7.3. City Bus System Plan

7.3.1 Advantages

Justification of introduction of city bus system to meet with a part of function which belong to PUJ at present has been studied and the bus service will bring about the following additional advantages:

a) The average passenger carried per PCU of the bus is more than twice that of the PUJ.

The average passenger carried per vehicle of the bus, which is 2 PCU (passenger car unit equivalent), is 22 passengers, while that of the PUJ, which is 1.5 PCU, is only 8 passengers; thus, the average passenger carried per PCU of bus is 11 against the only 5.4 of the PUJ.

b) The higher transport efficiency of the bus tends to facilitate the mitigation of road traffic congestion.

If PUJs are to meet the traffic demand on Davao-Agusan/Davao-Cotabato Road in the year 2000, the number of PUJs in certain section will be about 55,000 PCUs per day, but if the same demand is to be met with buses, the number of buses in the same section will be about 46,000 PCU per day for the mitigation of traffic congestion by about 9,000 PCUs. Less congestion means, at the same time, less travel time for the same distance.

c) The prevention of swell in traffic volume tends to alleviate the need of road construction.

As it was clarified in the review and comparative analysis of alternative plans, the road network needed in the year 2000 if the bus service is to be introduced will require a smaller total amount of road construction cost than will the network should the PUJ is to be continuously depended upon as the major mode of public transport. The saving in construction cost is a substantial 180 million pesos.

d) The passenger transport cost of the bus is only 70% of that of the PUJ.

The cost (operating cost and fixed costs) of transporting one passenger for one kilometer by bus is 0.102 pesos, as against such cost by the PUJ of 0.139 pesos (both in 1980 prices). Thus, the economy of bus transportation is higher than that of PUJ.

These advantages of buses, already attested in the process of evaluating alternative transport plans, will justify the city bus system plan to be discussed hereunder.

7.3.2 Planning Method

A new city bus plan must have the following seven items established:

i) The city bus route

ii) The city bus service level

iii) The number of buses required

iv) The identification of bus operation facilities required and a concept about bus company organization

v) Construction cost of the bus company's required facilities

vi) A conceptual plan of bus terminal(s)

vii) Bus terminal(s) construction cost

Ordinarily, plan formulation follows steps of process in the order of enumeration of the above list, as shown by the flow chart. (Fig. 7.14)

a) The establishment of city bus routes

Bus service routes are to be determined based on the already specified travel pattern of bus passengers. The routes thus established are checked against the demand, in the following steps of b) and c), to see if the routes mean any over- or under-supply of transportation. The routes are adjusted for any demand-supply disparity and finalized for adoption.

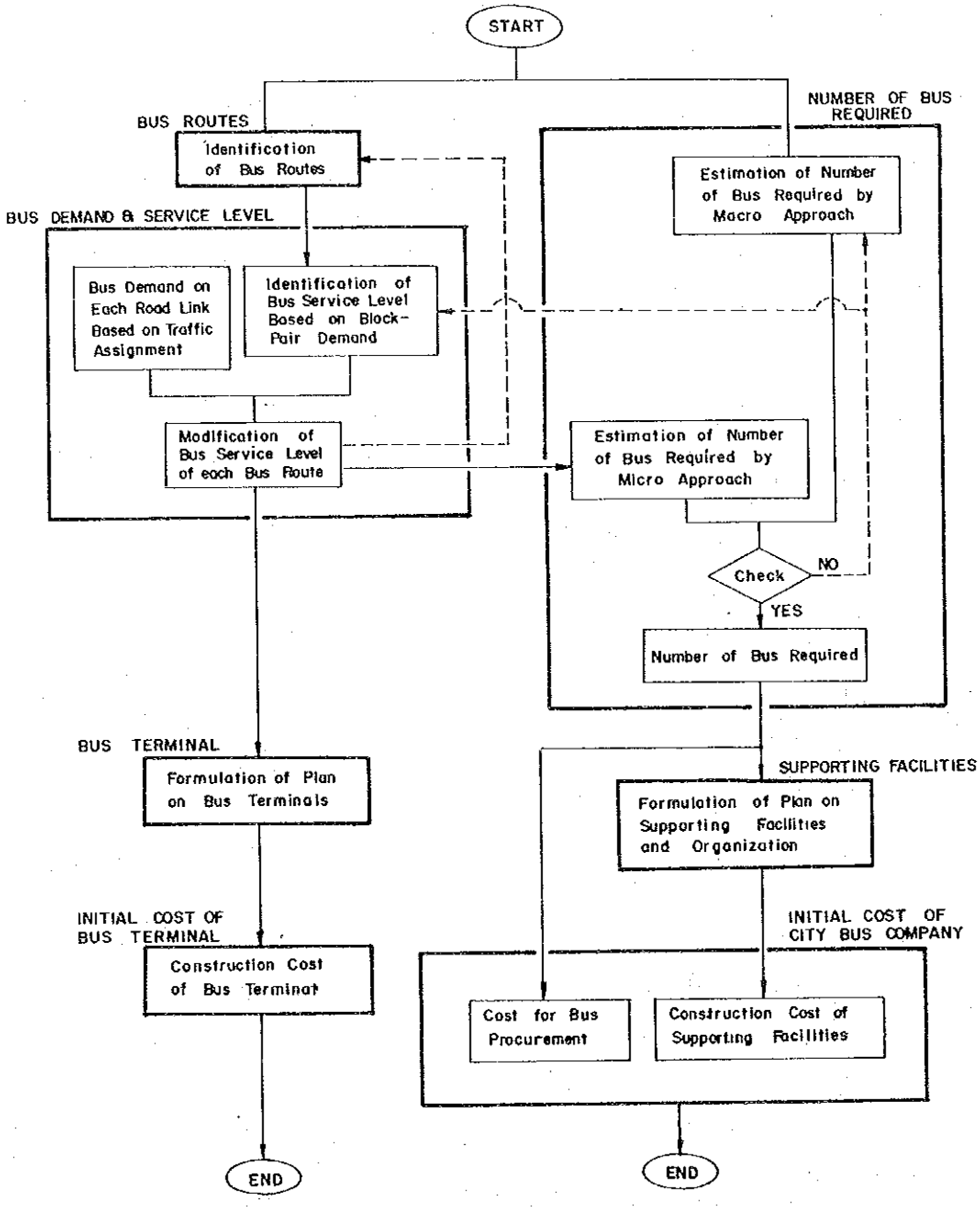


Figure 7.14 Working Procedure of City Bus Planning

b) Establishment of Service Level

Demand is calculated with regard to each of the thus established bus routes, and the bus service frequency which is commensurate with the demand is calculated. The demand is divided into inter-block passenger travel demand and intra-block passenger travel demand for the purpose of this process. In this step, both the checking of the appropriateness of bus routes and the calculation of appropriate bus service frequency on each route are accomplished concurrently.

c) Determination of the number of buses required

The number of buses required by the bus company for it to be able to provide service to meet the demand is calculated. Both microscopic approach and macroscopic approach are used, and the results of the two are compared against each other in arriving at the final determination of the number of buses required.

d) Bus Company's Facilities and its Organization, and

e) The Construction Cost of Supporting Facilities

Based on the already established number of buses required and the geographical spread of the bus service routes, the kind, size, and locations of bus repair maintenance and operation control/management facilities, and the bus company organization—which are essential for the sustainance of the intended level of bus service—are determined. Also, the construction cost of such facilities is estimated as an input for the financial evaluation of the bus introduction project.

f) Conceptual Plan of Bus Terminals and

g) Estimation of Bus Terminal Construction Cost

Both for the convenience of passengers and of the traffic control authorities, it is desirable that buses use common bus terminals even if they are operated by two or more bus companies. The conceptual plan of bus terminals will, therefore, include the total number and locations of bus terminals and the size of each terminal, as well as their construction costs.

The introduction of bus service (bus company plan) and the establishment of bus terminals (bus terminal company plan) are treated as two separate projects for the purpose of financial evaluation in Chapter 10.

7.3.3 City Bus Plan

1) Characteristics of City Bus Routes

(1) Establishment of End Points

Reflecting the travel pattern of inter-block passengers—the major group of bus passengers, the following classification of pairs of bus route and end points (O-D pairs) are considered:

(a) One end point in Poblacion and the other, in one of other blocks

a-1 For a relatively long route length

a-2 For a relatively short route length

(b) One end point in a northern block and the other, in a southern block.

(2) Estalishment of Routes

In order to satisfy the travel demand of all groups of bus passengers—who are mostly on inter-block trips but some on intra-block trips, the designation of the points or the road which the bus is to cover between the two end points is also indispensable in addition to the designation of the two points—origin and destination.

Thus, a total of 16 routes are established utilizing the nine O-D pairs. Of the routes identified with the destination in Poblacion, 3 routes will have their destination in Ecoland. (Table 7.9 and Fig. 7.15)

Table 7.9 Origin, Destination and Route of City Bus in 2000

Origin of City Bus Route	Destination of City Bus Route	Place or road where City Bus pass through	Ecoland as origin of City Bus Route
1. POBLACION	BUNAWAN	1.1 E. Quirino Ave., Sta. Ana Ave., Lapu-lapu St., R. Castillo St., Davao-Agusan Road	
		1.2 E. Jacinto St., Ext., Rolling Hills Rd., Diversion Rd., Buhangin, North Diversion Road	
2. POBLACION	TORIL	2.1 E. Quirino Ave., McArthur Highway	
		2.2 E. Jacinto St., Coastal Rd.	
		2.3	Bolton Div. Rd.,
3. POBLACION	CALINAN	3.1 E. Quirino Ave., McArthur Highway, Dvo-Bukidnon Rd.	
		3.2	Bolton Div. Rd., McArthur Highway Davao-Bukidnon Rd.
4. TALOMO	PANAKAN	4.1 McArthur Highway, E. Quirino Ave., Sta. Ana Ave., Lapu-lapu St., R. Castillo St., Davao-Agusan Road	
		4.2 McArthur Highway, E. Quirino Ave., J.P. Laurel, Davao-Agusan Road.	
		4.3 McArthur Highway, E. Quirino Ave., Sta. Ana Ave., Lapu-lapu St., Dacudao Ave., Buhangin Rd., Davao Diversion Road, Davao-Agusan Rd.	
5. TALOMO	CABANTIAN	5.1 McArthur Highway, E. Quirino Ave., Sta. Ana Ave., Lapu-lapu St., Dacudao Ave., Buhangin Road	
6. POBLACION	TALOMO	6.1 E. Quirino Ave., McArthur Highway.	
7. POBLACION	PAMPANGA	7.1 E. Quirino Ave., Sta. Ana Ave., Lapu-lapu St., R. Castillo St.	
8. POBLACION	MA-A	8.1 E. Jacinto St., Ext. J.P. Laurel Ext., New Ma-a Bridge, Ma-a Rd.	
		8.2	Ecoland Rd., Ma-a Rd. Ext., Ma-Rd.
9. POBLACION	ECOLAND	9.1 E. Jacinto St., Coastal Rd. (Bucana)	

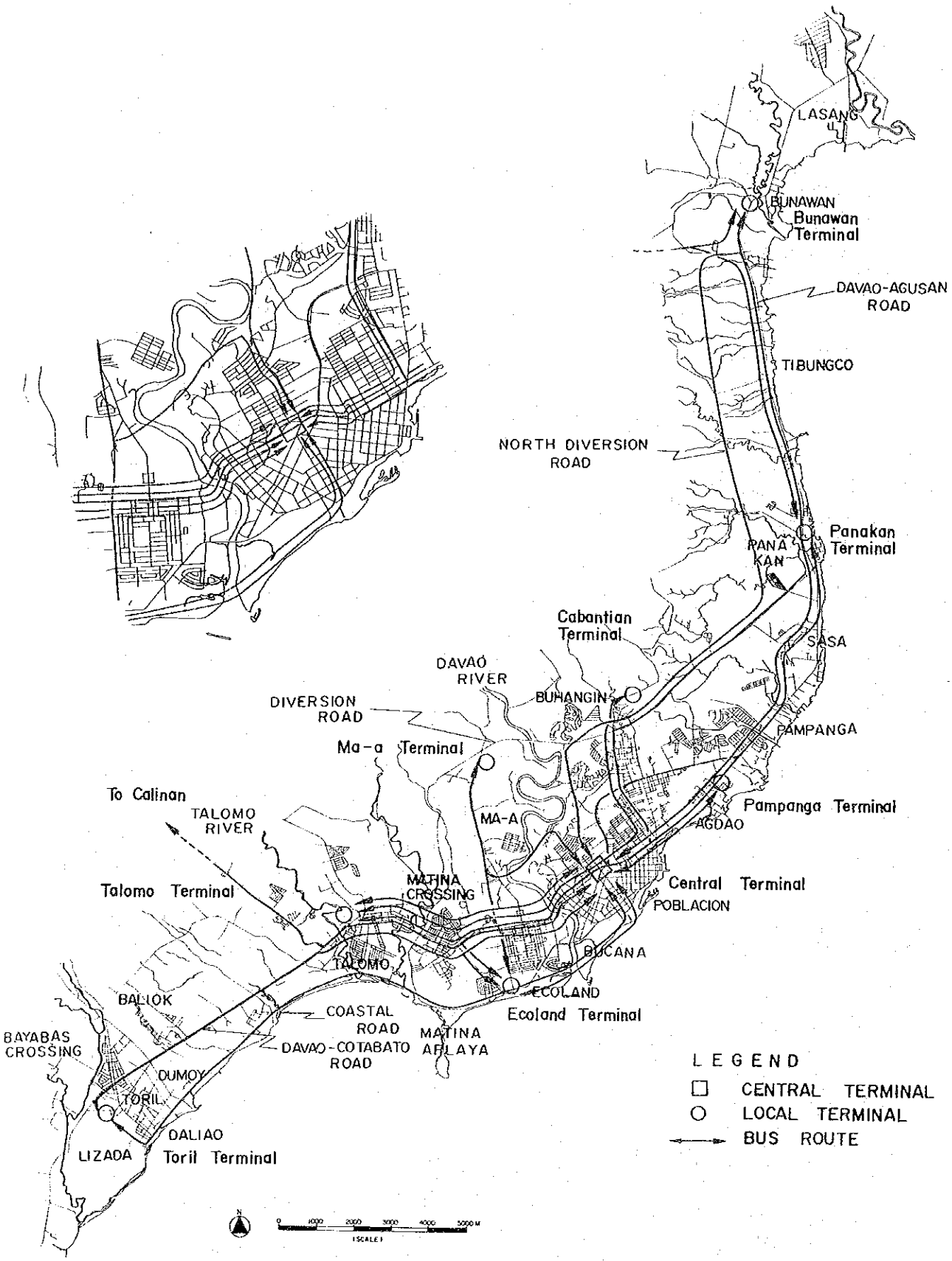


Figure 7.15 City Bus Route, 2000

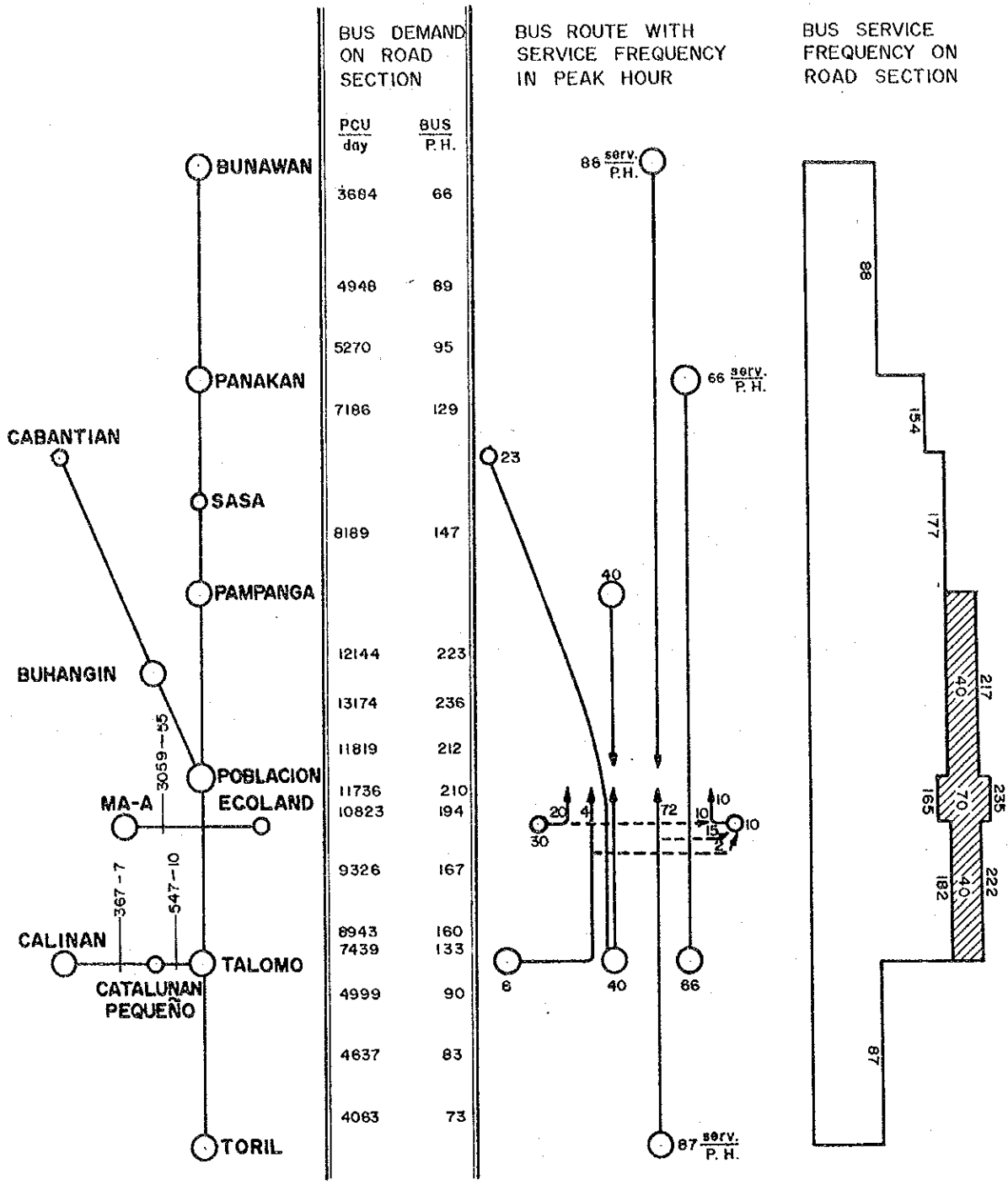
2) Passenger Assignment and Service Frequency by bus service route

First, the number of inter-block passengers--the major group of bus passengers--are assigned to each of the nine O-D pairs with reference to the O-D matrix and/or the desired-line diagram of bus passengers in order to establish the required service frequency in the peak hour for each of the nine.

In the second step, routes or parts of a route are identified where the service frequency as established in first step, will be short of satisfying the demand, now including intra-block passengers, are considered. Then, by increasing the frequency or by adding new routes, bus routes and service frequency for each route is finally determined. (Table 7.10, Fig. 7.16)

Table 7.10 Service Frequency in Peak Hour by City Bus Route as Defined by Origin and Destination of Route (2000)

NAME OF CITY BUS ROUTE		SERVICE FREQUENCY	
ORIGIN	DESTINATION	IN PEAK HOUR, PEAK DIRECTION	FOR WHOLE DAY BOTH DIRECTIONS
1. POBLACION	BUNAWAN	88	1,354
2. POBLACION	TORIL	87	1,339
3. POBLACION	CALINAN	6	93
4. TALOMO	PANAKAN	66	1,016
5. TALOMO	CABANTIAN	23	354
6. POBLACION	TALOMO	40	616
7. POBLACION	PAMPANGA	40	616
8. POBLACION	MA-A	30	462
9. POBLACION	ECOLAND	10	154
TOTAL		390	6,004



ASSUMPTION OF CONVERTION FROM PCU TO NUMBER OF BUS

i) 1 Bus is equivalent to 2 PCUs (Passenger Car Unit).

ii) Peaktime Ratio is 13%.

iii) Peak Direction Ratio is 75%.

iv) No. of Passengers carried per Bus in heavier direction in peaktime is 60 (120% Occupancy Rate) but the average of that in both directions for whole day is 22 passengers, as utilized in the calculation of traffic assignment.

Additional Service for Intra-block Demand.

Figure 7.16 Checking of Bus Demand and Bus Service Frequency

3) Required Number of Bus

(1) Macroscopic Approach

The required standard sized bus fleet is estimated to consist of 200 units by 1990 and 500 units by 2000, based on the passenger-kilometer value calculated from the O-D matrix of bus passengers and under the following assumptions: (Table 7.11)

Table 7.11 Estimation Process of Number of Bus Units

	1990	2000
1. Passenger kilometer/day	1,309,500 pass. km.	3,504,000 pass. km.
2. Peak Hour Ratio in terms of Pass. km.	15%	15%
3. Occupancy Ratio of City Bus in Peak Hour	80%	80%
4. Average Number of Passengers Carried per one Bus in both Directions in Peak Time	40 persons	40 persons
5. Total Vehicle kilometers in Peak Hour	4,911 veh. km.	13,140 veh. km.
6. Distance served by Bus in Peak Hour	les than 1/30 Km (27 kph)	less than *1 30 Km (29 kph)
7. Number of Bus Units Required	182	more than 450 units
8. Proportion of Number of Bus for Reservation	approximately 10%	approximately 10%
9. Number of Bus Units Required	200 Units	500 Units

1/ Around 25 kph for PUJ at present along McArthur Highway after Bankerohan Bridge to Talomo. Using Bus will increase this speed up to less than 30 kph, assumed to be 27 kph in 1990 and 29 kph in 2000.

(2) Microscopic Approach

Based on the bus service frequency (peak hour headway) established for each route, the number of bus required is estimated using the following equations, at 500 units for the year 2000, which coincides with the result of the macroscopic approach estimation:

a) If the time required for making one round trip on the route, including terminal time, is one hour or less; that is,

when $\frac{2L}{V} + \alpha_1 + \alpha_2 < 60$ Min.

then

$$N = \frac{\frac{2L}{V} + \alpha_1 + \alpha_2}{\Delta t_1} (1 + r)$$

b) Likewise, if the time required is over one hour (but not over two);

$$N = \left(\frac{60}{\Delta t_1} + \frac{\left(\frac{2L}{V} + \alpha_1 + \alpha_2\right) - 60}{\Delta t_2} \right) (1 + r)$$

wherein:

- N : Number of Bus units Required
- L : Distance of City Bus Routes
- V : Bus Operation speed (30 km/H)
- α : Terminal Time α_1 = 10 minutes in Central Terminal
  α_2 = 5 minutes in Local Terminal
- Δt_1 : Headway of Bus Service in Peak Hour
- r : proportion of Bus units for Reservation
- Δt_2 : 1.5 x Δt_1 in one Hour Before after peak Hour

Table 7.12 Number of Bus Units Required per Bus Route by Origin and Destination

ORIGIN AND DESTINATION	ROUTE LENGTH (Km.)	HEADWAY IN Peak Hour Ot1 (min.)	HEADWAY IN Another Hour Ot2 (min.)	Number of Bus Units Required
1. POBLACION BUNAWAN	21.5	0.5	1.0	129
2. POBLACION TORIL	15.8	0.5	1.5	99
3. POBLACION CALINAN	28.5	10.0	20.0	10
4. TALOMO PANAKAN	22.9	0.5	1.5	97
5. TALOMO CABANTIAN	17.6	2.5	5.0	28
6. POBLACION TALOMO	9.9	1.5	3.0	36
7. POBLACION PAMPANGA	6.3	1.5	3.0	27
8. POBLACION MA-A	5.7	2.0	4.0	19
9. POBLACION ECOLAND	4.5	6.0	12.0	6
			TOTAL	451

* Total number of Buses required including 10% reservation = 500 units

4) Required Facilities and Bus Company Organization

To maintain buses in good mechanical condition and to efficiently operate the city bus service system, adequate maintenance and operational facilities are needed. Such a maintenance shop is usually established together with or along bus parking

space which, together, are referred to as bus depot. The total land space required for the bus depot (it is desirable that two depots will be established at separate locations) by the year 2000 is estimated at about 4.5 hectares according to the following standards:

Total Space: 90 – 100 m^2 per unit of bus (entire land space, including parking lots and maintenance shop)

Parking lot: 40 m^2 per unit of bus

Parking related space: 30 m^2 per unit of bus (thoroughfare, fuel filling station, vehicle washing space, etc.)

Maintenance shop: 8 – 10 m^2 per unit of bus

Crew shed: 0.5 – 1. m^2 per person (Drivers and conductors: 1.94 x 2 per unit of bus)

Office: 1 – 1.5 m^2 per unit of bus

Workers Space: 4 – 5 m^2 per person (0.25 persons per unit of bus)

The bus company should have established within its organization such functions as (a) operation section, which formulate bus operation plans and put such plans into effect, (b) maintenance section, which will be responsible for the adequate repair and maintenance of the buses, (c) accounting section, which will collect and count daily bus fare revenue and attend to other financial matters, and (d) administration section for the overall administration and management of the company. The personnel requirements of the company will be approximately 2,000 bus drivers and conductors, about 200 shop workers, about 300 clerical workers at depots and head office, and certain numbers of janitors, guards, and so forth, for a total of about 3,000 staff.

5) City Bus Terminal

The establishment of bus terminals upon the inception of city bus service will be advantageous not only to bus passengers and the bus company, but also to the urban traffic control authorities. Bus terminals facilitate:

a) City bus passenger embarkathion/debarkation

b) Passenger transfers from bus to peripheral modes of transport

c) The controlling of buses for regular service runs

d) (And, depending on the position, in the urban planning of the bus terminal site), the bus traffic management in the urban area.

In addition to the central bus terminal in Poblacion, eight terminals of varying sizes (see Table below) should be established and developed gradually in pace with the expansion of the city bus service network and the increase of service routes. (Table 7.13 and Fig. 7.17)

Table 7.13 Necessary Area for City Bus Terminals in 2000

NAME OF TERMINAL	TOTAL AREA (Ha.)
CENTRAL TERMINAL	4.0
LOCAL TERMINALS	
N BUNAWAN	1.0
O PANAKAN	1.0
R CABANTIAN	0.2
T PAMPANGA	0.3
H Sub-Total	2.5
S MA-A	0.2
O ECOLAND	0.5
U TALOMO	1.4
T TORIL	1.0
H Sub-Total	3.1
TOTAL	9.6

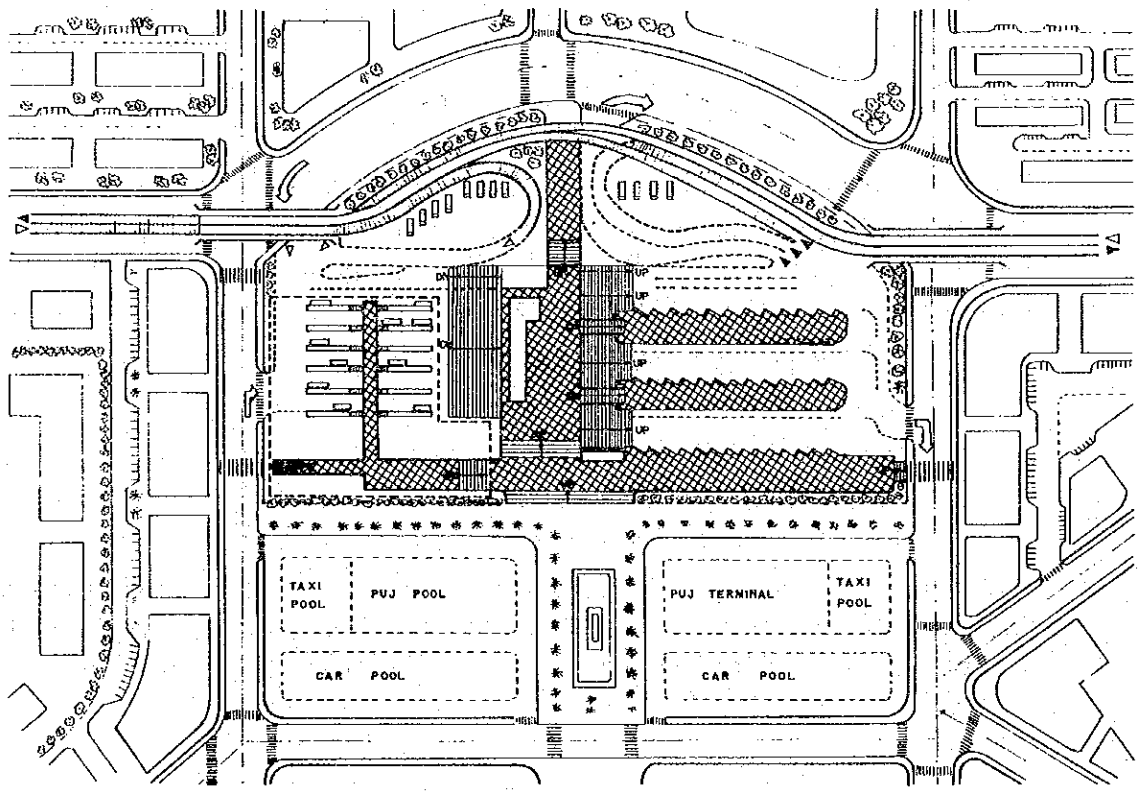


Figure 7.17 Model of Traffic Core with Central Bus Terminal

7.3.4 Bus/PUJ Competition and Counter-Measure

The introduction of city bus system to the City of Davao will mean a radical revolution of the City's public transport system, inasmuch as one of the two urban transport functions which the PUJ is currently called upon to perform will be taken away from the PUJ and be given to new comer-- the bus. PUJ operators' resistance against such transition will probably be strong.

In addition, the citizens of Davao at large can disfavor the changeover in view that bus service is inferior to PUJ service in certain aspects. Then, the conditions of competition between the bus and the PUJ should be defined and the weekpoints of the bus, the situation under which such weekpoints would become most patent, and measures to overcome such weekpoints be identified, in order not only to support the inception of bus system but also to help maintain the maximum level of bus service even after the system has become viable.

It will be in the initial stage of bus service inception that the inferiority of bus service, relative to PUJ service, will show out and that the two will compete with each other for passengers. This is because the bus service and PUJ service will be overlapped with each other in that stage. That is,

a) Bus service route will be limited to major trunk roads, while PUJs will be serving on both major roads and collector roads, and, therefore, bus passengers will have to walk for a longer distance before and after riding a bus than PUJ passengers. Depending on the origin of bus passengers, they may have to use some other mode of transport to reach a bus station. But, generally, the travel speed of buses is faster than that of PUJs (for example, in Metro Manila).

b) The embarkation and debarkation of bus passengers are limited to one of the predetermined bus stops or the bus terminal. Whereas, PUJ passengers are and will be allowed to get on and off the PUJ at any point on the service route. This will add to the disadvantage of bus in terms of the walking distance before and after riding a bus.

c) The frequency of buses, whose per-unit carrying capacity is greater than that of PUJs, will inevitably have to be lower than the PUJ service frequency. Thus, the waiting time of bus passengers will have to be longer than that of PUJ passengers.

Basic approaches recommended in order to compensate for the inferior competitiveness of the bus vis-a-vis PUJs will be as follows:

a) Although it may be inevitable to some extent that bus passengers will have to walk longer to catch a bus, the positioning of the central bus terminal and the distribution of bus routes (and, therefore, bus stops) so as to cover, within a walking distance, every point in CBD in Poblacion, where the concentration of bus passengers will be the greatest, will improve the attractiveness of the bus.

b) The operation of buses in strict accordance with the operational time schedule will tend to minimize the waiting time for time conscious passengers with a planning mind.

c) The limiting of bus loading and unloading to predetermined bus stops will tend to reduce the number of bus stoppings and to increase the service speed of the bus—hence a shorter riding time to reach the destination. This advantage of the bus should be emphasized against said disadvantage (of having to walk to a bus stop).

d) The very high profitability of bus enterprise, as will be proven through financial analyses of bus company business, should be taken advantage for guaranteeing the level of passenger amenity such as that offered by Love Bus in Manila and for providing certain fare discount scheme; the improvement of passenger service will facilitate the improvement of competitiveness.

7.4. Rail-Transit Introduction: Preparation and Plan

7.4.1 Timing and Preparation Need of Rail-Transit

The idea of introducing a light rail transit system as the means of urban public transport in Davao City makes sense in view of the predicted demand expansion and the geographical shape of the City. However, the rail-transit introduction will remain premature until the year 2000 from the economic view point, at the earliest, unless for some unusual circumstances: the accomplishment of development faster than contemplated by this Plan, oil price increases beyond expectation, or unexpected disturbance in oil supply.

Although this urban transportation plan has its target year in 2000, Davao City will naturally continue to exist beyond that year and it will be meaningful to think what will help the City in the 21st century.

Demand for public transport is generated in area where the people's activities are concentrated. In such a place, demand is also high for commercial and business facilities, and, when a large number of buildings have been constructed, the acquisition of land for the introduction of a new public transport system will be nearly impossible . Therefore, it will be appropriate and desirable that this Plan, although with the target year of 2000, will attempt to open and leave a room and possibility for the post-2000 introduction of a new means of public transport, thereby providing the continuity of planning and urban construction into the long future.

7.4.2 Preparation for Rail-Transit Introduction

The introduction of a type of rail-transit will require a kind of preparation different from the kind required for the introduction of another type of rail transit. Therefore, for the purpose of this Plan, it is assumed that the type of light rail transit (LRT) which is now being introduced in Metro Manila will be introduced in Davao City.

The greatest task in the construction of a rail transit system is the acquisition of a narrow strip of land extending for a very long distance needed for railroad tracks. The acquisition of land will be difficult where transportation demand is concentrated and the existing mode of public transport is already in service—most difficult in urban centers where mass transportation demand is the highest.

Therefore, it is recommended that the acquisition of the most of land needed for rail transit be incorporated into and made a part of the road development projects to be implemented by the year 2000.

This can be accomplished by the acquisition of road right-of-way of a wide breadth, a part of which is to be used for railroad track. The excessive width can be utilized, for the time being, either (a) as extra carriageway drive-lanes or (b) as a wide center median.

(a) The extra drive-lanes made available by the securing a wide road right-of-way are to be utilized as exclusive or priority bus lanes until the time of rail-transit introduction. Then, the all or a part of such lanes can be utilized for the construction of ground level rail tracks or, in Poblacion, piers to support elevated rail tracks (Pattern A).

(b) In suburban areas expected to become a conurbation in the future, a wide center median is to be established, which, by clearly separating traffic flowing in one direction from that in the other direction, will fully facilitate the smooth flow of traffic with reduced chances of traffic accidents. Then, railroad track is to be constructed utilizing this center medium (or using a part of the carriageway width, in the case of Davao-Cotabato Road, wherein the newly built coastal Road is expected to supplement for the reduced lanes on said Road) (Patterns B and C).

In addition, a different method of road/railroad development pattern (pattern D) will be necessary for the section between Bankerohan Bridge and Ecoland, and the section from Ecoland to the point where railroad track is to meet with Davao-Cotabato Road again after deviation from it toward the coastal area. Because these sections go through areas of Slum Improvement and Resettlement Project and the Ecoland Development Project, this rail-transit land acquisition/construction plan should be fully coordinated with such projects. (Table 7.14 and (Fig. 7.18)

Table 7.14 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

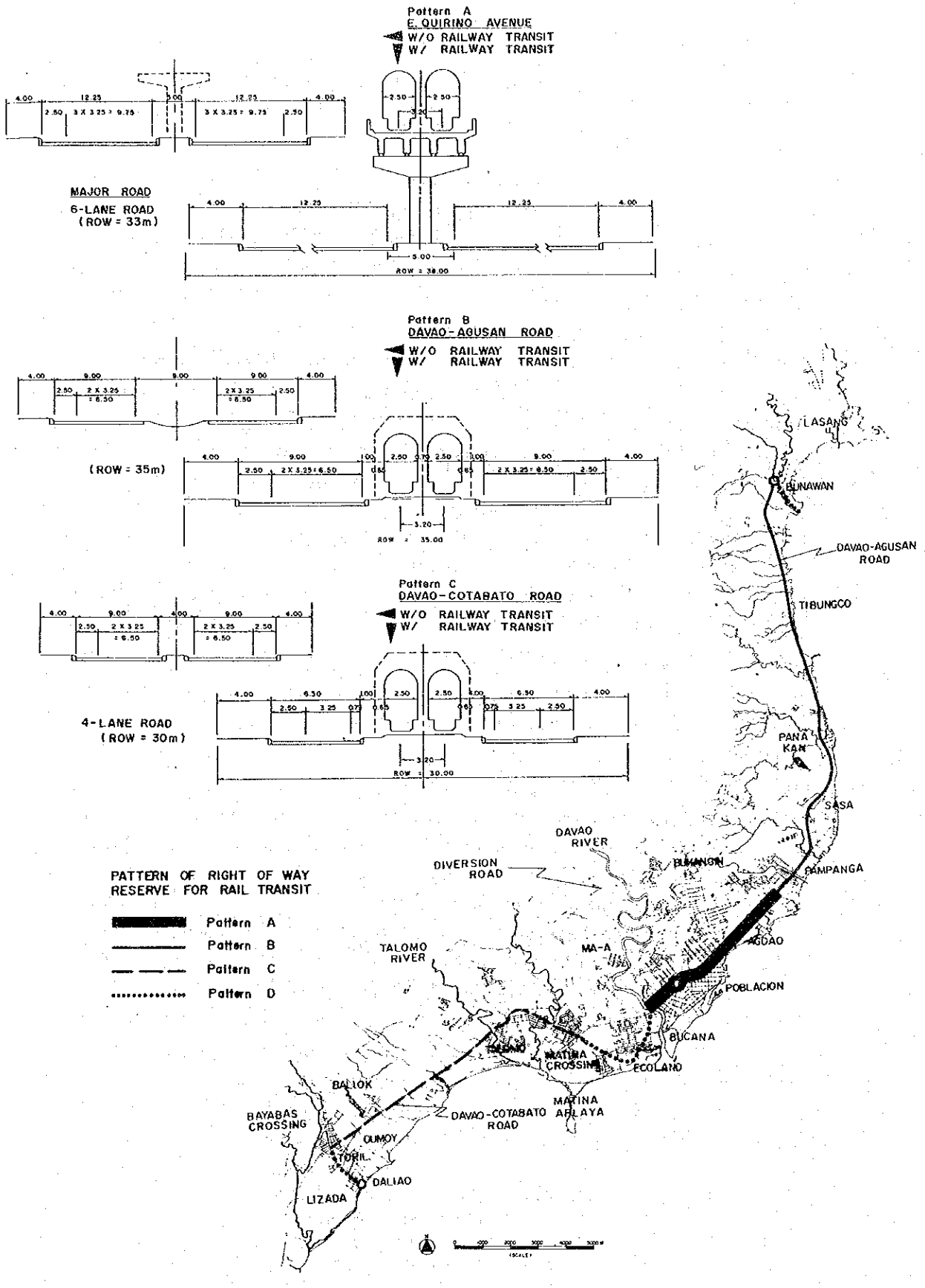


Figure 7.18 Pattern and Distribution of Right of Way Reservation for Rail Transit

7.4.3 Rail-Transit Plan

The basic conceptual plan for the introduction of rail-transit system is discussed hereunder.

1) Demand

Rail-transit passenger demand is estimated at 235,000 passengers in the year 2000. The majority of this demand represents, as in the case of bus, inter-block travels with a relatively long trip length, and the above estimate includes 40,000 passengers estimated to shift from car. The average trip length will be in excess of 10 kilometers, and the total passenger-kilometers will be 2.5 million.

Said average trip length indicates that the most of inter-block passengers will utilize rail-transit. In this sense, it will be appropriate that the rail transit route be laid from Bunawan, through Poblacion, and to Toril, connecting the urban center and sub-centers to be developed in the Project Area under this Plan.

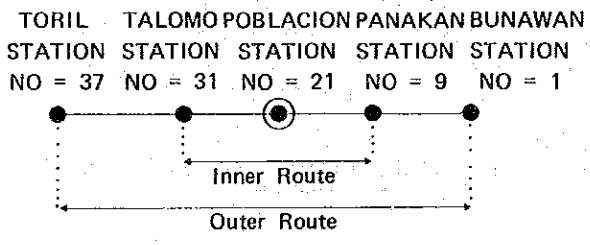
Using this route and the anticipated locations of railroad stations, the maximum station-to-station passenger demand of 97,000 per day is estimated for the section between Station No. 18 (R. Castillo St.) and Station No. 19 (Agdao), indicating that the passenger demand of 90,000 to 100,000 per day will be concentrated in the vicinity of Poblacion. Such demand is estimated at 70,000 to 80,000 per day from Ecoland to Talomo and in the vicinity of Sasa. Outside of these areas, the demand level is 30,000 to 50,000 per day up to Bunawan in the north and down to Toril in the south.

2) Rail Transit Types and Service Systems

Rail-transit transport demand in excess of 50,000 passengers per day at certain cross section means that a mode with a capacity in the order of street car will be totally inadequate, and that a highly efficient monorail transit or the type of light rail transit to be introduced in Manila will be in need.

In addition to the capability to meet the identified transport demand, criteria for the selection of the type of rail-transit for introduction—inasmuch as railroad is the package of a large variety of technologies—naturally include train operation, operation management, rolling stock, facility management and maintenance, and other technological aspects. In the Philippines, technological experiences have already been accumulated with regard to the railroad on Luzon Island and the commuter train in Manila, to which added soon will be the light rail transit. Metro Manila. Particularly, this Manila LRT will offer useful experience for the introduction of LRT in Davao City.

Two service systems are possible. One is the shuttling of trains for the entire length of the route, and the other is the combination of such entire-route shuttling and another shuttle to cover only the high-demand inner section in order to effect a higher service frequency in the inner section than in the outer section.



3) Service Frequency and Rolling Stock Required

The required frequency of rail-transit service is determined by the following standards as applied to the highest-demand parts of the inner section and of the outer section:

a) Peak Ratio: 13%
b) Peak Direction Ratio: 75%
c) Practical Capacity: 280 passengers per car (1-car trains)

Thus, it is clear that the headway of two minutes must be maintained for the inner section and that of four minutes for the outer section. The operation schedule is conceived of as follows:

Table 7.15 Operation Schedule of Rail Transit

HOUR	MORNING								AFTERNOON										
	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
INNER ROUTE (PANACAN-TALOMO)	2	14	30	20	14	16	20	20	20	16	14	20	30	20	14	8	8	4	2
OUTER ROUTE (BUNAWAN-TORIL)	1	7	15	10	7	8	10	10	10	8	7	10	15	10	7	4	4	2	1

Note: Timetable of a certain station of inner route.
Headway of Service in peaktime in one direction is 2 minutes in inner route and 4 minutes in outer route.

The extension of the inner section is 21.4 kilometers, and that of the outer section, 35.7 kilometers, and the number of train (cars) needed is 31 and 21, respectively. With a 10% reserve cars, the total of 60 cars will be necessary.

4) Supporting Facilities

Thirty-seven (37) stations will be provided along railroad route in the total length of 35.7 kilometers. Distance between stations will be shorter in area with high density of population on the other hand will be longer in low density area.

This railroad will require yards and maintenance shops with an area of one hectare estimated on the basis of planning units of LRT project in Metro Manila. (Table 7.16)

Table 7.16 Summary of Rail Transit Plan

Demand in 2000			
Passengers	pass/day	235,000	30% of PUV passenger
Passenger.Kilometer	pass.km/day	2,512,000	46% of PUV passenger.kilometer
Maximum Demand in a Certain Section	pass/day	97,000	(9,500 pass/P.H./Peak Direction)
Characteristics of LRT			
Capacity of 1 Unit	persons/unit	280	
Transport Capacity	pass/H/Direction	8,400 – 16,800	1-2 Units/1 train
Service			
No. of Units Required	Unit	60	
Alignment		Bunawan – Poblacion – Toril	
Service Frequency in Peak Hour	Service/Peak Hour	30 for inner route 15 for outer route	
for whole day	trains/day	584 for inner route (Both Direction) 292 for outer route (Both Direction)	
Operation Hours	Hour	19 hours (5:00 a.m. ⟶ 12:00 p.m.)	

5) Financial Analysis of the Railroad Project

The financial analysis of this project, explained in detail in Chapter 9, will be summarized here.

Estimated, based on the number of rail-transit passengers in the year 2000, railroad revenue will be about 131 million pesos (per year). Assuming an average yearly increase of 15% thereafter due to demand increase, fare adjustment, and so forth, the revenue is estimated to reach 1,979 million pesos per year by the year 2020.

The cost of railroad is much affected by such factors as capital and the interest rate of long term loan. (Inflation rate is assumed to be 12% per year).

Case A:

Condition: Capital: about 23% of initial investment
Long Term loan interest rate: 15% per annum (5-year moratorium redemption in 20 years)
Short term loan: interest: 20%

Expenses in 2000: Operating cost, about 73 million pesos; interest payment, 200 million pesos

Expenses in 2020: Operating cost, 750 million pesos, interest, 2,288 million pesos; and loan principal repayment, 101 million pesos.

The amount of outstanding short term loans will increase yearly in financing the payment of interests on long term loan, and the railroad company will be bankrupt.

CaseB:

Condition: Capital: same above
Long term loan: interest, 3.5%, moratorium 5 years, redemption in 20 years
Short term loan: interest, 20%

Expenses in 2000: Operating expense, about 60 million pesos; interest payment, about 47 million pesos and loan principal repayment about 12 million pesos.

Expenses in 2020: Operating expense, 60 million pesos; interest, 34 million pesos; and loan principal repayment, 101 million pesos

In this case, the amount of short term loans will continue to be required until the year 2003, and will not be necessary thereafter; the railroad company will achieve a profit after 2003.

The above analysis shows that the railroad business starting in the year 2000 will be adequately self-liquidating, provided that preferential long term loan is available, as in the Case B above.

7.5 City Bus Introduction Project

In view of its grave impact, the project for the introduction of a city bus service system to Davao City should be implemented carefully, awaiting the result of the feasibility study expected to start in the near future.

1) Time for Introduction

City buses should be introduced in accordance with the increment of public transport demand. In view of the current trend, the number of PUJs will continue to increase if left alone, and the increase will be greater if the introduction of city bus will be delayed. Therefore, it will be desirable that the city bus introduction will be accomplished at an early opportunity, so as to avoid double investments in the PUJ and the bus.

A sufficient demand already exists to support a city bus system in Davao City: according to the analysis based on the characteristic of public transport passengers by trip length distribution, the existing demand will support the operation of about 70 units of buses. Nevertheless, in view of its importance and the influence, the commencement of the city bus operation should be preceded by sufficient and careful preparations: commercial feasibility study, bus and terminal companies establishment, the construction of necessary facilities, the procurement of buses, and so forth.

2) Initial Bus Fleet

The number of buses required to meet the present demand is estimated at about 70 units, as stated in the above, and to meet 1990 demand, 200 units. Then, it is presumed that the number of buses needed in 1985 will be somewhere between 70 and 200, or probably about 100 to 130.

The city bus routes are to be established starting with major trunk roads and gradually expanded. Therefore, the initial fleet of buses need not be large enough to meet the all demand in the entire Project Area.

Demand increment from 1979 to 1985 will correspond to 30 to 60 buses—a suitable fleet size for a bus company in view of the sizes of other bus companies in the Philippines. Thus, the size of the initial bus fleet is set at 50 units for the purpose of this project.

3) Bus Route Expansion

The initial city bus routes will be established on trunk roads connecting Poblacion with neighboring blocks. Then, as demand will increase, routes which will by-pass Poblacion will be added. The city bus service network will be further expanded in pace with the construction of trunk roads. By the year 2000, short routes will have been added so that the city bus service will be available in any part of the urbanized areas. (Figure 7.19).

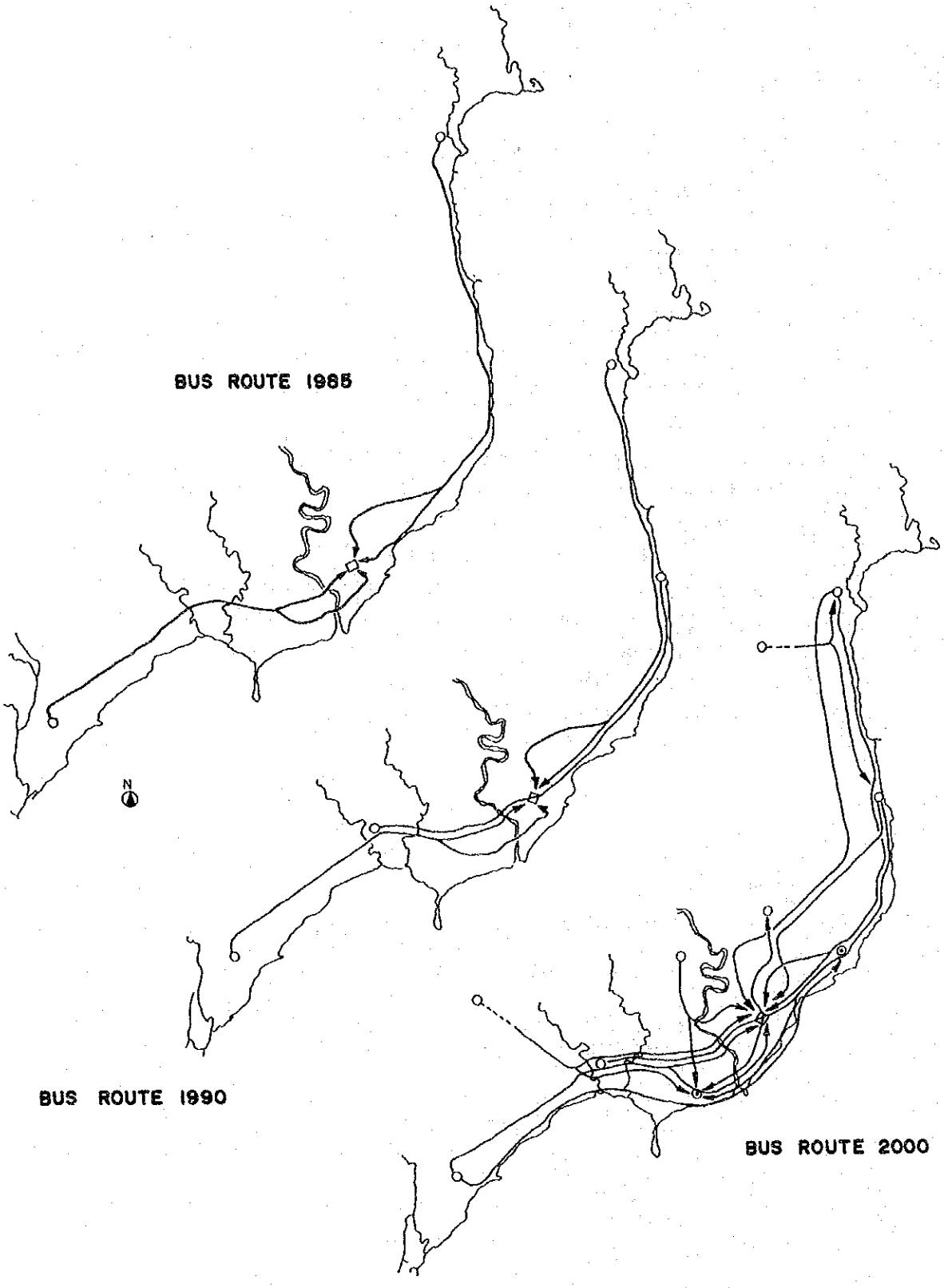


Figure 7.19 Bus Route Plan from 1985 to 2000

4) Financial Evaluation of City Bus Project

The financial evaluation of the city bus projects, explained in detail in Chapter 9, will be summarized here.

The facilities and equipment needed for the city bus operation will be as follows:

(1) Bus: 500 units (year 2000). Initial fleet will be 50 units, yearly increased by an increment of 30 buses. By the 8-year useful life, buses are to be replaced when obsolete, and therefore, the cumulative total number of buses to be purchased by the year 2000 will be 760 for a total cost of 162 million pesos.

(2) Supporting Facilities

Bus depots in two locations both including maintenance shops and bus yards for a total land space of 4.5 hectares. Together with head office building, total construction cost will be about 20 million pesos.

City bus revenue is estimated to increase from the 25 million pesos per year in the initial years to about 1,579.1 million pesos by the year 2000 due to demand increases and fare revisions. Expenditures are estimated at 20 million pesos in 1985 and 1,185 million pesos in 2000.

Based on this profit and loss forecast, the need for short term loans will be limited to the initial three years, after which net profit will be available for carry forward to each next year. Thus, bus operation enterprise will be an attractive business. These observations are based on the assumptions: capital, one million pesos; long term loan for 20 years with 5-year moratorium, interest rate, 15% per annum; short term loan, 20% per annum interest. (Table 7.17)

Table 7.17 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 (x1000)	478.5 [1]	927,000 [2]	1,300	3,500
Minimum Requirement of Bus Units [3]	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.

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

[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.

7.6 City Bus Terminal Project

7.6.1 Project Independence

Bus terminals are indispensable facility to the introduction of city bus system. Bus terminals, though they may appear as if only ancillary to bus operation, are more of a public nature than the bus operation itself, and, therefore, should be subject to urban planning and urban traffic management.

Furthermore, should bus terminals be established, operated, and maintained by private bus company (ies), the cost thereof will inevitably be reflected on bus fares, only to undermine the purpose and intent of bus introduction. In this view, bus terminal should be an independent project separate from bus project.

7.6.2 City Bus Terminal Establishment Methods

The following three schemes are available for the establishment of bus terminals:

(1) To have the central and/or local governments establish bus terminals, in the recognition that terminals are public facilities, and to have bus companies only defray the cost of terminal operation through the payment of terminal use charges. This scheme has only exceptional precedents in the Philippines and will require increases in the public investment fund budget of the government, and, therefore, the application of this scheme will be difficult.

(2) To have city bus company (ies) establish bus terminals. This scheme will result in the bus company passing the cost of terminal construction onto the passenger in the form of bus fares, and, therefore, cannot be adopted.

(3) To have a semi-government (semi-private) organization established, which will be charged with the responsibility and authority of establishing not only bus terminals but also of developing commercial facilities suited for locating on the premises of bus terminal, and to have bus companies defray the cost of terminal maintenance through the payment of terminal use charges. The terminal organization (company) is to fund the construction cost of the terminals with the revenue receipts from the commercial facilities.

Bus terminal, being a place where people will gather, will be an ideal site for locating commercial facilities. Depending on the social classes and trip purposes of the people who gather at the terminal, the following commercial facilities will be generally desirable for location on the terminal premises:

a) Department stores, supermarkets

b) Display room (foreign manufacturers, domestic importers)

c) Hotels, restaurants

d) Bowling centers

e) Night clubs, disco clubs

f) Offices for rent

The locating of such commercial facilities will be suitable only to bus terminals which are located in commercial/business districts, particularly those which serve a substantial number of passengers each day.

7.6.3 City Bus Terminal Financial Analysis

The financial evaluation of bus terminal, discussed in detail in Chapter 9, is summarized as follows:

While judgment as to whether bus terminal is financially feasible or not must await the result of a full feasibility study, a simple analysis is done here, assuming that only terminal operation cost is paid for by terminal use charges, based on the conditions and assumptions discussed in the above. This analysis measures the magnitude of impact of terminal use charge on bus company, in order to determine whether or not the terminal operating cost may be borne by bus fare.

As the condition of this analysis, the following terminal development schedule is assumed. That is, a part of the central terminal and the most of terminals in Bunawan and Toril, are to be constructed by the time of bus operation commencement. Subsequently, in pace with bus route expansion, the first phase of central terminal expansion is done and Panacan and Talomo terminals are to be completed by 1990. Then, the second phase expansion of the central terminal and the construction of terminals in Cabantian, Ecoland, and Ma-a will be accomplished (see Table 7.18).

Table 7.18 Investment Schedule of City Bus Terminal Project

LOCATION OF TERMINAL	TOTAL COST (₱Million)	CONSTRUCTION SCHEDULE							
		1984	'88	'89	'91	'92	'94	'96	'97
CENTRAL TERMINAL	56.8	7.1		21.3				28.4	
BUNAWAN	5.1	5.1							
PANAKAN	5.4		5.4						
CABANTIAN	1.5					1.5			
PAMPANGA	2.2								2.2
MA-A	1.2						1.2		
ECOLAND	2.9				2.9				
TALOMO	7.9		7.9						
TORIL	5.7	5.7							
TOTAL	88.7								

Note: Bus terminal cost includes land acquisition and compensation costs.

Bus terminal operating cost, consisting of personnel expense, building maintenance cost, and utilities, amount to 1.7 million pesos at the time of inception and 4.5 million pesos in the year 2000.

Terminal operating cost at the time of bus operation commencement will amount to 0.016 pesos per passenger-kilometer and 3,213 pesos per bus per month, and that in 2000, to 0.004 pesos per passenger-kilometer and 841 pesos per bus per month. As it was discussed with regard to the bus project, this magnitude of terminal operating cost, if passed onto the bus company, will not appreciably suppress the excellent profitability of the bus company, and therefore, it is financially feasible that the cost be collected from the bus company.

7.7 Recommendations on Public Transportation Administration

7.7.1 Major Issues

Improvement of public transportation system in local cities in the Philippines is one of the major policies for the decentralization of population and development of growth pole in the local area.

In the near future local cities and towns will request MOTC and MPWH for assistance in conducting a transportation study and to implement their projects such as PUJ rerouting plan and city bus introduction plan like Davao and Cebu City.

To cope with these necessities, the following items will be regarded as their shortcomings:

i) Difficulties to conduct the study and formulate the projects on urban transportation especially public transportation by their own capacity.

ii) Shortage of proper channel to inform the situation of transportation condition and project of local cities to the central government and at the same time, shortage of policy-formulating-function in central government regarding improvement of public transportation system in local cities.

iii) Although the franchise system is one way to control the public transportation plan, franchise issuance system has some problems such as:

a) Inadequate basis for evaluation of application.

- Lack of standard or forms for evaluation
- Provincial Authority processing requires no hearing
- No thorough evaluation of Certificate of Public Convenience (CPC) application before hearing.

b) No requirements for submission of all necessary documents upon filing of application

c) Weak monitoring of franchisee's opinions

d) Need to improve certain forms in use

e) Inadequate safeguard to BOT seal and copies of authorities/decisions forwarded to BLT

f) Non observation of policies to raffle off applications.

Conclusively, the franchise system does not function as a planning tool of local city's public transport plan.

7.7.2. Proposed New Organization and It's Function

Consequently, the new organization, of which functions in general are leading/teaching the measures of study and planning on public transportation, formulating the policy and strategies to promote the public transport improvement in local cities, and coordinating various agencies concerned, is likely to be established in MOTC. As these planning, however, are closely related to other agencies such as MPWH, CHPG and so forth, certain part of the new organization should be under supervision by the agencies concerned.

New organization will be established under the planning service of MOTC to be named Division of Urban Transportation and special projects office specially for foreign assisted projects under the steering committee of agencies concerned.

This division has four sections such as:

a) Technical service section
b) Plan evaluation section
c) Policy formulating section
d) Implementation section

Functions of each section:

a) Technical Service Section

- to assist the local officials in conducting traffic survey, analysis and plan preparation
- to collect the information of urban transport project in local cities through above mentioned activities.

b) Plan evaluation Section

- to evaluate the urban transportation plans and the projects proposed by local officials
- selection and prioritization of projects to be adopted and to decide which will be given some form of subsidy.

c) Policy Formulating Section

- To formulate policy and strategy of Urban Transport System improvement in local cities based on the information and Data of the other three sections.
- Special projects office conducts the comprehensive transportation study on major local cities assisted by foreign governments like Davao and Cebu City.

d) Implementation Section

- to study suitable subsidy system on promotion of Public Transport Improvement, to supply necessary subsidy according to the request of the local government upon recommendation of Plan Evaluation Section.

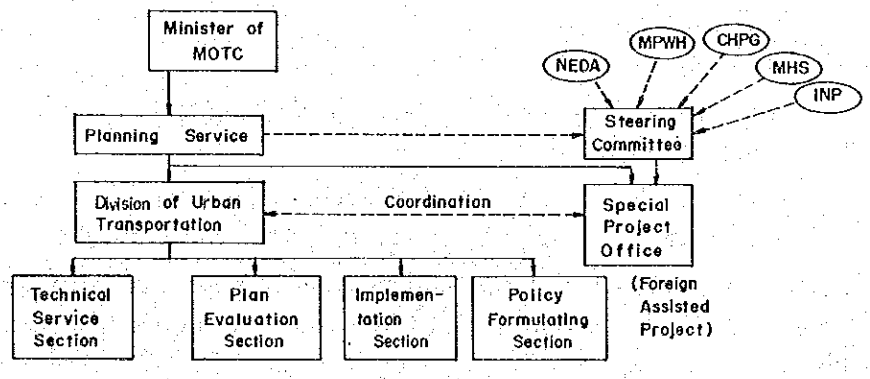


Figure 7.20 Creation of Division of Urban Transportation in MOTC

7.7.3. Coordination with Local Government and BOT Planning Section on Issuance of Franchise

Some problems regarding franchise system at present are expected to be straightened in the near future.

At the same time it is recommendable that the new policy for franchise should be adopted as follows:

Way of issuance of franchize for public transportation modes are divided into 3 categories based on the city scale such as large, Medium and Small cities and towns.

Table 7.19 Classification of Franchise Issuance

	Large and Medium City	Small City and Town
BUS	◎	◎
PUJ	◎	○
TRICYCLE	△	△
PU	□	□

Category No. 1. (shown with ◎ in Table)

BOT franchise for public transport modes belonging to category No. 1 will designate their service routes and allocation of required number of units based on the recommendations of local government.

Category No. 2 (shown with ○ in Table)

BOT franchise for PUV in Category No. 2 will designate the origin and destination of the PUV routes and number of units based on the recommendation by the local government. Consequently, the local government should decide the route between origin and destination mainly in the built-up area (Poblacion).

Category No. 3 (shown with △ in Table)

The local government will issue the franchize and designate the service areas.

Category No. 4 (shown with □ in Table)

The local government will issue only the franchize without designation of service routes or areas.

Local government having PUV modes belonging to category No. 1 and No. 2 should prepare the PUV route and allocation in their own plan and their recommendations for BOT franchise.

Planning for routing of PUV Modes, the coordination between local government and BOT and/or MOTC is necessary in both technical and administrative aspects.

Local government are recommended to provide the coordinating agency as for improvement of Urban Transport System especially for public transport system in their city or town, such as the executive committee of Cebu City PUJ rerouting and DCTTMC in Davao City.

CHAPTER 8 INVESTMENT PROGRAM

Tables and Figures

CHAPTER 8

INVESTMENT PROGRAM

8.1 Projects in Masterplan

8.1.1 Project Variety

The Masterplan consists of the following kinds of projects:

(1) Regional development projects

(2) Transportation projects

Then, the transportation projects are of the following three kinds:

- Road projects
- Public transport projects
- Traffic management projects

Regional development projects represent those which have been selected from among the existing land use plans for their strategic importance, and they are consequential in determining the justification of, and the appropriate time for implementation of, individual transportation projects. Among transportation projects, road projects pertain to traffic "hardware" (so to speak), while the other two kinds pertain to the "software" for the utilization of that hardware. The three kinds of transportation projects are organically interrelated and are mutually supplemental in that the conditions of one define the others.

In this Sub-Chapter, various plans discussed in the above are to be brokendown into project components and the components arranged into a project list in accordance with the above classification of the kinds of projects.

8.1.2 Regional Development Projects

Following are the regional development projects, which are strategically important to the realization of land use plans:

• Commercial Center	Bunawan	55 ha.
	Panakan	60 ha.
	Poblacion	350 ha.
	Ecoland	150 ha.
	Talomo	50 ha.
	Toril	60 ha.
	Total	725 ha.
• Industrial Estates	Bunawan	160 ha.
	Panakan	260 ha.
	Sasa	50 ha.
	Agdao	15 ha.
	Ma-a	10 ha.
	Daliao	30 ha.
	Lizada	40 ha.
	Total	565 ha.

• Academic Town	Tibungco	80 ha.
	Talomo	70 ha.
	Total	150 ha.
• Government Facilities	Baliok	5 ha.
• Sport Center	Ma-a	10 ha.
• Bucana Island Development		150 ha.
• New CBD Development Roxas Avenue		
• Port Development	Sasa, Sta. Ana Industrial Ports	

Of these, Bucana Island Development and New CBD Development are composites of commercial, housing, and other varieties of land use and will have significant impacts on the future prosperity of Poblacion area.

8.1.3 Road Projects

Road project components are presented in Figure 8.1 and Table 8.1. The projects cover 25 sections of new road (30 construction stages) and the upgrading/improvement of 40 sections of the existing roads (47 construction stages). Of the new roads, those which are long and important are North Diversion Road, Ring Road, and Coastal Road. All others are short distance link roads for the facilitation of smooth traffic flow in urban area and between major roads. Upgrading/improvement projects cover practically all roads existing in the Project Area, particularly important of which is the development of Davao-Agusan/Davao-Cotabato Road into a trunk highway traversing the City of Davao.

8.1.4 Public Transport Projects

Public transport projects aim at the introduction of buses as the mode of trunk service. The projects are:

- Establishment and Operation of Bus Company
  - Procurement of Bus Units

Bus Fleet Size	
50 units	1985
200 units	1990
500 units	2000

  - Construction of Supporting Facilities

• Northern Bus Base	2.1 ha. for 240 units
• Southern Bus Base	2.3 ha. for 260 units
• Office	Land 0.1 ha., Floor 60 m^2
• Miscellaneous	Bus Stop per 500 m

- Construction of Bus Terminals
  - Central Bus Terminal — 66 Berths, 4.0 ha.
  - Local Bus Terminal

• Bunawan	20 Berths, 1.0 ha.
• Panakan	22 Berths, 1.0 ha.
• Cabantian	4 Berths, 0.2 ha.

	• J.P. Laurel/Davao – Agusan Road Intersection	7 Berths, 0.3 ha.
	• Ma-a	3 Berths, 0.2 ha.
	• Ecoland	6 Berths, 0.5 ha.
	• Talomo	29 Berths, 1.4 ha.
	• Toril	20 Berths, 1.0 ha.
• PUJ Rerouting	Modification of PUJ Route after Introduction of Buses	

8.1.5 Traffic Management Projects

Traffic Management projects cover the following:

• Improvement of Miner Intersection	Poblacion,	15 points
• Traffic Signal	Poblacion,	66 points
• Six Lane Road Traffic Control		9.6 km.
• Roxas Avenue Traffic Control	0.9 km,	30 ha.
• CBD Environmental Area	Poblacion,	2 districts (105 ha., 95 ha.)
• CBD Parking Facility	• Off-Street Pay Parking 3.6 ha. for 1,200 lots	
	• On-Street Pay Parking 1.7 km. for 300 lots	
	• Off-Street Private Parking 72.9 ha. for 24,300 lots	
• CBD One-Way Operation	• A. Pichon – San Pedro • C.M. Recto – C. Bangoy • R. Magsaysay – Sta. Ana	
• Bus Priority Lane	9.6 km.	

These traffic management projects, most of which pertain to Poblacion, should be implemented concurrently with other (road, public transport) projects, provided that, in the case of new road construction and existing road upgrading/improvement, traffic management projects should be included in the particular road project starting from the stage of designing. In fact, intersection improvement and other traffic management projects treated here and are rather urgently needed ones and such actions which can be taken as a part of future road projects are not considered here.

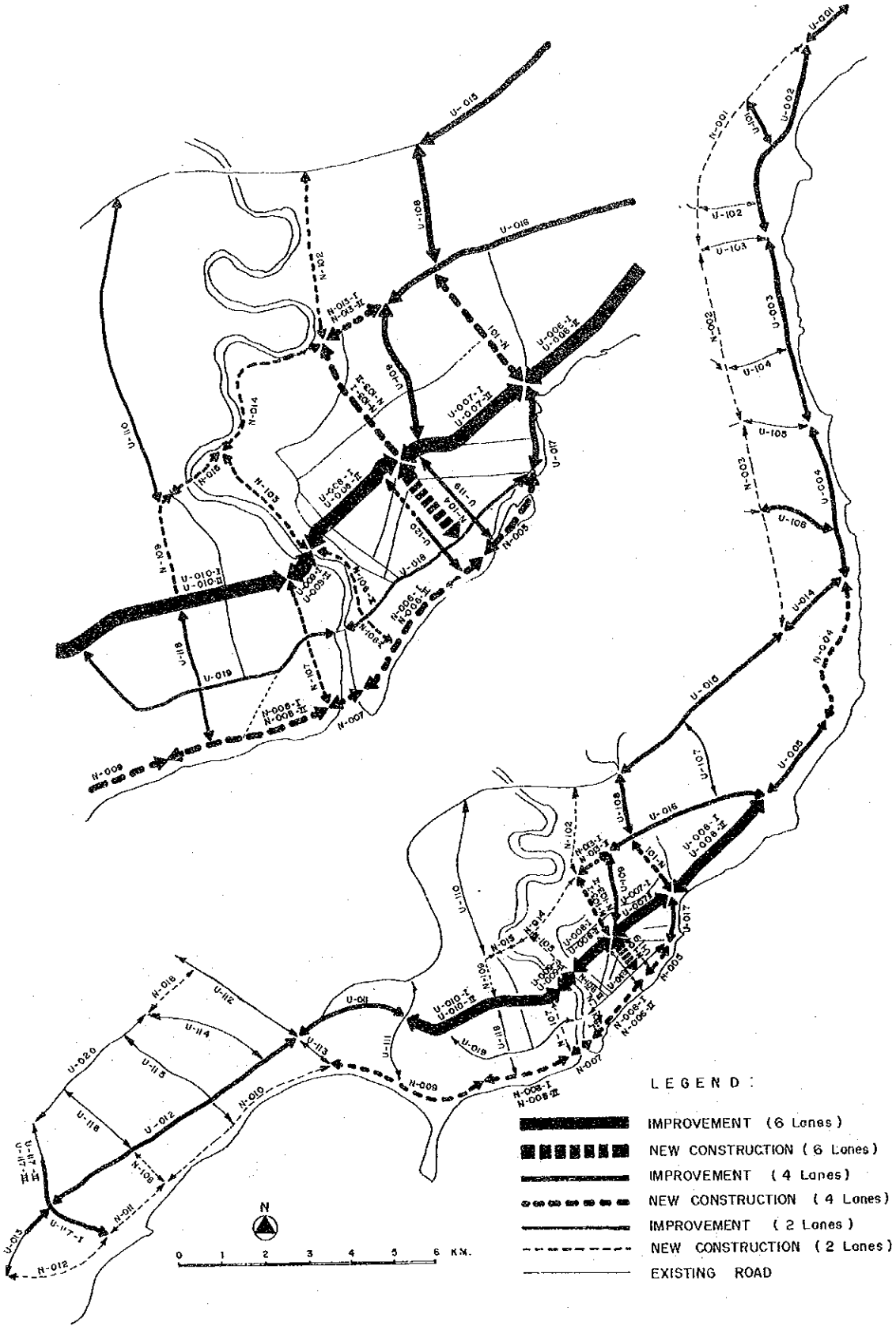


Figure 8.1 Project Components Map

Table 8.1 Road Project List (1)

Squ No.	Project No.	PROJECT TITLE	PROJECT DESCRIPTION	ESTIMATED COST (In Million P)			
				Construc-tion	Land/Ac-quisition	Property Compen-sation	Total
		CONSTRUCTION OF NORTH DIVERSION ROAD	Construction of about 14.8 kms. of new road running almost parallel to and about 1.5 kms. west of Davao-Agusan Road and diverting from existing Diversion Road at Panacan andmerging into Davao-Agusan Road at Lasang.				
1	N-001	: Bunawan Section	— Construction of about 6.0 kms. of 2-lane road between Davao/Agusan Road and Mahayag/Calinan Road including about 400 meters of bridges	39.6	5.4	—	45.0
2	N-002	: Tibungo Section	— Construction of about 4.0 kms. of 2-lane road between Mahayag/Calinan Road and Ilang including about 400 meters of bridges	33.1	3.6	—	36.7
3	N-003	: Panacan Section	— Construction of about 4.8 kms. of 2-lane road between Ilang and Existing Diversion Road including about 350 meters of bridges	33.2	4.3	—	37.5
4	N-004	CONSTRUCTION OF SASA SECTION OF DAVAO-AGUSAN ROAD	Construction of about 3.9 kms. of a 4-lane divided road starting at Davao-Agusan Road/Airport Road intersection, by passing SASA PORT AREA and ending at Diversion Road. The project includes construction of about 1.3 kms. of a new road, widening of about 2.6 kms. of existing Airport Road and Davao-Agusan Road and construction of sidewalks on both sides.	18.0	11.0	2.8	31.8
		CONSTRUCTION OF COASTAL ROAD	Construction of about 20.5 kms. of road running along Davao Gulf, starting at 1.5 kms. south of LIPADAS Bridge and ending at R. Magsaysay Park.				
5	N-005	: Piapi Section	— Construction of about 1.3 kms. of a 4-lane divided road passing through the reclamation area (Bucana Island) between Magsaysay Park and Piapi including construction of sidewalks on both sides.	14.7	7.8	1.0	23.5
	N-006	: Bucana Section	— Construction of about 1.9 kms. of a 4-lane divided road passing through the reclamation area (Bucana Island) between Piapi and Davao River including construction of sidewalks on both sides.				
6	— I	Phase — I	(Construction of Western half of the section)	7.3	6.3	1.0	14.6
7	— II	Phase — II	(Construction of Eastern half of the section)	6.5	6.2	1.0	13.7
8	N-007	: Bucana Bridge	— Construction of about 360 meters of a 4-lane bridge with sidewalks on both sides crossing Davao River at the river mouth.	56.5	—	—	56.5

Table 8.1 Road Project List (2)

Squ No.	Project	PROJECT TITLE	PROJECT DESCRIPTION No.	ESTIMATED COST (In Million P) Construction	Land/Acquisition	Property Compensation	Total
	N-008	: Ecoland Section	– Construction of about 2.2 kms. of a 4-lane divided road passing along the south side of a proposed Ecoland Commercial Center between Davao River and the Times Beach. The project consists of construction of about 1.2 kms. of a new road, widening and paving of about 1.0 km. of the existing 2-lane gravel road and construction of sidewalks of both sides				
9	– I	Phase – I	(Widening and paving of existing road Section)	5.1	1.2	–	6.3
10	– II	Phase – II	(Construction of new road Section)	8.6	4.9	–	13.5
11	N-009	: Matina Aplaya Section	– Construction of about 4.2 kms. of a 4-lane divided road between the Times Beach and the Ulas-Talomo Beach Road. The project consists of construction of about 1.8 kms. of a new road, widening and paving of about 2.4 kms. of the existing gravel road and construction of sidewalks on both sides	20.4	12.3	1.2	33.9
12	N-010	: Talomo Section	– Construction of about 4.6 kms. of 2-lane road between Ulas-Talomo Beach Road and GBBC – Greenhills Village Road	10.2	4.1	0.8	15.1
13	N-011	: Dumoy Section	– Construction of about 2.4 kms. of 2-lane road between GBBC – Greenhills Village Road and Daliao – Lubogan Road. The project consists of construction of about 1.2 kms. of a new road and improvement of about 1.2 kms. of the existing gravel road.	5.0	1.8	1.0	7.8
14	N-012	: Lizada Section	– Construction of about 3.6 kms. of a 2-lane road between Daliao-Lubogan Road and Davao-Cotabato Road. The project consists of construction of about 2.6 kms. of a new road and improvement of about 1.0 km. of the existing gravel road.	7.8	2.9	1.5	12.2
		CONSTRUCTION OF J.P LAUREL EXTENSION	Construction of about 3.2 kms. of a new road diverting from J.P. Laurel Avenue at Redemptorist Church, running about 1.3 to 1.5 kms. north of Quirino Avenue and ending at Davao River.				
	N-013	: Chinese Cemetery Section	– Construction of about 3.2 kms. of 4-lane road between J.P. Laurel Avenue and Jacinto Extension				
15	– I	Phase – I	(Construction of 2-lane road)	2.7	6.0	2.0	10.7
16	– II	Phase – II	(Widening to 4-lane road)	2.4	–	–	2.4

Table 8.1 Road Project List (3)

Squ No.	Project No.	PROJECT TITLE	PROJECT DESCRIPTION	ESTIMATED COST (In Million P)			
				Construc-tion	Land/Ac-quisition	Property Compen-sation	Total
17	N-014	: Riverside Section	– Construction of about 2.2 kms. of a 2-lane road between Jacinto Extension and Davao River	7.1	13.2	2.0	22.3
18	N-015	CONSTRUCTION OF NEW MA-A BRIDGE	Construction of about 150 meters of a 2-lane bridge on Davao River, linking J.P. Laurel Extension with New Ma-a Bridge DMP Road	12.8	–	–	12.8
19	N-016	CONSTRUCTION OF GBBC – GREEN-HILLS VILLAGE ROAD	Construction of about 1.0 km. of a 2-lane road linking GBBC-Lubogan Road with Ulas-Calinan Road	2.2	1.2	0.3	3.7
20	N-101	CONSTRUCTION OF DACUDAO AVENUE	Construction of about 1.7 kms. of 4-lane divided road between J.P. Laurel Avenue and R. Castillo St. including construction of sidewalks on both sides.	7.9	–	–	7.9
21	N-102	CONSTRUCTION OF ROLLING HILLS ROAD	Construction of about 2.1 kms. of a 2-lane road between Diversion road and J. P. Laurel Extension	4.6	9.5	–	14.1
	N-103	CONSTRUCTION OF JACINTO EXTENSION	Construction of about 1.6 kms. of a 4-lane road. The project consists of construction of about 0.8 km. of a new road, upgrading of about 0.8 km. of the existing 2-lane gravel road and construction of sidewalks on both sides.				
22	– I	Phase – I	(Construction of a 2-lane road and paving of the existing road)	3.7	7.2	2.4	13.3
23	– II	Phase – II	(Widening to a 4-lane road)	3.4	–	–	3.4
24	N-104	CONSTRUCTION OF ROXAS BOULEVARD	Construction of about 1.5 kms. of a 4-lane divided road with frontage roads on both sides. The project consists of construction of about 0.35 km. of a new road, upgrading of about 1.15 kms. of the existing 2-lane gravel road and construction of sidewalks on both sides.	10.9	8.8	4.0	23.7
		CONSTRUCTION OF RIVERSIDE ROAD	Construction of about 3 kms. of a 2-lane running along Davao River at Poblacion side between Coastal Road and J. P. Laurel Extension				
25	N-105	: Northern Section	– Construction of about 1.5 kms. of a 2-lane road between J. P. Laurel Extension and Bankerohan Bridge	5.3	10.5	2.0	17.8
	N-106	: Southern Section	– Construction of about 1.5 kms. of a 2-lane road between Bankerohan Bridge and Coastal Road				
26	– I	Phase – I	(Construction of a 2-lane road between Quezon Blvd., and Coastal Road)	2.0	2.0	1.0	5.0
27	– II	Phase – II	(Construction of a 2-lane road between Bankerohan Bridge and Coastal Road)	3.3	4.0	2.0	9.3

Table 8.1 Road Project List (4)

Squ No.	Project No.	PROJECT TITLE	PROJECT DESCRIPTION	ESTIMATED COST (In Million P)			
				Construc-tion	Land/Ac-quisition	Property Compen-sation	Total
28	N-107	CONSTRUCTION OF NEW MATINA ROAD	Construction of about 1.4 kms. of a 2-lane road between McArthur Highway and Coastal Road	3.0	3.4	1.0	7.4
29	N-108	CONSTRUCTION OF VILINDA VILLAGE ROAD EXTENSION	Construction of about 1.0 km. of a 2-lane road between Davao-Cotabato Road and Coastal Road	2.2	0.6	–	2.8
30	N-109	CONSTRUCTION OF MA-A ROAD EXTENSION	Construction of about 1.4 kms. of a 2-lane road between J. P. Laurel Extension and McArthur Highway	3.0	5.0	1.0	9.0
		UPGRADING OF DAVAO-AGUSAN ROAD	Upgrading of about 16.8 kms. of the existing 2-lane Davao-Agusan Road between Davao/Panabo Boundary and R. Castillo intersection excluding Sasa Section.				
31	U-001	: Lasang Section	– Widening of about 1.8 kms. of the existing road to a 4- lane divided road including construction of sidewalks on both sides between Davao/Panabo/boundary and Diversion Road (N-001) Intersection.	8.3	0.7	–	9.0
32	U-002	: Bunawan Section	– Widening of about 5.2 kms. of the existing road to a 4-lane divided road including construction of side-walks on both sides between Diversion Road (N-001) and Bunawan-Calinan Road	23.7	3.1	2.5	28.7
33	U-003	: Tibungco-Ilang Section	– Widening of about 4.4 kms. of the existing road to a 4-lane divided road including construction of side-walks on both sides between Bunawan-Calinan Road and Ilang-Diversion Road	19.5	5.3	4.6	29.4
34	U-004	: Panacan Section	– Widening of about 3.4 kms. of the existing road to a 4-lane divided road including construction of side-walks on both sides between Ilang-Diversion Road and Diversion Road (U104)	15.1	6.6	2.4	24.1
35	U-005	: Pampanga Section	– Widening of about 2.0 kms. of the existing road to a 4-lane divided road including construction of sidewalks on both sides between Airport Road and R. Castillo Street.	8.9	3.9	1.0	13.8
	U-006	UPGRADING OF R. CASTILLO STREET	Upgrading of about 3.2 kms. of the existing 2-lane between Dacudao Avenue and J. P. Laurel Avenue including widening to a 6-lane divided road with sidwalks on both sides.				
36	– I	Phase I	(Widening to a 4-lane road)	7.9	–	–	7.9
37	– II	Phase II	(Widening to a 6-lane road)	18.6	8.6	13.9	41.1

Table 8.1 Road Project List (5)

Squ No.	Project No.	PROJECT TITLE	PROJECT DESCRIPTION	ESTIMATED COST (In Million P)			
				Construction	Land/Acquisition	Property Compensation	Total
	U-007	UPGRADING OF LAPU-LAPU STREET	Upgrading of about 1.5 kms. of the existing 2-lane road between R. Castillo Street and J. P. Laurel Avenue including widening to a 6-lane divided road with sidewalks on both sides.				
38	– I	Phase – I	(Widening to a 4-lane road)	3.7	–	–	3.7
39	– II	Phase – II	(Widening to a 6-lane road)	8.7	13.5	45.9	68.1
	U-008	UPGRADING OF QUIRINO AVENUE	Upgrading of about 1.8 kms. of the existing 2-lane divided road between J. P. Laurel Avenue to Bankerohan Bridge including widening to a 6-lane divided road with sidewalks on both sides.				
40	– I	Phase – I	(Widening to a 4-lane road)	4.5	–	–	4.5
41	– II	Phase – II	(Widening to a 6-lane road)	10.4	16.4	32.5	59.3
	U-009	CONSTRUCTION OF BANKEROHAN BRIDGE	Construction of about 200 meters of two 3-lane bridges on Davao River connecting Quirino Avenue and Davao-Cotabato Road.				
42	– I	Phase – I	Construction of a 3-lane bridge)	22.2	–	–	22.2
43	– II	Phase – II	Construction of a 3-lane bridge)	20.1	–	–	20.1
		UPGRADING AND IMPROVEMENT OF DAVAO-COTABATO ROAD	Upgrading and improvement of about 14.7 kms. of the existing 2-lane road between Bankerohan Bridge and Sirawan				
	U-010	: Matina Section	– Upgrading of about 4.0 kms. of the existing 2-lane road between Bankerohan Bridge and Matina Aplaya – GSIS Road including widening to a 6-lane divided road with sidewalks on both sides				
44	– I	Phase – I	(Widening to a 4-lane road)	5.6	–	–	5.6
45	– II	Phase – II	(Widening to a 6-lane road)	23.2	6.8	4.2	34.2
46	U-011	: Bangkal Section	– Upgrading of about 2.8 kms. of the existing 2-lane road between Matina Aplaya – GSIS Road and Ulas – Calinan Road including widening to a 4-lane divided road with sidewalks on both sides.	12.9	2.8	2.4	18.1
47	U-012	: Ulas-Toril Section	– Upgrading of abour 3.9 kms. of the existing 2-lane road between Ulas-Calinan Road and Daliao –Lubogan Road including widening to a 4-lane divided road	18.1	3.1	2.2	23.4

Table 8.1 Road Project List (6)

Squ No.	Project No.	PROJECT TITLE	PROJECT DESCRIPTION	ESTIMATED COST (In Million P)			
				Construction	Land/Acquisition	Property Compensation	Total
48	U-013	: Toril-Sirawan Section	— Upgrading of about 6.7 kms. of the existing 2-lane road between Daliao-Lubogan Road and Sirawan including widening to a 4-lane divided road for 2.4 kms. and improvement of about 4.3 kms.	13.0	1.9	1.0	15.9
		UPGRADING OF DIVERSION ROAD	Upgrading of about 6.9 kms. of the existing 2-lane road between Davao-Agusan Road and Buhangin Road				
49	U-014	: Sasa Section	— Upgrading of about 1.8 kms. of the existing 2-lane road between Davao-Agusan Road and North Diversion Road including Widening to a 4-lane road	3.2	—	—	3.2
50	U-015	: Buhangin-Sasa Section	— Upgrading of about 5.1 kms. of the existing 2-lane road between North Diversion Road and Buhangin Road including widening to a 4-lane road	9.0	—	—	9.0
51	U-016	UPGRADING OF LANANG-BAJADA SECTION OF J. P. LAUREL AVENUE	Upgrading of about 4.0 kms. of the existing 2-lane between R. Castillo Street and Bajada including widening to a 4-lane road	7.0	—	—	7.0
52	U-017	UPGRADING OF L. GARCIA STREET	Upgrading of about 1.1 kms. of the existing 2-lane road between R. Castillo Street and Magsaysay Avenue including widening to a 4-lane divided road with sidewalks on both sides.	5.1	8.8	7.4	21.3
53	U-018	IMPROVEMENT OF QUEZON BOULEVARD	Improvement of about 2.1 kms. of the existing 2-lane divided road between Magsaysay Avenue and Bolton Bridge including replacement of the existing deteriorated pavement with P.C.C. pavement	3.8	—	—	3.8
54	U-019	IMPROVEMENT OF BOLTON DIVERSION ROAD	Improvement of about3.5 krns. of the existing 2-lane road between Bolton Bridge and Davao-Cotabato road including pavement of shoulders	1.5	—	—	1.5
55	U-020	IMPROVEMENT OF GBBC — LUBOGAN ROAD	Improvement of about 4.0 kms. of the existing 2-lane gravel road between Talomo-GBBC Road and Daliao-Lubogan Road including construction of P.C.C. pavement	7.8	—	—	7.8
56	U-101	UPGRADING OF BUNAWAN — SAN MIGUEL ROAD	Upgrading of about 1.3 kms. of the existing 2-lane gravel road between Davao-Agusan Road and North Diversion Road including widening to a 4-lane road	5.5	0.6	—	6.1
57	U-102	IMPROVEMENT OF FISHPOND — DIVERSION ROAD	Improvement of about 1.7 kms. of the existing 2-lane gravel road between Davao-Agusan Road and North Diversion Road including construction of P.C.C. pavement	3.3	0.5	—	3.8

Table 8.1 Road Project List (7)

Squ No.	Project No.	PROJECT TITLE	PROJECT DESCRIPTION	ESTIMATED COST (In Million P)			
				Construc-tion	Land/Ac-quisition	Property Compen-sation	Total
58	U-103	IMPROVEMENT OF BUNAWAN – CALINAN ROAD	Improvement of about 1.7 kms. of the existing 2-lane gravel road between Davao-Agusan Road and North Diversion Road	3.3	0.5	–	3.8
59	U-104	IMPROVEMENT OF TIBUNGCO – DIVERSION ROAD	Improvement of about 1.6 kms. of the existing 2-lane gravel road between Davao-Agusan Road and North Diversion Road including construction of P.C.C. pavement	3.1	0.5	–	3.6
60	U-105	IMPROVEMENT OF ILANG – DIVER-SION ROAD	Improvement of about 1.7 kms. of the existing 2-lane gravel road between Davao-Agusan Road and North Diversion Road including construction of P.C.C. pavement	3.3	0.5	–	3.8
61	U-106	UPGRADING OF PANACAN – DIVERSION ROAD	Upgrading of about 1.7 kms. of the existing 2-lane gravel road between Davao-Agusan Road and North Divserion Road including widening to 4-lane road	7.1	1.3	–	8.4
62	U-107	IMPROVEMENT OF BELISARIO ROAD	Improvement of about 2.3 kms. of the existing 2-lane gravel road between J. P. Laurel Avenue and Diversion Road including construction of P.C.C. pavement	4.4	1.2	–	5.6
63	U-108	UPGRADING OF BUHANGIN ROAD	Upgrading of about 1.5 kms. of the existing 2-lane road between J.P. Laurel Avenue and Diversion Road including widening to a 4-lane road with sidewalks on both sides	6.4	1.5	1.2	9.1
64	U-109	UPGRADING OF BAJADA SECTION OF J.P. LAUREL AVENUE	Upgrading of about 1.8 kms. of the existing 2-lane road between J.P. Laurel Extension and Quirino Avenue including widening to a 4-lane road	3.2	–	–	3.2
65	U-110	IMPROVEMENT OF NORTHERN SECTION OF MA-A ROAD	Improvement of about 3.6 kms. of the existing 2-lane gravel road between Diversion Road and New Ma-A Bridge – DMP Road including construction of P.C.C. Pavement	7.0	–	–	7.0
66	U-111	IMPROVEMENT OF MATINA APLAYA – GSIS ROAD	Improvement of about 2.3 kms. of the existing 2-lane gravel road between Coastal Road and Diversion Road including cons-truction of P.C.C. pavement	4.4	1.6	0.6	6.6
67	U-112	IMPROVEMENT OF ULAS – CALINAN ROAD	Improvement of about 2.3 kms. of the existing 2-lane road between Davao-Agusan Road and GBBC – Greenhills Village Road	4.4	–	–	4.4
68	U-113	IMPROVEMENT OF ULAS – TALOMO BEACH ROAD	Improvement of about 0.5 km. of the existing gravel road and construction of about 0.5 km. of 2-lane road between Davao-Cotabato Road and Coastal Road	2.1	1.4	1.0	4.5
69	U-114	IMPROVEMENT OF TALOMO – GBBC ROAD	Improvement of about 2.7 kms. of the existing gravel road between Davao-Agusan Road and GBBC – Lubogan Road including construction of P.C.C. pavement	5.3	1.4	–	6.7

Table 8.1 Road Project List (8)

Squ No.	Project No.	PROJECT TITLE	PROJECT DESCRIPTION	ESTIMATED COST (In Million P)			
				Construction	Land/Acquisition	Property Compensation	Total
70	U-115	IMPROVEMENT OF SAN ANTONIO – BAGO GALLERA ROAD	Improvement of about 3.3 kms. of the existing gravel road between Coastal Road and GBBC – Lubogan Road including construction of P.C.C. pavement	6.4	1.7	0.8	8.9
71	U-116	IMPROVEMENT OF VILINDA VILLAGE ROAD	Improvement of about 2.2 kms. of the existing gravel road between Davao-Agusan Road and GBBC – Lubogan Road including construction of P.C.C. pavement	4.3	1.1	0.6	6.0
	U-117	UPGRADING OF DALIAO - LUBOGAN ROAD	Upgrading of about 3.6 kms. of the existing road between Coastal Road and GBBC – Lubogan Road including widening to a 4-lane road with sidewalks on both sides				
72	– I	Phase – I	(Widening to a 4-lane road between Davao-Agusan Road and Coastal Road)	6.5	2.2	1.6	10.3
73	– II	Phase – II	(Improvement of the existing 2-lane road between Davao–Agusan Road and GBBC – Lubogan Road)	4.0	–	–	4.0
74	– III	Phase – III	(Widening to a 4-lane road between Davao-Agusan Road and GBBC-Lubogan Road)	6.1	2.2	1.6	9.9
75	U-118	IMPROVEMENT OF ECOLAND ROAD	Improvement of about 1.6 kms. of the existing road between McArthur Highway and Coastal Road.	3.1	–	–	3.1
76	U-119	IMPROVEMENT OF E. JACINTO STREET	Improvement of about1.3 kms. of the existing 2-lane road between E. Quirino Avenue and Quezon Boulevard and Construction of about 0.2 kms. of 2-lane road between Quezon Blvd. and Coastal Road.	5.0	0.8	1.0	6.8
77	U-120	IMPROVEMENT OF A. MABINI EXTENSION	Improvement of about 0.6 kms. of the existing 2-lane road and construction of about 0.9 km. of a 2-lane between E. Quirino Avenue and Coastal Road	5.0	13.2	27.1	45.3
		TOTAL		726.9	256.9	183.5	1,167.3

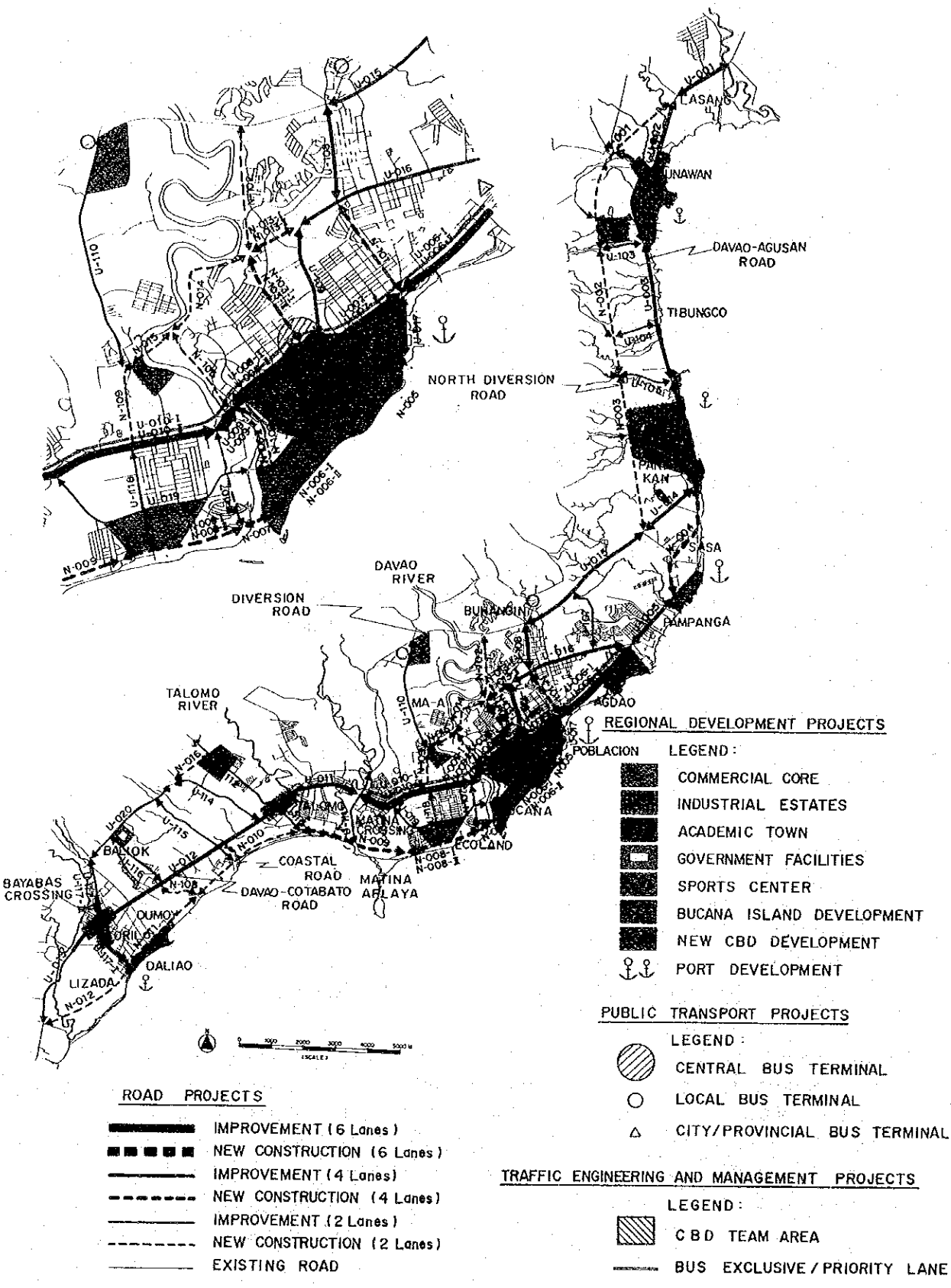


Figure 8.2 Project Components

8.2 Project Packages

8.2.1 Purpose and Method of Packaging

The Masterplan consists of multitude of projects, and its implementation will require a long period of time and a huge amount of funds. It is nearly impossible to process the entire Masterplan projects altogether, and it is strategically sensible to breakdown the Plan into core packages of projects and to re-structure the Plan on the basis of such project packages.

Each project package is considered to be a group of projects which satisfy the following:

- That they are interrelated in terms of logic
- That they belong to certain geographical group or are physically continuous
- That they are to be implemented about the same time

However, the selection of projects in the satisfaction of all of the above conditions would result in too few a project components per each package. Therefore, the first two (logic and space) are emphasized on for project packaging, leaving the time factor up to phasing.

8.2.2 Area Project Packages

All of the regional development, road public transport, and traffic management projects are divided into eight groups of projects which are interrelated with each other in terms of both logic and space.

1. Traffic Core Development
2. New CBD Development
3. Poblacion Urban Transport Improvement
4. Bucana Island Development
5. Bunawan/Panakan/Sasa Development
6. North Diversion Road Development
7. Davao-Cotabato Road Development
8. Talomo-Toril Coastal Area Development

Table 8.2 enumerates project components which belong to each group. Each group include "hardware" projects for the construction of facilities and "software" projects as the technique for utilizing the facilities. They are mutually supplemental to each other and, effective regional development will be impossible when either one of them is missing.

Each of these project groups can in itself be considered of as an independent project package. However, because (1) some of the groups geographically overlap with each other, (2) when divided into phases, project scales become very small, and (3) sufficiently large groups of projects—large enough to be evaluation units—must be available for the purpose of economic evaluation based on assigned traffic (see Chapter 9), these eight project groups are arranged into three area packages: Poblacion, North Project Area, and South Project Area. The composition of the three area packages are as follows:

A. Poblacion
    1. Traffic Core Development
    2. New CBD Development
    3. Poblacion Urban Transport Improvement
    4. Bucana Island Development

B. North Project Area
    5. Bunawan/Panakan/Sasa Development
    6. North Diversion Road Development

C. South Project Area
    7. Davao-Cotabato Road Development
    8. Talomo-Toril Coastal Area Development

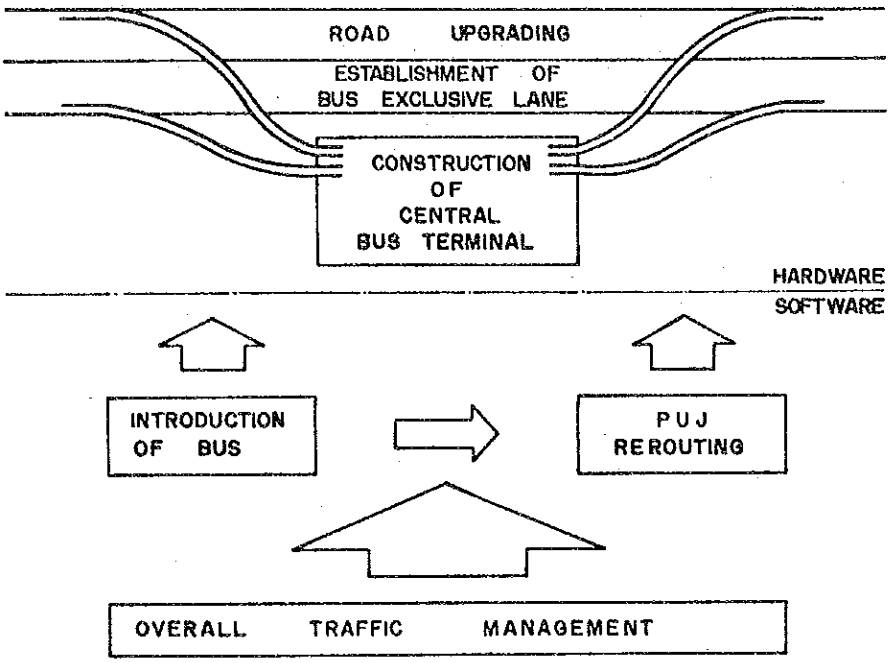


Figure 8.3 Interrelationship among Projects Grouped in a Package — Traffic Core Development (Example)

8.2.3 Road Project Packages

All of regional development, road, public transport, and traffic management projects are included in these three area packages without exception and without overlapping. However, because the packages are geographically confined, long continuous road projects are broken into or cross over more than one package. Therefore, in view of the nature and the continuity of roads, packages consisting only of road projects are created separately from area packages. Four road project packages have been created:

A. Davao Traverse Road
B. Coastal Road
C. Ring Road
D. North Diversion Road

Table 8.2 List of Area Project Packages

NAME OF PROJECT PACKAGE	PROJECT COMPONENTS INCLUDED	CORRESPONDING ROAD SECTIONS
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	U006 (I, II), U007 (I, II) U008 (I, II), U009 (I, II) U010 (I, II), U016, U109
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	N 104, U 119, U120
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	N013 (I, II), N 014, N015, N109, U118, U019, U018, U017, N101, N103 (I, II), N105, N102, U110
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	N 005, N006 (I, II), N007, N008 (I, II), N106, (I, II), N107
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	U 001, U002, U003, U004, N004, U 005, U103, U106
6. North Diversion Road Development	o Road Construction/Upgrading	N001, N002, N003, U014, U015, U108, U107, U101, U102, U104, U105
SOUTH PROJECT AREA		
7. Davao-Cotabato Road Development	o Road Construction/Upgrading o Development of Talomo Academic Town o Development of Government Buildings	U011, U012, U013, U112, U115, U114, U116, U117, (II, III), U020, N016
8. Talomo – Toril Coastal Area Development	o Development of Industiral Estates – Lizada – Daliao o Road Construction/Upgrading	N009, N010, N011, N012, U111, U113, U117 (I), N108

Among these, Davao Traverse Road and Coastal Road represent continuous roads extending beyond the physical limits of area packages. Particularly, Davao Traverse Road package aims at the upgrading/improvement of existing roads into a trunk highway which will go through and serve all three of North Project Area, Poblacion, and South Project Area; when completed, this highway will, judging from its function and geographical extension, bring substantial impact on the future development of Davao City. Coastal Road, Ring Road, and North Diversion Road are to supplement the function of this Traverse Road in South Project Area, in Poblacion and in North Project Area, respectively, and at the same time, disperse various developmental effects to an areal expansion. A part of Coastal Road constitute a part of Ring Road.

Table 8.3 List of Road Project Packages

NAME OF PROJECT PACKAGE	ROAD SECTIONS
A. DAVAO TRAVERSE ROAD DEVELOPMENT	U001, U002, U003, U004, N004, U005, U006, (I, II), U007 (I, II) U008 (I, II), U009 (I, II), U010 (I, II), U011, U012, U013.
B. COASTAL ROAD CONSTRUCTION	N005, N006 (I, II), N007, N008 (I, II), N009, N010, N011, N012, N106 (I, II), N107, U111, U113, U117, (I), N108
C. RING ROAD DEVELOPMENT	N013 (I, II), N014, N015, N109, U118, N008 (I, II), N007, N006 (I, II), N005, U017, N101, N103, (I, II), N105, N102
D. NORTH DIVERSION ROAD CONSTRUCTION	N001, N002, N003, U014, U015 U108, U107, U101, U102, U104 U105, U103

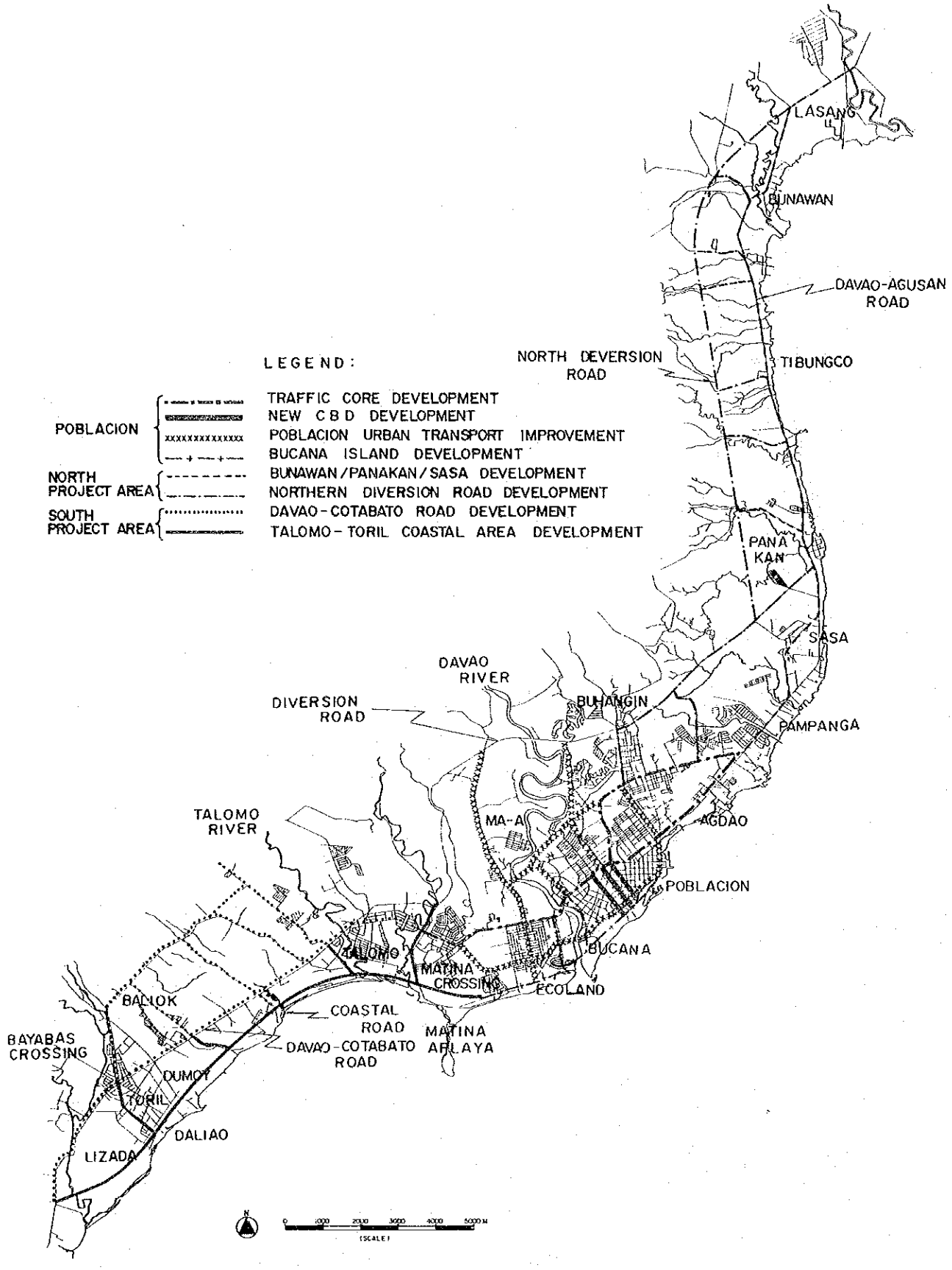


Figure 8.4 Area Project Packages

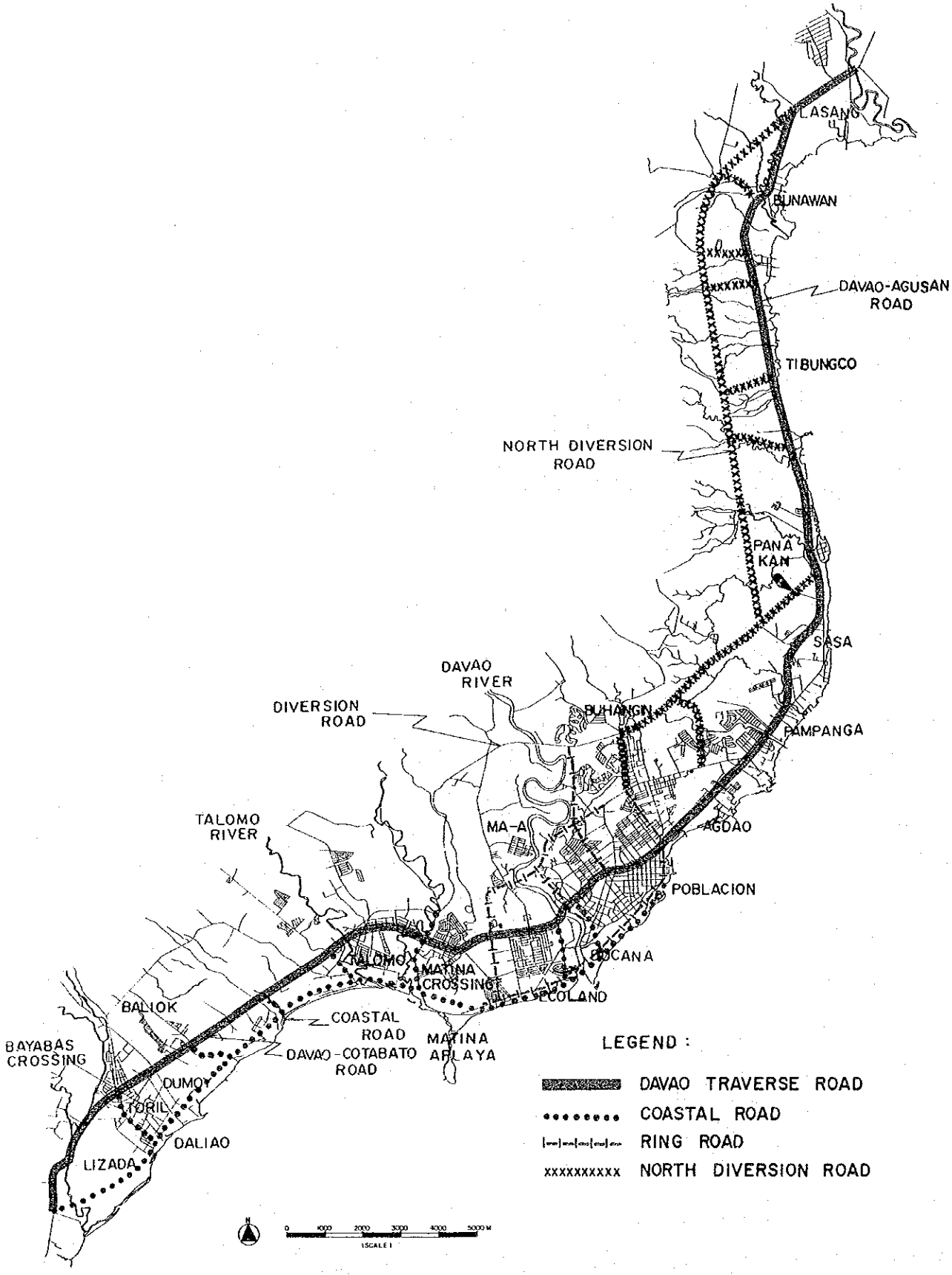


Figure 8.5 Road Project Packages

8.3 Project Implementation Schedule and Required Investment

8.3.1 Implementation Schedule of Regional Development Projects

The implementation schedule of regional development projects is governed by land use plans and, in turn, socio-economic framework.

In land use planning, estimated, by zones and for 1990 and for 2000, were night population, day population, the numbers of persons at work in the primary, secondary, and tertiary industries, respectively, as counted at their residence and as counted at the place of their work, and the numbers of students as counted at their residence and as counted at their school (see Volume IV 4.1). These indicators, as estimated, roughly determined the distribution of commercial, industrial, residential, and educational areas. Now, the regional development implementation schedule, shown in Table 8.4, has been established basically in accordance with such indicators and in consideration of strategic interrelation between industrial estates (see Volume IV 3.3) and the need of developing commercial cores in pace with the expansion of residential area.

Parts of the Project Area where development will progress the earliest will be Panacan, Agdao, Ma-a, and Toril, followed by Sasa and Bunawan; the development of Talomo will be relatively late. The development of Poblacion/Ecoland will continue for a long time. Overall, Poblacion area (including Agdao, Ma-a, and Ecoland), Panacan, and Toril will become urban cores first. Then, Bunawan, Sasa and Talomo will join them to finally form a multi-core urban complex.

Regional development projects are pre-condition to the implementation of road, public transport, and traffic management projects. These transportation projects make sense only when supported by the endorsement of regional development projects. As such, regional development project implementation schedule can readily be translated into transportation project implementation schedule. Although regional development projects are essential pre-condition to transportation projects and are important element of the Masterplan, the Plan does not establish detail schedule for the implementation of, or estimate the amount of investment funds necessary for, the regional development projects, because evaluation is done only of transportation projects.

Table 8.4 Schedule of Regional Development Projects

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)				

8.3.2 Project Package Implementation Schedule

When, for instance, a regional development project is to be implemented for certain area facing a road, that road must be accordingly upgraded/improved at about the same time, and related public transport and traffic management projects must be implemented concurrently with that road project. Therefore, the determination of a regional development project implementation schedule practically results in the determination of area project package implementation schedule. Such schedule by the sections of road, based on and translated from regional development project implementation schedule, is presented in Figure 8.6. The amounts of required investment funds indicated for Phase I (1981-1985), Phase II (1986-1990), and Phase III (1991-2000) represent only the cost of road projects implementation (for the reasons stated in Chapter 9).

Figure 8.7 presents the implementation schedule (which naturally is simultaneous with area package implementation schedule) and the amount of investment fund required in each phase by road project package.

A review of investment schedule for each package reveals that, aside from relatively even fund requirement distribution throughout the Phases in cases of North Project Area package and Davao Traverse Road package, most packages require continuously greater amounts of investment funds as the phase progresses—which trend coincides with that of the available amount of public investment fund estimated in Chapter 5.

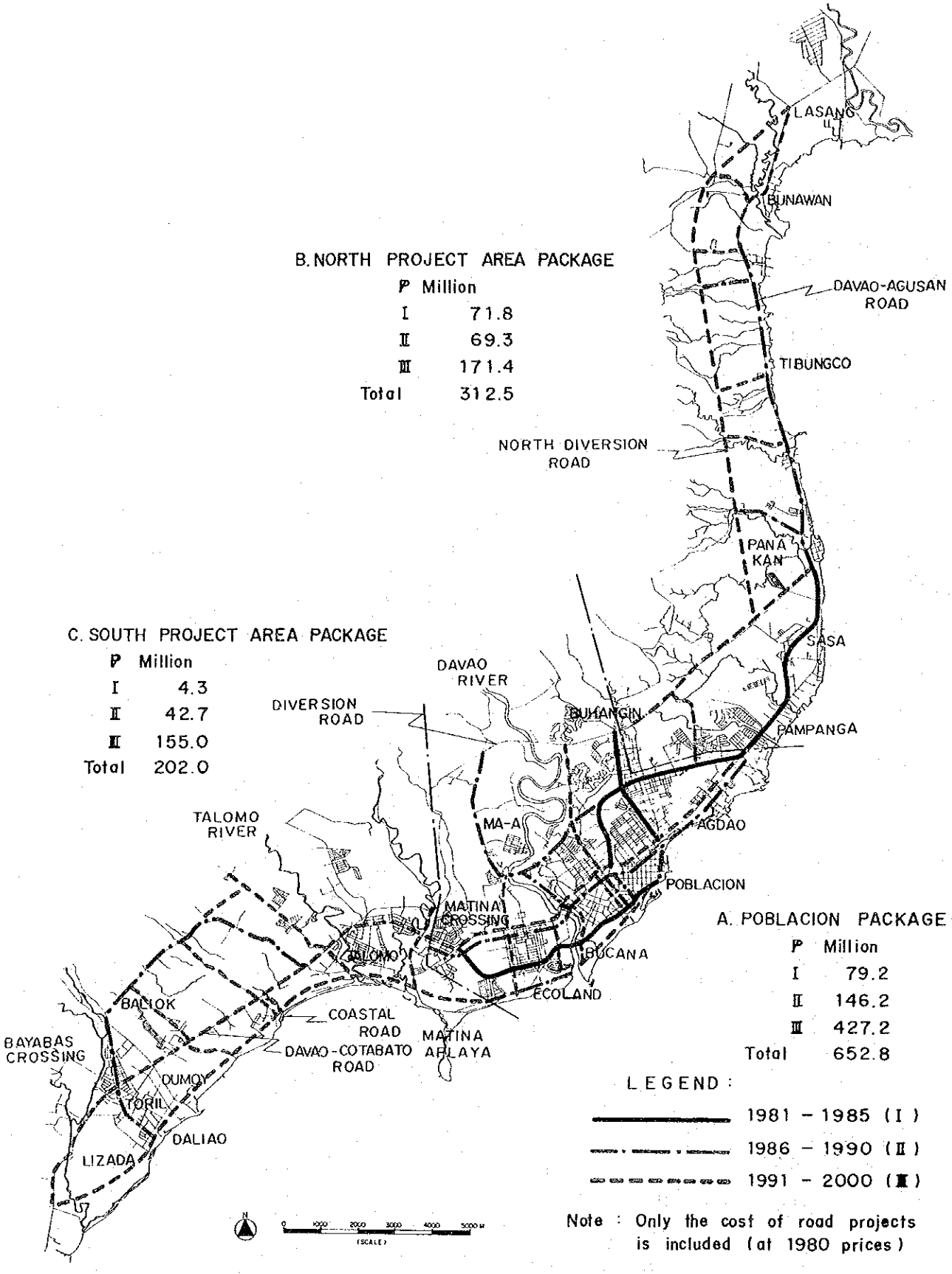


Figure 8.6 Schedule of Area Project Packages

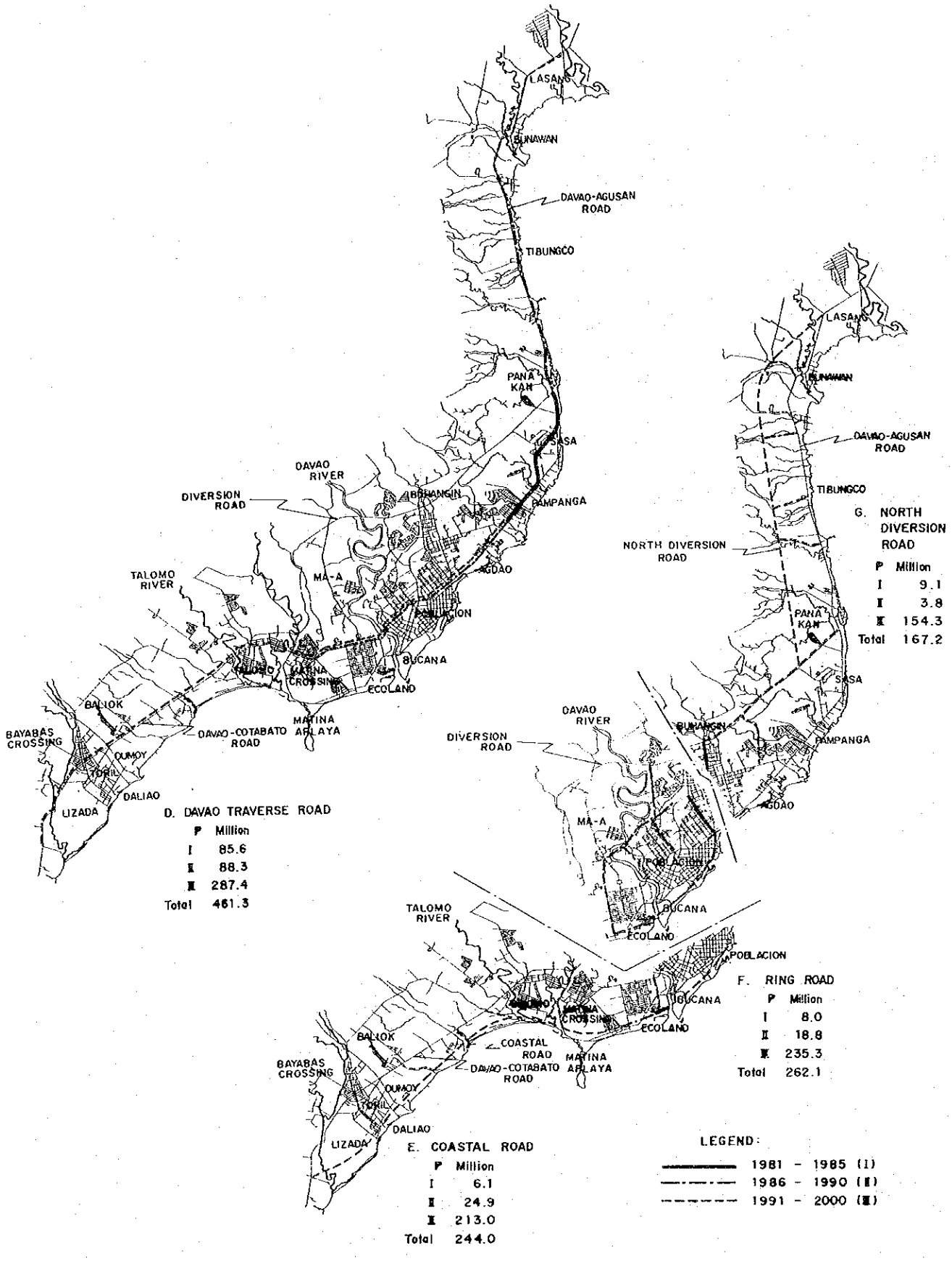


Figure 8.7 Schedule of Road Project Packages

8.3.3 Implementation Schedule of Project Components

Table 8.5 and Figure 8.8 show the implementation schedule of each road component as determined based on the implementation schedule of each project package and in consideration of the amount of available investment fund, the continuity between road sections, and the trend of traffic demand. Each road project will require from one to three years of time for construction work, depending on the size of the project. Generally, it is planned that the upgrading/improvement of existing roads will be finished early and that the construction of new roads will be done late.

The implementation schedule of public transport projects has been decided as shown in Table 8.6, chiefly in consideration of growth of demand for bus transportation service. Their coherence with road projects is secured in that the road project implementation schedule is determined based on demand as the function of land use.

The implementation schedule of traffic management project is shown in Table 8.7, as determined in consideration of the road and public transport project implementation schedules and growth of demand (for parking lots). Traffic management projects are mostly of a small scale. Therefore, most of those treated here are those which should be implemented by about 1990, leaving non-urgent ones for inclusion in future road projects.

Table 8.5 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	GBBC – 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				

Table 8.5 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				

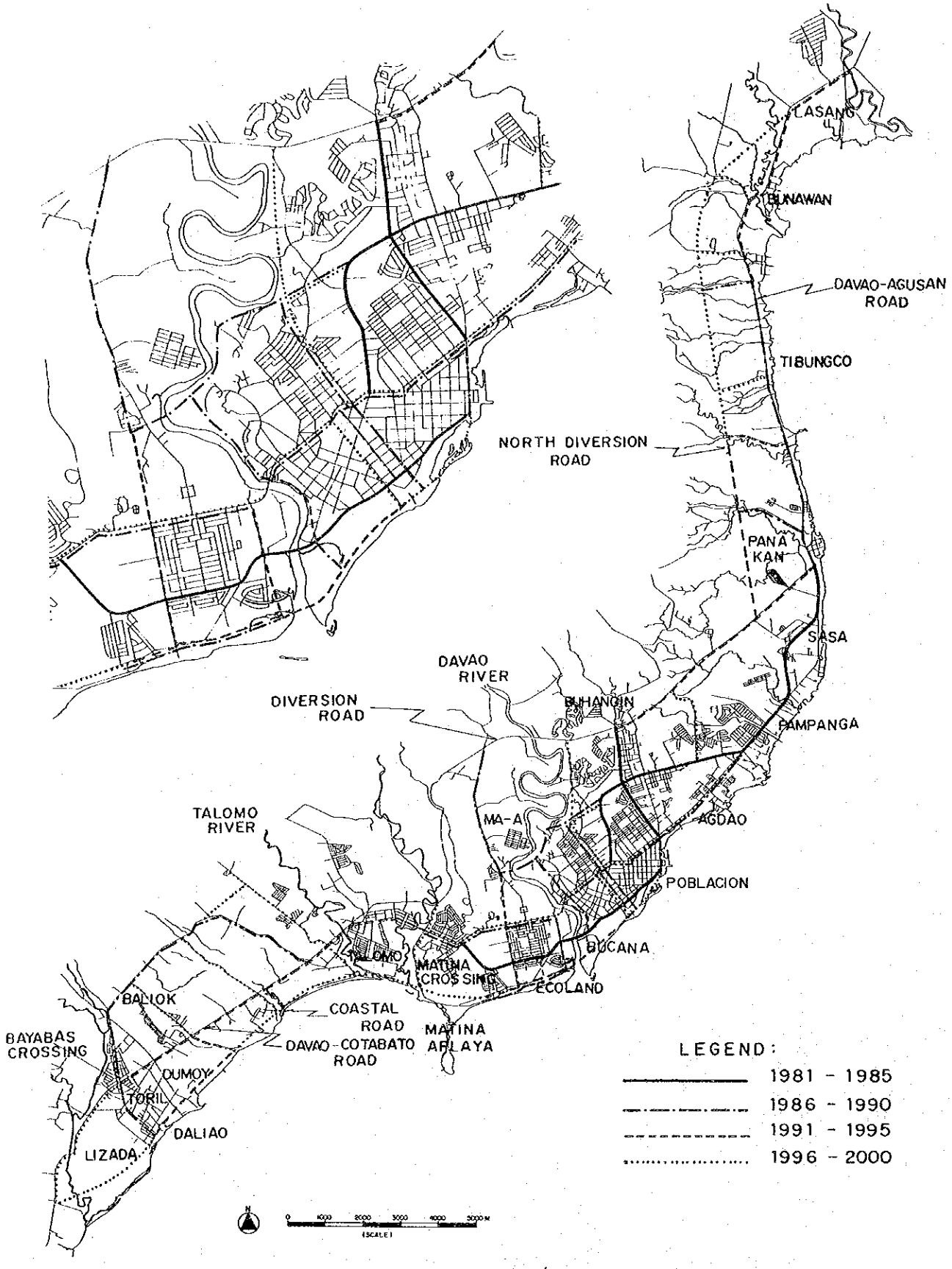


Figure 8.8 Road Construction/Improvement Schedule

Table 8.6 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					

Table 8.7 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

8.3.4 Investment Schedule

Shown in Table 8.8 and Figure 8.9 are the amount of required investment funds by project types, by phases, and by fund sources (public, public-private, or private) as classified basically under the following concept.

Public:

The construction and upgrading/improvement of all roads except private roads in subdivisions, and all of the traffic management projects except privately owned parking lots: These projects are of a highly public characteristic and the specification of benefactors is difficult. (Publicly owned parking lots may be transferred to private sector for operation.)

Public + Private:

The establishment and operation of the bus terminals: it is believed reasonable that the bus terminals, the construction of which is usually beyond the financial capability of the bus company, be constructed with public funds, but the installation of commercial facilities within the terminal premises, without which terminal operation would not become self-liquidating, will amplify the profit-seeking nature of the terminal. Therefore, public + private cooperation will be desirable for the establishment/operation of the bus terminals.

Private:

The establishment and operation of bus companies: although the bus system can be operated as a public enterprise, it is believed desirable that bus transport service be left up to private enterprises for a greater efficiency and fair competition (as exemplified by bus companies in Metro Manila). Besides, unlike in advanced nations, bus business is profitable in the Philippines and no public subsidy will be needed to support private bus operations, provided that basic conditions such as the improvement of roads are to be satisfied.

Road project components discussed heretofore all pertain to major and secondary roads. Collector and local roads are merely added in order to form a total for the purpose of estimating the amount of total investment funds necessary. Investments in road are to be made principally with funds from public sources, but some of collector and local roads (private roads within subdivisions) are to be developed by the private sector. In comparison with public transport and traffic management projects, road project investment funds are huge in amount and represent an overwhelming majority of total: 85% of total investments and 98% of public investments.

Private sector potentials and vitality are to be much depended upon for public transport project—the establishment and operation of bus companies are to be entirely left up to private capitals. It would be reasonable that bus terminal construction and operation will be accomplished under the cooperation of public and private sectors. Bus terminal project is attractive in that the required investment is much smaller than road project investments and that the amount of initial investment is particularly small.

The amount of investment funds required for traffic management projects,

all of which will be from public sources, is extremely small and account for only about 2% of the total investment funds.

Total amount of investment funds needed for road, public transport, and traffic management projects for the period 1981 through 2000 is estimated at approximately 1,850 million pesos 80% of which, or about 1,480 million pesos will come from public sources. The amount of available public investment funds estimated for this period is a comparable 1,067 to 1,758 million pesos. Thus, the amount required is fairly realistic. However, the problem is that, when amount required for each Five-Year period is compared with available amount, the concentration in the first half (1981-1990) of the required amount is heavier than that of the available amount. The necessary substantial advance investment will have to be funded by bond issuance, foreign loans, and so forth.

The breakdown of the required investment fund into foreign currency part and domestic currency part, indicated in Table 8.8 has been based on the result of various available feasibility study reports.

Table 8.8 Financial Requirement, 1980 Constant Prices (₱ Million)

Project Type	1981-1985	1986-1990	1991-1995	1996-2000	Total	Foreign Component	Local Component
I. ROAD PROJECT							
1. Trunk Road Network Construction and Improvement							
– Public	155.3	258.2	363.3	390.5	1,167.3	642.1	525.2
2. Collector/Local Roads Construction and 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
II. PUBLIC TRANSPORT PROJECT							
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	39.3	48.8
(Note: Operating costs are not included)							
III. TRAFFIC ENGINEERING AND MANAGEMENT PROJECT							
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	258.5	430.5	543.8	617.0	1,849.8	1,023.2	826.6
PUBLIC	212.9	333.5	448.7	483.7	1,478.8	805.7	673.1
PUBLIC/PRIVATE	7.9	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

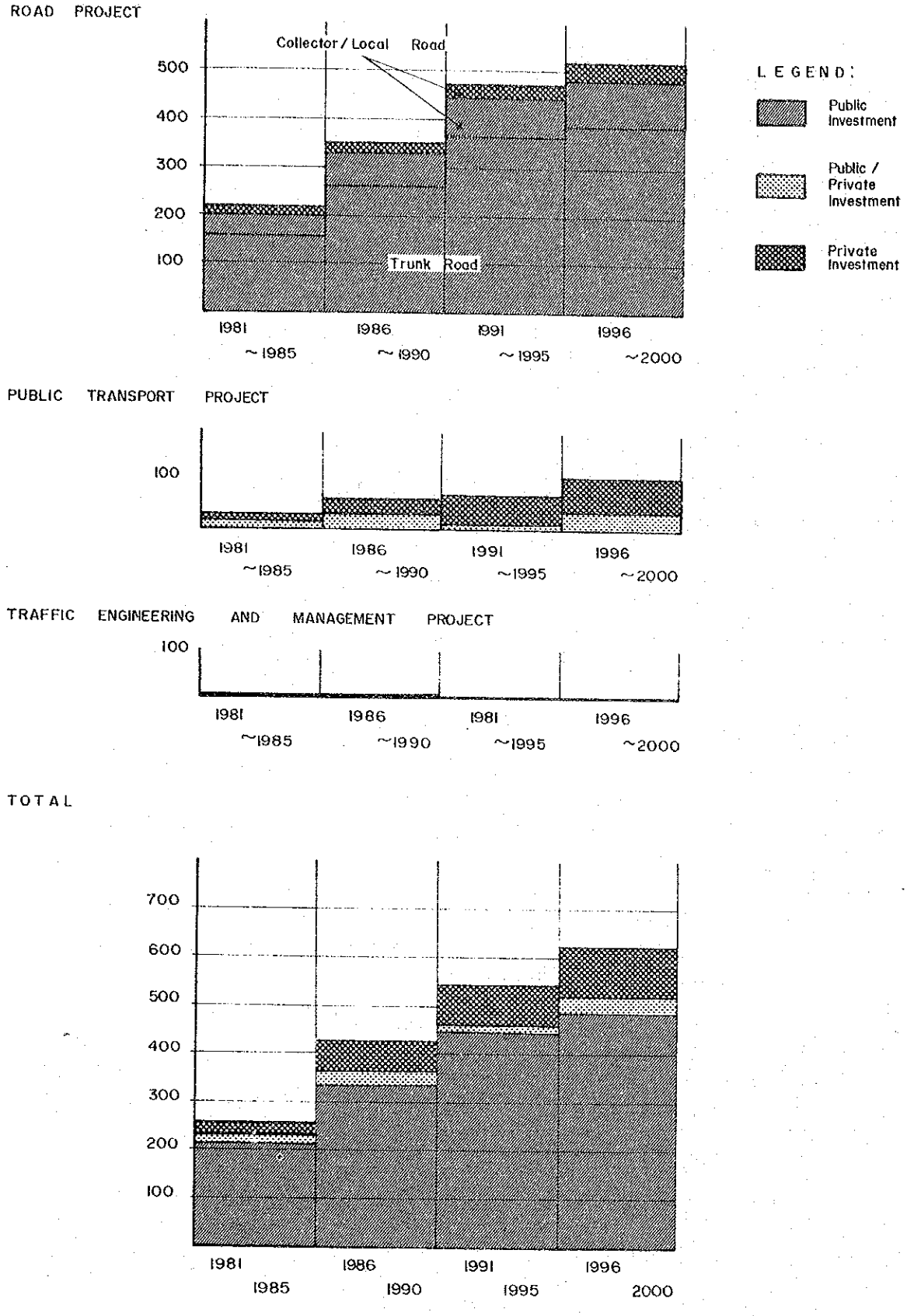


Figure 8.9 Financial Requirement, 1980 Constant Prices(₱Million)

CHAPTER 9 PROJECT EVALUATION

Tables and Figures

CHAPTER 9

PROJECT EVALUATION

9.1 Economic Evaluation

9.1.1 Scope of Evaluation

The evaluation, in the style of ordinary feasibility study, of each of the projects constituting the Masterplan will result not only in a fabulous volume of data processing due to the very large number of projects, but also in an economic evaluation with too low a precision to be of any realistic significance due to the very small scale of each project element. Furthermore, many projects produce either no economic benefit or only non-quantifiable benefit, as being only supplementary to, and justifiable only as a part of, other projects; examples: most of traffic management projects and the bus terminal project.

For these reasons, it has been decided that project packages (see preceding Chapter) are to be used as the evaluation unit, and that economic evaluation to be accomplished with regard to:

(1) The Masterplan as a whole (MP)

(2) Subdivisions of the Masterplan: Phase I (1981-1985), Phase II (1986-1990), and Phase III (1991-2000) (MP 1-3)

(3) Project packages as broken into Phase (A 1-3, B 1-3, C 1-D, D 1-3, E 1 + 3, F 1-3, and G 1-3).

The above division/grouping is illustrated in Table 9.1 for easy understanding.

9.1.2 Evaluation Method

The economic evaluation of a project is accomplished by comparing the economic benefit to be derived from the implementation of the project against the cost of implementation. The indicators to be calculated are: (1) the net present value of the project (NPV), (2) benefit/cost ratio (BCR), and (3) internal rate of return (IRR).

The amount of NPV is the balance of total 20-year benefits (the total of yearly benefits from 1981 through the year 2000, as discounted by 15% p.a.) after deducting total 20-year costs (the total of yearly cost from 1981 through the year 2000, as discounted by 15% p.a.). NPV shows the absolute amount of the net benefit to be realized through the implementation of the project.

The discount rate represents the opportunity cost of capital, and the 15% rate is that which is usually used by NEDA and other government agencies and banks for project evaluation.

Table 9.1 Scope of Economic Evaluation

	1981-85	1986-90	1991-2000
I EVALUATION OF AREA PROJECT PACKAGE			
A. POBLACION			
1. Traffic Core Development	A - 1	A - 2	A - 3
2. New CBD Development			
3. Poblacion Urban Transport Improvement			
4. Bucana Island Development			
B. NORTH PROJECT AREA	MP 1	MP 2	MP 3
5. Bunawan/Panakan/Sasa Development	B - 1	B - 2	B - 3
6. North Diversion Road Development			
C. SOUTH PROJECT AREA	C - 1	C - 2	C - 3
7. Davao-Cotabato Road Development			
8. Talomo-Toril Coastal Area Development			
II EVALUATION OF ROAD PROJECT PACKAGE			
D. Davao Traverse Road	D - 1	D - 2	D - 3
E. Coastal Road	E - 1	E - 2	E - 3
F. Ring Road	F - 1	F - 2	F - 3
G. North Diversion Road	G - 1	G - 2	G - 3

Note: The entire transportation projects are classified geographically into nine area project packages and functionally into twelve road project packages. As to project components, refer to Table 8.2 in Volume III.

BCR is a ratio arrived at by dividing said total 20-year benefit by total 20-year cost. BCR shows the level of efficiency of the project.

IRR is defined as "the discount rate which makes the value of BCR 1." and is a concept similar to BCR, except that IRR is an indicator of the efficiency of project investment, rather than of the project itself. Also, IRR differs from BCR in that it is sensitive to investment schedule; even if BCR is the same, the greater the initial investment portion of the total cost, the lower the IRR. Put differently, IRR is an indicator of the earning power, in the economic sense, of the project.

Economic benefit is expressed as the amount of saving in vehicle operating cost and passenger time cost. "Saving" is understood as the balance arrived at by deducting, from the total of vehicle operating cost and passenger time cost in the "do nothing case" wherein all of the projects are not implemented (hereinafter referred to as the "without" case). The method of calculating economic benefit will be explained below, following the order of process.

i) Traffic Assignment

As for the Masterplan as a whole, traffic volume in the "with" case and that in the "without" case are arrived at by assigning traffic demand (which is same in both the "with" and "without" cases) per predicted O-D table to the road network in the "with" case and that in the "without" case, with respect to both 1990 and the year 2000. The existing road network is that in the without case. In the with case, the proposed road networks for 1990 and 2000 are used.

As for project packages in each phase, traffic volume is assigned only for the year 2000. The road networks to be used for the "with" and "without" cases are the same before the starting year of the phase, and will differ, from that year, depending upon whether "with" or "without" the project. In this process, other projects, which belong to the same period, but not to the same project package, are ignored in order to quantify the influence only of projects of the phase of the package. (See Figure 9.1)

ii) Vehicle Operating Cost and Passenger Time Cost

As a result of traffic assignment, vehicle-kilometer, vehicle-hour, and passenger-hour values can be calculated for each type of vehicle. These values are multiplied respectively by distance-proportionate and time-proportionate vehicle operating cost of each type of vehicle and by passenger time cost of each type of vehicle (see Tables 5.9 and 5.10, Chapter 5). Then, the products of these multiplications are added up to become total vehicle operating cost and total passenger time cost.

iii) Economic Benefit

Economic benefit is the balance of total vehicle operating and passenger time costs in the "without" case after the deduction of total vehicle operating and passenger time costs in the "with" case. However, because traffic assignment is done only for certain years, the total economic benefit accruing in the period of 1981 through 2000 may not be readily obtained. Therefore, such total is to be obtained through exponential interpolation as shown

in Figure 9.2, provided that economic benefit is ignored for the period in which no project is to be completed.

Included in the economic cost is only the cost of road projects, because the most of public transport project costs are already included in the operating cost of the bus and reflected on economic benefit, and because traffic management project cost is negligible. The economic of road project is estimated from financial cost using economic cost/financial cost ratio (0.97 for land cost and for compensation for demolished houses, 0.88 for other costs), calculated based on the results of various feasibility studies. The cost thus estimated for each project element is added up to become yearly totals according to the project implementation schedule. The residual value of each project in the year 2000 is calculated assuming a 20-year life of project (and infinite life of land) and added, as a negative value, to economic cost.

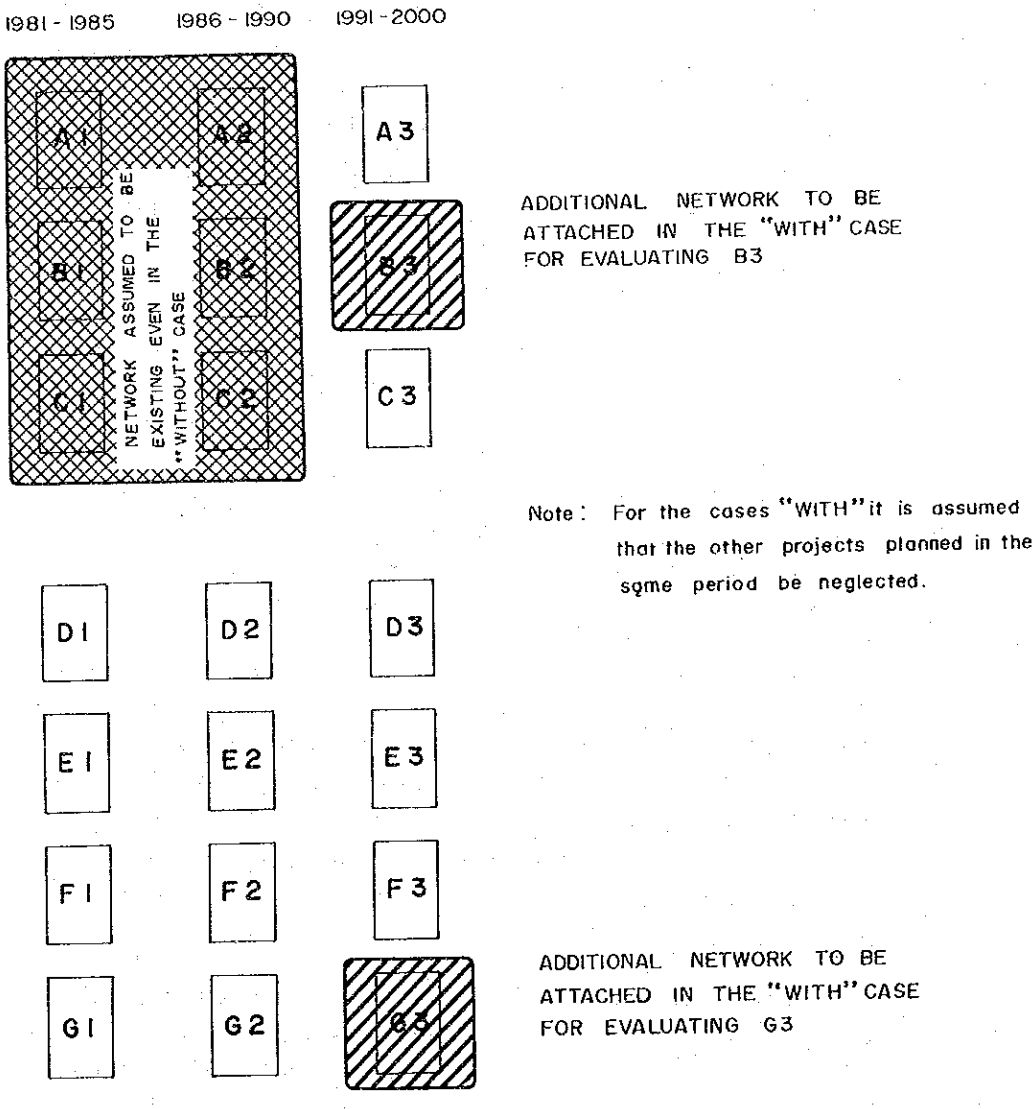


Figure 9.1 "With" and "Without" Cases for Economic Evaluation (Example)

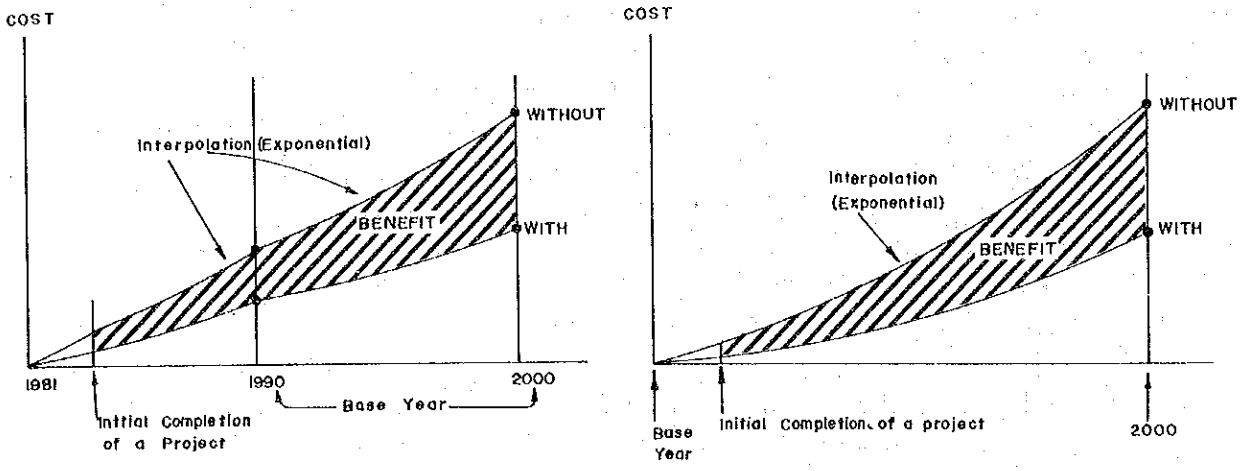


Figure 9.2 Schematic Methodology for Calculating Economic Benefit

Economic valuation has been carried out in the method discussed in the above, provided that the calculation of economic benefit has been fairly simplified in order to minimize the volume of computation, particularly the number of traffic assignment cases. It is believed that the simplified calculation is sufficient for the purpose of establishing the overall feasibility of the Masterplan and of relative desirability of the projects.

9.1.3 Evaluation Result

Table 9.2 shows the yearly economic benefits and yearly economic costs of the Masterplan, and Table 9.3 shows the result of economic evaluation of all projects. The yearly economic benefits and costs of projects are contained in Volume IV 4.10.

As a result of economic evaluation, the Masterplan is judged highly feasible with the NPV of 413.8 million pesos, the BCR of 3.08, and the IRR of 78.7%. The particularly high IRR value indicates that the economic earning power of the Masterplan is high. The evaluation by phases resulted in the finding of particularly favorable results for Phase I (1981-1985) and Phase III (1991-2000), indicating that highly urgent projects are concentrated in those phases. Especially remarkable is the IRR value of 92.8% for Phase I, showing that projects should be implemented as soon as possible. Phase II (1986-1990) also showed a favorable result. The Masterplan , if implemented, will produce economic benefits throughout all the phases.

Area project packages (A, B, and C) have proven economically feasible throughout the phases, with particularly favorable results for Phases I and II of Poblacion Package, Phases I and III of North Project Area Package, and Phase III of South Project Area Package. Phases which showed relatively unfavorable results are no less important as they include many projects essential to the entire Master Plan; rather, it should be understood that certain benefit accruals are delayed into other phases.

Among Road Project Packages, the evaluation result is extremely good for the Davao Traverse Road Package, producing huge economic benefits throughout the phases. The implementation of this project will require a relatively small amount of cost, as it pertains to the upgrading/improvement of the existing roads, with only partial exception (near Sasa Port) and, when completed, this road will not only become the most important route of public transport but also will play a key role in the introduction of bus service an the later introduction of railroad. Therefore, it is urged that a feasibility study be conducted and the project implemented soon.

In the case of Coastal Road Package, the entire economic benefit is to be generated in Phase III, and an economic loss is to result in Phase II, when project is implemented for only one section in Ecoland and, because both roads on the east and the west of it will not be constructed until Phase III, there will be few traffic on that section. This road, indispensable to the development of Ecoland and the vicinity, is expected to produce many non-quantified benefits in addition to saving in vehicle operating and passenger time costs. The completion of Phase II project is precondition to the benefit expected in Phase III, and it is apparent that the Package is feasible as a whole; the Phase II projects are fully justified.

Although their NPV values are somewhat low, Ring Road and North Diversion Road are feasible throughout the entire phases. Ring Road Package, although barely feasible in Phase III, is also indispensable, because important regional development projects (Bucana Island, new CBD) depend on the performance of this Road. Favorable results have been shown for the Phases I and II of Ring Road and the all phases of North Diversion Road Packages.

Table 9.2 Economic Evaluation of the Masterplan

	ECONOMIC BENEFIT (₱ Million)		Economic Cost (₱ Million)						
			Before Discount						After Discount
	Before Discount	After Discount	FS/DD	Land Acquisition	Compensation for Property	Const.	Maint.	Total	
1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1982	0.0	0.0	1.7	0.0	0.0	0.0	0.0	1.7	1.3
1983	0.0	0.0	2.7	9.1	2.3	15.9	0.0	30.0	18.7
1984	62.7	35.8	1.6	10.0	3.7	35.4	0.0	50.7	29.0
1985	73.0	36.3	2.0	23.6	13.8	20.5	0.0	59.9	29.8
1986	85.1	36.8	1.6	14.8	5.2	38.9	0.0	60.5	26.1
1987	99.1	37.3	1.0	15.9	4.2	19.0	–0.1	40.0	15.0
1988	115.5	37.7	3.1	5.9	3.2	26.6	–0.1	38.7	12.6
1989	134.5	38.2	1.0	13.0	4.3	29.2	–0.1	47.4	13.5
1990	156.7	38.7	1.3	17.4	5.3	24.9	–0.2	48.7	12.1
1991	177.0	38.1	1.5	16.3	4.0	36.3	–0.1	58.0	12.5
1992	200.0	37.4	0.1	3.4	1.1	25.3	–0.1	29.8	5.6
1993	226.0	36.7	3.3	18.4	46.5	22.3	–0.1	90.4	14.7
1994	255.3	36.1	2.0	7.4	0.6	46.2	–0.1	56.1	7.9
1995	288.4	35.4	0.5	22.0	27.5	49.1	–0.1	99.0	12.2
1996	325.8	34.8	2.0	21.5	33.2	51.3	0.0	108.0	11.5
1997	368.1	34.2	1.6	12.5	0.0	38.1	0.0	52.3	4.9
1998	415.9	33.6	0.4	25.4	19.3	27.0	–0.1	72.0	5.8
1999	469.8	33.0	0.0	12.6	4.0	68.0	0.0	84.6	5.9
2000	530.8	32.4	0.0	0.0	0.0	38.3	0.0	38.3	2.3
Residual Values	–	–	–	249.3	106.4	358.0	–	713.6	43.6
Total	3,983.7	612.6	27.4	0.0	71.8	254.3	–1.2	352.3	198.8

Note: Discount rate is set at 15% per annum

Table 9.3 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	6.16	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