measure to induce the owners of the existing route to switch to the new routes.

As previously repeated, the number of bus transfers will increase under the new system, because bus routes will be divided into city routes and suburban routes in the pursuit of a higher operational efficiency of buses, ignoring passenger inconvenience of transfer. To buffer the passenger resistance against transferring, facilities for convenient transfers should be established and bus routes should be made to converge to them. Also, the zone fare system should be revised to use more precise division of zones as to result in the same amount of fare to reach the same destination, regardless of whether or not the passenger transfers. Such fare system should be designed in advance and be effected at the next opportunity of fare revision.

3) Rail Transit Service Introduction Plan

(1) Perspective

Being prevented from growing north and south by topographical restraints and the operation of history, Panama Urban Area extends east-west. Centro in its western corner has a daily bus traffic of approximately 300,000 persons to and from it. This traffic will continue to swell and is predicted to reach 450,000 by 1990 and 650,000 by the year 2000. Should the prediction be true, how long will bus remain effective?

Additional road installation is extremely difficult in Panama Urban Area, which is almost fully built-up and has little unoccupied land space. Future transport planning can but seek to improve the utilization efficiency of the existing road spaces. The road utilization efficiency of buses is five to seven times higher than that of cars, but the capacity of bus system is not without limits—the likely first obstacle to appear will be bus stops where buses will be stuck with multitude of passenger getting off and on, clogging the flow of traffic.

The peculiar characteistics of urban transport in the Planning Area is that heavy streams of people flow constantly in regular directions, the hourly fluctuation of transport demand is moderate as reflected by the presence of three daily peak hours (one in noon time), and demands on roads are fairly evenly distributed to both directions as reflected by the low heavy-direction rates in peak hours. In this situation, a rail transit system will be more profitable and more effective than otherwise in solving urban transport problems.

When road capacity is limited, the most effective response to expanding demand is to shift the demand from individual means of conveyance to a mass mode of transport, as attempted in many cities in the world under policy emphasis. The propensity of Panamanians to use car is so high that few of them would shift to the bus, at least when the bus service remains at the present level. The conversion may be easier to a rail transit which, due to the exclusive right-of-way, offers faster and safer service. Transition of demand from cars to a mass transit system, if accomplished, will mitigate car parking problems and lead to savings in total transportation energy consumption.

Thus, it is evident that the introduction of a rail transit will sooner or later become inevitable in Panama Urban Area. The construction of a rail transit system, however, will entail the investment of an enormous amount of funds. Unlike road projects, the rail transit project ideally is a self-liquidating enterprise which expects revenue from passenger fares. Otherwise, even if the cost is met with loans, this large scale project will remain a perpetual burden on the government offers. The question, then, is whether or not the passengers have the ability to bear the fares which will be enough to recover the project cost within a reasonable length of time.

Therefore, plans for the introduction of a rail transit is analyzed here with focus on the financial feasibility. The types and routes of rail transit and the basis of their construction cost are first defined, and, then, demand is forecast to enable the evaluation of possibility of rail introduction by the end of this century.

(2) Planning Preconditions

i) Terminal Points

It is assumed that the rail transit route will originate in Centro, where the greatest number of passenger gather, and go to San Miguelito intersection, a traffic node where many bus passengers transfer. Whether the route should thence go north toward Las Cumbres or go east toward Tocumen is debatable. The eastward route is assumed for the time being, however, in view of the fact that northward urban development will be blockaded by the cuenca (water catchment area of the Gatun Lake) and of the prediction that future traffic will be greater from east than from north. Then, the ultimate terminal of the route should be Tocumen, but it is assumed that, in the first step, the rail transit will terminate at the entrace of Urb. Cerro Viento where the development of an suburban type commercial area is envisaged.

ii) Utilization of Road Right-of-Way

In Panama Urban Area, to secure exclusive right-of-way for rail transit, if at all possible, will be impractical in view of the difficulty of, and the prohibitively expensive and profit-squeezing cost of, land acquisition, demolition of houses, relocation of public facilities, and so forth. For the purpose of analysis here, therefore, it is assumed that the existing road right-of-way will be utilized for rail transit. This means that nearly entire length of the transit will have to be elevated in order that the speed, safety, and stability of rail operation is to be achieved while supporting the function of the arterials concerned.

iii) Construction Time and Service Commencement Year

The construction of a continuous viaduct for an extension of over 10 kilometers will require three to four years. With additional two or three years necessary for investigations, designing, fund raising, and other preparatory work, the total time need for the rail transit project will be six to seven years. Then, if the rail transit system construction project is implemented immediately (in 1982), the system will not be opened for service before 1990. Therefore, the profitability of the system will be analyzed based on three service commencement years: 1990, 1995, and 2000.

iv) Transport Demand

The proposed transport capacity of the rail transit is 200,000 to 300,000 persons per day, which corresponds to one-half of bus passengers flowing east-west.

(3) Types of Rail Transit

Rail transits are classified into elevated, surface, and underground. Surface railroad without exclusive right-of-way can be introduced most inexpensively, but conventional surface cars are limited in capacity, safety, and speed. Moreover, the introduction of streetcars, which will compete with motor traffic in the use of ground surface already crowded by cars, will be a regressive action. The splitting of wide streets to create exclusive rail right-of-way will still be inacceptable in view of confusion with motor traffic at intersections and of inadequate passenger safety at street-car stops.

Although not a rail transit, trolleybus is another inexpensive means of transport to which conversion from motor buses will be easy. In cities where surplus electric power is abundantly available, the introduction of trolleybus system would be worth considering from the standpoint of petroleum oil conservation. However, in cities (like Panama) where trolleybuses will have to be operated with short headways to provide adequate level of service in view of their small capacity (only comparable to that of motor buses) and of the lack of over-taking capability, they will only cause confusions at stops.

Underground rail transit is excellent from the standpoint of speed, safety, and environmental pollution. If shield driving method is adopted for its construction, it will have a wide freedom of route selection. It is very expensive, however; the construction cost is estimated at an average of 40 million balboas per each kilometer of its route (including stations). With additional costs of rolling stocks, electricity, and other necessaries, the subway system construction project will require more than 60 million balboas per each kilometer, which will be too excessive for the system to be financially feasible. Judging from its gigantic cost, underground rail system is considered undesirable for opening before the end of this century.

The only remaining possibility of constructing a rail transit system utilizing the existing road right-of-way is by the means of viaduct. Elevated rail transit will have a sufficient capacity, will not compete with motor traffic, and will not be so expensive as subways. Elevated railroad systems are available in a variety of rolling stock types, capacities, and loads, and come with either steel wheels or rubber tires (monorail). However, the analysis hereunder will assume merely an elevated electric rail transit with an adequate capacity to meet the predicted quantity of transport demand (leaving the determination of details to the project feasibility study), provided that the estimation of construction cost will assume a conventional system supported by an established technology such as those currently operated in the metropolises of the world (monorail or conventional railroad), rather than new, computer-controlled transit systems.

(4) Route and Station Locations

For rail transit route to connect said center points, strong candidates are Via Espana and Via Transistmica–arterials with heavy traffic, both running east-west in about the middle of Panama Urban Area, and having wide enough right-of-way to provide for the construction of the rail transit.

Ave. Balboa-Via Cincuentenario route also has a heavy traffic but is too close to the shore (particularly Ave. Balboa is an outright coastal road) or too far from the rail transit service area for the construction cost to achieve an adequate investment effect. Via Ricardo J. Alfaro, which goes around the urban area, is long in its length and will result in a greater construction cost and longer travel time. Area north of this route will eventually be developed, but the passenger "catchment" area presently lies only in the south and the investment effect of a rail transit on this route will also be small. (See Fig. 12-23)

Via Transistmica has a 60-meter right-of-way for nearly entire extension from Centro to San Miguelito and shows fine horizontal and vertical alignment. The construction of any type of rail transit along this route will, therefore, have no technical difficulty. Via Espana, on the other hand, has sections with poor horizontal alignment and sections with inadequate width. Monorail, which has a greater tolerance against curves and slopes than ordinary urban rail transit, is believed more suitable to Via Espana. For the sake of comparative analysis, an ordinary type rail transit is assumed for Via Transistmica and monorail for Via Espana. Their standard cross-section geometries are presented in Fig. 12-24. Both should have the urban Center in El Maranon, where the establishment of Centro Bus Center is planned. Then, a several alternative approaches to this terminal are possible (See Fig. 12-25).

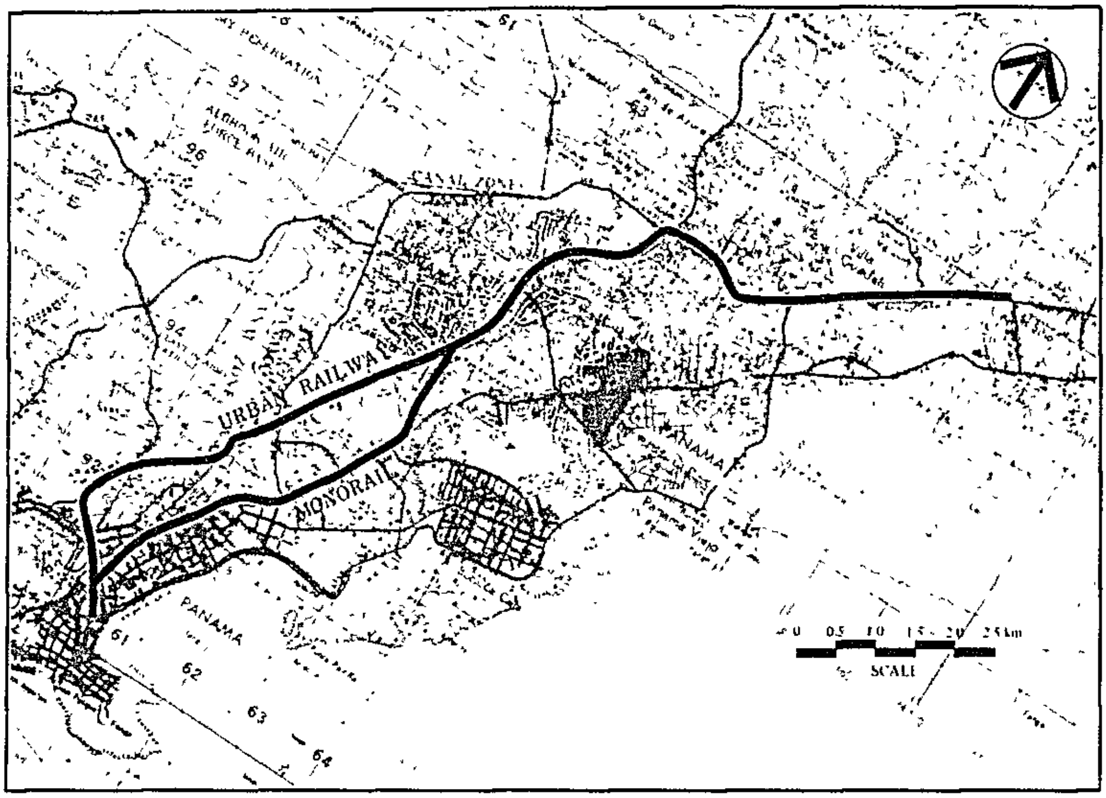


FIG. 12-23 ALTERNATIVE RAIL TRANSIT ROUTES

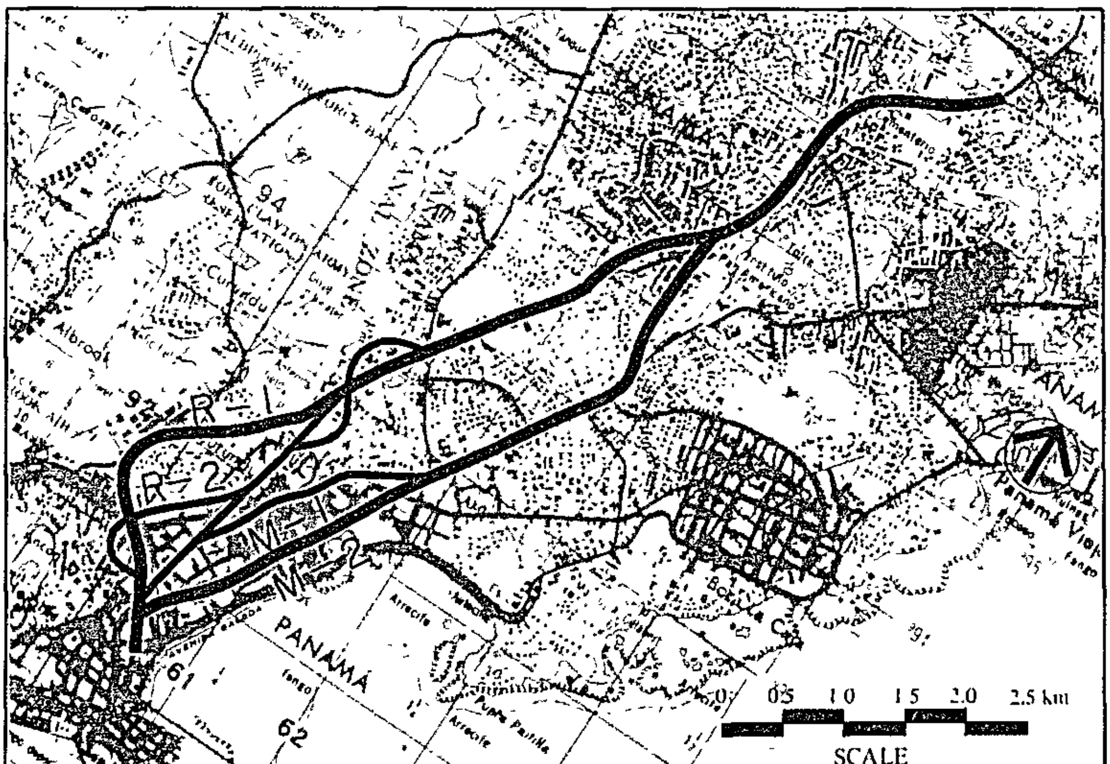


FIG. 12-24 ALTERNATIVE RAIL TRANSIT ROUTES IN PANAMA URBAN AREA

Alternative M-1:

Goes straight on Via Espana, follows Ave. Central, and reaches the Center. The construction of a station will be difficult in the section of Ave. Central where right-of-way is only 20 meters.

Alternative M-2:

Via Espana – Ave Justo Arosemena (25-meter right-of-way – Terminal)

Alternative R-1:

From the vicinity of Hospital del Seguro Social on Via Simon Bolivar, goes westward along Curundu River, turns to south near the entrance of Albook, follows Via Cerro Ancon (a 6-lane road recommended in Road Plan) to reach Terminal.

Alternative R-2:

Follows Via Transistmica (Via Simon Bolivar) westward until end, then, turns at the minimum radius of curveture (R = 200 meters) and gets on Via Cerro Ancon.

Alternative R-3:

Follows an S-shape alignment in the vicinity of Hospital del Seguro Social to get underground, and follows Ave. Central – Ave. Jose Domingo Espinar – Terminal. Underground section is about 2.5 kilometers long.

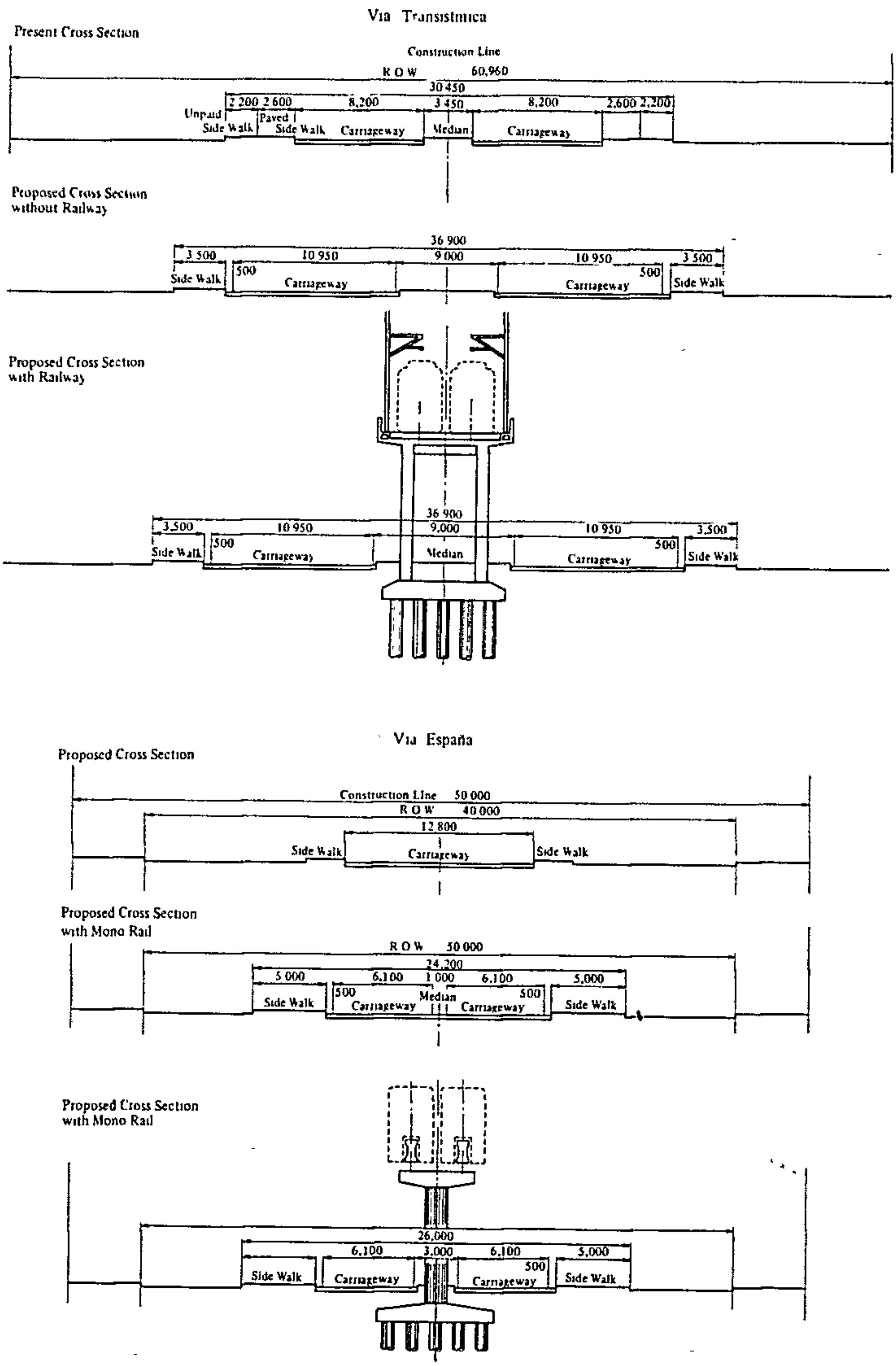
Stations are to be established fundamentally at the intervals of one kilometer, but in the vicinity of major intersections and of major transport demand genration/attraction points. The number of stations, assumed for cost and demand estimation purposes, is 13 for conventional railway (some elevates, some on ground, some underground) and 14 for monorail (all elevated).

(5) Construction Cost

The construction cost of rail transit system is estimated by applying unit costs in Panama to the quantities of Japanese examples. Neither operational labor-saving equipment, nor automation equipment is considered. The acquisition cost only of privately owned land outside road right-of-way is considered. As 5% overhead cost (personnel expenses of the project), 7% designing and supervision cost, and 10% contingency fund are considered.

For the quantity estimation of rolling stocks, a periodical inspection relief train and a reserve train are added to the number of rolling stocks needed to meet maximum one-way peak hour demand, in the assumption that no car will be borrowed from the existing Panama – Colon Railroad due to guage and equipment differences.

The total construction cost of the monorail system including rolling stocks, thus estimated (see Table 12-15) is 312 to 318 million balboas and that of the conventional railway, 302 to 303 million balboas (or 392 million balboas for that which has an underground portion (R-3)), all in 1981 prices. The average cost per kilometer of the conventional railway and that of the monorail are both slightly over 16 million balboas, while that of the railway with an underground portion is 21.6 million. Of those alternatives, demand forecast and financial analysis are done for M-2 and R-1, which will present relatively few technical problems.



Source : ESTAMPA

FIG. 12-25 STANDARD CROSS-SECTION OF RAIL TRANSIT

TABLE 12-15 CONSTRUCTION COST OF RAIL TRANSIT

(1) Monorail

Item/Alternative	Unit Cost	M – 1		M – 2	
		Quantity	Cost	Quantity	Cost
Length (km)	–	15.130	–	14.935	–
1. Right of Way	25 B/m	243,900	6.10	243.900	6.10
2. Earth Work	3.12 B/m	205,600	0.64	205,600	0.64
3. Truck Viaduct	6.14 MB/km	10.905	66.96	9.930	60.97
Rail	1.91 MB/km	4.225	8.07	5.005	9.56
4. Station	2.07 MB/St.	14	28.98	14	28.98
5. Yard	24.26 MB	1	24.26	1	24.26
6. Catenary	1.65 MB/km	15.130	24.96	14.935	24.64
7. Signal	1.06 MB/km	15.130	16.04	14.935	15.83
8. Telecommunication	0.24 MB/km	15.130	3.63	14.935	3.58
9. Power Substation	20.8 MB	1	20.80	1	20.80
Sub Total	–	–	200.44	–	195.36
10. Miscellaneous and Engineering Cost	–	–	45.84	–	44.64
Construction Cost Total	–	–	246.28	–	240.00
Cost per Kilometer			16.28		16.07
11. Rolling Stock	0.63 MB/car	114	71.82	114	71.82
Total Cost	–	–	318.10	–	311.82

(2) Railway

Item/Alternative	Unit Cost	R – 1 1)		R – 2 2)		R – 3 3)	
		Quantity	Cost	Quantity	Cost	Quantity	Cost
Length (km)	–	15.700		15.330		15.447	
1. Right of Way	25 B/m	279,900	7.00	277,900	6.95	261,500	6.54
2. Earth Work	3.12 B/m	335,180	1.05	326,740	1.02	326.150	1.02
3. Truck Viaduct	7.83 MB/km	10.100	79.08	20.105	79.12	7.772	60.86
Rail	1.21 MB/km	15.700	19.00	15.330	18.55	15.497	18.75
4. Tunnel							
Cut & Cover	16.92 MB/km	–	–	–	–	1.875	31.73
Semi Shield	19.72 MB/km	–	–	–	–	0.540	10.65
5. Station							
Surface	1.29 MB	4	5.16	4	5.16	4	5.16
On bridge	1.40 MB	8	11.20	8	11.20	6	8.40
Underground	4.14 MB	–	–	–	–	3	12.42
6. Yard	19.00 MB	1	19.00	1	19.00	1	19.00
7. Catenary	1.50 MB/km	15.700	23.55	15.330	23.00	15.497*1	35.02
8. Signal	1.00 MB/km	15.700	15.70	15.330	15.33	15.497*2	26.66
9. Telecommunication	0.23 MB/km	15.700	3.61	15 330	3.53	15.497*3	14.88
10. Power Substation	20.80 MB	1	20.80	1.	20.80	1	20.80
Sub Total	–	–	205.15	–	203.66	–	271.88
11. Miscellaneous and Engineering Cost	–	–	46.15	–	46.39	–	62.58
Construction Cost Total	–	–	251.88	–	250.05	–	334.46
Cost per Kilometer	–	–	16.04	–	16.31	–	21.58
12. Rolling Stock	0.716 MB/car	72	51.55	72	51.55	72	51.55
Total Cost	–	–	303.43	–	301.60	–	386.01

Note : Unit Costs are 2.26 million Balboa/km for *1, 1.72 million Balboas/km for *2 and 0.96 million Balblas/km

(6) Transport Demand

In absence of any urban rail transit system in Panama, no demand forecast model can be constructed for such a system. Therefore, the demand forecast is accomplished by treating the rail transit as if a large capacity bus, disregarding the qualitative difference between the two.

The model split of O-D traffic volume is estimated by first adding the rail transit route (links) to the road network, while defining an overall speed to the rail route. Then, based on this combined network, travel time and cost are obtained for each O-D pair and used in separating the total O-D traffic volume between passenger cars and public modes of transport by the modal split model. The volume of O-D traffic by public modes of transport, thus obtained, theoretically includes the quantity of traffic converted from passenger car.

Next, this volume of O-D traffic by public modes of transport is assigned onto the public transport (bus and rail) network, without giving any capacity retained. This will result in assigning to the rail transit, the O-D trips which can be performed faster by rail than by bus.

The above forecast considered only the rapidity of rail transit, abstracting such qualitative elements as the regularity and amenity of rail service. In this sense, the transport demand on rail transit map have been under stated. On the other hand, only the time required for transfers between bus and rail transit was considered, disregarding psychological resistance to modal transfers. Also, same fare system as for buses was assumed for rail transit. In this sense the forecast may have been an overstatement. The improvement of transport demand forecast precision and accuracy is subject to future study.

The forecast results are presented in Table 12-16 and Fig. 12-26. The number of passengers on Via Espana monorail is estimated to be 290,000 (in 1990) to 340,000 (in 2000) and that on Simon Bolivar railway, 250,000 (in 1990) to 300,000 (in 2000). Maximum cross-section traffic of monorail is 210,000 to 250,000 and that of railway, 2000,000 to 230,000.

TABLE 12-16 DAILY PASSENGERS OF RAIL TRANSIT

Year	Monorail	Railway
1990	288,000	249,000
1995	314,000	262,000
2000	340,000	302,000

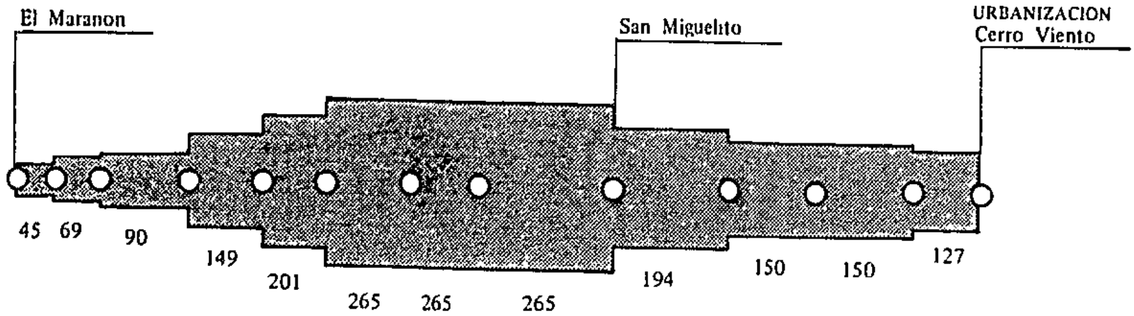
Source: ESTAMPA

(7) Financial Analysis

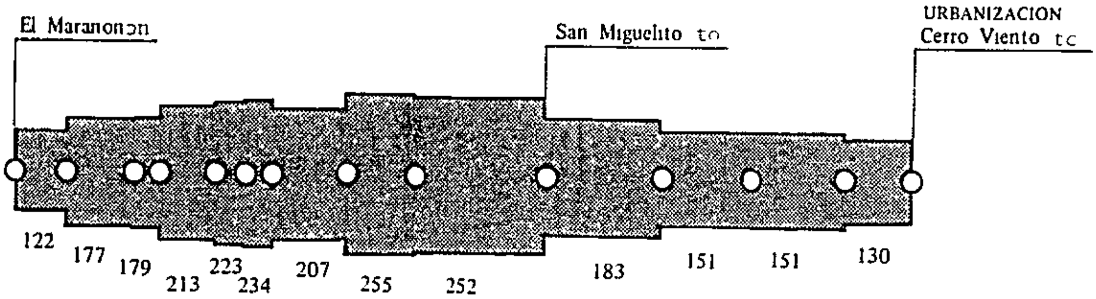
The construction costs of and transport demands on the monorail and railway systems are discussed in detail in Chapter 16, Sub-Chapter 2), and summarized hereunder.

i) Operational Expenses

The number of employees will range from 330 to 370, and annual personnel expense about 2.4 million to 2.7 million balboas in 1981 prices. Other operational and maintenance expenses are estimated at five to six million balboas per year.



(1) Railway along Transistmica



(2) Monorail along Via Espana

passengers/day

Unit: 1000
Source : ESTAMPA

FIG. 12-26 DEMAND OR RAIL TRANSIT, 2000

ii) Major Inputs for Financial Analysis

- The fund sources of the initial investment: 10% from equity capital, 90% by loan at 12% per annum interest, 5-year grace period, and 20-year redemption period.

- Initial year passenger fare: 90% of passengers: 25 centavos. 10%, 35 centavos. Collection rate, 83%. Fares raised 20% each three years in view of inflation.

- Additional rolling stocks corresponding to one-half of the initial number to be purchased ten years after inception.

- Short term loan interest: 15% per annum. Bank deposit interest: 5% per annum.

iii) Analysis Results

The financial internal rate of return of the monorail project is 6.5% (if opened in 1990) or 7.4% (if opened in 2000), and that of the railway project, 5.4% (1990)) or 6.8% (2000). The indicated internal rates of return are too low for the projects to be commercially feasible even if service commencement is held back to the year 2000 for a higher internal rate of return. The projects may become commercially feasible if (1) long term and short term interest rates can be reduced to 6% per annum by government subsidy, or (2) the fare can be raised to 35 centavos in 1981 prices, or (3) the ratio of equity capital can be raised to at least 40% (See Table 12-17).

TABLE 12-17 FINANCIAL EVALUATION OF RAIL TRANSIT PROJECT

Case/ Condition	Mode	First Year of Operation	Profit after 25 year: Annual (million B.)	Profit after 25 year: Acumulated (million B.)	Indicators for Evaluation: B/C	NVP (million B.)	IRR (%)
Case 1		1990	−1,660	−14,449	0.468	−114	6.47
IL = 12%	Monorail	1995	−1,587	−13,906	0.499	−110	6.87
IS = 15%		2000	−1,436	−12,745	0.544	−102	7.42
C = 25¢		1990	−1,952	−16,746	0.391	−130	5.41
r = 20%	Railway	1995	−1,913	−16,456	0.406	−128	5.61
		2000	−1,592	−13,950	0.499	−110	6.89
Case 2		1990	−1,016	−9,155			
IL = 10%	Monorail	1995	−925	−8,474	Same as Case 1		
LS= 15%		2000	−767	−7,240			
C = 25¢		1990	−1,301	−11,398			
r = 20%	Railway	1995	−1,259	−11,077	Same as Case 1		
		2000	−933	−8,529			
Case 3		1990	71	−650	0.793	−44	10.2
IL = 10%	Monorail	1995	199	462	0.844	−34	10.7
IS = 15%		2000	239	965	0.912	−19	11.2
C = 35¢		1990	−332	−3,806	0.672	−70	8.9
r = 20%	Railway	1995	−241	−3,107	0.699	−65	9.2
		2000	186	252	0.833	−36	11.1

Note : IL = Interest rate of long-term loan; IS = Interest rate of short-term loan
C = Normal tariff for one ride; r = Increase rate of tariff in every three years
Source : ESTAMPA

(8) Economic Effects

An economic evaluation through comparison against the do-nothing case indicates that the economy of the recommended road network masterplan, treated as a project in itself, will be very high with benefit/cost ratio of 6.34 (see Chapter 16, Sub-Chapter 1)). When the rail transit project is added to this masterplan, the overall benefit-cost ratio, similarly evaluated, is lower at 3.42, but still high enough to be economically justified.

However, when benefit and cost increments by the addition of the rail transit project to the masterplan are separately quantified, under the condition that the masterplan will be carried out in accordance with the recommended schedule, the benefit/cost ratio of the rail transit project is as low as 0.30 and the internal rate of return, only 1.8% (if service is commenced in 1995). Then, the rail transit project must be judged little meaningful to the Republic's economy. This is so, chiefly because the masterplan road network capacity is designed to meet, without a rail transit, the size of transport demand forecast for the end of this century, while said benefit/cost ratio of rail transit project is calculated using cost and benefit only up to the year 2000. In other words, the analysis results indicate that a rail transit project is unnecessary and will have little economic effects as far as this century is concerned.

Now, the qualitative aspects of rail service, such as regularity and safety, were abstracted in the above analysis. If such quality is powerful weapon of rail transit for the attraction of passengers away from buses, its economic analysis will be different. For instance, if a greater transition of passengers from the bus to the rail can be achieved, savings in total transport energy will be greater (see Chapter 16, Sub-Chapter 3)).

(9) Conclusions and Recommendations

Through the above discussions and analysis, the following conclusions are drawn on the project for the introduction of a rail transit system into Panama urban transport.

i) Bus transport system in Panama Urban Area will sooner or later reach its limit, necessitating the introduction of a rail transit system.

ii) The commencement of rail service within this century will be financially unfeasible without government subsidy, in view of the ability of passengers to bear the fares, as against the construction costs of conceivable rail transit systems.

iii) As long as roads wil be developed in the Metropolitan Area in accordance with the schedule of the recommended masterplan, little economic effect can be expected of the rail transit system introduction project.

iv) The introduction of a rail transit system to Panama Urban Area is presently judged premature for the reasons of b) and c) above.

v) On the other hand, vacant land spaces will shrink and the high-density utilization of land accelerated as urbanization will progress, and, as a result, the later the rail transit project is implemented, the less freedom of route selection and the harder land acquisition will be.

vi) Inasmuch as a rail transit system introduction project will have to be implemented in the future, early preparation therefor in a long term perspective will be essential for the purposes of (1) securing the necessary land spaces to facilitate the project implementation, (2) achieving a high investment efficiency through coordination with other related projects, and (3) reducing the work of demolition of existing facilities to the essential minimum.

vii) In order to assure that a well balanced overall transport network will be developed ultimately in Panama Urban Area, the rail transit introduction project will be included in the recommended masterplan as a reminder. For this purpose, rail transit service commencement is planned for the end of this century, subject to final determination depending on the conditions of road investment, bus service improvement, fare policy, the economy of energy, and so forth.

viii) The following are recommended as a part of preparation for the eventual introduction of a rail transit system:

(1) That a preliminary engineering study be done for the selection of candidate routes, so as that the land use plan can be reviewed under the light of land acquisition necessities for rail transit outside the road right-of-way, that development applications can be checked under such light.

(2) That the modal preference and farebearing ability of the inhabitants be surveyed for the compilation of basic information needed for estimating the quantity of traffic demand converted from the bus to the rail.

(3) That the masterplan be reviewed in appropriate time for the evaluation of road development and bus service improvement so far, and that, if judged necessary as a result, study for the introecuction of a rail transit be started.

CHAPTER 13.

INVESTMENT PLAN

13. INVESTMENT PLAN

1) Project Formulation

Gap between the quantity of facilities according to Masterplan, discussed in the previous Chapters, and the quantity of facilities existing in the Planning Area represents the amount of investment that has to be made by the year 2000. This increment of facilities is broken down into the units of facilities as far as the function of each facility will not be impaired. That is, in the case of roads, the unit of facility is usually a road section set off by two major intersections (or a link of road network to which traffic is assigned), rather than breaking it into such elements as carriageway, center median, sidewalk, shoulder, side ditch, illumination facility, and so forth, which individually cannot function as a road. Also, in the case of bus centers, each center is treated as a unit, rather than breaking it down to loading/unloading zone, waiting room, fuel pump area, and so forth. These units of facilities are referred to as project components.

Project components which are too small to be units of investment and those which can be expected to perform only in combination with other components are grouped together to form projects. Each project constitutes an investment unit for the purpose of formulating investment plan. Furthermore, mutually supplementing or related projects whose combined, rather than isolated implementation is expected to achieve a better result are grouped together to form project packages. The above procedures are illustrated in Fig. 13-1.

Masterplan consists of road projects, public transport projects, and traffic management projects.

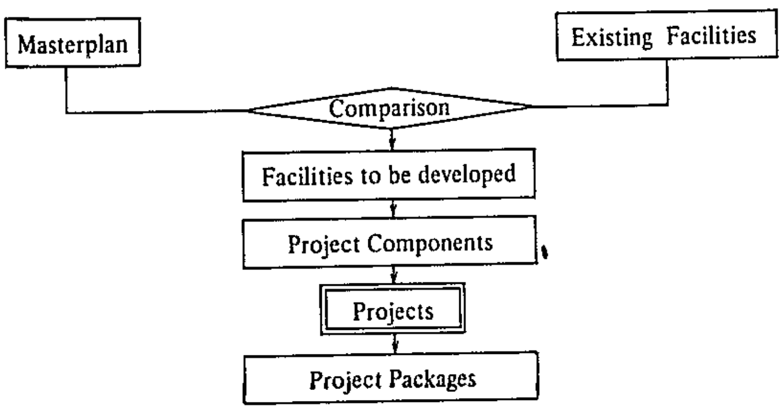


FIG. 13-1 PROJECT FORMULATION PROCEDURE

(1) Road Projects

Road projects can be classified into new road construction projects, existing road upgrading projects, and intersection improvement (grade separation) projects. The construction of new road/new road intersections and of new road/existing road intersections is included in the respective new road construction project, and only the work of grade separation at existing road/existing road intersections is treated as an intersection improvement project. (see Table 13-1 and Fig. 13-2 for the list of road projects)

TABLE 13-1

No.	Project	Length (Km)	No. of Lanes Before	After	No. of Bridges	Cost (Million B/.) Construction	Right-of-Way	Total
1	Calle 17 (Ave. B–Central)	0.74	2, 0	4	–	0.90	4.50	5.40
2	Balboa (Ave. B–Brasil)	4.14	4	6	1	5.20	0.42	5.62
3	Balboa (Via Brasil–11 de Oct.)	3.72	4	6	1 *	6.74	2.01	8.75
4	Ave. Panama Viejo	1.59	0	6	3	5.02	1.35	6.37
5	Ave. Nuevo Panama	2.27	4	6	2 *	6.81	0.13	6.94
6	Corredor Sur A	3.59	0	4	2	5.52	0.88	6.40
7	Corredor Sur B	5.80	0	2	4	3.42	1.42	4.84
8	Corredor Norte (Via Curundu)	3.48	2, 0	4	1 *	7.82	0.01	7.83
9	Corredor Norte-A	4.95	0	4	1 *	8.29	0	8.29
10	Corredor Norte-B	2.80	0	4	1	4.11	2.67	6.78
11	Corredor Norte (Via Samaria)	2.16	0	4	3	5.20	2.76	7.96
12	Corredor Norte-C	7.03	0	4	4	10.81	2.16	12.97
13	Villa Lobos-CPA	5.55	0	4	2	7.96	1.37	9.33
14	Gaillard-Roosevelt	0.55	0	4	–	0.66	0.08	0.74
15	Via Albrook-A	1.50	0	4	–	1.80	0	1.80
16	Via Albrook-B	4.15	2, 0	4	–	5.37	0	5.37
17	Gaillard Miraflores	3.85	2	4	–	3.00	0.04	3.04
18	Gaillard Clayton	7.90	2	4	–	6.61	0.08	6.69
19	Via Cerro Ancón	1.61	4, 2, 0	6	–	2.15	5.35	7.50
20	Via Bolivar (M. Sosa–V. Brasil)	2.37	4	6	1	3.11	0.59	3.70
21	Via Bolivar (V. Brasil–S. Mgto.)	5.53	4	6	1	2.05	6.09	8.14
22	Via Bolivar (S. Mgto–S. Isidro)	3.30	4	6	3 *	7.64	0.03	7.67
23	Via Bolivar (S. Isidro–A. Diaz)	6.00	2	4	3	5.72	0.06	5.78
24	Via Bolivar (A. Diaz–Chilibre)	18.25	2	4	1	14.35	0.18	14.53
25	S. Miguelito Central	8.13	2, 0	4	5	8.40	0.12	8.52
26	S. Miguelito-Chanis	4.05	0	4	5	6.90	1.74	8.64
27	Ave. E T. Lefevere	1.38	2	4	–	1.69	0.30	1.99
28	Betania Central	1.53	0	4	–	2.11	5.68	7.79
29	S. Mgto. Oeste-A	1.48	0	4	3 *	4.89	0.35	5.24
30	S. Mgto Oeste-B	2.58	0	4	4	5.05	1.16	6.21
31	S. Mgto Oeste-C	1.45	0	4	1	4.23	0.90	5.13
32	Via España (M. Sosa–F. Cordoba)	2.51	4	5	1	2.87	0.04	2.91
33	Via José A. Arango	6.68	2	4	1	6.50	0.07	6.57
34	Ave. José M. Torrijos	6.60	2	4	2	6.93	0.07	7.00
35	Via El Paical	2.49	2, 0	4	1	3.70	2.71	6.41
36	Via Ramón Arias	0.90	4	4	–	0.21	0.97	1.18
37	Extension Martin Sosa	2.12	0	4	1	3.27	–	3.27
38	Via Bella Vista	1.54	2	4	–	1.76	0.42	2.18
39	Extension Via Argentina	1.41	2, 0	4	3	3.64	0.84	4.48
40	Extension Calle 34 Este	1.41	2, 0	4	1	2.56	3.51	6.07
41	Extensión Autopista	3.38	0	4	1	4.73	1.69	6.42
42	S. Miguelito Este	2.85	0	2	–	1.83	0.71	2.54
43	S. Mgto-Hipodromo	3.74	0	2	–	4.39	0.47	4.86
44	Via Club de Golf	2.13	0	4, 2	–	2.32	0.95	3.18
45	Via Juan Díaz Sur	1.22	0	2	–	0.77	0.24	1.01
46	Via San Antonio	0.85	0	4	–	1.21	0.09	1.30
47	Via Ciudad Radial	1.90	2, 0	4	1	2.96	0.06	3.02
48	Vías Santa Ana	0.15	2, 0	2	–	0.14	4.08	4.22
50	Via Central Arraiján	4.50	2	4	2	4.59	0.04	4.63
51	Via Central Nov. Arraijan	4.35	2	4	2	5.05	0.04	5.09
52	Via Central Chorrera	12.72	2	4	–	11.35	0.09	11.44
53	Anillo Arraiján	15.75	2, 0	2	2	6.12	0.27	6.39
54	Anillo Nov. Arraiján	8.45	2, 0	2	3	3.36	0.21	3.57
55	Anillo Chorrera	29.90	2, 0	2	3	11.54	0.32	11.86
209	Club X	–				3.62	–	3.62
210	Las Sabanas	–				3.79	–	3.79
222	Branca Plaza	–				3.25	–	3.25
223	Contraboría	–				2.61	–	2.61
224	Iglesia Del Carmen	–				5.76	1.80	5.76
225	Multicines	–				3.25	0.54	3.25
226	Ent San Miguelito	–				2.53	–	2.53
229	Balmoral	–				2.97	–	2.97
230	Motores Colpan	–				3.61	1.08	3.61
231	Galerias Obarrio	–				4.33	1.62	4.33
232	Aeropuerto Paitilla	–				2.08	–	2.08
TOTAL		240.98				293.13	65.36	353.36

Note: * Including grade separated Intersections.
Source : ESTAMPA

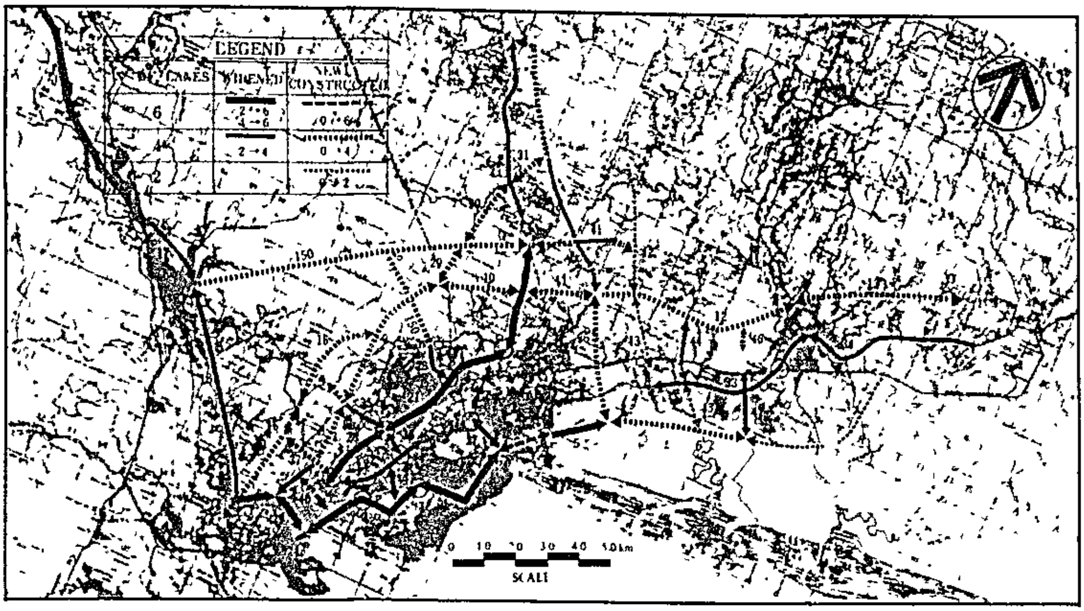


FIG. 13-2 ROAD PROJECT MAP

Road projects consist of the construction of 25 new road sections and the upgrading of 29 existing road sections. Because Autopista is now under construction, this project (including the access road from Via Ricardo J. Alfaro to the interim interchange between Gaillard Highway and Via Transistmica) is treated as an existing project and its cost is not accounted for, although it is included in the project list of Table 13-1.

Major upgrading projects are: the widening of Ave. Balboa (2) – Via Paitilla/Via Israel (3), the widening of the section of Carretera Boyd Roosevelt west of San Miguelito (20, 21, and 22), upgrading of Via Cerro Ancon (19) to a 6-lane road, the widening of Gaillard Highway (18), the upgrading of Via Jose A Arango (33)/Via Ramon Arias (34), and the widening of the section of Pan American Highway in the urban parts of Arraijan and LA Chorrera (50, 51, and 52). Of the new roads to be constructed, the important one is Corredor Norte, the road which will run north of, and in parallel to, Via Ricardo J. Alfaro up to Via Transistmica (8 – 11). This road will be further extended to east (12 and 13) in the future in response to the urbanization of Cerro Viento/Villa/Lobos. Other important new roads are Corredor Sur (6, 7), which will go through the northern edge of mangroved area on Juan Diaz coast and streets to support urban development in the reverted area and suburban areas (15, 16, 43 – 46, and 53 – 55), which will enhance the network of east-west arterials.

A total of 21 multi-level crossing intersections are recommended in area east of the Canal, ten of which are existing intersections. Of the existing, important in view of the current traffic condition are; intersection at the entrance of San Miguelito (226), Motores Colpan intersection (230), and Martin Sosa intersection (222).

(2) Public Transport Project

Projects recommended in the area of public transport are those for bus rerouting, the construction of bus centers and a bus pool for the purpose of improving bus service, as well as conditional introduction of a rail transit system for service commencement at the end of this century.

a) Bus Rerouting

Bus route modifications, staged merging/abolition of certain bus routes, introduction of express bus service, introduction of circulating city bus service, and the reorganization and improvement of institutional systems as needed to achieve the route projects.

b) Construction of Bus Centers

- o El Maranon Bus Center (69 berths)
- o New CBD Bus Center (40 berths)
- o San Miguelito Bus Center (23) berths)
- o Chanis Bus Center (34 berths)

c) Construction of a Bus Pool

- o Albrook Bus Pool (4.5 hectares)

d) Construction of a Rail Transit System

- o El Maranon – San Miguelito – Urbanizacion Cerro Viento (about 16 kilometers)

(3) Traffic Management Projects

Traffic management aims at the safer and more efficient use of a given transport facility, and the way in which this is accomplished varies depending on the traffic demand structure, the pattern of traffic accidents, and the pattern of traffic congestion in each locality. The economy of traffic management projects is very high, because their cost is relatively small but their effects are substantial when projects are well designed and properly implemented. It is important that traffic management system is not rigidly fixed for a long term future; it should be updated from time to time in response to change of attendant conditions so that flexible operation of facilities can be achieved. In this sense, a long term traffic management plan is not only useless but, rather, harmful. Only projects that should be implemented within the time frame of two or three years for the solution of mitigation of existing problems are recommended hereby, provided that signal installation and parking space development projects have been formulated in a medium range perspective.

(a) Signal Control Projects
(b) Intersection Improvement Projects
(c) Safety Facilities Development Projects
(d) Traffic Regulation Projects

2) **Project Package**

A number of projects functionally connected with each other are grouped into a project package, for the convenience of project scheduling and evaluation.

The masterplan consists of a very large number of projects, and it is in fact nearly impossible to arrange all of these projects in chronological order, on the axis of time from now to the year 2000, in accordance with their individual priority while considering yearly fund allocations. Also for individual evaluation, some projects are too small from the standpoint of methodology, and some other projects are inappropriate in terms of their nature. Therefore, project scheduling and evaluation are facilitated by rearranging the project list of the previous sub-chapter 13-1 into a number of project packages, each consisting of a core projects and accompanying projects (those which are desirably implemented concurrently with the core project, or those whose implementation is preconditioned upon the core project implementation).

Care should be used in project packaging so as that both "Hardware" projects (projects for roads, bus centers, and other facility construction) and "software" projects (projects pertaining to bus rerouting, organizational and institutional renovation, traffic regulations, and other aspects of traffic management) are carefully matched in each package, because the two are supplemental to each other and the absence of either will lead to wasteful investment.

Two or more mutually related construction projects should also be combined into the same package. If either of any two geographically neighboring projects cannot function without the other, the two are functionally related with each other. Then, they are to be connected with a line on the project packaging diagram. If functionally related projects are thus connected one after another, all projects of masterplan will eventually be connected because, after all, any two geographically neighboring projects must be related with each other much or less. This project conglomeration, which defeats the purpose of project packaging should be avoided. Packages of a reasonable can be achieved by selecting a number of core projects (large investment, substantial effect on urban transport), and placing, around each core project, the projects which are deeply related with it. Those having a limited relationship with the core project are disconnected from it.

Centro Traffic Improvement Project Package is presented in Fig. 13-3 as an example. In this package, core projects are the construction of a 6-lane road called Via Cerro Ancon, the construction of Maranon Bus Center, and bus rerouting. Deeply connected to these core projects are traffic control, express bus service introduction, mini bus service introduction and the construction of Albrook Bus Base. It is desirable that all of these projects are implemented at the same time.

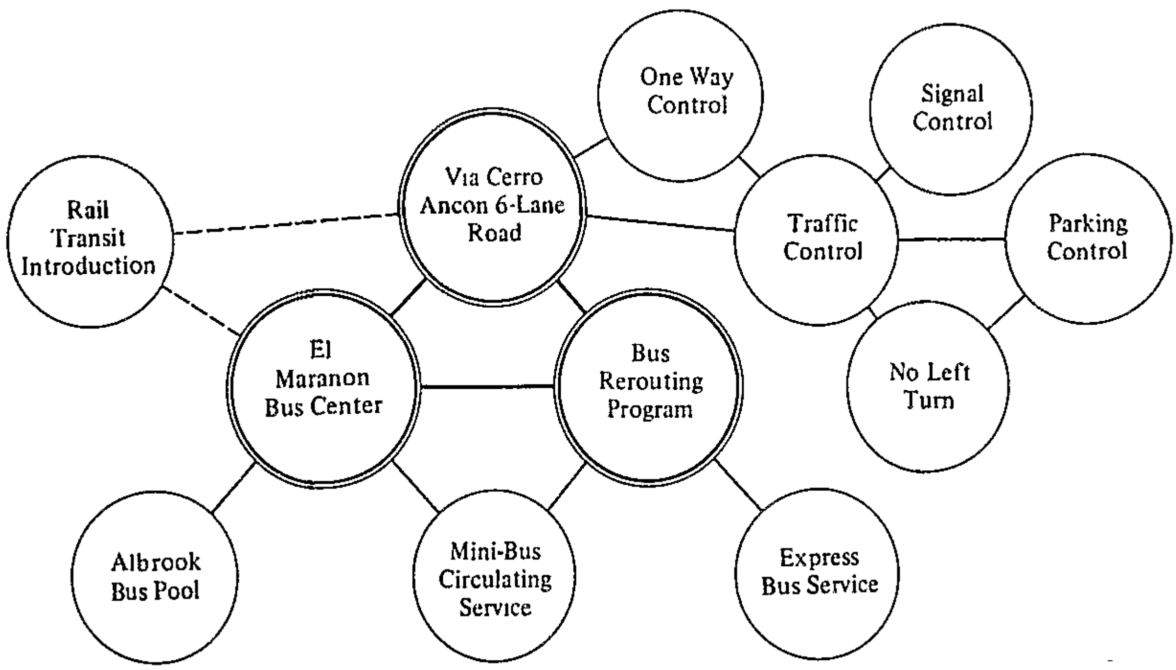


FIG. 13-3 CENTRO TRAFFIC IMPROVEMENT PROJECT PACKAGE

Also, the rail transit service introduction project, which will possibly be implemented in Centro in the future, is connected by a broken line, indicating that land space requirement for this project and the relationships of rail stations with roads and bus centers should be taken into consideration upon designing.

Another project packaging example is the road project package, presented in Table 14-4 in Chapter 14 as an example of economic evaluation of road projects.

3) Estimation of Available Investment Funds

(1) Past Investment Trend

The amount of road investments by the Central Government of Panama doubled, or grew by an average annual rate of 15.5%, from 1975 to 1980 (see Table 13-2). If the rate of inflation is estimated to have been 8% per annum, this was an increase of 7% per annum in real term. During the same period of time, Central Government investments in the entire sector of transportation increased by 4.6% per annum and its total development investments, by 5.6% per annum–both being a negative growth in real term. From 1978 to 1980, road investments represented 10% to 12% of total government investments, but if this trend continues, the result will be an unrealistic investment fund allocation pattern with a rapid expansion in the share

TABLE 13-2 PUBLIC INVESTMENT EXPENDITURES IN THE TRANSPORT SECTOR, 1975-1980

(in millions of current Balboas)

Sector\Year	1975	1976	1977	1978	1979	1980
Transport Sector	47.3	64.3	62.8	71.9	69.5	59.2
Roads	28.5	35.9	31.6	44.0	39.1	53.6
Rail Transit	–	–	–	–	–	–
Airports	16.5	25.0	17.4	6.3	4.8	0.5
Ports	2.3	3.4	13.8	21.6	25.6	5.1
Other Sectors	295.9	340.7	346.2	327.4	323.0	392.0
Total Investment	343.2	405.0	409.0	399.3	392.5	451.2
Transport as % of Total	14	16	15	18	18	13
Roads as % of Total	8	9	8	11	10	12

Source: IBRD Report "Road Rehabilitation Project, Panama" April, 1981

of road investment alone. In this view, road investments cannot be expected to grow in the future at the past trend, unless the government's development investments will, as a whole, grow.

In order for the Panamaian national economy to be able to sustain a yearly growth of 3.5% in terms of GDP, the government development investments must continue to grow by at least 5% per annum, as it was pointed out in the discussion of economic frame in Chapter 8. The sectral allocation of investment funds depends on the government's development policy, but the cumulative total of road investments to be made by the end of this century will be estimated under the assumption that such investments will continue to grow at the same pace as will the entire government investments. Regarding the 3 year average of road investments from 1978 to

1980 of about 50 million balboas as the amount of investment in the base year (1980), the cumulative total road investments from 1983 to 1999 will be:

$$50 \times (1 + 0.05)^{i-1} = 2{,}424 \text{ Million Balboas}$$

A review of regional allocation of road investments during the past five years indicates that 20% to 25% went to Panama Metropolitan Area. However, this share will possibly shrink gradually, because the Government has annuciated its policy to strive for the development of the currently undeveloped roads in parts outside the Metropolitan Area.

If 15% to 20% share can be assumed for the Metropolitan Area for the period from now to 1999, investment will accumulate to 364 million to 485 million balboas. This exceeds the 350 million balboas recommended by Masterplan, but, in view of the need of investments in collector and local roads, as well as in bus facilities, in addition to the road development, it is believed reasonable to expect that investments in road sector will increase by 5% per annum and the Metropolitan share in those investments will range between 15% and 40%—and these values can be used as targets to strive for.

(2) Revenue Augmentation Effect of New Taxes

In Chapter 10 of this Masterplain, it was suggested that gasoline/diesel fuel tax be raised under the "principle of benefit" in order to generate funds for the development of traffic facilities and the improvement of public transport system, and, further that motor vehicle tax be levied for the purpose of curbing passenger car uses and stimulating the use of public mode of transport, with its revenue also utilize for investment for the development of transportation sector. Here, cumulative total revenues from these taxes by the end of this century will be estimated.

a) Number of Motor Vehicles and Yearly Total Mileage

The number of motor vehicles in the Planning Area and that in the entire Republic are estimated in Table 13-3 (see Chapter 9, Sub-Chapter 2) for estimation). The Planning Area presently represents 53% of all motor vehicles in the nations, and this share will ascend yearly in the future to reach an estimated 60% in the year 2000.

TABLE 13-3 PROJECTION OF PRIVATE VEHICLES

(1000 Vehicles)

	1980	1985	1990	1995	2000
Planning Area	52	74	98	127	161
Other Areas	46	61	77	92	107
Republic Total	98	135	175	219	268

Note: Excluding official vehicles and vehicles in the Canal Area

Source: ESTAMPA

Average yearly mileage per motor vehicle is usually shorter in urban areas than in rural. An average of 8,000 kilometers is assumed for Planning Area and 12,000 kilometers for outside the Planning Area.

b) Taxation Schedule

In order for the objective taxes to be effective for the purpose of establishment, the rate of gasoline; diesel fuel surtax must be at least 30% of market price sans existing tax and motor vehicle tax, at least 240 balboas per vehicle per year. However, the creation of this taxes abruptly at these levels of burden will be unreasonable. In order to achieve the intended level of taxation on a gradual basis by the end of this century, a tax schedule has been designed as presently in Table 13-4.

TABLE 13-4 SCHEDULE OF NEW OBJECTIVE TAX INTRODUCTION

Tax\Year			1982-1984	1985-1990	1991-1995	1996-2000
Fuel Tax	Rate (%)	Gasoline	0	20	25	30
		Diesel	0	10	15	20
	Tax (¢/litter)	Gasoline	0	6	7	8
		Diesel	0	3	5	6
Motor Vehicle Ownership Tax and Insurance (Balboa/Year)			0	80	160	240

Source: ESTAMPA

The current (end of 1981) market price of gasoline is 56 centavos per liter and that of diesel fuel, 32 centavos, but the former is believed to include a tax of about 50%. In this view, the object tax on gasoline will be livied at the rates enumerated in Table 13-4 against the taxable standard corresponding to one-half the market price.

Motor vehicle tax will be established first at the rate of 80 balboas per vehicle per year in 1985, and the rate will be gradually raised to reach 240 balboas per vehicle per year within ten years.

c) Tax Revenue

Revenue from these taxes have been estimated for periods up to 2000, assuming that the current ratio of diesel-engined vehicles to all motor vehicles of 30% in the Planning Area will remain constant in the future. The result of this estimation is presented in Table 13-5.

d) Investment Allocation to the Planning Area

The Planning Area accounts for 39% of the national population and for 53% of all motor vehicles in the Republic, but these shares are expected to rise to 50% to 60%, respectively, by the year 2000. Also, the Planning Area is responsible for the majority of Tax revenue increases shown in Table 13-5. In view of these facts, nothing stands in argument against raising the investment allocation ratio to the Planning Area to over 50%.

On the other hand, however, demand for road development is strong in rural parts. Roads for agricultural and mining development are also highly needed. If 20% to 25% of the objective tax revenue from the Planning Area is allocated to rural parts, retaining the remaining 75% to 80% for the Area, the Planning Area will have a 40% share in the total Republic's revenue from these taxes. Then, the amount allocated to the Planning Area will be as shown in Table 13-6. The cumulative total to 2000 will be 330 million balboas, which will nearly meet the investment need of 350 million balboas contemplated under this Masterplan.

TABLE 13-5 REVENUE FROM THE NEW OBJECTIVE TAXES

(Million Balboa in 1981 price, Percent)

Tax \ Year		1985–1990	1991–1995	1996–2000	Total
Motor Vehicle Ownership Tax	Planning Area	41.0	89.6	172.1	302.7
	Other Area	33.0	67.5	119.3	219.8
	Republic Total	74.0	157.1	291.4	522.5
Fuel Tax	Planning Area	31.9	44.8	66.7	143.4
	Other Area	38.5	50.7	74.1	163.3
	Republic Total	70.4	96.5	140.8	306.7
Total	Planning Area	72.9	134.4	238.8	446.2
	Other Area	71.5	118.2	193.4	383.1
	Republic Total	144.4	252.6	432.2	829.2
Composition (%)	(by Period)				
	Planning Area	16	30	54	100
	Other Area	18	31	51	100
	Republic Total	17	30	53	100
	(by Area)				
	Planning Area	50	53	55	54
	Other Area	50	47	45	46
	Republic Total	100	100	100	100

Source: ESTAMPA

TABLE 13-6 FUND AND INVESTMENT FOR THE PLANNING AREA

(Million Balboas in 1981 Price)

	1985–1990	1991–1995	1996–2000	Total
Fund from new Tax (40% of total)	57.8	101.0	172.9	331.7
Investment for Road Development	105.5	122.8	121.6	350.0

Source: ESTAMPA

4) Investment Schedule

In order to decide an investment schedule by alinging numerous projects on the axis of time. a multitude of scheduling conditions must be considered simultaneously. It is intended that an investment schedule be decided which will be in pace with economic growth, will achieve early implementation of those projects designed to solve already surfaced problems, will maintain a balance and harmony with existing projects, and will be coherent with the result of traffic volume forecast.

Public investment must be increased by 5% each year, in order that the Panamanian Government's objective of sustaining a long term economic growth of 3% to 5% per annum will be achieved. If the estimated cumulative total road investment in the Metropolitan Area of 350 million balboas is considered to be the result of 5% per annum increase in such investment, the amount which will be investment by 1990 will be 120 million balboas (34% of the cumulative total), the amount which will be invested from 1991 to 1995 will be 100 billion balboas, and the amount which will be invested from 1996 to 2000 will be 130 million balboas. These investment increments can be used as a guidline for determining the proportion at which investment funds are allocated to each period. Also, the indicated amounts of investment increments can be financed with revenue from the road development special tax to be recommended later in this Report.

(1) Road Investment Schedule

The following investment schedule is recommended (in terms of million balboas): 1983 - 1985, 31.2; 1986 - 1990, 72.3; 1991 - 1995, 117.7, and 1996 - 1999, 130.3. The amount of investment in five years from 1983 to 1987 will be 63.9 million balboas, or an average of 12.8 million balboas per year, which will be slightly higher than the previous record. (Fig. 13-4)

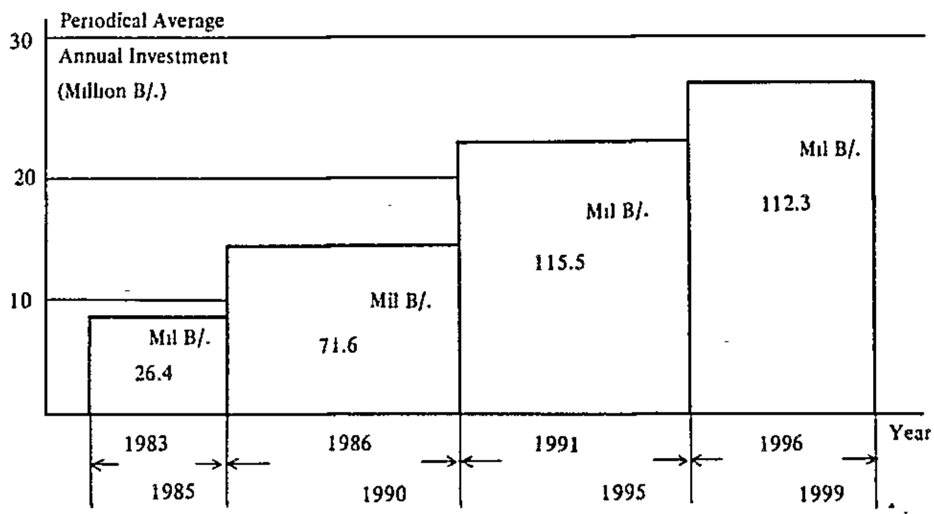


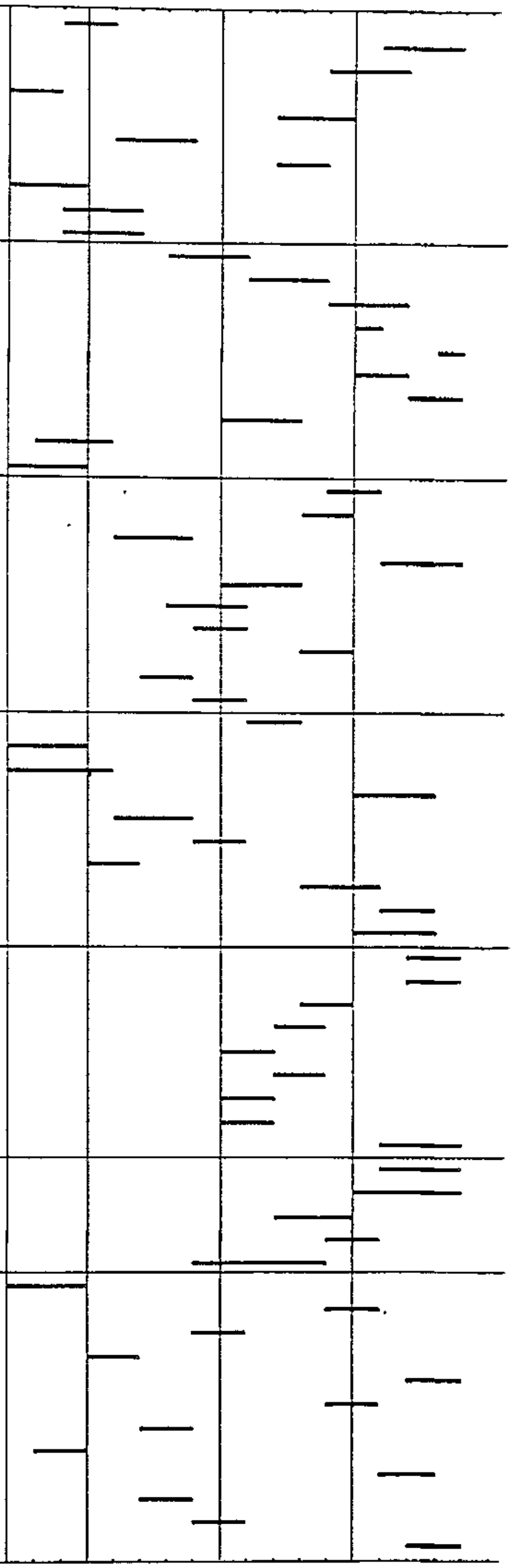
FIG. 13-4 ROAD INVESTMENT BY PERIOD

Major projects scheduled for implementation in the 1980s are: the construction of new Corredor Norte, which will go through the reverted area; the realignment of Via Cincuentenario in Panama Viejo; the construction of Via Cerro Ancon as a 6-lane road; the widening of sections of Via Simon Bolivar, Via Martin Sosa (see Table 13-7). Projects for grade separation at intersections will be implemented in accompaniment to the relevant road construction or upgrading project.

TABLE 13-7 ROAD INVESTMENT SCHEDULE

(Million B/.)

No.	Project	Investment Amount	Economic Cost
1	Calle 17 (Ave. B-Central)	5.40	5.32
2	Balboa (Ave. B-Brasil)	5.62	5.11
3	Balboa (Via Brasil-11 de Oct.)	8.75	8.13
4	Ave. Panama Viejo	6.37	5.87
5	Ave. Nuevo Panma	6.94	6.30
6	Corredor Sur A	6.40	5.85
7	Corredor Sur B	4.84	4.51
8	Corredor Norte (Via Curundu)	7.83	7.06
9	Corredor Norte-A	8.29	7.47
10	Corredor Norte-B	6.78	6.38
11	Corredor Norte (Via Samaria)	7.96	7.46
12	Corredor Norte-C	12.97	11.91
13	Villa Lobos-CPA	9.33	8.54
14	Gaillard Roosevelt	0.74	0.68
15	Via Albrook-A	1.80	1.62
16	Via Albrook-B	5.37	4.87
17	Gaillard Miraflores	3.04	2.74
18	Gaillard Clayton	6.69	6.04
19	Via Cerro Ancon	7.50	7.29
20	Via Bolivar (M. Sosa-V. Brasil)	3.71	3.40
21	Via Bolivar (V. Brasil-S. Mgto.)	8.14	7.40
22	Via Bolivar (S. Mgto-S. Isidro)	7.67	6.93
23	Via Bolivar (S. Isidro-A. Diaz)	5.78	5.21
24	Via Bolivar (A. Diaz-Chilibre)	14.53	13.10
25	S. Miguelito Central	8.52	7.68
26	S. Miguelito-Chanis	8.64	7.95
27	Ave. E. T. Lefevere	1.99	1.83
28	Betania Central	7.79	7.58
29	S. Mgto. Oeste-A	5.24	4.76
30	S. Mgto Oeste-B	6.21	5.71
31	S. Mgto Oeste-C	5.13	4.73
32	Via España (M. Sosa-F. Cordoba)	2.91	2.63
33	Via José A. Arango	6.57	5.93
34	Ave. José M. Torrijos	7.00	6.31
35	Via El Paical	6.41	6.05
36	Via Ramón Arias	1.88	1.79
37	Extension Martin Sosa	3.27	2.95
38	Via Bella Vista	2.18	2.01
39	Extension Via Argentina	4.48	4.12
40	Extension Calle 34 Este	6.07	5.82
41	Extension Autopista	6.42	5.98
42	S. Miguelito Este	2.54	2.36
43	S. Mgto-Hipodromo	4.86	4.44
44	Via Club de Golf	3.18	2.97
45	Via Juan Díaz Sur	1.01	0.94
46	Via San Antonio	1.30	1.18
47	Via Ciudad Radial	3.02	2.73
48	Vias Santa Ana	4.22	4.20
50	Via Central Arraiján	4.63	4.17
51	Via Central Nvo. Arraiján	5.09	4.59
52	Via Central Chorrera	11.43	10.31
53	Anillo Arraiján	6.39	5.79
54	Anillo Nov. Arraiján	3.57	3.24
55	Anillo Chorrera	11.86	10.72
150	Autopista	0.0	0.0
209	Club X	3.62	3.37
210	Las Sabanas	3.79	3.52
222	Branca Plaza	3.25	3.00
223	Contraloría	2.61	2.44
224	Iglesia Del Carmen	5.76	5.40
225	Multicines	3.25	2.98
226	Ent San Miguelito	2.53	2.28
229	Balmoral	2.97	2.70
230	Motores Colpan	3.61	3.36
231	Galerias Obarrio	4.33	4.06
232	Aeropuerto Paitilla	2.08	1.91
TOTAL		354.06	325.07



Note: As the Autopista is under construction, the cost is eliminated, regarding as a sunk cost.

Source: ESTAMPA

(2) Public Transport Investment Schedule

The construction of four bus centers and Albrook Bus Base is scheduled for the latter half of the 1980. Projects for bus rerouting, express bus service introduction, circulating city bus service introduction, and mini bus service introduction will be implemented at the time each relevant bus center is opened for service. The renewal and strengthening of bus fleets will be continued as private projects (Table 13-8).

TABLE 13-8 INVESTMENT SCHEDULE OF PUBLIC TRANSPORTATION PROJECTS, 1983–1990

Project	Cost (million B/.)		Year							
	Financial	Economic	83	84	85	86	87	88	89	90
1 Bus Center										
El Maranon	5.8	5.2								
Curundu Norte	3.7	3.3								
San Miguelito	3.6	3.2								
Chanis	1.9	1.7								
2 Albrook Bus Pool	3.6	3.2								
3 Bus Rerouting Program	–	–								
Total	18.6	16.6	83	84	85	86	87	88	89	90

Source: ESTAMPA

(3) Traffic Management Projects

In the area of traffic management, only short term projects to be implemented in 1983 to 1985 are recommended. Signal control projects (4.4 million balboas) are scheduled for implementation in 1983 to 1984, intersection improvement projects (8.6 million balboas), chiefly in 1984 and 1985, and safety facilities installation projects (2.9 million balboas), in 1984. (See Table 13-9).

TABLE 13-9 INVESTMENT SCHEDULE OF TRAFFIC MANAGEMENT PROJECTS, 1983-1985

Project	Cost (Million B/ .)		Year		
	Financial	Economic	1983	1984	1985
1 Traffic Signal Installation	4.4	4.0			
2 Intersection Improvement	8.6	7.7			
3 Safety Device Installation	2.9	2.6			
4 Traffic Restriction Program	–	–			
Total	15.9	14.3	1983	198	1985

Source: ESTAMPA

CHAPTER 14.

PLAN EVALUATION

14. PLAN EVALUATION

The plans and projects discussed in the previous Chapters are subject to cost-benefit analysis from economic and financial viewpoints. This is achieved by comparing the benefit to derive from the realization of the plan against its cost. In economic evaluation, benefits and costs are calculated from the viewpoint of the Panamanian economy, or of the regional economy of the Planning Area. while in financial evaluation, benefits and costs are calculated from the standpoint of the entity which will operate the project to be evaluated. Financial analysis, therefore, is limited to revenue producing projects, the entity of whose operation is clearly identifiable, namely, bus center projects and rail transit project. (Although the Bus Pool is envisaged to be operated by the same entity as of the Bus Centers, it is not analized here due to the uncertain factors such as the bus parts prices and parts stock costs.)

While the transportation sector consumes a huge quantity of energy each year, petroleum consumption is a heavy burden on the economy of any country in the world (with the exception of some oil producing countries). Panama is no exception to this and petroleum and petroleum products represent about 30% of its total importation. The discussion of transport energy consumption and its assessment from national economy viewpoint fall in the realm of economic evaluation, but, in view of the particular importance of energy problem to Panama, it will be treated separately and independently.

1) Economic Evaluation

(1) Benefit and Cost

The construction of a road brings about diverse benefits. The construction of a road with fine alignment and surface, and with an adequate capacity vis-a-vis transport demand, will result in lower motor vehicle operation cost and higher safety. If travel time can be reduced, the time thus saved can be directed for productive undertakings for a greater income. The benefit of favorable traffic conditions to passengers and cargo carriers will be a higher vehicle turnover ratio, savings in parking costs, and the stimulation of transport demand. Those benefits directly resulting from the transport facility development are called direct benefits, while the vitalization of the economy both in the aspects of production and consumption through high-density utilization of land, which, in long term, result from a higher land value due to improved accessibility by the construction of a road, is called the development benefit of the road.

Some of these benefits are hardly quantifiable. Improvements in amenity or safety may not be easily measured, and the accurate definition of long term development benefits of urban road development is in fact nearly, if not totally, impossible. If somehow measured, cost-benefit analysis based on unreliable benefit measurement will undesirably distort the result of evaluation. Therefore, of direct benefits, only that which is known to exist and which is easily quantifiable–namely, vehicle operating cost–is used for the present evaluation. It follows that whether projects whose feasibility is judged low based on such economic evaluation should be implemented or not should be decided through the review of aspects other than vehicle operating cost.

In the evaluation of Masterplan, as a whole, benefit is defined as the difference between the total vehicle operating cost in "do nothing" case and the total vehicle operating cost when Masterplan is fully carried out (see Fig. 14-1). On the other hand, in the evaluation of each constituent project, the total operating cost increment resulting from the exclusion of the project from Masterplan is regarded the benefit of that project. For this purpose, the case of Masterplan realization, rather than do-nothing case, is used as the base of comparison, in an attempt to clarify the significance of the project in the process of Masterplan realization.

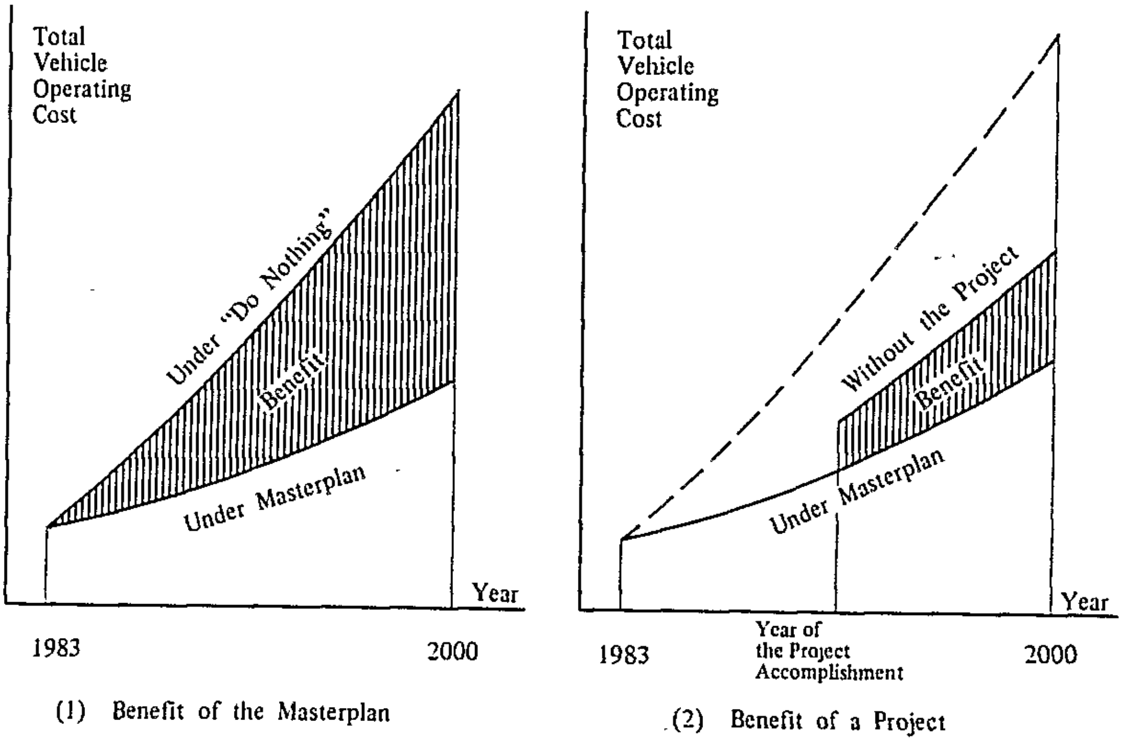


FIG. 14-1 ECONOMIC BENEFIT OF THE MASTERPLAN AND A PROJECT

Benefits are calculated up to the year 2000. Accordingly, project cost is defined as the depreciation expense up to 2000 of the facilities constructed. That is, the undepreciated residual value of each project in 2000 is accounted for in 2000 as a negative cost. Also, for economic evaluation and analysis, all costs are economic costs expressed in market value after the deduction of taxes.

Cost and benefits, thus calculated, are input for ordinary discounted cash flow analysis in calculating indices (benefit/cost ratio, net current value, internal rate of turn) for project evaluation.

(2) Vehicle Operating Cost

Vehicle operating cost consists of running cost, which is a variable expense, and fixed expense. The former depends on the distance driven, and the latter, on running time. The two are broken into the following items:

A. Running Cost

a) Fuel Cost
b) Lubricant Oil Cost
c) Tire Cost
d) Maintenance and repair Cost
e) Distance-dependent Depreciation Cost

B. Fixed Cost

a) Time-dependent Depreciation Cost
b) Capital Opportunity Cost
c) Crew Cost

d) Overhead, license, etc.
e) Insurance Cost

Motor vehicles are classified into four types: passenger cars, light trucks, trucks, and buses, based on the definition presented in Table 14-1. Using the data of Panama City, the values of the above costs are obtained for each type of motor vehicle. The results are presented in Table 14-2.

In Table 14-2, depreciation expense is partly accounted for as a variable expense, and partly as a fixed expense. The former represents the wear of equipment, and the latter, devaluation by obsolescence. Their ratios are set at 50 : 50 for passenger cars, 70 : 30 for trucks and light trucks, and 85 : 15 for buses.

TABLE 14-1 VEHICLE CHARACTERISTICS AND COST

Vehicle Characteristics	Car	Light Truck	Truck	Bus
1. Fuel Type	Gasoline	Diesel	Diesel	Diesel
2. Gross Veh. Weight (metric tons.)	1.20	4.45	14.33	8.17
3. Financial Cost (new vehicle)	7,323	13,482	28.350	44,000
4. Economic Cost (new vehicle)	5,575	8,500	18,500	37,000
5. Annual Operating Hour	1,200	1,500	1,500	2,250
6. Annual Operation Distance (kilometers)	15,000	30,000	30,000	45,000
7. Average Vehicle Life (years)	10	12	12	15

Source: ESTAMPA

TABLE 14-2 VEHICLE OPERATING COST

(1) SUMMARY OF RUNNING COSTS

(Cents/Vehicle/Km)

Cost Item	Car	Light Truck	Truck	Bus
Financial Cost				
1. Fuel	7.84	6.72	9.92	9.28
2. Lubricant Oil	0.19	0.38	0.85	0.85
3. Tire	0.39	0.74	2.05	1.92
4. Spare Parts	0.67	1.19	3.46	13.99
5. Maintenance Labour	0.40	0.33	2.50	3.00
6. Depreciation (Distance related)	2.27	2.44	4.74	6.68
7. Total	11.76	11.80	23.52	32.72
Economic Cost				
1. Fuel	3.92	6.72	9.92	9.28
2. Lubricant Oil	0.19	0.38	0.85	0.85
3. Tire	0.35	0.70	1.96	1.82
4. Spare Parts	0.51	0.75	2.26	11.77
5. Maintenance Labour	0.38	0.30	2.38	2.84
6. Depreciation (Distance related)	1.72	1.52	3.03	5.61
7. Total	7.07	10.37	20.40	32.17

(2) SUMMARY TABLE OF FIXED COST

(Cents/Vehicle/Km)

Cost Item	Car	Light Truck	Truck	Bus
Financial Cost				
1. Depreciation (Time related)	28.4	12.6	40.7	23.6
2. Capital Opportunity Cost	30.5	4.9	94.5	97.8
3. Crew Cost	–	160.0	250.3	170.2
4. Insurance Cost	17.4	4.0	20.0	16.0
5. Overhead Cost	–	–	40.6	–
6. Total	76.3	181.5	446.1	307.6
Economic Cost				
1. Depreciation (Time related)	21.6	7.8	26.0	19.8
2. Capital Opportunity Cost	23.2	2.8	61.7	82.2
3. Crew Cost	–	153.0	237.5	162.0
4. Insurance Cost	16.5	3.8	19.0	15.2
5. Overhead Cost	–	–	34.4	–
6. Total	61.3	167.4	378.6	243.2

Source: ESTAMPA

The data which supported the calculation of each cost item are presented at the end of this Chapter. The unit costs, thus calculated, are multiplied by the total running distance and total running time, obtained as the result of traffic assignment, in arriving at total vehicle operating cost.

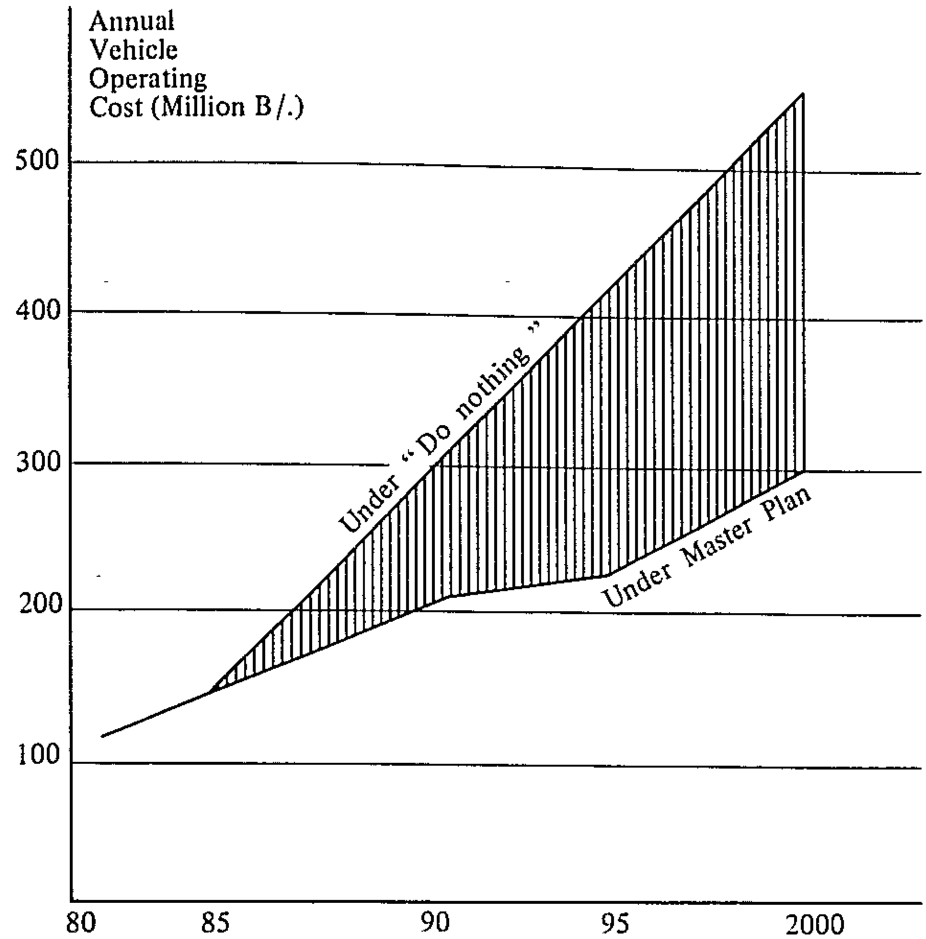
(3) Evaluation Result

The benefits expected to derive from the realization, according to the schedule, of Masterplan are presented in Fig. 14-2. The benefits expected in 1990 amount to 89.5 million balboas, and those in 2000, as much as 262.6 million balboas, and cumulative benefit from 1983 through 2000 is 2,023.7 million balboas (all in 1981 prices) (see Table 14-3).

On the other hand, the net cost of the road Masterplan up to the year 2000 is 89.3 million balboas, arrived at by deducting from the 327.6 million balboas of total investment under Masterplan in terms of economic cost, the residual value of 238.3 million balboas (depreciation over the life of 30 years) in 2000. After discount at the rate of 12%, total benefit amounts to 507.3 million blaboas, the total cost, 80.0 million balboas, and the net current value, 427.5 million balboas, as shown in Table 14-3. Benefit/cost ratio is a favorable 6.34. Over 100% internal rate of return is shown, but this indicator is unsuitable to the evaluation of a projects under which expenses are continuously incurred along with and in parallel to benefits throughout the entire period for evaluation, such as in the case of this Masterplan.

With the addition of a rail transit project (service commencement in 1995), the road Masterplan now shows a lower but still high enough benefit/cost ratio of 3.42 to prove its economic soundness.

For the convenience of project evaluation, related road projects are grouped into project packages as shown in Table 14-4. Package Numbers 1 consists of projects to be implemented east of the Canal and Number 2, those to be implemented west of the Canal. Package Numbers 3 through 8 are those grouped by the period of implementation. Functionally related projects are grouped into



TOTAL VEHICLE OPERATING COST
(million Balboas in 1981 price)

Year	" Do Nothing "	Masterplan	Saving
1981	113.5	113.5	–
1990	294.7	205.2	89.5
2000	545.9	283.3	262.6

FIG. 14-2 REDUCTION OF VEHICLE OPERATING COST BY ROAD MASTERPLAN

Package Numbers 9 through 28 (See Table 14-5).

Project packages to be implemented east of the Canal, as a whole, show a higher benefit/cost ratio than Masterplan. Conversely, those to be implemented west of the Canal show a relatively low evaluation. Separated into the periods of implementation, the economy of projects to be invested prior to 1990 is very favorable, while those invested in the 1990s show a relatively low investment efficiency. These facts only prove the soundness of Masterplan.

TABLE 14-3 ECONOMIC EVALUATION OF ROAD MASTERPLAN T

(Million Balboas in 1981 price)

Year	Before Discount			After Discount by 12%		
	Benefit	Cost	B–C	Benefit	Cost	NPV (B–C)
1983	0.0	1.5	–1.5	0.0	1.3	–1.3
1984	0.0	12.3	–12.3	0.0	9.8	–9.8
1985	14.2	12.5	1.7	10.1	8.9	1.2
1986	29.3	16.4	12.8	18.6	10.4	8.1
1987	44.3	15.9	28.5	25.1	9.0	16.1
1988	59.4	10.5	48.9	30.1	5.3	24.8
1989	74.4	19.8	54.6	33.7	9.0	24.7
1990	89.5	9.2	80.3	36.1	3.7	32.4
1991	101.4	27.0	74.4	36.6	9.8	26.8
1992	113.4	18.0	95.3	36.5	5.8	30.7
1993	125.3	27.1	98.2	36.0	7.7	28.2
1994	137.2	21.6	115.6	35.2	5.6	29.7
1995	149.2	22.7	126.5	34.2	5.2	29.0
1996	171.9	25.2	146.6	35.1	5.1	30.0
1997	194.6	24.8	169.7	35.5	4.5	31.0
1998	217.3	31.4	185.8	35.4	5.1	30.3
1999	240.0	32.1	207.9	34.9	4.6	30.3
2000	262.7	0.4	262.3	34.1	–	34.1
Residual Value*	–	–238.3	238.3	–	–31.1	31.1
TOTAL	2033.7	89.3	1934.3	507.3	80.0	427.5

Note: Residual value is the sum of investment minus depreciation up to the end of 2000.

Source: ESTAMPA

Excepting for a several small projects, all project packages are feasible. The economy of Corredor Norte, Corredor Sur, and the north-south arterial in the east of Panama Urban Area, which, together, form a skeleton of the future road network, is proven particularly favorable. Streets in the reverted area, extenion of Autopista, and San Miguelito – Hipodromo Road, which are planned for implementation toward the end of this century, also show good results, and their earlier implementation is worth considering, if funds are available. A review of a number of projects with low economy indicated that, although they will not work to reduce vehicle operating cost, they have important functions of promoting urbanization of suburban areas or as access roads to Autopista.

TABLE 14-4 MAIN PROJECT/PACKAGE FOR EVALUATION

No.	PROJECT/ PROJECT PACKAGE	COMPONENT PROJECT
1	Projects east of the Canal	all except those in No.2 bellow
2	Projects west to the Canal	50, 51, 52, 53, 54, 55
3	Projects in 1983–1987	1, 4, 19, 20, 32, 33, 214
4	Projects in 1986–1990	1, 6, 8, 9, 10, 19, 20, 23, 29, 32, 35, 37, 150, 207, 214, 215, 216, 222, 225, 226, 230
5	Projects in 1991-1995	7, 11, 12, 18, 21, 25, 26, 27, 30, 31, 36, 44, 45, 46, 47, 48, 55, 206, 210, 231
6	Projects in 1996–2000	2, 3, 5, 13, 14, 15, 16, 17, 22, 24, 28, 34, 39, 41, 42, 43, 50, 51, 52, 53, 54, 209, 211, 217, 219, 223, 224, 229, 232, 234, 235
7	Projects in 1983–1990	Nº 3 + Nº 4
8	Projects in 1991–2000	Nº 5 + Nº 6
9	Northern Corridor (I)	19, 8, 9, 10, 29, 37, 35, 214, 215, 216, 207, 225, 222, 230
10	Northern Corridor (II)	11, 12, 13
11	Coastal Corridor (I)	4, 6, 7
12	Coastal Corridor (II)	2, 3, 5, 223, 232, 234, 235
13	Transistmica	20, 21, 222, 230, 226
14	San Miguelito – Chanis	25, 26
15	Gaillard – Clayton	18
16	El Paical – Ramon Arias	35, 36, 225
17	E.T. Lefevre – Betania	27, 28, 210
18	Streets reverted area	15, 16
19	San Miguelito – Hipodromo	42, 43, 219
20	San Miguelito West	30, 31, 206
21	N–S Corridor, eastern area	44, 45, 47
22	Via Cerro Ancon	19
23	Northern Corridor B	10
24	Auto Pista Extension	41
25	Gaillard – Ancon	18, 19
26	San Miguelito East	29, 30, 31

Source: ESTAMPA

TABLE 14-5 EVALUATION OF ROAD PROJECT

No.	Project Package	Construction Period	Construction Cost		Indicators for Evaluation		
			Financial (million B.)	Economic (Billion B.)	B/C	NPV (million B.)	IRR (%)
0	Master Plan as a Whole	1983–1999	354.0	325.7	6.34	427	*
1	All Projects east to Canal	1983–1999	311.1	286.9	6.52	416	*
2	All Projects west to Canal	1990–1999	43.0	38.8	1.63	3	20.4
3	Projects in 1983–1987	1983–1986	34.5	32.2	7.31	131	51.4
4	Projects in 1986–1990	1983–1989	88.7	81.9	6.90	250	75.2
5	Projects in 1991–1995	1989–1995	105.7	97.3	2.46	33	26.8
6	Projects in 1996–2000	1993–1999	153.3	140.6	3.31	25	51.0
7	Projects in 1983–1990	1983–1989	95.1	87.8	8.39	345	*
8	Projects in 1991–2000	1989–1999	259.0	237.9	4.83	127	60.4
9	Northern Corridor (I)	1983–1989	55.4	51.3	3.87	75	59.4
10	Northern Corridor (II)	1989–1997	30.3	27.9	4.58	18	47.4
11	Coastal Corridor (I)	1983–1994	17.6	16.2	4.48	26	30.0
12	Coastal Corridor (II)	1993–1999	23.9	22.0	3.68	5	55.4
13	Transistmica	1983–1993	21.2	19.4	1.05	1	15.3
14	San Miguelito-Chanis	1988–1993	17.2	15.6	1.56	2	17.1
15	Gaillard-Calyton	1991–1993	6.7	6.0	1.16	0	13.7
16	El Paical-Ramon Arias	1986–1991	11.5	10.8	0.19	–3	1.5
17	E.T. Lefevre-Betania	1990–1995	13.6	12.9	1.14	0	13.7
18	Streets in reverted area	1996–1999	7.2	6.5	4.03	1	61.5
19	San Miguelito-Hipodromo	1994–1999	7.4	6.8	2.57	1	34.7
20	San Miguelito West	1990–1993	11.3	10.4	0.77	–1	9.3
21	N–S Corridor, eastern area	1991–1994	8.5	7.8	6.31	8	60.0
22	Via Cerro Ancon	1984–1986	7.5	7.3	1.03	0	12.3
23	Northern Corridor B	1985–1987	6.8	6.4	1.65	2	17.1
24	Auto Pista extension	1998–1999	6.4	6.0	3.55	1	70.0
25	Gaillard-Ancon	1984–1993	14.2	13.3	1.81	5	18.6
26	San Miguelito east	1988–1993	12.4	11.5	0.76	–1	8.9

Note: * indicates that IRR is more than 100%

Source: ESTAMPA

2) Financial Evaluation

(1) Financial Evaluation Model

For the purpose of analyzing conditions necessary for a project to be profitable or financially feasible, models for the prediction of profits and losses, and of cash flow, have been constructed. The entire flow is presented in Fig. 14-3. The step of calculation is explained hereunder. Asn an indicators for evaluation (benefit/cost ratio NPV and FIRR) have been calculated using the amount of profit, (per profit and loss statement, before depreciation of fixes assets and sans interests) as the benefit, and the amount of investment as the cost. The method is the same as that of economic evaluation.

a) Profit and Loss Statement

1. Total Revenues: $SR_t = RT_t + RO_t + RI_t$

1-1 Revenue from fares or facility usages charges : RT_t

1-2 Miscellaneous revenues : RO_t

1-3 Interests received : RI_t

2. Total Expenditures:

$$SE_t = EW_t + EOP_t + EM_t + EOT_t + I_t$$

2-1 Personnel expenses : EW_t

2-2 Operational expenses : EOP_t

2-3 Maintenance expenses : EM_t

2-4 Miscellaneous expenses : EOT_t

2-5 Interests paid : $I_t = IL_t + IS_t$

On long term loans (construction investment portion) : IL_t

On short term loans : IS_t

3. Profit and loss before depreciation:

$$R_t = SR_t - SE_t$$

4. Cumulative profits and losses before depreciation:

$$AR_t = AR_{t-1} + R_t$$

5. Depreciation expenses: DEP_t

6. Profit and loss after depreciation:

$$T_t = R - DEP_t$$

7. Cumulative profits and losses after depreciation:

$$At_t = AT_{t-1} + T_t$$

b) Cash Flow

1. Total Revenues: $INF_t = CP_t + B_t + LN_t + SB_t + R_t$

1-1 Capital : CP_t

1-2 Bonds : B_t

1-3 Loans : LN_t

1-4 Government subsidy : SB_t

1-5 Profit and loss before depreciation : R_t (see above)

2. Total Expenditures: $OTF_t = INV_t + RPL_t + RPB_t$

2-1 Investment : INV_t

2-2 Loan redemption : RPL_t

2-3 Redemption of bonds : RPB_t

3. Fund overs and shorts: $BAL_t + INF_t - OTF_t$

4. Cumulative total of fund overs and shorts:

$$ABAL_t = ABAL_{t-1} + BAL_t$$

c) Formula

1. Revenue from fares: RT_t

$$RT_t = N_t \times P_t \times \beta_1$$

$$P_t = P_o \times (1 + \delta_1)^{\left[\frac{t-1}{m_1}\right]}$$

N_t : Passengers per day

P_0 : Initial year fares

δ_1 : Fare increase rate in every 3 years

β_1 : Number of days per year

[ ] : Gauss' integer notation

2. Miscellaneous revenues: RO_t

$$RO_t = RT_t \times \beta_2$$

β_2 : Miscellaneous revenue rate

3. Personnel expenses: EW_t

$$EW_t = M_t \times S_t \times 12 = M_t \times S_o \times (1 + \delta_2)^{t-1} \times 12$$

M_t : Number of personnel

S_0 : Per capita personnel expense, initial year

δ_2 : Yearly personnel expense increase rate

4. Operational expenses: EOP_t

$$EOP_t = \sum_i OP_{t \cdot 1} = \sum_i \left\{ OP_{o \cdot i} \prod_{k=o}^{t=to} (1 + \gamma^{(1)}_{k \cdot i}) \right\}$$

$OP_{o \cdot i}$: Initial year operation expense of item i

$\gamma^{(1)}_{k \cdot i}$: Rate of inrease of item i in K-th year

5. Maintenance expenses: EM_t

$$EM_t = \sum_i M_{t \cdot i} = \sum_i \left\{ M_{o \cdot i} \prod_{k=o}^{t-to} (1 + \gamma_{k \cdot i}^{(2)}) \right\}$$

$M_{o \cdot i}$: Initial year maintenance expense item i

$\gamma_{k \cdot i}^{(2)}$: Rate of increase of item i in K-th year

6. Miscellaneous expenses: EOT_k

$$EOT_t = OT_t + PT_t$$

$$= OT_o \prod_{k=1}^{t-to} (1 + \gamma_k^{(3)}) + PRO_t \times \gamma_t^{(4)} + TAX_t$$

$$TAX_t = \begin{cases} 0 & (t \leqslant p) \\ T_t \times \gamma_t & \left(\begin{matrix} p + 1 < t \\ AT_{t-1} \geqslant 0 \end{matrix} \right) \end{cases}$$

OT_o : Initial year miscellaneous expenses

PT_o : Initial year fixed property tax

PRO_t : Assessed value of fixed properties

TAX_t : Corporate income tax

$\gamma_k^{(3)}$: Rate of miscellaneous expenses increase in K-th year

$\gamma_t^{(4)}$: Fixed property tax rate

γ_t : Corporate income tax rate

7. Amount of investment: INV_t

$$INV_{t \cdot i} = \sum_i CINV_{t \cdot i}$$

$CINV_{t \cdot i}$: Amount of investment of item i in t-th year

8. Depreciation expense: DEP_t

$$DEP_t = \sum_i \sum_x DINV_{t \cdot i \cdot x}$$

$DINV_{t \cdot i \cdot x}$: Depreciation in t-th year of investment of item x in i-th year

Declining balance method:

$$DINV_{t \cdot i \cdot x} = \begin{cases} 0 & (t - M < 1) \\ CINV_{i \cdot x} \ (1 - d)^{t-M-1} \times d & (1 \leq t - M < N) \\ 0 & (N < t - M) \end{cases}$$

$$d = 1 - (REX_x / CINV_{i \cdot x})^{\frac{1}{N}}$$

Straight line method:

$$DINV_{t\cdot i\cdot x} = \begin{cases} 0 & (t - M < 1) \\ CINV_{i\cdot x} \times (1 - \frac{RES_x}{CINV_{i\cdot x}}) \times d & (1 \leq t - M < N) \\ 0 & (N < t - M) \end{cases}$$

$d = \frac{1}{N}$

d	:	Depreciation rate
RES_x	:	Residual value of item x
M	:	Period of construction
N	:	Useful life

9. Redemption of borrowed funds

1) Redemption of loans

LN_k	:	Amount borrowed in year k
$RPL_{t\cdot k}$	:	Amount of k year loan repaid in year t
$LI_{t\cdot k}$	:	Amount of interest when LN is repaid in year t
$RR_{t\cdot k}$	:	Redemption of k year loan in equal installment (principle and interest)
i	:	Rate of loan interest
m	:	Grace period
n	:	Redemption period

(1) Redemption by equal installments (both principal and interest)

$$RP_{t\cdot k} = LN_k (1 + i) / \sum_{k=o}^{n-1} (1 + i)^k$$

$$LI_{t\text{-}k} = \begin{cases} LN \times i & (1 \leqslant t - k \leqslant m) \\ (LN_k - \sum_{i=k}^{t-1} RPL_{t\cdot k}) \times i & (m + 1 \leqslant t - k \leqslant m + n) \end{cases}$$

$$RPL_{t\text{-}k} = \begin{cases} 0 & (1 \leqslant t - k \leqslant m) \\ RP_{t\cdot k} - I_{t\cdot k} & (m + 1 \leqslant t - k \leqslant m + n) \end{cases}$$

(2) Redemption of loan principal by equal installment

$$RR_{t\cdot k} = I_{t\cdot k} + RPL_{t\text{-}k}$$

$$LT_{t\cdot k} = \begin{cases} Ln_k \times i & (1 \leqslant t - k \leqslant m) \\ LN_k \times (1 - \frac{t\text{-}k\text{-}m\text{-}1}{n}) \times i & (m + 1 \leqslant t - k \leqslant m + n) \end{cases}$$

$$RPL_{t \cdot k} = \begin{cases} 0 & (1 \leq t - k \leq m) \\ LN / n & (m + 1 \leq t - k \leq m + n) \end{cases}$$

2) Redemption of bonds

B_k	:	Issuance amount in k-th year
$RPB_{t\text{-}k}$	:	Amount of redemption of Bk in t-th year
$BI_{t\text{-}k}$	:	Interest on Bk in t-th year
i	:	Interest rate
r	:	Rate of periodical redemption of bonds
m	:	Moratorium
n	:	Redemption period

$$TPB_{t \cdot k} = \begin{cases} 0 & (1 \leq t - k \leq m) \\ B_k \times \gamma & (m + 1 \leq t - k \leq m + n) \\ \{1 - (n - 1)\} \times B_k & (t - k = m + n) \end{cases}$$

$$I_{t \cdot k} = i \times (B_k - \sum_{t=k}^{t-1} RPB_{t \cdot k}) \quad (1 \leq t - k \leq m + n)$$

10. Amount of redemption: SR_t

$$SR_t = RPL_t + RPB_t = \sum_k RPL_{t \cdot k} + \sum_k RPB_{t \cdot k}$$

11. Interest paid: $I_t = IL_t + IS_t$

1) Long term loan interest rate: IL_t

$$IL_t = LI_t + BI_t = \sum_k LT_{t \cdot k} + \sum_k BI_{t \cdot k}$$

2) Short term loan interest rate: IS_t

$$IS_t = \begin{cases} ABAL_{t-1} \times is + BAL_t \times \frac{1}{2} is & \left(\begin{matrix} ABAL_{t-1} \leq 0 \\ BAL < 0 \end{matrix}\right) \\ 0 & (ABAL_{t-1} > 0) \end{cases}$$

is: Short term loan interest

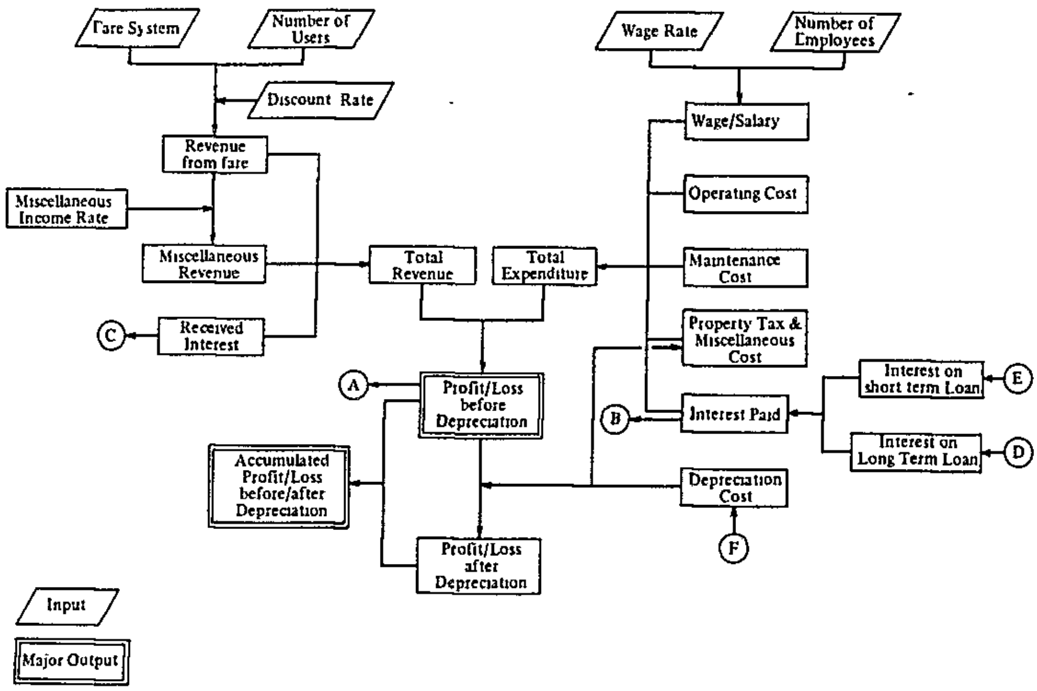
12. Interest received: IR_t

$$RI_t = \begin{cases} 0 & (ABAL_{t-1} < 0) \\ ABAL_{t-1} \times id + BAL_t \times \frac{1}{2} id & \left(\begin{matrix} ABAL_{t-1} > 0 \\ BAL_t > 0 \end{matrix}\right) \end{cases}$$

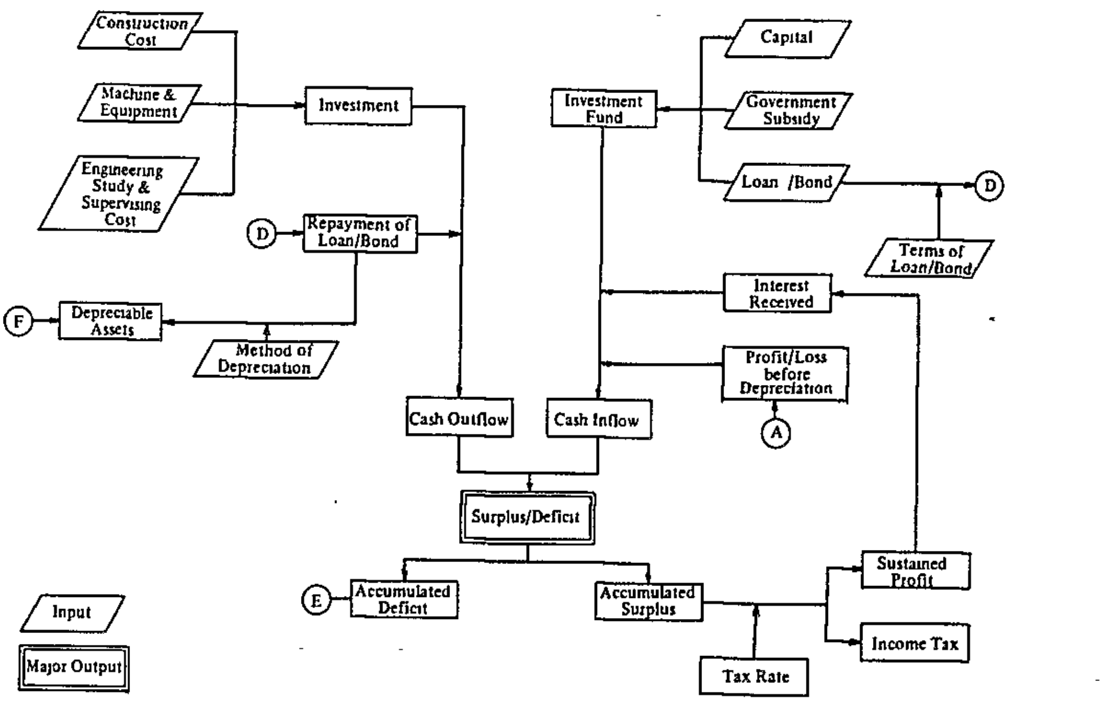
id: Rate of interest received

FIG. 14-3 PROCEDURE OF FINANCIAL ANALYSIS

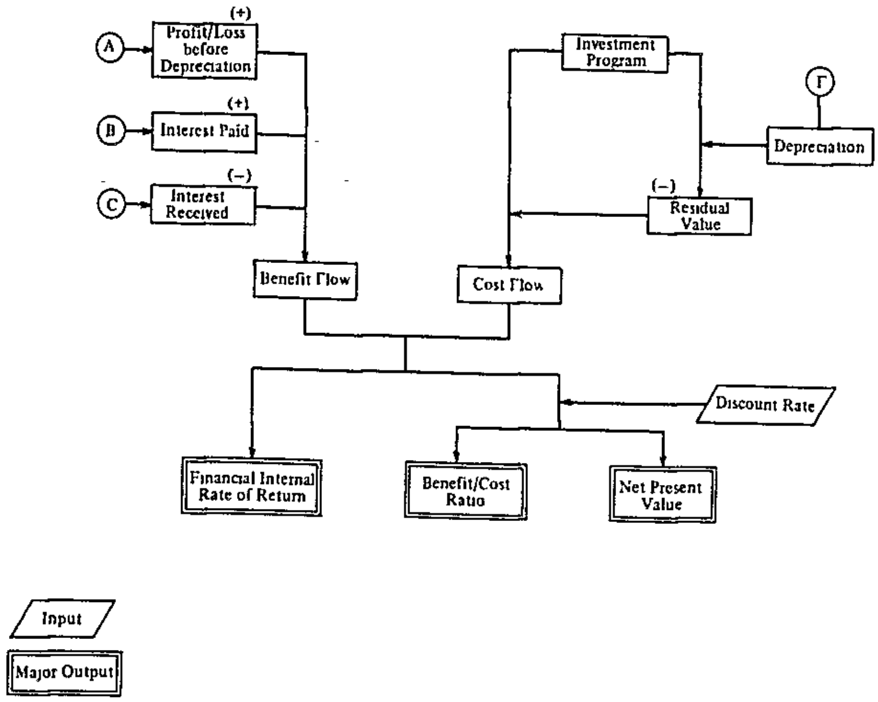
1. PROFIT/LOSS STATEMENT



2. CASH FLOW



3. DISCOUNTED CASH FLOW



(2) Rail Transit Project

The rail transit system discussed in Chapter 12 (Via Espana monorail system or Via Transistmica railroad system) is subjected to financial analysis, assuming three cases of different service commencement dates: 1990, 1995, and 2000. Preconditions to the analysis are as follows:

a) Capital Cost

The capital cost will consist of land acquisition cost (needed where the rail deviates from road right-of-way, which is to be used as a principle), compensations, construction cost, cost of rolling stocks and equipment, and so forth. The result of estimation of these capital costs is presented in Table 12-15, Chapter 12. The rolling stocks will have to be augmented in years from inception by the addition of the number corresponding to one-half the starting number.

b) Revenues

Passengers will increase by 2.8% yearly, according to the result of traffic assignment. With the base fare of 15 centavos, average fare per passenger will be 22 centavos, provided that, if such tariff is inadequate for the commercial operation of the system, an adequate tariff will be calculated.

c) Operating Expenses

Operational expenses are classified into fixed costs, which are proportionate to the amount of capital cost, and variable costs, which are proportionate to the quantity of train operation. Bases for the estimation of these expenses and the result of estimation are presented in Table 14-6.

TABLE 14-6 OPERATING AND MAINTENANCE COST OF RAIL TRANSIT IN 1995

(Million Balboas in 1981 Prices)

Cost Item	Cost in 1995		Estimation Basis
	Monorail	Railway	
1. Wage and Salary	2.56	2.46	356 Workers for monorail, 342 for railway. 600 B/. monthly per worker.
2. Power	1.34	1.19	Consuming 100 wh. per ton. km. 7.2 centravos per kwh. Add 20% of car operating power for other purposes purposes
3. Rail Maintenance	0.52	0.55	3,500 B/. per kilometer for monorail and railway
4. Electric Facilities Maintenance	0.33	0.36	22,000 B/. per kilometer for monorail and railway
5. Rolling Stocks Maintenance	2.38	1.67	20,900 B/. per car for monorail and 22,000 B/. for railway
6. Tickets and others	1.37	1.10	1.2 centavos per passenger
7. Total	8.50	7.33	

Source: ESTAMPA

d) Other Preconditions

- The necessary funds will be generated 10% from equity capital and the remainder through loans (bond issuance and government subsidy are not contemplated)

- Loan condition will be 12% per annum interest, 5-year grace period, and 20-year redemption period; provided that when commercial operation of the system is not possible, loan condition will be made easier.

- Inflation rate will vary from 6% to 9% depending on cost item, but the average rate will be 8% per annum.

- Fixed property tax will be 1% of the assessed value of taxable items. Income tax is disregarded, because this is an evaluation of project feasibility.

As a result of this analysis, it was revealed that the project will not be financially feasible if operated for the same tariff as the bus and an interest of 12% per annum has to be paid on borrowed funds. That is, because of insufficient current profits, short term loadns will become inevitable, but because of the same reason, the short term loan will remain unredeemed, and interests will snowball, making additional short term loans necessary. Due to this vicious cycle, the enterprise will eventually bankrupt.

The financial evaluation indicators as calculated for the three cases are presented in Table 14-7. At the discount rate of 12% per annum, the benefit/cost ratio is far below 1.0, indicating that the project can in no way be feasible. The internal rate of return will range from 5% to 7%, depending on the time of service commencement, with the later commencement being more favorable, but not to the extent that the rail transit system can be operated on commercial basis.

TABLE 14-7 EVALUATION OF RAIL TRANSIT PROJECT

Mode (Route)	First Year of Operation	Initial Investment (million Bl.)	Daily Passenger	Indicators for Evaluation		
				B/C	NPV (million Bl.)	IRR (%)
Monorail (Via Espana)	1990	302	288,000	0.468	−114	6.47
	1995	309	314,000	0.499	−110	6.87
	2000	313	340,000	0.544	−102	7.42
Suburban Railway (Transistmica)	1990	303	249,000	0.391	−130	5.41
	1995	306	262,000	0.406	−128	5.61
	2000	309	302,000	0.499	−110	6.89

Source: ESTAMPA

TABLE 14-8 TREND OF CUMULATIVE PROFITS OF THE RAIL TRANSIT PROJECT

(Million Balboas in 1981 prices)

Year \ Mode / Opening Year	Monorail along Via Espana 1995	Monorail along Via Espana 2000	Railway along Transistmica 1995	Railway along Transistmica 2000
1	18.11	20.10	14.30	17.75
2	37.53	14.30	29.65	36.80
3	49.52	55.82	37.37	48.41
4	57.17	66.18	39.53	55.46
5	45.22	56.87	21.90	42.89
6	21.41	35.75	−8.44	18.46
7	5.19	23.10	−35.71	1.30
8	−12.07	10.49	−68.91	−17.29
9	−32.24	−2.28	−109.48	−39.49
10	−44.89	−3.61	−149.38	−55.04
11	−61.88	−6.63	−199.67	−75.10
12	−82.70	−10.14	−261.67	−99.58
13	−92.47	2.63	−325.02	−114.38
14	−103.54	18.11	−402.52	−131.60
15	−116.26	35.37	−497.59	−151.89
16	−111.27	74.40	−597.85	−156.88
17	−114.13	105.99	−728.60	−170.45
18	−116.48	140.42	−889.31	−185.96
19	−92.29	203.89	−1065.44	−178.90
20	−60.67	272.34	−1281.81	−168.36
21	−19.93	345.92	−1548.02	−153.63
22	61.23	458.89	−1847.66	−101.16
23	159.41	588.84	−2206.90	−24.44
24	276.30	739.47	−2636.79	79.36
25	462.53	965.04	−3107.93	252.91

Source: ESTAMPA

As it can be known from the internal rate of return, the cumulative net losses can be offset in 25 years from inception in the three cases of monorail and the case of railroad commencing in 2000, only if the rate of payable interest is held to 6% per annum, the tariff at which the project will be feasible will be about 30 centavos for monorail and 35 centavos for railroad, both commencing service in the year 2000. This means that when the fare-bearing ability of passengers has increas-

TABLE 14-9 PRO FORMA FINANCIAL STATEMENT OF THE RAILWAY PROJECT

(1) Income Statement

Item / Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Renevue										
Tariffe						26.37	27.10	27.86	34.37	35.33
Miscellaneous						2.11	2.17	2.23	2.75	2.83
Interest							0.89	1.84	2.42	2.77
Sub-total						28.47	30.16	31.93	39.54	40.93
Expenditure										
Wage and Salary						2.51	2.70	2.90	3.12	3.36
Operating Cost						1.47	1.60	1.75	1.90	2.08
Maintenance Cost						2.67	2.77	2.89	3.01	3.13
Miscellaneous Cost						4.08	4.04	4.01	4.00	4.00
Interest on										
Short Term Loan										
Long Term Loan								7.47	17.30	34.41
Sub-total						10.73	11.11	19.01	29.32	46.97
Depreciation Cost						16.23	15.13	14.19	13.38	12.68
Profit/Loss										
Before Depreciation						17.75	19.05	12.92	10.22	−6.04
After Depreciation						1.51	3.92	−1.26	−3.16	−18.72
Accumulated Profit/Loss										
Before Depreciation						17.75	36.80	49.72	59.94	53.90
After Depreciation						1.51	5.43	4.17	1.01	−17.71

(2) Cash Flow

Item / Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Inflow										
Capital	30.92									
Bond										
Loan		46.37	61.83	108.21	61.83					
Subsidy										
Profit Before Depreciation						17.75	19.05	12.92	10.22	−6.04
Balance Brought Forward							17.75	36.80	48.41	55.45
Sub-total	30.92	46.37	61.83	108.21	61.83	17.75	36.80	49.72	58.63	49.42
Outflow										
Investment	30.92	46.37	61.83	108.21	61.83					
Repayment of Loan								1.30	3.17	6.53
Sub-total	30.92	46.37	61.83	108.21	61.83			1.30	3.17	6.53
Surplus/Deficit						17.75	36.80	48.41	55.46	42.89
Interest										
Balance Carried Forward						17.75	36.80	48.41	55.46	42.80

(1) Income Statement

Item / Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Renevue										
Tariff	36.32	44.81	46.06	47.35	58 41	60.05	61.73	76.15	78.28	80.47
Miscellaneous	2.91	3.58	3.68	3.79	4.67	4.80	4.94	6.09	6 26	6.44
Interest	2.14	0 92	0.07							
Sub-total	41.37	49.31	49.81	51.14	63.09	64 85	66.67	82.24	84.54	86.91
Expenditure										
Wage and Salary	3.61	3.89	4.18	4.50	4.84	5.49	5.91	6.35	6 84	7.36
Operating Cost	2.26	2.47	2.69	2.93	3.19	3.48	3.79	4.13	4.51	4 91
Maintenance Cost	3.26	3.41	3.56	3.71	3.88	5.37	5.64	5.92	6.22	6.54
Miscellaneous Cost	4 03	4 07	4.14	4.22	4.32	4.45	4.96	5.08	5.23	5.42
Interest on										
Short Term Loan				2.59	5.92	8 26	11.27	14.94	17.16	19.74
Long Term Loan	43.71	42.82	41.84	40.76	39.57	38.26	36.82	35 24	33.50	31.59
Sub-total	56.88	56.65	56.40	58.71	61.73	65 30	68 39	71.67	73.46	75.56
Depreciation Cost	12.08	11.57	11.13	10 76	10.44	10.16	16 03	14.96	14.34	13.25
Profit/Loss										
Before Depreciation	−15.51	−7.23	−6.58	−7.57	1.36	−0.45	−1 72	10.57	11.09	11.36
After Depreciation	−27.59	−18.91	−17.72	−18.33	−9.08	−10.61	−17.75	−4.38	−2 95	−1.89
Accumulated Profit/Loss										
Before Depreciation	38.39	31.06	24.47	16.90	18.26	17.81	16.09	26.66	37.75	49.11
After Depreciation	−45.30	−64.21	−81.93	−100.26	−109.33	−119.94	−137.60	−142.08	−145.03	−146.92

(2) Cash Flow

Item / Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Inflow										
Capital										
Bond										
Loan						42.94				
Subsidy										
Profit before Depreciation	−15.51	−7.33	−6.58	−7.57	1.36	−0 45	−1.72	10.57	11.09	11.36
Balance Brought Forward	42.89	18.46	1.30	−17.29	−39.49	−55.04	−75.10	−99.58	−114.38	−131.60
Sub-total	27.38	11.12	−5.28	−24 86	−38.13	−12 55	−76.82	−89.01	−103.29	−120.25
Outflow										
Investment										
Repayment of Loan	8.93	9.82	10.80	11.88	13.07	14 37	15.81	17.39	19.13	21.04
Sub-total	8 93	9.82	10.80	11.88	13.07	57.31	15.81	17.39	19.13	21.04
Surplus/Deficit	18.46	1.30	−16.08	−36.74	−51.20	−69 86	−92.63	−106.40	−122.42	−141.29
Interest			−1.21	−2.76	−3.84	−5.24	−6.95	−7.98	−9.18	−10.60
Balance Carried Forward	18.46	1.30	−17.29	−39.49	−55.04	−75.10	−99.58	114.38	−131.60	−151.89

ed and the bus tariff has been raised to 30 to 35 centavos in 1981 prices, the introduction of a rail transit will become commercially feasible. Presented in Table 14-8 are the shift of cumulative profits and losses over years under the tariff of 35 centavos (if opened in 1990, the net losses of either monorail or railroad system will accumulate to an amount beyond recovery). Also, profit and loss statement and cash flow of railroad system are presented in Table 14-9.

(1) Income Statement

Item　　Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Renevue										
Tariff	99.27	102.05	104.91	129.42	133.04	136.77	168.71	173.44	178.29	219.94
Miscellaneous	7.94	8.16	8.39	10.35	10.64	10.94	13.50	13.88	14.26	17.60
Interest										
Sub-total	107.21	110.22	113 30	139.77	143.68	147.71	182.21	187.31	192.56	241.51
Expenditure										
Wage and Salary	7.91	8.51	9.16	9.86	10.60	11.41	12.28	13.21	14.21	15.29
Operating Cost	5.35	5.84	6.36	6.93	7.56	8.24	8.98	9.79	10 67	11.63
Maintenance Cost	6.88	7 24	7.62	8 02	8.44	8.90	9.38	9.88	10.42	10.99
Miscellaneous Cost	5.70	6.02	6.37	6.77	7.21	7.70	8.25	8.85	9.50	10 22
Interest on										
Short Term Loan	22.78	23.53	25.57	27.89	26.83	25.25	23.05	15.17	3.67	
Long Term Loan	29.49	34.09	31.42	28.49	25.26	21.71	17.80	13.51	9 66	6 60
Sub-total	78.11	85.22	86.50	87.96	85.91	83.21	79.73	70.41	58.13	54.71
Defreciation Cost	6.56	6 09	5.69	5.34	5.04	3 93	3.72	3.53	3.37	3.23
Profit/Loss										
Before Depreciation	29.10	24.99	26.81	51.82	57.78	64.50	102.48	116.91	134.43	186.77
After Depreciation	22 54	18.90	21.12	46.47	52.73	60.56	98 77	113.38	131.06	183.54
Accumulated Profit/Loss										
Before Depreciation	78.21	103.20	130.01	181.83	239.60	304.10	406.59	523.49	657.92	844.69
After Depreciation	–124.38	–105.48	84.36	–37.88	14.85	75 41	174.18	287.56	418.62	602.15

(2) Cash Flow

Item　　Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Inflow										
Capital										
Bond										
Loan										
Subsidy										
Profit before Depreciation	29.10	24.99	26.81	51.82	57.78	64.50	102.48	116.91	134.43	186.77
Balance Brought Forward	–151.89	–156.88	–170.45	–185.96	–178.90	–168.36	–153.63	–101.16	24 44	79.36
Sub-total	–122.79	–131.89	–143 65	–134.14	–121.12	–103.87	–51.15	15.74	109.99	266.14
Outflow										
Investment										
Repayment of Loan	23.15	26.67	29.34	32.27	35.50	39.05	42.95	38.48	30.63	13.22
Sub-total	23.15	26.67	29.34	32.27	35.50	39.05	42.95	38.48	30.63	13.22
Surplus/Deficit	–145.94	–158.56	–172.98	–166.41	–156.62	–142.92	–94 10	–22.73	79 36	252.91
Interest	–10.95	–11.89	–12.97	12.48	–11.75	–10.72	–7.06	–1.70	•	
Balance Carried Forward	–156.88	–170.45	–185.96	–178.90	–168.36	–153.63	–101.16	–24.44	79.36	252.91

(3) Bus Center

The financial feasibility of bus Center project is assessed by the same method of analysis applied to the rail transit project in the preceding item. In addition to the assessment of profitability of each of the four bus terminals of Masterplan, the four terminals, as a whole, are also evaluated assuming that they will be operated by one organization. Preconditions to the analysis are as follows.

a) Capital Cost

The amounts of investment are shown in Table 12- , Chapter 12: El Maranon Center (5.2 million balboas), Curundu Norte Center (3.4 million balboas), San Miguelito Center (3.2 million balboas) and Chanis Center (3.2 million balboas) for a total of 15.0 million balboas.

b) Revenues

The number of buses which will utilize each bus Centers is estimated in Table 12-9, also in Chapter 12. Fee for the use of terminal will be 50 centavos per each use, but 75% discount will be given to circulating buses which will use the terminals frequently (for the fair of 50 centavos per circulation, utilizing four terminals). Miscellaneous revenue including advertisement and rentals of kiosks and other stores are estimated at 20% o fee income.

c) Operating/Maintenance Expenses

The number of employees will be 40 at El Maranon Center, 20 at Curundu Norte Center and 15 each at the remaining two Centers. Operating cost is estimated at 2,400 balboas per employee per year, maintenance cost at 1% of capital cost, and miscellaneous expenses at 20% of the total of operating and maintenance expenses. Also, taxes are included in operating expenses.

d) Other Precoditions

o For the convenience of analysis, it is assumed that the construction of the four terminals will require a period of two years, and that they will be opened for service in 1988.

o The same equity capital ratio, loan interest rate, and inflation rate as in the case of rail transit are used for bus Centers, provided that 3-year grace period and 10-year redemption period are used here.

As a result of the analysis, evaluation indicators have been calculated as presented in Table 14-10. As a whole, the internal rate of return is 14.7%, making the project barely self-liquidating. In fact, in view of the cash flow under long term interest rate of 12% and short term interest rate of 15%, the balance of cumulative profits and losses will turn to a net surplus (profit) in 18 years from inception, and in 20 years, a profit of 12.5 million balboas will be realized. Individually reviewed, however, El Maranon Center will about break even, Curundu Norte and San Miguelito Center will not be individually feasible, while Chanis shows a high profitability, because many buses will use it but its cost will be relatively small (see Table 14-11).

Bus Center will become a point of heavy concentration of people: the value of area in the vicinity as commercial and business district will appreciate and land price will rise. In Panama, therefore, the bus Center establishment may be accomplished as a part of a CBD development project, and, if a part or all of the terminal development cost can be financed with revenue from commercial and/or business activities, the financial position of the terminal operation will be much im-

TABLE 14-10 FINANCIAL EVALUATION OF BUS CENTER PROJECTS

Bus Center	B/C	NPV (Million/B)	IRR (%)
El Maranon Center	1.26	1.28	14.7
Crundu Norte Bus Center	0.54	−1.39	6.1
San Miguelito Center	0.89	−0.34	10.7
Chanis Center	3.49	3.77	31.8
Bus Centers as a whole	1.27	3.27	14.7

Note: B/C and NPV are calculated under 12% of discount rate.

proved and Center use fee may be reduced substantially.

TABLE 14-11 TREND OF CUMULATIVE NET PROFIT (LOSS) OF BUS CENTER PROJECT

Year	El Maranon Bus Center	Crundu Norte	San Miguelito Bus Center	Chanis Bus Center	Bus Centers as a Whole
1987	0.00	0.00	0.00	0.00	0.00
1988	–0.27	–0.17	–0.16	–0.09	–0.69
1989	–0.36	–0.43	–0.32	–0.19	–0.91
1990	–0.49	–0.77	–0.50	0.49	–1.19
1991	–0.76	–1.26	–0.79	0.78	–1.84
1992	–1.25	–1.99	–1.29	1.13	–3.06
1993	–1.84	–2.89	–1.89	1.50	–4.53
1994	–2.56	–3.98	–2.61	1.90	–6.30
1995	–3.02	–5.10	–3.29	2.56	–7.45
1996	–3.59	–6.46	–4.11	3.28	–8.83
1997	–4.28	–8.10	–5.08	4.04	–10.50
1998	–4.56	–9.81	–6.01	5.18	–11.15
1999	–4.91	–11.88	–7.11	6.40	–11.93
2000	–5.34	–14.38	–8.43	7.70	–12.89
2001	–5.00	–16.94	–9.60	9.58	–11.89
2002	–4.15	–19.73	–10.73	11.71	–9.57
2003	–3.17	–23.11	–12.06	13.97	–6.84
2004	–0.97	–26.64	–13.21	17.01	–1.03
2005	1.55	–30.88	–14.57	20.24	5.54
2006	4.25	–35.99	–16.18	23.67	12.52

Source: ESTAMPA

3) Transport and Energy

(1) Transport Energy Consumption

The Panamanian economy has for years been plagued by a chronic deficit trade balance, which swelled after each of the two oil crisis in the 1970s. In 1979, commodity imports amounted to 1,069 million balboas, or 3.7 times the 291 million balboas in exports. The largest import was crude oil and petroleum products, amounting to 316 million balboas in said year (preliminary estimate in Panama en Cifras, 1979).

In an effort to formulate a comprehensive energy demand-supply forecast and plans, the Government of Panama organized the National Energy Commission (CONADE) in 1980 and is currently having the Commission undertake–with IBRD assistance and for completion in 1982 with a total cost of 600 million balboas a study of (a) energy demand-supply forecast, (b) domestic energy resources survey with the aim of reducing import reliance for petroleum, (c) designing of measures to inhibit price inflation due to rise in oil prices, and (d) review of alternative energies. According to this Study, the total energy consumption in the Republic in 1980 was 12,628 Tcal (10^{12} cal), of which 55.3% was petroleum products, 11.4% was electric power, and 8.2% was fire wood, charcoal, and bagasse. Petroleum products consisted of gasoline, diesel fuel, and others in about equal proportions (Table 14-12). Demand for energy grew at an average annual rate of 3.5% from 1970 to 1980, or much faster than the population growth of 2.5% in the same period.

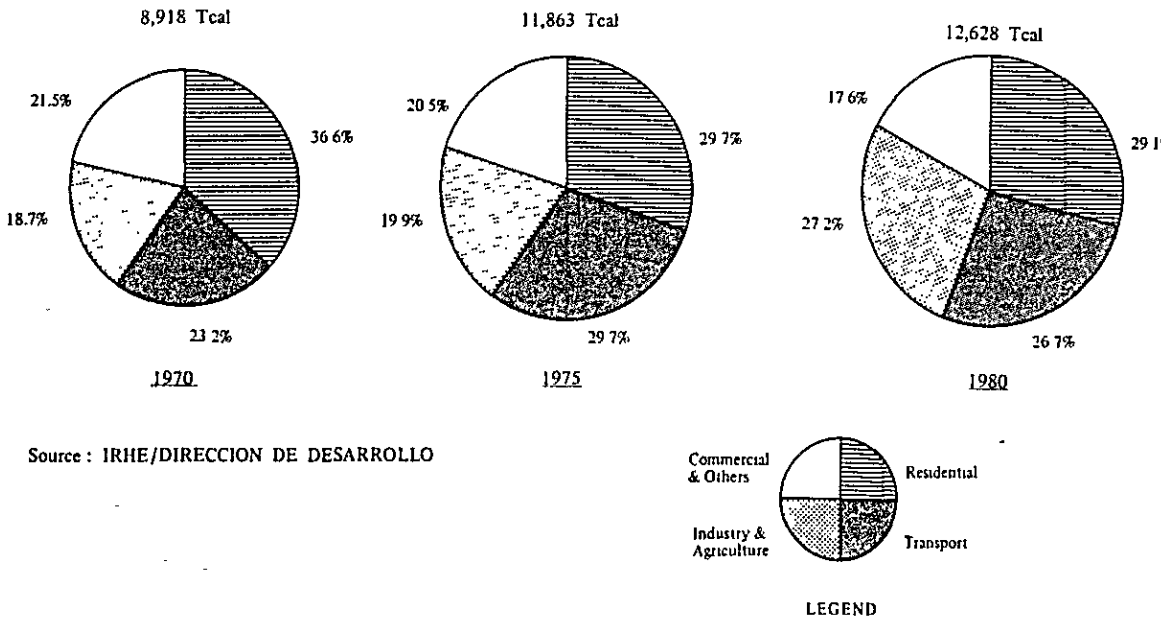
TABLE 14-12 TOTAL NET ENERGY CONSUMPTION BY SOURCE
REPUBLIC OF PANAMA

(Tcal)

Energy	1970		1977		1980	
Petroleum Products	4905	(55.0)	6839	(57.1)	6983	(55.3)
Gasoline	1766	(19.8)	2455	(20.5)	2323	(18.4)
Diesel	535	(6.0)	1725	(14.4)	2248	(17.8)
Other Products	2604	(29.2)	2647	(22.1)	2412	(19.1)
Fuel Woods, Charcoal	2979	(33.4)	3042	(25.4)	3170	(25.1)
Bagasse	375	(4.2)	946	(7.9)	1035	(8.2)
Electricity	660	(7.4)	1150	(9.6)	1340	(11.4)
Total	8919	(100.0)	11977	(100.0)	12628	(100.0)

Source: "Balance Energetico Nacional" IRHE/DIRE CCION DE DESARROLLO

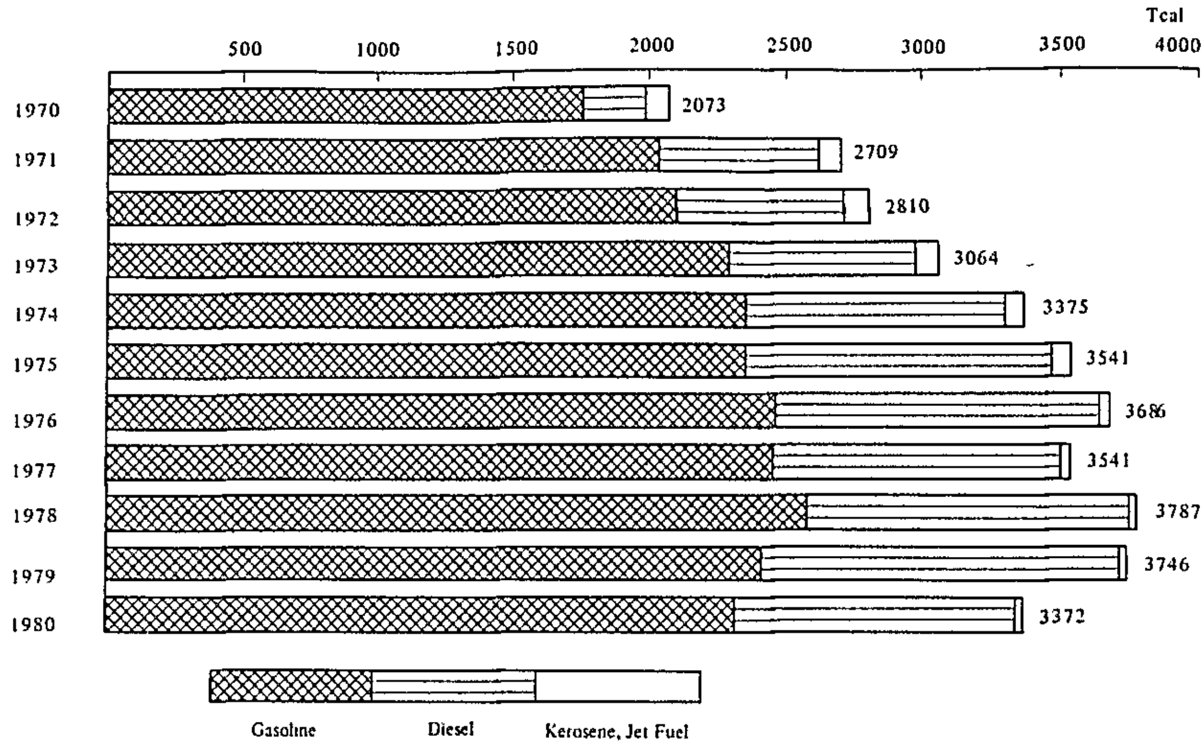
By sector, residential (29%), industry and agriculture (27%), and transport (27%) accounted for about equal shares of the total energy consumption. The shares of the residential and transport sectors will be reversed in the near future, as energy demand in the transport sector has grown rapidly at an annual rate of 5.0%, while that in the residential sector was only 1.2% per year (Fig. 14-4).



Source : IRHE/DIRECCION DE DESARROLLO

FIG. 14-4 NET ENERGY CONSUMPTION BY SECTOR

It is characteristic that the transport sector of the Republic relies totally on petroleum products for energy. As seen in Table 14-13, the transport sector consumed 1.9 million barrels of gasoline and 0.7 million barrels of diesel fuel in 1980, which together amounted to about one-half of the total petroleum consumption in the Republic. The fact that 52% of the total 130,000 vehicles in the Republic are concentrated in the Metropolitan Area (the Study Area, P.T. Zones 01 through 53) suggests that about one-fourth of the total Panamanian petroleum consumption is consumed for



Source . "Balance Energetico Nacional", IRHE, DIRECCION DE DESARROLLO

FIG. 14-5 ENERGY CONSUMPTION IN TRANSPORTATION SECTOR

transportation purposes in the Study Area. In this sense, transport planning for the Metropolitan Area is vitally important to the Panamanian energy economy.

TABLE 14-13 ENERGY CONSUMPTION IN TRANSPORTATION SECTOR, THE REPUBLIC OF PANAMA, 1970–1980

Year	Total		Gasoline			Kerosene (Jet Fuel)			Diesel Oil		
	Tcal	%	1000 Bls	Tcal	%	1000 Bls	Tcal	%	1000 Bls	Tcal	%
1970	2072.9	100	1442.6	1759.7	84.9	65.6	87.3	4.2	163.7	225.9	10.9
1971	2708.7	100	1670.2	2037.4	75.2	64.6	86.0	3.2	424.1	585.3	21.6
1972	2810.3	100	1721.3	2099.9	74.7	73.0	97.4	3.5	444.2	613.0	21.8
1973	3064.1	100	1879.0	2292.3	74.8	63.8	84.3	2.8	498.2	687.5	22.4
1974	3374.9	100	1930.9	2355.6	69.8	51.8	69.2	2.0	688.5	950.1	28.2
1975	3541.0	100	1932.4	2357.4	66.6	53.0	70.8	2.0	806.4	1112.8	31.4
1976	3685.9	100	2026.1	2466.1	66.9	32.3	43.2	1.2	852.6	1176.6	31.9
1977	3541.1	100	2015.2	1458.3	69.4	28.5	37.9	1.1	757.2	1044.9	29.5
1978	3787.1	100	2117.2	2582.9	68.2	23.2	30.9	0.8	850.2	1173.3	31.0
1979	3745.9	100	1979.3	2414.8	64.5	21.4	28.4	0.7	944.0	1302.7	34.8
1980	3372.3	100	1902.3	2320.8	68.8	18.3	24.4	0.8	744.3	1027.1	30.4

Source: "Balance Energetico Nacional", IRHE/DIRECCION DE DESARROLLO

(2) Energy Conservation Effect of Masterplan

When the development of transport facilities is neglected and the transport environment is deteriorated, vehicle operation speed will drop and trip lengths will increase due to detouring caused by traffic congestions. With the result of an otherwise unnecessary consumption of energy in the transport sector. Or, conversely, the improvement of traffic network will result in energy conservation. Therefore, the energy conservation effect of the masterplan is estimated based on the result of traffic assignment by comparing energy consumption should the road network be left as is until the end of this century (do nothing case) and energy consumption should the masterplan be realized. Of the various economic effects of the masterplan as discussed in Sub-Chapter 1 above, energy conservation will be limited to savings in fuel consumption. In viewing the result of this analysis, the followings should be borne in mind:

a) The economic evaluation considered only traffic on arterials (that is, interzonal traffic), and likewise, intra-zonal traffic is not considered for the estimation of fuel consumption savings.

b) Under the assumption that fuel consumption is proportionate to vehicle operation distance, the vehicle operation cost estimation model uses a unit fuel consumption quantity per kilometer under constant operation speed, without considering fuel consumption increase due to drop in operation speed.

For those reasons, it is expected that the analysis has resulted in a substantial understatement, and the estimation should be understood as the minimum values of energy saving expected from the realization of the masterplan.

(i) Energy Saving by Road Network Development

According to the result of traffic assignment to the road network of the masterplan, the total vehicle operation distance will be 8,190,000 vehicle-kilometers per day, about 17% less than that in the Do Nothing Case (Table 14-14). By multiplying this operation distance by the average fuel consumption by each type of vehicles shown in Table 14-15, the quantity and cost of fuel consumption are calculated as shown in Table 14-17. Here a 300-day year (counting Saturdays, Sundays, and Holidays as half days in view of lower transportation energy consumptions than on weekdays) is used and the shares of light trucks and heavy trucks in total operation distance are arbitrarily considered to be half and half.

TABLE 14-14 TOTAL VEHICLE-KILOMETERS ESTIMATED THROUGH TRAFFIC ASSIGNMENT

(1000 Veh-Km Iday)

Vehicle Type	"Do Nothing" Case		Under Masterplan	
	1990	2000	1990	2000
Car/Taxi	4,382	7,069	3,707	5,634
Truck	1,259	2,029	1,137	1,738
Bus	598	795	623	821
Total	6,239	9,893	5,467	8,193

Source: ESTAMPA

TABLE 14-15 FUEL CONSUMPTION RATE BY TYPE OF VEHICLE

(in 1981 price)

Vehicle Type	Fuel Type	Unit Price (Cents/liter)	Fuel Consumption Rate (liter/Km)	Fuel Consumption Rate (Cents/Km)
Car/Taxi	Gasoline	56	0.14	7.84
Light Truck	Diesel	32	0.18	-5.76
Heavy Truck	Diesel	32	0.21	6.72
Bus	Diesel	32	0.29	9.28

Source: ESTAMPA

TABLE 14-16 TOTAL ENERGY CONSUMPTION

(Million Liter/Year)

Vehicle Type		"Do Nothing" Case		Under Masterplan	
		1990	2000	1990	2000
Car/Taxi	Gasoline	128.8	207.8	109.0	165.6
	Diesel	71.1	114.5	60.1	91.2
Light Truck	Diesel	39.7	63.9	35.8	56.7
Heavy Truck	Diesel	58.5	94.3	52.9	80.8
Bus	Diesel	52.0	69.2	54.2	71.5

Source: ESTAMPA

TABLE 14-17 ENERGY SAVING UNDER MASTERPLAN

Fuel Type	Volume (Million Liter/Year)		Value (Million Balboa/Year)	
	1990	2000	1990	2000
Gasoline	19.8	42.2	11.1	23.6
Diesel	18.3	41.7	5.9	13.3
Total	38.1	83.9	17.0	36.9

Source: ESTAMPA

Energy conservation to result from the realization of the masterplan is estimated at 17 million balboas in 1990 and as much as 37 million balboas in the year 2000. Based on this trend, the cumulative total energy conservation from 1983 through 2000 is estimated at 310.4 million balboas, based on the market price of petroleum products in 1981, which must be adjusted for the tax included in the market price in order to evaluate the conservation effect from the national economy standpoint. Even if 50% of the gasoline price is assumed to be tax, cumulative energy saving up to the year 2000 will be 213 million balboas, which will be as much as 60% of the total investment of about 350 million balboas needed for the development of the road network and which, furthermore, will be much greater than the depreciation of said investment up to 2000 in the amount of 89 million balboas. In short, the masterplan will have a substantial energy conservation effect, enough to pay for the investment needed in its development. It follows that the factor of energy conservation alone will make the development of roads in the Metropolitan Area worthwhile.

(ii) Energy Conservation Effect of Reilroad

Discussed hereunder will be the energy conservation effect, if any, of the introduction of a railroad after the completion of the road netowrk according to the masterplan.

(a) Railroad demand is estimated as follows:

1990 : 2,278,000 passenger-kilometers/day
1995 : 2,490,000 passenger-kilometers/day
2000 : 2,820,000 passenger-kilometers/day

b) The cost of electric power needed to meet the above demand will be:

1990 : 1.19 million balboas/year
1995 : 1.33 million balboas/year
2000 : 1.47 million balboas/year

c) If no railroad is constructed, the demand of a) above will have to be met by cars and/or buses. Assuming 100% satisfaction by buses, the additional bus operation and energy consumption to meet the demand are estimated as shown in Table 14-18 (average number of bus passengers is 42/bus, bus fuel consumption is calculated at 0.29 liters of diesel fuel per kilometer x 0.32 balboas/liter = 9.28 cents/kilometer).

d) The comparison of bus fuel consumption shown in Table 14-18 and the power consumption by railroad estimated in b) above shows little difference. Energy conservation resulting from the introduction of a railroad will be 0.30 to 0.40 million balboas per year. However, if the construction cost of power generation facilities can be treated as sunk cost in view that the existing hydraulic power generation facilities have a substantial unused capacity, the total amount of bus fuel can be considered as savings by the introduction of a railroad.

TABLE 14-18 ADDITIONAL BUS OPERATION AND FUEL REQUIREMENTS WITHOUT RAIL TRANSIT

Year	Bus Operation (Million Vehicle-Km/Year)	Fuel Cost (Million Balboa/Year)
1990	16.2	1.50
1995	17.8	1.65
2000	20.1	1.87

Source: ESTAMPA

e) Now, assuming that 20% of railroad passengers will be converted from cars and 80% from buses, railroad power consumption for carrying the passengers of a) above is compared against car and bus fuel consumption for carrying the same as shown in Table 14-19, using the same factors as for the bus and assuming the average number of car passengers as 1.5 per car, fuel costs as presented in Table 14-16, and the ratio of diesel engine cars to total cars as 30%.

f) Deducting gasoline tax from the amount of energy cost-savings by railroad, the amount of yearly savings will be four to five million balboas. If opened in 1995, cumulative energy cost-saving over a period of 25 years will be 252 million balboas, or, reduced to 1995 prices by the annual discount rate of 12%, 48 million balboas.

TABLE 14-19 ADDITIONAL FUEL REQUIRED BY CARS AND BUSES WITHOUT RAIL TRANSIT

(Million Balboa/Year)

Year	Additional Fuel Cost			Power Cost of Rail Transit	Saving by Rail Transit
	Car	Bus	Total		
1990	6.65	1.20	7.85	1.19	6.66
1995	7.27	1.32	8.59	1.33	7.26
2000	8.23	1.50	9.73	1.47	8.26

Source: ESTAMPA

As seen in the above, the introduction of a railroad cannot be expected to result in a substantial energy saving if passengers are all converted from buses. The energy conservation effect will be large if conversion from cars is large. If 20% of railroad passengers are converted from cars, the amount of energy saving will pay for about 15% of the railroad construction cost.

CHAPTER 15.

A SUGGESTION FOR ORGANIZATIONAL / INSTITUTIONAL IMPROVEMENT

15. A SUGGESTION FOR ORGANIZATIONAL/INSTITUTIONAL IMPROVEMENT

It is felt that a set of actions should be taken in order to secure the materialization of the Masterplan. Such actions are discussed in this Chapter, although they are outside the scope of this Study. Resolution will be required for the taking of these actions, which will undoubtedly meet objections. Also the actions discussed hereunder are not proposed to be the only solutions, but there can be other ways and means of the achieving the same effects. Therefore, this Chapter is written as a suggestion supplementary to this Report, rather than as recommendation.

1) Road Investment Fund Generation System

(1) Need of Ear-Marked Funds

Roads, needless to say, are the base for national land preservation and economic development. Yet, in the Republic of Panama, road development is lagging due to inadequate national funds available for this purpose. In 1981, for instance, the national road budget was 78.0 million balboas, and that of Panama City was only 7.0 million balboas for widening Via Porras, replacing a bridge, and improving streets.

In view of this budgetary situation, it is believed that the raising of 350 million balboas, needed for the implementation of the Masterplan formulated for the Panama Metropolitan Area in this Study, will be extremely difficult. On the other hand, foreign loans will be not only undesirable to the maintenance of planning autonomy, but also difficult in the absence of direct relationship between the investment and the revenue. Thus, it will be necessary that ways and means be devised by which funds will be generated and ear-marked for use in road projects.

It is suggested that gasoline diesel fuel sales tax and motor vehicle tax can be made object taxes to generate such ear-marked funds by having road users bear the cost of road development and maintenance under the principle of benefit (the beneficiary should pay for the cost of the benefit) or the principle of cause (the causer should pay for the result). This is believed logical inasmuch as it is the motor vehicle users who directly benefit from the construction of new roads and who damage roads, causing need for repair.

A ad valorem of nearly 50% is already imposed on gasoline in the Republic of Panama. It is therefore, suggested that this revenue be left as genral fund and that a surtax be levied on gasoline to produce an additional revenue that can be ear-marked for road purposes.

Revenue from motor vehicle tax should be made a special fund and be used not only for the development and maintenance of roads, but also for the construction and maintenance of exclusive bus lanes, bus centers, and other facilities (railroad or monorail, etc.) which will mitigate burdens on existent road facilities to achieve grater effectiveness of their use.

(2) Justification for Levying the Proposed Object Tax

It is generally accepted that when a group of people require, or will benefit from, a specific public service, individuals belonging to that group are required to bear the cost of that service. When the service is exclusively available to a precisely definable group of people and when the level of benefit enjoyed by the individuals can be translated into a countervalue (such as in the case of a drainage system), the defrayment of such cost is usually achieved in the form of public dues and charges.

On the other hand, when the service is available to the public at large and the individual level of benefit may not be readily quantifiable, the defrayment depends on tax. In this case, however, the method of tax imposition must be contrived so that the tax burden on individuals will approximate the actual level of benefit enjoyed. This can be achieved by selecting some external standards which will categorically distribute the tax in approximate proportion to benefit. Thus any object tax to be levied under the principle of benefit (the principle that beneficiaries should pay for the cost of the benefit) or the principle of cause (the principle that causers of need for a public service should pay for the cost of the service) is justified when the beneficiaries or the causers are categorically definable and when the tax burden is socially accepted as reasonably related to the level of benefit.

The public service of developing, maintaining, and administering road network is available to the public at large, and individual benefits from this service may not be readily quantifiable on such criteria as family structure, occupation, place of living, the place of working, and so forth. Therefore the cost of this service should be paid for in the form of object tax. Gasoline-diesel fuel tax and motor vehicle tax are justified as long as they are imposed on vehicle users/owners, who cause road damage and who directly benefit from road development, and as long as their taxable standards – the quantity of fuels consumed or the weight of motor vehicles owned–are fairly accurate indicators of the level of need or benefits from such service.

(3) Factors Supporting the Taxes

The taxes discussed above are not only justified but also supported from the fact that they will have an inhibitive effect on motor vehicle ownership, which will be important to minimizing need for road investment. The review of urban traffic problems in Panama Metropolitan Area resulted in the finding that the trip production rate of car owners is significantly larger than that of non-motorvehicle owners (see Chapter 5) and that modal preference is always for the car whenever the use of a car is possible. Thus, it is known that rise in motor vehicle rate will lead to increase in trip production and in total vehicle-trips, which, in turn, will result in a swell in traffic volume, entailing needs for additional roads and funds, therefore. The effectiveness of object taxes on inhibiting vehicle trips will be reviewed here.

Motor vehicle tax is expected to damp propensity to own a vehicle. This damping effect is estimated with the understanding that income is reduced by the amount of the tax, as applicable to the curve of motor vehicle ownership ratio as the function of income.

As seen in Table 15-1, car ownership ratio with no owners tax will drop by 3.17% under a car owners tax of 200 balboas per year, by 4.72% under 300 balboas per year, and by 6.25% under 400 balboas per year.

The imposition of gasoline diesel fuel surtax will tend to cause a reduction in car trips and a resultant increase in bus trips. The degree of this effect is quantitatively estimated using the modal split model discussed in Chapter 9 (See Table 15-2).

As shown in Table 15-2, the car trip inhibitive effect of a surtax is remarkable on car-owning families, as a matter of course; car-owning families are responsible for 90% of total car trip reductions under such a tax. A 15% surtax on gasoline-diesel fuel is estimated to cause a shift of 53,000 passengers per day (or 35,300 vehicles per day) from private to public mode of transport.

(4) Land Transport Fund

A Land Transport Fund is to be organized as a public organization subject to audit by the

TABLE 15-1 EFFECT OF CAR LICENCE PLATE FEE ON CAR OWNERSHIP

Plate Fee (Balboas per Year)	Car Ownership (Number of Vehicles)	Discouragement Effect
0	42,776	0
100	42,095	–1.59%
200	41,421	–3.17%
300	40,758	–4.72%
400	40,103	–6.25%
500	39,458	–7.76%
600	38,822	–9.24%

Source: ESTAMPA

TABLE 15-2 IMPACT OF FUEL SALES TAX INCREASE ON TRANSPORT MODE SELECTION

(Unit in 1000 Persons)

Car Own Status	Mode	Increase of Fuel Sales Tax					
		0%	5 %	10 %	15 %	20 %	25 %
Car Owning Family	Car	0	–16	–31	–46	–61	–75
	Truck	0	– 2	– 3	– 4	– 6	– 7
	Taxi	0	– 1	– 2	– 3	– 4	– 5
	Bus	0	18	36	54	71	86
Non-Car Owning Family	Car	0	– 2	– 5	– 7	– 8	–10
	Truck	0	– 1	– 3	– 4	– 5	– 6
	Taxi	0	– 2	– 3	– 4	– 5	– 6
	Bus	0	6	10	15	19	22
Total Family	Car	0	–18	–36	–53	–69	–84
	Truck	0	– 3	– 6	– 8	–11	–13
	Taxi	0	– 3	– 5	– 7	– 9	–11
	Bus	0	24	47	69	89	108

Note: Figures do not necessarily add to the indicated totals due to rounding.
Source: ESTAMPA

Contraloria General, but free from the rules of profit and loss, for the purpose of handling the accounting of government funds ear-marked for land transport purposes. The Fund will receive from the Ministerio de Hacienda y Tesoro (MHT) gasoline-diesel fuel surtax and car owners tax revenues and, under the direction of the Land Transport Planning Agency (discussed later), disburse these revenues to agencies implementing projects for the construction, improvement, or maintenance of roads and means of public transport, make investments in public corporations, and give subsidies on relevant projects. The Fund's disbursement program will be developed in conformity with the Masterplan investment program, but when disbursement temporarily exceeds receipts, the Fund may borrow on future receipts.

Of the cumulative total amount of 829 million balboas which the Fund is expected to handle up through the year 2000, 332 million balboas will be used in Panama Metropolitan Area, which is close to the 350 million balboas anticipated under the Masterplan. The expected receipts are compared against the Masterplan investment plan, in Fig. 15-1.

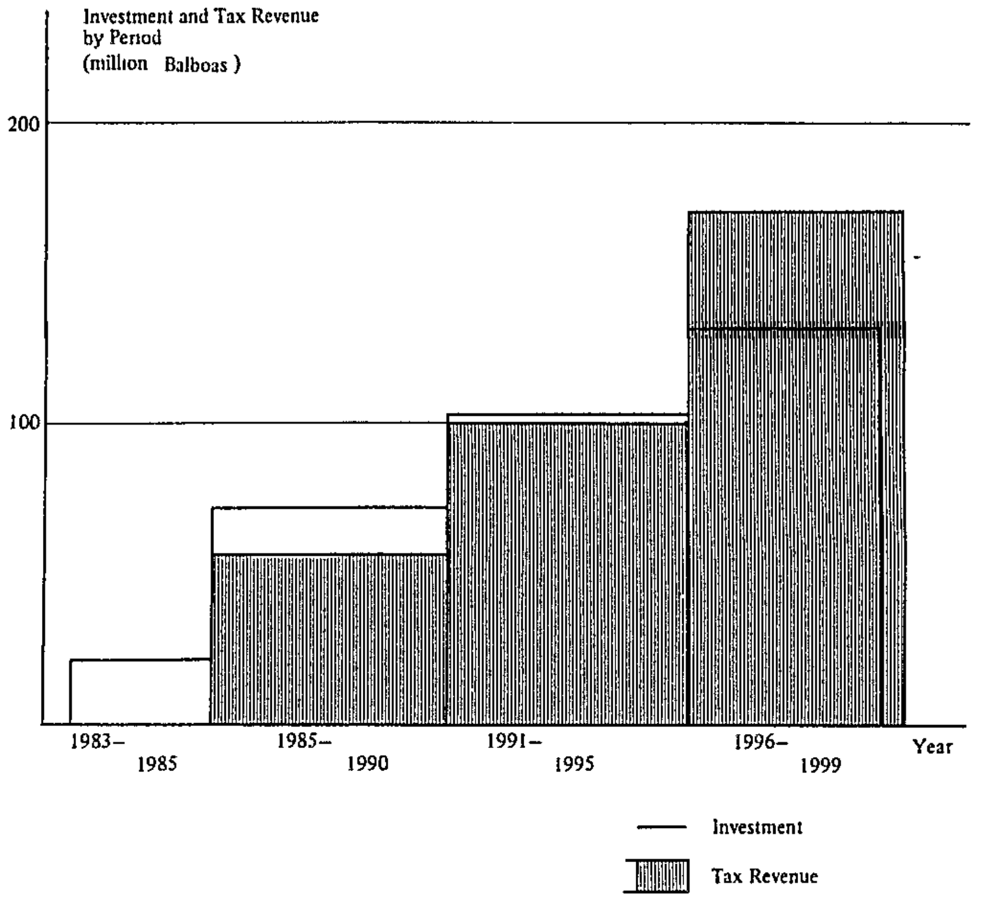


FIG. 15-1 COMPARISON OF INVESTMENT AND OBJECTIVE TAX REVENUE BY PERIOD

2) Unification of Transport Administration

(1) Roads and Streets Administration

Arterial road development is under the jurisdiction of MOP, which formulates Road Development 5-Year Plans, requests budgetary allocations under this Plan, and implements road development projects under the approved budget. The essentials of road development is the same regardless of whether the fund is from domestic source or foreign source and of whether directly implemented or contracted.

The weakness of this system is manifested by the fact that 5-year plans are short-lived and, therefore, cannot function as a guideline for the formulation of yearly execution programs.

Most of the street plans are being formulated and implemented by private housing developers. Each developer draws a street plan for each housing project, attaches the plan to the housing development application to MIVI, and implements the plan when MIVI approval is obtained. In this process, consultation with MOP is done only with regard to draining.

A discussion of parking spaces is in order. As it was pointed out in Chapter 11, it is obvious that parking spaces will be in short supply in the urban center in the future. Yet, sufficient public land spaces cannot be found in the urban center. One possible solution is to induce the use of vacant lots in prescribed areas for parking purposes by the means of tax. A practical example of a tax measure is to levy a vacant lot tax on one hand and to exempt parking lot income from profit tax on the other. The stimulation of private investment in parking spaces, while enforcing the existing obligatory parking lot requirement, will facilitate the solution of parking problems without requiring public fund investment.

Traffic management is currently being planned and carried out by DNTT, with no coordination with MOP or MIVI.

(2) Public Transport Administration

Public transport problems will be identified hereunder in five areas, namely, tarriff determination, operation surveillance, route determination, safety and maintenance, and passenger facilities development, and ways to solve these problems will be discussed.

Bus fares are reviewed, modified, and approved by the Price Adjustment Agency under the advice of the DINTRANT. However, applications are not founded on objective data justifying the fare, nor are the decisions of the authorities based on bus operation costs or route revenues. Thus, fares are decided through political negotiations. It will be essential that bus operators have basic information concerning their revenues and expenses by route and that DINTRANT also gather and accumulate such information on their own.

Bus operation surveillance is currently left up to the bus operators. Operation by cooperatives is generally acceptable. SICOTRAC controls bus departures, not in accordance with an operation schedule, but in terms of order in which buses are to depart and their headway. Bus drivers decide when to start at their own discretion, and route change, route cutting, and turning back at their will are formally prohibited but actually acquiesced. Facts about bus operation are not known to the authorities, and regulations are not enforced on said driver practices.

For authorities, the first step toward improving bus operation is to know about it. It is strongly suggested that a system be developed through which the authorities will be able to regularly obtain necessary information pertaining to various aspects of bus operation.

Outward urban expansions would generate new transport demands, requiring the establishment of new bus routes. Applications for new routes are filed by bus operators, but the authorities cannot evaluate the routes and bus allocations to routes, as proposed, because of the lack of data on demands by route and other necessary information.

As for the maintenance and safety of buses, the motor vehicle inspection system has now become a mere shell, having little effect. The standard of maintenance is low, and preventive maintenance and periodical mid-inspection servicing are never thought of. It is urgent that training centers for automobile mechanics be established, a system for the certification of automobile mechanics be devised, a system of periodical mid-inspection servicing be introduced, and the automobile inspection system be enhanced. Also, automobile indemnity insurance should be made compulsory, particularly with regard to buses for public use.

Bus centers for serving inter-city bus lines are established by DINTRANT but no considerations are given to urban center terminals and major bus stops where passengers change buses. As it was pointed out in Chapter 12, a need for a traffic network presupposing transfers arises when a city grows beyond a certain scale. Panama Metropolitan Area has now come to the very point where its network should be reorganized into one which will accommodate and facilitate transfers. A public organization should be created without delay for the establishment and management of bus centers on an independent profit basis.

As seen in the above, the maintenance and operation of public transport system under the leadership of private organizations present no particular problem as an institution. Problem lies in the fact that the bus operating entities are immature, functioning under a decision making mechanism with little regards to overall efficiency or without gathering necessary information to base decisions on, and in the fact that these common carriers are not subjected to any surveillance from the standpoint of public interest. A new system should be developed through which management information useful for decision making will be regularly collected, processed, and made available, together with systems for the fosteration of automobile mechanics and mechanical inspection of automobiles. Also, the establishment of a bus center public corporation system and the organization of such a corporation will be urgently necessary.

(3) Land Transport Planning Agency

The greatest weakness of Panamanian administrative organizations concerned with land transport is inadequate coordination; that is. the absence of a basic plan which, when formulated, can function as the common language for adjusting between the authorities and various plans as well as the lack of confidence that long term plans will be actually carried out.

The establishment of a system to obtain ear-marked government funds as a security for the

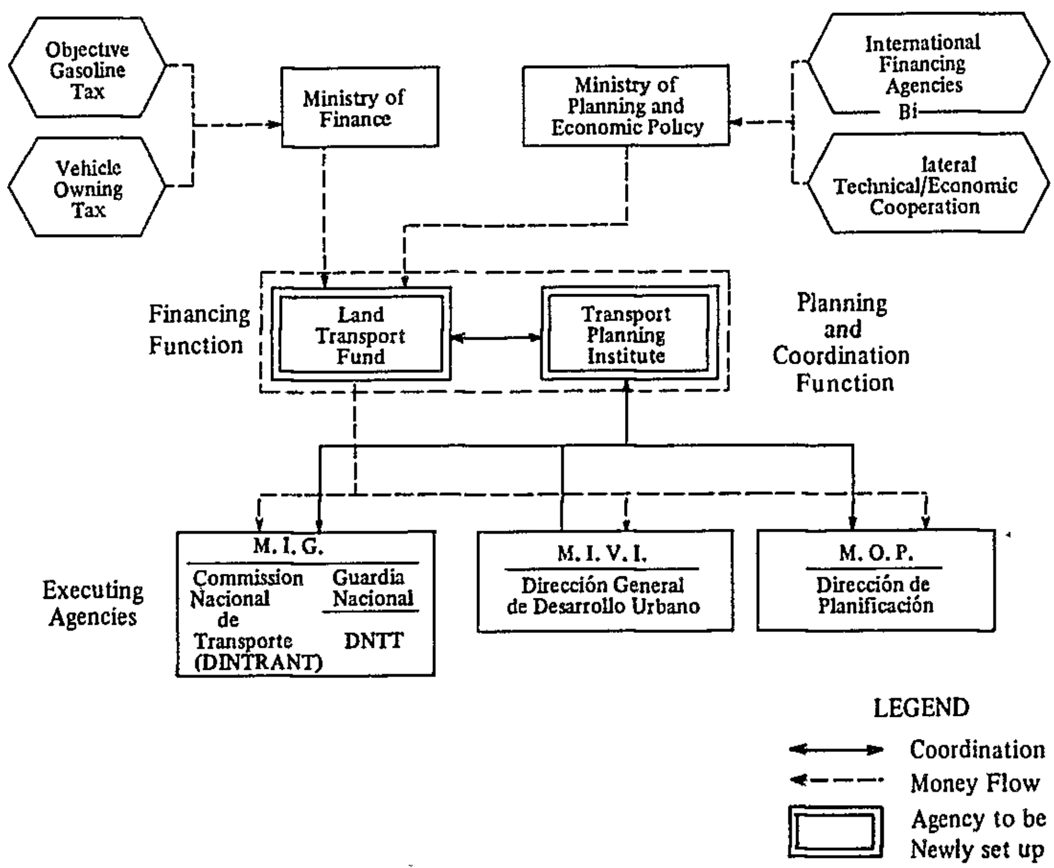


FIG. 15-2 INTEGRATION OF FINANCING AND PLANNING FUNCTION IN TRANSPORTS FOR ADMINISTRATION

realization of the masterplan was suggested in Section 1) above. Here, the establishment of a Land Transport Planning Agency is suggested as a security for the optimum allocation and distribution of such funds. As previously pointed out, road plans and street plans are presently made separately and, traffic management plans are also made separately, despite the fact that the same area and the same means of transport are involved in all these plans. This leads to the conclution that an organization is necessary for the formulation of yearly programs to best realize a comprehensive transport plan and to distribute common funds to a number of project implementation functions to achieve common objectives..

Such an organization might be established by absorbing parts of planning functions of MIPPE, MOP, MIVI, DINTRANT, DNTT, and IPAT. It will formulate yearly execution programs of established Masterplan and review such Masterplan as necessary. The Land Transport Fund will disburse necessary amounts to various relative agencies in accordance with the yearly program, and the agencies are to execute respective projects under such program.

The foregoing discussions have been summarized in Figure 15-2.

3) Legislative Actions

In order to establish the Land Transport Fund and the Land Transport Planning Agencies (both temporary names), respective laws for their establishment need to be enacted. A "Land Transport Fund Establishment Law" should stipulate the rate at which special resources fund and gasoline-diesel fuel tax revenues will be allocated to the Fund and conditions at which the Fund may borrow on such funds. Also a gasoline-diesel fuel special tax law and a motor vehicle tax law must be enacted to provide the Fund with a financial backup.

A "Land Transport Planning Agency Establishment Law" should provide for the responsibilities and authorities of the Agency and desirably emphasize on the formualtion, execution, and continuity of long term comprehensive basic transport plans.