2.2.2. INTERSECTION TRAFFIC MOVEMENT SURVEY

Intersection traffic volume count surveys were also carried out for 14 sections of road along the project route. Survey was carried out for 13 hours from 6:00 to 19:00, on weekdays excluding Monday and Friday. Table 2.2-9 is a list of survey locations. Location numbers in the table correspond to location map in Figure 2.2-1.

In this survey, vehicle types were classified into 3 category; cars, trucks and buses. Small pick-up trucks were counted as cars. At the signalized intersections, queue lengths were also recorded. Queue lengths were recorded every five minutes, and the longest of each fifteen minutes was selected as representing queue length of that fifteen minutes.

Vehicle movements at three typical intersections are shown in order to understand the bus turning movement at major intersections. This information is utilized in the management of trunk bus routes.

Table 2.2-9 Intersection Traffic Volume Counts Locations

	Intersection Traffic Volume Count	
1	Apt. Norte – Calle 170´	
2	Calle 127 – Avenida Suba	Signalized
3	Avenida Suba - Avenida 68	Signalized
4	Calle 100 – Carrera 7a	
5	Avenida Ciudad de Quito - Av. 78	
6	Calle 72 - Av. 68	
7	Calle 72 – Avenida Caracas	Signalized
8	Calle 72 – Carrera 7a	Signalized
9	Avenida Ciudad de Quito - Calle 53	
10	Avenida Caracas - Calle 26	
11	Avenida Caracas - Calle 19	Signalized
12	Av.Ciudad de Quito - Av. Comuneros	Signalized
13	Avenida Caracas -Avenida 1o de Mayo	Signalized
14	Autopista Sur - Av. 68	

(1) Intersection Traffic Volume (Av. Caracas and Calle 72)

Figure 2.2-20 shows traffic movement in peak hours at intersection between Avenida Caracas and Calle 72. At this intersection, Carrera 15 also intersects diagonally from north-east direction. Central 4 lanes of Avenida Caracas are used by buses and are fully segregated from other traffic with curbstone. There is no left turn movement at this intersection. Peak hour in the morning was recorded from 8:00 to 9:00. For the evening it was during 17:00 to 18:00.

There are many right turn movements from Avenida Caracas into Calle 72. More than 50 % of cars make right turn into Calle 72 or Carrera 15 during a morning peak hour, while it is 40 % during a evening peak hour. Since this intersection involves Avenida Caracas, ratio of public vehicles (buses) are high at some 24% and 19% for morning and evening peak hours, respectively.

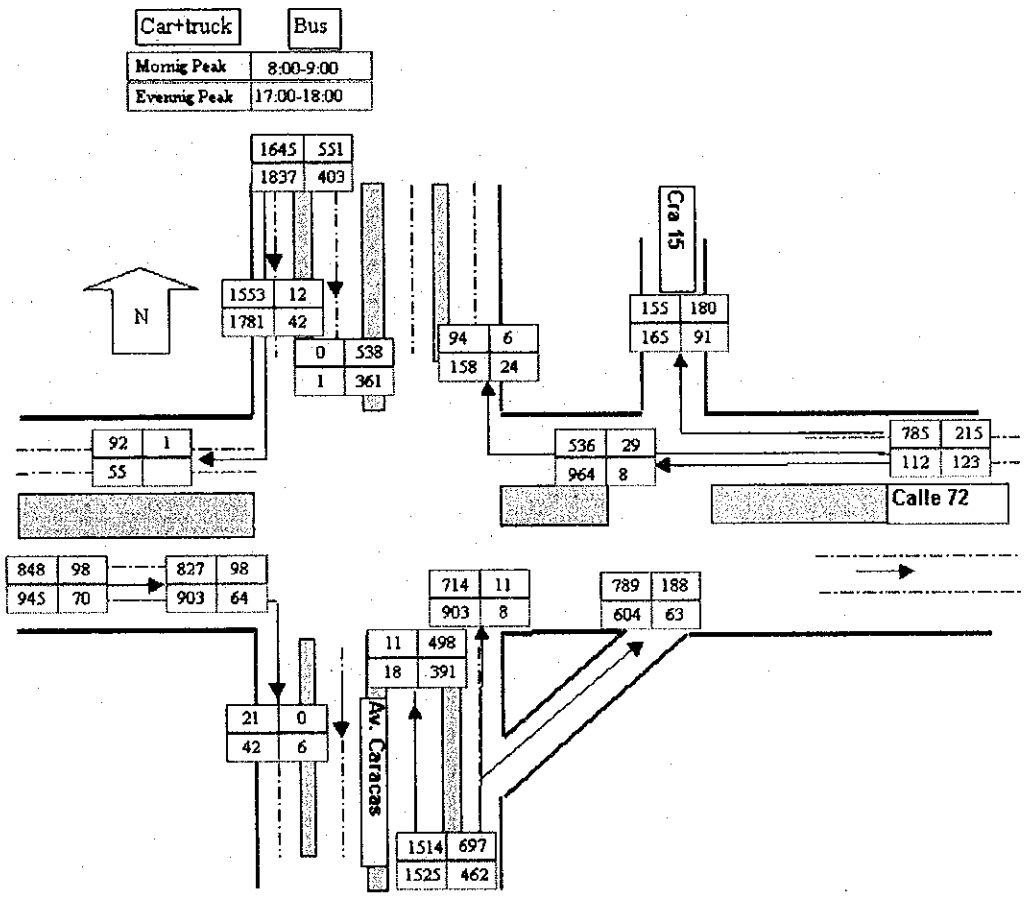


Figure 2.2-20 Intersection between Avenida Caracas and Calle 72

(2) Intersection Traffic Volume (Av. Quito and Av. Los Comuneros)

Figure 2.2-21 is intersection between Avenida de Los Comuneros and Av. Ciudad de Quito. Peak hour in the morning was recorded between 7:00 and 8:00. Highest hourly traffic volume in the evening was recorded between 14:00 and 15:00. All the left turn movements are prohibited at this intersection and right turns could be made without influence of the traffic signals at all directions.

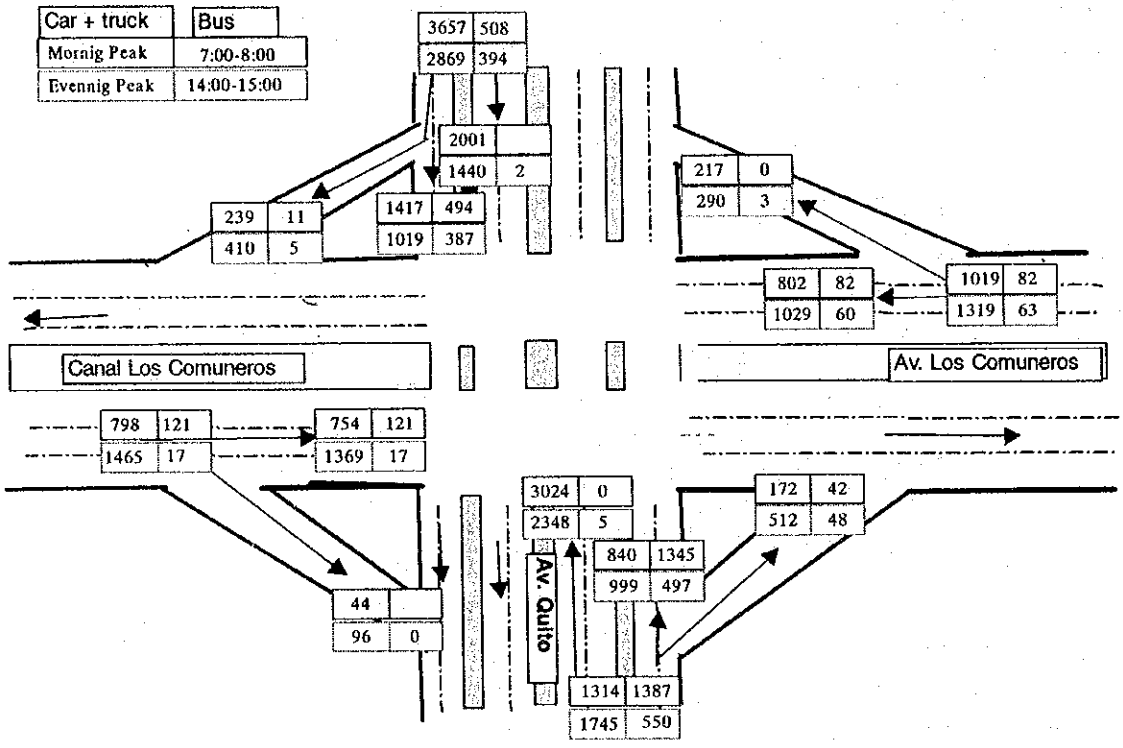


Figure 2.2-21 Av. Quito at Av. Los Comuneros

(3) Intersection Traffic Volume (Av. Suba and Calle 127)

Figure 2.2-22 shows the intersection between Calle 127 and Avenida Suba. This intersection is similar to interaction between Av. de Los Comuneros and Av. Quito. All right turns can be made from outer lanes. At this intersection, left turn is allowed in direction of Calle 127 to Avenida Suba, which heads for east-south direction.

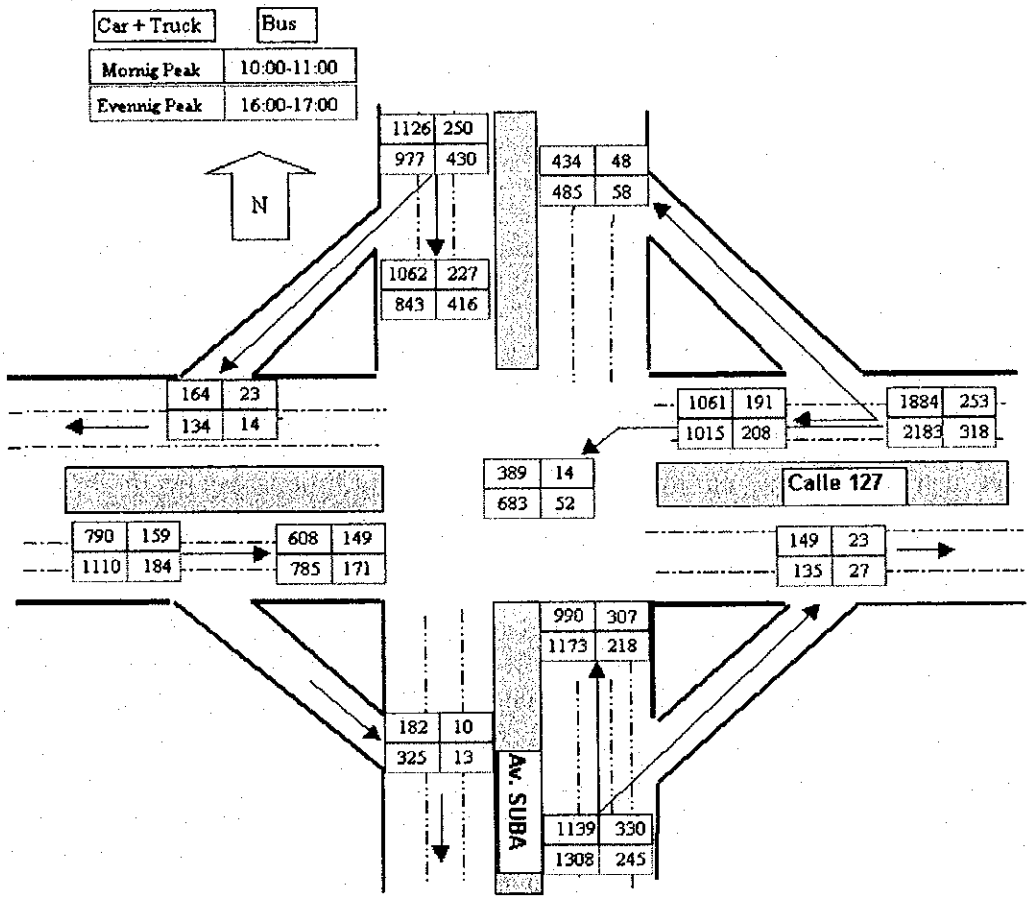


Figure 2.2-22 Av. Suba at Calle 127

2.2.3. BUS PASSENGER SURVEY

Bus passenger survey was carried out on 240 buses on the study road. Twenty (20) bus routes were chosen which most represent the study routes. Buses were surveyed in both directions in the morning, midday and evening, and were surveyed twice. Thus, total of buses surveyed were 12 vehicles per route, which totals to 240 buses for 20 routes. Bus routes were chosen by carefully examining preliminary survey of each bus route, using the data from STT in the Master Plan survey. At first, percentages of the bus route on the project route were calculated, and those with higher percentage were chosen. Then, by the visual observation of selected route maps, survey routes were selected. Questionnaire sheet is attached in annex.

(1) Objectives of the Survey

This survey was conducted mainly to understand characteristics of bus passengers, how they are using public transport, who is using the public transport, most congested segments of the bus route, and so on. For this purpose, basic questions of their social status, purpose of using a public transport, time spent on the bus, origin and destination (of the bus passengers), and the number of passengers getting off and getting on were also counted. Though public transport in Bogota has bus stops, buses stop to load and unload passengers at any point. Therefore, the number of passengers who get on or off was integrated into node points of network links used in the traffic assignment. Other items surveyed include number of transfers made during the whole trip, waiting time to get on the bus, walking time to get on the bus, and opinion about the bus operation.

(2) Characteristics of Bus Passengers

Approximately, 2000 passengers were interviewed. Interviewees were 55% male and 45% female, and 70% of the passengers were between age of 20 to 40. According to the Master Plan study, this age group has higher trip production than any other age group.

Almost half of interviewees had income between 210,001 and 419,999 pesos, which is second lowest class of income classification. Minimum monthly income of Colombia is 210,000 pesos. Figure 2.2-23 shows level of income of interviewees. Three lowest classes of income, i.e., monthly income of less than $623,000 pesos, dominate the bus users with percentage of some 90%. 68% of the passengers were non-car owner, and 24% family car owner (car does not belong to the interviewee). Figure 2.2-24 shows the composition of car ownership of the interviewees. Since family car owners do not have car which belong to them , it could be said that 92% of the interviewees do not have a car as their property.

According to the Person Trip Survey of the Master Plan Study, the car owner families exceeds the non car owner families in terms of percentage when the income level is around 1,000,000 pesos per month, and percentage of car ownership increases accordingly with the increase of monthly income. Figure 2.2-25 shows car ownership by income level obtained in this survey. Car owner families include those who replied that family has a car, but it does not belong to them.

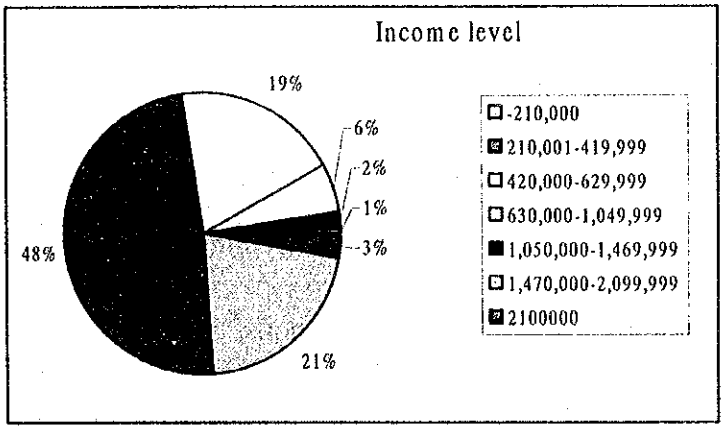


Figure 2.2-23 Income Levels of Bus Passengers

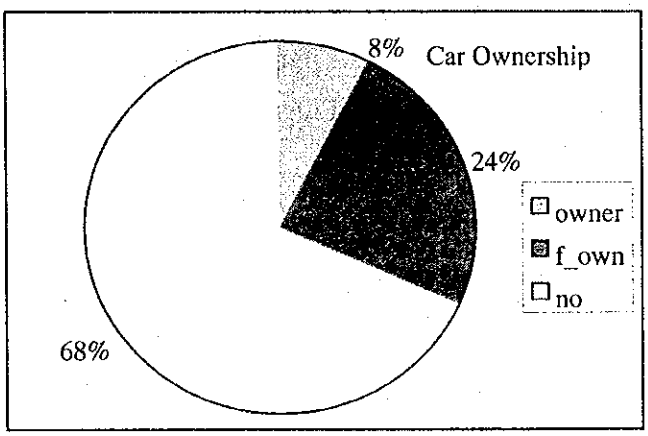


Figure 2.2-24 Car Ownership of Bus Passengers

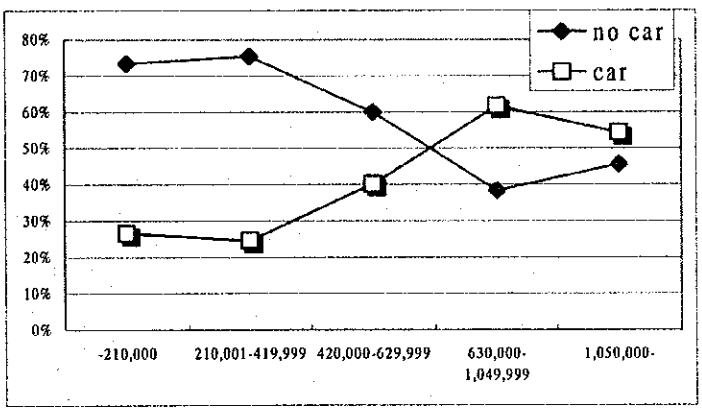


Figure 2.2-25 Car Ownership by Income Levels

(3) Bus Passenger OD Trips

Bus passenger OD trips were surveyed to obtain following information:

- Bus stop OD trip pairs of passengers, where they boarded and where they alighted
- Number of passengers boarding and alighting at bus stops

The OD information survey was carried out on board asking directly to passengers in random sampling manner. Passengers counting of loading and unloading was carried out at the same time on board. OD interview survey and counting survey were carried out twice per direction and per time period.

The bus loading conditions such as congested sections, demand, heavy volume bus stop locations, etc., in bus routes on the Study roads are developed form these survey data.

Figure 2.2-26 to Figure 2.2-28 show the number of passengers on board and number of passengers loading and unloading along the surveyed bus route selected on the Study roads. Those figures illustrate passenger information on board along the Study road.

The following typical routes from survey data are shown in the following section.

1) Route 263 on Av. de las Americas Figure 2.2-26
2) Route 164 in Av. Caracas Figure 2.2-27
3) Route 163 on Av. Ciudad de Quito Figure 2.2-28

1) *Route 263 Avenida de las Americas*

Figure 2.2-26 illustrates passenger movement of a bus which runs on Avenida de las Amriacas. Y axis on left indicates number of passengers on board, and y axis on right hand side indicates number of passengers getting on and off the bus. X axis indicates link number of which passengers are recorded. Link number 542 is in the Centro area, and link number 507 is close to Ciudad Kennedy.

It is clear in a morning that people get on at Ciudad Kennedy, and get off as they get closer to the Centro.

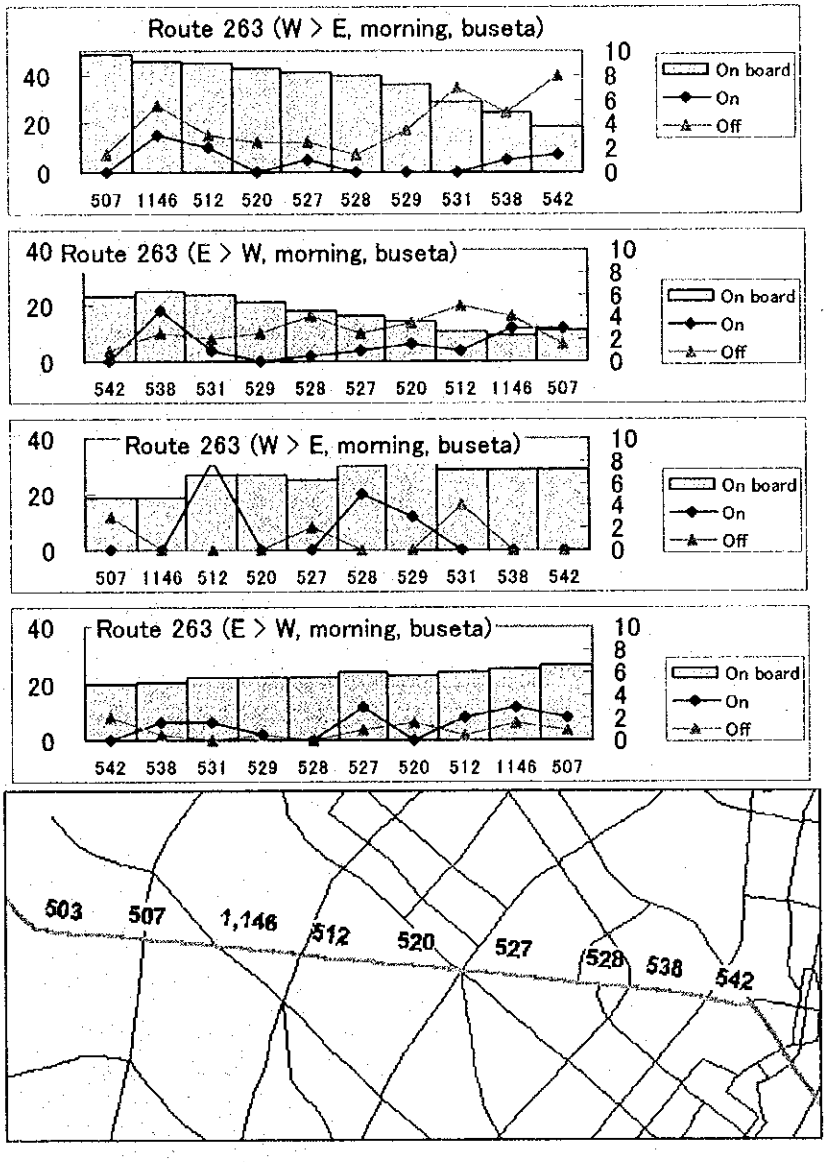
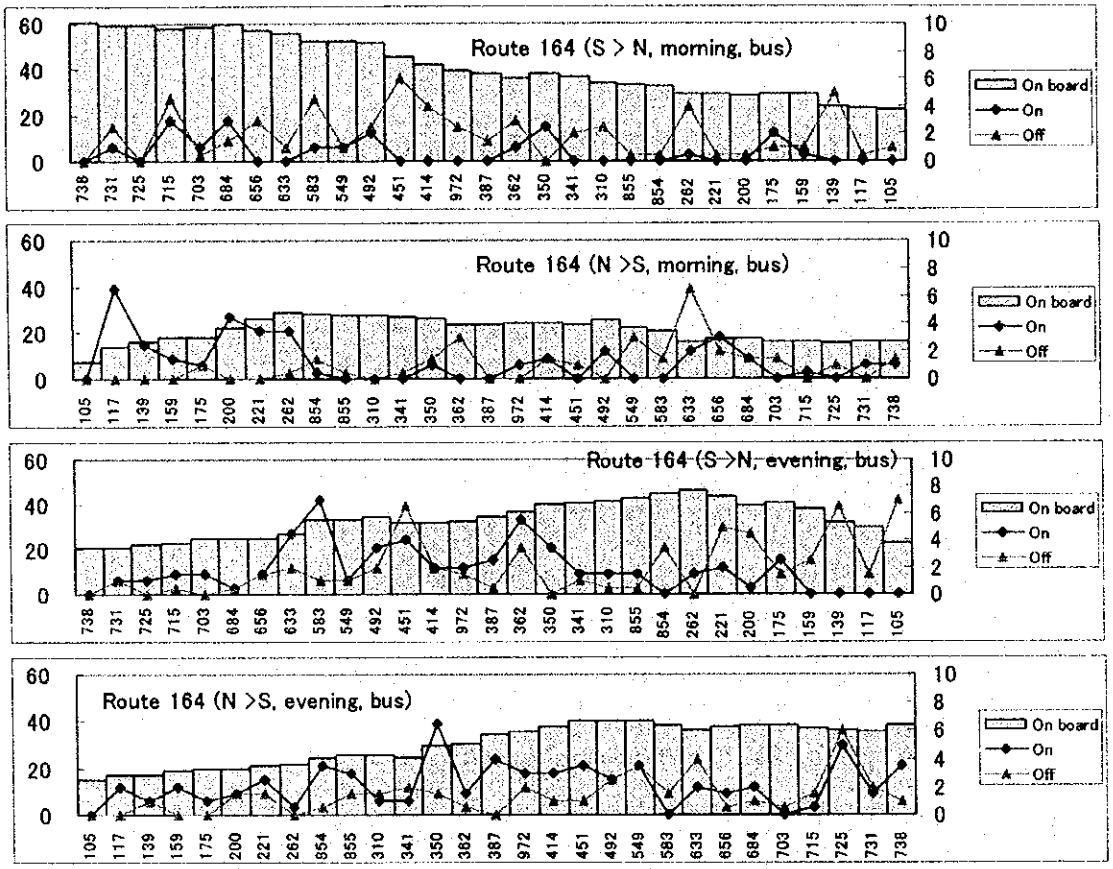


Figure 2.2-26 Route 263 on Av. De las Americas

2) *Route 164 Avenida Caracas*

Figure 2.2-27 indicates passenger movements on a bus which runs on Avenida Caracas. Link number 105 is in the north side of the city on Autopista Norte at Calle 170, link number 738 is in a south, and around link number 549 is the Centro. Calle 72 is in link number 362.



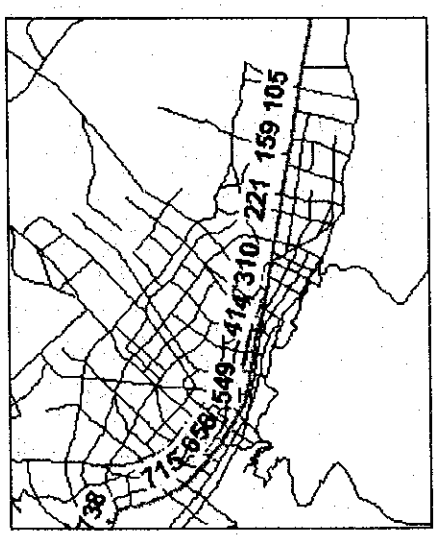
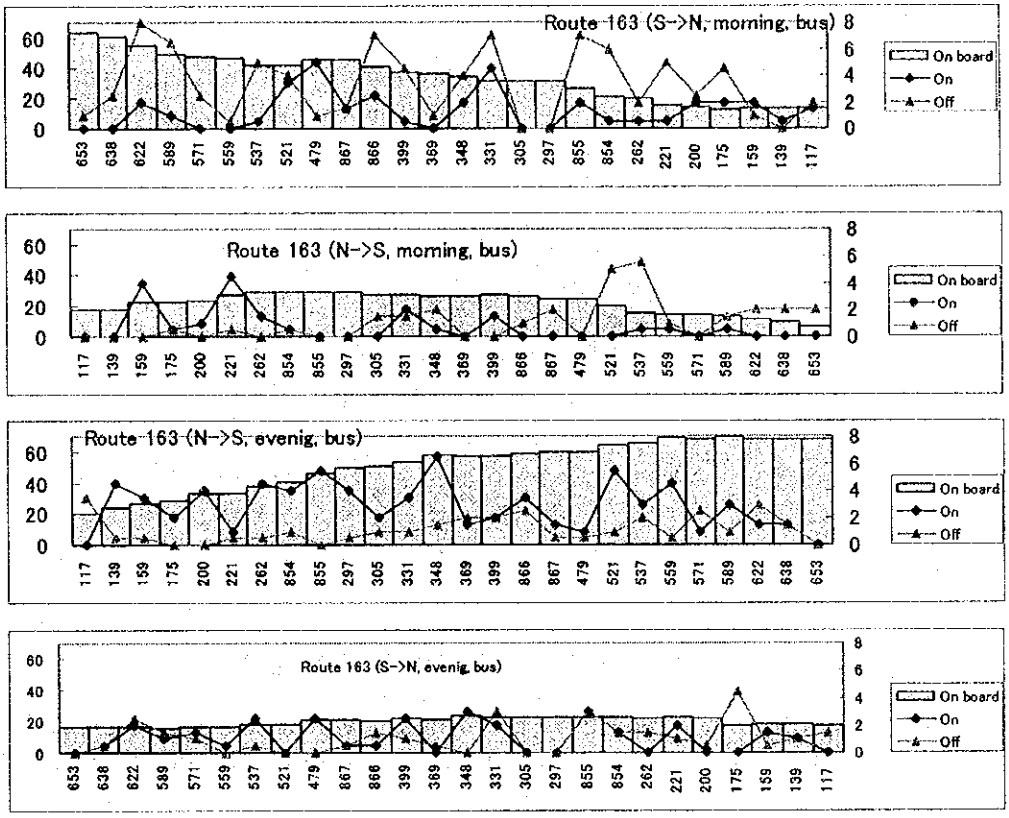


Figure 2.2-27 Route 164 on Avenida Caracas

3) Route 163 Avenida Ciudad de Quito

Route 163 runs on Autopista Sur, Avenida Ciudad de Quito, and on Autopista Sur. Link number 117 in north side of the city, link number 521 is at Centro Administrativo Distriatal building, link 653 is crossing point of Autopista Sur and Av. Ciudad de Quito.



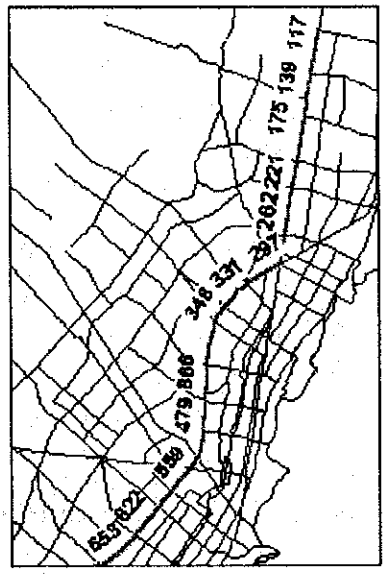


Figure 2.2-28 Route 163 on Avenida Ciudad de Quito

(4) Travel Time by Bus Passengers

Figure 2.2-29 shows the composition of travel time of bus passengers on board. The highest percentage of travel time is recorded at 40-60 minutes. Its figure is approximately 30%. The passengers using a the travel time from 60 – 90 minutes share 27%, followed by 20-40 minutes (23%), 90-120 minutes (11%). The average travel time is approximately 50 minutes.

The whole travel time including access time from /to home or office is approximately 60 minutes, of which the access time is also surveyed and is analyzed (5 – 10 minutes).

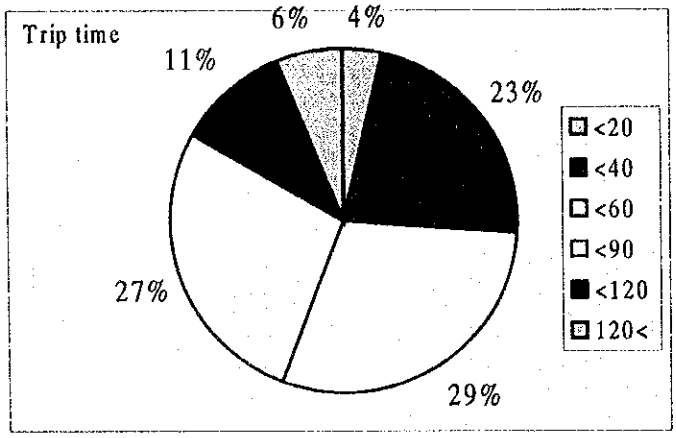


Figure 2.2-29 Trip Time Compositions of Passengers

Figure 2.2-30 shows trip time composition by income level of the passengers. Peak is around 60 minutes of travel time, but there is no significant difference among the level of income.

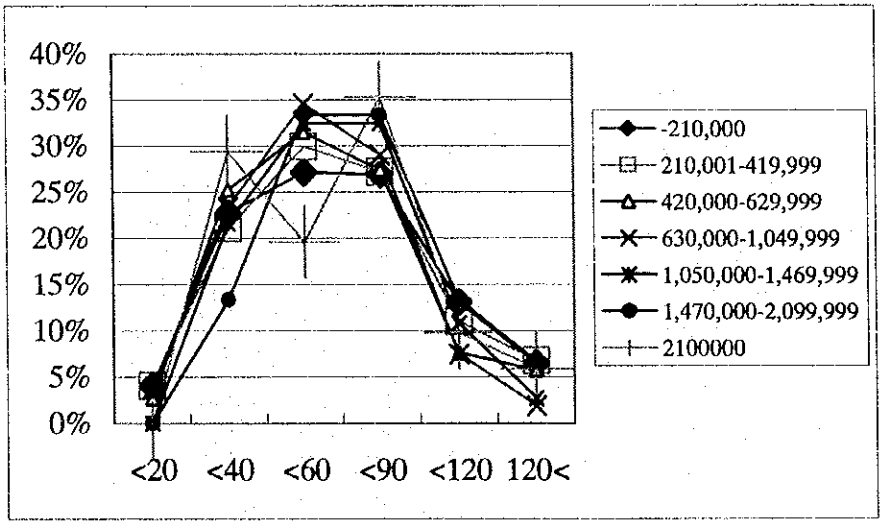


Figure 2.2-30 Trip Time Compositions by Income Level

(5) Trip Purpose

Trip purpose of the interviewee is shown in the Figure 2.2-31. More than half of the interviewees in the morning peak hour had 'to work' purpose, while in the evening peak hour, it is 'to home' purpose which had the highest share. It implies that majority of passengers who are using a public transport are working people, with a rather low level of income.

Figure 2.2-32 shows travel time by trip purpose. Travel time here is a time spent on a bus. Waiting and/or walking times are not included. There is no significant difference of time composition among the 5 trip purposes. According to the figure, the travel time of most bus passengers is between 40 - 90 minutes. All trip purposes have one peak between 40 – 50 minutes. Between 60 – 70 minutes, the travel time for purposes of 'to work', 'to home', and 'to school' have their second peaks.

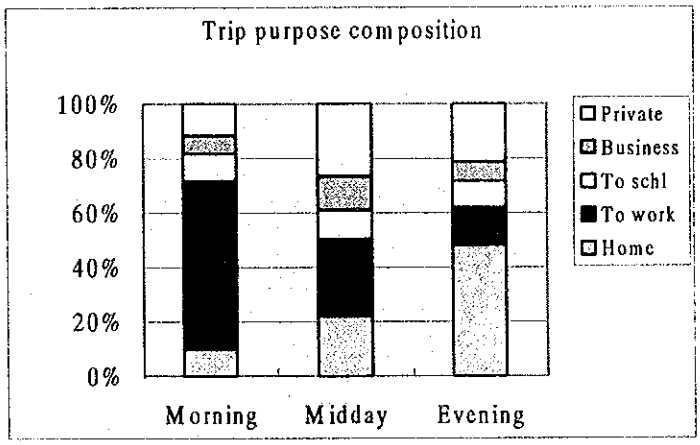


Figure 2.2-31 Trip Purpose Compositions

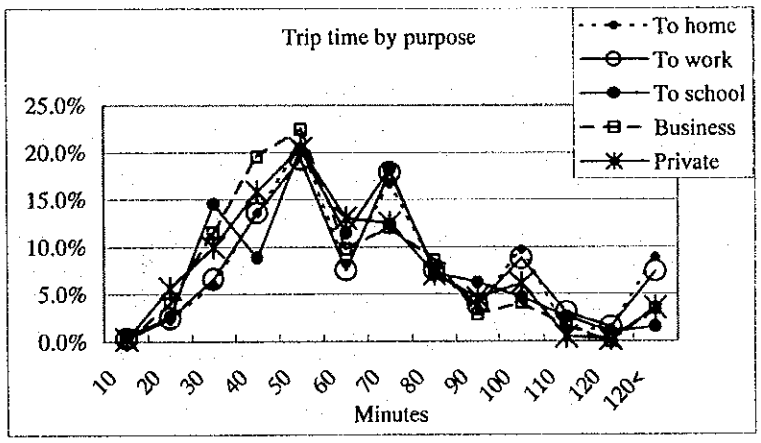


Figure 2.2-32 Trip Time by Purpose

(6) Zone Fare System

Question here was whether passengers are willing to accept a variable fare system which varies according to the length of their trip on the public transport, rather than type and service of the vehicles of current fare system. 35% of total bus passengers interviewed answered 'yes' while 47% replied 'no'. It is interesting that 30 % of the low-income level (210,000 pesos or less) are willing to accept the system, although those who are against the system are 40%. As clearly seen from the Figure 2.2-33, the lower the income, the more the bus passengers are against the system.

Figure 2.2-34 shows the relationship between opinion of new tariff system and travel time. As can be seen, bus passengers who take long travel time approve the system, while passengers with short journey are against the system. Approximately 50% of the total in the longer travel (120 minutes or longer) approve, in contrast to 30% in shorter trips. An evaluation was also made based on income level. The results are shown in Figure 2.2-35.

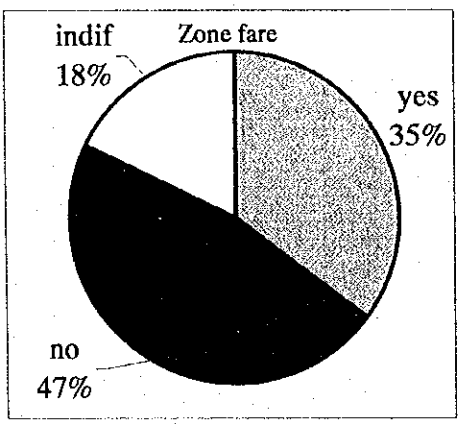


Figure 2.2-33 New Tariff System

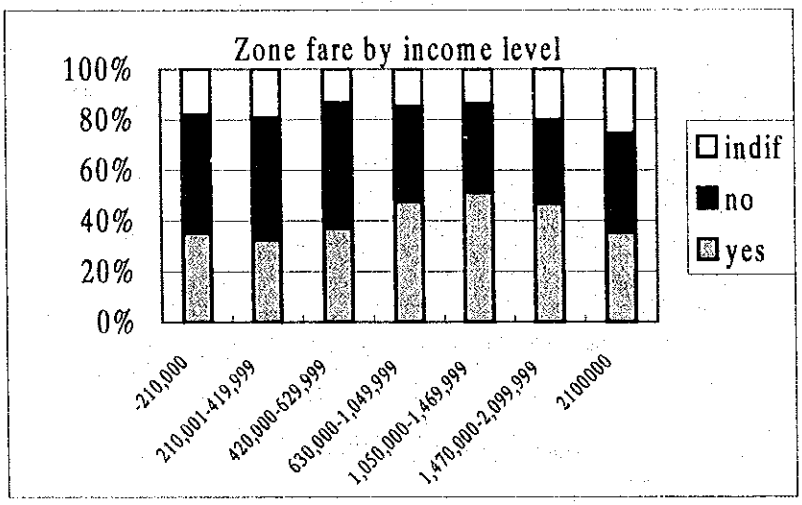


Figure 2.2-34 New Tariff System and Trip Time

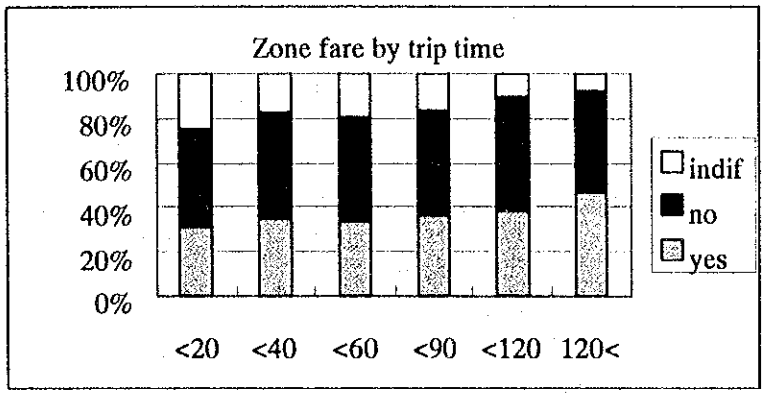


Figure 2.2-35 New Tariff System by Income

(7) Willingness to pay

In the passenger opinion survey, the survey is carried out for whether bus passengers are willing to pay more, if better bus service will be provided by the public transport operators. Questions were asked how much they are willing to pay more for time reduction of the trip, more comfort on the bus, and less waiting time.

Passengers would answer how much they are willing to pay in pesos. Results are now being processed.

(8) Choice between two bus systems

In this section, a choice between two types of bus system, regular bus and express bus, is surveyed. This is a relationship between cost and time difference of two bus services. Naturally, express bus system is faster than a regular bus but it will cost more than regular bus system.

Questionnaire form was prepared as shown in Table 2.2-10, which shows relationship between the cost and travel time of both mode types by case.

The data is used to analyze price sensitivity of bus passengers when the new bus operation and tariff system will be introduced to the proposed operation system.

The data analysis is in progress now.

Table 2.2-10 Interviewed Cases

Case	Mode Type	Trip Time	Cost	Choice
CASE A	Regular Bus	60	600	
	Express Bus	20	1100	
CASE B	Regular Bus	60	600	
	Express Bus	30	1200	
CASE C	Regular Bus	60	600	
	Express Bus	40	1100	
CASE D	Regular Bus	30	600	
	Express Bus	20	1000	
CASE E	Regular Bus	80	550	
	Express Bus	40	850	
CASE F	Regular Bus	50	550	
	Express Bus	20	950	
CASE G	Regular Bus	40	550	
	Express Bus	20	850	
CASE H	Regular Bus	40	550	
	Express Bus	30	750	
CASE I	Regular Bus	20	600	
	Express Bus	10	1200	
CASE J	Regular Bus	40	550	
	Express Bus	10	750	

Table 2.2-10 (continued)

Case	Mode Type	Trip Time	Walking and Waiting	Total Time	Cost	Choice
CASE K	Regular Bus	40	20	60	600	
	Express Bus	20	20	40	1200	
CASE L	Regular Bus	40	20	60	600	
	Express Bus	35	5	40	1200	
CASE M	Regular Bus	50	30	80	550	
	Express Bus	10	30	40	850	
CASE N	Regular Bus	50	30	80	550	
	Express Bus	30	10	40	850	

CHAPTER 3
Existing Natural Feature Conditions

3. EXISTING NATURAL FEATURE CONDITIONS

3.1. GEOLOGICAL CONDITIONS

Total of five locations was selected for boring survey. They are located along the proposed inner ring highway. See figure for boring site locations.

3.1.1. GENERAL CONDITIONS OF THE STUDY AREA

(1) Basic Geology

The Bogota area corresponds to a Late Tertiary Sinclinal filled in by Quaternary deposits mostly of a Lake bed origin. In Cretaceous times the land was covered by a shallow ocean, and the area slowly depressed to be filled by more than 16800m of marine deposits, mainly shales, occasionally limestones and finally sandstones. Then the ocean slowly retreated; coal was deposited then. In early Tertiary the miocene origeny folded, faulted and brought up previous deposits. Tranquil times made possible new depositions of continental claystones and occasional sandstones. New and persistent tectonic pulses have kept the orogeny active to present times.

The whole are conforms in reality a cynclinorium. One of the valleys with cretaceous rocks as a basis and partially filled with tertiary claystones was flooded in old times. In this lake, deposits of clays and sands were slowly formed at a rate of 0.2mm per year through all the Cuaternary. This is the area on which Bogota was built. The depth of the deposit reaches to 300m or so in the open Sabana and to 160m in the small Bogota synclinical located between the mountains of Suba and Bogota. (SOURCE;AREAS,1995)

3.1.2. DESCRIPTION OF BORING SITES

Actual boring sites were decided upon with due consideration of the materials to be encountered. Two of them were assigned to soft rock formation at elevation of 2800m. Two of them were set at soil tansition between the foot of the hill and open sabana, and the fifth hole was drilled at the low flat area close to Carrera 30.

A description of the sites follows;

1) Los Rosales Creek

Hilly terrain at elevation of 2800m. The site marks the transition between Guaduas formation gently rolling and Guadalupe formation abrupt sandstore slopes.

2) Politecnico Gran Colombiano

Gently rolling terrain corresponding to the corridor assigned for the Expressway. It is located at the base of old abandoned quarries, to the east, and on top of massive claystones of Guaduas formation.

3) Chico Reservado (Calle 100 at Carrera 11)

It is located at the intersection between Calle 100 and Carrera 11. Soft clays and silts with interstratified lenses of sand were encountered.

4) Parque Nacional (Carrera 7a at Calle 36)

Close to the trace of Arzobispo Creek, it lies on the flat terrain where its valley opens to the Sabana.

5) Calle 72 at Carrera 24

It is assumed that site is close to the contact between Tunjeko formation and Sabana formation where the influence of the hill deposition fades away.

In following section, boring logs of boring sites 1 to 5 are shown. The characteristics of each boring log are shown in section 3.3.3.

3.1.3. CHARACTERISTICS OF EACH BORING LOGS

Figure 3.1-1 shows the characteristics of each boring log.

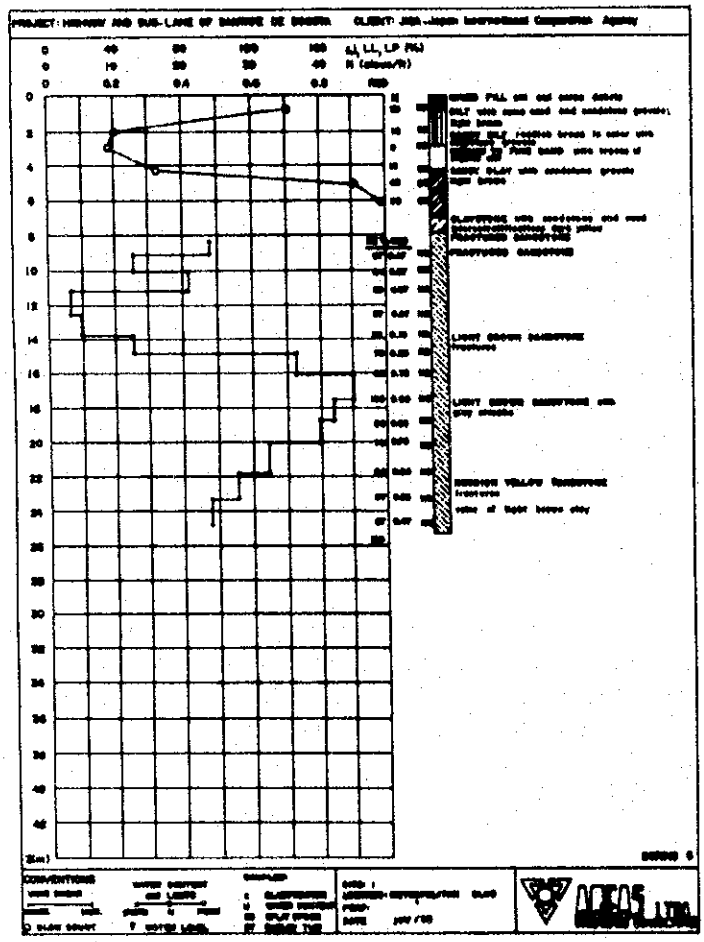


Figure 3.1-1 Characteristics of Boring Logs

3.2. TOPOGRAPHIC CONDITIONS

Topographic survey was carried out for 6 bus routes and one inner ring highway. The results of the topographic surveys are depicted in the drawing sheet 1/2000.

3.3. NATURAL CONDITIONS

3.3.1. RAINFALL CONDITIONS

According to existing information, it has been known that:

Mean annual rainfall	826.4 mm
Minimum monthly rainfall	0 -> 10.0 mm
Maximum monthly rainfall	340.0 mm
Rainy seasons	April – June
	August- November

The following table shows some pertinent figures.

Table 3.3-1 Rainfall Conditions

Station	Elevation (m)	Max Monthly (mm)	Max Daily (mm)	Max yearly (mm)
San Diego		340.8		
Torca	2579.0	442.0	69.0	2751.5
El Bosque	2880.0	486.6	78.9	2429.7
Usaquen	2647.0	386.0	72.6	2450.0
La Casita	3045.0	300.0	68.0	1669.0
Manuel Mejia	2580.0	241.3	56.9	964.7

3.3.2. FLOOD CONTROL CONDITIONS

The project area drains in general towards the western part of the Sabana, where small rivers and creeks become tributary of the Bogata River that flows from north to south. The topography is gently rolling to hilly and mountainous in the eastern direction. On the mountains that border the eastern city limits, seven small rivers and creeks are originated. These are;

1) Quebrada de los Molinos
2) Quebrada Chico
3) Quebrada de Rosales
4) Quebrada La Vieja
5) Quebrada Las Delicias
6) Rio de Arzobispo

7) Rio San Francisco

There are also some small rivers, such as San Augustin Creek, San Cristobol, Fucha and Tunjuelo.

3.3.3. EARTHQUAKE CONDITIONS

Historic data attests to the existence of important seismic activity taking place or affecting the area close to Bogota and its surroundings. In fact, the first traceable event dates back as far as 1644 and was felt in Chipaque (Cundnamarca). Then in 1785 came the strongest event felt in the city and its surroundings; this was assigned to Chongaza area where the main reservoirs for the Aqueduct are located. After those shocks, it was followed with Tamana, Huila in 1827 and Sumapz in 1917. The one in Timana could be the first distant event to cause damage in Bogota.

Recent events –intermediate and distant- were: Murindo (1992), Puerto Rondon (1993), Paez (1994), Tauramena, Calima, Pasto (1995). Of these, Tauremena was originated at the Eastern Andean Front fault which is believed to be the controlling seismeogenic spot for Bogota seismicity.

3.3.4. NATURAL DISASTERS

Apart from seismic activity only two types of natural disasters are forseeable, namely, floods and landslides (or mass movements).

As far as floods are concerned, it can be said that those currents do not have the capacity to overflow the steep channels along which they run. This is particularly true at elevations near 2800m. The risk increases when the river passes the transfer –intermediate zone- and flows into the storage zone. But the river is channeled or confined under-ground and offers no peril. However though in recent times, due to indiscriminate filling and straightening of valleys, the Chico creek overflowed the channels and run through the Carrera Septima at Calle 93.

Landslides are a permanent but local phenomena along cuts of the Circunvalar where it crosses soft materials lake Bogota formation (claystones). An old slide in the Paraiso area was controlled in the past by drainage works and retaining structures of several types.

CHAPTER 4
Development Plan in Bogota

4. DEVELOPMENT PLAN IN BOGOTA

4.1. BOGOTA CITY DEVELOPMENT PLAN (1998-2001)

4.1.1. GENERAL

The Bogota City Development Plan is the district government's program which is presented when new mayor takes office. The term of mayor is four years, therefore, a new development plan is prepared for each four years period when the mayor takes his office. In this plan, the objectives, goal, resources and responsibility for the performance of the constitutional mandate of the mayor are articulated. After the intensive work between all the district entities and meetings to establish priorities, programs and actions to implement them in the next four(4) years will be set. The Development Plan will then be presented to the district planning council.

The plan consists of seven(7) priority categories. Each category includes several programs as described below. Each district will implement its own plan based on this Development Plan.

(1) Priority Category-1: No-Marginalization

1) Extension and Improvement of the road Infrastructure and Public service
2) Extension and Improvement of the Public Infrastructure of the social sector
3) Extension and Improvement of Public Spaces and the Recreational and Sports Infrastructure
4) Improvement of the risky zones and Attention to affected families
5) Promotion of the communal and institutional development
6) Promotion of the local investment

(2) Priority Category-2: Social Interaction

1) Improvement of the education quality
2) Improvement of the quality and coverage of the health care services
3) Improvement of the quality and extension of coverage of the services for vulnerable groups

(3) Priority Category-3: City to Human Scale

1) Recuperation, Improvement and Extension of the Public Space
2) Recuperation, Improvement and Extension of the Parks, Recreational and Sports Facilities
3) Infrastructure and strategic Ecosystem
4) Administration of the Public Space and of the Recreational and Sports Infrastructure
5) Control and Mitigation of the Environment Impact

(4) Priority Category-4: Mobility

1) Development of comprehensive mass transit system

2) Construction of the Cycle routes
3) Strengthening of the Traffic Management
4) Improvement of the Road Infrastructure

(5) Priority Category-5: Urban Planning and Services

1) Development of the low cost housing
2) Urban Renovation
3) Orderly expansion of the city

(6) Priority Category-6: Security and Coexistence

1) Institutional strengthening for public security
2) Development and Reinforcement of Coordinated Action between the police authority and the public
3) Promotion of the Solidarity and Compromise among the general public
4) Encouragement for the good utilization of free time and Public Space
5) Public Safety against danger and handling of Emergencies

(7) Priority Category-7: Institutional Efficiency

1) Reinforcement of the Decentralization
2) Modernization and Reinforcement of the Public Authority
3) Modernization of the District Finance System

The program and investment for the above mentioned projects is shown in Table 4.1-1. The details are shown in Table 4.1-2.

Table 4.1-1 Programs and Investment of the project

Millions pesos

	1998	1999	2000	2001	Total
1.No-Marginalization	257.359	560.912	566.438	448.664	1.833.373
2.Social Interaction	889.589	923.888	952.643	930.318	3.696.437
3.City to Human Scale	198.034	405.131	358.678	290.657	1.252.501
4.Mobility	395.529	805.657	900.337	688.537	2.790.060
5.Urban Planning and Services	679.997	459.761	751.397	689.14	2.580.269
6.Security and Coexistence	84.573	118.681	106.574	75.717	385.546
7.Institutional Efficiency	261.183	190.995	137.344	106.314	695.835
Total	2.766.263	3.465.024	3.773.412	3.229.321	13.234.020

4.1.2. INVESTMENT PLAN

(1) Financial Strategy

The investment plan "For the Bogota which we love" amount to $13.2 billions pesos in 1998, of which $ 10.1 billions will be used for the district administration, $ 0.9 billions for the public establishment and $ 2.1 billions to the Industry and Commercial Companies.

This ambitious plan is demanding huge resources because of lack prior investment in the city and the need for substantial improvement in the implementation as well as in the district efficiency and its decentralized entities.

The income and expense projection of the district administration for 4 years indicate that the funds available for investment during the period amount to $2.2 billions, a rather small amount compared with the urgent large sums needed by the city. That is the reason why it is indispensable to design a financial strategy that permits the fulfillment of the proposed plan and that will be consistent with a good financial context. The strategy requires new income generation, saving in some expenses and much use of external sources. These efforts, however, are not enough and for that purpose. Therefore, it is proposed for the basic part of the strategy to sell the stock of ETB which the city holds, with which will permit to duplicate the district administration's investment.

The public establishment investment with own resources amount to $0.9 billions, meanwhile, the Industrial and Commercial Companies will finance their investment with $1.04 billions in savings and $1.1 billions with indebtedness.

The detail of the consolidated investment plan is shown in Table 4.1-3

Table 4.1-2 Consolidated Investment

Concept	1998	1999	2000	2001	Total
District Administration	1.628.935	2.929.540	2.983.981	2.606.408	10.148.864
Public Establishment	309.081	176.495	245.03	198.138	928.744
Industrial and Commercial Companies	828.247	358.989	544.401	424.775	2.156.412
Total	2.766.263	3.465.024	3.773.412	3.229.321	13.234.020

Millions pesos

Table 4.1-3 Development Plan 1998-2001

PLAN OF DEVELOPMENT 1998-2001
Annual Programation

Priority/Program	1998	1999	2000	2001	Total
1. No-MARGINALIZATION	**257,359**	**560,912**	**566,438**	**448,664**	**1,833,373**
1.Extension and Improvement of the road Infrastructure and Public serv	75,856	217,531	209,827	154,514	657,729
2.Extension and Improvement of the Public infrastructure of the social s	73,273	233,104	244,595	188,817	739,790
3.Extension and Improvement of the Public space and the recreative infrastructure and sporting	5,704	5,850	8,214	3,560	23,328
4.Adaptation of zones of risk and attention to affect families	13,803	8,714	6,445	3,309	32,271
5.Promotion of the comunal gestion and Institutional	0	366	357	350	1,072
6.Promotion to the local investment	88,723	95,346	97,000	98,114	379,183
2. SOCIAL INTERACTION	**889,589**	**923,888**	**952,643**	**930,318**	**3,696,437**
7.Improvement of the quality of the education	511,494	554,524	568,377	547,353	2,181,748
8.Improvement of the quality and cover of the help of the health services	301,932	292,841	304,317	309,317	1,208,408
9.Improvement of the quality and extension of the cover of the group ser	76,164	76,522	79,948	73,647	306,281
3. CITY TO HUMAN SCALE	**198,034**	**405,131**	**358,678**	**290,657**	**1,252,501**
10.Recuperation, Improvement and extension of the public space	30,471	103,721	69,694	74,365	278,252
11.Recuperation, Improvement and extension of the parks, recreative infrastructure sporting and strategic ecosystem	78,632	183,500	171,608	171,035	550,774
12.Administration of the public space and of the recreative infrastructure and sporting	9,019	37,203	34,403	16,406	97,031
13.Control of the enviroment impact	79,912	80,708	82,973	82,852	326,445
4. MOVILITY	**395,529**	**805,657**	**900,337**	**688,537**	**2,790,060**
14.Developement of the integrate system of the masive transport	49,060	292,363	334,185	259,124	934,732
15.Construction of the cycle-routes	4,000	11,000	24,016	45,984	85,000
16.Strengthening of the traffic management	24,036	34,531	37,003	37,408	132,978
17.Adaptation of the road infrastructure	318,433	467,763	505,134	346,021	1,637,350
5. TOWN PLANNING AND SERVICES	679,997	459,761	751,397	689,114	2,580,269
18.Promotion of housing of social interest	20,000	156,900	206,000	226,573	609,473
19.Urban renovation	23,926	101,394	101,184	96,204	322,708
20.Organizacion of the city extension	636,071	201,467	444,213	366,337	1,648,088
6. SECURITY AND COEXISTENCE	**84,573**	**118,681**	**106,574**	**75,717**	**385,546**
21.Qualification and strengthening for the segurity of the city	19,021	28,696	18,139	10,922	76,777
22.Normative Development and stengthening of the coordinate action between the police and the townspeople	1,173	2,441	1,834	1,400	6,848
23.Promotion of the solidarity and engagement for the coexistence of th	29,494	46,527	46,653	28,254	150,928
24.A good promotion the use of the free time and the public space	22,449	28,037	28,923	26,073	105,482
25.Precaution of risks and attention of emergencies	12,436	12	11,025	9,069	45,511
7. INSTITUTIONAL EFFICIENT	**261,183**	**190,995**	**137,344**	**106,314**	**695,835**
26.Strengthening of the secentralization	40,157	45,927	43,666	43,803	173,553
27.Modernization and Strengthening of the public gestion	212,400	136,118	90,763	60,261	499,542
28.Modernization of the financiare Distrital System	8,626	8,950	2,914	2,250	22,740
	2,766,263	**3,465,024**	**3,773,412**	**3,229,321**	**13,234,020**

(2) New Income Generation

The new income generation will be achieved through a tax strategy that involves better control and eliminates the distortion and unfairness in the collection of taxes.

1) Anti Evasion Plan

Different calculation suggests the tax evasion is near to 30% in the two main district taxes. A basic purpose of the plan is to improve the tax levy and increase the income and therefore to decrease the existing gap between the potential collection and real collection.

It is estimated that the administration will be able to collect $50 thousand millions pesos yearly from this concept.

2) Tax Rationalization

This involves the elimination of some preferential treatment and tax strengthening. With respect to the first, it is proposed to eliminate the exemption or no subjection of district tax when not justified, such as some national public entities. Such measure will be able to generate to the district treasury about $ 8 thousand millions pesos per year.

3) Charge for Valorization

This contribution is a very equitable mechanism, because it is charged to the property owner who has patrimonial benefit for a public work. In the investment plan, it is estimated to collect US $ 250 millions from this concept.

4) Other Effort

The administration will clarify the participation of the district in any state tax, like as registration, national cigarette and global tax to the gasoline.

The detail of the investment for sectors is shown in Table 4.1-4.

Table 4.1-4 Investments for Sectors

Sectors	Total without E.T.B.	Resources E.T.B.	% Increment
Transport, Transit, Road works, Aqueduct and Drains	1.185.369	1.174.701	99.1%
Housing and Urban Development	171.097	690.973	403.8%
Education	381.361	386.960	101.5%
Culture, Re-creation, Sport and Communication	291.330	138.200	47.4%
Environment	34.656	138.200	398.8%
Health and Social Welfare	279.508	234.94	84.1%
Total	2.343.321	2.763.974	118.0%

Millions pesos

4.2. DAPD DEVELOPMENT PLAN

4.2.1. GENERAL

Based on the Bogota City Development Plan which is presented by the new mayor, District Planning Department (DAPD) prepares the concrete development plan. The Principal Development plans which correspond to DAPD in the area of the Urban Transportation are listed below.

1) Comprehensive System of Mass Transportation Development Plan
2) Construction of Cycle Routes Development Plan
3) Reinforcement of Traffic Management Development Plan
4) Adaptation of the Road Infrastructure Development Plan

4.2.2. OUTLINE OF EACH DEVELOPMENT PLAN

(1) Comprehensive System of Mass Transportation Development Plan

The first line of subway will have a length of 29,3km and 23 stations that will be built in two (2) stages during nine (9) years. The Project will be executed under the total concession mode in which the concessionaire will be in charge of the routing, the definitive design, the construction, operation and also the economic and technical risks.

(2) Construction of Cycle Routes

One element of the Principal development Plan is the construction of cycle routes which will have a length of 80 Km. Its objective is to serve as part of the public transportation system as well as for recreation.

(3) Strengthening of Traffic Management

There are several programs which are involved in this category.

1) Paint striping on the roads, Road signs on 3000 Km
2) Traffic Control Center
3) Detector System for the traffic rule offenders

(4) Adaptation of the Road Infrastructure

The programs in this area are described below.

1) Total 70 Km of Trunk Line on the Autopista Norte, La Av.Medellin (Calle 80), la Av.Ferrocarril del Sur and Av.19.
2) Construction of 14 terminals for feeder line and one(1) central terminal.
3) To extend the road network by 100Km.
4) Rehabilitation of 1300 Km of the road network.

The program and investment of the above-mentioned projects is shown in Table 4.2-1.

Table 4.2-1 Programs and Investments of the Projects

(Unit: Millions pesos)

	1998	1999	2000	2001	Total
Comprehensive System of Mass Transport	49,060	292,363	334,185	259,124	934,732
Construction of Cycle Routes	4,000	11,000	24,016	45,984	85,000
Strengthening of Traffic Management	24,036	34,531	37,003	37,408	132,978
Improvement of Road Infrastructure	318,433	467,763	505,134	346,021	1,637,350
Total	395,529	805,657	900,337	688,537	2,790,060

(5) Territorial Ordinance Plan

D.A.P.D has a Territorial Ordinance Plan that is one of the most important components to the transport planning. This plan must be integrated with the development plan and transportation plan as mentioned below.

1) Transportation, as a structural element of the city social-economic development.

2) Transportation, as a comprehensive element of the city with the neighboring municipalities, the nation and the world.

3) Comprehensive plan that contemplates every transport mode (private car, public transport, bicycle, pedestrian) through the road, as well as pedestrian network and traffic management element.

4) To stimulate the use of collective transport.

5) Expansion, improvement, rehabilitation and preservation of public space.

(6) MEGA Projects

The Bogota City has five (5) Mega projects which are included in the development plan 1998-2001. Most of them are principal elements of the transport development plan

1) Comprehensive System of Mass Transportation

2) Construction and Maintenance of the Road Network

3) Land Bank

4) Local System of Park

5) Local System of Libraries

The program and investments of the above-mentioned projects is presented in Table 4.2-2.

Table 4.2-2 Mega projects and Investments of the Projects

Millions pesos

	1998	1999	2000	2001	Total
Comprehensive System of Mass Transport	49.060	292.243	333.935	258.873	934.111
Construction and Maintenance of Road Network	317.766	466.763	504.236	344.966	1.633.731
Land Bank	20.000	142.500	182.000	198.000	542.500
Local System of Park	45.897	93.466	83.486	48.936	271.785
Local System of Libraries	1.635	41.234	30.194	6.910	79.973
Mega Projects Total	434.358	1.036.206	1.133.851	857.685	3.462.100

4.3. IDU DEVELOPMENT PLAN

4.3.1. GENERAL

Based on the Bogota City Development Plan prepared by DAPD, the Urban Development Institute (IDU) is responsible for the implementation of the development plan.

In planning strategies for the development of the road infrastructure, the IDU contemplates the following objectives: Access to the City, Transversals, Continuous Arterial Road, and Cycle Routes.

(1) Access to the City

It will design and execute the works and it will establish the finance mechanism for the execution and maintenance of the access to the city. In the specifications, the project guarantees good work with conditions of high quality in the urban context.

(2) Transversals

It will design and execute the works those cross the city: East-West, from East mountains to the Bogota river.

(3) Continuous Arterial Road

It will design and execute the works which designate which of the city's avenues from north-south have the elevated intersections to permit the crossing of the roads without interruptions.

(4) Cycle Routes

It will design and execute the works of cycle routes network which integrate all the city. The main avenues of the city will have the cycle routes.

4.3.2. DETAILS OF EACH PROJECT

(1) Road Improvement Projects

In the development plan of the IDU for the years 1998-2001, within the priority "Mobility," the program of Improvement of the Road Infrastructure is included. This program contains the project of Expansion and Improvement of the Road Infrastructure of the following road projects:

1) North-Quito-South Avenue
2) Ciudad de Cali Avenue
3) Las Callejas (Calle 127) Avenue
4) Primero de Mayo Avenue
5) Centenario (Calle 13) Avenue
6) Carrera 7a Avenue
7) San Jose (Calle 170) Avenue
8) East Circunvalar Avenue

The program of the projects and investment is shown in Table 4.3-1.

Table 4.3-1 Projects and Investment

	1998	1999	2000	2001	Total
North-Quito-South Avenue	6228	107900	124705	0	238833
Ciudad de Cali Avenue	1170	9000	18000	0	28170
Las Callejas(Calle 127) Avenue	495	37800	20250	0	58545
Primero de Mayo Avenue	445	7200	8250	0	15895
Centenario (Calle 13) Avenue	0	1905	128706	0	130613
Carrera 7a Avenue	248	18900	10125	0	29273
San Jose (Calle 170) avenue	4020	28200	53020	0	85240
East Circunvalar Avenue	2200	0	0	0	2200

Millions pesos

(2) New Road Construction Projects

In the Development Plan named "To Form City," the next new road construction projects are included:

1) Longitudinal de Occidente Avenue

The project is to construct the road by concession which will cross the city from north to south for the west part of the city, permitting the vehicles through the city without increase the internal traffic of the city. Actually, it is in the phase of the land acquisition.

The program of the construction is shown in Table 4.3-2.

Table 4.3-2 Construction Program

CONCEPT	Year 0	Year 1	Year 2	Year 3	Total
Budget of the Nation	80,000				80,000
Concessionaire	0	89,404	149.004	59,600	298.008
District and IDU	0	169,000			169,000
Total	80,000	258.404	149.004	59,600	547.008

(Unit: Millions pesos)

(3) Parking Development Projects

In the IDU's Action Plan for the year 1998, the contract for the study and design of the parking lot on the Carrera 15, World Trade Center and the Plaza de Toros is included.

Additionally, it will be contracted the Feasibility Study of Parking Lot by Concession will also be contracted.

(4) Pedestrian Bridge Development Projects

The IDU is planning the construction of the pedestrian bridge over the Autopista Sur by Diagonal 35 Sur located in Villa del Rosario. The respective studies and designs for this project are completed.

(5) Bus Trunk Development Projects

1) The IDU is in the process of the consultants selection for the contracting of the studies and designs on the Centenario Avenue Trunk.
2) The study on the Boyaca Avenue Trunk was assigned to the consortium LA VIALIDAD LTDA-CIVILTEC at the end of April of 1998.
3) The study and design of the Las Americas Avenue Trunk was assigned to INGETEC.
4) The Trunk of the Calle 80 is going on the execution of the first section between the Boyaca Avenue and Bogota River. The second section between the Boyaca Avenue and the Caracas avenue is in the phase of the land acquisition.

(6) Others Projects

1) The construction of tree-lined avenue in different zones of the city in order to provide a space for the social welfare to the pedestrians in a city, where public space is important in its infrastructure.
2) Extension and improvement of the traffic signal network.
3) Access to neighborhood, local pavement and basic infrastructure of local development.
4) Side Walk, separator and curb maintenance
5) Cycle routes design and construction
6) Expansion and maintenance of the road sign system of the city
7) Maintenance and rehabilitation of vehicle bridge.

(7) Development Plan of MEGA-Projects 1998-2001

The road development and urban transportation in the district have had a slower expansion and development pace than the population growth and urban development of the city. This phase lag has generated serious problems of transit, chronic congestion, accidents, and environmental deterioration. The last study conducted to find a solution of long term for this problem has concluded that Bogota needs a Integrated System of Mass Transportation which consists of new bus system and metro.

The program and investment of the projects is shown in Table 4.3-3.

Table 4.3-3 Program and Investment of MEGA-Projects

MEGA Projects	1998	1999	2000	2001	Total
Re-structuring of Bus Transportation System	34.537	46.116	32.330	42.315	155.298
Construction of the First Metro Line	6.173	61.701	61.649	61.577	191.100
Construction and Maintenance of the Road Network	317.766	466.763	504.236	344.966	1633.731

(Unit: Millions pesos)

4.4. STT DEVELOPMENT PLAN

4.4.1. GENERAL

Based on the Bogota City Development Plan, the Transport and Transit Secretary (STT) is charged with the study of the mass public transportation by buses which is referred to as the "Transmilenio Project".

4.4.2. TRANSMILENIO PROJECT

The Transmilenio Project look for the evolution from actual thinking of provision of the urban public transport service towards the development of an integrated system of collective public transport. This would be technically operated, through the construction and implementation of a new system which will modify the institutional, physical, operational, financial and functional components, until it progressively covers all the city. It also envisions to formulate a comprehensive project of rehabilitation, renovation and better use of the southern railway corridor, consistent with the development plan and regional and urban territorial ordinance plan, and as a part of the integrated plan of the city transportation.

(1) Components of the "Transmilenio" System

As solution of the public transport problem of the city, it proposes to introduce a new system of trunk routes that consist of, basically, big capacity buses on the main road.

The principal components that will have a new system are as follows:

1) Trunk routes
2) Feeder routes
3) Transfer and integration terminals
4) Simple bus stop, integration bus stop, bus stop point (feeder line).
5) Management organization.

(2) Urban railway system

1) Northern railway corridor: from La Caro to the Western railway corridor
   - Length: 16 Km
2) Western railway corridor : from the Kilometro 2 of the railway line (cra 36) to the west until Mosquera.
   - Length: 17 Km
3) Southern railway corridor: from the Kilometro 2 of the railway line (cra36) to the limit of the district with Soacha.

- Length: 13 Km

(3) General characteristics of the corridor

The railway corridor will be a part of the urban-regional component of the city and connect the Capital District with Soacha and Sibate (bed town of the capital) and with the South of the country.

The southern railway will cover the area with potential demand for public transportation of the city (53 zone). The most important data are:

- Approximately 190,000 trips/day/one way from Soacha to the city.
- It is estimated that the railway corridor may capture a demand of 10.000 passengers for one way in the peak hour.

Soacha-Bogota inter-municipal transportation routes.

- 16 companies authorized for the INTRA.
- 9 routes authorized.
- 40% of transfer in the trip Soacha-Bogota.
- The transfer implies an additional trip time of 30 minutes

The relation between fleet and number of trips of the Soacha-Bogota inter-municipal transportation is shown in Table 4.4-1.

Table 4.4-1 Fleet and trip of the Soacha-Bogota inter-municipal transportation routes.

Vehicle type	No. of vehicle		Soacha-Bogota Daily Trips	Percentage of trips for vehicle type
	No.	%		
Bus	8	1	28.500	15%
Buseta	133	14	38.000	20%
Microbus	656	71	117.800	62%
Others	133	14	5.700	3%
Total	930	100	190.000	100%

(4) Physical and operative integration of the corridor to Transmilenio

As strategy of operation, the corridor will be integrated to Transmilenio, joining the Avenida Caracas with an outlying terminal, located in the limit with Soacha.

The route: integration terminal-railway corridor-Calle 22-Avenida Caracas-Avenida Ciudad Lima (Calle 19)-railway corridor-integration terminal.

(5) Cost estimation for adaptation and operation of the corridor

The estimated cost according to the capacity of the passengers of the bus is shown in Table 4.4-2.

Table 4.4-2 Cost estimation for adaptation and operation of the corridor

Item	Option 1		Option 2	
	154 buses of 110 passengers		74 buses of 250 passengers	
	4 lane	6 lane	4 lane	6 lane
Initial investment cost				
Collect and control technology	3.858.800	3.858.800	3.842.800	3.842.800
Bus stop and charge system	3.021.200	3.021.200	3.021.200	3.021.200
Transfer station	3.000.000	3.000.000	3.000.000	3.000.000
Land	60.000.000	100.000.000	60.000.000	100.000.000
Infrastructure adaptation	27.826.087	41.739.130	27.826.087	41.739.130
Intersection(signalized and over or under pass)	21.594.203	50.376.812	21.594.203	50.376.812
Sub total cost of initial investment	119.300.290	201.995.942	119.284.290	201.979.942
Estimated cost of mobile equipment	20.543.600	20.543.600	18.756.040	18.756.040
Total investment	139.843.890	222.539.542	138.040.330	220.735.982
Investment source				
District	119.300.290	201.995.942	119.284.290	201.979.942
Operators	20.543.600	20.543.600	18.756.040	18.756.040

(Unit: millions of Pesos)

(6) Legal Frame for the use of the southern railway corridor

Executed principal obligations:

On 12 of January 1996, National Railway Company, through the agreement, submitted to the capital district-IDU the southern railway corridor and was permitted to use and share the inter-administrative terms of agreement of the date, 5 of June 1995, which correspond to the total section of the projected corridor.

IDU gave to the National Railway Company the land strip described in the agreement, corresponding to the section of the Avenida Cundinamarca.

(7) Transmilenio Company

Considering that the bus system is and will be the principal axis of the mass transportation system of the city, even after the construction of the metro, it is fundamental to make this system orderly and permit its operation with priority of road use. The buses must work in the network with the metro, and be flexible and adaptable to the demand to permit the users to change the mode and inter-mode without additional payment in the transfer. To accomplish such intention, it is proposed that the development program of the mass transportation be an integrated system that involves the participation of those who presently offer to the service of public transportation in the city.

(8) Development Stage of the Integrated System of Collective Public Transportation in Bogota

1) Stage 1998-2000

Road Corridor: Auto pista Norte(Calle 80-Calle170)

Avenida Caracas(Molinos-Calle80)

Calle 80(Caracas-Rio Bogota)

Southern railway corridor(Limit Soacha-Caracas)

2) Stage 2001-2004

Road Corridor:Avenida de las Americas(Cra 30-Mosquera Limit)

Avenida Suba(Cra 30-Subazar)

Avenida Cra 68(Venecia-Autopista Norte)

Avenida Boyaca(Autopista del Sur-Calle 127)

3) Stage 2004-2007

Road Corridor: Structural Routes of Metro

Ave.Boyaca-Autopista to llano until Juan Rey

Ave.San Jose o Calle 170(Cra.7-Ave.Boyaca)

Troncal Juan Rey(Calle 1-Juan Rey)

Ave.Ciudad de Cali(Autosur-Calle 170).

4.5. SITM DEVELOPMENT PLAN

4.5.1. BACKGROUND

The structural nature of the transport problem of Santa Fe de Bogota, its huge impact on the productivity and competitive loss of the city, the social effect on the quality of life and the environment, highlighted the need for the National and District Administration to design a long term strategy which permits the comprehensive solution of the problem.

The National Development Plan of 1994-1998 considered the introduction of a comprehensive system of mass transportation (SITM) for the city. To implement the project, the plan needed the technical and financial support for the development of the study on the demand, feasibility and design of the SITM.

On the other hand, the Economic, Social and Public Work Development Plan for Santa Fe de Bogota, for 1995-1998, included the participation of the district in the long term study to define the future transportation in Bogota and in the evaluation study of the metro alternative and its viability for the city.

With resources of international technical cooperation of the Japanese Government, it developed the study of "Master Plan of Urban Transportation for Santa Fe de Bogota". The principal conclusions of the study were integrated and brought up to date for the district administration in the "Transport Road and Traffic Management Plan –short term Year 2006", which was completed in September of 1997. To develop the component of mass transportation that make it a part of this Master Plan, the District and National Governments agreed to develop a specific study including the conceptual design of the SITM, the pre-design of the First Metro Line (PLM), and the technical, economical evaluation of special, environmental and financial impact.

Continuing with these lines, the present District Administration considered in its plan 1998-2001 a mobility strategy that covers the public transportation system structuring, the first metro line construction, cycle-routes construction, road network extension and improvement and traffic management reinforcement.

In February of 1998, the National Government and District Government signed an agreement of intent which defined the procedure and joint action designed to guarantee the first line execution of the SITM.

4.5.2. COMPREHENSIVE SYSTEM STRATEGY OF MASS TRANSPORTATION

The demand study of the Master Plan of the SITM Conceptual Design demonstrates that some corridor of the city present superior demand in where bus system on exclusive lane may be operated efficiently. It provided justification to begin the construction of an efficient system of mass transportation that permits to overcome the traffic congestion, reduces the passenger trip time, lowers the private car use and improves the transport service quality in general.

Nevertheless, this system development by itself is not enough to resolve the transport problem of the city and its benefit can not be received completely if its development is not in keeping with a comprehensive strategy.

It is therefore necessary to find a way where the bus system can be worked like a network that permits to interchange between buses with different routes and transfer to the metro. It is urged to adopt this system and to permit its operation with the road use priority.

In this way, through the adoption of exclusive road for bus, the construction of express bus trunk and/or only bus, the fitting out of corridor specialized for the public transportation, the adoption of mixed use feeder line (public and private) and the development of a commuter train system will be realized. Above-mentioned elements include the station design and bus stop and the definition of the technical specification of the mobile equipment to provide efficiency, quality, and less adverse environmental impacts.

The construction of the First Metro Line (PLM) represents a first phase in the creation of a metro system with a total 3 lines to be developed in stages.

4.5.3. FIRST METRO LINE PROJECT PROPOSED BY THE SITM STUDY

The construction of the PLM is planned in two stages and will be completed in 9 years. The first stage covers the construction of 15.34 Km from Tintalito terminal yard to the San Martin station with the estimated duration of 5 years (1999-2003). The second stage covers the construction of 14 Km from the San Martin station to Puerto Amor terminal, and its construction is estimated to take 6 years (2002-2007). See Table 4.5-1.

Table 4.5-1 First Metro Line Project

Length	29.3 Km 21.7 Km elevated 1.0 Km level 6.6 Km underground
Station	23 stations 16 elevated with side platform 3 elevated with center platform 5 underground
Commercial average velocity	38.3 km/h
Maximum demand	56.000 passenger/hour/one way with two minutes interval between Trains.
Train capacity	1.867 passengers per train
No. of trains	40 trains of five coaches
Estimated duration of the construction	9 years
Estimated cost	US$ 3.041.3 millions of 1998

4.5.4. COMPLEMENTARY IMPROVEMENT OF THE TRANSPORT AND URBAN INFRASTRUCTURE

The project also includes actions for the improvement of transport improvement and the urban infrastructure. These actions cover, among others, the following activities.

1) Construction and conditioning of the bus-metro transfer point: 8 bus terminals and 4 feeder points.
2) Bus trunk construction of 29.1 Km for the service of less than 30.000 passenger/hour/direction.
3) Reorganization of the feeder routes system. These routes will work as interface between the metro station and the suburbs of the city. The objective is to limit the number of buses that travel to the expanded center of the city.

The definition of these works and actions is in a conceptual level. It is the responsibility of the District Administration to initiate the work to a design level, so that it can be developed parallel with the construction of the PLM.

4.5.5. CONSTRUCTION COST

(1) Estimated Cost for the Proposed Line of the PLM

The construction cost of the PLM amount to US$ 3.041.3 millions of 1998: US$ 1.604.7 millions correspond to the first stage and US$ 1.436.6 millions to the second stage. However, these costs do not include the associated financial costs for the development of a project of such magnitude.

(2) Estimated Cost for the Improvement Component of Transport and Urban Infrastructure

The cost for this component, also designated flexible component of the SITM, is estimated in US$ 236.8 millions of 1998.

4.5.6. THE PARTICIPATION OF THE NATIONAL GOVERNMENT

(1) Investment of the National Government for the Project

The definition of the National Government support is evaluated with the legal frame. In this means, the national government's investment is 70 % of the project cost: it is estimated US$ 2.294.6 millions of 1998, which includes US$ 2.128.9 millions to the construction of the PLM and US$ 165.7 millions for the improvement work of urban infrastructure. See Table 4.5-2.

Table 4.5-2 Participation of the National Government

US$ millions of 1998	Total	National Gov't	District
PLM	3.041.251	2.128.876	912.375
Improvement of urban infrastructure	236.798	165.759	71.039
STM Total	3.278.049	2.294.634	983.415

PART B

PLANNING OF TRUNK BUS SYSTEM

CHAPTER 5
Planning Conditions

PART-B PLANNING OF TRUNK BUS SYSTEM

5. PLANNING CONDITIONS

5.1. GENERAL

In the Master Plan Study conducted in 1996 by JICA, the present bus system in Bogota was studied and current issues of public transport were disclosed as shown below:

1) Prevailing illegal operation on unauthorized routes and route cutting
2) No respect for laws and regulations
3) Loading and unloading at non bus stop
4) Too many bus routes concentrated on same major roads
5) Lack of safety and security in buses
6) No transport terminal facilities
7) Reckless bus drivers with bad manners

The future public transport plan in the Master Plan recommended to improve the above issues through the introduction of a trunk bus system as a short-term measure based on the following three fundamental policies:

1) Reorganization of bus route
2) Restructuring of bus operation
3) Revision of tariff system

The trunk bus system shall be served by trunk lines and feeder lines, with the trunk lines connecting each zone centroid and operated by large-sized buses with minimum stops. Feeder lines shall serve inside a zone and should be operated with medium and small sized buses. The trunk bus lines should receive priority measures such as exclusive bus roads/ lanes and grade separations necessary to provide better service.

In this Feasibility Study, further studies for the trunk bus system is carried out for advancing the basic policies and plans recommended by Master Plan Study, in which six (6) trunk busway plans, which are the study roads in this Study, were proposed.

In this Chapter, demand and supply of public transport are further analyzed based on the information from the Person Trip Survey conducted in the Master Plan. This will help to understand bus passenger trip characteristics such as number of trips, trip generation and attraction, passenger OD pairs, etc., and will be based on the counting survey data such as bus flows and bus stop characteristics. Bus management and operation system, tariff system and bus facilities are also studied again. These studies disclose existing problems and issues.

According to the above analyses, the conceptual plan of trunk and feeder bus system will be proposed. It will consist of basic planning policy, trunk bus network system, tariff system, facility plan, organization and management, etc.

5.2. DEMAND AND SUPPLY OF PUBLIC TRANSPORT

5.2.1. BUS PASSENGER CHARACTERISTICS

(1) General

In the Master Plan Study, various types of traffic surveys were planned and carried out in 1995 to obtain detailed information on travel characteristics. The surveys aimed to collect new comprehensive trip information and socioeconomic data. The major survey was the Person Trip Survey conducted through home interviews in which interviewers directly visited selected homes. The comprehensive travel characteristics by private and public modes in Bogota were developed from analyzing the survey data.

This section focuses on analysis for bus passenger trip characteristics in more detail than that in the Master Plan Study, especially the Person Trip Survey data. The analyzed basic information is used for making a conceptual plan.

(2) Number of Trips

The total number of trips per day in the Study Area in 1995 is approximately 11.1 million excluding walking trips. 8.1 million trips, equivalent to 72 % of the total, are made by bus transport mode, and 3.1 million are by private modes (car, taxi and truck).

The trip composition of mode by purpose is shown in Figure 5.2-1. Busses are used for trips with the purpose of "to work", "to school", "private" and "to home", while private modes, especially, car has relatively high percentage of "business".

It is obvious that Bus transportation plays a very important role in Bogota in terms of volume, and is utilized in every trip purpose. Especially, for students, where it is an indispensable transportation means.

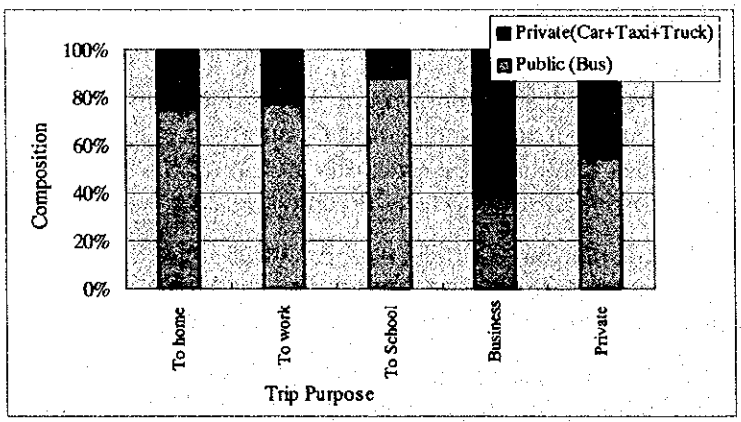


Figure 5.2-1 Composition of Modes by Purpose

(3) Hourly Trip Distribution

The number of trips per hour by bus and private modes (car+taxi+truck) are shown in Figure 5.2-2. The figure shows the hourly trip distribution under "departure time". The trip patterns of hourly distribution by mode are nearly the same throughout the day. Bus trips in both the morning and evening peak hours remarkably raise and decrease, in comparison with those of private mode. This shows that many people take the bus daily to work or school during 6:00 to 7:00 and to home during 17:00 to 19:00 in Bogota.

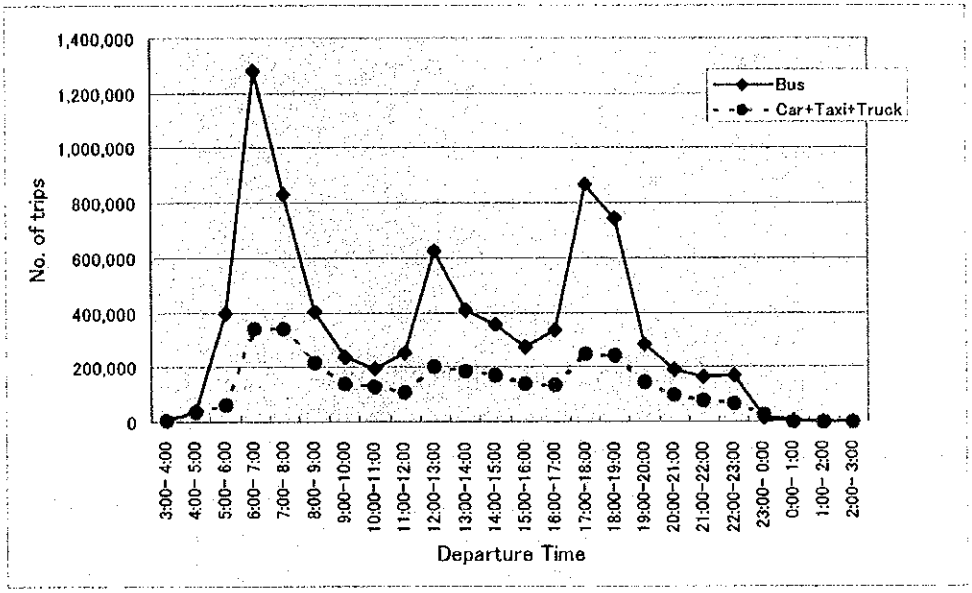


Figure 5.2-2 Hourly Trip Distribution by Mode

(4) Travel Time

Travel time distribution by mode is shown in Figure 5.2-3. The travel time of bus trips indicates three significant lengths: around 30 -35 minutes, 60 minutes and 100 or more minutes. The private travel time also shows similar patterns but shorter than those of bus. The high trip ratio of travel time by the private has three crests: around 15 -25 minutes, 35 minutes and 70 minutes. Approximately 50% of the bus total trips have the travel time within 60 minutes, in contrast to 30 minutes for the private. This shows that travel time for approximately 50% of bus passengers extends 1 hour or more.

(5) Trip Generation and Attraction

Figure 5.2-5 show trip generation and attraction by zone and transport mode in which the mode is classified into 2 groups: car (including taxi and truck) and bus. The zones in which the bus in the trip generation is higher are 11, 15, and 24 because these are residential areas in suburbs. . On the other hand, the highest zones in the attraction are zone No. 5, 6 and 21. These areas are in the central commercial and business districts in Bogota.

Many bus passengers dwelling in residential areas in the suburbs commute to the central business areas, using buses to link the city center with the suburbs for about 1 hour or more.

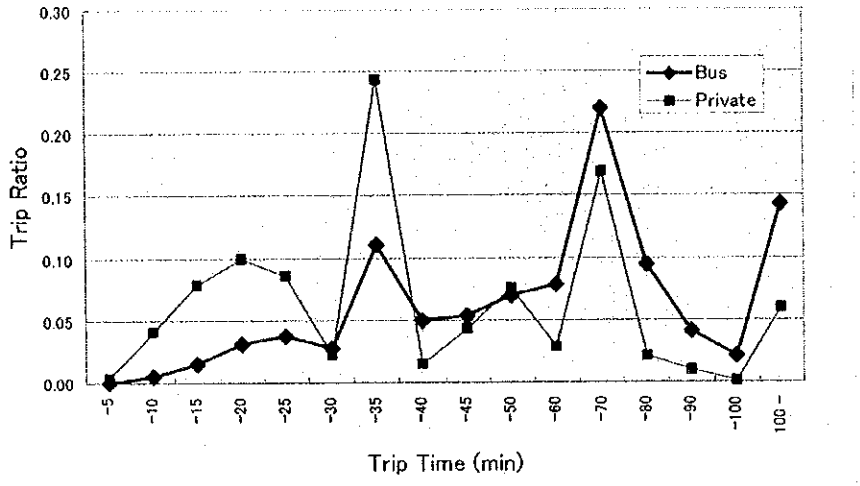


Figure 5.2-3 Travel Time by Mode

(6) Trip Composition by Income Level

The trip composition rate of mode by household income level is shown in Figure 5.2-4. The relationship between travel mode used and income level is found from this figure which shows the composition of transport mode on the Y-axis against monthly income on the X-axis. The higher the household income level is, the higher the share of private mode (car) is. As for bus, the middle income levels between 200,000 Peso and 500,000 Peso are higher than the others. This trend is based on the relationship between household income, and car ownership and bus user.

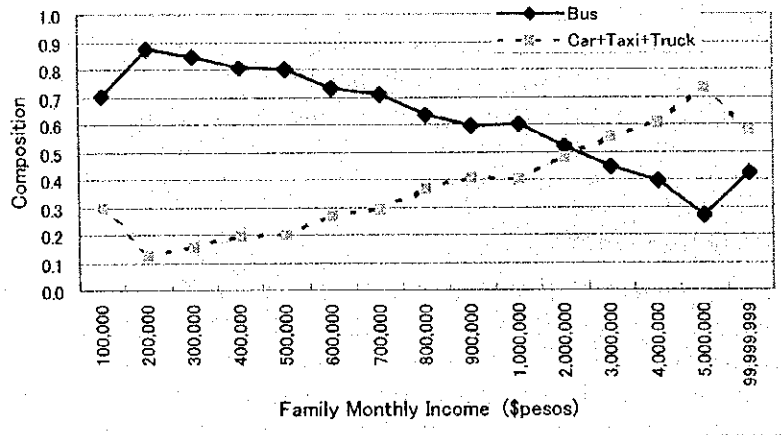


Figure 5.2-4 Trip Compositions of Modes by Family Income Level

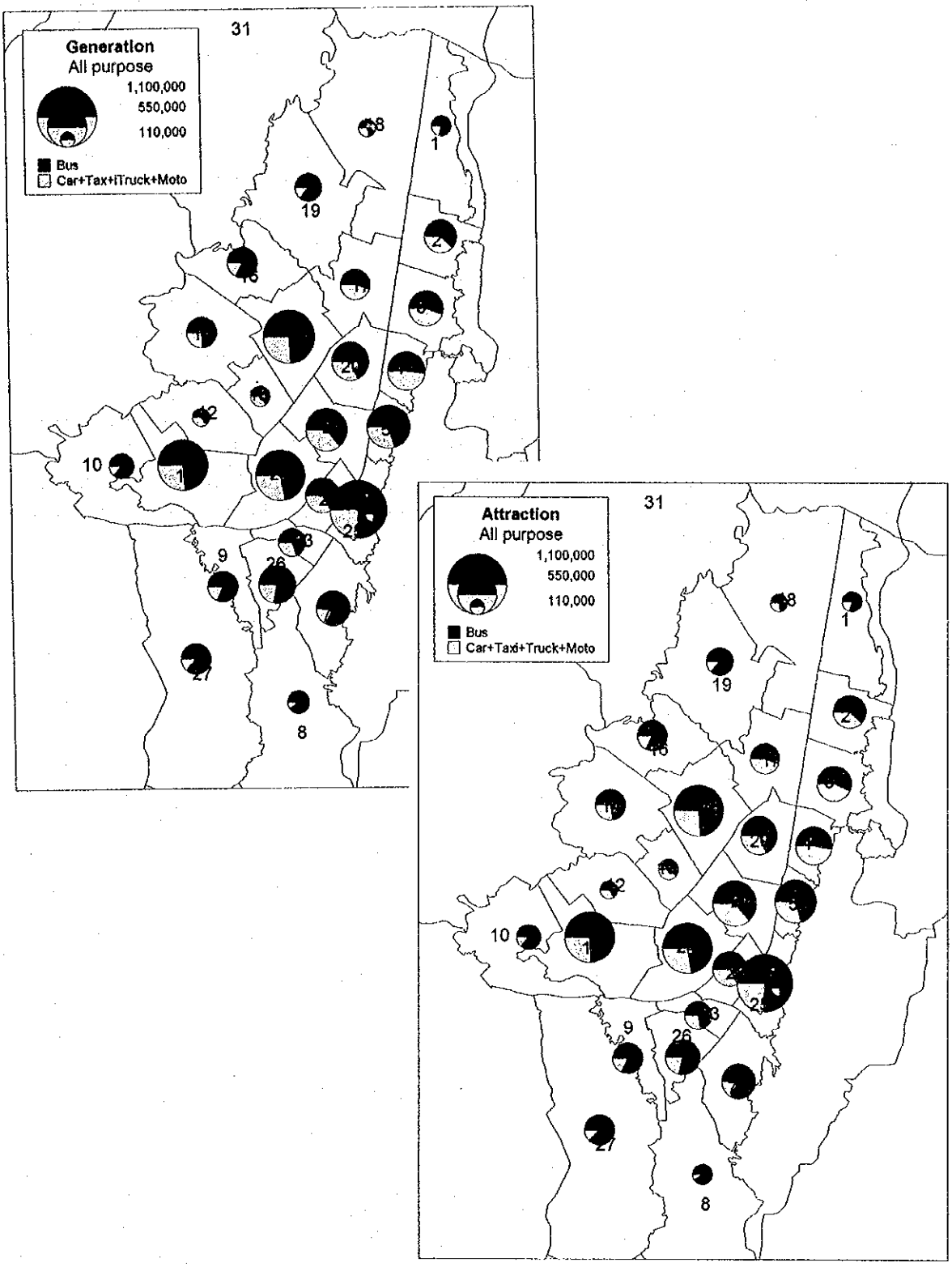


Figure 5.2-5 Trip Generation and Attraction by Mode

(7) Bus Passenger OD Pairs on the Study Roads

It is difficult to specify bus routes selected by bus passengers in the whole Bogota city. In this Study, bus passenger OD survey was carried out on the study roads in which the origin and destination of passengers on board on selected bus routes were surveyed on a random sampling basis. Analysis of the data only shows the trend of routes selected by bus passengers.

Therefore, in order to know bus routes selected by bus passengers in the whole city of Bogota, bus transit assignment was carried out by using input data which are bus passenger OD trip data and existing bus routes with service frequency.

Figure 5.2-6 to Figure 5.2-8 show the passenger link OD trips on selected bus routes on the six (6) Study roads and other five (5) major roads on which the Bogota City plans trunk busways: Cra. 7a, Av. Cuidad de Quito, Av. 68, Calle 170, Av. Suba and Av. Caracas for the Study road, and Calle 80, Centenario, Av. Americas, Av. Boyaca and Corredor Ferreo del Sur. In these figures, the passenger movement between each pair of traffic zone blocks is drawn by a line whose width is proportional to the number of trips between the zones. The sections in which bus passengers pass through are drawn by a line with a grid pattern, and the black lines with width line show the routes selected by bus passengers.

As can be seen, many bus passengers who pass through on radial roads: Av. Suba, Calle 80,etc., proceed directly to their destination toward Centro. On the other hand, on the circle roads such as Av. Boyaca and Av. 68, also head to Centro.

This information is used for configuration of future trunk busway network.

Figure 5.2-6 Bus Passenger OD Pairs on Cr. 7, Av. Quito, Av. 68 and Calle 170

Figure 5.2-7 Bus Passenger OD Pairs on Av. Suba, Av. Caracas, Av. Boyaca and Calle 80

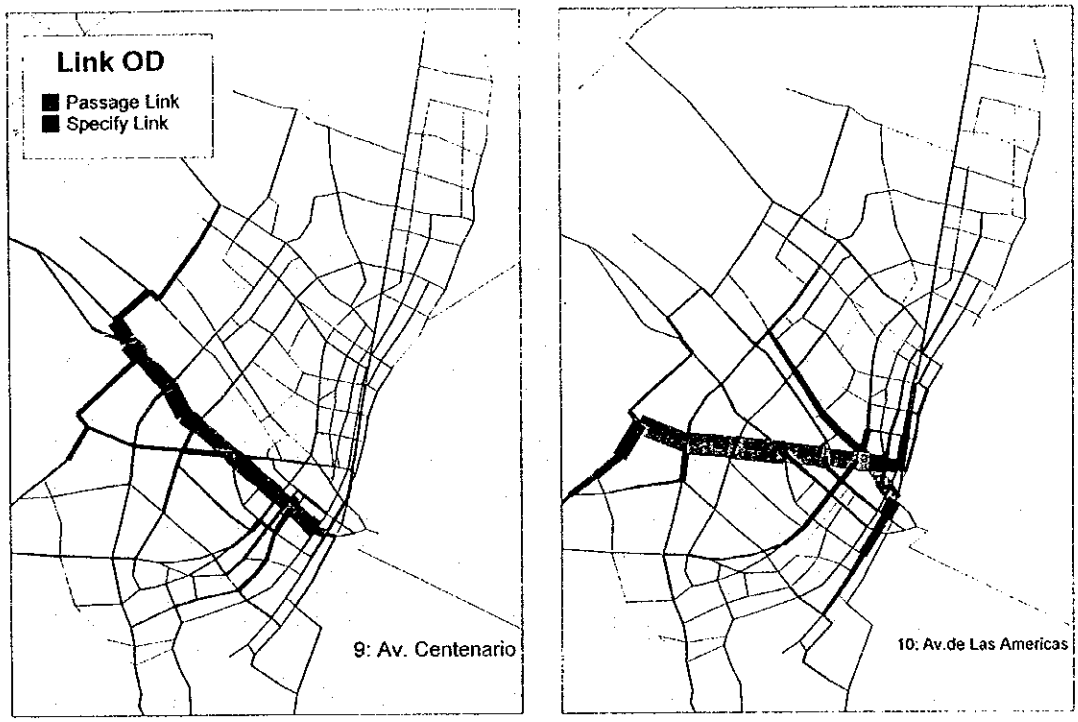


Figure 5.2-8 Bus Passenger OD Pairs on Av. Centenario, Av. Americas and Corredor Ferreo

5.2.2. Bus Flow Characteristics

Several traffic surveys were carried out to measure the performance of existing bus service, and to identify the key factors which influence performance. Bus flows past a point during a given time period on major roads, normal bus loading conditions in the peak and off-peak hours, and average travel distance of passengers are analyzed as shown in the following section.

(1) Bus Flows

1) Major Roads

Table 5.2-1 shows the hourly bus flows observed along the Study roads. The highest record bus flows are along Av. 68 (No. 14), with 2,139 / hour inbound (towards the city center) during the morning peak, followed by 1,145 on Aut. Norte near Calle 12 (No. 6), 936 on Av. Suba. The flows are achieved with no-busway with no special operation measures.

As for the flows per lane, Av. 68 near Av.1^{0} de Mayo recorded the highest volume with 1,070 buses/lane/hour. This is followed by 573 on Aut. Norte (No. 6), 468 on Av. Suba. On the other hand, bus flows on Av. Caracas with two lane busway is 240 buses/lane/dir.

Table 5.2-1 Peak Hour Traffic Volume (7:00 -8:00)

No.	Location Name	Dirct	Privste Vehicles	Bus Total	Bus Composition	Total	No. of Lane Total	No. of Lane Bus	Bus Flow/lane /dirct.
		E-W	1,681	161	8.7%	1,842	4	2	81
1	Calle 100 enter Crs. 10	W-E	1,185	114	8.8%	1,299	4	2	57
		N-S	543	246	31.2%	789	3	2	123
2	Carrera 7a enter Calle 85	S-N	1,857	169	8.3%	2,026	3	2	85
		E-W	684	168	19.7%	852	2	2	84
3	Calle 170 enter Cr. 7	W-E	758	109	12.6%	867	2	2	55
		E-W	570	117	17.0%	687	2	2	59
4	Calle 170 enter Cr. 58	W-E	1,222	106	8.0%	1,328	2	2	53
		N-S	2,306	399	14.8%	2,705	3	2	200
5	Aut. Norte enter Cafam	S-N	1,005	238	19.1%	1,243	3	2	119
		N-S	4,327	1,145	20.9%	5,472	5	2	573
6	Aut. Norte enter Calle 129	S-N	3,413	999	22.6%	4,412	5	2	500
		N-S	2,859	22	0.8%	2,881	3	2	11
8	Av. Quito enter Calle 94	S-N	1,422	66	4.4%	1,488	3	2	33
		N-S	2,250	936	29.4%	3,186	3	2	468
9	Av. Suba enter Calle 129	S-N	1,411	514	26.7%	1,925	3	2	257
		N-S	8,748	140	1.6%	8,888	5	2	70
10	Av. Quito enter Calle 63	S-N	5,109	361	6.6%	5,470	5	2	181
		N-S	0	481	100.0%	481	2	2	241
11	Av. Caracas nera Calle 26	S-N	0	484	100.0%	484	2	2	242
		N-S	1,602	568	26.2%	2,170	3	2	284
12	Car. 7a enter Calle 45	S-N	2,865	126	4.2%	2,991	3	2	63
		N-S	3,191	352	9.9%	3,543	4	2	176
13	Av 68 enter Calle 13	S-N	2,020	742	26.9%	2,762	4	2	371
		N-S	1,491	382	20.4%	1,873	4	2	191
14	Av. 68 enter Av. 1 de May	S-N	1,463	2,139	59.4%	3,602	4	2	1,070

The bus composition ratio to the total at peak hour is shown in Figure 5.2-9. The bus shares on the above roads are in range of 3% to 30%, exclusive of 60% on Av. 68 and 100% on Caracas busway. The roads with higher bus ratio are Carrera 7ª (31%), Auto Norte (22%), Av. Suba (30%), Av. 68 and Av. Caracas.

2) *Av. Caracas*

Table 5.2-2 shows bus flows in the morning peak (7:00-8:00) recorded on Av. Caracas in the inbound and outbound directions which were counted at three locations between Calle 2 and Calle 67 during August and September, 1998. Bus segregated busway with 2-lane/direction located on the existing right-of-way in the median has been introduced on this road. Private vehicles are restricted to use on the busway. Buses are operated on the busway without any special operation measures. The recorded figures are on the busway.

As can be seen, in the inbound direction from south area to north area, the bus flows vary from 540 to 620 /hour/direction. Bus flows in the outbound direction are somewhat low. Their figures vary from 400 to 540 /hour/direction.

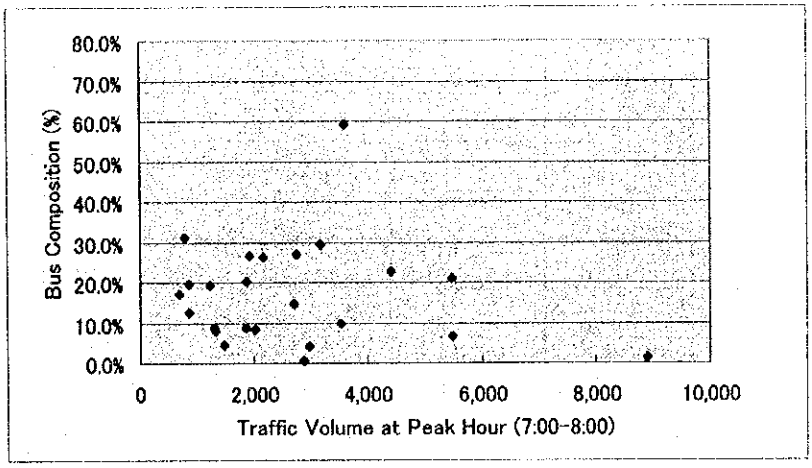


Figure 5.2-9 Bus Composition Ratios at Peak Hour

Table 5.2-2 Bus Flows in the Morning Peak (7:00-8:00) on Av. Caracas

Direction: South to North, 1-hours: 7:00-8:00 (unit: buses/hour)

Location		Corriente	Intermedio	Others	Total
Calle 2- Calle 3	South	235	305	1	541
Calle 32A - Calle33	Centro	322	270	26	618
Calle 66- Calle 67	North	253	338	0	591

Direction: North to South, 1-hours

Location		Corriente	Intermedio	Others	Total
Calle 2- Calle 3	South	192	273	0	465
Calle 32A - Calle33	Centro	175	217	6	398
Calle 66- Calle 67	North	183	352	7	542

(2) Bus Loading Conditions

1) Loading Conditions on Screen Line

Table 5.2-3 summarizes bus load factors at peak hour on the Screen Line surveyed in Master Plan in 1995, which are defined as the number of passengers per bus capacity: 100% means the load condition in which all seats are occupied.

As can be seen, Bus load factors for inbound buses reached 100% or higher, in contrast to 80 – 90% for Buseta and Colectivo. Most of the survey results showed maximum load factors of around 100%.

In general, with conventional bus services, passengers are only prepared to board certain buses and it is more difficult to achieve high average load factors without extensive crush loading. In Bogota, however, the load factors in the peak hour exceed 100% or higher. This means bus on-board conditions are heavily congested in the peak hour.

Table 5.2-3 Bus Loading Conditions at Peak Hour (7:00 - 8:00) on the Screen Line in 1995

Location	Direction	Bus Loading (%)		
		Bus	Buseta	Colectivo
Car. 7a	Inbound	102.70	81.05	84.78
	Outbound	69.58	0.00	69.17
Aut. Norte	Inbound	87.76	89.78	94.00
	Outbound	94.36	90.20	79.61
Av. Suba	Inbound	123.59	96.53	62.28
	Outbound	75.93	55.18	57.95
Av. 10	Inbound	115.40	97.23	97.00
	Outbound	30.13	21.41	13.90
Av. Caracas	Inbound	198.61	0.00	0.00
	Outbound	28.98	40.00	30.00
Av. Sur	Inbound	118.08	100.22	97.26
	Outbound	28.85	31.36	39.98
Av. 68	Inbound	143.39	114.07	91.73
	Outbound	57.92	58.65	60.96

Data in 1995
100% means all seats occupied

2) *On Av. Caracas*

Figure 5.2-10 shows the bus loading conditions in terms of bus passengers on board in the inbound and outbound directions in the morning peak. The number of passengers on board presents a line graph and number of passengers at boarding and alighting present a bar graph.

As can be seen, the passengers on board on the bus bound for the north direction decrease with going to Centro and North areas. At the starting bus terminal, approximately 60 passengers are on board and gradually decrease with going to the North. Since Intermedio bus has a seat of 40- 45, approximately 15 –20 passengers are standees in the peak hour. In the outbound direction, the maximum 40 –45 passengers are carried without standees.

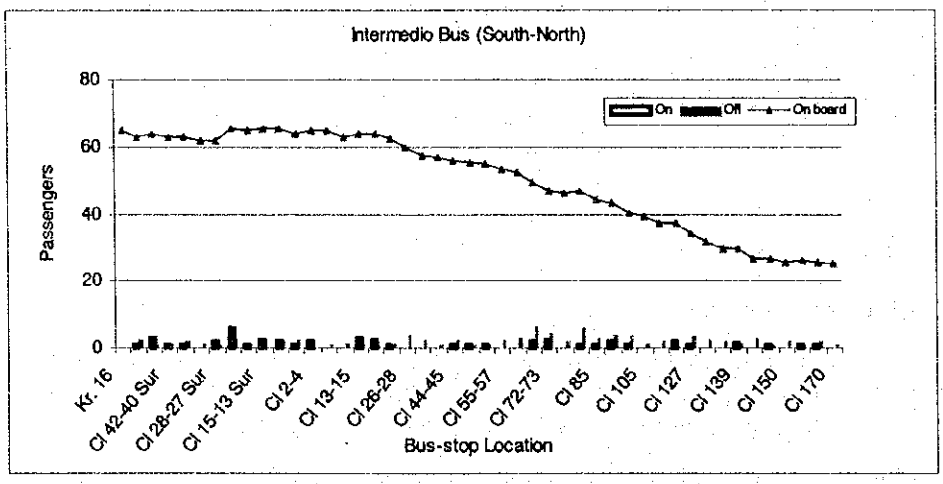


Figure 5.2-10(1) Bus passengers on Board in the Peak Hour on Av. Caracas

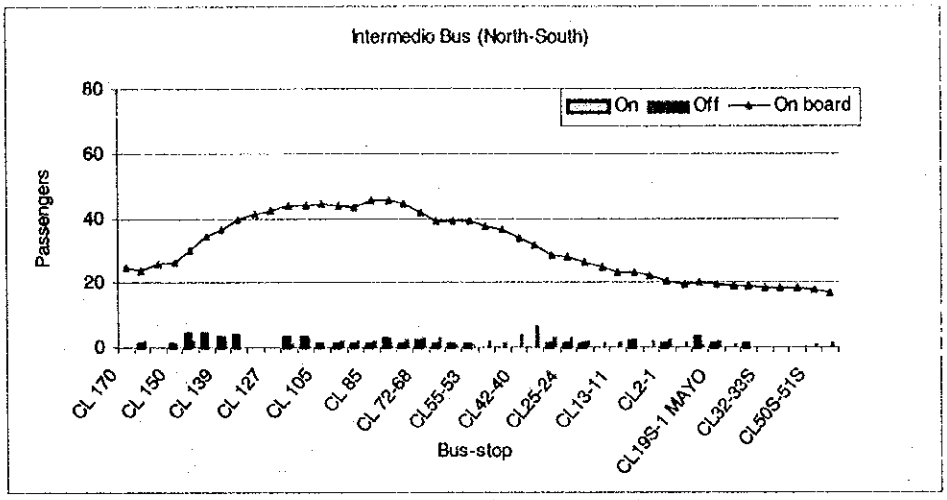


Figure 5.2-10(2) Bus passengers on Board in the Peak Hour on Av. Caracas

(3) Bus Commercial Speed

1) Av. Caracas

Figure 5.2-11 summarizes bus commercial speed and travel speed of private vehicle in the peak hour in both inbound and outbound directions on Av. Caracas. The data were recorded during September and October 1998. The bus commercial speeds range from 15 to 20km/h in the morning peak hour, while average recorded travel speeds of private vehicles are around 25km/h. The speed different is approximately 5km/h.

Figure 5.2-12 shows the variation of bus commercial speed along Av. Caracas in the both inbound and outbound directions. The commercial speeds vary depending on locations. The commercial speeds in both directions in the central commercial and business areas between Calle 4 and Calle 72 are lower. The average speeds of three times in this section are as low as 12 – 18 km/h, in contrast to around 25 km/h on South area and 30 –40 km/h on North area.

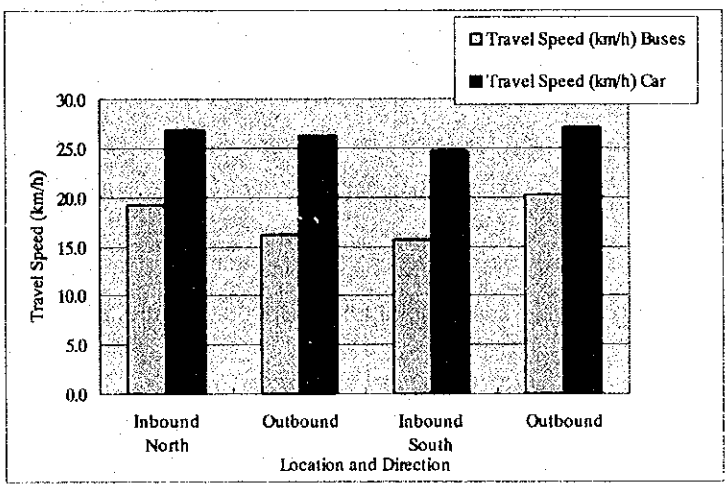
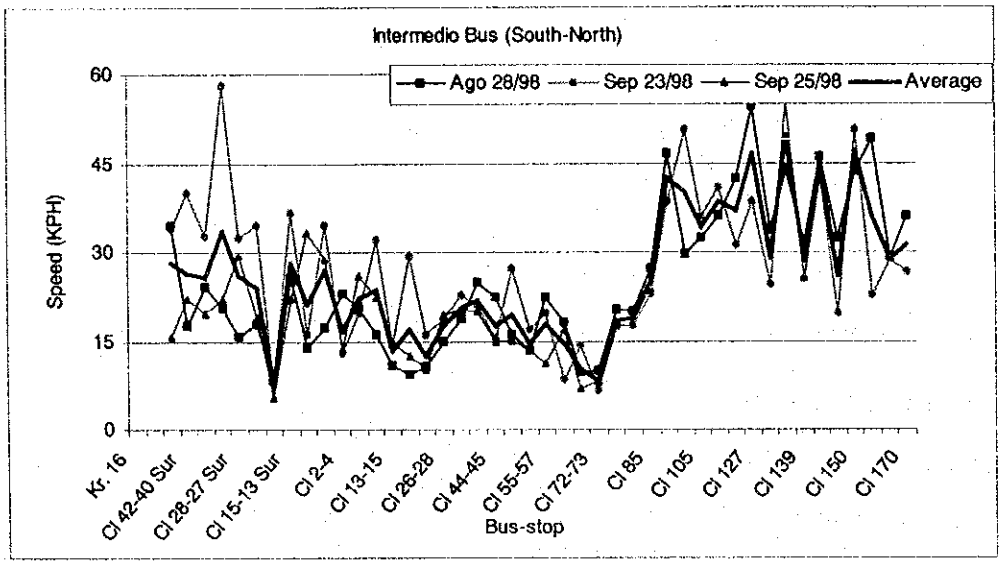


Figure 5.2-11 Comparing between Travel Speed and Bus Commercial Speed on Caracas

2) *Autopista Sur and Av. Quito*

Figure 5.2-13 shows the variation of bus commercial speed along Autopista Sur and Av. Quito in the both inbound and outbound directions. The average speed of two times in the inbound direction ranges from 10 to 18 km/h, in contrast to approximately 25-35 km/h in the outbound direction. Comparing to that on Av. Caracas, the commercial speeds in the inbound on this road are the similar to those on Av. Caracas in the commercial area.



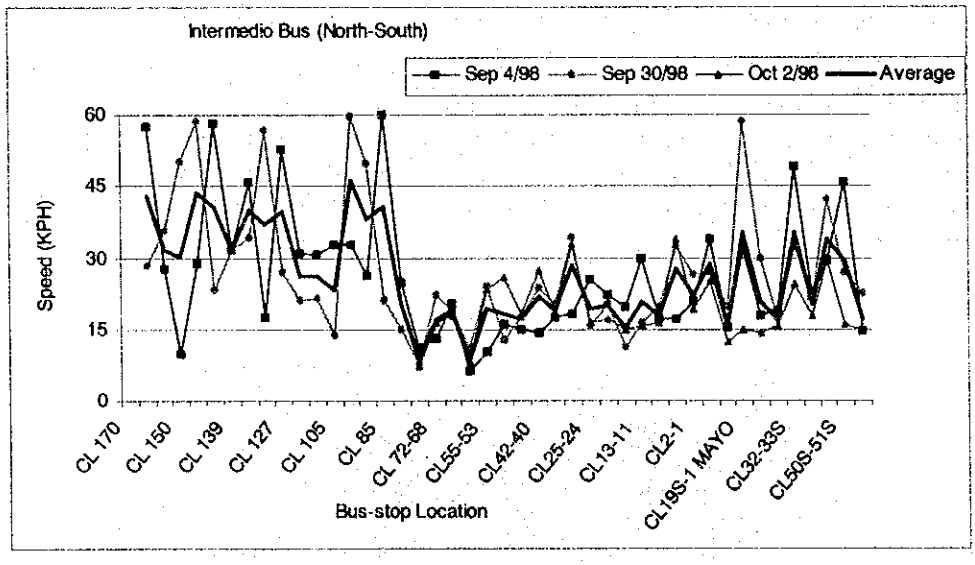
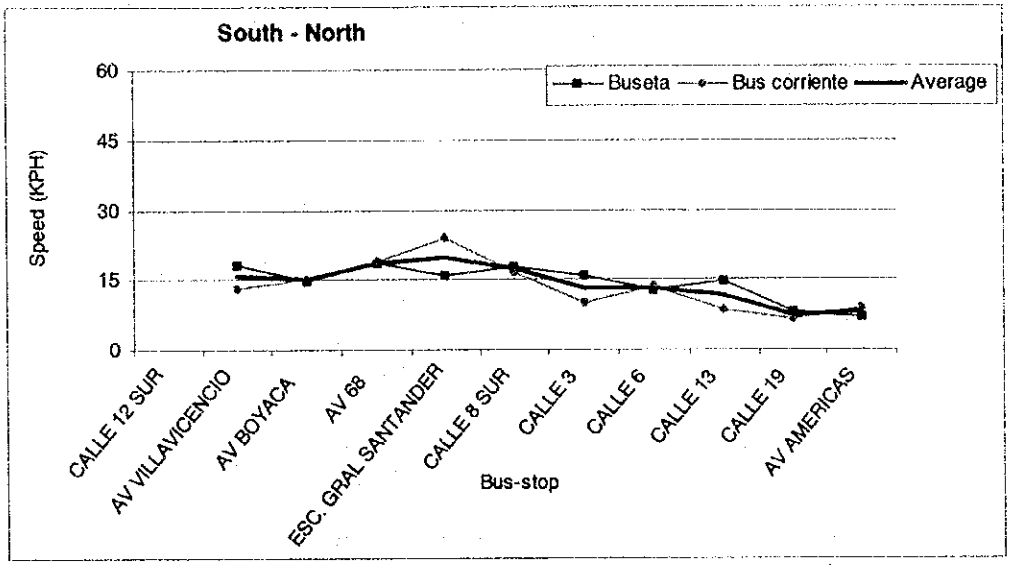


Figure 5.2-12 Bus Commercial Speed on Caracas



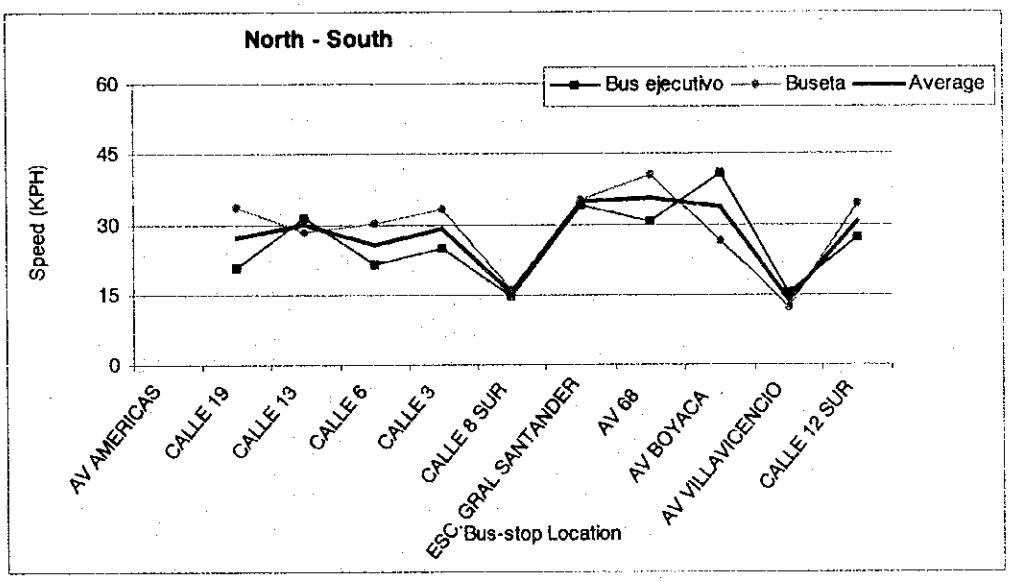


Figure 5.2-13 Bus Commercial Speed on Autopista Sur-Av. Quito

5.2.3. Bus Stop Characteristics

(1) Waiting Time at Bus Stop

Figure 5.2-14 shows the waiting time at bus stops analyzed from the interview survey. Approximately 70 % of the samples have a waiting time at bus stop of about 5 minutes. Its accumulative percentage reaches 90% with a waiting time of 10 minutes. Almost all the people take a bus within 10 minutes.

Table 5.2-4 summarizes an accumulative percentage of waiting time within 10 minutes or less to total samples at bus stop counted on major roads. As can be seen, bus passengers who wait bus at stop with a waiting times of 10 minutes or less on the major roads reach 95% or more of the total.

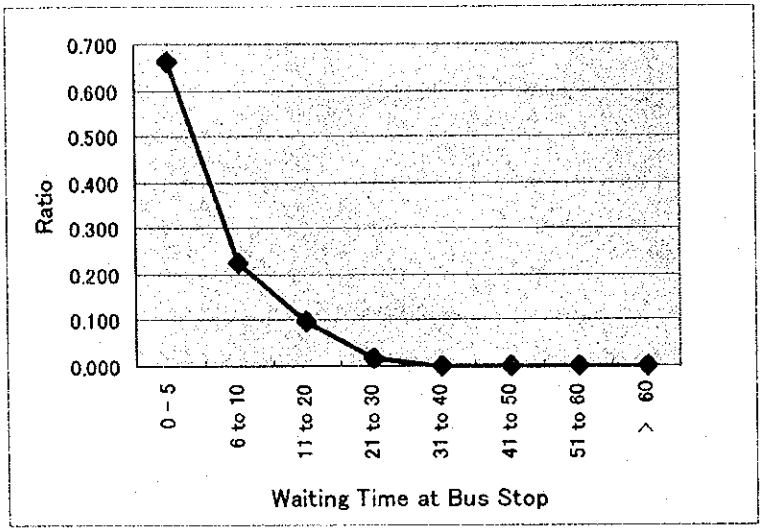


Figure 5.2-14 Waiting Time at Bus Stop

Table 5.2-4 Waiting time on Major Roads

(Accumulative percentage of waiting time within 10 minute or less)

Roads	Location	Accum. Percentage	Samples
Carrera 7	Calle 40	98.9%	180
Calle 170	Carrera 47	95.6%	90
Av. Suba	Calle 127	100.0%	90
Av.Quito	Calle 24	97.6%	209
Av. 68	Calle 78	97.0%	362
Av. Caracas	Calle 45	99.0%	902

(2) Bus Dwelling Time

At most bus stop, travel times are measured for some buses passing through the stop area between an upstream "entry point" and a downstream "exit point". The dwelling time is the duration from moment when the bus wheels stop at loading point to moment when wheels start to move at bus stop including loading/ unloading times. Figure 5.2-15 and Figure 5.2-16 show the dwelling time against number of passengers at boarding with the parameter of number of passengers at alighting. As shown in Figures, bus dwelling times varied from 1 to 45 seconds with 2-door buses, in contrast to 3 to 26 seconds for 1-door buses. The 2-door bus dwelling time is longer than that of 1-door bus, depending on the number of passengers. The 2-door buses are mainly ordinary buses with 45 seats, while the 1-door buses are Buseta and Colectivo with 12-35 seats.

The relation between dwelling time and number of passengers at boarding and alighting was analyzed by using multi-linear regression method. Figure 5.2-17 and Figure 5.2-18

show those relationships for 2-door buses and 1-door buses, respectively. The dwelling time under the same conditions for the number of passengers at boarding and alighting; for instance, 4 passengers at boarding and 8 for alighting, is approximately 25 sec. for 2-door buses, in contrast to 27 sec. for 1-door buses. The dwelling time for 2-door buses is somewhat shorter than that of 1-door buses.

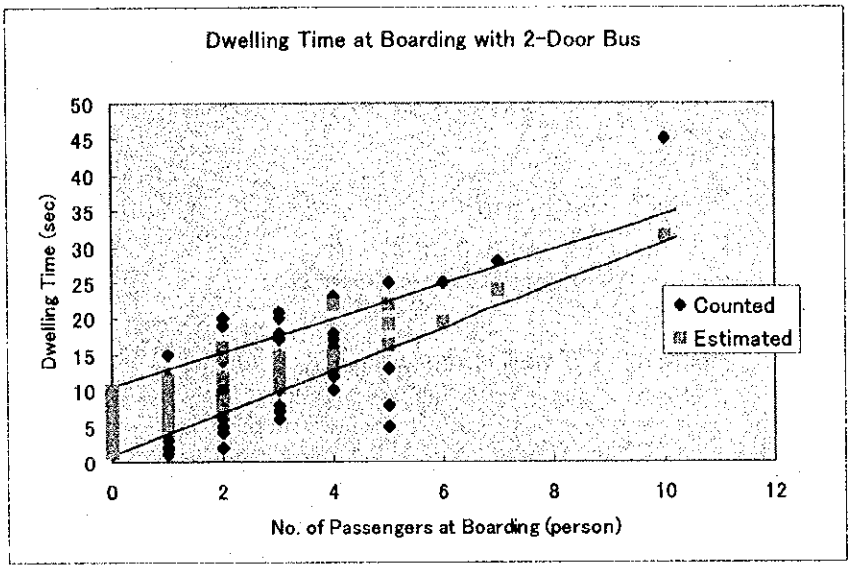


Figure 5.2-15 Dwelling Time with 2-Door Buses

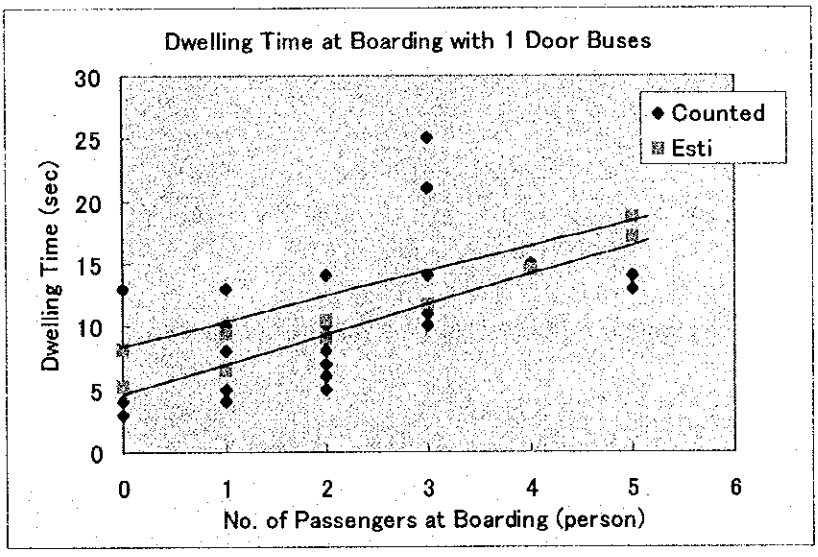


Figure 5.2-16 Dwelling Time with 1-Door Buses

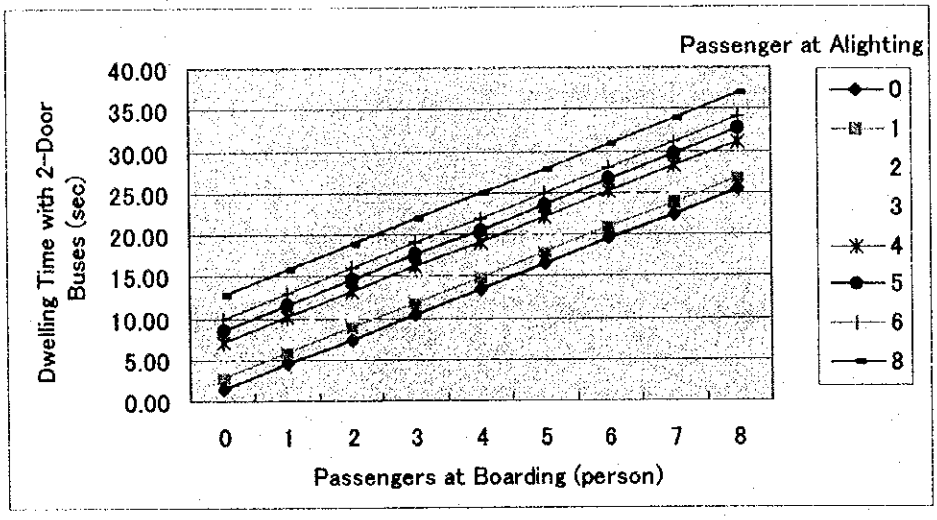


Figure 5.2-17 Dwelling Time with 2-Door Buses

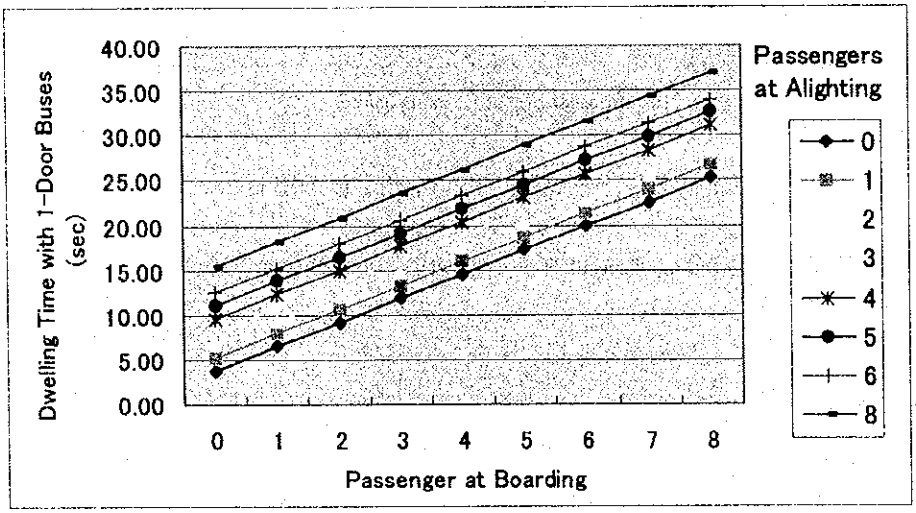


Figure 5.2-18 Dwelling Time with 1-Door Buses

(3) Walking Time

Figure 5.2-19 shows the walking time from/ to bus stop to / from origin or destination. The walking time, equivalent to walking distance, has close relation with the distance of bus stop location or spacing, and with feeder bus network system in the trunk –feeder bus system.

As can be seen, approximately 70 % of the samples have the walking time from/ to bus stop within 5 minutes. Its accumulative percentage reaches 90% by 10 minutes. Almost all the people walk from/ to bus stop within 10 minutes. This is equivalent to a distance of 800 meters – 1 km. Therefore, this also indicates that the covering areas of bus service are within a distance of 0.8 – 1 km on either side of a bus route.

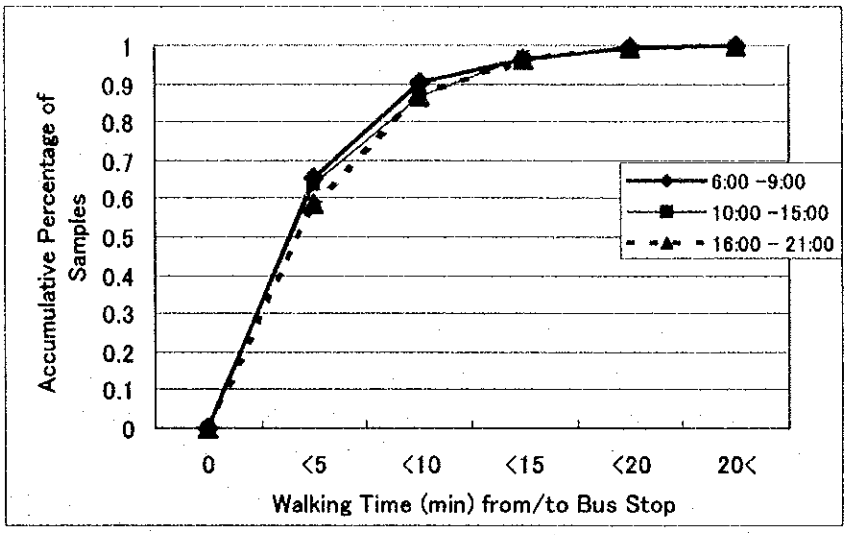


Figure 5.2-19 Walking Time from/to Bus Stop

(4) Bus Transfer

The bus transfer times have close relation to bus network services. Figure 5.2-20 summarizes the number of bus transfer times based on the bus passenger's interview survey. The ratio of non-transfer to the total reaches approximately 80%, and one (1) time transfer is 18%. The passengers who utilize three bus routes are only 3%.

According to the transfer times, almost all passengers are able to arrive at their destinations without the transfer by assistance of the fine bus route service. However, approximately 850 bus routes are operated as results of those route services and too many bus routes concentrate on some major roads with loading and unloading at non bus stop. On the some roads, traffic volume is very heavy with heavy bus volume. At the same time, the traffic flows are sometimes confused by bus loading and unloading at non bus stop.

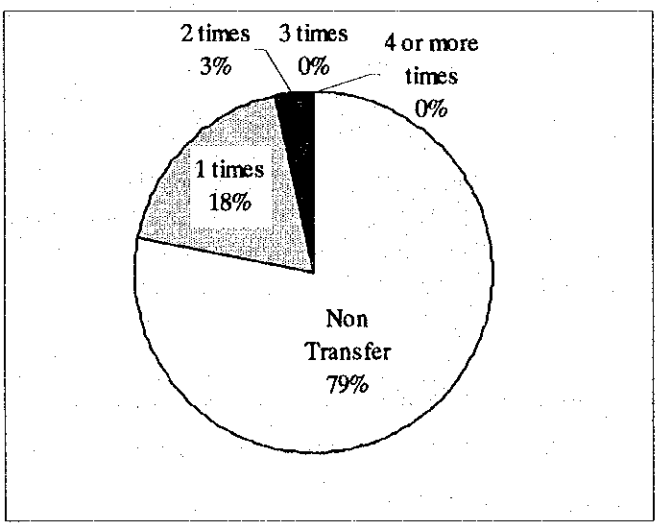


Figure 5.2-20 Number of Bus Transfers