Step 1: Construction of Route No.5 (Autopista del Norte - Avenida Ciudad de Quito - Railway South Line - Autopista del Sur)

Step 2: Construction of Routes No.1 & 2, excluding the common section of Route No.5.

Operation is switched to the original form of Route 1 and 2.

Step 3: Construction of Route No.4. Circular operation will be started. The sections of Avenida Caracas and Avenida 27 are used commonly with Route No.1.

Step 4:Construction of Route No.3, exclusive of the section east of Avenida Caracas. Two lines of Avenida 81 and the west railway line will be operated individually.

12.3.5 Express Bus System

The express bus system is to upgrade from "exclusive bus lane" to "exclusive busway" by completely segregating bus lanes from lanes in common use. It will have a railway-like nature, providing shuttle service from end to end of a route, not allowing mixed use, like in the current Avenida Caracas. To provide a better service with such operation, it is necessary to construct for segregation facilities, grade separation at intersections and expansion of bus stops.

Among those, the expansion of bus stops may be the most important job. Transport capacity is enlarged not by segregation nor by grade separation but by increasing the capacity of bus stops. Because the lane capacity is much larger than the capacity of bus stops. To transport 43,000 passengers per hour in one direction, at least 8 berths will be needed. As one berth requires 20 m, a bus stop becomes more than 160 m in length. Thus, 2 to 3 platforms should be prepared, as in the such designs shown in Figure 12.3-10.

To increase the transport capacity, it is another way to use larger-sized buses. An express bus should have the capacity over 60 passengers including standing passengers as well as the trunk bus. In this sense, a joint-type bus is worth while planning to introduce.

12.3.6 Terminal Facilities

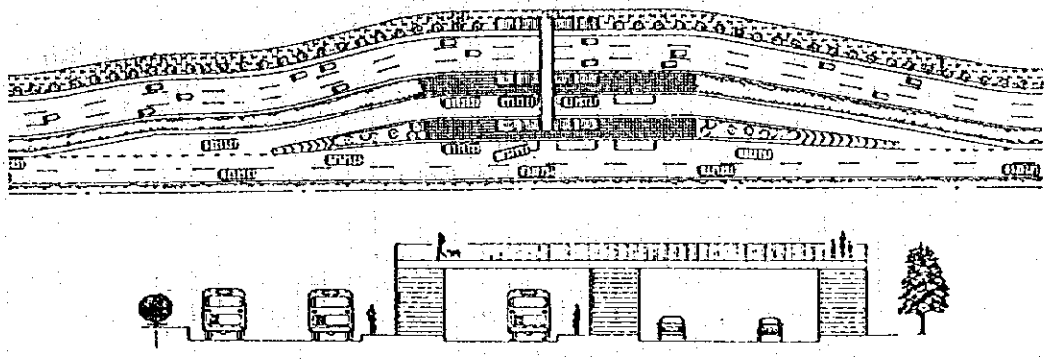
(1) Bus Terminal

As well as bus stop improvement, construction of bus terminals is also essential, as they are in very poor condition at present. It is strongly recommended, for the qualitative improvement of bus service to construct 16 terminals, as proposed in the Short Term plan. They are classified into two types: one is as the origin of routes in the suburbs (No.6-16) and the other is at the urban center (No.1-5). The latter is mainly for the convenience of transferring passengers.

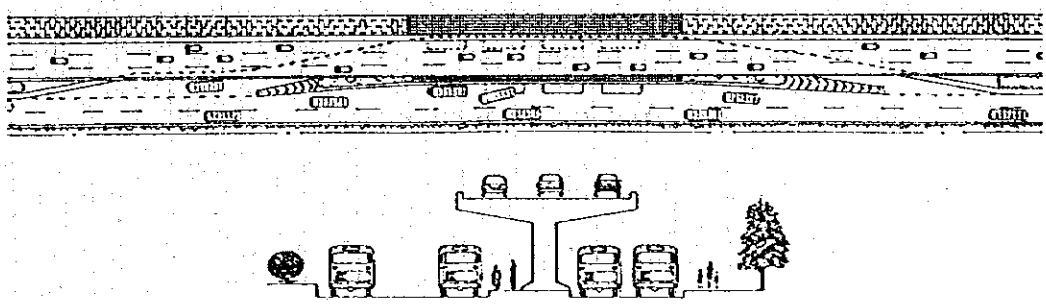
Terminal No.1 at Paloquemao is the most important one; it will be an integrated transport core of Bogota in the future, with the concentration of an urban railway station, an express bus terminal, a trunk/feeder bus terminal and urban expressway ramps. More than 500,000 passengers will be attracted daily, just to the railway station in the year 2020.

Fortunately, there are many vacant lots around the site of Terminal No.1, which are currently used as an open market, a container yard, a play yard, etc. By the development of this area as a major transport hub, the development potential would rise significantly as well as the land price. Therefore, a comprehensive urban development plan of the terminal should be established covering the adjacent area.

(1) Type A: Bus Bay by Road Widening



(2) Type B: Underneath Flyover



(3) Type C: Off-Road Bus Stop Building

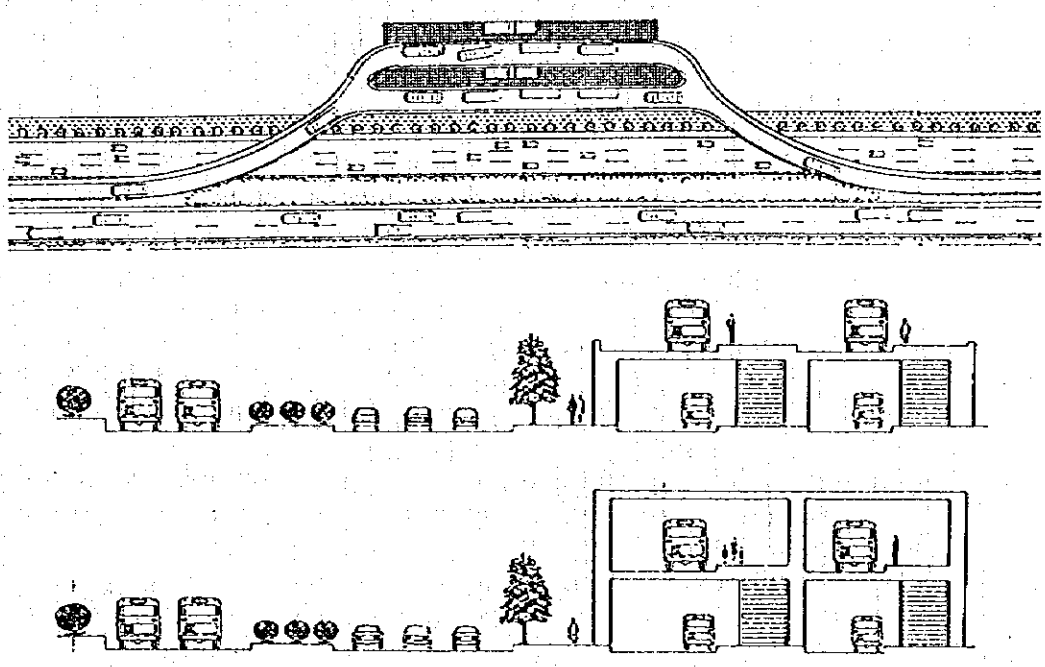


Figure 12.3-10 Express Bus Stop Layout

All the sixteen terminals are planned for urban trunk buses. For inter-regional buses, there is a central terminal at El Salitre, which does not serve for inter-city buses operated in Sabana de Bogota. There is an idea to develop terminals for short-distance inter-city buses. However, after construction of a perimeter road called "Cundinamarca", most of such short-distance inter-city buses should destine to the central terminal via Cundinamarca. If the terminal does not have capacity enough to accommodate them, relocation of the terminal to outer area should be planned, considering new location somewhere along the outer-ring road called "Sabana de Bogota".

(2) Truck Terminal (Cargo Transport)

1) Outline

Generally speaking, nationwide survey is indispensable when examining Cargo Transport System, to understand volume, OD, and type of cargo.

In case of imported goods, they arrive at the port first and then conveyed in land by train or truck. This tells that cargo transport surveys requite to cover wide range of area.

This Study concentrates on formulation of transport master plan focusing on movement of people, which was obtained from the Person Trip Survey. Therefore, another survey is necessary to obtain data for improvement of cargo transport system.

2) Concept of Cargo Transport in Bogota

Bogota has two modes of cargo transport, rail and truck. However, cargo transport relays heavily on trucks because the railway practically does not function as cargo transport.

Rail transported cargoes in Bogota are gathered at accumulation center near central station and then reloaded on to trucks for further delivery. Thus, trucks are forced to go through the city, which may cause traffic congestion and road deterioration. Furthermore, they cause traffic accidents.

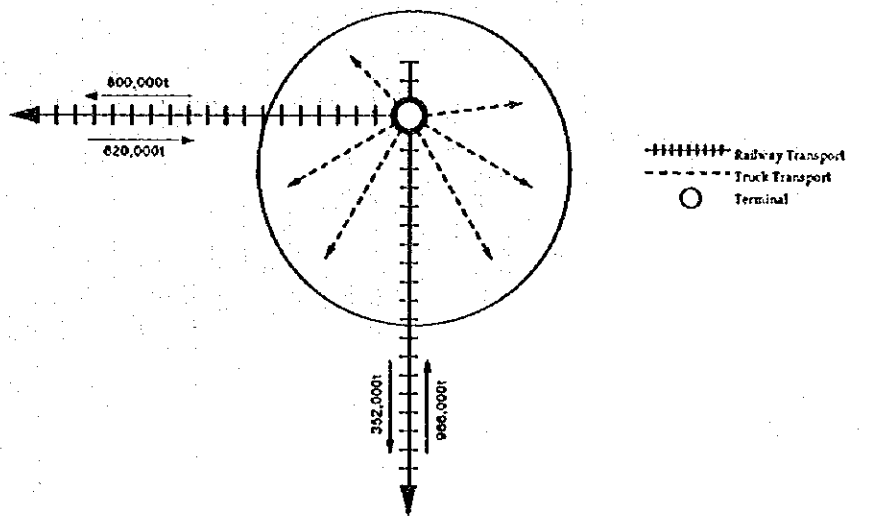
Figure 12.3-11 illustrates existing cargo transport system in Bogota. New cargo transport system, as shown in Figure 12.3-11, is proposed to solve the problems which cargo transport in Bogota faces today. As seen, basic concepts are as follow;

a) Rail track which go through city center is relocated to outskirts of Bogota.
b) Track is laid along Cundinamraca road, a road planned for the future.
c) Site of abandoned rail track in the city is used to build public transport facilities.
d) Transport terminal is built around Funza. Terminal has truck and bus terminals, etc.
e) Rail transported cargoes are accumulated at the terminal and reloaded to smaller trucks for further delivery.
f) Cargoes transported by large trucks from outer regions are also accumulated at the terminal and then reloaded to smaller trucks. In this case, large trucks use Cundinamrca road.
g) Large trucks are restricted into central Bogota.

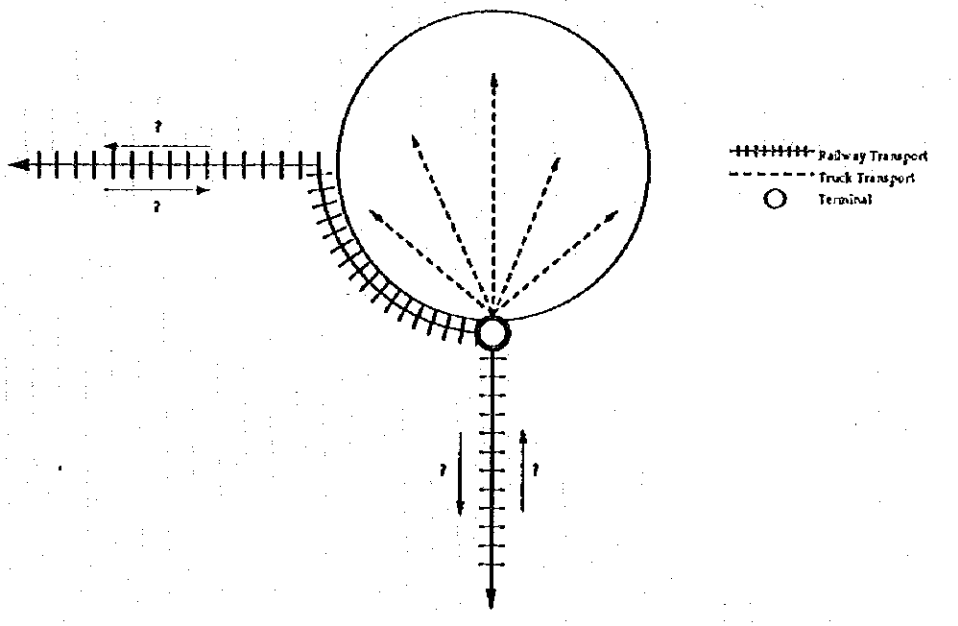
3) Actions by Bogota

Bogota must settle following issues in order to realize the concepts of the Cargo Transport System.

a) Transfer jurisdiction of two railroads to Municipal Government from National Government.
b) Construction of Cundinamarca Road and new railway.
c) Construction of transport terminal
d) Establishment of relevant laws and regulations such as restriction of trucks into the city.
e) Obtain consensus from transport companies.
f) Secure investment (including BOT).



Existing Cargo Transport System



Future Cargo Transport System

Figure 12.3-11 Future Cargo Transport System

CHAPTER 13
Traffic Management Sector Plan

13. TRAFFIC MANAGEMENT SECTOR PLAN

There are two ways of dealing with traffic problems. One is the construction of new roads and the public transport network, with improvement of existing roads and public transport network, which require long term and large investment to increase the transport capacity. The other is traffic management which makes the most of existing traffic system and facilities, implemented with much less time and investment. In this chapter, the latter is studied.

Recently, the preparation of a 'mall' where landscaping and street furniture are provided in the street, has been promoted world wide in order to make shopping, traffic and recreational activities comfortable. The objectives of the 'mall' are the activation of the commercial area in the city center (shopping mall) and improvement of the traffic environment, focusing on public transport (transit mall) etc. In this traffic management plan, the preparation plan of the mall was proposed.

13.1 Basic Considerations for Planning

13.1.1 Present State and Subjects of Traffic Management

To cope with recent worsening of traffic conditions, Bogota has implemented many kinds of countermeasures to improve traffic management, which are working effectively and are outlined as follows:

a) Introduction of bus exclusive lanes
b) Implementation of one-way system on arterial and collector roads
c) Introduction of reversible (tidal flow) lanes
d) Introduction of on-street parking charge system: 'Zonas Azules'
e) Linear coordinated control of traffic signals

The principal factor responsible for of traffic congestion in Bogota is the deficient road capacity due to delay in the expansion of the road network to meet traffic demand. The deficient capacity itself is a consequence of a rapid increase in the number of motor vehicles in the upper income brackets and in traffic demand caused by the concentration of population in urban areas.

Current issues in traffic management are summarized as follows:

a) Increase of congestion and accidents due to increases in population and in traffic volume
b) Mixed traffic of vehicles and pedestrians
c) Insufficient traffic facilities for pedestrians
d) Low awareness of traffic safety and manners

Measures to solve these problems must include traffic management as well as the improvement of public transport, i.e., bus transport. The improvement is planned mainly with due attention paid on the following areas because this management plan intends to overcome these problems by attempting to improve policies and facilities within a relatively short period, while effectively utilizing the currently operating traffic management system and traffic facilities:

a) Road and traffic management facilities
b) Traffic operation
c) Education on traffic safety

13.1.2 Concept of the Traffic Management Plan

(1) Objectives of the Traffic Management Plan

The objectives of the traffic management plan are as follows:

a) To secure smooth traffic flows
b) To mitigate traffic congestion
c) To decrease traffic accidents

As the policy of the traffic management plan, 5 year short term projects should be set as: Short Term plan to be implemented immediately by the year of 2001.

It is difficult to forecast traffic and road conditions in the future, therefore the traffic management plan should be reviewed after 5 years to assess the traffic and road conditions at that time.

(2) Strategy of the Traffic Management Plan

The location and the areas of traffic congestion which are found to present problems as a result of analysis of the fact-finding survey, vary as to the period in which they occur: morning, noon and evening peak hours. Those are shown in Fig. 13.1-1 (a), (b), and (c). When viewed over a 24-hour period, however, the location may be roughly divided into those in the city center and those in the suburbs, as shown in Fig. 13.1-2.

In the outskirts, chronic traffic congestion has been observed. Countermeasures to contribute to smoother traffic on the radial roads are necessary; however, this will accelerate the concentration of traffic in the city center. Therefore, the traffic management plan places the priority of improvement on the city center rather than the suburbs, in the belief that congestion in the city center must be eliminated even by suppressing the traffic flowing from the suburbs to the city center. In the outskirts similar improvement as in the city center should be carried out, placing emphasis on having smooth traffic in the ring roads, and studying traffic conditions in the city center in the future.

Though solving there problems will contribute strongly to the achievement of the plan's targets, it is not enough to promote measures taken solely by the road management authorities. What is most essential for solving traffic problems in Bogota is the positive and renewed awareness of traffic manners and the cooperation of drivers and pedestrians using the roads. It is considered that it will be advantageous to expand the improvement to the peripheral areas, with emphasis on the ring roads, and on studying traffic conditions in the central area.

Consequently, strengthening the guidance of manners, and safety education for pedestrians and drivers, even if it may take a considerable time, must be promoted positively as an essential part of this plan.

(a) Morning Peak (b) Noon (c) Evening Peak

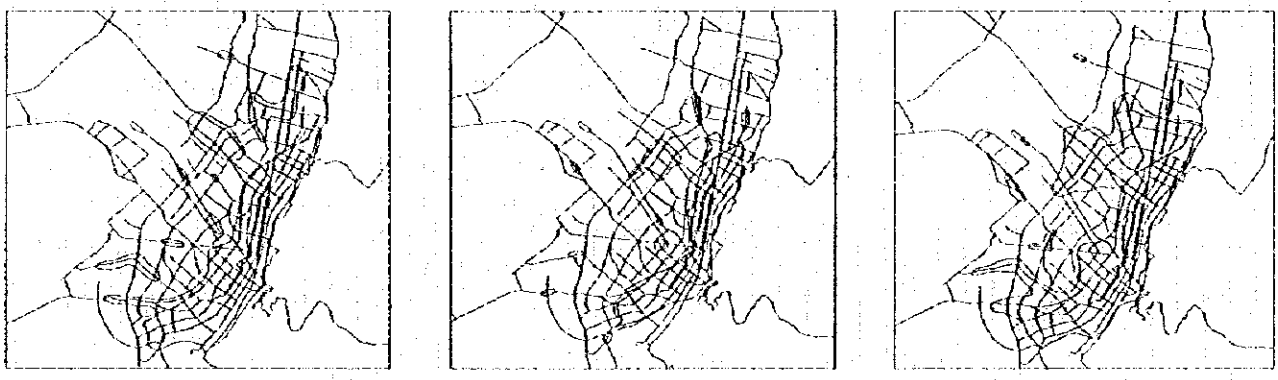


Figure 13.1-1 Areas of Congestion at Peak Hours

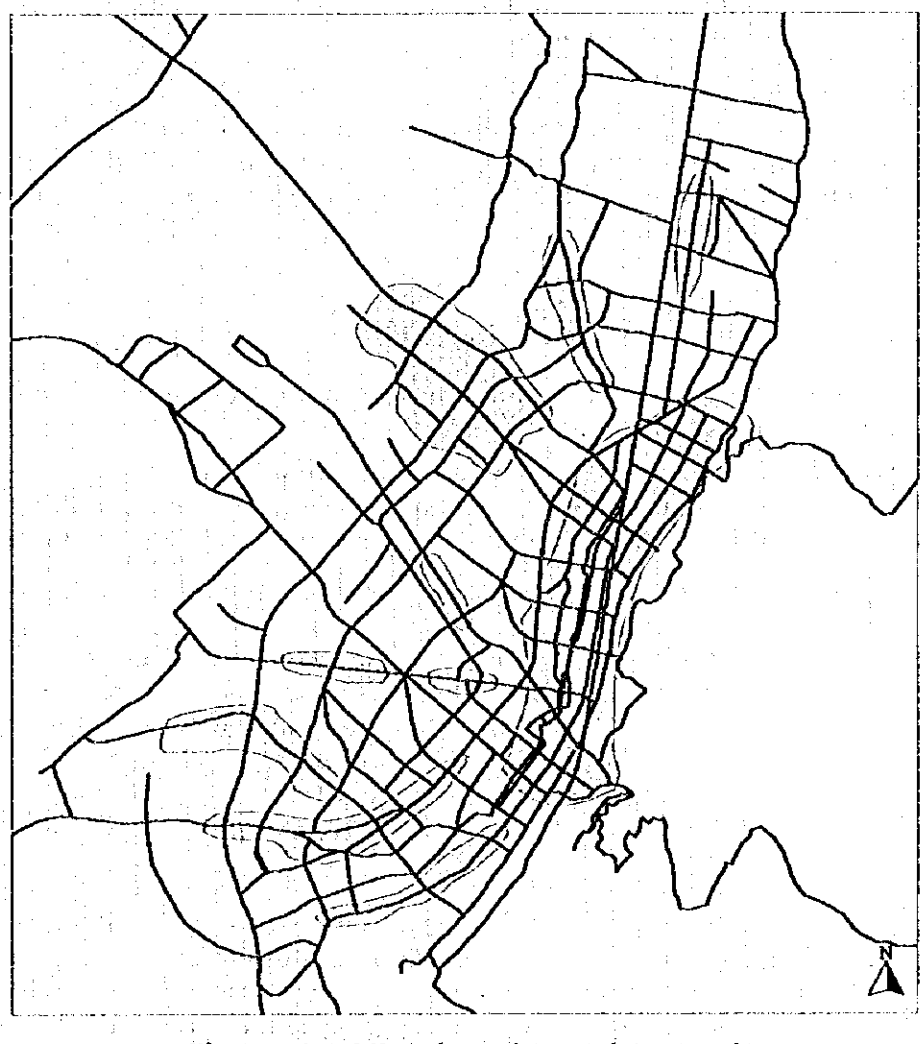
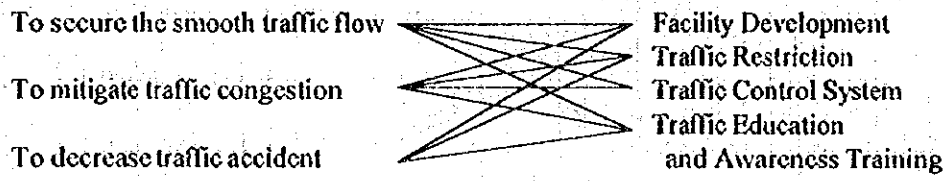


Figure 13.1-2 Day-long Areas of Congestion

13.1.3 Outline of the Traffic Management Plan

(1) Applicability of the traffic management plan

The principal measures to achieve the targets of the management plan are proposed as shown below.



(2) Outline of the Traffic Management Plan

There is chronic traffic congestion in the area between Carrera 7 and Avenida Quito around the axis of Avenida Caracas, and it extends to the radial roads due to the concentration of traffic in the central area.

It is difficult to provide road capacity to meet traffic demand in the Short Term. In order to satisfy the balance between the demand and the facilities required, strong control of demand, or the preparation of public transport means, will be necessary. However, both measures present difficulty and problems for present implementation. Traffic management will be applied to effectively mitigate traffic congestion in the Short Term as follows:

1) Improvement of Traffic on the Avenida Caracas

The most important main axis is Avenida Caracas in the central area. In order to increase the capacity, the following policies are considered:

a) To provide grade separation at the main intersections
b) To extend the green light time of the signal in the direction of Avenida Caracas
c) To distribute traffic to related roads such as Carrera 7 and Carrera 13 etc.

2) Preparation of Road Marking and Guard Fences

In order to encourage smooth traffic flow, road markings at all intersections with signals should clearly indicate lanes. Guard fences should be provided in the main intersections separating cars and pedestrians, from the viewpoint of safety. The wide intersections should be improved, including the provision of channeling islands to increase the traffic volume as much as possible.

3) Bus Transport

The bus routes should be re-organized, with the adequate distribution of bus stops, bus priority lanes and bus bays. These details are described in the public transport plan. Since it will take time to complete the proposed projects after a long study period, regulation of getting on and off the buses in the intersection areas in order to increase the capacity of the traffic volume should be a priority.

4) Traffic Control at Signalized Intersections

To improve traffic signal control at intersections, the proposed systematized signal control plan should be implemented, and information and data should be collected and

analyzed. The information system should be promoted to offer urgent traffic information such as road conditions and traffic conditions to the drivers by radio or television, in addition to the signal control plan. The advanced traffic control system is to be sought through collection, recording and analysis of the road traffic data.

5) Awareness training and Education for Traffic Safety and Manners

One of the major reasons for traffic congestion is traffic interaction due to the inadequate use of roads by drivers and pedestrians. Improvement of this condition is expected to contribute to the alleviation of traffic jams, therefore it should be adopted as one of the priority measures. A traffic safety center should be prepared in order to promote smooth and safe traffic, offering systematic and effective education, enlightenment and training of traffic manners or traffic awareness.

6) Parking Development Plan

Parking facilities are to be developed in the north-west part in Zonas Azules, according to demand. In the city center, public parking should be constructed under vacant public land. However, the balance between demand and supply should be considered and the parking facilities controlled in order to restrain the concentration of traffic.

The relations and structure of traffic problems, objectives and the traffic management plan is shown in Figure 13.1-3.

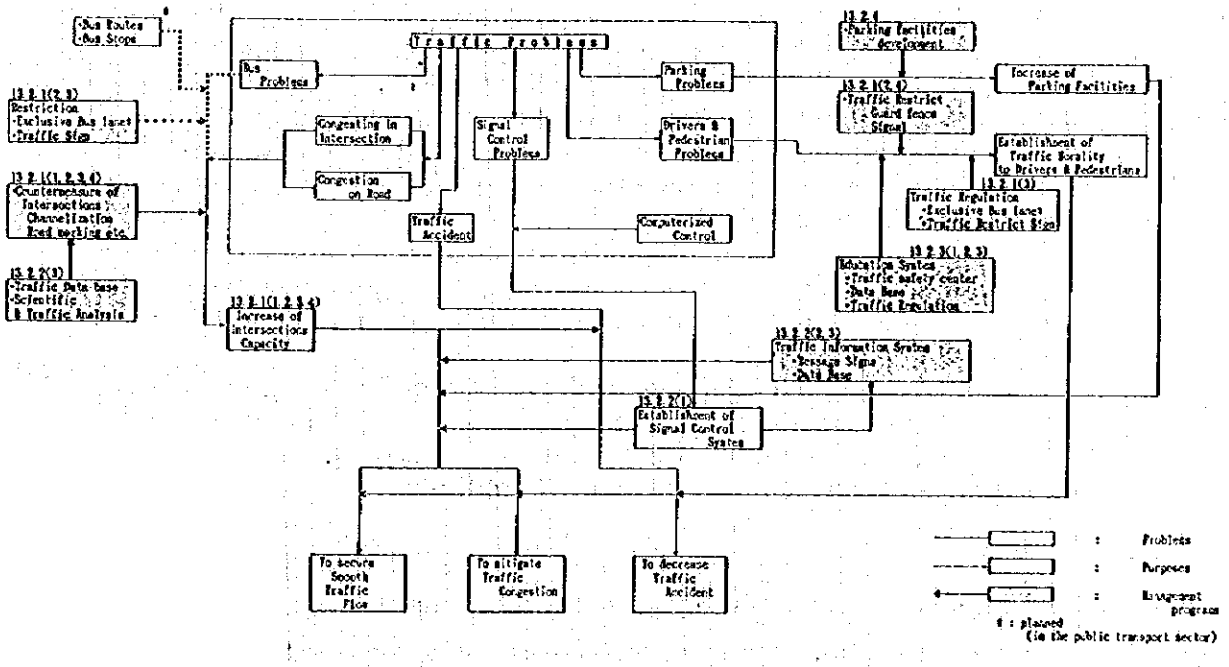


Figure 13.1-3 Traffic Management Program

13.2 Short Term Traffic Management Plan

13.2.1 Intersection Facility Improvement Plan

(1) Intersection Improvement Plan

1) Objective of the Plan

The objective is to ensure the smooth flow of traffic, to alleviate the traffic congestion, and to prevent traffic accidents by means of appropriate improvement and operation of the intersections. Also it aims to increase the capacity of traffic volume at intersections by normal operation of vehicles at intersections by improving the layout of intersections.

2) Issues of Intersection Improvement

The layout of most intersections in Bogota is acceptable. From the results of the traffic survey, saturated traffic volume, in addition to the high ratio of buses in the city and the high ratio of heavy vehicles in the suburbs, decrease traffic capacity at intersections. Changing lanes and passengers getting on and off buses in the intersections and right-turn lanes, generate traffic conflicts and lower traffic volume, adversely affecting the flow of vehicles.

In order to increase the capacity, traffic manner of the drivers at intersections, and those of passengers should be improved, and an education program has to be implemented, mentioned in chapter 13.2.3, Traffic Safety Education.

The following subjects of improvement of the intersections are considered and need to be worked on:

a) Intersections in the city have relatively wide areas. Action is required to avoid loss time due to conflicts by minimizing the mutual conflict area of vehicles within the intersection and prevent accidents caused by high-speed driving.
b) Intersections in the city have few road-marking. Vehicle stop-lines, lane-lines, pedestrian-crossings and markings will reduce conflicts and accidents.
c) Pedestrian crossings must be clearly identified and marked. The pedestrian crossings must be provided, at the same time pedestrians must be prevented from crossing the road in places other than pedestrian crossings, avoiding conflict with right-turning vehicles.
d) For the intersection approach where the left-turning traffic volume is large, a left-turn lane of minimum available width of 2.75m must be provided, separating through and left-turning traffic even when the standard lane width cannot be obtained.
e) Records of accidents indicate that they occurred mostly at grade-separated interchanges, in diverging and merging sections. It is necessary to take measures, such as provision of acceleration and deceleration lanes, etc. to prevent rear-end collision and other kinds of collisions.

3) Improvement of Intersections

Intersections should be improved according to the following criteria; (see Table 13.2-1)

a) The ratio of saturation of intersection is over 1 or is expected to exceed 1 in the near future.
b) The number of traffic accidents is over 60. (points of frequent traffic accidents)

c) The travel speed average is always less than 10 km/h around the intersection area, from the traveling speed survey.
d) Consideration of traffic flows in the surrounding area
e) The results of site investigation and observation

Table 13.2-1 Traffic Situation of the Intersection

NO.	Location			Intersection Type		Saturation Degree of Intersection		Traffic Accident	Low Travel Speed Intersection	Traffic Accidents in 1994-5
	Avenida	Carrera	Calle	Cross	Grade separated	over 1.0	near 1.0	High Frequency Intersection	near Entrance of Intersection	(muertos, heridos)
1		7	109	○			○			(1 , 5)
2		7	94	○			○			
3		7	85-84	○		○				
4		7	72					○		
5	Jimenez Del Quesada	7	13	○			○		○	
6	Cuidad de lima	10		○		○			○	
7		11	72	○			○			(3 , 5)
8		13	45	○			○			
9	con 100	15		rotary				◎		
10		15	92	○			○			
11		19	100	○		○				
12	Auto. del Norte con 100				○			○		
13	Caracas con		78	○		○				
14	Caracas con		72	○			○		○	
15	Caracas con		68	○			○			
16	Caracas con		63	○			○		○	
17	Caracas con		45	○			○			
18	Caracas con		34	○			○			
19	Caracas con Jimenez del Quesada		13	○			○	◎	○	(3 , 10)
20	Ciudad de Quito Jorge Eliecergaitan	30			○			◎		
21		36	26	○			○	○		
								○ : 60～100 ◎ : 100～160		

4) Intersection Improvement Plan

The following two types are classified for the improvement plan;

a) Type A : Partial structural improvement such as improvement of channeling islands is required, in addition to provision of road marking and traffic signs.
b) Type B : Layout improvement is not necessary. Road marking and traffic signs are to be provided.

As a sample, improvement plans are shown in Table 13.2-2, Figure 13.2-4. At merging sections where traffic accidents have a high frequency, sight spaces and marking as shown Figure 13.2-3 should be provided. This plan should be put into practice specifically after in-depth study of these plans and of the history of traffic flows and accidents.

For intersections with frequent accidents, in particular, caused by the road layout, improvement measures such as channelization and widening of entrance lanes, should be made.

5) Location of the Improvement plan

The main locations of intersection improvements are shown in Figure 13.2-5. The intersections at Calle 63, Calle 53, Calle 34 are planned as the Road Project(RP-1) of the previous chapter.

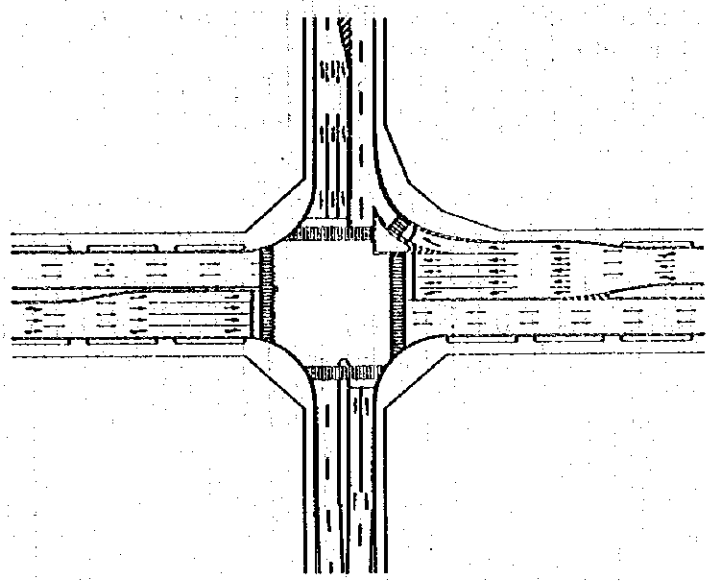


Figure 13.2-1 Channelization and Marking of Intersection*

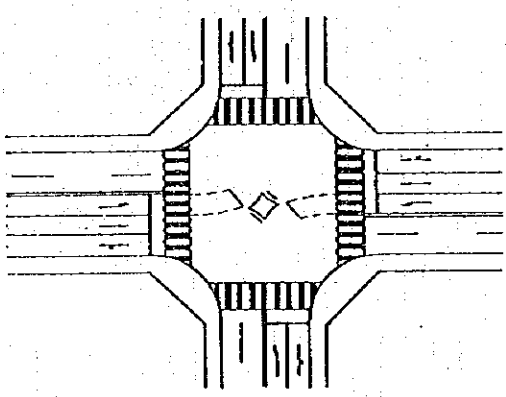


Figure 13.2-2 Marking of Left-turn*

*The Planning & Design of At-Grade Intersection by J.S.T.E.

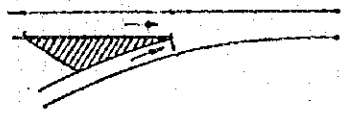


Figure 13.2-3 Sight-space at the Merging Section

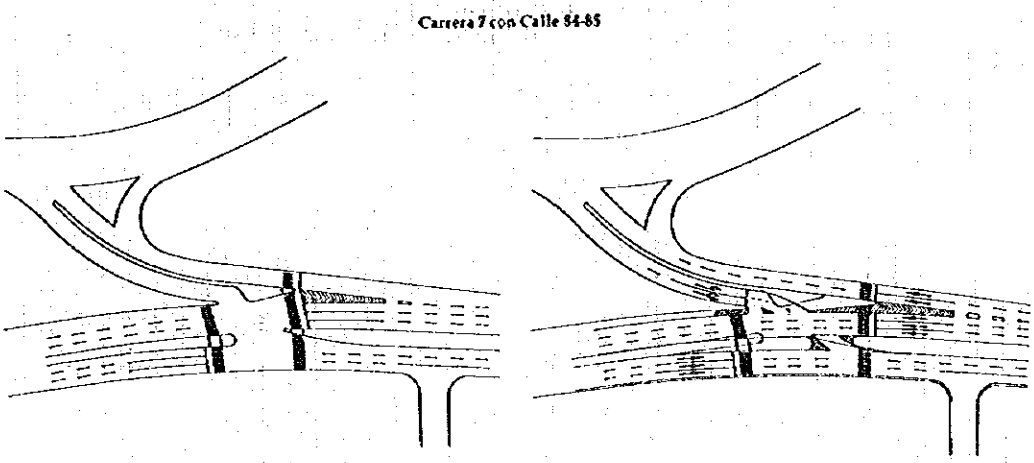


Figure 13.2-4(a) Example of the Intersection Improved Intersection

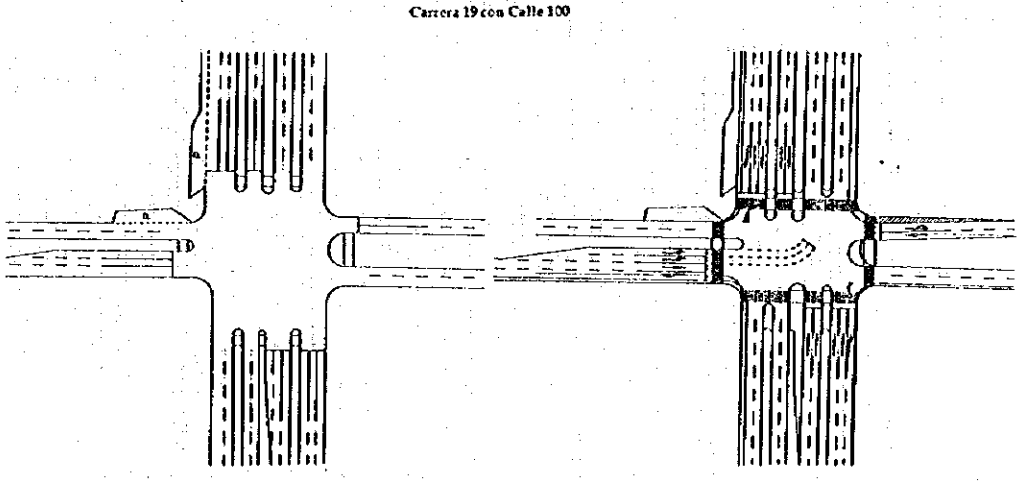


Figure 13.2-4(b) Example of the Improved Intersection

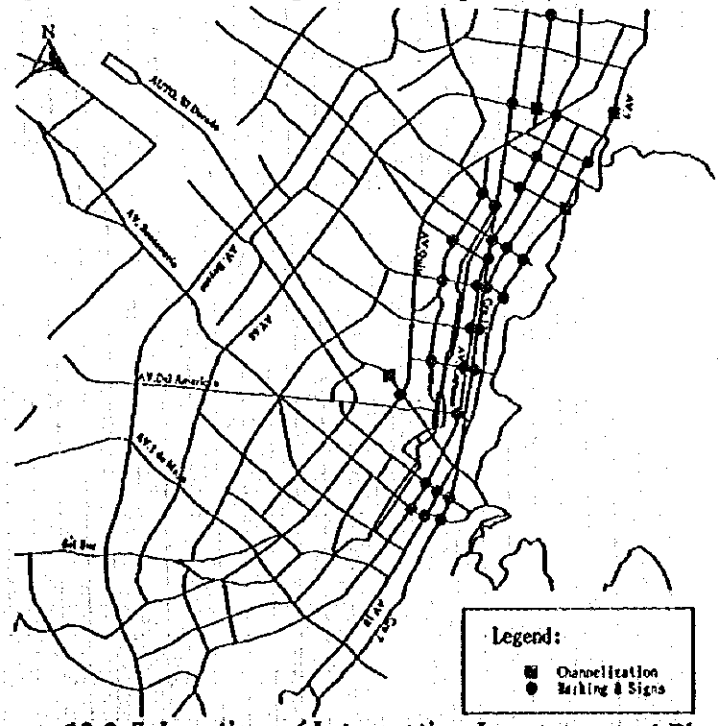


Figure 13.2-5 Location of Intersection Improvement Plans

Table 13.2-2 Improvement Plans for Intersections

NO.	Location			Intersection Type		Present Major Problems in Intersection	Improvement Method	Improvement	
	Avenida	Carrera	Calle	Cross	Grade Separated			A	B
1		7	109	O		Near saturated flow in the intersection Very high frequency traffic accidents Many uneven islands Many illegal loading/unloading of the passengers by Bus and Taxi	Making of lane-separator etc. Transfer the loading and unloading places Road marking	O	
2		7	94	O		Near saturated flow in the intersection	Provision of left-turn lane of the northern approach of the intersection		O
3		7	85-B	O		Over saturation in the intersection Vehicular swept path	Increasing of Right-turn lane at the eastern Approach of the Intersection Channelization; Ave.Quito, ** Avenida 7	O	
4		7	72	O		Very high frequency traffic accidents	Supplement of signals & signs for reversible-lane		O
5		7	63	O		Irregular queue at the eastern approach	Paving and road marking		O
6	con Ciudad de Lima	7		O		Many illegal passing of the pedestrian Imperfection of Marking	Road marking		O
7	con Jimenez de Quesada	7		O		Near saturated flow in the intersection Imperfection of Marking Many illegal Passing of pedestrian	Road marking		⊕
8	con Ciudad de Lima	10		O		Over saturation in the intersection Imperfection of Marking	Paving and road marking		⊕
9	con Jimenez de Quesada	10		O		Near saturated flow in the intersection Imperfection of Marking	Paving and road marking		⊕
10		11	72	O		Very high frequency traffic accidents Near saturated flow in the intersection	Provision of left and right-turn lane to approach the intersection Paving and road marking		O
11		13	65	O		Imperfection of Marking Many illegal loading/unloading of the passengers by Bus and Taxi	Installation of signal for pedestrian Paving and road marking		O
12		13	83	O		Imperfection of Marking Many illegal loading/unloading of the passengers by Bus and Taxi	Installation of signal for pedestrian Paving and road marking		O
13		13	45	O		Irregular intersection in shape (2way→1way road) Many conflict between car and pedestrian	Widening of eastern exit of intersection Installation of signal for pedestrian Paving and road marking		O
14		18	100	rotary		Very high frequency traffic accidents Many conflict of the merging and weaving	Installation of warning signs for merging & weaving Paving and road marking		O
15		15	92	O		Bus station near intersection (Many loading/unloading passengers) Near saturated flow in the intersection	Transfer the loading and unloading places Increasing of right-turn lane at the eastern Approach of the Intersection, Paving and marking		O
16		15	85	O		Irregular intersection in shape (3 lanes→4 lanes road)	Ajustment the number of lanes in the Calle 85 street Paving and road marking		O
17		19	127	O		Irregular intersection in shape (caused canal) Over saturation in the intersection	Road marking concerning canal		⊕
18		19	100	O		Area of Intersect. is too much wide Imperfection of Island Length Over saturation in the intersection	Changing the stop-line Channelization the intersection Improving the lane-separator, road marking	O	
19	del Norte con		100		O	Very high frequency traffic accidents On the Island, many loading/unloading/passing of the passengers	Installation of Regurulatory signs & marking crossing Paving and road marking		O
20	Caracas con		78	O		Very congested intersection In Cal.78→Caracas for North and Caracas for south, Heavy queue	Provision the information ; Detouring at the Avenida Quito bound for northern trips Paving and road marking		O
21	Caracas con		72	O		Many illegal loading/unloading of the passengers by Bus and Taxi Near saturated flow in the intersection	Imploving the Pedestrian Island Paving and road marking		O
22	Caracas con		68	O		Many illegal Passing of pedestrian Near saturated flow in the intersection Non signal for Pedestrian	Installation of Signal for Pedestrian Paving and road marking		O
23	Caracas con		63	O		Near saturated flow in the intersection Irregular intersection in shape (2way→1way road)	Widening of eastern exit of intersection Paving and road marking		⊕
24	Caracas con		53	O		Irregular intersection in shape (2way→1way road)	Widening of eastern exit of intersection Paving and road marking		⊕
25	Caracas con		45	O		Near saturated flow in the intersection Irregular intersection in shape (2way→1way road)	Widening of eastern exit of intersection Paving and road marking		⊕
26	Caracas con		34	O		Near saturated flow in the intersection Irregular intersection in shape (2way→1way road) Lane in Exit is 2 lanes, Area is too much wide	Widening of eastern exit of intersection Paving and road marking		⊕
27	Caracas con Ciudad de Lima			O		Many illegal loading/unloading of the passengers by Bus and Taxi	Paving and road marking		⊕
28	Caracas con Jimenez de Quesada			O		Very high frequency traffic accidents Many illegal Passing of pedestrian	Paving and road marking		⊕
29		24	68	O		Many illegal loading/unloading of the passengers by Bus and Taxi Non road Marking	Paving and road marking		O
30		24	78	O		Many illegal loading/unloading of the passengers by Bus and Taxi Non road Marking	Paving and road marking		⊕
31		24	63	O		Many illegal loading/unloading of the passengers by Bus and Taxi	Paving and road marking		O
32		24	45	O		Many illegal Passing of pedestrian	Paving and road marking		O
33	Ciudad de Quito con Jorge Eliecergaitan				O	Very high frequency traffic accidents	Re marking to near the lane separator on Ave.Quito Installation warning-signs and right-space at merging point (In accordance with traffic accident analysis)		O
34		36	26	O		High frequency traffic accidents Near saturated flow in the intersection	Channelization the intersection Imploving the lane-separator Paving and road marking	O	

Note : ⊕ are planned as "Grade Separated Intersection" in Road Project (JP-1)

(2) Guard Fence Development Plan

1) Objective of the Plan

Unlawful crossing of pedestrians in or immediately near the intersection will hinder the smooth traffic flow, sometimes causing a traffic accident. The objective of this plan is to regulate unlawful crossing of pedestrians, thereby protecting pedestrians and ensuring a smooth traffic flow, by constructing guard fences.

2) Subject of the Plan

Imprudent crossing of pedestrians immediately near the intersection is often observed, which hinders the safety and smooth traffic flow. This deteriorates an image of Bogota as an international city. This problem is very difficult, but it must be corrected immediately.

3) Installation Plan for Construction Plan

The guard fences should generally be installed in following locations:

a) Points near signalized intersections of arterial roads
b) Points near intersections where accidents occurred frequently

A typical guard fence is shown in Figures 13.2-6 and 13.2-7. The length of guard fences to be installed should be 50 - 100 m from the pedestrian crossings. Guard fences are installed mainly in or around intersections at first, with the result referenced in the future expansion of the roads.

4) Location of the Guard Fences Installation

The location of the construction of 20 guard fences is planned and shown in Figure 13.2-8.

Carrera 7 :	Calle 109, Calle 84-85, Calle 72, Avenida Ciudad de Lima, Avenida Jimenez de Quesada ,
Carrera 10 :	Avenida Ciudad de Lima, Avenida Jimenez de Quesada,
Carrera 11:	Calle 72,
Carrera 15 :	Calle 92,
Carrera 19 :	Calle 100,
Avenida Caracas:	Avenida 78, Avenida Chile, Calle 68, Calle 63, Calle 53, Calle 45, Calle 34, Avenida Ciudad de Lima, Avenida Jimenez de Quesada,
Carrera 36:	Calle 26.

5) Proposal

Guard fences are intended to separate pedestrians from vehicle traffic. Green belts of road have the same function as the separation. To improve the aesthetic view, it is recommended to design roads to incorporate landscaping, planting, or provide flower beds.

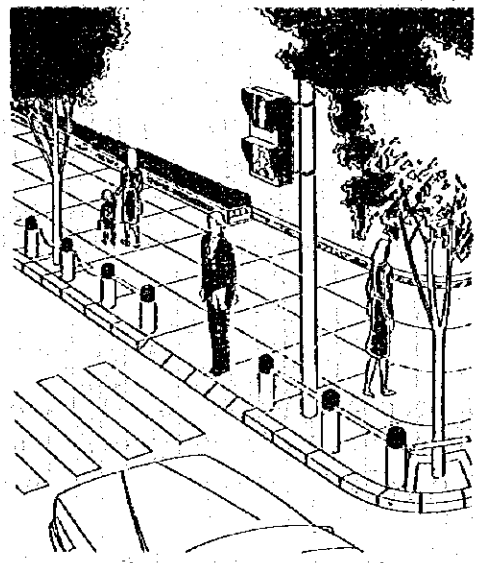


Figure 13.2-6 Guard Fence

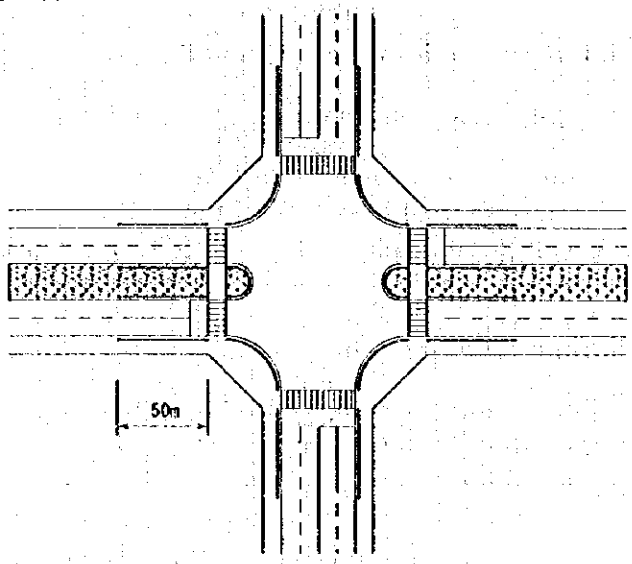


Figure 13.2-7 Standard Improvement

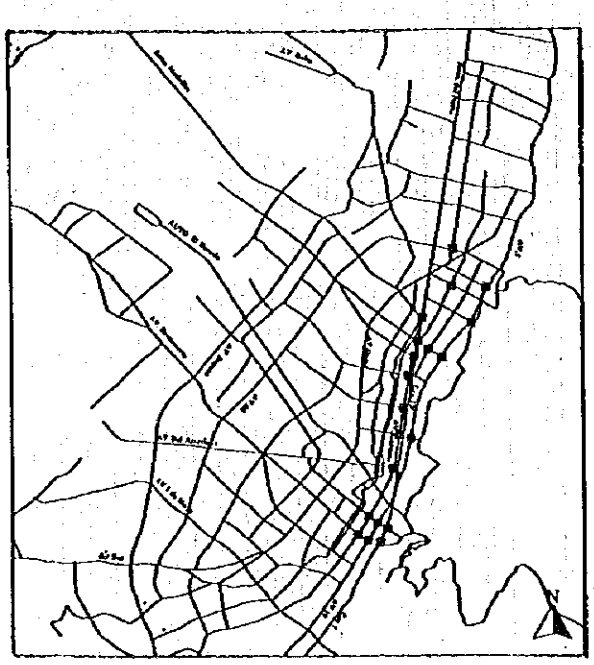


Figure 13.2-8 Location of Improvement of Guard Fence Plan

(3) Traffic Sign Installation Plan

1) Objective of the Plan

The objective of traffic signs is, especially, to achieve efficient road utilization by ensuring smooth traffic flows and safety at the main intersections.

2) Issues of Traffic Signs

At present, traffic signs are not sufficient in Bogota, except for guide signs and stop signs. It is therefore necessary to increase signs to assure traffic safety and increase the capacity of intersections.

3) Improvement Standard

Signs, shown as Figure13.2-9, need to be installed to give advance warning of pedestrian crossings and signalized intersections. In particular, installation of the following signs must be promoted positively in the future, near the intersection.

a) b) c)

No changing lanes No crossing (of pedestrians) No getting on or off a bus

Figure 13.2-9 Installed signs

Although 'stop' and 'no parking' signs are provide in major location, some signs are hard to recognize. Those should be improved changing to pole type signs installed just before intersections.

4) Location of the Signs

The location of traffic signs is planned as shown in Table 13.2-3

Table 13.2-3 Location of Traffic signs near Main Intersections

Type of signs	Approach of Intersection	Exit of Intersection
a) No changing lane	-50m	-
b) No crossing	-30m	+30m
c) No riding a bus	-50m	+10m

(- before intersection, + beyond intersection)

The existing bus system should be reviewed and rearranged to determine where the bus stops and their signs should be installed, on the basis of the optimum bus service system.

(4) Traffic Signal Improvement Plan

1) Objective of the plan

Traffic signals are necessary not only for vehicles but also for controlling pedestrians. They must be installed and operated properly to control the safety and smooth flow of both vehicles and pedestrians.

2) Issues of Traffic Signals

At present, signal optical units at intersections are 20 cm. Those for pedestrians are generally poor in visibility and should be improved. (Figure 13.2-11)

Signals are provided before the intersection approach. In view of the visibility in the vicinity of the intersection, installation of signals at the four corners of the intersection exit will prove convenient for driving. (Figure 13.2-10)

The number of signals for pedestrian crossings is insufficient at the one-way exit of the intersection and at parts of arterial roads in the city center. It is therefore necessary to install the signal so as to ensure the safety and convenience of pedestrians. (Figure 13.2-12)

3) Proposed Improvement Items and Installation Details

For signals, only the proposal is made here, because it is advisable to attempt improvements, first with signals to be installed in future:

In order to achieve efficient maintenance and enhanced visibility, it is proposed to change the signals scheduled for installation in the future to overhang type signals with lenses of a 30 cm diameter.

For Carreras 13 and 19, arterial roads with long intersection sections, it is recommended to install pedestrian signals every 300 - 500 m.

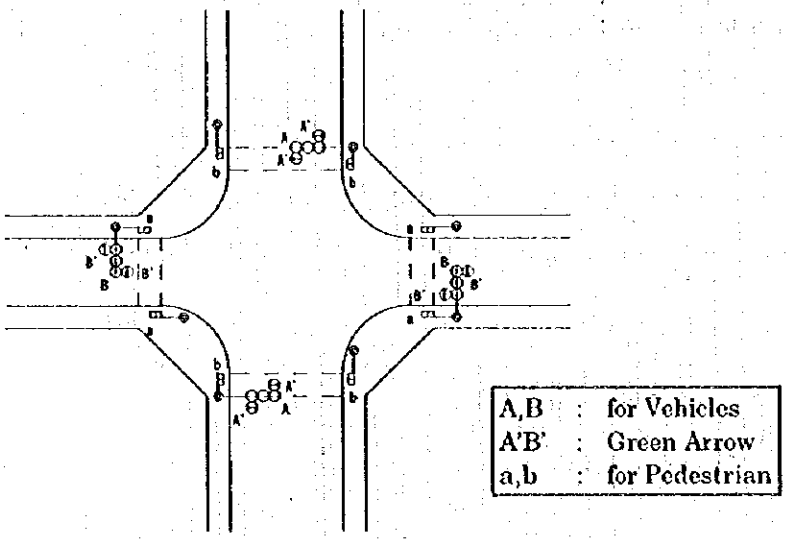


Figure 13.2-10 Standard Installation of Traffic Signal

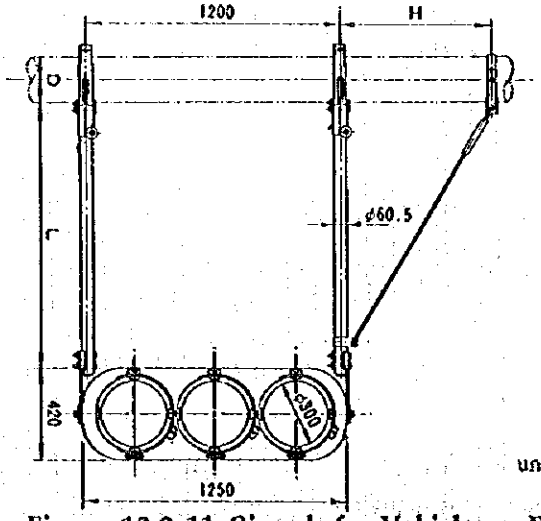


Figure 13.2-11 Signals for Vehicles

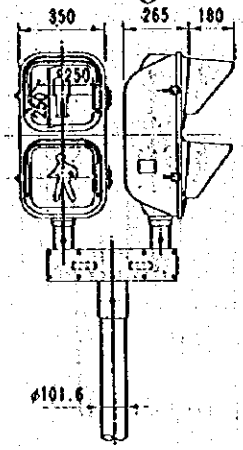


Figure 13.2-12 Signals for Pedestrians

13.2.2 Traffic Control System Improvement Plan

The traffic control system performs the linear coordinated signal control for each route by using about 700 signals currently installed within the city. As the improvement and expansion of signals are planned on the basis of the traffic-actuated control with vehicle detector, the recommended plan described here is based on the purpose of the above plan.

(1) Traffic Control System Plan

1) Objective of the Plan

The linear coordinated control for each route is a basic system currently operating to control traffic signals. In future, the signal control system must be constructed on the basis of the existing system to ensure the smooth traffic appropriate to the traffic demand.

2) Issues of the Traffic Signal Control System

Subjects related to the traffic control system of Bogota are as described below:

a) Efficient operation with traffic-actuated control

Currently, the traffic signal control is based on coordinated route control, but not of a traffic-actuated type. The signal covered by this plan must permit real-time control in response to changes in the traffic flow.

b) System with a long term plan

A system which can cope with increases in future traffic volume and with the road network constructed in the future must be introduced in the plan. Stepwise expansion must be planned.

c) Utilization of existing facilities

The system must be constructed with maximum utilization of existing facilities.

3) Concept for the Plan

The signal control system will be planned based on the following existing action plan "FORMAR CIUDAD (1996 - 1998)":

a) Updating and modernization of the system
b) Installation of traffic signals on new intersections
c) Traffic supervision system
d) Traffic study and research

The signal control system will be constructed stepwise, because existing systems are to be used and improved step by step. The system expansion will be done as follows:

a) Renewal for functional upgrading of various traffic control installations of the control center and the local facilities
b) Expansion of the traffic control area providing traffic signals at new intersections
c) TV cameras should be installed at effective points such as traffic congestion liable places in order to expand traffic surveillance and to improve traffic control.
d) Expansion of the linear traffic-actuated control for each sub-area of each existing route.

e) Expansion of an area traffic control through interconnection of sub-areas around the city center
f) Improvement and expansion to achieve an advanced system which can control traffic quickly and in a timely manner, in response to real changes.

4) Scope of Objectives

The objectives of the signal control system are to achieve effective utilization of existing roads and smooth vehicle traffic.

The system will have the following basic functions: (see Figure 13.2-13)

a) Automatic collection of traffic data with vehicle detectors
b) Monitoring of traffic condition by means of TV cameras
c) Aggregation of collected traffic data for calculation of signal parameters
d) Control of signals
e) Indication of traffic conditions on a graphic panel
f) Accumulation of traffic data in a data bank
g) Collection of basic data for the traffic control operation
h) Supply of necessary traffic information (occurrence of accidents, etc.) to users

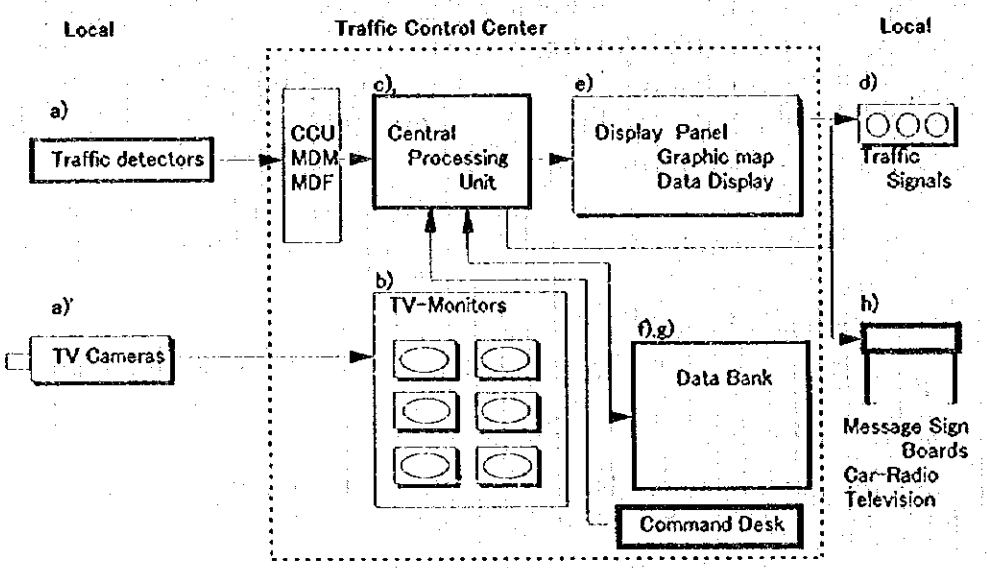


Figure 13.2-13 Block Diagram of Traffic Control System

a) Traffic Detector

The information concerning traffic and road conditions includes the digital observed information and the following visual information in addition to reports by the police and those who are concerned;

- Traffic Detector
- TV Camera

The traffic detectors will be installed at entrances of major intersections and road sections of uninterrupted flow, required for traffic control. The data observed by the detectors at these points will be sent to the control center in real time. The observing traffic data include traffic volume, length of traffic congestion, occupancy rate, traveling speed etc. and they should be selected and decided according to the adopted

traffic control policy, because such data will be used traffic analysis and planning as well as the signal control.

b) TV Camera, b)' TV Monitor

The TV Cameras (closed circuit television system camera) will be installed at the points where the observation is necessary at all times such as the conflict intersections, merging or diverging points and the places where traffic accidents often occurred. The surveillance system of road conditions and traffic situations in the control center at all times should be very important in traffic control. The monitors systematically observing the information of the TV Cameras by route will be provided in the control center, strengthening the surveillance system.

The surveillance of various traffic situations such as road conditions and accident conditions in real tine at the control center, will facilitate the counter-action and instruction to the traffic phenomena such as congestion and accidents, grasping the occurring condition and the progress visually.

The effects of this surveillance system by using TV camera are shown in Table 13.2-4.

Table 13.2-4 The Effects of Surveillance System

Surveillance condition	Control method	Direct effect	Indirect effect
-Traffic situation -Road environment -Climatic condition -Condition of accident vehicles	-Appropriate traffic control -Appropriate information provision	-Mitigation of traffic congestion -Quicker solution of traffic obstacle -Avoidance of occur of secondary obstacle -Increase of traffic volume -Improvement of traffic control	-Shortening of traveling time -Reduction of travel expense -Reduction of traffic accidents -Reduction of traffic pollution -Improvement of pleasance of driving

c) Central Processing Unit (CPU)

In the Central Processing Unit, information of traffic flow monitored by the traffic detectors will be collected and processed, and the parameters of signal control will be set. In addition, control of exchange and monitor of traffic information with the sub-centers will be carried out.

d) Traffic Signal

The traffic signals will be operated based on the parameters of signal control by the Central Processing Unit.(CPU)

e) Display Panel

In the display panels, the following data will be monitored, providing the information for judgment of the traffic flow control for the traffic controller at the command desk.

- Route map & Road condition
- Traffic situation
- Condition of traffic obstacles
- Traffic regulation
- Traffic control devises etc.

f), g) Data Collection

The detected data for traffic control such as traffic flow data will be collected and processed by route, by areas and by time zones etc. as data-base, which should be up-dated periodically. The data-base will be utilized for analysis and improvement of various traffic technology as well as for setting parameter of signal control. (cf. 13.2.2.(3))

h) Supply of Traffic Information

The traffic information such as the traffic situation and the location , cause, result of the incident will be also offered to drivers for safe and pleasant drive as much as possible.

In particular, quick delivery of information on unusual traffic phenomena will contribute to a secondary traffic obstacle such as accidents and congestion. Appropriate instruction and regulation to drivers on the unusual phenomena can be made through grasping correct situation with visual information by TV cameras.

Sign board, which displays variable message, is considered as a media for provision of information in addition to broadcasting by radio and television. The detail is described in the following section.

The system will be conceived with improvement and expansion done in three stages:

a) 1st stage (1996 - 1998): Installation of terminal equipment in the city center and on radiating roads individual linear controls, surveillance system
b) 2nd stage (1998 - 2000): Improvement of traffic control operation Transition to area traffic control
c) 3rd stage (2000 -2003) : Operational start-up of a concentrated-control advanced system

(2) Traffic Information Supply Plan

It is proposed to construct a system to supply information of road and traffic conditions as required for drivers, by a resident traffic manager, in addition to the traffic control system to control traffic signals. (See Figure 13.2-14)

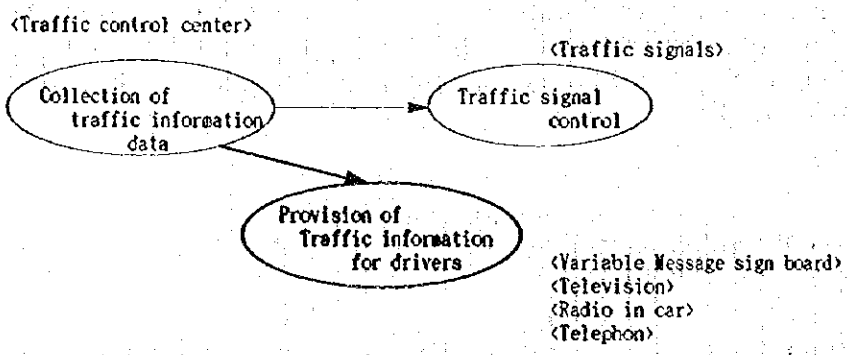


Figure 13.2-14 Signal Control System and Information System

1) Object of Supplying the Road Traffic Information

By supplying emergency information (traffic accidents, abnormalities in traffic regulation etc.), the following effects are aimed at:

a) Immediate notification of incidents to users
b) Selection of the route, to prevent secondary congestion

c) Traffic flows will be distributed as a result.
d) Users can be involved in the traffic problems by having such information and cooperate to mitigate traffic congestion.

2) Information Supply Plan

The following function should be added to the traffic signal control center (see Figure. 13.2-15).

The steps of information supply will be as follows;

a) 1st step Radio broadcast and TV, telephone in car
b) 2nd step Information indication units, such as electrical variable message signboards, , installed at the principal intersections of arterial roads

The following information will be supplied

a) Information concerning route prohibition
b) Weather conditions
c) Information on congestion
d) Road traffic regulations
e) Other public information

Research was carried out on drivers during commuting and on business driving on the roads of Japanese urban districts. The result showed that about 60% of drivers had changed their route after listening to the information on road conditions and traffic congestion. Also, 95% of drivers interviewed said that they wanted to know the traffic information. In conclusion, the drivers wanted information on road and traffic conditions.

3) Location of Information Indication Units

The center will be housed in the traffic signal control center and the information indication units will be installed at major crossroads on arterial roads, as shown in Figure 13.2-16 and Figure13.2-17.

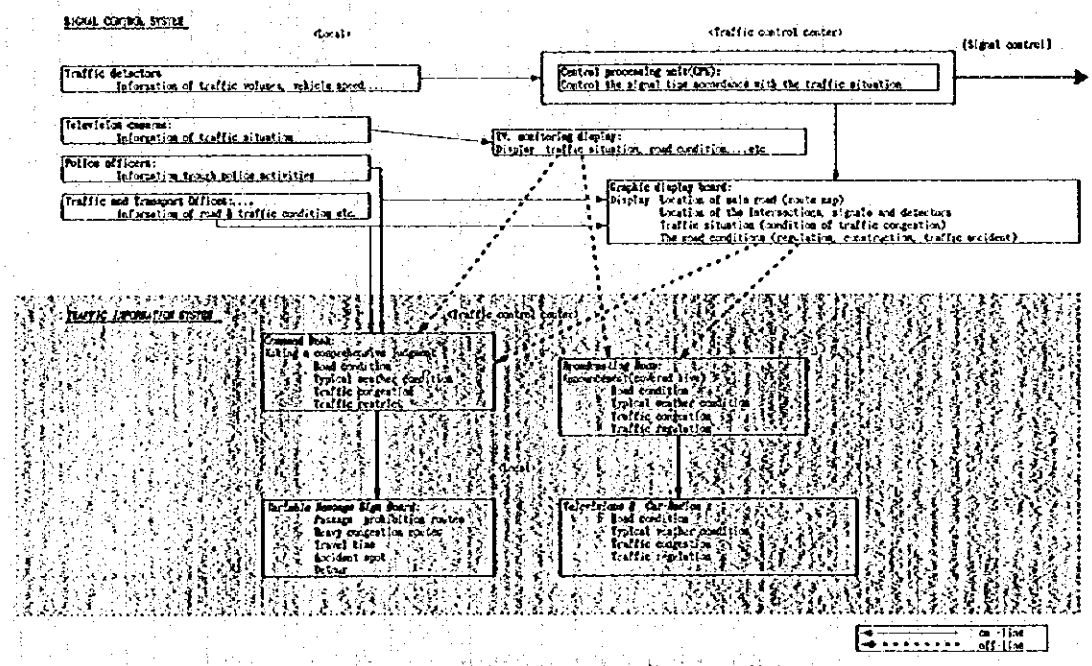


Figure 13.2-15 Traffic Information Supply System

Figure 13.2-16 Variable Message Signboard

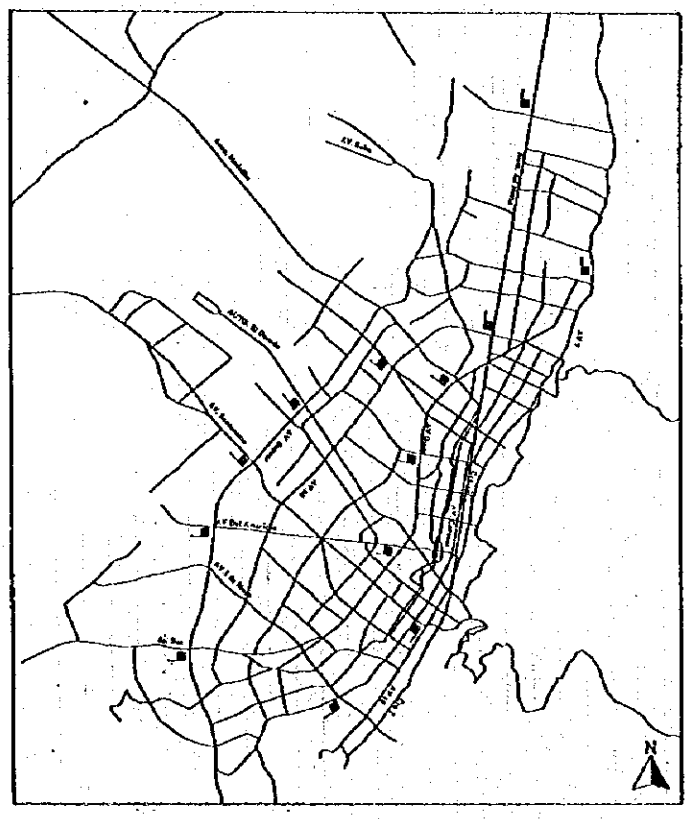


Figure 13.2-17The Location of Installations

(3) Positive Collection and Accumulation of Data Concerning Traffic Control

To perform adequate traffic control, collection, accumulation, and analysis of various fundamental data by place and by route are essential.

The following data should be collected and accumulated without omission. The data base should be constructed and information supplied to those who are concerned with traffic control and study.

a) Traffic volume
b) Traffic density (occupation ratio)
c) Traveling speed
d) Conditions of traffic signals etc.

The data will be collected by surveys and vehicle detectors etc.

13.2.3 Traffic Safety Education

(1) Necessity of Traffic Education

The roads in the city of Bogota suffer chronic congestion because the number of vehicles using them is greater than the road capacity. Drivers and pedestrians who are pressed for time often neglect traffic safety rules. This situation not only presents danger to traffic safety, but also hinders the smooth flow of traffic. It is therefore essential for both drivers and pedestrians to recognize their respective responsibilities.

In this respect, people must have correct knowledge concerning pedestrians, vehicles, and traffic, as well as how correct traffic should be. At the same time, it is essential for people to judge the situation and act while making necessary adjustments with each other in traffic.

Negligence of traffic laws or regulations by drivers and pedestrians on the roads in the Bogota may be due to insufficient consciousness of traffic safety, and the lack of consistent traffic regulation.

If drivers and pedestrians follow traffic regulations, current traffic congestion and accidents should be alleviated considerably. It may be assured that improvement of the consciousness of drivers and pedestrians will prove effective in achieving the expected improvement results.

(2) Issues of Behavior by Drivers and Pedestrians

a) Drivers are observed to behave illegally by ignoring the traffic signal or by breaking into the queue, causing frequent accidents or traffic congestion. In this respect, education to develop consciousness of traffic safety among drivers is necessary.
b) Pedestrians are also observed to ignore the signals or attempt illegal road crossing quite frequently. This means that traffic safety education shall also be aimed at pedestrians.
c) Currently, education and activities for the traffic safety have been held from time to time in schools and places of employment, but with little effect. Efforts must be made to make such education and activity more practically effective through clearer awareness.
d) There are a large number of disabled vehicles, which are either stopped or repaired on the roadways for long period of time. These vehicles hinder the smooth traffic flow. There are problems to be solved concerning the frequency of disabled vehicles.

(3) Improvement Items

Reduction of accidents and a smooth traffic flow can be achieved when the traffic safety plan is developed, as shown in Figure 13.2-18. This plan is intended to establish plans for specific improvement of these items.

The following are to be implemented;

a) Preparation of the Traffic Safety Education Center
b) Strengthening traffic guidance and regulation

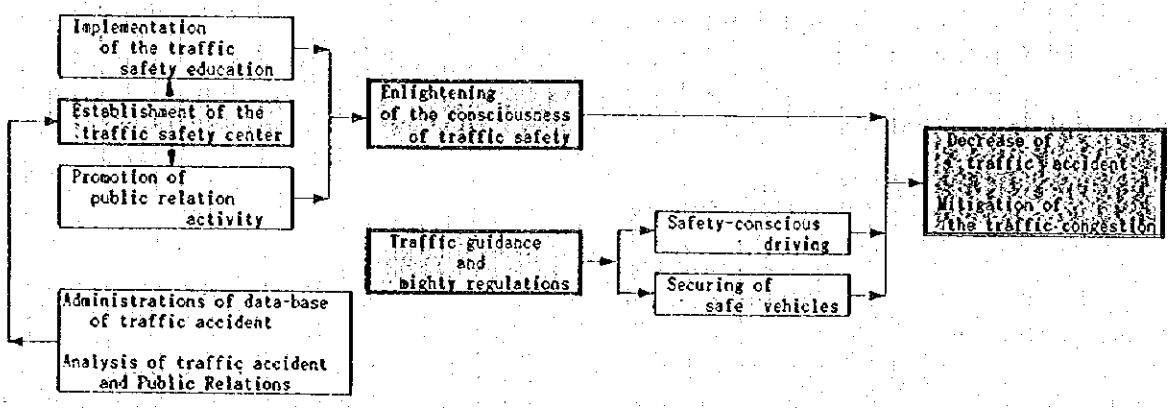


Figure 13.2-18 The Flow of Education and Regulation

(4) Traffic Safety Education Plan

Traffic safety education will be promoted by the traffic safety education center to be installed.

1) Increasing Awareness of Traffic Safety

a) Traffic Safety Education

Education of for traffic safety appropriate to each age group will be provided. For younger-age groups, a traffic park is to be constructed to use as a place of practical exercise.

- Education for infants
- Education for students
- Education for members of society, especially drivers who always use a car
- Education for traffic managers of traffic-related enterprises

b) Guidance for Safety-Conscious Driving

Strengthening education in the course of obtaining a driving license; Education on driver etiquette and the danger of traffic accidents when licensees are issued

- Increase in the number of experienced instructors
- Increase and improvement of the training curriculum (subjects and driving exercises)
- Attending a course when the license is renewed : "Study of the revival of the license renewal system, or proposal of the alternative"
- Attendance of beginners (those for whom only a short period has passed since obtaining of the license) in the course
- Re-education of offenders whose license has been canceled

2) Promotion of Public Relations Activities

Strengthening implementation of public relation and awareness activities by means of TV, radio, newspaper advertisements, posters, and public relations magazines, etc.

- Advertisement concerning traffic safety
- Traffic safety activities
- Campaigns (Traffic safety fair)

Improvement and Expansion of Traffic Technology Data

In order to establish the traffic safety measures, it is extremely important to carry out analysis of the causes of accidents beforehand. Traffic accidents include those between a pedestrian and a vehicle, between vehicles, and between a vehicle and facilities, and the measures necessary for the safe traffic of pedestrians and vehicles must be planned. For this purpose, improvement and expansion is indispensable regarding following matters:

- Databases on all roads, intersections, and their structure
- In-depth situation survey and recording information concerning accidents
- Database concerning the traffic volume

This data must be compiled for analysis based on scientific and traffic engineering and for taking appropriate measures. What is necessary in this context includes a new data system, filing of original survey slips, implementation of periodical inspection and collection of results data, and development of the analysis system.

3) Facility Plan

a) Traffic safety center (Figure 13.2-19)

Functions of the traffic safety center:

- Activities to disseminate safety education
- Management of the accident database
- Statistical analysis of motor vehicle accidents, and public relations

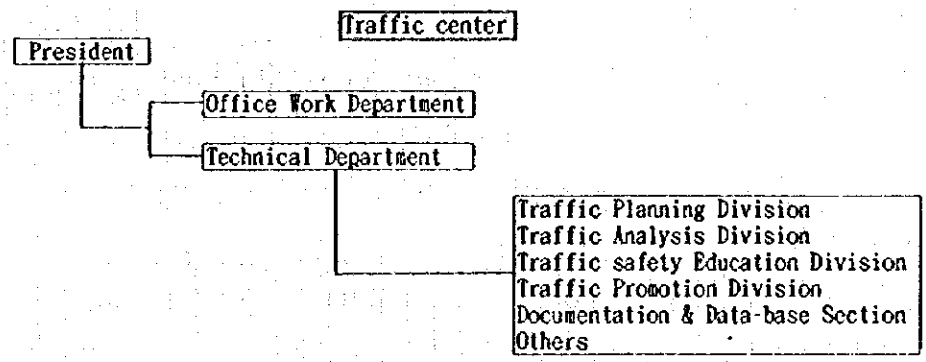


Figure 13.2-19 Organization of the Traffic Safety Center

b) Traffic Park (Figure 13.2-20)

The traffic park should be as described below. This facility must be of a simple construction to ensure saving on the maintenance cost.

Size : About 70m x 50m - 30m x 40m
Park site : One side of an existing park
Location : Parque National Olaya Herrera, Parque Simon Bolivar.
Facilities to be installed : Cross walk, signals, signs, and road markings etc.

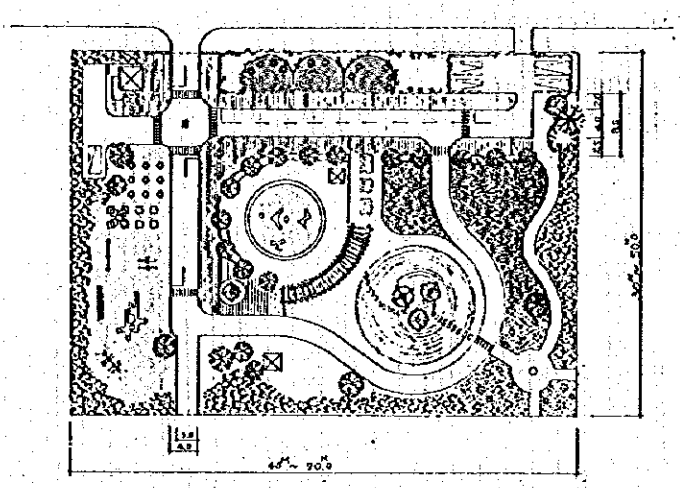


Figure 13.2-20 Example of the Traffic Park

(5) Plan for Strengthening Traffic Guidance and Regulation

In this management plan, an extremely vigorous implementation of traffic guidance and regulation is recommended. With strengthened regulation of traffic, the secondary effect is obtained, that is, the fines thus collected can be used as a source for the fund for expanding the traffic control facilities.

1) Prosecution of Illegal Drivers and Prevention of Recurrence

Traffic regulation by traffic policemen must be strengthened, thereby contributing to improvement of the awareness of offenders.

a) Strengthening the prosecution of illegal driving

Drivers must be regulated in terms of following offenses:

- Ignoring traffic signals
- Sudden stop and lane change
- Illegal cut-in
- Passenger loading / unloading of buses outside the bus stop area

b) Strengthening warnings to pedestrians

For pedestrians, warning must be made in terms of the following behaviors:

- Ignoring traffic signals
- Road crossing in places other than pedestrian crossings
- Getting on and off the buses outside the bus stop area

c) Strengthening traffic police

For strengthening regulations, the number of existing policemen is not considered enough, and their increase should be encouraged. It is required that the increase in number and the improvement of quality should be carried out step by step.

2) Making vehicles safe

To ensure safe utilization of vehicles, the servicing of vehicles must be strengthened to secure satisfactory safety-related quality.

a) Public relations to promote safe utilization and to enhance the thoroughness of inspections
b) Promotion of inspection and servicing
c) Review of the automobile inspection system

Parking facilities should be developed according to increasing ratios of car ownership by zone, and not be planned uniformly.

(6) Recommendation

Although various countermeasures have been planned and implemented for the alleviation of traffic congestion in Bogota, satisfactory effects and results meeting to the increase in the traffic volume have not been attained because of the difficulty of securing the budget of the projects. Traffic safety education and strengthening traffic regulations was proposed as one of the low-cost traffic problem mitigation measures, and it is considered very important in Bogota. Traffic safety education and strengthening traffic regulations has been planned and implemented in various and good manners, and it should be continued and further strengthened with emphasis on the following:

a) Improvement of the renewal system for driving license
b) Re-education of driving license holders
c) Strengthening the regulation of violators
d) Revision of the vehicle inspection system for securing vehicle safety
e) Analysis of traffic accidents and its application

13.2.4 Parking Facility Plan

(1) Demand for Parking

1) Objective of the Plan

Parking is generally prohibited on arterial roads in the city of Bogota, but sometimes illegal parking is observed on the road. This plan is intended to promote the toll parking system and to develop the off-street parking facilities while increasing road capacity. As construction of on-street and off-street parking facilities requires long time for preparation, the short term plan for the year 2001 is formulated in this section, considering the long term-plan under the framework of Master Plan. In other words, the parking plan should be being implemented continuously step by step.

2) Issues of Parking Facilities

a) There are 880,000 trips/day of parking requiring in the city center of Bogota at present, and they are still expanding with the increase of traffic volume.
b) It is necessary to improve and expand the parking places to increase the road capacity by eliminating illegal parking on local streets and in the suburbs.
c) It is also necessary to improve and expand parking places to ensure smooth passage of pedestrians by eliminating occupation of sidewalks by parked vehicles.

3) Estimation of the Parking Demand

a) Planning Area

Parking demand is estimated in the zones 3, 4, 5, 6, 17, 20, 21, 22 and 25 in the center as the planning area (Figure 13.2-21, Table 13.2-5). Table 13.2-6 shows percentage of growth of parking demand of the planning area compared to the study area .

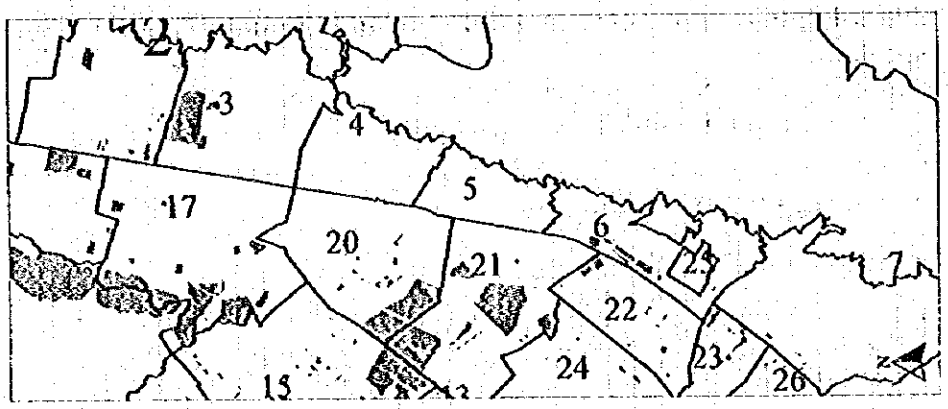


Figure 13.2-21-Planning Area (number shows Zone NO.)

Table 13.2-5 Planning Area

Zone No.	Zone Name
3	Usanquen 3
4	Chapinero 1
5	Chapinero 2
6	Santa Fe
17	Suba 2
20	Barrios Unidos
21	Teusaquillo
22	Los Martires
25	La Candelaria

Table 13.2-6 Growth of Parking Demand (vehicle/day)

	1995	2020
Study Area (a)	1,120,000	2,440,000
Planning Area(b)	337,000	643,000
(b)/(a) %	30.0	26.3

Note: Excluding Parking at home

b) Parking demand in the planning area

The total 880,000 demand in the planning area is classified by parking purpose and by parking type as shown in Tables 13.2-7 and 13.2-8 respectively. The planning demand subject to off-street parking consists of the demand of on-street parking and the public parking facilities.

Table 13.2-7 Share of Parking Demand by Purpose

(%)

	to Home	to Work	to School	Business	Others	Total
Free	14	21	3	18	44	100
Charged	15	32	11	16	26	100

Table 13.2-8 Shares of Parking Demand by Type of Parking

(%)

	Own Garage	Road Side	Private	Public	Vacant	Total
Free	33	35	26	4	2	100
Charged	11	16	35	36	1	100

c) Present Supply of Parking Space

The data from 1995 (STT) was used to estimate the present available parking space in the Zonas Azules and the present public parking space was estimated based on the peak hour occupancies by zone obtained from the interview survey.

d) Turnover Ratio

The turnover ratio is as shown in the table 13.2-9 below.

Table 13.2-9 Turnover Ratio

	to Home	to Work	to School	to Business	Others
Zonas Azules	4.5	4.7	4.5	4.7	4.8
Public Free Parking	1.0	2.5 - 3.5	3.2	2.4 - 3.5	2.4 - 3.5
Public Charged Parking	1.0	2.4 - 3.5	3.2	2.4 - 3.5	2.4 - 3.5

4) Parking Demand and Supply/Demand Balance Estimate

The on street parking demand in 1995 was estimated as 279,800 cars/day, among which parking of Zonas Azules was 21,980 cars/day. (Table 13.2-10) Other on-street parking includes illegal parking and other various types of parking. The demand of off-street parking using parking facilities was 49,640 cars/day. Parking demand during 2001 to 2020 is shown in Table 13.2-10.

Table 13.2-10 Parking Demand (1995)

	On Street		Off Street	Total
	Zonas Azules	Except Zonas Azules	Public Parking	
Demand				
to Home	1,940	36,290	3,310	41,540
to Work	3,490	54,410	17,190	75,090
to School	1,860	7,410	7,050	16,320
Business	4,220	46,580	8,800	59,600
Others	10,470	113,210	13,290	136,970
Sub Total	21,980	257,900	49,640	329,520
Supply (lots)	4,600	-	30,130	34,730

Table 13.2-11 Parking Demand (2001 - 2020)

	Parking Purpose		Year		
			1995	2001	2020
On Street	Zonas Azules	To Work	1,550	1,810	2,950
		Business	3,130	3,650	5,960
		sub-total	4,680	5,460	8,910
	Except Zonas Azules	To Work	9,810	11,440	18,660
		Business	14,530	16,960	27,680
		sub-total	24,340	28,400	46,340
Public Parking		To Work	18,370	21,430	34,970
		Business	11,050	12,890	21,030
		sub-total	29,420	34,320	56,000
Total		To Work	29,730	34,680	56,580
		Business	28,710	33,500	54,670
		Total	58,440	68,180	111,250

The demand was calculated based on the following conditions.

a) The growth rate of parking demand was assumed to be the same as that of the traffic volume estimated in this study.
b) The purpose of parking was classified into "to work" (including "to home" and "to school") and "business" (including "others",i.e., shopping, social purpose).

The parking space for parking "to work" should be provided by each destination such as the offices or the schools, and not by public parking, in principle.

On-street parking, except Zonas Azules, would be illegal parking in principle, about 30 % of which would be considered to require public parking the on-street parking for

commercial facilities. The control of illegal on-street parking should be strengthened while the preparation of public parking should be promoted to meet the parking demand.

(2) Parking Facilities Development Policy (2001)

Figure 13.2-22 and Table 13.2-12 show Zonas Azules, Public sector and Private use parking as source facilities, by purpose, on demand.

Three (3) alternatives are studied as the policy of preparation of Zonas Azules (Table 13.2-12);

Case A; serving for only the present demand of Zonas Azules (3,650 lots)
Case B; serving for the business purpose road-side parking demand, in addition to Case A
Case C; serving for the total road side parking demand

In this study of parking the demand was calculated based on Case B. Table 13.2-13 shows parking demand and supply balance and 7,330 lots will be short of in 2001.

1) Zonas Azules

The parking demand and supply are shown in Table 13.2-13.

Table 13.2-12 Public Parking Facilities: Target Year 2001

Scenario Case	Zonas Azules Allotment*	lots	%	Government Sector(30%)	Private Sector(70%)	Sub-total	(%)	Total lots
Case A	Minimum:	3,650	11	8,960	20,890	29,850	89	33,500
Case B	Medium:	8,580	26	7,480	17,440	24,920	74	33,500
Case C	Maximum:	20,610	62	3,870	9,020	12,890	38	33,500

*: Minimum = Parking purpose "Business,shopping" in Zonas Azules
Medium =Minimum + "Business" except Zonas Azules
Maximum = "Business" & "Illegal and Others" on street

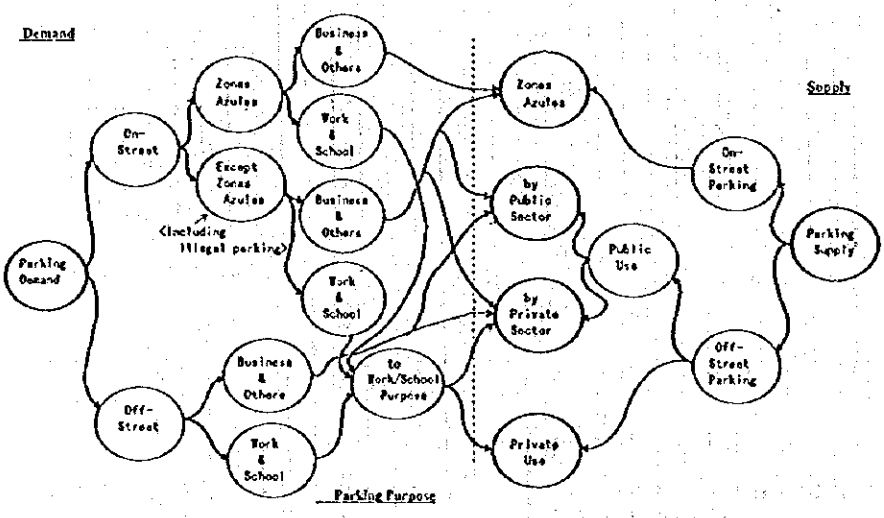


Figure 13.2-22 Basic Policy for Parking Plan

The parking demand for Zonas Azules is estimated at 8,580 lots in the year 2001, and a shortage of 4,230 lots is anticipated. The development of parking spaces in zones 6, 22 and 20, which are located in the north east and the north west of the city center, will have priority for the time being.

Since, under the present situation, the introduction of mass transit facilities is absolutely necessary, the parking plan must be established for the internal traffic demand while considering the introduction of public transit..

2) Public Parking

The public parking demand in the year 2001 is expected to grow to 4,450 lots. Although in Table 13.2-12 sufficient zones are found, it is not certain that the parking supply of those zones will satisfy all the parking demand, because the parking demand in this table excludes 'to work', ' to home' and 'to school'.

In the city, there are self-parking type indoor and outdoor parking facilities, currently observed. But their increase can-not be expected when considering economic growth in the future.

The space for parking facilities must be found within the urbanized area concerned. In this respect, it is indispensable to plan parking facilities on the basis of the utilization of public spaces, such as public vacant land, underground space of the road, etc.

Table 13.2-13 Parking Demand and Supply Balance

[Case B] (slots)

Zone NO.	Zonas Azules			Public Parking Facilities			Total
	Capacity	Demand 2001	Shortage	Capacity	Demand 2001	Shortage	Shortage
3	0	690	-690	1,420	1,930	-510	-1,200
4	1,000	1,440	-440	1,820	2,930	-1,110	-1,550
5	1,700	1,450	-	4,370	3,370	-	-
6	1,200	2,300	-1,100	9,010	5,000	-	-
17	0	430	-430	1,740	1,880	-140	-570
20	0	520	-520	1,080	2,750	-1,670	-2,190
21	300	570	-270	2,530	3,550	-1,020	-1,290
22	300	1,010	-710	3,280	3,100	-	-530
25	100	170	-70	610	410	-	-
	4,600	8,580	-4,230	25,860	24,920	-4,450	-7,330

The following places have been chosen to construct additional public parking facilities in the IDU plan either under the plaza, in the park, or under roads, and the preparation of public parking should be implemented in the above-mentioned priority zones. (Figure 13.2-23, Figure 13.2-24)

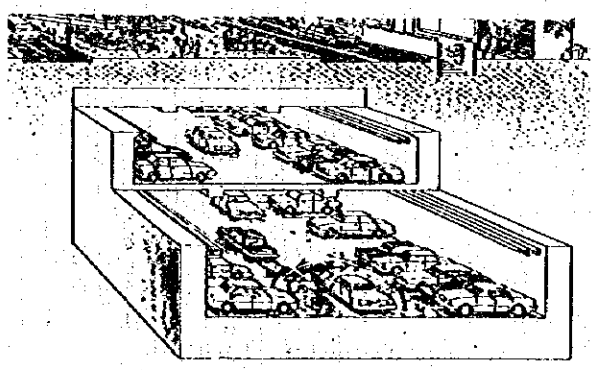
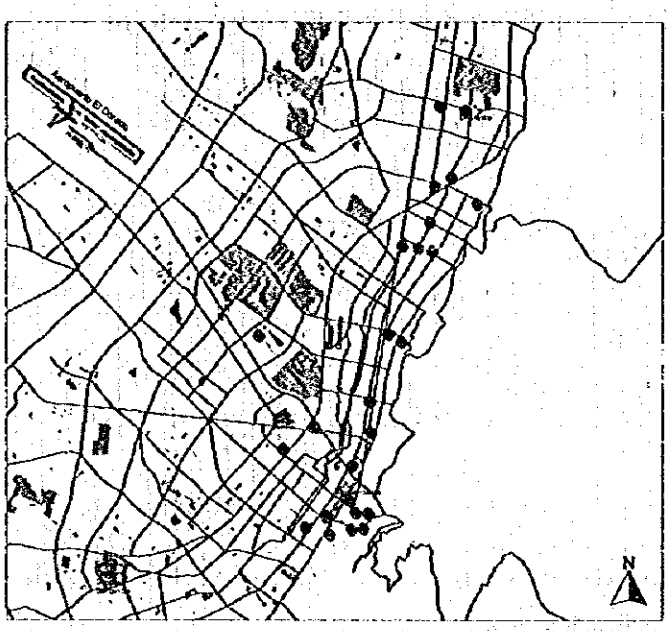


Figure 13.2-23 The Underground Parking Facility



Source:IDU 1995

Figure 13.2-24 The Location of Available Open Space for Parking

The cooperation of the private sector will be indispensable to cover all the expected demand and the further planning for various aspects will be needed.

Zone: 3	
Iglesia Santa Beatriz	Ave. Pepe Sierra
Zone: 4	
Iglesia Cristo Rey,	Carrera 3 y Calle 8
World Trade Center ,	Carrera 15 y Calle 90
Calle 5 X2 ,	Unilago
Zone: 5	
Parque De Loudes,	Calle 63
University Gran Colombia,	Parque Nacional,
Zone: 6 ,25	
Plaza De Toros,	Plaza Las Nieves
Intercambiador Calle 22,	Lote IDU
Calle 16 Lote IDU,	Plaza A. Nariño
Plaza De Parquelos Martires,	La Concordia
Plaza de Bolivar	
Zone: 21,22	
C.A.N. Ala Solar,	T.I.T

(3) Proposed

In Bogota, it is considered that development of parking facilities supplied from the public sector should serve the minimum demand for parking, and the uses of parking should be limited to business, shopping and social activities.

In this study, it is thought better for the private sector to supply parking facilities for the purposes of 'going to work ' and 'going to school', because they have a choice of using public transport. In terms of responsibility for cars on the street, it is suggested that Zonas Azules continue to provide parking for those.

On the other hand, it can not be denied that Zonas Azules has its own limitation for supply and can become an obstruction to the beauty of the city.

It is estimated that the demand or parking for Zonas Azules plus demand of parking for business use of 'Except Zonas Azules' consists of 26% of the total demand. That means that 4,230 lots are needed. And it is concluded that 4,450 parking lots should be supplied as 'public parking' facilities. So more than 11 parking facilities, which can accommodate 400 cars, are needed by the year 2001.

As it will be impossible to supply public parking facilities for all the parking demand, this report focused instead on calculating the minimum demand. And it is acknowledged that this figure does not satisfy the needs for future parking perfectly, so it is necessary to carry on research on the realities and achieve a better service level.

Some of the recommendations to meet future parking demand are described below:

a) In the city center, parking facilities development only by the private sector will result in imbalance of supply and demand, which will cause illegal on-street parking and hinder the appropriate development of the city. Therefore, public authority shall also be involved in the development of off-street parking facilities.
b) Expansion of public parking places must be preferred, and public investment is necessary for positive promotion of such expansion.
c) Though Zonas Azules is considered helpful in providing parking space, the priority of expansion must be lowered from now on in view of the decrease in the traffic capacity and aesthetic view. The stress point of the plan should therefore be shifted toward improvement and expansion of public parking facilities.
d) It is necessary to strengthen application of the regulation in which attachment of a parking facility to new buildings is obligatory.
e) It is necessary to take pricing measures to balance the supply of parking facilities and parking demand.
f) The effective use of existing parking facilities shall be taken into consideration (introduction of the parking-guidance system, review of parking-fare system, etc.)
g) The census for parking demand and facilities shall be prepared for further planning of parking facility development.

(4) Financial Analysis and Development Policy for the Underground Parking Facility Project

1) Objectives of the Analysis

As described in the previous section, IDU is carrying out underground parking development projects under public open spaces, by the concession system using capital and manpower from the private sector. IDU pointed out that the citizens' capacity to pay parking charges is still low, while the construction cost of underground facilities is more than double the construction cost of a superstructure with the same capacity. This suggests that those projects would not be suitable as profit-oriented projects. On the other hand, the shortage of parking will become more critical and chronic in the central part of the city and parking development projects will more urgently needed than ever.

In this section, a simplified financial analysis is made of the project from the standpoint of a private company, in order to examine if the project is profitable enough to attract investment by the private sector and if not, what kind of policy measures should be taken. To simplify the problem, it is assumed that all the funds to develop the parking

facility are procured by long-term loans and that the parking demand is not much affected by the level of parking charges.

2) Construction Cost

As a prototype of a parking facility, the project assumes a two or three-storied underground parking building with a capacity of 400 lots in the self-parking system (not the mechanical system). It will be built of reinforced concrete.

According to the data on similar parking facilities in Japan, the required area per lot ranges from 15 m^2 to 20 m^2. Assuming 18 m^2 per lot for this analysis, the total ground area required would be 3,600 m^2 for a two-storied underground building (type A) and 2,400 m^2 for a three-storied one (type B). The land is provided free of charge to a concessionaire company.

The deeper the underground floor, the higher the construction cost geometrically; two to three times of the cost of the upper floor. Based on the estimate by IDU, the construction cost per lot is assumed as 8 million pesos for the first undergrotind floor (basement), 20 million pesos for the second floor and 50 million pesos for the third floor. As shown in Table A, the total project cost will be 56,000 million pesos for type A and 103,800 million pesos for type B, which results in the cost per lot of 14 million pesos for type A and 26 million pesos for type B. (Table 13.2-14)

Table 13.2-14 Construction Cost of an Underground Parking Facility

Basement Floor	Unit Cost (P1,000/lot)	No. of lots		Construction Cost(mill.P)	
		Type A	Type B	Type A	Type B
1st.	8,000	200	134	1,600	1,072
2nd.	20,000	200	133	4,000	2,660
3rd.	50,000	-	133	-	6,750
Total	-	400	400	5,600	10,382
Av.Cost/lot	-	-	-	14	26

3) Long-Term Loan

As this analysis aims only at estimation of the project profitability, the entire amount of the investment is assumed simply to be procured by a long-term loan. The terms of the loan are as follows;

a) Loan Disbursement

Construction will take two years and the loan will be disbursed thus: 40% for the first year and 60% for the second year.

b) Repayment Period

Repayment will start from the first operating year (3rd year of the project) for 15 years, in the repayment method of constant amounts of principal and interest.

c) Interest Rate

Assuming 25% of nominal interest rate and 20% of annual inflation rate, the real interest rate would be 4.2% per annum (1.25/1.20-1.0). Interest during the construction period is charged to the balance at the beginning of the year, and half of the loan amount is disbursed in the first year.

4) Maintenance/Operating Cost

Maintenance and operating costs consist of personnel, maintenance/repair, power, depreciation, insurance and miscellaneous costs. Taxes such as business tax and income tax are disregarded in this analysis.

a) Personnel Cost

To collect parking charges, 4 persons will be needed (2 persons x 2 shifts). As one parking control staff (navigator) should be assigned for each one hundred lots, the parking building with 400 lots will need 4 persons. For the second shift, however, half of the staff in the first shift will be assigned. The total amount of the annual personnel cost will be 112 million pesos, assuming annual wages based on the current wage level in Bogota (Table 13.2-15).

b) Maintenance / Repair Cost

The sum of two million pesos is allotted for maintenance and repair costs, covering wall painting, waterproofing, repair of pipe works, cleaning, maintenance of fire extinguishers, etc.

Table 13.2-15 Personnel Cost

Personnel	No. of Staff			Annual Wage	Total
	1st shift	2nd shift	Total	(million P)	(million P)
Administrator	1	-	1	13.0	13.0
Charge Collector	2	2	4	7.8	31.2
Parking Control	4	2	6	6.5	39.0
Staff	2	2	4	7.2	28.8
Guard					
Total	9	6	15	-	112.0

c) Power Cost

Electricity will be consumed mainly for lighting, elevators and air conditioners. As a self-driven system is assumed, no parking machinery is used. Power cost is estimated at 1.2 million pesos per annum.

d) Depreciation Cost

The depreciation period is 45 years for the building and 15 years for the equipment, in linear depreciation, with 10% of residuals. This depreciation cost is used only in the income statement, not in the cash flow analysis, because this cost does not cause real cash Electricity will be consumed mainly for lighting, elevators and air conditioners. As outflow.

e) Insurance Cost

Annual fire insurance charge is 0.2% of construction cost and annual vehicle insurance charge is 50,000 pesos per lot.

f) Miscellaneous Cost

As the miscellaneous cost, 10% of the sum of (a) to (e) above is accounted. Based on the assumptions stated above, the maintenance and operating cost is summarized as shown in Table 13.2-16. The figures in the table represent the cost in the first year of operation and every component other than the depreciation cost is assumed to rise at 3.0% per annum in real term.

Table 13.2-16 Annual Operation/Maintenance Cost

Cost Item	Annual Cost(million P)	
	Type A	Type B
Personnel Cost	112.0	112.0
Maintenance/Repair Cost	20.0	20.0
Power Cost	12.0	12.0
Depreciation Cost	112.0	207.6
Insurance Cost	31.2	40.8
Miscellaneous Cost	28.7	39.2
Total Annual Cost	315.9	431.6

5) Revenue

A parking lot is commonly rented by the hour and sometimes by month (either specifying a lot or not) . The parking project in this analysis is planned basically for short-time parking demand in the central part of the city. Therefore, only hourly rental is considered here. Annual rental revenue is estimated by the formula below.

Annual Revenue = Hourly Rental x Average Parking Hour x Turnover Rate x Parking Capacity x Annual Operating Days

According to the result of our parking survey on "Zonas Azules" users' opinion, many people parks their car less than one hour and want to change the current 2-hour rental system to a minimum one-hour system. In this analysis, the parking charge is assumed to be 1,000 pesos per hour as the base case, and a sensitivity analysis will be made by changing the annual revenue.

According to the same survey results, average parking duration for the purposes of business, shopping, restaurant, etc. (other than "to work" and "to school") is 1.2 to 1.6 hours in the case of "Zonas Azules" and 1.5 to 2.3 hours in the case of off-street parking. The turnover rate is 4.7 to 4.8 times for "Zonas Azules" and 2.4 to 3.5 times for off-street parking. In general, the higher the turnover rate, the shorter the parking duration. In this analysis, average turnover rate and parking duration of off-street parking are applied to the project case:

Total daily parking hour per lot = Average Parking duration x Turnover rate = 1.9 x 3.0 = 5.7 hours

Parking capacity is 400 lots and annual operating days are 300, provided that Saturdays, Sundays and National Holidays are equivalent to half a weekday. Based on these assumptions, the annual revenue is calculated as below,

Annual Revenue = 1,000 x 5.7 x 400 x 300 = 684 million pesos

This revenue is also assumed to rise at 3.0% per annum in real terms (nominally 3.0+20.0=23% per annum) as the parking situation becomes more difficult in the central part of the city and the private income level rises higher in the future.

6) Financial Evaluation

The income statement and the cash flow are estimated based on costs and the revenue stated above, as shown in Table 13.2-17 and Table 13.2-18. Estimation is made for the period of twenty (20) operating years, that is, the presumable concession period.

In case of the type A in Table 13.2-17, the current account shows surplus from the first operating years. The only deficit results from the interest payment of 211.6 million

Table 13.2-17 Income Statemet of Parking Project

(1) Type A (milliom pesos)

Year	Revenue	Operating Cost and Interest Payment				Profit/ Loss
		Operating Cost	Depre-ciation	Interest Payment	Total	
1				47.0	47.0	-47.0
2				164.6	164.6	-164.6
3	684.0	203.9	112.0	235.2	551.1	132.9
4	704.5	210.0	112.0	223.6	545.7	158.9
5	725.7	216.3	112.0	211.6	539.9	185.7
6	747.4	222.8	112.0	199.0	533.8	213.6
7	769.8	229.5	112.0	185.9	527.4	242.4
8	792.9	236.4	112.0	172.3	520.7	272.3
9	816.7	243.5	112.0	158.1	513.5	303.2
10	841.2	250.8	112.0	143.2	506.0	335.2
11	866.5	258.3	112.0	127.8	498.1	368.3
12	892.5	266.1	112.0	111.7	489.8	402.7
13	919.2	274.1	112.0	95.0	481.0	438.2
14	946.8	282.3	112.0	77.5	471.8	475.0
15	975.2	290.7	112.0	59.3	462.0	513.2
16	1004.5	299.5	112.0	40.3	451.8	552.7
17	1034.6	308.4	112.0	20.6	441.0	593.6
18	1065.6	317.7	112.0	0.0	429.7	635.9
19	1097.6	327.2	112.0	0.0	439.2	658.4
20	1130.5	337.0	112.0	0.0	449.0	681.5
21	1164.5	347.2	112.0	0.0	459.2	705.3
22	1199.4	357.6	112.0	0.0	469.6	729.8
Total	18379.3	5479.4	2240.0	2272.8	9992.2	8387.2

(2) Type B (milliom pesos)

Year	Revenue	Operating Cost and Interest Payment				Profit/ Loss
		Operating Cost	Depre-ciation	Interest Payment	Total	
1				87.2	87.2	-87.2
2				305.2	305.2	-305.2
3	684.0	224.0	207.6	436.0	867.7	-183.7
4	704.5	230.7	207.6	414.6	853.0	-148.4
5	725.7	237.6	207.6	392.2	837.5	-111.9
6	747.4	244.8	207.6	368.9	821.4	-73.9
7	769.8	252.1	207.6	344.7	804.4	-34.6
8	792.9	259.7	207.6	319.4	786.7	6.2
9	816.7	267.5	207.6	293.0	768.1	48.6
10	841.2	275.5	207.6	265.6	748.7	92.5
11	866.5	283.8	207.6	236.9	728.3	138.1
12	892.5	292.3	207.6	207.1	707.0	185.4
13	919.2	301.0	207.6	176.1	684.7	234.5
14	946.8	310.1	207.6	143.7	661.4	285.4
15	975.2	319.4	207.6	109.9	637.0	338.3
16	1004.5	329.0	207.6	74.8	611.4	393.1
17	1034.6	338.8	207.6	38.2	584.6	450.0
18	1065.6	349.0	207.6	0.0	556.6	509.0
19	1097.6	359.5	207.6	0.0	567.1	530.5
20	1130.5	370.2	207.6	0.0	577.9	552.7
21	1164.5	381.4	207.6	0.0	589.0	575.5
22	1199.4	392.8	207.6	0.0	600.4	599.0
Total	18379.3	6019.1	4152.8	4213.6	14385.4	3993.9

Note: Total does not exactly coincide with the sum of annual figures in the table, because of fraction treatment.

pesos during the construction period, which can be canceled within two years after opening. As the sum of the annual surplus and the depreciation cost always exceeds the amount of annual repayment of the loan, short-term borrowing will not be needed for cash flow.

In case of the type B, the current deficit will last for five years and it will take 12 years to cancel the accumulated deficit. In the peak year, short-term borrowing of over 3,000 million pesos will be required to cover the deficit and loan repayment. In this case, an annual increase of revenue at 3% is a critical condition to make this project financially viable.

Using the cash flow of Table 13.2-17, the internal rate of return (IRR) is estimated at 8.2% for the type A and 1.5% for the type B. This means that, in term of nominal interest rate, the project type A can bear the interest rate up to 28.2% per annum and the type B can bear 21.5% per annum. In general, IRR should be over 10% in real terms to attract capital in the private sector to the project. From this criterion, both of the type A and type B are not profitable enough.

In order to make a project more profitable, it is apparently necessary to reduce the construction cost while increasing the revenue. The sensitivity of construction cost and revenue to IRR is tested by multiplying the factor of 0.4 to 1.4 to those variables. The results are illustrated in Figure 13.2-25 which shows that the IRR of type A will exceed 10% with a 5% cost reduction or 5% revenue rise. However, the IRR of type B hardly exceeds 10%, unless the construction cost is reduced by more than 20% and at the same time the revenue increases by over 50% which seem very difficult conditions to realize.

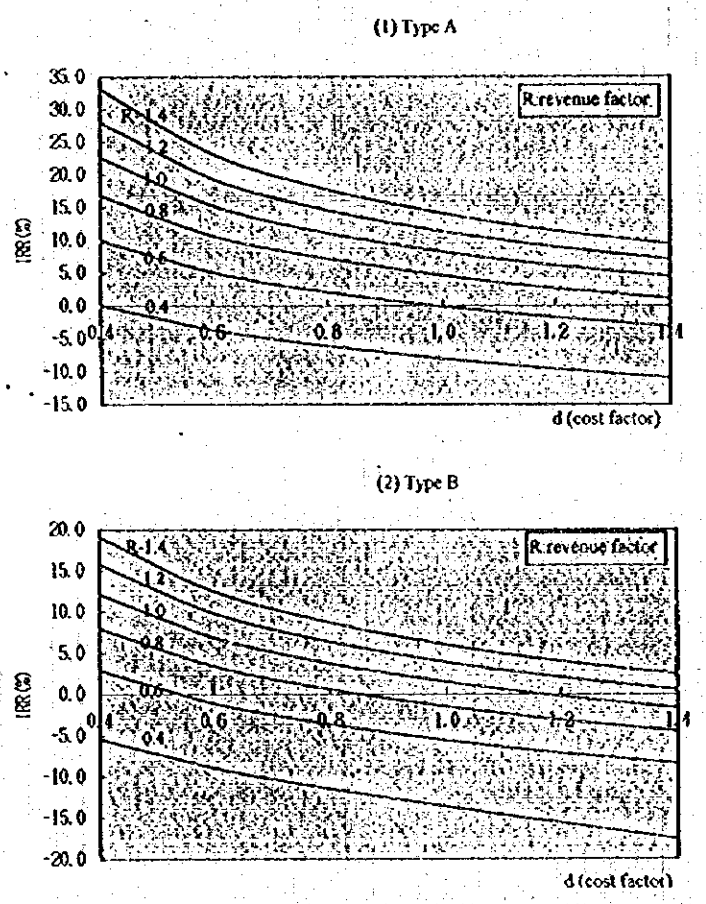


Figure 13.2-25 Sensitivity of IRR to Cost and Revenue

Table 13.2-18 Cash Flow Analysis for Parking Project

(1) Type A				(million pesos)
Year	Const. Cost	Operating Cost	Revenue	Net Cash Flow
1	2240.0			-2240.0
2	3360.0			-3360.0
3		203.9	684.0	480.1
4		210.0	704.5	494.5
5		216.3	725.7	509.3
6		222.8	747.4	524.6
7		229.5	769.8	540.3
8		236.4	792.9	556.5
9		243.5	816.7	573.2
10		250.8	841.2	590.4
11		258.3	866.5	608.2
12		266.1	892.5	626.4
13		274.1	919.2	645.2
14		282.3	946.8	664.5
15		290.7	975.2	684.5
16		299.5	1004.5	705.0
17		308.4	1034.6	726.2
18		317.7	1065.6	747.9
19		327.2	1097.6	770.4
20		337.0	1130.5	793.5
21		347.2	1164.5	817.3
22		357.6	1199.4	841.8
Total	5600.0	5479.4	18379.3	7299.9
			IRR=	8.2%

(2) Type B				(million pesos)
Year	Const. Cost	Operating Cost	Revenue	Net Cash Flow
1	4152.8			-4152.8
2	6229.2			-6229.2
3		224.0	684.0	460.0
4		230.7	704.5	473.8
5		237.6	725.7	488.0
6		244.8	747.4	502.6
7		252.1	769.8	517.7
8		259.7	792.9	533.3
9		267.5	816.7	549.3
10		275.5	841.2	565.7
11		283.8	866.5	582.7
12		292.3	892.5	600.2
13		301.0	919.2	618.2
14		310.1	946.8	636.7
15		319.4	975.2	655.8
16		329.0	1004.5	675.5
17		338.8	1034.6	695.8
18		349.0	1065.6	716.7
19		359.5	1097.6	738.2
20		370.2	1130.5	760.3
21		381.4	1164.5	783.1
22		392.8	1199.4	806.6
Total	10382.0	6019.1	18379.3	1978.3
			IRR=	1.5%

7) Development Policy for Underground Parking Facilities

The analysis revealed that the underground parking project is not profitable enough to involve the private sector: IRR of a two-storied underground building falls in boundary range of feasible and unfeasible areas, and three-storied building will gain almost no return. Therefore, some policy measures should be taken to raise its return and make it more attractive to the preferential private sector. The following measures are suggested:

a) Preferable Financial Treatment

A kind of subsidiary measure to offer a developer a long-term soft loan by a governmental development bank.

b) Tax Haven Policy

A support policy of exemption from income tax, business tax, etc.

c) Revenue increasing Policy

A policy to raise the average occupancy by mean of night time parking service and a reduced charge system in the weekend, and a policy to stabilize revenue by introduction of monthly contracts.

d) Joint Concession with another High Return Project

To concede the right of a parking development together with another project with higher return, such as commercial facility development along an underground concourse or in the area adjacent to the parking site.

e) Cost reduction by development above ground

Instead of underground facility, to build a two- to-three storied parking building with a park or greenery on the roof for environmental harmonization. (Figure 13.2-26)

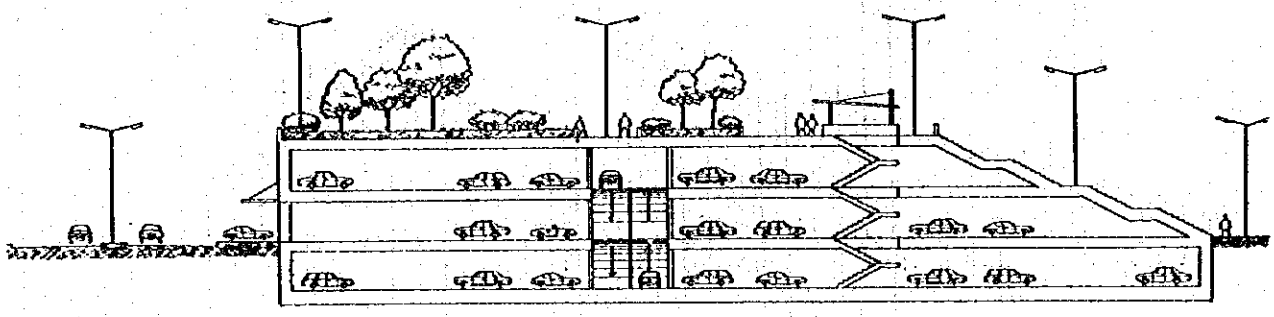


Figure 13.2-26 Two Storied Parking Building with Roof Park

13.3 Street Landscaping and Traffic Cell System

13.3.1 Street Landscaping Plan

The road is a prime public space the citizens. Among various functions of a road, amenity and contribution to the landscape of the city are considered important from the view-point of a comfortable and rich city life. In these circumstances, the following street upgrading projects are proposed for some of the priority projects in the traffic management plan, with the purpose of creating of rich road landscaping and city space, smoother traffic of both vehicles and pedestrians, and assuring pedestrian activities.

(1) Street Landscaping of Avenida Jimenez

1) Present condition
   a) Length : 1,700 m, width : 15 to 30 m (4 lanes)
   b) Shopping area in the lower part and trees in the upper part
   c) Winding slope with variable width

2) Needs for improvement
   a) Improving landscape and amenity
   b) Securing smooth car traffic

3) Planning strategy
   a) Improvement of pedestrian environment
   b) Securing bus and car traffic
   c) Conservation of median

4) Conceptual plan
   a) 4 lanes of roadway
   b) Conservation of median space and its improvement with promenade
   c) Improvement of sidewalks
   d) Pavement of sidewalk
   e) Street furniture (benches, signs etc.), bus stop shelters and lighting on sidewalk
   f) Vegetation on sidewalk

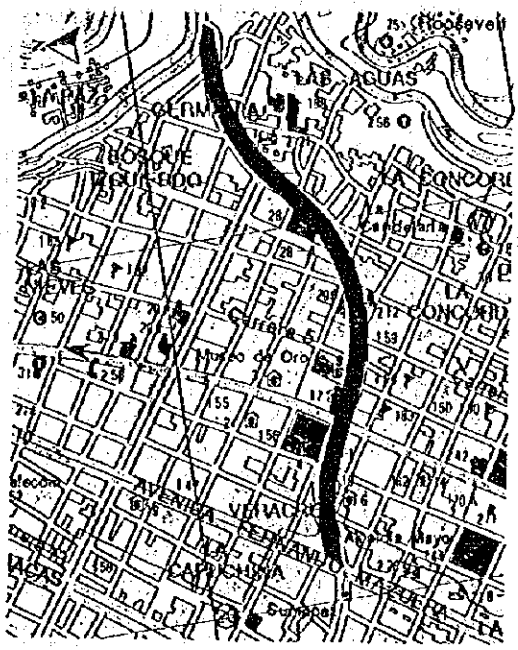


Figure 13.3-1 Location of Street Landscaping

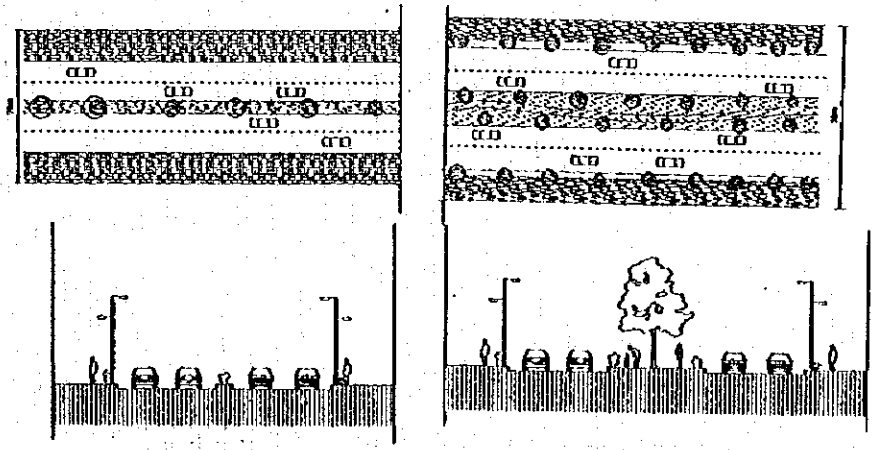


Figure 13.3-2 Typical Horizontal and Cross section

(2) Street Landscaping of Carrera 15

1) Present condition
   a) Length : 2,100 m, width : 25 m (3 lanes)
   b) Shopping area in CBD (Central Business District)
   c) Illegal parking is disturbing the sidewalks and pedestrian traffic.

2) Needs for improvement
   a) Assuring pedestrian traffic and shopping activity
   b) Improving landscape and amenity
   c) Controlling illegal parking

3) Planning strategy
   a) Improvement of pedestrian environment
   b) Assuring bus and car traffic
   c) No parking and consideration of loading / unloading

4) Conceptual plan
   a) Curving roadway of 3 lanes, one lane will be designated for a bus priority lane.
   b) Pavement to sidewalk
   c) Street furniture (benches, signs etc.), bus stop shelters and lighting on sidewalk
   d) Vegetation on sidewalk

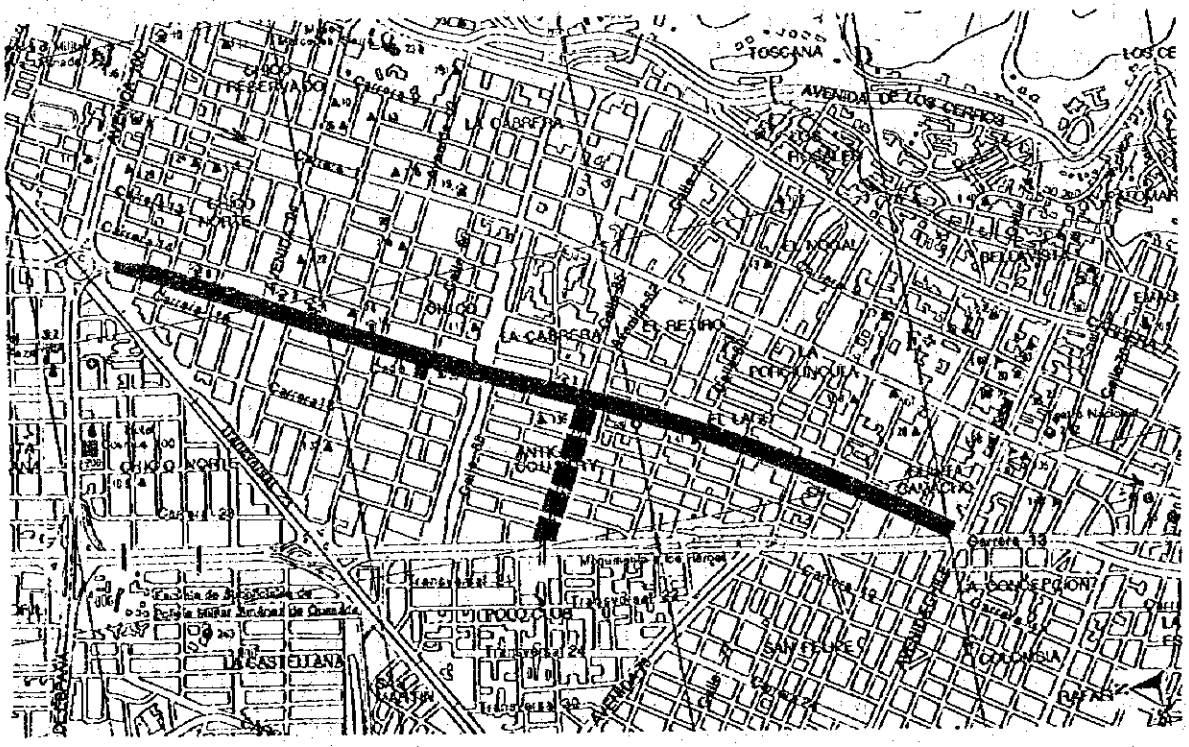


Figure 13.3-3 Location of Landscaping: (Carrera 15, Calle 85)

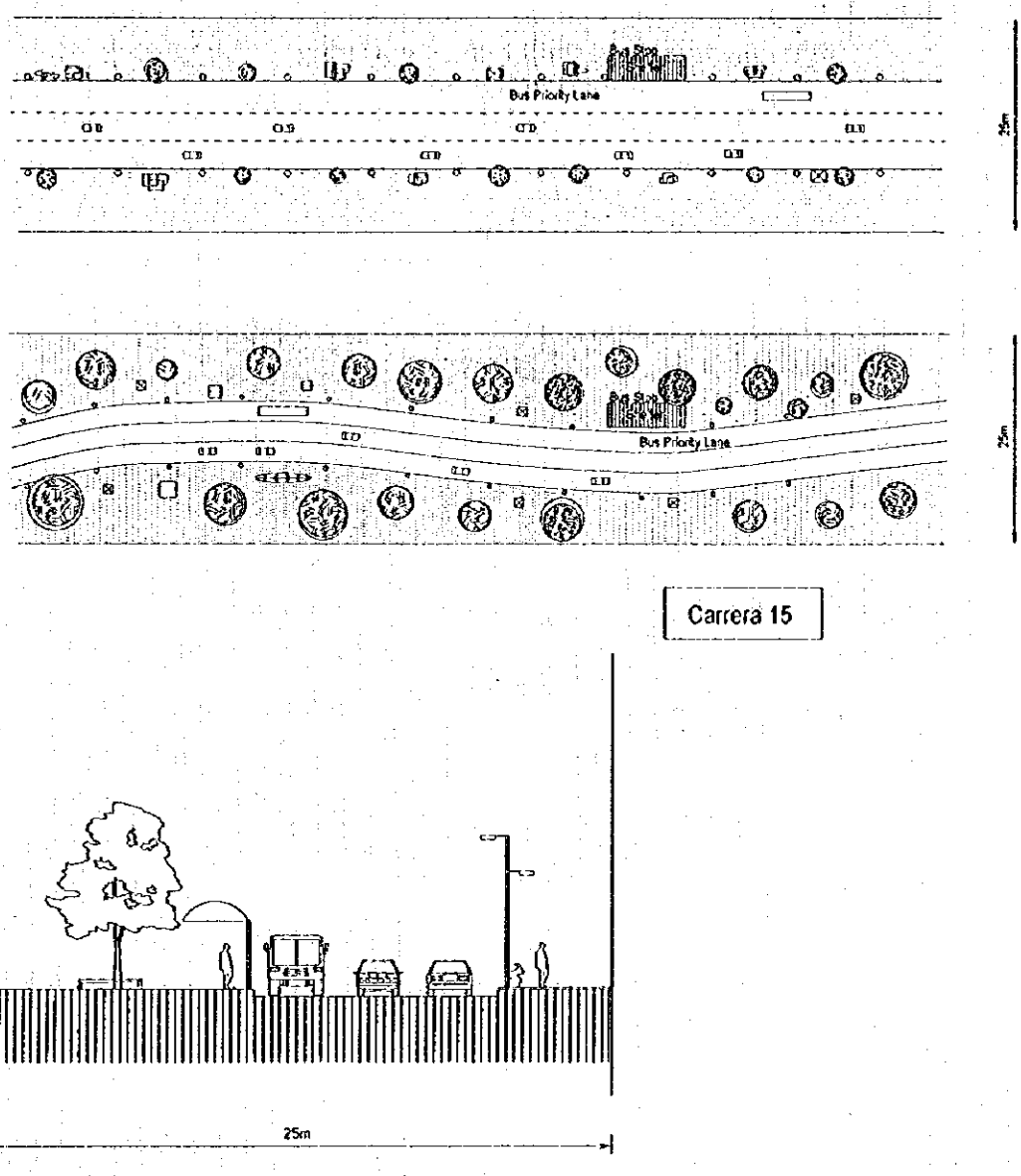


Figure 13.3-4 Typical Horizontal and Cross section: (Carrera 15)

(3) Pedestrian Mall * of Calle 85

1) Present condition

a) Length : 500 m, width : 50 m (8 lanes)
b) Set-back of fronting buildings
c) Street trees in sidewalk and median
d) Main carriage-way and side road

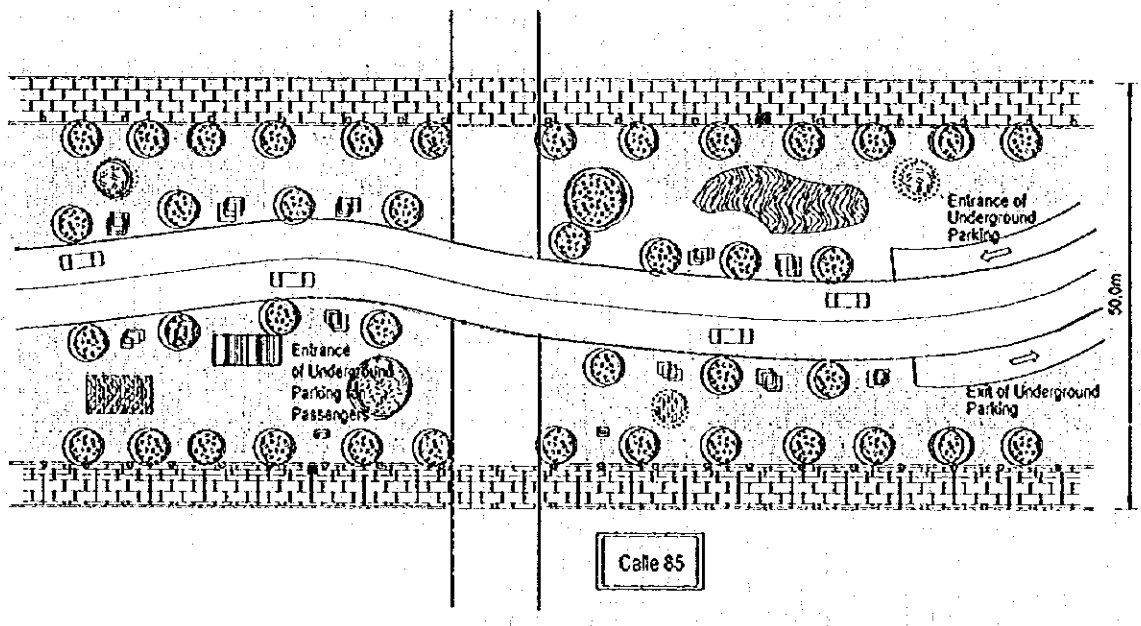
2) Needs for improvement

a) Effective and efficient use of road space
b) Creation of a park road improving landscape and amenity
c) Controlling illegal parking

*: The original meaning of the mall is a walkway with shade. But in this report, the mall means a shopping mall that has shopping areas along pleasant sideways.

3) Planning strategy
   a) Preparation of a park road with rich landscaping
   b) Optimal use of the existing vegetation
   c) Preparation of underground parking

4) Conceptual plan
   a) Curving 2 lane roadway in the center
   b) Park road with paved pedestrian way on fronting sides (emergency vehicle use only)
   c) Rich vegetation, recreational facilities and open space as park
   d) Construction of underground parking



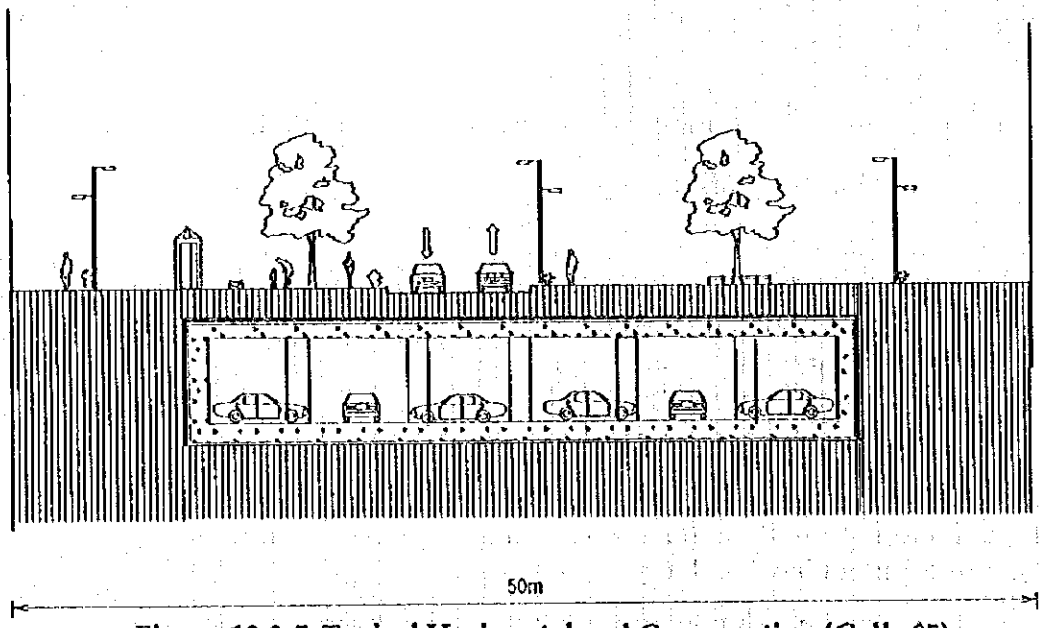


Figure 13.3-5 Typical Horizontal and Cross section (Calle 85)

(4) Proposed

In recent years, the purpose for the constructing roads has implied not only running cars quickly and efficiently, but also creating attractive sidewalks for pedestrians along the roads. Serving the needs of pedestrians has become an important factor to generate a better life-style for citizens.

In 1972, pedestrians-cars coexisting roads, was created in the Netherlands. Since then, (pedestrians-cars coexisting) roads have been created with the concept of 'safety', 'comfort' and 'charm' worldwide.

Finally, it is strongly recommended to apply these concepts of creating roads to the development of the road-system in Bogota city.

13.3.2 Traffic Cell System

(1) Traffic Cell System in the Candelaria

1) Objectives of the Plan

In order to achieve improvement of traffic and activation of social activities in a specific zone, introduction of the traffic cell system is proposed. The objective of the system is the creation of a comfortable and safe environment for the residents and pedestrians in a specific zone by reduction of through traffic, controlling the traffic flow. The following effects are expected;

a) Reduction of vehicle traffic in the zone
b) Improvement of the environment in the zone
c) Activation of commercial activities
d) Contribution to the development of tourism
e) Recreation for the citizens

2) Basic Idea of Traffic Cells

The system of 'traffic cell' or 'traffic zone' was realized in Bremen in Germany (1960) and Yeteboli in Sweden (1970), and it has been implemented based on the following idea:

a) The 'cells' divide an urbanized area.
b) The traffic directly connecting each cell shall be regulated.
c) The traffic inside each cell shall be controlled with a one-way system, cul-de-sac etc.
d) The access to each cell shall be built from the surrounding trunk roads or collector roads.
e) The pedestrian networks shall be made inside and among the cells.

With this system, separation of vehicle and pedestrian traffic will be basically achieved with a combination of local roads of loop type or cur-de-sac type. Some examples are shown as in Figure 13.3-6.

3) Traffic Cell Surrounded by Carrera 4 and 7 and Calle 9 and 12

Implementation of the traffic cell surrounded by Carrera 4 and 7 and Calle 9 and 12 shall be proposed in the Candelaria area. This cell or zone has the characteristics of an active commercial and tourist area, and there are concentrated important cultural and tourist sites in this area, such as

a) the religious museum,
b) the military museum,
c) the colon theater,
d) the colonial art museum,
e) the cathedral, San Ignacio Church etc.

Improvement of the pedestrian traffic environment, enhancement of commercial activities, enlargement of new tourist area etc., in the future will be promoted by the introduction of this system.

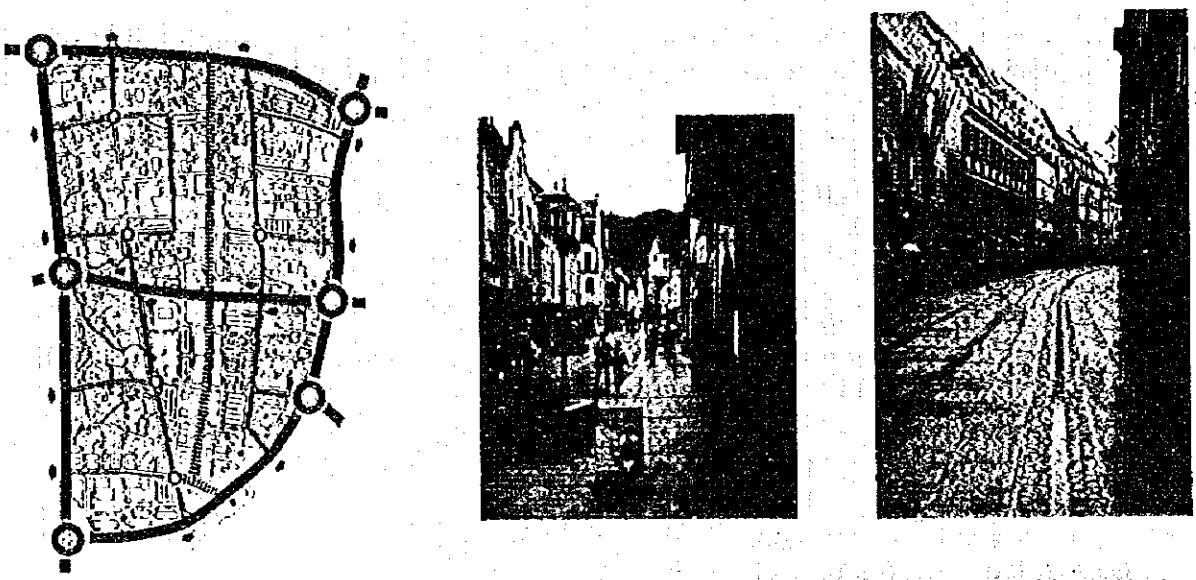


Photo: Plan of Transit Mall, by GIHODO

Figure 13.3-6 Some Examples of Traffic Cell in Europe

4) Operation

The operation of this area as a traffic cell will be as follows:

a) The roads inside the cell will be designated as a 'pedestrian mall' for pleasant pedestrian space.
b) Vehicle traffic into this zone should be controlled during day-time (e.g. 9 am to 6 pm)
c) Loading and unloading should be basically done during night-time (e.g. 6 pm to 9 am)
d) Underground parking should be constructed under the Plaza Bolivar, mainly for tourists.
e) Only buses can enter the cell through Carrera 5 for access into the cell.
f) Parking should be provided in the vicinity according to necessity.

It is recommended that after experimental operation of this system the cells should be expanded step by step from the east side cell of this cell and the cells north of Avenida Quesada, and that an effective traffic cell system should be realized suitable for Bogota city, ultimately.

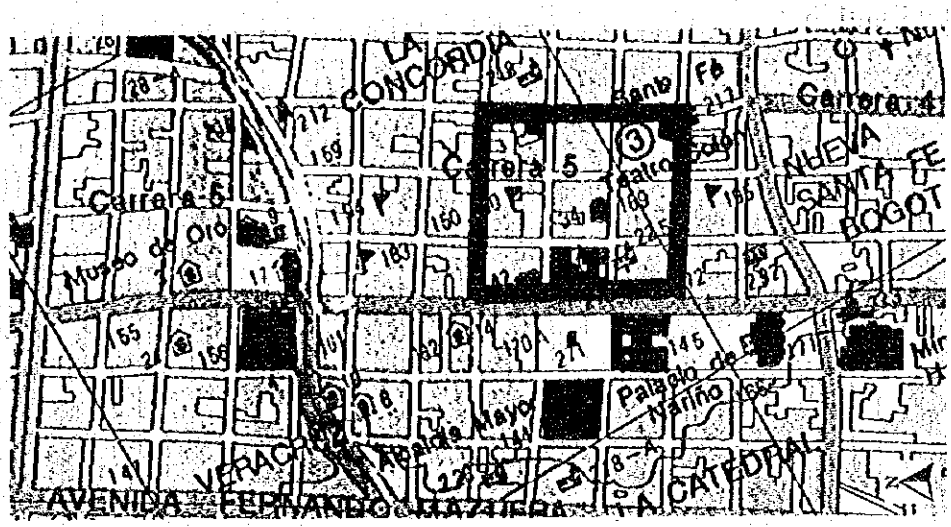


Figure 13.3-7 The Location of the Plan

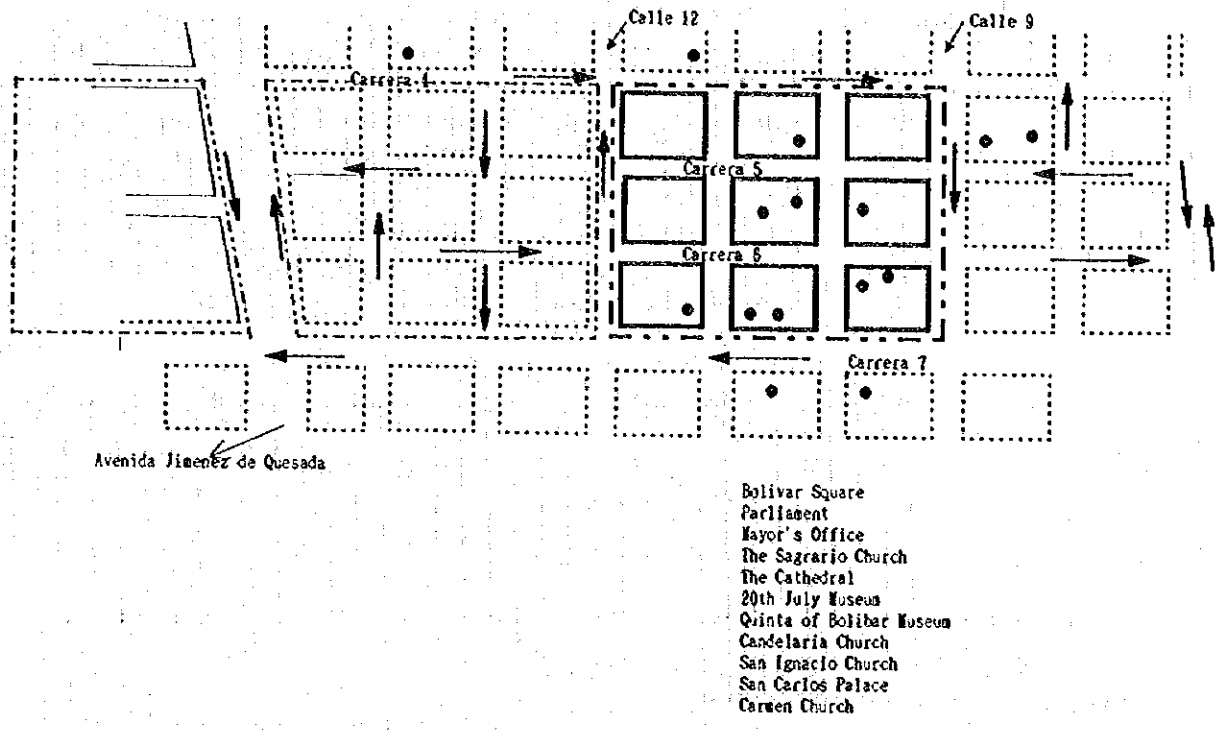


Figure 13.3-8 Traffic Cell in Candelaria

13.4 Bicycle Road Plan

13.4.1 Necessity of Bicycle Roads

As the results of the Person Trip Survey conducted in 1995 by the JICA Study Team, the number of bicycle in Bogota was estimated at about 60,000 bicycles. International Races of Bicycle have operated many times in all Colombia and Bogota. At present, four (4) existing roads such as Avenida 7a, Autopista El Dorado, Autopista Sur and Avenida Boyaca introduce open spaces for bicycle and walking and roller skating on Sundays or National holidays as recreation areas for citizens. On Sundays or National Holidays, many people use these open spaces with family or friends. In Colombia, the bicycle is very popular for sports and recreation.

On the other hand, on Sundays and National Holidays, many people go outside of Bogota by bicycle. They pass on the existing trunk ring and radial roads such as Autopista Sur and Medellin, and Avenida Centenario. The traffic of bicycles on these roads is very dangerous due to the mixed traffic, with buses and other motor vehicles on the road. Considering the above mentioned conditions, the necessity for the development of Bicycle Roads is summarized as follows;

a) To offer open space for the recreation of citizens
b) To keep traffic safety
c) To encourage sports
d) To maintain a good urban environment
e) To promote good communication with family and friends
f) To mitigate traffic congestion in Bogota.

13.4.2 Bicycle Road Planning Concept

There are many small parks and large parks such as National Park, Simon Bolivar Park , Tunal Park, Timiza Park, Florida Park , and Kennedy Park in Bogota. Four (4) rivers and canal are located in Bogota, and on the east side of Bogota there are mountainous areas. They maintain a good urban environment in the city. Considering the existing environmental conditions and the necessity of Bicycle Roads, the following planning concepts are identified.

a) Bicycle Roads should be constructed as individual roads.
b) Motor bicycles and motor vehicles can not be used on Bicycle Roads.
c) Bicycle Roads are connected to the major Parks and institutional areas as a bicycle road network.
d) At least, a 4-lane bicycle road should be constructed.
e) The space for shopping areas, rest areas, and maintenance shops for bicycles should be established on the Bicycle Road.
f) Information boards and traffic sign and signals should be prepared.
g) Traffic safety facilities should be prepared.

13.4.3 Route Location for Bicycle Road

The route location of Bicycle Roads was carried out based on the following conditions.

a) To avoid passing through traffic congestion areas
b) To use the good environmental areas
c) To avoid passing through areas where additional is land acquisition required, insofar as possible.
d) To locate them in vacant areas as possible.
e) To connect the parks and institutional areas.

Basically, the bicycle road should be connected to the major parks and institutional areas, considering the characteristics of the bicycle road. The major parks in Bogota which are National Park and Simon Bolivar Park; these parks are occupied by many people who come with family and friends for recreation.

There is no room for the new Bicycle Road without additional land acquisition, in the urbanized areas of Bogota, because many buildings and houses are constructed along the existing roads. Therefore, the route should be planned on vacant areas such as river areas and cannel areas, considering the easy construction of bicycle roads..

From the viewpoint of recreation, the route location should connect the major park and institutional areas, and pass through the good environmental areas to avoid the traffic congested areas. At present, the mountainous area of the Avenida Circunvalar maintains a good environment. Considering environmental aspects, the bicycle road is designed to pass the mountainous areas. As a result of a route location study, the twelve (12) routes are selected as shown in Figure 13.4-1 and Figure 13.4-2.

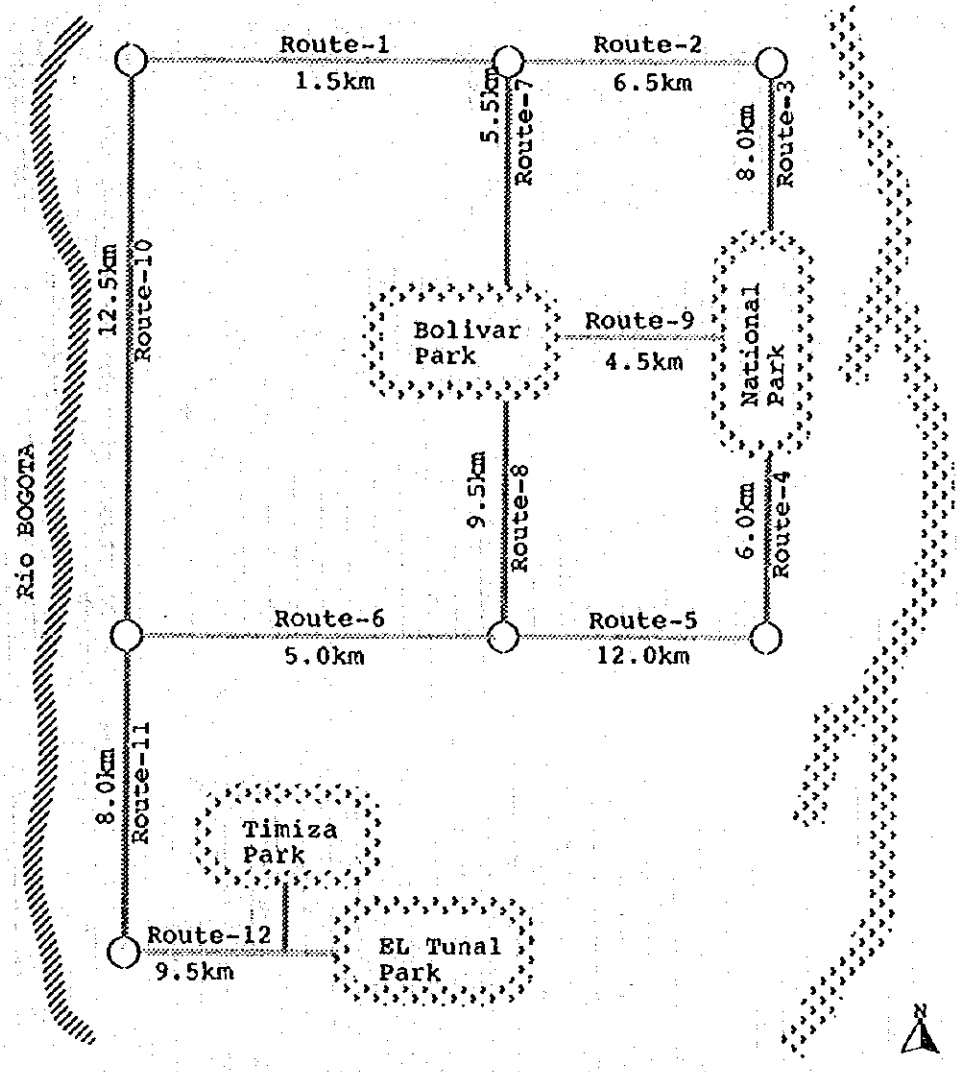


Figure 13.4-1 Concept of Route Location of the Bicycle Road.

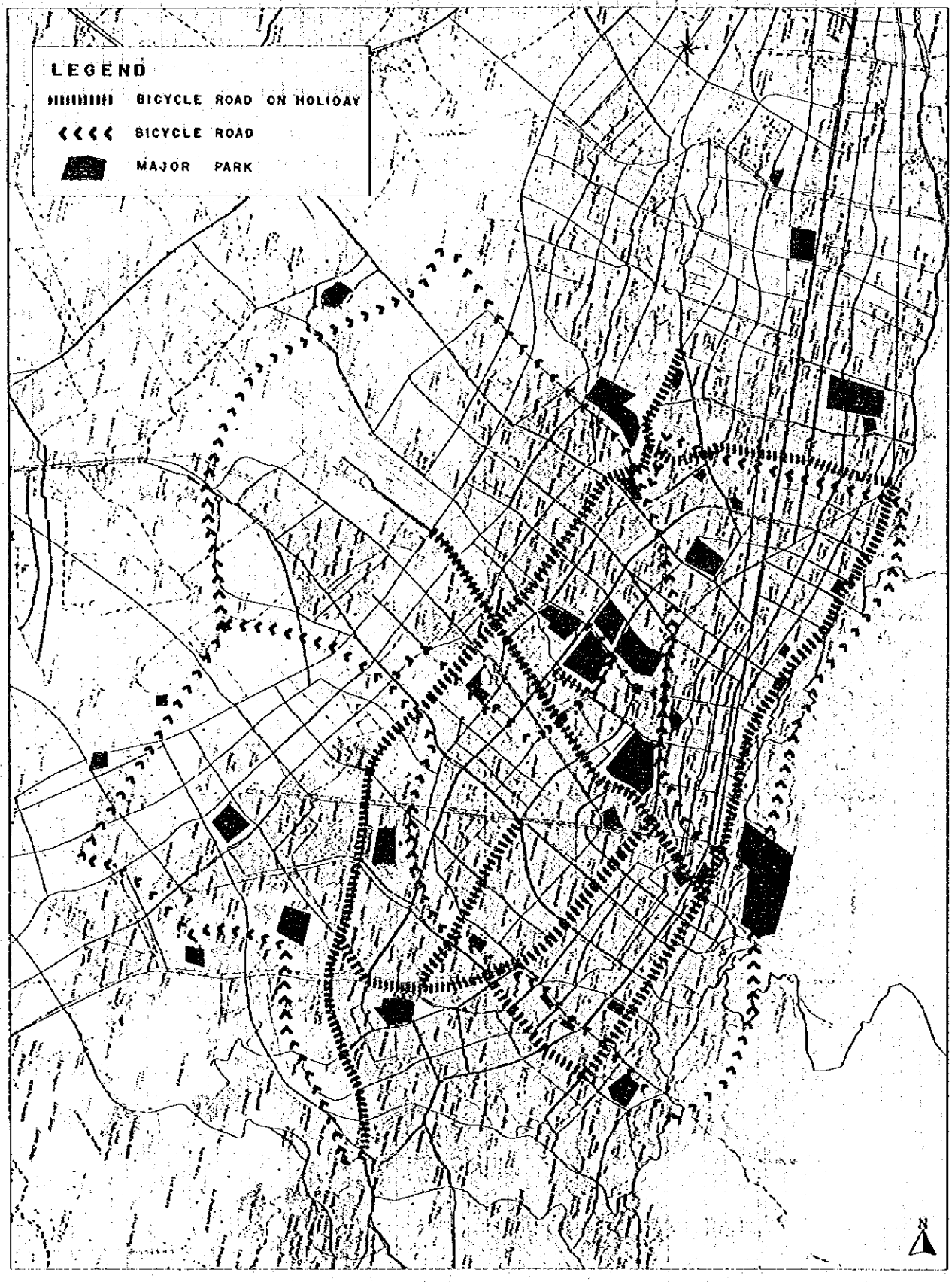
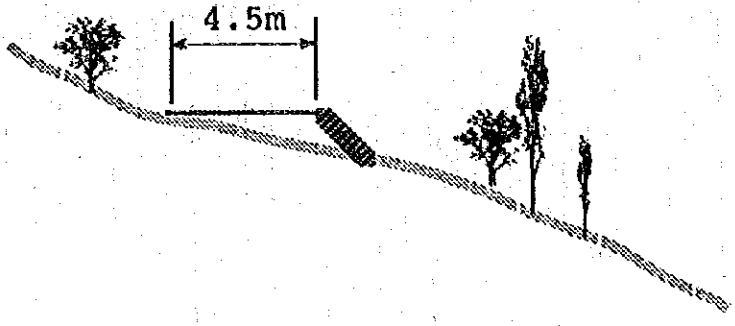


Figure 13.4-2 Route Location of the Bicycle Road

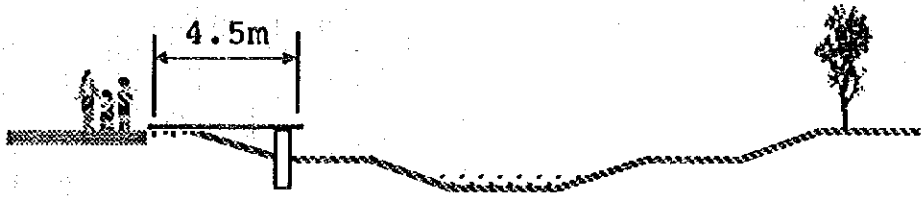
13.4.4 Typical Cross Section on Each Route

The typical cross sections are identified considering the land use condition and topographic features based on the field reconnaissance survey. The typical cross section of each route is shown below:

(1) In Mountainous Area (Type-A)

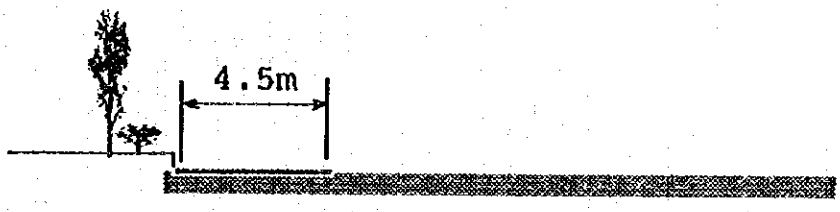


(2) On River or Canal Areas(Type-B)



(3) On Embankment of River or Canal Areas (Type-C)

(4) On a Street or Avenida (Type-D)



13.4.5 Description of the Bicycle Road

The description of each route is summarized in Table 13.4-1.

Table 13.4-1 Summarized Bicycle Road

Name of Route	Length (m)	Located Area	Cross Section	Construction Difficulty	Construction Cost(1000US$)
Route-1	7,500	Rio Amarillo	Type-C	Easy	750
Route-2	6,500	Canal Nolinos	Type-C	Easy	650
Route-3	8,000	Mountainous	Type-A	Difficult	4,000
Route-4	6,000	Mountainous	Type-A	Difficult	3,000
Route-5	12,000	Canal Cristbal	Type-C	Easy	1,200
Route-6	5,000	Rio Fucha	Type-C	Easy	500
Route-7	5,500	Rio Amarillo	Type-B	Easy	5,500
Route-8	9,500	Ave. Esmeralda	Type-D	Easy	-----
Route-9	4,500	Canal Arsobispo	Type-B	Easy	4,500
Route-10	12,500	Rio Bogota	Type-C	Easy	1,250
Route-11	8,000	Rio Bogota	Type-C	Easy	800
Route-12	9,500	Rio Tunjuelito	Type-C	Easy	950
Total	94,500				23,100

13.5 Project Cost Estimate for Traffic Management Plans

As mentioned previously, the total of nine (9) combination plans are proposed for the traffic management plan. The project cost of each plan is estimated based on the results of discussion with Colombian counterparts of the Study, actual project cost of similar projects, and data analysis of material cost and construction cost in Bogota.

The project costs consists of construction cost, engineering cost, administrative cost, and physical contingency, and its estimated based on US$ in 1996 price. The each project cost estimated is shown in Table 13.5-1.

Table 13.5-1 Traffic Management Planning Cost

Project Name	Component of Plan		Project Size	Construction Cost (1,000 US$)
MP1	Intersection facilities improvement(At-grade)			
		A-type	4 vol.	
		B-type	30 vol.	
		Guard fence	20 vol.	
		Traffic sign	20 vol.	
		Signal for Ped.	4 vol.	1,474
MP2	Traffic signal control system			
		Signal facilities	1 unit	
	Information system	Center facilities	1 unit	
		Message sign board.	13 vol.	44,930
MP3	Traffic education			
	Traffic safety center	Office facility	1 unit	
	Traffic park	signal,sign etc.	2 vol.	1,572
MP4	Parking Facility			
		Zonas Azules	1 unit	
		Parking facility	14 vol.	82,366
MP5	Traffic Cell			
		Cell	1 unit	
		Parking facility	1 vol.	16,155
MP6	Street Landscaping(1)			
		Ave. Himenez	1 unit	25,000
MP7	Street Landscaping(2)			
		Carrera 15	1 unit	20,000
MP8	Pedestrian Mall			
		Calle 85	1 unit	
		Parking facility	1 vol.	11,620
MP9	Bicycle Road			
		12 routes	12 vol.	23,100
	TOTAL			226,217

CHAPTER 14
Implementation Program for Comprehensive Master Plan

14. IMPLEMENTATION PROGRAM FOR THE COMPREHENSIVE MASTER PLAN

14.1 Proposed Projects for the Comprehensive Master Plan

In the Chapters 11, 12, and 13, three (3) sector plans conceived as road, public transport, and traffic management plans are examined, based on the selected transport network described in Chapter 10. In this chapter, based on these plans, projects for the Comprehensive Urban Transport Master Plan in Bogota are identified, and the priority of each project is examined.

14.1.1 The Road Facility Development Projects

In the Chapter 11, various road facility development plans are studied. The following four (4) plans are identified.

a) Existing road improvement plans
b) Grade separated intersection plans
c) New road (At-grade road) construction Plans
d) Urban expressway (Viaduct road) construction plans

(1) Existing Road Improvement Projects (Road Project- RP)

The existing road improvement plans consist of the 27 existing road improvement plans. Based on the 27 existing road improvement plans, the nine (9) projects are identified taking into account of the following three (3) project identification conditions.

a) Project size
b) Project located area and land use
c) Project characteristics

The name of nine (9) projects and their component plans are summarized in Table 14.1-1 as the existing road improvement project.

Table 14.1-1 List of Existing Road Improvement Project

Name of Project	Component of Planned Roads	Total Road Length (km)	Project Cost (1,000US$)
RP-01	Car.11, Calle 31, Calle 45, Calle 53, Calle 63, Av. Mariscal, Av. Santander, Av. Conuneros, Av. Indastrial, Av. Aranda	30.0	144,955
RP-02	Av. Quiroga, Av. Pedro, Av, San Juan, Av. San Antonio, Av. Casablanca	17.8	70,129
RP-03	Av. Fontibon, Av. Versalles, Av. TDM, Av. Luis	9.4	49,128
RP-04	Av. Tital, Av. Circunvalar, Auto. Llano	37.9	155,124
RP-05	Auto. Medellin	12.1	47,975
RP-06	Av. Centenario	10.9	43,368
RP-07	Auto. Sur	9.1	36,140
RP-08	Av. Alberto (7a)	9.5	63,410
RP-09	Auto. Norte	9.2	36,338
Total		145.9	646,567

(2) Grade Separated Intersection Project

In Chapter 11, a total of 34 intersections are improved from at-grade intersection to grade-separated intersections. A total of 34 improvement plans are identified as the grade separated intersection project (RP-10). The total project cost of RP-10 is estimated at US$136,000 thousand, at 1996 prices.

(3) New Road (At-grade Road) Construction Projects

In Chapter 11, a total of 53 new road construction plans are proposed. Based on these 53 new road construction plans, 18 new road construction projects are identified, taking into account the following three (3) matters.

a) Project size
b) Project characteristics
c) Project located area and future land use plan

Table 14.1-2 List of New Road Construction Project

Name of Project	Component of Planned Roads	Total Road Length (km)	Project Cost (1,000US$)
RP-100	Av. Cundinamarca (V-0)	40.0	734,230
RP-101	Av. Cali (V-1, V-2)	35.0	451,002
RP-102	Av. Suba - Kennedy (V-2)	34.4	288,600
RP-103	Av. Suba Extension (Boyaca) (V-1)	12.3	155,929
RP-104	Av. Norte - Estoril (V-2)	16.4	130,392
RP-105	Av. San Jose (V-1)	7.1	85,590
RP-106	Av. Jose Celestion (V-2)	10.2	106,722
RP-107	Auto. Americas Extension (V-0)	5.9	105,396
RP-108	Av. 1a de Mayo (V-2)	5.9	57,258
RP-109	Av. Laureano Gomez, Av. Jorge Botero, Av. Santa Barabara (V-2)	22.1	175,370
RP-110	Av. Guaymaral, Av. Los Arrayanes, Av. Polo, Av. Tibabita (V-2, V-3)	23.1	222,414
RP-111	Av. San Antonio Extension, Av. Cota Ext., Av. Santa Rosalia (V-2, V-3)	18.1	117,029
RP-112	Av. Sirena, Av. Marcedes, Av. Cordoba, Av. Conejera, Av. Cerezos, Av. Villa Maria, Av. Tabor, Av. Iberia,Av. Cedritos (V-2, V-3)	29.1	182,599
RP-113	Av. Esmeralda Ext., Av. Salitre, Av. Pablo (V-2, V-3)	6.9	122,291
RP-114	Av. Morisca, Av. Bolivia, Av. Cortijo (V-2, V-3)	13.9	88,074
RP-115	Av. Alsacia, Av. Tintal, Av. Castilla, Av. Timiza (V-3)	24.2	174,316
RP-116	Av. Santa Fe, Av. San Bernadino, Av. Terreros, Av. Bosa (V-2, V-3)	14.8	75,536
RP-117	Av. Circunvalar Sur, Av. Camino Pasquilla, Av. Ciudad Villavicencino, Av. Victoria, Av. Guacamaya, Av. Caracas, Av. Uval, Av. Mariscas Ext. (V-2, V-3)	60.2	268,753
Total		379.6	3,541,501

(4) Urban Expressway Construction Projects

In the chapter 11, three (3) Urban Expressway Network Plans conceived as 1st Ring, 2nd Ring, and four (4) Radial Urban Expressways are proposed. Taking into account the following three (3) matters, the three (3) Urban Expressway projects are identified, as shown in Table 14.1-3.

a) Project size
b) Project located area
c) Balance of the future transport network plans

Table 14.1-3 List of Urban Expressway Projects

Name of Project	Component of Planned Roads	Total Road Length (km)	Project Cost (1,000US$)
HP-01	1st Ring (Av. 7a, Calle 72, Carerra 24, Av. Quito, Calle 28)	17.7	511,329
HP-02	2nd Ring (Canal, Calle 68, Railway Area)	23.9	666,939
HP-03	Av. 7a Radial, Rio Amarillo Radial, Auto. Americas Radial, Auto. El Dorado Radial Roads	23.0	671,307
Total		64.6	1,849,575

14.1.2 Public Transport Development Projects

In Chapter 12, the following diverse public transport plans are proposed based on the selected transport network plan in Chapter 10.

a) Trunk bus system development plans
b) Express bus system development plans
c) Bus terminal development plans
d) Railway system development plans

Four (4) public transport development projects are identified, as shown in Table 14.1-4 to Table 14.1-7, considering the following three (3) matters.

a) Future transport demand and capacity of the transport system
b) Characteristics of the public transport mode.
c) Future transport network development plans

Table 14.1-4 List of Trunk Bus Projects

Name of Project	Component of Plans	Route Length (km)	Project Cost (1,000US$)
BP-01	Route on Av. 7a	21.4	1,700
BP-02	Route on Av. Caracas	37.5	2,300
BP-03	Route on Av. Quito	28.8	2,900
BP-04	Route on Carerra 68	15.9	1,600
BP-05	Route on Av. Boyaca	24.5	2,500
BP-06	Route on Calle 22 & Av. 1a Mayo	11.0	900
BP-07	Route on Villa de Rio Cundinamrca	9.5	25,800
BP-08	Route on Autopista Americas	8.2	800
BP-09	Route on Av. Centenario	13.4	1,300
BP-10	Route on Ciudad de Lima	4.0	400
BP-11	Route on Autopista el Dorado	13.4	1,100
BP-12	Route on Calle 68 & Av. 68	6.6	500
BP-13	Route on Av. 78 & Av. 81	10.3	1,000
BP-14	Route on Av. Suba	5.4	400
BP-15	Route on Calle 170	4.9	400
Total		214.8	43,600

Table 14.1-5 List of Express bus Projects

Name of Project	Component of Plan	Total Route Length (km)	Project Cost (1,000US$)
BX-16	Route on Av. Caracas - Av. 27 - Autopista Sur	19.0	9,900
BX-17	Route on Av. Caracas - Autopista Norte	9.2	112,800
BX-18	Route on Av. Boyaca	18.4	5,800
BX-19	Route on Av. Boyaca - Av. Parque el Tunnel	5.0	500
BX-20	Route on Autopista Medellin	15.0	5,500
BX-21	Route on Av. Lima - Av. West	15.8	83,500
Total		82.4	218,000

Table 14.1-6 List of Bus Terminal Projects

Name of Project	Component of Plan	No. of Terminals	Project Cost (1,000US$)
BT-01	Main Bus Terminal (on Av. Quito - Calle 22)	1	40,000
BT-02	Sub- Bus Terminal (on 6 express bus route)	8	48,000
BT-03	Feeder Bus Terminal	7	14,000
BT-04	Truck Terminal	1	20,000

Table 14.1-7 List of Railway Projects

Name of Project	Component of Plan	Project Route Length (km)	Project Cost (1,000US$)
FP-01	Auto. Norte-Av. Quito-Railway-Auto.Sur	32.0	2,275,000
FP-02	Extension of Auto. Norte	8.0	201,200
		40.0	2,476,200

14.1.3 Traffic Management Development Projects

In Chapter 13, the following eight (8) traffic management plans are studied, in accordance with the concept of traffic management study. Basically, the traffic management plans are carried out as the urgent action program or short term plan.

a) Intersection improvement plan (At-grade intersections)
b) Traffic signal and control improvement plan
c) Traffic education Plan
d) Parking development plan
e) Traffic cell plan
f) Pedestrian mall plan
g) Bicycle road development plan
h) Pedestrian development plan

Taking into accounts, the characteristics of the above-mentioned plans, the nine (9) projects of traffic management are identified, as shown in Table 14.1-8.

Table 14.1-8 List of Traffic Management Projects

Name of Project	Component of Plan	Project Size	Project Cost (1,000US$)
MP-01	Improvement of Intersection (At-grade)	34 vol.	1,474
MP-02	Traffic Signal & Control	13 vol.	44,930
MP-03	Traffic Education	1 unit	1,572
MP-04	Construction of Parking	14 vol.	82,366
MP-05	Traffic Cell	1 unit	16,155
MP-06	Pedestrian Mall (Av. 85)	1 unit	11,620
MP-07	Bicycle Road Construction	23.1 km	23,100
MP-08	Improvement of Sidewalk (Carerra 15)	1.5 km	20,000
MP-09	Improvement of Sidewalk (Av.Jimenz)	1.5 km	25,000
Total			226,217