DCUTCLUS

DAVAO CITY URBAN TRANSPORT CUM LAND USE STUDY

GOVERNMENT OF THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

VOLUME II

EXECUTIVE SUMMARY

DECEMBER 1981

MINISTRY OF PUBLIC WORKS AND HIGHWAYS

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to the request of the Government of the Republic of the Philippines, the Japanese Government decided to conduct a study on the Davao City Urban Transport Cum Land Use Project and entrusted it to the Japan International Cooperation Agency (JICA). The J I C A sent to the Philippines a survey team headed by Mr. Tetsuo Wakui from August 1979 to October 1981, under the guidance of the Supervisory Committee headed by Dr. Yoshiro Watanabe, professor of the Tsukuba University.

The team had discussions with the officials concerned of the Government of the Philippines and conducted a field survey in Davao city. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Philippines for their close cooperation extended to the team.

December 1981

Keisuke Arita
President
Japan International Cooperation Agency

REPUBLIC OF THE PHILIPPINES
MINISTRY OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE MINISTER
MANILA

MESSAGE

We are pleased to have the Final Report on the Davao City Urban Transport Cum Land Use Study (DCUTCLUS).

In no small measure, the Study reflects the technical cooperation of the Government of Japan, through the Japan International Cooperation Agency (JICA), and the Philippine Government, through the Ministry of Public Works and Highways with the assistance of other agencies. The Study, which took two and a half years to complete, aims at the formulation of a comprehensive urban transportation and land use master plan for the large and progressive City of Davao in Mindanao. The cooperation and support of local government authorities in this undertaking underscore their concern to long-term solutions beneficient to the public interest and welfare of the residents of the Project Area.

It is the desire of the national leadership that area development planning adhere to the requirements of growth and national priority targets by clearly defining the issues, problems and options. President Ferdinand E. Marcos, through the organizational frame work of the Ministry of Public Works and Highways, has provided the leadership to document, validate and propose institutional as well as legislative actions to a variety of problems of the City of Davao spawned by rapid population growth and other factors.

The Study, therefore, is creditably the right step towards the right direction for the modernization and balanced growth of this burgeoning metropolis, particularly with respect to the vital transport systems that must be provided in relation to the overall development plan for the city.

It is my hope that the present leaders and future generations of Davao City will be guided by this Study.

May I commend all the members of the DCUTCLUS Steering Committee led by Project Director Prudencio F. Baranda, Project Manager Esther L. Alino, and her staff for a job well done. Special thanks is also extended for the invaluable help of former Mayor Luis T. Santos and the present Davao City Administrator, Mayor Elias B. Lopez, and the local authorities, as well as to Mr. Tetsuo Wakui and the team of Japanese consultants for their tireless efforts to realize the Study.

JESUS S. HIPOLITO
Minister
Ministry of Public Works and Highways

MESSAGE FROM CITY MAYOR

It is with genuine pleasure that I take this opportunity to extend my congratulations to the Philippine and Japanese teams which produced this final report on the Davao City Urban Transport Cum Land Use Study (DCUTCLUS).

As Mayor of Davao City, I am happy to know that there are other people who are also very much concerned with the planning of Davao City's future development. Considering the size of this city, we certainly need all the assistance we can get from other sources.

We are therefore thankful to the Ministry of Public Works and Highways (MPWH) and the Japan International Cooperation Agency (JICA) for having initiated and concluded this study which, to my mind, may prove very useful to the development of our beloved city in the years to come.

The thoroughness of this study shows the deep interest of those involved in this joint efforts between the Philippine and Japanese governments.

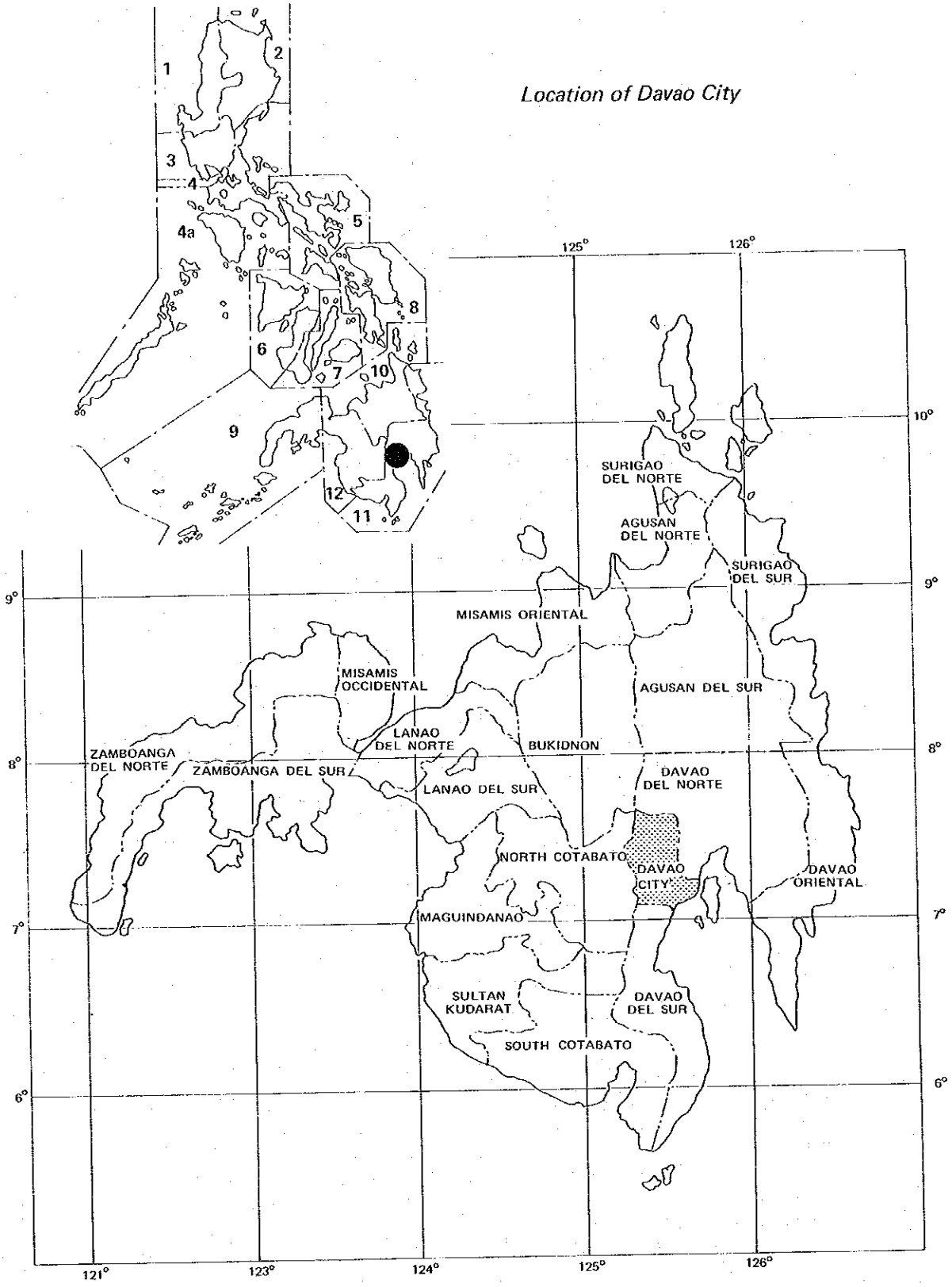
In the final analysis, however, is the crucial question on whether these plans contained in this study are implementable or not. This, of course, brings into mind the possible sources of funds needed to transform these plans to reality.

I would suggest, therefore, that those involved in this study should take one step further beyond the context of mere planning and venture into the next logical sequence, which is the realm of reality and implementation.

Again, please accept my warmest best wishes for a job well done.

October 20, 1981
City Hall, Davao City

ELIAS B. LOPEZ
Mayor, City of Davao


Location of Davao City
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AGUSAN DEL SUR
LANAO DEL NORTE
BUKIDNON
ZAMBOANGA DEL NORTE
ZAMBOANGA DEL SUR
LANAO DEL SUR
DAVAO DEL NORTE
NORTH COTABATO
DAVAO CITY
DAVAO ORIENTAL
MAGUINDANAO
SULTAN KUDARAT
DAVAO DEL SUR
SOUTH COTABATO

Contents

Tables and Figures

1. Introduction

This Study aims at the formulation of a comprehensive urban transportation and land use Masterplan for the 18,000-hectare coastal part of the City of Davao, Mindanao, with the target year of 2000 A.D. The Plan is expected to offer long term guidelines on the administration of transportation and development of the City, with modifications from time to time in response to socio-economic changes. The entire work of this Study has been accomplished through the joint operation of the DCUTCLUS Team and JICA Team.

Purpose

The government of the Republic of the Philippines set up, within the organizational frame of the Ministry of Public Works and Highways, a team for a Davao City Urban Transport Cum Land Use Study (DCUTCLUS) and a steering committee consisting of representatives from agencies concerned. The DCUTCLUS Team undertook the study during the past two and a half years with technical cooperation from Japan through the Japan International Cooperation Agency (JICA) and completed the entire process of the study by the end of 1981.

The Terms of Reference for the DCUTCLUS Project set forth two purposes of the study: the formulation and implementation of an Urgent Implementation Program for the remedy of impending problems from which Davao City was currently suffering, and the laying down of a transportation and land use masterplan which would provide the City with a guide for development and transportation/traffic administration up to the year 2000. In addition, the training and education of personnel in charge of transportation planning was also intended through the process of the Study.

Urgent Implementation Program

- A traffic management plan for Poblacion and the vicinity
- A plan for the improvement/development of streets
- A PUJ rerouting scheme

Transportation Cum Land Use Masterplan

- Establishment of a socio-economic framework
- Formulation of medium and long term land use plans
- Designing of a road/street development plan
- Formulation of a traffic management plan
- Designing of a public transportation plan
- Formulation of an investment program
- Pre-feasibility studies of major projects.

Study Area and Project Area

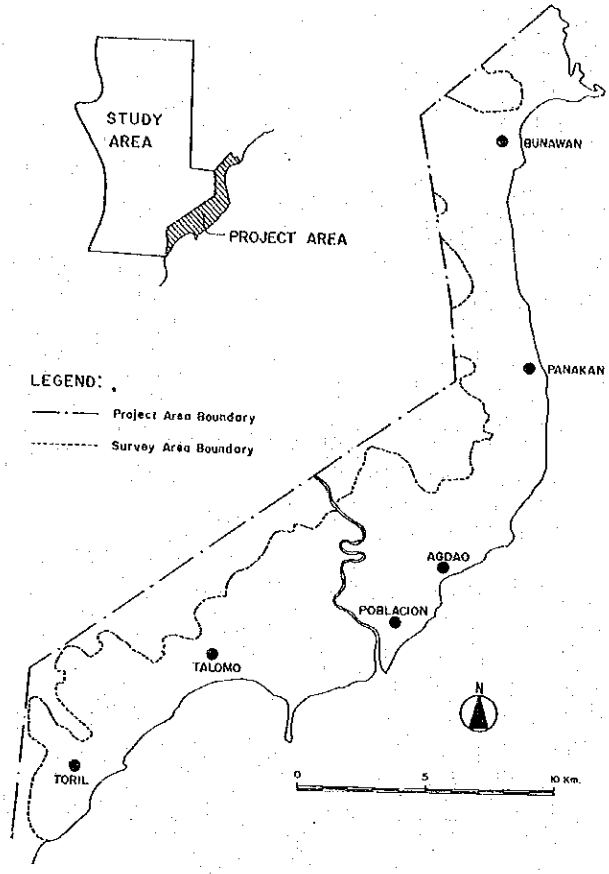
The socio-economic study is to survey Davao City as a whole, while the transportation and the land use plans are to be formulated for only the coastal part of the city in a total land space of about 18,000 hectares. The former is referred to as "the Study Area", and the latter, "the Project Area." The Part of Davao City outside the Project Area is referred to as "the non-Project Area."

A person-trip survey, the most important of the data generating efforts, has been conducted covering approximately 85% of the Study Area. After an aero-photographic survey, maps of the entire Project Area have been drawn at the scale of 1:10,000 and those of Poblacion and the vicinity, 1:5,000.

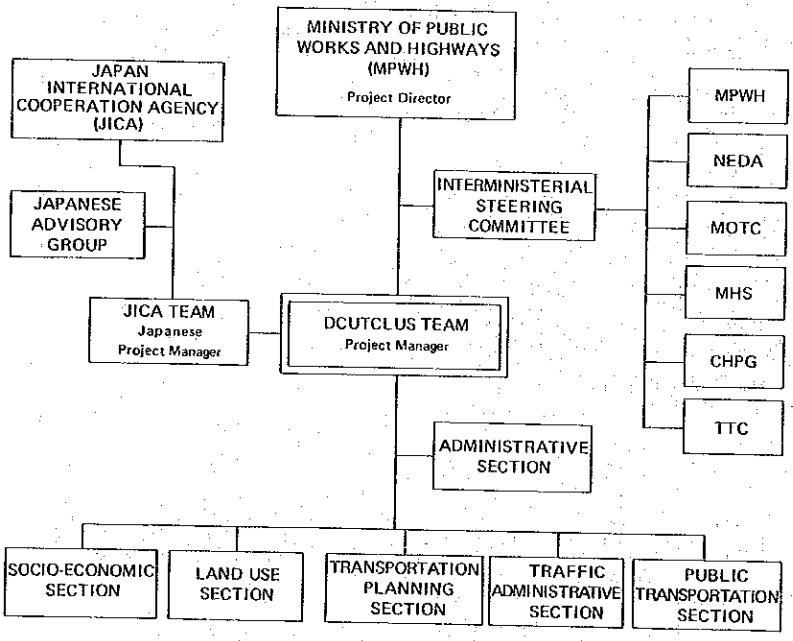
Reporting

The findings of the Study have been compiled in a report consisting of the four volumes listed below. In addition, a report of the Urgent Implementation Program, several sets of geographical maps including the original drawings and computer printouts generated in the process of the Study have been submitted to MPWH under a separate cover.

- Volume 1 Executive Summary
- Volume 2 Current Status of the Project Area
- Volume 3 Plans and Recommendations
- Volume 4 Appendices



Study Area and Project Area



Organization of DCUTCLUS

DCUTCLUS

2. Why DCUTCLUS?

Infrastructural and economic development has lagged behind the rapid postwar population growth in the Project Area, and, as a consequence, unemployment, slum formation, sprawl land development, and traffic concentration in Poblacion have become apparent. If left alone, these problems will undoubtedly be aggravated seriously. Thus, comprehensive land use and transportation plans in a long-term urban development perspective are in order.

Current Issues

Davao is one of the cities in the world where population increased faster than the pace of infrastructural and economic development to meet the population pressure, and urban problems such as unemployment and the formation of slums have started to appear.

In the absence of an effective zoning system to encourage desirable development while curtailing undesirable land use, certain unwelcome situations have come about to include the housing estates development in a sprawl fashion and the coexistence of houses and factories. Fortunately, such confused and random land use has not yet caused a serious consequence in the Project Area, where only 20% of land is urbanized. However, as urbanization will step up, these problems will increase in both number and complexity.

In the area of transportation, too, some degree of morning and evening rush hour traffic congestion is observed only in and around Poblacion, and the serious degree of traffic congestion and accidents which are plaguing world's metropolises has not yet come about, inasmuch as road development has so far been relatively favorable and the number of vehicles is still relatively small in Davao. However, continued dependence on the existing accumulation of social capital will no longer be permissible under incessantly surging traffic demand expansion in the future.

The service system of the PUJ, which in Davao City is the mainstay of public transport along with the AC, is no longer in tune with the level of demand and, despite the repeated efforts of the relevant authorities, finally acceptable routing scheme has not yet been devised. Therefore, the administration is now under demand to establish a new policy and a prospect of public transport in view of the current status of the PUJ service and from a long-term perspective.

Study Tasks

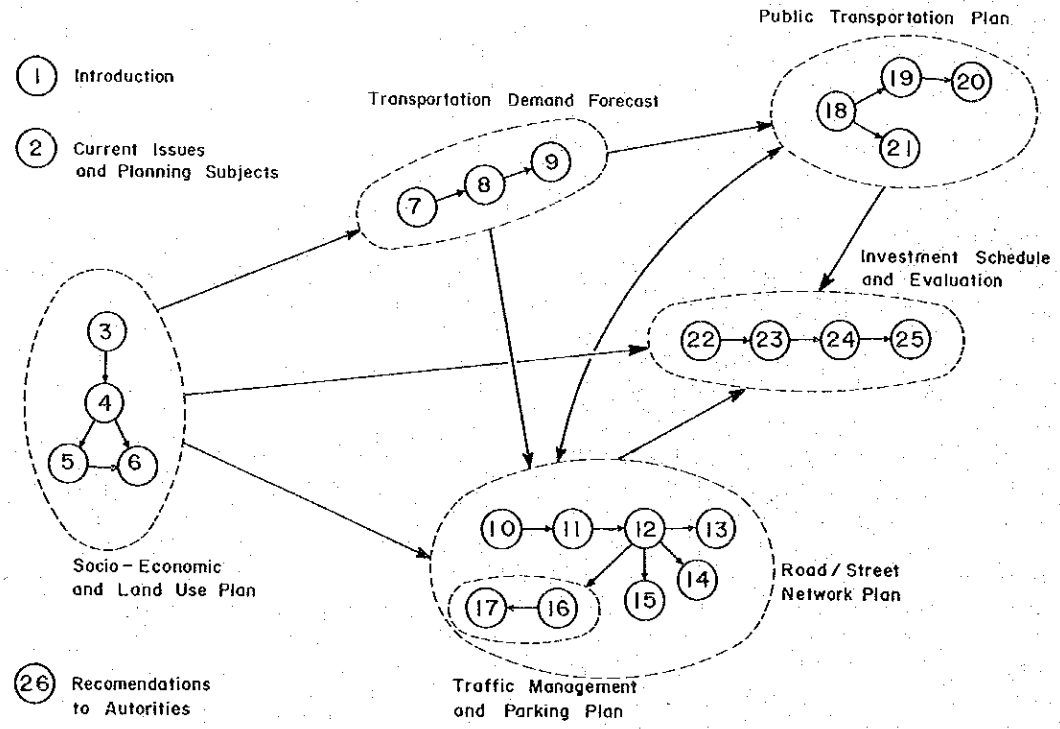
- The estimation and establishment of future population, labor force, production, and other socio-economic indicator values to form a planning framework.
- The formulation of a practical land use masterplan, translating the socio-economic framework onto maps. The masterplan must be such that future land use demand will be adequately met, the safety and amenity of urban life be guaranteed, and an attractive and vital urban complex be developed.
- The formulation of an urban transport masterplan based on the forecast of future traffic demand. Along with the important objectives of safety and amenity, economy must also be pursued. In this sense, the existing stock must be used to a maximum extent, while the traffic network of the masterplan must be able to fully support the continuing urban development after the turn of the century.
- The formulation of a traffic management plan and a public transport plan for the effective utilization of the future traffic network. In this regard, the passenger safety and amenity, and the economy of transport operation are to be pursued.

Composition of the Executive Summary Report

This report consists of sets of 2-page double spread, each containing a short summary of a subject theme. The succinct description of the summary in the page-top box will help the reader to select the subject theme of his interest for perusal. The diagram on the right shows the interrelationships between the subject themes.

C.M. Recto Avenue

A. Pichon Extension



Relationship among Study Items

3. Socio-Economic Framework

The population of the Project Area is estimated to increase from the current 400,000 to 900,000 by the year 2000, when the required number of employment will be 320,000, which means that an additional 210,000 employment opportunities will have to be created. Of this total additional jobs, 70% to depend on the tertiary industries. In other words, Davao City will function as administrative, cultural, educational, commercial, financial, and distribution centers, rather than as an industrial city.

Function of the Project Area

The concentrated development investments made in Metro Manila in the past has accelerated the economic growth of the metropolitan area on one hand, while, on the other hand, it not only has brought about rapid population swell and consequential aggravation of transportation, housing, unemployment and other urban problems in that area, but also has hindered sound development of local cities. In order that limited funds be effectively investmented, the strategic and emphatic fosteration of local core cities, which will become development bases, will be essential. The fosteration of Davao City as the core city of Mindanao will facilitate the mitigation of population pressure and help the solution of urban problems in Metro Manila, while it will stimulate local economies for a well-balanced national development.

Davao City will continue to be the administrative and cultural center for the entire Mindanao, and developed in the Project Area in heavy concentration will be various administrative, medical, educational, cultural, and amusement facilities. In the economic aspect, the Project Area will play a greater role in tertiary sector than in secondary sector. In other words, the Project Area will become the greatest center of commercial transactions, goods distribution, financing, and information in Mindanao, and a large labor force will be given jobs in these industrial sectors.

The secondary sector will, nevertheless, continue to be important. Excessive reliance of a city economy on the tertiary industries would jeopardize its economic stability. Furthermore, an expanding labor force would not be fully utilized and the labor productivity elevated in pace with other cities, without the continuous development of the secondary industries. In this sense, it will be essential that industrial development be strongly propelled in Davao City.

Population/Labor Force

The extrapolation of population increase trends toward the future results in an estimated population of 1.25 to 1.3 million in the year 2000. The year 2000 Davao City population estimated by various government agencies falls between 1.1 and 1.5 million, and that estimated by Davao City authority is 1.3 million. DCUTCLUS has adopted this 1.3 million as the target population, and will formulate plans to accommodate this size of population. The Project Area population is estimated to grow from the 371,000 in 1979 to 590,000 by 1990 and, further, to 900,000 by the year 2000.

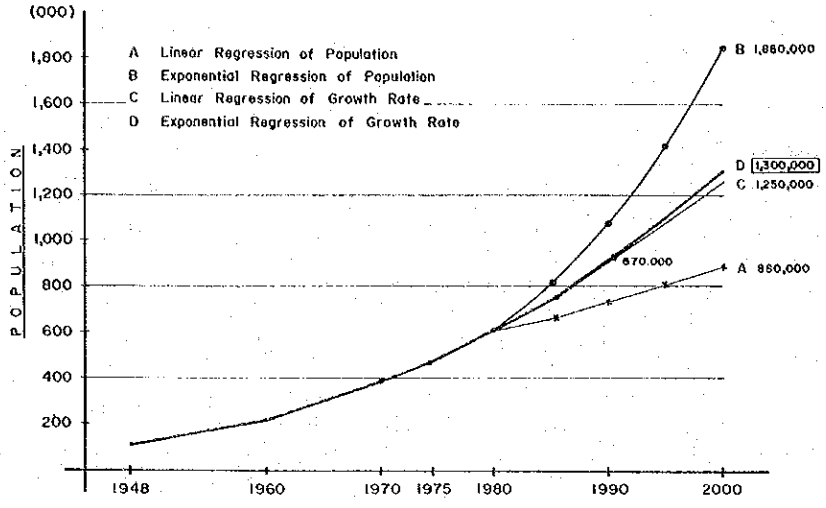
Meanwhile, the number of those at work as a percent of total population is estimated to be 32% to 36% in 2000, and the number of those at work in the Project Area and that in the non-Project Area are estimated to rise to 324,000 and 114,000, respectively, by the year 2000. The composition rates of those at work in the secondary and tertiary sectors are 19% and 60%, respectively, in the Project Area, which are estimated to increase to 27% and 70%, respectively, by the year 2000. On the other hand, agriculture will continue to be the main activity in the non-Project Area, where the primary sector will occupy 70% of total at work.

Gross Regional Products

The per capita average productivity of those at work in Davao City is estimated to advance from the 12,000 pesos (in 1972 prices, hereinafter the same) to 19,200 pesos in the year 2000 for an increase by 1.6 times in real term. As a result, the gross regional products of the Project Area will expand from the 1.7 billion pesos in 1979 to 7 billion pesos in the year 2000, (with a breakdown at the ratio of 1:50:49 among the primary, secondary, and tertiary sectors by industrial origin). On the other hand, that of the non-Project Area is predicted to rise from 0.6 billion pesos to 1.9 billion pesos (49:29:22) during the same period. The labor productivity of Davao City as a whole was twice the national average in 1975, which will level off to 1.3 times in the year 2000, for a reduction of regional productivity gap.

School Children/Students

The number of elementary school children will be 153,000, that of secondary schools, 90,000, and that of higher education schools, 45,000 in the Project Area in the year 2000, which will account for 32% of the population. This suggests that traffic between schools and homes will become a fair portion of total traffic in the future.



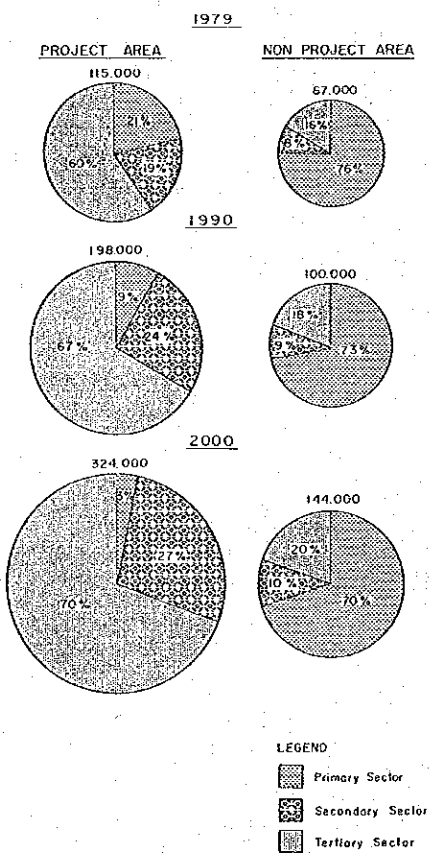
Population Projection of Davao City

Planned Population

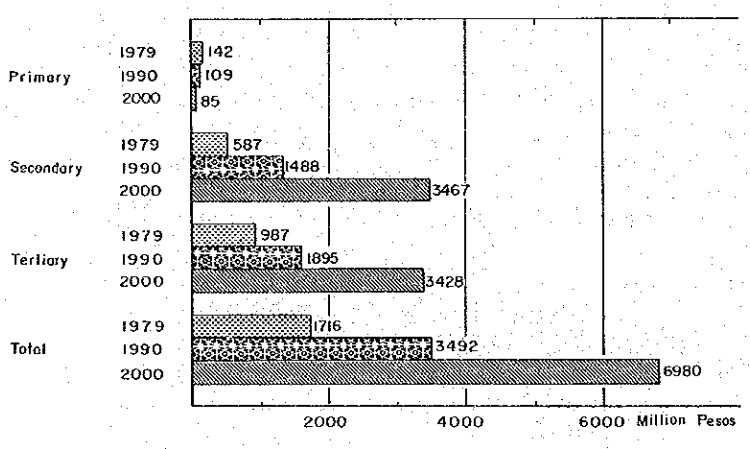
	1979	1990	2000
Project Area	371,740	590,000	900,000
Non-Project Area	188,260	280,000	400,000
Davao City	560,000	870,000	1,300,000

Labour Productivity (Pesos/Year at 1972 Prices)

	1979	1990	2000	Growth Rate p.a. (%)
Primary	5,900	7,500	9,400	2.2
Secondary	26,700	32,700	39,400	1.9
Tertiary	14,300	14,700	15,100	0.2
Average	12,000	15,300	19,200	2.3



Employment



Regional GDP of the Project Area (at 1972 Prices)

4. The Project Area Development Pattern

The development of the Project Area in the next 20 years should set its objective at the formulation of a multi-core, if balanced growth without over-concentration is to be accomplished. Then, efforts should be made for the creation of new urban cores in Bunawan, Panakan, Buhangin, Talomo, and Toril blocks, in addition to Poblacion and Ecoland. The multi-core city will grow into an urban belt in the 21st century.

Urban Development Pattern

Conceivable as the pattern of urban development for the Project Area are 3 alternatives:

A: Mono-Center Development Pattern

The outward expansion of the existing Poblacion, in an attempt to contain the urban space to as compact an area as possilbe.

B: Belt Shape Development Pattern

The development of urban space along a major road and/or a secondary road which will traverse the Project Area in north-south direction, in an attempt to achieve development with an even geographic spread.

C: Multi-Center Development Pattern

The designation of a number of strategic development districts as growth centers and the accumulation of social capital in these districts with a priority emphasis, in an attempt to prevent the overcrowding of the urban area while preventing the over-dispersion of investment.

Alternative A provides for development which rests on the past trend and, therefore, is the easiest of all for realization. However, the implementation of Alternative A will inevitably bring about over-crowding and its undesirable consequences such as the aggravation of dwelling environment and traffic congestion. Also, this Alternative is undesirable in that it will hinder the segregation or purification of commercial, industrial, and housing land uses. Alternative B has an advantage of distributing various functions evenly throughout the area and offer a greater degree of freedom in selecting sites for various facilities, but the excessive distribution of investment in the Project Area, where the accumulation of social capital is still limited, will dilute the effects of the investment. Therefore, it must be concluded that Alternative C offers the most desirable development pattern for the Project Area. This may be called an eclectic plan between Alternatives A and B, and the multi-core development pattern will eventually evolve into the belt shape urban development in the future.

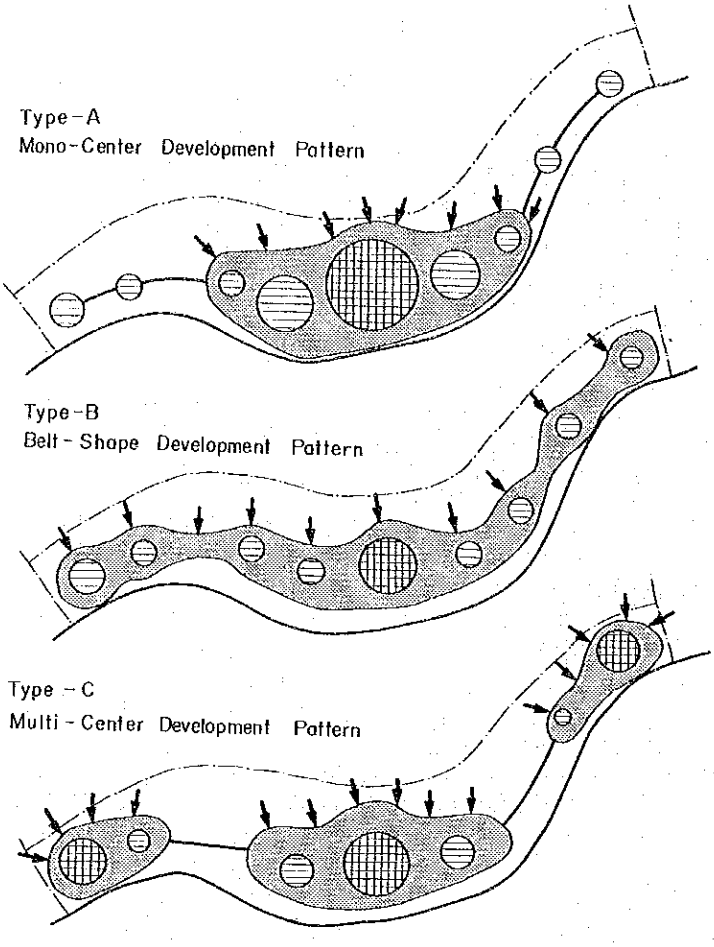
Block Division and Population Allocation

Districts which can become strategic development points in the future are selected based on the review of various conditions such as the present population distribution, the inhabitants activities pattern (or the spheres of commuting radius and shopping radius), the present land use status, the distribution of spaces that can be developed, the existing large scale development projects, and so forth. In conformity with these districts, the Project Area is divided into 6 blocks: Bunawan, Panakan, Buhangin, Poblacion, Talomo, and Toril.

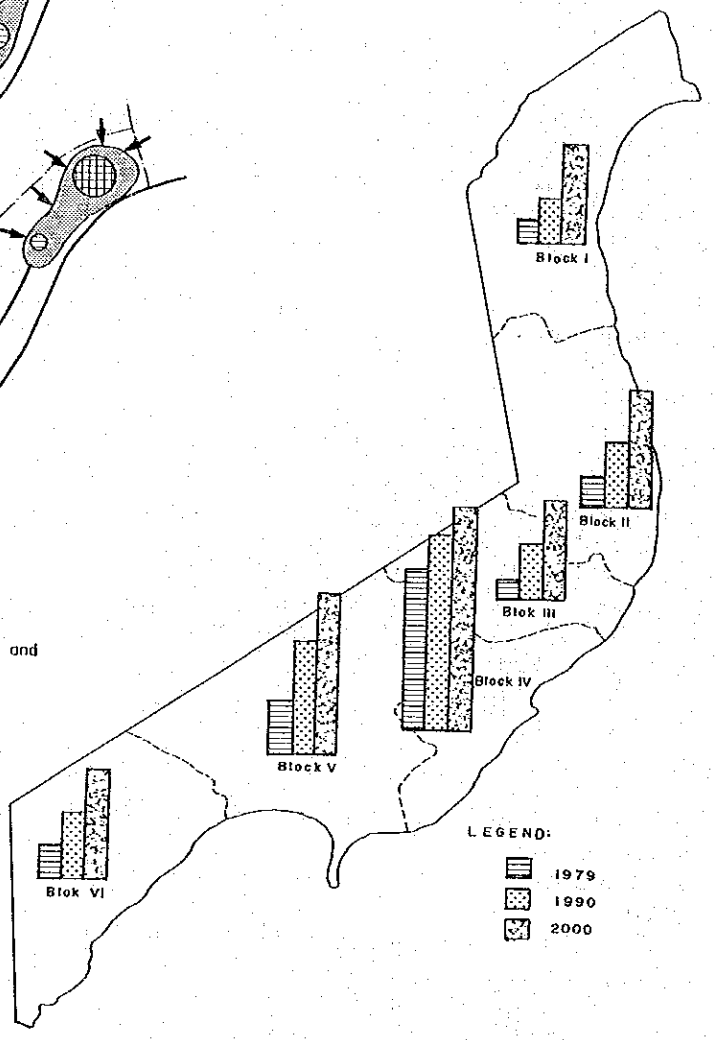
Each of these blocks is planned to become semi-independent city. In other words, employment opportunities and the size of labor force, as well as primary and secondary educational facilities and the number of children, should be in balance with each other in each block, and necessary facilities are to be allocated so as to facilitate the completion of daily activities, such as shopping, amusement, and medical care within the block, while higher, non-routine urban functions are to be enjoyed in Poblacion and the vicinity (Block IV, see Table below for the list of the 6 blocks). Blocks III and V, highly characterized as housing areas in the environs of Poblacion, will have higher reliances on Block IV than will other blocks. Table on the right shows the planned future population of each block as estimated based on the development density and population density of the block.

Block Division and Planned Population

No.	Block	Population in 2000	(%)
I	Bunawan	110,000	(12.2)
II	Panakan	130,000	(14.5)
III	Buhangin	110,000	(12.2)
IV	Poblacion	250,000	(17.8)
V	Talomo	180,000	(20.0)
VI	Toril	120,000	(13.3)
Project Area		900,000	(100.0)



Alternatives of Urban Development Pattern for the Project Area



Night Population by Block

	Population			Growth Rate	
	in 1979	in 1990	in 2000	1990/1979	2000/1979
Block I	24,950	45,000	110,000	1.8	4.4
Block II	30,670	60,000	130,000	2.0	4.2
Block III	23,170	65,000	110,000	2.8	4.7
Block IV	179,880	225,000	250,000	1.3	1.4
Block V	61,480	125,000	180,000	2.0	2.9
Block VI	39,850	70,000	120,000	1.8	3.0
Total	360,000	590,000	900,000	1.6	2.5

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5. Land Use Plan

Of the 18,000-hectare Project Area, the land space used as urban area will expand from the present 3,500 hectares (19%) to 9,700 hectares (54%) by the year 2000. Distributed to each block will be a commercial district in the center and, around it, housing areas of a high density, medium density, and low density in that order. Industrial estates will be developed to accommodate most of industrial sites in order not to damage the urban environment in these blocks.

Land Demand

Demand for development land spaces in the year 2000 is estimated at 900 hectares of commercial land, 730 hectares of industrial land, 5,720 hectares of housing land, 510 hectares of public use land, and 1,840 hectares of land for open spaces, for a total of 9,700 hectares, which will amount to about one-half of the Project Area. Of the remaining one-half, 2,400 hectares is rivers and hills, which are unsuitable for development, and 6,000 hectares will be used for agricultural activities.

Industrial Land

Suited for industrial sites is a flat land on or near a major road or a port for transportation convenience or on or near a river or coast for easy draining. Land which meets these conditions has been identified at 7 locations in the Project Area for a total of 730 hectares, taking into consideration the existing industrial accumulations and industrial projects. It will be desirable that most of the 7 locations be developed as industrial estates. The important estates will be those in Panakan (320 hectares) and Bunawan (160 hectares).

Commercial Land

Poblacion is conceived of as the commercial and business centers which will serve not only the Project Area but also eventually the entire Mindanao. However, the existing commercial and business district will fall short of supporting the more sophisticated and further outreaching commercial/distribution functions of Poblacion, and, therefore, the development of additional CBDs in Poblacion will be necessary. DCUTCLUS recommends the development of Roxas Avenue and Ecoland.

In the center of each block, a secondary commercial district is to be established and, in housing areas having poor access to such districts, neighborhood commercial centers as appropriate.

Housing Land

Distributed around the central commercial area of each block will be high density housing areas, around which, medium density housing areas, and around the medium density housing areas, low density housing areas. Also, housing estates are to be planned for construction in scenic and quiet hilly areas.

The coexistence of housing area and an area of some other land use should be avoided if at all possible. The housing area should be segregated from an adjacent industrial area, if any, for instance, by a green belt for shielding against environmental pollution.

Public Use Land

The development of academic towns containing educational and research facilities in Tibungco and Talomo (80 hectares and 70 hectares, respectively) is recommended as large-scale land development projects, in addition to the existing plan for the development of joint government agencies building area in Baliok. Also, comprehensive athletic parks within a park and various sports facilities are blended into one are to be established in Ma-a and Bucana Districts.

As for ports, Sasa Wharf and Sta. Ana Pier are to be expanded, along with the relocation a part of Davao-Agusan Road from the present location to closer to the airport in order that an adequate land space be secured for the former port. The review of feasibility of constructing exclusively industrial wharfs may become necessary when industries have been accumulated to some extent in Panakan, Bunawan, and Toril.

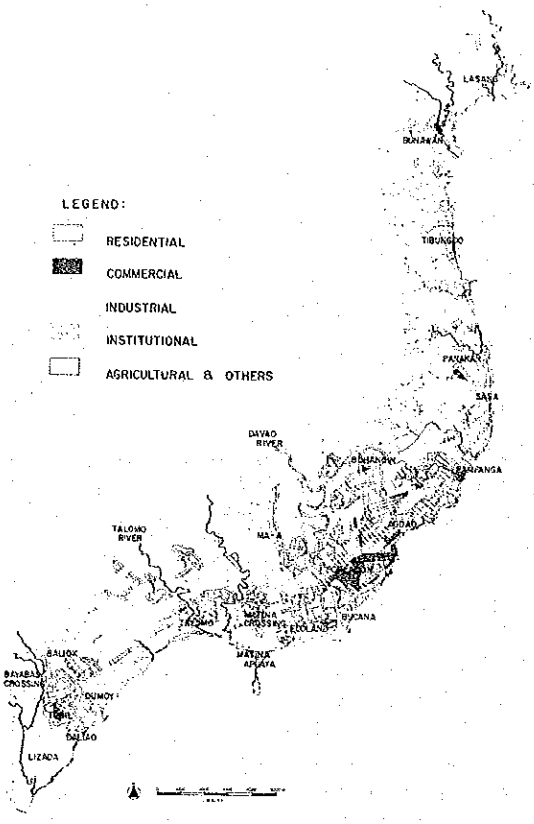
Open Space

The park is one of the kinds of facilities which the Project Area presently lacks in particular. Therefore, active efforts should be made in the future to create parks in Bucana, the Hill of Shrine, coastal area from Talomo to Daliao, and parts of Davao River and Talomo River basins.

As large a land space as possible should be set aside for Bangoy Airport in order that room for insulating airplane noise and room for the future extension of runway be secured.

Present Land Use

Land Use	1979 Area (ha)	%
Residential	2,549	(14)
Commercial	283	(1)
Industrial	322	(2)
Institutional	202	(1)
Open Space	160	(1)
Agricultural and others	14,584	(81)
Total	18,100	(100)

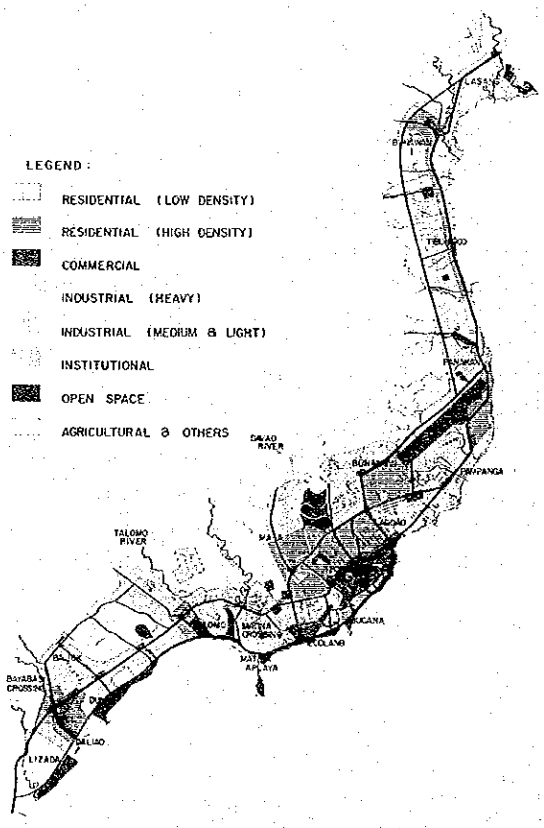


Present Land Use

Future Land Requirment

Land Use	2000 Area (ha)	%
Residential	5,720	(32)
Commercial	900	(5)
Industrial	730	(4)
Institutional	510	(3)
Open Space	1,840	(10)
Agricultural and others	8,400	(46)
Total	18,100	(100)

Urbanized Area 3,500 ha (19%) → 9,700 ha (54%)



Future Land Use, 2000

DOUTCLUS

6. Conceptual Plans for Area Development

The development of a new central business district, having a traffic core along Roxas Avenue, in the central part of Poblacion and the comprehensive development of administrative, educational, cultural, sports, park, and housing facilities on Bucana Island are recommended. Also, the development of an industrial estate for both light and heavy industries in Panakan and of academic towns in Tibunco and Talomo is recommended. These four large projects, if implemented, will greatly enhance the attraction of Project Area in the future.

For year 2000 land use plan, 4 areas are selected for the virtue of their substantial development scales and impacts, as well as their strategic significance. Conceptual are plans are to be formulated for these four.

Roxas Avenue Area

The greatest commercial and business center of Mindanao is to be developed by designating 58-meter wide Roxas Avenue as a park avenue for pedestrians where no vehicle, except emergency vehicles, will be permitted and by establishing a central PUJ terminal on the northern end of the Avenue and a government area with the New City Hall and other official buildings on the southern end. The Avenue will be lined with the rows of modern multi-story and highrise Office buildings, banks, hotels, shopping centers, and other buildings. Worth considering will be the adoption of so-called "urban redevelopment system" to the development of this new CBD.

Bucana Island Area

Another future symbol of Davao City, along with the Roxas Avenue CBD, is to be developed on a developable land of about 150 hectares created adjacent to Poblacion by reclaiming the old river basin. This area will be divided into administrative zone, business zone, education/cultural zone, sports zone, park zone, and housing zone. Also PUV terminals and parking spaces will be established as necessary.

In the housing zone, apartment type houses for low income people are to be constructed in order to facilitate the clearance of the existing squatters. For the securing of public use land, the adoption of so-called "land readjustment system" should be considered in addition to outright purchase system.

Panakan Area

Panakan is deemed the most important industrial development area in view of the existing accumulation of industries in its coastal part, of the fact that it is close to a port, and of the high possiblity of securing sites in the inland part. In fact, NEDA has conducted a feasibility study of the construction of an industrial estate in Panakan.

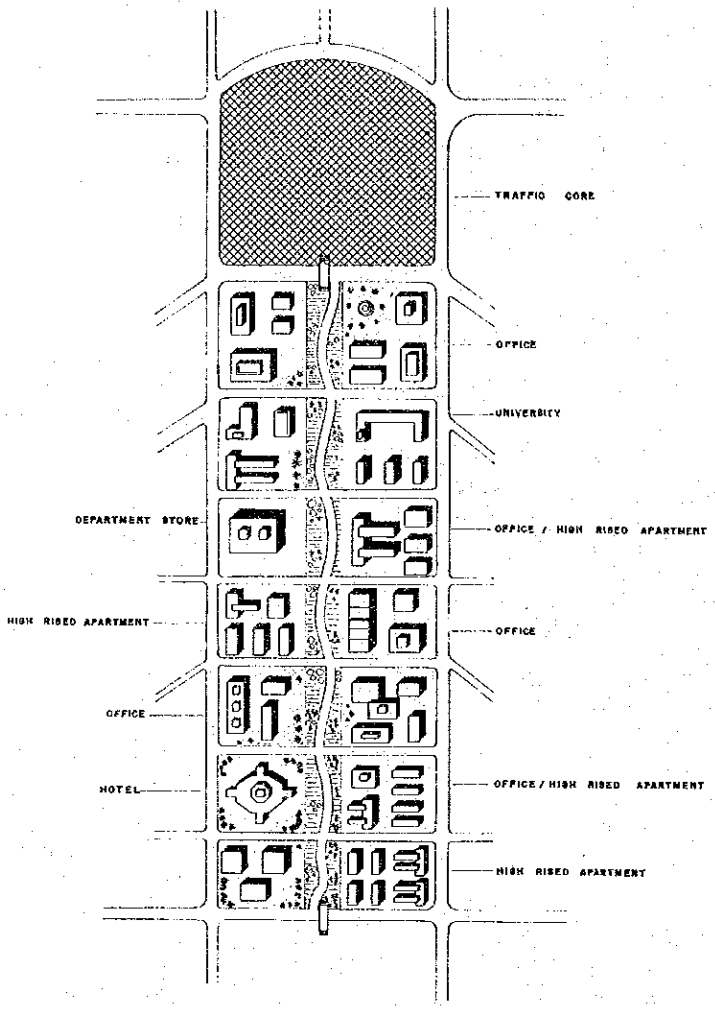
It is recommended that an industrial estate of a total land space of 320 hectares, housing both heavy and light industries, be constructed in this area over 2 phases of construction. Also recommended is the establishment of a distribution center and a commercial center adjacent to the industrial estate. The commercial center will not only serve workers in this estate but also will become the central commercial district for Panakan Block.

All feasible types of industry should be introduced to this estate; particularly promising will be capital incentive, but sufficiently labor intensive, industries such as chemical industries (plastic processing, fertilizer, and medical supplies) and metal processing industries (metal parts, electric products, and agricultural tools and equipment). Also feasible, drawing upon local raw materials, will be food processing industries (fruits canning, flour milling).

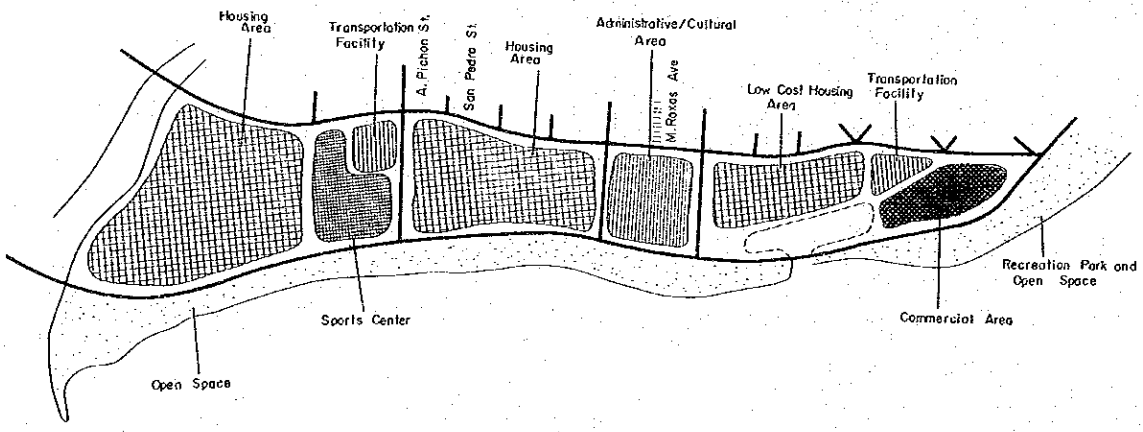
Academic Towns

The academic town is a community consisting of such major facilities as various research institutes, laboratories, and universities and such ancillary facilities as faculty and administrative staff housing, sports facilities, shopping center, and amusement facilities in order that daily activity needs can be satisfied within the community. All concerned should be persuaded so that research and educational facilities to be newly constructed in the future be located in either Tibungco or Talomo Academic Town, or in the educational zone of Bucana Island.

Tibungco, occurring between Panakan and Bunawan Industrial Estates, is an ideal place for the location mainly of industrial research and educational/training institutions for the fosteration of human capabilities essential for industrial development. On the other hand, it will be appropriate to allocate political, economic, and commercial research and educational facilities to Talomo.



Future Image of Roxas Blvd. New CBD/Traffic Core



Zoning of Bucana Island Comprehensive Development Plan

DCUTCLUS

7. Transportation Demand Expansion

By the year 2000, transportation demand in the Project Area will increase to 2.8 times that of the present level. While the fosteration of block economies will result in the dispersion of transportation demand throughout the entire Project Area, such demand in Poblacion will continue to be overwhelmingly large, and high trip density area will expand to cover the radius of about 4 kilometers from the City Hall Area.

Transportation Demand Expansion

As basic information to support ransportation planning, transportation demand has been estimated for the years 1990 and 2000, the medium term and long term target years, on the basis of the 1979 person-trip survey findings and prediction values of population, production, and other socio-economic indicators.

- Trip generation rate (per capita average number of trips) will rise from the 2.42 trips per day in 1979 to 2.77 in the year 2000, due chiefly to changes in employment structure.
- While population will increase by 2.5 times, the number of trips generating from or trips ending in the Project Area will increase by 2.8 times from the 748,000 trips in 1972 to 2,104,000 trips in the year 2000.
- Of such total trips, about 40% are and will be by walking
- The purpose composition of trips will shift as follows:

Purpose Composition of Trips

(%)

Purpose	1979	2000
Office	10.2	12.4
School	16.3	15.1
Home	36.3	35.9
Business	9.0	10.1
Shopping	4.3	3.3
Private	23.9	23.3

Block Transportation Demand Expansion

A review of transportation demand expansion by blocks reveals that such expansion is a substantial 6.3 times (2000/1979) in Panakan Block, which is planned to become an industrial area, followed by Bunawan and Buhangin Blocks – the demand expansion is remarkable in the northern blocks. Conversely, demand expansion in Poblacion Block is by 1.7 times, which is fairly low in comparison with other blocks, and the share of Poblacion Block in the generated trips in the Project Area as a whole drops from the 61% in 1979 to 35% in the year 2000.

Urban Trip Density

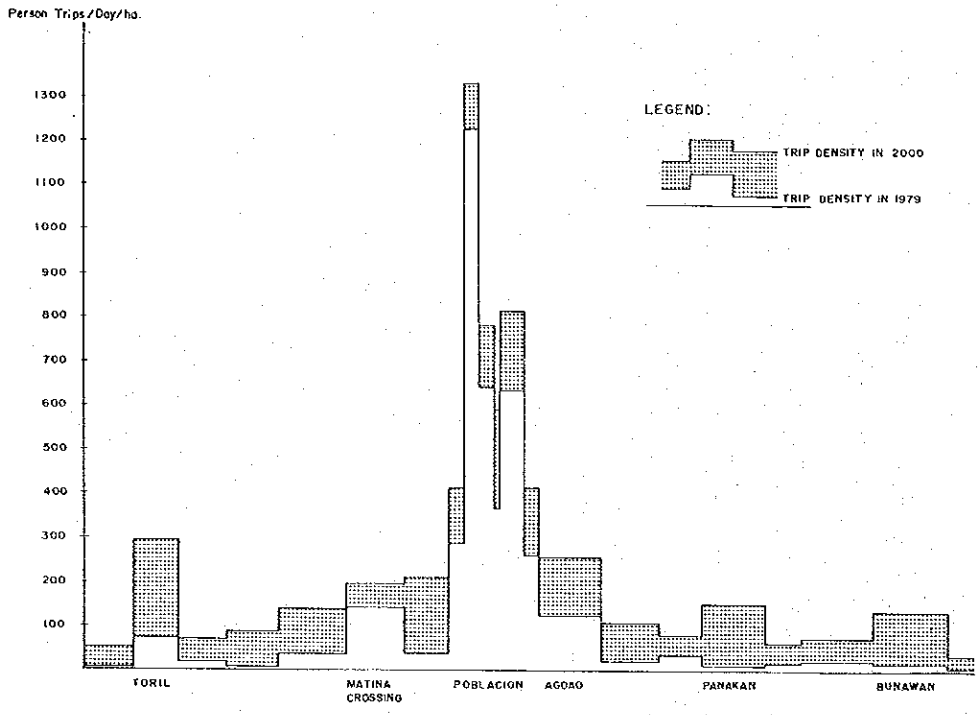
Poblacion shows an overwhelmingly high trip density (number of generated trips per hectare), indicating an extreme trip concentration in the area of only 2-kilometer radius from the City Hall, and traffic congestion and traffic accidents have become apparent problems. While Poblacion will continue to be the area of a high trip density, the high density area is expanding to the outskirts of Poblacion over 4-kilometer radius by the year 2000. This shows that not only the development of transportation facilities in Poblacion is an urgent task, but also in Poblacion and the surrounding areas should be considered one body in the development of such facilities. Therefore, development of a ring road around such areas having a high effect of dispersing trips is required. Trip density will become heavy also in the central part of each block, and, therefore, the formation of street network will be indispensable.

Growth Rates in the Project Area

(unit: person trips/day)

	NUMBER OF TRIPS BY RESIDENTS			NUMBER OF TRIPS BY NON-RESIDENTS	TOTAL
	INTERNAL TRIPS	EXTERNAL TRIPS	SUB-TOTAL		
1979	664,000	21,000	685,000	63,000	748,000
1990	1,186,000 (1.79)	35,000 (1.67)	1,221,000 (1.78)	103,000 (1.63)	1,324,000 (1.77)
2000	1,902,000 (2.86)	55,000 (2.62)	1,957,000 (2.86)	147,000 (2.33)	2,104,000 (2.81)

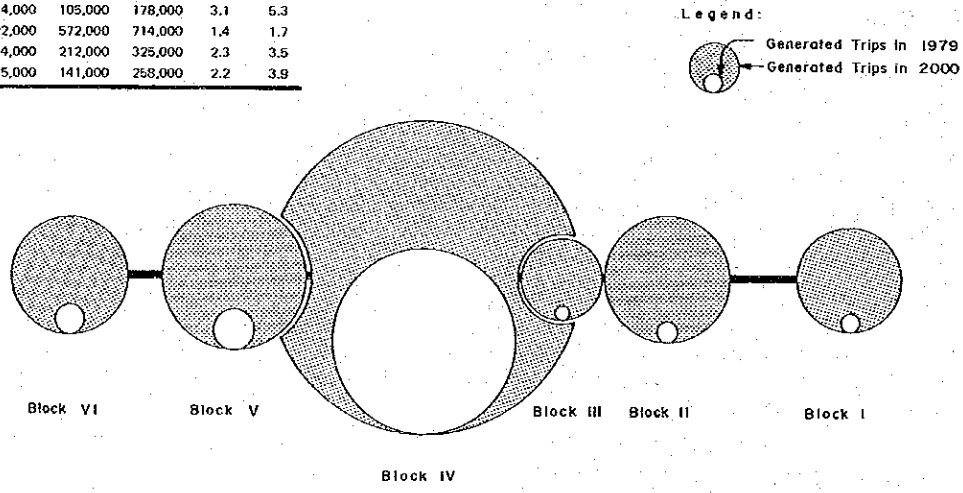
NOTE: FIGURES IN ( ) SHOW GROWTH RATES IN EACH TARGET YEAR.



Trip Density along the Central Line in the Project Area

(Unit: Person Trips/Day)

	Generated Trips			Growth Rate	
	in 1979	in 1990	in 2000	1990/1979	2000/1979
Block I	39,000	85,000	228,000	2.2	5.8
Block II	46,000	129,000	288,000	2.8	6.3
Block III	34,000	105,000	178,000	3.1	5.3
Block IV	422,000	572,000	714,000	1.4	1.7
Block V	94,000	212,000	325,000	2.3	3.5
Block VI	65,000	141,000	258,000	2.2	3.9



Transportation Demand Expansion

8. Pattern of Person-Trip Flow in the Future

A large transportation sphere with center in Poblacion and a number of small transportation spheres, formed around each block center as their core, will coexist in the future. Road capacity shortage will occur on the major roads connecting the northern part of the Project Area with the southern part and at the entrances to Poblacion, where traffic demands will swell remarkably. Therefore, introduction of city bus system and development of road network will be required.

Transportation Sphere Formation

The rate of the intra-block person-trips to the total generation in each Block is one of the important indicators of the independence of the block as a transportation sphere. In the year 2000, intra-block trips will represent about 80% of total generation in Blocks I, II, and VI, followed by about 70% in Block IV, and about 65% in Blocks III and V. The high intra-block rates shown for Blocks I, II, and VI indicate that these Blocks will function as separate transportation spheres around their centers as the core. Very much of trips will be absorbed into Block IV (Poblacion) from Blocks III and V, and these Blocks should be considered to form a transportation sphere together with Block IV, which is and will continue to be the center of the Project Area. About 73% of inter-block person-trips will be either generated or terminated in Poblacion, indicating that a large sphere will be formed centering around Poblacion.

Transportation Demand Increases at Major Cross Sections

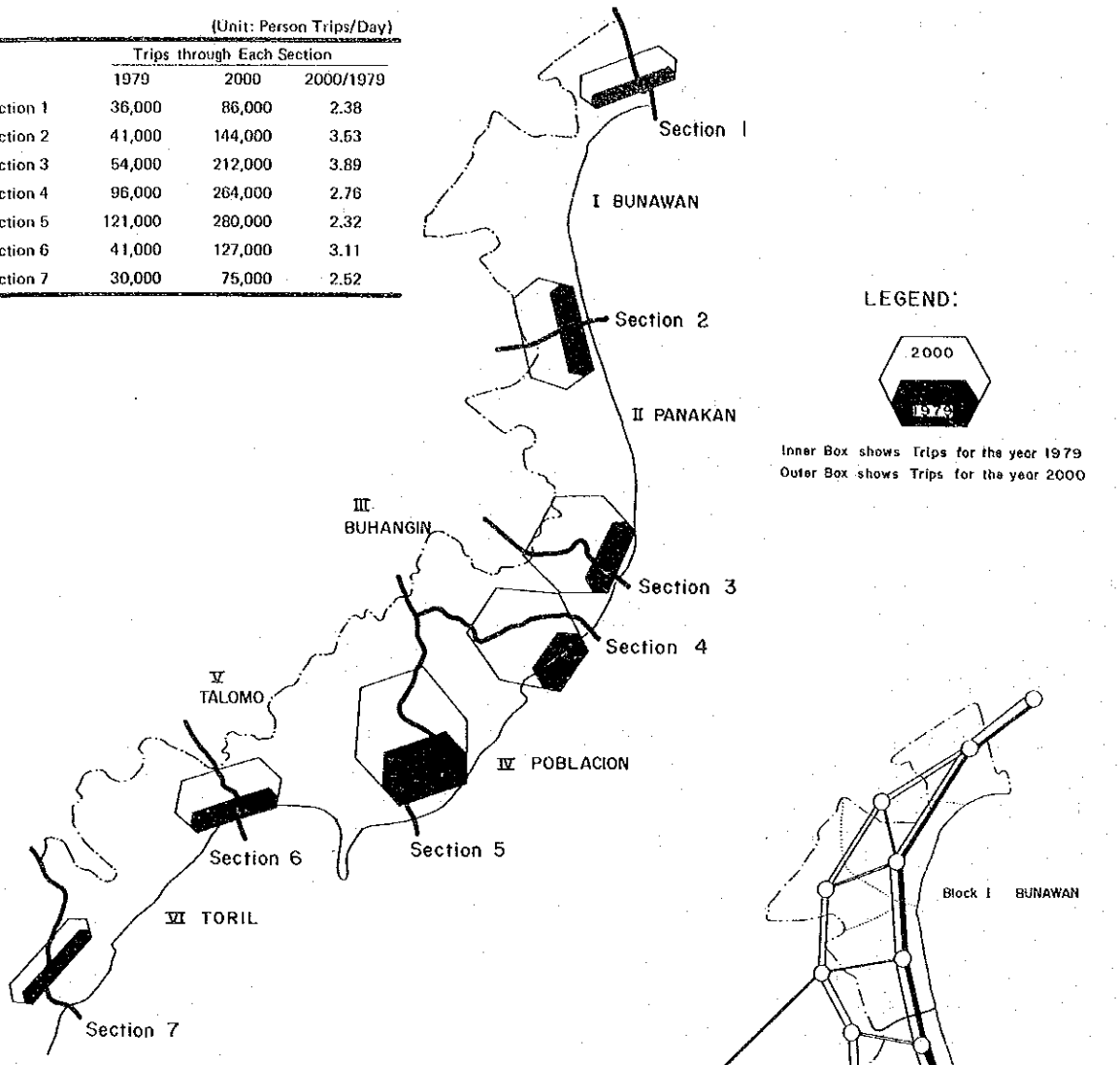
A review of transportation demand (number of person-trips) at block interfaces indicates that at Cross Section 5 (Davao River Cross Section) the largest number of trips, or 280,000 trips, will flow in the year 2000, although the rate of increase in such demand is rather low. The next largest but almost comparable number of trips is indicated at Cross Section 4. The highest rate of increase in transportation demand is indicated at Cross Section 3, followed by Cross Section 2 – both showing about 3.5 times increase. It should be pointed out that transportation demand will increase particularly in the northern part of the Project Area.

People's Travel Pattern

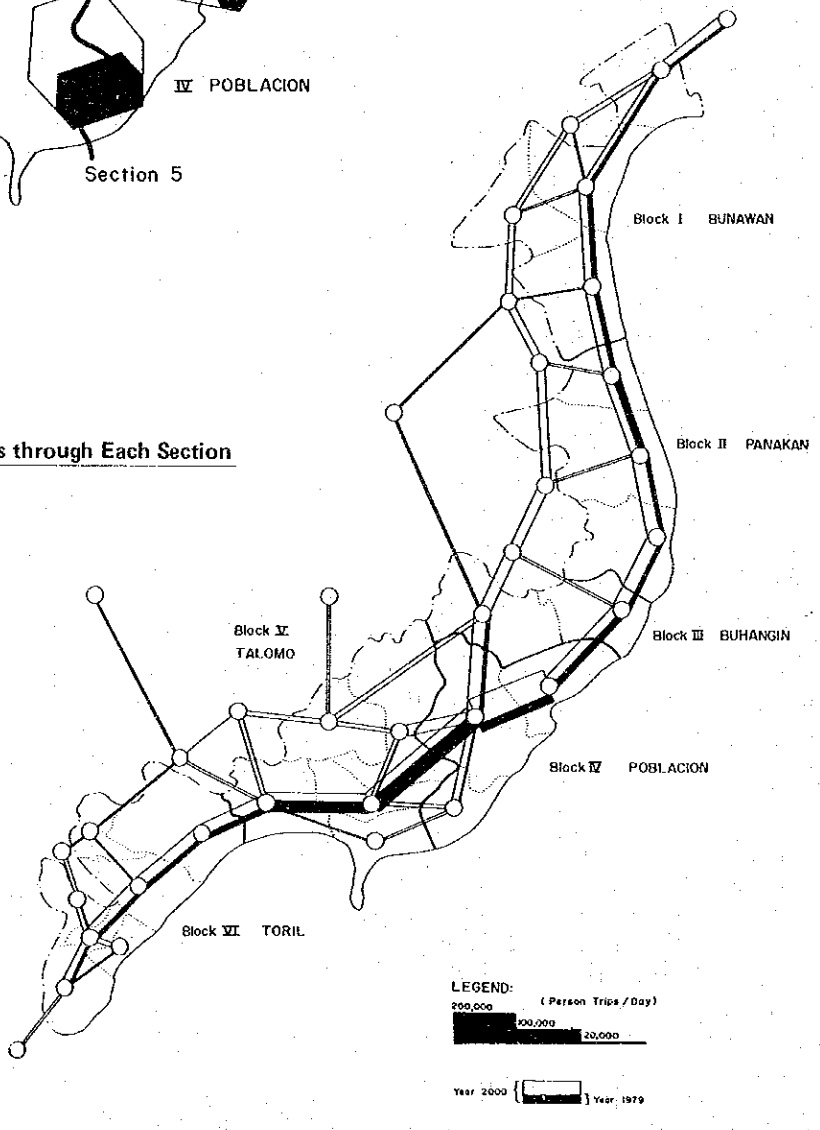
The assignment of total person-trips in the Project Area to the spider network shows that the flow pattern is relatively simple due to the geographic conditions of the Project Area: an overwhelming majority of traffic flow in north-south direction, and little traffic flow in east-west direction. Also, it is predicted that the volume of traffic flowing from north and that from south will remain constant up to near Block IV, after which they will suddenly swell at the respective entrances to that Block. These flow pattern characteristics clearly indicate that in Blocks I, II, and VI, capacity of north-south major roads will be insufficient and that, in consideration of the goegraphic location of the existing road and future land use, a new major road will have to be built on the mountain side in Blocks I and II and on the sea side in Block VI, while large-capacity major streets will have to be built at the both entrances to Block IV in order to meet the rapidly increasing traffic at these points. Also, the relatively simple flow pattern extending in north-south direction indicates that a rapid public transit system with a high transport capacity, such as buses and railroad, will be more suited to this area than a public transport system with door-to-door convenience, such as PUJs.

(Unit: Person Trips/Day)

	Trips through Each Section		
	1979	2000	2000/1979
Section 1	36,000	86,000	2.38
Section 2	41,000	144,000	3.53
Section 3	54,000	212,000	3.89
Section 4	96,000	264,000	2.76
Section 5	121,000	280,000	2.32
Section 6	41,000	127,000	3.11
Section 7	30,000	75,000	2.52



Number of Person Trips through Each Section



Person Trips Flow on Spider Network

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9. Car and Cargo Vehicle Trips

While it is predicted that car ownership ratio will ascend from the present 8.7% to 18.5% by the year 2000 as real income will increase, the average number of vehicle trips per car is to be depressed to about 2/3 of the present average by the strengthening of public transport system for the minimization of traffic congestion, parking space problem, and fuel consumption. Meanwhile, the number of cargo vehicle-trips will increase by about 4.1 times the present level due to the multiplication of volume of commodity flow as production will be expanded, and, as a result, the present 5% share of cargo vehicles in total number of vehicle-trips will rise to about 9%.

Future Car Ownership Ratio

As income will continue to increase in real term, car ownership ratio (the total family members owning a car to population) in the Project Area will continue to rise from the present 8.7% and is predicted to reach 18.5% by the year 2000. This prediction assumes that income will increase by the same rate as will gross products and that the present car ownership ratio of each income class will remain unchanged in the future. The predicted value is believed right, because it about coincides with the result obtained from the extrapolation of past increase trends of the ratio up to the year 2000 and is in line with the relationship between car ownership ratio and GNP observed in other Asian countries.

Public Transport System vs. Car

As car ownership grows, the total number of car trips will inevitably increase. In the Project Area, where car ownership is still low, average number of trips per each car is presently a high 7.9 trips per day. If this average will be sustained, total number of car trips will "explode" to 4.8 times by the year 2000, when the shares of public transport and the car in person-trips will be 1:1, as compared against the present shares of 2.5:1.

Increase in car utilization of this magnitudes will confuse urban transportation; it is possible that cars will flood every narrow street, and it is feared that parking space shortage, traffic accident increase, and the aggravation of living environment by cars will be brought about. It is desirable that car utilization will be held to a minimum in view of these and, also, in the interest of economy and fuel efficiency.

Recommended in the Masterplan is a series of measures to strengthen public transport system including the introduction of city buses and also establishment of exclusive bus lanes and the construction of bus terminals which support the bus system to be operated efficiently. These measures taken, average operation frequency of each car is expected to decline to about 2/3 of the present frequency, with resultant mitigation of traffic congestion by about 14% as compared with the situation when public transport system is not strengthened. This will also result in an equal or greater rate of reduction in the volume of gasoline and other fuel consumption.

Cargo Vehicle Trips Increase

Presently, the Person-Trip Survey indicates that cargo vehicles (trucks, pick-up trucks, and vans) are used not only for commodity conveyance, but also fairly much used for the transportation of people, such as to office, to home, and private trips. Cargo vehicle trips for the conveyance of goods average only about 7,800 vehicle-trips per day, or 29% of total cargo vehicle-trips. This is probably because pick-up trucks and vans are being used as semi-truck and semi-car.

Total cargo vehicle-trips for goods distribution will increase as production will increase and the quantity of goods to be distributed will increase in the Project Area and are predicted to reach 32,200 vehicle-trips per day, or 4.1 times the present level, in the year 2000. Of this total cargo vehicle-trips, those which will generate or terminate in the industrial estates recommended under Land Use Plan will amount to 20% of the total, or 6,300 vehicle-trips per day, most of which will generate or terminate in Bunawan or Panakan Industrial Estates which are located in the northern part of the Project Area.

Also, cargo vehicle-trips generating or terminating in these industrial estates will concentrate on Davao-Agusan Road, R. Castillo Street, and Coastal Road (between Sta. Ana Wharf and Toril), and, therefore, these roads should accordingly be given proper road structure and pavement, and its access road controlled by traffic management scheme such as "no entry of big cargo vehicles."

Modal Share of Car Dependent Case

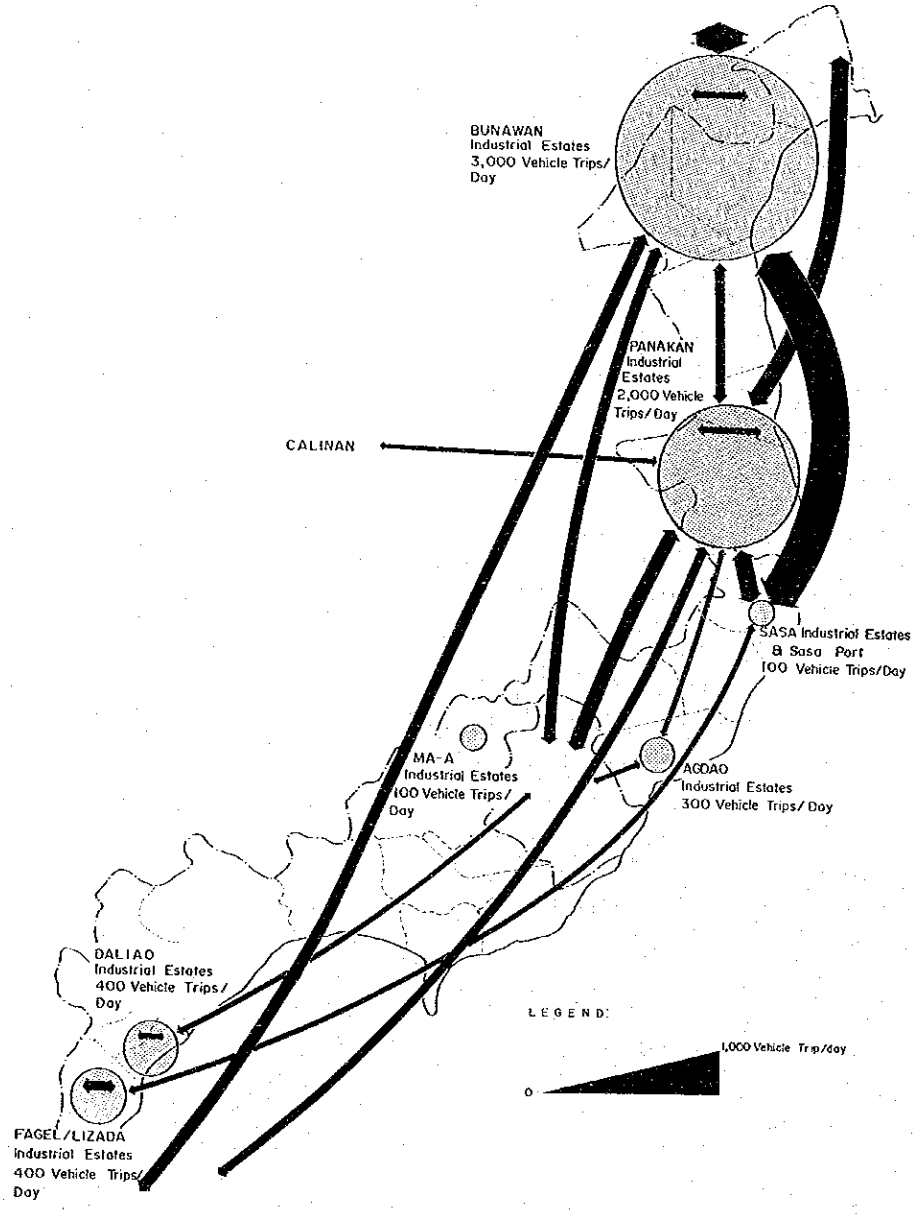
(unit: person trips/day)

	Walk	Car /1	PUV	Total
Masterplan in 2000	777,000 (39.7)	401,000 (20.5)	779,000 (39.8)	1,957,000
Car-Dependent /2 Case	777,000 (39.7)	578,000 (29.5)	602,000 (30.8)	1,957,000

Note: /1 Truck Trips are included in Car Trips

/2 In Car-Dependent Case, average number of daily Trips per Car in 2000 is assumed same as the present.

/3 Figures in ( ) show the share of modes.



Commodity Truck Flows from Industrial Estates

10. Transport Plan Formulation

To establish a transportation masterplan, the following 3 alternative were considered: A, which will introduce rail-transit, B, which will introduce bus service, and C, which will basically depend on PUJs. The required construction costs are estimated at 1,266 million to 1,786 million pesos each.

Targets

- Formulation of a network that will support the future society and economy
- Achievement of convenience, safety, and amenity
- Support and accommodation of future development
- Plan practically for implementation

Conditions

- Existing Plans:

  In the transportation planning, the following existing plans should not be ignored: the improvement/development of various roads under the Regional Cities Development Project and the construction of relocation roads in conjunction with the Sasa Wharf facilities expansion under the Davao Gulf Masterplan.

- Future Transportation Problems:

  The future transportation problems (traffic accidents, traffic congestion to deteriorate transportation environment and to paralyze urban functions for a serious diseconomy) to result from the total neglect of transportation capacity expansion are translated into a total future demand increment, which is estimated to require in its satisfaction the additions of 4 to 6 lanes between Bunawan and Panakan, 6 to 8 lanes in Poblacion and the vicinity, and 2 to 4 lanes between Talomo and Toril.

- Funds

  Public funds available for investment in land transportation facilities (roads, railroads, bus terminals, etc.) in 20 years, 1981 to 2000, are estimated to be 1.1 to 1.8 billion pesos at 1980 prices, based on the past investment records and expected future economic growth.

Network

- The basic skeleton of the traffic network should be in the pattern of a ladder, which best coincides with the shape of, and land uses in, the Project Area.
- Trunk roads to shape the "Ladder" should be distributed with desirable intervals of 1.0 to 1.5 kilometers, but never to exceed 2.0, in both lateral and longitudinal directions.
- A ring road around Poblacion should be formed.
- Davao-Agusan/Davao-Cotabato Road should function as the most important major road.
- Another major road should be constructed between Bunawan and Calinan to enhance linkages between the Project Area and the inland areas.

Alternatives

Three alternative plans, each relying upon different mode for public transport, have been considered with a similar network shapes, but with different link capacities of the road depending on the mode selected under each alternative.

Alternative A

Envisages the introduction of a medium capacity rail transit system; will require the smallest amount of road construction/improvement of the 3 alternatives, inasmuch as demand will shift from cars to railway-transit, which will offer stable, regular, and faster services.

Alternative B

Proposes to introduce buses as the major mode of public transport in place of PUJs; will require smaller amount of road construction/improvement than Alternative C, in view of the larger unit transportation capacities of buses than of PUJs.

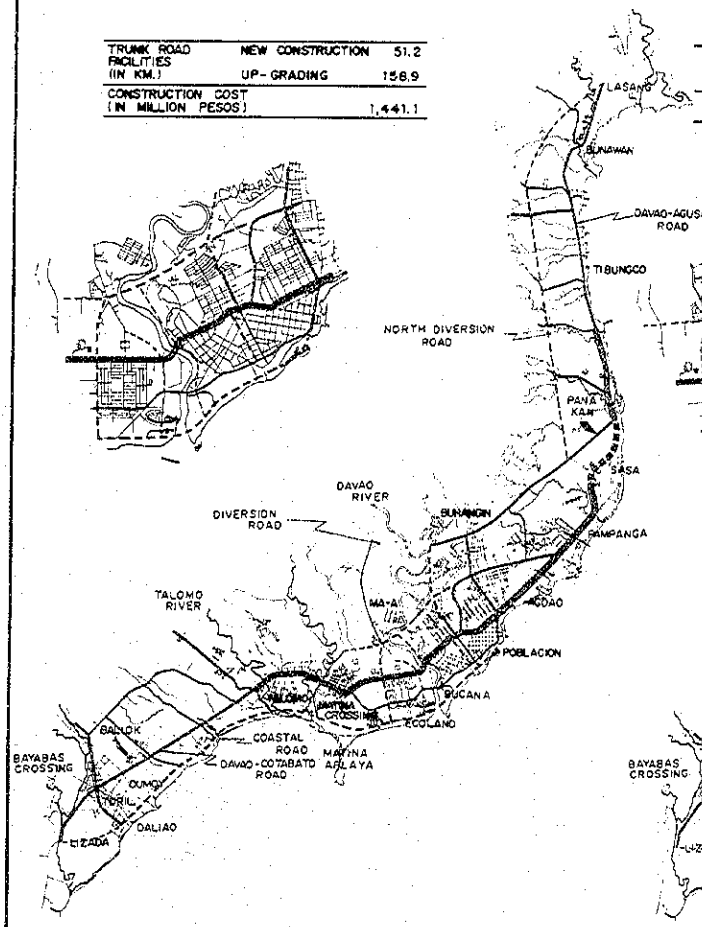
Alternative C

Will introduce no new mode but will rely on the existing PUJs; will require a greater volume of road construction/improvement than the other 2, in view of the smaller transport capacities of each PUJ than those of the railway-transit and the bus.

Whichever of the three Alternatives, 50 to 51 kilometers of roads will be constructed and 87 to 108 kilometers of roads improved, requiring total construction costs of 1,786 million pesos (Alternative A), 1,266 million pesos (B), or 1,422 million pesos (C).

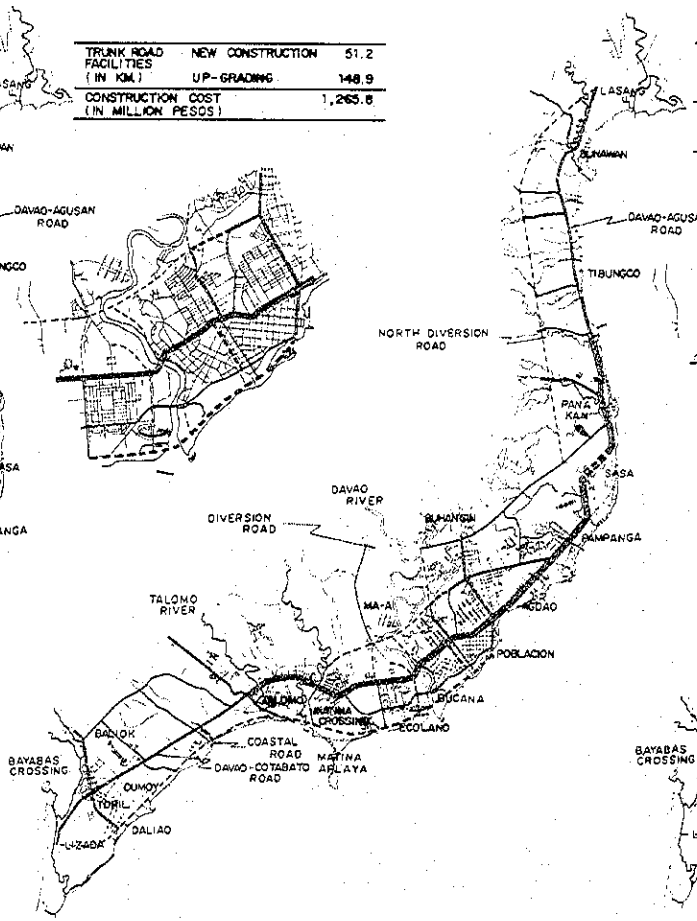
Plan—C

TRUNK ROAD FACILITIES (IN KM.)	NEW CONSTRUCTION	51.2
	UP-GRADING	158.9
CONSTRUCTION COST (IN MILLION PESOS)		1,441.1



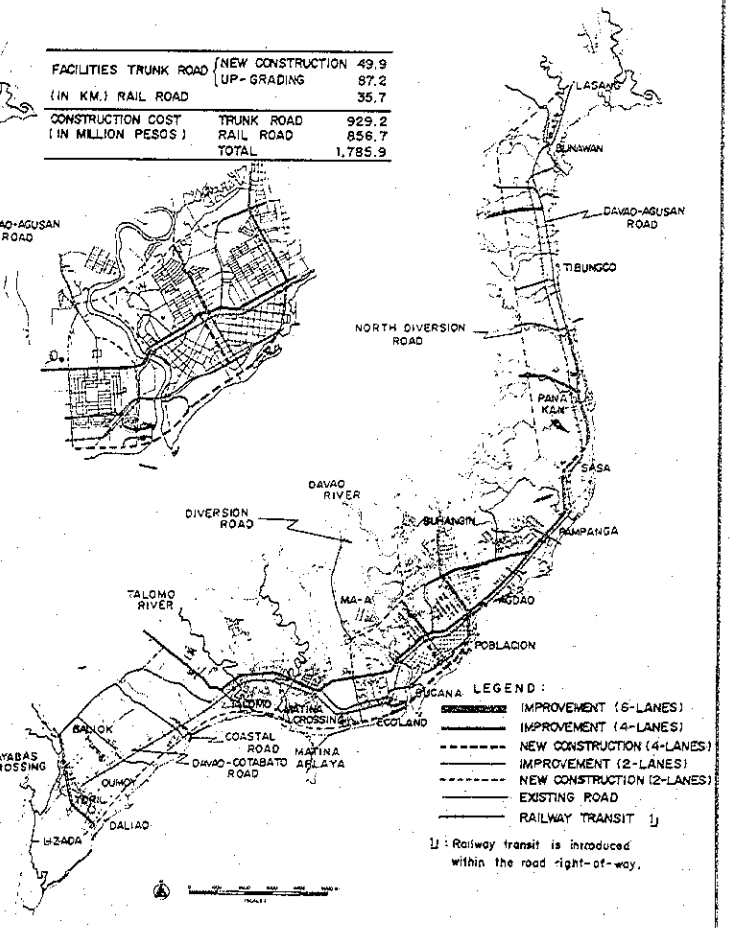
Plan—B

TRUNK ROAD FACILITIES (IN KM.)	NEW CONSTRUCTION	51.2
	UP-GRADING	148.9
CONSTRUCTION COST (IN MILLION PESOS)		1,265.8



Plan—A

FACILITIES TRUNK ROAD (IN KM.) RAIL ROAD	NEW CONSTRUCTION	49.9
	UP-GRADING	87.2
		35.7
CONSTRUCTION COST (IN MILLION PESOS)	TRUNK ROAD	929.2
	RAIL ROAD	856.7
	TOTAL	1,785.9



11. Alternatives Evaluation/Selection

The 3 Alternatives have been evaluated based on the analyses of economic desirability, estimated traffic indicators, and the plan conformity with transport policies. An eclectic plan blending or drawing from Alternatives A and B has been selected, which will rely on the bus up to the year 2000, while road network facilitating the future introduction of rail-transit is to be developed.

Features

Different public transport modes depended upon by these Alternatives would result in different modal splits and, therefore, different features.

Alternative A

Will require a relatively small passenger-hours (aggregate travel time) owing to the rapidity of rail-transit service to be introduced, while passenger-kilometers (aggregate travel distance) will be the largest of all Alternatives due to the inevitable access trips to and from railroad stations.

Alternative B

Will require the smallest passenger-hours of all Alternatives – slightly smaller than that under Alternative A passenger-kilometers will be larger than that under Alternative C, but the level of transportation service will be the highest of all.

Alternative C

Will require the smallest passenger-kilometers due to the close PUJ service route network, but, conversely, passenger-hours will be the longest due to the low speed of PUJ service.

Economy

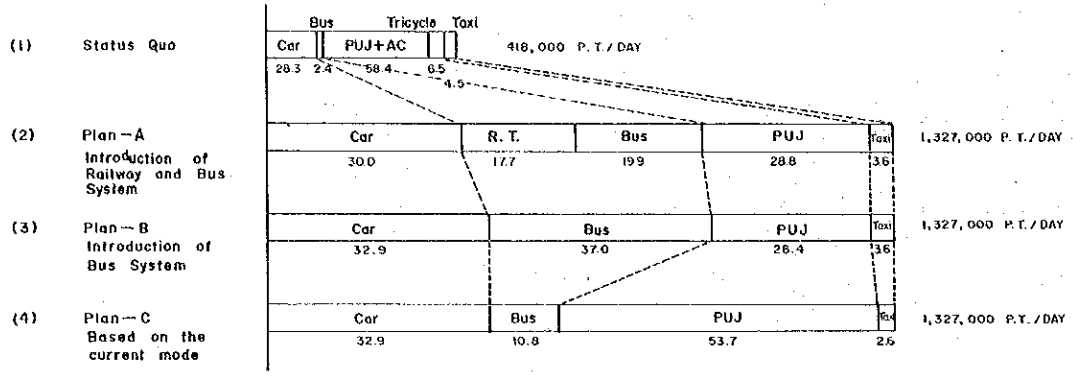
Economy is particularly high of Alternative B, the bus based plan, while both Alternatives A and C show a desirable level of economy, based on the value of benefit over cost estimated for the year of 2000 as an indicator of the level of economic desirability of each Alternative.

Assuming an average yearly increase in motor vehicle fuel cost of 5% in real term, in order to evaluate the influence of the continuing energy cost rises, said ratio of benefit over cost is calculated at 4.1 under Alternative A, 5.4 under B, and 4.5 under C. The rail-transit-based Alternative A is most resilient to energy cost hike but not to the extent of making it more desirable than Alternatives B and C.

Selection

An eclectic plan blending Alternatives A and B together (which emphasizes on bus as the major mode of public transport, while developing a road network which will facilitate the future introduction of rail-transit with care so as not to over-invest in roads) has been selected for recommendation as a result of the above discussed review, summarized as follows:

- Alternatives A, B, and C are evaluated fairly or highly desirable and all feasible.
- Alternative B shows a relative – but only slight– advantage over the other two.
- Between Alternatives B and C, the latter shows a greater benefit but requires even greater cost.
- Detailed financial analysis has revealed that the introduction of rail-transit will still be premature in the year 2000. However, in view of further demand expansion after the year 2000 and of various advantages of rail-transit (the regularity and rapidity of service, less contamination of environment, and higher fuel efficiency), its introduction will become mandatory sooner or later after 2000.
- Should rail-transit be introduced at any time, the road network to be developed under Alternative B by the year 2000 will tend to be an over-investment.



Modal Shares by Alternative

Major Characteristics of Alternatives, 2000

		Plan A	Plan B	Plan C	Do-Nothing Case
Passenger-Kms.	(000/day)	9,499	9,114	9,016	9,516
Passenger-Hrs.	(000/day)	315	365	377	905
Vehicle-Kms. by Mode (000/day)	Car	854	995	997	1,075
	Jeep	384	447	448	483
	P.U. Taxi	311	316	271	293
	PUJ	151	118	564	595
	Bus	128	222	54	54
	Truck	252	279	279	301
	Railway	17	–	–	–
Vehicle-Hours by Mode (000/day)	Car	26	30	29	69
	Jeep	11	13	13	31
	P.U. Taxi	10	10	9	19
	PUJ	9	7	28	68
	Bus	5	9	2	5
	Truck	11	12	11	28
	Railway	1	–	–	–
Average Volume/Capacity Ratio		0.53	0.51	0.47	1.86

Benefit and Cost in 2000 in 1980 Constant Prices

	Plan A	Plan B	Plan C
Benefit in 2000 (₱ Million)	612.7	572.5	576.7
Annualized Cost (₱ Million)	190.8	120.0	138.0
Ratio	3.2	4.8	4.2

Note: The Ratio above does not necessarily show the Benefit-Cost ratio of each alternative in the absence of scheduling project components.

12. Long- and Medium-Term Trunk Road Network

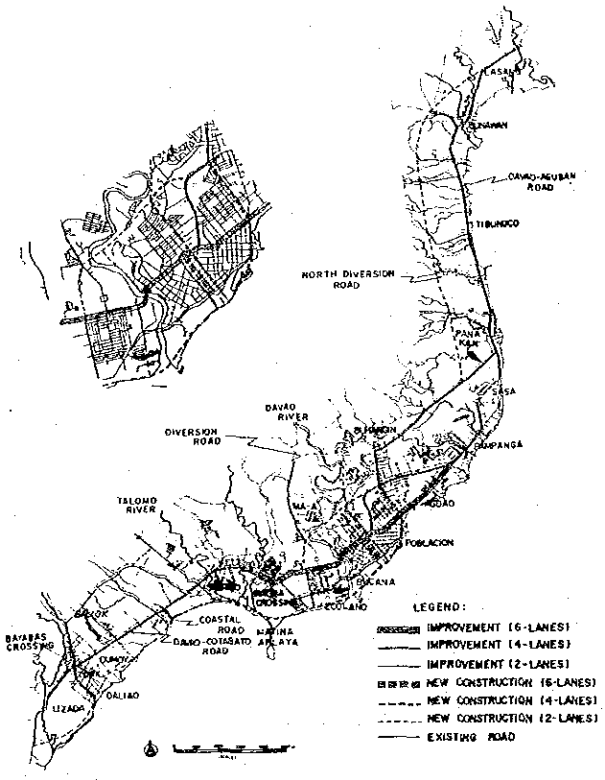
The plan finally selected for recommendation envisages the construction of 49 kilometers of new roads and the improvement of 112 kilometers of existing roads by the year 2000 for a total cost of 1,167 million pesos. By the year 1990, 10 kilometers of new roads will be constructed and 63 kilometers of existing roads improved for a total cost of 387 million pesos, which will constitute about 33% of cumulative total up to 2000.

Long-Term Trunk Road Network

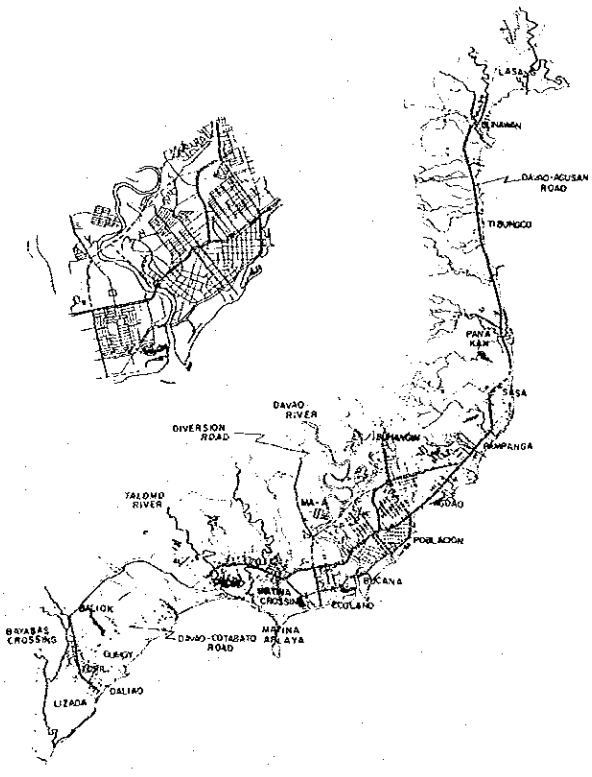
The functional classification of trunk roads constituting the long-term network of the finally selected plan is shown on the next page. This network, in the pattern of a ladder, comprises new roads (a Ring Road, A Coastal Road, and a North Diversion Road between Panakan and Bunawan, etc.) for a total length of 49 kilometers and existing roads improved for a total length of 112 kilometers (6-lane Road to transverse Poblacion, Davao-Agusan/Davao-Cotabato Road, etc.) The required construction cost is estimated at 1,167 million pesos.

Medium-Term Trunk Road Network

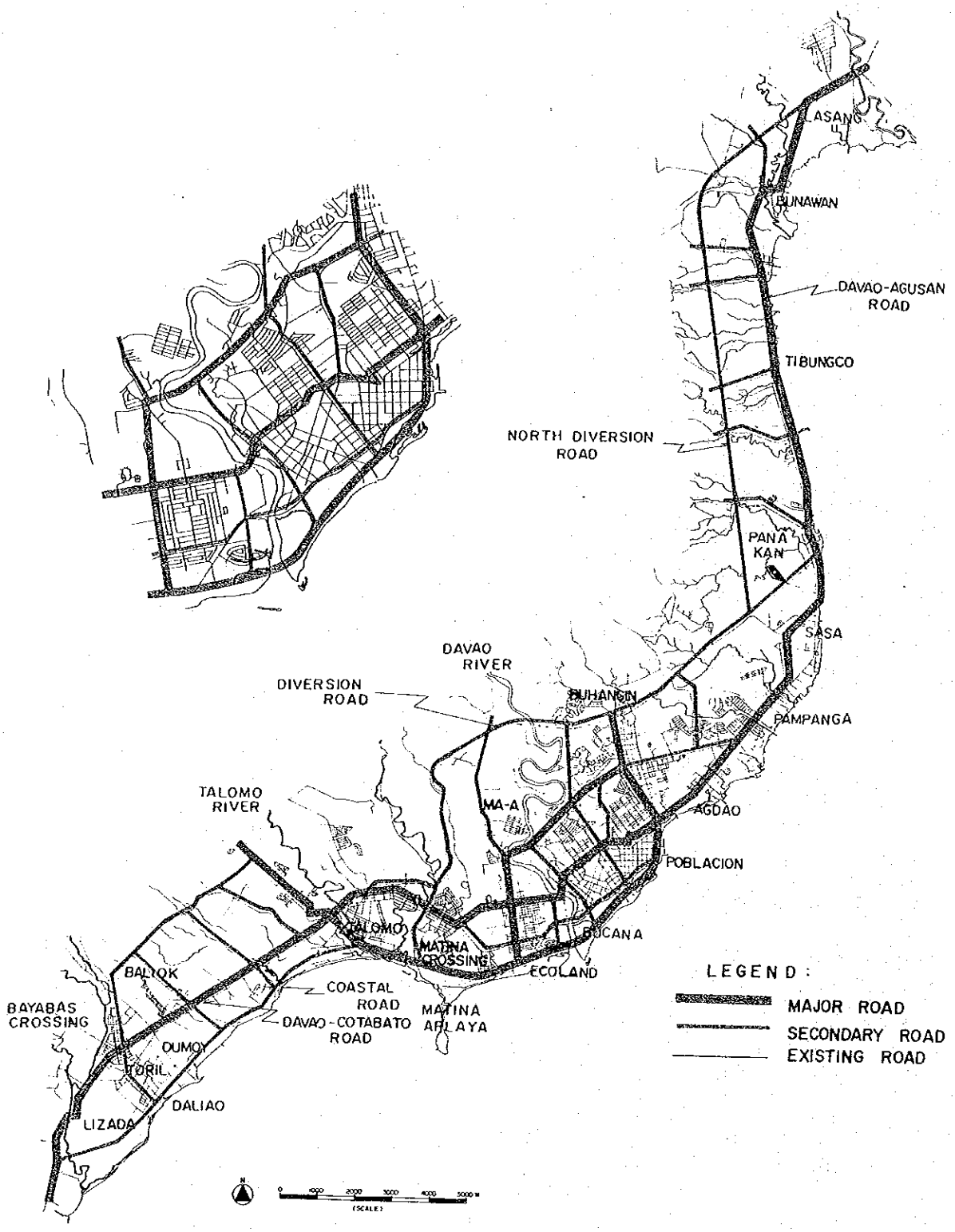
The trunk road network to be developed by the year 1990, a mid-point on the way to ultimate network development, will not yet show the pattern of a ladder, as shown below. This mid-point network will include 10 kilometers of new roads (J.P. Laurel Extension as a part of Ring Road, a part of Coastal Road, etc.) and 63 kilometers of existing roads to be improved (Davao-Agusan/Davao-Cotabato Road, and the upgrading of J.P. Laurel Avenue to a 4-lane road). The required cost is estimated at 387 million pesos, or about 33% of the total required by the year 2000.



Road Network Masterplan 2000



Road Network Plan 1990



Proposed Road Network

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13. Road Transportation Improvement

The Masterplan is to achieve, in the year 2000, a very substantial improvement over the "do nothing" case: a reduction in total passenger-kilometers and an impressive 60% reduction in total passenger-hours, as well as the abatement of traffic congestion ratio of otherwise 1.9 (a total traffic jam) to only 0.5.

Road Functions

The Masterplan provides for a road network which will fully satisfy the expanding future demand not only in terms of quantity but also of quality through the assignment of varying functional levels. The functions of the roads to be constructed by the year 2000 and the demand which they are to satisfy are as follows:

- Ring Road

  Will function to distribute the traffic which otherwise will concentrate into Poblacion at large, to parts of Poblacion, while providing a by-pass to the traffic which will otherwise go through Poblacion. This road is believed to satisfactorily perform such functions in view of the traffic demand estimated for roads which will constitute parts of Ring Road: 13 to 18 thousand PCU/day on J.P. Laurel Extension, a road section to be newly constructed in the north, and 16 to 25 thousand PCU/day on the Coastal Road.

- Six-Lane Road

  Of Davao-Agusan/Davao-Cotabato Road, which is most heavily travelled in the Project Area, the 10-kilometer section between R. Castillo Street and McArthur Highway, where the occurrence of traffic congestion is predicted, is to be upgraded to a 6-lane road, 2 lanes of which are to be designated exclusive bus lanes in order that the service level and transportation efficiency of the bus will be heightened. These bus lanes will have to be administered carefully in view of the heavy traffic demand of 34 to 55 thousand PCU/day on this road.

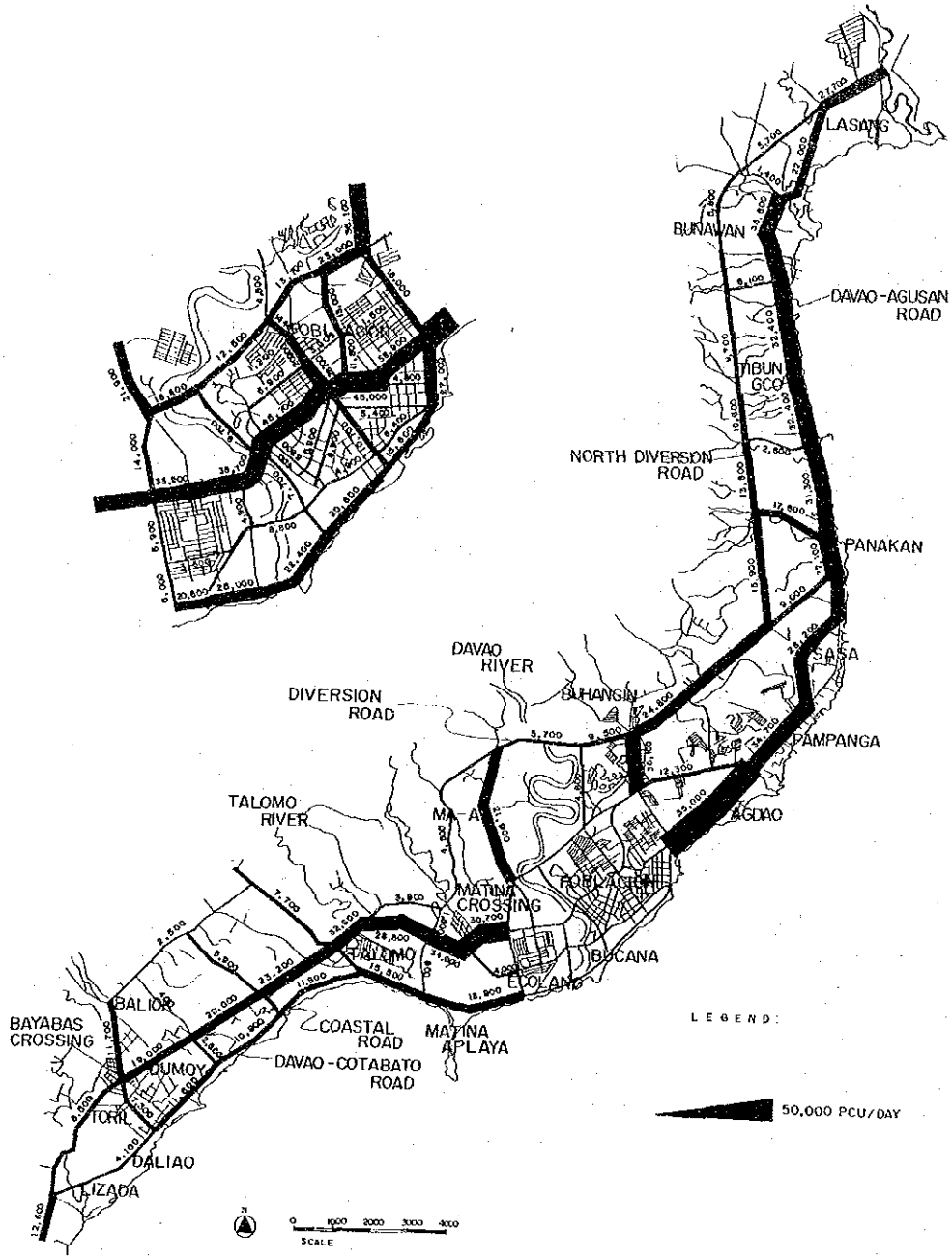
- Coastal Road and North Diversion Road

  While constituting a part of the Ring Road discussed in the above, Coastal Road is to accelerate Bucana Island Development. North Diversion Road, while functioning to stimulate land uses in the northern areas, is an important road which, together with Coastal Road, will constitute parts of the ladder shape road network that will offer greater urban safety in emergency situations. The importance of these roads can be also substantiated by the heavy traffic demands expected on them: 10 to 12 thousand PCU/day on Coastal Road and 6 to 16 thousand PCU/day on North Diversion Road.

Improvement Effects

In "do nothing" case, traffic congestion will occur on all of the roads in the Project Area, the transportation environment will be deteriorated, and urban functions inevitably paralyzed for serious economic consequences, as suggested by the high traffic congestion ratio (traffic volume/road capacity) of 1.9. In contrast, the Masterplan will result in the abatement of this ratio to only 0.5, for a greater ease of traffic flow. The magnitude of this improvement effect can also be understood from an estimated 5% reduction in total passenger-kilometers and a very substantial 60% reduction in total passenger-hours, as compared with the "do nothing" case, in the satisfaction of the same level of demand.

Also, the total length of road sections where congestion ratio will be 1.0 or higher, expected to be 92 kilometers in the "do nothing" case, will be only 15 kilometers under the Masterplan. Moreover, little traffic handling problems are expected for the road sections of this 15 kilometers, because alternative roads will be available with regard to all of these sections, and congestion ratio is not expected to reach 1.5 on any road; the recommended Masterplan is judged a rational plan that will fully satisfy the future transportation demand in the Project Area.



Traffic Volume Year 2000 (Masterplan)

Major Indicators of Masterplan

	Do Nothing Case	Masterplan (Year 2000)
Passenger-kms	9,516,000	9,075,000
Passenger-Hours	905,000	373,000
Overall Road Capacity of the Project Area (PCU x km)	1,645,000	4,991,000
Total Length of Road Sections with 10,000 or more PCU's/day (kms.)	97.5	87.2
Average Volume/Capacity Ratio	1.86	0.48
Total Length of Road Sections with 1.0 or more v/c ratio (kms.)	92.1	14.8

14. Major Trunk Roads: Features and Technical Questions

The details of route locations and structures, etc. of major trunk roads must be decided in accordance with the Masterplan intention, in the post-Masterplan stages of feasibility study and detailed designing. Also, it is necessary that construction control within the proposed right-of-way and other measures be put into effect now, in order to facilitate the future acquisition of project lands in urban areas.

Six-Lane Road

This road, to be made up of 6 existing roads, will be the spinal road running through about the center of Poblacion, Matina, and Agdao; the entire transport network of the Project Area will also be shaped based on this road. In commensuration with traffic demand, the road will be first upgraded to a 4-lane road utilizing the existing road right-of-way by 1987, and, in the second phase, it will be upgraded to a 6-lane road by the year 2000. In order to alleviate the expected difficulty in land acquisition and building demolition for the 13- to 18-meter road widening in this second phase, attempt should be made to acquire the necessary pieces of land as soon as possible, while statutory regulation be put in force to require that all new buildings will be set back off the proposed road right-of-way when constructed. Between the planned Sta. Ana-Lapu-Lapu Section and a conceivable route alternative thereto, it is believed that the planned route will have advantages over the latter, because, although the former will involve the removal/relocation of 1 church, 1 university, and 10 concrete structures, and the latter, only 1 high school, 1 university, and 3 concrete structure; the latter will require the acquisition of about twice as large a land space and make traffic handling complicated at Sta. Ana Intersection and Lapu-lapu Intersection.

Bankerohan Bridge, existing on this route, will be expanded by the addition of a new 3-lane bridge on the upstream of the existing bridge by 1985 (first phase) and the addition of another new 3-lane bridge in its downstream by about 1996 (second phase), the existing bridge will become a railroad bridge upon the future introduction of rail-transit. Although an alternative route or widening of the existing bridge at first or second stage will be possible, it is believed that the use of the existing bridge in its present condition until second phase will be more realistic and economical.

Ring Road

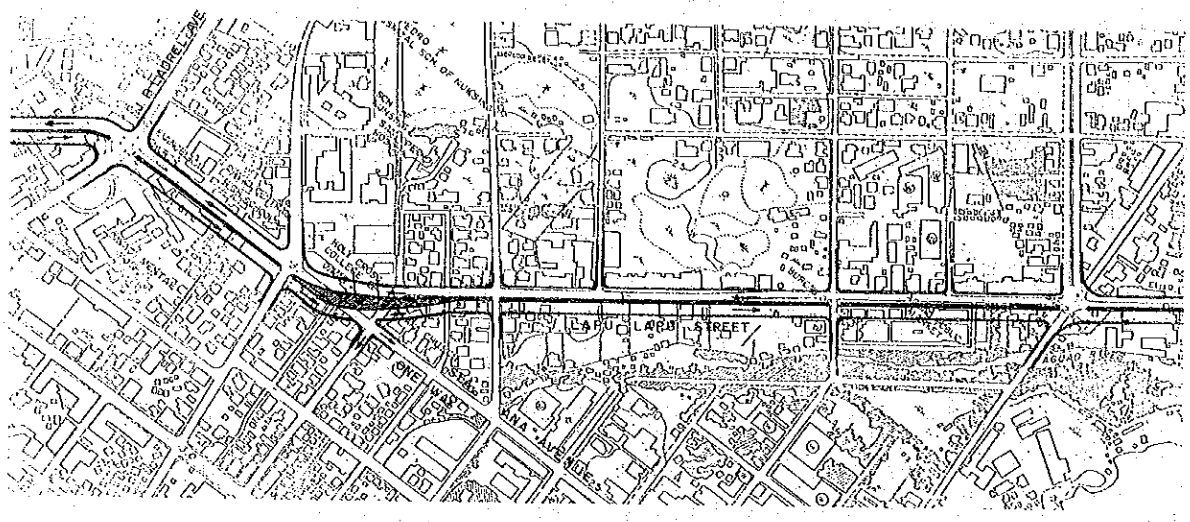
The central commercial/business district (CBD) will not remain confined to Poblacion but will expand to the vicinity of Ecoland in the future. A Ring Road to be formed around this expanded CBD will consist of 6 (3 new, 3 existing) roads representing 11 project elements. The Riverside Road and E. Jacinto Street, which will provide north-south connections of the formed ring, will function in unity with Ring Road and, therefore, should be completed about the same time as Ring Road. The northern semicircle of Ring Road is to be completed by 1990 and the remaining southern semicircle (which will be Coastal Road) by 2000. Thus, Bolton Road and M. Quezon Boulevard will be used as the southern semicircle of Ring Road in lieu of Coastal Road until its completion.

Coastal Road

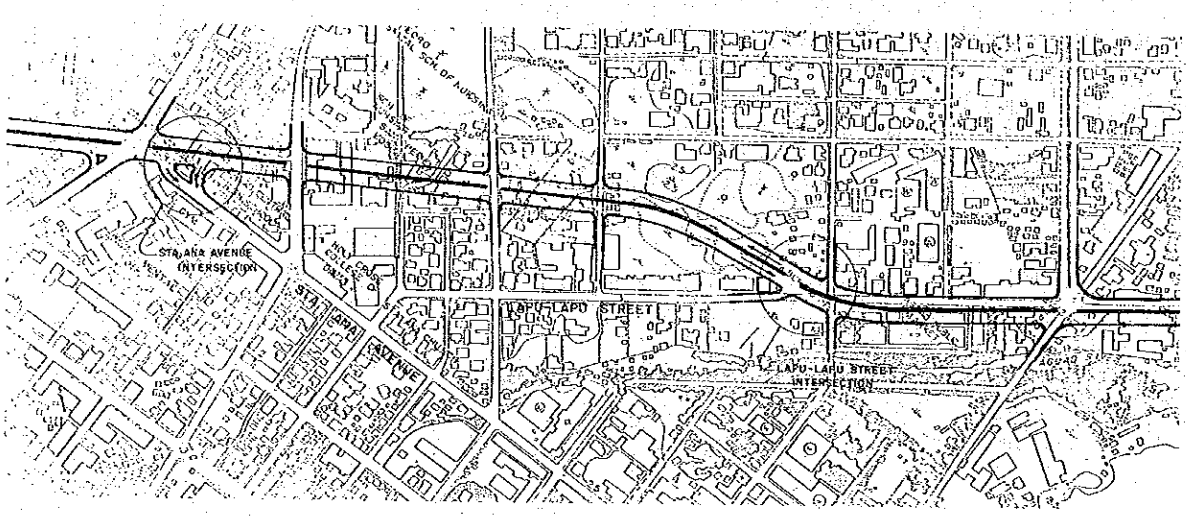
A Coastal Road which will run along recreational beaches near Talomo and Ecoland, should be constructed with emphasis not only on economy but also on easthetics and, in Bucana District, where the road will utilize reclaimed land, with a particular care that the road structure will fully support and withstand motor traffic load. Also, it would be realistic that the southern section of the Riverside Road be built first, which will facilitate land reclamation/soil delivery and the construction of Coastal Road.

North Diversion Road

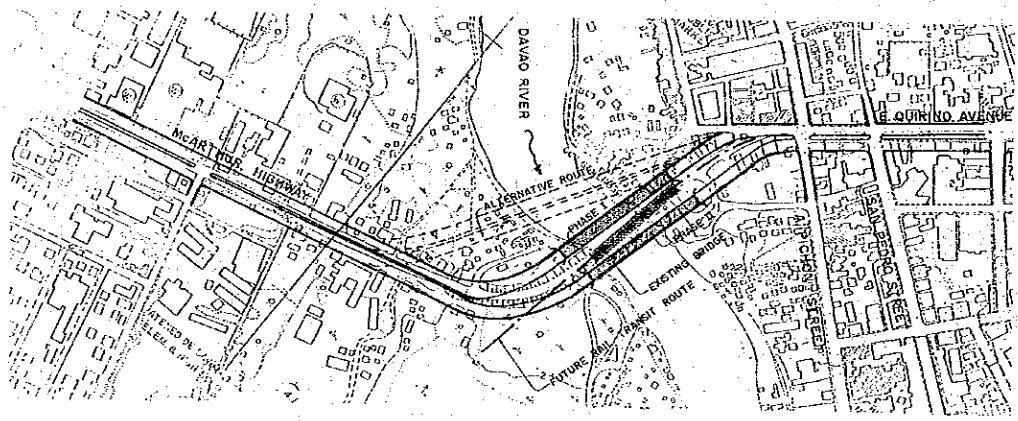
Constituting a pair with Davao-Agusan Road, this new road will run in north-south direction in the inland about 1.5 to 1.8 kilometers from the coast. As it will pass through an area highly undulating between 30 and 60 meters above sea level, it will have to clear gorges at 11 locations; it should be so designed so that its vertical alignment will help minimizing the volume of earthwork and the length of bridges.



Planned Route (6-Lane Road: Sta. Ana Ave. —Lapu-lapu St. Section)



Alternative Route (6-Lane Road: Sta. Ana Ave.—Lapu-lapu St. Section)



Construction Phases of Bankerohan Bridge

15. Road Construction Costs

In addition to trunk roads, new collector and local roads must be built for an estimated total length of 253 kilometers. Up to the year 2000, the construction costs required for the building of these new, and the improvement of existing, collector and local roads are estimated to total 380 million pesos. Adding this to the construction costs of trunk roads, the total necessary road construction cost will be 1,547 million pesos.

Collector Roads and Local Roads

Required for the accomplishment of healthy, safe, and pleasant development of the Project Area in its entirety will be an integral road network wherein the component trunk roads, collector roads, and local roads will perform different levels of function in a coordinated manner for a well balanced total performance by the network as a whole. In the structuring of such a network, therefore, it is essential that each road section be assigned with a specific function which it is expected to perform and that roads with a lower level function be subordinated to those with a lower level function in connection with each other. The basic concept of this road distribution/connection in a network is presented below.

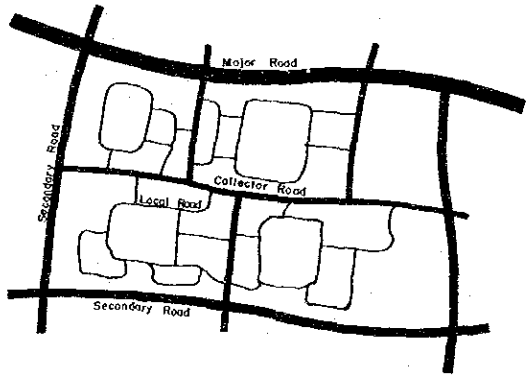
From an analysis of the road density level required for each type of land use, the quantity of collector and local roads required in the Project Area is calculated at 619 kilometers in total length. Deducting the existing 336 kilometers from this total, 253 kilometers will have to be newly built. To build this 253 kilometers of new roads and to pave a targeted 50% of all collector and local roads (619 kilometers), a total fund of 380 million pesos will be required.

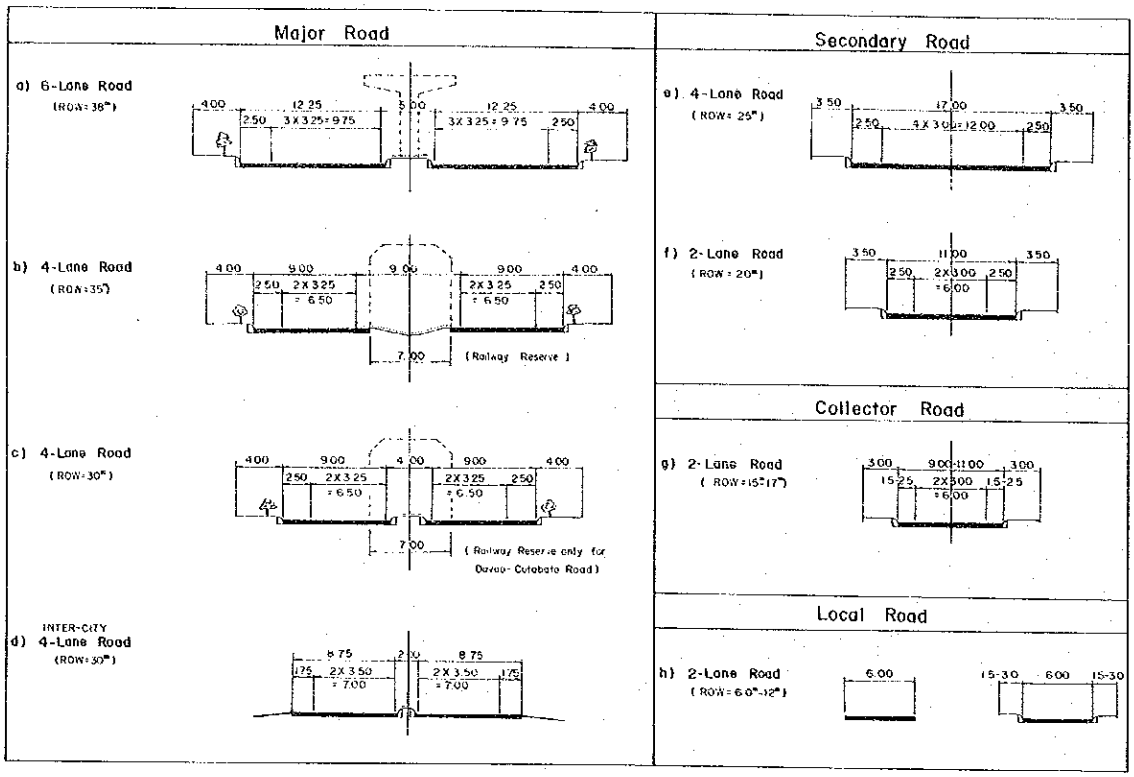
This is a substantial size of fund both in terms of absolute amount and as a percent of the estimated total public investment funds available, therefore, it will be desirable that many of these roads be constructed by private sector, as have already been seen in some housing projects or through some new urban development scheme.

Road Construction Costs

The total amount of construction costs required to build new, and to improve/upgrade the existing, trunk roads, collector roads, and local roads by the year 2000 is estimated at 1,547 million pesos in 1980 constant prices, under the following basic conditions:

- The unit construction costs which have been used by the Bureau of Construction of the Ministry of Public Works and Highways are used after modification in accordance with the cross section of roads under plan and with the topography of the Project Area. A standard cross section is prescribed for the road of different function. For the road sections which will accommodate railroad tracks in the future, a cross section has been prescribed which utilizes and occupies an adequate width for the preservation of transportation environment and traffic safety upon the eventual introduction of railroad.
- Trunk roads will be concrete-paved, and collector and local roads either asphalt-paved or given a gravel surface.
- The unit cost of upgrading/improvement of the existing roads is estimated at 90% of the new road construction unit cost in view of the low predicted level of contribution by the existing "stock".





Standard Road Cross-section

Total Length and Construction Costs of Trunk Roads

	Length in kms.				Construction Cost in Million ₱ (1980 constant price)		
	2-lane	4-lane	6-lane	Total	Construction	ROW	Total
New Construction	37.1	11.7	—	48.8	342.5	171.2	513.7
Upgrading/ Improvement	43.4	57.9	10.7	112.0	384.4	269.2	653.6
Sub-Total	80.5	69.6	10.7	160.8	726.9	440.4	1,167.3

16. Traffic Management Plan

Essential to Poblacion, where traffic concentration is the heaviest in the Project Area, will be, along with road development, the introduction of an effective traffic management system, consisting of the improvement of intersections, the installation of traffic signals, the introduction of one-way traffic, and other measures to prevent traffic congestion and accidents which will otherwise tend to increase in the future.

Basic Policy

- The year 1990 is basically set as the target year for traffic management plan, unlike road network development with target years of 1990 and 2000.
- Traffic management plan is to be formulated for Poblacion, where traffic concentration is the heaviest in the Project Area.

Intersection Improvement

Component roads of a network should, as a whole, constitute a hierarchy of levels of various road functions. Roads of the network existing in Davao City generally show ambiguous functional assignment and structure, and, therefore, even through traffic is observed to flow into local roads, unnecessarily complicating traffic flow pattern on the network. Also, a radial road pattern and a grid road pattern coexist in Poblacion, and irregular intersections have been formed at the interface of these two road patterns, causing problems to traffic safety. In an attempt to remedy these difficulties, 8 intersections are to be improved as follows:

- Multi-leg (5 or 6-leg) intersections are to be changed into intersections with 4 or less legs.
- Acute-angle intersections, zig-zag intersections, and intersections with an extremely short interval between each other are to be corrected into normal intersections through their reshaping, access control, and other means.

Note: The intersection existing on roads which are to be widened are to be improved at the time of and as a part of the upgrading work, and, therefore, are not included in these recommendations.

Traffic Signal Installation

Presently, manually operated traffic signals are installed at 9 locations in Poblacion. It is recommended that automatic fixed-cycle traffic signals be installed at 66 locations in and around Poblacion in order to meet the expected future transportation demand expansion with greater traffic capacities of the intersections and to control traffic accidents, to secure proper split against major traffic flow, and to protect pedestrians.

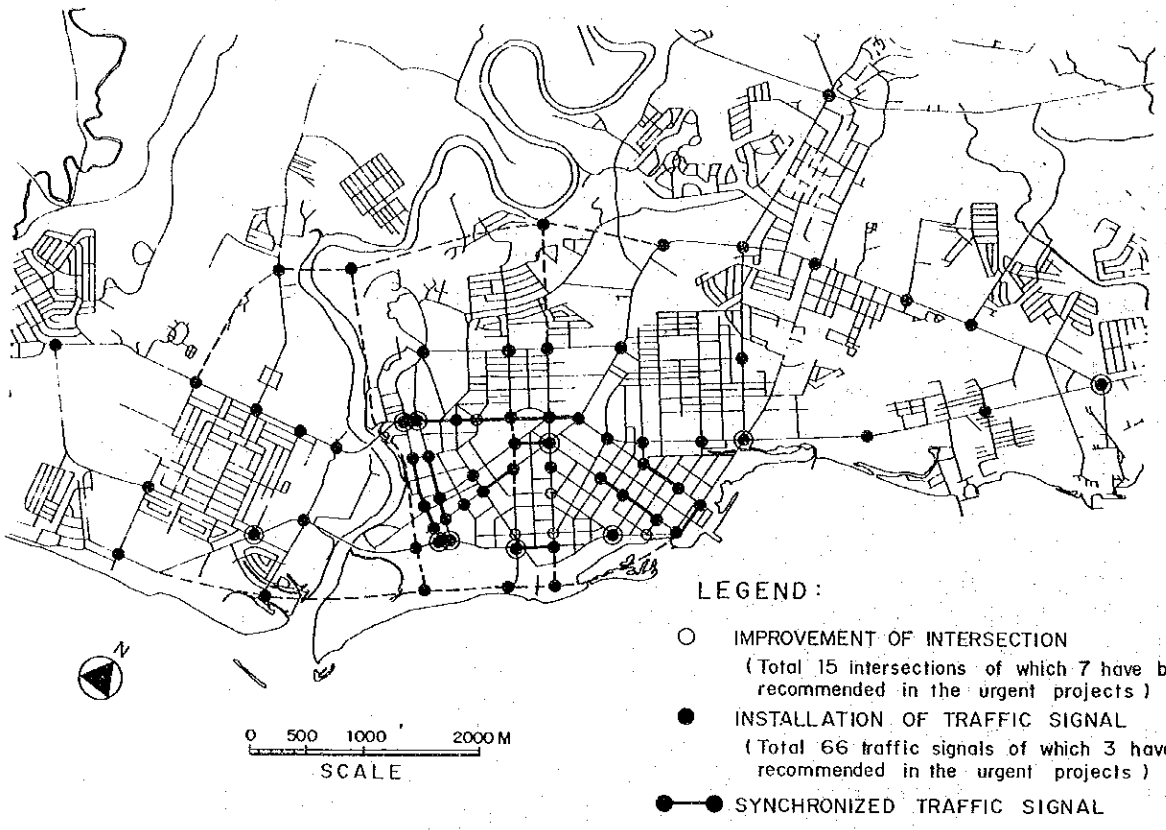
Traffic Management in CBD

- One-Way Traffic Plan

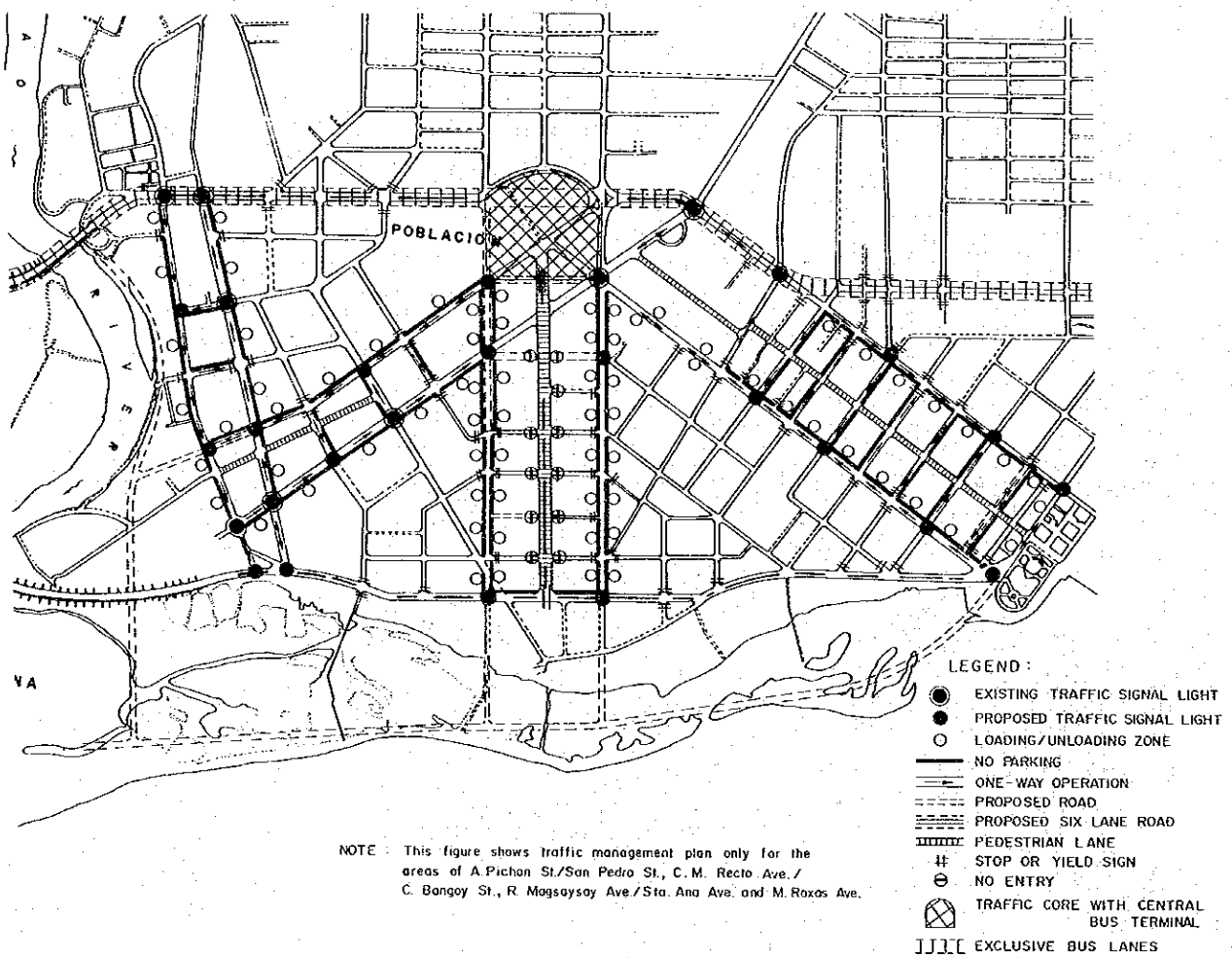
  One-way traffic operation is to be implemented for the purpose of achieving smooth traffic flow at intersections, the expansion of traffic capacities of intersections and the creation of spaces for pedestrians use and for parking. The introduction of one-way traffic operation to A. Pichon Street and San Pedro Street was already recommended in the Urgent Implementation Program. If the implementation of this recommendation brings about a desirable result, the introduction of one-way traffic operation also to two districts, namely: C. Bangoy Street – C.M. Recto Avenue and R. Magsaysay Avenue – Sta. Ana Avenue should be considered. Necessary for the implementation of one-way system will be the installation of PUJ loading/unloading zones at the rate of one zone per each block and the enforcement of no parking on the right side of the streets, the installation of on-street toll parking spaces on the left side of streets, and the making of road signs and markings perfect.

- Traffic Management in the Vicinity of M. Roxas Avenue

  In accordance with the development image of the Mindanao's largest commercial and business district recommended for the vicinity of M. Roxas Avenue, this Avenue should be made a park avenue and opened for pedestrians by prohibiting the entrance of all but emergency vehicles. E. Jacinto Street and A. Maboni Extension should be developed so as that these two streets will provide access to E. Quirino Avenue and M. Quezon Boulevard, with concurrent installation, on these two streets, of traffic signals, PUJ loading/unloading zones, as well as the enforcement of no parking on them, and the prohibition of crossing M. Roxas Avenue by means of converting local roads into cul-de-sac and other traffic regulation measures. Also, exclusive bus lane is to be installed on E. Quirino Avenue in order that Central City Bus Terminal to be established on the northern end of M. Roxas Avenue will fully function.



Location of Intersection Improvement and Traffic Signal Installation



NOTE : This figure shows traffic management plan only for the areas of A.Pichon St./San Pedro St., C.M. Recto Ave./ C. Bangoy St., R. Magsaysay Ave./Sta. Ana Ave. and M. Roxas Ave.

Traffic Management in CBD

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17. Parking Lot Plan

In order to secure smooth and safe traffic flow in CBD in Poblacion, it will be necessary that a total of 1,100 parking lots be established by 1990, and a cumulative total of 1,500 by the year 2000.

Parking Problems in Davao City

Parking Problems in Davao City are concentrated in Poblacion. That is, the person-trip survey found approximately 13,300 vehicles parked on street and about 22,700 vehicles, off-street; on-street parking represented about 37% of all parked vehicles, and as much as 60% of on-street parking was found in Poblacion. Particularly in CBD, road capacity is reduced and the smooth flow of traffic substantially hindered by on-street parking practice. Therefore, the development of adequate parking spaces will be imperative specifically in CBD.

Future Parking Demand

Future demand for parking spaces in CBD is estimated for each trip purpose as presented in the table below. Total parking space demand is predicted to be 18,100 vehicles/day in 1990 and 25,800 vehicles/day in the year 2000.

Future Parking Demand for Private Cars by Trip Purposes, CBD (Vehicles/Day)

Purpose	1990	2000
Office	14,000	21,800
School	6,900	8,500
Home	15,100	19,400
Business	19,600	28,600
Shopping	3,300	4,600
Private	19,700	26,600
Total	78,600	109,500

Parking Lot Development Policy

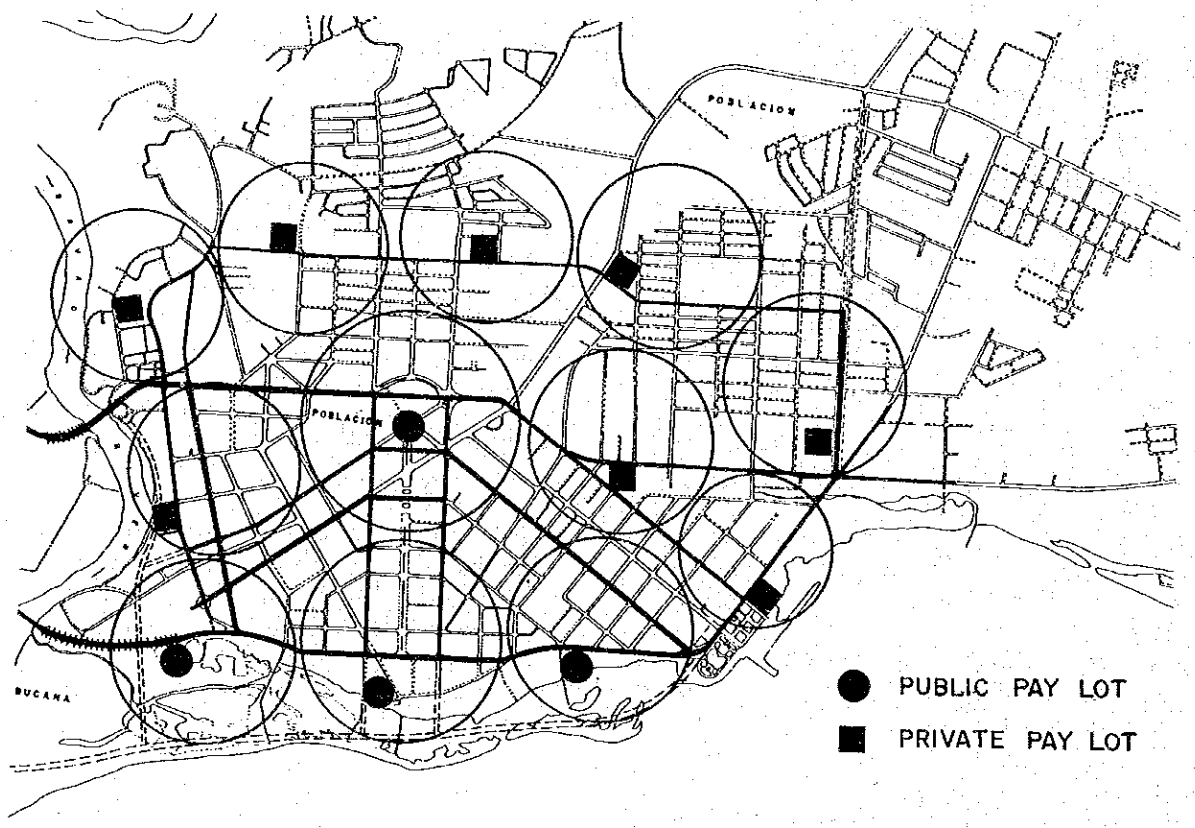
- As a principle, the employer and the landlord (house owner) are to establish at the place of work and within the housing premises, respectively, parking spaces with an adequate capacity to satisfy the needs of commuters. Parking space demand of commuters is estimated at about 17,000 in 1990 and 24,300 in the year 2000. Parking demand for other (than going to work and going home) purposes is to be met with on-street and off-street parking spaces.
- On-street parking is to be held to an absolute minimum. Parking is to be prohibited basically on major and secondary roads, while parking is to be allowed on parts of collector and local roads, provided that such on-street parking be subject to toll and be limited to about 200 lots in total in 1990 and 300 lots in 2000.
- Off-street parking facilities are to accommodate a predicted total of 900 vehicles in 1990 and 1,200 vehicles in 2000 and be geographically distributed in a manner so as that the entire CBD will be covered by the service spheres (of 500-meter radius) of these facilities.
- Of these total capacities of off-street parking spaces, public organization (s) is to accommodate 400 vehicles in 1990 and 500 vehicles by 2000, while toll parking for 500 vehicles be established by private capital by 1990 and for 700 vehicles by same by the year 2000.

Profitability of Parking Lots

The profitability of a hypothetical 100-vehicle parking space in CBD is calculated as follows: against an estimated annual revenue of 263,000 pesos, annual expenditures will be 103,000 pesos without land cost, and 433,000 pesos with land cost. In view that the privately operated parking space on a newly acquired land will be of a negative profitability, the government should encourage the use of existing idle land spaces and provide preferential financing and/or tax incentive in the recognition of the public nature of parking spaces, or directly operate non-profitable parking lots in required locations.

Allocation of Parking Lots in CBD

			Office	Home	Business Shopping Private	Total Lot	Total Space
	On-Street		–	–	200	200	1.3 km.
1990	Off-Street	Public	–	–	400	400	1.2 ha.
		Private	8,600	8,400	500	17,500	52.5 ha.
	Sub-Total		8,600	8,400	1,100	18,100	1.3 km. 53.7 ha.
	On-Street		–	–	300	300	1.7 km.
2000	Off-Street	Public	–	–	500	500	1.5 ha.
		Private	13,500	10,800	700	25,000	75.0 ha.
	Sub-Total		13,500	10,800	1,500	25,800	1.7 km. 76.5 ha.



Proposed Distribution of Parking Facilities

18. Public Transport System: A Long Term Prospect

Public transport demand in the City of Davao will increase by 2.6 times in terms of the number of passengers and 3.7 times in terms of passenger-kilometer by the year 2000. Major passenger flow will run on and in parallel to Davao-Agusan/Davao-Cotabato Road. Such increase of, and characteristical change in, major public transport demand on trunk roads will stimulate the introduction of new major urban transit system, such as the City bus and/or rail transit.

Increase and Qualitative Change of Public Transport Demand

It is predicted that, by the year 2000, public transport demand in Davao City will increase, in terms of the number of passengers, to 780,000 pass/day or 2.6 times the present level, or, in terms of passenger kilometer, to 5,450,000 pass. km/day, or 3.7 times the present level. These increases will be attributable to the expansion of urban scale of Davao City, but, because the industrial structure and geographical feature of the City will also change, the transportation demand will undergo qualitative change at the same time. That is, travels to go to office, as a proportion of total travels for all purposes of public transport passengers, will much increase, while the proportion of travels to go shopping will decrease. Passenger trips which are now concentrated in the range of 1 to 4 kilometers will extend to the range of 1 to 15 kilometers, for an increase in the average length of trip from about 5 kilometers, (1979) to about 7 kilometers (2000).

As a result, such a regular and long distance public transport commuter traffic to office or school, as seen on EDSA and M. Quezon Avenue in Metro Manila both in the morning and evening, will concentrate on and in parallel to Davao-Agusan/Davao-Cotabato Road running in north-south direction.

Qualitative Change of Public Transit System

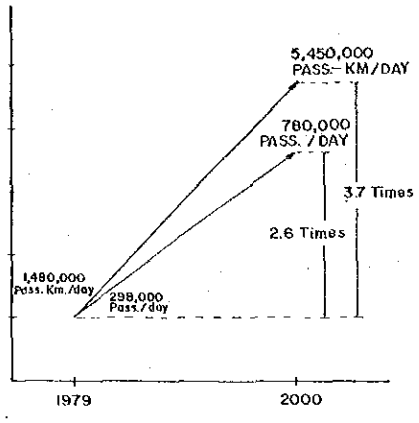
Urban public transport in Davao City currently depends on 8- to 16-passenger PUJs and ACs, which are excellent modes of transportation to meet demand within a relatively narrow area with random orientations in the fashion of Brown's movement. However, when demands concentrate in certain direction, as it will be in Davao as discussed in the above, the poor transport efficiency and economy of small-capacity vehicles such as PUJs and ACs become more apparent than their advantage of being convenient. To meet concentrated demands with some means of public transport with a large capacity and, therefore, a high transport efficiency, is more favorable than to meet them with a small-capacity mode.

Innovation of Public Transportation System in Davao

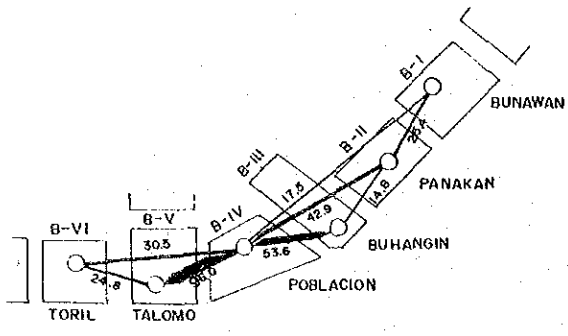
The city bus, which used to serve Poblacion in Davao City in post-war periods, was taken over by the type of jeepneys now called ACs, the mainstay of urban public transport further shift was from ACs to PUJs in the 1970s. Taxi cabs, which were previously in service, were driven out of market by PUs after the oil crisis. These facts show the process of selecting a mode of transportation more suited to the characteristics of the trips made by public transport passengers – or the selection of cheaper public transport mode. The currently predicted change in the characteristics of public transport passengers suggests that re-selection, accordingly, of a new public transport mode will be necessary in the near future.

Analysis under the existing conditions indicates that the introduction of a rail transit will be still premature in the year 2000. However, the feasibility of electric-powered rail transit will rise in a long term future, beyond the target year of 2000, or when an unusually large oil price increase will be on the horizon. Precedents of development of bus service as the major means of urban transportation to be depended upon until the year 2000 while preparing physical space for rail transit in the future beyond that year are numerous as seen in Kuala Lumpur, whose population is greater than that of Davao City, as well as in Bangkok and Jakarta. When demand will exceed the transportation capacity of the bus, that will be the time when the introduction of rail transit is to be taken up, as is in Manila.

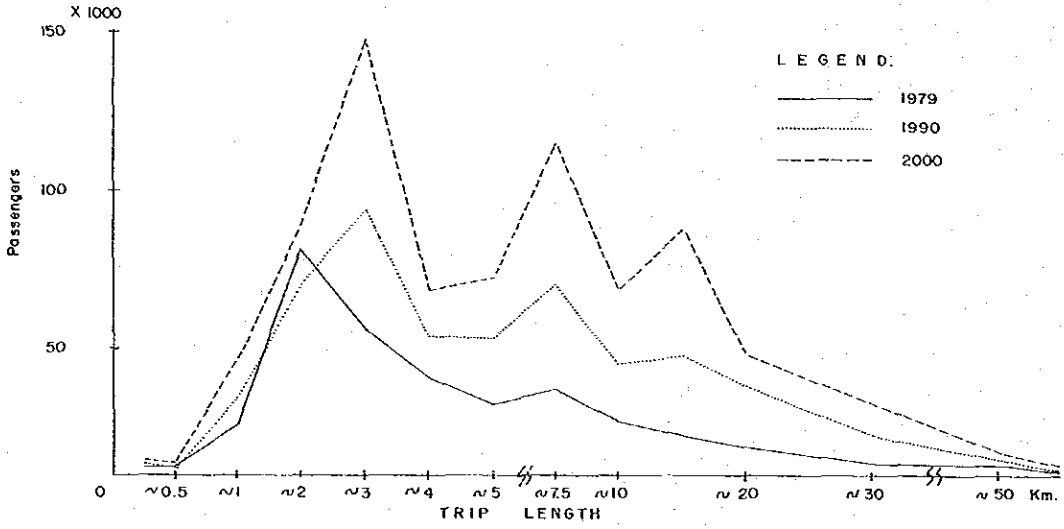
The enhancement of bus service as the means of public urban transport in Davao City, while securing physical conditions for innovation of public transport means in the future, will be an urgent task to be achieved in this Masterplan.



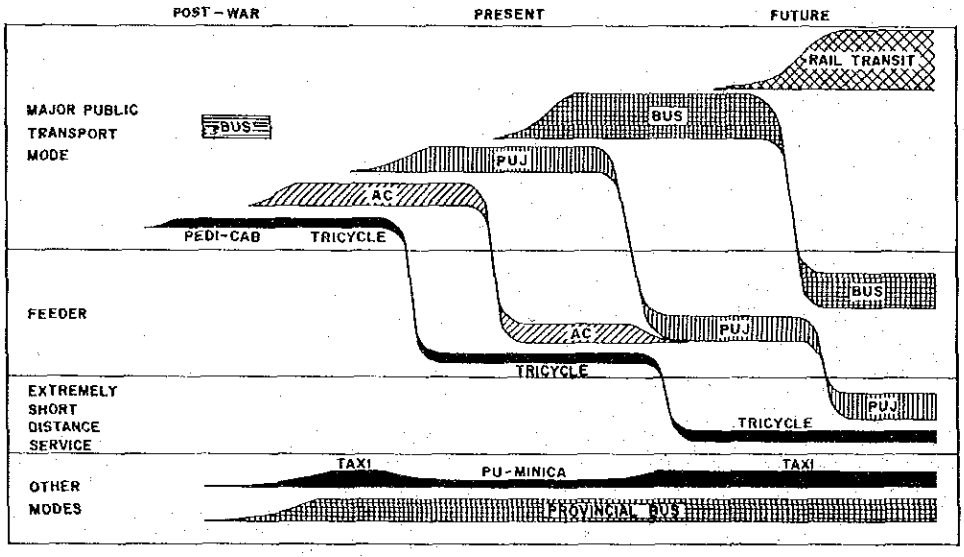
Variation of PUV Passengers



Desire Line of PUV Passengers, 2000
(x 1,000 Person Trips/Day)



Variation of PUV Passengers by Trip Length



Evolution Model of Public Urban Transport Modes in Davao City

19. City Bus Introduction Plan

To meet the predicted rapid increases in medium trip length demand in the Project Area, the introduction of standard sized bus service is recommended. Initially 50 units of buses are to be put into service by the targeted 1985, after which the fleet is to be augmented to 200 buses by 1990, and to 500 by the year 2000. Along the introduction and expansion of city bus service, the PUJ, now the primary means of public transport, will be given the function of serving passengers on short distance trips in supplementation to the city bus, while the number of PUJs will increase by about 1.5 times by 2000.

Advantages

The introduction of standard sized buses with twice the capacity per PCU of PUJs will tend to mitigate road traffic congestion, thereby alleviating road construction demand for public investment saving. In addition, the cost of transporting one passenger for one kilometer by bus is only about 70% of the cost by PUJ.

Basic Policy

As the city buses will serve passengers on relatively long trips moving from one Block to another (the Project Area being divided into 6 Blocks), bus routes will be limited to major roads. In supplementation to such city bus service, PUJs will serve chiefly passengers moving within each Block.

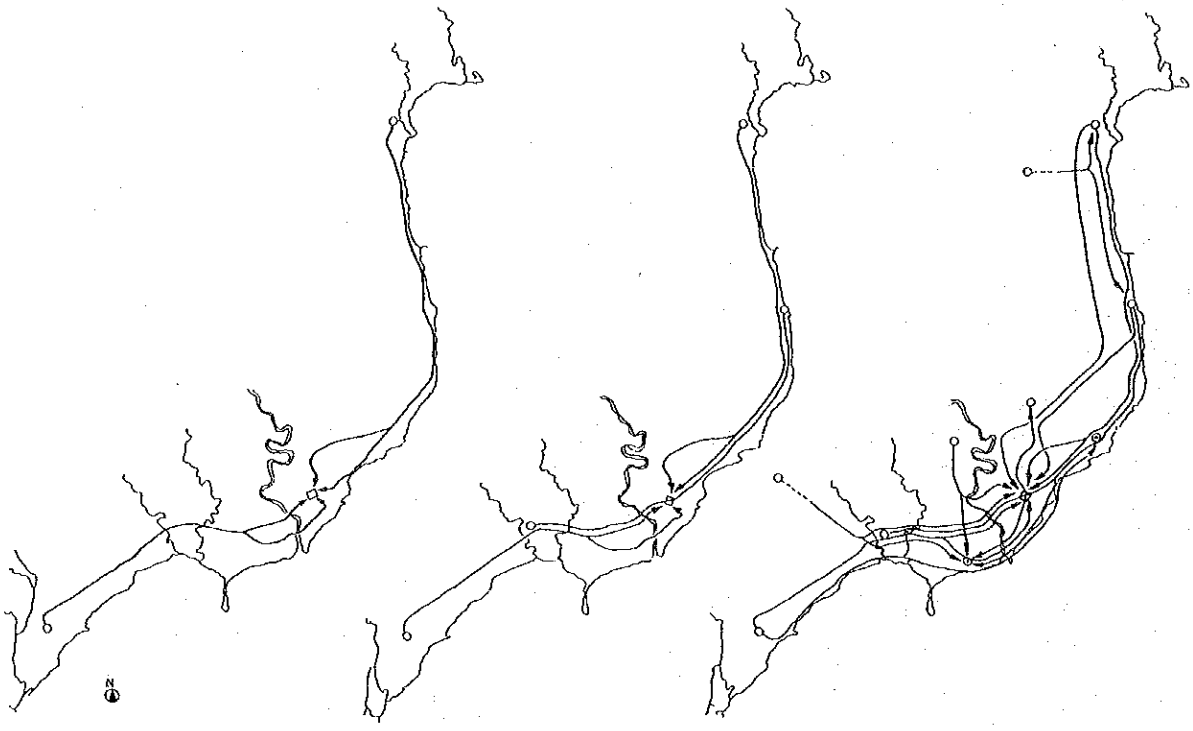
- Bus service route network should be closely laid out so that people will be able to walk to a bus stop from anywhere, particularly within the existing and new CBDs. This objective will have been nearly fully achieved when bus routes are established on the 6-lane boulevard (E. Quirino Avenue and Lapu-lapu Street) and Ring Road to be developed under the Masterplan.
- In addition, the geographical location of bus terminal will also be important to the achieving of said objective (or, stated in reverse, placing the entire areas of CBDs within walking distance from at least one bus stop). The central city bus terminal for Poblacion is to be sited at the northern end of M. Roxas Avenue, which will be transformed into a street lined with modern office buildings, and the terminal will become a nodal point where bus service and PUJ and taxi service will interface. Only few permanent structures currently exist on this site, which will later be in the middle of CBD to be newly developed, and it is believed that the development of a bus terminal will be relatively easy on this site.
- Terminals for provincial buses (already in service) are to be established on the fringe of Poblacion, and the service is not to be extended into Poblacion. When city bus service has fully developed, provincial bus terminals might be established also in Toril and Bunawan.

Implementation

Although the existing demand would support 70 buses now and, in 1985, some 130 buses, it is recommended that an ample time be taken for preparation and that a trial service be started with 50 units of buses in 1985. After a 5-year trial period, the bus fleet is to be enlarged to 200 buses for normal commercial operation in 1990, and finally to 500 buses by the year 2000. The establishment of 2 bus depots will be necessary to support the bus fleet. For the procurement of buses and the construction of bus depots, a total fund in the amount of 180 million pesos will be necessary by 2000. The result of financial analysis of the bus service operation is favorable enough to believe that it will be adequately profitable as a private enterprise.

Bus-PUJ Competition

Buses, which evidently would not be able from the outset to satisfy all the demand, and PUJs will inevitably have to be left in competition with the bus for the time being. However, against the advantage of PUJs with their tighter service route network and higher service frequency, the inferior competitiveness of buses will have to be improved with a fare discount system (student discount, season tickets, coupon ticket), the extension of service into central Poblacion, and so forth. As the city bus service will develop, the PUJ will recede as secondary mode of public transport, and the competition will ultimately cease.



Bus Route 1985 | Bus Route 1990 | Bus Route 2000

Summary of City Bus Project

	Unit	1979	1985	1990	2000
DEMAND					
Bus passengers	pass.	50,000 1/	85,500 2/	115,000	329,000
Passenger .Kilometers	pass. km	478.5 1/	927,000 2/	1,300	3,500
Minimum Requirement of Bus Units 3/	(x1000) Unit	70	130	190	450
PROJECT					
No. of Bus	Unit	–	50	200	500
No. of Bus Routes 4/		–	2	3	9
No. and Area of BUS BASE	Unit	–	1	2	2
	ha.	–	0.5	1.8	4.5
Employment	person	–	400	1,200	3,000
INVESTMENT SCHEDULE 5/					
Bus procurement	Million pesos		10.7	42.7	162.3
Construction of supporting Facilities	Million pesos		2.0	7.9	20.0
COST 6/					
Operating Cost	Million	–	22.2	135.5	1,033.6
Interest of Loans	Pesos/		4.4	16.6	124.5
Loan Repayment	year		–	1.3	27.6
REVENUE	Million Peso/Year		25.4	187.3	1,579.1

1/ Estimated Based on Passenger Distribution by trip length in 1979 using Modal Share in 1990.
2/ Estimated Using No. of Passengers of both, 1979 and 1990
3/ About 11.7% of Passenger .Kilometer belongs to activity outside project area.

$$\text{Minimum Bus requirement} = \frac{\text{Pass. Km} \times (1\text{-}0.117) \times 0.15}{40 \times 30}$$

4/ No. of routes are counted based on the combination of origin and destination. A certain route with same O/D have sometimes more than two Routes.
5/ Investments are accumulated to each year
6/ With 12% inflation rate
7/ No. of Bus procured are 760 units up to 2000, because life cycle of Bus is assumed 8 years.

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20. Bus Terminal

The bus terminal facilitates effective bus operation management and control to secure passenger safety and amenity, as well as bus service regularity and reliability. In Poblacion, a central city bus terminal is to be established at the northern end of M. Roxas Avenue so as that newly developed CBD will be within walking distance of the terminal. In addition, a local terminal is to be sited at each of the newly developed urban cores and, as the city bus service will develop, local terminals will be increased to a total of 8.

Function

The bus terminal offers passengers a wide selection of routes and easy and safe loading and unloading, while it helps the bus company to secure the regularity of bus operation. When plural number of bus companies are in market, their use of a common terminal will make it easier for the competent authority to control the flow of bus traffic within its jurisdiction. Thus, it will be of a strong need that bus terminals, particularly the central terminal in Poblacion, be constructed concurrently with the introduction of city bus system.

Demand and Location

The size of a bus terminal is decided for a large part by the total number of bus arrivals and departures which it is to accommodate. Such service demand in the Project Area is estimated for the year 2000 at 1,048 arrivals/peak hour and 1,017 departures/peak hour for a total of 2,065/peak hour. Slightly more than 1/3 of this total will concentrate in Poblacion, followed by Panakan, Talomo, and Pampanga. As a principle, bus terminals are to be sited at the end of bus service routes in order to maximize the advantages discussed in the above.

Implementation

Government participation in bus terminal development is imperative for the following reasons:

- The bus terminal provides not only for a private enterprises productivity improvement, but also for the improvement of public transport service and road traffic control.
- Bus terminal construction cost is beyond the financial capability of a private company: the estimated construction cost of terminals under this Plan is approximately 89 million pesos, and this is as large as approximately half of a bus company's initial investment.
- It should be desirable that bus terminal land site be acquired through a new development scheme, such as so-called "urban redevelopment".

Bus terminal operating cost, estimated at about 4.5 million pesos per year, corresponds to 3 or 4% increase in the amount of bus fares in 2000. This means that bus companies may be required to bear the terminal operating cost and pass it onto the fare.

The determination of method for the generation of initial investment fund for bus terminal development (chiefly construction cost) will have to await the result of feasibility study. However, worth mentioning here is a method proven successful in Kuala Lumpur, Malaysia, and in many cities of Japan; and that is to have a commercial building constructed on the terminal premises in addition to the terminal building itself and to fund the initial terminal investment cost with rentals received from the commercial building tenants, who will be attracted to the terminal area because of advantage of location, such as:

- Department store, supermarket
- Brand merchandise retailers in various lines
- Bowling alley, disco club, night club, and other amusement facilities
- Hotel, restaurant
- Display/show rooms (importers, foreign manufacturers)
- Offices for rent

Summary of Bus Terminal Facilities, 2000

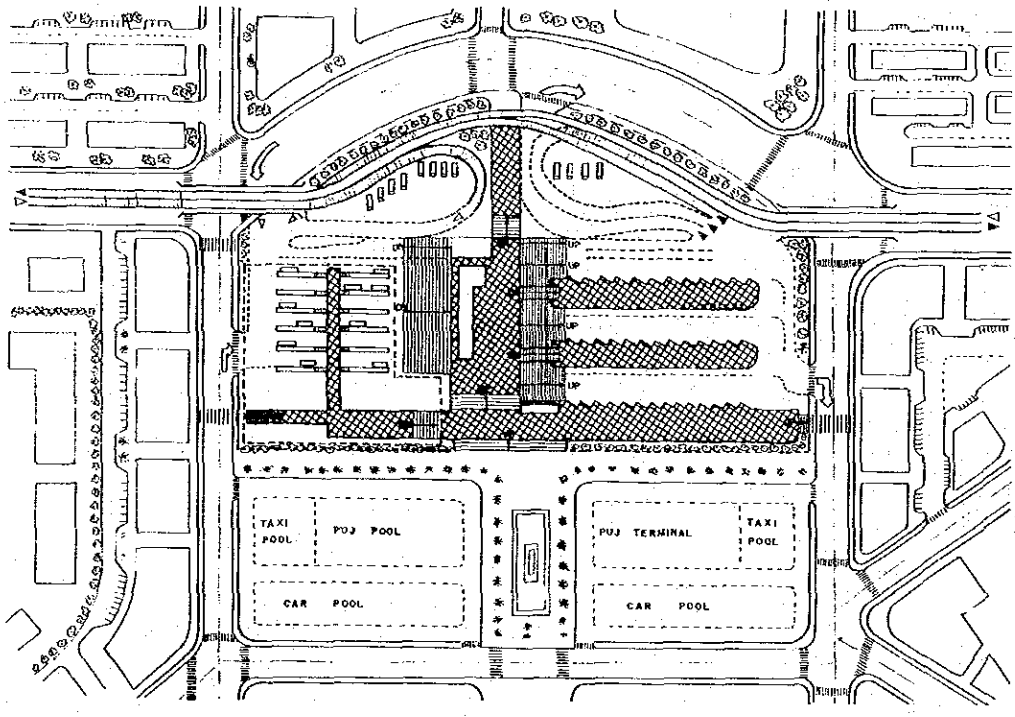
Name of Terminal	No. of Departures[1] and Arrivals in morning peak hour		No. of Berths[4]		Total Area (ha)	Total Cost[3] (₱1000)
	Arrival	Departure	Arrival	Departure[2]		
1. Central Terminal	452	278	19	47	4.0	56,800
2. Bunawan	30	88	2	18	1.0	5,100
3. Panakan	146	146	5	17	1.0	5,400
4. Cabantian	23	23	2	2	0.2	1,500
5. Pampanga	124	124	1	6	0.3	2,200
6. Ma-a	10	30	1	2	0.2	1,200
7. Ecoland	66	48	2	4	0.5	2,900
8. Talomo	167	193	6	23	1.4	7,900
9. Toril	30	87	2	18	1.0	5,700
Total	1,048	1,017	40	137	9.6	88,700

1/ including pass-through buses

2/ including berths for pass-through buses

3/ at 1980 constant prices

4/ Departure berths at Local Terminals can sometimes be utilized as Arrival berths when necessary.



Model of Traffic Core with Central Bus Terminal

21. Preparation for Introduction of Rail Transit

Although the introduction of a rail transit in the City of Davao will, judged at this time, not become economically and financially favorable by the year 2000, it is believed that, come 21st century, the expansion of the City's urban scale will eventually justify rail transit. In energy or traffic predicament, need for rail transit can arise earlier. The progress of urbanization, on the other hand, will make the acquisition of land for railroad difficult. Therefore, in order to facilitate the future introduction of rail transit, preparations should be started now, e.g. the construction of roads with a wide right-of-way or a wide center median, as well as the railroad-minded positioning of bus terminal locations, as recommended hereunder.

Land Reserve

It is recommended that roads along future rail transit route be constructed with as wide a breadth as possible so that a reserve width is secured for future conversion into railroad track. Also, the 9 bus terminals to be constructed should be positioned at locations along the future rail transit route where railroad stations can be constructed.

Three patterns, presented in Table below, are recommended for the construction of railroad on the road right-of-way.

Conceptual Rail Transit Plan

A rail transit system is to be planned for route connecting Bunawan, Poblacion, and Toril. Starting from Bunawan, the route will go south along Davao-Agusan Road, R. Castillo Street, and Lapu-lapu Street, and reach the central station in Poblacion on E. Quirino Avenue. Then, after crossing Bankerohan Bridge, the route will deviate from the road and detour toward the shore, go through Ecoland, and return to meet the road and follow Davao-Cotabato Road down to Toril. Of the total route extension of 35.7 kilometers, approximately 4 kilometers will occur in downtown Poblacion, where elevated railroad track will be used. Necessary facilities will include 37 stations, 60 cars, and a yard and a repair shop occupying a land of 1 hectare. If a similar type of vehicle of light rail transit (LRT) used in Manila is assumed, the total investment fund requirement will be an estimated 1.4 billion pesos in 1980 prices.

Rail transit demand estimated for the year 2000 is substantial; 235 thousand passengers or 2.5 million passenger-kilometers per day. The demand will be particularly strong between Panakan and Talomo. If one-car trains (280-passenger capacity each) are used, they will have to be operated at 2-minute intervals in peak hours.

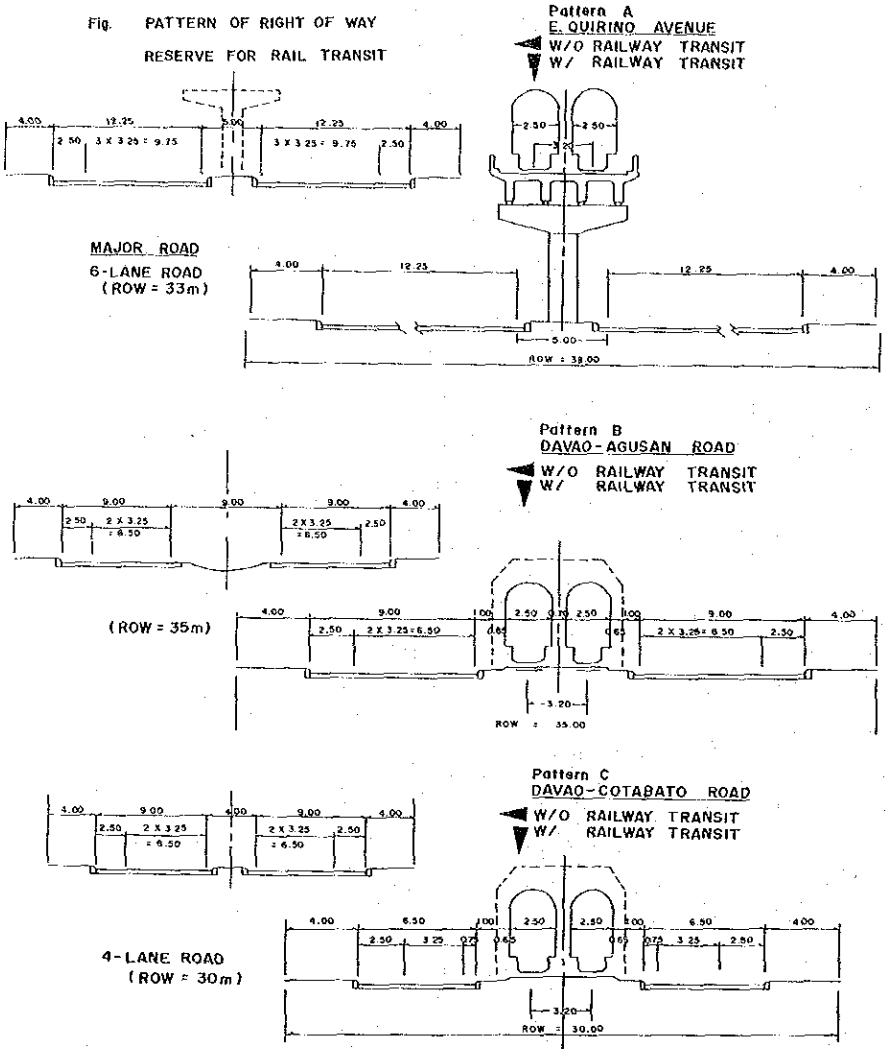
Revenue from fares, assuming the same 1980 fare rate of the PUJ, is estimated at 131 million pesos in 2000 and will increase to 1,979 million pesos by 2020. The cost, however, will be greatly affected by the amount of capital and the interest rates of long term and short term loans. For the financial analysis of the railway company, two cases were evaluated. Using 15% per annum interest rate for long term loan in the first case and 3.5% for the second case. In both cases the interest rate for short term loans and the amount of capital was considered the same. As a result, the first case showed that short term loan is increased year by year and therefore the project is not feasible. In the second case, short term loan will not be necessary after a few years of operation, so the project will be feasible.

The foregoing financial analysis and the economic evaluation discussed in the comparison of alternative plans support the conclusion that railroad will be still premature in the year 2000. However, the introduction of railroad will become both economically and financially feasible and justified when the demand has risen to the level requiring the service of 2- or 3-car trains, or when the energy situation has substantially deteriorated.

Preparation of Rail Transit Introduction by Wide Right of Way and Center Median of Major Road

	Measures	Location
Pattern A	6-lane-Road with 5 meter Center Median	G. McArthur Highway, E. Quirino Avenue, Sta. Ana Ave., Lapu-lapu St., R. Castillo St.
Pattern B	4-lane-Road with 9 meter Center Median	Davao-Agusan Road
Pattern C	4-lane-Road with 4 meter Center Median	Davao-Cotabato Road

Fig. PATTERN OF RIGHT OF WAY RESERVE FOR RAIL TRANSIT



Pattern of Right of Way Reserve for Rail Transit

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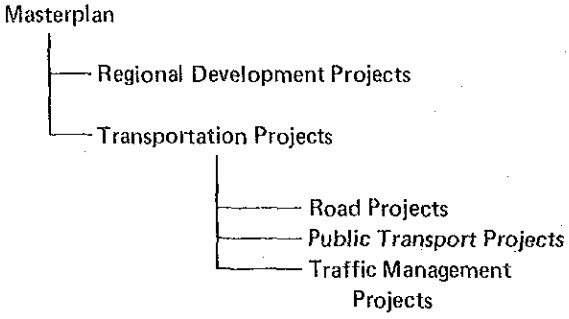
22. Projects Constituting Masterplan

The Masterplan will consist of regional development projects and transportation projects. The latter will be implemented, principally in conformity with demand, as a part of infrastructure development to support the former. The latter will include the construction of 25 sections of new roads, the upgrading/improvement of 40 existing road sections, the construction of bus terminals at 9 locations, the purchase of buses, and traffic management in the CBD.

Masterplan Structure



Regional Development Projects

The regional development projects will be of a strategic importance to the realization of land use plans and will constitute prerequisites to the formulation of transportion plans.

- Industrial Estate Development: At 7 locations for a total land space of 565 hectares
- Commercial Core Formulation: At 6 locations, 725 hectares
- Academic Town Development: At 2 locations, 150 hectares
- Government Agencies Building Area Development: At 1 location, 5 hectares
- Sports Center Development: At 1 location, 10 hectares
- Port and Harbor Expansion/Improvement: 2 public ports and several private ports
- Bucana Island Comprehensive Development
- New CBD Development

Road Projects

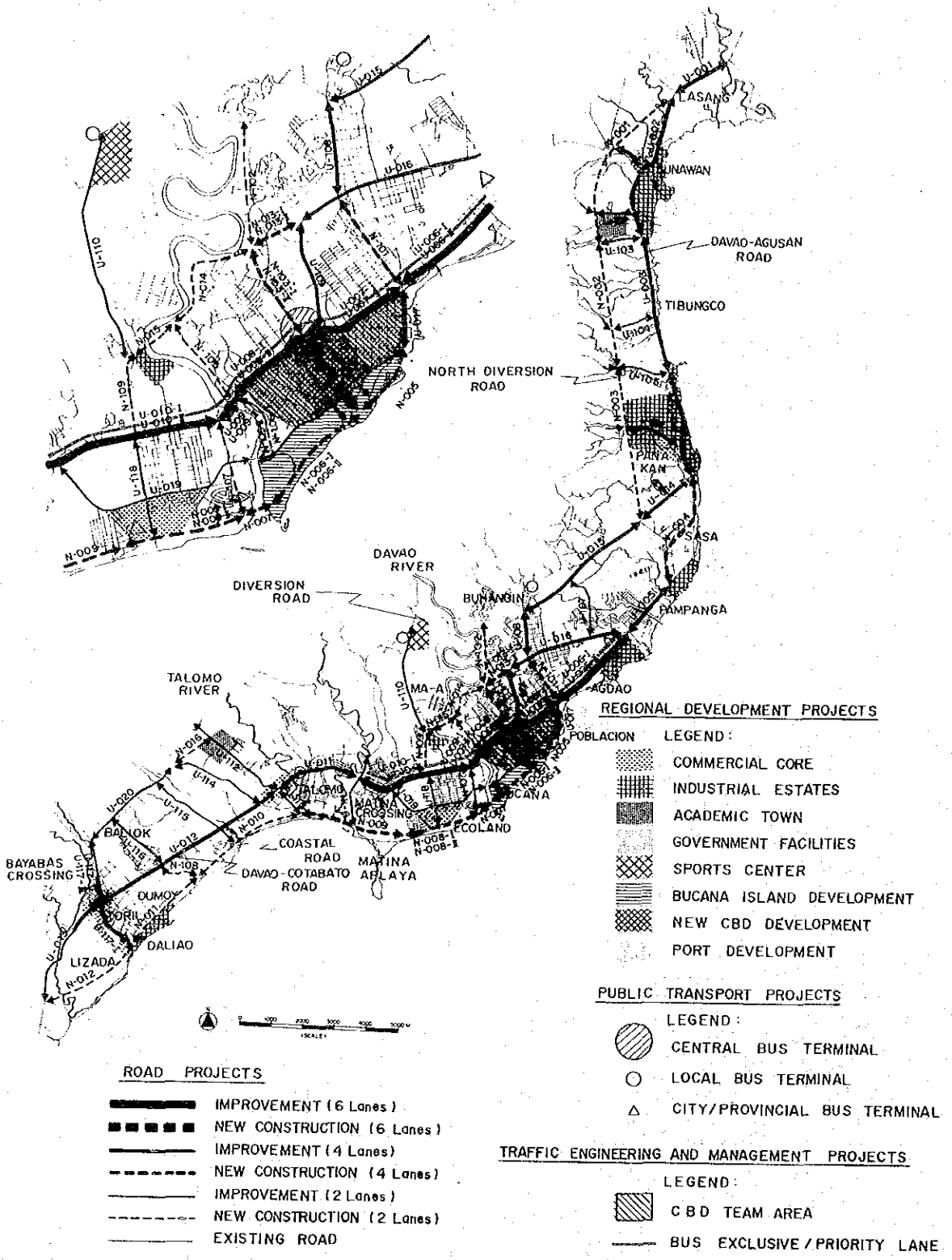
Road projects will be for the construction of 25 sections of new trunk roads (30 construction stages) and the upgrading/improvement of 40 sections of existing trunk roads (46 construction stages). The important road projects will be North Diversion Road, Ring Road, and Coastal Road, the remainder being all short distance link roads to provide connection between major roads and to facilitate smooth flow of traffic in urban areas. To be upgraded/improved are almost all of the trunk roads existing in the Project Area; the upgrading/improvement of Davao-Agusan Road and Davao-Cotabato Road aims at their development into a strategically important arterial road traversing Davao City.

Public Transport Projects

Aiming at the introduction of the bus as the major road public transportation mode, these projects include the establishment of a bus company, the purchase of buses, and the construction of a central bus terminal and 8 local bus terminals, together with ancillary facilities. The accompanying PUJ rerouting will also be of importance.

Traffic Management Projects

Traffic Management Projects include intersection improvement, traffic signal installation, parking space development, one-way traffic, and the introduction of exclusive bus lanes on 6-lane roads. Most of these projects are for implementation within Poblacion. Traffic management projects are to be basically executed concurrently with other transportation (road, public transport) projects, but in the case of roads to be newly built or upgraded/improved, it will be desirable that they are made a part of the relevant road project from design stage.



Project Components

23. Project Packages

The entire projects recommended under the Masterplan are classified into 8 groups of deeply interrelated projects. The 8 groups of projects are then lumped into 3 packages: Poblacion package, North Project Area Package, and South Project Area package. Aside from this, important road projects are selected and lumped into 4 packages.

Purpose of Packaging

The number and variety of projects constituting the Masterplan are so great and the execution thereof will require so long a time period and so much of a fund that it is of a strategic importance to break the Masterplan into a number of project packages in the formulation of an investment schedule.

Packaging Method

The project package is understood to be the collection of projects which satisfy the following:

- Projects which are logically and closely related with each other
- Projects which pertain to one geographical area or which are geographically continuous
- Projects which are to be executed at about the same time

The former 2 criteria are to be emphasized upon in the project packaging for the purpose of this Report, while, with regard to the timing of project execution, projects will be grouped into each of implementation phases.

Area Project Packages

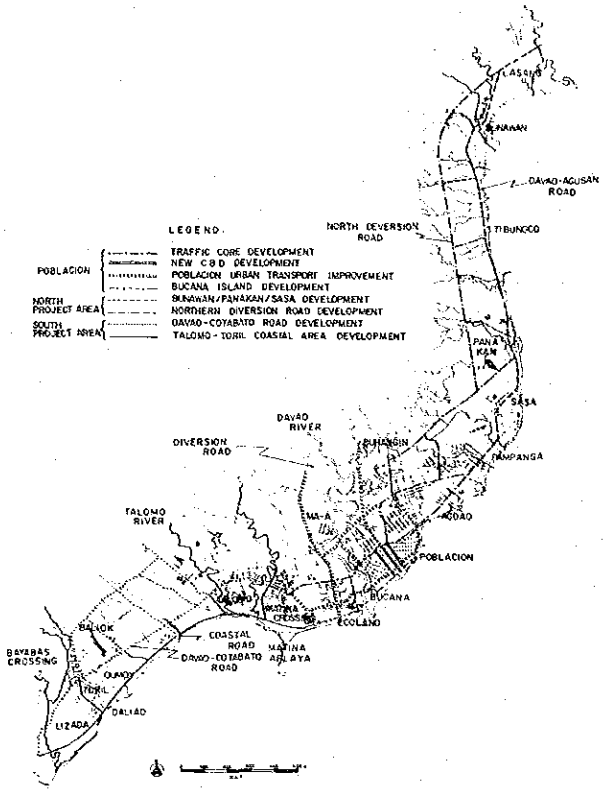
All of the regional development projects, road projects, public transport projects and traffic management projects under the Masterplan are classified into 8 groups of closely interrelated projects. The 8 groups are further classified into 3 area project packages: Poblacion, North Project Area, and South Project Area. The Poblacion package will consist of 4 Project groups: traffic core development projects, new CBD development projects, urban transport improvement projects, and Bucana Island development projects. The North Project Area package will consist of 2 Project groups: Bunawan/Panakan/Sasa development projects and North Diversion Road Development projects. The South Project Area package will consist of 2 project groups: Davao-Cotabato Road development projects and Talomo-Toril coastal area development projects.

Road Project Packages

Said 8 project groups are all deeply related with road projects. In view of the function and continuity of roads, related road projects are gathered into 4 packages. Unlike area project packages, these packages consist of nothing but road projects, though without regional identity. Particularly of a long extension is the Davao Traverse Road Project Package, which envisages the upgrading/improvement of existing major roads into a long-extending high-functional arterial road with a substantial impact upon the future development of entire Davao City. Coastal Road Project package, Ring Road Project package and North Diversion Road Project Package aim at the development of the new roads from which the package names derive and which will supplement the Traverse Road in the South Project Area, in Poblacion, and in the North Project Area, respectively, while promoting the spread of various development efforts over wider areas. Coastal Road and Ring Road partially overlap each other.

List of Area Project Packages

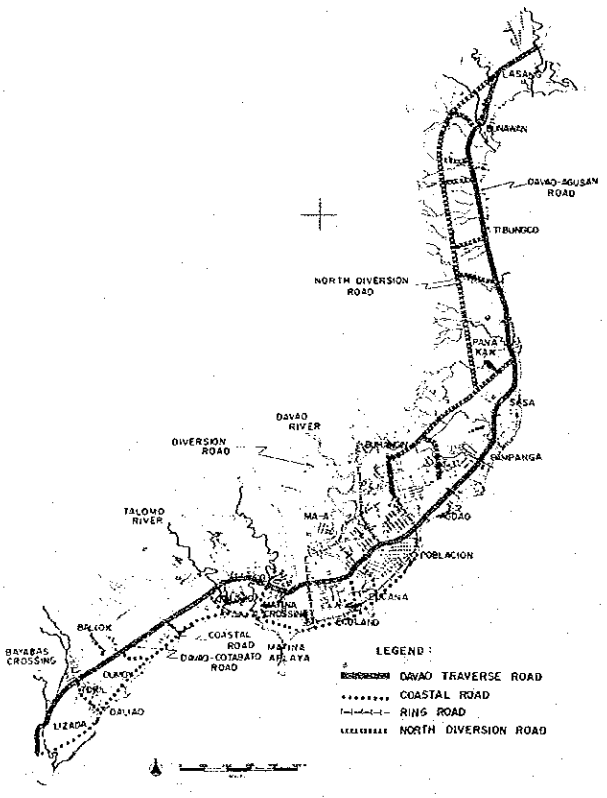
NAME OF PROJECT PACKAGE	PROJECT COMPONENTS INCLUDED
POBLACION	
1. Traffic Core Development	o Construction of Central Terminal o Road Upgrading o Introduction of Bus o Establishment of Bus Exclusive Lane o PUJ Rerouting o Related Traffic Management
2. New CBD Development	o Area Development Including: – Urban Renewal – Land Readjustment – Construction of Business/ Commercial Facilities – Creation of Open Space o Road construction/Upgrading
3. Poblacion Urban Transport Improvement	o Road Construction/Upgrading o Overall Traffic Management and Engineering including: – Improvement of Intersections – Traffic Signal Allocation – One-way system – Bus/PUJ Bays – Off-Road Parking Development – Development of Pedestrian Exclusive Roads
4. Bucana Island Development	o Area Development including: – Administrative/Government Buildings – Cultural/Educational Facilities – Housing Development – Parks/Sporting Ground – Parking – Fishery Port o Road Construction/Upgrading
NORTH PROJECT AREA	
5. Bunawan/Panakan/ Sasa Development	o Development of Industrial Estates – Bunawan – Panakan – Sasa o Sasa Port Development o Development of Tibungco Academic Town o Road Construction/Upgrading
6. North Diversion Road Development	o Road Construction/Upgrading
SOUTH PROJECT AREA	
7. Davao-Cotabato Road Development	o Road Construction/Upgrading o Development of Talomo Academic Town o Development of Government Buildings
8. Talomo – Toril Coastal Area Development	o Development of Industiral Estates – Lizada – Daliao o Road Construction/Upgrading



Area Project Packages

List of Road Project Packages

	Name of Project Package
A.	Davao Traverse Road Development
B.	Coastal Road Construction
C.	Ring Road Development
D.	North Diversion Road Construction



Road Project Packages

24. Investment Schedule

During the period of 20 years from 1981 to 2000, a total of 1,547.3 million pesos (or 83% to total investment) will be invested for road projects, 271.0 million pesos(or 15%) for public transport projects, and 31.5 million pesos (or 2%) for traffic management projects – for a total of 1,849.8 million pesos – all in agreement with the schedule of regional development projects.

Regional Development Projects Schedule

Project	81-85	86-90	91-95	96-00
Population	480,000	590,000	730,000	900,000
Population Increase	90,000	110,000	140,000	170,000
Industrial Estates				
	ha		ha		ha
Bunawan	(160)		(80)		(80)
	ha	ha		ha	
Panakan	(260)	(130)		(130)	
Sasa	(50)		(50)		
Agdao	(15)	(15)			
Ma-a	(10)		(10)		
Daliao	(30)	(30)			
Lizada	(40)		(40)		
Commercial Center				
	ha				
Bunawan	(55)		(25)	(30)	
Panakan	(60)	(30)		(30)	
Poblacion	(350)	(80)	(90)	(90)	(90)
Ecoland	(150)	(50)	(50)	(50)	
Talomo	(50)			(25)	(25)
Toril	(60)	(30)	(30)		
Development of Academic Town				
Tibungco	(80)				
Talomo	(70)				
Government Facility Component				
Baliok	(5)				
Sport Center				
Ma-a	(10)				
Port				
Sasa				
Sta. Ana				
Industrial Port				
Development of Bucana Island				
	ha				
Land Reclamation	(20)				
City Hall, Governmental Buildings	(9)				
Office Buildings	(7)				
Sport Facilities	(8)				
Park	(55)				
Terminal	(1)				
Housing	(70)				

Investment Schedules

Road Projects

Project	Type	1981-1985	1986-1990	1991-1995	1996-2000	Total	Currency: Foreign	Currency: Local
1. Trunk Road Network Construction & Improvement	Public	155.3	258.2	363.3	390.5	1,167.3	642.1	525.2
2. Collector/Local Roads Construction & Improvement	Public	45.0	65.0	80.0	90.0	280.0	154.0	126.0
	Private	15.0	25.0	25.0	35.0	100.0	55.0	45.0
Total		215.3	348.2	468.3	515.5	1,547.3	851.1	696.2

(₱Million)

Public Transport Projects

Project	Type	1981-1985	1986-1990	1991-1995	1996-2000	Total	Currency: Foreign	Currency: Local
1. Establishment and Operation of Bus Company	Private	12.7	37.4	64.5	67.7	182.3	122.6	59.7
2. Construction of Bus Terminals	Public/ Private	17.9	34.6	5.6	30.6	88.7	39.9	48.8
Total		30.6	72.0	70.1	98.3	271.0	162.5	108.5

* Note: Operating cost are not included

(₱ Million)

Traffic Management Projects

Project	Type	1981-1985	1986-1990	1991-1995	1996-2000	Total	Currency: Foreign	Currency: Local
1. Improvement of Minor Intersections	Public	0.6	0.3	–	–	0.9	0.5	0.4
2. Traffic Signal Installation	Public	2.0	2.0	1.4	1.2	6.6	4.3	2.3
3. Development of Off-Street Pay Parking	Public	10.0	8.0	4.0	2.0	24.0	4.8	19.2
Total		12.6	10.3	5.4	3.2	31.5	9.6	21.9

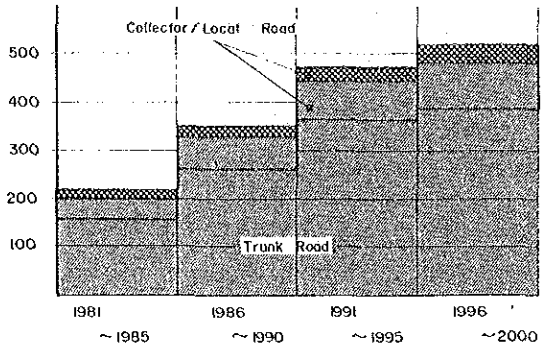
(₱ Million)

Total

Investment Type	1981-1985	1986-1990	1991-1995	1996-2000	Total	Currency: Foreign	Currency: Local
Public	212.9	333.5	448.7	483.7	1,478.8	805.7	673.1
Public/Private	17.9	34.6	5.6	30.6	88.7	39.9	48.8
Private	27.7	62.4	89.5	102.7	282.3	177.6	104.7
Total	258.5	430.5	543.8	617.0	1,849.8	1,023.2	826.6

(₱ Million)

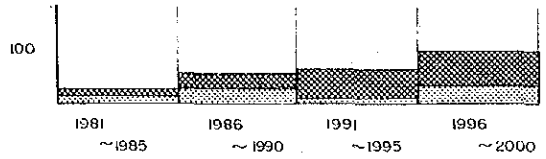
ROAD PROJECT



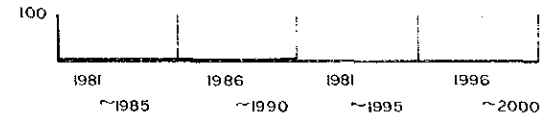
LEGEND:

- Public Investment
- Public / Private Investment
- Private Investment

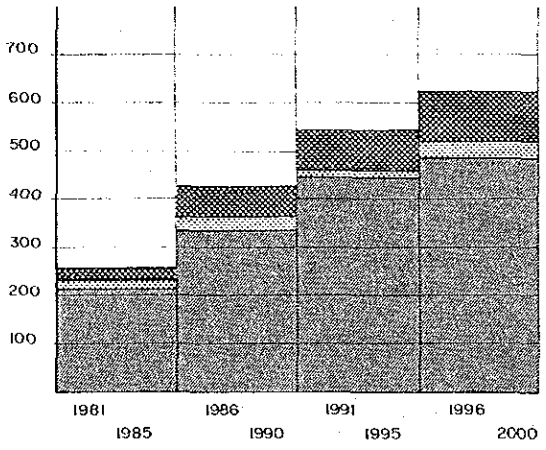
PUBLIC TRANSPORT PROJECT



TRAFFIC ENGINEERING AND MANAGEMENT PROJECT



TOTAL



Financial Requirement, 1980 Constant Prices (₱ Million)

Road Construction/Improvement Schedule

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25. Economic Evaluation

As a result of economic evaluation, the recommended Masterplan has shown an overall economic feasibility of net present value of 413.8 million pesos, the benefit-cost ratio of 3.08, and the internal rate of return of 78.7%. All the individual project packages have also proven economically feasible. Among them, the Davao Travers Road has proven to be a particularly excellent project package; it is hoped that detailed feasibility studies be conducted and the projects implemented at an early opportunity.

Economic Evaluation Method

The economic benefit of a transportation project is measured as the total savings in vehicle operating cost and passenger travel time cost achieved through the project implementation. Compared against this benefit is the cost of road proejcts only, inasmuch as the cost of public transport projects is included in vehicle operating cost, and the cost of traffic control projects is negligible.

Masterplan Feasibility

As a whole, the Masterplan is economically feasible. The Plan can be asserted economically very effective in view of the extremely favorable values resulted from its economic evaluation for the period of 1981 through the year 2000: a net present value of 413.8 million pesos, a benefit-cost ratio of 3.08, and an internal rate of return of 78.7%. By phases, particularly good results have been indicated for Phase I (1981-1990). In other words, the implementation of the Masterplan will continue to provide the Project Area with economic benefits throughout the entire phases.

Project Package Feasibility

As a result of economic evaluation for each phase, all of the Area Project packages have proven economically feasible throughout the entire phases. Particularly favorable indicator values have been shown for the Phases I and II of Poblacion package, Phases I and III of the North Project Area package, and Phase III of the South Project Area package. Package/phases with rather unfavorable results contain a large number of projects which are indispensable to the Masterplan as a whole.

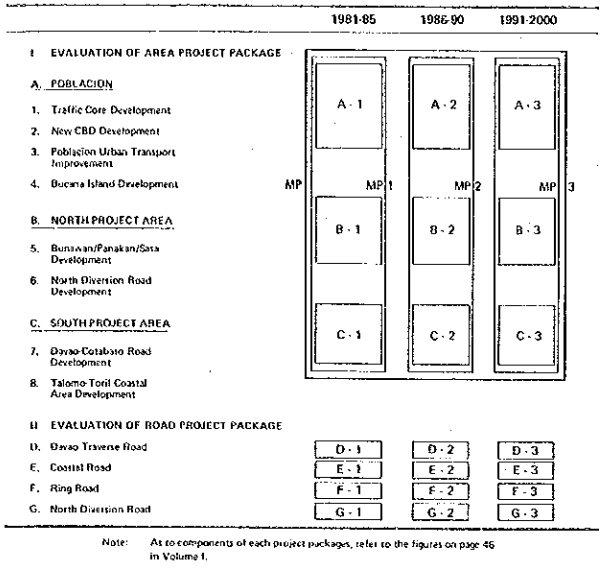
Of the Road Project packages, Davao Traverse Road package showed very favorable results and will continuously produce huge economic benefits throughout the entire phases. It is hoped that detailed feasibility study be conducted and the projects implemented soon, inasmuch as the implementation of these projects for the upgrading/improvement of the existing roads in the entire extension, except for a portion (near Sasa Wharf), will require only a relatively small amount of fund, while the consequently developed major road will become the most important route of public transport mode and will play a central role in the introduction of bus service and, eventually, of railroad service.

Although the economic evaluation of Coastal Road package resulted in the indication of an economic loss in Phase II, with all of its benefits enjoyed in Phase III, it should be pointed out that roads constructed in Phase II will be essential to the regional development of Ecoland and the vicinity, and that the package as as whole is economically feasible.

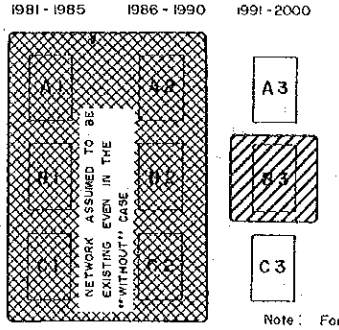
Ring Road package and North Diversion Road pacakage are economically feasible throughout the phases, though the indicated net present values of the projects are somewhat small. While Phase III of Ring Road package is barely feasible, the successful implementation of many of important regional development projects, such as Bucana Island Development and new CBD Development will largely depend on the performance of this road project. Favorable results have been indicated for Phases I and II of Ring Road and the entire phases of North Diversion Road packages.

These projects, which constitute the Masterplan, are essential for the smooth handling of the increasing traffic demand in the future, for the substantial improvement of the Project Area's attractiveness, and for the fosteration of Davao City as the core city of Mindanao, which will help mitigating the excessive socio-economic concentration in Metro Manila and developing sound economies in the metropolitan and rural areas on the whole.

Scope of Economic Evaluation



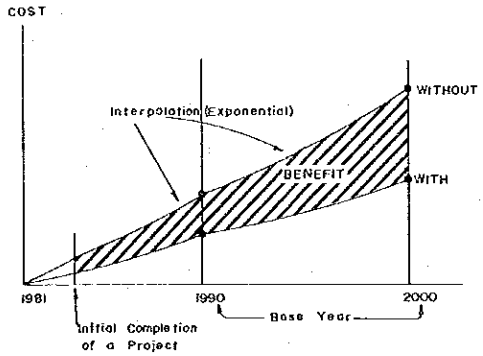
Note: As to components of each project packages, refer to the figures on page 46 in Volume I.



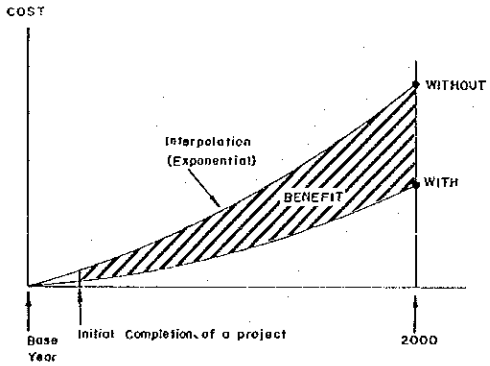
ADDITIONAL NETWORK TO BE ATTACHED IN THE "WITH" CASE FOR EVALUATING B3

Note: For the cases "WITH" it is assumed that the other projects planned in the same period be neglected.

"With" and "Without" Cases for Economic Evaluation (Example)



MASTER PLAN



PROJECT PACKAGE BY PERIOD

Schematic Methodology for Calculating Economic Benefit

Summary of Economic Evaluation

Code	Name of Project	NPV Net Present Value (P Million)	BCR Benefit-Cost Ratio (at 15% p.a.)	IRR Internal Rate of Return (%)
MP	Master Plan	413.8	3.08	78.7
MP1	Master Plan I (1981-85)	184.4	4.58	92.8
MP2	Master Plan II (1986-90)	107.0	2.24	36.6
MP3	Master Plan III (1991-2000)	132.9	3.18	122.4
A1	Master Plan I (1981-85) — Poblacion	28.3	2.26	35.1
A2	Master Plan II (1986-90) — Poblacion	65.1	2.17	35.2
A3	Master Plan III (1991-2000) — Poblacion	1.8	1.07	17.3
B1	Master Plan I (1981-85) — North Project Area	33.3	2.21	31.0
B2	Master Plan II (1986-90) — North Project Area	1.2	1.06	16.0
B3	Master Plan III (1991-2000) — North Project Area	40.9	3.78	111.9
C1	Master Plan I 1981-85) — South Project Area		(No Project)	
C2	Master Plan II (1986-90) — South Project Area	10.5	2.20	40.0
C3	Master Plan III (1991-200) — South Project Area	58.4	5.55	153.9
D1	Davao Traverse Road Project I (1981-85)	36.6	2.11	30.5
D2	Davao Traverse Road Project II (1986-90)	127.5	6.18	108.0
D3	Davao Traverse Road Project III (1991-2000)	96.6	5.48	143.6
E1	Coastal Road Project I 1981-85)		(No Project)	
E2	Coastal Road Project II (1986-90)	-6.5	0.17	–
E3	Coastal Road Project III (1991-2000)	60.7	4.31	286.6
F1	Ring Road Project I (1981-85)	5.3	2.17	29.8
F2	Ring Road Project III (1986-90)	13.0	1.39	20.9
F3	Ring Road Project III (1991-2000)	0.2	1.02	15.4
G1	North Diversion Road Project I (1981-85)	11.5	3.72	50.4
G2	North Diversion Road Project II (1986-90)	1.4	2.30	36.9
G3	North Diversion Road Project III	12.9	2.62	133.4

26. Recommendations for Authorities

Certain legislative and executive actions will be mandatory for the successful accomplishment of the Masterplan. The huge public investment funds needed for the implementation of DCUTCLUS projects will mean budgetary requirements of a new order. To alleviate this burden on the national and local coffers, it is recommended that systems be devised so as to utilize private sector potentials for development and to meet development costs with parts of benefits from development. Also, while it is important that the existing laws, regulations, and procedures be efficiently administered and strictly adhered to, those which have become obsolete and unrealistic must be rescinded/amended.

Institutional

(1) Enforcement

It is recommended that the authorities enforce strict controls over traffic violations and PUJ operator violations, which, incidentally, will stimulate the fosteration of law abiding citizens. Land developers should be severely punished for the violations of building and land development standards provided for by laws and regulations.

(a) Traffic Violations

In the interest of safety, the authorities should enforce stricter controls over the violations of speed limits, left-turn restrictions, and stopping requirements, as well as the disregard of traffic signals and operation in the opposit direction on one-way streets. Control against illegal parking will be essential not only for the smooth flow of traffic on the road but also for accelerating the establishment of parking lots. Inevitable for the enforcement of stricter controls over traffic violations will be the strengthening of CHPG and INP enforcement personnel; the size of the present CHPG staff in Davao City is only 27, which is inadequate for the accomplishment of the duties.

(b) Enforcement Officer's Ethics

Important, along with the quantitative enlargement of enforcement staff, will be their qualitative upgrading. Unless law enforcement officers punish violators in strict accordance with laws and regulations, their authorities will be lost and law abiding spirit will not be fostered in the minds of the citizens. Long term education programs will be essential for the education of both traffic policemen and citizens. Some institutional measures for the prosecution of violating traffic policemen should also be considered.

(c) PUV Franchise

Illegal PUVs should be prosecuted. However, a majority of PUVs in Davao City are illegal in that their franchise has and are left as expired chiefly due to delay in processing by BOT/BLT of the renewal of expired franchise, and, therefore, the prosecution of PUVs which became illegal automatically by the expiry of their franchise is neither appropriate nor practical. Therefore, the clerical efficiency of BOT/BLT should first be improved so that an adequate number of franchise be issued. Only after this has been accomplished, stricter controls should be enforced on illegal PUVs (operation without franchise, operation outside the approved routes, trip cuts).

(d) Periodical Inspection of Vehicles

The periodical mechanical inspection of vehicles, which is required under the existing laws and regulations, is not actually enforced. Due to the abundance of old vehicles, those stalled with mechanical troubles are numerous enough to be causes for frequent traffic jam. The poor maintenance of vehicles has resulted in the sudden, unexpected opening of engine hood, obstructing the driver's sight, and the loosening off of a wheel, thereby causing traffic accidents. The periodical mechanical inspection particularly of PUVs by publicly certified garages should be made mandatory by law.

(e) Obsolete Laws and Regulations

Certain statutory requirements exist only in name and remain unenforced, as in the case of mechanical vehicle inspection. Some statutory provisions have now become obsolete and not in consistent with the existing situation, while some provisions may not be strictly enforced, though desirable. An example of the former is the prohibition of operation in the Philippines of large vehicles in excess of 15 tons. The rescission or amendment of the provisions of laws and regulations which are obsolete or which may not be enforced will be essential to the development of law abiding spirit.

(f) Building Code and Land Development Standards

The number of housing estates (sub-divisions) is presently large in Davao City and will further increase in the future. Developers are obligated by the City Ordinance to install an access way to a major road

and to secure transportation service, but, in some small housing estates in remote locations, the surface condition of access roads is very poor and PUJ service is offered only during few hours each day. It is necessary that improved arrangements be made for giving guidance to and supervising developers so as that they will abide by the Ordinance, in order to realize desirable land use.

The strict enforcement of controls on permanent buildings on the site of planned road will be indispensable to the realization of projects for the upgrading of existing roads, as recommended in the Masterplan.

(2) Organization/Jurisdiction

For smoother and more effective accomplishment, it will be desirable that such local matters as the PUJ franchise and the construction and maintenance of barangay roads be transferred to or closely coordinated with local authorities, which, for this purpose, should be strengthened in organization and financial capability. Particularly important to traffic administration in Davao City will be the strengthening of the Davao City Transport and Traffic Management Council.

(a) Davao City Transport and Traffic Management Council

The former Davao City Transport Committee was reorganized in March 1981 into the existing Davao City Transport and Traffic Management Council (DCTTMC), which is an advisory organ on traffic policy matters, consisting of the head of traffic administrative agency and the representatives of academic and economic circles and of mass media. It is essential in the first place that this Council have its own budget and be able to carry out research and surveys and to formulate plans, and that, in the second, working groups be formed under the Council which will compile materials for study by the Council, formulate practical plans based on the result of deliveration by the Council, and evaluate the effectiveness of such plans. The working groups can be established for individual themes as adhoc groups, such as "PUJ Re-routing Group," "One-Way Traffic Control Introduction Group," and "Bus Terminal Study Group."

(b) Barangay Roads

Barangay roads are presently under the jurisdiction of the regional office of the Ministry of Public Works and Highways (MPWH), but jurisdiction over Barangay roads, which are inherently local roads closely connected with secondary major roads, distribution roads, and other municipal roads, should be coordinated more closely with local authorities (city mayor).

(c) Local City Transport Division

It is recommended that a Local City Transport Division be newly established within the MOTC organization which will conduct surveys needed for the review of PUJ routes and for the introduction of bus service, formulate policies and strategies, and promote the improvement of public transport system. This Division will perform the functions of (i) technical service, (ii) project evaluation, (iii) policy formulation, and (iv) project implementation. (See Volume III, Chapter 7.7 for detail.)

(d) PUV Franchise

Under the current system, PUV operators must go through a complicated set of procedures: the franchise which stipulate the terminal points of each route must be obtained from the central BOT, approval of the route must be obtained from the city authority, and the approval of vehicles must be obtained from BLT. This complexity of franchise system is one reason why the renewal of expired franchise is lagging to the extent that a large number of PUJs are inevitably compelled to operate without valid franchise. The rationalization of this system is imperative. Particularly in such large cities as Davao and Cebu, the consolidation of the entire system into one and the transferring of jurisdiction over such system to BOT/BLT regional office should be studied (See Volume III, Chapter 7.7 for detail).

(3) Statistical Data

Only insufficient data are presently available for the formulation of rational transport plans and for the effective management of traffic. Minimum essential to the formulation of transport policies will be the reliable statistics on the number of vehicles and on the operational and business conditions of public transport service systems.

(a) Inhabitants Statistics

Data on urban population and its dynamics are most fundamental and important not only to transport management but also to urban administration at large. Population census is taken once every ten years in the Philippines. Therefore, it will be desirable that the census data be supplemented with population data for years other than when census is taken; district population and its dynamics can be accurately comprehended by requiring inhabitants to register and report the change of their residence, thereby maintaining the inhabitants registry. In addition to demographic data, other socio-economic data of a city should be also developed as much as possible to attain an effective and realistic urban development/management.

(b) Computerization

It will be essential that a system be developed by which data on the number of registered vehicles, the issuance of driver's licenses, and accidents will be compiled in accordance with prescribed formats, gathered to the central government and, after computer processing, fed back to local concerns. Although local transport/traffic information is presently being gathered to the central government to a fair degree, the processing of such information is still inadequate, and the processing results are not fed back and, therefore, not utilized fully for local administration purposes.

(c) PUV Operation Report

The operators of means of public transport such as buses and PUJs are obligated to submit annual report on their business operation performance, and such reports produce important basic information needed for the determination of traffic policies. However, the report is of a very complicated format and requires an excessive amount of information, and, for this reason, the operators would rather pay the fine of 50 pesos for the failure of submission of this report. Therefore, it will be essential that the obligation to submit detailed information be limited to operators with a capital in excess of certain amount or to those with a large number of operational vehicles and that the format of report from local PUJ operators be much simplified while limiting the reported items to the essential minimum, so that information can be gathered from a greater portion of the operators.

(d) Periodical Traffic Counts

In cities with a population in excess of 100,000, it is desirable that traffic count is conducted at the major cross-sections of major roads once each year. Particularly at points where traffic is heavy, traffic counters should be installed for the collection of traffic data throughout the year. Selection of a traffic counter model should be made mainly from the view of economical and easy operation/maintenance.

(e) Goods Distribution Data

One of the most difficult to obtain is data on goods distribution in cities. In case a comprehensive goods traffic study is too costly to carry out, it is recommended that data on the kind and quantity of cargo and its origin and destination be gathered periodically on a prescribed form at the weighing stations where heavy vehicles are weighed.

Recommendations on Development Method

The most important tasks that must be performed in the implementation of each development project are the procurement of necessary funds and the acquisition of necessary land. For the former, the fundamental is to strengthen the financial capability of central government so as that greater development funds can be obtained, while it is also necessary that active efforts be made for the introduction of international cooperation funds and for the issuance of local bonds under central government guarantee. For the latter, methods currently used include the donation of, the negotiated acquisition of, and the compulsory purchase of land, while worth considering in the future will be methods for mitigating the burden of development funds on public finance by paying for the necessary project expenses from development benefits, such as "land readjustment" and"urban renewal" schemes. The former scheme is particularly useful in creating, with little public investment, land for roads, parks, and other public facilities, and land readjustment accomplished in China (Taiwan) and Korea as well as in Japan will be good examples.

(a) Land Readjustment Scheme

Land readjustment projects are implemented by individuals, cooperatives, and/or public organizations for the purpose of preventing the advancement of urbanization without adequate roads, parks, sewer systems and other public facilities. The project cost is met with proceeds from the sale of some of housing lots created through land readjustment. The readjusted land, sans the portion set aside for sale and the land used for roads and other public facilities, is distributed to the original land owners.

(b) Urban Redevelopment Scheme

Urban redevelopment projects are implemented by individuals, cooperatives, and/or organizations for the purpose of renewing an urban area crowded with wooden buildings without adequate open spaces and facilities for public use into a new urban area with aseismatic and fireproof buildings and ample public use open spaces and facilities, for better protection of life and property upon earthquake, fire, and other calamities. The project cost is met with proceeds from the sale of a part of floor space of the new building. The new building floors, sans the portion set aside for sale, are distributed to the original land/building owners.

Feasibility Study

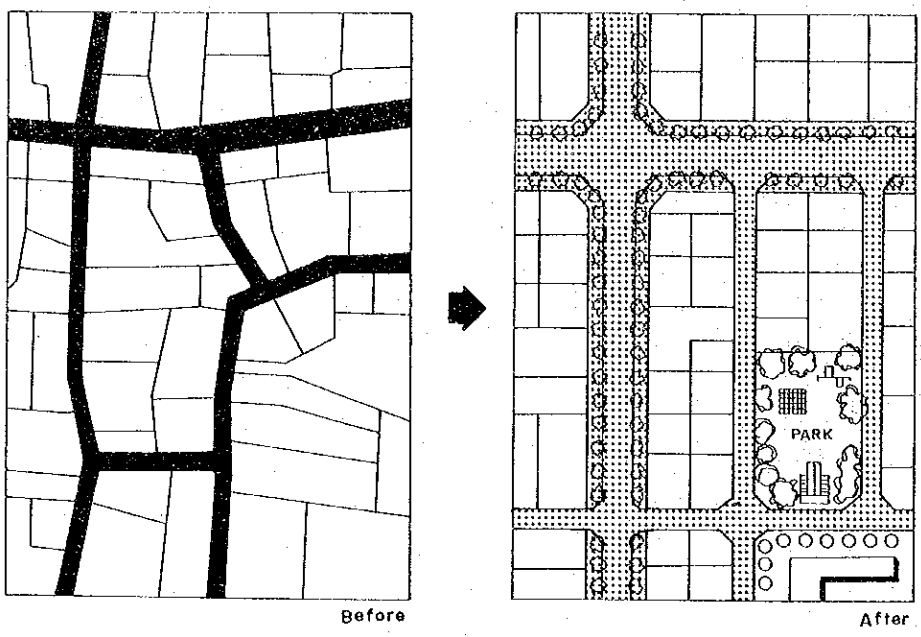
A feasibility study is essential prior to the implementation of all projects which require a large amount of investment fund and which are expected to have substantial impacts, particularly the following:

(a) Davao-Agusan/Davao-Cotabato Road Upgrading Project

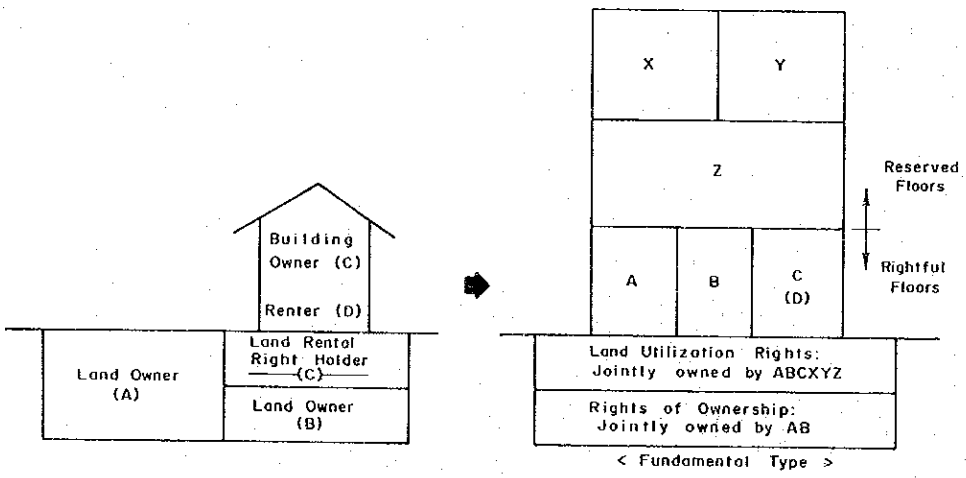
(b) Davao Ring Road Project Package

(c) City Bus Introduction Project

(d) Industrial Estate Development Project



Land Readjustment



Rights Conversion System of Urban Redevelopment

Implementation Schedule of Road Construction/Improvement Projects (1)

Seq. No.	Project No.	Project Name		Length (in km.)	No. of Lanes	Cost (In Million ₱)			Implementing Schedule			
						Construction	R O W	Total	1981-1985	1986-1990	1991-1995	1996-2000
1	N – 001	North Diversion Road	(Bunawan)	6.0	2	39.6	5.4	45.0				
2	002	–do–	(Tibungco)	4.0	2	33.1	3.6	36.7				
3	003	–do–	(Panacan)	4.8	2	33.2	4.3	37.5				
4	004	Davao-Agusan Road	(Sasa)	3.9	4	18.0	13.8	31.8				
5	005	Coastal Road	(Piapi)	1.3	4	14.7	8.8	23.5				
6	006-I	–do–	(Bucana, Phase I)	0.65	4	7.3	7.3	14.6				
7	006-II	–do–	(Bucana, Phase II)	0.65	4	6.5	7.2	13.7				
8	007	–do–	(Bucana, Bridge)	0.36	4	56.5	–	56.5				
9	008-I	–do–	(Ecoland, Phase I)	1.0	4	5.1	1.2	6.3				
10	008-II	–do–	(Ecoland, Phase II)	1.2	4	8.6	4.9	13.5				
11	009	–do–	(Matina Aplaya)	4.2	4	20.4	13.5	33.9				
12	010	–do–	(Talomo)	4.6	2	10.2	4.9	15.1				
13	011	–do–	(Dumoy)	2.4	2	5.0	2.8	7.8				
14	012	–do–	(Lizada)	3.6	2	7.8	4.4	12.2				
15	013-I	J.P. Laurel Extension	(Chinese Cemetery I)	1.0	2	2.7	8.0	10.7				
16	013-II	–do–	(Chinese Cemetery, II)	1.0	4	2.4	–	2.4				
17	014	–do–	(River Side)	2.2	2	7.1	15.2	22.3				
18	015	New Ma-a Bridge		0.15	2	12.8	–	12.8				
19	016	GBSC – Green Hills Village Road		1.0	2	2.2	1.5	3.7				
20	N – 101	Dacudao Avenue		1.7	4	7.9	–	7.9				
21	102	Rolling Hills Road		2.1	2	4.6	9.5	14.1				
22	103-I	Jacinto Extension	(Pase I)	1.6	2	3.7	9.6	13.3				
23	103-II	–do–	(Phase II)	1.6	4	3.4	–	3.4				
24	104	Roxas Boulevard		1.5	4	10.9	12.8	23.7				
25	105	Riverside Road	(Northern)	1.5	2	5.3	12.5	17.8				
26	106-I	–do–	(Southern, Phase I)	0.5	2	2.0	3.0	5.0				
27	106-II	–do–	(Southern, Phase II)	1.0	2	3.3	6.0	9.3				
28	107	New Matina Road		1.4	2	3.0	4.4	7.4				
29	108	Villinda Village Road Extension		1.0	2	2.2	0.6	2.8				
30	109	Ma-a Road Extension		1.4	2	3.0	6.0	9.0				
31	U – 001	Davao-Agusan Road	(Lasang)	1.8	4	8.3	0.7	9.0				
32	002	–do–	(Bunawan)	5.2	4	23.1	5.6	28.7				
33	003	–do–	(Tibungco)	4.4	4	19.5	9.9	29.4				
34	004	–do–	(Panacan)	3.4	4	15.1	9.0	24.1				
35	005	–do–	(Pampanga)	2.0	4	8.9	4.9	13.8				
36	006-I	R. Castillo St.	(Phase I)	3.2	4	7.9	–	7.9				
37	006-II	–do–	(Phase II)	3.2	6	18.6	22.5	41.1				
38	007-I	Lapu-lapu St.	(Phase I)	1.5	4	3.7	–	3.7				
39	007-II	–do–	(Phase II)	1.5	6	8.7	59.4	68.1				

Implementation Schedule of Road Construction/Improvement Projects (2)

Seq. No.	Project No.	Project Name	Length (in km.)	No. of Lanes	Cost (In Million ₱)			Implementing Schedule			
					Construction	R O W	Total	1981-1985	1986-1990	1991-1995	1996-2000
40	U – 008-I	Quirino Avenue (Phase I)	1.8	4	4.5	–	4.5				
41	008-II	–do– (Phase II)	1.8	6	10.4	48.9	59.3				
42	009-I	Bankerohan Bridge (Phase I)	0.2	3	22.2	–	22.2				
43	009-II	–do– (Phase II)	0.2	3	20.1	–	20.1				
44	010-I	Davao-Cotabato Road (Matina, Phase I)	4.0	4	5.6	–	5.6				
45	010-II	Davao-Cotabato Road (Matina, Phase II)	4.0	6	23.2	11.0	34.2				
46	011	–do– (Bangkal)	2.8	4	12.9	5.2	18.1				
47	012	–do– (Ulas-Toril)	3.9	4	18.1	5.3	23.4				
48	013	–do– (Toril-Sirawan)	6.7	4/2	13.0	2.9	15.9				
49	014	Diversion Road (Sasa)	1.8	4	3.2	–	3.2				
50	015	–do– (Buhangin)	5.1	4	9.0	–	9.0				
51	016	J.P. Laurel Avenue (Lahang-Bajada)	4.0	4	7.0	–	7.0				
52	017	L. Garcia St.	1.1	4	5.1	16.2	21.3				
53	018	Quezon Boulevard	2.1	2	3.8	–	3.8				
54	019	Bolton Diversion Road	3.2	2	1.5	–	1.5				
55	020	GBBC – Lubogan Road	4.0	2	7.8	–	7.8				
56	U – 101	Bunawan – San Miguel Road	1.3	2	5.5	0.6	6.1				
57	102	Fishpond – North Diversion Road	1.7	2	3.3	0.5	3.8				
58	103	Bunawan – Calinan Road	1.7	2	3.3	0.5	3.8				
59	104	Tibungco – North Diversion Road	1.6	2	3.1	0.5	3.6				
60	105	Ilang – North Diversion Road	1.7	2	3.3	0.5	3.8				
61	106	Panacan – North Diversion Road	1.7	4	7.1	1.3	8.4				
62	107	Belisario Road	2.3	2	4.4	1.2	5.6				
63	108	Buhangin Road	1.5	4	6.4	2.7	9.1				
64	109	J.P. Laurel Avenue (Bajada)	1.8	4	3.2	–	3.2				
65	110	Ma-a Road	3.6	2	7.0	–	7.0				
66	111	Matina Aplaya – GSIS Road	2.3	2	4.4	2.2	6.6				
67	112	Ulas – Calihan Road	2.3	2	4.4	–	4.4				
68	113	Ulas – Talomo Road	1.0	2	2.1	2.4	4.5				
69	114	Talomo – GBBC Road	2.7	2	5.3	1.4	6.7				
70	115	San Antonio – Bago Gallera Road	3.3	2	6.4	2.5	8.9				
71	116	Villinda Village Road	2.2	2	4.3	1.7	6.0				
72	117-I	Daliao – Lubogan Road (Phase I)	1.5	4	6.5	3.8	10.3				
73	117-II	–do– (Phase II)	2.1	2	4.0	–	4.0				
74	117-III	–do– (Phase III)	1.5	4	6.1	3.8	9.9				
75	118	Ecoland Road	1.6	2	3.1	–	3.1				
76	119	E. Jacinto St.	1.5	2	5.0	1.8	6.0				
77	120	A. Mabini Extension	1.5	2	5.0	40.3	45.3				
					726.9	440.4	1,167.3				

Implementation Schedule of Public Transport Projects

Seq. No.	Project No.	Project Name	Brief Description of the Project	Cost (P Million)	Implementation Schedule 1981-1985	1986-1990	1991-1995	1996-2000
1	B-001	Establishment and Operation of Bus Company						
		– Procurement of Bus Units	Bus Fleet Size 50 Units 1985 200 Units 1990 500 Units 2000	162.3	50 units	150 units	560 units	
		– Construction of Supporting Facilities			for 50 units	for 150 units	for additional 190 units	for additional 110 units
		o Northern Bus Base	2.1 ha. for 240 units	9.0	—		—	
		o Southern Bus Base	2.3 ha. for 260 units	9.0		—		—
		o Office	Land 0.1 ha., Floor 60 m^2	1.8			—	
		o Miscellaneous	Bus stop per 500 m	0.2	—		—	
2	B-002	Construction of Bus Terminals						
		– Central Bus Terminal	66 Berths, 4.0 ha.	56.8	—	—		—
		– Local Bus Terminals						
		o Bunawan	20 Berths, 1.0 ha.	5.1	—			
		o Panacan	22 Berths, 1.0 ha.	5.4		—		
		o Cabantian	4 Berths, 0.2 ha.	1.5			—	
		o J.P. Laurel/Davao-Agusan Road Intersection	7 Berths, 0.3 ha.	2.2				—
		o Ma-a	3 Berths, 0.2 ha.	1.2			—	
		o Ecoland	6 Berths, 0.5 ha.	2.9			—	
		o Talomo	29 Berths, 1.4 ha.	7.9		—		
		o Toril	20 Berths, 1.0 ha.	5.7	—			
3	B-003	PUJ Rerouting	Modification of PUJ Routes after Introduction of Buses					

Implementation Schedule of Traffic Management Projects

	Quantity	Unit Cost	Total Cost	1981–85	1986–90	1991–95	1996–2000
1) Improvement of Minor Intersection	15	₱0.06 M	₱0.90 M	10 ₱0.60 M	5 ₱0.30 M	–	–
2) Traffic Signal	66	₱0.10 M	₱6.60 M	20 ₱2.00 M	20 ₱2.00 M	14 ₱1.40 M	12 ₱1.20 M
3) Six Lane Road Traffic Control	9.6 km.	–	–	–	9.6 km.	–	9.6 km.
4) Roxas Avenue Traffic Control	0.9 km. 30 ha.	–	–	–	0.9 km. 30 ha.	–	0.9 km. 30 ha.
5) CBD Environmental Area	105 ha. 95 ha.	–	–	–	105 ha.	95 ha.	–
6) CBD Parking Facility 2000							
– Off-Street Private Parking	24,300 lots (72.9 ha.)	–	–	10,000 lots (30.0 ha.)	7,000 lots (21.0 ha.)	3,700 lots (11.1 ha.)	3,600 lots (10.8 ha.)
– Off-Street Pay Parking	1,200 lots (3.6 ha.)	₱0.02 M	₱24.00 M	500 lots ₱10.00 M	400 lots ₱8.00 M	200 lots ₱4.00 M	100 lots ₱2.00 M
– On-Street Pay Parking	300 lots (1.7 km)	–	–	200 lots	–	100 lots	
7) CBD One-Way Operation							
– A. Pichon – San Pedro	2.6 km.	–	–	2.6 km.	–	–	–
– C.M. Recto – C. Bangoy	2.5 km.	–	–	–	2.5 km.	–	–
– R. Magsaysay – Sta. Ana.	3.8 km.	–	–	–	3.8 km.	–	–
8) Bus Priority Lane	9.6 km.	–	–	–	–	–	9.6 km.
			₱31.50 M	₱12.60 M	₱10.30 M	₱5.40 M	₱3.20 M

INDIVIDUALS AND ORGANIZATIONS CONSULTED

The following are Agencies and individuals consulted during the Study and whose advice and help have been invaluable to the team:

AGENCIES

Central Government Offices

- Ministry of Public Works and Highways
- Ministry of Transportation and Communication
- National Economic & Development Authority
- Constabulary Highway Patrol Group
- National Census & Statistics Office
- Central Bank
- TEAM Project
- Philippine National Railways
- Transport Training Center, University of the Philippines
- Philippine Ports Authority
- Export Processing Zone Authority
- National Transport System Study

Regional Offices

- Ministry of Works and Highways
- National Economic & Development Authority
- Constabulary Highway Patrol Group
- Ministry of Human Settlement
- Ministry of Public Works
- Ministry of Education & Culture
- Ministry of Public Information
- Bureau of Land Transportation
- Board of Transportation
- Highway District Engineer's Office
- Integrated National Police
- Davao Gulf Master Plan Study Office
- Regional Cities Development Project (RCDP)
- Southern Philippine Development Authority
- Commission on Election
- Philippine Atmospheric Geophysical & Astronomical Service Administration (PAGASA)
- Bureau of Soils
- Cotabato-Agusan River Basin Development Project Office (CARBDP)

City Government Offices

- Office of the Mayor
- City Council
- City Planning & Development Office
- City Engineer's Office
- City Assessor's Office
- Davao City Transport & Traffic Management Council (DCTTMC)
- Slum Improvement and Resettlement Office (SIR)
- Barangay Secretariat/Barangay Hall

Japanese Government Agencies

- Japan International Cooperation Agency (JICA)
- Embassy of Japan
- Overseas Economic Cooperation Fund (OECF)

Other Agencies

- SOPI, Davao Chapter
- Davao City Chamber of Commerce and Industry
- Davao City Contractors Association
- Jeepney Owners Association
- Kabataang Barangay
- Davao City Print & Broadcast Media
- F.F. Cruz
- Acre Survey & Development
- Asian Data Entry Corporation

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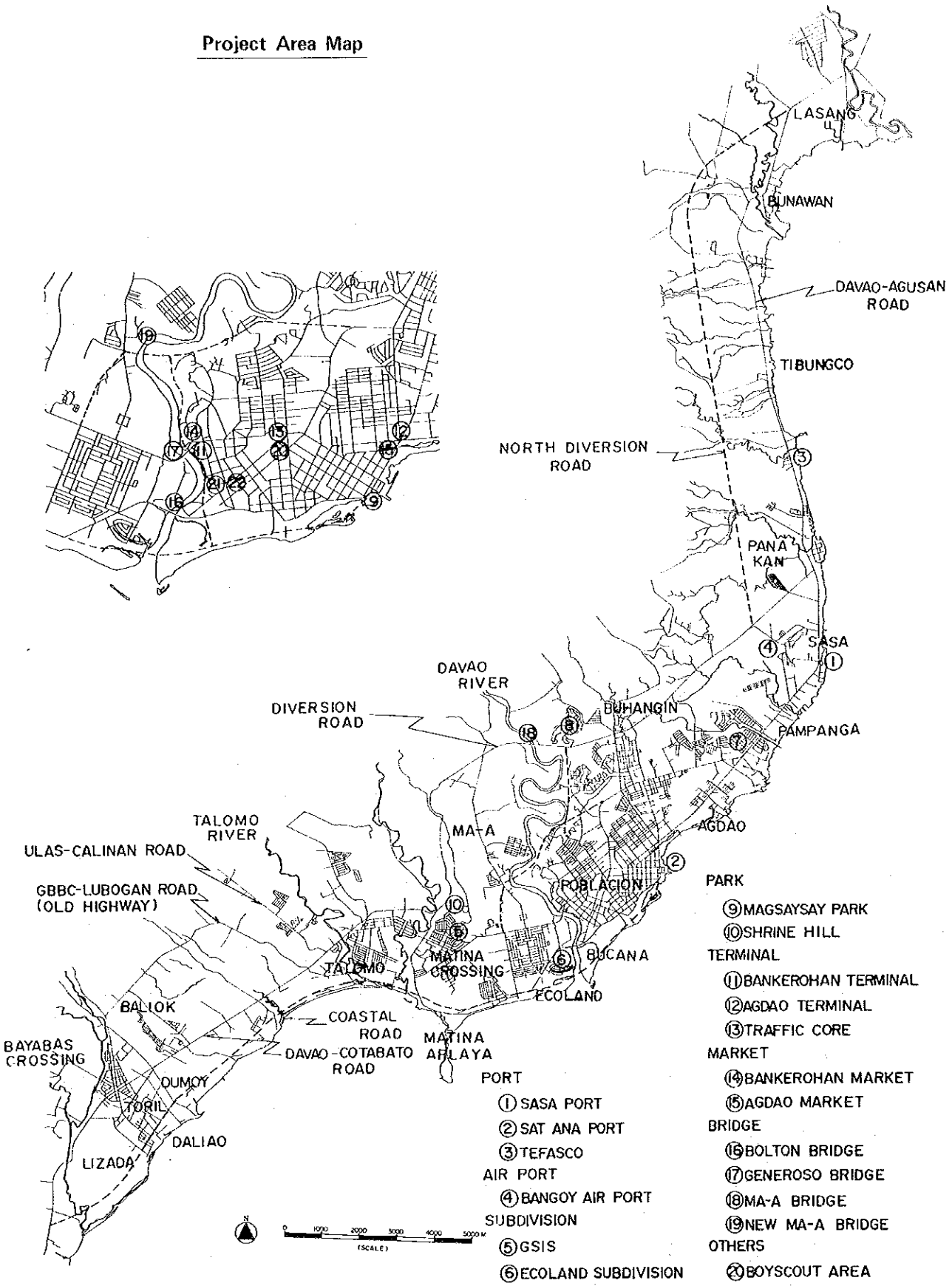
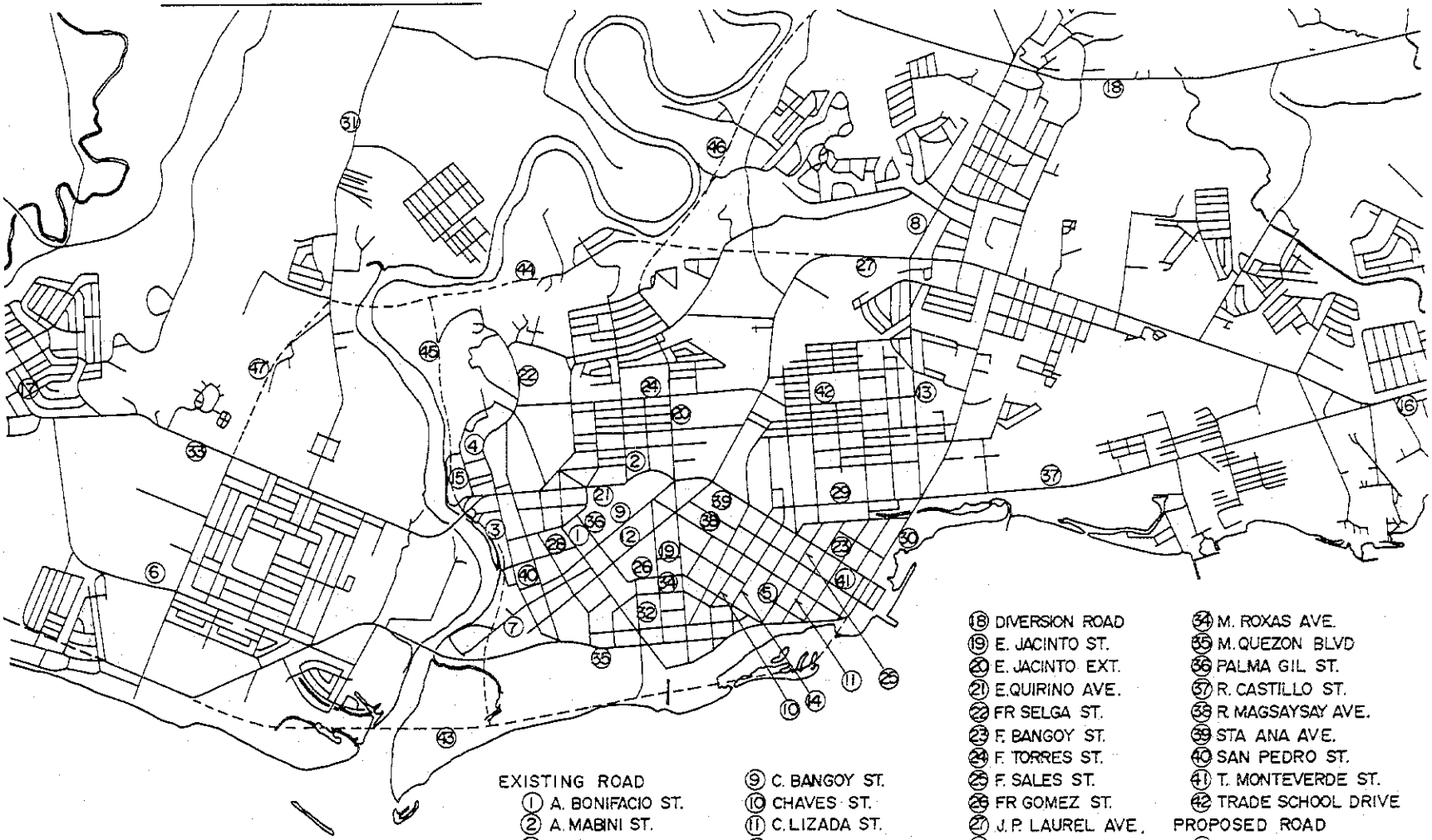
Project Area Map



Road/Street Map in Poblacion

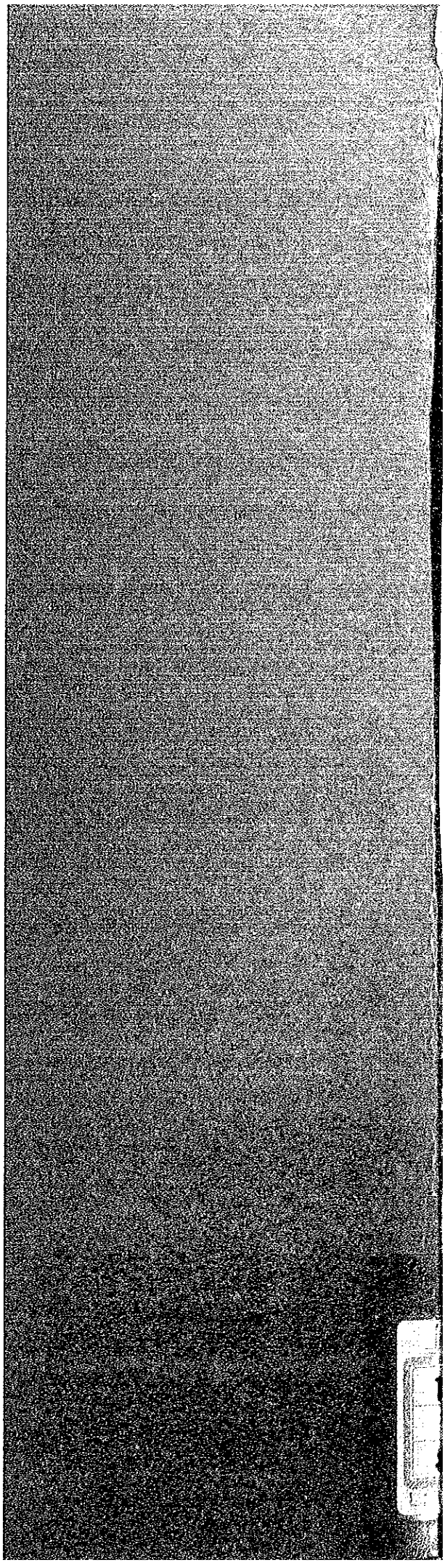


EXISTING ROAD

① A. BONIFACIO ST.
② A. MABINI ST.
③ A. PICHON ST.
④ A. PICHON EXT.
⑤ B. GEMPESAW ST.
⑥ BOLTON DIVERSION ROAD
⑦ BOLTON ST.
⑧ BUHANGIN ROAD
⑨ C. BANGOY ST.
⑩ CHAVES ST.
⑪ C. LIZADA ST.
⑫ C.M. RECTO AVE.
⑬ DACUDAO AVE.
⑭ D. SUAZO ST.
⑮ DATU BAGO ST.
⑯ DAVAO-AGUSAN ROAD
⑰ DAVAO-COTABATO ROAD
⑱ DIVERSION ROAD
⑲ E. JACINTO ST.
⑳ E. JACINTO EXT.
㉑ E. QUIRINO AVE.
㉒ FR SELGA ST.
㉓ F. BANGOY ST.
㉔ F. TORRES ST.
㉕ F. SALES ST.
㉖ FR GOMEZ ST.
㉗ J.P. LAUREL AVE.
㉘ J. RIZAL ST.
㉙ LAPU-LAPU ST.
㉚ L. GARCIA ST.
㉛ MA-A ROAD
㉜ MABINI EXT.
㉝ McARTHUR HIGHWAY
㉞ M. ROXAS AVE.
㉟ M. QUEZON BLVD
㊱ PALMA GIL ST.
㊲ R. CASTILLO ST.
㊳ R. MAGSAYSAY AVE.
㊴ STA ANA AVE.
㊵ SAN PEDRO ST.
㊶ T. MONTEVERDE ST.
㊷ TRADE SCHOOL DRIVE

PROPOSED ROAD

㊸ COASTAL ROAD
㊹ J.P. LAUREL EXT.
㊺ RIVERSIDE ROAD
㊻ ROLLING HILLS ROAD
㊼ NEW MA-A ROAD



JICA