INTERIM REPORT (Volume I)
CURRENT STATUS OF DAVAO CITY

DAVAO CITY URBAN TRANSPORT CUM LAND USE STUDY

(March, 1981)

REPUBLIC OF THE PHILIPPINES
MINISTRY OF PUBLIC HIGHWAYS

JAPAN INTERNATIONAL COOPERATION AGENCY

CONTENTS

CHAPTER 1

OUTLINE OF THE STUDY AREA

1.1 Natural Condition

1.1.1 Geographical Location

In the southern most portion of the Philippine Archipelago, Davao City is lying in the grid squares of Mindanao of which $6^{O}58'$ to $7^{O}34'$ N latitude and $125^{O}14'$ to $125^{O}40'$ E longitude in the west. Central part of Region XI. (See Fig. 1.1). It is surrounded by mountains from North Cotabato on the west side; Davao del Norte Province in the North; Davao Gulf and Davao del Norte on the east; and Davao del Sur on the south. The city proper is approximately 946 aerial kilometers or 588 miles southeast of Manila. (See Fig. 1.2).

Davao City has an area of 244,000 hectares or probably 8 percent of the land area in Region XI and considered one of the largest city in the world. There are 8 political districts; However, Bunawan, Buhangin and Talomo in the east; Baguio and Paquibato in the North and Toril in the south. The city government is situated in San Pedro Street southern portion of Buhangin District. (See Fig. 1.3 Davao City District Map)

1.1.2 Nature and Drainage

The Profile of Davao City is mountainous in some part with irregular distribution of Plateaus and lowlands. The city's west boundary look up the mountain ranges far down to South Cotabato. There it lies the Mt. Apo, the highest peak mountain range in the Philippines intersecting North Cotabato, Davao del Sur and Davao City itself.

The elevation of Mt. Apo is approximately 9,696 feet (2,953 meters) above the sea level and considered as Semi-active volcano. (See Fig. 1.4 contour map of Davao City)

The coastal plain and valleys in Davao City are a vast lowland areas continuous inland gradually rising valleys. Specially, Paquibato District, a rural portion of Davao City is a very wide lowland agricultural area with a slope ranging from 0 to 3 percent and located eastern sides of the City. On the other hand, the lowland areas situated along the western coast of the Gulf, southeastern part of the city are Bunawan, Buhangin, Talomo and Toril.

Practically most districts of Davao City composed of recent alluvium consisting of clay, silt and some sand and gravel. Those grouping are shown in Table 1.6 soil types and tabulated for reference.

1.1.3 Topography

The view point along the coastal line and uplands north and westwards to Calinan is plain with slopes slightly hilly generally below four to five degrees. Fig. 1.5, shown a slope map of Davao City with some variation relief of the area. The merging view of the Plains and valleys gradually into the uplands, and the upland in turn into the mountains. The land capability map of Davao City (classes and sub-classes) indicates the variation relief of the area; (See Table 1.1 and 1.2)

Davao Gulf is the outlet of water flowing from the mountain meanding the panoramic trend of the hills and valley down toward the sea. The whispering Davao river and its several water connection are the main drainage system of the city. This river originates from Davao del Norte creeping along the central part and finally coze eastward entering into the gulf at the southern periphery of the city proper. Another smaller drainage system, the Talomo river murmurs from the eastern slope of Mt. Apo is the secondary drainage system. There are many other brookes and streams that drain the area, but Davao and Talomo rivers are the most important river basins of the city.

1.1.4 Climate and Vegetation

In comparing with other island in the archipelago, Davao City enjoys a very nice mild tropical climate, where the days are always sunshine and mild followed by nights of rains, unlike the other part of the country has a distinct day and wet season. Practically, Davao City is beyond the reach of typhoon belt and lacks major seasonal variations.

The median monthly temperature varied from 33.16^{o}C (highest) in April to 21.61^{o}C (lowest) in January. The average rainful during the same ten-year period has the highest record of 235.35 mm in August and the lowest in the month of March which was 77.63 mm. The city has a regular atmospheric humility of 77% and 83%.

The northward direction wind from Davao Gulf gives cooler air replaces the warm air mass over the city. The weather station in Sasa reports the micro climate data from ten-years observation that there has been no significant climatic change within this period. (See Table 1.3 and 1.4)

There are four types of vegetation in the city, namely: grasslands, forest, swamp and cultivated land. Cogon is predominant vegetation grass located in the undulating and rolling areas. Mangrove swamp are scattered along the coastal line and serve as breeding place for the fish. The coastal plain and some part of the upland areas are cultivated and planted to crops like coconuts, corn, abaca, rice, banana, and many other root crops. Fruit trees and other agricultural products are the ideal culture due to the absence of tropical storm.

1.1.5 Seismicity

Davao City is affected by the active foulting line extending the entire length of the Philippine Archipelago. It is 60 kilometers west of the Philippine rift, Earthquakes occuring in this city are generally tectonic origin cause by the readjustment of the earth's crust and cave-inn. The weather Bureau's seismograph recorded the highest intensity V in the year 1969 to 1972 and compiled by PAGASA Office. (See Table 1.5)

1.1.6 Soil Condition

A soil test shown on the map of Davao City, Fig. 1.6 so do with the ocular observation found out that the fertility of the soil is capable of giving nourishment to all tropical plants. This fertile soil mostly located in Tugbok and San Miguel attributed much to the productivity of Fruit Trees and Abaca.

The soil quality in Davao City differ from that of other places in color, texture, depth, drainage, ulief, permeability and fertility. The apportionment of the different soil type in Davao City are attributive to the productivity, ease in cultivation and adoptability to agriculture. The soil characteristics are classified into seven series and categorized into three groups depending on the topography they occupy on the landscape. These groups are (1) soil of the plain and valleys; (2) soil of immediate uplands; and (3) soil of hills and mountains. The table

1.6 shows the different soil types and characteristics tabulated for futher reference.

Fig. 1.1 Location of Davao City in Region XI

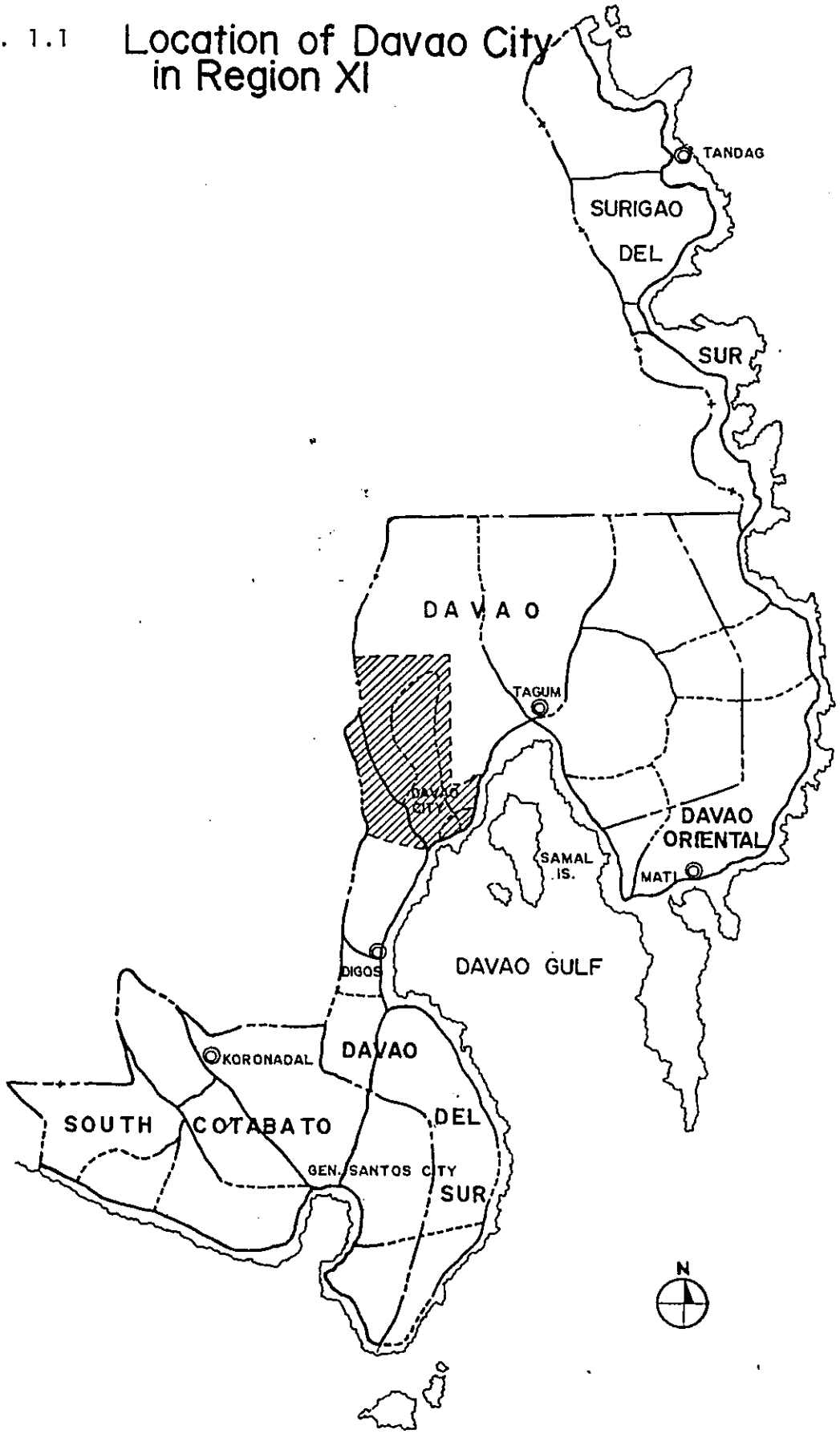


Fig. 1.2 Location and transportation map

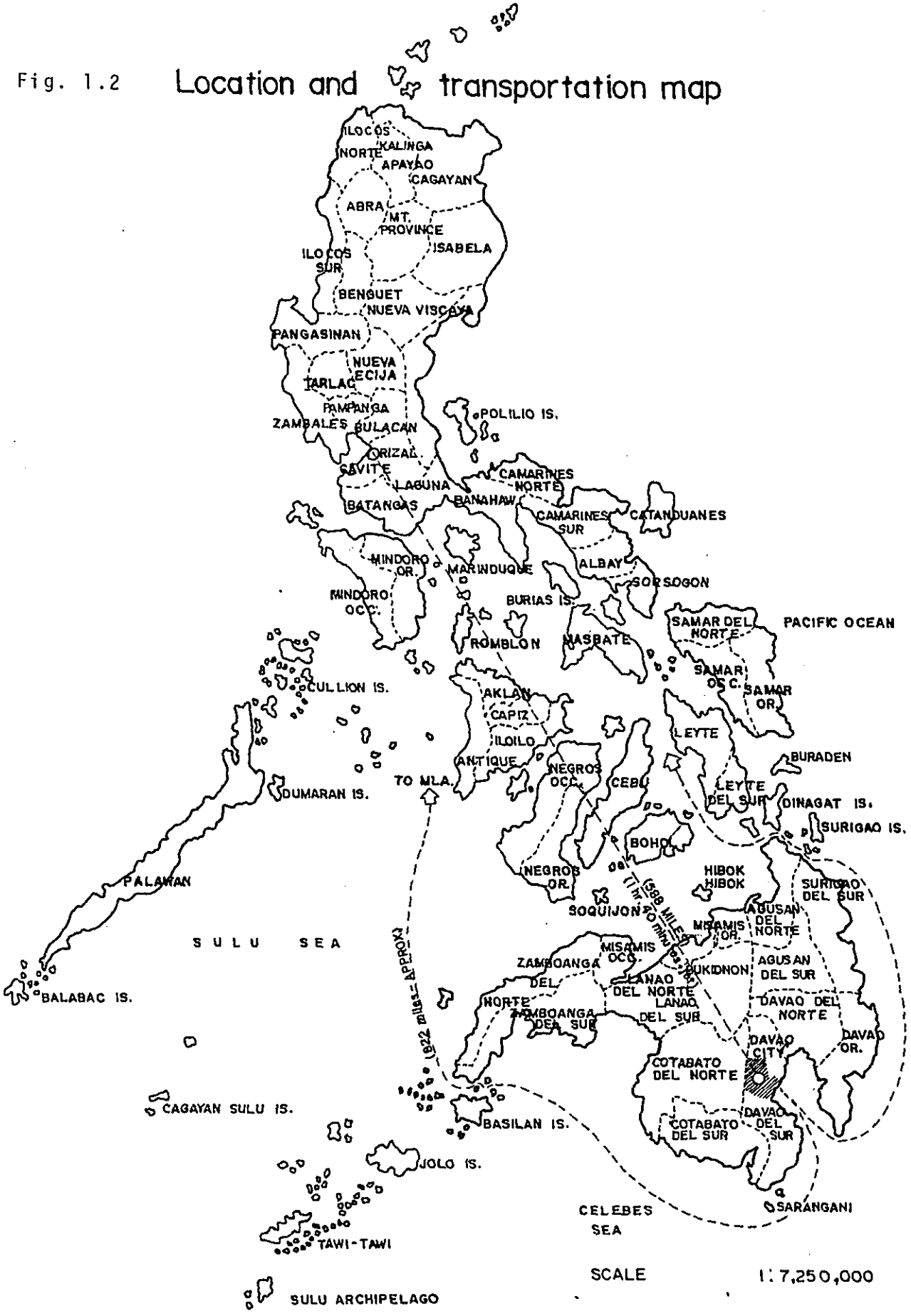


Fig. 1.3 Davao City District map

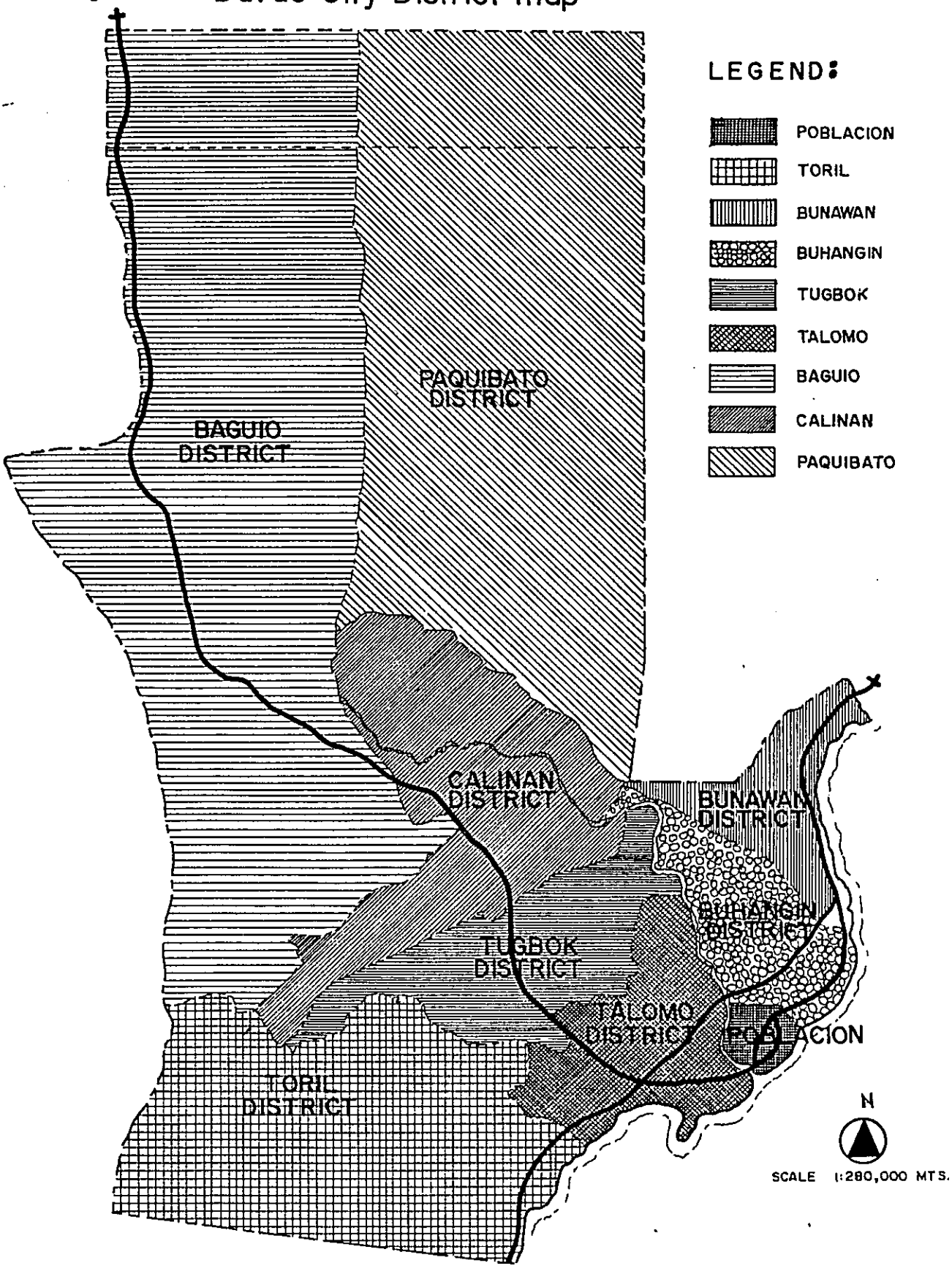


Fig. 1.4 Contour Map of Davao City

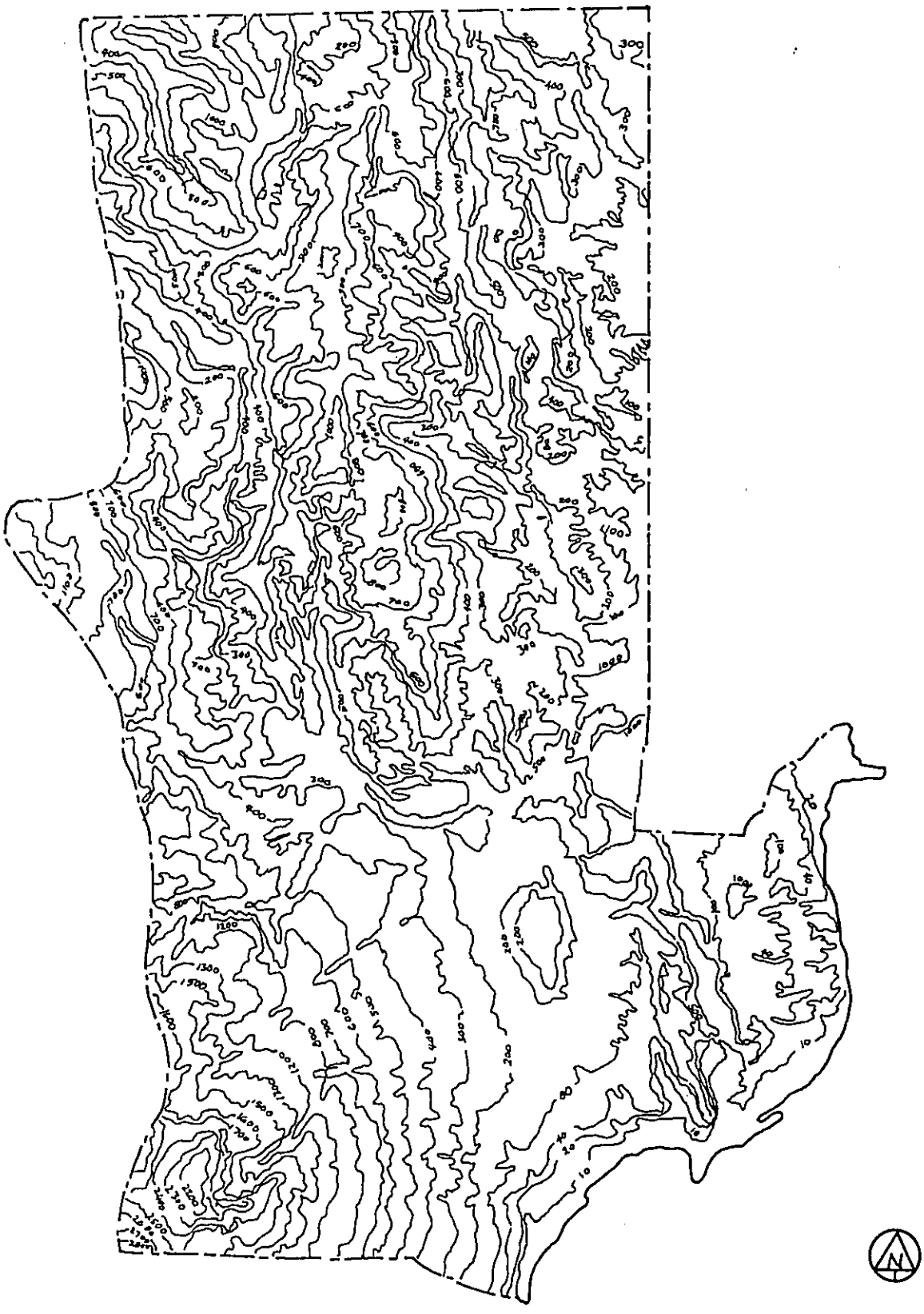


Fig. 1.5 Slope map, Davao City

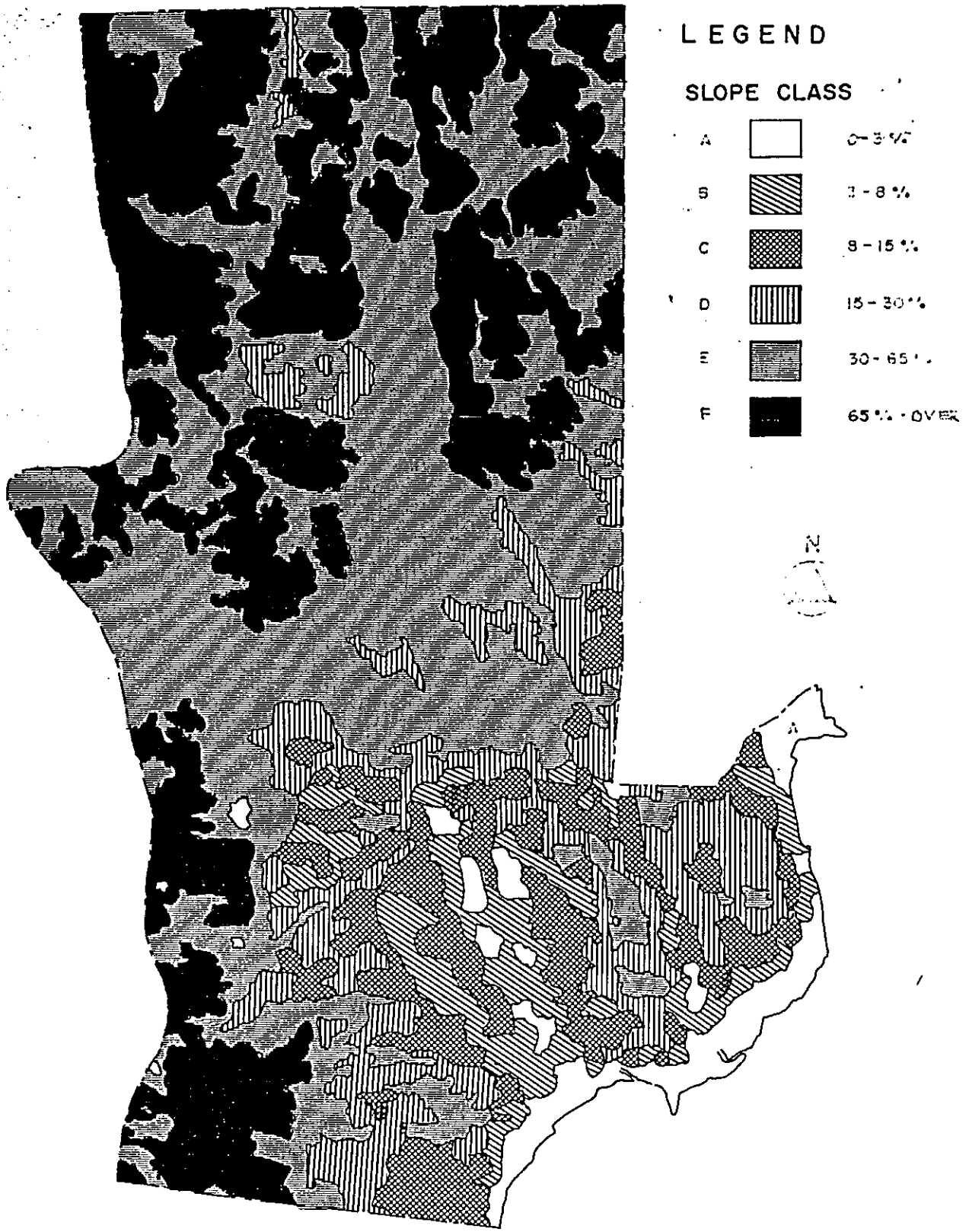
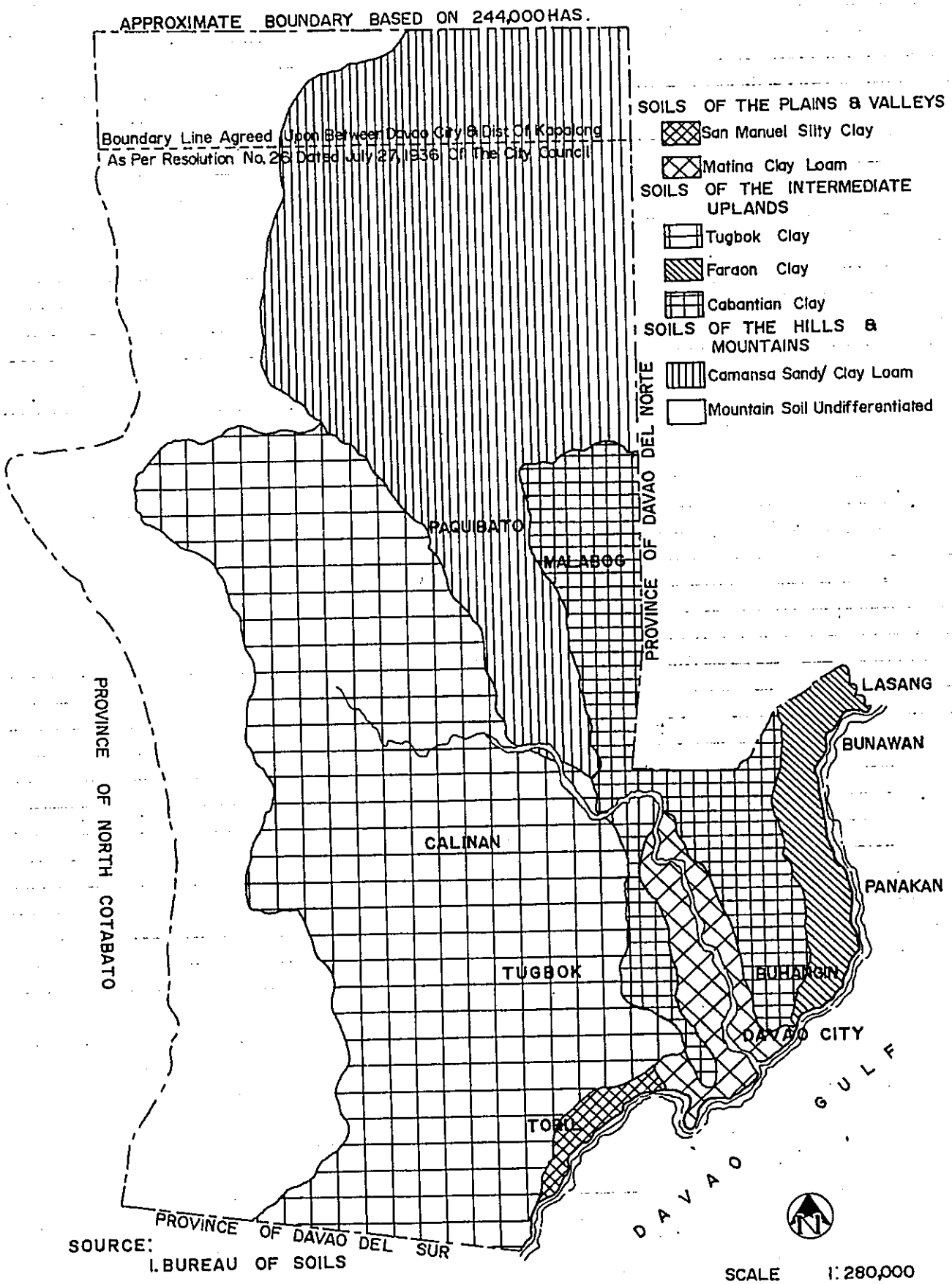


Fig. 1.6 Soil map of Davao City



SOURCE:
1. BUREAU OF SOILS
2. CARBDP

SCALE 1: 280,000

TABLE 1.1 LAND CAPABILITY CLASSIFICATION, DAVAO CITY

CLASS/ SUBCLASS	AREA (has.)	DESCRIPTION
A	2,043.3	The soil is very fertile and water easily absorb into the ground, a plain with good nutrient elements and easy to cultivate.
Be	92,796.2	A plain to gently, sloping land and a portion land as moderately slope of 8% susceptible to slight erosion.
Bw	16,669.2	This is gently level and occnos in depresion near large stream or lowland including wet portion that can easily drains. The area is subject to occational overflow due to its deep subsoil and heavy.
B_s	26,499.2	The slight level land with sandy loam or light texture soils. Essentially good land but low fertile and its porous soil allow water to Percolate rapidly. It is a less fertile and easily day.
C_e	53,245.8	Gradually sloping portion and easily eroded land. The effective depth may extend to 90 m. or more. Its 8-15% slope accelerates erosion and deplete fertility.
D_e	19,399.1	A hilly land and easily eroded. Topsoil is generally thin. The slope is 15-25% with excessive run-off.
M	24,950.8	This portion land is step, severely to excessively eroded or shallow land. Its about 25 - 40% slope with stones or gravel present making the land unfit for seasonal cultivation.
N	8,447.6	Very steep, shallow, rough or day for cultivation, land is rugged and broken by large gullies with 40% over slope causes excessive erosion.

SOURCE: BUREAU OF SOIL

*Planimeter readings

From the above table, classes A, B, C & D, are grouped as cropland, class M is considered Pastureland, and class N is considered as forestland.

TABLE 1.2 SLOPE DISTRIBUTION AND CLASSIFICATION, DAVAO CITY

SLOPE CLASS	AREA (has.)	PERCENT (%)	DESCRIPTION
A	18,375	7.53	The land is almost level with very slight slope of 0 to 3% and has very slow runoff
B	10,462.8	44.36	Gradually sloping landwith 3-8% inclimation, this portion land is slow runoff as medium for most soils.
C	63,930.3	26.20	Gently rolling or moderately sloping land ranging from 8-15%.
D	21,829.5	9.09	A slanting or hilly land with slope ranging from 15-30%.
E	23,858.1	9.94	Steep or hilly areas with slope ranging from 30-65%, Runoff is very rapid on most soil.
F	9,545.2	3.98	A very steep land with slope more than 65%.
*	Planimeter readings		

SOURCE: BUREAU OF SOIL

TABLE 1.3 EVERY THREE YEARS AVERAGE TEMPERATURE AND RAINFALL INTENSITY FOR THE PERIOD 1968-1978 (DAVAO CITY)

PERIOD	LOWEST TEMPERATURE ^{O}C	HIGHEST TEMPERATURE ^{O}C	RAINFALL INTENSITY MM	PREVAILING WIND DIRECTION
1968-70	22.36	31.9	149.39	NORTH
1971-73	22.27	32.25	176.54	NORTH
1974-76	22.15	31.15	135.70	NORTH
1977-78	22.39	33.70	146.83	NORTH

TABLE 1.4 EVERY TWO YEARS AVERAGE TEMPERATURE AND RAINFALL DENSITY FOR THE PERIOD, DAVAO CITY, 1968-77.

PERIOD	LOWESR TEMPERATURE ^{O}C	HIGHEST TEMPERATURE ^{O}C	RAINFALL INTENSITY	PREVAILING WIND DIRECTION
Jan & Feb.	21.64	31.29	107.77	
March & April	22.43	32.66	104.62	
May & June	22.80	32.38	191.39	
July & Aug.	22.62	32.00	189.06	
Sept.& Oct.	22.82	32.20	181.57	
Nov. & Dec.	22.41	31.75	148.77	

* Minimum Temperature

** Maximum Temperature

*** Maximum Rainfall Intensity

SOURCE: Weather Bureau, Bangoy Airport, Sasa.

TABLE 1.5 DATA INTENSITY, TIME & DIRECTION OF EARTHQUAKES; DAVAO CITY, 1969 - 1976.

DATE	TIME	EPICENTER °N	EPICENTER °E	INTENSITY	MAGNITUDE REMARK
1-30-69	6:32 PM	4.8	127.4	VI	M = 5.9
2-04-69	5:44 AM	4.9	127.4	II	M = 6.1
9-19=69	9:31 AM	6.1	125.4	V	M = 5.7
6-05-70	5:23 PM	6.1	126.2	II	M = 5.5
12-04-70	11:57 PM	8.1	126.6	III	M = 5.5
12-02-72	8:22 AM	6.5	126.6	VI	M_b = 6.3
10-26-75	6:44 PM	6.1	126.4	IV	M_s= 5.8
11-08-76	1:11 AM	9.1	126.4	IV	M_s =6.2
9-19-77	10:40 PM	11.9	125.7	II	
9-25-77	9:56 PM	6:2	127.2	II	
6-08-78	4:29 AM	6.4	125.6	II	
6-23-78	5:54 AM	7.0	126.0	II	
2-06-79	4:38 AM	6.7	125.7	II	
4-28-79	9:53 AM	6.7	125.9	II	
9-06-79	12:44 AM	6.8	126.3	II	
1-02-80	6:58 AM	7.0	127.0	III	
1-02-80	5:48	6.0	126.2	V	

Note: "Adapted Rossi Free Scale" of nine intensities is being used.

Source: Philippine Atmospheric Geophysical and Astronomical Service Administration.

TABLE 1.6 KEY TO THE SOILS OF DAVAO CITY

Soil Type	Source of Parent Material	Dominant Relief
SOILS OF THE PLAIN AND VALLEYS		
San Manuel Silty Clay loam	Alluminum of igneous origin	Nearly level to level
Matina clay loam	Alluminum form lime-stone shale sand origin	First gently undulating
SOIL OF THE INTERMEDIATE UPLANDS		
Tugbok clay	Igneous socks mainandesites	Undulating to gently rolling
Faraon clay	Soft coralline lime-stone	Undulating to gently rolling
Cabantian clay	Soft shales with mix-tures of weathered gravel and sand	Hilly to mountains
SOIL OF THE HILL AND MOUNTAINS		
Camansa Sandy	Shales ans sandstones with weathered gravel and sand	Hilly to mountains
Mountain soils undifferentiated	Different Kind of igneous and metamorphic rocks	These soils are generally shallow and stony with excessive drainage ; not sutied to agriculture.

SOIL OF THE PLAINS AND VALLEYS

Soil Types	Drainage Ext.	Drainage Int.	Area (has.)	Percent	Remarks
San Manuel Silty clay loam	Fair	Good	6,717	3%	Fertile soil; good for most crops
Matina clay	Fair	Fair	11,217	5%	Good soil abaca,corn, upland rice and vege-tables.

TABLE 1.6 (cont'd)

SOIL OF THE INTERMEDIATE UPLANDS					
Tugbok clay	Good	Good	79,780	33%	Excellent for abaca, fruit trees do well and other crops
Faraon clay	Free	Fair	10,092	4%	Moderately fertile;for coconut and corn.
Cabantian clay	Free	Poor	25,592	10%	For coconut and corn bananas grove fairly well.
SOIL OF THE HILL AND MOUNTAINS					
Camansa Sandy	Free	Good	51,092	21%	Moderately fertile but not recommended for cultivation due to rough topography.
Mountain soil undifferentiated			59,510	24%	Suited for forestry purposes us sources of of lumber.

1.2 Land Use

Now, the urbanized area in the Project Area is located from Bunawan to Toril along the Davao Gulf as closed up the plateau at west side of the Project Area and represented about 19% (3,500 hectares), of the Project Area (18,100 hectares).

The most urbanized area is the Poblacion which is located in the center of the Project Area. Bucana, Agdao and Buhangin in the vicinity of the Poblacion are presently urbanizing.

Poblacion is the biggest commercial center of the Project Area which is located along C.M. Recto, San Pedro, Quirino and Magsaysay Avenue.

Industrial Area is located detachedly along the trunk road from Bunawan to Toril.

Residential area is densely built up in the Poblacion. Many sub-division is detachedly built up away from trunk road.

The percentage share of Land Use in 1979 is shown in Table 1.7. The urbanized are has only 20%. Fig. 1.7 illustrated the present Land Use.

Table 1.7 Land Use in 1979

	ha.	%
Residential	2,549	14
Commercial	283	1
Industrial	322	2
Institutional	202	1
Open Space	160	1
Others	14,584	81
T o t a l	18,100	100

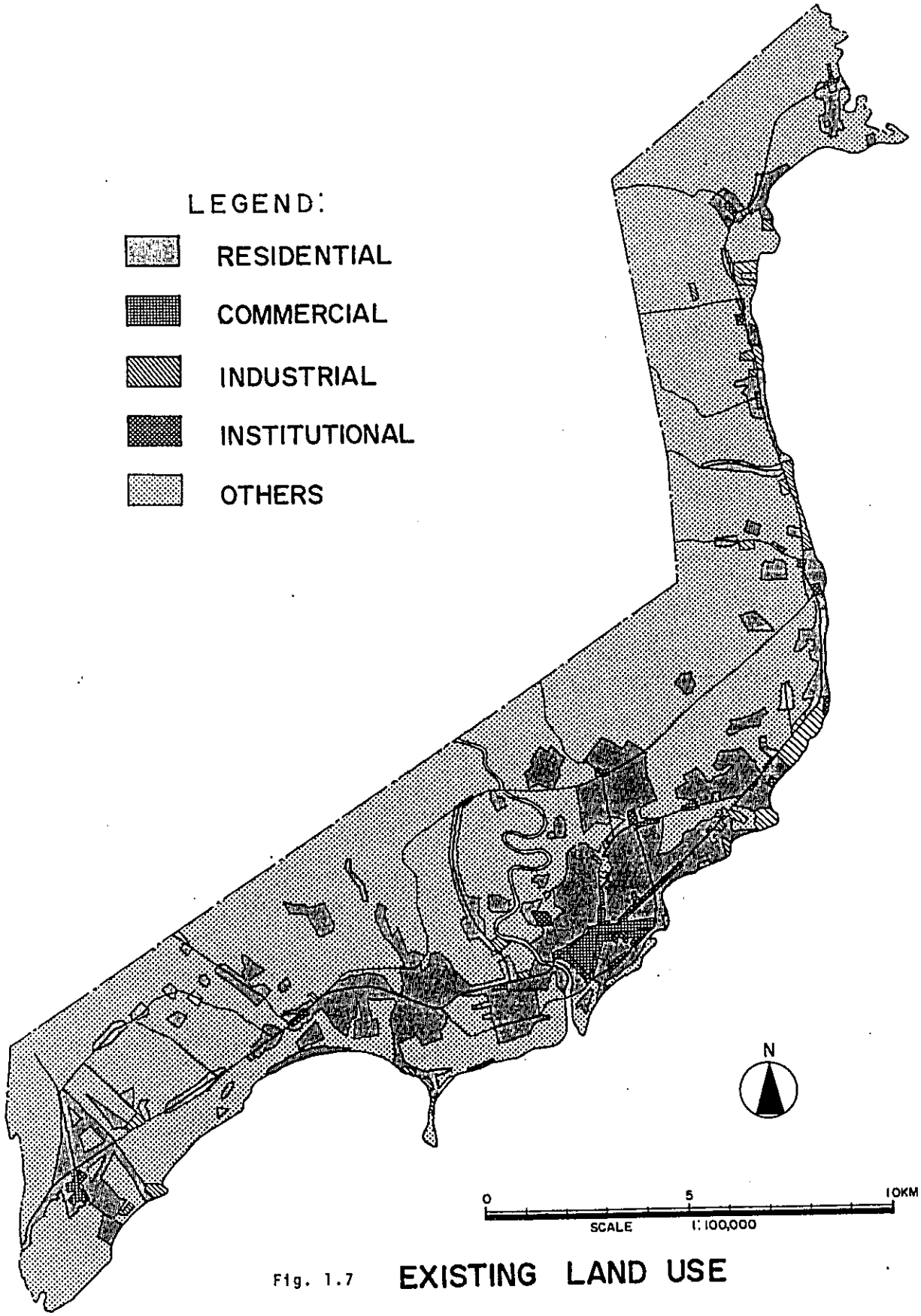


Fig. 1.7 EXISTING LAND USE

1.3 Population and Employment

1.3.1 Population

Davao City has a total population of 484,678 in 1975 Census which represnts an increase of 23.5 per cent over the 1970 population which was 392,475.

Table 1.8 shows the population density and distribution by district.

The Poblacion has the highest population density which is 119 persons per hectare.

Table 1.8
Population Density in Davao City in 1975

District	Area (ha)	Population (person)	Population Density (person/ha)	Distribution (%)
Poblacion	1,028.2	122,375	119.02	25.25
Bunawan	6,550	39,300	5.96	5.96
Buhangin	9,221.8	75,246	8.16	15.52
Talomo	11,040	71,570	6.48	14.77
Toril	32,300	55,677	1.72	11.49
Paquibato	65,635	25,562	0.39	5.27
Baguio	82,735	26,062	0.32	5.38
Calinan	22,360	39,300	1.76	8.11
Tugbok	13,130	29,841	2.27	6.16
T o t a l	244,000	484,678	1.98	100.00

Source: NCSO

The population in 1979 was estimated by using the average annual growth rate between 1970 and 1975 population, which was calculated at 4.3% per annum.

The total population in the Project Area and Non-Project Area are estimated by using the average annual growth rate by each Barangay and checking the total population. The estimated population in Project Area and Non-Project Area in 1979 are 371,740 and 188,260 respectively.

Table 1. 9 Population in 1979

	Project Area	Non-Project Area	Davao City
1970	264,242	128,231	392,473
1975	318,720	169,958	484,678
1979	371,740	188,260	560,000

Source: DCUTCLUS

1.3.2 Employment

On the basis of employment of Davao del Sur in 1970 and 1975, and of Davao City in 1970, employment of the Project Area and Non-Project Area by industry in 1979 was estimated as shown in Table 1.12. The flow chart of calculation method is presented in Fig. 1.8.

Table 1.10 Employment by Industry, Davao del Sur and Davao City

	DAVAO DEL SUR				DAVAO CITY	
	1970		1975		1970	
		%		%		%
Primary	149,060	(59)	171,726	(58)	54,167	(42)
Secondary	30,548	(12)	31,968	(11)	21,470	(17)
Tertiary	73,059	(29)	90,311	(31)	52,294	(41)
Total	252,667	(100)	294,005	(100)	127,931	(100)
Total Population	785,000		936,000		392,473	
Ratio of Employment	32.2		31.4		32.6	

* Figures in Parenthesis show share.
Source: NCSO

Table 1.11 Employment Classified by Industry, DAVAO DEL SUR, 1975

	URBAN		RURAL		TOTAL	
		%		%		%
Primary	18,717	(20.1)	153,009	(76.1)	171,726	(58.4)
Secondary	18,321	(19.7)	13,647	(6.8)	31,968	(10.9)
Tertiary	56,034	(60.2)	34,277	(17.1)	90,311	(30.7)
TOTAL	93,072	(100)	200,933	(100)	294,005	(100)

* Figures in parenthesis show share.
Source: NCSO

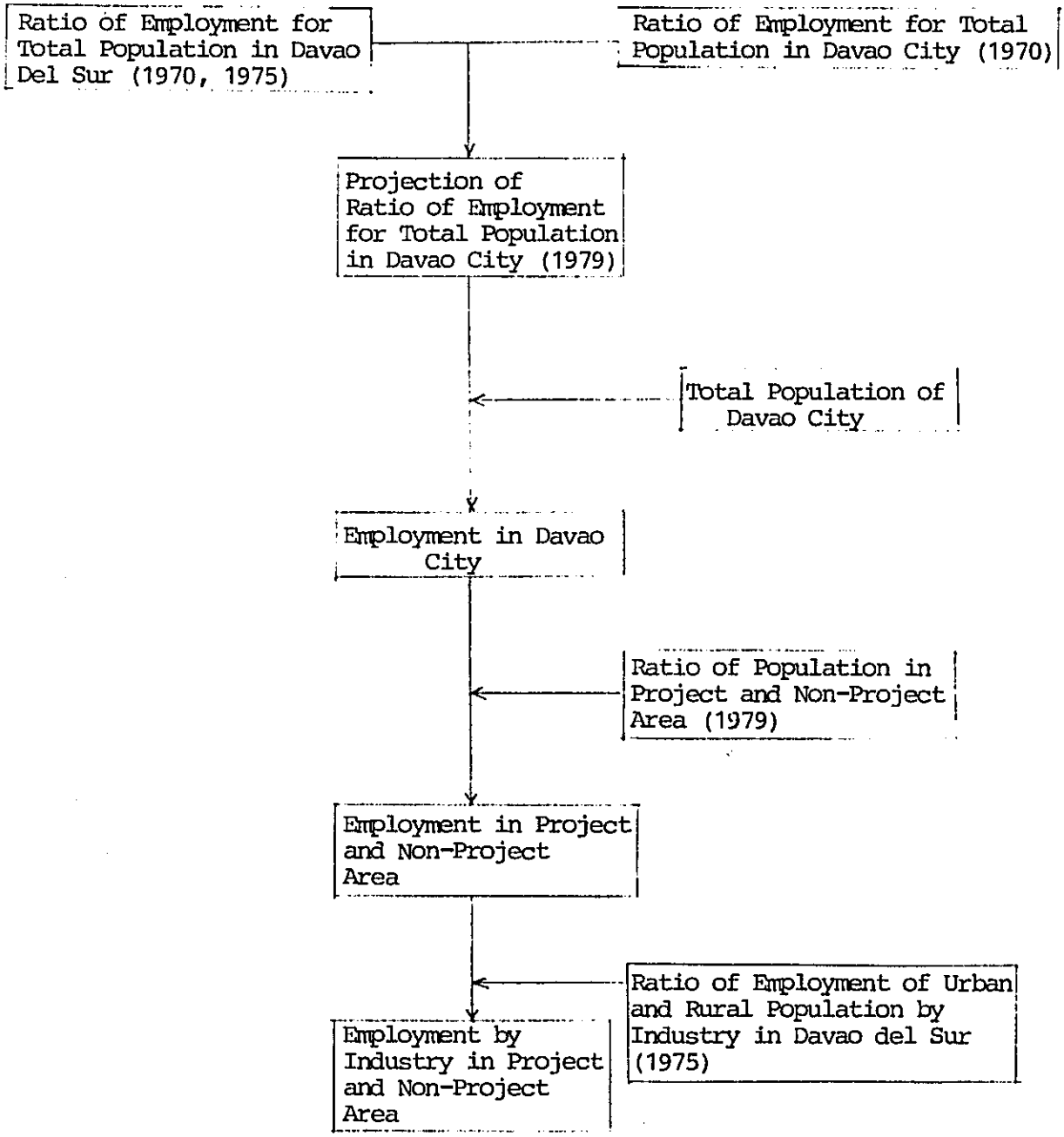
Table 1.12 Employment of Project Area and Non-Project Area in 1979

Sector	Project Area		Non-Project Area		Davao City	
		%		%		%
Primary	24,000	(21)	51,000	(76)	25,000	(41)
Secondary	22,000	(19)	5,000	(8)	27,000	(15)
Tertiary	69,000	(60)	11,000	(16)	80,000	(44)
TOTAL	115,000	(100)	67,000	(100)	182,000	(100)

* Figures in parenthesis show share.

Source: DCUTCLUS

Fig. 1.8 Flow Chart for Projection of Employment by Industry in 1979



1.4 Economic Profile

1.4.1 GNP and GDP

The real gross national product (GNP) in 1972 registered an amount of ₱55.5 billion and increased to ₱ 92.2 billion in 1979 with an average annual growth rate of 7.5 percent within the seven year period. The per capita GNP rose from ₱1,424 in 1972 to ₱1.952 in 1979. This represents an annual growth rate of 4.3 percent.

Meanwhile, the gross domestic product (GDP) reached to ₱56.1 billion in 1972 and rose to ₱92.9 billion in 1979 with an average annual growth rate of 7.5 percent. The per capita GDP gradually increased from ₱1,438 in 1972 to ₱1,967 in 1979.

The national income however, had the same fluctuating trend as the GNP, GDP. In 1972, it registered an amount of ₱45.8 billion and ₱75.7 billion in 1979. This represents an average annual growth rate of 7.4 percent. The per capita national income rose from ₱1,174 in 1972 to ₱1,602 in 1979 with an average annual growth rate of 4.5 percent.

GNP, GDP and national income are shown in Table 1.13.

Table 1.13 GNP, GDP and National Income of Philippines

(at constant 1972 prices)

	1972	1973	1974	1975	1976	1977	1978	1979	Average Annual Growth Rate 1972 - 1979
GNP (In million pesos)	55,526	60,881 (9.6)	64,379 (5.7)	68,530 (6.4)	73,342 (7.0)	77,958 (6.3)	82,477 (5.8)	92,201/1 (11.8)	(7.5)
Per capita GNP	1,424	1,517	1,568	1,622	1,690	1,747	1,796	1,952	(4.3)
GDP (In million Pesos	56,075	60,931 (8.7)	64,139 (5.3)	68,361 (6.6)	73,585 (7.6)	78,163 (6.2)	82,681 (5.8)	92,902/1 (12.4)	(7.5)
Per capita GDP	1,438	1,519	1,553	1,618	1,696	1,751	1,801	1,967	(4.6)
National Income (In million pesos)	45,790	49,864 (8.9)	52,263 (4.8)	55,063 (5.4)	59,538 (7.9)	63,280 (6.4)	66,129 (4.5)	75,659/1 (14.4)	(7.4)
Per capita National Income	1,174	1,243	1,266	1,303	1,370	1,418	1,440	1,602	(4.5)
Population as of July 1 (In thousand)	38,991	40,123	41,297	42,261	43,402	44,628	45,912	47,233 /2	(2.8)

/1 : Central Bank Data

/2 : Estimate

Figures in parenthesis show growth rate.

Source: Statistical Yearbook 1979

1.4.2 GRDP

The gross regional domestic product (GRDP) increased from ₱4,454 million in 1973 to ₱4.937 million in 1976 with an average annual growth rate of 3.5 percent.

Agriculture, fisheries and forestry sector contributed about 46 percent of the total GRDP. On the otherhand, industry and service sectoes contributed about 17 percent. and 37 percent respectively. The per capita GRDP decreased from ₱1,752 million in 1973 to ₱1,695 million in 1976.

GRDP is shown in Table 1.14.

Table 1.14 Gross Regional Domestic Product

(In million pesos at 1972 prices)

Sector	1973	1974	1975	1976
Agriculture, Fisheries, and Forestry	2,060.0 (46)	1,981.0 (45)	2,118.6 (46)	2,265.4 (46)
Industry	735.2 (17)	766.8 (18)	788.7 (17)	842.2 (17)
Manufacturing	625.0	617.0	625.2	664.1
Mining and Quarrying	1.7	4.2	4.9	5.6
Construction	98.3	134.3	146.3	159.5
Electricity, Gas and Water	10.5	11.6	12.3	13.0
Service	1,656.3 (37)	1,615.1 (37)	1,716.1 (37)	1,829.3 (37)
Transport, Communication and Storage	98.3	99.1	106.8	115.5
Commerce	1,277.0	1,230.0	1,305.0	1,388.5
Other Services	283.0	286.0	304.3	325.3
GRDP	4,453.5 (100)	4,362.9 (100)	4,623.4 (100)	4,936.9 (100)
Per capita GRDP	1,752.3	1,638.7	1,657.7	1,695.1

Figures in parenthesis show share to total GRDP (%)

Source: Region XI Five - Year Development Plan

1.4.3 Establishments

Based from the NCSO's report on the 1978's census on establishments, there were 33,329 business establishments operating in the region. Table 1.15 showed that more than one third (39.5%) were located in Davao del Sur. Out of the provincial total, there were 9,047 (68.8%) business establishments located in Davao City representing 27.1% share from the regional total.

By major industry group, the report revealed that most of the establishments were concentrated in wholesale/retail group. Davao City registered 4,903 wholesale/retail establishments in the City. Community Services group have 1,917 establishments which is 21.2% share, followed by Manufacturing for 1.163 establishments or 12.9% of the City's listed total. Table 1.16 further illustrated percentage-share of each industry group for the region, Davao del Sur and Davao City.

Table 1.17 showed total number of establishments by major industry group and by employment size. By employment size, a great majority (90%) of the City were reported under 1-9 employment category /1; (5%) for 10-19 employment size; for establishments in the 20-99 group (4%); and less than (1%) for 100-199 and 200 over employment size.

/1 Estimated figures based from NCSO sample survey

TABLE 1.15 DISTRIBUTIONS OF ALL ESTABLISHMENTS BY MAJOR INDUSTRY DIVISION, BY REGION, BY PROVINCE, & DAVAO CITY : 1978

Region XI Province & Davao City	Total No. of Establishments	NUMBER OF ESTABLISHMENTS CLASSIFIED BY MAJRO DIVISION								
		agriculture Fishery & forestry	Mining & Quarrying	Manufacturing	Electricity Gas & Water	Construction	Wholesale & Retail	Transport Storage & Communication	Finance/ Business	Community Services
Region XI	33,329	594	19	4,968	38	64	18,947	2,417	681	5,601
	(100.0)	(1.8)	(0.1)	(14.9)	(0.1)	(0.2)	(56.8)	(7.3)	(2.0)	(16.8)
Davao del Sur	13,158	149	7	1,815	20	47	7,334	845	434	2,507
	(39.5)	(0.4)	(0.02)	(5.4)	(0.06)	(0.1)	(22.0)	(2.5)	(1.3)	(7.5)
Davao City	9,047	85	5	1,163	16	47	4,903	514	397	1,917
	(27.1)	(0.3)	(0.02)	(3.5)	(0.05)	(0.1)	(14.7)	(1.5)	(1.2)	(5.8)

SOURCE: NCSO

( ): Percentage share

TABLE 1.16 PERCENTAGE DISTRIBUTION OF ALL ESTABLISHMENTS BY MAJOR INDUSTRY DIVISION, 1978

ESTABLISHMENTS BY INDUSTRY	REGION XI Number	%		DAVAO DEL SUR Number	%		DAVAO CITY Number	%	
Total number of establishments	33,329		100.0	13,158		100.0	9,047		100.0
Agriculture, Forestry, Hunting & Fishing	594		1.8	149		1.1	85		1.0
Mining/Quarrying	19	0.06		7	0.05		5	0.06	
Manufacturing	4,968	14.9		1,815	13.8		1,163	12.9	
Electricity, Gas & Water	38	0.1		20	0.2		16	0.2	
Construction	64	0.2	15.3	47	0.4	14.4	47	0.5	13.7
Wholesale, Retail	18,947	56.8		7,334	55.7		4,903	54.2	
Transportation, Storage Communication	2,417	7.3		845	6.4		514	5.7	
Finance, Business	681	2.0		434	3.3		397	4.4	
Community Services	5,601	16.8	82.9	2,507	19.1	84.5	1,917	21.2	85.5

SOURCE: NCSO
Davao City

TABLE 1.17 TOTAL NUMBER OF ESTABLISHMENTS BY MAJOR INDUSTRY GROUP AND BY EMPLOYMENT SIZE IN REGION XI: 1978

INDUSTRY	NUMBER OF ESTABLISHMENTS BY EMPLOYMENT SIZE					
	TOTAL	1 - 9	10 - 19	20 - 99	100 - 199	200 over
ALL INDUSTRIES						
Region XI	33,329	31,429	1,083	625	82	110
Davao del Sur	13,158	11,991	654	413	46	54
Davao City	9,047	8,109 (89.6)	531 (5.9)	324 (3.6)	39 (0.4)	44 (0.5)
1) AGRICULTURE, FORESTRY HUNTING & FISHING						
Region XI	594	297	119	100	21	57
Davao del Sur	149	24	56	46	6	17
Davao City	85	17	32	18	4	14
2) MINING/QUARRYING						
Region XI	19	8	3	5	-	3
Davao del Sur	7	3	2	1	-	1
Davao City	5	2	2	1	-	-
3) MANUFACTURING						
Region XI	4,968	4,645	181	105	15	22
Davao del Sur	1,815	1,615	105	74	8	13
Davao City	1,163	977	98	69	8	11
4) ELECTRICITY, GAS WATER						
Region XI	38	27	3	5	2	1
Davao del Sur	20	14	3	1	1	1
Davao City	16	12	3	-	1	-
5) CONSTRUCTION						
Region XI	64	26	12	17	5	4
Davao del Sur	47	17	10	13	4	3
Davao City	47	17	10	13	4	3

INDUSTRY	NUMBER OF ESTABLISHMENTS					
		EMPLOYMENT SIZE				
	TOTAL	1 - 9	10 - 19	20 - 99	100 - 199	200 over
6) WHOLESALE/RETAIL						
Region XI	18,947	18,477	333	127	7	3
Davao del Sur	7,334	7,016	204	104	7	3
Davao City	4,903	4,616	184	94	7	2
7) TRANSPORTATION,STORAGE COMMUNICATIONS						
Region XI	2,417	2,258	94	54	6	5
Davao del Sur	845	730	70	38	4	3
Davao City	514	422	55	30	4	3
8) FINANCE/BUSINESS						
Region XI	681	521	92	56	7	5
Davao del Sur	434	326	55	42	6	5
Davao City	397	300	50	38	6	3
9) COMMUNITY SERVICES						
Region XI	5,601	5,170	246	156	19	10
Davao del Sur	2,507	2,246	149	94	10	8
Davao City	1,917	1,746	97	61	5	8

SOURCE: NCSO
Davao City

1.5 Financial Status of Davao City

1.5.1 City Government Income and Expenditure

(1) Income

The overall financial capability of Davao City covering a five year period from 1975-1979 with emphasis on the 1979 financial data is presented on the following table:

Table 1.18 Income of Davao City 1975-1979

(Current Price in thousand pesos)

I N C O M E	1975	(%)	1976	(%)	1977	(%)	1978	(%)	1979	(%)
A. Revenue from Taxation										
Bus. & Occupation Taxes	11,241		12,126		15,902		15,402		15,178	
Property Tax	4,998		8,588		-		-		-	
Other taxes & duties	1,246		4,542		11,228		17,289		39,088	
Local Gov't. share from Internal Revenue	-		-		9,926		9,924		3,462	
Sub-Total	17,485	(48)	25,256	(54)	37,056	(56)	42,616	(68)	57,728	(83)
B. Non-Tax Revenue										
Earnings & Other Credit	-		-		5,759		9,273		8,474	
Misc. Income & Receipts	-		-		8,286		10,394		3,302	
Sale of Assets -	-		-		3		-		4	
Income from Public Enterprises	-		-		664		-		-	
Incidental Revenue	3,014		1,099		-		-		-	
Receipts from Operation	3,575		4,277		-		-		-	
C. Other Receipts										
Return of Advances	323		4,616		-		-		-	
Borrowings	-		-		14,975		-		-	
D. National Gov't. Aides & Allotments										
Internal Revenue Allotments	9,932		9,982		-		-		-	
National-Municipal	1,936		1,906		-		-		-	
Sub-Total	18,780	(52)	21,880	(46)	29,687	(44)	19,667	(32)	11,780	(17)
GRAND TOTAL INCOME	₱36,265		₱47,136		₱66,743		₱62,282		₱69,508	

Source: Statistics Division, Ministry of Finance, Manila

Davao city's income since 1975, with the exception of 1978, showed in upward climb - that is, from, ₱36,265,000 in 1975 to ₱69,508,000 in 1979 with an average annual growth rate of 17.7 per cent. The decrease of ₱4,461,000 in 1978 may be attributed to the city's non-borrowing from the national and other local governments as reflected in the "Other Receipts" group category of the revised Budget Operation Statement. However, there was no apparent change in the economic condition in the city as the total revenue collection was relatively higher than 1977 collection.

During 1977 innovative measures to facilitate efficient tax collection in the city begun. A new classification of the city's revenues was evolved with the shift of the city's fiscal set-up to calendar year. /2

In 1979, the government introduced packages of measures relating to domestic taxation which were designed to supplement existing revenue measures and help achieve equity, energy conservation and efficiency objectives. The regional budgeting system was adopted to minimize regional disparities and allocate resources more equitably./3 The city's income was regrouped categorically into four (4) major groups namely:

A) Revenue from Taxation, which accounted most of the city's earnings amounting to 48-83 per cent share of the total earnings during the five (5) years period under review, include real property taxes, business and occupational taxes, other taxes and duties local government share from internal revenue collection;

B) Non-Tax Revenue which include earnings and other credits from operating and service income, income from government business operation, interest income, fines and penalties and other miscellaneous earnings;

C) Other receipts; and

D) Internal Revenue Allotment

In 1979 total revenue from taxation amounted to ₱57,728,000 or 83 per cent of the total collection of ₱69,508,000. Non-Tax Revenue had ₱11,780,000 or 17 per cent share of the total.

/1 Source: Statistics Division, Ministry of Finance, Manila

/2 Source: 1979 Davao City Profile, Vol. 1

/3 Source: Development Bank of the Philippines
1979 Annual Report

(2) Expenditure

The city's expenditure is categorized into two major groups namely:

A. Current operating which includes general administration of government, public welfare and internal safety, economic development operation of economic enterprise, inter-government aids and debt services;

B. Capital outlays which include real property and equipment expenditures.

In recognition of the national drive to minimize regional disparities and allocate resources more equitably the city's expenditures were restructure in 1979. The three major expenditure of the city were for public welfare and internal safety (36%), inter-government aids (25%) and economic and social development (18%) wherein the latter expenditure were channelled to social development notably health nutrition, family planning and human settlement development and general public services. For the period 1975 - 1979, the city increased the total expenditure from ₱38,981,000 to ₱65,242,800.

This increase was attributed to the increase of the city's income and operational expansion of the city government machinery development.

It seems clearly over the years that the city's financial resources have credibly tackled the needs of the city's growth and development.

Table 1.19 Actual Income Realized in Davao City CY 1977 - 1979

(In thousand pesos)

	1977	1978	1979
Total Funds Available for Expenditures			
Gross Fund Balance at the Beginning of the calendar year	10,834	10,369	10,726
Plus:			
Actual Income Realized during current calendar year	55,909	51,913	58,782
GRAND TOTAL	66,743	62,282	69,508

Source: Statistics Division, Ministry of Finance, Manila

As shown in the Table 1.19, gross fund balance for each year was included in the next year's gross fund balance at the beginning to form part of the latter year's total funds available for expenditures.

Nowadays, Davao City is a dynamic metropolis in the South and there appears a great potential for the city to increase revenues, and hence increase its debt capacity.

Table 1.20 Expenditures of Davao City
1975 - 1979

(current price in thousand pesos)	1975	(%)	1976	(%)	1977	(%)	1978	(%)	1979	(%)
A. Current Operating										
1) General Adm. of Government	5,759	(15)	8,052	(15)	7,137	(11)	7,672	(12)	5,629	(9)
2) Public Welfare & Internal Safety	8,762	(22)	18,276	(35)	17,345	(26)	23,190	(37)	23,516	(36)
3) Gov't. Finance & Adjudication	4,575	(12)	-		-		-		-	
4) Eco. & Social Development	11,529	(30)	4,927	(9)	7,494	(11)	5,423	(9)	11,827	(18)
5) Operation of Eco. Enterprises	1,610	(4)	1,744	(3)	930	(1)	1,782	(3)	-	
6) Debt Service	329	(1)	329	(1)	328	(1)	4,951	(8)	101	
7) Inter-Gov't. Aids	1,758	(4)	2,229	(4)	3,504	(5)	3,703	(6)	16,267	(25)
Sub-Total	34,322	(88)	35,557	(67)	36,738	(55)	46,721	(75)	57,340	(88)
B. Capital Outlays										
1) Real Property	2,931	(8)	12,182	(23)	5,874	(9)	4,750	(8)	7,902	(12)
2) Equipment	1,728	(4)	4,474	(8)	17,269	(26)	1,268	(2)	-	
Sub-Total	4,659	(12)	16,656	(32)	23,143	(35)	6,018	(10)	7,902	(12)
C. Other Disbursement										
1) Loans, Advances & Transfers	-		321	(1)	6,277	(9)	9,119	(15)	-	
TOTAL EXPENDITURES	₱38,981	(100%)	₱52,534	(100%)	₱66,158	(99%)	₱69,858	(100%)	₱65,242	(100%)

1.5.2 National Government Expenditure /1

Major capital projects in Davao City have been implemented by the central line agencies such as the Ministries of Public Highways and Public Works, the Philippine Ports Authority, and the waterworks districts./2 These projects have been executed with funds from the national government and other sources such as foreign aids, grants & loans.

Table 1.21 shows the average central government line agency expenditure, by type of project, in Davao City during the past three to five years.

Table 1.21 Central Government Line Agency Expenditure by Project Type, Davao City

Line Agencies/Projects (₱000)	Amount
Ministry of Public Highways	
Roads and Bridges	23,975
Road improvement	660
Ministry of Public Works	
School Buildings	3,265
Other Buildings	-
Portworks	2,220
Waterworks	6,743
Philippine Ports Authority	
Portworks	-
Average annual expenditure (averaged over three to five years)	36,863

Source: Financial Study, RCDP, 1979

/1 Due to unavailability of pertinent data on this subject, the Financial Study conducted by Alexander Grant & Company in connection with Regional Cities Development Project (RCDP) sponsored by the World Bank, was considered a good reference and was continuously referred to throughout the report.

/2 The water works districts are quasi-private corporations operating under the supervision of the Local Water Utilities Administration (LWUA)

As shown in the Table, capital expenditure patterns of these agencies in the city have shown large variations. For the Ministry of Public Highways, the total average capital expenditure per year amounted to ₱24,635,000. About 97 per cent of this went to construction of roads and bridges, and 3 percent for the improvement or repair of roads and bridges. The RCDP report identified Davao as the recipient of the largest share (76%) of the amount that went for the construction of roads & bridges among all other regional cities under the RCDP. However, this expenditures include regional projects which may have had a direct impact on the city. Davao City was also named as the recepient of the largest share of school building construction funds (47%) and "Other Project" funds (69%) under the Ministry of Public Works capital expenditures. The MPW averaged ₱5,485,000 capital expenditures per year, with 60 per cent going to the construction of school buildings and 40 per cent to other projects in the city.

Table 1.22 Comparative capital expenditures of Davao City and Central Government Line Agencies

Line Agencies/Projects	Davao City (%)
Roads and Bridges	
Ministry of Public Highways	95
City Government	5
Road Improvements	
Ministry of Public Highways	35
City Government	65
Buildings	
Ministry of Public Works	64
City Government	36
Other Projects	
Ministry of Public Highways	1
Ministry of Public Works	34
City Government	65

NOTE: Other projects include construction/repairs/maintenance of plaza, parks, monuments, flood/river control projects, drainage & shore protection projects.

SOURCE: Financial Study, RCDP, 1979

As shown in the Table, no apparent pattern is evident with respect to the relative percentages of expenditures by the national and city government on any type of project over the past three to five years. This may suggest that although the capital projects undertaken in the city have been following some planned direction, the funding of these projects have not necessarily been coordinated resulting to wide disparity between appropriations and releases of funds. The operation of the public works program had been greatly hampered by the poor procurement procedures.

Table 1.23 shows the project appropriations in the city for 1980. This is about double the average annual expenditures for the past 3-5 years. Table 1.24 shows the infrastructure investment requirements by package for Region XI and Davao City from 1981-1985.

Table 1.23 Central Government Line Agency Appropriations for 1980

Line Agencies/Projects (₱000)	Davao City
Ministry of Public Highways	
Roads & Bridges	25,630
Road Improvements	47,050
Ministry of Public Works	
School Buildings	5,083
Other Buildings	-
Portworks	6,200
Philippine Ports Authority	
Portworks	5,202
	89,165

SOURCE: Financial Study, RCDP, 1979

TABLE 1.24 INFRASTRUCTURE INVESTMENT REQUIREMENTS
By Package, Region XI
1981 - 1985

(in thousand pesos at 1979 prices)

PROJECT PACKAGE	F I N A N C I A L R E Q U I R E M E N T S											
	1981		1982		1983		1984		1985		1986	
	Reg. XI	Dvo. City	Reg. XI	Dvo. City	Reg. XI	Dvo. City	Reg. XI	Dvo. City	Reg. XI	Dvo. City	Reg. XI	Dvo.City
Regionwide	139,478	-	128,007	-	142,659	-	138,246	-	142,287	-	690,677	-
Roads and Bridges	49,498	6,838	57,252	7,058	55,242	6,550	52,952	5,883	41,512	5,513	256,456	31,842
Rural Water Supply	19,114	1,663	20,268	1,713	21,226	1,613	22,478	1,663	23,683	1,713	106,769	8,365
Municipal Waterworks	11,947	-	12,936	-	12,962	-	13,818	-	15,280	-	66,943	-
Flood Control & Drainage	29,086	1,920	59,386	2,064	79,926	2,280	77,160	2,520	59,956	2,760	305,514	11,544
Social Infrastructure	-	1,620	-	-	-	-	-	-	-	-	-	1,620
Other Services	8,977	-	7,546	-	8,851	-	11,239	-	14,500	-	51,113	-
T O T A L	258,100	12,041	285,395	10,835	320,866	10,443	315,893	10,066	297,218	9,986	1,477,472	53,371

SOURCE: Regional Development Investment Program, 1981 - 1985
NEDA, Region XI, Davao City

1.5.3 Financial Institutions

(1) Development Bank of the Philippines (DBP)

The objectives of the DBP are:

i. Committed to the goals of employment generation, industry dispersal, export promotion, and regional and social development the DBP harnessed its resources to accelerate national development in various fronts through the establishments of a national networks of branches, the acceptance of savings & time deposits to mobilize idle capital & the encouragement of foreign investment.

ii. Act as a prime catalyst for development by, through its branches in the city, granting sumptuous loans to pioneering as well as those already established industries particularly those of small- and medium-scale industries.

The bank's investment exposure to 27 different industries and other commercial establishments on the city reached ₱946,625.00 in 1977. It is hopefully speculated that more industries will be served by the bank in the future.

Table 1.25 Summary of Loans granted by the Development Bank of the Philippines in Davao City for 1977

(In thousand pesos)

T Y P E	NUMBER	AMOUNT
Ceramics	1	30
Hauling of sand & gravel	1	100
Machine Shop	1	150
Printing Press	1	110
Professional	8	157
Public Utility	3	77
Tricycles	8	63,825
Food Manufacture	2	108.300
Furniture Factory	1	50.000
T O T A L	27	946.625

SOURCE: 1979 Davao City Profile

(2) Other Banks

Table 1.26 shows that as of 1977 there were 124 /1 financial institutions operating within Davao City. About 44 per cent of these financial institutions belong to insurance companies and 23 per cent were under commercial banking.

/1 Latest data for 1979 in the city is 150 financial institutions, representing 54 per cent of the regional total of 279.

SOURCE : Southeastern Mindanao Trade Profile TAC, Ministry of Trade, Region XI

Table 1.26 - Summary List of Financial Institutions in Davao City as of 1977

BANK CLASSIFICATION	NO.	NO. OF SEPARATE OFFICES			LOCATION
		TOTAL	BRANCH	EXTENSION/ AGENCY	
1. Commercial Banks	29	37	29	8	City Proper & Toril
2. Thrift Banks					
2.1 Savings & Mortgage Banks	3	8	4	4	City Proper
3. Savings & Loan Association	1	-	-	-	City Proper
4. Mutual Building & Loan Association	1	-	-	-	City Proper
5. Development Banks	2	-	-	-	City Proper
6. Specialized Government Non-Bank Entities					
6.1. G.S.I.S.	1	-	-	-	-
6.2. S.S.S.	1	-	-	-	Davao City*
7. Other Finance Companies					
7.1. Finance Companies	12	-	-	-	City Proper
7.2. Investment Companies	4	-	-	-	City Proper
8. Pawnshops	11	-	-	-	City Proper
9. Lending Investors	4	-	-	-	Davao City*
10. Insurance companies					
10.1 Life Insurance	13	-	-	-	Davao City*
10.2 Non-Life Insurance	42	-	-	-	
TOTAL	124				

SOURCE: 1979 Davao City Profile

*No available data as to the exact location in the City

Majority of these financial institutions are conveniently located along the main streets of the city proper. However, these banks are yet to be activated, as well as DBP, to reinvest the collected local funds more to the local industries.

1.6 Infrastructure

1.6.1 Transportation and Communication

(1) Port

Davao City has two port facilities which are Sasa and Sta. Ana. Sasa wharf handles both foreign and domestic passengers and goods. Sta. Ana pier handles only domestic passengers and goods.

Table 1.27 Facilities and Traffic Handled, Port of Davao

	Type	Existing Berthing Space	Depth	Traffic Handled (1978) Cargo	Passenger
Sasa Wharf	Marginal	575 m	9 m	684,000 tons	N.A.
Sta. Ana Pier	Finger	104 m	4.6 m	271,000 tons	N.A.
TOTAL	-----	1.020 m[1/]	----	955,000 tons	220,000

Note: 1/ includes privately owned berths
Source: Profile of Davao City, 1979, and RCDP Report

(2) Airport

There is only one airport in Davao City, which has runway of 2.154 m x 36 m and another airport facilities of this airport is to serve domestic flight.

Table 1.28 Facilities and Traffic Handled, Bangoy Airport

	Size or Quantity	
Size of Runway	2,154 m x 36 m	Concrete Paved
Size of Apron	200 m x 100 m	Concrete Paved
Size of Taxiway	66 m x 21 m	Concrete Paved
Size of Terminal Building	1.600 m^2	2 - 5 Storied
No. of Passengers Handled (1977)	420,000	
No. of Aircraft Operations (1978)	28,000	

(3) Telecommunication

There are two telephone system in Davao City. Davao City Telephone System (DCTS) is owned by the City. The franchise area of DCTS is the whole of the City but only an area of approximately 20 sq. kms. The DCTS has 3950 lines. The waiting list is approximately 1500.

The other system is Philippine Long Distance Telephone Co. (PLDT) which has 7700 lines. The waiting list is approximately 1700.

A major problem is the waiting lists totalling around 3000.

Table 1.29 Number of Existing and Wait-Lissed Subscribers of Davao City, 1979)

	No. of Subscribers	
	Existing	Wait-Listed
The Davao City Telephone System	3,950	1,500
The Philippine Long Distance Telephone Co.	7,700	1,700
T o t a l	11,650	3,200

Source: RCPD Report

1.6.2 Utilities

(1) Electric Power

Presently, there are three power sources: Bajada Diesel Power Plant owned by Davao Light and Power Co., Inc. (DLPC), Mintal Hydro Plant owned by National Power Corp. (NPC) and Maria Cristina Hydro-Electric Plant owned by NPC.

The total generating capacity at Bajada is approximately 58.7 MW divided up on 13 generators. Only 7 or 8 of these generators with a total capacity of approximately 25 MW are presently in operation. Mintal Hydro Plant is supplemental 3.5 MW. Maria Cristina Hydro Plant is the major importance of the Mindanao grid. The agreement with NPC is to Supply Davao with 45 MW since December 1979.

Table 1.30 Monthly Average Electricity Consumption, Davao City, 1977

	No. of Customers	Electricity Consumption (KPH/month)	Share in Consumption (%)	Ave. Electricity Consumption per Customer (KPH/month/ inst.)
Residential	34,390	3,567,823	21	104
Commercial	9,010	2,247,317	13	249
Industrial	945	10,160,711	60	13,639
Other	49	998,490	6	20,377
T o t a l	44,194	16,974,341	100	384

Source: Profile of Davao City, 1979

(2) Water Supply

The main water source is a well field at Dumoy 10 km west of the Poblacion tapping the conglomerated sandstone. The water quality conforms to drinking water standards without treatment. The capacity totals approximately 50,000 m^3/day.

(3) Flood Control, Drainage and Sewer System

Davao City is subjected to flooding due to poor drainage system, especially along Sta. Ana Avenue area and C.M. Recto Avenue and in area along the Davao River.

Davao City has no other sewer system except in the G.S.I.S. Subdivision in Matina. Domestic sewerage is usually piped into backyard septic tanks and is discharged through the city storm drains stick ultimately lead to the Davao Gulf.

(4) Refuse Disposal System

According to the Department of Public Services, the amount of refuse generated in Davao City is approximately 86 tons daily. Of the total refuse, 95 per cent are collected for dumping while the other 5 per cent are disposal by some other means.

The refuse is made up of the following with thier respective percentage: 37 per cent, kitchin; 5 per cent, metals; 15 per cent, paper; 5 per cent, glass; 3 per cent, plastic; and 39.5 per cent, tree cuttings and grasses, etc.

There is only one refuse dumpsite at present.

CHAPTER 2
INTERCITY TRANSPORT SYSTEM

2.1 General

2.1.1 Transportation in the Philippines

Road, railway, marine, and air transportation constitute the traffic system of the Philippines. In this nation, which comprizes thousands of islands of varying sizes, inter-island traffic inevitably depends almost entirely on marine and air transportation, the only inter-insular land (road/railway) transportation currently being that between Leyte and Samar via bridge. It is expected, however, that land transportation will gain a fair share of inter-isular traffic when the Pan-Philippino Highway is constructed to cover all the way from Luzon to Mindaao. Short distance inter-island passenger movements are pre-dominantly by marine transportation, and long distance, by air, while practically all goods conveyed between islands are by marine transportation.

The mode of intra-island transportation varies by the areal size and population of the island, industrial and road development levels in the island, and other factors. Generally speaking, small (size/population) islands depend on marine transportation, while larger islands show greater reliance on land transportation. Air transportation is often utilized even for intra-island travels by passengers on the two major islands of the Republic--Luzon and Mindanao. Nevertheless, land and marine transportation remain to be the standard modes of traffic in the nation as a whole.

A national inventory of traffic facilities as of 1978 included roads for a total extension of approximately 125,000 kilometers (of which 22,600 kilometers were national roads), railroads for a total extension of 930 kilometers (all on Luzon Island), 832 sea ports (some three-quarters each of passengers and goods were concentrated to 18 of these ports), 206 airports (of which 83 were state-owned, and 4 of the 83 were international airports).

Yearly growths in total road extension and their breakdowns by jurisdiction are presented in Table 2.1.

Table 2.1 ROAD DEVELOPMENT, THE PHILIPPINES, 1969-1978

YEAR	NATIONAL ROADS (km)	PROVINCIAL ROADS (km)	CITY ROADS (km)	MUNICIPAL ROADS (km)	BARANGAY ROADS (km)	FEEDER ROADS (km)	TOTAL (km)
FY 1969	18,540	23,312	5,232	16,176		16,176	63,260
FY 1970	19,198	25,219	6,254	16,854		10,424	77,950
FY 1971	20,066	27,879	6,805	18,781		13,714	87,246
FY 1972	21,315	28,103	6,714	18,636		13,714	88,483
FY 1973	21,415	28,123	7,397	19,444		16,651	93,030
FY 1974	21,516	28,144	8,340	21,561		18,769	98,330
CY 1975	21,665	28,175	2,680	7,512	44,399		104,430
CY 1976	21,796	28,186	2,726	7,902	52,271		112,881
CY 1977	22,333	28,224	3,004	9,141	56,518		119,220
CY 1978	22,600	28,243	3,133	9,793	61,366		125,135

Note: FY — Fiscal Year, CY — Calendar Year
Source: MPH

Of the total 125,135-Kilometer road extension as of 1978, approximately 20% were paved, about 50% were gravel-surfaced, and about 30% were dirt-surfaced (most of barangay roads). Twently percent of newly constructed roads are being concrete-paved, 10% asphalt-paved, and 7% gravel-surfaced. The pavement ratio continues to rise steadily under Ministry of Public Highway objective to pave all national roads with an ADT of 400 vehicles or more.

2.1.2 Transportation in Mindanao

On Mindanao Island, where roads have not yet developed to facilitate the formation of an integral economic body to cover the entire territory of the island, the mobility of passengers and goods is still limited. This constitutes the islands decisive difference from Luzon Island, whose parts are closely linked with each other and with Metro Manila by road transportation. Traffic on Mindanao Island can be characterized and contrasted against that on Luzon Island as follows:

i) Roads are yet to be developed. The ratio of paved roads is low and their condition is poor as shown in Table 2.2 No railway exists on the island.

ii) Traffic is chiefly confined to the boundary of each of the several isolated economic spheres which exist centering around such major cities on the island as Davao, Capayan de Oro,

Table 2.2 ROAD CONDITIONS IN MINDANAO IN COMPARISON WITH LUZON, 1977

	MINDANAO				LUZON			
	GOOD	FAIR	BAD	TOTAL	GOOD	FAIR	BAD	TOTAL
GRAVEL	297 (6)	1,326 (27)	1,925 (39)	3,548 (71)	138 (2)	1,571 (22)	1,753 (25)	3,462 (50)
BITUMINOUS SURFACE TREATMENT	31 (1)	79 (2)	33 (1)	143 (3)	24 (0)	345 (5)	113 (2)	482 (7)
ASPHALT CONCRETE	19 (0)	142 (3)	76 (2)	237 (5)	428 (6)	460 (7)	396 (6)	1,284 (18)
CEMENT CONCRETE	970 (19)	71 (1)	12 (2)	1,053 (21)	1,292 (18)	282 (4)	191 (3)	1,765 (25)
TOTAL	1,317 (26)	1,618 (32)	2,046 (41)	4,981 (100)	1,882 (27)	2,658 (38)	2,453 (35)	6,993 (100)

Note: 1) Mindanao Comprises Regions IXA, IXB, X, XI and XII, while Luzon is composed of Regions I, II, III, IXA and XIB.

2) Good; flat, regular non-skid surface, fair: slightly uneven surface with light damage patched or cracked up to 20% surface patched or cracked.

3) Barangay roads and other less important roads are not included.

and Butuan. For traffic between these economic spheres, road transportation is chiefly relied upon for short distances, with increased reliance on marine transportation for longer distances and for goods conveyance than for passenger travel. In any event, these economic spheres have a greater communication with Metro Manila and other non-Mindanao locations than with each other. In other words, Mindanao consists of "islands" of economies, rather than being an integral insular economy of its own.

iii) Road traffic volume is small. The large ADT volume observed on Bankerohan Bridge in Davao City of about 30,000 vehicles is nothing unusual in Metro Manila, where ADT is as heavy as about 100,000 vehicles in EDSA, Taft, P. Burgos, and so forth. Inter-city traffic shows even a greater contrast between the two islands; the ADT of approximately 2,000 vehicles counted between Davao and Digos, a nearby city, during the 1976 NTSS Team Traffic Survey, ranked among heavy ADT's in Mindanao, where most of trunk roads had an ADT of only less than 1,000 vehicles, whereas, on Luzon Island trunk roads in provinces near Metro Manila showed an ADT of 10,000 to 20,000 vehicles and many other trunk roads, several thousands.

2.2 Road Transport in Mindanao

2.2.1 Passenger Transport

(1) General

For passenger transportation in Mindanao, jeepneys play an important role for short distance travels and buses for long distance. The traffic counts taken at various points in Region XI by the Ministry of Public Highway in 1976, summarized in Table 2.3, show that:

i) Passenger cars and jeepneys have greater shares in urban areas, while

ii) Buses and trucks have greater shares in rural areas (it is assumed that trucks are used for moving not only goods but also passengers for short distances).

The trip length of jeepneys is usually short, as reflected by the fact that their activities are concentrated in urban areas. Even in the case of those which come in and out of Davao City, the longest routes end at Panabo (about 35 kilometers from Davao) in north and at Digos (about 50 kilometers) in south. The trip length of trucks is also short, although the frequency of their use is high in rural areas, inasmuch as they are chiefly used for carrying forest and plantation workers.

It can be concluded from above that inter-city passenger transportation depends almost entirely upon buses--particularly long distance buses called "provincial buses."

Table 2.3 SUMMARY OF TRAFFIC COUNT IN REGION XI, 1976

	RURAL	URBAN	TOTAL
LIGHT VEHICLE	41 %	50 %	46 %
JEEPNEY	24	37	32
BUS	12	4	7
TRUCK	23	9	15
TOTAL	100	100	100
TOTAL VEHICLE Counted (ooo)	10	15	25

Source: M P H

(2) Passenger Flows via Provincial Buses

An outline of passenger flows in and out of Region XI, which encompasses Davao City, may be understood from the only avaukabke data on such flows via provincial buses as revealed by the 1976 NTSS Survey, although the data is incomplete inasmuch as the survey failed to cover Region IX and parts of data pertaining to Region II have accidentally been lost. First, inter-regional movements are summarized in Table 2.4.

Table 2.4 BUS PASSENGER TRIP AMONG MINDANAO REGIONS, 1976
(TRIPS / DAY)

ORIGIN	XIB	X	XI	XII	TOTAL ORIGINS	% SHARE
IX B	0	6	3	3	12	0
X	30	1,372	948	796	3,147	30
XI	11	832	4,538	711	6,092	56
XII	76	959	242	228	1,505	14
TOTAL DESTINATIONS	117	3,169	5,731	1,738	10,756	100
% SHARE	1	29	54	16	100	

Note: Figures above are numbers of samples taken
Source: NTSS

The above table supports the following comments;

i) Movements between points within same region represent more than half, or 57%, of total trips. The share of intra-regional travels to total is particularly high in Region XI, in which Davao City exists.

ii) The few intra-regional trips registered in Region XII is explained by the discouraging road conditions between the northern and souther parts of the region and the poor security in the region.

Region XI (which includes Davao City) shows a limited road traffic between itself and surrounding regions, which is more or less true with all regions of Mindanao. On this island, road transportation activities are confined to each of relatively small isolated traffic shperes centering around such major cities as Davao, Cagayan de Oro, and Butuan.

Inter-provincial passenger flows via provincial buses have been translated into an OD table as shown in Table 2.5. Despite said limitations of the data and the fact that the data is based on samples, and, therefore, unreliable in terms of absolute values, the following are indicated.

i) Passenger flow is most vigorous around Davao City, such as in Davao del Sur and Davao del Norte. The radius of influence of Davao City extends beyond the boundary of Region XI but reaches only to parts of Maguindanao of Region XII, Agusan del Norte of Region X, and so forth.

ii) Next vigorous passenger flow is seen in Misamis Oriental of Region X, which encompasses Cagayan de Oro. Cagayan de Oro has much communication with Iligan (Lanao del Norte).

iii) Agusan del Norte, which encompasses Butuan, is to be mentioned as the third. Butuan and the vicinity have much communication with Davao and Cagayan de Oro and together function as a node of provicial bus transportation in Mindanao.

(3) Provincial Bus Operation in and around Davao City

Approximately 20 provincial bus operators are in business currently in Davao City, serving in two directions, north and south, from terminals at Bankerohan, Magsaysay, San Pedro, or Agdao in Poblacion. The number of runs of provincial buses of these operators to each destination are shown in Table 2.6.

The shortest northbound route is that which terminates at Tagum (approximately 40 kilometers) and the longest, at Cagayan de Oro (about 400 kilometers).

Table 2.5 BUS PASENGER TRIP AMONG MINDANAO PROVINCES, 1976 (trips/day)

	FROM \ TO	ZAMBO. N.	ZAMBO. S.	AGUSAN N.	AGUSAN S.	BUKIDNON	MISAMIS OCC.	MISAMIS OR.	SURIGAO N.	S. COTABATO	DAVAO N.	DAVAO S.	DAVAO OR.	SURIGAO S.	LANAO N.	LANAO S.	MAGUINDANAO	N. COTABATO	SUL. KUD.	TOTAL
IXB	ZAMBOANGA DEL NORTE			1	1							1		1						4
	ZAMBOANGA DEL SUR				1		1	1	1					1	2	1				8
X	AGUSAN DEL NORTE	1	3		255	13	2	366	90	15	78	250	6	271	21	11	4	5	1	1,392
	AGUSAN DEL SUR			29		1		6	2	4	5	29	2	33	1		2	3		117
	BUKIDNON		2	9			8	9	5	2	1	11		1	23	5				76
	MISAMIS OCCIDENTAL		1	2					1		2		1		4					11
	MISAMIS ORIENTAL	3	21	269	19	1	79		38	9	15	71	2	8	623	85	3	1	1	1,248
	SURIGAO DEL NORTE			147	10		1	10		2	2	14	1	113	2		1			303
XI	SOUTH COTABATO			18	16	2	2	16	6		31	499	15		2	8	2	11	15	643
	DAVAO DEL NORTE	1		178	37			2	2	55		1,388	198	6	3		12	43		1,925
	DAVAO DEL SUR	6	3	218	132	7	5	40	28	466	945		533	31	16	3	111	473	5	3,022
	DAVAO ORIENTAL			8				1	5	9	110	234					1	4		372
	SURIGAO DEL SUR	1		69	23		1	4	11	1	2	4	2			1		1		130
XII	LANAO DEL NORTE	8	65	17	2	51	112	730	13	3	2	19		2		8	2			1,034
	LANAO DEL SUR			8				1		2		1		1						13
	MAGUINDANAO			9	3			2	2	93	10	81	2		2	2		148	62	416
	NORTH COTABATO		3	2				3	1	1	9	5	7	1	1		3			36
	SULTAN KUDARAT				3						1	1		1						6
	TOTAL	20	98	984	502	75	211	1,191	206	661	661	1,213	769	470	700	124	141	689	122	G-Total 10,756

Source: NTSS

Table 2.6 FREQUENCY OF PROVINCIAL BUS SERVICE FROM DAVAO CITY BY DESTINATION, 1979

DESTINATION	DAILY NUMBER OF DEPARTURES	ESTIMATED NUMBER OF PASSENGERS PER DAY AND PER DIRECTION
NORTH BOUND		
CAGAYAN DE ORO	57	1,122
TAGUM	41	902
STO. TOMAS	40	880
MATI	37	814
BUTUAN	23	506
COMPOSTELA	21	462
NEW BATAAN	15	330
MONKAYO	13	286
MANGAGOY	13	286
SEGABOY	6	132
NABUNTURAN	6	132
SURIGAO	3	66
MASARA	2	44
CAMANLANGAN	2	44
TANDAG	1	22
TOTAL	274	6,028
SOUHT BOUND		
MIRAL	75	1,650
COTABATO	69	1,518
GENERAL SANTOS	57	1,254
MALITA	51	1,122
KIDAPAWAN	37	814
DIGOS	32	704
MARBEL	30	660
TACURONG	23	506
MALALAG	16	352
MAITUM	3	66
TOTAL	393	8,646
GRAND TOTAL	667	14,674

Most of the routes remain within Davao del Norte and Davao Oriental of Region XI, but about 30% of them go to Cagayan de Oro, Butuan, or Surigao.

The shortest southbound route is that which ends at Digos (about 50 kilometers) and the longest, at Cotabato (about 200 kilometers). The shortest of provincial bus routes--both northbound and southbound alike--is longer than the longest of jeepney routes, and this shows a clear division of work between modes of transportation by route distance. Among southbound routes, Davao shows the heaviest communication with Maguindanao Province of Region XII (with about 50% of total bus runs), followed by Davao del Sur and South Cotabato Provinces of Region XI.

Although direct comparison is unreasonable due to dissimilar survey methods, the above data shows somewhat greater interregional passenger flows than did the NTSS data, provided that they agree in the finding that the radius of influence of Davao City is limited to portions of the southeastern and northern parts of Mindanao Island.

2.2.2 Goods Transport

(1) General

The transportation of goods on Mindanao Island is performed practically all by such cargo vehicles as vans/pick-up trucks, light trucks, heavy trucks (including truck-trailors), with few goods carried by jeepneys or provincial buses. These cargo vehicles represent approximately 30% of the total volume of goods flow in entire Mindanao (vans/pick-up trucks representing 12%, light trucks, 17%, and heavy trucks, 1%), but this ratio is low at about 15% in areas where economic activities are high, such as in Region XI.(see Table 2.3).

Light trucks count (average capacity of 6.6 tons) the largest of all cargo vehicles, followed by vans/pick-up trucks (average capacity of 1.5 tons). Heavy trucks (average capacity of 11.2 tons) are very few in number. In consideration of traffic

volume and per-vehicle capacity, therefore, it can be asserted that the majority of goods are carried by light trucks. The average loading factor of cargo vehicles is 65%, but that of vans/pick-up trucks is low and that of heavy trucks is high. Said average factor is, however, about 10% lower than such average factor on Luzon Island, indicating that goods transportation demand is still not so large on Mindanao Island.

The length of cargo vehicle trips is generally greater than that of passenger vehicle trips. The large proportion of total volume of goods which cargo vehicles represent in rural areas is not only b ecause of small number of passenger vehicles in such areas, but also because of the long cargo vehicle trip length.

Overloading of cargo vehicles is less severe than on Luzon Island but is quite common on Mindanao, where large trucks loaded up to about 250% of capacity are not area. The over-loading practice is believed chiefly attributable to the fact that current tarrif of P0.40 to 0.50 per ton per kilometer (although official tariff established by BOT is P0.50 to 0.60/ ton/kilometer) is, at the loading factor of 100%, bearly enough to pay for the estimated running expense of P0.30 per ton per kilometer.

Table 2.7 LOADING CHARACTERISTICS OF GOOD VEHICLES, MINDANAO 1975

VEHICLE TYPE	SHARE IN TOTAL VEHICULAR TRAFFIC (%)	AVERAGE LOAD (tons)	AVERAGE CAPACITY (tons)	LOADING FACTOR	SHARE IN TOTAL GOODS TRANSPORTED (%)
VAN/PICK-UP	12	0.5	1.5	0.36	5
LIGHT TRUCK	17	4.5	6.6	0.69	85
HEAVY TRUCK	1	8.6	11.2	0.77	10
TOTAL	30	3.0	4.7	0.65	100

Source: N T S S

(2) Goods Flow in Mindanao

The 1975 NTSS Survey findings is the only data available also on goods flow in Mindanao, although its statistical reliability is limited.

Inter-regional goods flow is shown in Table 2.8.

The flows indicated for Regions X and XI represent 38% and 43%, respectively, of the total goods flow in Mindanao, showing that economic activities are high in these regions. The flow of goods is particularly vigorous in and around Cagayan de Oro of Region X and Davao of Region XI.

The situation noted with regard to passenger flow via provincial buses is also true but is even more apparent with regard to goods flow via cargo vehicles--more apparent because

Table 2.8 REGIONAL GOODS FLOWS IN MINDANAO, 1975 (tons/day)

REGION	INTRA-REGIONAL FLOW	OUTGOING FLOW	INCOMING FLOW	TOTAL FLOW
IX	791	131	63	888
X	5,255	485	642	5,819
XI	6,181	430	679	6,735
XII	1,372	851	513	2,054
TOTAL	13,599	1,897	1,897	15,496

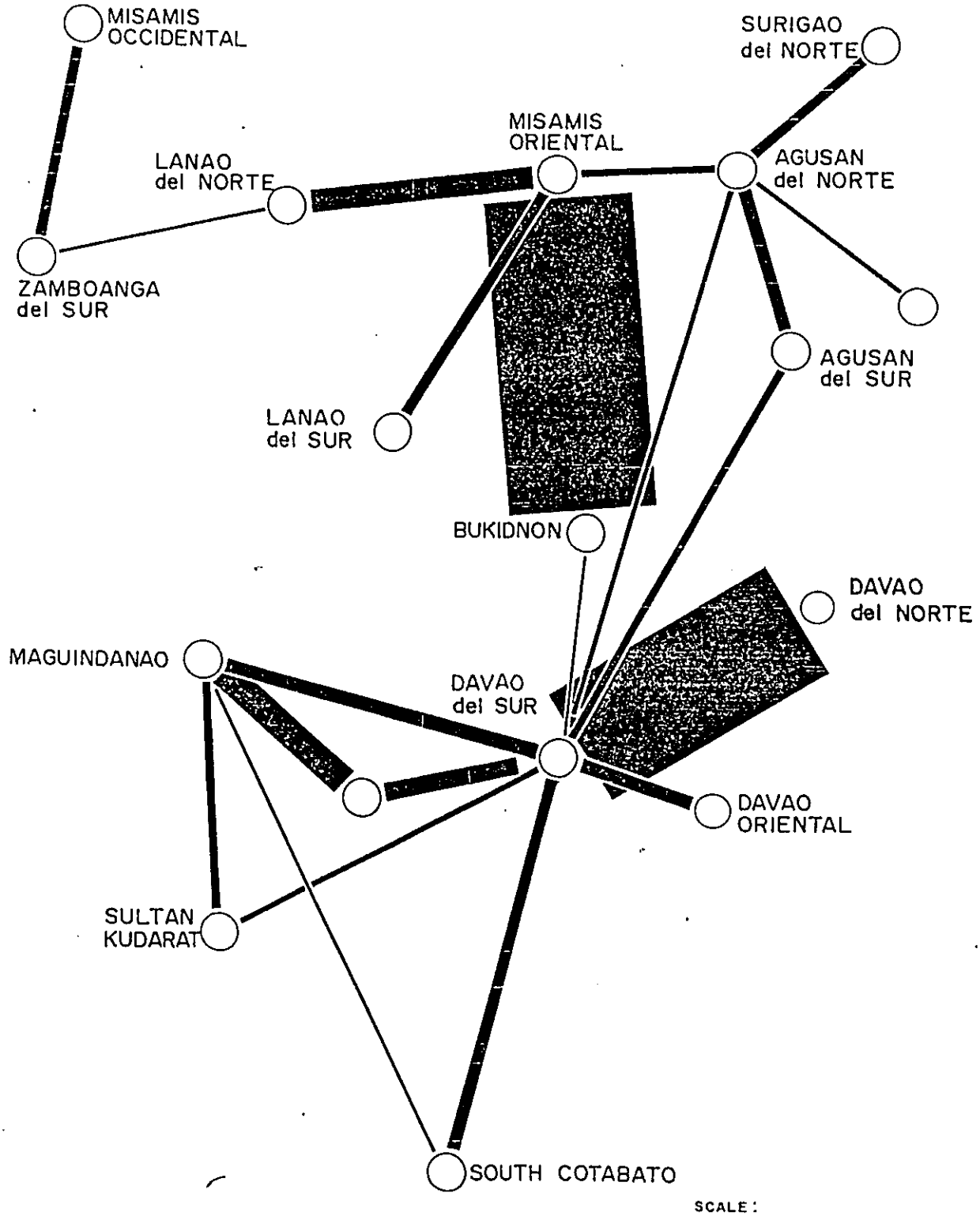
Source: NTSS

goods flow more heavily depends on marine, rather than road, transportation than does passenger flow; the total volume of inter-regional goods flow via road transportation is much smaller than that of intra-regional flow. Improvement of roads and security level in Mindanao will result in a higher share of road transportation in total goods flow.

The greatest inter-regional good flow of 872 tons per day is seen between Regions XI and XII, followed by 623 tons per day between Regions X and XII and 359 tons per day between Regions X and XI. Almost no goods flow via road transportation is seen in and out of Region IX, which heavily relies on marine transportation because of very poor road conditions.

In comparison to the intra-regional goods flow of 88% of total, intra-provincial goods flow is only 46% of total.

Davao del Sur and Misamis Oriental occupy substantial shares of total inter-provincial goods flow. The former encompasses Davao City and the latter, Cagayan de Oro, but both show greater volumes of influx than outflow, presumably because of large volumes of agricultural products shipped 3 in via the ports and of high consumption in these cities. In terms of share in inter-provincial goods flow, these two provinces are followed by Bukidnon and Davao del Norte, but the volume of outgoing goods from these provinces is greater than incoming, both shipping out more than 1,000 tons per day of goods each, Bukidnon to Misamis Oriental and Davao del Norte to Daval del Sur. These two channels represent a large volume of goods flow, all other inter-provincial channels in Mindanao being insignificant with only less than 500 tons per day each. (See Fig. 2.1)



Source: NTSS

Fig. 2.1 Inter-Provincial Goods Flow in Mindanao, 1975

A number of provinces show no goods flowing in from or out to some other province in the same region. Typical pairs of such provinces are:

Maguindanao - Lanas del Norte/Sun
Surigao del Sun - Davao del Norte/Sun
Zamboanga del Norte - All other Provinces

The indicated total absence of inter-provincial goods flow is attributed to under- developed roads and poor security, but, in addition, the questionable reliability level of the NTSS data may partly be responsible for this indication.

Of the items of goods transported, agricultural products represent an overwhelming majority--60% of more of goods flowing into Davao City or Cagayan de Oro City. In general, agricultural and forestry products and mineral ores constitute a majority of goods flowing from rural areas to urban, while construction materials, processed foods, and agricultural products are the mainstream flowing in the opposite direction.

(3) Goods Flows in and around Davao City

The 1975 NTSS Commodity Flow Survey utilized two survey stations in Davao City: Tibungco on Davao-Agusan Road and Matina on Davao-Cotabato Road.

The re-tabulations of the prime data obtained through this Survey are presented in Table 2.9. It should be noted that the values shown on this Table, which present a cross-section of goods flow between Tibungco and Matina, do not necessarily represent inter-provincial long distant trips.

Goods flow in and around Davao City may be characterized as follows:

i) Influx is more than double the volume of outgoing goods--a trend similarly shown by inter-provincial goods flow.

ii) Goods flow is greater to and from north than flow to and from south. Outflow volume is about the same in both directions, but influx from north reaches 1.5 tomes

that from south, making the total flow to and from north 1.3 times that of total southern flow.

iii) Agricultural and forestry products--such as fruits, vegetables, coconuts, copra, and timbers--represent a majority of goods flowing from both north and south as a general trend. Aside from this trend, unique product flowing from north is mineral ores from Davao del Norte or Davao del Sur (Davao City) and that from south is beverages shipped from bottling plants in the vicinity of Talomo or Dumoy in Davao City, the hauling distance being rather short in both cases.

iv) Industrial products--such as chemical products, cement, and petroleum products--represent a majority of goods flowing to both north and south. A fair volume--although less than influx--of agricultural and forestry products is being shipped out from Davao City, suggesting that Davao is performing the function of a sort of distribution center.

v) The origins and destinations of goods flowing to and from Davao City are concentrated in neighboring provinces such as Davao del Sur, Davao del Norte, and South Cotabato, making the distance of transportation rather short.

vi) Light trucks with a capacity of 6 to 7 tons are most commonly used, but the utilization of vans/pickup trucks is high for the transportation of meats, tobacco products, textile products, and electric appliances and that of large trucks (11 to 12 tons) is high for the transportation of coconuts, timber, cement, non-ferrous metal construction materials, and beverages.

Table 2.9 Goods Flow in Davao City

Goods Item	No. of Vehicles / Day			Tonnages / Day			No. of Vehicles / Day			Tonnages / Day		
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
Palay	25	5	30	132	23	155	36	6	42	207	25	232
Rice	39	39	78	46	108	154	39	11	50	188	18	206
Unmilled Corn	22	24	46	64	53	117	83	12	95	391	38	429
Milled Corn	56	10	66	46	42	88	20	2	22	63	10	73
Other Cereals	7	-	7	44	-	44	1	1	2	4	-	4
Fresh Fruits and Vegetables	304	50	354	1,076	179	1,255	158	13	171	307	14	321
Coconut and Copra	266	3	269	1,192	11	1,203	182	21	203	1,071	134	1,205
Fresh Fish and Other Marine Products	11	30	41	7	10	17	15	14	29	9	11	20
Livestock and Poultry	71	7	78	45	4	4	42	8	50	62	4	66
Abaca and Abaca Products	28	-	28	106	-	106	6	2	8	16	1	17
Tobacco	-	-	-	-	-	-	1	-	1	3	-	3
Sugar Cane	-	-	-	-	-	-	1	-	1	4	-	4
Logs and Other Forest Products	127	8	135	422	10	432	41	35	76	177	129	306
Other Agricultural	-	4	4	-	1	1	5	5	10	22	5	27
Processed Food	24	229	253	16	96	112	26	79	105	33	89	122
Sugar and Sugar Products	6	15	21	6	2	8	13	17	30	124	126	250
Animal Feeds	71	9	80	97	21	118	8	17	25	23	61	84
Beverage	14	118	132	49	548	597	223	35	258	1,288	115	1,403
Tobaco Products	-	31	31	-	41	41	4	13	17	1	16	17
Cement	7	41	48	10	235	245	5	30	35	43	183	226
Processed Timber	97	63	160	350	197	547	20	56	76	79	202	281
Chemical Products	35	57	92	15	134	149	22	46	68	99	75	174
Paper Products	-	15	15	-	6	6	1	8	9	-	8	8
Empty Containers	73	32	105	297	43	340	20	68	88	70	164	234
Washing and Cleansing Products	17	57	74	5	26	31	12	28	40	7	35	42
Fertilizer	2	19	21	15	80	95	2	15	17	2	71	73
Non-Metal Construction Materials	22	4	26	127	4	131	39	27	66	216	178	394
Minerals	238	-	238	2,520	-	2,520	-	1	1	-	1	1
Petroleum Products	32	86	118	26	298	324	13	72	85	64	326	390
Metal and Metal Products	2	48	50	11	52	63	1	29	30	-	24	24
Machinery and Transport Equipment	7	23	30	32	19	51	6	34	40	8	126	134
Electrical and Mechanical Appliances	25	19	44	5	4	9	4	13	17	2	3	5
Textile and Wearing Apparel	32	40	72	3	17	20	8	19	27	23	9	32
Other Industrial	34	71	105	1	17	18	7	29	36	1	4	5
Total	1,694	1,157	2,851	6,765	2,281	9,046	1,064	766	1,830	4,607	2,205	6,812

Source : Recompiled from NTSS Data

2.3 Sea Transport in Mindanao

2.3.1 Passenger Transport

(1) General

Marine transportation has a large share in passenger travels between points in Mindanao and is in competition with road transportation. However, the utilization of provincial buses has reached a substantial level on such major route as Cotabato-Davao-Butuan-Cagayan de Oro, as pointed out in the preceding sub-chapter, and the importance of marine transportation in passenger travel in Mindanao has been on the gradual decrease as the island's roads have recently been improved. Only in Region IX, which encompasses Zamboanga and where roads are still poor, heavy reliance on marine--and sometimes air--transport continues.

In contract to the declining share in passenger transportation within Mindanao, the number of marine passengers between Mindanao and other islands has been increasing by more than 10% each year. While marine and air transportation is available for inter-insular travels, the utilization of air transportation is limited to those with sufficient income to be able to afford the air fares.

(2) Passenger Flows

In the absence of statistical data on the origins and destinations of marine passengers, the passenger departures and arrivals counted by the Philippine Port Authority at each seaport are tabulated in Table 2.10.

As indicated, the number of marine passengers originating from and terminating at Zamboanga is by far the greatest at about 58% of all ports, the second being only about 13% shown by Iligan. Zamboanga enjoys a number of peculiar benefits including the fact that it is a transit port on Indonesia-Philippines route, but the scale of its economic activities is smaller than those of Davao and Cagayan de Oro. Difficulty of passenger travel via road is the only possible explanation of the indicated overwhelmingly large number of marine passengers.

Table 2.10 ESTIMATED PORT PASSENGER TRAFFIC IN MINDANAO, 1978

PORT DISTRICT	NUMBER OF VESSELS	NUMBER OF PASSENGERS		
		EMBARKED	DISEMBARKED	TOTAL
CAGAYAN DE ORO	3,688	267,132	196,702	463,834
DAVAO	2,758	120,182 -	101,790	221,972
ILIGAN	4,356	285,295	237,900	503,195
ZAMBOANGA	14,455	1,133,299	1,168,466	2,301,765
GENERAL SANTOS	4,540	91,804	117,935	209,439
SURIGAO	3,724	91,398	113,995	195,393
MASAO (BUTUAN)	2,305	20,844	20,388	41,232
TOTAL	35,726	1,979,654	1,957,176	3,936,830

Source: 1978 PPA Annual Statistical Report

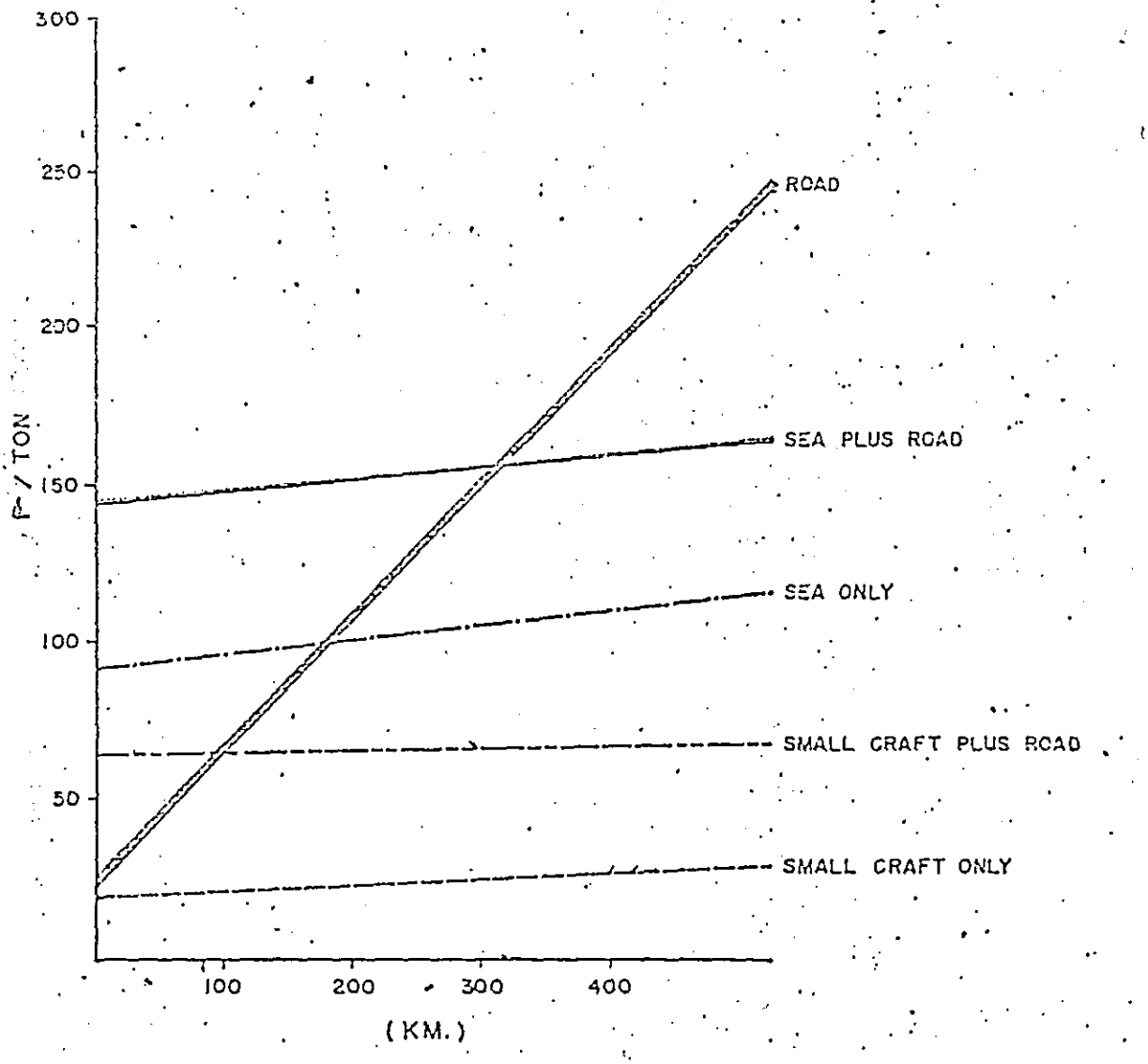
In fact, a large number of ferry boats connect Zamboanga with Cotabato, Iligan, Cagayan de Oro, Davao, and Sulu--a sheer contrast to Davao, where ferry connection is with offshore locations such as Metro Manila and Cebu.

In the case of Davao, procincial bus passengers are estimated at 50 to 70 times the ferry boat passengers and it is assumed that the vast majority of passengers travelling to destinations within the island, with the exception of Zamboanga, go by provincial buses.

2.3.2 Goods Transport

(1) General

While it is only a matter of course that marine transportation emjoys 100% share of inter-island goods transportation, it occupies an extremely large share also in goods flow within Mindanao, where trucks play only an insignificant role except in and around Davao and Cagayan de Oro. According to MOTC estimate, the share of intra-island goods flow in total volume of cargo handled at all ports of Mindanao is 36%--a marked difference from Luzon, whose comparable rate is only 13%. Relative advantage of marine transportation generally increases as transportation distance becomes longer. In the case of Mindanao, however, the following factors constitute additional benefit in favor of marine transportation: (a) that the island is large and the shore line is long, (b) that roads are yet to be developed, and (c) that the hinter land of the port cities is small and, therefore, road transportation to and from ports involves only short distances. (See Fig. 2.2)



Note: Road --- 7-ton Truck
Sea ---- Domestic Ship of 1,300 DWT
Small Craft --- Motorized Sailboat

Source: MOTC

Fig. 2.2 Comparison of Goods Transport Cost, Single Leg Journey, 1977

Table 2.11 NUMBER OF PORTS IN MINDANAO, 1978

Port District	Base Ports	Sub-Ports and National Ports	Other National and Municipal Ports	Private ports and offshore area	Total
Cagayan de oro	1	0	4	16	21
Davao	1	1	1	11	14
Iligan	1	2	1	14	18
Zamboanga	1	4	0	20	25
General Santos	1	2	0	4	7
Surigao	1	1	0	2	4
Masao (Butuan)	1	2	0	22	25
Mindanao (total)	7	12	6	89	114
Philippines	18	42	20	185	265

Source: 1978 PPA Annual Statistical Report

The number of ports of various categories existing in Mindanao is shown in Table 2.11. All 6 of the 7 base ports (that is, excluding Masao) handled more than 200,000 tons of cargo in 1978, when, in Luzon, Manila was the only port handling cargo in excess of 200,000 tons. The level of port development is relatively high in Mindanao.

(2) Goods Flows

PPA maintans statistics on, in addition to number of passengers, the volume of cargo handled at each port (see Table 2.12).

Goods flow presents an entirely different picture from passenger flow: Zamboanga drops to a low position in terms of cargo volume, while Cagayan de Oro, Davao, and Iligan emerge to high ranks. This is because most of cargo is moved inter-island (unlike passengers) and is immune from local road condition within Mindanao. In this sense, it is reasonable to say that the volume of goods reflects more directly the level of local economic activities than does the number of passengers. Marine cargo flow in Mindanao is characterized by a high ratio of foreign cargo to the total handling. While more domestic cargo than foreign is handled in four port districts--Iligan, Zamboanga, General Santos, and Masao--substantial volumes of foreign cargo handled at Cagayan de Oro and Davao bring the overall ratio of foreign cargo to approximately 61% (imports, 24% , and exports, 37%). International cargo flow is particularly vigorous through Cagayan de Oro, where the volumes of both imports and exports exceed the average by far. Another noteworthy phenomenon is the very high ratio of exports to total cargo handling at Davao, where net export surplus is greater than at Cagayan de Oro.

Inversely, substantial net domestic cargo "import" surpluses have been registered in Mindanao, as affected by excess inflow of domestic cargo over outflow at the same two important ports: Cagayan de Oro and Davao.

Agricultural and forestry products--such as lumber, plywood, sugar, corn, copra, and coconut oil--are popular items which flow out of Mindanao, and processed foods and sundry goods are popular inflow goods, provided, however, that at Cagaya de Oro imports are uniquely characterized by a large volume of iron are and exports, by sintered ore. Davao follows said general pattern of Mindanao, provided that pulp, paper, banana, and other fruits are "exported" from Davao in addition. In Davao City, cargo handling volume at private ports is very large (57% of all cargo and 61% of foreign cargo).

Table 2.12 DOMESTIC AND FOREIGN CARGO TONNAGE BY PORT DISTRICT, 1978

PORT DISTRICT	DOMESTIC CARGO TONNAGE			FOREIGN CARGO TONNAGE		
	TOTAL	INWARD	OUTWARD	TOTAL	IMPORT	EXPORT
CAGAYAN DE ORO	1,754,020	1,296,930	457,090	8,182,762	3,834,944	4,347,818
DAVAO	1,947,762	1,174,788	772,974	2,061,336	192,549	1,868,787
ILIGAN	1,508,317	645,211	863,106	1,049,624	502,693	546,931
ZAMBOANGA	1,212,394	829,553	382,841	576,016	4,770	571,246
GENERAL SANTOS	1,249,751	598,634	651,117	438,688	50,039	388,649
SURIGAO	405,328	196,359	208,969	818,783	735,414	83,369
MASAO (BUTUAN)	361,320	150,081	211,239	254,992	557	254,435
TOTAL	8,438,892	4,891,556	3,547,336	13,382,201	5,320,966	8,061,235

Source: 1978 PPA Annual Statistical Report

CHAPTER 3
CURRENT STATUS OF ROAD TRAFFIC

3.1 Road Network Structure

Davao City is located in the southeastern part of Mindanao Island and constitutes one of important land and sea transportation terminals in the eastern part. (Fig. 3.1).

In this city, which has developed generally in the shape of a belt extending in the north-south direction along the shore line, roads are positioned to meet the demand which has arisen also in parallel to the shore line. The skelton road running from north to south goes through Poblacion, the nucleus of the city which is positioned in about the center of the city (Fig. 3.2, 3.3).

McArthur Highway, which connects Toril in south with Poblacion, runs across the Davao River and handles a traffic of about 30,000 vehicles per day. The road network depends on McArthur Highway and a route which branches off from it and runs through Ecoland and across Bolton Bridge for handling traffic from south.

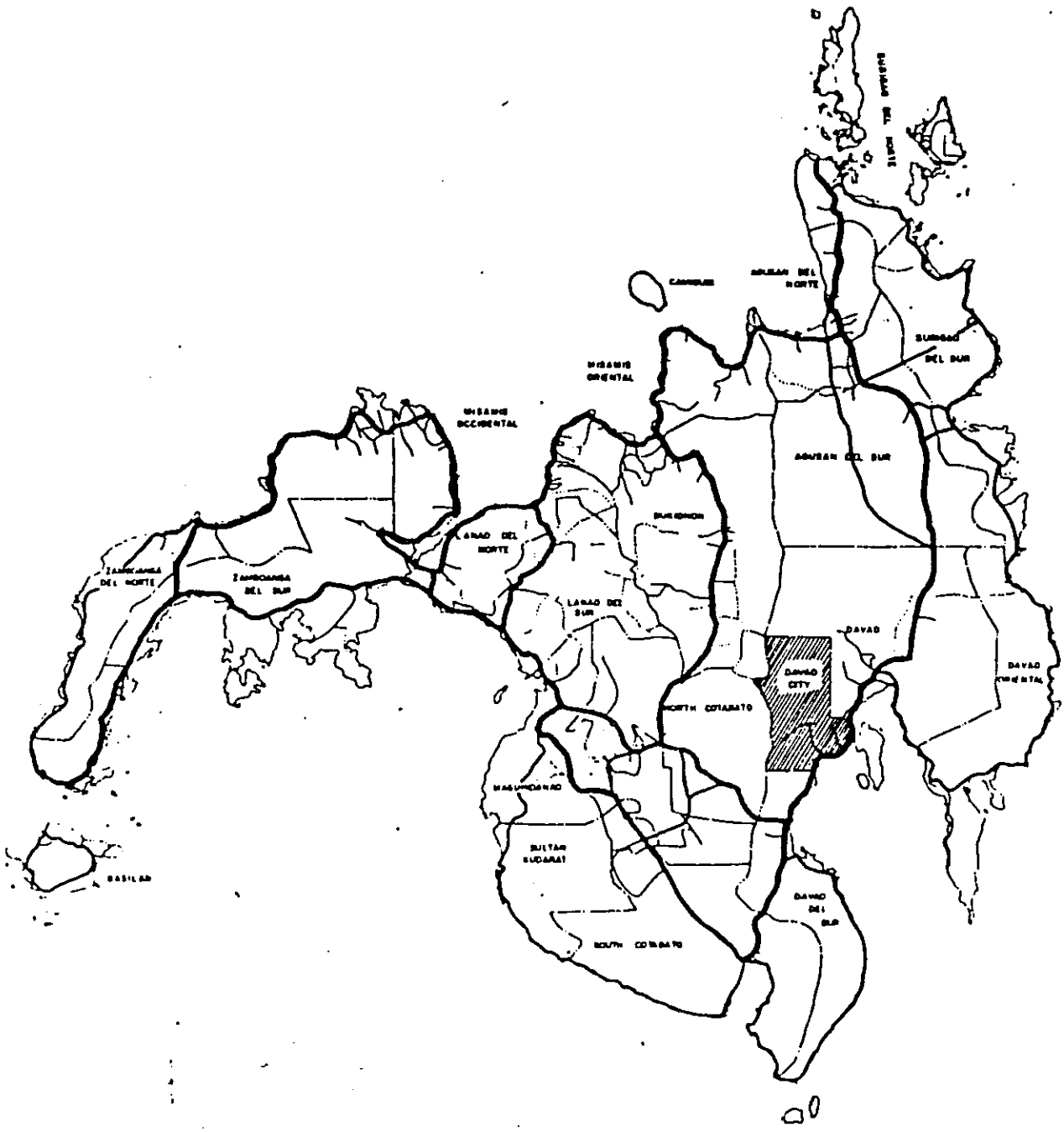
Davao-Agusan Road, which extends from Poblacion toward north along the shore line, is important in that it is the only truck road which connects the industrial areas of Sasa and Panakan and Airport with Poblacion.

Diversion Road, which is positioned in the mountain side at about 8 kilometers from Poblacion, somewhat embraces Poblacion and serves traffic by-passing poblacion. The road-side area is not yet urbanized, and the volume of traffic on this road is very small at about 2 to 4 thousand vehicles per day

Davao-Bukindon Road, which runs from inland area to the sea-side part of the city, is the only truck road which connect agricultural production area with consumption area and is also important as road to support foreign trade activities. This road will become very important fuse to " ignite" industrial activities in the city by offering the shortest route to connect the industrial areas in the northern part of Mindanao with Davao when the section of this road in inland part which is currently non-passable for automobile will be mended.

Important routes in Poblacion are J.P. Laurel, Quirino Avenue, Quezon Boulvard, Recto Avenue, Magsaysay Avenue, and Pichon Avenue. The road network of Poblacion is formed by 11 national roads including said 6, which are likned with each other, as well as by city roads, which are organically connected with the national roads.

On the whole the road network of Poblacion is densely distributed, but is not without any problem from traffic handling and safety standpoints, as indicated by the existence of some 5-leg or 6-leg inter-sections.



LEGEND:

NATIONAL ROAD (Primary)

NATIONAL ROAD (Secondary)

PROVINCIAL BOUNDARY

Fig. 3.1 ROAD NETWORK IN MINDANAO

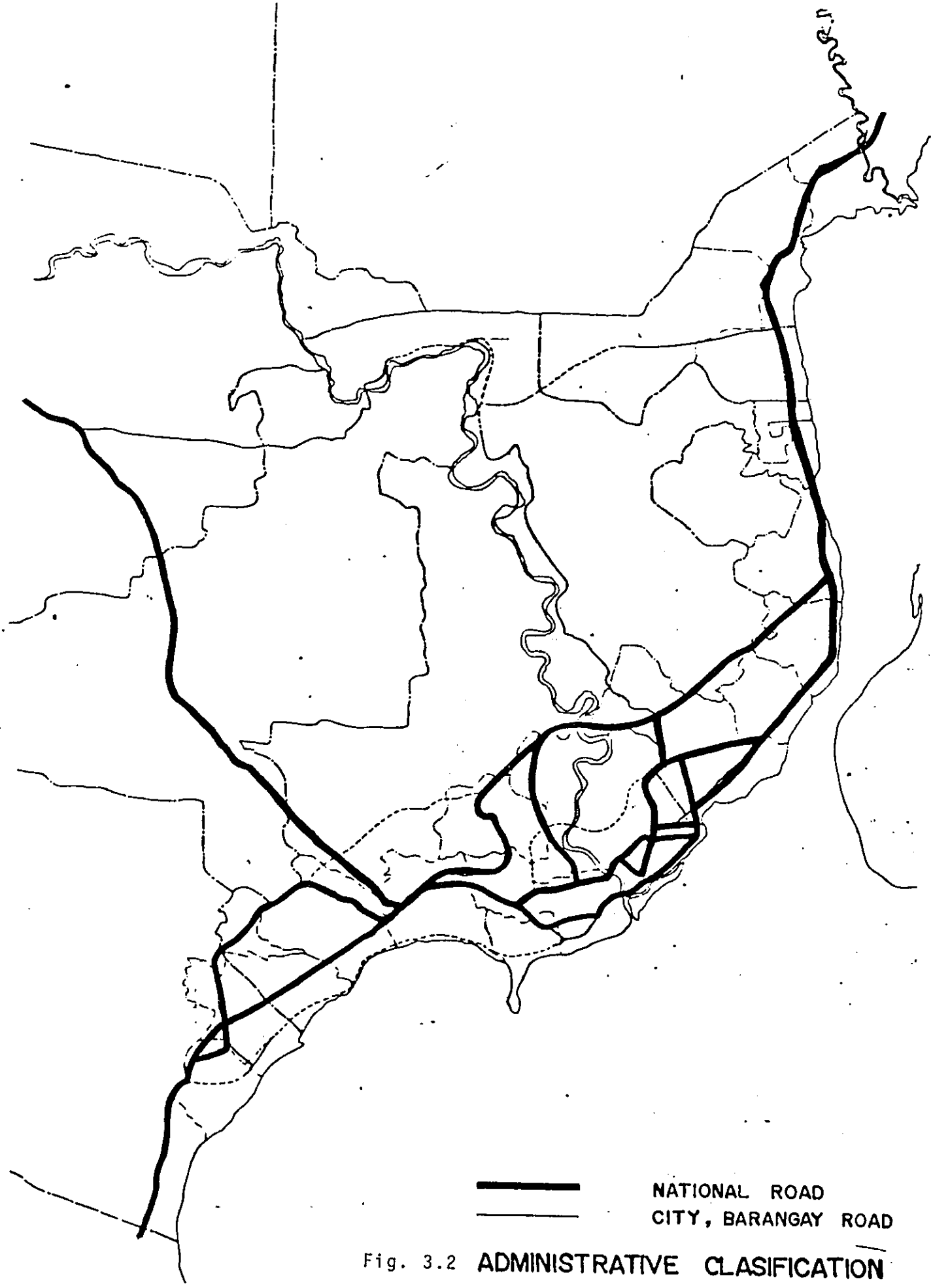


Fig. 3.2 ADMINISTRATIVE CLASIFICATION

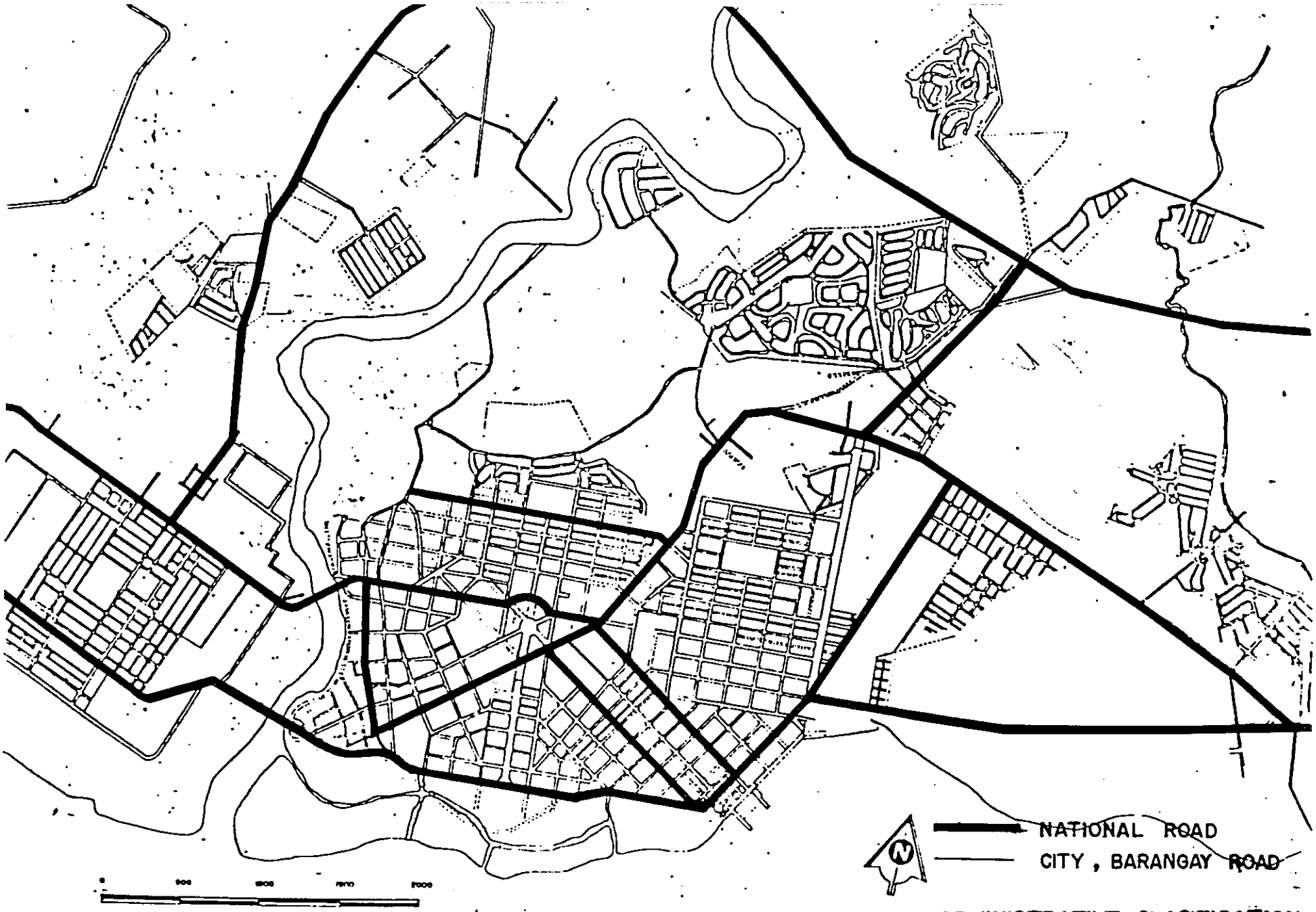


Fig. 3.3 ADMINISTRATIVE CLASIFICATION

3.2 Current Status of Road Facilities

(1) Road Maintenance

Depending on jurisdiction for maintenance, roads in Davao City are classified into:

(i) National roads
(ii) Barangay roads
(iii) National-aided city roads
(iv) City roads

National and barangay roads are managed and maintained by the District Engineer's Office, while national-aided city road a and city roads are managed and maintained by the City Engineer's Office.

An inventory of existing road facilities in Davao City is shown in Table 3.1. The City's road network, whose total road extention is 1,731 kilometers, consits of national roads for a total extention of 204 kilometers (12%), city roads for 446.5 kilometers (26%), and barangay roads for 1,080.3 kilometers (62%). Overall pavement ratio of these roads is very low at only 17% (284 kilometers out of the total 1,731). While 57% of national roads is paved, pavement ratio is very low for city roads at 15% and barangay roads at 9%.

Even some of important national roads still have unpaved sections, such as in the case of R. Castillo Avenue and Ma-a Road, as shown in Figure 3.4,3.5. Particularly in the case of R. Castillo Avenue, the volume of traffic is only about 2,000 vehicles per day because of the existence of unpaved sections, even though this road offers the shortest route for traffic flowing into Poblacion. J.P. Laurel Avenue and Quezon Boulvard are paved, but the surface condition is poor and inadequate maintenance is evident. The inferior condition of these trunk roads is referetted in view of derogatory effect on the safety, economy, and amenity of traffic.

From the aspect of spational function of road, Poblacation shows bearly satisfactory levels of road density (at 8.2%) and road ratio (at 14.7%) (see Table 3.1), but the function is low in other districts. Average road space per capita, on the other hand, is the smallest in Poblacion, reflecting the high population concentration there.

Table 3.1 Condition of Existing Road/Street

District	Road Length				Pavement				Road Density	Road Ratio	Length per 1000-Person	Road Area per Million-Person
	National	Barangay	City	Total	National	Barangay	City	Total				
Poblacion	25.4 (30)	-	58.8 (70)	84.2	25.2 (100)	-	37.7 (64)	62.9 (77)	8.2	14.7	0.69	0.12
Bunawan	12.6 (10)	88.5 (73)	20.9 (17)	122.0	12.6 (100)	-	-	12.6 (10)	1.9	2.1		0.32
Buhangin	16.6 (10)	117.0 (71)	31.3 (19)	164.9	13.9 (84)	-	-	13.9 (8)	1.8	2.0	2.19	0.25
Talomo	42.8 (23)	92.7 (51)	47.8 (26)	183.3	42.8 (100)	10.0 (11)	6.1 (13)	58.9 (32)	1.7	2.4	2.56	0.37
Toril	9.8 (2)	372.3 (88)	44.4 (10)	426.5	9.8 (100)	13.0 (3)	6.2 (14)	29.0 (7)	3.2	3.7	7.66	0.88
Others	97.1 (13)	409.8 (55)	243.2 (32)	750.1	15.7 (16)	6.5 (2)	10.7 (4)	32.9 (4)	-	-	-	-
Total	204.3 (12)	1080.3 (62)	446.4 (26)	1731	120.0 (59)	29.5 (3)	23.0 (5)	172.5 (10)	-	-	-	-

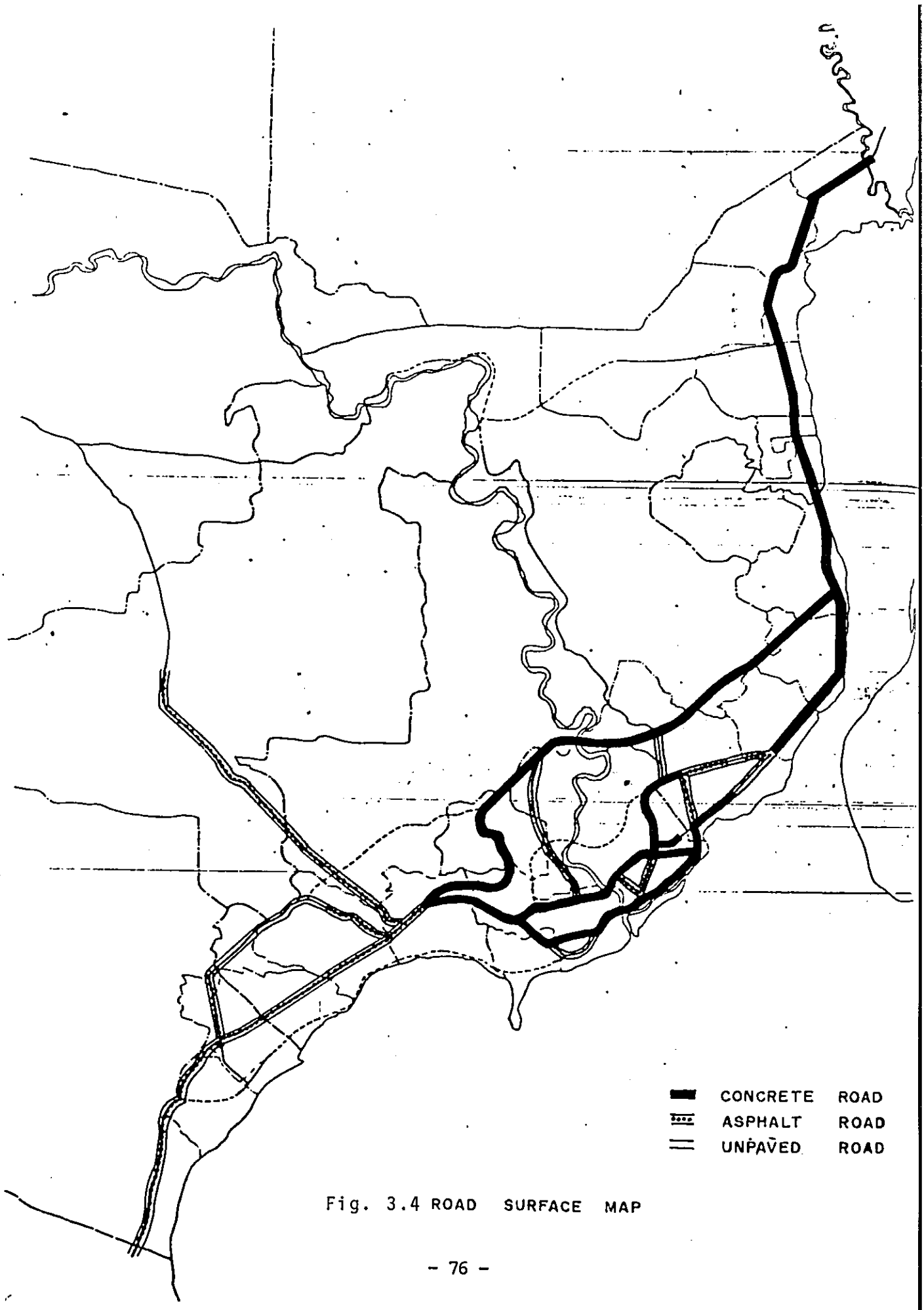


Fig. 3.4 ROAD SURFACE MAP

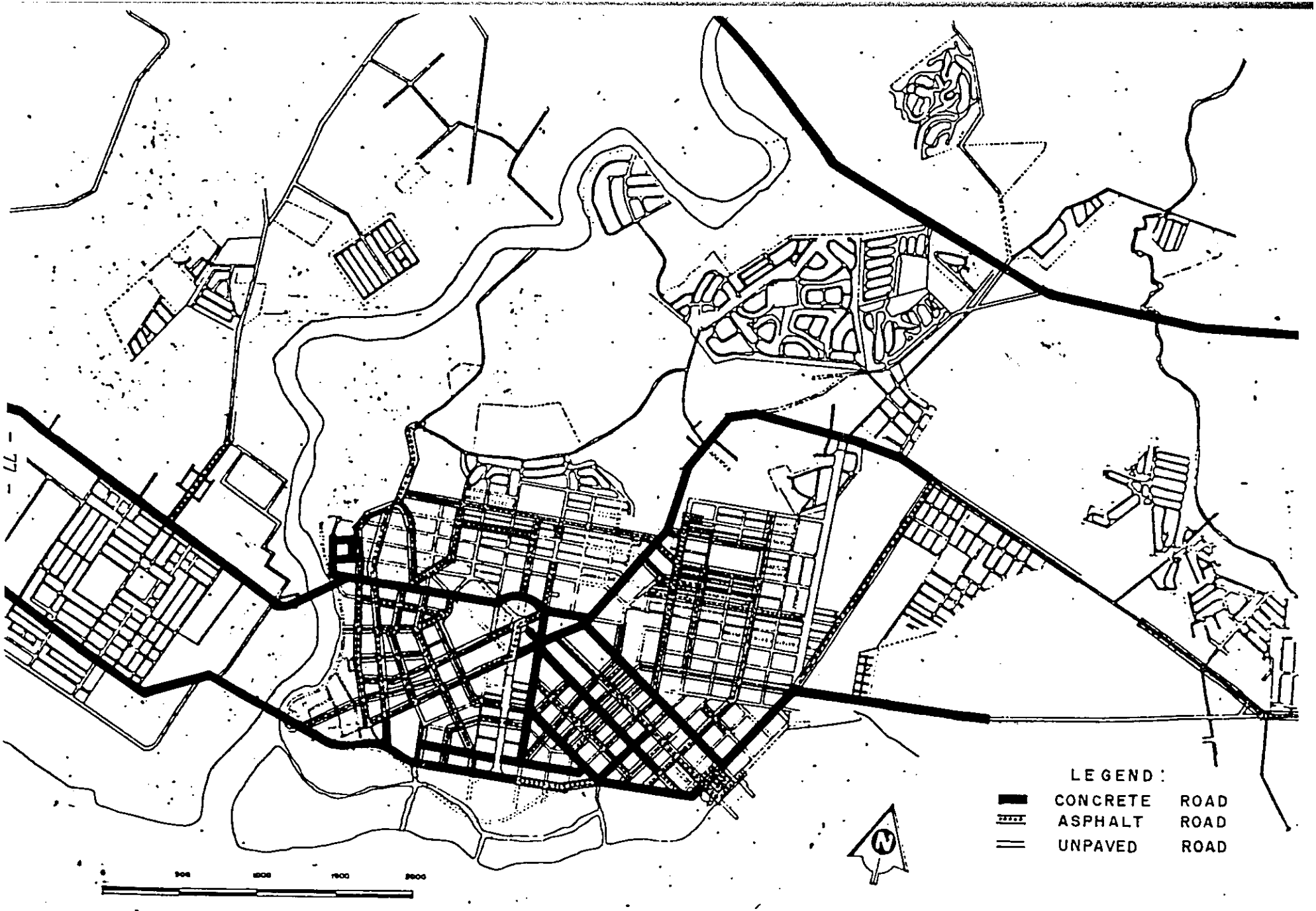


Fig. 3.5 ROAD SURFACE MAP

CHAPTER 4
ROAD TRAFFIC CHARACTERISTICS

4.1 Road Traffic Characteristics

(1) Traffic Volume on Major Roads

Traffic counts on major roads are graphically presented in Figure 4.1,4.2 McArthur Highway and Davao-Agusan Road, running from north to south, constitute the artery of Davao City, and the volume of traffic between toril and Buhangin is currently about 10,000 vehicles per day.

Traffic on this north-south trunk road becomes great near the edge of Poblacion and reaches about 30,000 veicles per day at Bankerohan Bridge over the Davao River, on the south side of Poblacion; that at Bolton Bridge is about 10,000 vehicles per day.

On the other hand, traffic flowing into poblacion from north mostly passes through J.P. Laurel Avenue, on which traffic is 12,000 to 20,000 vehicles per day.

Within Poblacion, heavy traffic roads are R. Magsaysay Avenue with 30,000 vehicles per day and C. Recto Avenue, A. Pichon Street, and San Pedro Avenue with 15,000 to 20,000 vehicles per day each.

(2) Daily Traffic Fluctuations

Fluctuations by the day of week of the volume of traffic on R. Magsaysay Avenue and at Bankerohan Bridge are shown in Table 4.1 and Figure 4.3.

On R. Magsaysay Avenue, traffic is the lightest on Sundays at about 67% of that on Mondays, when traffic reaches maximum. Traffic volume stays about equal on other days of the week, which is a general trend observed in the Philippines.

Daily fluctuations of traffic at Bankerohan Bridge follows generally the same pattern as that on R. Magsaysay Avenue, provided that Sunday traffic is heavier at the former than on the latter, presumably because of goods delivery and shopper traffic headed to the market on Sundays.

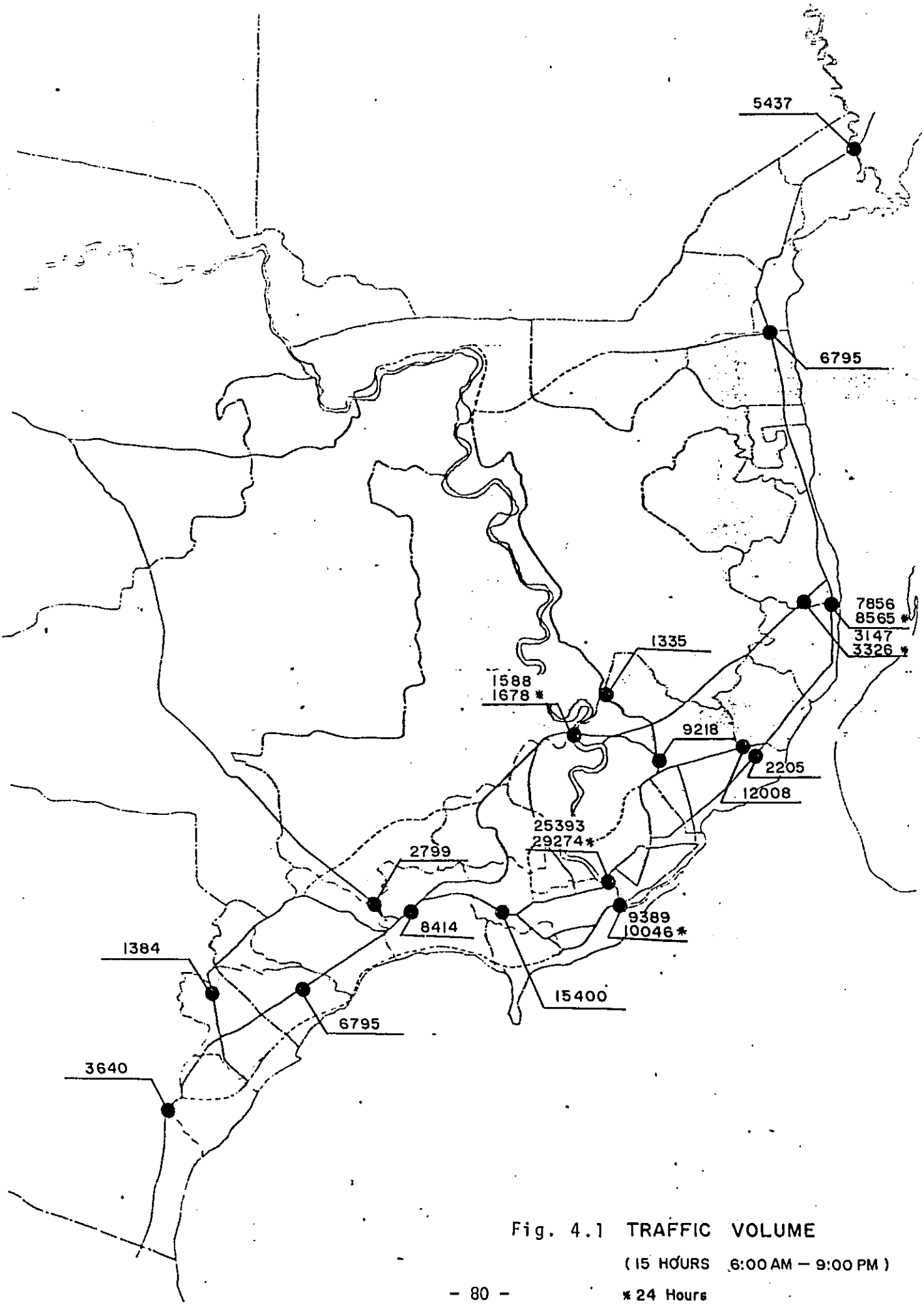


Fig. 4.1 TRAFFIC VOLUME

(15 HOURS 6:00 AM — 9:00 PM)

* 24 Hours

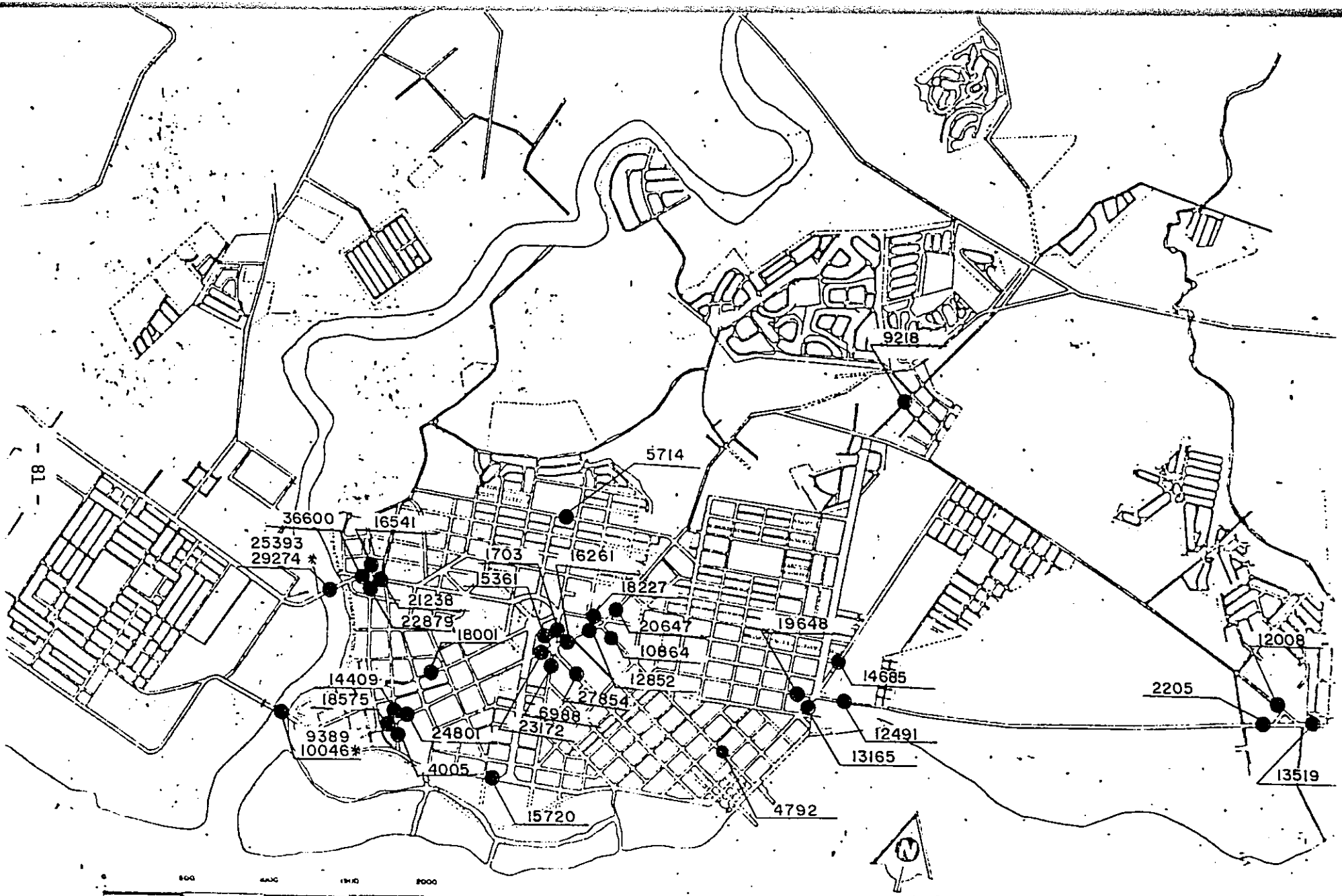


Fig. 4.2 TRAFFIC VOLUME
(15 HOURS 6:00 AM – 9:00 PM)
* 24 Hours

About equal volume of traffic is observed to flow in 50th directions on voads within the urban area. However, traffic flowing from suburban to urban area is 60% to 70% of the both direction total during the morning peak hours, and evening peak hours, clearly reflecting the commutationed movement of workers and students living in the suburban areas.

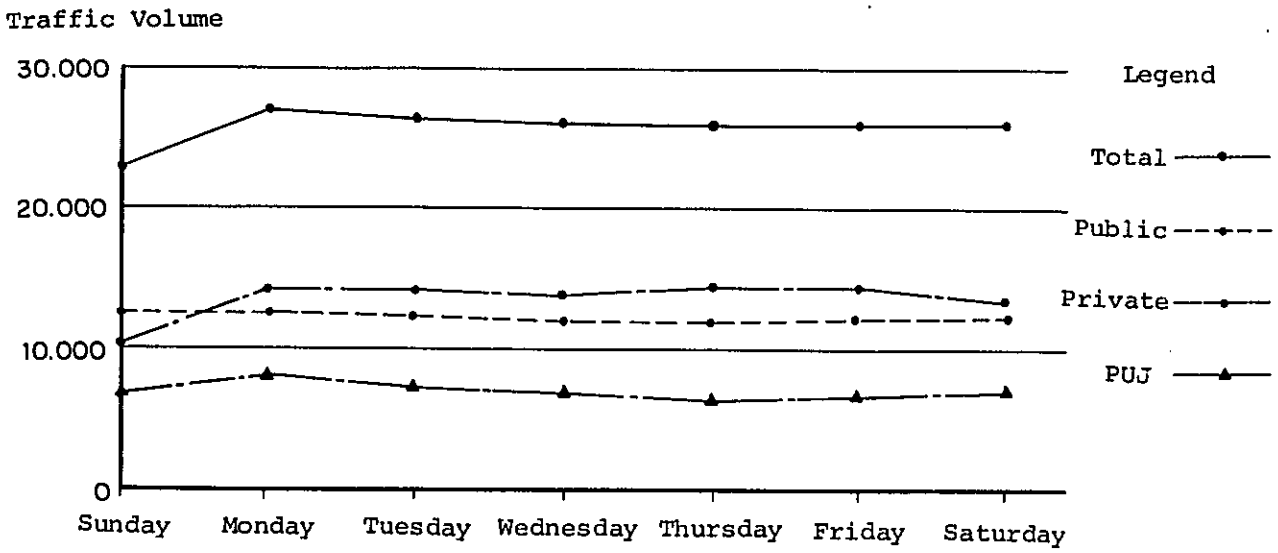
Table 4.1 Daily Fluctuations of Traffic

	Station	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Bankerohan Br.	Traffic Volume (VEH/DAY)	23,240	26,852	26,194	25,374	25,083	25,796	25,261
	Daily Fluctuation (%)	86	100	98	94	93	96	94
Magsaysay Ave.	Traffic Volume (VEH/DAY)	18,966	27,989	26,311	26,533	25,977	26,421	25,640
	Daily Fluctuation (%)	68	100	94	95	93	94	92

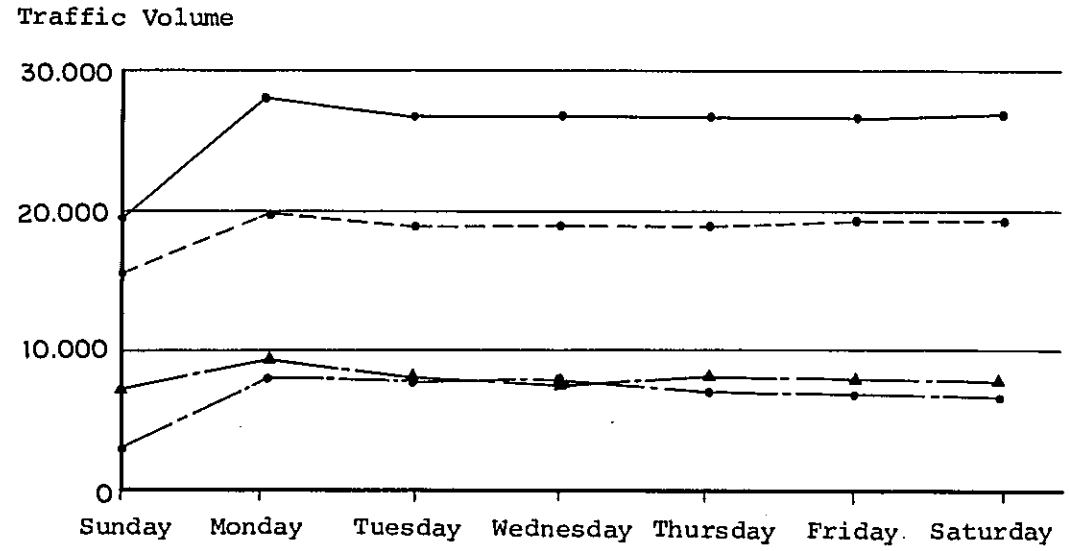
Note: (1) Traffic Volume is 15 hours traffic count. (6:00 am - 9:00 pm)
(2) Daily fluctuation is based on traffic volume on Monday.

Fig. 4.3 Daily Variation

[Station: Bankerohan Br.] (6:00 AM-9:00 PM)



[Station: Magsaysay Ave.] (6:00 AM - 9:00 PM)



(3) Hourly Distribution of Traffic

Hourly distribution of daily traffic on R. Magsaysay Avenue and at Bankerohan Bridge is shown in Figure 4.4.

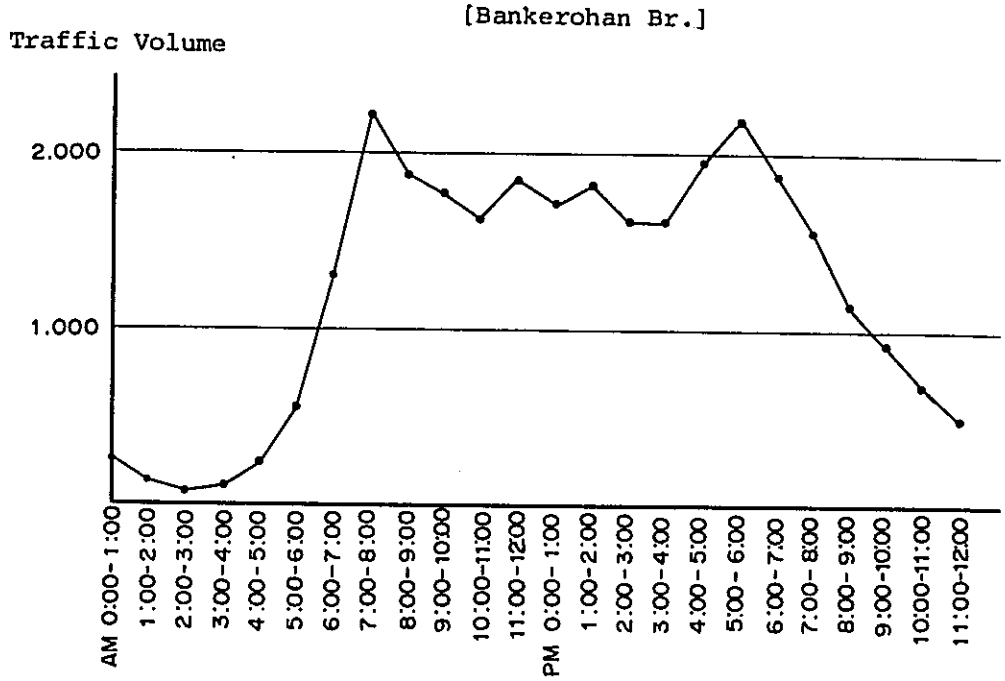
While the two counting stations showed two peaks daily, one in morning and one in afternoon, with a peak ratio of 7% alike, the peak continue longer on R. Magsaysay Avenue than at Bankerohan Bridge. Moreover, the two showed different peak hours: Magsaysay Avenue from 9:00 to 10:00 A.M. and 3:00 to 4:00 P.M., and Bankerohan Bridge from 7:00 to 8:00 A.M. and 5:00 to 6:00 P.M. This difference may be explained by the greater business traffic than commuting traffic on R. Magsaysay Avenue which occuers in a business district. Peak ratio in urban area (7 to 8%) is generally lower than such ratio in rural area (9 to 11%), as shown in Table 4.2.

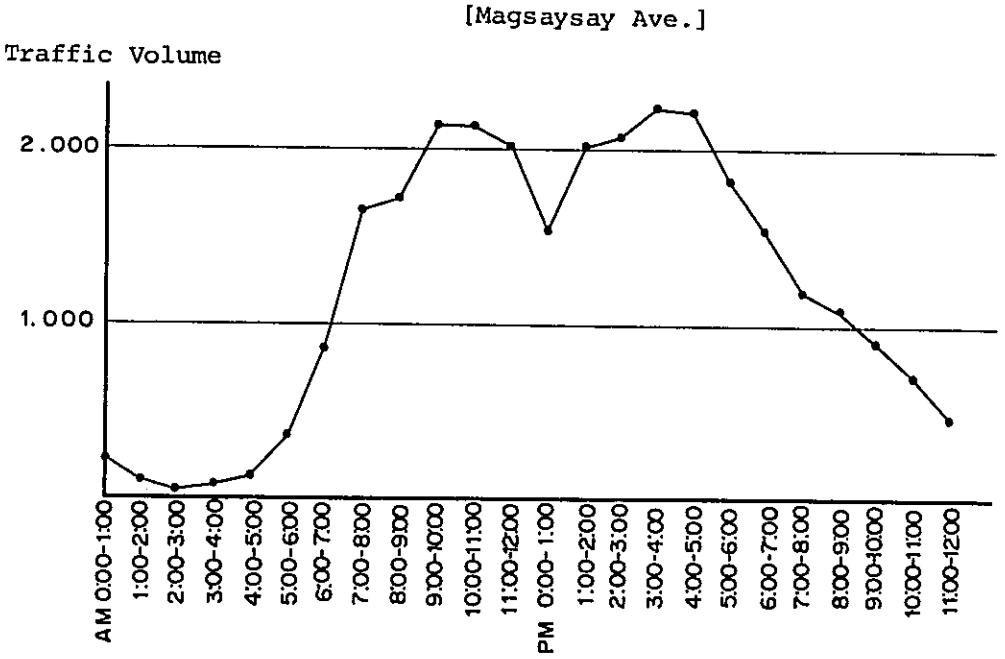
Table 4.2 Peak Hour Ratio

Station	Traffic Volume (Veh./day)	Peak Hour Traffic Volume	
		Traffic Volume (Veh./hour)	Peak Hour Ratio (%)
Magsaysay Ave.	26,311	2,149	8.2
Bangoy Ave.	19,895	1,721	8.7
Quezon Boul.	16,621	1,606	9.7
Bankerohan Br.	26,194	2,225	8.5
Bolton Br.	9,389	1,097	11.7
Davao-Agusan R.	7,856	749	9.5

Note: Traffic Volume is 15 hours traffic count.

Fig. 4.4 24 Hours Traffic Count





(4) Traffic by Vehicle Type

The distribution of road traffic by the type of vehicle is presented in Table 4.3, which indicates that the ratio of public utility vehicles to total traffic is high on Quezon Boulvard, R. Magsaysay Avenue, and, particularly on Davao-Agusan Road where the ratio is approximately 50%. Thus, sublic utility vehicles and Private cars complete in crowding the road.

Conversely, the ratio of private cars to total traffic is high at Bolton Bridge and Bangoy Avenue. Even though Bolton Bridge is a PUJ route, cars and jeeps represent as much as about 45% of total traffic. This fact, together with the fact that truck traffic is also heavy, tends to show that Bolton Bridge functions as both communting route and industrial route.

PUJs and other public utility vehicles make frequent stops on road, blocking the passage of other vehicles, and generally constitute a cause for traffic congestion. Therefore, road function and road structure should be taken into full consideration in the formulation of public transportation plans, particularly the route plans of PUJs.

Table 4.3 Vehicle Type Distribution at Major Road Sections

Vehicle Type / Station	CAR & Jeep	Truck & Pick-up	PUJ	AC	PU TAXI	Tricycle	Bus	Others (2-wheels)	Total
Magsaysay Ave.	4,389	2,310	8,285	5,213	4,616	28	115	1,355	26,311
	16.7	8.8	31.5	19.8	17.6	0	0.4	5.2	100
Bangoy Ave.	7,165	3,034	496	162	7,084	52	60	1,842	19,895
	36.0	15.3	2.5	0.8	35.6	0.2	0.3	9.3	100
Quezon Boul.	3,580	2,300	6,398	948	2,252	40	242	861	16,621
	21.5	13.8	38.5	5.7	13.5	0.2	1.5	5.3	100
Bankerohan Br.	8,662	3,596	7,075	269	4,300	32	585	1,675	26,194
	33.1	13.7	27.0	1.0	16.4	0.1	2.2	6.5	100
Bolton Br.	4,147	2,552	662	41	934	28	44	981	9,389
	44.2	27.2	7.1	0.4	9.9	0.3	0.4	10.5	100
Davao-Agsan R.	1,256	1,954	3,909	26	97	9	266	473	7,990
	15.7	24.5	48.9	0.3	1.2	0.1	3.4	5.9	100

Note: Upper shows traffic volume and lower shows vehicle type distribution.

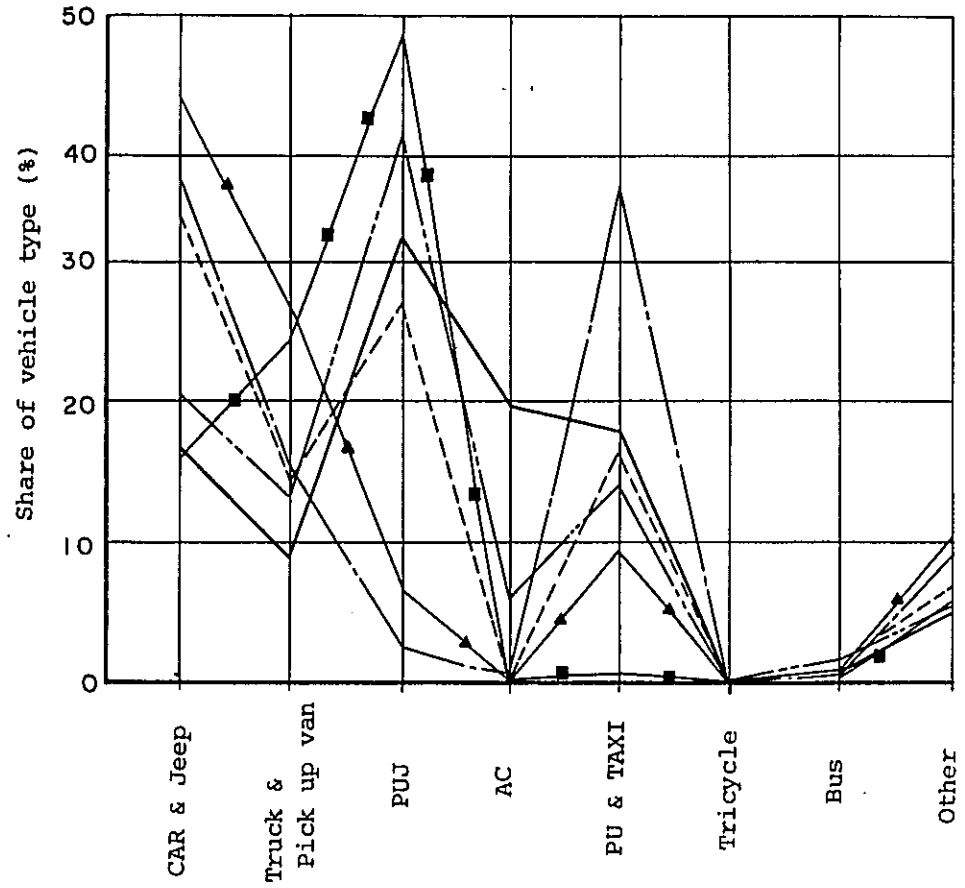


Fig. 4.5 Vehicle Type Distribution by Routes

(5) Intersection Traffic Flow

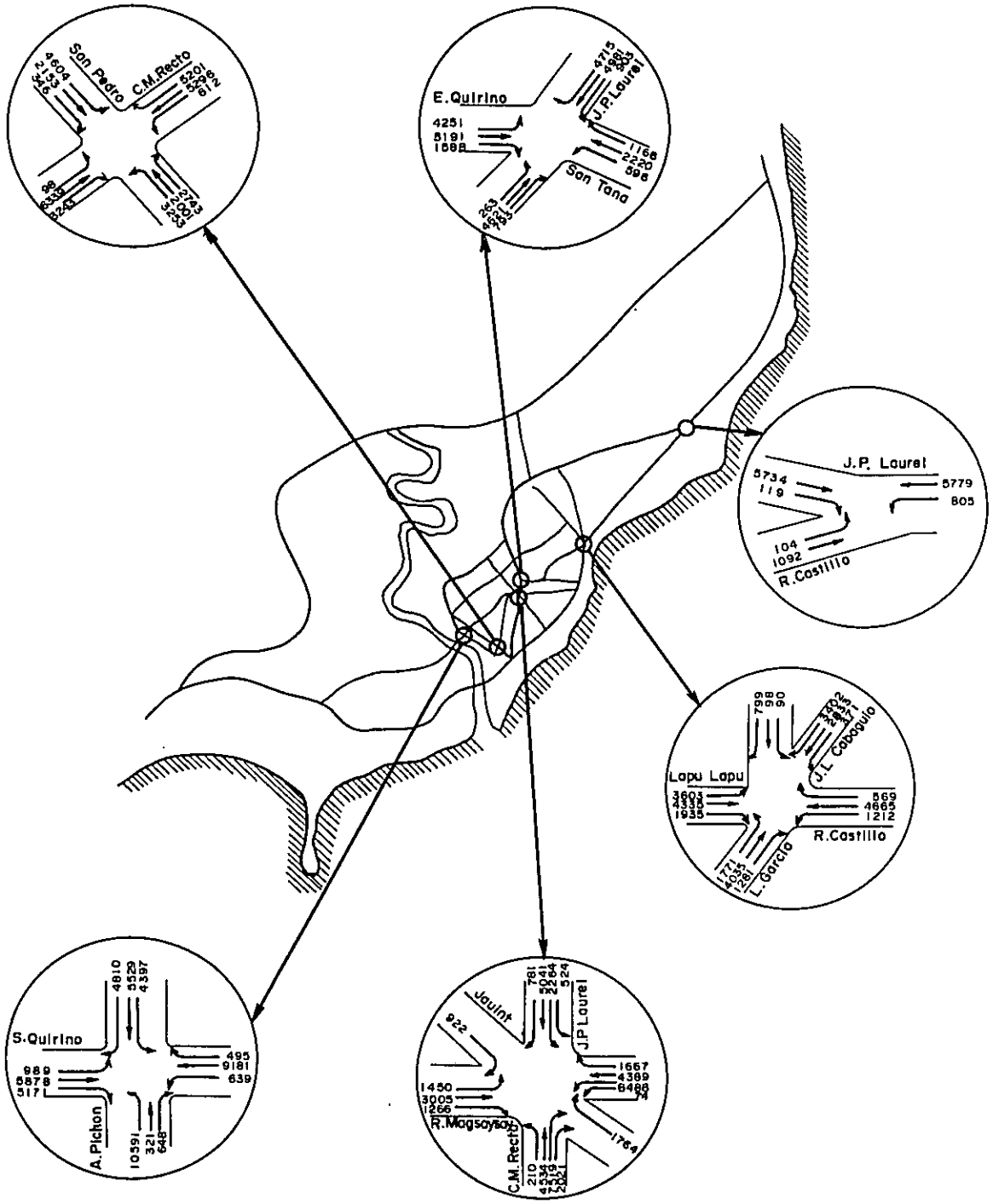
Traffic counts in each direction at major intersections are presented in Figure 4.6.

In Davao City, 9 intersections are installed with manually operated traffic signals, which are operated only during the peak hours of morning and evening. Intersections with a heavy graffic, and therefore congested, are E. Quirino Avenue/A Pichon Street, C.M. Recto Avenue/R. Magsaysay Avenue, and Agdao Market Intersection. Traffic is most congested at E. Quirino Avenue/A. Pichon Street Intersection, where a large number of vehicles flowing on these roads make either left or right turn. With this traffic bottleneck, traffic jam sometimes extends for over 1 kilometer.

Also safety and traffic management problems, which must be solved, are evident at C.M. Recto Avenue/R. Magsaysay Avenue Intersection, which has 6 legs, and Agdao Market Intersection, which has 5 legs.

Traffic congestion is being aggravated by the fact that intersections generally have no lane markings and training islands. Therefore, it is felt essential that road markings, traffic channelization, and signal operation be given serious thoughts toward the objectives of expanding intersection capacities and improving traffic safety.

Fig.- 4.6 Traffic Flows at Major Intersections.



4.2 Existing Road Problems Requiring Solution

In order to identify the problems of the existing roads which need to be solved, the existing road traffic will be assigned to the existing road network to facilitate the qualitative and quantitative analyses of road traffic, while utilizing the above discussed road traffic characteristics and the findings of vehicle running speed survey.

(1) Demand-Capacity Relationship at Major Road Cross Sections

The assignment of the existing traffic to the existing road network resulted in the levels of congestion as illustrated in Figure 4.7. Figure 4.8 compares the traffic capacities against traffic demand at major road cross sections, wherein the hatched portions indicate the excess demand over the capacity. Figure 4.8 shows that the volume of traffic oriented toward Poblacion is large, and road sections where balance is not maintained between demand and supply (capacity) often occur in the perimeter of Poblacion. Excess demands at major road cross sections have been summarized in Table 4.4.

i) Northern District (Cross Sections 1 through 6)

The volume of traffic heading to Poblasion from Bunawan/Tibunco area in the north has gradually increased and the volume of traffic in the vicinity of Panaka has reached the level of 14,000 PCU per day and the concestion ratio of 1.3. Because Diversion Road starts from the vicinity of Panakan, traffic demand and road capacity are about balanced at Cross Sections 5 and 6. However, roads show uneven degrees of utilization; traffic on Davao-Agusan Road of 14,000 PCU per day is about twice that on Diversion Road, which is 7,000 PCU per day. Therefore, in addition to radical actions which will be needed in the near future in view of the fact that road capacities are nearly fully filled with demand already, measures will be necessary to achieve a well balanced distribution of demand individual roads.

ii) Vicinity of Poblacion (Cross Sections 7 and 8)

The road network has J.P. Laurel Avenue and R.

Castillo Street meet the demand of traffic flowing to Poblacion from north (Cross Section 7) and has Bankerohan and Bolton Bridges to serve the demand of traffic flowing to Poblacion from south (Cross Section 8).

No margin in road capacity remains at Cross Section 7. Routes are observed to show uneven degrees of utilization; for instance, traffic is heavy on J.P. Laurel Avenue with traffic diverted thereto from partly unpaved R. Castillo Street. This traffic, together with that flowing from Buhangin Road, makes the traffic volume as much as 24,000 PCU per day at the point J.P. Laurel Avenue reaches Poblacion, where congestion ratio is 1.6.

At Cross Section 8, road capacity has already become insufficient to meet the demand, and congestion ratio has reached 2.5 at the heavily utilized Bankerohan Bridge, where traffic jam extends for more than 1 kilometer in the morning and evening peak hours.

Uneven degrees of utilization is observed at this Cross Section also; traffic utilizing Bankerohan Bridge has reached 27,000 PCU per day or about twice that of Bolton Bridge.

The existing facilities are insufficient in capacity at both northern and southern cross sections, and the expansion of capacities of these roads will be required in addition to the leveling off of traffic utilization among routes.

(iii) Southern District (Cross Sections 9 through 12)

The demand of traffic flowing to Poblacion from the direction of Talomo and Toril has reached approximately 19,000 PCU per day. Congestion ratio is particularly high at 1.6 at Cross Section 10, due to the influx and ad-misture of traffic from Calinan way, indicating the inadequcy capacity of the existing roads.

Demand and capacity are about in balance with each other at other cross sections.

Table 4.4 Demand and Supply Relationship at Major Road Sections

Section	Present Road Capacity (100 PCU/day)	1979		Excess Volume of Traffic (100 PCU)
		Present ADT (100 PCU)	Congestion Degree	
1[1/]	110	84	0.8	-
2	110	103	0.9	-
3	110	110	1.0	-
4	110	139	1.3	29[2/]
5	240	178	0.7	-
6	240	204	0.9	-
7	390	400	1.0	10
8	330	431	1.3	101
9	220	185	0.8	-
10	110	171	1.6	61
11	110	101	0.9	-
12	110	41	0.4	-

1/ : Section on Numbers Correspond to those of Fig. 4.8

2/ : Excess Volume of Traffic = Total Traffic Volume
- Existing Road Capacity

(2) Demand-Capacity Relationship by Route

The degree of congestion on each route is illustrated in Figures 4.7 and 4.8.

Highly congested ro-tes are concentrated within and on the perimeter of Poblacion, most of which are PUJ routes. They are:

Vicinity of Bankerohan Bridge
A. Pichon Street
C.M. Recto Avenue
J.P. Laurel Avenue
Lapu Lapu Avenue

In addition, congestion ratios of 1.0 to 1.5 are indicated on the following routes, for which some solution will be necessary:

Quezon Boulvard
E. Quirino Avenue
L. Garcia Street
Santa Ana Avenue

Points of traffic congestion are ubiquitous in other district, too, and, as seen in the preceding sub-chapter, traffic jam has occured on Davao-Agusan Road near Panakan and on Davao-Cotabato Road near Talamo.

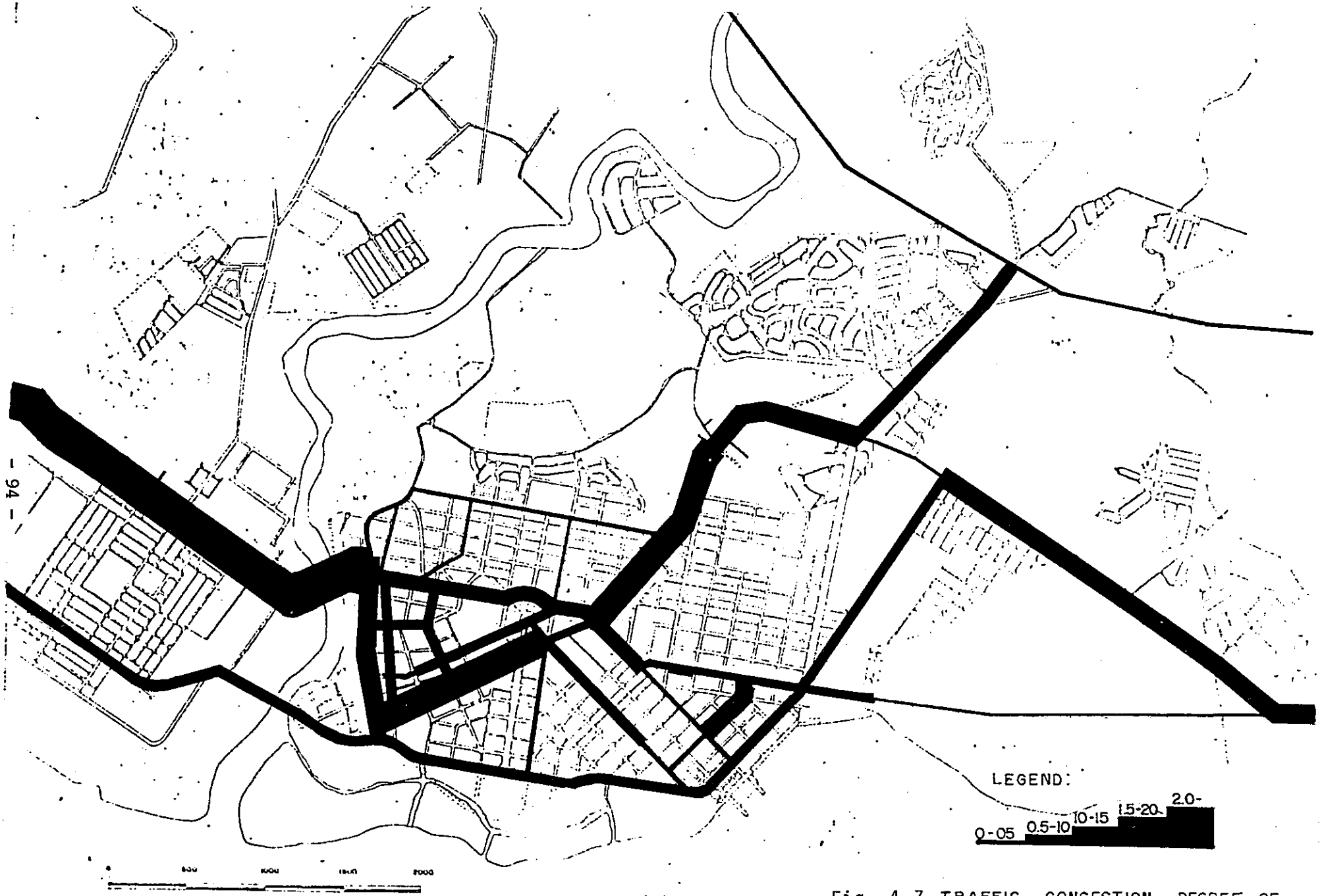
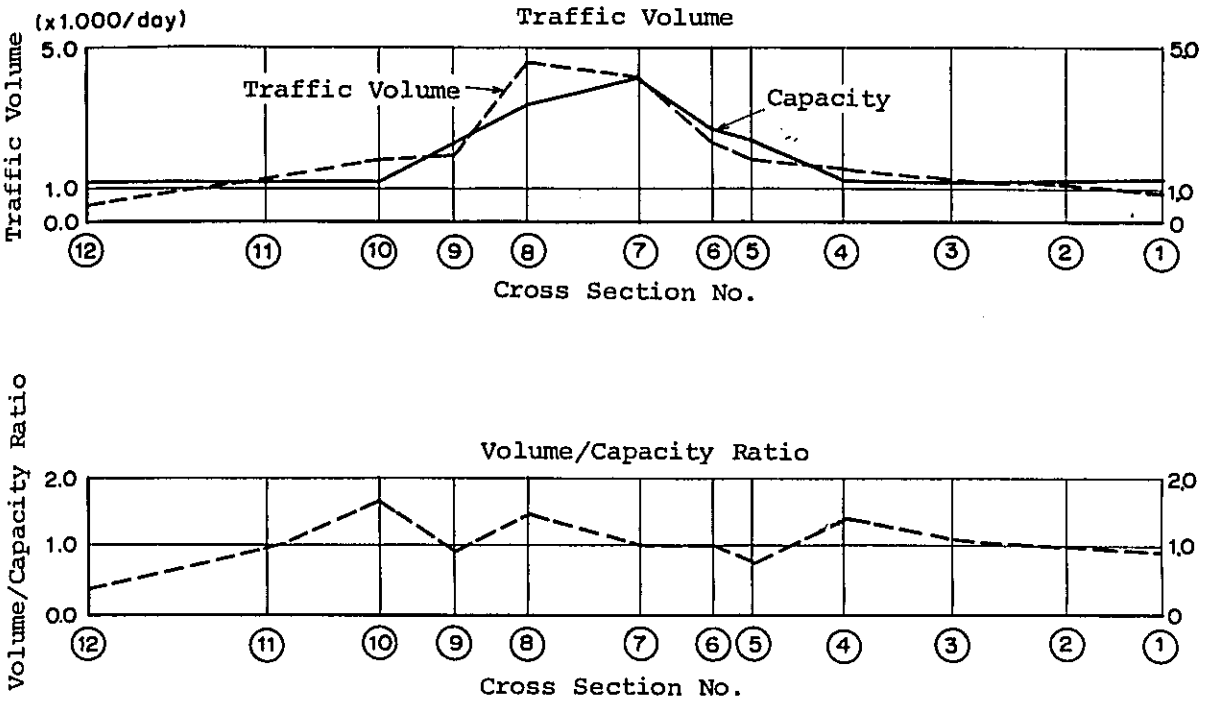
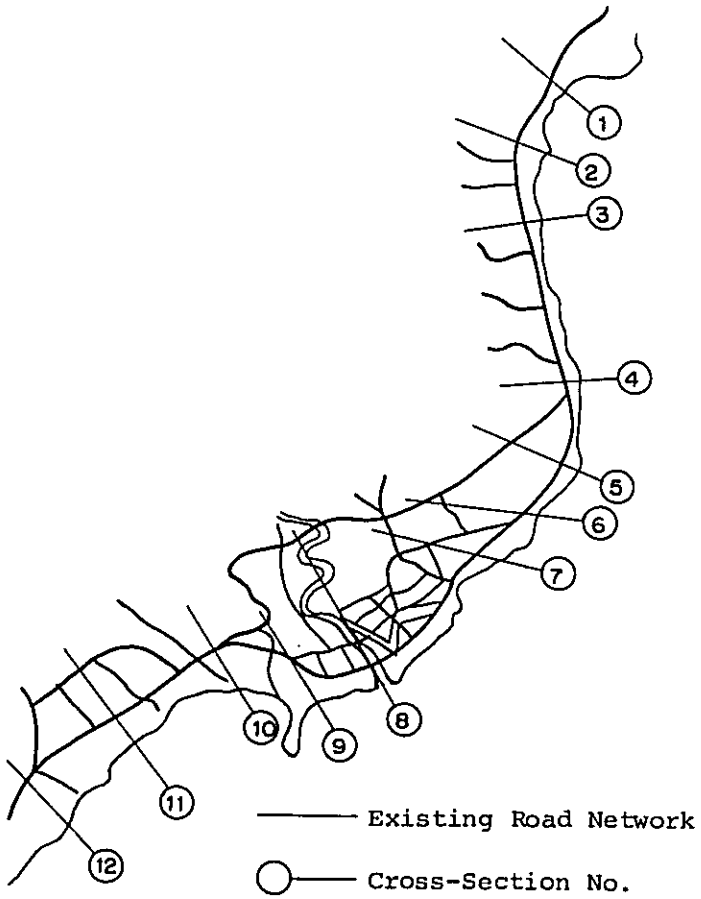


Fig. 4.7 TRAFFIC CONGESTION DEGREE OF MAJOR ROAD

Fig. 4.8 Volume/Capacity Ratio at Major Road Sections

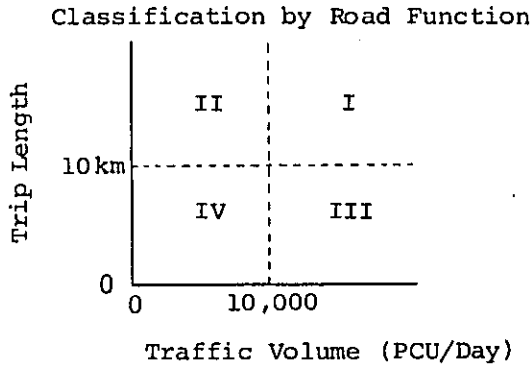




(3) Road Network Characteristics

The determination of road function (how the road is being used) is vitally important to the formulation of a policy for road maintenance/development. Some roads will have to meet the passage of a large volume of traffic, while some others will be required to support the movement of traffic at a high speed. Still some other roads will be expected to support the activities of life within the district in which they exist. Defferent road functions will call for different road structures.

Road functions can be classified as presented in Figure 4.9 based on the volume of assigned traffic and trip length.



(Road Function Categories)

I: Major trunk roads to serve a large volume of traffic moving between points within a large area, which are required to have a large capacity and capability to support high speed traffic.

II: Roads which serve a wide area, which are not required to have a large capacity but must be capable of tolerating high speed traffic.

III: Urban trunk roads which does not necessarily cover a wide area but are required to withstand a large volume of traffic moving between districts.

IV: Roads to support the activities of life within a district, which cover a rather small area and support a rather small traffic volume.

By function, major roads are classified as follows:

[Category I]

Davao-Agusan Road (J.P. Laurel Avenue)
Davao-Cotabato Road (McArthur Highway)

[Category II]

Diversion Road
Calinan Road
Bolton Bridge Road

[Category III]

A. Pichon Street
Quezon Boulvard
E. Quirino Avenue
C.M. Recto Avenue
M. Magsaysay Avenue, etc.

[Category IV]

All other roads are characterized as local roads.

It is believed that the determination of the character of relevant roads will help the designing of future road development plans.

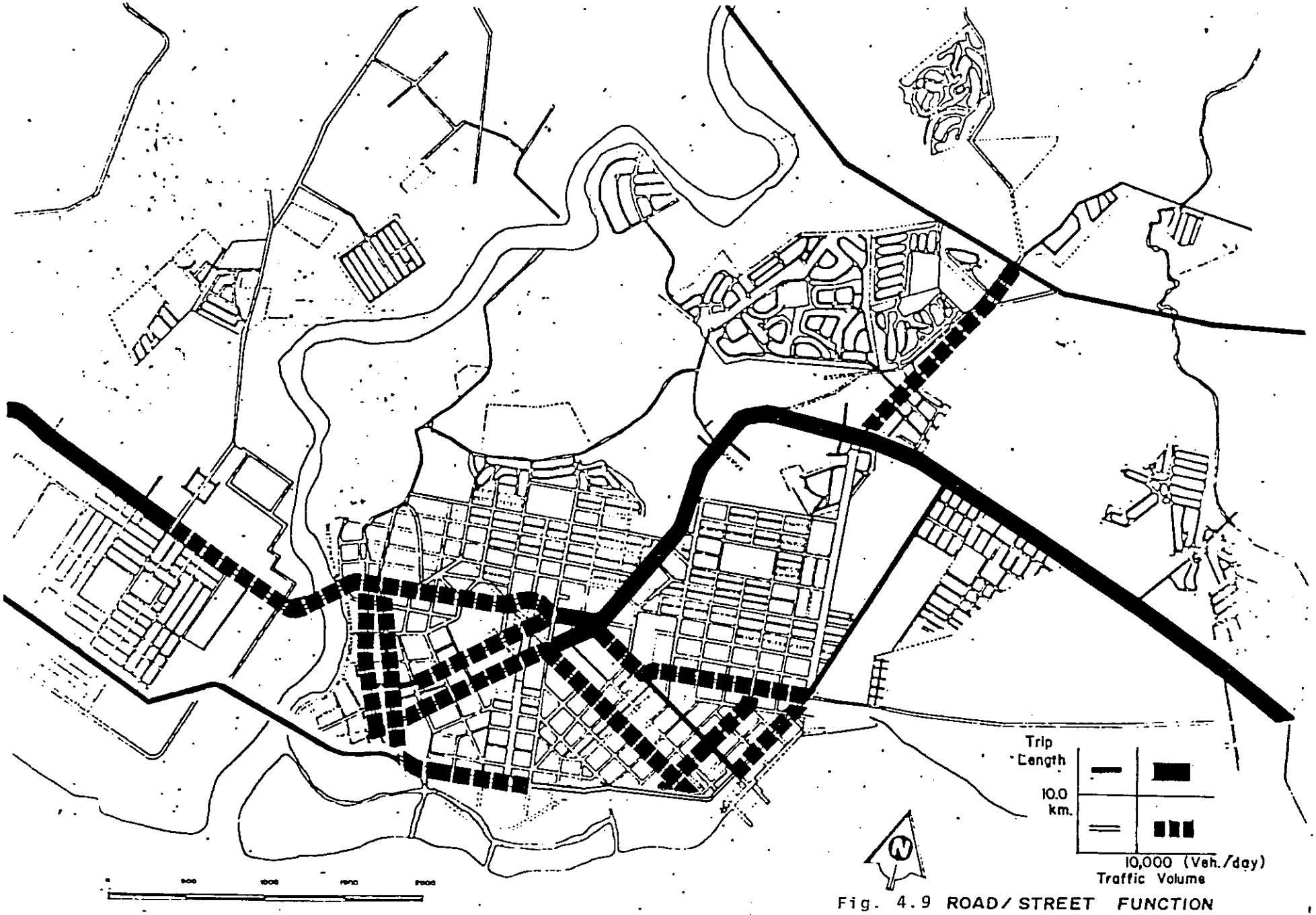


Fig. 4.9 ROAD/STREET FUNCTION

(4) Present Vehicle Operation Speed

Most of trunk roads in Davao City have a PUJ route. Vehicle operation speed survey findings on these trunk roads are illustrated in Figure 4.10. Figures 4.11 and 4.12 give schematic presentation of vehicle speed in each of sections of roads extending from Poblacion to the direction of Toril and roads in the direction of Bunawan.

The following may be pointed out from these Figures.

(i) In heavy traffic sections, particularly on McArther Highway and J.P. Laurel Avenue, slow moving JPUs hinder the operation of other vehicles with a consequence that they all run at about the same speed. Vehicles are seen to form clusters as they move in some sections during the morning and evening peak hours.

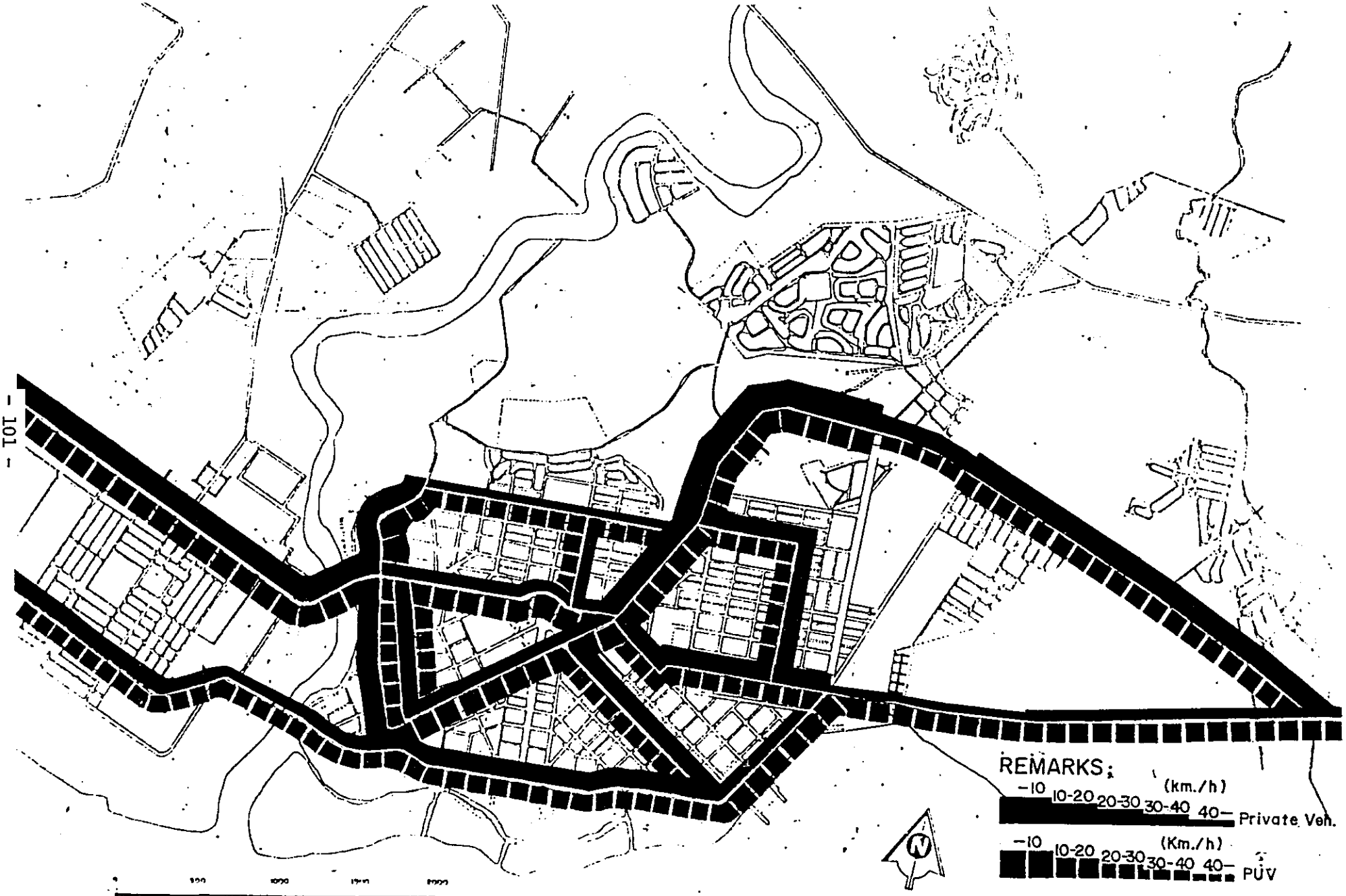
(ii) In the morning peak hour, vehicles are forced to move at a slow speed on McArthur Highway toward Poblacion (the section from E. Quirino Avenue/A. Pichon Intersection to Diversion Road), where PUJ's move at the speed of 18 to 23 kilometers per hour, on J.P. Laurel Avenue toward Poblication (the section from Santa Anna Avenue to R. Castillo Street), where PUJs run at 17 to 18 kilometers per hour. In some sections within Poblacion, they move at the speed of only 12 or 13 kilometers per hour.

(iii) The frequencies of vehicle stopping are presented in Table 4.5 in terms of distribution ratio, by factor causing the vehicle stopping, in an attempt to identify reasons for the retardation of traffic flow.

A srutiny of this Table indicates that the loading and unloading of PUJs is the greatest reason for the indicated slow vehicle flow on all of the surveyed roads in Poblacion, as well as on McArthur Highway and J.P. Laurel Avenue. Another conspicuous factor of the delay is traffic influx from adjoining roads. (Construction work on McArthur Highway has a temporary effect on traffic flow.)

Local peculiarities contribute to the retardation of traffic flow, such as pedestrian crossing within Poblacion and poor pavement in the case of J.P. Laurel Avenue.

In view of the fact that slow vehicle operation speed leads to the deterioration of traffic environment and adversely affects urban activities, the maintenance of a proper speed is believed one of the essential objectives which a traffic plan should aim to accomplish. Causes of traffic delays should be investigated and analyzed in detail, in order that effective measures to improve the currently inadequate vehicle operation speed may be designed.



SOURCE: 1979 DCUTCLUS TRAVEL SPEED SURVEY

Fig. 4.10 TRAVEL SPEED

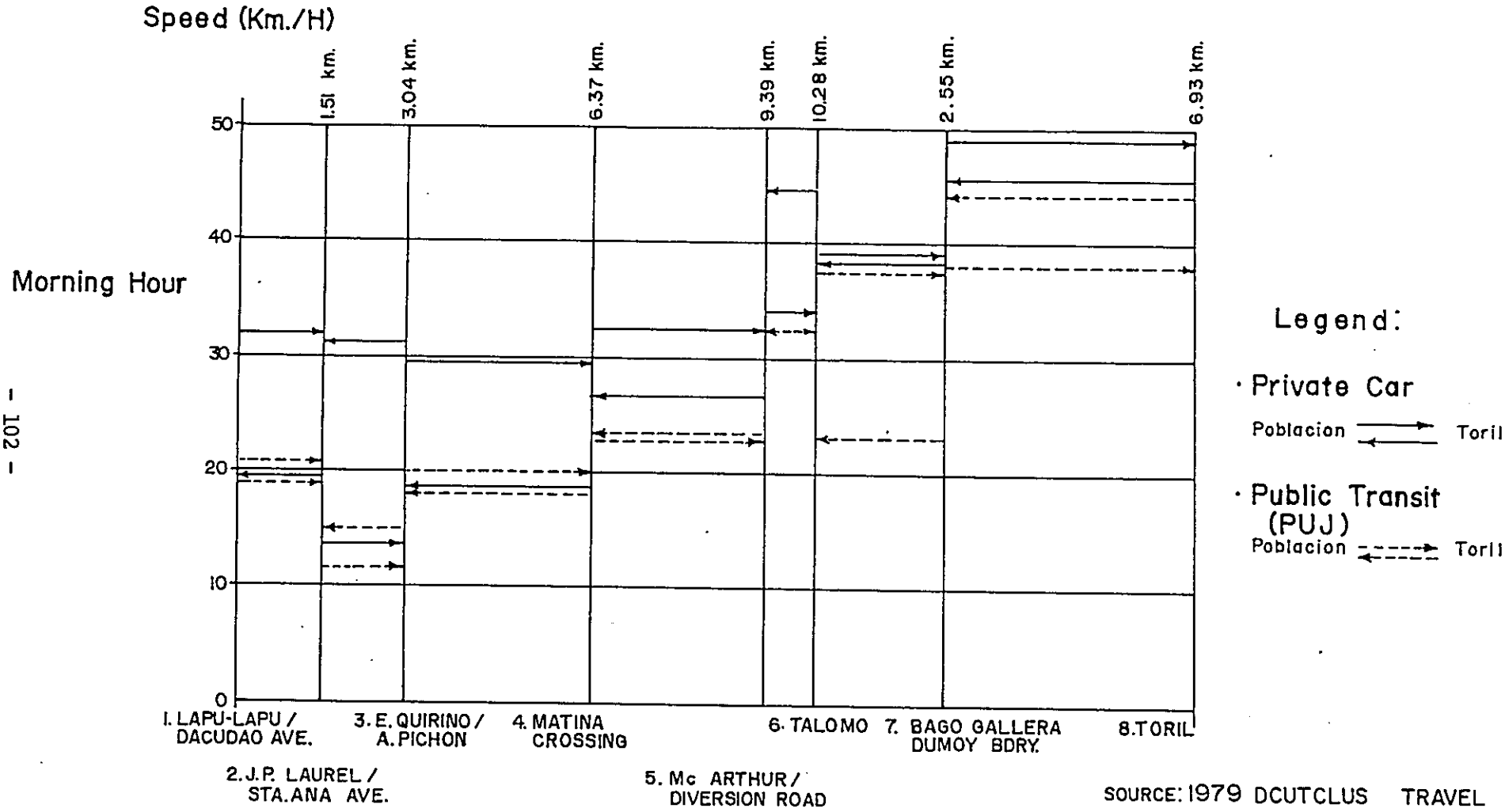


Fig. 4.11 TRAVEL SPEED (Poblacion - Toril)

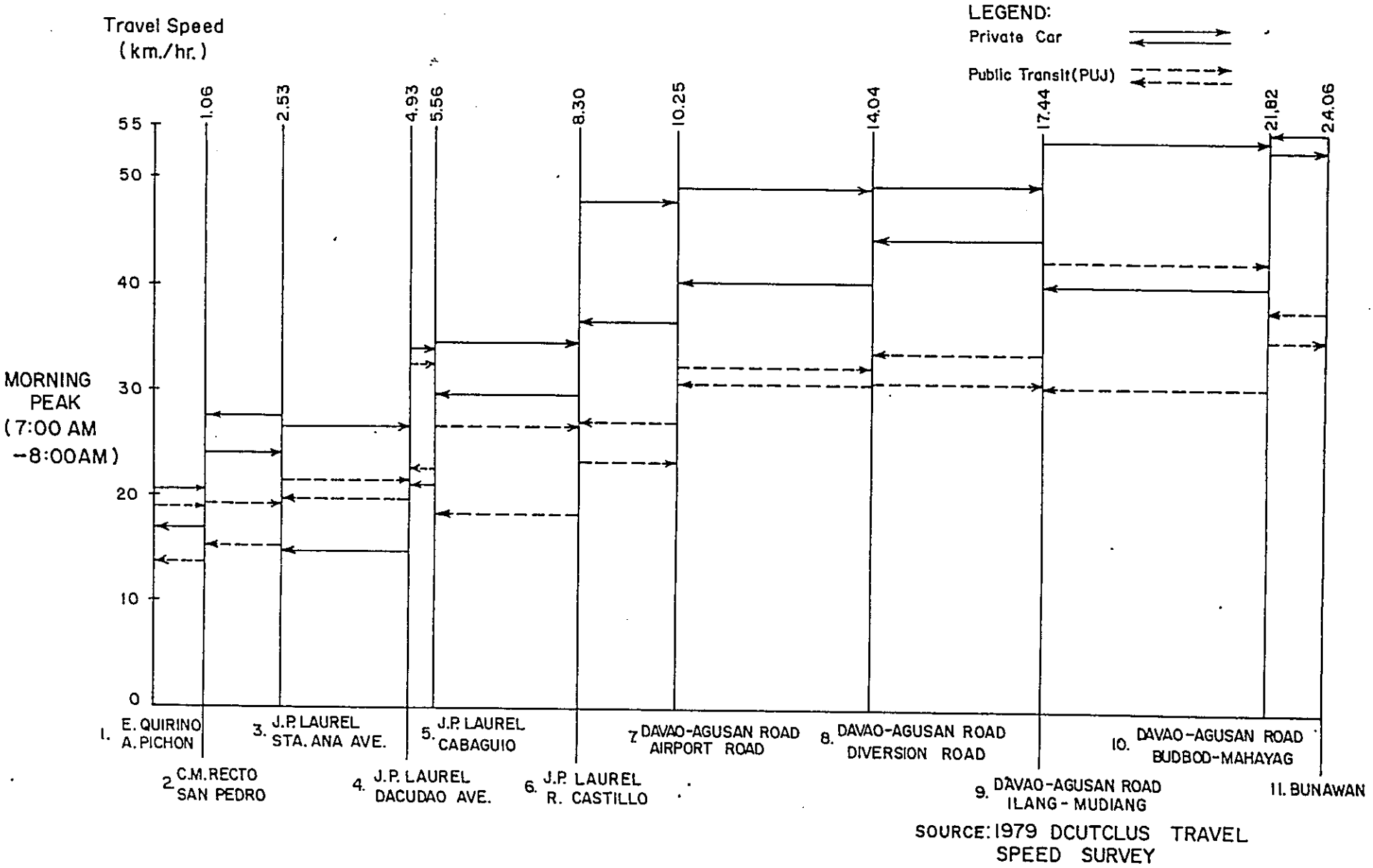


Fig. 4.12 TRAVEL SPEED (Poblacion - Bunawan)

Table 4.5 Causes for Vehicle Operation Delay

In Poblacion	
1. PUJ loading and unloading	62.%
2. Adjoining traffic at intersection	14.%
3. Pedestrian crossing	9 %
4. Traffic Signal	6 %
5. Curb Parking	3 %
6. Others	5 %
McArthur Highway	
1. PUJ loading/unloading	60 %
2. Under construction or improvement	16 %
3. Adjoining traffic at intersection	14 %
4. Others	10%
J.P. Laurel Avenue	
1. PUJ loading and unloading	61 %
2. Adjoining traffic at intersection	14 %
3. Uneven pavement surface	11 %
4. Curb parking	3 %
5. Others	10 %

SOURCE: 1979 DCUTCLUS Travel Time Survey

CHAPTER 5

INTRACITY PASSENGER MOVEMENT

5.1 Person-Trip Survey Conducted

The Person-Trip survey was conducted by home interviews. All members who are 7 years old and over of the sampled household were interviewed. The survey was conducted from November 12 to December 10, 1979.

5.1.1 Person-Trip Survey Area

It was agreed between the Steering Committee of the Philippines and the Mission that the Person-Trip Survey area was the whole part of Poblacion (Davao City proper) and urbanized area as well as the urbanizing area of four Districts namely: Buhangin, Bunawan, Talomo and Toril. The following criteria were formulated to select the urban and urbanizing area:

a) Barangays with a population density of more than 10 persons/hectare by Definition of 1975 Population Census by NCSO.

b) Barangays with Population of over 3,000.

c) Barangays which are included in the study area of the Future Land Use Plan being undertaken by the City Planning Office of Davao City.

d) Continuity of the survey area.

Barangays which satisfy one of these criteria were selected as the Person-Trip Survey area. Refer to Table 5.1.

TABLE 5.1 PERSON-TRIP SURVEY AREA
(Area, Population and Population Density)

District	Barangays	1/ Area (ha.)	2/ Population (Person)	Population Density Persons/ha.
Poblacion	All barangays	10,282	122,375	119.0
Bunawan	Bunawan	790	3,232	10.4
	Ilang	200	3,721	18.6
	Lasang	780	3,922	5.0
	Mahayag	590	956	1.6
	Panacan	530	10,745	20.3
	Tibungco	200	9,134	45.7
Sub-Total		3,090	31,710	10.3
Buhangin	Buhangin	715	13,409	18.7
	Pampanga	708	5,239	7.4
	Sasa	705	11,050	14.7
	Agdao	477	31,543	41.9
Sub-Total		2,605	61,242	23.5
Talomo	Talomo	653	11,243	17.3
	Bago Gallera	768	3,370	4.4
	Baliok	360	400	1.1
	Bucana	455	8,427	18.5
	Dumoy	508	3,248	6.4
	Ma-a	895	7,949	8.9
	Matina Aplaya	343	4,135	12.1
	Matina Pangi	566	1,460	2.6
	Matina Crossing	643	20,941	32.6
Sub-Total		5,191	61,173	11.8
Toril	Toril	263	9,043	39.5
	Crossing Bayabas	275	8,695	31.6
	Daliao	160	7,467	46.5
	Lizada	505	2,710	5.5
Sub-Total		1,203	27,915	23.2
T O T A L		22,371	304,414	13.6

1/ Area is measured by planimeter

2/ 1975 Population Census (NCSO)

5.1.2 Zoning of Person-Trip Survey Area

1. Criteria for Zoning

The following criteria for zoning were formulated:

a) The administrative boundary and/or boundary of population/economic statistic units in view of the availability and use of base data.

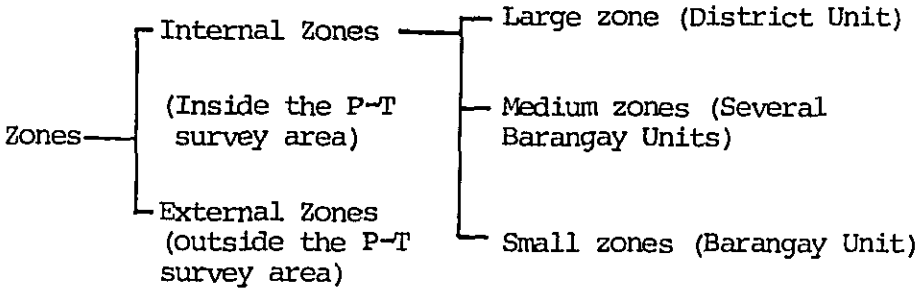
b) Suitability for the analysis of the existing road network and corresponding to the proposed development plan and/or road network plan.

c) Consistency with the existing and proposed land use as much as possible to facilitate the analysis of regional characteristics and the projection of trips.

Zoning of the survey area is to facilitate the tabulation, analysis, projection and the planning. The internal survey zones were subdivided into smaller zones suitable for use in subsequent activities of the Study.

2. Zone classification

Zones were classified into the following:



A. INTERNAL ZONES

o Large Zones

The Person-Trip Survey area was divided into five (5) large zones on the basis of the District boundaries. Traffic characteristics between Districts will be studied by this unit.

o Medium Zones

A large zone was divided into several medium zones considering characteristics of land use and the size of population. Twenty one (21) medium zones were established.

o SMALL ZONE

A medium zone was divided into several small zones and sixty three (63) small zones were established. A small zone consists of a barangay.

B. EXTERNAL ZONE

Fifteen (15) external zones were established to study the effects of the external area on the internal area, considering the District, Provincial and Regional boundaries.

Refer to Tables 5.2 and 5.3.

TABLE 5.2 INTERNAL ZONES

Zone No. District	Large zone	Medium zone	Small zone
Poblacion	1	10	40
Bunawan	1	2	6
Buhangin	1	3	4
Talomo	1	4	9
Toril	1	2	4
TOTAL	5	21	63

TABLE 5.3 EXTERNAL ZONES

	Number of External zones
Davao City	7
Mindanao Island	7
Outside of Mindanao Island	1
TOTAL	15

5.1.3 Home Interview Form

The Person-Trip Survey is time and money consuming survey. The home interview form is the essence of the survey. Therefore, it was designed to provide sufficient and complete information necessary fot the study.

The format of the Home Interview Form was reviewed in accordance with the following check items:

a) Whether the questionnaire is sufficient and complete to provide necessary information for the study.

b) Whether each question is simple for the interviewer to ask and record.

c) Whether the volume of questions is adequate for the interviewee to answer.

d) Whether it reflects the local characteristics of Davao City, especially traffic conditions and activity of the various industries.

e) Whether it is convenient for the subsequent data processing.

5.1.4 Sampling

1) Sample Frame

The survey or census data for the sample frame, population and number of households, of the Person-Trip Survey area for the year 1979 were not available. Therefore, the sample frame was projected on the basis of the 1970 and 1975 National Population Census data conducted by NCSO. Projected population and number of households of the survey area in 1979 were 360,000 and 60,120 respectively.

2) Sample Rate

Three (3) kinds of sample rates were introduced in accordance with the procedure of the survey. These are as follows:

o Effective samples (after checking of data collected) . . .	6% of total households
o Home Interviews	8% of total households

o Sampling (selection of samples) . . . . . 12% of total households

6% of effective samples - Final samples effective will be 6% or more. In this case, reliability of the survey will be ranged from 90% to 95%.

8% of home interview - Eight (8%) of households will be interviewed. A safety factor is provided considering the possibility of incomplete answers and errors during data processing.

12% of Sampling - Some households sampled may have transferred at the time of home interviews. The sample rate was increased to eliminate confusion during home interviews.

3) Basic Records for Sample Selection

The following basic records for sample selection were studied:

- o Barangay Census Data, August to October, 1979 (Poblacion Barangay Secretariate)
- o Barangay Census Data, February 1979 (Bunawan barangay hall)
- o Voting List, April, 1978 (COMELEC)
- o SIR (Slum Improvement and Resettlement Data, October 1977 to May 1978) City Government of Davao
- o Barangay Map with locations of houses and names of family heads, 1979 (Barangay Baliok)
- o Field Sampling by the aid of Purok Leaders (Barangay where no suitable data is available)

When selecting basic records to be used, the priority was given to the latest record. As a result, these recores were used;

Barangay Census Data, Poblacion	- 26 Barangays
Barangay Census Data, Bunawan	- 6 Barangays
Voting Lists	- 24 Barangays
SIR Data	- 1 Barangay
Barangay Map	- 1 Barangay
Field Sampling	- 5 Barangays
TOTAL	- 63 Barangays

5.2 Ancillary Surveys Conducted

5.2.1 Cordon Line Survey

The cordon line survey was conducted to obtain data with regard to person trips inside the Person Trip Survey Area made by persons living outside the person trip survey area (non-resident).

Six survey stations were established at the intersecting point of the Survey Area boundary and a major road. These were

1) Davao-Bukidnon Road
2) Buhangin - Lapanday Road
3) Davao-Cotabato Road
4) Old Highway
5) Davao-Agusan Road
6) Lasang-Malabog Road

A roadside O-D survey and a classified vehicle count survey were conducted at these survey stations.

5.2.2 Screen Line Survey

The screen line survey was conducted to test the result of the Person Trip Survey. A screen line is a imaginary established so as to divide the Survey Area into two. Davao River was selected as a screen line and three stations were established at Bankerohan Bridge, Bolton Bridge and Ma-a Bridge. The administrative boundary between Sasa and Panacan was also selected as a supplemental screen line and two stations were established on Diversion Road and Davao-Agusan Road.

A classified vehicle count survey and a pedestrian count survey were conducted at these stations.

5.3 DATA PROCESSING AND COMPILATION OF MASTER M/T FOR THE PERSON TRIP SURVEY

5.3.1 General

The master magnetic tape (M/T) is the most basic and the most essential information source for the traffic analysis work, which implies all the results of the person trip survey.

The compiling procedure is shown in Fig. 5.1, through which expansion process from sample is important above all. Fig. 5.2 shows the master M.T format, that is, specification of the memory allocation in the master M/T.

5.3.2 Expansion Process

1) Methodology

The meaning of expansion is to estimate the mother population using the sample population. This has been done by multiplying the number of samples by expansion coefficient.

Expansion coefficient is defined as a reciprocal number of effective sampling ratio, that is:

$$\text{Expansion Coefficient} = 1/\text{Effective Sampling Ratio}$$

$$= \frac{\text{Effective Sample Population}}{\text{Mother Population}}$$

2) Zones and Categories for Expansion

The expansion coefficient tend to vary more widely and to be less reliable as the Study area is divided into smaller zones (Table 5.4), and also as the trips are divided into smaller groups (categories) according to the individual characteristics such as sex, age, car-ownership, income level, etc. (Table 5.5, 5.6 and 5.7).

It is necessary, therefore, to adopt an appropriate zone-size and categories in order to make the expansion coefficient more reliable. In this study, the expansion coefficients have been determined by each B zone (medium-size zone) and also by sex and by age group, of which examples is shown in Table 5.8.

Fig. 5.1 Procedure of Compiling the Master Tape

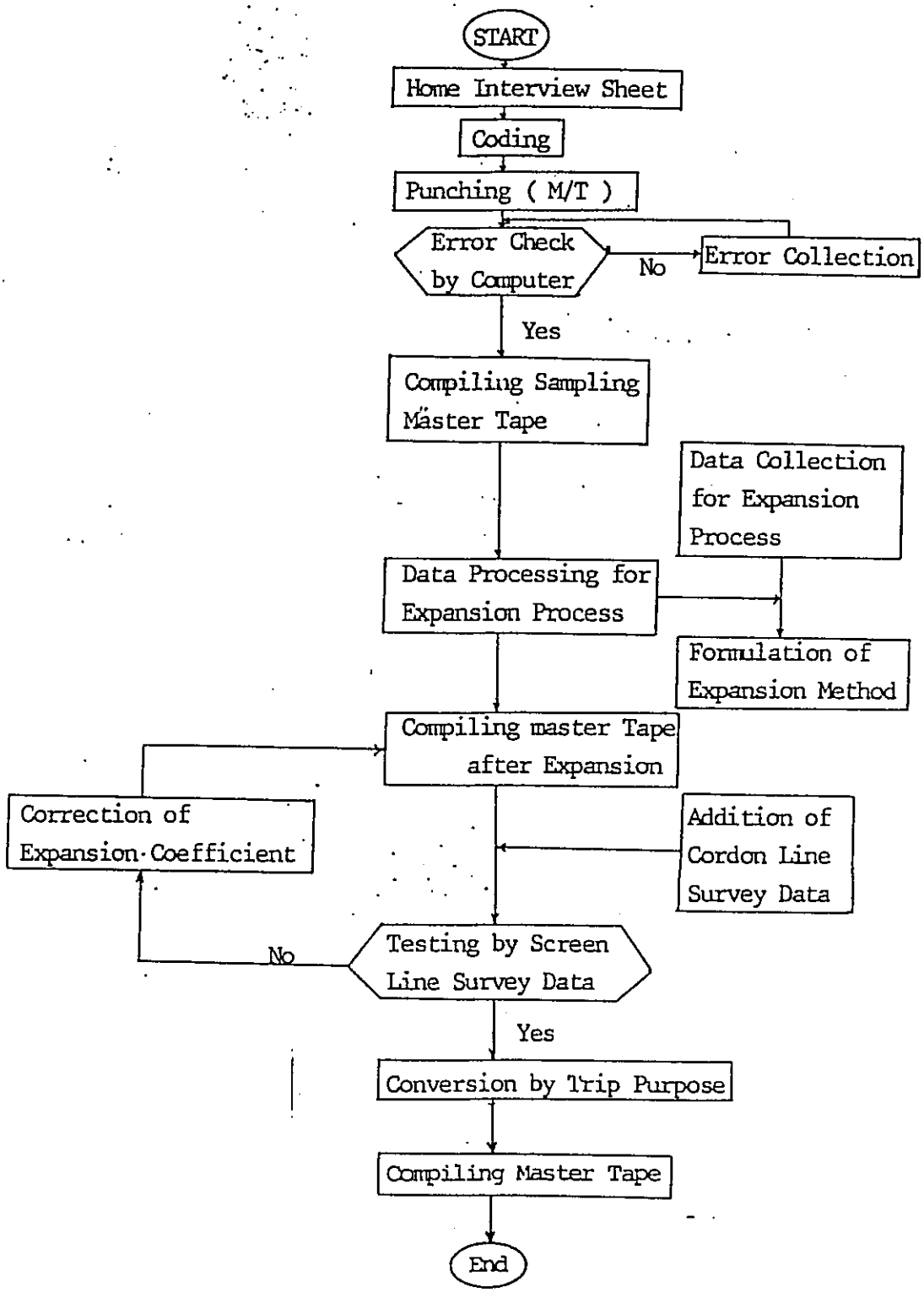


Fig. 5.2 Master M/T format

Zone			H.H-No.	Indivi. No.	Date		No. of trip	Home			Office			School			Sex	Age	Occupation	Industry	License	Classifi.	Unit	Classifi.	Unit	Classifi.	Unit	Distance	Time	Income	Segue. No.
A-Zone	B-Zone	C-Zone			Month	Day		A-Zone	B-Zone	C-Zone	A-Zone	B-Zone	C-Zone	A-Zone	B-Zone	C-Zone															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

No. of trip	Origin							Distination							Purpose	Passenger	Drive	Parking	1st				2nd				3rd			
	Zone			Institution	Time			Zone			Institution	Time							Mode	A-Zone	B-Zone	C-Zone								
	A-Zone	B-Zone	C-Zone		AM. PM.	Hour	Minute	A-Zone	B-Zone	C-Zone		AM. PM.	Hour	Minute																
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63

4th				5th				6th				7th				8th				Expansion facter (1)	Expansion facter (2)	Expansion facter (3)	Tray Kay
64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87

Table 5.4 Effective Sampling by Zone

Zone Code	Total Population	7years old and over	Effective samples	Sampling Ratio
				%
1010	3,910	3,070	254	8.27
1020	13,000	10,250	354	8.37
1030	4,650	3,650	283	7.75
1040	13,040	10,235	822	8.03
1050	5,790	4,545	383	8.43
1060	12,060	9,465	796	8.41
1070	14,950	11,735	1049	8.94
1080	18,220	14,305	1301	9.09
1090	29,490	23,150	1921	8.30
1100	7,890	6,195	507	8.18
1000	123,000	96,555	8170	8.46
2010	13,430	10,545	893	8.47
2020	27,570	21,640	1735	8.02
2000	41,000	32,185	2628	8.17
3010	21,610	16,965	1434	8.45
3020	16,180	12,700	1025	8.07
3030	45,210	35,490	2778	7.83
3000	83,000	65,155	5237	8,04
4010	14,280	11,210	1062	9.47
4020	40,660	31,915	2696	8.45
4030	18,210	14,295	1190	8.32
4040	8,850	6,950	642	9.24
4000	82,000	64,370	5590	8.68
5010	20,320	15,950	1230	7.71
5020	10,680	8,385	669	7.98
5000	31,000	24,335	1899	7.98
Total of Survey Area	360,000	282,600	23524	8.32

Source : DCUTCLUS Team

Table 5.5 Effective Sampling Ratio by Sex

	Population 7years old and over	Effective Samples	Sampling Ratio(%)
Male	141 205	22293	7.93%
Female	141 395	12326	8.72%
Total	282,600	23524	8.32%

Source DCUTCLUS Team

Table 5.6 Effective Sampling Ratio by Age Group

Age Group	Population 7years old and over	Effective Samples	Sampling Ratio
7-9	29248	2297	7.85%
10-14	43663	3803	8.71%
15-19	44369	3844	8.66%
20-29	69240	5395	7.79%
30-39	41970	3284	7.82%
40-49	26279	2473	9.41%
50-59	14975	1509	10.08%
60-	12856	919	7.15%
Total	282600	23524	8.32%

Source: DCUTCLUS Team

Table 5.7 Effective Sampling Ratio by Sex by Age group

Age group	Mother Population		Effective samples		Sampling Ratio	
	Male (A)	Female (B)	Male (C)	Female(D)	Male $\frac{(C)}{(A)}\times 100$	Female $\frac{(D)}{(B)}\times 100$
7 - 9	14,967	14,281	1,173	1,124	7.84	7.87
10 - 14	21,465	22,198	1,884	1,919	8.78	8.64
15 - 19	20,473	23,896	1,712	2,132	8.36	8.92
20 - 29	33,609	35,631	2,386	3,009	7.10	8.44
30 - 39	21,888	20,082	1,588	1,696	7.26	8.45
40 - 49	13,978	12,301	1,188	1,285	8.50	10.45
50 - 59	8,049	6,926	768	741	9.54	10.70
60 -	6,176	6,080	499	420	7.36	6.91

SOurce: DCUTCLUS Team

Table 5.8 Example of Expansion Coefficient

Age Group / Sex	Male			Female		
	Mother Population	Effective Sample	Expansion Coefficient	Mother Population	Effective Sample	Expansion Coefficient
7 - 9	519	40	13.0	539	31	17.4
10 - 14	745	83	9.0	838	84	10.0
15 - 19	711	65	11.0	902	73	12.4
20 - 29	1166	97	12.0	1344	160	13.6
30 - 39	760	42	18.1	758	52	14.6
40 - 49	485	39	12.4	464	44	10.5
50 - 59	279	29	9.6	261	19	13.7
60 -	235	11	21.4	229	13	17.6
Total	4900	406	12.1	5335	416	12.8

source: DCUTCLUB Team

This decision has been made based on the results of χ^2 test* which is a statistical measure to assess the reliability of data.

The expansion coefficients are distributed most from 8.0 to 15.0.

5.3.3 Check of Reliability by Screen Line Survey Data

Screen Line is an imaginary line which divides the Survey Area into two parts and all the traffics crossing this line have been counted. In this study, the Davao River has been designated as a screen line.

On the other hand, traffic volume can be estimated based on the person trip survey and cordon-line survey and this estimated traffic volume should be checked by the result of the screen line survey. (The ratio of the former to the latter is called a catchment ratio).

The result of analysis is shown in Table 5.10. The catchment ratio varies by traffic mode and for the mode with low catchment ratio, all the relevant O-D volumes by residents in the Survey.

---

* χ^2 -test

$$= \sum_{k=1}^{n} (Yk - Xk)^2 / Xk$$

where, Xk : percentage share of category k in the mother population

Yk : percentage share of category k in the sample population

n : number of categories

Table 5.9 χ^2 value categorized by Sex and by Age

	Number of Category	χ^2	$\chi^2_{max.}(95\%)$	Reliability
Sex	2	0.336	0.00393	X
Age Group	8	0.701	2.167	0
Sex and Age Group	16	1.198	7.261	0

Source: DCUTCLUS Team

Table 5.10 Screenline (Davao River) Check and Adjustment Coeffecient

(vehicles/day)

Traffic Mode	Vehicle Trip by PT Survey (A)	Cordon Line Survey (B)	Total Traffic Volume estimated (C)=(A)+(B)	Screen Line Survey (D)	Catchment Ratio (E)=(C)/(D)	Adjust-ment (F)*	Adjustment Coefficient (G)
Walking	6,844	-	6,844	7086	0.97	-	
Bicycle	261	-	261	3,119	0.63	○	1.74
Motor-Cycle	1,305	390	1,695				
Car	5,794	574	6,368	14,642	0.43	○	2.43
Truck	4,201	952	5,143	7614	0.67	○	1.60
Bus/ Mini-Bus	124	561	685	744	0.92	-	-
PUJ	5,575	1,345	6,920	8,293	0.83	-	-
AC	192	-	192	348	0.55	○	1.81
PU	4,043	12	4,055	6,111	0.66	○	1.51
Tricycle	92	-	-	68	1.35	-	-
Total	28,431	3,834	32,265	48,025	0.67	-	-

Source : DCUTCLUS Team * Note : ○ ; Adjustment necessary, - Adjustment not necessary

Area have been modified, multiplied by the following adjustment coefficient:

$$\text{Adjustment Coefficient} = \frac{\text{Counted Traffic} - \text{Traffic by Cordon Line Survey}}{\text{Estimated Traffic} - \text{Traffic by Cordon Line Survey}}$$

$$= \frac{(D) - (B)}{(C) - (B)} \quad \text{(ref. Table 5.10)}$$

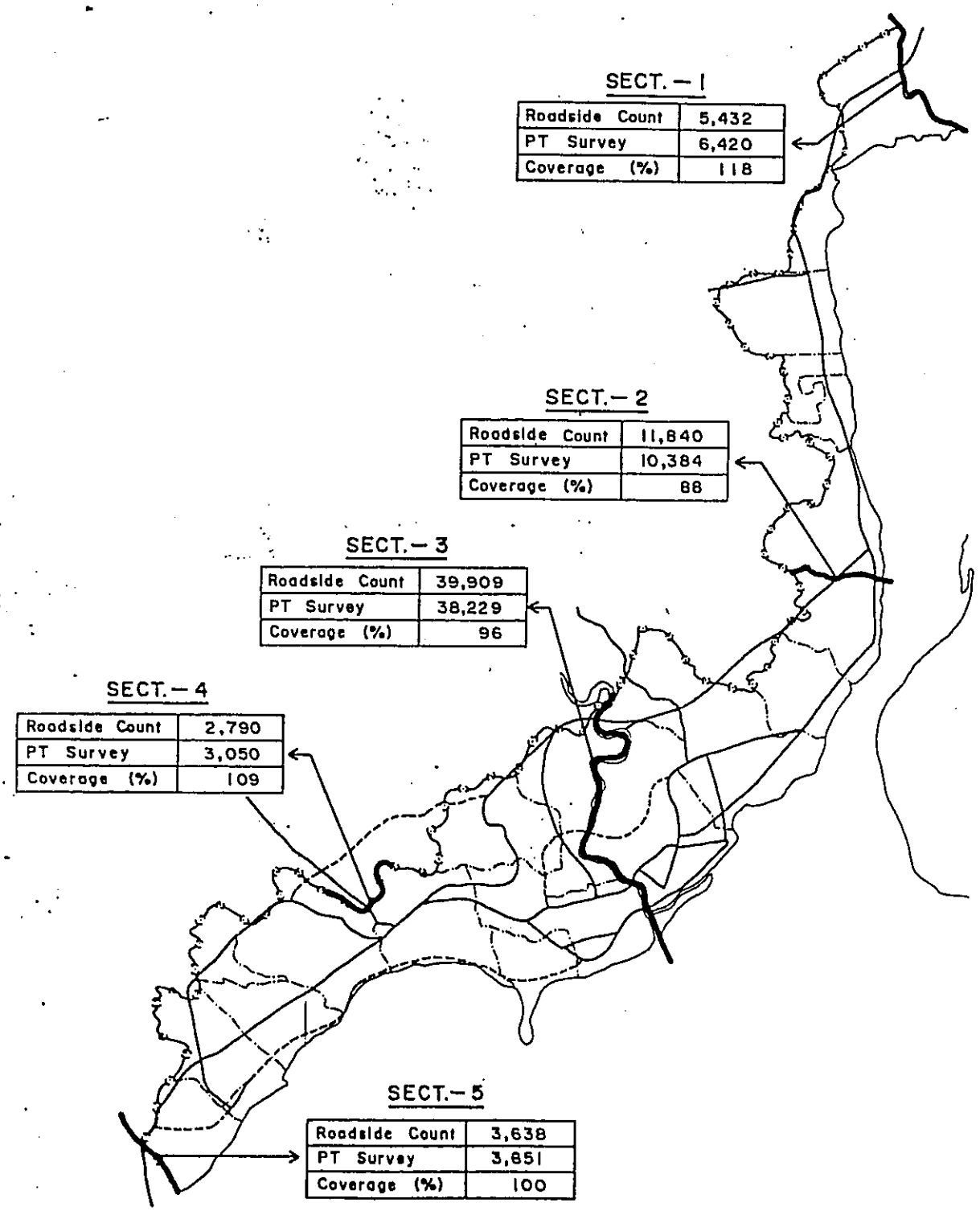
The traffic volumes after adjustment are shown in Fig. 5.3 compared with the counted traffic volume.

5.3.4 Conversion of Trip Purpose

Trip purposes in the person trip questionnaire are arranged mainly for the convenience of interviewees, not for the analytical purpose. So they are not necessarily suitable for the analysis after data processing. For example, all the "go to office" trips does not mean the commuting trips from home. By this reason, trips should be rearranged in accordance with the new trip purposes, which have been synthesized from nine categories into six as shown below:

Person Trip Questionnaire	Master Tape
1. Work (Office)	1. To Office
2. School	2. To School
3. Business	3. To Home
4. Medical and Dental	4. Business
5. Social, Recreation	5. Shopping
6. Eat Meal	6. Private
7. Shopping	
8. Church	
9. Home	

Fig. 5.3 COMPARISON OF TRAFFIC VOLUMES BY PT SURVEY WITH THOSE BY ROADSIDE COUNT



NOTE: Figure shows 24 hour traffic volume (vehicles / day)

5.4 Basic Rules with regard to Trips

All trips in this chapter were dealt with as follows, unless otherwise stated;

1) Trips are those made by persons living in the P.T. Survey Area (residents)
2) Trips are dealt with as linked trips
3) Analysis concerning mode of travel is made in terms of a representative mode which is determined on the basis of priority of mode. Priority of mode is ranked as follows:
   Bus → PUJ → A.C. → Automobile - → Truck → Taxi, PU → Motorcycle → Tricycle → Bicycle → Walking

5.5 Outline of Person Trips in the Survey Area

5.5.1 Total Person Trips in the Survey Area

Total number of Person trips concerned with the survey area is 748,000 trips per day. Number of trips made by residents in the survey area (residents) is 685,000 trips per day with a share of 92%. Number of trips made by residents living outside the survey area (non-residents) is 63,140 trips per day with a share of 8% and most of them are dependent on PUJs and buses. (Refer to Table 5.11 and Fig. 5.4)

5.5.2 Purpose Share of Trips

As to the share of trips by purpose, going home trips show the highest share of 36.4% and second is private trips with a share of 23.9%. On the other hand, shopping trips and business trips show low share of 4.3% and 9.0%, respectively. Going-to-office, going-to-school and going-home trips are home-based trips so as most of the shopping trips and private trips. Home-based trips share high percentage of trips.

Such daily habitual trips as going-to-office, going-to-school and going-home trips share more than half of the total trips (62.9%). (Refer to Fig. 5.5)

Fig. 5.4 TOTAL NUMBER OF PERSON TRIPS IN THE SURVEY AREA

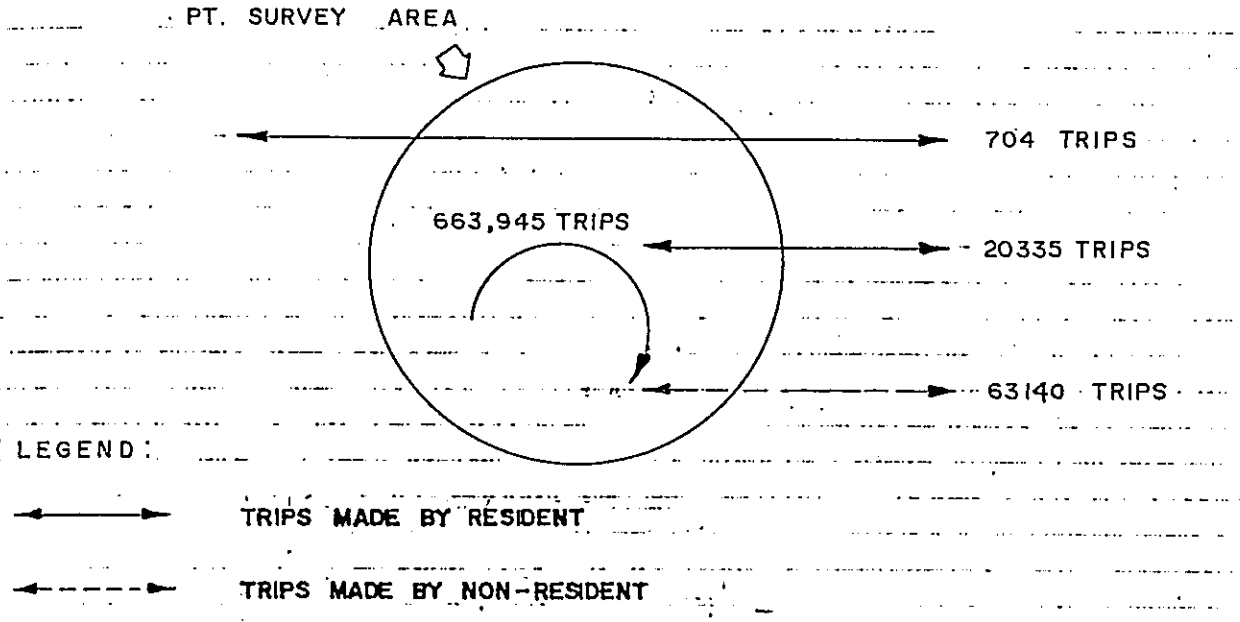


TABLE 5.11 Total Number of Trips by Mode

	Walks	Bicycle	Motor Cycle	Auto Mobile	Trucks	Bus	P.U.J.	A.C.	P.U. Taxi	Tricycle	Others	Total
TRIPS MADE BY RESIDENT	253622	5287	7955	69985	48442	9808	180578	63285	18744	25950	1328	684984
	100 %	93 %		93 %	86 %	41 %	86 %	100 %	100 %	81 %	100 %	92 %
TRIPS MADE BY NON-RESIDENT	—	944		4902	7680	14066	29154	176	50	6168	—	63140
	— %	7 %		7 %	14 %	59 %	14 %	0 %	0 %	19 %	— %	8 %
TOTAL	253622	14186		74887	56122	23874	209732	63461	18794	32118	1328	748124
	100 %	100 %		100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %

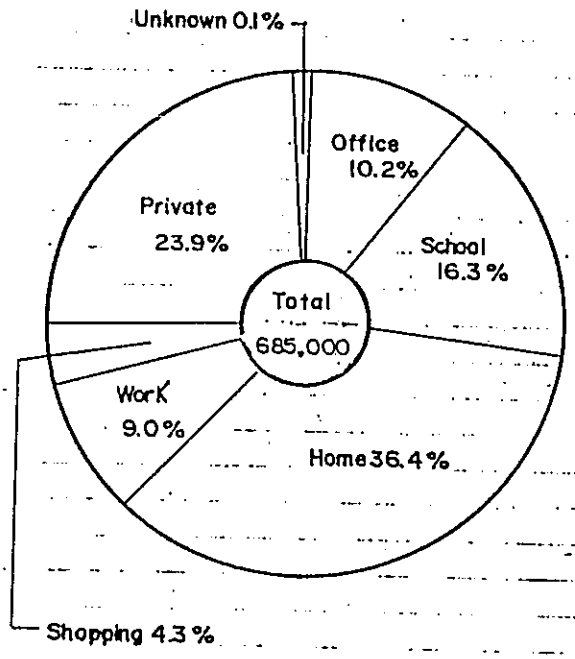


Fig. 5.5 TRIP PERCENTAGE BY PURPOSE

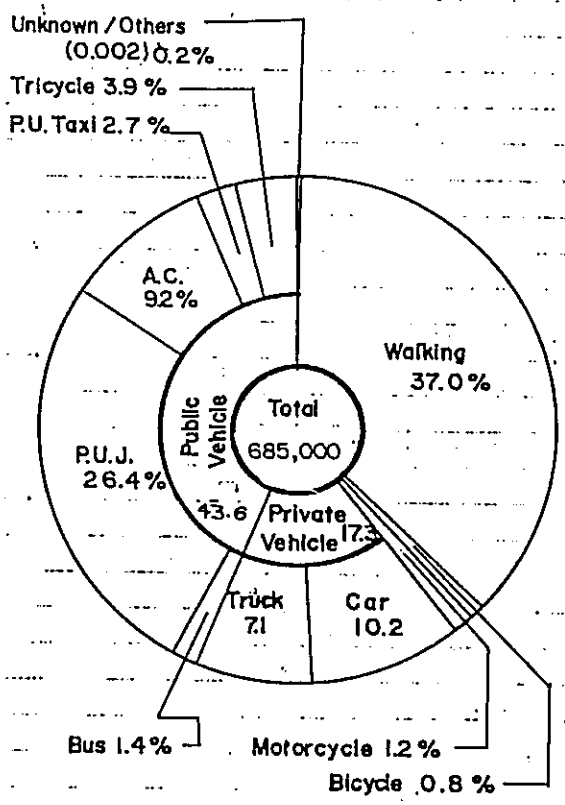


Fig. 5.6 TRIP PERCENTAGE BY MODE

5.5.3 Modal Share of Trips

Two modes of travel, walking and PUJ, share high percentage of 63.4%. While bicycles, motorcycles and buses share low percentage.

As to the share of trips by functional classification of modes, modes for short trips such as walking, bicycle and motorcycle share 39.0%, private transportation modes (car and truck) share 17.3% and public transportation modes (bus, PUJ, AC, Taxi and Tricycle) share 43.6%. It is clear that public transportation modes are utilized quite often (Refer to Fig. 5.6).

5.6 Person Trips by Personal Attribute

5.6.1 Trip rate by sex

Trip rate of male is 2.765 trips per day, which is 1.33 times higher than that of female.

Such trips as going-to-office, going to work and private purpose are made more often by male than by female. This can be understood that social activities related to employment by male are more vital than by female. As to going-to-school trips, there is no big difference between male and female. On the other hand, shopping trips are made more often by female than by male. (Refer to Fig. 5.7)

5.6.2 Trip rate by age group

Among age groups, the age group of 10 to 14 years old shows the highest trip rate of 2.813 trips per day. High trip rate of relatively younger generation is outstanding.

As to trip rate by sex and age group, the male age group of 30 to 39 years old has the highest trip rate of 3.21 trips per day, which is originated by vital social activities as indicated by purpose share. Compared with male, trip rate related to employment by female is small.

Trip rate by female age group of schooling is high, however, that by age group of over 20 is quite small. (Refer to Figures 5.8, 5.9)

Fig. 5.7 TRIP MADE BY SEX (TRIP/PERSON)

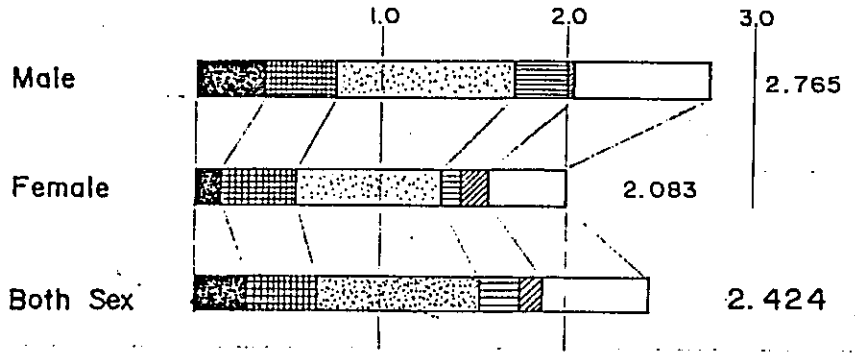
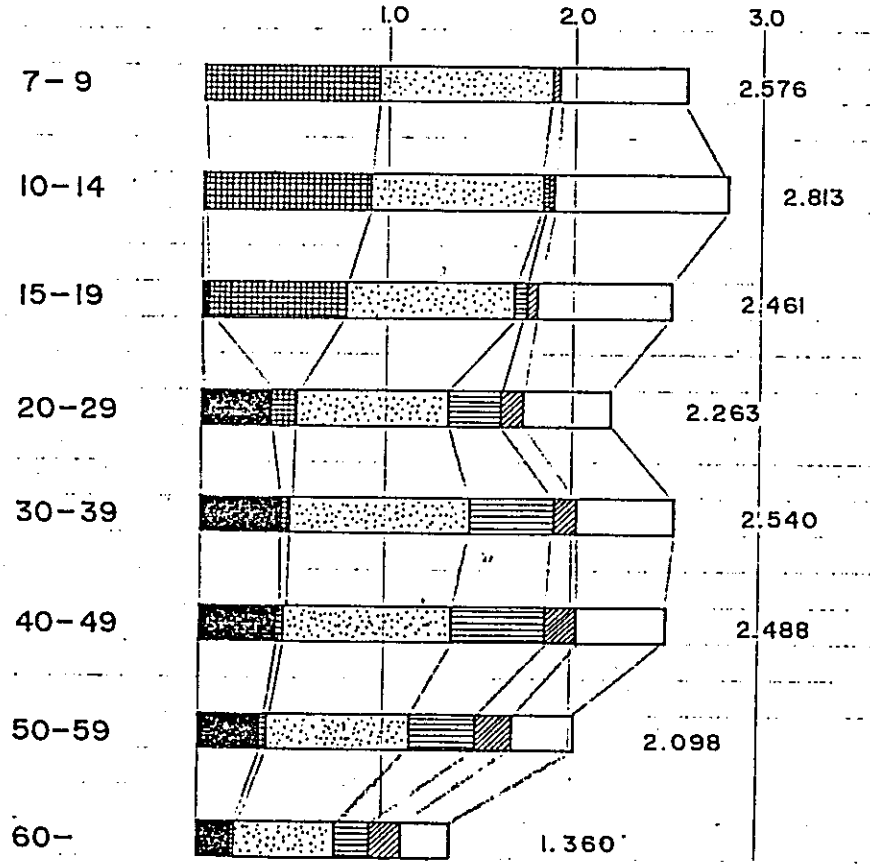


Fig. 5.8 TRIP MADE BY AGE (TRIP/PERSON)



LEGEND:

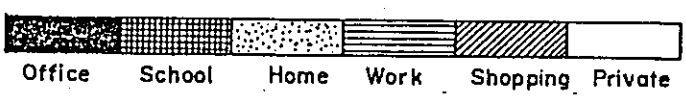
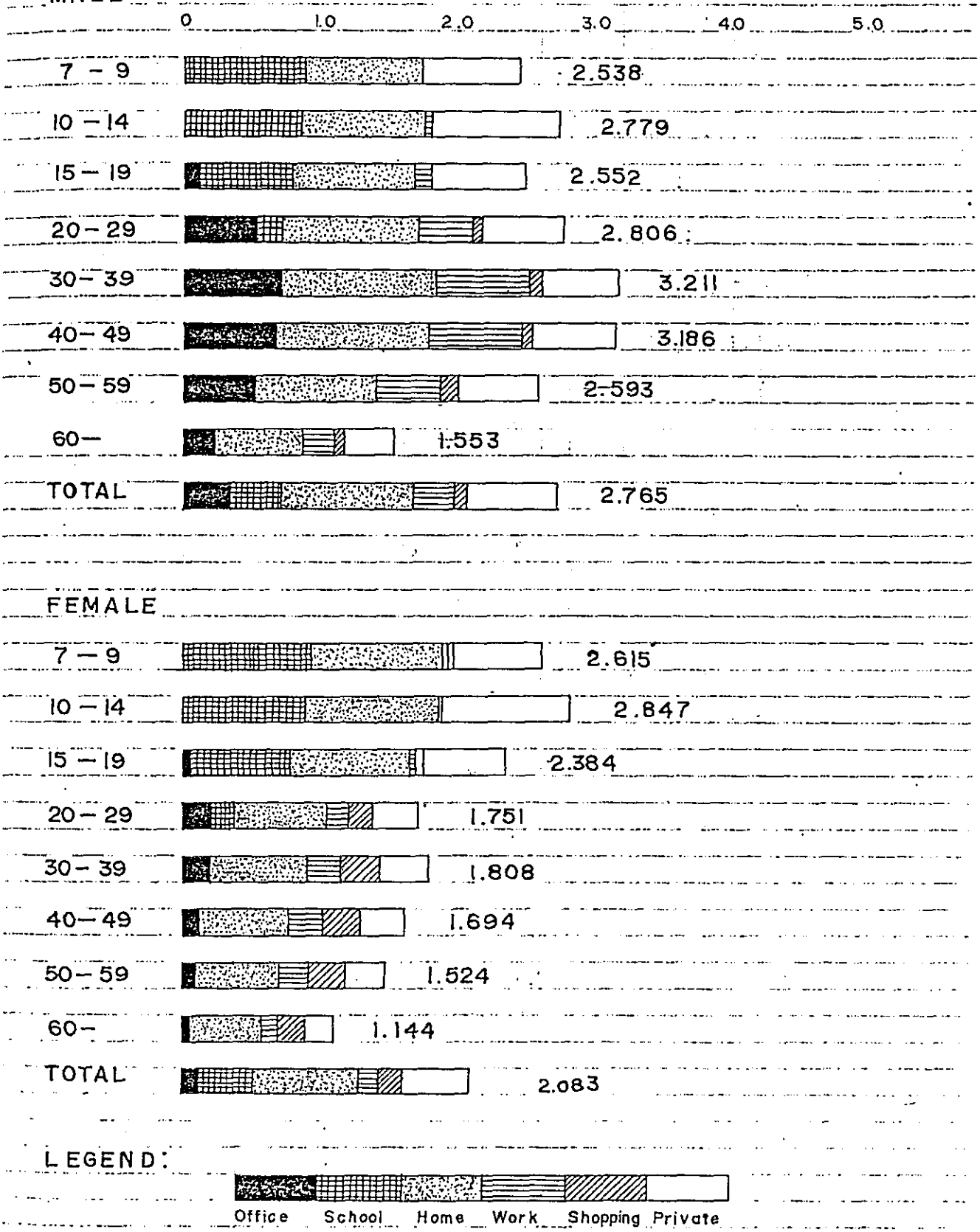


Fig. 5.9 TRIP MADE BY SEX & BY AGE (TRIP/PERSON)



5.6.3 Trip rate by Industry

Trip rate by Government employees shows the highest rate of 3.784 trips per day. As an outstanding tendency, trip rate increases in the order of primary, secondary and tertiary industry. Number of trips by housewives and jobless persons is quite few. (Refer to Fig. 5.10)

5.6.4 Trip rate by car-ownership and income level

Person trips made by a member of vehicle-owned household apparrently differ in numbers from that by a member of non-vehicle owned household. The former makes 4.147 trips per day, while the latter makes 2.259 trips per day. The ratio between two is 1.84. As to share of trip purpose, there is no big difference between two, except work trips.

Number of generated trips is quite sensitive to income level. There also exists strong relationship between vehicle ownership and income level. (Refer to Figures 5.11, 5.12)

As shown in Fig. 5.13, relationship between income per month and vehicle ownership is in linear proportion.

5.6.5 Trip maker ratio by industry

On an average, 71.4% of people make trips in a day. Trip maker ratio of primary industry shows low rate. There is no outstanding difference of trip maker ratio between secondary and tertiary industry, although trip rate of secondary industry shows higher rate than tertiary industry. (Refer to Fig. 5.14)

5.6.6 Comparison of generated trips with Manila P.T.

Because of the difference of survey methodology, it does not provide appropriate idea to compare Davao with Manila P.T. data, however, comparison is made to get the tendency of trip characteristics.

Trip generation rate of Manila is higher by 1.17 times than Davao. This may imply that difference of economic activity such as female employment rate, expansion of industry, etc., may be reflected to trip generation rate. (Refer to Table 5.12)

Fig. 5.10 Trip Made by Industry (Trip / Person)

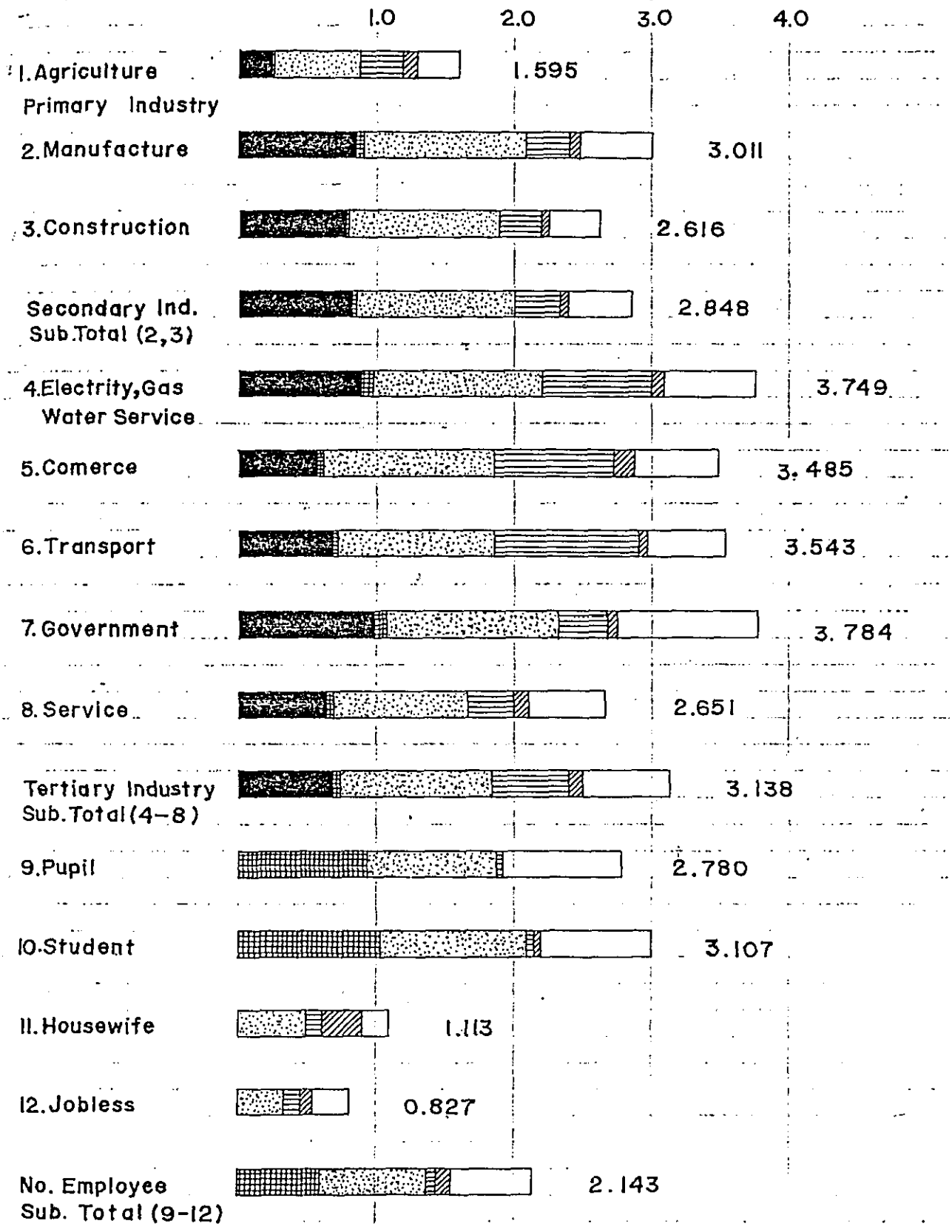


Fig. 5.11 Trip Made by Vehicle Owned (Trip/Person)

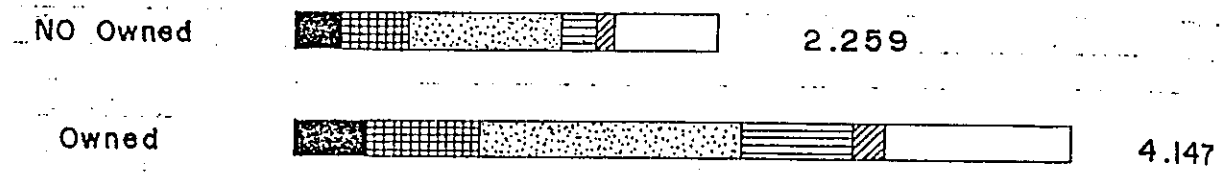


Fig. 5.12 Trip Made by Income Level (Trip / Person)

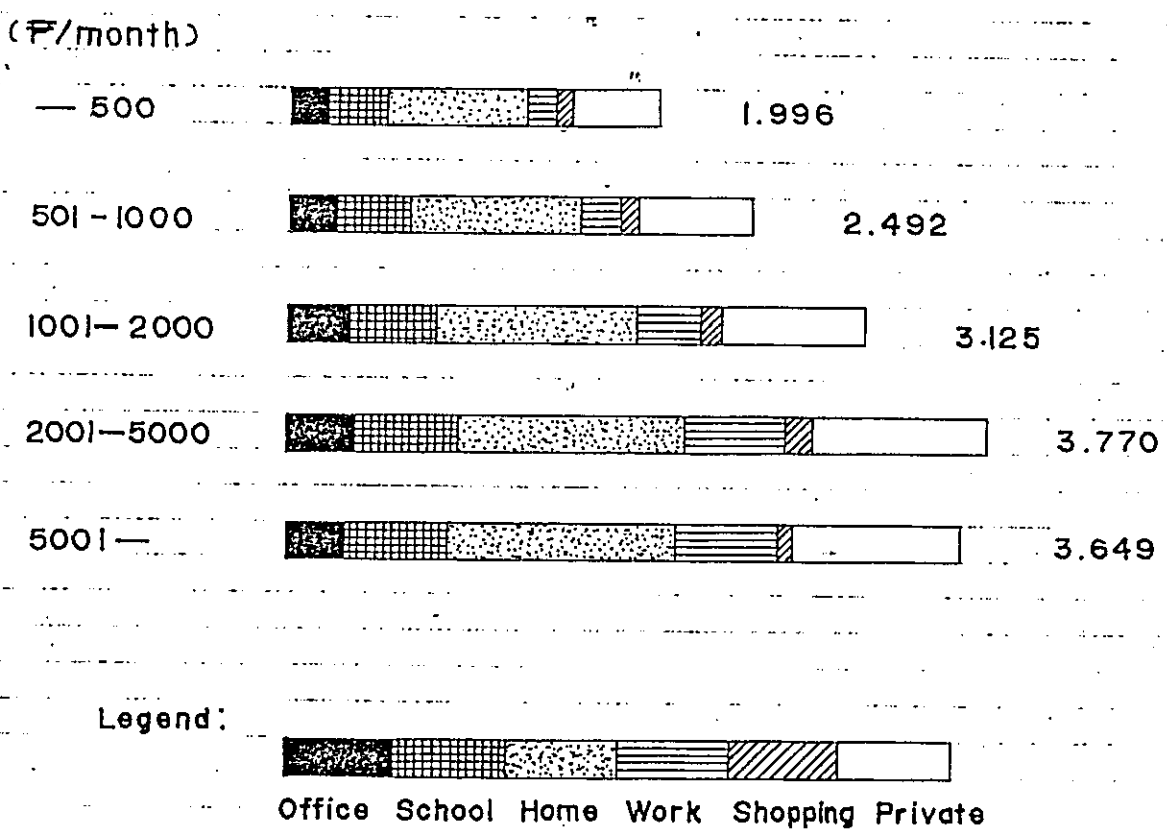
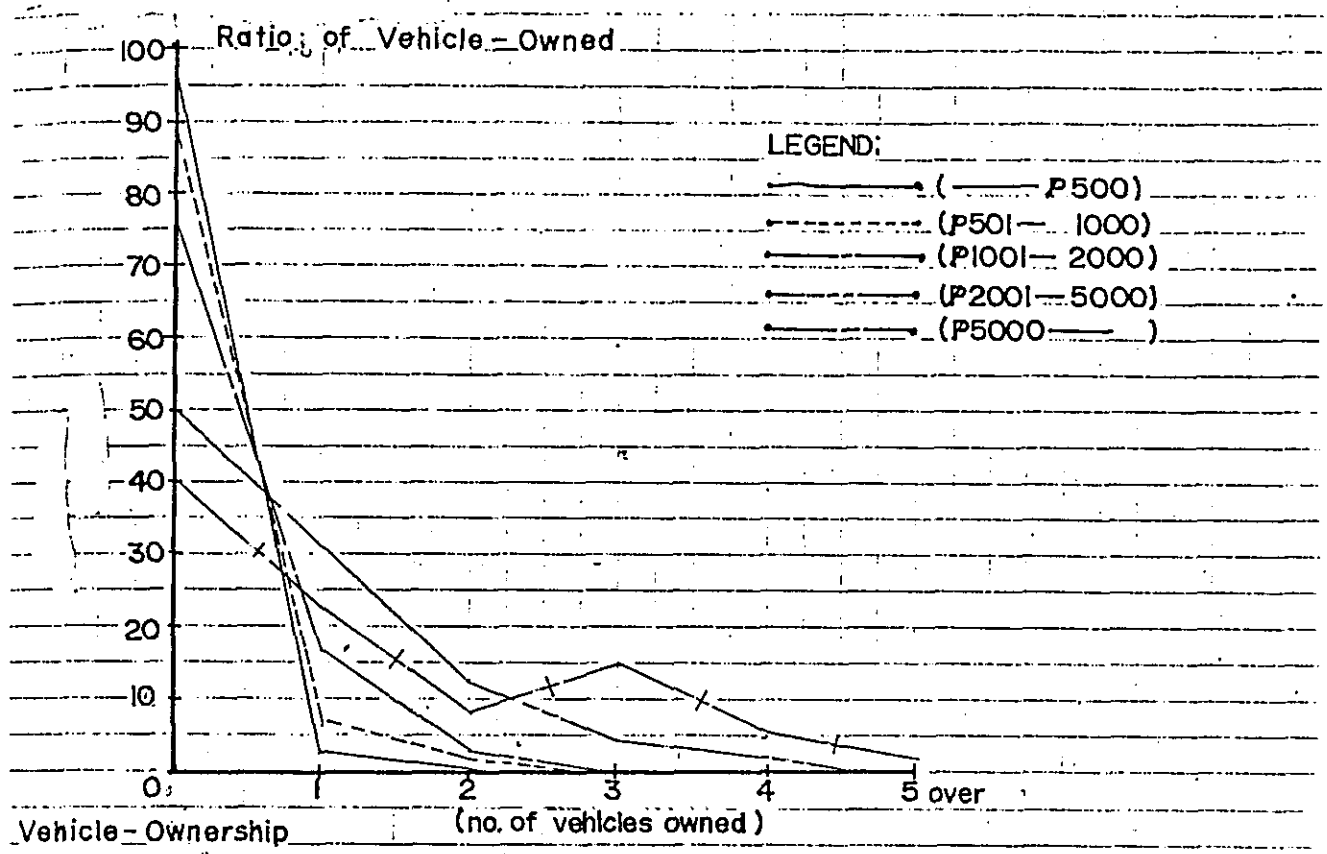


Fig. 5.13 VEHICLE-OWNED RATIO BY INCOME LEVEL



Vehicle-Ownership

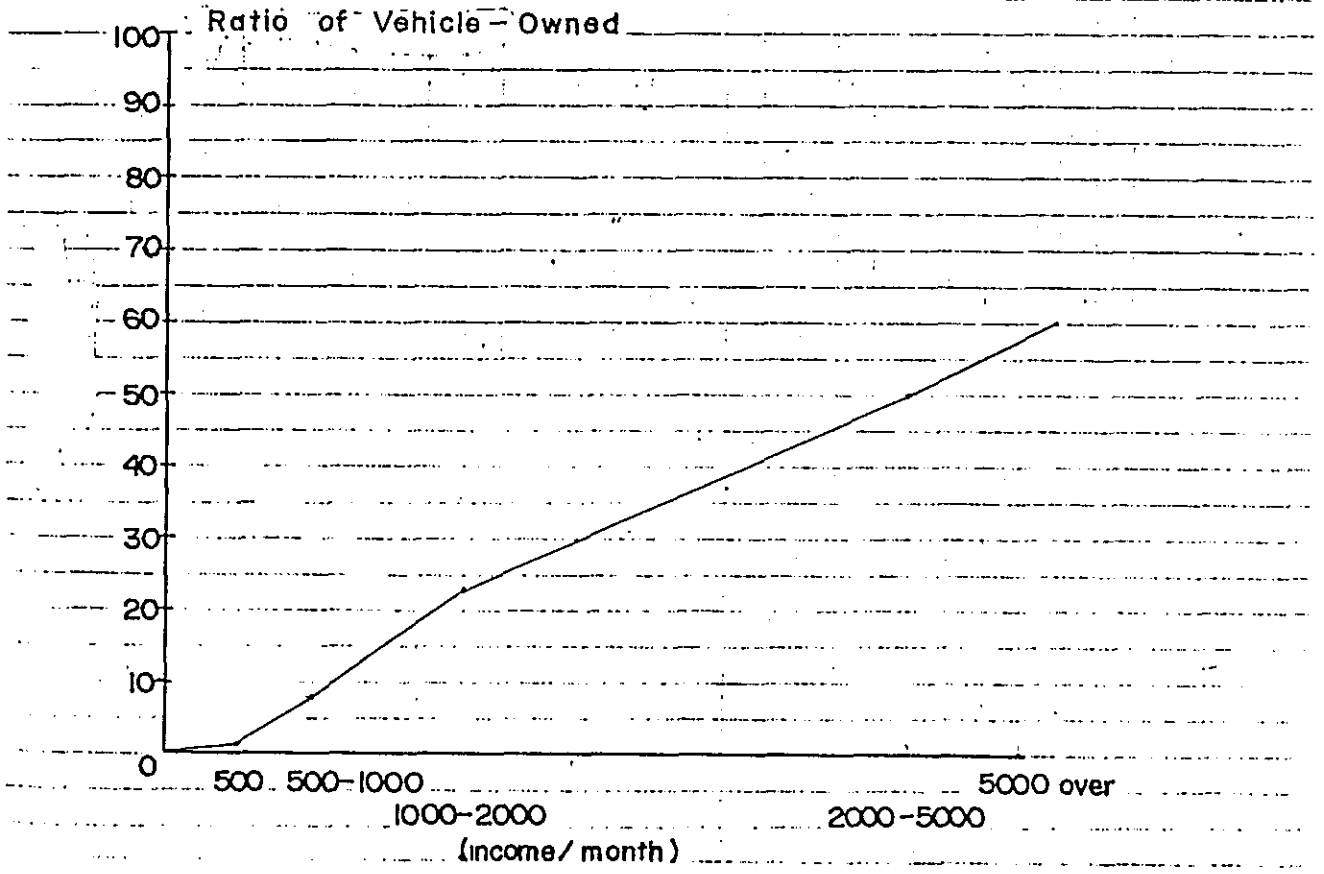


Fig. 5.14 Trip-Maker Ratio (Trip Maker/Population)

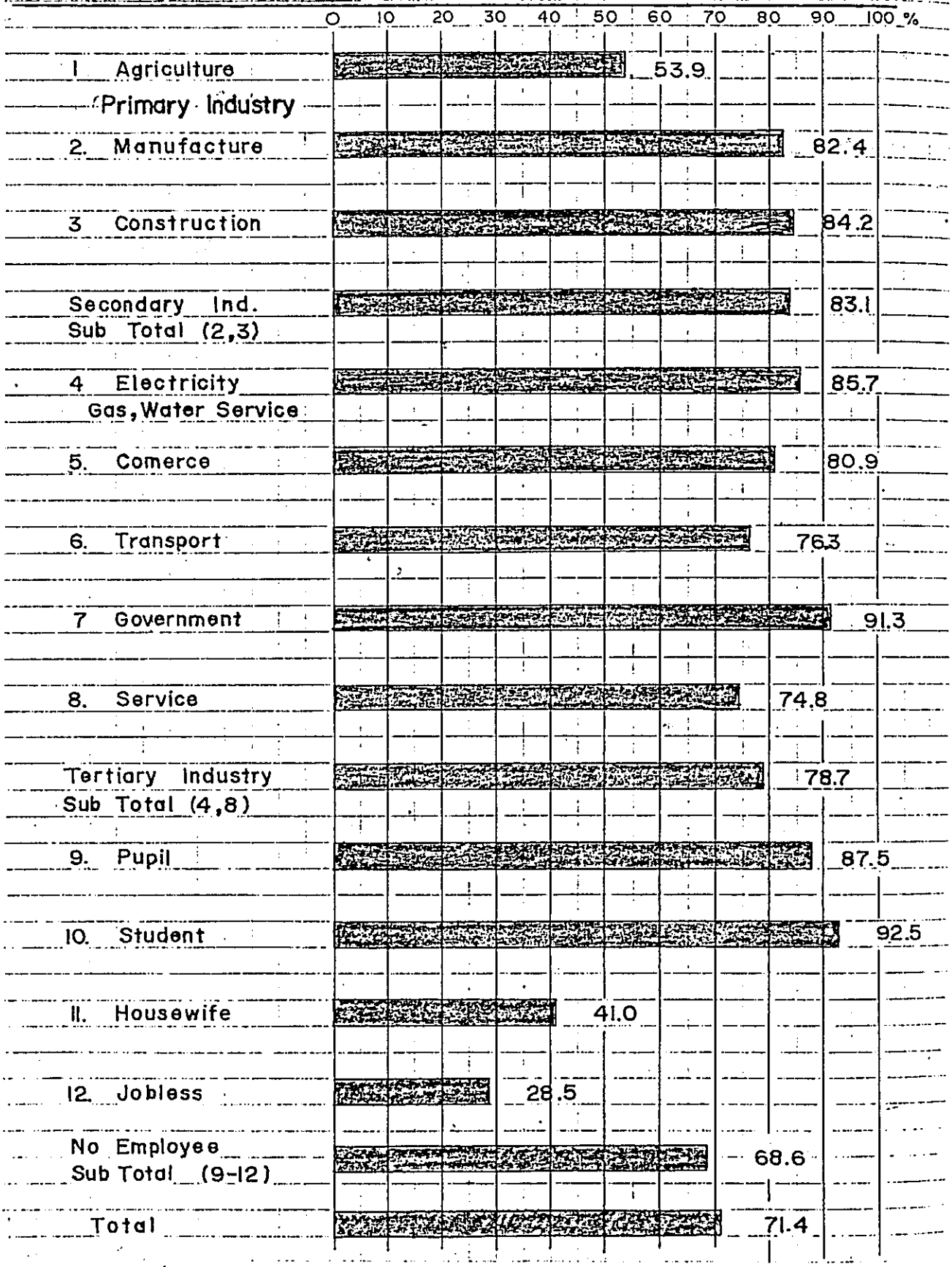


Table 5.12 Comparison Of Trip Generation Rate

(Trip / Person)

	DAVAO (1979)	MANILA (1970)	TOKYO (1968)	FUKUI (1977)
Trip Generation	2.42	—	2.48	2.87
Trip Generation (1)	1.48	1.73	1.22	1.62

(1) Trip Generation Rate Except Walking , Bicycle And Motorcycle Mode

* Comparison of Purpose Share

5.7 Person Trips by Zone

5.7.1 Trip rate by a resident of each zone

Fig. 5.15 shows number of trip rate by a person who lives in the zone. A person who lives in Poblacion has the highest rate of tri trips. The further a person lives from Poblacion, the less he mades trips. This could be understood that vitality of social activities influences number of person trips. It is evident that a sphere of life is created centering around Poblacion.

5.7.2 Generated trips by B zone

Number of generated trips in Poblacion is 327,000 trips per day which shares 48% of total generated trips of 685,000 trips per day, by the residents in the survey area. Population in Poblacion is 123,000 persons which shares 34% of total population of 360,000 in the survey area. This implies that trips are concentrated in Poblacion. Specifically, Zones 1020 and 1080 in Poblacion generate big amount trips. (Refer to Figures 5.16, 5.17)

5.7.3 Trip density by B and C zones

When number of generated trips is expressed in terms of trip density, it provides better understandings of zonal characteristics. Trip density of Poblacion and Agdao (Zone 3030) is high and shows trip characteristics of urbanized area. It is understood that various traffic problems such as traffic congestion are currently concentrated in these two zones. Fig.5.19 implies that a center is formed in zone 1020 and a sub-center is formed in zone 1080. (Refer to Figures 5.18, 5.19 and 5.20)

5.7.4 Trip desires in Poblacion

O-D distribution is concentrated on zones 1020, 1080 and 1090. Zone 1090 is strongly linked with other zones, however, as a trip density map shows, most trips related to zone 1090 are going-in or going-out trips, therefore, zone 1090 may be characterized as residential area. (Refer to Fig. 5.21)

Fig. 5.15 TRIP MADE BY ZONE (TRIP / PERSON)

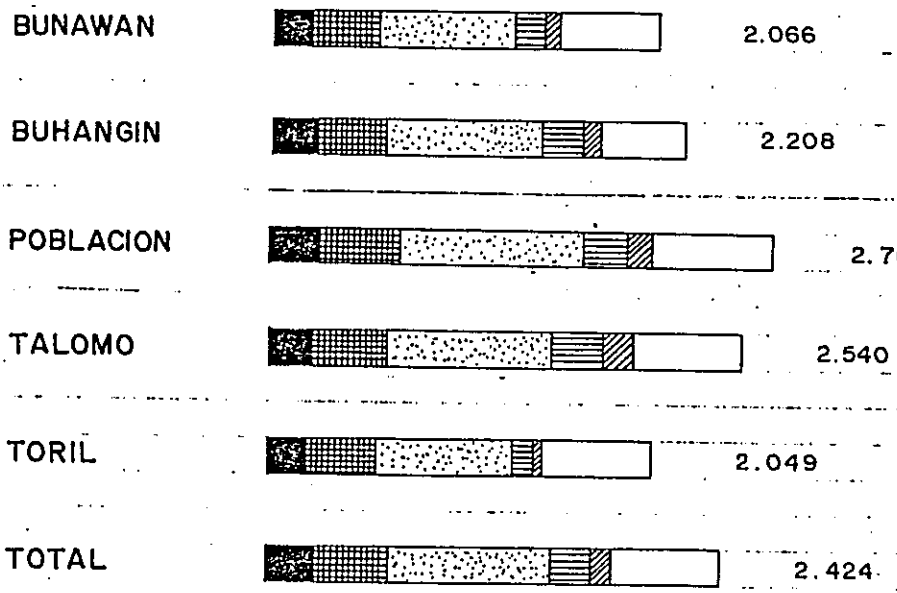


Fig.5.16 TRIP GENERATED BY B-ZONE (SURVEY AREA)

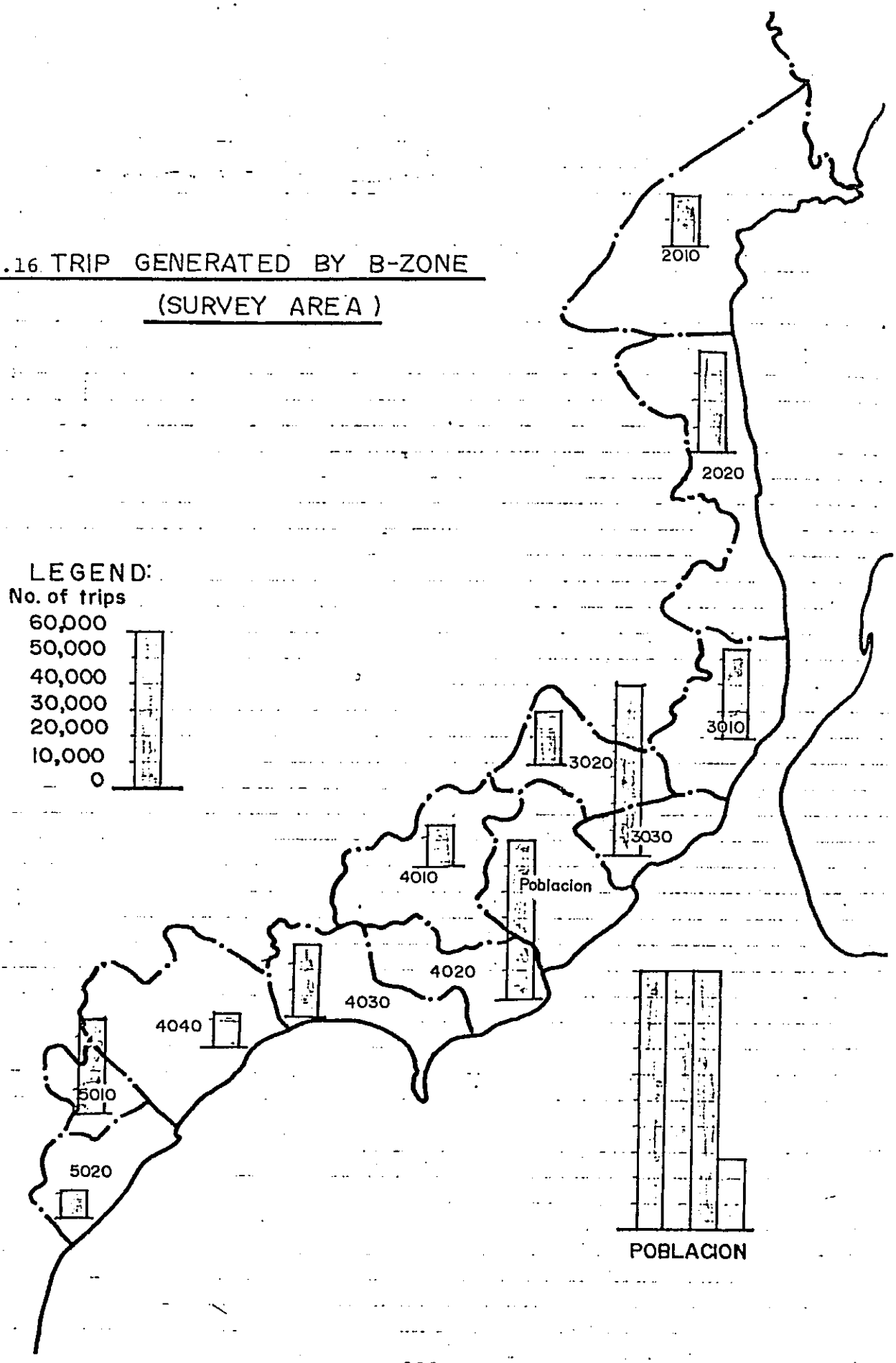
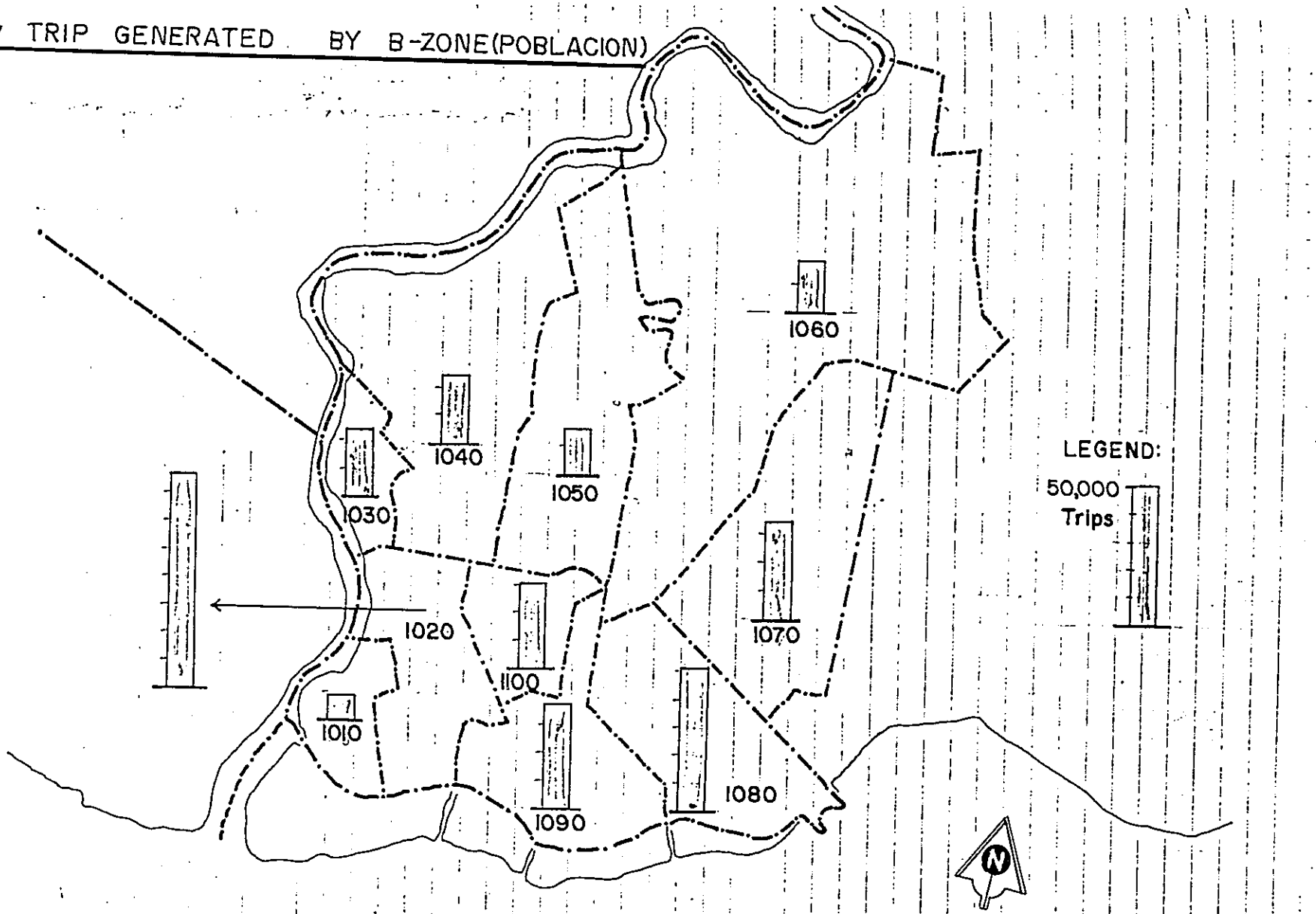


Fig.5.17 TRIP GENERATED BY B-ZONE(POBLACION)



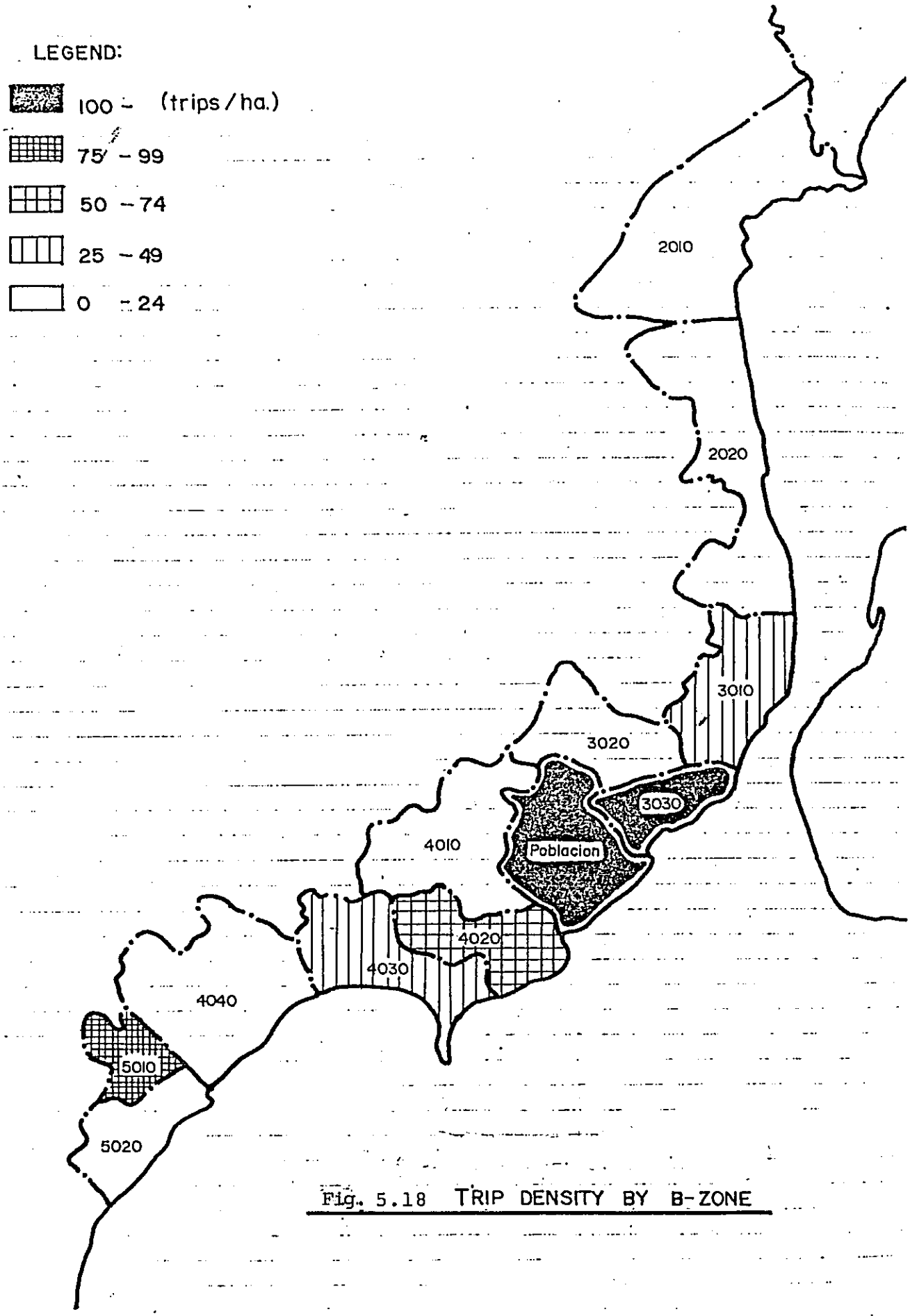


Fig. 5.18 TRIP DENSITY BY B-ZONE

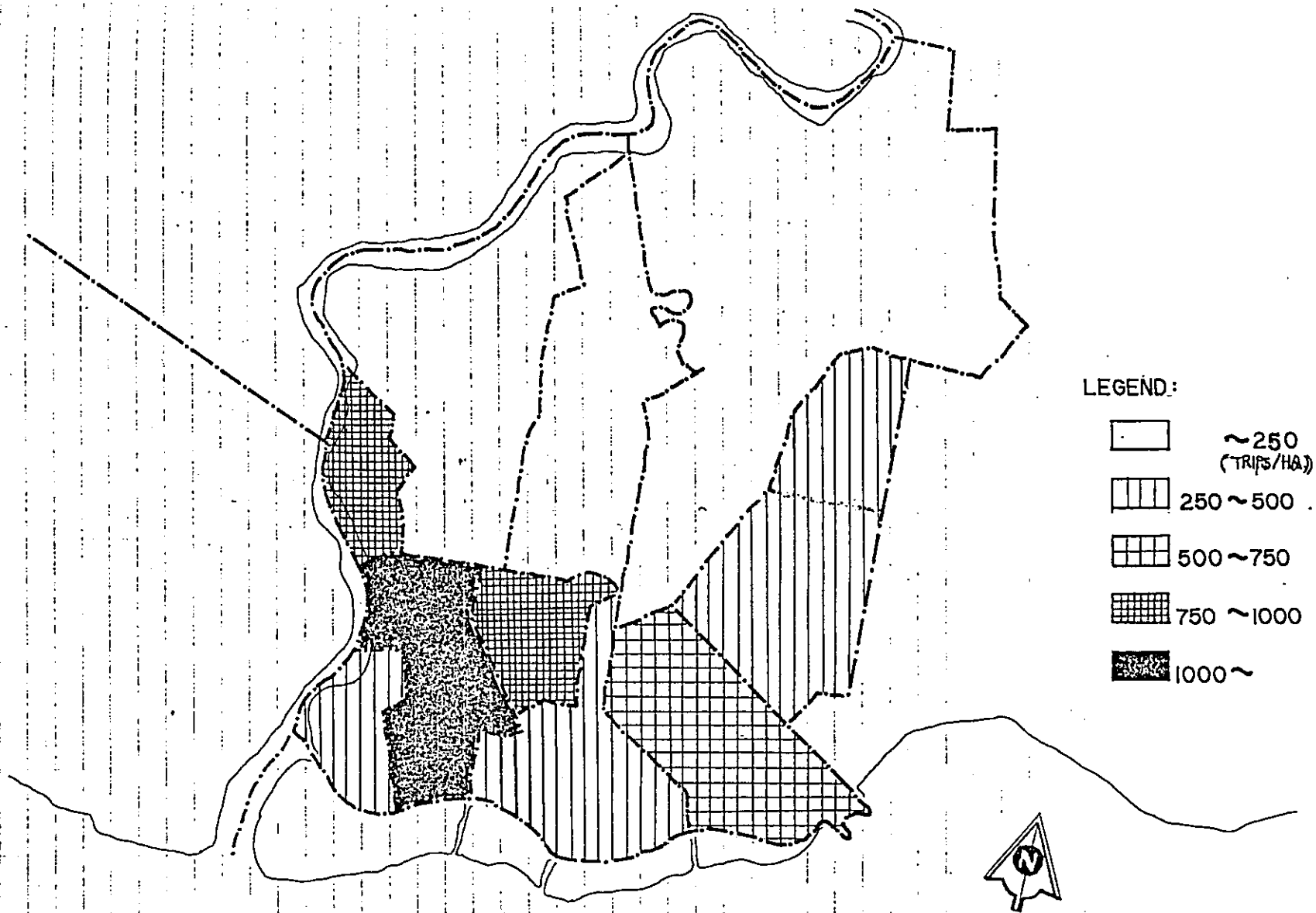


Fig. 5.19 TRIP DENSITY BY B-ZONE (POBLACION)

Fig. 5.20 TRIP DENSITY BY C-ZONE (POBLACION)

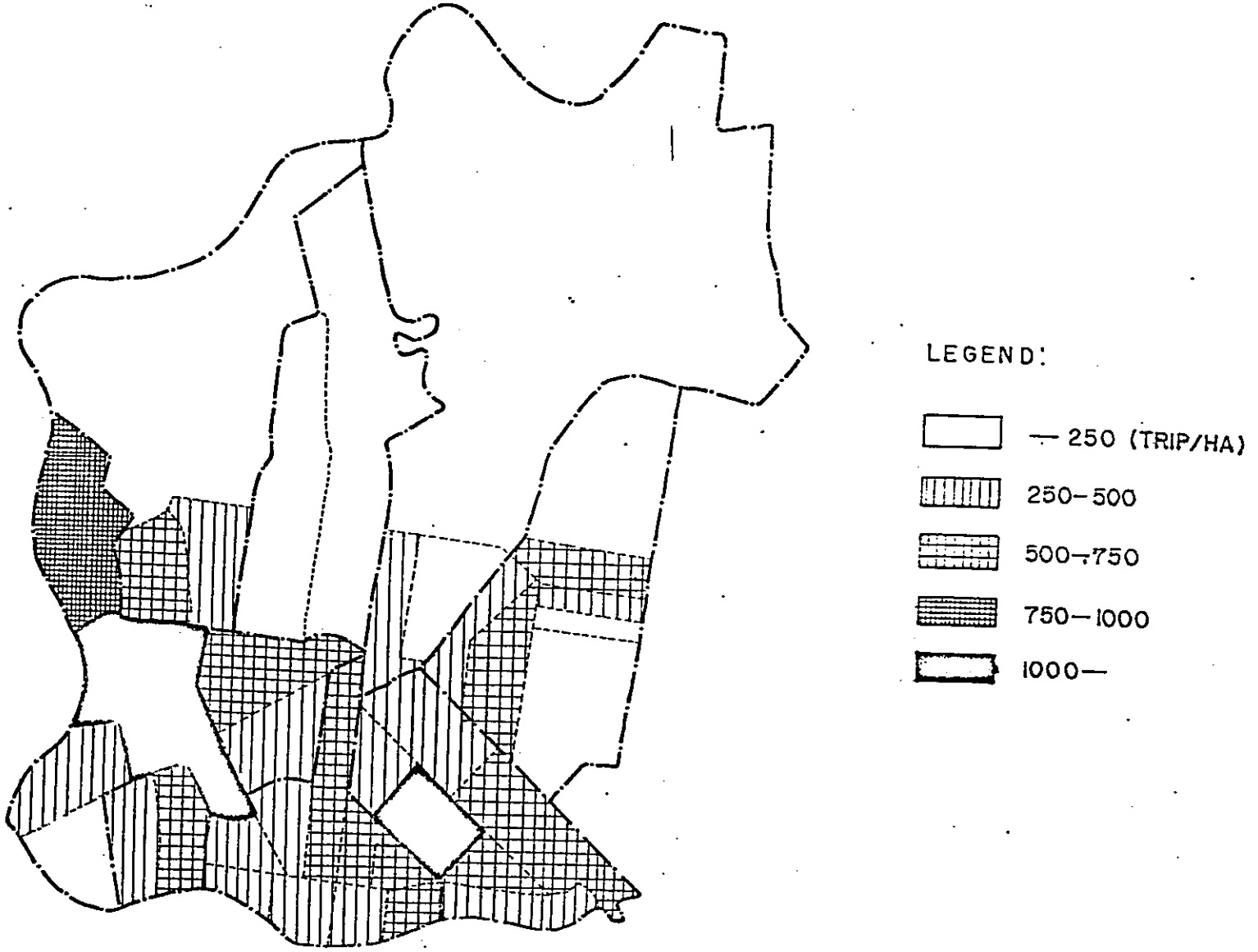
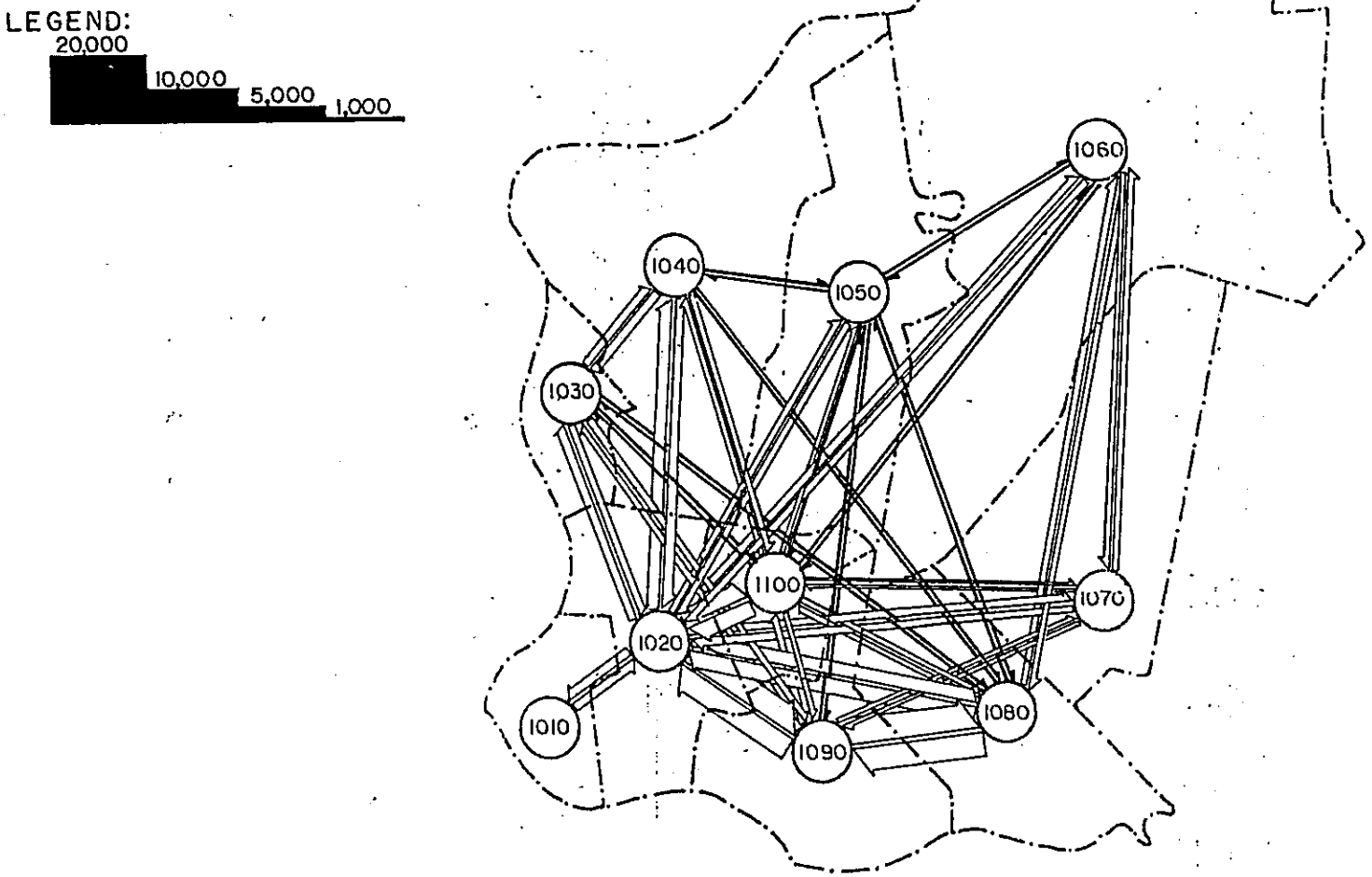


Fig. 5.21

TRIP DESIRE LINES BY ALL PURPOSE



5.8 Person Trips by Purpose and Mode

5.8.1 Purpose share (by all modes and by each mode)

As going-home trips and private trips have high percentage share to total trips, accordingly share of these two purposes in trips by each mode is high. Aside from these two purposes each mode is also well-used by particular purpose.

Walking - Going-to School trips
Car and truck - Work trips
Bicycle and bus - Going-to-office trips
PUJ - Going-to-office and school

Cars and trucks show a tendency to be utilized by work trips. Bicycles and buses are used for going-to-office trips, specifically bicycles for short trips and buses for long trips. PUJ is characterized as a mode for going-to-work and going-to-school trips. (Refer to Figures 5.22, 5.23)

5.8.2 Modal share (by all purpose and by each purpose)

Going-to-office trip- PUJ shares 35% of this trip purpose, which implies that PUJ is positioned as a very important mode for this purpose. Among others excluding walking, an automobile is the second important mode.

Going-to-school trip - Walking is important mode for this purpose. Each of three modes has almost same share. Share of walking is the lowest. Characteristics of modal share for this purpose is clearly shown on this figure.

Shopping trips - - - PUJ has high share of 36%. Among other excluding walking, role of A.C. for this purpose is important.

Private trips - - - - Walking is the main mode for this purpose as it shares 50% of this purpose. PUJ for this purpose is less used compared to other purposes.(Refer to Figures 5.24, 5.25)

5.8.3 Comparison of purpose share with Manila P.T.

Davao P.T. data shows that shares of going-to-office trip, going-to-school trip and going-home trip are slightly lower and shares of shopping trip and private trip are higher than Manila P.T. data (Refer to Table 5.13)

Fig. 5.22 Trip Purpose Share By Mode

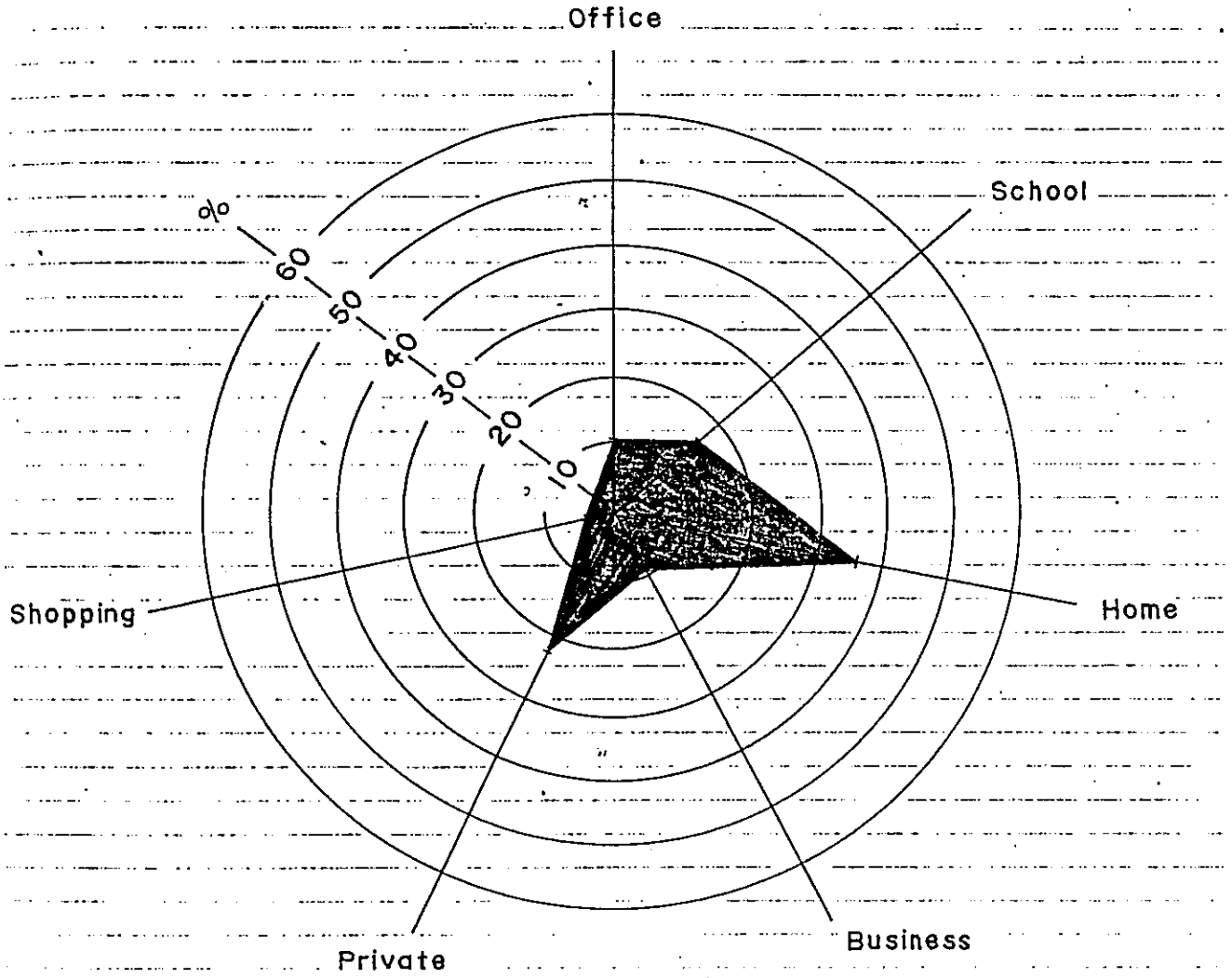
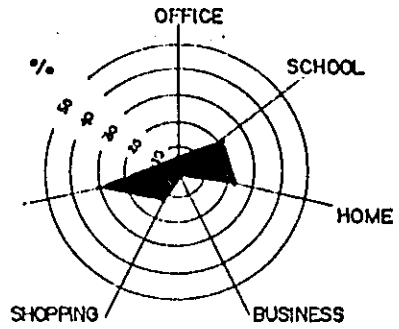
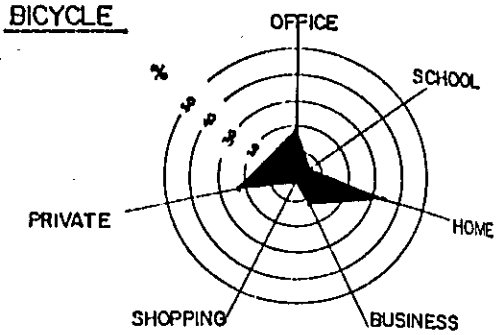


Fig. 5.23 PURPOSE SHARE BY EACH MODE

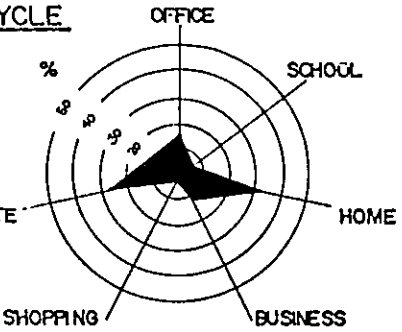
WALK



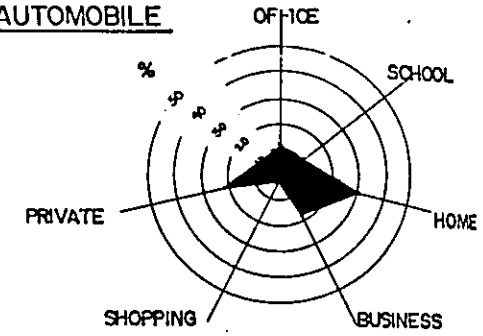
BICYCLE



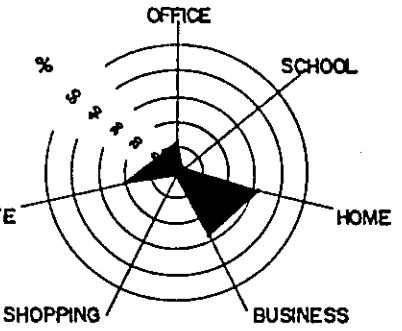
MOTORCYCLE



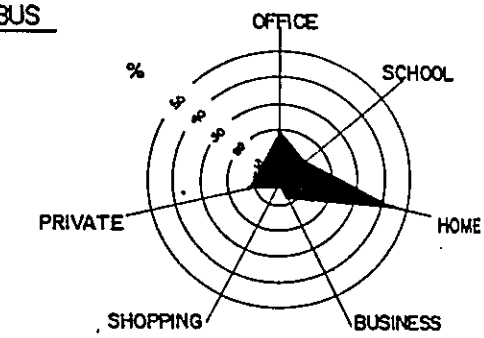
AUTOMOBILE



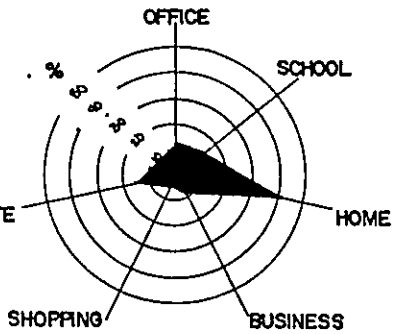
TRUCK



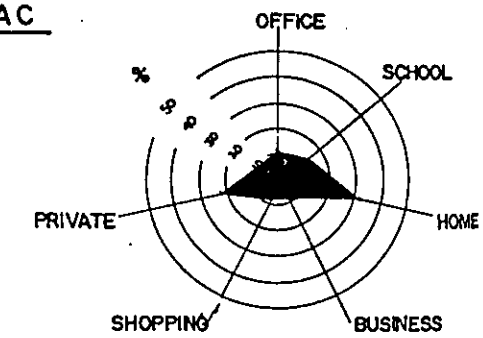
BUS



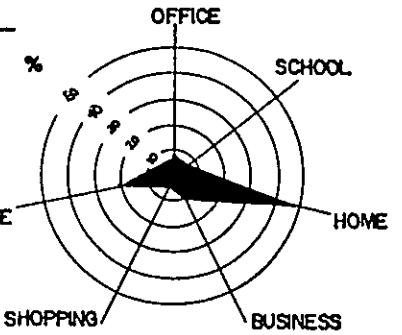
PUJ



AC



PU TAXI



TRICYCLE

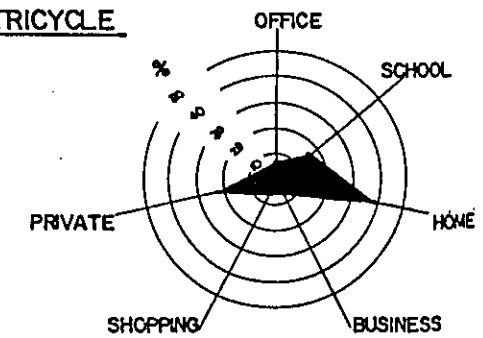


Fig. 5.24 MODAL SHARE BY PURPOSE

TOTAL ALL PURPOSE

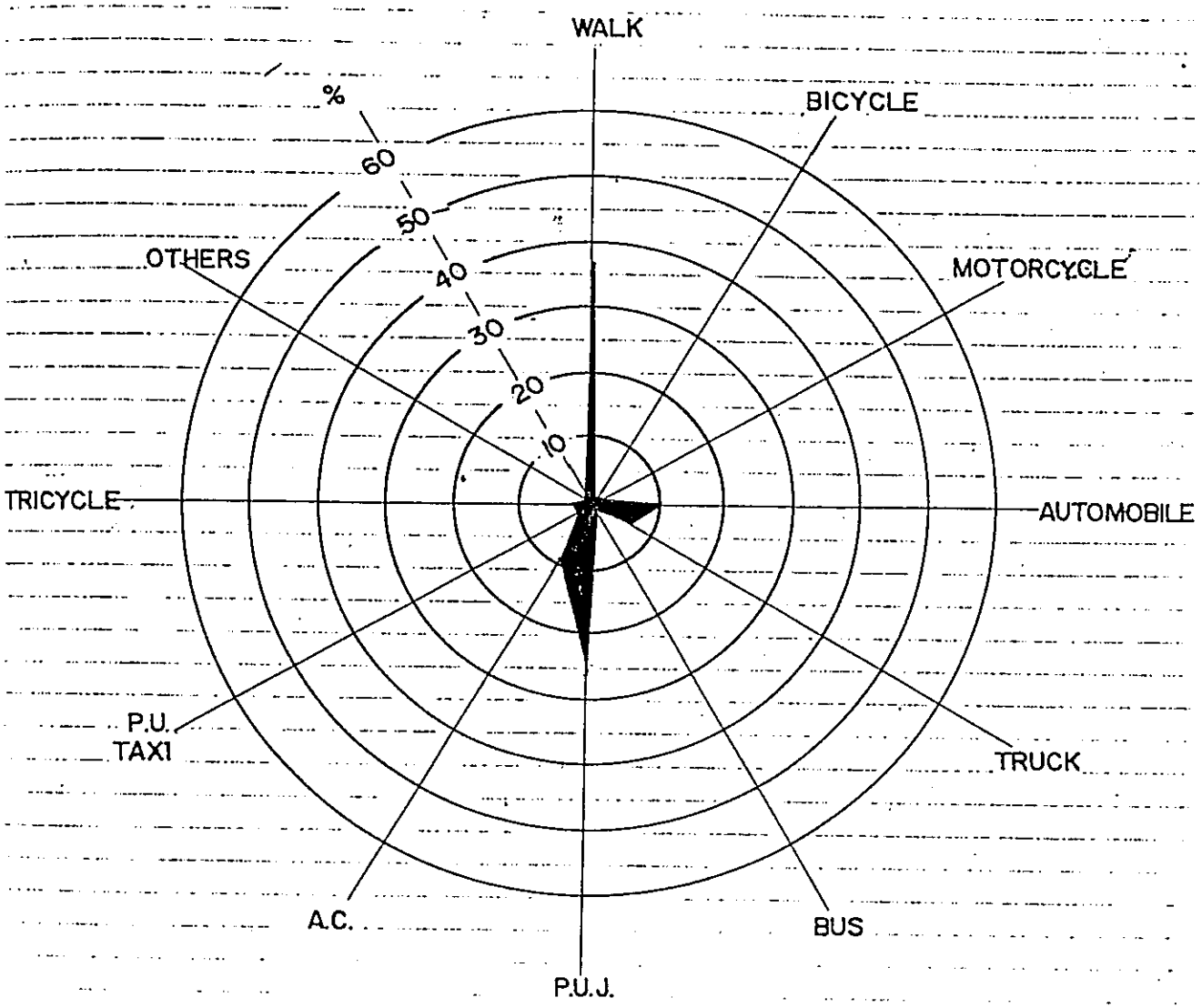
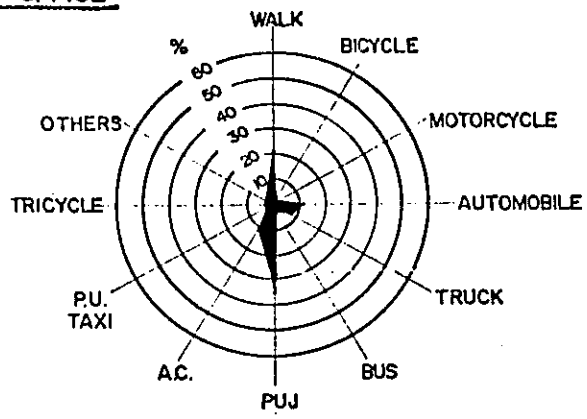
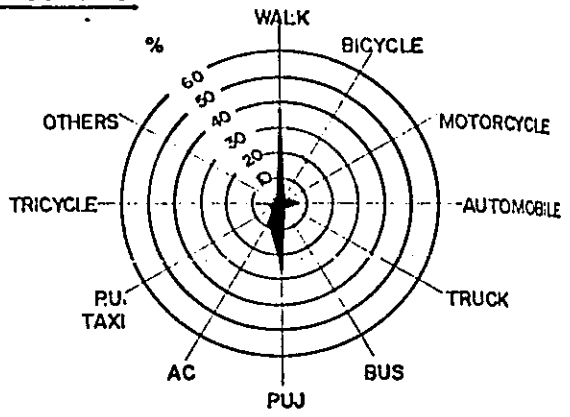


Fig. 5.25 MODAL SHARE BY EACH PURPOSE

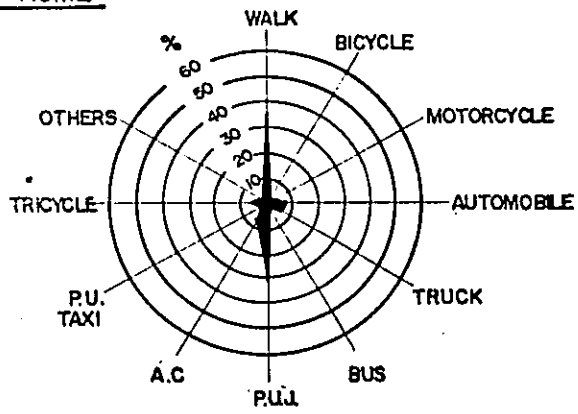
TO OFFICE



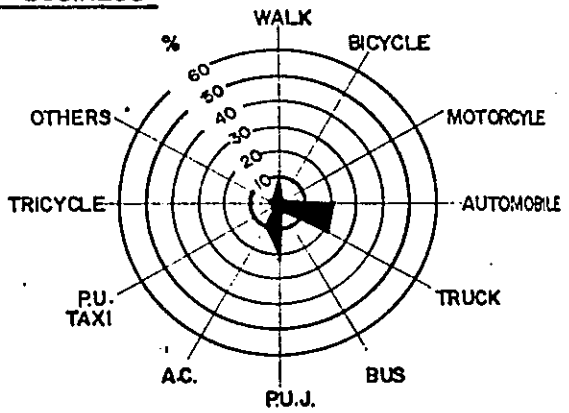
TO SCHOOL



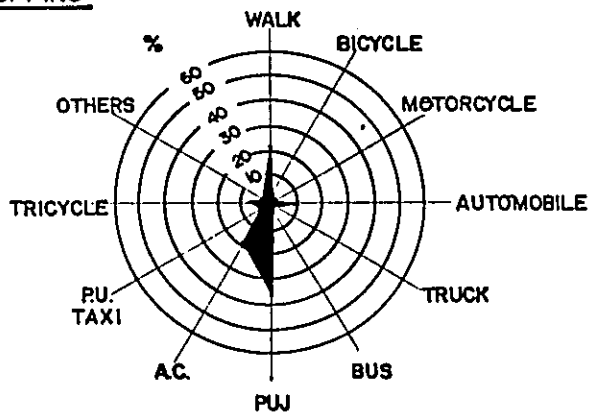
TO HOME



TO BUSINESS



SHOPPING



PRIVATE

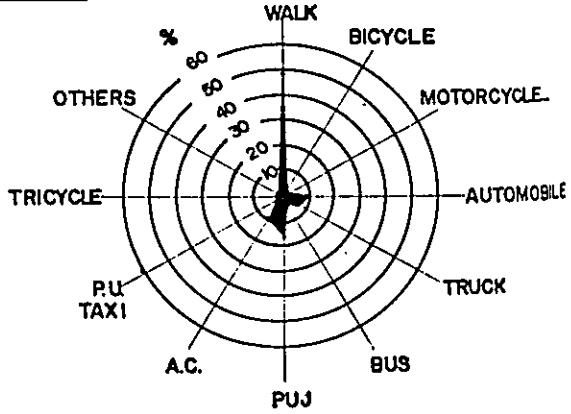


Table 5.13 Comparison of Trip Purpose Share

	DAVAO			MANILA	
	No. of trips	Ratio[1] (%)	Ratio[2] (%)	No. of trips	Ratio[2] (%)
To Office	69.536	10.2	12.6	1,046,000	15.5
To School	111.325	16.3	13.0	1,060,000	15.7
To Home	248,561	36.4	37.8	2,836,000	42.1
Business	61.910	9.0	12.3	843,000	12.5
Shopping	29.308	4.3	24.3	909,000	13.6
Private	163,844	23.9			
Unknown	500	0.1	0.1	41,000	0.9
TOTAL	684,984	100.0	100.0	6,735,000	100.0

Ratio 1); Percentage of Each Purpose

Ratio 2): Percentage of Each Purpose Excluding Walking, Bicycle And Motorcycle

5.8.4 Comparison of modal share with Manila P.T.

Share of all public transportation modes in Davao City is almost same as that in Manila. Share of PUJ in Davao City is quite high, instead, share of bus is quite low. This fact may be because of the difference of the city size and demand of trips. (Refer to Table 5.14)

5.9 Other Characteristics

5.9.1 Hourly Variation of trip

Ordinary metropolitan areas usually have two peak hours, morning and evening peaks, while, Davao City has three peaks, morning, noon and evening peaks. This is due to people movement of going back to home to take lunch. Inspite of the existence of three peak hours, peak ratio is more or less 13% which is almost same as other ordinary metropolitan area. While ratio of peak hour with off- peak hour is 3.6, which implies very big difference in number of person trips between peak hour and off-peak hour. In case of Metro Manila, ratio is about 2.8. (Refer to Figures 5.26, 5.27)

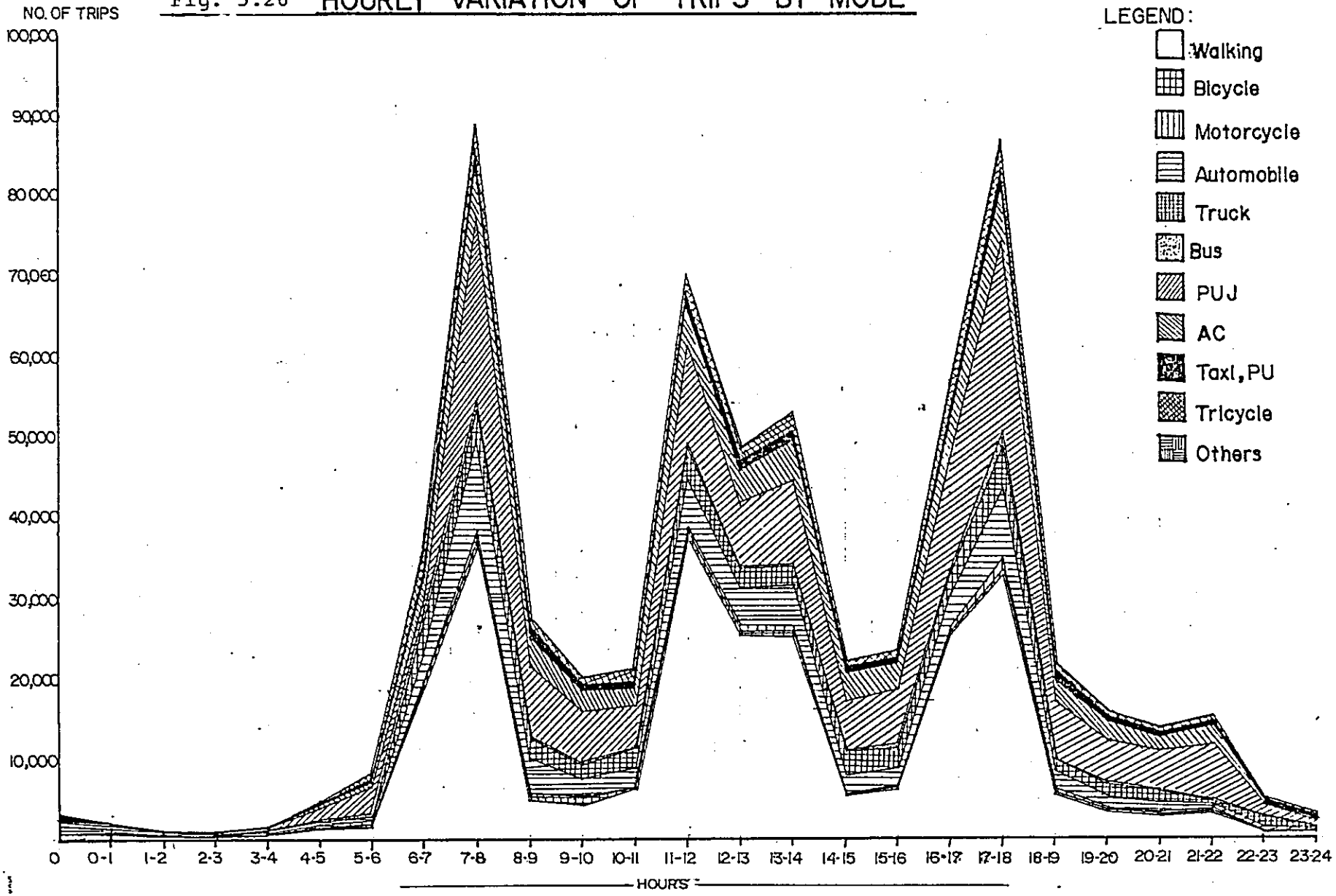
Table 5.14 Comparison of Modal Share

	DAVAO			MANILA	
	No. of trips	Ratio 1) (%)	Ratio 2) (%)	No. of trips	Ratio 2) (%)
WALKING	253,622	37.0	—	—	—
BICYCLE	5,284	0.8	—	—	—
MOTORCLE	7,955	1.2	—	—	—
CAR	69,985	10.2	10.7	2,055,000	25.1
TRUCK	48,442	7.1	11.6	411,000	5.7
BUS	9,808	1.4	2.4	1,271,000	16.4
P.U.J.	180,578	26.4	58.3	2,482,000	46.1
A.C.	63,285	9.2			
TAXI, P.U.	18,744	2.7	4.5	411,000	5.4
TRICYCLE	25,950	3.9	6.5	63,000	1.3
OTHERS	1,328	0.2			
TOTAL	684,984	100.0	100.0	6,735,000	100.0

Ratio 1); Percentage by All Modes

Ratio 2); Percentage by Mode excluding Walking, Bicycle and Motorcycle

Fig. 5.26 HOURLY VARIATION OF TRIPS BY MODE



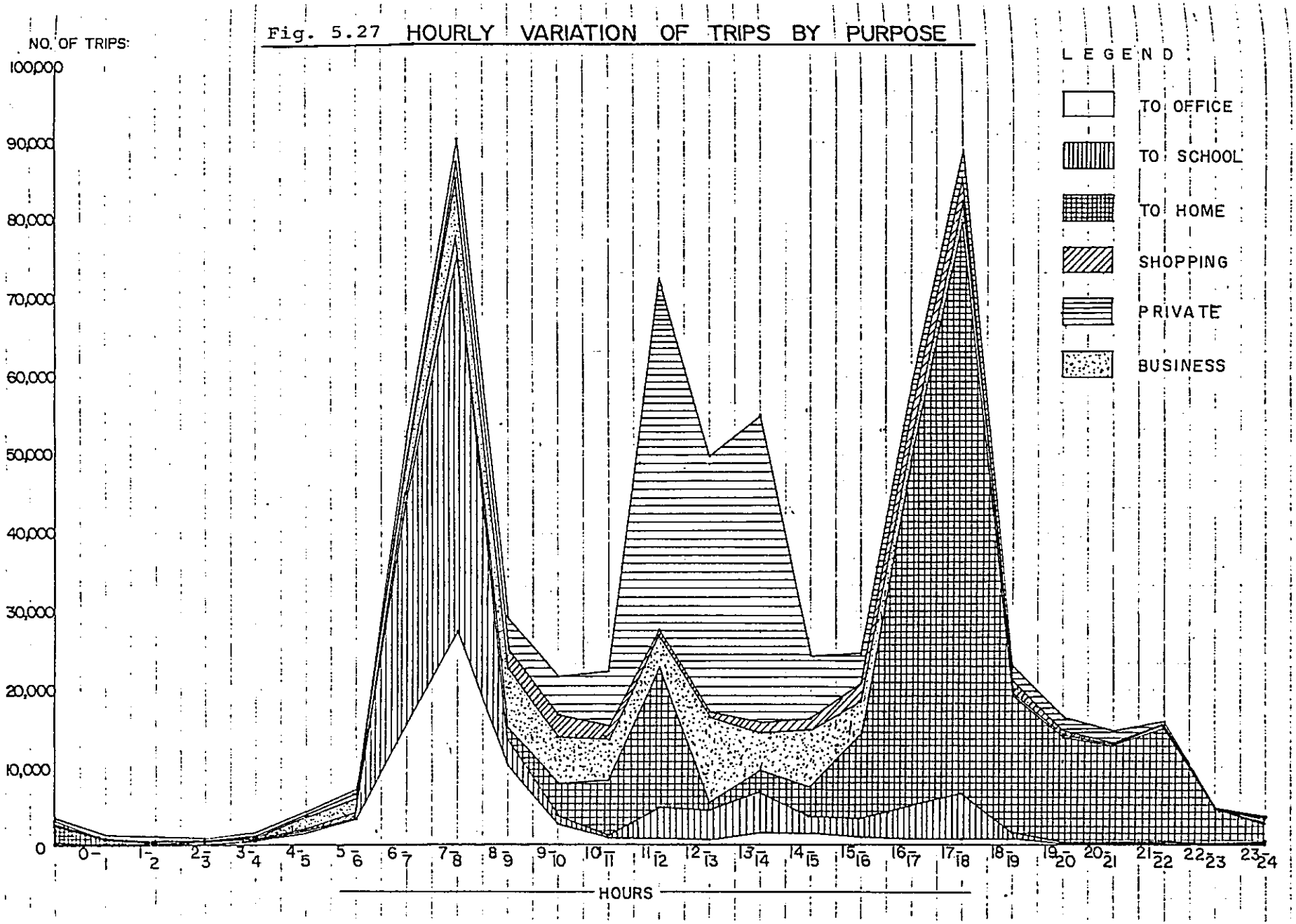


Fig. 5.27 HOURLY VARIATION OF TRIPS BY PURPOSE
NO. OF TRIPS
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
0-1 1-2 2-3 3-4 4-5 5-6 6-7 7-8 8-9 9-10 10-11 11-12 12-13 13-14 14-15 15-16 16-17 17-18 18-19 19-20 20-21 21-22 22-23 23-24
HOURS
LEGEND
TO OFFICE
TO SCHOOL
TO HOME
SHOPPING
PRIVATE
BUSINESS

CHAPTER 6

PUBLIC TRANSPORTATION OF DAVAO CITY

6.1 Public Transportation System

6.1.1 Role of Davao City in Mindanao and its major characteristics

Davao City which is located in the Southeastern part of Mindanao ranks second in terms of agglomeration of population in this country.

Davao City is directly connected to major cities in Northeastern Mindanao such as Cagayan De Oro City, Butuan City and major cities in South Mindanao such as Cotabato City, General Santos City making this city the point of origin and destination if provincial bus routes.

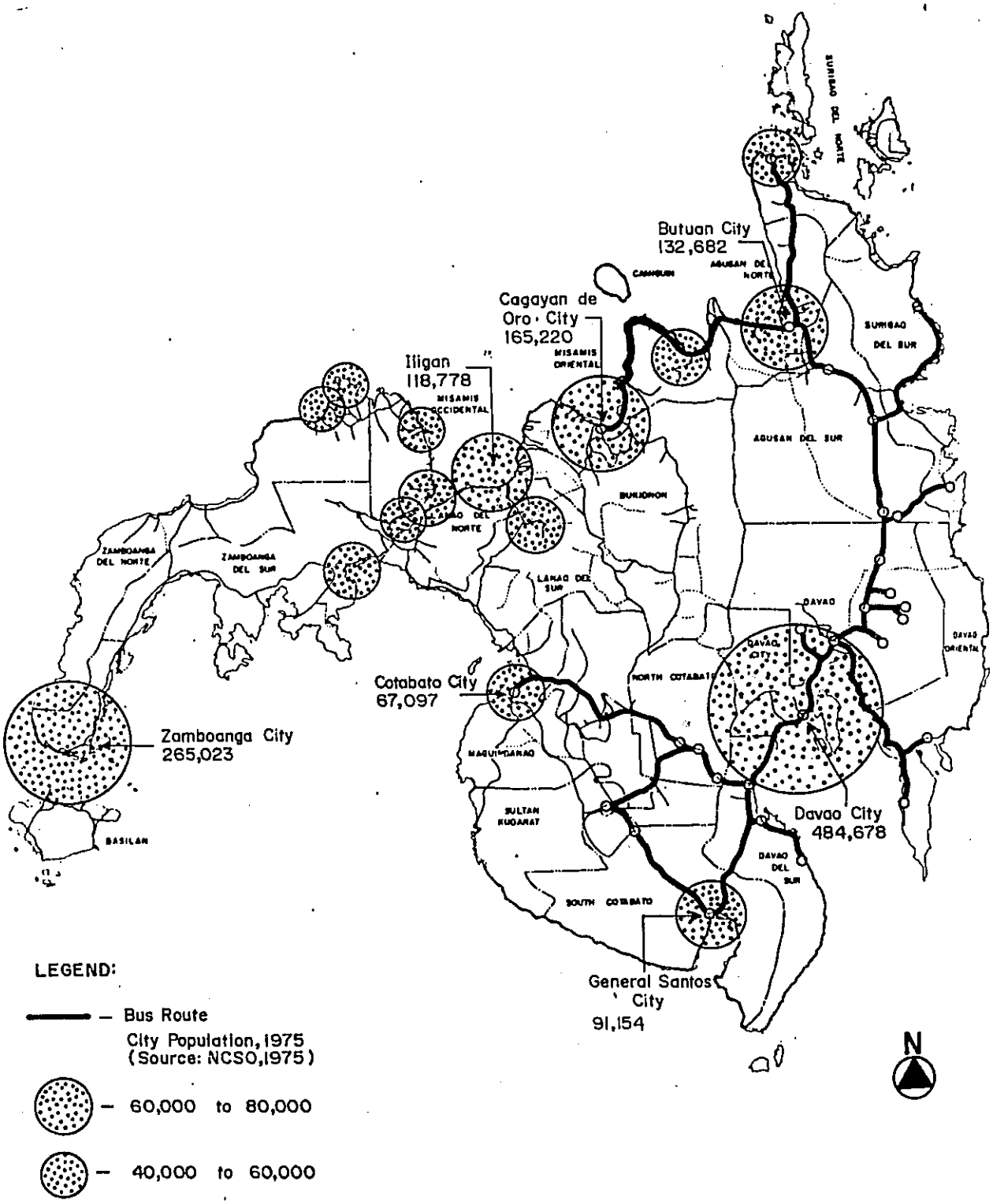
One of the reasons why Davao City has a relatively large number of population, 480,000 people in 1975 according to the census, is that Davao City covers more than 244,000*2 ha. which can be considered one of the widest in the world. And this affects the shape of urbanized area of the city.

Urbanized area is approximately 3,500* ha in 1979 and is equivalent to only 3.5% of thecity area. And the existing built up areas are scattered along the coastal line such as Poblacion, as the center, Bunawan, Panacan, Tibungco, Sasa, Agdao and Buhangin for North of Poblacion and Toril, Talomo, Ulas and Matina for South of Poblacion.

*1 Census in 1975
*2 Profile of Davao City, 1979 Vol. 1. p7
*3 Report for the 7th Steering Committee p9

Fig. 6.1

ROUTE OF PUBLIC UTILITY BUS



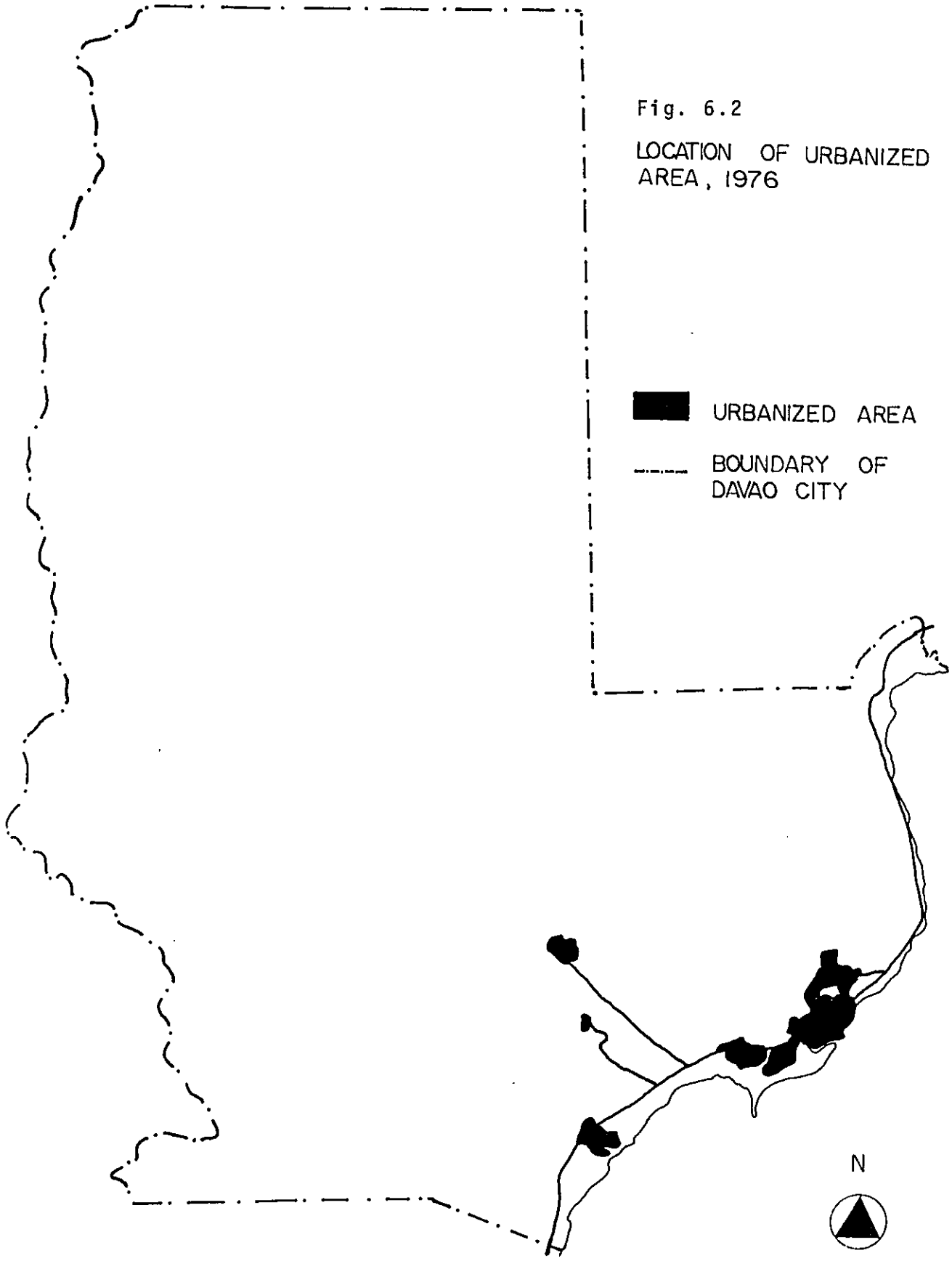


Fig. 6.2

LOCATION OF URBANIZED AREA, 1976

SOUCE: Profile of Davao City 1979 Vol. I.

6.1.2 Present Situation of Public Transportation System

(1) Kinds and role of each Public Transport Mode

There are five kinds of public transport modes plying in Davao City and their roles and service sphere are as follows:

BUS - - - - - - - To connect major cities and towns in the Eastern part of Mindanao but not to serve passengers who move inside the city.

PUJ - - - - - - - PUJ is a major urban public transport mode and has two kinds of role such as;

1) to serve commuters from outside and inside Poblacion
2) to distribute passengers to their destination scattered in Poblacion.

AC - - - - - - - To distribute passengers inside Poblacion. Service area of AC is designated within Davao City but AC's usually ply inside Poblacion.

Tricycle - - - - To serve local trip with extremely short distance as a feeder service of PUJ and BUS

Actually a greatest number of tricycles are concentrated in Toril and Agdao to serve some area without enough PUJ service.

PU - - - - - PU is short for Public Utility and its function is similar to taxi but without taximeter. Almost all PU used Minicab named Mitsubishi Minica.

PUJ's, AC's and Tricycles service system is shown in Fig. 6.3.

(2) Registered Number of PUV and its Yearly Fluctuation

Total number of PUVs which is short for public utility vehicles have been increasing for ten years.

PUJs percentage share of total number of PUV is bigger among other PUV's which is 45% in 1979 and still increasing.

Fig. 6.3 MODEL OF PUBLIC TRANSPORT SERVICE DAVAO CITY
(EXCEPT LONG DISTANCE BUS)

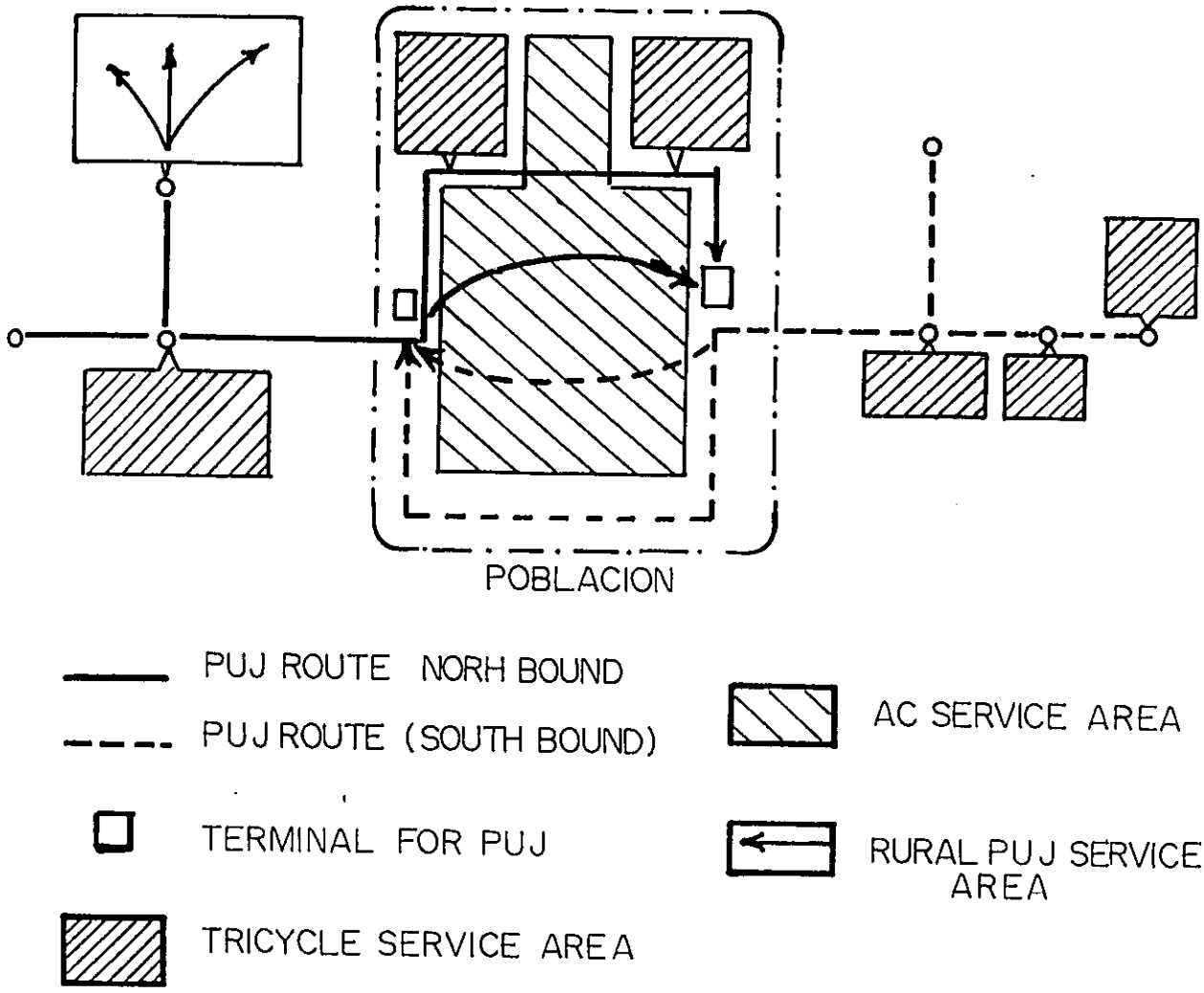


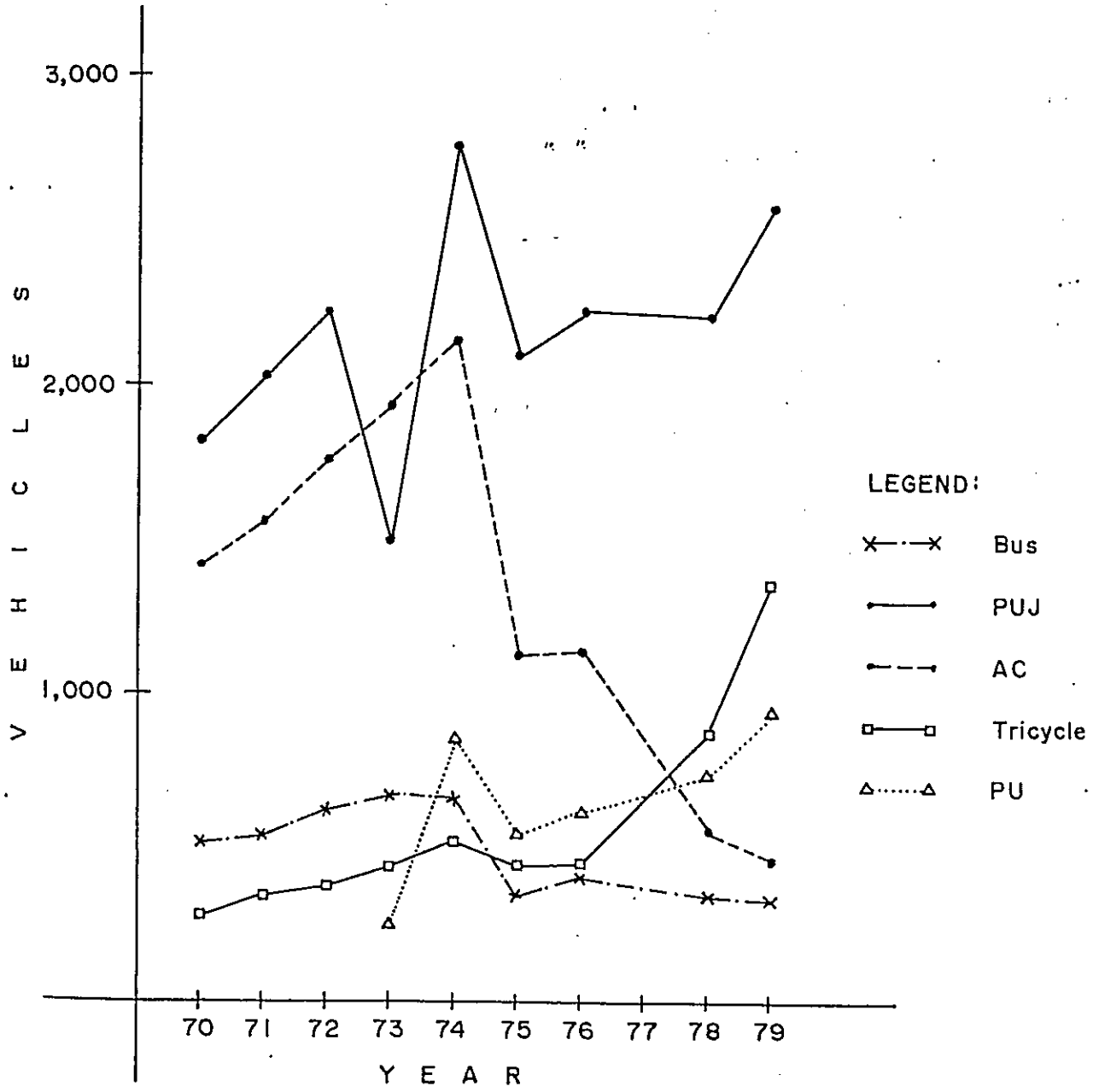
Table 6.1 NUMBER OF REGISTERED PUBLIC UTILITY VEHICLES

YEAR / PUV	70	71	72	73	74	75	76	77	78	79
BUS	508	564	628	698	674	360	400	*	368	340
PUJ	1826	2030	2256	1508	2788	2100	2255	*	2221	2597
AC	1410	1566	1740	1934	2150	1120	1136	*	570	487
TRI	398	442	492	548	610	432	450	*	875	1353
PU	-	-	-	258	864	550	601	*	725	943
TOTAL	4142	4602	5116	5946	7086	4562	4843	*	4759	5720

* Data are not available.

SOURCE : BOT

Fig. 6.4 VARIATION OF REGISTERED PUBLIC UTILITY VEHICLES



The order of the number of PUVs following PUJ is tricycle, PU, AC and BUS.

Tendency of increase of tricycle and PUJ and tendency of decrease of AC and BUS are the major characteristics of PUV Mode in terms of registered number of PUV.

For the past five years PUJ and BUS are increasing gradually, so with Tricycle. On the other hand it is very essential that there is a decrease in the number of AC.

Total number of buses are decreasing in the past five years but it is expected that bus registration will occur in other city outside Davao City which will serve this city and other cities.

Therefore decrease of bus does not mean less service level.

Decrease in the number of ACs, however, will not affect the service level and may be phasing out is necessary because almost all ACs are of old vintage and seating capacity of AC is less than PUJ.

6.2 Demand for Public Transportation

Demand for public transportation modes mentioned in this section is the result of the person-trip survey conducted by DCUTCLUS in October of 1979.

(1) Total Number of Passengers and Passenger-kilometers of PUV

Total number of trips generated a day in the survey area is about 685,000 trip. Any among them 44%, 298,000 passengers used public utility modes.

Among public transport users, approximately 180,000 passengers which is equivalent to 61% of PUV users are by PUJ, 63,000 passengers, 21% are by AC, 26,000 passengers, 9% by tricycles, 6% by PU and 3% by BUS.

Based on the percentage structure of public transport users by modes, PUJ is identified as a major urban transportation mode.

Major characteristics of modal shares of public transportation modes in terms of Passenger.kilometer as follows:

Table 6.2 Transport Demand in terms of passengers and passenger.kilometers

UNIT: Trip or pass.

	Total Trip	Private Car	Total PUV	Bus	PUJ	AC	TRI	PU
No. of person trips	684,984	131,650	298,104	9,808	180,482	63,219	25,936	18,659
Percentage share of Total P.T.	100%	19.2	43.5	1.4	26.4	9.2	3.8	2.7
Percentage share of Total PUV pass.	-	-	100%	3.2	60.7	21.2	8.7	6.2
NO. OF PASS.KM			1,480,290 100%	187,670 12.7%	1,028,720 69.5%	136,760 9.2%	63,000 4.3%	64,140 4.3

Total passenger.kilometer of PUV is 1,480 thousand pass.km. and among them, PUJ shares about 70%, 1,029 thousand passenger kilometers followed by Bus, 13% and AC which shares 9%.

Based on this fact it is identified that trip-length of bus users are generally longer than other PUV users and PUJ can be considered as an important urban public transportation mode at present. (Refer to Tab. 6.2)

(2) Major characteristics of Public Transportation Users from the viewpoint of Trip Purpose

Trip-purpose of which largest number of passengers is to-go-to home followed by "private", "school", "office" but this order is just same to order of total number of Person Trip using all kinds of traffic measures.

According to the fluctuation of percentage share of the number of passengers by trip-purpose and by modes, percentage share of PUJ users for all trip-purposes is the biggest among other PUV, and PUJs share of trip-purpose such as "office", "school", "Home" is over than PUJ's average percentage share of whole trip purposes.

AC users will increase when they move to trip purpose as "Business", "Shopping", "Private".

Tricycle users will increase when their trip purposes are "to go to school","to go to shopping","to do private matter" and Bus users increase when their trip purpose is "to go to office".

PUJ's serve users in any kind of trip purpose with 50-60% of the total number of passengers with a certain trip purpose.

And ACs are serving users with 15-30% of the total number of passengers with a certain trip purpose.

Based on these facts these two kinds of public transportation modes have great roles for urban public transportation. Refer to Fig. 6.5.

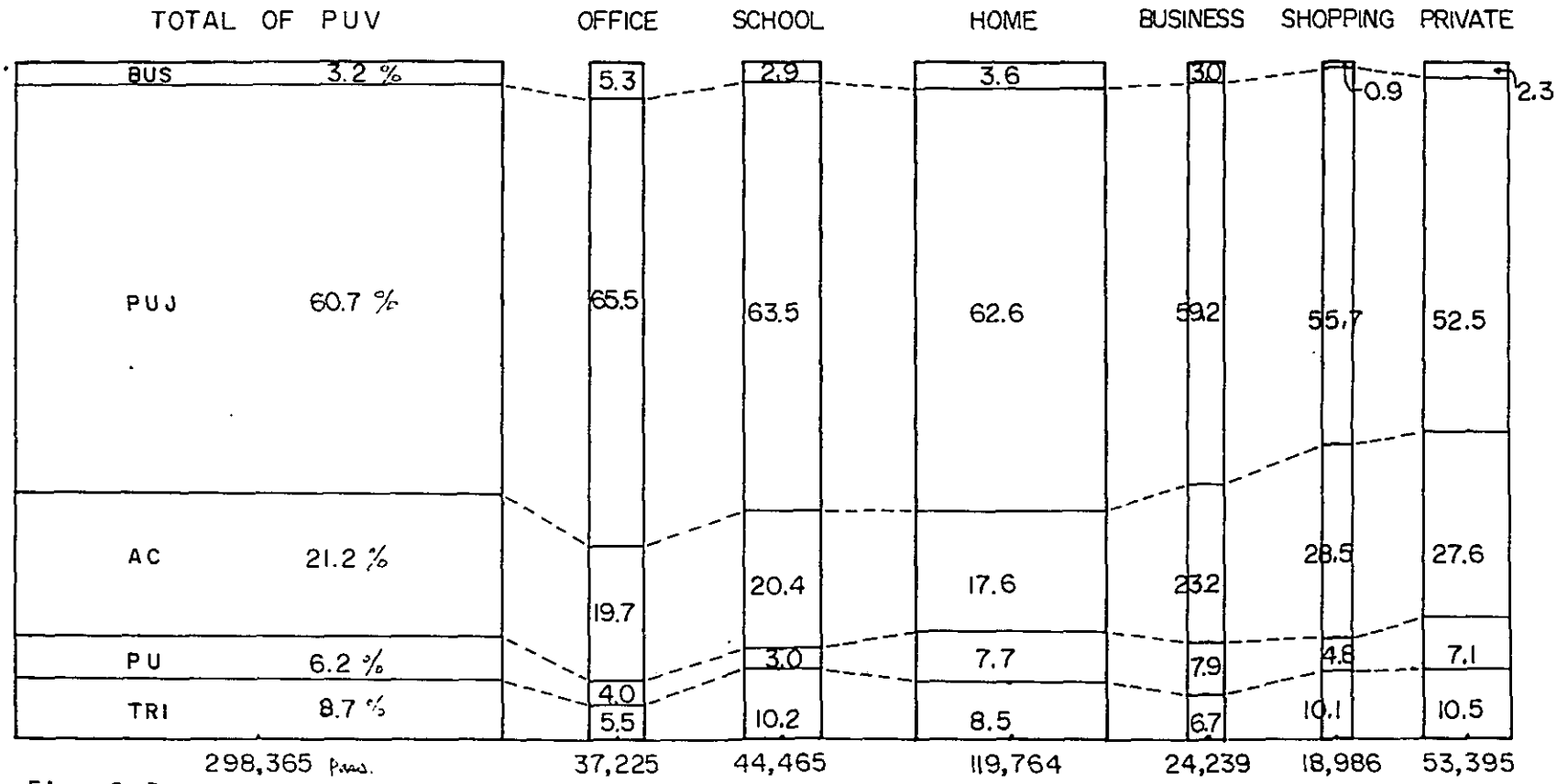


Fig. 6.5

No. of Trips and Modal shares in No. of Passengers by Trip Purpose by Modes.

(3) PUV Users by trip-length

Distribution of PUV users by trip-length is shown in Fig. 6.6.

First peak of the graph in Fig. 6.6 shows that 80 thousand passengers have 1 to 2 kms. trip length, on the other hand, second peak of the graph shows that there are 30 thousand passengers have from 5 km to 7.5 km trip-length.

First peak are consisted by peaks of all kinds of transport modes but second peak are consisted by PUJ's peak only.

Based on this, PUJs role of medium distance service is identified as essential.

Public transport modal shares by trip-length is shown in Fig. 6.7.

Major characteristics of modal shares are summarized below:

1) Percentage share of PUJ users with from 2-3 km to 20 Kms is 50-80%.

2) AC users share with 500 m to 3 kms is 30%.

3) Tricycle, users share with 500 - 1 Km is 40%.

4) Bus users' share is increased only over 20 Km.

Refer to Fig. 6.6 and 6.7.

Fig. 6.6 DISTRIBUTION OF NO. OF PT BY PUV BY TRIP LENGTH, 1979

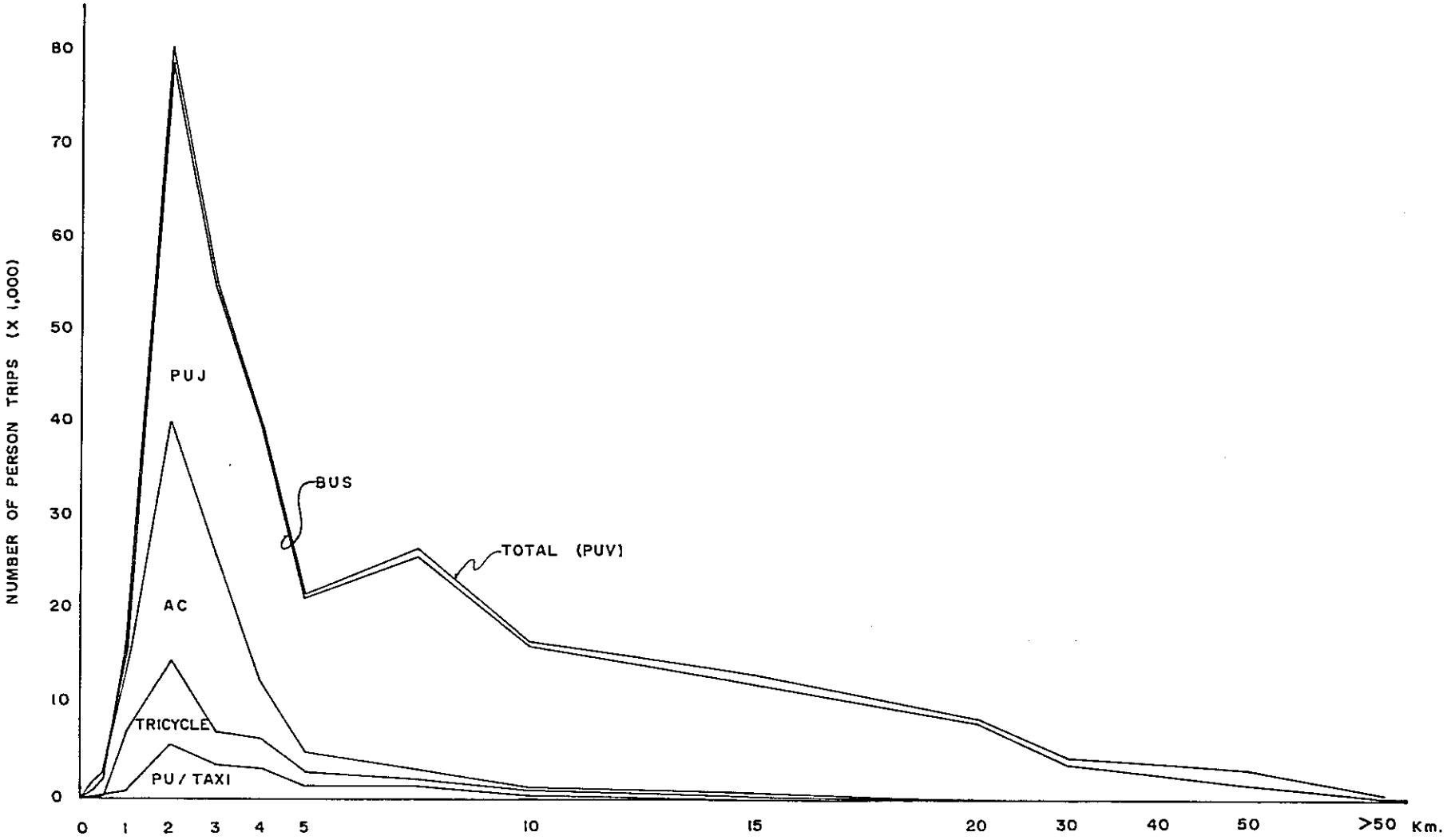
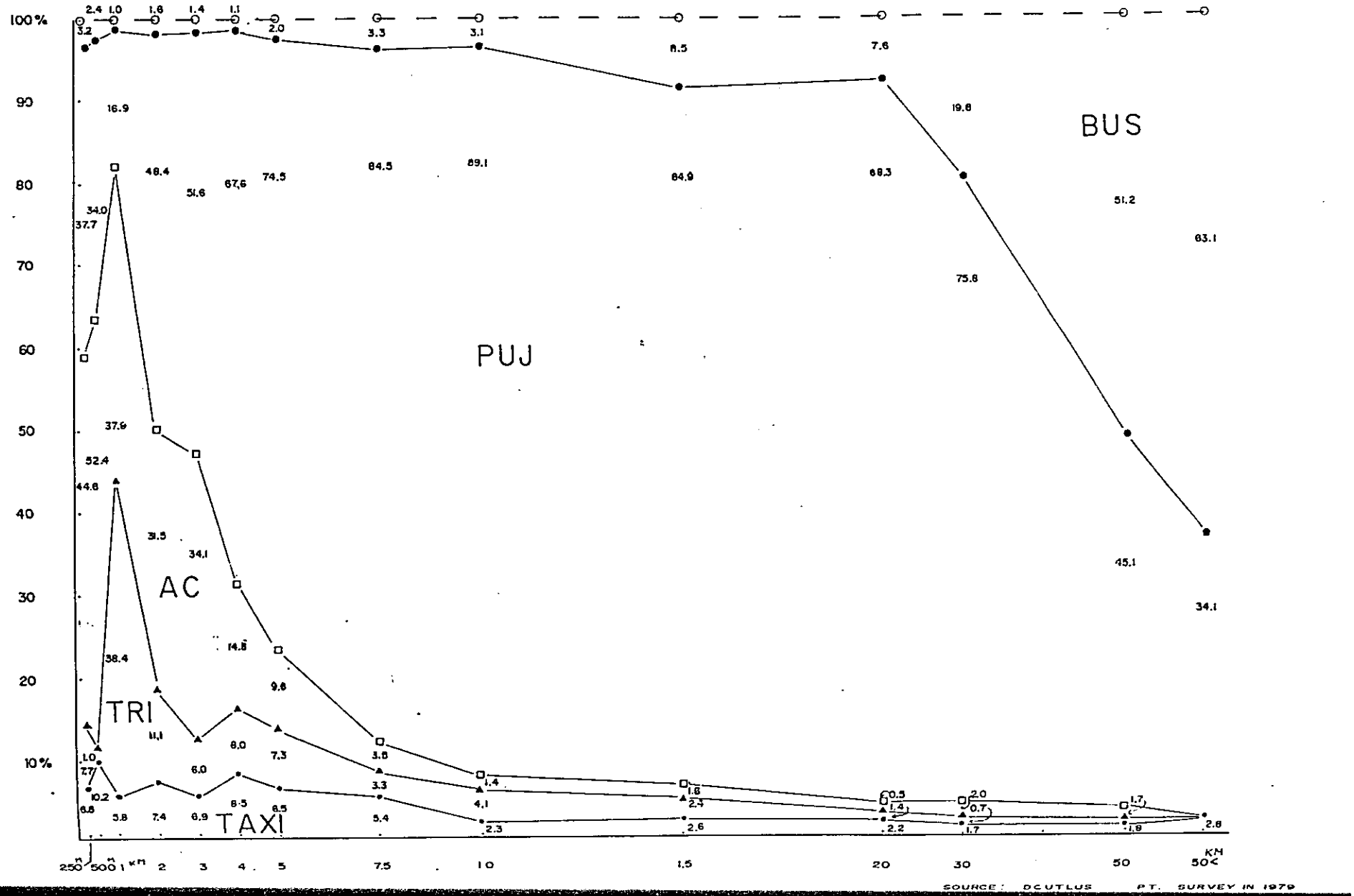


Fig. 6.7 MODAL SHARE BY TRIP LENGTH (1979)



6.3 PUJ Service;: Current Status and Problems

6.3.1 Current Status of PUJ Service

(1) Public Transportation Modes in Poblacion and its vicinity

Of the two modes of intramural transportation, the predominant is PUJ, which represents 70% of the total intermural traffic in terms of passenger-kilometer and 60% of total number of passengers, as against only 10% and 20%, respectively, of AC as mentioned above.

For PUJ, service between Poblacion and other urban parts of Davao City and between Poblacion and other neighboring municipalities are the major function, and service within Poblacion is only supplemental. On the other hand, Poblacion is the major area of service for AC. As far as seen from the number of passengers, PUJ and AC are competing with each other in Poblacion.

Fig. 6.8
PT ACTIVITIES BY PUJ

TOTAL: 180,600 PT

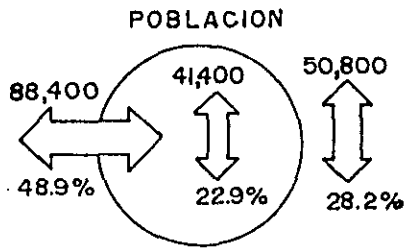
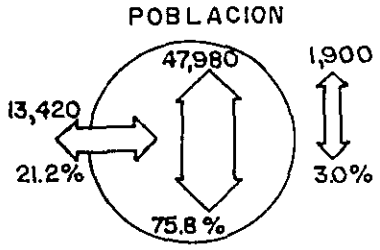


Fig. 6.9
PT ACTIVITIES BY AC

TOTAL : 63,300 PT



SOURCE: DCUTCLUS

A review of the registered number of vehicles used for public transportation purposes reveals that ACs are rapidly fading out as they are mostly aged jeeps.

In addition, the recent series of actions to reorganize PUJ routes and also the recent ban against ACs on C.M. Recto Street suggest a basic policy of having ACs replaced by PUJs in the future.

(2) Transition of PUJ Routes

The series of action to reorganize PUJ routes started in February 1979 with the Rerouting Scheme (drafted by C.H.P.G.), followed by the Modified Rerouting Scheme (August,1979, drafted by the Davao City Transport Committee) and the Remodified Rerouting Scheme February, 1980, also drafted by the Transport Committee), and the rerouting is still in the stage of experiment.

These rerouting schemes, whose aim, route pattern, and difficulties are presented in the Fig. 6.10 and Tab. 6.3, all attempted to improve the convenience and benefits of both PUJ users and operators through:

i) The systematic unification of PUJ routes in and out of Poblacion, and

ii) The allocation of proper number of PUJs to each of the routes in commensuration with the demand.

Fig. 6.10 **VARIATION OF PUJ ROUTE IN DAVAO CITY**

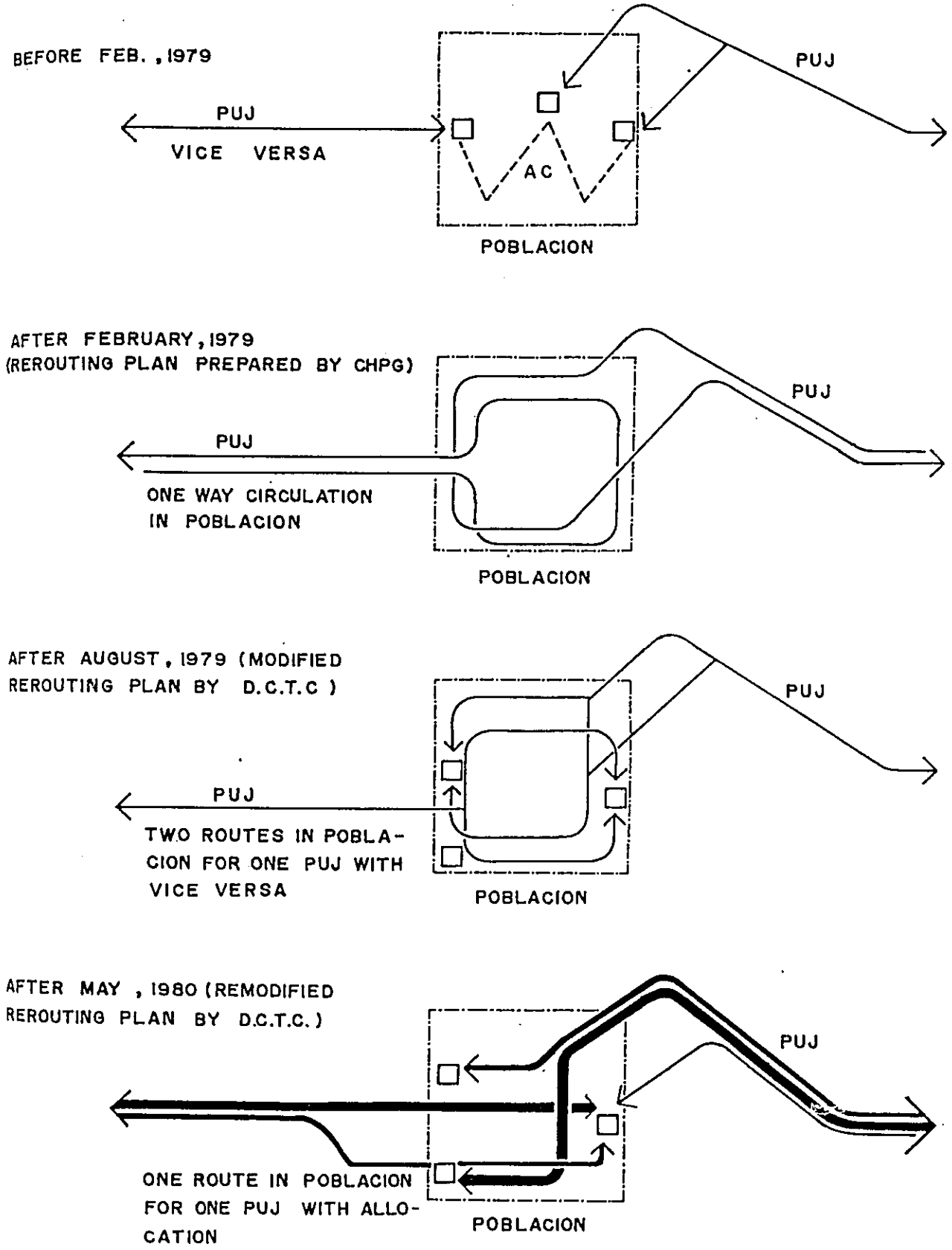


Table 6.3 Aims and Problems of PUJ Rerouting Schemes

SCHEME	AIM	PROBLEM
Prior to February 1979		1. PUJ service only connected terminals on the fringe of Poblacion with origins outside Poblacion. 2. Traffic congestion around PUJ Terminals. 3. Transfer at the terminal and double fare were necessitated. 4. Terminal operation was in violation of traffic rules
Rerouting Scheme of C. H.P.G.	1. Extension of PUJ service to points inside Poblacion, so passengers could reach the city center without transfer. 2. Elimination of double fare. 3. Uniform display of destination. 4. Ban on the use of private terminals. 5. Establishment of intra-Poblacion circular routes and direction controlled one-way routes	1. Longer operational distance. 2. Rapid increase in fare due to rise in gasoline price at this time. 3. Drivers no longer had a place to rest after the ban on the use of terminals. 4. At some of PUJ routes it was difficult to find enough passengers for drivers.
Modified Rerouting Scheme by D.C.T.C.	1. To shorten the length of routes through the placement of circular routes by shuttle routes. 2. Establishment of two routes for each PUJ for selection by driver at each time, as demand on each route was unknown.	1. Parts of road were used as PUJ terminals and, therefore, they lacked sufficient space. 2. Over-served routes and under-served routes resulted, and, therefore,

SCHEME	AIM	PROBLEM
	3. Branch service routes were established to cover areas not previously served by PUJ. 4. Uniform display of destination and route.	3. Some drivers started to cut trips. 4. Area served by PUJs was not adequately expanded.
Remodified Rerouting Scheme by D.C.T.C.	1. The assignment of PUJ service to each route for even distribution of the service.	

6.3.2 PUJ Service Problems

(1) Uneven Spread of Route Network

The recent PUJ rerouting schemes aimed at the coverage of entire downtown area centering around Poblacion, but the scheme covered only the area surrounded by F. Torres Street, Davao River, and Cabaguio Street. Built-up area continued to outside this area, but there were few systematically laid roads which could be used as PUJ routes and, therefore, such scheme was hardly applicable. PUJ routes should be expanded in accordance with the future road development program.

(2) Gap in Users and Service Frequencies

Modified and remodified rerouting schemes (at the time of November 1979 Traffic Survey) authorized two routes to each PUJ, and the driver was given freedom of selecting the route to take from the two as he sees fit. As a result, gap in the level of service remarkably widened between routes, whereas, supply gap reached as much as 60 times. An also maximum average occupancy rate estimated by route was more than 20 times that of the minimum. Remodified rerouting scheme tried to correct this problem by stipulating the number of PUJs for each route, but only for a limited effects.

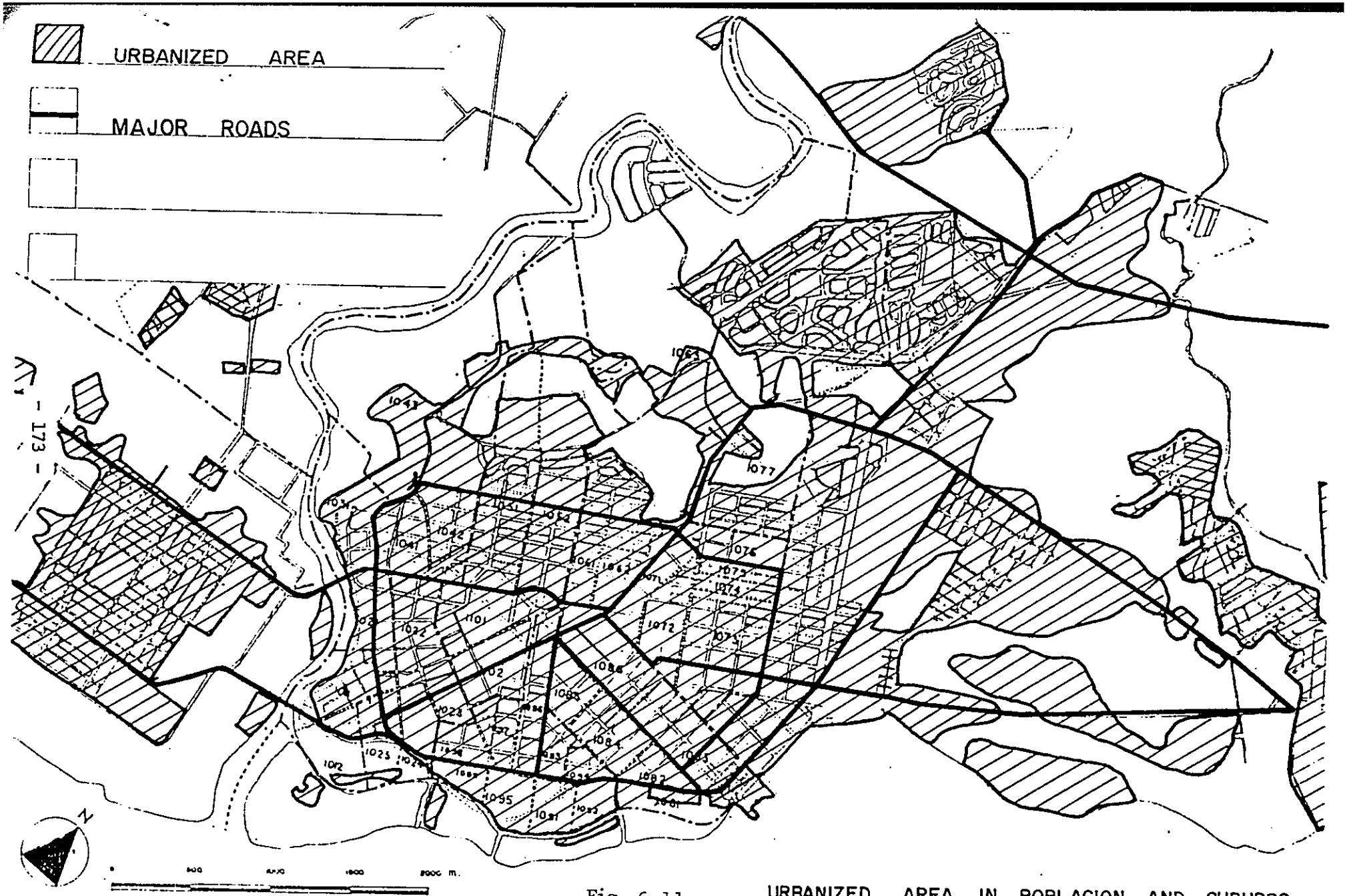


Fig. 6.11 URBANIZED AREA IN POBLACION AND SUBURBS

Table 6.4 COMPARISON BETWEEN PUJ TRAFFIC DEMAND IN PASSENGER.KILOMETER AND NUMBER OF CAR TRIP.KILOMETER MODIGIED REROUTING SCHEME

NAME OF ROUTE	INTRA-ZONAL PASS.KM IN POBLACION	INTER-ZONAL PASS.KM BY	TOTAL*1 PASS.KM ROUTE	CT.KM*2 BY ROUTE	AVERAGE OCCUPANCY RATE
R-1	5,829	87,516	93,345	8,688	10.7
R-2	12,040	66,300	78,340	5,630	13.9
R-3	8,536	123,480	132,016	57,866	2.3
R-4	4,314	37,706	42,020	5,151	8.2
R-5	11,535	76,423	87,958	962	91.4
R-6	6,497	100,389	106,886	1,927	55.5
R-7	16,443	64,859	81,302	20,091	4.0
R-8	10,687	65,102	75,789	984	77.0
R-9	9,796	73,489	83,285	27,198	3.1
R-10	21,790	48,415	70,205	32,491	2.2
R-11	11,230	62,849	74,079	20,349	3.6
Unknown	3,554		3,554		
TOTAL	122,251	806,528	928,779	181,337	

SCURCE: DCUTCLUS

*1 No. of PT x (Ave. P.T. Length)
Intrazonal = 1.92 Km/PT
Interzonal = 8.5 Km/PT South
8.7 Km/PT North

*2 From Table "Estimation for Volume of Car-Transportation in CT.Km by PUJ Route".

(3) PUJ-AC Competition and Role Sharing

PUJs and ACs are in competition with each other in Poblacion, as far as the number of transported passengers is concerned. However, PUJ service is tied to routes established on arterials, while ACs can serve (door to door) even in extremely narrow streets. In this sense, PUJs and ACs share different roles. Assuming that the citizens' radius of walk is 100 meters, approximately 50% of the old downtown* is served by PUJs and the remaining 50% by ACs.

The above observation is generally true, but both ACs and PUJs tend to concentrate to busy streets, such as C.M. Recto Street, which is crowded not only by PUJs and ACs, but also by PUs and private cars and traffic confusion is terrible in the evening hours.

(4) Hourly Fluctuations of PUJ Transportation Demand and PUJ Service.

While demand for PUJ transportation varies by hour of the day, PUJ service frequency is not regulated but is left up to ihdividual drivers. Therefore, the supply of PUJ service may not be systematically adjusted to coincide with the hourly fluctuating demand. Average daily demand is 7,500 passengers per hour, average hourly demand in the morning and evening peak hours is 23,000 to 25,000, and that in daytime, 9,600.

The drivers of PUJs for which the only stipulation is the route rest parked on roads or in terminal area in day time when the demand slackens off. PUJ allocation which will enable drivers to secure a minimum of income by full operation during the hours of their choice and a facility program which will provide parking lots for them to park and rest will be desirable, the realization of which will normalize PUJ service and lead to the mitigation of traffic congestion in areas around the terminal.

NOTE: * The part of Poblacion which is south of F. Torres.

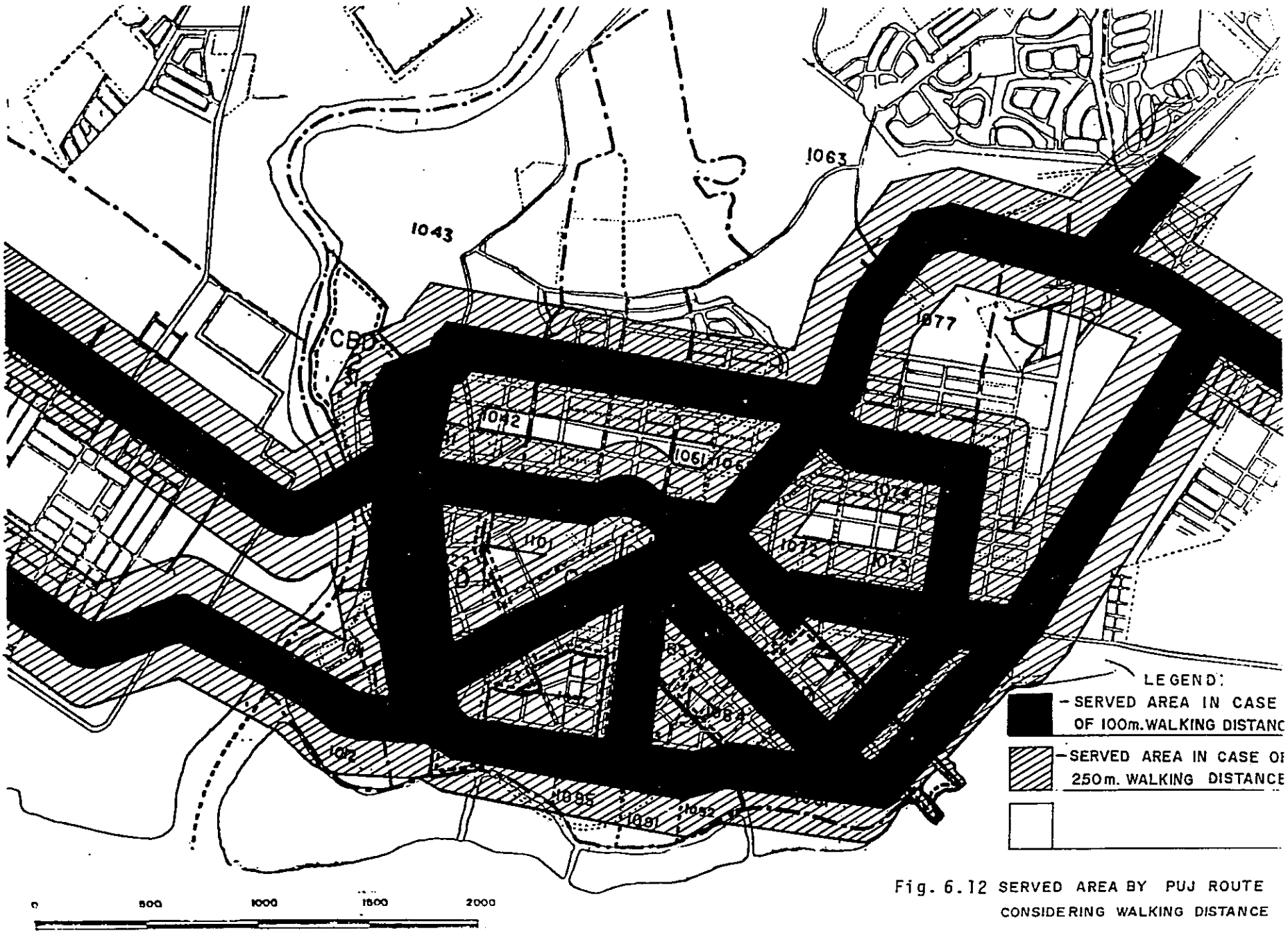
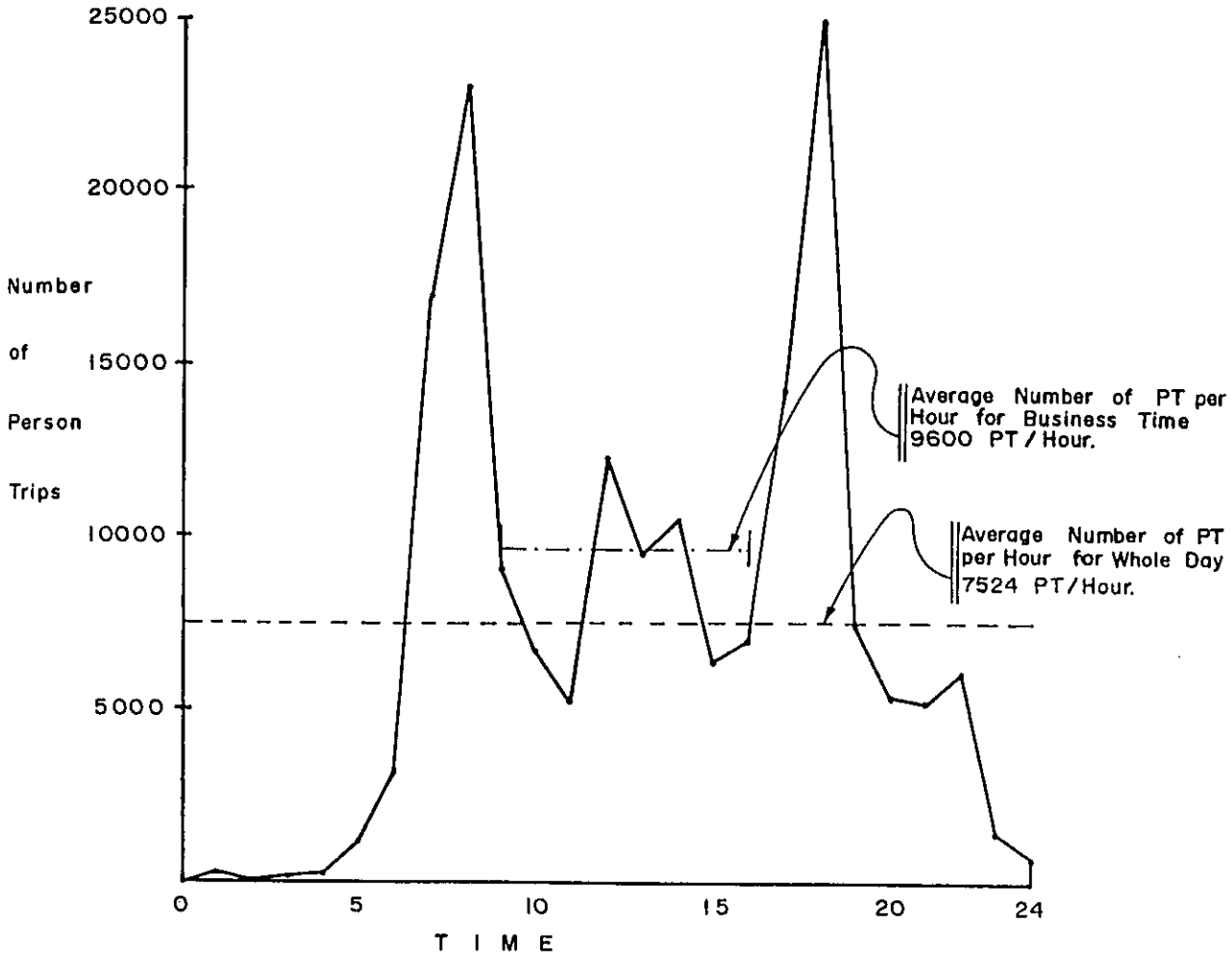


Fig. 6.12 SERVED AREA BY PUJ ROUTE CONSIDERING WALKING DISTANCE

Fig. 6.13 HOURLY VARIATION OF PT BY PUJ



Source: DCUTCLUS

(5) Profitability and Population of PUJs

PUJ fare structure, at the time of survey, was 50¢ for the first 5 kilometers with additional 10¢ for each subsequent kilometer with 10% addition for practice in reality.

Based on the result of the Person Trip Survey, average income per transportation unit (passenger-kilometer) is calculated as ₱0.129 per passenger-kilometers [1/], total volume transported as 1,617,000 passenger-kilometers [2/], and gross income as ₱229,500 [3/], or ₱ 89 per PUJ.[4/]

1/ According to the result of Person trip survey.

2/ Total passenger-kilometers of inhabitants in the survey area (1,028,720) plus those outside the area (588,762).

3/ Reflects 10% addition which is effective in reality.

4/ The number of registered PUJ was 2,579 (in 1979).

The cost of PUJ to the PUJ driver are rental of ₱45 per day, fuel cost of ₱ 40 per day [1/], and salary of ₱30 per day, for a total of ₱115 per day. In this example, revenue (₱89 per day) is less than expenditure (₱115 per day) and profitability is negative. Breakeven point in terms of the total number of PUJs is about 1,955.

On the other hand, the Ministry of Public Highway has calculated this cost at ₱1.15 [2/] per each kilometer of operation. Revenue per unit of operation distance is calculated at about ₱1.18 [3/] based on the result of PUJ survey. In view of the actual state of PUJ operation, it is definitely profitable.

From 10% to 15% of registered PUJs are said to be inoperative due to accidents, repairing, and other reasons. This means that the total number of PUJs actually in service is 2,2000 to 2,3000, but, in view of the break even point of 1,955 PUJs, the actual number is estimated at about 2,000.

1/ Fuel cost = daily operation distance (100 Km) - mileage (7 Km/liter) x gasoline price (₱2.8/liter)

2/ According to Study Report for Vehicle Running Cost by MPH

3/ Average Occupancy Rate =

$$\frac{\text{Total Volume of passengers of PUJ in passenger.Kilometer}}{\text{Total Traffic Volume of PUJ in car.kilometer}} =$$

$$\frac{1,760,000 \text{ PT.KM}}{193,840 \text{ CT.KM}^{*}} = 8.3 \text{ PT/CT}$$

Revenue per Km = 8.3 PT x ₱0.129/PT x 1.1 (considering practice in reality).

CHAPTER 7

TRAFFIC CONTROL

7.1 Purpose of Traffic Control Analysis

The term "traffic control", in the wide sense of the word, denotes the control of people and vehicles in order to assure that the use of vehicles by man will afford him a safe, convenient, and pleasant social life (essential to which is the fulfullment of three Es: Education, Enforcement, and Engineering). In the narrow sense of the word, traffic control is the enforcement of fundamental traffic rules stipulated by laws and regulations.

The traffic problems existing in Davao City are primarily characterized, as previously pointed out, by the substantial qualitative and quantitative differences between problems in the central downtown area called "Poblacion," those in the urban areas surrounding it, those in suburban towns, and those in inland rural areas and also by the fact that traffic problems are concentrated in the central downtown area.

The secondary characteristic is the absence of railway, which is found in cities of Japan and other advanced nations, and the fact that public transportation depends on buses, taxis, jeepneys, and ACs _ particularly on jeepneys.

Traffic control in Davao City is to be analyzed focussing on traffic safety, amenity, convenience, and reliability, with road network and the means of public transportation in mind.

7.2 Philippine and Davao City Traffic Control Systems

Republic Act No. 4136 entitled "Land Transportation and Traffic Code" provides the base for traffic control in the Philippines.

Details of traffic control are stipulated by the ordinances issued by local jurisdictions under the authority of said Code.

1) Republic Act No. 4136

Republic Act No. 4136, established June 20, 1964, and subsequently amended by Presidential Decrees No. 843, 896,

and 1059, regulates the registration and operation of motor vehicles by owners, dealers, conductors, and drivers.

The Land Transportation and Traffic Control Code consists of 5 chapters, or a total of 18 articles or 66 clauses. Chapter 2 provides for the registration of motor vehicles, Chapter 3 regulates the operation of motor vehicles, Chapter 4 stipulates traffic rules, and Chapter 5 contains penal and other provisions. Of these, Chapters 4 and 5 will be studied in order to evaluate traffic control against said "3 Es," while relationship between traffic rules and physical facilities will be reviewed particularly from the standpoint of "engineering."

This Code, enforced in the entire nation, is administered by BLT under the jurisdiction of MOTC. Within BLT is the Land Transportation Commission consisting of commissioners appointed by the President under Congressional approval. This Commission is headquartered in Quezon City (where Motor Vehicle Office is located) and has 10 regional branches, one of which being in Davao City.

This Commission is in charge of the administration of the Land Transportation and Traffic Control Code. The Philippine Constabulary, city police forces, and municipal police forces are given authority to enforce the Code, and traffic courts, city courts, and municipal courts try the violators of traffic rules.

2) Traffic Rules under Republic Act No. 4136

The traffic rules provided for by the Act consist of the following 5:

CHAPTER IV. - TRAFFIC RULES

I. Speed Limit and Keeping to the Right

II. Overtaking and Passing a vehicle, and Turning at Intersections

III. Right of Way and Signals

IV. Turning and Parking

V. Miscellaneous Traffic Rules

Motor vehicle speed limits are listed below for information:

MAXIMUM ALLOWABLE SPEEDS

	Passenger cars and motorcycles	Motor trucks and buses
1. On open country roads, with no "blind corners" not closely bordered by habitations.	80 km. per hour	50 km. per hour
2. On "through streets" or boulevards clear of traffic, with no "blind corners", when so designated	40 km. per hour	30 km. per hour
3. On city and municipal streets, with light traffic, when not designated "through streets."	30 km. per hour	30 km. per hour
4. Through crowded streets, approaching intersections at "blind corners" passing school zones, passing other vehicles which are stationary, or for similar dangerous circumstances.	20 km. per hour	20 km. per hour

3) Penal and Other Provisions of Republic Act No. 4136

Following are the provisions of this Act pertaining to penalties and miscellaneous matters.

CHAPTER V - PENAL AND OTHER PRIVISIONS

Article I - Penalties

Section 56. Penalty for violation

Section 57. Punishment for other oftenses

Section 58. Duty of clerks of court

Article II - Collection of Fees, Taxes and Fines, Liens, Allotment ment of Funds

Section 59. Collection of fees; national and local texes; fees

Section 60. The lien upon motor vehicles

Section 61. Disposal of monies collected

Article III - Final Provisions

Section 62.

Section 63. Repeal of laws and ordinances

Section 65. Appropriation

Section 65. Separability

Section 66. Effectivity

4) Traffic Ordinance No. 778

The Davao City Assembly established Ordinance No. 778, "The Traffic Ordinance of the City of Davao," under the authority of the Land Transportation and Traffic Control Code. Ordinance No. 778 was a revision of Ordinance No. 9 and might be called a "Revised Traffic Ordinance of the City of Davao."

Ordinance No. 778 takes its skelton from Republic Act No. 4136 with some modifications to conform with peculiar situation existing in Davao and consists of 16 articles.

The provisions of Ordinance 778 which concern traffic control are:

(1) Speed Limits

Maximum allowable speed at which motor vehicles may be operated in Davao City is stipulated at 20 to 30 kilometers per hour for Pobulacion and other urban areas and at yo to 80 kilometers per hour for suburban areas.

(2) One-way Traffic

One-way traffic is stipulated for portions (a total of 6 sections) of roads in Poblacion.

(3) No Parking

In Poblacion, parking is prohobited on both sides of the road in 8 sections and on one side of the road in 5 sections.

(4) PUJ Loading/Unloading Zones

PUJ loading/unloading zones are designated along PUJ routes on roads in certain parts of Davao City.

One of the tasks which future plans and analyses are to perform will be evaluation as to whether or not these traffic control provisions are useful in the improvement of traffic condition and to determine how these provisions should be applied in relation to emergency or long range plans.

5) Traffic Management Authorities

The planning, construction, administration, and maintenance of road network and traffic facilities are shared by numerous organizations, the major ones of which are:

(1) Planning, Construction, and Maintenance

Roads existing in Davao City are classified by Jurisdictional authority into national highways, city roads, and barangay roads, which are planned and maintained by various organizations as indicated below:

(a) National Highways: Highway District Engineer of the Regional Office of MPH.

(b) City Roads: City Engineer Office under City Mayor

(c) Barangay Roads: The barangay division of MPH's Regional Office

(2) Administration and Enforcement

Roads and traffic facilities are administered by the

following parties under the authority of Republic Act No. 4136 and Ordinance 778:

(a) National Highways: The Constabulary Highway Patrol Group (CHPG) of the Traffic Bureau, the Ministry of National Defense. CHPG also handles ordinary crimes committed on national highways.

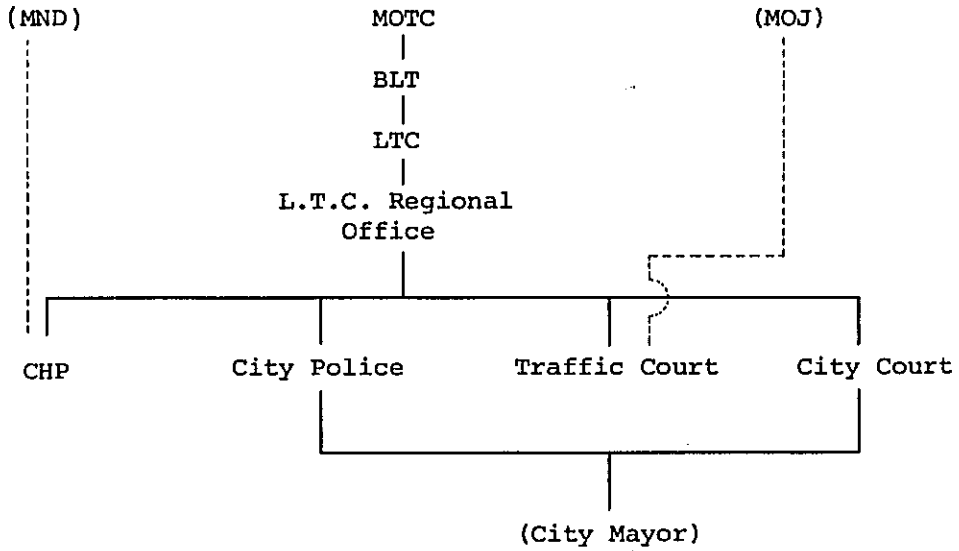
(b) City Roads: Administered and enforced by the City Police under Mayor. The City Police is also subordinate to MND.

(3) Trial

The trial of the violations of Republic Act No.4136 or Ordinance 778 is either by a traffic court of the Republic as the court of trial in the first instance or by the City Court under Mayor according to jurisdiction over the road (as in the case of road construction and maintenance).

(4) Overall Organizational Structure

The structure of the jurisdictional organizations discussed in the above can be expressed by the diagram presented below:



7-3 Traffic Accidents

The number of traffic accidents has yearly increased in Cavao City by, during the period of 8 years, the factor of 2.58 from the total of 1,507 accidents in 1970 to3,896 in 1878, according to the Traffic Control Division data. Facts about these traffic accidents will be reviewed in detail in search for a base to support traffic management plan for greater safety.

1) Traffic Accident Frequency

The incidence of traffic accidents in Davao City has generally been on an upward trend from 1970 to 1978. Accidents rapidly increased particularly after 1975. Increase in accidents was faster than increase in the number of registered motor vehicles (PUV), and the average number of accidents per registered PUV rose from the 0.643 in 1970 to 0.525 in 1975, and, further to 0.769 in 1978. At this trend, this ratio might have reached 1.0 in 1980, when each PUV might have been involved in at least one accident on the average.

In 1978, average number of accidents per month was 325 and that per day was approximately 11, according to said data.

2) Traffic Accident Locations

(1) Davao City as a Whole

A scrutiny of traffic accidents occurred in Davao City as a whole indicates that they were concentrated to Poblacion and, in urban areas on its perimeter and in suburban areas,

Table 7.1 Number of Traffic Accidents in Davao City (1970-1978)

	Number of Accidents	Number of PUVS	Number of Accidents per PUV
1970	1,507	4,142 PUV	0.364
1971	1,562	4,602	0.339
1972	1,484	5,116	0.290
1973	-	5,946	-
1974	1,713	7,084	0.242
1975	2,397	4,562	0.525
1976	1,857	4,843	0.414
1977	3,293	-	-
1978	3,896	5,064	0.769

Source: Traffic Control Division
- unknown

Fig. 7.1 Number of Traffic Accidents in Davao City

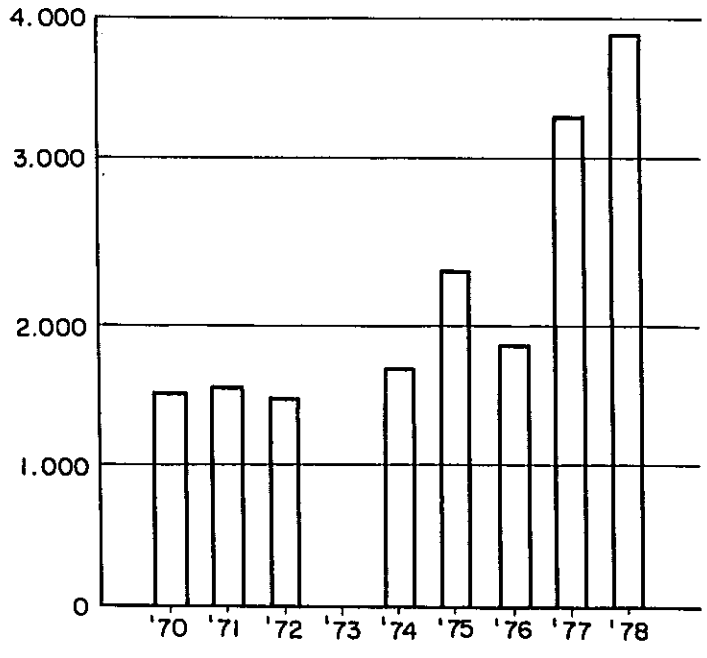
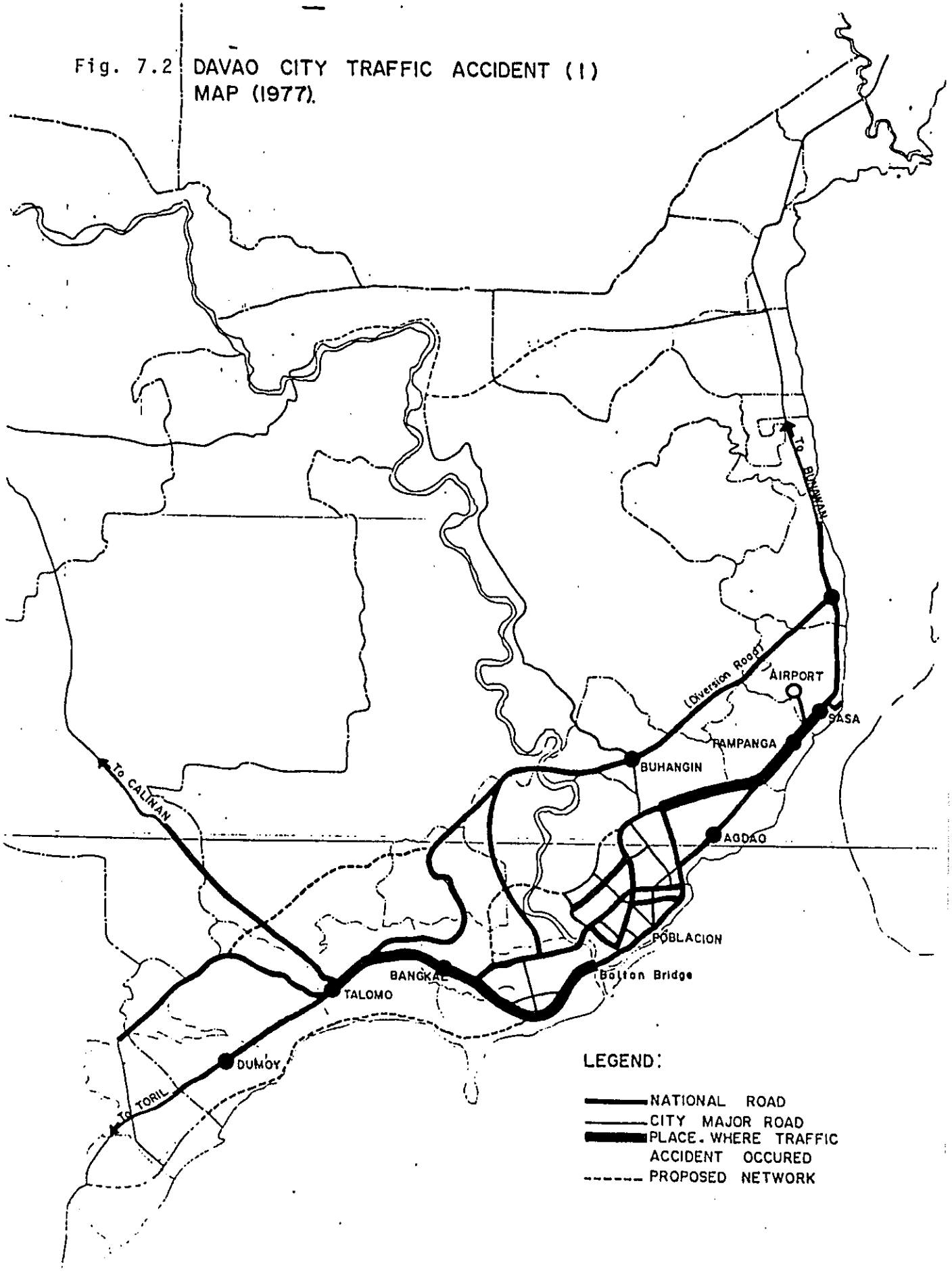


Fig. 7.2 DAVAO CITY TRAFFIC ACCIDENT (1) MAP (1977).



to areas along national highways particularly between Talomo and Poblacion and between Poblacion and Panacan.

Few accidents have occurred on Diversion Road, which is one of trunk roads in Davao City.

(2) Poblacion

Traffic accidents concentrated in Poblacion are noted to have been distributed primarily to its southwestern part (downtown area in the vicinity of the City Hall) and secondarily to the Magsaysay Avenue/Agdao Market area of its northeastern part.

Roads with frequent traffic accidents are:

- o Lupulapu
- o Second
- o T. Monteverde
- o Villa Abrille
- o D. Ponce
- o I. ñigo
- o C. Bangoy
- o D. Suazo
- o C. Chavez
- o L. Ma Guerrerro
- o M. Roxas
- o Jose' Palma Gil
- o A. Bonifacso
- o J. Rizal
- o C.M. Recto
- o Gen Bolton
- o F. Bangoy
- o F. Iñigo
- o P. Pelayo
- o V. Illustre
- o Duta Bago
- o F. Magallanes
- o San Pedro
- o Gen. Malver
- o Father Selga
- o Gen. A. Luna
- o J. Camus
- o P. Magsaysay Av.
- o F. Jacinto
- o Sobrecary
- o N. Torres
- o R. Cabaguio
- o Sta Ana Ave.
- o 5th Ave.

Also, the concentration was consipicuous of traffic accidents to intersections.

On the other hand, a review of those occurred within Poblacion in 1977 and in 1978 shows that accidents spreaded to a wider area in 1978 than in 1977 and that incidence rose in 1978 particularly

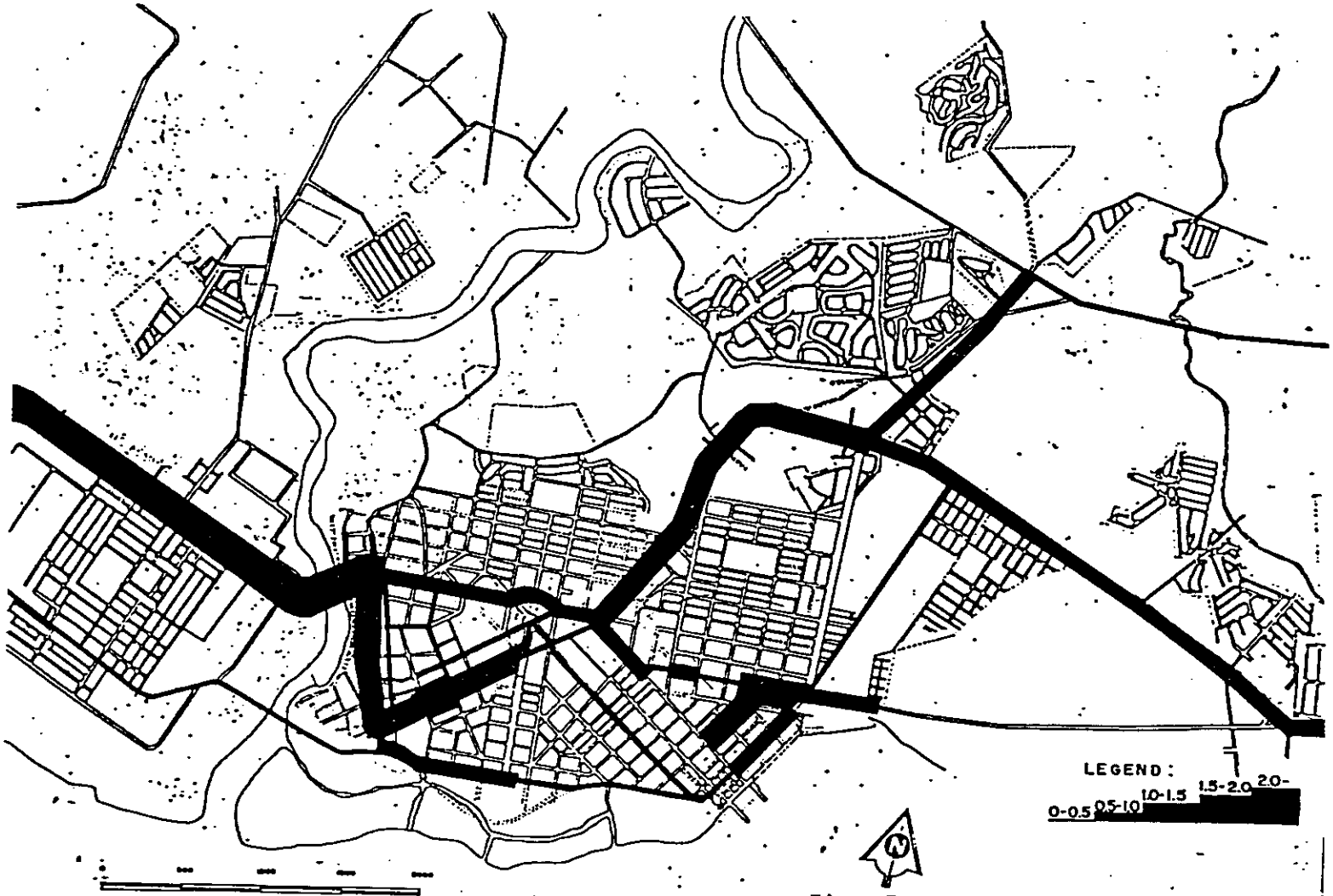
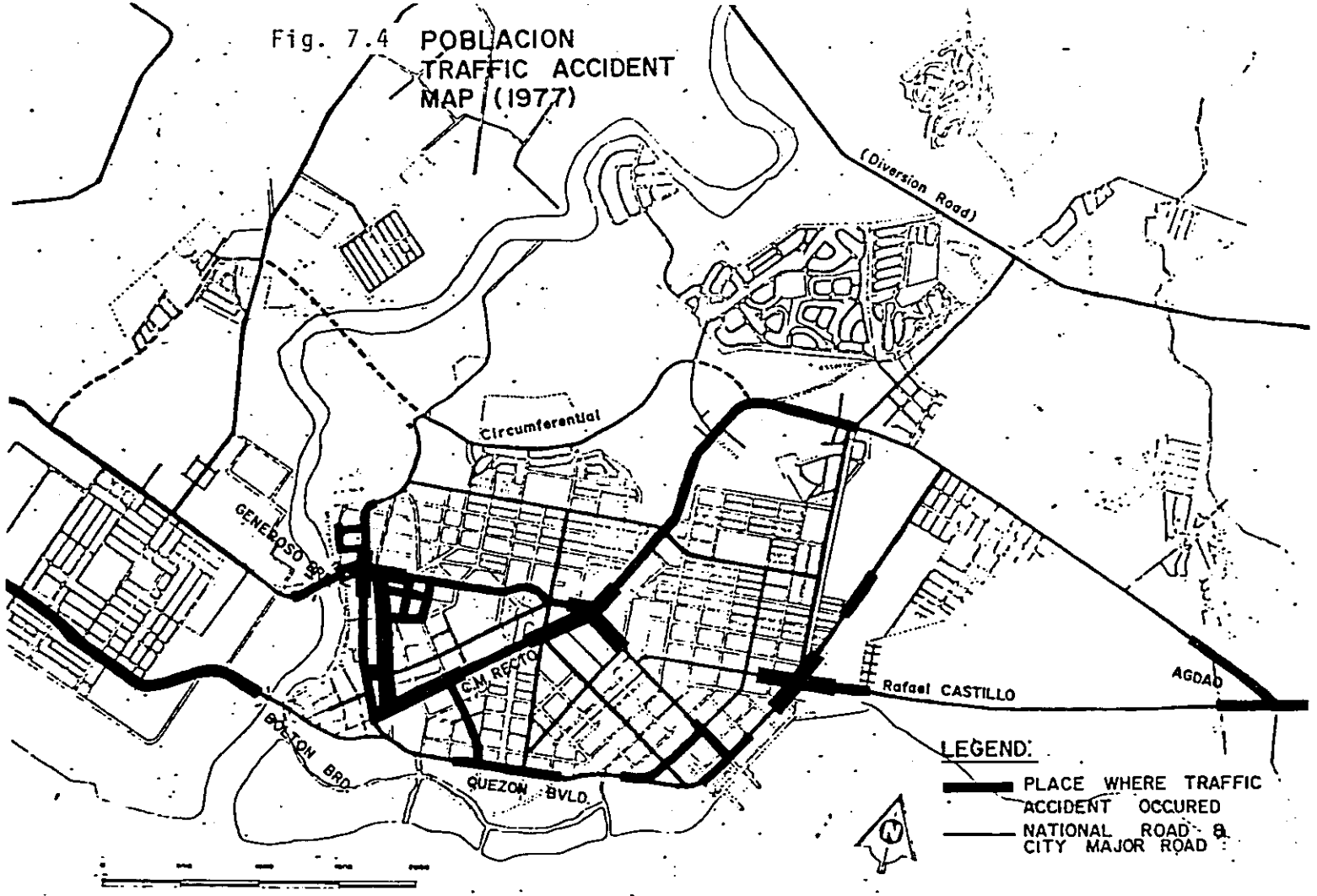


Fig. 7.3 TRAFFIC CONGESTION DEGREE OF MAJOR ROAD

Fig. 7.4 POBLACION
TRAFFIC ACCIDENT
MAP (1977)



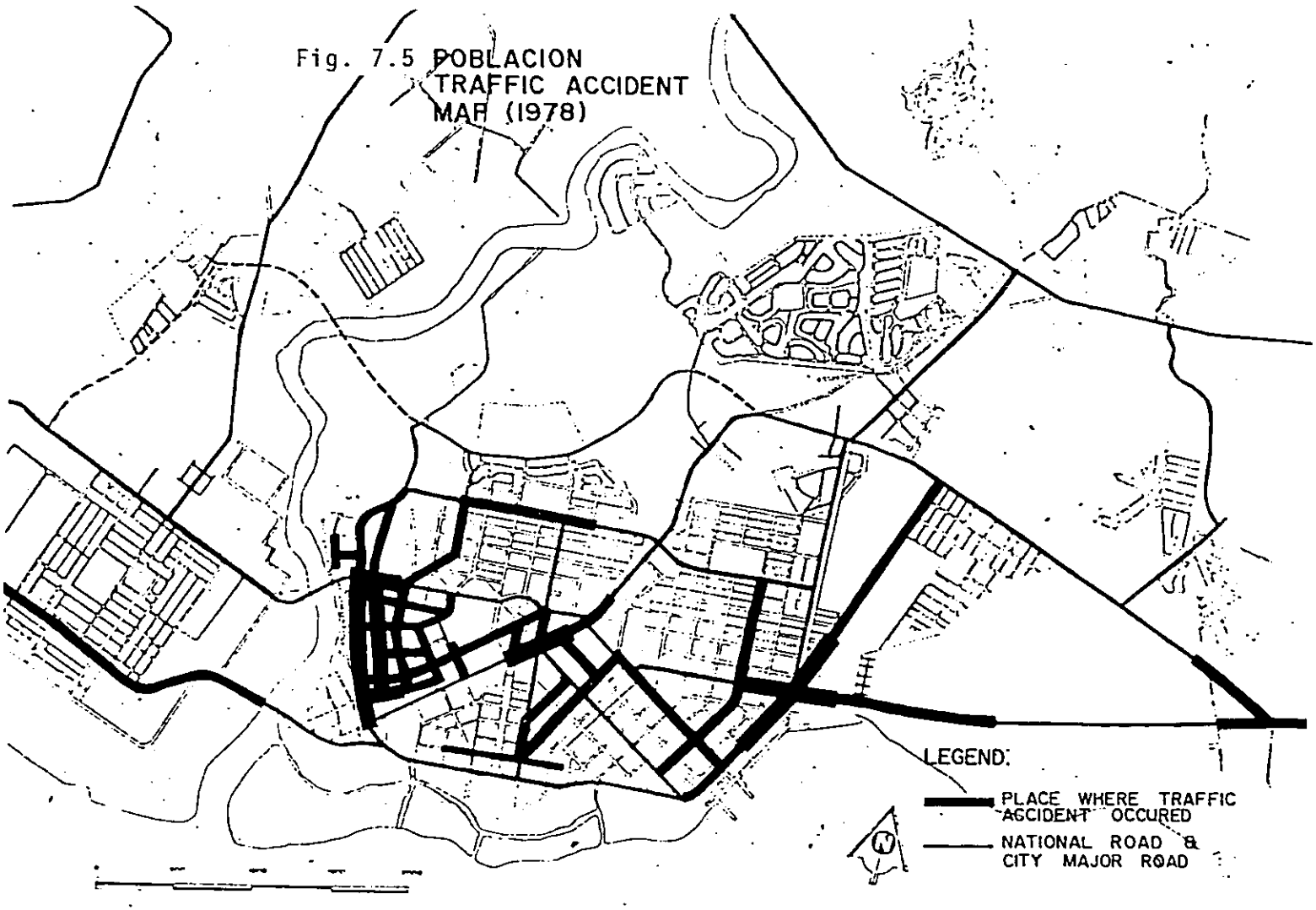


Fig. 7.5 POBLACION
TRAFFIC ACCIDENT
MAP (1978)
LEGEND:
PLACE WHERE TRAFFIC ACCIDENT OCCURED
NATIONAL ROAD & CITY MAJOR ROAD
N

in the northeastern downtown area and area from Adgao Market to Magsaysay Avenue. Also, whereas accidents concentrated to areas along national highways in 1977, they spreaded out to areas along almost all of trunk roads in Poblacion and areas along almost all of access roads in the downtown around the City Hall in 1978.

Another phenomenon observed through the 1977/1978 comparison was the fact that, in the case of pairs of roads running in parallel, accidents which tended to concentrate to one of each such pairs in 1977 spreaded to the other of the pair in 1978 for a more even distribution. Such pairs of roads were:

	Number of Traffic Accidents		
	1977	→	1978
C.M. Recto Avenue	More	→	Less
F. Bangoy Street	Less	→	More
San Pedro Stree	More	→	Less
A. Pichon Street	Less	→	More

Although no definite cause of this phenomenon has been confirmed, it is assumed that the installation of traffic signals and/or the enforcement of no parking on roads might have been partly responsible.

3) Traffic Accident Analysis I

The traffic accidents which occurred in Davao City at the average rate of 11 per day in 1978 will be analyzed based on the data of Davao City Weekly Accident Reports covering a net period of 6 months from March 1 to September 30, 1978 (some reports are missing).

(1) Incidence

During said 6-month period, the total number of traffic accident was 2,136 for the monthly average of 356 (or the daily average of 12), which was greater than the monthly average of 325 for the entire year of 1978. The breakdown of the total 2,136 was 28 fatal accidents (1% of the total), 485

casual accidents (23%), and 1,623 property damage accidents (76%) - on the average, one out of every 4 accidents involved Personal death or injury.

(2) Casualties

During this 6-month period, a total of 32 people were killed in these traffic accidents (for monthly average of 5.3) and a total of 826 were injurred (monthly average of 138) for a total of 858 casualties.

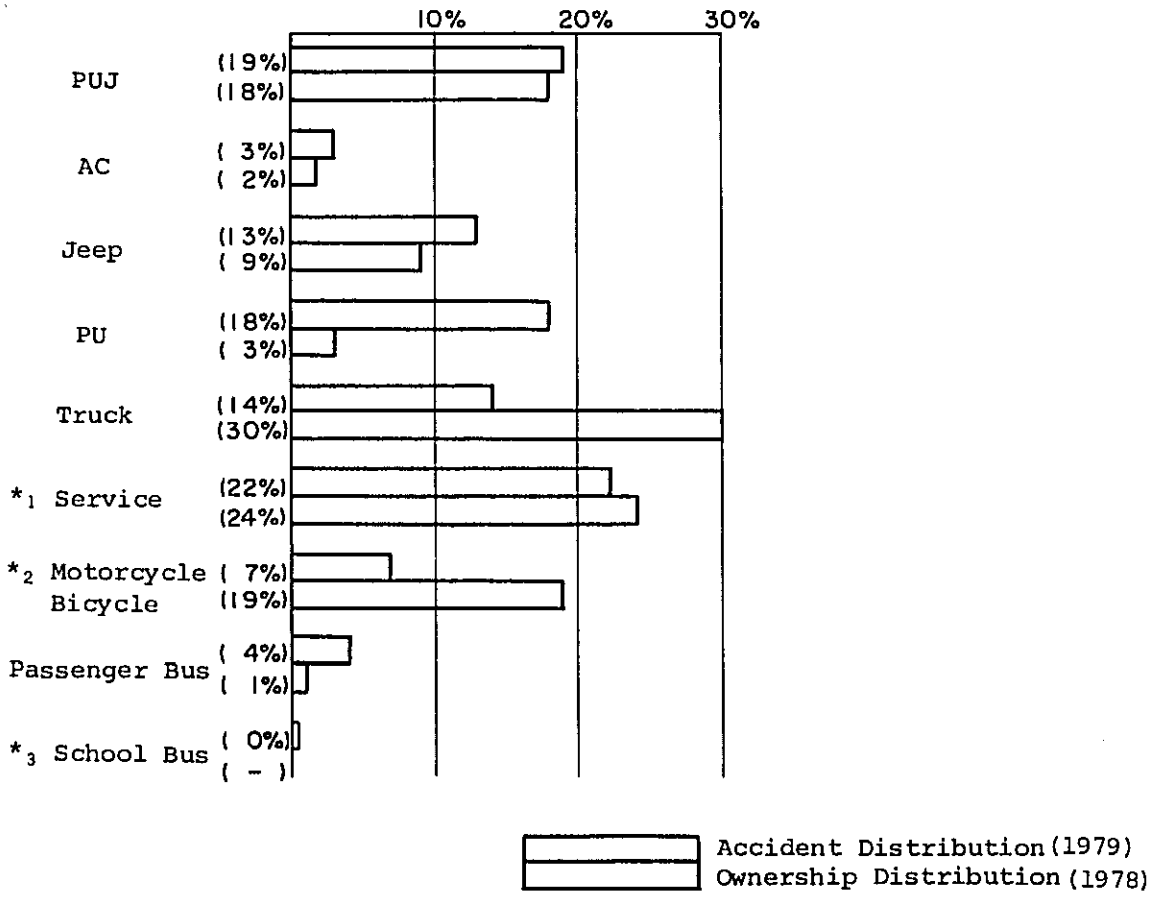
(3) Collisions

A total of 1,343 accidents (69% of all accidents) were collision between automobiles, 344 (17%) were collision wherein the automobile hit a person or persona, and 134 (&%) were collision between the automobile and the motorcycle/bicycle.

(4) Vehicle Type

The breakdown by the type of vehicles which were the cause of traffic accident is as follows: 22% was service vehicles, 19% was PUJs, 18% was PU, 13% was jeepneys, 13% was trucks, and 7% was motorcicles/bicycles. A comparison of this distribution against the distribution of vehicle ownerships by the type of vehicle (BLT data) indicates that the rate of accidents is high among PUs and low among trucks and motorcycles/bicycles and, further, that such rate is generally higher among public utility vehicles than among private vehicles.

Fig. 7.6 Accident and Ownership Distribution by kinds of Vehicle



*1 Ownership distribution based on the total including private cars.

*2 Ownership distribution based on the total of motorcycles and tricycles. Accident distribution based on the total of motorcycles and bicycles.

*3 Ownership distribution unknown.

Fig. 7.7 CLASSIFICATION OF ACCIDENT(1979, March, April, May, June, July, Aug, Sept.)

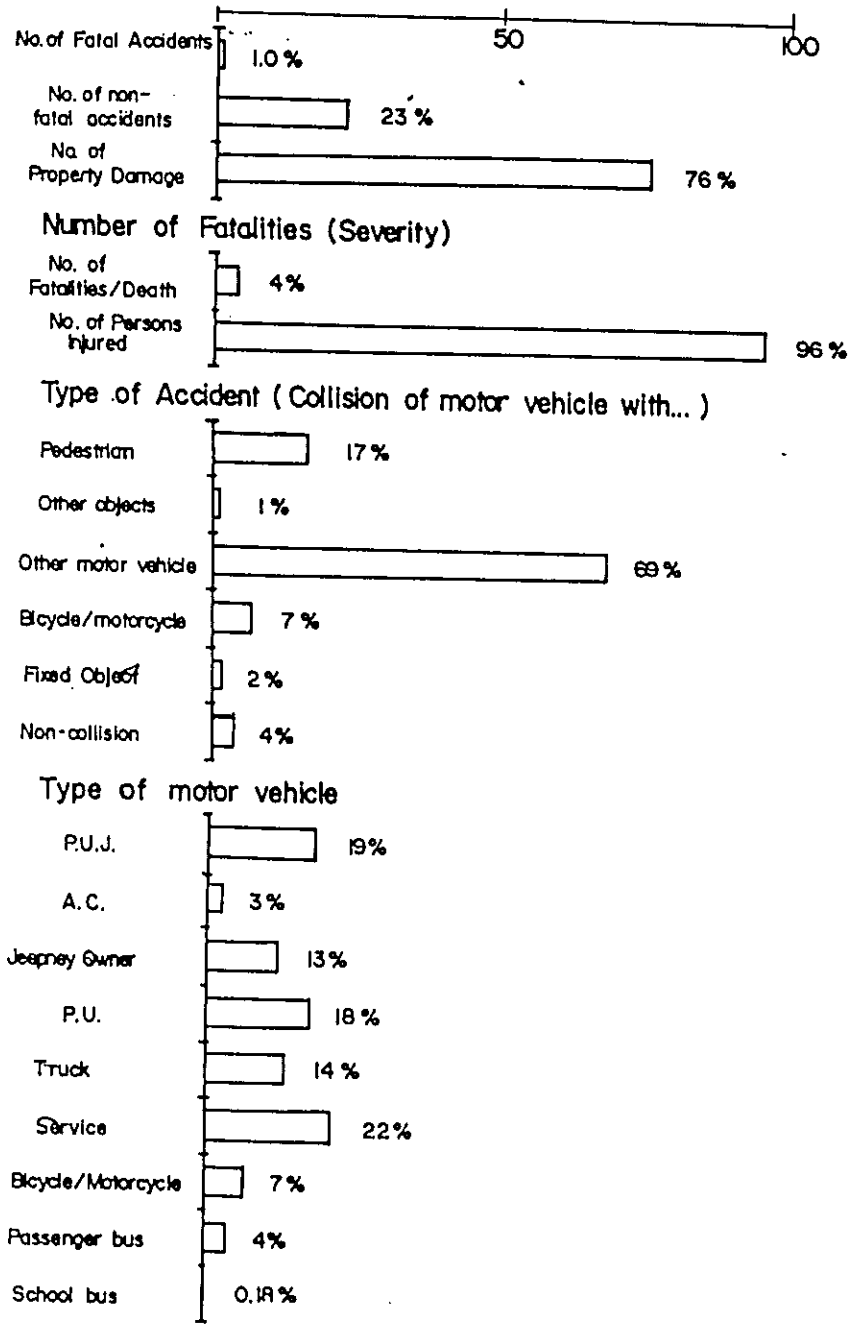
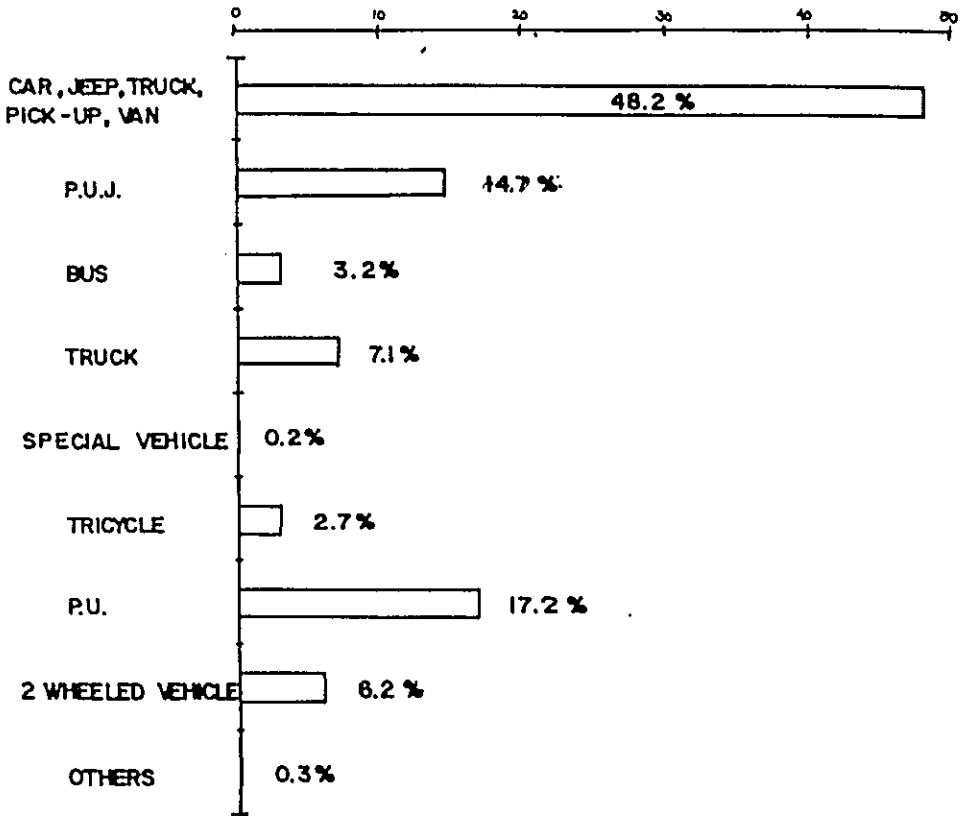


Fig. 7.8 CLASSIFICATION OF MOTOR VEHICLES (%)



4) Traffic Accident Analysis II

Further analysis of traffic accidents will be made based, this time, on 827 accidents recorded by the City Police during a 5-month period from July through November of 1978. The 827 samples represents 48% of the population (a total of 1,712 accidents reported by the Traffic Control Division).

The 827 samples, substantiated by 827 accident records of the City Police, anables the establishment of relationships between traffic accidents and:

(1) The day of the week
(2) The hour of the day
(3) The structural characteristics of the road
(4) The condition in which the driver was
(5) The condition in which the pedestrian involved in the accident was
(6) Weather condition
(7) The place where the accident occurred

Of these relationships, important phenomena are summarized below.

(1) Fluctuation by the Day of the Week

Generally, it appears that accidents occurred more frequently on weekdays than on weekends (and holidays), although no definite trend could be established for each day of the week.

(2) Horuly Fluctuation

The maximum accident hour was from 9:00 to 10:00 A.M., followed by 11:00 to 12:00 A.M. and 4:00 to 5:00 P.M. Plotted into a graph, the accident curve starts rising rapidly rom after 7:00 A.M., reaches the peak in 9:00 to 10:00 A.M., declines to about 34% of the peak level in 12:00 A.M. to 1:00 P.M., rises sharply again and remains at 85% to 95% level of the peak during the hours of ;:00 P.M. through 5:00 P.M., when it drops to a 70% level of the peak and stays at that level until 7:00 P.M., and descends steadily after 8:00 P.M.

It is believed that this hourly fluctuations in the incident of traffic accidents directly reflect hourly changes in the level of daily routine activities of people: commutation to and from work or school, shopping, amusement, and so forth: it is interesting to note that during the lunch hour of 12:00 A.M. to 1:00 P.M. the incidence drops to only about 1/3 of the peak hour level.

(3) Road structure

Most of traffic accidents are noted to have occurred either at intersections, straight road sections, or flat road sections. However, it is only natural that the incidence was high in road sections with a linear horizontal alignment and those with a liner vertical alignment, when it is considered that the entire road network of Davao City has few curved road sections and that the City's downtown areas are spread on a flat land.

(4) Driver's Condition

Vehicle operators are required to observe 18 difference practices

Of the 18, the failure to observe the following 6 are believed responsible for or contributory to the occurrence of traffic accidents (and these failures represent about 90% of total driver violations):

- o Failure to yield right of way
- o Failure to give proper signal
- o Turning in an improper manner
- o Failure to watch side mirrors
- o Failure to watch ahead
- o Failure to practice other elements of good drivership

(5) Pedestrian

A total of 16 pedestrian practices are believed responsible for or contributory to the occurence of traffic accidents. Of the 16, the following 4 pedestrian violations are most significant (representing about 90% of the total pedestrian violations):

- o Road crossing without using a crosswalk
- o Recklessly dashing out into road from behind a parked
- o vehicle
- o Walking on driveway

5) Geometric Road Structure

The geometric structure of road much affects the incidence of traffic accidents. Therefore, the distribution of traffic accidents in Davao City will be analyzed in relation to the geometric road structure at the location of the accident.

(1) Drive Lane

The roads on which a high incidence rate of traffic accidents has been recorded happened to be generally those which constitute the skelton of the City's road network. Although roads with varying overall breadths exist in the City, little difference is observed between national highways, city road, and barangay roads in the pavement width (or carriageway width). The carriageways are not separated into drive lanes by road markings, and overtaking and passeing common practice in the City.

Fig. 7.9 HOURLY CHANGE (179 days)

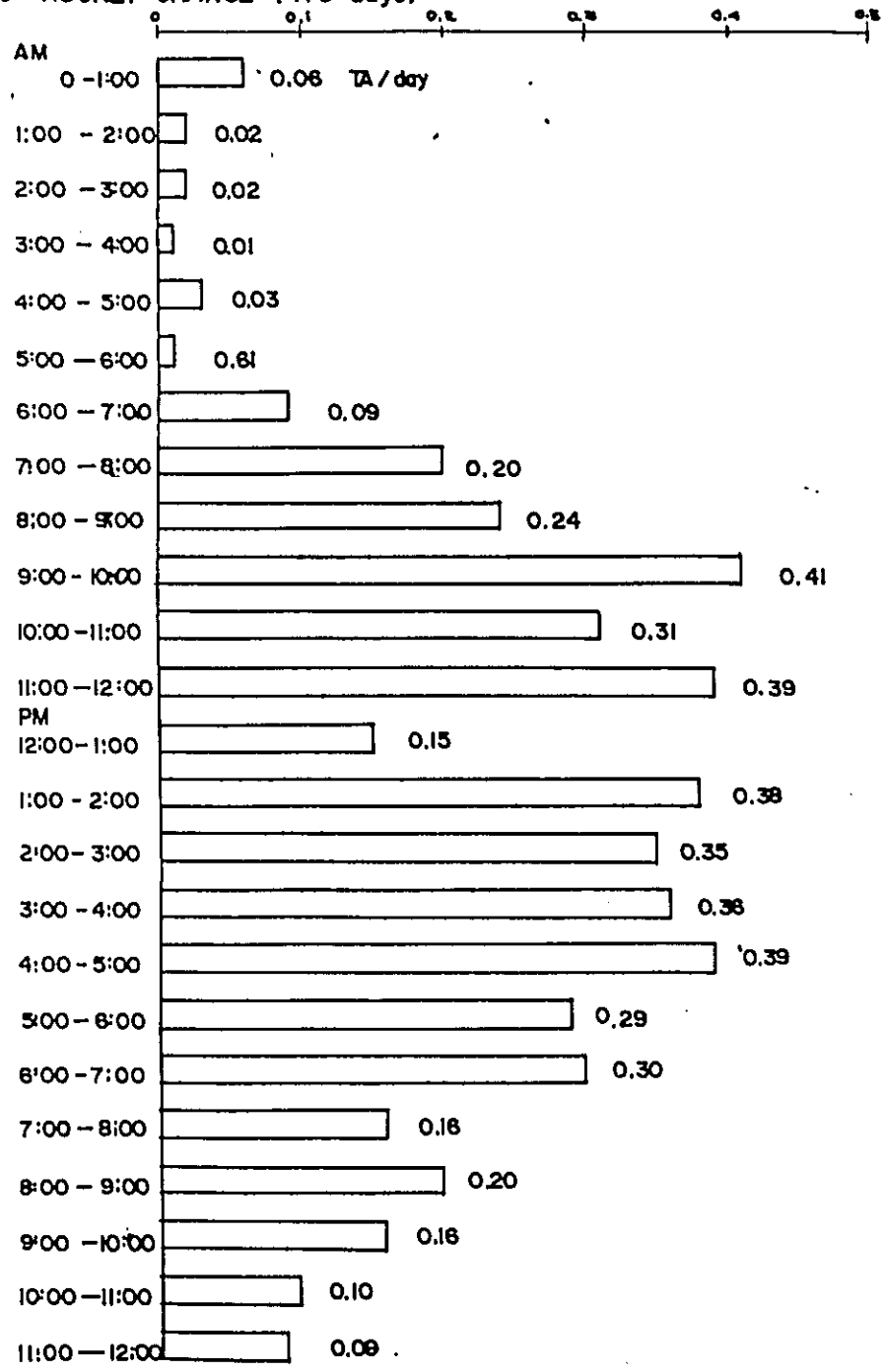


Fig. 7.10 DAILY CHANGE (1978 - March, May, June, July, Aug., Dec.) 179 days

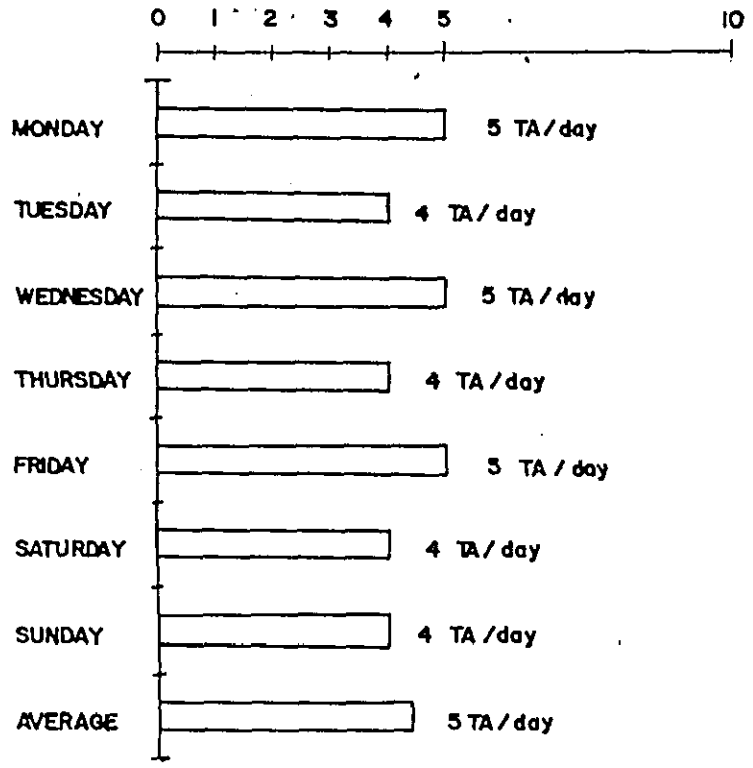


Fig. 7.11 ROAD CHARACTER (%)

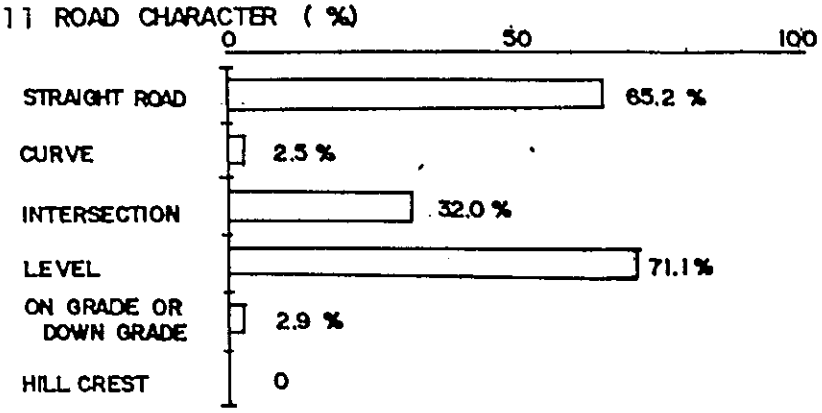


Fig. 7.12 ROAD SURFACE

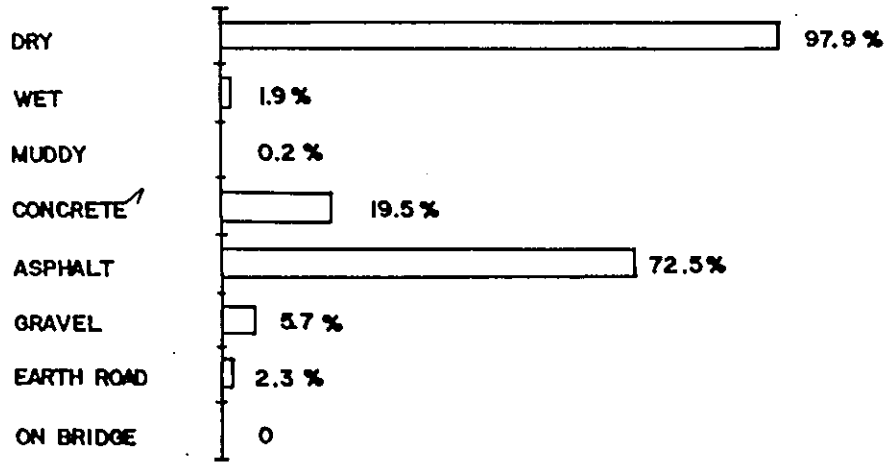


Fig. 7.13 WEATHER

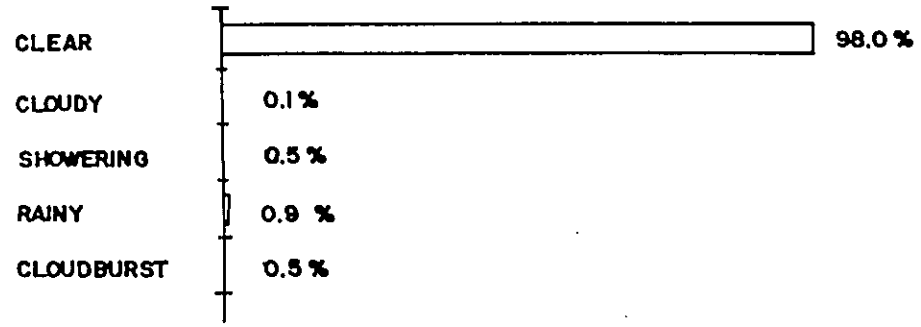


Fig. 7.14 DRIVERS VIOLATIONS:

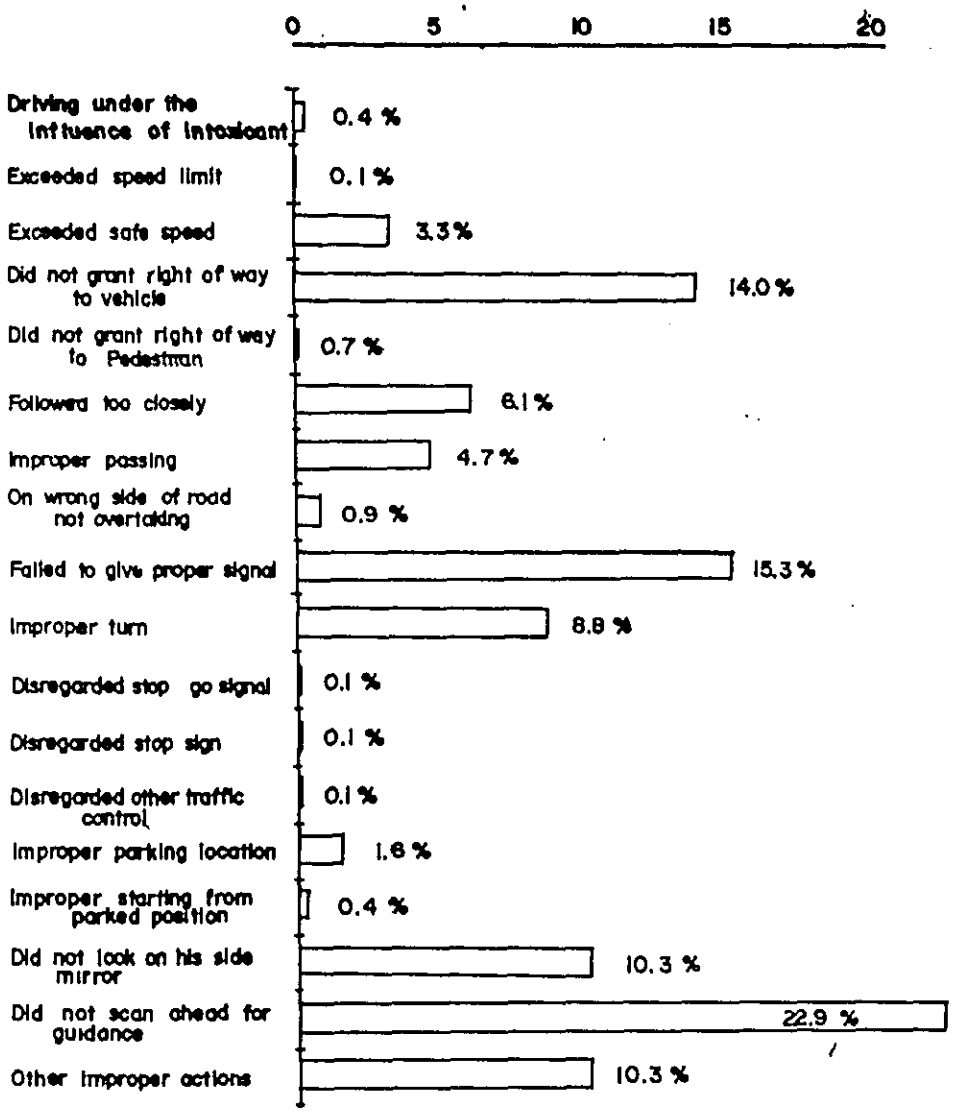
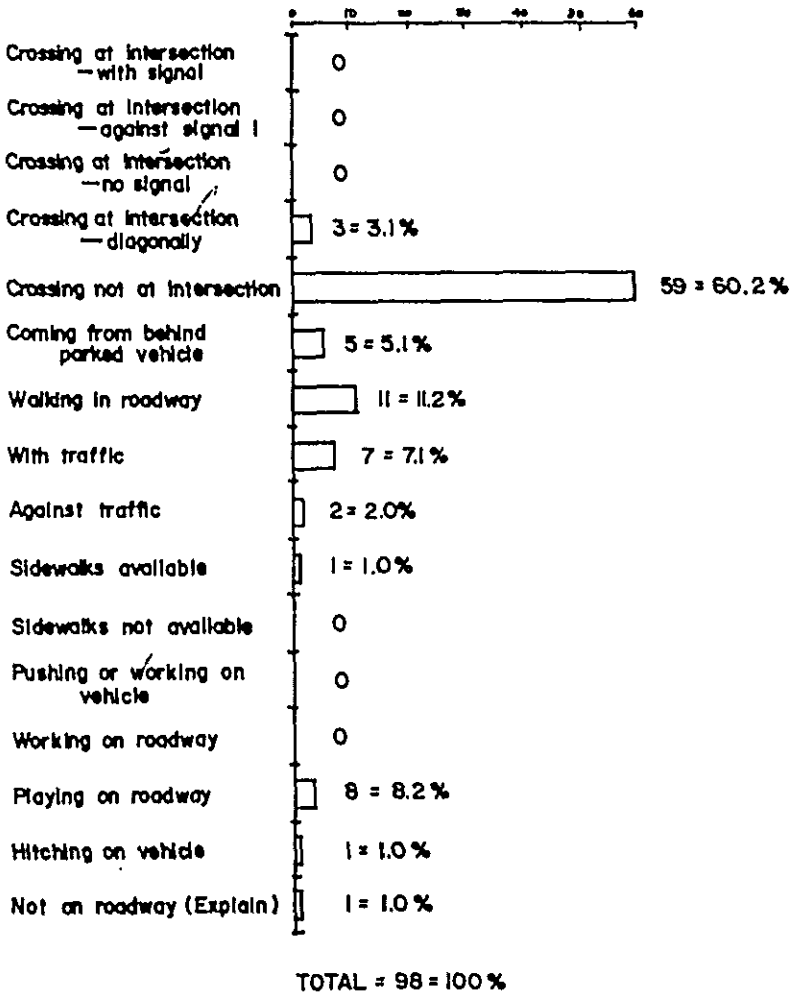


Fig. 7.15 WHAT THE PEDESTRIAN WAS DOING %



(2) Center Median

Portions of national highways in Davao have a center median. It is observed that the incidence of traffic accidents is markedly low in road sections where a center median is installed. For instance, the incidence is very low even though traffic is heavy on Quirino Avenue and Quezon Boulvard, which have a center median.

This proves that the installation of a center median is an effective way to reduce traffic accidents and suggests that the enforcement of one-way traffic (by traffic Ordinance) will facilitate the control of accidents.

(3) Sidewalk

Almost all of roads in the downtown Poblacion have sidewalks of somewhat varying qualities of pavement, either as a part of the overall breadth of the road as by utilyzing a space created by setting back the first floor (ground floor) of buildings. The installation of sidewalks is helpful in preventing traffic accidents from occurring, and this can be substantiated by the 827 samples which show that accidents involving pedestrians occurred when the pedestrian was walking in carriageway.

Therefore, important in the future will be the development/improvement of sidewalks by pavementand/or making clear distrinction between the sidewalk and the drive lane.

6) Traffic Signal

In Davao City, a total of 9 traffic signals are installed currently on Quirino Avenue, San Pedro Street, and C.M. Recto Avenue in L shape. These signals are manually operated by policemen in response to the traffic condition existing from time to time and in accordance with the indications and phases given in the manual.

The installation of traffic signals is an effective means of controlling traffic accidents. However, in Davao City drivers tend to avoid sections where signals are installed.

7) Traffic Rules

Traffic control is being currently accomplished in Davao City using the following 4 tools, whose relationship with traffic accidents will be analyzed.

(1) Speed Limit

The speed limits provided for by Ordinance 778 of 20 to 30 kilometers per hour for trunk roads in Poblacion and other urban areas and of 70 to 80 kilometers per hour for trunk roads in suburban areas are not necessarily observed by drivers in Davao City. Therefore, it is believed that the traffic accident control will be facilitated by the re-assignment of speed limits appropriate to the functional level of each road, as analyzed in detail, and by the implementation in roadside areas of the access control which will be commensurate with the re-assigned speed limit.

(2) One-Way Traffic

One-way traffic is enforced in parts of roads in Poblacion, chiefly where traffic generation is high, where vehicle parking and stopping are much practiced, in downtown areas, in the vicinity of market, and in the vicinity of PUJ terminals. One-way streets are limited to a short distance from an intersection to another.

Little has been observed to directly support the claim that the implementation of one-way traffic will result in the reduction of traffic accidents. However, the fact as seen in the above that the installation of a center median would result in fewer traffic accidents will adequately explain the desirable effect of one-way traffic on accident control.

(3) No Parking

No parking is currently being enforced in portions of roads within Poblacion. The enforcement of no parking is effective on the reduction of traffic accidents, as it was revealed by the 827 samples that a large number of accidents involved pedestrians pluging out from behind a parked vehicle,

that the commonly practiced passing and overtaking due to the absence of drive lane markings have been the cause not only of traffic confusion and the impairment in road capacity but also of accidents, and that accidents actually reduced on San Pedro Street after the designation of no parking zones.

(4) PUJ Loading/Unloading Zone

The analysis of said Weekly Report has indicated that the highest incidence of traffic accidents was registered by the means of public transportation. PUJs are contradictory in that, while they are Davao citizens' "locomotive organ" or their most important means of daily travel, the rate at which PUJs are involved in traffic accidents is very high.

The designation of PUJ loading/unloading zones, as has already been done on San Pedro Street and C.M. Recto Avenue, is strongly needed on other roads for the expansion of road's traffic capacity and for the improvement of passenger safety upon getting on and off the PUJ.

8) Road Signs and Markings

(1) Road Signs

Road signs are currently being installed in the Philippines in accordance with the International Road Signs of 1968, but the extent to which road signs have been installed in Davao is still far from being completes one sees few road signs as he drives in the City.

To be installed are the fallowing three kinds of road signs:

Warning signs

Control signs

Information signs

(2) Road Markings

Road markings are currently been accomplished in the Philippines in accordance with the Road Marking Manual. However, as in the case of road signs, road markings are still inadequate in Davao City.

In the City, the completion of road markings is an urgent need for the purposes of improving intersections and of reducing traffic accidents. In addition, it is of a vital importance that proper road markings is effected whenever a new road is constructed, a road is widened, a traffic signal is installed, and a new traffic control is implemented.