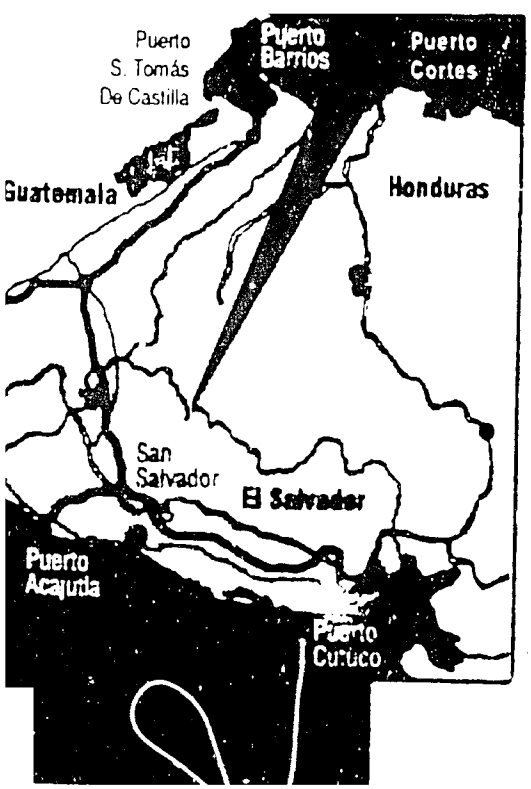
GOES/USAID
Mission to El Salvador
Intermodal
Transportation Study

PN-ABX-450



Final Report
TASK 4
RAIL
STUDIES
prepared by
Frederic R. Harris, Inc.
in association with
Tech International, Inc.
and
Sontay S.A. de C.V.

June, 1995

AGENCY FOR INTERNATIONAL DEVELOPMENT
PPC/CDIE/DI REPORT PROCESSING FORM

ENTER INFORMATION ONLY IF NOT INCLUDED ON COVER OR TITLE PAGE OF DOCUMENT

1. Project/Subproject Number:

2. Contract/~~Grant~~ Number: 519-0394-C-00-4112-00

3. Publication Date: 06/95

4. Document Title/Translated Title:
USAID/GOES Intermodal transportation study Task 4: Rail studies
USAID/GOES Estudio de optimización del sistema de transporte Tarea 4: Estudios ferroviarios

5. Author(s):
1. Frederic R. Harris, Inc.
2. Tech International, Inc.
3. Sontay, S.A. de C.V.

6. Contributing Organization(s):
USAID/El Salvador

7. Pagination: [illegible]

8. Report Number:

9. Sponsoring A.I.D. Office: USAID/El Salvador

10. Abstract (optional - 250 word limit)

11. Subject Keywords (optional)
1.
2.
3.
4.
5.
6.

12. Supplementary Notes
1 copy EN
1 copy ES

13. Submitting Official: Renee Scott, Library USAID San Salvador

14. Telephone Number: (503) 298-1666 X-1306

15. Today's Date: 11/22/95

DO NOT write below this line

16. DOCID:

17. Document Disposition: DOCRD [ ] INV [ ] DUPLICATE [ ]

AID 590-7 (10/88)

Frederic R. Harris, Inc.
Condominio Parque Residencial Altamira
Edificio "G" Local 11 y 12
San Salvador El Salvador
Tel 273 - 5755
Tel y Fax 273 - 5735

HARRIS

San Salvador June 23, 1995

Mr. Ernesto Girón, CTO
USAID Mission in El Salvador
San Salvador, El Salvador

Ref.: Intermodal Transportation Study
Contract No. 519-0394-C-00-4112-00
Final Report, Task 4 "Rail Studies"

Dear Mr. Girón:

In compliance with section C.3.6 of above referenced contract enclosed herewith are 10 (ten) copies, in English, of the Final Report of Task 4 **"Rail Studies"**.

We are calling this "Final Report" rather than "Final In-Depth Report" because we are now incorporating in one single volume phases 1 (Assessment) and 2 (Analysis) of the Study.

Sincerely yours,

José H. Cosío, P.E.
Team Leader

PN-ABX-450

TASK 4

RAIL STUDIES

INDEX

		Page
	Glossary of Terms	4-1
4.1	**Rail Assessment**	4-2
4.1.1	Objectives	4-2
4.1.2	Introduction	4-2
4.1.3	Institutional Assessment	4-2
	a. Place within CEPA	4-2
	b. Organization and Staffing	4-4
	c. Constraints	4-6
	d. Regulations	4-6
4.1.4	Financial Analysis	4-7
	a. Balance Sheet	4-7
	b. Income Statement	4-9
	c. Accounting System	4-13
	d. Present Operating Costs	4-15
	e. Possible Cost Reductions	4-17
	f. Derailments	4-17
4.1.5	Network Description and Condition	4-18
	a. Characteristics	4-18
	b. Rail Condition	4-19
	c. Sleepers	4-20

Page

d. Ballast 4-21

e. Bridges 4-21

f. Embankments 4-22

g. Rolling Stock 4-23

h. Workshops 4-26

i. Other Facilities 4-26

4.1.6 Operations and Traffic 4-27

a. Passenger Traffic 4-27

b. Freight Traffic 4-27

c. Opportunities for Increasing Traffic 4-29

d. Small Shipment Traffic 4-30

e. Tariffs 4-30

f. Operating Procedures 4-32

4.1.7 Development Scenarios 4-34

4.1.8 Operational Improvements and Investment Requirements 4-35

a. Marketing Programs 4-35

b. Modern Handling Systems 4-35

c. Container Systems 4-37

d. Encroachments 4-37

e. Rehabilitation of Permanent Way 4-37

f. Track Machinery 4-40

Page

g. Bridges 4-40

h. Santa Ana Connection 4-40

i. Apopa Connection 4-42

j. Repair Between Kilometer 246 and 255 4-42

k. New Communications Systems 4-44

4.1.9 Summary and Recommendations 4-45

4.2 Rail Analysis 4-47

4.2.1 Introduction and Objectives 4-47

4.2.2 Description of Present Operations 4-47

a. Freight Traffic and Revenues 4-47

b. Existing Route 4-52

c. Operations 4-53

d. Operational Improvements 4-55

e. Feasibility of Continuing Present Operations 4-56

4.2.3. Evaluation Criteria 4-57

a. Rehabilitation Costs 4-57

b. Development of Operating Costs 4-64

c. Net Liquidation Values 4-68

d. Indemnification (Severance) Payments 4-70

e. Traffic 4-72

f. Financial Projections 4-81

Page

g. Investments Requirements 4-81

h. Subsidies and Other Considerations 4-83

4.2.4 Evaluation of Scenarios 4-84

a. Scenario 1: Acajutla-San Salvador 4-84

b. Scenario 1a: Include Sitio del Niño-Santa Ana 4-91

c. Scenario 1b: Include San Salvador-Soyapango-Ilopango 4-93

d. Scenario 1c: Include Cutuco-Sagrisa-San Miguel 4-94

e. Scenario 2 : Retain Metapán-San Salvador 4-96

f. Scenario 3 : Combine Scenarios 1 and 2 4-102

g. Scenario 4: Include San Salvador-Cutuco 4-109

h. Scenario 5: Total Closure 4-110

4.2.5 Organization and Regulation 4-111

a. Institutional Analysis 4-111

b. Legal and Regulatory Aspects 4-114

4.2.6 Management Alternatives 4-115

a. Privatization 4-115

b. Commercial Railway, Government Owned 4-116

c. Industrial Railway 4-117

d. Joint Private-Government Company 4-118

e. CEPA Owned Commercial Company 4-118

f. Government Department 4-119

Page

4.2.7 Development of Strategic Plan 4-119

4.2.8 Financial Requirements and Sources 4-122

a. Financial Projections of Scenarios 4-122

b. Sources of Funds 4-133

4.2.9 Conclusions and Recommendations 4-136

LIST OF TABLES

Table 4.1.1 FENADESAL Balance Sheet (in thousands of Colones) 4-7/8

Table 4.1.2 Consolidated Income Statement (in thousand of Colones) 4-10

Table 4.1.3 FENADESAL Railroad Income Statement (in thousands of Colones) 4-12

Table 4.1.4 Fixed and Variable Costs by Districts Per Ton/Km. 4-17

Table 4.1.5 Rail Weight and Age 4-19

Table 4.1.6 Freight Wagons 4-23

Table 4.1.7 Tons, Ton-Kilometers, Length of Haul 4-27/28

Table 4.1.8 Traffic Distribution by District 4-28

Table 4.1.9 Summary of Revenue Per Ton and Ton-Km 4-31/32

Table 4.2.1 Railroad Freight Traffic 1993-1994 4-48

Table 4.2.2 Rehabilitation Costs Per Kilometer 4-63/64

Table 4.2.3 Annual Maintenance Costs Per Kilometer 4-67/68

Table 4.2.4 Project Rail Traffic (In Thousands of Metric Tons per Year 4-72

Table 4.2.5 Operating Statistics-Scenario 1 4-90

		Page
Table 4.2.6	Scenario 1: Retain Acajutla-San Salvador Service Cash Flow Projections 1996-2015 (Monetary Values in 1994 Prices)	4-124
Table 4.2.7	Scenario 2A: Retain Metapán Service Via Existing Route Cash Flow Projections 1995-2015 (Monetary Values in 1994 Prices)	4-125
Table 4.2.8	Scenario 2B: Retain Metapán San Salvador Service Via Apopa Connection-Cash Flow Projections 1995-2015 (Monetary Values in 1994 Prices)	4-126
Table 4.2.9	Scenario 3B: Retain Acajutla-San Salvador and San Salvador-Metapán Service Via Apopa Connection Cash Flow Projections 1995-2015 (Monetary Values in 1994 Prices)	4-127
Table 4.2.10	Scenario 3C: Retain Acajutla-San Salvador and San Salvador-Metapán Service Via Santa Ana Connection Cash Flow Projections 1995-2015 (Monetary Values in 1994 Prices)	4-128
Table 4.2.11	Scenario 5 : Total Closure of the Railroad System (Monetary Values in 1994 Prices)	4-129
Table 4.2.12	Financial Indicators of Scenarios (In Million 1994 Colones)	4-132

LIST OF FIGURES

Figure 4.1.1	Rail Lines of El Salvador	4-3
Figure 4.1.2	FENADESAL's Organization	4-5
Figure 4.1.3	FENADESAL Financial Profitability Indexes	4-11
Figure 4.1.4	FENADESAL Railroad Financial Profitability Indexes	4-14
Figure 4.1.5	The Santa Ana Connection	4-41
Figure 4.1.6	The Apopa Connection	4-43

Figure 4.2.1 Study of Scenarios 4-92

LIST OF ANNEXES

Annex 1 Inspection Report of Section San Salvador-Acajutla

Annex 2 Inspection Report of Section San Salvador, La Toma

Annex 3 Inspection Report of Section Metapan-San Francisco

Annex 4 Inspection Report of Section Zacatecoluca-Usulután

Annex 5 Inspection Report of Sections Sitio del Niño-Santa Ana, Santa Ana-Texis Junction

Annex 6 Inspection Report of Section La Toma-Texis Junction

Annex 7 Inspection Report of Section San Miguel-Cutuco and Cutuco Port

Annex 8 Report on Special Conditions in the Railway: Bridges and Landslides

Annex 9 Determination of Detailed Operating Costs

Annex 10 Alternative Traffic Analysis and Scenarios

Annex 11 Comments on Salvage Values

GLOSSARY OF TERMS

CEL	Comisión Ejecutiva del Río Lempa
CEPA	Comisión Ejecutiva Portuaria Autónoma
DAFP	Document of the Advance of Public Funds
DFE	Fiscal Document of Expenditures
EUA	Estados Unidos de América
FENADESAL	Ferrocarriles Nacionales de El Salvador
FRA	Federal Rail Administration of the United States
IRCA	International Railways of Central America
MOP	Ministerio de Obras Públicas
NLV	Net Liquidation Value
PSO	Public Services Obligations

4

4.1 Rail Assessment

4.1.1 Objectives

This rail assessment responds to the requirements of Part II, Section 2, transportation by railroad, of the Terms of Reference; as defined in task 4.1 Rail Assessment of the Proposal. The objectives of this assessment are to determinate the current condition of the infrastructure and equipment, present organization, finances, operation and regulation and traffic Scenarios for future development, including necessary investments, are defined. These scenarios will be analyzed during the second phase of the study.

4.1.2 Introduction

El Salvador's existing rail system was built by two companies, the Salvador Railways operating between San Salvador and Acajutla with a branch to Santa Ana, and the International Railways of Central America (IRCA) which operated from the Guatemalan Border to Cutuco with a branch to Santa Ana. Rail lines are shown on Figure 4.1.1. No connection existed between the two systems except at San Salvador. Both systems were nationalized as a result of bankruptcy and were merged as Ferrocarriles Nacionales de El Salvador (FENADESAL) in 1975, administered since then by the Comisión Ejecutiva Portuaria Autónoma (CEPA). Current rail operations are essentially as they were in 1975 except for the discontinuance of most passenger services.

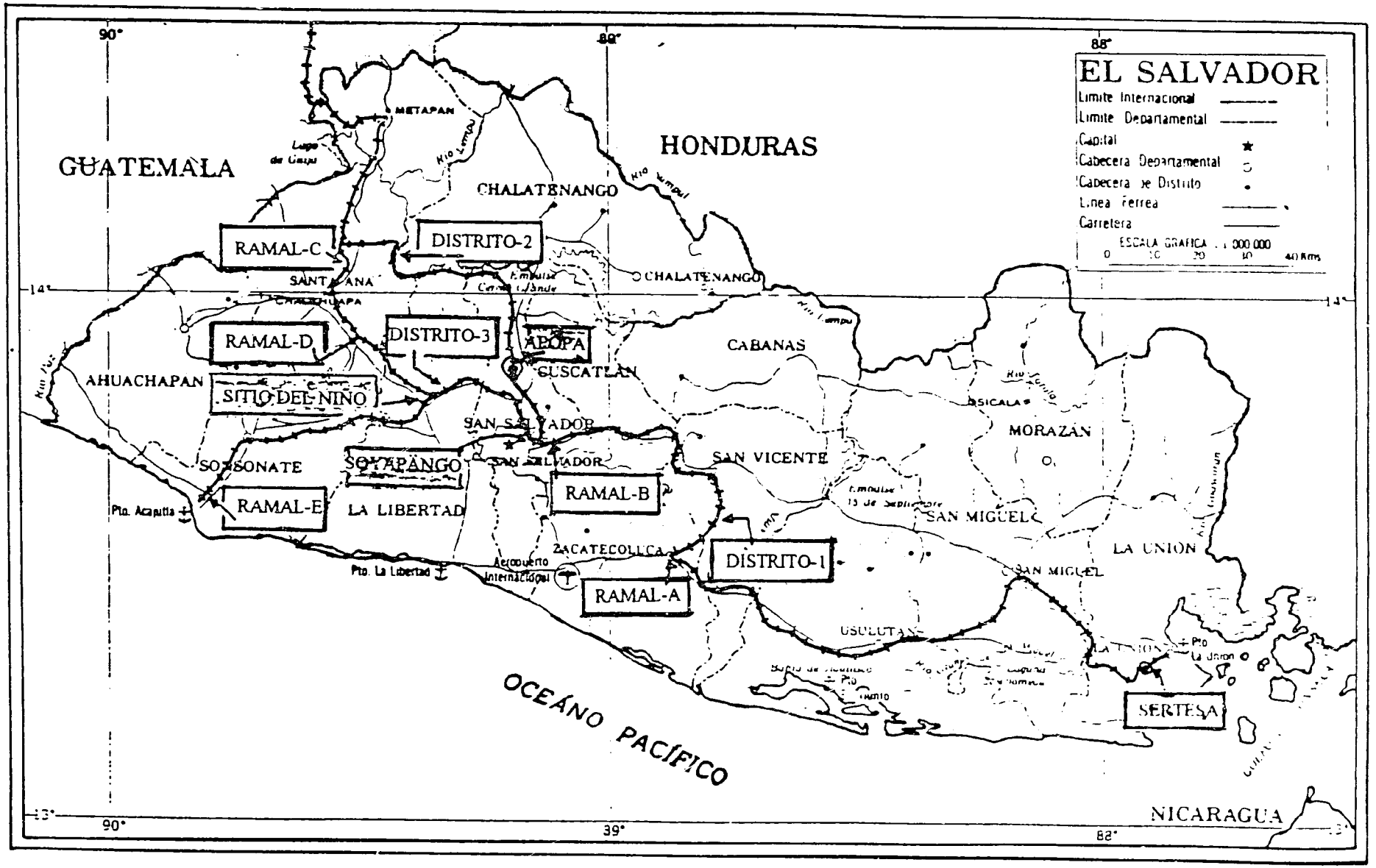
Railroad properties suffered extensive damage during the Armed Conflict which prevented regular operation and resulted in a substantial traffic decline. At the same time, development of competitive transportation services operating over modern highways diverted much of what had been traditional railroad cargo. Financial constraints resulted in under maintenance of the physical plant. Today, FENADESAL's physical plant is essentially worn-out with substantial investment required to restore it to good operating condition. The low present traffic volume suggests that this investment may be unwise, making a definition of the proper role of the railroad necessary for future transport plan development.

4.1.3 Institutional Assessment

a. Place within CEPA

FENADESAL is administered by CEPA as it has been since FENADESAL's inception in 1975. The Manager, FENADESAL, reports to the Manager of Operations, of CEPA who reports to the General Manager, who reports to the CEPA Board of Directors. There are several layers of management between the railroad and the policy making body, the Ministry of Public Works. FENADESAL also operates the Port of Cutuco, this reflecting a historic

FIGURE 4.1.1
Rail Lines Of El Salvador



10

relationship. The port was built and operated by IRCA as its port on the Pacific and with transport services restricted to rail only. The Port's revenues and expenses are included in FENADESAL's financial statements and, although separately stated, are not evident to persons outside the organization.

b. Organization and Staffing

FENADESAL's organization is shown in Figure 4.1.2. Numbers in parentheses indicate the number of persons within each department. In general, the organizational structure is relatively simple with clear lines of reporting responsibility. The management structure is good, and the general office is not overloaded with senior positions.

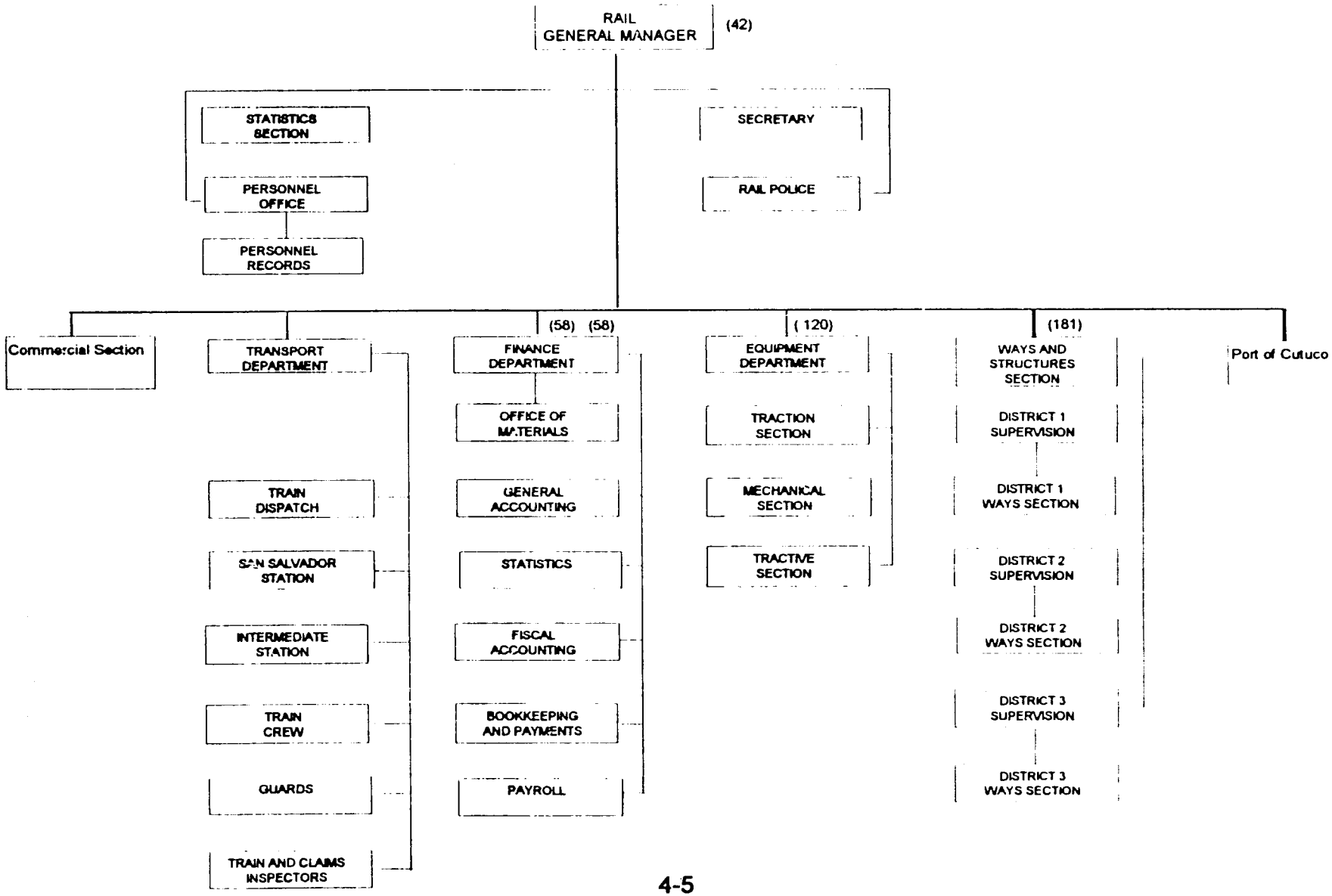
FENADESAL has recently undergone severe staff cuts. From approximately 1,050 staff in 1992, the railroad has reduced to its current level of 628 (not including 41 staff in the Port of Cutuco). Staff reductions will continue to be made as personnel retire. Twenty nine persons are expected to retire before the end of 1994 and a further nineteen in 1995. With these retirements, all staff over sixty years of age will have left the active labor force. Staffing of individual departments appears adequate except as noted below.

The Way and Structures Department appears to be seriously under manned. While there are a total of 168 persons assigned to track maintenance, this overstates the number actually performing maintenance work. There are a total of 27 foremen and 14 motor car operators included in this number who do not actually perform track repairs. When these are deducted, the number of individuals available is reduced to 127 to maintain 540 km of route. The normal standard for railroads without mechanized track machinery is 1 man per kilometer (including supervision). On this basis, Way and Structures should have a staff of about 540. The need for additional personnel can be reduced by contracting as is now done for some routine unskilled work.

There are thirty two staff assigned to locomotive repairs. A typical private railroad of the same size as FENADESAL will have one maintenance man per locomotive. With a fleet of fourteen locomotives, this would indicated that FENADESAL has twice as many persons as needed. However, FENADESAL does heavy repairs and rebuilding work which very few railroads perform. This may require that the present staffing level be maintained. The need for this large a staff should be reviewed in consideration of future needs.

Station staffs at certain points are greatly in excess of needs (see the discussion of small shipment traffic in the Operations and Traffic section). There appear to be opportunities for major reductions in this area. Agents are located at several stations at which no freight is reported as being handled, but who may be required for operational reasons. There are some part-time day workers in this area not included in the count.

FIGURE 4.1.2
FENADESAL's Organization



12

On train staffing is excessive. Present train manning includes engineer, assistant engineer, conductor, and two brakemen. A reduction from three brakemen has been instituted recently. Present practice is for the conductor and brakemen to ride the tops of wagons (an obsolete and very dangerous practice) to apply hand brakes when shunting or operating downhill. Crews also watch for derailments when the train is in motion. This precaution results from present poor track conditions. At least one man is necessary to guard the portion of the train left behind when the train is divided due to severe grades. All wagons have air brakes which appear to function properly and trains are relatively short.

Within the Administrative Department, there are 39 persons in the finance and accounting section, well above world standards. Virtually all data processing is manual, the use of computers being limited to monthly and annual cost center reports. Present procedures were established by a 1982 CEPA study which analyzed each functional in detail. Staffing has been reduced below that existing in 1982, reflecting a reduction in workload. There is a need for a complete function analysis similar to the CEPA study in order to establish current staffing requirements including the possible impact of expanded computer use.

c. Constraints

FENADESAL's ability to take action in the personnel area is restricted by operational regulations. These agreements specify how many men will be used on trains and any major reduction will face a labor reaction.

On other railroads, when small work units are involved, the foreman and other specialized staff perform general work with the remainder of the staff. It is apparent that FENADESAL does not use the concept of the working foreman, which is assumed to be due to labor agreements and historic work practices.

Finances also constrain some activities. Funding has been insufficient to permit adequate maintenance of track and related facilities. Capital investment requests have been routinely deleted from FENADESAL's budgets by the government through the Ministry of the Treasury. As a result, the physical condition of facilities has become quite poor.

d. Regulations

There is limited regulation of the railroad. When FENADESAL became a part of CEPA, the establishing of tariffs became CEPA's responsibility. FENADESAL participates in their setting, the CEPA Board approves the level and sends them to the MOP for final approval and publication in the Official Diary. Rates become effective eight days after publication. Prior to 1994, CEPA and FENADESAL were under the Ministry of Economics.

FENADESAL establishes its own rules relating to operations and work practices such as safety. Unlike many countries, there is no national government agency, external to the

railway, which regulates conditions of employment and directs operative practices. FENADESAL is subject to the provisions of the National Labor Code which applies to the terms and conditions of employment.

4 1.4 Financial Analysis

a. Balance Sheet

Table 4.1.1 shows FENADESAL's Balance Sheets for the years 1991 to 1993. These are broken down by main components; assets, liabilities, and accounting capital. During the period, the annual growth of subsidies to cover operating losses is the most noticeable aspect, this being the only item showing any significant change, increasing an average of annual rate of 11.2 percent. However, during the same period, the average annual inflation rate was 16.0 percent and, therefore, in real terms the subsidy has actually declined.

TABLE 4.1.1
FENADESAL Balance Sheet (in thousands of Colones)

ITEM	1,991.00	1,992.00	1,993.00
ASSETS			
CURRENT ASSETS			
Cash and banks	713.00	1.37	1.765
Accounts receivable	1.73	3.04	913.00
Inventory	9.31	8.10	9.20
Total Current Assets	11.752	12.508	11.873
FIXED ASSETS			
Land	1.553	1.553	1.553.00
Buildings and structures	44.437	44.896	44.805
Machinery and operating equipment	15.151	15.331	16.363
Other fixed assets	7.76	7.78	7.96
Depreciations	(8,174)	(8,682)	(9,164)
Total fixed assets	60.722	60.881	61.514
Deferred Assets	6.798	1.423	7.452
TOTAL ASSETS	79.272	74.812	80.839

14

TABLE 4.1.1 (continued...)
FENADESAL Balance Sheet (in thousands of Colones)

ITEM	1,991.00	1,992.00	1,993.00
LIABILITIES			
CURRENT LIABILITIES			
Accrued payables	10.11	6.79	10.51
Reserves	1.548	1.907	1.872
Total Current Liabilities	11.659	8.701	12.379
EQUITY			
Original Capital contribution	46.938	46.938	46.938
Retained earnings (Losses)	(152,938)	(173,108)	(198,326)
Current earnings (losses)	(23,937)	(27,150)	(25,405)
Subsidies	197.55	219.431	244 253
Total equity	67.613	66.111	67.46
TOTAL LIABILITIES AND EQUITY	**79.272**	**74.812**	**79.839**

Source: CEPA

The procedure by which subside payments are made is as follows. FENADESAL has included the quarterly subsidy requirements in its approved annual budget so that cash requirements are known to the Ministry. When subsidy payments are required, FENADESAL prepares the "Document for the Advance of Public Funds" (DAFP) including its budgetary number. The Ministry of Public Works also prepares a DAFP using its budgetary number, to which the FENADES^L DAFP is attached. The Ministry send the two DAFP's to the Directorate of the Budget for approval which requires three days or more, depending on objections or comment. The Directorate of the Budget sends the approved DAFP to the National Auditing Office (Corte de Cuentas de la República). Auditing Office approval requires three days. Upon approval the DAFP'S are picked up by the transmitter

of the Ministry of Public Works who takes them to the Ministry. The Ministry notifies FENADESAL of the approval (where upon) the Fiscal Document of Expenditures (DFE) is prepared and signed by the CEPA Treasurer. CEPA sends the DFE to the Ministry for its approval which requires two days. Once approved, the DFE is sent with others to the General Directorate of the Treasury. The General Directorate prepares a check in a favor of CEPA. CEPA decides how much of the money will be provided to FENADESAL for each of the three months of the Quarter. Upon receiving the check, the CEPA Treasurer places the funds in the corresponding account. The actual amount transmitted depends upon the cash position of CEPA.

b. Income Statement

- Consolidated

Table 4.1.2 shows FENADESAL's Consolidated Income Statement for the years 1991 to 1993. From the revenues side, the results show a reduced participation of revenues resulting from railroad activities, although in 1993 railroad activities still accounted for more than 70 percent of FENADESAL's revenues.

From the expenses side, the relative participation of all expense items remained constant during the 1991-1993 period. The most important expense items are wages, salaries and fringe benefits (approximately 60%), materials and consumable products (approximately 20%), and Central Office distributed expenses (approximately 9%).

In all, FENADESAL expenses grew 4.3% between 1991 and 1993, which, together with constant revenues, resulted in an increase in losses from ¢24 million in 1991 to ¢25.4 million in 1993 an increase of 5.8 percent. As a result, FENADESAL financial profitability indexes (see Figure 4.1.3) were held constant during the 1991-1993 period. In constant colones (adjusted for inflation) FENADESAL's operating 1993 losses declined to ¢ 20.1 million, a 16.3 percent reduction.

- Railroad

Table 4.1.3 shows FENADESAL railroad activity Income Statement for the years 1991 to 1993. From the revenues side, the results show constant share of its revenue for the years 1991 to 1993, with railroad freight movement accounting for three fourths of FENADESAL's total railroad activity revenues.

14

TABLE 4.1.2
Consolidated Income Statement (in thousand of colones)

ITEM		1991		1992		1993	
REVENUES							
Port	General cargo	537	4.5%	551	4.7%	300	2.5%
	Solid bulk cargo	122	1.0%	165	1.4%	311	2.6%
	Liquid bulk cargo	58	0.5%	78	0.7%	10	0.1%
	Services to ships	42	0.4%	36	0.3%	21	0.2%
	Other port revenues	180	1.5%	323	2.7%	783	6.5%
Railroad	Railroad freight	8,955	74.9%	8,516	72.2%	8,154	67.5%
	Railroad passengers	393	3.3%	418	3.5%	403	3.3%
	Other revenues	1,675	14.0%	1,701	14.4%	2,095	17.3%
	Total revenues	11,962	100.0%	11,788	100.0%	12,077	100.0%
EXPENSES							
	Operating expenses						
	Salaries (including fringes)	1,617	4.5%	575	1.5%	525	1.4%
	Wages (including fringes)	19,673	54.7%	21,463	55.1%	19,971	53.2%
	Other fringes	1,565	4.4%	2,004	5.1%	1,519	4.0%
	Material and consumable products	7,229	20.1%	7,496	19.2%	7,284	19.4%
	External services	1,633	4.5%	1,985	5.1%	2,986	8.0%
	Depreciation and amortization	575	1.6%	675	1.7%	687	1.8%
	Travel and representations	206	0.6%	203	0.5%	167	0.4%
	Total operating expenses	32,498	90.4%	34,401	88.3%	33,139	88.3%
	Previous fiscal years expenses	0	0.0%	1,161	3.0%	424	1.1%
	Financial expenses	140	0.4%	118	0.3%	523	1.4%
	Distributed expenses	3,327	9.3%	3,276	8.4%	3,433	9.2%
	Total expenses	35,965	100.0%	38,956	100.0%	37,519	100.0%
CURRENT PROFIT (LOSS)		(24,003)		(27,168)		(25,442)	

Source: CEPA

FIGURE 4.1.3
FENADESAL Financial Profitability Indexes

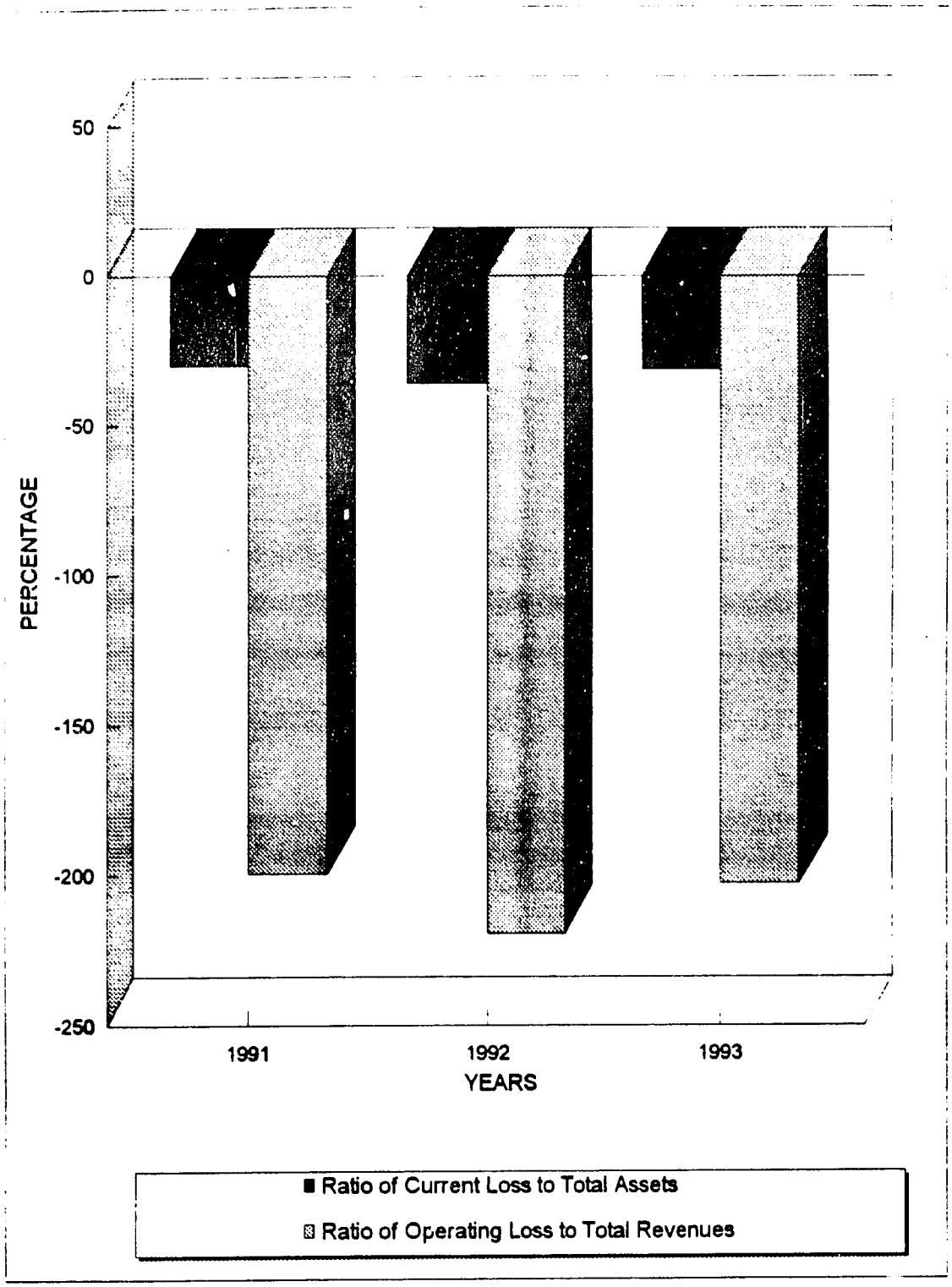


TABLE 4.1.3

FENADESAL Railroad Income Statement (in thousands of colones)

ITEM	1991		1992		1993	
REVENUES						
General cargo	216	1.9%	217	2.0%	300	2.7%
Railroad freight	8,954	79.7%	8,516	78.5%	8,154	74.5%
Railroad passenger	393	3.5%	419	3.9%	403	3.7%
Other revenues	1,677	14.9%	1,699	15.7%	2,095	19.1%
Total revenues	11,240	100.0%	10,851	100.0%	10,952	100.0%
EXPENSES						
Operating expenses						
Salaries (including fringes)	353	1.1%	369	1.0%	393	1.1%
Wages (including fringes)	18,434	57.5%	20,202	55.8%	18,724	53.6%
Other fringes	1,302	4.1%	1,899	5.2%	1,443	4.1%
Materials and consumable products	7,060	22.0%	7,321	20.2%	7,173	20.5%
External services	1,346	4.2%	1,691	4.7%	2,628	7.5%
Depreciation and amortization	542	1.7%	[illegible]	1.7%	636	1.8%
Travel and representations	199	0.6%	197	0.5%	167	0.5%
Total operating expenses	29,236	91.1%	32,307	89.2%	31,164	89.2%
Previous fiscal years expenses	0	0.0%	1,093	3.0%	359	1.0%
Financial expenses	37	0.1%	31	0.1%	503	1.4%
Distributed expenses	2,811	8.8%	2,768	7.6%	2,901	8.3%
Total expenses	32,084	100.0%	36,199	100.0%	34,927	100.0%
CURRENT PROFIT (LOSS)	(20,844)		(25,348)		(23,975)	

Source: CEPA

15

From the expenses side, the relative participation of all expense items also remained constant during the 1991-1993 period. Just as FENADESAL consolidated results, the most important items are wages, salaries and fringe benefits (approximately 60%), materials and consumable products (approximately 20%), and Central Office distributed expenses (approximately 8%).

In all, FENADESAL railroad activity expenses grew 8.9% between 1991 and 1993, which, together with constant revenues, resulted in an increase in losses from ¢20.8 million in 1991 to ¢24.0 million in 1993. As a result, FENADESAL financial profitability indexes (see Figure 4.1.4) were held constant during the 1991-1993 period.

c. The Accounting System

Operating expenses include depreciation and amortization. The depreciation schedules being used appear to reasonably reflect the typical service life of the assets involved. The asset register for rolling stock records both original cost and present undepreciated value. Depreciation is on an original cost and not a current replacement cost basis. Equipment is generally depreciated to a residual value which appears low. Many wagons have been depreciated to a value of ¢2.50 which is much less than scrap value.

When wagons are rebuilt, they are recapitalized for asset register and depreciation bases, entering the depreciation schedules at the cost to rebuild.

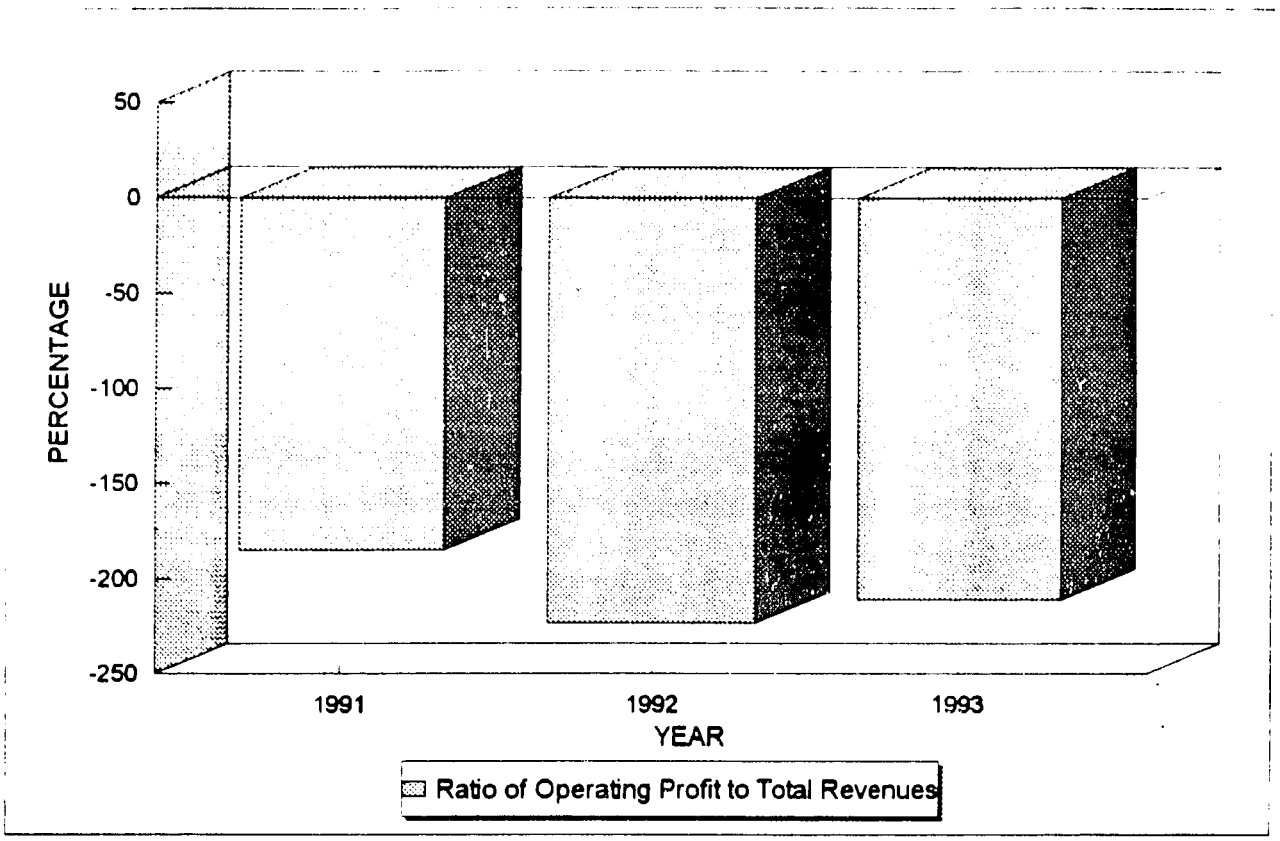
The basic accounting system follows that established by the United States Interstate Commerce Commission for U.S. railroads, commonly known as the Form A. This is a system designed for railroads and used in many countries. It is an adequate system for determining the total costs of specific activities.

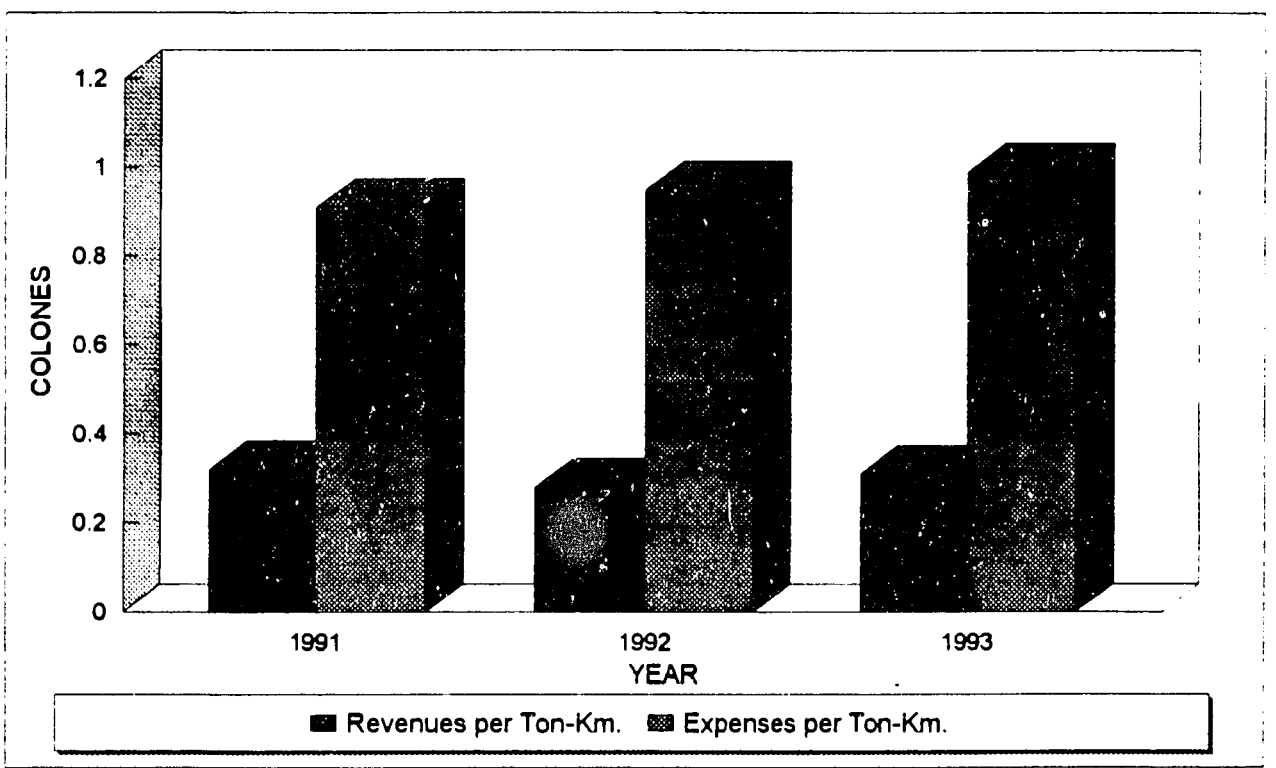
A recently passed law requires that all Government Departments must use the same accounting system, beginning 1995. FENADESAL has been directed to change its accounting system in accordance with this law. While this system has not been reviewed, it is most likely not adequate for railroad purposes. FENADESAL, is engaged in selling its services to others, hopefully at a profit. It must know the costs of providing specific services in order that proper pricing procedures may be followed. Most Government systems do not need to meet this requirement. FENADESAL is not the only agency so affected.

There is a need for improvement in the current accounting system. The Form A system was initially established in the United States in order to insure that reports filed by individual railroads were prepared in a consistent manner and were directly comparable.

20

FIGURE 4.1.4
FENADESAL Railroad Financial Profitability Indexes





The Form A system provides total costs of functions but was not designed to provide cost information on specific commodity movements in the detail required for proper pricing. All the Form A system can provide is average costs on a functional basis such as wagon maintenance, average labor cost per train kilometer, etc.

The Personnel Department has a new computer, furnished by USAID, which is used to maintain most personnel records. Personnel are assigned on a cost center basis reflecting departmental, functional and geographical location. The Accounting Department also uses a cost center approach. Personnel center detail is manually aggregated and entered into the accounting system.

Within the limits imposed by the present accounting system, average costs of functions such as wagon repair can be calculated. However, computing the specific costs of individual movements can not be done. For example, costs of transporting cement from Metapán to San Salvador should be much less per ton than the system average cost due to the much higher volume being transported. This can not be determined from the presently available information.

During the second phase of the study, a detailed analysis of the present accounting system will be made in order to determine just what information can be abstracted from the system in a form useable for marketing and pricing purposes and the extent to which the system should be changed.

d. Present Operating Costs

Estimated fixed and variable costs have been developed using FENADESAL's operating costs for 1993 and the first six months of 1994. The allocations of expenses between districts has also been taken from information provided by FENADESAL's accounting section.

In determining costs which are fixed and which are variable, the following procedure has been used. All expenses related to maintenance of the permanent way are assumed to be fixed. This is based on numerous studies of moderate and high density railroad operations which have established that these expenses are fixed until volume exceeds 10 million gross tons per kilometer per year.

All labor expense, except overtime payments to on-train personnel, is also considered to be fixed. In practice, FENADESAL is not in a position to further reduce staff nor to make adjustments as traffic volume varies. Separation allowance requirements are such that it is not economic to discharge employees for a short period of time. As noted elsewhere, FENADESAL's present staffing is not excessive. Overtime payments to on-train personnel are directly related to the volume of train operations.

Studies on other railroads have indicated that 84 percent of locomotive maintenance materials are used on a time related basis. This reflects that most spares, such as filters, are changed on a time, rather than distance run, basis. Locomotive materials are considered 84 percent fixed and 16 percent variable with traffic. Wagon maintenance materials are all considered variable with traffic. Locomotive fuel is directly related to traffic volume and is considered a variable cost.

On the basis of the above analysis, FENADESAL's present operating costs are considered to be 93 percent fixed and seven percent variable. While the proportion of fixed costs is quite high, this conclusion is supported by a 1992 study of FENADESAL's costs prepared by CEPA's Gerencia de Asistencia Técnica y Proyectos, Departamento de Estudios Económicos. During the study, railroad operating costs for years 1987 through 1990 were examined and the ratio between fixed and variable costs estimated. For the four years examined, fixed costs ranged from 86.5 to 90.6 percent of the total, averaging 88.1 percent. Although the study was not made in great detail, the methodology used was appropriate and the conclusions reached are supported by the analysis.

FENADESAL average operating costs for 1993 are estimated as ¢0.9068 per ton-kilometer. During the first six months of 1994, costs increased approximately 17 percent while tons remained constant (the ton-kilometer figure is not available). Average operating costs for 1994 are estimated as ¢1.0521 per ton-kilometer. Note that this is an average cost based on several assumptions and will not accurately reflect the costs of any specific movement. These costs compare with an average 1993 revenue of ¢0.3078 per ton-kilometer. For 1993, variable costs per ton-kilometer are estimated as ¢0.0599 and fixed costs as ¢0.8469. For 1994, variable costs are ¢0.0612 and fixed costs as ¢0.9909.

The influence of traffic volume is illustrated by the costs per district, as shown in Table 4.1.4 below. In 1993, District 1 (San Salvador-Cutuco) produced 26,000 ton-kilometers per route kilometer, District 2, 165,000, and District 3, 62,000. The ability to spread fixed costs over a larger base results in the unit costs for District 2 being substantially lower than for the other districts. This also provides an indication of the impact that increased traffic will have on railroad costs.

The extremely high cost for District 1 (San Salvador-Cutuco) reflects not only the low volume being handled but also the poor track conditions which restrict operating speeds and require several days for a train to complete a trip. District 2 (San Salvador-Guatemala) costs are reduced, not only by the larger volume but also because virtually all cement moves over the entire district and there is no intermediate shunting of wagons.

23

TABLE 4.1.4
Fixed And Variable Costs By District
Per Ton/Km.

District	1993			1994		
	Fixed	Variable	Total	Fixed	Variable	Total
1	1.7735	0.0599	1.8334	2.0750	0 0612	2.1362
2	0.4022	0.0599	0.4621	0.4706	0.0612	0.5318
3	1.4422	0.0599	1.5021	1.6874	0.0612	1.7486

e. Possible Cost Reductions

FENADESAL's present operating costs are extremely high when compared with other light density railroads and with other modes of transport. There are some opportunities for reducing costs. The possibilities of reducing staff have been discussed above. The vast majority of railroad cargo consists of cement and imports from the ports, all one-way cargo. There are few return movements, resulting in wagons moving empty a great part of the time. 48 percent of all wagon movements during 1993 were empty, indicating an empty return ratio of 92 percent. In other words, for every 100 loads in one direction, there are 92 empty and 8 loaded movements in the other direction.

Marketing efforts must concentrate on finding return loads for wagons now moving empty. Railroad incremental costs are extremely low for such traffic as wagons are already being moved. Based on a serviceable wagon fleet of 502 (558 less 10 percent in repair), the average wagon transports 27 loads per year resulting in an average turn-around time of 13.5 days. Given the extremely short haul nature of the railroad, this is quite high. It would appear that improvements can be achieved in this area. Part of the problem is known to result from poor line condition under which a train may require three days to travel from San Salvador to San Miguel. Improvements can be made in this area through improved fleet management and possibly by retiring wagons not required for current levels of business. The operation of dedicated trains for major commodity movements such as cement is another area in which operating costs can be reduced.

f. Derailments

Derailments are a major expense for FENADESAL. These have increased in recent years. In 1991, there were a total of 438 derailments of which 242 were caused by defects in the permanent way. In 1992, derailments increased to 545, of which 369 were due to permanent way. In 1993, there was a further increase to 597, of which 409 were permanent way related. The 1993 figure was reduced by the temporary closing of District

1 which occurred in July and August. Derailments related to other than permanent way, principally rolling stock defects, have remained constant while those related to track have increased rapidly. This reflects the increasing deterioration of the track due to inadequate maintenance. For 1991 and 1992, the most recent years for which detailed figures are available, one-half of all derailments were on District 1 even though train kilometers were less than on other districts. District 1 also has the poorest track conditions.

Derailment cost was estimated as ¢1,041,000 for 1992 and ¢1,560,000 for 1993. While these costs seem to reflect accurate estimates of repairing damage to track and equipment, they do not reflect cargo damage nor costs resulting from delays to trains. The impact on future business from customers whose goods were damaged is not included. While no program will eliminate all derailments, track improvements should result in eliminating at least two-thirds of derailments. This would represent a cost saving of ¢1,040,000 per year (at 1993 cost levels).

4.1.5 Network Description and Condition

Rail lines currently in operation include District 1 extending from Cutuco to San Salvador, 251 Km.; District 2 from Soyapango to Guijat, 140 Km.; and District 3 from San Salvador to Acajutla, 103 Km., with a branch from Sitio del Niño to Santa Ana, 40 Km. Branches to Zacatecoluca and the Port of Acajutla add 6 Km. making a total of 540 route kilometers. The lines between Texis Junction and Santa Lucía, 20 km. and between Guijat and the Guatemalan Border, 7 Km., are not presently operated. Lines are shown on Figure 4.1.1.

a. Characteristics

In order to evaluate line condition and operating characteristics, a detailed inspection was made by motor car of District 3, San Salvador to Acajutla; District 2 between Guijat (Km 384) and San Francisco (Km. 354) and San Salvador (Km. B-7) and La Toma (Km. 281); and District 1 between Zacatecoluca (Km. 157) and Usulután (Km. 99). Other lines will be inspected during the next phase of the study. The Sub-Chief of the Department of Way and Structures participated in the inspections and provided a great deal of information on track conditions. The evaluations of maintenance needs are based on these inspections.

Virtually all of the railroad has severe grades reaching a maximum of 3.5 percent. Grades on 17.5 percent of the network exceed 2.5 percent and exceed 2 percent on another 44.6 percent. District 2, currently the most heavily used part of the railroad, has almost one third of its length on grades exceeding 2.5 percent and all of the district has grades exceeding 0.5 percent. These grades are against northbound trains, thus favoring southbound trains which transport virtually all loads on this line.

Compounding the grade problem are severe curves. Almost forty percent of the railroad is curved, with a maximum of 16 degrees. The combination of curves and grades severely

restricts the tonnage which can be hauled by a locomotive. Locomotives commonly in use by FENADESAL are limited to 300 tons (12 loaded wagons) on these segments of the network.

Clearances determine the maximum load height and width which the railroad can handle. These are defined in terms of the envelope within which the load must fit. Clearances are adequate for present traffic. No reports were received of traffic being refused due to clearance restrictions.

b. Rail Condition

FENADESAL main line tracks are laid with weights of rail, rolled and installed in the years as shown in Table 4.1.5.

Rail used in side tracks and yards is usually of lighter weight. All but the 70 lb rail dates from the original construction of the railroad. Despite its age, rail appears to be in generally good condition except as noted below.

In considering the following discussion of track components, it must be recognized that the track structure is a unit. Components function as parts of a system, such that a failure to maintain one part of the system results in premature failure of other parts. While routine maintenance of track in good condition can be postponed for one or more years, it ultimately results in a substantial increase in maintenance costs over what would have been required on a normal basis due to these premature failures.

TABLE 4.1.5
Rail Weight and Age

District 1	54 pound/yard	6 km.	1896
	60 pound/yard	209 Km.	1912-1925
	70 pound/yard	37 Km.	1952
District 2	60 pound/yard	167 Km.	1924-1926
District 3	54 pound/yard	1 Km.	1884-1904
	60 pound/yard	67 Km.	1891-1894
	70 pound/yard	75 Km.	1926-1979

All 54 lb rail, 50 Km. of the 60 lb and 2 Km. of the 70 lb are reported by FENADESAL as being in bad condition. requiring immediate replacement. This rail will be inspected during the next pnase of the study in order to determine needs. The majority of this rail is located on District 1.

Rail joints are a problem throughout the railroad. Worn joint bars and missing, badly corroded or worn bolts prevent proper functioning of the joint. A failure to properly tighten and maintain the joints results in end batter which will ultimately require rail replacement. About one-third of the switch points and one quarter of the frogs are badly worn requiring replacement.

c. Sleepers

FENADESAL currently uses both concrete and wooden sleepers. Concrete sleepers are six inches high by eight inches wide by six feet in length. The desired size of wooden sleepers is 6 inches high by eight inches wide by seven feet in length. Concrete sleepers are of local manufacture with internal reinforcement but are not prestressed. With virtually no foundation provided by ballast, they fail frequently, having an average life of five years instead of the fifty years expected elsewhere. They are often mixed with wood, a very bad practice which results in the premature failure of both types due to the differing resiliency of the two materials. Various woods are used for sleepers, principally chichipate and madre cacao. Neither is treated before installation in track. The chichipate is reported as having an average life of ten years, the madre cacao, a life of fifteen years. The primary reason for sleeper failure is "spike kill" where the wood is unable to hold the spike in the proper position against the rail. This is usually due to wear of the hole holding the spike. This problem can be alleviated by the use of sleeper plates between the rail and sleeper. The plate provides resistance against horizontal movement of the spike, as well a preventing the rail from cutting into the sleeper. In El Salvador, sleeper plates are rarely used. When holes wear, it is possible to drive the spike in a new location which FENADESAL sometimes does. Plugs are used to fill the old holes in order to prevent internal rot.

FENADESAL considers preservative treatment to be beneficial. Limited funds have preeluded the use of the treatment. Inspection revealed a great many badly rotted sleepers, indicating that treatment should be beneficial and cost effective. In many areas, dirt has completely covered the sleepers preventing inspection of condition. Without treatment, no sleeper will provide a satisfactory life under this condition. Many new sleepers observed in stock were badly warped and will not provide a satisfactory foundation for the track.

FENADESAL has recently purchased locally produced sleepers for District 1 which are logs of about 6 inches diameter. These, being round, do not provide a proper base for the rail and are reported as having an average life of three years or less. These have

apparently been purchased due to availability and low price. With the extremely short life, use of these sleepers does not appear economic.

To assist in maintaining gauge where sleeper condition is poor, FENADESAL uses locally fabricated "tie bars". These are made from six foot lengths of scrap rail, to which clips are welded. The clips fit around the base of the rail to prevent gauge widening. They appear to be effective.

d. Ballast

Official railroad documents indicate that only 85 kilometers have ballast, between Modesto (Km. 287) and Metapán (Km. 372) of District 2. The primary ballast material is volcanic slag or cinder which is obtained from several different points located on railroad land adjacent to the tracks. It is not a satisfactory material for use as ballast. It is extremely porous, light weight, and quickly degrades into a dust. As such, it does not provide a proper foundation with a cushioning effect for the track structure. It also becomes quite hard and does not shed moisture. Although the top of this material appears to be dry, removal of the top 1/4 inch of material reveals mud. In many instances, when sleepers were being replaced, standing water was observed in the hole left by removal of the old sleeper.

Much of the track is weed grown and this applies to all districts. The roots of weeds hold ballast together, preventing the cushioning effect, and also hold moisture in the ballast which weakens the track structure. Weed control is needed over the entire railroad, including the right of way adjacent to the track. It was indicated that FENADESAL has not had sufficient funds available to permit hiring contract labor for this purpose.

e. Bridges

Bridges generally are in good condition and adequate for several years of service, except as noted below. The one deficiency noted on all but one bridge inspected is the condition of sleepers. All require a 100 percent replacement. This is especially important in the case of FENADESAL as the bridge stringers are on 5 foot centers while the rail is on 3 foot, 2 inch centers (3 feet gauge face to gauge face). As the stringers are not directly under the rail as they are in most railroad bridge construction, a severe bending stress is placed on the sleepers with the passage of a train. This requires that the sleepers be in very good condition. Many of the bridges lack paint but corrosion is not serious. Section loss due to corrosion is minimal.

Bridges on districts 1 and 2 are generally capacity rated as Cooper's E-40, permitting a loading of 4,000 lbs per lineal foot. Bridges on district 3 are rated as Cooper's E-26 with a maximum load of 2,600 lbs per foot. Following a Japanese study in 1966, several major bridges on district 3 were reinforced to increase capacity.

Bridge 21.10 over the Rio Cenizas on District 3 is a three span deck truss with spans of 8.636, 17.780 and 12.598 meters, a total length of 39.014 meters. It is 10.566 meters high. It was fabricated in 1934 using scrap rail for many of the structural members. It has been reinforced several times and is currently restricted to an axle loading of 14 tons, has a slow order in effect, with operation of coupled locomotives being prohibited. It is considered to be in very poor condition. FENADESAL has prepared plans and cost estimates for its rehabilitation.

There are several bridges on District 1 which were heavily damaged during the armed conflict. These bridges were repaired where possible by straightening and reinforcing the main girders. Where such action was not feasible, girders were reinforced with scrap rails, these in effect becoming additional girders. One bridge has had wood cribbing installed at one end to support the stringers due to the absence of floor beams which were destroyed by bombs during the recent conflict.

Several bridges on District 1 show extreme corrosion which has resulted in section loss and weakening of the main girders. One main girder has lost virtually all of the bottom flange for a distance of one foot. These bridges will require replacement, including foundations, if the railroad is continued in operation.

Bridge 134.80 over the Río Lempa is also damaged. The bridge shows evidence of fire damage to wooden parts, primarily sleepers. Sleeper replacement on this bridge must be a priority due to its size.

f. Embankments

Encroachments have greatly reduced the effective width of the right of way in many cases and have damaged embankments. In several areas, buildings have been constructed in such a way that minimum clearance is available for train passage. In some cases, the track area has been covered with concrete in order to provide a road. Proper drainage can no longer be provided due to these structures. While the problem is most severe in the San Salvador area, it exists over virtually the entire railroad.

There are several areas where the embankment shows significant erosion damage. This appears to result from inadequate drainage being provided. In many areas, the track is located at or below the level of the surrounding land. In order to provide adequate drainage, the track should be raised through the application of ballast to bring it to a point where water will drain naturally. In many areas, this action will not be possible without correcting the encroachment problem noted earlier.

There are a number of grade crossings with very poor visibility for both train crews and highway vehicles. In some cases, the visibility problem results from the encroachments referred to above. In other cases, it results from a failure to control vegetation.

52

g. Rolling Stock

FENADESAL's active locomotive fleet consists of two 45 ton, four axle locomotives of 400 horsepower, built by General Electric in 1956; and twelve 65 ton, four axle locomotives of 800 horsepower built by General Motors in 1965. The 45 ton locomotives are used for switching in San Salvador. Of the 65 ton locomotives, nine are in active service. One is out of service for minor repairs. The remaining two are in the workshop for heavy repair including rebuilding of engines and main generators. These should be returned to service shortly. All locomotives in use are in good operating condition, appear well maintained, and should be serviceable for several years.

In addition, FENADESAL has on the roster one 800 horsepower, four axle locomotive built by General Electric in 1961, one built by Ferrostal-Siemens, and two additional 65 ton General Motors locomotives. Although badly damaged during the war and considered unrepairable, they have not been officially retired.

There are also two serviceable steam locomotives held for possible tourist train use and stored in the San Salvador roundhouse.

FENADESAL has the freight wagons available for service, as described in Table 4.1.6, below.

In addition to the above equipment, FENADESAL owns 8 cabooses.

Of the flat cars listed above, 24 have been modified for container handling by adding retaining pins permitting the handling of a single container on each wagon. Nine wagons will accommodate a 40 foot containers.

TABLE 4.1.6
Freight Wagons

Box Cars

Series	Nº	Date Built	Rebuilt		Capacity	Tare
			Nº	Date		
14000	125	1913-1926	40	1979-1994	20 MT	11 MT
15000	262	1926-1951	71	1978-1991	25 MT	23 MT
16000	13	1956-1960	6	1979-1988	30 MT	15 MT
Total	400		117			

30

Box Car, Insulated (Ex Refrigerator)

Series	Nº	Date Built	Rebuilt		Capacity	Tare
			Nº	Date		
1883	1	1926			25 MT	17 MT
Total	1					

Flat Cars (Platforms)

Series	Nº	Date Built	Rebuilt		Capacity	Tare
			Nº	Date		
109,3360	2	1914			20 MT	9 MT
34000	88	1914-1930	33	1979-1984	20 MT	9MT
35000	16	1930	9	1979	25 MT	9 MT
38000	8	1956	2	1980-1983	40 MT	14MT
Total	114		44			

Gondolas

Series	Nº	Date Built	Rebuilt		Capacity	Tare
			Nº	Date		
34052	1	1914			20 MT	10 MT
35001,4	2	1930			25 MT	11 MT
38000	15	1956	11	1980-90	40 MT	14 MT
Total	18		11			

31

Mix Cars

Series	Nº	Date Built	Rebuilt		Capacity	Tare
			Nº	Date		
44000	4	1913	1	1982	20 MT	12 MT
Total	4		1			

Tank Cars

Series	Nº	Date Built	Rebuilt		Capacity	Tare
			Nº	Date		
54000	8	1914-1926	1	1983	4500Gls	13 MT
55001	1	1983			5400Gls	14 MT
57000	6	N/A	1	1982	7600Gls	19 MT
Total	15		2			

Stock Cars

Series	Nº	Date Built	Rebuilt		Capacity	Tare
			Nº	Date		
24000	5	1918-1925			20 MT	11 MT
25001	1	1930			25 MT	13 MT
Total	6					

Grand Total

Series	Nº	Date Built	Rebuilt		Capacity	Tare
			Nº	Date		
Total	558		175			

32

USAID has recently supplied FENADESAL with new roller bearing bogies which are apparently intended for existing tank wagons. These bodies have not yet been installed.

There are one self-propelled coach, four conventional coaches and one baggage car in use on the Sonsonate-Armenia passenger service. There are a number of additional coaches available if necessary, although these have not been maintained for several years and are in generally poor condition. There is also one deluxe coach (the "President's Coach") in storage in San Salvador.

FENADESAL owns one tamper but no other on-track equipment for track maintenance such as ballast regulators. There are two side-dump wagons used for transporting rock which were built in 1930 and 30 motor-cars built between 1947 and 1986. There are four tracked tractors with blades and four front-end loaders available for earth moving functions, as well as one dump truck. There is also one flame type weed burner.

Other mobile equipment includes one 60 ton crane currently on loan to CEPA and in use at the Port of Acajutla. There is one tank car used to provide an emergency fire fighting water supply and kept at the San Salvador workshop. FENADESAL owns 18 forklifts for warehouse handling of goods, of which six are assigned to the Port of Cutuco. There are 13 motor vehicles including 5 automobiles, 1 truck, 3 pick-up trucks, 4 motorcycles, etc. used for personnel and material transport.

h. Workshops

There are two workshops, the primary facility at San Salvador and a smaller facility at Sonsonate. The San Salvador workshop was the main workshop of IRCA. This was built as a steam locomotive roundhouse and repair shop and converted to diesel-electric locomotive, wagon and coach maintenance. The complex includes the former steam locomotive roundhouse and two shop buildings which are separated by a transfer table. The general offices of FENADESAL have been incorporated into the complex using former shop buildings. The workshop is equipped with a limited number of tools including wheel lathe, other lathes, wheel press, forges, and woodworking tools. The heavy repair section has a hydraulic lift for locomotives and a 20 ton overhead crane while the machine shop area has a 10 ton overhead crane. All machinery dates from the 1920's but was indicated by shop personnel as being in good condition and useable. The equipment available is adequate for the repair work being performed. The buildings, while old, also appear adequate and weather tight.

i. Other Facilities

Other facilities include stations and warehouses, many of which are leased to customers. Many station buildings were totally destroyed during the war, only the concrete platforms remaining. Where necessary, buildings have been replaced. Other buildings, while not in

good condition, are adequate for present uses. Many station buildings have excess space which could be leased to others if there is demand for such facilities.

4.1.6 Operations and Traffic

a. Passenger Traffic

FENADESAL operates a limited passenger service between Sonsonate and Armenia. Four round-trips are operated per day, seven days per week. Trains also transport freight wagons when available. Patronage approximates 350-400,000 per year with revenue of about ¢400,000. Patronage has remained steady for several years.

b. Freight Traffic

Freight tons and ton-kilometers for the last ten years are shown in Table 4.1.7. The 1994 figure is estimated based on 10 months actual traffic. Tonnage has remained at about the same level for this period. Ton-kilometers and average distance per shipment increased sharply between 1986 and 1987 and have since remained steady. The decline in 1994 ton-kilometers resulted from the closure of District 2 at Km. 246, discussed elsewhere.

Table 4.1.8 shows 1993 distribution of traffic by District. District 2 accounted for 52 percent of tons and 63 percent of ton-kilometers. The average distance on District 2 shows the influence of the cement, most of which moves the full length of the District. The high average weight per load on District 1 results from the fertilizer imported through Cutuco.

TABLE 4.1.7
Tons, Ton-Kilometers, Length of Haul

Year	Tons	Ton. Km (000)	Average Distance (Km)
1984	314,452	25,429	80.9
1985	324,172	25,442	78.5
1986	321,996	24,454	75.9
1987	353,344	39,536	111.9
1988	319,880	36,152	113.0
1989	215,751	21,995	101.9
1990	324,715	37,541	115.6
1991	309,995	35,124	113.6

34

TABLE 4.1.7 (continued...)
Tons, Ton-Kilometers, Length of Haul

Year	Tons	Ton. Km (000)	Average Distance (Km)
1992	325,983	38,202	117.2
1993	309,496	35,322	114.1
1994	284,347	29640	103.2

TABLE 4.1.8
Traffic Distribution by District
1993

District	Tons	%	Ton-Km (000)	%	Aver Haul (Km)	Aver Ld	Ton-km per route-km (000)
1	70,237	22.7	6,578	18.6	93.7	36.8	26.2
2	159,990	51.7	22,314	63.2	139.5	22.3	165.3
3	79,269	25.6	6,430	18.2	81.1	18.0	62.4
TOTAL	309,946	100.0	35,322	100.0	113.9	23.0	72.2

Major commodities being handled include cement from Metapán to San Salvador, San Miguel, La Toma and other destinations. Cement represents 59 percent of total rail tonnage and 77 percent of ton-kilometers. Steel imported through Acajutla represents 12 percent of total tonnage. Fertilizer from Cutuco to Sertesa is third in tonnage but insignificant in ton-kilometers and revenue due to the very short haul.

1994 tons and ton-kilometers were affected by the closure of District 2 between Km. 245 and 249 which precluded through transport of cement. This has diverted some cement to truck movement and the balance to rail-truck intermodal movement with the transfer being made at Apopa. The decline in local traffic has been partially offset by a significant increase in import traffic at both Cutuco and Acajutla.

FENADESAL keeps no records of the number of containers transported. It appears to be insignificant. They have been transported for about 10 years. In late 1992, several flat wagons were modified to transport single containers. More existing wagons are not long

enough to transport 40 foot containers there are no terminal facilities at San Salvador. With these limitations, FENADESAL can not effectively compete for container traffic.

The major freight destination is San Salvador. Virtually all customers are located in warehouses leased from FENADESAL in the station area and freight terminates at this point. Many of these customers receive freight in containers which have moved by highway from Acajutla or Guatemala.

c. Opportunities for Increasing Traffic

Opportunities for increasing traffic volume appear limited. The establishment of a proper container service between Acajutla and San Salvador may produce some positive results as many containers terminate in the immediate vicinity of the railroad yard. However, the extremely short length of haul will make successful competition difficult. There are some possibilities of increasing participation in the cement traffic.

At one time, the railroad was the predominate hauler of import/export commodities, including coffee, grain and fertilizer. This traffic has been lost to highway movement, apparently due to better service and more aggressive marketing by competitors. To compete effectively, FENADESAL must improve its service level and price competitively. While track conditions restrict the extent to which service may be improved, changes in operating patterns to improve consistency of transit times should assist in increasing traffic.

There needs to be a concentrated effort made on finding traffic moving to the principal origins of Metapán and Acajutla. Acajutla provides an interesting example. Truck traffic is almost exactly balanced between imports and exports while railroad traffic is not. As imports exceed exports, the truckers handle only the balanced movements leaving the one-way hauls to the railroad. Thus the railroad must find a way to increase its participation in exports which should be accompanied by an increase in imports. The only identified commodity moving into the Metapán area is paper bags for cement, of which FENADESAL handles a small quantity. The area of possible return movements will be studied in detail during the next phase of the study when greater detail on commodity flows will be available.

There is an oil fired power plant at Nejapa on which construction is to be completed shortly. The plant operators intend to use rail for transportation of bunker fuel from Acajutla. They are very strongly oriented toward rail and are designing the plant for rail delivery. This will aggregate 120,000 gallons per day. The power company is willing to provide its own trains, including locomotives. Although FENADESAL's tank wagons have been approved by the plant operator they are old and required for other services.

d. Small Shipment Traffic

In 1993, FENADESAL transported 177 shipments weighing less than 20 tons each. These shipments totalled 357.93 tons with revenue of ¢49,566. Shipments under 15 tons totalled 167, with 184.39 tons and revenue of ¢34,737. Fifty-six percent of these shipments originated at San Salvador and 25 percent at San Miguel. Destinations were much more diverse, the most predominate destination, La Toma, representing 11 percent and the next, Metapán, accounting for 9 percent.

It has not been possible to identify the costs associated with these shipments. FENADESAL has stated that these are often transported in wagons with wagon load shipments. There is evidence that many of these shipments had to utilize an entire wagon (no other shipments between the same origin and same destination). These shipments are not handled by railroad personnel. The shipper is required to load and the receiver to unload the wagon. San Salvador has a station staff of 21 persons with a reported payroll cost (including additives) of ¢717,123 and San Miguel has a staff of 11 with a cost of ¢332,591. If small shipments were discontinued and even one-half of these two staffs laid off, the payroll saving would be ¢524,857. Assuming revenue loss of ¢49,566 the net saving in cost considering payroll only would be ¢475,291. The railroad should terminate the handling of such shipments. This could be achieved by establishing a minimum charge for 20 tons. It may be that shipments between 15 and 20 tons would continue to move paying the higher minimum. The potential revenue loss would then be reduced to ¢34,737 and the saving increased to ¢490,120.

e. Tariffs

As discussed in Section 4.1.3, the CEPA board is responsible for the approval and publication of the tariffs. Rates are set jointly by FENADESAL and CEPA staff. Within FENADESAL, setting of rates is the responsibility of the Chief, Finance Department. When considering rate changes, he survey's truck owners and shippers to ascertain what rates are being charged by competitive motor carriers. FENADESAL's pricing policy is to establish rates at a level sufficiently below truck charges to maximize traffic volume and revenues. Operative costs are not considered in this decision.

FENADESAL is following the recommendations of 1992 CEPA cost study, referred to earlier, that FENADESAL should price to maximize total revenue. Given FENADESAL's present cost structure, the policy of maximizing volume, even though very low rates are required, is wise.

Table 4.1.9 shows a selection of rates per ton and revenue per ton-kilometer for several major movements. Between 1993 and 1994, cement revenue per ton declined about 7 percent although railroad costs increased 17 percent. Rates for the fertilizer movement

from Cutuco and Acajutla to Sertesa remained unchanged. Revenues per ton for other commodities increased between 6 and 27 percent.

Rail rates per ton-kilometer should decline as the length of haul increases. FENADESAL revenues show some interesting departures from this pattern. Cement rates decline as distance increases up to about 175 km. but then tend to increase sharply. Coffee rates follow the pattern except for San Salvador which is higher than would be expected.

All rates shown are far below average, full (including fixed) costs except for the fertilizer movement between Cutuco and Sertesa. This movement is a special case due the short haul and erratic shipments. FENADESAL has several wagons assigned to this movement which are used only when a ship is in port. It is necessary to send a locomotive and crew, normally with a train, when necessary to transport fertilizer. It is to be expected that the cost of handling the fertilizer will be well above average and thus this movement also fails to cover its full cost.

TABLE 4.1.9
Summary Of Revenue Per Ton And Ton-km.
Commodity: Cement

Origin	Destination	Rev/Ton	Distance	Rev/Ton-Km
El Ronco	La Toma	¢28.70	100	¢0.2870
	Apopa	¢33.13	121	¢0.2738
	San Salvador	¢33.13	145	¢0.2285
	Quezaltepeque	¢34.44	169	¢0.2038
	Acajutla	¢53.58	248	¢0.2160
	San Miguel	¢79.81	320	¢0.2494

Commodity: Coffee

Origin	Destination	Rev/Ton	Distance	Rev/Ton-Km
Nejapa	Acajutla	¢37.29	85	¢0.4387
San Salvador		¢46.33	103	¢0.4498
Santa Ana		¢37.84	106	¢0.3570
San Miguel		¢61.91	292	¢0.2120

Commodity: Fertilizer

Origin	Destination	Rev/Ton	Distance	Rev/Ton-Km
Cutuco	Sertesa	¢10.45	4	¢2.6125
Acajutla		¢88.71	350	¢0.2535

Commodity: Imports

Origin	Destination	Rev/Ton	Distance	Rev/Ton-Km
Acajutla	Entre Rios	¢27.64	59	¢0.4685
	Quezaltepeque	¢40.94	79	¢0.5183
	Corinca	¢32.03	80	¢ 0.4004
	Nejapa	¢31.40	85	¢ 0.3694
	Paleca	¢31.85	100	¢ 0.3185
	San Salvador	¢41.44	103	¢0.4024
	Santa Ana	¢33.64	106	¢0.3173
	Km.154	¢73.84	200	¢0.3692
	El Ronco	¢82.13	248	¢ 0.3312
	Usulután	¢60.26	255	¢ 0.2363
	San Miguel	¢74.58	292	¢ 0.2554

Commodity: Local

Origin	Destination	Rev/Ton	Distance	Rev/Ton-Km
San Salv.	San Miguel	¢51.58	189	¢0.2729

f. Operating Procedures

This section discusses the operating procedures used by the railroad including communication, equipment control and operations management.

All operations are controlled from San Salvador. This office includes three dispatchers (one for each district), wagon control and distribution, and general supervision. Dispatcher

positions are maintained 24 hours per day, seven days per week. Dispatching procedures reflect those in use on U.S. railways many years ago. Train movements are recorded on a train sheet by the dispatcher. Train orders are issued by the dispatcher through an operator at the station. The order permits a train to operate to a certain point, at which a new order must be obtained. Meets between trains are established by the dispatcher through train orders. At stations where no operator is located, there is provision for use of a portable telephone which is carried on locomotives and motor cars. All communication on District 3 is via telegraph. Communication on the other districts is normally by telephone, in some cases of the magneto type, or radio in those instances where telephone communication is unsatisfactory. These practices are typical of those in use on United States railroads in 1920. The Transport Department also includes a small shop repairing telegraph keys, magneto telephones and clocks.

Wagon control is through one person in this department. Customer orders for wagons are transmitted to the agent at the nearest station who transmits the order to San Salvador. The order is filled by Transport. The wagon controller appears to have limited information on the location of available wagons so that the nearest suitable wagon can be dispatched to fill an order.

All on-train personnel are based in San Salvador and Sonsonate. Train crews are paid for a period beginning 30 minutes before their scheduled departure time and ending 15 minutes after arrival at their destination. Overtime is paid for all hours over eight. When the crew can not return to the point at which they are based lodging is provided in the station and they are reimbursed for actual meal expense. Crews are authorized to operate between specific points. In the case of District 1, for example, a crew will operate from San Salvador to San Vicente, remain overnight, then operate to Usulután or San Miguel, remain overnight, and operate to Cutuco the next day. Where feasible, crews will sometimes meet and exchange trains, such as between San Salvador and Sonsonate. There are no limits on the number of hours a crew can remain on duty.

The normal train crew consists of engineer, assistant engineer, conductor and two or three brakemen. A reduction from three to two brakemen has recently been agreed to with the labor representatives but has not been implemented.

The decision to operate a train is made by the dispatchers or Chief of the Transport Department. While freight trains do not operate on a fixed schedule, operations typically follow a regular pattern. Crews are assigned on a rotative basis, whereby the individuals who have been in the terminal the longest are assigned to the run. Crews are paid on a monthly basis and are paid whether needed for train operations or not.

40

4.1.7 Development Scenarios

There are a number of possible future scenarios for rail development which will be evaluated. Given the large financial losses and low traffic levels, retaining the present railroad operation is not considered as a feasible option and will not be included. Scenarios to be considered include the following:

Retain San Salvador-Acajutla Only

- Include Sitio del Niño-Santa Ana
- Retain Cutuco-Sertesa

Retain San Salvador-Metapán Only

Combine Scenarios 1 and 2

- Build Santa Ana Connection
- Build Apopa Connection

Retain San Salvador-Cutuco

Total Closure

Retention of the Cutuco-Sertesa segment is an option under all scenarios except that calling for total abandonment of the railroad. The possibility of retaining traffic to points no longer served by rail through the use of intermodal transport systems will be investigated under all scenarios. Abandonment of part of the present system may also make salvaged materials available for use elsewhere on the system, reducing immediate rehabilitation costs. Although major investment will still be required to improve the condition of the permanent way.

Complete closure of the railway may be necessary if costs can not be reduced to a truck competitive level. As District 1 (San Salvador-Cutuco) has the highest operating costs, lowest traffic levels and is in the poorest physical condition, abandonment of this district is a likely scenario unless a container terminal is built in the Cutuco area. Retention of the Cutuco-Sertesa line as an independent operation is also closely related to the future of the Port of Cutuco. Abandonment also involves economic costs to the Country from the factors external to the railway.

In evaluating the various scenarios, the objective will be to identify that rail system which can economically meet the needs of El Salvador. The evaluation methodology will focus primarily on operating costs and investments required to keep the railway in operation. The ability of the railroad to provide a service competitive with other modes will also be a

factor in the evaluation. In projecting future traffic levels and revenues, projected increases in local economic activity will be included.

Non railroad costs such as highway congestion resulting from increased traffic, environmental pollution, and similar considerations will be included in the evaluation. The rail study is part of a larger analysis which has the objective of developed the least cost transport system which will best support the economic development of El Salvador. In the event that no economically feasible rail system is found, the subsidy requirements necessary to retain rail service will be estimated. This will place the Government of El Salvador in a position to determine if the required assistance can be justified in the context of national goals and resources available.

4.1.8 Operational Improvements and Investment Requirements

This section discusses two areas, programs to improve operations and efficiency not requiring investment, and investments. Investments fall into two categories; those required to keep the railroad in operation; and those which improve efficiency and/or permit the handling of additional traffic. Where recent cost estimates are available, they are included in the discussion. Evaluations of these investments will be made during the next phase of the study, when detailed information on traffic potential will be available.

a. Marketing Programs

During the next phase of the study, detailed information on specific commodity flows will be developed. Those movements which are adaptable to railroad transport will be identified. If FENADESAL is to successfully compete for these movements, they must offer a competitive package of rates, service and equipment. This requires a skilled marketing approach in defining exactly what competitive carriers are offering and exactly what the railroad must offer to attract this traffic. FENADESAL must also identify which of these prospective movements they wish to handle. Priorities for marketing efforts must be established based on profitability. There are no major marketing efforts being made at the present time. Establishment of a proper marketing program will require staff training to overcome the present lack of experience in FENADESAL. Immediate opportunities exist in cement and bunker oil.

b. Modern Handling Systems

FENADESAL can increase its market share of certain commodity movements through the institution of modern handling methods. While some investment by both FENADESAL and the shipper may be required, transport costs should be greatly reduced. Cement is used as an example.

42

At the present time, approximately twenty percent of the cement produced at the Metapán plants is transported by rail. The cement companies have indicated a willingness to increase this but have stated that wagon shortages are the limiting factor. Review of FENADESAL records revealed that all orders for wagons for the cement companies had been filled and there were additional wagons available. It is evident that wagon shortages are not a restrictive factor. FENADESAL should be able to increase their participation in the cement movement to at least seventy percent with the institution of modern handling methods.

Most cement is transported in bags from the plants to distribution centers located in the major consumption areas. Bags are filled directly from storage silos and dropped down a chute feeding a roller conveyor reaching into the wagon. One wagon is loaded at a time, after which it must be moved and replaced with another, during which time loading stops. Bags are stacked about six high, being limited by the height to which a man can conveniently stack heavy bags. Loading is also limited in many cases by the capacity of the wagons, many of FENADESAL's wagons being of 20 ton capacity. The average load per wagon is 22.3 tons, indicating that the full capacity of all wagons is not being used. At destination, cement is often sold to customers by the bag directly from the wagon. Individual bags are carried by men to customer vehicles. Some cement is also unloaded into storage by men carrying individual bags. Although records have not been checked, it is apparent that this system often results in substantial unloading delays to wagons

The efficiency of this system could be improved through the institution of a modern palletized system. While this would be a limited improvement at the cement plants, it would vastly improve the handling at the distribution center. Pallets could be loaded directly to storage or customer vehicles by the use of forklift trucks. This will be especially important if intermodal handling is instituted to destinations not served by rail. With the use of pallets stacked two high, the full capacity of the 30 ton wagons could be utilized, making it practical to assign them to cement service. Wagon modifications would be necessary to permit stacking without shifting and to permit rapid unloading.

Modified wagons would be operated in dedicated trains sized to utilize the full hauling capacity of a locomotive. Wagons in such service would operate as a unit from the plant to a distribution center and be returned to the plant as a unit. With palletization, wagons would be quickly unloaded so that they are ready for a return trip. With scheduled service, elimination of shunting and an increase in utilization, rail costs will be substantially reduced and equipment supply increased. In order to further improve efficiency, it may be desirable to construct purpose built distribution facilities to improve handling.

The same or similar techniques could also be applied to other commodities moving in substantial volume.

c. Container Systems

Although having some flat wagons equipped for handling twenty foot containers, FENADESAL is not properly equipped to transport the majority of containers which will be moved in the future. New equipment is required for FENADESAL to actively participate in this type of traffic.

There are two routes which can be followed. A sufficient number of new wagons of 50 ton or greater capacity and 41 foot or greater length can be acquired to permit handling of 2-20 or 1-40 foot containers per wagon. Terminal facilities with mechanized loading/unloading, possibly by forklift, would be needed at Acajutla, San Salvador and possibly other points.

FENADESAL may also acquire "Roadrailer" type equipment whereby a modified container chassis is mounted on a special bogie for rail movement. At destination, the chassis is removed from the bogie for highway movement. The terminal requires only a paved track of sufficient length to handle projected train sizes. The loaded container is placed on the chassis at shipside and moved direct to the customer without being removed from the chassis. It is returned to shipside in the same way that highway movements are handled. A terminal can be established at any point where a paved strip of track with a road connection can be provided. This system may prove to be the most economic for FENADESAL.

d. Encroachments

As noted in the report, encroachments on the right of way are a major problem for FENADESAL. These must be removed to permit proper drainage and to improve grade crossing visibility. Many of these have apparently existed for some time. While illegal, it is assumed that users of the encroachments will expect compensation in return for moving. Based on experience in other countries, these payments will be high. As this represents an expense of retaining the railroad in operation, and is considered essential, it is included here as an investment. Costs will be determined based on the experience of other countries who have used such programs and through discussion with the appropriate El Salvador Government staff. Encroachments are continuing to occur without apparent control, compounding the problem. In one instance, highway widening between San Salvador and Sonsonate has encroached at least 25 feet into the right of way in a manner which will create severe drainage problems for FENADESAL.

e. Rehabilitation of Permanent Way

This project covers restoration of the track structure to good operating condition, permitting competitive train speeds. It includes all of the permanent way components such as embankments, ballast, sleepers and rail.

In the case of a typical light density railroad such as FENADESAL, it is often possible to overcome deferred maintenance through an increase in yearly track repairs to the level required for long term operation. While this requires several years to fully restore proper standards, it avoids the need for concentrated expenditures in a short time period.

In FENADESAL's case, the property has deteriorated to such an extent that such a program can not be followed. Immediate action to improve ballast and sleeper condition, and rail joint maintenance is necessary if rail damage is to be avoided. A failure to quickly implement such a program will result in rail damage requiring its replacement. A time period of no more than three years for improving rail lines to be retained is required.

Proper drainage is essential if long term maintenance costs are to be minimized. A failure to drain water from the right of way results in washouts and makes it virtually impossible to maintain a satisfactory track surface and alignment. In many instances, the encroachments noted above have resulted in damage to embankments and have occupied the land area required for drainage. These encroachments must be removed and the embankments repaired if the track is to be properly stabilized. Drainage ditches have been neglected, resulting in retention of water in the track structure. A program of constructing new and repairing existing drainage systems is required. This program can be phased over several years.

The railroad has suffered washouts and flooding in certain areas for several years. A program of improving drainage in specific problem areas has been developed by FENADESAL with a cost of ¢1,560,000 (not including Km. 246-255 discussed below). This program includes ¢1,080,000 for District 1, ¢380,000 for District 2 and ¢100,000 for District 3.

As noted in the report, only 85 km of the railway are ballasted, with a volcanic ash which is not suitable for such use. The railroad has identified some sources of better ballast material which has not been used due to higher cost. The volcanic cinder currently being used is from lands owned by FENADESAL and has a cost of ¢10 per cubic meter, including transportation and handling. The better stone, located close to the tracks in the vicinity of Km. 295-303 has a purchase price of ¢150 per cubic meter. This does not include transportation and handling. Several possible ballast sources were identified in a 1966 Japanese study of Salvador Railways.

Proper ballast is essential for proper functioning of the track structure. It provides the foundation for sleepers and rail; facilitating drainage. The failure to provide proper ballast has resulted in a very short sleeper life and will soon result in damage to the rail. A program of reballasting all mainlines to be retained must be initiated quickly to avoid this damage. This can not be postponed. Use of poor stone simply because it is available at low cost is a foolish investment. This program must include proper quality stone regardless of price. FENADESAL estimates that one cubic meter of ballast per linear meter of track

is required and this estimate seems reasonable. A three year program to reballast the entire railroad, concentrating in the areas currently in poorest condition, is a necessary investment.

Sleeper condition is extremely poor over the entire railroad. To some extent, this reflects the poor ballast condition existing over much of the railroad. In determining the type of sleeper to be used, the comparative costs of local woods, both treated and untreated, must be compared with the cost of imported wood and concrete sleepers. The best option must be selected based on life cycle costs assuming the railroad will be continued in operation indefinitely. An initial program of replacing 25 percent (every fourth sleeper) of the existing sleepers is suggested. This will provide a sufficient number of good sleepers to retain the track in gauge while other track programs are initiated. This would initiate a program of replacing one quarter of the sleepers each five years as is now done on many railways. All sleeper replacements must include sleeper plates.

Rail is generally in good condition. There are some exceptions, primarily on District 1, where replacement will be required shortly. There are spot replacements required in other areas. A program of replacing 2 percent of existing rail per year will be required as part of restoring track to good operating condition. Rail replacement can be postponed until other more pressing needs are met.

One urgent need is for joint bolts to replace those which are missing or badly worn. This is also essential if proper track standards are to be maintained and serious rail damage avoided.

Approximately 50 percent of switch points and 25 percent of frogs are badly worn and require replacement. The point problem is critical with several main-line switches which can cause derailments. This problem may be alleviated by retiring all sidings which are no longer required for operation. Many of the switches for these sidings have at least one good point which can be used for replacement elsewhere. Removal of these sidings may also make replacement rail available for other use.

A scrap dealer, located at km. 49 near Armenia, has recently purchased a large quantity of 75 pound rail from Nicaragua as scrap. FENADESAL has inspected this rail and estimates that much of it is useable. Purchase of this rail may permit a reduction in the initial cost of the replacement rail program. However, as it is a section not currently in use on FENADESAL, it should be installed in one area in order to avoid the need to join frequently with other rail sections.

FENADESAL has estimated their rehabilitation costs using 70 lb rail as this is the heaviest section currently in use. Experience on other railroads has shown that heavier rail can reduce routine surfacing and alignment requirements on lightly used lines. The desirability of using 90 or 115 lb rail should be investigated. As the 115 lb is a standard section while

the others are not, at least in the United States, the 115 lb section may be less costly than the others, in addition to providing reduced maintenance expense. Special sections generally require a substantial price premium by the manufacturer.

In addition to rehabilitation, FENADESAL should adopt a program of normalized track maintenance. Under such a program, the number of annual sleeper and rail replacements reflects average service life. Assuming a 20 year sleeper life, 5 percent of all sleepers must be replaced each year. Assuming a fifty year life, 2 percent of the rail will also require replacement. Reballasting is also necessary based on the average time between resurfacing. This must be recognized as a fixed annual expense which must be incurred if efficient rail operations are to be maintained.

f. Track Machinery

FENADESAL has only one tamper for track maintenance. With the shift to modern maintenance practices more, such equipment will be required. The number of machines depends upon the amount of railroad to be retained. At a minimum, one tamper and one ballast regulator will be required. Necessary spares and training for the staff is also required.

g. Bridges

Virtually all bridges require full sleeper replacement. The bridge over the Río Cenizas near Sonsonate requires major repair work due to corrosion damage to the main trusses. FENADESAL has estimated the minimum cost of these repairs as ¢500,000 to ¢750,000. These repairs are necessary if the railroad is to be continued in operation.

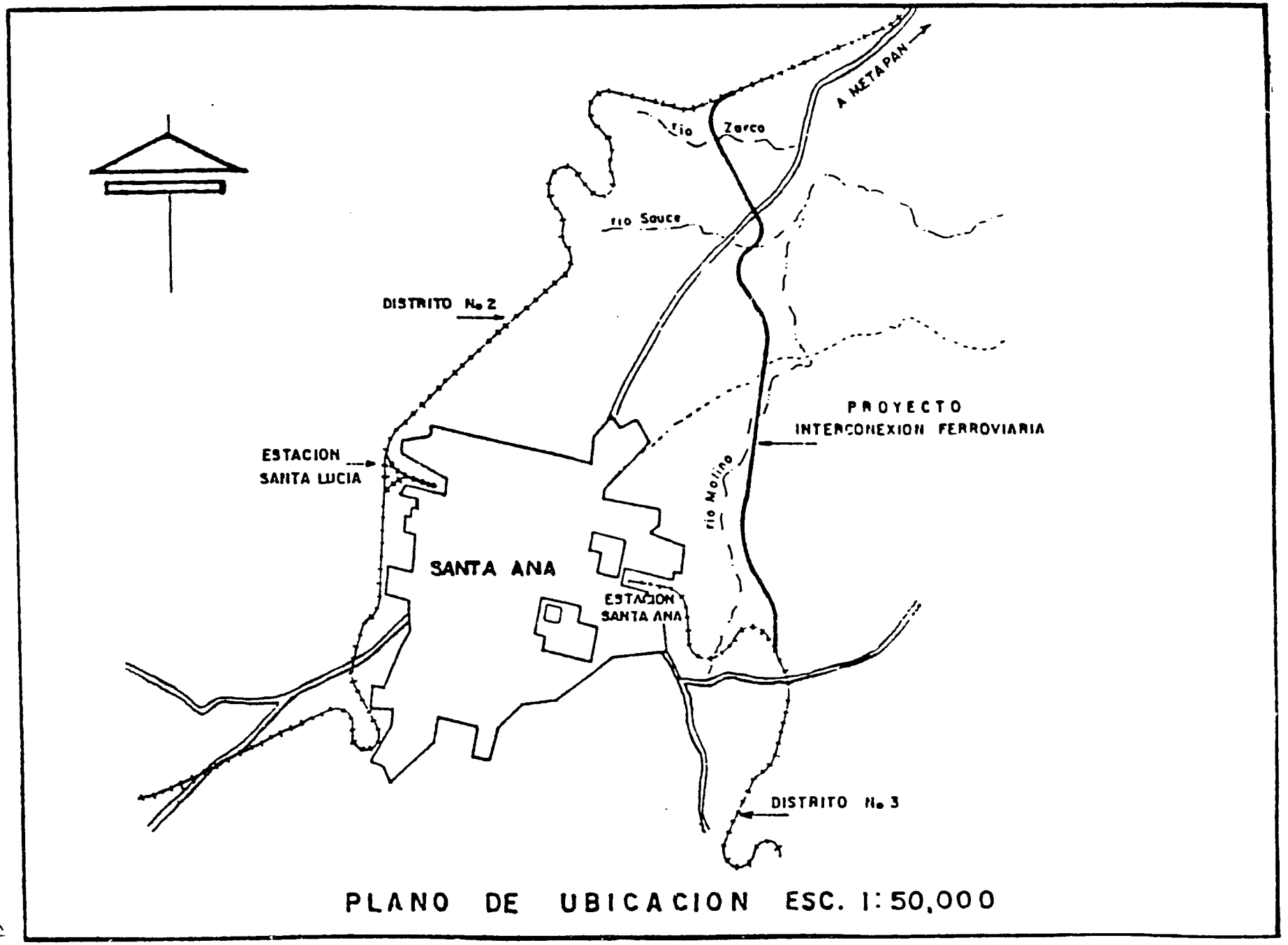
Several bridges on District 1 require major repairs or replacement due to war or corrosion damage. Abandonment of some line segments may make bridges available for use elsewhere. A program of increasing bridge capacities on District 3 is also needed.

h. Santa Ana Connection

This project, shown in Figure 4.1.5, includes construction of a 4.75 km connection between the former Salvador Railways and IRCA lines at Santa Ana, and rehabilitation of the Santa Ana (Santa Lucía)-Texis Junction line which is currently out of service. Total cost is estimated as ¢60,882,000 for the connection and ¢8,817,000 for the rehabilitation, a total of ¢69,699,000.

Construction of this project will create a new through route from Metapán to San Salvador via Santa Ana and Sitio del Niño. It will permit abandonment of the existing District 2 between Texis Junction and Soyapango or Apopa (see Apopa Connection below), avoiding rehabilitation expense, releasing track materials for use elsewhere. It will

FIGURE 4.1.5
The Santa Ana Connection



substantially shorten the distance between Metapán and Acajutla, possibly permitting FENADESAL to compete effectively for the cement now moving via truck. This route may have higher operating costs per train kilometer due to more and sharper curves and steeper grades which limit the size of trains. The grades however, generally are against northbound trains so that they favor loaded movements. Trade offs between higher operating costs and shorter distances will be evaluated in determining the feasibility of this investment.

i. Apopa Connection

For the last several years, FENADESAL has had problems along the Río Las Cañas between Km 246 and 255 (see below). In order to avoid the problem area, FENADESAL has proposed building a new connection between Districts 2 and 3 in the vicinity of Apopa, as shown in Figure 4.1.6, rerouting District 2 trains via District 3, and abandoning District 2 through the problem area.

This connection can also be used in reverse. Assuming that the problem area at Km 246-255 can be readily repaired, it is possible to reroute District 3 trains via District 2, permitting abandonment of District 3 between Apopa and San Salvador. This avoids the severe encroachment problem on District 3 and rehabilitation and maintenance expenses for this line segment. With the light traffic density involved, concentrating traffic on the minimum route distance is generally economic. The feasibility of this option depends upon the feasibility of correcting the Km 246-255 problem. The estimated cost of this connection is ¢23,600,000.

j. Repair between Kilometer 246 and 255

For several years, FENADESAL has had problems with roadbed stability between kilometer 246 and 255 along the Río Las Cañas. The river is undercutting the west bank underneath the railroad causing landslides which destroy the grade and track. At the same time, landslides from the opposite side of the track cause suspensions of service which last for some time. The current suspension started in June, 1994. with the line not expected to reopen before January, 1995. In order to avoid this problem, FENADESAL planned the Apopa Cutoff to reroute trains and abandon this line.

The proper solution appears to be one of cutting the hillside on the west side of the track back at the top so it forms a stable slope. Material removed in this process can be deposited on the other side of the track, again forming a stable slope and introducing a barrier between the river and the bank. Because of the extremely soft nature of this material, it may be necessary to provide retaining walls or other stabilization to prevent the material from being washed away. FENADESAL is presently making repairs using this approach. FENADESAL has estimated the cost at ¢500,000.

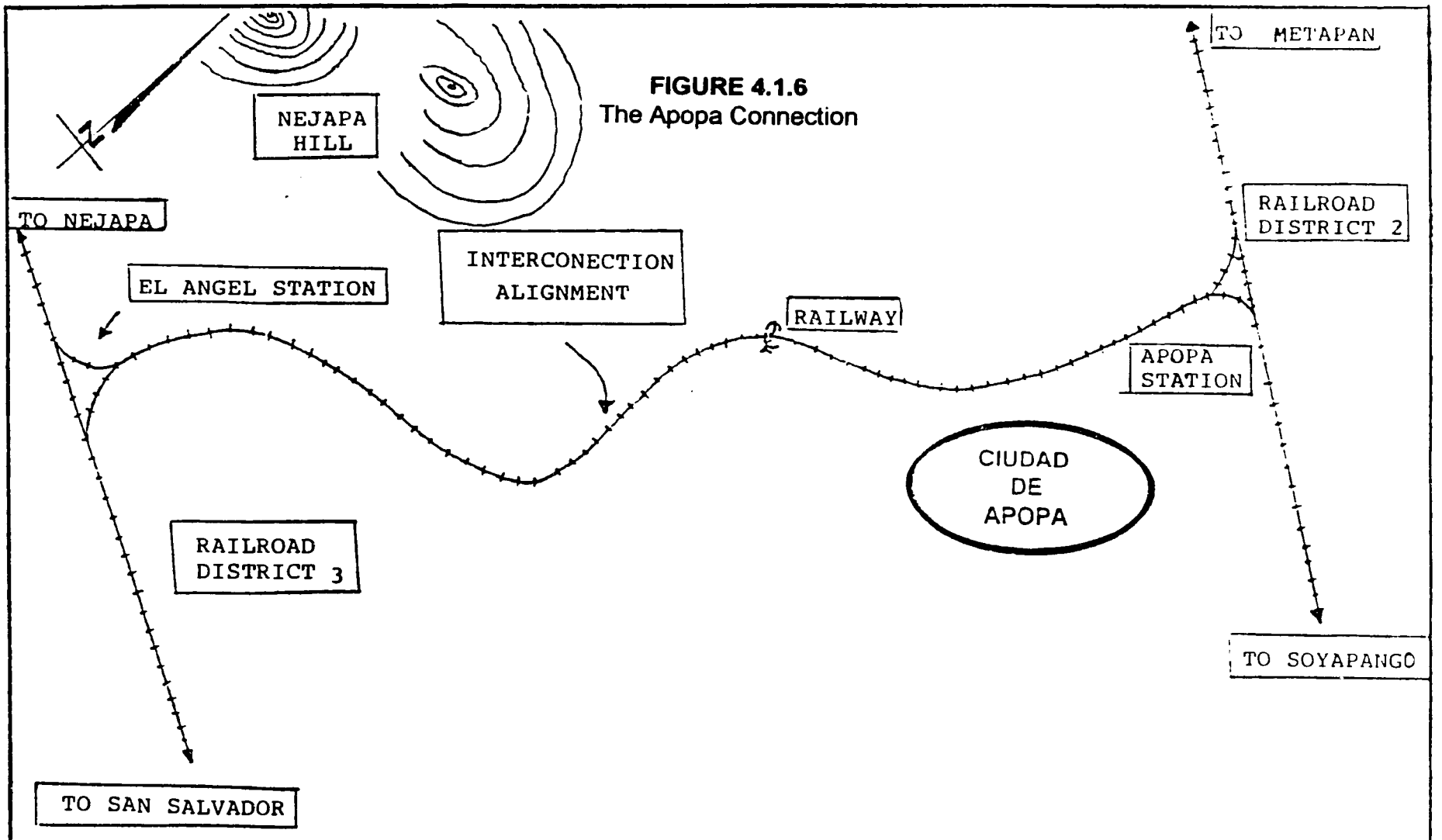


FIGURE 4.1.6
The Apopa Connection

INTERCONECTION BETWEEN DISTRICTS 2 & 3
(EL ANGEL-APOPA)

50

This estimate appears low given the extent to which work is required and may cover only the immediate repairs now under way.

The rail line between San Salvador and Soyapango presents several issues. The vast majority of rail customers in San Salvador receive or ship their goods through the San Salvador station, with many leasing storage space from FENADESAL. Rail traffic data presently available does not indicate where customers are specifically located in the San Salvador area, making a decision regarding the future of this line difficult. Very few, if any customers are apparently located on this line segment. If all rail operations in the San Salvador area are concentrated on District 3, it should be possible to abandon the San Salvador-Soyapango segment. If they are concentrated on District 2 and District 3 between San Salvador and Apopa is abandoned, it will be necessary to retain this line to reach present customers.

There is a substantial amount of railroad served vacant land in the vicinity of Soyapango. This property also has good highway access and is outside the congested area of San Salvador, making it ideal for modern distribution centers. The development potential of this area indicates that retention of rail service to Soyapango may be wise no matter what service option is ultimately selected. If operations are concentrated on District 2 and present customers in railroad facilities at San Salvador persuaded to move to new facilities in Soyapango, continued operation of this segment would no longer be necessary. In order to permit abandonment, it would be necessary to provide repair facilities for locomotives and wagons in Soyapango. Major overhaul work could remain in San Salvador with components such as engines, traction motors, and generators being transported by truck between the workshops and Soyapango. Costs of such an operation will be included in the evaluation of this line segment.

The several options above could result in a restructuring of present operations. The investments proposed in connections are not mutually exclusive. One or more of them may be built without affecting others. When possible combinations are considered, there are a great many alternative approaches which may be used. These will be evaluated during the next phase of the study.

k. New Communications System

FENADESAL has proposed an investment to modemize its existing communication system at a cost of ¢772,000. The existing system consists of a mixture of radio, telephone (often magneto type) and telegraph. It is proposed to install a new telephone and fax system for communication between the headquarters office and 18 major stations.

5

4.1.9 Summary and Recommendations

Due to low traffic volume, El Salvador's rail system has operated at a substantial financial loss for many years. Potential savings in operations are not sufficient to offset these losses. As past marketing efforts have not resulted in traffic increases to the level required for profitable operation, and growth potential appears limited, the future role of the railway is uncertain. Investment in the railway should be postponed until its future role is defined.

There are some actions which can be taken immediately to reduce operating costs, or to increase service levels and revenues.

Small shipments are moved at very substantial losses. The handling of such shipments should be discontinued and related station staffing reduced accordingly.

Staffing requirements should be analyzed in Finance, Equipment Maintenance, and Stations; and appropriate adjustments made. These functional areas appear to be overstaffed based on current workloads.

Action must be taken to control encroachments into the right of way and to remove those which have recently occurred. Without immediate action this problem will continue to increase in severity. The concept of the working foreman should be instituted, especially in maintenance of permanent way.

Rates for present traffic should be increased to the maximum which the competitive situation will permit. This will require marketing research to determine exact levels of highway carrier rates and service. FENADESAL should adopt modern marketing techniques including the identification of specific markets in which the railroad can effectively compete and the development of marketing programs including price, service and proper equipment to maximize participation in these markets. Finding of return loads for wagons currently being moved empty should be a priority.

A conversion to dedicated train operations for major shippers, such as the cement companies, should be instituted. Operation of block trains for major customers on a scheduled basis should both reduce costs and improve service.

While FENADESAL's present track conditions severely restrict train speeds and often prevent FENADESAL from offering a competitive service, major investment in repairs and rehabilitation should be postponed until the need for specific rail lines is established. Unneeded sidings and other facilities should be removed and the material used for replacement or sold as scrap in order to reduce maintenance expense. The use of present design concrete sleepers should be discontinued.

Unrepairable equipment should be retired and removed from the accounts.

Continued long-term operation will require a major rehabilitation program including extensive sleeper replacement and ballasting. Design of the program should be coordinated with Marketing to insure that initial efforts are in those areas where traffic potential is available. As a part of this program, FENADESAL should evaluate the woods available for use as sleepers, with and without preservative treatment. A similar evaluation of available ballast materials should also be made and that material which is most cost effective on a long term basis selected for future use. Expanded use of contract labor should be considered.

New track connections at Santa Ana and Apopa will permit route restructuring and increase efficiency. These will require substantial investment. The impact on total operating cost and service levels must be determined in evaluating the feasibility of these investments.

Investment in new container handling equipment will be required if FENADESAL is to participate effectively in this traffic. Any action to invest in such equipment should be postponed until the future role of the railroad is established.

The next phase of the project will determine potential railroad traffic flows, develop the economics of a fully rehabilitated railway, evaluate proposed investments in route restructuring, and define the railroad system which can best meet El Salvador's transportation needs.

4.2 Rail Analysis

4.2.1 Introduction and Objectives

This section presents the analysis of options for continuing rail service and recommends a strategy for future railroad development within the context of developing the most efficient multimodal transport system meeting the needs of El Salvador. It addresses the rail related issues contained in the Terms of Reference, as detailed in Task 4 of the Proposal. It also contains all new material which has been developed subsequent to preparation of the Section 4.1 of this Report.

The primary objective of this analysis is to evaluate the costs and benefits of continued rail service. A detailed analysis is made of each of the scenarios described in Section 4.1. titled "Possible Scenarios for Future Development". Criteria including operating costs, revenues, investment costs, service levels and other benefits have been developed for use in this evaluation. The primary criteria is economic, based on investment requirements and operating costs as measured by transport costs per ton-kilometer.

The results of this analysis are evaluated against other transport modes in other chapters of this report. Analyses are also made in financial terms, in order to determine if future rail operations can be profitable or if continued financial assistance will be required.

The problems cited in this analysis as adversely affecting the railroad's ability to operate efficiently are of a very long standing nature. Virtually all of them were cited in the CANAC Report of 1979. Most were mentioned in the 1966 Evaluation of Ferrocarril de El Salvador (now FENADESAL's District 3) by Nippon Koei Co. Ltd., Japan Transportation Consultants Inc. Without corrective action having been taken as a result of these analyses, the problems have become more severe and will now require far greater expenditures to correct.

4.2.2 Description of Present Operations

a. Freight Traffic and Revenues

Traffic handled by the railroad in 1993 and 1994, by commodity, major origin and destination, is shown in Table 4.2.1. Comparable detail for 1992 is not available. Total traffic handled by FENADESAL declined significantly in 1994. In the Section 4.1, it was projected, based on six months experience, that 1994 volume would exceed that handled in 1993, and that 1994 would be the second highest volume year in the last ten, exceeded only by 1987. This did not happen. During the last four months of 1994, there was a precipitous decline in volume and revenue. This was concentrated in FENADESAL's primary commodities, cement, fertilizer (other than from Cutuco), and steel imported through Acajutla. The decline was such that in December, District 1 transported nothing

except fertilizer and cement from Cutuco. Although some imports were transported from Acajutla, FENADESAL's figures show no rail suitable imports received in the Port in the month of December. As a result of the decline in revenue, the operating deficit for 1994 was the highest in the last several years.

TABLE 4.2.1
Railroad Freight Traffic 1993-1994

000 METRIC TONS			
COMMODITY ORIGIN	**DESTINATION**	**1993**	**1994**
Cement			
Metapán	San Salvador	116,391	57,778
	Apopa	-	43,988
	La Toma	8,904	3,088
	San Miguel	17,850	12,882
	San Vicente	2,613	-
	La Unión	2,278	-
	Zacatecoluca	1,764	-
	Quezaltepeque	2,158	-
Coffee			
Santa Ana	Acajutla	11,861	9,214
San Salvador		1,596	764
Ateos		5,189	2,282
Nejapa		993	679
San Miguel		3,044	764
Import Traffic			
Acajutla	San Salvador	16,133	24,620
	Palenco	325	1,605
	Corinca	6,027	14,657
	Quezaltepeque	-	1,118
	Entre Ríos	6,853	13,727
	Km. 154 (Dist. 1)	4,259	2,610
	Usulután	134	2,260
	San Miguel	3,463	6,749
	Santa Ana	4,423	-

Source: Frederic R. Harris

With the closure of the railroad, due to landslides, between Km. 249 and Km. 255 in August, 1994, transport of cement was disrupted. The impact can be seen in the decline in cement shipments to San Salvador and points on District 1. Cement destined to San Salvador and points beyond must now be transferred by hand to trucks at Apopa. Revenue

figures indicate that the rail rate to Apopa is the same as that to San Salvador. According to FENADESAL, the cement transporters pay all costs associated with transfer and trucking. This must represent a significant increase in cost to the cement companies. Average cement shipments from Metapán during the first six months of 1994, before the closure, averaged 12,795 tons per month. During the second six months, average shipments were 6,846 tons, reaching a low of 3,430 tons in December. While reasons for the decline have not been investigated, the higher costs caused by the truck transfer may have resulted in major diversions to all truck movement. Identifying the precise causes of this decline is critical to projecting future rail volumes and to developing the future role of the railway.

Traffic has continued to decline in 1995. For the first two months of 1995, District 1 transported a total of 2,719 tons which compares with 6,501 tons for the same period of 1994. Freight moved on District 2 totalled 10,226 tons, down from 22,907 tons in the same months of 1994. The 1994 figure included 1,021 tons of fuel oil from Acajutla. Cement traffic was down by more than half, indicating that the loss of traffic is continuing.

Cement is imported when domestic production can not meet demand. Imports are used to insure that total supply meets demand and prices are not inflated as a result of shortages. As a result, import volumes are erratic. Most import cement passes through the Port of Acajutla although rare shipments are made via the Port of Cutuco. During 1994, there was one vessel at Cutuco which discharged 6,700 tons of cement. This vessel also called at Acajutla. All cement received at Cutuco is moved from the pier by rail. It may move inland as far as San Salvador. No import cement was moved by rail from Acajutla. Import cement is considered an unusual movement, the need for which will be replaced by expanded domestic production capacity and it is not included in forecasts of future demand.

The landslide problem also resulted in loss of the fuel oil movement from Acajutla to Metapán. Shipments had reached a high of 1,493 tons in March with nothing being transported after July. Fuel oil shipments previously moved via San Salvador and District 2 due to the absence of shorter rail routes. With the extremely circuitous haul, it is hard for FENADESAL to meet truck transit times and may make retention of this movement difficult.

- Fertilizer

Domestic fertilizer traffic also declined significantly, from 35,033 tons in 1992 to 18,172 tons in 1994. Domestic fertilizer originates on both District 1, at Cutuco, and District 3 at Acajutla. While no domestic fertilizer was transported in November and December, this reflects a normal seasonal pattern of low shipments in the winter months.

Imported fertilizer handled at Cutuco in 1994 increased to 44,296 tons, an increase of 7,234 tons over 1993.

This movement is historically erratic, depending upon vessel arrivals at Cutuco and not showing any significant seasonal pattern. As usual, this material was for the two plants in the Cutuco area.

- Acajutla Traffic

Imports and exports through the Port of Acajutla have historically been the second most important commodity grouping for FENADESAL. FENADESAL identifies the cargo moving through Acajutla as suitable for rail movement or not. They then evaluate their own performance on the basis of the percentage of rail suitable cargo which was handled by FENADESAL.

FENADESAL's export cargo at Acajutla has been limited to coffee for the last several years. Coffee originates principally at Santa Ana, San Salvador and San Miguel, and all is transported in conventional closed wagons. No containers are moved, although virtually all export coffee moves from the port in containers. Although coffee traffic increased from 1992 to 1993, it declined sharply between 1993 and 1994. The net effect was that, between 1992 and 1994, actual coffee tonnage fell slightly from 16,568 tons to 14,332 tons. The market however, as represented by total coffee exports, increased dramatically.

As a result, FENADESAL's share of the coffee export market via Acajutla was cut in half, from 12 percent to 6.5 percent. It is clear that FENADESAL is loosing its traditional market in this area.

As detailed in the Global Report, rail suitable import cargo (using FENADESAL's definition) has exceeded rail suitable export cargo for a number of years. Examination of statistics indicates that, through 1993, truck movements were balanced between imports and exports, with FENADESAL transporting the import cargo which did not have a balancing export movement. This was not true in 1994. Truck transport of rail suitable export cargo exceeded imports by about 21,000 tons. This would indicate that the trucks are now handling cargo to the port for which a backhaul is not available. When a backhaul is not available, trucking costs per ton-kilometer are almost doubled as the freight must now pay for a round-trip of the truck. This indicates that the truckers are now in a position to divert most traditional rail cargo.

Of Acajutla's 1994 rail suitable imports of 252,142 tons, FENADESAL transported 65,168 tons, or 26 percent. Percentagewise, this was up from 16 percent in 1992. FENADESAL's import tonnage virtually doubled in these two years. Iron and steel products accounted for 45,054 tons, or 72 percent

of total rail import traffic. This is up from 32,032 tons in 1992, which then represented 93 percent of import tonnage.

Hardware is the significant growth commodity, increasing from 106 tons in 1992 to 13,743 tons in 1994. Hardware represented 22 percent of import tonnage in 1994. There was a small movement of cereals, 2,546 tons, four percent of total imports. This is up from zero in 1992. This may represent a new market for FENADESAL, although most cereal grains are moved in bulk to distribution points. FENADESAL has no suitable bulk transport wagons.

- Dependency on Few Commodities

Iron and steel, and hardware accounted for 94 percent of FENADESAL's 1994 import tonnage. Cereals represented four percent. With this extreme concentration in three commodity groupings, rail import traffic will be extremely sensitive to changes in flows of these commodities. The substantial increase in import traffic experienced in these three years may not be typical of other time periods.

The commodities discussed above accounted for 98 percent of the total tons transported in 1994. This was up from 89 percent of 1992 tonnage and indicates that the railroad is increasingly becoming a transporter of a very limited number of commodities. Shipments at Cutuco remain with the railroad only because of the lack of truck access and would be expected to shift to truck if road access were available. With the increasing concentration in three commodities, railroad traffic volume and revenues are vulnerable to changes in these industries.

- Traffic Suspended to Guatemala

No traffic is transported to or from Guatemala. The connecting line in Guatemala has been out of service for a number of years and is not expected to be restored in the near future. Substantial investment would be required to restore this line to operation.

Guatemala has requested expressions of interest from private firms interested in acquiring the railway. It is our understanding that several expressions of interest have been received. The Guatemalan Government has indicated that, if a suitable offer is not received by the end of June, 1995, it is their intention to abandon the railway.

Due to the uncertainty surrounding the Guatemalan situation, it has been assumed that no traffic will be moved via this route, now or in the future.

b. Passenger Traffic and Revenues

- Existing Traffic

FENADESAL operates a limited passenger service between Sonsonate and Armenia. During 1994, passengers transported declined to 357.000 from 392,000 transported in 1993, a decline of nine percent. Revenues declined by an equal amount. A cursory examination of railroad costs indicates that this service, even with the decline in use, is more than covering its direct costs for staff, fuel and equipment maintenance. No new investment is justified in this service, given the low level of usage and the alternate services which are available.

There is extensive bus service in the area served by the rail passenger trains. Although the rail line is as much as six kilometers from the main highway between Sonsonate and San Salvador, virtually all roads crossing the railroad have bus service and there is such service between every rail station and Sonsonate or Armenia. Although train ridership is significant, especially on weekends, there appears to be no Government policy reason to retain this limited service. National and regional transport needs are met by the existing bus services. Because of its limited importance to both FENADESAL and national/regional transport needs, the economics of this service have not been examined in detail, nor have projections of future demand been made. From FENADESAL's viewpoint, as long as the service is making a positive cash contribution to the railway, it should be retained.

- Tourist Traffic

Should all or part of the railway be retained for freight service, there may be a market for tourist train service. FENADESAL recently operated a three day excursion for a foreign group which was highly profitable. FENADESAL has two functional steam locomotives, the "President's Coach," and several other coaches which can be used for this type of service. Detailed examination of this potential market is beyond the scope of this study. Although it is doubtful that this market is sufficiently large to justify retention of the railroad, it should be recognized that it may represent a significant source of additional income. From a national economy viewpoint, these operations could be a substantial source of foreign exchange.

- Commuter Service

As discussed in other sections of this report, abandonment of the railway will increase highway truck traffic significantly. The costs of this congestion are

extremely high and provide justification for retaining rail freight services. In the future, this same circumstance may begin to justify expanded rail passenger service in some areas. There is a need for a detailed analysis of the potential for this service, principally commuter, between San Salvador and Santa Ana, and between San Salvador and the Guatemalan border. If intermodal traffic grows as projected, around 2015 this service may divert sufficient buses from the highway during peak hours to result in major savings in congestion costs.

c. Operations

The railroad is operated in the form of three districts, District 1 from San Salvador to Cutuco including the San Salvador yard, District 2 from Soyapango (connection with District 1) to Guijat, with a currently non operational branch from Texis Junction to Santa Lucía (Santa Ana), and District 3 from San Salvador to Acajutla with a branch from Sitio del Niño to Santa Ana. Operations on each district are conducted independently of each other. One shunting locomotive is operated for two shifts, with a total operating period of ten to twelve hours, Monday through Friday, in the San Salvador Yard. The two 45-ton General Electric locomotives (700 series) are used for this assignment.

Train operations for the Month of January, 1995, were analyzed in detail in order to obtain an accurate picture of operating patterns. On District 1, there were a total of five round-trips between San Salvador and Cutuco, and five between San Salvador and San Miguel. There was one round-trip between Cutuco and San Miguel. The average time for a round-trip between San Salvador and Cutuco was six days. Trains typically operate from San Salvador to San Vicente, 71 kilometers, and rest overnight. The second day, the train operates to Usulután (81 km.) or San Miguel (112 km.), and to Cutuco (62 km from San Miguel, 93 km. from Usulután) on the following day. The return journe y is similar. Crews are working extensive overtime to make these distances. Crews are given orders to operate to a specific point, such as San Vicente. Examination of train sheets indicated a number of instances where crews failed to reach their scheduled terminal in a ten to twelve hour working day.

There were a total of 35 loads handled southbound (toward Cutuco), 34 fertilizer which originated at Acajutla and one hardware. There were 99 loads northbound including 48 cement from Cutuco to San Salvador, 9 pallets and 42 coffee from San Miguel to Acajutla.

Derailments are frequent on District 1. Of the 21 derailments reported in January, 9 occurred on District 1. One February train was reported as derailing five times on a single trip from Cutuco to San Salvador. The slow service, high operating costs, and number of derailments reflect the extremely poor condition of the way (see Annexes 4 and 7). In January, derailments averaged one for each 375 train-kilometers.

On District 2, current operations are conducted only between Apopa and Guijat. Crews are transported by commercial bus between San Salvador and Apopa or Metapán as needed for operations. Actual train operations depend upon the level of loadings at the cement companies. Trains operate from Apopa to Metapán, sometimes remaining overnight at La Toma. The yard at Metapán is used as a holding yard for both empties and loads. A crew will start from Metapán delivering empty wagons to the cement plants and return with loads. Assuming the crew has not completed a day's work, that crew will take a loaded train to Apopa, remaining overnight at La Toma. Regular shunting locomotives are not worked at Metapán, this work being performed by train crews. On occasion, shunters will work at Apopa depending upon the number of wagons to be placed for unloading. Two shunting assignments were worked in January. Other than a small amount of cement destined for La Toma, all freight on District 2 moves from Guijat or El Ronco to Apopa.

The frequency of train operations depends upon the number of cement loads to be moved from Metapán. Assuming that loads are removed from the plants on the day they are loaded, the number of wagons loaded varies substantially from one day to the next. During the month of January, daily loadings ranged from none to 41. The erratic pattern of loading creates a very erratic demand on railroad facilities, including the transfer at Apopa. During January, a total of 15 round-trips were operated with an average of 16 loaded wagons southbound and 20 empty wagons northbound. More empties were moved north than loads south indicating that empty wagon supply at the plants was adequate. This is supported by railroad records which indicate that all orders for wagons were filled and there were additional empty wagons available. The average loaded train weight was 626 tons, exceeding the official tonnage rating of 400 tons per locomotive between Metapán and Texis Junction. Only one derailment occurred on District 2 during the month of January. This represents one derailment per 2,280 train-kilometers.

District 3 has the greatest frequency of train operations. Seventeen round-trips were operated between San Salvador and Acajutla in January. Typically, one crew will work from Sonsonate to Acajutla and return. Another crew will take the train from Sonsonate to San Salvador. Operations between Sonsonate and San Salvador are coordinated so that north and southbound (geographically east and westbound) trains will meet at an intermediate point such as Ateos. Crews and locomotives are exchanged between trains so that the crews return to their starting points.

Because of the severe grades between Sonsonate and Armenia, southbound trains are operated in sections over this segment. A crew may make as many as three round-trips between Sonsonate and Armenia with portions of a single train, running light (with no wagons) from Armenia to Sonsonate, before proceeding on toward San Salvador. In some cases, turns are operated as far as Sitio del Niño to handle traffic to and from Santa Ana.

Trains are also moved in sections from Apopa to San Salvador because of locomotive tonnage restrictions on the steep grade approaching San Salvador.

Operation on the Santa Ana branch depends upon the volume of traffic to be moved. During January, there were nine round-trips to Santa Ana, of which three operated between San Salvador and Santa Ana. Five operated from Sonsonate. One operated San Salvador - Santa Ana - Acajutla. There is a frequent exchange of wagons at Sitio del Niño between trains operating to Santa Ana and from Acajutla.

There are a limited number of origin/destination points on District 3. Santa Ana is the only point of origin on that branch. Between San Salvador and Acajutla, these are the major origin/destination points. Ateos and Nejapa originate a significant amount of coffee for Acajutla. Part of the steel transported by FENADESAL from Acajutla goes to Kilometer 79/80, near Quezaltepeque. There is also a steel yard at Km. 49, near Armenia.

District 3 had 5 derailments in January, all caused by equipment failures, or one per about 1,036 train-kilometers.

d. Operational Improvements

The major operating problems of FENADESAL are concentrated on District 1 and relate directly to the condition of the track. These problems cannot be solved or reduced without a major rehabilitation. Rehabilitation needs are so large on most portions of District 1 that it is preferable to consider major relocations rather than rehabilitation of the existing line. With the magnitude of investment required, this does not appear feasible at present traffic levels. No operational improvements can be achieved without this rehabilitation.

The excessive size of train crews, five to six persons, was discussed in the Section 4.1. FENADESAL has advised that several factors require the present crew size and make reductions infeasible. A major function of the brakemen is to ride the roofs of wagons to watch for derailments and stop the train when necessary. This results from neither the engineer in the locomotive or the conductor in the caboose being able to see the entire train on many curves. This is directly related to the condition of the track. The fast response may reduce the severity and damage caused by derailments. The additional payments to crew members may be more than offset by these reductions in damage. This requirement may be eliminated with track rehabilitation which will reduce the possibility of derailments. When trains must be handled in sections on steep grades, at least one member of the crew must be left to guard the portion of the train remaining behind. This is to prevent theft from the wagons. Given current economic conditions in El Salvador, this requirement appears valid. This makes it doubtful that the crew size can be reduced. In some places, such as Armenia, wagons are left where they are visible from the station, such that the agent can take action if he observes theft taking place.

It may be feasible to assign security people to this function, or to add agents at presently unmanned stations where wagons are commonly left. This may however, cost more than having extra on-train staff.

There are some operational improvements which can be made but which require the cooperation of customers. The amount of cement shipped on any given day varies greatly. If a constant amount were loaded per day, based on monthly demand, rail operations could be scheduled on this basis and both wagon and locomotive utilization improved accordingly.

Steel shipments offer a similar opportunity for improvement. Steel is off-loaded from the vessel at the Port and stored awaiting customs clearance. It often remains in storage at the Port after clearance is complete. Steel consigned to San Salvador is stored at FENADESAL facilities until required by the customer. With existing storage on both ends of the rail movement, it should be possible to schedule shipments on a steady daily basis, again improving equipment utilization. As this is imported, there is a long lead time between order and delivery at the port. The customer should know well in advance how much steel will be on each vessel and its arrival date. This should also benefit the customer by insuring a steady flow of material.

As noted in the Section 4.1, identified savings from operation improvements are but a small portion of present financial losses. They are not sufficient to offset present subsidy requirements. Fixed expenses of track maintenance represent such a large portion of total expenses that savings in other areas are insignificant. Track maintenance can not be reduced without adversely affecting the performance of the railroad.

e. Feasibility of Continuing Present Operations

Continuing the present railway operation does not appear feasible. As noted above and in Section 4.1, there are no areas in which cost savings can be achieved sufficient to eliminate or make major reductions in subsidy requirements.

As is discussed in detail below, providing adequate maintenance of the permanent way for the existing rail system will require a budget of about ¢47,400,000 per year. This is more than FENADESAL has been spending in total for all functions. This is not rehabilitation but the annual amount which is required to maintain the present route structure in satisfactory condition for long-term operation. While this high amount of maintenance cost should be partially offset by a reduction in expenses, principally transportation overtime, and by future traffic increases, increased subsidies will be required, especially in the near term.

Present traffic volume has declined in recent months and is continuing to drop. This must be assumed to reflect the gradual deterioration of the railroad fixed facilities and the

declining service standards which result. As traffic declines, revenue declines and operating losses increase. With the present cost structure, in which 93 percent of total costs are fixed, a reduction in traffic volume results in virtually no change in operating costs. A continuation of present operations, without major rehabilitation of the permanent way, will result in declining revenues and increasing subsidies. This conclusion is supported by the modal analysis of projected traffic flows which is discussed in following Section below and in Chapter 2 in which it is anticipated that the railroad, without rehabilitation, will loose all of its present traffic.

Given the prospective loss of traffic, it is evident that operations as presently structured cannot be continued. To do so will result in a railroad which is rapidly loosing its reason for being and at the same time, increasing its financial demands upon the Government. Preservation of any railroad service on an economically feasible basis will require rehabilitation of the segments of the system to be continued in operation.

Various scenarios for preserving all or a part of the existing system are discussed in the following sections.

4.2.3 Evaluation Criteria

In order to provide an objective basis for evaluation of the various scenarios which have been proposed for future rail development, it is necessary to have specific criteria which can be measured for each option and specific economic and non- economic impacts determined. The criteria which are used in this analysis are discussed in this section.

a. Rehabilitation Costs

FENADESAL's existing track structure has deteriorated extensively in recent years due to inadequate spending on permanent way maintenance. As a result, sleeper condition has become extremely poor, service has become erratic and undependable, speeds have been reduced and operating costs have increased. If the railroad is to compete successfully in the transport marketplace, track must be rehabilitated to a desirable level of adequacy. The United States Federal Railroad Administration (FRA) has developed a series of track standards, each permitting a certain maximum speed, which have proven effective in establishing what is required to permit certain operating speeds with a high level of safety. These standards are now being used in several countries and have been used as a guide to rehabilitation requirements.

- Design Speed

The FRA Class 1 standards permit a maximum speed of 10 miles per hour (16 kph), Class 2 a speed of 25 mph (40 kph), and Class 3 40 mph (64 kph). Even with the short distances involved and the type of traffic which it is

projected that the railroad will carry, a speed of 16 kph is not adequate. Experience in the United States has shown that it is very difficult for a locomotive engineer to restrict his operation to 16 kilometers per hour. The result is that he operates too fast and a derailment results. When operating at extremely low speeds, railroad locomotives are not fuel efficient and the rotating machinery can be damaged by excessive operation at these speeds. With a maximum speed of 16 kph, a commercial speed of 13 kph typically results. This would be too slow for true participation in the market and will incur additional train operating costs for fuel consumption and crew payments over Class 2 or 3 standards.

FRA Class 2 standards have been generally used in the United States for U.S. Government funded rehabilitation projects. Class 2 and 3 have the same requirements for sleepers, differing only in standards relating to alignment and surface.

As the additional cost is small, most railroads have found it economic to rehabilitate track to Class 3 standards, reducing maintenance expenses over the next several years as the track is allowed to gradually decline to Class 2 standards. A rehabilitation to Class 2 levels is assumed for the purpose of estimating these costs and performing economic analysis. The as built design speed of the railway was approximately 40 kph. This has been developed from FENADESAL's Schedule No. 1, effective January 1, 1977, which defines permissible speeds in terms of minimum running times between stations rather than by maximum speed limits. This also fits with the Class 2 standards.

- Axle Loads

The operating efficiency of the railroad could be improved significantly by an increase in maximum permissible axle loading from 16 to 20 tons. This would permit an increase in the maximum weight of locomotives which would increase the hauling capacity. This is directly proportional to the weight. An increase from 16 to 20 tons would result in an increase of 25 percent in the tonnage hauling capacity of the locomotives. It would also permit an increase in wagon loading, permitting the same volume of cargo to be transported with fewer wagons.

Axle load restrictions result from several factors. The capacity of wagon frames and axle bearing size and capacity limit what the wagon can carry. Rail size and bridge limitations restrict what the track can carry. In order to achieve the benefits of an increased axle loading, it is recommended that those parts of the rehabilitation program which affect axle loading be

designed to permit this increase in axle loading. In the initial rehabilitation program, this will involve only bridges. An increase in rail weights is included in the expanded routine annual maintenance program. Wagon replacement is discussed elsewhere.

- Sleepers

FRA Class 2 standards require a minimum of eight good sleepers per 39 foot rail length with one good sleeper under each rail joint. FENADESAL's standards assume 1,791 sleepers per kilometer, equivalent to 2,866 per mile. To meet the FRA standard, a minimum of 1,083 good sleepers are required per mile or 677 per kilometer. If all sleepers presently in track were bad, it would be necessary to replace at least 677 sleepers per kilometer as part of the rehabilitation program. However, FENADESAL estimates that 75 percent of present sleepers require replacement, a figure which has been confirmed by physical track inspection. For cost estimating purposes, it has been assumed that 75 percent of the 677, or 508 sleepers per kilometer, will be required. The rehabilitation program will replace about 25 percent of present sleepers which is typical of major sleeper replacement programs by other railroads. While some railroads follow a program of replacing the entire track structure (rails, sleepers and ballast) at one time, many follow a program of replacing every fourth sleeper at fixed intervals based on estimated sleeper life.

As to the type of sleeper to be used for both rehabilitation and normal replacement, FENADESAL has the option of using domestic or imported wood, with or without preservative treatment. Imported, treated, wood sleepers may also be used. Concrete sleepers, either imported or domestically produced, may also be used. Each of these has a different life-cycle cost.

FENADESAL's past experience with locally manufactured concrete sleepers has not been satisfactory. These have failed frequently. This poor experience can be traced to several factors. While containing some internal reinforcement, these have not been of the pre-stressed type of manufacture in which the reinforcing rods are placed under tension before the concrete is poured around them. Pre-stressing has proven essential to obtaining a proper service life in other parts of the world. FENADESAL has not used a cushioned pad between the rail and the sleeper, resulting in the sleeper receiving a sharp impact with the passage of each axle. Probably the most significant cause of premature failure has been the lack of a proper foundation due to the lack of ballast. This condition will take several years of routine maintenance to correct. It has also been found that mixing concrete and wood sleepers results in premature failure of both due to the

differing resiliency of the two materials. Due to the lack of a proper foundation and the need to avoid an immediate full replacement of sleepers, the use of concrete for the rehabilitation program is not recommended. Rather, replacement during the rehabilitation program should be with wood. Depending on life-cycle cost, concrete may be considered for replacement as a part of normal maintenance in future years.

At the present time, FENADESAL has tried to standardize on two local woods which have a life, without treatment, of ten to fifteen years. With the installation of proper ballast, this life should be extended to twenty years. These sleepers have a cost of ¢50 each. FENADESAL has no recent experience with the impact of treatment on the life of these sleepers. Treated sleepers, of the same woods, are available at a price of ¢200. With this difference in price, the treated sleepers would have to have a life of at least sixty years to make them economic. This is a much longer life than can be reasonably expected. Thus treatment, at least in the short run is not economic. Imported, treated wood sleepers are also available at a cost of about US $ 40, or ¢348. As these sleepers can not be expected to have a life exceeding forty years, their purchase is also uneconomic. The use of untreated local wood sleepers is recommended. FENADESAL estimates the production capacity of the local sleeper producers at 25,000 per year. This is approximately the number required for routine maintenance, indicating that acquisition of sufficient sleepers for the rehabilitation program may be difficult. It may be necessary to purchase imported sleepers in order to permit the rehabilitation program to proceed on schedule, or to assist producers in increasing capacity. Suitable sleepers are available from Guatemala at a cost of ¢150 each. It is assumed that sleeper base plates will be used with all new sleepers and that all new track spikes will be required.

Concern has also been expressed by FENADESAL that their preferred local wood, chichipate, comes from trees planted to protect coffee trees from sun. Newer species of coffee do not require this protection and chichipate trees are not being planted in the newer plantations. To meet rehabilitation and long-term sleeper needs, FENADESAL should consider implementing a reforestation program on lands currently owned by the Government. Trees planted under this program would be grown specifically to provide sleepers for FENADESAL.

FENADESAL has established specifications for the purchase of sleepers. In recent years, sleepers not meeting these specifications have been purchased due to their lower cost, budgetary restrictions, and shortages of sleepers meeting requirements. Many of the sleepers presently being purchased are unsatisfactory in that they are not straight, have large checks, or are not square. Some still have bark attached. For proper performance in track, these defects can not be present.

In order to provide sleepers meeting specifications, and to minimize future maintenance costs, it may be necessary to develop a dependable source of supply. This is another justification for FENADESAL's establishing its own tree farms. With the present scarcity of suitable sleepers in El Salvador, the only alternate is to import at substantially higher cost.

- Ballast

FENADESAL's present track is practically unballasted. In order to develop a proper track structure, ballasting of the entire railroad is required. FENADESAL has estimated that 1,000 cubic meters per kilometer are required for new track construction. Given the lack of ballast on present lines, this is a reasonable estimate and has been used for developing requirements and costs of the rehabilitation program. Ballast is estimated to cost ¢110 per cubic meter, or ¢110,000 per kilometer. This figure has been used even though this material may not be suitable for long term use.

As a part of final design of the rehabilitation program, efforts should be made to locate sources of suitable rock for ballast such as granite or andesite. There are believed to be suitable materials along the Santa Ana line. Development of a new ballast quarry will be necessary to provide suitable material.

- Rail

No rail is included in the rehabilitation program, except for District 1 should that line be retained. The primary need is for switch points and frogs. Immediate needs can be met by retiring unneeded sidings and yard tracks, releasing the material for use elsewhere. Joint bar and bolt replacement is a critical need. There are approximately 200 rail joints per kilometer. It is estimated, based on track inspection, that one-half of the joint bars require replacement, as do all bolts. 100 pairs of joint bars and 800 bolts (four per joint) will be required per kilometer.

- Bridges

All bridges require major sleeper replacement, 100 percent in many cases. The rehabilitation program includes replacement of these sleepers. Because of the damage which can be caused by a major derailment on a bridge, it is exceedingly important that these sleepers be in good condition. This is especially important in FENADESAL's case where the stringers are located outside of the rails, rather than directly underneath. With this situation, the passage of a train creates a severe bending stress on the sleeper. FENADESAL's standard bridge sleeper is 8 inches square by eight feet long. A few bridges have sleepers which are 10 feet in length. Some bridges have

8 by 10 inch and one bridge has 8 by 12 inch sleepers. Normal spacing is approximately one per foot of length. As part of a program to increase permissible axle loads, sleeper size should be increased to at least 10 inches by 10 inches.

Cost estimates for the rehabilitation program assumes replacement with this size of sleeper.

Bridges on District 3 were originally rated at Coopers E-27, permitting a maximum axle load of 2,700 pounds per running foot of span. After the Japanese study of 1966 identified problems with several major bridges, a program was instituted to reinforce these spans and increase the capacity to Coopers E-40, with an allowable load of 4,000 pounds per running foot. Some of the reinforcements are showing problems.

The base of one of the piers added to the Río Tomayate bridge was well below normal ground level when installed in the mid-1970's. Today, the entire base is exposed and undercut significantly. Bridges on the other districts were rated as Coopers E-40 when built. Many of these bridges were damaged during the armed conflict and also have severe corrosion on major structural members. As part of rehabilitation program design, a detailed inspection of all bridges is required to identify problems, determine present capacity, and design a program of repair.

Specific needs are discussed in the evaluation of individual scenarios. Costs of bridge rehabilitation are estimated in connection with evaluation of the scenarios.

Estimated costs of the rehabilitation program per kilometer are shown in Table 4.2.2. In estimating the costs of rehabilitation, it has been assumed that 508 sleepers, 1,016 fastenings (sleeper plates and spikes), 100 pairs of joint bars, 800 bolts, nuts and washers, and 1,000 cubic meters of ballast will be required per kilometer. Bridge costs are estimated based on the total length and condition of bridges within the line segment being evaluated, and are not included in this summary. None of the materials required are assumed to be salvaged from other lines or from materials replaced. Costs per kilometer are as follows:

TABLE 4.2.2
Rehabilitation Costs Per Kilometer

MATERIALS			
ARTICLE	QUANTITY	UNIT COST	TOTAL AMOUNT
Sleepers	508	¢ 50.00	¢ 25,400
Sleepers Plates	1016	24.00	24,384
Spikes	2032	5.00	10,160
Join Bars	100	120.00	12,000
Bolt/Nuts	800	10.00	8,000
Washers	800	1.10	880
Ballast	1,000 cumtr	110.00	110,000
Total			¢190,224
Freight on Above			29,023
Total Materials			¢219,247

LABOR	
ITEM	TOTAL AMOUNT
750 Person Days @ ¢55.97	¢41,975
	¢3,614
Total, Direct Labor	¢45,589
Additive to Direct @ 70%	¢31,912
Total Labor	¢77,501

continued..

TABLE 4.2.2. (continued...)
Rehabilitation Costs Per Kilometer

LABOR AND MATERIALS	
ITEM	TOTAL AMOUNT
Total Labor and Materials	¢296.748
Indirect Cost @ 30%	¢89.024
Total Cost Per Kilometer	¢385.772
Additional 10% for Miscellaneous	¢424.349 per kilometer

Source: Frederic R. Harris

The material quantities have been developed by the consultants. Unit costs and labor requirements have been supplied by FENADESAL's Way and Structures Department.

Although the costs developed above reflect the use of FENADESAL staff, it is assumed that the actual work will be performed by contractors. Rehabilitation will represent a substantial increase in workload which can not be accommodated by FENADESAL's present staff. Use of contractors to meet this increased workload should be cost effective when compared with short-term hiring of regular staff. Contractor costs are lower than those of FENADESAL. In developing final costs of the rehabilitation, contractor costs should be used. For purposes of the analysis in this report, FENADESAL costs have been used in order to introduce a conservative bias.

No replacement of wagons or locomotives is included in the rehabilitation program. Present locomotives are considered adequate for the needs of the next several years. There is actually a surplus of capacity in the present wagon fleet. However, at some point it will be necessary to initiate a program of replacing existing equipment. New wagons should be designed for a 20 ton axle loading, permitting an increase in gross weight (wagon and lading) to 80 tons. New locomotives should also be designed for this increase in axle loading.

b. Development of Operating Costs

The primary source documents used in the development of operating costs are the monthly and annual expense reports prepared by the Finance Section of FENADESAL. Internal

individual cost center reports have been used which identify costs in much greater detail than the reports which are commonly published. In each case, an effort has been made to identify those costs which are fixed, or will not vary with the volume of traffic, and those which are directly related to the volume being transported. Unit costs per ton or ton-kilometer, will vary widely for the individual scenarios, largely reflecting the total route kilometers and the average volume per kilometer which is estimated to be transported. Certain aspects of cost development are discussed below. The application of costs to individual scenarios is discussed in following Section "Evaluation of the Scenarios". Details of cost calculations are discussed in Annex 9.

Permanent way maintenance costs are calculated on what is known as a "normalized" basis. This approach assumes that the railroad will remain in operation indefinitely with replacement of track components being performed on a regular basis. The objective is to maintain a track structure in which the average component has one-half of its expected service life remaining. Numerous studies of heavy haul railroads, and medium to light density routes have determined that railway track maintenance expenses are constant up to a volume of 10,000,000 gross tons (including the weight of lading, locomotives and wagons) per kilometer per year. With projected volumes on the FENADESAL network being well below this level, annual track maintenance expenses must be considered a fixed expense, varying only with the number of route kilometers to be maintained. Routine maintenance must be performed on a regular basis if an acceptable standard of utility is to result. While certain functions can be occasionally postponed from one year to the next, this introduces the danger that total maintenance expenses will be increased. This is because track components function as a system and a failure to replace one defective component can result in premature failure of adjacent components. A failure to replace a defective sleeper, for example, increases the loading on adjacent sleepers, resulting in increased wear and accelerating their failure. It also increases bending stresses in the rail, possibly leading to damage and premature failure. In developing normalized costs, the cost per kilometer of main-line track is increased by ten percent to cover costs associated with sidings, yard and other incidental tracks. In considering annual maintenance costs, it is assumed that the railroad has been rehabilitated to an acceptable standard of utility as discussed above.

As discussed under rehabilitation, it is assumed that the track will be maintained to the United States Federal Railroad Administration (FRA) track standard permitting operation at 40 kph (25 mph). Annual maintenance costs are estimated on that basis.

Under the normalized approach, rail is assumed to have a life of fifty years. Much of FENADESAL's rail has been in track for seventy to ninety years and is not showing excessive wear, probably due to the light traffic. There are some areas where replacement will soon be required. With a fifty year life, replacement of two percent of the rail each year is required. In considering the cost of replacement rail, it has been assumed that good quality used 115 pound per yard rail will be used for replacement. Although FENADESAL's

lines are currently laid with 54 to 70 pound rail, the heavier rail is considered a better investment. Heavier rail has been shown to better maintain surface and alignment, permitting a reduction in surfacing expenses. This may also permit a reduction in the number of sleepers per kilometer. FENADESAL's current standard of 1,791 per kilometer is higher than that used in many parts of the world (1,405 per kilometer))but also reflects the use of light weight rail which requires greater support. It will also aid in a gradual increase in permissible axle loads as discussed under the rehabilitation program. New rail of less than 115 pound is now considered as a "special section" by the manufacturers, resulting in 115 pound often costing less than lighter weight rail. While 90 pound rail would be more than adequate for FENADESAL's needs, good used 90 pound rail is no longer readily available in the market. Good 115 pound is available for about the same price as new 70 pound. With rail replacement, new joint bars, bolts and sleeper plates are included.

The options for sleeper replacement were discussed under rehabilitation costs above. The lowest life cycle sleeper is the locally produced untreated wood sleeper with an estimated life of twenty years. With a twenty year life, five percent of the sleepers must be replaced each year, or 90 per kilometer. With sleeper replacement, it is assumed that twenty-five percent of the requirements for spikes and sleeper plates will be met from salvaged materials. FENADESAL presently has some materials in track which are reusable. This situation will be true for the next twenty years, or until all present sleepers have been replaced. At this point, fifty percent of the sleepers and spikes should be reusable.

Switch points and frogs are considered to have a life of thirty years under the traffic densities being considered. Replacement costs for these items are estimated by individual line segment, based on the actual number of switches required for operation. It is assumed that all sidings not required for the anticipated volume of traffic will be removed. Normal replacement of present rail by much heavier weight rail will also require replacement of switches with ones made from the same weight rail. In estimating costs of these replacements, it has been assumed that they will be in the heavier weight rail.

Ballast is considered to last for ten years. Once each ten years, the track must be surfaced and new ballast applied. This is especially important given the light weight rail which will remain in use for a number of years. For cost estimating purposes, it has been assumed that 50 cubic meters of new ballast will be required per kilometer and ten percent of total kilometers will be surfaced each year. This ballast quantity is one half of that used for the rehabilitation program, recognizing that there will be ballast in the track following completion of that program. In developing personnel requirements, it has been assumed that no modern track machinery is available. The feasibility of acquiring such equipment is considered under the investment program.

Bridges require routine maintenance including sleeper replacement, spacers, painting and foundation repairs. These costs are estimated on a segment specific basis, reflecting the actual feet of bridge on each segment. Bridge life is estimated at fifty years with the cost

of bridge replacement estimated on the basis of the number and type of bridge on each part of the line. Cleaning of the water courses under each bridge must also be performed, insuring that proper channels are available. This work is extremely important on some parts of the railroad where channels tend to fill with silt very quickly.

Embankments must also be maintained on a regular basis. This includes repairing washouts and similar work. The work requires little material but does require a great amount of labor. Costs of this work are not specifically identified in Table 4.2.3 but are included in determining the staffing requirements.

Replacement of hand tools (mauls, picks, hammers, shovels, etc.) represents another regular maintenance expense. These tools wear out, break or are lost and must be replaced if the efficiency of the workers is to be maintained. It has been assumed that each ten workers (at the rate of one worker per kilometer) will have four complete sets of tools (not all workers use the same tool at the same time). A set includes shovel, pick, maul, lifting bar, pinch bar, joint bar bolt wrench, and miscellaneous hand tools. The average life of a tool is four years and the cost per tool is ¢400. Estimated cost is ¢400 per kilometer per year.

TABLE 4.2.3
Annual Maintenance Costs Per Kilometer

MATERIALS			
ITEM	**QUANTITY**	**UNIT COST**	**AMOUNT**
Rail	2.53 Tons	¢4,350.0	¢11,005
Joint Bars	2 Pr	140	280
Bolts/Nuts	8	10	80
Washers	8	1.1	9
Sleepers	125	50	6250
Sleepers Plates	250	24	6000
Spikes	500	5	2500
Ballast	50 cumtr	110	5500

continued...

TABLE 4.2.3 (...continued)
Annual Maintenance Costs Per Kilometer

Tools	1	400	400
Sub-Total Materials			¢34,524
Freight			2,125
Total Materials			¢36,649
LABOR			
ITEM			**AMOUNT**
Laborer, 1 per Km			¢20,148
Supervision and Support			¢1,349
Total Labor			¢21,497
Indirect Expenses @ 70%			¢15,048
Total Labor Cost			¢36,545
LABOR AND MATERIALS			
ITEM			**AMOUNT**
Total Labor and Materials			¢73,194
Plus 10% for Additional Tracks			¢80,513

Source: Frederic R. Harris

Materials required and total labor requirements have been developed by the consultants. Unit prices and cost per labor hour have been supplied by FENADESAL's Way and Structures Department.

c. Net Liquidation Values

The concept of Net Liquidation Value (NLV) is an effort to estimate what the market value of railroad properties will be in the case of abandonment of service. This approach assumes that all railroad properties are sold for their "highest and best use," either for continued use elsewhere or as scrap if no alternate use is available. In determining FENADESAL's NLV, the following approach has been used.

All rail and related track materials will be removed and sold. With the light weight of the

rail, no value for operational use by other railroads is believed to be available. It is assumed that all track materials will be sold as scrap. FENADESAL's most recent sale of scrap, at auction, obtained a price of ¢0.25 per pound or ¢500 per net ton. This price (equivalent to US $ 57.47) is considered reasonable and has been used for valuing railroad materials. 54 pound rail weighs 59.4 short tons per kilometer, 60 pound 65.62 short tons, and 70 pound 76.55 short tons per kilometer. To these weights should be added 12 tons per kilometer to cover joint bars, sleeper plates and other track materials. Using the above price, existing rail has the value shown below per kilometer:

54 Pound	¢ 35,070
60 Pound	¢ 39,000
70 Pound	¢ 44,050

The estimated cost of removing the materials and transporting them to a sale point must be deducted from the sale price. The estimated cost of removal is ¢35,100 per kilometer. This is estimated assuming that the labor cost will be one-half of FENADESAL's estimated cost of new line construction. The 54 pound rail is considered to have no salvage value, the 60 pound ¢3,900 per kilometer and the 70 pound ¢8,950 per kilometer.

While bridges contain a large amount of steel, they typically cost more to remove than they will bring as scrap. They are also considered to have no value. There may be some instances where local authorities or the Roads Administration may wish to purchase bridges for other uses. As most bridges will permit only a single lane of traffic, this is not considered likely and has also been assigned no value.

A recent property appraisal determined a value for FENADESAL's commercial properties of ¢221,020,000. This includes station sites, yards, workshops, and properties located in urban areas. FENADESAL recently requested authority to sell certain real estate formerly a part of the abandoned line to Ahuachapán and one parcel at Sonsonate which is not needed for current operations. These properties are valued at ¢21,060,000, or approximately ¢131 per square meter. Property in Santa Ana (Santa Lucía) was valued at ¢159.78 M2 and that in Sonsonate at ¢143.41M2. For purposes of determining NLV, the total value of commercial property above has been used.

Other properties were valued at ¢6,000,000, or ¢11,000 per route kilometer. This value has been used for right of way. Although details of the calculations have not been made available, it is assumed that the valuation process recognized the problems with encroachments and the value was reduced accordingly.

Once the railroad is abandoned, it may be expected that the number of encroachments will increase quickly. In order to avoid this situation, FENADESAL must provide security until the property is sold. It is assumed that three years will be required to sell all of the properties and that security staff must be employed throughout that period. This represents

70

a cost of sale and must be deducted from the sale value. FENADESAL's present security staff has an annual cost of ¢855,000. Given the need to provide protection on a 24 hour a day basis for properties which are geographically widespread, it will be necessary to increase the size of the security staff. This cost has been doubled to allow for this increase. This has been increased by an additional fifty percent to allow for administrative costs which will also continue. These costs are estimated as ¢2,138,000 per year for the three years it will take to dispose of the properties.

FENADESAL has 558 wagons with an average weight of 10 tons. While many have wood siding, most are of all steel construction and considered to have an average steel content of 8 tons. Using the above sale value per ton, each wagon has a scrap value of ¢4,000, less the cost of dismantling. FENADESAL's past practice has been to sell retired wagons as complete units with the buyer being responsible for dismantalling. In practice, these are often moved to a new location for use as housing or warehousing. It is assumed that these wagons could be sold for an average of ¢2,000 each.

Two of the GA-8 locomotives have recently received new engines and electrical equipment and are considered resalable. Their estimated value is ¢304,500 each although the world market for locomotives of this gauge is limited. Other locomotives have value only as scrap. These are valued rather arbitrarily at ¢15,000 each, or a total for 14 locomotives of ¢210,000 (see Annex 11).

FENADESAL does have two steam locomotives, one of which was recently used, which should have resale value for tourist train operations in other parts of the world. These have been assigned a value of ¢130,500 each. FENADESAL also owns what is known as the "Presidential Coach" which should also be saleable for tourist operations. This has been assigned a value of ¢43,500.

Should the entire railroad be abandoned, the Net Liquidation Value is estimated to be ¢249,807,000. This will be reduced to the extent certain equipment is required for those portions of the railroad which may be kept in operation. This is discussed in the evaluation of individual scenarios.

d. Indemnification (Severance) Payments

Many of the proposed scenarios involve the abandonment of all or a part of the existing rail system. In the event of such abandonment, it may be necessary to reduce staff. Efficiency improvements may also involve staff reductions. This makes the procedure to be followed in the case of staff reductions, and the associated costs, an important factor in evaluation of alternative scenarios. This procedure is set forth in the National Labor Code and FENADESAL has advised that it must be followed.

A person whose job is abolished and who is subject to termination has several options. He can transfer to a similar position in another location if it is offered. However, he does not

have to accept such a transfer. FENADESAL's experience indicates that individuals will rarely accept such a transfer due to family or financial considerations. FENADESAL has not offered relocation allowances as an incentive to employees to accept a transfer. Based on experience, the transfer of employees is not considered an option

If terminated involuntarily and not for cause, an employee is entitled to a termination payment based on his full monthly salary times the number of years of service plus certain fringe benefits. For a voluntary termination, the employee receives a benefit calculated in the same way, but which is reduced for employees with less than 20 years of service. Percentages range from 15 percent for a person with three or less years to service to 100 percent for an employee with twenty or more years.

When a person elects to retire (normal retirement age is 60 for men, 55 for women), the retirement benefit is calculated in the same way but all retires receive full benefits. With reductions in staffing, termination costs can represent a major expenditure. For purposes of termination or retirement, service with the former private railways is not included. At the time of nationalization, all private company employees were terminated and received severance allowances as above.

FENADESAL has developed a computer program which calculates the cost of indemnification at any time. This can be done on a daily basis if required, reflecting changes in service time and retirements which have occurred since the last update. Total indemnification payments are reported by individual and by cost center, making it possible to determine payments related to individual route segments. If portions of the railroad remain in operation, it is possible to determine the cost trade-offs between terminating employees, offering a relocation allowance to move, or transporting them by bus on a daily basis between their former work location and points on the system which remains in operation.

FENADESAL estimated that total indemnification payments, as of 20 February, 1995, would be ¢21,544,000. Of this, ¢1,181,000 is attributable to the 41 employees at the Port of Cutuco. The Port is considered separately from the railroad. These employees have been deducted from the figure above, leaving an indemnification amount due to the railroad of ¢20,363,000. FENADESAL has recommended that a figure of ¢23,000,000 be used to allow for increases in benefits between now and the actual time of termination. This amount will be paid out only if the entire railroad is abandoned and all employees are terminated. If terminations are delayed, the amount will change reflecting that some persons will have retired and received retirement bonuses while others will have increased their service time and the indemnification payment which is due. There are several long-service employees known to be planning retirement before the end of June, 1995.

Indemnification payments to be made depend upon the specific scenario which is being followed, and the number of employees who are involuntarily terminated as a result. Specific implications of this cost are discussed under the individual scenarios.

28

e. Traffic

- Traffic Assigned by the Modal Analysis

As discussed in Chapter 2, detailed modal analysis has projected future rail traffic under various sets of assumptions. This analysis has projected that, without rehabilitation and some improvement in service, no traffic will move via rail. This is supported by recent declines in railroad traffic and revenues, as discussed in the Traffic and Revenues Section above. Rehabilitation is considered essential to the continuance of any rail operations. In discussing future traffic flows, it is assumed that rehabilitation has been made of all rail lines retained in operation.

Projected rail traffic under Traffic Projection Scenario C (completion of committed road improvements and full rail rehabilitation) is shown in Table 4.2.4. The projection assumes that, with rehabilitation, FENADESAL will retain the cement movement from Metapán and steel and other low valued commodities from Acajutla. This is considered the base load. Rail will retain these movements only if the present pricing policy of establishing rates at a level approximately 80 percent of the truck rate, without regard for railroad costs, continues to be used. If full costs were charged to each movement, no traffic would remain on the railroad.

TABLE 4.2.4
Project Rail Traffic / In Thousands of Metric Tons per Year

ORIGIN	DESTINATION	COMMODITY	2000	2005	2010	2015
Metapán	San Salvador	Cement	251	342	433	525
Ciudad Arce	Metapán	Puzzolana (1)	135	173	222	284
Acajutla	Metapán	Fuel Oil	44	57	73	94
Acajutla	Nejapa	Fuel Oil	156	156	156	156
Acajutla	San Salvador	Steel/misc.	45	57	73	107
Total			631	785	957	1,166

(1) Puzzolana is a volcanic material used in cement manufacturing. An alternative demand scenario with less Puzzolana and more cargo from Acajutla is shown in Annex 10 of this Chapter and is analyzed in another Annex of Chapter 10.

The economic impacts are discussed in connection with individual scenarios. In addition to the traffic assigned by the modal analysis, there are some

other commodities which may move via rail under certain conditions. These are discussed below.

- Nejapa Power Plant

The new Nejapa power plant, built and to be operated by Coastal States Management Corporation, plans to begin operations in June, 1995. The plant has 17 diesel engine driven alternator units and will be fueled with bunker fuel oil imported through Acajutla. All transport during the first year will be by truck while remaining facilities are completed and test operations are made. On a long term basis, Coastal expects to use both rail and truck. Coastal is constructing its own vessel unloading facilities and storage tanks at Acajutla, immediately north of the existing port. The storage tanks will be located adjacent to the railroad. Provision for rail loading has been included in the design. Construction of the rail loading track at Acajutla is estimated at ¢703,000 for a 1/2 km track. Loading spouts will replace those planned for truck so are not an incremental cost of rail service.

At Nejapa, a storage tank is being provided at the plant, to which trucks will deliver directly. Coastal had planned to construct another storage tank and rail unloading facilities 2 km. east of Nejapa station. This would be connected to the plant by a pipeline approximately 4 km in length. Difficulty was encountered in obtaining property for the storage tank and right of way for the pipeline, making it necessary to relocate the unloading facility to Nejapa station. This increased the length of the pipeline, using public road rights of way, to 7 km. Coastal's initial estimate for construction of the storage tank and pipeline are reported as US$ 3.5 million (¢30.45 million). At this cost level, Coastal considers that use of rail may be impractical. This cost estimate may be reduced with more detailed estimates.

FENADESAL has prepared conceptual plans for a 3.4 km. rail extension leaving the existing line just east of the Nejapa station and running directly to the plant. The preliminary cost estimate of this extension is as follows:

Right of Way Acquisition	¢ 4,340,000
Grading	¢ 3,927,000
Track Construction	¢ 9,338,000
Contingencies (15 percent)	¢ 2,640,000
Total	¢20,245,000

These estimates have been prepared by the Consultant based on information obtained from the Ministry of Public Works for right of way

acquisition of ¢85 per square meter and cost estimates for new track construction furnished by FENADESAL.

Construction of the unloading track at the Nejapa station is estimated at ¢703,000. The above estimate assumes FENADESAL purchases second-hand 115 lb per yard rail. This rail, heavier than historically used by FENADESAL, is recommended as discussed above. FENADESAL has indicated that construction cost can be reduced by using second-hand rail currently in stock. This is not recommended due to the light weight of most of this rail and the axle loadings involved. Light rail, as is presently available in FENADESAL's stock, will require a substantial increase in the number of sleepers and may not last more than a few years under the proposed loads.

FENADESAL's existing tank wagons are not considered suitable for this movement due to their small size and age. Wagons will be used in intensive service and must perform with minimal breakdowns. The present tank wagons have archbar trucks with friction bearings which are not suitable for the intensive planned use. These trucks are of a structurally weak design which frequently breaks in service. USAID has provided FENADESAL with some new, modern trucks, several of which have not yet been installed under wagons. There are not enough of these to equip all of FENADESAL's existing wagons, which may also be required for other oil movements, such as that to Metapán.

The planned burn rate is 2,300 to 3,000 barrels per day (96,600 to 126,000 gallons), with an average of 2,400 (100,800 gallons). Investment will be required in a fleet of tank wagons sufficient to meet this demand. Two approaches are being considered. Conventional tank wagons may be acquired. With a 16 metric ton axle load, or 64 metric tons per four-axle wagon, the 11,000 gallon wagon is the largest which can be used. Such a wagon loaded to full capacity weighs approximately 63 metric tons gross. With a single train per day, a 10 wagon train will be required. Between Sonsonate and Armenia, where trains are limited to 250 tons per locomotive, three trips will be required for each train. Tonnage restrictions on the Río Ceniza Bridge preclude operating two coupled locomotives on the train.

Coastal is discussing another approach to providing wagons with FENADESAL. Under this scheme, Coastal would furnish 6,000 gallon tank containers which would be fitted to existing FENADESAL flat wagons. Fourteen such wagons would be created. Use of existing wagons may introduce a problem with the trucks as discussed in connection with the existing tank wagons. These would make one and one-half round trips per day with a total capacity of 126,000 gallons per day, well above the projected burn rate. Wagons would have a gross weight of approximately 50

tons which may permit use of lighter rail in loading and unloading tracks. It would also reduce loads on main-line tracks.

FENADESAL has prepared operating diagrams for the proposed service which require 24 hours for the round-trip. With existing track conditions, this is a reasonable schedule. However, with track improvements and rehabilitation, it appears that a substantial improvement could be made. FENADESAL's SCHEDULE No. 1, dated 1 January 1977, established a minimum running time of three hours for freight trains between Acajutla and Quezaltepeque, an average speed of 26 kph. Extending the same schedule to Nejapa, 6 kilometers beyond, results in a schedule of 3 hours and 14 minutes. Passenger trains were authorized 40 kph in the same timetable. With rehabilitated track and 40 kph authorized speed, a schedule of 3 hours and 30 minutes appears feasible. To this must be added the time required to handle the loaded train in two sections from Sonsonate to Armenia if necessary. One hour and two minutes is the minimum running time established by the 1977 timetable between these points. Assuming two hours and thirty minutes for this operation results in a time for the loaded train of six hours. Allowing two hours to load and two hours to unload results in a round-trip time of thirteen and one-half hours.

Turn-around times for locomotives and crews can be reduced by adding additional wagons to the fleet. With an additional set of wagons placed at either the loading or unloading point, it would not be necessary for the locomotive and crew to wait while wagons are loaded or unloaded. This would permit the locomotive to make two round trips per day while the wagons make one and one-half. For purposes of estimating investment requirements, it has been assumed that a fleet of ten 11,000 gallon wagons will be required. It is assumed that good condition second-hand wagons will be available at a cost of US$40,000 each. Total investment in wagons, including two spares, will be USD $480,000 (C. ¢1,176,000).

FENADESAL has indicated that locomotive requirements for this service can not be met from the existing fleet. However, under the various scenarios discussed in this report, locomotive demands will be reduced below present requirements. This should permit accommodating this requirement without the purchase of additional locomotives.

N
46

In summary, investments required for this service are as follows:

Loading Track, Acajutla	¢ 703,000
Rail Line to Plant	¢ 20,245,000
Unloading Track	¢ 703,000
Wagons	¢ 4,176,000
Total Colones	¢ 25,827,000
Total	$ 2,969,000

Financing of this investment may be provided in one or more of several ways. Coastal may chose to make the investment, recovering it as a part of their charge for power supplied to CEL. FENADESAL may make the investment, recovering costs through charges to Coastal for transportation. Coastal has indicated that they may consider providing the wagons and locomotives as a part of their service contract.

In order to insure movement by rail, FENADESAL must establish a rate level which is attractive to Coastal. FENADESAL's normal policy is to establish rates sufficiently under truck rates to insure that rail movement is secured. In this instance, the rate level must comprehend the extent of investment by each of the parties. If Coastal supplies the wagons, for example, rates charged must comprehend this investment. FENADESAL must also obtain an adequate return on it's investment in facilities. Operation of a train of this nature represents something new for FENADESAL and must be carefully negotiated. It is assumed that rates will be established by contract which will extend for the estimated twenty year life of the plant.

It should also be noted that service is critical in an operation of this kind. Trains are planned to operate twice per day, seven days per week. A failure to operate on schedule will result in equipment not being available to move the projected demand, requiring additional investment in wagons and possibly locomotives.

Should tanks mounted on existing flat wagons be used, there will be several impacts on investment. Loading and unloading tracks must now be longer to accommodate the longer train and have additional loading spouts. This will increase cost. The use of lighter weight rail, especially if this can be taken from stock, will reduce cost. Investment in wagons will be substantially reduced. Operating costs will be higher due to the higher gross weight per gallon and the need to use two locomotives. It may be possible to use one locomotive, making two trips with each train between Sonsonate and Nejapa.

- Soyapango Power Plant

CEL has an oil fired power plant at Soyapango which currently receives all fuel via truck from Acajutla. CEL has expressed interest in the possibility of moving this oil via rail. The Soyapango Plant is a peaking plant, meaning that it operates at a high level of generation only when electricity demand is high. At the time of this Study it is operating at a high level due to demand for the export of power to Guatemala, resulting from the lack of rain and the inability to meet demands from normal hydroelectric sources. CEL has the same problem, with many hydroelectric stations operating well below capacity.

As a peaking plant, demand for power from this source will be erratic. CEL provided a number of demand forecasts for this plant based on various assumptions regarding the availability of power from other sources. Under normal conditions, even with a projected gradual increase in demand, fuel oil consumption will not exceed 10,000 gallons per day, an amount that can be readily met by one truck delivery per day. In order to provide rail delivery, it will be necessary for CEL to construct either a track or a pipeline from a rail unloading point which must also be constructed. At present volume, this investment can not be justified.

For this plant to reach the consumption level at which rail shipments would become economic, a number of factors must work to the benefit of the Soyapango Plant; (1) a lower than normal rainfall for several consecutive years, (2) a continuing high level of demand from Guatemala, (3) no action to increase Guatemalan generating capacity, such that electricity imports will continue to be required. All of these factors must work together for Soyapango to operate at high production levels. This is not considered likely.

While the age of this plant is not known, peaking plants are typically the older and least efficient plants in the utility system. This is assumed to be true in this situation. Thus it is difficult to justify major investment in a facility which is reaching the end of its life. Rail oil movement to Soyapango is considered to be very unlikely and it has not been considered in scenario evaluation.

- Food Grains (Cereals)

At the present time, there are about 400,000 tons of food grains (corn, wheat, etc.) imported in bulk through the Port of Acajutla. Destinations are widely distributed throughout El Salvador with the largest being San Salvador. Distribution quantities are closely related to population. Virtually

all grain moves by truck as FENADESAL has no equipment for transporting bulk commodities. In order for this to move via rail, there must be investment in wagons and in tracks to the major receivers.

No grains have been forecast by the modal analysis to move via rail as it has not historically moved in this way and FENADESAL is not presently equipped to handle this type of commodity. With the requisite investment, rail movement is feasible. A detailed evaluation of market potential has not been made. However, some possibilities have become evident with a very limited investigation. At Sitio del Niño there are two major grain distribution facilities, one north and one south of the tracks. Both are within about two kilometers of the existing railroad, and can be reached by public highway rights of way. Access to the one located north of Sitio del Niño would require a bridge over a river which may make access unfeasible.

- Containers

The projections of future traffic flows indicate that container volume at the Port of Acajutla will increase very substantially between now and 2015. In the modal analysis, none of this cargo has been assigned to the railroad. This is understandable. Most container cargo is of relatively high value and requires rapid, dependable transit. Present levels of railroad service do not meet the requirements for this type of cargo.

With the short distances involved and conventional container handling technology, it is virtually impossible for a railroad to meet the service requirements at an economic cost level. Transfer of containers between highway chassis and wagon at each end of the movement involve both time and cost considerations. Costs and delays inherent in the terminal handling make rail service uneconomic and not time competitive at distances of less than 1,000 kilometers. Conventional container terminals also require substantial investment.

There is a relatively new system known as Roadrailer© which does not require a wagon for rail transport, nor the large conventional terminal. This system could make rail transport of containers feasible. A standard railway wagon truck is used with special devices which permit attaching a conventional container chassis to the truck for rail movement. The minimum terminal requirement is a paved strip approximately 12 feet wide by 50 feet long containing the loading-unloading track. With this system, the container is offloaded from the ship to the chassis in a conventional manner. The container is moved to the rail terminal area where it is attached to the rail truck and several units are formed into a train. The train is then moved to the

destination rail terminal where the containers are separated from the rail trucks and moved via highway to final destination. The container remains with the chassis until it returns to the Port and is reloaded aboard ship or placed in storage in the container yard. Investment requirements include construction of the terminals, acquisition of rail trucks and container chassis. The number of units required depends upon the desired capacity.

Provision must be made for movement of containers between the rail terminal and customer locations. Although FENADESAL could provide this service, it is assumed that will contract with a trucking firm who will provide the tractors and drivers. Charges will per hour of use. It is also assumed that drivers will remain with containers while they are being unloaded in order to prevent possible theft of the contents. If is not necessary for the driver to remain with the container during unloading, additional loads can be delivered by the same tractor and driver, reducing cost per load. For purposes of estimating cost, it has been assumed that the driver will remain with the container and that each driver will handle two deliveries per day.

Within San Salvador, there is an industrial area along both sides of the Pan American Highway, beginning at the FENADESAL workshops and extending to Soyapango. The majority of import containers are believed to terminate in this area and this traffic is predicted to increase in future years. FENADESAL can readily serve this area from a terminal located at either the present yard or from Soyapango. With a terminal at Soyapango, most traffic would be outside the highly congested area, reducing delivery cost. Soyapango also has an old customs facility which could be used for clearance of inbound containers moving in bond. With these potential terminal locations, local delivery cost should be low, indicating that there is substantial potential for this service.

There are several factors which may adversely affect the ability of FENADESAL to compete in this market. These conditions raise questions about the actual level of participation. As modern container facilities are constructed at the port and the shipping industry shifts to full container ships, daily container handling at the port are expected to very greatly from one day to the next. This is a function of vessel arrivals. On the day of arrival, a substantial number of containers will be handled with few or none on subsequent days. The initial system proposed for installation on the railroad has a capacity of fifteen containers per day in each direction. This capacity must be fully utilized if revenues are to exceed costs and to provide an adequate return on the investment. With limited capacity, FENADESAL will not be able to meet peak demands and will have days with little or no

48

traffic. Full utilization of capacity is unlikely. at least in the next ten to fifteen years.

Obtaining a satisfactory share of the market requires close supervision. Adherence to published schedules is absolutely essential. Train services must be coordinated with highway delivery operations so that tractors and drivers are fully utilized and costs are minimized. This requires a precision operation of a type with which FENADESAL has no experience. Proper supervision requires the use of management skills in planning, scheduling, and coordination of rail and truck services which FENADESAL does not currently possess. These will require time to develop.

In view of the problems with capacity utilization and the extremely short haul, immediate successful participation in the container market is unlikely. Therefore, containers are not considered as a source of immediate increases in rail traffic. They do offer a potential for longer term development once total container volume has increased and management skills have been improved through training.

With rehabilitation, FENADESAL should be able to operate a train between Acajutla and San Salvador in four hours. Adding terminal time increases total time to approximately six hours. While not as fast as direct highway service, this should be adequate for most containers. The container which is ready for movement from the Port in late afternoon will not be delivered by highway until the next morning. Assuming that receivers of freight open their doors at 7 AM, FENADESAL can easily have containers available for delivery in San Salvador at this time with a late evening departure from Acajutla. With the extremely low level of incremental costs, it is profitable for FENADESAL to establish rates well under truck charges. Container movements between Acajutla and San Salvador, including points reached by highway from San Salvador, are a part of the railroad's future cargo market. This system could also be used to retain cargo moving between points on the remaining rail system and lines to be abandoned.

On a long term basis, it may also be possible to use the Roadrailer© system for other movements such as the steel, avoiding the necessity to purchase new wagons for this movement.

- Other

The projections from Chapter 2 assume no additional cargo will be transported by rail. However, there are some other commodities which are presently transported by rail. Present rail service seems to meet the

requirements of these customers. It is assumed that, with the improvement in service resulting from rehabilitation, the railroad should retain these movements. The extent to which other cargoes will be transported is discussed in connection with the evaluation of individual scenarios.

f. Financial Projections

- Revenues and Costs

A key factor in evaluating and comparing individual scenarios is the extent to which each can be financially self supporting. Revenue projections are made based on the specific cargo which is expected to be transported under each of the scenarios. This will include only that cargo which has been assigned to rail movement In Chapter 2. The impact of adding additional potential rail cargo is also discussed. In determining revenues, it is assumed that FENADESAL will continue its present policy of setting rates at a level just under truck rates, at the level which maximizes total revenue, and without consideration of railroad fixed costs.

Cost estimates are based upon the operating plan detailed at the start of discussion of each scenario. This describes the level of train operations which will be necessary to move the expected traffic. It also defines equipment requirements and staffing levels. Based on this operating plan, the requirements for indemnification payments and the possible realization of net liquidation values can also be determined. The emphasis in this evaluation is on the costs per ton or ton-kilometer of goods transported. The object is to identify those transport roles which can be filled by the railway at a lower cost than other modes.

g. Investment Requirements

Each of the scenarios requires a different level of investment to maintain rail operations in an efficient manner. All will require track rehabilitation, the amount depending upon the route distance which is retained in operation.

- Encroachments

Over several years, local residents have encroached on the right of way in many locations. While these are concentrated in the San Salvador area, the problem exists over much of the railroad. These encroachments have apparently existed for many years, the problem having been mentioned in the 1966 Japanese report. People have built substantial buildings on railroad property, damaging the embankments in many cases, with no action

87A

to remove them. Some occupants may have been in place so long with no action to remove them that they may have acquired what amounts to title to the property. The encroached areas are considered the source of many thefts from trains and attacks on personnel. FENADESAL minimizes night-time operations for this reason. In many instances, inadequate right of way is now available for necessary track maintenance and for providing adequate drainage. In a few instances, FENADESAL has leased portions of the right of way to individuals for specific purposes, generally agricultural. In such instances, the encroachments do not materially interfere with railroad operations. These legal encroachments are not included in this discussion.

There is s little available information from which to estimate the cost of correcting these encroachments. For estimating purposes, the following procedure has been used. A recent property appraisal indicated that the marker value of currently surplus land in Santa Lucía was approximately ¢ 160 per square meter. Although real state in San Salvador should have a higher value, this has been used for this estimate. As the residents of this area do not have legal title, they should not be able to obtain the full value for moving. The encroached area is assumed to be 30 feet wide on each side of the truck. With 100 foot right of way, this leaves an area of 40 feet for railroad purposes. Based on inspection, this appears reasonably accurate. Where virtually all possible land has been occupied, as in San Salvador vicinity, the occupied area is 18,288 square meters per kilometer of line. With a value of ¢ 160 per square meter, this represents a cost of ¢ 2,926,000 per kilometer. This figure has been used for estimating the cost under the various scenarios. In smaller communities, where encroachments are not as severe as in San Salvador, adjustments have been made based on physical inspections.

In the abandoned section Santa Ana-Ahuachapán, FENADESAL is considering offering to sell the property to the present occupiers, thus legalizing the encroachments. While this would produce some cash for the railroad, it would also permanently restrict the railroad to a very narrow right of way, and require reacquisition of the property when necessary to improve the railroad. In evaluating the economics of various alternatives, the cost of correcting encroachments has not been considered. Once the most desirable system has been selected, the cost of correcting encroachments must be added. This is a problem which must be solved.

Other investments are required to maintain efficient operations. This would include the possible construction of the Apopa and/or Santa Ana connections. Other investments are related specifically to increasing the volume of traffic. Investments of this type are discussed in the evaluation of the first scenario in which each is a factor. No investment in locomotives or

wagons is included in this evaluation. Present locomotives are in generally good condition and expected to be useable for twenty additional years which is the span of this study. Wagons should also be adequate for projected demand during this period. The need to make this investment can be postponed for several years such that including it will not significantly affect the conclusions reached in this analysis.

h. Subsidies and Other Considerations

This evaluation focuses on defining the proper role for FENADESAL in economic terms. The Government of El Salvador is interested in the financial costs and the amount of subsidy which is required for each option. The extent to which each scenario can meet its operating and investment costs is a significant factor in determining the most desirable course of action. As a part of the evaluation process, the direct costs of maintaining various rail services to the Government are evaluated.

There are certain factors which directly affect the desirability of retaining rail operations. These represent areas which are not directly related to the railway such as highway congestion, but which can represent significant economic benefits to the economy.

Highways are extremely congested in the San Salvador area. As is discussed elsewhere in this Study, it will not be possible to expand highway capacity rapidly enough to eliminate this congestion. As virtually all rail cargo involves San Salvador, total abandonment of the railway will add significantly to congestion in this area. Expanded use of the railway will reduce this congestion. Costs resulting from delays due to congestion represent a true cost to the economy. This cost is estimated in Chapter 10 and included as a benefit of continued rail operation based on the tonnage transported to and from San Salvador. As the congestion level will increase regardless of actions taken by the railway, highway construction will still be necessary and continuing railway service will not avoid the need to invest in expanded highway facilities. The subsidy amount may be justified up to the level of the reduced costs due to lower highway congestion.

Railroads also produce positive environmental benefits. Pollutants released to the atmosphere per ton transported are much less than those of highway transport. Although a benefit, this has not been measured in economic terms and is not included in the evaluation.

4.2.4 Evaluation of Scenarios.

a. Scenario 1: Acajutla-San Salvador (See Figure 4.2.1)

- Traffic

This option retains service only between Acajutla and San Salvador, with all other routes of the railway abandoned. The modal analysis in Chapter 2 projects that the rehabilitated railway will transport only low value commodities, including steel, between Acajutla and San Salvador. The modal analysis anticipates that rail traffic will decline between 1994 and 2000, as committed highway improvements are made and competitive motor carrier services improve. As the modal analysis includes only those commodities moving by rail until 2015, it projects a decline in rail tonnage, followed by an increase as the economy expands. In order to minimize the effect of these diversions, the year 2000 has been used as the base year. Projections of 44,652 tons for 2000 and 107,010 tons for 2015 have been used. All cargo is assumed to be transported between San Salvador and Acajutla except for the steel moving from Acajutla to Quezaltepeque.

FENADESAL's District 3 actually transported 86,842 tons in 1994. Of this, 69,576 tons had both origin and destination on District 3. Traffic to and from Districts 1 and 2 is assumed to be lost with their abandonment. The remaining traffic includes a number of commodities which the modal analysis assumes will divert to truck with planned highway improvements. Coffee, for example, will move in containers which FENADESAL is not presently equipped to transport efficiently.

To the basic analysis, the Nejapa Power Plant traffic is added. The Nejapa traffic is considered highly likely to move via rail.

- Operating Plan

The volume projected above represents 122 tons per day, or approximately 6.1 wagons per day. With this volume, the operating plan assumes that three trains per week will be operated in each direction in 2000. The 107,010 tons projected for 2015 represents 293 tons per day, or 15 wagons. All loads are expected to move from Acajutla with empty wagons only being moved in the reverse direction. At this level, six trains per week will be required. Present operating practices will be followed. A crew based in Sonsonate will take trains from Sonsonate to Acajutla and return. A second Sonsonate crew will take a train to Ateos or nearby point, exchanging trains with a crew from San Salvador. With the low volume involved, it is assumed that no shunters will

be operated at San Salvador, with switching required being performed by train crews. For the 2000 level of operations, one locomotive will be required for operation between San Salvador and Ateos, one between Ateos and Acajutla, and one spare making a total of three. This will increase to five in 2015. With an average loading of 6 wagons per day and a turn-around time of 6 days (from the Section 4.1.), 42 wagons will be required in 2000, including 6 spares. This will increase to 100 in 2015. It is anticipated that surplus locomotives and wagons will be stored pending future demand, rather than being disposed of. They can used as replacements for equipment which becomes inoperative or unrepairable between 1995 and 2015.

The present workshop facilities at San Salvador will be retained, as will the present yard. Yard and workshop facilities at Sonsonate can be largely retired although it will be necessary to provide a minimal maintenance facility for the passenger equipment so long as this service is continued. It will be necessary to retain the present station as the base of operations.

In determining financial feasibility, it has been assumed that all properties on District 1 and 2 which are rented to others will be retained and the rental and miscellaneous income will continue at 1994 levels.

Maintenance of Way staffing will be increased to a level of one person per kilometer, assuming no use of mechanized equipment, for a total of 103 persons. It is assumed that there will be no reduction in the number of on-train personnel required. Five train crews of five men each, or twenty-five, are required. Five dispatchers will be required and five station agent/operators. With the reduction in volume, it is anticipated that mechanical and administrative staffing can be reduced to one-half of present levels, to a total of 58 and 37 respectively. Total staffing will be 243.

- Investment Requirements

The only investment initially required for this scenario is the rehabilitation of the 103 kilometers between Acajutla and San Salvador. This is estimated to cost ¢ 63,328,000 as follows:

Rehabilitation of Track	¢ 43,708,000
Replacement of Río Ceniza Bridge	¢ 1,000,000
Repair of Other Bridges	¢ 1,064,000
Encroachments	¢17,556,000
Total	¢ 63,328,000

90

Some action must be taken to correct the encroachment problem, especially in the San Salvador area. No estimate has been made of the cost of relocating these residents. This is known to be a high theft area and the operation of trains at night which will be required to meet certain service requirements may aggravate this problem. With Roadrailer© equipment, one container is coupled closely enough to the one in front that the doors can not be opened. This should minimize the theft problem in the encroached areas. For cost estimating purposes, it has been assumed that six kilometers in the vicinity of San Salvador are encroached. Removal of the residents will require a payment of ¢ 2,926,000 per kilometer, or a total of ¢ 17,556.000.

If FENADESAL would enter the container market, it is anticipated that the railroad would initially equip itself to transport fifteen containers per day in each direction. This would require the acquisition of fifty chassis and thirty-five trucks. Chassis are estimated to cost US $10,000 (¢ 87,000) each and the trucks US $ 20,000 (¢ 174,000) each, for a total investment of ¢ 10,440,000. Construction of concrete loading/unloading platforms at a cost of ¢ 15,000 would be required. It is assumed that these would be laid along an existing track and will each be 4 meters by 15 meters in size. This limited capacity may not be adequate for long-term operation.

Indemnification payments to employees not retained for the reduced rail system will be required. As noted above, the estimated staffing for this scenario is 243 persons. This will require the termination of 372 present employees at an average cost of ¢ 37,398 each. The estimated cost is ¢ 13,912,000.

- Net Liquidation Values

Initial investment costs may be offset by liquidation of all routes not included in this scenario. This includes District 1 from San Salvador to Cutuco, District 2 between Soyapango and Guijat including the line from Texis Junction to Santa Lucía, and the Sitio del Niño to Santa Ana. The estimated NLV of these lines is ¢ 6,837,000, coming entirely from the sale of rail and rural real estate. It is assumed that urban properties under lease to others will be retained in order to preserve the rental income. It is assumed that all equipment will be kept to meet future needs, or as replacements for equipment which wears out or is damaged beyond repair.

61

- Operating Costs

Operating costs for this scenario, at the 44,652 ton level, are estimated as follows:

Maintenance of Permanent Way	¢ 8,397,000
Payroll and Related	5,223,000
Combustibles/Lubricants	506,000
Tools	30,000
Office Supplies	89,000
Repair Parts, Locomotive	154,000
Wagon	6,000
Office Equipment	10,000
Utilities and Services	1,331,000
Total	¢15,984,000

Costs above have been developed from FENADESAL's Statement for Calendar Year 1994, adjusted to reflect the reduced operations as described in the operating plan. Cost categories shown reflect those in FENADESAL's report. At this level of operation, the cost per ton is ¢ 358. This will produce 4,599,000 ton-kilometers with a cost of ¢ 3.48 each.

The modal analysis projects an increase to 107,010 tons in the Year 2015. An increase in traffic to this level will require the operation of one round-trip per day, six days per week. This will require the addition of ten employees to operate the additional trains and an increase of two additional locomotives. The wagon fleet will be increased from 50 to 200 wagons. Operating costs at this tonnage level are estimated as:

Maintenance of Permanent Way	¢ 8,397,000
Payroll and Related	5,671,000
Combustibles/Lubricants	806,000
Tools	30,000
Office Supplies	89,000
Repair Parts, Locomotive	246,000
Wagon	16,000
Office Equipment	10,000
Utilities and Services	1,331,000
Total	¢16,596,000

At this tonnage level, the cost will be ¢ 155 per ton and ¢ 1.51 per ton kilometer. The railroad will produce a total of 11,022,000 ton-kilometers. The operating costs assume that all traffic moves from Acajutla and that the railroad will not transport any commodities to the port. This is based on historical traffic flows where coffee has been the only significant movement to Acajutla and the modal analysis which projects that the railroad will continue to handle only imported low value commodities and will not transport any export freight. If FENADESAL is successful in attracting export cargo, the estimated cost per ton and ton-kilometer will be reduced.

The Nejapa Power Plant traffic adds 156,000 tons per year and 13,728,000 ton-kilometers, requiring the operation of one and one-half dedicated round-trips per day, seven days per week. One additional locomotive and three train crews will be required for this operation. Incremental costs for this operation are estimated as follows (cost categories not shown do not change):

Maintenance of Perm. Way (3.5 Km)	¢ 282,000
Additional Payroll	560,000
Combustibles/Lubricants	858,000
Repair Parts-Locomotive	41,000
Wagon	2,000
Total	¢ 1,743,000

Including this movement increases total operating costs at the 44,652 ton level of other traffic to ¢ 17,277,000. With the increase in total tonnage to 200,652 and ton-kilometers to 18,327,000, operating costs are reduced to ¢ 88 per ton and ¢ 0.97 per ton-kilometer.

At the 107,000 ton level, inclusion of the Nejapa movement raises total operating costs to ¢ 18,339,000. Total tons are now 263,000 with a cost of ¢ 70 per ton. Ton-kilometers increase to 24,750,000 with a cost of ¢ 0.74 per ton-kilometer.

Equipping the railroad to carry containers would result in further traffic increases. For purposes of evaluation, it is assumed that the container terminals would be constructed adjacent to the Port of Acajutla and in Soyapango in order to avoid congestion. This would require retention of the San Salvador-Soyapango line segment. It is assumed that FENADESAL would operate one round-trip per day for containers, six days per week, and would transport an average of 15 containers in each direction per day. This is less than 10 percent of the containers which are projected to move

through the Port of Acajutla, indicating that future traffic increases above this level are likely.

The costs shown below do not include the costs of local pick-up and delivery. These have been omitted do to difficulties in obtaining realistic estimates of the cost of providing exist in San Salvador. Detail cost estimates will be required before a decision is made to invest in new container services.

The average weight of containers handled at Acajutla is 6 tons. This low weight would require making some adjustments in order to maintain comparability of numbers. As one container requires a full truck or wagon, regardless of the weight it contains, it has been assumed that all containers would be loaded to 20 tons. While this overstates the tons transported and ton-kilometers generated, it reflects the basis used for setting container rates and the associated costs.

With the operation of one additional round-trip, six days per week, it will be necessary to add two additional train crews and one locomotive. Wagon repair parts cost reflects that required to maintain the trucks and container chassis. Incremental costs of this operation are as follows:

Maintenance of Perm. Way, (7 Km.)	¢	564,000
Additional Payroll		323,000
Combustibles/Lubricants		536,000
Repair Parts-Locomotive		41,000
Wagon		2,000
Total	¢	1,466,000

At the 2000 traffic level, including containers but not the Nejapa Power Plant traffic, FENADESAL would transport 261,652 tons generating 26,966,000 ton-kilometers. Operating costs are estimated at ¢ 17,450,000 resulting in unit costs of ¢ 67 per ton and ¢ 0.67 per ton-kilometer. If the Nejapa Power Plant traffic and containers were to be added to the 2000 base, total tons increase to 417,652 and ton-kilometers to 40,694,000. Operating costs at this level are ¢ 19,193,000, with estimated unit costs of ¢ 46 per ton and ¢ 0.47 per ton-kilometer.

At the 2015 traffic level, including containers but not the Nejapa Power Plant traffic, FENADESAL would transport 294,000 tons, generating 30,304,000 ton-kilometers. Operating costs are ¢ 18,062,000. Unit costs are ¢ 61 per ton and ¢ 0.60 per ton-kilometer. Including both the Nejapa Power Plant and

containers, tons increase to 450,000 and ton-kilometers to 44,032,000. Costs increase to ¢ 19,805,000. Unit costs are ¢ 44 per ton and ¢ 0.45 per ton-kilometer.

These figures are summarized in Table 4.2.5 for the options discussed above. This table also includes estimates of revenues and operating profits or losses

TABLE 4.2.5.
Operating Statistics
Scenario 1
(Figures in Thousands Except Cost per Ton and Ton-km)

2000				
	1	2	3	4
Tons Transported	45	201	262	418
Tons Kilometers	4,599	18,327	26,966	40,694
Operating Costs ¢	15,984	17,727	17,450	19,193
Cost per Tons ¢	358	88	67	46
Cost per Ton-Km. ¢	3.48	0.97	0.65	0.47
Revenue 1,000 ¢	3,946	9,280	12,938	18,272
Operating Loss 1,000 ¢	(12,038)	(8,447)	(4,512)	(921)
2015				
Tons Transported	107	263	294	450
Ton-Kilometers	11,022	24,750	30,304	44,032
Operating Costs ¢	16,596	18,339	18,062	19,805
Costs per Ton ¢	155	70	61	44
Cost per Ton-Km.	1.51	0.74	0.6	0.45
Revenue 1,000 ¢	6,460	11,795	15,549	20,884
Operating Loss 1,000 ¢	(10,136)	(6,544)	(2,513)	(1,079)

1. Base case. Modal analysis traffic only.
2. Base case plus Nejapa Power Plant traffic.
3. Base case plus containers, no Nejapa traffic.
4. Base case plus containers and Nejapa traffic.

- Financial Analysis and Subsidy Requirements

In order to estimate the financial feasibility of this option and the subsidy requirements, revenue estimates have been made. For the cargo moving to San Salvador, a rate of ¢ 41.44 per ton has been used. This is taken from the Section 4.1 and is developed from 1994 revenue for Acajutla-San Salvador divided by the tons transported. Nejapa revenue has been estimated using a rate of ¢ 34.19 per ton, assuming that the rate per ton-kilometer will be the same as that to San Salvador. A container rate of ¢ 830 per box has been used based on the assumption that a truck transporting a container will charge for a full load of twenty tons, irrespective of the actual weight. FENADESAL would also charge for twenty tons at the ¢ 41.44 per ton rate.

Comparative financial results for the various traffic levels are shown in Table 4.2.5 above. The results as shown indicate that as FENADESAL increases its volume, revenues increase substantially and the cost per ton declines as would be expected. Operating costs increase but at a much slower rate, resulting in a decline in operating losses. The operating cost estimates do not include amortization of investment costs for rehabilitation or investments required for transport of the Nejapa Power Plant fuel and containers.

Assuming that FENADESAL is successful in obtaining the transport of the Nejapa fuel and a limited number of containers, an operating profit should result in about 2006. Without both of these commodity flows, FENADESAL will continue to operate at a loss and require outside financial assistance.

Government subsidies are assumed to cover operating losses. These will be at a much lower level than currently being experienced.

b. Scenario 1a: Include Sitio del Niño - Santa Ana (See Figure 4.2.1)

One option for expanding operations proposed under Scenario 1 is to include the existing branch line from Sitio del Niño to Santa Ana. This inclusion will add forty additional kilometers to the system, adding to rehabilitation and annual track maintenance costs.

FIGURE 4.2.1
Study of Scenarios

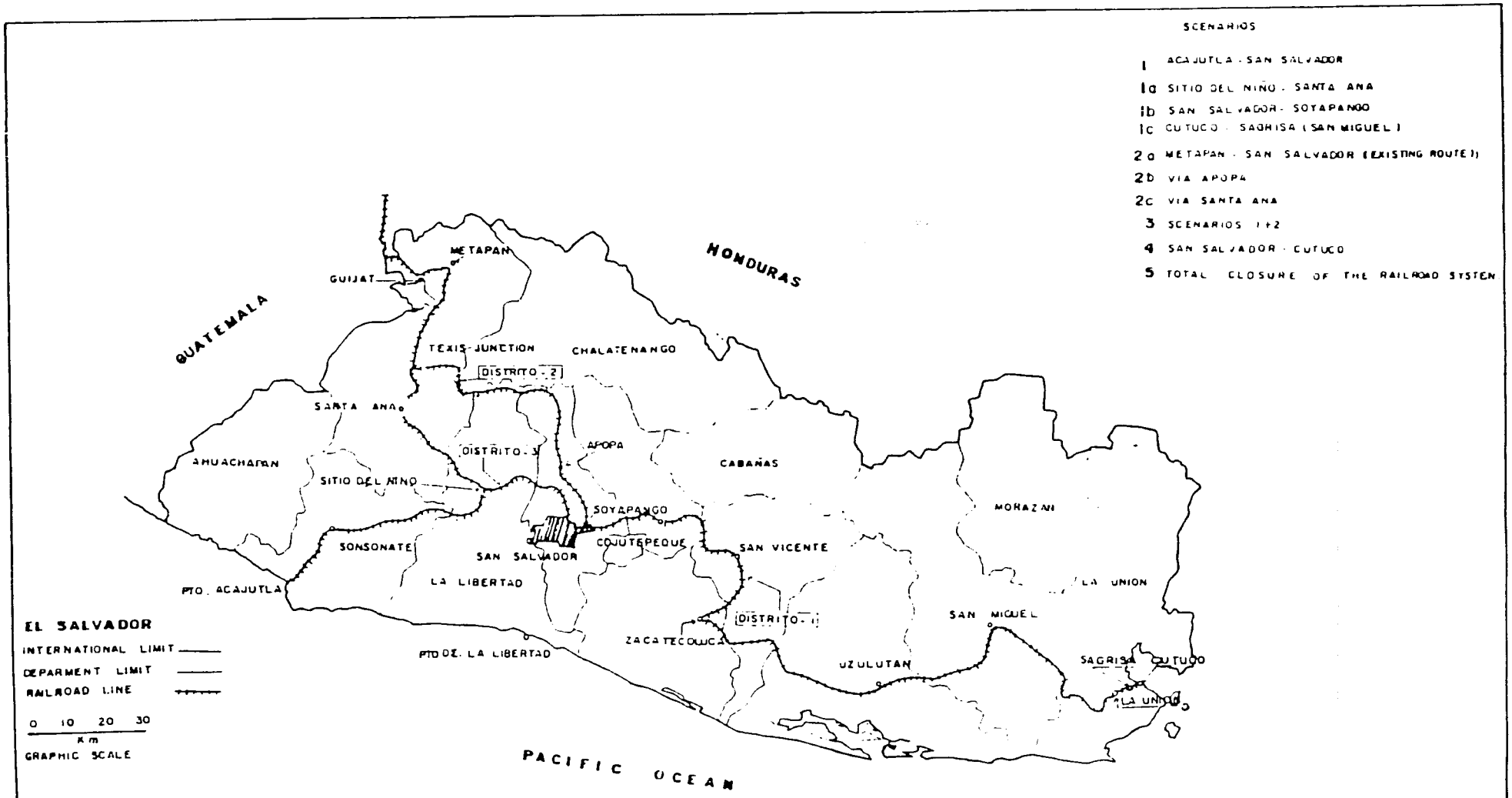


FIGURE 4.2.1 Study of Scenarios	INTERMODAL TRANSPORTATION STUDY EL SALVADOR	Source FENADESAL

The only traffic handled by FENADESAL at Santa Ana for the last several years has been coffee, approximating 12,000 tons per year. As discussed in the modal analysis and elsewhere in this chapter, coffee is increasingly transported in containers, for which FENADESAL does not presently have proper equipment. The modal analysis forecasts that FENADESAL will loose all of its coffee traffic, which is supported by the loss in rail market share.

FENADESAL is at a substantial competitive disadvantage in transporting coffee from Santa Ana, especially when movement is in containers. The direct highway between Santa Ana and Acajutla is much shorter than the rail route via Sitio del Niño. Given this factor, it is anticipated that FENADESAL will no longer handle coffee from Santa Ana. Without coffee, there is no traffic available to support this branch.

Including this route in the system will increase rehabilitation costs by ¢ 16,974,000. Annual track maintenance alone is estimated at ¢ 3,221,000 per year. Revenue from the existing coffee movement is ¢ 456,000. With the likely loss of this movement and the low level of revenue, retention of this route under Scenario 1 is not feasible.

c. Scenario 1b: Include San Salvador-Soyapango/Ilopango (See Figure 4.2.1)

It was suggested in the Section 4.1 that retention of the line between San Salvador and Soyapango may be desirable. FENADESAL suggested that, if this line was retained, it may also be feasible to retain the 5 kilometers of District 1 between Soyapango and Ilopango.

No traffic has been identified that currently originates or terminates on this line segment. All rail traffic to or from San Salvador originates or terminates in the immediate vicinity of the Soyapango Station and Yard. With regard to the Soyapango-Ilopango segment, the total lack of traffic indicates that there is no justification for retaining this line if the remainder of District 1 is abandoned.

The possibility of locating a container terminal at Soyapango has been discussed under Scenario 1 before. This has the major advantage of locating this facility where it will not be adversely affected by highway congestion in reaching the majority of container users. To retain this seven kilometer segment will incur rehabilitation expenses of ¢ 2,970,000. Of the three major bridges on this segment, two are in reasonably good condition. Bridge B-5 has problems with washouts around the foundations which must be repaired. Bridge rehabilitation includes replacement of sleepers and retainers and correction of the foundation problem.

Routine track maintenance on the additional seven kilometers between San Salvador and Soyapango would be ¢ 564,000 per year. Other operating expenses for a daily container train have not been estimated but would be extremely small as the operation would be integrated with the Acajutla-San Salvador service. The proposed container service would

4
5

be estimated to handle 54,000 tons of freight, at least in the initial years. At this tonnage level, the additional track maintenance represents a cost of approximately ¢ 10 per ton.

Retention of this segment would increase the expenses related to correcting the encroachment problem. This entire segment is heavily encroached. Costs are estimated as ¢ 20,482,000 on the same basis as discussed above.

Continued rail operation is expected to have a congestion reduction benefit. Locating the intermodal terminal in Soyapango would produce a congestion benefit, given the nature of highway traffic in the vicinity of FENADESAL's yard at San Salvador. Amortizing of rehabilitation cost over ten years at the volume shown results in a cost of ¢ 1.00 per ton. Assuming that operation of District 3 is continued, it should include the San Salvador-Soyapango segment in order to retain access to the potential container terminal site.

d. Scenario 1c: Include Cutuco - Sagrisa/San Miguel (See Figure 4.2.1)

This sub-option entails retaining the four kilometers of line between Cutuco Pier and the Sagrisa fertilizer plant at Kilometer 4. There is also a second fertilizer plant, operated by Sertesa, immediately adjacent to the pier at Cutuco. This route segment would continue to transport the fertilizer presently being imported through Cutuco and avoid the need to modify the existing pier for truck operation.

It has been suggested that the rail line from Cutuco to San Miguel should be retained to transport cement imported via Cutuco. This is not feasible nor desirable. Cement imports via Cutuco are unusual and very erratic in nature. These imports occur only when domestic production and imports through Acajutla can not meet demand in the area adjacent to the Port of Cutuco.

The physical condition of the rail line between Cutuco and San Miguel is the worst of any line segment in the system. This route has deteriorated to such an extent that a complete rebuilding is required if the line is to be retained in service. This subject is discussed in detail under Scenario 4, Retention of the San Salvador - Cutuco line.

With the erratic nature of cement imports and the extremely poor condition of the track, retention of the route to San Miguel is not economically desirable nor is it feasible due to the massive investment in rebuilding which will be required.

This does not apply to the route between Cutuco and Kilometer 4. This track is in fairly good condition and has no bridges. For a low speed switching railroad, rehabilitation requirements are about half of those required elsewhere, or ¢ 219,000 per kilometer. Total rehabilitation cost is ¢ 876,000.

It is assumed that this line segment would handle only fertilizer between the pier and the two fertilizer plants, as at present and that FENADESAL would assign one of the 700 series locomotives to the Cutuco operation. FENADESAL would also keep the gondolas presently being used at Cutuco in this service. As this line would be isolated from the remainder of the system with an infrequent demand for transportation services, it is assumed that FENADESAL would send crews from San Salvador by bus when required. Two crews would be required as the port works twenty hours per day while a ship is in port. To try to provide the service with a single crew would result in excessive overtime payments. It is also assumed that repair crews, with tools and repair parts, would be sent in a pick-up truck by highway when the locomotive or wagons need repair.

An estimated four vessels per year would be handled. This would result in total revenue of ¢ 418,000 per year, based on the present rates being charged. Revenues resulting from rental of railroad properties are not included in the financial evaluation as they do not require continued rail operation in order to be collected.

Routine maintenance of the track will cost ¢ 322,000 per year. Each sailing, averaging 10,000 tons with a discharge rate of 600 tons per day, requires 17 days for discharge. Four sailings require a total of 68 days. Assuming a five person train crew, FENADESAL would require 340 person days, or the equivalent of 1.4 full time staff. This has been increased to 2 persons to allow for travel time and delays in unloading. The cost of these two persons, with full benefits is ¢ 64,000.

It is assumed that the locomotive will require one inspection per sailing and that all necessary repairs to the locomotive and wagons will be made on these trips. It is assumed that a four person team will be sent from San Salvador and will require one week for repairs. This requires four trips per year, using 80 person days, or one-third of a person year. Personnel cost will be ¢ 11,000. Repair parts cost is estimated on the same basis as used elsewhere, a fixed cost of ¢ 16,000 per locomotive and a variable cost of ¢ 2,000. Fuel cost is ¢ 5,000. There is also a cost in connection with sending the crew via highway. Truck operation is estimated as ¢ 3,000 per year. Total costs of this operation at the 40,000 ton level are estimated as ¢ 423,000, resulting in an operating loss of ¢ 5,000 per year. An increase of 500 tons per year would eliminate this loss[1].

Retaining this small segment of District 1 will reduce the NLV received from salvage of District 1 by ¢ 44,000.

Costs of this operation could be reduced by using contractors or by multi-function personnel. One qualified locomotive engineer could be assigned on a full-time basis, performing needed locomotive and wagon repairs, and track maintenance when not required to operate the train. This practice is followed on many small railroads which operate less than daily service. Costs have been assumed based on present operating practices as a change may require negotiation with the employees.

---

[1]The analysis assumes that the Port of Cutuco will be continued in operation regardless of whether the railroad is kept or not. Maintenance costs related to port facilities are not a part of the rail operation.

This operation is a prime candidate for privatization, or operation by the Port. A private operator could achieve many savings in the operation, especially if he had other business activities in the Cutuco area which could use the otherwise idle time of the rail employees.

So long as port cargo is restricted to bulk petroleum and fertilizer, continuing the rail operation avoids the need to modify the Cutuco Pier for truck operation. This may be necessary if other cargos are handled. Cost estimates have not been received for this work. It would also be possible to replace the rail operation on the pier with a conveyor feeding directly to a storage silo at the plant nearest the pier. Material could then be tracked from that plant to the other plant. Based on inspection of the Sagrisa plant, truck delivery in lieu of rail would require very little modification of the unloading facilities. However, as these plants are owned by different firms, it may be necessary to construct a storage silo at the end of the pier for truck delivery to the Sagrisa plant. Costs have not been estimated for this type of system.

e. Scenario 2: Retain Metapán-San Salvador

This option, while oriented to possible retention of FENADESAL'S District 2, has the objective of preserving service for the cement traffic to San Salvador. There are three ways in which this may be done. Operation of the present District 2 may be retained from the cement plants to San Salvador (1) via Soyapango, (2) by constructing the Apopa Connection between Districts 2 and 3, or (3) by constructing the Santa Ana Connection, operating trains between Metapán and San Salvador via Texis Junction, Santa Ana and Sitio del Niño. Each of these has different operating and maintenance costs. For purposes of this analysis, it is assumed that all parts of the rail system which are not included in this scenario are abandoned.

- Existing Route

For several years, FENADESAL has suffered service interruptions caused by landslides between Km. 249 and 255. These result from the Rio Las Cañas undercutting the embankment on the east side of the track and rock slides from the hill to the west of the track. This entire area is underlaid with relatively soft rock which deteriorates, causing slides. Inspection has indicated that permanent repair is not possible (see Annex 8). FENADESAL is presently attempting to correct the problem by cutting back the hillside above the tracks using the spoil to fill the area between the tracks and the river. Cutting back the hillside above the tracks for a distance of about six kilometers will minimize the problem of landslides from above. In order to prevent undermining of the embankment by the river, it will be necessary to fill the area and to armor it with rip-rap. This must be done on a routine basis as a part of annual maintenance. This route will have high annual maintenance costs as a result. It will also be necessary to police the sand

101

gatherers operating in that area to prevent their undermining the embankment. Controlling this activity may prove to be extremely difficult and introduce political difficulties.

- Apopa Connection Between Districts 2 and 3

One option which has been proposed is to construct a new connection between Districts 2 and 3 at Apopa, permitting trains to operate into San Salvador via District 3 and abandoning District 2 between Apopa and San Salvador. This connection was designed by FENADESAL to avoid the landslide problem along the Rio Las Cañas. This connection shortens the distance between Metapán and San Salvador by 11 kilometers, resulting in some savings in operating expenses, as well as avoiding the high maintenance cost section of District 2. With the saving in maintenance and operating cost, this approach is vastly superior to maintaining the present route.

- Santa Ana Connection Between Districts 2 and 3

This project has two components, construction of approximately 4.5 kilometers of new line at Santa Ana connecting the existing lines from Sitio del Niño and Texis Junction, and rehabilitation of the Texis Junction-Santa Lucia line which is currently out of service due to poor sleeper condition.

These two lines have never been connected. Although approximately 1.5 kilometers apart at Santa Ana, a connection at this point will require obtaining a right of way through the city, an approach which will be extremely costly. FENADESAL selected a route bypassing the city to the east and made detailed estimates of construction costs in 1993. These estimates have been updated to reflect current costs. The one major change made has been an increase in right of way acquisition costs. At the time this connection was initially designed, it passed through rural areas. Since selection of the route was made, development has occurred on several parcels. It will now be necessary to acquire buildings as well as vacant property, increasing the estimated cost.

The Texis Junction-Santa Lucia line has been out of service for several years due to the poor condition of the track. A limited physical inspection has indicated that the line, other than sleepers, is not in extremely poor condition. Rail is generally good. There are no reported problems with bridges or embankments. Rehabilitation costs are expected to be greater than normal only for higher than normal sleeper replacement. There are some encroachments which have developed since the line was shut down.

These consist primarily of local residents fencing off portions of the right of way for use as part of their yards. Removal of fences is all that will be required at this time.

Construction of this connection will permit routing of the Metapán cement traffic via Santa Ana and permit abandonment of the existing District 2 between Texis Junction and Soyapango. Abandonment of this portion of District 2 will make several bridge spans available which can be used for replacements on District 3 where axle loadings are limited by bridges.

Several FENADESAL staff have indicated a concern with this approach due to higher operating costs when compared with District 2 due to the more severe grades and curves which limit locomotive capacity. Trains would be limited to 300 tons per locomotive between Texis Junction and Santa Ana, rather than the 625 tons being currently operated via District 2. The 1989 study by Tech International/Louis Berger made this specific point. It is also longer than the route via Apopa and requires a greater capital investment in the connection and in rehabilitation. Although construction of this connection would make it possible for the railroad to transport calcareous Puzzolana from the area south of Santa Ana to Metapán, this not appear sufficient to offset the higher operating costs. With these higher costs, this approach is not feasible and it has not been further evaluated in connection with Scenario 2. It is discussed in more detail in connection with Scenario 3 below as the cost and traffic impacts differ with the inclusion of the Acajutla-San Salvador line in the system.

The existing route via Soyapango is assumed to be the base case for evaluating the possible routes over which this service can be provided. The other options are measured against the base case in order to provide a measure of the benefits from constructing one or the other of the connections.

- Traffic

Under this scenario, the only traffic will be cement from the two plants near Metapán to La Toma and San Salvador. With the abandonment of District 1, it is assumed that cement to points served by this line will no longer be transported. There is a possibility that this may continue to move with a transfer to truck at San Salvador. This is estimated as 160,000 tons for 1995, increasing to 525,000 tons in 2015.

123

- Operating Plan

Trains will be operated based on the demand from the cement companies and all will operate between Metapán and San Salvador. With an average loading of 22 tons per wagon, the forecast volume for 2000, 160.000 tons, represents 7,300 loads per year or 20 per day. This represents one train per day, seven days per week. It is assumed that this is the service level which will be operated initially. The routing to be used (existing vs the Apopa Connection) has a major impact on the operating plan. If the existing route is used, a crew will not be able to make a full round-trip without incurring a high level of overtime. This is true, even if the line is rehabilitated to design standard level, 40 kph. Via Apopa, a crew can make a full round-trip although this will require some overtime. For purposes of estimating operating costs, it is assumed that crews make one-way trips via the existing line and round-trips via Apopa. Two locomotives and 135 wagons will be required to provide this level of service. Total staffing requirements are 267 persons if via the existing line and 251 if via Apopa.

At the 2015 forecast demand, 525,000 tons, represents 23,900 loads per year or 65 loads per day. This requires three trains per day with a fourth train each four days to meet the total demand. The same considerations regarding operations via the existing line and via Apopa apply as discussed above. With this level of operations, the faster running times permitted by the Apopa Connection permits a reduction of one locomotive in the requirements. This level of service will require six locomotives if via the existing line and five if via Apopa, and 400 wagons. Staffing requirements are 307 if via the existing line and 261 if via Apopa.

- Investment Requirements

Investment requirements vary significantly between the options of retaining the existing line and building the Apopa Connection. These are:

	EXISTING	APOPA
Track Rehabilitation	¢ 62,379,000	¢ 55,590,000
Bridge Repair/Rehabilitation	¢ 296,000	¢ 273,000
New Construction	----	¢ 24,900,000
TOTAL	¢ 62,675,000	¢ 80,763,000

Construction of the Apopa Connection will release 30 kilometers of the existing line for salvage and sale of right of way. It will require retaining 14 kilometers of District 3 which can not be salvaged. The value of the portion of District 3 which is retained is considered to be of about equal value to the

urban portion of District 2. There will be 16 kilometers of rural line released which has a value of ¢ 238,000 which is a benefit of building the Connection.

Both Options will require action to correct encroachment problems. These are virtually identical. The existing line is severely encroached between San Salvador and Soyapango, as well as having others between Soyapango and Apopa. The existing District 3 line has severe encroachments in the vicinity of San Salvador. Costs of correcting this problem are estimated as ¢ 18,000,000 in each case.

Total NLV from the portions of the railroad to be abandoned are ¢ 5,870,000 if operation is continued via the existing line and ¢ 6,108,000 if the Apopa Connection is built.

Indemnification must be paid to 348 employees if routing is via the existing line and to 364 if the Apopa routing is used. Costs are ¢ 13,015,000 if via the present line and ¢ 13,613,000 if via Apopa.

- Operating Costs

Operating costs between the two options are as shown below. Cost differences reflect the shorter distance via Apopa and the better utilization of personnel which will result. All figures are in thousands of colones.

2000

	EXISTING LINE	APOPA
Maintenance of Permanent Way	¢ 14,586	¢ 11,176
Staff, O / T Permanent Way	5,410	5,410
Combustibles, Lubricants	1,235	1,162
Tools	30	30
Paper	60	60
Repair Parts, locomotive	328	328
wagon	68	68
Office Equipment	3	3
External Services	1,330	1,330
TOTAL	23,050	19,567

105

2 0 1 5 (...continued)

	EXISTING LINE	A P O P A
Maintenance of Permanent Way	¢ 14,586	¢ 11,176
Staff, O / T Permanent Way	6,503	5,223
Combustibles, Lubricants	2,727	2,543
Tools	30	30
Paper	80	80
Repair Parts, locomotive	656	656
wagon	143	143
Office Equipment	3	3
External Services	1,330	1,330
T O T A L	¢ 26,058	¢ 21,184

Building the Apopa Connection requires an additional investment of ¢ 18,450,000 including the changes in NLV and Indemnification payments to employees. This investment produces a return of ¢ 3,483,000 in the first year, increasing to ¢ 4,874,000 in the 2015. This indicates that the investment will be returned through reduced operating costs in about four years. This would indicate that, if the railroad is retained in operation, building this connection is a good investment. For purposes of the evaluations made below, it is assumed that this connection is built.

At the forecast level of traffic for 2000 of 251,000 tons, the cost per ton is ¢ 78. The railroad will produce 34,136,000 ton-kilometers at a cost of ¢ 0.57 per ton-kilometer. Via the existing line, comparable costs are ¢ 92 per ton and ¢ 0.63 per ton-kilometer. At the 2015 forecast volume of 525,000 tons, the cost per ton via Apopa will be ¢ 40. This traffic will result in 71,400,000 ton-kilometers at a cost of ¢ 0.30 per ton-kilometer. Comparative costs via the existing line are ¢ 50 per ton and ¢ 0.34 per ton-kilometer.

- Financial Analysis and Subsidy Requirements

Revenue from cement traffic, using the existing rate of ¢ 33.13 per ton is estimated at ¢ 8,316,000 in 2000. Rentals and miscellaneous income are ¢ 2,096,000, resulting in a total revenue of ¢ 10,412,000. The operating loss via Apopa at this level is ¢ 9,155,000. At the 2015 estimated volume, revenue will be ¢ 17,393,000. Including rental and miscellaneous income of ¢ 2,096,000 gives a total of ¢ 19,489,000. The operating loss at this level is ¢ 1,695,000. Rail operations proposed to be retained under this scenario

106

continue to loose money throughout the forecast period although the amount of loss is reduced as traffic volume grows. Assuming steady traffic growth and present pricing policies, this rail operation can not be expected to be profitable in financial terms prior to 2020.

f. Scenario 3: Combine Scenarios 1 and 2

This scenario continues rail service between Acajutla, Metapán, and San Salvador. The service between Acajutla and San Salvador, is the same as that in Scenario 1, including the potential traffic flows. For service from Metapán, the same three options, via the existing line, via Apopa or via Santa Ana, as analyzed in Scenario 2 are available. The existing line via Soyapango has been excluded from the evaluation as the Scenario 2 evaluation found routing via Apopa to be superior. Inclusion of service to Acajutla affects the economics of constructing the Santa Ana Connection so this has been reanalyzed in this Scenario.

- Traffic

Traffic flows are the same as those of Scenarios 1 and 2 plus additional traffic. The movement of fuel oil from Acajutla to Metapán can move via either Santa Ana or Apopa. Fuel oil is projected by the modal analysis at 44,476 tons in 2000, increasing to 93,793 tons in 2015. The Santa Ana route is shorter but has higher operating costs per kilometer when compared with the Apopa route. Construction of the Santa Ana Connection would permit FENADESAL to handle the Puzzolana which is produced in the area south of Santa Ana to Metapán. This is projected at 134,777 tons in 2000, increasing to 284,222 tons in 2015. It would also permit transport of cement to Santa Ana. This would also open a more direct route for cement moving to Sonsonate, Acajutla and Quezaltepeque. With abandonment of District 2 east of Texis Junction, the present cement movement to La Toma would no longer be handled.

There is a substantial movement of marine containers from the Sonsonate and Santa Ana areas to Caribbean ports. Existing rail warehouses are leased to coffee companies and used for container consolidation. The railroad obtains some income by renting parking space to container operators. Should rail service into Guatemala be restored at some point in the future, the railroad has sufficient space to establish a container terminal at a location with which the container operators are already familiar.

107

- Operating Plan

The basic structure of train operations will be similar to that of Scenarios 1 and 2 combined. At the 2000 level of traffic, it is assumed that three round-trips per week will be operated between San Salvador and Acajutla, increasing to six in 2015. One or two round-trip per day will be initially operated between San Salvador and Metapán, increasing to three or four per day in 2015. This operating structure will be maintained regardless of whether operations are via Apopa or Santa Ana.

It is assumed that under this scenario, the railroad will transport fuel oil from Acajutla to Metapán. This will require the operation of additional trains to either Sitio del Niño or Apopa. At this point, the oil wagons will be added to trains moving empty cement wagons to Metapán. Because of tonnage limitations on the route via Santa Ana, it may be necessary to move the oil in separate trains to Santa Ana. For purposes of estimating costs, it is assumed that the oil will move in 300 ton trains from Acajutla to Santa Ana, and 400 ton trains beyond. Via Apopa, the oil will move in 300 ton trains from Acajutla to Apopa, and 600 ton trains beyond.

Puzzolana for cement will also be handled from the area south of Santa Ana to Metapán. This will move in 300 ton trains to Santa Ana and 400 ton trains beyond. Handling of this commodity will require investment in new wagons as FENADESAL does not currently have suitable bulk transport wagons. A fleet of 35 such wagons will be required in 2000, increasing to 86 in 2015.

At the 2000 level of operations, seven locomotives and 332 wagons, including the 50 new wagons for Puzzolana, will be required. At the 2015 level of operations, twelve locomotives and 626 wagons, including 86 wagons for Puzzolana, will be required.

With the increase in train operations caused by the additional traffic, total administrative and mechanical staffing will be required at present levels, 116 administrative and 74 equipment repair personnel. Train operations staff is estimated at 75, resulting in a total staffing requirement at 2000 traffic levels of 470 persons.

- Investment Requirements

Investment requirements differ due to the difference in route kilometers and costs of new construction on the two routes to Metapán. Comparative costs of the routes via Apopa and Santa Ana are as follows, in thousands of colones:

2000 (...continued)

	Apopa	Santa Ana
Rehabilitation	¢ 95,482	¢ 91,241
Replacement of Río Ceniza Bridge	1,000	1,000
Repair of Other Bridges	1,337	1,164
New Construction	24,900	58,519
Wagons for Puzzolana	--------	15,225
Total	122,719	167,149

The investment shown for wagons depends upon whether or not the railroad transports the Puzzolana. Without wagons, the investment required for the Santa Ana route is ¢ 151,924,000. Investment required for the Nejapa Power Plant is not included above as this does not affect the routing decision and it is independent of the evaluation.

Both of the above options will require action to correct encroachments. The area from San Salvador to Apopa is severely encroached for approximately six kilometers and to a lesser degree on the remainder of the line. The Santa Ana line has approximately 2 kilometers of severe encroachments al Ciudad Arce. The estimated cost of correcting encroachments is ¢ 20,000,000 via Apopa and ¢ 26,000,000 via Santa Ana.

Selection of this option will require indemnification payments to 145 employees. At an average rate of ¢ 37,500, the total cost will be ¢ 5,438,000.

Net Liquidation Values for this scenario are ¢ 4,977,000 via Apopa and ¢ 5,216,000 via Santa Ana. The routing via Apopa will permit abandonment of District 2 between Apopa and Soyapango, and between Texis Junction and Santa Lucía, and District 3 between Santa Ana and Sitio del Niño. Routing via Santa Ana permits abandonment of District 2 between Texis Junction and Soyapango but requires keeping the two lines to Santa Ana. Abandonment of District 2 should make several bridge spans available for use elsewhere on the system. As with the other scenarios, it is assumed that land and buildings currently leased to others will not be sold and the rental income will continue.

- Operating Costs

Operating costs will vary depending upon whether routing via Apopa or Santa Ana is selected. In order to provide comparisons, cost estimates have been made for each option at the 2000 and 2015 projected traffic levels. The initial comparison below assumes that the railroad transports only the base traffic from Acajutla plus the fuel oil for Metapán. The routing via Santa Ana also includes the Puzzolana.

2000	(In Thousand of Colones)	
	Apopa	Santa Ana
Maintenance of Permanent Way	¢ 18,970	¢ 17,710
Staff, O/T Permanent Way	9,812	9,812
Combustibles, Lubricants	2,167	2,388
Tools	45	45
Paper	149	149
Repair Parts, Locomotive	287	328
Wagon	25	28
Office Equipment	6	6
External Services	2,365	2,365
Total	¢ 33,820	¢ 32,825

2015		
Maintenance of Permanent Way	¢ 18,970	¢ 17,710
Staff, O/T Permanent Way	10,159	10,805
Combustibles/Lubricants	3,141	3,670
Tools	45	45
Paper	149	149
Repair Parts, Locomotive	451	492
Wagon	43	50
Office Equipment	6	6
External Services	2,325	2,325
Total	¢ 35,289	¢ 35,252

Under this scenario, via Apopa, total 2000 tonnage will be 44,652 tons of low value commodities from Acajutla, 251,000 tons of cement, and 44,476 tons

110

of fuel oil, for a total of 340,128 tons. The average cost per ton is ¢99. This railroad will produce 48,030,000 ton-kilometers with an average cost of ¢ 0.70 per ton-kilometer.

Tonnage is projected to increase to a total of 739,000 tons in 2015, consisting of 107,000 tons of low value commodities from Acajutla, 525,000 tons of cement, and 107,000 tons of fuel oil. Ton-kilometers are 109,342,000. At this level of traffic, costs are ¢ 48 per ton and ¢ 0.32 per ton-kilometer.

Via Santa Ana, in 2000 the railroad will transport the above 340,128 tons plus 134,777 tons of Puzzolana, for a total of 474,905 tons. The average cost per ton is ¢ 69. This traffic will produce 62,242,000 ton-kilometers at a cost of ¢ 0.53 per ton-kilometer.

In 2015, projected tonnage reaches 1,023,000 including the above 739,000 tons plus 284,000 tons of Puzzolana. Total ton-kilometers are 139,240,000. At this volume and via this route, costs are ¢ 34 per ton and ¢ 0.25 per ton-kilometer.

Caution must be used in applying these figures. The cost per ton of cement moving to San Salvador will be higher via Santa Ana because of the longer distance while the fuel oil will incur greater cost via Apopa. Averages can not be used to determine how a particular commodity should move.

Should FENADESAL be successful in obtaining the movement of fuel oil to the Nejapa Power Plant, there will be a positive impact on costs. As discussed under Scenario 1, the incremental cost of this movement is ¢ 1,743,000. It will add 156,000 tons and 13,728,000 ton-kilometers per year to total volume. Containers, if transported as described in Scenario 1, between Acajutla and San Salvador, will add incremental costs of ¢ 1,466,000. Estimated tons are 217,000 and ton-kilometers 22,367,000. The impact on the average cost per ton and per ton-kilometer of adding these movements is shown below.

Average Cost per Ton and per Ton-Km
Scenario 3

2000 (In Colones)	VIA APOPA	VIA SANTA ANA
With Base Traffic		
Cost per Ton	99	69
Cost per Ton-Kilometer	0 70	0 53
Plus Nejapa Fuel		
Cost per Ton	72	55
Cost per Ton-Kilometer	0 58	0 56
Plus Containers (Acajutla)		
Cost per Ton	63	50
Cost per Ton-Kilometer	0 50	0 41
Plus Nejapa Fuel and Containers		
Cost per Ton	52	43
Cost per Ton-Kilometer	0.44	0 37
2015 (In Colones)	**VIA APOPA**	**VIA SANTA ANA**
With Base Traffic		
Cost per Ton	48	34
Cost per Ton-Kilometer	0.32	0.25
Plus Nejapa Fuel		
Cost per Ton	41	31
Cost per Ton-Kilometer	0.30	0.24
Plus Containers (Acajutla)		
Cost per Ton	38	30
Cost per Ton-Kilometer	0.28	0.23
Plus Nejapa Fuel and Containers		
Cost per Ton	35	28
Cost per Ton-Kilometer	0.26	0.22

- Financial Evaluation

In order to estimate total revenues for the operation proposed under this scenario, it has been necessary to estimate the charges which will be made for the fuel oil and Puzzolana. For the fuel oil destined to Metapán, the existing rate of ¢ 82.13 per ton has been used. For the Puzzolana, it is assumed that the rate per ton-kilometer will be similar to that for other low value commodities, approximately ¢ 0.46. This results in a rate of ¢ 42.5 per ton. Other revenue figures have been taken from Scenarios 1 and 2. Miscellaneous income is assumed to continue at the 1994 level, ¢ 2,096,000, as was used in Scenarios 1 and 2.

Revenues and operating costs for this Scenario 3, considering constant the costs of the Metapán-San Salvador sector, vary depending upon whether the Apopa or Santa Ana route is selected for operation. This has a major impact on the operating profit or loss. The operating profit or loss is summarized below (all figures in thousands of colones):

112

2000 (In Colones)	VIA APOPA	VIA SANTA ANA
Without Nejapa Fuel or Containers	(17,905)	(11,182)
With Nejapa Fuel	(14,314)	(7,591)
With Containers	(10,379)	(3,656)
With Nejapa Fuel and Containers	(6,788)	(65)
2015 (In Colones)	**VIA APOPA**	**VIA SANTA ANA**
Without Nejapa Fuel or Containers	(3,733)	8,383
With Nejapa Fuel	(141)	11,975
With Containers	3,890	16,006
With Nejapa Fuel and Containers	7,482	19,598

The reduced operating loss when routing is via Santa Ana results from the handling of Puzzolana and from reduced track maintenance due to the shorter total distance which must be maintained. This is partially offset by increase train operating costs. Construction of the Santa Ana Connection will result in annual benefits of ¢ 6,723,000 by 2000, increasing to ¢ 12,000,000 by 2015. Construction of this connection will cost about ¢ 29,000,000 more (excluding the Puzzolana wagons but including proceeds from liquidation of the existing line) than the Apopa Connection, indicating that the investment should be recovered from reduced operating losses within about six years. Eight years will be required if the wagon investment is included.

Assuming that the Nejapa fuel and containers are not handled, operations via Santa Ana should result in an operating profit by 2008. With both the Nejapa fuel and containers, there should be an operating profit by 1999. This scenario has the greatest potential for creating a commercially viable railroad and is the recommended approach.

- Other Considerations

There are other alternates to this scenario which have not been evaluated. It may be feasible to rehabilitate the Texis Junction-Santa Lucía line without building the Santa Ana Connection. An intermodal service could be installed whereby Puzzolana would be moved from the quarry to Santa Lucía by truck being transferred at that point to rail. This would avoid the need to operate short trains on the steep grade from the quarry area to Santa Ana, improving rail efficiency, but would require the Puzzolana trucks to operate through Santa Ana. In this instance, the Apopa Connection would still be required for the Metapán trains.

113

There is another reason for retaining at least a portion of the Santa Ana branch. There will be a need for substantial quantities of ballast as a part of rehabilitation and regular maintenance. This will require the establishment of one or more quarries designed for the purpose of producing ballast. Much of the rock along the Santa Ana branch appears to be granite which has been identified as suitable for ballast use. This is one of only two areas currently served by rail which appear to have suitable rock. The other is on District 2 in the vicinity of Kilometer 310 where the deposits appear to be much smaller and more difficult to reach efficiently by rail.

The above analysis has been made on the basis of readily available information and has not been made in the detail which is normally required for a major investment. Before a commitment is made to construct the Santa Ana Connection, much more detailed analysis should be made including the preparation of detailed engineering drawings with related cost estimates.

g. Scenario 4: Include San Salvador - Cutuco

This scenario assumes that all or part of Districts 2 and 3 are continued in operation and evaluates adding District 1 to that system. The objective is to determine if continued operation of District 1 improves the economic viability of the rail system.

The modal analysis assigns, even with rehabilitation, no traffic to this line. It is extremely circuitous when compared with the highway route with resultant long transit times. The modal analysis determined that even extremely low value commodities such as cement would not be transported by rail because of the transit time. Some traffic is currently moving but in very low volume and it is declining rapidly.

The physical condition of this route is an important factor in the evaluation. This line has deteriorated to the point that rehabilitation is no longer feasible. Rather, a complete rebuilding will be necessary if service is retained.

In order to properly rehabilitate this line, it will be necessary to replace one-half, rather than one-quarter of the sleepers. Approximately one-half of the rail will also require replacement. This raises the rehabilitation cost to c\ 650,709 per kilometer. For the 251 kilometers, the cost will be ¢ 163,328,000. In addition, there are 124 bridges totalling 6,286 feet on this line. On the portion of the line physically inspected, seven bridges out of fifteen require complete replacement due to bomb or corrosion damage and all require total replacement of sleepers and retainers as well as rehabilitation. Sleeper and retainer replacement will cost ¢ 1,257,000. Rehabilitation costs are estimated as ¢ 9,500,000. Detailed estimates for bridge replacement have not been made. Based on the line segments actually inspected, it is assumed that 15 bridges with a total length of 760 feet will require replacement. With an estimated cost of ¢ 6,900 per foot, bridge replacement

114

entails a cost of ¢ 5,244,000, raising the total cost of the rehabilitation program to ¢ 179,329,000.

Due to the high cost of rehabilitation and the circuitous nature of route, with resultant low traffic projections, this scenario is not economically feasible. Given the extremely poor condition of the line, its high operating cost and the number of derailments, the line between Soyapango and Kilometer 4 near Cutuco should be abandoned as quickly as possible.

The NLV of District 1, not including commercial properties, is estimated as ¢ 3,830,000. It is assumed that the commercial properties currently leased to other parties will be retained in order to preserve the rental income. Retention of this line would also require keeping virtually all of the present employees. This would reduce the indemnification payments required but would not offset the added operating expense. NLV and indemnification payment impacts are discussed under Scenarios 1, 2 and 3.

The future of the Port of Cutuco is presently uncertain. Other groups are studying the Port with the possibility that a major container facility will be built at this location. If such development takes place, it is possible that retention of the railroad can be justified. In this instance, rather than rehabilitate the existing line, a series of relocations to shorten the distance should be considered. Even though these will require the purchase of right of way and entail major expenditures, operational benefits could conceivably justify the additional cost. Any such program must be postponed until potential traffic at the Port is known. If justified, the construction of a relocated railway can be initiated at that time. It does not justify retaining the present line.

h. Scenario 5: Total Closure

This approach assumes that all rail operations are abandoned, the staff is given separation payments, and the assets are sold for use elsewhere or for scrap. This scenario will result in the following economic impacts.

The Port of Cutuco is excluded from this analysis. It is assumed that the Port, including present employees, will be transferred directly to CEPA and remain in operation. The future of the Port is discussed in Chapter 5 of this report.

115

The annual subsidy received from the Government will no longer be required. These are based on the cash operating losses of FENADESAL. Operating deficits reported by FENADESAL have been adjusted to remove those directly related to the Port of Cutuco. During the years 1991-1993, the railroad deficit averaged ¢ 23,389,000 per year.

Included in this figure however, are charges made by CEPA to FENADESAL for distributed administrative expenses which averaged (without Cutuco) ¢ 2,827,000 per year. This is not a cash expense, but a bookkeeping entry as CEPA is not reimbursed for this amount. The Expert in Ports, who has analyzed the CEPA structure, has indicated that abandonment of the railroad will not result in any CEPA staff reductions or other significant cost savings. It is assumed that these CEPA expenses will continue and will not represent a saving to the Government from railroad abandonment, related to the Cutuco port. The net saving in Government subsidy payments, based on railroad operating deficits, will be ¢ 20,562,000 per year.

Employees will be due indemnification allowances. FENADESAL has estimated that immediate total abandonment of the railroad will result in separation allowance payments of ¢ 21,544,000 as of 20 February, 1995. Excluding the 41 employees employed at the Port of Cutuco, indemnification payments will be ¢ 20,363,000. FENADESAL has recommended that a figure of ¢ 23,000,000 be used to reflect increases in payments due which will occur between 20 February and the actual date of abandonment.

The total Net Liquidation Value of the railroad is estimated as ¢ 249,807,000. It is anticipated that disposal of the salable land will require about three years. Sale of the four locomotives considered resalable will take place in the second year after abandonment. Sale of other assets, including the two steam locomotives, will take place in the first year.

Cash flows resulting from this scenario are as follows. In the year of abandonment, indemnification payments of ¢ 23,000,000 will be required. During the three years following abandonment, the NLV of ¢ 249,807,000 will be received. Besides, there will be a net saving to the Government of ¢ 20,562,000 per year through elimination of railroad operating deficits (subsidies) and this will continue indefinitely.

4.2.5 Organization and Regulation

This section discusses the proper organizational structure for FENADESAL and its place within the Government organization.

a. Institutional Analysis

At present, FENADESAL is administered by CEPA. It is important to note that CEPA does not own the railroad, as they do the airports, but simply administers the railroad for the owner, the Government of El Salvador. There are a number of problems with the present organization.

114

CEPA was organized to operate ports and airports, both of which are similar in their functions. Both provide terminal facilities for other companies which actually provide the transportation services. In the case of the railroad, it is a transport enterprise providing services to users. As such, it requires a different type of administration than do ports and airports. FENADESAL operates in a competitive market place where other carriers are available and willing to provide transport services. Both the airports and marine ports operate in relatively protected non-competitive markets. While some El Salvador cargo moves through Guatemala, the limited competition provided to Acajutla does not create a true competitive situation. The major airport, likewise, has no effective competition. Thus these activities can be expected to operate on at least a break-even financial basis.

FENADESAL's problems with obtaining Government subsidies when needed were discussed in Section 4.1. Further complications result in the budget process where additional administrative processes are involved. This becomes quite slow and cumbersome, as illustrated by the procedure described below.

FENADESAL prepares two budgets each year. The first is a cash budget including revenues and cash expenses. This budget is submitted to CEPA. Following approval by the CEPA Board, it is included within the CEPA budget. This budget is submitted through the appropriate Ministries to the National Budget Director and ultimately the Legislative Assembly. The budget may be amended at any stage in the approval process, without appeal from the affected agency. It is this budget which defines the amount of subsidy which FENADESAL will receive. While FENADESAL normally includes capital expense (investment) items, these are routinely deleted from the budget.

The second budget includes non-cash items such as reserve accounts, depreciation and the allocation of expenses by CEPA. The objective of this budget is to provide a complete financial picture of railroad operations. Historically, it has been submitted to CEPA but not to the Government. CEPA has indicated that they no longer wish to receive copies of this budget. It is now simply an informational report to railroad management. It will continue to be prepared as FENADESAL management desires the information.

The proper solution is for the FENADESAL budget to be submitted separately from that of CEPA. This would identify the railroad as a separate operation. This budget should present the complete picture of railroad operations. It must include the non-cash accounts in order to present that picture. Depreciation, for example, is an expense reflecting the wearing out of assets which will require future replacement. There should also be a depreciation reserve to provide funds for these needed replacements. Expenses incurred by CEPA, whether reimbursed by FENADESAL or not, also represent a cost of railroad operations. The issue of proper reimbursement has apparently been a controversial issue for some time.

CEPA provides services in Purchasing and Planning. When purchases of certain materials are required, CEPA's Purchasing Department obtains bids and furnishes this information to FENADESAL with recommendations on the best vendor. Actual vendor selection is made by CEPA. CEPA also provides some services in planning of future activities although they have no railroad expert. The CEPA Board of Directors also functions as the FENADESAL Board. Were FENADESAL to be an independent agency, it would have to provide its own Board which would incur some additional cost. In return for these services, CEPA has historically allocated about ¢ 4 million of its expenses to FENADESAL. However, this is a non-cash item and CEPA is not reimbursed for this amount. It is however, included in the FENADESAL Annual Report in order to present a complete picture of railroad operations. It has been reported that CEPA plans to discontinue this allocation starting from 1995. The Manager, FENADESAL, has indicated that he feels an appropriate level for charges, based on the services actually provided by CEPA, would be ¢ 300,000 per year.

Another problem with the present structure relates to the sale of surplus railroad land. As a Government Agency, when FENADESAL offers surplus real estate for sale, it is usually claimed by other Government Departments. As a result, FENADESAL transfers the land to the claiming agency without compensation. As sale of surplus land offers one source of funds for rehabilitation expenses, it will be necessary that the railroad receive adequate compensation in such circumstances.

FENADESAL is not properly a part of the CEPA organization because (1) it is a transportation company operating in a competitive market place rather then providing terminal facilities, (2) is not owned by CEPA as are port facilities but only administered by CEPA, and (3) requires a different type of management than do the ports and airports. FENADESAL requires an organization which recognizes these distinct features. This can not be achieved within the CEPA organization. What is required is a new organization recognizing the commercial realities of the railroad.

For a railway to perform efficiently, it is essential that the right environment be established as follows:

> The railway must be permitted to operate as a commercial transport enterprise and to compete fairly in the marketplace with other modes of transport.
>
> Management must be given the authority to make decisions and to be held responsible for those decisions, without interference from parties who are not accountable for railway performance.
>
> The railway must be permitted to divest itself of non-profitable services or to obtain Public Service Obligation (PSO) payments from government when required to continue such services.

The railway must not be restrained by restrictive public service obligations, human resource procedures and practices which remove all incentives to work and lead to gross inefficiencies.

While based on FENADESAL's history under CEPA and GOES management, it seems unlikely that the appropriate regulatory environment described above can be established under the present organizational structure. It may be possible if ownership were transferred to CEPA, accompanied by regulations establishing the proper environment and providing FENADESAL with the capital and flexibility it needs to make the management decisions necessary to compete in the transport market.

As a result of historical precedent, FENADESAL operates the Port of Cutuco. It does not properly fit with the railroad operation. It is recommended that FENADESAL, as a part of its reorganization, sell the Port and related facilities to CEPA. This would place all port related activities in that organization.

b Legal and Regulatory Aspects

As it is proposed to reorganize FENADESAL as a commercial enterprise, any existing laws that restrict such action will require change. The National Legislature should be requested to amend existing law as quickly as possible, authorizing Fenadesal's reorganization. It is assumed that a new commercial enterprise would be created which would acquire title to all FENADESAL properties from the Government, providing all of its capital stock to the Government in return. The law should also authorize the Government to sell its stock interest to private parties, should such action become feasible in the future.

The regulatory structure must also support commercial operation. As has been found in much of the world, regulation has a very restrictive impact on transport efficiency and is now limited to preventing abuse of monopoly power. Most regulatory structures now restrict only such practices as predatory pricing (setting rates below cost with the deliberate intent of driving a competitor out of business) and the charging of excessive rates where the railroad has no effective competition. Service standards are set by the marketplace rather than by Government.

Given the competitive situation in El Salvador, where there are a multitude of private truck operators competing with FENADESAL, there should be no regulation of rates. Many countries have largely deregulated transport pricing in the last fifteen years. This has generally resulted in a lowering of transport price levels while the profitability of many operators, especially the railroads, has improved. Competition will provide all of the control which is necessary.

115

One specific legal problem occurs in the 1995 Budget Law. This law requires that all Government Departments use the same accounting system. While the objective of consistency is laudable, the new accounting system does not recognize the needs of a commercial operation. The system, which FENADESAL is required to use, does not provide the financial data which is required to support marketing efforts.

FENADESAL must be exempted from this law or they will ultimately have to operate two accounting systems, one for Government and one for internal use in identifying costs of specific operations. It may be possible to exempt FENADESAL by establishing it as a commercial company. Since it would no longer be a part of a Department, it is possible that the Budget Law would not apply. If this approach can not be used, then a modification in the existing law will be required. It is essential that the railroad have an accounting system which properly supports commercial activities.

Where rail services are not commercially viable, but are considered socially necessary, the railroad and the Government often enter agreements providing for the operation of these services under what have become known as Public Service Obligation (PSO) grants. The Government must determine the specific services which it wants and, jointly with the railroad, define the costs and anticipated revenues. Railroad operating losses will be covered by the PSO so that the railroad does not incur financial losses from such operations. Capital investments in rolling stock and other facilities also become the responsibility of the Government.

Under these contracts, the railroad agrees to operate specific services with a predetermined level of financial assistance from the Government. The railroad is expected to meet specific service standards with total cost responsibility. If costs exceed estimates, or revenues are less than anticipated, any increased loss is the railroad's responsibility. Assistance levels are not increased except under the most unusual conditions. Laws and regulations must authorize the Government to enter into these PSO agreements to provide for possible future financial assistance.

4.2.6. Management Alternatives

a. Privatization

Privatization of publicly owned transport networks is often suggested as an effective approach to improving the efficiency of transportation services. It has been used in several countries to improve service levels and reduce operating costs. However, privatization is not a panacea which will automatically produce the most economic solution.

There are several approaches which have been used for privatizing railway services. The complete railway may be sold as a unit to private owners. It may be divided into an infrastructure company owning and maintaining the fixed facilities and a separate

operating company providing the transportation services. Either or both may be sold to private interests. One approach uses a government owned infrastructure company charging tolls for use of the fixed facilities with a private or joint government-private operating company. More than one operator may be authorized to use all or a part of the system. In other instances, concessions have been granted for specific time periods including exclusive use of existing infrastructure. In some cases, the concessionaire has been permitted to offset investments in improvements or in correcting deferred maintenance against rentals to be paid for the property.

In some instances, auxiliary or non-core functions have been sold or leased to private operators who provide services to the railway under contract as well as to other firms. Examples include station and on-train catering, pick-up and delivery services, truck and bus operations, and workshops. At least one railway now obtains all locomotive maintenance services from a contractor. This approach may offer the opportunity for substantial cost savings while the railway remains a government operation as before.

In the case of El Salvador, sufficient demand to support any rail service on a commercially viable basis can not be assured. Current economic conditions are poor and the future outlook is uncertain. The former private companies operated at substantial losses for many years and were rescued from abandonment by nationalization. FENADESAL has incurred operating losses since its formation with losses and subsidy requirements increasing. There are no obvious efficiency improvements which will improve operating results. Thus there can be no assurance that a private operator will be able to provide services on an economically viable basis. Without this assurance, privatization is not feasible. This conclusion could change in the future if the economy continues to grow and new sources of rail suitable traffic develop.

The feasibility of privatization is also impeded by the poor condition of the infrastructure and equipment. While there nave been successful privatization programs for railways in very poor condition, notably Argentina and Colombia, these have been in areas where the Government railway was unable to adequately meet the needs of rail customers.

b. Commercial Railway, Government Owned

Although the fashion in today's world is to privatize, and some people consider this to be the only satisfactory way to improve efficiency given the past poor performance of government railways, there is no reason why a government owned railway can not be as efficient and cost effective as a private system. It does require the proper organization and regulatory environment.

As privatization of I ENADESAL is not presently feasible, it is recommended that ownership remain with the Government. It should logically be a part of the Ministry of

121

Public Works with the Manager of FENADESAL reporting to the Vice Minister of Transport or the Minister of Public Works. If the railroad is to operate successfully on a commercial basis, it must have the freedom to operate in a commercial manner and to quickly respond to changes in the transport market. It should be reorganized as an autonomous commercial enterprise in the same fashion as used for private firms but with the ownership interest remaining with the Government. A Board of Directors, appointed by the Minister of Public Works, should be created with full power to manage the enterprise and with accountability for their actions.

One alternative to immediate privatization of FENADESAL is an intermediate step, allowing the railway to operate as a commercial company while remaining in Government ownership. This will give management time to establish itself as a viable operation and to define what public service obligation grants will be necessary. As a commercial company, it can, given the proper legal and regulatory environment, achieve virtually all of the advantages of private operation. The important aspect is that the railroad operate as efficiently as possible and gradually bring its operations up to world standards.

Unlike many railroads, FENADESAL has not entered to the types of auxiliary business which frequently offer opportunities for partial privatization. There is no passenger service, nor auxiliary highway services to points not reached by the railway. Should expanded intermodal operations require such services, FENADESAL can contract with private sector trucking firms.

The workshops may offer a privatization opportunity. Although the tools and equipment are old, the workshop has a trained workforce capable of producing good quality work. Two approaches may be feasible. The railway may reorganize the workshops as a separate commercial organization for sale to others or to remain as a contractor. The railroad may simply contract for maintenance services with a private sector firm, closing the workshops.

c. Industrial Railway

Under the recommended Scenario 3, keeping Districts 2 and 3, there will be three primary users of the rail system. The two cement companies (which have common ownership) will be the principal users of the line between Metapán and Sitio del Niño, and between Nejapa and San Salvador. Coastal Management will be the major user between Acajutla and Sitio del Niño, sharing the route between Sitio del Niño and Nejapa with the cement companies. This may make it desirable for these firms to acquire and operate the railroad. They could contract with other parties who might wish to provide other transport services.

With this approach, the railroad would be operated by two distinct organizations, one for the cement companies and one for Coastal Management. This would result in a duplication of organizations. With the size of railroad proposed, this could result in

12

substantial inefficiencies. The proposed railroad is not big enough to justify two complete organizational structures. Having two companies would not necessarily result in efficient operation. These organizations may also have the same problems of obtaining capital funding as would a private or government railway company.

There would be the issue of cooperation between the two parties on the shared track between Nejapa and Sitio del Niño. There must be close cooperation if efficient operation is to result. The question of who receives priority when both wish to operate a train at the same time must be settled.

This approach has been informally discussed with Coastal, CEL (as the client of Coastal) and the cement companies. Both cement companies have indicated that they are not in the transportation business and do not wish to become directly involved with these problems. They want their responsibility to end at the plant gate, as it is today. Coastal and CEL have indicated that they may be willing to furnish locomotives and rolling stock for their service but do not wish to operate the railroad. As none of these firms have any interest in operating the railroad, this approach is not feasible.

d. Joint Private - Government Company

One approach which has been used in other countries with varying degrees of success is the organization of a commercial company in which the Government and private parties share ownership. In Colombia, for example, the primary railroad operating company is so owned. At the time of organization, fifty-one percent of the stock was held by the Government with the balance being held by private companies. Subsequent stock sales have reduced the Government interest to approximately thirty percent and this may be further reduced with future stock sales. Virtually all of the privately held stock is owned by major rail users. The Minister of Transport appoints the Chairman of the Board of Directors but all other directors are elected by the stockholders. The Government, as a major stockholder participates in these elections on the same basis as other stockholders.

This form of organization is especially effective if the private investors are major shippers. They not only have a voice in the operation of the company but also have an interest in using the railroad in order to protect their investments. This makes available to the railroad the skills of the private companies in running successful businesses, and also gives the Government a major voice, helping to insure that operations reflect public policy considerations.

e. CEPA Owned Commercial Company

In addition to the option of organizing a commercial company, it is possible to place the ownership interest with CEPA. CEPA would now own the railroad but it would be administered by its own management. In practice, this is little different from the above

122

organizations. CEPA would now have responsibility for insuring efficient operation. However, the problem noted above regarding different markets and different management skills being needed would still apply. This would solve some of the problems with the present organizational structure but leave others in place. Other approaches appear to better solve these problems.

f. Government Department

FENADESAL could become a separate department within the Government. This would simply remove the railway from CEPA and establish it as a separate unit, reporting to the Vice Minister for Transport within the Ministry of Public Works. This would represent relatively little change from the present organization. It is extremely difficult for a Government Department to act as would a commercial company when there is no clear responsibility for profit and the agency is subject to all of the political pressures which bear upon Government activities. Most publicly owned railways have been identified as economic disasters. Many aspects of this type of organization have been discussed on above paragraph titled. Privatization Reorganization, as a separate Government Department would simply shift responsibilities without attacking the real problems. This organization would not create the commercial orientation within the company which is essential to efficient operation.

4.2.7 Development of Strategic Plan

- Organization Plan

There are a number of steps to be followed in developing the strategic plan. Initially, FENADESAL must be reorganized as a commercial enterprise with full control over it's operations and properties. To the extent that current El Salvador laws do not permit the type of operation proposed, laws must be revised. This must be the first step in order to insure that full control over all properties is vested in the railway.

As a commercial enterprise, FENADESAL will require restructuring of the present organization. Some of the changes required are discussed below. Development of a new, commercially oriented, organization is critical to the future success of the railroad.

Action should be taken to abandon service between San Salvador and Cutuco. This may be a phased abandonment with some service remaining until the properties are sold in order to avoid problems with encroachments.

Service may consist of operation of motor cars over portions of the line until such time as properties are disposed of.

- Business Plan

One of the first actions taken by the new private company must be the development of a detailed business plan. This describes the projected operations in detail and includes a number of sub-plans which together, form a coordinated plan for all business operations. These sub-plans include marketing and pricing, operations and finance. The business plan should also include a training plan for improving the skills of staff at all levels. All of the sub-plans are closely related such that a change in one may require revision of the others. In developing the overall business plan, there is a great deal of interaction between the components.

- Marketing and Pricing Plan

The marketing plan identifies the traffic which management expects to handle. It defines service requirements which provides a key input to the operating plan and the expected revenues which provides input to the financial plan. FENADESAL needs to develop a comprehensive marketing plan which identifies the major commodities which are available for movement and the service requirements of the customers involved. The rates which can be charged for each movement are also determined. From this research, a marketing strategy is developed This assigns priorities to each commodity based on projected revenue and profitability. Efforts are concentrated on meeting the needs of those customers which will result in the greatest increase in revenues.

Detailed financial information is required to support marketing plan development. Marketing staff must know the costs of each movement so that potential revenues can be compared with costs in order to identify where the most profitable marketing opportunities are located. FENADESAL already has the beginnings of the required cost system. The present cost center approach provides an adequate basis for the cost detail needed. Within the Equipment Department, for example, employee time sheets and work orders show what individual pieces of rolling stock were worked on, making it possible to determine the cost of maintaining each locomotive and wagon. What is needed are refinements to the existing system, primarily in the way that costs are summarized and reported. Development of these refinements is a part of marketing plan development.

125

Development of the pricing strategy is also a key part of the marketing plan. At the present time, FENADESAL follows a strategy of relating rail rates to truck rates, with the objective of keeping rail rates sufficiently under truck rates that revenue is maximized. With FENADESAL's present cost structure, most costs being fixed, and unused capacity, this is a wise policy. Pricing policy should address what strategy will be followed when surplus capacity is utilized and investment in wagons and locomotives is required. This also requires detailed information on the costs associated with specific commodity movements.

FENADESAL must establish a Marketing Department with the responsibility for maximizing railroad traffic and profitability. The present organizational structure where marketing functions are divided between and a minor part of the Finance and Transport Departments does not recognize the present highly competitive market within which FENADESAL operates, a professional marketing staff working with customers in maximizing railroad participation in available traffic flows is necessary. Training of staff in marketing functions is also a critical need.

- Operating Plan

The marketing plan identifies specific customers and defines the services which the railroad must offer. From this, an operating plan is developed which establishes the trains to be operated. The operating plan establishes train frequency and defines the requirements for locomotives, wagons and operating staff. It includes operating costs which is a crucial input to determining costs of individual commodity movements. There is a great deal of interaction between marketing and operations in developing these phases of the business plan. Certain customer requirements may require operations that are expensive or difficult for the railroad to meet. This must be recognized in establishing marketing priorities. The railroad may not wish to transport certain commodities because of these requirements. Transport and Marketing must work together in developing that strategy which maximizes benefits to the railroad.

Maintenance of the permanent way is also a part of the operating plan. The operating plan must reflect the influence of track standards and the impact of rehabilitation on operating costs and service levels. Priorities for rehabilitation must also be established jointly by Maintenance of Way, Transport and Marketing.

- Financial Plan

The financial plan develops total financial requirements for the railroad. The marketing plan projects revenues from traffic. The operating plan projects major expenses. To this, administrative expenses are added. The financial plan determines total financial requirements and the sources of any outside financing which will be needed.

The financial plan also identifies the impacts of failure to obtain needed financial resources. There must also be interaction between all plans in development of the financial plan. The inability to rehabilitate the permanent way as planned will result in reduced service levels which may result in higher costs and have a negative impact on market share. These interrelationships must be recognized in overall plan development.

- Training

Training requirements are typically included in the individual plans discussed above. In the case of FENADESAL, establishment of a commercial enterprise will place the company in a new environment with a new organization. This will require extensive training for all levels of staff in how a commercial enterprise operates and how individual functions relate to each other. In designing a proper training program, the skills required for each position must be defined and the skills held by each incumbent determined. The skill gaps can then be identified and programs designed to close the gaps. Preparing employees for promotion by insuring that they have the skills required for the next higher position level must also be addressed in the training program.

4.2.8. Financial Requirements and Sources

a. Financial Projections of Scenarios

Cash flows forecast were prepared for these scenarios and alternatives that seemed potentially acceptable from a financial or economic perspective. These include the following:

- Scenario 1 - Retain Acajutla - San Salvador Service.
- Scenario 2A - Retain Metapán - San Salvador Service Via Existing Route.
- Scenario 2B - Retain Metapán - San Salvador Service Via an Apopa Connection.

TABLE 4.2.6

Scenario 1 : Retain Acajutla - San Salvador Service - Cash Flow Projections 1996-2015
(monetary values in 1994 prices)

ITEM	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CARGO (TONS)																				
BASE TO/FROM DISTRICT 3	61,268	57,114	52,960	48,806	44,652	47,672	50,693	53,713	56,734	59,754	63,796	67,838	71,880	75,922	79,964	85,373	90,782	96,192	101,601	107,010
BASE TO/FROM DIST 1 AND 2	15,367	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NEJAPA POWER PLANT	0	0	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000
TOTAL CARGO	76,635	57,114	208,960	204,806	200,652	203,672	206,693	209,713	212,734	215,754	219,796	223,838	227,880	231,922	235,964	241,373	246,782	252,192	257,601	263,010
TARIFF PER TON (COLONES)																				
BASE	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44
NEJAPA FUEL	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19
REVENUES (MILLION COLONES)																				
BASE	3.18	2.37	2.19	2.02	1.85	1.98	2.10	2.23	2.35	2.48	2.64	2.81	2.98	3.15	3.31	3.54	3.76	3.99	4.21	4.43
NEJAPA FUEL	0.00	0.00	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33
RENTAL AND MISCELLANEOUS	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
TOTAL REVENUES	5.28	4.47	9.62	9.45	9.28	9.41	9.53	9.66	9.78	9.91	10.07	10.24	10.41	10.58	10.74	10.97	11.19	11.42	11.64	11.86
OPERATING COSTS (MILLION COLONES)																				
BASE																				
FIXED	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86
SEMI- VARIABLE	6.44	6.25	6.21	6.17	6.13	6.16	6.19	6.22	6.25	6.28	6.32	6.36	6.40	6.44	6.48	6.53	6.58	6.64	6.69	6.74
TOTAL BASE	16.30	16.11	16.07	16.03	15.99	16.02	16.05	16.08	16.11	16.14	16.18	16.22	16.26	16.30	16.34	16.39	16.44	16.50	16.55	16.60
NEJAPA SERVICE (ADDED COST)	0.00	0.00	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74
TOTAL OPERATING COSTS	16.30	16.11	17.81	17.77	17.73	17.76	17.79	17.82	17.85	17.88	17.92	17.96	18.00	18.04	18.08	18.13	18.18	18.24	18.29	18.34
OPERATING MARGIN	(11.02)	(11.64)	(8.19)	(8.32)	(8.45)	(8.35)	(8.26)	(8.16)	(8.07)	(7.97)	(7.85)	(7.72)	(7.59)	(7.46)	(7.34)	(7.16)	(6.99)	(6.82)	(6.65)	(6.48)
TOTAL REVENUES (MILLION COLONES)																				
NET LIQUIDATION VALUES		2.28	2.28	2.28																
REVENUES	5.28	4.47	9.62	9.45	9.28	9.41	9.53	9.66	9.78	9.91	10.07	10.24	10.41	10.58	10.74	10.97	11.19	11.42	11.64	11.86
TOTAL REVENUES	5.28	6.75	11.90	11.73	9.28	9.41	9.53	9.66	9.78	9.91	10.07	10.24	10.41	10.58	10.74	10.97	11.19	11.42	11.64	11.86
TOTAL COSTS (MILLION COLONES)																				
TRACK REHABILITATION	4.37	14.57	14.57	14.57																
ENCROACHMENT CORRECTION		5.85	5.85	5.86																
BRIDGE REPLACEMENT/REPAIR	0.21	2.06																		
NEJAPA SERVICE INVESTMENT	2.51	25.13																		
INDEMNIZATION COSTS		13.90																		
OPERATING COSTS	16.30	16.11	17.81	17.77	17.73	17.76	17.79	17.82	17.85	17.88	17.92	17.96	18.00	18.04	18.08	18.13	18.18	18.24	18.29	18.34
TOTAL COSTS	23.39	77.62	38.23	38.20	17.73	17.76	17.79	17.82	17.88	17.88	17.92	17.96	18.00	18.04	18.08	18.13	18.18	18.24	18.29	18.34
NET CASH FLOW (MILLION COLONES	(18.11)	(70.87)	(26.33)	(26.47)	(8.45)	(8.35)	(8.26)	(8.16)	(8.07)	(7.97)	(7.85)	(7.72)	(7.59)	(7.46)	(7.34)	(7.16)	(6.99)	(6.82)	(6.65)	(6.48)

SOURCE FREDERIC R HARRIS, INC.

128

TABLE 4.2.7

Scenario 2A : Retain Metapan - San Salvador Service via Existing Route - Cash Flow Projections 1995-2015
(monetary values in 1994 prices)

ITEM	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CARGO (TONS)																				
CEMENT	104,900	104,900	214,600	232,800	251,000	264,800	278,600	292,400	306,200	320,000	338,400	356,800	375,200	393,600	412,000	434,800	457,200	479,800	502,400	525,000
TARIFF PER TON (COLONES)																				
CEMENT	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13
REVENUES (MILLION COLONES)																				
CEMENT	3.48	3.48	7.11	7.71	8.32	8.77	9.23	9.69	10.14	10.60	11.21	11.82	12.43	13.04	13.65	14.40	15.15	15.90	16.64	17.39
RENTAL AND MISCELLANEOUS	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
TOTAL REVENUES	5.58	5.58	9.21	9.81	10.42	10.87	11.33	11.79	12.24	12.70	13.31	13.92	14.53	15.14	15.75	16.50	17.25	18.00	18.74	19.49
OPERATING COSTS (MILLION COLONES)																				
FIXED	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95	15.95
SEMI- VARIABLE	5.50	5.50	6.70	6.90	7.10	7.25	7.40	7.55	7.71	7.86	8.06	8.26	8.46	8.67	8.87	9.12	9.36	9.61	9.86	10.11
TOTAL OPERATING COSTS	21.45	21.45	22.65	22.85	23.05	23.20	23.35	23.50	23.66	23.81	24.01	24.21	24.41	24.62	24.82	25.07	25.31	25.56	25.81	26.06
OPERATING MARGIN	(15.87)	(15.87)	(13.44)	(13.04)	(12.63)	(12.33)	(12.02)	(11.71)	(11.42)	(11.11)	(10.70)	(10.29)	(9.88)	(9.48)	(9.07)	(8.57)	(8.06)	(7.56)	(7.07)	(6.57)
TOTAL REVENUES (MILLION COLONES)																				
NET LIQUIDATION VALUES		1.96	1.96	1.96																
REVENUES	5.58	5.58	9.21	9.81	10.42	10.87	11.33	11.79	12.24	12.70	13.31	13.92	14.53	15.14	15.75	16.50	17.25	18.00	18.74	19.49
TOTAL REVENUES	5.58	7.54	11.17	11.77	10.42	10.87	11.33	11.79	12.24	12.70	13.31	13.92	14.53	15.14	15.75	16.50	17.25	18.00	18.74	19.49
TOTAL COSTS																				
TRACK REHABILITATION	6.24	20.79	20.79	20.80																
ENCROACHMENT CORRECTION		6.00	6.00	6.00																
BRIDGE REPAIR/REHABILITATION	0.03	0.30																		
INDEMNIZATION COSTS		13.02																		
OPERATING COSTS	21.45	21.45	22.65	22.85	23.05	23.20	23.35	23.50	23.66	23.81	24.01	24.21	24.41	24.62	24.82	25.07	25.31	25.56	25.81	26.06
TOTAL COSTS	27.72	61.56	49.44	49.65	23.05	23.20	23.35	23.50	23.66	23.81	24.01	24.21	24.41	24.62	24.82	25.07	25.31	25.56	25.81	26.06
NET CASH FLOW (MILLION COLONES)	(22.14)	(54.02)	(38.27)	(37.88)	(12.63)	(12.33)	(1[illegible].02)	(11.71)	(11.42)	(11.11)	(10.70)	(10.29)	(9.88)	(9.48)	(9.07)	(8.57)	(8.06)	(7.56)	(7.07)	(6.57)

SOURCE FREDERIC R HARRIS, INC

125

TABLE 4.2.8

Scenario 2B : Retain Metapan - San Salvador Service via Apopa Connection - Cash Flow Projections 1995-2015
(monetary values in 1994 prices)

ITEM	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CARGO (TONS)																				
CEMENT	104,900	104,900	104,900	232,800	251,000	264,800	278,600	292,400	306,200	320,000	338,400	356,800	375,200	393,600	412,000	434,600	457,200	479,800	502,400	525,000
TARIFF PER TON (COLONES)																				
CEMENT	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13
REVENUES (MILLION COLONES)																				
CEMENT	3.48	3.48	3.48	7.71	8.32	8.77	9.23	9.69	10.14	10.60	11.21	11.82	12.43	13.04	13.65	14.40	15.15	15.90	16.64	17.39
RENTAL AND MISCELLANEOUS	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
TOTAL REVENUES	5.58	5.58	5.58	9.81	10.42	10.87	11.33	11.79	12.24	12.70	13.31	13.92	14.53	15.14	15.75	16.50	17.25	18.00	18.74	19.49
OPERATING COSTS (MILLION COLONES)																				
FIXED	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54
SEMI- VARIABLE	5.43	5.43	5.43	6.83	7.03	7.18	7.33	7.48	7.64	7.79	7.99	8.19	8.39	8.60	8.80	9.05	9.29	9.54	9.78	8.65
TOTAL OPERATING COSTS	17.97	17.97	17.97	19.37	19.57	19.72	19.87	20.02	20.18	20.33	20.53	20.73	20.93	21.14	21.34	21.59	21.83	22.08	22.33	21.19
OPERATING MARGIN	(12.39)	(12.39)	(12.39)	(9.56)	(9.15)	(8.85)	(8.54)	(8.23)	(7.94)	(7.63)	(7.22)	(6.81)	(6.40)	(6.00)	(5.59)	(5.09)	(4.58)	(4.08)	(3.59)	(1.70)
TOTAL REVENUES (MILLION COLONES)																				
NET LIQUIDATION VALUES		2.04	2.04	2.04																
REVENUES	5.58	5.58	5.58	9.81	10.42	10.87	11.33	11.79	12.24	12.70	13.31	13.92	14.53	15.14	15.75	16.50	17.25	18.00	18.74	19.49
TOTAL REVENUES	5.58	7.62	7.62	11.85	10.42	10.87	11.33	11.79	12.24	12.70	13.31	13.92	14.53	15.14	15.75	16.50	17.25	18.00	18.74	19.49
TOTAL COSTS																				
TRACK REHABILITATION	5.58	18.53	18.53	18.53																
ENCROACHMENT CORRECTION		6.00	6.00	6.00																
BRIDGE REPAIR/REHABILITATION	0.03	0.27																		
NEW CONSTRUCTION	2.49	12.45	12.45																	
INDEMNIZATION COSTS		13.61																		
OPERATING COSTS	17.97	17.97	17.97	19.37	19.57	19.72	19.87	20.02	20.18	20.33	20.53	20.73	20.93	21.14	21.34	21.59	21.83	22.08	22.33	21.19
TOTAL COSTS	26.05	68.83	54.95	43.90	19.57	19.72	19.87	20.02	20.18	20.33	20.53	20.73	20.93	21.14	21.34	21.59	21.83	22.08	22.33	21.19
NET CASH FLOW (MILLION COLONES)	(20.47)	(61.21)	(47.33)	(32.05)	(9.15)	(8.85)	(8.54)	(8.23)	(7.94)	(7.63)	(7.22)	(6.81)	(6.40)	(6.00)	(5.59)	(5.09)	(4.58)	(4.08)	(3.59)	(1.70)

SOURCE FREDERIC R HARRIS, INC

130

TABLE 4.2.9

Scenario 3B : Retain Acajutla - San Salvador and San Salvador - Metapan Service via Apopa Connection - Cash Flow Projections 1995-2015

(monetary values in 1994 prices)

ITEM	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CARGO (TONS)																				
BASE DIST 3 TO/FROM DISTRICT 3	61,266	57,114	52,960	48,808	44,652	47,672	50,693	53,713	56,734	59,754	63,795	67,836	71,880	75,922	79,964	85,373	90,782	96,192	101,601	107,010
BASE DIST 3 TO/FROM DIST 1 AND 2	15,367	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NEJAPA POWER PLANT	0	0	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000
CEMENT	104,900	104,900	104,900	232,800	251,000	284,800	278,600	292,400	306,200	320,000	338,400	356,800	375,200	393,600	412,000	434,800	457,200	479,800	502,400	525,000
FUEL OIL	0	0	0	41,980	44,476	46,968	49,500	52,011	54,523	57,035	60,256	63,477	66,698	69,919	73,140	77,271	81,401	85,532	89,662	93,793
TOTAL CARGO	181,535	162,014	313,860	479,588	486,128	515,460	534,792	554,125	573,457	592,789	618,452	644,115	669,778	695,441	721,104	753,244	785,384	817,523	849,663	881,803
TARIFF PER TON (COLONES)																				
BASE	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44
NEJAPA FUEL	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19
CEMENT	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13
FUEL OIL	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13
REVENUES (MILLION COLONES)																				
BASE	3.18	2.37	2.19	2.02	1.85	1.98	2.10	2.23	2.35	2.48	2.64	2.81	2.98	3.15	3.31	3.54	3.78	3.98	4.21	4.43
NEJAPA FUEL	0.00	0.00	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33
CEMENT	3.48	3.48	3.48	7.71	8.32	8.77	9.23	9.69	10.14	10.60	11.21	11.82	12.43	13.04	13.65	14.40	15.15	15.90	16.64	17.39
FUEL OIL	0.00	0.00	0.00	3.45	3.65	3.86	4.07	4.27	4.48	4.68	4.95	5.21	5.48	5.74	6.01	6.35	6.69	7.02	7.36	7.70
OTHER REVENUES	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
TOTAL REVENUES	8.78	7.95	13.10	20.61	21.25	22.04	22.83	23.62	24.40	25.19	26.23	27.27	28.32	29.36	30.40	31.72	33.03	34.34	35.64	36.95
OPERATING COSTS (MILLION COLONES)																				
BASE PLUS CEMENT AND FUEL OIL																				
FIXED	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17
SEMI- VARIABLE	14.08	14.01	14.00	14.60	14.68	14.73	14.80	14.87	14.94	15.01	15.11	15.20	15.29	15.39	15.48	15.60	15.71	15.83	15.95	16.12
TOTAL BASE	33.25	33.18	33.17	33.77	33.83	33.90	33.97	34.04	34.11	34.18	34.28	34.37	34.46	34.56	34.65	34.77	34.88	35.00	35.12	35.29
NEJAPA SERVICE (ADDED COST)	0.00	0.00	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74
TOTAL OPERATING COSTS	33.25	33.18	34.91	35.51	35.57	35.64	35.71	35.78	35.85	35.92	36.02	36.11	36.20	36.30	36.39	36.51	36.62	36.74	36.86	37.03
OPERATING MARGIN	(24.49)	(25.23)	(21.81)	(14.90)	(14.32)	(13.60)	(12.88)	(12.16)	(11.45)	(10.73)	(9.79)	(8.84)	(7.88)	(6.94)	(5.99)	(4.79)	(3.59)	(2.40)	(1.22)	(0.08)
TOTAL REVENUES (MILLION COLONES)																				
NET LIQUIDATION VALUES		1.66	1.66	1.66																
REVENUES	8.78	7.95	13.10	20.61	21.25	22.04	22.83	23.62	24.40	25.19	26.23	27.27	28.32	29.36	30.40	31.72	33.03	34.34	35.64	36.95
TOTAL REVENUES	8.78	9.61	14.76	22.28	21.26	22.04	22.83	23.62	24.40	25.19	26.23	27.27	28.32	29.36	30.40	31.72	33.03	34.34	35.64	36.95
TOTAL COSTS (MILLION COLONES)																				
REHABILITATION OF BASE LINE	9.55	31.83	31.83	31.82																
ENCROACHMENT CORRECTION		6.67	6.67	6.66																
BRIDGE REPLACEMENT/REPAIR	0.23	2.34																		
NEW CONSTRUCTION	2.49	12.45	12.45																	
NEJAPA SERVICE INVESTMENT	2.51	25.13																		
INDEMNIZATION COSTS		6.44																		
OPERATING COSTS	33.25	33.18	34.91	35.51	35.57	35.64	35.71	35.78	35.85	35.92	36.02	36.11	36.20	36.30	36.39	36.51	36.62	36.74	36.86	37.03
TOTAL COSTS	48.03	117.04	85.86	73.99	35.57	35.64	35.71	35.78	35.85	35.92	36.02	36.11	36.20	36.30	36.39	36.51	36.62	36.74	36.86	37.03
NET CASH FLOW (MILLION COLONES)	(39.27)	(107.43)	(71.10)	(51.73)	(14.32)	(13.60)	(12.88)	(12.16)	(11.45)	(10.73)	(9.79)	(8.84)	(7.88)	(6.94)	(5.99)	(4.79)	(3.59)	(2.40)	(1.22)	(0.08)

SOURCE FREDERIC R. HARRIS, INC

131

TABLE 4.2.10

Scenario 3C : Retain Acajutla - San Salvador and San Salvador - Metapan Service via Santa Ana - Cash Flow Projections 1995-2015

(monetary values in 1994 prices)

ITEM	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CARGO (TONS)																					
BASE DIST 3 TO/FROM DISTRICT 3	91,299	97,114	92,860	49,808	44,652	47,872	50,680	53,713	56,734	59,754	63,798	67,838	71,880	75,922	79,964	85,373	90,782	96,192	101,601	107,010	
BASE DIST 3 TO/FROM DIST 1 AND 2	16,267	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NEJAPA POWER PLANT	0	0	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	
CEMENT	104,800	104,800	104,800	232,800	261,000	284,800	279,800	292,400	308,200	320,000	338,400	364,800	375,200	390,800	412,000	434,800	457,200	479,800	502,400	526,000	
FUEL OIL	0	0	0	41,880	44,478	48,888	49,500	52,011	54,523	57,036	60,298	63,477	66,898	69,918	73,140	77,271	81,401	85,532	89,662	93,793	
STONE	0	0	0	127,200	134,777	142,399	150,000	157,611	165,223	172,834	182,986	193,204	202,118	211,877	221,638	234,155	246,672	259,188	271,705	284,222	
TOTAL CARGO	181,835	162,014	313,860	608,708	630,805	657,849	654,782	711,738	738,679	765,623	801,047	838,471	871,894	907,318	942,742	967,399	1,032,055	1,076,712	1,121,368	1,166,025	
TARIFF PER TON (COLONES)																					
BASE	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	41.44	
NEJAPA FUEL	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	
CEMENT	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	33.13	
FUEL OIL	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	
STONE	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	
REVENUES (MILLION COLONES)																					
BASE	3.19	2.37	2.19	2.02	1.85	1.99	2.10	2.22	2.38	2.49	2.64	2.81	2.99	3.19	3.31	3.54	3.79	3.99	4.21	4.43	
NEJAPA FUEL	0.00	0.00	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	
CEMENT	3.48	3.48	3.48	7.71	8.32	8.77	9.23	9.68	10.14	10.60	11.21	11.82	12.43	13.04	13.65	14.40	15.16	15.80	16.64	17.39	
FUEL OIL	0.00	0.00	0.00	3.48	3.63	3.99	4.07	4.27	4.48	4.68	4.85	5.21	5.48	5.74	6.01	6.35	6.69	7.02	7.36	7.70	
STONE	0.00	0.00	0.00	5.41	5.73	6.05	6.37	6.70	7.02	7.35	7.78	8.18	8.59	9.00	9.42	9.95	10.48	11.02	11.55	12.08	
OTHER REVENUES	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	
TOTAL REVENUES	8.78	7.95	13.10	28.02	28.88	28.09	29.20	30.32	31.42	32.64	33.89	35.45	36.91	38.36	38.82	41.67	43.61	45.36	47.19	49.03	
OPERATING COSTS (MILLION COLONES)																					
BASE PLUS CEMENT AND FUEL OIL																					
FIXED	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	17.91	
SEMI-VARIABLE	13.69	13.60	13.49	14.81	14.82	16.04	15.19	15.29	15.41	15.53	15.69	15.85	16.01	16.17	16.34	16.54	16.74	16.94	17.15	17.34	
TOTAL BASE	31.60	31.41	31.39	32.72	32.63	32.85	33.07	33.20	33.32	33.44	33.60	33.76	33.92	34.08	34.25	34.45	34.65	34.85	35.06	35.25	
NEJAPA SERVICE (ADDED COST)	0.00	0.00	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	
TOTAL OPERATING COSTS	31.60	31.41	33.13	34.46	34.67	34.69	34.81	34.94	35.08	35.18	35.34	35.50	35.65	35.82	35.99	36.19	36.39	36.59	36.80	36.99	
OPERATING MARGINS	(22.74)	(23.46)	(20.03)	(6.44)	(7.89)	(6.60)	(5.61)	(4.62)	(3.64)	(2.54)	(1.35)	(0.05)	1.26	2.54	3.83	5.48	7.12	8.77	10.39	12.04	
TOTAL REVENUES (MILLION COLONES)																					
NET LIQUIDATION VALUES		1.74	1.74	1.74																	
REVENUES	8.78	7.95	13.10	28.02	28.88	28.09	29.20	30.32	31.42	32.64	33.89	35.45	36.91	38.36	38.82	41.67	43.61	45.36	47.19	49.03	
TOTAL REVENUES	8.78	9.69	14.84	27.78	28.88	28.09	29.20	30.32	31.42	32.64	33.89	35.45	36.91	38.36	38.82	41.67	43.61	45.36	47.19	49.03	
TOTAL COSTS (MILLION COLONES)																					
REHABILITATION OF BASE LINE	9.13	30.41	30.41	30.42																	
ENCROACHMENT CORRECTION		9.67	9.67	9.68																	
BRIDGE REPLACEMENT/REPAIR	0.22	2.14																			
NEW CONSTRUCTION	5.68	28.28	28.28																		
WAGONS FOR STONE			15.23																		
NEJAPA SERVICE INVESTMENT	2.91	20.13																			
INDEMNIZATION COSTS		5.44																			
OPERATING COSTS	31.60	31.41	33.13	34.46	34.67	34.69	34.81	34.94	35.08	35.18	35.34	35.50	35.65	35.82	35.99	36.19	36.39	36.59	36.80	36.99	
TOTAL COSTS	49.20	132.48	116.70	73.84	34.67	34.69	34.81	34.94	35.08	35.18	35.34	35.50	35.65	35.82	35.99	36.19	36.39	36.59	36.80	36.99	
NET CASH FLOW (MILLION COLONES)	(40.44)	(122.79)	(101.86)	(46.76)	(7.89)	(6.60)	(5.61)	(4.62)	(3.64)	(2.54)	(1.35)	(0.05)	1.26	2.54	3.83	5.48	7.12	8.77	10.39	12.04	

SOURCE: FREDERIC R. HARRIS, INC.

132

TABLE 4.2.11
Scenario 5 : Total Closure of the Railroad System
(monetary values in 1994 prices)

ITEM	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CARGO (TONS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REVENUES (MILLION COLONES)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OPERATING COSTS (MILLION COLONES)																				
FIXED	2.14	2.14	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OPERATING MARGIN	(2.14)	(2.14)	(2.14)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL REVENUES (MILLION COLONES)																				
NET LIQUIDATION VALUES	83.27	83.27	83.27																	
TOTAL COSTS (MILLION COLONES)																				
INDEMNIZATION COSTS	23.00																			
OPERATING COSTS	2.14	2.14	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL COSTS	25.14	2.14	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NET CASH FLOW (MILLION COLONES)	58.13	81.13	81.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SOURCE FREDERIC R HARRIS, INC

133

- Fuel oil to Metapán. It is assumed that all potential fuel oil to Metapán would be serviced after the construction of the Apopa or Santa Ana connection.

- Puzzolana to Metapán. It is assumed that all potential Puzzolana to Metapán would be serviced after construction of the Santa Ana connection.

- Tariffs and Revenues

Tariffs used in the cash flow forecast are those previously presented, as follows:

- Acajutla - San Salvador traffic: 41.44 colones per ton.
- Nejapa power plant fuel oil: 34.19 colones per ton.
- Cement: 33.13 colones per ton.
- Puzzolana: 42.50 colones per ton.
- Acajutla - Metapán fuel oil: 82.13 colones per ton.

Revenues were determinated from FENADESAL's 1994 monthly report showing tons and revenue by individual origin-destination pair. This was considered to be the most accurate information available. In order to avoid inflationary impacts, revenues and unit costs were considered to remain constant throughout the study period. This is a standard study approach.

Tariff changes were no considered because at the time of the study, the increases under consideration had not been approved. No effective date for increases could be determined at that time and it was possible that the increases would not be approved.

While it is maintained that not diversions to highway will result from the increases proposed, this may or may not be true. FENADESAL's policy has been to price at 80 percent of the truck rate and tonnage projections made by the model assume this will continue. Comparisons were made of rail and truck rates for cement indicating that rail was about 80 percent of truck. If existing 1994 rates were at the 80 percent level, an increase of 30 percent would bring rail rates above the truck level. More detailed evaluations may be required in this area.

A prior comment was made that cement rates were too low. This was base on the fact that the transporting companies were absorbing truck cost from Apopa (rail rates to Apopa and San Salvador are the same, based on the tons/revenue reports) and had not diverted any tonnage. The severe decline in cement tonnage beginning in late 1994 and continuing into 1995 indicates that this added cost of trucking may have resulted in diversions and present rates are not too low.

However, if an increase in revenues of 30 percent were possible without loss of traffic, it would improve the economics of rail operation, especially if combined with the increase in base load traffic.

No revenues or costs are considered for the operation of the segment between Cutuco and the Sagrisa fertilizer plant at Kilometer 4 in La Unión.

Revenues resulting for the net liquidation values of line closures, previously estimated, were included in each scenario. In addition, 2.1 million colones in rental and miscellaneous income are assumed in all scenarios.

- Operating Costs

Operating costs are those previously developed for the years 2000 to 2015 for each scenario and interpolated for other years identifying fixed costs and variable costs per ton.

- Total Costs

Total costs are based on operating cost projections and investment cost estimates previously presented for each scenario. Investment costs include infrastructure investment, costs associated with the resolution of the encroachment problem, as required for the rehabilitation of lines, and severance payments due to closure of lines.

Table 4.2.12 summarizes the financial indicators resulting from Tables 4.2.6 through 4.2.11 Monetary values are presented in 1994 prices and present values of revenues and costs are estimated for the period 1996-2015, discounted at a 12% annual rate. Assets not liquidated at the beginning of the analysis period are considered to be liquidated in the following three years after 2015.

Based on these results, the following conclusions are drawn:

- Overall financial performance. With the exception of Scenario 5 - Total Closure of the Railroad System-all scenarios show negative cash flows and benefits to costs ratios between 0.4 and 0.5, at a 12% annual discount rate. Therefore, based on financial performance only, the preferred alternative is to close the system down at the earliest possible time.

- If total closure of the system is not economically or socially acceptable, then, from a financial perspective, the best alternatives

TABLE 4.2.12
Financial Indicators of Scenarios
(in million 1994 colones)

SCENARIO	PRESENT VALUE OF REVENUES	PRESENT VALUES OF COSTS	NET PRESENT VALUE	REVENUES TO COSTS RATIO	PRESENT VALUE OF OPERATING MARGIN
SCENARIO 1	90.67	214.16	(123.49)	0.42	(65.13)
SCENARIO 2A	104.92	247.26	(142.34)	0.42	(92.58)
SCENARIO 2B	102.49	236.26	(133.77)	0.43	(68.17)
SCENARIO 3B	175.47	404.37	(228.91)	0.43	(111.48)
SCENARIO 3C	212.90	436.31	(223.41)	0.49	(66.79)
SCENARIO 5	200.00	25.68	174.32	7.79	N.A.

SCENARIO 1 -Retain Acajutla-San Salvador Service

SCENARIO 2A -Retain Metapán-San Salvador Service Via Existing Route

SCENARIO 2B -Retain Metapán-San Salvador Service Via Apopa Connection

SCENARIO 3B -Retain Acajutla-San Salvador and San Salvador-Metapán Service Via Apopa Connection

SCENARIO 3C -Retain Acajutla-San Salvador and San Salvador-Metapán Service Via Santa Ana Connection

SCENARIO 5 -Total Closure of Railroad System

SOURCE: FREDERIC R. HARRIS, INC.

130

are these requiring the least investment, Scenario 1 - Retain Acajutla - San Salvador and Scenario 2B - Retain Metapán - San Salvador, via Apopa connection

- If Scenario 3 - Retain Acajutla - San Salvador and Metapán - San Salvador, is the preferred alternative from a social or economic perspective, then Scenario 3C, with the Santa Ana connection, would minimize financial losses.

- Considering operating revenues and costs only, Scenarios 1 and 3C present the highest present value of operating margin (operating revenues less operating costs), although they are still negative. Scenario 3C would also require diminishing operating subsidies throughout time and is projected to generate positive operating margins by the year 2008.

b. Sources of Funds

The rehabilitation program represents the major financial requirement. In addition, payments to severed employees will represent a major investment. This discussion assumes the adoption of Scenario 3, with construction of the Santa Ana Connection. This approach has the greatest investment requirements and is used in order to include a conservative bias in the financial requirements. Total requirements for rehabilitation and new construction are:

Track Rehabilitation	¢ 91,241,000
Bridge Rehabilitation	1,164,000
Replace Río Ceníza Bridge	1,000,000
Santa Ana Connection	58,519,000
Indemnification to Employees	5,438,000
Total	¢ 157,362,000

Investments required for expanded traffic which is necessary to achieve the revenue projections shown above are:

Nejapa Power Plant	¢ 25,131,000
Puzzolana Wagons	15,225,000
Total	¢ 40,356,000

Adding pre-investment and design costs of ¢ 17,705,000, total investment costs amount to ¢ 215,423,000.

137

In addition to the requirements listed above, there is the need to buy out the encroachments along the rail lines to be retained. For Scenario 3, with construction of the Santa Ana connection, this is estimated at ¢ 26,000,000. This is an action which must be taken if adequate rail service is to be provided.

A portion of the funds required for rehabilitation can be provided by sale of surplus land and materials salvaged from abandoned lines. Based on Scenario 3 via Santa Ana, this is estimated to provide ¢ 5,216,000. This is but a small part of the total requirement.

The rehabilitation could possibly be funded by a toll on cargo transported. However, it has been assumed in the evaluation that FENADESAL has established rates at the level which maximizes profitability and minimizes subsidy requirements. A toll will represent an increase in rail transport costs to the user and possibly result in diversion of traffic. This could then force a reduction in FENADESAL's rates which would reduce operating income and increase subsidy requirements. The benefits of the rehabilitation program will not be received until the program is complete and it may take some time after that before possible rail users shift their traffic to rail. Thus, increased rates will not be feasible until the program is completed.

Railroad rehabilitation projects have been funded in some countries, including the United States, by joint government-shipper-railroad financing. In effect, shippers prepay freight charges in order to finance the program, receiving a reduction in freight charges. Such a program may be feasible in El Salvador.

The above financial results are highly dependent in the railroad attracting all potential traffic from the Nejapa power and cement plants in Metapán. Traffic projections indicate that the Nejapa power plant would provide 70% of the total projected traffic on the Acajutla-San Salvador line. The cement factories in Metapán would provide all of the projected traffic on the San Salvador - Metapán line.

Given the level of dependency on those two potential rail users, some level of commitment to make use of rail services would be required before going ahead with any investment in the railroad sector. This commitment would be most easily achieved if these two private enterprises participate in some capacity in the investments.

In the case of the Nejapa fuel, the customer may be willing to provide at least a part of the investment. This is subject to negotiation between FENADESAL and Coastal Management. It should be expected that, as Coastal's investment increases, the rates they would be willing to pay will decline.

A similar program may be followed in acquiring wagons for Puzzolana transport. The cement companies may be willing to purchase wagons if they feel they will benefit

from reduced transport costs. This is common practice in many countries. To date, however, the cement companies have shown no interest in becoming involved with rail transportation.

Also, outside suppliers may be willing to invest in specific items. For example, Roadrailer© Corporation may be willing to provide the container equipment under lease, if container traffic becomes an important rail cargo movement. This company has, on some occasions, established a service under contract with the railroad. Roadrailer© does not contract with the railroad to operate the trains but otherwise provides all equipment and staff and markets the service. The railroad's only obligation is to operate the trains as provided by contract. Several steamship lines also operate inland container services on a similar basis in many countries. This may offer a source of financing for the container equipment.

International aid agencies may provide certain materials as part of an assistance program. However, the rehabilitation program does not include a significant amount of imported materials. Only the rail joint bars need to be imported and these represent only four percent of the project cost. International lending agencies, in similar fashion, will fund the foreign exchange component of projects but not the local portion.

In addition, the multilateral banking agencies, such as the World Bank and the Interamerican Development Bank, may require the institutional restructuring of FENADESAL before considering any capital funding. For example, major World Bank's rail loans in the 1980's and 1990's have included substantial institutional components, including private sector development, labor reductions, performance agreements, changes in regulatory policies, and other significant up-front conditions destined to increase the operating efficiency, accountability, and market-oriented approach of the managing body.

With an organized development plan and defined economic benefits from retention and improvement of the railway, agencies such as the Interamerican Development Bank or World Bank may be willing to provide a loan for at least a portion of the project. However, such a loan would be made to the Government and not to the railroad. As such, it would be an obligation of the Government for repayment. Often such loans are made to cover only the foreign exchange component of the project. As noted above, this involves only a very small part of the total cost.

Because of the high market risk involved with the continuation of rail operations, it is possible that any track rehabilitation and construction of rail connections will need to be fully funded by the Government of El Salvador. In addition, with the high local content of this project, the Government of El Salvador becomes, in effect, the only available source of funding. There is justification for this action. To a great extent, the need for rehabilitation reflects a failure to supply adequate funds for proper maintenance in previous years. Rehabilitation will improve rail efficiency and maximize the benefits of continued rail service. Supply of materials and labor provides economic benefits to the economy of El Salvador which will be spread throughout the area served by the railroad.

The rehabilitation program should create substantial employment opportunities for at least the next three years. To the extent of current unemployment, this should reduce

unemployment and may have a positive impact on the payment of unemployment benefits. This offers further justification for Government funding of the program.

4.2.9 Conclusions and Recommendations

Abandonment of all rail operations and liquidation of the assets has the highest net cash flow of any of the scenarios. Although it results in the highest financial benefits, it may not be the most desirable in economic or social terms. To the extent that rail operating costs are lower than those of other modes, it would result in higher transport costs to the economy. It may also result in negative impacts from highway congestion and increased costs.

The railroad system with higher present value of operating margins (operating revenues less operating costs) includes service between Acajutla, Metapán and San Salvador. These lines have the possibility of operating profitably within the next twenty years should traffic volumes increase as expected. The study analysis indicates that service between Metapán and San Salvador is most economic when via Santa Ana. However, the analysis has been prepared using readily available data which is not sufficiently detailed to perform the analysis normally associated with major investment projects. More detailed analysis should be made before a final decision on routes is made.

Immediate rehabilitation of the rail lines which are retained in operation must be made. This is absolutely necessary if the railroad is to provide adequate service levels which meet market requirements and permit the handling of sufficient traffic volume to offset operating costs.

Continued operation of the San Salvador-Cutuco line is not feasible due to the extremely low traffic volume and the high costs of rehabilitation which is urgently required. Should major port development take place at Cutuco, restoration of rail service can be evaluated at that time. In the event that rail service is desirable, the existing route should be relocated to provide a shorter route with lower operating costs which will be better able to compete with highway transport.

Operation of the segment between Cutuco and the Sagrisa fertilizer plant at Kilometer 4 should be retained. This should be established as a separate division and offered for sale to private interests.

In all scenarios, there will be continuing need for government financial assistance for at least the next ten years. Due to low traffic volumes, revenues will not cover all operating expenses. Traffic growth, motivated by economic growth, will ultimately permit the rail system to generate positive operating margins.

140

FENADESAL should sell the Port of Cutuco to CEPA, so that all port activities are in the same organization. FENADESAL should use the proceeds for investments including rehabilitation projects which are urgently required.

FENADESAL should also consider privatizing the existing workshops at both San Salvador and Sonsonate. This could take the form of new commercial enterprises with FENADESAL and private sector firms having the ownership interest. FENADESAL would contract with the new enterprises for equipment maintenance services. This would make the private sector expertise and financial resources available to FENADESAL for modernizing and improving the operation of the workshops.

As privatization of the railroad is not presently feasible, it is recommended that ownership remain with the Government. It should logically be a part of the Ministry of Public Works with the Manager of FENADESAL reporting to the Vice Minister of Transport or the Minister of Public Works. If the railroad is to operate successfully on a commercial basis, it must have the freedom to operate in a commercial manner and to quickly respond to changes in the transport market. It should be reorganized as an autonomous commercial enterprise in the same fashion as used for private firms but with the ownership interest remaining with the Government. A Board of Directors, appointed by the Minister of Public Works, should be created with full power to manage the enterprise and with accountability for their actions. All present rail properties, including those not needed for current operations, should be transferred to the new enterprise.

The new enterprise must have full control over all properties including the right to sell surplus land and buildings, and to acquire properties needed for new construction. As presently surplus land and buildings are a potential source of funding for the initial stages of the rehabilitation program, the enterprise must have the right to dispose of these assets for cash and to receive the full proceeds. The present policy of allowing other Government departments to claim surplus properties before they are sold, without paying compensation, must be discontinued.

There is a need for additional studies of some aspects of continued rail service. The evaluation of routing District 2 traffic via Apopa or Santa Ana has been based on limited information. The economics of these two routes are sufficiently similar in costs and benefits to indicate the need for a detailed study which is beyond the scope of this evaluation. This analysis should be prepared before a decision is made to proceed with one route or the other.

Continued freight service is expected to have a major positive impact on the level of highway congestion beginning in about 2010. These benefits are sufficiently large to indicate that new rail passenger service in the San Salvador-Santa Ana Corridor may also result in benefits. The desirability of initiating rail passenger service in this corridor, including a possible extension to the Guatemalan border, should be studied in detail.

141

There is currently a major movement of containers between El Salvador and the Caribbean ports in Guatemala. This volume is expected to increase in future years. This may make restoration of through rail service to Guatemala feasible although substantial capital investment would be required. This area should also be studied in detail once the present uncertainty regarding the future of the Guatemalan rail system is resolved.

There may also be a need for technical assistance to FENADESAL in reorganizing as a commercial enterprise. This will require development of marketing and planning skills which FENADESAL staff have not previously required. Operating as a commercial company in a competitive market will represent a completely new environment for railroad management. As these skills have not been previously required, extensive training and assistance will be required to make a successful transition to commercial operations.

ANNEX 1

INSPECTION REPORT OF SECTION

SAN SALVADOR - ACAJUTLA

On 12 November, 1994, an inspection was made of Fenadesal's District 3 between San Salvador and Acajutla. The inspection was made by motor car with the Sub Chief, Way and Structures Department. Its purpose was to ascertain existing conditions of the permanent way and to identify repair and rehabilitation requirements for continuing operation.

For the first nine kilometers leaving San Salvador, the encroachment problem is especially severe. Buildings have been constructed within the right of way to the extent that only the minimum clearance required for the passage of trains remains. Although the right of way is 100 feet in width, there remains no more than 20 feet useable for railroad purposes. Where the track has been located on a fill, buildings have been built at natural ground level including removal of the embankment. There is no room left for adequate drainage, nor for access for many routine track maintenance functions. In some areas, drainage ditches have been constructed by the residents to channelize the water flow. Although some of these encroachments are obviously new, many have existed for many years. There has been no effort to control these incursions into the right of way.

There are also encroachments in virtually every urban area through which the railroad passes. These are not as severe as those within San Salvador. There are a limited number of rural encroachments. Many of these have been made with the permission of Fenadesal where the property is used for agricultural purposes and does not adversely affect railroad operations. In most such cases, there are fences along the right of way property line and along the edges of the encroachments.

Within urban areas, these encroachments have created severe grade crossing visibility problems. Some buildings appear to have been built in such a way that they encroach on both the railroad and highway rights of way.

In general, the surface and alignment on this line is satisfactory. Rail is a mixture of 60 and 70 pound per yard, all of which appears in generally good condition. Between Sonsonate and Acajutla, there are several areas in which the rail is starting to become surface bent. While this rail is still useable, a failure to restore good sleeper condition and add ballast will shortly result in destruction of the rail. Numerous joints have pull-aparts where the rail is beginning to show end batter. A failure to correct this condition will also result in destruction of the rail within a few months. Many joints are loose which the Sub Chief, Way and Structures, indicated was due to worn joint bars and bolts. There are areas on heavy grades where the rail has been burned by wheel slips. These may result in broken rails although this has not been reported as a problem.

Sleeper condition varies from good to poor. In the San Salvador area, about 40 percent are bad. Between Sonsonate and Acajutla, about 80 percent are bad. This is reflected in potential problems with the rail becoming surface bent.

There is no ballast over this line. Over much of the route, dirt is used as ballast with the result that the line is quite dirty. Train passage results in clouds of dust being raised. Drainage is also poor. Drainage ditches exist along portions of this route and where they do, they appear to be clean. As there had been no rain for some time, it was not possible to evaluate the adequacy of present drainage.

In the Kilometer 70 area, the railroad passes through an old lava flow. There are a number of curves in this area which apparently resulted from a desire to minimize grading at the time the railroad was built. Some use of this material has been made for ballast. It does not appear suitable for such use. The material is porous and very light in weight. It crushes easily, indicating that it will not provide proper support for the track structure. It degrades quickly into dust and will not provide adequate drainage.

Between Sonsonate and Acajutla, the track is heavily overgrown with weeds. Vegetation is so heavy that the condition of the sleepers can not be ascertained. Track is this area is built at natural ground level without any provision for drainage.

There are several major bridges on this line. All were built to Cooper's E-26 capacity (2,600 lbs per running foot of length). Following a Japanese study in 1966, several were reinforced to approximately E-40. The Milingo River Bridge at Km. 98.22 is a 69 foot pony truss. It appeared to be in generally good condition aside from the sleepers, all of which require replacement.

The Río Tomayate Bridge at Km. 90.81 is a single span deck truss, 136 feet in length. This bridge was reinforced by adding two piers approximately one third of the distance from each abutment. Reinforcements were added to the truss immediately above the piers. Plans for the additional piers show the pier footings resting on bedrock (firm ground) approximately 5 meters below normal ground level. At present, the base of one pier is completely exposed and has been undercut severely by the river. Approximately one-third of the pier now has no support. Although above normal water level at the time of inspection, this pier will be standing in water during the rainy season. This bridge also appears to be in good condition, except for sleepers which require total replacement.

The most serious bridge problem is Bridge No. 21,18 over the Río Ceniza. This bridge was built in 1934 from scrap rail. It was evaluated by the Japanese as having no more than Cooper's E-7 capacity. Reinforcements were added following this study. This bridge is in exceedingly poor condition. Many of the structural members appear to be badly corroded making it's current strength questionable. Fenadesal has prepared plans for a major rebuilding of this structure. Replacement appears to be a vital necessity if this rail line is to be continued in service.

145

There are a total of 11 other bridges on this line, 40 feet or more in length. Detailed inspections of these bridges was not made. All require extensive sleeper replacement. None appear to have excessive corrosion.

There is a large yard and workshop at Sonsonate. This shop maintains the passenger motors. Shop buildings and machinery are old and do not appear to be in good condition. There is also a small yard at Sitio del Niño. There are limited yard facilities at the Port of Acajutla.

At the port, the railroad terminates some distance from the piers. There are several warehouses with open space between them. Railroad tracks are located in these open areas, rather than at the warehouses. It is normally necessary to store cargoes waiting for Customs clearance. The location of present rail facilities is not considered to be a problem. The Port's proposed container storage yard is adjacent to the warehouse area and not far from existing tracks.

The general condition of this line is fairly good although it shows evidence of inadequate maintenance for the last several years. A major problem is presented by the extensive level of encroachments in the San Salvador area. Action must be taken to control these developments if an adequate level of rail service is to be available.

ANNEX 2

INSPECTION REPORT OF SECTION

SAN SALVADOR - LA TOMA

On November 16, 1994, an inspection was made of the rail line between San Salvador and La Toma. This inspection covered the 7 kilometer branch between San Salvador and Soyapango, a part of District 1, and that portion of District 2 between Soyapango (Km. 244.6) and La Toma (Km. 281.9). The primary purpose was to inspect the damaged bridge at Km. 245 and the area between Kilometer 249 and 255 where damage has been experienced from landslides.

Leaving San Salvador yard, there is a crossing with the Boulevard del Filocita National (Pan-American Highway). This crossing is extremely busy and has very restricted sight distances for vehicles approaching the crossing. There is no crossing protection at this, or any other, highway crossings. Flagmen are used when trains cross the highway. The track in this area is on a severe downgrade with sharp curves. Approximately one kilometer after leaving the yard, the track enters an area where encroachments have been built along the railroad, leaving a very limited area for the passage of trains. At approximately Kilometer 6 of the branch, residents have paved the track area with concrete to provide better access to their houses. The track area is used by the residents and several clotheslines had to be removed to permit passage of the motor car. Encroachments continue to Soyapango and are quite severe. In several areas, residents have constructed concrete drainage ditches to divert water away from their houses. These encroachments also are built in such a way that visibility at highway crossings is severely restricted.

Bridge B5.37, the largest bridge on the branch, is a two span deck girder with a total length of 80 feet, over the Río Acelhuate. The bridge appeared to be in good condition. Little corrosion was noted. Sleeper condition was poor, virtually all sleepers requiring replacement.

From the bridge, the track climbs to Soyapango. Many of the encroachments in this area have been built into the side of the embankment. There is poor drainage throughout this area as a result of the encroachments which is resulting in damage to the track structure. There appears to be little possibility of correcting these problems without the removal of the encroachments. The Sub-Chief, Way and Structures, mentioned that theft of sleepers is a problem in this area. Residents will also cut off that portion of the sleeper which is outside the track area, apparently for use as firewood. There is no ballast in this area, the sleepers being laid in dirt. There is also a great amount of household garbage along the right of way.

Sleeper condition is poor on the branch. About sixty percent require replacement. In several areas, concrete and wood sleepers are intermixed. Concrete sleepers have been used to assist in maintaining gauge where few good sleepers exist. There has also been use of locally fabricated gauge bars fabricated from scrap rail. A piece of rail, about six feet long, has had two clips made from steel reinforcing rod welded to the bottom. These fit over the base of the rail in order to prevent gauge widening. They are used primarily

14.8

in curves and appear to be effective.

At Soyapango, District's 1 and 2 join with a wye connection which permits train movement in any direction. There is a small yard which is apparently not used. Immediately adjacent to the junction is a great deal of vacant land which would provide a site for a modern distribution complex including rail to truck transfer. Access could be readily provided to the Pan-American Highway. Also in this area is a former customs facility. This was apparently intended as a clearance point for import cargoes moving in bond by rail. It is no longer used but has facilities for rail-truck transfer. This could also provide a rail-truck transfer and distribution facility.

Bridge 245.37 is a 40 foot deck plate girder span over the original Pan-American Highway. The bridge was struck by an excessive height truck. One end of the span was displaced approximately 8 feet and one of the main girders was bent at about a 15 degree angle. There was also some damage to one of the abutments. The Sub-Chief, Way and Structures indicated that the bridge could be repaired and returned to service within about two weeks. Work had not been started due to landslide problems between Km 249 and 255 which had closed the line. Fenadesal was also waiting for agreement from the truck owner to pay for the repairs. This span appears to have been heavily damaged by the accident. While possibly repairable, the structural strength of the bridge may have been reduced by the damage. There should be an inspection by a bridge engineer to determine the feasibility of repair. Other than the damage caused by the accident, the span appears to be in good condition. Sleepers are poor, requiring full replacement. Sleeper retainers are also required to maintain proper spacing. Few bridges appear to have retainers. Due to track misalignment, motor cars only are permitted to use this span.

At Kilometer 249, there is a major washout apparently caused by the failure of the drainage system. The railroad at this point is on a fill about 1/4 kilometer east of the Río Cañas. There is a small stream which had been routed under the track in a pipe. When built, this pipe apparently discharged at ground level. Erosion of the river bed resulted in the pipe discharging several meters above ground level. A failure of the pipe washed out the embankment. Proper repair of this area will require the construction of a new culvert at a much lower level and the construction of retaining walls to channel the water flow and protect the embankment.

There are a number of encroachments through this area. From Soyapango to Kilometer 249, the problem is severe. Beyond this point, the number of such encroachments declines significantly.

Rail, all sixty pounds per yard, is generally in good condition. Alignment and surface are good. Several joints have pull-aparts with some joint batter becoming evident. Sleeper condition is fair to poor. From 25 to 50 percent of sleepers require replacement. There is no ballast, sleepers being laid in dirt. There are several points where washouts have

undermined the track. Many of these can be traced to encroachments preventing proper drainage.

Beginning at about Kilometer 251, and continuing to Kilometer 254, there is an area where Fenadesal has suffered from landslide problems for several years. The most recent slide occurred in August and resulted in closing of the line between Apopa and Soyapango. Reopening is not expected before January, 1995. The problem is twofold, slides which undermine the track and which result from the Río Cañas undermining the embankment, and slides coming down from the area west of the tracks. Throughout this area the railroad was built on a ledge cut into the side of the gorge formed by the river. At the time of construction, the track was four meters above the normal river level. It is now twenty-seven meters above.

The bank along the west side of the railroad appears to be a very unstable form of rock, probably of volcanic origin. The railroad is now cutting back the hillside to reduce the angle of slope. Given the nature of the rock, this will require a very gentle slope, probably about 2:1. With the distance involved, there is a substantial amount of rock which must be removed. The debris is being pushed across the track and added to the embankment on the river side.

The river side problem is being compounded by the removal of sand from the river bed for construction purposes. This is being removed in an indiscriminate manner, in some cases from the railroad embankment itself. This is also deepening the channel in this area. On the day of the inspection, there were about twenty trucks so engaged.

The railroad has tried for years to control this problem. Past actions have included attempts to stabilize the bank with driven rails and old wagon and coach frames. These have not worked, the bank now being several feet behind where the barriers are located. They are now creating new retaining walls of driven rails and old tires.

There is no obvious solution to this problem, other than relocating the railroad. Conventional retaining walls will have to be built on unstable ground and will likely wash out quickly. If the railroad remains in this location, it appears the only feasible approach is to add large rock to the embankment on an annual basis. This portion of the rail route must be recognized as a high maintenance cost area. As this line is unusable at the present time, it was traversed by walking and a second motor car used for inspecting the line to the north.

Between the landslide area and Apopa, the track is fair to good condition. Alignment and surface are adequate for the normal service (it is out of service). Sleeper condition is poor with fifty percent or more requiring replacement. There is no ballast and the track area is overgrown with vegetation. There are several bridges in this area. All require full replacement of sleepers. All also require retainers or spacers to maintain proper spacing

of sleepers. Spacing is currently very erratic.

Apopa, which has a small yard, is currently being used as a rail-truck transfer point for cement. Wagons are moved from Metapàn to Apopa, where the lading is transferred by hand. A truck is parked next to the wagon where roadway space is available, permitting transloading. The facility shows an ingenious use of available property to solve the problem of transfer. Apopa is also the primary repair point for rolling stock in use on this line. Mechanical staff travel from San Salvador with a heavy duty pick-up truck carrying tools and repair parts. Operations are being conducted with the equipment that was on the line at the time the landslide occurred. At the time of the visit, the yard was completely full of wagons. A large amount of switching was required in order to open a track for passage of the motor car. Two trains were being held on the main-line north of Apopa due to lack of space in the yard. Although the yard was congested, this reflects its use as a major intermodal terminal for which it was not designed and the demand for which is temporary.

All of the line to La Toma is laid with sixty pound per yard rail. The rail is in good condition with little wear. General alignment and surface of the track was good. There is no evidence of the rail becoming surface bent. There were several joints which were poorly aligned, many with pull-aparts and loose joint bars. The Sub-Chief, Way and Structures. emphasized that this was due to badly worn bolts and that corrections could not be made without new bolts. This statement seems reasonable. Many joints were missing one or more bolts, where they had broken and fallen out. This is a problem which appears to be prevalent over the entire rail system.

Sleeper condition is poor throughout this line. From forty to seventy-five percent of the sleepers require replacement. In several areas, the number of truly good sleepers is so limited, it is questionable that the gauge can be maintained. A major sleeper replacement program is required as quickly as possible.

All right of way was overgrown with vegetation, except where track had clearly been worked on very recently. There were some areas where efforts appear to have been made to surface and align the track surface. As a part of this effort, vegetation was cleared from the track area. There is no ballast except in the immediate vicinity of San Francisco. In this area, escoria volcanica was applied to the track some years ago. However, it was simply laid on the top of the track structure, and as such, performs no function. There was no apparent effort to work it into the track structure. The original dirt around the sleepers remains with resultant drainage problems.

There were no evident drainage problems. However, there had been no rain for some time prior to the visit. Where drainage ditches exist, they appeared to be clean and functioning. In most areas, the track structure is at normal ground level. In order to facilitate drainage, raising the track a few inches above normal ground level is necessary.

There are three major bridges on this line. All require a virtual 100 percent replacement of sleepers. Although retainers were apparently installed at some point in the past, virtually all have disappeared. Most of these were made of wood. With the lack of retainers, the spacing of sleepers is erratic. With the poor condition of most bridge sleepers, proper spacing is essential to provide rail support and to maintain gauge. As the stringers on all bridges are located outside the rail (spacing center to center is 5 feet), good sleeper condition is improved. Replacement of bridge sleepers must be addressed as a priority repair.

Bridge 290.30 just south of La Toma is a 100 foot through truss. The bridge appeared to have been recently painted and in good condition, other than sleepers. No corrosion was noted.

Grade crossings on this line are typically dirt. Guard rails have been placed adjacent to the running rails, and in some cases, in the center of the crossing to retain the dirt surface in place. Crossings were in reasonable condition for this type of construction.

If this line is to be retained in service, extensive rehabilitation is required. This program should concentrate on immediate replacement of bridge sleepers and retainers, and worn switch points and frogs. An extensive program of replacing joint bars and bolts is also necessary. Replacement is the only way joints can be properly tightened. Extensive sleeper replacement and ballasting is also necessary.

ANNEX 3

INSPECTION REPORT OF SECTION

METAPAN - SAN FRANCISCO

On 16 November, 1994 an inspection was made of the rail line between the cement plants at Metapán and San Francisco, District 2. The two cement plants, located at Güijat and El Ronco, were visited and transport problems discussed with plant staff.

The two cement plants are operated by different companies but are owned by the same firm. In effect, they operate as divisions of the same company and not as true competitors. Both are similar in their loading and distribution practices. Stone is obtained from hillsides immediately behind the plants. Both work the same deposit which is expected to last for many more years. The one plant was initially located at Acajutla but was moved when that stone deposit was exhausted.

Both plants were visited and shipments discussed with plant personnel. Both are arranged in a similar manner. The CEESA plant at El Ronco has five bagging machines which are fed directly from the storage silos. The baggers are located on the second floor level above the loading area. Three of these machines feed conveyors to the truck loading docks, of which there are four. Trucks pull under the bagging area and are fed by individual conveyors which deliver the bags to the truck floor. Actual stacking is performed by men on the truck. Bag counts are made by a mill employee at the loading area. For the handling of individual bags, this is an extremely efficient system. There are three bulk truck loading spouts which feed directly from the silos in an area adjacent to the bag loading area.

The fourth loader feeds directly to the rail loading area. Bags are dropped down a chute which feeds a telescoping roller conveyor reaching into the wagon. Bags are taken from the end of the conveyor and stacked in the wagon by hand. There are two parallel loading tracks and the conveyor can be extended to reach into the second wagon, making it possible to load two wagons with a single positioning of the conveyor. The second track is not normally used. Once a wagon is loaded, it must be moved and another wagon placed. There is space for four wagons between the conveyor and the end of the track. Once these four wagons are loaded, another group must be brought from the storage tracks. The mill generally uses a front end loader for pushing wagons around the loading area. This action frequently damages the wagons, as is evidenced by the number with bent end frame members where the loader contacts the wagon. Total wagon storage at the mill is approximately 50 wagons. There is a rail/truck bulk loader for rail wagons on the outside loading track adjacent to the bag loading area. This has never been used for rail loading as Fenadesal has no bulk handling equipment.

There is a narrow dock along the track. While this provides access to wagons, it is not used for actual loading. All loading is through the conveyor system, one or two wagons at a time.

The transportation manager was asked for information on shipments including destination and planned increases in volume. He indicated that he did not have this information

available but would obtain it and send it to the project office. He also indicated that 200 bags of 97.5 lbs each are considered a truck load. This would be about 20,000 lbs. However, many articulated tandem axle trucks were observed loaded four bags wide by 25 bags long by six high with a few extra bags on top. This would represent a load of 57,000 lbs, pushing highway weight limits.

The second cement plant at Güijat was also visited. This plant produces portland cement only, and ships only in bags. There is no bulk. The plant has two truck loading spots and one for rail. Movement from the bagging machines to the rail loading spot is similar to that at CEESA. The tail track holds three wagons plus the one being loaded, after which a new placement of wagons must be made. A front end loader is also used here for moving wagons within the plant. Plant track capacity for wagons appears to be about forty.

The manager indicated that plant capacity is 22,000 bags per day and the plant is presently operating at capacity. Shipments are made to independent distributors who are located throughout the country. Several customers are in the Metapán vicinity. They do not have their own distribution centers. The customer determines whether shipments are made by rail or truck. At present, 24 percent of shipments are by rail. Normal distribution is 5,000 bags by rail, 17,000 by truck. Rail rates are considered very competitive with truck. A complaint was registered regarding the lack of empty wagons. He indicated that rail shipments could be increased substantially if they could obtain sufficient empty wagons. Transit time is not good on the railroad. The plant's average sales are 5,000 bags per day. Some of these statements appear questionable given the size of plant facilities.

Following the plant visit, a inspection was made of the rail line between Güijat (Km.384.9) and San Francisco (Km.354.6). This portion of the rail system is laid with 60 pound per yard rail. It is generally in good condition with little wear. Some joints had pull-aparts with joint batter just starting. Several joints were loose. Problems with worn joint bars and bolts were evident. There were a number of missing bolts in rail joints. Surface and alignment were generally satisfactory for the present scope of operations.

Sleeper condition is poor. Replacement requirements range from 25 to 60 percent. Many sleepers have completely disappeared. A portion of this line has been ballasted with escoria volcanica. This was apparently laid directly on top of the track with no effort to work the material in around and under the sleepers. Being laid on top of the track, this ballast performs no function whatever. This material does not appear suitable for use as ballast, being too light and porous. It appears to degrade quickly as well.

Much of the track was heavily overgrown with vegetation. In some areas, vegetation is reaching the point of interfering with train operations.

There are no major bridges on this line segment. The short beam type bridges require a major replacement of sleepers as quickly as possible. There was no evidence of serious corrosion.

ANNEX 4

INSPECTION REPORT OF SECTION

ZACATECOLUCA - USULUTAN

On December 1, 1994, an inspection was made of Fenadesal's District 1 between Zacatecoluca (Km. 157.0) and Usulutan (Km. 99.2). Zacatecoluca is on a two kilometer branch off of the main-line. It was the original terminal for the rail line from Cutuco. When the extension to San Salvador was constructed, the new line left the existing main-line at Km. 155.6, leaving Zacatecoluca on the branch. Little or no traffic uses this branch. There are a number of side tracks to industries which are no longer operating, and which appear in such poor condition that future operation is doubtful.

Over the entire route inspected, alignment and surface was poor. The alignment is adequate for 15 to 20 kph operation but no more. Sleeper condition is also poor with approximately 75 percent of sleepers requiring replacement. There has been some apparent effort to replace sleepers in a few areas but the general condition appears just marginally adequate for continued operation.

Rail in the area inspected is all sixty pound per yard and appears to be in fair condition with little wear. As yet, there is no evidence of surface bending although this may be expected in the near future unless action is taken to replace sleepers and provide an adequate foundation. Numerous switch points are worn to the point that they are dangerous. Some effort has been made to reinforce the points with plates and to add point protectors to the approach rails. In most switches, the main-line point is worn while that for the siding is in good condition. Frogs are also worn in the direction of predominate use. There are several closed (spring) frogs which appear to be in generally good condition. Most sidings appear unused and many are now unusable due to a lack of sleepers. With the present limited traffic, most of these sidings appear unnecessary. Switches should be removed and replaced with plain rails in order to avoid the possibility of derailments on worn points and frogs. This would make points available for replacement in other areas.

There is no ballast and the track is overgrown with vegetation in most areas. There are areas where trees and brush are overhanging the track, such that operations may be adversely affected in the near future. The Sub Chief, Way and Structures Department, indicated that no funds are available for this work. He would like to contract with local individuals for this work but has no funding with which to pay them. In one instance, a local farmer was removing and burning vegetation from the right of way in order to protect his fields from weeds. This action was benefiting the railway. There were very few encroachments on this line segment. Most were of an agricultural nature where the property had been leased to an adjacent land owner for farming purposes.

This route has one major bridge (the largest on Fenadesal) over the Río Lempe. This bridge consists of 518 feet of steel trestle, three deck plate girder spans (2 of 50 feet, one of 61 feet), and five truss spans (four of 200 feet, one of 400 feet). This bridge was modified during the Armed Conflict to permit use by highway traffic when the paralleling Golden Bridge was destroyed. This bridge was also damaged. Wooden parts (sleepers,

walkways, etc.) show evidence of fire damage. The bridge appeared to be in good condition and was recently painted. Sleepers are in poor condition, with total replacement being necessary.

All bridges on this segment require total replacement of the sleepers. Most are in poor condition, showing the results of bomb damage during the Armed Conflict. Bridges 150.00 and 152.09, both 100 foot trusses, have significant corrosion on the bottom chords, floor beams and stringers.

Bridge 143.27, a 61 foot plate girder, was severely damaged by bombs. Due to the loss of floor beams, the stringers on one end of the span are supported by timber cribbing. Other bridges have been repaired with rails or by welding reinforcement plates over damaged areas. Most bridges show some evidence of corrosion damage. If this line is to be continued in service, a major bridge program, including replacement of several spans will be necessary. If this line were to be abandoned, several of the spans may be useable in other areas.

In the vicinity of Km. 105, the railway has major drainage problems. According to the Sub Chief, this area is an illustration of what is becoming a common problem. Waterways tend to fill with silt, diverting rainy season flows to new channels. Fenadesal has attempted to clean old natural channels in order to keep the water flowing under existing bridges. However, these fill quickly, resulting in water striking the embankment at other points, causing major washouts. What may be required in this area is a series of culverts or permanent retaining walls along stream channels. Continued cleaning of channels and culverts will be required in order to avoid washouts. This area, and possibly others, will require continuing high maintenance levels. These costs must be incurred if operation is to be continued.

If operations are to be continued, this line segment will require major rehabilitation of the way, including bridge replacement in many instances. Certain parts of this route will require higher than normal levels of maintenance and will incur relatively high annual maintenance costs.

156

ANNEX 5

INSPECTION REPORT OF SECTIONS

SITIO DEL NIÑO - SANTA ANA,

SANTA ANA - TEXIS JUNCTION

On February 9, 1995, an inspection was made of Fenadesal's route between Sitio del Niño and Santa Ana. This entire line has recently been relaid with 60 pound per yard rail removed from the abandoned line between Santa Ana and Ahuachapan. Replacement was funded by USAID. Rail condition was generally good with proper alignment, especially on curves. Surface is also generally good. The 54 lb rail recently removed from this line is stored at El Congo and Santa Ana. It is in good condition, showing little wear, but is too light for modern operations. The Sub-Chief, Way and Structures Department, advised that this rail was intended for use as replacements in sidings.

Sleeper condition was poor. In general, approximately fifty percent of the sleepers in track require replacement. This line has steep grades (maximum 3 percent for 6.2 kilometers) and has many sharp curves ranging to 100 meters radius (16 degrees). With the extent of grades and curves, maintaining good sleeper condition is critical to maintaining proper track gauge. There is no evidence of ballast which adds to the problems of maintaining proper gauge, alignment and surface. Track was generally free of weeds reflecting work performed recently in connection with the rail replacement.

There is only one bridge, over the Río Sucio immediately north of Sitio del Niño. This bridge is weight restricted and replacement or reinforcement has been planned for a number of years but not carried out. It is a two span Warren pony truss with a total length of 68 meters, rated at Cooper's E-27. No serious corrosion problems were noted.

At La Joya (Ciudad Arco), there is a severe encroachment problem extending through the town. The track is being used as a street serving a great many vendor's stands which are located on railroad property. Difficulty was encountered in operating the motor car through this area due to the number of people using the railroad track for access. There are few other encroachments on this line.

Station facilities at Santa Ana were inspected. The only traffic handled here is coffee. FENADESAL ttransports coffee only in closed wagons, although most coffee is now moving in containers. During the coffee shipping season, trains may be operated on a daily basis. At other times, there is no operation. There is a very substantial yard with most tracks in poor condition, turntable, and small shop. There was a large quantity of new sleepers at Santa Ana.

In the vicinity of Kilometer 19, a new stone deposit is being developed for the cement plants at Metapán. Stone is presently being trucked to the plants. From the size of the area being worked, it appears that this is a very large deposit. There was a great deal of activity visible around the quarry area, indicating that shipments may have reached considerable proportions. The quarry is located about 1 kilometer east of the railroad and at a much lower level. The topography indicates that providing rail access will be difficult. However, it should be feasible to install a conveyor to a loading track on the existing rail line. The cement companies currently receive stone by conveyor from the deposits

101

adjacent to the plant and should be familiar with the operation and maintenance of such equipment.

Starting in the vicinity of Kilometer 15 and continuing almost to Santa Ana are frequent outcroppings of rock which appears to be granite and may be suitable for ballast. This area was identified in the 1966 Japanese study as a potential ballast source. The feasibility of using this rock for ballast should be investigated.

The former IRCA line from Santa Ana (Santa Lucía) to Texis Junction is out of service due to poor track conditions. Rail is in good condition but sleepers are poor and many spikes are missing. Station facilities were inspected. There are very extensive facilities at this point although most tracks have been removed. The freight house is leased to coffee producers who transload from small trucks to containers for movement beyond. A portion of the former passenger station is leased to El Salvador Customs for clearance of both import and export movements. Fenadesal also rents parking space to trucks (principally containers on chassis). There is apparently a significant amount of income generated from this source. The majority of these containers are moving to or from Guatemalan ports with some destined to Acajutla. None are handled by rail.

A limited inspection was made of the Santa Ana - Texis Junction line. Much of this line is not accessible by highway. Rail, all 60 lb, appears to be in good condition. Sleeper condition is very bad and is the reason this line has been taken out of service. Restoration of service would require only a major sleeper replacement program. It was reported by the Sub-Chief, Way and Structures, that there are no problems with bridges, tunnels or embankments. Other than the sleeper problem, this route appears to be in better condition than lines which are still in operation.

There were a limited number of encroachments noted. These generally consist of local property owners running fences across the track in order to add the right of way to their adjacent lands. This is most evident in areas where farm houses are separated from the highway by the railroad. These will be easy to remove, should operation be restored.

Restoration of operations on the Santa Ana - Texis Junction segment does not appear to present major problems.

102

ANNEX 6

INSPECTION REPORT OF SECTION

LA TOMA - TEXIS JUNCTION

On February 23, 1995, an inspection was made of District 2 between La Toma and Texis Junction in order to determine existing conditions of the track and other fixed facilities. The primary purpose of this inspection was to evaluate possible ballast sources along the Rio Lempa between Kilometers 310 and 328. It was the opinion of Fenadesal engineering staff that the stone which has been deposited by the river in this area is suitable for railroad ballast.

The river in this area has a number of broad bends, in which substantial quantities of gravel and rock have been deposited. Recovery would be relatively easy. However, this is normal river gravel composed of a variety of rocks ranging in size from extremely small to approximately 8 inches in diameter. Types of rocks are mixed varieties with a broad range of hardness. The gravel is mixed with mud. Having been deposited by the river, all rocks are relatively smooth on the outside. With the mixture of rocks and the need for cleaning to remove the mud, this material does not appear suitable for ballast use.

Several cuts between Km 310 and 312 have been made through rock which appears to be andesite or granite. Several moderate size stones were fractured by hammering and broke with jagged edges. This material appears to be quite suitable for ballast and is apparently available in quantity in this area. Most of the railroad cuts are quite narrow and should be widened as a part of line rehabilitation and improvement. It should be easy to develop a quarry immediately adjacent to the rail line. Assuming that this route is retained as a part of the rationalized rail system, the extent of these deposits should be determined. Assuming that sufficient material is available, action should be taken to determine the suitability of this rock for ballast and to establish a quarry.

The area between Km 310 and 318 is a landslide area where service has been frequently disrupted by slides. One slide was inspected at Km. 312 where relocation of the track away from the hillside has been required in order to maintain service. The rock in this area also appears suitable for ballast. While not granite or andesite (it is white in color), it is quite hard and also breaks with jagged edges. There appears to be a substantial quantity of this stone in the immediate area. This area should also be explored for suitable ballast.

The track inspection started at the La Toma station and proceeded north. Within the town of La Toma, north of the station, there are a substantial number of encroachments on the east side of the right of way. While not as severe as in some other areas, they have reduced the effective right of way width below that required for proper drainage. Interestingly, there are no encroachments on the west side of the right of way in this area. Over the remainder of the line, there are limited encroachments, usually one or two buildings, in most of the villages. There are some instances where portions of the right of way have been leased by Fenadesal for agricultural purposes. These do not create a maintenance problem.

The entire line is laid with 60 lb per yard rail dating from 1926. Most of the rail is in good

condition, showing very little wear. Approximately 20 percent is badly surface bent and must be considered scrap. This is located immediately north of La Toma. Virtually all rail joints contained pull-aparts with rail beginning to show joint batter. Many joints have short pieces of rail spliced within the joint. The Sub-chief, Way and Structures, stated that 30 foot rails had been used during the Armed Conflict when 33 foot rails were not available. It was necessary to add short rail pieces to maintain the original joint spacing. These should be removed as a part of rehabilitation.

Track alignment and surface was satisfactory over the entire line, except in those areas where the rail has been surface bent. This line has some of the best alignment and surface conditions of any inspected.

Inspection at one 14 degree curve indicated that the installed superelevation reached 4 inches in the outer rail. This should be far too much for speeds being currently operated. Yet neither rail showed any indication of curve wear, indicating that flanges are not bearing excessively against the rail.

Sleeper condition ranges from poor to fair. Sleepers were being replaced at several points along the line. The quantity requiring replacement ranges from 30 to 70 percent with an average of about 50 percent.

Bridge 298.53 is a three span deck truss built in about 1985 to replace a steel arch bridge which had been destroyed. Due to a shortage of proper steel beams, many of the structural members consist of three plates welded together on top of each other to provide a plate of proper size. This bridge has also been damaged by bombing and has been repaired through the use of steel angles and old rails. The bridge appeared to be in generally good condition despite the damage. Approximately 10 percent of the sleepers are in bad condition.

Bridge 302.50 is a single span truss which has also received some bomb damage. Although needing paint, there was no evidence of corrosion and the span appears to be in good condition. Approximately 25 percent of the sleepers require replacement. The sleeper retainers were fabricated from old 38 lb rail in which the base has been notched to hold the sleepers in position. This is not working as sleeper spacing is extremely erratic with the retainer being well above the sleepers.

At Km. 318, five I-Beams had been placed under the track in an effort to control a washout area. A pipe has now been installed under the track and restoration of the fill is under way. Fenadesal plans to remove the beams and use them as a part of upgrading the Rio Cenizas Bridge at Km. 21 of District 3.

The only ballast on this line consists of volcanic escoria which has been applied in a few areas. This material was applied to the top of track structure and does not appear to

perform any function. Much of the track is weed grown although there has been an obvious effort to remove weeds in some areas. The embankment is in generally good condition. One area at Km. 304 was noted where a washout has undermined the track structure.

One area at Km. 314 showed evidence of very poor drainage. There was standing water around several sleepers. As there had been no rain for several months, this would indicate that there is both a source cf ground water and poor drainage in this area.

Crossing signals are being installed at Highway A-12, Kilometer where a collision with a bus recently occurred. These are generally ignored by vehicle drivers. The inspection ended at this point and the inspection party returned to San Salvador by automobile.

ANNEX 7

INSPECTION REPORT OF SECTION

SAN MIGUEL - CUTUCO

AND CUTUCO PORT

On February 9, 1995, an inspection trip was made over the rail line between San Miguel and Cutuco, District 1, as well as an inspection of port facilities. Travel over the rail line was via motor-car. The Sertesa Fertilizer Plant at Km. 4 in the vicinity of Cutuco was also visited.

Bridge 55.56 over the Rio Grande at San Miguel is a riveted through truss bridge, 100 feet in length. This bridge was extensively damaged during the Armed Conflict which resulted in one portal being literally blown off the span and one end falling into the river. Portions of the span were dismantalled and repaired in the San Salvador workshop. The primary repair was made by welding additional steel plates over the existing plates. This repair seems to be working but must be regarded as temporary. This span still shows other evidence of damage in bent structural members. There is extensive corrosion in several parts of the span which are sufficiently severe to result in loss of strength. Replacement of this span should be planned as soon as possible. Sleeper condition is also poor, total replacement being necessary in the immediate future.

Other bridges on this line segment consist of nine deck-plate girders ranging from 22 to 50 feet in length, four 61 foot through plate girders, and eleven I-Beam spans of 9 feet, 8 inches to 25 feet in length. Virtually all of these spans have some corrosion although it has not yet reached serious proportions. All of these bridges require immediate replacement of all sleepers, as well as painting. Some spans show evidence of bomb damage but not to the extent noted on other sections of the railroad.

General track conditions are terrible. Deteriorating track conditions are responsible for the very frequent incidence of derailments. Much of the rail is badly surface bent and must be considered as scrap. Approximately two kilometers are laid with 54 pound per yard rail, all of which is scrap. About 25 kilometers are 60 pound rail, about 90 percent of which is scrap. The remaining 26 kilometers are laid with 70 pound rail, about 40 percent of which is scrap. In these instances, the rail has literally been destroyed by a failure to maintain sleepers and ballast. The rail is not badly worn but is severely surface bent to the extent that proper line and surface, even for speeds as low as 16 kph can not be restored.

Sleeper condition is extremely poor. Approximately ninety percent of sleepers require replacement, with the only new sleepers in evidence being those installed at derailment sites. These locations are frequent, often less than a kilometer apart. There is no ballast in evidence over any of this route.

Track conditions are so bad on this route that we recommend Fenadesal consider an immediate closure between San Miguel and Cutuco. If this line is to be continued in operation, it will require a complete rebuilding of the existing track structure.

The foregoing discussion does not apply to the four kilometers between the Port and the Sertesa plant. Rail in this area, 70 pound, is generally in good condition. There are no

bridges in this area. The track is covered with dirt which precluded determining the condition of most of the sleepers. It is assumed that their condition is similar to that on the remainder of the line, although line and surface is much better. Some attention must be paid to the sleepers if this segment is retained for operation. Rehabilitation needs for this segment should be less than average, however.

The Sertesa plant was visited and rail unloading facilities inspected. Fertilizer is received in bulk in four to eight wagon consignments. Wagons are unloaded by having a man shovel the contents into a pit adjacent to the tracks, from which the material is conveyed to the storage bins. There is space beyond the pit for four wagons and for several more on the tracks approaching the unloading point. There are also additional tracks in the plant which can be used for wagon storage. Normal practice is for a locomotive to stand-by while wagons are unloaded, and to then return them to the port. (train sheets indicate that some of this traffic is being handled by trains operating to San Miguel). With minor roadway construction, the unloading facilities appear readily convertible to truck delivery. Trucks would dump into the existing pit.

There is a second plant in Cutuco which is immediately adjacent to the pier. Fertilizer is also transported by rail to this plant where handling is similar to that at Kilometer 4. This plant was not visited. Approximately one-half of the fertilizer received at Cutuco goes to each plant. Individual vessels are consigned to one plant. Individual cargoes are not split between the two plants.

The Port of Cutuco consists of a single pier, built in 1914 and extended in 1963. The pier is restricted to rail loading only although Fenadesal staff indicated that the pier can and does handle trucks on occasion. Vessels are normally unloaded only at the bay side although berths exist on the other. Petroleum is discharged into a pipe (one connection only) which feeds to shoreside tanks. Fertilizer is discharged using ship s gear with a planned unloading rate of 550 to 600 tons per day. Normal unloading practice is for the railroad to spot up to 15 wagons on the two tracks on the pier. The vessel loads eight which are then removed and sent to Sertesa. The vessel continues to discharge into the remaining wagons. The locomotive returns with the original eight which have been unloaded and repeats the operation until the full cargo is unloaded. Fenadesal has 15 gondolas which are assigned to this movement.

The pier is reported to be in poor condition, needing extensive repairs. Fenadesal has had plans completed since the 1970's for repairs which have not been carried out due to lack of funds. A detailed inspection was not carried out from underneath the pier although the opportunity was offered by port staff. These comments are based upon inspection from deck level. Visible pilings show substantial erosion of the concrete at the water line. These pilings consist of an "H" Beam encased in concrete. Reinforcing rods, in both vertical and horizontal directions, surround the H Beam, and are encased in the concrete. These rods have been exposed by the erosion of the concrete and are highly corroded in

114

the water line area. The deck appears to be in generally good condition. Little or no spalling of the concrete was noted. The only patches evident were those resulting from the installation of electrical equipment several years ago. Photographs of the pier structure and plans for repairs were examined. There are a number of broken support beams and some of the central pilings are in very poor condition. Fenadesal has emphasized the need to repair the pier and has developed several plans at different times. Each plan has identified additional work required beyond that proposed the previous time. These plans, prepared over about a fifteen year period, show clearly that the pier is rapidly deteriorating and major repairs will be required shortly if the pier is to be kept in operation. Based on these inspections and plans, it appears a complete rebuilding of the pier is required and no investment will be worthwhile without it.

Although Fenadesal reports that trucks are permitted to use the pier, this appears difficult due to the construction of the approach trestle. The track is in a ballasted section raised about one foot above the normal deck level with concrete curbs to retain the ballast. There are walkways on either side of the track area. The track area would have to be removed and the deck resurfaced in order to provide for efficient truck operation.

It appears feasible to install a conveyor system on the pier, assuming the pier's condition is adequate to justify the investment. This system would deliver fertilizer directly to the plant adjacent to the pier. Truck delivery could be made from this plant to the other plant, eliminating any need for rail service. This would also avoid any need to modify the pier for truck access.

There are a limited number of encroachments along this line. There are some in both the San Miguel and Cutuco areas. These are not as numerous as those in other areas. There will have to be some action to correct this problem if rail service is to be retained.

On the return trip via automobile, a stop was made at El Tránsito where channelization work is in progress to relocate water flows into a formerly dry channel. This work requires the replacement of the existing bridge with a much longer span. This work is being carried out by ANCA, with a bridge span salvaged from the abandoned Ahuachapan Branch being used for the replacement. Work is expected to be completed before the start of the next rainy season.

As noted above, the extremely poor condition of the track between San Miguel and Cutuco requires some action to either repair the line or close it down. This line is in such poor condition and derailments so frequent that immediate closing must be recommended. Without major rehabilitation, efficient operations have become virtually impossible.

ANNEX 8

REPORT ON SPECIAL CONDITIONS IN THE RAILWAY:

BRIDGES AND LANDSLIDES

REPORT ON SPECIAL CONDITIONS IN THE RAILWAY: BRIDGES AND LANDSLIDES

On February 2, 1995 an inspection was carried out of the sector Soyapango-La Toma, District 3, of the railway. The inspection was concentrated on the bridges and landslides that have occurred in this sector. Following the results of the inspections and recommendations.

Bridge at Km. 245

This 40 ft. steel girder bridge was hit by a truck with excessive cargo height. As a result it was displaced several feet and the girders were badly bent. At the time of the inspection, the bridge has already been repositioned and the beams straightened, making cuts in the lower flange of the girders, and, after straightening, reinforcing the cut flanges with additional plates. This procedure seems adequate. Still remains for some stiffeners to be straighten. It was noted that the girders do not have sliding bearing plates. In old bridges this is a common occurrence.

The bridge seems to be again in good condition. it is recommended to complete the straightening of the stiffeners.

Embankment Erosion at Km. 245

In this zone there is a large erosion of the railroad platform, which is located about 30 mt. above the river bed that runs parallel to the railroad line. This erosion is due to two broken drainage pipes located about 5 meters below the railroad line. One pipe comes from a nearby slaughter house the other one is a railroad culvert. Both pipes are about 48"in diameter. The outlets of these pipes have been washed out and the landslide produced is very large. FENADESAL has displaced the railroad line from the edge of the landslide and is trying to redirect the pipes properly. Down stream, the river has a wide and meandering course.

The only permanent solution will be to redirect the two pipes all the way down to the river bed. Then, rebuilt the embankment to the railroad platform level, by means of compacted layers, and stabilize the embankment with vegetation. Also, the river itself requires some small training works to avoid hitting the railroad embankment. This is a costly solution, but absolutely necessary if the railroad will continue operating in this sector.

It is an ecological crime that the pipe coming from the slaughter house be discharged directly to the river, without any treatment.

Landslides at Km. 249

172

These landslides, which destroy the grade and tracks, about 300 meters long, and over 30 meters high, are caused in part by a broken culvert under the railroad (its original outlet has been washed out and it is now hanging up about 30 meters above the river bed). The nature of the soils in this area is extremely soft. Other cause for these landslides is that the river, which runs parallel to the railroad, is undercutting the west bank underneath the railroad. The problem is compounded because, across the river in front of this area, there is another large waterway that in the rainy season has a considerable flow which also hits the west bank and further undercuts this bank. Besides, this area is utilized by the construction industry as a sand quarry. At the time of the visit, a large number of trucks were there extracting sand in an indiscriminate way and detrimental to the river channel.

FENADESAL is relocating the line to the west by means of a large horizontal hillside cut. To protect the river bank, they are also building at the river channel a barrier between the river and the bank made up of driven old rails and used tires.

Permanent protection works to rehabilitate this landslide section of the railroad would be a very expensive proposition. It would require to provide retaining walls of reinforced concrete or large stone rip-rap protection, at least 500 meters long. Then, rebuilt the embankments, by compacted layers of fill. Both, this new embankment as well as the hillside cut, would require an adequate slope, probably in the order of 2:1 and have vegetation and even arborization. Any temporary solution, as the one presently being carried out by FENADESAL, requires as a first step to control the flow of the broken culvert all the way down to the river bed. We were informed that ANDA is going to take care of this water control problem, but certainly not in a near future.

Taking into consideration the soil instability in this area, and in general between Km 245 and 260, it seems that the Apopa new connection between Districts 2 and 3 could be an adequate solution. However, it remains to solve the problem of the right-of-way encroachments in the sector Apopa-San Salvador. It should be noted that the encroachment problem is also serious in the sector Soyapango-Km. 249.

Bridge at Km. 251

This bridge of approximately 90 ft. long, was washed away by a flash flood about 7 years ago. It has been rebuilt by FENADESAL in an empirical way. The piers are cylindrical concrete structures as well as the new south abutment, whose wing walls are built around a barrier of driven rails with large stone fill-in. This abutment is behaving well, but eventually should be replaced by a properly designed structure. We were informed that the two north end piers do not have bases. Two spans of the bridge are built with very shallow double steel beams. Up stream from the bridge, in the river channel, have been left the remains of a temporary bridge built while the present structure was under construction. Equally, at the bridge section there is a massive concrete remain of the original bridge. These two obstacles are detrimental to the free flow of the waters and

123

create strong currents in the area. Protective river bed stone works downstream from the bridge are in bad condition. In this area there are two considerable free falls.

In this bridge we recommend:

- To verify the design of the girders.
- To remove the obstacles in the river channel.
- To rebuild the stone river bed protection.
- To observe the behavior of the south abutment and the two north end piers.

Bridges at Km. 267, 268 and 280

These bridges are in good structural condition, except what follows about bridge at Km. 267. These bridges have been recently painted, but areas of difficult access have been left with corrosion and without painting. Bridge at Km. 280 is a truss bridge; the other ones are steel girder bridges.

In the bridge at Km. 267, former flow control works have been washed away. There are large undercutting under both abutments that require immediate attention. The progress of these undercutting must be observed frequently until underpinning is accomplished.

Bridge at Km. 21, District 3

This bridge was inspected on February 8, 1995.

This is a three span bridge, 39 meters (128 ft.) long, over the Ceniza river. The original bridge, a masonry arch, was destroyed by a flood in 1934.

The new bridge was built totally with used rail sections as a truss bridge. Also the piers are rail truss structures. About five years ago, with AID financing, the bridge was strengthened with a steel structure under the main central span.

Most of the low joints of the superstructure truss are badly corroded due to rain water accumulation in those joints. FENADESAL has reinforced some of these joints with gusset plates, but their structural behavior is dubious. In top of the truss, parallel to the tracks, supporting the sleepers, but eccentric with the rails, there are two wooden continuous 12"x12" beams (in some sections they are only 10"x10"). These beams are 8 ft. long, but in many instances their joints are not centered with the joints of the bridge truss, where they are supposed to transmit the train loads. This is a dangerous structural condition. The bridge sleepers are in poor condition and need total replacement. At the abutments, the

174

superstructure bearings are covered by garbage; these bearing do not appear to have sliding bearing plates. The abutments and the pier tower bases seem to be in good condition.

FENADESAL intents to reinforce this bridge, including the piers converting them into cylindrical concrete piers. This would increase substantially the piers weight to the bases. Before making any modification to this bridge, it is recommended:

- To contract a Structural Engineer, with experience in railway bridge design. He must take precise measurements of all the structural members of the bridge, taking into consideration loss of sections by corrosion, to ascertain the actual load capacity of the bridge. We were informed that in past years a Japanese Mission did some of this work. This verification is urgent if the railroad will continue to operate, more so, if the railroad was to be used for fuel transportation for the CEL and/ or the Nejapa thermic plants. The consultant feel positive that this bridge needs replacement.

- The possibility of building additional piers to shorter the bridge span lengths should not be considered at all. That will reduce the waterway. Although at present it seems that the river has not substantial floods, occasionally it must be so. Otherwise the original structure had not been washed away. Any addition of central piers requires hydraulic studies.

- It does not seem necessary to build water flow control devices down stream from the bridge.

- If the structural verification shows that the bridge can continue to be used, it would be necessary to sand blast all corrosion from the metallic structure and paint with anticorrosive paint.

- The wood continuous beams, supporting the sleepers, must be replaced by H type steel beams, that is wide flange beams.

175

ANNEX 9

DETERMINATION OF DETAILED OPERATING COSTS

This annex discusses the approach used to determining the operating costs which have been used in evaluation of the scenarios for future railroad development. The primary source of cost data has been the Finance Section of FENADESAL. The primary reports have been the Estado de Resultados Comparativo for December, 1994 as this includes the annual total; and the Detalle de Gastos Departamento (de FENADESAL),also published monthly by individual department. This report shows costs by cost center, broken into materials, labor and other categories. It contains a much greater level of detail than does the comparative report. A special report prepared by the Personnel Section showing the number of employees, pay and benefits, by cost center has been used in developing labor costs for specific activities.

The method of developing maintenance of permanent way costs has been discussed in the report and is not repeated here.

Direct labor costs have been taken from the above reports on a district basis. The average compensation for employees in various functions has been developed from the cost center reports. These have been incorporated into the costs for individual scenarios based on the number of such employees required for the planned operation. Benefits, including social security, vacations, insurance, etc. have been determined as a percentage of direct salaries and wages. As reported, this excludes employees in maintenance of permanent way as these are included in that expense category.

Combustible and lubricant expense has been determined in the following way. Lubricant consumption is assumed to be directly related to the number of train kilometers and has been included as part of the fuel cost. FENADESAL's Anuario Estadistico, 1994 (published annually) reports the annual consumption of lubricants, gasoline and diesel fuel in gallons and also reports the cost for each category. A separate table reports diesel consumption by locomotives and the average number of locomotive kilometers per gallon. Gasoline and non-locomotive diesel consumption is due to the operation of automobiles and light trucks, motor cars and similar vehicles. Based on reports of the last three years, a cost factor for non-locomotive consumption was developed. This was increased by 50 percent in order to allow for increased motor vehicle operation as a result of increased maintenance of the permanent way. This amount, c/ 269,000 per year, has been used in all scenarios as a constant amount. The cost of diesel fuel per locomotive kilometer, ¢6.7, has been assumed to be the cost per train kilometer. Total train kilometers, including movement of locomotives without trains, have been determined for each scenario. Train-kilometers, multiplied by the cost per kilometer, gives the variable fuel cost for each scenario and tonnage level.

Examination of the cost codes for materials indicates that virtually all of these purchases were of maintenance of way supplies. These are included in the estimates of maintenance of permanent way expenses. None of these expenses have been charged as general operating expenses.

Examination of charges to the accounts for tools and hardware (herramientas) indicates that all purchases in this category were for maintenance of permanent way. This has been included in that expense. However, it will be necessary to purchase tools for repair and servicing of locomotives and wagons. An estimate of c/ 30,000 per year, increasing to c/ 45,000 in the high volume scenarios, has been used to cover this expense category.

Paper and office tools has been taken directly from the district allocations as reported in the annual summary. It has been assumed that this cost will remain constant based on the districts which remain in operation.

Spare parts have been analyzed, based on cost center reports, to determine the division between locomotives and wagons. Virtually all purchases in this category were for locomotives. As other studies indicate most locomotive spares requirements are time related. This has been converted to a cost per locomotive in service and assigned to each scenario based on the number of locomotives required. The same procedure has been followed in estimating wagon spare parts requirements.

Office equipment costs are based on the district allocation used in the monthly summary and are assumed to be constant, reflecting only the number of stations in use.

External Services (Remuneracion de Servicios Externos) includes utilities and other miscellaneous services purchased from others. This includes all contract services provided to FENADESAL. The expense allocated to each district has been used for evaluating the scenarios with one exception. As San Salvador is a part of District 1, expenses related to the headquarters office are included in the District 1 expenses. Therefore, under Scenarios 1,2 and 3, twenty-five percent of District 1 expenses have been added to those of Districts 2 and 3, as appropriate, to provide an estimate of these costs,

Internal costs (Remuneracion Servicios Internos) includes depreciation and amortization and the allocation of expenses from CEPA. None of these are cash costs. These have been ignored in calculating operating costs.

ANNEX 10

ALTERNATIVE TRAFFIC ANALYSIS AND SCENARIOS

1. Análisis de Tráfico

No se espera que FENADESAL retenga tráfico sin la rehabilitación férrea y otras medidas para alcanzar la competitividad. Llevándose a cabo la rehabilitación de toda la via férrea y de mantenerse la política actual de tarifas subsidiadas para competir con las carreteras, así mismo se podrá perder mucho tráfico a las carreteras.

En el cuadro del texto se presentan pronósticos de demanda férrea hacia el año 2015 para el escenario C (mejoras viales comprometidas más la rehabilitación vial). El tráfico real dependerá de las tarifas y las condiciones efectivas de operación una vez rehabilitada la via. Los pronósticos presentados en en cuadro suponen que:

- Las necesidades que tenga el país de cemento sean proveidas principalmente por las fábricas ubicadas en Metapán. Eso se ha confirmado por las reservas minerales suficientes.

- La construcción de una conexión nueva en Santa Ana hará ventajosa el recibir insumos al cemento por vía férrea (Puzolana de Santa Ana y combustible de Acajutla), en las mismas proporciones de la producción de hoy.

- La planta termoelétrica en Nejapa decide por el transporte de todo su combustible por vía férrea.

- Con una distribución favorable de costos férreos fijos, la carga importada de bajo valor (incluyendo a productos metálicos) que actualmente se transporta de Acajutla a San Salvador, seguirá creciendo. En el caso de las cargas a entregar mas al oriente, preferirán el servicio direto de camiones, resultando en perdida de carga.

- No haya asignación de contenedores a la red férrea.

Es totalmente posible que el ferrocarril pueda capturar las tres primeras cargas, creciendo al 5.1%, la tasa de crecimiento proyectada para la demanda del cemento. Sin embargo, el potencial para retener la última categoría es menor, considerando que la rehabilitación férrea a evaluar de Acajutla a San Salvador no se compara con la mejora vial en construcción. Por otro lado, si fuera factible la rehabilitación de esta sección férrea con la atracción del tráfico de combustible a Nejapa, la aplicación de criterios marginales de tarifas podría permitir la preferencia de otras cargas por el modo férreo, las cuales se supone crecerán al 6% al año, por esta y otras rutas.

Paradójicamente, mientras se preveía que las inversiones portuarias en Cutuco fueran revitalizar al Distrito 1, no producen este efecto esperado. Por motivo de la red vial

mejorada al oriente y la extensión y características geométricas del Distrito 1, el modelo no asigna tráfico a esta línea. Toda la carga transportada al oriente se lleva por camión, especialmente con el acceso vial al muelle. Veáse los anexos del Capitulo 10 para la deficición de los escenarios adicionales desarrollados para la evaluación de inversiones alternativas.

2. Escenrios Alternativos de Tráfico

CEPA-FENADESAL opinan que los pronósticos para los flujos de Acajutla a San Salvador sean bajos. el consultor presenta a continuación la justificación de esta previsión como también supuestos alternativos en cuanto a la carga que podrá atraer el ferrocarril en este tramo, llevando a cabo un análisis de sensibilidad para estimar el impacto financiero de incrementos importantes de estos pronósticos.

en cuanto al Distrito 3, se supone que todo el café se desplazará a transporte por camión por su proceso acelerado de contenedorización, dejando FENADESAL de transportar productos de exportación. Por la mejora del transporte vial y la limitada capacidad de FENADESAL en comercializar sus servicios delante de la competencia, se supone que se retenga solamente parcela un poco inferior del hierro, acero, y varios, productos químicos, ferretería y varios.

Esos productos representaban en 1993 un total de 38,324 toneladas, mientras con las condiciones de la competencia vial previstas para el año 2000, en términos de carga de 1993, el ferrocarril retendría cerca de 30,000 toneladas, lo que significaría un incremento de cerca de 12,000 toneladas sobre el pronóstico o alrededor del 27%. Si se retuviera todas las importaciones que detenía en 1993, llegaría en este año a 63,539 toneladas, o un incremento de cerca de 19,000 toneladas o aproximadamente el 42%.

En cuanto a los usuarios con espuelas propias, la experiencia ha demostrado que eso no impide que opten por otro servicio. Existen varias industrias con espuela que no reciben carga más por ferrocarril. Si pueden obtener servicio más favorable por camión, no van a preocuparse por inversiones anteriores.

Una carga potencial fue identificada por el Consultor en el campo y en entrevista con transportista proveedor de las empresas de cemento. Corresponde a puzolana, un material volcánico utilizado en la fabricación de cemento, mejorando su permeabilización y adherencia. esta carga proviene de Ciudad Arce, cerca de la linea férrea entre Sitio del Niño y Santa ana, y se destina a Metapán. Es factible atraer esta carga a FENADESAL, especialmente, si se construyera la conexión en Santa Ana, y también posiblemente con la conexión en Apopa. Sin embargo, exigiría un gran esfuerzo de mercadeo

Por tanto, el análisis de sensibilidad considera que el tráfico de puzolana de Ciudad Arce a Metapán sería 40% inferior a lo pronosticado, reduciéndola al 60% del total, lo que

141

llevaría a una disminución de cerca de 113,000 toneladas en el año 2015 de la cantidad prevista.

El Consultor está de acuerdo con los comentarios de que sea poco probable la reactivación de la interconexión a Guatemala y el transporte de yeso.

En el capítulo 10, anexo 10.2.3 (Análisis Adicionales de Sensibilidad) se ha calculado el impacto financiero de este escenario alternativo.

182

ANNEX 11

COMMENTS ON SALVAGE VALUES

Las locomotoras tienen valores de chatarra relativamente bajos por motivo de los problemas de desmontaje y la variedad de metales que se encuentran en su estructura. El desmontaje de los componentes grandes, como del motor, con frecuencia generan costos que exceden a sus valores de chatarra.

FENADESAL recibió una cotación reciente para rieles de chatarra de 500 colones por tonelada. Las locomotoras actuales pesan 65 toneladas, lo cual resultaría en un valor de 32,500 colones por locomotora, del cual debe deducirse el costo de desmontaje. Se debe notar que esta cotación fue para rieles, considerado como chatarra de la mejor calidad.

Puede ser que sea factible la venta de motores y generadores para uso posterior. Sin embargo, son incomunes las aplicaciones no ferroviarias de equipo de 600 voltios en corriente directa.

El valor de salvamento de las locomotoras ha sido determinado de una forma algo arbitraria. Si FENADESAL determina que un valor más elevado sea apropiado, el Consultor no tiene objeción alguna.

Sin embargo, FENADESAL deberá investigar el mercado de salvamento de locomotoras. Notase que Nicaragua hace tiempo está intentando sin éxito de vender algunas locomotoras más nuevas y de tipo de uso más generalizado.