3.3 Sea Transport in Mindanao

3.3.1 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 where roads are still poor, and heavy reliance on marine – and sometimes air-transport continues.

In contrast 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 3.10.

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.

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, provincial 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.

Table 3.10 Estimated Port Passenger Traffic in Mindanao, 1978

Port District	Number of Vessels	Number of Passengers		
		Embarked	Disembarked	Total
Cagayan de Oro	3,588	267,132	196,702	463,834
Davao	2,756	120,182	101,790	221,972
Iligan	4,356	265,296	237,900	503,195
Zamboanga	14,455	1,133,299	1,168,466	2,301,765
General Santos	4,540	91,504	117,935	209,439
Surigao	3,724	81,398	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

3.3.2 Goods Transport

(1) General

While it is only a matter of course that marine transportation enjoys 100% share of inter-island goods transportation, it occupies an extremely large share also in goods flow within Mindanao, where trucks play an insignificant role except in and around Davao and Cagayan de Oro. According to MOTC estimate (TRAPOLI Reports), 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 hinterland of the port cities is small and, therefore, road transportation to and from ports involves only short distances.

The number of ports of various categories existing in Mindanao is shown in Table 3.11. All six of the seven 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.

Table 3.11 Number of Ports in Mindanao, 1978

Port District	Base Ports	Sub-Ports and National Ports	Other National and Municipal Ports	Private Ports and off-shore 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 P.O.A. Annual Statistical Report

(2) Goods Flows

PPA maintains statistics on, in addition to number of passengers, the volume of cargo handled at each port (see Table 3.12).

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 moves 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 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, 25%

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 forest 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 Cagayan de Oro imports are uniquely characterized by a large volume of iron ore 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 3.12 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	735,414	388,469
Surigao	405,238	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 4 CURRENT STATUS OF ROAD FACILITIES

Tables and Figures

CHAPTER 4

CURRENT STATUS OF ROAD FACILITIES

4.1 Road Network

4.1.1 Network Structure

Davao City is located in the southeastern part of Mindanao Island and constitutes one of the most important land, air and sea transportation terminals. Road network of Davao City is shown in Fig. 4.1. The Project Area has developed generally in the shape of a belt extending from north to south along the shore line, and roads in the City have been positioned to meet the demand which has arisen also in parallel to the shore line. The skeleton road running in the north-south direction passes through Poblacion, which is the nucleus of and located at about the center of the City. MacArthur Highway, which connects Toril in the south with Poblacion, runs across the Davao River and handles a traffic of about 30,000 vehicles per day. The City's road network in the south of Poblacion depends on McArthur Highway and a road that branches off from it and runs through Ecoland, crosses Bolton Bridge, and handles traffic from south. Davao-Agusan Road, which extends from Poblacion toward north along the shore line, is important in that it is the only trunk road that connects the industrial areas such as Sasa and Panacan, and Airport with Poblacion.

Areas are not yet urbanized along Diversion Road, which is a part of the Philippine-Japan Friendship Highway and which is positioned about eight kilometers from Poblacion, and the volume of traffic on this road is currently very small at about two to four thousand vehicles per day. In the future, however, this road will become an important one to serve traffic by-passing Poblacion.

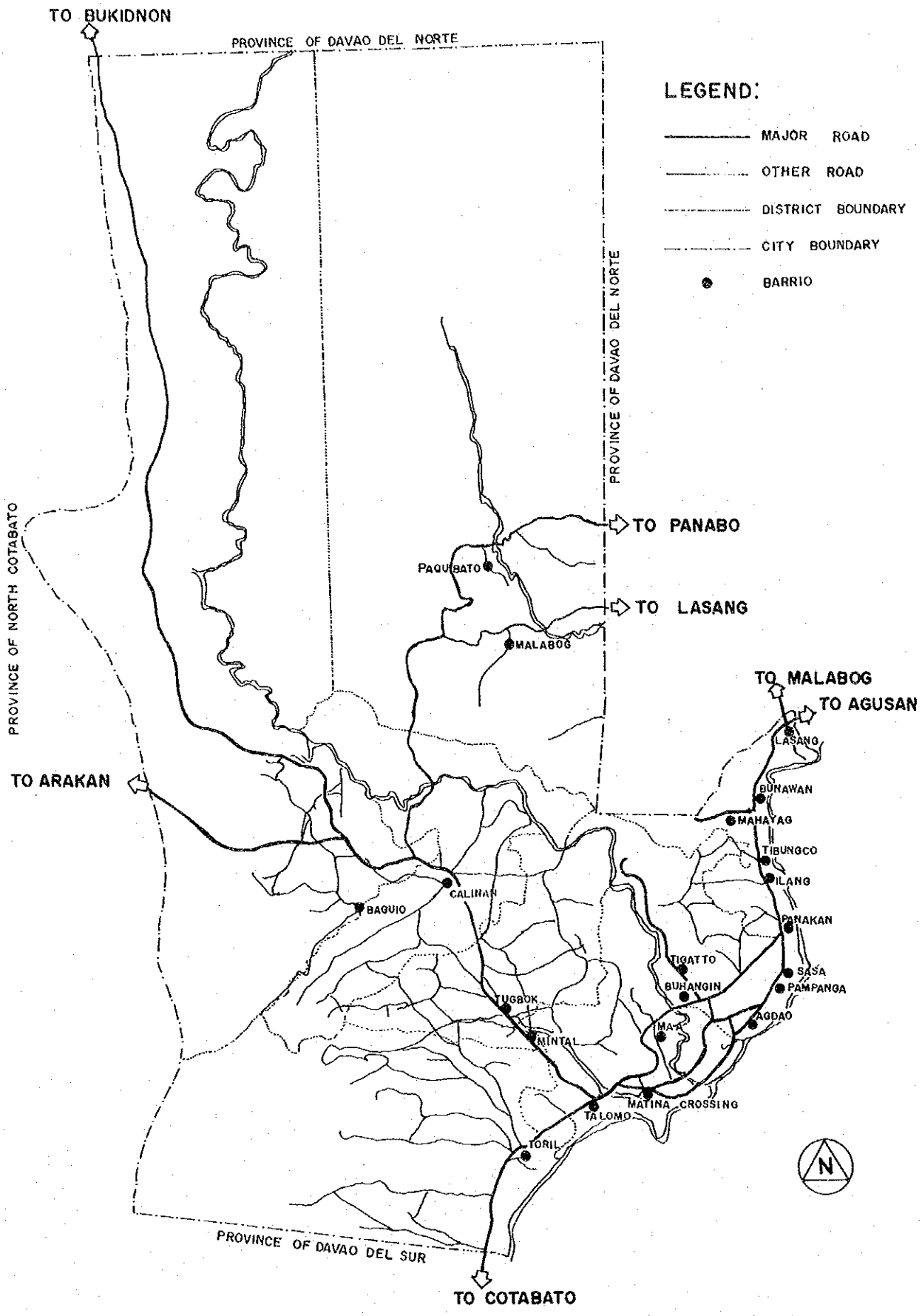


Figure 4.1 Road Map of Davao City

Davao-Bukidnon Road, which runs from inland area to the seaside part of the City, is important not only as the only road to connect agricultural production area with consumption area but also as road to support foreign trade activities. This road will become even more important as "a fuse to ignite" industrial activities in the City by offering the shortest route connecting the industrial areas in the northern part of Mindanao with Davao when Calinan-Kibawe section, which now often becomes non-passable for automobiles due to rain, will be improved.

Important routes in Poblacion are J.P. Laurel Avenue, E. Quirino Avenue, Quezon Boulevard, C.M. Recto Avenue, R. Magsaysay Avenue, and A. Pichon Street. The road network of Poblacion is formed by 11 national roads including said six, which are linked with each other, and by city roads, which are organically connected with the national roads.

4.1.2 Road Functions

Generally, roads (and highways) are classified by their functions into four namely: (i) Major roads (having the capacity of accommodating a large volume of traffic moving at a high speed for a relatively long distance between cities by-passing cities, (ii) Secondary roads (which handle urban traffic within an area surrounded by major roads, connecting traffic generating sources in said area and providing traffic with rational access to major roads), (iii) Collector roads (which collect traffic on local roads onto secondary and/or major roads, providing connections between such roads), and (iv) Local roads (to support the livelihood of local inhabitants serving the needs of roadside residential areas).

In order for roads to guarantee the smooth flow of traffic, they must have a structure that is suitable to the function each road is expected to perform. In addition, urban roads are expected to perform other functions of an open space, such as the facilitation of disaster prevention, ventilation, and lighting. These multiple functions of roads must be taken into consideration in planning a road network.

In view of the formation of Davao City road network, the width of, and the volume of traffic on, each component road, and other observations, it is judged that national roads may be classified as major roads, with the exception of R. Castillo Street and F. Torres Street. However, it is difficult to determine the classification of other roads in the network.

Roads in Davao City are generally narrow. Particularly roads in Poblacion, all have about the same width, and, therefore, traffic is seen to diverge from every road to every road in disorderly manners. As a result, each road is usually under competition between large vehicles and small vehicles and between traffic on a long trip and that on a short trip. Also, major roads are seen to fail performing the expected functions (high speed, large traffic capacity) due to very short intervals between intersections which resulted from the direct connection of narrow streets with major roads. In order to guarantee the smooth flow of traffic in Davao City, therefore, it will be essential that the function of each road be clearly identified, that roads be developed in commensuration with their function, and that an effective traffic management system be introduced concurrently.

4.2 Current Status of Road Facilities

4.2.1 Road Extension

Roads in Davao City are classified by jurisdiction into (i) national roads, (ii) barangay roads, and (iii) city roads. National roads are managed and maintained by the Highway District Engineer's Office of MPWH, barangay roads by Ministry of Local Government and Community Development and city roads by the City Engineer's Office of the City Government (See Fig. 4.2).

An inventory of these roads are presented in Table 4.1. below. Davao City road network consists of roads whose total length is 1,731 kilometers, 12% of which (or 204 kilometers) are national roads, 62% (1,080.3 kilometers) are barangay roads, and 26% (446.5 kilometers) city roads.

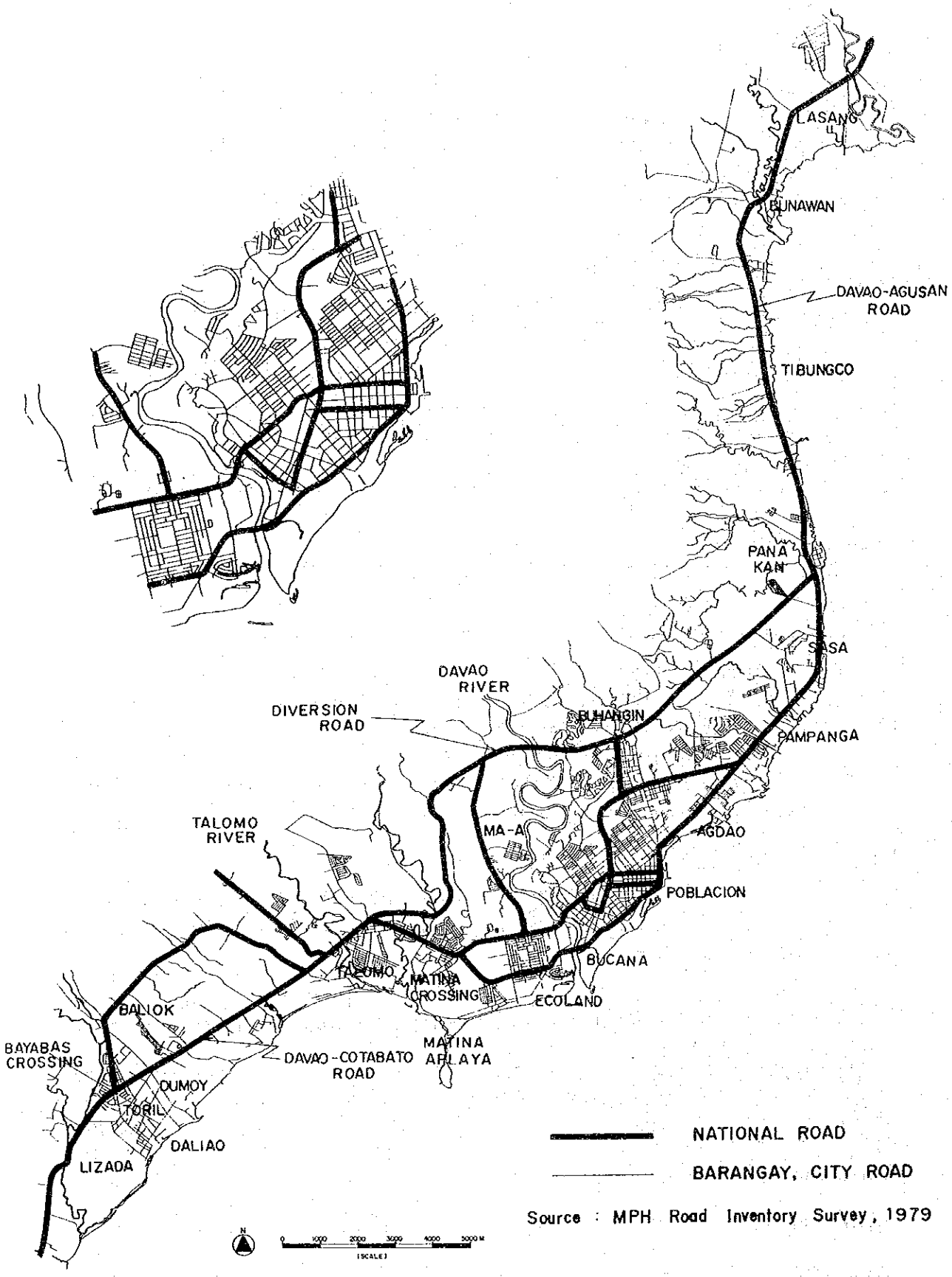


Figure 4.2 Administrative Classification of Roads

Table 4.1 Condition of Existing Road/Street

District	Road Length (km.)				Pavement (km.)				Road Density (km./km.^{2})	Length per 1000-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	0.69
Bunawan	12.6 (10)	88.5 (73)	20.9 (17)	122.0	12.6 (100)	–		12.6 (10)	1.9	–
Buhangin	16.6 (10)	117.0 (71)	31.3 (19)	164.9	13.9 (84)	–		13.9 (8)	1.8	2.19
Talomo	42.8 (23)	92.7 (51)	47.8 (26)	183.3	42.9 (100)	10.0 (11)	6.1 (13)	58.9 (32)	1.7	2.56
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	7.66
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)	1,080.3 (62)	446.4 (26)	1731.0	120.0 (59)	29.5 (3)	60.7 (14)	210.2 (12)		

Source: MPH Road Inventory Survey, 1979

The total length of roads existing within the Project Area is 398 kilometers or 23% of the City's total, while the land size of the Project Area is only 7.4% of the total areal size of the city. In other words, road facilities per unit of land is greater in the Project Area than in non-Project Area. On the other hand, road facilities per inhabitant is conversely smaller in the Project Area, in view of the 66% composition rate of the Project Area population to the entire City population.

4.2.2. Pavement Status

Of said total length of roads in Davao City, only 12% (or 210 kilometers) are paved (see Table 4.1). This pavement ratio is lower than those in other cities in the Philippines (see Table 4.2).

Table 4.2 Comparison of Pavement Ratio with Other Cities

City	Road Length by Pavement Type (Km)				Pavement Ratio (%)
	Concrete	Asphalt	Gravel	Total	
Metro Manila 1/	1,386.9	925.1	347.3	2,659.3	87
Metro Cebu 2/	79.8	297.9	664.5	1,042.2	36
Davao City 3/	69.1	141.1	1,520.8	1,731.0	12

Source: 1/ MPH Road Inventory Survey, 1980
2/ MPH Road Inventory Survey, 1979
3/ MPH Road Inventory Survey, 1979

Only 59% of national roads, 14% of City roads, and 3% of barangay roads are paved in Davao City. In the Project Area, pavement ratios are low at 14.3% for barangay roads and 41.6% for city roads, but the high 90% pavement ratio of national roads pushes the overall average up to 43.1% in comparison with the 12% of the entire city (See Table 4.3). Some downtown portions of a national road are still left unpaved. Although R. Castillo Street is the shortest access to Poblacion from the north, traffic on this road is currently light at about only 2,000 vehicles per day with inevitable traffic diversion to J.P. Laurel Avenue (volume of traffic is 12,000 vehicles per day), because only 1.5 kilometers are paved out of the total length of R. Castillo Street of about three kilometers. In addition, such major roads as M. Quezon Boulevard and J.P. Laurel Avenue are poorly paved and maintained.

The observed inadequate pavement and maintenance of major roads are believed to impair the safety, economy, and the user amenity of such roads. Vehicle running cost is estimated for each type of road surface condition in Table 4.4 below. Such cost is 23% lower on paved roads than on gravel roads, and it is believed that roads with average daily traffic in excess of 400 vehicles should be paved for better economy.

Table 4.3 Surface Conditions of Existing Road/Street in the Project Area

Surface Type	National Road 1/	City Road 2/	Barangay Road 3/	Total
PCC Pavement	59.2	3.8	—	63.0
AC Pavement	29.6	56.6	22.1	108.3
Gravel	9.8	70.7	99.9	180.4
Earth	—	14.2	31.7	45.9
Total (km)	98.6	145.3	153.7	397.6
(%)	(25)	(36)	(39)	(100)
Pavement Ratio (%)	90.0	41.6	14.3	43.1

Source: 1/ MPH, Road Inventory Survey, June 1979
2/ MPH, Road Inventory Survey, May 1979
3/ MPH, Road Inventory Survey, October 1978

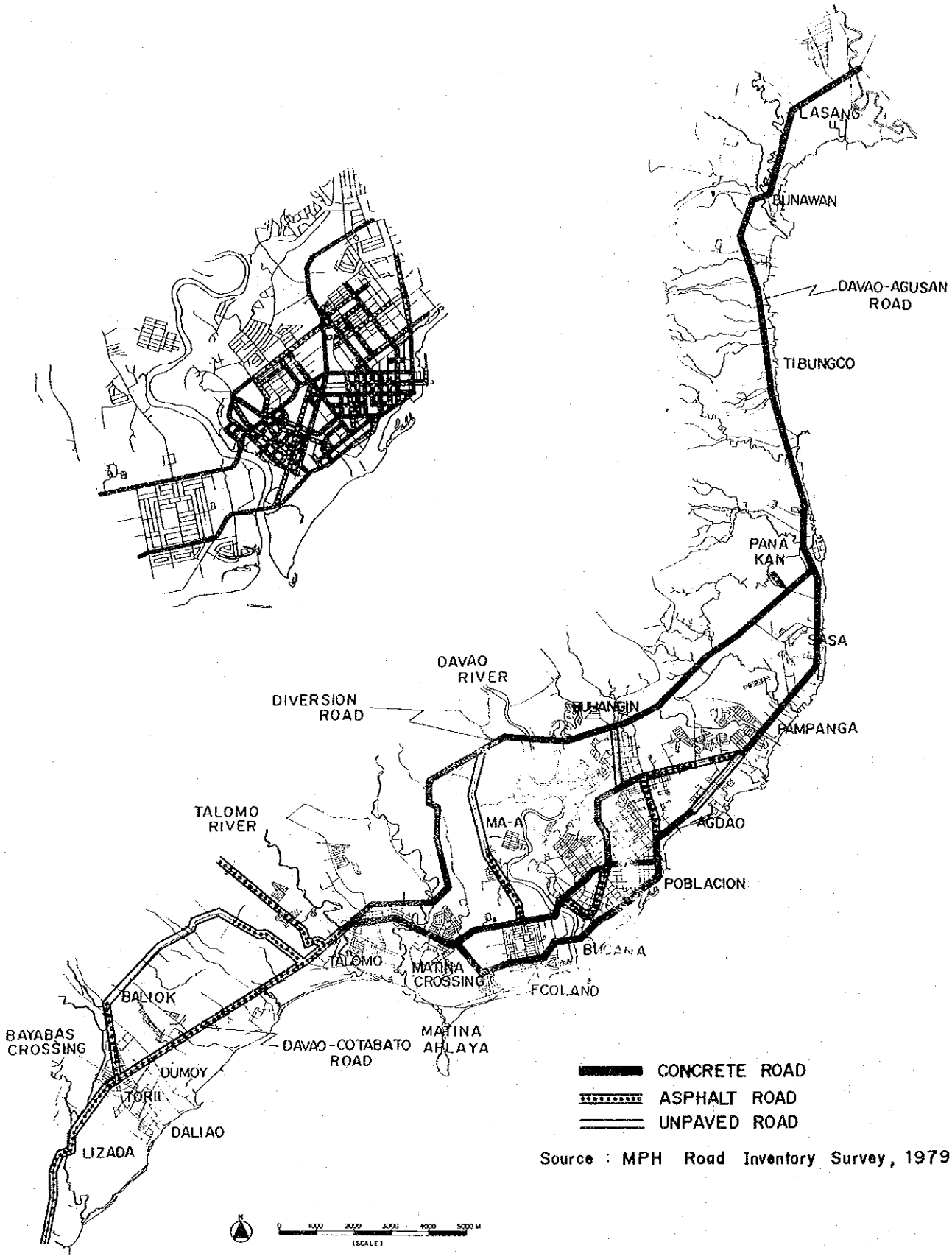


Figure 4.3 Road Surface Map

Table 4.4 A Comparison of Vehicle Running Cost by Road Surface Condition

(Cost Including Tax in Pesos/Vehicle/km)

	Car	Jeep	PU Taxi	Jeepney & AC	Bus	Truck
Paved Road	0.812	0.855	0.622	0.784	1.354	1,393
Gravel Road	1.056	1.112	0.809	1.019	1.760	1.811

Source: Highway Planning Mannual, PPDO, MPWH

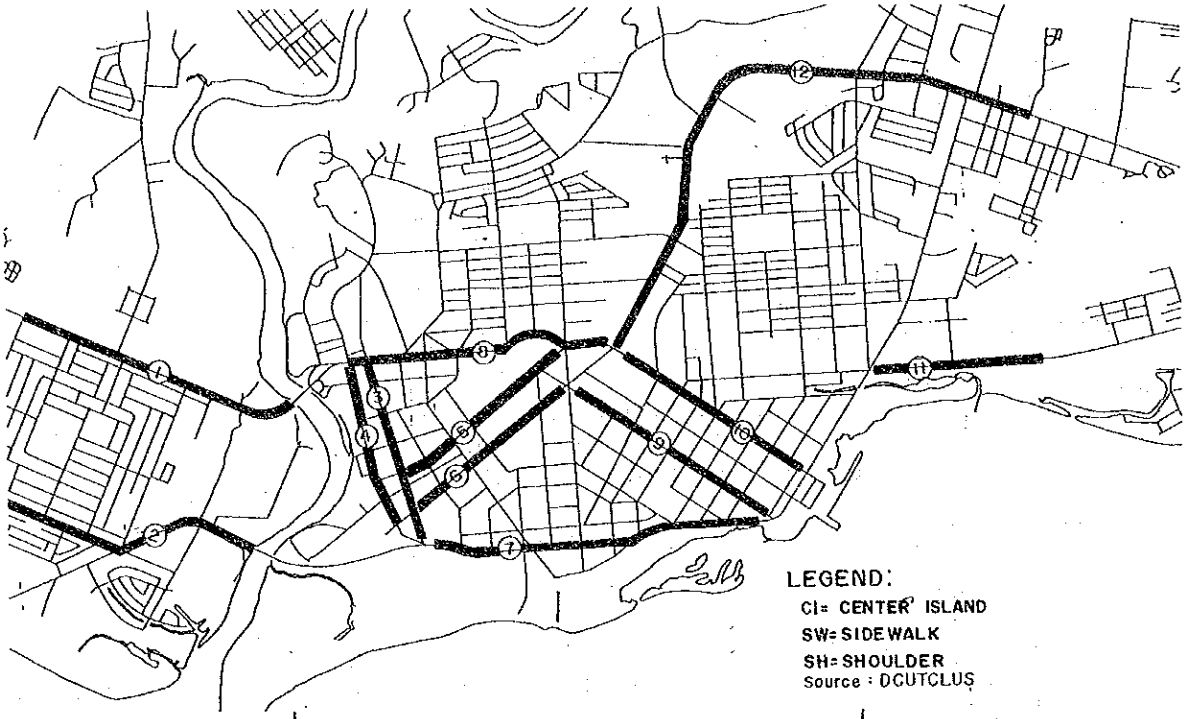
4.2.3 Road Space

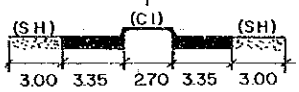
Many functions which roads can perform are roughly classified into (i) traffic movement, (ii) land utilization induction, and (iii) open space. The last is particularly important in urban areas where open spaces for public use are scarce. Roads can offer spaces for basic urban need, such as disaster prevention space (evacuation road, rescue road, strip of open space to deter the spread of a fire), space to offer an environment of life (space for ventilation, lighting, recreational or social activities), and utility space (for the installation of gas and water pipes, electric cables, sewage pipes, etc.).

Road density in Poblacion is 8.2 kilometers per square kilometer (including local roads; see Table 4.1), which means that roads occur at an average intervals of about 250 meters. A lower density of two to three kilometers per square kilometer is registered in other districts. Road spaces are on the shortage in other districts and, in view of the future land use, it is hoped that road density in parts of the Project Area outside Poblacion be improved at least to the level of Poblacion.

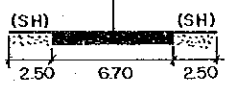
4.2.4 Trunk Road Cross Sections and Safety Facilities

The alignment of roads existing in the Project Area is good, because of the flat terrain of Poblacion and other sites of the roads, but they are generally narrow. Most of the roads in and around Poblacion are two-lane roads, and four-lane roads are limited to parts of E. Quirino Avenue, R. Magsaysay Avenue, and M. Quezon Boulevard in Poblacion (see Figure 4.4). Only those in Poblacion are urban roads and roads in other areas are still classified as rural roads, whose design standards used for the Highway Projects implemented in the Philippines under the cooperation of the World Bank are shown in Table 4.5.

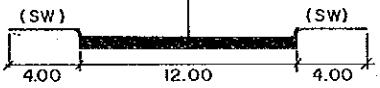




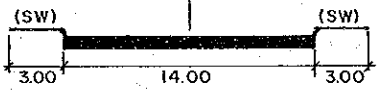
1) Mc ARTHUR HIGHWAY



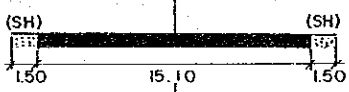
2) BOLTON DIVERSION ROAD



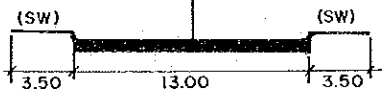
3) SAN PEDRO ST. (Corner Illustre St.)



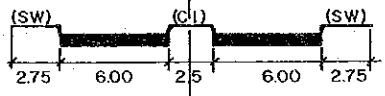
4) A. PICHON ST. (Cor. Bolton)



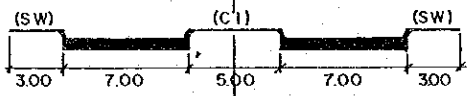
5) C. BANGOY ST.



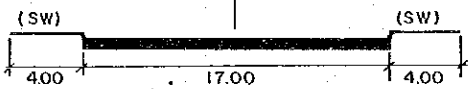
6) C. M. RECTO ST. (Cor. San Pedro St.)



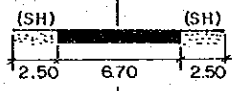
7) M. QUEZON BLVD. (Cor. San Pedro St.)



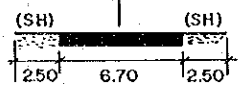
8) E. QUIRINO AVE. (Cor. Gen. Luna St.)



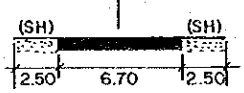
9) R. MAGSAYSAY ST.



10) STA. ANA. AVE.



11) R. CASTILLO ST.



12) J. P. LAUREL AVE.

Figure 4.4 Cross-Section of Major Roads

Table 4.5 Highway Design Standards

Terrain	Flat			
Class of Road	II	III	IV	V
Annual Average Daily Traffic	400	1,000	2,000	2000 +
Design Speed (Km/h)	60	80	80	100
Travelled-Way width (m)	6.0	6.7	7.0	7.3
Shoulder width (m)	1.5	2.0	2.4	3.0
Pavement Type	G BST	G AC	AC	AC PCC
Normal-Right-of-Way Width (m)	30	30	60	60

Source: IBRD Highway Projects (Recommended Highway Design Standards)

AC : Asphalt Concrete
PCC : Portland Cement Concrete
BST : Bituminous Surface Treatment
G : Gravel

Shown in Figure 4.5., are the locations and sections of roads which have sidewalks, which is important to the safe, smooth, and pleasant passage of pedestrians. These sections that have sidewalks are rather small for urban roads. Also, discontinuation of sidewalk surface is ubiquitous, as in the case of A. Pichon Street parts of which sidewalks are still unpaved.

The installation of guardrails, lights, and other traffic safety facilities and of road signs, markings, and other traffic control facilities is still very limited and is far from guaranteeing traffic safety.

With regard to the future urban traffic planning for the City, extremely important will be the full development of sidewalks and traffic safety and control facilities.

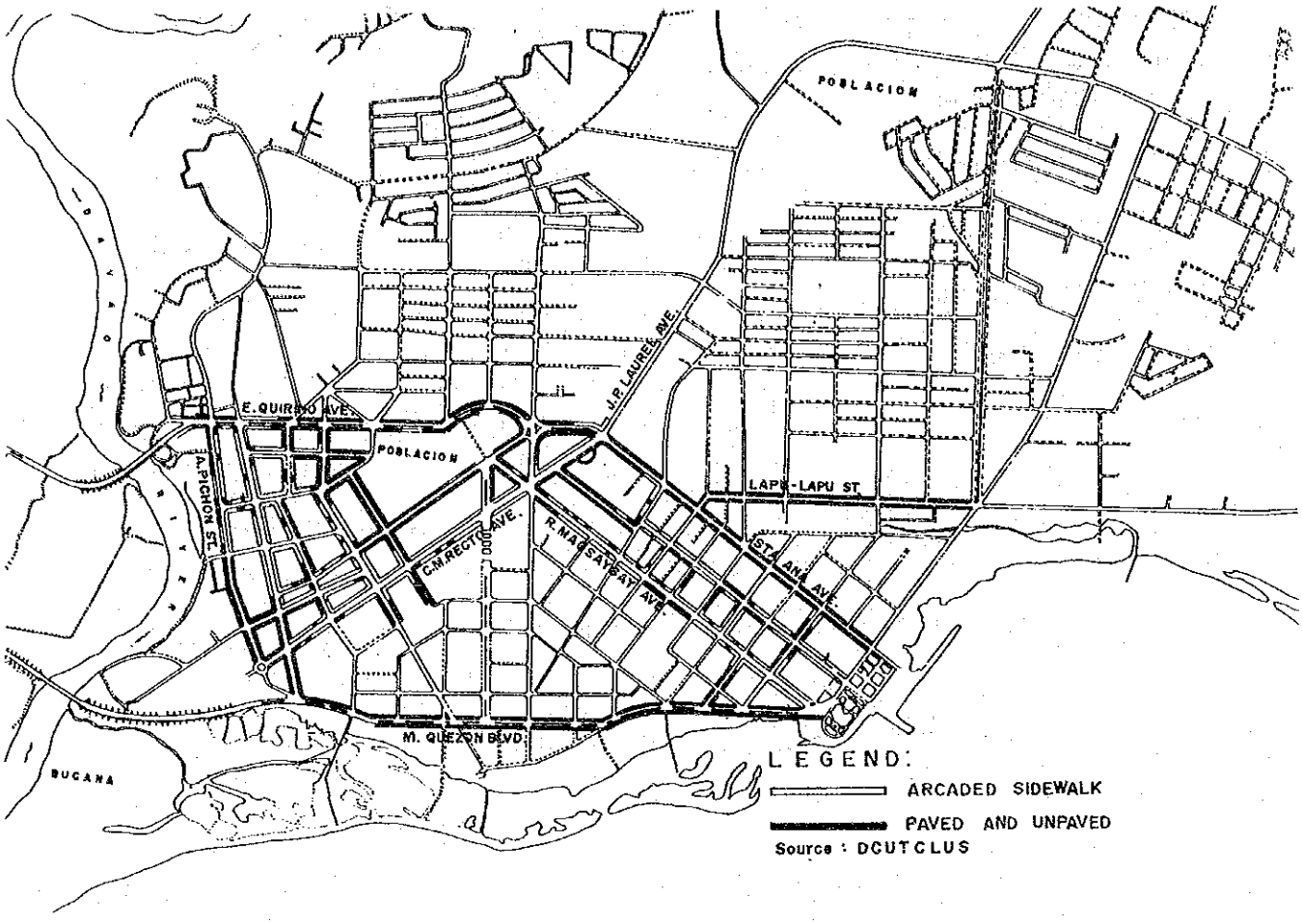


Figure 4.5 Location of Existing Sidewalks and Center Median

4.3 Road Construction and Maintenance

4.3.1 Road Construction History

During the period of 1972 through 1979, from 2% to 10% of total Ministry of Public Highways (MPH) investment in the construction and improvement of national roads were yearly allocated to the Regional Office (Region XI), and in turn, from 2% to 17% of this regional allocation were invested in Davao City (see Table 4.6). With these investments, only 7.6 kilometers of roads were improved in 1977, and 8.3 kilometers in 1978. The low road densities and pavement ratios support the presumption that road investments have been rather inadequate for Davao City. This was because priority emphasis has been planned on the construction and improvement of inter-city roads and the construction of farm-to-market roads.

In 1978, city funds in the total amount of 1.36 million pesos were spent for the construction/improvement of a total length of 20.8 kilometers of city roads. Likewise, in 1979, 2.96 million pesos were spent on 14.9 kilometers of city roads.

As indicated, road development has so far progressed slowly in Davao City. It is hoped that the pace of road development be much accelerated in the future in the interest of citizens' amenity and convenience as well as to support economic and industrial activities.

Table 4.6 The Record of Yearly MPH Investment for the Construction/Improvement of National Roads

(1,000 Current Pesos)

Year	All Philippines	of which share of Region XI		of which share of Davao City	
1972	545,500	45,600	(8.4)	920	(2.0)
1973	669,500	22,400	(3.3)	2,130	(9.5)
1974	1,004,000	23,800	(2.4)	4,060	(17.1)
1975	1,004,000	49,000	(4.9)	3,050	(6.2)
1976	1,361,000	46,100	(3.4)	3,000	(6.5)
1977	1,263,000	80,500	(6.4)	2,000	(2.5)
1978	1,612,000	118,400	(7.3)	2,000	(1.7)
1979	1,189,000	117,500	(9.9)	7,000	(6.0)

Source: PPDO, MPH

4.3.2 Road Construction in Davao City: Current Status

Cost comparison for the past three years in Davao City is presented by major construction pay items in Table 4.7. The cost of bituminous pavement has markedly risen due to the rise of petroleum price. More than 20% increases were registered for

steel bars, structural steel, and concrete during 1978 to 1979, and these increases must be said very rapid in comparison with 12% consumer price increase in Region XI during the same period. MPH's Bureau of Construction has tabulated road construction record data and, based on such data, calculated average unit construction cost per kilometer of two-lane, two -way road for each surface type (see Table 4.8).

Some 34 construction contractors are currently in business in Davao City according to the Davao Business and Trade Directory, 1979 edition. Only four of them belong to the Ministry of Public Works and Highways (MPWH) classification Medium-B, the remainder being small scale contractors. According to MPWH Classification, construction contractors are classified into six categories (Large-A, Large-B, Medium-A, Medium-B, Small-A, and Small-B) according to their performance records in project execution, and contractors who have successfuly completed a project or concurrent projects whose total construction expenses range between 7.5 million and 15 million pesos are classified as Medium-B. Thus it appears that opportunities available to the most of these Davao contractors are projects on which the Regional Office of MPWH has the authority of awarding contract, namely projects of 1.0 million pesos or less.

Private capitals have often funded the construction of roads, such as those incidental to the development of subdivisions or commercial centers. Some of these privately constructed roads which are higly utilized by the populace are often donated to or bought by the Government and maintained by MPWH or the local authority. In Davao City, local roads in Juna Subdivision have been transferred to the City and are being maintained by the City Engineer's Office.

Table 4.7 Unit Prices for Road Construction Pay Items

(Current Pesos)

Item 1/ No.	Description	Unit	Unit Prices July 1978	Unit Prices July 1979	Unit Prices Jan. 1980	Increase in Unit Price 1978-1979
						%
105	Roadway & Drainage Excavation	cu. m.	9.00	10.70	11.50	19
107	Borrow (Common)	cu. m.	21.00	25.00	26.00	19
108	Aggregate Sub-base	cu. m.	35.50	39.00	40.00	10
110	Foundation Fill	cu. m.	34.00	37.00	39.00	9
200	Aggregate Base Course	cu. m.	43.00	50.00	53.00	16
310	Bituminous Concrete Surface Course	M.T.	320.00	430.00	480.00	34
316	P.C.C. Pavement (0.23 m thick)	sq. m.	72.00	85.00	95.00	18
405	Concrete Class "A"	cu. m.	580.00	710.00	800.00	22
406	Reinforcing Steel	kilo	6.50	8.40	9.20	29
407	Structure Steel	kilo	12.50	15.50	17.00	24
502	Combined Concrete Curb and Gutter	lin.m.	52.50	60.00	65.00	14
503	Concrete Sidewalk	sq. m.	42.50	47.50	50.00	12

Source: Region XI, MPH
Contractors in Davao City

Note: 1/ Item number corresponds to that in "Philippines Standard Specifications for Highways and Bridges (Revised 1972)"

Table 4.8 Construction Cost of Each Kilometer Road

(1,000 current Pesos)

Type of Surface	Terrain	Construction Cost			Increase in Cost (%)	
		July 1978	July 1979	July 1980	78-79	79-80
Portland Cement Concrete Pavement t = 0.23 m	Mountainous	1,910	2,340	2,720	23	16
	Rolling	1,230	1,560	1,840	27	18
	Flat	1,060	1,330	1,600	25	20
Bituminous Concrete Pavement (t = 0.05 m)	Mountainous	1,550	1,830	2,250	18	23
	Rolling	870	1,050	1,370	21	30
	Flat	690	820	1,120	19	37
Gravel (Aggregate Subbase t = 0.15 m) (Aggregate Base Course t = 0.15m)	Mountainous	1,260	1,460	1,700	16	16
	Rolling	590	680	820	15	21
	Flat	410	450	570	10	27

Source: Bureau of Construction, MPH

Note: Pavement width = 6.7 m
Roadbed width = 11.7 m
Shoulder width = 2.5 M + 2.5 M = 5.0 M (Gravel)

4.3.3 Road Maintenance System

Road Maintenance projects are undertaken by administration by MPWH or the local government. In Davao City, national roads are maintained by the Highway District Engineer's Office of MPWH, city roads by the City Engineer's Office, and barangay roads by the Ministry of Local Government and Community Development. In the alleviation of diseconomy of separate individual authorities owning and maintaining road maintenance equipment, the Equipment Service Center established in each region by the Bureau of Equipment, MPWH, is engaged in the centralized administration and maintenance of construction equipment and lends the equipment to the Highway District Engineer's Office and the City Engineer's Office.

National road maintenance budgets are determined by "equivalent maintenance kilometer" (EMK) system. Under this system, the length of road to be maintained is translated into equivalent maintenance kilometer (e.m.k.) using coefficients prescribed for each of three different road widths, six types of road surface, and three levels of average daily traffic, and the budget amount is arrived at by multiplying the basic cost (annual unit maintenance cost per each e.m.k.) by the thus calculated/value of e.m.k.

For the allocation of maintenance funds to the Highway District Engineer's Office, three steps are followed: (1) each of the Highway District Engineer's Office calculates e.m.k. based on data from the road inventory, based on which maintenance

program is formulated and submitted to the Central Government via the Regional Office; (2) the Central Government determines the total maintenance budget based on the submitted maintenance programs; and (3) the Bureau of Maintenance allocates the total budget to each of Highway District Engineer's Offices. The allocated budget is paid quarterly to the Highway District Engineer's Office. In the last of these steps, various fund reserves are retained: 10% of the total budget is set aside as the Minister's discretionary fund, and at the Regional Office, 42% is retained for equipment, rental, 5% as discretionary fund, and 10% as calamity fund.

City and barangay road maintenance is subsidized by the national government. The subsidy equals to 33.3% of basic cost per kilometer in the case of city roads and to 40% of same in the case of barangay roads.

4.3.4 Road Maintenance: Current Status

Against the requested annual Bureau of Maintenance budget of 14,970 Pesos (in 1979) per each e.m.k., the approved budget was 11, 342 Pesos. Maintenance fund allocations to Davao City during the past three years are listed in Table 4.9.

Table 4.9 Road Maintenance Fund Allocation to Davao City

(1,000 Current Pesos)

Year	National Road	Barangay Road	City Road
1977	1,583	1,127	1,593
1978	2,173	282[1/]	3,192
1979	1,764	242[2/]	3,485

Source: City Engineer's Office, Davao City

Notes: [1/] 2nd Quarter (Apr. - June) only

[2/] 4th Quarter (Oct - Dec.) only

Authorities have been held from accomplishing, in full, the responsibility of road maintenance due to such serious problems as:

- Insufficient budget and delay in budget allocation
- Non-availability of needed equipment at needed time
- Shortage of engineers and skilled laborers

Due to inadequate maintenance, road surfaces are in poor condition on the whole. Asphalt-paved sections suffer from general alligator cracks and frequent pot holes, ruttings, and washboard-creases. Particularly, Davao-Cotabato Road in the vicinity of Talomo, Quezon Boulevard, and A. Pichon Street are noted of damage so serious that re-pavement is believed necessary.

Concrete-paved sections are in a relatively good surface condition, except for local ravelling, lateral and longitudinal cracks, damaged joints, and cracked corners. In many

places, gravel shoulders have sunk to create a step between the shoulder and concrete plates. Many road sections are submerged in heavy rain due to the lack of or the poor maintenance of drainage facilities.

CHAPTER 5 ROAD TRAFFIC

Tables and Figures

CHAPTER 5

ROAD TRAFFIC

5.1 Characteristics

5.1.1 Traffic on Trunk Roads

Counts of traffic on trunk roads are graphically presented in Figure 5.1. Davao-Cotabato Road and Davao-Agusan Road, which run in the north-south direction, are the artery of Davao City, and the volume of traffic between Toril and Bunawan is currently from 7,000 to 15,000 vehicles per day. On this longitudinal trunk road, the volume of traffic rises near the edge of Poblacion, reaching the level of about 30,000 vehicles per day at Bankerohan Bridge over the Davao River, and, at Bolton Bridge, about 10,000 vehicles per day. On the other hand, a majority of traffic flowing into Poblacion from north uses 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.M. Recto Avenue, A. Pichon Street, and San Pedro Street, each with 15,000 to 20,000 vehicles per day.

Uneven split of traffic between two directions on the same road on trunk roads is shown in terms of heavy-direction rate (of the two directions in which traffic move on the same road, the rate of traffic volume on the heavier direction to the both-direction total) for morning and evening peak hours in Table 5.1. Of these, the highest heavy-direction rate of 74% is recorded at Bankerohan Bridge during the morning peak hour. On other routes, the rate ranges from 53% to 63%.

It is noted that the directional inclination of traffic demand is inverse between the north of Poblacion and the south of Poblacion. That is, in the morning peak hour, during which commuters (to work or to school) represent the majority of traffic, traf-traffic moving toward north away from Poblacion is greater than that moving from north toward Poblacion, reflecting the existence of numerous job concentrations as in Sasa and Panacan in the north of Poblacion while in the south, traffic heading to Poblacion is conversely greater than that heading to Toril, reflecting the high reliance of southern areas on Poblacion for employment and education. Thus, traffic movements toward workplaces and schools explain the directions of traffic polarity.

Table 5.1 Directional Inclination of Traffic Movement

Location	Peak Hour	Traffic Volume: Both Direction (Veh./h.) (A)	Traffic Volume: Heavier Direction (veh./h.) (B)	Heavy Direction rate (B)/ (A) x 100	Direction with Heavier Traffic
G.S.I.S.	Morning	1,074	794	74	To Poblacion
(Davao-Cotabato Road)	Evening	1,237	721	58	To Talomo
Bankerohan Bridge	Morning	2,225	1,370	62	To Poblacion
	Evening	2,184	1,284	59	To Talomo
Bolton Bridge	Morning	1,097	688	63	To Poblacion
	Evening	942	586	62	To Ecoland
Sasa	Morning	749	395	53	To Panacan
Davao-Agusan Road)	Evening	618	329	53	To Poblacion
J. P. Laurel Ave.	Morning	1,247	773	62	To Sasa
(R. Castillo Intersection)	Evening	1,117	649	58	To Poblacion

Source: Vehicle Count Survey in 1979, DCUTCLUS

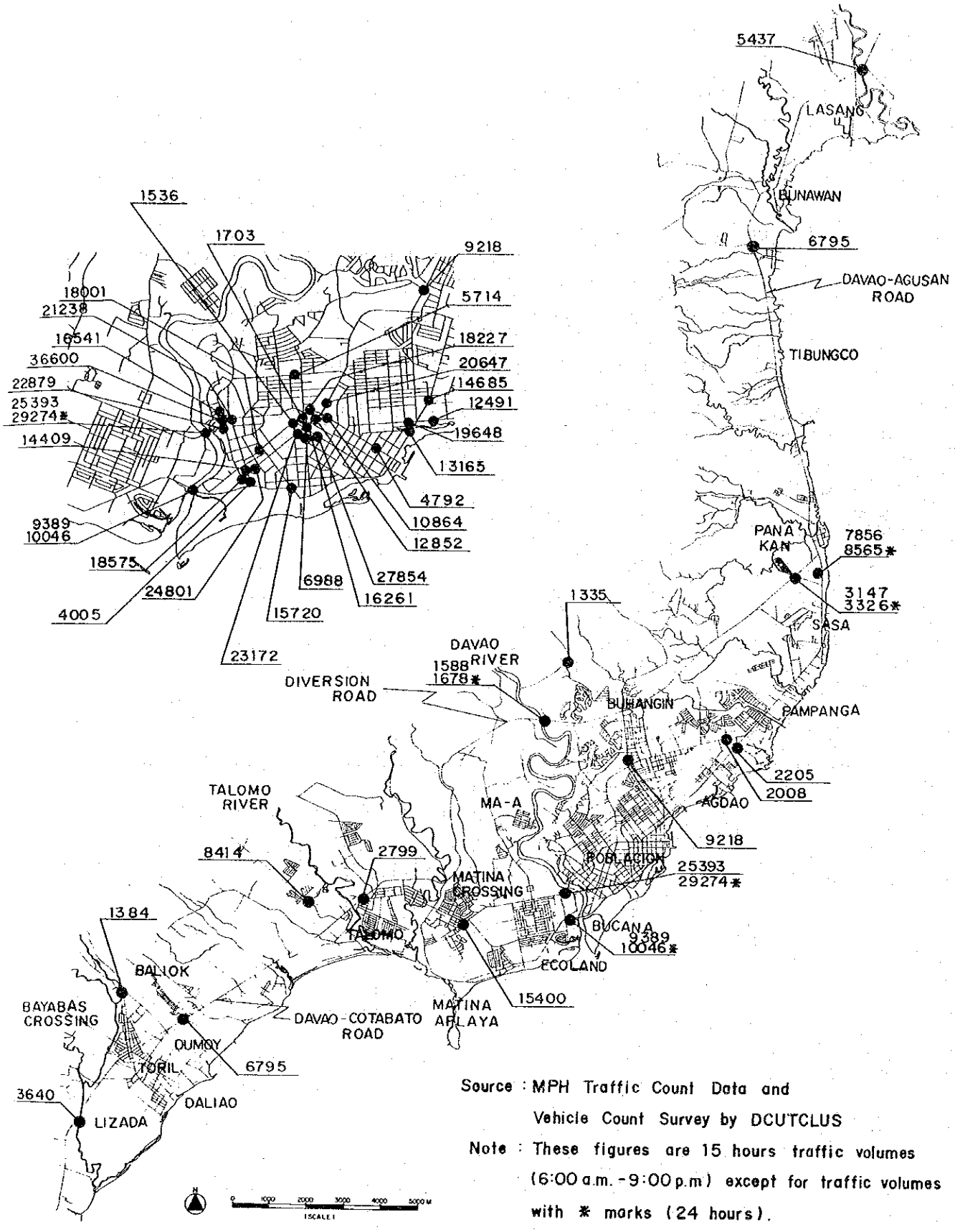


Figure 5.1 Traffic Volume on Trunk Roads

5.1.2 Daily Traffic Fluctuation

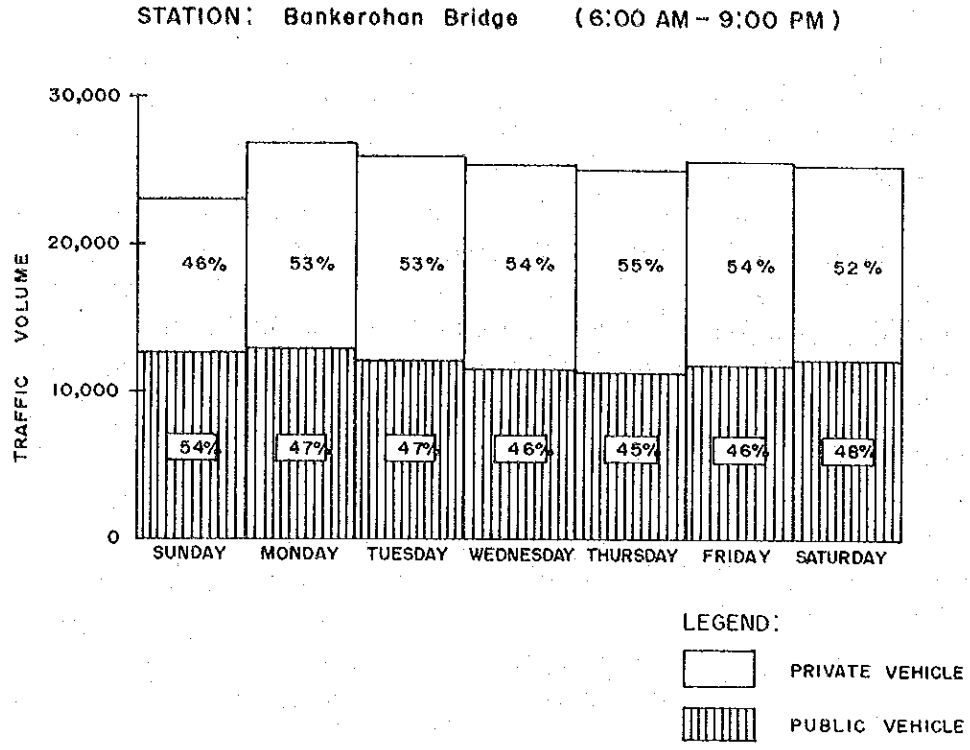
Fluctuations of traffic volume by the day of week for R. Magsaysay Avenue and Bankerohan Bridge are shown in Table 5.2. and Figure 5.2. On R. Magsaysay Avenue, traffic is lightest on Sundays at about 68% of that on Mondays, when traffic reaches maximum. Traffic volume stays relatively constant on other days of the week, which is a trend generally observed in the Philippines. Daily fluctuations of traffic at Bankerohan Bridge follows generally the same pattern as that on R. Magsaysay Avenue, except that Sunday traffic is heavier at the former than on the latter, presumably because of goods delivery and shopper traffic heading to the market on Sundays.

Table 5.2 Daily Traffic Fluctuations

Station		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Bankerohan Bridge	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)	18,996	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.

Source: Vehicle Count Survey in 1979, DCUTCLUS



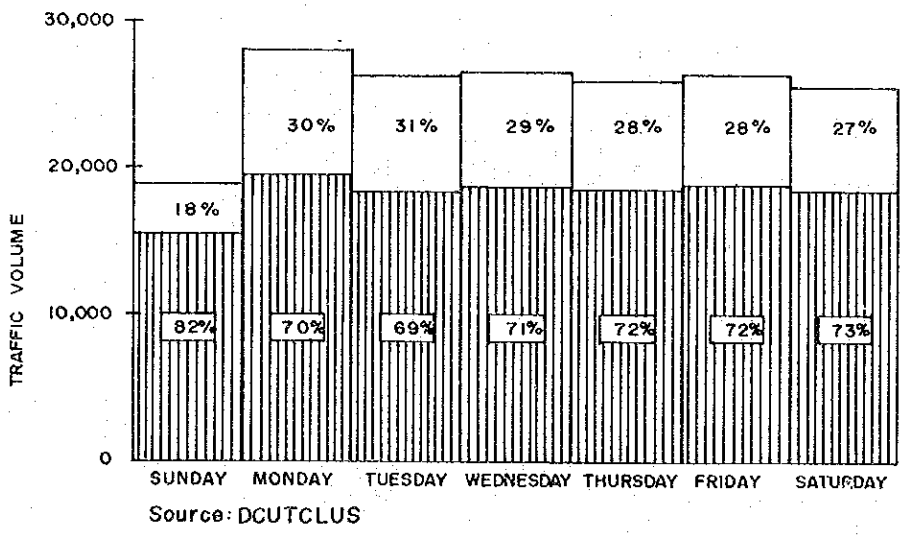


Figure 5.2 Daily Traffic Fluctuations

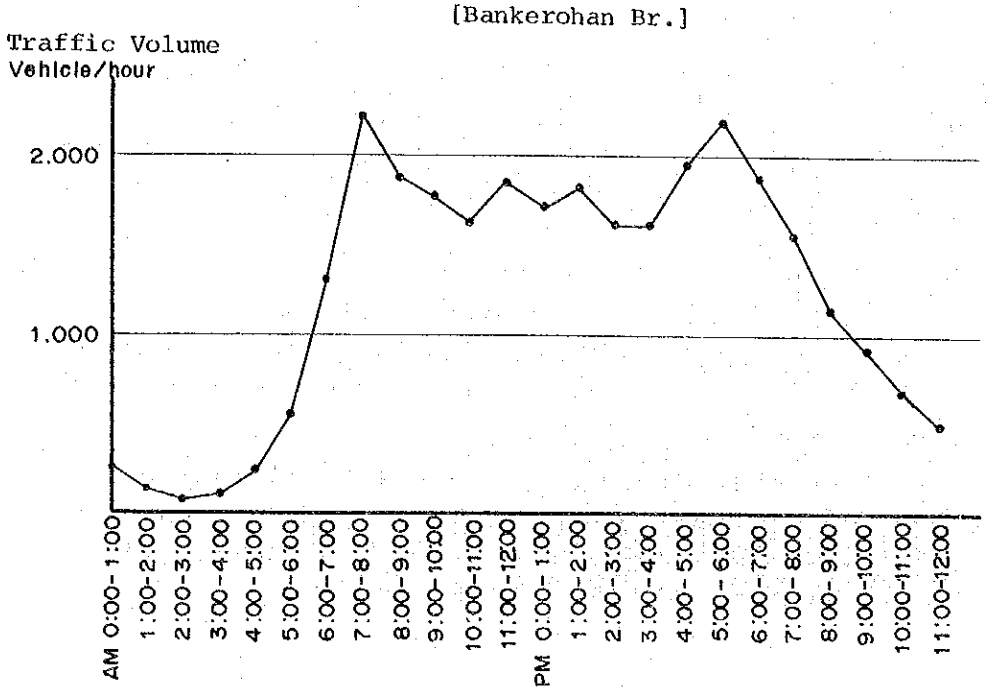
5.1.3 Hourly Distribution of Traffic

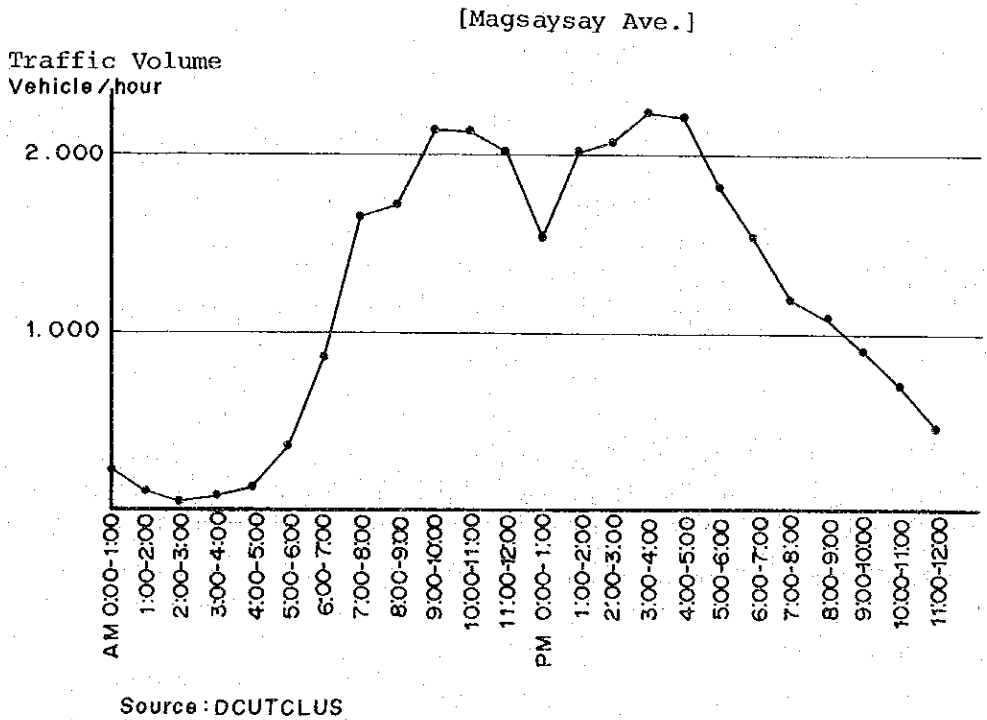
The hourly distributions of daily traffic on R. Magsaysay Avenue and at Bankerohan Bridge are shown in Figure 5.3. The two counting stations showed two peaks daily, one in the morning and one in the afternoon, with a peak ratio of 7% alike, but the peak continued longer on R. Magsaysay Avenue than at Bankerohan Bridge. Moreover, different peak hours were shown by them; Magsaysay Avenue from 9:00 to 10:00 A.M. and 3:00 to 4:00 P.M., while 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 occurs in a business district. Peak ratio is generally lower in urban area (7 to 8%) than in rural area (9 to 11%) as shown in Table 5.3).

Table 5.3 Peak Hour Ratio

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

Note: Traffic Volume is 15 hours traffic count.
Source: DCUTCLUS





Source : DCUTCLUS

Figure 5.3 Hourly Distribution of Traffic

5.1.4 Traffic by Vehicle Type

The distribution of road traffic by the type of vehicle is presented in Table 5.4, which indicates that the ratio of public utility vehicles to total traffic is high on M. Quezon Boulevard, R. Magsaysay Avenue, and, particularly on Davao-Agusan Road, where the ratio is approximately 50%. Thus, public utility vehicles and private cars compete 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 on 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 services both commuting traffic and industrial traffic.

PUJs and other public utility vehicles make frequent stops on road, blocking the passage of other vehicles, and generally become a cause for traffic congestion. Therefore, road function and road structure should fully be considered in formulating public transportation plans – particularly PUJ route plans.

Table 5.4 Distribution of Vehicle Types on Trunk Roads

Station \ Vehicle Type	Car & Jeep	Truck & Pick-up	PUJ	AC	PU Taxi	Tricycle	Bus	Others (2-wheels)	Total
Magsaysay Avenue	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 Avenue	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 Boulevard	3,580	2,300	6,398	948	2,252	40	242	661	16,621
	21.5	13.8	38.5	5.7	13.5	0.2	1.5	5.3	100
Bankerohan Bridge	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 Bridge	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-Agusan Road	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 (vehicle/day) and lower shows vehicle type distribution (%).
Source: DCUTCLUS

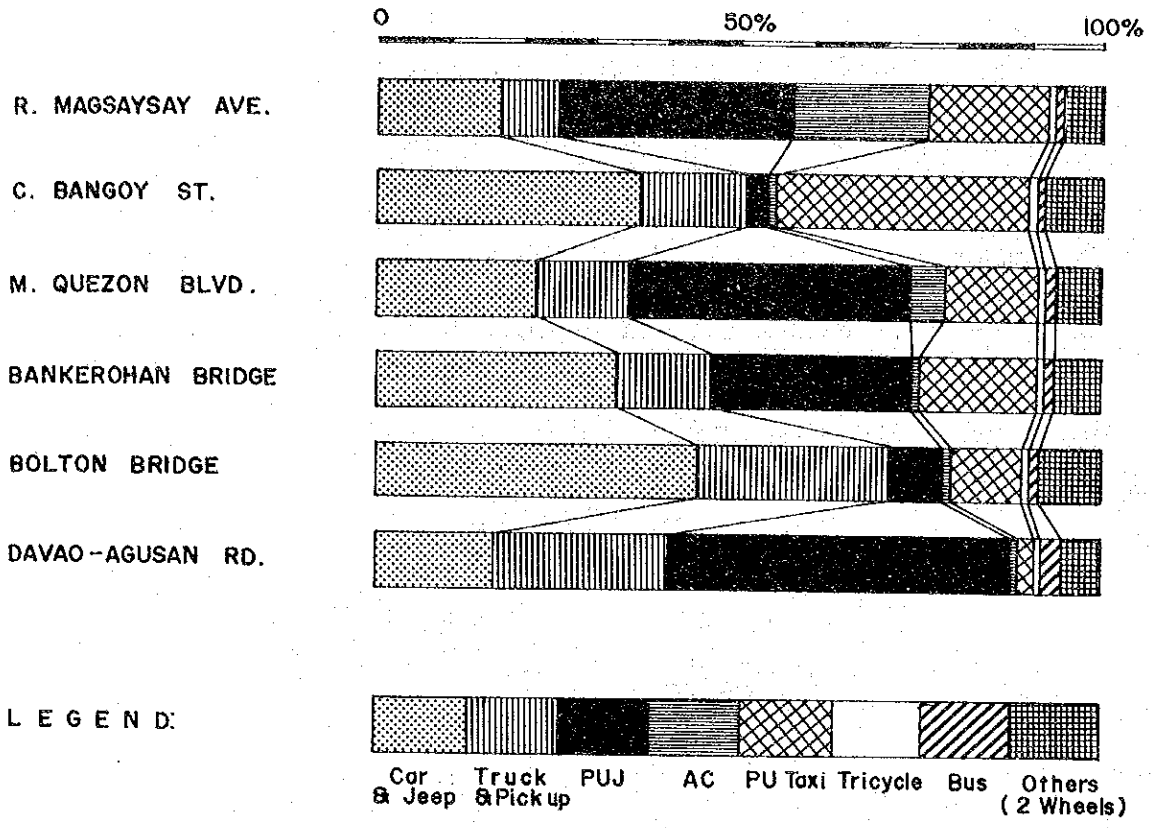


Figure 5.4 Distribution of Vehicle Type by Route

5.1.5 Travel Speed on Trunk Roads

Trunk roads in Davao City mostly have a PUJ route. Travel speed survey findings on these trunk roads are illustrated in Figure 5.5. Figures 5.6 and 5.7 give schematic presentation of travel 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) On heavy traffic sections, particularly on McArthur Highway and J.P. Laurel Avenue, slow moving PUJs hinder the operation of other vehicles and as a result they all run at about the same speed. Vehicles are seen to form clusters as they move in some section during the morning and evening peak hours.

ii) In the morning peak hour, vehicles are forced to move at a slow speed on Mc-Arthur Highway toward Poblacion (the section from E. Quirino Avenue/A. Pichon Intersection to Diversion Road), where PUJs move at the speed of only 18 to 23 kilometers per hour, and on J.P. Laurel Avenue toward (the section from Sta. Ana to R. Castillo Street), where PUJs run at 17 to 18 kilometers per hour.

iii) The frequencies of vehicle stopping are presented in Table 5.5. in terms of distribution ratios by the factor causing the vehicle stopping, in an attempt to identify reasons for the retardation of traffic flow. A scrutiny 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 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 travel speed leads to the deterioration of traffic environment and adversely affects urban activities, the maintenance of 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 depth, in order that effective measures to improve the currently inadequate travel speed may be designed.

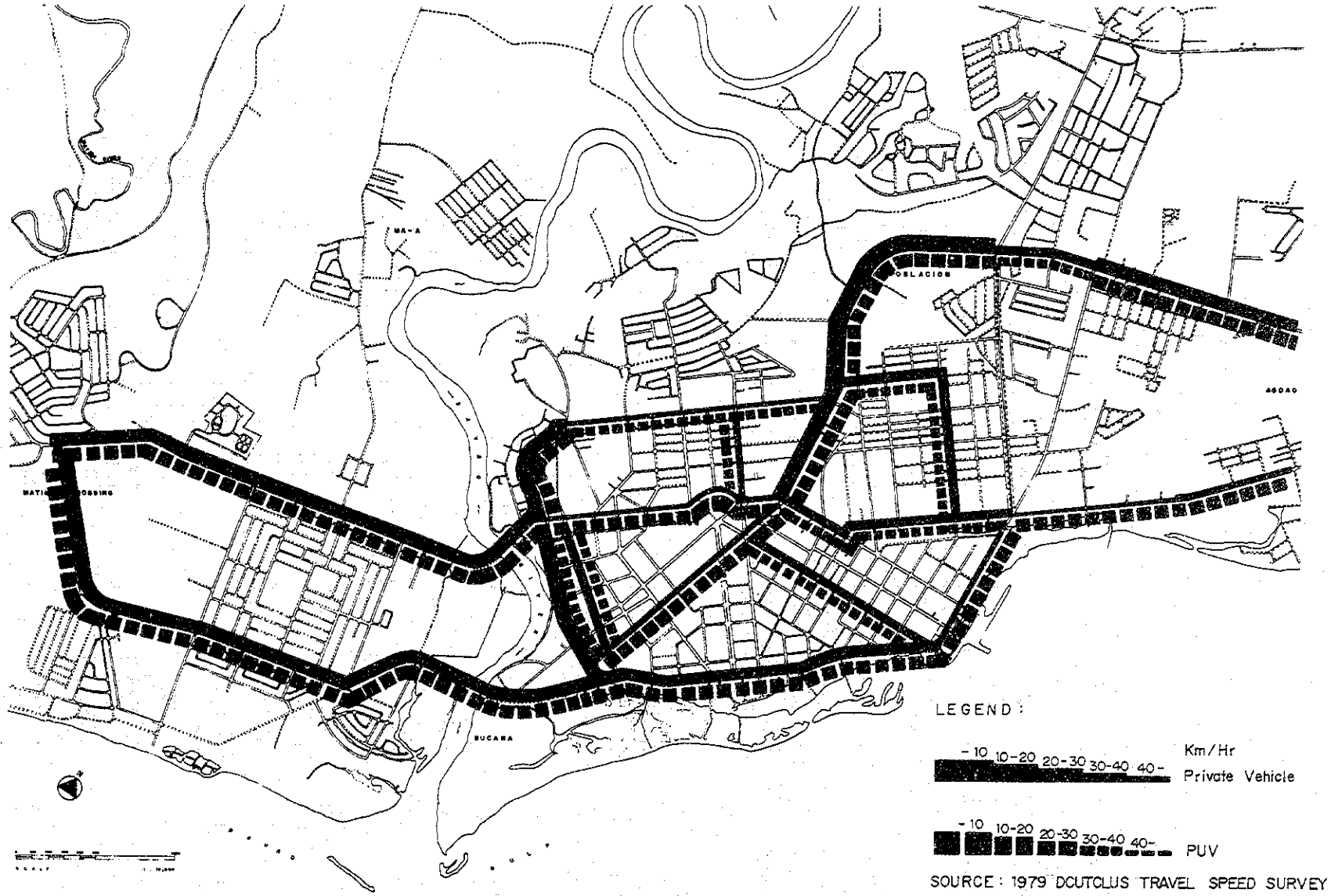
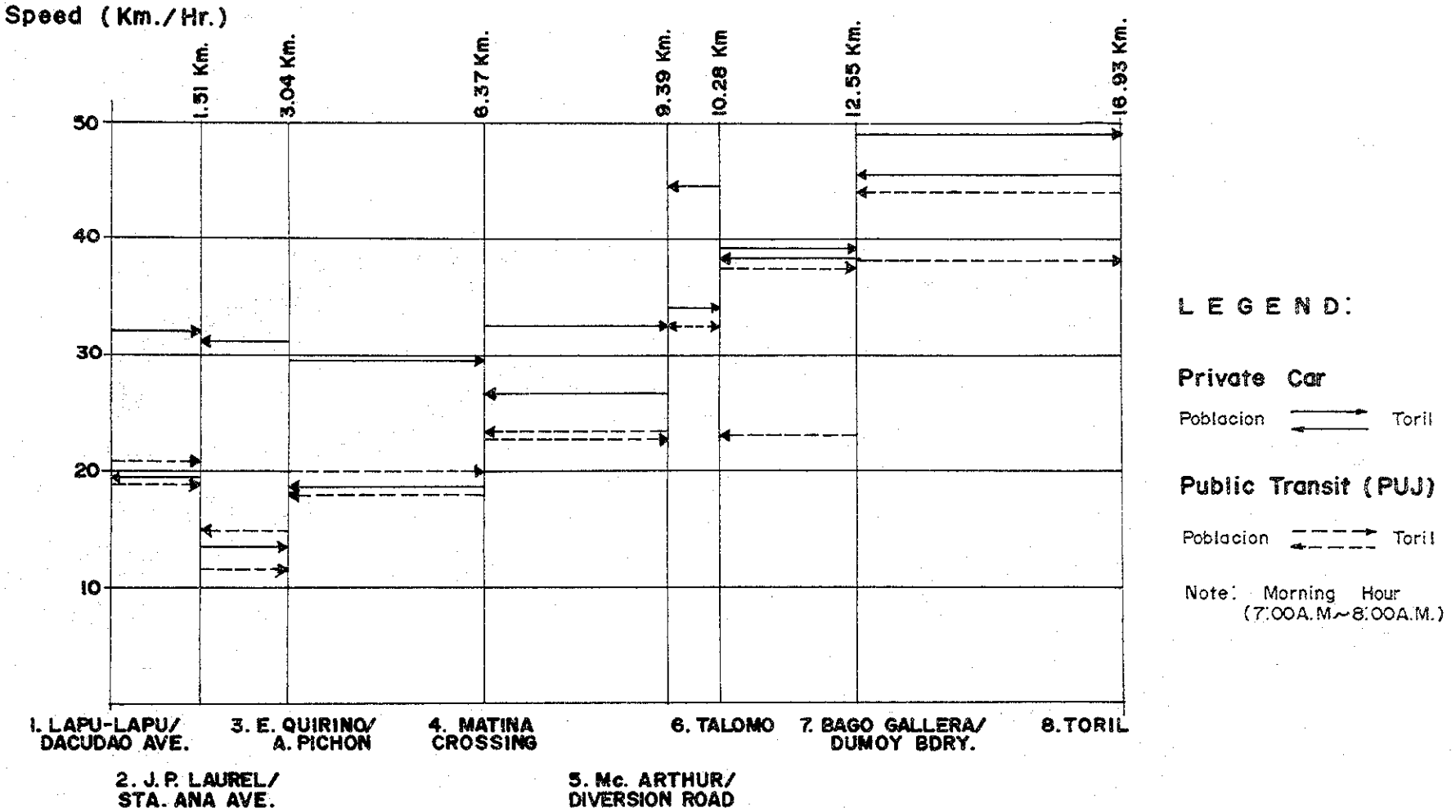
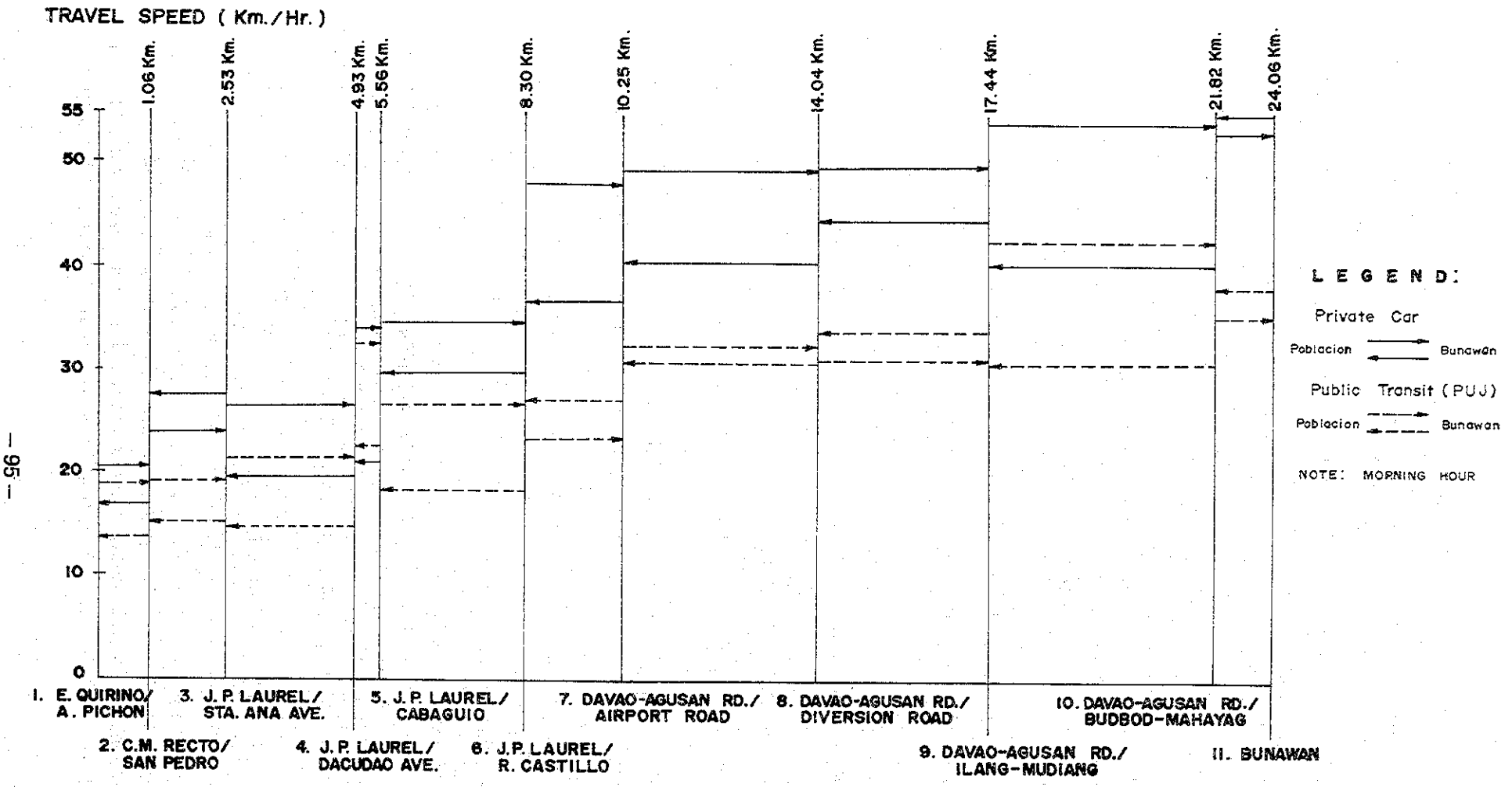


Figure 5.5 Travel Speed (Poblacion)



SOURCE: 1979 DCUTCLUS TRAVEL SPEED SURVEY

Figure 5.6 Travel Speed (Poblacion-Toril)



SOURCE: 1979 DCUTCLUS TRAVEL SPEED SURVEY

Figure 5.7 Travel Speed (Poblacion-Bunawan)

Table 5.5 Causes for Vehicle Operation Delay

In Poblacion	
1. PUJ loading and unloading	62 %
2. Adjoing traffic at intersection	14 %
3. Pedestrian crosssing	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

5.1.6. Traffic Flow at Major Intersections

Intersections often become the bottleneck to cause traffic congestion and the point of highest traffic accident frequency, and, therefore, traffic handling at intersections is an extremely important question in traffic planning. In Davao City, traffic signals are installed at a total of nine locations in Poblacion, all manually operated and only during the morning and evening peak hours.

The result of traffic flow survey conducted at major intersections is shown in Figure 5.8. and summarized as follows:

(1) A Pichon Street/E. Quirino Avenue Intersections

This intersection is saturated with traffic up to its capacity. Traffic which turns left from A. Pichon Street toward the direction of Bankerohan Bridge is the heaviest of all, followed by that which proceeds straight from E. Quirino Avenue toward Bankerohan Bridge. Traffic influx is greater at this intersection

than at any others in Davao City, and PUJ loading and unloading near the intersection often obstruct the progress of vehicles that follow the PUJ, thereby turning the intersection into a traffic bottleneck and causing traffic jam for a length of over one kilometer often during the morning peak hour. PUJs' hindrance to traffic flow is greater at this intersection due to the existence of a nearby market. It is believed necessary that plans be made for the improvement of this intersection which accompany measures for the control of traffic, particularly PUJ.

(2) San Pedro Street/C.M. Recto Avenue Intersection

Stores and shops line both San Pedro and C.M. Recto Avenue, and these roads are crowded with a heavy traffic of over 20,000 vehicles per day each. Of total traffic flowing through this intersection, the largest portion (6,300 vehicles per day) is that which flow from A. Pichon onto C.M. Recto Avenue, followed by that which turn right onto C.M. Recto Avenue or San Pedro Street.

(3) C.M. Recto Avenue/R. Magsaysay Avenue Intersection

The main streams of traffic through this intersection are those which turn either left or right from R. Magsaysay Ave. or C.M. Recto Avenue, which connect commercial centers of this City. The next largest increment of traffic is that which flows straight between C.M. Recto Avenue and J.P. Laurel Avenue. Physically, this is a 6-leg intersection, but it is treated as 4-leg for traffic control purposes. That is, only right-turn is allowed on Jacinto Street and Jacinto Extension and traffic is not allowed to proceed straight from J.P. Laurel Street and from C.M. Recto Avenue – rather irrational arrangement. Even with such traffic control arrangement, the intersection is already saturated in the morning and evening peak hours, and the intersection needs to be improved in a way concomitant to a traffic management system.

(4) E. Quirino Avenue/J.P. Laurel Avenue Intersection

This intersection is entrance to Poblacion from north and has a relatively heavy traffic. The heaviest traffic (5,200 vehicles per day) that flow through the intersection is that which proceed from E. Quirino Avenue straight onto Sta. Ana Avenue, followed by that which flows from J.P. Laurel Avenue straight on and that which comes from the same avenue but turns to the right onto E. Quirino Avenue. The intersection is saturated nearly up to its capacity and is believed incapable of bearing additional traffic in the future.

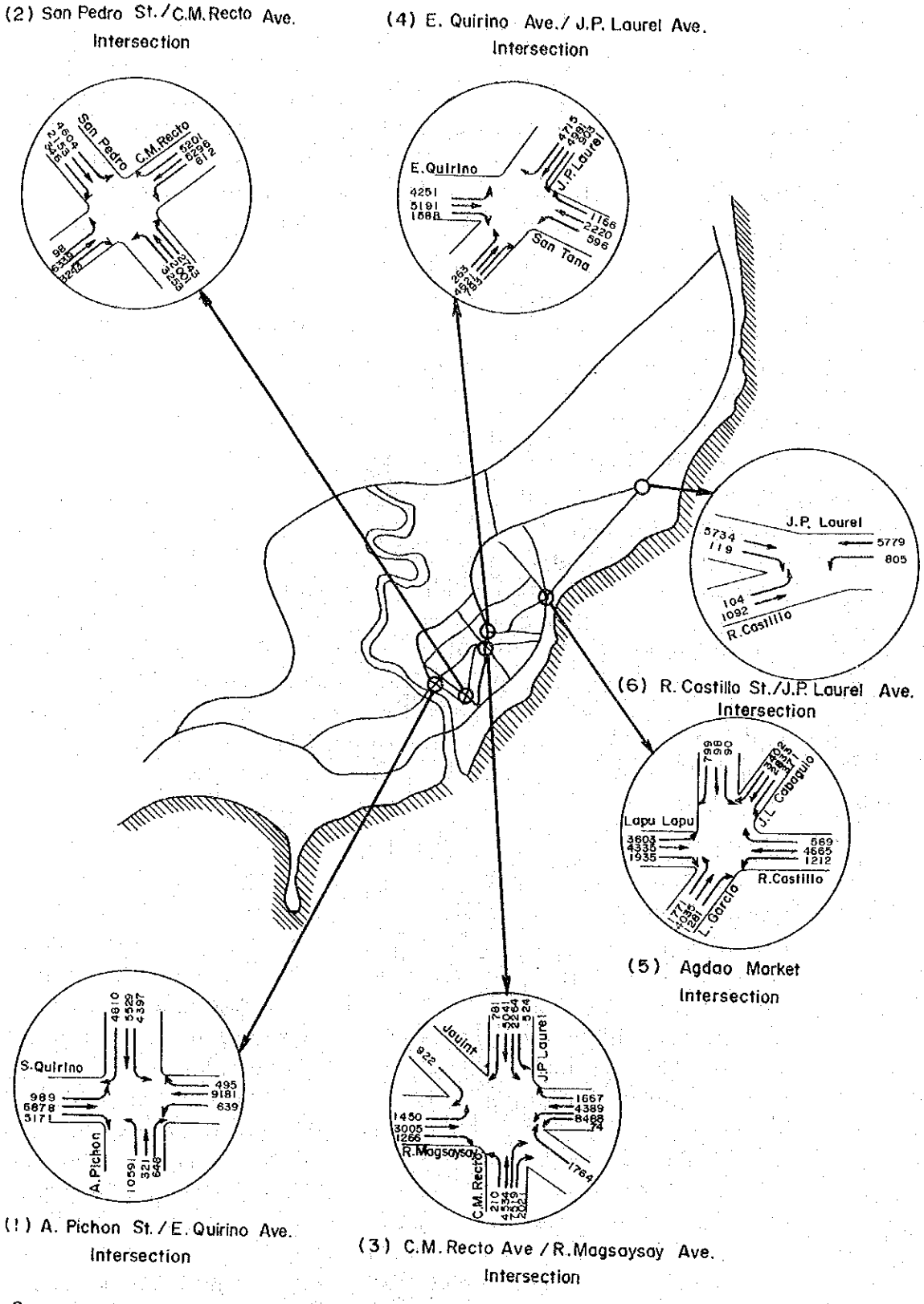
(5) Agdao Market Intersection

Extremely large number of PUJs and tricycles stay near this intersection due to the existence of a market in the vicinity, and traffic congestion is worse than can be expected from traffic volume statistics. The heaviest traffic at this 5-leg intersection is that which flows from R. Castillo Street to Lapu-lapu Avenue, followed by that which moves straight on Garcia Street or J.P. Cabaguio Avenue. Traffic is light on Dacudao Avenue, which is not yet connected with J.P. Laurel Avenue. R. Castillo St. offers the shortest access to Poblacion from north, and a substantial volume of traffic is expected to diverge onto this street, when the unpaved portions of it will be paved. Therefore, this already saturated intersection needs to be upgraded together with the development PUJ and tricycle terminals.

(6) R. Castillo Street/J.P. Laurel Avenue Intersection

The major traffic current through this intersection flows in the direction of J.P. Laurel Avenue, and R. Castillo Street is being little used. This is because about one-half of the total length (about three kilometers) of R. Castillo Street is still unpaved and traffic from north toward Poblacion is concentrated on J.P. Laurel Ave. to the extent traffic congestion is caused. Thus, the complete pavement of R. Castillo Street is urgently needed. In order to accelerate traffic diversion onto R. Castillo Street, however, this intersection will have to be upgraded.

Traffic congestion is often spurred by the absence of lane markings (through lane, left-turn lane), marking of stop line, and traffic islands at intersections in Davao City, including the major intersections discussed in the above. Traffic handling is being made difficult and traffic safety impaired by the physical shape of some intersections, such as 5-leg and 6-leg intersections. Therefore, traffic capacity of intersections should be expanded through their structural improvement and the accomplishment of road markings, traffic channelization, and signal operation.



Source : Intersection Traffic Count, DCUTCLUS

Figure 5.8 Traffic Flows at Major Intersections

5.1.7 Existing Road Capacity and Demand

In order to compare the traffic capacity of the existing roads against traffic demand, the existing road traffic volumes are assigned to the existing road network. The levels of congestion, thus calculated, are presented in Figure 5.9. Based on such calculation, the demand-supply (traffic demand-road capacity) relationships at major road cross sections, and relationships on each route, are summarized as follows:

1) Demand-Supply of Road Facilities at Major Cross Sections

A comparison of the traffic capacities with traffic demand at major road cross sections are presented in Figure 5.10 and Table 5.6, wherein the hatched portions indicate the excess demand (the volume of traffic which attempt to use the road in excess of road's capacity). As shown, the volume of traffic oriented toward Poblacion is large, and traffic demand (burden) often excess the capacity of road sections on the perimeter of Poblacion. Major road cross sections are summarized as follows:

i) Northern District (Cross Sections 1 through 6)

The volume of traffic heading to Poblacion from Bunawan/Tibungco area in the north has gradually increased and the volume in the vicinity of Panacan has reached the level of 14,000 PCU per day and the congestion ratio of 1.3. Because Diversion Road starts in the vicinity of Panacan, traffic demand and road capacity are about balanced with each other at Cross Sections 5 and 6. However, road 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 to individual roads.

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

The road network except J.P. Laurel Avenue and R. Castillo Street meet the demand of traffic flowing to Poblacion from North (Cross Section 7) and Bankerohan and Bolton Bridge to serve the demand of traffic flowing to Poblacion from south (Cross Section 8). No extra room 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, causes the build up of traffic up to 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 short of meeting the demand, and congestion ratio has reached 2.5 at the heavily utilized Bankerohan Bridge, where traffic jam extends for more than one 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 levelling off of traffic utilization among routes.

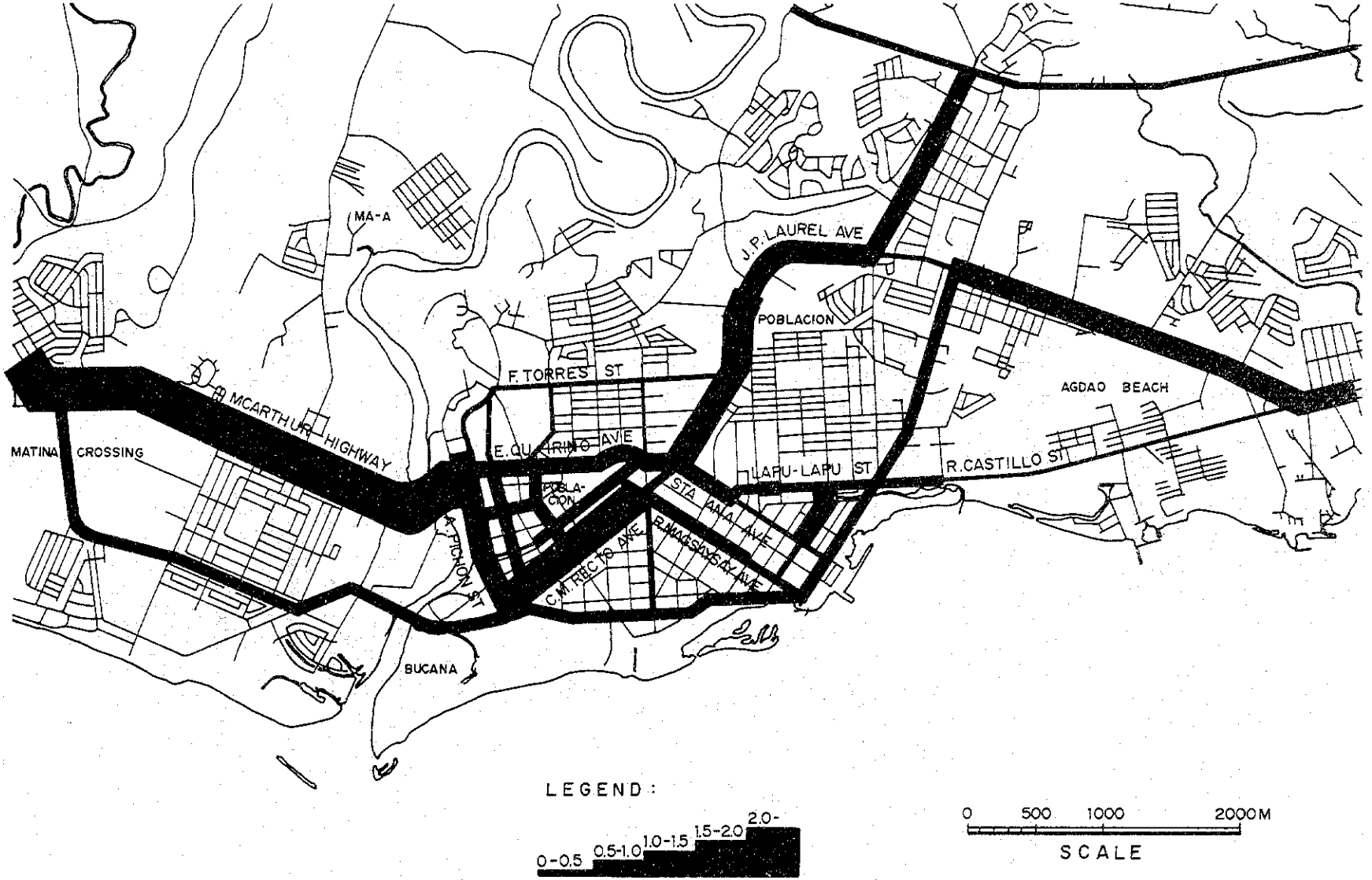


Figure 5.9 Volume/Capacity Ratios of Trunk Roads

iii) Southern District (Cross Section 9 through 12)

The 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-mixture of traffic from Calinan way, indicating the inadequacy of the existing road capacity.

iv) Other Cross Sections

Demand and capacity are about in balance with each other at cross sections other than those discussed in the above.

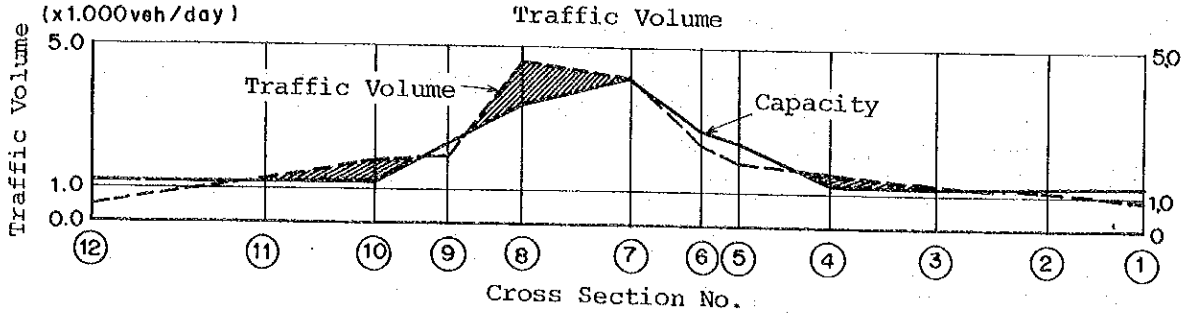
Table 5.6 Demand and Supply Relationship at Major Road Cross Sections

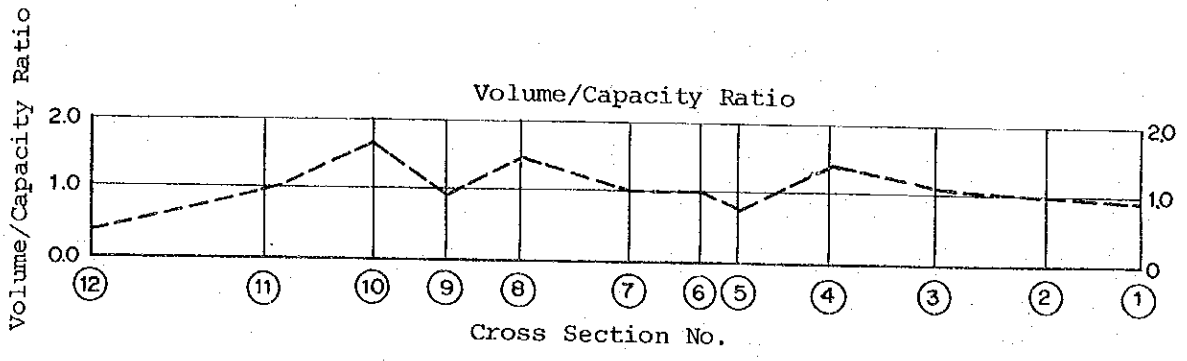
Section	Present Road Capacity (100 PCU/day)	1979 Present ADT (100 PCU)	1979 Volume/Capacity Ratio	Excess Volume of Traffic (100 PCU)
1[1/]	110	84	0.8	–
2	110	103	0.9	–
3	110	110	1.0	–
4	110	139	1.3	29[2/]
5	240	178	0.7	–
6	240	204	0.9	–
7	390	400	1.0	–
8	330	431	1.3	10
9	220	185	0.8	101
10	110	171	1.6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

1/ : Section on Numbers Correspond to those of Fig. 5.10

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

Source: DCUTCLUS





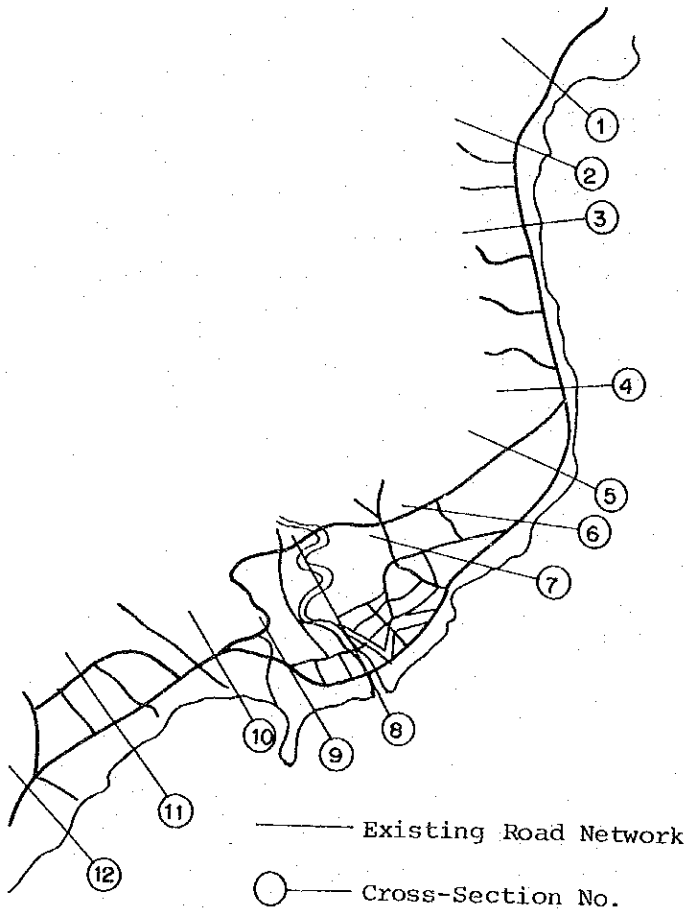


Figure 5.10 Volume/Capacity Ratios at Major Road Cross Sections

2) Demand-Supply Relationship by Route

The level of congestion on each route is illustrated in Figures 5.9 and 5.10. Highly congested routes are concentrated within and on the perimeter of Poblacion, most of which are PUJ routes. They are:

Vicinity of Benkerohan Bridge

A. Pichon Street
C.M. Recto Avenue
J.P. Laurel Avenue
Lapu-Lapu Street

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

M. Quezon Boulevard
E. Quirino Avenue
L. Garcia Street
Sta. Ana Avenue

Traffic congestion is ubiquitous in other districts, too, and, as seen in the preceding sub-Chapter, traffic jam has occurred on Davao-Agusan Road near Panacan and on Davao-Cotabato Road near Talomo.

5.2 Existing Traffic Problems and Remedy

Commuters from subdivisions, which were developed in areas around Poblacion, daily gather into Poblacion, which is the center of economic activities in Davao City, and, therefore, traffic problems mostly occur on the perimeter of Poblacion. Traffic problems discussed in the above are summarized below, with the discussion of direction in which remedial actions should be sought for (for the detail of solution recommendations, see *Urgent Traffic Recommendations for the City of Davao, September 1980).*

Table 5.7 Traffic Problems and the Direction of Remedial Actions (1)

Action Objective	Description of Traffic Problems	Direction of Remedial Actions
1. Diversification of Routes to reach the Downtown	• Of the two routes from northern areas to Poblacion the preference of J.P. Laurel Avenue over partly unpaved R. Castillo Street is causing traffic congestion on the latter. • Of the two routes from southern areas to Poblacion, the preference of McArthur Highway over Bolton Road, because of poor access from Bolton Bridge to the downtown and of poor condition of related roads, is spurring congestion on the former and is causing underutilization of the latter.	• The complete pavement of R. Castillo Street • The upgrading of J.P. Laurel/R. Castillo intersection • The extension of A. Pichon Street up to M. Quezon Boulevard • The complete pavement of M. Quezon Boulevard
2. The upgrading of Intersections	• Intersections are often the bottleneck to cause traffic congestion in the peak hours. • Traffic congestion is spurred by confusion in traffic movement due to the absence of lane markings and stop line marking as well as of training islands, at intersections • Signals are installed at only nine locations and, moreover, they are manually operated and operated only in the morning and evening peak hours. • Traffic management and traffic safety are being hindered and impaired by the physical shape of some of of intersections which are 5-leg or 6-leg intersection.	• The upgrading of intersections: — A. Pichon/E. Quirino Intersection — C.M. Recto/R. Magsaysay Intersection — Agdao Market Intersection • Installation of additional signals and the review of signal operation scheme. • Installation of road signs in full.

Table 5.7 Traffic Problems and the Direction of Remedial Actions (2)

Action Objective	Description of Traffic Problems	Direction of Remedial Actions
3. Acceleration of travel speed	• Highly congested sections all occur on PUJ routes. • Traffic jam is often caused by the loading and unloading of PUJ passengers, which hold up the movement of vehicles following the PUJ.	• Improvement of the structures of the road which are on PUJ route. • Establishment of PUJ bays • Establishment of PUJ loading-unloading zones • Reorganization of PUJ routes • Enforcement of no parking on PUJ routes
4. Road facility capacity expansion	• Approach roads around Poblacion have insufficient capacities. • In addition, the capacity of Davao-Agusan Road is inadequate in the vicinity of Panacan, and that of Davao-Cotabato Road is also inadequate in the vicinity of Ulas.	• Improvement of McArthur Highway and/or Bolton Bridge Road • Improvement of J.P. Laurel Avenue and/or R. Castillo Street • Improvement of Davao-Agusan Road • Improvement of Davao-Cotabato Road
5. Strengthening of street network in Poblacion	• Many streets in Poblacion have the same width and, therefore the function of each street is not well defined. • Although Dacudao Avenue should be a part of the Poblacion's ring road and Roxas Avenue should be the development axis of Poblacion when judged from the pattern of street network, they are not effectively utilized as such because of their unfinished portions.	• The completion of unfinished roads: – Dacudao Avenue – Roxas Avenue

CHAPTER 6 PERSON TRIPS IN THE SURVEY AREA

Tables and Figures

CHAPTER 6

PERSON TRIPS IN THE SURVEY AREA

6.1 Person Trip Survey

6.1.1 Survey Purpose

Cars, buses, jeepneys, and other means of transportation are merely the container in which people are moved from a place to another, and traffic is generated by people themselves. In order to clarify facts about the movement of people, a person-trip (P-T) survey has been accomplished.

The P-T survey is to find out the trip maker characteristics (age, sex, income, car ownership, industry engaed in and, address) and trip characteristics (purpose, origin-destination, time and types of mode). The survey findings provide us with the fundamental data to support the formulation of comprehensive transportation plan.

6.1.2 Survey Method and Samples

Surveyed were all seven years or older members of the families sampled from the P-T survey area, and the survey was carried out through home interviews using the survey form (a sample of which is attached as Appendix), during a four-week period from November 12 to December 12, 1979).

6.1.3 Person Trip Survey Area

The P-T Survey Area covered a total of 63 barangays in all of Poblacion and the urbanized or urbanizing parts of four districts: Buhangin, Bunawan, Talomo, and Toril.

The population of the P-T Survey Area in 1979 was estimated at 360,000, those over six years of age, 282,000 and the number of households, 60,120.

6.1.4 Zoning

Traffic zoning was determined based on jurisdictional units, in consideration of the availability of economic indicators, population, and other statistics and the ease of comprehending the existing situations and of planning future road network and land use.

Traffic zones are classified into (1) internal zones (which are in the P-T Survey Area) and (2) external zones. Internal zones are divided into zones referred to as A-zones, each of which is subdivided into B-zones, each of which, further into C-zones.

Zone Code			
X	X	X	X
A Code	B Code		C Code

Table 6.1 Internal Traffic Zones

District	No. of Zones		
	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 6.2 External Traffic Zones

	No. of zones
Davao City	7
Mindanao Island	7
Outside of Mindanao	1
Total	15

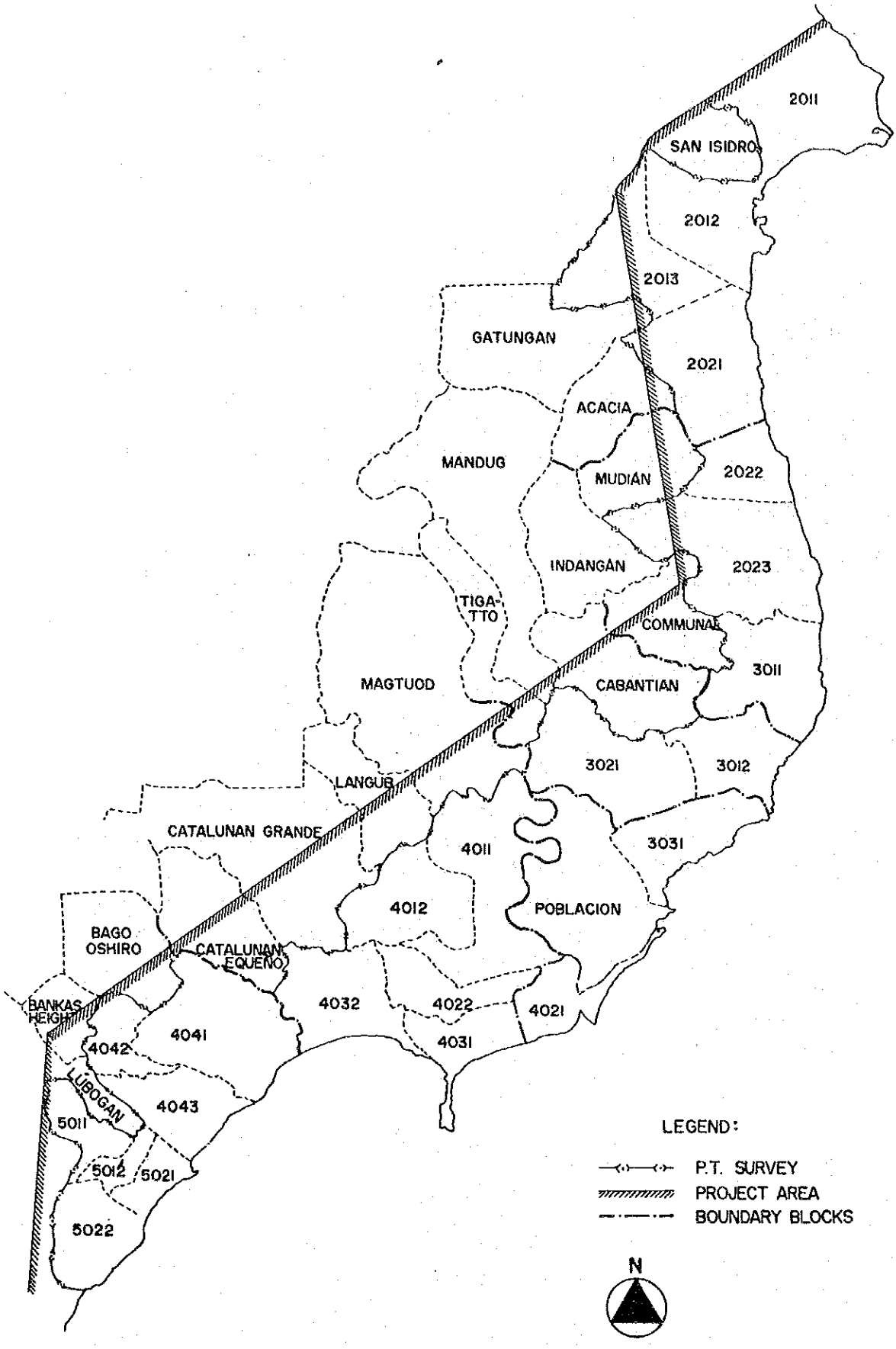


Figure 6.1 Zone Map

6.1.5 Sampling

The effective sampling rate of 6% of all households was selected in order to achieve the survey reliability of 90% to 95%, but allowing for the non-retrieval of survey forms due to the absence or refusal on the part of samples (respondents), 8% of the households were sampled by fixed intervals based on such basic data as barangay census data and voting lists.

6.1.6 Data Processing

In order to facilitate the checking and the computer processing of the huge volume of data the P-T survey produce, the data are stored on magnetic tapes. Master tapes are finalized after the checking of various kinds of data, the expansion process required in the case of a sampled survey, and checking and corrections through screen line survey and, therefore, become the most fundamental source of information needed for the accomplishment of trip demand analysis. Master tapes are compiled through the process shown in Figure 6.2 . Of this process the most important is the step of expansion from samples.

Expansion process is followed in order to expand the obtained samples to as close a resemblance to the population as possible, and expansion coefficient is expressed as follows:

$$\text{Expansion Coefficient} = \frac{1}{\text{Effective Sampling Rate}} = \frac{\text{Population}}{\text{Effective Samples}}$$

Table 6.3 presents the population, effective samples and effective sampling rate of each B-zone which were for the purpose of expansion process. The effective sampling rate exceeds the targeted 6% in all B-zones.

The B-zone, sex, and age group data were adopted for the expansion process after confirming their reliability as data by χ^2 test, one of commonly used statistical techniques for such purpose.

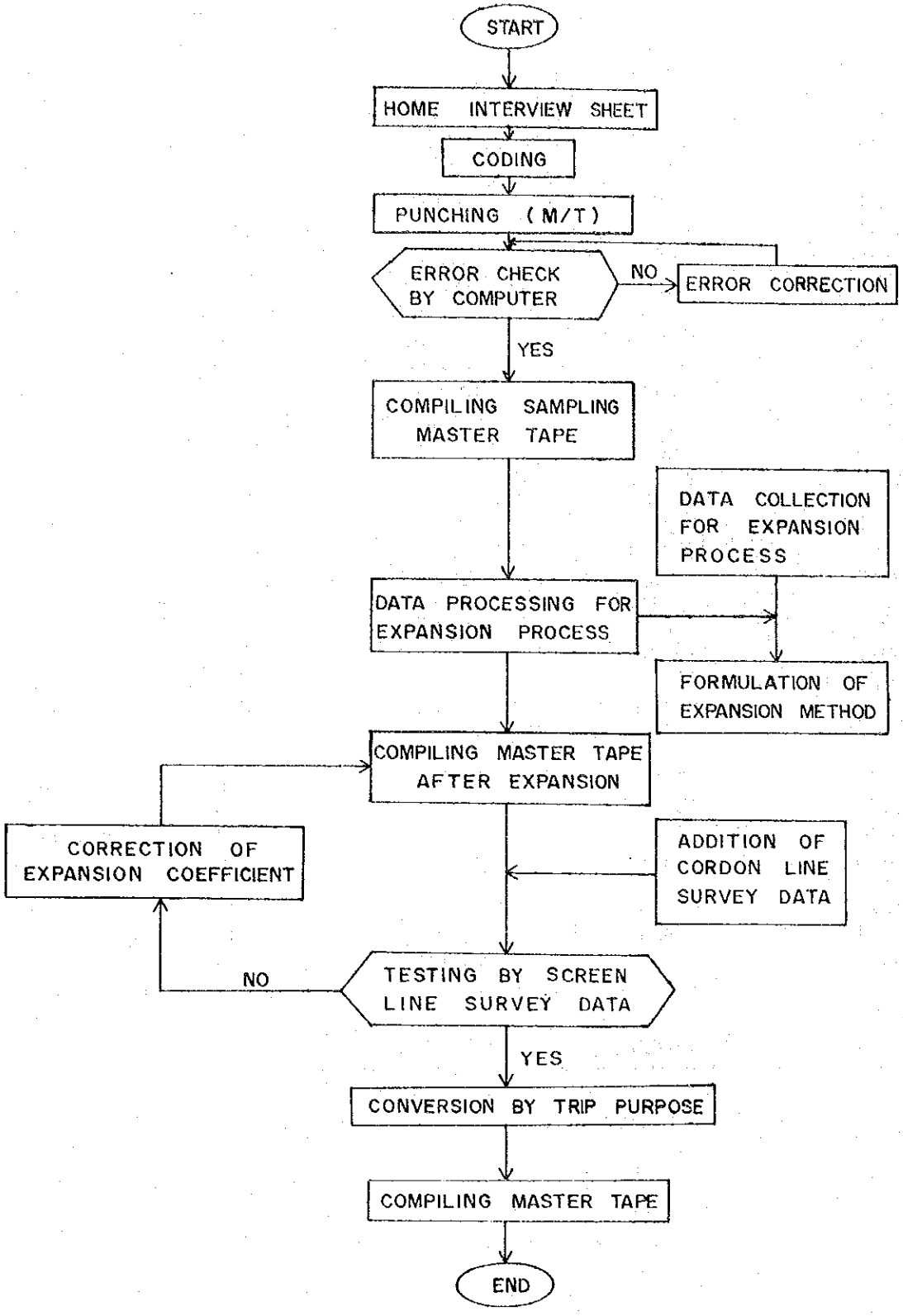


Figure 6.2 Procedure of Compiling the Master Tape

Table 6.3 Effective Sampling by Zone

Zone Code	Total Population	7 years old and over	Effective samples	Sampling Ratio
				%
1010	3,910	3,070	254	8.27
1020	13,000	10,250	354	8.27
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

6.2 Supplemental Surveys

6.2.1 Cordon Line Survey

In order to survey the movement within the P-T survey Area of non-residents, a cordon line survey has been accomplished at stations established at points at which P-T Survey Area border intersects with one of the following six major roads:

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

Conducted at these stations are roadside O-D survey, classified vehicle count survey, and passenger counting by type of vehicle.

6.2.2 Screen Line Survey

For the purpose of checking the accuracy of P-T survey data, a screen line survey has also been done. The screen line is an imaginary line drawn to divide a P-T survey area into two. In this study, the Davao River is used as the screen line, and stations are established at three points: Bankerohan Bridge, Bolton Bridge, and Ma-a Bridge.

Accomplished at these stations are classified vehicle count survey and pedestrian counting.

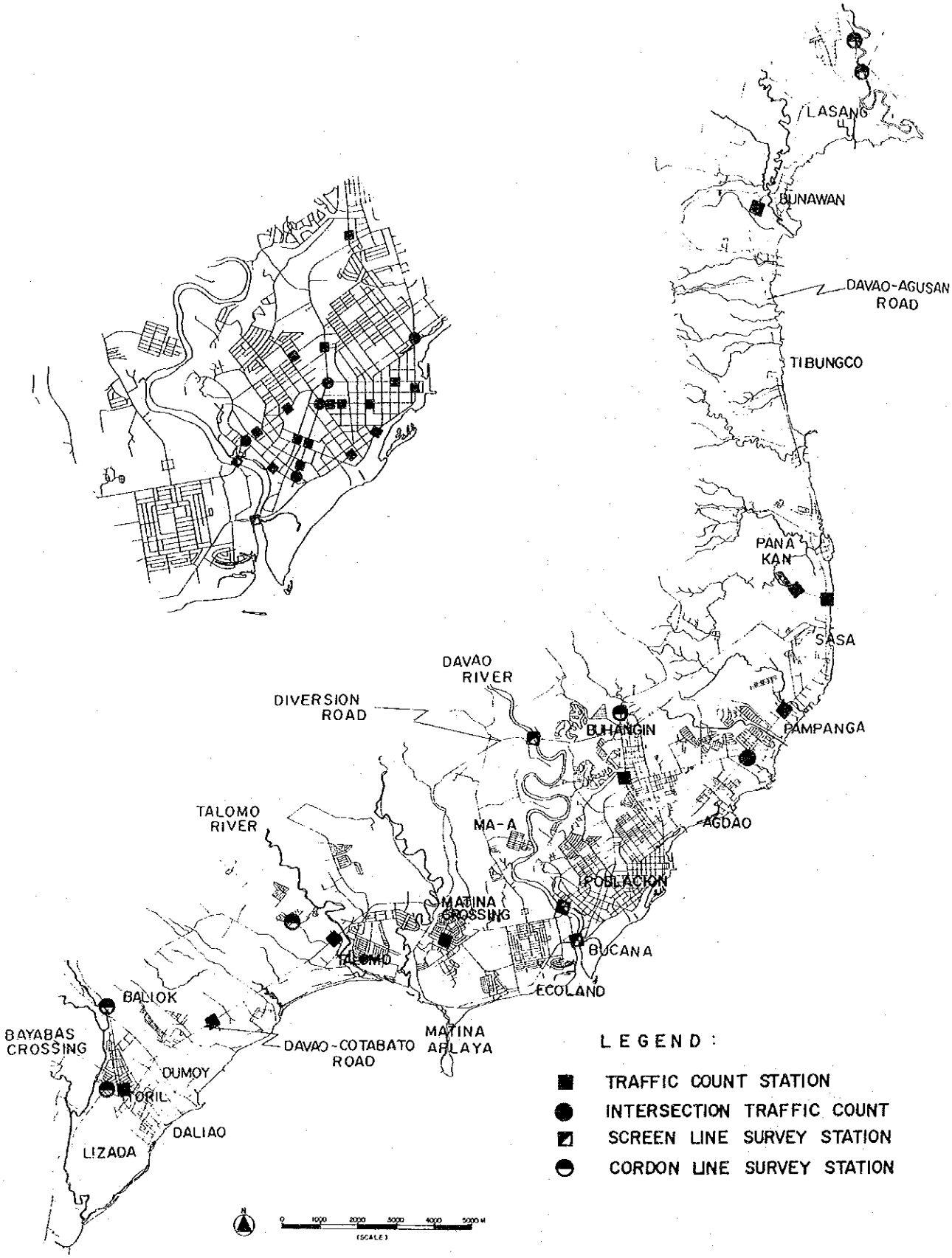


Figure 6.3 Traffic Survey Location Map

6.3 Person Trips in the Survey Area

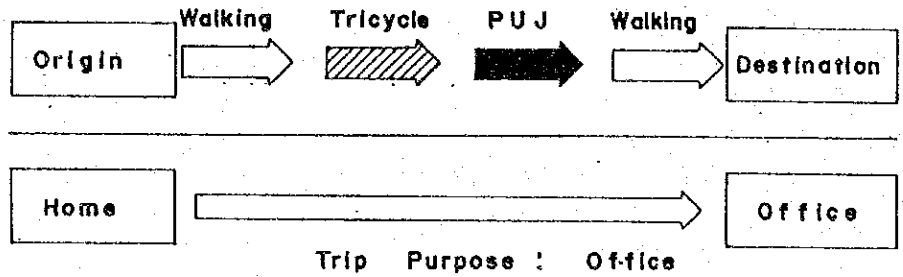
In this Report, "trip" is treated as follows, unless otherwise specifically noted:

1) Trips in which a series of transportation modes are utilized are linked trips. A linked trip is counted as one trip, rather than as a number of unlinked trips. Therefore, in the case of an example illustrated below, the activity is counted as one (linked) trip, rather than four (unlinked) trips.

2) For the purpose of modal analysis, each linked trip is expressed by the most representative of the modes of transportation which were used, and the most representative is determined by the following priority order:

Bus–PUJ–AC–Car–Truck–PU. Taxi–
Tricycle–Motorcycle–Bicycle–Walking

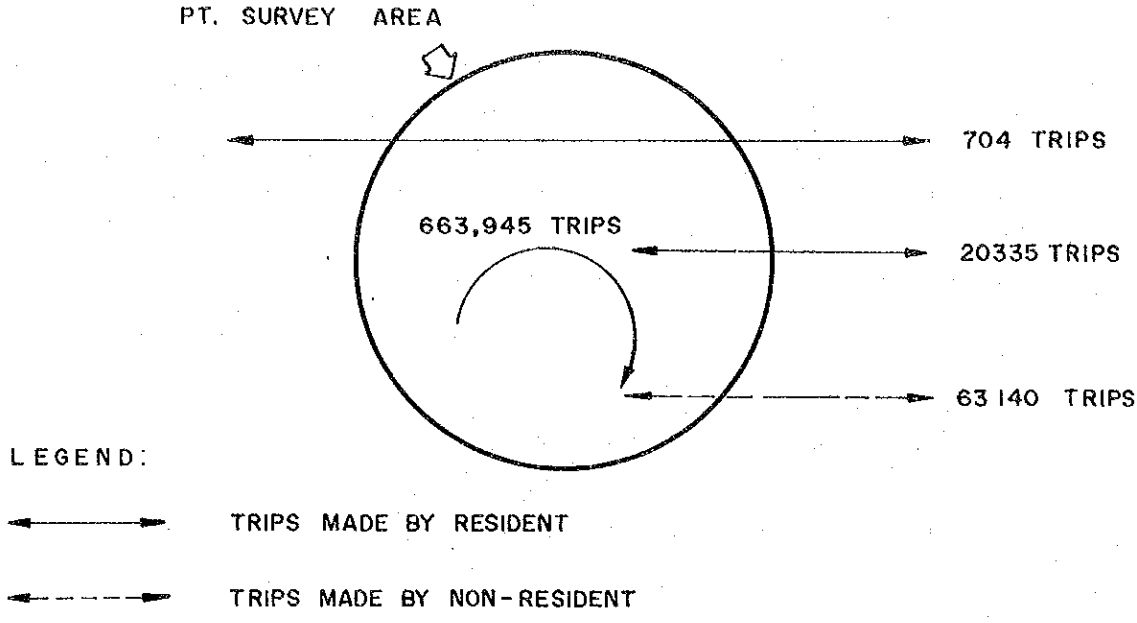
Thus, the example trip is expressed by PUJ, which is the highest in priority of the four modes of travel used in this case.



6.3.1 Aggregate Trips

The aggregate amount of total people movements in the P-T Survey Area is 748,000 trips/day. Of this aggregate, 92% or 685,000 trips/day are those of the residents (of the Survey Area), and the remaining 8% or 63,000 trips/day are by non-residents.

Of the trips of residents, 97% or 664,000 trips have both the origin and destination within the P-T Survey Area. Inasmuch as a higher precision of P-T Survey findings can be achieved by selecting a more closed survey area (closed, in the significance that the movements of surveyed samples are confined within the area), it is believed that the particular area selected for this survey was an appropriate one.



(unit : person trips / day)

	Walk	Bicycle	Motor Cycle	Car	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%

Source : Person Trip Survey in 1979, DCUTCLUS

Figure 6.4 Total Number of Person Trips in the Survey Area

There are three major entrances through which non-residents come into the P-T Survey Area. Although the total non-resident trips into the Area is only 63,000 trips/day or 8% of the aggregate such trips account for so large a share of trips in local areas in the vicinity of said entrances that they cannot be ignored in transportation planning. PUJs and buses are highly used by non-residents for entry into the Survey Area, their bus utilization rate is particularly high in comparison with such rate shown by residents. The buses operated within the P-T Survey Area are exclusively for inter-provincial trips, and non-residents represent a majority (59%) of the bus passengers.

6.3.2 Trip Purposes

Trips are made for a variety of purposes, the most frequent of which, or 36.4%, is "to home", followed by "private" (23.9%) and "to school" (16.3%). On the other end, "shopping" (4.3%) and "business" (9.0%) represent small shares in the purpose mix. Daily routine trips (to office, to school and to home) constitute a high 63% of total trips. In other words, trips between home and office and between home and school represent about two-thirds of all trips. Hence, traffic jam in the morning and evening peak hours and the concentration of traffic toward Poblacion.

The composition of trip purposes as revealed by this survey closely follow the pattern in Manila as revealed by a 1970 survey, except that "private" trips show a higher share in the Survey Area of Davao City than in Manila. This is because of the peculiar behavioral pattern of people in the Survey Area that school children, students, and workers often go home for lunch, and such trips are counted as "private" trips.

6.3.3 Modes of Travel

A review of the modal composition of trips shows that about two-thirds (63%) of all trips are performed by walking, (37%) and PUJ (26%), while bicycles, motorcycles, and buses are little used. As for the function of each mode, those which are utilized for short trips (walkings, bicycles, and motorcycles) represent 39% of all trips, private transportation (cars and trucks), 17%, and public transportation (buses, PUJs, PU Taxis, and tricycles), 44%.

Table 6.4 Trip Purpose Composition
Davao vs. Manila

	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	36.3	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

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

It is only natural that walking, which is one of the most basic physical activities of man, shows a high percentage of total trips, and that it is not believed to be peculiar to this P-T Survey Area. Walking is known to represent 30 to 40% of trips in urbanized area of Japan. The very high rate of the use of public transportation modes is, however, a peculiarity not only of this P-T Survey Area but also of the Philippines as a whole.

A comparison of the modal mix revealed by this survey with the P-T Survey findings for Metro Manila brings out some interesting points, provided that the comparison is made disregarding walking, bicycle, and tricycle, which were not included in the Metro Manila Survey (therefore, the comparison is made in terms of "Ratio 2" shown in Table 6.5.

The rates of utilization of public transportation modes were about comparable, but it is slightly higher at 67% in the Survey Area of Davao City than 64% in Metro Manila. Among such modes, PUJ shows an overwhelmingly high rate in the Survey Area, while PUJ is less predominant and bus shows a higher rate in major roads in the city. The seven times difference in bus utilization rate between 2% in the Survey Area and 16% in Metro Manila is attributable to the difference in urban scale between the two, and it is believed that buses and other large capacity transportation modes are suited to the Survey Area which has developed in the geographical shape of a belt.

Dissimilar car utilization rates shown by the Survey Area of Davao City (11%) and Metro Manila (25%) are explained by the fact that, at the time of each P-T survey, only

8% of families in the survey area owned a car, while 20% of families in Metro Manila owned a car. The fairly high truck utilization rate in the Survey Area (higher than in Metro Manila) is partly due to the fact that trucks are being used not only for the conveyance of goods but also for carrying people to their offices or homes.

Table 6.5 Transportation Mode Composition Davao vs. Manila

	DAVAO			MANILA	
	No. of Trips	Ratio 1) (%)	Ratio 2) (%)	No. of trips	Ratio 2) (%)
Walking	253,622	37.0	—	—	—
Bicycle	5,284	0.8	—	—	—
Motorcycle	7,955	1.2	—	—	—
Car	69,985	10.2	16.7	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, PU	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

6.4 Personal Attributes and Trips

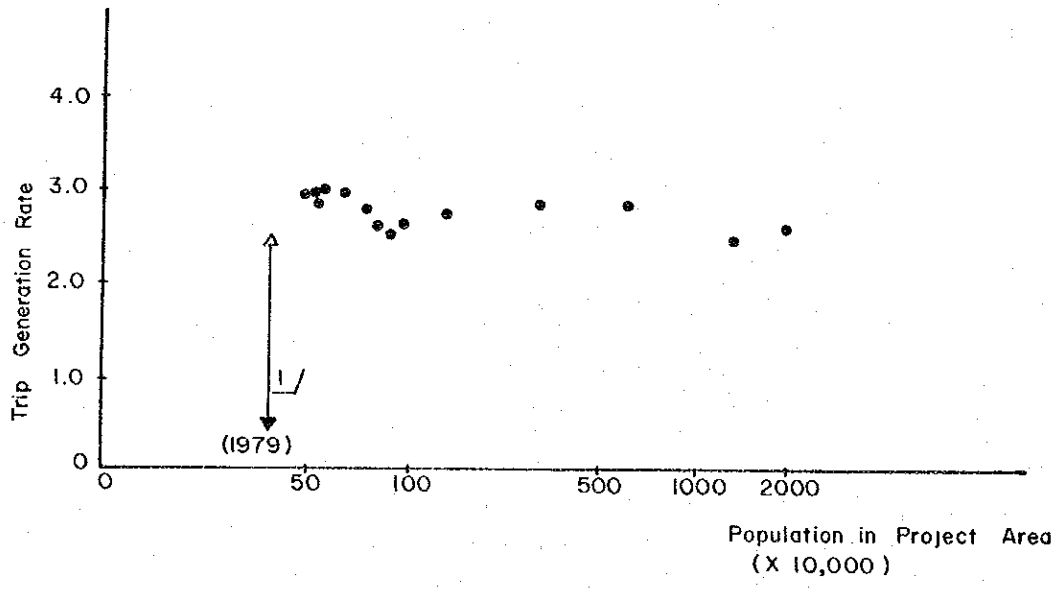
6.4.1 Trip Generation Rates

Trip generation rate is expressed as the average number of trips made per person in one day.

Trip generation rate is sometimes calculated with regard to only the persons who made at least one trip per day, and it is, in other times, calculated with regard to all the subject persons regardless of whether they made any trip or not. In this report, trip generation rate is calculated by the latter method. "trip" is defined in detail under 6.1 above. Trip generation rate is known to be a fairly stable indicator and is an important material for the forecasting of future trip demands.

(1) Comparison with Other Cities

The trip generation rate of 2.42 trips/day in the P-T Survey Area is compared with such rates in other cities in Figure 6.5. Trip generation rates revealed by the studies of other cities range between 2.5 and 3.0 trips/day, which suggests that this rate is little affected by the size of the city. The trip generation rate of this Survey Area is slightly below the rates of other cities, but this is presumably because of difference in employment structure between the Survey Area and other compared cities. Although the Survey Area of Davao City is an urban area, the number of inhabitants engaged in the primary industries shows a high comparison ratio and the Survey Area contains a number of parts which are still premature as urban area. As the Survey Area will continue to mature in the future, trip generation rate of the Survey Area will rise to the levels of other cities.



1/ Trip Generation Rate of this study in 1979

• Trip Generation Rates of Several Cities in Japan

Figure 6.5 Comparison of Trip Generation Rates in other Studies (Person Trips/Person/Day)

(2) Age and Trip Generation

Trip generation rates by age and sex, presented in Fig. 6.6 indicate that male rate of 2.77 trips/day is 1.33 times greater than the female rate of 2.08. Almost no difference is noted between sex in the age bracket of seven to 19, or school children and students. Difference is remarkable, however, in the age bracket of 20 to 59, in which males are much more active than females in making office, business and private trips. The male's rate reaches the maximum of 3.21 trips/day in the age bracket of 30 to 39, in which males are actively engaged in work, as it can be seen from the trip purpose composition shown in said Figure. The female rate drops to a fairly low level after reaching the age of 20.

(3) Trip Generation by Industries

By industries, "government" shows the highest trip generation rate of 3.78 trips/day, closely followed by "electricity, gas, water service". A conspicuous tendency noted is that trip generation rate of people in various industrial sectors rises in the order of primary, secondary, and tertiary industries. The rate of business trips to total trips is higher in tertiary industry than in other industries, and this is because, in tertiary sector, many trips are made for marketing, delivery, and other purposes. The trip generation rate of students is nearly as high as that showed by tertiary industry workers. In contrast, few trips are made by housewives and the jobless.

To be seen in the Survey Area of Davao City in the future will be an overall trip generation rate increases due to the shift of workers from the primary industry to secondary, and from secondary to tertiary, as well as to improvement in employment rate. Also to be seen will be rises in the composition ratios of commuting and business trips due to changes in employment structure.

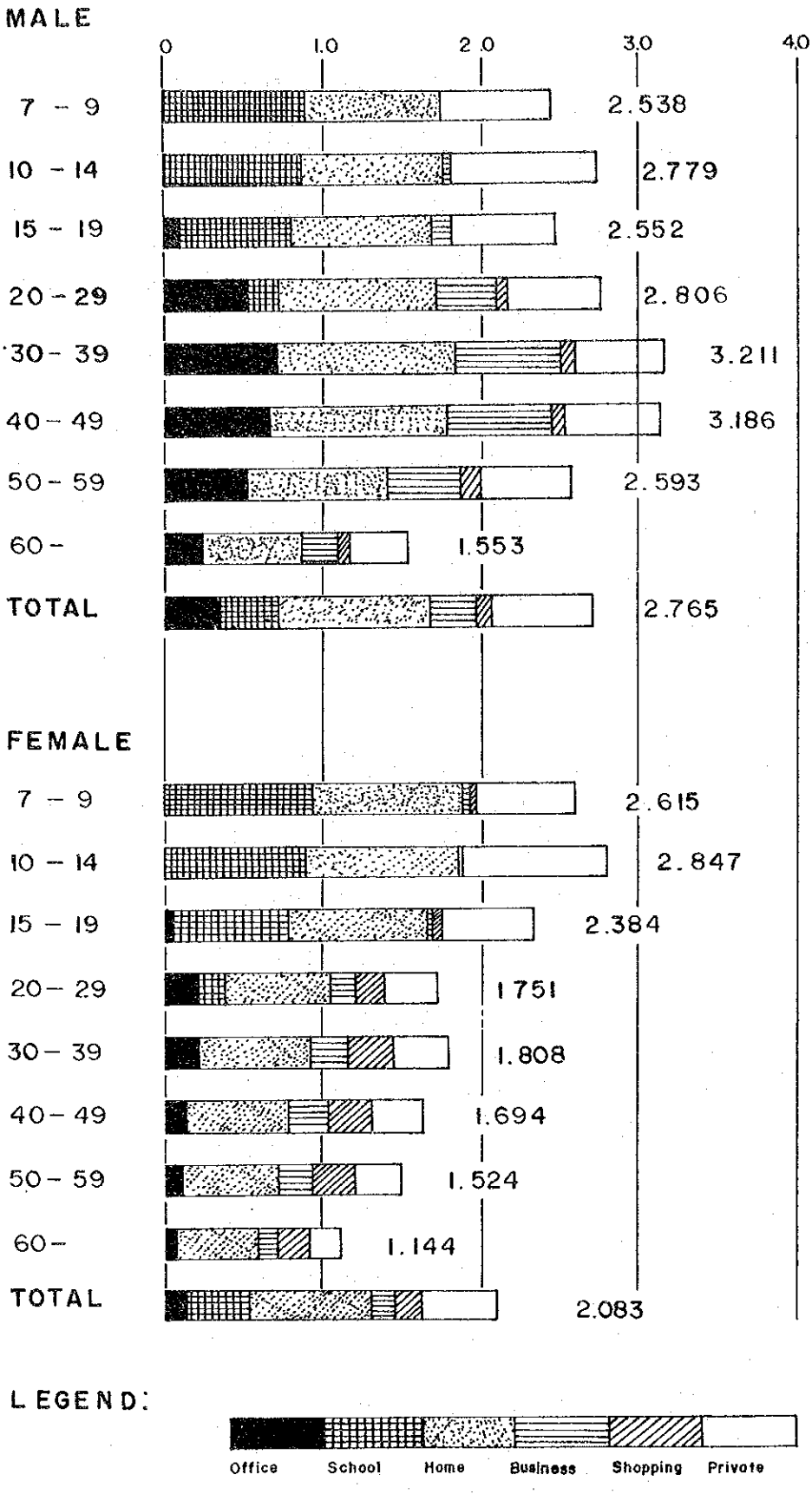


Figure 6.6 Trip Generation Rate by Sex and by Age
(Person Trips/Person/Day)

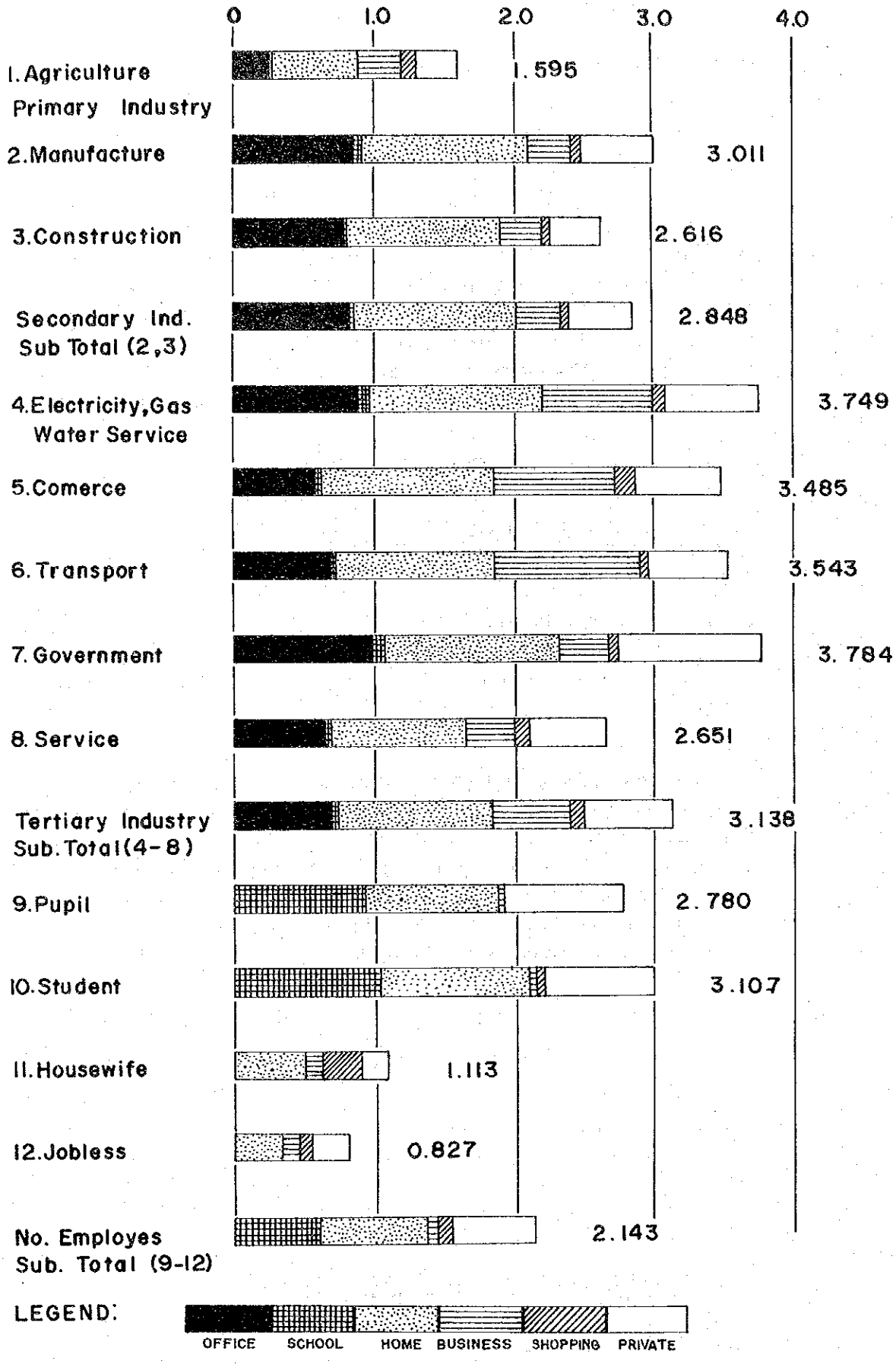


Figure 6.7 Trip Generation Rate by Industry
(Person Trips/Person/Day)

6.4.2 Car Ownership and Person Trips

(1) Car Ownership Trend

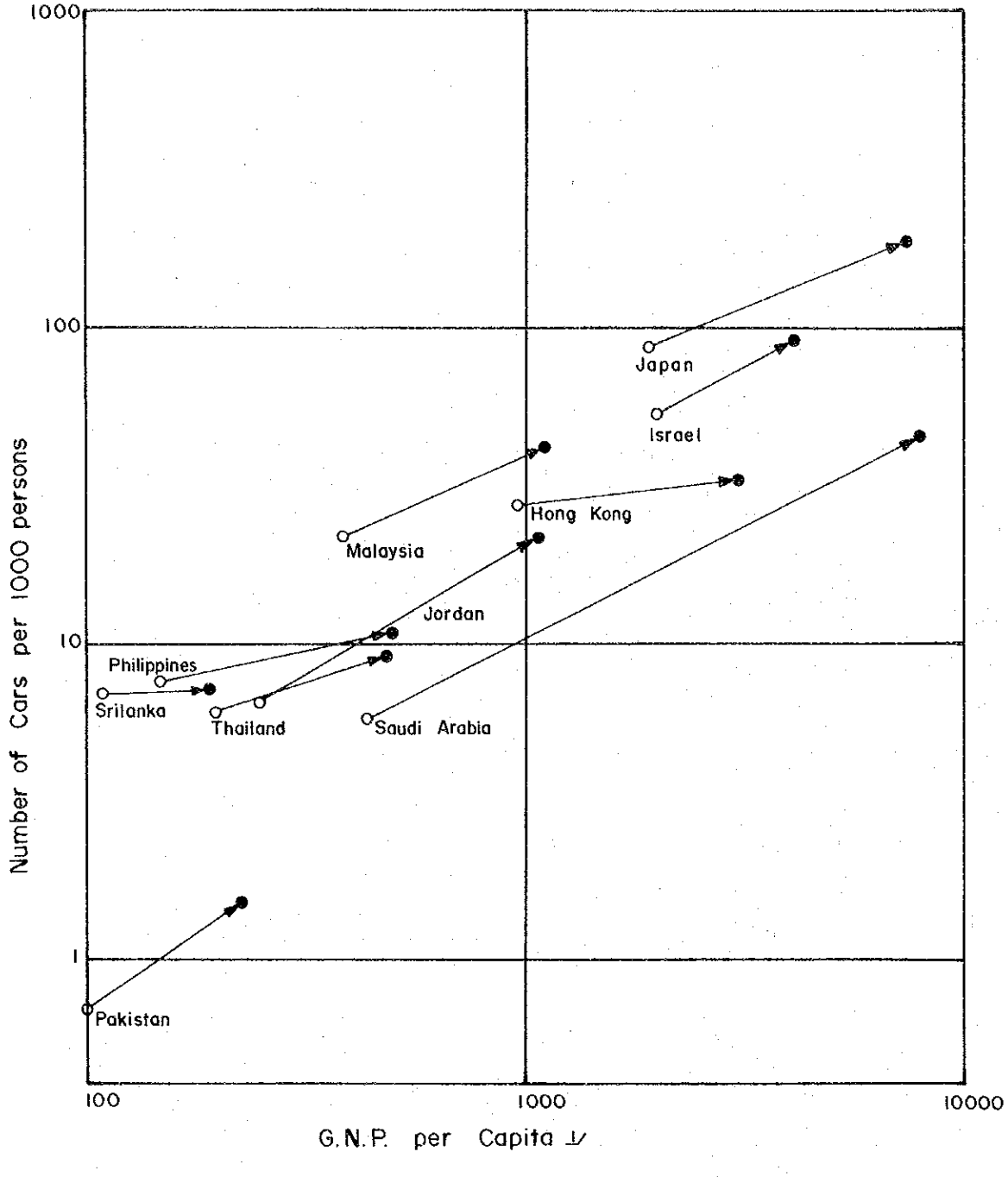
Car ownership grew remarkably in Asian countries in the recent years. The data from "Urban Transport Sector Policy Paper" of the World Bank, presented in Figure 6.8, which does not cover all Asian countries, will allow us to comprehend a general picture. Average car ownership per person grew by two to four times in these countries during eight years from 1970 to 1978, with the exception of Sri Lanka, whose average ownership remained stable. The highest growth was registered by Saudi Arabia, where average car ownership multiplied eight times in said eight years. The Philippines achieved an increase of 1.4 times, which is somewhat lower than other countries. It is generally observed that growth rate in average car ownership per capita is about one half of average per capita GNP growth rate.

Average car ownership in Davao City is not on the level of Metro Manila, but is higher than the average of the Philippines as a whole and of Mindanao. The city registered average annual increase rate of 6.9% in car ownership from 1970 to 1977, which was higher than in other areas of the nation.

It is believed that average car ownership in Davao City will accomplish a sustained increases in the future despite the oil price hikes and other deterrent factors, because the level of car ownership is still low in Davao when compared with levels in Western nations and Japan and because of the persistent desire to own a car.

(2) Effect of Car Ownership

Whether a person is a member of car owning family (person with car) or not clearly affects the number of trips the person makes on the average. The trip generation rate of 4.15 trips/day shown by persons with car is about 1.8 times greater than the rate of 2.26 trips/day shown by persons without car. This parity, however, is not believed to continue in the future, because it is usually observed that, as average car ownership rises, persons with car and those without car show increasingly similar trip generation rates.



Source : World Road Statistics (1972,1979)

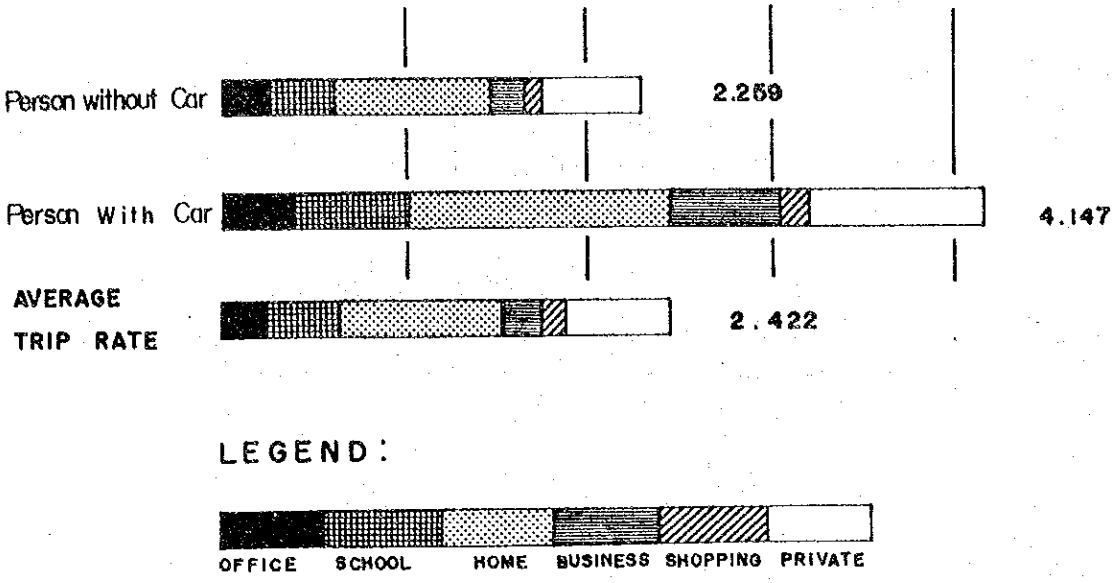
1/ : US $ at Current Prices

Figure 6.8 Car Ownership in Asian Countries

Table 6.6 Number of Private Cars per 1000 Population

	POPULATION (x 1000)				CARS PER 1000 POPULATION			
	DAVAO CITY	PHILIPPINES	MINDANAO	METRO MANILA	DAVAO CITY	PHILIPPINES	MINDANAO	METRO MANILA
1970	372	36,684	7,966	3,967	14.7	7.6	2.5	40.6
1971	409	37,703	8,189	4,150	15.3	7.7	2.5	40.8
1972	427	38,750	8,419	4,341	15.2	8.3	3.2	41.5
1973	445	39,827	8,655	4,542	15.5	8.5	3.0	40.2
1974	465	40,934	8,898	4,751	17.4	10.1	3.6	47.2
1975	485	42,071	9,147	4,970	14.2	9.9	3.1	45.7
1976	506	43,398	9,403	5,200	21.4	9.5	3.2	43.8
1977	528	44,766	9,667	5,440	24.0	10.0	3.5	45.4
1977/1970	1.35	1.22	1.21	1.37	1.6	1.37	1.4	1.12
GROWTH RATE (1970-1977)	4.4%	2.9%	2.8%	4.6%	6.9%	4.1%	4.9%	1.6%

Note: Private Cars: Heavy, Light, Bantam, Jeep, Service



Note : Person with car is a member of car owning family, and, person without car, of no-car owning family.

Figure 6.9 Trip Generation Rate by Car Owned (Person Trips/Person/Day)

The purpose composition of trip by persons with car is not so different from such composition shown by those without car, except that the former show a slightly higher rate of business trips to total trips than the latter.

6.5 Zonal Trip Demand

6.5.1 Generated and Attracted Trips by Zone

The number of trips generated in each of A-zones is shown in Table 6.7, and such number generated in each of B-zones is graphically presented in Figure 6.11.

Table 6.7 Trip Generation by A Zone

Zone No.	Trip Generation (Unit: Trips/day)	(%)	Population (Unit: Person)	(%)
2000 (Bunawan)	59,694	8.7	41,000	11.4
3000 (Buhangin)	120,997	17.7	83,000	23.0
1000 (Poblacion)	327,475	47.8	123,000	34.2
4000 (Talomo)	118,099	17.2	82,000	22.8
5000 (Toril)	47,413	6.9	31,000	8.6
Outside P.T. Survey Area	11,306	1.7	—	—
Total	684,984	100.0	360,000	100.0

Source: DCUTCLUS, 1979

Of the aggregate trips of 685,000 per day generated by the residents of P-T Survey Area, about one-half (48%) or 327,000 trips/day are generated in Poblacion. Poblacion population is only 34% of the Survey Area population, and this means that Poblacion, where people move actively, generates more trips for its population than other parts of the Survey Area. After Poblacion, coastal zones adjacent to Poblacion generate a large number of trips.

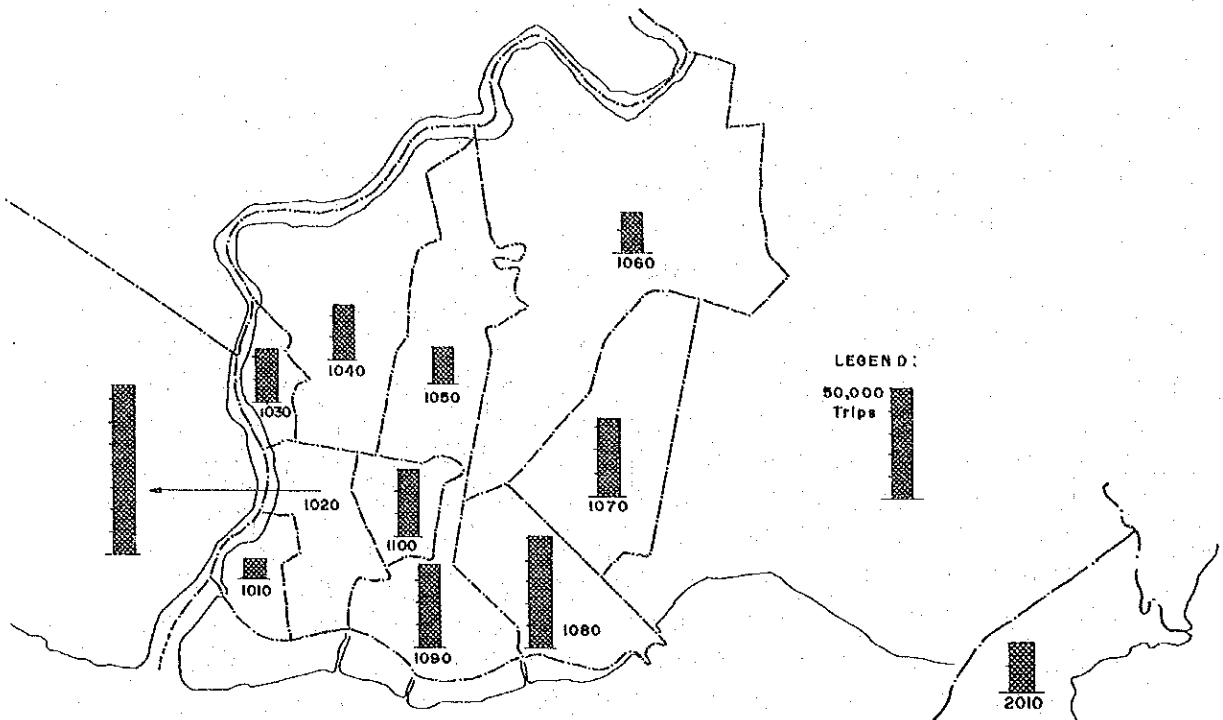


Figure 6.10 Generated Trips by B-Zone (Poblacion)

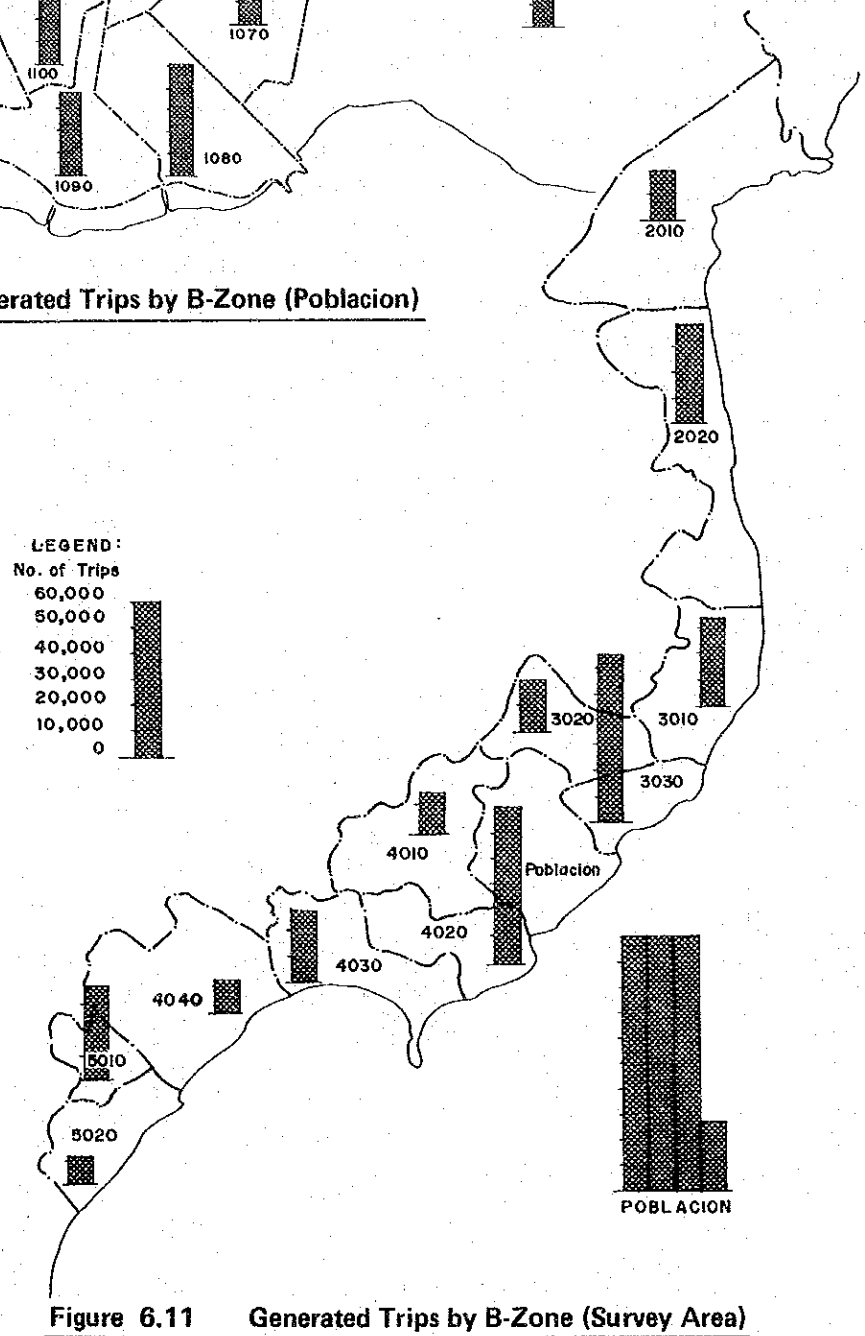


Figure 6.11 Generated Trips by B-Zone (Survey Area)

In Poblacion, Zone 1020 (City Hall Area), which encompasses the commercial and business districts along San Pedro Street and A. Pichon Street, Zone 1080 (R. Magsaysay Avenue Area), which encompasses business districts along R. Magsaysay Avenue, and Zone 1090 (Roxas Avenue Area), which is a densely populated area, generate large number of trips.

The density of trip generation, expressed in terms of the number of trips per hectare of land, is illustrated in Figure 6.13. Of the Survey Area of Davao City, high trip density is shown in Poblacion and in Zone 3030 (Agdao) which together form an area of 2- or 3-kilometer radius in which traffic congestion and other traffic problems are presently concentrated. In addition, trip density is high in Zone 5010 (Toril), which is the nucleus of a smaller livelihood community sphere than, and which stands separately from, the sphere formed around Poblacion. Nevertheless, Poblacion is far predominantly the core of the entire Survey Area, and, generally, the farther away the zone is from Poblacion, the lower the trip density is in the zone.

In Poblacion, trip density is high in CBD, which is presently being formed (the City Hall area, areas along C.M. Recto Avenue, Bankerohan Market, and R. Magsaysay Avenue). CBD shows a bi-polar structure around the City Hall area and R. Magsaysay Avenue area. These areas are confined to a rather small land space 2.5 kilometers long and one kilometer wide, sandwiched between E. Quirino Avenue and M. Quezon Boulevard. The area stretching out on the northwest of E. Quirino Avenue is now being used as a residential area and, therefore, trip density is low.

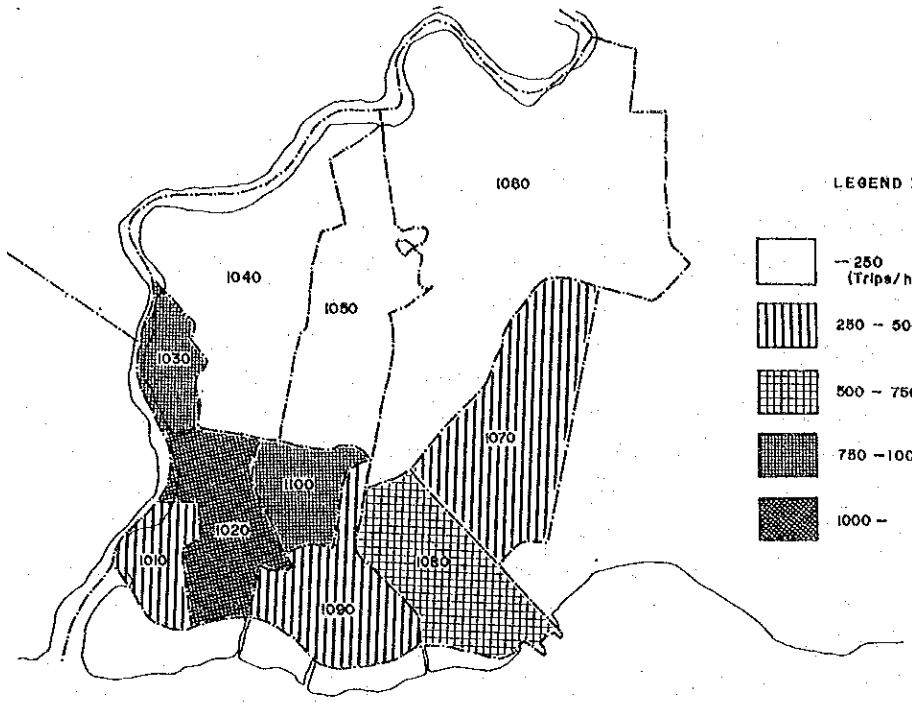


Figure 6.12 Trip Density by B-Zone (Poblacion)

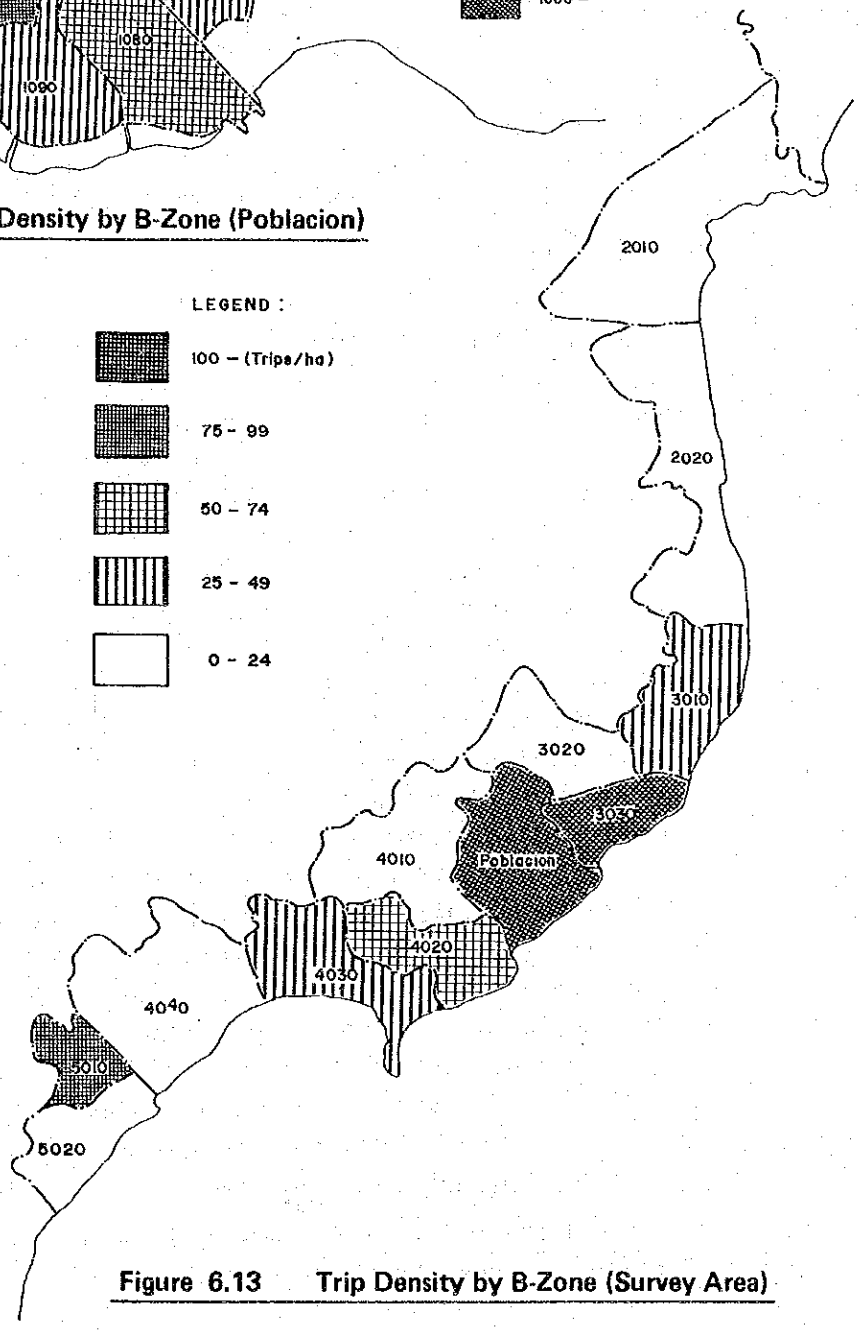


Figure 6.13 Trip Density by B-Zone (Survey Area)

6.5.2 Inter-Zonal Trips

(1) Internal and External Trips

The number of trips made by the residents of the P-T Survey Area across the Area boundary is a very small 21,000 trips/day or only 3% of the aggregate trips. In comparison, such trips made by non-residents count 63,100 trips/day, or 8% of the aggregate. The fact that external trips (those across the Survey Area boundary) made by non-residents are greater, by a fair margin, than those made by residents shows that the Survey Area functions as the center of Davao City. Fig. 6.14 graphically shows in three general directions in which external trips flow: (1) Tagum and Mati way (Northern entrance to the Survey Area); (2) Calinan way (Western entrance); and (3) Digos way (Southern entrance). Of the three, most important is northern entrance with the largest number of 32,400 trips/day, followed by southern entrance with 27,100 trips/day, and western entrance with 23,700 trips/day. The mode of travel most frequently used in making these external trips is PUJs, followed by buses and trucks. It is characterize that, reflecting the high utilization of buses for inter-provincial trips, 20% of external trips depend on buses while only 1% of internal trips depend on buses.

(2) Internal Trips

A-zone distribution of origin-destination pairs is shown in Figure 6.15. Intra-A zone trip ratio (the composition ratio of trips within an A zone to all trips) is about 80% in Bunawan and Toril, 72% in Poblacion, and about 55% in Buhangin and Talomo. The high Intra-A zone trip ratios in Bunawan and Toril, which are positioned in the northern end and southern end of the Project Area, are explained by the fact that each of them forms a small livelihood community sphere of its own, although under some influence of Poblacion. On the other hand, intra A-zone trip ratios are small in Buhangin and Talomo, which are under a stronger influence of Poblacion, because they are parts of a large livelihood community sphere shaped around Poblacion and which house numbers of workers and students who commute to Poblacion, and therefore, a high proportion of trips generated in these A zones are not completed within the same zone. An overwhelmingly majority of 86% of trips between A-zones are either originated from or destined to Poblacion. The number of trips between Poblacion and northern areas (Bunawan and Buhangin) is 92,000 trips/day, and that between Poblacion and southern areas (Toril and Talomo) is 89,000 trips/day. Of the two available access roads to Poblacion from north, J.P. Laurel Avenue and R. Castillo Street, and also of the two available access roads to Poblacion from south, Bankerohan Bridge and Bolton Bridge, R. Castillo Street in the north and Bolton Bridge in the South are not fully utilized, and the resultant traffic congestion in the morning and evening peak hours has become a serious problem. Transit trips through Poblacion are very few in number at about 13,000 trips/day. At the present, it is observed that there is little connection between Bunawan and south of Talomo and between Toril and north of Buhangin.

Like trips for all purposes, working commuter trips concentrate overwhelmingly into Poblacion, within whose commuting radius is the entire parts of the

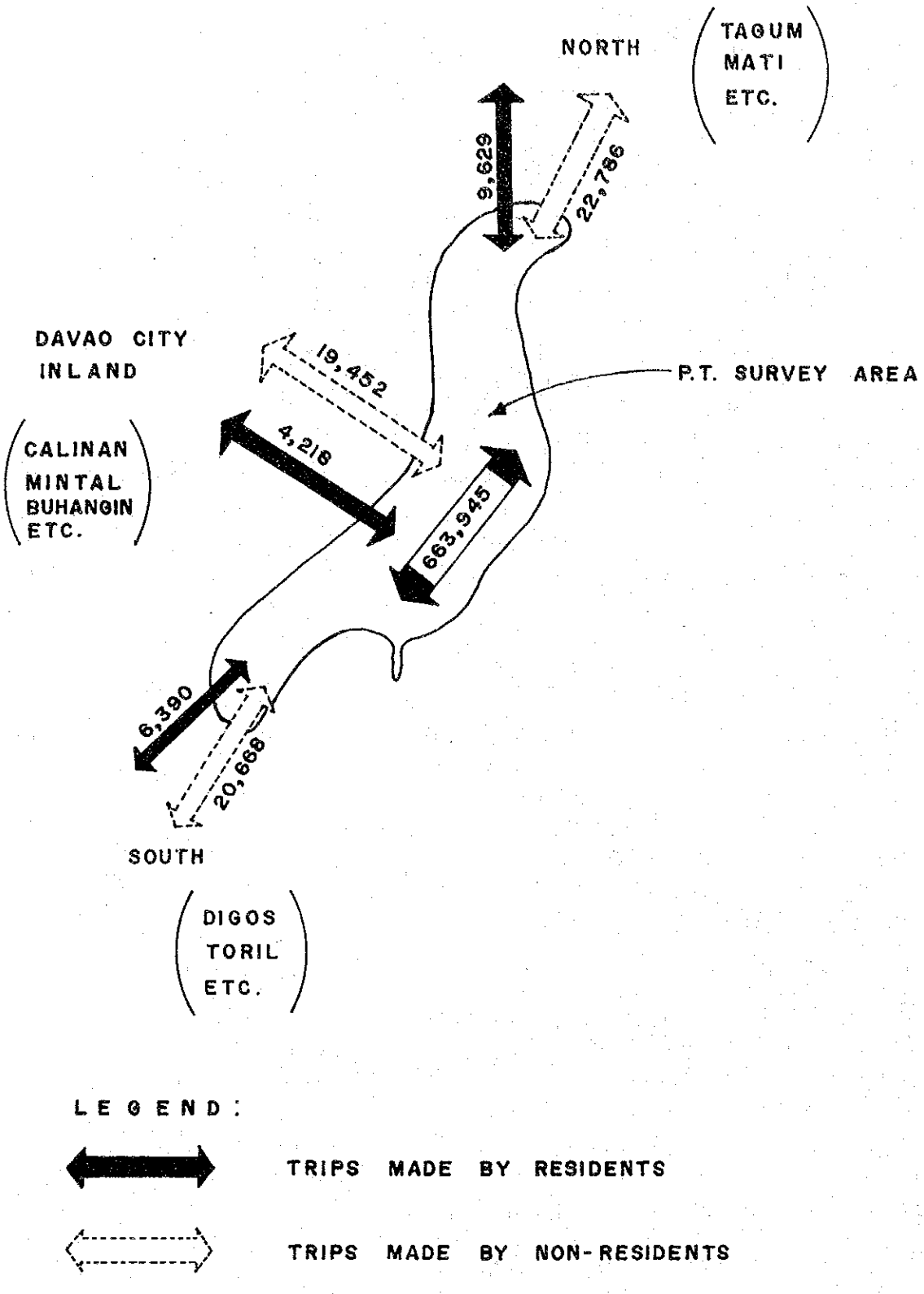
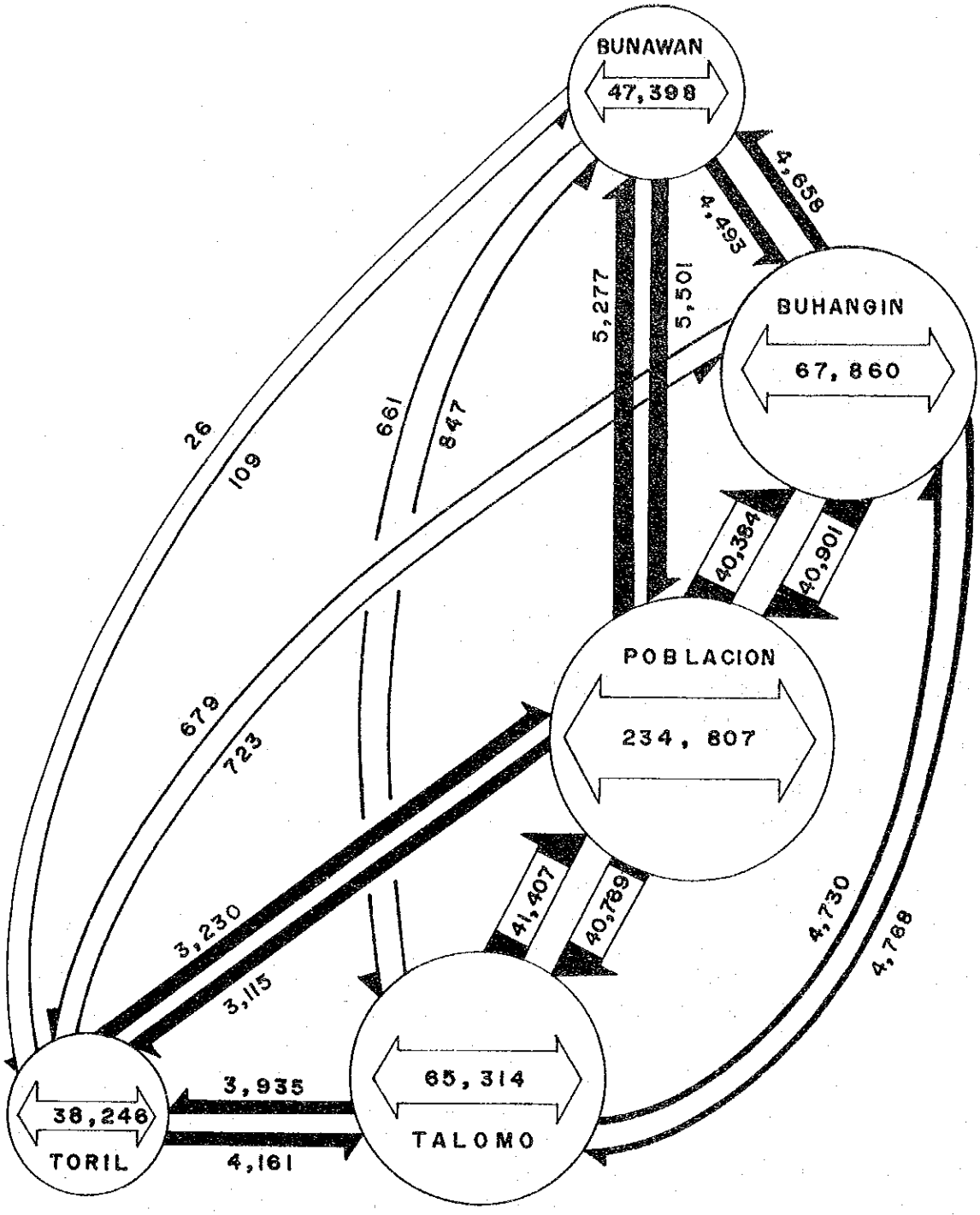


Figure 6.14 Internal and External Trips (Person Trips/Day)



NORTH	⟷ POBLACION	92,063
SOUTH	⟷ POBLACION	88,521
NORTH	⟷ SOUTH	12,543

Figure 6.15 Internal Trips in the Survey Area (Person Trips/Day)

Survey Area. Particularly large number of working commuters come to Poblacion from Zone 3031 (Agdao), Zone 3021 (Buhangin), and Zone 4022 (Matina Crossing), all of which are located at about five kilometers from Poblacion. Areas other than Poblacion do not show a substantial concentration of working commuter trips, but a minor concentration is seen in Zone 3011 (Sasa), which encompasses Sasa Port, and Zone 3012 (Pampanga) from northern part of the Project Area and from redidential areas in the northern and/or northwestern parts of Poblacion. Inside Poblacion, concentration is high in Zone 1020 (City Hall area), which functions as the nucleus of CBD, followed by Zone 1080 (R. Magsaysay Avenue area). A concentration of some degree is seen in Zone 1100 (Boyscout area) and Zone 1070 (Bo. Obrero Area).

The concentration of students going to schools in Poblacion is also conspicuous, and the entire land of the Project Area is within the commuting radius of students. Local concentration is seen in Zone 5011 (Crossing Bayabas), which is located in the north of Toril. Within Poblacion, the areas where intra-Poblacion trips are concentrated do not necessarily coincide with the areas where trips from outside are concentrated.

The concentration of both intra-Poblacion trips and inter-zonal trips into Poblacion is substantial in Zone 1020 (City Hall Area) revealing the dual characteristics of the Zone as CBD and as educational area. Intra-Poblacion trips are concentrated in Zone 1050 (City High School Area) as another educational area, while inter-zonal trips into Poblacion are more conspicuously concentrated into Zones 1070 and 1040 (Brokenshire Area). The difference is explained by the existence of a highschool in Zone 1050 and of colleges in Zones 1070 and 1040.

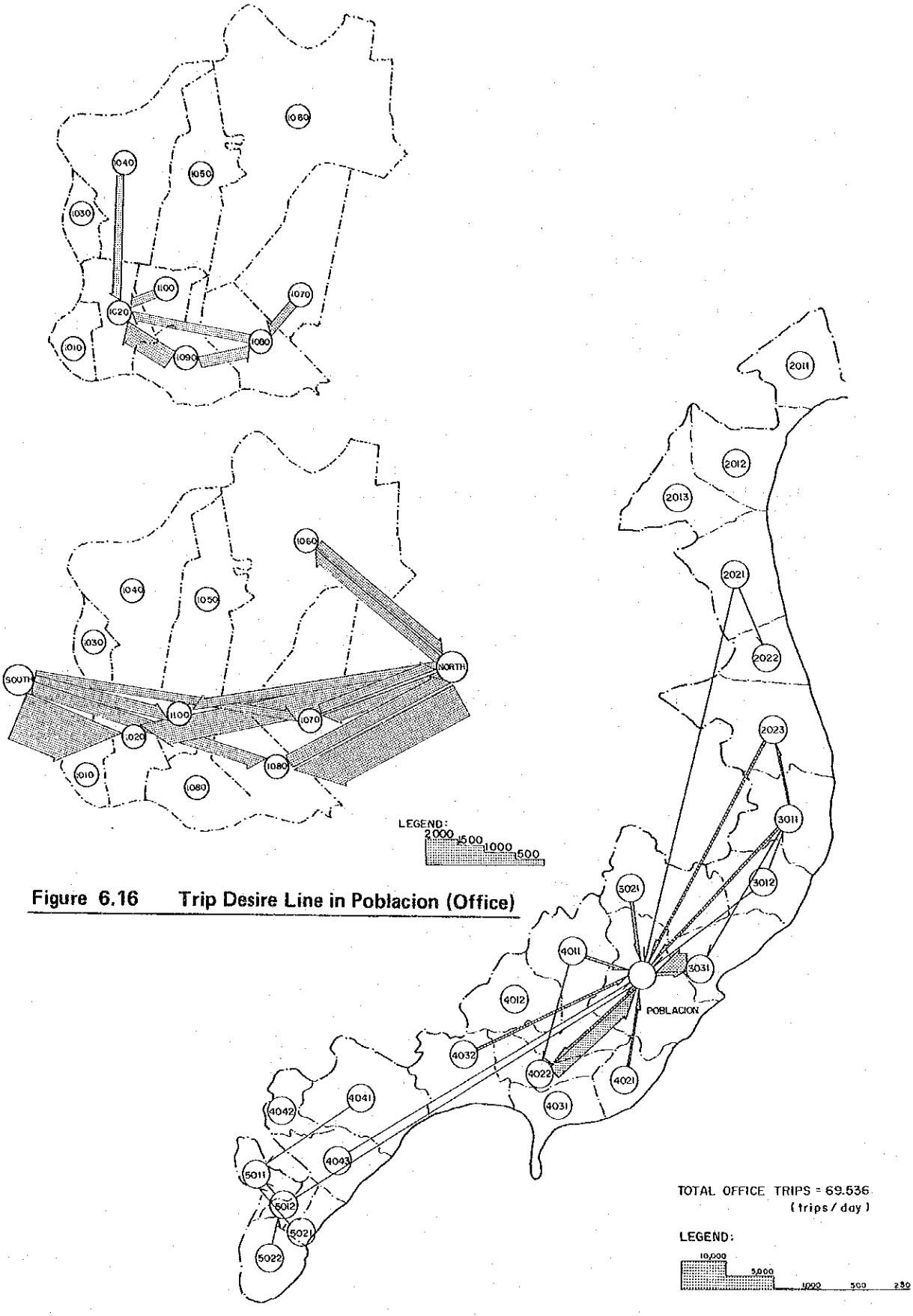


Figure 6.16 Trip Desire Line in Poblacion (Office)

Figure 6.17 Trip Desire Line in the Survey Area (Office)

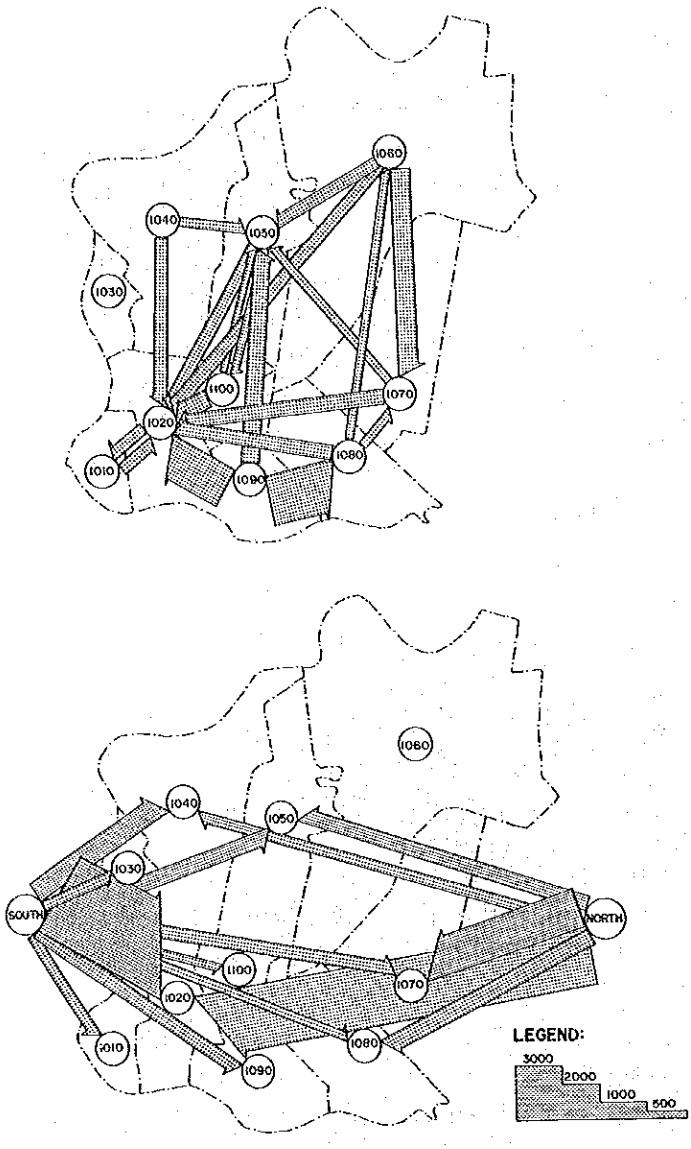


Figure 6.18 Trip Desire Line in Poblacion (School)

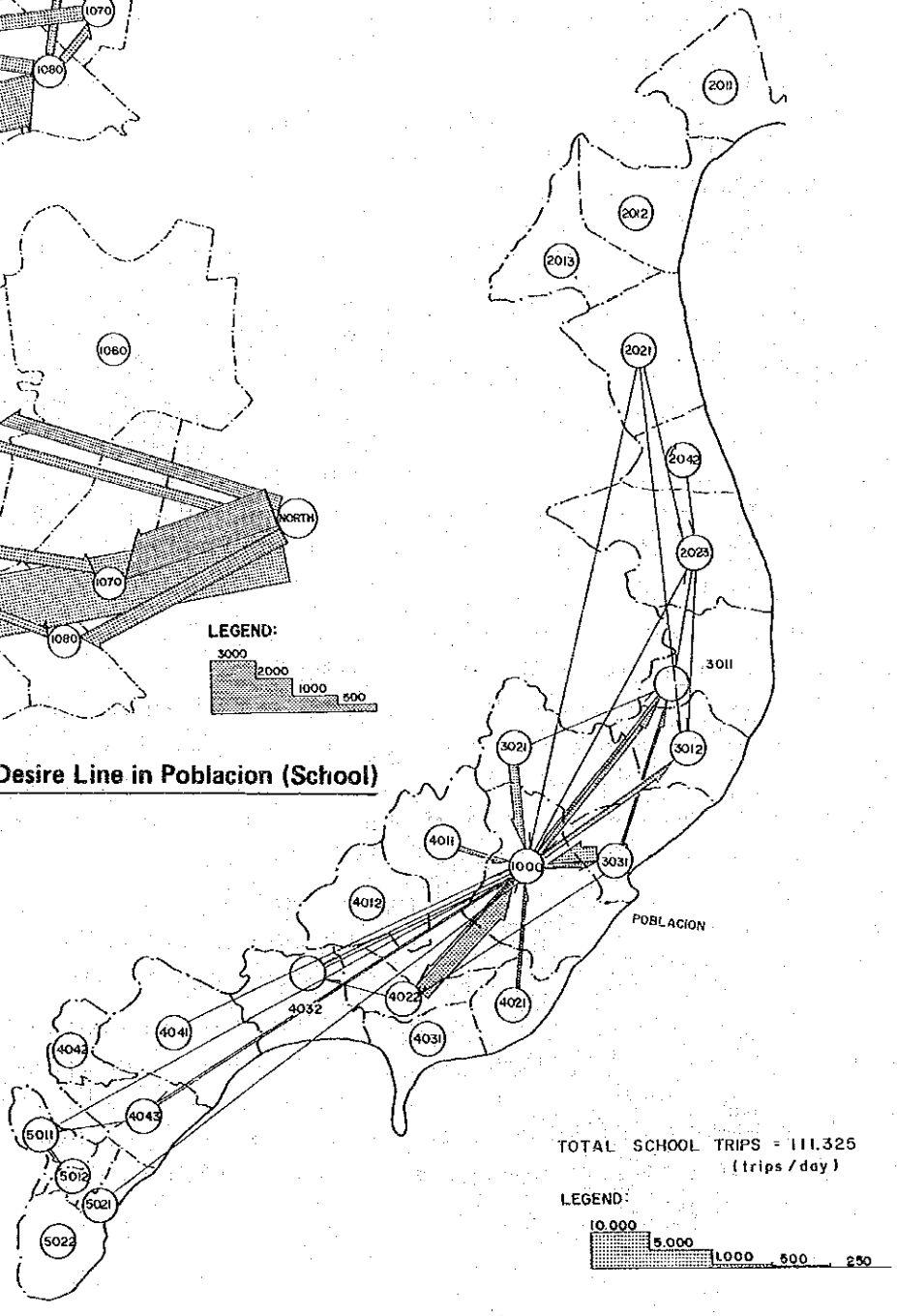


Figure 6.19 Trip Desire Line in the Survey Area (School)

6.5.3 Zonal Peculiarities in Modal Preference

Modal compositions of trips within each A-zone and those of trips concentrating from other A-zones to Poblacion are described in Fig. 6.20. The zonal peculiarities in modal preference is clearly depicted by three or four modes most frequently used for trips within each A-zone.

Table 6.8 Highly Utilized Modes for Intra-A Zone Trips

Zone	High	—		—	Low
2000 Bunawan	Walking	—	PUJ	—	Truck
3000 Buhangin	Walking	—	PUJ	—	Tricycle
1000 Poblacion	Walking	—	AC	—	PUJ — Car
4000 Talomo	Walking	—	PUJ	—	Car
5000 Toril	Walking	—	Tricycle	—	Truck

The most utilized mode of intra A-zone trips is walking in any A-zone, but the utilization rate of walking in Poblacion is only 41% as compared to 60 to 70% shown in other A-zones.

Another peculiar characteristic of modal distribution of trips within Poblacion is the fact that the AC is much used. ACs show a higher, but only slightly higher, utilization rate than, and compete with, PUJs in intra-Poblacion transportation. The indicated low "walking" rate in Poblacion can be explained by the wider expansion of urbanization in Poblacion than in other A-zones, by the distribution of schools, hospitals, markets, and other public facilities in such urbanized areas scattered beyond reach by foot, and also by the availability of AC service.

As for Bunawan and Toril, the next highly utilized is PUJ in Bunawan, and characteristically tricycle in Toril, which forms a compact livelihood community sphere where tricycles, which are suitable for short trips, are handy.

PUJ is important as means of transportation for going to Poblacion, and about 60% each of trips from Bunawan and Toril to Poblacion depend on PUJs, while about 45% of trips from Buhangin and Talomo to Poblacion depend on PUJs. It is characteristic that PUJs are followed by buses in the case of trips from Bunawan to Poblacion, and by cars in the case of trips from Talomo to Poblacion.

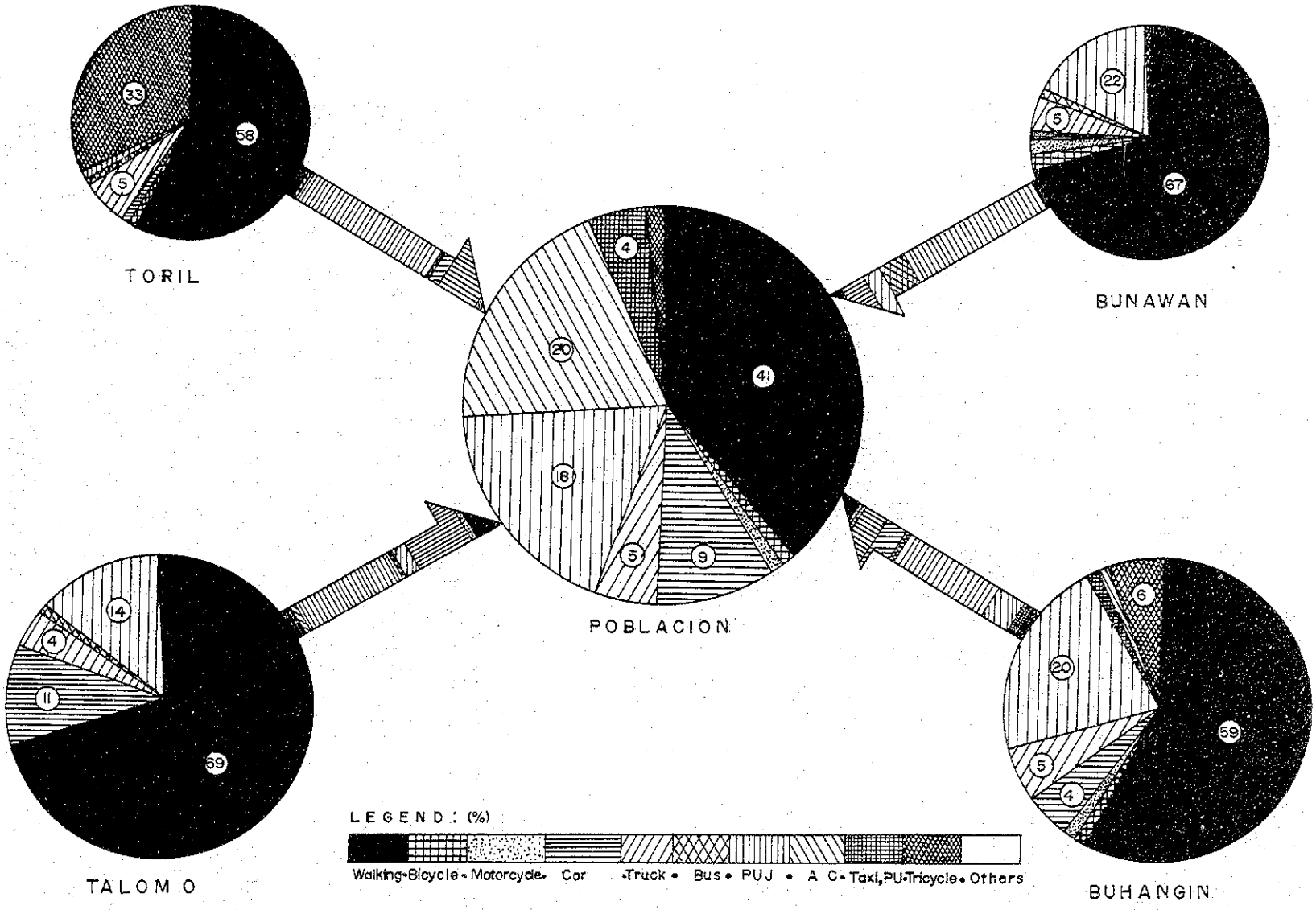


Figure 6.20 Modal Composition by A-Zone