at 97dB in Japan, therefore the motorcycle's noise is 4dB lower than that for car at their speed. In other words, the noise of a car is equivalent to that of 2-3 motorcycles. As the horns of vehicles are frequently used, it is estimated that the degree of influence of the horn noise is high. Nevertheless the Assessment Law prohibits the use of horns in densely populated residential areas between 11:30 and 13:00 and after 22:00. It is, therefore, necessary to improve the traffic flow and to educate drivers to decrease the use of their horns.

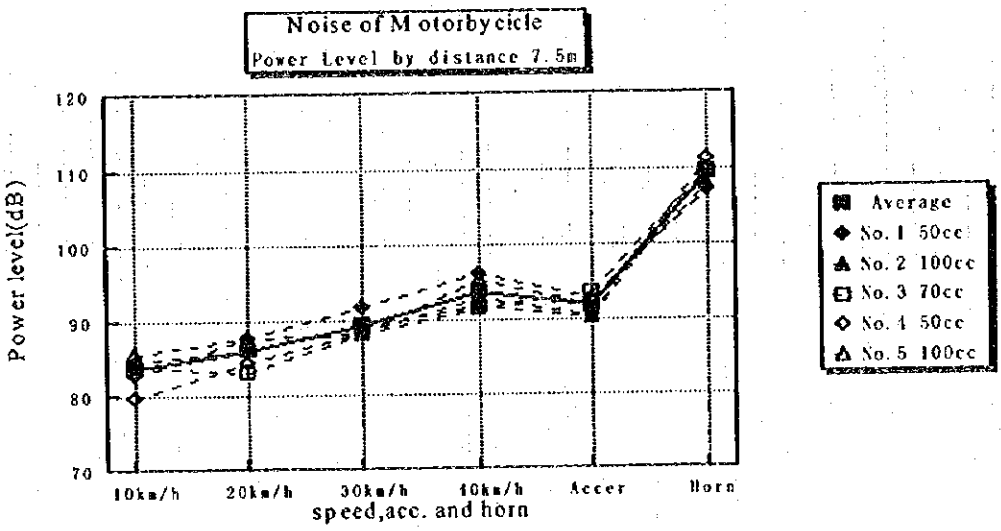


Fig. 5-3-13 Noise level of motorcycles

CHAPTER 6 PERSON TRIP DEMAND

6.1 Outline of Home Interview Survey

The first Home Interview Survey (HIS) in Hanoi was conducted by Vietnam Urban Transport Assistance Project (VUTAP) sponsored by Swedish International Development Cooperation Agency (SIDA) in 1994. The JICA study team received the VUTAP data base, cross checked and analyzed the trip behavior in Hanoi. The data analysis described in this chapter is based the VUTAP data file. However, the Study Team was responsible for this analysis. The survey covered the 4 urban districts of Hoan Kiem, Dong Da, Hai Ba Trung and Ba Dinh, and some adjacent *Phuongs* in Hanoi as illustrated in Fig. 6-1-1.

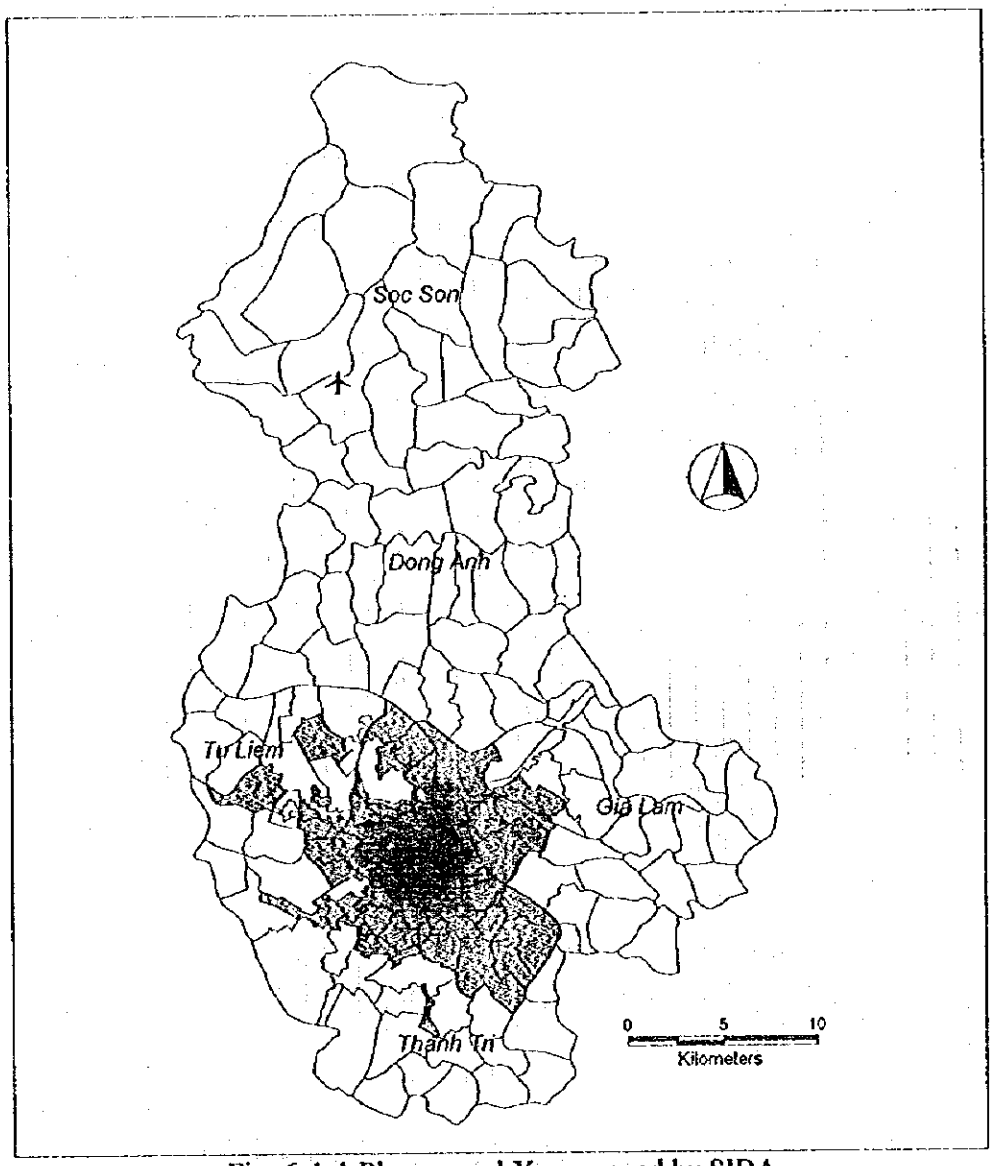


Fig. 6-1-1 Phuong and Xa surveyed by SIDA

6.2 Summary of Trips

The main results are summarized on Table 6-2-1.

Table 6-1-1 Summary of VUTAP Survey

Items	Figures
Population in Sample Area (1994)	1,040,929
Sampled Population (5 or more)	21,714
Number of Total Trips (5 or more)	55,486
Sampling Rate (%)	2.56
Trip Production Rate (per person, Gross)	2.56

6.2.1 Trip Composition

(1) Trip (excluding walking trips) Composition by Purpose

As shown in Fig. 6-2-1, the major trip end purposes of trips were "To Home" (50%), "To School" (16%) and "To Work" (10%). These three purposes, which combine to make up 76% of all trips, and account for a large proportion of trips made during the peak hours. Furthermore, as the destination of half of the trips was "To Home" indicates that the almost all trips were from Home based.

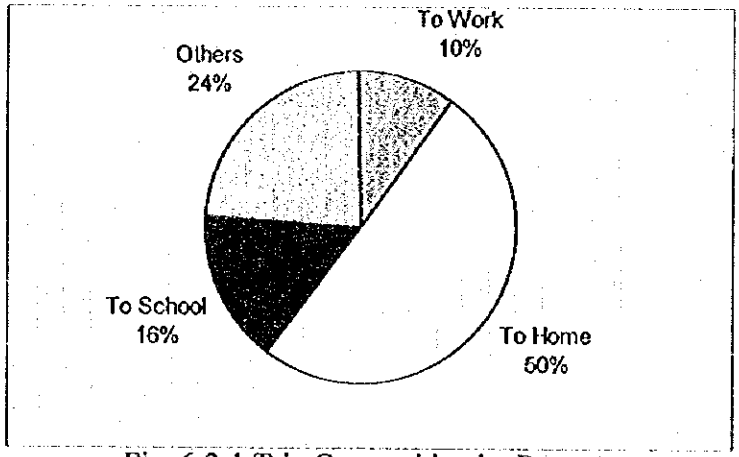
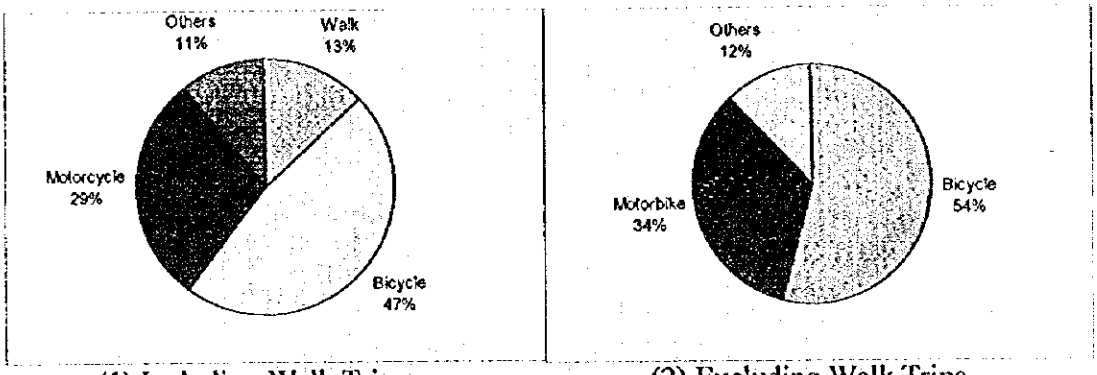


Fig. 6-2-1 Trip Composition by Purpose

2) Trip Composition by Mode

The composition of trips by mode is shown in Figs. 6-2-2 and 6-2-3. The mode "Others" includes trips by private cars and by such public transport modes as bus, taxi, cyclo and train. The figures show that bicycles accounted for the largest number of trips at 46.9%, followed by motorcycles at 29.4% and walking at 13.1%. Use of private cars was very low 0.2%. Almost all the trips (89.4%) in Hanoi urban area were made by "Walk", "Bicycle" and "Motorcycle".

The traffic counting at the main streets and intersections in the Hanoi urban area shows the higher motorcycle flows than bicycle, however the results of the home interview survey shows the higher bicycle use than motorcycles.



(1) Including Walk Trips (2) Excluding Walk Trips

Fig. 6-2-2 Trip Composition by Mode

6.2.2 Trip Production Rate

(1) Trip Production Rates

1) Net Trip (excluding walking trips) Production by Age and Sex

The net trip production rates excluding walk trips are 3.0 for males and 2.8 for females. Fig. 6-2-3 shows trip production rate distribution by age and sex. The trip rate for males close not very much with age, while females over seventy year old show steep drop in trip production rate.

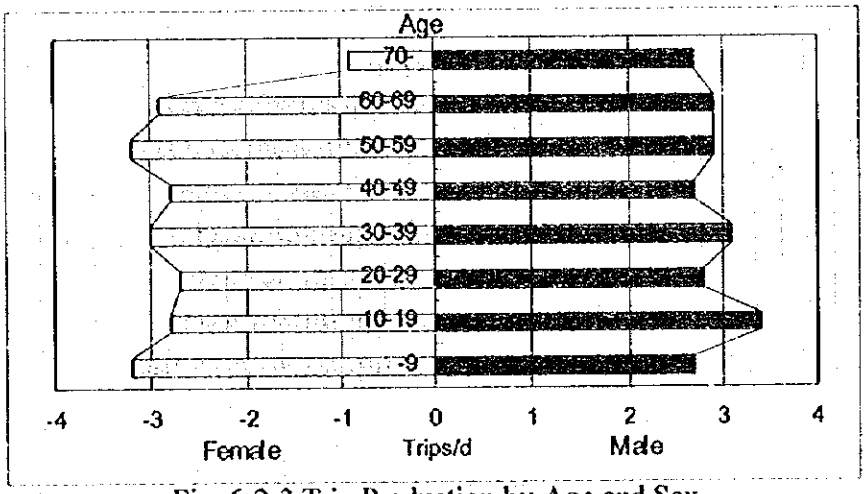


Fig. 6-2-3 Trip Production by Age and Sex

2) Net Trip (excluding walking trips) Production by Occupation

Fig. 6--2-4 shows the trip production rate distribution by occupation. There is a little difference in trip production between occupations. The trip production rate is slightly higher for sales (3.3) and workers (3.1). It is slightly lower for house wives (2.8) and for unemployed workers (2.7). The persons who are engaged in service industries have the highest trip production rate of 3.3 trips/day.

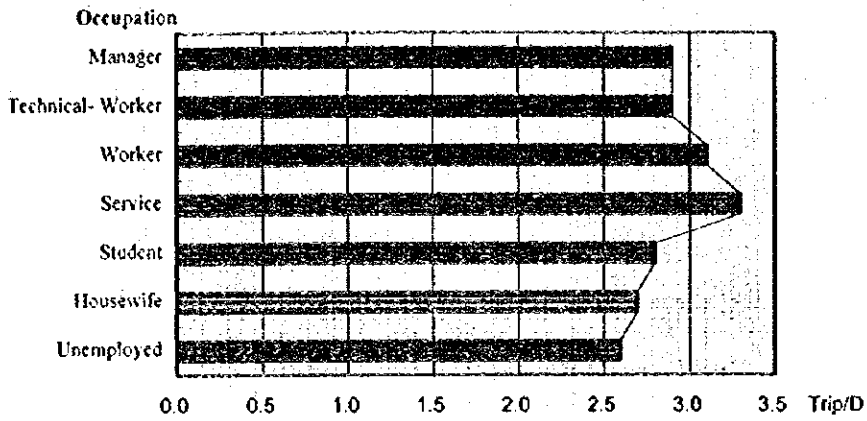


Fig. 6-2-4 Trip Production by Occupation

3) Net Trip (excluding walking trips) Production by Income

The trip production rate fluctuates around 2.5 but is not correlated with the household income level (Fig. 6-2-5).

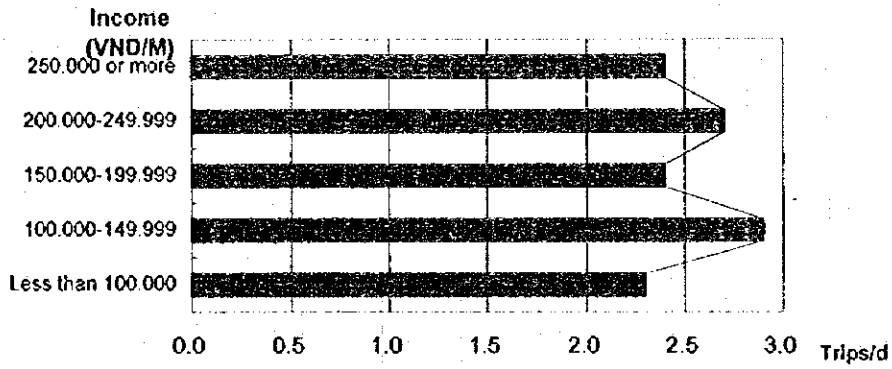


Fig. 6-2-6 Trip Production by Income

4) Trip (excluding walking trips) Production by Car/Motorcycle Ownership and Purpose

46% of interviewees owned a bicycle, 36% owned motorcycle. 2% owned car and 16% owned no personal transport mode. The trip production rate for persons who own bicycles is 3.0 while that for car/motorcycle owning persons is 2.9 (see Fig. 6-2-6).

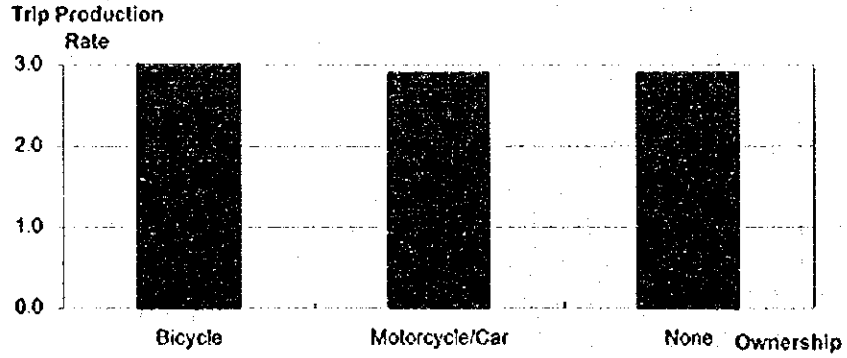


Fig. 6-2-6 Trip Production by Vehicle Ownership

6.3 Trip Production and Attraction

6.3.1 Production/Attraction by Zone and Purpose

(1) Production/Attraction Table by Zone and Purpose

The urbanized area of Hanoi is composed of 84 *Phuongs* (Towns). These *Phuongs* have been integrated into 28 traffic zones. The characteristics of 28 zones are summarized in Table 6-3-1. Intra-zonal trip rates by purpose and by mode are shown in Table 6-3-2. For both bicycle and motorcycle in intra-zonal trips compared 49% of the total. 48% of "To School" and "To Work" trips were intra-zonal.

Table 6-3-1 Characteristics of 28 Traffic Zones

Zone No	Name	Characteristics
1	Yen Phu	Residential w/ minihotels, low income class.
2	Chuong Duong	Residential w/ wood-work shops, mixed income class.
3	Quan Thanh	Residential, high income class.
4	Ngoc Ha	Residential, low income class.
5	Buoi	Residential, low-middle income class.
6	Dong Xuan	Residential/ commercial, high income class.
7	Dien Bien	Government offices, middle income class.
8	Kim Ma	Residential/ commercial/ government, high income class.
9	Cau Giay	Commercial, low income class.
10	Hoan Kiem Lake	Center of Hanoi, high income class.
11	Hang Buom	Residential/ commercial, high income class.
12	Van Mieu	Residential/ commercial, mid - high income class.
13	O Cho Dua	Government built apartment complex, low income class.
14	Lang	Newly developed residential w/ large hotels/ offices, low.
15	Tran Hung Dao	Government offices embassies, high-mid income class.
16	Bach Dang	Residential w/ hospitals/ offices: mixed income class.
17	Pho Hue	Residential/ commercial, mixed income class.
18	Lenin Park	Park/offices, residential, high income class.
19	Kim Lien	Government built apartment complex, mid-low inc. class.
20	Tay Son	Government built apartment complex w/ shops, middle.
21	Mai Dong	Residential w/ warehouse/ industries, mixed income class.
22	Thanh Nhan	Commercial w/ industries/ residential, mid-low inc. class.
23	Bach Khoa	University/ hospital w/ residential, middle income class.
24	Giap Bat	Residential w/ commercial high-middle income class.
25	Khuong Thuong	Newly developed residential w/agricultural land, middle.
26	Thanh Xuan	Newly developed residential w/ industries mid-low.
27	Minh Khai	Newly developed residential w/ industries middle.
28	Hoang Van Thu	Newly developed residential w/ agricultural land, mid-low.

Table 6-3-2 Intra-zonal Trip Rates

Mode	Intra-Zonal Trip Share(%)
All-Purpose	52.7
To Work	48.3
To School	48.2
Bicycle	48.5
Motorcycle	48.5
Car	28.6
Walking	59.7

6.3.2 Trip Generation/Attraction Rate

Table 6-3-3 shows the rates of Trip Generation/Attraction by Purpose in each zone. Hoan Kiem Lake (zone 10) shows high rate of Generation/Attraction Rate. Adjacent zones, which are Hang Buom (zone 11), Tran Hung Dao (zone 15) and Dong Xuan (zone 6), form a group of high with Generation/Attraction rates. Other high rate zones are Kim Ma (zone 8) and Thanh Xuan (zone 26). Bach Khoa (zone 23) shows high Generation/Attraction Rate of "To School" and Yen Phu (zone 1) "Other" purposes.

Table 6-3-3 Generation/Attraction Ratio by Zone and Purpose

Zone No.	Traffic Zone	Work	School	Other	Zone No.	Traffic Zone	Work	School	Other
1	Yen Phu	0.53	0.27	1.57	15	Tran Hung Dao	1.26	1.65	2.04
2	Chuong Duong	0.74	0.35	0.64	16	Bach Dang	0.82	1.48	1.07
3	Quan Thanh	0.86	1.13	0.75	17	Pho Hue	1.51	0.65	0.91
4	Ngoc Ha	0.65	0.41	0.60	18	Lenin Park	1.61	0.41	0.86
5	Buoi	0.53	1.27	0.78	19	Kim Lien	0.46	0.44	0.84
6	Dong Xuan	2.25	1.61	2.51	20	Tay Son	0.47	0.81	1.04
7	Dien Bien	1.45	1.08	0.82	21	Mai Dong	0.65	0.36	0.53
8	Kim Ma	1.61	2.02	1.98	22	Thanh Nhan	0.48	1.08	0.92
9	Cau Giay	1.80	0.83	1.27	23	Bach Khoa	0.53	1.77	0.55
10	Hoan Kiem Lake	9.45	2.39	5.87	24	Giap Bat	0.61	0.38	0.40
11	Hang Buom	2.28	1.58	1.80	25	Khuong Thuong	0.89	1.00	0.44
12	Van Mieu	1.05	1.86	1.08	26	Thanh Xuan	1.64	1.68	1.25
13	O Cho Dua	0.56	0.55	0.79	27	Minh Khai	1.57	0.20	1.20
14	Lang	1.20	1.24	1.10	28	Hoang Van Thu	0.54	0.35	0.35

Fig. 6-3-1 shows the hourly fluctuation of trips by purpose. The trips generation peaks between 7:00 and 8:00 in the morning for the purpose of "To Work" and "To School" (roughly 106,000 trips; peak ratio 22.7%). Evening peak is seen between 17:00 and 18:00. Slight peak occurs from 11:00 to 12:00.

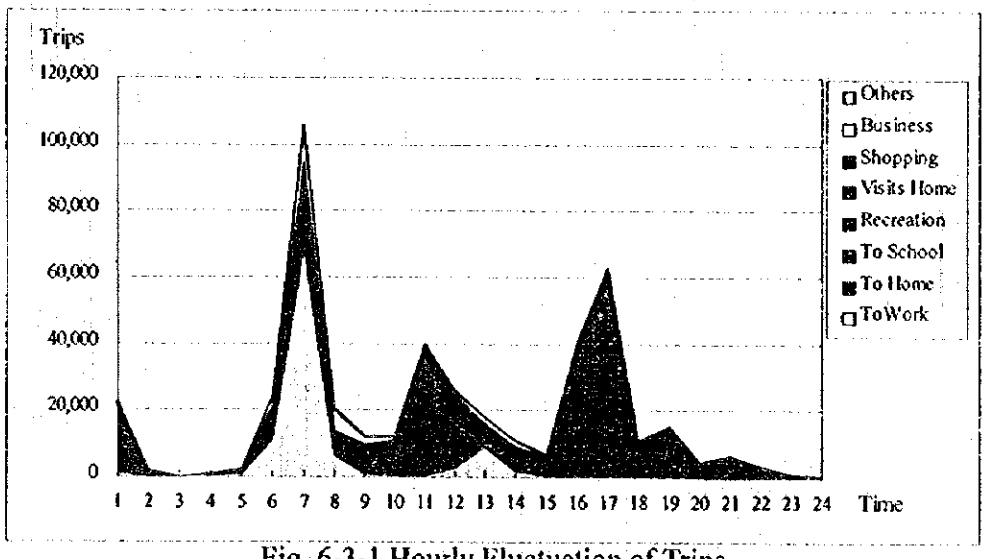


Fig. 6-3-1 Hourly Fluctuation of Trips

6.4 Trip Distribution

6.4.1 All-Purpose, All-Mode Trips

The distribution of trips made by residents in terms of all-purpose and all-mode of trips is compiled in a zonal OD table and the desire lines of the all purpose all mode trips are shown in Fig. 6-4-1.

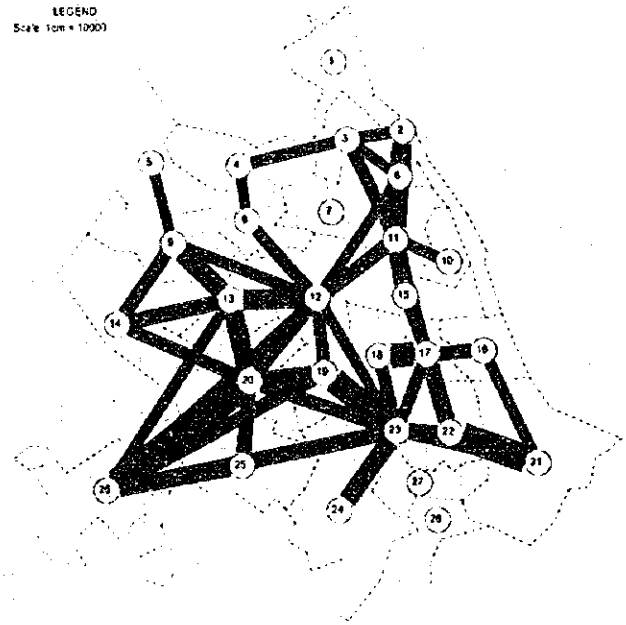


Fig. 6-4-1 Desire Line (All Purpose, All Mode)

6.4.2 To Work and To School

Fig. 6-4-2 shows the desire lines of "To Work". There is traffic flow of Hang Buom (zone 11) - Van Mieu (zone 12) - Tay Son (zone 20) - Thanh Xuan (zone 26) connecting traffic attraction centers. Also, tight connection is seen between Mai Dong (zone 21) and Thanh Nhan (zone 22).

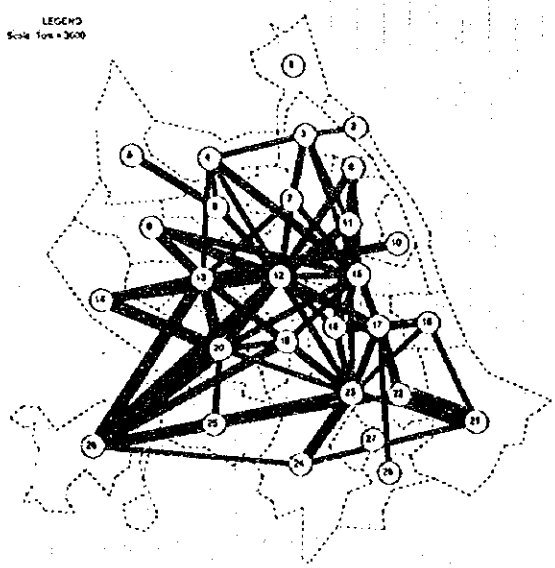


Fig. 6-4-2 Desire Line (To Work, Without Walk)

Fig. 6-4-3 shows the movement of students between area of habitation and areas in which schools are located. South and south-west zones are closely connected. Others are mostly independent except local relations like Chuong Duong (zone 2) - Dong Xuan (zone 6) - Hang Buom (zone 11), Buoi (zone 5) - Cau Giay (zone 9) - Lang (zone 14) - O Cho Dua (zone 13) - Tay Son (zone 20). Quan Thanh (zone 3) - Ngoc Ha (zone 4) or Mai Dong (zone 21) - Thanh Nhan (zone 22).

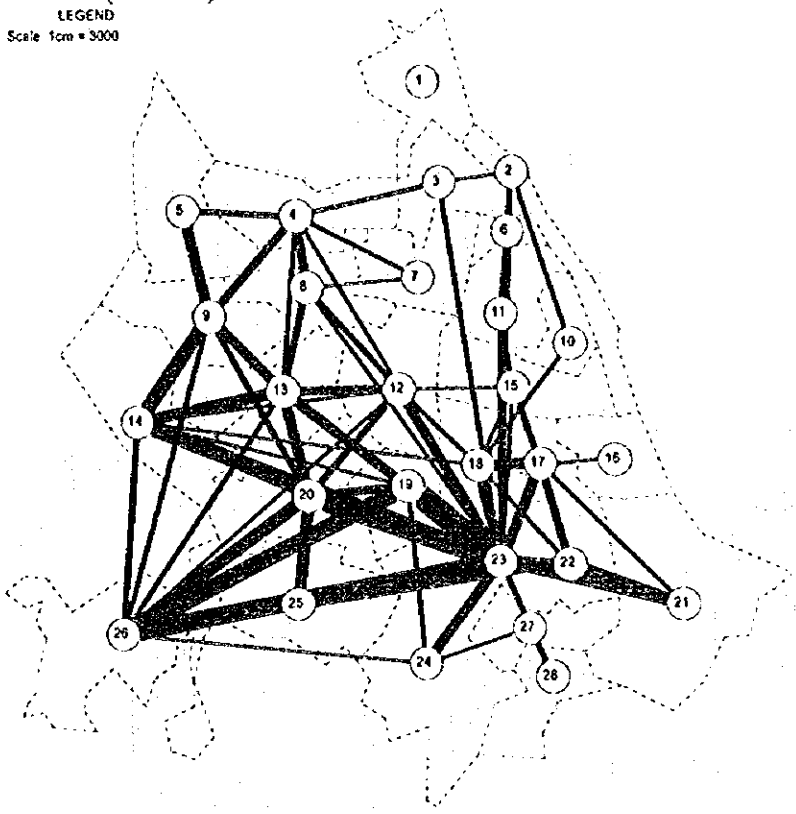


Fig. 6-4-3 Desire Line (To School, Without Walk)

6.5 Modal Split

6.5.1 Modal Split by Purpose

The number of trips (including walking trips) categorized by mode of transport and purpose is shown in Fig. 6-5-1. The use of bicycles is high for those who commute to school. Walk is high in shopping purpose. Motorcycles are used widely except for going to school and going shopping.

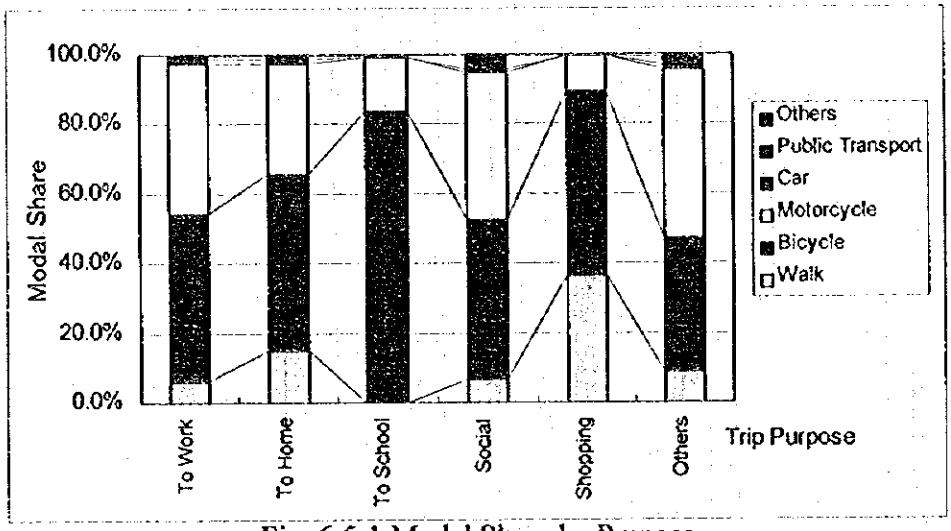


Fig. 6-5-1 Modal Share by Purpose

6.5.2 Trip distribution by mode

The desire lines of bicycles and motorcycles are shown in Figs 6-5-2 and 6-5-3. The trip flow "by Bicycle" forms a dense network but both show a similar pattern.

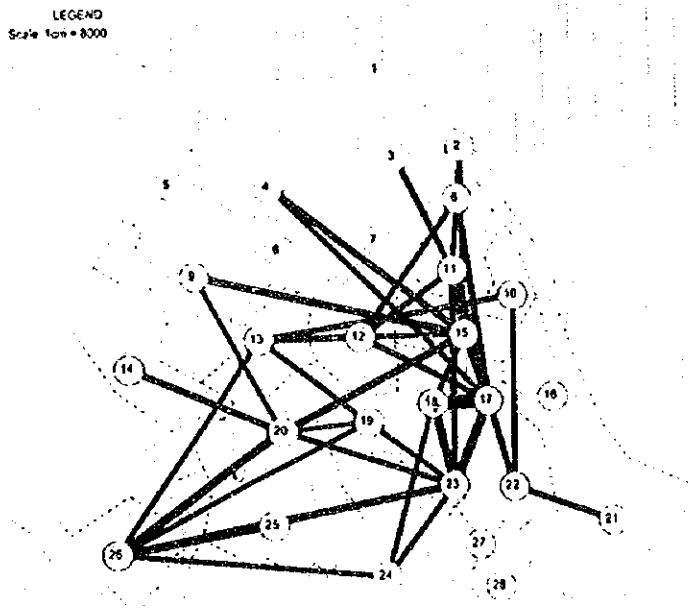


Fig. 6-5-2 Desire Line of Bicycles

LEGEND
Scale 1cm = 8000

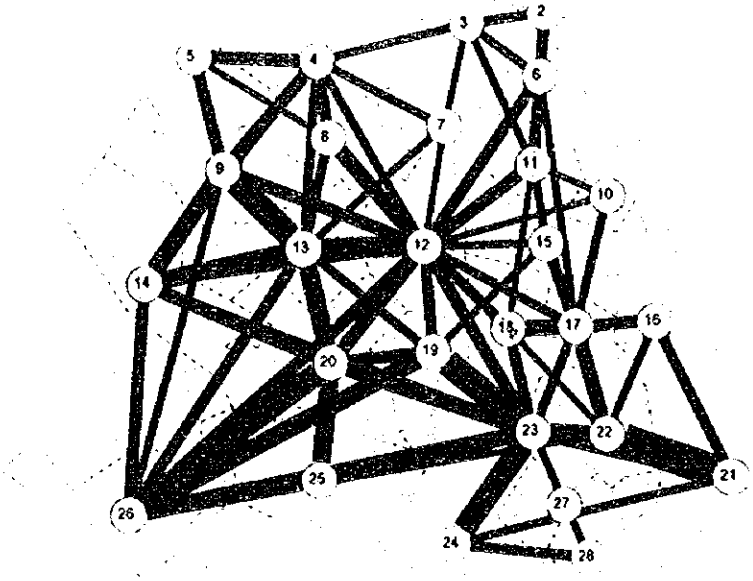


Fig. 6-5-3 Desire Line of Motorcycles

CHAPTER 7 TRAFFIC MANAGEMENT

7.1 Introduction

The assignment given to consultants was to set up appropriate measures to ease traffic conditions, using available technology and resources to produce smoother traffic flow and increase levels of safety for people in Hanoi. To fulfill this assignment, sustainable traffic management schemes to ease "traffic chaos" in Hanoi should be undertaken immediately, along with a campaign strategy in cooperation with the projects proposed by the World Bank.

The consultant team have surveyed the existing situation in Hanoi with respect to traffic phenomena, including road users' behavior, through observation. Interviews with government officials, representatives and other key professionals were also conducted. From this survey it is apparent that both physical and non-physical barriers impede the resolution of current traffic issues.

Since the majority of transport currently relies heavily on bicycles and motorcycles, a unique but entirely different scheme for traffic management should be carefully considered. The opportunity to modify the current situation in desirable directions such as "two wheel - oriented transportation" is promising since most of Hanoi's population have not been exposed to a four wheel - oriented transport system.

It is necessary that road users, particularly drivers/riders, obey traffic regulations and the law and behave safely. The main aim of this chapter is to review the current traffic driver/rider education and campaign program for the city of Hanoi, in order to identify an effective management approach toward the year 2015, aimed at improving the current situation where heavily mixed traffic is undermined by undisciplined drivers/riders, cyclists and pedestrians.

In particular, the chapter reports the results of the tasks involving the followings:

- Observation and analysis of driver/ rider, cyclist and pedestrian behavior.
- Reviewing the current accident situation in Hanoi.
- Reviewing the existing law and enforcement.
- Reviewing the current accident reporting system and database.
- Reviewing the existing safety campaign programs.
- Reviewing the existing safety facilities including traffic signals, signs and markings.
- Reviewing the existing program for safety education for children.

The programs for traffic safety in cities in developing countries should be adjusted to the countries' own situation, for which reason the program applied in countries which are already motorized can seldom be offered in the developing countries without considerable readjustment. Hanoi is not an exception.

There are a number of methods by which human behavior can be improved and by which road user accidents may be reduced. These methods are as follows:

By means of introducing appropriate infrastructure:

- By means of an education and training program. Those may be aimed at the most vulnerable road users such as children,
  pedestrians, cyclo operators, cyclists, motorcyclists and drivers, and high risk groups such as these already convicted of traffic offenses.
- By means of a publicity campaigns. These make use of the mass media and aim to improve public awareness especially of important issues such as lack of courtesy to other road users and illegal behavior on road.
- By means of law enforcement practices and policies. These include the enactment of the legislation and adequate enforcement by traffic police officers including policing, cautioning and processing.

In the near future, an increase in traffic accidents and congestion will result from the predominant share of private transport among other modes, including the huge number of bicycles and motorcycles (mainly less than 100cc) which provide relatively cheap door to door service. However, the condition of the road network and traffic safety facilities will be insufficient to serve larger traffic volumes. Considering the future income distribution, it is most likely that bicycle users will transfer to motorcycle, which will remain as the major mode of transport, unless the public transport level of service can be significantly improved.

It is strongly recommended that Hanoi government policy should be formulated to improve driver/ rider training and road safety campaigns, which may be applicable in the existing political, social and economic situation in Hanoi. All the agencies involved in transport and traffic claim some responsibility for accident reduction and road safety. However, partly as a consequence of the lack of clear agency responsibility, efforts to improve drivers/ riders education and road safety have been ineffective.

In developing countries, a major problem is the financing of traffic safety, including campaigns since traffic safety is often given a very low priority. This is completely understandable when one takes into consideration all of the problems with which many of the countries or cities are confronting.

At present, efforts to promote safety and comfort in the traffic environment, utilizing the campaign technique, are relatively underdeveloped. From a psychological point of view, unless the other two "Es" (i.e., engineering and enforcement) are also promoted, the general public will not pay much attention to media campaigns or alter their behavior or attitudes through education.

7.2 Road User's Behavior

7.2.1 Drivers/Riders Behavior

In Hanoi, the driving habit of four wheel vehicle drivers is to drive in the middle of the road. This is caused by the road sides being fully occupied by slow moving motorcycles and bicycles. As a result, automobiles are squeezed towards the center of the road. Sometimes they cross the center lines which are poorly marked. The road surface is often ill-maintained, bumpy and have a low friction coefficient for vehicle tires. These factors lead to high risk situations.

Better driving behavior could be achieved if appropriate polices were instituted and management schemes established. Unfortunately many drivers/riders leave their good manners or courtesy at home. Discourteous driving/riding takes many forms in which the right of way of other motorists and cyclists is ignored. This behavior on the road creates a general atmosphere of frustration among other road users, who also behave in a selfish uncoordinated manner.

Since Hanoi people have not been exposed to traffic congestion caused by heavy volumes of four wheel vehicle traffic, their attitude toward road safety is somewhat different from other cities in Asia. Lack of traffic education and training for drivers and riders are coupled with general ignorance of traffic laws, social responsibilities and the reasons for law enforcement.

Human error which leads to accidents is not so much due to ignorance of traffic rules and regulations or unwillingness to observe them, but to a lack of knowledge and experience of the wide range of actual hazards on the road and how to cope with these situations. In this sense, "Defensive Driving/Riding" here, becomes "Self Defense Driving/Riding" which is somewhat different from the concept in other advanced motorized societies.

Retardation of drivers/riders behavior in Hanoi is explained in following manner; Drivers/riders choose their behavior depending upon the situations they face. In other words, drivers/riders behavior are conditioned by the traffic environment, namely road configuration and strength of enforcement.

Almost all motorcycle riders are given informal riding instruction, but the majority of the riding population simply learn how to maneuver vehicles/cycles without uniform training. The lack of courtesy and discipline, if it which is often observed on road, is simply due to a lack of proper training and knowledge.

Compounding the problem is the propensity of road users in Hanoi to violate the most basic traffic rules and regulations, by for example: improper overtaking; jaywalking; improper lane changing; and disregarding traffic rules. As is to be expected, conflicts between pedestrians and drivers/riders result. Without strict enforcement and guidance for both violating drivers/riders or pedestrians, no improvement can be expected.

Here in Hanoi, no "lane principle" is followed and courtesy is lacking. For example,

their undisciplined manner is frequently apparent when opposite lanes are vacant while their own lanes are fully occupied. In this situation drivers/riders tend to use the opposite lane as if it were a reversible lane.

No "give way" manners are observed. as drivers/riders do not follow lane markings which are often ill-maintained, they make sudden and frequent lane changes which conflict with oncoming traffic. They are instructed by current traffic regulations, to sound the horn when they want to overtake other four wheel vehicles. They also use the horn to warn other road users, particularly motorcycles, slow moving bicycles, cyclos and pedestrians.

Intersections without traffic signals operate on a chaotic basis. Traffic from different directions merges haphazardly and causes all traffic to slow down. Apparently they do not realize that smooth traffic flow would be obtained by ordinal behavior. Drivers/riders prefer to go along without any interference or disturbance while driving/riding and they don't want to slow down and stop. Interaction between cyclist, motorcyclists and four wheel vehicles is a problem of concern everywhere, especially where two wheel traffic is dominant in relation to the road capacity.

To summarize, driving habits here in Hanoi are not well disciplined and are ad hoc. However, given the Hanoi people's attitude, drastic and violent behavior is not observed, although they experience certain frustration. Therefore, delays and choking at intersections would be alleviated by the installation of traffic signals, improvement of education and implementation of current traffic rules and regulations combined with campaigns.

7.2.2 Bicycles

In Asia alone bicycles transport more people than all of the world's automobiles. For example China's annual production of 41 million bicycles exceeds world automobile production.

In Asia, increased motorization has led to a reduction in available street space, as for example in Bangkok, and non-motorized vehicles have not been adequately considered in urban transport planning and investment programs. Thus, non-motorized transportation is believed to be the main cause of congestion. However, in most of regions of the world, the main constraints on greater bicycle use are: unsafe operating conditions; a view that bicycles are a symbol of "backwardness"; and the high price relative to incomes for the poor. However, Hanoi is an exceptional case.

The total number of bicycles in operation in Hanoi has been estimated at more than 700,000 units. The ownership rate is 2.0 per household. The bicycle provides very high mobility which is really appreciated by users. Therefore, the bicycle can not be seen as an unimportant low mode of transport.

In most of car-oriented cities, car drivers firmly believe that they have scale domain over the streets and that pedestrians, motorcyclists, cyclists are "Intruders". However, Hanoi is somewhat different. Historically, the bicycle has been used as the main

personal transportation system and cyclists think stop signs at the junctions, where they exist, and traffic signals are only for cars and motorcycles. As the result, cyclists, and sometimes motorcycle riders disregard traffic signs and rules.

The bicycle is a sustainable transportation mode and a way of providing flexible personal transport at minimal cost. In addition, it benefits human health and the environment and minimizes energy consumption. The future of personal and goods transportation in urban areas should not be a "Winner takes all" contest between motorized and non-motorized transportation modes. A well balanced and integrated transportation system is likely to be the best way out of the urban transport problem (Ref.: "Urban Age", World Bank). The study of Hanoi will provide new information on mobility needs and the bicycle's role in urban transport systems.

7.2.3 Pedestrians

The fact that a fairly large number of minor casualties involved in traffic accidents in Hanoi are pedestrians suggests the necessity of urgent countermeasures for this so-called "transport minority" who are generally exposed to the traffic scene without any protection. Conflicts between pedestrian and vehicle traffic, which reduce the efficiency of the urban street network, can be minimized by improving the traffic control systems and implementing pedestrian safety measures, including effective pedestrian education programs. Such measures and programs, if successfully implemented, will not only improve traffic flows but also improve safety, convenience, and comfort of both pedestrians and motorists.

The crossing manner of Hanoi pedestrians is undisciplined easy and risky. Traffic signals at intersections are frequently not observed. Particularly, traffic violations by pedestrians are high at major intersections in the CBD area. Pedestrian do not always use the crosswalks which are provided but sometimes unmarked or obscured. Pedestrians in Hanoi who were used to being the "King of road" are generally accorded low priority. Drivers easily disregard pedestrians since they feel pedestrians are "Outsiders in traffic". This attitude must be changed, with pedestrian traffic considered as important as vehicular traffic, through the provision of safe and convenient facilities and the according of sufficient priority to pedestrians at intersections.

Slow crossing behavior is commonly observed while crossing streets as if pedestrians are sure to be protected by other vehicles in this way. On the contrary, pedestrians behave fairly well at less congested and signalized intersections where traffic signals are functioning properly and traffic flow is smooth.

With respect to software, appropriate traffic rules and regulations and their enforcement are an essential tool for reducing pedestrian-vehicular conflicts and thereby promoting pedestrian safety. Unfortunately, at present, priority rules between vehicles and pedestrians are not necessarily clear; moreover, to the extent that they are clear, they are not always appreciated or followed.

Unfortunately, the majority of pedestrians have received no uniform safety education or training. Thus, they ignore any traffic regulations. Advise or guidance should be given

to pedestrians on the importance of the correct manner of crossing, by means of traffic enforcement and mass media campaigns. Pedestrian education for school-age children, is also of vital importance, since once children become adults, education is more difficult.

In general, pedestrian behavior is closely related to rider behavior, the general traffic situation, and enforcement. Evidence that a large number of minor injuries involved in traffic accidents in Hanoi could be pedestrians suggests the necessity of urgent countermeasures to protect them.

7.3 Current Accident Situation

7.3.1 General trend

Human loss, both physical and mental, has not modified people's attitudes even though the accident rate is much higher than for other advanced countries. People feel that the priority is how fast people and goods arrive at their destinations, ignoring the question of safety. Particularly the general public in Hanoi has been rather indifferent to such an uncontrolled traffic situation. The training and discipline of drivers/ riders, cyclists and pedestrians has not been up to the necessary standard.

Following analysis was conducted using a limited accident database. According to Traffic Police reports, traffic accidents caused by motorcycles accounted for 60 percent of total accidents which is twice as high as the ratio in 1994.

Since new traffic laws were adopted (36/CP) 12 months ago, the traffic death toll has fallen markedly, but between August 1995 to May 1996, according to "Business and Investment 8/26/1996", there were 13,062 traffic accidents which injured 14,698 people and killed 3,534. This means approximately one in every 3,900 people were victims of traffic accident in nationwide base. Also in Hanoi, approximately 300 persons were killed and 600 injured in a year (See Fig. 7-3-1).

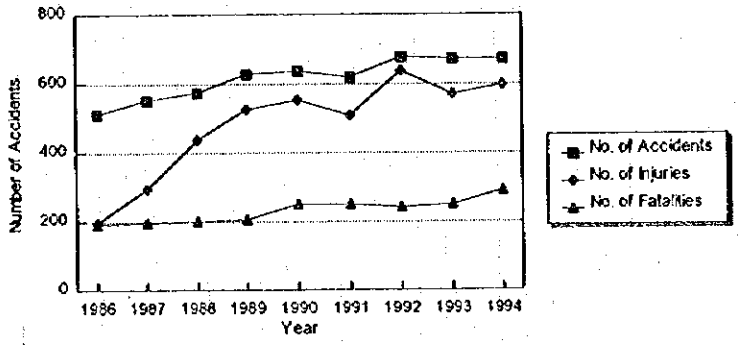


Fig. 7-3-1 Accident Trend in Hanoi

Motorcycle ownership increased rapidly since 1990, which is reflected by the higher involvement of motorcycles in accidents. For example, approximately 10 to 12 accidents per 10 thousand motorcycle registration were observed between 1990 to 1992 (See Table 7-3-1).

Table 7-3-1 Motorcycle Ownership and Accidents in Vietnam

	Motorcycle Ownership (x1,000)	Traffic Accidents	Accident Rate (/10,000 motorcycle)
1990	180	223	12.4
1991	210	251	11.9
1992	240	276	11.5
1993	320		
1994	380		
1995	460	167*	3.6

* Severe accidents only

Fig. 7-3-2 indicates total number of accidents (excluding property damage) by different transportation modes in Hanoi municipality. It clearly shows this the involvement of motorcycles is growing year by year.

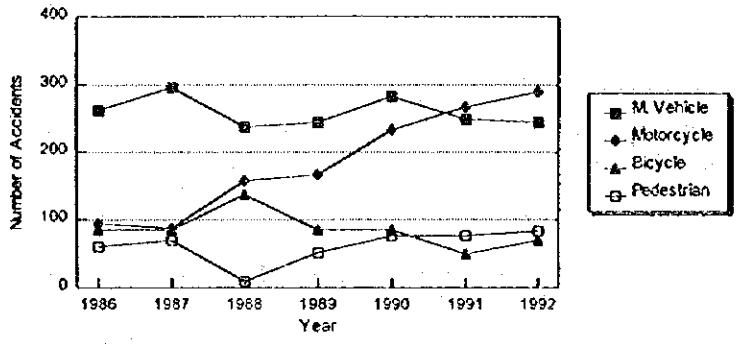


Fig. 7-3-2 Accident by Type of Vehicle

As far as severe accidents are concerned, the accident rate is 3.6 for every 10,000 motorcycles (see Table 7-3-1, 1995). Assuming motorcycle ownership will increase to 600,000 in near future and no immediate implementations for road management are undertaken, motorcycle accidents would increase to 600 cases per annual. The severe accidents involving motorcycles would increase 180-200 cases in a year.

Considering the total traffic volume and extremely low share of 4 wheel vehicles, the current accident situation in Hanoi would be improved by optimal traffic management schemes including safety education and campaigns.

7.3.2 Analysis of serious accidents

There were 363 serious accidents in Hanoi the year 1995/96 and 314 people were killed in the same period. This means that nearly 26 people were killed every month. Among these, 46.0% were for motorcycle riders and 38.3% for four wheel vehicles occupants. The high involvement of motorcycles release not only the high demand for two wheel transportation, but also drinking riding and without wearing helmets increase high rate of the involvement. It is noticeable the fatality rate is very high given the number of severe accidents. The reason for this is not clear.

Less than 12 pedestrians were involved in severe accidents during a 6 month period. Presumably, most of the pedestrian accidents occur in dense traffic situations where vehicle speed are lower and they do not cause serious injuries. Taking into account of causation of accidents, approximately 40% accidents were caused by "over speeding" in the suburban area of Hanoi. More precise data for accident causation is needed for further analysis.

Accident distribution by time of day for 6 months (Jan. 96 to June 96) is shown on Table 7-3-2. The highest numbers of accidents occurred between 17:00-24:00 (29.5%) and between 10:00-14:00 (25.3%). Probably this reflects the high traffic volumes, but may be related to lunch time and evening driving and increase danger on the evening due to drinkers.

Table 7-3-2 Severe Accidents by Month and Time of Day

Time	January	Feb	March	April	May	June*	Total (%)
0- 6	1	0	3	6	3	4	17 (10.2)
6-10	2	7	2	6	5	13	35 (21.0)
10-14	9	5	5	5	12	6	42 (25.3)
14-17	4	3	3	3	8	2	23 (13.8)
17-24	10	9	8	12	6	4	49 (29.5)
Total	26	24	21	32	34	29	166(100.0)

* Up to June 20

Comparing 10hr data between 0:00-10:00 and 14:00-24:00, the latter (afternoon to evening) shows 43.5%, which means higher rate of evening to night time for severe accidents. This reflects more difficult driving conditions at night when smaller vehicles, such as cyclos and bicycles usually have no lights.

Analysis of accidents by routes shows that National Highway No.5A and No.3 are high numbers of severe accidents (Table 7-3-3). Accident rates per km also shows that National Highway No.5A in the highest, namely 1.42 severe accidents per 1 km length of highway. National Highway No. 32 and No. 3 also have high rates. Highway No.5A inside Hanoi municipality is located in the outskirts of the city. Presumably, over-speeding is a key factor causing this high rate.

Table 7-3-3 Severe Accidents by Routes

	Number of accidents (A)	Distance (km) (B)	(A)/(B)
Highway No.5A	17	12	1.42
Highway No.3	14	17	0.82
Highway No.1A	8	17	0.47
Highway No.1B	2	11	0.18
Highway No.2	2	12	0.17
Highway No.6	2	13	0.15
Highway No.32	6	6	1.00

Conversely in terms of total accidents including minor injuries, Hoan Kiem area in CBD showed the highest occurrence. As the traffic flow in CBD area is over saturated, the speed of vehicles is slow and accidents with minor injuries and without reporting could frequently occur. Particularly, conflicts at the uncontrolled intersection may be the major factor causing such minor accidents.

To prevent the serious traffic accidents in suburban districts, should be installed medians to avoid head-on collisions and wrong lane driving. At the same time, the installation of appropriate signs and markings and the optimal enforcement by police officers should be facilitated in the urban road network.

7.4 Law and Enforcement

7.4.1 Law and Regulation

Although the recent promulgation of "Decree 36 CP" is an attempt to implement traffic safety, the basic concept of road traffic law in Vietnam is out of date and will not be suitable to cater for growing traffic demand. In addition to "Decree 36-CP", directive 317 TTG which strengthens control of order and safety traffic on road and in urban centers, was issued by the Prime Minister.

It is important to understand the responsibilities of related government agencies. MOTC has become the primary state organization for organizing traffic safety and the Ministry of Interior (MOI) is responsible mainly maintaining order and safety by enforcement of the new Decree 36. The Ministry of Education and Training (MOET) is responsible for the traffic safety teaching program in schools. The Ministry of Culture and Information (MOCI) is responsible for safety campaigns through mass media and publicity.

In the Decree, sidewalk sellers on streets were clearly banned to secure public order and safety. However this sparked criticism because of the loss of their livelihoods and has not been enforced.

The regulation on traffic order and safety attached to Decree 36-CP (May, 1995) consists of 73 articles in the following chapters:

Chapter 1. General problem
Chapter 2 Roads and street traffic
Chapter 3 Vehicles in traffic
Chapter 4 People in traffic
Chapter 5 Traffic regulation on roads
Chapter 6 Traffic order and safety in urban areas
Chapter 7 Final

Careful comparison with the previous regulation (176-QB/LBG TVT) showed that the main topics on safety rules and regulations are almost the same as previous ones. Such practices as warning other road users by sounding the horn are not restricted. More efficient enforcement operation police officers should be clearly indicated in the road traffic law.

Since traffic regulations can only be effective when road users such as drivers/riders, cyclo operators and pedestrians observe them. Observance depends upon the extent to which the vast majority of road users acknowledge reasonableness of the regulations and on the extent to which they are enforced.

7.4.2 Traffic Police

Police traffic law enforcement policy may be regarded as a single act, the selection of the activities in which all the police agencies engage. One of the important problems

associated with traffic law enforcement is the provision of some mechanism for obtaining consistent policy decision from policy makers. Regarding this, Hanoi police have no serious problems.

The primary activities of the traffic police are based upon the objectives of making traffic flow smoother and safer and to eliminate traffic impediments. In traffic problems there is likely to be general agreement that both safety and efficiency are important. (In this sense, garbage control and the licensing of business should be shouldered by other appropriate agencies not by the Traffic Police).

Strengthening of traffic law enforcement could be a type of road safety education since drivers/riders would be forced to obey traffic rules and regulations. Here, strong enforcement does not mean "more effective". Maintenance of a fair level of enforcement by traffic police officers strongly influences drivers/rider, cyclist and pedestrian behavior and discipline. Apparently such fair enforcement by officers is not fully maintained.

A general good impression would be given by police officers if they observed the following guidelines:

(1) Equitable treatment.
(2) Softer attitude to the public in contact.
(3) Listen carefully to what drivers/riders or pedestrians say.
(4) Avoid treating traffic offenders as criminals.

In practice, the enforcement system in Hanoi is deficient. Lack of police officer activities on the street, particularly at intersections, cause few traffic offenders to be apprehended and even fewer to be penalized, leading to widespread disregard and contempt for basic traffic regulations. Also the lack of appropriate guidance or enforcement by police officers is one of the issues relating to most drivers/riders deliberately ignoring the rules, since they believe their conduct is almost the accepted manner. Thus, insufficient traffic law enforcement encourages drivers/riders to think that it is not necessary to obey traffic rules and regulations.

Most mishaps or accidents can be avoided through a proper attitude and traffic behavior encouraged by training, education and enforcement. Formulation of good driving/riding habits will take five to ten years along with painstaking and continuous effort by the related agencies. Particularly, traffic police officers should assist road users, including pedestrians, to help them to observe rules and good manners.

Police accident control policies must be carried out with limited resources which must be used effectively. An adequate accident reporting and evaluation system should be set up to provide suitable data and accident statistics including their causes, location and time.

Shortage of adequate traffic police equipment, such as vehicles and radio communication equipment and the lack of adequate and specialized training for traffic police personnel are urgent issues.

In August 1995, a so-called traffic management campaign was conducted. Obstacles on the streets were removed and the traffic rules were better applied than before through comprehensive law enforcement. It is also proposed that training courses on traffic regulations will be provided for households in the near future. Hanoi police reported that: since 1992 the number of traffic fatalities was 19,000 and injuries 53,000 and the campaign resulted in a dramatic reduction of about 19% in the traffic accidents. Also many illegal drivers/riders have decided to become legal drivers and have applied for licenses.

7.4.3 Licensing

In many of the developing countries, work is going on to prevent road traffic accidents, to reduce the seriousness of resulting injuries and to penalize those who commit severe traffic violations frequently or are frequently involved in accidents. But in Hanoi, a "Free riding" or "Me first policy" which commonly prevails.

To obtain a drivers license in Vietnam the applicant must be 18 years of age or older, physically and mentally fit to drive a motor vehicle and literate. License processing in Hanoi has been undertaken at several centers which test the skills and knowledge of applications, But there are inefficiently maintained and the quality of test is poor. Proper testing should be implemented.

At present, obtaining a license for a motorcycle of more than 50cc is easy. However, to keep up with the increasing demand for large motorcycles among young Vietnamese, future demand for 110cc - 120cc motorcycles will increase. The motorcycle licensing system should be carefully reconsidered.

Operator licensing can be seen as a component of the education process. The matter of issuing, controlling and suspending the license to operate a vehicle on the roadway is central to achieving safety among road users. In this aspect, the current licensing system in the Vietnam aims only for formality. In the case of truck, bus and other public utility vehicle operators, there should be an even more strict and exact standard for knowledge and performance before licensing. No professional drivers license scheme is adopted in Vietnam.

7.4.4 Accident Report System and Database

Accidents are viewed as a multiphase process where the critical situations at every stage are partly the result of actions and circumstances. Human factors are generally to blame when it comes to traffic accidents and other elements can be ignored or are not as important. This outlook is very much in evidence in the recording of accidents, where the human factor is blamed more often than short comings of the vehicle or the road.

The frequency with which the various combinations of vehicles and road users are involved in accidents varies from road to road depending on characteristics of the roads and traffic using them. Here in Hanoi, the type of accident data for example between motorcycle and motorcycle or between motorcycle and bicycle are not clear enough at moment. Similarly, accident investigation should be handled more effectively and

quickly by police. Such tools as cameras and video to record accident circumstances and a proper investigation format would be desirable. Training in investigation techniques is also indispensable.

It is a known that many vehicle traffic accidents are not reported. Hanoi is not n exception. Traffic accidents involving fatal or severe injuries are normally reported, while those resulting in slight injuries and limited property damage are seldom reported. Accidents involving private vehicles, especially small size motorcycles and bicycles, are frequently not reported. Many drivers/riders prefer to settle the case privately.

Motorcycles and bicycles are inherently more vulnerable than four wheels vehicles. For example, the fatality rate among motorcycle riders is many times higher than that for car drivers or passengers. In the light of those high accident rates, it is deemed urgent that appropriate measures are identified and steps taken to reduce the number of traffic accidents.

The accident data collection and processing system is out of date and may cause ambiguity and data unreliability. Since the availability of reliable data is required for further analyses as the first step toward developing workable countermeasures, there is a strong need to improve accident data management schemes. In future, computer based systems would also have on-line connections between local police stations to deliver the data to the central computer located at Police Headquarters.

In Vietnam the average economic cost of a fatal accident or serious injury the average accident involving only slight injury costs and the average accident involving damage only to vehicles and property costs are unknown.

There is a "lost output rate" estimated from US data as shown in the following table:

Table 7-4-1 Loss Output Rate

Types of Accident	Loss Output Rate
Property damage only (PDO)	1.0
Slight injury	2.3
Serious injury	7.0
Fatal	170.0

According to the lost output rate, fatal accident cost is 170 times greater than that for a properly damage only accident. The total economic loss due to accidents is high in Hanoi, therefore such information should be given to the public through a mass media campaigns.

7.4.5 Road Safety Campaigns

In a nation relatively new to the dynamic transport society, part of the problem may be a lack of understanding on the part of drivers/riders and pedestrians of the problems and limitations of the other road users.

A campaign is one of the tools to provide this understanding. Campaigns may be classified as follows:

1. Campaign through mass media: This campaign aims to inform the public of the facts on congestion and accidents and to draw attention to disciplined safe driving/riding. This is considered effective but expensive.
2. On-road campaign: This aims to draw attention to traffic safety or to give warning on unsafe activities on the road. Intensive police patrols are required during rush hours.
3. Campaign through distributing pamphlets.
4. Campaign by the private sector.

The theme for a safety campaign must be specific and unambiguous to be measurable and effective. There are two main sources in the choice of topics :

- Changing road users' behavior, particularly for motorcycle riders.
- Encouraging the use of innovations.

At the moment, such efforts to promote safety and comfort in the traffic environment by campaign techniques are not well developed in Hanoi. From the psychological point of view, unless the other two E's; Namely Engineering and Enforcement, go together, the general public do not pay any attention and do not alter their behavior or attitude. A basic assumption for safety campaigns is that awareness leads to obedience. Ignorance of the law or traffic regulations is an easy excuse which the experiences of developed countries tend to disprove.

Apparently several organizations are currently undertaking various activities. Shell Vietnam in conjunction with the MOTC has launched a safety campaign to raise the awareness of traffic regulations. This was initiated with 100,000 official traffic regulation books being printed and distributed throughout the country. Shell has also product a public service video for television stations to help to reduce more than 30,000 road accidents (Each year about 5,600 people are killed and 13,800 injured).

One of the inexpensive and desirable features of safety campaigns is to use signs for safety slogans and tips. The safety messages that arise in Hanoi would also be paid for by private sector also. Prominent locations and placements make the signs eye-catching.

7.5 Traffic Safety facilities

The current issues on safety facilities in Hanoi are as follows:

Coordination with infrastructure: Road user's behavior on street is closely related with traffic infrastructure. We can not simply say "Obey traffic rules" where no reliable markings and signs are available. In Hanoi, lack of these safety facilities may cause a deterioration in road users behavior.

At the same time, public has little idea of the economic loss of death or incapacity resulting from road accidents. People accept accidents as unpreventable or unavoidable. Thus, they do not feel that they can do anything and do not change their behavior in traffic situations.

Recently three main attempts were made to improve the traffic conditions in addition to traffic management schemes:

1. Rationalizing the use of the road network by introducing one way streets (Hoan Kiem district, for example);
2. Restraining access for some vehicles (Heavy and slow moving vehicles like cyclos and lamboros) through some congested areas;
3. Control of traffic movement.

7.5.1 Signs and Markings

In order to attain safe, smooth and efficient traffic flow through the application of traffic management schemes, traffic signs and markings as well as traffic signals are essential tools which should be consistently applied. In most traffic management schemes, regulations are generally not applied to bicycles, cyclos and pedestrians. In Hanoi, the scheme should be aimed at these uncontrollable targets since they are a high percentage of road users.

As far as traffic markings are concerned: dotted center lines; continuous center lines; double continuous center lines which mean no passing; lines from pedestrian crossings; and arrow marks designating lanes for vehicles are seldom seen.

At most of the intersection approaches, no clear lane or other markings are drawn. Horizontal overhead signs are not appropriate, due to scarce four wheel vehicles and environment protection. At present, some signs and markings are inappropriate or are already obsolete and have not been updated. This confusion is exacerbated by traffic enforcers who interpret signals, signs and markings differently from location to location. Lane markings and guide markings (arrows) are not maintained due to muddy roads caused by vehicles from rural areas near Hanoi where road paving is scarce. To cure this situation road cleaning by the responsible agencies should be undertaken on heavily trafficked roads.

Due to budget constraints, repainting works could not be carried out in a satisfactory and comprehensive manner. As the result, many marked locations are found to be

devoid of any road markings (counter flow traffic is a major source of danger). Thus, drivers/riders behavior is getting worse, partly due to irregularity and insufficiency of traffic safety facilities. Insufficiency of warning signs is one of the causes for unexpected behavior by motorists, while lack of regulating signs leads to controversies and difficulties in enforcing reckless driving.

Center marking, with broken lines drawn in some places but with continuous lines for side markings bordering shoulders, which are seen in other countries, are not observed in Hanoi. At the same time, road users are not well-informed on the meaning of traffic signs and markings.

7.5.2 Traffic Signals

A survey was conducted by the Study Team on existing markings and signs on Hue, Hang Bai and Ba Trieu Streets(4km, total length). The results are shown in Fig. 7-5-1. Generally prewarning sign and pedestrian crossing markings are insufficient. Guide signs and land mark signs are few. Road markings are poorly maintained.

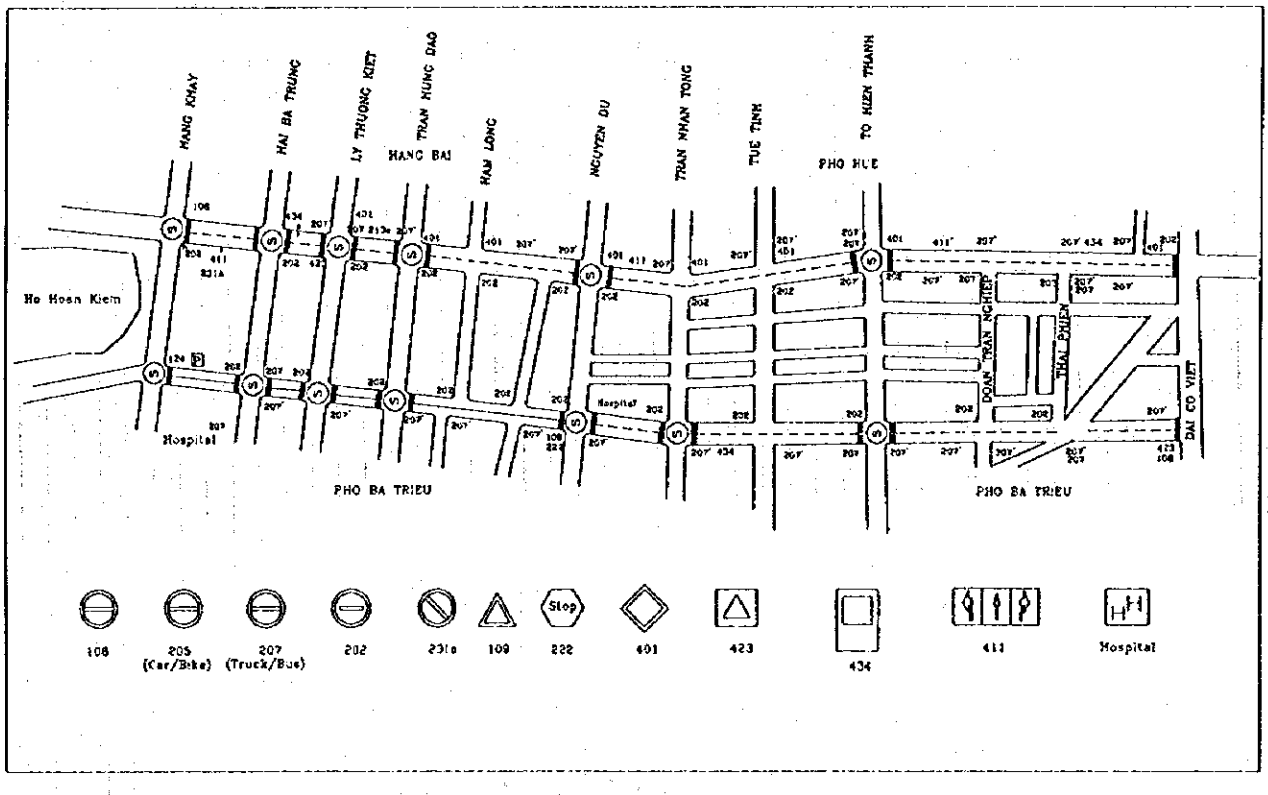


Fig. 7-5-1 Existing Road Markings and Signs

In Hanoi, the roads are poorly maintained. Maintenance has to compete for funds with new road construction. Often, the pressure is in favor of constructing new roads even while existing ones fall effectively into disuse due to lack of maintenance.

The installation of signals generally shows that they have been highly effective not only in reducing the number of accidents but to improve the flow of traffic in Hanoi. Without

signal installation there is no control at intersections where motorcycles, cars and bicycles are arriving from different directions. It is vital to install traffic signals even at the level of fixed time cycles, particularly at T type or multi-legged intersections.

A newspaper reported recent signal installation by France in Hanoi as follows:

" The project, to be implemented in three stages, was agreed in March 1995 between the Vietnamese and French governments. The initial stage cost more than USD 2.4 million: two thirds funded by French Overseas Development Agency (ODA) and the rest coming from Vietnamese Government. These will operate from 6:30 a.m. to 11 p.m. every day with a yellow light blinking through the night to let traffic know there is an intersection coming up. All traffic activities at the intersection are monitored by computerized Traffic Control Center located at Hang Bai 40 through a camera system installed together with the signal lights".

From the previous experience data showed that the installation of signal for motorcycles, automobiles, cyclists, and pedestrians has been effective in improving traffic flow and in reducing accidents. The French contribution for installation of traffic signals in the CBD area is mostly welcomed. Subsequent phases which will cover the remaining 115 intersection and are expected to continue up to the year 2000, but the financing system is still not yet confirmed.

Travel times will also be reduced by the installation of traffic signals because traffic flow becomes more smooth and faster and unnecessary speeding up is minimized, without choking of the intersection. This is particularly true for four way intersections. Although current signal installations suffer from low height and poor visibility but as the majority of the traffic flow is bicycles and motorcycles no serious problems have occurred.

7.5.3 One-way Systems

One-way streets should be introduced mainly on a trial and error based to alleviate congestion which takes place at critical intersections. The irregular "Reversible one-way system" at Doi Can street is still effective.

7.5.4 Parking

As far as parking is concerned, at present, there seems to be sufficient parking space if "off street" parking is included, although some wholesale areas and retail areas, particularly in old city area, are very congested with commercial vehicles including cyclos which hamper the smooth flow of traffic. More than 10,000 cars regularly register at parking lots and thousands of vehicles from surrounding areas also need a place to park overnight. Some of the 120 car parks which are available do not meet the standard.

At the same time, the number of taxis is growing. The serious lack of parking space is increasingly apparent. According to Hanoi Transport and Road Work Service data, there are 58,000 four wheel vehicles in Hanoi. This figure is expected to rise to 80,000 by the year of 2,000. Present parking space accounts for only 20% of this number.