

CHAPTER 7 OTHER IMPROVEMENT PLANS RELATED TO MRT

The operation of the MRT will not only improve the present urban transport system dramatically, but also produce various effects on the wayside of the MRT route. Several measures related to the MRT should be adopted to maximize good results and minimize disadvantages.

The concept of such improvement measures including examination of environmental problems is summarized as follows.

7-1 Scheme of Public Transport Network Development

1) Reorganization of Bus Routes

Basic idea on bus route reorganization is applied to each existing bus route as shown in Figure 7-1.1, considering the followings;

- a. To maximize the MRT services of high speed, big transport capacity, etc.
- b. To prevent passengers from unnecessary transferring between the MRT and buses
- c. To reduce bus operation costs and recover intensive efficiency, eliminating too long route through congested areas
- d. To secure even for the road users to receive benefits by recovering smooth running condition on road by reduction of bus traffic

2) Coordination Plan between Bus and MRT in Main Stations

In order to make the MRT work effectively, it is desirable to prepare some transport facilities to coordinate the MRT with the road transport system. It needs to keep the space for passengers to walk to bus stops, to get on/off buses, or to wait at main stations.

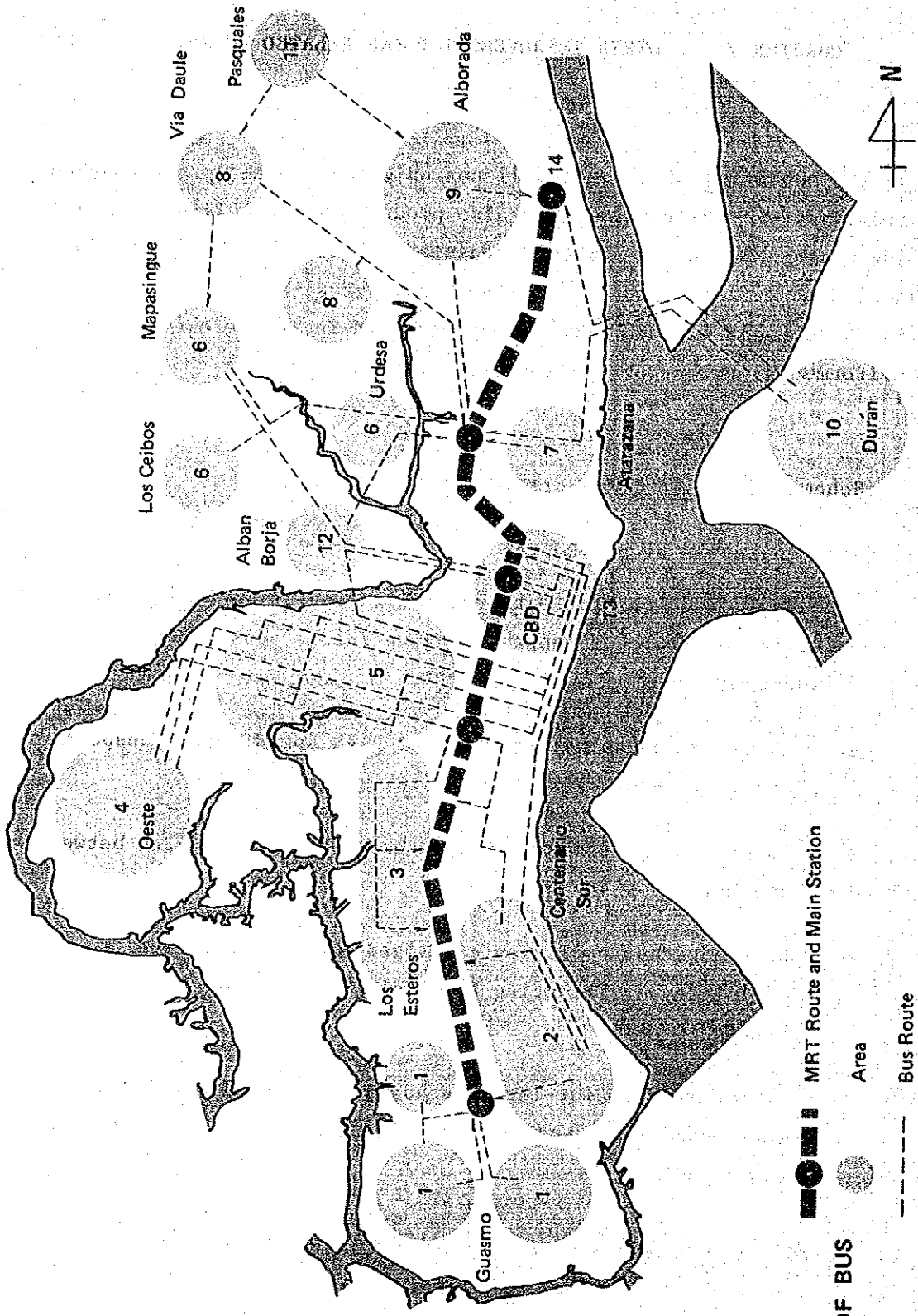





Figure 7-1.1
CONCEPT OF BUS NETWORK

-  MRT Route and Main Station
-  Area
-  Bus Route

The commercial development around stations is expected to increase dramatically because of the big volume of passenger and convenient conditions of transportation, and surroundings are also expected to develop more rapidly and become a center of the area.

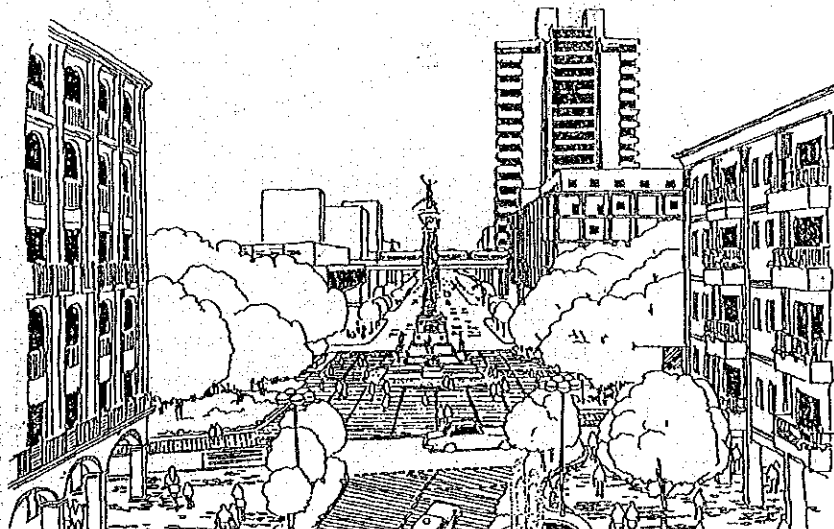
As examples of 5 main stations, the coordination plans in Guasmo and 9 de Octubre Station are shown in Figure 7-1.2 and 7-1.3.

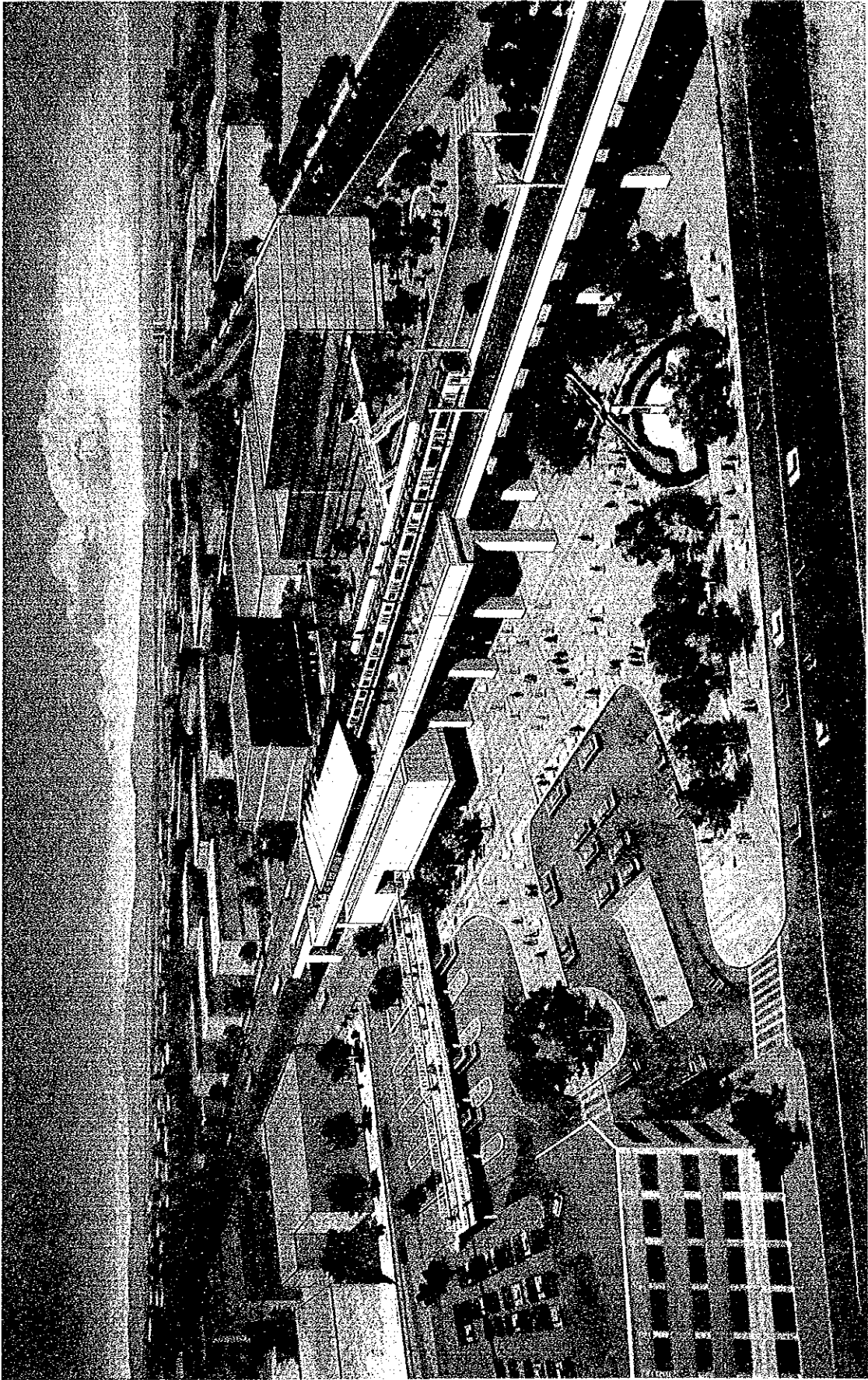
3) Improvement Plan of Accessibility to Rio Guayas from MRT stations

Although the CBD (Central Business District) expands to the south and west, the most important functions of commerce, business and administrative are still concentrated on the area along Rio Guayas and will be left there in future. The distance between Rio Guayas and the MRT stations seems to be a little far as an access distance by walk and bus access seems to be required. However, because of the crowd on roads in the CBD, the operation of the access bus may be disturbed to some extent.

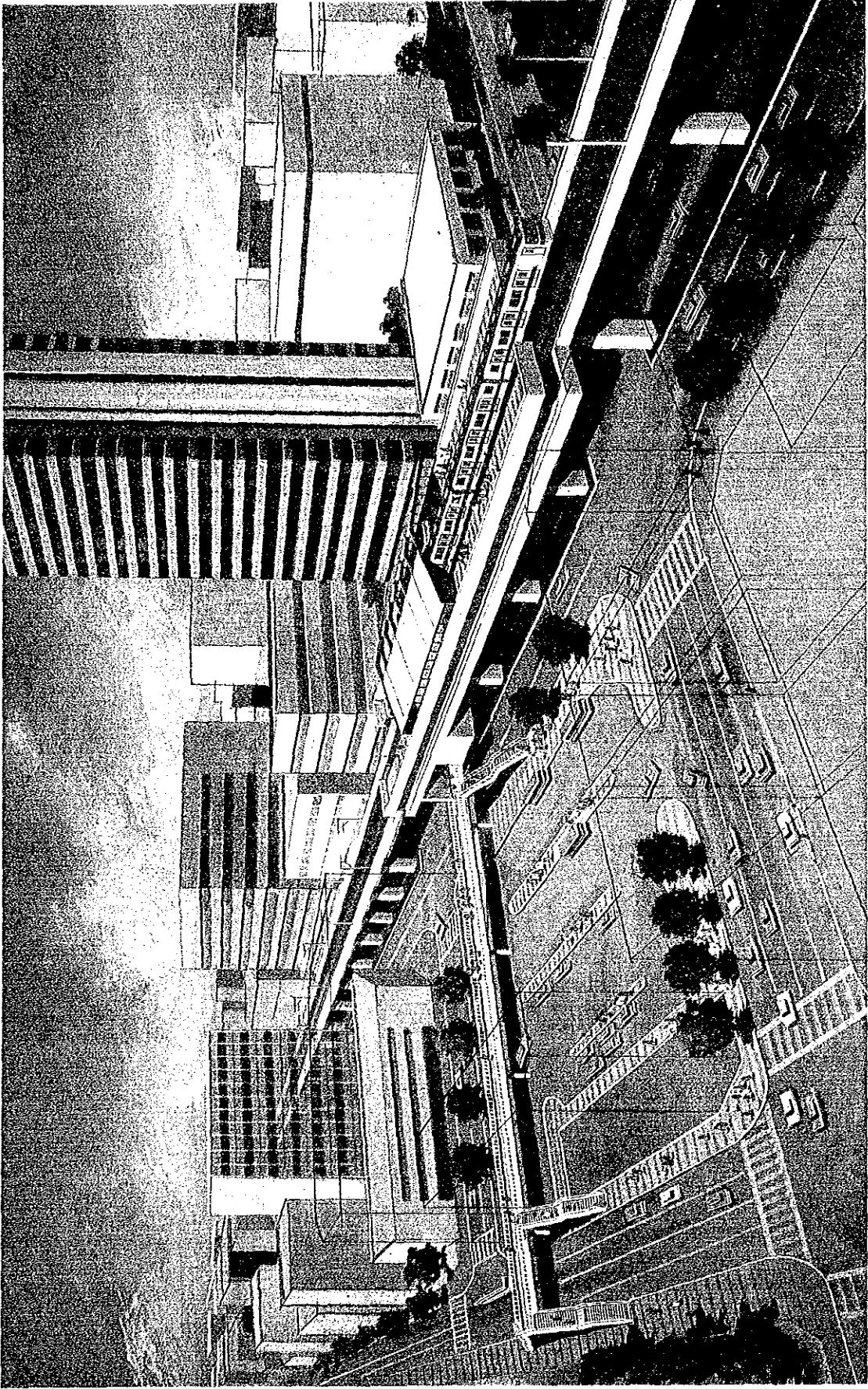
As the countermeasure, it is desirable to promote the access by walk and arrangement of bus exclusive lane, and transit mall will be one of desirable solutions. And Av. 9 de Octubre is recommended to be suitable to the transit mall, judging from the comparison with 3 alternative streets around Parque Centenario (Central Park).

Image Sketch of Transit Mall
(Area of Av. 9 de Octubre and Parque Centenario)





OVERLOOK VIEW OF GUASMO STATION



OVERLOOK VIEW OF 9 DE OCTUBRE STATION

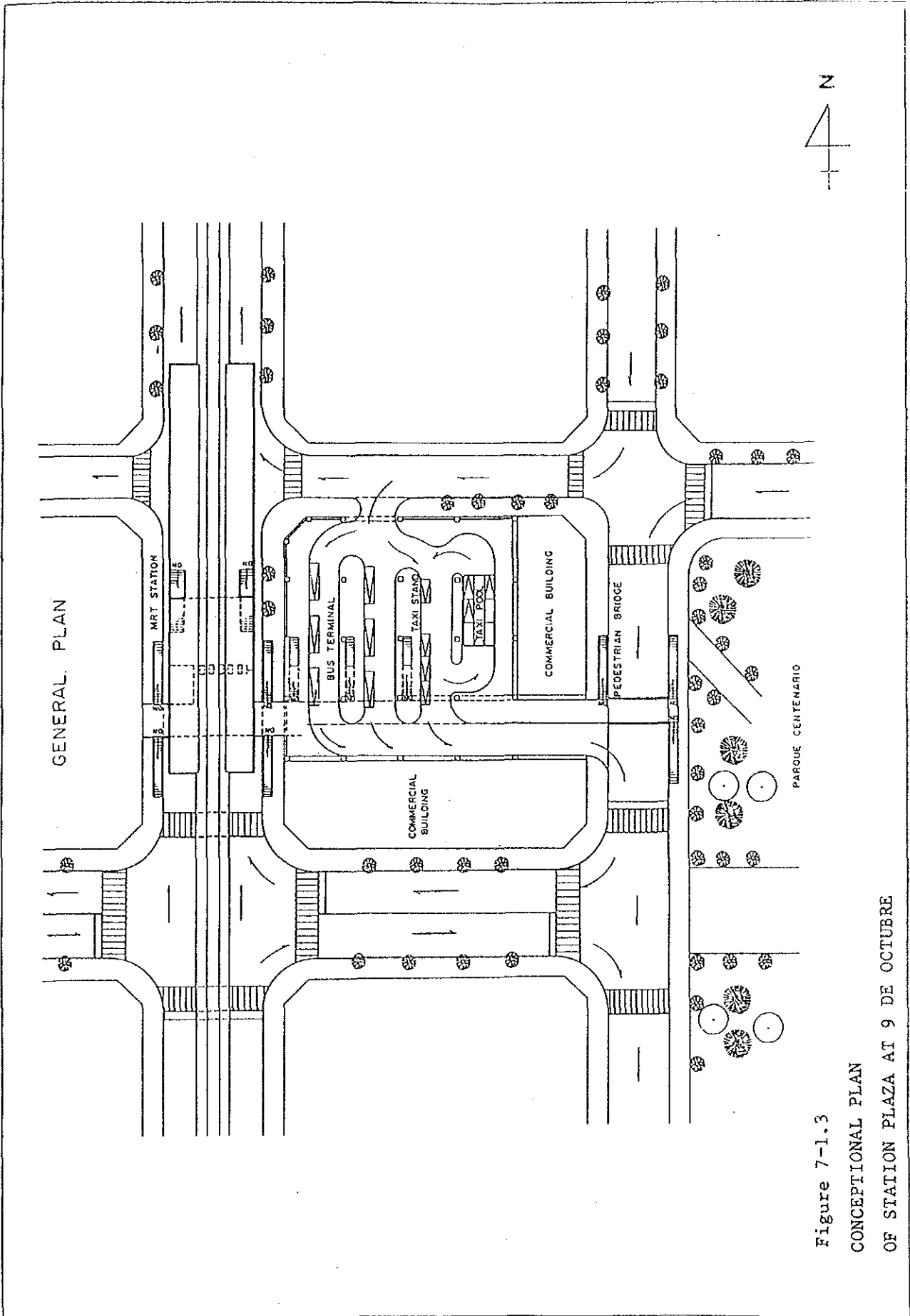


Figure 7-1.3

CONCEPTUAL PLAN

OF STATION PLAZA AT 9 DE OCTUBRE

7-2 Coordination Plan between Bus and MRT at Temporary Terminal in First Opening Section

In the cases to execute the construction by stages, during a certain period of time before completing the whole line the intermediate station will be required to serve as a terminal station temporarily. Such temporary terminals are at Centro Civico and at 9 de Octubre, where the heavy traffic of passengers concentrate, and so some extra space will be necessary in order to cope with such situation.

The Centro Civico station has an ample extra space near the station and no special measures for traffic control will be required, whereas the 9 de Octubre station does not have enough space for the measures, so that the traffic control, bus berth and taxi pool, etc. will be necessary for the time being before the extension of the line.

Figure 7-2.1 shows an example of the temporary arrangement around the terminal station of 9 de Octubre.

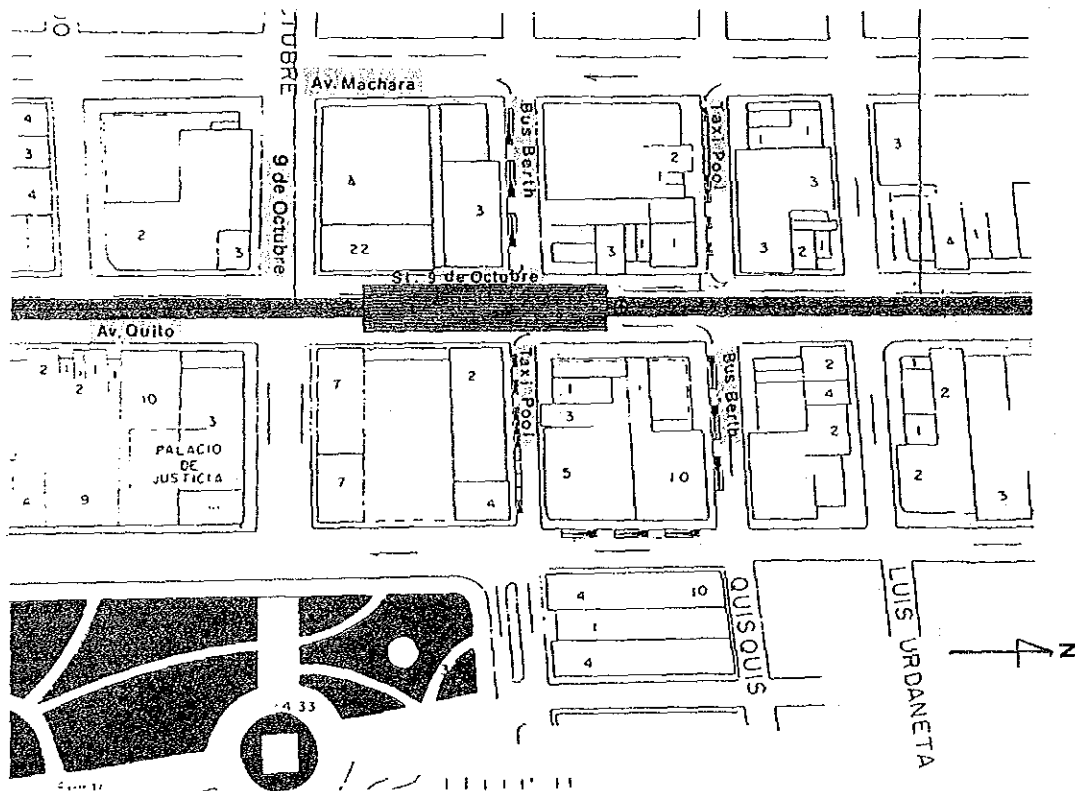


Figure 7-2.1 ARRANGEMENT OF TERMINAL

7-3 Road Improvement Plans Used for MRT

Since the most part of the MRT route is built over the main roads in the city, the trackway, stations, and their structures should be constructed not to give any hindrance to the existing road traffic and other improvement plans in future.

Important items between the MRT and road traffic to be considered in advance, are discussed as under;

- (1) Examination to secure full turns safe at the main level crossings on Av. Quito
- (2) Coordination plans of the MRT and grade separations of the roads projected in future
- (3) Proposal of a community street plan of Calle Manuel Galecio with 18 meters wide

7-4 Impacts on MRT Wayside Area

1) Impacts on Land Use of Wayside

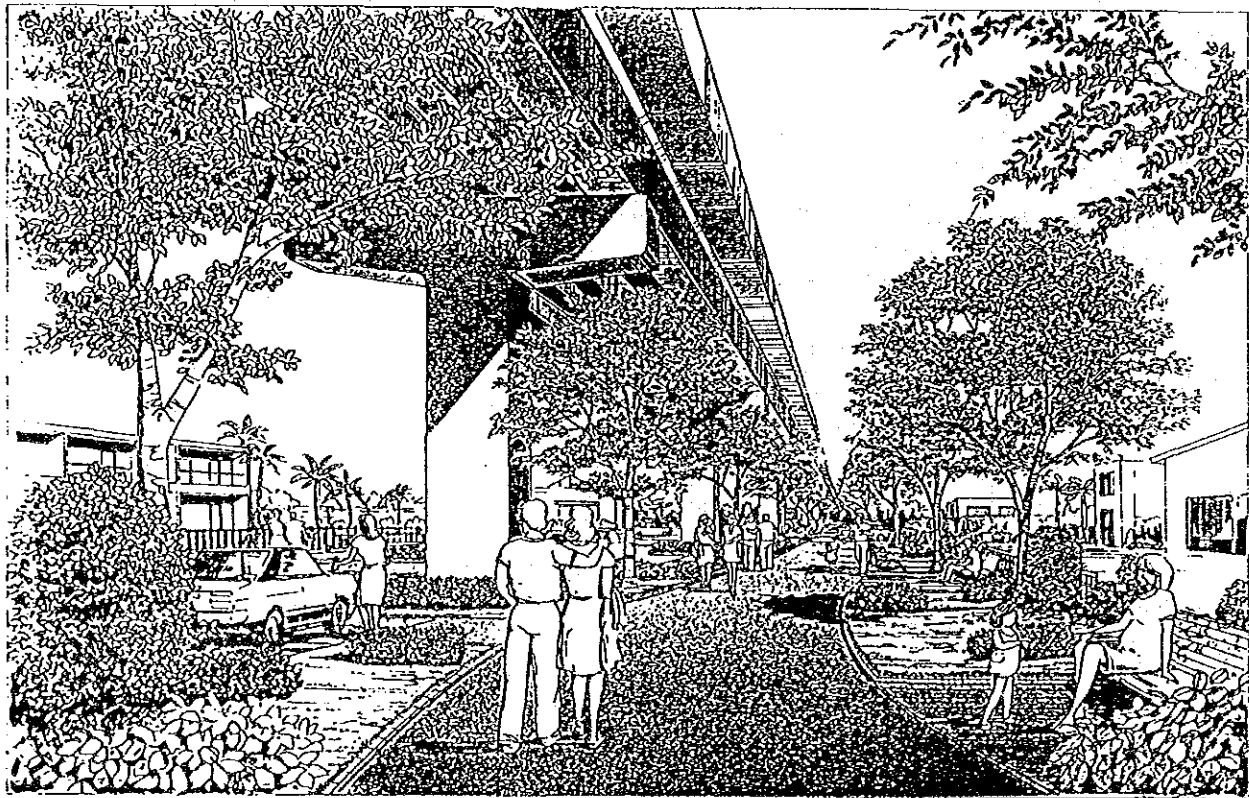
For future landuse, it is important to consider various impacts brought about by the MRT such as encouragement to the urban development, re-development and preservation of the existing conditions in good residencial areas along the wayside. The considerable points for such impacts are discussed as follows.

- a. Residential developments in the northern area and better re-development in the existing urban area
- b. Promotion of new urban center projects
- c. Re-development in Guasmo area
- d. Preservation of favorable residencial area
- e. Coordination with the development project around the Airport

2) Considerations for Environmental Impacts

Many items, which influence the environments, were examined. The items of environments like air pollution are improved by the MRT operation but some are thought to deteriorate the environment partly. As the counter measures for the environmental deterioration, the overall urban planning is desired, not only to conserve the environments but also renovate urban environment. A few items of environment like radio wave interference remains to be solved in the future, although they are allowable for the present.

Image sketch of preservation of environment along MRT route



CHAPTER 8 ECONOMIC AND FINANCIAL ANALYSIS

8-1 Economic Analysis

The economic analysis is made on a basis of cost and benefit comparison. Both cost and benefit are calculated on several items, taking into consideration the "with the project" and "without the project" situation.

8-1.1 Evaluation Index for Economic Analysis

(1) Following 3 indexes are used for evaluation of the test cases.

- 1 NPV (Net Present Value)
- 2 B/C ratio (Benefit Cost ratio)
- 3 EIRR (Economic Internal Rate of Return)

(2) Project life for analysis is assumed to be 30 years.

(3) The 12 percent is used for the discount rate of economic analysis, assuming it as market opportunity cost of Ecuador without considering the present inflation.

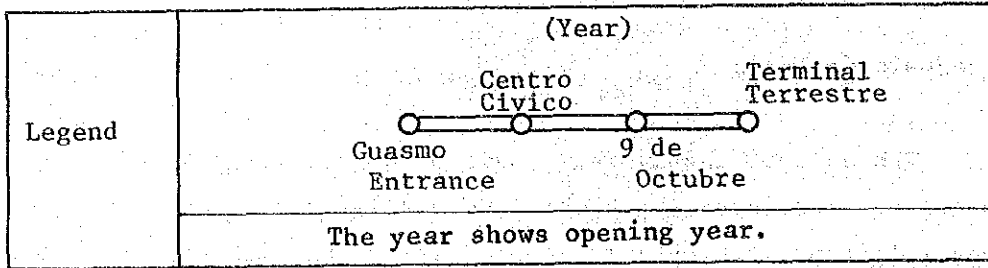
8-1.2 The Test Cases of Economic Analysis

The 10 execution plans of the MRT are selected for the test cases of economic analysis. They are described in Table 8-1.1.

Since the economic analysis assumes the following 2 conditions as a basic situation, the changes of these conditions is taken into consideration in the sensitivity analysis later.

(1) The bus route reorganization is made completely in accordance with the MRT construction.

Table 8-1.1 TEST CASES FOR ECONOMIC ANALYSIS



Cases	Schematic Layout
Basic Case	
Case A-1	
Case A-2	
Case B-1	
Case C-1	
Case C-2	
Case D-1	
Case E	
Case F	
Case G	

- (2) The average MRT fare is assumed to be 25 sucres in connection with the demand forecast when the whole line commences its operation.

8-1.3 Economic Benefit

Table 8-1.2 shows the items to be supposed as the benefit of MRT and thus 3 items are taken into account in the benefit calculation.

Table 8-1.2 LIST OF BENEFIT ITEMS TO BE ADOPTED IN THIS ANALYSIS

Benefit Items	Possibility of Quantification	Selection
1. Running Cost Saving	Possible	o
2. Capital Cost Saving	"	o
3. Travel Time Saving	"	o
4. Traffic Accident Reduction	Difficult	
5. Health improvement effect	"	
6. Area Development effect	"	
7. Industrial Promotion effect	"	

1) Running Cost Savings

This benefit covers reduction of the vehicle running cost owing to road traffic improvement by the MRT and consists of fuel cost, oil and manpower cost for drivers, etc.

It is calculated according to the following formula.

$$RB = \sum_{ij} (P^{1ij} \times L^{1ij} - P^{2ij} \times L^{2ij}) \times RC^1 + \sum_{ij} (P^{1ij} \times t^{1ij} - P^{2ij} \times t^{2ij}) \times RC^2$$

RB	;	Running cost savings
L ^{1ij}	;	Running distance in km between zone i and j in the "without project" case
L ^{2ij}	;	Running distance in km between zone i and j in the "with project" case
P ^{1ij}	;	Traffic volume from zone i to j in the "without project" case
t ^{1ij}	;	Travel time from zone i to j in the "without project" case
P ^{2ij}	;	Traffic volume from zone i to j in the "with project" case
t ^{2ij}	;	Travel time from zone i to j in the "with project" case
RC ¹	;	Running cost per km
RC ²	;	Running cost per hour

The unit running cost used in the M/P Study was adjusted to the current prices in 1985 for this analysis.

2) Capital Cost Savings

Since the capital cost saving is assumed to be materialized already in term of unit running cost including the interest payment and the depreciation, it is neglected in this term.

3) Travel Time Savings

The total travel time difference between with and without case is economized by giving the time value to it. The calculation is made according to the following formula.

$$TB = \sum_{ij} (P^{1ij} \times t^{1ij} - P^{2ij} \times t^{2ij}) \times V$$

TB	;	Benefits from travel time saving
V:	;	Time value

The time value used in the M/P Study was modified to the current price.

8-1.4 Economic Cost

The economic cost consists of the MRT investment cost and its running cost. Both are estimated in the preceding chapter on market price basis. Accordingly they are converted into economic price basis, taking into consideration the followings:

- (1) As for the imported materials, no conversion is made since there is no bias between the official foreign currency exchange rate and the actual one, and the imported tax is exempted both in the economic and the financial analysis.
- (2) Tax is excluded because it belongs to the transfer items and the subsidy to encourage the domestic industry is also excluded in this analysis.
- (3) The wage cost for the unskilled labor is converted, taking into consideration the gap between the official basis and market basis.
- (4) The interest payment is excluded.
- (5) The land cost is included on basis of the appreciated value for taxation.

8-1.5 Economic Analysis Results

Table 8-1.3 shows the result of economic indexes by test case.

- (1) Economic Internal Rate of Return (hereinafter referred to as EIRR).

All cases obtained the EIRR over 12 percents that is assumed to be the market opportunity cost in Ecuador.

The Case A-2 has the highest EIRR of 19.5%, while the case G remains to be the lowest of 16.5%.

(2) Net Present Value (hereinafter referred to as NPV)

The Case A-1 has the largest NPV of 17,980 mil. Sucres while the Case E has the smallest NPV of 7,096 mil. Sucres.

All cases are greater than null.

(3) Benefit Cost Ratio (hereinafter referred to as B/C ratio)

All cases have the B/C ratio larger than 1.0 and it shows that all cases are economically feasible.

Table 8-1.3 COST BENEFIT ANALYSIS RESULT

Case	Net Present Value (in Mil. Sucres in 1985 Prices)	B/C Ratio	Economic Internal Rate of Return (%)
Basic Case	17,229	1.64	17.8
Case A-1	17,980	1.77	19.1
Case A-2	17,596	1.82	19.5
Case B-1	17,649	1.72	18.6
Case C-1	16,774	1.69	18.4
Case C-2	16,144	1.73	18.6
Case D-1	16,332	1.64	17.8
Case E	7,096	1.56	17.0
Case F	12,753	1.76	18.4
Case G	8,540	1.50	16.5

- (4) As for the MRT construction, to begin from the north section is better than from the south section from the economic viewpoints as shown below.

Case	NPV (Mil.Sucres)	B/C Ratio	EIRR (%)
Case A-1	18,000	1.77	19.1
Case C-1	16,800	1.69	18.4
Comparison	A-1	A-1	A-1

- (5) To construct MRT by steps is better than to construct it at one time from economic viewpoints as shown below.

Case	Staging	NPV (mil.Sucres)	B/C Ratio	EIRR (%)
Basic Case		17,200	1.64	17.8
Case A-2		17,600	1.82	19.5
Comparison		A-2	A-2	A-2

- (6) The plans to continue the partial operation like cases E, F and G are worse than the other plans to construct the whole line from economic aspect.
- (7) The additional examination finds that the largest economic benefit is expected at the MRT opening year of 1990 or 1993.

8-2 Financial Analysis

The cash flow analysis is adopted in the financial analysis below.

8-2.1 Items Consisting of Cash Flow

The cash flow is the difference between the cash inflow and the cash outflow. The cash inflow shows the annual cash amount to be gained in the project and the cash outflow shows the annual cash amount to be invested to the project. They consist of the following terms.

1) Cash Inflow

The cash inflow is expressed in term of the net Operating Surplus and calculated by following formula.

$$\text{Net Operating Surplus} = \text{Gross Operating Revenue (GOR)} - \text{Operating Expenditure (OEX)} + \text{Depreciation (DEP)}$$

The residual value of the investment capital is added to the cash inflow at the final project year.

2) Cash Outflow

The cash outflow is estimated as the total amount of fixed capital investment and the amount is included in the cash outflow at the time when it is spent for the construction or the operation. Therefore no loan repayment is included in the cash outflow.

3) Discount Rate

A discount rate of 12 percents is assumed to calculate the discount cash flow.

8-2.2 Evaluation index

The following indexes are used for the evaluation in the financial analysis.

- (1) Financial internal rate of return (hereinafter referred to as FIRR)

In order to evaluate the financial profitability of the project, the FIRR is calculated by the following formula:

$$\phi(P) = \frac{\sum (R_i - C_i)}{(1 + P)^{i-1}}$$

Where R_i : Cash inflow in i -th year

C_i : Cash outflow in i -th year

p : Discount rate

The FIRR should be determined where $\phi(p) \div 0$.

- (2) Net operating profit after depreciation

The net operating profit is calculated by cash business year and tested when it turns to positive from deficit and its accumulated value as well.

- (3) Interest earned ratio

The ratio of the net profit to the interest paid.

- (4) Debt service coverage ratio (hereinafter referred to as DSCR)

It represents the ratio of the income before depreciation to the annual repayment of the debt, and it can be calculated by the following formula:

$$\text{Debt service coverage ratio} = \frac{\text{GOR} - \text{OEX} + \text{DEP}}{\text{DIT} + \text{ROL}}$$

Where GOR: Gross Operating Revenue
OEX: Operating Expenditure
DIT: Debt Interest Payment
ROL: Repayment of Loan
DEP: Depreciation

8-2.3 Basic Condition of Financial Analysis

1) Fund Raising Plan for Investment Cost

a. Loan sources in Ecuador

- General budgets of Ecuadorian government and local public bodies.
- Borrowing from Banco de Desarrollo del Ecuador.
- Borrowings from commercial banks in Ecuador.

b. Loan sources in foreign countries

- Development aid loans from foreign governments.
- Borrowings from IBRD (International Bank for Reconstruction and Development - World Bank), IBD (Inter-American Development Bank), etc.
- Borrowings from foreign commercial banks or syndicate of foreign commercial banks.

In the following financial analysis, some combinations of the above sources of the funds will be considered, and the most realistic combination will be applied to each of the test cases of the project so that the financial conditions of these test cases can be compared and evaluated respectively.

Note)

Loan condition and fund limits of each financial sources are described in detail in the section 3-2 of supplementary volume 4.

The shares of the foreign currency portion and the local currency portion needed for completing the construction of the whole line of the MRT are 65% and 35% in the cost respectively in any case tested. In raising the construction fund, the cost of the foreign portion is supposed to be financed by the foreign funds while the cost of the local portion is supposed to be

financed by the domestic funds. However, the loans from the foreign private banks is supposed to be used both for the foreign and local portion.

Cases for the fund raising plan are shown in Table 8-2.1

Table 8-2.1 COMBINATION OF FUND SOURCES

	Foreign Currency(65%)			Local Currency (35%)			
	Foreign government	Int'l national organization	Foreign private banks	Ecuadorian Government	Banco de Desarrollo del Ecuador	Ecuadorian private banks	Foreign private banks
Financing condition:							
Interest rate/year	4.75%	8.5%	9%	-	12%	16%	9%
Term of repayment, years (grace period)	25(7)	20(5)	12(3)	-	15(3)	10(3)	12(3)
Method of refunding, years	Average over 18 yrs	Average over 15 yrs	Average over 9 yrs	-	Average over 12 yrs	Average over 7 yrs	Average over 9 yrs
Case 1	0	0		10%	10%		15%
Case 2	0		0	10%	10%		15%
Case 3	0		0	10%		15%	10%
Case 4	0	0		15%		20%	
Case 5	0		0	15%		20%	
Case 6	0		0	15%	20%		

(Note) In the above, the fund of the foreign government is supposed to be 8,600 mil. Suces at most of the total investment cost.

Of the above 6 fund cases, the Case 2 is applied to the financial analysis for evaluating the test cases of construction works, and the most advantageous case will be selected based on the result of evaluation. The rest of five fund cases are used for the sensitivity analysis.

2) Other Basic Conditions

(1) Cost estimation and inflation

The investment cost and the running cost are estimated in market price in 1985 and used in this analysis.

No cost inflation is taken into account during the project life and the MRT fare escalation neither.

(2) Depreciation

The cash flow does not have the term of depreciation but it is taken into consideration to calculate the salvage value in the cash inflow at the final year of project.

(3) Fare revenue

The fare revenue is calculated by the following formula:
Fare revenue = (Number of MRT passengers) x (Average fare payment)

8-2.4 Financial Analysis Result

Table 8-2.2 shows the result of cash flow analysis.

- (1) The largest of FIRR is 13.3% for the Case B-1 and the smallest is 6.4% for the Case G.
- (2) As for the recovery of yearly net profit from deficit to surplus, the Case B-1 takes 5 years in both annual and accumulated basis, the shortest of all. In the worse cases like Case C-1, E and G the yearly net profit is not able to turn to positive in 30 years of the project life.

Table 8-2.2 FINANCIAL ANALYSIS RESULT (1)

Case	No. of Years after Commencement		Financial Internal Rate of Return %
	Yearly Net Profit turns to positive	Accumulated Surplus turns to positive	
Basic Case	5	6	12.79
Case A-1	6	11	12.33
Case A-2	7	7	12.41
Case B-1	5	5	13.26
Case C-1	-	-	11.05
Case C-2	25	-	10.53
Case D-1	16	25	11.43
Case E	-	-	7.94
Case F	8	14	10.75
Case G	-	-	6.41

(Note) Calculation is made based on the assumption that the average fare is 25 Sucres/ride.

Table 8-2.2 FINANCIAL ANALYSIS RESULT (2)

Case	Interest Earned Ratio		Debt Service Coverage Ratio	
	Lowest	Highest	Lowest	Highest
Basic Case	0.8	5.2	1.1	1.8
	5.4	46.4	1.8	7.8
	15.1	43.2	5.3	14.2
Case A-1	0.3	3.0	1.0	1.6
	3.3	37.9	1.4	6.8
	14.3	42.9	5.2	13.3
Case A-2	0.3	5.0	1.1	2.0
	1.6	21.4	1.2	3.7
	12.4	41.7	3.6	12.8
Case B-1	0.9	3.4	1.0	2.2
	3.7	40.0	1.5	6.8
	14.7	43.2	5.2	14.2
Case C-1	-0.8	2.8	0.2	1.5
	3.1	38.0	1.3	6.8
	14.4	42.9	5.2	13.3
Case C-2	-0.8	4.7	0.2	1.8
	1.4	20.5	1.1	3.6
	12.2	41.7	3.5	12.8
Case D-1	0.0	3.3	0.7	1.3
	3.6	40.0	1.4	6.8
	14.7	43.2	5.2	14.2
Case E	0.3	1.8	0.8	1.3
	2.3	14.1	1.1	2.7
	12.4	82.3	2.7	18.2
Case F	0.7	3.0	1.0	1.7
	4.0	27.2	1.5	4.7
	10.3	32.6	3.3	10.7
Case G	0.0	1.7	0.6	1.0
	2.4	16.0	1.0	2.9
	13.4	81.9	2.8	26.5

(Note) Upper row: 1990 -1999
Middle row: 2000 - 2009
Lower row: 2010 - 2020

Table 8-2.3 BORROWING AND REPAYMENT

Case	FIRR %	Working capital required(Max) during 1990 - 2000 (Mil. Sucres)	Maximum Cumulative long term and short term loan(Mil. Sucres)	Final maturity year		Construction cost (Mil. Sucres)
				Short term loan (Year)	Long term loan (Year)	
Basic Case	12.79	785	23,577	2003	2004	31,275
Case A-1	12.33	1,122	26,401	2006	2007	31,586
Case A-2	12.41	259	20,812	1996	2006	31,680
Case B-1	13.26	735	23,584	1999	2004	31,573
Case C-1	11.05	2,379	30,288	-	-	32,933
Case C-2	10.53	1,566	27,887	-	-	33,036
Case D-1	11.43	1,921	28,742	2017	2017	32,946
Case E	7.94	1,189	76,855	-	-	13,781
Case F	10.75	747	15,612	2007	2008	19,704
Case G	6.41	3,309	307,544	-	-	18,384

(3) Debt service coverage ratio

It is in the range from 1.0 to 2.0 for all the cases during the first decade of this project.

(4) Outstanding debts

As for the debt outstandings, the long and short term loan can be matured within 30 years of project in the Basic Case, Case A-1, A-2, B-1, D-1 and F, while they can not be matured in the same period in the Case C-1, C-2, and G.

8-2.5 Consideration of MRT Fare System

(1) The trip pattern of the MRT users is shown in the table below according to the demand forecast.

- The average riding distance of the MRT users is about 5.5 km, less than the half the of whole route length of 14.7 km.

MRT PASSENGERS VOLUME AT FULL OPENING IN 1990

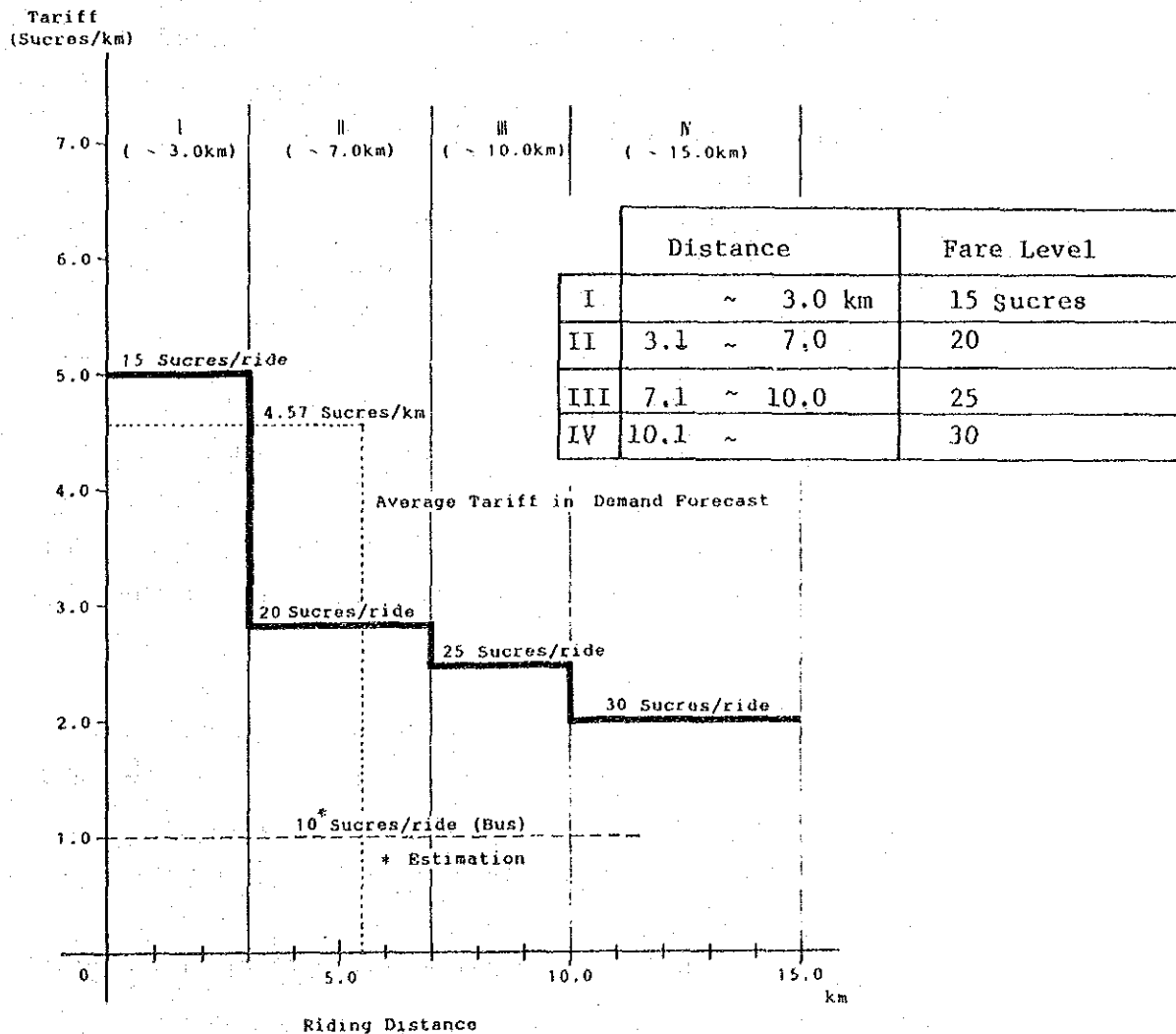
Riding distance (km)	Passengers number	Ratio (%)	Accumulated ratio(%)
0 - 3.0	141,349	35.3	35.3
3.1 - 7.0	143,169	35.7	71.0
7.1 - 10.0	83,998	21.0	92.0
10.1 - 15.0	32,434	8.0	100.0
Total	400,950	-	-
Passengers kilometer (personKm) (km)	2,193,051		
Average riding distance (km)	5.47		

(2) The proposed MRT fare system

Taking into consideration the MRT users behaviour to the fare system, the fare system proportional to the riding distance is recommended.

Taking into consideration the present bus fare, the following tariff level and the fare system is proposed. Based on this fare system, the average fare for one ride is estimated about 20sucres in case of the whole line being operated and the average tariff is estimated about 3.7 sucres per 1 passenger kilometerage.

When this fare system is adopted, the financial score will be a little lower than in case of the average fare of 25 Sucres, but the project feasibility does not change.



8-3 Evaluation of Test Cases

The best plan is selected from the test cases in the followings, based on the economic and financial analysis which was described already, and other aspects. The sensitivity analysis is applied to the best plan finally selected.

8-3.1 Economic Aspect

Figure 8-3.1 to 8-3.3 show the result of EIRR, NPV and B/C ratio obtained in the economic analysis.

- (1) Almost same level of the EIRR is obtained between the test cases and they are over 12 percent of the opportunity cost. This means all the test cases are economically feasible but it can be seen that the EIRRs of such cases of which the first stage begins from the northern section like the Case A-1 and Case A-2 are higher, over 19 percent.
- (2) The partial opening plans with no further extension like the Case E, F and G show lower NPV than others but they are still feasible because their NPV have positive value. Comparing the NPV of test cases each other, it is observed that the stage construction plans from the north are superior to the others from the south as a whole. The NPV becomes smaller in the partial opening plans as mentioned before because their project size is relatively small. The NPV of the Case F, however, is higher than that of the other two plans.
- (3) The B/C ratio is supposed to show the project efficiency from the aspect of costs versus benefits. The Case A-2 and Case F are more efficient plans while the Case E and G are less efficient from a viewpoint of the B/C ratio.
- (4) The following tentative conclusions are obtained from these discussions.

- a. The result of economic analysis shows no plans are excluded from the economic aspect on a conservative criteria.
- b. However, the partial opening plans with no further extension like the Case E and G seem to be inferior because their scores are low in point of EIRR, NPV and B/C ratio. Whereas the Case F seems to be well enough except a point of being a little small in the NPV.
- c. The Case A-1, A-2 and B-1 are superior to others in several items and they are supposed to have higher project priority.

8-3.2 Financial Aspect

As a result of the financial analysis, the FIRR and the number of years to turn from deficit to surplus in the net surplus after depreciation cost being considered are shown in from Figure 8-3.4 to 8-3.7.

- (1) The FIRR of all cases are between 5% and 12%, and those of the Case E, G, C-1 and C-2 show lower levels.
- (2) A financial stability is evaluated from the year when the net profit after depreciation cost being considered turns from negative to positive. The Basic Case, Case A-1, A-2, B-1 and F are eligible both in the yearly net profit and in the accumulated one, based on the criteria in Japan in which the annual net profit turns to positive within 10 years and the accumulated within 20 years.
- (3) According to the change of the accumulated debt, the loan repayment within the project life period will be impossible in the Case C-1, C-2, E and G and they seem to be unfeasible from viewpoints of the financial liability, whereas the Basic Case, Case A-1, A-2 and B-1 seem to be favourable from these financial aspects.

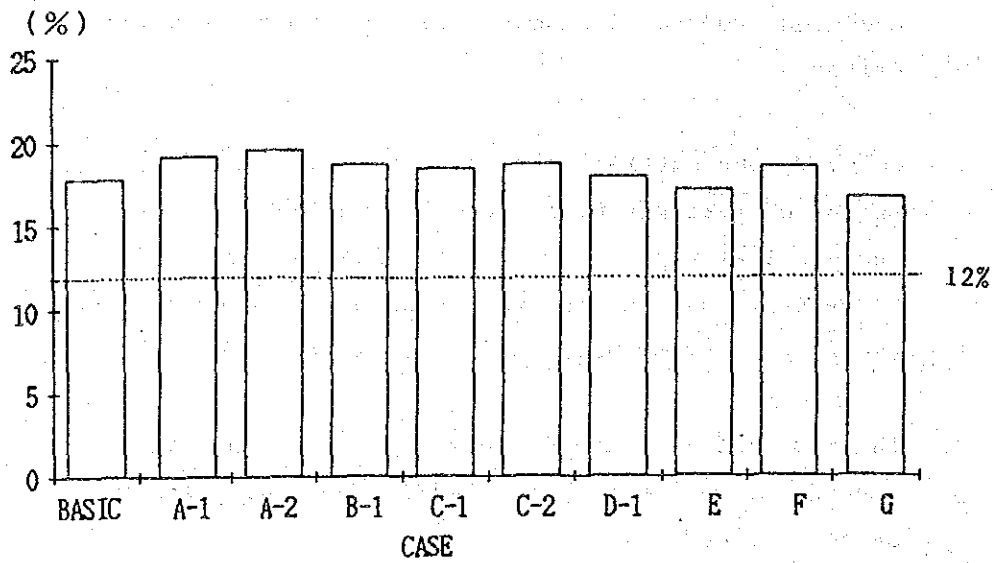


Figure 8-3.1 COMPARISON OF ECONOMIC INTERNAL RATE OF RETURN BY TEST CASE

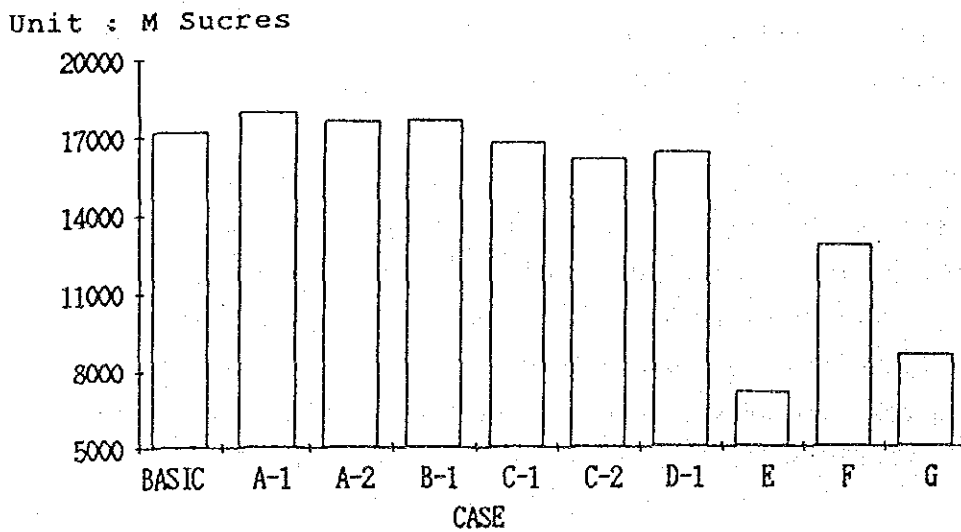


Figure 8-3.2 COMPARISON OF NET PRESENT VALUE BY TEST CASE

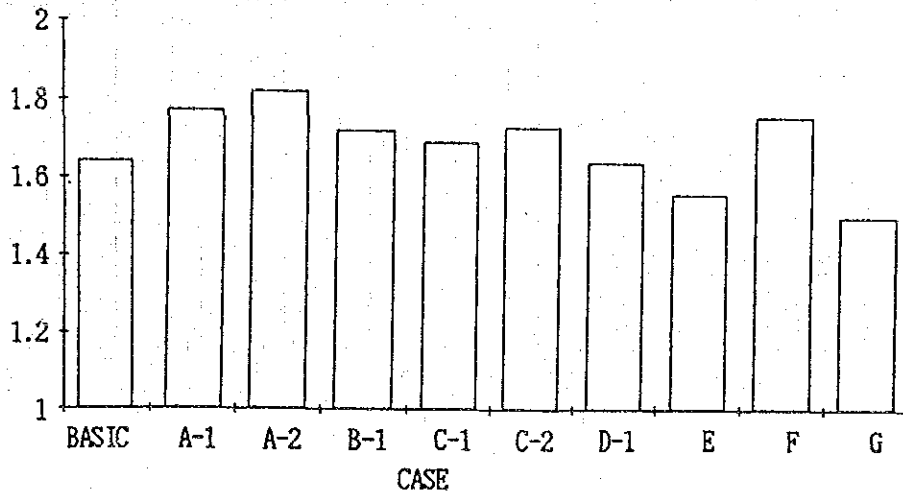


Figure 8-3.3 COMPARISON OF B/C RATIO BY TEST CASE

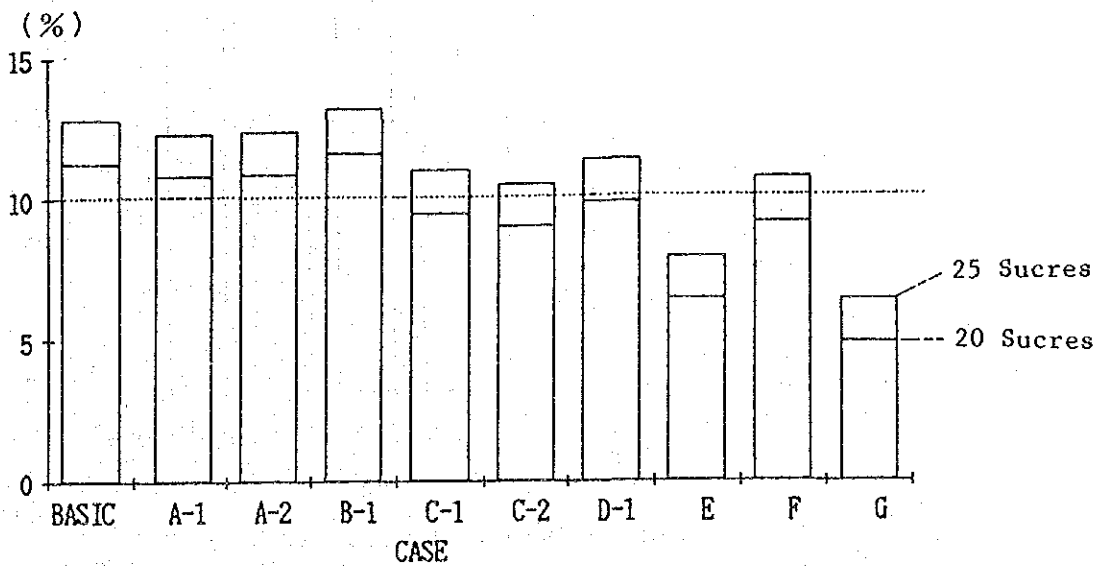


Figure 8-3.4 COMPARISON OF FINANCIAL INTERNAL RATE OF RETURN BY TEST CASE

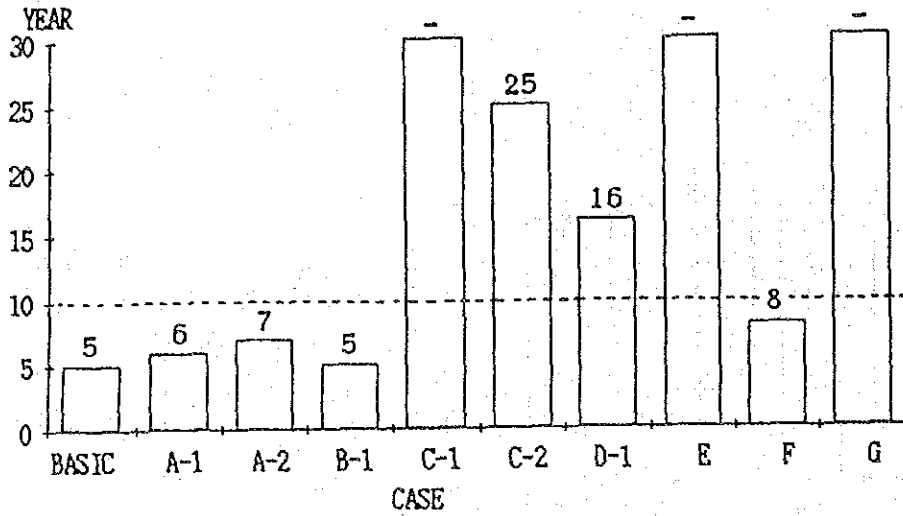


Figure 8-3.5 NO. OF YEAR WHEN YEARLY NET PROFIT TURNS TO POSITIVE

- (Note) 1. Yearly Net Profit includes the depreciation.
 2. Average MRT fare is 25 sucres/ride.

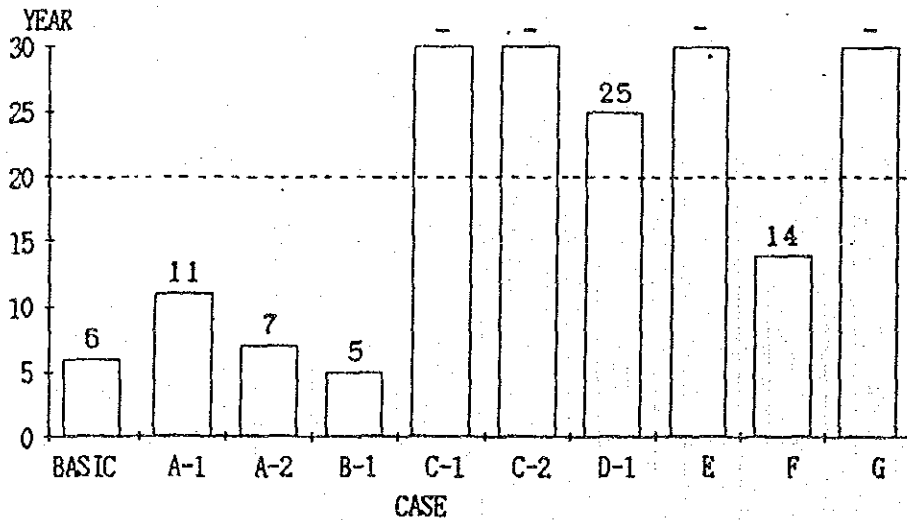


Figure 8-3.6 NO. OF YEAR WHEN ACCUMULATED SURPLUS TURNS TO POSITIVE

- (Note) 1. Average MRT fare is 25 sucres/ride.

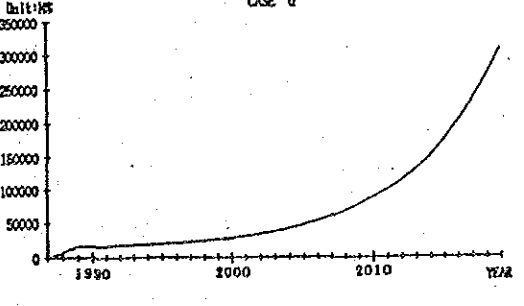
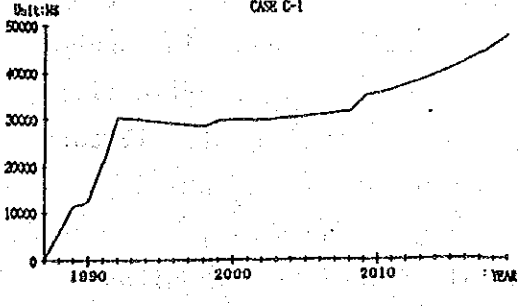
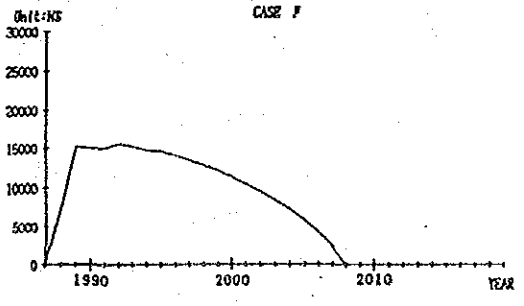
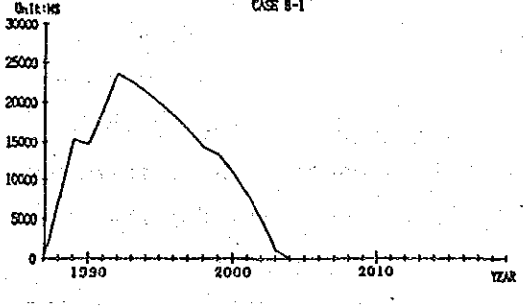
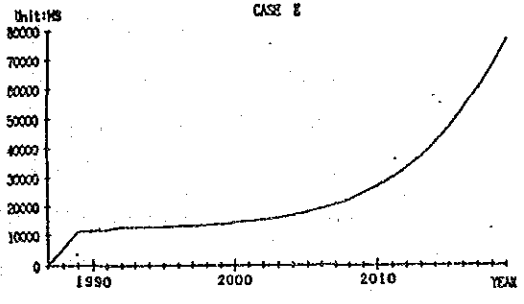
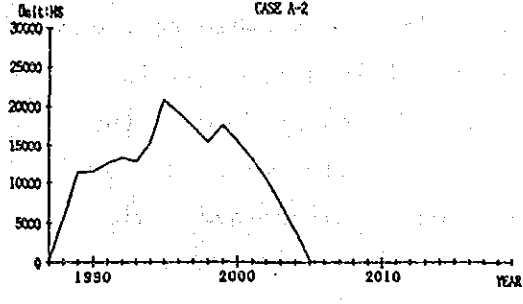
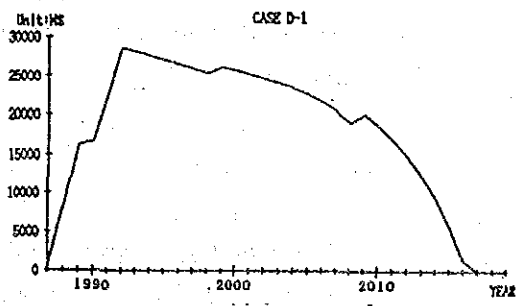
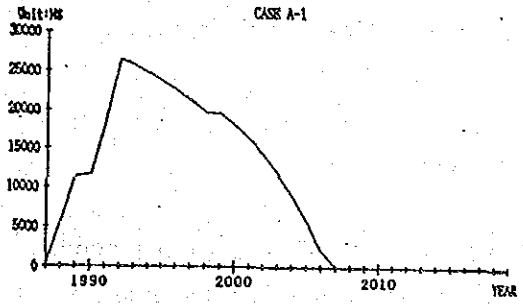
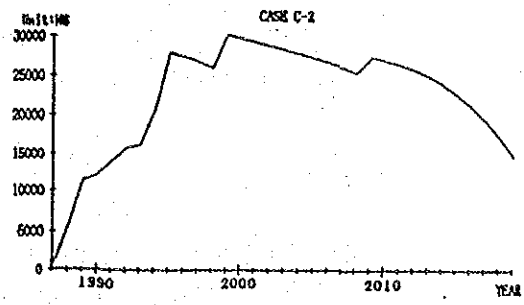
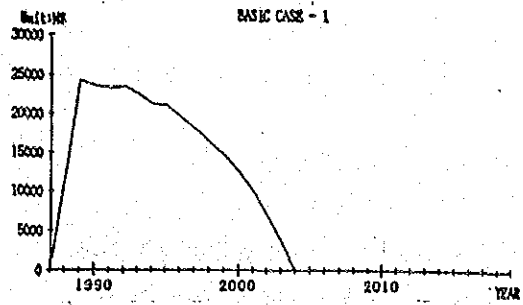


Figure 8-3.7 TREND OF THE OUTSTANDING DEBTS BY CASE

8-3.3 Final Evaluation

1) Approach

The tentative screening of test cases has been done in the economic and financial aspect. In addition to that, the best case is selected from the other aspects as described in the followings:

a. Amount of fund to be raised initially

The major portion of the fund for this project is sought in various foreign loans. Thus, in order to increase the potentiality for raising the fund, it is desirable to reduce the initial investment as far as possible. Also, it is easier for the project to raise the necessary fund if the line will be extended by stages while taking adequate care for not permitting the balance of outstanding liabilities to increase excessively.

b. Technical implementation capability

This project is intended for the construction of the first rapid transportation system in Ecuador. Thus, in order to make this project successful, it is necessary for the project not only to ensure the technical capability (engineering capability in planning and designing over the whole system, construction work capability, schedule control for completing the project, procurement of the construction materials and machines, etc.), but also to complete all the necessary preparations (establishment of the new MRT corporation, employment and training of the staff, preparation and application of rules/regulation required, etc.) within a shortest possible period of time from now.

Therefore, the feasibility of this project will be higher if the initial investment is reduced to a minimum so that the investment can be increased by stages.

- c. Control of traffic at intermediate station to serve as a temporary terminal

In the case proposing to execute the construction work by stages, during a certain period of time before completing the construction of the whole line the station located in the middle of the proposed line will be required to serve as the terminal station where the heavy traffic of passengers will concentrate, and so some extra space will be necessary around such temporary terminal station in order to cope with such situation.

In the Cases A-1 and A-2, 9 de Octubre station is expected to serve as the first temporary terminal station, so that several bus stops will be provided near that station. Thus, the traffic congestion may occur on the streets near the station, so that the traffic control will be necessary for the time being before the extension of the line is completed. On the other hand, in the Case B-1, Centro Civico station has an ample extra space, and so no special measures for the traffic control will be required near this station.

- d. Convenience for passengers

- i) Access to the central area of the city (Casco Central)

The central area of Guayaquil ranges about 2 km east to west and north to south respectively, so that the Case B-1 to construct the line up to Centro Civico station passing the central area will provide better access to the central than the Case A-1 and A-2 to finish the construction work of the first stage at 9 de Octubre station situated at the entrance to the central area.

At present, Centro Civico station is situated at the nodal point of the bus routes leading to the western area and Av. Quito, so that this station is conveniently situated for the transfer from the bus routes to the MRT and vice versa.

Besides, the Case B-1 is also advantageous in that the number of buses going into the central area will be able to be reduced considerably.

ii) Substitute for the existing bus route between Terminal Terrestre and Centro Civico

At present, frequent bus services are available from Terminal Terrestre to Centro Civico along the proposed line of the MRT. Its passenger flow is heavy between Terminal Terrestre and 9 de Octubre, while some number of passengers decrease gradually before arriving at Centro Civico station. Thus, for the passengers using the bus service covering this section, the Case B-1 to provide the service of the MRT over the exactly same section will be very convenient.

2) Evaluation

Table 8-3.1 shows the tendency of test cases from the aspects mentioned above.

As a whole, the Case B-1 has the superiority to others. The Basic Case remains to be at low priority because its initial construction fund is large and its investment pattern seems to be venturous. The Case A-1 and A-2 are exactly same at their first opening section and only different in the extension steps. Accordingly they are very similar and remain possible selections. But the Case A-2 is more favorable from viewpoints of being implemented step by step on the stable management basis if the construction fund is restricted.

The Case E, F and G which complete the project at their first section only have considerably lower priority than the full line opening cases, and however, only the Case F has the possibility in economic and financial condition.

This means that the Case F will have the feasibility and produce if the section of 9.1 km from the Terminal Terrestre to Centro Civico is opened and even though the whole line could not be completed in the future.

3) Conclusion

The Study Team studied the preliminary process for raising the fund needed in the project and other important items in addition to the economic and financial analysis.

As a result, the Team has reached a conclusion that the best plan is the Case B-1 which completes the whole line by the two stages;

1st stage

Terminal Terrestre to Centro Civico (9.1 km) opening in 1990

2nd stage

Centro Civico to Guasmo (5.6 km) opening in 1993

However, when the completion of the above 1st stage of 9.1 km has become difficult due to the financial limitation or others, the Team recommends the Case A-2 as the second best case which constructs the section between the Terminal Terrestre to 9 de Octubre at the first and then continues the subsequent extension to Centro Civico.

Even when the whole line cannot be completed at the final stage, this project will be feasible since the operation of the MRT by the 1st stage of the Case B-1 between the Terminal Terrestre to Centro Civico, which equals to the Case F, can generate a profit large enough to make the project feasible.

Table 8-3.1 EVALUATION RESULT

Test Cases	Economic Aspect	Financial Aspect	Intermediate Selection	Other Aspects				Final Selection	Test Cases
				Initial Investment Cost	Technical Implementation capability	Transfer Problem at Terminal Point	Passengers Convenience Characteristics		
Basic Case	○	○		△	△	○	○	Basic Case	
Case A-1	◎	○		○	○	△	△	Case A-1	
Case A-2	◎	○		○	○	△	△	Case A-2	
Case B-1	◎	◎		○	○	○	△	Case B-1	
Case C-1	○	×		○...Small	○...Possible	○...Enough	○...Excellent	Case C-1	
Case C-2	○	×		△...Large	△...Difficult	△...Not enough	△...Fair	Case C-2	
Case D-1	○	×						Case D-1	
Case E	△	×						Case E	
Case F	○	○						Case F	
Case G	△	×						Case G	

8-4 Sensitivity Analysis

8-4.1 Economic Sensitivity Test

(1) The Case B-1 which was concluded to be the most favorable in the preceding section is used for analysis.

a. Cost inflation

The sensitivity by the cost inflation is analyzed when the investment cost has risen by 20% and 50%.

b. Reorganization of bus routes

The reorganization of the bus routes is a precondition for the execution of the project. The case without the reorganization of the bus routes is tested.

c. Change of MRT fare

In the demand forecast, 25 Sucres per passenger on the average is assumed. The effect of the decrease of the fare to 20 Sucres and the effect of the increase to 30 Sucres are analyzed.

d. Variation of time value

The benefit from the reduction of the time is estimated from the time value based on the income distribution in Guayaquil. The time value is proportional to the quality and the quantity of the actual economic activity. Cases where the time values decrease to 70% and 50% of the assumptive values are tested.

(2) The result is shown in Table 8-4.1

a. The variations of EIRR where the investment cost estimated for the project has increased by 20% and 50% are quite certain.

When the investment cost has increased by 50%, the EIRR is down to 14.1%, which are still much higher than 12% of the opportunity cost of the interest, but the NPV is below the half of that without the cost inflation.

- b. When the reorganization of the bus routes is not implemented, the EIRR is 16.2%, and this indicates that the project is feasible, but the EIRR has fallen obviously, and the reorganization of the bus routes is considered necessary in this case.
- c. All of the EIRR, NPV and B/C ratio are still high to make the project feasible at the 20 Sucres of the fare level and it shows that the fare system of which the average is 20 Sucres is reasonable. On the contrary all the indexes become lower at 30 sucres of the fare level.
- d. The project feasibility does not change when the time value gets lower.

Table 8-4.1 SENSITIVITY ANALYSIS RESULTS

Economic Indicators		Net Present Value (Mil. Sucres)	B/C Ratio	Economic Internal Rate of Return (%)
Compared Cases				
Base case: Case B-1		17,649	1.72	18.6
Investment Cost Inflation	Base case + 20%	13,514	1.47	16.5
	Base case + 50%	7,311	1.21	14.1
Without Bus route reorganization		9,920	1.41	16.2
MRT Fare Level Change	20 sucres/ride	19,979	1.82	19.2
	30 sucres/ride	11,246	1.46	16.5
Time Value	Base case X 70%	12,728	1.52	17.0
	Base case X 50%	9,447	1.39	15.9

8-4.2 Financial Sensitivity Test

1) Cases for analysis

The Case B-1 which is considered to be the most favorable case in the preceding section is also used for the financial sensitivity. The conditions for analysis are set up as follows:

a. Alteration of fund raising plan

Combination cases by the fund sources are shown in Table 8-2.1 in the preceding section. Here, the effect by the alteration of the fund raising plan on the financial position of the project will be analyzed by each case except the Case-2 used for the financial analysis.

b. Cost inflation

The cases where the actual project cost has increased by 20% and 50% of the originally estimated cost will be analyzed.

c. Variation of MRT fare

As for the MRT fare, 25 Sucres per passenger on the average was already assumed in the demand forecast. Here, the cases where this estimated average fare is changed to 20 Sucres or 30 sucres are analyzed.

2) The result of financial sensitivity test is shown in Table 8-4.2.

a. Alteration of fund raising plan

The financial characteristics of this project gets worse a little in the yearly net profit and the loan repayment if no government fund is invested.

b. Cost inflation

All of the financial indexes, that is FIRR, Yearly net profit and Debt repayment go down and the project will be unfeasible in the worst case.

c. MRT fare level change

There is no significant problem for the project implementation although a small change takes place.

Table 8-4.2 RESULT OF FINANCIAL SENSITIVITY TEST

	FIRR	Net Profit	Debt Repayment
Loan Condition	Not affected	In case of government fund = 0, Maximum 14 years delay.	In worst case, maturity delays 14 years
	-	△	△
Construction Cost Inflation	Cost up 20% → -2% Cost up 50% → -5%	Cost up 50% → Do not turn to positive	Cost up 50% → Maturity period is beyond project life.
	▲	▲	▲
MRT Fare Level	Fare level 20 sucres → -1%	Negrigible	Allowable
	△	-	-

(Note) ▲ : Project feasibility is reduced largely.
 △ : Project feasibility is reduced slightly.
 - : Project feasibility is not changed.

CHAPTER 9 IMPLEMENTATION PROGRAM

The implementation program is made for the Case B-1 which was selected as a best case in the preceding section. It consists of the following 3 parts:

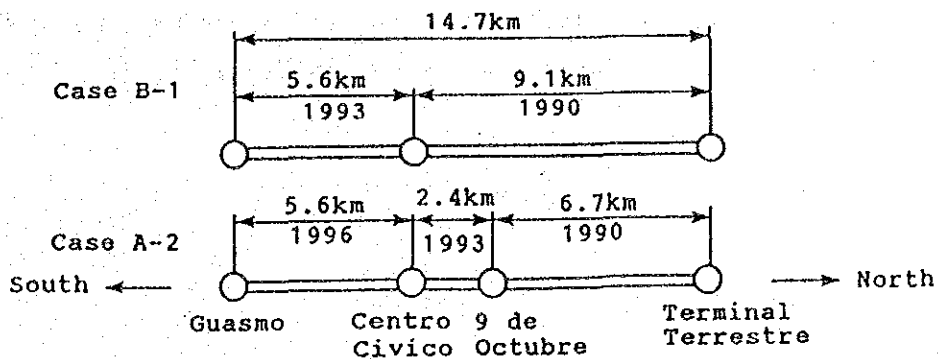
1. Annual investment program and fund raising program by the source of fund
2. Preparation process in the MRT management
3. Construction schedule

9-1 Fund Raising Plan

The Case B-1 is an ideal plan because it has the high profitability and convenience for the users.

However, the section to be constructed first covers 9.1 km out of the total length of 14.7 km, so that a substantial portion of the total fund needed for the whole line has to be raised in the early stage. Therefore, in the following fund raising plan, besides the Case B-1, the Case A-2 will also be considered, since the amount of initially needed fund is smaller than that of the former case.

(Cases to be studied and year of opening)



1) Annual Project Cost

The annual project cost was estimated by cases as shown in Table 9-1.1.

Table 9-1.1 ANNUAL PROJECT COST

L.P. = Local Portion
F.P. = Foreign Portion

Unit: Million sucres in 1985 prices
1 US dollar = 120 sucres = 210 Japanese Yen
(November, 1985)

Case	Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Total
Case B-1	Open year				→ 1st Section opening			→ 2nd Section opening				
	L.P.	58	2,812	2,812	50	1,653	1,653	-	-	*	(46)	9,084
	F.P.	104	5,044	5,044	117	3,864	3,864	-	-	(1,570)	-	19,607
	Total	162	7,856	7,856	167	5,517	5,517	-	-	(1,616)	-	28,691
Case A-2	Open year				→ 1st Section opening			→ 2nd Section opening			→ 3rd Section opening	
	L.P.	48	2,100	2,100	24	900	900	45	1,504	1,504	-	9,125
	F.P.	85	3,774	3,774	48	1,839	1,839	122	4,096	4,096	-	19,673
	Total	133	5,874	5,874	72	2,739	2,739	167	5,600	5,600	-	28,798

* Figures in parentheses represent the cost for increasing the number of train coaches, and this cost should not be included in the initial cost of project.

2) Availability of fund by source

The availability of fund is examined by each fund source which was included in the fund list and shown as fund combination case-2. Their conditions are shown in Table 9-1.2.

Table 9-1.2 COMBINATION OF FUNDS IN CASE-2

Source of fund	Local portion cost (About 35% of total)			Foreign portion cost (About 65% of total)	
	* Ecuadorian government	Banco de Desarrollo del Ecuador	Foreign private banks	Foreign governments	Foreign private banks
Estimate of loan conditions					
Annual interest	-	12%	9%	4.75%	9%
Term (Grace period)	-	15 (3) years	12 (3) years	25 (7) years	12 (3) years
Repayment system	-	paying in yearly flat installment of 12 years	paying in yearly installment of 9 years	paying in flat installment of 18 years	paying in yearly flat installment of 9 years
Composition of funds	10% of total	10% of total	15% of total	** Of foreign portion, 8,600 mil. sucres at a max.	Remainder of foreign portion

*: As for the fund from the Ecuadorian government, the payment of the interest and the repayment of the principal are not required.

** : 8,600 million sucres = 15,000 million Japanese yens

a. Availability of fund from the Ecuadorian government

The Ecuadorian government expense is estimated for the Case B-1 as shown in Table 9-1.3 and this amount is supposed to share at most about 18% of the annual investment amount to the transportation sector in the study area.

Table 9-1.3 AMOUNT OF INVESTMENT FROM GOVERNMENTAL BUDGET IN CASE B-1

Million sucres in 1985 prices

Year	A. Annual project cost	B. Governmental fund (A × 10%)	C. Investment in transportation in study area	B/C (%)
1987	162	16.2	4,400	0.4
1988	7,856	785.6	"	17.9
1989	"	"	"	"
1990	167	16.7	"	0.4
1991	5,517	551.7	"	12.5
1992	"	"	"	"
Total	27,075	2,707	26,400	10.3

b. Borrowing from Banco de Desarrollo del Ecuador

The interest rate on the loans made by this bank is 12% annually which is higher nominally than the annual interest rate of 9% which is estimated to be charged by foreign private banks, but the actual annual interest rate to be charged by the former is quite low when the current inflation in Ecuador is considered (the consumer price index: 28% annually as of September, 1985).

In view of the importance of this project, however, at least 10% (the share equal to that of the Ecuadorian government fund indicated in Tables 9-1.3) of the

total cost of the project should be covered by the fund from this bank by strongly urging the bank to do so.

c. Economic cooperations extended by foreign governments

The Ecuadorian government should give high priority to this project as an important national project and seek the largest possible values of foreign economic aids and loans at the best conditions. Introducing the funds at the lowest possible costs leads to low project cost and then the benefit will be returned to the citizens.

The combination of the funds proposed by this case does not include the loans from international organizations, but the Ecuadorian government should be recommended to seek the loans from international organizations at the conditions almost equal to those of the loans from foreign governments.

d. Loans from foreign private banks

In raising the fund for any project through an international tender, it is a common practice to require the tenderers to present their financing plans, and this system should be recommended for this project too.

Normally, the interest rate on the loan provided by a private bank includes the commission of the broker and risk coverage cost. Thus, the conditions at which the loans from foreign private banks are available area, to some extent, dependent on the attitude of the Ecuadorian government towards this project. Thus, it is important for this project to introduce the governmental fund, the loan from Banco de Desarrollo del Ecuador and the loans from foreign governments and international organizations.

3) Annual Fund Raising Plan

The examples of the annual fund raising plan using the various funds described in the above are shown in Table 9-1.4 (Case B-1) and Table 9-1.5 (Case A-2) respectively. Besides these combinations, there are many other combinations of the funds. Thus, it should be recommended for the project to seek a better and more potential combination of funds according to the progress of the project.

Table 9-1.4 AN EXAMPLE OF FUND RAISING PLAN (CASE B-1)

Source of fund		Year	1st Stage (1990 opening)				2nd Stage (1993 opening)				Total (%)
			1987	1988	1989	Sub-total (%)	1990	1991	1992	Sub-total (%)	
Local portion	Ecuadorian government		16	786	786	1,588 (10.0)	17	552	552	1,121 (10.0)	2,709 (10.0)
	Banco de Desarrollo		16	786	786	1,588 (10.0)	17	552	552	1,121 (10.0)	2,709 (10.0)
	Foreign private banks		26	1,240	1,240	2,506 (15.8)	16	549	549	1,114 (10.0)	3,620 (13.4)
	Sub-total		58	2,812	2,812	5,682 (35.8)	50	1,653	1,653	3,356 (30.0)	9,038 (33.4)
Foreign portion	Foreign governments		88	4,256	4,256	8,600 (54.2)	-	-	-	-	8,600 (31.8)
	Foreign private banks		16	788	788	1,592 (10.0)	117	3,864	3,864	7,845 (70.0)	9,437 (34.8)
	Sub-total		104	5,044	5,044	10,192 (64.2)	117	3,864	3,864	7,845 (70.0)	18,037 (66.6)
Total			162	7,856	7,856	15,874 (100)	167	5,517	5,517	11,201 (100)	27,075 (100)

- (Note)
- 1 US dollar = 120 sucres = 210 Japanese yens (Free market exchange rate as of October, 1985)
 2. The loan from foreign governments is limited to 8,600 mil. sucres (15,000 mil. Japanese yen) at a maximum in one case, and such fund should be applied to the foreign portion. This fund is available at the lowest interest rate and wholly appropriated for the first-stage (phase) work.
 3. The fund amounting to 1,616 mil. sucres which will be needed for the purchases of train coaches to be used in 1995 should be made available by the credit to be offered by the coach manufacturers. This fund should not be listed in Table 9-1.4.

Table 9-1.5 AN EXAMPLE OF FUND RAISING PLAN (CASE A-2)

Million sucres in 1985 prices

Source of fund	Year	1st Stage (1990 opening)				2nd Stage (1993 opening)				3rd Stage (1996 opening)				Total (%)
		1987	1988	1989	Sub-total (%)	1990	1991	1992	Sub-total (%)	1993	1994	1995	Sub-total (%)	
Local portion	Ecuadorian government	13	587	587	1,187 (10.0)	7	274	274	555 (10.0)	17	560	560	1,137 (10.0)	2,879 (10.0)
	Banco de Desarrollo	13	587	587	1,187 (10.0)	7	274	274	555 (10.0)	17	560	560	1,137 (10.0)	2,879 (10.0)
	Foreign private banks	22	926	926	1,874 (15.8)	10	352	352	714 (12.9)	11	384	384	779 (6.9)	3,367 (11.7)
	Sub-total	48	2,100	2,100	4,248 (35.8)	24	900	900	1,824 (32.9)	45	1,504	1,504	3,053 (26.9)	9,125 (31.7)
Foreign portion	Foreign governments	85	3,774	3,774	7,633 (64.2)	48	919	-	967 (17.4)	-	-	-	-	8,600 (29.9)
	Foreign private banks	-	-	-	-	-	920	1,839	2,759 (49.7)	122	4,096	4,096	8,314 (73.1)	11,073 (38.4)
	Sub-total	85	3,774	3,774	7,633 (64.2)	48	1,839	1,839	3,726 (67.1)	122	4,096	4,096	8,314 (73.1)	19,673 (68.3)
Total		133	5,874	5,874	11,881 (100)	72	2,739	2,739	5,550 (100)	167	5,600	5,600	11,367 (100)	28,798 (100)

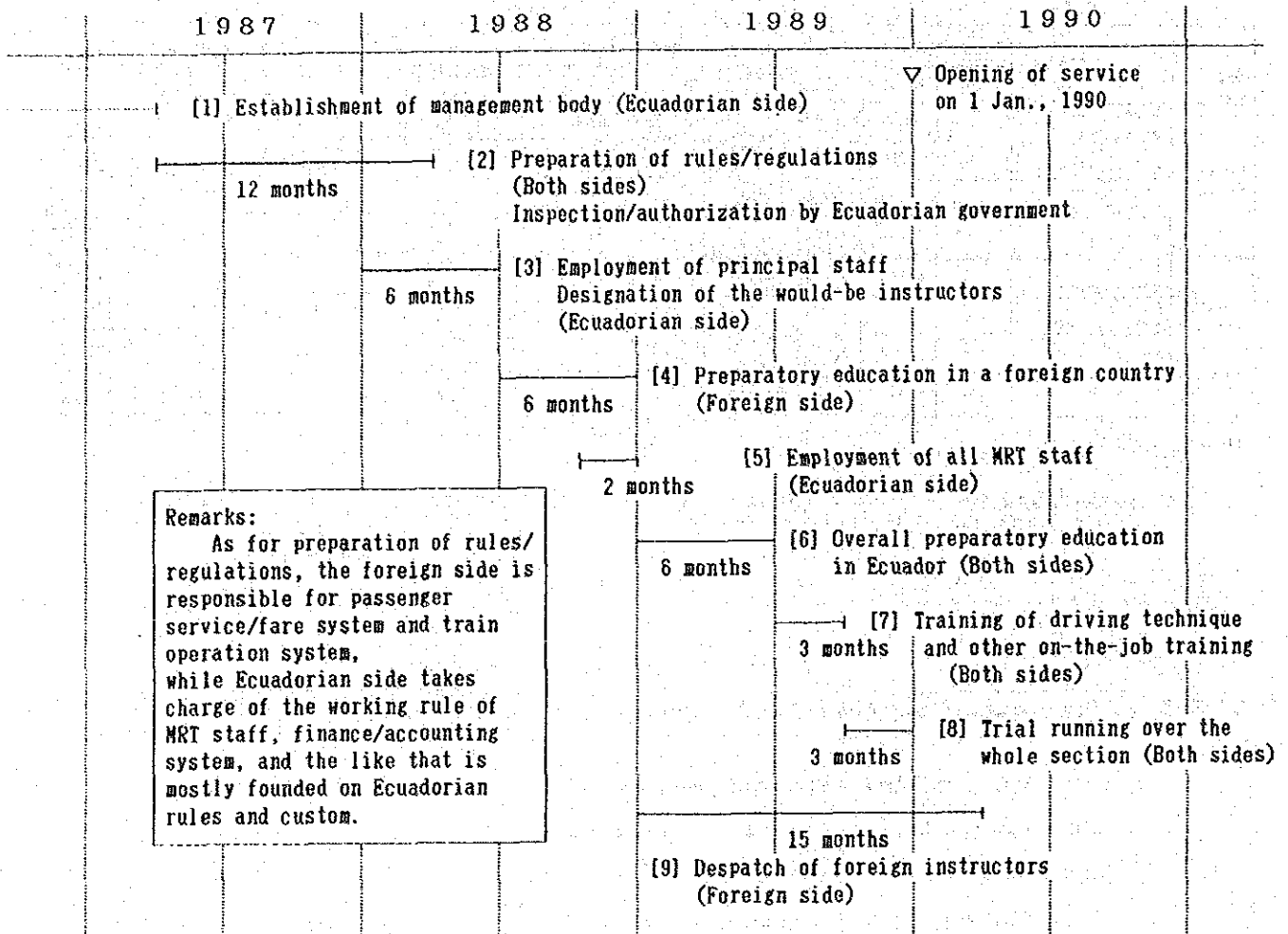
- (Note) 1. The same as those in Table 9-1.4
 2. The same as those in Table 9-1.4
 3. The fund needed for purchasing train coaches in 1995 is included in the fund appropriated for the third-stage (phase) work (Not listed in Table 9-1.5).

9-2 Preparatory Process in MRT Management

In parallel with the survey and construction of MRT system, if this project is to be implemented, various kind of preparatory work have to be planned carefully. Proposed schedule of this preparatory work is shown in Table 9-2.1 in which the target date of opening MRT services is set as 1 January, 1990.

Among various items shown in the table, items (1) and (2) are thought urgently required. The both are the establishment of the basic character and rules of MRT system and eventually might produce a heated debate among Ecuadorian parties concerned. But, if the work on these two items delays, then the opening of service on the target date would not be assured, because every work on other items is planned in a limited period and will not be able to carry out in a less period.

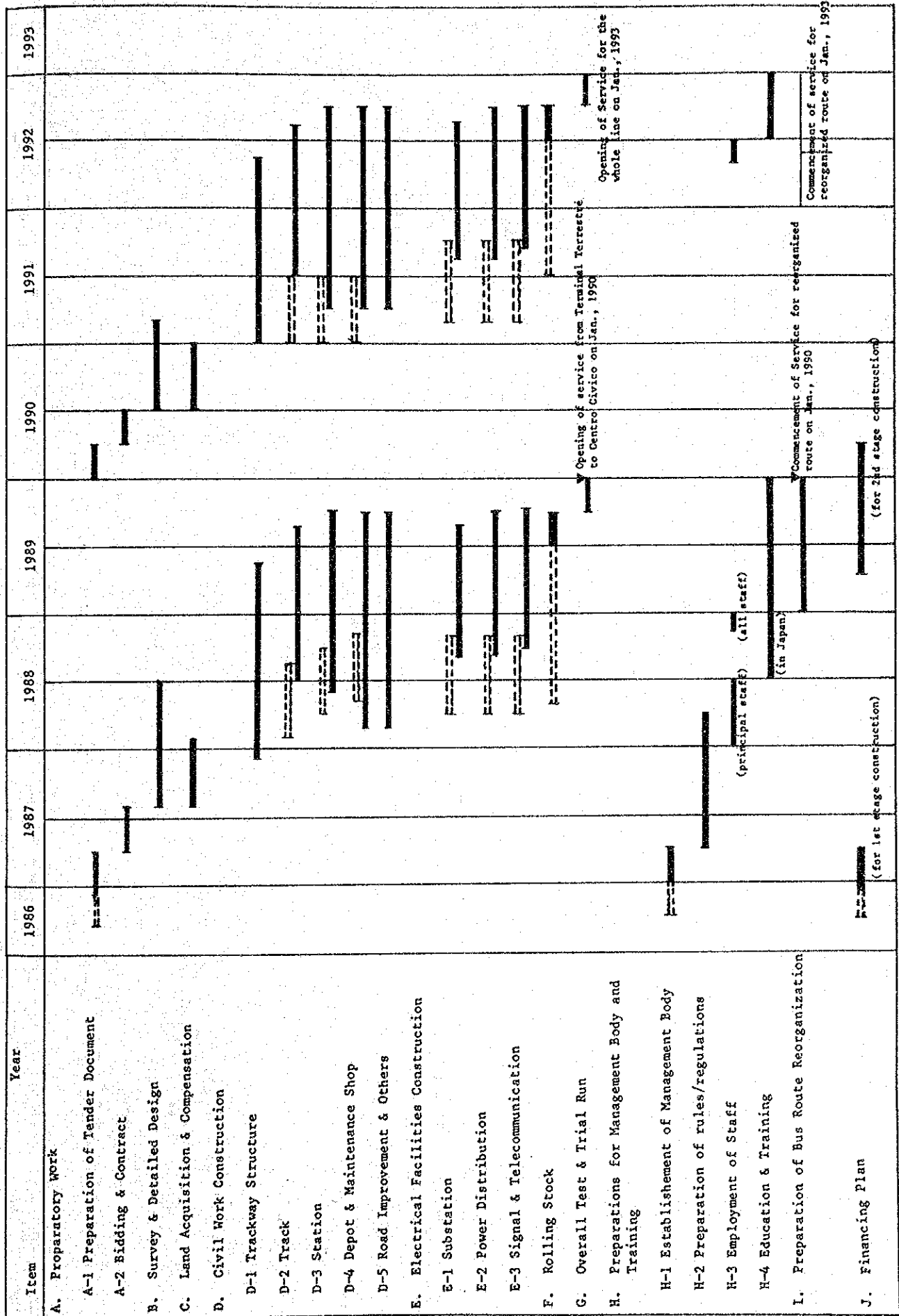
Table 9-2.1 PREPARATORY PROCESS IN GUAYAQUIL MRT PROJECT



9-3 Implementation Schedule

An implementation schedule to construct the whole line of 14.7 kilometer in the Case B-1 is shown in Figure 9-3.1.

Figure 9-3.1 IMPLEMENTATION PROGRAM



Note. For Items D, E and F, "-----" means period for manufacturing and transport of imported equipments and materials.

APPENDIX

Appendix A.1 STAFFING

1) Comisión de Tránsito de la Provincia de Guayas (C.T.G.)

1. Mr. Jaime Nebot Saadi
Presidente Princial/Governador de la Provincia del Guayas
2. Mr. Humberto Plaza Lavezzari
Mr. Jorge Arosemena Gallardo (Predecessor)
Presidente Alterno de la C.T.G.
3. Mr. Alejandro Ponce Noboa
Mr. Jaime Vernaza (Predecessor)
Director Ejectivo de la C.T.G.
4. Mr. Jorge Placios C.
Mr. Flavio Maridueña (Predecessor)
Sub-Director Ejecutivo de la C.T.G.
5. Mr. Arturo Cabrera Sotomayor
Director del Departamento de Ingenieria de la C.T.G.

2) Members of Joint Meeting

1. Comisión de Tránsito del Guayas (C.T.G.)

Mr. Humberto Plaza Lavezzari
Presidente Alterno de la C.T.G.

Mr. Jorge Placios C.
Mr. Flavio Maridueña (Predecessor)
Sub-Director Ejecutivo de la C.T.G.

Mr. Walter Orozco (Predecessor)
Jefe Provincial de Tráfico de la C.T.G.

Mr. Arturo Cabrera Sotomayor
Director del Departamento de Ingenieria de la C.T.G.

2. Unidad Ejecutora de Transporte Masivo de la Ciudad de Guayaquil

Mr. Leopoldo Benítez
Director Ejecutivo

3. Ministerio de Obras Publicas y Comunicaciones (M.O.P.)

Mr. Eduardo Moncayo Marmol
Subsecretario del M.O.P.

4. Municipio de Guayaquil

Mrs. Lourdes Becerra
Subdirector Departamento de Urbanización y Planificación

5. Fondo de Desarrollo Urbano de Guayaquil (FODUR)
 - Mr. David Flores
 - Director Encargado del FODUR
 6. Fuerza Aerea Ecuatoriana (F.A.E.)
 - Mr. Alirio Zambrano
 - Jefe del Departamento de Infraestructura del Aeropuerto
 7. Aviación Civil
 - Mr. Colon Gonzales
 - Jefe de la Unidad Ejecutora del Nuevo Aeropuerto
- 3) Japanese Advisory Committee
1. Dr. Yoshiji Matsumoto
Professor, University of Tokyo
 2. Mr. Kazuo Notake
Ministry of Transport
 3. Mr. Kazumi Sugihara
Ministry of Transport
 4. Mr. Hisayuki Tanaka
Ministry of Construction
- 4) JICA Coordinator
1. Mr. Takaaki Ohiwa
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- 5) Study Team
- 5)-1 Japanese Expert
1. Mr. Etsutaro Iimuro
Project Manager/Economic & Financial Analysis
 2. Mr. Kotaro Yamada
Route Alignment & Operation Plan
 3. Mr. Hiroshi Ohguchi
Civil Engineering & Structural Plan

4. Mr. Hiroyuki Takami
Management Plan
5. Mr. Kenji Araki
Rolling Stock & Yard Facility Plan
6. Mr. Mitsunori Shibuya
Electric Facility Plan
7. Mr. Hirotooshi Yamakawa
Bus Transport Plan
8. Mr. Takeshi Isaji
Road Plan
9. Mr. Yoshinao Sawahata
Land Use Plan
10. Mr. Seiichiro Yamazaki
Traffic Demand Forecast
11. Mr. Tsuneyoshi Jitsuhara
Traffic Survey
12. Mr. Junichi Ishihara
Land Survey
13. Mr. Ryosuke Itoh
Land Survey
14. Mr. Takeo Okuno
Land Survey
15. Mr. Masashi Suzuki
Land Survey

5)-2 Ecuadorian Counterpart

1. Mr. Henry Antonio Aulestia Canales
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2. Mr. Evaristo Villón Mateo
Departamento Ingenieria de la C.T.G.
3. Mr. Tobias Narea Muñoz
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4. Mr. Jorge Vera Burgos
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10. EMAG (Empresa Miunicipal de Alcantarillado Guayaquil)

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Mr. Rodolfo Gonzalez
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13. INEC (Instituto Nacional de Estadística y Censos)

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15. ENFE (Empresa Nacional de Ferrocarriles del Estado)

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17. IETEL (Instituto Ecuatoriano de Telecomunicaciones)

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19. Embajada del Japon

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20. Fujita Co.

Mr. Yoshihiro Takatsu
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21. Mr. Yasuo Torii
Interpreter

