

**URGENT TRAFFIC RECOMMENDATIONS  
FOR  
THE CITY OF DAVAO**

**DAVAO CITY URBAN TRANSPORT  
CUM LAND USE STUDY**

**(September, 1980)**

**REPUBLIC OF THE PHILIPPINES  
MINISTRY OF PUBLIC HIGHWAYS**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

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FOR  
THE CITY OF DAVAO

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Background and Characteristics

Inasmuch as the accomplishment of the Davao City Urban Transport Cum Land Use Study (DCUTCLUS), which was started in August 1979, and is currently being undertaken, is expected to require a time period of approximately two years and five months for completion in the targeted year-end of 1981, the local authority has requested that, should any measures be identified, in the course of said Study, which the City of Davao should take immediately in order to solve the urgent traffic problems existing in the City, the Mission would compile them into a set of recommendations rather than waiting until the time of final DCUTCLUS Report. Recommendations are hereby made in response to this request and in accordance with the agreement reached between the Government of the Philippines and the Government of Japan in August, 1979 on the implementation of DCUTCLUS.

While the final DCUTCLUS Report will recommend various policy measures and development projects for urban traffic in Davao City in three stages, namely:

- a) Urgent Projects
- b) Medium Range Projects (to be completed by 1990), and
- c) Long Range Projects (to be completed by the year 2000)

recommendations hereby will provide basis for and constitute, after refinements, a major part of a) above.

As it is assumed that the recommended urgent projects will be implemented before the end of 1982, they must characteristically be as follows:

- i) They must not only be highly essential, as judged from the result of the analysis of the existing traffic condition in Davao City, but must also be immediately implemented easily from the standpoint of funding, technology, and institutional systems;
- ii) It follows that the recommended projects will center on software improvement, rather than hardware development, and, in identifying the recommendations therefore, the improvement of traffic management and control, the reorganization of public transportation systems, and similar subjects will be brought into focus, and infrastructural construction projects which will require large sums of investment funds and long periods of time for necessary feasibility studies and detailed design must mostly be excluded even if they are in strong demand. Therefore, the urgent projects will primarily attempt (1) to counter the traffic congestions in peak hours, (2) to counter traffic accidents, (3) to rationalize PUJ services, and (4) to effectuate regulatory controls on long term land uses; and
- iii) The traffic facilities improvement projects to be recommended hereby will be coherent to the current hence preliminary, version of the concepts of future traffic network and urban development in Davao City to be presented in the Final Report and will contribute to the fulfillment of the entire masterplan.

## 1.2 Composition of the Report

The remainder of this present report will consist of an inventory of traffic problems and difficulties now existing in the Project Area and the discussion of basic course of action for the solution of same in Chapter 2, a preview of major projects for the realization of future visions in the central part

(Poblacion and the vicinity) of Davao City in Chapter 3, various urgent projects recommended in Chapter 4 on the basis of the results of Chapters 2 and 3, and, finally, a summary table of the recommended projects in the style of a project list to be presented in Chapter 5.

Chapters comprising this report will have relationship between each other as schematically illustrated below.

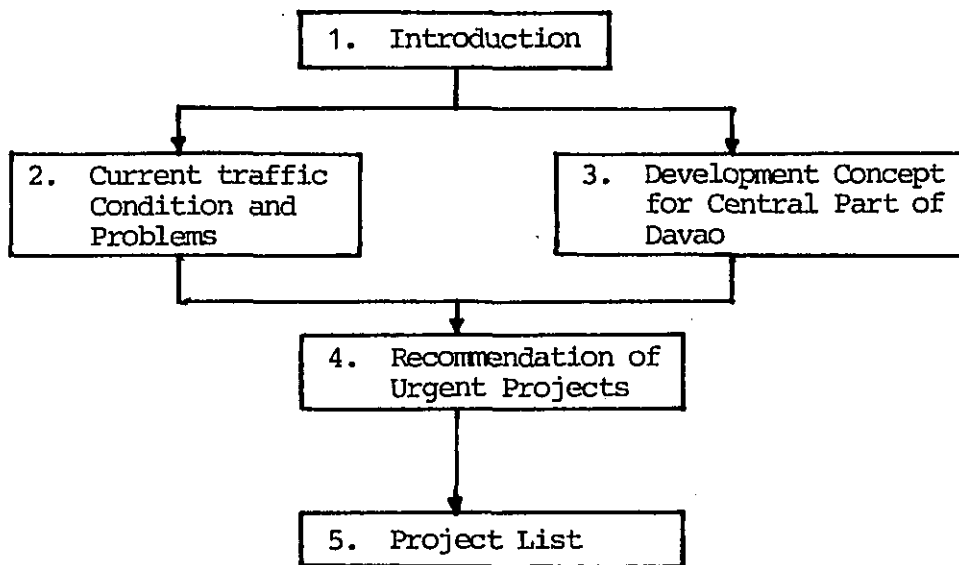


Fig. 1.1 Report Structure



## CHAPTER 2

### EXISTING TRAFFIC PROBLEMS AND SOLUTIONS

#### 2.1 Problems

At the beginning of the 1970s Davao City had a population of only about 400,000, and Poblacion, 120,000. Poblacion's street network was fairly well developed for this size of population, and the number of motor vehicles was still small. The citizens of Davao suffered little from traffic problems in the 1960s. Even today, the kind of traffic problems which plague large cities are non-existent in Davao, which other than Poblacion and its vicinity, is agricultural area with the sporadic occurrence of small towns.

Since the beginning of this decade, however, both population and vehicles incessantly multiplied, and traffic congestion and accidents have become frequent in Poblacion. Large housing areas called sub-divisions have been developed away from Poblacion, but the dispersion of economic activities has not kept up with it, with Poblacion still functioning as the center of such activities. Thus, a large volume of suburban-Poblacion commuter traffic was generated, greatly contributing to the aggravation of traffic problems. Efforts to develop traffic facilities, as seen in the construction of Diversion Highway and Bolton Bridge, lagged behind the rapid swell of transportation demand. Major traffic problems existing in the Project Area will be reviewed hereunder.

##### 1) Peak Hour Traffic Snarl

Of the morning, noon, and evening peak hours, the worst traffic snarl occurs in the morning peak hour (7:00 to 8:00 A.M.). The most congested are McArthur Highway for entry into Poblacion from south and J.P. Laurel Avenue for entry from north, and, within Poblacion, E. Quirino Avenue, A. Pichon Street, C.M. Recto

Avenue, and L. Garcia Street. Particularly on McArthur Highway, traffic is often jammed for a length of over one kilometer due to the bottleneck at Bankerohan Bridge area. Congested intersections are E. Quirino Avenue/A. Pichon Street, C.M. Recto Avenue/A. Pichon Street, J.P. Laurel Avenue/Sta. Ana Avenue, and Agdao Market Intersection (Fig. 2-1).

## 2) Increasing Traffic Accidents

Traffic accidents have recently increased in direct proportion to swell in the volume of traffic. Accidents occur on all of Poblacion arterials with heavy traffic, but particularly often on A. Pichon Street, San Pedro Street, and J.P. Laurel Avenue, as well as on those in Bankerohan Market area and Agdao Market area (Fig. 2-2). The incidence of traffic accidents is high where PUVs gather and the concourse of people embarking and debarking them and vehicles occurs, and many accidents are caused by reckless drivers who pay little respect to rules and good driving manner.

## 3) Frequent PUJ Service Network Revamp

The service routes of PUJs, which are the most important means of public transportation serving two-thirds of total passengers in Davao, have been reorganized three times since February 1979. Too frequent route changes would bring confusion to PUJ users and can cause their disinterest in PUJs, which, in turn, can result in the disadvantage of PUJ operators and drivers. The local authorities, which consider the PUJ service system (routes and the number of franchised PUJs) currently in force only a product of trial and error rather than the final one to stay, have asked that DCUTCLUS includes recommendations on how an appropriate PUJ service system might be attained.

## 2.2 Solutions

DCUTCLUS Team has reviewed and analyzed various possible solutions of traffic problems in the Project Area, as summarized under three items presented in 2.1. above, and formulated recommendations which will be presented in detail in chapter 4. The

Mission's philosophy which underlie the recommendations is discussed below.

Said three items of problems all pertain to Poblacion and its vicinity. The rest of the Project Area is not necessarily claimed free of traffic problems, but, there, problems are not of congestions and accidents but are of accesibility or amenity (such as the lack or inferiority of roads), whose remedy should be taken up as medium or long range projects. Thus, recommendations hereby pertain to only Poblacion and its vicinity.

1) Diversification of Access Routes to Poblacion

For entry into Poblacion, two each routes are available both from north and from south: J.P. Laurel Avenue and R. Castillo Street for entry from north, and, for entry from south, the route via McArthur Highway and Bankerohan Bridge and the route via Ecoland and Bolton Bridge. However, the volume of traffic is not presently shared evenly by these mutually-substituting routes in either direction. The volume is relatively large on McArthur Highway and J.P. Laurel Avenue in comparison with that on their substitute roads. Particularly in the case of approach from north, traffic on J.P. Laurel Avenue is as much as 12,000 vehicles per day, as opposed to only 2,000 vehicles per day on R. Castillo Street. For the efficient utilization of available roads, therefore, some traffic should be diverted from the heavily travelled routes to the lightly travelled routes so that the substitute roads will share about equal volumes of traffic. This is particularly important in the morning peak hour.

2) Mitigation of Traffic Congestion by the Establishment of PUJ Bays

Passengers embarking and debarking PUJs often crowd the street to obstruct the operation of vehicles which follow the PUJs. The establishment of PUJ bays along McArthur Highway and J.P. Laurel Avenue, which will result in orderly embarkation/debarkation at designated locations off the driveway, will mitigate traffic congestion of this cause.

3) Intersection Improvement

The lack of proper marking of driveline and left-turn lane and of traffic islands is the cause of traffic confusion in intersections, which is spurring traffic congestion. The congested intersections identified in 2.1 above should be improved through channelization, effecting of proper road marking, and the installation of traffic signs, as well as the review of present traffic signal operation, installation of new signals at locations needed, and the synchronization of signals.

4) Traffic Control and the Intensification of Traffic Law Enforcement

The introduction of traffic control by means of one-way, no left turn, no parking, and so forth should be considered for implementation chiefly from the standpoint of safety and the smooth flow of traffic. Particularly recommended is to make A. Pichon Street and San Pedro Street one-way traffic arterials. Traffic control, needless to say, is as good as it is enforced. In view of the frequent illegal curb parking presently observed, it is recommended that traffic law enforcement be intensified.

5) Rationalization of PUJ Service

The present PUJ routing is to be evaluated against the results of the Person Trip Survey and, if any problems are identified, new routing which will solve such problems is to be recommended. PUJ route network will be evaluated from both the standpoints of users and operators. Plans for the construction of PUJ terminals will also be studied.

6) Cultivation of Driver Moral

The driving manner of many drivers in Davao can hardly be commended, as evidenced by frequently observed parking violations, overtaking, cutting in, and speed limit violations. Most fundamental to traffic safety are the respect of rules

and the spirit of mutual compromise. In this view, a number of programs will be recommended for the cultivation of driver moral.

With the exceptions of PUJ route reorganization and the cultivation of driver moral, which will be treated as separate sections, the high incidence of problems subject to these solutions is seen on map to occur either on certain arterials or in certain areas. Therefore, projects to be recommended in Chapter 4 will, for the purpose of discussion, be classified into the following arterials and areas (Fig. 2-3):

A. Improvement of Arterials

1. R. Castillo Street
2. R. Castillo Street/J.P. Laurel Avenue Intersection
3. McArthur Highway and J.P. Laurel Avenue

B. Traffic Measures for Areas

1. Bankerohan Bridge Area
2. A. Pichon Street and San Pedro Street Area
3. Central Area
4. Agdao Market Area



LEGEND:

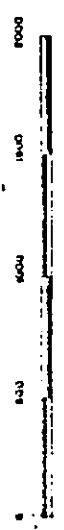
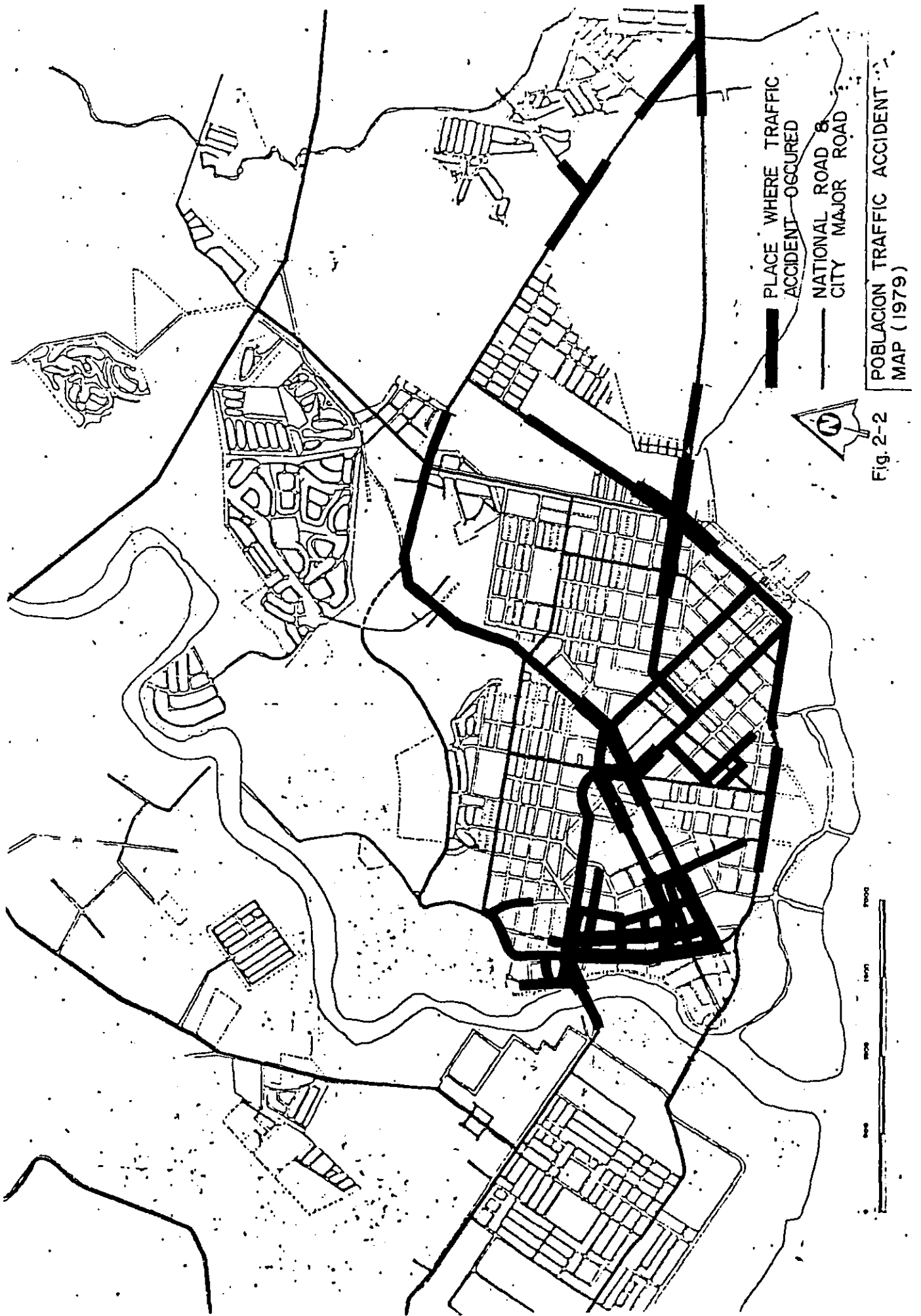


Fig. 2.1 TRAFFIC CONGESTION DEGREE OF MAJOR ROAD



POBLACION TRAFFIC ACCIDENT MAP (1979)

Fig. 2-2





## CHAPTER 3

### LONG RANGE POBLACION DEVELOPMENT CONCEPT

Recommendations hereby consist of both stop-gap type urgent measures and projects which require substantial investments for the development of facilities for use for a long time. The latter must be in harmony and coherent with the future image of the Project Area, because, as pointed out in Chapter 1, the diseconomy of large investment for only stop-gap purposes must be avoided. In this sense, an explanation is now in order of the Poblacion development concept, or of the future image of Poblacion, as we understand it now and which underlies the urgent actions recommended hereby. Therefore, a summary of such concept is offered below, with the understanding that it is still under study and is subject to modifications, additions, and refinements as a result of traffic volume forecast and project evaluation to be accomplished in the future.

#### 3.1 Future Image of Poblacion

##### 1) Development Axis

Development space is limited in Poblacion. Although some room still remains for housing development in the area between J.P. Laurel Avenue and Diversion Road, space is extremely limited for the accumulation of urban functions, that is, central management (administrative and private enterprise management) and goods distribution functions.

Nevertheless, the formation of a modern central business district (C.B.D.) with high rise office buildings standing side by side will be inevitable, if Davao is to grow as one of prominent economic and cultural centers of the Philippines with a population of 1.3 million. A plan for the development of a new business district in Ecoland should be evaluated high in that it

envisages the formation of a development base outside Poblacion. However, to depend solely on the development of this district for the future C.B.D. functions can lead to the hindrance of Poblacion modernization and the dwindling of its urban vitality.

In this situation, the only remaining possibility, which occurs in the center of the existing C.B.D., is M. Roxas Avenue. This street is yet to be completed, and, therefore, has vacant lots on its sides, making the renewal of this roadside area relatively easy. It is therefore, strongly recommended that this precious space be developed as business street in the heart of Davao City.

2) Seaside Cultural/Educational Park Development

The reclamation of old Davao River from Magsaysay Park to Bolton Bridge will connect Poblacion and Bucana by land and produce an expanse of space for development. With the exception of a part of this space where housing compounds for low income families be developed, the concept is to utilize this space for park, educational and athletic facilities, convention hall, cultural center, and other buildings and facilities which will collectively become a practical expression of Davao as a cultural city, while providing a place of recreation and relaxation for the citizens of Davao.

A parkway comparable to Roxas Boulevard in Manila should be constructed along the coast as a part of the future trunk through-fare network. City hall, police station, court house, and other buildings closely related to the life of the citizens might be gathered in the area occurring at the end of the office street of M. Roxas Avenue. In any event, this colossal project should be incorporated into the package of long range projects to be implemented towards the year 2000.

3) Traffic Core Development

It is recommended that the large rotary existing at the inland side end of M. Roxas Avenue and the adjacent blocks be developed as a traffic core where terminals will be concentrated for long distance buses, middle-distance buses, and PUJs which

will serve Poblacion and its vicinity. When the construction of a rapid transit is considered for the Project Area in the future, the construction of a central station on this traffic core, around which the future traffic system will be formed, should be considered in the first place. The M. Roxas Avenue-length radius of this traffic core, or the major part of the C.B.D. will be a walking radius.

#### 4) Metamorphosis of Existing Downtown

The realization of the M. Roxas office street and the traffic core will result in the shift of the town's gravity center and changes in the flow of people and the characteristics of areas along the major streets. As we envisage, C.M. Recto Avenue and F. Bangoy Street will become the busiest shopping streets in Poblacion, while area adjacent to A. Pichon Street and San Pedro Street will increasingly become a leisure/recreation quarter. On the other hand, it would be reasonable to expect that area along R. Magsaysay Avenue, where port is close by and many warehouses exist, will attract distributors and wholesalers to locate.

### 3.2 Arterial Network

For Poblacion and its vicinity, the following road construction projects are under study (Fig. 3-2), the completion of which will result in Poblacion having a total of four roads, or 14 drive lanes, that cross Davao River, in addition to Diversion Road:

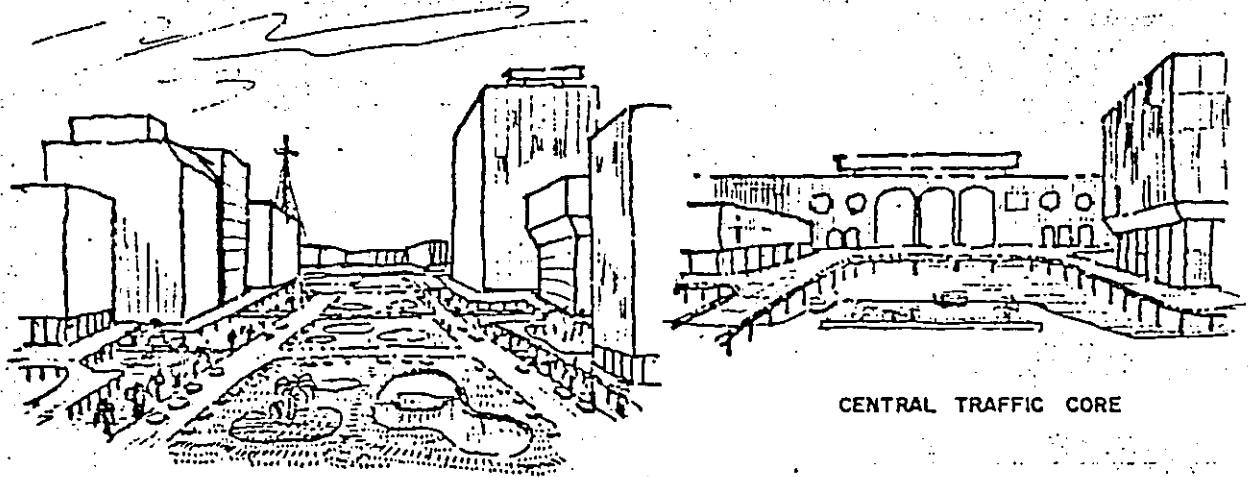
- a) The development of McArthur Highway and E. Quirino Avenue as four-lane roads, and the replacement of Bankerohan Bridge with a new bridge.
- b) The construction of a bridge between Bankerohan Bridge and Diversion Road, and the construction of a north-to-south transversal thoroughfare in the inland part of Poblacion. The construction of this 4-lane thoroughfare, connecting J.P. Laurel Avenue with Diversion Road, will involve the construction of an about 800-meter tunnel in the south of Davao River.

- c) The construction of a 4-lane parkway along the coast of Poblacion and Ecoland, which will involve the construction of a bridge over Davao River at its estuary.
- d) The construction of road to connect Diversion Road with the coastal parkway.
- e) The construction of a Davao Riverside road, connecting the new road of b) above with the coastal parkway of c) above.
- f) The connection of E. Jacinto Extension with Diversion Road.
- g) The construction of supplementary arterials.

With the implementation of these projects, a ring road will be formed to encircle the central part of the Project Area by Diversion Road, Buhangin Street, Dacudao Avenue, coastal parkway (c), and the connecting road of (d). If this is called the outer ring, that which will be formed by Dacudao Avenue and the roads of the above projects (b), (c), and (e) may be called the inner ring embracing the heart of Poblacion.

### 3.3 Long Term Development Concept-Urgent Projects Coordination

In order that the long term development concept will be realized under the plan, it will become necessary that appropriate measures be taken to prevent the occurrence in the area of any project which will be inconsistent with or irrelevant to such concept.



ROXAS BLVD.

CENTRAL TRAFFIC CORE

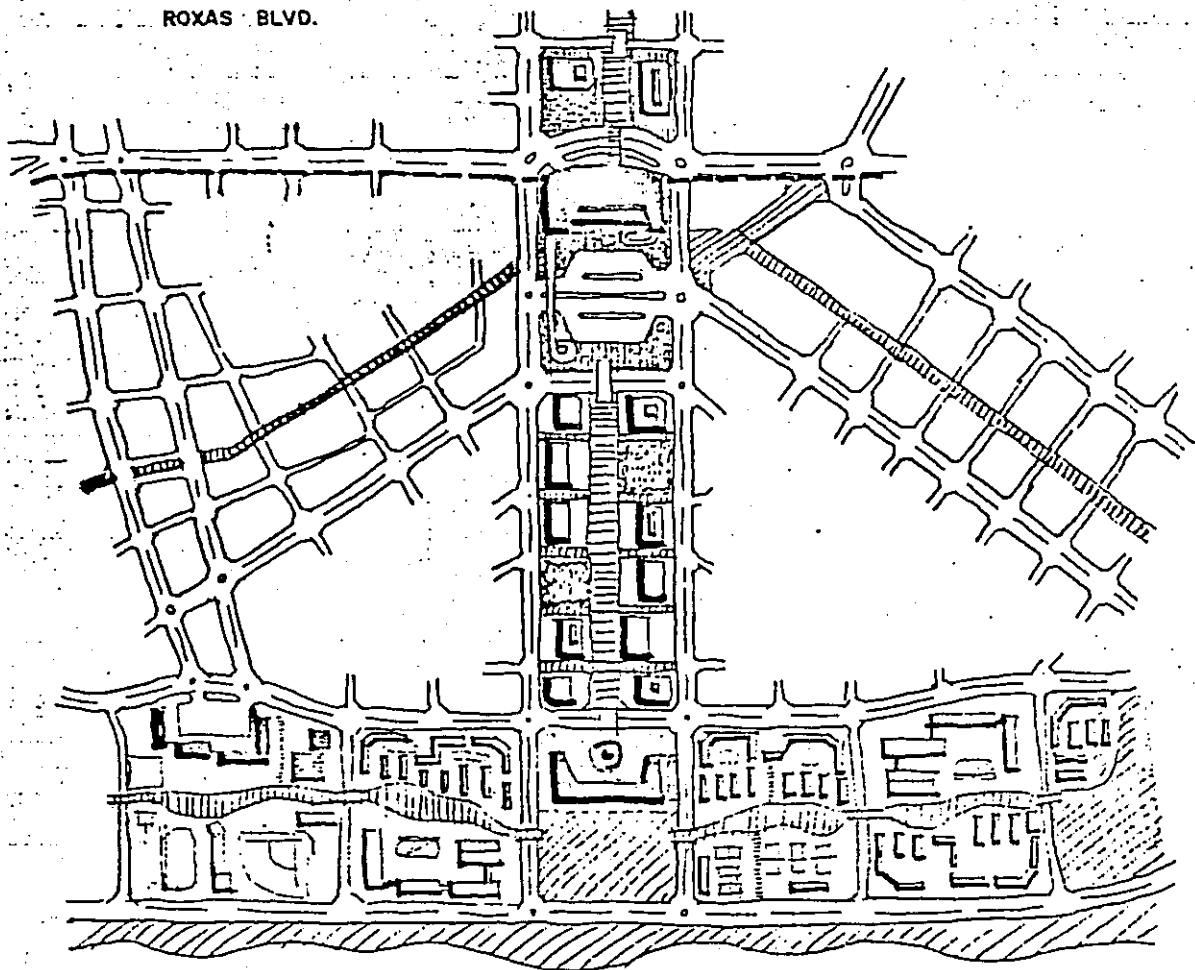
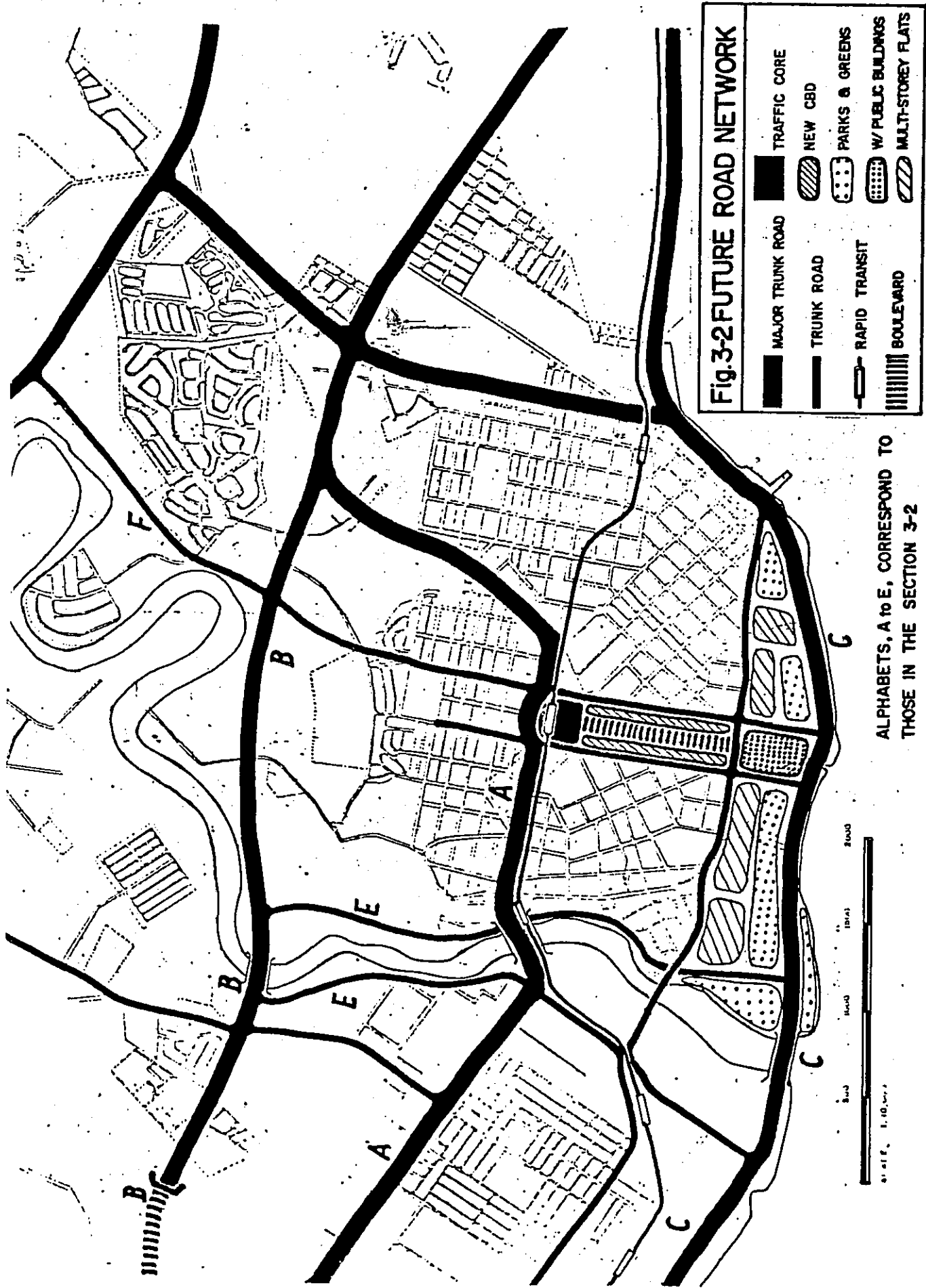


Fig.3-1 URBAN RENEWAL AT CENTRAL PART OF POBLACION



**Fig.3-2 FUTURE ROAD NETWORK**

- MAJOR TRUNK ROAD
- TRUNK ROAD
- RAPID TRANSIT
- BOULEVARD
- TRAFFIC CORE
- NEW CBD
- PARKS & GREENS
- W/ PUBLIC BUILDINGS
- MULTI-STOREY FLATS

ALPHABETS, A to E, CORRESPOND TO  
THOSE IN THE SECTION 3-2

## CHAPTER 4

### RECOMMENDATIONS

#### 4.1 Network Development and Traffic Management

While traffic problems in Davao City are concentrated in its central area, namely, Poblacion and the adjacent areas as has been previously pointed out, the downtown area of Davao City extends along the coastal line in the form of a belt and, therefore, Poblacion interfaces with adjacent areas in two directions, one on its north and another on its south. For the purpose of urgent recommendations, therefore, solutions will be discussed for Poblacion and these two adjacent areas.

##### 1) Upgrading of Arterials

###### (1) Pavement of R. Castillo Street

###### a) Existing Problems

A review of the existing roads and traffic condition in Davao City reveals that, although two national highways serve traffic moving from north to Poblacion, the utilization of J.P. Laurel Avenue is high but the utilization of R. Castillo Street, which is only half paved (1.5 kilometers out of the total 3.0) and poorly equipped with road signs and markings, is low, and the traffic is faced with following problems:

- (a) According to the November 1979 Traffic Survey, the volume of traffic flowing between Poblacion and the north amounted to only 2,000 vehicles per day or, in peak hour (which vary by road section but is generally from 7:00 to 8:00 A.M.), 150 vehicles on R. Castillo Street, while, on J.P. Laurel Avenue, it is as high as 12,000 vehicles per day or 900 vehicles per peak hour.

- (b) On approaching Poblacion, traffic on J.P. Laurel Avenue becomes even heavier by the adjoining traffic from the Buhangin way of about 10,000 vehicles per day, or 900 per peak hour, creating heavy traffic congestion in section 1.0 kilometer to 1.5 from intersection with Magsaysay Avenue.
- (c) Although R. Castillo Street is the shortest route connecting areas near Santa Ana Pier with the northern area, other detour routes are being preferred over it, which is only partly paved. (A comparison of O-D survey findings and the result of traffic volume count further supports the observation of this preference.)

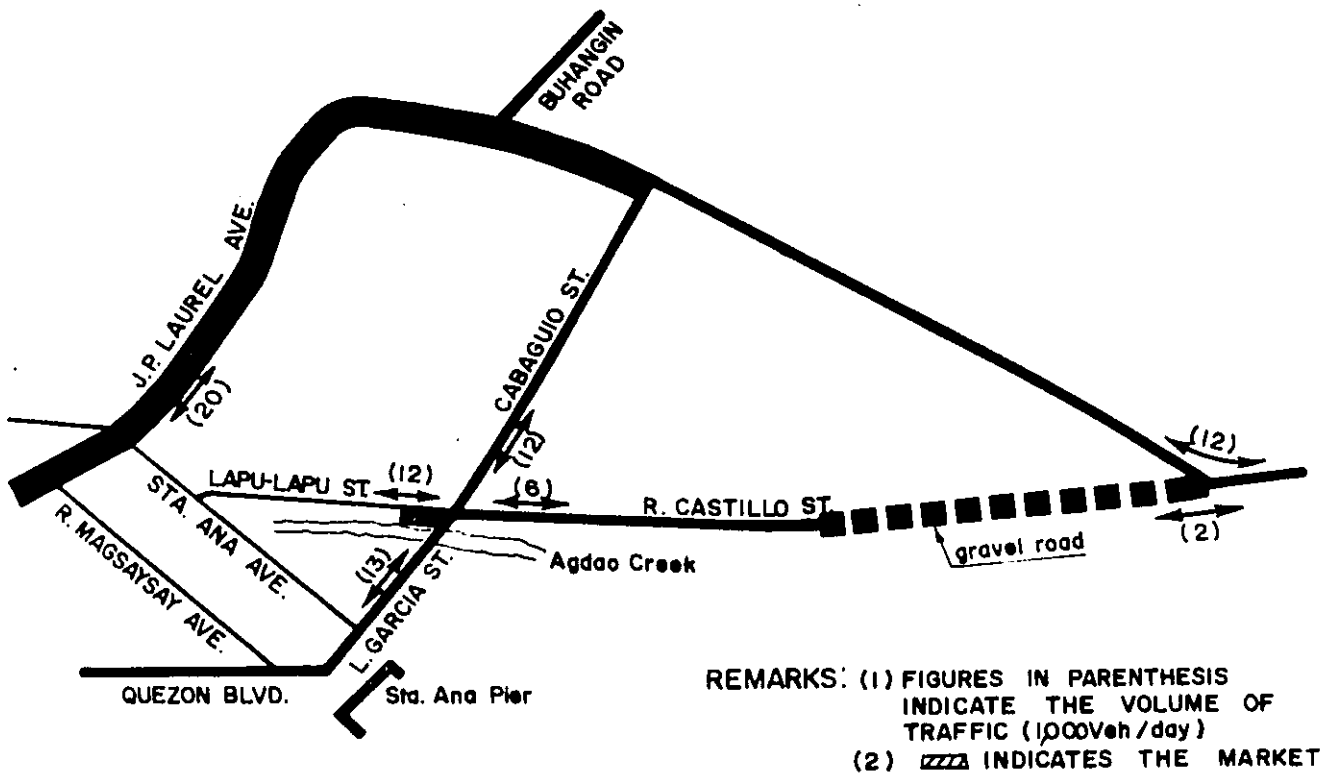


Fig. 4.1 EXISTING SITUATION ON AND NEAR R. CASTILLO ST.



(d) Of the two highways, PUJ service is available only on J.P. Laurel Avenue. The concentration of PUJs on this Avenue constitutes a factor of traffic congestion on it, while inhabitants along R. Castillo Street are deprived of PUJ service and are required to be content with only tricycle service.

b) Recommendations

In order to solve these problems, it is essential that the unpaved section of R. Castillo Street be paved so that a part of traffic now flowing on J.P. Laurel Avenue will divert to R. Castillo. Trucks will constitute a large part (about 27%) of the diverted traffic, it will be necessary that the pavement will have a sufficient strength to withstand the cargo traffic. Also necessary will be the markings of center lines, lane lines, crosswalks, and stop lines, and the installation of speed limit signs, the pedestrian crossing signs, and other ancillary facilities in the roadway parts. Along with the pavement of the unpaved section, the currently paved sections should be repaired as necessary.

(2) R. Castillo Street/J.P. Laurel Avenue Intersection Improvement and Traffic Signal Installation

a) Existing Problems

Although traffic flowing from north toward Poblacion would otherwise naturally proceed onto Castillo Street in view of the shape of the road network, the traffic not only separate onto it and J.P. Laurel Avenue at R. Castillo Street/J.P. Laurel Avenue Intersection but also concentrate more onto the latter (12,000 vehicles per day) than on the former (2,000 vehicles per day) for reasons. At this intersection, traffic accidents are frequent.

b) Recommendations

It is recommended that the shape of this intersection be corrected and traffic signal lights be installed.

(a) Intersection Improvement

- i) Marked in and near the intersection be stop lines, center lines, crosswalks, and lane lines.
- ii) Carriageways approximately 30 meters from the intersection be paved for their entire width.
- iii) The traffic island to attain smooth traffic flow be constructed.

(b) Traffic Lights Installation

- i) The traffic lights be of regulated 60-second cycles.
- ii) The signal be of two phases.
- iii) As the access road near the intersection, of which traffic volume is as small as 600 vehicles/day, is 40 meters away from the intersection, its traffic signal control be disregarded.

TABLE 4.1 TRAFFIC SIGNAL PHASE PLAN

PHASE	PHASE 1	PHASE 2
GREEN TIME	30 SECONDS	22 SECONDS
APPROACH		
APPROACH A		←
APPROACH B	↘	
APPROACH C		→

- REMARKS:
- (1) CYCLE LENGTH: 60 sec.
  - (2) A YELLOW TIME OF 3 SECONDS AND AN ALL-RED TIME OF 1 SEC BE PROVIDED BETWEEN PHASES.
  - (3) RIGHT TURNS BE ALWAYS ALLOWED.

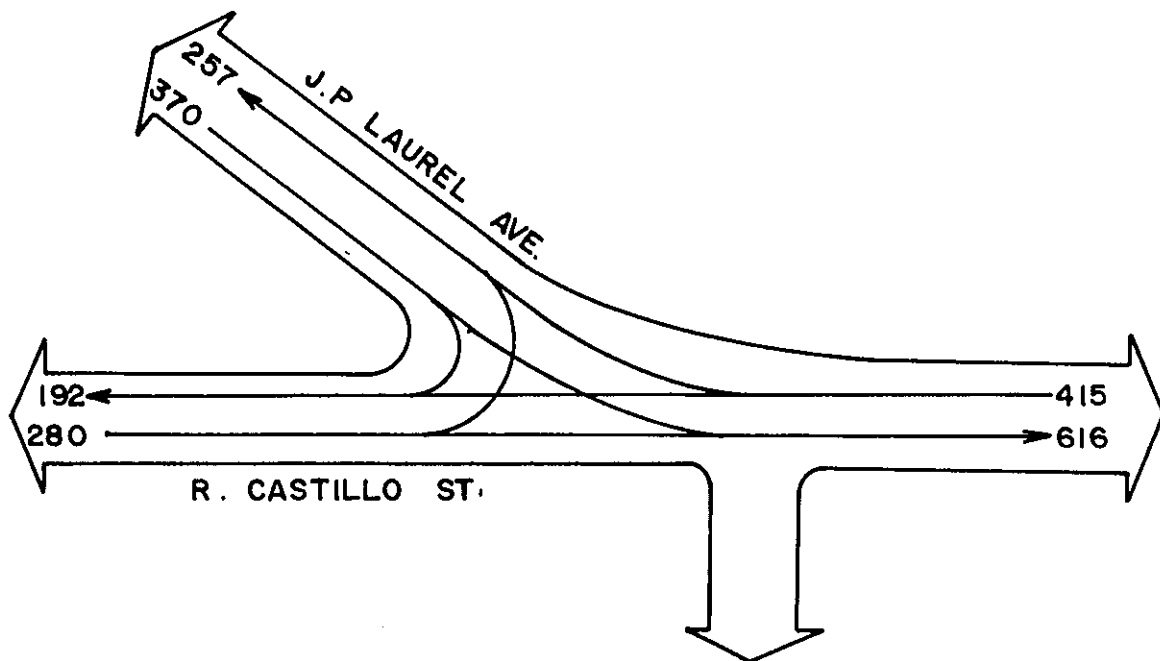


FIG. 4.2 ESTIMATED PEAK HOUR TRAFFIC VOLUME OF CASTILLO ST./J.P. LAUREL AVE. INTERSECTION

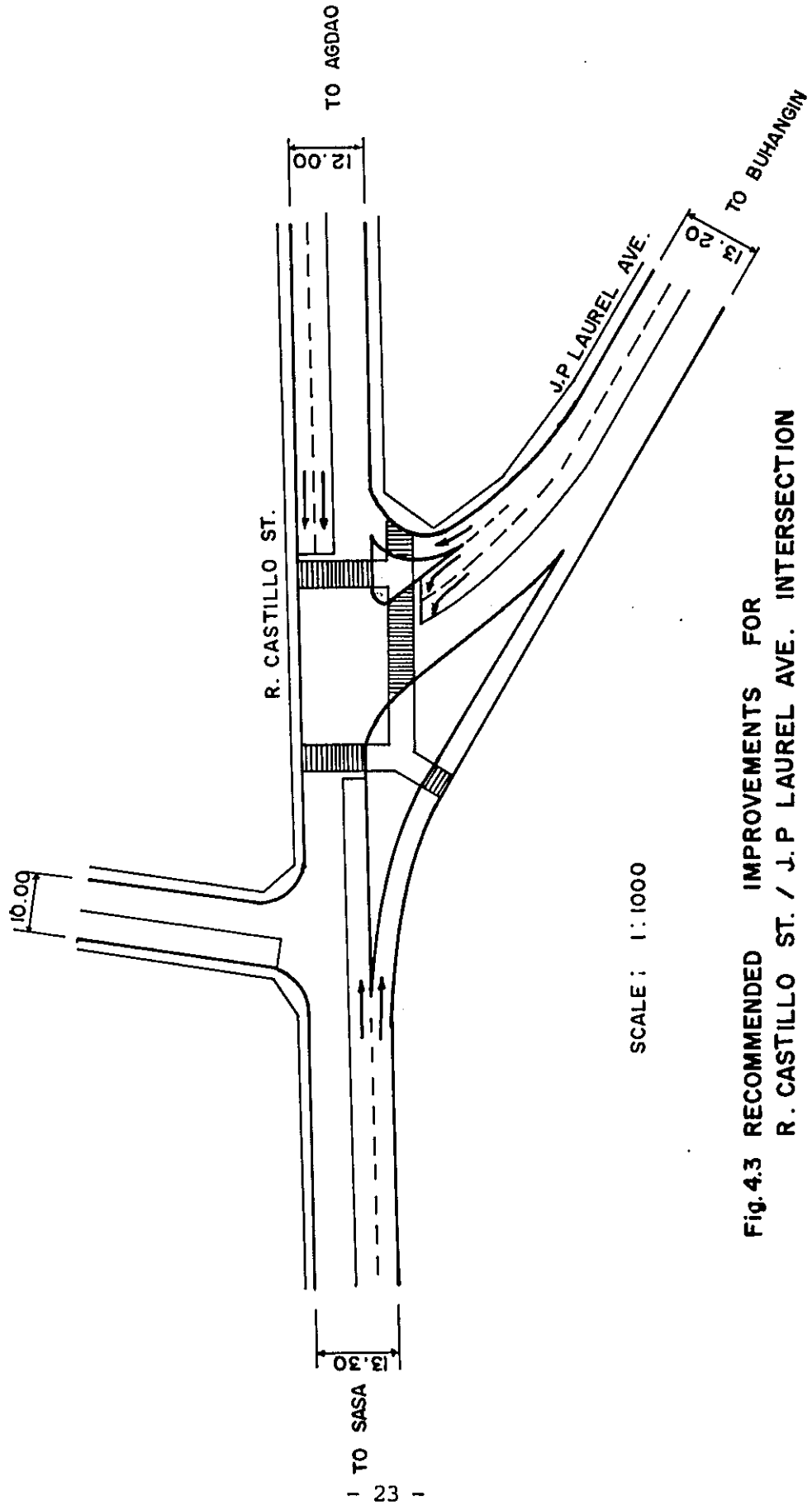


Fig. 4.3 RECOMMENDED IMPROVEMENTS FOR  
R. CASTILLO ST. / J.P. LAUREL AVE. INTERSECTION

(3) Construction of PUJ Bays along J.P. Laurel Avenue and McArthur Highway

a) Existing Problems

The congestion degree map (Fig. 2.1) shows that traffic congestion generally occur along the PUJ routes. A review of this map together with the result of travel speed survey on major thoroughfares reveals the following problems.

- (a) In heavy traffic sections, particularly on McArthur Highway and J.P. Laurel Avenue, private cars and PUJs are being operated at about the same speed and they often form conglomerates as they proceed on road in morning peak hours. This phenomenon only proves that the operation of private cars are being hindered by the slower movement of PUJs.
- (b) Travel speed in roadways is being inevitably held at low in morning peak hours 18 to 23 kilometers per hour in the case of traffic moving on McArthur Highway towards Poblacion (between E. Quirino Avenue/A. Pichon Avenue and Diversion Road) and 17 to 18 kilometers per hour in the case of that going to Poblacion via J.P. Laurel Avenue (between Santa Ana Avenue and R. Castillo Street).  
(See Fig. 4.5, 6 ,7)
- (c) A study of the causes of delay by the number of stoppages of vehicles reveals that the greatest cause for all surveyed roads in Poblacion is PUJ stopping for loading and unloading. In the above mentioned sections of McArthur Highway and J.P. Laurel Street, such causes, in descending order of importance, are PUJs stopping for loading/unloading, vehicles joining the traffic at inter-sections, and pedestrians crossing the road.  
(See Table 4.2).

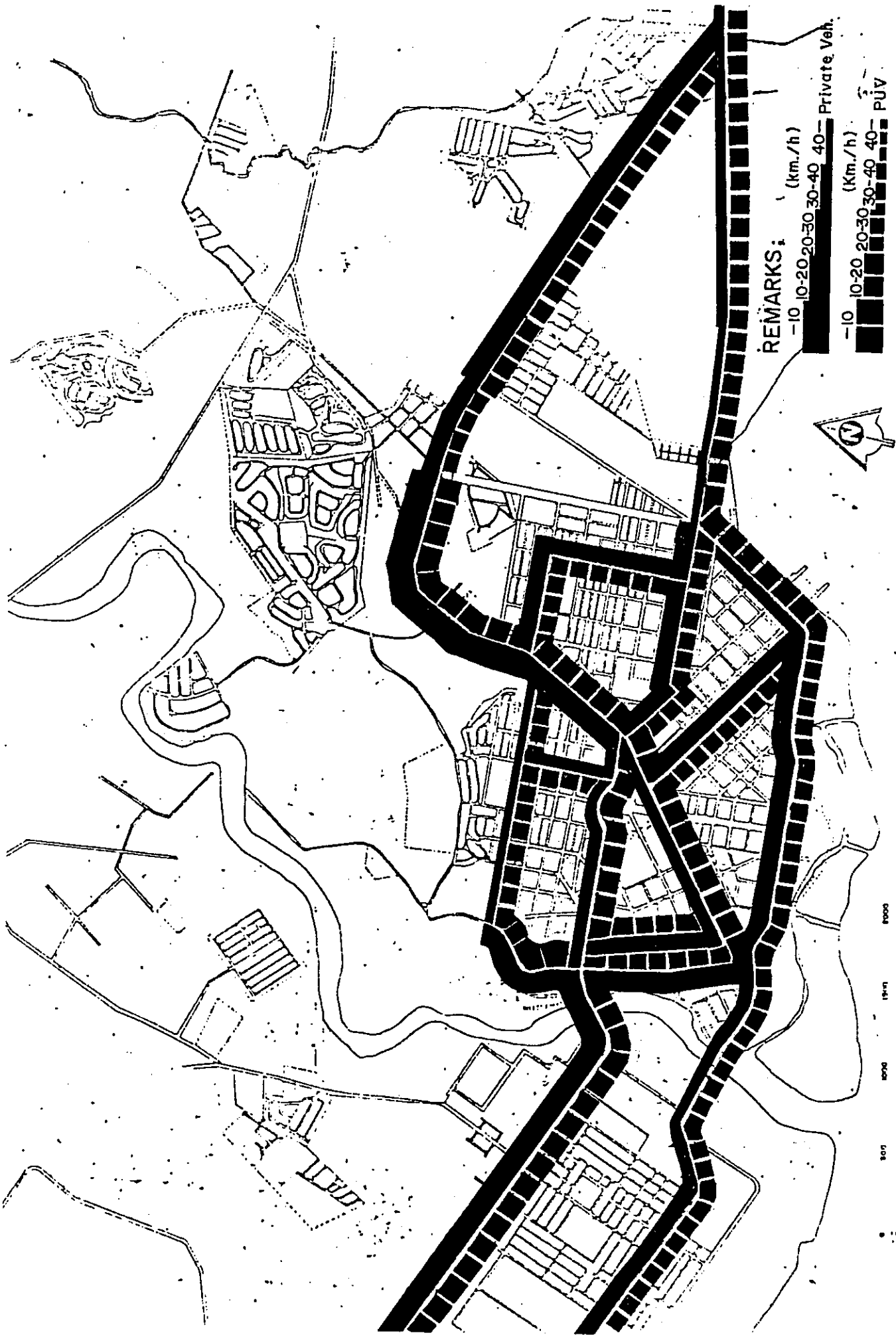
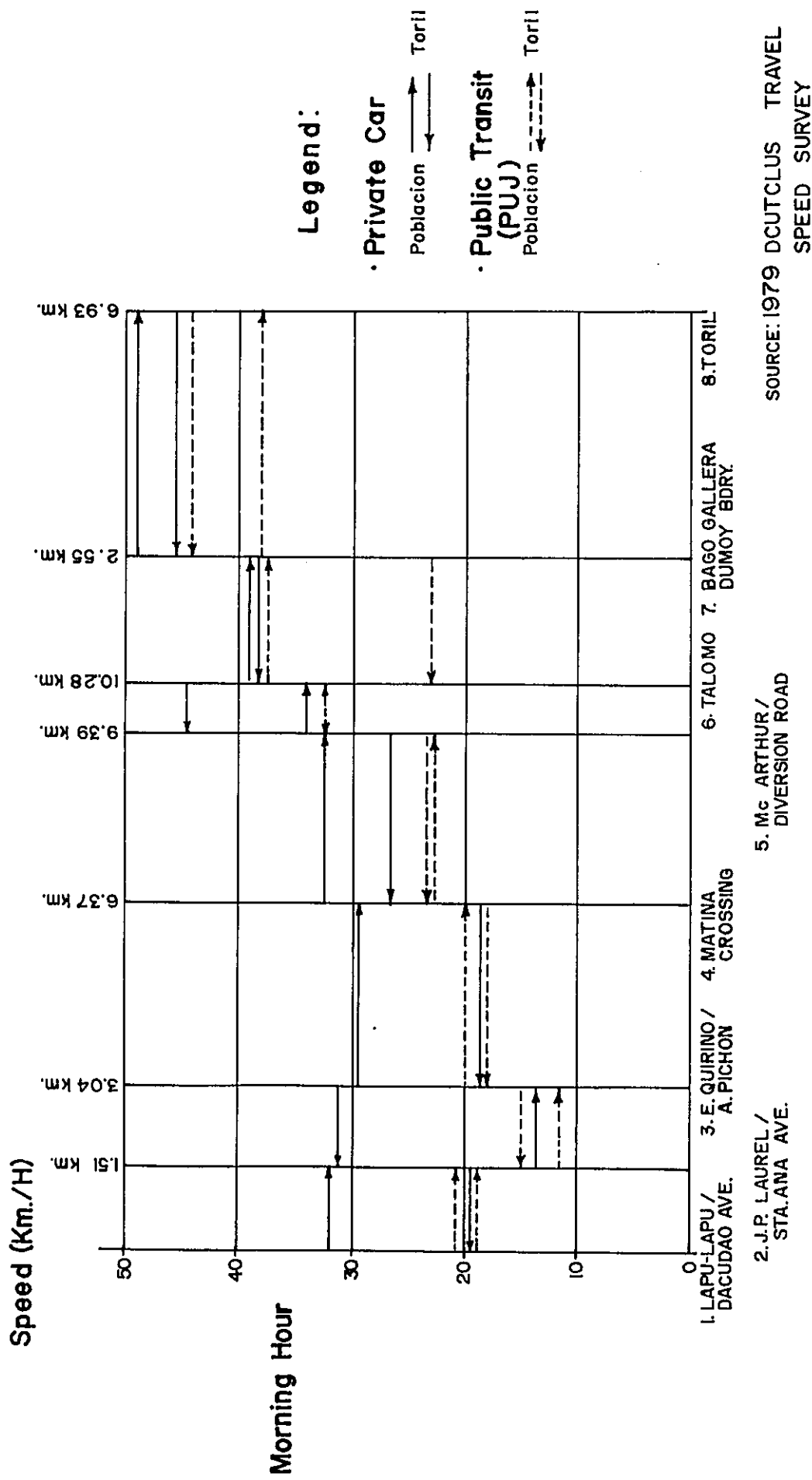


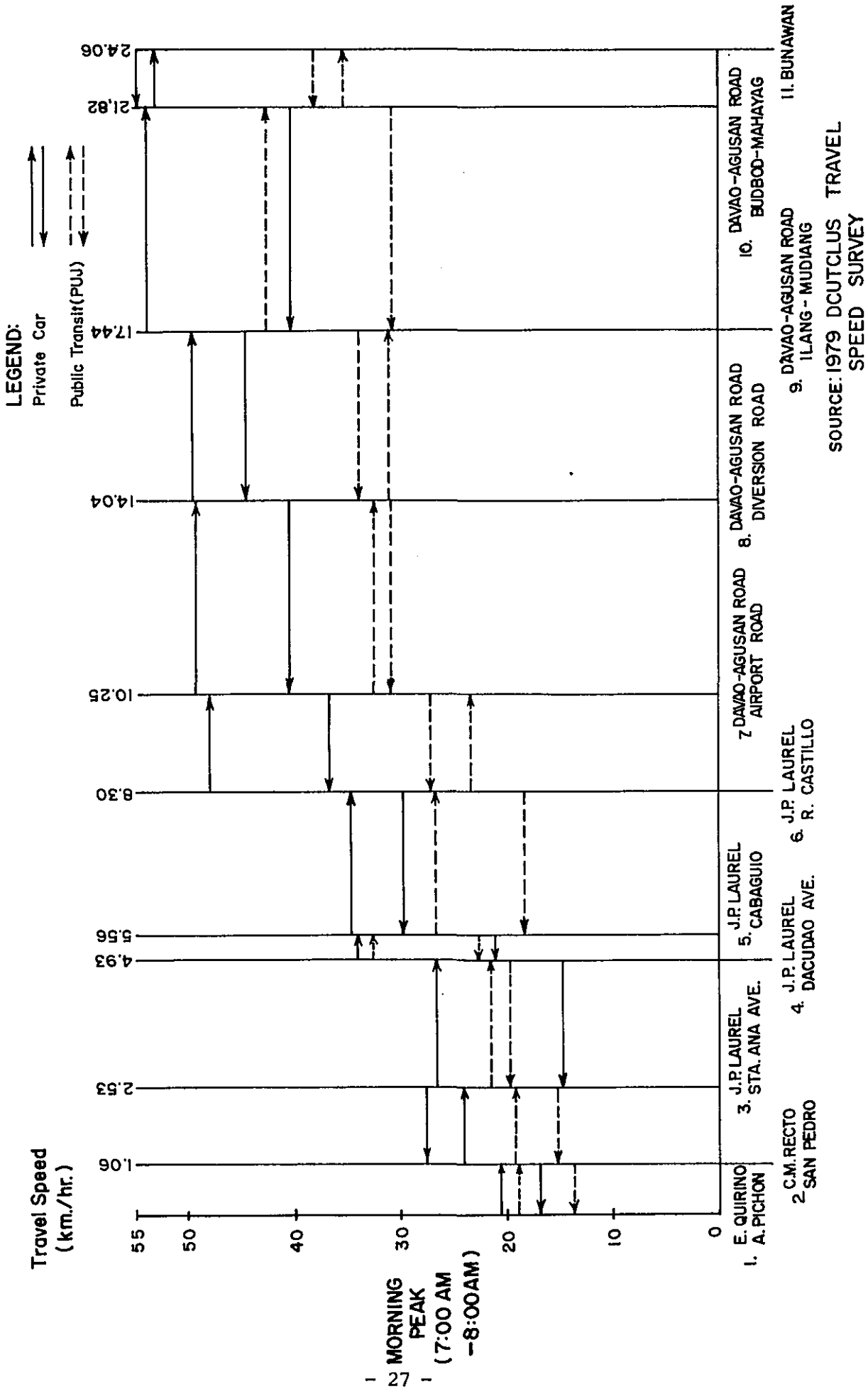
Fig.4.4 TRAVEL SPEED

SOURCE: 1979 DCUTCLUS TRAVEL SPEED SURVEY



SOURCE: 1979 DCUTCLUS TRAVEL SPEED SURVEY

Fig. 4.5 TRAVEL SPEED (Poblacion - Toril)



**Fig. 4.6 TRAVEL SPEED (Poblacion - Bunawan)**



Table 4.2 Causes for Vehicle Operation Delay

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

SOURCE: 1979 DCUICLUS Travel Time Survey

b) Recommendations

In order to minimize the obstruction to vehicles following the preceding PUJs, it is recommended that PUJ bays be installed on these thoroughfares. The bays will also lead to the improvement of PUJ user safety. The following are suggested with regard to the establishment of PUJ bays.

- (a) PUJ bay establishment is recommended for the section of McArthur Highway between Bankerohan and Matina Crossing and in the section of J.P. Laurel Avenue between Santa Ana Avenue and J. Cabaguio Street, where the frequency of PUJ operation is high and traffic is heavy (see Fig. 4.7).
- (b) PUJ bays should be created in locations convenient for user utilization, but not within about ten meters of any road intersection. Standard intervals between bays to be established on any side of the road should be 400 meters. It is recommended that, on McArthur Highway, PUJ bays be faced with each other across the road, while on J.P. Laurel Avenue, those on one side of the road alternate with those on the other side, as shown in Fig. 4.8.
- (c) Each bay should have a standard width of three meters and a standard effective length of 21 meters ( to accommodate three stopping PUJs; should a greater number of PUJs are to be stopped at a bay, seven meters should be added to the effective length of the bay for each additional PUJ), as shown in Fig. 4.9.
- (d) Each bay should be sandwiched by tapered sections with a length of about 10 meters each in order to facilitate the easy entry of PUJs into the bay and their departure from it.
- (e) For user amenity in waiting for and embarking and debarking PUJs, area just outside each bay be paved for the entire length of the bay (the effective length and tapered sections), where a shelter of

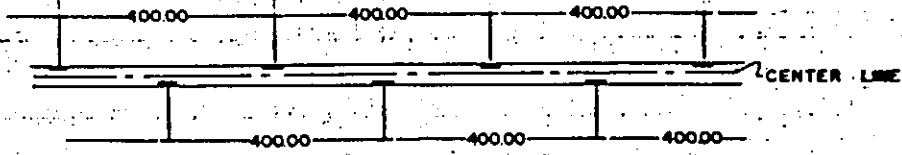
about two meters by four meters be erected to provide protection from heat and rain.

- (f) Road surfaces in the vicinity of each bay should be marked with lane lines, crosswalk lines, and arrows to indicate the direction in which vehicles are to proceed. Also, signs indicating the PUJ loading/unloading zone should be erected.
- (g) In order to assure the proper and effective utilization of PUJ bays, appropriate guidance and law enforcement should be effected.



**Fig.4.7 RECOMMENDED ROAD SECTIONS FOR  
PUJ BAY ESTABLISHMENT**

( J.P. LAUREL AVE.)



( MC ARTHUR HIGHWAY )

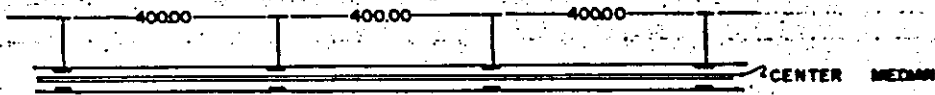
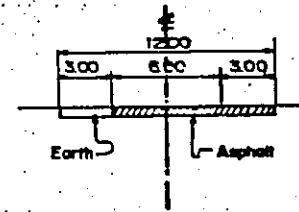
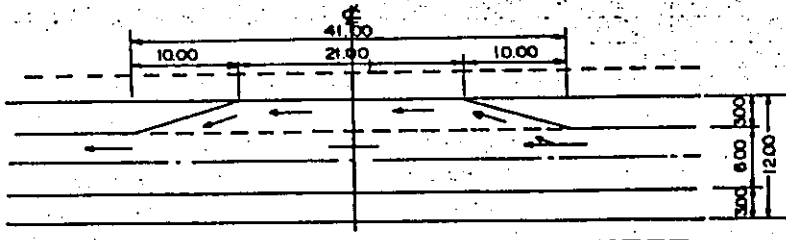


FIG. 4.8 RECOMENDED LAYOUT OF PUJ BAYS

(J.P. LAUREL AVE.)



(McARTHUR HIGHWAY)

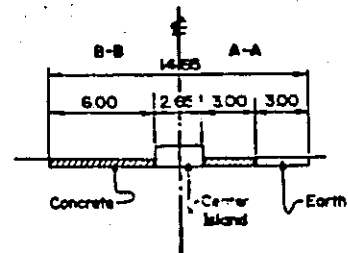
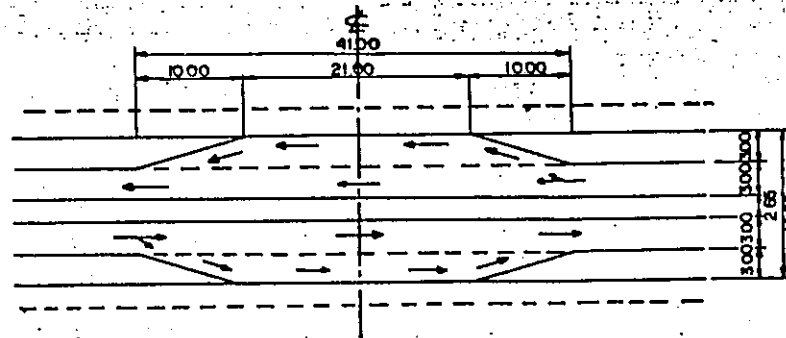


FIG. 4.9 RECOMENDED STANDARD TYPE OF PUJ BAY

2) Remedial Measures for Selected Areas

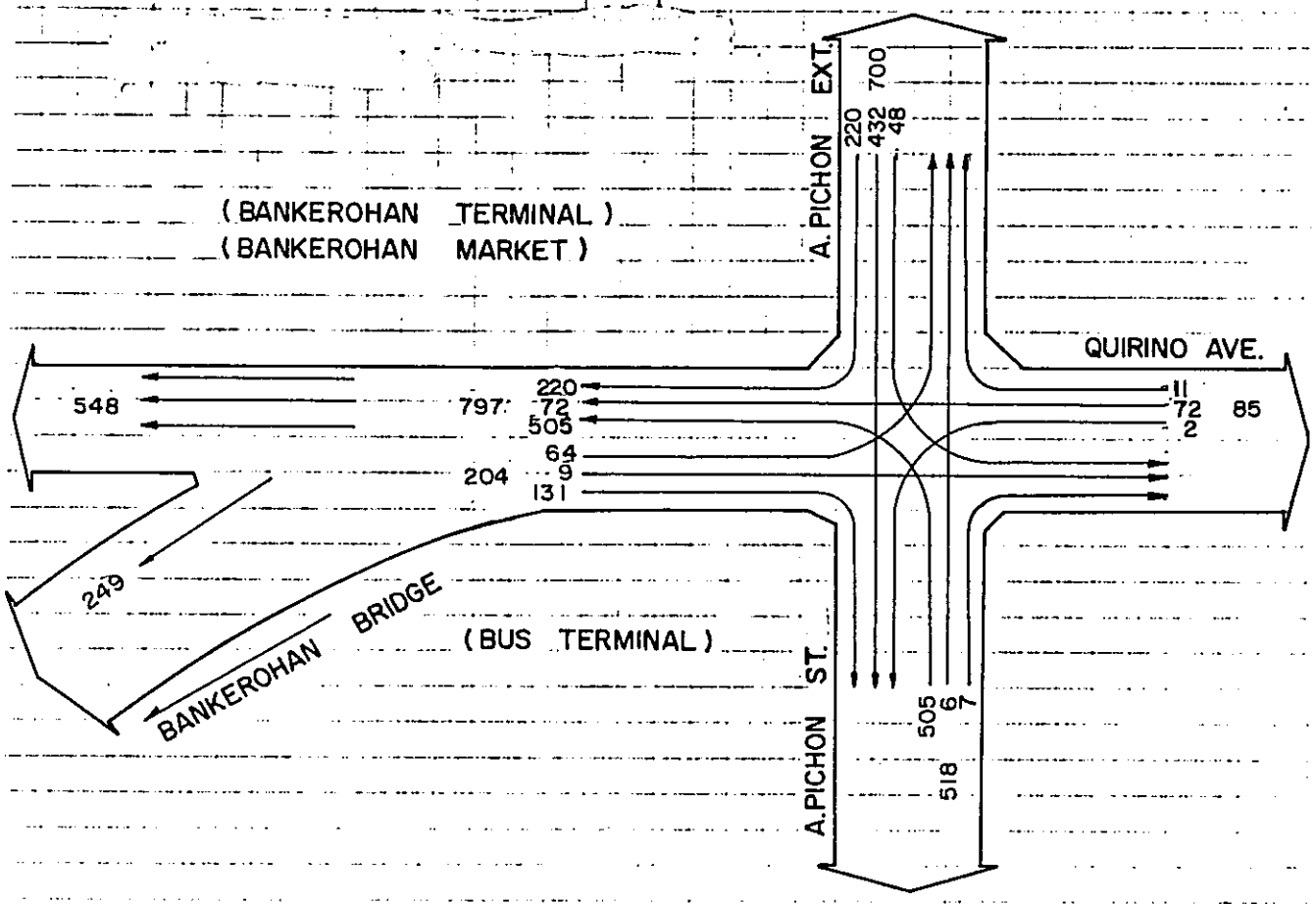
(1) Bankerohan Bridge Area

a) Existing Problems

This is the entrance to Poblacion of traffic flowing from south. The traffic flowing on McArthur Highway crosses Bankerohan Bridge and enters into this particularly congested area of Poblacion where a market, a bus terminal, and PUJ and tricycle loading/unloading zones are concentrated and is close to the downtown area.

- (a) This is the area in Davao City where traffic snarl is the worse. The volume of traffic which crosses the river via Bankerohan Bridge - the entrance to this area -- reaches 28,000 vehicles per day.
- (b) The traffic capacity of Bankerohan Bridge is limited by the traffic capacity of two intersections existing in the area: the intersection formed ramps connecting the section of road between McArthur Highway and Quirino Avenue with an underpass and that where this road intersects with A. Pichon Street.
- (c) As one crosses Bankerohan Bridge and enters into Poblacion, he finds a bus terminal on the right and PUJ and tricycle loading/unloading zones and a market on the left, which are all important sources of traffic demand. Therefore, traffic departing from and arriving at these sources hinder the smooth flow of through traffic, spurring the traffic snarl in the area.
- (d) An average total of 550 PUJs proceeds from Quirino Avenue through the one-way road into the market area in the morning peak hour. This traffic accounts for about one-third of the exit traffic, in the Bankerohan market direction of Quirino Avenue, of the intersection (A. Pichon Street/Quirino Avenue) in the morning peak hour. This traffic coming from A. Pichon Street mostly

make left turn at the intersection, and greatly impairs the traffic handling capacity of the intersection. It is, therefore, strongly desired that appropriate measures be taken with regard to PUJs making left turn at the A. Pichon/Quirino intersection and those entering into the Bankerohan Market Area.



Source: Nov. 1979 DCUTCLUS  
Traffic Count Survey

FIG. 4.10 EXISTING PUJ TRAFFIC VOLUME (7:00-8:00 A.M)

b) Recommendations

It is recommended that the following measures be taken in order to solve these urgent traffic problems. (While this Area is connected in a unified manner with A. Pichon Street-San Pedro Street Area, discussed under the next section, please refer to Fig. 4.18 with regard to recommendations pertaining to traffic management in this Area).

- (a) In addition to the already effected prohibition of parking on the both sides of road between Bankerohan Bridge and A. Pichon Street, "no left" turn should also be effected in this section for all vehicles except buses which utilize the bus terminal.
- (b) The PUJ loading/unloading zones now existing in said section of the road should be eliminated and moved to the market area.
- (c) PUJ exits from the market area should be located on A. Pichon Street and A. Pichon Extension.
- (d) The entry/exist of buses from the bus terminal should be to/from Quirino Avenue and A. Pichon Street. Buses be allowed to make left turn at the Quirino Avenue exit.
- (e) In addition to the intersection improvement to be recommended under (2)-b) (b) (v), the thoroughfares in this area should be marked with lane lines, stop lines and crosswalk lines. Also, signs should be erected indicating pedestrian crossings, no parking areas, one-way streets, loading/unloading zones, speed limits, no left turn, and no entry.
- (f) It will be essential that public relations program be implemented in order to educate the users and drivers of PUJs, tricycles, and buses in the way in which traffic should flow smoothly in this area. Equally essential will be to provide effective guidance to and fair and strict law enforcement on violators.

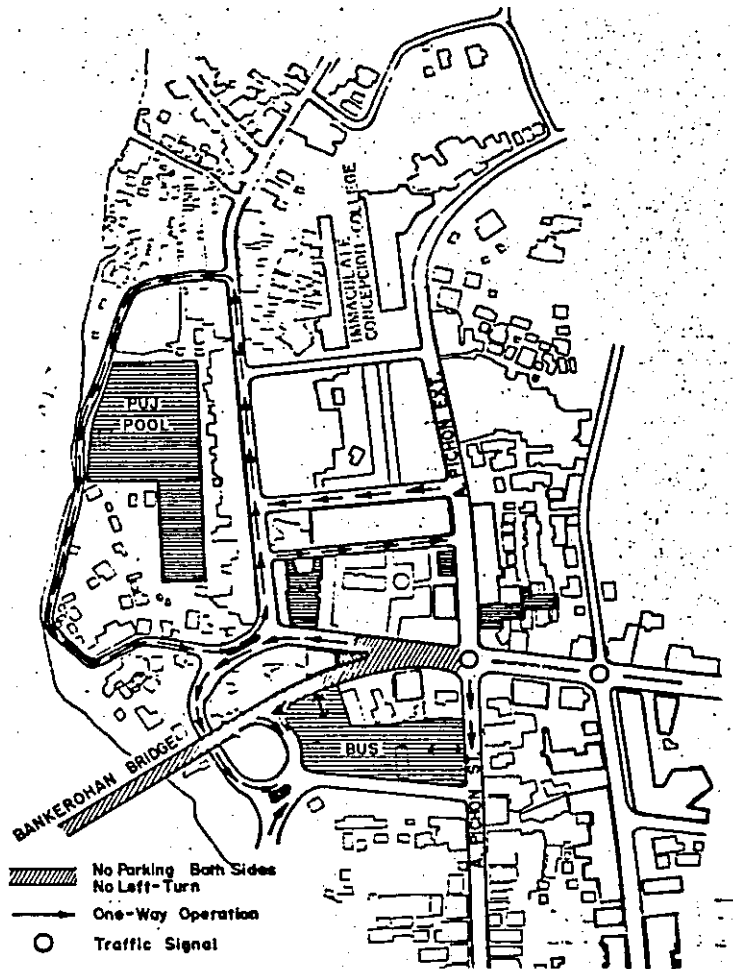


Fig. 4.11 TRAFFIC MANAGEMENT SCHEME IN THE BANKEROHAN BRIDGE AREA

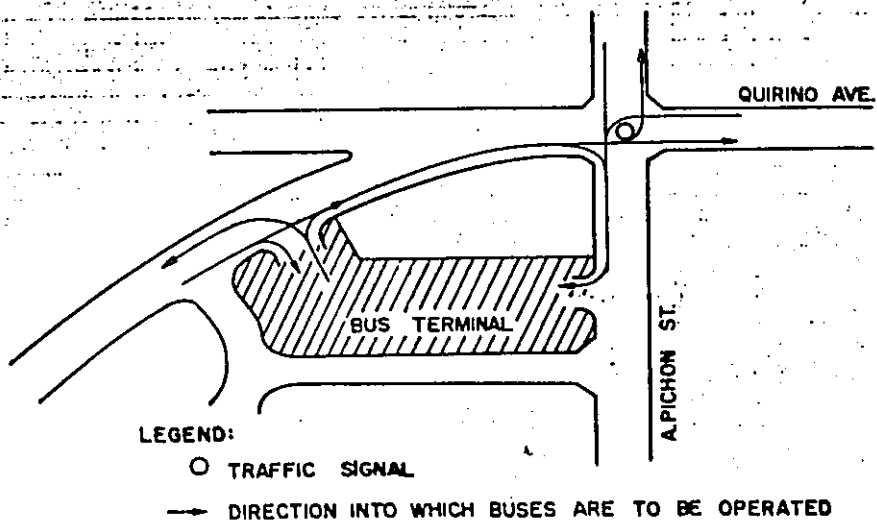


Fig.4.12 TERMINAL BUS ROUTING SCHEME

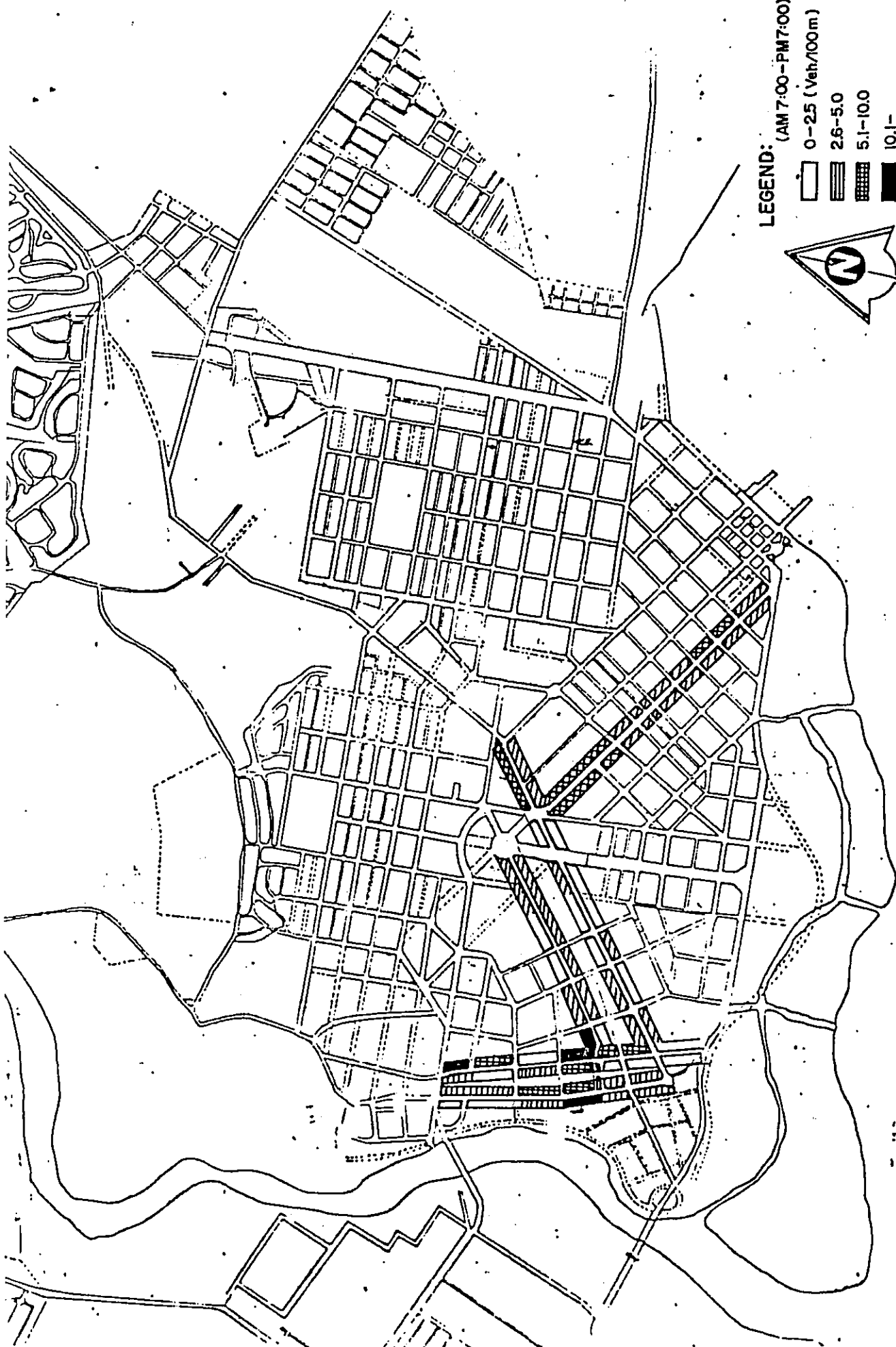


(2) A. Pichon Street-San Pedro Street Area

a) Existing Problems

The City Hall, universities, churches, and other large public facilities are concentrated in the vicinity of A. Pichon Street and San Pedro Street which, by serving as a nucleus of commercial area, constitutes the center of urban activities in Davao. For this reason, traffic converges into this area for a large variety of purposes, creating diverse substantial traffic problems.

- (a) All PUJ routes in the area start from A. Pichon Street, on which traffic congestion is severe for that reason (See Fig. 2.1).
- (b) The incidence of traffic accidents is very high on both A. Pichon Street and San Pedro Street (See Fig. 2.2).
- (c) The traffic capacity of these streets is much deteriorated by the excessive numbers of vehicles parked on them (See Fig. 4.13).
- (d) An unevenly large number of vehicles entering this area from the south of Davao River utilize Bankerohan Bridge in comparison with the number utilizing Bolton Bridge, through which accessibility to this area is poor.



LEGEND: (AM 7:00-PM 7:00)

- 0-2.5 (Veh/100m)
- 2.6-5.0
- 5.1-10.0
- 10.1+

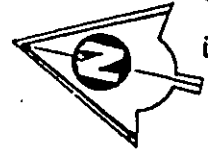


Fig. 4.13 CURRENT DENSITY OF CURB PARKING

1000 1500 2000

SOURCE: 1979 DCUTCLUS PARKING SURVEY

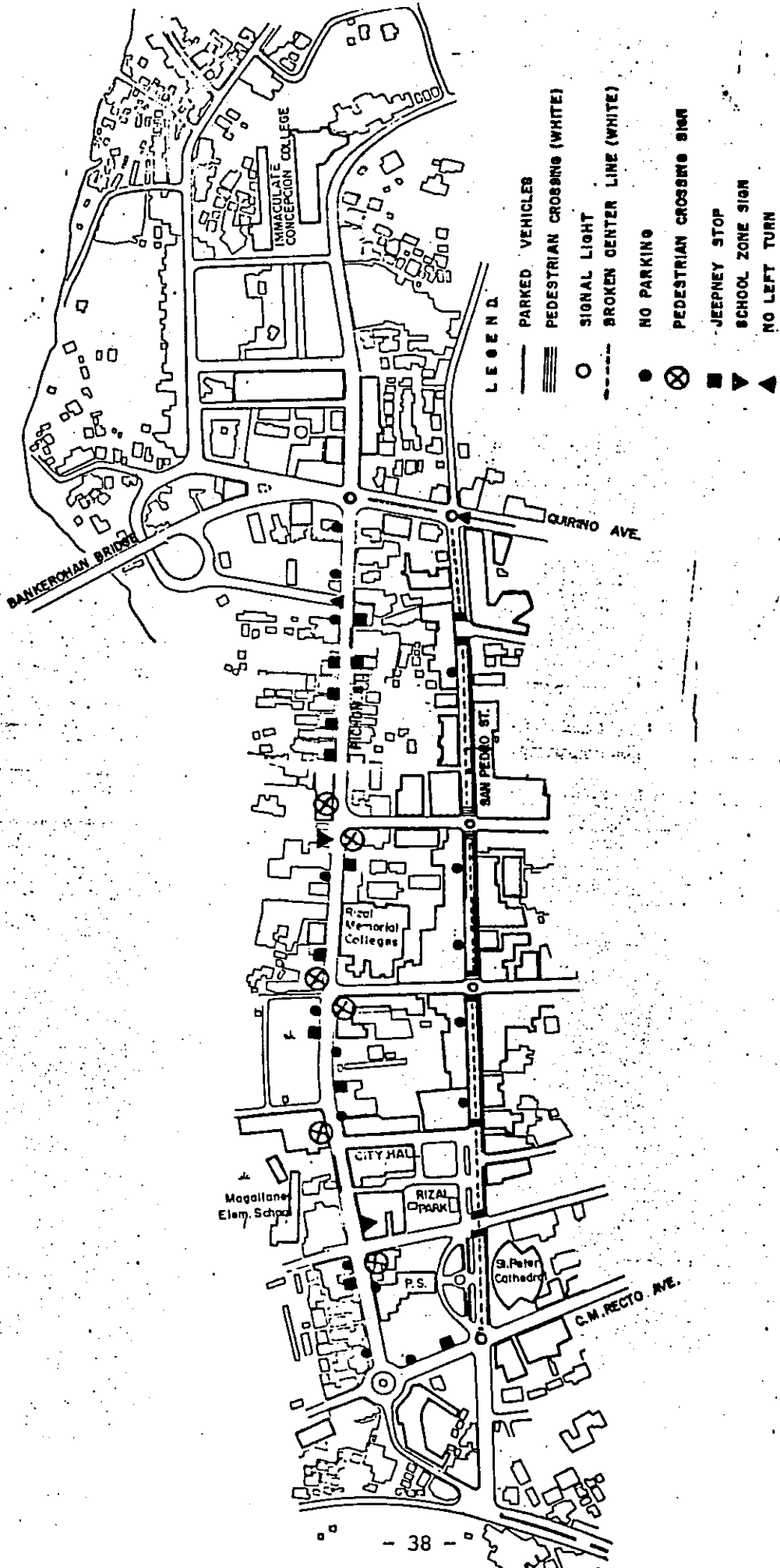


FIG. 4.14 EXISTING ROAD SIGNS AND MARKINGS

b) Recommendations

A comprehensive analysis of these traffic problems, both from qualitative and quantitative aspects, has resulted in the recommendation of projects in various fields to include road construction, traffic facilities installation, and traffic control.

(a) Extension of A. Pichon Street

It is recommended that A. Pichon Street be extended and directly connected with Quezon Boulevard, or that the road conceived of by some as "Washington Avenue" be constructed. When this is done, the accessibility of this area from the direction of Ecoland will be much improved, and the existing traffic will be diverted from Bankerohan Bridge to Bolton Bridge in an appreciable degree so that the existing congestion on and through the former will be mitigated. The change in traffic volumes through these two bridges due to the implementation of this project is estimated as presented in Table 4.3. A total of 3 houses will have to be relocated to allow the construction of this road.

Table 4.3. A FORECAST OF DIVERSION TRAFFIC RESULTING FROM THE EXTENSION OF A. PICHON STREET

	Unit: veh/day	
	Current Traffic Volume	Traffic volume after Improvement
Bankerohan Bridge	29,000	25,000
Bolton Bridge	10,000	14,000

(b) Introduction of Traffic Management System

(b)-1 Under One-Way Traffic System

A. Pichon Street and San Pedro Street, which run parallel to each other with a distance of about 150 meters between them both constitute the two major shopping streets in Davao City. The solution of the above sited traffic problems on these streets is difficult. The number of person trips on these streets are too large to allow the banning of PUJ operations on them, while parking spaces are too few to justify the strict enforcement against curb parking. Therefore, the traffic management system described below is recommended. Although this will be a substantial undertaking, it is, nevertheless, recommended in belief that the accomplishment of smooth flow of traffic and the improvement of traffic safety on these streets, through the implementation of this project, will be vitally important.

i) Introduction of one-way traffic system

The designation of one-way streets will enable not only the expansion of road's traffic capacity and improve traffic safety but also allow the securing of PUJ stopping lane, through which public transportation service will be upgraded.

Listed below are candidates for designation as one-way streets (see Fig. 4.18). In the implementation of a one-way system of this wide coverage, the understanding and consent of the citizenry, particularly of the road-side inhabitants, must be obtained in advance. For this purpose, ample opportunities should be provided for explanation to and discussions between them and the authority.

- (i) A. Pichon Street, from the intersection of Quirino Avenue to the intersection of C.M. Recto Avenue.
- (ii) San Pedro Street, likewise from the intersection of Quirino Avenue to that of C.M. Recto Avenue.

- (iii) P. Pelayo Street, from the intersection of A. Pichon to that of San Pedro
  - (iv) F. Inigo Street, also from A. Pichon to San Pedro Street
  - (v) C. Bangoy Street, from A. Pichon Street to J.P. Rizal Street
  - (vi) Bolton Street from A. Pichon to San Pedro Street
- ii) Establishment of Loading/Unloading Zones

It is recommended that loading/unloading zones be established on both A. Pichon Street and San Pedro Street in the manner explained below, in order to secure the safety of those who utilize public transportation systems.

- (i) First, sidewalks should be constructed on these streets where they are now missing.
- (ii) These zones should be established on the right side of the road (in the direction of vehicle proceeding), one for each block or at the intervals of 200 meters as a principle, provided that no zone should be made within 10 meters of each intersection.
- (iii) Each loading/unloading zone should have a length of 30 meters.
- (iv) Sidewalk curbstone should be painted white in order to indicate the loading/unloading zones.
- (v) In order to effectuate the prohibition of pedestrians from entering into driveways in a haphazard manner, it is recommended that guard fences be erected or flower boxes be placed in line along curbstone other than at the loading/unloading zones and crosswalks.

iii) Establishment of No Parking Areas

In order to improve the traffic capacity and safety of roads in this area, which are currently being much hampered by the practice of curb parking by vehicles many of which continue to remain parked all day (see Figure 4.13). The prohibition of parking should be effected on one side (indicated below) of the one-way sections of the following streets

- (i) A. Pichon Street (right side of the road)
- (ii) San Pedro Street (also right side)
- (iii) P. Pelayo Street (left side)
- (iv) F. Inigo Street (left side)
- (v) C. Bangoy Street (left side)
- (vi) Bolton Street (left side)

iv) Installation of Traffic Signal

It is recommended that traffic signals be installed at the following intersections in order to facilitate the smooth flow of traffic and to minimize traffic accidents.

- (i) San Pedro Street/Quezon Boulevard Intersection
- (ii) A. Pichon Street/Quezon Boulevard Intersection

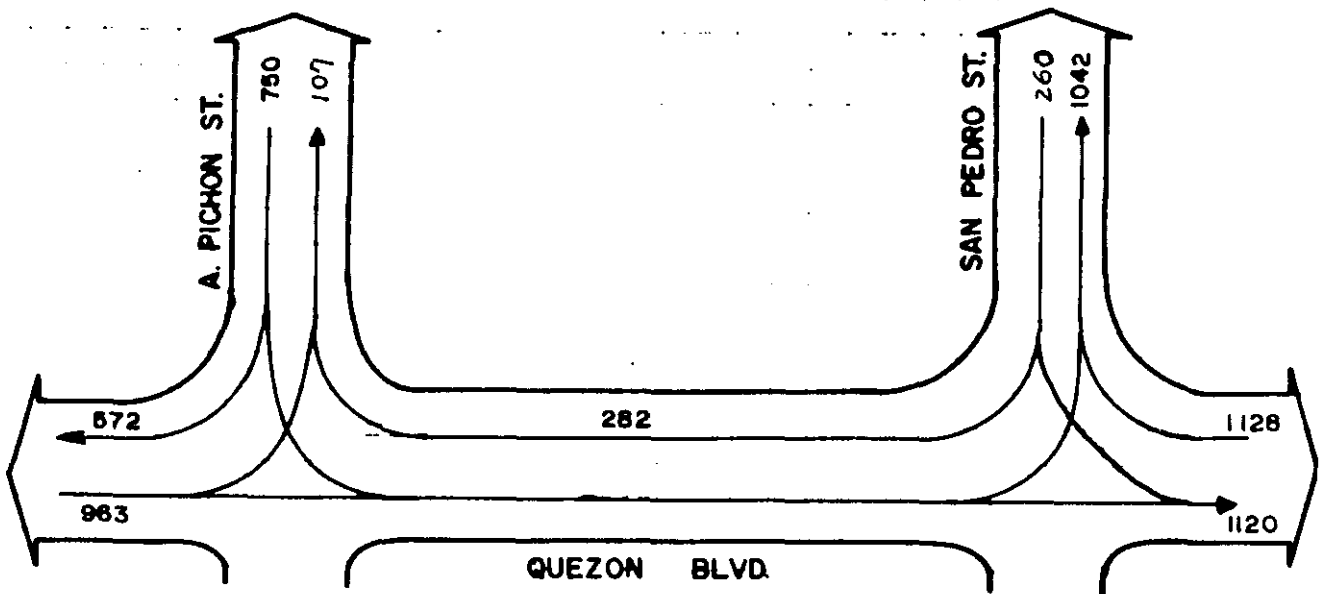
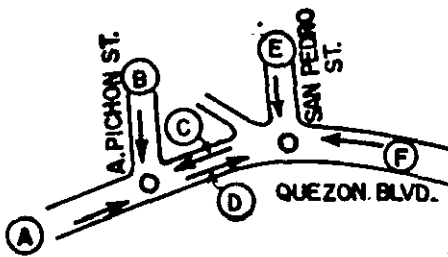
It is further recommended that a constant cycle multi-dial signal with a cycle length of not longer than 120 seconds be adopted in place of the currently used manual signal. In view of the short distance between the two intersections mentioned above, signals at these intersections should be synchronized with each other.

Table 4.4 TRAFFIC SIGNAL PHASE PLAN

Phase		Phase-1	Phase-2	Phase-3
Green Time		23 sec.	18 sec.	20 sec.
Approach				
Approach	A	→	→	
	B			↘
	C	←		
	D	→	→	
	E			↘
	F	←		

Remarks: (1) Cycle length : 70 seconds

(2) Right turns be always allowed.



**Fig. 4.15 ESTIMATED PEAK HOUR TRAFFIC VOLUME OF QUEZON BLVD.**



v) Improvement of Intersection

In addition to the improvement of road environment in the vicinity of Bankerohan Bridge, it is recommended that the following measures be taken in order to improve A. Pichon/Quirino Intersection, where congestion is the heaviest with traffic flowing from the south of Poblacion to the downtown area.

- (i) The establishment of a left-turn lane on Quirino Avenue to accommodate vehicles turning into A. Pichon Street.
- (ii) The automation of signal phase changes and the synchronization of traffic signal at this intersection with those at the two adjacent intersections.
- (iii) Road surface markings to indicate lanes and crosswalks.
- (iv) Effectuation of parking prohibition in the vicinity of the intersection.

Incidentally, it is believed necessary that the need of same measures for San Pedro/Quirino Intersection be studied and evaluated.

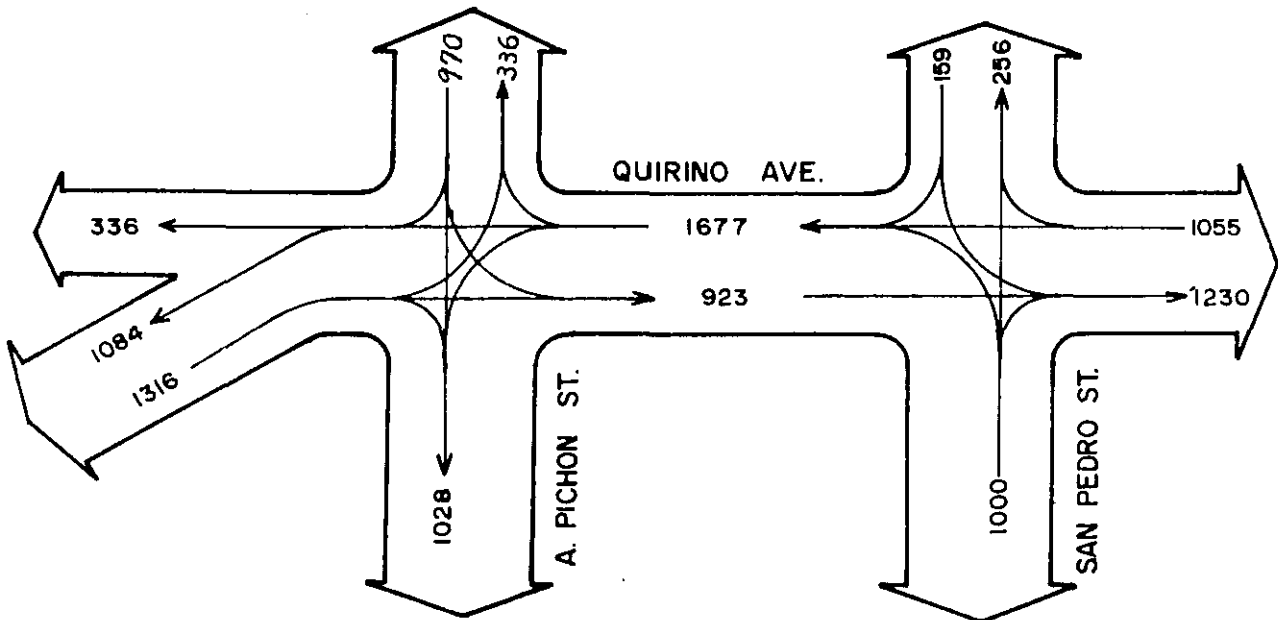


Fig. 4.16 TRAFFIC VOLUME IN THE MORNING PEAK HOUR UNDER THE PROPOSED PUJ REROUTING PLAN

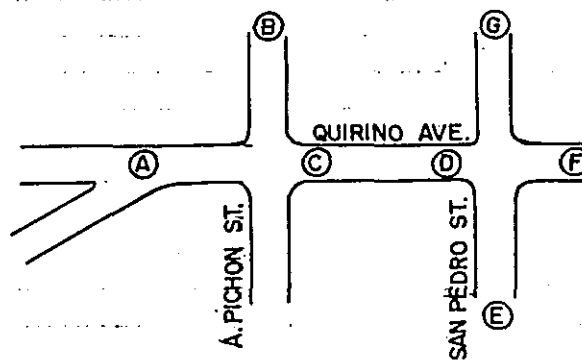
Table 4.5 TRAFFIC SIGNAL PHASE PLAN

Phase	Phase-1	Phase-2	Phase-3
Green Time			
Approach	42 sec.	40 sec.	26 sec.
Approach A	→	→	
Approach B			↓
Approach C	←	←	
Approach D	→		
Approach E		↗ ↑	
Approach F	←		
Approach G			↘

Remarks: (1) Cycle length : 120 sec.

(2) A yellow time of 3 sec. and an all-red time of 1 second be provided between phases.

(3) Right turns be always allowed



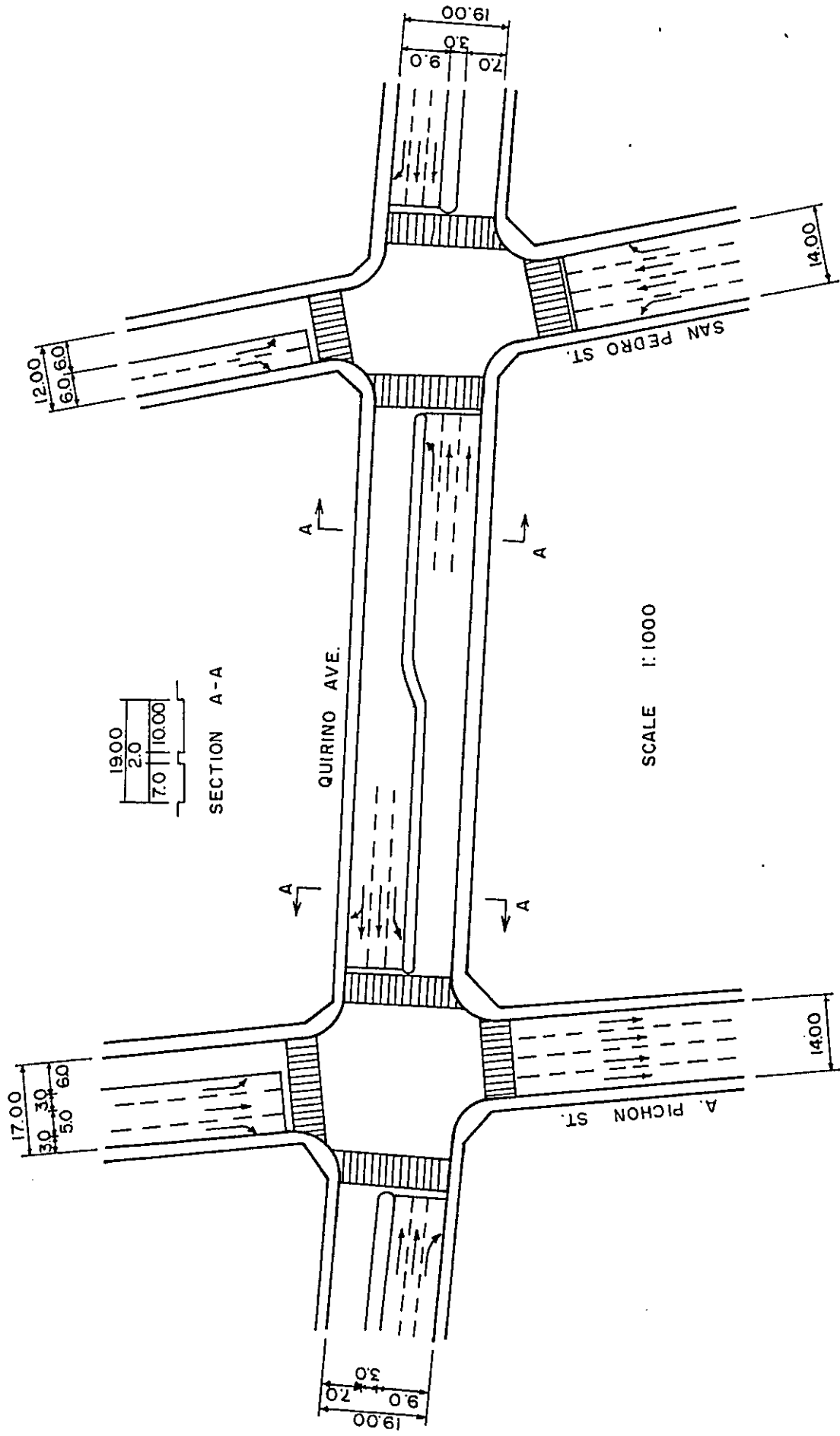


Fig. 4.17 RECOMMENDED IMPROVEMENTS FOR A. PICHON ST. / QUIRINO AVE. INTERSECTION

vi) Effectuation of Road Markings and Signs

The following road markings should be accomplished and road signs erected in this area where one-way system will be introduced, loading/unloading zones established, no parking areas designated, traffic signals be installed, and intersections be improved.

(i) Road Markings

- o Lane lines
- o Crosswalk lines
- o Stop lines
- o Mandatory arrows
- o No entry

(ii) Road Signs

- o Pedestrian Crossing
- o Stop and Yield
- o Mandatory
- o One-way
- o Speed Limit
- o No Parking
- o Loading/Unloading Zone

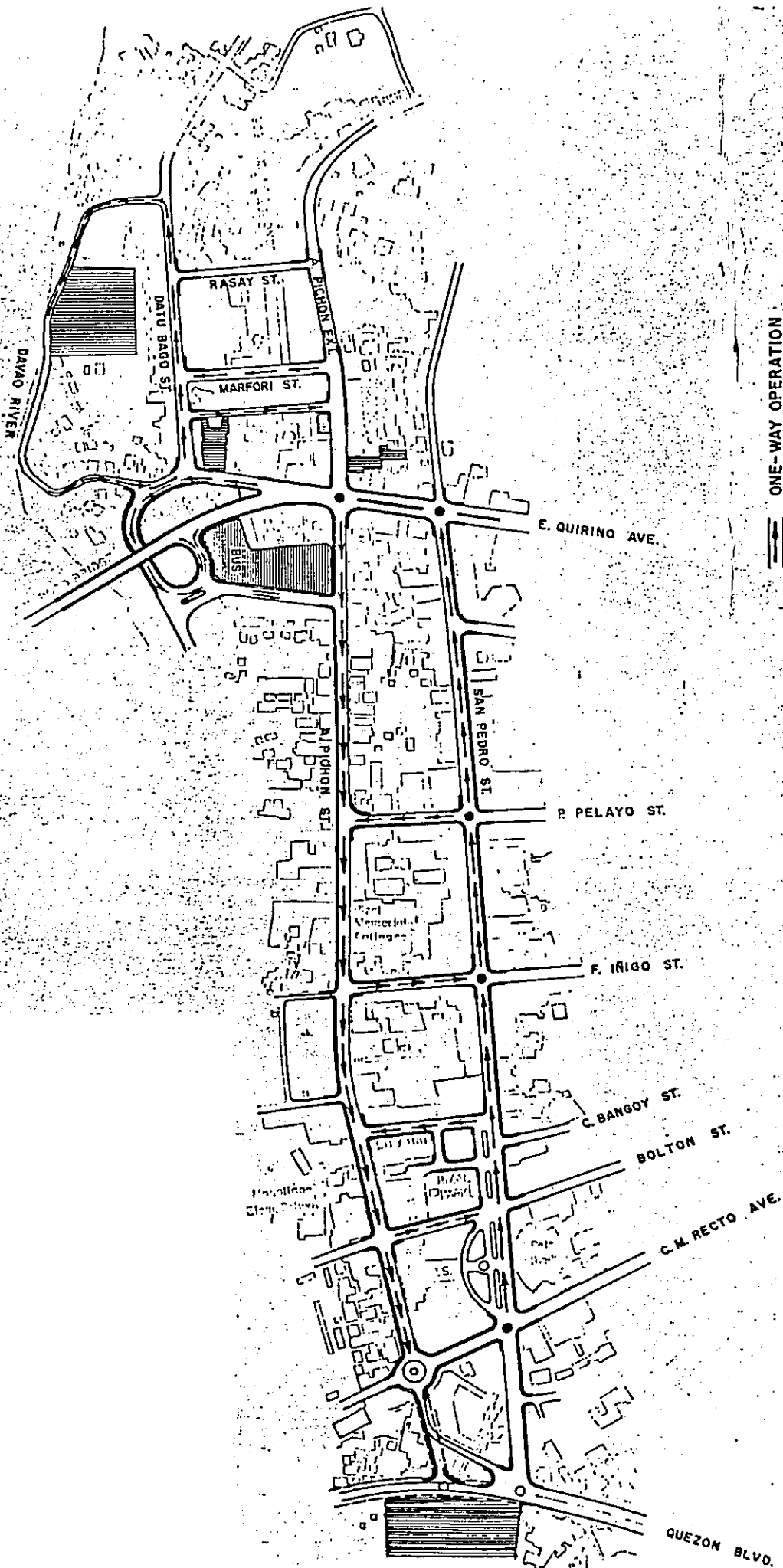
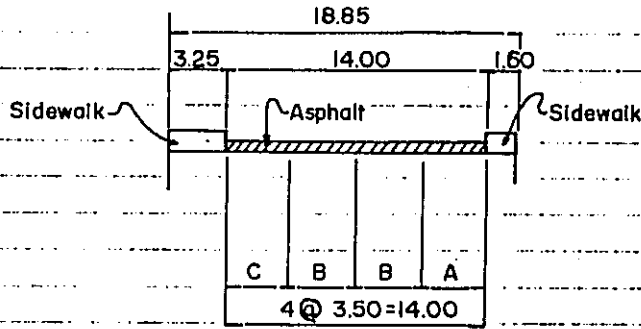
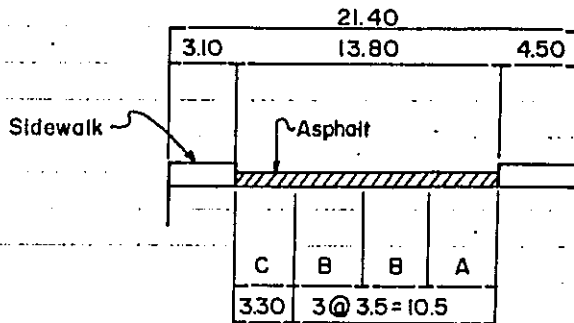


Fig. 4.18 RECOMMENDED TRAFFIC MANAGEMENT SYSTEM FOR A PICHON ST.- SAN PEDRO ST. AREA

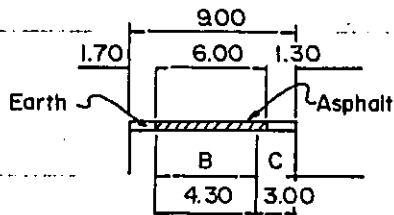
A. PICHON ST. SECTION (QUIRINO AVE.—QUEZON BLVD.)



SAN PEDRO ST. SECTION (QUEZON BLVD.—QUIRINO AVE.)



A. INIGO ST. (P. PELAYO ST.) SECTION (J. RIZAL—SAN PEDRO AVE)



LEGENDS:

- A --- LOADING / UNLOADING LANE
- B --- TRAFFIC LANE
- C --- PARKING LANE

Fig. 4.19 CROSS SECTION OF ONE-WAY ROAD AND UTILIZATION OF ITS ROADWAY

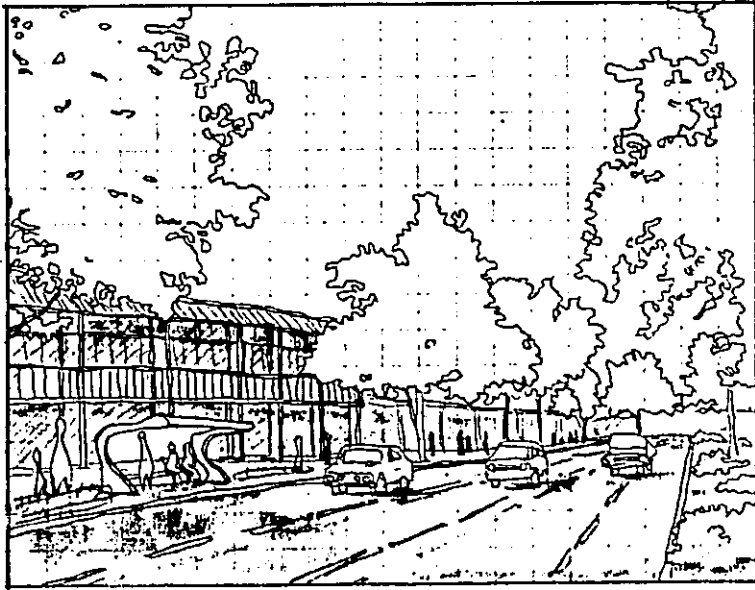
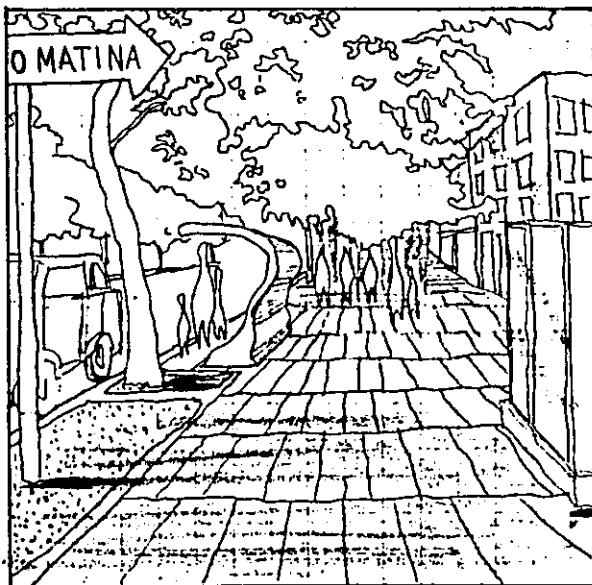


Fig. 4.20 SKETCHES OF  
A. PICHON ST.  
AFTER IMPROVE-  
MENT



(b)-2 Under Two-Way Traffic System

If one-way traffic system is not to be introduced on A. Pichon Street and San Pedro Street for the solution of their roadside problems, it is recommended that the following traffic management system be introduced.

i) Establishment of Loading/Unloading Zones

In order to secure the safety of those who utilize public transportation systems, loading/unloading zones should be established on A. Pichon Street and San Pedro Street in the manner described under b)-1 ii) above.

ii) Prohibition of Curb Parking

In order to expand the traffic capacities of, and to secure traffic safety on roads in this area, which are currently degraded by excessive number of vehicles parked on them all day, it is recommended that the following no-parking operation be effected.

(i) No parking on both sides of A. Pichon Street from E. Quirino Avenue to Quezon Boulevard;

(ii) No-parking also on both sides of San Pedro Street from E. Quirino Avenue to Quezon Boulevard;

(iii) No-parking on one side of P. Pelayo St., F. Inigo Street, C. Bangoy Street, Bolton Street, and C.M. Recto Avenue, from San Pedro Street to A. Pichon Street.

iii) Installation of Traffic Signals

It is recommended that traffic signals be installed at the following intersections for the smooth traffic management and the reduction of traffic accidents at the intersections.



- (i) San Pedro Street/Quezon Boulevard Intersection
- (ii) A. Pichon Street/Quezon Boulevard Intersection

The details of signal installation discussed under b) 1, iv) are also applicable in this case, provided that the signal phase plan should be as presented below. It should be noted that the installation of traffic signals at the San Pedro Street/Quezon Boulevard Intersection is essential even when A. Pichon Street will not be extended.

iv) Intersection Improvement

In case one-way traffic system discussed under b)-1 above will not be introduced, A. Pichon Street/Quirino Avenue Intersection should be improved and traffic management be accomplished in the following manners.

- (i) For traffic flowing from the direction of Bankerohan Bridge, the effectuation of no-left turn toward the direction of A. Pichon Extension.
- (ii) The establishment of center island on the Bankerohan Bridge side of Quirino Avenue
- (iii) Drive lane widening in one section of A. Pichon Street.

The schematic plan of the intersection improvement and signal phase plan should be as presented below. Recommendations of b)-1, v) and vi) pertaining to other improvements of the intersections and to road signs and markings are also applicable to this case.

Fig. 4.20 (a) ESTIMATED PEAK HOUR TRAFFIC VOLUME OF QUEZON BLVD.

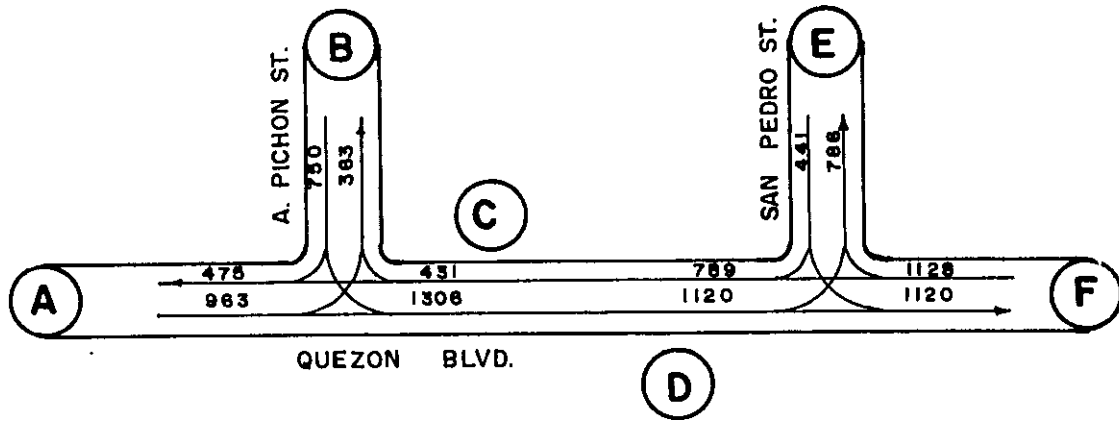


TABLE 4.5(a) TRAFFIC SIGNAL PHASE PLAN

PHASE GREEN TIME	1	2	3
APPROACH	96	21	51
A	→	↷	
B			↶
C	←		
D	→	↷	
E			↶
F	←		

- REMARKS: 1) CYCLE LENGTH: 180 Seconds.  
 2) A YELLOW TIME OF 3seconds AND AN ALL-RED TIME OF 1second BE PROVIDED BETWEEN PHASES.  
 3) RIGHT TURNS BE ALWAYS ALLOWED.

Fig. 4.20(b) TRAFFIC VOLUME IN THE MORNING PEAK HOUR OF QUIRINO AVE.

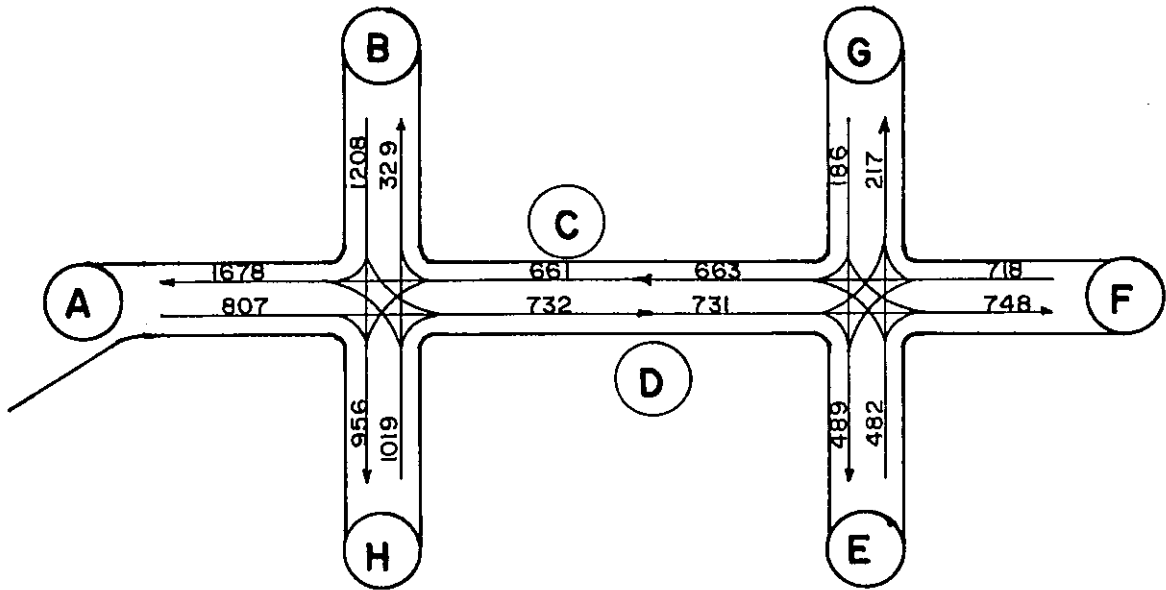


TABLE 4.5(b) TRAFFIC SIGNAL PHASE PLAN

PHASE APPROACH	1	2	3	4
A	(28) →			
B			39) ↓	32) ↘
C	(28) ↘	(6) ↘		
D	(36) →	(21) ↘		
E			(29) ↘	(18) ↘
F	(36) ←	(21) ↘		
G			(29) ↓	(18) ↘
H			(39) ↘	(32) ↘

- REMARKS :
- 1). CYCLE LENGTH : 120 Seconds.
  - 2). A YELLOW TIME OF 3seconds AND AN ALL-RED TIME OF 1second BE PROVIDED BETWEEN PHASES.
  - 3). RIGHT-TURNS AT THE APPROACHES A,B,D AND F BE ALWAYS ALLOWED.
  - 4). FIGURES IN ( ) SHOW A GREEN TIME IN SECOND.

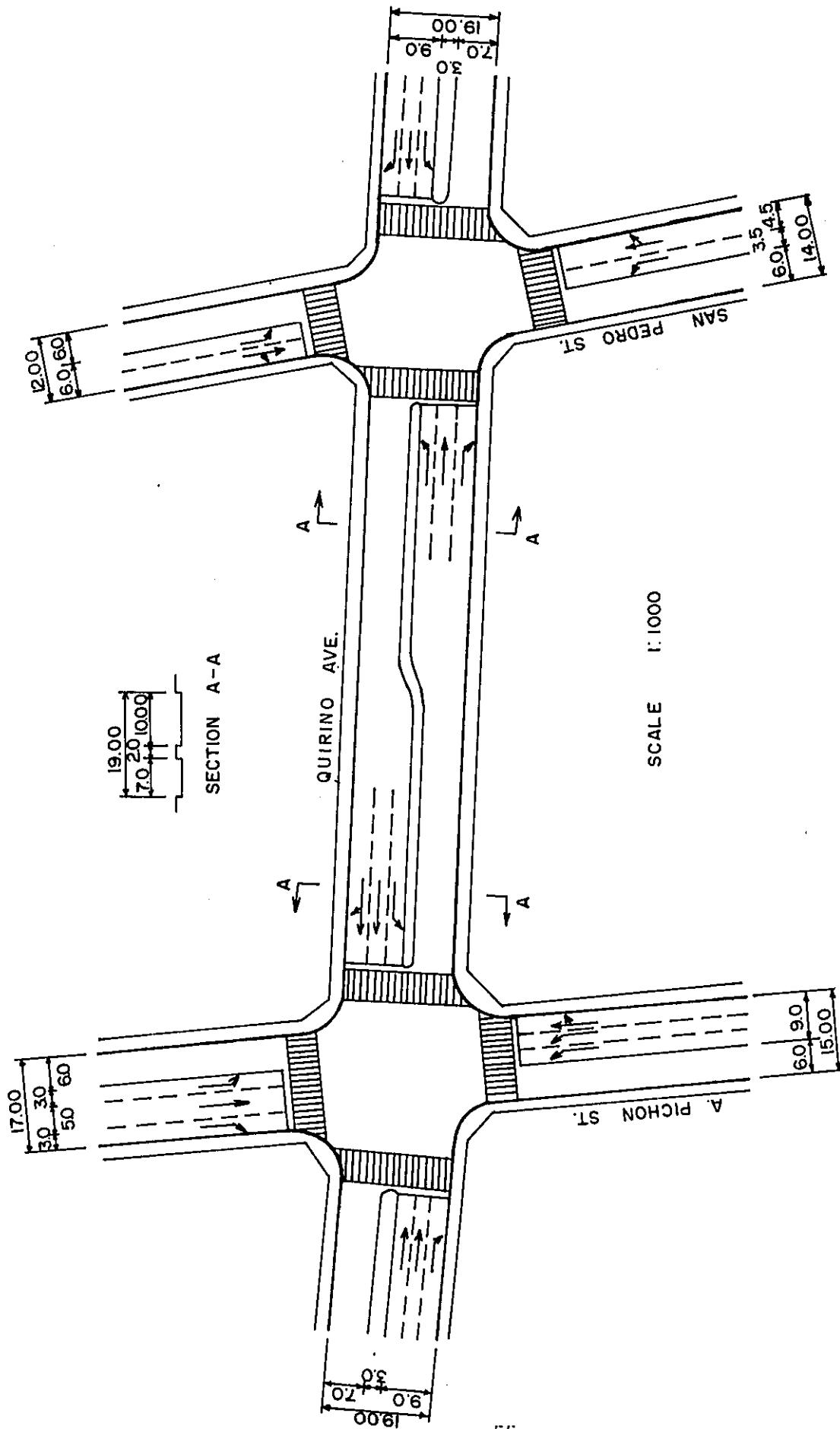
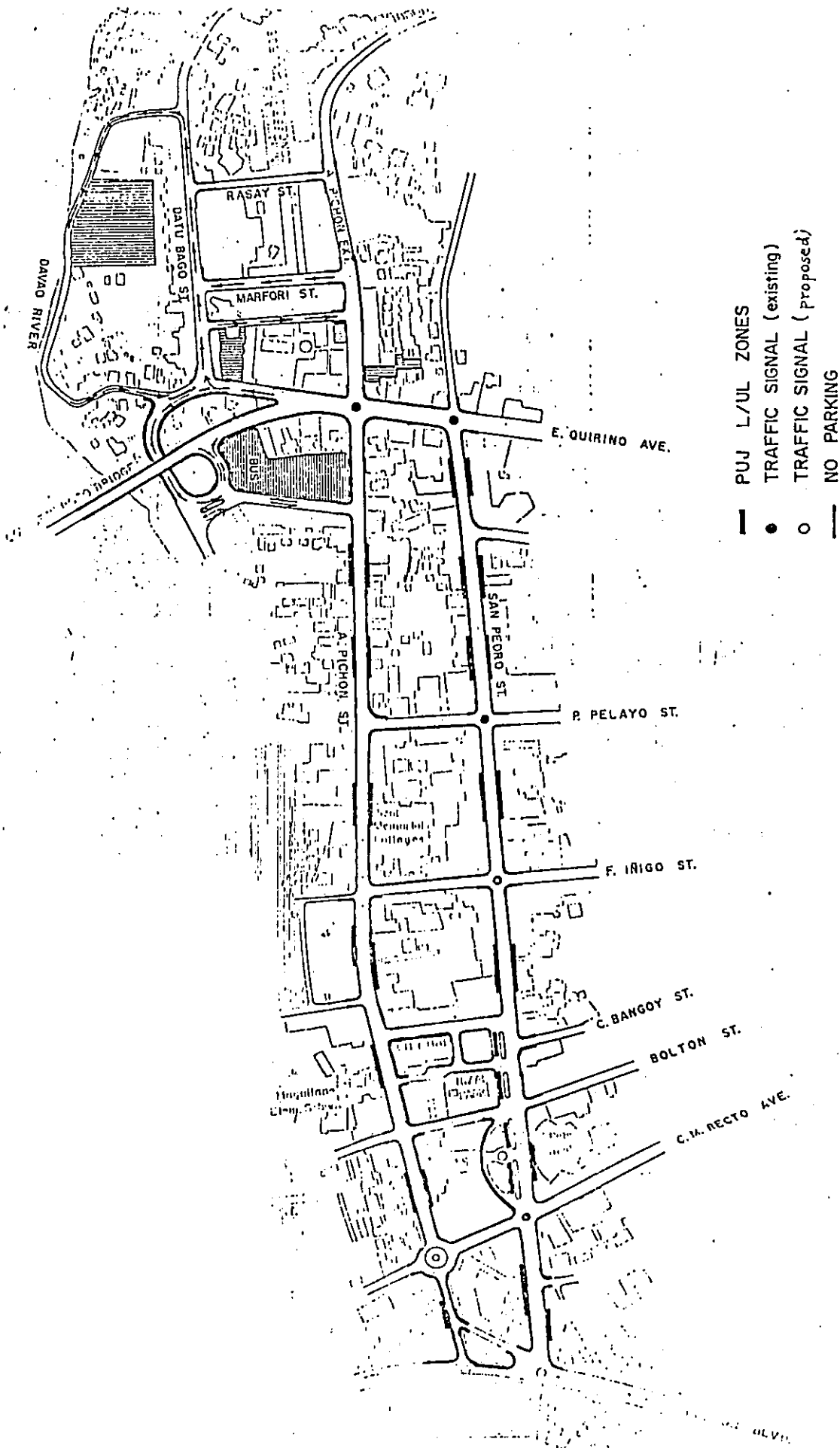


Fig. 4.20(c) RECOMMENDED IMPROVEMENTS FOR A. PICHON ST./ QUIRINO AVE. INTERSECTION



- P.U.J. L/U.L. ZONES
- TRAFFIC SIGNAL (existing)
- TRAFFIC SIGNAL (proposed)
- NO PARKING

Fig. 4.20(d) Recommended traffic management system for A. Pichon st. — San Pedro st. Area

(3) Central Area

a) Existing Problems

- (a) The intersection existing in this area, C.M. Recto Avenue/R. Magsaysay Avenue Intersection, has as many as six legs and, at this intersection, traffic management is extremely difficult and traffic on J.P. Laurel Avenue and that on E. Jacinto Street are not allowed to proceed straight but required to make a turn.
- (b) It has been observed that one of the traffic signal phases at this intersection fails to conform with maximum traffic safety, that is, two currents of traffic are allowed to intersect with each other.
- (c) Radial roads converge into this area and the establishment of a several five-leg and six-leg intersections is in plan in addition to the existing 6-leg intersection. However, because intersections with more than four legs accompany a number of problems, it is believed essential that the plan be reconsidered.

b) Recommendations

(i) Intersection Improvement

(i)-1 Under the proposed PUJ re-routing plan

The following are recommended for the improvement of C.M. Recto/Magsaysay Intersection.

- (a) Elimination of a part of the median strip from E. Jacinto Street (to enable vehicles to proceed straight on this street through the intersection).
- (b) Effectuation of road surface markings in the vicinity of the intersection to indicate stop lines, center lines, crosswalks lines and lane lines.

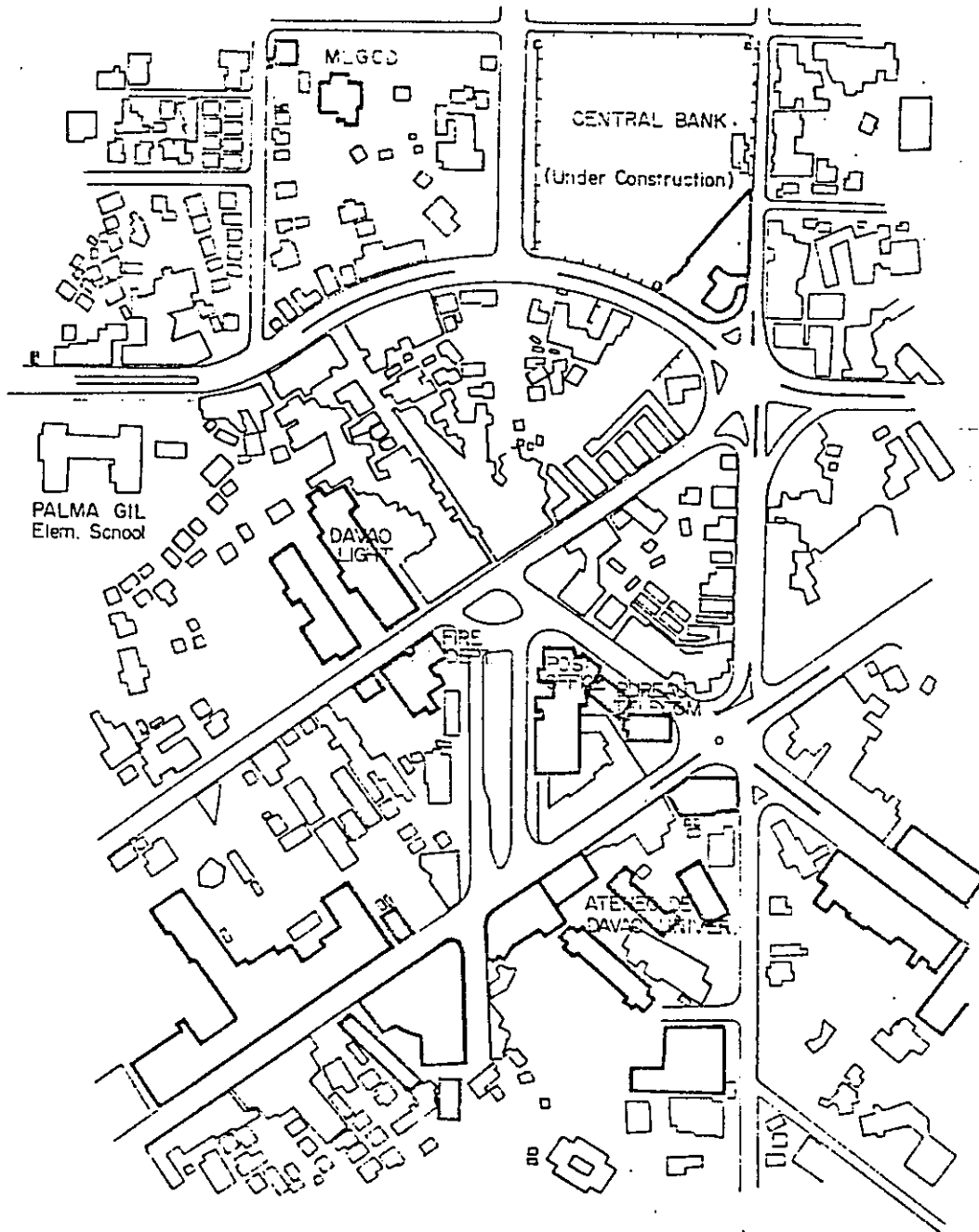


FIG. 4.21 EXISTING ROAD/STREET NETWORK AT CENTRAL AREA

- (c) Full-width pavement of the road within 30 meters from the intersection.
- (d) Alteration of signal phases as indicated in Table 4.6 for the following reasons:
  - i) Traffic on J.P. Laurel Avenue, on which traffic is heavy, cannot proceed straight onto C.M. Recto Avenue
  - ii) A new PUJ route is to be established which will follow E. Jacinto Avenue straight through the intersection onto E. Jacinto Extension (and vice versa)

The directions in which vehicles may not proceed after the signal phase alteration are indicated in Fig. 4.22 (b). In these directions, the existing traffic is light and, when closed, the traffic demand can be served by detours.

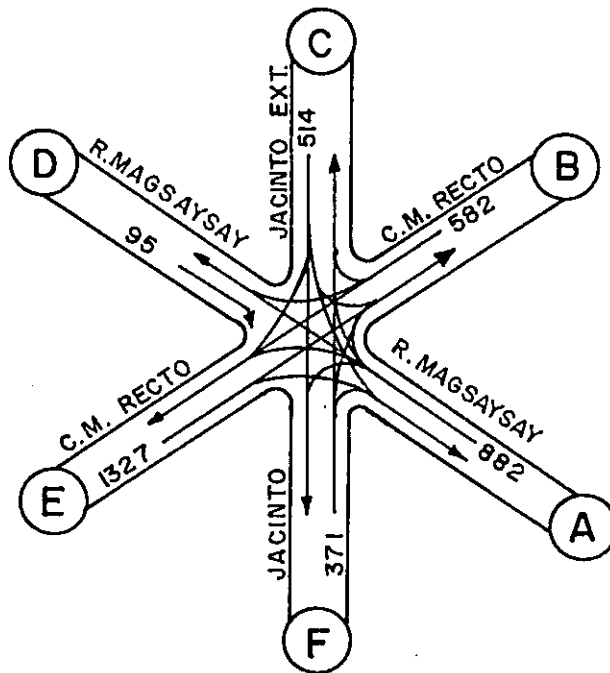








FIG. 4.22 (a) ESTIMATED PEAK HOUR TRAFFIC VOLUME OF C.M. RECTO AVE./R. MAGSAYSAY AVE. INTERSECTION



Table 4.6 TRAFFIC SIGNAL PHASE PLAN

Phase		Phase-1	Phase-2	Phase-3	Phase-4
Green Time					
Approach		24 seconds	37 seconds	27 seconds	15 seconds
Approach	A				
	B				
	C				
	D				
	E				
	F				

Remarks: (1) Cycle length : 130 sec.

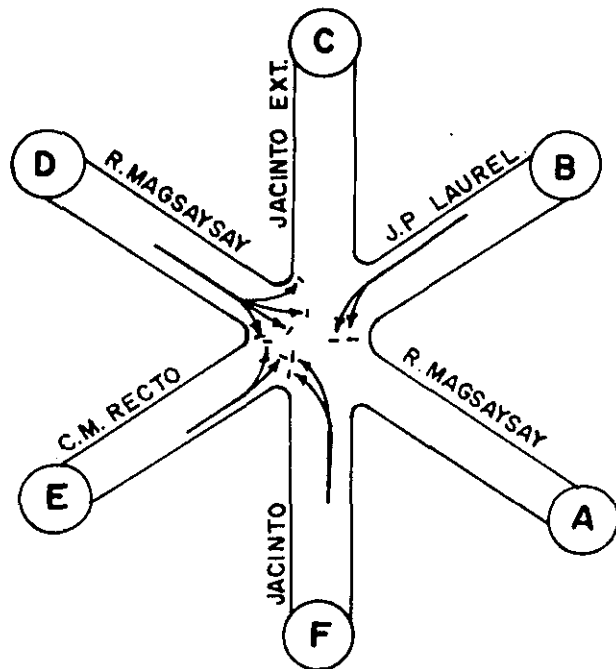
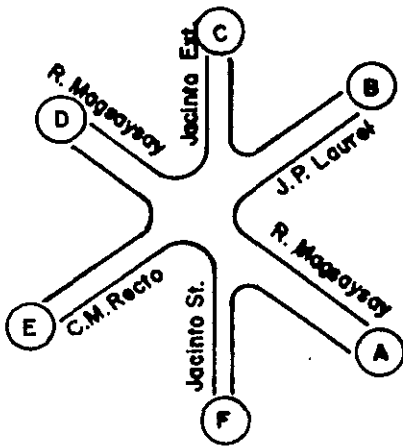
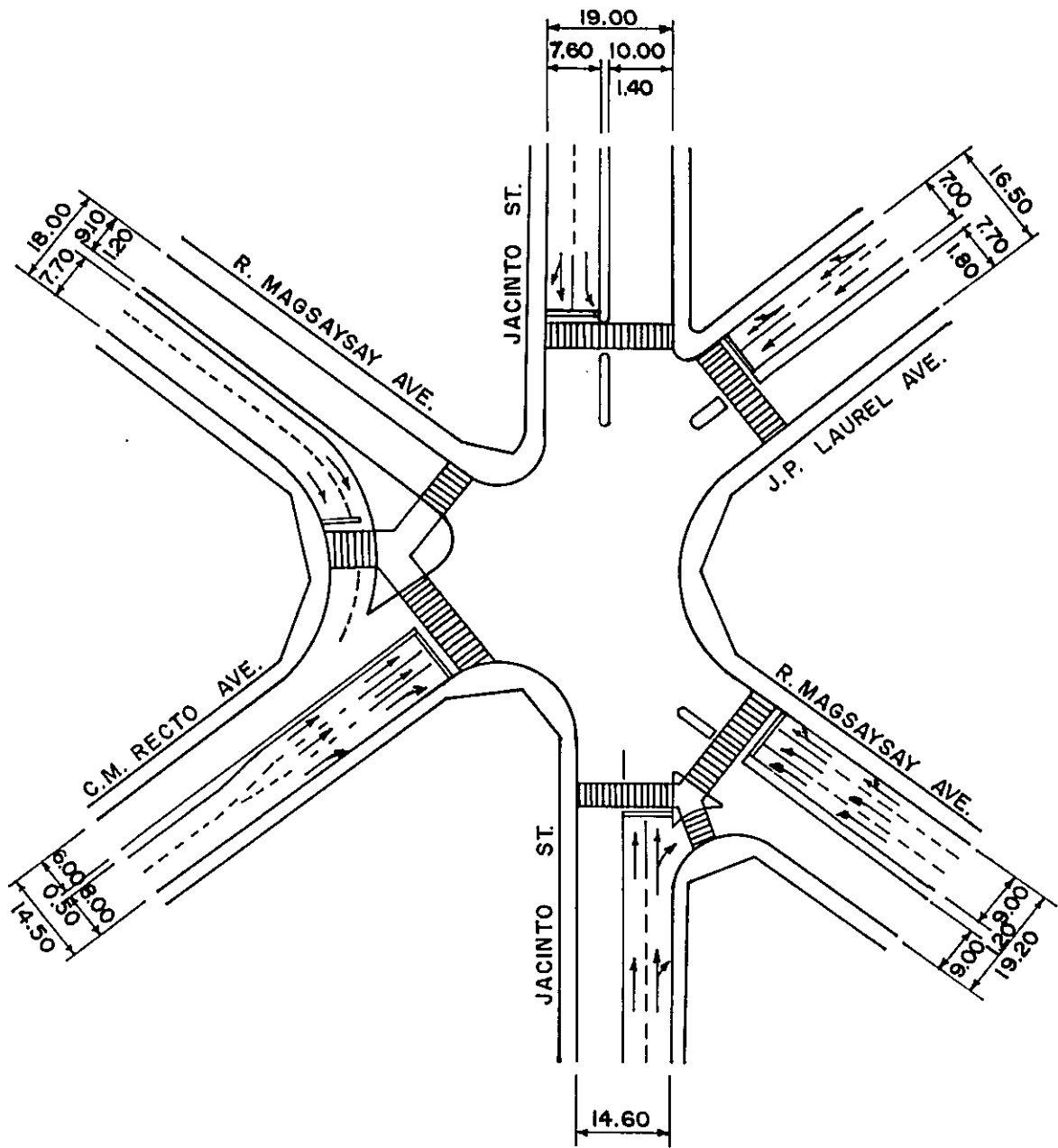


FIG. 4.22(b) DIRECTIONS PROHIBITED TO PASS THROUGH UNDER THE RECOMMENDED PLAN.



**FIG. 4.23 RECOMMENDED IMPROVEMENTS FOR J.P LAUREL / MAGSAYSAY AVE. INTERSECTION**

(i)-2 Under the current PUJ rerouting scheme

Recommendations under (i)-1 above are appropriate if PUJ service route is to be established on E. Jacinto Street. If, however, the establishment of no PUJ service route is assumed for said Street, the following are recommended for the improvement of C.M. Recto/Magsaysay Intersection.

- (a) Improvement of said intersection into a three-leg structure, with traffic entering from E. Jacinto Street and that entering from Magsaysay Extension allowed to make only right turn at the intersection.
- (b) Effectuation of road surface markings in the vicinity of the intersection to indicate stop lines, center lines, crosswalk lines, and lane lines.
- (c) Full-width pavement of the road within 30 meters from the intersection.
- (d) Change of traffic signal phase plan to that described below in the accommodation of the three-leg intersection.

Fig. 4.20 (f) indicates the directions in which traffic will not be allowed to proceed, in which case the traffic will have to use a detour.

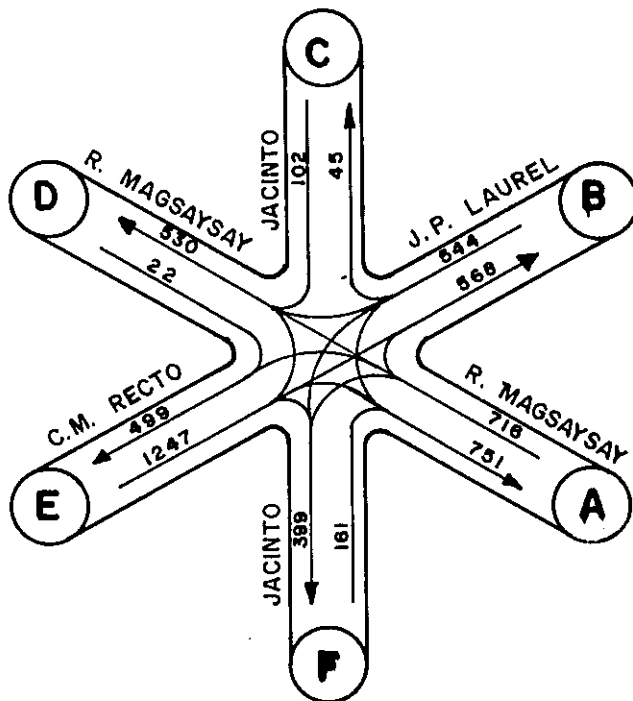


Fig. 4.20(e) ESTIMATED PEAK HOUR TRAFFIC VOLUME OF C.M. RECTO AVE./R. MAGSAYSAY AVE. INTERSECTION.

TABLE 4.5(c) TRAFFIC SIGNAL PHASE PLAN

PHASE GREEN TIME	1	2	3
APPROACH	36	21	22
B	↙	↖	
A			↘
E	↗	↘	

- REMARKS: 1). CYCLE LENGTH: 100Seconds  
 2). A YELLOW TIME OF 5Seconds AND AN ALL-RED TIME OF 2Seconds BE PROVIDED BETWEEN PHASES.  
 3). RIGHT TURNS AT APPROACHES C,D AND F BE ALWAYS ALLOWED.

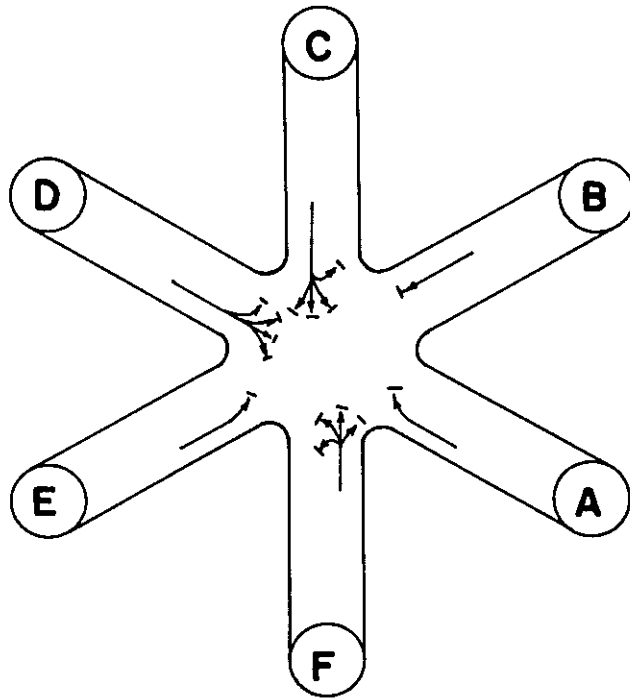


Fig. 4.20 (f) DIRECTIONS PROHIBITED TO PASS  
THROUGH UNDER THE RECOMMENDED PLAN

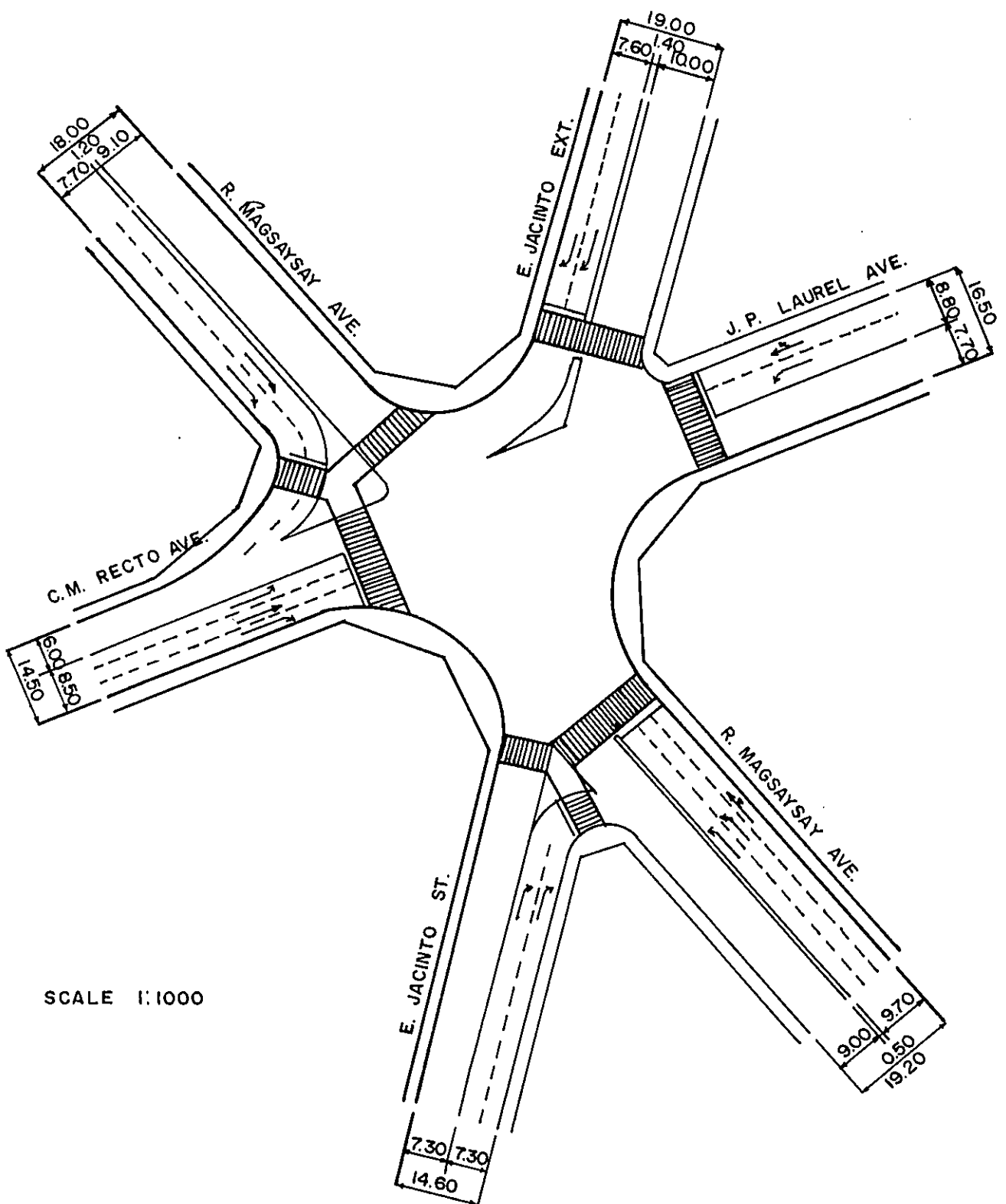


Fig. 4.20(g) RECOMMENDED IMPROVEMENTS FOR J.P. LAUREL/MAGSAYSAY / JACINTO INTERSECTION

ii) Preparation for Traffic Core and Roxas Avenue Development

As it was explained in Chapter 3, this area must play the most important role in the formation of a future urban structure in Poblacion under our vision of Poblacion development. Planned for the blocks adjacent to the rotary at the northern end of M. Roxas Avenue are a central terminal where medium and long distance buses and short distance PUJs will gather and, possibly, the central station of a rapid transit system, while envisioned for M. Roxas Avenue are the development of a central business district where high rise office buildings will stand side by side to embellish the 1.3 million city to be built.

While the accomplishment of such a large scale development program will require a long period of time and, therefore, should be planned for completion in the 21st century, implementation of projects inconsistent with the vision if any will eventually obstruct the realization of the vision and make the required investment funds inevitably much larger than would otherwise be and, therefore, should be avoided.

Thus it is believed vital that certain urgent measures be taken before the dramatic long range program to accomplish spectacular results will be hindered. The following are recommended for immediate attention.

- a) Formulation of a masterplan for the renewal of this area
- b) Coordination and adjustment between this masterplan and projects already in plan for this area
- c) Provision of administrative guidance and directions on private parties and the establishment of necessary land use and construction control laws in

order to assure that private projects to be implemented will conform and be in harmony with the masterplan.

(4) Agdao Market Area

a) Existing Problems

Agdao market area is where traffic flowing into Poblacion from north via R. Castillo Street intersects with those flowing on L. Garcia Street, J. Cabaguio Street, Lapu-lapu Street and Dacudao Avenue. The numerous convergent trunk thoroughfares cause the following traffic problems in the area.

- (a) Because these trunk roads form a five-leg intersection, a very large number of traffic merging points, separating points, and crossing points exist in the intersection, where PUJ and bus loading/unloading zones exist in addition, causing confusion in the flow of traffic through the intersection.
- (b) Traffic accidents occur very frequently in this market area where mass traffic generation of both pedestrian and vehicles is caused by the concentration of tricycle and PUJ loading/unloading zones, bus terminal, and the market.
- (c) Pavement of R. Castillo Street will immediately result in further increase in the volume of traffic flowing from north, immediately aggravating the congestion and increasing potential accidents in and at the intersection.



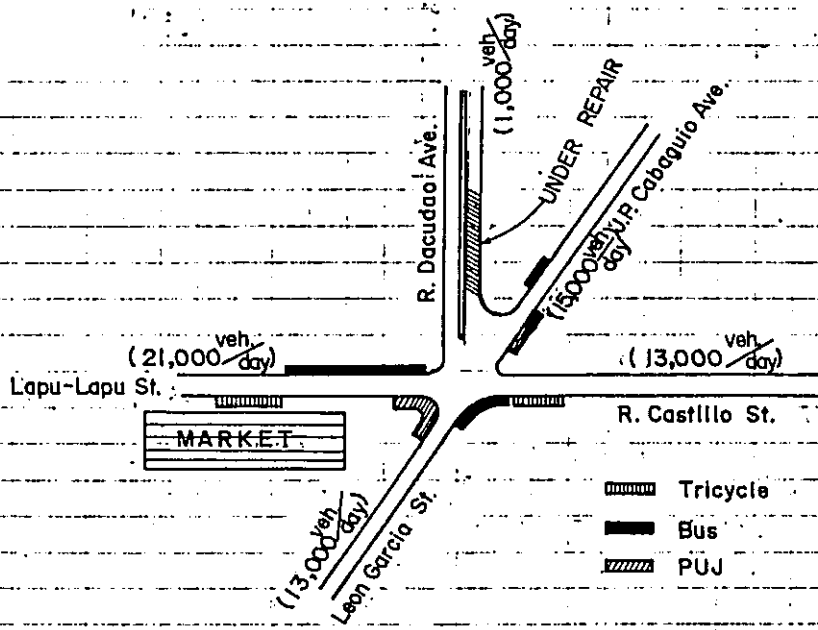


Fig. 4.24 EXISTING SITUATION OF AGDAO MARKET AREA

b) Recommendations

(a) Intersection Improvement

- i) Marking of lane lines, center lines, stop lines and pedestrian crossing lines in the vicinity of the intersection
- ii) Improvement of traffic signal phases (see (b) below)
- iii) Relocation of entry/exist to/from gasoline stations located on each of the four corners of the intersection to locations far from the intersection
- iv) Carriageways approximately 30 meters from the intersection be paved for their entire width.

(b) Traffic Signal Phases

- i) The signal be a constant cycle multi-dial signal with a cycle length of not longer than 120 seconds.

ii) The signal be made of four phases as shown in Table 4.7.

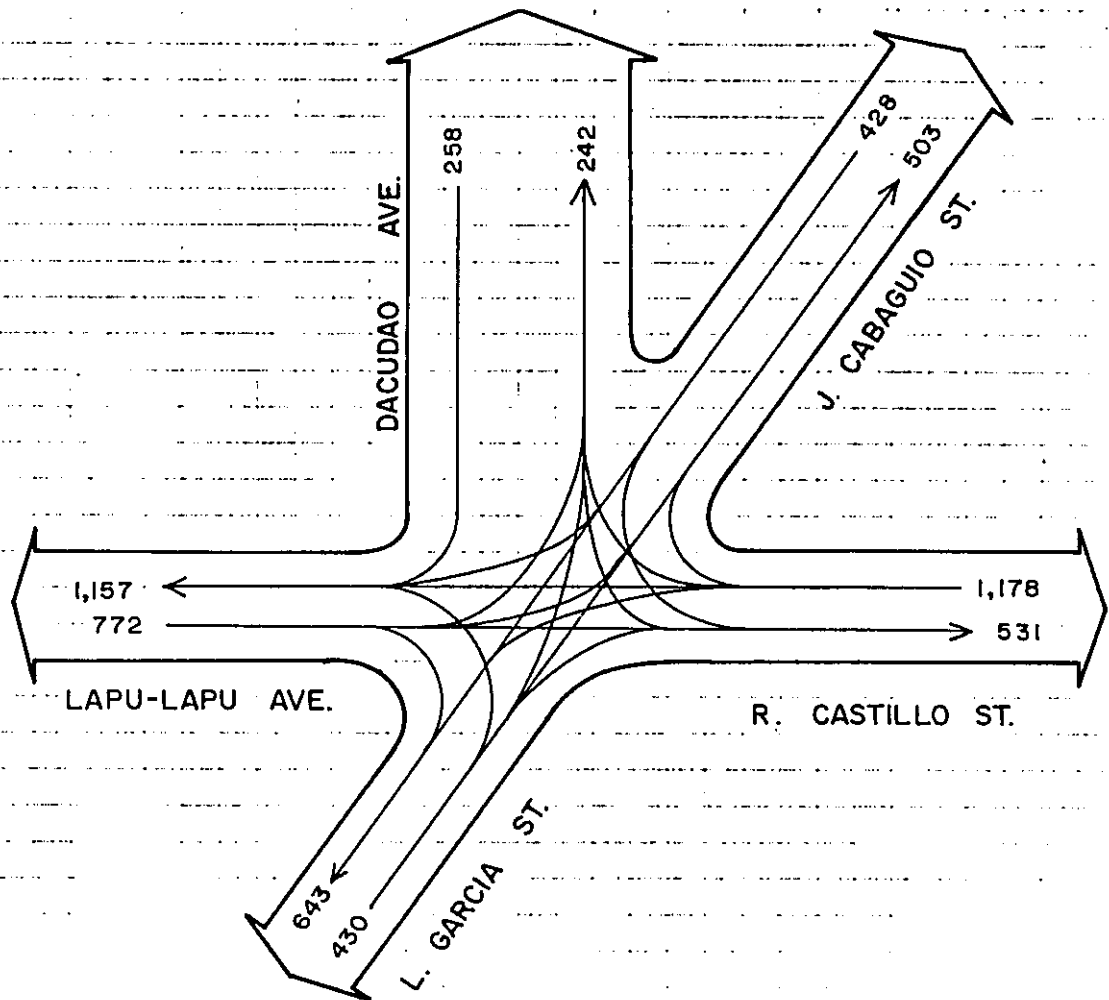







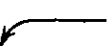
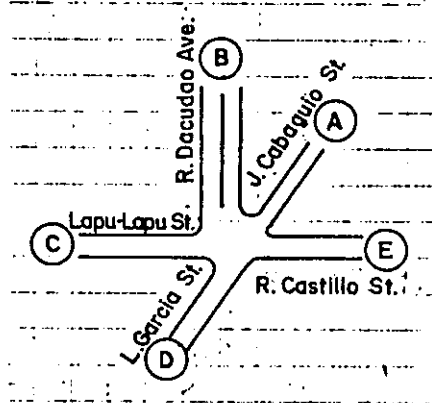


Fig. 4.25 ESTIMATED PEAK HOUR TRAFFIC VOLUME OF AGDAO INTERSECTION

Table 4.7. TRAFFIC SIGNAL PHASE PLAN

Phase	Phase-1	Phase-2	Phase-3	Phase-4
Green Time				
Approach	15 sec.	15 sec.	30 sec.	24 sec.
Approach A				
B				
C				
D				
E				

- Remarks:
- (1) Cycle Length :100 sec.
  - (2) A yellow time of 3 seconds and an all-red time of , second be provided between phases.
  - (3) Right turns be always allowed.



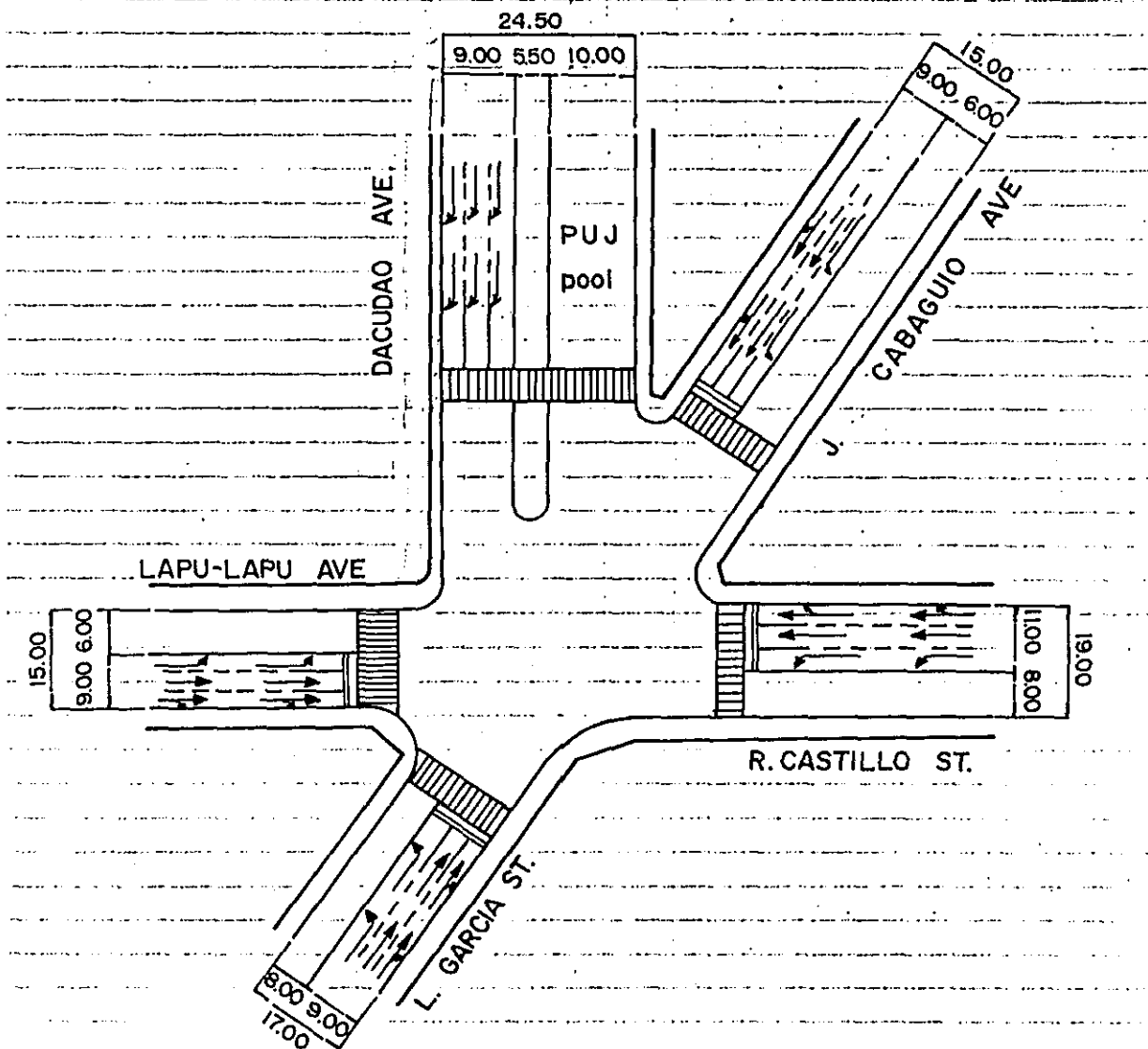


Fig. 4.26 RECOMMENDED IMPROVEMENTS FOR AGDAO INTERSECTION

- (c) Rearrangement/Improvement of PUJ, Bus, Tricycle Loading/Unloading Zones and the utilization of R. Dacudao Avenue.

It is recommended that spaces for buses, PUJs, and tricycles now concentrated be relocated to 30 meters away from the intersection, where they be established as loading/unloading zones. Although a six-lane road, R. Dacudao Avenue is little used (traffic being only 1,200 vehicles per day) because its northern end, close to J.P. Laurel Avenue, is yet to be constructed. Therefore, it is recommended that, as a temporary measure until the completion of the entire extension of this street and the increase of traffic on it, one-half of the road width be utilized to create PUJ and tricycle stopping space (belt), together with the establishment of PUJ and tricycle parking spaces utilizing vacant lots existing in this area.

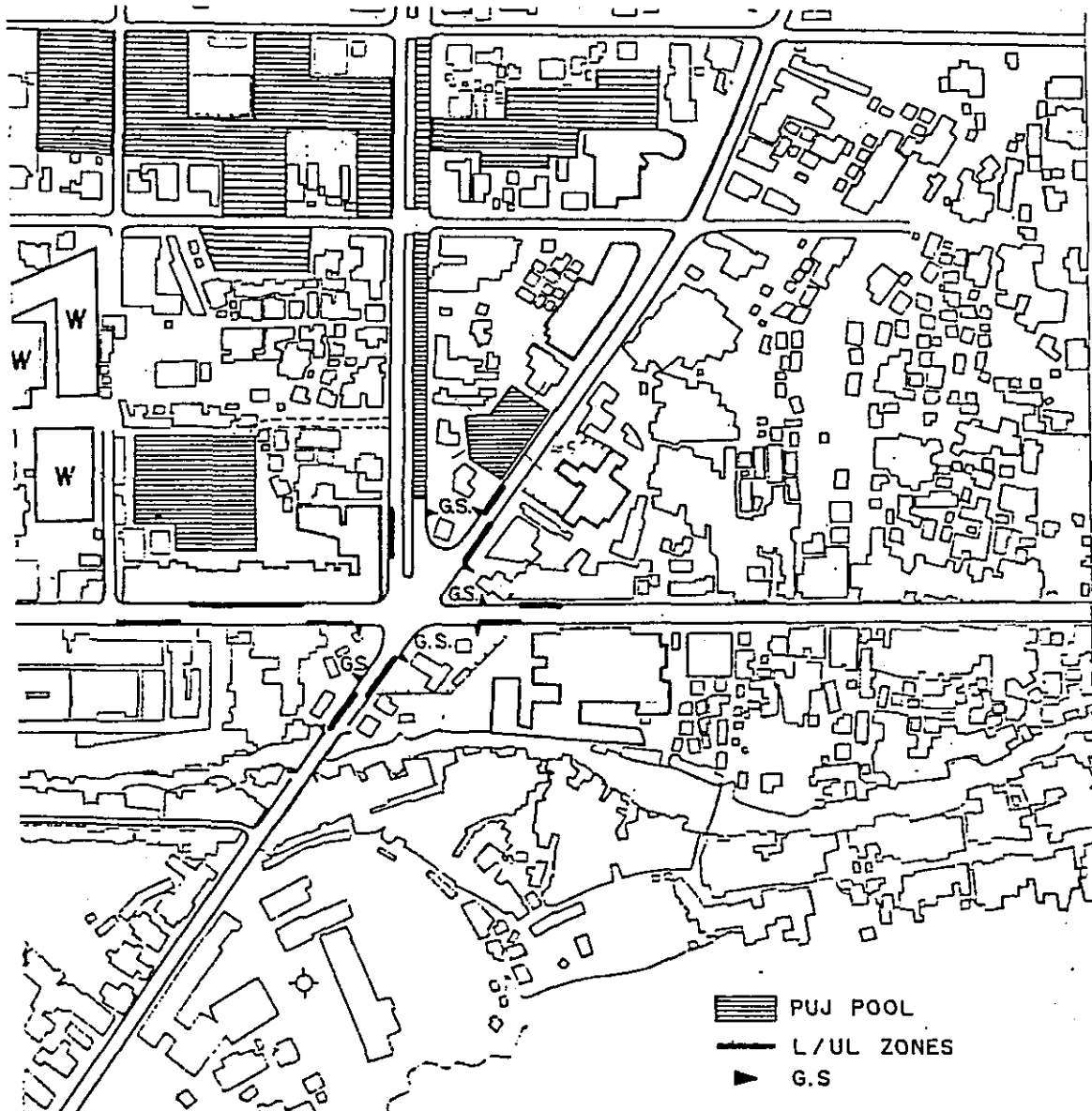


Fig. 4.27 AGDAO MARKET AREA TERMINAL FACILITIES PLAN

4.2 PUJ Rerouting Plan

1) PUJ Service: Current Status and Problems

(1) Current Status of PUJ Service

a) Public Transportation Modes in Davao City and its utilization

Five modes of public transportation coexist and share different roles: Long distance bus for interprovincial transportation, PUJ for middle-distance intramural transportation, AC for PUJ terminal service in Poblacion, tricycle for short daily trips in neighborhoods other than the center of Poblacion, and PU as the only non-omnibus transportation.

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

Table 4.8 TRAFFIC VOLUME OF PUBLIC UTILITY VEHICLES

TRAFFIC VOLUME IN	BUS	PUJ	AC	TRI	PU	TOTAL
NO. OF PASS -KM	187,670 12.7%	1,028,720 69.5%	136,760 9.2%	63,000 4.3%	64,140 4.3	1,480,290 100%
NO. OF PT.	9,808 3.2%	180,482 60.7%	63,219 21.2%	25,936 8.7%	18,659 6.2%	298,104 100%

Source: DCUTCLUS

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

Fig. 4.28  
PT ACTIVITIES BY PUJ

TOTAL: 180,600 PT

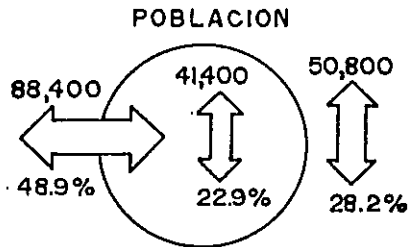
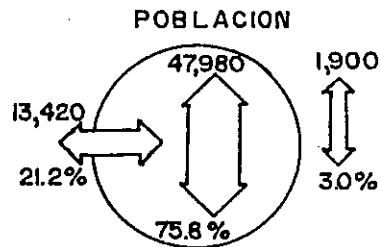


Fig. 4.29  
PT ACTIVITIES BY AC

TOTAL: 63,300 PT



SOURCE: DCUTCLUS

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

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

b) Transition of PUJ Routes

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

These rerouting schemes, whose aim, route pattern, and difficulties are presented in the figure and table below, all attempted to improve the convenience and benefits of both PUJ users and operators through:

- i) The systematic unification of PUJ routes in and out of Poblacion, and
- ii) The allocation of proper number of PUJs to each of the routes in commensuration with the demand.



Fig. 4-30 **VARIATION OF PUJ ROUTE IN DAVAO CITY**

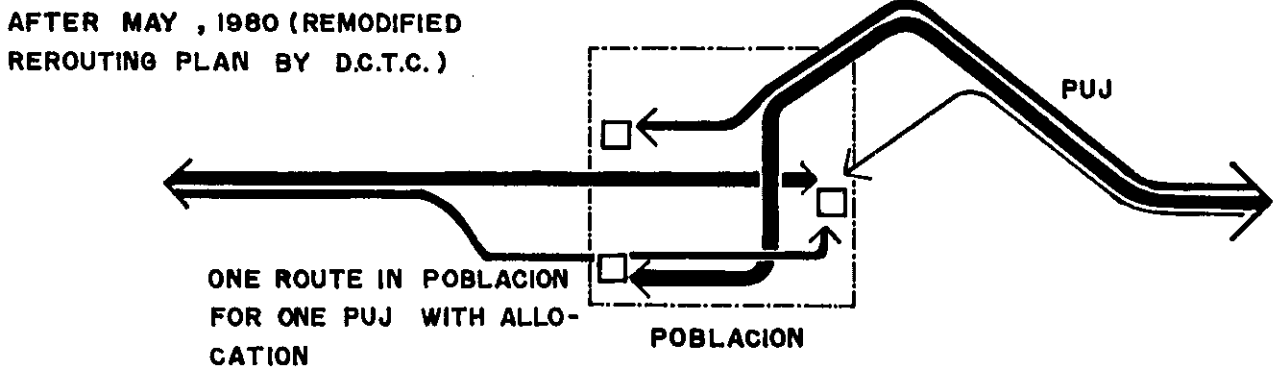
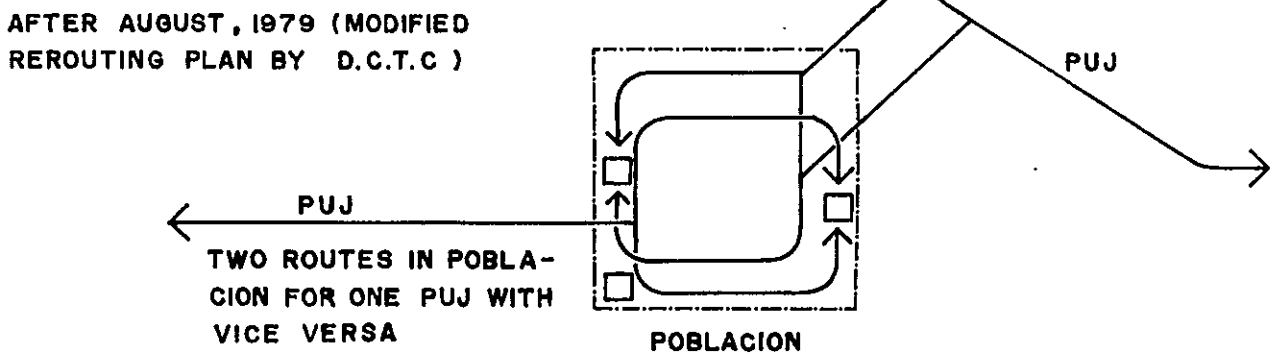
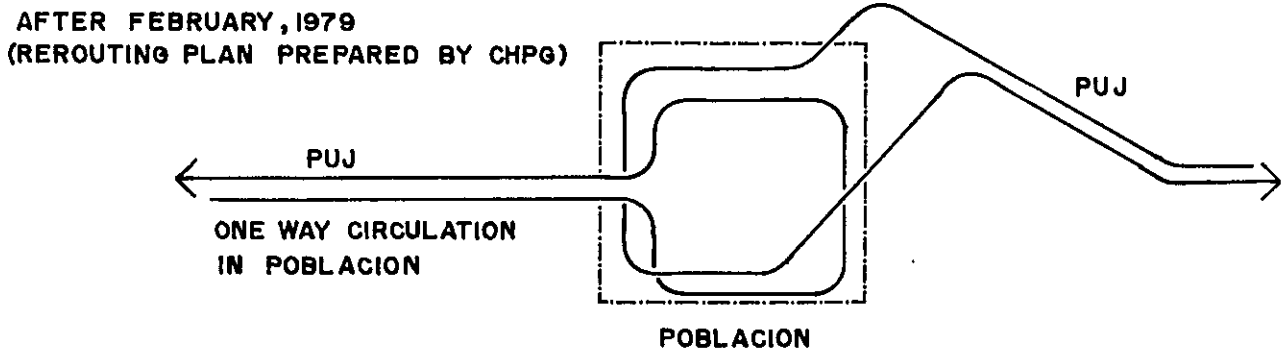
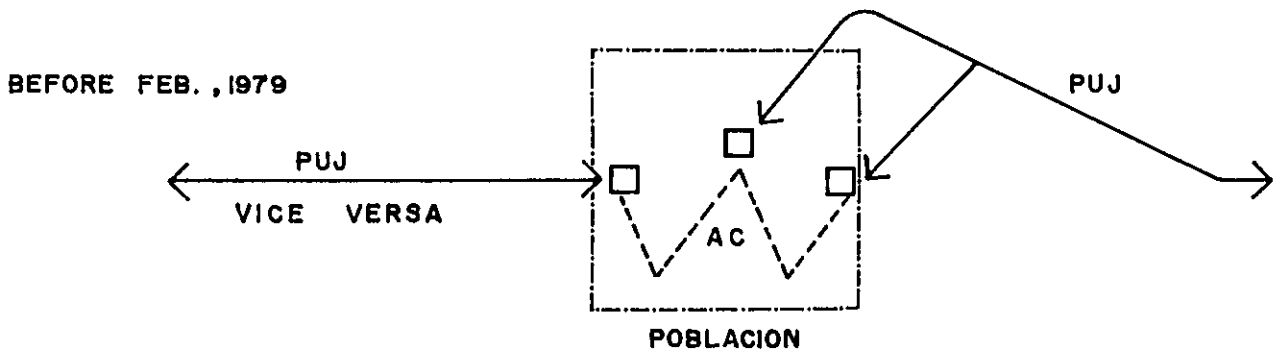


Table 4.9 Aims and Problems of PUJ Rerouting Schemes

SCHEME	AIM	PROBLEM
Prior to February 1979		<ol style="list-style-type: none"> <li>1. PUJ service only connected terminals on the fringe of Poblacion with origins outside Poblacion.</li> <li>2. Traffic congestion around PUJ Terminals.</li> <li>3. Transfer at the terminal and double fare were necessitated.</li> <li>4. Terminal operation was in violation of traffic rules</li> </ol>
Rerouting Scheme of C.H.P.G.	<ol style="list-style-type: none"> <li>1. Extension of PUJ service to points inside Poblacion, so passengers could reach the city center without transfer.</li> <li>2. Elimination of double fare.</li> <li>3. Uniform display of destination.</li> <li>4. Ban on the use of private terminals.</li> <li>5. Establishment of intra-Poblacion circular routes and direction controlled one-way routes</li> </ol>	<ol style="list-style-type: none"> <li>1. Longer operational distance.</li> <li>2. Rapid increase in fare due to rise in gasoline price at this time.</li> <li>3. Drivers no longer had a place to rest after the ban on the use of terminals.</li> <li>4. At some of PUJ routes it was difficult to find enough passengers for drivers.</li> </ol>
Modified Rerouting Scheme by D.C.T.C.	<ol style="list-style-type: none"> <li>1. To shorten the length of routes through the placement of circular routes by shuttle routes.</li> <li>2. Establishment of t/c routes for each PUJ for selection by driver at each time, as demand on each route was unknown.</li> <li>3. Branch service routes were established to cover areas not previously served by PUJ.</li> <li>4. Uniform display of destination and route.</li> </ol>	<ol style="list-style-type: none"> <li>1. Parts of road were used as PUJ terminals and, therefore, they lacked sufficient space.</li> <li>2. Over-served routes and under-served routes resulted, and, therefore,</li> <li>3. Some drivers started to cut trips.</li> <li>4. Area served by PUJs was not adequately expanded.</li> </ol>
Remodified Rerouting Scheme by D.C.T.C.	<ol style="list-style-type: none"> <li>1. The assignment of PUJ service to each route for even distribution of the service.</li> </ol>	

(2) PUJ Service Problems

a) Uneven Spread of Route Network

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

b) Gap in Users and Service Frequencies

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



Table 4.10 COMPARISON BETWEEN PUJ TRAFFIC DEMAND IN PASSENGER.KILOMETER AND NUMBER OF CAR TRIP.KILOMETER MODIFIED REROUTING SCHEME

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

Source: DCUICLUS

\*1 No. of PT x (Ave. P.T. Length)

Intrazonal = 1.92 Km/PT

Intrazonal = 8.5 Km/PT South

8.7 Km/PT North

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

c) PUJ-AC Competition and Role Sharing

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

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

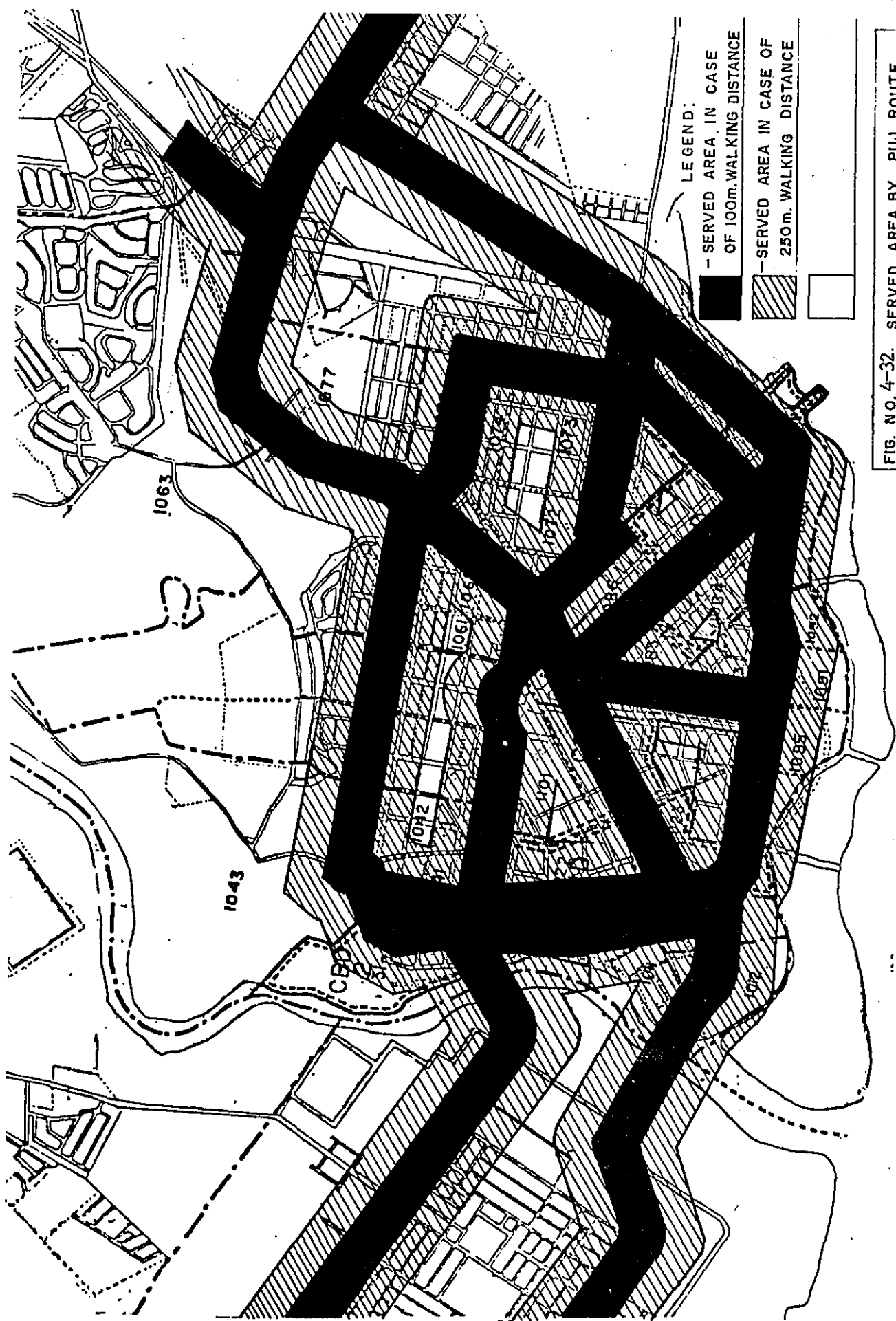
d) Hourly Fluctuations of PUJ Transportation Demand and PUJ Service.

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

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

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



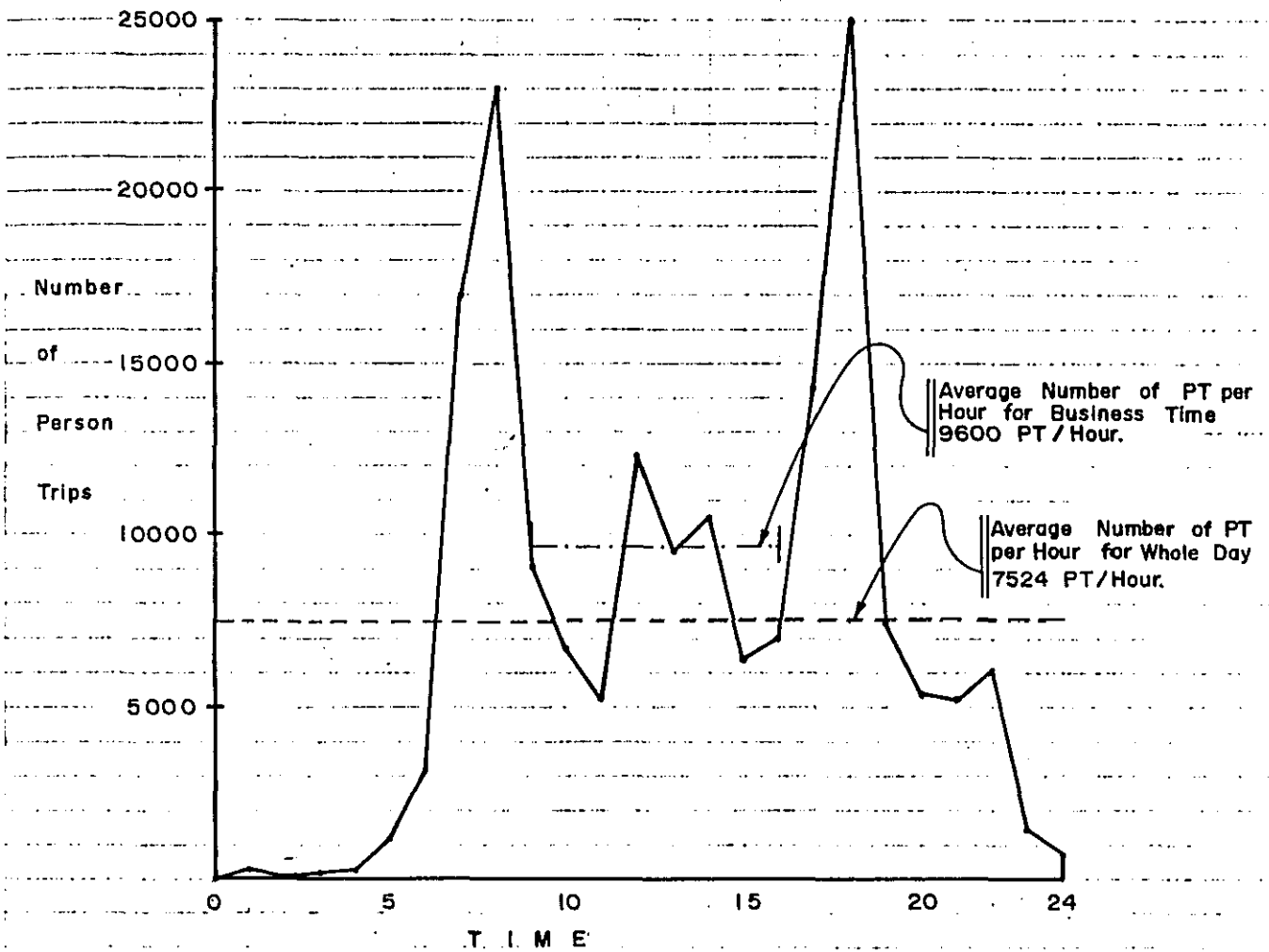
LEGEND:

- SERVED AREA IN CASE OF 100m. WALKING DISTANCE
- SERVED AREA IN CASE OF 250m. WALKING DISTANCE

FIG. NO. 4-32. SERVED AREA BY PUJ ROUTE CONSIDERING WALKING DISTANCE



Fig. 4.33 HOURLY VARIATION OF PT BY PUJ



Source: DCUTCLUS



e) Profitability and Population of PUJs

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

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

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<sup>1/</sup> See Table 4-18(a) in appendices

<sup>2/</sup> Total passenger-kilometers of inhabitants in the survey area (1,028,720) plus those outside the area (588,762). See Table 4-18(b) and PUJ allocation (Tab. 4-12.)

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

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

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

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

From 10% to 15% of registered PUJs are said to be inoperative due to accidents, repairing, and other reasons. This means that the total number of PUJs actually in service is 2,200 to 2,300, but, in view of the break even point of 1,955 PUJs, the actual number is estimated at about 2,000.

---

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

2/ Table 4-19 in appendices

3/ Average Occupancy Rate =

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

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

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

\*Table 4-21 in appendices

## 2) Basic Ideas for PUJ Rerouting

### (1) Significance of Rerouting as an Urgent Project.

After three changes in the PUJ route system since 1979, the PUJ routing of Davao City is still in the stage of trial. Davao City authority is waiting for the DCUICLUS Team to recommend a PUJ rerouting plan based on the result of the Person Trip Survey and is allegedly prepared to make another trial as soon as the recommendations are submitted.

With possible implementation as early as in 1981 in mind, the urgent measures to be recommended will be limited to the ways of improvement without any substantial change, of the existing route system to make it better coincide with the demand.

### (2) Service Area

The previously pointed out uneven spread of the PUJ service area in Poblacion and the discrepancy between this area and the scope of expansion of built-up areas are due to the absence in this locality of a road network to physically support the development of a well balanced PUJ service network. Therefore, the rerouting scheme to be recommended will, by necessity, have to be limited to the area south of Torres Street and between Davao River and Agdao Market where the existing PUJ network is established. PUJ service should in the near future, be extended to cover the terminal which is two bus terminals. The accomplishment of this service extension in 1981 is judged impossible and, therefore, disregarded for the purpose of urgent project.

### (3) Routing Policy

PUJ transportation demand varies greatly between the peak time, when worker and student commuters represent the main stream of the demand flowing over a long distance, and day time, when business trips are the major substance of the demand moving relatively short distances. Such quantitative, as well as qualitative, variations by hour of the day require that both the routes which will serve the movement of people between suburban areas and Poblacion during the peak hours and the routes which

serve short distance movement of people within Poblacion in day time be established.

In determination of the geographical positions of PUJ routes to be established in Poblacion, the following flows of the major PUJ users should be taken into full account.

Flow of PUJ users from south

- 1st : CBD 1 (City Hall, San Pedro Street Area), about 15,200 P.T.
  - 2nd : Poblacion north, about 9,000 P.T.
  - 3rd : CBD 2 (Bankerohan Market area), about 8,000 P.T.
- These represent more than 70% of total flow from south.

Flow from north

- 1st : Poblacion north, about 12,400 P.T.
  - 2nd : CBD 1 about 12,300 P.T.
  - 3rd : CBD 4 area (C.M. Recto Avenue Magsaysay Avenue Intersection area, and other commercial and business districts) about 7,300 P.T.
- These represent more than 70% of total flow from north.

On the other hand, major flows within Poblacion (including Agdao) are:

- 1st : CBD 2 - Poblacion south
- 2nd : CBD 1 - Poblacion north
- 3rd : CBD 1 - Agdao
- 4th : Poblacion- Agdao

Fig.4.34 CURRENT OF PUJ PASSENGERS FROM SOUTH TO POBLACION

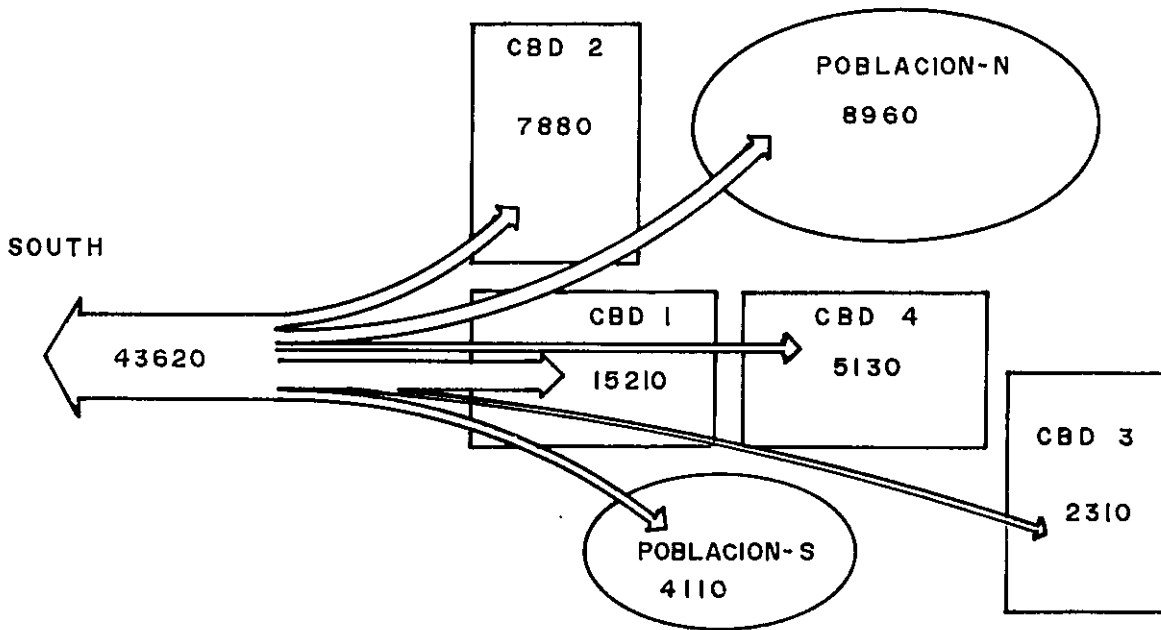
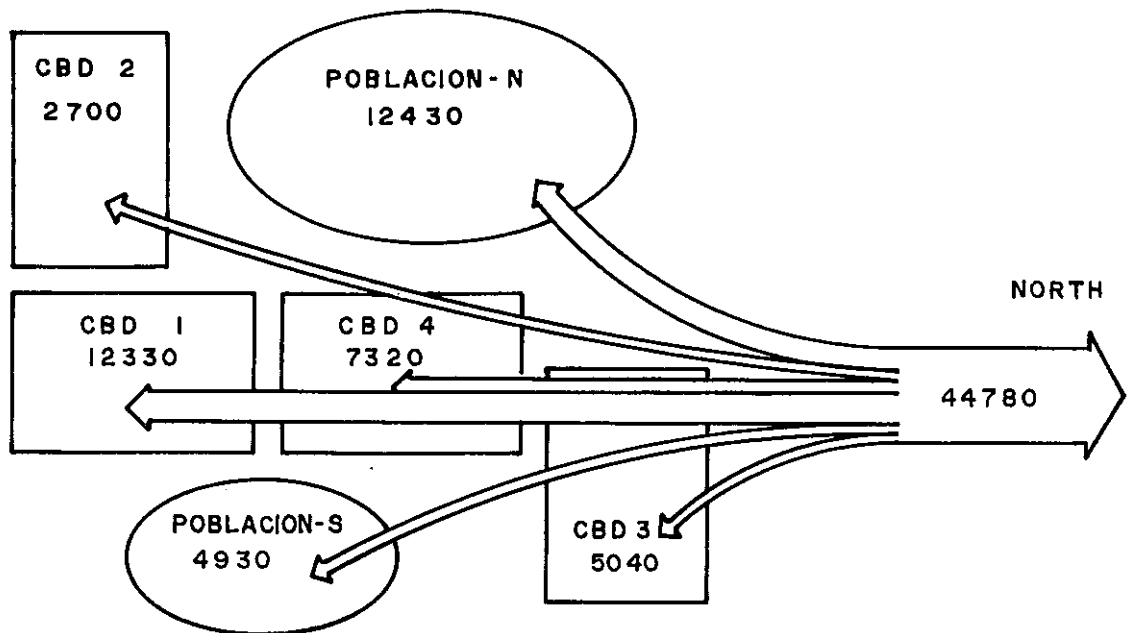


Fig.4.35 CURRENT OF PUJ PASSENGERS FROM NORTH TO POBLACION



Note: Numbers in figures show No. of Person Trips between each zones and North or South area.

Location of CBD's and Other Areas Are Shown in Fig.4.49 in Appendices.

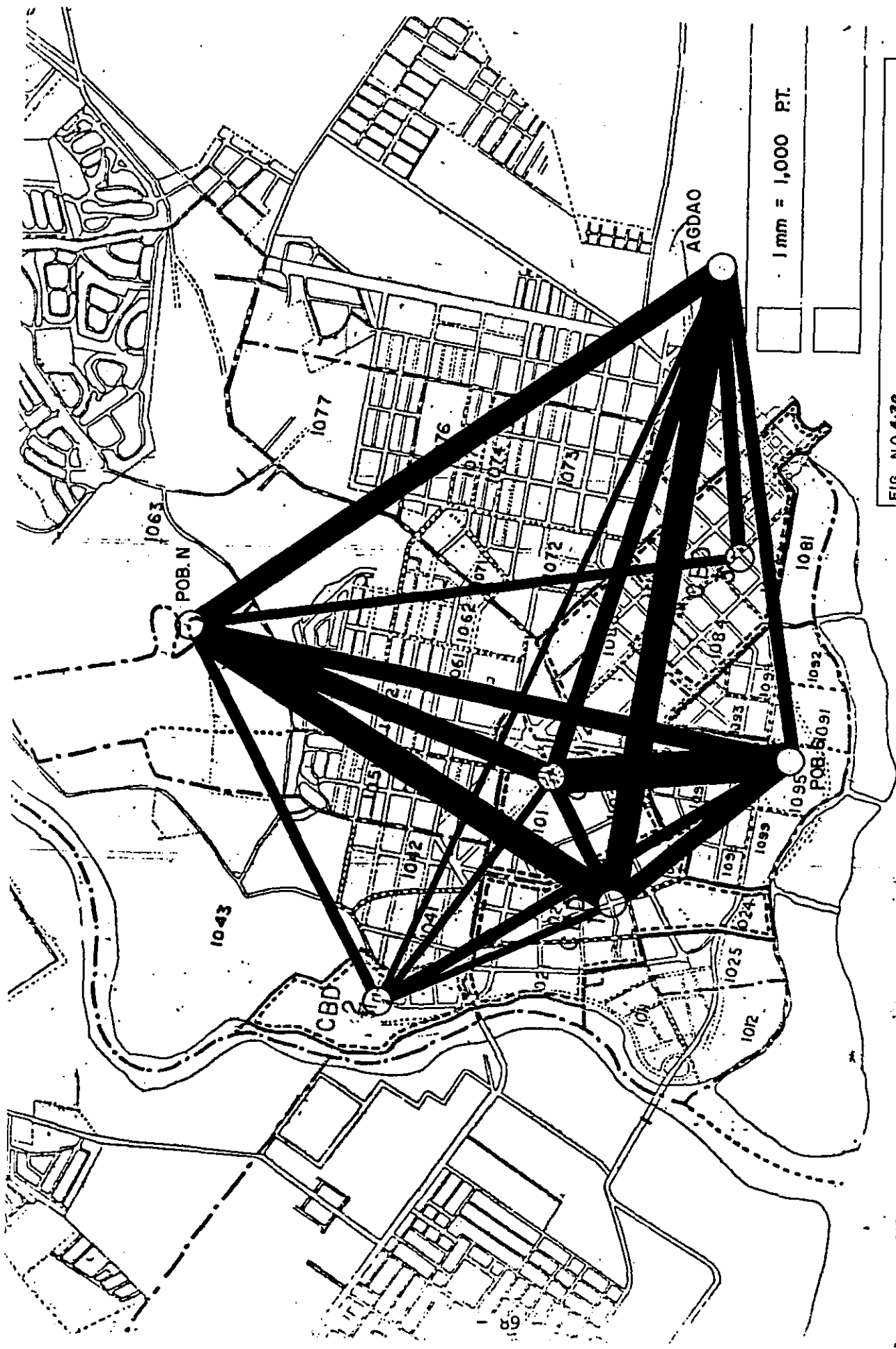
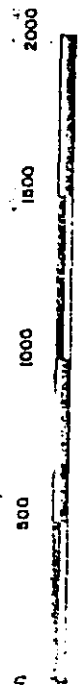


FIG. NO. 4:38  
 PUJ DESIRE LINE  
 WITHIN POBLACION (including AGDAO)



1 mm = 1,000 FT.

(4) Division of Service Area among PUJ, AC and Tricycle

As previously stated, PUJs serve narrow strips of area along arterials, ACs serve the blank area left between the service areas of PUJs, and tricycles serve a part of fringe areas of PUJ service network.

The PUJ rerouting schemes so far chiefly aimed to make the service network more expanse and dense, and it is quite possible that ACs and tricycles will be driven out of Poblacion by PUJ service. In fact, ACs are on the decrease, and B.O.T. and other competent authorities predict that this will occur.

It is, however, believed unrealistic to expect that all ACs and tricycles will be banned and replaced by PUJs by 1981, when there exist about 500 ACs even though they are on the decrease and 1,400 tricycles.

The division of service area among these modes of public transportation will possibly be changed as the facilities of public transportation will be modernized under long range planning, but the urgent measures to be recommended will fundamentally respect and retain the existing modal division of service area, provided that slight modification in the shared service area will result from the implementation of the urgent measures. (for instance, PUJ service on new route will compete with tricycles on R. Castillo Street and with ACs on Jacinto Street, and AC control on San Pedro Street will be changed due to the introduction of one-way system).

3) Recommendation of a New PUJ Rerouting Plan

(1) General Discussion

The series of PUJ route modifications in Davao City which began in February 1979 had the following purposes:

- a) The improvement of user benefit by connecting points in and out of Poblacion by single PUJ route.

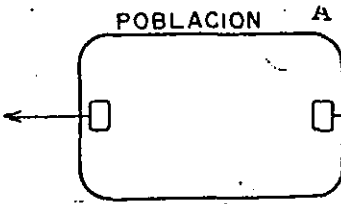
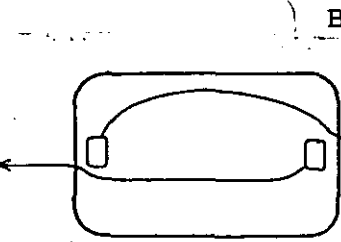
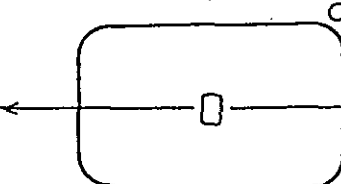
b) The improvement of user benefit by accomplishing an even spread of PUJ routes in the downtown area existing in Poblacion.

c) The assignment, to each route, of the commensurate number of PUJs with demand, and the acceleration of equalization of profitability which differed from one route to another.

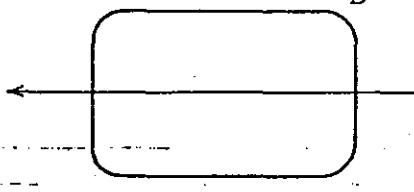
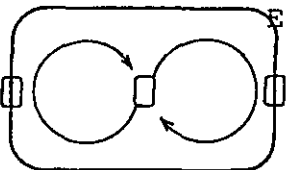
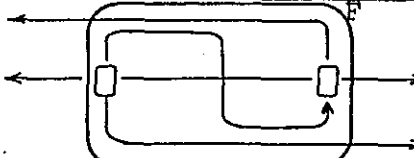
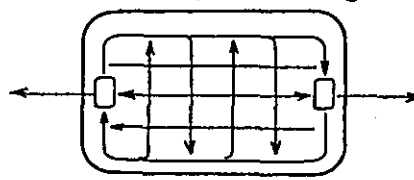
The recent Person Trip Survey revealed for the first time the details of urban traffic in Davao City, and the principal aim of the new PUJ routing scheme to be recommended is to select the optimum routes and the optimum allocation of PUJs based on the result of said Survey.

Attempts have been made to establish a proper pattern of PUJ routes, but the following typical patterns are useful, the analysis of which has resulted in the adoption of patterns B and E for recommendation.

Table 4.11 Typical PUJ Patterns

Pattern	Description and Evaluation
	<p>This is the pattern that was in effect prior to the February 1979 route modification. The principal aim of rerouting schemes were to connect points in and out of Poblacion by one mode of transportation.</p>
	<p>This is the pattern that is now in force. Points in and out of Poblacion are connected by one ride, and, as long as right route is used, passengers can reach any major destination in downtown. This pattern should be retained and continued for the time being.</p>
	<p>The entry into a city of vehicle such as PUJ whose capacity is limited (therefore, the number of vehicle units required is larger than in the</p>



Pattern	Description and Evaluation
<p style="text-align: center;">C (continued)</p>	<p>case of those with a greater capacity) causes traffic confusion, the elimination of which was the very purpose of the first rerouting scheme.</p>
<p style="text-align: right;">D</p> 	<p>Presently, transit passengers through Poblacion are few. Unlike railroad, change of destination at a terminal is easy in the case of PUJ. Therefore, the usefulness of this route is presently limited.</p>
<p style="text-align: right;">E</p> 	<p>Intra-Poblacion movements, chiefly generated in day time, are different from the PUJ route service pattern that existed. This is a pattern which should be added to the new PUJ routes.</p>
<p style="text-align: right;">F</p> 	<p>This consists of Pattern B and circuit service within Poblacion. The service is limited to arterials.</p>
<p style="text-align: right;">G</p> 	<p>This is a version of Pattern F with a higher service density in Poblacion for a greater competition with the service area of ACs and, therefore, undesirable for use in the urgent measure, which is to retain the function of ACs.</p>

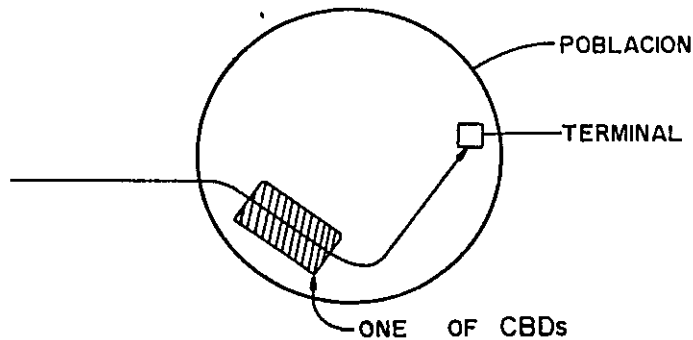
(2) Commuting Routes and Circulation Routes

The rerouting plan recommended hereby consists of:

- a) Commuting routes which will connect points in and out of Poblacion, and
- b) Circulation routes, which will circulate through and within Poblacion.

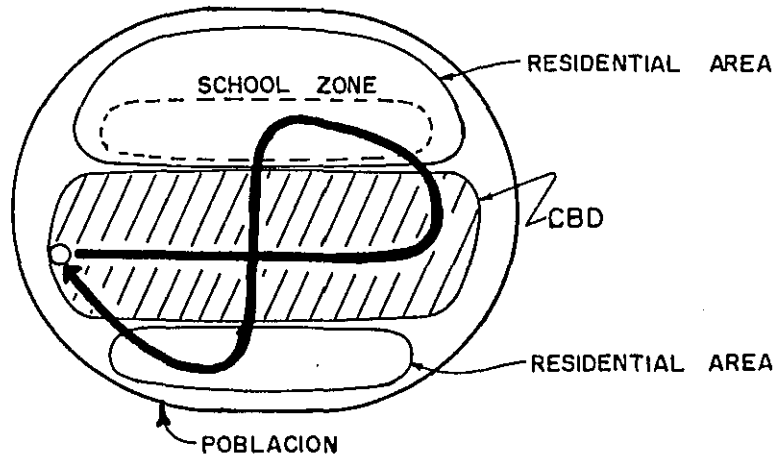
Each of commuting routes will enter Poblacion from outside, go through at least one of high-demand districts in Poblacion, and reaches a terminal on the opposite side (from the point of entry). Shuttle service will be provided on these routes.

Fig. 4-37 Commuting Route Pattern



Circulation routes, on the other hand, will serve demands in C.B.D., which extends from Davao River to Santa Ana Port and to Agdao Market and connect the C.B.D. with the housing areas (including school zone) in the north and the south of C.B.D.

Fig. 4-38 Circulation Route Pattern



The above patterns have been translated into the new routes presented in the figures below, taking into full consideration the area in which PUJ Person trips are concentrated as discussed in the preceding section, namely, City Hall and San Pedro Street Area, Bankerohan Area, the Central Area, and the school zone in Poblacion north. Arterials to be used for these routes already exist, and, therefore, if any roads are to be improved under this urgent project, the use of such roads should also be considered (for instance, the use of Roxas Avenue instead of E. Jacinto Street).

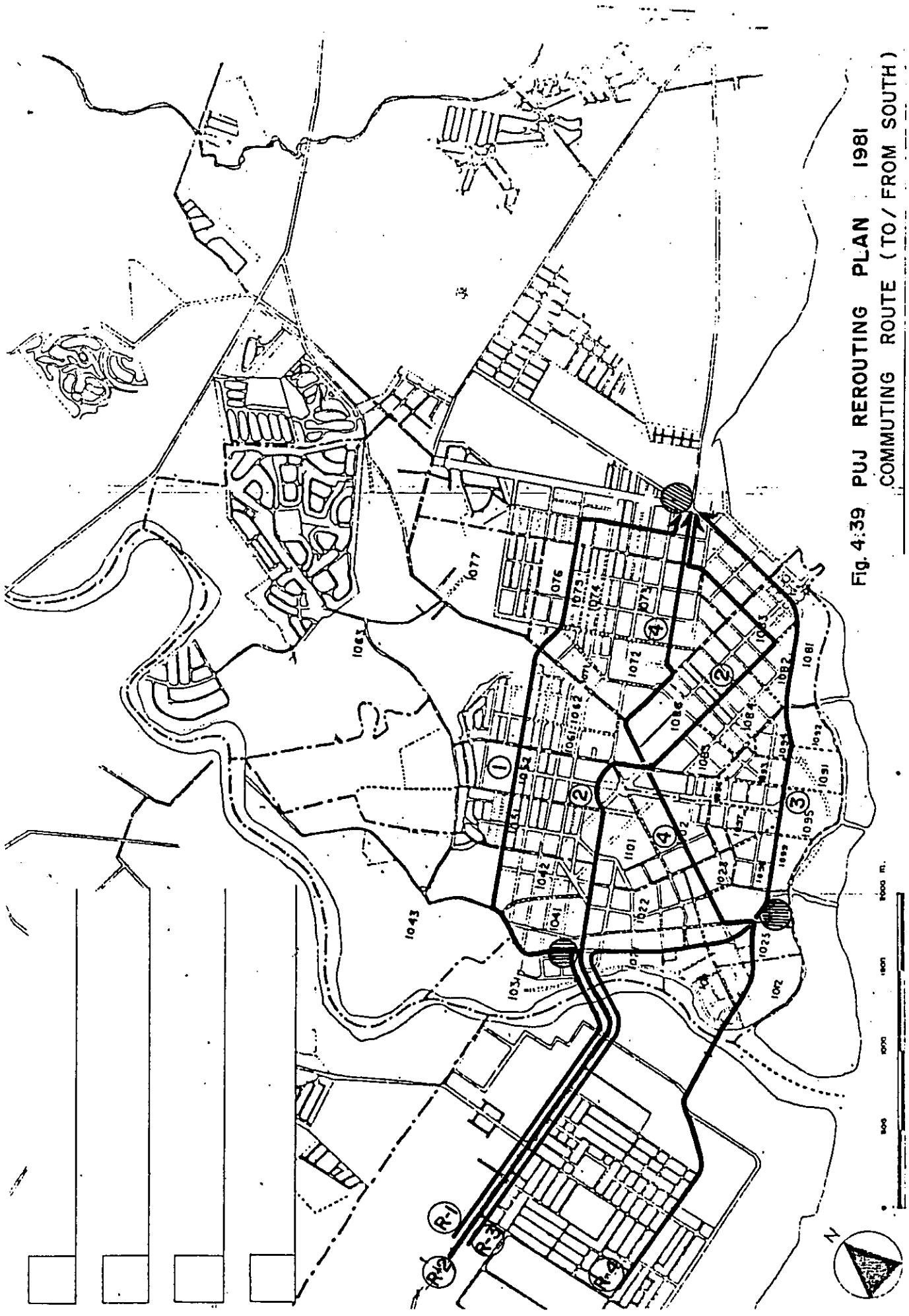


Fig. 4.39 PUJ REROUTING PLAN 1981  
COMMUTING ROUTE (TO / FROM SOUTH)

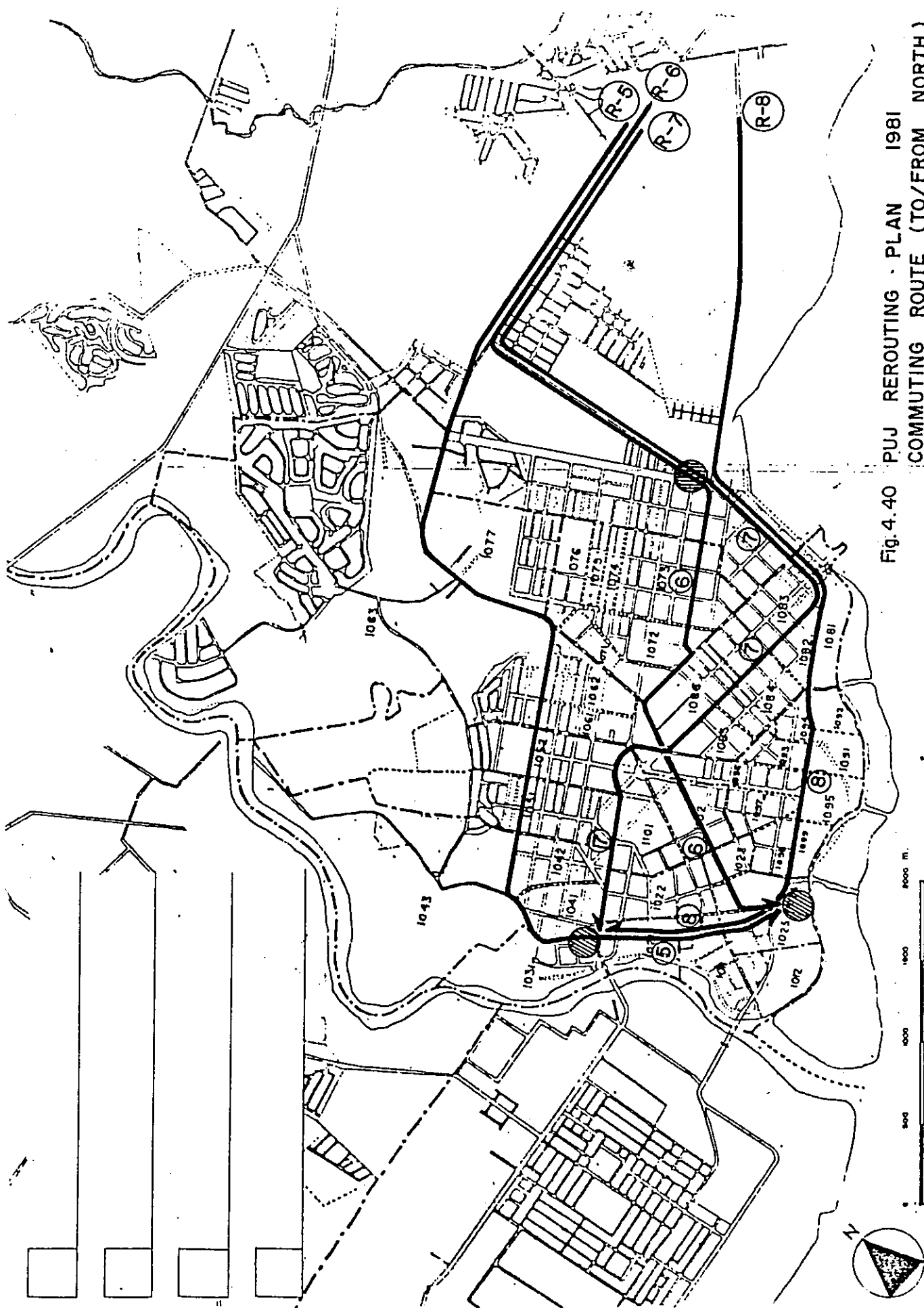


Fig. 4.40 PUJ REROUTING · PLAN 1981  
 COMMUTING ROUTE (TO/FROM NORTH)



(3) PUJ Allocation to the New Routes

The PUJ allocation plan hereby attempts to allocate to each route the number of PUJs which is commensurate with the volume of demand on that route, to determine optimum service frequencies, and to correct the existing disparity in driver revenue between routes.

The process to accomplish this PUJ allocation is explained in summary as follows:

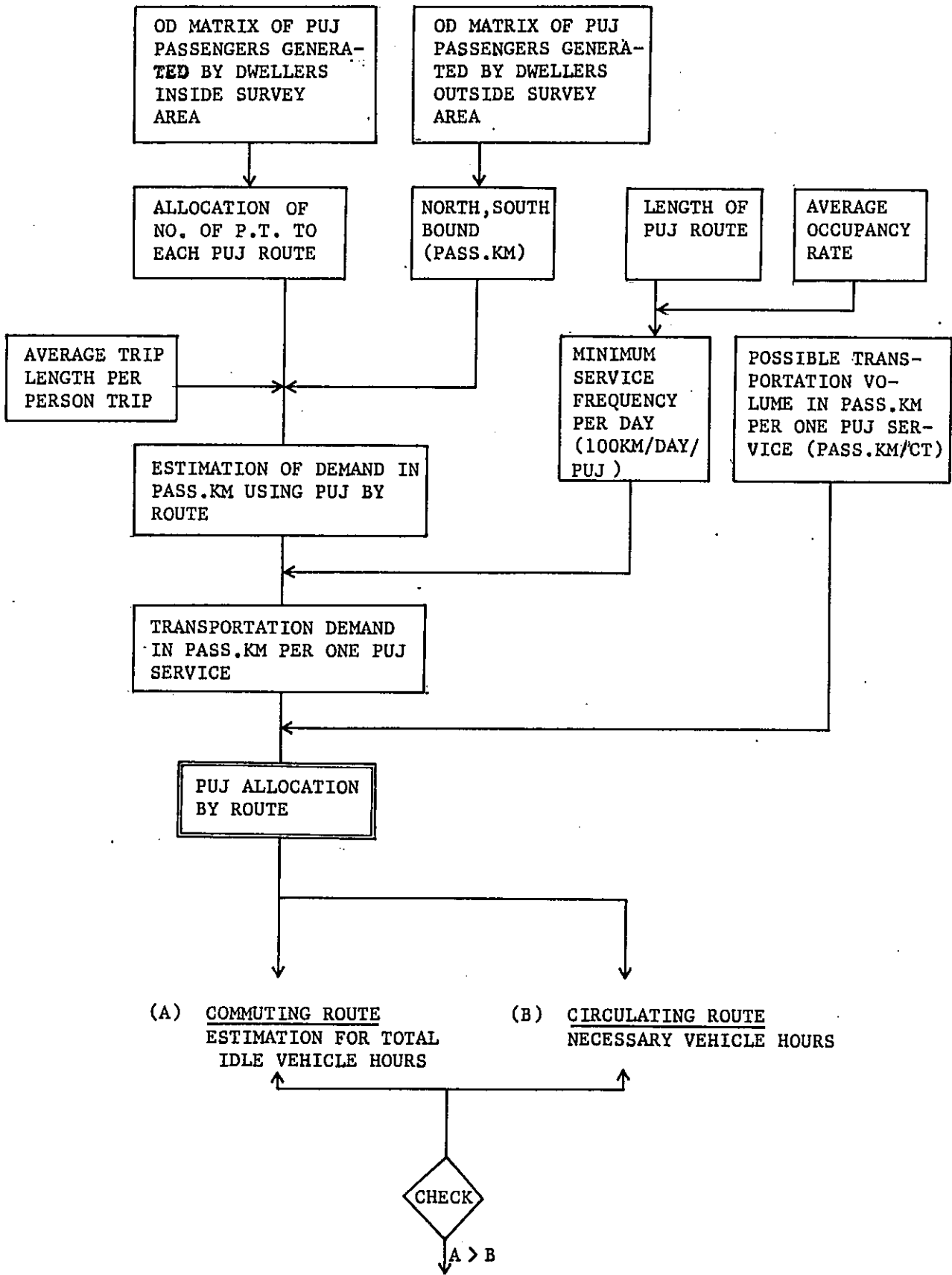
- a) First, transportation demand on each PUJ route is calculated in terms of passenger kilometer based on the number of present O-D trips and average trip length.
- b) Then, average transportation capacity per round PUJ trip is calculated in terms of passenger kilometer for the same route based on the length of and occupancy rate on the route.
- c) Also, maximum service frequency (number of trips per day) per PUJ on that route is obtained from the route length and the cruising speed of the PUJ.
- d) Then, the minimum number of PUJs which must be assigned to that route is determined based on the average transportation capacity per round PUJ trip (of b) above) and the maximum service frequency of c) above).
- e) Likewise, the number of PUJs which must be assigned to the some route from a practical point of view (that the maximum service frequency is not necessarily always achieved by each PUJ driver) is determined based on the average transportation capacity per round PUJ trip (of b) above) and the service frequency which assume the practical operation length of each PUJ of 100 kilometers per day in average.

- f) Finally, the PUJ fleet (total number of PUJs) is allocated to each route by the ratio of the route's practical assignment number (of e) above) to the total of such numbers for all routes.
- g) Because each PUJ is assigned to two routes, one commuting route and one circulation route, the above steps a) to f) is followed twice separately, once for commuting routes and once for circulation routes.
- h) Then, in order to assure that all of PUJs have, after serving the demands on commuting routes, an adequate remaining capacity to serve demands on circulation routes, the idle time of PUJs on commuting routes in terms of vehicle hour is compared against demands on circulation routes also in terms of vehicle hour. If the former is greater than the latter, PUJs are expected to adequately serve the demands on circulation routes.

The above process is illustrated by the flow chart diagram below, and the resultant PUJ allocation is shown in the table that follows.



FIG. 4.44 FLOW CHART OF PUJ ALLOCATION



Tab. 4.12 PUJ ALLOCATION

	A ALLOCATED NO. OF PT (PT)	B AVERAGE PT LENGTH (KH)	C=A x B TRANSPORTATION DEMAND BY ROUTE INSIDE SURVEY AREA. ( Pass-Km. )	D TRANSPORTATION DEMAND FOR OUT- SIDE SURVEY AREA DWELLERS USING PUJ ( Pass-Km. )	E=C+D TOTAL TRANS- PORTATION DEMAND ( Pass-Km. )	F LENGTH OF ROUTE (KH)	G AVERAGE CAPACITY FOR ONE C.T. ( Pass-Km/C.T.)	H NECESSARY SERVICE FREQUENCY (NO. OF ROUND TRIPS)	I $\frac{E}{G} \div H$ PUJ ALLOCA- TION
S									
R1	11,066	8.5	94,061	78,316	172,377	14.64	131.8	3	218
R2	10,621	8.5	90,279	78,316	168,595	14.37	129.3	3	217
R3	15,647	8.5	133,000	78,316	211,316	14.65	131.9	3	267
R4	8,716	8.5	74,086	78,316	152,402	14.75	132.8	3	192
ST	46,050		391,426	313,262	704,690				894
N									
R5	14,858	8.7	129,265	68,875	198,140	19.93	179.4	2	276
R6	7,074	8.7	61,544	68,875	130,419	18.87	160.8	2	203
R7	10,754	8.7	93,560	68,875	162,435	18.87	170.0	2	239
R8	15,027	8.7	130,735	68,875	199,610	18.40	174.6	2	286
ST	47,713		415,104	275,500	690,604				1,004
TOTAL	93,763		806,530	588,762	1,395,294				1,898
CR1	17,939	1.92	34,443	-	34,443	8.41	75.7	6	76
CR2	21,181	1.92	40,668	-	40,668	8.99	80.9	5	101
CR3	21,543	1.92	47,123	-	47,123	10.62	95.6	5	100
ST	63,663		122,234		122,234				277
GT	157,426		928,764	588,762	1,517,528				

NOTE: A - Excluding no. of PT using PUJ which has no origin and destination in Poblacion including Agdao.

B - Poblacion to North: 6.8 km/PT; South = 6.6 km/PT; Inside Poblacion = 1.92 km/PT (Trip length table)

D - No. of PT using PUJ by dwellers outside survey area who go inside survey area and Poblacion.. Refer to Tab. 4.11

F - Using average car-trip length for outside Poblacion plus length of route inside Poblacion.. Refer to Tab. 4.21

G - Average occupancy rate = 9 PT/CT

I - Considering Operation of 100 km/day/PUJ

4) Evaluation and Implementational Proposals

(1) Evaluation of New Rerouting Plan

The PUJ rerouting plan recommended hereby is evaluated in comparison with the previous schemes.

The new routing plan has been formulated with contrivance to extend PUJ service to the fringe areas of Poblacion where such service was previously inadequate and to correct gaps in the level of service between routes. Therefore, the following criteria which will be explained further in the succeeding paragraph will be appropriate for the evaluation. With regard to the improvement of user benefits:

- Reduction in waiting time by each route
- Reduction in total riding time of PUJ users as a whole

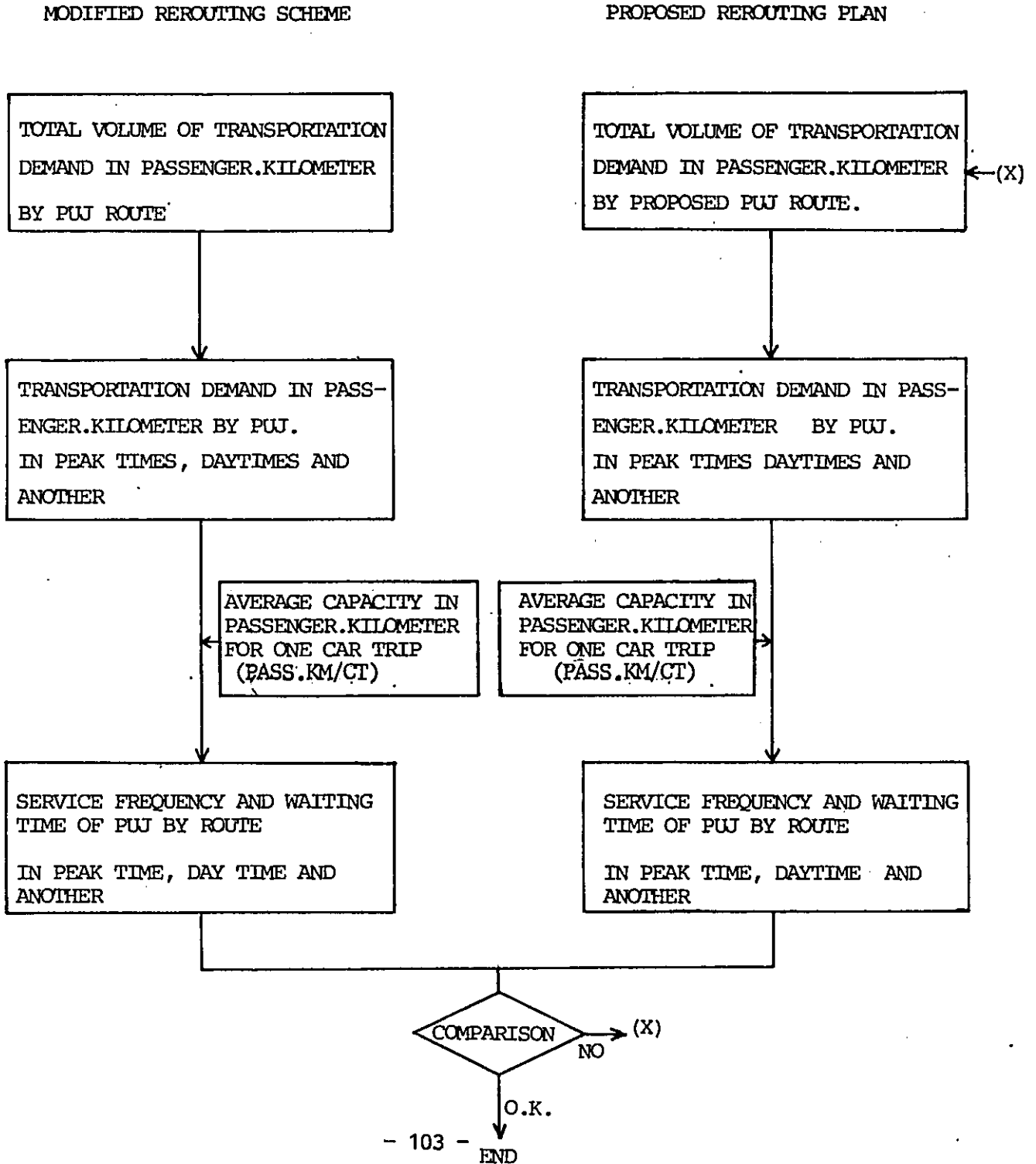
With regard to the equalization of PUJ driver and operator revenue by route:

- The degree of equalization of demand per PUJ between routes, by the assignment to each route of the number of PUJs in line with the demand on that route.

a) Reduction in Waiting Time

The process of estimating average waiting time in each PUJ route is illustrated by the flow chart presented below.

FIG. 4.45 FLOW CHART FOR ESTIMATION OF WAITING TIME OF PUJ



Service frequency on each route is left up to the free will of each PUJ driver, and, therefore, such frequency can become relatively low on a high demand route if the driver believes that demand is low on that route. Average waiting time under the Proposed Rerouting Plan, as estimated based on the service frequency of peak time, day time and another time, which assumes the daily operation distance of 100 kilometers and the daily PUJ continued service of 19 hours is compared against average waiting time under the Modified Rerouting Scheme, because service frequency was surveyed in November 1979. The result of this comparison is presented on the table below.

Table 4.13 WAITING TIME FOR PUJ BY PUJ ROUTE

PROPOSED ALLOCATION #1				MODIFIED REROUTING SCHEME									
PEAK TIME (4 HRS.)	DAY TIME (8 HRS.)	ANOTHER TIME (7 HRS.)	MIN	ESTIMATION				ACTUAL #2					
				PEAK TIME	DAY TIME	ANOTHER TIME	MIN	PEAK TIME	DAY TIME	ANOTHER TIME	MIN		
R1	0.8	2.0	3.6	0.9	2.2	3.9	1.4	3.4	6.0				
R2	0.8	2.0	3.6	0.9	2.2	4.0	2.0	4.9	8.7				
R3	0.6	1.6	3.7	0.7	1.8	3.2	0.2	0.5	0.9				
R4	0.9	2.3	5.0	1.3	3.2	5.8	2.4	5.6	10.1				
R5				0.9	2.2	4.0	13.0	31.0	56.0				
R6	1.0	2.3	4.2	1.2	3.0	5.4	7.5	18.1	32.3				
R7	1.3	3.2	5.7	1.5	3.6	6.5	0.8	1.9	3.4				
R8	1.1	2.7	4.9	1.4	3.4	6.1	9.2	22.3	40.4				
R9	0.9	2.3	4.6	1.4	3.5	6.2	0.5	1.3	2.4				
R10				1.7	4.1	7.3	0.5	1.3	2.3				
R11				1.5	3.7	6.6	0.7	1.8	3.2				
CR1	1.2	2.8	5.6										
CR2	1.1	2.6	4.7										
CR3	1.1	2.6	4.7										

Source: DOUTIUS

Note: #1 Based on Transport Demand Allocation (in Passenger.Kilometer) by route as a result of P.T. assignment by Route, Re-allocated according to percentage structure of P.T. by Time Zone (Peaktme = 44.6%; Daytime = 37.2%; Another Time = 18.2%)

#2 Based on number of Car Trips by Route from PUJ survey result, Re-allocated according to percentage structure of number of passengers by time zone.

If rational allocation of PUJs to the demand on each zone-to-zone O-D pair is accomplished, waiting time on all routes can be limited to less than 2 minutes in Peak Time and about 3 minutes in Daytime. Presently, however, waiting time under the Modified Rerouting Scheme extends to 7 or 13 minutes in Peak Time 20 to 30 minutes in Daytime on some routes, as seen in the above table.

Thus, from the standpoint of waiting time, the Proposed Scheme and the allocation of PUJs thereunder are judged appropriate.

(b) Reduction in Riding Time

The PUJ user benefit is increased when he can reach the same destination (from the same origin) in a shorter time than before. In order to see if the Proposed Rerouting Plan will accomplish this, the total riding time of all PUJ users is calculated for the Plan and compared with such total riding time for the previous scheme.

Riding time is computed first for each O-D zone pair based on the length of O-D zone pair route, cruising speed, and the number of person trips, and then, the total of such riding time for all routes is obtained.

The result of this computation is compared on Table 4-14 below, which reveals that the total riding time of all PUJ users will reduce by 400 hours from the 40,800 hours under the previous scheme to 40,400 hours under the Proposed Plan. The reduction will be 200 hours each for trips between points in and out of Poblacion and for trips between points within Poblacion.

Table 4.14 Comparison of Total Riding Time

	Proposed Rerouting Plan	Modified Rerouting Scheme
Commuting Routes	33,200	33,400
Circulation Routes	7,200*	7,400*
TOTAL	40,400	40,800

\* Total Riding Time of PT in Poblacion Including Agdao

c) Equalization of Demand and Revenue per one PUJ  
Between Routes

Not only user benefits but also operator advantages must be accomplished simultaneously through the rerouting of PUJs and the allocation of PUJs to routes. A review of the routes now in use reveals that PUJ service is heavily concentrated on routes, in busy downtown areas, as it has been pointed out, which are empirically but not (necessarily correctly) believed by PUJ drivers as the areas of high demand. This skew in service distribution has stayed until users have become accustomed to either walk or take a tricycle to an arterial where they can catch a PUJ.

Therefore, a well balanced PUJ allocation to routes has been attempted based on the result of the Person Trip Survey. This allocation has resulted in the average demand per PUJ by route of 640 to 790 passenger kilometers, as shown on the table below. The average demand then is translated into average fare income of ₱100 to ₱120 per PUJ, which fully supports the expectation that the proposed scheme will facilitate the accomplishment of an even distribution of revenue to routes.

Table 4.15 ALLOCATED TRAFFIC VOLUME IN PT.KM AND FARE RATE INCOME PER PUJ BASED ON PROPOSED RE-ROUTING PLAN

	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	CR 1	CR 2	CR 3
Traffic volume in PT.KM for 1 PUJ	790.7	776.9	791.4	793.8	717.9	642.5	679.9	697.9	453.	402.	471.
Fare rate in- come per PUJ (₱)	112	110	112	113	102	91	96	99.0			
		*1 +₱8.3		*2 ₱7.5							



Table 4.16 ALLOCATED TRAFFIC VOLUME IN PT.KM & FARE RATE INCOME PER PUJ BY ROUTE BASED ON REMODIFIED REROUTING SCHEME

	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11	R 12
Traffic volume in PT.KM for 1 PUJ	2046	3120	161	162	279	197	225	1571	141	952	131	1266
Fare rate income Per PUJ (₱)	290	443	23	23	40	28	32	223	20	135	19	180

Note: \*1 - Additional income for each PUJ serving circulation route in Poblacion.

\*2 - Additional income for each PUJ from dwellers inside survey area with trips not related to Poblacion

Fare rate income is added 10% to show actual income for outside Poblacion.

(2) Proposals Pertaining to the Implementation of the New PUJ Rerouting Plan

a) Public Relations and Post-Implementation Appraisal

While the Proposed PUJ Rerouting Plan respects the existing policies and systems, it introduces circulation routes and a new way to utilize PUJ terminals, with which the Davao City authority and people is unfamiliar. The implementation of such new institutions will require that PUJ users be accustomed to the new system and PUJ operators change their management/operation attitude/method.

Davao City authority advertised the implementation of each of the previous rerouting schemes in advance through mass media, but such public relations activities should be further intensified for the implementation of the Proposed Plan. Therefore, following additional programs should be reviewed:

- i) Public relations activity through high grade elementary school children, pupils and students.
- ii) Briefing of barangay inhabitants
- iii) Briefing of local inhabitants and shop workers

Then, after the implementation:

- iv) Intensification of hearings
- v) Questionnaire survey of users each area, drivers of each route, and operators, on the new route.
- vi) The establishment of an ad hoc Rerouting Project Team in the Mayor's Office for the execution of the above programs and activities, with the cooperation of MPH and related agencies.

(b) PUJ Terminals Development

Like existing routes, the routes to be established under the Proposed Rerouting Plan terminate in Bankerohan area, Agdao area, and Bolton area. However, all existing terminals other than four PUJ terminals in Bankerohan area and two tricycle parking spaces in Agdao area have no fixed land space of their own.

Furthermore, two terminal areas other than Bolton are designated in the fringe of a market, where traffic is generally heavy and loading and unloading PUJ passengers, and PUJs waiting for passengers or otherwise parked crowd the street. Traffic congestion in Bankerohan Market Area is particularly severe.

Therefore, upon the implementation of the Proposed PUJ Rerouting Plan, the terminal areas should be developed so as that:

- i) Traffic congestion in terminal areas, as exemplified by Bankerohan area, be solved.
- ii) The benefit, particularly the ease of loading and unloading at terminals and safety, of PUJ users be improved.

- iii) Drivers' resting and dozing facilities be improved.
  - iv) Government type management and public service system be introduced to the privately operated terminals.
  - v) Terminals must be utilized according to the Proposed Rerouting Plan, meaning Bankerohan and Bolton Terminals must serve to North and Agdao Terminal must serve to south.
- i) Improvement of Bankerohan Terminal

Bankerohan Terminal can be most significantly improved for the betterment of passenger and vehicle safety and convenience through the attainment of smooth flow of incoming vehicles for a minimum of staying time and through the dispersion of PUJs which crowd the loading/unloading terminal which faces Quirino Avenue.

Therefore, it is proposed that a PUJ parking lot be established at Bankerohan Terminal and that this parking lot, the operation of the existing PUJ terminal, and traffic control in the market area be all together managed as one system.

The proposed Bankerohan Terminal area development is summarized as follows:

- \* Establishment of a PUJ parking lot along Pag-asa Street (land space: 1.5 to 2.0 hectares)
- \* Establishment of PUJ arrival, departure, and non-service departure channels.
- \* Linkage of PUJ parking and PUJ terminal operation
- \* Development of PUJ loading/unloading zones in the vicinity of the terminal.

The above proposals of terminal improvement is illustrated by the figure below:

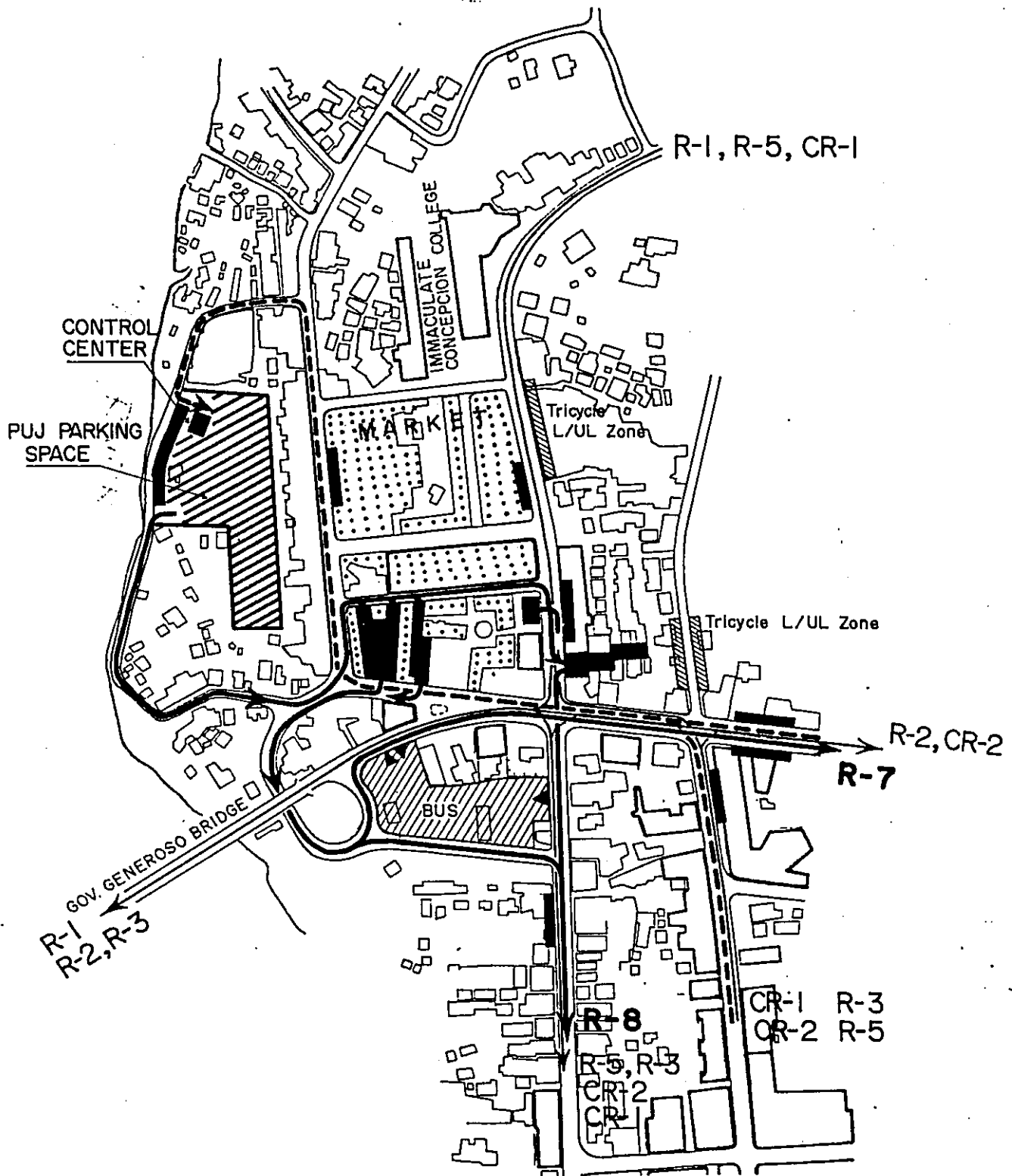


FIG. 4.46

## PUJ TERMINAL AREA IMPROVEMENT IN BANKEROHAN

- PUJ L/UL ZONE
- PUJ TERMINAL (LEAVING BERTH)
- PUJ ROUTE FOR LEAVING
- PUJ ROUTE FOR ARRIVING
- PUJ ROUTE FOR PASSING THROUGH

ii) Development of Agdao Terminal

PUJs, ACs, tricycles, and mini-buses (generally registered as PUJ) gather at Agdao Terminal, forming a huge nodal point. Yet, parking and standing of public transportation vehicles are limited to arterial roadside (the only parking lot is that for tricycles located in the market), and, therefore, they are parked on the sides of Cabaguio Street and Lapulapu Street, as well as in gasoline stands along these roads.

Urgent measures for the development of Agdao Terminal are:

- \* The development of Dacudao Avenue as a temporary PUJ departure terminal for PUJs coming from South.
- \* The leasing (or acquisition) of open spaces available along Dacudao Avenue and their development as PUJ parking lots (2-3 hectares).

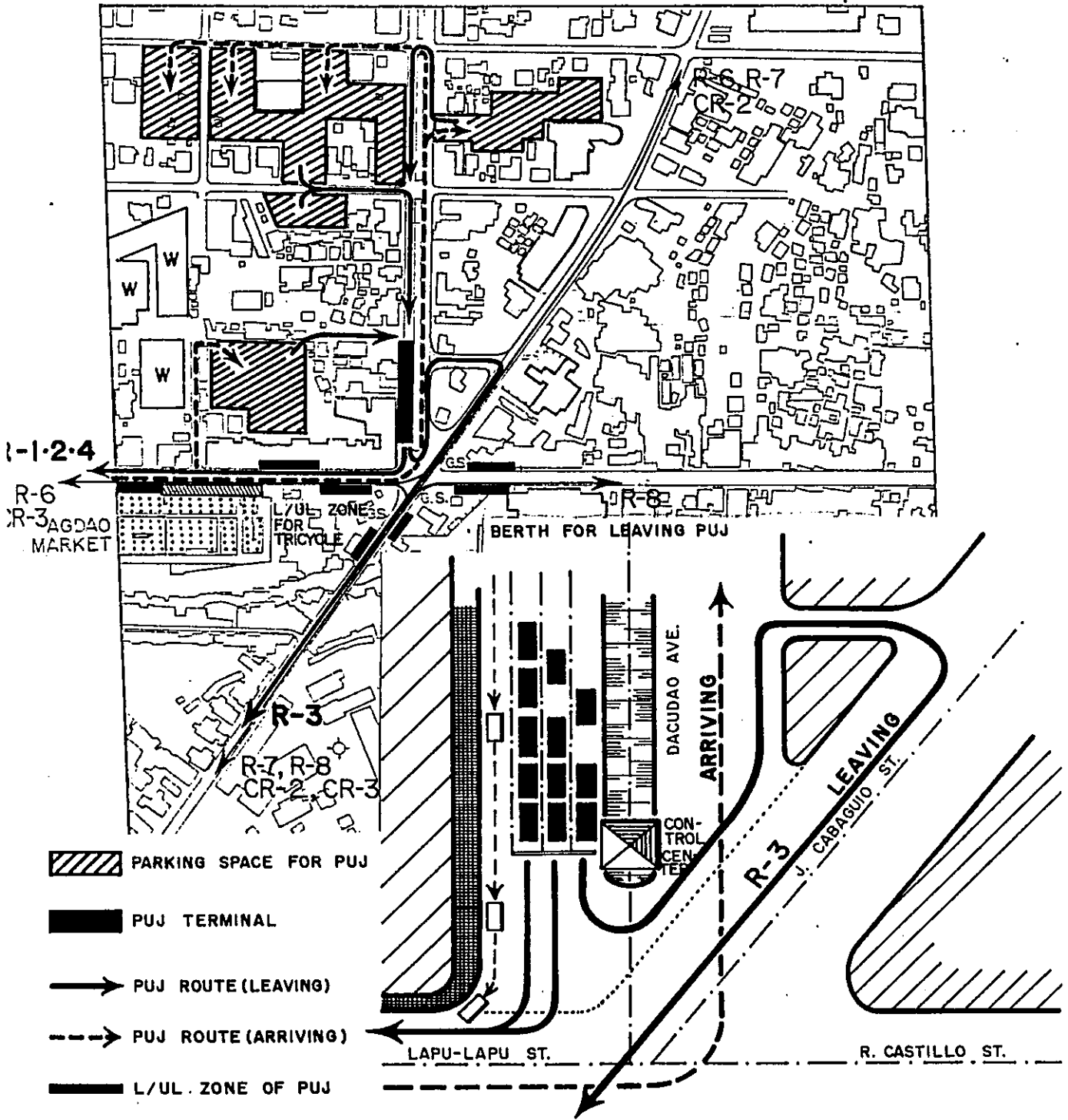
The proposed development of Agdao Terminal is illustrated in the figure below. (Refer to Fig. 4.47).

iii) Development of Bolton Terminal

No terminal facility has been erected for this terminal, which was so designated at the time of the implementation of previous rerouting schemes. However, its site condition would be improved as the construction of roads in the vicinity will advance, although it is a block away from San Pedro Street/C.M. Recto Street Intersection. Moreover, ample open spaces are available in the vicinity and, therefore, a model parking space and a model PUJ terminal can desirably be developed here.

The items of Bolton Terminal Development are:

- \* Reclamation of a part of the riverside lowlands for the development of the PUJ terminal which will facilitate the effectively functioning of the Proposed PUJ Rerouting Plan.








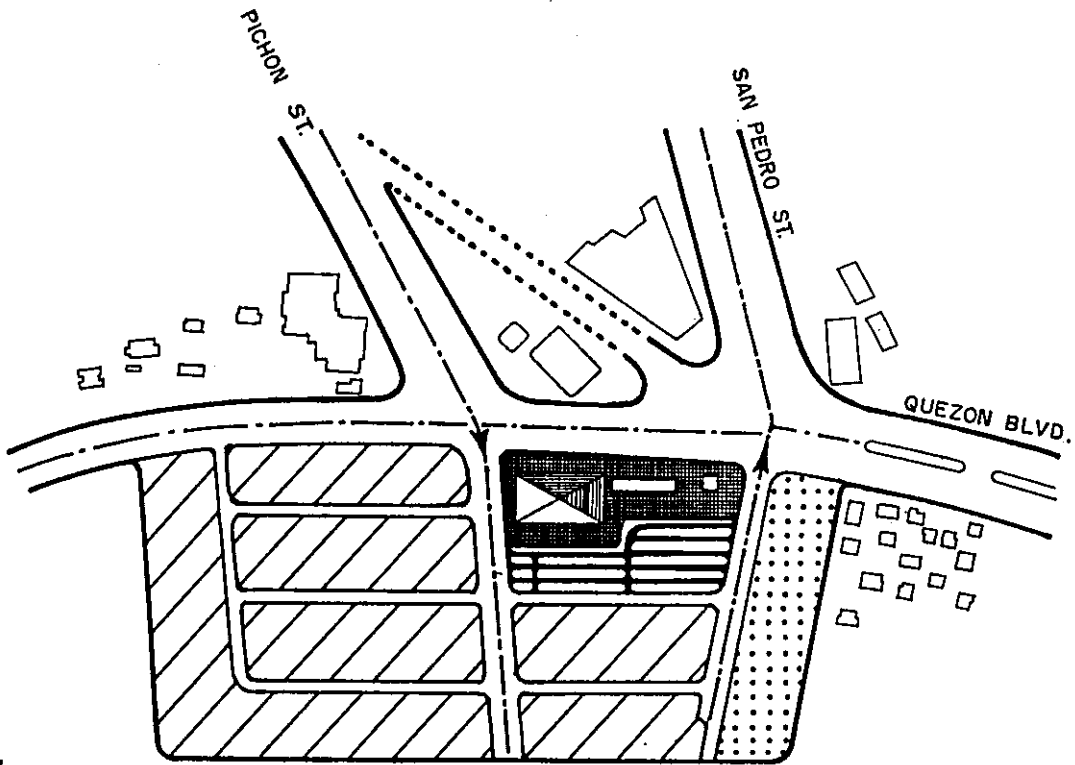
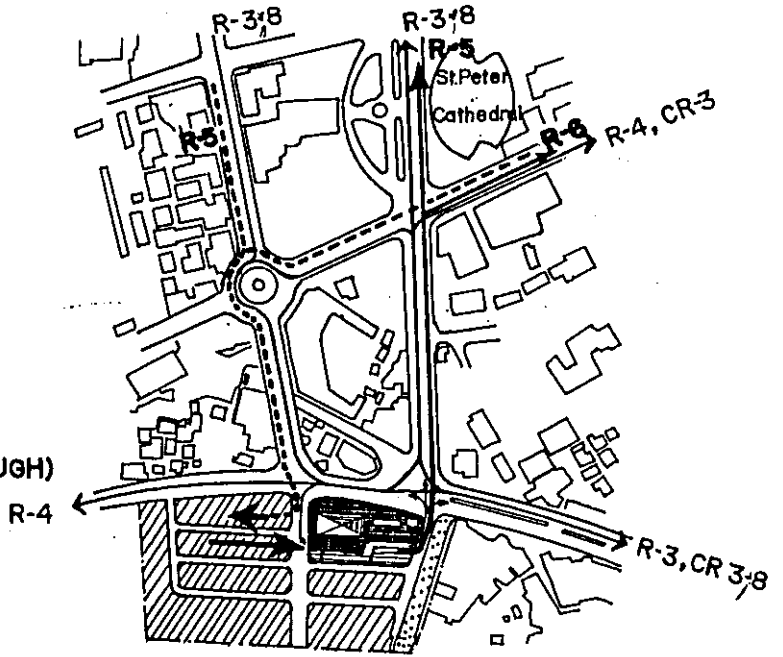
DETAIL OF PUJ TERMINAL

Fig 4-47

**PUJ TERMINAL AREA IMPROVEMENT IN AGDAO**

LEGEND:

-  PUJ PARKING SPACE
-  PUJ TERMINAL
-  PUJ ROUTE (LEAVING)
-  PUJ ROUTE (ARRIVING)
-  PUJ ROUTE (PASSING THROUGH)



LEGEND:

-  PEDESTRIANS SPACE
-  LOADING SPACE
-  PARKING SPACE
-  SERVICE FACILITIES SPACE

## CONCEPT FOR PUJ TERMINAL IN BOLTON

Fig 4.4B

## PUJ TERMINAL AREA IMPROVEMENT IN BOLTON

\*Also, the development of a parking lot for PUJs originating from and terminating at this terminal.

(c) Proposals on PUJ Terminal Operation

Key to the success of terminal improvement program will be the linkage of the operation of publicly established PUJ parking lot and of the existing facilities of privately operated PUJ terminals, particularly Bankerohan Terminal.

PUJs returning from service are to be parked (and the drivers to rest) in the PUJ parking lot, where PUJs will wait for its turn for departure. The establishment of such parking lot will result in fewer PUJs parked at the existing terminal and fewer PUJs waiting for passengers at the terminal, and the space thus vacated by these PUJs can be utilized as additional departure berths.

A communication system will be necessary between the parking lot and the terminal for the purpose of calling out PUJs waiting in parking lot in queue and directing them into departure berths in an orderly manner (just as taxi cabs are called to the front of the hotel).

In order to implement such a calling system, it will be necessary that:

- \* A numbered destination card be given to each PUJ as it returns from service and enters into the parking lot, and that PUJs are called out to departure berth for given destination in the order of the number on the destination card.
- \* That PUJs without a destination card not be allowed to depart for service from PUJ departure berth, and that PUJs be allowed to depart in the order of the card number.

For the purpose of ensuring the accomplishment of the proposed management/operation of terminals, it is recommended that an organization which might be called "Terminal Operation Council" be formed with the representatives of private terminal operators and the Traffic officials of Davao City, which will be



charged with responsibility for the implementation of the proposed improvement program. It will be further, desirable that an Operation Committee be organized under this Council with the participation of PUJ operators and drivers among others, as the committee members who, under the leadership of technical personnel of the City, will sponsor workshops and consultation meetings on the optimum operation method by route, the way in which the terminal parking lot be utilized, and so forth.

d) Summary Evaluation

The PUJ Rerouting Plan is evaluated from the two aspects discussed above-- the user's convenience and the driver's/operator's profit--as summarized in Table 4.17.

Improvement in the user's convenience was measured by the reduction of average waiting time and the reduction of total riding time.

In terms of waiting time (only that in peak hour is shown in said Table), the Plan is judged acceptable in that it will reduce gaps in waiting time between routes and will result in shorter waiting time on most of new routes when compared with those on the most comparable existing routes.

Also in terms of total riding time the Plan is judged acceptable in that it will not aggravate the existing situation which must be said significant when the fact is taken into consideration that the Plan, which was based on the existing behavioral pattern of PUJ passengers (which is indicated by their O-D Matrix) and on the new routes established on roads which are currently used for the routes, cannot, by definition, achieve any appreciable total riding time reduction.

The driver's/operator's profit was evaluated in terms of the degree by which the quantity of passengers (expressed in the unit of person-kilometer) per each PUJ will be evenly distributed to each route. This is because the major objective of the PUJ Rerouting Plan, which is based on the constant numbers of PUJs and their passengers as the present, is to distribute the total

demand evenly to each route. The range of the number of passengers per PUJ on each route is estimated to narrow from the existing 131 to 3,120 person kilometers to 642 to 793 person-kilometers under the Plan. Thus, it was judged that the Plan will result in a more rational PUJ route network and more rational distributions of PUJs and service frequencies to routes based on the existing passenger behavioral pattern.

TABLE 4.17 A SUMMARY EVALUATION OF PUJ REROUTING PLAN

EVALUATION CRITERIA	VALUES UNDER THE PLAN	CURRENT VALUES	COMMENTS AND REMARKS			
PUJ Passenger Convenience Improvement	Reduction of Average Peak Hour Waiting Time	R 1 0.8 R 2 0.8 R 3 0.6 R 4 0.9 R 5 1.0 R 6 1.3 R 7 1.1 R 8 0.9 CR 1 1.2 CR 2 1.1 CR 3 1.1	R 1 1.4 R 2 2.0 R 3 0.2 R 4 2.4 R 5 13.0 R 6 7.5 R 7 0.8 R 8 9.2 R 9 0.5 R 10 0.5 R 11 0.7	<ul style="list-style-type: none"> <li>The range of waiting time is 0.6 to 1.3 minutes under the new Plan, while the range of existing waiting time is 0.2 to 13 minutes.</li> <li>Although routes under the Plan are different from the existing routes, a comparison of most comparable routes indicates that waiting time will reduce under the Plan on most of such routes.</li> <li>From the foregoing, it may be asserted that the new Plan is an improvement with regard to waiting time on each route.</li> </ul> <p>Remarks: In view that the number of PUJs operating on each route in each hour was surveyed at the time of the Modified Rerouting Scheme, routes under said Scheme are used for the calculation of the existing waiting time.</p>		
	Reduction of Total Riding Time	40,400 hours	40,800 hours	Little difference is estimated between the existing total riding time and total riding time under the Plan, which is, therefore, judged not to aggravate the existing situation		
	PUJ Driver Profit Improvement	Transportation Demand per each PUJ	Route	Person-Km	Route	Person-Km
			R 1	790.7	R 1	2,046
			R 2	776.9	R 2	3,120
			R 3	791.4	R 3	161
			R 4	793.8	R 4	162
			R 5	717.9	R 5	279
			R 6	642.5	R 6	197
			R 7	679.9	R 7	225
			R 8	697.9	R 8	1,571
CR 1			453.0	R 9	141	
CR 2			402.0	R 10	952	
CR 3			471.0	R 11	131	
		R 12	1,266			

# APPENDICES

TABLE 4.18 (a) INCOME FROM FARE RATE OF PUJ

		FARE RATE *1 (¢)		NO. OF PT FOR WHOLE SURVEY AREA	TOTAL INCOME ₱
less					
	250 m	Mini	50	768	384
	250 - 500	Mini	50	1019	510
	500 - 1 km	Mini	50	2815	1408
	1 - 2	Mini	50	39359	19680
	2 - 3	Mini	50	29023	14512
	3 - 4	Mini	50	27346	13673
	4 - 5	Mini	50	16600	8300
	5 - 7.5	6.25 km	63	22993	14486
	7.5 - 10	8.75 km	88	15401	13553
	10 - 15	12.5	125	11617	14521
	15 - 20	17.5	175	8197	14345
	20 - 30	25.0	250	3636	9090
	30 - 50	40.0	400	1538	6152
	Over 50	60.0	600	266	1596
				180578	₱132210

Source: DCUTCLUS

\*1 Based on Fare rate in November, 1979

\*2 Based on total number of person trips generated by dwellers inside survey area.

Total No. of PASS.KM : 1,028,720 PASS.KM

Average Fare Rate for P.T.: ₱0.732/PT

Average Fare Rate for PASS.KM: ₱0.129/PASS.KM

Table 4.18(b) ESTIMATION OF TRAFFIC VOLUME OF PUJ ACTIVITIES IN PASSENGER.KILOMETERS GENERATED BY DWELLERS OUTSIDE SURVEY AREA (BASED ON CORDON LINES SURVEY)

	(A) *1	(B) *1	(C) *2	(L)	(E)	(F)
	No. of PT. between Poblacion and B zone in left column	No. of PT. between survey area outside Poblacion and B zone in left column	Length of Route from Boundary of survey area to B-zones	Length of Route from Pob. *1 to boundary of survey area	Traffic Volume in Pass.km between Poblacion and B-zone	Traffic volume in Pass.km between survey area outside Poblacion and B-zones
N 6040	3130	1036	9.33	4.93	44,634	12,220
O 6010	34	20	57.57	25.44	2,822	1,406
R 7010	3772	3498	13.90	25.44	148,390	93,117
T 7020	42	-	114.00	25.44	5,857	-
H 7030	28	-	146.57	25.44	4,816	-
ST	7006	4554			206,519	106,743
					(313,262)	
S 6060	2004	730	5.90	9.91	31,683	7,924
O 6050	4086	842	10.02	9.91	81,434	12,609
U 6030	2104	290	20.50	9.91	63,983	7,382
T 6020	126	4	23.02	9.91	4,149	112
H 6070	72	1,564	4.30	19.00	1,678	21,583
7070	132	1,436	17.10	19.00	4,765	38,198
7060	-	-	55.40	19.00	-	-
7050	-	-	89.80	19.00	-	-
7040	-	-	273.40	19.00	-	-
ST	8524	4,866			187,692	87,808
					(275,500)	
GRAND TOTAL	15,530	9,420			394,211	194,551
	24,950	PT				588,762 Pass.Km

\*1 According to Cordon Line Survey, Excluding No. of PT.between Zones outside survey area using PUJ by dwellers outside Poblacion.

\*2 Northern Boundary of Survey Area is represented C zone 2011, South Boundary is C zone 5022, and boundary to Calinan is zone 4032. Distances are based on distance table by C zone.

$$(E) = x (C + L) \quad (F) = (B) \times (C + L/2)$$

Table 4.19 ADJUSTMENT OF OPERATION COST OF PUJ IN AUGUST 1979

<u>(RUNNING COST PER VEHICLE KILOMETER)</u>				<u>(FIXED COSTS IN PESO PER VEHICLE HOUR)</u>	
	Average *1 Running Cost (¢/Km)	Areal *2 Adjust- ment Factor	Running Cost (¢/Km)		
Fuel	32.61 *3	1.029	33.556	Time Determined Capital Costs	₱0.30
Oil	0.71	1.04	0.738	Opportunity Cost of capital.	0.91
Tires	2.74	1.03	2.822	Crew Cost	2.90
Maintenance				Over head taxes & licenses	1.80
Parts	5.87	1.01	5.929	Insurance	0.77
Labor	3.95	0.9	3.555		
Depreciation	8.36	1.01	8.444		
<b>TOTAL</b>	<b>54.24 ¢/Km</b>		<b>55.044¢/Km</b>	<b>Total Fixed Cost</b>	<b>₱6.67 *4</b>

\*1 Average Cost of Fiera and Tamaraw shown in Highway Planning Manual Vol. 4, by MPH

\*2 According to same source

\*3 Price of gasoline in Davao City (₱2.010/1 in March 1979, ₱2.714/1 in August 1979 Increase by 35.02% during March to August, 1979

\*4 Total fixed cost should be reduced by reduction factor  $\text{₱}6.67/\text{H} \times 0.9 = \text{₱}6.00/\text{H}$

\*5 Total cost per vehicle kilometer is ₱1.150/km.  
Based on following conditions: Working hours: 10 hours/day  
Working distance: 100 km/day

Table 4.20 ESTIMATION FOR VOLUME OF CAR-TRANSPORTATION  
IN CAR-TRIP KILOMETER BY PUJ ROUTE

Route	Length of Route (Km)			No. of Car Trip *3 (Car Trip)			CAR-TRIP KILO- METER		
	POB*1	OUT POB*2	TOTAL	Intra POB*4	Inter POB-Out	*5 Tripcut	Intra	Inter	Trip cut
1	4.33	10.24	14.57	1	596	150	4	8,684	650
2	3.23	10.24	13.47	-	418	105	-	5,630	339
3	4.74	10.24	14.98	6	3861	965	28	57,838	4,574
4	3.37	11.18	14.55	-	354	89	-	5,151	300
5	4.33	10.24	14.57	-	66	16	-	962	69
ST				7	5295 (6627)	1325	32	78,265 (84,912)	5,932
6	5.05	14.66	19.71	3	97	24	15	1,912	121
7	5.09	14.66	19.75	5	1016	254	25	20,066	1,293
8	3.23	14.66	17.89	-	55	14	-	984	45
9	4.74	14.66	19.40	8	1400	350	38	27,160	1,659
10	5.80	14.66	20.46	7	1586	396	41	32,450	2,297
11	4.33	14.66	18.99	7	1070	267	30	20,319	1,156
ST				30	5224 (6559)	1305	149	102,891 (109,611)	6,571
GT				37	10,519 (13,186)	2630	181	181,156 (193,840)	12,503

\*1 Based on length of Links of Road Section \*2 Tab - E

\*3 Excluding Car Trips outside -outside of Poblacion

\*4 Poblacion including Agdao

\*5 Trip cutting means not to go outside Poblacion and Total No.  
of Trip Cutting is estimated 20% of Total No. of Car Trips.

Average Length of one Car-Trip of South = 12.813 Km/CT

Average Length of one Car-Trip of North = 16.712

Average both North and South = 14.70 Km/Car Trip



Table 4.21 ESTIMATION OF AVERAGE LENGTH OF PUJ ROUTES

B-Zone	CAR TRIPS			DISTANCE (Km)			CAR TRIP KM.		
	POB.	AGDAO	TOTAL	POB.*	AGDAO	TOTAL	POB.	AGDAO	TOTAL
N	2010	549	23	572	22.01	23.00	12,083	529	12,612
O	2020	1810	89	1899	13.46	14.45	24,363	1,286	25,649
	3010	669	43	712	7.00	7.99	4,683	344	5,027
R	3020	1978	12	1990	2.34	3.33	4,629	40	4,669
T	3030	6	-	6	1.30	2.29	8	-	8
H	S.T.	5,012	167	5,179			45,766	2,199	47,965
	6010	2	1	3	34.54	35.53	69	36	105
	6040	329	1	330	11.61	12.60	3,820	13	3,833
	S.T.	331	2	333			3,889	49	3,938
	7010	1213	29	1242	37.92	38.91	45,997	1,128	47,125
	7020	-	-	-	-	-	-	-	-
	7030	-	-	-	-	-	-	-	-
	S.T.	1213	29	1242			45,997	1,128	47,125
	TOTAL	6,556	198	6,754			95,652	3,376	99,028
S	4010	445	130	575	2.49	2.49	1,432		1,432
O	4020	916	1019	1935	3.11	3.11	6,018		6,018
U	4030	646	780	1426	8.53	8.53	12,164		12,164
T	4040	12	13	25	12.88	12.88	322		322
H	5010	749	1002	1751	14.44	14.44	25,284		25,284
	5020	1	-	1	15.46	15.46	15		15
	S.T.	2,769	2,944	5,713			45,235		45,235
	6020	-	-	4	29.61	29.61	-		-
	6030	322	329	651	27.09	27.09	17,636		17,636
	6050	169	147	316	16.61	16.61	5,249		5,249
	6060	41	32	73	12.49	12.49	912		912
	S.T.	532	508	1,040			23,797		23,797
	6070	-	-	-	17.38		-		-
	7040	-	-	-	291.02		-		-
	7050	-	-	-	107.42		-		-
	7060	-	-	-	73.02		-		-
	7070	3	2	5	34.72		174		174
	S.T.	3	2	5			174		174
	TOTAL	3,304	3,454	6,758			69,206		69,206
GRAND TOTAL		9,860	3,652	13,512			164,858	3,376	168,234

NOTE: - DISTANCES ARE BASED ON COMPUTER OUTPUT TABLE.  
 - EACH B-ZONE ARE REPRESENTED BY C-ZONES TO FIND DISTANCE

Average Length of Route in North bound is 14.66 km and South is 10.24 Km.

Average both of them is 12.45 Km, 124\* -- up to entrance of Poblacion

Table 4.22 ALLOCATION OF PUJ SERVICE BY PEAKTIME, DAY TIME AND ANOTHER TIME

	TRAFFIC DEMAND IN PASSENGER-KILOMETER				NO. OF ROUND TRIP			ALLOCATION OF PUJ*4		
	(A) *1 WHOLE DAY	(B)*2 PEAK TIME (4 HOURS)	(C) DAY TIME (8 HOURS) (7 HRS.)	(D) ANOTHER TIME	(E) PEAK TIME *3	(F) DAY TIME	(G) ANOTHER TRIP	(H) NO. OF PUJ	(I) AVERAGE SERVICE FREQUENCY IN ROUND TRIP	(J) (H) x (I) VEHICLE ROUND TRIP
R1	172,377	76,880	64,124	31,373	292	243	119	218	3	654
R2	168,595	75,194	62,717	30,684	291	242	119	217	3	651
R3	211,316	94,247	78,609	38,060	357	298	146	267	3	801
R4	152,402	67,971	56,694	27,737	256	213	104	192	3	576
ST	704,690	314,292	262,144	128,254				894		
R5	198,140	88,370	73,708	36,062	246	205	101	276	2	552
R6	130,419	58,167	48,516	23,736	181	151	74	203	2	402
R7	162,435	72,446	60,426	29,563	213	178	87	239	2	478
R8	199,610	89,026	74,255	36,329	255	213	104	286	2	572
ST	690,604	308,009	256,905	125,690				1,004		
TOTAL	1,395,294	622,301	519,049	253,944				1,898		
CR1	34,443	15,362	12,813	6,268	203	169	83	76	6	456
CR2	40,668	18,138	15,128	7,402	224	187	91	101	5	505
CR3	47,123	21,017	17,530	8,576	220	187	90	100	5	500
ST	122,234	54,517	45,471	22,246				277		
GT	1,517,528	676,818	564,520	276,190						

SOURCE: DOT/ICLUS

\*1 Refer PUJ Allocation Table

\*2 Percentage share of traffic demand is based on Hourly Variation of No. of Passengers by PUJ  
 Peak Time: 44.6% for 4 Hrs. Day Time: 37.2% for 8 Hrs. Another: 18.2% for 7 Hrs. (Service  
 Hours A day: 19 hours)

\*3 (E) = (B) ÷ Average capacity for One CT (Refer PUJ Allocation Table Column G)

\*4 PUJ Allocation Table

Table 4.22 (continued)

ALLOCATION OF PUJ SERVICE											
(K)	PEAK TIME		*6 NO. OF PUJ NECESSARY	(M) *5 SERVICE FREQUENCY	DAY TIME (N) (N)	*7 SUB-TOTAL OF VEHICLE ROUND TRIP	ANOTHER		(R)*9 NO. OF PUJ FOR ANOTHER	(S) *10 SERVICE FREQUENCY	
	*5 SERVICE FREQUENCY	(L)					(P)	(Q) *8 VEHICLE ROUND- TRIPS FOR ANOTHER			
R1	2		146	2	122	536	179	118	39	3	R.T.
R2	2		146	2	121	534	178	117	39	3	
R3	2		179	2	149	656	219	145	48	3	
R4	2		128	2	106	468	156	108	84	1	
ST											
R5	1		246	1	205	451	226	101	50	2	
R6	1		181	1	151	332	766	74	37	2	
R7	1		213	1	178	391	196	87	43	2	
R8	1		255	1	213	468	234	104	52	2	
ST											
TOTAL											
CR1	3		68	3	57	368	61	88	15	5	
CR2	3		75	2	94	413	83	92	18	5	
CR3	3		74	2	92	408	82	92	18	5	
ST											
GT											

\*5 Suitable Service Frequency Judged by DCUICIUS Team

\*7 (O) = (K x L) + (MxN)

\*6 (L) = (E) ÷ (K)

\*8 (Q) = (J) - (O)

\*9 (R) = (H) - (P)

\*10 (S) = (A) ÷ (R)

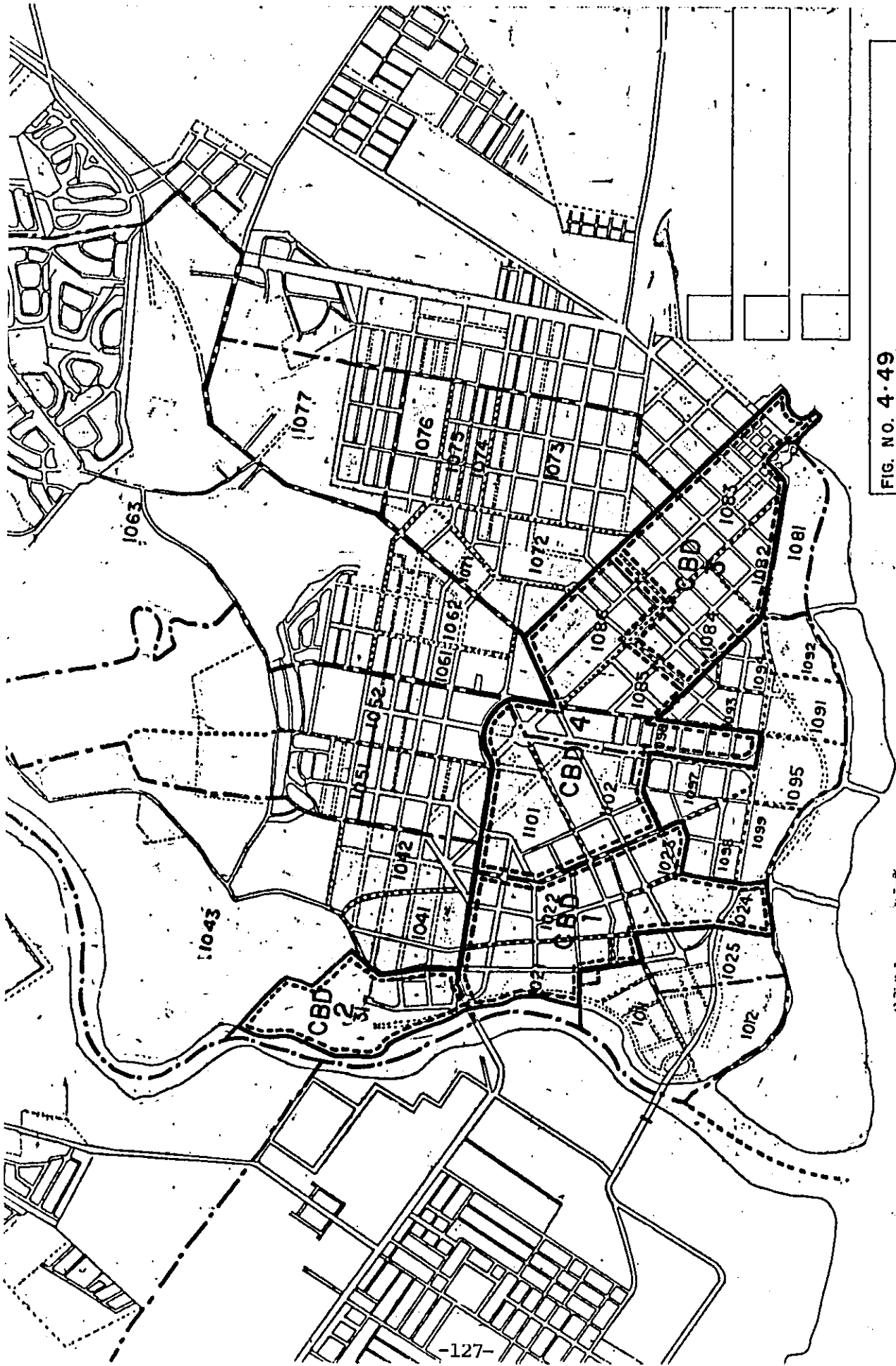
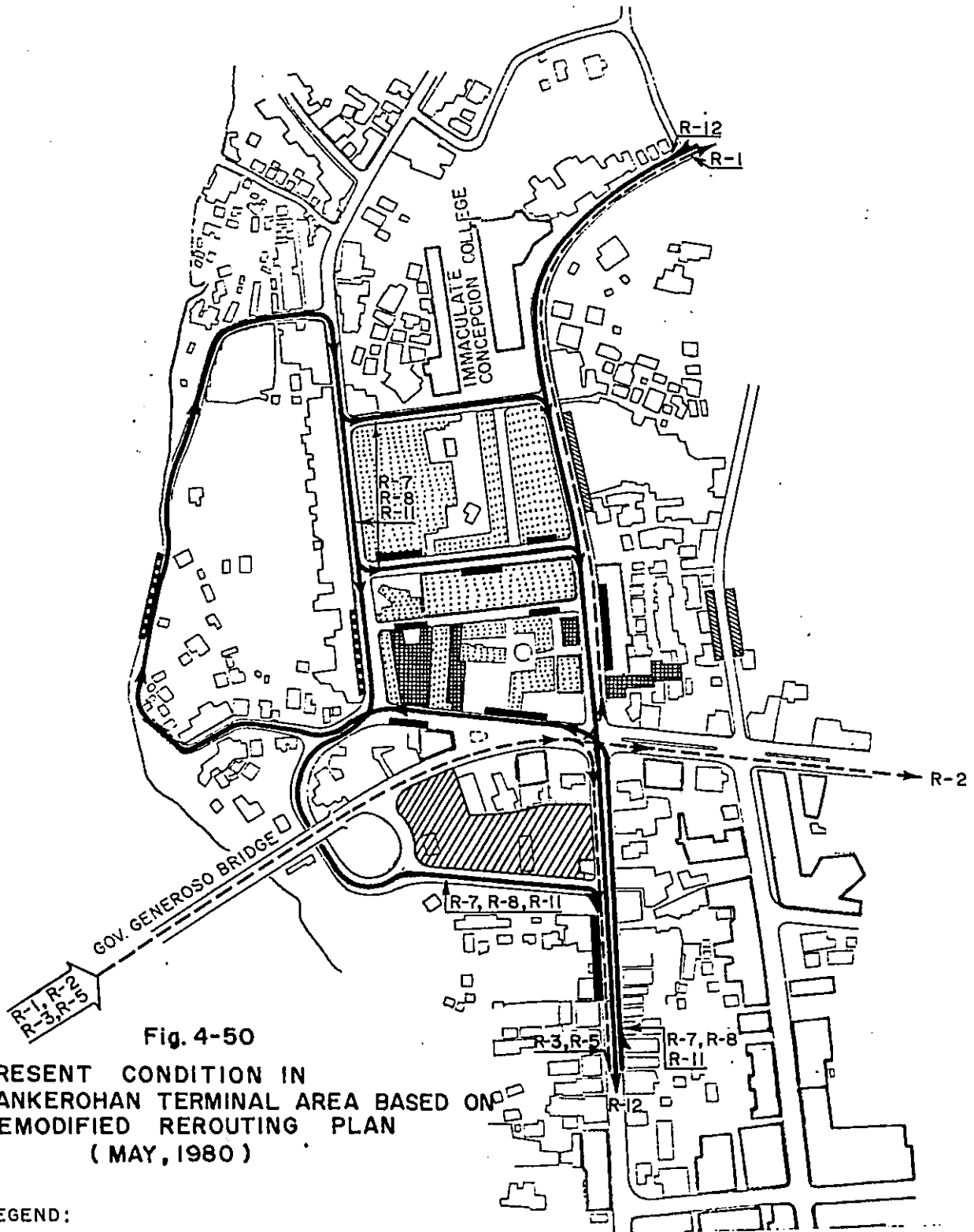


FIG. NO. 4-49








CBD AREA IN POBLACION

0 500 1000 1500 2000



**Fig. 4-50**  
**PRESENT CONDITION IN**  
**BANKEROHAN TERMINAL AREA BASED ON**  
**REMODIFIED REROUTING PLAN**  
**( MAY, 1980 )**

**LEGEND:**

-  - PUJ L/UL ZONE
-  - PUJ TERMINAL
-  - TRICYCLE L/UL ZONE AND PARKING AREA
-  - PUJ PARKING / WAITING AREA
-  - BUS TERMINAL AREA
-  - PUJ ROUTE FROM NORTH
-  - PUJ ROUTE FROM SOUTH

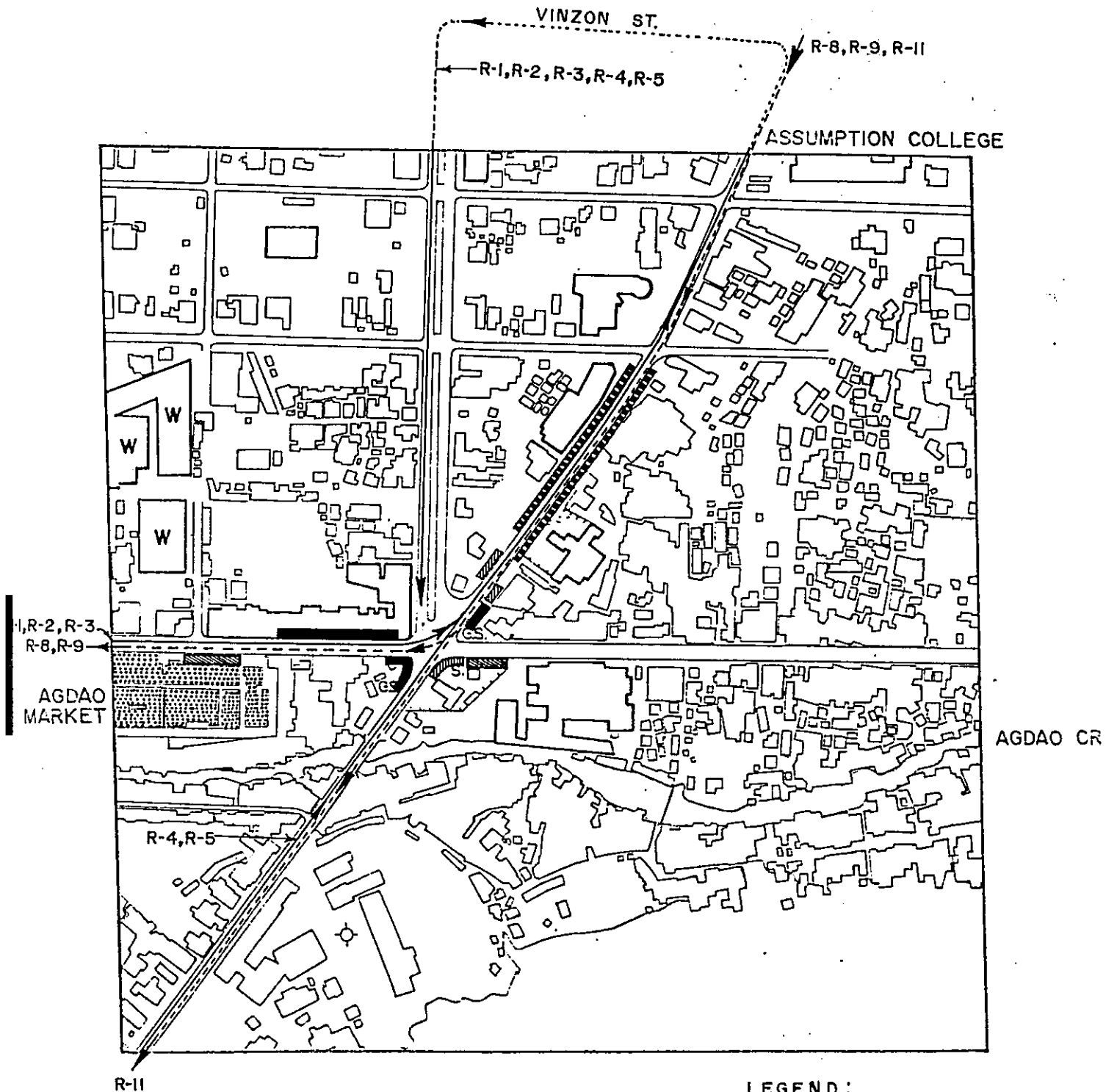
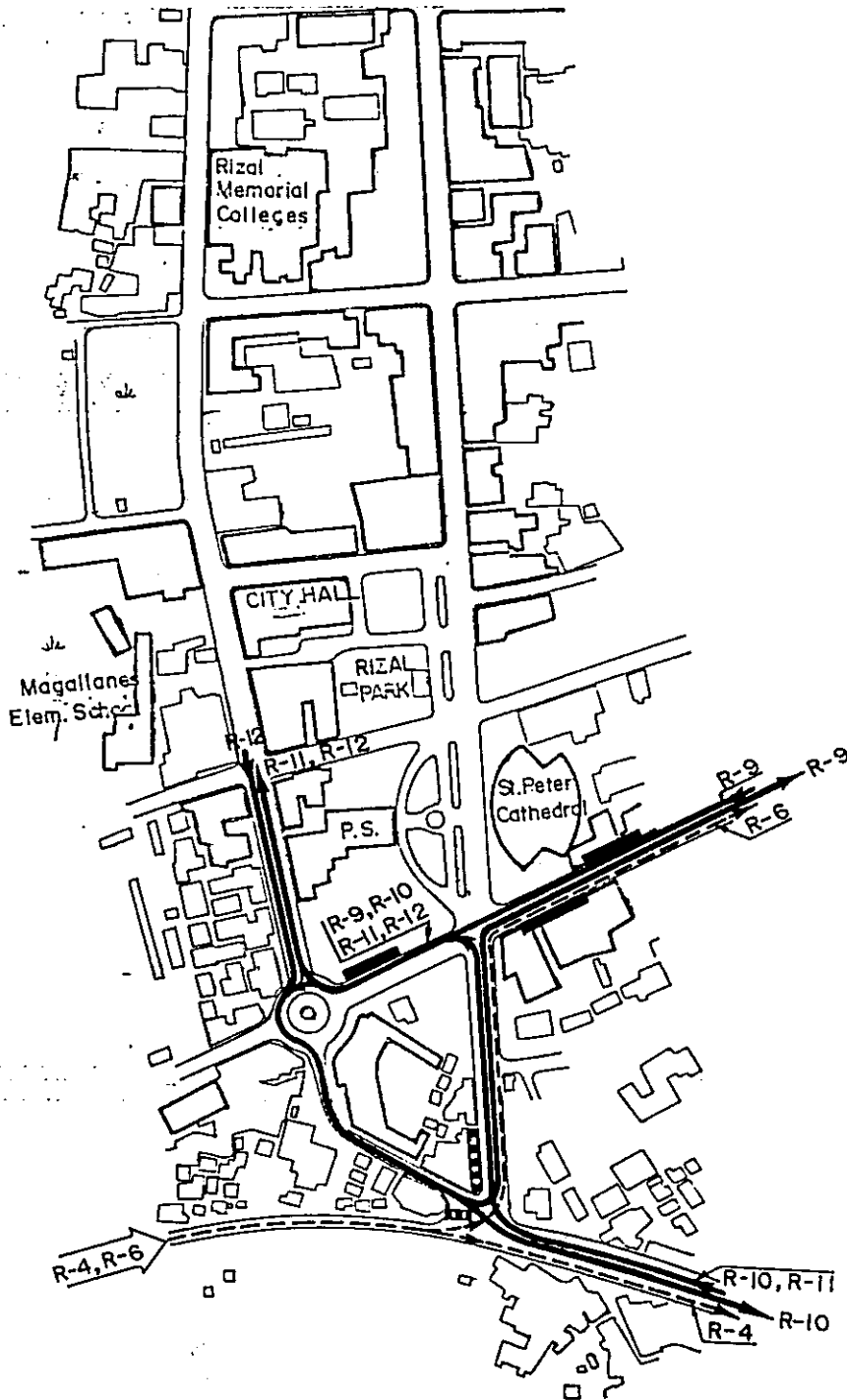


Fig. 4-51  
 PRESENT CONDITION BASED ON  
 MODIFIED REROUTING PLAN  
 ( AGDAO TERMINAL AREA )

- LEGEND :
- - PUJ L/UL ZONE
  - ▨ - BUS (MINI) L/UL ZONE AND PARKING AREA
  - ▧ - TRICYCLE L/UL ZONE
  - ▩ - PUJ, AC L/UL ZONE AND PARKING OR REST AREA



**LEGEND:**

- █** - PUJ L/UL ZONE
- ▤** - PUJ PARKING/WAITING AREA
- - PUJ ROUTE FROM NORTH
- - -** - PUJ ROUTE FROM SOUTH

**Fig. 4.52**

**PRESENT CONDITION IN BOLTON TERMINAL AREA BASED ON REMODIFIED REROUTING PLAN (MAY, 1980)**

#### 4.3 Cultivation of Traffic Moral

##### 1) Existing Problems

The number of traffic accidents in Davao City has been increasing year after year from the 1,507 in 1970 to 3,896 in 1978 an increase of 2.6 times in eight years. Truly, "traffic war" has begun in Davao.

Various factors compete in the causation of accidents: weather, road, and other factors of traffic environment, physical and psychological condition of the parties involved, and the lack of traffic moral on the part of the driver and/or the pedestrian are often direct or indirect causes.

In this regard, two kinds of measures are believed effective for the prevention of traffic accidents: one is the development of traffic safety facilities (e.g. guardrails, lane markings, crosswalk markings, road signs, and traffic signals), and the other is the enforcement of traffic rules (speed limit, no parking, one-way). It is evident, however, that measures in these two areas, even if taken, can have effects only when drivers and pedestrians adhere to good traffic moral.

Generally, the incidence of traffic accidents rises in direct proportion to increase in the volume of traffic. In view of the swell in traffic demand anticipated for Davao in the near future, it is believed an urgent need that effective safety traffic measures be taken immediately. In this significance, some suggestions will be made below for the improvement of traffic moral as an integral part of a comprehensive traffic accident counter-measure scheme.

##### 2) Recommendations

###### (1) Driver Education

All drivers must know the traffic rules if vehicles are to be operated in accordance with the provisions of road traffic laws and regulations. Therefore, the Ministry of Transportation



and Communication, Integrated National Police and Constabulary Highway Patrol Group will engage in the education of drivers in traffic rules.

Driver education should emphasize on law abiding spirit and the spirit of mutual compromise and should generally cover the following:

a) Vehicle Operation Manner

(a) Speed Limit

The strict observation of the designated maximum speed limit and the avoidance of panic braking.

(b) Crossing

Method for crossing a road. The driver should not hinder the operation of other vehicles when making left or right turn, U-turn, and backing up.

(c) Overtaking and the like

Maintenance of a sufficient distance from the preceding vehicle, avoidance of double-overtaking, of lane change in "keep lane" sections, and of cutting in, adherence to the principle of overtaking on the left, and giving way to buses departing from bus stops.

(d) At Intersections

The understanding of right-of-way in intersections, as well as the understanding of parts of the intersection to be used when making left or right turn.

(e) Pedestrian Crossing

The understanding of speed with which vehicles should approach pedestrian crossing, of the need of halting the vehicle when pedestrian is crossing or when other vehicle is parked at or near the crossing, of the right-of-way of pedestrians at intersections without a pedestrian crossing.

(f) Emergency Vehicles

The understanding of the right-of-way of fire trucks, ambulances, police patrol cars, and other emergency vehicles and their privileges in the use of road.

(g) Halting and Parking

The understanding of manner in which vehicles should be halted or parked, of places where vehicles should not be parked, and of the actions to be taken by the police on illegal parking.

(h) Lights and Signals

The understanding of obligation to light head lights and other appropriate lights after daylight or otherwise required, to give signal to indicate the intention of making left or right turn, and to sound and not sound the horn in various places and situations.

(i) Prohibition of Operation of Mechanically Defective Vehicles

b) Driver Duties

Prohibition of vehicle operation without driver's license, under the influence of alcohol, or when over-exhausted. The duty of the driver of a vehicle involved in a traffic accident is to provide protection to the injured and to report the accident to the police.

(2) School Program

The education of school children in traffic rules is vitally important in view that children, together with the aged, constitute a major portion of the victims of traffic accidents. The practical contents of this school program can include:

a) Traffic Handbook

A traffic handbook in a form of brochure or, if possible, booklet, which will show the safe method and manner of passage

and crossing of roads should be prepared, distributed, and used in traffic education as one of classroom courses.

b) Police Briefing

The briefing of school children on and the demonstration of traffic rules by traffic police should be held at least every six months.

c) Commutation Routes

Routes should be designated for use by school children in their going to and from school, and low grade elementary school children should be encouraged to commute between the school and home in group, rather than as individuals.

(3) Police Education

Traffic policemen must be well versed in the provisions of the traffic laws and regulations and be capable of quickly responding to various unexpected situations in order for them to be able to handle the traffic effectively and to secure traffic safety. For the purpose of fostering skilled and capable traffic police force, it is recommended that every traffic policeman be required to periodically attend the following seminars and receive the following training:

a) Traffic Seminars

- a) Seminars on the Road Traffic Laws and Regulations
- b) Seminars on traffic law enforcement
- c) Seminars on the causes of traffic accidents
- d) Seminars on the rules of traffic control

b) Demonstrative Training

- a) Manual traffic control (direction of traffic)
- b) Handling of facilities and equipment for traffic management and control
- c) Disposition of traffic accidents

(4) Volunteer Activities

Desirable for the protection of school children as they travel between the school and home will be to have their parents volunteer to take the job of directing children traffic in their commuting routes, particularly at intersections and other critical points.

## CHAPTER 5

### PROJECT LIST

The projects pertaining to arterials and specific areas recommended in Chapter 4 are now rearranged, for easier reference, by the kind of project in Table 5.1.

In using this Project List, the following should be borne in mind:

- i) The costs given in the table are rough estimates which should be used merely as "the rule of thumb", subject to detailed and precise estimation in the future.
- ii) Recommendations on the new institutional and management system aforementioned in Chapter 4 are excluded here as the projects.
- iii) Therefore, the costs indicated pertain only to direct expenses of physical projects and excludes indirect expenses, which pertain to traffic management/operation.

TABLE 5.1. PROJECT LIST

PROJECT TITLE	PROJECT LOCATION	PROJECT DESCRIPTION	RELEVANT AUTHORITIES	ESTIMATED COST
1. Establishment of PUV Bays	1) McArthur Highway	a) Establishment of PUV bays between Bankerchan Bridge and Matina Crossing	o Ministry of Public Highways	P340,000
		b) A total of 14 bays to be established at the intervals of about 400 meters on both sides of the street across from each other.		
		c) Each PUV bay to consist of asphalt pavement of about 93 square meters and a shed (2 meters X 4 meters)		
		d) In the vicinity of each bay, road marking (lane line, arrow to direct entry and exist of vehicles from the bay) is to be effected, and "PUV Loading/Unloading Zone" sign to be installed.		
2. Establishment of PUV Loading/Unloading Zones	2) J.P. Laurel Avenue	a) Establishment of PUV bays between Santa Ana Avenue and I. Cabeguio Street.	o Ministry of Public Highways	P310,000
		b) A total of 18 bays to be established at the intervals of about 400 meters, alternately on both sides of the street.		
		c) Same bay size, marking, and signs as those on McArthur Highway.		
3. Improvements and Construction of Roads	1) San Pedro Street 2) A. Pichon Street	a) Establishment of Loading/Unloading Zone (length of about 30 meters) at about the middle of each block on the right side of the street.	o City Engineer's Office o Ministry of Public Highways	P150,000
		b) Curbstone at the Loading/Unloading Zone to be painted white to indicate the zone. The edge of sidewalk at other than Loading/Unloading Zones be lined with flower pots for about 500 meters each on both San Pedro Street and A. Pichon Street.		
		c) Asphalt pavement (sidewalk width: 1.6 meters, length: 500 meters) of portions of A. Pichon Street where sidewalk does not exist.		
3. Improvements and Construction of Roads	1) R. Castillo Street 2) A. Pichon Street	a) Concrete pavement of unpaved sections for about 1.5 kilometers; width; 6.7 meters.	o Ministry of Public Highways	P2,410,000
		b) Marking of crosswalk, stop line, Center Line.		
		(n) Section newly constructed; 150 meters, land width: 20 meters. Number of houses to be relocated: 3.		
		(b) Pavement by asphalt; width: 14 meters		P3,680,000

PROJECT TITLE	PROJECT LOCATION	PROJECT DESCRIPTION	RELEVANT AUTHORITIES	ESTIMATED COST
4. Improvements of Intersections	1) R. Castillo/J.P. Laurel 2) R. Castillo/L. Garcia 3) Quezon/A. Pichon 4) Quezon/San Pedro 5) C.H. Recto/R. Magwayay 6) Quirino/A. Pichon 7) Quirino/San Pedro	a) Establishment of a traffic island at Intersection 1), 5) and 6) b) Establishment of medium strip at Intersection 6) c) Establishment of left-turn lane at Intersections 2), 3), 4), 5) 6) and 7) d) Full-width pavement of the vicinity (about 30 meters) of Intersections 1), 2), 3) and 4) e) Sidewalk development in the vicinity (about 30 meters) of all of the intersections f) Marking of crosswalk, lane line, stop line, center line, and arrows to be effected in the vicinity (about 30 meters) of all of the intersections	1), 3), and 6) Ministry of Public Highways 2), 4), and 7) Ministry of Public Highways City Engineer's Office	1) P 290,000 2) 280,000 3) 200,000 4) 100,000 5) 100,000 6) 200,000 7) 50,000 TOTAL 1,220,000
5. Installation of Traffic Signals	1) R. Castillo/J.P. Laurel Intersection 2) Quezon/San Pedro Intersection 3) Quezon/A. Pichon Intersection 4) Bankerohan Bus Terminal	a) Constant cycle, automatic control, 2-phase signal a) Constant cycle, automatic control, 3-phase signal a) Constant cycle, automatic control, synchronized with signal at Intersection 2)	Ministry of Public Highways Integrated National Police	P 180,000
6. Development of PU Terminals	1) Bankerohan Terminal 2) Bolton Terminal	a) Development of an about 1.5-hectare terminal with gravel surface on the side of Davao River b) Shuttle service necessary between the terminal, where passengers will not be loaded or unloaded, and a Loading/Unloading Zone. a) Development of an about 2.0-hectare terminal with gravel surface along Quezon Boulevard. Soil needs to be filled in for about 1.0 meter. b) Construction of a terminal lobby building, and a driver rest house.	City Government City Government	P110,000 (Land acquisition cost is not included) P1,430,000 (Land acquisition cost is not included)

PROJECT TITLE	PROJECT LOCATION	PROJECT DESCRIPTION	RELEVANT AUTHORITIES	ESTIMATED COST
	3) Agdao Terminal	<p>a) Development of a 2.5-hectare terminal with gravel surface in a vacant lot in the vicinity of Agdao Market.</p> <p>b) Utilization of R. Dacudao Avenue as FUI pool</p> <p>c) Development of access road to the terminal:</p> <p>1) Widening of existing road; <math>f=100</math> meters</p> <p>ii) Construction of new road; <math>f=200</math> meters</p>	<ul style="list-style-type: none"> <li>o City Government</li> </ul>	P 400,000 (land acquisition cost is not included)
7. Planning of Traffic Signal Phases	<p>1) R. Castillo/L. Garcia</p> <p>2) C.M. Recto/R. Magsaysay</p> <p>3) Quirino/A. Pichon</p> <p>4) Quirino/San Pedro</p>	<p>a) Phases : 4, Cycle length: 100 seconds</p> <p>a) Phases : 4, Cycle length: 120 seconds</p> <p>a) Phases : 3, Cycle length: 120 seconds</p> <p>a) Phases : 3, Cycle length: 120 seconds</p>	<ul style="list-style-type: none"> <li>o Integrated National Police</li> </ul>	*
8. Introduction of One-way System	<p>1) A. Pichon Street</p> <p>2) San Pedro Street</p> <p>3) F. Bangoy Street</p> <p>4) Bolton Street</p> <p>5) P. Pelayo Street</p> <p>6) Inigo Street</p> <p>7) Marfori Street</p> <p>8) Datu Bago Street</p> <p>9) Quirino Avenue Extension</p>	<p>a) A. Pichon Street and San Pedro Street are to be designated as one-way both from Quirino Avenue to C.M. Recto Avenue.</p> <p>b) F. Bangoy, Bolton, P. Pelayo, and Inigo Street are to be designated as one-way from A. Pichon Street to San Pedro Street.</p> <p>c) Of these one-way streets, those which are FUI routes be made "no parking" on their right side, and other streets be made "no parking" on their left side.</p> <p>d) On-road parking to be allowed on one-way streets within Bankerohan Market.</p>	<ul style="list-style-type: none"> <li>o City Government</li> <li>o Integrated National Police</li> <li>o Constabulary Highway Patrol Group</li> </ul>	*
9. Introduction of No Left Turn	<p>1) Quirino Avenue</p> <p>2) Bankerohan Bridge Road</p> <p>3) Ilustre Avenue Extension</p>	<p>a) From Quirino Avenue, no left turn to Ilustre Extension Avenue</p> <p>a) From the direction of Bankerohan Bridge, no left turn to Quirino Avenue Extension.</p> <p>a) From Ilustre Avenue Extension, no left turn to Bankerohan Bridge way.</p>	<ul style="list-style-type: none"> <li>o City Government</li> <li>o Integrated National Police</li> <li>o Constabulary Highway Patrol Group</li> </ul>	*



PROJECT TITLE	PROJECT LOCATION	PROJECT DESCRIPTION	RELEVANT AUTHORITIES	ESTIMATED COST
10. Introduction of No Parking	<ol style="list-style-type: none"> <li>1) San Pedro Street</li> <li>2) A. Pichon Street</li> <li>3) F. Bangoy Street</li> <li>4) Bolton Street</li> <li>5) P. Pelayo Street</li> <li>6) Inigo Street</li> </ol>	<ol style="list-style-type: none"> <li>a) San Pedro Street and A. Pichon Street be made "no parking" on the right side (Loading/unloading side) both between Quirino Avenue and C.M. Recto Avenue.</li> <li>b) F. Bangoy, Bolton, P. Pelayo, and Inigo Street be designated "no parking" on left side between San Pedro Street and A. Pichon Street.</li> </ol>	<ul style="list-style-type: none"> <li>o City Government</li> <li>o Integrated National Police</li> <li>o Constabulary Highway Patrol Group</li> </ul>	*
11. PUJ Rerouting	<ol style="list-style-type: none"> <li>1) Poblacion</li> </ol>	<ol style="list-style-type: none"> <li>a) Reorganization of PUJ routes into a network which corresponds to the portion trip demand. <ol style="list-style-type: none"> <li>i) Establishment of 8 commuter routes and 3 circular routes</li> <li>ii) Formulation of operation schedule for each PUJ route</li> </ol> </li> </ol>	<ul style="list-style-type: none"> <li>o City Government</li> <li>o Constabulary Highway Patrol Group</li> </ul>	*
12. Cultivation of Traffic Moral	Davao City	<ol style="list-style-type: none"> <li>a) Driver Education <p>The inculcation of drivers in good driving practice from traffic standpoint and in drivers' obligations, using handbooks (booklets, brochures) prepared for this special purposed.</p> </li> <li>b) Traffic Education at School <ol style="list-style-type: none"> <li>i) Preparation of traffic handbook (booklet, brochure) Right Way of Using and Crossing Roads"</li> <li>ii) Briefing and demonstration by traffic police to teach and school children in traffic rules</li> <li>iii) Designation of school children commuting routes and the encouragement of commuting to and from school in groups</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>a) <ul style="list-style-type: none"> <li>o Ministry of Transportation and Communication</li> <li>o Integrated National Police</li> <li>o Constabulary Highway Patrol Group</li> </ul> </li> <li>b) <ul style="list-style-type: none"> <li>o Ministry of Education and Culture</li> <li>o Integrated National Police</li> <li>o Constabulary Highway Patrol Group</li> </ul> </li> </ol>	*

PROJECT TITLE	PROJECT LOCATION	PROJECT DESCRIPTION	RELEVANT AUTHORITIES	ESTIMATED COST
		<p>c) Traffic Police Training</p> <p>i) Traffic Seminars on:</p> <ul style="list-style-type: none"> <li>o Road traffic law</li> <li>o Traffic law enforcement</li> <li>o Traffic rules and regulations</li> <li>o Causes of traffic accidents</li> </ul> <p>ii) Demonstration of:</p> <ul style="list-style-type: none"> <li>o Ways and methods of handling and directing traffic</li> <li>o The handling (operation) of traffic control facilities and equipment</li> <li>o The handling (processing) of traffic accidents</li> </ul> <p>d) Volunteer Activities:</p> <p>The direction and protection of school children as they commute to and from school, accomplished by volunteer parents.</p>	<p>c) Ministry of Transportation and Communication</p> <p>d) City Government</p>	

GRAND TOTAL P10,230,000

\* Cost estimate was not made because the projects are mostly softwares and, therefore, the cost depends largely on the way of implementation.

## SUPPLEMENT

### EFFECTS AND BENEFITS OF THE MAJOR PROPOSED PROJECTS

#### 1. General

Given the list of the proposed urgent projects and its cost estimates, it would be normal to conduct an economic evaluation of these projects as a next step.

However, the economic benefit of these projects as a whole cannot be determined quantitatively unless many assumptions are made on many assumptions, because these projects are urgent and, therefore, tend to be minor changes in the transportation network of Davao City. The possible benefits of the projects depend largely on the method of implementation.

Nevertheless, the following projects, which incur a slight modification of the present road network of Davao City, are selected to estimate the rough magnitude of the possible benefit of the projects:

- A. Pavement of R. Castillo Street, and Installation of PUJ Bays along J.P. Laurel Avenue.
- B. Installation of PUJ Bays along McArthur Highway
- C. One-Way Traffic Control of A. Pichon Street and San Pedro Street, and Extension of A. Pichon Street
- D. PUJ Rerouting

#### 2. Economic Cost

The economic cost is assumed as 85% of the financial cost based on the various feasibility studies carried out by MPH.

The financial and economic costs of the proposed projects are summarized below:

Table A. Financial and Economic Costs of the Proposed Projects

Projects	(million pesos)	
	Financial Cost	Economic Cost
All Proposed Projects	10.23	8.70
A. Pavement (R. Castillo Street), PUJ Bays (J.P. Laurel Avenue)	2.72	2.31
B. PUJ Bays (McArthur Highway)	0.34	0.29
C. One-Way (San Pedro Street and A. Pichon Street), Extension (A. Pichon Street)	3.83	3.26
D. PUJ Rerouting	-	-
Sub-Total	6.89	5.86
Other Projects	3.34	2.84

3. Changes in Vehicle-Kms and Vehicle Hours

As a remarkable effect of the selected projects A,B, C and D above, vehicle-kms and vehicle-hours reduce considerably as shown in the following table:

Table B. Savings in Vehicle-Kms and Vehicle Hours (Entire Network)

	(000 veh.kms or veh.hrs/year)					TOTAL
	Car/ Jeep	Truck	Auto Calesa	P.U. Taxi	PUJ/ bus	
Vehicle-Kms (Present Network)	90,160	88,498	18,907	34,595	89,717	321,877
Vehicle-Kms (Improved Network)	88,675	87,350	18,864	34,306	67,585	296,780
Savings	1,485	1,148	43	289	22,132	25,097
Vehicle-Hours (Present Network)	2,607	2,420	685	1,137	2,760	9,609
Vehicle-Hours (Improved Network)	2,479	2,301	643	1,069	1,860	8,352
Savings	128	119	42	68	900	1,257

It should be noted that the savings in vehicle-kms and vehicle-hours are especially large for PUJ/Bus. This is directly attributable to the proposed PUJ rerouting scheme.

Vehicle-kms and vehicle-hours on the road sections directly affected by the proposed projects A, B and C also change considerably as shown in the following table:

Table C. Changes in Vehicle-Kms and Vehicle-Hours of the Road Sections Directly Affected by the Proposed Projects

Projects	(000 veh.kms or veh.hrs/year)					
	Vehicle-kms			Vehicle-Hours		
	Present	Improved	Change	Present	Improved	Change
A. Pavements (R. Castillo St.), PUJ Bays (J.P. Laurel Avenue)	32,465	28,777	-3,688	1,032	795	- 237
B. PUJ Bays (Mc-Arthur Highway)	45,286	40,299	-4,987	1,291	1,076	- 215
C. One-Way (San Pedro Street and A. Pichon Street) Extension (A. Pichon Street)	14,176	10,677	-3,499	523	346	- 177

4. Economic Benefit

Based on the savings in vehicle-kms and vehicle-hours the economic benefit of the proposed projects can be estimated as a difference between the total vehicle operating costs on the present road network and those on the improved road network. Other benefits, such as the time benefit of vehicle passengers, are not taken into account to avoid overestimation.

With the unit vehicle operating cost estimated based on the Highway Planning Manual, Volume 4, PPDO, MPH, the first-year economic benefit is calculated as shown below:

Table D. Calculation of First Year Economic Benefits Resulting from the Savings in Vehicle-Kms and Vehicle-Hours

	(million pesos/year)
Economic Benefit due to the Reduction of Vehicle-kms	16.6
Economic Benefit due to the Reduction of Vehicle-Hours	11.5
Total Economic Benefits for the First Year	28.1

Out of the ₱28.1 million first-year benefit, ₱4.8 million is contributed by R. Castillo Street and J.P. Laurel Avenue (Area Project A), ₱4.7 million by McArthur Highway (Area Project B) and ₱3.2 million by San Pedro Street and A. Pichon Street (Area Project C). ₱15.4 million benefit is obtained from other road sections. Although these benefits are not attributable to individual projects (each project influences whole network), it is certain that each project is beneficial for each project area as well as for the City.

#### 5. Evaluation

The proposed projects prove economically feasible.

Inspite that the foregoing economic benefit is only for the first year and, moreover, is derived only from the savings in vehicle operating costs, it already covers not only the cost of the projects A, B, C and D aforementioned, but also the cost of all projects proposed here.

Apart from the economic benefit discussed above, other benefits can also be expected from the implementation of the proposed projects. For example, if a monetary value of 2 pesos/hour/passenger could be determined for the reduction of passenger-hours, more than ₱15 million additional benefit could be expected for the first year from the proposed projects. Safety of the vehicles, passengers and pedestrians, improved living environment due to the smoother traffic, convenience of passengers, easier law enforcement, etc. are also considered as possible benefits to be expected, although these benefits are mostly intangible.

