

3.2 EUSEBIO AYALA AVENUE AND MCAL. ESTIGARRIBIA ROAD

3.2.1 Cross Section Elements

1) Actual Situation and Planning Conditions

The traffic demand of Eusebio Ayala Av. and Mcal. Estigarribia Road for the year 1992 and 2000 is shown on the TABLE 3-2-1. When the lane capacity is of 10,000 vehicles per day, for the years 1992 and 2000, 6 and 8 lanes will be needed.

TABLE 3-2-1 TRAFFIC DEMAND
Unit:pcu/day

Section	1992	2000
Within Asunción City	61,000	76,000
Outside of Asunción City	47,000	64,000

(1) Land Use and Buildings along the Road

Buildings, retail shops, services related to cars, administration offices, deposits, etc., are observed along the avenue. These are classified in two groups: offices and shops, and the ones related to transportation.

The front of each lot is taken and its use is studied, and the index of each one is shown in the FIGURE 3-2-1. In first place, in the space between Pettirossi and Kubitscheck Avenues, there are some shops which sell daily necessities, bars and restaurants, which occupy 75% of the total. In the space between Kubitscheck and Choferes del Chaco Avenues, supply stores and mechanical workshops occupy 45% of the space, and 25% is occupied by shops selling daily necessities.

In the space between Choferes del Chaco and Republica Argentina Avenues, which is located on the center of the Eusebio Ayala Av. (taking into account the space in the Municipality of Asunción), the number of bars, restaurants, and retail shops is growing and 40% of the land is used by these. In this space, the number of supply stores for vehicles is diminishing by 20%.

Around 4 km away from the Market No. 4, are lands which are not used, and they occupy 15 to 20% of the total. Going east, more or less from Republica Argentina Av. up to Madame Lynch Av., the principal activity is related to cars, 50%, and retail shops occupy around 20%.

At the start of the Fdo. de la Mora Municipality, great variation exist with respect to the characteristics of the facilities located along the avenue. The retail shops, offices, bars, restaurants occupy 50% and the activities related to cars are diminishing to 20%. This characteristic continues around 1 km. From this point on, towards the city of San Lorenzo, the retail shops diminish and the deposits and terrains with no use grow in number.

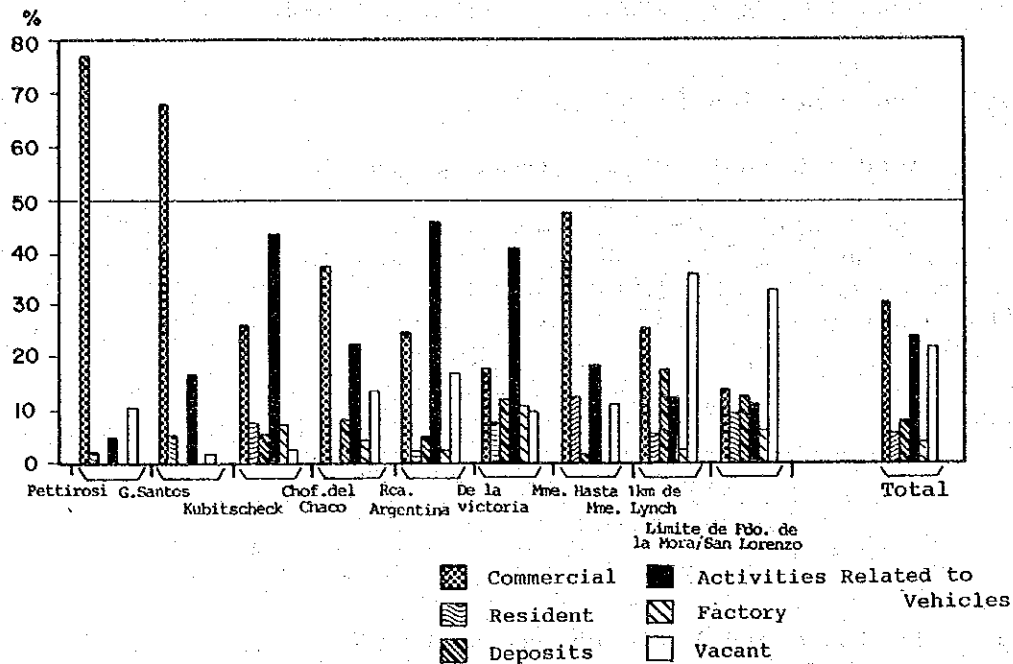


FIGURE 3-2-1 LAND USE ALONG E. AYALA AV.

Actual use of land along the Eusebio Ayala Av. is shown in FIGURES 3-2-2 and 3-2-3. On the east of Market No. 4 approximately 1.5km, there are lots of minor shops which sell daily necessities. They try to get benefits by forming groups of the same kind of retail shops. The next space is occupied by activities related to cars. With the exception of the spaces which are out of the commercial influence of Market No. 4 and the commercial nucleus of the city of Fdo. de la Mora, again, in the area with influence from the commercial nucleus of Fdo. de la Mora, the appearance of offices and minor shops are observed.

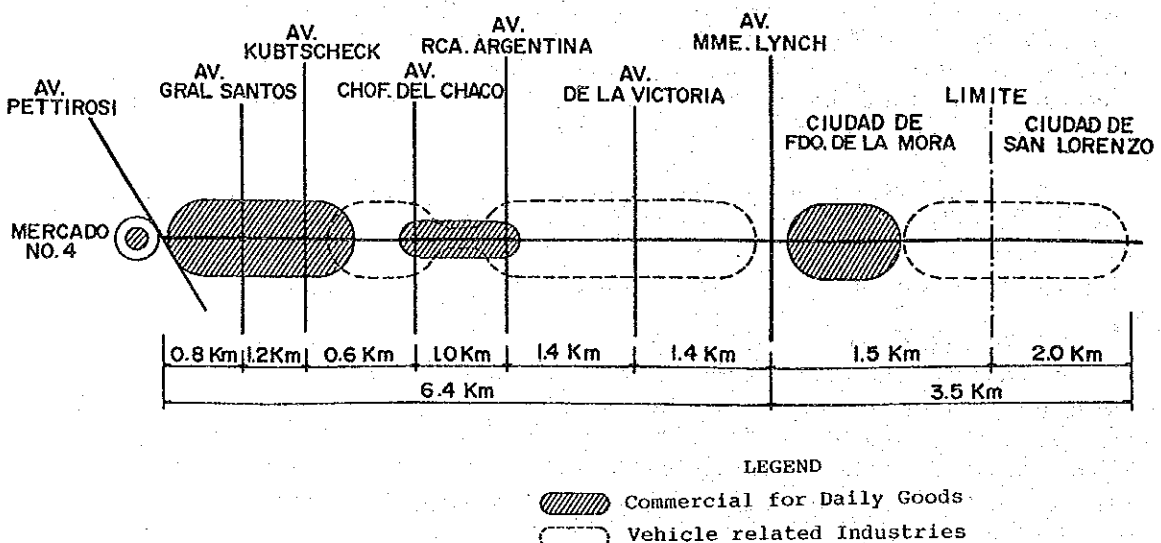
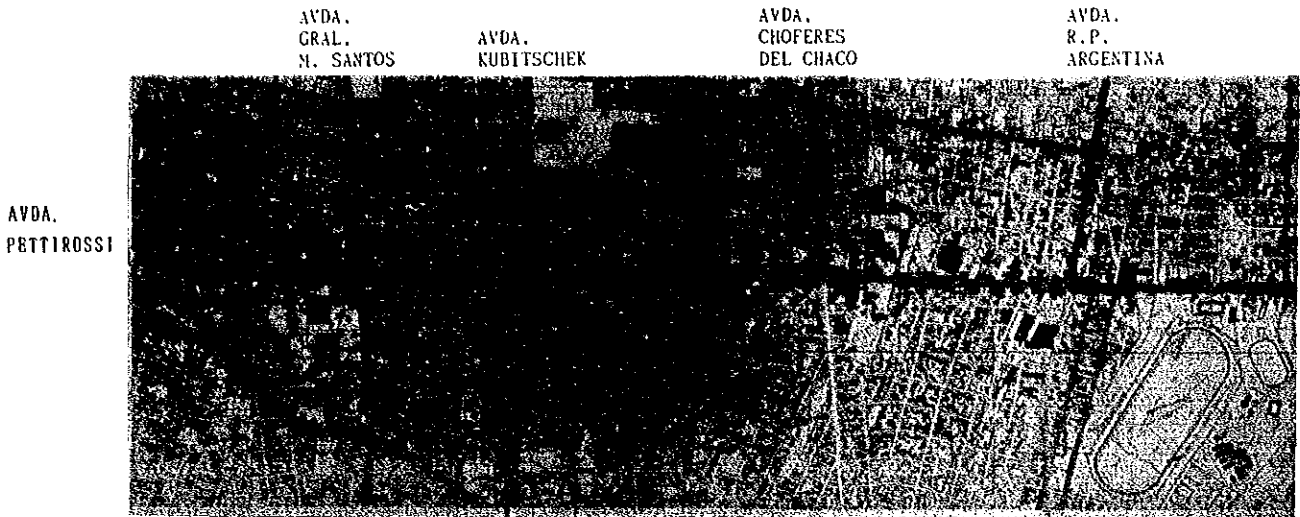


FIGURE 3-2-2 SCHEMATIC PRESENT LAND USE ALONG E. AYALA AV.



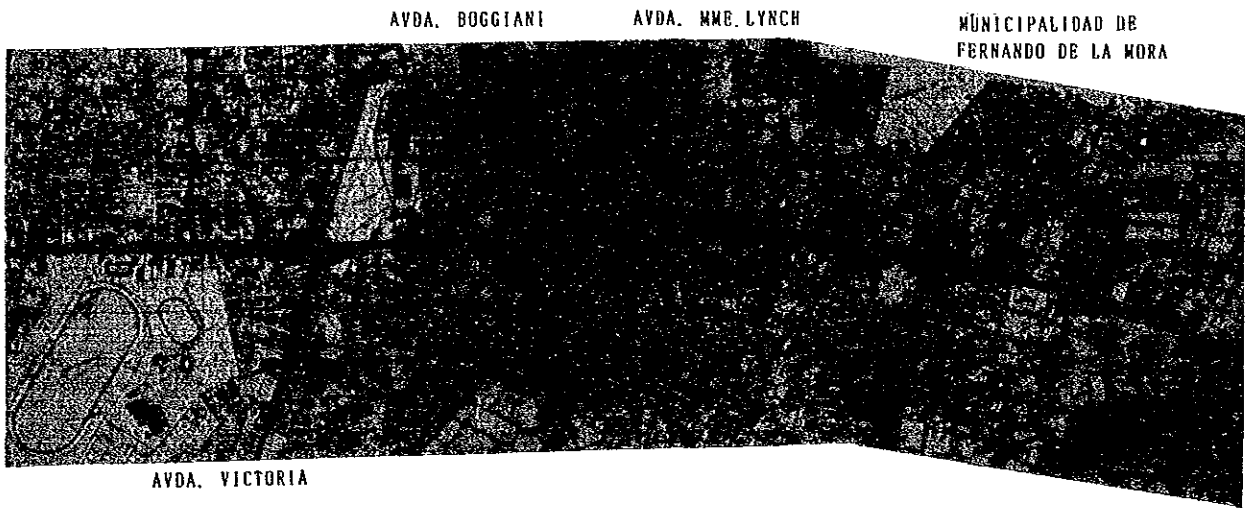
AVDA.
PETTIROSSI

AVDA.
GRAL.
M. SANTOS

AVDA.
KUBITSCHKEK

AVDA.
CHOFERES
DEL CHACO

AVDA.
R.P.
ARGENTINA

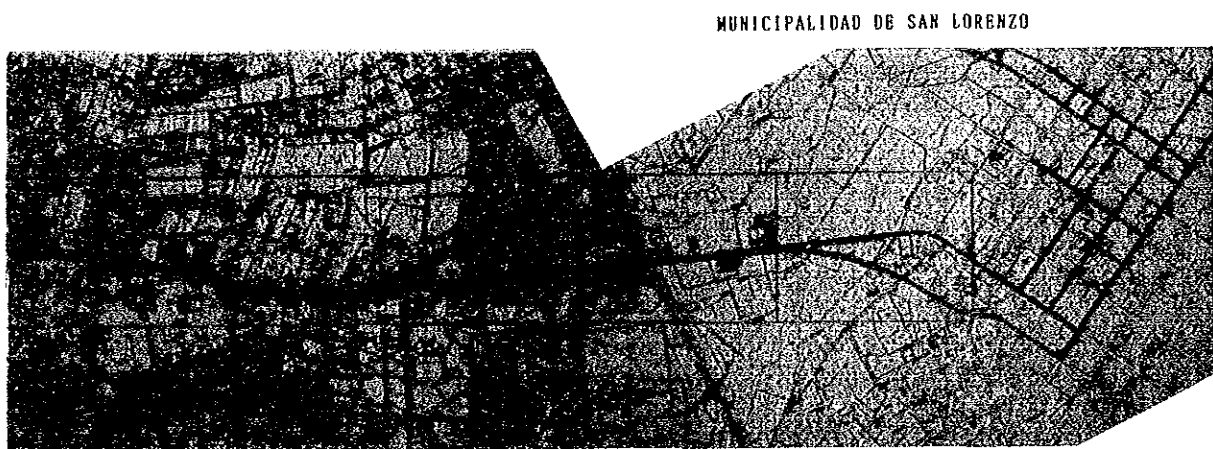


AVDA. VICTORIA

AVDA. BOGGIANI

AVDA. MWE LYNCH

MUNICIPALIDAD DE
FERNANDO DE LA MORA



MUNICIPALIDAD DE SAN LORENZO

LEGEND

Resident	Not Defined/Vacant
Commercial	Under Construction
Offices	Industries
Resident/Commercial	Deposits
Office/Commercial	Hospitals
Resident/Office	Education
Public Institution	Agriculture
Military	

FIGURE 3-2-3 EXISTING LAND USE ALONG E. AYALA AV.

(2) Right of Way and the Municipality Line

The whole extension of Eusebio Ayala Av. and Mcal. Estigarribia Road corresponds to National Routes No. 1 and No. 2, whose starting points are located in the intersection formed by the Gral. Aquino Street, adjacent to the Market No 4. From the start up to the intersection formed with Mme. Lynch Av., it is under Asunción's City jurisdiction. Because of the Municipal Order of the City of Asunción, the Municipality Line of Eusebio Ayala Av. is 35 meters.

From the intersection formed with Mme. Lynch Av., the Avenue is under MOPC jurisdiction. The national route under MOPC jurisdiction is established at 50 meters, but the spaces corresponding to the Municipalities of Fdo. de la Mora and San Lorenzo are of 35 meters.

The enlargement to 6 lanes (actually 4 lanes) will be able to be done with the actual right of way.

In the Master Plan and in relation to the traffic demand, it is proposed to enlarge up to 8 lanes. In this case, land expropriation will be needed.

(3) Public Transportation

The maximum traffic volume of buses for the year 2000 is estimated in 16,000 unit per day, which shows the necessity to create an exclusive lane for buses and to install bus bays.

2) Alternatives to be studied

(1) Alternatives

The following four alternatives will be studied (See FIGURE 3-2-4).

Alt.1: 6 mix lanes

Alt.2: 6 lanes: 4 mix and 2 exclusive bus lanes

Alt.3: 8 lanes: 6 mix and 2 exclusive bus lanes

Alt.4: 8 lanes: 4 mix, 2 exclusive for bus and 2 marginal lanes

Characteristics of these alternatives are summarized in TABLE 3-2-2.

Alternative "3-2" really requires expropriation to obtain a width of 40m almost in the whole extension, due to the widening of sections where the bus stop bays are foreseen. For that purpose, the same procedures must be carried out as those required for alternative "4", but the advantage is smaller if compared with this one. Therefore, it was excluded from the analysis to be executed in the future.

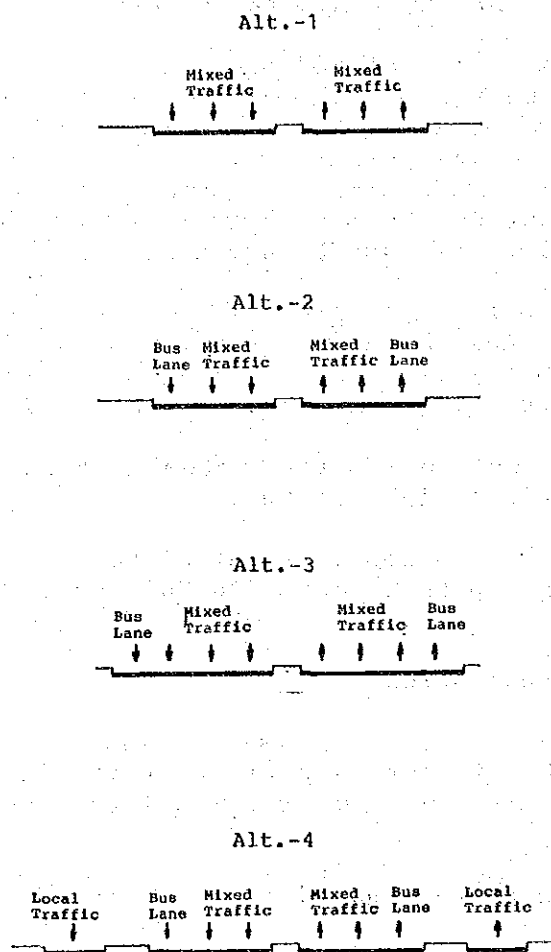


FIGURE 3-2-4 CROSS SECTION ALTERNATIVES

TABLE 3-2-2 CHARACTERISTICS OF IMPROVEMENT ALTERNATIVES

Alt.	Mixed Traffic Lane No.	Bus Exclusive Lane No.	Frontage Road Lane No.	Sidewalk Width (m)	Bus Bay Location	Total Width (m)
1	6	-	-	5.0	Sidewalk	35m
2	4	2	-	5.0	Sidewalk	35m
3-1	6	2	-	3.5	-	35m
3-2	6	2	-	3.5	Sidewalk	35m and 40m at Bus Bay Locat.
4	4	2	2	4.5	Lateral Separation Strip	50m

(2) Traffic Assignment

Results of Traffic Assignment for each Alternative are shown in TABLE 3-2-3.

The case of mixed traffic with 6 lanes (Alternative 1) is compared with 4 lanes plus 2 lanes exclusively for bus use (Alternative 2). The congestion degree in the principal ways is raised a little bit and as a consequence circulation velocity is diminished, but the bus velocity is maintained.

The 6 lanes in which 2 are exclusively for bus use (Alternative 2) will support the traffic demand for the year 1992, but for the year 2000 it will almost get to the maximum limit of congestion which will be of 1.48. Therefore, 8 lanes will become necessary for the year 2000.

In the case of 8 mixed lanes (Alternative 3), the capacity and the circulating velocity will be calculated under the assumption that the distance from one to the other access to the principal paved way would be of around 200 meters. In actuality, where there is access with each 100 meters without any access/egress control the circulating velocity and the congestion degree expressed above might not be assured.

Two major figures which indicate efficiency of the road, total running distance (vehicles/ kilometers) and total running time (vehicles/hours), show Alternative 4 is the best for the year 1992 as well as 2000. Additionally, the traffic volume is greater in Alternative 4. As a consequence the improvements with Alternative 4 for Eusebio Ayala Av. and Mcal. Estigarribia Road consists of not only the solution for the vehicles which use that avenue, but it does a lot to help lightening the congestion of other avenues. Consequently, the reforms of Eusebio Ayala Av. not only consists of the solution for the vehicles which circulate along this avenue, but it also helps with the action of lightening the congestion of other arteries.

(3) Street Trees and Shrubs

The majority of the principal arteries of the Metropolitan Area are densely planted with trees (ex. Mcal. López Av.: plant type "Jacaranda", España Av.: plant type "Chivato"). E. Ayala Av. has no dense vegetation, furthermore the roadway characteristics are not well defined because of the ill coordinated vegetation actually found on E. Ayala Av. As Paraguay has great sources of vegetation, it would be convenient if E. Ayala Av. is the representative avenue of Asunción City and its Metropolitan Area and characterized by trees of an unusual nature.

From the said point of view of evaluation of the alternatives, all alternatives, with the exception of Case 3, permit to secure enough space for plantation in the Center Median, as well as in the paved way.

TABLE 3-2-3 TRAFFIC ASSIGNMENT RESULTS

Alternative	Lane Number	Velocity (km/h)	Congest. Rate	Volume (1000 pcu)	Bus (%)	1000 pcu x km	1000 pcu x h	
Year 1992								
Alt. 1	Through lane	6	25.1	1.12	63.6	20.0	4101	278.6
	Bus lane							
	Frontage road							
Alt. 2	Through lane	4	20.9	1.12	45.7	0.0	4003	276.9
	Bus lane	2	25.0	1.00	15.9	100.0		
	Frontage road							
Alt. 3	Through lane	6	29.6	1.00	57.6	0.0	3988	269.4
	Bus lane	2	25.0	1.00	15.9	100.0		
	Frontage road							
Alt. 4	Through lane	4	21.7	1.11	49.3	0.0	3977	267.2
	Bus lane	2	25.0	1.00	15.9	100.0		
	Frontage road	2	19.2	0.27	0.5	0.0		
Year 2000								
Alt. 1	Through lane	6	14.9	1.37	78.0	17.1	5660	646.3
	Bus lane							
	Frontage road							
Alt. 2	Through lane	4	12.6	1.42	58.0	0.0	5549	689.0
	Bus lane	2	25.0	1.00	16.4	100.0		
	Frontage road							
Alt. 3	Through lane	6	19.6	1.27	72.4	0.0	5527	621.4
	Bus lane	2	25.0	1.00	16.4	100.0		
	Frontage road							
Alt. 4	Through lane	4	15.2	1.26	57.1	0.0	5492	618.6
	Bus lane	2	25.0	1.00	16.4	100.0		
	Frontage road	2	14.7	0.99	19.3	0.0		

(4) Consideration on the Parking Demands and the Vehicles Stop

The actual parking situation over Eusebio Ayala Av. demands serious considerations, because almost 90% of the parking is done over the roadway. Parked cars are found along the whole extension. This demand tends to grow as we get nearer to Pettirossi Av. The Regulator Plan establishes that every shop must build Parking Lots for one vehicle. It would be desirable that the spaces for parking be located basically inside private lands, but considering the actual tendency it will be planned in accordance to the criterion mentioned below:

- a. Parking on the through lane will be principally eliminated, because the exterior lanes of both through lanes will be for the use of buses exclusively.
- b. In spite of parking control policy mentioned in item a), complete elimination of parking might be unexpected. Some of the parking space along the sidewalk will be facilitated.

Looking at the comparisons of Alternatives from that point of view, we could select Case 2 and 4, as shown in TABLE 3-2-4.

TABLE 3-2-4 COMPARING ALTERNATIVES OF PARKING REFORMS

Alternative	Parking elimination out of through lane	Parking space out of the way
1	-	0
2	0	0
3	0	-
4	0	0

Note : 0 = adequate
 - = inadequate

(5) Proposed Alternatives

A) Improvement Policy

- a. By the year 1992 the improvement work on the first stage will be done, with actual right of way.
- b. In a parallel way, the Municipal Order Modification will be introduced, which is that the Municipal Line will be 50 meters from actual 35 meters.
- c. From the year 1992 on, the second stage will be carried out, including land expropriation and by the year 2000 the enlargement to 50 meters will be completed.

B) Improvement Alternative for the Year 2000

- a. Eight lanes including the ones for marginal traffic
- b. The right lane of both principal road lanes will be exclusive for buses.
- c. Reducing the access influence from the adjacent streets to the principal running, by providing marginal lanes
- d. The Central Median width will be determined considering the installation of trees and shrubs.
- e. The separation strip between the through lanes and the marginal road will be determined with sufficient width to introduce bus bays.
- f. The said separation strip will be facilitated road side parking lots which are not used for bus bays.
- g. The principal intersections will be the elevated crossings with 4 lanes.
- h. Adding all these, the total width will be of 50 meters which over passes the actual Municipal Line, which is of 35 meters. Consequently, the reform work, which will be carried out within this last limit, will correspond to the first stage.

C) Improvement Alternative for the Year 1992 (First Stage)

- a. The cross section for the year 1992 shall be adjusted to the cross sections of the improvement alternatives for the year 2000 (second stage).
- b. The right lane of both sides of the roadway will be exclusively for buses.
- c. On the sidewalks, bus bays will be installed.

- d. With the exception of the points where the bus bays are located, roadside parking lots will be considered.
- e. The width of the Center Median will be adjusted to the width required for the year 2000 (second stage).
- f. The principal intersections will be elevated crossings.

The width of each one of the components is shown in the FIGURE 3-2-5.

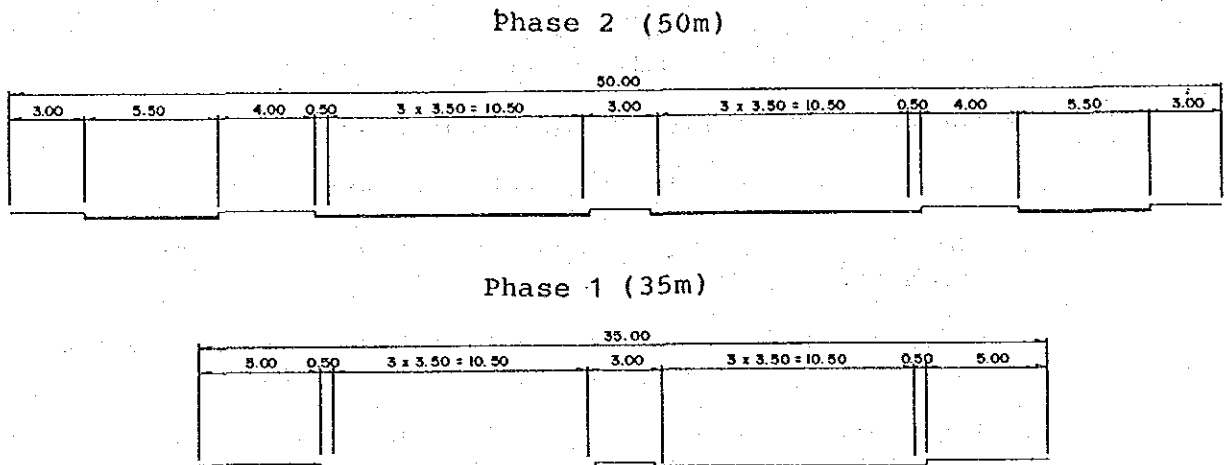


FIGURE 3-2-5 TYPICAL CROSS SECTION OF E. AYALA AV.

3.2.2 Access Control Plan

The separation strip between principal road lanes and marginal road will be definitely necessary for the separation of roadside commercial activities from the traffic principal flow. Additionally, super blocking on the roadside to control access from transversal local road will be required.

1) Future Land Use along the Avenue

In relation to the lane's fringe activities, they will be classified considering the future use of Eusebio Ayala Av. in two types: city sector and industrial sector.

The first one refers to the fringe of the Principal Arteries that are found inside of the urbanized zone and that realize various urban activities, sustained by the local population or by the population of larger hinterland. On the other hand, the Industrial Sector refers to the zones of the principal ways which are in charge of absorbing the inter zone traffic. In short, it will be a zone where

c. Blocking

Average block size along Eusebio Ayala Av. is around 100 meters. Super Blocking of 2 to 3 blocks will be encouraged to control access to/from transversal roads.

(2) Industrial Sector

a. Type of Land Use

The principal uses will be for activities related to vehicles (mechanical workshops, supply stores, etc.), commercial activities (deposits, major commerces) and administrative activities in large scale. The residence installations is not desirable.

b. Structure and Form of the Buildings

The buildings must have sufficient frontal retirement and lateral retirement, in the way that the internal operations don't occupy public spaces. They must limit the rate of floor space divided by land space as minimum 50% given in the Regulator Plan, must be modified to maximum 50%.

c. Lot Dimension

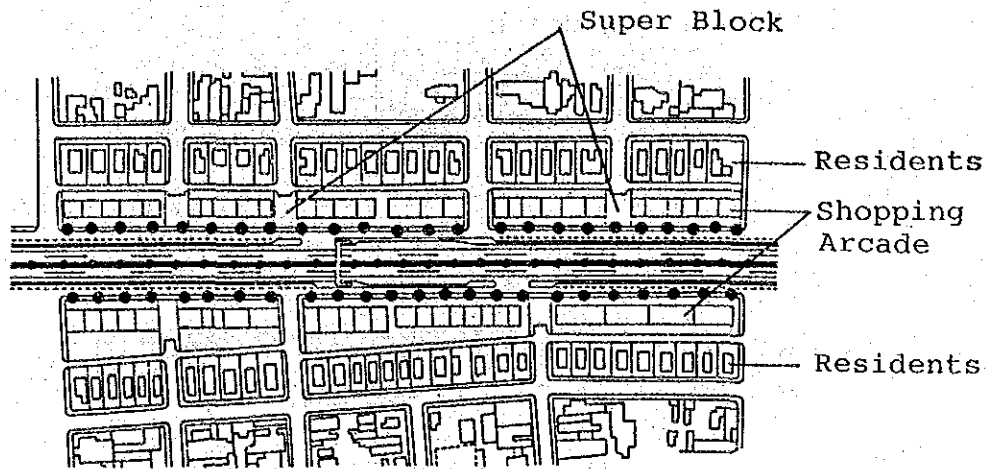
In relation to the fringes of the Industrial Sectors of E. Ayala Av., a minimum surface of 750 m² per lot shall be adopted. This cipher coincides with the Industrial zone's lot dimension which is regulated by the Regulator Plan.

d. Blocking

The same trial for super blocking as done in city sector will be recommended.

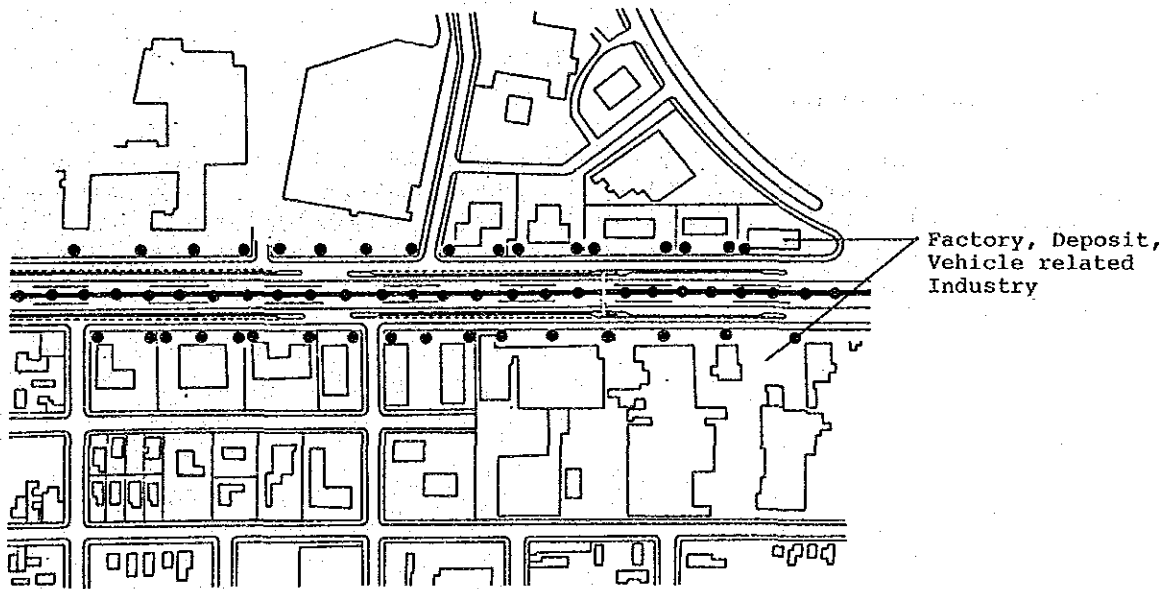
(3) Model Plan for the Equipment Project

Model plans for each sector are given in FIGURES 3-2-7, 3-2-8 and 3-2-9.



Super Block Residents Shopping Arcade Residents
 Plants : Low-Middle Height Trees for Central Median
 Low-Middle Height Trees for Lateral Separating Strip
 High Trees for Sidewalk
 Buildings : To Be Enlarged by Clustering
 Parking Space : Back Yard of Buildings
 Front Private Space
 Loading Space : On Frontage Road

FIGURE 3-2-7 LAND USE MODEL PLAN (URBAN ARTERIAL TYPE)



Plants : High Trees for Central Median
 Low-Middle Height Trees for Lateral Separating Strip
 High Trees for Sidewalk
 High Trees on Road Private
 Land with Approx: 20m Interval
 Lots : To Be Devided in Min. 750 - 1000 Sqm.
 Access : Rear Access, If Possible

FIGURE 3-2-8 LAND USE MODEL PLAN (INDUSTRIAL ARTERIAL TYPE)

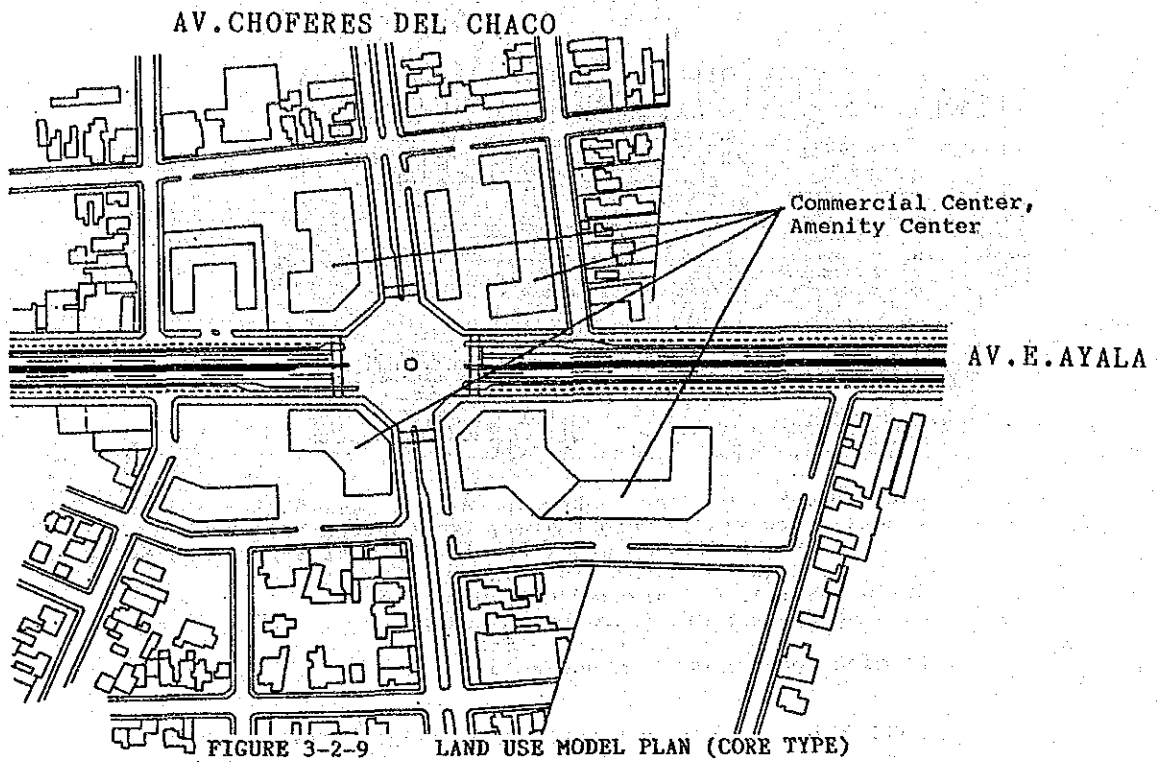


FIGURE 3-2-9 LAND USE MODEL PLAN (CORE TYPE)

(4) Access Control

In the FIGURE 3-2-10 the actual access condition to the arterial fringes of the Eusebio Ayala Av. is shown. The characteristics are as pointed out in the left column on the TABLE 3-2-5. In the project, regulatory rules will show in the right column, in order to assure the traffic harmony in the through-traffics, will be introduced.

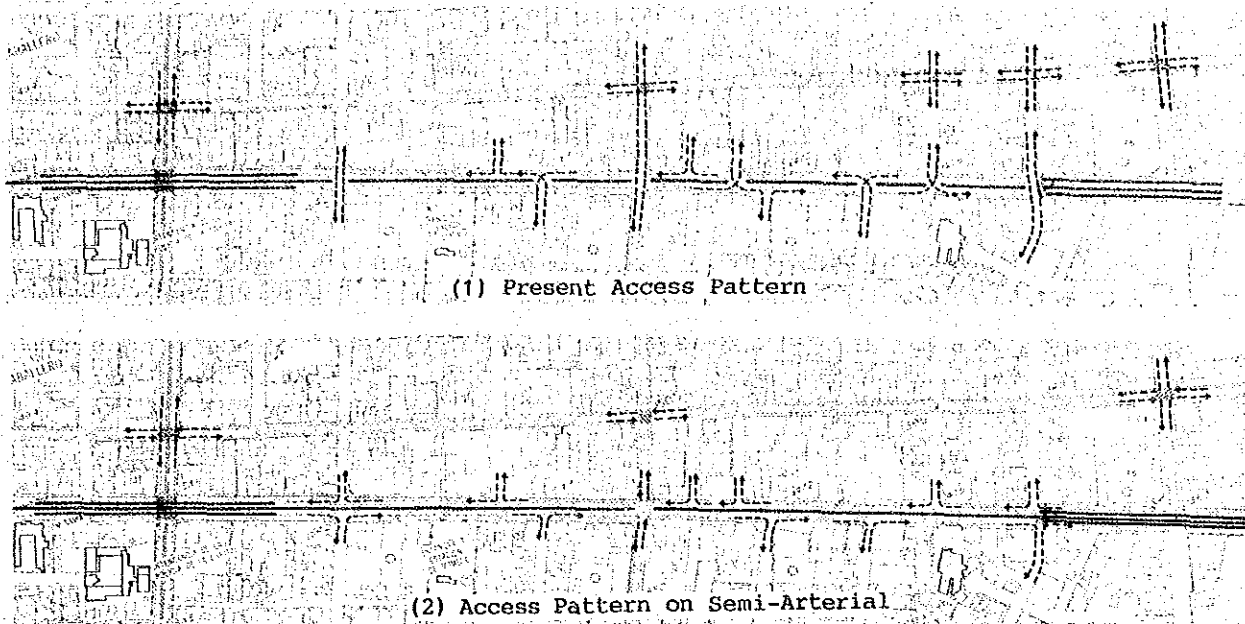


FIGURE 3-2-10 ACCESS WAYS

TABLE 3-2-5 ACCESS CONTROL PLAN ALONG E. AYALA AV.

Intersections	Present	Stage I	Stage II
1. Crossing with main roads			
Separation	1km	1km	1km
Type of crossing	Stop light intersections (with turning prohibition & no returning lane).	Grade separation or stop light crossing. (With no turning prohibition & returning lane according to needs).	
2. Crossing with secondary roads			
Separation	500m	500m	500m
Type of crossing	Stop light intersections (with turning prohibition & returning lane).	Stop light intersection (with no turning prohibition & returning lane according to needs).	
3. Crossing with local roads			
Separation	Approx. 100m	Approx. 100m	Approx. 200m joining it with the slow speed lane.
Type of crossing	With open central median & without turning prohibition	Allows right hand turn only.	Allows the access to the slow speed lane (only right hand turn).
4. Entrance from the building to the roads			
	Allows right hand turn only	Allows right hand turn only	Allows entrance to the slow speed lane (only right hand turn)

3.2.3 Intersection Plan

FIGURE 3-2-11 shows the actual traffic volume by direction in the peak hours (veh./hour), of the intersections formed by the principal arteries distributed every 1km (more or less), they are:

- a. Gral. Santos Av.
- b. J. Kubitscheck Av.
- c. Choferes del Chaco Av.
- d. Rca. Argentina Av.
- e. De la Victoria Av.
- f. Madame Lynch Av.

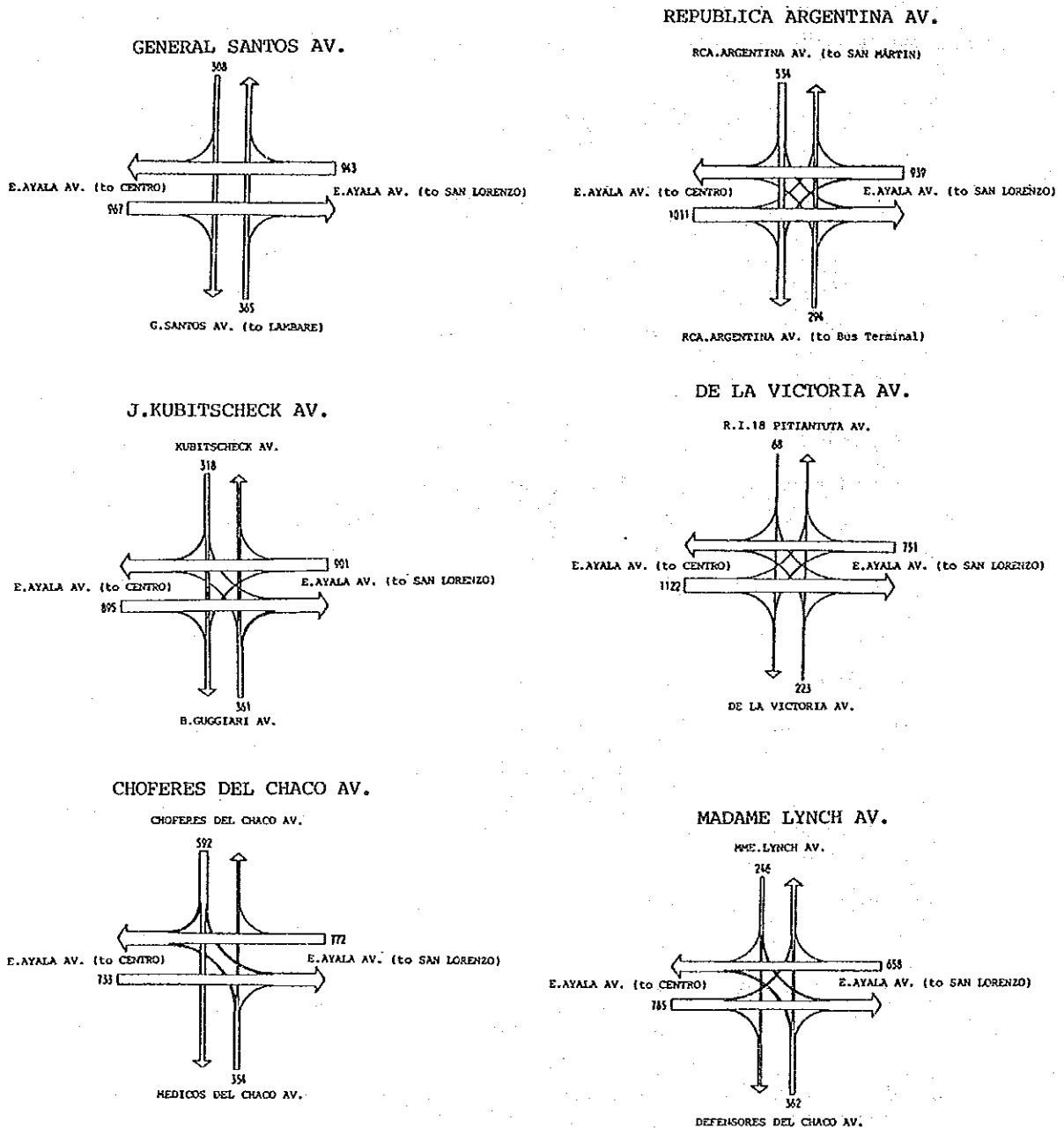


FIGURE 3-2-11 INTERSECTION TRAFFIC VOLUME (1987)

Considering the future growth of the demand on the intersection formed with Pitiantuta Street, which constitutes the principal artery in Fdo. de la Mora City, it will be added as an object of study.

In FIGURES 3-2-12 and 3-2-13, show traffic volumes by direction in the peak hours for the years 1992 and 2000. The vehicle in-flow volume in the intersections in the peak hour is indicated in FIGURE 3-2-14. The major traffic in the year 1992 will be observed in the intersection formed by Kubitscheck Av., followed by Rca. Argentina Av. This tendency will not present variations in the year 2000, but growth will be registered in the intersection's demand formed with the Madame Lynch and De la Victoria Avenues.

In response to this traffic volume, the saturation ratio of the intersections are counted with following conditions:

- a. according to the necessities, in E. Ayala Av. an exclusive lane will be created for the exclusive use of a left turn and,
- b. supposing that the transversal arteries have 4 lanes, and in accordance to the necessities, we create an exclusive lane for left turns. On the other hand, the intersections which will have a saturation flow rate over 1.0 in the year 1992 will be the following:
 - J. Kubitscheck Av.
 - Rca. Argentina Av.
 - De la Victoria Av.
 - Madame Lynch Av.

In the year 2000 (after the second stage is over) it is predicted that the rate on the intersection formed with the Choferes del Chaco Av. will overpass 1.0.

Based on all the mentioned analysis, it is determined that:

- a. The four intersections mentioned above will have an elevated crossing constructed in the first stage.
- b. The intersections formed on Choferes del Chaco Av. and Pitiantuta Street (Fernando de la Mora Municipality) will be signal crossings with an exclusive lane for left turn.
- c. The actual viaduct of Gral. Santos Av. that crosses E. Ayala Av. will be used in the future.

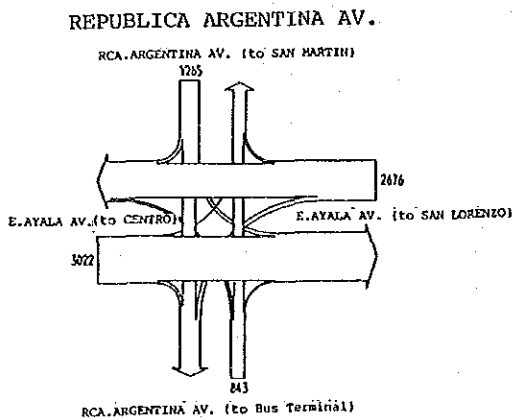
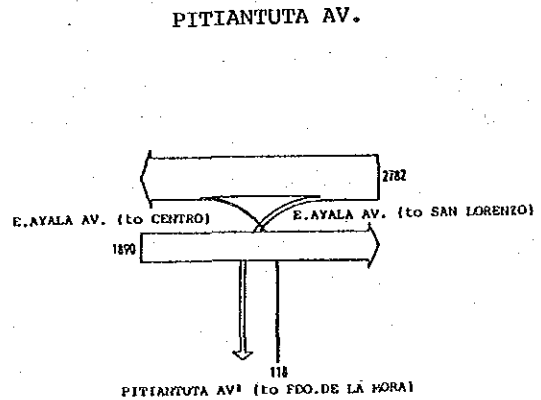
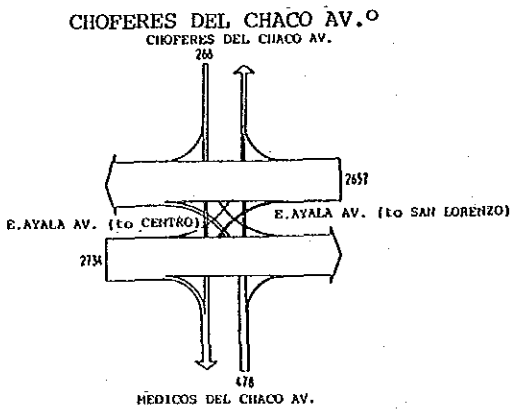
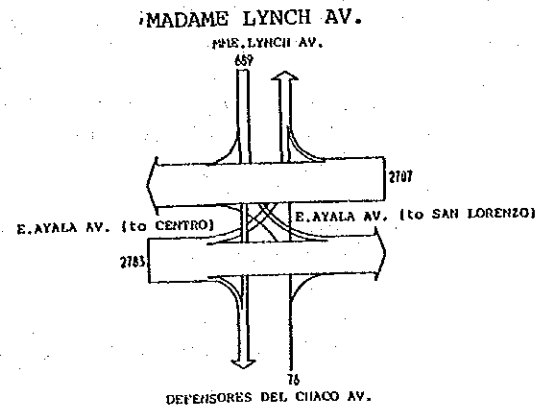
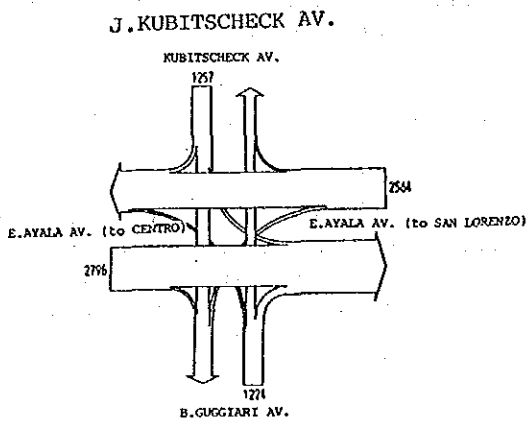
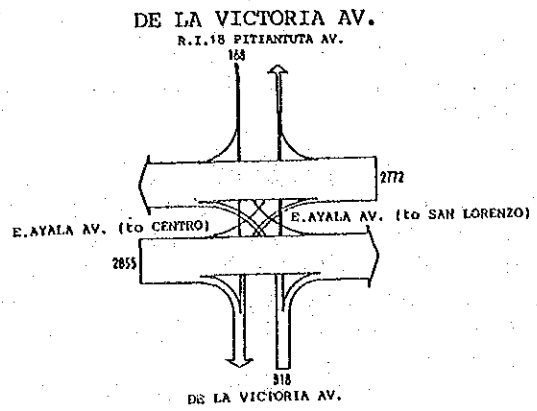
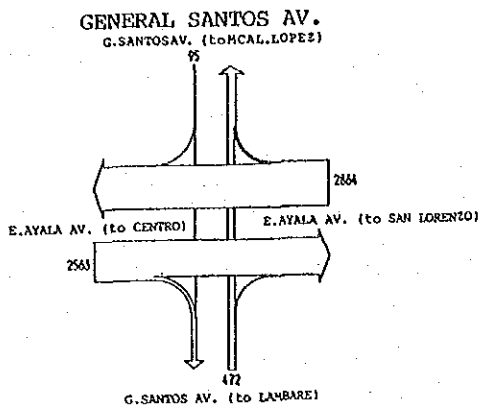


FIGURE 3-2-12 INTERSECTION TRAFFIC VOLUME (1992)

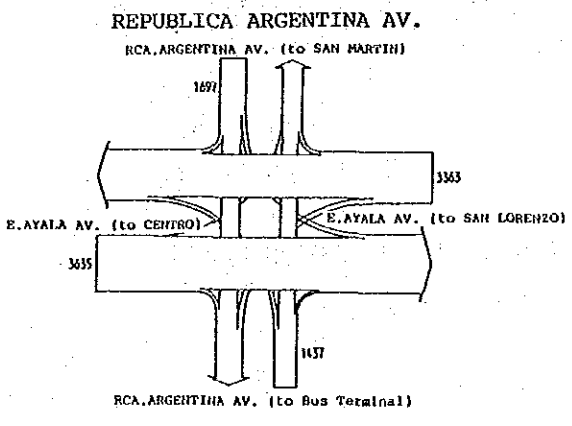
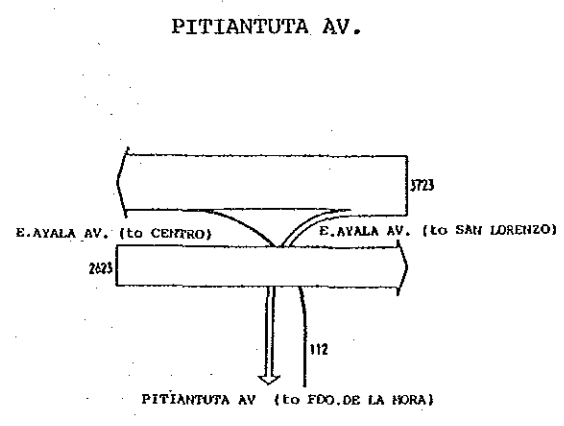
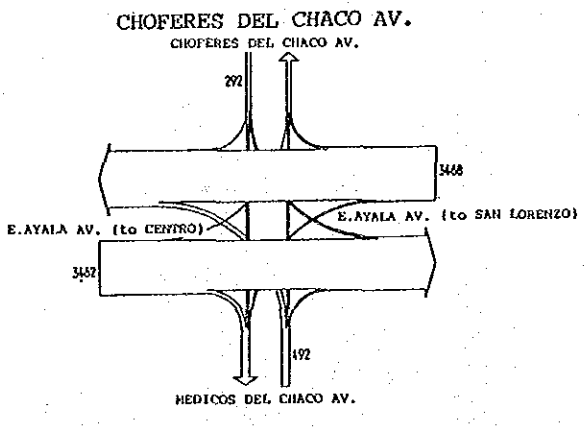
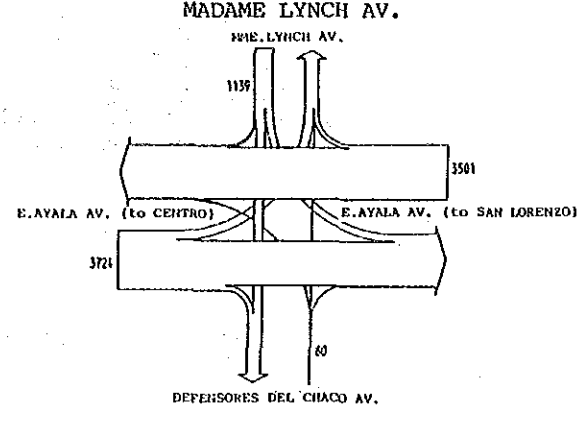
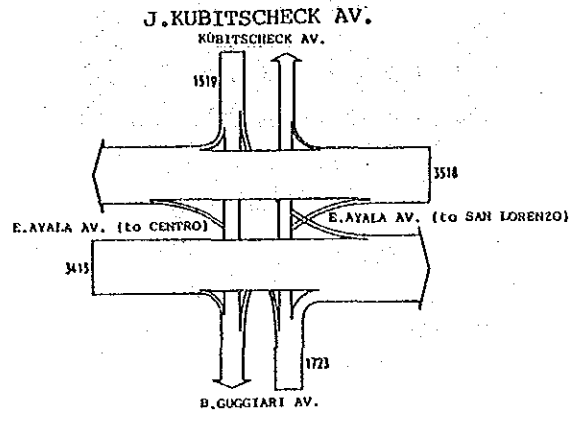
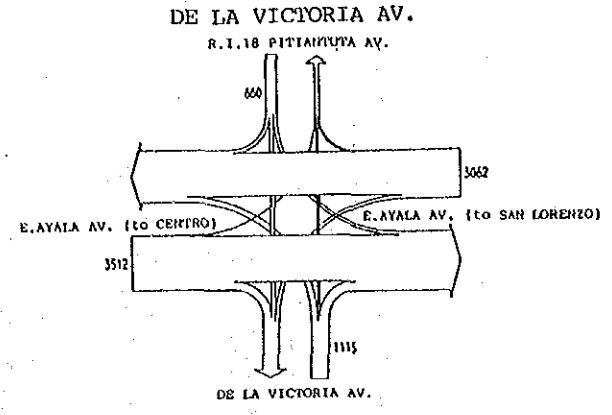
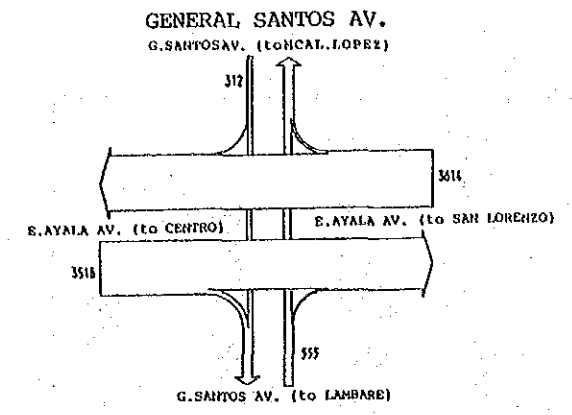


FIGURE 3-2-13 INTERSECTION TRAFFIC VOLUME (2000)

1,000 pcu/h

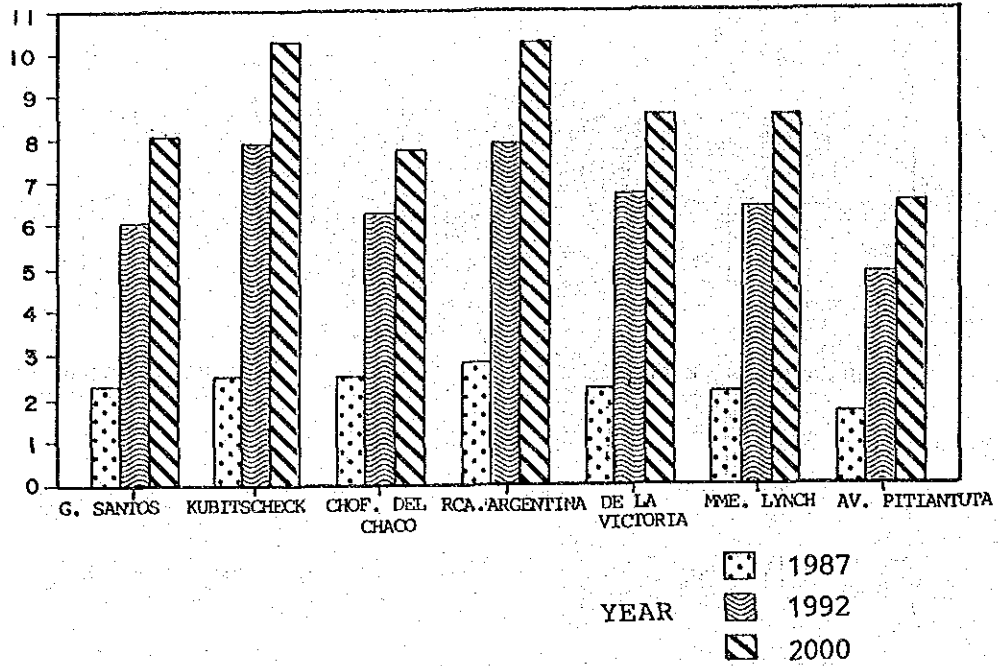


FIGURE 3-2-14 ENTRANCE TRAFFIC VOLUME INTO INTERSECTION

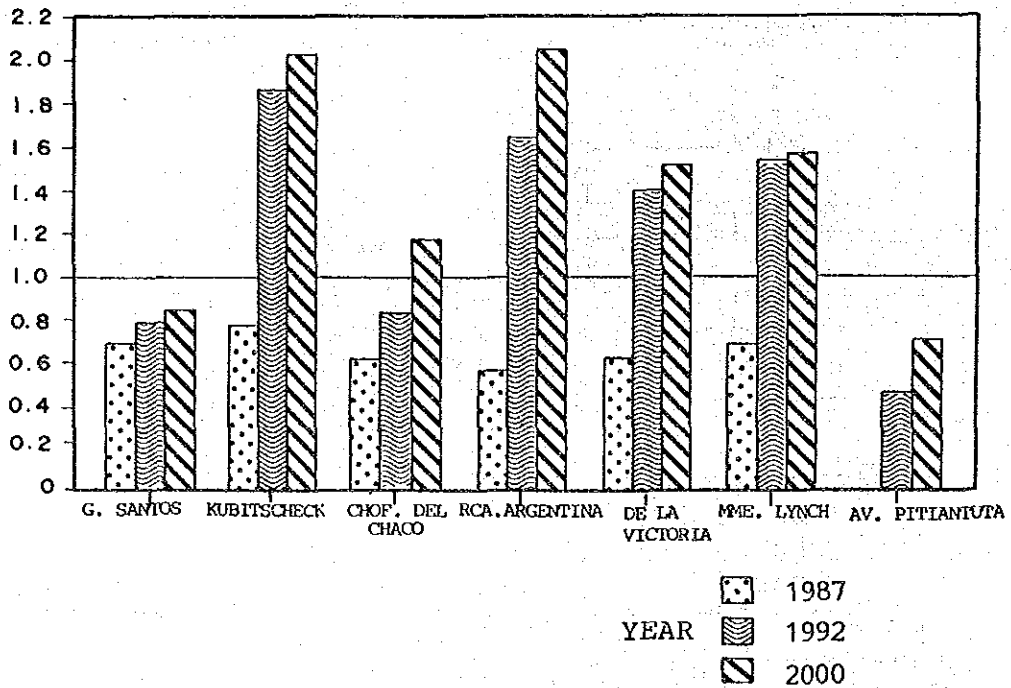


FIGURE 3-2-15 SATURATION FLOW RATES ON INTERSECTIONS

3.3 VIADUCT BETWEEN E. AYALA AND R. DE FRANCIA AVENUES

3.3.1 Cross Section Elements

1) Traffic Demand

According to the traffic assignment on demand, the traffic of the viaduct by the years 1992 and 2000, will be of 18,600 veh./day and 23,800 veh./day respectively. It is suggested to equip it with 4 lanes, since the 2 lane road capacity (one lane/way), estimated at 10,000 veh./day is not enough. When implementing 4 lanes, the assigned traffic volume estimated by the years 1992 and 2000 will be of 43,000 veh./day and 46,000 veh./day respectively (See FIGURE 3-3-1). If the mentioned viaduct is used, the saturation flow rate at the intersection of E. Ayala Av. and Pettirossi Av., and at E. Ayala Av. and Yuty Street by the years 1992 and 2000 will be as shown in FIGURE 3-3-2, the suggestion being to eliminate the traffic difficulties of E. Ayala Av. and R. de Francia Av. Axis, through the implementation of the connecting viaduct.

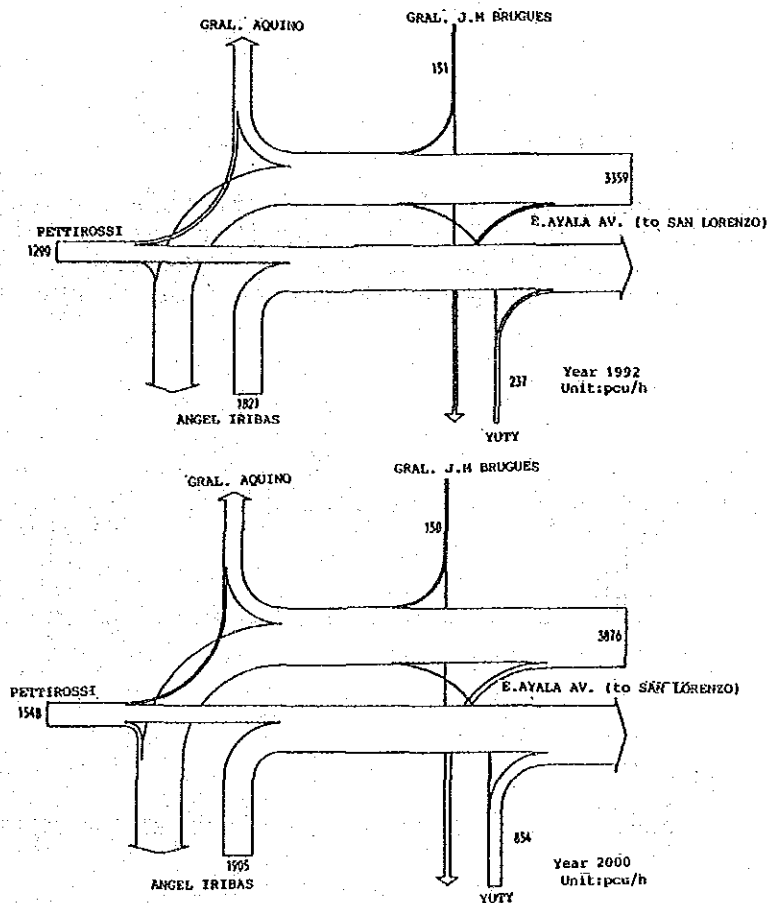


FIGURE 3-3-1 INTERSECTION TRAFFIC VOLUME ON PETTIROSSI AND YUTY

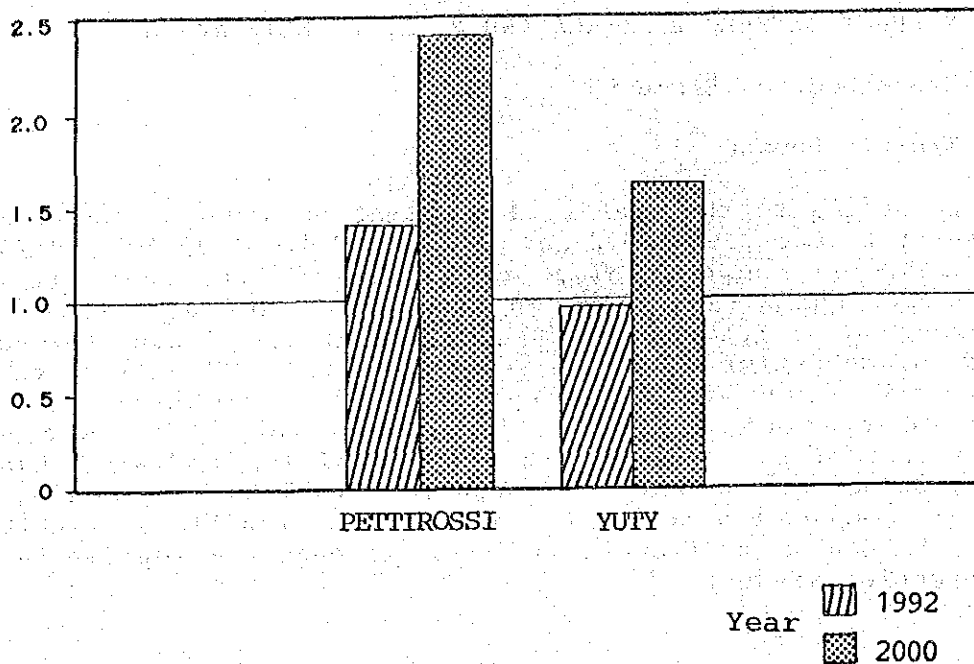


FIGURE 3-3-2 SATURATION FLOW RATES ON PETTIROSSI AND YUTY

2) Cross Section

The present road width of R. de Francia Avenue is 23 meters. In order to minimize land expropriation, it has been established that the main road lane width be 3.25 meters, and the side streets width be 3.0 meters, the total width being 32 meters (See FIGURE 3-3-3).

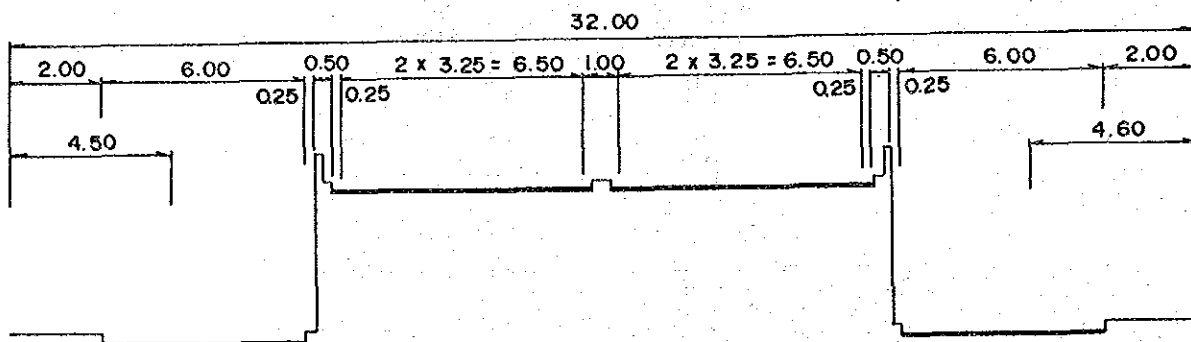


FIGURE 3-3-3 TYPICAL CROSS SECTION AT THE END OF VIADUCT

3.3.2 Location Plan

The alternative, in order to avoid the indemnification of big buildings, could be a third one, that goes between alternatives 1 and 2 and is shown in FIGURE 3-3-4; but due to the following reasons, alternatives 1 and 2 will be taken as the study object.

- a. As observed in FIGURE 3-3-4, at least 2 city blocks are affected.
- b. In case of a third alternative between routes 1 and 2, 3 city blocks are affected.

The surface, the buildings, the construction surface and the indemnification's total sum of each block (FIGURE 3-3-5, blocks 1-4) are shown in TABLE 3-3-1.

The table shows that, alternative 1 offers a greater economic advantage, as long as the road be the only one constructed, since alternatives 1 and 2 have almost the same surface. But, in case of the implementation of the Bus Terminal and the road in the same place, it is required to expropriate city blocks 3 and 4 in alternative 1, and city blocks 1 and 2 in alternative 2. This last one results in more advantages concerning the aspect of the indemnification total sum.



FIGURE 3-3-4 VIADUCT ROUTE ALTERNATIVES



FIGURE 3-3-5 BLOCK LOCATIONS AT MUNICIPAL MARKET NO.4 AREA

TABLE 3-3-1 LAND AND BUILDING EVALUATIONS BY BLOCK

Block No.	Area (m ²)	Floor Area (m ²)	Total Cost (Mill.Gs.)	Unit Cost (1,000Gs/m ²)
1	7,178	9,488	737.2	102.7
2	3,780	3,700	340.2	90.0
3	8,800	7,500	808.8	91.9
4	13,750	8,100	1,036.8	75.4

Considering the above indicated aspects and according to the following reasons, alternative 2 will be taken as a planning basis:

- a. Bus Terminal construction should be considered as a basic condition for land selection.
- b. Land expropriation for the road opening (without building the Bus Terminal) will be difficult from the point of view of the future land use, because, even when the Bus Terminals not exist, care should be take for the reorganization of the city blocks affected by such work.

3.3.3 Intersection Plans

FIGURE 3-3-6 shows the hourly traffic volume at peak hours, by direction, to be registered by the year 2000 at the intersection of R. de Francia Avenue and Próceres de Mayo Street for the following cases:

- a. Without the Bus Terminal
- b. With the Bus Terminal

When not building the Bus Terminal, the intersection will have 5 approaches and will register the following traffic flow:

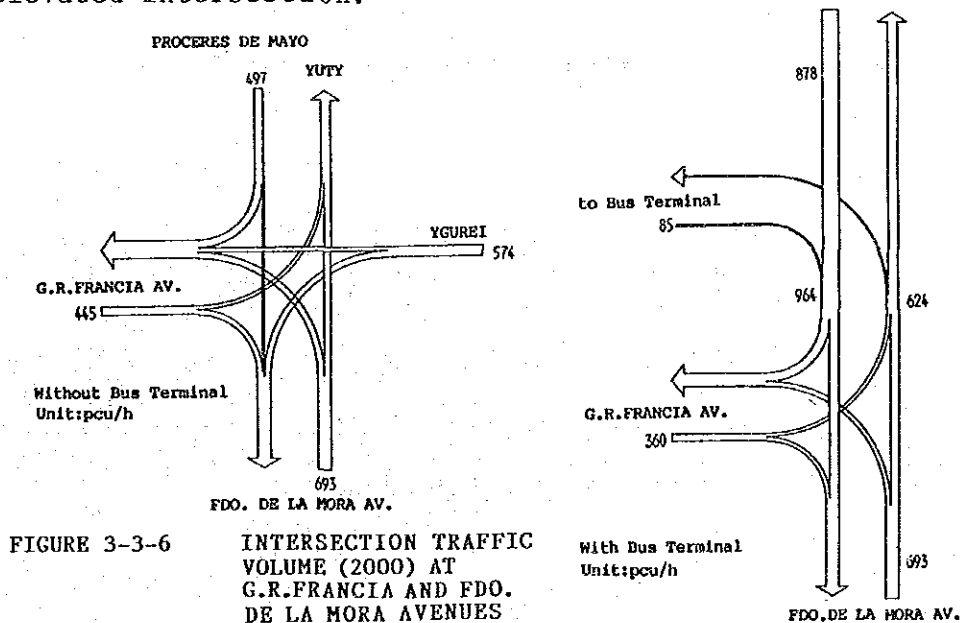
- a. Traffic from Próceres de Mayo Avenue (one way)
- b. Traffic to and from R. de Francia Avenue (4 lanes at present)
- c. Traffic to and from F. de la Mora Avenue (2 way, 2 lanes at present)
- d. Traffic from Ygurei Street (one way)
- e. Traffic to Yuty (one way)

If the Bus Terminal is constructed, some of the above flow will be modified as follows:

- a. The traffic flow from Ygurei Street will be transferred to the Yuty Street, due to the access to the Terminal.
- b. Consequently, Yuty Street will be a 2 way Street.
- c. Approaching flow from Pettirossi Avenue should be changed to Yuty Street.

The traffic to and from the Bus Terminal will pass Yuty Street. Therefore the intersection from R. de Francia Avenue will have 3 approaches, eliminating flows from Ygurei Street and flows from Pettirossi Avenue.

The saturation flow rate at the intersection, in both cases, will be of 0.56 and 0.65 respectively, resulting in enough capacity for the traffic by the year 2000, without the implementation of the elevated intersection.



3.4 DR. RODRIGUEZ DE FRANCIA AVENUE

3.4.1 Cross Section Elements

1) Land Use

Land use along the section between Colón and Estados Unidos Avenues is completely different from the section between Estados Unidos and Próceres de Mayo. In the first case, more than 50% of the lands are destined for residential use. On the other hand, trading installations prevail on the second section, mainly from Perú Avenue facing east, where shops occupy 85% of the total.

The west section of Estados Unidos Avenue, although R. de Francia Av. represents the microcentro main artery, constitutes a good residential area. The east sector of Estados Unidos Av. constitutes part of the Municipal Market No. 4 commercial core (FIGURE 3-4-1).

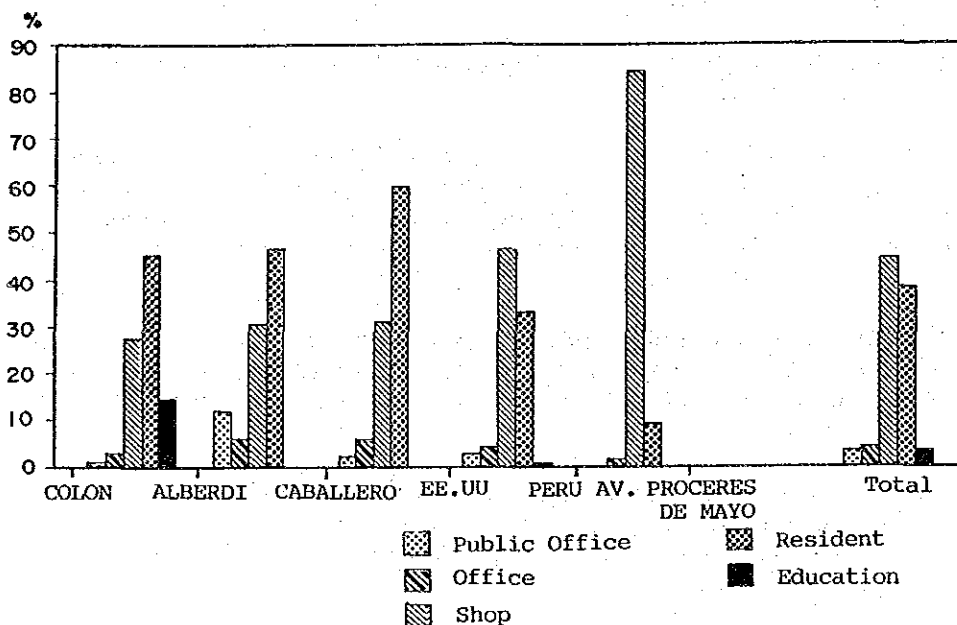


FIGURE 3-4-1 PRESENT LAND USE ALONG G.R.FRANCIA

2) Future Land Use

Trading installations will increase along the west sector of Estados Unidos Av., but it is not possible to imagine they will produce major changes on the commercial/residential use type.

It is estimated that the section between Estados Unidos and Perú Avenues, will present the aspect which is actually presented on the section between Perú and Próceres de Mayo Avenues, due to the increase of trading installations because of the expansionist tendency of the Municipal Market No. 4 commercial core.

3) Traffic Flow on R. de Francia Avenue

The sections for traffic flow to and from the Microcentro expected by the year 2000 for each direction (north, south, east and west) and the traffic volume are shown in FIGURES 3-4-2 and 3-4-3 respectively.

FIGURE 3-4-3 (1) shows the flow in the case of no improvement projects of R. de Francia Avenue. According to it, there are 9,200 veh./day/traffic, joining the south and west sectors; and 45,700 veh./day coming from the east sector and ending at the Microcentro. Only with the improvement of E. Ayala and R. de Francia Avenues, and the consequent modification of the traffic flow system (from the east-west direction to the north-south direction) suggested by the Master Plan, almost nothing will be useful for the environmental preservation of the residential zone, located east of the Microcentro.

FIGURE 3-4-3 (2) shows the traffic flow by direction to be registered if R. de Francia Avenue gets widened to 6 lanes (4 lanes at present) for its entire length. According to this, the east-west traffic that goes through the Microcentro, decreases more or less 3,000 veh/day and that coming from the east sector, about, 4,000 veh/day. This will be transferred to R. de Francia Avenue.

FIGURE 3-4-3 (3) shows the traffic flow when the east/west corridor gets regulated through the implementation of traffic light sets, exclusive lane for buses, etc., concerning the traffic flow of the east sector coming from the east/west sector, actually observed at the Microcentro. The 2/3 parts of the flow from the east sector go through R. de Francia Avenue.

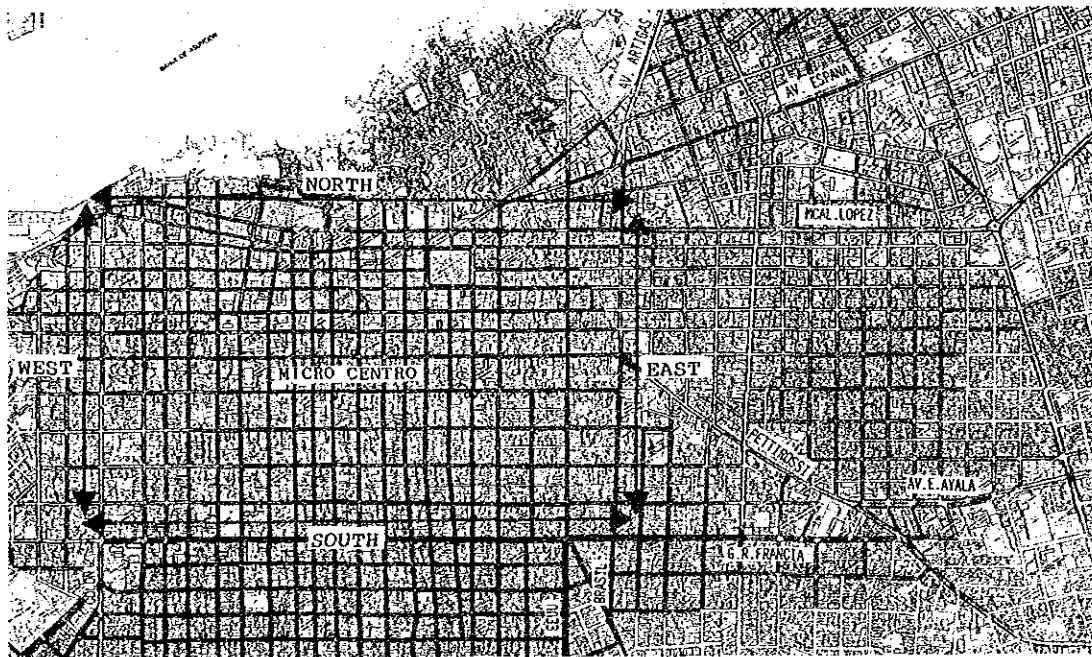
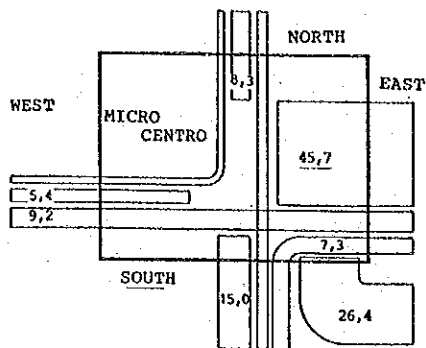
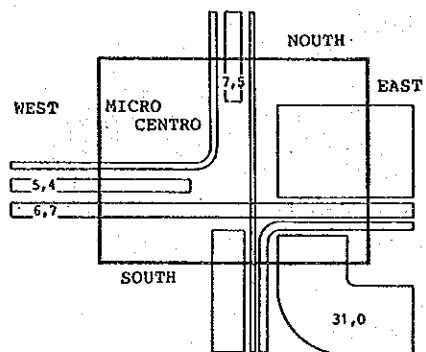


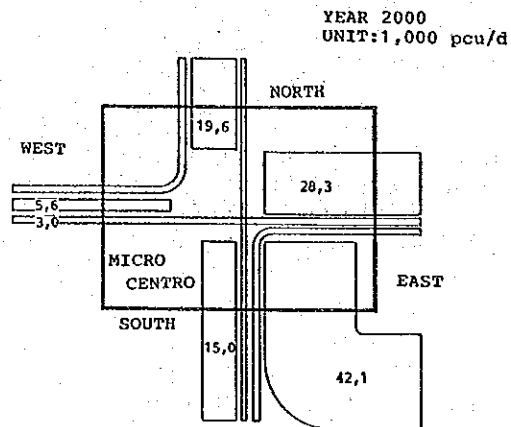
FIGURE 3-4-2 SECTIONS LOCATION



(1) PRESENT ROAD NET



(2) 6 LANES ON R. FRANCIA AV.



(3) WITH TRAFFIC CONTROL

FIGURE 3-4-3 TRAFFIC FLOW IN AND FROM MICROCENTRO

The widening of R. de Francia Avenue to 6 lanes would be convenient to be done parallel to the traffic flow control. With such steps, it is expected:

- a. The environmental preservation of the residential zone, east of the Microcentro
- b. The elimination of the through traffic at the zone of the Microcentro
- c. Shortening of access distance to the Microcentro through the traffic modification from an east-west to a north-south direction. Consequently, the quantity of vehicles at the the Microcentro decreases

FIGURE 3-4-4 shows the congestion rate for the years 1992 and 2000 in the following 4 sections of R. de Francia Avenue.

- a. Colón to EE.UU Avenues
- b. EE.UU to Perú Avenues
- c. Perú Avenue to West side of the bridge
- d. Connecting bridge

Such congestion rate has been estimated for the following 4 cases:

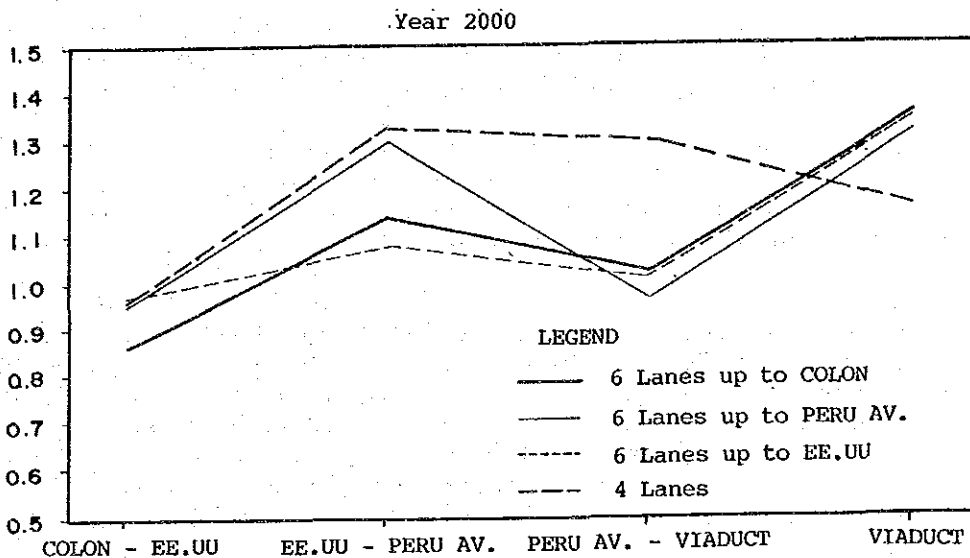
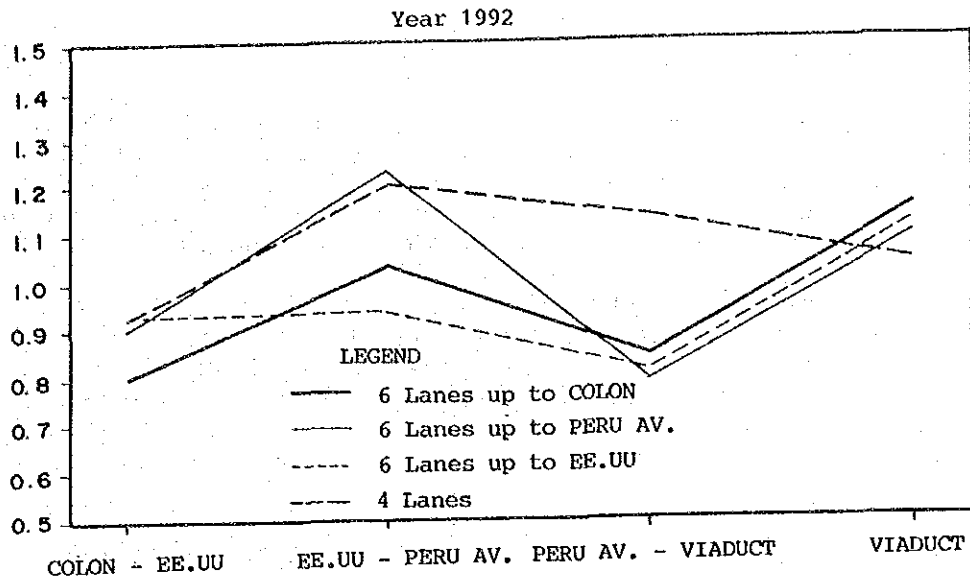


FIGURE 3-4-4 CONGESTION RATE

- Case 1: When no modifications are done
- Case 2: When widening to 6 lanes from the connecting bridge to Perú Avenue
- Case 3: When widening to 6 lanes from the connecting bridge to EE. UU Avenue
- Case 4: When widening to 6 lanes for the entire length (as for Colón Avenue)

The congestion rate of all four lane sections is of 1.2 for 1992, this means, the necessity of equipping it to 6 lanes is not very strong. For the year 2000, even when not reaching the 1.5 limit, the congestion rate of the last 3 sections overpasses slightly the 1.3, consequently, if the circumstances allow, it will be convenient to equip it with 6 lanes in order to achieve the most desirable level. On the other hand, it is not required to widen to 6 lanes, especially on the section between Estados Unidos and Colón Avenues.

4) Cross Section Elements

As shown in the FIGURE 3-4-5, the present width of R. de Francia Avenue is more or less 23 meters, with 4 lanes (at places where on road parking is registered they allow to use only one lane on each way) and does not have a front space. This width gets close to the 4 lane road of 3.5 meters each, with 0.5 of shoulder.

FIGURE 3-4-6 shows the cross section of Alternative 1, which has 6 lanes of 3.0 meters each, fitting the present road width. In such case, according to H.C.M. (Highway Capacity Manual), the traffic capacity should be 1.5 times regarding the 4 lanes. However, since there are no free spaces on both sides of the streets (shoulders), the capacity of each lane might get reduced. Consequently, an increase of only 1.2 times is expected.

FIGURE 3-4-7 shows the cross section of the mentioned avenue when widened to 6 lanes of 3.25 meters in each; without land expropriation. In such case, even when reducing the Center Median width to 1 meter, the sidewalks will get reduced to 1 meter each, which constitutes an inappropriate side for an urban street.

FIGURE 3-4-8 shows the cross section of the 6 lane road, maintaining the traffic sizes or even more. In such a case, the total width will be of 30 meters, so, it requires an enlargement of 3.5 meters on each side of the present road.

TABLE 3-4-1 shows the number of buildings to be indemnified in the sections between the connecting viaduct and the EE.UU Av., in the cases of widening to 26 and 30 meters. In the section between the connecting viaduct and Perú Avenue, many precarious shops are concentrated on both sides of the avenue, but without seizing to the width of the widening. When widening to 26 meters, the amount of buildings to be affected in the section between Perú and EE.UU Avenues will decrease as much as 3/4 of the 30 meters widening.

TABLE 3-4-1 NUMBER OF BUILDINGS TO BE INDEMNIFIED

Section	No. of Buildings	
	26m	30m
Viaduct - Perú Av.	33	33
Perú Av. - EE.UU Av.	35	46

YGATIMI - G.R.FRANCIA

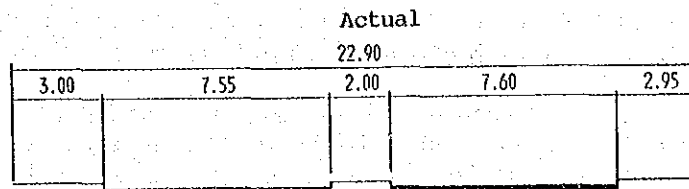


FIGURE 3-4-5 PRESENT CROSS SECTION OF G.R.FRANCIA

EE.UU - VIADUCT

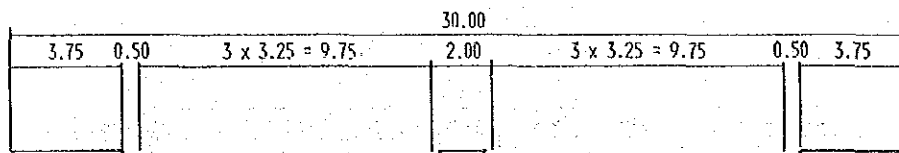


FIGURE 3-4-6 PROPOSED CROSS SECTION OF G.R.FRANCIA
(3.25m x 6LANES, 30m)

FIGURE 3-4-1 shows the real situation of land use along R. de Francia Avenue, which is characterized by a high ratio of commercial establishments registered between Perú Avenue and Próceres de Mayo Street. To the west side of Perú Avenue, 30% belong to residences. Consequently, it is suggested:

- a. Plan, to Perú Avenue, based mainly on the through traffic.
- b. Plan, for sections located west of Perú Avenue considering also the residential environment.

The real situation and the above-mentioned traffic demand suggested the following widening criteria:

- a. The section between the viaduct to Perú Avenue, indefectibly requires to be widened, in order to take care of the viaduct implementation, as well as lane junction and separation. According to the present alternative, the section that omits the widening is from about 200 meters. Consequently, this section will be planned considering the widening by the same time (1992) as the improvement of E. Ayala Avenue, the construction of the connecting viaduct and the improvement to 6 lanes of the sections between Perú and EE.UU Avenues.
- b. Concerning the section between EE.UU and Colón Avenues, the pavement does not resist heavy vehicle traffic, so the suggestion will be to centralize around the pavement improvement, maintaining the same number of lanes.

According to the sections to be widened, a 26 meter road width will be used (See FIGURE 3-4-9) and will be based on the following criteria:

- a. The present Central Median trees will be kept in the section between Perú and EE.UU Avenues. But, trees will not be considered in the section between the viaduct and Perú Avenue (Central Median of approximately 1 meter).
- b. In order to minimize land expropriation and the consequent indemnification, the width of the private car lane will be 3.0 meters, and for buses and trucks it will be 3.25 meters, apart from lateral clearance.

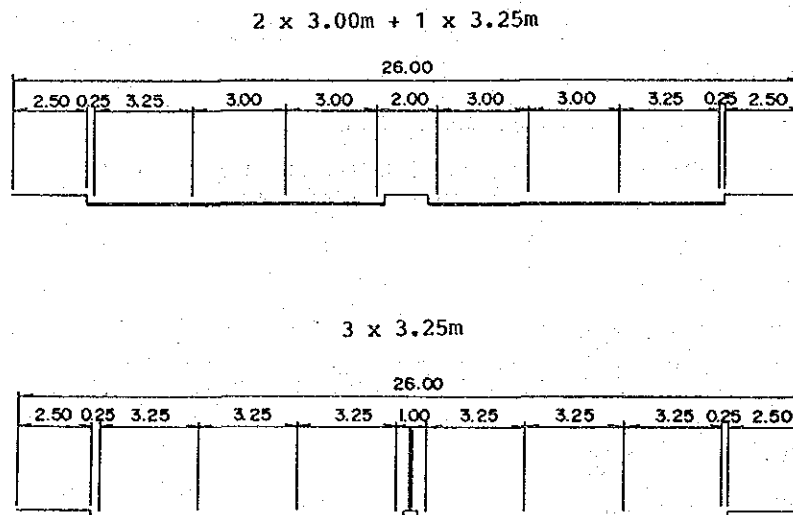


FIGURE 3-4-7 PROPOSED CROSS SECTION OF G.R.FRANCIA (26.0m)

3.4.2 Intersection Plans

FIGURE 3-4-10 shows the traffic volume by circulation maneuvers in the peak hours for the years 1987, 1992 and 2000 for the intersection of R. de Francia and Perú Avenues. The traffic volume of R. de Francia Avenue will increase by the completion year of the first stage of improvement from E. Ayala Avenue, connecting viaduct and R. de Francia Avenue (1992), estimated at 3 to 5 times of the 1987 registered volume. Parallel to this increase, the saturation ratio of the intersection will be as shown in FIGURE 3-4-9, supposing that the limit of admissible lanes for R. de Francia Avenue be of 3 lanes/per one direction and that for Perú Avenue 2 lanes per one direction, estimating that for the year 2000 it will surpass the admissible capacity of the level intersection. However, due to the following reasons, a level intersection will be planned.

- a. Land expropriation, more than as planned in order to implement the viaduct will be very difficult, due to its proximity to the Microcentro.

- b. By assigning greater time of green wave to R. de Francia Avenue, the capacity can be assured, with respect to the flow of the main corridor.
- c. Since it is a point close to the Microcentro, the secondary flow should be sacrificed to that point with respect to the main flow.

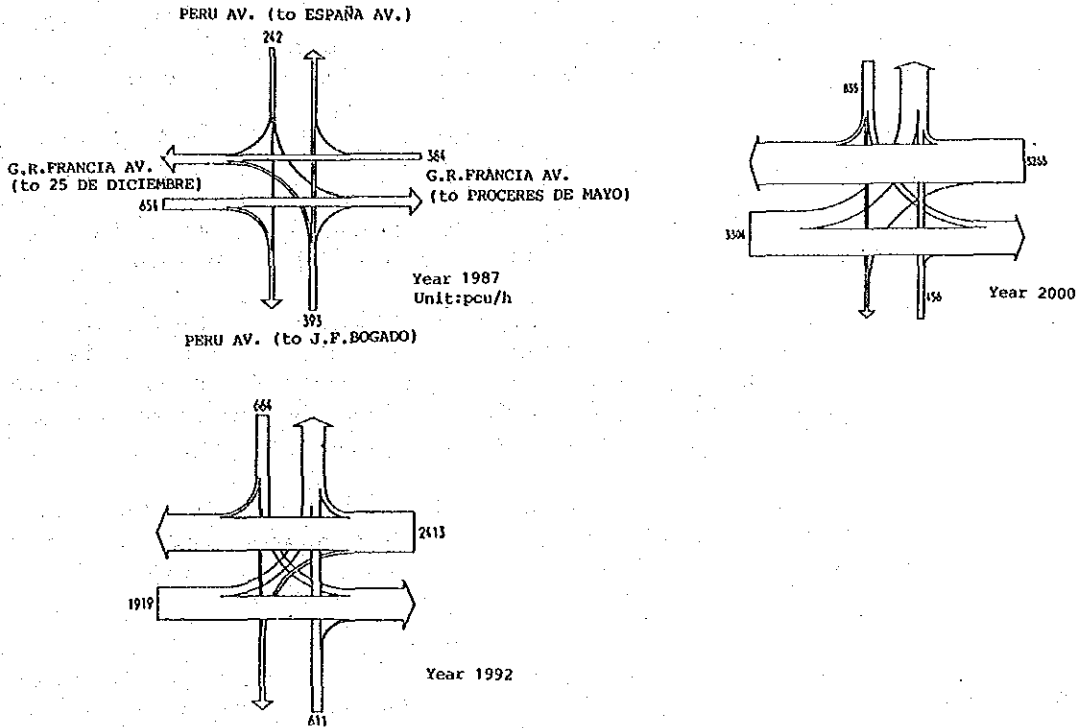


FIGURE 3-4-8 INTERSECTION TRAFFIC VOLUME ON G.R.FRANCIA AV.

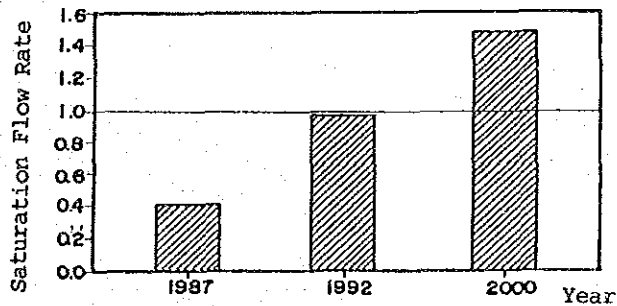


FIGURE 3-4-9 SATURATION FLOW RATE AT INTERSECTION OF PERU AND R. DE FRANCIA AV.

3.5 MADAME LYNCH AVENUE

3.5.1 Cross Section Elements

1) Traffic Demand

In FIGURE 3-5-1 two kinds of congestions can be seen, for the years 1992 and 2000 in relation to the number of lanes of E. Ayala and Madame Lynch Aves. TABLE 3-5-1 indicates the traffic volume and the traveling average velocity of those years and of those Avenues. As a consequence to that, the following considerations were obtained:

- a. If no improvement is executed in E. Ayala Av., the congestion rate of the Madame Lynch Av. with two lanes will grow up to 1.5 in the year 1992. If the Avenue is widened to four lanes, the congestion rate in the year 1992 would be 0.7 and in the year 2000 it would be maintained at 1.1.
- b. If E. Ayala Av. is widened to 6 lanes by the year 1992, the period of time in which the congestion rate of Madame Lynch Av. with two lanes gets to 1.5 could be delayed for 2 or 3 years from 1992. Even if E. Ayala Av. gets 8 lanes instead of 6 lanes, the period of time would be almost the same.
- c. If E. Ayala Av. is enlarged to 8 lanes, the congestion rate of Madame Lynch Av. would grow a lot more than if it is enlarged only up to 6 lanes. This is because the 8 lanes would absorb more flow through Madame Lynch Av.

Considering the traffic demand it can be deduced that improvements on Mme. Lynch Avenue could be carried out after 1992. However, considering the urgent improvement proposed by the PRODEMA project and by posterior projects in relation to the recovery measures of the channel that runs parallel to the Avenue, it is convenient to carry out the improvement of Mme. Lynch Avenue before 1992.

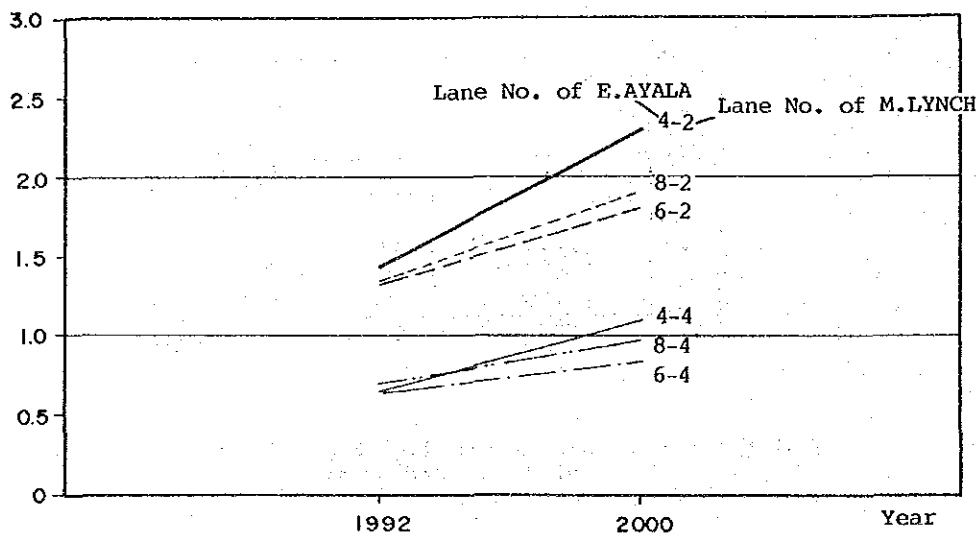


FIGURE 3-5-1 CONGESTION RATE ON MADAME LYNCH AV.

TABLE 3-5-1 TRAFFIC VOLUME AND CONGESTION BY CASE

No. of Lane		Congest.	Volume (1000 pcu)
Year 1992			
Mme. Lynch Av.	E. Ayala Av.		
2	4	1.43	13.2
2	6	1.32	14.5
2	8	1.34	12.4
4	4	0.64	24.4
4	6	0.63	23.9
4	8	0.69	26.3
Year 2000			
Mme. Lynch Av.	E. Ayala Av.		
2	4	2.30	21.2
2	6	1.80	16.5
2	8	1.91	17.6
4	4	1.08	40.9
4	6	0.83	31.6
4	8	0.96	36.6

2) Land Use

According to the results of the building survey, 70% of the buildings which are located on the sides of this Avenue, serve as houses and 15% are used as retail shops. The frontal width of the land indicates that 50% of it is occupied by wasteland, 30% is used for houses and 10% for retail shops and car supply stores. The ratio of wasteland is increased to 70% in the north of the intersection with E. Lilio Street. (see FIGURE 3-5-2)

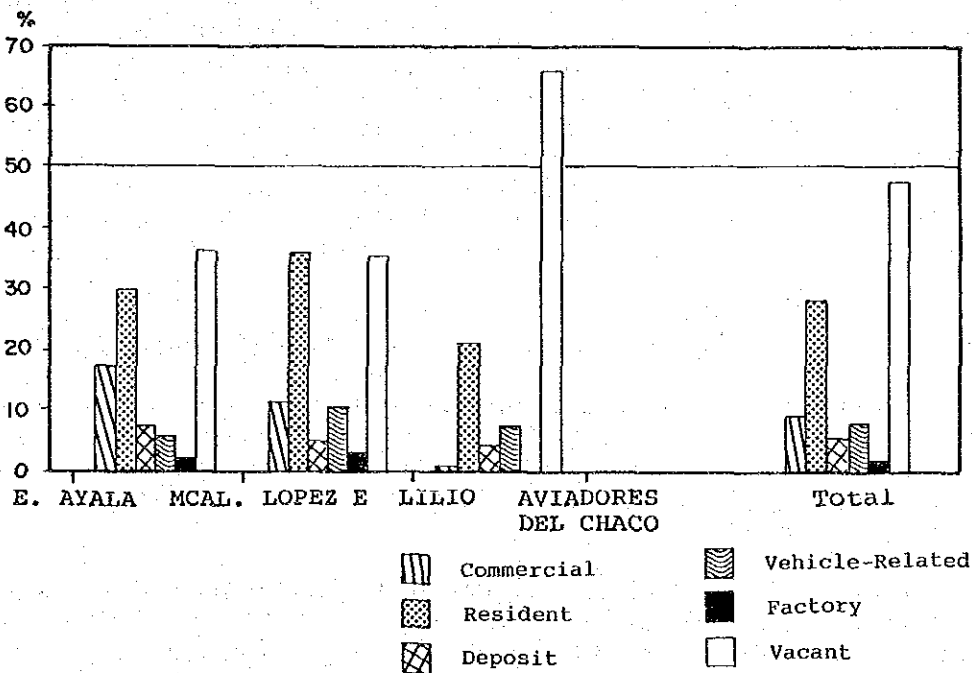


FIGURE 3-5-2 PRESENT LAND USE ALONG MADAME LYNCH AV.

Supply stores, deposits, factories and other shops represent only 1/4 of the total land front. Each block has a frontal width of 200 to 250 meters.

When the improvements are carried out, more urbanized activities will be set along the Avenue. The Asunción City Regulator Plan defines this area as an industrial area. In future, the use of this area will be related mainly to the transportation and distribution industries. Also the accelerated growth of the surrounding cities Luque, F. de la Mora, and San Lorenzo are foreseen. That increases the commercial potentiality of Madame Lynch Av. Consequently, large scale suburban type shopping centers or super-markets might be located there.

This avenue will be equipped basically as a principal way but for industrial use. For this purpose there is the advantage that the blocks have a frontal length of around 300 meters which make it easy to control the vehicles access to the Avenue, preventing congestion.

Municipal Line of the Madame Lynch Av. is set at 50 meters, in response to Order No. 2140. The effect of order No. 2140 is observed between Santa Teresa Av. and Aviadores del Chaco Av. (2.1km), but not along the remaining 3.3km from E. Ayala Av. to Santa Teresa Av.

3) Cross Section

The configuration of the cross section proposed by "Storm Drainage System Improvement Project in Asunción City", JICA, 1987, is shown in FIGURE 3-5-3.

According to the study, the Itay branch along the Madame Lynch Av. is improved in the following way (See FIGURE 3-5-4). The first section of 650 meters from E. Ayala Av. is assumed to be improved by Asunción City (a part of these have already been carried out). The following 200 meters from the first section is structured by a dual box culvert system (the second section). The third section, 2300 meters, is proposed with a triple box culvert system. The section from Santa Teresa Av. up to Aviadores del Chaco Av. is planned to be constructed with four lanes parallel to the right river side.

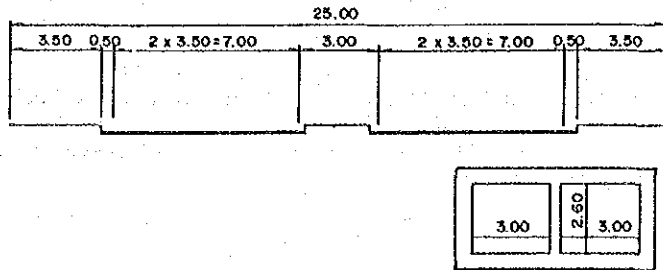
FIGURE 3-5-5 shows the cross section for the case of the channel being open between Eusebio Ayala Av. and Santa Teresa Av.

The section of 0.8km from E. Ayala Av. has no width of road, which is required on order No. 2140 and the channel width is less than in the other sections. In response to this the total width for this section might be 40 meters. After this, wider sections with 50 meters are proposed.

In TABLE 3-5-2 the advantages and disadvantages are set, either if the channel is opened or closed and in TABLE 3-5-3, the number of buildings that will have to be compensated, are counted.

TABLE 3-5-4 shows the calculation result obtained by the method described hereafter.

Starting Point - 0.211 km



2.310 km - AV. SANTA TERRESA

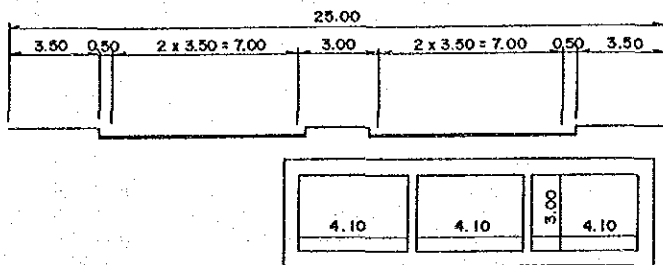


FIGURE 3-5-3 CROSS SECTIONS OF MADAME LYNCH AV. PROPOSED IN THE CURRENT STUDIES (CLOSED CHANNEL PART)

AV. SANTA TERRESA - 3,038 Km

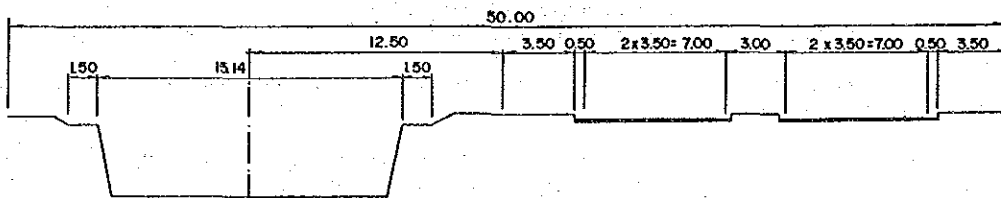
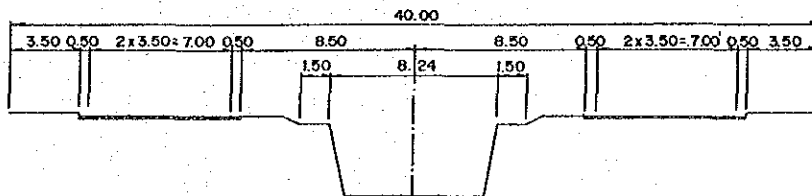


FIGURE 3-5-4 CROSS SECTION OF MADAME LYNCH AV. PROPOSED IN THE CURRENT STUDIES (OPEN CHANNEL PART)

AV. E. AYALA - 0,861 Km



0,861 Km - AV. SANTA TERRESA

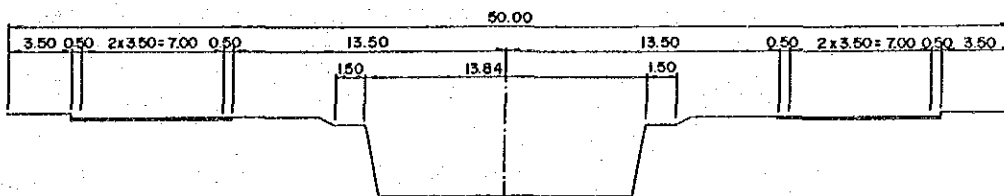


FIGURE 3-5-5 CROSS SECTIONS OF MADAME LYNCH AV. (OPEN CHANNEL CASE)

Concerning the comparative and evaluation results of the mentioned data, the open channel has been chosen considering the lower maintenance costs, lower global construction costs and few land expropriation problems.

TABLE 3-5-2 COMPARISON OF OPEN CHANNEL AND CLOSED CHANNEL

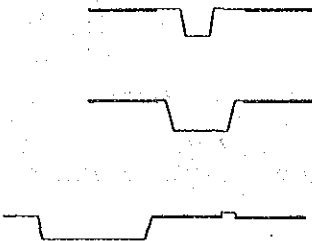
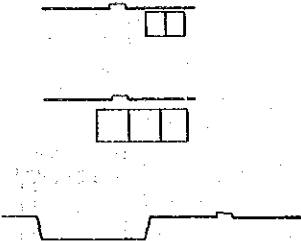
Canal Structure	Open Channel	Closed Channel
Structure Type		
1. Cleaning (Extraction of Sand)	Easy Special structures are not needed.	Entrance for cleaning is required at each 100m interval. Entrance for such equipment as Bulldozer D-5 is required.
2. For the Flood Exceed Design High Water Level	Widening of canal	Construction of new canal
3. Construction Timing	Canal construction after road construction is possible. One side of the canal should be constructed simultaneously with road construction.	Canal construction should be the first.
4. Note in View of the Canal Construction	To construct from the down stream is desirable.	
5. Access	Concrete bridges are needed.	Access free.
6. Row	To be constructed within designated row of 50m.	To be constructed within the present row of 25m.

TABLE 3-5-3 NO. OF HOUSE TO BE DEMOLISHED

Section	Open Channel			Closed Channel		
	F.Mora	MCA	Total	F.Mora	MCA	Total
1. E.Ayala Av. - 600m	21	23	44	5	0	5
2. 600m - Mcal.López Av.	17	26	43	6	0	6
3. Mcal.López Av. - S.Teresa Av.	48	42	90	26	0	26
4. S.Teresa Av. - España Av.	6	7	13	6	7	13
Total	92	98	190	43	7	50

TABLE 3-5-4 COST ESTIMATIONS OF OPEN CHANNEL AND CLOSED CHANNEL

Channel Structure	Construction Cost		Indemnity Cost (1000GS)	Total Cost (1000GS)
	Foreign (1000US\$)	Local (1000GS)		
Open	6,868	1,529,418	1,384,088	8,751,000
Closed	9,451	3,087,559	927,720	12,048,000

4) Executing Body

The following Institutions are related to the widening of Madame Lynch Av. and the adjacent channel reforms:

(1) MOPC

Madame Lynch Av. is a trunk way that forms part of the principal country network, which links national highway No. 9 (Transchaco) with national highways No. 1 and No. 2 and the petroleum refinery (Petropar). Madame Lynch Av. was under MOPC's charge, but in the year 1980, with law No. 818/80, the National Highways in Asunción City are passed to MCA control. Nevertheless, the channel is being referred with MOPC participation.

(2) Fdo. de la Mora and Luque Municipalities

The boundaries between Asunción City, Fdo. de la Mora and Luque Municipalities are not clearly defined and the Itay stream is like a natural boundary between all three municipalities, so the executing organization will depend on which side of the stream the reforms take place, either the right or left.

(3) CORPOSANA

The Itay stream itself is under CORPOSANA's control.

(4) Asunción Municipality

Existing roads located on the West side of the Itay branch are under Asunción Municipality's control.

3.5.2 Access Control Plan

1) Access Control

In relation to Mme. Lynch Av., they are structured with big blocks with 300 meters on the front side. The accesses to the parallel streets will be controlled easily by the previously mentioned big blocks. All the transport business related facilities along the avenue have to be requested to have space for their maneuvers in their terrain so the congestion will be controlled, and the entrance and exit might be located on the transversal streets. (See FIGURE 3-5-6)

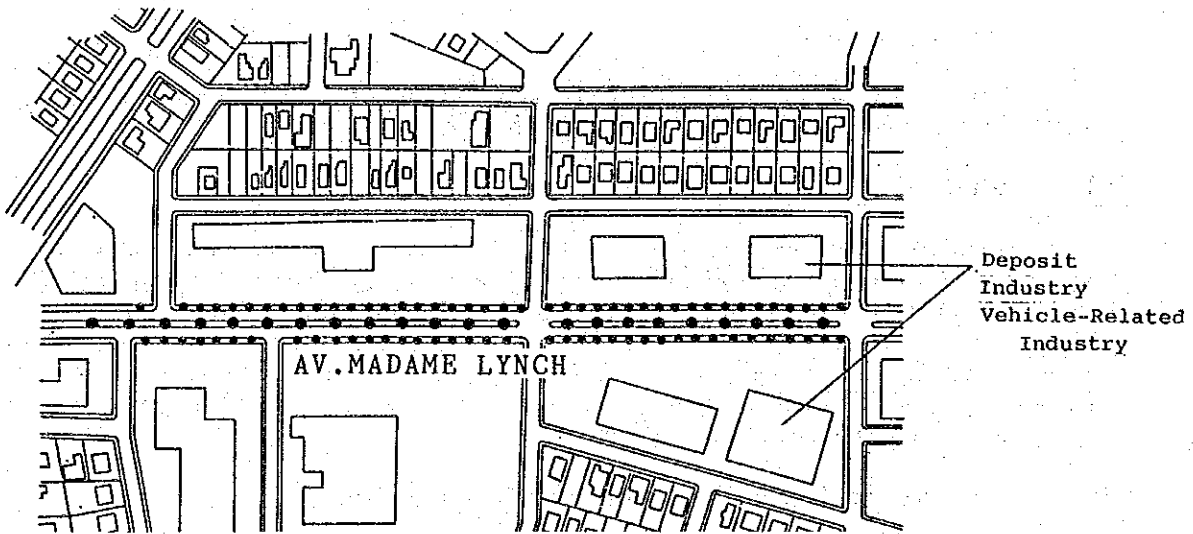


FIGURE 3-5-6 MODEL PLAN OF ACCESS CONTROL(URBAN ARTERIAL TYPE)

2) Crosses

The location of the actual bridges over the Itay stream, which is adjacent to the Mme. Lynch Av. (including the wooden ones), are shown in FIGURE 3-5-7. Average distances between bridges fluctuate from 90 meters to 180 meters, which correspond to easy walking distances. (See TABLE 3-5-5).

In the year 2000 it will have 37,000 pcu/day. The crossings are controlled with a medium distance of 500 meters between each one, which is the stage with four lanes.

FIGURE 3-5-8 indicates the proposed location of bridge construction.

TABLE 3-5-5 AVERAGE CROSSING INTERVAL

Section	Distance (km)	No. of Bridges	Average Interval(m)
1. E.Ayala Av. - Mcal.López Av.	1.60	18	89
2. Mcal.López Av. - S.Teresa Av.	1.68	9	187
3. S.Teresa Av. - Av.del Chaco Av.	2.08	13	160

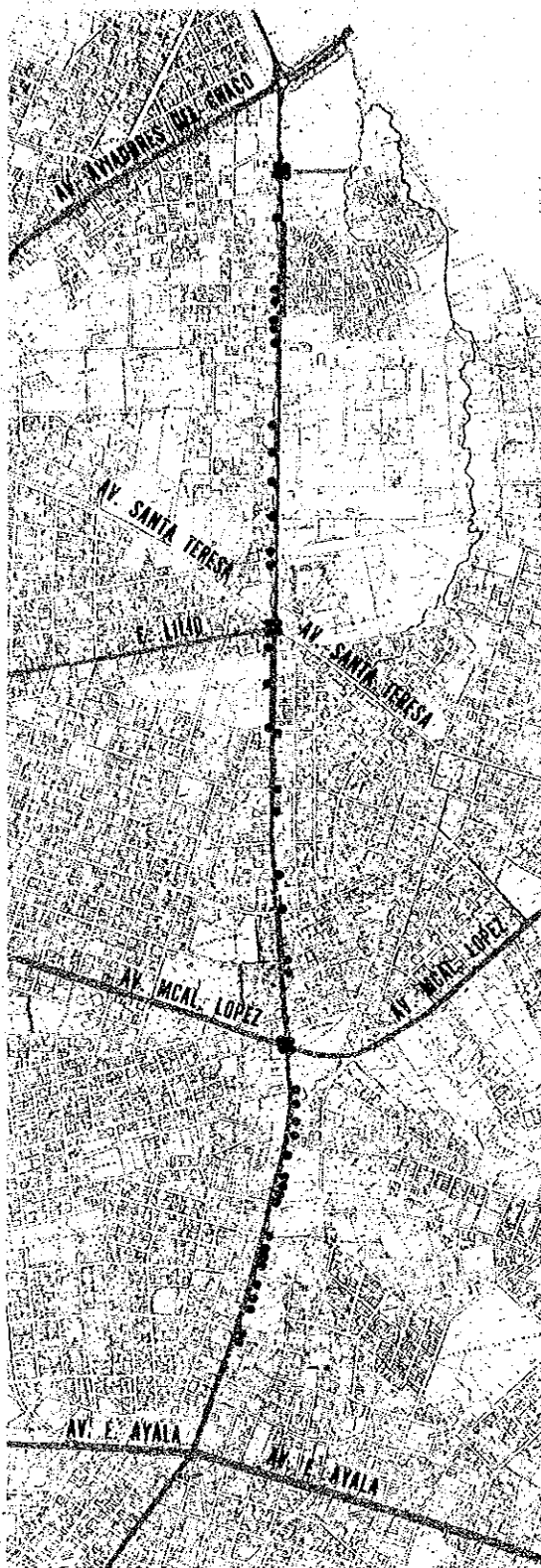


FIGURE 3-5-7 LOCATION OF EXISTING CROSSINGS ON MADAME LYNCH AV.

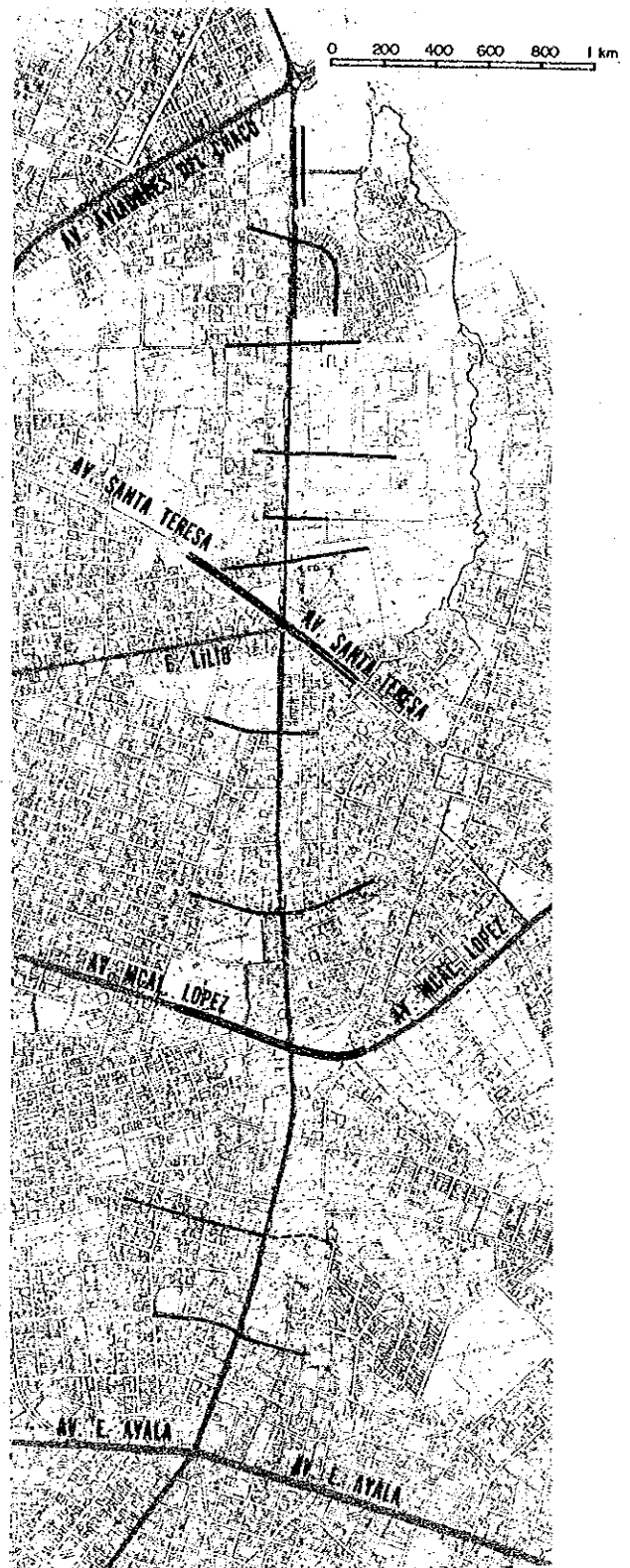


FIGURE 3-5-8 LOCATION OF PROPOSED CROSSINGS ON MADAME LYNCH AV.

3.5.3 Intersection Plan

In FIGURE 3-5-9 the actual traffic volume is presented by direction in the peak hours of the principal intersections of Mme. Lynch Av., which are the ones where Mme. Lynch Av. meets: Mcal. López, Santa Teresa and Aviadores del Chaco Avenues. In FIGURES 3-5-10 and 3-5-11, the same traffic volumes for the years 1992 and 2000 are shown. FIGURE 3-5-12 shows total traffic volume in peak hours at the above mentioned intersections and the intersection with E. Ayala Av.. Saturation flow rates are indicated in FIGURE 3-5-13.

Excluding the intersection formed with E. Ayala Av., the saturation flow rates of the remaining intersections will not reach up to 1.0 in the year 1992, but for the year 2000, the intersection with Mcal. López Av. will be equal to 1.0. However, some modification of the intersection might ease the saturation flow rate, so a reform plan for that intersection will be thought in the at-grade intersection.

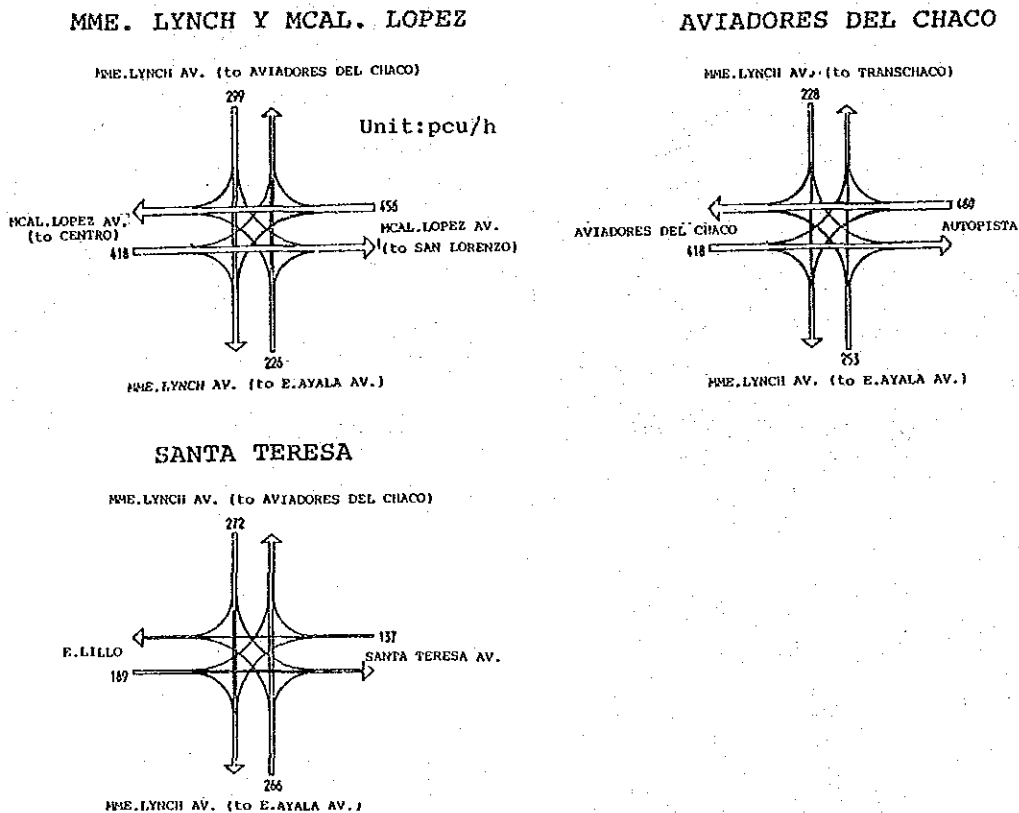
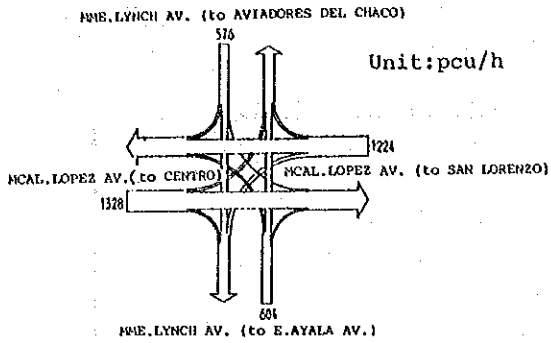
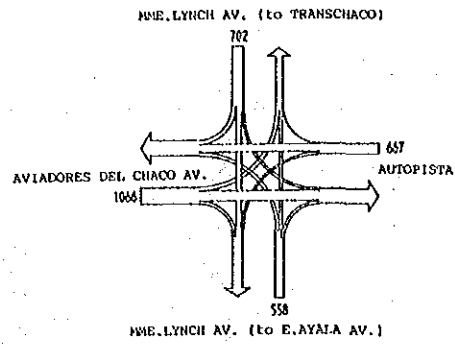


FIGURE 3-5-9 INTERSECTION TRAFFIC VOLUME ON MADAME LYNCH AV. IN 1987.

MCAL. LOPEZ



AVIADORES DEL CHACO



SANTA TERESA

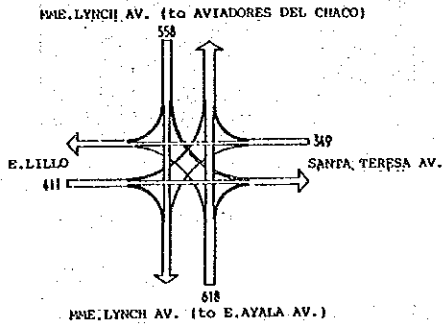
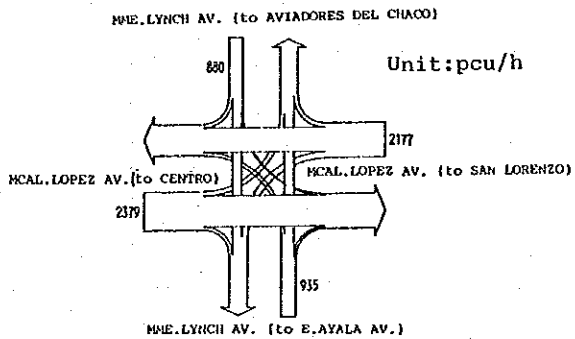
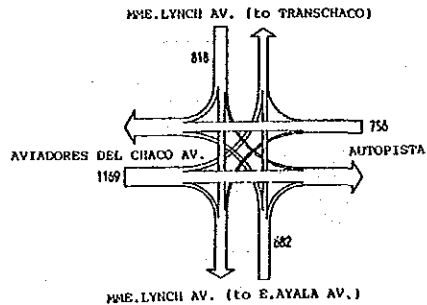


FIGURE 3-5-10 INTERSECTION TRAFFIC VOLUME ON MADAME LYNCH AV. IN 1992

MCAL. LOPEZ



AVIADORES DEL CHACO



SANTA TERESA

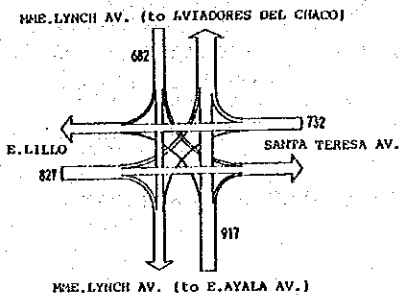


FIGURE 3-5-11 INTERSECTION TRAFFIC VOLUME ON MADAME LYNCH AV. IN 2000

1,000 pcu/h

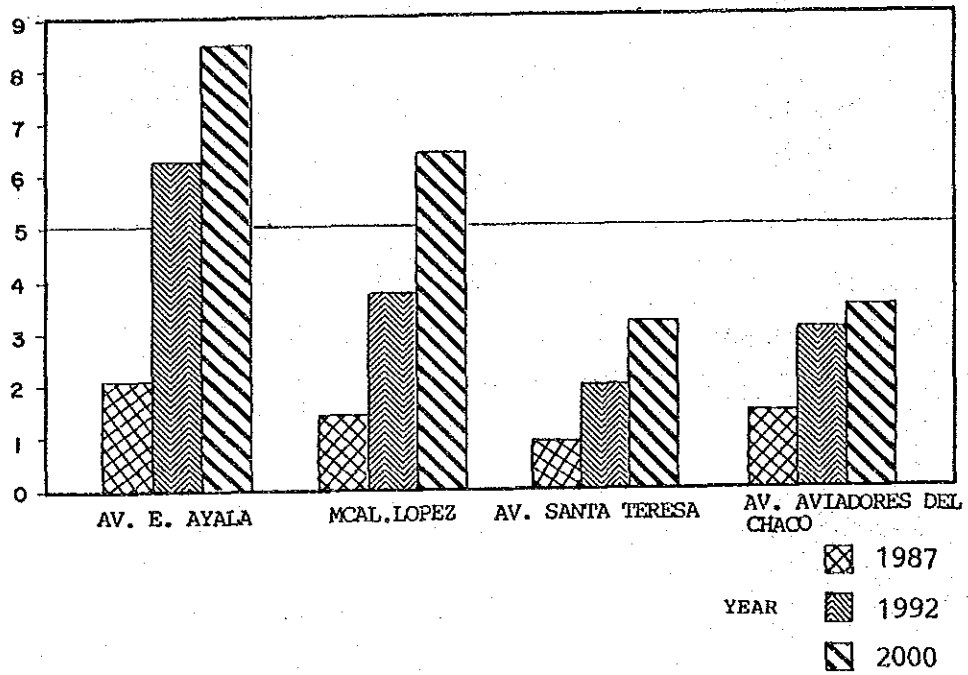


FIGURE 3-5-12 APPROACHING TRAFFIC VOLUME AT INTERSECTIONS ON MADAME LYNCH AV.

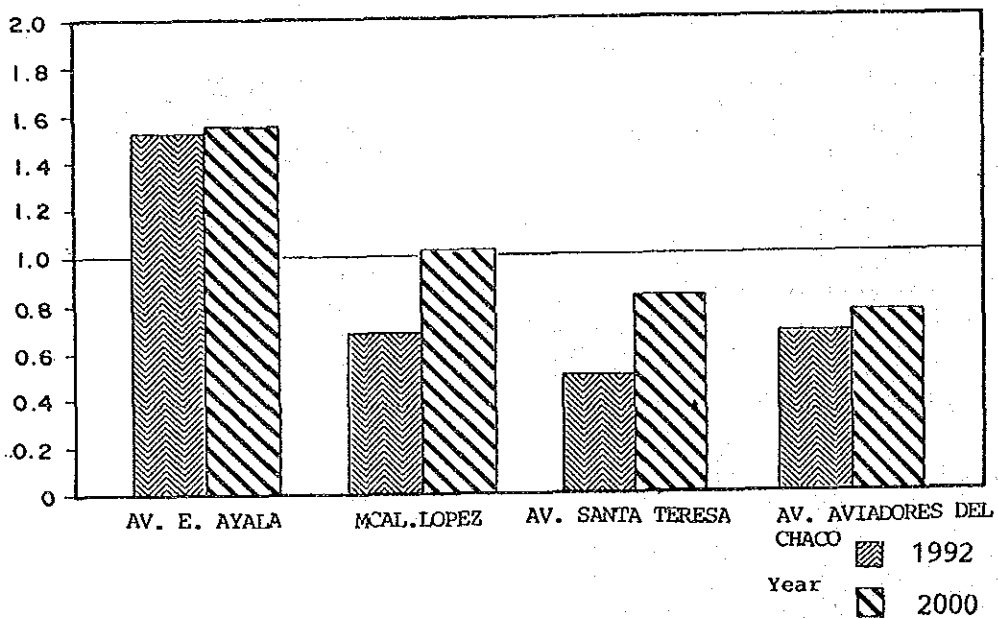


FIGURE 3-5-13 SATURATION FLOW RATE AT INTERSECTIONS ON MADAME LYNCH AV.

3.6 MICROCENTRO TRAFFIC PLANNING

The actual main problems are the difficult pedestrian-automobile crossing, and the small parking space.

In the Master Plan the following basic policy have been defined.

- a. At present all traffic modes use the same street. The Microcentro traffic network is a dense square arrangement, and presents many options, so pedestrian - automobile mixed traffic must be divided to preserve the security, regularity and convenience to each one. It is recommended to classify each street into a pedestrian, car or public transport street.
- b. The commercial activity is concentrated to some extent, so the pedestrian traffic ambience will be improved. A pedestrian traffic priority will be assured basically modifying the actual system where the automobiles possess traffic priority. The pedestrian axis should have first priority and must be established along the commercial one, and an access between this axis and the Public Transport axis should be secured.
- c. The pedestrian and commercial axis must be supported by the Public Transport axis.
- d. It is important that the car traffic axis should have continuity with the suburban traffic network, so in its definition, easy access to the Microcentro system and its distribution within it must be considered.
- e. Furthermore, for the car traffic axis, new parking areas will be included and street parking will be limited to guarantee the security and regularity of the traffic flow. The traffic flow in Microcentro relies on that in the sub urban area. The traffic flow in the year 1992 is used as the basis of Microcentro traffic planning, with the following premises:
 - 6 lanes for E. Ayala Av.
 - 4 lanes for R. de Francia Av., section Colón to EE.UU.

3.6.1 Sub-Zoning

1) Land Use in the Microcentro

The present building is shown in FIGURE 3-6-1. The figure shows that:

- a. The shops are located in an east/west direction on Pte. Franco and Eligio Ayala streets between Brasil street and Colón Av., and in a North/South direction on Chile street,

between N.S. de la Asunción and Independencia Nacional streets.

- b. Public institutions such as Palacio de Gobierno, el Cabildo, the Government Secretaries bureaus, Central Post Office, Impuestos Internos, the Cathedral and others are concentrated from Pte. Franco/E. Ayala Streets to the Costanera (river coast street) making up the City Civic Center (See FIGURE 3-6-2).
- c. The inhabited areas are spread from F.R. Moreno/Humaitá Streets to the southern part of the city.

It is estimated that the density of the commercial city area will expand in future to the southern part of the city. Consequently, based on the actual land use and its tendencies, the future land use by zones has been delineated, as shown in FIGURE 3-6-3.

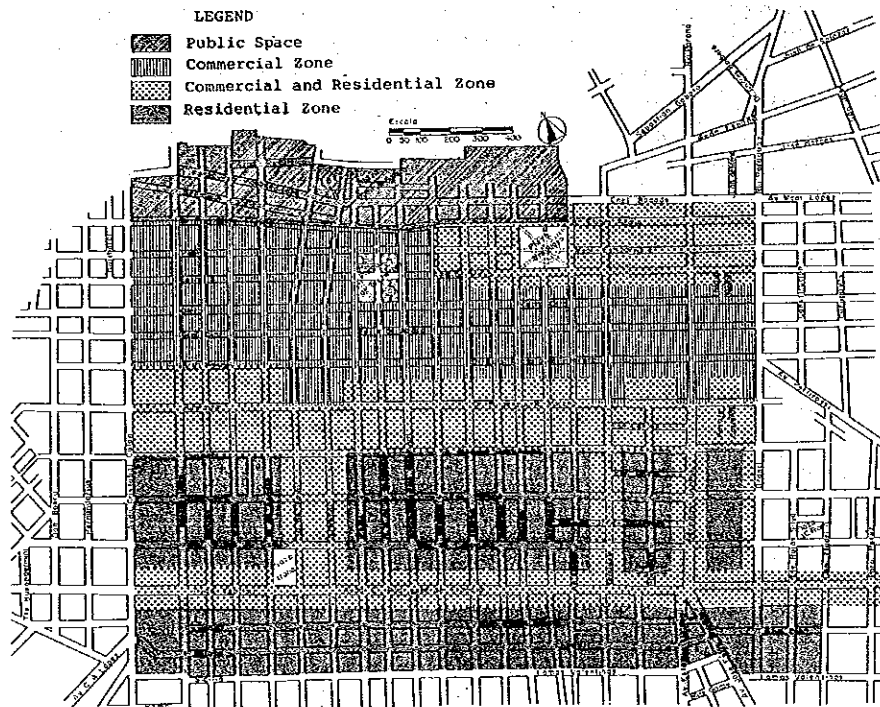
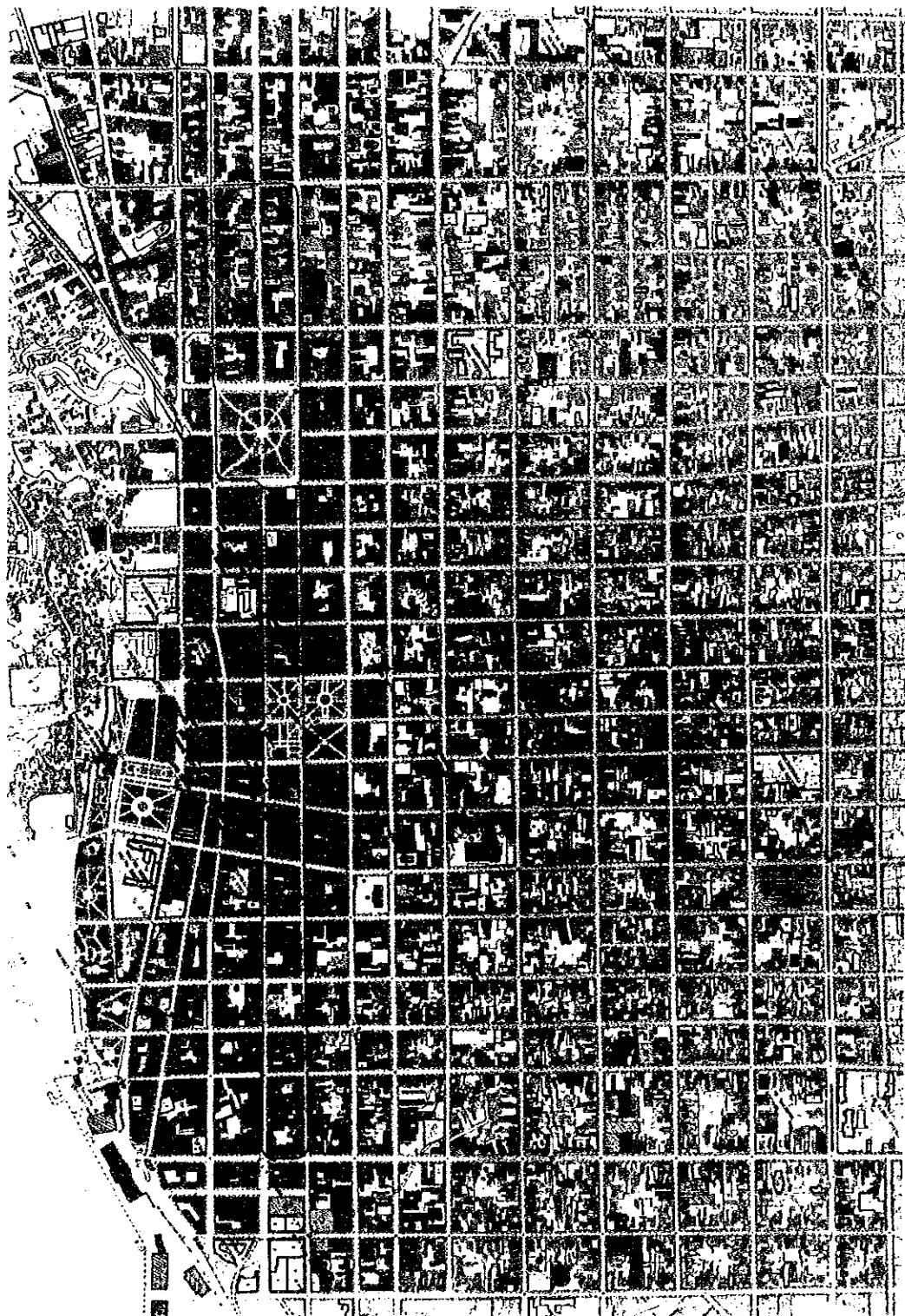


FIGURE 3-6-3 FUTURE LAND USE IN MICROCENTRO

The sub-zones are divided as follows:

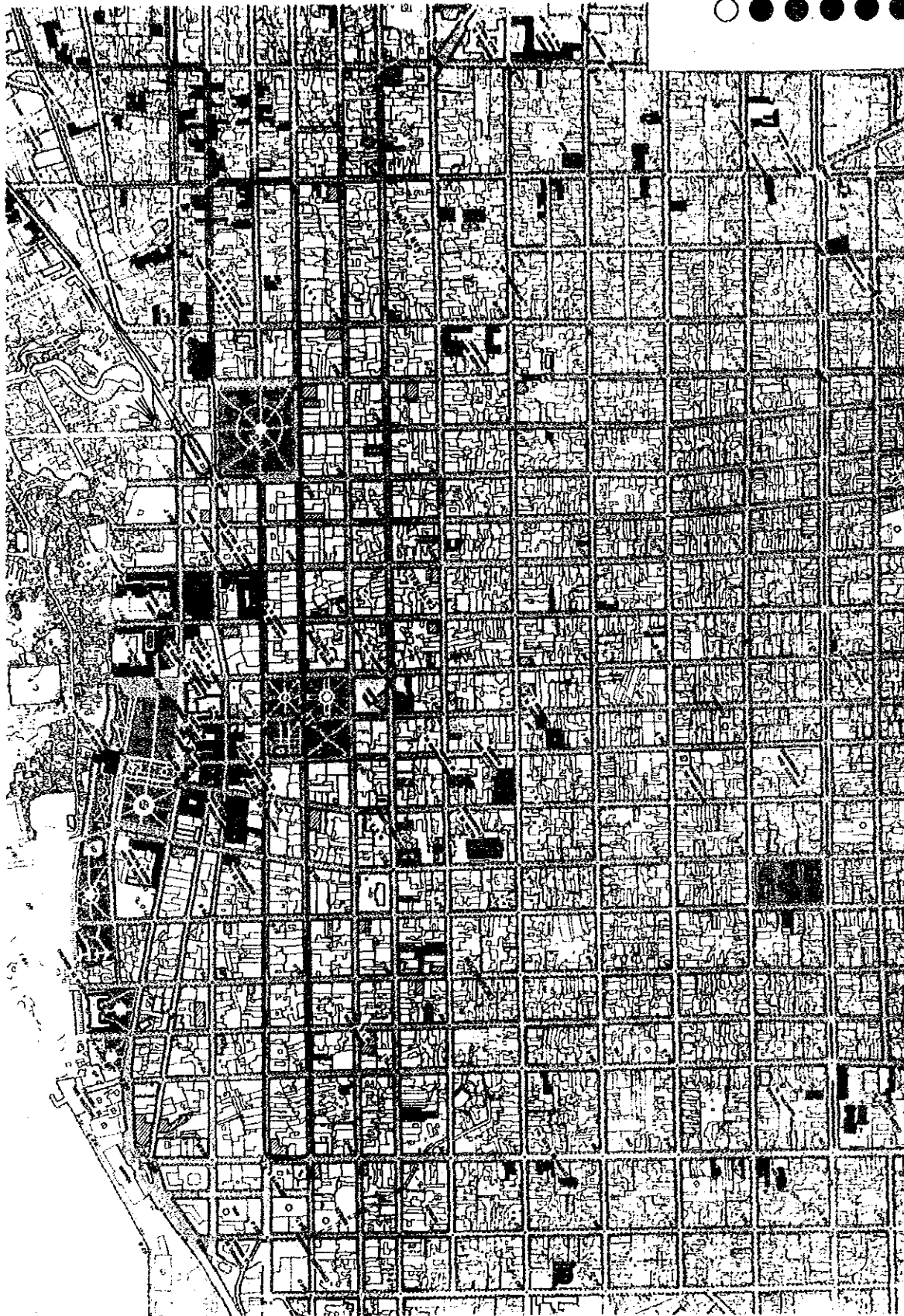
- a. Civic Center (area surrounded by Pte. Franco/E. Ayala St., Paraguay River, Colón Av. and Tacuary St.) Buildings, public institutions, parks, churches and schools areas for community use are located here.
- b. Commercial Zone (area surrounded by Pdte. Franco / Eligio Ayala St., E.V.Haedo/L.A. de Herrera St., Colón Av. and Brasil St.). Zone with a concentration of shops, and with East/West bus lines.



LEGEND

- Resident
- Shops
- Offices
- Resident-Shops
- Offices-Shops
- Resident-Office
- Public Institution
- Military Institution
- Vacant
- Under Construction
- Industry
- Deposit
- Hospital
- School
- Greenery

FIGURE 3-6-1 PRESENT BUILDING USE IN MICROCENTRO



- LEGEND
- Historical Building
 - School
 - Church
 - Hospital
 - Theatre
 - Public Institution

FIGURE 3-6-2 LOCATION OF PUBLIC INSTITUTIONS

c. Commercial Inhabited Mixed Zone (area surrounded by 25 de Mayo, Yegros and Brasil Streets)

- Area surrounded by Cnel. Bogado, 25 de Mayo Yegros and Brasil Streets.
- E.V. Haedo/L.A. de Herrera Street, Piribebuy/M. Domínguez Street, Colón Av., Brasil Street.
- Alberdi St., 14 de Mayo St., Tacuary St., Estados Unidos Av., Brasil St. Area along R. de Francia Av. / Ygatimí St. Zones adjustment to the commercial zones and with high volume traffic.

d. Residential Zone (the remaining area)

2) Traffic Cell

According to future land use, each zone will be sub-divided into sectors. Each sector will be delimited by the car traffic axis to facilitate inter sector movement. A zonal system, where the access will be done through the traffic axis, and inside the sector where flow will be distributed through local streets, will be introduced. Principally, the car traffic axis crossing will not be allowed.

The following criteria has been adopted for the sectors division:

- a. Each sector side will be around 500 square meters for the convenience of pedestrians.

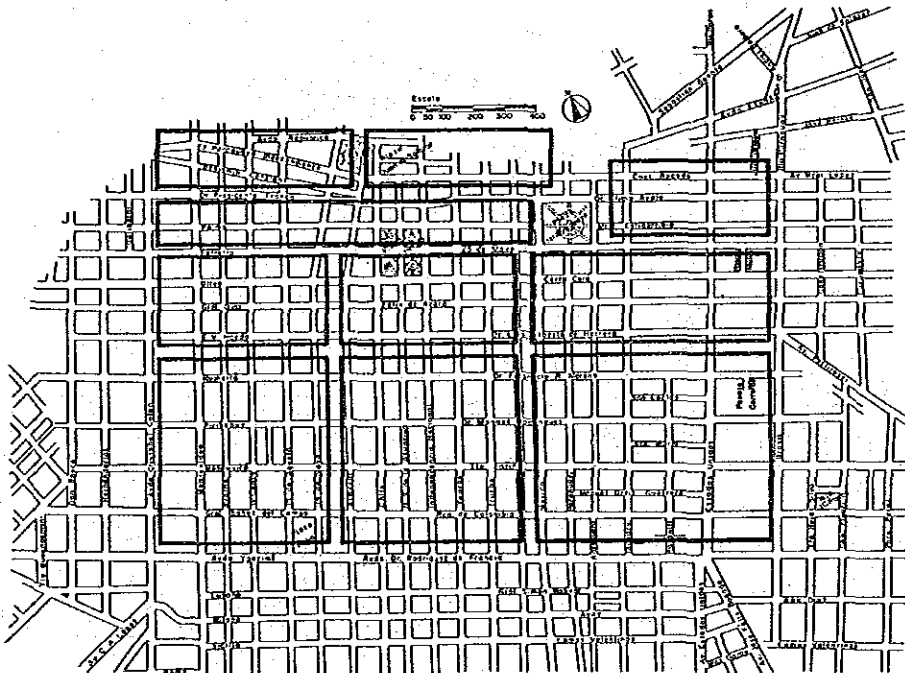


FIGURE 3-6-4 TRAFFIC SUB ZONES

- b. To preserve the continuity of the Palma street, there will be central commercial axis with an uninterrupted length of approximately 1km.

Based on these criteria, 9 sectors have been divided as shown in FIGURE 3-6-4. Out of the 9 sectors, the one surrounded by Humaitá, R. de Francia Av., Caballero and Brasil Streets, the east / west side has a length of approximately 700 meters. The block between Tacuary and Brasil Streets are larger than the others, and the sectors cannot be sub-divided because in this case each square block would be enclosed by the car traffic axis.

3.6.2 Traffic Flow Plan

1) Relation with the Master Plan

As shown in FIGURE 3-6-5, the division of the traffic flow has been proposed in the Master Plan defining Palma and Estrella Streets, as pedestrian axis, public transport axis in the east-west orientation and private car traffic axis in the North/South orientation.

Based on this statement, for the present, it is proposed, principally, to enlarge the center area and it's division in sectors according to land use. Principally based on this idea, the traffic flow will be planned for the enlarged areas, to determine the sectors corresponding to the land use.

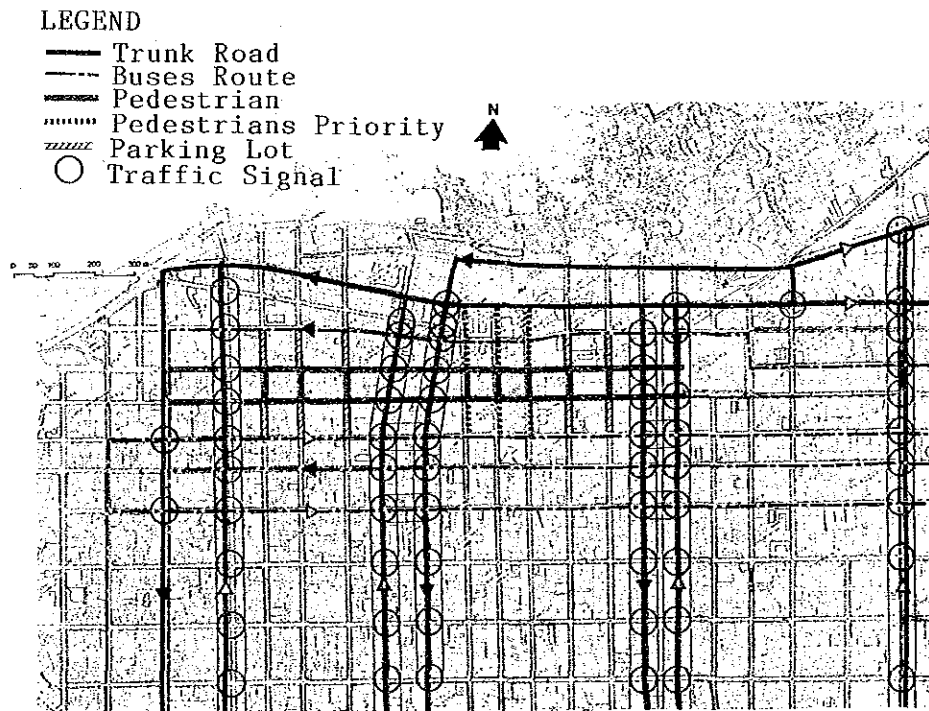


FIGURE 3-6-5 PROPOSED TRAFFIC FLOW IN MASTER PLAN

2) Traffic Axis Determination

(1) Public Transport Axis

The Public transport axis must be arranged to facilitate the access and distribution of the passengers to each sector. The axis passing across the center of each sector will be most convenient for the users. The actual buses itinerary network uses most of the downtown streets (9 out of the 12 East/West Streets and 14 out of the 20 North/South Streets), as shown in FIGURE 3-6-5, so it is necessary to integrate the buses itinerary to organize the public transport axis.

However, to unify the itinerary it is necessary to integrate the bus companies and it implies many problems. The most important bus companies profit comes from the suburbs -downtown trip users, so all the companies want to include downtown in their itinerary. In consequence, the public transport axis will be determined considering the rerouting in the north/south orientation only, and leaving the itinerary in the East/West orientation at present.

A) Bus Itinerary

The itinerary inside the Microcentro will be integrated as shown in TABLE 3-6-1, taking the following aspects into consideration:

TABLE 3-6-1 PLAN OF BUS ITINERARY

Direction	Street	Line No.	Note
East/West	Pta. Franco/ E. Ayala	1-4-6-8-11-17-23-30 31-37-39-41.	
	Oltava/ Cerro Corá	1-8-9-12-15-16-23- 25-28-30-31-35-36 37-44-47.	
	Gral. Díaz/ Azuara	9-10-14-15-16-19-21 23-26-27-28-29-30- 40-44-45.	
	E. V. Huérfan/ Herrera	5-10-11-14-21-26-27 29-33-30-39-4-22- 45-19-32.	
	Humboldt/ F.R. Moreno	20-22-24-32-33-34 35-36-40-46-5.	2 up to Ind. Nacional.
	Piribebuy/ N. Dominguez	3-19-22-32-40.	
	14 de Julio/ Tta. Fariña	38-2-4-20-33-40.	2-38 up to EE.UU 4-20-33-40 up to Ind. Nacional
	L. del Campesino/ Rca. de Colombia	25-18-5-46.	
	Yguel/ R. de Francia	30-3-4-8-38.	3 up to Ayolas. 4 & 8 up to Brasil. 38 up to Ntra. Sra. de la Anunciación.
	North/ South	Colón	1-6-8-9-10-12-13 14-15-16-20-21-23 26-29-30-31-33-34 35-36-37-38-40-44
Ayolas		3 (up to R.de Francia)	Integration of Ayolas & 15 de Agosto.
O'Leary		3-40-9-30.	Integration of O'Leary & Montevideo.
Ind. Nacional		2-38	Integration of Chile & Ind. Nacional.
Tegros		41-42.	Integration of Tegros & Ntra. Sra. de Anunciación.
México		3-19-22-32-40.	
Paraguari			
Antequera			
EE.UU		8-17-20-24-3-46 26-33-40.	
Brasil		8-14-23-24-34-35 36-37-38-3-46.	

- a. If it is possible, the bus itinerary must cross the center of each sector.
- b. To move the buses itinerary from Montevideo Street, where synchronized traffic lights have been installed, because the buses that frequently stop on the street do not need that sort of equipment.

The bus traffic volume before and after the itinerary integration is shown on FIGURES 3-6-6 and 3-6-7.

B) Public Transport Axis

The bus traffic capacity is calculated based on:

- a. If the bus stopping time is 1.5 min. at a bus stop, a bus berth capacity will be 45 unit/hour.
- b. If the bus berths quantity is increased, vehicular traffic will difficult. Therefore the streets where the bus traffic capacity is greater than 135 buses/hour during the peak hour is considered as public transport axis.

Thus, the street considered as public transport axis are (See FIGURE 3-6-8):

Oliva/Cerro Corá	(Colón-Brasil)
Gral. Díaz/Azara	(Colón-Brasil)
Haedo/L.A. Herrera	(O'leary-Brasil)
Colón	(Pte. Franco-Ygatimí)
O'leary	(Haedo-Ygatimí)

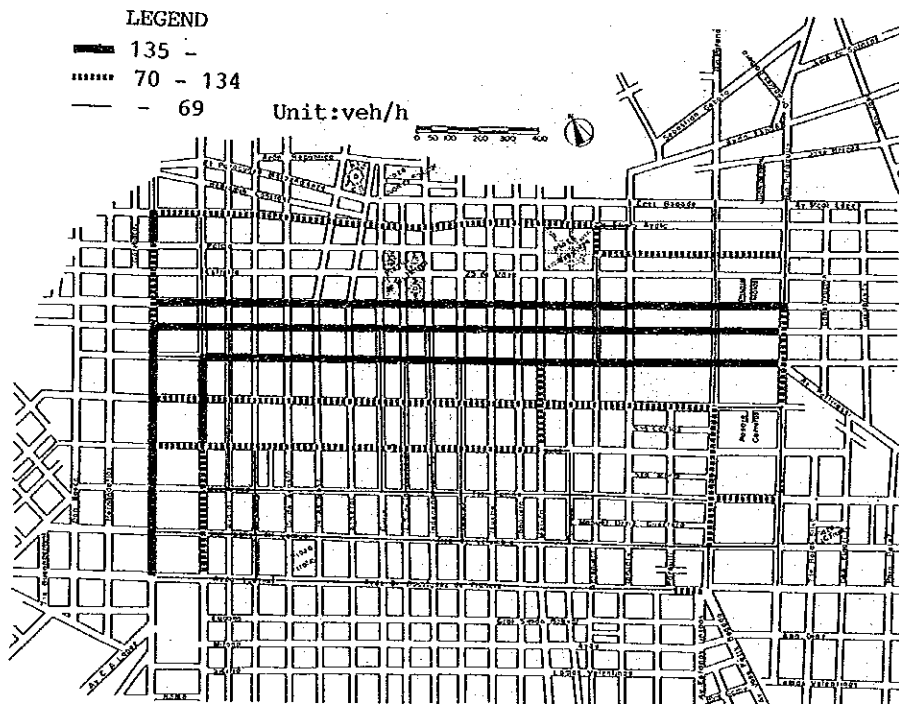


FIGURE 3-6-6 BUS VOLUME BY ITINERARY IN 1992

The buses will have priority on the streets determined as public transport axis, so the actual bus prohibition to change lane to go ahead must be removed and two lanes assured for public transport traffic. In these axis the private vehicles will be mixed with the buses.

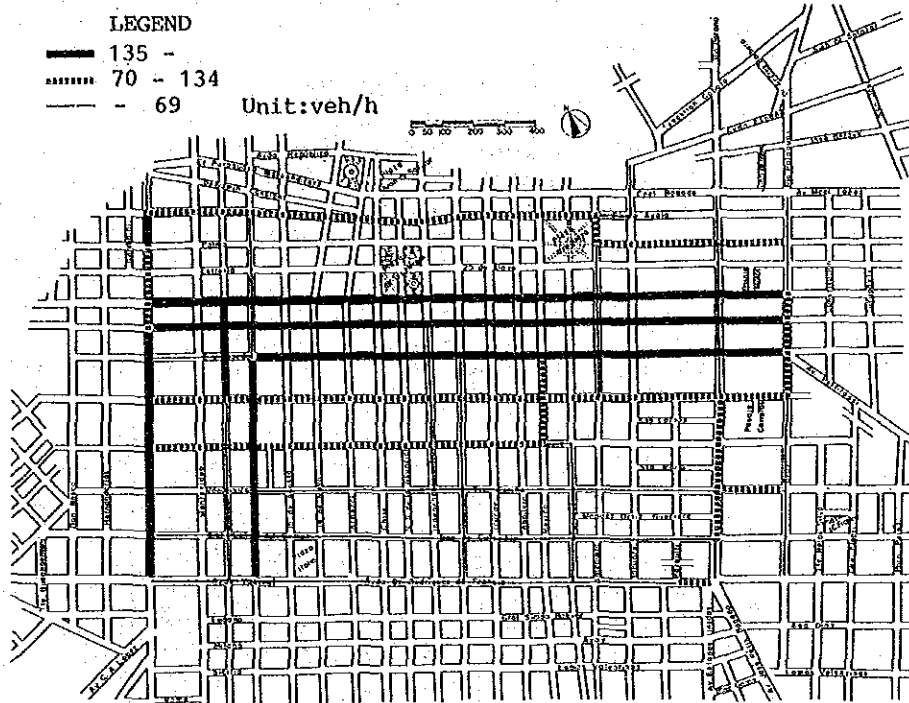


FIGURE 3-6-7 PLANNED BUS VOLUME BY ITINERARY IN 1992

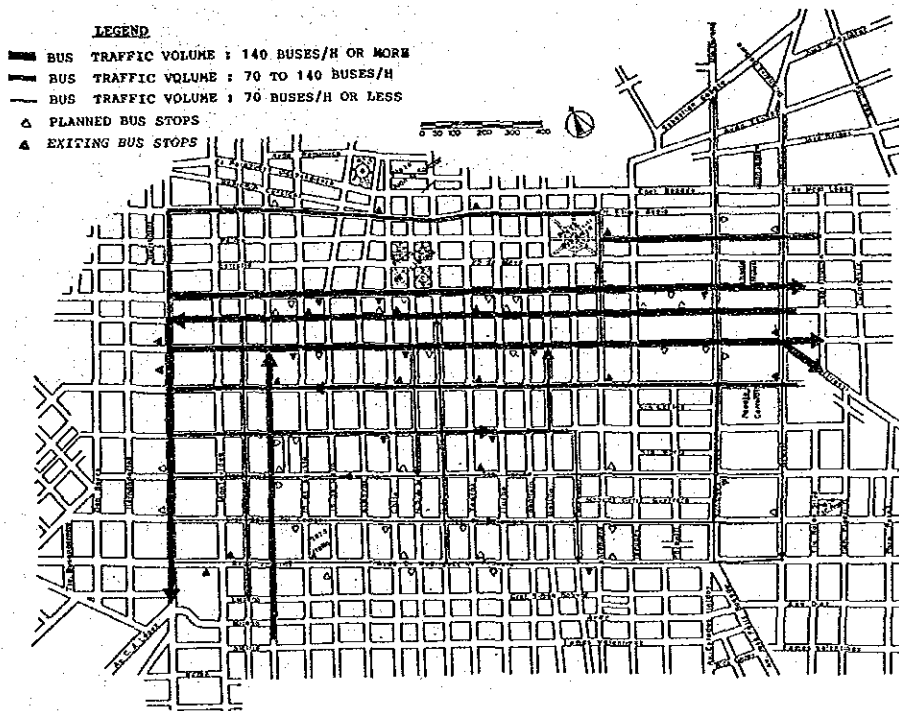


FIGURE 3-6-8 PUBLIC TRANSPORTATION AXIS

C) Bus Stop

Actually, bus stops are located in 5 places on the East/West oriented streets with average interval of 400 meters. But the buses also stop in other places according to the users demand, making the normal traffic flow difficult. In consequence, 4 bus stops on the East/West street will be placed at 500 meter intervals, so that the users would walk an average distance of 250 meters.

On the North/South oriented streets, bus stops will be located on bus priority streets, on Colón Av. and O'leary St., and on the others stops will not be allowed. The quantity of bus berths calculated at 45 unit/hour capacity is shown in FIGURE 3-6-9. The bus stops which require more than 4 bus berths will occupy two blocks. An example is illustrated in FIGURE 3-6-10.

In consequence, the bus stops in the Microcentro will be located as shown in FIGURE 3-6-8.

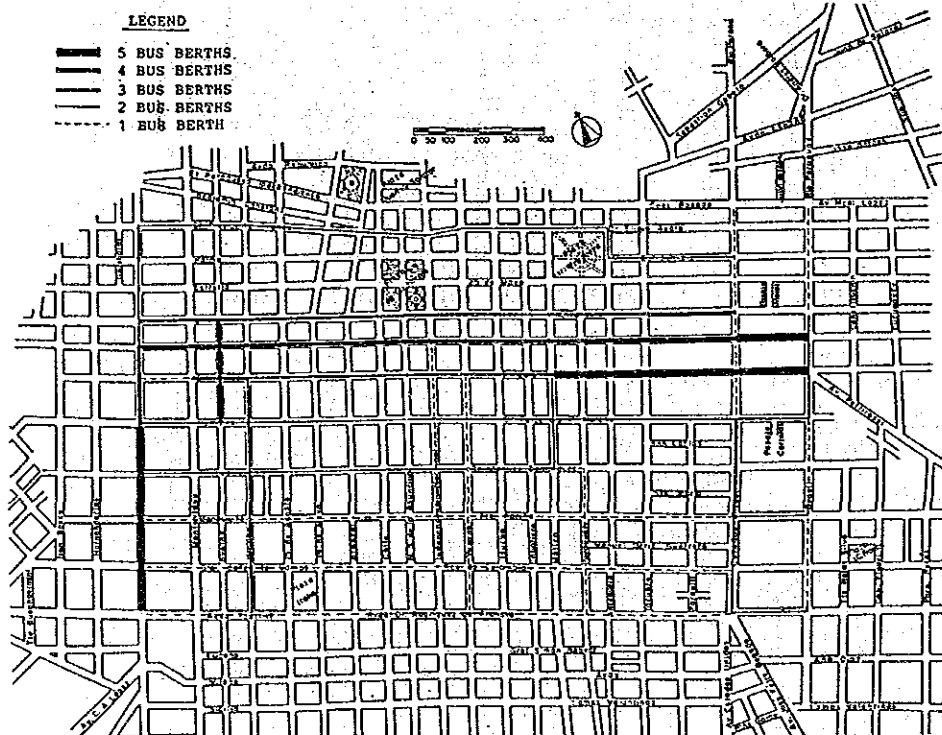


FIGURE 3-6-9 BUS BERTHS REQUIREMENT

D) Problems for Traffic Circulation on E.V.Haedo and O'leary Intersection

In this corner, O'leary Street which has been determined as a public transport axis and will have a great volume of buses turning right, has a 6%-7% gradient. If the buses stop on this slope as located before entering into Haedo street, there will be many traffic security risks. Because of the slope, the front bus can go backwards when starting and crash into the bus behind it.

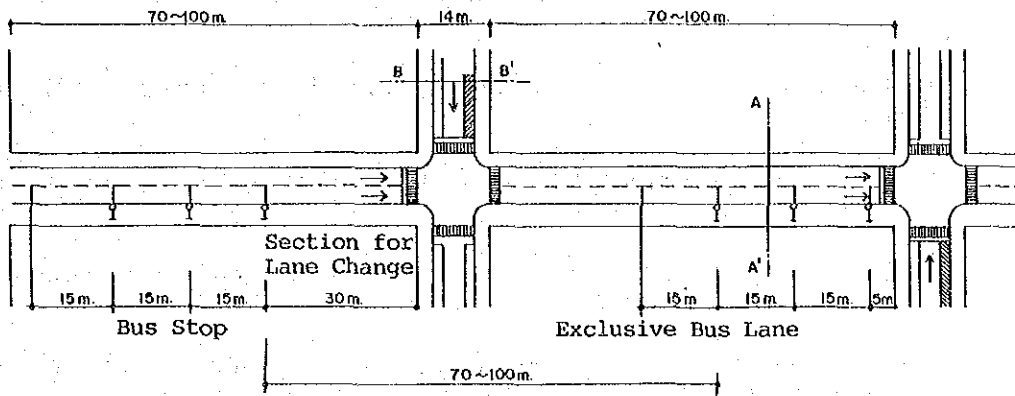


FIGURE 3-6-10 BUS STOP LAYOUT (EXAMPLE)

Therefore, vehicles turning right directly from O'leary to E. V. Haedo Streets will be allowed to do so without stops at the intersection. The vehicles from E. V. Haedo Street will be obliged to stop and the entrance and the access to the street will be done in just one lane, considering that the volume of buses during the peak hours on that street is estimated to be at the low level of 30 buses/h in the year 1992 (See FIGURE 3-6-11).

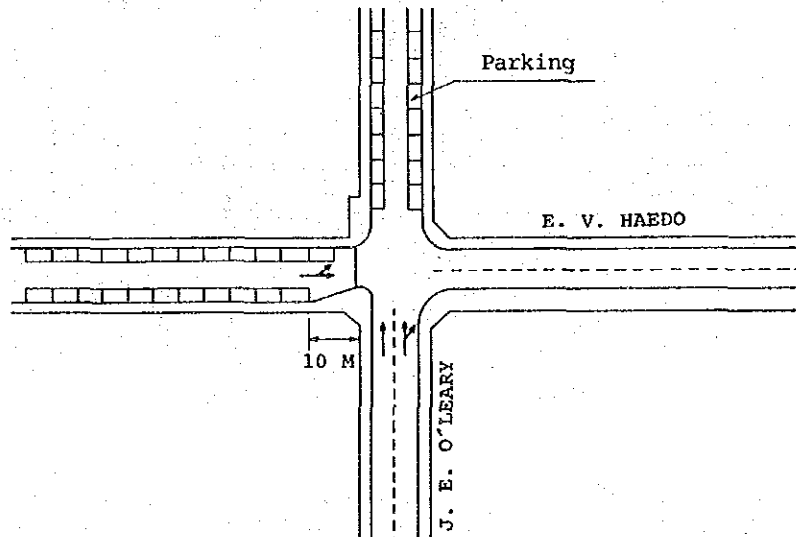


FIGURE 3-6-11 INTERSECTION IMPROVEMENT LAYOUT (O'LEARY AND E.V.HAEDO)

- (2) Pedestrian Axis
- A) Pedestrian Service Level

The pedestrian volume of the Microcentro and the street service levels were obtained by observations on each street. The sidewalk services level were classified as follows (See FIGURE 3-6-12):

- a. Pedestrian space less than $3.7\text{m}^2/\text{person}$ (equivalent to a H.C.M. level C)
- b. Pedestrian space between 3.7 and $12.0\text{m}^2/\text{person}$ (H.C.M. level B)
- c. Pedestrian space between 12.0 and $24.0\text{m}^2/\text{person}$ (greater than the H.C.M. level A)
- d. Pedestrian space greater than $24.0\text{m}^2/\text{person}$ (greater than the H.C.M. level A)

The pedestrian spaces were modified considering the existing trees and stands. The following streets have a low pedestrian service level:

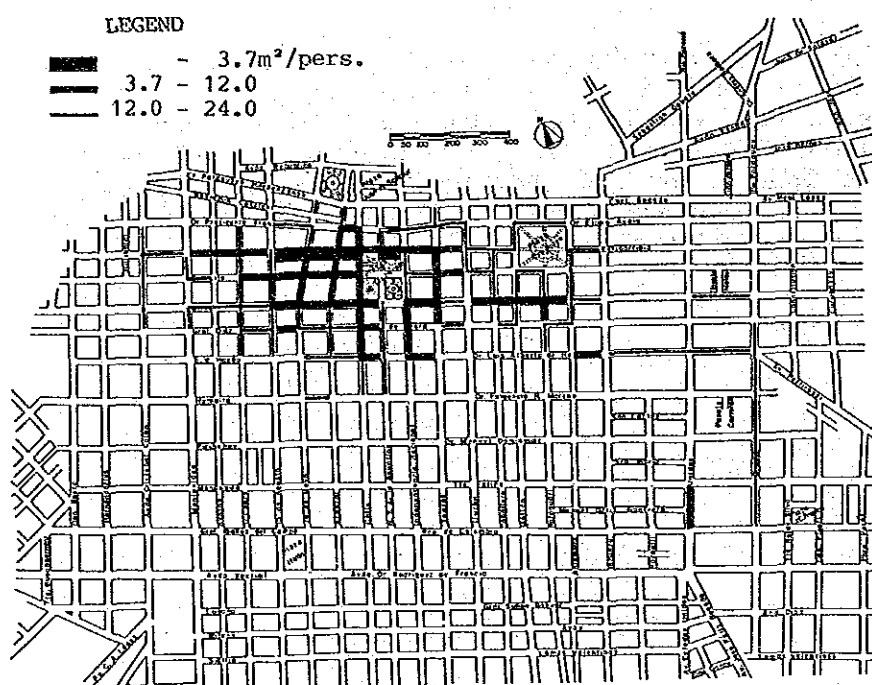


FIGURE 3-6-12 PEDESTRIAN SPACE

- a. On Palma St. and Estrella St., where most commerce concentration is located, the pedestrian traffic column is high and the pedestrian service is low.
- b. The service level is really low between Yegros St. and O'leary St.
- c. On the North/South orientation, the low service level on Chile St. is glaring and that is because that street provides the pedestrian traffic for the main route between the bus stops and the commercial center.

The Cerro Corá and Haedo Streets have low pedestrian service level near Estados Unidos Av. due to the high concentration of stores and bus stops.

However, when walking on them the streets were felt more congested, than the services level indicated. The reason is because the trees and stands reduce the available sidewalk space to 1 m, making the linear circulation more difficult that way (See PHOTO 3-6-1).

PHOTO 3-6-1 DECREASING USEFUL WIDTH OF THE SIDEWALK DUE TO KIOSKS



B) Confusion Level

The degree of vehicular and pedestrian traffic confusion can be calculated by the following formula;

$$C = P/L + Q$$

Where, C : Degree of confusion

P/L: Pedestrian volume - section length rate (psn./m)

Q : Hourly traffic volume in pcu)

Relationship between pedestrian density (P/L) and pedestrian service level is;

Pedestrian service level	Pedestrian Space (m ² /psn.)	P/L (psns./m ²)
a	3.7	1.08
b	12.0	0.33
c	24.0	0.17

The calculation premises are:

walking speed = 1.0 m/s
sidewalk width = 4.0 m
street length = 100 m

Q = Peak traffic volume on:
 E. Ayala Av.: 850 pcu/L (2 lanes per one direction)
 Fdo. de la Mora Av.: 600 pcu/L
 (2 lanes per one direction)
 J. Félix Bogado Av.: 600 pcu/L
 (2 lanes per one direction)

C = Confusion Level (see following table);

Confusion Level	Standard	Application
1	900 (psns./m ²)	1.08 x 850 = 918
2	600 - 900	1.08 x 600 = 648
3	300 - 600	0.33 x 850 = 280
4	200 - 300	0.33 x 600 = 198

The streets with the greatest confusion level and high pedestrian volumes are: Palma St. between Ind. Nacional and 14 de Mayo Sts., and Cerro Corá St. between Caballero and Tacuary Sts.

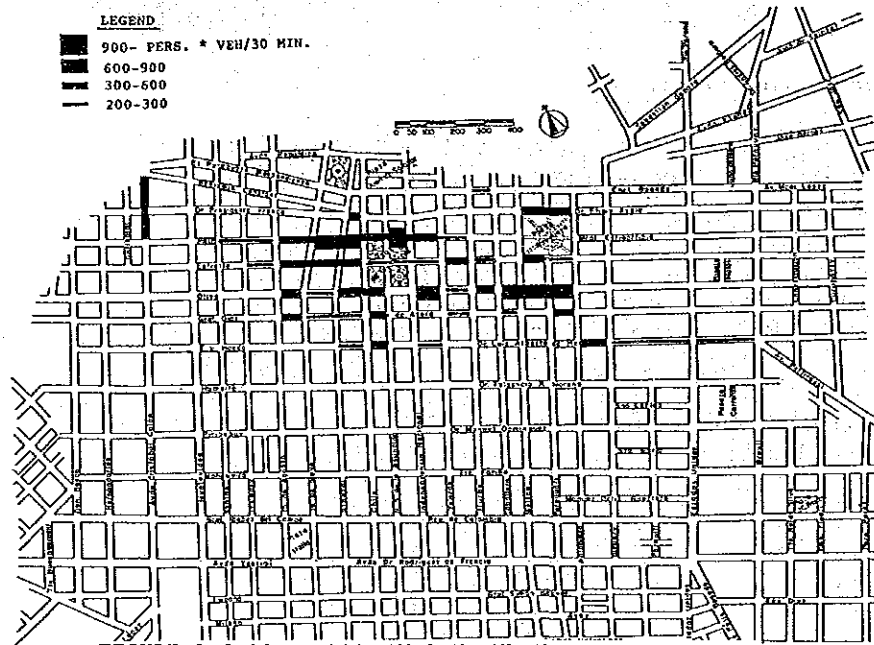


FIGURE 3-6-13 PEDESTRIAN AND VEHICULAR RATES

C) Exclusive Pedestrian Street

Because of its high degree of vehicular and pedestrian confusion, Palma street has many traffic problems, so it is convenient to assign it as a pedestrian street to symbolize the pedestrian traffic preference in the city center.

The part of Palma street which will be a pedestrian street is located between Yegros St. and O'leary St. (760 m length approximately) where the greatest pedestrian volume is observed (See FIGURE 3-6-14) and the most commercial activity will be concentrated.

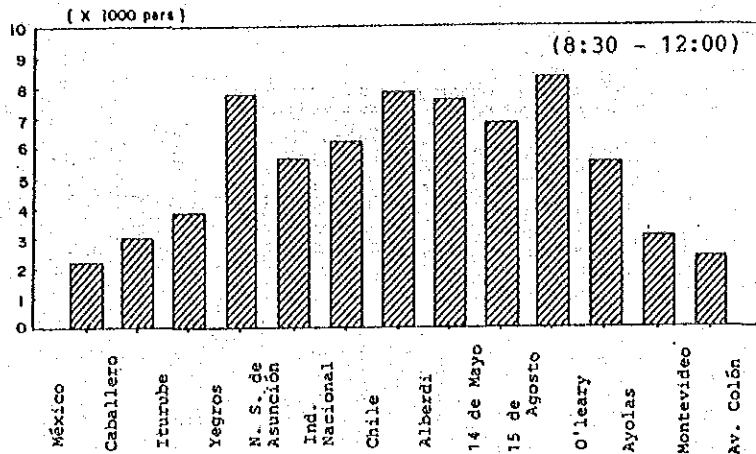


FIGURE 3-6-14 OBSERVED PEDESTRIAN VOLUME (PALMA)

D) Pedestrian Priority Street

The streets that will be used as access from the bus stops on the public transport axis toward the pedestrian street have high pedestrian traffic volumes, so the sidewalks must be enlarged 3.0 m - 4.0 m and should be planted to offer a comfortable area to the pedestrian. They will be preferably pedestrian priority streets.

The streets referred to above are:

- 15 de Agosto (from Pdte. Franco to Humaitá)
- Chile (from Pdte. Franco to Humaitá)
- Yegros (from E. Ayala to F. R. Moreno)

Besides, after the parking spaces have been installed, the pedestrian priority streets should be extended to Cnel. Bogado St.

E) Local Pedestrian Axis

About the pedestrian axis of the other sectors (especially in the residential sectors), in the same way as the priority pedestrian streets, only the streets with a North/South orientation will be equipped to handle the convenient circulation among each bus stop.

In consequence, the local pedestrian axis will be on the extension of the pedestrian priority streets. On those streets, sidewalks will not be made widened, but plants provided, to assure a comfortable pedestrian area. The pedestrian axis will be as shown on FIGURE 3-6-15.

(3) Vehicle Traffic Axis

A) Traffic Flow

As shown in FIGURES 3-6-16 and 3-6-17, the present east/west oriented vehicle traffic flow has the axis formed by the Cnel. Bogado St., R. de Francia Av. and 25 de Mayo St., but in the North/South orientation, with the exception of Colón Av., there is no well defined axis in an East/West extension of 2 km.

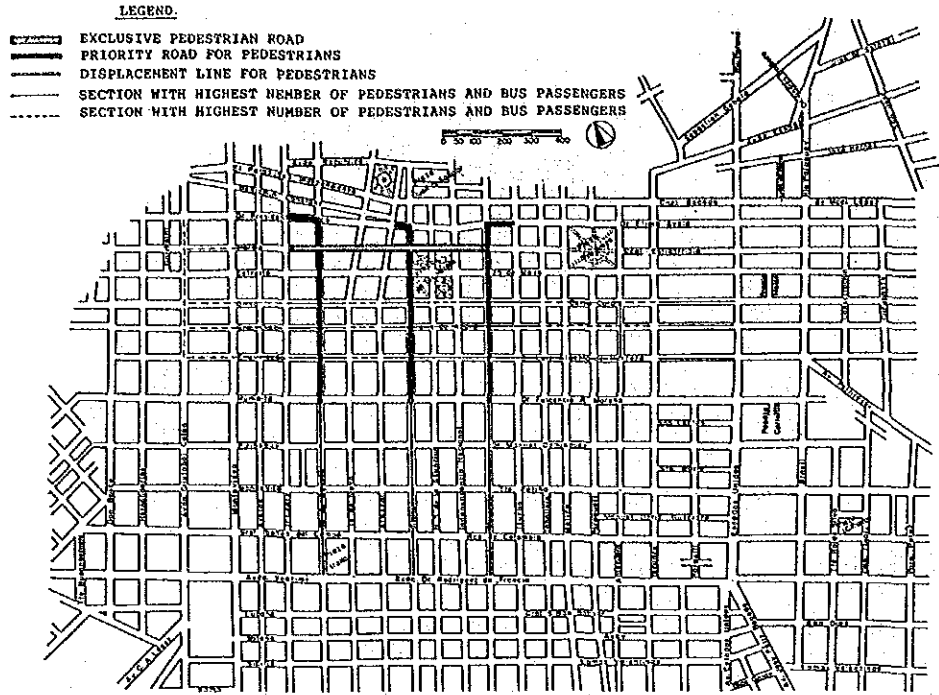


FIGURE 3-6-15 PEDESTRIAN AXIS

In the future, the E. Ayala Av. enlargement to six lanes and its connection to R. de Francia Av. will modify the present Microcentro access pattern and as shown in FIGURE 3-6-18, the access flow from R. de Francia Av. will increase 2.05 times by 1992, the access flow through Mcal. López Av. and adjacent streets will decrease in a rate of 0.78.

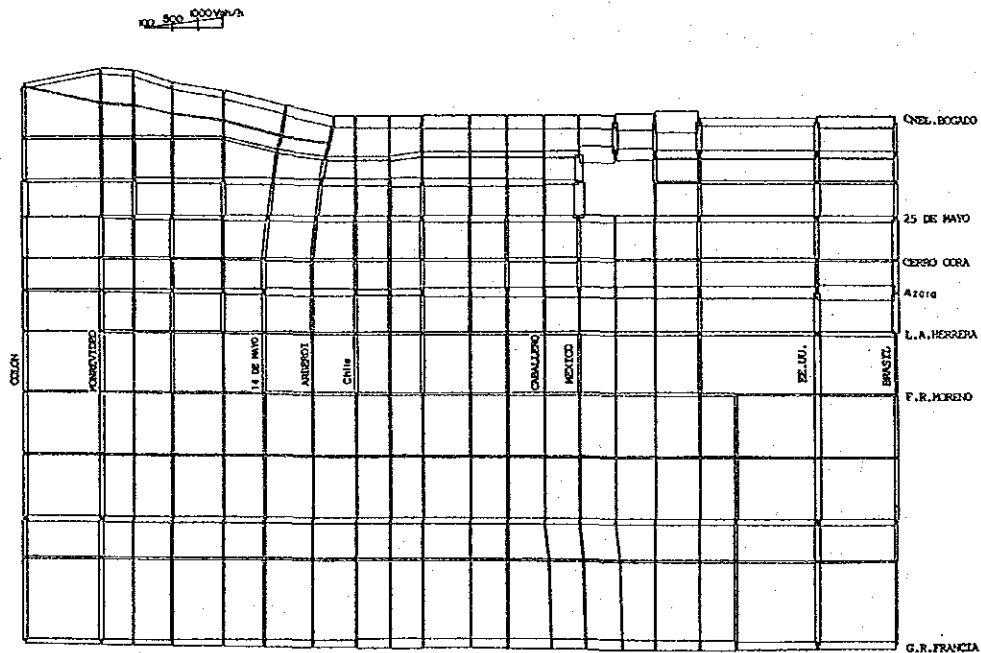


FIGURE 3-6-16 ACTUAL TRAFFIC VOLUME (PRIVATE VEHICLES, 7:00- 8:00)

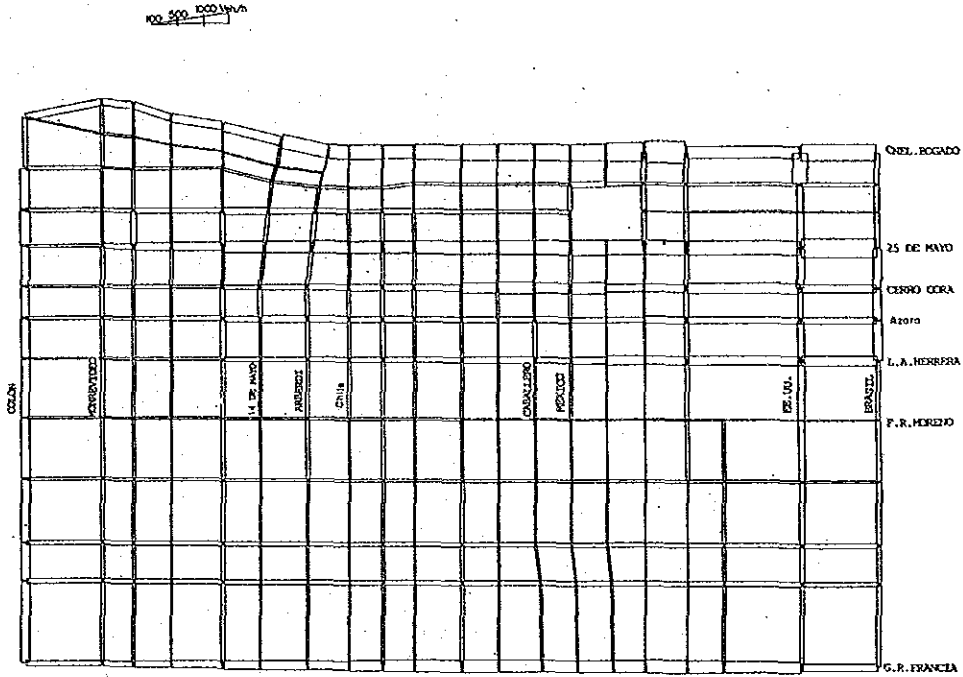


FIGURE 3-6-17 ACTUAL TRAFFIC VOLUME (PRIVATE VEHICLES, 11:30-12:30)

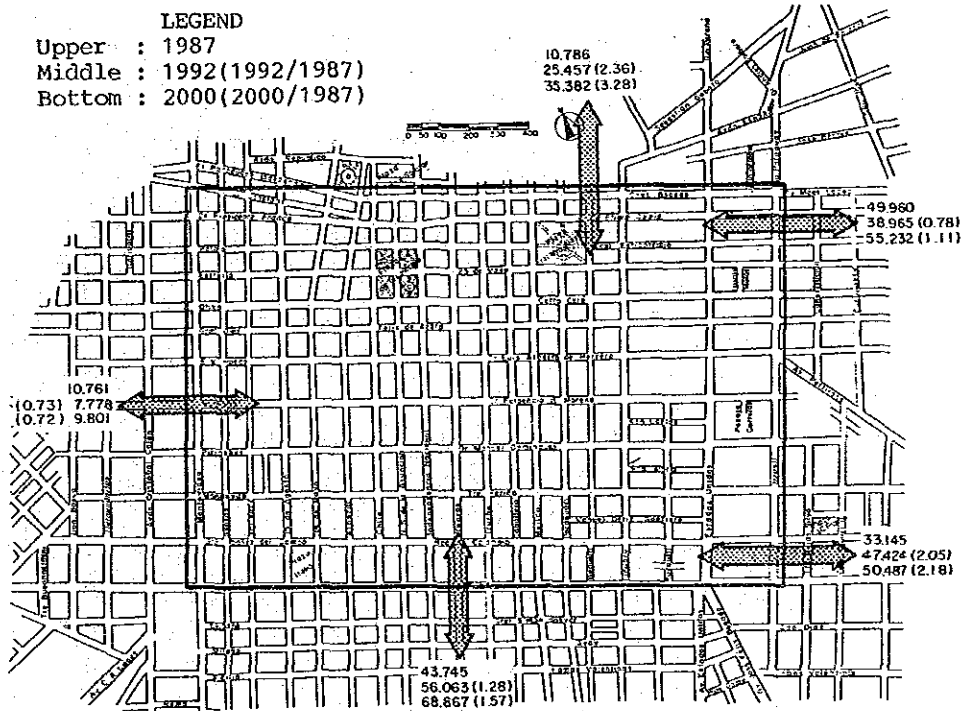


FIGURE 3-6-18 VEHICULAR CONCENTRATION TO MICROCENTRO

B) Vehicle Traffic Axis

The private vehicle traffic axis will be located at the boundary of each sector, forming a peripheral, to easily facilitate the vehicular access and distribution within a sector and inter-sector movement.

All the Microcentro streets, except Cnel. Bogado and R. de Francia Av., are one way streets, therefore the vehicle traffic axis were determined to be pairs of streets as below. (See FIGURE 3-6-19)

a. East/West Orientation

- Paraguayo Independiente / Cnel. Bogado (two way)
- R. de Francia Av. / Ygatimí (two way)
- 25 de Mayo / Estrella (one way)
- Humaitá / F.R. Moreno (one way)

b. North/South Orientation

- EE.UU Av. and Brasil (one way)
- México and Caballero (one way)
- Alberdi and Ygatimí (one way between Estrella and Ygatimí)
- Colón Av. and Montevideo (one way)

A synchronized signal system and parking restrictions are planned to assure vehicle traffic flow on these streets.

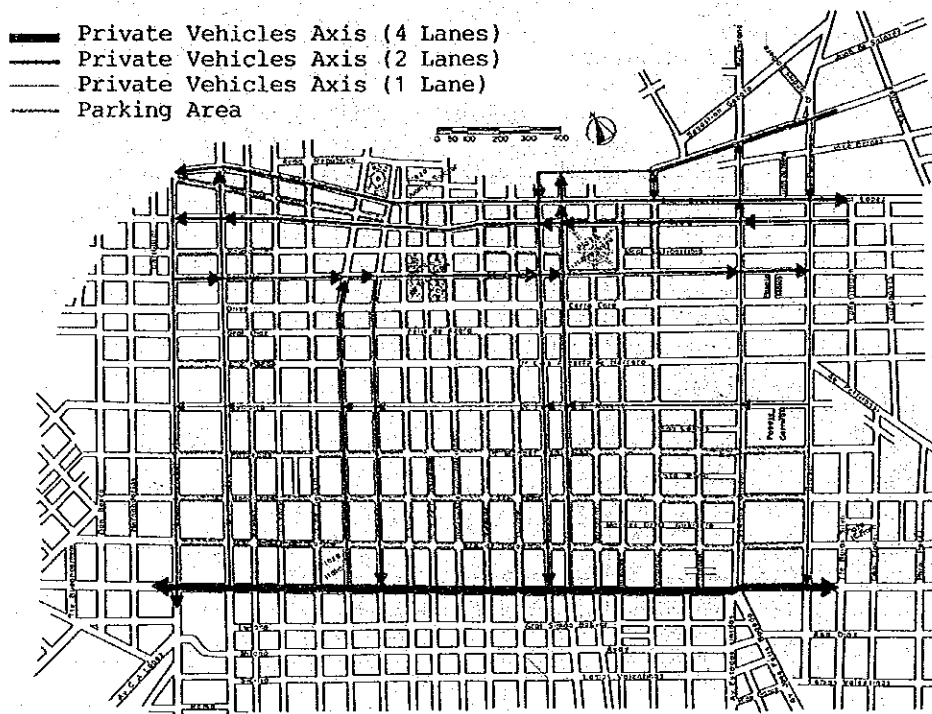


FIGURE 3-6-19 PRIVATE VEHICLES TRAFFIC AXIS

C) Local Street

The streets inside of the sectors enclosed by the main streets should be planned to be convenient for road side users, to serve as access to the main streets and to avoid through traffic. Therefore, parking on those streets will be allowed.

D) Traffic Control for the Traffic Cell

To obtain a traffic cell, it is recommended to clearly define the main traffic axis prohibiting the crossing through those axes by modifying the local streets traffic ways as shown in FIGURE 3-6-20. However, bus routes run on the East/West oriented streets, so it is difficult to change from one way to two way or vice versa.

In the past, a way change of just one street created much traffic confusion, so a total modification of the street ways would be very difficult. In consequence, traffic control is recommended as follows (See FIGURE 3-6-21):

- a. R. de Francia Av. will have a continuous median to disallow any left turn and access to local streets, except at in the intersection with the vehicle and bus axis.
- b. The crossing through Humaitá / F. R. Moreno St. will not be allowed, except at the intersection with vehicle axis.

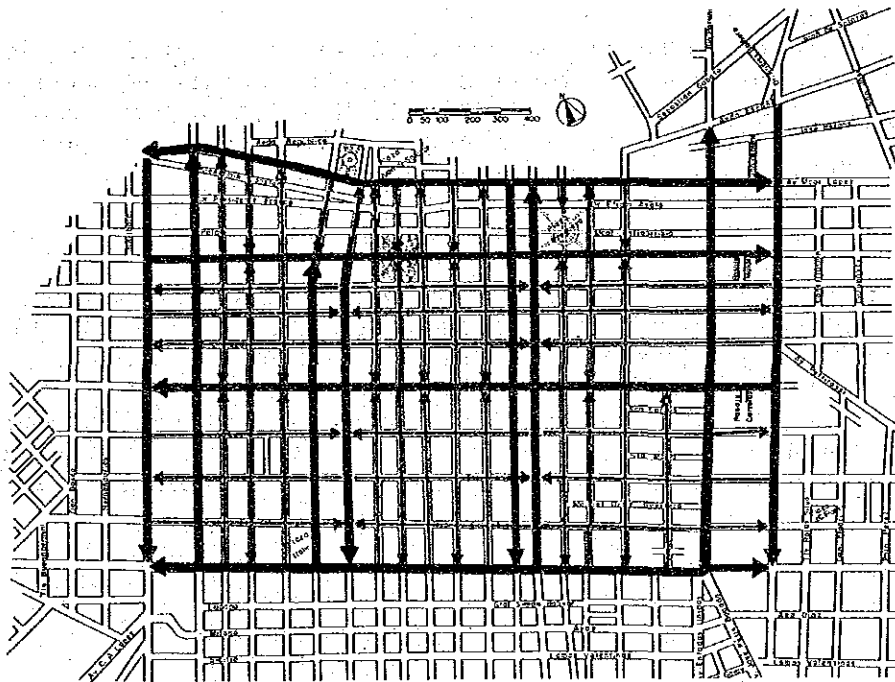


FIGURE 3-6-20 PROPOSED ONE WAY SYSTEM

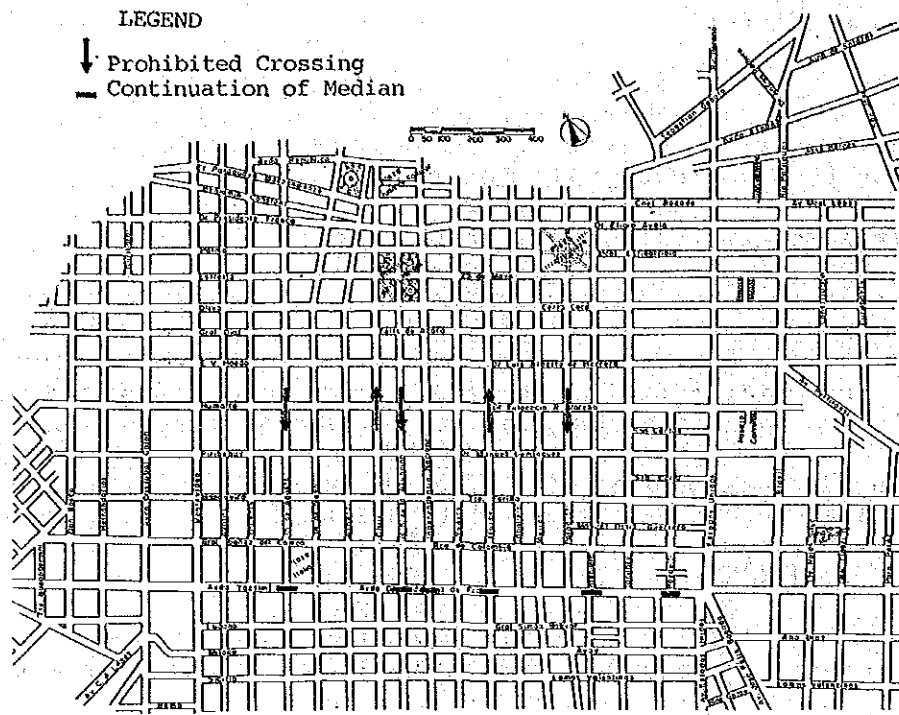


FIGURE 3-6-21 PROPOSED TRAFFIC CONTROL FOR TRAFFIC CELL

E) Crossings on Exclusive Pedestrian Streets

The North/South orientation streets connected to the exclusive pedestrian street will be local streets where parking will be allowed. These streets will have a 9m - 10m width, with an 10m area for vehicle maneuvers for their return, thus avoiding the crossing of vehicles through the pedestrian street.

F) Traffic Flow with Transportation Axis

Once the vehicle axis and local streets have been defined clearly and the traffic control implemented, the vehicle flow for the year 1992 is estimated as shown in FIGURE 3-6-22, where the North/South oriented axis can be seen. The traffic load with the project will be 1.04 times greater than that without the project. But to secure pedestrian priority and regularity in the Microcentro the establishment of transportation axis will be necessary (See TABLE 3-6-2).

TABLE 3-6-2 CHANGE IN TRAFFIC LOAD
 Unit: Veh*km

Case	Year	1992	2000
Without Project		3101	3736
With Project		3211	3865

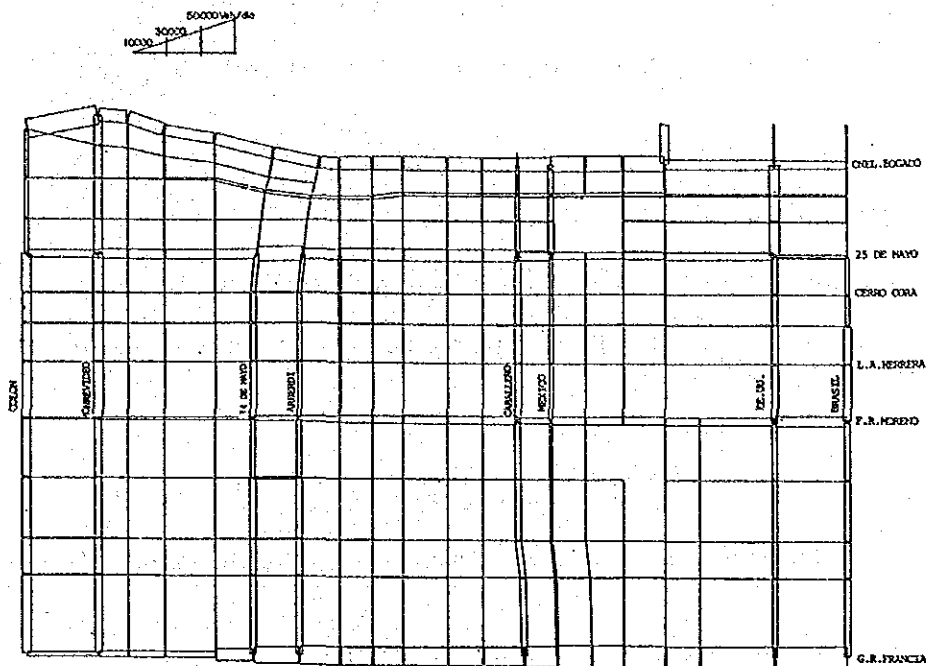


FIGURE 3-6-22 FUTURE TRAFFIC VOLUME (PRIVATE VEHICLES)

(4) **Cross Sections**

Cross Sections of each traffic axis are shown in FIGURE 3-6-23.

A) **Vehicle Traffic Axis**

a. **2 Way Streets with No Change**

- R. de Francia Av./ Ygatimí (2 lanes/way)
- Paraguayo Independiente / Cnel. Bogado (1 lane/way)

b. **One Way Streets (private vehicles only)**

- México
- Caballero
- Alberdi (between Estrella and Ygatimí)
- Estrella / 25 de Mayo

Characteristics : 2 lanes, each 3.5m wide

The lateral free space will be 1 m wide to minimize the influence of houses, bureaus and parking gates that can affect main line traffic.

c. **One Way Streets (2 lanes mixed)**

- Estados Unidos Av.
- Brasil
- F. R. Moreno

Characteristics : 2 lanes, each 3.5m wide

Pedestrian walk enlargement to 3-4m on the side where the bus stops are located.

d. One way streets (3 lanes mixed)

- Colón Av.

Characteristics : 3 lanes, each 3.5m wide

Pedestrian walk enlargement to 3-4 m on the side where the bus stops are located.

B) Zonal Street

a. Non-Bus Stop Street Blocks

Parking zones of 2.5 m width along both sides. One lane, 4-5 m wide

b. One Street Block with Bus Stops

Pedestrian walk enlargement to 2.5 - 3 m of the side where the bus stops will be located. 2.5 m wide parking places on the left side. 6.5 m net traffic width to assure fluid traffic even though the buses stop.

C) Bus Preferential Streets

- Cerro Corá
- Azara
- L. A. Herrera
- J. E. O'leary

Characteristics : Pedestrian walk enlargement to 3-4 m the side where the buses stop will be placed to offer space to the bus users. 2 lanes, of 3.5 m each.

D) Pedestrian Streets

a. Pedestrian Preferential Streets

- 15 de Agosto
- Chile
- Yegros

Characteristics : Pedestrian walk enlargement of both sides to 3.25-3.75 m with tree cover all the way. 2.5m parking places on the left side. 4.0 m street width.

b. Pedestrian Exclusive Streets

- Palma street

Characteristics : To maintain the same design. The pedestrian space will be divided into 2 zones: the North zone will be 2 m wide and the South zone 9-10 m wide.

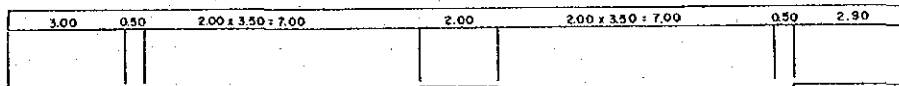
The non-exclusive parts (between Colón and O'leary, Yegros and México), will have 2.5 m parking place and 3 m pedestrian walks on both sides.

1. PRINCIPAL ARTERIES FOR VEHICULAR TRAFFIC

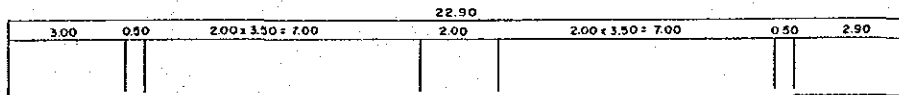
A. TWO WAY (4 LANES)

AV. R. DE FRANCIA - YGATIMI

PRESENT



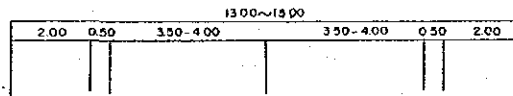
FUTURE



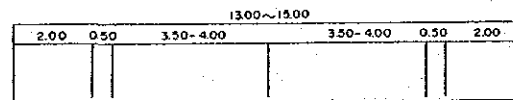
B. TWO WAY (2 LANES)

PARAGUAYO IND. - CNEI. BOGADO

PRESENT



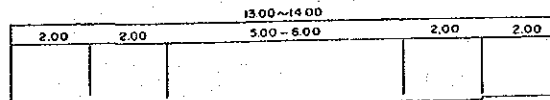
FUTURE



C. ONE WAY WITHOUT BUS STOP

MEXICO
 CABALLERO
 ALBERDI (ESTRELLA - YGATIMI)
 14 DE MAYO
 ESTRELLA - 25 DE MAYO

PRESENT



FUTURE

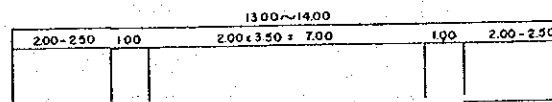
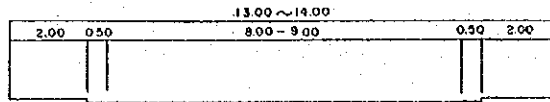


FIGURE 3-6-23 CROSS SECTIONS OF MAIN ROADS (1)

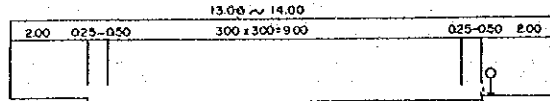
D. ONE WAY WITH BUS STOP

EEU
BRASIL

PRESENT



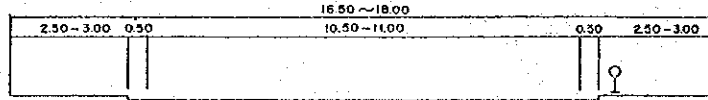
FUTURE



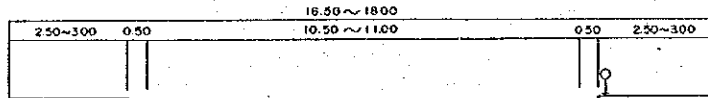
E. ONE WAY WITH BUS STOP

COLON

PRESENT



FUTURE



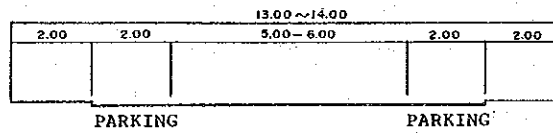
2. LOCAL ROADS FOR VEHICULAR TRAFFIC

A. WITHOUT BUS STOP

B. WITH BUS STOP

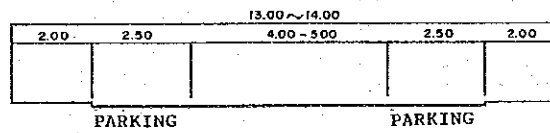
A - B

PRESENT



A

FUTURE



B

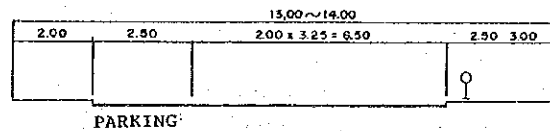
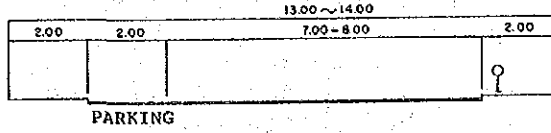


FIGURE 3-6-23 CROSS SECTIONS OF MAIN ROADS (2)

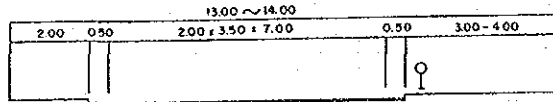
3. PRIORITY ROADS FOR BUSES

CERRO CORA
AZARA
L. A. HERRERA
AYOLAS

PRESENT



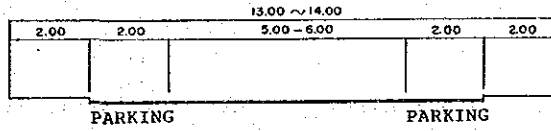
FUTURE



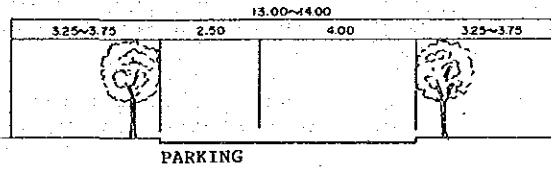
4. PEDESTRIAN ROADS

A. PRIORITY ROAD FOR PEDESTRIANS

PRESENT



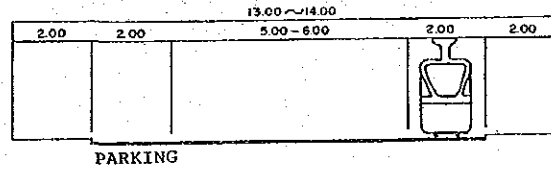
FUTURE



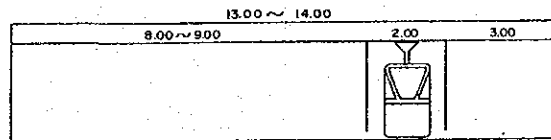
B. EXCLUSIVE PEDESTRIANS ROAD

PALMA

PRESENT



FUTURE



PLAN

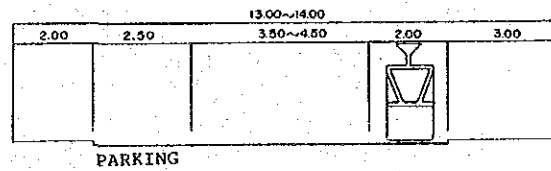


FIGURE 3-6-23 CROSS SECTIONS OF MAIN ROADS (3)