

**DOTC\*MMDA\*DPWH\*NEDA\*PNP-NCR\*HUDCC\*UP-NCTS\*EMB  
Japan International Cooperation Agency (JICA)**

**METRO MANILA  
URBAN TRANSPORTATION  
INTEGRATION STUDY**

**TECHNICAL REPORT NO. 4**

**TRANSPORTATION DEMAND  
CHARACTERISTICS BASED ON  
PERSON TRIP SURVEY**

**March 1999**

**mmutis**

**MMUTIS STUDY TEAM**

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## **1. INTRODUCTION**

### **1.1 Background**

The Japan International Cooperation Agency (JICA) conducted a comprehensive urban transportation study in Metro Manila from October 1982 to September 1985. This study was the JICA Update on Metro Manila Study on Urban Transport, or JUMSUT. The study resulted in the compilation of one of the most comprehensive transportation databases on Metro Manila, which was used extensively by the Department of Transportation and Communications (DOTC), the National Center for Transportation Studies (NCTS), formerly known as Transport Training Center, and other government agencies.

The ongoing Metro Manila Urban Transportation Integration Study (MMUTIS) intends to update the database, and to this end, a large-scale Person Trip Survey had been conducted from July to December 1996. The results have already been coded, compiled and analysed. This new database will contribute largely to enhance planning and education capabilities in the Philippines.

This Technical Report presents the methodology of data processing and selected results of analysis (for details of the field survey, refer to the Survey Report).

### **1.2 Outline of Person Trip Survey**

The objective of the Person Trip Survey is to understand the movement of people on a particular day in connection with their socio economic characteristics.

#### **(1) Coverage**

The survey coverage was Metro Manila and the 17 adjoining municipalities of Bulacan, 14 municipalities of Cavite, 6 municipalities of Laguna and 14 municipalities of Rizal. All barangays in the study area were sampled (except for some where problems of peace and order and accessibility existed). The survey covered all 4 years old and above of the sampled households. Inside Metro Manila, about 50,400 households (2.5 percent) were interviewed, and in the adjoining areas, about 11,000 households (1.1 percent).

#### **(2) Survey Method**

In order to determine the households to be interviewed, an “area sampling” was adopted in the absence of complete household listings. First, the target number of households by zone was determined, then streets were selected randomly, and finally, interviews were conducted in households along the selected streets at a certain interval until the target number was reached. Direct interviews were conducted with each of the household members, and their answers were entered in the questionnaires by the interviewers. If not all the household members 4 years old and above were present during the first visit, the household was visited again at a later time and date.



(3) Survey Items

The information to be produced by this survey are listed and described as follows:

- (a) **Household Information:** covers the socio economic characteristics of household members, household structure, car ownership, income level location of residence, etc.
- (b) **Household Member Information:** covers the socio economic characteristics of household member 4 years old and above. These include age, sex, occupation, work and/or school address, income and so on.
- (c) **Trip Information:** covers the characteristics of trips made by residents of the area, including origin and destination, trip purpose, travel mode, transfer departure and arrival time, and so on.
- (d) **Information on Vehicle Users:** covers vehicle use patterns during the implementation of the Unified Vehicular Volume Reduction Program (UVVRP) as well as parking practices.
- (e) **Information on the Specially Abled and Elderly People:** covers trip patterns of the disabled and elderly people.
- (f) **Environmental and Leisure Information:** covers characteristics of leisure trips of residents of the area as well as their environmental opinion which includes awareness and views for improvement and willingness to contribute to environmental conservation.

Usually, a Person Trip Survey covers a), b), and c) only. However d), e), and f) above were included in order to obtain additional information useful to determine policy directions.

(4) Survey Schedule

The Person Trip Survey was conducted according to the following schedule:

Schedule	Activity
July 1996	Preparation (training, sampling etc.)
August- December, 1996	Interview
January- February 1996	Error Check

### 1.3 Premises of Analysis

#### 1.3.1 Scope of Analysis

Trip information of the study area are classified into those of residents and non-residents. The MMUTIS Person Trip Survey covered residents, both in Metro Manila and in adjoining areas. Hence, there is sufficient trip information on residents of the study area. For non-residents, however, trip information is limited only to those obtained from the cordonline survey. Because of this reason, the analysis is made only for residents of the study area (Metro Manila and its adjoining area).

The MMUTIS Person Trip Survey was carried out to include household members of age group 4 years old and above, unlike in JUMSUT where the coverage was 7 years old and above. Therefore, to compare MMUTIS with JUMSUT, the scope of analysis had to be adjusted. It should be noted that the comparison presented in Chapter 10 of this report was for Metro Manila residents of age group 7 years old and above.

#### 1.3.2 Zoning

The MMUTIS zoning system was developed by sub-dividing the JUMSUT zoning, as shown below:

Study Area <ul style="list-style-type: none"> <li>· Metro Manila (265)</li> <li>· Adjoining Area (51)</li> </ul>	316 zones
External Area	78 zones
<b>Total</b>	<b>394 zones</b>

The above zoning was used in all MMUTIS field surveys. However, this fine zoning was integrated in several ways for graphic presentation, analysis, etc. as follows:

- (1) Large Zones (24 zones): The 17 cities/municipalities in Metro Manila stand for 17 zones, for 4 provinces in the adjoining area, 4 zones, and for external area, 1 zone.
- (2) Medium Zones (29 zones): Based on the Large Zoning above, Manila was sub-divided into 4 zones, Quezon into 4 zones, and Caloocan into 2 zones.
- (3) Analytical Zones: This zoning was used only for compiling and incorporating the screenline/cordonline survey results consistent with the Person Trip Survey. They are as follows:
  - (a) Screenline Zones: The study area was divided into 4 zones defined by the two (2) T-shaped screenlines.
  - (b) Cordonline Zones: The study area was divided into 7 zones defined by the inner and outer cordonline, and by direction: north, east and south (refer to Figure 2.5).

### **1.3.3 Travel Mode and its Integration**

There are two ways to define a trip: in terms of linked trip and unlinked trip. The former is an entire trip of a person for a single purpose, while the latter is a part of the former segregated by mode of travel. In other words, a linked trip is a chain of unlinked trips by different individual modes of travel. Hence, in order to define the representative mode of travel, there is a need to determine the priority among various modes of travel.

In JUMSUT, the priority was defined based on the following considerations:

- (a) Public mode has a higher priority than private mode.
- (b) Line-haul mode has a higher priority than feeder mode.

Considering the above, the priority was determined in MMUTIS as shown in Table 1.1.

**TABLE 1.1**  
**PRIORITY FOR DEFINITION OF REPRESENTATIVE TRAVEL MODE**  
**AND INTEGRATION OF TRAVEL MODES**

Surveyed Category Number	Mode	Priority for Representative Mode		Integration of Modes		
		JUMSUT	MMUTIS	5 Mode Type (*1)	9 Mode Type (*2)	Public/Private (*3)
1	Walk	16	19	5	9	3
2	Pedicab	-	16	5	9	3
3	Bicycle	-	17	5	9	3
4	Motorcycle	14	15	5	9	3
5	Tricycle	9	8	5	4	1
6	Jeepney	8	7	2	3	1
7	Minibus	7	6	3	2	1
8	Standard Bus	6	5	3	2	1
9	Taxi	10	10	1	6	2
10	HOV Taxi	-	9	1	6	2
11	Car/Jeep	13	14	1	5	2
12	School/Tourist Bus	4	4	3	2	1
13	Utility Vehicle	12	13	1	5	2
14	Truck	11	12	4	7	2
15	Trailer	-	11	4	7	2
16	LRT	3	3	5	1	1
17	PNR	2	2	5	1	1
18	Water Transport	1	1	5	8	1
19	Others	15	18	5	8	2

Note: Integrated travel modes are as follows:

(*1)		(*2)	
No.	Mode	No.	Mode
1	Car	1	Train
2	Jeepney	2	Bus
3	Bus	3	Jeepney
4	Truck	4	Tricycle
5	Others	5	Car
(*3)		6	Taxi
		7	Truck
		8	Others
		9	Walk
No.	Mode		
1	Public		
2	Private		
3	Walk		

## **2. CREATION OF PERSON TRIP MASTER FILE**

### **2.1 Introduction**

The data processing pertinent to the Person Trip Survey can be roughly divided into four (4) parts; expansion, screenline adjustment, cordonline adjustment and adjustment by other surveys as presented in Figure 2.1.

#### **(1) Expansion**

Person Trip Survey is a sample survey, and needs expansion in order to represent the characteristics of the whole population. The expansion is in general related closely to the methodology of sampling. In MMUTIS, several means of expansion had been tested, and the one that was considered most accurate was selected.

#### **(2) Screenline Adjustment**

This adjustment first calculates the traffic volume by vehicle type crossing the screenlines from the expanded person trip results, and then compares them with the actually counted traffic volume on screenlines. The initially identified expansion factors are then adjusted based on this comparison. Although the details are explained hereafter, the traffic by non-residents, average occupancy by vehicle type, and the influence of UVVRP (color coding) are the major factors to be taken into account.

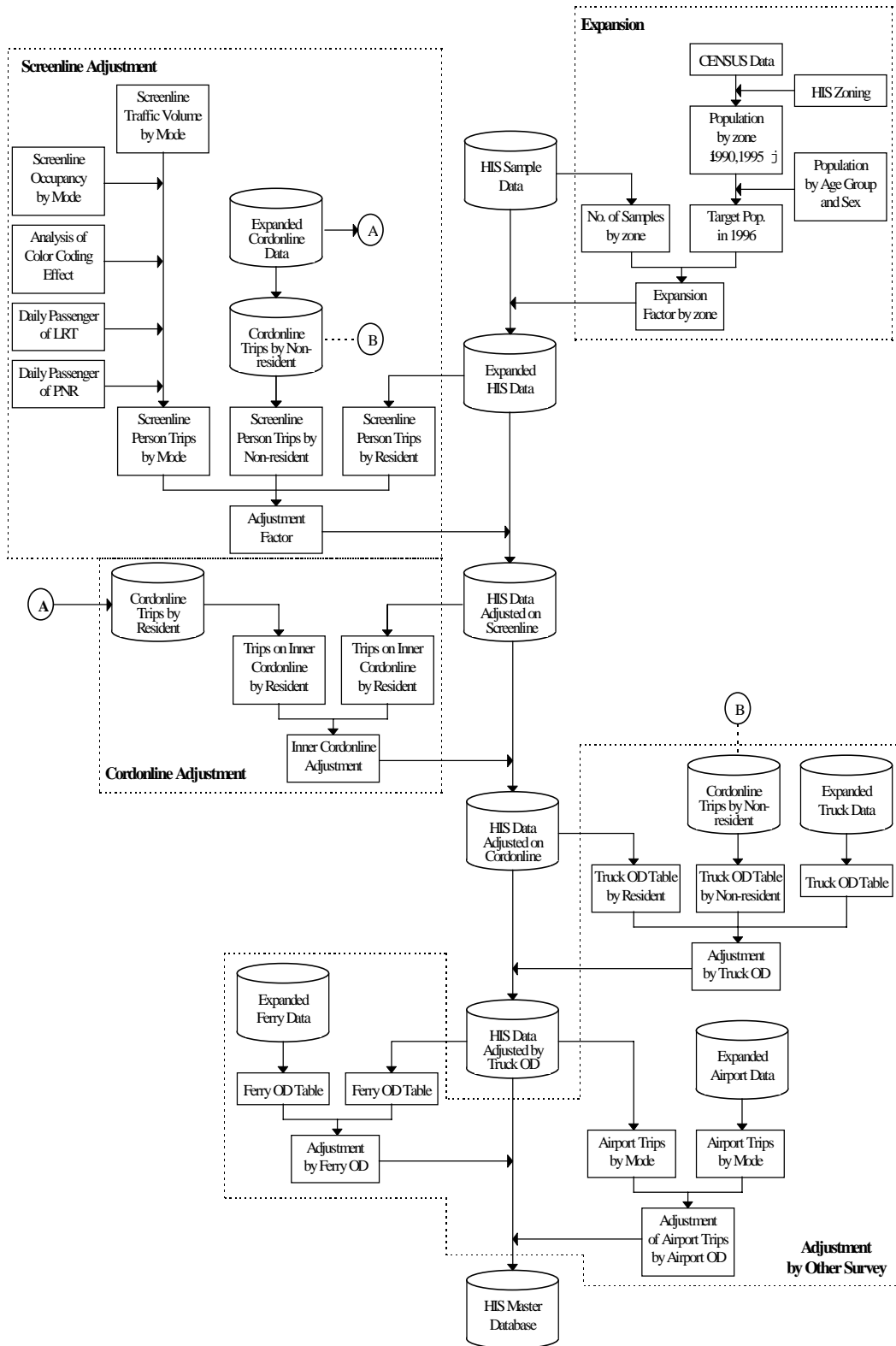
#### **(3) Cordonline Adjustment**

The purpose of this adjustment is two-fold; creation of OD matrices of non-residents and adjustment of expansion factors for the trips of residents crossing the cordonlines. Since MMUTIS has two (2) cordonlines in a concentric pattern, data processing becomes more complicated than usual.

#### **(4) Adjustment by Other Surveys**

This adjustment involves doing further calibrations based on other surveys including Truck Survey, Airport Survey and Ferry Survey (a part of the cordonline survey).

**FIGURE 2.1**  
**CREATION OF PERSON TRIP MASTER FILE**



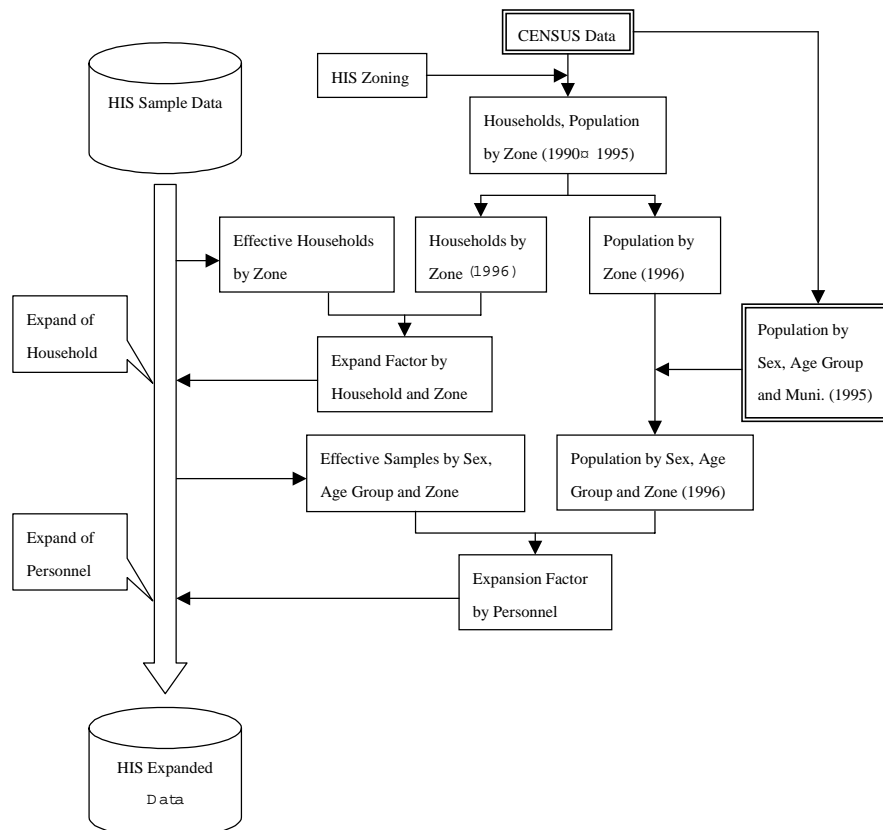
## 2.2 Expansion

In the process of expansion, the bias of the sampled data can be eliminated if the expansion factor is set according to the distribution of known attributes, so that no statistically significant difference exists.

In the MMUTIS Person Trip Survey, sampling was done by household. If there is a bias in the household size and in the sex/age structure of households, the expanded result will show a deviation from the actual sex/age structure. Taking this into account, the expansion was done independently based on the number of households and on the population by sex and by age group as follows:

- (a) Calculate population and number of households by zone based on the 1990 and 1995 census.
- (b) Extrapolate population and number of households to obtain 1996 figures based on the 1990 and 1995 census data.
- (c) Compare the estimated total number of households by zone and the effective number of interviewed households to obtain the expansion factor for households.
- (d) Compare the estimated total population and the effective number of interviewed persons by zone, sex, and age group to obtain the expansion factor for population by sex/age.

**FIGURE 2.2**  
**FLOW CHART OF EXPANSION PROCESS**



## 2.3 Screenline Adjustment

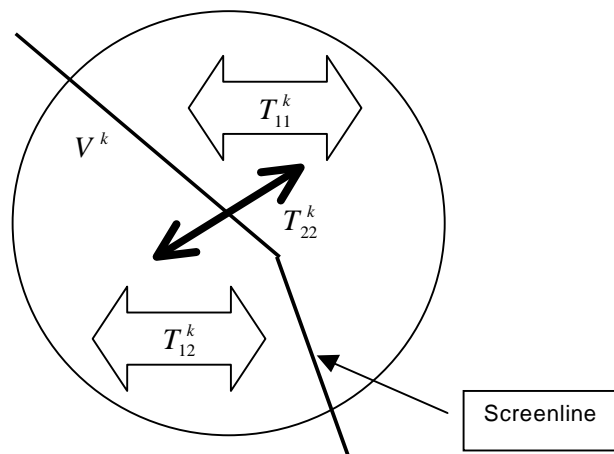
During the process of screenline adjustment, the following issues had to be discussed:

- Since there are two (2) screenlines, the adjustment factors cannot be determined uniquely for each of the screenlines.
- The Person Trip Survey deals with person trips while the screenline survey counts vehicular traffic.
- The Person Trip Survey deals with the traffic of residents while the screenline count includes the traffic made by non-residents.
- The Person Trip Survey deals with the travel behavior of people on a weekday that is not influenced by UVVRP (color coding). Hence, in order to compare this with the actual traffic count on screenlines, the impact of color coding should be eliminated.

### 2.3.1 Concept of Screenline Adjustment

The screenline adjustment aims to adjust the person trip data by multiplying the ratio between the screenline traffic and the person trip data ( $V^k / T_{12}^k$ ) with all the person trip data ( $T_{11}^k, T_{12}^k, T_{22}^k$ ), as shown in Figure 2.3.

**FIGURE 2.3**  
**CONCEPT OF SCREENLINE ADJUSTMENT**



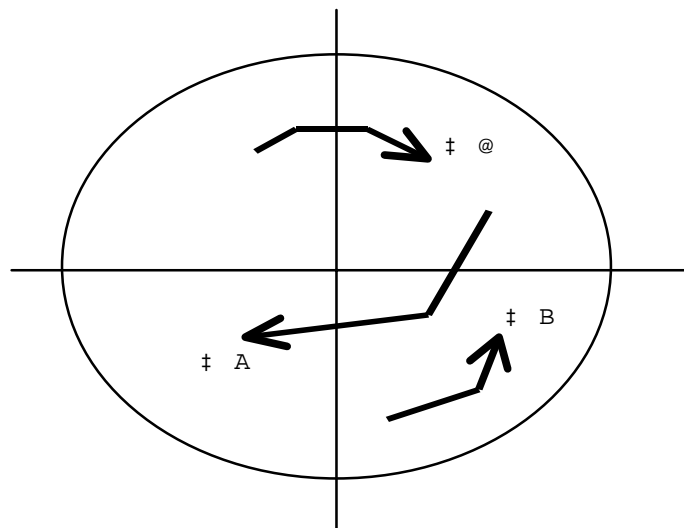
- $V^k$  : Screenline traffic of vehicle type k  
 $T_{12}^k$  : Person trip traffic crossing the screenline of vehicle k  
 $T_{11}^k, T_{22}^k$  : Person trip traffic not crossing the screenline of vehicle type k



In MMUTIS, however, there are two (2) T-shaped screenlines, as mentioned earlier. Therefore, there will be a contradiction for the traffic crossing the screenline twice if an adjustment factor is determined for each of the screenline. In order to avoid this conflict, the process explained in Figure 2.4 was taken:

- 1) For trips crossing the screenline once, the ratio of the counted volume to the estimated number of unlinked trips was used for expansion of linked trips.
- 2) For trips crossing the screenline twice, the average of the two ratios of the counted volume to the estimated number of unlinked trips was used for expansion of linked trips.
- 3) For trips not crossing the screenline, the ratio of the total counted volume to the estimated total number of unlinked trips on all screenlines was used for expansion of linked trips.

**FIGURE 2.4**  
**TYPE OF TRIPS IN RELATION TO SCREENLINES**



### 2.3.2 Average Occupancy by Vehicle Type

In order to compare the counted vehicular traffic volume and the estimated number of person trips, the average occupancy or average number of persons per vehicle must be determined by vehicle type. The average occupancy was surveyed by vehicle type on screenlines at the same time as the traffic counts (refer to Table 2.1).

**TABLE 2.1**  
**AVERAGE OCCUPANCY BY VEHICLE TYPE**  
**(2 HOURS, BOTH DIRECTIONS)**

Mode	Average Occupancy
Standard Bus	50.62
Minibus	28.96
Jeepney	14.98
Tricycle	2.64
Pedicab	1.38
Car/Jeep	1.75
Taxi	2.17
HOV Taxi	4.49
Utility Vehicle	3.12
Truck/Trailer	2.07
Private Bus	20.72
Motorcycle/Bicycle	1.12
Others	1.36

### 2.3.3 Screenline Traffic by Non-Residents

Traffic volume crossing the screenlines includes that of non-residents. In order to exclude the non-resident traffic from the screenline traffic, the OD matrices of non-residents must be identified. These could be obtained from the cordonline survey, and its cross-screenline traffic was subtracted from the screenline traffic. (For more details, see Section 2.4.)

### 2.3.4 Elimination of Bias Imposed by Color Coding

As mentioned earlier, the influence of color coding should be eliminated before comparing the actual traffic on screenlines with the cross-screenline traffic estimated from the Person Trip Survey.

In the MMUTIS Person Trip Survey, some ancillary interviews have been conducted to quantify the influence of color coding. Tables 2.2, 2.3, and 2.4 show the changes of trip pattern, the alternative travel mode, and the public transportation modes due to color coding, respectively.

**TABLE 2.2**  
**CHANGES IN TRIP PATTERN DUE TO COLOR CODING**

Answer	To Work		Other Purposes	
	No.	%	No.	%
No change	1,877	45.4	556	18.1
Stay home mostly	1,055	25.5	442	14.4
Change time of travel	363	8.8	1,258	40.9
Change usual car	794	19.2	755	24.5
Others	48	1.2	68	2.2
<b>Total</b>	<b>4,137</b>	<b>100.0</b>	<b>3,079</b>	<b>100.0</b>

**TABLE 2.3**  
**ALTERNATIVE TRAVEL MODE DUE TO COLOR CODING**

Answer	To Work		Other Purposes	
	No.	%	No.	%
Use another family veh.	406	30.4	256	27.3
Share a ride	175	13.1	83	8.8
Use public transport	442	33.1	380	40.5
Use taxi	288	21.5	204	21.7
Use other modes	26	1.9	15	1.6
<b>Total</b>	<b>1,337</b>	<b>100.0</b>	<b>938</b>	<b>100.0</b>

**TABLE 2.4**  
**PUBLIC TRANSPORTATION MODES USED DUE TO COLOR CODING**

Answer	To Work		Other Purpose	
	No.	%	No.	%
Pedicab	2	0.6	0	0.0
Tricycle	17	4.8	7	2.5
Jeepney	215	61.3	144	51.8
Minibus	16	4.6	12	4.3
Standard bus	91	25.9	101	36.3
LRT	10	2.8	14	5.0
PNR	0	0.0	0	0.0
<b>Total</b>	<b>351</b>	<b>100.0</b>	<b>278</b>	<b>100.0</b>

Tables 2.2, 2.3 and 2.4 above can be converted into all-purpose weighted average as shown in Tables 2.5, 2.6 and 2.7.

**TABLE 2.5**  
**CHANGES IN TRIP PATTERN DUE TO COLOR CODING**  
**(WEIGHTED AVERAGE)**

Answer	%
No change	26.5
Stay home mostly	17.8
Change time of travel	30.9
Change usual car	22.9
Others	1.9

**TABLE 2.6**  
**ALTERNATIVE TRAVEL MODE WHEN CAR CANNOT BE USED**  
**(WEIGHTED AVERAGE)**

Answer	%
Use another family vehicle	28.2
Share a ride	10.2
Use public transport	38.2
Use taxi	21.7
Use other modes	1.7

**TABLE 2.7**  
**PUBLIC TRANSPORTATION MODE DUE TO COLOR CODING**  
**(WEIGHTED AVERAGE)**

Answer	%
Pedicab	0.2
Tricycle	3.2
Jeepney	54.7
Minibus	4.4
Standard bus	33.1
LRT	4.4
PNR	0.0

Based on the above tables, the major impacts of color coding can be summarized as follows:

- (a) 23 percent of car users are forced to change their mode of travel on a restricted day.
- (b) 38 percent of this 23 percent, or 9 percent of restricted car users, share a ride. Car traffic volume decreases by this percentage.
- (c) 38 percent of this 23 percent, or 9 percent of restricted car users, shift to public transportation. Car traffic volume decreases by this percentage and public transportation traffic increases accordingly. Out of this 9 percent, 55 percent or 5 percent of restricted car users shift to jeepney, and 33 percent, or 3 percent of restricted car users, shift to standard bus.

- (d) 22 percent of this 23 percent, or 5 percent of restricted car users, shift to taxi. Car traffic volume decrease by this percentage and the modal share of taxis increases accordingly.

If color coding were not in effect, a reverse phenomena to the above would occur. Based on Table 2-8, in calculating the number of restricted car users per weekday (1/2 of total), the adjustment of screenline traffic was done as follows:

- (i) Car traffic increase due to the shift from car sharing to single car use.

$$381 \times 0.088 = 33.5 \text{ (000 trips/day)}$$

- (ii) Car traffic increase due to the shift from jeepney to car.

$$381 \times 0.048 = 18.3 \text{ (000 trips/day)}$$

- (iii) Car traffic increase due to the shift from standard bus to car.

$$381 \times 0.029 = 11.0 \text{ (000 trips/day)}$$

- (iv) Car traffic increase due to the shift from taxi to car

$$381 \times 0.050 = 19.1 \text{ (000 trips/day)}$$

**TABLE 2.8**  
**NUMBER OF CAR TRIPS RESTRICTED BY COLOR CODING**

Mode	Screenline Trips	Trips by Non-Resident	Trips by Resident
Car/Jeep	937,299	14,880	922,419
Utility Vehicle	874,124	27,039	847,085
<b>Total</b>	<b>1,811,423</b>	<b>41,919</b>	<b>1,769,504</b>
Private Vehicle Potential Demand	1,863,987	43,135	1,907,123
1/5 of above			381,425

### 2.3.5 Adjusted Screenline Traffic

Table 2-9 shows the result of the screenline adjustment done according to the methodology explained previously.

**TABLE 2.9  
 RESULT OF SCREENLINE ADJUSTMENT**

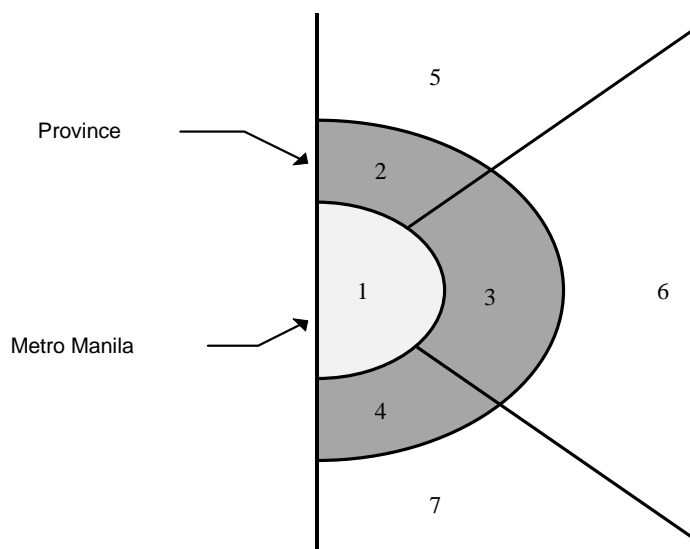
Mode	Person Trips on Screenline						Person Trips Calculated from HIS (f)	Screen-line Adjust. Value (e/f)	
	Screenline Survey		Effect of UVVRP (b)	Total Person Trips (c=a+b)	Trips by Non-resident (d)	Trips by Resident (e=c-d)			
	Counted by Direction	Total (a)							
Pedicab	2,544	5,152	7,696	0	7,696	0	7,696	18,230	0.42
Motorcycle	32,160	39,453	71,613	0	71,613	1,085	70,528	42,540	1.66
Tricycle	87,909	69,618	157,527	0	157,527	1,016	156,511	135,068	1.16
Jeepney	1,536,596	649,607	2,186,203	-18,300	2,167,903	35,440	2,132,463	1,839,392	1.16
Minibus	31,392	13,781	45,173	0	45,173	418	44,755	58,170	0.77
Standard Bus	770,542	1,614,019	2,384,561	-11,000	2,373,561	110,786	2,262,775	1,131,267	2.00
Taxi	330,852	291,827	622,679	-12,700	609,979	1,000	608,979	243,522	2.50
HOV Taxi	166,224	84,341	250,565	-6,400	244,165	216	243,949	118,620	2.06
Car/Jeep+UV	836,199	975,224	1,811,423	81,900	1,893,323	41,919	1,851,404	1,121,841	1.65
Private Bus	52,113	44,258	96,371	0	96,371	0	96,371	116,839	0.82
Truck/Trailer	149,346	144,912	294,258	0	294,258	7,861	286,397	20,437	14.01
Others	941	1,381	2,322	0	2,322	16	2,306	8,355	0.28
<b>All Vehicles</b>	<b>3,996,818</b>	<b>3,933,573</b>	<b>7,930,391</b>	<b>33,500</b>	<b>7,963,891</b>	<b>199,757</b>	<b>7,764,134</b>	<b>4,854,281</b>	<b>1.60</b>

## 2.4 Cordonline Adjustment

### 2.4.1 Creation of Resident and Non-Resident OD Matrices

The OD information collected on a sampling basis on the cordonlines were expanded as against the counted traffic volume and were compiled into OD matrices by survey station. In order to obtain OD matrices for non-residents, these station-wise OD matrices should be consolidated. For this purpose, an analytical zoning system was introduced as shown in Figure 2.5.

**FIGURE 2.5**  
**CORDONLINE ZONING**



According to this zoning, interzonal trips can be classified as presented in Table 2-10, based on the cordonline crossed and the number of times crossed. Incorporating station-wise OD matrices, OD pairs crossing the cordonline only once were summed. Those OD pairs crossing the cordonlines twice were summed and their averages taken for the traffic of the OD pair.

**TABLE 2.10**  
**CLASSIFICATION OF INTER ZONAL TRAFFIC TYPE**

Area	Zone No.	1	2	3	4	5	6	7
Metro-Manila	1		I - 1	I - 1	I - 1	I - 1 O - 1	I - 1 O - 1	I - 1 O - 1
Intermediate (North)	2			I - 2	I - 2	O - 1	O - 1	I - 2 O - 1
Intermediate (East)	3				I - 2	O - 1	O - 1	I - 2 O - 1
Intermediate (South)	4					I - 2 O - 1	I - 2 O - 1	O - 1
Outside (North)	5						O - 2	I - 2 O - 2
Outside (East)	6							I - 2 O - 2
Outside (South)	7							

Note: I - 1 : crossing the inner cordon once      O-1 : crossing the outer cordon once  
 O-2 : crossing the outer cordon twice      I - 2 : crossing the inner cordon twice

As a result, for both of the inner and outer cordonlines, OD matrices were produced for residents and non-residents. Logically, the values of the OD matrices should be the same for some OD pairs (e.g., 1-5, 1-6, 1-7 above) between the inner and outer cordonline OD matrices. However, due to the inevitable errors in the field surveys and the estimation procedures, there were some discrepancies between the two (2)

cordonlines. After evaluating the reliability of both by comparing the same OD pairs, the inner cordonline was taken for the resident OD matrix, and the outer cordonline for the non-resident OD matrices. Tables 2.11, 2.12, 2.13 and 2.14 show these non-resident OD matrices.

**TABLE 2.11  
 NON-RESIDENT OD MATRIX (CAR)**

Area	No.	1	2	3	4	5	6	7	Total
Metro Manila	1	0	188	999	89	9,322	1,249	7,048	18,895
Intermediate (North)	2	160	0	0	0	4,987	62	60	5,269
Intermediate (East)	3	889	62	0	165	832	2,150	7,434	11,532
Intermediate (South)	4	1,074	0	35	0	2,215	152	639	4,115
Outside (North)	5	18,038	4,008	874	318	0	5	281	23,524
Outside (East)	6	1,922	47	5,924	429	103	0	391	8,816
Outside (South)	7	9,029	0	8,704	400	156	196	0	18,485
<b>Study Area Total</b>		<b>31,112</b>	<b>4,305</b>	<b>16,536</b>	<b>1,401</b>	<b>17,615</b>	<b>3,814</b>	<b>15,853</b>	<b>90,636</b>

**TABLE 2.12  
 NON-RESIDENT OD MATRIX (JEEPNEY)**

Area	No.	1	2	3	4	5	6	7	Total
Metro Manila	1	0	199	332	121	0	665	1,296	2,613
Intermediate(North)	2	595	0	0	0	7,993	0	0	8,588
Intermediate (East)	3	1,925	0	0	0	482	8,691	14,528	25,626
Intermediate (South)	4	1,056	0	0	0	0	152	622	1,830
Outside (North)	5	0	6,159	1,275	238	0	0	0	7,672
Outside (East)	6	337	0	6,322	49	0	0	93	6,801
Outside (South)	7	719	38	10,170	780	0	102	0	11,809
<b>Study Area Total</b>		<b>4,632</b>	<b>6,396</b>	<b>18,099</b>	<b>1,188</b>	<b>8,475</b>	<b>9,610</b>	<b>16,539</b>	<b>64,939</b>

**TABLE 2.13  
 NON-RESIDENT OD MATRIX (BUS)**

Area	No.	1	2	3	4	5	6	7	Total
Metro Manila	1	0	8,171	485	35	181,190	4,289	26,300	220,470
Intermediate (North)	2	0	0	0	0	17,358	0	0	17,358
Intermediate (East)	3	6,492	0	0	0	5,753	3,658	2,135	18,038
Intermediate(South)	4	1,267	0	0	0	8,172	0	34	9,473
Outside (North)	5	38,800	2,580	2,648	0	0	162	840	45,030
Outside (East)	6	6,361	0	3,874	70	0	0	0	10,305
Outside (South)	7	36,057	0	7,521	71	202	90	0	43,941
<b>Study Area Total</b>		<b>88,977</b>	<b>10,751</b>	<b>14,528</b>	<b>176</b>	<b>212,675</b>	<b>8,199</b>	<b>29,309</b>	<b>364,615</b>



**TABLE 2.14**  
**NON-RESIDENT OD MATRIX (TRUCK)**

Area	No.	1	2	3	4	5	6	7	Total
Metro Manila	1	0	314	165	113	2,557	425	737	4,311
Intermediate (North)	2	306	0	179	0	2,107	0	193	2,785
Intermediate (East)	3	0	0	0	33	814	616	1,453	2,916
Intermediate (South)	4	218	0	0	0	422	86	90	816
Outside (North)	5	2,520	5,648	488	120	0	0	255	9,031
Outside (East)	6	293	0	585	42	0	0	89	1,009
Outside (South)	7	1,385	37	2,473	107	156	93	0	4,251
<b>Study Area Total</b>		<b>4,722</b>	<b>5,999</b>	<b>3,890</b>	<b>415</b>	<b>6,056</b>	<b>1,220</b>	<b>2,817</b>	<b>25,119</b>

**2.4.2 Adjustment of Person Trip Survey Results by Resident OD on Cordonline**

Using the resident OD matrices obtained from the inner cordonline, the results of the Person Trip Survey were adjusted in a manner similar to the screenline adjustment. Figure 2.6 shows the zoning used in this adjustment. In this figure, ①, ②, and ③ show the northern, eastern and southern sections of the inner cordonline.

**FIGURE 2.6**  
**CORDONLINE ZONING AND SECTIONS OF INNER CORDONLINE**

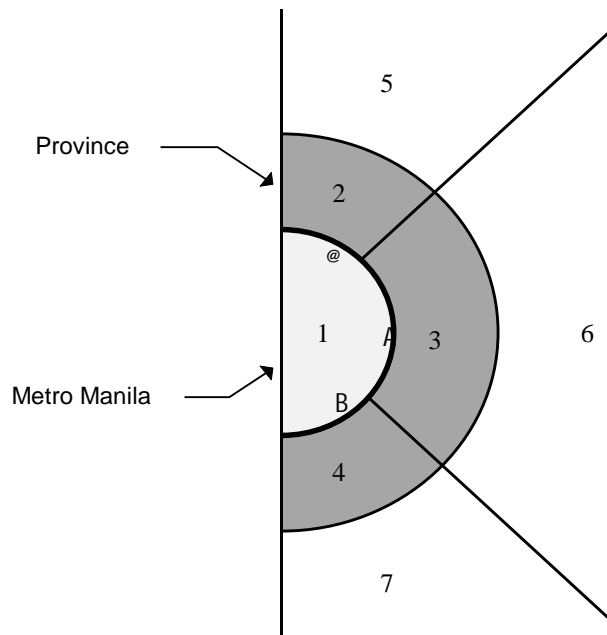


Table 2.15 presents the sections of the inner cordonline crossed by traffic for each OD pair.

**TABLE 2.15**  
**SECTIONS OF THE INNER CORDONLINE CROSSED BY OD PAIR**

Area	Zone No.	1	2	3	4	5	6	7
Metro-Manila	1		①	②	③	①	②	③
Intermediate (North)	2			① ②	① ③		① ②	① ③
Intermediate (East)	3				② ③	① ②		② ③
Intermediate (South)	4					① ③	② ③	
Outside (North)	5							① ③
Outside (East)	6							② ③
Outside (South)	7							

Legend: ① : northern section  
 ② : eastern section  
 ③ : southern section

On each of the inner cordonline section, the traffic volume estimated from the Person Trip Survey was compared with the results of the resident OD matrices. Tables 2.16 and 2.17 show the results of comparison.

**TABLE 2.16**  
**RESULT OF ESTIMATED TRAFFIC VOLUME OF PERSON TRIP SURVEY OVER INNER CORDONLINE OD MATRICES (METRO MANILA RESIDENTS)**

Type of Vehicle	Screenline Section		
	North	East	South
Car	1.342	1.131	0.909
Jeepney	3.591 *	2.014 *	1.573 *
Bus	2.055 *	1.384	1.519
Truck	0.472 *	0.631	0.697

**TABLE 2.17**  
**RESULT OF ESTIMATED TRAFFIC VOLUME OF PERSON TRIP SURVEY OVER INNER CORDONLINE OD MATRICES (RESIDENTS OF ADJOINING AREA)**

Type of Vehicle	Screenline Section		
	North	East	South
Car	0.258 *	0.906	0.444 *
Jeepney	0.211 *	1.100	0.626
Bus	0.460 *	0.668	0.247 *
Truck	0.078 *	1.952 *	0.621

For the values with an asterisk in Tables 2.16 and 2.17, the OD matrices worked out from the Person Trip Survey had been adjusted.

## 2.5 Other Related Surveys

The results of the Person Trip Survey were further tested for specific OD pairs as against the results of individual surveys including the following: (a) Truck Survey at Manila Port (b) Ferry Passenger Survey (c) Airport Survey.

With the surveys (a) and (b) above, the person trip OD matrices were consistent, and no adjustment was made. For the Airport Survey, however, the discrepancy was adjusted when considered appropriate as shown in Table 2.18.

**TABLE 2.18**  
**ADJUSTMENT OF PERSON TRIP SURVEY IN RELATION TO AIRPORT SURVEY**

Survey	Zone	Trip Purpose		
		to home	to work	others
		Generation	Attraction	Attraction
<b>HIS</b>	69, 70	34,387	16,956	23,006
	240	33,144	23,897	19,842
	<b>Total</b>	<b>67,531</b>	<b>40,853</b>	<b>42,848</b>
<b>Airport Survey (Employees)</b>	69, 70	555	555	
	240	715	715	
	<b>Total</b>	<b>1,270</b>	<b>1,270</b>	
<b>Airport Survey (Passengers)</b>	69, 70	20,959		20,404
	240	56,373		55,658
	<b>Total</b>	<b>77,332</b>		<b>76,062</b>
<b>Airport Survey Total</b>	69, 70	21,514	555	20,404
	240	57,088	715	55,658
	<b>Total</b>	<b>78,602</b>	<b>1,270</b>	<b>76,062</b>
<b>Adjustment Value</b>	69, 70	0.626	0.033	0.887
	240	1.722 *	0.030	2.805 *
	<b>Total</b>	<b>1.164</b>	<b>0.031</b>	<b>1.775</b>

Note: Adjustment was made for values with asterisk (\*).

### 3. DEMOGRAPHIC FEATURES OF THE STUDY AREA

Based on the created person trip master file, basic demographic features of the study area have been compiled by expansion (area).

#### 3.1 Population and Number of Households

Table 3.1 shows that the population of age group 4 years old and above is 13.6 million in the study area (8.9 million in Metro Manila and 4.7 million in the adjoining area), and the number of households is 3.2 million (2.1 million in Metro Manila and 1.1 million in the adjoining area). Hence the average household size in Metro Manila and the adjoining area is 4.25 and 4.40, respectively.

**TABLE 3.1**  
**POPULATION OF 4 YEARS OLD AND ABOVE AND NUMBER OF HOUSEHOLDS**  
**IN THE STUDY AREA, 1996**

Area	Population (000)	No. of Households (000)	Ave. Household Members
Metro Manila	8,899	2,095	4.25
Province	4,666	1,060	4.40
<b>Survey Area Total</b>	<b>13,565</b>	<b>3,155</b>	<b>4.30</b>

Note: Population of 4 years old and above is estimated by JICA Study Team, 1996

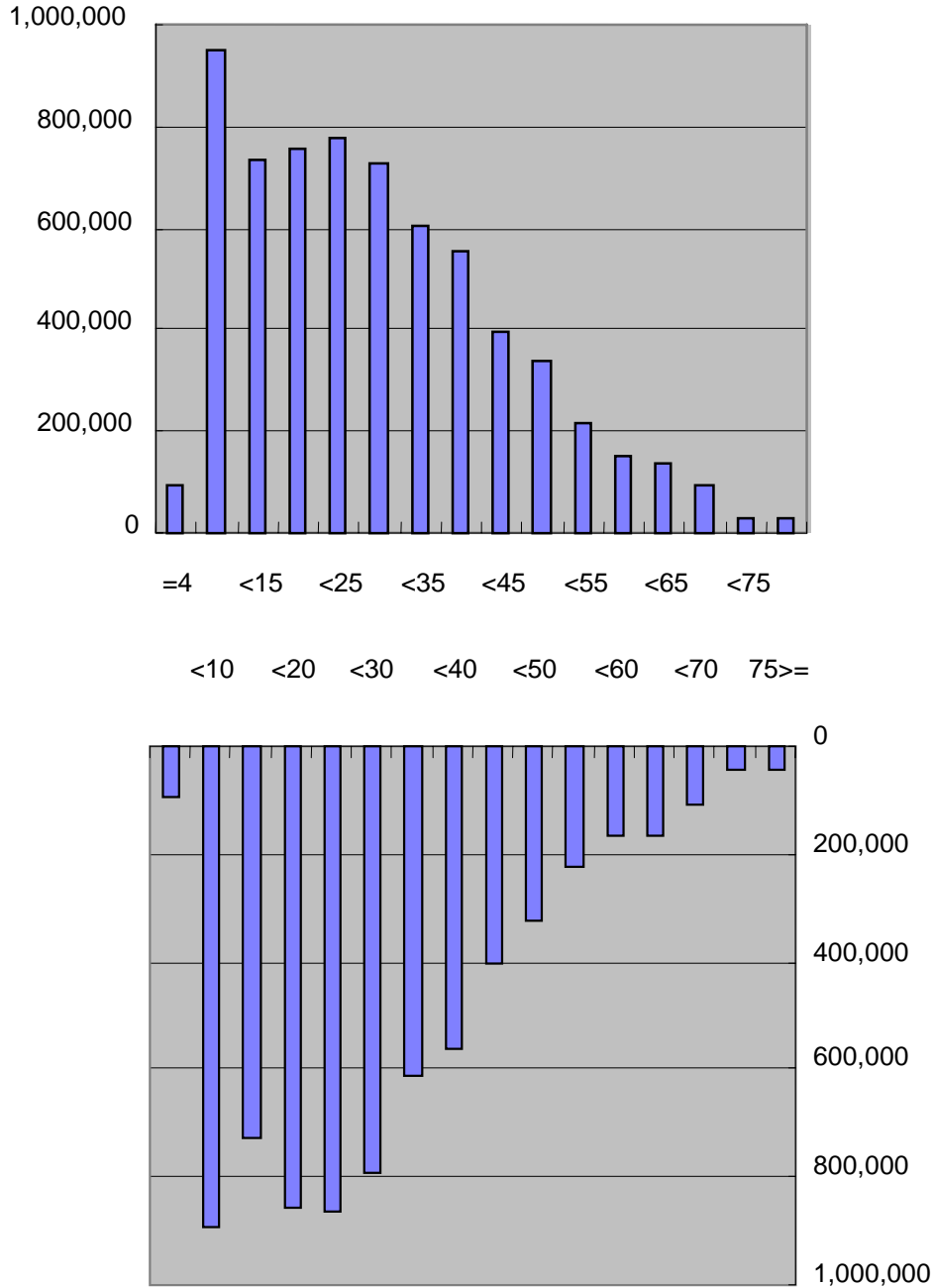
#### 3.2 Population by Sex and by Age Group

Of the 6,648,490 population in the study area, 49 percent are male, while 51 percent are female. Sixty-one (61) percent belong to the younger group (4-29 years old). The labor force (15 years old and over) accounts for 10 million or seventy-four (74) percent of the total population (refer to Table 3.2 Figure 3.1).

**TABLE 3.2**  
**POPULATION BY SEX AND BY AGE GROUP**

Age Group	Male		Female		Total	
	No.	%	No.	%	No.	%
4 Years old	94,768	1.4	92,691	1.3	188,664	1.4
5 - 9	946,086	14.2	882,201	12.8	1,841,690	13.5
10 - 14	736,037	11.1	724,776	10.5	1,461,592	10.8
15 - 19	763,327	11.5	869,398	12.6	1,618,228	12.0
20 - 24	784,218	11.8	865,421	12.5	1,639,250	12.2
25 - 29	724,583	10.9	790,155	11.4	1,518,564	11.2
30 - 34	603,043	9.1	611,129	8.8	1,212,598	9.0
35 - 39	563,995	8.5	566,718	8.2	1,119,440	8.3
40 - 44	401,026	6.0	404,496	5.8	796,440	5.9
45 - 49	351,468	5.3	334,244	4.8	664,470	5.1
50 - 54	226,308	3.4	231,504	3.3	440,867	3.4
55 - 59	158,866	2.4	169,402	2.4	318,104	2.4
60 - 64	140,945	2.1	170,652	2.5	311,597	2.3
65 - 69	93,726	1.4	112,057	1.6	205,783	1.5
70 - 74	32,728	0.5	43,535	0.6	76,263	0.6
75 & above	27,366	0.4	48,076	0.7	75,442	0.6
<b>Total</b>	<b>6,648,490</b>	<b>49.0</b>	<b>6,916,455</b>	<b>51.0</b>	<b>13,564,945</b>	<b>100.0</b>

**FIGURE 3.1**  
**POPULATION DISTRIBUTION BY SEX AND BY AGE GROUP**



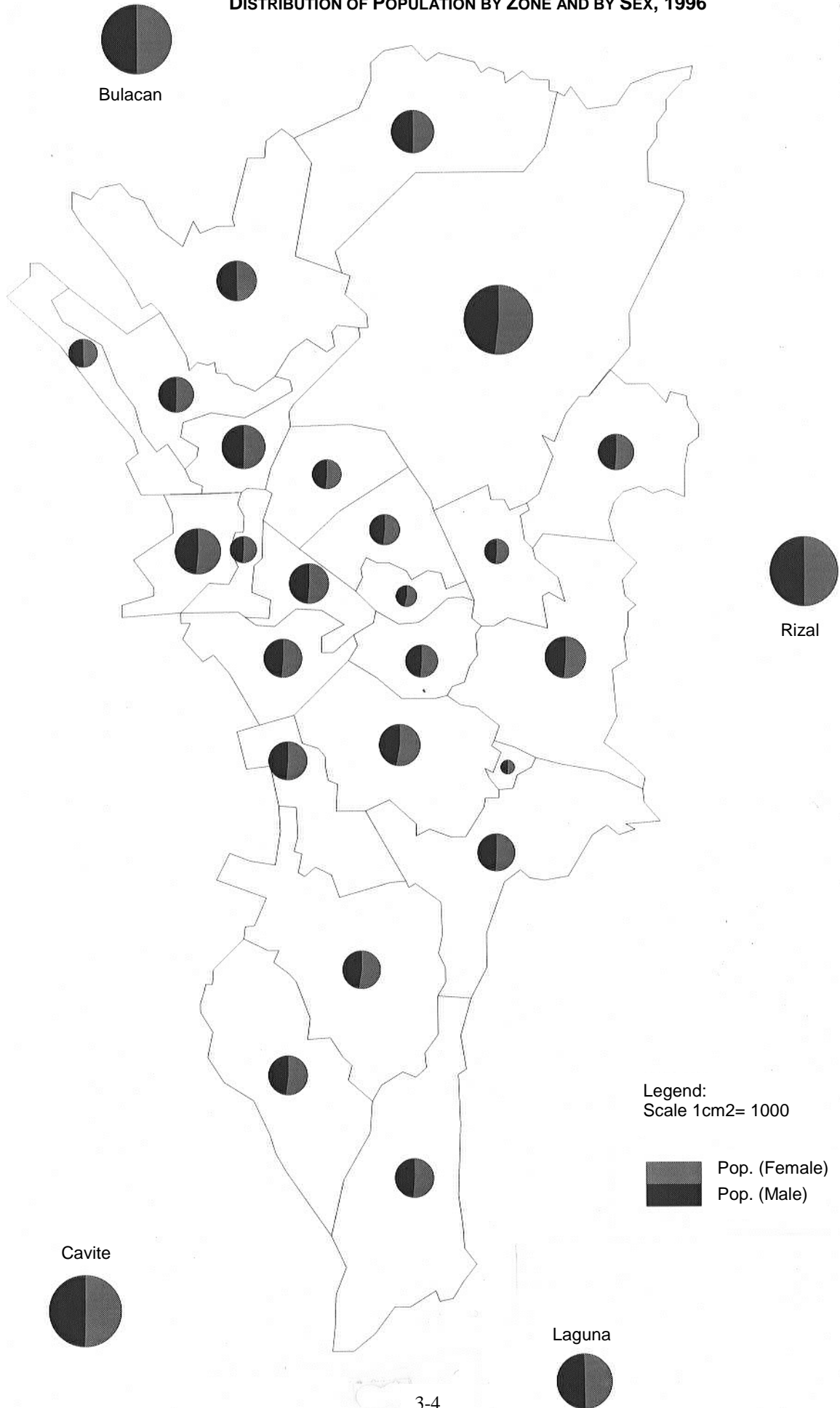
### 3.3 Population by Zone

Among the cities surveyed in Metro Manila, the most populous are Manila, Quezon and Caloocan, while outside Metro Manila, Cavite has the largest population, followed by Bulacan and Rizal (refer to Table 3.3 Figure 3.2).

**TABLE 3.3  
 POPULATION BY ZONE**

City/ Municipality	Male	Female	Total
City of Manila	739,060	783,241	1,519,301
1st	263,917	280,497	544,414
2nd	88,692	93,977	182,669
3rd	201,325	213,251	414,576
4th	185,126	195,516	380,642
Pasay	186,415	197,285	383,700
Makati	211,194	236,973	448,167
Mandaluyong	129,590	139,834	269,424
San Juan	53,311	62,185	115,496
Quezon City	902,835	970,913	1,873,748
I	106,971	114,995	221,966
II	598,818	644,959	1,243,777
III	77,865	83,438	161,303
IV	119,181	127,521	246,702
Caloocan City	484,461	488,852	973,313
South	246,561	247,512	494,073
North	237,900	241,340	479,240
Valenzuela	207,215	207,086	414,301
Malabon	161,280	165,274	326,554
Navotas	107,182	105,858	213,040
Marikina	164,120	171,429	335,549
Pasig City	213,382	228,129	441,511
Pateros	24,609	25,484	50,093
Taguig	178,680	184,969	363,649
Parañaque	177,538	197,943	375,481
Muntinlupa	190,459	200,471	390,930
Las Piñas	192,952	209,191	402,143
<b>Metro Manila Total</b>	<b>4,324,283</b>	<b>4,575,117</b>	<b>8,899,400</b>
Bulacan	631,121	631,580	1,262,701
Cavite	671,296	681,936	1,353,232
Laguna	403,225	406,938	810,163
Rizal	618,565	620,884	1,239,449
<b>Provinces Total</b>	<b>2,324,207</b>	<b>2,341,338</b>	<b>4,665,545</b>
<b>Survey Area Total</b>	<b>6,648,490</b>	<b>6,916,455</b>	<b>13,564,945</b>

**FIGURE 3.2**  
**DISTRIBUTION OF POPULATION BY ZONE AND BY SEX, 1996**

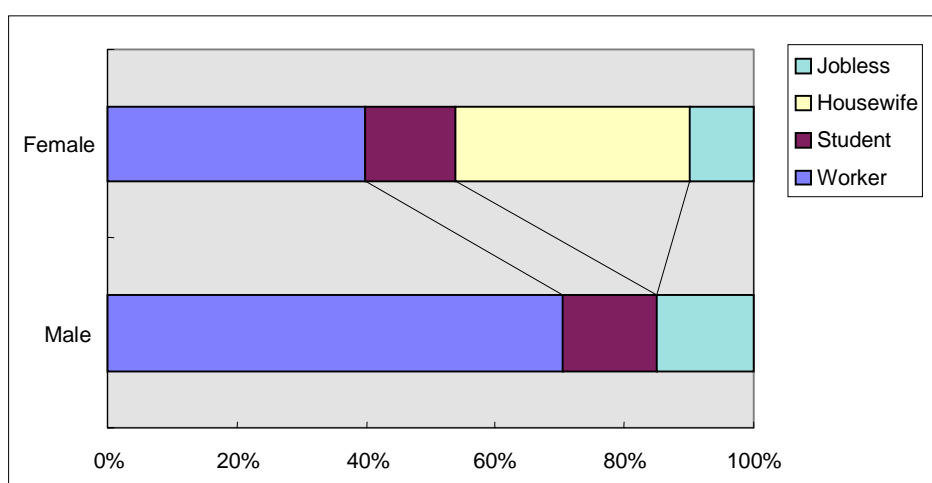


### 3.4 Population by Occupation

Labor force is defined as the population of 15 years old and over. Figure 3.3 and Table 3.4 show the composition of the labor force.

Forty-five (45) percent of the female population of age group 15 years old and over are not working (either jobless or housewife); 41 percent are gainfully employed while the rest are students (14 percent). Of the male population belonging to age group 15 years and over, 70 percent work, while the rest are either students or jobless.

**FIGURE 3.3**  
**COMPOSITION OF LABOR FORCE BY SEX**



**TABLE 3.4**  
**COMPOSITION OF LABOR FORCE**

Item	Male		Female		Total	
	No. (000)	%	No. (000)	%	No. (000)	%
Labor Force	4,872	100.0	5,217	100.0	10,088	100.0
Gainful Worker	3,425	70.3	2,114	40.5	5,538	54.9
Student	732	15.0	752	14.4	1,484	14.7
Housewife	0	0.0	1,844	35.4	1,844	18.3
Jobless	715	14.7	507	9.7	1,222	12.1

Note: Population of age 15 years old and over

Table 3.5 shows that in the age group 4 years and over 54 percent of the male population are employed/working, while the rest are students or jobless. On the other hand, 32 percent of the female population are working/employed while 68 percent are not working (either student, housewife or jobless). Of the total population, 43 percent are employed.



**TABLE 3.5**  
**POPULATION BY SEX AND BY OCCUPATION**

Occupation	Male		Female		Total	
	No. (000)	%	No. (000)	%	No. (000)	%
Official of Govt., Manager & Supervisors	664	10.0	596	8.6	1,260	9.3
Professionals	227	3.4	257	3.7	484	3.6
Technicians & Assoc. Professionals	216	3.3	76	1.1	292	2.2
Clerical Worker	161	2.4	233	3.4	394	2.9
Service, Shop & Market Workers	501	7.5	302	4.4	804	5.9
Farmers, Forestry Workers & Fishermen	113	1.7	8	0.1	121	0.9
Trades & Related Workers	308	4.6	136	2.0	444	3.3
Machine Operators & Assemblers	492	7.4	82	1.2	574	4.2
Laborers & Unskilled Workers	602	9.0	346	5.0	948	7.0
Others	283	4.3	199	2.9	482	3.6
Sub-total	3568	53.7	2,236	32.3	5,803	42.8
Student (Elem.)	1379	20.7	1,303	18.8	2,682	19.8
Student (H.S. & Univ.)	955	14.4	993	14.4	1,949	14.4
Housewife	0	0.0	1,852	26.8	1,852	13.7
Jobless	746	11.2	532	7.7	1,279	9.4
Sub-total	3,081	46.3	4,681	67.7	13,565	57.2
<b>Total</b>	<b>6,648</b>	<b>100.0</b>	<b>6,916</b>	<b>100.0</b>	<b>13,565</b>	<b>100.0</b>

Note: Population aged 4 years and over.

Table 3.6 presents the population distribution by employment status. In Metro Manila, 44 percent are gainfully employed, while the rest are either students, housewives or jobless. Outside Metro Manila, the percentage of employed population is 41 percent. For the whole study area, gainful workers comprise 43 percent of the total population (refer to Figure 3.4).

**TABLE 3.6**  
**POPULATION BY ZONE AND BY EMPLOYMENT STATUS**

City/ Municipality	Population (000)	Gainful Worker (000)	Student (000)	Housewife (000)	Jobless (000)
City of Manila	1,522.3	645.9	507.3	200.4	168.7
1st	544.4	22.8	174.3	77.5	68.7
2nd	182.7	82.8	59.7	22.8	17.4
3rd	414.6	178.3	144.4	48.2	43.7
4th	380.6	161.0	128.9	51.8	38.9
Pasay	383.7	174.7	125.3	46.1	37.6
Makati	448.2	205.6	143.2	58.8	40.6
Mandaluyong	269.4	115.8	85.3	41.1	27.2
San Juan	115.5	54.1	36.8	13.5	11.1
Quezon City	1,873.7	816.2	637.5	287.3	132.8
I	222.0	95.8	78.1	33.9	14.1
II	1,243.8	539.2	416.7	196.8	91.0
III	161.3	72.2	58.2	21.0	9.9
IV	246.7	109.0	84.4	35.5	17.8
Caloocan City	973.3	404.5	350.6	133.8	84.4
South	494.1	206.5	177.8	60.4	49.3
North	479.2	198.0	172.8	73.4	35.1
Valenzuela	414.3	177.4	139.5	59.2	38.2
Malabon	326.6	138.4	110.7	49.8	27.8
Navotas	213.0	90.1	73.5	32.7	16.6
Marikina	335.5	144.1	115.1	46.5	29.8
Pasig City	441.5	200.2	139.0	59.6	42.7
Pateros	50.1	21.6	17.0	6.7	4.8
Taguig	363.6	156.7	121.2	53.4	32.3
Parañaque	375.5	178.4	122.1	41.3	33.7
Muntinlupa	390.9	178.2	126.7	43.7	42.4
Las Piñas	402.1	179.0	136.7	48.2	38.3
<b>Metro Manila Total</b>	<b>8,899.4</b>	<b>3,881.0</b>	<b>2,987.6</b>	<b>1,222.0</b>	<b>808.8</b>
Bulacan	1,262.7	508.5	446.2	184.5	123.5
Cavite	1,353.2	540.8	464.9	191.6	156.0
Laguna	810.2	341.4	289.4	103.0	76.4
Rizal	1,239.4	531.7	442.9	150.9	114.0
<b>Provinces Total</b>	<b>4,665.5</b>	<b>1,922.4</b>	<b>1,643.3</b>	<b>630.0</b>	<b>469.8</b>
<b>Survey Area Total</b>	<b>13,564.9</b>	<b>5,803.4</b>	<b>4,630.9</b>	<b>1,852.0</b>	<b>1,278.6</b>

**FIGURE 3.4**  
**POPULATION DISTRIBUTION BY EMPLOYMENT STATUS**

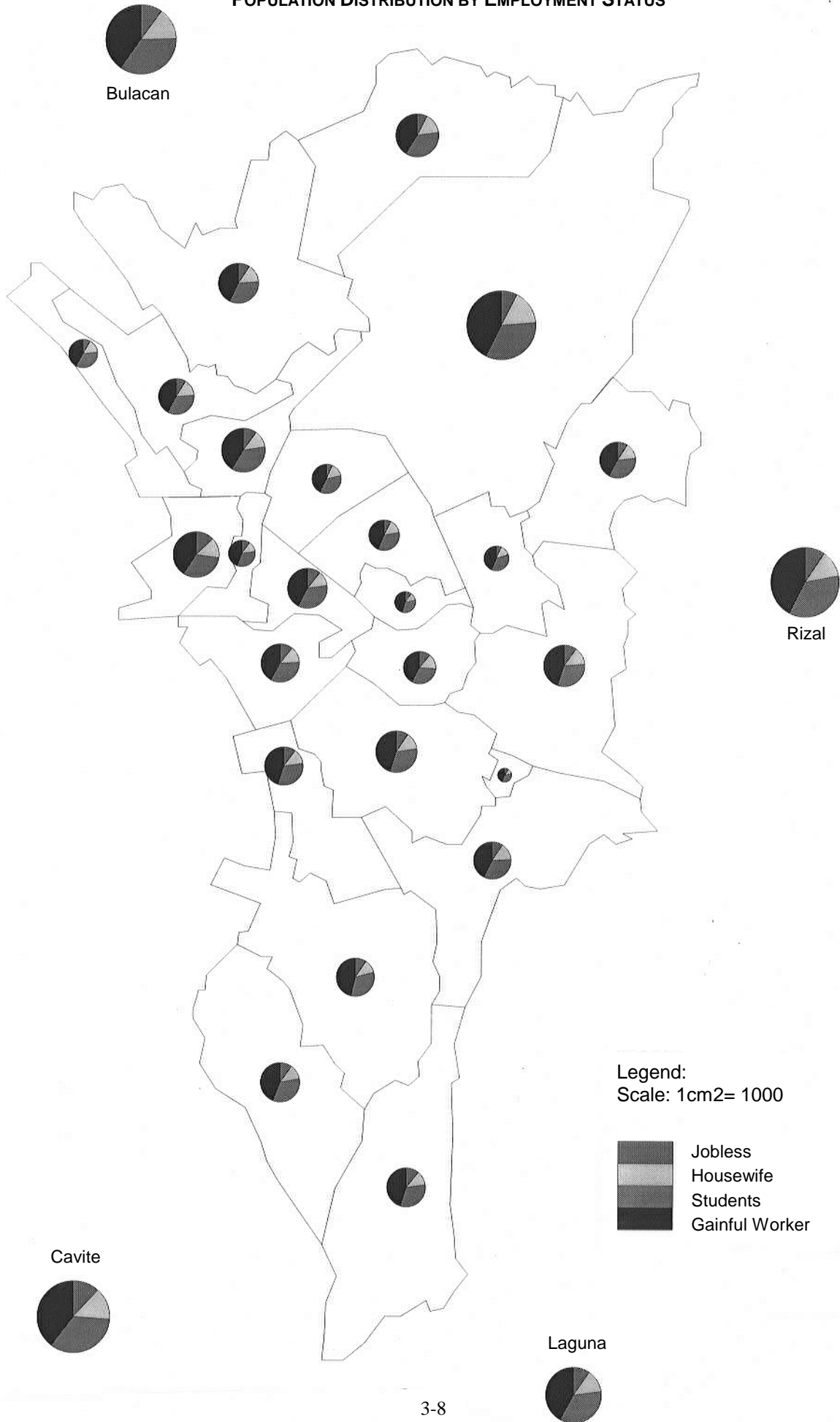


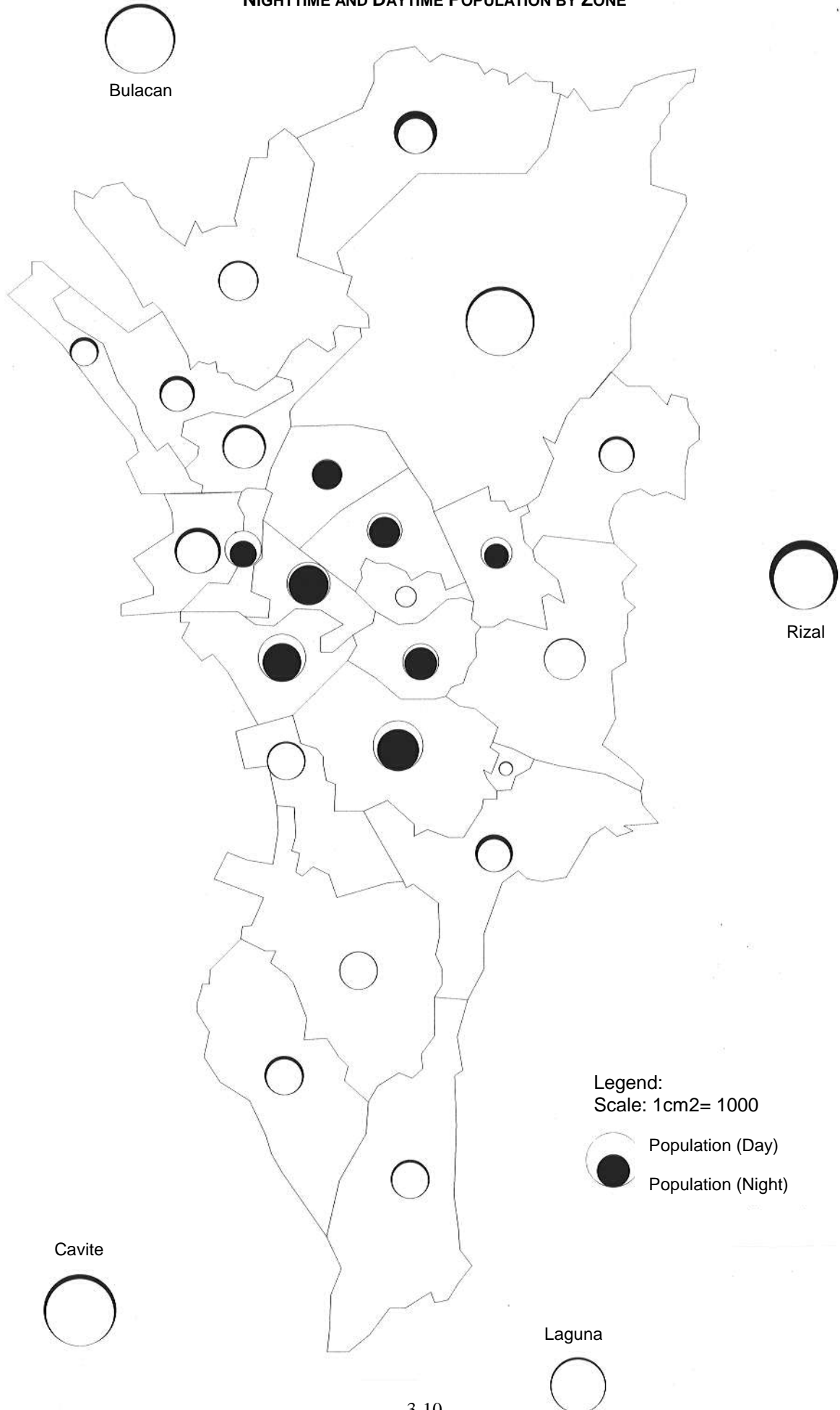
Table 3.7 shows daytime and nighttime population by zone. The daytime population was calculated considering workplace and schoolplace. The reason for the discrepancy between nighttime and daytime population is the existence of “unknown” samples in relation to their workplace/schoolplace and the samples going outside the study area.

The zones that include CBDs, such as Makati, Manila and Mandaluyong, have a daytime population larger than the nighttime population (refer to Figure 3.5).

**TABLE 3.7**  
**NIGHTTIME AND DAYTIME POPULATION BY ZONE**

City/ Municipality	Population (000)		Day/Night Ratio (B/A)
	Nighttime (A)	Daytime (B)	
City of Manila	1,522.3	1,902.3	1.25
1st	544.4	451.0	0.83
2nd	182.7	345.0	1.89
3rd	414.6	497.8	1.20
4th	380.6	608.6	1.60
Pasay	383.7	373.0	0.97
Makati	448.2	671.0	1.50
Mandaluyong	269.4	339.7	1.26
San Juan	115.5	112.9	0.98
Quezon City	1,873.7	1,940.2	1.04
I	222.0	236.4	1.06
II	1,243.8	1,130.6	0.91
III	161.3	255.6	1.58
IV	246.7	317.6	1.29
Caloocan City	973.3	748.4	0.77
South	494.1	427.5	0.87
North	479.2	320.9	0.67
Valenzuela	414.3	376.1	0.91
Malabon	326.6	259.6	0.79
Navotas	213.0	167.4	0.79
Marikina	335.5	282.6	0.84
Pasig City	441.5	428.2	0.97
Pateros	50.1	43.9	0.88
Taguig	363.6	282.4	0.78
Parañaque	375.5	349.2	0.93
Muntinlupa	390.9	337.7	0.86
Las Piñas	402.1	335.3	0.83
Metro Manila Total	8,899.4	8,949.9	1.01
Bulacan	1,262.7	1,132.2	0.90
Cavite	1,353.2	1,185.5	0.88
Laguna	810.2	747.1	0.92
Rizal	1,239.4	944.1	0.76
Provinces Total	4,665.5	4,008.9	0.86
<b>Survey Area Total</b>	<b>13,564.9</b>	<b>12,958.7</b>	<b>0.96</b>

**FIGURE 3.5**  
**NIGHTTIME AND DAYTIME POPULATION BY ZONE**



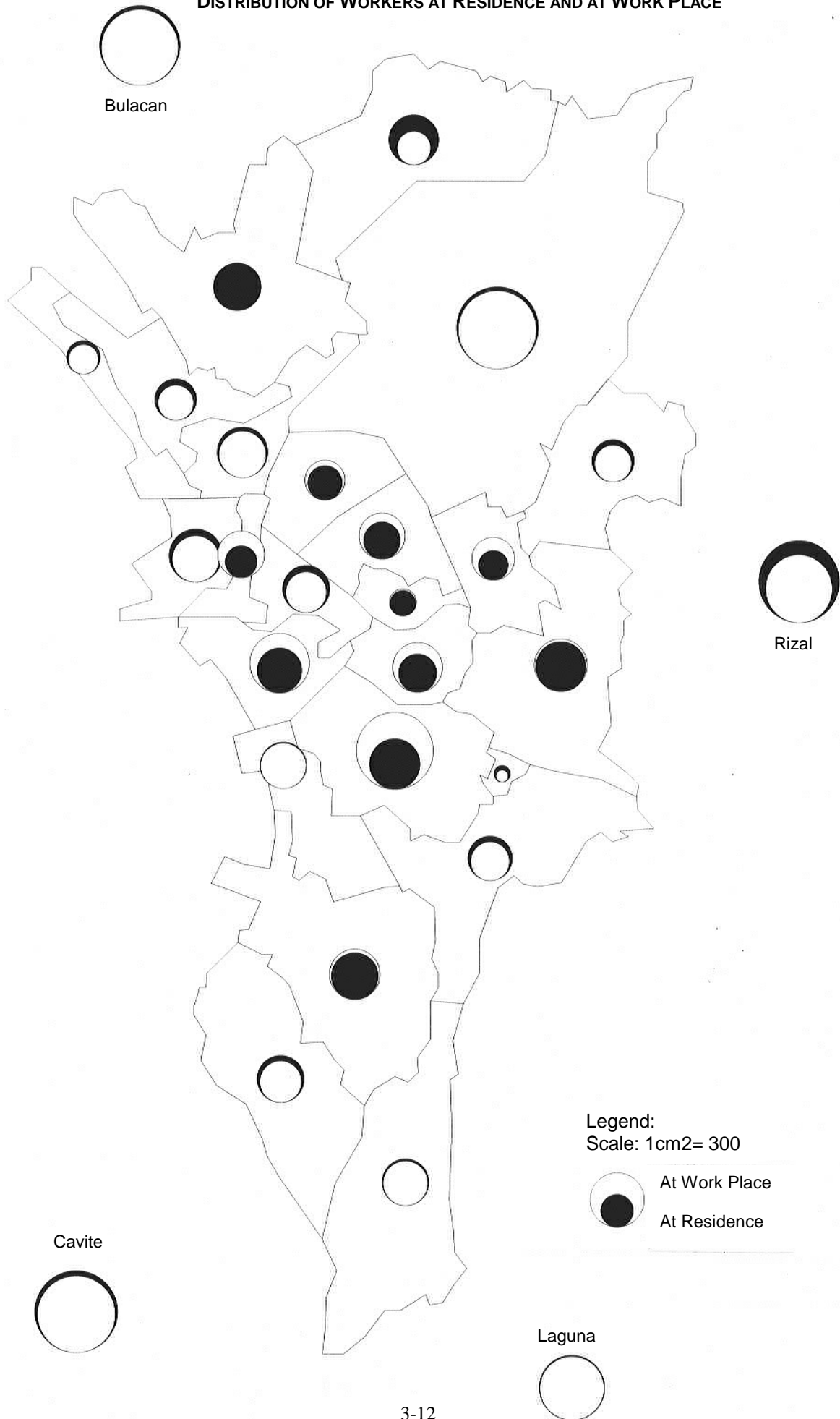
### 3.5 Distribution of Workplace

Table 3.8 shows the number of workers at residence and at workplace by zone. In the zones including Makati, Mandaluyong, Manila, Parañaque and Quezon, the inflow of workers in the daytime is remarkable (refer to Figure 3.6).

**TABLE 3.8**  
**NUMBER OF WORKERS AT RESIDENCE AND AT WORKPLACE BY ZONE**

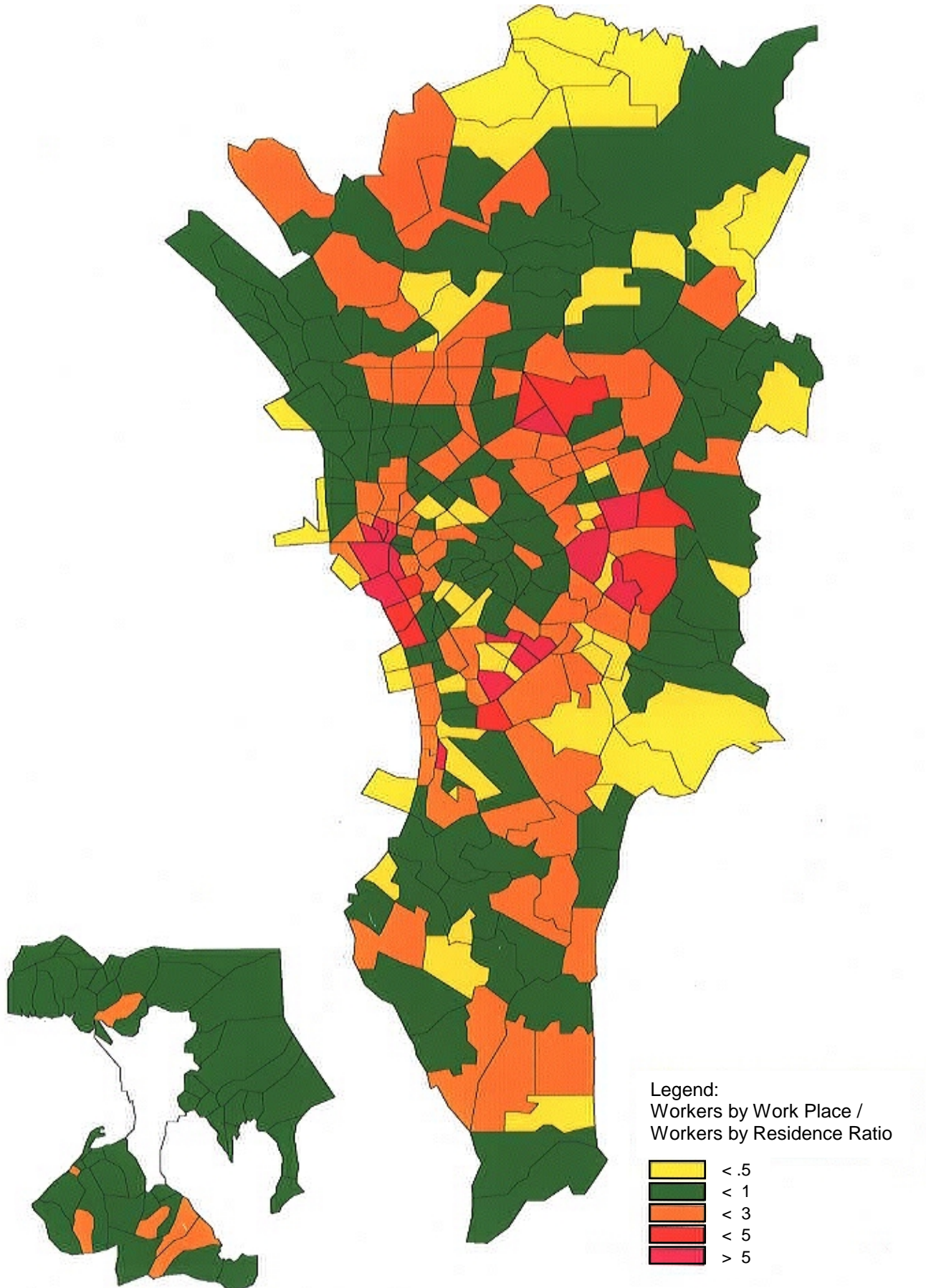
City/ Municipality	No. of Workers (000)		Day/Night Ratio (B/A)
	Residence (A)	Work Place (B)	
City of Manila	645.9	771.7	1.19
1st	223.8	173.0	0.77
2nd	82.8	173.7	2.10
3rd	178.3	133.8	0.75
4th	161.0	291.2	1.81
Pasay	174.7	188.8	1.08
Makati	205.6	494.7	2.41
Mandaluyong	115.8	196.9	1.70
San Juan	54.1	61.2	1.13
Quezon City	816.2	940.0	1.15
I	95.8	128.0	1.34
II	539.2	490.4	0.91
III	72.2	148.0	2.05
IV	109.0	173.5	1.59
Caloocan City	404.5	261.6	0.65
South	206.5	171.4	0.83
North	198.0	90.2	0.46
Valenzuela	177.4	180.1	1.02
Malabon	138.4	97.5	0.70
Navotas	90.1	68.6	0.76
Marikina	144.1	106.7	0.74
Pasig City	200.2	225.5	1.13
Pateros	21.6	11.7	0.54
Taguig	156.7	117.9	0.75
Parañaque	178.4	185.2	1.04
Muntinlupa	178.2	158.3	0.89
Las Piñas	179.0	136.5	0.76
<b>Metro Manila Total</b>	<b>3,881.0</b>	<b>4,203.0</b>	<b>1.08</b>
Bulacan	508.5	451.7	0.89
Cavite	540.8	468.9	0.87
Laguna	341.4	321.7	0.94
Rizal	531.7	358.1	0.67
<b>Provinces Total</b>	<b>1,922.4</b>	<b>1,600.5</b>	<b>0.83</b>
<b>Survey Area Total</b>	<b>5,803.4</b>	<b>5,803.4</b>	<b>1.00</b>

**FIGURE 3.6**  
**DISTRIBUTION OF WORKERS AT RESIDENCE AND AT WORK PLACE**





**FIGURE 3.7**  
**DAY/NIGHT RATIO OF WORKER BY TRAFFIC ZONE**

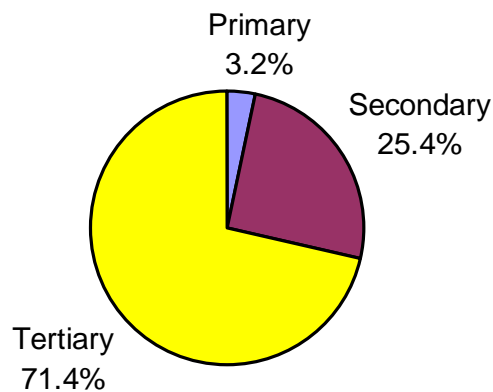




### 3.6 Employment by Industrial Sector

About 71 percent of the working population are engaged in tertiary activities (i.e., wholesale and retail trade; transport, storage and communication), while 25 percent are in secondary industry sector (manufacturing; electricity, gas and construction). Only 3 percent are employed in the primary sector (refer to Table 3.9 and Figure 3.8).

**FIGURE 3.8**  
**EMPLOYMENT BY INDUSTRIAL SECTOR**



**TABLE 3.9**  
**NUMBER OF WORKERS BY INDUSTRY**

Industry	Workers	
	(000)	%
Agriculture & Forestry	116	2.2
Fishing	43	0.8
Mining & Quarrying	11	0.2
Manufacturing	811	15.2
Electricity, Gas & Water	137	2.6
Construction	351	6.6
Wholesale & Retail Trade	1,379	25.9
Hotels & Restaurants	207	3.9
Transport, Storage & Comm.	580	10.9
Financial Intermediation	182	3.4
Real Estate & Renting Business	299	5.6
Public Adm. & Defense	343	6.4
Education	168	3.2
Health & Social Work	136	2.6
Other Social Service	350	6.6
Private Households	211	4.0
Extra-territorial Organizations	7	0.1
<b>Total</b>	<b>5,330</b>	<b>100.0</b>

### 3.7 Distribution of School Place

Table 3.10 and 3.11 show the number of pupils/students by zone at residence and at school place, respectively. In Manila and Quezon, the number of pupils/students at school place is larger than that at residence. Particularly, in Manila there is a large inflow of pupils/students of more than 300 thousand during the daytime (refer to Figure 3.9).

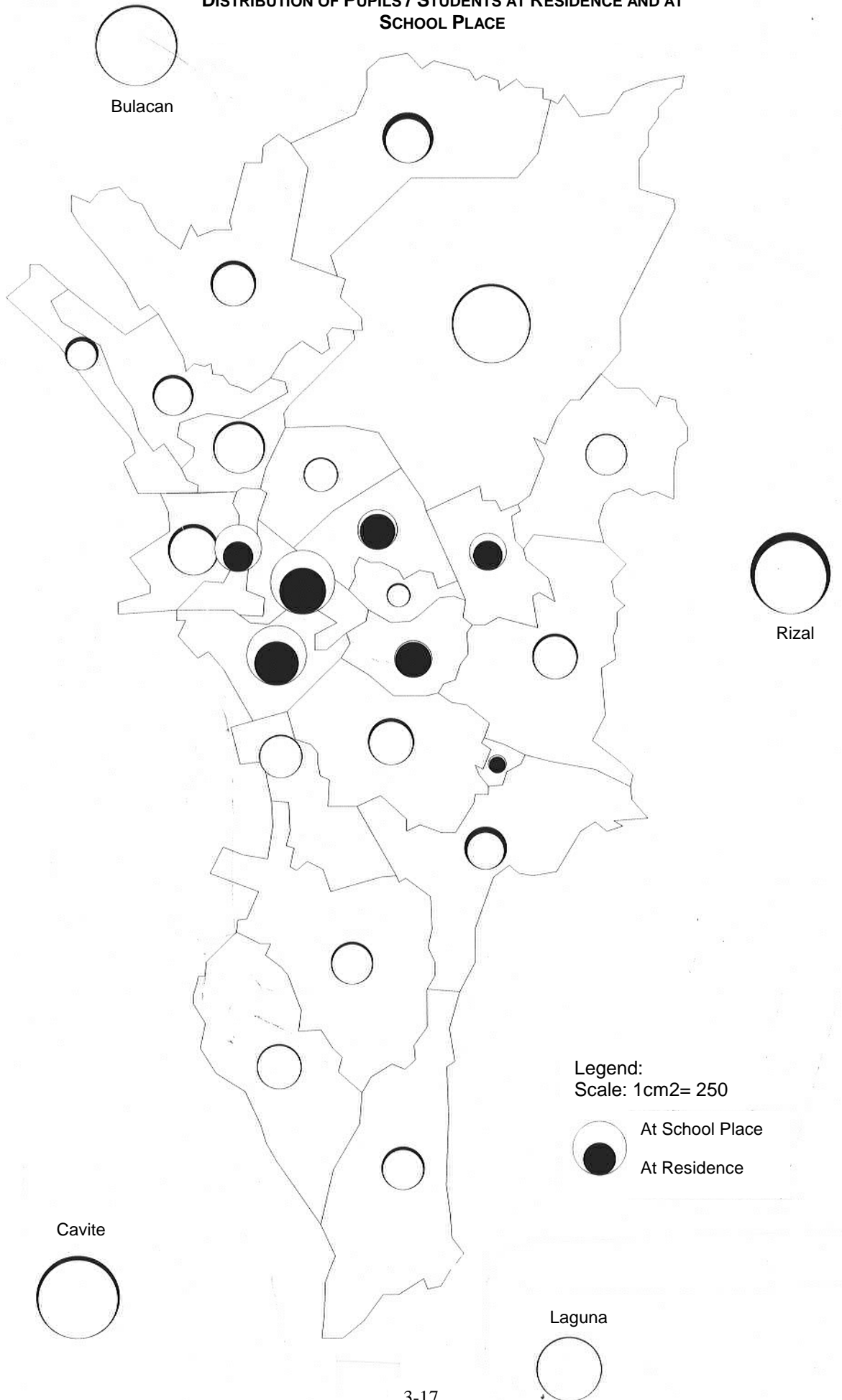
**TABLE 3.10**  
**NUMBER OF PUPILS/STUDENTS BY ZONE AT RESIDENCE**

City/ Municipality	Pupil		Student		Total	
	(000)	%	(000)	%	(000)	%
City of Manila	263.7	9.8	243.6	12.5	507.3	11.0
1st	98.7	3.7	75.6	3.9	174.3	3.8
2nd	29.9	1.1	29.2	1.5	59.7	1.3
3rd	66.5	2.5	77.9	4.0	144.4	3.1
4th	68.5	2.6	60.4	3.1	128.9	2.8
Pasay	67.8	2.5	57.5	3.0	125.3	2.7
Makati	77.8	2.9	65.4	3.4	143.2	3.1
Mandaluyong	49.4	1.8	35.9	1.8	85.3	1.8
San Juan	18.6	0.7	18.3	0.9	36.8	0.8
Quezon City	359.3	13.4	278.2	14.3	637.5	13.8
I	43.0	1.6	35.1	1.8	78.1	1.7
II	237.0	8.8	179.8	9.2	416.7	9.0
III	31.4	1.2	26.8	1.4	58.2	1.3
IV	47.9	1.8	36.6	1.9	84.4	1.8
Caloocan City	211.6	7.9	139.0	7.1	350.6	7.6
South	103.8	3.9	74.1	3.8	177.8	3.8
North	107.9	4.0	64.9	3.3	172.8	3.7
Valenzuela	80.8	3.0	58.7	3.0	139.5	3.0
Malabon	66.9	2.5	43.8	2.2	110.7	2.4
Navotas	46.0	1.7	27.5	1.4	73.5	1.6
Marikina	65.4	2.4	49.7	2.6	115.1	2.5
Pasig City	80.1	3.0	58.9	3.0	139.0	3.0
Pateros	9.9	0.4	7.1	0.4	17.0	0.4
Taguig	73.1	2.7	48.1	2.5	121.2	2.6
Parañaque	69.0	2.6	53.1	2.7	122.1	2.6
Muntinlupa	72.1	2.7	54.7	2.8	126.7	2.7
Las Piñas	75.3	2.8	61.4	3.2	136.7	3.0
<b>Metro Manila Total</b>	<b>1,686.8</b>	<b>62.9</b>	<b>1,300.7</b>	<b>66.8</b>	<b>2,987.6</b>	<b>64.5</b>
Bulacan	275.6	10.3	170.6	8.8	446.2	9.6
Cavite	276.1	10.3	188.8	9.7	464.9	10.0
Laguna	176.4	6.6	112.9	5.8	289.4	6.2
Rizal	267.3	10.0	175.6	9.0	442.9	9.6
<b>Provinces Total</b>	<b>995.4</b>	<b>37.1</b>	<b>647.9</b>	<b>33.2</b>	<b>1,643.3</b>	<b>35.5</b>
<b>Survey Area Total</b>	<b>2,682.3</b>	<b>100.0</b>	<b>1,948.6</b>	<b>100.0</b>	<b>4,630.9</b>	<b>100.0</b>

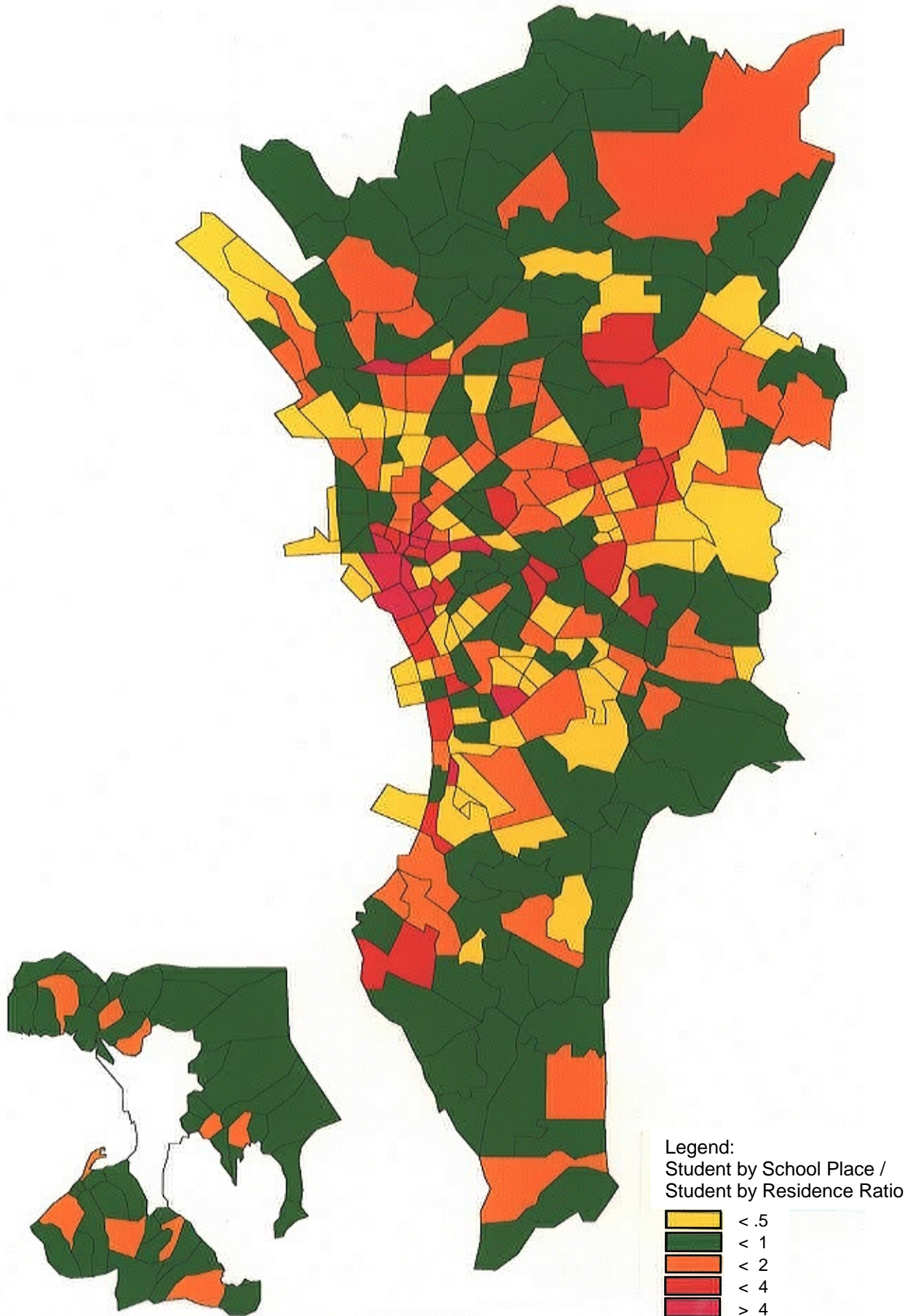
**TABLE 3.11**  
**NUMBER OF PUPILS/STUDENTS BY ZONE AT SCHOOL PLACE**

City/ Municipality	Pupil		Student		Total	
	(000)	%	(000)	%	(000)	%
City of Manila	288.3	10.9	547.7	28.4	836.0	18.2
1st	102.5	3.9	45.9	2.4	148.4	3.2
2nd	48.0	1.8	99.8	5.2	147.8	3.2
3rd	65.3	2.5	219.7	11.4	285.0	6.2
4th	72.4	2.7	182.3	9.4	254.8	5.6
Pasay	64.5	2.4	54.2	2.8	118.6	2.6
Makati	73.0	2.7	51.7	2.7	124.7	2.7
Mandaluyong	49.3	1.9	44.3	2.3	93.6	2.0
San Juan	21.9	0.8	11.1	0.6	33.0	0.7
Quezon City	371.7	14.0	299.2	15.5	670.9	14.6
I	45.0	1.7	27.8	1.4	72.7	1.6
II	243.1	9.2	156.6	8.1	399.7	8.7
III	34.0	1.3	57.0	3.0	91.0	2.0
IV	49.6	1.9	57.9	3.0	107.5	2.3
Caloocan City	182.1	6.9	111.8	5.8	294.0	6.4
South	86.3	3.3	76.7	4.0	163.0	3.6
North	95.8	3.6	35.1	1.8	131.0	2.9
Valenzuela	76.5	2.9	39.6	2.1	116.0	2.5
Malabon	66.8	2.5	27.1	1.4	94.0	2.0
Navotas	42.6	1.6	13.4	0.7	56.0	1.2
Marikina	76.4	2.9	33.4	1.7	109.8	2.4
Pasig City	82.7	3.1	39.4	2.0	122.2	2.7
Pateros	13.0	0.5	9.0	0.5	21.9	0.5
Taguig	68.7	2.6	21.5	1.1	90.2	2.0
Parañaque	71.3	2.7	35.6	1.8	106.9	2.3
Muntinlupa	73.9	2.8	34.7	1.8	108.6	2.4
Las Piñas	72.5	2.7	53.1	2.8	125.5	2.7
<b>Metro Manila Total</b>	<b>1,695.1</b>	<b>63.8</b>	<b>1,426.7</b>	<b>73.9</b>	<b>3,121.9</b>	<b>68.1</b>
Bulacan	272.4	10.3	143.6	7.4	416.0	9.1
Cavite	267.8	10.1	146.6	7.6	414.3	9.0
Laguna	173.8	6.5	103.2	5.3	277.0	6.0
Rizal	246.4	9.3	109.3	5.7	355.7	7.8
<b>Provinces Total</b>	<b>960.4</b>	<b>36.2</b>	<b>502.7</b>	<b>26.1</b>	<b>1,463.1</b>	<b>31.9</b>
<b>Survey Area Total</b>	<b>2,655.5</b>	<b>100.0</b>	<b>1,929.4</b>	<b>100.0</b>	<b>4,585.0</b>	<b>100.0</b>

**FIGURE 3.9**  
**DISTRIBUTION OF PUPILS / STUDENTS AT RESIDENCE AND AT SCHOOL PLACE**



**FIGURE 3.10**  
**DAY/NIGHT RATIO OF PUPILS/STUDENTS BY TRAFFIC ZONE**

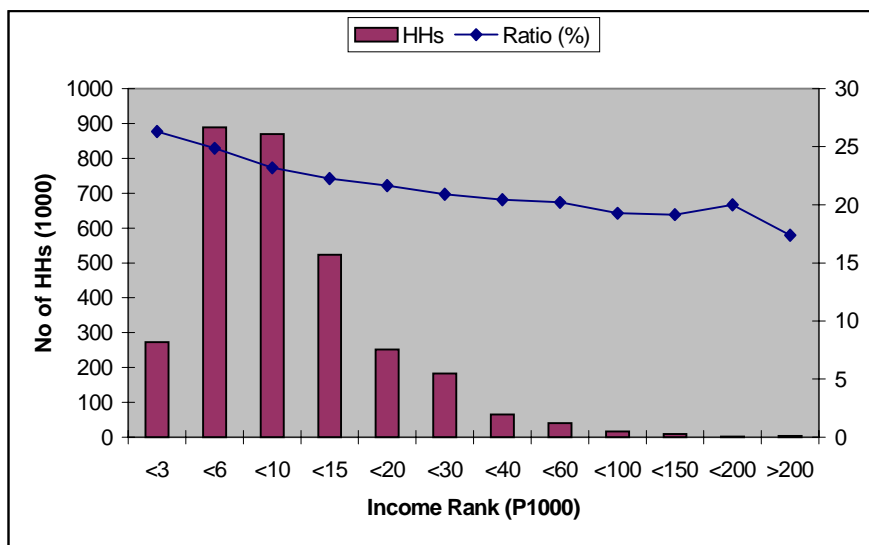


## 4. HOUSEHOLD CHARACTERISTICS AND CAR OWNERSHIP

### 4.1 Household Income

Figure 4.1 and Table 4.1 show the distribution of household income in the study area, while Figure 4.1 presents its distribution by traffic zone. Of the total households, 889 (28.4 percent) and 870 (27.8 percent) belong to the income bracket of P3,000 ~ P6,000 per month and P6,000 ~ P10,000 per month, respectively,

**FIGURE 4.1**  
**NUMBER OF HOUSEHOLDS BY INCOME GROUP**

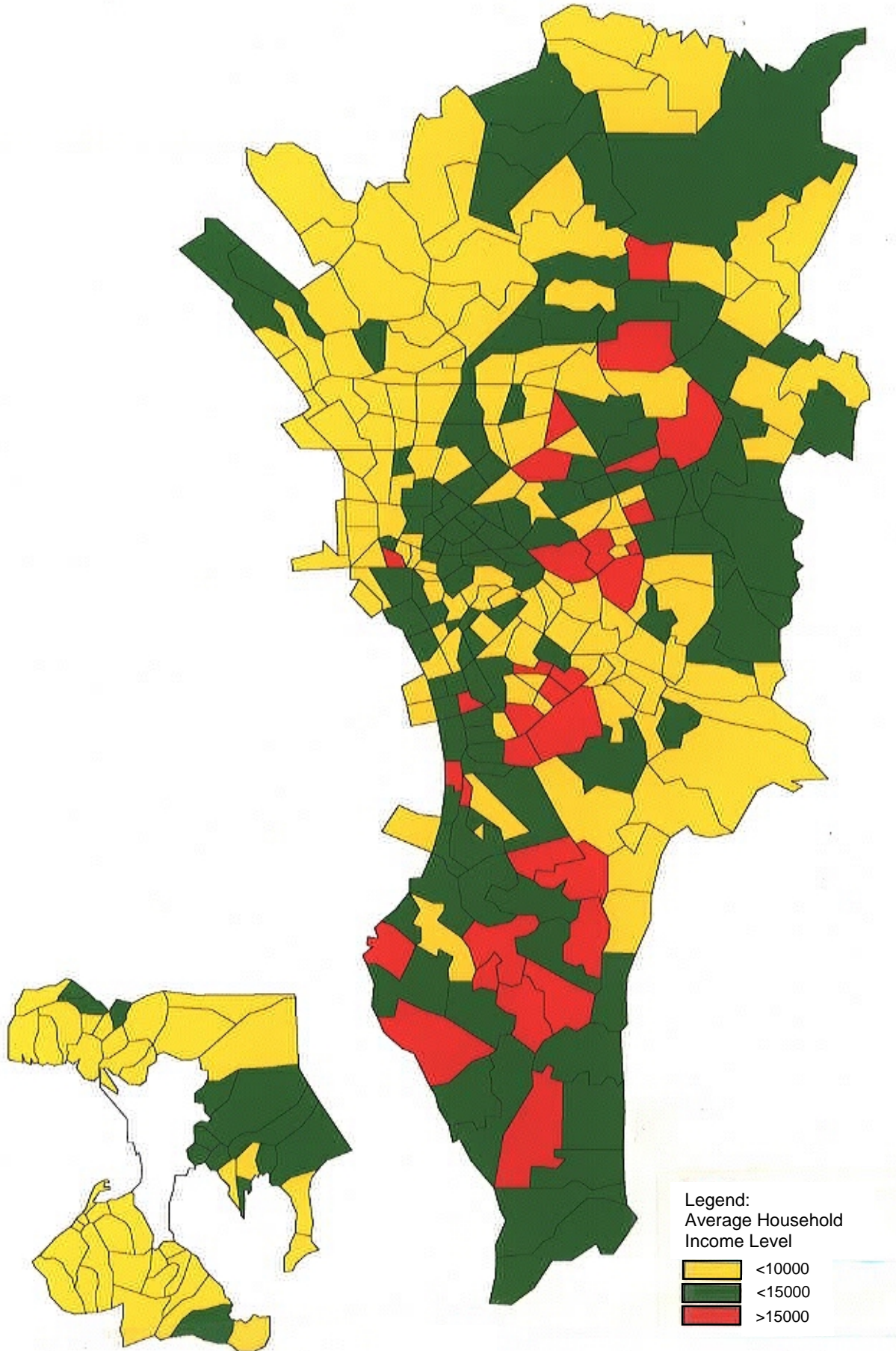


**TABLE 4.1**  
**NUMBER OF HOUSEHOLDS AND POPULATION BY INCOME GROUP**

Household Income	No. of Households		No. of Population	
	(000)	(%)	(000)	(%)
<P3,000	273	8.7	1,038	7.7
<P6,000	889	28.4	3,577	26.6
<P10,000	870	27.8	3,751	27.9
<P15,000	524	16.8	2,355	17.5
<P20,000	251	8.0	1,160	8.6
<P30,000	183	5.9	875	6.5
<P40,000	65	2.1	318	2.4
<P60,000	40	1.3	198	1.5
<P100,000	16	0.5	83	0.6
<P150,000	9	0.3	47	0.3
<P200,000	2	0.1	10	0.1
P200,000 & over	4	0.1	23	0.2
<b>Total</b>	<b>3,125</b>	<b>100.0</b>	<b>13,435</b>	<b>100.0</b>



**FIGURE 4.2**  
**AVERAGE HOUSEHOLD INCOME BY TRAFFIC ZONE**



## 4.2 Ownership of Land and House

In the household interviews, household heads were asked about land and house ownership. Table 4.2 summarises the results by zone.

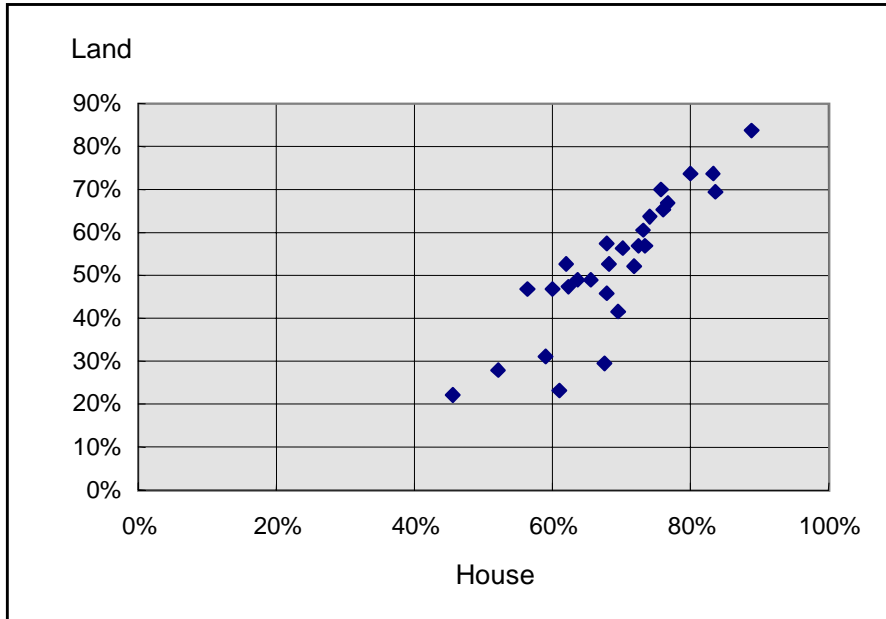
**TABLE 4.2**  
**LAND AND HOUSE OWNERSHIP BY ZONE**

City/ Municipality	% of HHs that own the House	% of HHs that own the Land
City of Manila	61.2	36.7
1st	68.5	53.1
2nd	46.2	22.4
3rd	52.9	28.7
4th	67.5	29.4
Pasay	61.0	48.3
Makati	68.3	57.7
Mandaluyong	61.1	23.6
San Juan	61.6	33.6
Quezon City	70.9	58.3
I	62.9	53.7
II	74.1	61.7
III	67.2	51.2
IV	64.3	50.3
Caloocan City	73.3	58.6
South	63.3	47.9
North	84.0	69.9
Valenzuela	58.4	49.1
Malabon	70.2	42.2
Navotas	72.6	57.2
Marikina	77.2	66.2
Pasig City	71.4	57.9
Pateros	78.4	69.0
Taguig	72.3	52.7
Parañaque	75.8	67.0
Muntinlupa	69.9	48.1
Las Piñas	74.9	59.3
Metro Manila Total	68.7	51.8
Bulacan	76.1	70.6
Cavite	89.4	84.4
Laguna	83.9	74.1
Rizal	80.7	74.6
Provinces Total	82.5	76.3
<b>Survey Area Total</b>	<b>73.3</b>	<b>60.0</b>



In the study area, the average land ownership rate is 60 percent, considerably lower than the average house ownership rate of 73 percent. Those rates are generally higher in the provinces than in Metro Manila. Figure 4.3 shows the interrelationship of land and house ownership.

**FIGURE 4.3**  
**RELATIONSHIP BETWEEN LAND AND HOUSE OWNERSHIP BY ZONE**



**FIGURE 4.4**  
**LAND OWNERSHIP RATIO BY TRAFFIC ZONE**

