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Technical and Economic Feasibility of a Rehabilitation of the Costa Rican Railway and an Assessment of an Interurban Passenger Service Between Alajuela, San José and Cartago

Presented by

Canadian Pacific
Consulting Services Ltd.

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VOLUME I

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APPENDIX A

TRAFFIC

APPENDIX A

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A. TRAFFIC IN THE CORRIDOR

Freight traffic forecasts are based on information gathered in Costa Rica. Tonnage forecasts are converted to net tonne-kms according to distances travelled by each commodity on the rail network. Segments and distances are presented below. Assumptions by commodity are presented in the following sections.

1 RAIL SEGMENTS

Atlantic Railway

Commodity	Origin	Destination	Distance (kms.)
Bunker	Moin	El Alto	143.4
Trunks	Turrialba	S.Jose	64.2
Other	Various	Various	83.5
Iron & Steel	Limon	S.Jose	167.0
Newsprint	Limon	S.Jose	167.0
Malt	Limon	Alajuela	188.0
Exports	S.Jose	Limon	167.0

Pacific Railway

Iron & Steel	Caldera	S.Jose	93.0
Wheat	Caldera	Alajuela	78.0
Wheat	Caldera	Barranca	9.0
Corn	Caldera	S.Jose	93.0
Sea Sand	P.Arenas	S.Jose	116.0
Other	Various	Various	58.0
Malt	Caldera	Alajuela	78.0
Exports	S.Jose	Caldera	93.0

Banana Transportation System			Avg. Distance (Kms.)
Bananas	Estrella	Moin	52.4
Bananas	Rio Frio	Moin	120.0
Bananas	Siquirres	Moin	65.0
Bananas	Ticaban Branch		119.0

2 TONNAGE FORECASTS

Rates of growth for most of the different commodities carried by INCOFER were estimated for the first five years of the study period, that is, from 1988 to 1993. After that, no further growth was assumed since growth beyond a five year period is hard to predict and generally inaccurate. It was learned during interviews with INCOFER's clients that the majority intended to maintain rail usage at current levels and that the increase in traffic transported by rail would match the increases in the clients' production volumes.

Bunker:

It was estimated that INCOFER would carry approximately 143,000 tonnes of bunker in 1988 between Moin and El Alto under a new agreement with COOPEBUNKER by which the railway would carry 100% of the bunker on this route. As bunker is a low grade fuel mainly used for industrial purposes, its rate of growth was assumed to keep pace with growth of the general economy. This was estimated conservatively at 2.5% per year which was the approximate average annual rate of growth of GDP between 1976 and 1986, the latest year for which figures were available at the time the traffic forecasts were developed. Growth would remain at 2.5% per year for 5 years and then no further growth in bunker traffic would occur to the end of the study period.

Trunks:

Based on conversations with Scott Paper, in 1988 15,000 tonnes of trunks would be carried from Turrialba to their plant in San Jose and 25,000 tonnes in 1989. Thereafter there would be no further growth since the capacity of Scott's pulp plant is only 25,000 tonnes per year.

Iron and Steel:

The two major clients of INCOFER who transport iron and steel are Transitaria and Metalco. Both companies manufacture metal products for use in the domestic construction industry. Transitaria's volume increased by about 40% between 1985 and 1986 and doubled between 1986 and 1987 to 180,000 tonnes. Between 1982 amd 1986 volumes had remained stable at around 60,000 tonnes. The large increases in volumes were meant to meet the current government's commitment to build 80,000 dwelling units during its term of office. It was therefore assumed that volumes would not be maintained at the higher levels but would gradually decrease until 1990 (end of present

government's term). In 1990 volumes would be about 135,000 tonnes. This would represent a more normal growth rate of 10% per year from 1986 which would be more reflective of growth in the construction industy in Costa Rica. After 1991, no growth was predicted.

Based on conversations with the company Metalco's traffic was assumed to grow at around 10% per year to 1993 and remain stable thereafter.

Newsprint:

About 6000 tonnes of newsprint were carried by rail in 1988. Annual average growth in volume of newsprint imported by rail was 5% per year between 1982 and 1987. It was estimated to continue to grow at this rate until 1992 with no further growth beyond that year.

Malt:

The volume of malt carried by rail in 1988 was estimated at 6000 tonnes. Growth was estimated at 2.5% for 5 years remaining steady thereafter.

Wheat and corn:

The volumes of wheat and corn imported in 1988 were estimated at 158,000 tonnes. It was assumed that this volume would increase at the same rate as the projected growth in population, namely 2.25% to 1993 and 1.8% to 1994 and no growth thereafter.

Sand:

It was estimated that about 30,000 tonnes of sand would be carried by rail in 1988. The majority of this is destined for the construction industry. The rate of growth in the volume of sand carried was assumed to be 10% per year to 1993 and stable thereafter. This rate was based on the historical increase in production of two cement companies and the growth in building floor space between 1983 and 1987.

Other local traffic was assumed to grow at 2.5% to 1993.

Exports:

Costa Rica's major exports other than bananas are coffee, cacao, livestock & fresh meat, sugar and fertilizer. Throughout the 1980's, the railway's share of export traffic on both the Atlantic and Pacific Railways has declined steadily. Since 1985, volumes carried have amounted to 2000 tonnes a year in total.

Coffee is increasingly being carried in containers. INCOFER does not now have a large share of either coffee or container traffic and it is not considered likely that this will change. Fresh meat destined mainly for the U.S. and Puerto Rico is time sensitive and therefore unsuitable for rail. The majority of the export fertilizer goes to Central and South America, mostly over land routes by truck and does not exit via the ports. Total volumes of cacao for export are insignificant and sugar is not now transported by rail in large amounts. This traffic pattern is expected to continue and therefore exports other than bananas are projected to remain at 1000 tonnes on each of the Atlantic and Pacific Railways throughout the 20 year study period.

TONNE/KILOMETRES TRAVELLED

(Thousands)

Atlantico Line (excl. Bananas)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996-2008
Local: Bunker	20506	21019	21544	22083	22635	23201	23201	23201	23201
Trunks	963	1605	1605	1605	1605	1605	1605	1605	1605
Other	3340	3424	3509	3597	3687	3779	3779	3779	3779
Iron & Steel	16809	15281	13752	13752	13752	13752	13752	13752	13752
Newsprint	1002	1052	1105	1160	1218	1279	1279	1279	1279
Malt	564	578	593	607	623	638	638	638	638
Exports	167	167	167	167	167	167	167	167	167
TOTAL	43351	43125	42275	42972	43687	44421	44421	44421	44421

Pacifico Line

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996-2008
Iron and Steel	9244	9021	8844	9235	9663	10146	10146	10146	10146
Wheat-Caldera/Alajuela	4914	5025	5138	5253	5371	5492	5591	5591	5591
-Caldera/Barranca	567	580	593	606	620	634	645	645	645
Corn	2976	3043	3111	3181	3253	3326	3386	3447	3447
Local: Sea Sand	3480	3828	4211	4632	5095	5605	5605	5605	5605
Other	580	595	609	625	640	656	656	656	656
Malt	234	240	246	252	258	265	265	265	265
Exports	93	93	93	93	93	93	93	93	93
TOTAL	22088	22424	22845	23877	24993	26217	26387	26448	26448

3 Cont'd

TONNE/KILOMETRES TRAVELLED (Banana Branch Lines)

(Thousands)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996-2008
Estrella Branch	6644	7572	8499	9291	9291	9291	9291	9291	9291
Rio Frio Branch	10260	11700	13128	14352	14352	14352	14352	14352	14352
Guapiles/Siquirres	4791	5460	6130	6702	6702	6702	6702	6702	6702
Ticaban	3213	3392	3403	3403	3403	3403	3403	3403	3403
Total	24908	28123	31160	33747	33747	33747	33747	33747	33747

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BANANA EXPORTS CARRIED BY ROAD - 1988-2008

(Thousands of Tonnes)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996-2008
Bandeco	435.0	451.5	453.4	453.4	453.4	453.4	453.4	453.4	453.4
Cobal	122.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0
Standard	112.0	74.0	34.0	0.0	0.0	0.0	0.0	0.0	0.0
Others	96.0	140.0	194.0	194.0	194.0	194.0	194.0	194.0	194.0
Total	765.0	789.5	805.4	771.4	771.4	771.4	771.4	771.4	771.4

APPENDIX B

INFRASTRUCTURE

APPENDIX B

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GENERAL OVERVIEW

I Description of the Existing Network

Limon to La Junta

Commencing at the Atlantic port city of Limon (Km 0.0), this line crosses the Atlantic coastal plain to the edge of the central mountain range. At La Junta (Km 65.0) the railway branches toward the west and north. The terrain traversed is relatively level and the alignment standard is good. In 1979-80 the track was rehabilitated to 60 km/h standard with new 42 kg/m rail and concrete ties. At the same time, the line was electrified for 25 kV 60 Hz motive power. Since rehabilitation, the line has received little maintenance and now suffers from a lack of ballast. Current track speed is 50 km/h.

La Junta to San Cristobal

From La Junta, the line follows the northern extension of the coastal plain to San Cristobal (Km 109.0), a total of 44 km. This line was also rehabilitated and electrified in 1980-81 to the same standards as Limon - La Junta. Alignment standards are good. The track is in reasonably good condition except for a lack of ballast. Track speed is 50 km/h.

La Junta to Turrialba

From La Junta to Turrialba (Km 102.8), the line follows the Rio Reventazon westward. The track alignment is poor with curve radii as small as 87 m (20 deg) and gradients in the westward direction as severe as 3.6% (averaged and compensated). The track has a variety of rail sections ranging from 30 kg/m to 40 kg/m and uses mainly wood ties although many concrete ties have been installed in recent years. The track quality is poor, due to tie and ballast condition. In the section between Km 65 and Km 88 there are several locations where the track is threatened by erosion from the turbulent Rio Reventazon. At Piedras de Fuego (Km 97.6) the track crosses a large, slow-moving landslide with consequent subgrade instability. Track speed between La Junta and Turrialba is 35 km/h.

Turrialba to Paraiso

From Turrialba to Paraiso (Km 140.0) the line continues to follow the Reventazon valley. Alignment is poor, with gradients in the westward direction of 3.6% (averaged and compensated) and curve radii as small as 71 m (24.5 deg). The track has 30, 35 and 40 kg/m rail and, at different

locations, wood, steel or concrete ties. Wood ties are in bad condition and ballast is very dirty, with the result that track quality is low at many locations. Track speed is 35 km/h.

Paraiso to San Jose (Atlantico)

From Paraiso to San Jose (Km 167.0), the line is on the central valley plateau. The alignment is much straighter than the section from La Junta to Paraiso, however this section of the line crosses the continental divide, giving it steeper gradients than any other section of the INCOFER system. The maximum gradients are 4.2% (averaged and compensated) in both directions. The minimum radius of curvature is 109 m (16 deg) although most curves have radii of 218 m (8 deg) or greater. As between La Junta and Paraiso, the track has a variety of rail sections from 30 kg /m to 40 kg/m and wood, steel and concrete ties. Ballast quality is usually poor, and a large number of the wood ties require replacement. Track speed is 40 km/h.

San Jose (Atlantico) to Alajuela

From San Jose to Alajuela (Km 188.0) the line remains on the central valley plateau. The station at Alajuela is located far from the city center, making it unsuitable for passenger service. The alignment is slightly worse than that between Paraiso and San Jose. The maximum gradients on this section are 3.2% westward and 4.0% eastward (averaged and compensated). The minimum radius of curvature is 79 m (22 deg) although only a few curves have less than 175 m radius (10 deg). The track has predominantly 25 kg/m rail, with some 35 kg/m and 40 kg/m rail recently installed. Ties are mainly wood, with some stretches of concrete or steel ties. The condition of wood ties and ballast is poor. Track speed is 20 km/h.

San Jose (Pacifico) to Ciruelas

From San Jose (Km 0.0), the main line of the Pacific railway begins its descent from the central valley plateau to the Pacific port of Puntarenas (Km 116.0). It should be noted that the Pacific railway station in San Jose is located more than 2 km from the Atlantic station. The railway yards at the two stations are connected by an interchange track which is suitable only for low-speed switching movements between the Atlantic and Pacific yards. Between San Jose and Ciruelas (Km 22.7), the track alignment is less severe than on the Atlantic railway. The maximum gradient is 3.1% eastward (averaged and compensated) and the minimum radius of curvature is 87 m

(20 degrees), although usually the radius of curvature is greater than 109 m (16 degrees). The track has various rail sections from 25 kg/m to 40 kg/m and has both wood and concrete ties. The track surface is poor due mainly to low rail joints. As at most locations, the condition of wood ties and ballast is unsatisfactory. Maximum track speed is 45 km/h.

Ciruelas to Alajuela

At Ciruelas (Km 0.0), the railway line branches north to Alajuela (Km 8.0). The alignment of this line is moderate except for the last 2 km where the track climbs 50 m and has excessive curvature. The maximum gradient is 3.2% northward (averaged and compensated) and the minimum radius of curvature is 87 m (20 degrees). Track speed is 35 km/h.

Ciruelas to Puntarenas

From Ciruelas to Puntarenas, the alignment is similar to that described between San Jose and Ciruelas. The minimum radius of curvature is 109 m (16 degrees) and the maximum gradient is 3.0% eastward (averaged and compensated. The track has a range of rail sections from 25 kg/m to 35 kg/m and has about 75% wood and 25% concrete ties. The track has pounding rail joints and the condition of wood ties and ballast is poor. Maximum track speed is 45 km/h.

Km 88.4 to Purruja

This spur line branches off the main line to Puntarenas at Km 88.4 (=Km 0.0 spur) and runs to Purruja (Km 4.6). The line was constructed in 1979-80 to serve the new Pacific port of Caldera. Alignment is good and track condition is not a problem as yet. Track speed is 35 km/h.

The Banana Branch Lines

In the Atlantic zone, INCOFER has a large number of branch and spur lines to banana plantations for the purpose of hauling export bananas to the Atlantic port of Moin (Km 7.6 from Limon). The bananas are packed in boxes at various packing plants on the plantations and loaded directly into railway boxcars spotted at the plants. Important factors in the transport of bananas are the elapsed time from the plantation to the port, and the amount of bruising which the fruit receives in transit. All the banana branch lines connect to the Limon - San Cristobal main line. They are summarized as follows:

Name	Junct Km	Trunk	Feeder
Estrella Branch	2.4	48.4 km	7.4 km
Monteverde Branch	54.6	21.0 km	2.5 km
Indiana/Imperio Br	61.2	16.1 km	14.5 km
Parismina Branch	82.2	9.5 km	0.0 km
Guapiles Branch	86.1	13.9 km	0.0 km
Santa Clara Br	95.4	10.0 km	0.0 km
Rio Frio Branch	109.0	10.7 km	12.8 km
Ticaban Branch	109.0	9.6 km	0.0 km
Trancari Branch	109.0	0.0 km	8.2 km
Other Branches:			
Freehold	55.4		0.5 km
Guajira	99.1		1.0 km
La Teresa	104.0		1.5 km
TOTAL		139.2 km	48.4 km

Because of the flat topography in the Atlantic coastal zone, the banana branch lines have little gradient. The lines are considered to be low class equivalent to yard trackage. Consequently, the track standards are low, and very sharp curvature - minimum radius 50 m (35 degrees) - is permitted. Light rail sections less than 25 kg/m are common. Ties are mostly wood, although a few concrete ties have been installed. Tie and ballast conditions range from bad to very bad. Track speed is 15 km/h.

II RECENT INFRASTRUCTURE STUDIES

During the 1985-86 period, the company ELC Electroconsult of Milan, Italy, studied the INCOFER plant and operation in its entirety and submitted three reports:

1. Feasibility Study for the Rehabilitation of Banana Branch Lines, April 1986
2. Feasibility Study for the Mass Transport of Passengers along the Cartago - San Jose - Alajuela Axis, May 1986
3. Feasibility Study for the Rehabilitation of the "Inter-Oceanic Railway" Puntarenas - San Jose - Limon, December 1986

All three reports proposed programs of investment in the railway, supported by economic and financial analysis of the estimated costs and projected revenues.

The Banana Branch Line Study

The "Feasibility Study for the Rehabilitation of Banana Branch Lines", submitted by ELC Electroconsult in April of 1986, considers most of the network of branch lines emanating from the Limon - La Junta - San Cristobal main line, i.e. those serving banana plantations more than 50 km from the port of Moin. The study recommends reconstruction of all branch lines as defined above, a total of 172 km. To support the activity of track renewal, certain investments in equipment are also recommended. The investments proposed (in Colones of 3/86; $1 US = 52 Colones) are summarised below:

ITEM	COST
Renew 172 km of track	1,000,300,000
Concrete tie plant	62,500,000
Track mtce equipment	105,900,000
Rolling stock	156,400,000
Ballast crushing equip	90,600,000
Locomotive overhaul	18,400,000
TOTAL	1,434,100,000

Also considered as an option but discarded after the economic analysis was the renewal of another 9.5 km of track and the construction of an additional 49.9 km of track extensions to serve areas which presently ship bananas by truck. This option would have added 429 million colones to the project cost.

The 172 km of track renewal, which represents most of the proposed expenditure, consists of replacement of all rails, ties and ballast with new 35 kg/m rails, concrete two-block ties and railway-produced ballast. No re-use of existing rails or ties is contemplated. The report proposes a low-cost tie design for production by INCOFER. The work is to be carried out in a three year program.

The Inter-Urban Railway Study

The "Feasibility Study for the Mass Transport of Passengers along the Cartago - San Jose - Alajuela Axis" submitted by ELC Electroconsult in May of 1986, investigates the possibility of developing a modern inter-urban or commuter railway service in the Central Plateau urbanized zone, making maximum use of the existing railway right-of-way from Cartago to Alajuela. In the report a conceptual design is developed for the new passenger service between Cartago and Alajuela, together with the cost of the civil works, new rolling stock and services. The estimated costs (expressed in US Dollars of 1986) are summarized below:

ITEM	COST
Roadway	$25,339,247
Track and accessories	5,661,423
Buildings and shops	1,590,264
Signalling	5,597,480
Communications	971,600
Electrification	4,582,412
Rolling Stock	29,099,730
Shop Equipment	1,444,800
TOTAL	$ 74,286,956

The proposed inter-urban railway would follow the existing railway right-of-way as much as possible, elevating the track for 4.87 km in the center of San Jose (includes an elevated yard at the Atlantic station), improving the alignment for 1.26 km at Km 170, and relocating the line for 3.19 km in Heredia (includes an elevated section 1.45 km in length). All track would be replaced with new 42 kg/m rail and concrete ties. New passenger station facilities are proposed for the following points:

STATION	KM
Cartago	146.57
El Alto	151.00
Tres Rios	157.20
Curridabat	162.20
San Jose	167.00
Colima	171.00
Heredia	176.20
Echeverria	183.00
Alajuela	187.97

For increased security, it is proposed to install a block signal system along the route, together with crossing protection signals at selected locations. A dedicated telephone system for dispatching of trains will augment existing communications.

The proposed trainsets will consist of an electric locomotive and 8 passenger cars. Each train will have a length of 165 m and a nominal capacity of 720 passengers. There will be 8 trainsets in operation plus 1 spare locomotive and 5 spare passenger cars. The trains will operate with 20 minute headways (in both directions) during peak periods.

Freight trains would share use of the new line, presumably at night. Where the new line is to be elevated in San Jose, the freight trains would operate below, at the original grade. At the Atlantic station, the at-grade yard layout would be modified for continued use by freight traffic.

Execution of the project would be in two phases; Cartago to Heredia to be placed in service as soon as possible, and Heredia to Alajuela about 5 years after.

The Inter-Oceanic Railway Study

The "Feasibility Study for the Rehabilitation of the Inter-oceanic Railway Puntarenas - San Jose - Limon", submitted by ELC Electroconsult in December of 1986, investigates rehabilitation of the INCOFER main line from Limon to San Jose to Puntarenas. In doing so, they cover most of what was missed by the previous two studies. The report recommends major investments in the railway for track upgrading, signalling and electrification, among other items. A summary of the proposed investments (in 1986 US Dollars) is given below:

ITEM	COST
Roadway (185.5 km)	$10,111,562
Track (185.5 km)	25,080,435
Buildings & misc.	6,094,218
Signalling (248.5 km)	9,350,376
Electrification (183.1 km)	21,614,332
Access roads	549,180
Shop equipment	4,574,648
TOTAL	$77,374,750

Track is to be reconstructed using new 42 kg/m rail and concrete ties from Limon to Km 2.4, from La Junta to Cartago and from Montecillos (Km 5.3 from Ciruelas) to Puntarenas. A new connection between the Atlantic and Pacific railways is to be constructed between Las Canas and Montecillos. A new railway yard and shop complex is to be constructed at Virilla (Km 172 from Limon). All stations from Limon to Puntarenas are to be equipped with station protect signals or switch point indicators. The lines from La Junta to Cartago and from Las Canas to Puntarenas are to be electrified to 25 kV 60 Hz. After completion of the works all freight traffic will proceed via Virilla yard, bypassing the Pacific station and rendering the Pacific yard, shops and track connections to Ciruelas and Ambos Mares redundant.

III FUTURE RAILWAY DEVELOPMENT

Operational Requirements

Rational development of an existing railway must be based on a realistic evaluation of future operational requirements. Improvements to the plant can then be directed toward meeting these requirements. The term "operational requirements" considers not only train operation, but also initial capital costs and subsequent maintenance costs. Therefore, the objective must be to develop the railway in such a way that train operation requirements are met while balancing capital costs against future maintenance costs.

Looking at train operation requirements, these can be broken down into several major categories:

- Axle Loading
- Speed
- Line Capacity
- Customer Interface
- Operational Support
- Operational Security

Using the same logical breakdown of INCOFER as used by ELC Electroconsult, we can establish the train operation requirements category by category:

The Banana Transportation System -

A. Axle loading;
   - main line 16.0 ton
   - trunk line 13.2 ton (restricted to Series 50 locs)
   - feeder line 13.2 ton (restricted to Series 50 locs)

B. Speed;
   - main line 60 km/h
   - trunk line 30 km/h
   - feeder line 15 km/h

C. Line Capacity; Present line capacity is adequate for present and forecast traffic levels.

D. Customer Interface; For the transport of bananas the customer interface consists of loading facilities at the banana plantation packing plants and classification/ unloading facilities at Moin. Existing loading facilities are adequate for conventional shipment of bananas in box cars, but may require modification for containerized or palletized shipments. The classification/unloading installation at Moin is new and generally adequate except for a lack of switching

flexibility in the port.

E. Operational Support; Mechanical maintenance support is provided by a main shop at Limon and a small shop at Siquirres. INCOFER has planned for several years to relocate the Limon shop to Moin. This move has been delayed partly for funding reasons and partly because the proposed site at Moin has been found to be unusable. The eventual site chosen will depend upon operational and staffing constraints.

F. Operational Security; Present dispatching methods and security devices (signs, locks) are adequate to ensure reasonable safety of operation. Crossings at grade with Class 1 roads (none presently exist) require automatic protection signals and lower-class crossings require warning signs.

Note: Class 1 road = 70 km/h or 10,000 veh/d Class 2 road = 50 km/h or 2,000 veh/d Class 3 road = >50 km/h and >2,000 veh/d

The Inter-Urban Transport System -

A. Axle Loading; 16 tons

B. Speed; 70 km/h

C. Line Capacity; Siding spacing will be adjusted to obtain the desired traffic capacity.

D. Customer Interface; The interface for passenger transport will consist of modern passenger stations at selected locations.

E. Operational Support; Mechanical support will be provided by a new dedicated facility in the San Jose area.

F. Operational Security; Due to the nature and frequency of movements, an automatic block signal system is required to protect against collisions between trains. Crossings with Class 1 roads must be grade-separated, or protected with automatic gates. Crossings at grade with Class 2 roads require automatic protection signals. In urban areas, automatic gates may also be required. Class 3 roads require warning signs.

The Inter-Oceanic Transport System -

A. Axle Loading; 16 tons

B. Speed; 60 km/h

C. Line Capacity; Except in the zone of the Inter-Urban traffic, present or forecast capacity is not a problem.

D. Customer Interface; At the ports, the customer interface consists of loading/unloading and classification facilities at Caldera and Limon, both of which are generally satisfactory at present. At San Jose, loading/unloading facilities exist at the Atlantic and Pacific yards, as well as private facilities scattered throughout the metropolitan area. Both public facilities are marginal at best, and have no container-handling capabilities. To properly integrate the system, it would be desirable to replace the Atlantic and Pacific yards with one modern yard outside the urban core of San Jose.

E. Operational Support; Mechanical support will be provided by the main shop located at the Pacific station, San Jose, or at a new alternate facility in the San Jose area.

F. Operational Security; In the zone of Inter-Urban transport, operational security is as described in the above section. Outside of that area, present dispatching methods and security devices (signs, locks) are adequate to ensure reasonable safety of operation. Crossings at grade with Class 1 roads require automatic protection signals and lower -class crossings require warning signs.

Conceptual Designs

In this report various infrastructure development scenarios will be detailed and the costs estimated. The scenarios will be, in fact, conceptual designs which have been developed in sufficient detail to demonstrate technical feasibility. In general, the scenarios will assume that the resulting economic rate of return is more Important than the initial capital cost. In the actual execution of a construction or rehabilitation project, it will be necessary to define investment constraints before proceeding to detailed design.

The scenarios will be of two types; those based on the 1986 studies and recommendations of ELC Electroconsult, and those developed in this report as alternatives to the ELC scenarios. The scenarios which are based on work by ELC Electroconsult will retain the original design concepts as far as possible, making changes only where errors or omissions are detected. The alternative scenarios developed by Canadian Pacific Consulting Services will

stress a practical and economical approach, in keeping with the economic and social environment of Costa Rica.

Tie Analysis

Due to deforestation and government regulation in recent years, it has become increasingly difficult for INCOFER to secure an adequate supply of wood ties at an acceptable price. When one considers the short service life of the wood tie (about 7 years), the concrete tie becomes an increasingly attractive alternative. INCOFER has been experimenting with concrete ties since the early 1970's, with mixed success. All concrete ties currently installed were manufactured by Productos de Concreto, S.A. (at high cost) or by INCOFER (at unknown cost).

In their report of April 1986, ELC Electroconsult proposed the use of a low-cost concrete tie. The new tie was of two- block (Bi-Bloc) design and used an elastic bolt & clip rail fastening system. ELC strongly promoted the use of this tie, which would be manufactured by INCOFER in a new plant. The plant was to have a 10-year production life, with production scenarios ranging from 70,000 to 280,000 ties per year.

Under close scrutiny, the ELC tie proposal begins to appear less attractive. The production level of 70,000 ties per year is sufficient to replace the wood ties on all of INCOFER's main lines and branch lines - making consideration of higher production levels unnecessary. ELC's tie cost estimate underestimated some costs and ignored others. Also, ELC ignored such factors as tie spacing, service life and maintenance costs, which must all be considered in order to evaluate the true cost of a tie.

Investigation of the cost of the Productos de Concreto tie revealed that the following cost components contributed to the high unit cost:

- Administration costs
- Plant maintenance costs
- Plant amortization
- Royalty payments
- Profit

Productos de Concreto's costs are based on a production scenario of 45,000 ties per year for 5 years. Plant administration, maintenance and amortization are annual costs whose effect on tie cost is inversely proportion to annual production.

In Appendix C-1, an study has been made to compare, on an equitable basis, the 1988 cost of three types of concrete

tie. The ELC estimate has been expanded and corrected, and the P/C cost has been adjusted to the same 10 year - 70,000 ties per year basis used by the other ties. For the ELC tie, a Nabla-type fastening system has been assumed, while a Pandrol-type system has been estimated for the other two ties. It should be noted that selection of a fastening system is independent of tie design, given that all three tie designs will accept a variety of fastening systems. In the comparison, the ELC tie has the lowest unit cost, partly due to the use of the less-expensive fastening system. However, when the annual cost per kilometer is calculated, the ELC tie is shown to be the most expensive of the three, with the two monobloc designs approximately equal in annual cost. The reasons for this swing are: the higher quantity of ties per kilometer due to the smaller bearing area of the ELC tie; the shorter service life of the passively reinforced ELC tie compared to that of a prestressed tie; and the higher maintenance cost of bolted fastening used on the ELC tie compared to the "fit and forget" fastening used by the other two ties.

At this point, it is relevant to re-introduce the wood tie, to see how it compares economically to its rival, the concrete tie:

ITEM	WOOD	CONCRETE
TIE COST	600	1,066
FASTENING COST	780	1,125
STORAGE COST	25	25
TIES PER KM	1,667	1,429
INSTALLATION	85	85
COST PER KM	2,483,830	3,287,622
TIE LIFE	7	50
FASTENING LIFE	50	50
COST OF MONEY	10%	10%
ANNUAL MTCE COST	33,340	14,290
ANNUAL COST / KM	407,595	345,877

The concrete tie, with its long life and low annual maintenance cost is the clear winner of this comparison. In fact, if the wood tie life were increased to 10 years and the concrete tie life were reduced to 35 years, the concrete tie would still come out ahead.

In addition to the above analysis, there are other factors to be considered. If INCOFER were to proceed with the installation of a concrete tie plant, this would represent a firm resolution and commitment to produce and install 70,000 ties a year for 10 years. Any slippage in production or shortening of plant life would reflect itself in increased tie costs above that which have been estimated. In addition to the administrative and technical

headaches, there would be a financial risk to such an undertaking. On the other hand, Productos de Concreto has an existing, partially depreciated plant ready to go into production, and they have the expertise to produce a consistently high-quality tie. With the assurance of higher annual production rates, P/C's price could be reduced to the levels shown in Appendix C-1.

In conclusion, if INCOFER is sufficiently resolved to make the investment in a new concrete tie plant, that same resolution should instead be used as leverage to negotiate the best possible price from Productos de Concreto.

Track Structure Designs

The two most important factors in design of track structure are axle loading and speed. In the previous section under Operational Requirements, the maximum axle loadings and maximum speeds were defined for various classes of track. To summarize, these were:

CLASS	LOADING	SPEED
Main Line (Inter-Urban)	16 tonnes	70 km/h
Main Line (Freight/Banana)	16 tonnes	60 km/h
Branch Line (Banana)	13.2 tonnes	30 km/h
Yard Track (Banana)	13.2 tonnes	15 km/h

Using the above parameters and assuming a ballast depth of at least 200 mm and the use of concrete monobloc ties at 1429 per km (or wood ties at 1667 per km), the remaining variable to be determined is the rail section. The analyses of track structure in Appendix D-1 give the following results:

CLASS	RAIL SECTION
Main Line (Inter-Urban)	42 kg/m
Main Line (Freight/Banana)	35 kg/m
Branch Line (Banana)	30 kg/m
Yard Track (Banana)	25 kg/m

The above results indicate that, with the exception of the Inter-Urban system, it will be possible to rehabilitate the existing track reusing some of the existing rails. When one takes into account the cascading of rail from higher class tracks to lower class tracks, this will significantly reduce the amount of new rail to be purchased.

Railway Signal Systems

The term "railway signals" includes all control devices such as fixed or movable signs, fixed or changeable colored lights, and audible alarms or bells affect the movement of trains. Also included are devices which control the movement of road vehicles at road - rail crossings at grade. For the purpose of this discussion, we will consider that the term "railway signals" refers only to electric light signal systems and other electronic systems used as aids in controlling train operation. Railway signal systems fulfill three main purposes:

1. Increased efficiency of train operation.
2. Improved safety of train operation.
3. Improved safety of road - rail crossings.

Because of the important functions carried out by signal systems, particularly that of a safety device, the systems are made to be as "fail-safe" as possible, which increases the cost of such systems. Railway signal systems are usually considered to be optional, to be installed only where conditions warrant. Conditions which would justify the installation of a railway signal system include:

- Railway traffic congestion.
- High speed or closely spaced passenger trains.
- High speed or congested road - rail crossings.

The railway signal system proposed by ELC Electroconsult are of a fairly conventional European arrangement. The signal system featurescontrol of siding signals and electric switches by station personnel, with track circuits only in the vicinity of stations. A block system would apply between stations, incorporating end-of-train detection or check-in/check-out for block occupancy. The block system would operate over wire in a new communications cable. The system would be designed for future upgrading to Centralized Traffic Control (CTC). Such a system is completely feasible and is common around the world. Disadvantages are the high manpower requirement and the high cost.

The main alternatives to the above system are: CTC, with or without power operated switches; or a traffic supervision system such as Advanced Train Control System (ATCS), with or without wayside luminous signals.

The main advantages of the CTC system are that it uses less manpower because signals (and often switches) are centrally controlled by a dispatcher, and that it provides excellent traffic supervision and a high level of safety. The disadvantages are the high capital and maintenance costs, especially if it has power operated switches.

In ATCS, the dispatcher issues standardized instructions to the train driver by voice radio, but is assisted in this procedure by a special computer in the office. The system can be augmented by wayside luminous signals, and can be modified to issue instructions in printed form using an electric printer in the locomotive. ATCS provides a degree of traffic supervision as good as CTC, a high level of safety, with low capital and maintenance costs.

For the Inter-Urban transportation system it is recommended that a type of ATCS modelled on CP Rail's Computer-aided Manual Block System (CMBS) be employed. This is similar to Level 10 of the ATCS now being developed in North America. More advanced levels include visual displays of movement authorities for the train driver, automatic location reporting, automatic train stop or speed control, radio control of power switches, etc. These features can be added in the future as required.

For the initial CMBS installation, each station will be equipped with a spring switch at each end, normally lined to route entering trains to, say, the right-hand track. At the leaving end, each train would trail through the switch and then the spring mechanism would restore the points to their original position. In other words, under normal circumstances, no one is needed to operate switches. For train switching, or other unusual movements such as in an emergency, spring switches can be operated by hand in the same way as a hand-throw switch.

To supplement the safety of the system, it is proposed to install a luminous station entrance signal at each end of the stations. These signals are fully automatic, providing facing-point protection for the spring switch and governing movements entering the station. The station area will be fully equipped with track circuits for train detection, and thus the entrance signal would display a "stop" indication if another train was occupying the route. Further out from the station, "approach" signals will be installed to give advance warning of a "stop" indication at the station entrance signal.

An important consideration in a railway signal system is compatibility with electric traction. The proposed system will provide proper surge protection and induction mitigation measures. Track circuits will be single-rail so that one rail can be reserved for traction return.

The advantages of the above proposed system are that it provides a high level of train supervision and safety, it is modern and expandable, and it is inexpensive to install and maintain.

The Banana Transportation System

Due to problems with rail service and extension of the road network into the banana-growing areas, INCOFER has lost a portion of its banana transportation business to trucks. As a consequence, some of the banana branch lines are not presently in use. It is probable that some of the business which has been lost can be re-captured, but only after the railway has demonstrated an improved level of service. INCOFER's first priority must be to prevent further loss of business.

A weakness of ELC Electoconsult's scenario is that it proposes upgrading of branch lines where there is no present traffic, on the hopes of recapturing business after the track is restored. A better approach is to upgrade the branch lines which are still in use and then, as a second phase, systematically try to win back lost business, making investments only after agreements have been made with the shippers, and only if the investments are found to be viable.

The Inter-Oceanic Railway

The previous scenario by ELC Electroconsult integrates the Atlantic and Pacific Railways into one system, linked by a new connection at Alajuela and sharing a new railway yard and shop facility at Virilla, north of San Jose. Because of the lack of potential for through train service, Canadian Pacific Consulting Services will study the viability of the Atlantic and Pacific Railways as separate systems. The above scenario will be split into its two component parts.

The alternate scenario for the Atlantic Railway will be developed on the assumption that it will exist between Cartago and Alajuela only if the Inter-Urban Railway is not built. It is felt that the two systems cannot coexist on the same right-of-way for reasons of fundamental operational and administrative incompatibility between the systems and that the right-of-way width will not permit separation of the systems onto two tracks. The alternate scenario will retain the existing Atlantic Yard at San Jose and the existing interconnection between the Atlantic and Pacific Yards.

Because of the low volume of train traffic foreseen for the Atlantic Railway, neither signalling nor electrification are warranted at this time and will be excluded from the alternate scenario.

The alternate scenario for the Pacific railway will retain the Pacific Yard in San Jose. As in the case of the

Atlantic Railway, the present traffic volumes do not warrant the installation of a signal system. The existing INCOFER-owned electrification system for the Pacific Railway will be retained, however, all costs associated with generation and distribution of electric power will be treated as the cost of energy rather than as an infrastructure cost. This will permit easy comparison of electric and diesel energy for motive power.

The Inter-Urban Commuter Railway

The alternative scenario for the Inter-Urban Railway will differ from the earlier ELC Electroconsult scenario in the following ways:

- The commuter railway will not share facilities or right-of-way with the freight railway.
- The section from Heredia to Alajuela will be implemented immediately with the rest.
- The commuter system will be extended to the Pacific station in Alajuela.
- The Cartago station will be redesigned.
- The Heredia bypass will be eliminated.
- The amount of elevated line in San Jose will be reduced.
- Stations will be added at San Pedro, Santa Rosa, San Joaquin and Rio Segundo
- The station at Echeverria will be eliminated.
- The shop facility will be located at the Atlantic station at Alajuela.
- A storage/cleaning yard will be added at Reventado (Km 147.6)
- Grade separations will be added at Km 165.6 and 168.6, and eliminated at Km 162.3
- Primary communication will be by radio rather than telephone

These changes are intended to enable the system to better serve the commuting public, while reducing overall infrastructure costs.

IV The Inter-Urban Commuter Railway

For several years INCOFER has recognized the potential to develop a modern commuter service along the existing route from Cartago to Alajuela. The majority of urban development in Costa Rica's central valley has occurred along this axis. INCOFER has already attempted to provide this type of service with conventional passenger trains, but the old-fashioned passenger equipment, rough track and infrequent trains have made the service unattractive.

The following infrastructure scenarios have been developed to enable implementation of a modern, attractive commuter service which will partially supplant bus transportation in the Cartago - Alajuela corridor.

D-1. This scenario is an update of work done by ELC Electroconsult in 1986. Passenger stations are proposed for the following locations:

STATION	LOCATION
Cartago	Km 146.6
El Alto	Km 151.0
Tres Rios	Km 157.2
Curridabat	Km 162.2
San Jose	Km 167.0
Colima	Km 171.0
Heredia	Km 176.2
Echeverria	Km 183.0
Alajuela	Km 188.0

The infrastructure scenario includes the following physical features:

- Track renewal from Cartago to Alajuela
- Road overpass at Km 162.3
- Elevated track from Km 163.5 to Km 168.4
- New alignment from Km 169.2 to Km 170.5
- New alignment from Km 175.8 to Km 178.8 (includes 1.5 km elevated track)
- Railway yard and shop at Heredia
- Electrification at 25 kV 60 Hz
- Automatic block signal system
- Automatic road crossing signals
- Telephone communication system

The new track will consist of 42 kg/m rail and concrete ties. The subgrade and drainage will be rehabilitated where the track remains at the original grade. The electrification will be fed by commercial power using substations to be installed by INCOFER.

D-2. This scenario is based on further investigation of passenger demand and road crossings, together with infrastructure changes which will reduce capital cost. Passenger stations are proposed for the following points:

STATION	LOCATION
Cartago	Km 146.6
El Alto	Km 151.0
Tres Rios	Km 157.1
Curridabat	Km 162.2
San Pedro	Km 165.3
San Jose	Km 167.1
Colima	Km 171.1
Santa Rosa	Km 173.2
Heredia	Km 176.6
San Joaquin	Km 180.7
Rio Segundo	Km 184.6
Alajuela	Km 189.5

The infrastructure scenario includes the following physical features:

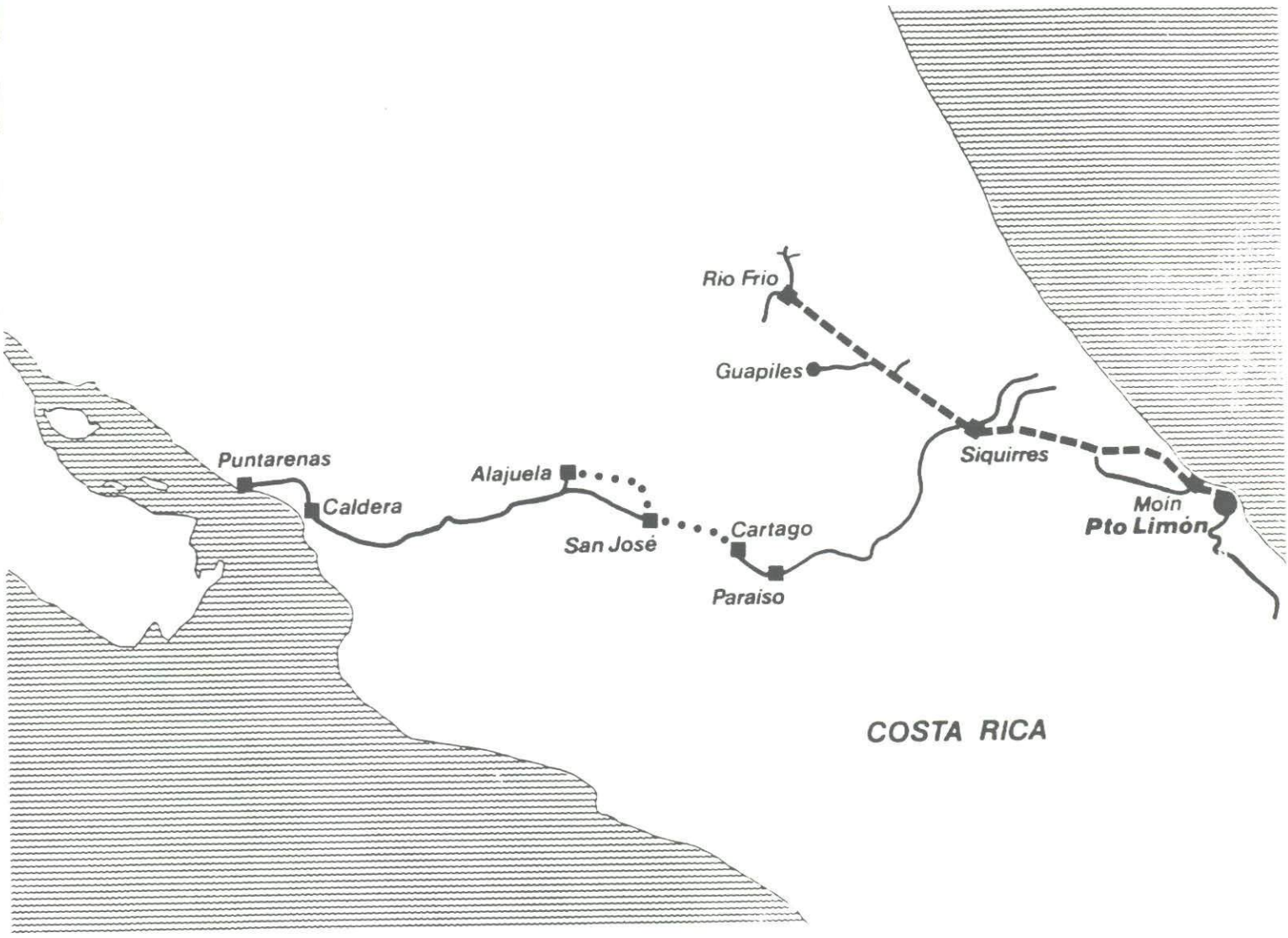
- Track renewal from Cartago to Alajuela
- Enlarged station site at Cartago
- Train storage yard at Reventado, Km 147.6
- Grade separation at Km 165.6
- Elevated track from Km 166.7 to Km 167.6
- Grade separation at Km 168.6
- New alignment from Km 169.2 to Km 170.5
- Enlarged station site at Heredia
- Railway yard and shops at Km 188.0
- New alignment from Km 188.1 to Km 188.9
- Electrification at 25 kV 60 Hz
- Computer-aided train supervision
- Station protection signal system
- Automatic road crossing signals
- Radio communication system

The new track will consist of 42 kg/m rail and concrete ties. The subgrade and drainage will be rehabilitated where the track remains at the original grade. The electrification will be fed by commercial power using substations to be installed by INCOFER.

D-3. This scenario is the same as Scenario D-2 except that electrification is excluded.

1. DATA ON EXISTING RAILWAY

Figure 1
THE COSTA RICA RAILWAY NETWORK

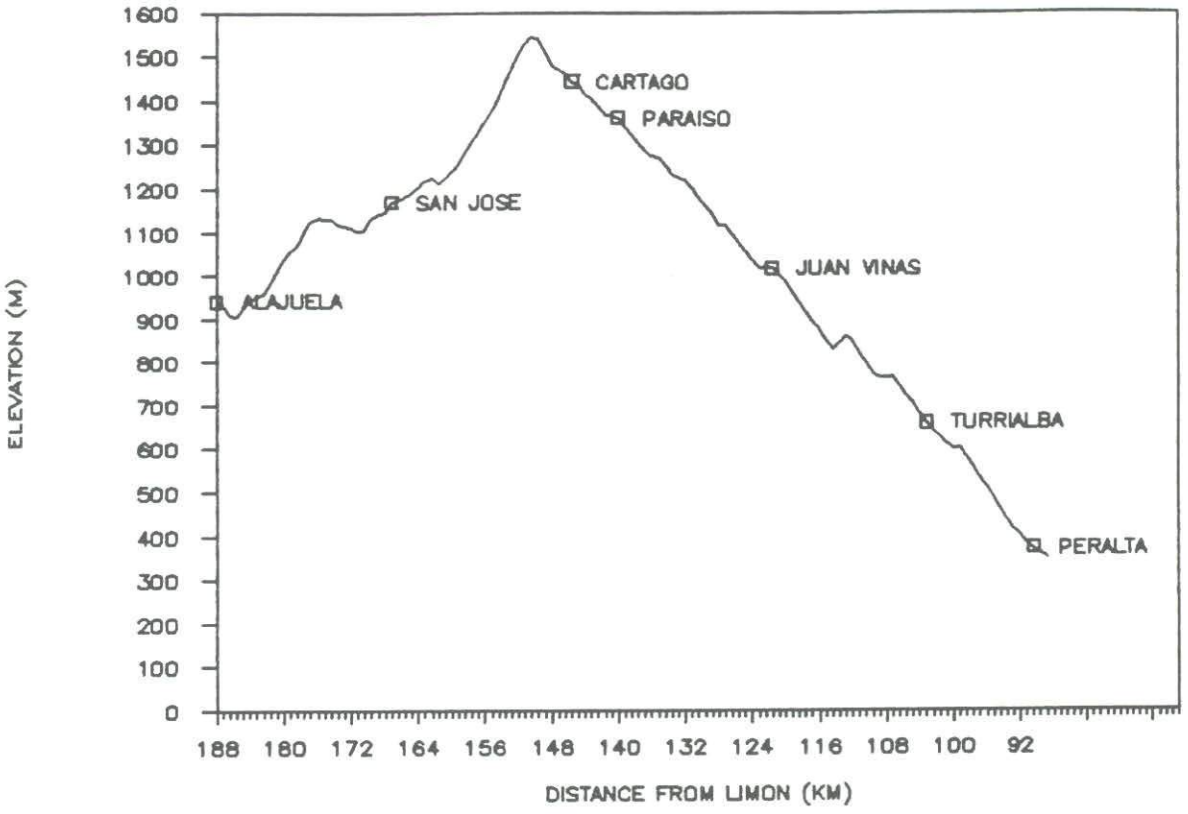


▬▬▬ Portion rehabilitated by Canadian Pacific Consulting Services Ltd.

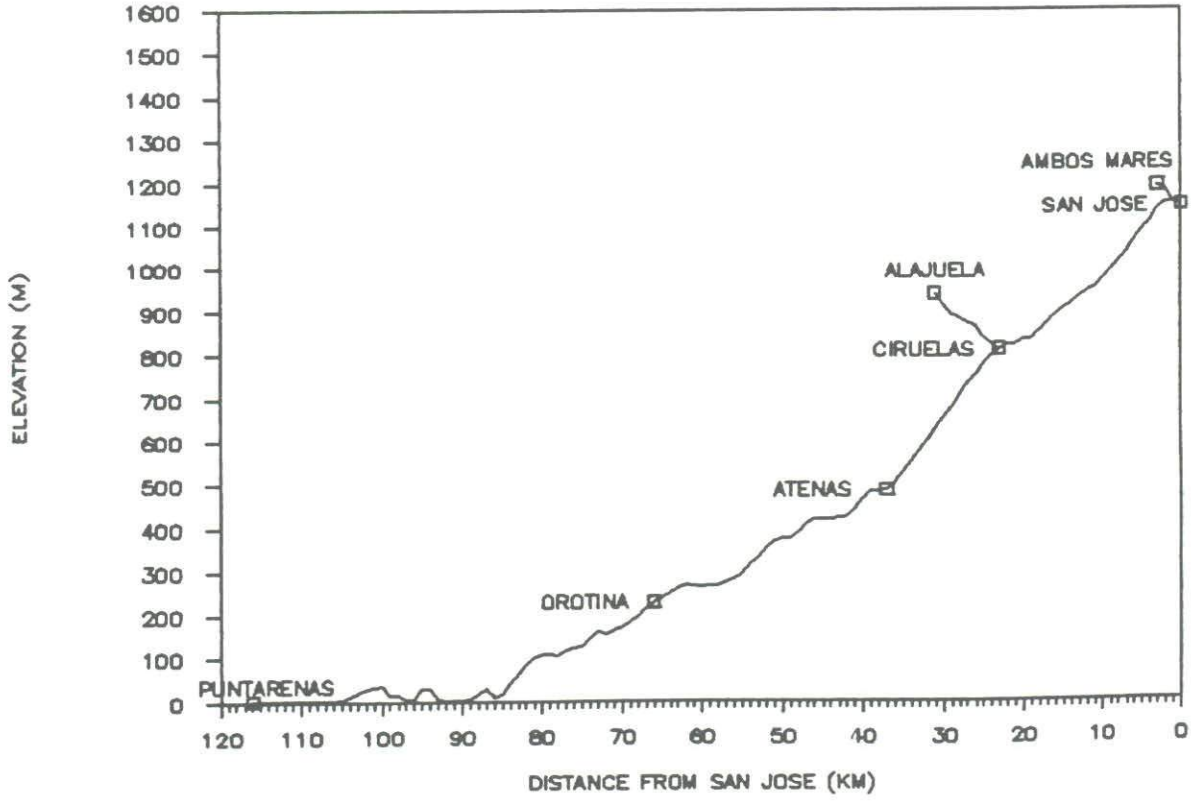
●●●●●●● Alajuela –San José –Cartago Corridor

1.2

PROFILE OF ATLANTIC RAILWAY



PROFILE OF PACIFIC RAILWAY



1.3 SUMMARY OF ROUTE LENGTHS - INCOFER

NAME	FROM	KM	TO	KM	DIST KM	CLASS	YARD TRKS	JUNCT
Via San Cristobal	Limon	0.00	La Junta	65.00	65.00	ML	39.00	-
Via San Cristobal	La Junta	65.00	San Cristobal	109.00	44.00	ML	8.50	-
Ramal Estrella	Km 2.4	2.40	Ley River	50.80	48.40	BL	4.50	Km 2.4 Via San Cristobal
	Ley River	50.80	Vesta	53.80	3.00	YD	0.50	Km 50.8 Ramal Estrella
	Ley River	0.00	Finca 20	4.40	4.40	YD	2.50	Km 50.8 Ramal Estrella
Ramal La Playa	La Playa	0.00	San Isidro	1.00	1.00	YD	0.00	Km 12.6 Via San Crist.
Ramal Monte Verde	Monte Verde	0.00	Freeman	21.00	21.00	BL	0.50	Km 54.6 Via San Crist.
Ramal G-Melina	G-Melina	0.00	Melina 2	2.50	2.50	YD	0.00	Km 8.7 Ramal Monte Verde
Ramal Indiana (*)	Indiana	0.00	Imperio 2	16.10	16.10	BL	0.50	Km 61.2 Via San Crist.
Ramal El Carmen (*)	El Carmen	0.00	"Y" Imperio	14.50	14.50	YD	1.00	Km 8.5 Ramal Indiana
Ramal Parismina (*)	Parismina	0.00	Rio Jiminez	9.50	9.50	BL	0.00	Km 82.2 Via San Crist.
Ramal Guapiles	Guacimo	0.00	Toro Amarillo	13.90	13.90	BL	0.50	Km 86.1 Via San Crist.
Ramal Santa Clara	Walkeria	0.00	Clara C	10.00	10.00	BL	0.50	Km 95.4 Via San Crist.
Ramal Rio Frio	San Cristobal	0.00	Viet Nam	10.70	10.70	BL	12.80	Km 109.0 Via San Crist.
Ramal Tica Ban	San Cristobal	0.00	Tica Ban 2	9.60	9.60	BL	2.50	Km 109.0 Via San Crist.
Ramal Trancari (*)	Trancari	0.00	San Pedro	8.20	8.20	YD	3.50	Km 5.2 Ramal Tica Ban
Via Alajuela	La Junta	65.00	San Jose	167.00	102.00	ML	14.50	Km 65.0 Via San Crist.
Via Alajuela	San Jose	167.00	Alajuela	188.00	21.00	BL	3.20	-
Via Puntarenas	San Jose	0.00	Puntarenas	116.00	116.00	ML	15.60	-
Ramal Empalme	San Jose	0.00	Ambos Mares	3.10	3.10	YD	0.00	Km 0.0 Via Puntarenas
Ramal Alajuela	Ciruelas	0.00	Alajuela	8.00	8.00	BL	1.50	Km 22.7 Via Puntarenas
Ramal Purruja	Km 88.4	0.00	Purruja	4.60	4.60	BL	5.50	Km 88.4 Via Puntarenas
Total Class ML					327.00 km			
Total Class BL					172.80 km			
Total Class YD					36.70 km		117.10 km	
TOTAL					536.50 km			

(*) - Not in service

Source: INCOFER

1.4 LIST OF IMPORTANT STATIONS - INCOFER

NAME	KM	LINE	SDG CAP	COMMENTS
Limon	0.00	Via San Cristobal		Yard
Moin	7.50	Via San Cristobal		Yard
Miramar	12.80	Via San Cristobal	30	Siding
Bocas	21.20	Via San Cristobal	30	Siding
Saborio	30.60	Via San Cristobal	30	Siding
Estrada	35.20	Via San Cristobal		Yard
Matina	37.80	Via San Cristobal	30	Siding
Margarita	41.20	Via San Cristobal	30	Siding
Madre de Dios	49.20	Via San Cristobal	30	Siding
Rio Hondo	50.40	Via San Cristobal	30	Siding
Siquirres	62.00	Via San Cristobal		Yard
Babilonia	70.40	Via San Cristobal	30	Siding
America	72.60	Via San Cristobal	30	Siding
Las Mercedes	77.40	Via San Cristobal	35	Siding
Aparicio	80.60	Via San Cristobal	30	Siding
Guacimo	86.10	Via San Cristobal		Yard
Altamira	88.60	Via San Cristobal	30	Siding
Leesville	96.40	Via San Cristobal		Yard
San Cristobal	109.00	Via San Cristobal		Yard
La Junta	65.40	Via San Jose		Yard
Araya	70.00	Via San Jose	25	Siding
Las Lomas	75.40	Via San Jose	23	Siding
El Rubi	77.60	Via San Jose	25	Siding
Tunel	87.80	Via San Jose	23	Siding
Peralta	90.20	Via San Jose		Yard
Rio Jesus Maria	96.40	Via San Jose	21	Siding
Turrialba	102.80	Via San Jose		Yard
Florencia	107.40	Via San Jose	18	Siding
Las Pavas	109.80	Via San Jose	17	Siding
Juan Vinas	121.40	Via San Jose	30	Yard/Siding
El Rincon	137.40	Via San Jose	25	Siding
Paraiso	140.00	Via San Jose	10	Siding
Cartago	146.40	Via San Jose		Yard
El Alto	151.00	Via San Jose	40	Siding
Tres Rios	157.20	Via San Jose	15	Siding
Curridabat	162.20	Via San Jose	20	Siding
San Jose	167.00	Via San Jose		Atlantic Yard
Colima	171.00	Via San Jose		Yard
Heredia	176.60	Via San Jose	6	Siding
San Francisco	178.00	Via San Jose	10	Siding
Alajuela	188.00	Via San Jose	47	Yard/Siding

Source: INCOFER

LIST OF IMPORTANT STATIONS - INCOFER

NAME	KM	LINE	SDG CAP	COMMENTS
San Jose	0.00	Via Puntarenas		Pacific Yard
San Antonio	14.40	Via Puntarenas	9	Siding
Ojo de Agua	18.70	Via Puntarenas	20	Siding
Ciruelas	22.70	Via Puntarenas	34	Yard/Siding
Fournier	26.70	Via Puntarenas	13	Siding
Turrucares	30.30	Via Puntarenas	12	Siding
Atenas	37.30	Via Puntarenas	19	Yard/Siding
Balsa	41.80	Via Puntarenas	28	Siding
Poncho Mora	46.50	Via Puntarenas	17	Siding
Escobal	49.70	Via Puntarenas	20	Siding
Quebradas	52.50	Via Puntarenas	18	Siding
Concepcion	56.00	Via Puntarenas	36	Siding
Dantas	59.00	Via Puntarenas	40	Yard/Siding
Hacienda Vieja	62.10	Via Puntarenas	20	Siding
Orotina	66.20	Via Puntarenas	40	Yard/Siding
Pozon	73.90	Via Puntarenas	17	Siding
Uvita	82.00	Via Puntarenas	16	Siding
Jesus Maria	85.80	Via Puntarenas	22	Siding
Salinas	89.20	Via Puntarenas	10	Yard/Siding
Cabezas	96.80	Via Puntarenas	16	Siding
Barranca	102.00	Via Puntarenas		Yard
Chacarita	110.00	Via Puntarenas	20	Siding
Puntarenas	116.00	Via Puntarenas		Yard
Montecillos	5.00	Ramal Alajuela	13	Siding
Alajuela	8.00	Ramal Alajuela	40	Siding
Purruja	4.60	Ramal Purruja		Yard

Source: INCOFER

1.5 TRACK PROFILE MILE 55.0 - 80.0 ATLANTIC RWY

0.04

MILE	ELEV FT	CURVES MAX	CURVES AVER	KM	ELEV M	GRADE AVER	GRADE COMP	
55.0	1148			88.51	350			
55.5	1185	0.0	0.0	89.32	361	1.40	1.40	+
56.0	1222	4.5	0.5	90.12	372	1.40	1.42	+
56.5	1260	4.5	0.5	90.93	384	1.44	1.46	+
57.0	1322	9.5	3.0	91.73	403	2.35	2.47	++
57.5	1362	10.0	6.5	92.54	415	1.52	1.78	+
58.0	1432	15.5	9.0	93.34	436	2.65	3.01	+++
58.5	1512	19.0	12.0	94.15	461	3.03	3.51	+++
59.0	1592	20.0	14.0	94.95	485	3.03	3.59	+++
59.5	1671	19.0	10.0	95.76	509	2.99	3.39	+++
60.0	1750	19.0	10.0	96.56	533	2.99	3.39	+++
60.5	1828	20.0	15.0	97.37	557	2.95	3.55	+++
61.0	1907	20.0	12.0	98.17	581	2.99	3.47	+++
61.5	1979	20.0	7.5	98.97	603	2.73	3.03	+++
62.0	1967	6.5	2.5	99.78	600	-0.45	-0.55	
62.5	2004	8.8	3.0	100.58	611	1.40	1.52	+
63.0	2051	9.5	3.0	101.39	625	1.78	1.90	+
63.5	2090	15.0	5.0	102.19	637	1.48	1.68	+
64.0	2161	20.0	6.0	103.00	659	2.69	2.93	++
64.5	2238	20.0	15.0	103.80	682	2.92	3.52	+++
65.0	2313	20.0	16.0	104.61	705	2.84	3.48	+++
65.5	2369	21.0	15.0	105.41	722	2.12	2.72	++
66.0	2442	20.0	12.0	106.22	744	2.77	3.25	+++
66.5	2518	16.0	8.0	107.02	767	2.88	3.20	+++
67.0	2509	20.0	12.5	107.83	765	-0.34	-0.84	
67.5	2509	18.0	9.0	108.63	765	0.00	-0.36	
68.0	2543	20.0	16.0	109.44	775	1.29	1.93	+
68.5	2620	20.0	13.0	110.24	799	2.92	3.44	+++
69.0	2701	20.0	15.0	111.04	823	3.07	3.67	+++
69.5	2775	20.0	17.0	111.85	846	2.80	3.48	+++
70.0	2815	20.0	16.0	112.65	858	1.52	2.16	++
70.5	2767	23.0	18.0	113.46	843	-1.82	-2.54	--
71.0	2719	20.0	13.0	114.26	829	-1.82	-2.34	--
71.5	2780	20.0	15.0	115.07	847	2.31	2.91	++
72.0	2861	20.0	15.0	115.87	872	3.07	3.67	+++
72.5	2925	20.0	16.0	116.68	892	2.42	3.06	+++
73.0	2998	20.0	12.0	117.48	914	2.77	3.25	+++
73.5	3075	20.0	10.0	118.29	937	2.92	3.32	+++
74.0	3154	18.0	8.0	119.09	961	2.99	3.31	+++
74.5	3229	20.0	12.0	119.90	984	2.84	3.32	+++
75.0	3271	20.0	2.5	120.70	997	1.59	1.69	+
75.5	3331	20.0	14.0	121.51	1015	2.27	2.83	++
76.0	3343	20.0	15.0	122.31	1019	0.45	1.05	+
76.5	3329	20.0	12.0	123.11	1015	-0.53	-1.01	-
77.0	3394	20.0	11.0	123.92	1034	2.46	2.90	++
77.5	3459	20.0	5.0	124.72	1054	2.46	2.66	++
78.0	3526	15.0	4.0	125.53	1075	2.54	2.70	++
78.5	3582	20.0	10.0	126.33	1092	2.12	2.52	++
79.0	3652	20.0	10.0	127.14	1113	2.65	3.05	+++
79.5	3656	20.0	10.0	127.94	1114	0.15	0.55	
80.0	3732	20.0	10.0	128.75	1138	2.88	3.28	+++

TRACK PROFILE MILE 80.0 -105.0 ATLANTIC RWY

MILE	ELEV FT	CURVES MAX	CURVES AVER	KM	ELEV M	GRADE AVER	GRADE COMP (0.04)	
80.0	3732			128.75	1138			
80.5	3795	20.0	15.0	129.55	1157	2.39	2.99	++
81.0	3869	20.0	10.0	130.36	1179	2.80	3.20	+++
81.5	3939		14.0	131.16	1201	2.65	3.21	+++
82.0	4004	20.0	12.0	131.97	1220	2.46	2.94	++
82.5	4013	20.0	18.0	132.77	1223	0.34	1.06	+
83.0	4037	24.5	13.0	133.58	1230	0.91	1.43	+
83.5	4110	20.0	12.0	134.38	1253	2.77	3.25	+++
84.0	4174	20.0	14.0	135.18	1272	2.42	2.98	++
84.5	4178	20.0	16.0	135.99	1273	0.15	0.79	
85.0	4224	16.0	5.0	136.79	1287	1.74	1.94	+
85.5	4276	20.0	6.0	137.60	1303	1.97	2.21	++
86.0	4342	20.0	16.0	138.40	1323	2.50	3.14	+++
86.5	4389	5.3	1.5	139.21	1338	1.78	1.84	+
87.0	4466	5.3	0.5	140.01	1361	2.92	2.94	++
87.5	4483	3.8	0.7	140.82	1366	0.64	0.67	
88.0	4486	1.0	0.1	141.62	1367	0.11	0.12	
88.5	4547	4.0	0.8	142.43	1386	2.31	2.34	++
89.0	4605	4.5	0.9	143.23	1404	2.20	2.23	++
89.5	4647	0.0	0.0	144.04	1416	1.59	1.59	+
90.0	4715	9.5	3.0	144.84	1437	2.58	2.70	++
90.5	4734	12.0	1.3	145.65	1443	0.72	0.77	
91.0	4797	16.0	1.4	146.45	1462	2.39	2.44	++
91.5	4819	4.5	1.5	147.25	1469	0.83	0.89	
92.0	4850	0.0	0.0	148.06	1478	1.17	1.17	+
92.5	4953	13.0	8.0	148.86	1510	3.90	4.22	+++
93.0	5055	16.0	6.0	149.67	1541	3.86	4.10	+++
93.5	5066	6.5	1.5	150.47	1544	0.42	0.48	
94.0	5011	7.0	2.5	151.28	1527	-2.08	-2.18	--
94.5	4941	8.5	3.0	152.08	1506	-2.65	-2.77	--
95.0	4836	9.8	4.0	152.89	1474	-3.98	-4.14	---
95.5	4729	8.0	4.0	153.69	1441	-4.05	-4.21	---
96.0	4624	4.5	2.5	154.50	1409	-3.98	-4.08	---
96.5	4519	8.0	3.5	155.30	1377	-3.98	-4.12	---
97.0	4429	8.0	2.5	156.11	1350	-3.41	-3.51	---
97.5	4351	8.0	3.5	156.91	1326	-2.95	-3.09	---
98.0	4290	8.0	3.0	157.72	1308	-2.31	-2.43	--
98.5	4199	6.0	3.0	158.52	1280	-3.45	-3.57	---
99.0	4124	9.3	4.5	159.32	1257	-2.84	-3.02	---
99.5	4068	13.0	4.5	160.13	1240	-2.12	-2.30	--
100.0	4019	11.0	5.0	160.93	1225	-1.86	-2.06	--
100.5	3981	8.0	3.0	161.74	1213	-1.44	-1.56	-
101.0	4013	0.0	0.0	162.54	1223	1.21	1.21	+
101.5	4004	9.0	4.5	163.35	1220	-0.34	-0.52	
102.0	3946	1.0	0.6	164.15	1203	-2.20	-2.22	--
102.5	3910	4.3	1.5	164.96	1192	-1.36	-1.42	-
103.0	3879	4.5	1.6	165.76	1182	-1.17	-1.24	-
103.5	3849	12.0	3.5	166.57	1173	-1.14	-1.28	-
104.0	3836	10.0	2.5	167.37	1169	-0.49	-0.59	
104.5	3749	13.5	2.5	168.18	1143	-3.30	-3.40	---
105.0	3744	20.0	4.5	168.98	1141	-0.19	-0.37	

TRACK PROFILE MILE 105.0 -116.75 ATLANTIC RWY

0.04

MILE	ELEV FT	CURVES MAX	CURVES AVER	KM	ELEV M	GRADE AVER	GRADE COMP	
105.0	3744			168.98	1141			
105.5	3710	3.5	0.3	169.79	1131	-1.29	-1.30	-
106.0	3623	15.0	1.5	170.59	1104	-3.30	-3.36	---
106.5	3616	22.0	11.5	171.39	1102	-0.27	-0.73	
107.0	3643	0.0	0.0	172.20	1110	1.02	1.02	+
107.5	3659	6.5	2.0	173.00	1115	0.61	0.69	
108.0	3666	2.0	0.4	173.81	1117	0.27	0.28	
108.5	3700	0.0	0.0	174.61	1128	1.29	1.29	+
109.0	3712	15.0	5.0	175.42	1131	0.45	0.65	
109.5	3714	4.8	0.3	176.22	1132	0.08	0.09	
110.0	3683	7.5	3.5	177.03	1123	-1.17	-1.31	-
110.5	3604	4.0	0.4	177.83	1098	-2.99	-3.01	---
111.0	3508	3.5	1.4	178.64	1069	-3.64	-3.69	---
111.5	3469	7.0	2.1	179.44	1057	-1.48	-1.56	-
112.0	3406	0.0	0.0	180.25	1038	-2.39	-2.39	--
112.5	3325	0.8	0.2	181.05	1013	-3.07	-3.08	---
113.0	3224	16.0	4.0	181.86	983	-3.83	-3.99	---
113.5	3139	9.8	3.5	182.66	957	-3.22	-3.36	---
114.0	3126	5.5	2.5	183.46	953	-0.49	-0.59	
114.5	3092	9.8	2.0	184.27	942	-1.29	-1.37	-
115.0	3029	5.0	2.4	185.07	923	-2.39	-2.48	--
115.5	2972	18.0	9.0	185.88	906	-2.16	-2.52	--
116.0	2987	8.8	4.7	186.68	910	0.57	0.76	
116.5	3047	8.5	4.0	187.49	929	2.27	2.43	++
116.8	3087	18.0	6.0	187.89	941	3.03	3.27	+++

TRACK PROFILE - San Jose Interconnection

KM	ELEV FT	CURVES MAX	CURVES AVER	ELEV M	GRADE AVER	GRADE COMP (0.04)
0.0	3760			1146		
0.5	3773	0.0	0.0	1150	0.79	0.79
1.0	3789	12.0	5.0	1155	0.98	1.18 +
1.5	3829	16.0	4.0	1167	2.44	2.60 ++
2.0	3870	9.0	4.0	1180	2.50	2.66 ++
2.5	3910	16.0	12.0	1192	2.44	2.92 ++
2.7	3912	16.0	16.0	1192	0.12	0.76

TRACK PROFILE Km 0 - 17.5 Pacific Railway

KM	ELEV FT	CURVES MAX	CURVES AVER	ELEV M	GRADE AVER	GRADE COMP (0.04)
0.0	3760			1146		
0.5	3758	0.0	0.0	1145	-0.12	-0.12
1.0	3791	10.0	4.0	1155	2.01	2.17 ++
1.5	3783	10.0	3.0	1153	-0.49	-0.61
2.0	3780	6.0	1.0	1152	-0.18	-0.22
2.5	3751	6.0	1.5	1143	-1.77	-1.83 -
3.0	3724	0.0	0.0	1135	-1.65	-1.65 -
3.5	3689	0.0	0.0	1124	-2.13	-2.13 --
4.0	3640	11.0	3.0	1109	-2.99	-3.11 ---
4.5	3600	17.0	10.0	1097	-2.44	-2.84 --
5.0	3559	10.0	1.5	1085	-2.50	-2.56 --
5.5	3518	10.0	4.0	1072	-2.50	-2.66 --
6.0	3487	5.0	1.0	1063	-1.89	-1.93 -
6.5	3446	0.0	0.0	1050	-2.50	-2.50 --
7.0	3404	15.0	6.0	1038	-2.56	-2.80 --
7.5	3361	15.0	7.0	1024	-2.62	-2.90 --
8.0	3325	12.0	3.0	1013	-2.19	-2.31 --
8.5	3286	8.0	2.5	1002	-2.38	-2.48 --
9.0	3257	10.0	1.5	993	-1.77	-1.83 -
9.5	3215	10.0	3.0	980	-2.56	-2.68 --
10.0	3191	20.0	10.0	973	-1.46	-1.86 -
10.5	3169	0.0	0.0	966	-1.34	-1.34 -
11.0	3133	16.0	6.0	955	-2.19	-2.43 --
11.5	3127	16.0	9.0	953	-0.37	-0.73
12.0	3105	20.0	10.0	946	-1.34	-1.74 -
12.5	3083	10.0	4.0	940	-1.34	-1.50 -
13.0	3062	5.0	4.5	933	-1.28	-1.46 -
13.5	3025	5.0	2.0	922	-2.26	-2.34 --
14.0	3010	10.0	4.0	917	-0.91	-1.07 -
14.5	3005	17.0	5.0	916	-0.30	-0.50
15.0	2975	5.0	1.0	907	-1.83	-1.87 -
15.5	2938	5.0	1.0	896	-2.26	-2.30 --
16.0	2916	0.0	0.0	889	-1.34	-1.34 -
16.5	2892	0.0	0.0	881	-1.46	-1.46 -
17.0	2856	10.5	2.5	871	-2.19	-2.29 --
17.5	2816	2.0	0.5	858	-2.44	-2.46 --

TRACK PROFILE Km 17.5 - 29 Pacific Railway

0.04

KM	ELEV FT	CURVES MAX	CURVES AVER	ELEV M	GRADE AVER	GRADE COMP	
17.5	2816	2.0	0.5	858	-2.44	-2.46	--
18.0	2798	2.0	0.4	853	-1.10	-1.11	-
18.5	2763	4.0	1.0	842	-2.13	-2.17	--
19.0	2744	0.0	0.0	836	-1.16	-1.16	-
19.5	2744	5.0	2.0	836	0.00	-0.08	
20.0	2744	0.0	0.0	836	0.00	0.00	
20.5	2735	7.5	2.0	834	-0.55	-0.63	
21.0	2699	7.5	4.0	823	-2.19	-2.35	--
21.5	2699	0.0	0.0	823	0.00	0.00	
22.0	2698	0.0	0.0	822	-0.06	-0.06	
22.5	2660	10.0	8.0	811	-2.32	-2.64	--
23.0	2663	4.8	1.5	812	0.18	0.24	
23.5	2649	0.0	0.0	807	-0.85	-0.85	
24.0	2609	4.2	2.0	795	-2.44	-2.52	--
24.5	2576	0.0	0.0	785	-2.01	-2.01	--
25.0	2544	0.0	0.0	775	-1.95	-1.95	-
25.5	2510	12.0	3.0	765	-2.07	-2.19	--
26.0	2470	10.0	9.0	753	-2.44	-2.80	--
26.5	2428	16.3	10.0	740	-2.56	-2.96	--
27.0	2386	16.0	6.0	727	-2.56	-2.80	--
27.5	2344	15.0	10.0	714	-2.56	-2.96	--
28.0	2302	15.2	10.0	702	-2.56	-2.96	--
28.5	2260	14.4	6.0	689	-2.56	-2.80	--
29.0	2218			676	-2.56	-2.56	--

TRACK PROFILE Km 0 - 8 Alajuela Br.

0.04

KM	ELEV FT	CURVES MAX	CURVES AVER	ELEV M	GRADE AVER	GRADE COMP	
0.0	2662			811			
0.5	2682	10.0	2.0	817	1.22	1.30	+
1.0	2707	0.0	0.0	825	1.52	1.52	+
1.5	2722	0.0	0.0	830	0.91	0.91	
2.0	2762	14.0	4.0	842	2.44	2.60	++
2.5	2802	20.0	11.0	854	2.44	2.88	++
3.0	2842	6.0	1.0	866	2.44	2.48	++
3.5	2864	0.0	0.0	873	1.34	1.34	+
4.0	2867	8.0	2.0	874	0.18	0.26	
4.5	2882	14.0	2.0	878	0.91	0.99	
5.0	2903	14.0	2.0	885	1.28	1.36	+
5.5	2885	0.0	0.0	879	-1.10	-1.10	-
6.0	2921	20.0	11.0	890	2.19	2.63	++
6.5	2962	20.0	17.0	903	2.50	3.18	+++
7.0	3000	20.0	18.0	914	2.32	3.04	+++
7.5	3041	20.0	14.0	927	2.50	3.06	+++
8.0	3083	20.0	14.0	940	2.56	3.12	+++

TRACK PROFILE Km 29 - 79 Pacific Rwy

					0.04
	ELEV	CURVES		GRADE	
KM	M	MAX	AVER	AVER	COMP
29.0	676				
30.0	650			-2.60	-2.60 --
31.0	625			-2.50	-2.50 --
32.0	600			-2.50	-2.50 --
33.0	575			-2.50	-2.50 --
34.0	550			-2.50	-2.50 --
35.0	525			-2.50	-2.50 --
36.0	501			-2.40	-2.40 --
37.0	485			-1.60	-1.60 -
38.0	483			-0.20	-0.20
39.0	483			0.00	0.00
40.0	463			-2.00	-2.00 --
41.0	438			-2.50	-2.50 --
42.0	423			-1.50	-1.50 -
43.0	422			-0.10	-0.10
44.0	419			-0.30	-0.30
45.0	419			0.00	0.00
46.0	419			0.00	0.00
47.0	410			-0.90	-0.90
48.0	390			-2.00	-2.00 --
49.0	375			-1.50	-1.50 -
50.0	375			0.00	0.00
51.0	369			-0.60	-0.60
52.0	352			-1.70	-1.70 -
53.0	333			-1.90	-1.90 -
54.0	316			-1.70	-1.70 -
55.0	296			-2.00	-2.00 --
56.0	282			-1.40	-1.40 -
57.0	278			-0.40	-0.40
58.0	269			-0.90	-0.90
59.0	267			-0.20	-0.20
60.0	265			-0.20	-0.20
61.0	269			0.40	0.40
62.0	270			0.10	0.10
63.0	260			-1.00	-1.00 -
64.0	252			-0.80	-0.80
65.0	241			-1.10	-1.10 -
66.0	230			-1.10	-1.10 -
67.0	215			-1.50	-1.50 -
68.0	198			-1.70	-1.70 -
69.0	183			-1.50	-1.50 -
70.0	173			-1.00	-1.00 -
71.0	163			-1.00	-1.00 -
72.0	153			-1.00	-1.00 -
73.0	159			0.60	0.60
74.0	144			-1.50	-1.50 -
75.0	128			-1.60	-1.60 -
76.0	124			-0.40	-0.40
77.0	118			-0.60	-0.60
78.0	106			-1.20	-1.20 -
79.0	109			0.30	0.30

TRACK PROFILE Km 79 -116 Pacific Rwy

0.04

KM	ELEV M	CURVES MAX	CURVES AVER	GRADE AVER	GRADE COMP	
79.0	109					
80.0	107			-0.20	-0.20	
81.0	102			-0.50	-0.50	
82.0	82			-2.00	-2.00	--
83.0	66			-1.60	-1.60	-
84.0	44			-2.20	-2.20	--
85.0	18			-2.60	-2.60	--
86.0	9			-0.90	-0.90	
87.0	32			2.30	2.30	++
88.0	19			-1.30	-1.30	-
89.0	6			-1.30	-1.30	-
90.0	3			-0.30	-0.30	
91.0	4			0.10	0.10	
92.0	3			-0.10	-0.10	
93.0	6			0.30	0.30	
94.0	31			2.50	2.50	++
95.0	31			0.00	0.00	
96.0	6			-2.50	-2.50	--
97.0	6			0.00	0.00	
98.0	14			0.80	0.80	
99.0	15			0.10	0.10	
100.0	39			2.40	2.40	++
101.0	35			-0.40	-0.40	
102.0	30			-0.50	-0.50	
103.0	21			-0.90	-0.90	
104.0	13			-0.80	-0.80	
105.0	7			-0.60	-0.60	
106.0	4			-0.30	-0.30	
107.0	4			0.00	0.00	
108.0	4			0.00	0.00	
109.0	4			0.00	0.00	
110.0	4			0.00	0.00	
111.0	4			0.00	0.00	
112.0	4			0.00	0.00	
113.0	4			0.00	0.00	
114.0	4			0.00	0.00	
115.0	4			0.00	0.00	
116.0	4			0.00	0.00	

1.6 INVENTORY OF RAILS IN TRACK

MAIN TRACKS:

FROM	KM	TO	KM	DIST	<60 LB	60 LB	70 LB	75 LB	80 LB	85 LB
Limon	0.0	La Junta	65.0	65.0						65.0
La Junta	65.0	San Cristobal	109.0	44.0						44.0
La Junta	65.0	Turrialba	102.8	37.8		17.0	16.2	3.8	0.8	
Turrialba	102.8	Paraiso	140.0	37.2		16.6	5.0	4.6	11.0	
Paraiso	140.0	San Jose	167.0	27.0		13.9	12.9		0.2	
San Jose	167.0	Alajuela	188.0	21.0	17.5		3.5			
San Jose (P)	0.0	Ambos Mares	2.7	2.7		1.5	1.2			
San Jose	0.0	Ciruelas	22.7	22.7	3.0	1.2	6.3		12.2	
Ciruelas	0.0	Alajuela	8.0	8.0	4.0	4.0				
Ciruelas	22.7	Km 88.4	88.4	65.7	2.6	0.2	48.5	4.2	10.2	
Km 88.4	0.0	Purruja	4.6	4.6			4.6			
Km 88.4	88.4	Puntarenas	116.0	27.6			10.4	2.0	15.2	
SUB-TOTAL				363.3	27.1	54.4	108.6	14.6	49.6	109.0

BANANA BRANCH LINES:

BRANCH LINE		DIST	< 60 LB	60 LB	70 LB	75 LB	80 LB	85 LB
Estrella	-Trunk	52.4	0.4	2.6	49.4			
	-Feeder	8.4	7.6	0.3	0.5			
Monteverde	-Trunk	14.8	12.4	2.4				
	-Feeder	6.2	6.2					
Indiana/Imperio	-Trunk	14.0	14.0					
	-Feeder	17.3	17.3					
Parismina	-Trunk	9.5	9.5					
	-Feeder	0.0						
Guapiles	-Trunk	11.9	11.9					
	-Feeder	2.0	2.0					
Roxana	-Trunk	7.2	7.2					
	-Feeder	2.8	2.8					
Rio Frio	-Trunk	4.0		1.4		2.6		
	-Feeder	19.8	19.8					
Ticaban	-Trunk	5.5	4.0	1.5				
	-Feeder	4.0	4.0					
Trancari	-Trunk	5.5	5.5					
	-Feeder	6.8	6.8					
Other Branches:								
Freehold	-Feeder	0.5		0.5				
Guajira	-Feeder	1.0	1.0					
La Teresa	-Feeder	1.5		0.8	0.7			
SUB-TOTAL		195.1	132.4	9.5	50.6	2.6	0.0	0.0
GRAND TOTAL		558.4	159.5	63.9	159.2	17.2	49.6	109.0

Source: INCOFER

1.7 INVENTORY OF TIES IN TRACK

MAIN TRACKS:

FROM	KM	TO	KM	DIST	WOOD	STEEL	CONC	% DEFECTIVE WOOD	% DEFECTIVE STEEL	% DEFECTIVE CONC
Limon	0.0	La Junta	65.0	65.0			65.0			1.0%
La Junta	65.0	San Cristobal	109.0	44.0			44.0			1.0%
La Junta	65.0	Turrialba	102.8	37.8	34.0		3.8	40.0%		5.0%
Turrialba	102.8	Paraiso	140.0	37.2	31.6	1.9	3.7	30.0%	10.0%	5.0%
Paraiso	140.0	San Jose	167.0	27.0	21.6	2.7	2.7	20.0%	10.0%	5.0%
San Jose	167.0	Alajuela	188.0	21.0	17.9	1.0	2.1	30.0%	10.0%	5.0%
San Jose (P)	0.0	Ambos Mares	2.7	2.7	2.4	0.3		30.0%	10.0%	
San Jose	0.0	Ciruelas	22.7	22.7	18.2		4.5	30.0%		5.0%
Ciruelas	0.0	Alajuela	8.0	8.0	7.2		0.8	10.0%		5.0%
Ciruelas	22.7	Km 88.4	88.4	65.7	49.3		16.4	20.0%		5.0%
Km 88.4	0.0	Purruja	4.6	4.6	3.6		1.0	40.0%		5.0%
Km 88.4	88.4	Puntarenas	116.0	27.6	20.7		6.9	20.0%		5.0%
SUB-TOTAL				363.3	206.5	5.9	150.9			

BANANA BRANCH LINES:

BRANCH LINE	CLASS	DIST	WOOD	STEEL	CONC	% DEFECTIVE WOOD	% DEFECTIVE STEEL	% DEFECTIVE CONC
Estrella	-Trunk	52.4	47.2		5.2	70.0%		3.0%
	-Feeder	8.4	8.4			70.0%		
Monteverde	-Trunk	14.8	14.8			60.0%		
	-Feeder	6.2	6.2			60.0%		
Indiana/Imperio	-Trunk	14.0	14.0			70.0%		
	-Feeder	17.3	17.3			70.0%		
Parismina	-Trunk	9.5	9.5			80.0%		
	-Feeder	0.0	0.0			80.0%		
Guapiles	-Trunk	11.9	11.9			80.0%		
	-Feeder	2.0	2.0			80.0%		
Roxana	-Trunk	7.2	7.2			50.0%		
	-Feeder	2.8	2.8			50.0%		
Rio Frio	-Trunk	4.0	2.0		2.0	40.0%		5.0%
	-Feeder	19.8	19.8			60.0%		
Ticaban	-Trunk	5.5	5.5			40.0%		
	-Feeder	4.0	4.0			40.0%		
Trancari	-Trunk	5.5	5.5			40.0%		
	-Feeder	6.8	6.8			40.0%		
Other Branches:								
Freehold	-Feeder	0.5	0.5			90.0%		
Guajira	-Feeder	1.0	1.0			90.0%		
La Teresa	-Feeder	1.5	1.5			60.0%		
SUB-TOTAL		195.1	187.9	0.0	7.2			
GRAND TOTAL		558.4	394.4	5.9	158.1			

Source: INCOFER

2. ELC ELECTROCONSULT COST ESTIMATES

2.1 BANANA BRANCH LINES - SUMMARY OF REHAB WORK PROPOSED (Colones)

BRANCH LINE	TRACK LENGTH (km)	TRACK RENEWAL (m)	REHAB SUBGRADE (m^2)	CLEAN DITCHES (m)	NEW DITCHES (m)	EARTH MOVEMENT (m^2)	T.O. (ea)	REHAB BRIDGES (LS)	TOTAL REHAB COST
Ticaban	9.50	9,500	3,200	12,700	1,500	4,500	12	2,958,000	50,846,457
Trancari	12.25	12,250	5,500	23,250	0	0	9	3,825,000	63,902,931
Rio Frio	23.75	23,750	9,500	8,000	0	0	22	7,410,000	119,787,391
La Teresa	1.50	1,500	600	3,000	0	0	0	543,597	7,630,538
Aisa	0.50	500	200	1,000	0	0	0	181,199	2,543,513
Guajira	1.00	1,000	400	2,000	0	0	0	362,398	5,087,025
Roxana	10.00	10,000	4,500	12,000	3,000	0	6	3,120,000	51,486,270
Guapiles	13.90								0
Parismina *	9.50	9,500	3,800	19,000	0	0		3,442,781	48,326,738
Indiana	28.25	28,250	13,490	19,500	18,000	0	8	8,814,000	143,327,713
Imperio	3.00	3,000	1,200	0	6,000	0	2	936,000	15,999,881
Freehold	0.50	500	200	1,000	0	0	0	181,199	2,543,513
Monteverde	21.00	21,000	6,500	4,000	23,250	6,180	8	6,552,000	107,836,167
Estrella	60.75	60,750	17,900	49,750	15,955	28,000	29	18,954,000	309,649,840
TOTALS	195.40	181,500	66,990	155,200	67,705	38,680	96	57,280,174	928,967,975
UNIT COST		4,374.63	200	135	200	150	250,000		

* - Only if extended.

BANANA BRANCH LINES - SUMMARY OF EXTENSIONS PROPOSED

BRANCH LINE	EXTENS LENGTH (km)	TRACK EXTENS (m)	NEW T.O. (ea)	TOTAL EXTENS COST
Trancari	12.00	12,000	7	78,563,524
San Rafael	1.50	1,500	2	10,101,691
La Sonia	0.50	500	2	3,700,564
Numancia	1.50	1,500	2	10,101,691
Jordan	0.50	500	2	3,700,564
El Prado	1.00	1,000	2	6,901,127
Roxana	5.70	5,700	2	36,986,424
Parismina	15.40	15,400	7	100,327,356
Indiana	2.60	2,600	1	16,892,930
Estrella	9.20	9,200	2	59,390,368
TOTALS	49.90	49,900	29	326,666,237
UNIT COST		6,401.13	250,000	

Source: ELC Electroconsult Report of April 1986

DEVELOPMENT OF UNIT COSTS (Colones)

BANANA BRANCH LINES - COST OF RENEWING 1 KM OF TRACK

RENEW EXISTING TRACK:

ITEM	UNIT	UNIT COST	QUANTITY	TOTAL COST
Removal of rails and ties	m	50	1000	50,000
Concrete tubes and bedding	m	70	1,000	70,000
Ballast	m^3	380	1,000	380,000
Rail (35 kg/m) new	tonne	24603	70.00	1,722,210
Concrete bi-bloc ties	each	600	1,500	900,000
Fastening system	set	600	1,500	900,000
Bolted rail joints	each	780	27.78	21,667
Welded rail joints	each	1107	27.78	30,750
Labor and equipment	m	300	1,000	300,000
TOTAL				4,374,627

UNIT COSTS:

ITEM	UNIT	UNIT COST
Renew track	m	4,374.63
Rehab subgrade	m^3	200
Clean ditches	m	135
New ditches	m	200
Earth movement	m^3	150
Turnouts	each	250,000

BANANA BRANCH LINES - COST OF CONSTRUCTING 1 KM OF TRACK

CONSTRUCT TRACK:

ITEM	UNIT	UNIT COST	QUANTITY	TOTAL COST
Right-of-way purchase	Ha	36,000	1.5	54,000
Clearing and grubbing	Ha	33,333	1.5	50,000
Earth movement	m^3	150	9,750	1,462,500
Subgrade fill	m^3	200	550	110,000
Drainage ditches	m	200	2,000	400,000
Concrete tubes and bedding	m	70	1,000	70,000
Ballast	m^3	380	1,000	380,000
Rail (35 kg/m) new	tonne	24,603	70	1,722,210
Concrete bi-bloc ties	each	600	1,500	900,000
Fastening system	set	600	1,500	900,000
Bolted rail joints	each	780	27.78	21,667
Welded rail joints	each	1,107	27.78	30,750
Labor and equipment	m	300	1,000	300,000
TOTAL				6,401,127

UNIT COSTS:

ITEM	UNIT	UNIT COST
Construct track	m	6,401.13
Turnouts	each	250,000

Source: ELC Electroconsult Report of April, 1986

COSTS OF CONCRETE TIES (Colones)

COMPONENT	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
CEMENT	kg	3.00	23.00	69.00	0.00	69.00
SAND	kg	0.23	42.00	9.84	0.00	9.84
GRAVEL	kg	0.20	70.00	14.21	0.00	14.21
STEEL (DEFORMED)	kg	23.58	1.70	0.00	40.09	40.09
STEEL (SMOOTH)	kg	24.94	4.50	0.00	112.23	112.23
WOOD (FOR STORAGE)	m^3	6,303.40	0.002	12.61	0.00	12.61
FORM OIL	l	12.00	0.05	0.00	0.60	0.60
ELECTRICITY	kw/h	3.98	1.40	5.57	0.00	5.57
OXYGEN	m^3	5.00	0.40	2.00	0.00	2.00
ACETYLENE	m^3	400.00	0.12	48.00	0.00	48.00
WATER	m^3	16.10	0.10	1.61	0.00	1.61
FASTENING SYSTEM	LS			0.00	600.00	600.00
LABOR	hr	38.00	1.00	38.00	0.00	38.00
PLANT FIXED COSTS	LS			58.68	126.85	185.53
TOTAL				259.52	879.77	1,139.29

Source: ELC Electroconsult Report of April 1986

T I E P L A N T C O S T S (Colones)

SUMMARY OF TIE PLANT INSTALLATION COSTS:

ITEM	UNIT	QUANTITY	UNIT COST	LOCAL COST	FOREIGN COST	TOTAL COST
Prepare site for concrete plant	m^2	500	400	200,000		200,000
Prepare site for storage of ties	m^2	8,000	600	4,800,000		4,800,000
Trackage serving tie plant	m	200	4,000	800,000		800,000
Tie production buildings	m^2	750	1,800	1,350,000		1,350,000
Material storage buildings	m^2	300	2,000	600,000		600,000
Office and service buildings	m^2	150	7,000	1,050,000		1,050,000
Accessory works	LS			1,320,000		1,320,000
Concrete batch plant	LS				14,000,000	14,000,000
Production line and equipment	LS				28,000,000	28,000,000
Fork-lift trucks	each	2	1,500,000		3,000,000	3,000,000
SUB TOTAL				10,120,000	45,000,000	55,120,000
Engineering	6%			607,200	2,700,000	3,307,200
Contingencies	10%			1,012,000	4,500,000	5,512,000
TOTAL INSTALLATION COSTS:				11,739,200	52,200,000	63,939,200
Interest Rate				12.0%	8.0%	
Amortization period (years)				10.0	10.0	
Annual amortization				2,077,652	7,779,339	9,856,992
Unit amortization expense -	70,000 Units annual production			29.68	111.13	140.81

ANNUAL FIXED TIE PLANT OPERATION COSTS:

ITEM	UNIT	QUANTITY	UNIT COST	LOCAL COST	FOREIGN COST	TOTAL COST
Administrative staff	man-year	7.0	214,286	1,500,002		1,500,002
Plant maintenance costs	LS			530,000	1,100,000	1,630,000
TOTAL OPERATION COSTS:				2,030,002	1,100,000	3,130,002
Unit annual fixed oper. cost -	70,000 Units annual production			29.00	15.71	44.71
TOTAL ANNUAL FIXED COSTS				4,107,654	8,879,339	12,986,994
UNIT ANNUAL FIXED COSTS	70,000 Units annual production			58.68	126.85	185.53

Source: ELC Electroconsult Report of April 1986

2.2 Interurban Transport Study

COST OF CIVIL WORKS (US DOLLARS)

COST OF LINE AND STATION CIVIL WORKS

ITEM	FROM KM	TO KM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Rehabilitate roadbed	146.51	163.50	km	$ 8,500	16.99	$ 144,415	$ 0	$ 144,415
Road overpass Km 162.3			LS			400,000	0	400,000
Elevated structure	163.50	168.37	km	2,032,000	4.87	8,569,515	1,326,325	9,895,840
Rehabilitate roadbed	168.37	169.19	km	8,500	0.82	6,970	0	6,970
New alignment	169.19	170.45	LS		1.26	618,050	0	618,050
Rehabilitate roadbed	170.45	175.81	km	8,500	5.36	45,560	0	45,560
New alignment	175.81	176.55	LS		0.74	2,111,000	0	2,111,000
Elevated structure	176.35	177.80	km	2,032,000	1.45	2,551,498	394,902	2,946,400
New alignment	177.80	178.80	LS		1.00	3,741,260	0	3,741,260
Rehabilitate roadbed	178.80	188.00	km	8,500	9.20	78,200	0	78,200
Sidings and spurs to rehabilitate			km	8,500	1.95	16,575	0	16,575
Stations:								
Cartago			LS			4,675	0	4,675
El Alto			LS			5,525	0	5,525
Tres Rios			LS			3,825	0	3,825
Curridabat			LS			1,700	0	1,700
San Jose			LS			1,034,106	207,510	1,241,616
Colima			LS			3,825	0	3,825
Heredia			LS			11,900	0	11,900
Echeverria			LS			1,700	0	1,700
Alajuela			LS			14,450	0	14,450
SUB-TOTAL						$ 19,364,749	$ 1,928,737	$ 21,293,486
CONTINGENCIES				12%		2,323,770	231,448	2,555,218
ENGINEERING				7%		1,355,532	135,012	1,490,544
TOTAL COST						$ 23,044,052	$ 2,295,197	$ 25,339,248

Source: ELC Electroconsult Report of May 1986

C O S T O F T R A C K W O R K S (US DOLLARS)

COST OF LINE AND STATION TRACK WORKS

ITEM	FROM KM	TO KM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Construct track at grade	146.51	163.50	km	$ 90,672	16.99	$ 374,630	$ 1,165,888	$ 1,540,517
Construct track elevated	163.50	168.37	km	83,172	4.87	70,859	334,189	405,048
Construct track at grade	168.37	176.35	km	90,672	7.98	175,959	547,604	723,563
Construct track elevated	176.35	177.80	km	83,172	1.45	21,098	99,502	120,599
Construct track at grade	177.80	188.00	km	90,672	10.20	224,910	699,944	924,854
Sidings and spurs to rehabilitate			km	90,672	1.60	35,280	109,795	145,075
Turnouts			each	9,000	12	0	108,000	108,000
Stations:								
Cartago	track		km	90,672	0.50	11,025	34,311	45,336
	turnouts		each	9,000	3	0	27,000	27,000
El Alto	track		km	90,672	0.50	11,025	34,311	45,336
	turnouts		each	9,000	6	0	54,000	54,000
Tres Rios	track		km	90,672	0.35	7,718	24,018	31,735
	turnouts		each	9,000	4	0	36,000	36,000
Curridabat	track		km	90,672	0.15	3,308	10,293	13,601
	turnouts		each	9,000	2	0	18,000	18,000
San Jose	track		km	90,672	0.67	14,774	45,977	60,750
	turnouts		each	9,000	7	0	63,000	63,000
San Jose yard	track		km	90,672	1.00	22,050	68,622	90,672
	turnouts		each	9,000	6	0	54,000	54,000
Colima	track		km	90,672	0.35	7,718	24,018	31,735
	turnouts		each	9,000	4	0	36,000	36,000
Heredia	track		km	90,672	1.16	25,578	79,602	105,180
	turnouts		each	9,000	20	0	180,000	180,000
Echeverria	track		km	90,672	0.15	3,308	10,293	13,601
	turnouts		each	9,000	2	0	18,000	18,000
Alajuela	track		km	90,672	0.79	17,420	54,211	71,631
	turnouts		each	9,000	8	0	72,000	72,000
SUB-TOTAL						$ 1,026,656	$ 4,008,578	$ 5,035,233
CONTINGENCIES					7%	71,866	280,600	352,466
ENGINEERING					6%	61,599	240,515	302,114
TOTAL COST						$ 1,160,121	$ 4,529,693	$ 5,689,813

Source: ELC Electroconsult Report of May 1986

COST OF BUILDINGS AND SHOPS (US DOLLARS)

COST OF BUILDINGS AND SHOPS AT STATIONS

STATION	ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Cartago	station bldg.	m^2	$ 210	210	$ 44,100	$ 0	$ 44,100
	platforms	m^2	20	1,360	27,200	0	27,200
	shelters	m^2	40	1,360	54,400	0	54,400
	ped. overpass	m	250	12	0	3,000	3,000
El Alto	station bldg.	m^2	210	210	44,100	0	44,100
	platforms	m^2	20	1,020	20,400	0	20,400
	shelters	m^2	40	1,020	40,800	0	40,800
	ped. overpass	m	250	12	0	3,000	3,000
Tres Rios	station bldg.	m^2	210	210	44,100	0	44,100
	platforms	m^2	20	1,020	20,400	0	20,400
	shelters	m^2	40	1,020	40,800	0	40,800
	ped. stairs	m	250	12	0	3,000	3,000
Curridabat	station bldg.	m^2	210	210	44,100	0	44,100
	platforms	m^2	20	1,020	20,400	0	20,400
	shelters	m^2	40	1,020	40,800	0	40,800
	ped. overpass	m	250	12	0	3,000	3,000
San Jose	station bldg.	LS			50,000	0	50,000
	platforms	m	600	300	180,000	0	180,000
	shelters	m^2	40	1,600	64,000	0	64,000
	ped. overpass	LS			20,000	0	20,000
Colima	station bldg.	m^2	210	210	44,100	0	44,100
	platforms	m^2	20	1,020	20,400	0	20,400
	shelters	m^2	40	1,020	40,800	0	40,800
	ped. overpass	m	250	12	0	3,000	3,000
Heredia	station bldg.	m^2	210	210	44,100	0	44,100
	platforms	m^2	20	2,210	44,200	0	44,200
	shelters	m^2	40	2,210	88,400	0	88,400
	ped. overpass	m	250	22	0	5,500	5,500
	shops	m^2	100	875	87,500	0	87,500
Echeverria	station bldg.	m^2	210	210	44,100	0	44,100
	platforms	m^2	20	1,020	20,400	0	20,400
	shelters	m^2	40	1,020	40,800	0	40,800
	ped. overpass	m	250	12	0	3,000	3,000
Alajuela	station bldg.	m^2	210	210	44,100	0	44,100
	platforms	m^2	20	1,020	20,400	0	20,400
	shelters	m^2	40	1,020	40,800	0	40,800
SUB-TOTAL					$ 1,335,700	$ 23,500	$ 1,359,200
CONTINGENCIES			10%		133,570	2,350	135,920
ENGINEERING			7%		93,499	1,645	95,144
TOTAL COST					$ 1,562,769	$ 27,495	$ 1,590,264

Source: ELC Electroconsult Report of May 1986

COST OF SIGNALS AND TELECOMMUNICATIONS (US Dollars)

COST OF SIGNALLING TOTAL PROJECT

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Inter-block equipment in stations:						
for station tracks	track	$ 104,000	26	$ 546,000	$ 2,158,000	$ 2,704,000
for entrance and departure	direction	35,000	16	112,000	448,000	560,000
Signalling misc. turnouts	track km	9,000	42.5	59,500	323,000	382,500
Crossing protection	track km	19,500	42.5	170,000	658,750	828,750
Line block equipment	section	43,000	8	56,000	288,000	344,000
Signal bungalows & equipment	track km	4,200	42.5	28,050	150,450	178,500
SUB-TOTAL				$ 971,550	$ 4,026,200	$ 4,997,750
CONTINGENCIES		5%		48,578	201,310	249,888
ENGINEERING		7%		68,009	281,834	349,843
TOTAL COST				1,088,136	4,509,344	5,597,480

COST OF TELECOMMUNICATIONS FOR TOTAL PROJECT

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Telephone system and various equip	LS			$ 15,000	$ 130,000	$ 145,000
Cable	track km	17,000	42.5	391,000	331,500	722,500
SUB-TOTAL				$ 406,000	$ 461,500	$ 867,500
CONTINGENCIES		5%		20,300	23,075	43,375
ENGINEERING		7%		28,420	32,305	60,725
TOTAL COST				454,720	516,880	971,600

Source: ELC Electroconsult Report of May 1986

COST OF ELECTRIFICATION (US Dollars)

COST OF ELECTRIFICATION OF TOTAL PROJECT

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Main substation 138/25 kV	each	$ 442,110	1	$ 55,447	$ 386,663	$ 442,110
Back-up substation 138/25 kV	each	442,110	1	55,447	386,663	442,110
Secondary substation	each	152,678	1	23,538	129,140	152,678
Catenary system	track km	46,856	41.4	743,296	1,196,543	1,939,838
Additional costs at stations:						
Catenary system	track km	46,856	8.7	156,200	251,447	407,647
Air layer section	each	8,477	13	21,528	88,673	110,201
Power feed to station	each	54,927	5	62,870	211,765	274,635
Power feed line	km	22,295	3.1	45,028	24,087	69,115
Cut-out 2 position	each	2,860	5	1,750	12,550	14,300
Cut-out	each	3,640	26	11,700	82,940	94,640
Cut-out for shops	each	4,155	2	1,020	7,290	8,310
Metal structures	ton	2,210	1	275	1,935	2,210
Additional concrete posts	each	260	20	4,900	300	5,200
Section insulators	each	2,465	21	7,035	44,730	51,765
Foundations for posts	each	245	20	4,900	0	4,900
SUB-TOTAL				$ 1,194,933	$ 2,824,726	$ 4,019,659
CONTINGENCIES		7%		83,645	197,731	281,376
ENGINEERING		7%		83,645	197,731	281,376
TOTAL COST				1,362,224	3,220,188	4,582,411

Source: ELC Electroconsult Report of May 1986

COST OF ROLLING STOCK AND SHOP EQUIPMENT (US Dollars)

COST OF ROLLING STOCK FOR TOTAL PROJECT

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Locomotives 1700 kW	each	$ 1,295,000	9	$ 36,000	$ 11,619,000	$ 11,655,000
Passenger coaches	each	218,000	69	69,000	14,973,000	15,042,000
SUB-TOTAL				$ 105,000	$ 26,592,000	$ 26,697,000
CONTINGENCIES		4%		4,200	1,063,680	1,067,880
ENGINEERING		5%		5,250	1,329,600	1,334,850
TOTAL COST				114,450	28,985,280	29,099,730

COST OF SHOP EQUIPMENT FOR TOTAL PROJECT

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Crane 10/3 ton	each	$ 70,000	1	$ 15,000	$ 55,000	$ 70,000
Jacks 15 ton	each	28,500	4	14,000	100,000	114,000
Jacks 10 ton	each	24,625	4	8,500	90,000	98,500
Axle lowerer 6 ton	each	225,000	1	35,000	190,000	225,000
Carpentry equipment	lot	59,500	1	11,500	48,000	59,500
Mechanical/Electrical shop equip.	lot	192,500	1	30,000	162,500	192,500
Electronic laboratory equipment	lot	87,500	1	9,500	78,000	87,500
Brake shop equipment	lot	49,500	1	6,500	43,000	49,500
Battery chargers	each	11,500	2	5,000	18,000	23,000
Compressed air system	each	90,000	1	25,000	65,000	90,000
Misc. equipment and furniture	lot	280,500	1	30,000	250,500	280,500
SUB-TOTAL				$ 190,000	$ 1,100,000	$ 1,290,000
CONTINGENCIES		5%		9,500	55,000	64,500
ENGINEERING		7%		13,300	77,000	90,300
TOTAL COST				212,800	1,232,000	1,444,800

Source: ELC Electroconsult Report of May 1986

UNIT COST OF ELEVATED STRUCTURE (US Dollars)

SINGLE TRACK POST-TENSIONED CONCRETE ON DOUBLE PILLARS 21.0 M C-C

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Concrete for post-tensioned beams	m^3	$ 280	22.50	$ 5,445	$ 855	$ 6,300
Concrete for floor structure	m^3	190	25.00	4,750	0	4,750
Concrete for pavement	m^3	190	5.00	950	0	950
Concrete for cap and crossbeams	m^3	190	13.00	2,470	0	2,470
Concrete for pillars	m^3	190	12.00	2,280	0	2,280
Concrete for foundations	m^3	130	25.00	3,250	0	3,250
Lean concrete	m^3	80	2.50	200	0	200
Special steelwork (railings, etc.)	tons	4,000	0.80	0	3,200	3,200
Reinforcing steel	tons	1,000	8.50	8,500	0	8,500
Wire fabric reinf. for pavement	tons	2,000	0.32	640	0	640
Neoprene seals	m	10	43.00	430	0	430
Tensioning boxes	each	280	2.00	0	560	560
Return boxes	each	100	2.00	0	200	200
Neoprene bearings	each	90	4.00	0	360	360
Pilings (80 t)	each	1,700	4.00	6,256	544	6,800
Excavation	m^3	4	65.00	260	0	260
Acrylic paint	m^2	8	110.00	880	0	880
Waterproofing	m^2	8	80.00	640	0	640
TOTAL				$ 36,951	$ 5,719	$ 42,670
COST PER KILOMETER				$ 1,759,571	$ 272,333	$ 2,031,905

Source: ELC Electroconsult Report of May 1986

UNIT COST OF TRACK & ROADBED (US Dollars)

COST OF REHABILITATING 1 KM OF EXISTING ROADBED

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Removal of rails and ties	m	$ 1.00	1,000	$ 1,000	$ 0	$ 1,000
Fill material for roadbed	m^3	4.00	100	400	0	400
Excavation and compacted fill	m^3	3.00	50	150	0	150
Excavation for drainage ditches	m	4.00	300	1,200	0	1,200
Cleaning of drainage ditches	m	2.50	1,700	4,250	0	4,250
Concrete tubes with bedding	m	1.50	1,000	1,500	0	1,500
TOTAL COST PER KILOMETER				$ 8,500	$ 0	$ 8,500

COST OF CONSTRUCTING 1 KM OF TRACK

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Ballast	m^3	$ 7.50	1,000	$ 7,500	$ 0	$ 7,500
Rails (42 kg/m)	tons	500.00	84	0	42,000	42,000
Concrete ties (Bi-bloc)	each	11.50	1,500	8,550	8,700	17,250
Fastening system	each	11.50	1,500	0	17,250	17,250
Labor and equipment	m	6.00	1,000	6,000	0	6,000
Welded joint	each	30.00	14	0	420	420
Bolted joint	each	18.00	14	0	252	252
TOTAL COST PER KILOMETER				$ 22,050	$ 68,622	$ 90,672

COST OF CONSTRUCTING 1 KM OF TRACK (ON ELEVATED STRUCTURE)

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Rails (42 kg/m)	tons	500.00	84	0	42,000	42,000
Concrete ties (Bi-bloc)	each	11.50	1,500	8,550	8,700	17,250
Fastening system	each	11.50	1,500	0	17,250	17,250
Labor and equipment	m	6.00	1,000	6,000	0	6,000
Welded joint	each	30.00	14	0	420	420
Bolted joint	each	18.00	14	0	252	252
TOTAL COST PER KILOMETER				$ 14,550	$ 68,622	$ 83,172

Source: ELC Electroconsult Report of May 1986

2.3 Inter-Oceanic Railway Study

C O S T O F C I V I L W O R K S (US Dollars)

COST OF LINE AND STATION CIVIL WORKS:

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Limon to Cartago						
Roadbed 0.0 - 2.4	km	8,750	2.40	21,000	0	21,000
Roadbed in stations	km	8,750	7.65	66,938	0	66,938
Roadbed 65.4 - 146.6	km	10,500	81.20	852,600	0	852,600
Roadbed in stations	km	10,500	4.91	51,566	0	51,566
Erosion protection	m^3	20	15,000.00	300,000	0	300,000
Piedras de Fuego	LS			1,208,080	613,000	1,821,080
Sub-Total				2,500,183	613,000	3,113,183
Ciruelas to Puntarenas						
Roadbed 22.7 - 116.0	km	8,750	93.30	816,375	0	816,375
Roadbed in stations	km	8,750	8.38	73,325	0	73,325
Protection at Rio Barranca Br.	LS			10,000	0	10,000
Sub-Total				899,700	0	899,700
Ciruelas to Montecillos						
Roadbed 0.0 - 5.3	km	8,750	5.30	46,375	0	46,375
Roadbed in stations	km	8,750	0.27	2,354	0	2,354
Sub-Total				48,729	0	48,729
Las Canas to Montecillos						
Complete existing grade	LS			47,340	0	47,340
Culvert Rio Ciruelas	LS			34,955	15,000	49,955
Underpass Olrich Road	LS			23,604	4,250	27,854
Sub-Total				105,899	19,250	125,149
Virilla Yard						
Land purchase	ha	50,000	24.00	1,200,000	0	1,200,000
Clearing and grubbing	ha	7,000	1.80	12,600	0	12,600
Earth excavation	m^3	3.00	894,000	1,877,400	804,600	2,682,000
Compacted earth fill	m^3	3.00	131,000	275,100	117,900	393,000
Drainage ditches	m	4.00	2,500	7,000	3,000	10,000
Concrete tube with bedding	m	1.50	8,500	5,950	6,800	12,750
Sub-Total				3,378,050	932,300	4,310,350
TOTAL COST				6,932,561	1,564,550	8,497,111

Source: ELC Electroconsult Report of December 1986

C O S T O F T R A C K W O R K S (US Dollars)

COST OF LINE AND STATION TRACK WORKS:

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Limon to Cartago						
Track Km 0.0 - 2.4	km	97,642	2.40	52,920	181,421	234,341
Track in stations	km	97,642	7.65	168,683	578,279	746,961
Turnouts	each	9,900	49	0	485,100	485,100
Track Km 65.4 - 146.6	km	97,642	81.20	1,790,460	6,138,070	7,928,530
Track in stations	km	97,642	4.91	108,288	371,232	479,520
Turnouts	each	9,900	39	0	386,100	386,100
Sub-Total				2,120,350	8,140,202	10,260,552
Ciruelas to Puntarenas						
Track Km 22.7 - 116.0	km	85,691	93.30	1,610,545	6,384,426	7,994,970
Track in stations	km	85,691	8.38	144,656	573,435	718,091
Turnouts	each	9,900	63	0	623,700	623,700
Sub-Total				1,755,200	7,581,561	9,336,761
Ciruelas to Montecillos						
Track Km 0.0 - 5.3	km	85,691	5.30	91,489	362,674	454,162
Track in stations	km	85,691	0.27	4,643	18,407	23,051
Turnouts	each	9,900	0	0	0	0
Sub-Total				96,132	381,081	477,213
Las Canas to Montecillos						
Track Km 0.0 - 5.3	km	97,642	3.30	72,765	249,454	322,219
Track in stations	km	97,642	0.00	0	0	0
Turnouts	each	9,900	2	0	19,800	19,800
Sub-Total				72,765	269,254	342,019
Virilla Yard						
Track Km	km	97,642	0.00	0	0	0
Track in stations	km	97,642	11.83	260,852	894,253	1,155,105
Turnouts	each	9,900	63	0	623,700	623,700
Sub-Total				260,852	1,517,953	1,778,805
TOTAL COST				4,305,299	17,890,051	22,195,350

Source: ELC Electroconsult Report of December 1986

C O S T O F S I G N A L I Z A T I O N (US Dollars)

COST OF LINE AND STATION SIGNALIZATION:

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Limon to Cartago						
Limon station	LS			48,900	114,100	163,000
Limoncito station	LS			40,200	93,800	134,000
Moin station	LS			114,000	266,000	380,000
Siquirres station	LS			66,000	154,000	220,000
La Junta station	LS			138,000	322,000	460,000
Peralta station	LS			45,300	105,700	151,000
Turrialba station	LS			37,800	88,200	126,000
Typical sidings	each	43,000	22	283,800	662,200	946,000
Typical junctions	each	32,000	11	105,600	246,400	352,000
Typical 2 track stations	each	66,000	10	198,000	462,000	660,000
Typical 3 track stations	each	75,000	2	45,000	105,000	150,000
Crossing protection	each	18,000	22	79,200	316,800	396,000
Sub-Total				1,201,800	2,936,200	4,138,000
Ciruelas to Puntarenas						
Ciruelas station	LS			33,900	79,100	113,000
Orotina station	LS			37,800	88,200	126,000
Salinas station	LS			38,700	90,300	129,000
Barranca station	LS			37,800	88,200	126,000
Puntarenas station	LS			63,900	149,100	213,000
Purruja station	LS			56,400	131,600	188,000
Typical sidings	each	43,000	15	193,500	451,500	645,000
Typical junctions	each	32,000	3	28,800	67,200	96,000
Typical 2 track stations	each	66,000	8	158,400	369,600	528,000
Typical 3 track stations	each	75,000	0	0	0	0
Crossing protection	each	18,000	67	241,200	964,800	1,206,000
Sub-Total				890,400	2,479,600	3,370,000
Ciruelas to Montecillos						
Typical 3 track stations	each	75,000	1	22,500	52,500	75,000
Sub-Total				22,500	52,500	75,000
Las Canas to Montecillos						
Las Canas junction	LS			60,000	120,000	180,000
Sub-Total				60,000	120,000	180,000
Virilla Yard						
Virilla yard	LS			159,900	360,100	520,000
Sub-Total				159,900	360,100	520,000
TOTAL COST				2,334,600	5,948,400	8,283,000

Source: ELC Electroconsult Report of December 1986

C O S T O F E L E C T R I F I C A T I O N (US Dollars)

COST OF LINE AND STATION ELECTRIFICATION:

ITEM	UNIT	UNIT COST	QUANTITY	LOCAL COST	FOREIGN COST	TOTAL COST
Limon to Cartago						
Electrify 65.4 - 146.6	km	105,000	81.20	2,415,700	6,110,300	8,526,000
Sub-Total				2,415,700	6,110,300	8,526,000
Ciruelas to Puntarenas						
Electrify 22.7 - 116.0	km	105,000	93.30	2,775,675	7,020,825	9,796,500
Sub-Total				2,775,675	7,020,825	9,796,500
Ciruelas to Montecillos						
Electrify 0.0 - 5.3	km	49,800	5.30	95,400	168,540	263,940
Sub-Total				95,400	168,540	263,940
Las Canas to Montecillos						
Electrify 0.0 - 3.3	km	49,800	3.30	59,400	104,940	164,340
Sub-Total				59,400	104,940	164,340
Virilla Yard						
Electrify Virilla yard	km	49,800	4.20	75,600	133,560	209,160
Sub-Total				75,600	133,560	209,160
TOTAL COST				5,421,775	13,538,165	18,959,940

Source: ELC Electroconsult Report of December 1986

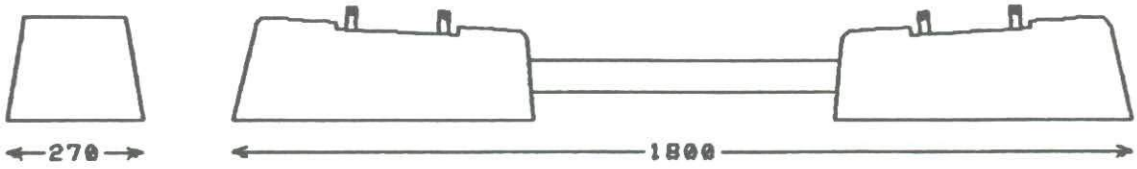
3. DESIGN ANALYSIS

3.1 COMPARISON OF COSTS OF CONCRETE TIES (Colones)

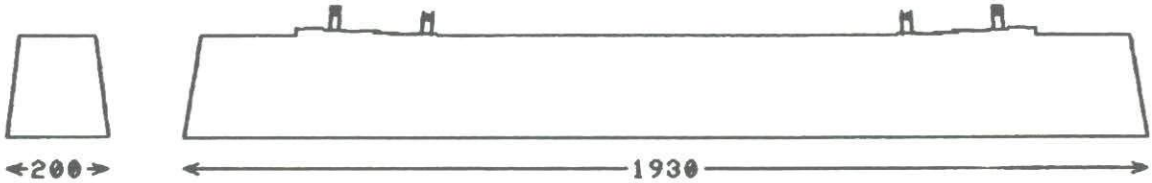
			ELC Bi-Bloc		INCOFER Monobloc		P/C CT-23M	
COMPONENT	UNIT	UNIT COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
CEMENT	kg	4.05	22.50	91.13	29.25	118.46	27.00	109.35
SAND	kg	0.35	30.83	10.88	40.08	14.14	37.00	13.05
GRAVEL	kg	0.45	64.17	29.00	83.42	37.70	77.00	34.80
REINFOCING BAR	kg	30.00	1.70	51.00	8.60	258.00	0.00	0.00
REINFORCING WIRE	kg	36.00	4.50	162.00	3.20	115.20	0.00	0.00
PRESTRESSING WIRE	kg	49.00	0.00	0.00	0.00	0.00	4.20	205.80
STEEL END PLATES	kg	100.29	0.00	0.00	0.00	0.00	1.70	170.50
CROSS TIE BEAM	kg	8.50	16.50	140.25	0.00	0.00	0.00	0.00
ENERGY, WATER	LS			28.25		28.25		28.25
OXYGEN	m^3	6.00	0.40	2.40	0.00	0.00	0.00	0.00
ACETYLENE	m^3	480.00	0.12	57.60	0.00	0.00	0.00	0.00
RESIN	kg	120.00	0.80	96.00	0.00	0.00	0.00	0.00
LABOR	hr	84.41	1.10	92.86	1.50	126.62	1.28	108.05
WASTE & REJECT	rate	0.5%		3.81		3.49		3.35
ENGINEERING	rate	9%		68.86		63.17		62.40
ADMINISTRATION	LS			25.72		25.72		55.07
PLANT MAINTENANCE	LS			27.95		27.95		33.78
PLANT AMORTIZATION	LS			140.83		140.83		88.74
ROYALTIES	LS			0.00		0.00		13.85
PROFIT	rate	15%		0.00		0.00		139.05
TOTAL TIE COST				1,028.52		959.52		1,066.04
TIE STORAGE COSTS	LS			25.00		25.00		25.00
FASTENING SYSTEM:								
ANCHOR (Steel)	kg	181.54	3.00	544.62	2.40	435.70	2.40	435.70
PAD (Rubber)	kg	393.68	0.25	98.42	0.25	98.42	0.25	98.42
INSULATOR (Nylon)	kg	400.00	0.40	160.00	0.00	0.00	0.00	0.00
CLIP (Steel)	kg	175.74	1.80	316.33	3.36	590.49	3.36	590.49
TOTAL FASTENING COST				1,119.37		1,124.60		1,124.60
TOTAL TIE & FASTENING COST (Colones)				2,172.89		2,109.13		2,215.65
TOTAL TIE & FASTENING COST (US $ @ 74.00)				$ 29.36		$ 28.50		$ 29.94
TIES PER TRACK KILOMETER				1,500		1,440		1,429
TIE INSTALLATION COST				90		85		85
TOTAL TIE COST PER KILOMETER				3,394,337		3,159,541		3,287,622
ESTIMATED SERVICE LIFE	yrs			35		35		50
COST OF MONEY	rate			10%		10%		10%
ANNUAL TIE MTCE COST PER KM				30,000		14,400		14,290
ANNUAL COST PER KILOMETER				381,958		342,012		345,877
VOLUME OF CONCRETE	l			50		65		60
WEIGHT OF TIE	kg			154		180		162
BEARING AREA	cm^2			3,240		3,860		4,000

Source: 1. ELC Electroconsult Report of April, 1986
2. INCOFER
3. Productos de Concreto S.A.

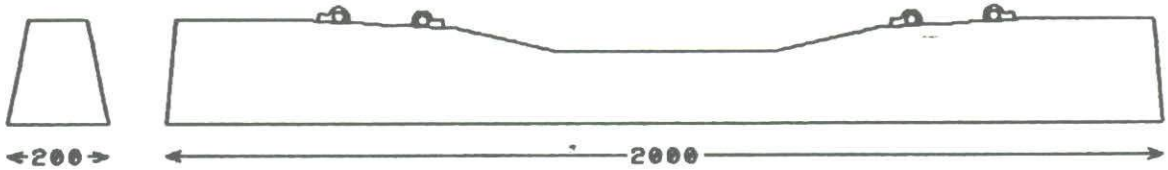
ELC Bi-Bloc



INCOFER Monobloc



CT-23M Monobloc



TYPES OF CONCRETE TIES

SCALE:	PLAN: C-1 PR	CPCS
	DATE: DEC 2/87	

3.2

TRACK ANALYSIS - EXISTING MAIN LINE

RAILROAD DATA:		INCOFER Alsthom loc
1 - Track Gauge	mm	1067.00
2 - Maximum Track Speed	kph	50.00
3 - Maximum Axle Load for Vmax.	tonnes	16.00
4 - Wheel Diameter for heavy loads.	mm	1250.00
5 - Number of Axles applying load		2
6 - Distance 1st Axle to 2nd Axle	mm	2800.00
7 - Distance 1st Axle to 3rd Axle	mm	0.00
8 - Distance 1st Axle to 4th Axle	mm	0.00

RAIL DATA:		60 ASCE
1 - Weight of Rail Section.	kg/m	30.31
2 - Moment of Inertia	cm^4	637.20
3 - Rail Head Width	mm	60.45
4 - Base of Rail to Neutral Axis.	mm	53.59

TIE DATA:		INCOFER Wood
1 - Type of Tie: 1=Wood 2=Conc 3=Bibloc		1
2 - Length of Tie	mm	2130.00
3 - Width of Tie.	mm	200.00
4 - Thickness of Tie.	mm	150.00

OTHER DESIGN DATA:

1 - Tie Spacing (centers)	mm	600.00
2 - Depth of Ballast below ties	mm	200.00
3 - Thickness of Sub-ballast layer.	mm	100.00

TRACK DESIGN PARAMETER		COMPUTED VALUE	RECOMMENDED VALUE
Rail Weight (RW).	kg/m	30.31	> 34.40
Dynamic Loading Coefficient (DL).		0.26	
Rail Support Modulus (U).	kPa	18897	> 10343
Moment Coefficient (CM)		1.00	
Deflection Coefficient (CD)		0.97	
Maximum Rail Moment (MO).	N-m	17912	
Maximum Track Deflection (YO)	mm	3.50	< 6.35
Maximum Rail Seat Load (QO)	N	39625	
Maximum Rail Stress (RS).	kPa	150630	< 172375
Zero Moment Distance (X1)	mm	570.82	
Tie Spacing (TS).	mm	600.00	< 699.77
Tie Rail Seat Moment (MR)	N-m	4675	
Tie Center Moment (MC).	N-m	1238	
Maximum wood fibre stress (WS).	kPa	6233	< 8274
Tie Effective Bearing Area (AB)	cm^2	3258	
Ballast Depth (BD).	mm	200.00	> 244.26
Sub-Ballast Depth (SD).	mm	100.00	> 137.93
Maximum Ballast Pressure (PA)	kPa	243.26	< 448.18
Maximum Sub-Ballast Pressure (PB)	kPa	309.83	< 241.33
Maximum Subgrade Pressure (PC).	kPa	186.64	< 137.90

TRACK ANALYSIS - EXISTING BANANA BRANCH LINES

RAILROAD DATA:		INCOFER U6B loc
1 - Track Gauge	mm	1067.00
2 - Maximum Track Speed	kph	30.00
3 - Maximum Axle Load for Vmax.	.tonnes	13.20
4 - Wheel Diameter for heavy loads.	mm	914.00
5 - Number of Axles applying load		2
6 - Distance 1st Axle to 2nd Axle	mm	2083.00
7 - Distance 1st Axle to 3rd Axle	mm	0.00
8 - Distance 1st Axle to 4th Axle	mm	0.00

RAIL DATA:		50 ASCE
1 - Weight of Rail Section.	kg/m	24.95
2 - Moment of Inertia	cm^4	435.45
3 - Rail Head Width	mm	54.10
4 - Base of Rail to Neutral Axis.	mm	48.01

TIE DATA:		INCOFER Wood
1 - Type of Tie: 1=Wood 2=Conc 3=Bibloc		1
2 - Length of Tie	mm	2130.00
3 - Width of Tie.	mm	200.00
4 - Thickness of Tie.	mm	150.00

OTHER DESIGN DATA:

1 - Tie Spacing (centers)	mm	600.00	
2 - Depth of Ballast below ties	mm	200.00	
3 - Thickness of Sub-ballast layer.	mm	100.00	

TRACK DESIGN PARAMETER		COMPUTED VALUE	RECOMMENDED VALUE
Rail Weight (RW).	kg/m	24.95	> 28.32
Dynamic Loading Coefficient (DL).		0.21	
Rail Support Modulus (U).	kPa	18989	> 10343
Moment Coefficient (CM)		0.96	
Deflection Coefficient (CD)		0.96	
Maximum Rail Moment (MO).	N-m	12407	
Maximum Track Deflection (YO)	mm	3.00	< 6.35
Maximum Rail Seat Load (QO)	N	34189	
Maximum Rail Stress (RS).	kPa	136772	< 172375
Zero Moment Distance (X1)	mm	518.36	
Tie Spacing (TS).	mm	600.00	< 668.58
Tie Rail Seat Moment (MR)	N-m	4085	
Tie Center Moment (MC).	N-m	959	
Maximum wood fibre stress (WS).	kPa	5447	< 8274
Tie Effective Bearing Area (AB)	cm^2	3274	
Ballast Depth (BD).	mm	200.00	> 216.22
Sub-Ballast Depth (SD).	mm	100.00	> 122.10
Maximum Ballast Pressure (PA)	kPa	208.87	< 448.18
Maximum Sub-Ballast Pressure (PB)	kPa	266.04	< 241.33
Maximum Subgrade Pressure (PC).	kPa	160.26	< 137.90

3.3 LIST OF ROAD CROSSINGS

TYPE: 0-Separated, 1-Asphalt, 2-Gravel, 3-Earth
CLASS: 1-70 km/h or 10,000 v, 2-50 km/h or 2,000 v, 3->50 km/h and >2,000 v
PROTECTION: A-Separate, B-Gates, C-Lights, D-Signs

NO	KM	NAME	WIDTH	TYPE	ANGLE	SPEED KM/H	TRAFFIC VEH/D	CLASS	PROTECT
1	146.30	Comand. de Cartago	8	1	90	40	2000 e	2	C
2	146.40	Mercado de Cartago	8	1	90	40	2000 e	2	C
3	146.50	Estac. de Cartago	8	1	90	40	2000 e	2	Close
4	146.60	Parada de Buses	8	1	90	40	2000 e	2	Close
5	146.70	Pali	8	1	50	40	1000 e	3	D
6	147.00	Cartago 2	6	1	50	40	1000 e	3	D
7	147.10	Cartago 1	6	2	90	40	500 e	3	D
8	147.20	Tropigas	6	1	90	40	1000 e	3	D
9	147.60	Reventado	4	2	90	20	500 e	3	D
10	147.70	Dique 2	3	2	90	20	500 e	3	D
11	147.80	Dique 1	5	2	90	20	100 e	3	D
12	148.00	Layola 2	6	1	90	20	100 e	3	D
13	148.20	Layola 1	8	1	90	40	200 e	3	D
14	149.10	Rural	4	2	90	20	500 e	3	D
15	149.20	Quircot	6	1	90	40	1000 e	3	D
16	149.50	Rural	3	3	90	20	200 e	3	D
17	149.70	Rural	3	3	45	20	100 e	3	D
18	150.60	El Alto	5	2	90	40	500 e	3	D
19	150.80	Recope 2	5	1	90	20	2000 e	2	C
20	151.45	Recope 1	8	1	90	40	1000 e	3	D
21	151.50	Lugrosa	3	2	90	20	100 e	3	D
22	151.80	Kativo	5	1	90	40	500 e	3	D
23	152.50	Kativo	5	1	90	40	500 e	3	D
24	153.60	El Vivero MAG	4	2	45	20	100 e	3	D
25	154.00	Rural	3	2	90	20	500 e	3	D
26	155.00	Rural	3	3	90	20	100 e	3	D
27	155.50	Yerbabuena 2	4	1	45	40	1000 e	3	D
28	155.75	Yerbabuena 1	4	1	90	40	500 e	3	D
29	156.20	Tres Rios 5	4	1	90	40	2000 e	2	C
30	156.80	Tres Rios 4	4	1	90	40	1000 e	3	D
31	156.90	Tres Rios 3	3	2	90	40	500 e	3	D
32	157.00	Tres Rios 2	4	2	90	20	100 e	3	D
33	157.10	Rural	3	3	90	20	100 e	3	D
34	157.30	Tres Rios 1	3	2	90	40	500 e	3	D
35	157.80	Rural	3	2	90	20	100 e	3	D
36	158.00	Rural	3	2	45	20	500 e	3	D
37	158.00	Rural	3	3	90	20	100 e	3	D
38	158.40	El Ran	3	2	45	20	100 e	3	D
39	158.60	Rural	3	2	45	20	100 e	3	D
40	159.00	Rural	3	2	90	20	100 e	3	D
41	159.25	Rural	3	2	45	20	100 e	3	D
42	159.60	Rural	3	2	90	20	100 e	3	D
43	160.50	Sanchez	4	1	90	20	100 e	3	D
44	161.50	Cipreses 2	5	1	90	40	500 e	3	D
45	161.70	Cipreses 1	8	1	45	40	1000 e	3	D

LIST OF ROAD CROSSINGS

NO	KM	NAME	WIDTH	TYPE	ANGLE	SPEED KM/H	TRAFFIC VEH/D		CLASS	PROTECT
46	161.90	Apt. Curridabat	3	3	90	20	100	e	3	D
47	162.40	Curridabat (#221)	6	1	90	40	2000		2	C
48	162.80	Dorado	4	2	90	40	1000	e	3	D
49	163.45	Freses	6	1	90	40	2000	e	2	C
50	163.70	Calle Siles	4	1	90	40	1000	e	3	D
51	164.05	Igl. Lourdes	4	1	90	40	1000	e	3	D
52	164.30	Lourdes (#203)	20	1	45	40	7600		2	B
53	164.50	Coleg. Calasang	6	1	90	20	100	e	3	D
54	164.80	Coleg. Vargas Calvo	6	1	90	40	2000	e	2	C
55	165.05	Guilia (Calle 3)	6	1	90	40	5000	e	2	C
56	165.15	U.C.R.	6	1	90	40	5000	e	2	C
57	165.55	Sabanilla (#208)	20	1	90	40	19000		1	A
58	166.15	Cent. Cult. (Ca. 37)	-	0	-	40	4500		2	A
59	166.40	La Luz (Ca. 33)	6	1	90	40	3000		2	C
60	166.65	Escalante (Ca. 29)	8	1	90	40	2000		2	C
61	166.85	Est. Aduana (Ca. 25)	4	1	90	40	4000		2	C
62	166.95	Est. Atlantico (Ca. 23)	15	1	90	40	30000		1	A
63	167.20	Est. Atlantico (Ca. 17)	-	0	-	40	5300		2	A
64	167.30	Est. Atlantico (Av. 7)	-	0	-	40	9200		2	A
65	167.50	Hosp. Calderon (Av. 7A)	8	1	90	40	2000		2	C
66	167.55	Hosp. Calderon (Av. 9)	8	1	80	40	10000		1	B
67	168.00	San Francisco	-	0	-	40	10000	e	1	A
68	168.10	Abast. La Esquina	6	1	90	40	2000	e	2	C
69	168.20	Street	5	1	90	40	1000	e	3	D
70	168.60	Concretera Nat'l (#100)	10	1	70	40	10500		1	A
71	168.80	Autopista N.	-	0	-	75	15000	e	1	A
72	169.00	Cinco Esquinas 1	4	1	90	40	1000	e	3	D
73	169.35	Cinco Esquinas 2	3	2	90	40	500	e	3	D
74	169.50	Carretera Tibas (#5)	12	1	90	60	13000		1	A
75	169.70	Cast. Azul (S. Agustin)	5	1	90	40	1000	e	3	D
76	170.60	Metalco (Colima) (#101)	5	1	80	40	2500		2	C
77	171.00	Cuatro Reinas 1	8	1	90	40	1000	e	3	D
78	171.30	Cuatro Reinas 2	5	1	90	40	1000	e	3	D
79	172.70	Rural	4	2	30	20	100	e	3	D
80	173.10	Santa Rosa 1	3	2	90	20	100	e	3	D
81	173.30	Santa Rosa 2	8	1	90	40	3000	e	2	C
82	173.50	La Rincarada	5	2	90	40	500	e	3	D
83	174.30	Rural	5	2	90	20	100	e	3	D
84	175.10	Rural	3	2	45	20	100	e	3	D
85	175.25	San Pablo	4	1	90	40	1000	e	3	D
86	175.70	Fosforera	5	1	90	40	500	e	3	D
87	175.80	Pirro (Rte 1)	12	1	30	60	10000	e	1	B
88	176.35	Calle 3	3	2	90	20	100	e	3	D
89	176.45	Av. 10 Calle 1	5	1	90	40	2000	e	2	C
90	176.55	Av. 10 Calle Cent.	6	1	90	40	3000	e	2	Close
91	176.65	Av. 10 Calle 2	6	1	90	40	3000	e	2	Close
92	176.75	Av. 10 Calle 4	6	1	90	40	3000	e	2	C
93	176.85	Av. 10 Calle 6	6	1	90	40	3000	e	2	C
94	176.90	Av. 10 Calle 8	6	1	90	40	2000	e	2	C
95	177.00	Av. 10 Calle 10	6	1	90	40	2000	e	2	C

LIST OF ROAD CROSSINGS

NO	KM	NAME	WIDTH	TYPE	ANGLE	SPEED KM/H	TRAFFIC VEH/D	CLASS	PROTECT
96	177.10	Av. 10 Calle 12	6	1	90	40	2000 e	2	C
97	177.20	Av. 10 Calle 14	6	1	90	40	2000 e	2	C
98	177.30	Av. 10 Calle 16	8	1	90	40	1000 e	3	D
99	177.80	San Fransisco 1	4	1	90	40	500 e	3	D
100	177.90	San Fransisco 2	8	1	90	40	2000 e	2	C
101	178.40	Mercedes Sur (Rte 1)	10	1	45	60	10000 e	1	B
102	178.55	Street	4	1	75	40	500 e	3	D
103	178.90	Street	3	2	90	40	500 e	3	D
104	179.10	La Palma	4	1	90	40	1000 e	3	D
105	179.50	Rural	3	3	90	20	100 e	3	D
106	180.40	Pulp. Cinco Esqinas	4	1	90	40	500 e	3	D
107	180.60	Street	5	1	90	40	500 e	3	D
108	180.70	Iglesia	5	1	90	40	500 e	3	D
109	180.80	Iglesia	5	1	90	40	1000 e	3	D
110	180.80	Esc. EE. UU.	5	1	90	40	1000 e	3	D
111	180.90	Colegio	5	1	90	40	1000 e	3	D
112	181.10	Gymnasio del Coleg.	4	1	90	40	500 e	3	D
113	181.70	Ruppin	4	1	90	40	1000 e	3	D
114	181.90	Cemetario	4	1	90	40	500 e	3	D
115	182.10	Private	3	2	90	20	100 e	3	D
116	182.80	Cerveceria (Rte 1)	6	1	90	60	10000 e	1	B
117	183.00	Echeverria	5	1	90	40	3000 e	2	C
118	183.40	Rural	3	3	90	20	100 e	3	D
119	184.00	Street	4	2	90	40	500 e	3	D
120	184.40	Private	3	2	90	20	100 e	3	D
121	184.70	Rio Segundo (Rte 1)	6	1	75	60	10000 e	1	B
122	184.90	La Chanchera	4	1	90	40	1000 e	3	D
123	185.15	Bo. El Carmen	4	1	90	40	500 e	3	D
124	185.50	Rural	3	3	90	20	100 e	3	D
125	185.70	Rural	3	3	90	20	100 e	3	D
126	187.40	Las Canas	12	1	90	40	5000 e	2	C
127	187.60	Street	5	1	90	40	1000 e	3	D
128	187.70	(Rte 1)	15	1	75	60	10000 e	1	B
129	187.80	Street	3	1	90	40	500 e	3	D
130	188.15	Autopista	-	0	-	40	8000 e	2	A
131	188.30	Street	-	0	-	40	1000 e	3	A
132	188.80	Street (Rte 124)	-	0	-	40	3000 e	2	A
133	189.00	Km 7.35	8	1	75	40	3000 e	2	C
134	189.20	Km 7.55	5	2	30	20	100 e	3	D
135	189.25	Km 7.6	5	1	90	40	1000 e	3	D
136	189.45	Km 7.8	6	1	90	40	2000 e	2	C
137	189.55	Km 7.9	5	1	90	40	500 e	3	D

Total "A" existing	5
Total "A" to constr	7
Total "B"	7
Total "C"	28
Total "D"	86
Total to close	4
Total Road Crossings	137

3.4 ESTIMATED RUNNING TIMES - MOIN TO SAN CRISTOBAL

STATION	KM	DIST	TT N/W	TT S/W	TT AV	AV SP	NEW AV SP	NEW TIME
MOIN	7.6							
		4.8	9	10	9.5	30.3	35	8
MIRAMAR	12.4							
		8.8	13	15	14.0	37.7	40	13
BOCAS	21.2							
		9.2	15	18	16.5	33.5	40	14
SABORIO	30.4							
		4.8	7	7	7.0	41.1	45	6
ESTRADA	35.2							
		2.8	5	10	7.5	22.4	35	5
MATINA	38.0							
		3.5	5	8	6.5	32.3	40	5
MARGARITA	41.5							
		7.7	14	10	12.0	38.5	45	10
MADRE DE DIOS	49.2							
		1.2	2	4	3.0	24.0	30	2
RIO HONDO	50.4							
		11.6	24	23	23.5	29.6	35	20
SIQUIRRES	62.0							
		3.0	10	10	10.0	18.0	25	7
LA JUNTA	65.0							
		5.4	15	15	15.0	21.6	25	13
BABILONIA	70.4							
		2.2	8	7	7.5	17.6	25	5
AMERICA	72.6							
		4.8	10	10	10.0	28.8	35	8
LAS MERCEDES	77.4							
		3.2	7	6	6.5	29.5	35	5
APARICIO	80.6							
		5.5	20	12	16.0	20.6	30	11
GUACIMO	86.1							
		2.5	5	15	10.0	15.0	30	5
ALTAMIRA	88.6							
		7.8	15	15	15.0	31.2	35	13
LEESVILLE	96.4							
		12.6	25	20	22.5	33.6	40	19
SAN CRISTOBAL	109.0							
T O T A L T I M E			209	215	212.0			172

ESTIMATED RUNNING TIMES - MOIN TO LEY RIVER

STATION	KM	DIST	TT N/W	TT S/W	TT AV	AV SP	NEW AV SP	NEW TIME
MOIN	7.6							
		5.2					35	9
KM 2.4	2.4							
		5.1					35	9
HOLANDA	7.5							
		10.1	28	25	26.5	22.9	35	17
LA POLONIA	17.6							
		14.4	33	35	34.0	25.4	35	25
SAN CLEMENTE	32.0							
		16.9	36	45	40.5	25.0	35	29
HALF WAY	48.9							
		1.9	8	5	6.5	17.5	25	5
LEY RIVER	50.8							
T O T A L T I M E			105	110	108			93

ESTIMATED RUNNING TIMES - LA JUNTA TO ALAJUELA

STATION	KM	DIST	TT E/W	TT W/W	TT AV	AV SP	NEW AV SP	NEW TIME
LA JUNTA	65.0							
		5.0	9.0	15.0	12.0	25.0	35.0	9
ARAYA	70.0							
		5.4	11.0	10.0	10.5	30.9	35.0	9
LAS LOMAS	75.4							
		2.2	5.0	5.0	5.0	26.4	30.0	4
EL RUBI	77.6							
		10.2	25.0	25.0	25.0	24.5	30.0	20
TUNEL	87.8							
		2.4	10.0	5.0	7.5	19.2	30.0	5
PERALTA	90.2							
		6.2	15.0	15.0	15.0	24.8	30.0	12
RIO JESUS M.	96.4							
		6.4	20.0	15.0	17.5	21.9	30.0	13
TURRIALBA	102.8							
		4.6	10.0	20.0	15.0	18.4	30.0	9
FLORENCIA	107.4							
		2.4	5.0	5.0	5.0	28.8	30.0	5
LAS PAVAS	109.8							
		11.6	40.0	28.0	34.0	20.5	30.0	23
JUAN VINAS	121.4							
		16.0	35.0	34.0	34.5	27.8	30.0	32
EL RINCON	137.4							
		2.6	5.0	5.0	5.0	31.2	35.0	4
PARAISO	140.0							
		6.4	15.0	13.0	14.0	27.4	35.0	11
CARTAGO	146.4							
		4.6	13.0	13.0	13.0	21.2	30.0	9
EL ALTO	151.0							
		6.2	12.0	12.0	12.0	31.0	35.0	11
TRES RIOS	157.2							
		5.0	10.0	12.0	11.0	27.3	35.0	9
CURRIDABAT	162.2							
		4.8	15.0	8.0	11.5	25.0	35.0	8
SAN JOSE	167.0							
		4.0	15.0	20.0	17.5	13.7	20.0	12
COLIMA	171.0							
		5.6	10.0	10.0	10.0	33.6	35.0	10
HEREDIA	176.6							
		1.4	5.0	5.0	5.0	16.8	25.0	3
SAN FRANSISCO	178.0							
		10.0			0.0		35.0	17
ALAJUELA	188.0							
T O T A L T I M E			285.0	275.0	280.0			236

ESTIMATED RUNNING TIMES - SAN JOSE TO PUNTARENAS

STATION	KM	DIST	TT E/W	TT W/W	TT AV	AV SP	NEW AV SP	NEW TIME
SAN JOSE	0.0							
		14.4	25.0	35.0	30.0	28.8	35.0	25
SAN ANTONIO	14.4							
		4.3	8.0	9.0	8.5	30.4	35.0	7
OJO DE AGUA	18.7							
		4.0	9.0	8.0	8.5	28.2	35.0	7
CIRUELAS	22.7							
		4.0	8.0	8.0	8.0	30.0	35.0	7
FOURNIER	26.7							
		3.6	8.0	9.0	8.5	25.4	30.0	7
TURRUCARES	30.3							
		7.0	14.0	15.0	14.5	29.0	35.0	12
ATENAS	37.3							
		4.5	8.0	9.0	8.5	31.8	35.0	8
BALSA	41.8							
		4.7	10.0	7.0	8.5	33.2	35.0	8
PONCHO MORA	46.5							
		3.2	13.0	7.0	10.0	19.2	25.0	8
ESCOBAL	49.7							
		2.8	7.0	6.0	6.5	25.8	30.0	6
QUEBRADAS	52.5							
		3.5	7.0	7.0	7.0	30.0	35.0	6
CONCEPCION	56.0							
		3.0	6.0	7.0	6.5	27.7	35.0	5
DANTAS	59.0							
		3.1	6.0	6.0	6.0	31.0	35.0	5
H. VIEJA	62.1							
		4.1	11.0	7.0	9.0	27.3	35.0	7
OROTINA	66.2							
		7.7	15.0	19.0	17.0	27.2	35.0	13
POZON	73.9							
		8.1	21.0	18.0	19.5	24.9	35.0	14
UVITA	82.0							
		3.8	6.0	6.0	6.0	38.0	40.0	6
JESUS MARIA	85.8							
		3.4	8.0	6.0	7.0	29.1	35.0	6
SALINAS	89.2							
		7.6	15.0	18.0	16.5	27.6	35.0	13
CABEZAS	96.8							
		5.2	9.0	8.0	8.5	36.7	40.0	8
BARRANCA	102.0							
		8.0	16.0	17.0	16.5	29.1	35.0	14
CHACARITA	110.0							
		6.0	10.0	8.0	9.0	40.0	40.0	9
PUNTARENAS	116.0							
TOTAL TIME			240.0	240.0	240.0			200

4. DESIGN DETAILS

4.1

TRACK DESIGN - BANANA "YD" LINES

RAILROAD DATA: INCOFER U68 loc

1 - Track Gauge	mm	1067.00
2 - Maximum Track Speed	kph	15.00
3 - Maximum Axle Load for Vmax.	tonnes	13.20
4 - Wheel Diameter for heavy loads.	mm	914.00
5 - Number of Axles applying load		2
6 - Distance 1st Axle to 2nd Axle	mm	2083.00
7 - Distance 1st Axle to 3rd Axle	mm	0.00
8 - Distance 1st Axle to 4th Axle	mm	0.00

RAIL DATA: 50 ASCE

1 - Weight of Rail Section.	kg/m	24.95
2 - Moment of Inertia	cm^4	435.45
3 - Rail Head Width	mm	54.10
4 - Base of Rail to Neutral Axis.	mm	48.01

TIE DATA: CT-23M Monobloc

1 - Type of Tie: 1=Wood 2=Conc 3=Bibloc		2
2 - Length of Tie	mm	2000.00
3 - Width of Tie.	mm	200.00
4 - Thickness of Tie.	mm	220.00

OTHER DESIGN DATA:

1 - Tie Spacing (centers)	mm	700.00
2 - Depth of Ballast below ties	mm	200.00
3 - Thickness of Sub-ballast layer.	mm	100.00

TRACK DESIGN PARAMETER		COMPUTED VALUE	RECOMMENDED VALUE
Rail Weight (RW).	kg/m	24.95	> 26.12
Dynamic Loading Coefficient (DL).		0.11	
Rail Support Modulus (U).	kPa	19886	> 10343
Moment Coefficient (CM)		0.96	
Deflection Coefficient (CD)		0.96	
Maximum Rail Moment (MO).	N-m	11221	
Maximum Track Deflection (YO)	mm	2.64	< 6.35
Maximum Rail Seat Load (QO)	N	36801	
Maximum Rail Stress (RS).	kPa	123693	< 172375
Zero Moment Distance (X1)	mm	512.42	
Tie Spacing (TS).	mm	700.00	< 689.42
Tie Rail Seat Moment (MR)	N-m	3554	
Tie Center Moment (MC).	N-m	2229	
Maximum wood fibre stress (WS).	kPa	0	< 8274
Tie Effective Bearing Area (AB)	cm^2	4000	
Ballast Depth (BD).	mm	200.00	> 195.39
Sub-Ballast Depth (SD).	mm	100.00	> 110.33
Maximum Ballast Pressure (PA)	kPa	184.02	< 448.18
Maximum Sub-Ballast Pressure (PB)	kPa	234.39	< 241.33
Maximum Subgrade Pressure (PC).	kPa	141.19	< 137.90

TRACK DESIGN - BANANA "BL" LINES

RAILROAD DATA:		INCOFER U68 loc
1 - Track Gauge	mm	1067.00
2 - Maximum Track Speed	kph	30.00
3 - Maximum Axle Load for Vmax.	.tonnes	13.20
4 - Wheel Diameter for heavy loads.	mm	914.00
5 - Number of Axles applying load		2
6 - Distance 1st Axle to 2nd Axle	mm	2083.00
7 - Distance 1st Axle to 3rd Axle	mm	0.00
8 - Distance 1st Axle to 4th Axle	mm	0.00

RAIL DATA:		60 ASCE
1 - Weight of Rail Section.	kg/m	30.31
2 - Moment of Inertia	cm^4	637.20
3 - Rail Head Width	mm	60.45
4 - Base of Rail to Neutral Axis.	mm	53.59

TIE DATA:		CT-23M Monobloc
1 - Type of Tie: 1=Wood 2=Conc 3=Bibloc		2
2 - Length of Tie	mm	2000.00
3 - Width of Tie.	mm	200.00
4 - Thickness of Tie.	mm	220.00

OTHER DESIGN DATA:

1 - Tie Spacing (centers)	mm	700.00
2 - Depth of Ballast below ties	mm	200.00
3 - Thickness of Sub-ballast layer.	mm	100.00

TRACK DESIGN PARAMETER		COMPUTED VALUE	RECOMMENDED VALUE
Rail Weight (RW).	kg/m	30.31	> 28.32
Dynamic Loading Coefficient (DL).		0.21	
Rail Support Modulus (U).	kPa	19886	> 10343
Moment Coefficient (CM)		0.93	
Deflection Coefficient (CD)		0.96	
Maximum Rail Moment (MO).	N-m	13147	
Maximum Track Deflection (YO)	mm	2.64	< 6.35
Maximum Rail Seat Load (QO)	N	36797	
Maximum Rail Stress (RS).	kPa	110561	< 172375
Zero Moment Distance (X1)	mm	563.58	
Tie Spacing (TS).	mm	700.00	< 758.29
Tie Rail Seat Moment (MR)	N-m	3503	
Tie Center Moment (MC).	N-m	2345	
Maximum wood fibre stress (WS).	kPa	0	< 8274
Tie Effective Bearing Area (AB)	cm^2	4000	
Ballast Depth (BD).	mm	200.00	> 195.37
Sub-Ballast Depth (SD).	mm	100.00	> 110.32
Maximum Ballast Pressure (PA)	kPa	184.00	< 448.18
Maximum Sub-Ballast Pressure (PB)	kPa	234.36	< 241.33
Maximum Subgrade Pressure (PC).	kPa	141.18	< 137.90

TRACK DESIGN - MAIN LINE

RAILROAD DATA: INCOFER Alsthom loc

1 - Track Gauge	mm	1067.00
2 - Maximum Track Speed	kph	60.00
3 - Maximum Axle Load for Vmax.	tonnes	16.00
4 - Wheel Diameter for heavy loads.	mm	1250.00
5 - Number of Axles applying load		2
6 - Distance 1st Axle to 2nd Axle	mm	2800.00
7 - Distance 1st Axle to 3rd Axle	mm	0.00
8 - Distance 1st Axle to 4th Axle	mm	0.00

RAIL DATA: 70 ASCE

1 - Weight of Rail Section.	kg/m	34.67
2 - Moment of Inertia	cm^4	830.38
3 - Rail Head Width	mm	61.98
4 - Base of Rail to Neutral Axis.	mm	57.91

TIE DATA: CT-23M Monobloc

1 - Type of Tie: 1=Wood 2=Conc 3=Bibloc		2
2 - Length of Tie	mm	2000.00
3 - Width of Tie.	mm	200.00
4 - Thickness of Tie.	mm	220.00

OTHER DESIGN DATA:

1 - Tie Spacing (centers)	mm	700.00
2 - Depth of Ballast below ties	mm	250.00
3 - Thickness of Sub-ballast layer.	mm	100.00

TRACK DESIGN PARAMETER		COMPUTED VALUE	RECOMMENDED VALUE
Rail Weight (RW).	kg/m	34.67	> 35.55
Dynamic Loading Coefficient (DL).		0.31	
Rail Support Modulus (U).	kPa	19886	> 10343
Moment Coefficient (CM)		0.99	
Deflection Coefficient (CD)		0.96	
Maximum Rail Moment (MO).	N-m	19524	
Maximum Track Deflection (YO)	mm	3.26	< 6.35
Maximum Rail Seat Load (QO)	N	45381	
Maximum Rail Stress (RS).	kPa	136136	< 172375
Zero Moment Distance (X1)	mm	602.16	
Tie Spacing (TS).	mm	700.00	< 755.49
Tie Rail Seat Moment (MR)	N-m	4304	
Tie Center Moment (MC).	N-m	2927	
Maximum wood fibre stress (WS).	kPa	0	< 8274
Tie Effective Bearing Area (AB)	cm^2	4000	
Ballast Depth (BD).	mm	250.00	> 231.05
Sub-Ballast Depth (SD).	mm	100.00	> 130.47
Maximum Ballast Pressure (PA)	kPa	226.93	< 448.18
Maximum Sub-Ballast Pressure (PB)	kPa	218.68	< 241.33
Maximum Subgrade Pressure (PC).	kPa	143.60	< 137.90

TRACK DESIGN - INTER-URBAN RAILWAY

RAILROAD DATA: INCOFER Alsthom loc

1 - Track Gauge	mm	1067.00
2 - Maximum Track Speed	kph	70.00
3 - Maximum Axle Load for Vmax.	tonnes	16.00
4 - Wheel Diameter for heavy loads.	mm	1250.00
5 - Number of Axles applying load		2
6 - Distance 1st Axle to 2nd Axle	mm	2800.00
7 - Distance 1st Axle to 3rd Axle	mm	0.00
8 - Distance 1st Axle to 4th Axle	mm	0.00

RAIL DATA: 85 CP

1 - Weight of Rail Section.	kg/m	42.21
2 - Moment of Inertia	cm^4	1227.46
3 - Rail Head Width	mm	61.98
4 - Base of Rail to Neutral Axis.	mm	58.42

TIE DATA: CT-23M Monobloc

1 - Type of Tie: 1=Wood 2=Conc 3=Bibloc		2
2 - Length of Tie	mm	2000.00
3 - Width of Tie.	mm	200.00
4 - Thickness of Tie.	mm	220.00

OTHER DESIGN DATA:

1 - Tie Spacing (centers)	mm	700.00
2 - Depth of Ballast below ties	mm	250.00
3 - Thickness of Sub-ballast layer.	mm	100.00

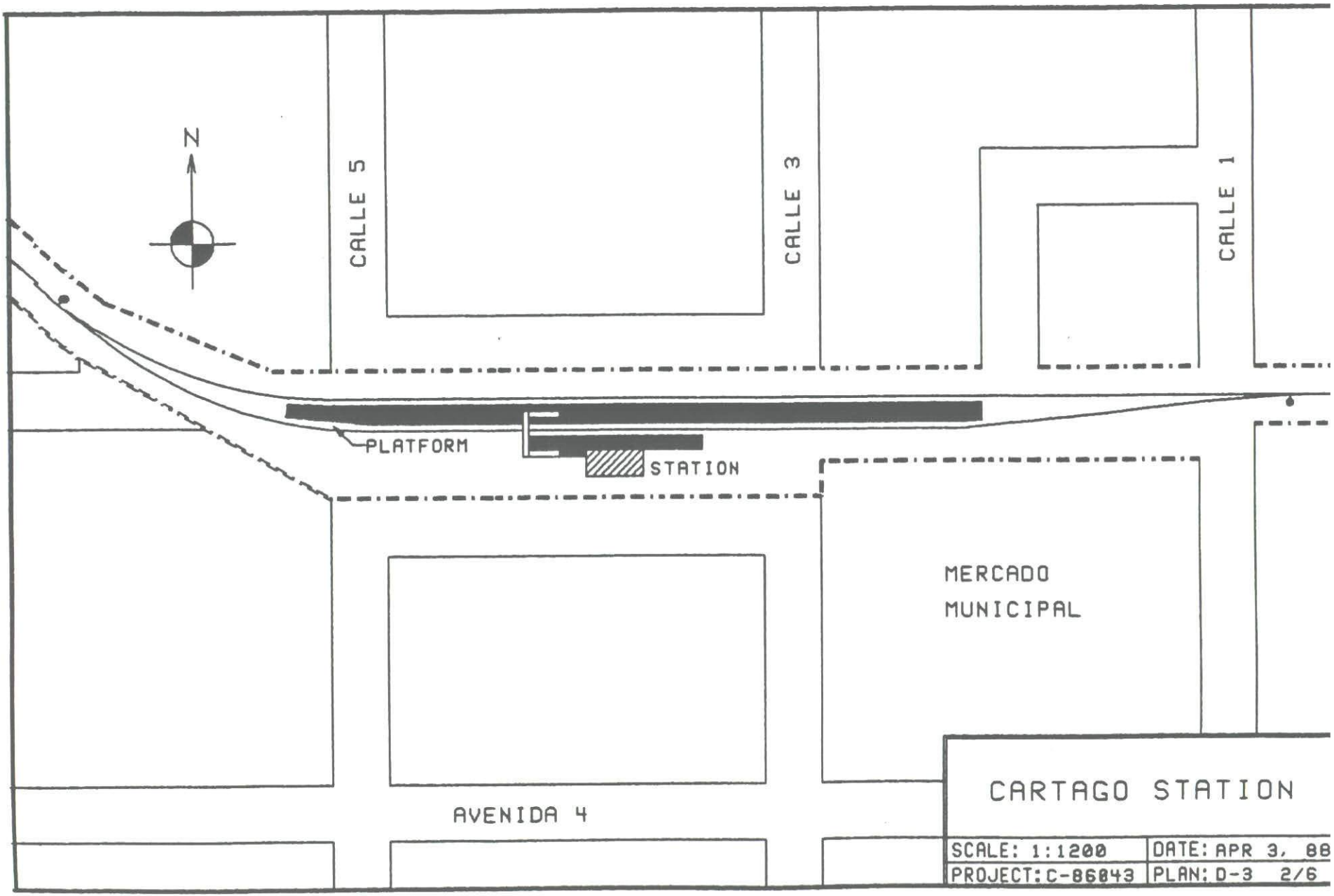
TRACK DESIGN PARAMETER		COMPUTED VALUE	RECOMMENDED VALUE
Rail Weight (RW).	kg/m	42.21	> 36.68
Dynamic Loading Coefficient (DL).		0.36	
Rail Support Modulus (U).	kPa	19886	> 10343
Moment Coefficient (CM)		0.97	
Deflection Coefficient (CD)		0.96	
Maximum Rail Moment (MO).	N-m	21936	
Maximum Track Deflection (YO)	mm	3.05	< 6.35
Maximum Rail Seat Load (QO)	N	42489	
Maximum Rail Stress (RS).	kPa	104382	< 172375
Zero Moment Distance (X1)	mm	663.96	
Tie Spacing (TS).	mm	700.00	< 851.52
Tie Rail Seat Moment (MR)	N-m	4030	
Tie Center Moment (MC).	N-m	2741	
Maximum wood fibre stress (WS).	kPa	0	< 8274
Tie Effective Bearing Area (AB)	cm^2	4000	
Ballast Depth (BD).	mm	250.00	> 219.19
Sub-Ballast Depth (SD).	mm	100.00	> 123.78
Maximum Ballast Pressure (PA)	kPa	212.46	< 448.18
Maximum Sub-Ballast Pressure (PB)	kPa	204.74	< 241.33
Maximum Subgrade Pressure (PC).	kPa	134.45	< 137.90

4.2 INTER-URBAN TRANSPORT STATION LOCATIONS

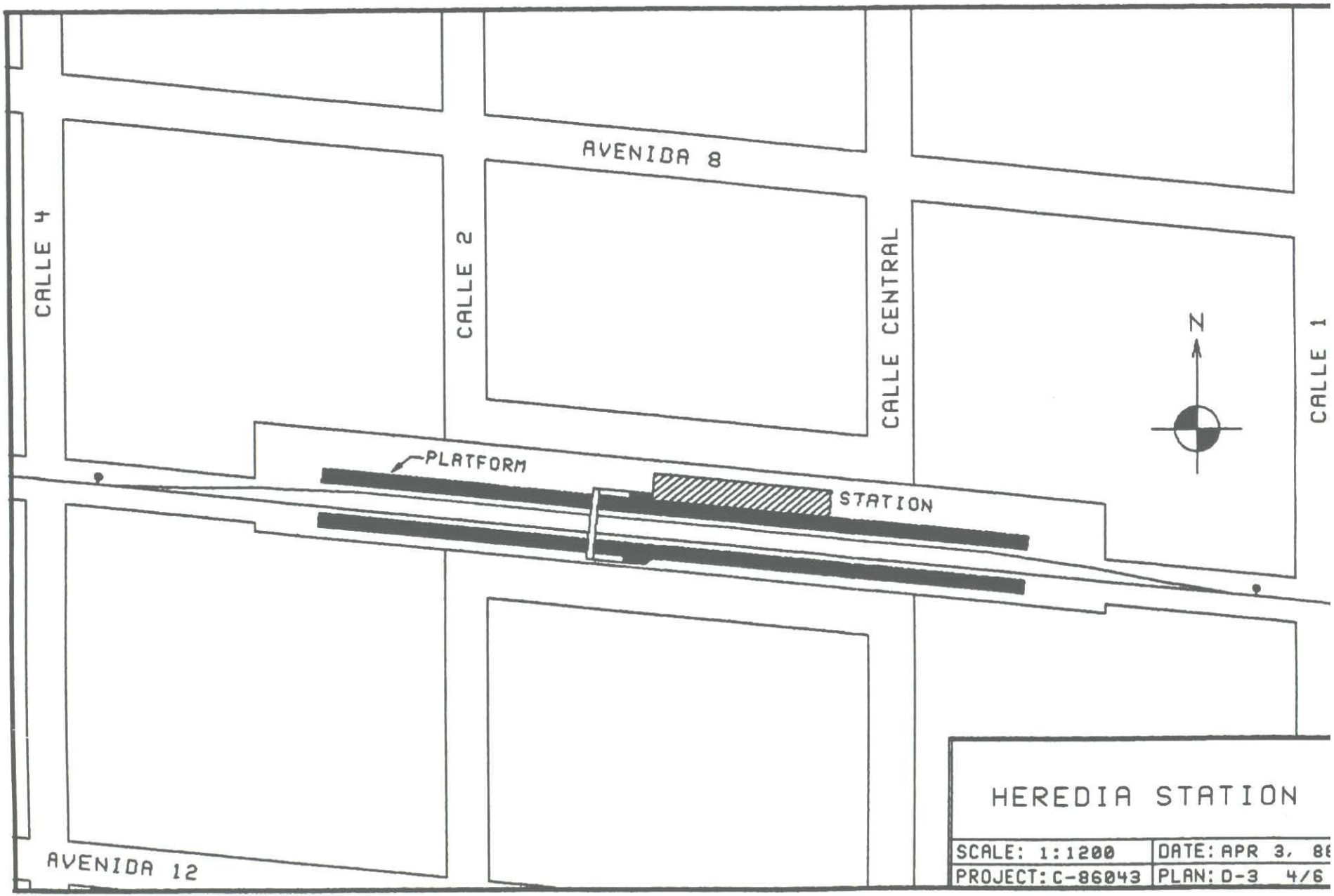
NO	STATION NAME	KM	NO OF SIDINGS	NO OF PLATFMS	T/O KM	INTERVAL DIST	ESTIMATED WW TIMES	ESTIMATED EW TIMES	COMMENTS
					146.47				To Paraiso
1.	Cartago	146.60	1	2	146.73	0.26	00:02:00	00:02:00	
						0.74	00:01:30	00:01:10	
2.	Reventado	147.60	0	0	147.47				No stops
						3.40	00:05:20	00:04:20	
					150.87				
3.	El Alto	151.00	1	2	151.13	0.26	00:00:30	00:00:30	
						5.84	00:07:20	00:10:40	
					156.97				
4.	Tres Rios	157.10	1	2	157.23	0.26	00:00:30	00:00:30	
						4.89	00:06:20	00:07:50	
					162.12				
5.	Curridabat	162.25	1	2	162.38	0.26	00:00:30	00:00:30	
						2.79	00:04:00	00:04:10	
					165.17				
6.	San Pedro	165.30	1	2	165.43	0.26	00:02:00	00:02:00	
						1.49	00:02:40	00:02:50	
					166.92				
7.	San Jose	167.10	2	2	167.28	0.36	00:03:00	00:03:00	
						3.74	00:05:50	00:06:30	
					171.02				
8.	Colima	171.15	1	2	171.28	0.26	00:00:30	00:00:30	
						1.79	00:04:00	00:04:00	
					173.07				
9.	Santa Rosa	173.20	1	2	173.33	0.26	00:00:30	00:00:30	
						3.14	00:04:30	00:03:50	
					176.47				
10.	Heredia	176.60	1	2	176.73	0.26	00:02:00	00:02:00	
						3.89	00:05:50	00:07:40	
					180.62				
11.	San Joaquin	180.75	1	2	180.88	0.26	00:00:30	00:00:30	
						3.59	00:05:20	00:07:30	
					184.47				
12.	Rio Segundo	184.60	1	2	184.73	0.26	00:00:30	00:00:30	
						2.99	00:05:00	00:05:30	
					187.72				
13.	Alajuela Shop	187.90	1	0	188.08	0.36	00:00:00	00:00:00	Meets only
						1.29	00:02:00	00:02:00	
					189.37				
14.	Alajuela	189.50	1	2	189.59	0.22	00:02:00	00:02:00	End of track
TOTAL STOPS (12)							00:14:30	00:14:30	
TOTAL RUNS (11)							00:54:20	01:03:40	
T O T A L S		42.90	14	24		43.12	01:14:10	01:22:30	

NOTE: Times based on ELC Electroconsult TPC runs using 1 250 kW locomotive.

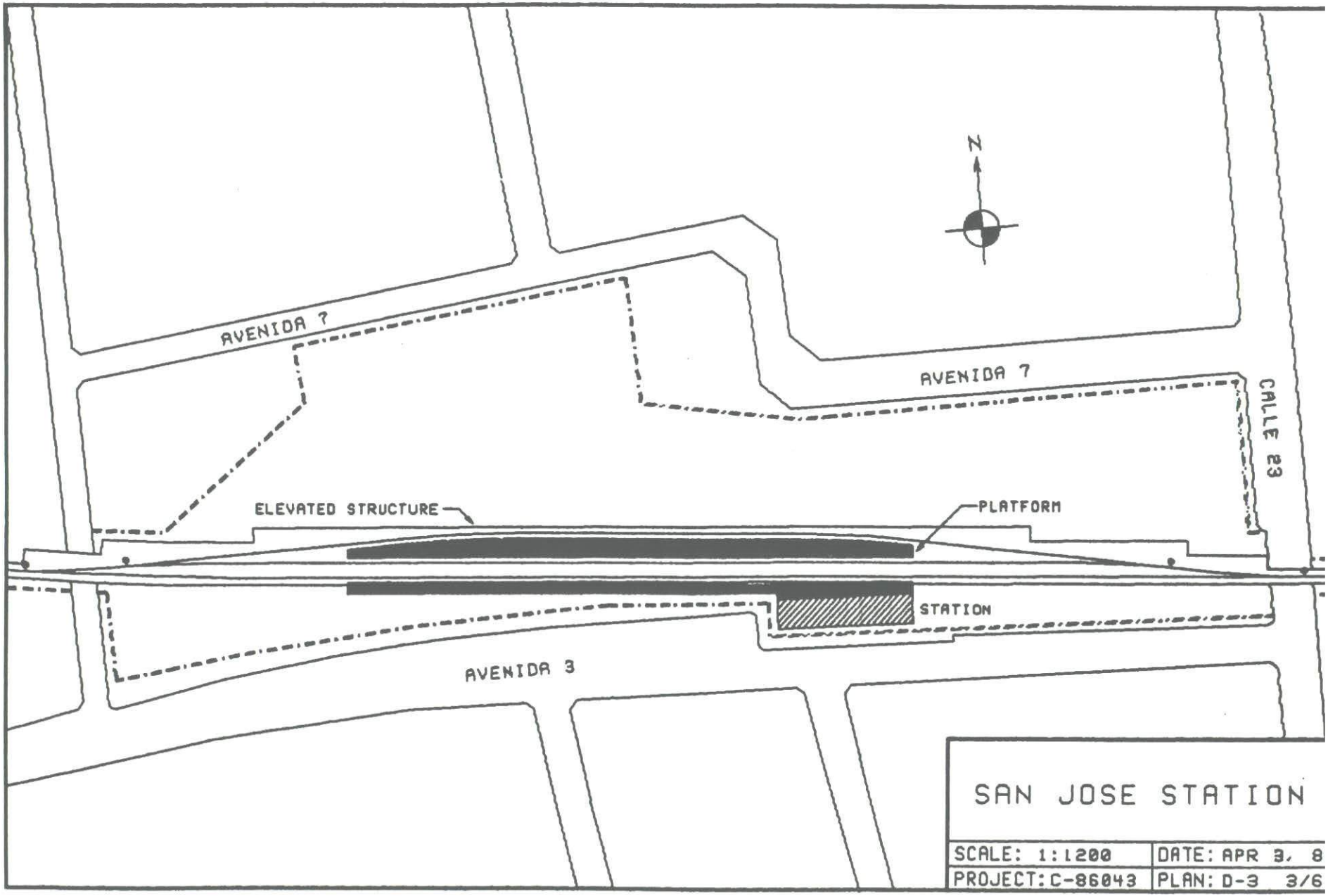
4.2 Interurban Station Locations

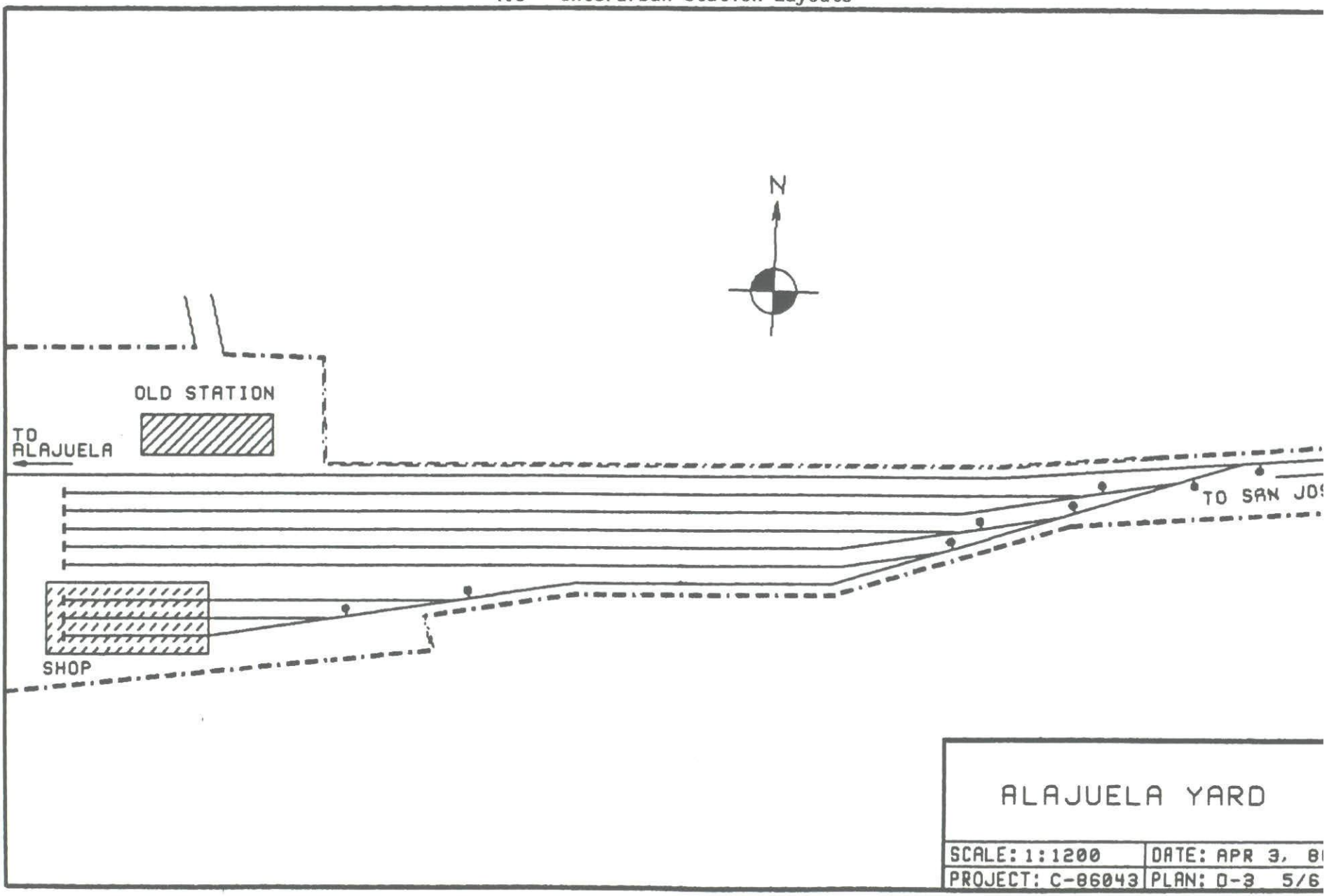


4.2 Interurban Station Locations

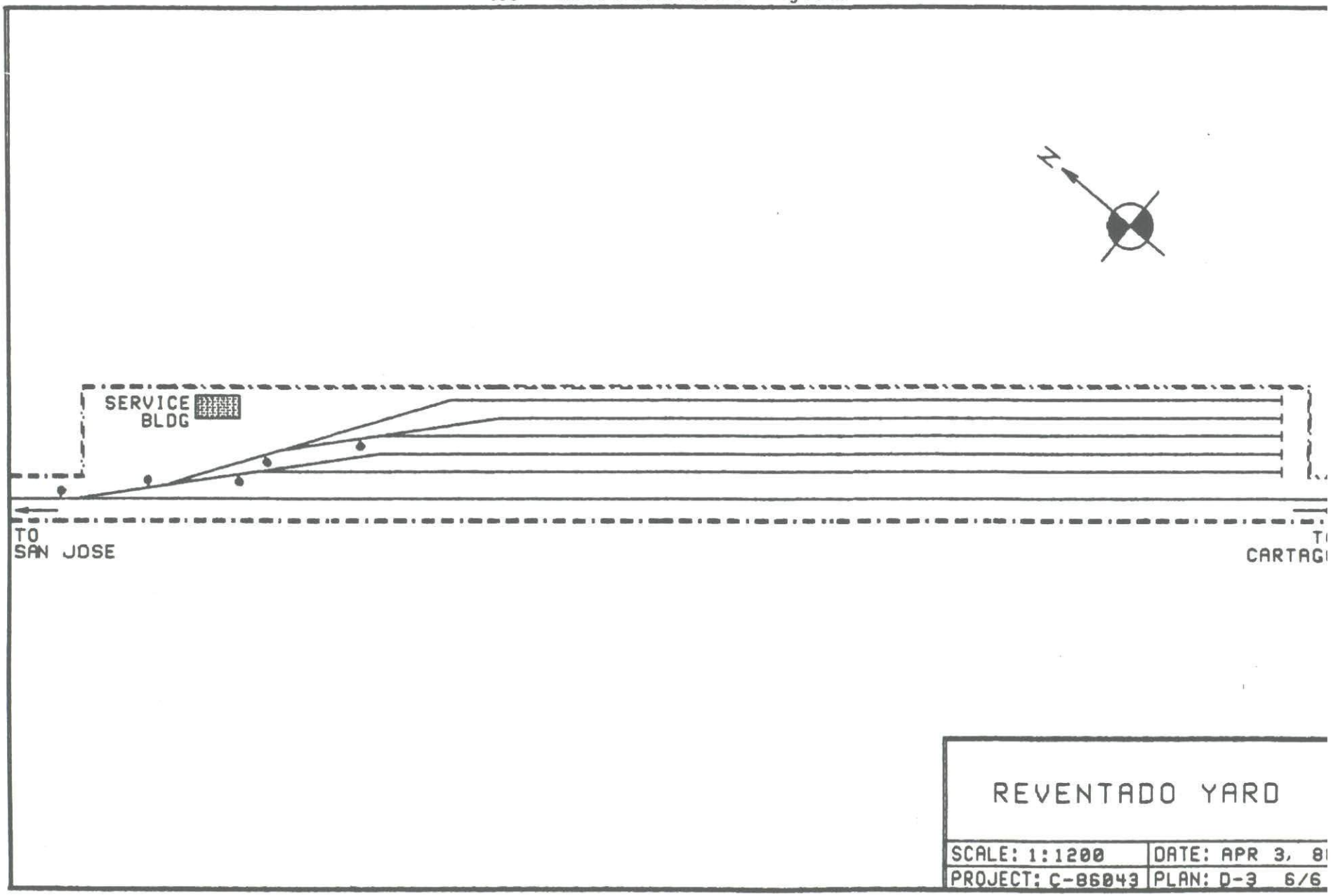


4.2 Interurban Station Locations

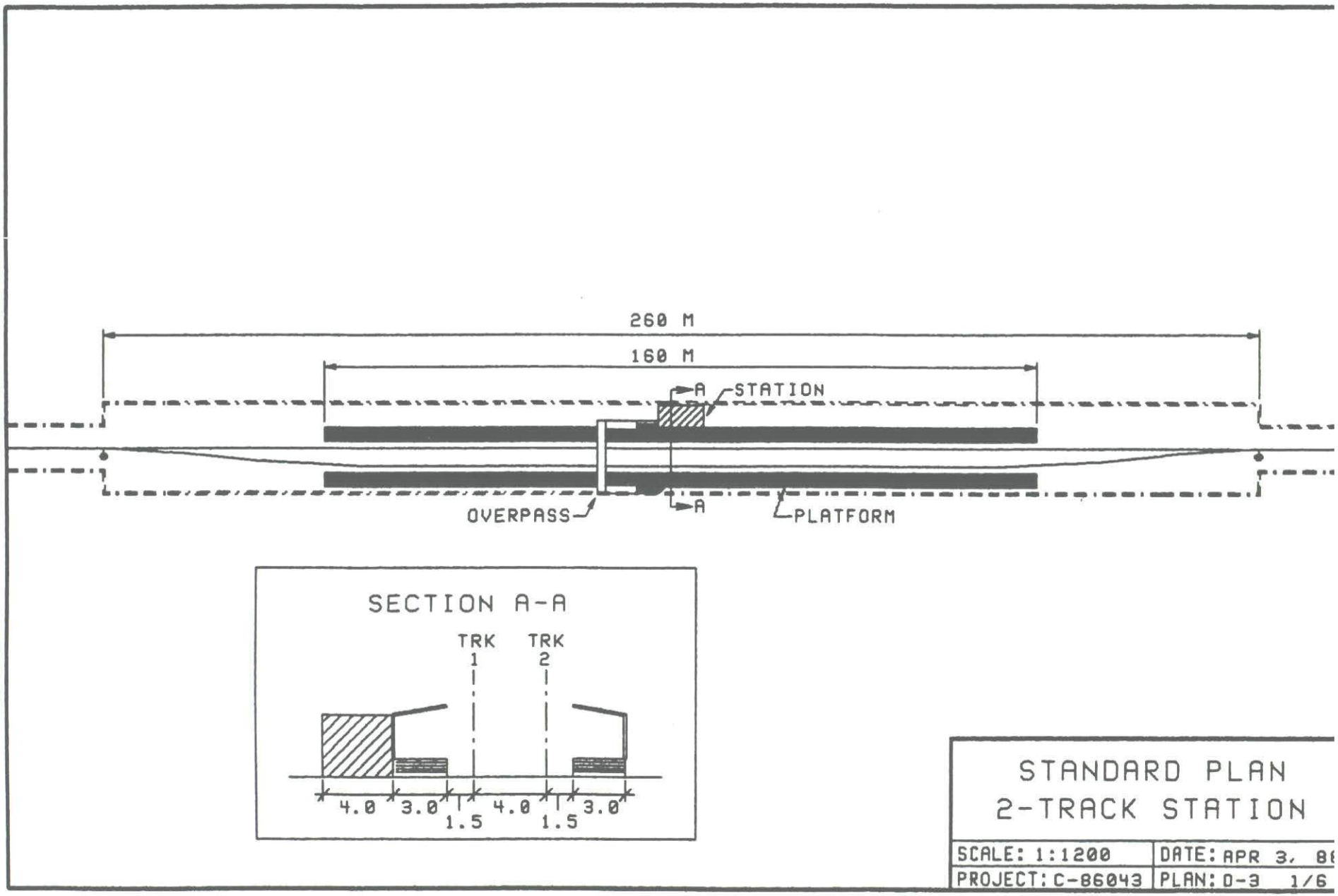


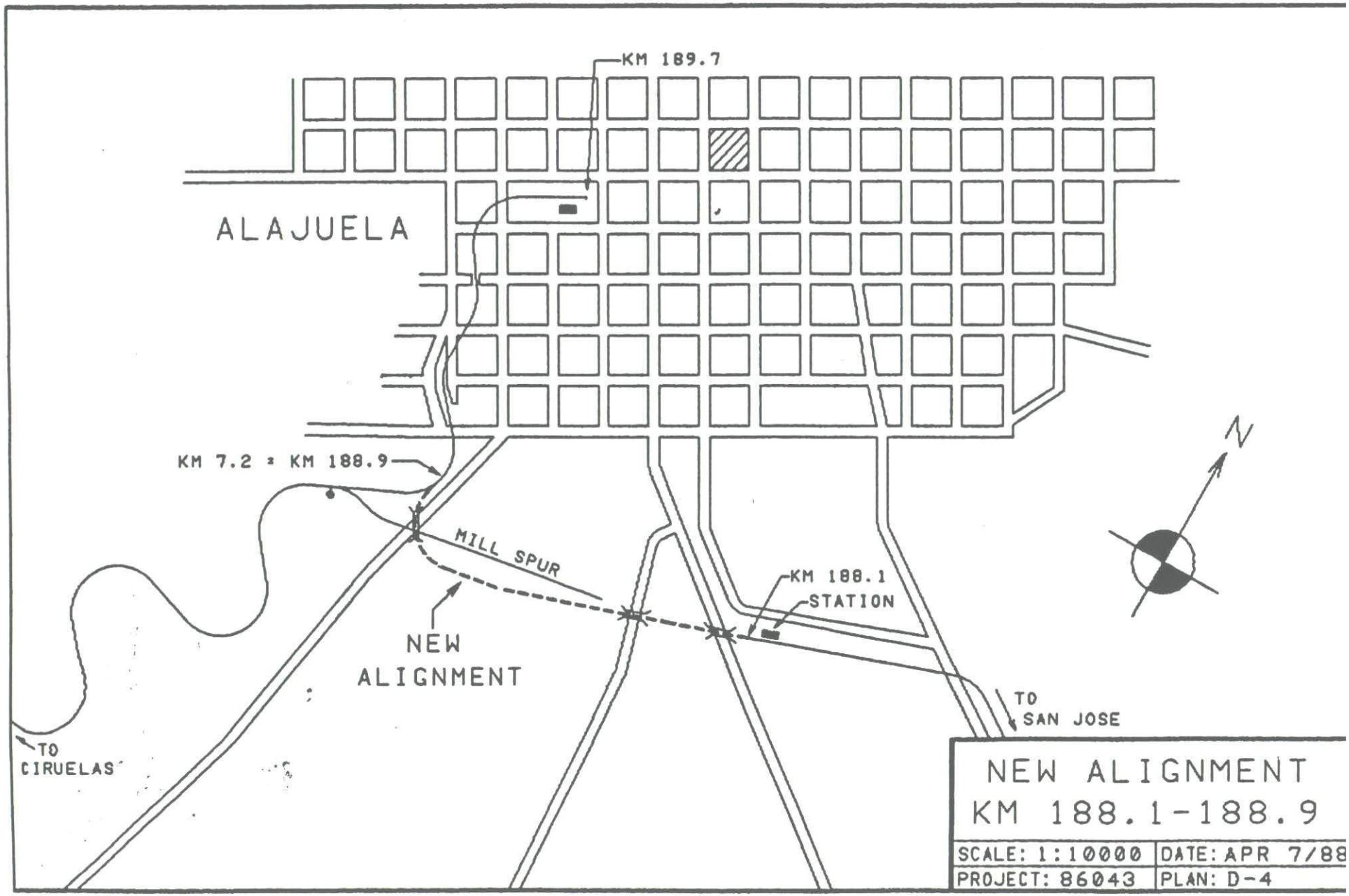

N
OLD STATION
TO ALAJUELA
TO SAN JOS
SHOP
ALAJUELA YARD
SCALE: 1:1200
DATE: APR 3, 8
PROJECT: C-86043
PLAN: D-3 5/6

4.3 Interurban Station Layouts



4.3 Interurban Station Layouts




KM 189.7
ALAJUELA
KM 7.2 = KM 188.9
MILL SPUR
KM 188.1
STATION
NEW
ALIGNMENT
TO
SAN JOSE
TO
CIRUELAS
N
NEW ALIGNMENT
KM 188.1-188.9
SCALE: 1:10000
DATE: APR 7/88
PROJECT: 86043
PLAN: D-4

5. UNIT COSTS

Colon exchange Rate: 1986= 52.00 Inflation Rate: 1986= 19.00%, 2.60% Local, Foreign
1988= 74.00 1987= 15.50%, 2.80% Local, Foreign

5.1 U N I T C O S T S - CIVIL (US Dollars)

DESCRIPTION	INCLUDES INSTALLATION	UNIT	1986 LOCAL	1986 FOREIGN	1986 TOTAL	1988 LOCAL	1988 FOREIGN	1988 TOTAL
Land for right-of-way	N	m^2	$ 0.07	$ 0.00	$ 0.07	$ 6.76	$ 0.00	$ 6.76
Clearing and grubbing r/w	Y	m^2	0.06	0.00	0.06	0.14	0.00	0.14
Land for yard site	N	m^2	5.00	0.00	5.00	6.76	0.00	6.76
Clearing and grubbing site	Y	m^2	0.70	0.00	0.70	0.14	0.00	0.14
Preparation of yard site	Y	m^2	-	-	-	2.50	0.00	2.50
Preparation of building site	Y	m^2	7.69	0.00	7.69	7.43	0.00	7.43
Preparation of storage site	Y	m^2	11.54	0.00	11.54	11.14	0.00	11.14
Earth movement	Y	m^3	3.00	0.00	3.00	2.90	0.00	2.90
Foundation excavation	Y	m^3	4.00	0.00	4.00	8.11	0.00	8.11
Compacted earth fill	Y	m^3	-	-	-	4.00	0.00	4.00
Compacted granular fill	Y	m^3	3.00	0.00	3.00	7.43	0.00	7.43
Earth movement for subgrade rehab	Y	m^3	4.00	0.00	4.00	3.86	0.00	3.86
Drainage ditch excavation	Y	lin m	4.00	0.00	4.00	3.86	0.00	3.86
Drainage ditch restoration	Y	lin m	2.50	0.00	2.50	2.41	0.00	2.41
Erosion protection	Y	m^3	20.00	0.00	20.00	19.32	0.00	19.32
Concrete duct c/w bedding	Y	lin m	1.50	0.00	1.50	2.50	0.00	2.50
Security fencing	Y	lin m	-	-	-	16.50	0.00	16.50
Asphalt pavement	Y	m^2	-	-	-	28.09	0.00	28.09
Pre-cast concrete for post-tension	Y	m^3	$ 242.00	$ 38.00	$ 280.00	$ 233.73	$ 40.08	$ 273.81
Cast-in-place structural concrete	Y	m^3	190.00	0.00	190.00	183.51	0.00	183.51
Concrete for foundation/pavement	Y	m^3	130.00	0.00	130.00	125.56	0.00	125.56
Lean concrete	Y	m^3	80.00	0.00	80.00	77.27	0.00	77.27
Structural steelwork	Y	kg	0.00	4.00	4.00	0.00	4.22	4.22
Reinforcement steel bars	N	kg	1.00	0.00	1.00	0.41	0.00	0.41
Reinforcement steel fabric	N	kg	2.00	0.00	2.00	0.66	0.00	0.66
Concrete bearing piles (80 t)	Y	each	1,564.00	136.00	1,700.00	1,689.19	160.00	1,849.19
Neoprene seals	N	lin m	10.00	0.00	10.00	9.66	0.00	9.66
Post-tension boxes	N	each	0.00	280.00	280.00	0.00	295.32	295.32
Post-tension returns	N	each	0.00	100.00	100.00	0.00	105.47	105.47
Neoprene bearings	N	each	0.00	90.00	90.00	0.00	94.93	94.93
Acrylic paint	Y	m^2	8.00	0.00	8.00	7.73	0.00	7.73
Waterproofing	Y	m^2	8.00	0.00	8.00	7.73	0.00	7.73
Station building construction	Y	m^2	$ 210.00	$ 0.00	$ 210.00	$ 216.22	$ 0.00	$ 216.22
Train platform construction	Y	m^2	20.00	0.00	20.00	50.00	0.00	50.00
Rain shelter construction	Y	m^2	40.00	0.00	40.00	75.68	0.00	75.68
Pedestrian overpass construction	Y	each	0.00	2,500.00	2,500.00	0.00	4,000.00	4,000.00
Elevated platform construction	Y	m^2	66.67	0.00	66.67	64.39	0.00	64.39
Mechanical shop construction	Y	m^2	100.00	0.00	100.00	202.70	0.00	202.70
Tie fabrication shop construction	Y	m^2	34.62	0.00	34.62	175.68	0.00	175.68
Storage building construction	Y	m^2	38.46	0.00	38.46	189.19	0.00	189.19
Office/service building constr.	Y	m^2	134.62	0.00	134.62	216.22	0.00	216.22

Colon exch. rate: 1986= 52.00
1988= 74.00

Inflation Rate: 1986= 19.00%, 2.60% Local, Foreign
1987= 15.50%, 2.80% Local, Foreign

5.2 U N I T C O S T S - TRACK (US Dollars)

DESCRIPTION	INCLUDES INSTALLATION	UNIT	UNIT WT	1986 LOCAL	1986 FOREIGN	1986 TOTAL	1988 LOCAL	1988 FOREIGN	1988 TOTAL
Dismantle track	Y	m	-	0.96	0.00	0.96	1.14	0.00	1.14
Construct track	Y	m	-	2.88	0.00	2.88	3.99	0.00	3.99
Equipment cost	Y	m	-	2.88	0.00	2.88	4.18	0.00	4.18
Ballast	N	m^3	3,400 Lb	7.31	0.00	7.31	8.50	0.00	8.50
Rail 85 CP new	N	tonne	2,200 Lb	0.00	500.00	500.00	0.00	554.17	554.17
Rail 70 ASCE new	N	tonne	2,200 Lb	0.00	473.13	473.13	0.00	554.17	554.17
Rail 60 ASCE new	N	tonne	2,200 Lb	-	-	-	0.00	554.17	554.17
Rail 50 ASCE new	N	tonne	2,200 Lb	-	-	-	0.00	554.17	554.17
Prestressed concrete ties	N	each	360 Lb	5.77	5.77	11.54	9.05	5.69	14.74
Rail-Tie fastening system	N	tie set	-	0.00	11.54	11.54	0.00	15.20	15.20
Rail joint bars 85 Lb	N	pair	52 Lb	0.00	14.80	14.80	0.00	24.67	24.67
Rail joint bars 70 Lb	N	pair	40 Lb	0.00	12.92	12.92	0.00	18.98	18.98
Rail joint bars 60 Lb	N	pair	33 Lb	-	-	-	0.00	15.66	15.66
Rail joint bars 50 Lb	N	pair	26 Lb	-	-	-	0.00	12.34	12.34
Track bolts 7/8" x 4 1/2"	N	each	1.19 Lb	0.00	0.80	0.80	0.00	0.62	0.62
Track bolts 3/4" x 4"	N	each	.77 Lb	0.00	0.52	0.52	0.00	0.40	0.40
Track bolts 3/4" x 3 1/2"	N	each	.73 Lb	-	-	-	0.00	0.38	0.38
Tie plates 7 1/2" x 10"	N	each	11.3 Lb	-	-	-	0.00	4.28	4.28
Tie plates 7" x 9"	N	each	9.5 Lb	-	-	-	0.00	3.60	3.60
Track spikes 5/8" x 5 1/2"	N	each	.75 Lb	-	-	-	0.00	0.30	0.30
Rail anchors 85 Lb	N	each	1.5 Lb	-	-	-	0.00	1.38	1.38
Rail anchors 70 Lb	N	each	1.2 Lb	-	-	-	0.00	1.10	1.10
Welded rail joints 85 Lb	N	each	-	0.00	30.00	30.00	0.00	36.87	36.87
Welded rail joints 70 Lb	N	each	-	0.00	21.29	21.29	0.00	30.36	30.36
Welded rail joints 60 Lb	N	each	-	-	-	-	0.00	26.02	26.02
Welded rail joints 50 Lb	N	each	-	-	-	-	0.00	21.69	21.69
Turnout #10 85 Lb complete	N	each	5,000 Lb	0.00	9000.00	9000.00	0.00	7571.43	7,571.43
Turnout #8 70 Lb complete	N	each	3,500 Lb	0.00	4807.69	4807.69	0.00	5300.00	5,300.00
Turnout #7 60 Lb complete	N	each	2,500 Lb	-	-	-	0.00	3785.71	3,785.71
Turnout #6 50 Lb complete	N	each	2,000 Lb	-	-	-	0.00	3028.57	3,028.57

Colon exchange Rate: 1986= 52.00 Inflation Rate: 1986= 19.00%, 2.60% Local, Foreign
1988= 74.00 1987= 15.50%, 2.80% Local, Foreign

5.3 U N I T C O S T S - SIGNALS & COMMUNICATIONS (US Dollars)

DESCRIPTION	INCLUDES INSTALLATION	UNIT	1986 LOCAL	1986 FOREIGN	1986 TOTAL	1988 LOCAL	1988 FOREIGN	1988 TOTAL
Inter-block equipment in stations:								
for station tracks	Y	track	$ 21,000	$ 83,000	$ 104,000	$ 20,282	$ 87,542	$ 107,825
for entrance and departure	Y	direction	7,000	28,000	35,000	6,761	29,532	36,293
Signalling misc. turnouts	Y	track km	1,400	7,600	9,000	1,352	8,016	9,368
Crossing protection lights	Y	each	-	-	-	10,030	42,329	52,359
Crossing protection lights & gates	Y	each	15,500	59,900	75,400	14,970	63,178	78,149
Line block equipment	Y	section	7,000	36,000	43,000	6,761	37,970	44,731
Signal bungalows & equipment	Y	track km	660	3,540	4,200	637	3,734	4,371
Computer-aided Manual Block System	Y	each	-	-	-	0	400,000	400,000
Signalling 2-track station	Y	each	-	-	-	27,918	84,942	112,860
Signalling 3-track station	Y	each	-	-	-	33,024	100,656	133,680
Signalling yard entrance	Y	each	-	-	-	17,816	54,504	72,320
Telephone system and varoius equip	Y	LS	15,000	130,000	145,000	14,487	137,115	151,602
Cable 50 pair armored	Y	track km	9,200	7,800	17,000	8,886	14,700	23,586
UHF diplex repeater c/w accessories	Y	each	-	-	-	1,200	13,125	14,325
UHF base stn. radio c/w accessories	Y	each	-	-	-	600	8,295	8,895
UHF mobile radio c/w accessories	Y	each	-	-	-	250	2,730	2,980
UHF hand-held radio c/w accessories	Y	each	-	-	-	50	2,205	2,255

Colon exch. Rate: 1986= 52.00 Inflation Rate: 1986= 19.00%, 2.60% Local, Foreign
1988= 74.00 1987= 15.50%, 2.80% Local, Foreign

5.4 U N I T C O S T S - ELECTRIFICATION (US Dollars)

DESCRIPTION	INCLUDES INSTALLATION	UNIT	1986 LOCAL	1986 FOREIGN	1986 TOTAL	1988 LOCAL	1988 FOREIGN	1988 TOTAL
Main substation 138/25 kV	Y	each	$ 55,447	$ 386,663	$ 442,110	$ 64,263	$ 489,389	$ 553,652
Secondary substation	Y	each	23,538	129,140	152,678	27,280	163,449	190,730
Catenary system	Y	track km	17,954	28,902	46,856	20,809	36,580	57,389
Section break	Y	each	1,656	6,821	8,477	1,919	8,633	10,552
Power feed to station	Y	each	12,574	42,353	54,927	14,573	53,605	68,178
Line for power feed	Y	km	14,525	7,770	22,295	16,834	9,834	26,669
Cut-out 2 position	Y	each	350	2,510	2,860	406	3,177	3,582
Cut-out	Y	each	450	3,190	3,640	522	4,037	4,559
Cut-out for shops	Y	each	510	3,645	4,155	591	4,613	5,204
Metal structures	Y	tonne	275	1,935	2,210	319	2,449	2,768
Concrete posts	Y	each	245	15	260	284	19	303
Section insulators	Y	each	335	2,130	2,465	388	2,696	3,084
Foundations for posts	Y	each	245	0	245	284	0	284

Colon exchange Rate: 1986= 52.00 Inflation Rate: 1986= 19.00%, 2.60% Local, Foreign
1988= 74.00 1987= 15.50%, 2.80% Local, Foreign

5.5 U N I T C O S T S - SHOP EQUIPMEMNT (US Dollars)

DESCRIPTION	INCLUDES INSTALLATION	UNIT	1986 LOCAL	1986 FOREIGN	1986 TOTAL	1988 LOCAL	1988 FOREIGN	1988 TOTAL
Crane 10/3 ton	Y	each	$ 15,000	$ 55,000	$ 70,000	$ 14,487	$ 58,010	$ 72,497
Jacks 15 ton	Y	each	3,500	25,000	28,500	3,380	26,368	29,749
Jacks 10 ton	Y	each	2,125	22,500	24,625	2,052	23,731	25,784
Axle lowerer 6 ton	Y	each	35,000	190,000	225,000	33,804	200,398	234,202
Carpentry equipment	Y	lot	115,090	48,000	163,090	111,157	50,627	161,784
Mechanical/electrical shop equip.	Y	lot	30,000	162,500	192,500	28,975	171,393	200,368
Electronic Laboratory equipment	Y	lot	9,500	78,000	87,500	9,175	82,269	91,444
Brake shop equipment	Y	lot	6,500	43,000	49,500	6,278	45,353	51,631
Battery chargers	Y	each	2,500	9,000	11,500	2,415	9,493	11,907
Compressed air system	Y	each	25,000	65,000	90,000	24,146	68,557	92,703
Misc. equipment and furniture	Y	lot	30,000	250,500	280,500	28,975	264,209	293,184

6. CURRENT COST ESTIMATES

6.1 SCENARIO A-1: ESTIMATE OF CAPITAL COST (US Dollars)

SUMMARY OF QUANTITIES:

BRANCH LINE	TRACK LENGTH (km)	TRACK RENEWAL (m)	REHAB SUBGRADE (m^2)	CLEAN DITCHES (m)	NEW DITCHES (m)	EARTH MOVEMENT (m^2)	T.O. (ea)	REHAB BRIDGES (Local)	REHAB BRIDGES (Foreign)
Ticaban	9.50	9,500	3,200	12,700	1,500	4,500	12	$ 36,590	$ 20,040
Trancari	12.25	12,250	5,500	23,250	0	0	9	47,363	25,861
Rio Frio	23.75	23,750	9,500	8,000	0	0	22	91,754	50,100
La Teresa	1.50	1,500	600	3,000	0	0	0	4,388	6,234
Aisa	0.50	500	200	1,000	0	0	0	1,463	2,078
Guajira	1.00	1,000	400	2,000	0	0	0	2,926	4,156
Santa Clara	10.00	10,000	4,500	12,000	3,000	0	6	38,633	21,095
Indiana	28.25	28,250	13,490	19,500	18,000	0	8	109,139	59,592
Imperio	3.00	3,000	1,200	0	6,000	0	2	11,590	6,328
Freehold	0.50	500	200	1,000	0	0	0	1,463	2,078
Monteverde	21.00	21,000	6,500	4,000	23,250	6,180	8	81,130	44,299
Estrella	60.75	60,750	17,900	49,750	15,955	28,000	29	234,697	128,149
TOTALS		172,000	63,190	136,200	67,705	38,680	96	$ 661,135	$ 370,009

ESTIMATED COST:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Track Renewal	m	172,000	$ 34.93	$ 70.04	$ 6,007,960	$ 12,046,880	$ 18,054,840
Rehab Subgrade	m^2	63,190	3.86	0.00	243,913	0	243,913
Clean Ditches	m	136,200	2.41	0.00	328,242	0	328,242
New Ditches	m	67,705	3.86	0.00	261,341	0	261,341
Earth Movement	m^2	38,680	2.90	0.00	112,172	0	112,172
Turnouts #8 70 Lb	each	96	0.00	5,300.00	0	508,800	508,800
Rehab Bridges	LS				661,135	370,009	1,031,143
SUBTOTAL					$ 7,614,763	$ 12,925,689	$ 20,540,452
Engineering	6%				456,886	775,541	1,232,427
Contingencies	10%				761,476	1,292,569	2,054,045
TOTAL					$ 8,833,125	$ 14,993,799	$ 23,826,924

DEVELOPMENT OF UNIT COSTS (US Dollars)

BANANA BRANCH LINES - COST OF RENEWING 1 KM OF TRACK

RENEW EXISTING TRACK:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Removal of rails and ties	m	1000	$ 1.14	$ 0.00	$ 1,140	$ 0	$ 1,140
Concrete tubes and bedding	m	1,000	2.50	0.00	2,500	0	2,500
Ballast	m^3	1,200	8.50	0.00	10,200	0	10,200
Rail (35 kg/m) new	tonne	70.00	0.00	554.17	0	38,792	38,792
Concrete ties	each	1,428	9.05	5.69	12,923	8,125	21,049
Fastening system	set	1,428	0.00	15.20	0	21,706	21,706
Bolted rail joints	each	27.78	0.00	20.58	0	572	572
Welded rail joints	each	27.78	0.00	30.36	0	843	843
Labor and equipment	m	1,000	8.17	0.00	8,170	0	8,170
TOTAL					$ 34,933	$ 70,038	$ 104,971

6.2 SCENARIO A-2: ESTIMATE OF CAPITAL COST (US Dollars)

BRANCH LINE	TRACK LENGTH (km)	TRACK CLASS	TRACK RENEWAL (m)	REHAB SUBGRADE (m^2)	CLEAN DITCHES (m)	NEW DITCHES (m)	EARTH MOVEMENT (m^2)	T.O. (ea)	REHAB BRIDGES (Local)	REHAB BRIDGES (Foreign)
Ticaban	9.60	BL	9,600	3,200	12,700	1,500	4,500	12	$ 36,590	$ 20,040
Ticaban	2.50	YD	2,500	0	0	0	0	0	0	0
Rio Frio	10.70	BL	10,700	4,300	8,000	0	0	22	91,754	50,100
Rio Frio	12.80	YD	12,800	5,250	0	0	0	0	0	0
La Teresa	1.50	YD	1,500	600	3,000	0	0	0	4,338	6,234
Santa Clara	10.00	BL	10,000	4,500	2,000	0	0	6	38,633	21,095
Santa Clara	0.50	YD	500	0	0	0	0	0	0	0
Monteverde	21.00	BL	21,000	6,500	4,000	23,250	6,180	8	81,130	44,299
Monteverde	0.50	YD	500	0	0	0	0	0	0	0
Estrella	48.40	ML	48,400	11,800	49,750	15,955	28,000	29	234,697	128,149
Estrella	14.90	YD	14,900	6,100	0	0	0	0	0	0
SUB-TOTAL		ML	48,400					29		
SUB-TOTAL		BL	51,300					48		
SUB-TOTAL		YD	32,700					0		
TOTAL			132,400	42,250	79,450	40,705	38,680	77	$ 487,142	$ 269,917

ESTIMATED COST:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Track Renewal ML	m	48,400	$ 32.43	$ 40.32	$ 1,569,612	$ 1,951,488	$ 3,521,100
Track Renewal BL	m	51,300	30.85	56.14	1,582,605	2,879,982	4,462,587
Track Renewal YD	m	32,700	30.97	40.37	1,012,719	1,320,099	2,332,818
Rehab Subgrade	m^2	42,250	3.86	0.00	163,085	0	163,085
Clean Ditches	m	79,450	2.41	0.00	191,475	0	191,475
New Ditches	m	40,705	3.86	0.00	157,121	0	157,121
Earth Movement	m^2	38,680	2.90	0.00	112,172	0	112,172
Turnouts #8 70 Lb	each	29	0.00	5,300.00	0	153,700	153,700
Turnouts #7 60 Lb	each	48	0.00	3,785.71	0	181,714	181,714
Turnouts #6 50 Lb	each	0	0.00	3,028.57	0	0	0
Rehab Bridges	LS				487,142	269,917	757,059
SUB-TOTAL					$ 5,275,931	$ 6,756,900	$ 12,032,831
Engineering	6%				316,556	405,414	721,970
Contingencies	10%				527,593	675,690	1,203,283
TOTAL					$ 6,120,080	$ 7,838,004	$ 13,958,084

D E V E L O P M E N T O F U N I T C O S T S (US Dollars)

COST OF REHABILITATING 1 KM OF TRACK

REHAB MAIN LINE TRACK:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Removal of rails and ties	m	1,000	$ 1.14	$ 0.00	$ 1,140	$ 0	$ 1,140
Ballast	m^3	1,200	8.50	0.00	10,200	0	10,200
Rail 35 kg/m new 20%	tonne	14.00	0.00	554.17	0	7,758	7,758
Concrete ties & fastenings	each	1,428	9.05	20.89	12,923	29,831	42,754
Welded rail joints	each	90	0.00	30.36	0	2,732	2,732
Labor and equipment	m	1,000	8.17	0.00	8,170	0	8,170
TOTAL					$ 32,433	$ 40,322	$ 72,755

REHAB BRANCH LINE TRACK:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Removal of rails and ties	m	1,000	$ 1.14	$ 0.00	$ 1,140	$ 0	$ 1,140
Ballast	m^3	1,000	8.50	0.00	8,500	0	8,500
Rail 30 kg/m new 80%	tonne	48.00	0.00	554.17	0	26,600	26,600
Concrete ties & fastenings	each	1,142	9.05	20.89	10,339	23,865	34,203
Wood ties & fastenings	each	333	8.11	10.00	2,703	3,335	6,038
Welded rail joints	each	90	0.00	26.02	0	2,342	2,342
Labor and equipment	m	1,000	8.17	0.00	8,170	0	8,170
TOTAL					$ 30,852	$ 56,141	$ 86,993

REHAB YARD TRACK:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Removal of rails and ties	m	1,000	$ 1.14	$ 0.00	$ 1,140	$ 0	$ 1,140
Ballast	m^3	1,000	8.50	0.00	8,500	0	8,500
Rail 25 kg/m new 50%	tonne	25.00	0.00	554.17	0	13,854	13,854
Concrete ties & fastenings	each	857	9.05	20.89	7,754	17,899	25,653
Wood ties & fastenings	each	667	8.11	10.00	5,406	6,669	12,076
Welded rail joints	each	90	0.00	21.69	0	1,952	1,952
Labor and equipment	m	1,000	8.17	0.00	8,170	0	8,170
TOTAL					$ 30,971	$ 40,374	$ 71,345

6.3 SCENARIO B-1: COST OF CIVIL WORKS (US Dollars)

COST OF LINE AND STATION CIVIL WORKS:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
LIMON TO CARTAGO:							
Roadbed 0.0 - 2.4	km	2.40	$ 9,667	$ 0	$ 23,201	$ 0	$ 23,201
Roadbed in stations	km	7.65	9,667	0	73,953	0	73,953
Roadbed 65.4 - 146.6	km	81.20	11,600 (*)	0	941,952	0	941,952
Roadbed 165.3 - 168.4	km	3.10	11,600 (*)	0	35,961	0	35,961
Roadbed in stations	km	4.91	11,600 (*)	0	56,970	0	56,970
Erosion protection	m^3	15,000.00	19.32	0	289,800	0	289,800
Piedras de Fuego	LS				1,166,800	646,548	1,813,348
TOTAL - LIMON TO CARTAGO					2,588,636	646,548	3,235,184
VIRILLA YARD:							
Land purchase	m^2	240,000	$ 6.76	$ 0.00	$ 1,622,400	$ 0	$ 1,622,400
Clearing and grubbing	m^2	18,000	0.14	0.00	2,520	0	2,520
Earth excavation	m^3	894,000	2.9	0.00	2,592,600	0	2,592,600
Compacted earth fill	m^3	131,000	4	0.00	524,000	0	524,000
Drainage ditches	m	2,500	3.86	0.00	9,650	0	9,650
Concrete tube with bedding	m	8,500	2.5	0.00	21,250	0	21,250
TOTAL - VIRILLA YARD					4,772,420	0	4,772,420
SUB-TOTAL					$ 7,361,056	$ 646,548	$ 8,007,604
Engineering	6%				441,663	38,793	480,456
Contingencies	10%				736,106	64,655	800,760
T O T A L - CIVIL WORKS					$ 8,538,825	$ 749,996	$ 9,288,821

(*) - Unit cost increased by 20% to cover embankment protection.

S C E N A R I O B - 1 : COST OF TRACK WORKS (US Dollars)

COST OF LINE AND STATION TRACK WORKS:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
LIMON TO CARTAGO:							
Track Km 0.0 - 2.4	km	2.40	$ 31,293	$ 78,160	$ 75,103	$ 187,584	$ 262,687
Track in stations	km	7.65	31,293	78,160	239,391	597,924	837,315
Turnouts	each	49	0	7,571	0	370,979	370,979
Track Km 65.4 - 146.6	km	81.20	31,293	78,160	2,540,992	6,346,592	8,887,584
Track in stations	km	4.91	31,293	78,160	153,680	383,844	537,524
Turnouts	each	39	0	7,571	0	295,269	295,269
TOTAL - LIMON TO CARTAGO					$ 3,009,166	$ 8,182,192	$ 11,191,358
VIRILLA YARD:							
Track Km	km	0.00	$ 31,293	$ 78,160	$ 0	$ 0	$ 0
Track in stations	km	11.83	31,293	78,160	370,196	924,633	1,294,829
Turnouts	each	63	0	7,571	0	476,973	476,973
TOTAL - VIRILLA YARD					370,196	1,401,606	1,771,802
SUBTOTAL - TRACK WORKS					$ 3,379,362	$ 9,583,798	$ 12,963,160
Engineering	6%				202,762	575,028	777,790
Contingencies	10%				337,936	958,380	1,296,316
T O T A L - TRACK WORKS					$ 3,920,060	$ 11,117,205	$ 15,037,266

S C E N A R I O B - 1 : COST OF SIGNALIZATION (US Dollars)

COST OF LINE AND STATION SIGNALIZATION:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
LIMON TO CARTAGO:							
Limon station	LS				47,229	120,344	167,574
Limoncito station	LS				38,826	98,933	137,760
Moin station	LS				110,105	280,558	390,662
Siquirres station	LS				63,745	162,428	226,173
La Junta station	LS				133,285	339,622	472,907
Peralta station	LS				43,752	111,485	155,237
Turrialba station	LS				36,508	93,027	129,535
Typical sidings	each	22	12,459	31,747	274,102	698,441	972,543
Typical junctions	each	11	9,272	23,626	101,992	259,885	361,877
Typical 2 track stations	each	10	19,123	48,728	191,234	487,284	678,519
Typical 3 track stations	each	2	21,731	55,373	43,462	110,746	154,209
Crossing protection	each	10	10,030	42,329	100,300	423,290	523,590
TOTAL - LIMON TO CARTAGO					1,184,540	3,186,045	4,370,585
VIRILLA YARD:							
Virilla yard	LS				154,436	379,808	534,244
TOTAL - VIRILLA YARD					154,436	379,808	534,244
SUB-TOTAL					1,338,977	3,565,852	4,904,829
Engineering	6%				80,339	213,951	294,290
Contingencies	10%				133,898	356,585	490,483
T O T A L - SIGNALIZATION					$ 1,553,213	$ 4,136,388	$ 5,689,601

S C E N A R I O B - 1 : COST OF ELECTRIFICATION (US Dollars)

COST OF LINE AND STATION ELECTRIFICATION:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
LIMON TO CARTAGO:							
Electrify 65.4 - 146.6	km	81.20	28,733	79,368	2,333,155	6,444,704	8,777,859
TOTAL - LIMON TO CARTAGO					2,333,155	6,444,704	8,777,859
SUBSTATIONS:							
Substation - Turrialba	each	1	64,263	489,389	64,263	489,389	553,652
TOTAL - SUBSTATIONS					64,263	489,389	553,652
VIRILLA YARD:							
Electrify Virilla yard	km	4.20	17,385	33,540	73,017	140,869	213,886
TOTAL - VIRILLA YARD					73,017	140,869	213,886
SUB-TOTAL					2,470,435	7,074,963	9,545,398
Engineering	6%				148,226	424,498	572,724
Contingencies	10%				247,043	707,496	954,540
T O T A L - ELECTRIFICATION					$ 2,865,704	$ 8,206,957	$ 11,072,661

DEVELOPMENT OF UNIT COSTS (US Dollars)

REHAB EXISTING SUBGRADE:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Removal of rails and ties	m	1,000	$ 1.14	$ 0.00	$ 1,140	$ 0	$ 1,140
Level and compact subgrade	m^3	200	3.86	0.00	772	0	772
Excavate new ditches	m	300	3.86	0.00	1,158	0	1,158
Clean existing ditches	m	1,700	2.41	0.00	4,097	0	4,097
Concrete tubes and bedding	m	1,000	2.50	0.00	2,500	0	2,500
TOTAL					$ 9,667	$ 0	$ 9,667

RENEW EXISTING TRACK:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Ballast	m^3	1,200	8.50	0.00	10,200	0	10,200
Rail (42 kg/m) new	tonne	84.00	0.00	554.17	0	46,550	46,550
Concrete ties	each	1,428	9.05	5.69	12,923	8,125	21,049
Fastening system	set	1,428	0.00	15.20	0	21,706	21,706
Bolted rail joints	each	27.78	0.00	27.15	0	754	754
Welded rail joints	each	27.78	0.00	36.87	0	1,024	1,024
Labor and equipment	m	1,000	8.17	0.00	8,170	0	8,170
TOTAL					$ 31,293	$ 78,160	$ 109,453

6.4 S C E N A R I O B - 2 : COST OF CIVIL WORKS (US Dollars)

COST OF LINE AND STATION CIVIL WORKS:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
LIMON TO ALAJUELA:							
Roadbed 0.0 - 2.4	km	2.40	$ 7,167	$ 0	$ 17,201	$ 0	$ 17,201
Roadbed in stations	km	3.50	7,167	0	25,085	0	25,085
Roadbed 65.4 - 171.3	km	105.90	7,167	0	758,985	0	758,985
Roadbed in stations	km	6.90	7,167	0	49,452	0	49,452
Roadbed San Jose interconnection	km	2.70	7,167	0	19,351	0	19,351
Erosion protection	m^3	5,000.00	19.32	0	96,600	0	96,600
Piedras de Fuego	LS				200,000	0	200,000
SUB-TOTAL					1,166,674	0	1,166,674
Engineering	6%				70,000	0	70,000
Contingencies	10%				116,667	0	116,667
T O T A L - CIVIL WORKS					$ 1,353,342	$ 0	$ 1,353,342

S C E N A R I O B - 2 : COST OF TRACK WORKS (US Dollars)

COST OF LINE AND STATION TRACK WORKS:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
LIMON TO CARTAGO:							
Track Km 0.0 - 2.4	km	2.40	$ 29,355	$ 47,485	$ 70,452	$ 113,964	$ 184,416
Track in stations	km	3.50	29,355	47,485	102,743	166,198	268,940
Turnouts	each	23	0	7,571	0	174,133	174,133
Track Km 65.4 - 171.3	km	105.90	29,355	47,485	3,108,695	5,028,662	8,137,356
Track in stations	km	6.90	29,355	47,485	202,550	327,647	530,196
Track San Jose interconnection	km	2.70	29,355	47,485	79,259	128,210	207,468
Turnouts	each	45	0	7,571	0	340,695	340,695
SUB-TOTAL					3,563,697	6,279,507	9,843,204
Engineering	6%				213,822	376,770	590,592
Contingencies	10%				356,370	627,951	984,320
TOTAL - TRACK WORKS					$ 4,133,889	$ 7,284,228	$ 11,418,117

DEVELOPMENT OF UNIT COSTS (US Dollars)

REHAB EXISTING SUBGRADE:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Removal of rails and ties	m	1,000	$ 1.14	$ 0.00	$ 1,140	$ 0	$ 1,140
Level and compact subgrade	m^3	200	3.86	0.00	772	0	772
Excavate new ditches	m	300	3.86	0.00	1,158	0	1,158
Clean existing ditches	m	1,700	2.41	0.00	4,097	0	4,097
TOTAL					$ 7,167	$ 0	$ 7,167

RENEW EXISTING TRACK:

ITEM		UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Ballast		m^3	1,200	8.50	0.00	10,200	0	10,200
Rail (35 kg/m) new	50%	tonne	35.00	0.00	554.17	0	19,396	19,396
Concrete ties	85%	each	1,214	9.05	5.69	10,985	6,907	17,891
Fastening system	85%	set	1,214	0.00	15.20	0	18,450	18,450
Welded rail joints		each	90.00	0.00	30.36	0	2,732	2,732
Labor and equipment		m	1,000	8.17	0.00	8,170	0	8,170
TOTAL						$ 29,355	$ 47,485	$ 76,840

6.5 S C E N A R I O C - 1 : COST OF CIVIL WORKS (US Dollars)

COST OF LINE AND STATION CIVIL WORKS:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
CIRUELAS TO PUNTARENAS:							
Roadbed 22.7 - 116.0	km	93.30	$ 9,667	$ 0	$ 901,931	$ 0	$ 901,931
Roadbed in stations	km	8.38	9,667	0	81,009	0	81,009
Protection at Rio Barranca Br.	LS				10,000	0	10,000
TOTAL - CIRUELAS TO PUNTARENAS					992,941	0	992,941
CIRUELAS TO MONTECILLOS:							
Roadbed 0.0 - 5.3	km	5.30	9,667	0	51,235	0	51,235
Roadbed in stations	km	0.27	9,667	0	2,600	0	2,600
TOTAL - CIRUELAS TO MONTECILLOS					53,836	0	53,836
LAS CANAS TO MONTECILLOS:							
Complete existing grade	LS				45,722	0	45,722
Culvert Rio Ciruelas	LS				33,761	15,821	49,581
Underpass Olrich Road	LS				22,797	4,483	27,280
TOTAL - LAS CANAS TO MONTECILLOS					102,280	20,304	122,584
SUB-TOTAL					1,149,056	20,304	1,169,360
Engineering	6%				68,943	1,218	70,162
Contingencies	10%				114,906	2,030	116,936
T O T A L - CIVIL WORKS					$ 1,332,906	$ 23,552	$ 1,356,458

S C E N A R I O C - 1 : COST OF TRACK WORKS (US Dollars)

COST OF LINE AND STATION TRACK WORKS:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
CIRUELAS TO PUNTARENAS:							
Track Km 22.7 - 116.0	km	93.30	28,063	70,702	2,618,278	6,596,497	9,214,775
Track in stations	km	8.38	28,063	70,702	235,168	592,483	827,651
Turnouts	each	63	0	7,571	0	476,973	476,973
TOTAL - CIRUELAS TO PUNTARENAS					2,853,446	7,665,952	10,519,398
CIRUELAS TO MONTECILLOS:							
Track Km 0.0 - 5.3	km	5.30	28,063	70,702	148,734	374,721	523,455
Track in stations	km	0.27	28,063	70,702	7,549	19,019	26,568
Turnouts	each	0	0	7,571	0	0	0
TOTAL - CIRUELAS TO MONTECILLOS					156,283	393,739	550,022
LAS CANAS TO MONTECILLOS:							
Track Km 0.0 - 5.3 (*)	km	3.30	31,293	78,160	103,267	257,928	361,195
Track in stations (*)	km	0.00	31,293	78,160	0	0	0
Turnouts	each	2	0	7,571	0	15,142	15,142
TOTAL - LAS CANAS TO MONTECILLOS					103,267	273,070	376,337
SUB-TOTAL					3,112,996	8,332,762	11,445,757
Engineering	6%				186,780	186,780	373,559
Contingencies	10%				311,300	311,300	622,599
TOTAL - TRACK WORKS					$ 3,611,075	$ 8,830,841	$ 12,441,916

(*) - Uses track unit costs from Scenario B-1

S C E N A R I O C - 1 : COST OF SIGNALIZATION (US Dollars)

COST OF LINE AND STATION SIGNALIZATION:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
CIRUELAS TO PUNTARENAS:							
Ciruelas station	LS				32,742	83,429	116,171
Orotina station	LS				36,508	93,027	129,535
Salinas station	LS				37,378	95,242	132,620
Barranca station	LS				36,508	93,027	129,535
Puntarenas station	LS				61,717	157,260	218,976
Purruja station	LS				54,473	138,802	193,275
Typical sidings	each	15	12,459	31,747	186,885	476,205	663,090
Typical junctions	each	3	9,272	23,626	27,816	70,878	98,694
Typical 2 track stations	each	8	19,123	48,728	152,984	389,824	542,808
Typical 3 track stations	each	0	21,731	55,373	0	0	0
Crossing protection	each	15	10,030	42,329	150,450	634,935	785,385
TOTAL - CIRUELAS TO PUNTARENAS					777,460	2,232,629	3,010,089
CIRUELAS TO MONTECILLOS:							
Typical 3 track stations	each	1	21,731	55,373	21,731	55,373	77,104
TOTAL - CIRUELAS TO MONTECILLOS					21,731	55,373	77,104
LAS CANAS TO MONTECILLOS:							
Las Canas junction	LS				57,950	126,567	184,517
TOTAL - LAS CANAS TO MONTECILLOS					57,950	126,567	184,517
SUB-TOTAL					857,141	2,414,569	3,271,711
Engineering	6%				51,428	144,874	196,303
Contingencies	10%				85,714	241,457	327,171
T O T A L - SIGNALIZATION					$ 994,284	$ 2,800,901	$ 3,795,184

S C E N A R I O C - 1 : COST OF ELECTRIFICATION (US Dollars)

COST OF LINE AND STATION ELECTRIFICATION:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
CIRUELAS TO PUNTARENAS:							
Electrify 22.7 - 116.0	km	93.30	28,733	79,368	2,680,789	7,405,034	10,085,823
TOTAL - CIRUELAS TO PUNTARENAS					2,680,789	7,405,034	10,085,823
CIRUELAS TO MONTECILLOS:							
Electrify 0.0 - 5.3	km	5.30	17,385	33,540	92,141	177,762	269,903
TOTAL - CIRUELAS TO MONTECILLOS					92,141	177,762	269,903
LAS CANAS TO MONTECILLOS							
Electrify 0.0 - 3.3	km	3.30	17,385	33,540	57,371	110,682	168,053
TOTAL - LAS CANAS TO MONTECILLO					57,371	110,682	168,053
SUBSTATIONS:							
Substation - Ciruelas	each	1	64,263	489,389	64,263	489,389	553,652
Substation - Puntarenas	each	1	64,263	489,389	64,263	489,389	553,652
TOTAL - SUBSTATIONS					128,526	978,778	1,107,304
SUB-TOTAL					2,958,826	8,672,256	11,631,082
Engineering	6%				177,530	520,335	697,865
Contingencies	10%				295,883	867,226	1,163,108
T O T A L - ELECTRIFICATION					$ 3,432,238	$ 10,059,817	$ 13,492,055

D E V E L O P M E N T O F U N I T C O S T S (US Dollars)

REHAB EXISTING SUBGRADE:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Removal of rails and ties	m	1,000	$ 1.14	$ 0.00	$ 1,140	$ 0	$ 1,140
Level and compact subgrade	m^3	200	3.86	0.00	772	0	772
Excavate new ditches	m	300	3.86	0.00	1,158	0	1,158
Clean existing ditches	m	1,700	2.41	0.00	4,097	0	4,097
Concrete tubes and bedding	m	1,000	2.50	0.00	2,500	0	2,500
T O T A L					$ 9,667	$ 0	$ 9,667

RENEW EXISTING TRACK:

ITEM		UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Ballast		m^3	1,200	8.50	0.00	10,200	0	10,200
Rail (42 kg/m) new	100%	tonne	84.00	0.00	554.17	0	46,550	46,550
Concrete ties	75%	each	1,071	9.05	5.69	9,693	6,094	15,787
Fastening system		set	1,071	0.00	15.20	0	16,279	16,279
Bolted rail joints		each	27.78	0.00	27.15	0	754	754
Welded rail joints		each	27.78	0.00	36.87	0	1,024	1,024
Labor and equipment		m	1,000	8.17	0.00	8,170	0	8,170
T O T A L						$ 28,063	$ 70,702	$ 98,764

6.6 S C E N A R I O C - 2 : COST OF CIVIL WORKS (US Dollars)

COST OF LINE AND STATION CIVIL WORKS:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
SAN JOSE TO PUNTARENAS:							
Roadbed 0.0 - 116.0	km	116.00	$ 7,167	$ 0	$ 831,372	$ 0	$ 831,372
Roadbed in stations	km	12.50	7,167	0	89,588	0	89,588
Protection at Rio Barranca Br.	LS				10,000	0	10,000
TOTAL - SAN JOSE TO PUNTARENAS					930,960	0	930,960
CIRUELAS TO ALAJUELA:							
Roadbed 0.0 - 8.0	km	8.00	7,167	0	57,336	0	57,336
Roadbed in stations	km	1.00	7,167	0	7,167	0	7,167
TOTAL - CIRUELAS TO ALAJUELA					64,503	0	64,503
KM 88.4 TO PURRUJA:							
Roadbed 0.0 - 4.6	km	4.60	7,167	0	32,968	0	32,968
Roadbed in stations	km	3.50	7,167	0	25,085	0	25,085
TOTAL - KM 88.4 TO PURRUJA					58,053	0	58,053
SUB-TOTAL					1,053,515	0	1,053,515
Engineering	6%				63,211	0	63,211
Contingencies	10%				105,352	0	105,352
T O T A L - CIVIL WORKS					$ 1,222,078	$ 0	$ 1,222,078

S C E N A R I O C - 2 : COST OF TRACK WORKS (US Dollars)

COST OF LINE AND STATION TRACK WORKS:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
SAN JOSE TO PUNTARENAS:							
Track Km 0.0 - 116.0	km	116.00	$ 28,063	$ 44,502	$ 3,255,308	$ 5,162,232	$ 8,417,540
Track in stations	km	12.50	28,063	44,502	350,788	556,275	907,063
Turnouts	each	83	0	7,571	0	628,393	628,393
TOTAL - SAN JOSE TO PUNTARENAS					3,606,096	6,346,900	9,952,996
CIRUELAS TO ALAJUELA:							
Track Km 0.0 - 8.0	km	8.00	28,063	44,502	224,504	356,016	580,520
Track in stations	km	1.00	28,063	44,502	28,063	44,502	72,565
Turnouts	each	7	0	7,571	0	52,997	52,997
TOTAL - CIRUELAS TO ALAJUELA					252,567	453,515	706,082
KM 88.4 TO PURRUJA:							
Track Km 0.0 - 4.6	km	4.60	28,063	44,502	129,090	204,709	333,799
Track in stations	km	3.50	28,063	44,502	98,221	155,757	253,978
Turnouts	each	16	0	7,571	0	121,136	121,136
TOTAL - KM 88.4 TO PURRUJA					227,310	481,602	708,913
SUB-TOTAL					4,085,973	7,282,017	11,367,990
Engineering	6%				245,158	436,921	682,079
Contingencies	10%				408,597	728,202	1,136,799
T O T A L - TRACK WORKS					$ 4,739,728	$ 8,447,140	$ 13,186,868

DEVELOPMENT OF UNIT COSTS (US Dollars)

REHAB EXISTING SUBGRADE:

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Removal of rails and ties	m	1,000	$ 1.14	$ 0.00	$ 1,140	$ 0	$ 1,140
Level and compact subgrade	m^3	200	3.86	0.00	772	0	772
Excavate new ditches	m	300	3.86	0.00	1,158	0	1,158
Clean existing ditches	m	1,700	2.41	0.00	4,097	0	4,097
TOTAL					$ 7,167	$ 0	$ 7,167

RENEW EXISTING TRACK:

ITEM		UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Ballast		m^3	1,200	8.50	0.00	10,200	0	10,200
Rail (35 kg/m) new	50%	tonne	35.00	0.00	554.17	0	19,396	19,396
Concrete ties	75%	each	1,071	9.05	5.69	9,693	6,094	15,787
Fastening system	75%	set	1,071	0.00	15.20	0	16,279	16,279
Welded rail joints		each	90.00	0.00	30.36	0	2,732	2,732
Labor and equipment		m	1,000	8.17	0.00	8,170	0	8,170
TOTAL						$ 28,063	$ 44,502	$ 72,564

6.7 S C E N A R I O D - 1 : COST OF CIVIL WORKS (US Dollars)

COST OF LINE AND STATION CIVIL WORKS

ITEM	FROM KM	TO KM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Rehabilitate roadbed	146.30	163.50	km	17.20	$ 9,481	$ 0	$ 163,073	$ 0	$ 163,073
Road overpass Km 162.3			LS				386,332	0	386,332
Elevated structure	163.50	168.37	km	4.87	1,502,302	290,433	7,316,211	1,414,409	8,730,619
Rehabilitate roadbed	168.37	169.19	km	0.82	9,481	0	7,774	0	7,774
New alignment	169.19	170.45	LS	1.26			596,931	0	596,931
Rehabilitate roadbed	170.45	175.81	km	5.36	9,481	0	50,818	0	50,818
New alignment	175.81	176.55	LS	0.74			2,038,867	0	2,038,867
Elevated structure	176.35	177.80	km	1.45	1,502,302	290,433	2,551,498	394,902	2,946,400
New alignment	177.80	178.80	LS	1.00			3,613,420	0	3,613,420
Rehabilitate roadbed	178.80	188.10	km	9.30	9,481	0	88,173	0	88,173
Sidings and spurs to rehabilitate			km	1.60	9,481	0	15,170	0	15,170
Stations:									
Cartago			LS				4,515	0	4,515
El Alto			LS				5,336	0	5,336
Tres Rios			LS				3,694	0	3,694
Curridabat			LS				1,642	0	1,642
San Jose			LS				998,770	218,867	1,217,637
Colima			LS				3,694	0	3,694
Heredia			LS				11,493	0	11,493
Echeverria			LS				1,642	0	1,642
Alajuela			LS				13,956	0	13,956
SUB-TOTAL							$ 17,873,011	$ 2,028,177	$ 19,901,188
Engineering			6%				1,072,381	121,691	1,194,071
Contingencies			10%				1,787,301	202,818	1,990,119
TOTAL COST							$ 20,732,693	$ 2,352,685	$ 23,085,378

S C E N A R I O D - 1 : COST OF TRACK WORKS (US Dollars)

COST OF LINE AND STATION TRACK WORKS

ITEM		FROM KM	TO KM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Construct track at grade		146.30	163.50	km	17.20	$ 31,302	$ 78,181	$ 538,394	$ 1,344,713	$ 1,883,108
Construct track elevated		163.50	168.37	km	4.87	21,102	78,181	102,767	380,741	483,508
Construct track at grade		168.37	176.35	km	7.98	31,302	78,181	249,790	623,884	873,674
Construct track elevated		176.35	177.80	km	1.45	21,102	78,181	30,598	113,362	143,960
Construct track at grade		177.80	188.10	km	10.30	31,302	78,181	322,411	805,264	1,127,675
Sidings and spurs to rehabilitate				km	1.60	31,302	78,181	50,083	125,090	175,173
Turnouts				each	12		7,571	0	90,852	90,852
Stations:										
Cartago	track			km	0.50	31,302	78,181	15,651	39,091	54,742
	turnouts			each	3		7,571	0	22,713	22,713
El Alto	track			km	0.50	31,302	78,181	15,651	39,091	54,742
	turnouts			each	6		7,571	0	45,426	45,426
Tres Rios	track			km	0.35	31,302	78,181	10,956	27,363	38,319
	turnouts			each	4		7,571	0	30,284	30,284
Curridabat	track			km	0.15	31,302	78,181	4,695	11,727	16,422
	turnouts			each	2		7,571	0	15,142	15,142
San Jose	track			km	0.67	31,302	78,181	20,972	52,381	73,354
	turnouts			each	7		7,571	0	52,997	52,997
San Jose yard	track			km	1.00	31,302	78,181	31,302	78,181	109,483
	turnouts			each	6		7,571	0	45,426	45,426
Colima	track			km	0.35	31,302	78,181	10,956	27,363	38,319
	turnouts			each	4		7,571	0	30,284	30,284
Heredia	track			km	1.16	31,302	78,181	36,310	90,690	127,000
	turnouts			each	20		7,571	0	151,420	151,420
Echeverria	track			km	0.15	31,302	78,181	4,695	11,727	16,422
	turnouts			each	2		7,571	0	15,142	15,142
Alajuela	track			km	0.79	31,302	78,181	24,729	61,763	86,492
	turnouts			each	8		7,571	0	60,568	60,568
SUB-TOTAL								$ 1,469,960	$ 4,392,687	$ 5,862,647
Engineering				6%				88,198	263,561	351,759
Contingencies				10%				146,996	439,269	586,265
TOTAL COST								$ 1,705,154	$ 5,095,516	$ 6,800,670

S C E N A R I O D - 1 : COST OF BUILDINGS AND SHOPS (US Dollars)

COST OF BUILDINGS AND SHOPS AT STATIONS

STATION	ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Cartago	station bldg.	m^2	210	216.22	0.00	$ 45,406	$ 0	$ 45,406
	platforms	m^2	1,360	50.00	0.00	68,000	0	68,000
	shelters	m^2	1,360	75.68	0.00	102,925	0	102,925
	ped. overpass	each	1	0.00	4,000.00	0	4,000	4,000
El Alto	station bldg.	m^2	210	216.22	0.00	45,406	0	45,406
	platforms	m^2	1,020	50.00	0.00	51,000	0	51,000
	shelters	m^2	1,020	75.68	0.00	77,194	0	77,194
	ped. overpass	each	1	0.00	4,000.00	0	4,000	4,000
Tres Rios	station bldg.	m^2	210	216.22	0.00	45,406	0	45,406
	platforms	m^2	1,020	50.00	0.00	51,000	0	51,000
	shelters	m^2	1,020	75.68	0.00	77,194	0	77,194
	ped. stairs	m	12	0.00	4,000.00	0	48,000	48,000
Curridabat	station bldg.	m^2	210	216.22	0.00	45,406	0	45,406
	platforms	m^2	1,020	50.00	0.00	51,000	0	51,000
	shelters	m^2	1,020	75.68	0.00	77,194	0	77,194
	ped. overpass	m	12	0.00	4,000.00	0	48,000	48,000
San Jose	station bldg.	LS				50,000	0	50,000
	platforms	m^2	2,700	64.39	0.00	173,853	0	173,853
	shelters	m^2	1,600	75.68	0.00	121,088	0	121,088
	ped. access	LS				20,000	0	20,000
Colima	station bldg.	m^2	210	216.22	0.00	45,406	0	45,406
	platforms	m^2	1,020	50.00	0.00	51,000	0	51,000
	shelters	m^2	1,020	75.68	0.00	77,194	0	77,194
	ped. overpass	m	12	0.00	4,000.00	0	48,000	48,000
Heredia	station bldg.	m^2	210	216.22	0.00	45,406	0	45,406
	platforms	m^2	2,210	50.00	0.00	110,500	0	110,500
	shelters	m^2	2,210	75.68	0.00	167,253	0	167,253
	ped. overpass	m	22	0.00	4,000.00	0	88,000	88,000
	shops	m^2	875	202.70	0.00	177,363	0	177,363
Echeverria	station bldg.	m^2	210	216.22	0.00	45,406	0	45,406
	platforms	m^2	1,020	50.00	0.00	51,000	0	51,000
	shelters	m^2	1,020	75.68	0.00	77,194	0	77,194
	ped. overpass	m	12	0.00	4,000.00	0	48,000	48,000
Alajuela	station bldg.	m^2	210	216.22	0.00	45,406	0	45,406
	platforms	m^2	1,020	50.00	0.00	51,000	0	51,000
	shelters	m^2	1,020	75.68	0.00	77,194	0	77,194
SUB-TOTAL						$ 2,123,392	$ 288,000	$ 2,411,392
Engineering		6%				127,404	17,280	144,684
Contingencies		10%				212,339	28,800	241,139
TOTAL COST						$ 2,463,135	$ 334,080	$ 2,797,215

S C E N A R I O D - 1 : COST OF SIGNALS AND TELECOMMUNICATIONS (US Dollars)

COST OF SIGNALLING TOTAL PROJECT

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Inter-block equipment in stations:							
for station tracks	track	26	$ 20,282	$ 87,542	$ 527,332	$ 2,276,092	$ 2,803,424
for entrance and departure	direction	16	6,761	29,532	108,176	472,512	580,688
Signalling misc. turnouts	track km	42.5	1,352	8,016	57,460	340,680	398,140
Crossing protection	each	11.0	14,970	63,178	164,670	694,958	859,628
Line block equipment	section	8	6,761	37,970	54,088	303,760	357,848
Signal bungalows & equipment	track km	42.5	637	3,734	27,073	158,695	185,768
SUB-TOTAL					938,799	4,246,697	5,185,496
Engineering	6%				56,328	254,802	311,130
Contingencies	10%				93,880	424,670	518,550
TOTAL COST					$ 1,089,006	$ 4,926,169	$ 6,015,175

COST OF TELECOMMUNICATIONS FOR TOTAL PROJECT

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	LOCAL COST	FOREIGN COST	TOTAL COST
Telephone system and various equip	LS				$ 14,487	$ 137,115	$ 151,602
Cable	track km	42.5	8,886	14,700	377,655	624,750	1,002,405
SUB-TOTAL					392,142	761,865	1,154,007
Engineering	6%				23,529	45,712	69,240
Contingencies	10%				39,214	76,187	115,401
TOTAL COST					$ 454,885	$ 883,763	$ 1,338,648

S C E N A R I O D - 1 : COST OF ELECTRIFICATION (US Dollars)

COST OF ELECTRIFICATION OF TOTAL PROJECT

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Main substation 138/25 kV	each	1	$ 64,263	$ 489,389	$ 64,263	$ 489,389	$ 553,652
Back-up substation 138/25 kV	each	1	64,263	489,389	64,263	489,389	553,652
Secondary substation	each	1	27,280	163,449	27,280	163,449	190,729
Catenary system	track km	41.8	20,809	36,580	869,816	1,529,044	2,398,860
Additional costs at stations:							
Catenary system	track km	5.62	20,809	36,580	116,947	205,580	322,526
Section break	each	13	1,919	8,633	24,947	112,229	137,176
Power feed to station	each	5	14,573	53,605	72,865	268,025	340,890
Power feed line	km	3.1	16,834	9,834	52,185	30,485	82,671
Cut-out 2 position	each	5	406	3,177	2,030	15,885	17,915
Cut-out	each	26	522	4,037	13,572	104,962	118,534
Cut-out for shops	each	2	591	4,613	1,182	9,226	10,408
Metal structures	ton	1	319	2,449	319	2,449	2,768
Additional concrete posts	each	20	284	19	5,680	380	6,060
Section insulators	each	21	388	2,696	8,148	56,616	64,764
Foundations for posts	each	20	284	0	5,680	0	5,680
SUB-TOTAL					1,329,177	3,477,108	4,806,285
Engineering	6%				79,751	208,626	288,377
Contingencies	10%				132,918	347,711	480,629
TOTAL COST					$ 1,541,846	$ 4,033,445	$ 5,575,291

S C E N A R I O D - 1 : COST OF SHOP EQUIPMENT (US Dollars)

COST OF SHOP EQUIPMENT FOR TOTAL PROJECT

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Crane 10/3 ton	each	1	$ 14,487	$ 58,010	$ 14,487	$ 58,010	$ 72,497
Jacks 15 ton	each	4	3,380	26,368	13,522	105,473	118,994
Jacks 10 ton	each	4	2,052	23,731	8,210	94,926	103,135
Axle lowerer 6 ton	each	1	33,804	200,398	33,804	200,398	234,202
Carpentry equipment	lot	1	111,157	50,627	111,157	50,627	161,784
Mechanical/Electrical shop equip.	lot	1	28,975	171,393	28,975	171,393	200,368
Electronic laboratory equipment	lot	1	9,175	82,269	9,175	82,269	91,444
Brake shop equipment	lot	1	6,278	45,353	6,278	45,353	51,631
Battery chargers	each	2	2,415	9,493	4,829	18,985	23,814
Compressed air system	each	1	24,146	68,557	24,146	68,557	92,703
Misc. equipment and furniture	lot	1	28,975	264,209	28,975	264,209	293,184
SUB-TOTAL					283,558	1,160,201	1,443,759
Engineering	6%				17,013	69,612	86,626
Contingencies	10%				28,356	116,020	144,376
TOTAL COST					$ 328,927	$ 1,345,833	$ 1,674,760

S C E N A R I O D - 1 : COST OF ELEVATED STRUCTURE (US Dollars)

SINGLE TRACK POST-TENSIONED CONCRETE ON DOUBLE PILLARS 21.0 M C-C

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Concrete for post-tensioned beams	m^3	22.50	$ 233.73	$ 40.08	$ 5,259	$ 902	$ 6,161
Concrete for floor structure	m^3	25.00	183.51	0.00	4,588	0	4,588
Concrete for pavement	m^3	5.00	183.51	0.00	918	0	918
Concrete for cap and crossbeams	m^3	13.00	183.51	0.00	2,386	0	2,386
Concrete for pillars	m^3	12.00	183.51	0.00	2,202	0	2,202
Concrete for foundations	m^3	25.00	125.56	0.00	3,139	0	3,139
Lean concrete	m^3	2.50	77.27	0.00	193	0	193
Special steelwork (railings, etc.)	kg	800.00	0.00	4.22	0	3,376	3,376
Reinforcing steel	kg	8500.00	0.41	0.00	3,485	0	3,485
Wire fabric reinf. for pavement	kg	320.00	0.66	0.00	211	0	211
Neoprene seals	m	43.00	9.66	0.00	415	0	415
Tensioning boxes	each	2.00	0.00	295.32	0	591	591
Return boxes	each	2.00	0.00	105.47	0	211	211
Neoprene bearings	each	4.00	0.00	94.93	0	380	380
Pilings (80 t)	each	4.00	1,689.19	160.00	6,757	640	7,397
Excavation	m^3	65.00	8.11	0.00	527	0	527
Acrylic paint	m^2	110.00	7.73	0.00	850	0	850
Waterproofing	m^2	80.00	7.73	0.00	618	0	618
TOTAL					$ 31,548	$ 6,099	$ 37,647
COST PER KILOMETER					$ 1,502,302	$ 290,433	$ 1,792,735

S C E N A R I O D - 1 : COST OF TRACK AND ROADBED (US Dollars)

COST OF REHABILITATING 1 KM OF EXISTING ROADBED

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Removal of rails and ties	m	1,000	$ 1.14	$ 0.00	$ 1,140	$ 0	$ 1,140
Fill material for roadbed	m^3	100	3.86	0.00	386	0	386
Excavation and compacted earth fill	m^3	50	4.00	0.00	200	0	200
Excavation for drainage ditches	m	300	3.86	0.00	1,158	0	1,158
Cleaning of drainage ditches	m	1,700	2.41	0.00	4,097	0	4,097
Concrete tubes with bedding	m	1,000	2.50	0.00	2,500	0	2,500
TOTAL COST PER KILOMETER					$ 9,481	$ 0	$ 9,481

COST OF CONSTRUCTING 1 KM OF TRACK

ITEM	UNIT	QUANTITY			LOCAL COST	FOREIGN COST	TOTAL COST
Ballast	m^3	1,200	8.50	0.00	$ 10,200	$ 0	$ 10,200
Rails (42 kg/m)	tons	84	0.00	554.17	0	46,550	46,550
Concrete ties	each	1,429	9.05	5.69	12,932	8,131	21,063
Fastening system	each	1,429	0.00	15.20	0	21,721	21,721
Labor and equipment	m	1,000	8.17	0.00	8,170	0	8,170
Welded joint	each	27.78	0.00	36.87	0	1,024	1,024
Bolted joint	each	27.78	0.00	27.15	0	754	754
TOTAL COST PER KILOMETER					$ 31,302	$ 78,181	$ 109,483

COST OF CONSTRUCTING 1 KM OF TRACK (ON ELEVATED STRUCTURE)

ITEM	UNIT	QUANTITY			LOCAL COST	FOREIGN COST	TOTAL COST
Rails (42 kg/m)	tons	84	0.00	554.17	0	46,550	46,550
Concrete ties	each	1,429	9.05	5.69	12,932	8,131	21,063
Fastening system	each	1,429	0.00	15.20	0	21,721	21,721
Labor and equipment	m	1,000	8.17	0.00	8,170	0	8,170
Welded joint	each	27.78	0.00	36.87	0	1,024	1,024
Bolted joint	each	27.78	0.00	27.15	0	754	754
TOTAL COST PER KILOMETER					$ 21,102	$ 78,181	$ 99,283

6.8 SCENARIOS D - 2 & 3 : COST OF CIVIL WORKS (US Dollars)

COST OF LINE AND STATION CIVIL WORKS

ITEM	FROM KM	TO KM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Rehabilitate roadbed	146.30	166.70	km	20.40	$ 9,481	$ 0	$ 193,412	$ 0	$ 193,412
Grade separation Km 165.6			LS				502,000	62,000	564,000
Elevated structure	166.70	167.60	km	0.90	1,502,302	290,433	1,352,072	261,390	1,613,462
Rehabilitate roadbed	167.60	169.19	km	1.59	9,481	0	15,075	0	15,075
Grade separation Km 168.6			LS				502000	62000	564,000
New alignment	169.19	170.45	LS	1.26			991,000	28,000	1,019,000
Rehabilitate roadbed	170.45	188.10	km	17.65	9,481	0	167,340	0	167,340
New alignment	188.10	188.90	LS	0.80			402,000	45,000	447,000
Rehabilitate roadbed	188.90	189.70	km	0.80	9,481	0	7,585	0	7,585
STATION SITES:									
1. Cartago	Land purchase		m^2	1,100	100.00	0.00	110,000	0	110,000
	Site preparation		m^2	5,000	2.50	0.00	12,500	0	12,500
	Asphalt pavement		m^2	1,100	28.09	0.00	30,899	0	30,899
2. Reventado yard	Land purchase		m^2	5,000	6.76	0.00	33,800	0	33,800
	Site preparation		m^2	5,800	2.50	0.00	14,500	0	14,500
3. El Alto	Site preparation		m^2	3,000	2.50	0.00	7,500	0	7,500
4. Tres Rios	Site preparation		m^2	3,000	2.50	0.00	7,500	0	7,500
5. Curridabat	Site preparation		m^2	3,000	2.50	0.00	7,500	0	7,500
6. San Pedro	Site preparation		m^2	3,000	2.50	0.00	7,500	0	7,500
7. San Jose	Site preparation		m^2	15,000	2.50	0.00	37,500	0	37,500
	Elevated structure		m	500	1,502.30	290.43	751,151	145,217	896,368
8. Colima	Site preparation		m^2	3,000	2.50	0.00	7,500	0	7,500
9. Santa Rosa	Site preparation		m^2	3,000	2.50	0.00	7,500	0	7,500
10. Heredia	Land purchase		m^2	2,000	75.00	0.00	150,000	0	150,000
	Site preparation		m^2	5,000	2.50	0.00	12,500	0	12,500
	Asphalt pavement		m^2	1,100	28.09	0.00	30,899	0	30,899
11. San Joaquin	Site preparation		m^2	3,000	2.50	0.00	7,500	0	7,500
12. Rio Segundo	Site preparation		m^2	3,000	2.50	0.00	7,500	0	7,500
13. Alajuela yard	Land purchase		m^2	3,000	6.76	0.00	20,280	0	20,280
	Site preparation		m^2	10,000	2.50	0.00	25,000	0	25,000
14. Alajuela	Site preparation		m^2	4,500	2.50	0.00	11,250	0	11,250
SUB-TOTAL							5,432,762	603,606	6,036,369
ENGINEERING			6%				325,966	36,216	362,182
CONTINGENCIES			10%				543,276	60,361	603,637
TOTAL COST							$ 6,302,004	$ 700,183	$ 7,002,188

S C E N A R I O S D - 2 & 3 : COST OF TRACK WORKS (US Dollars)

COST OF LINE AND STATION TRACK WORKS

ITEM		FROM KM	TO KM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Construct track at grade		146.30	166.70	km	20.40	$ 31,302	$ 78,181	$ 638,561	$ 1,594,892	$ 2,233,453
Construct track elevated		166.70	167.60	km	0.90	21,102	$ 78,181	18,992	70,363	89,355
Construct track at grade		167.60	189.70	km	22.10	31,302	78,181	691,774	1,727,800	2,419,574
STATION TRACKAGE:										
1. Cartago	track			km	0.30	31,302	78,181	9,391	23,454	32,845
	turnouts			each	2	0	7,571	0	15,142	15,142
2. Reventado yard	track			km	1.20	31,302	78,181	37,562	93,817	131,380
	turnouts			each	5	0	7,571	0	37,855	37,855
3. El Alto	track			km	0.26	31,302	78,181	8,139	20,327	28,466
	turnouts			each	2	0	7,571	0	15,142	15,142
4. Tres Rios	track			km	0.26	31,302	78,181	8,139	20,327	28,466
	turnouts			each	2	0	7,571	0	15,142	15,142
5. Curridabat	track			km	0.26	31,302	78,181	8,139	20,327	28,466
	turnouts			each	2	0	7,571	0	15,142	15,142
6. San Pedro	track			km	0.26	31,302	78,181	8,139	20,327	28,466
	turnouts			each	2	0	7,571	0	15,142	15,142
7. San Jose	track			km	0.56	21,102	78,181	11,817	43,781	55,598
	turnouts			each	4	0	7,571	0	30,284	30,284
8. Colima	track			km	0.26	31,302	78,181	8,139	20,327	28,466
	turnouts			each	2	0	7,571	0	15,142	15,142
9. Santa Rosa	track			km	0.26	31,302	78,181	8,139	20,327	28,466
	turnouts			each	2	0	7,571	0	15,142	15,142
10. Heredia	track			km	0.26	31,302	78,181	8,139	20,327	28,466
	turnouts			each	2	0	7,571	0	15,142	15,142
11. San Joaquin	track			km	0.26	31,302	78,181	8,139	20,327	28,466
	turnouts			each	2	0	7,571	0	15,142	15,142
12. Rio Segundo	track			km	0.26	31,302	78,181	8,139	20,327	28,466
	turnouts			each	2	0	7,571	0	15,142	15,142
13. Alajuela yard	track			km	0.17	31,302	78,181	5,217	13,030	18,247
	turnouts			each	14	0	7,571	0	105,994	105,994
14. Alajuela	track			km	0.22	31,302	78,181	6,886	17,200	24,086
	turnouts			each	1	0	7,571	0	7,571	7,571
SUB-TOTAL								1,493,447	4,100,406	5,593,853
Engineering			6%					89,607	246,024	335,631
Contingencies			10%					149,345	410,041	559,385
TOTAL COST								$ 1,732,399	$ 4,756,471	$ 6,488,869

S C E N A R I O S D - 2 & 3 : COST OF STRUCTURES (US Dollars)

COST OF STRUCTURES AT STATIONS:

STATION	ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
1. Cartago	station bldg.	m^2	80	216.22	0.00	$ 17,298	$ 0	$ 17,298
	platforms	m^2	990	50.00	0.00	49,500	0	49,500
	shelters	m^2	800	75.68	0.00	60,544	0	60,544
	ped. overpass	each	1	0.00	4,000.00	0	4,000	4,000
2. Reventado yard	service building	m^2	50	216.22	0.00	10,811	0	10,811
3. El Alto	station bldg.	m^2	50	216.22	0.00	10,811	0	10,811
(Standard plan)	platforms	m^2	960	50.00	0.00	48,000	0	48,000
	shelters	m^2	960	75.68	0.00	72,653	0	72,653
	ped. overpass	each	1	0.00	4,000.00	0	4,000	4,000
4. Tres Rios	standard plan	LS				142,275	4,000	146,275
5. Curridabat	standard plan	LS				142,275	4,000	146,275
6. San Pedro	standard plan	LS				142,275	4,000	146,275
7. San Jose	station bldg.	LS				50,000	0	50,000
	platforms	m^2	1,280	67.46	0.00	86,349	0	86,349
	shelters	m^2	1,280	75.68	0.00	96,870	0	96,870
	ped. access	LS				0	6,500	6,500
8. Colima	standard plan	LS				142,275	4,000	146,275
9. Santa Rosa	standard plan	LS				142,275	4,000	146,275
10. Heredia	station bldg.	LS				25,000	0	25,000
	platforms	m^2	2,210	50.00	0.00	110,500	0	110,500
	shelters	m^2	2,210	75.68	0.00	167,253	0	167,253
	ped. overpass	each	1	0.00	4,000.00	0	4,000	4,000
11. San Joaquin	standard plan	LS				142,275	4,000	146,275
12. Rio Segundo	standard plan	LS				142,275	4,000	146,275
13. Alajuela yard	station bldg.	LS				10,000	0	10,000
	shops	m^2	875	100.00	0.00	87,500	0	87,500
14. Alajuela	station bldg.	LS				25,000	0	25,000
	platforms	m^2	1,020	50.00	0.00	51,000	0	51,000
	shelters	m^2	1,020	75.68	0.00	77,194	0	77,194
SUB-TOTAL						2,052,206	46,500	2,098,706
ENGINEERING		7%				143,654	3,255	146,909
CONTINGENCIES		10%				205,221	4,650	209,871
TOTAL COST						$ 2,401,081	$ 54,405	$ 2,455,486

SCENARIO D-2&3: COST OF SIGNALS AND TELECOMMUNICATIONS (US Dollars)

COST OF SIGNALLING TOTAL PROJECT

ITEM	UNIT	QTY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Inter-block equipment in stations:							
for station tracks	track	26	$ 20,282	$ 87,542	$ 527,343	$ 2,276,103	$ 2,803,446
for entrance and departure	direction	16	6,761	29,532	108,173	472,518	580,691
Signalling misc. turnouts	track km	43.4	1,352	8,016	58,684	347,891	406,575
Crossing protection lights	each	20	7,035	29,480	140,700	589,600	730,300
Crossing prot. lights & gates	each	20	14,970	63,178	299,407	1,263,564	1,562,971
Line block equipment	section	8	6,761	37,970	54,086	303,762	357,848
Signal bungalows & equipment	track km	43.4	637	3,734	27,665	162,044	189,709
SUB-TOTAL					1,216,059	5,415,483	6,631,541
Engineering	6%				72,964	324,929	397,892
Contingencies	10%				121,606	541,548	663,154
TOTAL COST					$ 1,410,628	$ 6,281,960	$ 7,692,588

COST OF TELECOMMUNICATIONS FOR TOTAL PROJECT

ITEM	UNIT	QTY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
UHF diplex repeater c/w accessories	each	2	1,200	13,125	$ 2,400	$ 26,250	$ 28,650
UHF base stn. radio c/w accessories	each	7	600	8,295	4,200	58,065	62,265
UHF mobile radio c/w accessories	each	26	250	2,730	6,500	70,980	77,480
UHF hand-held radio c/w accessories	each	30	50	2,205	1,500	66,150	67,650
SUB-TOTAL					14,600	221,445	236,045
Engineering	6%				876	13,287	14,163
Contingencies	10%				1,460	22,145	23,605
TOTAL COST					$ 16,936	$ 256,876	$ 273,812

S C E N A R I O D - 2 : COST OF ELECTRIFICATION (US Dollars)

COST OF ELECTRIFICATION OF TOTAL PROJECT

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Main substation 138/25 kV	each	1	$ 64,263	$ 489,389	$ 64,263	$ 489,389	$ 553,652
Back-up substation 138/25 kV	each	1	64,263	489,389	64,263	489,389	553,652
Secondary substation	each	1	27,280	163,449	27,280	163,449	190,730
Catenary system	track km	43.4	20,809	36,580	903,094	1,587,594	2,490,687
Additional costs at stations:							
Catenary system	track km	6.32	20,809	36,580	131,510	231,189	362,699
Section break	each	13	1,919	8,633	24,951	112,231	137,182
Power feed to station	each	5	14,573	53,605	72,866	268,025	340,891
Power feed line	km	3.1	16,834	9,834	52,187	30,486	82,673
Cut-out 2 position	each	5	406	3,177	2,028	15,884	17,912
Cut-out	each	26	522	4,037	13,560	104,975	118,535
Cut-out for shops	each	2	591	4,613	1,182	9,227	10,409
Metal structures	ton	1	319	2,449	319	2,449	2,768
Additional concrete posts	each	20	284	19	5,679	380	6,059
Section insulators	each	21	388	2,696	8,154	56,614	64,767
Foundations for posts	each	20	284	0	5,679	0	5,679
SUB-TOTAL					1,377,015	3,561,281	4,938,296
Engineering	6%				82,621	213,677	296,298
Contingencies	10%				137,701	356,128	493,830
TOTAL COST					$ 1,597,337	$ 4,131,086	$ 5,728,423

S C E N A R I O D - 2 & 3 : COST OF SHOP EQUIPMENT (US Dollars)

COST OF SHOP EQUIPMENT FOR TOTAL PROJECT

ITEM	UNIT	QUANTITY	UNIT COST (Local)	UNIT COST (Foreign)	COST (Local)	COST (Foreign)	TOTAL COST
Crane 10/3 ton	each	1	$ 14,487	$ 58,010	$ 14,487	$ 58,010	$ 72,497
Jacks 15 ton	each	4	3,380	26,368	13,522	105,473	118,994
Jacks 10 ton	each	4	2,052	23,731	8,210	94,926	103,135
Axle lowerer 6 ton	each	1	33,804	200,398	33,804	200,398	234,202
Carpentry equipment	lot	1	111,157	50,627	111,157	50,627	161,784
Mechanical/Electrical shop equip.	lot	1	28,975	171,393	28,975	171,393	200,368
Electronic laboratory equipment	lot	1	9,175	82,269	9,175	82,269	91,444
Brake shop equipment	lot	1	6,278	45,353	6,278	45,353	51,631
Battery chargers	each	2	2,415	9,493	4,829	18,985	23,814
Compressed air system	each	1	24,146	68,557	24,146	68,557	92,703
Misc. equipment and furniture	lot	1	28,975	264,209	28,975	264,209	293,184
SUB-TOTAL					283,558	1,160,201	1,443,759
Engineering	6%				17,013	69,612	86,626
Contingencies	10%				28,356	116,020	144,376
TOTAL COST					$ 328,927	$ 1,345,833	$ 1,674,760

7. MAINTENANCE COST ESTIMATES

(6) [FF*100/P*L]
(7) [SUM(Labor Costs)*BB]

C-86043 17-Mar-88

7.1 ESTIMATED MAINTENANCE COST FOR 1 KM OF TRACK - EXISTING

ASSUME: Currency= U.S. Dollars
Gauge= 1,067 mm
Rail Wt= 30 kg/m
Rail Len= 10 m
Wood Ties= 1,667 /km

Productivity (P)= 60 %
Mechanization (M)= 25 %
Labor Cost (L)= 11.00 /MAN-DAY
Equipment Cost (E)= 11.00 /EQUIV MAN-DAY

		AA	BB	CC	DD	EE	FF	GG	HH	JJ
								ANNUAL COST		
ITEM	UNIT	QTY	UNIT COST	REPLACE VALUE [AA*BB]	MAN-DAYS PER UNIT	AV. LIFE (Years)	LABOR MAN-DAYS [AA*DD/EE]	MATERIAL [CC/EE]	LABOR (1)	TOTAL [GG+HH]
Rail	tonnes	60	554.17	33,250	5.00	50	6.00	665	83	748
Ties	each	1,667	8.11	13,516	0.25	7	59.54	1,931	819	2,750
Ballast	m^3	1,000	8.50	8,500	0.25	20	12.50	425	172	597
Other Track Matl:										
Joint Bars	pair	200	15.66	3,132						
Bolts	each	800	0.38	304						
Tie Plates	each	3,334	3.60	12,002						
Spikes	each	6,668	0.30	2,000						
Anchors	each	0	1.10	0						
Turnouts	each	0.25	3,786	947						
Total O T M	m	1,000	18.39	18,385	0.80	50	16.00	368	220	588
Other Track Mtce							50.00	613 (2)	688 (3)	1,300
O&M of Equipment								660 (4)	132 (5)	792
Structures	m	1,000	30.00	30,000	1.00	60	16.67	500	306 (6)	806
Signals and Comms	m	1,000	0.50	500	0.10	50	2.00	10	37 (6)	47
Engineering/Supervision			10%					245 (7)	245 (7)	491
T O T A L				122,537				5,417	2,700	8,117

Man-Years/km = 0.93 + Eng/Supv

Notes:
(1) [FF*(100-M)/P*L]
(2) [SUM(Trk Matl Repl Value)*0.005]
(3) [FF*(100-M)/P*L]
(4) [SUM(Trk Lab Man-days)*M/P*E]
(5) [GG*0.2*L/E]
(6) [FF*100/P*L]
(7) [SUM(Labor Costs)*BB]

(7) [SUM(Labor Costs)*BB]

C-86043 17-Mar-88

ESTIMATED MAINTENANCE COST FOR 1 KM OF TRACK - EXISTING ELECTRIFIED

ASSUME: Currency= U.S. Dollars
Gauge= 1,067 mm
Rail Wt= 30 kg/m
Rail Len= 10 m
Wood Ties= 1,667 /km

Productivity (P)= 60 %
Mechanization (M)= 25 %
Labor Cost (L)= 11.00 /MAN-DAY
Equipment Cost (E)= 11.00 /EQUIV MAN-DAY

		AA	BB	CC	DD	EE	FF	GG	HH	JJ
								ANNUAL COST		
ITEM	UNIT	QTY	UNIT COST	REPLACE VALUE [AA*BB]	MAN-DAYS PER UNIT	AV. LIFE (Years)	LABOR MAN-DAYS [AA*DD/EE]	MATERIAL [CC/EE]	LABOR (1)	TOTAL [GG+HH]
Rail	tonnes	60	554.17	33,250	5.00	50	6.00	665	83	748
Ties	each	1,667	8.11	13,516	0.25	7	59.54	1,931	819	2,750
Ballast	m^3	1,000	8.50	8,500	0.25	20	12.50	425	172	597
Other Track Matl:										
Joint Bars	pair	200	15.66	3,132						
Bolts	each	800	0.38	304						
Tie Plates	each	3,334	3.60	12,002						
Spikes	each	6,668	0.30	2,000						
Anchors	each	0	1.10	0						
Turnouts	each	0.25	3,786	947						
Total O T M	m	1,000	18.39	18,385	0.80	50	16.00	368	220	588
Other Track Mtce							50.00	913 (2)	688 (3)	1,600
O&M of Equipment								660 (4)	132 (5)	792
Structures	m	1,000	30.00	30,000	1.00	60	16.67	500	306 (6)	806
Signals and Comms	m	1,000	0.50	500	0.10	50	2.00	10	37 (6)	47
Electrification	m	1,000	60.00	60,000	0.25	50	5.00	1,200	92 (6)	1,292
Engineering/Supervision			10%					255 (7)	255 (7)	509
T O T A L				182,537				6,926	2,801	9,727

Man-Years/km = 0.96 + Eng/Supv

Notes: (1) [FF*(100-M)/P*L]
(2) [SUM(Trk Matl Repl Value)*0.005]
(3) [FF*(100-M)/P*L]
(4) [SUM(Trk Lab Man-days)*M/P*E]
(5) [GG*0.2*L/E]

ESTIMATED MAINTENANCE COST FOR 1 KM OF TRACK

ASSUME: Currency= U.S. Dollars
Gauge= 1,067 mm
Rail Wt= 30 kg/m
Rail Len= 15 m
Conc Ties= 1,142 /km
Wood Ties= 333 /km

Productivity (P)= 60 %
Mechanization (M)= 25 %
Labor Cost (L)= 11.00 /MAN-DAY
Equipment Cost (E)= 11.00 /EQUIV MAN-DAY

		AA	BB	CC	DD	EE	FF	GG	HH	JJ
								ANNUAL COST		
ITEM	UNIT	QTY	UNIT COST	REPLACE VALUE [AA*BB]	MAN-DAYS PER UNIT	AV. LIFE (Years)	LABOR MAN-DAYS [AA*DD/EE]	MATERIAL [CC/EE]	LABOR (1)	TOTAL [GG+HH]
Rail	tonnes	60	554.17	33,250	5.00	50	6.00	665	83	748
Conc Ties	each	1,142	20.34	23,228	0.25	50	5.71	465	79	543
Wood Ties	each	333	8.11	2,701	0.25	7	11.89	386	164	549
Ballast	m^3	1,000	8.50	8,500	0.25	20	12.50	425	172	597
Other Track Matl:										
Joint Bars	pair	133	15.66	2,088						
Bolts	each	533	0.38	203						
Tie Plates	each	666	3.60	2,398						
Spikes	each	1332	0.30	400						
Tie Pads	each	2,284	0.80	1,827						
Clips	each	4,568	2.00	9,136						
Anchors	each	0	1.10	0						
Turnouts	each	0.25	3,786	947						
Total O T M	m	1,000	17.00	16,998	0.80	50	16.00	340	220	560
Other Track Mtce							50.00	661 (2)	688 (3)	1,348
O&M of Equipment								468 (4)	94 (5)	562
Structures	m	1,000	30.00	30,000	1.00	60	16.67	500	306 (6)	806
Signals and Comms	m	1,000	0.50	500	0.10	50	2.00	10	37 (6)	47
Engineering/Supervision			10%					184 (7)	184 (7)	368
T O T A L				132,174				4,103	2,024	6,127

Man-Years/km = 0.70 + Eng/Supv

Notes:
(1) [FF*(100-M)/P*L]
(2) [SUM(Trk Matl Repl Value)*0.005]
(3) [FF*(100-M)/P*L]
(4) [SUM(Trk Lab Man-days)*M/P*E]
(5) [GG*0.2*L/E]
(6) [FF*100/P*L]

ESTIMATED MAINTENANCE COST FOR 1 KM OF TRACK

ASSUME: Currency= U.S. Dollars | Productivity (P)= 60 %
Gauge= 1,067 mm | Mechanization (M)= 25 %
Rail Wt= 35 kg/m | Labor Cost (L)= 11.00 /MAN-DAY
Rail Len= 20 m | Equipment Cost (E)= 11.00 /EQUIV MAN-DAY
Conc Ties= 1,429 /km

		AA	BB	CC	DD	EE	FF	GG	HH	JJ
								ANNUAL COST		
ITEM	UNIT	QTY	UNIT COST	REPLACE VALUE [AA*BB]	MAN-DAYS PER UNIT	AV. LIFE (Years)	LABOR MAN-DAYS [AA*DD/EE]	MATERIAL [CC/EE]	LABOR (1)	TOTAL [GG+HH]
Rail	tonnes	70	554.17	38,792	5.00	50	7.00	776	96	872
Ties	each	1,429	20.34	29,066	0.25	50	7.15	581	98	680
Ballast	m^3	1,200	8.50	10,200	0.25	20	15.00	510	206	716
Other Track Matl:										
Joint Bars	pair	100	18.98	1,898						
Bolts	each	400	0.40	160						
Tie Pads	each	2,858	0.80	2,286						
Clips	each	5,716	2.00	11,432						
Anchors	each	0	1.10	0						
Turnouts	each	0.25	5,300	1,325						
Total O T M	m	1,000	17.10	17,101	0.80	50	16.00	342	220	562
Other Track Mtce							50.00	714 (2)	688 (3)	1,401
O&M of Equipment								436 (4)	87 (5)	523
Structures	m	1,000	30.00	30,000	1.00	60	16.67	500	306 (6)	806
Signals and Comms	m	1,000	0.50	500	0.10	50	2.00	10	37 (6)	47
Engineering/Supervision			10%					174 (7)	174 (7)	348
T O T A L				142,761				4,043	1,911	5,954

Man-Years/km = 0.66 + Eng/Supv

Notes:
(1) [FF*(100-M)/P*L]
(2) [SUM(Trk Matl Repl Value)*0.005]
(3) [FF*(100-M)/P*L]
(4) [SUM(Trk Lab Man-days)*M/P*E]
(5) [GG*0.2*L/E]
(6) [FF*100/P*L]
(7) [SUM(Labor Costs)*BB]

ESTIMATED MAINTENANCE COST FOR 1 KM OF TRACK

ASSUME: Currency= U.S. Dollars
Gauge= 1,067 mm
Rail Wt= 42 kg/m
Rail Len= 25 m
Conc Ties= 1,429 /km

Productivity (P)= 60 %
Mechanization (M)= 25 %
Labor Cost (L)= 11.00 /MAN-DAY
Equipment Cost (E)= 11.00 /EQUIV MAN-DAY

		AA	BB	CC	DD	EE	FF	GG	HH	JJ
								ANNUAL COST		
ITEM	UNIT	QTY	UNIT COST	REPLACE VALUE [AA*BB]	MAN-DAYS PER UNIT	AV. LIFE (Years)	LABOR MAN-DAYS [AA*DD/EE]	MATERIAL [CC/EE]	LABOR (1)	TOTAL [GG+HH]
Rail	tonnes	84	554.17	46,550	5.00	50	8.40	931	116	1,047
Ties	each	1,429	20.34	29,066	0.25	50	7.15	581	98	680
Ballast	m^3	1,200	8.50	10,200	0.25	20	15.00	510	206	716
Other Track Matl:										
Joint Bars	pair	80	24.67	1,974						
Bolts	each	320	0.62	198						
Tie Pads	each	2,858	0.80	2,286						
Clips	each	5,716	2.00	11,432						
Anchors	each	0	1.10	0						
Turnouts	each	0.25	7,571	1,893						
Total O T M	m	1,000	17.78	17,783	0.80	50	16.00	356	220	576
Other Track Mtce							50.00	1,132 (2)	688 (3)	1,819
O&M of Equipment								442 (4)	88 (5)	531
Structures	m	1,000	30.00	30,000	1.00	60	16.67	500	306 (6)	806
Signals and Comms	m	1,000	75.00	75,000	0.25	50	5.00	1,500	92 (6)	1,592
Engineering/Supervision			10%					181 (7)	181 (7)	363
T O T A L				226,382				6,134	1,995	8,128

Man-Years/km = 0.69 + Eng/Supv

Notes:
(1) [FF*(100-M)/P*L]
(2) [SUM(Trk Matl Repl Value)*0.005]
(3) [FF*(100-M)/P*L]
(4) [SUM(Trk Lab Man-days)*M/P*E]
(5) [GG*0.2*L/E]
(6) [FF*100/P*L]
(7) [SUM(Labor Costs)*BB]

ESTIMATED MAINTENANCE COST FOR 1 KM OF TRACK - ELECTRIFIED

ASSUME: Currency= U.S. Dollars
Gauge= 1,067 mm
Rail Wt= 42 kg/m
Rail Len= 25 m
Conc Ties= 1,429 /km

Productivity (P)= 60 %
Mechanization (M)= 25 %
Labor Cost (L)= 11.00 /MAN-DAY
Equipment Cost (E)= 11.00 /EQUIV MAN-DAY

		AA	BB	CC	DD	EE	FF	GG	HH	JJ
								ANNUAL COST		
ITEM	UNIT	QTY	UNIT COST	REPLACE VALUE [AA*BB]	MAN-DAYS PER UNIT	AV. LIFE (Years)	LABOR MAN-DAYS [AA*DD/EE]	MATERIAL [CC/EE]	LABOR (1)	TOTAL [GG+HH]
Rail	tonnes	84	554.17	46,550	5.00	50	8.40	931	116	1,047
Ties	each	1,429	20.34	29,066	0.25	50	7.15	581	98	680
Ballast	m^3	1,200	8.50	10,200	0.25	20	15.00	510	206	716
Other Track Matl:										
Joint Bars	pair	80	24.67	1,974						
Bolts	each	320	0.62	198						
Tie Pads	each	2,858	0.80	2,286						
Clips	each	5,716	2.00	11,432						
Anchors	each	0	1.10	0						
Turnouts	each	0.25	7,571	1,893						
Total O T M	m	1,000	17.78	17,783	0.80	50	16.00	356	220	576
Other Track Mtce							50.00	1,059 (2)	688 (3)	1,747
O&M of Equipment								442 (4)	88 (5)	531
Structures	m	1,000	30.00	30,000	1.00	60	16.67	500	306 (6)	806
Signals and Comms	m	1,000	0.50	500	0.10	50	2.00	10	37 (6)	47
Electrification	m	1,000	60.00	60,000	0.25	50	5.00	1,200	92 (6)	1,292
Engineering/Supervision			10%					185 (7)	185 (7)	370
T O T A L				211,882				5,775	2,035	7,810

Man-Years/km = 0.70 + Eng/Supv

Notes:
(1) [FF*(100-M)/P*L]
(2) [SUM(Trk Matl Repl Value)*0.005]
(3) [FF*(100-M)/P*L]
(4) [SUM(Trk Lab Man-days)*M/P*E]
(5) [GG*0.2*L/E]
(6) [FF*100/P*L]
(7) [SUM(Labor Costs)*BB]

ESTIMATED MAINTENANCE COST FOR 1 KM OF TRACK - ELECTRIFIED

ASSUME: Currency= U.S. Dollars
Gauge= 1,067 mm
Rail Wt= 42 kg/m
Rail Len= 25 m
Conc Ties= 1,429 /km

Productivity (P)= 60 %
Mechanization (M)= 25 %
Labor Cost (L)= 11.00 /MAN-DAY
Equipment Cost (E)= 11.00 /EQUIV MAN-DAY

		AA	BB	CC	DD	EE	FF	GG	HH	JJ
									ANNUAL COST	
ITEM	UNIT	QTY	UNIT COST	REPLACE VALUE [AA*BB]	MAN-DAYS PER UNIT	AV. LIFE (Years)	LABOR MAN-DAYS [AA*DD/EE]	MATERIAL [CC/EE]	LABOR (1)	TOTAL [GG+HH]
Rail	tonnes	84	554.17	46,550	5.00	50	8.40	931	116	1,047
Ties	each	1,429	20.34	29,066	0.25	50	7.15	581	98	680
Ballast	m^3	1,200	8.50	10,200	0.25	20	15.00	510	206	716
Other Track Matl:										
Joint Bars	pair	80	24.67	1,974						
Bolts	each	320	0.62	198						
Tie Pads	each	2,858	0.80	2,286						
Clips	each	5,716	2.00	11,432						
Anchors	each	0	1.10	0						
Turnouts	each	0.25	7,571	1,893						
Total O T M	m	1,000	17.78	17,783	0.80	50	16.00	356	220	576
Other Track Mtce							50.00	1,432 (2)	688 (3)	2,119
O&M of Equipment								442 (4)	88 (5)	531
Structures	m	1,000	30.00	30,000	1.00	60	16.67	500	306 (6)	806
Signals and Comms	m	1,000	75.00	75,000	0.25	50	5.00	1,500	92 (6)	1,592
Electrification	m	1,000	60.00	60,000	0.25	50	5.00	1,200	92 (6)	1,292
Engineering/Supervision			10%					190 (7)	190 (7)	381
T O T A L				286,382				7,643	2,095	9,738

Man-Years/km = 0.72 + Eng/Supv

Notes:
(1) [FF*(100-M)/P*L]
(2) [SUM(Trk Matl Repl Value)*0.005]
(3) [FF*(100-M)/P*L]
(4) [SUM(Trk Lab Man-days)*M/P*E]
(5) [GG*0.2*L/E]
(6) [FF*100/P*L]
(7) [SUM(Labor Costs)*BB]

8. CAPITAL DISBURSEMENT SCHEDULES

8.1 CAPITAL DISBURSEMENT SCHEDULES

SCENARIO A-1:	COST x1000	DURATION MONTHS	SCHEDULE MONTH 1 5 10 15 20 25 30 35 40 45 50 55 60
Final Design	$1,232	6	######
Tender & Award	0	6	######
Purchase Imported Matl.	14,219	6	######
Track & Civil Works	8,377	44	###
TOTAL	$23,828		

SCENARIO A-2:	COST x1000	DURATION MONTHS	SCHEDULE MONTH 1 5 10 15 20 25 30 35 40 45 50 55 60
Final Design	$ 722	5	#####
Tender & Award	0	6	######
Purchase Imported Matl.	7,433	6	######
Track & Civil Works	5,804	28	############################
TOTAL	$13,959		

SCENARIO B-1:	COST x1000	DURATION MONTHS	SCHEDULE MONTH 1 5 10 15 20 25 30 35 40 45 50 55 60
Final Design	$2,125	9	#########
Tender & Award	0	6	######
Purchase Imported Matl.	10,542	6	######
Track & Civil Works	12,526	25	#########################
Signals	5,396	25	#########################
Electrification	10,500	25	#########################
TOTAL	$41,089		

SCENARIO B-2:	COST x1000	DURATION MONTHS	SCHEDULE MONTH 1 5 10 15 20 25 30 35 40 45 50 55 60
Final Design	$ 661	9	#########
Tender & Award	0	6	######
Purchase Imported Matl.	6,908	6	######
Track & Civil Works	5,203	28	############################
TOTAL	$12,772		

SCENARIO C-1:	COST x1000	DURATION MONTHS	SCHEDULE MONTH 1 5 10 15 20 25 30 35 40 45 50 55 60
Final Design	$1,651	8	########
Tender & Award	0	6	######
Purchase Imported Matl.	9,166	6	######
Track & Civil Works	4,710	20	###################
Signals	3,599	20	###################
Electrification	12,794	20	###################
TOTAL	$31,920		

CAPITAL DISBURSEMENT SCHEDULES

SCENARIO C-2:	COST x1000	DURATION MONTHS	SCHEDULE MONTH 1 5 10 15 20 25 30 35 40 45 50 55 60
Final Design	$ 745	8	########
Tender & Award	0	6	######
Purchase Imported Matl.	8,010	6	######
Track & Civil Works	5,654	25	#########################
TOTAL	$14,409		

SCENARIO D-1:	COST x1000	DURATION MONTHS	SCHEDULE MONTH 1 5 10 15 20 25 30 35 40 45 50 55 60
Final Design	$2,446	12	############
Tender & Award	0	6	######
Purchase Imported Matl.	4,832	6	######
Civil Works	21,891	24	#########################
Track Works	1,617	12	############
Buildings	2,652	18	##################
Signals	5,705	12	############
Communications	1,269	8	########
Electrification	5,287	12	############
Shop Equipment	1,588	4	####
TOTAL	$47,288		

SCENARIO D-2:	COST x1000	DURATION MONTHS	SCHEDULE MONTH 1 5 10 15 20 25 30 35 40 45 50 55 60
Final Design	$1,493	10	##########
Tender & Award	0	6	######
Purchase Imported Matl.	4,510	6	######
Civil Works	6,640	18	##################
Track Works	1,642	12	############
Buildings	2,309	18	##################
Signals	4,983	12	############
Communications	260	3	###
Electrification	5,432	12	############
Shop Equipment	1,588	4	####
TOTAL	$28,857		

SCENARIO D-3:	COST x1000	DURATION MONTHS	SCHEDULE MONTH 1 5 10 15 20 25 30 35 40 45 50 55 60
Final Design	$1,196	9	#########
Tender & Award	0	6	######
Purchase Imported Matl.	4,510	6	######
Civil Works	6,640	18	##################
Track Works	1,642	12	############
Buildings	2,309	18	##################
Signals	4,983	12	############
Communications	260	3	###
Shop Equipment	1,588	4	####
TOTAL	$23,128		

APPENDIX C

OPERATIONS

APPENDIX C

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1. PACIFICO LINE

1.1 TONNAGE FORECAST FOR PACIFICO LINE BY COMMODITY (IN TONNES)

	1988	1989	1990	1991	1992	1993	1994	1995-2008
Iron and Steel:								
Transitaria	64.4	58.5	52.7	52.7	52.7	52.7	52.7	52.7
Metalco	35.0	38.5	42.4	46.6	51.2	56.4	56.4	56.4
Wheat:								
Caldera/Alajuela	63.0	64.4	65.9	67.3	68.9	70.4	71.7	71.7
Caldera/Barranca	63.0	64.4	65.9	67.3	68.9	70.4	71.7	71.7
Corn	32.0	32.7	33.5	34.2	35.0	35.8	36.4	37.1
Local: Sea Sand	30.0	33.0	36.3	39.9	43.9	48.3	48.3	48.3
Other	10.0	10.3	10.5	10.8	11.0	11.3	11.3	11.3
Malt	3.0	3.1	3.2	3.2	3.3	3.4	3.4	3.4
Exports	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
TOTAL	301.4	305.9	311.4	323.0	335.9	349.7	352.9	353.6

1.2 CALCULATION OF OPERATING INPUTS

With the increased axle loading to 16 tonnes/axle after rehabilitation the average wagon should be able to handle 40 net tonnes. Assuming an average tare weight per wagon of 15.5 tonnes the average gross weight per wagon would equal 55.5 tonnes.

According to the timetable, one locomotive on the Pacifico Line can handle 280 gross tonnes. Therefore, the average number of wagons per locomotive = 280/55.5 = 5.0450 wagons (say 5). To maximize equipment utilization and capacity a train consist of 2 locomotives with 10 wagons was selected.

AVERAGE TRAINS PER DAY

YEAR	ANNUAL TONNES	WAGONS/ YEAR	WAGONS/ DAY	TRAINS/ DAY
	A	B=A/40t	C=B/350	D=C/5
1988	301,400	7,535.0	21.53	2.15
1989	305,900	7,647.5	21.85	2.19
1990	311,100	7,777.5	22.22	2.22
1991	323,100	8,077.5	23.08	2.31
1992	335,100	8,377.5	23.94	2.39
1993	349,600	8,740.0	24.97	2.50
1994	352,800	8,820.0	25.20	2.52
1995-2008	353,500	8,837.5	25.25	2.53

When calculating the average number of wagons per day the Consultant assumes 350 operating days per year.

The number of trains per day is the average number of trains in each direction needed to handle the given tonnage in the assumed number of operating days.

1.3 OPERATIONAL ANALYSIS OF INCOFER

The overall simulation of the INCOFER railroad system utilizes a proprietary computer-based model to generate the necessary output data. The model analyses capacity of the track sections enroute in terms of the total number of trains in the system. A more detailed description can be found in Section I.

CPCS has evaluated the transit time over each section of track to be utilized, taking into account current running times, expected track improvements and increasing delays for meets and waits as traffic levels rise within the system.

The model takes as inputs the following data:

- Average bi-directional transit time between stations
- Average number of trains per block in both directions
- Average train delay times at stations

The number of INCOFER trains on the track sections has been calculated using 350 operating days per year. This is not to say the INCOFER will be idle 15 days per year but it is meant to ensure that even if this many days are lost due to unforeseen circumstances, INCOFER will have the necessary capacity to move the full tonnage volume.

Exhibit A shows by year the operational analysis of the Pacifico Line. The average number of trains per block in both directions reflects the train consist of 2 locomotives with 10 wagons and also the inclusion of a tourist train operating intermittently between San José and Puntarenas.

Originally, the operational analysis was conducted using all the sidings contained in the timetable of the Pacifico Line. The operational analysis as shown in Exhibit A has the number of sidings minimized taking into account the low number of trains and low tonnage. The running time between sidings was kept at approximately 35 minutes and wherever posible lengthened sidings were utilized for the analysis. A list of sidings is included along with the wagon capacity of each.

JANUARY 25,1986

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

2 LOCO. - 10 WAGONS

PACIFICO LINE SAN JOSE PACIFICO-PUNTARENAS
EST.RUNNING TIMES *
C-86043

YEAR: 1988

TONNAGE: 301,400 t.

NUMBER OF BLOCKS 8

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C ...)) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
SANJ-TUBO	9.0	6.31	0	228.21	9.20	0.3	0.12	0	0.12	9.32	142.55	136.24
TUBO-CIRU	30.0	6.31	0	228.21	30.67	0.3	1.43	0	1.43	32.10	42.06	35.75
CIRU-ATEN	26.0	6.31	0	228.21	26.58	0.3	1.05	0	1.05	27.63	48.69	42.38
ATEN-QUEB	30.0	6.31	0	228.21	30.67	0.3	1.43	0	1.43	32.10	42.06	35.75
QUEB-OROT	23.0	6.31	120	209.19	23.56	0.3	0.90	0	0.90	24.46	54.97	48.66
OROT-JESU	33.0	6.31	120	209.19	33.81	0.3	1.96	0	1.96	35.76	37.95	31.64
JESU-JCT.	6.0	6.31	120	209.19	6.15	0.3	0.06	0	0.06	6.20	213.77	207.46
JCT.-PURR	10.0	4.31	0	334.11	10.15	0.3	0.10	0	0.10	10.25	129.42	125.11
	167											

INCLUDES 1 TOURIST TRAIN/DAY IN EACH DIRECTION
WHEN IN OPERATION.

TOTAL TRIP TIME	177.83	
TOTAL CIRCUIT TIME	355.65	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	3.90	
INITIAL TERMINAL TIME AT SAN JOSE	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT SAN JOSE	45.00	
INITIAL TERMINAL TIME AT PURRUJA	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT PURRUJA	45.00	
LOCO. TOTAL TURNAROUND TIME	999.55	MINS.
LOCO. TOTAL TURNAROUND TIME	16.66	HRS.
LOCO. TOTAL TURNAROUND TIME	0.69	DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING AT PURRUJA/PORT	960.00	
WAGON TOTAL TURNAROUND TIME	2979.55	MINS.
WAGON TOTAL TURNAROUND TIME	49.66	HRS.
WAGON TOTAL TURNAROUND TIME	2.07	DAYS

:----- IF NEGATIVE,REDUCE COL. AND RESUBMIT

LIST OF STATIONS

		CAPACITY
SANJ	SAN JOSE	YARD
TUBO	TUBO TICO	22
CIRU	CIRUELAS	34
ATEN	ATENAS	19
QUEB	QUEBRADAS	18
OROT	OROTINA	40
JESU	JESUS MARIA	22
JCT.	JUNCTION	--
PURR	PURRUJA	YARD

* C.E.TAYLOR

JANUARY 25,1986

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

2 LOCO. - 10 WAGONS

PACIFICO LINE SAN JOSE PACIFICO-PUNTARENAS
EST.RUNNING TIMES *
C-86043

YEAR: 1989

TONNAGE: 305,900 t.

NUMBER OF BLOCKS 8

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
SANJ-TUBO	9.0	6.37	0	226.06	9.20	0.3	0.12	0	0.12	9.32	142.52	136.15
TUBO-CIRU	30.0	6.37	0	226.06	30.68	0.3	1.45	0	1.45	32.12	42.04	35.67
CIRU-ATEN	26.0	6.37	0	226.06	26.59	0.3	1.06	0	1.06	27.65	48.67	42.30
ATEN-QUEB	30.0	6.37	0	226.06	30.68	0.3	1.45	0	1.45	32.12	42.04	35.67
QUEB-OROT	23.0	6.37	120	207.22	23.57	0.3	0.91	0	0.91	24.48	54.95	48.58
OROT-JESU	33.0	6.37	120	207.22	33.82	0.3	1.98	0	1.98	35.79	37.93	31.56
JESU-JCT.	6.0	6.37	120	207.22	6.15	0.3	0.06	0	0.06	6.20	213.71	207.34
JCT.-PURR	10.0	4.37	0	329.52	10.15	0.3	0.10	0	0.10	10.25	129.38	125.01
	167											

INCLUDES 1 TOURIST TRAIN/DAY IN EACH DIRECTION WHEN IN OPERATION.

LIST OF STATIONS		CAPACITY
SANJ	SAN JOSE	YARD
TUBO	TUBO TICO	22
CIRU	CIRUELAS	34
ATEN	ATENAS	19
QUEB	QUEBRADAS	18
OROT	OROTINA	40
JESU	JESUS MARIA	22
JCT.	JUNCTION	--
PURR	PURRUJA	YARD

TOTAL TRIP TIME	177.95	
TOTAL CIRCUIT TIME	355.89	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	3.94	
INITIAL TERMINAL TIME AT SAN JOSE	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT SAN JOSE	45.00	
INITIAL TERMINAL TIME AT PURRUJA	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT PURRUJA	45.00	
LOCO. TOTAL TURNAROUND TIME	999.83	MINS.
LOCO. TOTAL TURNAROUND TIME	16.66	HRS.
LOCO. TOTAL TURNAROUND TIME	0.69	DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING AT PURRUJA/PORT	960.00	
WAGON TOTAL TURNAROUND TIME	2979.83	MINS.
WAGON TOTAL TURNAROUND TIME	49.66	HRS.
WAGON TOTAL TURNAROUND TIME	2.07	DAYS

|----- IF NEGATIVE, REDUCE COL. AND RESUBMIT

* C.E.TAYLOR

JANUARY 25,1986

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)
2 LOCO. - 10 WAGONS
PACIFICO LINE SAN JOSE PACIFICO-PUNTARENAS
EST.RUNNING TIMES *
C-86043

YEAR: 1990

TONNAGE: 311,100 t.

NUMBER OF BLOCKS 8

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
SANJ-TUBO	9.0	6.44	0	223.60	9.21	0.3	0.12	0	0.12	9.32	142.47	136.03
TUBO-CIRU	30.0	6.44	0	223.60	30.69	0.3	1.46	0	1.46	32.15	42.01	35.57
CIRU-ATEN	26.0	6.44	0	223.60	26.59	0.3	1.08	0	1.08	27.67	48.65	42.21
ATEN-QUEB	30.0	6.44	0	223.60	30.69	0.3	1.46	0	1.46	32.15	42.01	35.57
QUEB-OROT	23.0	6.44	120	204.97	23.58	0.3	0.92	0	0.92	24.49	54.92	48.48
OROT-JESU	33.0	6.44	120	204.97	33.83	0.3	2.01	0	2.01	35.83	37.90	31.46
JESU-JCT.	6.0	6.44	120	204.97	6.15	0.3	0.06	0	0.06	6.21	213.64	207.20
JCT.-PURR	10.0	4.44	0	324.32	10.16	0.3	0.10	0	0.10	10.26	129.34	124.90
	167											

INCLUDES 1 TOURIST TRAIN/DAY IN EACH DIRECTION
WHEN IN OPERATION.

LIST OF STATIONS

		CAPACITY
SANJ	SAN JOSE	YARD
TUBO	TUBO TICO	22
CIRU	CIRUELAS	34
ATEN	ATENAS	19
QUEB	QUEBRADAS	18
OROT	OROTINA	40
JESU	JESUS MARIA	22
JCT.	JUNCTION	--
PURR	PURRUJA	YARD

* C.E.TAYLOR

TOTAL TRIP TIME	178.08
TOTAL CIRCUIT TIME	356.17
BLOCK CLOSURE DELAY	10.00
TRUE MEETING DELAY	3.98
INITIAL TERMINAL TIME AT SAN JOSE	60.00
POST TRIP INSPECTION AND SERVICING	180.00
FINAL TERMINAL TIME AT SAN JOSE	45.00
INITIAL TERMINAL TIME AT PURRUJA	60.00
WAIT FOR DEPARTING TRAIN	240.00
FINAL TERMINAL TIME AT PURRUJA	45.00
LOCO. TOTAL TURNAROUND TIME	1000.15 MINS.
LOCO. TOTAL TURNAROUND TIME	16.67 HRS.
LOCO. TOTAL TURNAROUND TIME	0.69 DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00
WAGON TIME LOADING AT PURRUJA/PORT	960.00
WAGON TOTAL TURNAROUND TIME	2980.15 MINS.
WAGON TOTAL TURNAROUND TIME	49.67 HRS.
WAGON TOTAL TURNAROUND TIME	2.07 DAYS

:----- IF NEGATIVE, REDUCE COL AND RESUBMIT

JANUARY 25,1986

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

YEAR: 1991

TONNAGE: 323,100 t.

NUMBER OF BLOCKS 8

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

2 LOCO. - 10 WAGONS

PACIFICO LINE SAN JOSE PACIFICO-PUNTARENAS
EST.RUNNING TIMES *
C-86043

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS	TRACK CLOSURE (MIN/DAY)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B)	SERVICE TIME PER BLOCK (A)/(1-(TD/C))	EMPIRICAL CORRECTION FACTOR	QUEUING DELAY(MINS.) E*((D)2/((C)-(D)))	PLANNED BLOCK DELAY MINS.	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G	TOTAL BLOCK TIME(MINS.) (D)+(H)	CAPACITY PER BLOCK (TRAINS)	EXCESS CAPACITY PER BLOCK (J)-(B)
	(A)	(B)	(MT)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	
SANJ-TUBO	9.0	6.62	0	217.52	9.21	0.3	0.12	0	0.12	9.33	142.35	135.73
TUBO-CIRU	30.0	6.62	0	217.52	30.71	0.3	1.51	0	1.51	32.22	41.95	35.33
CIRU-ATEN	26.0	6.62	0	217.52	26.61	0.3	1.11	0	1.11	27.72	48.59	41.97
ATEN-QUEB	30.0	6.62	0	217.52	30.71	0.3	1.51	0	1.51	32.22	41.95	35.33
QUEB-OROT	23.0	6.62	120	199.40	23.59	0.3	0.95	0	0.95	24.54	54.85	48.23
OROT-JESU	33.0	6.62	120	199.40	33.85	0.3	2.08	0	2.08	35.93	37.84	31.22
JESU-JCT.	6.0	6.62	120	199.40	6.15	0.3	0.06	0	0.06	6.21	213.46	206.84
JCT.-PURR	10.0	4.62	0	311.69	10.16	0.3	0.10	0	0.10	10.27	129.23	124.61
	167											

INCLUDES 1 TOURIST TRAIN/DAY IN EACH DIRECTION
WHEN IN OPERATION.

TOTAL TRIP TIME	178.44	<-- IF NEGATIVE, REDUCE COL. AND RESUBMIT
TOTAL CIRCUIT TIME	356.89	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	4.10	
INITIAL TERMINAL TIME AT SAN JOSE	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT SAN JOSE	45.00	
INITIAL TERMINAL TIME AT PURRUJA	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT PURRUJA	45.00	
LOCO. TOTAL TURNAROUND TIME	1000.99 MINS.	
LOCO. TOTAL TURNAROUND TIME	16.68 HRS.	
LOCO. TOTAL TURNAROUND TIME	0.70 DAYS	
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING AT PURRUJA/PORT	960.00	
WAGON TOTAL TURNAROUND TIME	2980.99 MINS.	
WAGON TOTAL TURNAROUND TIME	49.68 HRS.	
WAGON TOTAL TURNAROUND TIME	2.07 DAYS	

LIST OF STATIONS

		CAPACITY
SANJ	SAN JOSE	YARD
TUBO	TUBO TICO	22
CIRU	CIRUELAS	34
ATEN	ATENAS	19
QUEB	QUEBRADAS	18
OROT	OROTINA	40
JESU	JESUS MARIA	22
JCT.	JUNCTION	--
PURR	PURRUJA	YARD

* C.E.TAYLOR

JANUARY 25,1986

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)
2 LOCO. - 10 WAGONS
PACIFICO LINE SAN JOSE PACIFICO-PUNTARENAS
EST.RUNNING TIMES *
C-86043

YEAR: 1992

TONNAGE: 335,300 t.

NUMBER OF BLOCKS 8

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
SANJ-TUBO	9.0	6.8	0	211.76	9.22	0.3	0.13	0	0.13	9.34	142.23	135.43
TUBO-CIRU	30.0	6.8	0	211.76	30.73	0.3	1.56	0	1.56	32.29	41.89	35.09
CIRU-ATEN	26.0	6.8	0	211.76	26.63	0.3	1.15	0	1.15	27.78	48.52	41.72
ATEN-QUEB	30.0	6.8	0	211.76	30.73	0.3	1.56	0	1.56	32.29	41.89	35.09
QUEB-OROT	23.0	6.8	120	194.12	23.61	0.3	0.98	0	0.98	24.59	54.78	47.98
OROT-JESU	33.0	6.8	120	194.12	33.87	0.3	2.15	0	2.15	36.02	37.77	30.97
JESU-JCT.	6.0	6.8	120	194.12	6.16	0.3	0.06	0	0.06	6.22	213.29	206.49
JCT.-PURR	10.0	4.8	0	300.00	10.17	0.3	0.11	0	0.11	10.28	129.12	124.32

INCLUDES 1 TOURIST TRAIN/DAY IN EACH DIRECTION WHEN IN OPERATION.

167

TOTAL TRIP TIME	178.81	<-- IF NEGATIVE, REDUCE COL. AND RESUBMIT
TOTAL CIRCUIT TIME	357.61	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	4.22	
INITIAL TERMINAL TIME AT SAN JOSE	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT SAN JOSE	45.00	
INITIAL TERMINAL TIME AT PURRUJA	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT PURRUJA	45.00	
LOCO. TOTAL TURNAROUND TIME	1001.83	MINS.
LOCO. TOTAL TURNAROUND TIME	16.70	HRS.
LOCO. TOTAL TURNAROUND TIME	0.70	DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING AT PURRUJA/PORT	960.00	
WAGON TOTAL TURNAROUND TIME	2981.83	MINS.
WAGON TOTAL TURNAROUND TIME	49.70	HRS.
WAGON TOTAL TURNAROUND TIME	2.07	DAYS

LIST OF STATIONS

		CAPACITY
SANJ	SAN JOSE	YARD
TUBO	TUBO TICO	22
CIRU	CIRUELAS	34
ATEN	ATENAS	43
QUEB	QUEBRADAS	18
OROT	OROTINA	40
JESU	JESUS MARIA	22
JCT.	JUNCTION	--
PURR	PURRUJA	YARD

* C.E.TAYLOR

JANUARY 25,1986

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)
2 LOCO. - 10 WAGONS
PACIFICO LINE SAN JOSE PACIFICO-PUNTARENAS
EST.RUNNING TIMES *
C-86043

YEAR: 1993

TONNAGE: 349,600 t.

NUMBER OF BLOCKS 8

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
SANJ-TUBO	9.0	6.99	0	206.01	9.22	0.3	0.13	0	0.13	9.35	142.11	135.12
TUBO-CIRU	30.0	6.99	0	206.01	30.75	0.3	1.62	0	1.62	32.36	41.83	34.84
CIRU-ATEN	26.0	6.99	0	206.01	26.65	0.3	1.19	0	1.19	27.83	48.46	41.47
ATEN-QUEB	30.0	6.99	0	206.01	30.75	0.3	1.62	0	1.62	32.36	41.83	34.84
QUEB-OROT	23.0	6.99	120	188.84	23.63	0.3	1.01	0	1.01	24.64	54.70	47.71
OROT-JESU	33.0	6.99	120	188.84	33.90	0.3	2.22	0	2.22	36.12	37.70	30.71
JESU-JCT.	6.0	6.99	120	188.84	6.16	0.3	0.06	0	0.06	6.23	213.10	206.11
JCT.-PURR	10.0	4.99	0	288.58	10.18	0.3	0.11	0	0.11	10.29	129.01	124.02
	167											

INCLUDES 1 TOURIST TRAIN/DAY IN EACH DIRECTION WHEN IN OPERATION.

LIST OF STATIONS		CAPACITY
SANJ	SAN JOSE	YARD
TUBO	TUBO TICO	22
CIRU	CIRUELAS	34
ATEN	ATENAS	19
QUEB	QUEBRADAS	18
OROT	OROTINA	40
JESU	JESUS MARIA	22
JCT.	JUNCTION	--
PURR	PURRUJA	YARD

TOTAL TRIP TIME	179.19	!----- IF NEGATIVE, REDUCE COL. AND RESUBMIT
TOTAL CIRCUIT TIME	358.38	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	4.35	
INITIAL TERMINAL TIME AT SAN JOSE	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT SAN JOSE	45.00	
INITIAL TERMINAL TIME AT PURRUJA	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT PURRUJA	45.00	
LOCO. TOTAL TURNAROUND TIME	1002.73 MINS.	
LOCO. TOTAL TURNAROUND TIME	16.71 HRS.	
LOCO. TOTAL TURNAROUND TIME	0.70 DAYS	
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING AT PURRUJA/PORT	960.00	
WAGON TOTAL TURNAROUND TIME	2982.73 MINS.	
WAGON TOTAL TURNAROUND TIME	49.71 HRS.	
WAGON TOTAL TURNAROUND TIME	2.07 DAYS	

* C.E.TAYLOR

JANUARY 25,1986

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

2 LOCO. - 10 WAGONS

PACIFICO LINE SAN JOSE PACIFICO-PUNTARENAS
EST.RUNNING TIMES *
C-86043

YEAR: 1994

TONNAGE: 252,800 t.

NUMBER OF BLOCKS 8

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
SANJ-TUBO	9.0	7.04	0	204.55	9.23	0.3	0.13	0	0.13	9.36	142.07	135.03
TUBO-CIRU	30.0	7.04	0	204.55	30.75	0.3	1.63	0	1.63	32.38	41.81	34.77
CIRU-ATEN	26.0	7.04	0	204.55	26.65	0.3	1.20	0	1.20	27.85	48.44	41.40
ATEN-QUEB	30.0	7.04	0	204.55	30.75	0.3	1.63	0	1.63	32.38	41.81	34.77
QUEB-OROT	23.0	7.04	120	187.50	23.63	0.3	1.02	0	1.02	24.65	54.68	47.64
OROT-JESU	33.0	7.04	120	187.50	33.90	0.3	2.25	0	2.25	36.15	37.69	30.65
JESU-JCT.	6.0	7.04	120	187.50	6.16	0.3	0.06	0	0.06	6.23	213.05	206.01
JCT.-PURR	10.0	5.04	0	285.71	10.18	0.3	0.11	0	0.11	10.29	128.98	123.94
	167											

INCLUDES 1 TOURIST TRAIN/DAY IN EACH DIRECTION
WHEN IN OPERATION.

LIST OF STATIONS		CAPACITY
SANJ	SAN JOSE	YARD
TUBO	TUBO TICO	22
CIRU	CIRUELAS	34
ATEN	ATENAS	19
QUEB	QUEBRADAS	18
OROT	OROTINA	40
JESU	JESUS MARIA	22
JCT.	JUNCTION	--
PURR	PURRUJA	YARD

TOTAL TRIP TIME	179.29	
TOTAL CIRCUIT TIME	358.59	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	4.38	
INITIAL TERMINAL TIME AT SAN JOSE	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT SAN JOSE	45.00	
INITIAL TERMINAL TIME AT PURRUJA	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT PURRUJA	45.00	
LOCO. TOTAL TURNAROUND TIME	1002.97	MINS.
LOCO. TOTAL TURNAROUND TIME	16.72	HRS.
LOCO. TOTAL TURNAROUND TIME	0.70	DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING AT PURRUJA/PORT	960.00	
WAGON TOTAL TURNAROUND TIME	2982.97	MINS.
WAGON TOTAL TURNAROUND TIME	49.72	HRS.
WAGON TOTAL TURNAROUND TIME	2.07	DAYS

<----- IF NEGATIVE, REDUCE COL. AND RESUBMIT

* O.E.TAYLOR

JANUARY 25,1986

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)
2 LOCO. - 10 WAGONS
PACIFICO LINE SAN JOSE PACIFICO-PUNTARENAS
EST.RUNNING TIMES #
C-86043

YEAR: 1995-2008

TONNAGE: 353,500 t.

NUMBER OF BLOCKS 8

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
SANJ-TUBO	9.0	7.05	0	204.26	9.23	0.3	0.13	0	0.13	9.36	142.07	135.02
TUBO-CIRU	30.0	7.05	0	204.26	30.75	0.3	1.64	0	1.64	32.39	41.81	34.76
CIRU-ATEN	26.0	7.05	0	204.26	26.65	0.3	1.20	0	1.20	27.85	48.44	41.39
ATEN-QUEB	30.0	7.05	0	204.26	30.75	0.3	1.64	0	1.64	32.39	41.81	34.76
QUEB-OROT	23.0	7.05	120	187.23	23.63	0.3	1.02	0	1.02	24.66	54.67	47.62
OROT-JESU	33.0	7.05	120	187.23	33.91	0.3	2.25	0	2.25	36.15	37.68	30.63
JESU-JCT.	6.0	7.05	120	187.23	6.16	0.3	0.06	0	0.06	6.23	213.04	205.99
JCT.-PURR	10.0	5.05	0	285.15	10.18	0.3	0.11	0	0.11	10.29	128.97	123.92
	167											

INCLUDES 1 TOURIST TRAIN/DAY IN EACH DIRECTION WHEN IN OPERATION.

TOTAL TRIP TIME	179.31	
TOTAL CIRCUIT TIME	358.63	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	4.39	
INITIAL TERMINAL TIME AT SAN JOSE	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT SAN JOSE	45.00	
INITIAL TERMINAL TIME AT PURRUJA	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT PURRUJA	45.00	
LOCO. TOTAL TURNAROUND TIME	1003.02	MINS.
LOCO. TOTAL TURNAROUND TIME	16.72	HRS.
LOCO. TOTAL TURNAROUND TIME	0.70	DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING AT PURRUJA/PORT	960.00	
WAGON TOTAL TURNAROUND TIME	2983.02	MINS.
WAGON TOTAL TURNAROUND TIME	49.72	HRS.
WAGON TOTAL TURNAROUND TIME	2.07	DAYS

<----- IF NEGATIVE, REDUCE COL. AND RESUBMIT

LIST OF STATIONS

		CAPACITY
SANJ	SAN JOSE	YARD
TUBO	TUBO TICO	22
CIRU	CIRUELAS	34
ATEN	ATENAS	19
QUEB	QUEBRADAS	18
OROT	OROTINA	40
JESU	JESUS MARIA	22
JCT.	JUNCTION	--
PURR	PURRUJA	YARD

C.E.TAYLOR

The last column of each computer analysis shows the excess capacity per block section after operating the number of trains shown. The large values indicate that INCOFER can easily operate the number of trains shown and still have capacity remaining. As shown, 6 sidings are included between San José and Purruja for the operation of trains. A lesser number of sidings could be used but the long running times between the remaining sidings could prove counterproductive when faced with such items as mechanical problems enroute.

Table A.3 summarizes the important results of Exhibit A.

TABLE A.3

YEAR	LOCOMOTIVE ROTATION (HOURS)	LOCOMOTIVE ROTATION (DAYS)	WAGON ROTATION (HOURS)	WAGON ROTATION (DAYS)
1988	16.66	0.69	49.66	2.07
1989	16.66	0.69	49.66	2.07
1990	16.67	0.69	49.67	2.07
1991	16.68	0.70	49.68	2.07
1992	16.70	0.70	49.70	2.07
1993	16.71	0.70	49.71	2.07
1994	16.72	0.70	49.72	2.07
1995-2008	16.72	0.70	49.72	2.07

1.4 LOCOMOTIVE REQUIREMENTS

	1988	1989	1990	1991	1992	1993	1994	1995-2008
Trains/Year	753.50	764.75	777.75	807.75	839.75	874.00	882.00	883.70
Trains/Day	2.15	2.19	2.22	2.31	2.40	2.50	2.52	2.52
Rotation Days	0.69	0.69	0.69	0.70	0.70	0.70	0.70	0.70
Number of Trains Sets	1.49	1.51	1.53	1.62	1.68	1.75	1.76	1.77
Number of Train Sets	2	2	2	2	2	2	2	2
Locomotives/Set	2	2	2	2	2	2	2	2
Availability	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Locomotives Required (134/145 1200 kW)	5	5	5	5	5	5	5	5
Switch Engines								
San José	1	1	1	1	1	1	1	1
Purruja	1	1	1	1	1	1	1	1
Spare	1	1	1	1	1	1	1	1
TOTAL (640 HP D.E.)	3	3	3	3	3	3	3	3

1.5 WAGON REQUIREMENTS

	1988	1989	1990	1991	1992	1993	1994	1995-2008
Trains/Year	753.50	764.75	777.75	807.75	839.75	874.00	882.00	883.70
Trains/Day	2.15	2.19	2.22	2.31	2.40	2.50	2.52	2.52
Rotation Days	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07
Number of Trains Sets	4.46	4.52	4.60	4.78	4.97	5.17	5.22	5.23
Number of Train Sets	5	5	5	5	5	6	6	6
Wagons/Set	10	10	10	10	10	10	10	10
Availability	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Wagons Required ** (All Types)	67	67	67	67	67	80	80	80
Flats	22	22	21	21	21	25	25	25
Boxes	38	38	38	38	38	44	44	44
Gondolas	7	7	8	8	8	11	11	11

** Split by wagon type accomplished by identifying the car type required for each commodity and then taking a ratio to the total annual commodity forecast.

1.6 LOCOMOTIVE AND WAGON OVERHAULS

NUMBER OF OVERHAULS BY CLASS

YEAR	LOCOMOTIVES 1200 kW	LOCOMOTIVES 640 HP	FLATS	BOXES	GONDOLAS	COACHES
1988	5	3	22	38	7	2
1989					1	
1990						
1991			3	6	3	
1992						
1993						
1994						
1995-2008						
TOTAL	5	3	25	44	11	2

OVERHAUL COSTS
(U.S. DOLLARS)

YEAR	LOCOMOTIVES 1200 kW	LOCOMOTIVES 640 HP	FLATS	BOXES	GONDOLAS	COACHES	TOTAL
1988	$494,000	$273,600	$167,200	$361,000	$ 79,800	$140,000	$1,515,60
1989					$ 11,400		$ 11,40
1990			$ 22,800	$ 57,000	$ 34,200		$ 114,00
1991							
1992							
1993							
TOTAL	$494,000	$273,600	$190,000	$418,000	$125,400	$140,000	$1,641,00

1.7 ANNUAL MAINTENANCE COSTS

YEAR	LOCOMOTIVES 1200 kW	LOCOMOTIVES 640 HP	MIXED WAGON FLEET	TOTAL	LABOUR*	MATERIAL*
1988	$75,240	$32,680	$76,380	$184,300	$55,290	$129,010
1989	$75,240	$32,680	$76,380	$184,300	$55,290	$129,010
1990	$75,240	$32,680	$77,520	$185,440	$55,632	$129,808
1991	$75,240	$32,680	$91,200	$199,120	$59,736	$139,384
1992	$75,240	$32,680	$91,200	$199,120	$59,736	$139,384
1993	$75,240	$32,680	$91,200	$199,120	$59,736	$139,384
1994	$75,240	$32,680	$91,200	$199,120	$59,736	$139,384
1995-2008	$75,240	$32,680	$91,200	$199,120	$59,736	$139,384

* Split on 30/70 Labour/Material Ratio

1.8 RADIO REQUIREMENTS

Assuming that there will be one portable radio on each lead locomotive, INCOFER will require the same number of radios as locomotive sets plus spares.

2 radios	@ $4,575 Cdn.	=	$ 9,150 Cdn.
1 spare	@ $4,575 Cdn.	=	$ 4,575 Cdn.
1 charger	@ $ 300 Cdn.	=	$ 300 Cdn.
			$14,025 Cdn.

For yard radios INCOFER will require 2 hand-held radios per yard crew (plus spares) and 1 charger unit per yard location.

San José:			
2 radios	@ $764 Cdn.	=	$ 1,528 Cdn.
1 spare	@ $764 Cdn.	=	$ 764 Cdn.
1 charger	@ $166 Cdn.	=	$ 166 Cdn.
Purruja:			
2 radios	@ $764 Cdn.	=	$ 1,528 Cdn.
1 spare	@ $764 Cdn.	=	$ 764 Cdn.
1 charger	@ $166 Cdn.	=	$ 166 Cdn.
	TOTAL		$ 4,916 Cdn.
	GRAND TOTAL		$18,941 Cdn.
			$14,241 U.S.

Annual Maintenance Cost:

25% for +5 Years		$ 3,560 U.S.

1.9 YARD ENGINE COSTS

	SAN JOSÉ	PURRUJA	TOTAL
Hours per Day*	8	8	
Fuel Cost/Hour	$ 4.62 U.S.	$ 4.62 U.S.	
Lube Cost/Hour	$ 0.22 U.S.	$ 0.22 U.S.	
Total Cost/Hour	$ 4.84 U.S.	$ 4.84 U.S.	
Cost per Day	$38.73 U.S.	$38.73 U.S.	$ 77.46 U.S.
Operating Days			350
Yard Fuel Cost/Year			$27,112 U.S.

* Assumes that yard engines will be shut down when not in use

1.10 ELECTRICITY COSTS

According to INCOFER, their generating plant at Tacares, which serves the Pacific Railway, produced an average of 620,000 kW/hour per month in 1986 at an average cost of 2.90 colones per kW/hour. Since this plant is dedicated to producing electric power to operate the railroad, the annual operating cost of the plant will be used as the annual cost of energy.

The annual cost of operating the Tacares plant is 21,576,000 colones. At a conversion rate of 74 colones = $1 U.S., this translates to $291,586 U.S.

1.11 ESTIMATION OF LABOUR COSTS

1.11.1 Crew Wages

The crew wages for the Pacifico Line have been costed under the assumptions that the road crews will operate with a 2-man crew consisting of an engineman and a conductor and that the yard crews will operate with a 3-man crew consisting of an engineman, a switchman and a yard foreman.

In consideration of the train size and the low operating speeds, a 2-man crew is reasonable for the road operation. The yard crew will be equipped with portable radios and the extra man is supplied for productivity and safety.

Crew Hours/Month	208	
Crew Months/Year	11.5	
Crew Hours/Year	2,392	
Duration of Trip	9.66	hours
Trains/Day	2.15	
Train Hours/Day	20.77	
Operating Days/Year	350	
Train Hours/Year	7,269.15	
Divide by 2392		
Crews Required	4	
Relief	1	
Total	5	

	AVERAGE COST/MONTH (Col)	AVERAGE COST/YEAR (Col)	AVERAGE COST/YEAR ($ U.S.)
Engineman	20,000	240,000	3,809.52
Conductor	20,000	240,000	3,809.52
Total/Road Crew/Year			7,619.05
			7,700.00
Total/5 Road Crews/Year			$38,500.00 U.S.

Yard Crews at San José and Purruja

3 Crews*/Year Purruja	$ 33,300
3 Crews/Year San José	$ 33,300
	$ 66,600 U.S.
Total Road and Yard Crew Wage Costs	$105,100 U.S.

* Assumed one extra man added to yard crew as below

18,000	216,000	$3,428.57 U.S.

The use of 3 crews per year allows for 2 crews to cover the 7 day/week operation plus the inclusion of one spare crew.

1.11.2 Dispatching

Under the assumption that the Pacifico Line is operating alone, it will require one dispatching office similar to what currently exists at Turrialba. The cost of this office is assumed to be identical to that of Turrialba. It will yield 24 hour coverage with 5 dispatchers.

Annual cost of dispatching office is 1,337,064 colones or $21,223 U.S.

1.11.3 Track Maintenance

Figures for annual track maintenance costs by scenario are found in a separate appendix of this report. These estimates assume a productivity rate of 60% and a mechanization rate of 25%. The productivity rate might be described as the percentage of the work-day in which productive work is accomplished. This takes into account such factors as travel time, time waiting for trains, and general efficiency. The assumed productivity rate is higher than that which presently exists, but is readily obtainable under the existing management.

Productivity rates could be improved by the force of an improved management organization, probably to a maximum of about 75% compared to the original estimate of 60%. This would directly reduce the labour portion of the maintenance costs by 20% with no increase in other costs.

In summary, the figures in the track maintenance have been reduced by 20% in direct labour and staffing to take into account increased productivity achievements.

1.11.4 Miscellaneous Labour

An allowance of $30,000 U.S. per year has been included to cover labour such as labourers, watchmen, clerks, etc. This would translate to roughly 15 employees.

1.11.5 Administration

The overall railway administration has been estimated on the basis of it being approximately 15% of the direct labour cost. This is meant to cover all administration above the first line supervisor level in all departments.

1.11.6 Summary of Estimated Operating Expenses

The following tables A.11.1 - A.11.4 present summaries of operating expenses for scenarios C1 and C2 on both economic and financial cost bases.

The economic cost reflects fuel costs at $0.1586 U.S./litre while financial cost reflects fuel costs at $0.32 U.S./litre.

Labour costs are kept constant over time as they are assumed to keep step with inflation in real terms.

TABLE A.11.1
SCENARIO C1
PACIFICO LINE
SUMMARY OF ESTIMATED OPERATING EXPENSES

ECONOMIC COST

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD ENERGY	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	382,813	57,422	291,586	27,112	129,010	780,000	1,667,943
1989	382,813	57,422	291,586	27,112	129,010	780,000	1,667,948
1990	383,155	57,473	291,586	27,112	129,808	780,000	1,669,134
1991	387,259	58,089	291,586	27,112	139,384	780,000	1,683,430
1992	387,259	58,089	291,586	27,112	139,384	780,000	1,683,430
1993	387,259	58,089	291,586	27,112	139,384	780,000	1,683,430
1994	387,259	58,089	291,586	27,112	139,384	780,000	1,683,430
1995	387,259	58,089	291,586	27,112	189,384	780,000	1,683,430
2008	387,259	58,089	291,586	27,112	139,384	780,000	1,683,430

TABLE A.11.2

SCENARIO C1

PACIFICO LINE

SUMMARY OF ESTIMATED OPERATING EXPENSES

FINANCIAL COST

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD ENERGY	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	382,813	57,422	291,586	54,703	129,010	780,000	1,695,534
1989	382,813	57,422	291,586	54,703	129,010	780,000	1,695,534
1990	383,155	57,473	291,586	54,703	129,808	780,000	1,696,725
1991	387,259	58,089	291,586	54,708	139,384	780,000	1,711,021
1992	387,259	58,089	291,586	54,703	139,384	780,000	1,711,021
1993	387,259	58,089	291,586	54,703	139,384	780,000	1,711,021
1994	387,259	58,089	291,586	54,703	139,384	780,000	1,711,021
1995	387,259	58,089	291,586	54,703	139,384	780,000	1,711,021
2008	387,259	58,089	291,586	54,703	139,384	780,000	1,711,021

TABLE A.11.3

SCENARIO C2

PACIFICO LINE

SUMMARY OF ESTIMATED OPERATING EXPENSES

ECONOMIC COST

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD ENERGY	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	409,213	61,382	291,586	27,112	129,010	522,000	1,440,303
1989	409,213	61,382	291,586	27,112	129,010	522,000	1,440,303
1990	409,555	61,433	291,586	27,112	129,808	522,000	1,441,494
1991	413,659	62,049	291,586	27,112	139,384	522,000	1,455,790
1992	413,659	62,049	291,586	27,112	139,384	522,000	1,455,790
1993	413,659	62,049	291,586	27,112	139,384	522,000	1,455,790
1994	413,659	62,049	291,586	27,112	139,384	522,000	1,455,790
1995	413,659	62,049	291,586	27,112	139,384	522,000	1,455,790
2008	413,659	62,049	291,586	27,112	139,384	522,000	1,455,790

TABLE A.11.4

SCENARIO C2

PACIFICO LINE

SUMMARY OF ESTIMATED OPERATING EXPENSES

FINANCIAL COST

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD ENERGY	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	409,213	61,382	291,586	54,703	129,010	522,000	1,467,894
1989	409,213	61,382	291,586	54,703	129,010	522,000	1,467,894
1990	409,555	61,433	291,586	54,703	129,808	522,000	1,469,085
1991	413,659	62,049	291,586	54,703	139,884	522,000	1,483,381
1992	413,659	62,049	291,586	54,703	139,384	522,000	1,483,381
1993	413,659	62,049	291,586	54,703	139,384	522,000	1,483,381
1994	413,659	62,049	291,586	54,703	139,384	522,000	1,483,381
1995	413,659	62,049	291,586	54,703	139,384	522,000	1,483,381
2008	413,659	62,049	291,586	54,703	139,384	522,000	1,483,381

1.11.7 Summary of Estimated Employees

Dispatchers	5
Operating	28
Mechanical	15
Track Maintenance	58 (C-1)
Miscellaneous Labour	15
Administration	15
Estimated Total	136

2. ATLANTICO LINE

2.1 TONNAGE FORECAST FOR ATLANTICO LINE BY COMMODITY (IN TONNES)

GROWTH ASSUMPTIONS:

Bunker: 0.025 first five years, then flat

Trunks:

15	1988
25	1989
Flat	2008

Other: 0.025 first five years, then flat

Newsprint: 0.05 first five years, then flat

Malt: 0.025 first five years, then flat

Iron & Steel:

			ATLANTIC	PACIFIC
Transitaria	165	1988	100.65	64.35
	150	1989	91.50	58.50
	135	1990	82.35	52.65

Metalco: 0.10 first five years, then flat

Wheat: 0.0225 first five years, then 0.018 to 2008

Corn: 0.0225 first five years, then 0.018 to 2008

Sand: 0.010 first five years, then flat (based on 20% annual increase in production of two cement companies, plus growth in building floor space since 1983)

	1988	1989	1990	1991	1992	1993-2008
Local: Bunker	143.0	146.6	150.2	154.0	157.8	161.8
Trunks	15.0	25.0	25.0	25.0	25.0	25.0
Other	40.0	41.0	42.0	43.1	44.2	45.3
Iron & Steel	100.7	91.5	82.4	82.4	82.4	82.4
Newsprint	6.0	6.3	6.6	6.9	7.3	7.7
Malt	3.0	3.1	3.2	3.2	3.3	3.4
Exports	1.0	1.0	1.0	1.0	1.0	1.0
TOTAL	308.7	314.5	310.4	315.6	321.0	326.6

2.2 CALCULATION OF OPERATING INPUTS

With the increased axle loading to 16 tonnes/axle after rehabilitation the average wagon should be able to handle 40 net tonnes. Assuming an average tare weight per wagon of 15.5 tonnes, the average gross weight per wagon would equal 55.5 tonnes.

According to the timetable, one locomotive on the Atlantic Line can handle 210 gross tonnes. This restriction is westward between Peralta and El Alto. Therefore, the average number of wagons per locomotive is 210/55.5 = 3.7837. For a 2 locomotive consist, the average number of wagons would be 420/55.5 = 7.567 (say 7).

AVERAGE TRAINS PER DAY

YEAR	ANNUAL TONNES	WAGONS/ YEAR	WAGONS/ DAY	TRAINS/ DAY
	A	B=A/40t	C=B/350	D=C/7
1988	308,700	7,717.50	22.05	3.15
1989	314,500	7,862.50	22.46	3.21
1990	310,400	7,760.00	22.17	3.17
1991	315,600	7,890.00	22.54	3.22
1992	321,000	8,025.00	22.93	3.28
1993-2008	326,400	8,160.00	23.31	3.33

The number of trains in both directions will remain approximately equal since there is a 225 gross tonnes/locomotive restriction eastward between San José and El Alto.

When calculating the average number of wagons required per day, the Consultant assumes 350 operating days per year.

The number of trains per day is the average number of trains in each direction needed to handle the given tonnage in the assumed number of operating days. This allows for the loads in one direction and the returning empties.

2.3 OPERATIONAL ANALYSIS OF THE ATLANTIC LINE

Exhibit B shows by year the operational analysis of the Atlantic Line. The average number of trains per block in both directions reflects the train consist of 2 locomotives with 7 wagons and also the inherent assumption that a restructured INCOFER system will not provide regular passenger train service.

Originally, the operational analysis was conducted using all the sidings contained in the timetable of the Atlantic Line. The operational analysis as shown in Exhibit B has the number of sidings minimized taking into account the low traffic volume and train speed. The running time between sidings was kept at approximately 35 minutes and wherever possible already lengthened sidings were included for the analysis. A list of sidings is included along with the wagon capacity of each.

The last column of each computer analysis shows the excess capacity per block section remaining after operating the number of trains shown. The large values indicate that INCOFER can easily operate the number of trains shown with the reduced number of sidings and still have capacity to spare. As shown, 8 sidings are utilized between Moin and San José for the operation of trains. A lesser number of sidings could, of course, be used but the longer running times between sidings could prove counterproductive when faced with such extraneous items as mechanical problems enroute.

JANUARY 25,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

YEAR: 1993-2008

2 LOCOS. - 7 WAGONS

TONNAGE: 326,400 t.

ATLANTICO LINE MOIN YARD-SAN JOSE
EST. RUNNING TIMES *
C-86043

NUMBER OF BLOCKS 10

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/(C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-BOCA	21.0	6.66	0	216.22	21.50	0.3	0.71	0	0.71	22.21	60.40	53.74
BOCA-MARG	30.0	6.66	0	216.22	30.71	0.3	1.53	0	1.53	32.24	41.94	35.28
MARG-SIQ	32.0	6.66	0	216.22	32.76	0.3	1.75	0	1.75	34.51	39.24	32.58
SIQ-ELRU	29.0	6.66	0	216.22	29.69	0.3	1.42	0	1.42	31.10	43.43	36.77
ELRU-PER	25.0	6.66	0	216.22	25.59	0.3	1.03	0	1.03	26.62	50.56	43.90
PER-FLOR	34.0	6.66	0	216.22	34.80	0.3	2.00	0	2.00	36.81	36.86	30.20
FLOR-JUAN	28.0	6.66	120	198.20	28.72	0.3	1.46	0	1.46	30.19	44.81	38.15
JUAN-PARA	36.0	6.66	120	198.20	36.93	0.3	2.54	0	2.54	39.47	34.55	27.89
PARA-TRES	31.0	6.66	120	198.20	31.80	0.3	1.82	0	1.82	33.63	40.35	33.69
TRES-SANJ	17.0	6.66	0	216.22	17.40	0.3	0.46	0	0.46	17.86	74.87	68.21

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LIST OF STATIONS		CAPACITY
MOIN	MOIN	
BOCA	BOCAS	30
MARG	MARGARITA	30
SIQ	SIQUERRES	--
ELRU	EL RUBI	25
PER	PERALTA	--
FLOR	FLORENCIA	18
JUAN	JUAN VINAS	30
PARA	PARAISO	10
TRES	TRES RIOS	15
SANJ	SAN JOSE	

* C.E.TAYLOR

TOTAL TRIP TIME	304.63	
TOTAL CIRCUIT TIME	609.26	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	7.04	
INITIAL TERMINAL TIME AT SAN JOSE ATLANTICO	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT SAN JOSE ATLANTICO	45.00	
INITIAL TERMINAL TIME AT MOIN	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	1256.31	MINS.
LOCO. TOTAL TURNAROUND TIME	20.94	HRS.
LOCO. TOTAL TURNAROUND TIME	0.87	DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING MOIN/LIMON AREA	1440.00	
WAGON TOTAL TURNAROUND TIME	3716.31	MINS.
WAGON TOTAL TURNAROUND TIME	61.94	HRS.
WAGON TOTAL TURNAROUND TIME	2.58	DAYS

<----- IF NEGATIVE, REDUCE COL. AND RESUBMIT

JANUARY 25,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS (ELBROND METHOD)

YEAR: 1992

TONNAGE: 321,000 t.

2 LOCOS. - 7 WAGONS

ATLANTICO LINE MOIN YARD-SAN JOSE
EST. RUNNING TIMES *
C-B6043

NUMBER OF BLOCKS 10

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-BOCA	21.0	6.56	0	219.51	21.49	0.3	0.70	0	0.70	22.19	60.44	53.88
BOCA-MARG	30.0	6.56	0	219.51	30.70	0.3	1.50	0	1.50	32.20	41.97	35.41
MARG-SIQ	32.0	6.56	0	219.51	32.75	0.3	1.72	0	1.72	34.47	39.28	32.72
SIQ-ELRU	29.0	6.56	0	219.51	29.68	0.3	1.39	0	1.39	31.07	43.46	36.90
ELRU-PER	25.0	6.56	0	219.51	25.58	0.3	1.01	0	1.01	26.60	50.60	44.04
PER-FLOR	34.0	6.56	0	219.51	34.79	0.3	1.97	0	1.97	36.76	36.90	30.34
FLOR-JUAN	28.0	6.56	120	201.22	28.71	0.3	1.43	0	1.43	30.15	44.85	38.29
JUAN-PARA	36.0	6.56	120	201.22	36.92	0.3	2.49	0	2.49	39.41	34.59	28.03
PARA-TRES	31.0	6.56	120	201.22	31.79	0.3	1.79	0	1.79	33.58	40.39	33.83
TRES-SANJ	17.0	6.56	0	219.51	17.40	0.3	0.45	0	0.45	17.85	74.91	68.35

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LIST OF STATIONS

		CAPACITY
MOIN	MOIN	
BOCA	BOCAS	30
MARG	MARGARITA	30
SIQ	SIQUERRES	--
ELRU	EL RUBI	25
PER	PERALTA	--
FLOR	FLORENCIA	18
JUAN	JUAN VINAS	30
PARA	PARAISO	10
TRES	TRES RIOS	15
SANJ	SAN JOSE	

* C.E.TAYLOR

TOTAL TRIP TIME	304.25	
TOTAL CIRCUIT TIME	608.51	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	6.93	
INITIAL TERMINAL TIME AT SAN JOSE ATLANTICO	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT SAN JOSE ATLANTICO	45.00	
INITIAL TERMINAL TIME AT MOIN	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	1255.44	MINS.
LOCO. TOTAL TURNAROUND TIME	20.92	HRS.
LOCO. TOTAL TURNAROUND TIME	0.87	DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING MOIN/LIMON AREA	1440.00	
WAGON TOTAL TURNAROUND TIME	3715.44	MINS.
WAGON TOTAL TURNAROUND TIME	61.92	HRS.
WAGON TOTAL TURNAROUND TIME	2.58	DAYS

;----- IF NEGATIVE, REDUCE COL AND RESUBMIT

JANUARY 25,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS (ELBROND METHOD)

YEAR: 1991

TONNAGE: 315,600 t.

2 LOCOS. - 7 WAGONS

ATLANTICO LINE MOIN YARD-SAN JOSE
EST. RUNNING TIMES *
C-B6043

NUMBER OF BLOCKS 10

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) 6TR.OF F OR 6 (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-BOCA	21.0	6.44	0	223.60	21.48	0.3	0.68	0	0.68	22.17	60.49	54.05
BOCA-MARG	30.0	6.44	0	223.60	30.69	0.3	1.46	0	1.46	32.15	42.01	35.57
MARG-SIQ	32.0	6.44	0	223.60	32.73	0.3	1.68	0	1.68	34.42	39.32	32.88
SIQ-ELRU	29.0	6.44	0	223.60	29.66	0.3	1.36	0	1.36	31.02	43.50	37.06
ELRU-PER	25.0	6.44	0	223.60	25.57	0.3	0.99	0	0.99	26.56	50.64	44.20
PER-FLOR	34.0	6.44	0	223.60	34.78	0.3	1.92	0	1.92	36.70	36.93	30.49
FLOR-JUAN	28.0	6.44	120	204.97	28.70	0.3	1.40	0	1.40	30.10	44.90	38.46
JUAN-PARA	36.0	6.44	120	204.97	36.90	0.3	2.43	0	2.43	39.33	34.63	28.19
PARA-TRES	31.0	6.44	120	204.97	31.78	0.3	1.75	0	1.75	33.52	40.43	33.99
TRES-SANJ	17.0	6.44	0	223.60	17.39	0.3	0.44	0	0.44	17.83	74.96	68.52

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LIST OF STATIONS

		CAPACITY
MOIN	MOIN	
BOCA	BOCAS	30
MARG	MARGARITA	30
SIQ	SIQUERRES	--
ELRU	EL RUBI	25
PER	PERALTA	--
FLOR	FLORENCIA	18
JUAN	JUAN VINAS	30
PARA	PARAISO	10
TRES	TRES RIOS	15
SANJ	SAN JOSE	

* C.E.TAYLOR

TOTAL TRIP TIME	303.80	
TOTAL CIRCUIT TIME	607.61	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	6.79	
INITIAL TERMINAL TIME AT SAN JOSE ATLANTICO	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT SAN JOSE ATLANTICO	45.00	
INITIAL TERMINAL TIME AT MOIN	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	1254.40	MINS.
LOCO. TOTAL TURNAROUND TIME	20.91	HRS.
LOCO. TOTAL TURNAROUND TIME	0.87	DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING MOIN/LIMON AREA	1440.00	
WAGON TOTAL TURNAROUND TIME	3714.40	MINS.
WAGON TOTAL TURNAROUND TIME	61.91	HRS.
WAGON TOTAL TURNAROUND TIME	2.58	DAYS

:----- IF NEGATIVE, REDUCE COL. AND RESUBMIT

JANUARY 25,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS (ELBROND METHOD)

YEAR: 1990

TONNAGE: 310,400 t.

2 LOCOS. - 7 WAGONS

ATLANTICO LINE MOIN YARD-SAN JOSE
EST. RUNNING TIMES *
C-86043

NUMBER OF BLOCKS 10

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-BOCA	21.0	6.34	0	227.13	21.47	0.3	0.67	0	0.67	22.15	60.53	54.19
BOCA-MARG	30.0	6.34	0	227.13	30.68	0.3	1.44	0	1.44	32.11	42.05	35.71
MARG-SIQ	32.0	6.34	0	227.13	32.72	0.3	1.65	0	1.65	34.37	39.35	33.01
SIQ-ELRU	29.0	6.34	0	227.13	29.65	0.3	1.34	0	1.34	30.99	43.53	37.19
ELRU-PER	25.0	6.34	0	227.13	25.56	0.3	0.97	0	0.97	26.54	50.67	44.33
PER-FLOR	34.0	6.34	0	227.13	34.77	0.3	1.88	0	1.88	36.65	36.97	30.63
FLOR-JUAN	28.0	6.34	120	208.20	28.69	0.3	1.38	0	1.38	30.06	44.93	38.59
JUAN-PARA	36.0	6.34	120	208.20	36.89	0.3	2.38	0	2.38	39.27	34.67	28.33
PARA-TRES	31.0	6.34	120	208.20	31.76	0.3	1.72	0	1.72	33.48	40.47	34.13
TRES-SANJ	17.0	6.34	0	227.13	17.38	0.3	0.43	0	0.43	17.81	75.01	68.67
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LIST OF STATIONS

		CAPACITY
MOIN	MOIN	
BOCA	BOCAS	30
MARG	MARGARITA	30
SIQ	SIQUERRES	--
ELRU	EL RUBI	25
PER	PERALTA	--
FLOR	FLORENCIA	18
JUAN	JUAN VINAS	30
PARA	PARAISO	10
TRES	TRES RIOS	15
SANJ	SAN JOSE	

* C.E.TAYLOR

TOTAL TRIP TIME	303.43
TOTAL CIRCUIT TIME	606.86
BLOCK CLOSURE DELAY	10.00
TRUE MEETING DELAY	6.68
INITIAL TERMINAL TIME AT SAN JOSE ATLANTICO	60.00
WAIT FOR DEPARTING TRAIN	240.00
FINAL TERMINAL TIME AT SAN JOSE ATLANTICO	45.00
INITIAL TERMINAL TIME AT MOIN	60.00
POST TRIP INSPECTION AND SERVICING	180.00
FINAL TERMINAL TIME AT MOIN	45.00
LOCO. TOTAL TURNAROUND TIME	1253.54 MINS.
LOCO. TOTAL TURNAROUND TIME	20.89 HRS.
LOCO. TOTAL TURNAROUND TIME	0.87 DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00
WAGON TIME LOADING MOIN/LIMON AREA	1440.00
WAGON TOTAL TURNAROUND TIME	3713.54 MINS.
WAGON TOTAL TURNAROUND TIME	61.89 HRS.
WAGON TOTAL TURNAROUND TIME	2.58 DAYS

!----- IF NEGATIVE, REDUCE COL. AND RESUBMIT

JANUARY 25,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)
2 LOCOS. - 7 WAGONS
ATLANTICO LINE MOIN YARD-SAN JOSE
EST. RUNNING TIMES *
C-86043

YEAR: 1989

TONNAGE: 314,500 t.

NUMBER OF BLOCKS 10

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-BOCA	21.0	6.42	0	224.30	21.48	0.3	0.68	0	0.68	22.16	60.49	54.07
BOCA-MARG	30.0	6.42	0	224.30	30.68	0.3	1.46	0	1.46	32.14	42.02	35.60
MARG-SIQ	32.0	6.42	0	224.30	32.73	0.3	1.68	0	1.68	34.41	39.32	32.90
SIQ-ELRU	29.0	6.42	0	224.30	29.66	0.3	1.36	0	1.36	31.02	43.51	37.09
ELRU-PER	25.0	6.42	0	224.30	25.57	0.3	0.99	0	0.99	26.56	50.65	44.23
PER-FLOR	34.0	6.42	0	224.30	34.78	0.3	1.91	0	1.91	36.69	36.94	30.52
FLOR-JUAN	28.0	6.42	120	205.61	28.70	0.3	1.40	0	1.40	30.09	44.90	38.48
JUAN-PARA	36.0	6.42	120	205.61	36.90	0.3	2.42	0	2.42	39.32	34.64	28.22
PARA-TRES	31.0	6.42	120	205.61	31.77	0.3	1.74	0	1.74	33.51	40.44	34.02
TRES-SANJ	17.0	6.42	0	224.30	17.39	0.3	0.44	0	0.44	17.83	74.97	68.55
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LIST OF STATIONS		CAPACITY
MOIN	MOIN	
BOCA	BOCAS	30
MARG	MARGARITA	30
SIQ	SIQUERRES	--
ELRU	EL RUBI	25
PER	PERALTA	--
FLOR	FLORENCIA	18
JUAN	JUAN VINAS	30
PARA	PARAISO	10
TRES	TRES RIOS	15
SANJ	SAN JOSE	

* C.E.TAYLOR

TOTAL TRIP TIME	303.73	
TOTAL CIRCUIT TIME	607.46	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	6.77	
INITIAL TERMINAL TIME AT SAN JOSE ATLANTICO	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT SAN JOSE ATLANTICO	45.00	
INITIAL TERMINAL TIME AT MOIN	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	1254.23	MINS.
LOCO. TOTAL TURNAROUND TIME	20.90	HRS.
LOCO. TOTAL TURNAROUND TIME	0.87	DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING MOIN/LIMON AREA	1440.00	
WAGON TOTAL TURNAROUND TIME	3714.23	MINS.
WAGON TOTAL TURNAROUND TIME	61.90	HRS.
WAGON TOTAL TURNAROUND TIME	2.58	DAYS

:----- IF NEGATIVE, REDUCE COL. AND RESUBMIT

JANUARY 25,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)
2 LOCOS. - 7 WAGONS
ATLANTICO LINE MOIN YARD-SAN JOSE
EST. RUNNING TIMES *
C-86043

YEAR: 1988

TONNAGE: 308,700 t.

NUMBER OF BLOCKS 10

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-BOCA	21.0	6.3	0	228.57	21.47	0.3	0.67	0	0.67	22.14	60.54	54.24
BOCA-MARG	30.0	6.3	0	228.57	30.67	0.3	1.43	0	1.43	32.10	42.06	35.76
MARG-SIQ	32.0	6.3	0	228.57	32.72	0.3	1.64	0	1.64	34.36	39.36	33.06
SIQ-ELRU	29.0	6.3	0	228.57	29.65	0.3	1.33	0	1.33	30.97	43.55	37.25
ELRU-PER	25.0	6.3	0	228.57	25.56	0.3	0.97	0	0.97	26.52	50.69	44.39
PER-FLOR	34.0	6.3	0	228.57	34.76	0.3	1.87	0	1.87	36.63	36.98	30.68
FLOR-JUAN	28.0	6.3	120	209.52	28.68	0.3	1.36	0	1.36	30.05	44.95	38.65
JUAN-PARA	36.0	6.3	120	209.52	36.88	0.3	2.36	0	2.36	39.24	34.68	28.38
PARA-TRES	31.0	6.3	120	209.52	31.76	0.3	1.70	0	1.70	33.46	40.48	34.18
TRES-SANJ	17.0	6.3	0	228.57	17.38	0.3	0.43	0	0.43	17.81	75.02	68.72
	283											

LIST OF STATIONS

		CAPACITY
MOIN	MOIN	
BOCA	BOCAS	30
MARG	MARGARITA	30
SIQ	SIQUERRES	--
ELRU	EL RUBI	25
PER	PERALTA	--
FLOR	FLORENCIA	18
JUAN	JUAN VINAS	30
PARA	PARAISO	10
TRES	TRES RIOS	15
SANJ	SAN JOSE	

* C.E.TAYLOR

TOTAL TRIP TIME	303.28	
TOTAL CIRCUIT TIME	606.56	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	6.63	
INITIAL TERMINAL TIME AT SAN JOSE ATLANTICO	60.00	
WAIT FOR DEPARTING TRAIN	240.00	
FINAL TERMINAL TIME AT SAN JOSE ATLANTICO	45.00	
INITIAL TERMINAL TIME AT MOIN	60.00	
POST TRIP INSPECTION AND SERVICING	180.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	1253.20	MINS.
LOCO. TOTAL TURNAROUND TIME	20.89	HRS.
LOCO. TOTAL TURNAROUND TIME	0.87	DAYS
WAGON TIME UNLOADING AT SAN JOSE	1440.00	
WAGON TIME LOADING MOIN/LIMON AREA	1440.00	
WAGON TOTAL TURNAROUND TIME	3713.20	MINS.
WAGON TOTAL TURNAROUND TIME	61.89	HRS.
WAGON TOTAL TURNAROUND TIME	2.58	DAYS

:----- IF NEGATIVE, REDUCE COL AND RESUBMIT

Table B.3 summarizes the important results of Exhibit B.

TABLE B.3

YEAR	LOCOMOTIVE ROTATION (HOURS)	LOCOMOTIVE ROTATION (DAYS)	WAGON ROTATION (HOURS)	WAGON ROTATION (DAYS)
1988	20.89	0.87	61.89	2.58
1989	20.90	0.87	61.90	2.58
1990	20.89	0.87	61.89	2.58
1991	20.91	0.87	61.91	2.58
1992	20.92	0.87	61.92	2.58
1993-2008	20.94	0.87	61.94	2.58

2.4 LOCOMOTIVE REQUIREMENTS

	1988	1989	1990	1991	1992	1993-2008
Trains/Day	3.15	3.21	3.17	3.22	3.28	3.33
Rotation Days	0.87	0.87	0.87	0.87	0.87	0.87
Number of Train Sets	2.74	2.79	2.76	2.80	2.85	2.90
Number of Train Sets	3	3	3	3	3	3
Locomotives/Set	2	2	2	2	2	2
Availability	0.80	0.80	0.80	0.80	0.80	0.80
Locomotives Required (80/89 1100 HP)	8	8	8	8	8	8
Switch Engines						
San José (640 HP)	1	1	1	1	1	1
Moín (820 HP)	2	2	2	2	2	2
Spares: 640 HP	1	1	1	1	1	1
820 HP	1	1	1	1	1	1
TOTAL: 640 HP	2	2	2	2	2	2
820 HP	3	3	3	3	3	3

2.5 WAGON REQUIREMENTS

	1988	1989	1990	1991	1992	1993-2008
Trains/Day	3.15	3.21	3.17	3.22	3.28	3.33
Rotation Days	2.58	2.58	2.58	2.58	2.58	2.58
Number of Train Sets	8.13	8.28	8.18	8.31	8.46	8.59
Number of Train Sets	9	9	9	9	9	9
Wagons/Set	7	7	7	7	7	7
Availability	0.75	0.75	0.75	0.75	0.75	0.75
Wagons Required** (All types)	84	84	84	84	84	84
Tanks	39	39	41	42	42	43
Flats	31	31	31	31	31	31
Boxes	14	14	14	14	16	15

** Split by wagon type accomplished by identifying the car type required for each commodity and then taking a ratio to the total annual commodity forecast.

2.6 LOCOMOTIVE AND WAGON OVERHAULS

NUMBER OF OVERHAULS BY CLASS

YEAR	LOCOMOTIVES 1100 HP	LOCOMOTIVES 820 HP	LOCOMOTIVES 640 HP	TANKS	FLATS	BOXES
1988	8	3	2	39	31	14
1989						
1990				1		
1991				1		
1992						1
1993-2008				1		
TOTAL	8	3	2	42	31	15

OVERHAUL COSTS
(U.S. DOLLARS)

YEAR	LOCOMOTIVES 1100 HP	LOCOMOTIVES 820 HP	LOCOMOTIVES 640 HP	TANKS	FLATS	BOXES	TOTAL
1988	$729,600	$273,600	$182,400	$444,600	$235,600	$133,000	$1,998,80
1989							$
1990				$ 11,400			$ 11,40
1991				$ 11,400			$ 11,40
1992						$ 9,500	$ 9,50
1993-2008				$ 11,400			$ 11,40
TOTAL	$729,600	$273,600	$182,400	$478,800	$235,600	$142,500	$2,042,50

2.7 ANNUAL MAINTENANCE COSTS (U.S. DOLLARS)

YEAR	LOCOMOTIVES 1100 HP	LOCOMOTIVES 820 HP	LOCOMOTIVES 640 HP	MIXED FLEET	TOTAL	LABOUR*	MATERIAL*
1988	$145,920	$98,496	$65,664	$ 95,760	$405,840	$121,752	$284,088
1989	$145,920	$98,496	$65,664	$ 95,760	$405,840	$121,752	$284,088
1990	$145,920	$98,496	$65,664	$ 96,900	$406,980	$122,094	$284,886
1991	$145,920	$98,496	$65,664	$ 98,040	$408,120	$122,436	$285,684
1992	$145,920	$98,496	$65,664	$ 99,180	$409,260	$122,778	$286,482
1993-2008	$145,920	$98,496	$65,664	$100,320	$410,400	$123,120	$287,280

* Split on 30/70 Labour/Material Ratio

2.8 RADIO REQUIREMENTS

Assuming that there will be 1 portable radio on each lead locomotive, INCOFER will require the same number of radios as locomotive sets plus spares.

3 radios	@ $4,575 Cdn.	=	$13,725 Cdn.
2 spares	@ $4,575 Cdn.	=	$ 9,150 Cdn.
1 charger	@ $ 300 Cdn.	=	$ 300 Cdn.
			$23,175 Cdn.

For yard radios, INCOFER will require 2 hand-held radios per yard crew and 1 charger unit per yard location.

San José:	2 radios @ $764 Cdn.	=	$ 1,528 Cdn.
	1 spare @ $764 Cdn.	=	$ 764 Cdn.
	1 charger @ $166 Cdn.	=	$ 166 Cdn.
Moín:	4 radios @ $764 Cdn.	=	$ 3,056 Cdn.
	1 spare @ $764 Cdn.	=	$ 764 Cdn.
	1 charger @ $166 Cdn.	=	$ 166 Cdn.
	TOTAL		$ 6,444 Cdn.
	GRAND TOTAL		$29,619 Cdn.
			$22,270 U.S.

Annual Maintenance Cost:

@ 25% for +5 years		$ 5,567 U.S.

2.9 YARD ENGINE COSTS

	640 HP SAN JOSÉ	820 HP MOÍN	TOTAL
Hours per Day*	8	16	
Fuel Cost/Hour	$ 4.62 U.S.	$ 5.92 U.S.	
Lube Cost/Hour	$ 0.22 U.S.	$ 0.30 U.S.	
Total Cost/Hour	$ 4.84 U.S.	$ 6.22 U.S.	
Cost per Day	$38.73 U.S.	$99.50 U.S.	$138.23 U.S.
Operating Days			350
Yard Fuel Cost/Year			$48,381 U.S.

* Assumes that yard engines will be shut down when not in use

2.10 ROAD FUEL CONSUMPTION

These figures are estimated based upon fuel consumption rates per hour at various throttle positions as per Section H.1.1.

	TIME	LITRES	
Initial Time at Moín	60	36.5	
Fuel Consumption (Moín-San José)		1,210.0	
Final Time at San José	45	27.4	
Wait for Departing Train	240	146.0	
Initial Time at San José	60	36.5	
Fuel Consumption (San José-Moín)		538.0	
Final Time at Moín	45	27.4	
Post Trip Inspection & Service	180	109.5	
TOTAL		2,131.3	
@ $0.32 U.S./litre		$338.02	/Round Trip
Lube Oil @ 5%		$ 16.91	
TOTAL		$354.93 U.S.	

YEAR	TRAINS/ DAY	COST/ TRAIN	NUMBER OF DAYS	TOTAL FUEL COST
1988	3.15	$354.93	350	$391,305
1989	3.21	$354.93	350	$398,759
1990	3.17	$354.93	350	$393,790
1991	3.22	$354.93	350	$400,001
1992	3.28	$354.93	350	$407,454
1993-2008	3.33	$354.93	350	$413,666

2.11 ESTIMATION OF LABOUR COSTS

2.11.1 Crew Wages

The crew wages for the Atlantic Line have been costed under the assumptions that the road crews will operate with a 2-man crew consisting of an engineman and a conductor and that the yard crews will operate with a 3-man crew consisting of an engineman, a switchman, and a yard foreman.

In consideration of the train size and the low operating speeds, a 2-man crew is reasonable for the road operation. The yard crew will be equipped with portable radios and the extra man is supplied for productivity and safety.

Crew Hours/Month	208	
Crew Months/Year	11.5	
Crew Hours/Year	2,392	
Duration of Trip	13.89	Hours (excluding San José and Moín)
Trains/Day	3.15	
Train Hours/Day	43.75	
Operating Days/Year	350	
Train Hours/Year	15,313.73	
Divide by 2392		
Crews Required	7	
Relief	1	
Total	8	

	AVERAGE COST/MONTH (Col)	AVERAGE COST/YEAR (Col)	AVERAGE COST/YEAR ($ U.S.)
Engineman	20,000	240,000	3,809.52
Conductor	20,000	240,000	3,809.52
Total/Road Crew/Year			7,619.05
Total/8 Road Crews/Year			$60,952
		Say	$61,000 U.S.

Yard Crews at San José and Moín

1.5 Crews/Year San José*		$ 16,650
3.0 Crews/Year Moín*		$ 33,300
		$ 49,950
	Say	$ 50,000 U.S.
Total Road and Yard Crew Wage Costs		$111,000 U.S.

* Includes spare crew for 7 day/week operation

NOTE: When combining the Atlantic and Pacific Lines, San José must be included twice since they are different locations.

NOTE: When combining the Banana and Atlantic Lines, Moín must be added only once to avoid double counting.

2.11.2 Dispatching

Under the assumption that the Atlantic Line is operating alone, it will require one dispatching office similar to what currently exists at Turrialba. The cost of this office is assumed to be identical to that of Turrialba. It will yield 24 hour coverage with 5 dispatchers.

Annual cost of dispatching office is 1,337,064 colones or $21,223 U.S.

2.11.3 Track Maintenance

Comments as Section A.11.3.

2.11.4 Miscellaneous Labour

An allowance of $40,000 U.S. per year has been included to cover labour such as labourers, watchmen, clerks, etc. This would translate to roughly 20 bodies.

2.11.5 Administration

The overall railway administration has been estimated on the basis of it being approximately 15% of the direct labour cost. This is meant to cover all administration above the first line supervisory level for all departments.

2.11.6 Summary of Estimated Operating Expenses

The following tables B.11.1 - B.11.4 present summaries of operating expenses for scenarios B1 and B2 on both economic and financial bases.

The economic cost reflects fuel costs at $0.1586 U.S./litre while financial cost reflects fuel costs at $0.32 U.S./litre.

Labour costs are kept constant over time as they are assumed to keep step with inflation in real terms.

2.11.7 Summary of Estimated Employees

Dispatchers	5	
Operating	30	
Mechanical	32	
Track Maintenance	51	(B-1)
Miscellaneous Labour	20	
Administration	17	
Estimated Total	155	

TABLE B.11.1

SCENARIO B1

ATLANTICO LINE

SUMMARY OF ESTIMATED OPERATING EXPENSES

ECONOMIC COST

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD FUEL	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	441,175	66,176	391,305	48,381	284,088	673,000	1,904,125
1989	441,175	66,176	398,759	48,381	284,088	673,000	1,911,579
1990	441,517	66,228	393,790	48,381	284,886	673,000	1,907,802
1991	441,859	66,279	400,001	48,381	285,684	673,000	1,915,204
1992	442,201	66,330	407,454	48,381	286,482	673,000	1,923,848
1993	442,543	66,381	413,666	48,381	287,280	673,000	1,931,251
2008	442,543	66,381	413,666	48,381	287,280	673,000	1,931,251

TABLE B.11.2

SCENARIO B1

ATLANTICO LINE

SUMMARY OF ESTIMATED OPERATING EXPENSES

FINANCIAL COST

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD FUEL	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	441,175	66,176	789,519	97,617	284,088	673,000	2,351,575
1989	441,175	66,176	804,557	97,617	284,088	673,000	2,366,618
1990	441,517	66,228	794,532	97,617	284,886	673,000	2,357,780
1991	441,859	66,279	807,064	97,617	285,684	673,000	2,371,503
1992	442,201	66,330	822,102	97,617	286,482	673,000	2,387,732
1993	442,543	66,381	834,634	97,617	287,280	673,000	2,401,455
2008	442,543	66,381	834,634	97,617	287,280	673,000	2,401,455

TABLE B.11.3

SCENARIO B2

ATLANTICO LINE

SUMMARY OF ESTIMATED OPERATING EXPENSES

ECONOMIC COST

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD FUEL	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	461,975	69,296	391,005	48,381	284,088	449,000	1,704,045
1989	461,975	69,296	398,759	48,381	284,088	449,000	1,711,499
1990	462,317	69,348	393,790	48,381	284,886	449,000	1,707,722
1991	462,659	69,399	400,001	48,381	285,684	449,000	1,715,124
1992	463,001	69,450	407,454	48,381	286,482	449,000	1,723,768
1993	463,343	69,501	413,666	48,381	287,280	449,000	1,731,171
2008	463,343	69,501	413,666	48,381	287,280	449,000	1,731,171

TABLE B.11.4

SCENARIO B2

ATLANTICO LINE

SUMMARY OF ESTIMATED OPERATING EXPENSES

FINANCIAL COST

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD FUEL	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	461,975	69,296	789,519	97,617	284,088	449,000	2,151,495
1989	461,975	69,296	804,557	97,617	284,088	449,000	2,166,533
1990	462,317	69,348	794,532	97,617	284,886	449,000	2,157,700
1991	462,659	69,399	807,064	97,617	285,684	449,000	2,171,423
1992	463,001	69,450	822,102	97,617	286,482	449,000	2,187,652
1993	463,343	69,501	834,634	97,617	287,280	449,000	2,201,375
2008	463,343	69,501	834,634	97,617	287,280	449,000	2,201,375

3. BANANA LINES

The analysis of the banana lines was done under the assumption that there will be no regular passenger trains in operation over the lines.

A description follows of the infrastructure required to operate the banana lines efficiently. The descriptions will be presented by location from west to east.

San Cristóbal:

A road switcher will be located at San Cristóbal making use of a light diesel switcher. It will be the western terminus of the banana system and from this location the switcher will operate to the boxitos spotting empties, lifting loads, and setting up trains in the yard at San Cristóbal for the road crews ex. Moín.

The rail operation will entail a 'hook and haul' system whereby the road crew arrives at San Cristóbal leaves their train of empties and lifts a train of loads which has been prepared by the road switcher assignment prior to their arrival. This will minimize the switching done by road crews resulting in higher equipment utilization and minimized crew requirements.

The road switcher crew at San Cristóbal will consist of 3 men - an engineman, a conductor and a switchman.

The station Vietnam will be used for the fuelling and light running repairs of the locomotive.

Leesville:

This location will be eliminated as a yard and as turnaround point with the through operation of trains to San Cristóbal. The road switcher at San Cristóbal will handle the switching in this area. The yard may be used for storing empty wagons closer to San Cristóbal. This would be beneficial during times of heavy loading, track work and derailments.

Siquerres:

This location will handle the day-to-day operation and administration of the banana lines.

A dispatching office will be located at Siquerres which will provide 24 hour per day, 7 day per week coverage, as is currently the case. No yard personnel will be necessary since the operation from Moín to the Fincas in this area assumes that road crews will do the switching in the yard and the spotting and lifting in the Fincas as part of their regular duties. With the low traffic volumes and light dispatching duties, these employees will handle any paperwork which results from locally generated traffic.

Under Phase II, the opening of Ramals Indiana and Monteverde to train traffic, it will probably be necessary to establish another switching assignment at Siquerres to handle the boxitos and the yard for the road crews.

Moín:

This location will be established as the main yard facility for the handling of banana traffic from the Fincas to the export market. It will require two yard assignments to handle the volume to the ships making use of heavier diesel locomotives.

A small maintenance facility will be established to replace the Limón Shops which are extremely delapidated and for the most part unsalvageable. Any heavy repair work that is required can be contracted out to local heavy equipment repair companies.

The south leg of the wye onto the Estrella Branch should be installed to eliminate movements through Limón.

The yard will be responsible for the movement of traffic to and from the Port of Limón and for the construction of trains destined for San Cristóbal, Siquerres and Ley River.

A yardmaster position will be required along with the attendant clerks and checkers. The size will be kept to a minimum under the assumption that a small computer system will be implemented to assist productivity.

Ley River:

No changes will be required at this location.

The road crews will perform all switching required as part of their regular assignment prior to their return to Moín.

As part of an organization which must become more customer-oriented, the position of Mobile Supervisor will be established and will be located at San Cristóbal, Siquerres and Moín. These employees will be responsible for liaison between the banana companies and INCOFER. They will satisfy the needs of the customer to ensure timely and proper service with adequate equipment to handle the traffic. They will also ensure that INCOFER employees perform their duties properly and maintain the transport plan between the Fincas and the Port. They will also communicate with Moín on a daily basis to ensure adequate supplies of empties based on input from the banana companies.

The analysis of the banana lines will proceed on the basis of three separate operations: Moín-San Cristóbal, Moín-Siquerres and Moín-Ley River.

3.1 TONNAGE FORECAST FOR THE BANANA LINE (000 TONNES)

COMPANY	1988	1989	1990	1991-2008
Bandeco	27.0	28.0	28.2	28.2
Cobal	0.0	0.0	0.0	0.0
Standard				
Estrella (44%)	125.8	143.4	161.0	176.0
Río Frio (30%)	85.8	97.8	109.8	120.0
Siquerres (26%)	74.4	84.8	95.2	104.0
TOTAL	313.0	354.0	394.2	428.2
TONNAGE EX:				
San Cristóbal	112.8	125.8	138.0	148.2
Siquerres	74.4	84.8	95.2	104.0
Estrella	125.8	143.4	161.0	176.0

3.2 CALCULATION OF OPERATING UNITS

Based upon information supplied by INCOFER and the banana companies the Consultant will assume that 900 boxes of bananas can be loaded into each wagon on the average and that each box contains 20 kg of bananas for export. This yields an average net load per wagon of 900*20 kg = 18,000 kg or 18 tonnes per wagon.

It is also assumed that switching will be provided at least twice per day because of the time constraint of 24 hours between cutting on the Finca and loading onto the ship in Limón. This is very important to the banana companies and is their main criteria for transport.

The number of trains per day will be adjusted to allow for this type of service. In this case, trains will be handled every 12 hours or 2 trains per day.

YEAR	1988	1989	1990	1991-2008
Tonnes Per Year:				
San Cristóbal	112,800	125,800	138,000	148,200
Siquerres	74,400	84,800	95,200	120,000
Estrella	125,800	143,400	161,000	176,000
Wagonloads Per Year:				
San Cristóbal	6,267	6,989	7,667	8,233
Siquerres	4,133	4,711	5,289	6,667
Estrella	6,989	7,967	8,944	9,778
Wagonloads Per Day:				
San Cristóbal	20.89	23.30	25.56	27.44
Siquerres	13.78	15.70	17.63	22.22
Estrella	23.30	26.56	29.81	32.59
Trains Per Day:				
San Cristóbal	2	2	2	2
Siquerres	2	2	2	2
Estrella	2	2	2	2

When calculating the average number of wagonloads per day the Consultant assumed 300 operatng days per year since the banana companies operate on a 6 day per week basis.

The number of trains per day is the average number of trains in each direction needed to handle the given tonnage in the above number of operating days.

3.3 OPERATIONAL ANALYSIS OF THE BANANA LINES

Exhibits C.3.1, C.3.2 and C.3.3 show by year the operational analyses of the Moín-Siquerres, Moín-San Cristóbal and Moín-Ley River banana transport systems respectively. They have been considered separately in order to minimize switching by road crews, minimize the requirements for yard staff and maximize equipment utilization. The average number of trains per block in both directions reflects the operation of 2 trains per day to each terminal.

In the case of Moín-Siquerres, the analysis shows 8 trains per day since the 4 trains per day destined from and to San Cristóbal also utilize the same line up to Siquerres. The analysis of Moín-San Cristóbal shows 8 trains per day between Moín and Siquerres for the same reason and 4 trains per day beyond Siquerres to San Cristóbal. The analysis of Moín-Ley River shows only the required 4 trains per day since there is no other traffic on this line.

As with the other sections, the analyses were first conducted using all the stations as listed in the timetable between the terminals. The analyses as shown in the three exhibits minimized the number of sidings required in keeping with traffic volume and operating efficiency. A list of sidings is included with each analysis along with the siding capacity of each.

As can be seen, 2 sidings are utilized between Moín-Siquerres, 7 between Moín-San Cristóbal and 3 between Moín-Ley River.

The last column of each computer analysis shows the excess capacity per block section after operating the number of trains shown. The large values indicate that INCOFER can easily operate the number of trains shown and still have sufficient capacity remaining.

Tables C.3.1, C.3.2 and C.3.3 summarize the important results of these exhibits.

JANUARY 26,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

1 LOCOS. - 7 WAGONS

MOIN - SIQUERRES BANANA LINE EST.RUNNING TIMES*
C-86043

YEAR: 1988

WAGONS/DAY: 13.78

TONNAGE: 74,400 t.

NUMBER OF BLOCKS 4

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-MIRA	8	8	0	180.00	8.23	0.3	0.12	0	0.12	8.35	159.27	151.27
MIRA-SABO	27	8	120	165.00	27.84	0.3	1.70	0	1.70	29.54	46.01	38.01
SABO-MADR	26	8	120	165.00	26.81	0.3	1.56	0	1.56	28.37	47.84	39.84
MADR-SIQ	22	8	0	180.00	22.63	0.3	0.98	0	0.98	23.60	57.10	49.10
	83											

* C.E.TAYLOR

LIST OF STATIONS

		CAPACITY
MOIN	MOIN	
MIRA	MIRAMAR	30
SABO	SABORIO	30
SIQ	SIQUERRES	--

8 TRAINS/DAY A/C TONNAGE EX. SAN CRISTOBAL

TOTAL TRIP TIME	89.86	
TOTAL CIRCUIT TIME	179.73	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	2.50	
EST.TIME REQT. AT SIQUERRES	30.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	312.22	MINS.
LOCO. TOTAL TURNAROUND TIME	5.20	HRS.
LOCO. TOTAL TURNAROUND TIME	0.22	DAYS
WAGON TIME SIQUERRES-FINCAS-SIQUERRES	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2472.22	MINS.
WAGON TOTAL TURNAROUND TIME	41.20	HRS.
WAGON TOTAL TURNAROUND TIME	1.72	DAYS

!----- IF NEGATIVE, REDUCE COL. AND RESUBMIT

JANUARY 26,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

1 LOCOS. - 8 WAGONS

MOIN - SIGUERRES BANANA LINE EST.RUNNING TIMES*
C-86043

YEAR: 1989

WAGONS/DAY: 15.70

TONNAGE: 84,800 t.

NUMBER OF BLOCKS 4

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-MIRA	8	8	0	180.00	8.23	0.3	0.12	0	0.12	8.35	159.27	151.27
MIRA-SABO	27	8	120	165.00	27.84	0.3	1.70	0	1.70	29.54	46.01	38.01
SABO-MADR	26	8	120	165.00	26.81	0.3	1.56	0	1.56	28.37	47.84	39.84
MADR-SIG	22	8	0	180.00	22.63	0.3	0.98	0	0.98	23.60	57.10	49.10
	83											

* C.E.TAYLOR

LIST OF STATIONS		CAPACITY
MOIN	MOIN	
MIRA	MIRAMAR	30
SABO	SABORIO	30
SIG	SIGUERRES	--

8 TRAINS/DAY A/C TONNAGE EX. SAN CRISTOBAL

TOTAL TRIP TIME	89.86	
TOTAL CIRCUIT TIME	179.73	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	2.50	
EST.TIME REQT. AT SIGUERRES	30.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	312.22	MINS.
LOCO. TOTAL TURNAROUND TIME	5.20	HRS.
LOCO. TOTAL TURNAROUND TIME	0.22	DAYS
WAGON TIME SIGUERRES-FINCAS-SIGUERRES	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2472.22	MINS.
WAGON TOTAL TURNAROUND TIME	41.20	HRS.
WAGON TOTAL TURNAROUND TIME	1.72	DAYS

<------ IF NEGATIVE, REDUCE COL. AND RESUBMIT

JANUARY 26,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

1 LOCOS. - 9 WAGONS

MOIN - SIQUERRES BANANA LINE EST.RUNNING TIMES*
C-86043

YEAR: 1990

WAGONS/DAY: 17.63

TONNAGE: 95,200 t.

NUMBER OF BLOCKS 4

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-MIRA	8	8	0	180.00	8.23	0.3	0.12	0	0.12	8.35	159.27	151.27
MIRA-SABO	27	8	120	165.00	27.84	0.3	1.70	0	1.70	29.54	46.01	38.01
SABO-MADR	26	8	120	165.00	26.81	0.3	1.56	0	1.56	28.37	47.84	39.84
MADR-SIQ	22	8	0	180.00	22.63	0.3	0.98	0	0.98	23.60	57.10	49.10
	83											

* C.E.TAYLOR

LIST OF STATIONS		CAPACITY
MOIN	MOIN	
MIRA	MIRAMAR	30
SABO	SABORIO	30
SIQ	SIQUERRES	--

8 TRAINS/DAY A/C TONNAGE EX. SAN CRISTOBAL

TOTAL TRIP TIME	89.86	
TOTAL CIRCUIT TIME	179.73	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	2.50	
EST.TIME REQT. AT SIQUERRES	30.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	312.22	MINS.
LOCO. TOTAL TURNAROUND TIME	5.20	HRS.
LOCO. TOTAL TURNAROUND TIME	0.22	DAYS
WAGON TIME SIQUERRES-FINCAS-SIQUERRES	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2472.22	MINS.
WAGON TOTAL TURNAROUND TIME	41.20	HRS.
WAGON TOTAL TURNAROUND TIME	1.72	DAYS

<----- IF NEGATIVE, REDUCE COL.(AND RESUBMIT

JANUARY 26,1983

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(E.BROND METHOD)

1 LOCOS. - 10 WAGONS

MOIN - SIGUERRES BANANA LINE EST.RUNNING TIMES*
C-86043

YEAR: 1991-2008

WAGONS/DAY: 19.26

TONNAGE: 104,000 t.

NUMBER OF BLOCKS 4

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-MIRA	8	8	0	180.00	8.23	0.3	0.12	0	0.12	8.35	159.27	151.27
MIRA-SABO	27	8	120	165.00	27.84	0.3	1.70	0	1.70	29.54	46.01	38.01
SABO-MADR	26	8	120	165.00	26.81	0.3	1.56	0	1.56	28.37	47.84	39.84
MADR-SIG	22	8	0	180.00	22.63	0.3	0.98	0	0.98	23.60	57.10	49.10
	83											

* C.E.TAYLOR

LIST OF STATIONS		CAPACITY
MOIN	MOIN	
MIRA	MIRAMAR	30
SABO	SABORIO	30
SIG	SIGUERRES	--

8 TRAINS/DAY A/C TONNAGE EX. SAN CRISTOBAL

TOTAL TRIP TIME	89.86	
TOTAL CIRCUIT TIME	179.73	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	2.50	
EST.TIME REQT. AT SIGUERRES	30.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	312.22	MINS.
LOCO. TOTAL TURNAROUND TIME	5.20	HRS.
LOCO. TOTAL TURNAROUND TIME	0.22	DAYS
WAGON TIME SIGUERRES-FINCAS-SIGUERRES	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2472.22	MINS.
WAGON TOTAL TURNAROUND TIME	41.20	HRS.
WAGON TOTAL TURNAROUND TIME	1.72	DAYS

<-------- IF NEGATIVE, REDUCE COL. AND RESUBMIT

JANUARY 26,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBPOND MET-OD)

1 LOCOS. - 11 WAGONS

MOIN - SAN CRISTOBAL BANANA LINE EST.RUNNING TIMES*
C-86043

YEAR: 1988

WAGONS/DAY: 20.89

TONNAGE: 112,800 t.
TICABAN + RIO FRIO

NUMBER OF BLOCKS 15

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/(*C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-MIRA	8	8	0	180.00	8.23	0.3	0.12	0	0.12	8.35	159.27	151.27
MIRA-SABO	27	8	120	165.00	27.84	0.3	1.70	0	1.70	29.54	46.01	38.01
SABO-MADR	26	8	0	180.00	26.74	0.3	1.40	0	1.40	28.14	48.10	40.10
MADR-SIQ	22	8	0	180.00	22.63	0.3	0.98	0	0.98	23.60	57.10	49.10
SIQ-BABI	20	4	0	360.00	20.28	0.3	0.36	0	0.36	20.64	64.51	60.51
BABI-GUAC	29	4	0	360.00	29.41	0.3	0.78	0	0.78	30.19	44.29	40.29
GUAC-LEES	18	4	0	360.00	18.25	0.3	0.29	0	0.29	18.55	71.74	67.74
LEES-SANC	19	4	0	360.00	19.27	0.3	0.33	0	0.33	19.59	67.93	63.93
	169											

* C.E.TAYLOR

LIST OF STATIONS

		CAPACITY
MOIN	MOIN	
MIRA	MIRAMAR	30
SABO	SABORIO	30
MADR	MADRE DE DIOS	30
SIQ	SIQUERRES	--
BABI	BABILONIA	30
GUAC	GUACIMO	--
LEES	LEESVILLE	--
SANC	SAN CRISTOBAL	--

8 TRAINS MOIN-SIQUERRES A/C RAIL TRAFFIC CY. SIQUERRES

TOTAL TRIP TIME	178.61	
TOTAL CIRCUIT TIME	357.23	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	4.96	
EST.TIME REQT. AT S.CRISTOBAL	30.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	492.19	MINS.
LOCO. TOTAL TURNAROUND TIME	8.20	HRS.
LOCO. TOTAL TURNAROUND TIME	0.34	DAYS
WAGON TIME S.CRISTOBAL-FINCAS-S.CRISTOBAL	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2652.19	MINS.
WAGON TOTAL TURNAROUND TIME	44.20	HRS.
WAGON TOTAL TURNAROUND TIME	1.84	DAYS

<----- IF NEGATIVE, REDUCE COL AND RESUBMIT

JANUARY 26,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(E.BROND METHOD)

1 LOCOS. - 12 WAGONS

MOIN - SAN CRISTOBAL BANANA LINE EST.RUNNING TIMES*
C-86043

YEAR: 1989

WAGONS/DAY: 23.3

TONNAGE: 125,800 t.
TICABAN + RIO FRIO

NUMBER OF BLOCKS 8

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-MIRA	8	8	0	180.00	8.23	0.3	0.12	0	0.12	8.35	159.27	151.27
MIRA-SABO	27	8	120	165.00	27.84	0.3	1.70	0	1.70	29.54	46.01	38.01
SABO-MADR	26	8	0	180.00	26.74	0.3	1.40	0	1.40	28.14	48.10	40.10
MADR-SIQ	22	8	0	180.00	22.63	0.3	0.98	0	0.98	23.60	57.10	49.10
SIQ-BABI	20	4	0	360.00	20.28	0.3	0.36	0	0.36	20.64	64.51	60.51
BABI-GUAC	29	4	0	360.00	29.41	0.3	0.78	0	0.78	30.19	44.29	40.29
GUAC-LEES	18	4	0	360.00	18.25	0.3	0.29	0	0.29	18.55	71.74	67.74
LEES-SANC	19	4	0	360.00	19.27	0.3	0.33	0	0.33	19.59	67.93	63.93
	169											

* C.E.TAYLOR

LIST OF STATIONS

		CAPACITY
MOIN	MOIN	
MIRA	MIRAMAR	30
SABO	SABORIO	30
MADR	MADRE DE DIOS	30
SIQ	SIQUERRES	--
BABI	BABILONIA	30
GUAC	GUACIMO	--
LEES	LEESVILLE	--
SANC	SAN CRISTOBAL	--

8 TRAINS MOIN-SIQUERRES A/C RAIL TRAFFIC EX. SIQUERRES

TOTAL TRIP TIME	178.61	
TOTAL CIRCUIT TIME	357.23	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	4.96	
EST.TIME REQT. AT S.CRISTOBAL	30.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	492.19	MINS.
LOCO. TOTAL TURNAROUND TIME	8.20	HRS.
LOCO. TOTAL TURNAROUND TIME	0.34	DAYS
WAGON TIME S.CRISTOBAL-FINCAS-S.CRISTOBAL	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2652.19	MINS.
WAGON TOTAL TURNAROUND TIME	44.20	HRS.
WAGON TOTAL TURNAROUND TIME	1.84	DAYS

!----- IF NEGATIVE, REDUCE COL. AND RESUBMIT

JANUARY 26,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(E.BROND METHOD)

YEAR: 1990

NUMBER OF BLOCKS 8

WAGONS/DAY: 25.56

1 LOCOS. - 13 WAGONS

TRACK MAINTENANCE TIME(MINS./DAY): 120

TONNAGE: 138,000 t.
TICABAN + RIO FRIO

MOIN - SAN CRISTOBAL BANANA LINE EST.RUNNING TIMES*
C-86043

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-MIRA	8	8	0	180.00	8.23	0.3	0.12	0	0.12	8.35	159.27	151.27
MIRA-SABO	27	8	120	165.00	27.84	0.3	1.70	0	1.70	29.54	46.01	38.01
SABO-MADR	26	8	0	180.00	26.74	0.3	1.40	0	1.40	28.14	48.10	40.10
MADR-SIQ	22	8	0	180.00	22.63	0.3	0.98	0	0.98	23.60	57.10	49.10
SIQ-BABI	20	4	0	360.00	20.28	0.3	0.36	0	0.36	20.64	64.51	60.51
BABI-GUAC	29	4	0	360.00	29.41	0.3	0.78	0	0.78	30.19	44.29	40.29
GUAC-LEES	18	4	0	360.00	18.25	0.3	0.29	0	0.29	18.55	71.74	67.74
LEES-SANC	19	4	0	360.00	19.27	0.3	0.33	0	0.33	19.59	67.93	63.93

* C.E.TAYLOR

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LIST OF STATIONS

		CAPACITY
MOIN	MOIN	
MIRA	MIRAMAR	30
SABO	SABORIO	30
MADR	MADRE DE DIOS	30
SIQ	SIQUERRES	--
BABI	BABILONIA	30
GUAC	GUACIMO	--
LEES	LEESVILLE	--
SANC	SAN CRISTOBAL	--

8 TRAINS MOIN-SIQUERRES A/C RAIL TRAFFIC EX. SIQUERRES

TOTAL TRIP TIME	178.61	
TOTAL CIRCUIT TIME	357.23	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	4.96	
EST.TIME REQT. AT S.CRISTOBAL	30.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	492.19	MINS.
LOCO. TOTAL TURNAROUND TIME	8.20	HRS.
LOCO. TOTAL TURNAROUND TIME	0.34	DAYS
WAGON TIME S.CRISTOBAL-FINCAS-S.CRISTOBAL	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2652.19	MINS.
WAGON TOTAL TURNAROUND TIME	44.20	HRS.
WAGON TOTAL TURNAROUND TIME	1.84	DAYS

|----- IF NEGATIVE,REDUCE COL AND RESUBMIT

JANUARY 26,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

YEAR: 1991-2008

NUMBER OF BLOCKS 8

WAGONS/DAY: 27.44

1 LOCOS. - 14 WAGONS

TRACK MAINTENANCE TIME(MINS./DAY): 120

TONNAGE: 148,200 t.
TICABAN + RIO FRIO

MOIN - SAN CRISTOBAL BANANA LINE EST.RUNNING TIMES*
C-86043

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-MIRA	8	8	0	180.00	8.23	0.3	0.12	0	0.12	8.35	159.27	151.27
MIRA-SABO	27	8	120	165.00	27.84	0.3	1.70	0	1.70	29.54	46.01	38.01
SABO-MADR	26	8	0	180.00	26.74	0.3	1.40	0	1.40	28.14	48.10	40.10
MADR-SIQ	22	8	0	180.00	22.63	0.3	0.98	0	0.98	23.60	57.10	49.10
SIQ-BABI	20	4	0	360.00	20.28	0.3	0.36	0	0.36	20.64	64.51	60.51
BABI-GUAC	29	4	0	360.00	29.41	0.3	0.78	0	0.78	30.19	44.29	40.29
GUAC-LEES	18	4	0	360.00	18.25	0.3	0.29	0	0.29	18.55	71.74	67.74
LEES-SANC	19	4	0	360.00	19.27	0.3	0.33	0	0.33	19.59	67.93	63.93

* C.E.TAYLOR

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LIST OF STATIONS		CAPACITY
MOIN	MOIN	
MIRA	MIRAMAR	30
SABO	SABORIO	30
MADR	MADRE DE DIOS	30
SIQ	SIQUERRES	--
BABI	BABILONIA	30
GUAC	GUACIMO	--
LEES	LEESVILLE	--
SANC	SAN CRISTOBAL	--

8 TRAINS MOIN-SIQUERRES A/C RAIL TRAFFIC EX. SIQUERRES

TOTAL TRIP TIME	178.61	<----- IF NEGATIVE,REDUCE COL. AND RESUBMIT
TOTAL CIRCUIT TIME	357.23	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	4.96	
EST.TIME REQT. AT S.CRISTOBAL	30.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	492.19	MINS.
LOCO. TOTAL TURNAROUND TIME	8.20	HRS.
LOCO. TOTAL TURNAROUND TIME	0.34	DAYS
WAGON TIME S.CRISTOBAL-FINCAS-S.CRISTOBAL	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2652.19	MINS.
WAGON TOTAL TURNAROUND TIME	44.20	HRS.
WAGON TOTAL TURNAROUND TIME	1.84	DAYS

JANUARY 26,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

1 LOCOS. - 12 WAGONS

MOIN - LEY RIVER BANANA LINE EST.RUNNING TIMES*
ESTRELLA BRANCH
C-86043

YEAR: 1988

WAGONS/DAY: 23.3

TONNAGE: 125,800 t.

NUMBER OF BLOCKS 5

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS	TRACK CLOSURE (MIN/DAY)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B)	SERVICE TIME PER BLOCK (A)/(1-(TD/C))	EMPIRICAL CORRECTION FACTOR	QUEUING DELAY(MINS.) E*((D)2/((C)-(D)))	PLANNED BLOCK DELAY MINS.	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G	TOTAL BLOCK TIME(MINS.) (D)+(H)	CAPACITY PER BLOCK (TRAINS)	EXCESS CAPACITY PER BLOCK (J)-(B)
	(A)	(B)	(MT)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	
MOIN-JCT.	9	4	0	360.00	9.13	0.3	0.07	0	0.07	9.20	144.07	140.07
JCT.-LAPO	26	4	0	360.00	26.37	0.3	0.63	0	0.63	26.39	49.48	45.48
LAPO-SANC	25	4	0	360.00	25.35	0.3	0.58	0	0.58	25.93	51.48	47.48
SANC-HALF	29	4	120	330.00	29.45	0.3	0.87	0	0.87	30.31	44.18	40.18
HALF-LEYR	5	4	0	360.00	5.07	0.3	0.02	0	0.02	5.09	259.78	255.78
	94											

* C.E.TAYLOR

LIST OF STATIONS		CAPACITY
MOIN	MOIN	
JCT.	JUNCTION	
LAPO	LA POLONIA	30
SANC	SAN CLEMENTE	31
HALF	HALF WAY	12
LEYR	LEY RIVER	

TOTAL TRIP TIME	97.52	
TOTAL CIRCUIT TIME	195.04	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	1.35	
EST.TIME REQT. AT LEY RIVER	180.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	476.40	MINS.
LOCO. TOTAL TURNAROUND TIME	7.94	HRS.
LOCO. TOTAL TURNAROUND TIME	0.33	DAYS
WAGON TIME LEY RIVER-FINCAS-LEY RIVER	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2636.40	MINS.
WAGON TOTAL TURNAROUND TIME	43.94	HRS.
WAGON TOTAL TURNAROUND TIME	1.83	DAYS

!----- IF NEGATIVE,REDUCE COL. AND RESUBMIT

JANUARY 26,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

1 LOCOS. - 14 WAGONS

MOIN - LEY RIVER BANANA LINE EST.RUNNING TIMES*
ESTRELLA BRANCH
C-86043

YEAR: 1989

WAGONS/DAY: 26.36

TONNAGE: 143,400 t.

NUMBER OF BLOCKS 5

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-JCT.	9	4	0	360.00	9.13	0.3	0.07	0	0.07	9.20	144.07	140.07
JCT.-LAPO	26	4	0	360.00	26.37	0.3	0.63	0	0.63	26.99	49.48	45.48
LAPO-SANC	25	4	0	360.00	25.35	0.3	0.58	0	0.58	25.93	51.48	47.48
SANC-HALF	29	4	120	330.00	29.45	0.3	0.87	0	0.87	30.31	44.18	40.18
HALF-LEYR	5	4	0	360.00	5.07	0.3	0.02	0	0.02	5.09	259.78	255.78
	94											

* C.E.TAYLOR

LIST OF STATIONS

		CAPACITY
MOIN	MOIN	
JCT.	JUNCTION	
LAPO	LA POLONIA	30
SANC	SAN CLEMENTE	31
HALF	HALF WAY	12
LEYR	LEY RIVER	

TOTAL TRIP TIME	97.52	
TOTAL CIRCUIT TIME	195.04	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	1.35	
EST.TIME REQT. AT LEY RIVER	180.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	476.40	MINS.
LOCO. TOTAL TURNAROUND TIME	7.94	HRS.
LOCO. TOTAL TURNAROUND TIME	0.33	DAYS
WAGON TIME LEY RIVER-FINCAS-LEY RIVER	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2636.40	MINS.
WAGON TOTAL TURNAROUND TIME	43.94	HRS.
WAGON TOTAL TURNAROUND TIME	1.83	DAYS

<----- IF NEGATIVE,REDUCE COL.(AND RESUBMIT

JANUARY 26,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)

YEAR: 1990

NUMBER OF BLOCKS 5

1 LOCOS. - 15 WAGONS

WAGONS/DAY: 29.81

TRACK MAINTENANCE TIME(MINS./DAY): 120

MOIN - LEY RIVER BANANA LINE EST.RUNNING TIMES*
ESTRELLA BRANCH
C-86043

TONNAGE: 161,000 t.

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-JCT.	9	4	0	360.00	9.13	0.3	0.07	0	0.07	9.20	144.07	140.07
JCT.-LAPO	26	4	0	360.00	26.37	0.3	0.63	0	0.63	26.99	49.48	45.48
LAPO-SANC	25	4	0	360.00	25.35	0.3	0.58	0	0.58	25.93	51.48	47.48
SANC-HALF	29	4	120	330.00	29.45	0.3	0.87	0	0.87	30.31	44.18	40.18
HALF-LEYR	5	4	0	360.00	5.07	0.3	0.02	0	0.02	5.09	259.78	255.78

* C.E.TAYLOR

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LIST OF STATIONS		CAPACITY
MOIN	MOIN	
JCT.	JUNCTION	
LAPO	LA POLONIA	30
SANC	SAN CLEMENTE	31
HALF	HALF WAY	12
LEYR	LEY RIVER	

TOTAL TRIP TIME	97.52	
TOTAL CIRCUIT TIME	195.04	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	1.35	
EST.TIME REQT. AT LEY RIVER	180.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	476.40	MINS.
LOCO. TOTAL TURNAROUND TIME	7.94	HRS.
LOCO. TOTAL TURNAROUND TIME	0.33	DAYS
WAGON TIME LEY RIVER-FINCAS-LEY RIVER	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2636.40	MINS.
WAGON TOTAL TURNAROUND TIME	43.94	HRS.
WAGON TOTAL TURNAROUND TIME	1.83	DAYS

:----- IF NEGATIVE,REDUCE COL. AND RESUBMIT

JANUARY 26,1988

TRACK CAPACITY AND CIRCUIT TIME ANALYSIS
(ELBROND METHOD)
1 LOCOS. - 17 WAGONS
MOIN - LEY RIVER BANANA LINE EST.RUNNING TIMES*
ESTRELLA BRANCH
C-86043

YEAR: 1991-2008

WAGONS/DAY: 32.59

TONNAGE: 176,000 t.

NUMBER OF BLOCKS 5

TRACK MAINTENANCE TIME(MINS./DAY): 120

ESTIMATED SIDING DELAY(MINS.): 5

BLOCK NO.	AVERAGE TRANSIT TIME(MINS.) (A)	AVG.NO.TRAINS PER BLOCK BOTH DIRECTIONS (B)	TRACK CLOSURE (MIN/DAY) (MT)	INTERARRIVAL TIME/BLOCK (1440-MT)/(B) (C)	SERVICE TIME PER BLOCK (A)/(1-(TD/C)) (D)	EMPIRICAL CORRECTION FACTOR (E)	QUEUING DELAY(MINS.) E*((D)2/((C)-(D))) (F)	PLANNED BLOCK DELAY MINS. (G)	ACTUAL BLOCK DELAY(MINS.) GTR.OF F OR G (H)	TOTAL BLOCK TIME(MINS.) (D)+(H) (I)	CAPACITY PER BLOCK (TRAINS) (J)	EXCESS CAPACITY PER BLOCK (J)-(B)
MOIN-JCT.	9	4	0	360.00	9.13	0.3	0.07	0	0.07	9.20	144.07	140.07
JCT.-LAPO	26	4	0	360.00	26.37	0.3	0.63	0	0.63	26.99	49.48	45.48
LAPO-SANC	25	4	0	360.00	25.35	0.3	0.58	0	0.58	25.93	51.48	47.48
SANC-HALF	29	4	120	330.00	29.45	0.3	0.87	0	0.87	30.31	44.18	40.18
HALF-LEYR	5	4	0	360.00	5.07	0.3	0.02	0	0.02	5.09	259.78	255.78
	94											

* C.E.TAYLOR

LIST OF STATIONS

		CAPACITY
MOIN	MOIN JUNCTION	
LAPO	LA POLONIA	30
SANC	SAN CLEMENTE	31
HALF	HALF WAY	12
LEYR	LEY RIVER	

TOTAL TRIP TIME	97.52	
TOTAL CIRCUIT TIME	195.04	
BLOCK CLOSURE DELAY	10.00	
TRUE MEETING DELAY	1.35	
EST.TIME REQT. AT LEY RIVER	180.00	
INITIAL TERMINAL TIME AT MOIN	45.00	
FINAL TERMINAL TIME AT MOIN	45.00	
LOCO. TOTAL TURNAROUND TIME	476.40	MINS.
LOCO. TOTAL TURNAROUND TIME	7.94	HRS.
LOCO. TOTAL TURNAROUND TIME	0.33	DAYS
WAGON TIME LEY RIVER-FINCAS-LEY RIVER	1440.00	
WAGON TIME MOIN-PORT-MOIN	720.00	
WAGON TOTAL TURNAROUND TIME	2636.40	MINS.
WAGON TOTAL TURNAROUND TIME	43.94	HRS.
WAGON TOTAL TURNAROUND TIME	1.83	DAYS

<----- IF NEGATIVE, REDUCE COL. (A) AND RESUBMIT

TABLE C.3.1

MOÍN - SIQUERRES

YEAR	LOCOMOTIVE ROTATION (HOURS)	LOCOMOTIVE ROTATION (DAYS)	WAGON ROTATION (HOURS)	WAGON ROTATION (DAYS)
1988	5.20	0.22	41.20	1.72
1989	5.20	0.22	41.20	1.72
1990	5.20	0.22	41.20	1.72
1991-2008	5.20	0.22	41.20	1.72

TABLE C.3.2

MOÍN - SAN CRISTÓBAL

YEAR	LOCOMOTIVE ROTATION (HOURS)	LOCOMOTIVE ROTATION (DAYS)	WAGON ROTATION (HOURS)	WAGON ROTATION (DAYS)
1988	8.20	0.34	44.20	1.84
1989	8.20	0.34	44.20	1.84
1990	8.20	0.34	44.20	1.84
1991-2008	8.20	0.34	44.20	1.84

TABLE C.3.3

MOÍN - LEY RIVER

YEAR	LOCOMOTIVE ROTATION (HOURS)	LOCOMOTIVE ROTATION (DAYS)	WAGON ROTATION (HOURS)	WAGON ROTATION (DAYS)
1988	7.94	0.33	43.94	1.83
1989	7.94	0.33	43.94	1.83
1990	7.94	0.33	43.94	1.83
1991-2008	7.94	0.33	43.94	1.83

3.4 LOCOMOTIVE REQUIREMENTS

The locomotive requirements have been developed on each operation separately as shown in Tables C.4.1, C.4.2 and C.4.3.

TABLE C.4.1
MOÍN - SIQUERRES

	1988	1989	1990	1991-2008
Trains/Day	2	2	2	2
Rotation Days	0.22	0.22	0.22	0.22
Number of Train Sets	0.44	0.44	0.44	0.44
Number of Train Sets	1	1	1	1
Locomotives/Set	1	1	1	1
Availability	0.8	0.8	0.8	0.8
Locomotives Required (134/145 1200 kW)	2	2	2	2
Switch Engines				
Siquerres	1	1	1	1
Spare *				
TOTAL	1	1	1	1

* Use the same spare as San Cristóbal

TABLE C.4.2

MOÍN - SAN CRISTÓBAL

	1988	1989	1990	1991-2008
Trains/Day	2	2	2	2
Rotation Days	0.34	0.34	0.34	0.34
Number of Train Sets	0.68	0.68	0.68	0.68
Number of Train Sets	1	1	1	1
Locomotives/Set	1	1	1	1
Availability	0.8	0.8	0.8	0.8
Locomotives Required (134/145 1200 kW)	2	2	2	2
Switch Engines				
San Cristóbal	1	1	1	1
Spare	1	1	1	1
TOTAL	2	2	2	2

TABLE C.4.3

MOÍN - LEY RIVER

	1988	1989	1990	1991-2008
Trains/Day	2	2	2	2
Rotation Days	0.33	0.33	0.33	0.33
Number of Train Sets	0.66	0.66	0.66	0.66
Number of Train Sets	1	1	1	1
Locomotives/Set	1	1	1	1
Availability	0.8	0.8	0.8	0.8
Locomotives Required (1100 HP D.E.)	2	2	2	2

Switch Engines

None Required. Road crews will do the spotting and lifting at Ley River due to the short round trip.

TABLE C.4.4

SUMMARY OF LOCOMOTIVE REQUIREMENTS

		1988	1989	1990	1991-2008
Locomotives:	134/145	5	5	5	5
	1100 HP	2	2	2	2
	640 HP	2	2	2	2
Spares:	134/145	1	1	1	1
	640 HP	1	1	1	1

3.5 WAGON REQUIREMENTS

The wagon requirements have been developed by each traffic segment and the results are shown in Tables C.5.1, C.5.2 and C.5.3.

TABLE C.5.1

MOÍN - SIQUERRES

	1988	1989	1990	1991-2008
Trains/Day	2	2	2	2
Rotation Days	1.72	1.72	1.72	1.72
Number of Train Sets	3.44	3.44	3.44	3.44
Number of Train Sets	4	4	4	4
Wagons/Set	7	8	9	10
Availability	0.75	0.75	0.75	0.75
Wagons Required	38	43	48	54

TABLE C.5.2

MOÍN - SAN CRISTÓBAL

	1988	1989	1990	1991-2008
Trains/Day	2	2	2	2
Rotation Days	1.84	1.84	1.84	1.84
Number of Train Sets	3.68	3.68	3.68	3.68
Number of Train Sets	4	4	4	4
Wagons/Set	11	12	13	14
Availability	0.75	0.75	0.75	0.75
Wagons Required	59	64	69	75

TABLE C.5.3

MOÍN - LEY RIVER

	1988	1989	1990	1991-2008
Trains/Day	2	2	2	2
Rotation Days	1.83	1.83	1.83	1.83
Number of Train Sets	3.66	3.66	3.66	3.66
Number of Train Sets	4	4	4	4
Wagons/Set	12	14	15	17
Availability	0.75	0.75	0.75	0.75
Wagons Required	64	75	80	91

TABLE C.5.4

SUMMARY OF WAGON REQUIREMENTS

	1988	1989	1990	1991-2008
Banana Boxes/Flats	161	182	197	220

3.6 LOCOMOTIVE AND WAGON OVERHAULS

NUMBER OF OVERHAULS BY CLASS

YEAR	LOCOMOTIVES 134/145	LOCOMOTIVES 1100 HP	LOCOMOTIVES 640 HP	BOXES/FLATS
1988	6	2	3	161
1989				21
1990				15
1991				23

OVERHAUL COSTS
(U.S. DOLLARS)

YEAR	LOCOMOTIVES 134/145	LOCOMOTIVES 1100 HP	LOCOMOTIVES 640 HP	BOXES/FLATS	TOTAL
1988	$592,800	$182,400	$273,600	$1,376,550	$2,425,350
1989				$ 179,550	$ 179,550
1990				$ 128,250	$ 128,250
1991				$ 196,650	$ 196,650
TOTAL	$592,800	$182,400	$273,600	$1,881,000	$2,929,800

3.7 ANNUAL MAINTENANCE COSTS

YEAR	LOCOMOTIVES 134/145	LOCOMOTIVES 1100 HP	LOCOMOTIVES 640 HP	BOXES/FLATS	TOTAL	LABOUR	MATERIA
1988	$90,288	$36,480	$32,832	$183,540	$343,140	$102,942	$240,19
1989	$90,288	$36,480	$32,832	$207,480	$367,080	$110,124	$256,95
1990	$90,288	$36,480	$32,832	$224,580	$384,180	$115,254	$268,92
1991	$90,288	$36,480	$32,832	$250,800	$410,400	$123,120	$287,28

3.8 RADIO REQUIREMENTS

Road Radios:	Estrella Branch	2 @ $4,575 Cdn.	=	$ 9,150 Cdn.
	Siquerres	1 @ $4,575 Cdn.	=	$ 4,575 Cdn.
	San Cristóbal	2 @ $4,575 Cdn.	=	$ 9,150 Cdn.
	Spares	2 @ $4,575 Cdn.	=	$ 9,150 Cdn.
	Charger	1 @ $ 300 Cdn.	=	$ 300 Cdn.
				$32,325 Cdn.
Yard Radios:	Siquerres	2 @ $ 764 Cdn.	=	$ 1,528 Cdn.
	San Cristóbal	2 @ $ 764 Cdn.	=	$ 1,528 Cdn.
	Spares	2 @ $ 764 Cdn.	=	$ 1,528 Cdn.
	Chargers	2 @ $ 166 Cdn.	=	$ 332 Cdn.
				$ 4,916 Cdn.
		TOTAL		$37,241 Cdn.
				$28,303 U.S.
Maintenance @ 25% for +5 Years				$ 7,076 U.S.

3.9 YARD ENGINE COSTS

	SAN CRISTÓBAL	SIQUERRES	TOTAL
Hours per Day*	8	8	
Fuel Cost/Hour	$ 4.62 U.S.	$ 4.62 U.S.	
Lube Cost/Hour	$ 0.22 U.S.	$ 0.22 U.S.	
Total Cost/Hour	$ 4.84 U.S.	$ 4.84 U.S.	
Cost per Day	$38.73 U.S.	$38.73 U.S.	$ 77.46 U.S.
Operating Days			300
Yard Fuel Cost/Year			$23,239 U.S.

* Assumes engines will be shut down when not in use.

3.10 ENERGY COSTS

3.10.1 Road Fuel Costs (Estrella Branch)

	TIME (HOURS)	LITRES
Initial Time at Moín	0.75	13.7
Moín-Ley River-Moín (@ 120 Litres/Hour)	3.44	412.8
Time at Ley River	3.00	150.0
Final Time at Moín	0.75	13.7
		590.2
Fuel @ $0.1586 U.S./Litre		$93.61 U.S.
Lube Oil @ 5%		$ 4.68 U.S.
		$98.29 U.S.

	TRAINS/ DAY	COST/ TRAIN	OPERATING DAYS	TOTAL COST
Fuel	2	$98.29	300	$58,974 U.S.

3.10.2 Electricity Costs Moín-San Cristóbal

The energy costs for the trains operating between Moín-Siquerres and Moín-San Cristóbal were estimated by calculating the number of kilowatt hours per month consumed per month by the operations and then applying an average load factor to estimate the actual consumption value. In consideration of the territory over which the trains operate a load factor of approximately 25% was applied to reduce the gross kilowatt hours to a net value to be costed.

The net kilowatt hours were costed on the following basis:

Energy Consumption:

First 20,000 kWh or less	63,109.30 Colones
Each additional kWh	2.28 per kWh

Note: The excess of monthly consumption during the rainy season (June-January) over the average monthly consumption during the dry season (February-May) will be charged at the reduced rate of 1.07 colones per kWh.

For the purposes of this study 1.70 colones per kWh was used for each additional kWh.

Peak Demand Charge:

First 27 kW or less	13,077.20 Colones
The next 60 kW	484.34 per kW
Each additional kW	736.17 per kW

Note: The peak demand charge is based on the highest average demand in kW for any 15 minute interval during the month, measured between 10:00 a.m. and 12:30 a.m. or between 4:30 p.m. and 8:00 p.m. During the rainy season (June-January), peak demand is not measured on Saturdays, Sundays, or holidays.

With the low traffic volumes and few number of trains per day it is assumed that INCOFER could, for the most part, plan the operation so as to minimize the very expensive peak demand charge. In order to recognize that complete elimination of this cost item is unlikely the Consultant has included a peak demand charge per month based on the average of the actual peak demands incurred during the months of October 1987, November 1987, December 1987 and January 1988.

3.11 ESTIMATION OF LABOUR COSTS

3.11.1 Crew Wages

The crew wages for the traffic segments of the banana line have been costs under the assumptions that the road crews will operate with a 2-man crew consisting of an engineman and a conductor and that the yard crews will operate with a 3-man crew consisting of an engineman, switchman and yard foreman.

The 2-man road crew is reasonable in the light of the train size and the low operating speeds. The yard crews will be equipped with portable radios and the extra man is supplied for productivity and safety.

	ESTRELLA BRANCH	MOÍN-SIQUERRES	MOÍN-SAN CRISTÓBAL
Crew Hours/Month	208	208	208
Crew Months/Year	11.5	11.5	11.5
Crew Hours/Year	2,392	2,392	2,392
Duration of Trip	7.94 hours	5.2 hours	8.2 hours
Trains/Day	2	2	2
Train Hours/Day	15.88 hours	10.4 hours	16.4 hours
Operating Days/Year	300	300	300
Train Hours/Year	4,764 hours	3,120 hours	4,920 hours
Divide by 2392	1.99	1.30	2.06
Crew Required	3	2	3
Relief Crews	1	1	1
TOTAL	4	3	4

Road Crews:	San Cristóbal	4
	Siquerres	3
	Estrella	4
	TOTAL	11
	Annual Cost/Crew	$ 7,619.04 U.S.
	Annual Cost	$83,809.44 U.S.
	Say	$84,000 U.S.

Yard Crews:	San Cristóbal	1.5
	Siquerres	1.5
	Moín	3.0
	TOTAL	6.0
	Annual Cost/Crew	$ 11,100 U.S.
	Annual Cost	$ 66,600 U.S.
	Say	$ 67,000 U.S.
Total Cost Road plus Yard		$151,000 U.S.

3.11.2 DISPATCHING

Under the assumption that the banana lines are operating alone only one dispatching office similar to what currently exists in Siquerres will be required. The traffic volumes are light and the amount of territory is small. The office will offer 24 hour coverage with 5 dispatchers. Although the banana traffic moves only 6 days per week the dispatching office will remain open on the 7th day, 2 shifts to allow track work to proceed and to allow the movement of motor cars.

Annual cost of dispatching office is 1,337,064 colones or$21,223 U.S.

3.11.3 TRACK MAINTENANCE

Comments as per Section A.11.3.

3.11.4 MISCELLANEOUS LABOUR

An allowance of $30,000 U.S. per year has been included to cover labour such as labourers, watchmen, clerks, etc. This would translate to roughly 15 employees.

3.11.5 ADMINISTRATION

The overall railway administration has been estimated on the basis of it being approximately 15% of the direct labour cost. This is meant to cover all administration above the first line supervisory level in all departments.

3.11.6 SUMMARY OF ESTIMATED OPERATING EXPENSES

The following Tables C.11.1 - C.11.4 present summaries of estimated operating expenses for Scenarios A1 and A2 on both economic and financial cost bases.

The economic cost reflects fuel costs at $0.1586 U.S./litre while the financial cost reflects fuel costs at $0.32 U.S./litre.

Labour costs are kept constant over time as they are assumed to keep step with inflation in real terms.

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD ENERGY	ROAD FUEL	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	769,908	115,486	82,196	58,974	23,239	240,198	1,313,000	2,603,00
1989	777,090	116,564	82,196	58,974	23,239	256,956	1,313,000	2,628,01
1990	782,220	117,333	82,196	58,974	23,239	268,926	1,313,000	2,645,88
1991	790,086	118,513	82,196	58,974	23,239	287,280	1,313,000	2,673,28
1992	790,086	118,513	82,196	58,974	23,239	287,280	1,313,000	2,673,28
1993	790,086	118,513	82,196	58,974	23,239	287,280	1,313,000	2,673,28
1994	790,086	118,513	82,196	58,974	23,239	287,280	1,313,000	2,673,28
1995	790,086	118,513	82,196	58,974	23,239	287,280	1,313,000	2,673,28
2008	790,086	118,513	82,196	58,974	23,239	287,280	1,313,000	2,673,28

TABLE C.11.2

SCENARIO A1

BANANA LINES

SUMMARY OF ESTIMATED OPERATING EXPENSES

FINANCIAL COST

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD ENERGY	ROAD FUEL	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	769,908	115,486	82,196	118,989	46,888	240,198	1,313,000	2,686,66
1989	777,090	116,564	82,196	118,989	46,888	256,956	1,313,000	2,711,68
1990	782,220	117,333	82,196	118,989	46,888	268,926	1,313,000	2,729,55
1991	790,086	118,513	82,196	118,989	46,888	287,280	1,313,000	2,756,95
1992	790,086	118,513	82,196	118,989	46,888	287,280	1,313,000	2,756,95
1993	790,086	118,513	82,196	118,989	46,888	287,280	1,313,000	2,756,95
1994	790,086	118,513	82,196	118,989	46,888	287,280	1,313,000	2,756,95
1995	790,086	118,513	82,196	118,989	46,888	287,280	1,313,000	2,756,95
2008	790,086	118,513	82,196	118,989	46,888	287,280	1,313,000	2,756,95

TABLE C.11.3

SCENARIO A2

BANANA LINES

SUMMARY OF ESTIMATED OPERATING EXPENSES

ECONOMIC COST

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD ENERGY	ROAD FUEL	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	673,108	100,966	82,196	58,974	23,239	240,198	1,109,000	2,287,68
1989	680,290	102,044	82,196	58,974	23,239	256,956	1,109,000	2,312,69
1990	685,420	102,813	82,196	58,974	23,239	268,926	1,109,000	2,330,56
1991	693,286	103,993	82,196	58,974	23,239	287,280	1,109,000	2,357,96
1992	693,286	103,993	82,196	58,974	23,239	287,280	1,109,000	2,357,96
1993	693,286	103,993	82,196	58,974	23,239	287,280	1,109,000	2,357,96
1994	693,286	103,993	82,196	58,974	23,239	287,280	1,109,000	2,357,96
1995	693,286	103,993	82,196	58,974	23,239	287,280	1,109,000	2,357,96
2008	693,286	103,993	82,196	58,974	23,239	287,280	1,109,000	2,357,96

TABLE C.11.4

SCENARIO A2

BANANA LINES

SUMMARY OF ESTIMATED OPERATING EXPENSES

FINANCIAL COST

YEAR	DIRECT LABOUR	ADMIN. EXPENSES	ROAD ENERGY	ROAD FUEL	YARD FUEL	EQUIPMENT MAINTENANCE MATERIAL/ OTHER	TRACK MAINTENANCE MATERIAL/ OTHER	TOTAL
	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.	$U.S.
1988	673,108	100,966	82,196	118,989	46,888	240,198	1,109,000	2,371,345
1989	680,290	102,044	82,196	118,989	46,888	256,956	1,109,000	2,396,363
1990	685,420	102,813	82,196	118,989	46,888	268,926	1,109,000	2,414,232
1991	693,286	103,993	82,196	118,989	46,888	287,280	1,109,000	2,441,632
1992	693,286	103,993	82,196	118,989	46,888	287,280	1,109,000	2,441,632
1993	693,286	103,993	82,196	118,989	46,888	287,280	1,109,000	2,441,632
1994	693,286	103,993	82,196	118,989	46,888	287,280	1,109,000	2,441,632
1995	693,286	103,993	82,196	118,989	46,888	287,280	1,109,000	2,441,632
2008	693,286	103,993	82,196	118,989	46,888	287,280	1,109,000	2,441,632

3.11.7 Summary of Estimated Employees

Dispatchers	5
Operating	40
Mechanical	27
Track Maintenance	151 (A-1)
Mobile Supervisors	3
Miscellaneous Labour	15
Administration	30
Estimated Total	271

4. ATLANTICO AND BANANA LINES

When combining these two sections of railway, the Tables B.11.1 - B.11.4 and Tables C.11.1 - C.11.4 are used.

All items except for direct labour and administration are additive in the combination scenario. Under the combination scenario only one dispatching office will be required because of low traffic volumes and short distances. The administration cost is assumed to be the larger of the Atlantico and Banana Lines. The administration of the smaller will be amalgamated with the larger with no increase in administration size.

The direct labour component for the scenario follows:

	(A1 + B1)	(A2 + B2)
1988	$1,189,860	$1,113,860
1989	$1,197,042	$1,121,042
1990	$1,202,514	$1,126,514
1991	$1,210,722	$1,134,722
1992	$1,211,064	$1,135,064
1993-2008	$1,211,406	$1,135,406

5. PACIFICO AND BANANA LINES

When combining these sections of INCOFER, Tables A.11.1-A.11.4 and Tables C.11.1-C.11.4 can be used.

Under this combination scenario it was assumed, because of the break in continuity between the sections, that one dispatching office would be necessary on each section. The administration cost was estimated on the basis that the main portion of the administration would be amalgamated with the Banana Lines but one-third of the Pacifico total would be added for handling the satellite section.

The direct labour component for the scenario follows:

	(A1 + C1)	(A2 + C2)
1988	$1,152,721	$1,082,321
1989	$1,159,903	$1,089,503
1990	$1,165,375	$1,094,975
1991	$1,177,345	$1,106,945
1992	$1,177,345	$1,106,945
1993-2008	$1,177,345	$1,106,945

6. ATLANTICO AND PACIFICO LINES

When combining these sections of INCOFER, Tables A.11.1-A.11.4 and Tables B.11.1-B.11.4 are used.

Under this combination scenario the direct labour portion reflects an amalgamation of dispatching and administration functions along with a reduction in the miscellaneous labour component

The direct labour component follows:

	(B1 + C1)	(B2 + C2)
1988	$772,765	$819,965
1989	$772,765	$819,965
1990	$773,449	$820,649
1991	$777,895	$825,095
1992	$778,237	$825,437
1993-2008	$778,579	$835,779

7. ATLANTICO, PACIFICO, AND BANANA LINES

When combining these sections of INCOFER, Tables A.11.1-A.1.4, Tables B.11.1-B.11.4, and Tables C.11.1-C.11.4 are used.

The direct labour estimate reflects the amalgamation of dispatching functions over the lines. The administration functions will be amalgamated and assumed to be the cost of the Banana Lines in the overall cost estimates.

The direct labour component for the scenario follows:

	(A1+B1+C1)	(A2+B2+C2)
1988	$1,551,450	$1,501,850
1989	$1,558,632	$1,509,032
1990	$1,564,446	$1,514,846
1991	$1,576,758	$1,527,158
1992	$1,577,100	$1,527,500
1993-2008	$1,577,442	$1,527,842

8. MECHANICAL ESTIMATES

8.1 FUEL CONSUMPTION ESTIMATES

Whenever sufficient detailed data is available, the Consultant utilizes a Train Performance Calculator (T.P.C.) to estimate the fuel consumed by a train consist over a section of railroad. One of the critical inputs to this program is detailed track profile that can be coded and supplied to the T.P.C. as an input. In this case no such profile was available. The Consultant therefore had to estimate fuel consumption based upon average gradients between points on the railroad and use standard consumption equations with average consumption characteristics of the locomotives in question.

The remainder of this section will present a summary of the fuel consumption estimates and details regarding the calculations.

8.1.1 Fuel Consumption Summary

Loaded Train: Assume a tonnage rating of 210 tonnes/locomotive

Assume 2 x 1100 HP locomotives per train

Assume 420 gross tonnes or 462 short tonnes per train

Fuel Consumed by Sections:	225 litres	
	310 ''	
	637 ''	
	38 ''	
	73 ''	(2 hours idling)
	1,283 litres	TOTAL

Empty Train: Assume 7 wagons @ 20 tonnes each

Fuel Consumed by Section:	83 litres	
	130 ''	
	325 ''	
	73 ''	(2 hours idling)
	611 litres	TOTAL

Assumptions: 25 km/hour allowable on grades

50 km/hour allowable on flats

8.1.2 Details of Fuel Consumption in Loaded Direction

For the loaded direction we assume a trailing tonnage of 210 tonnes per locomotive or 231 tonnes for the 2 locomotive consist. This implies a total trailing tonnage per train of 462 tonnes. The gross tractive effort capacity of the 2 locomotives is 57,240 lbs.

Grade Calculation: 57,240 = (159*20x)+(462*6)+(462*20x)

= 3180x + 2772 + 9240x

= 54,468 = 12,420x

x = 4.4% Gradient

Figure H.1 shows elevations used in the process of these calculations.

Section 1: Moin-Peralta

462 Short Tonnes Trailing

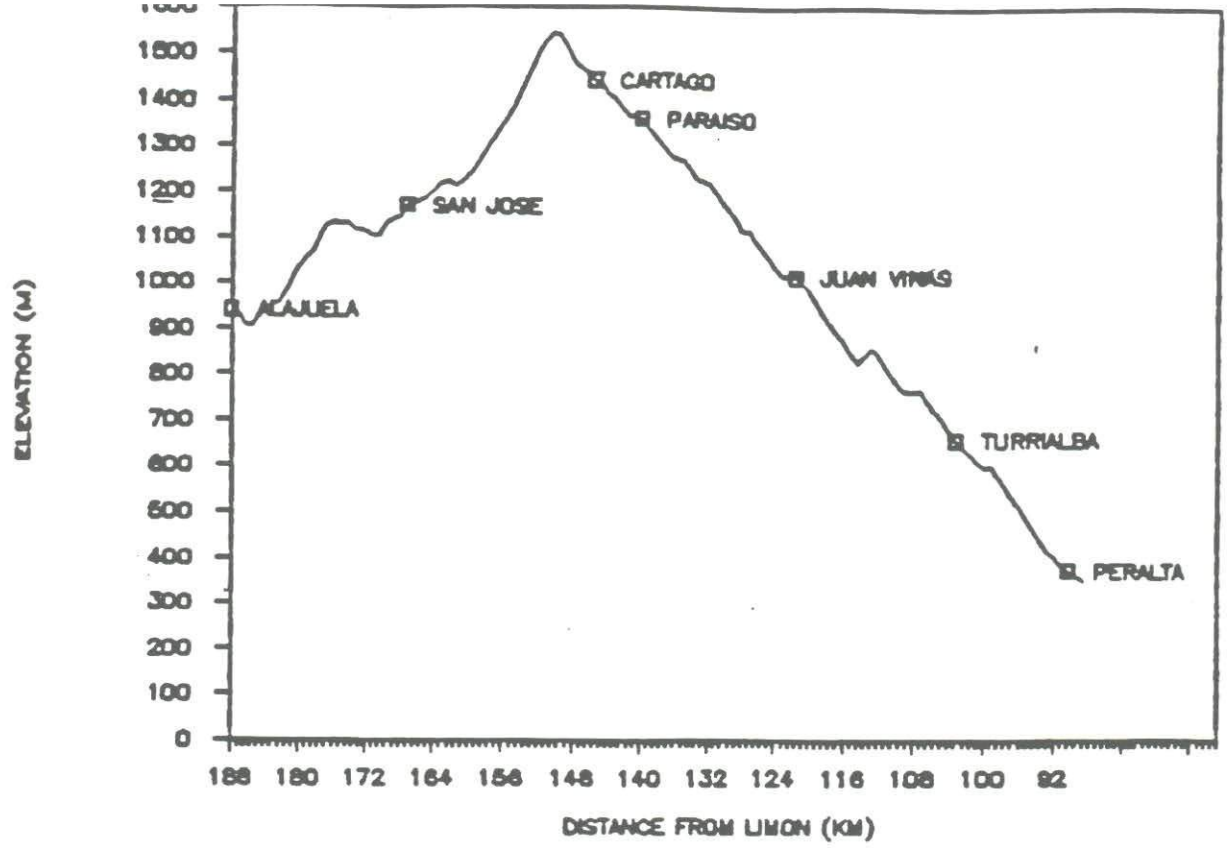
Rolling Resistance on Flat, say 9 lb/tonne
Tractive Effort Required = 4,158 lbs.

Time Required over Section 1 @ 50 km/hour maximum = 1.66 hours (say 2 hours)

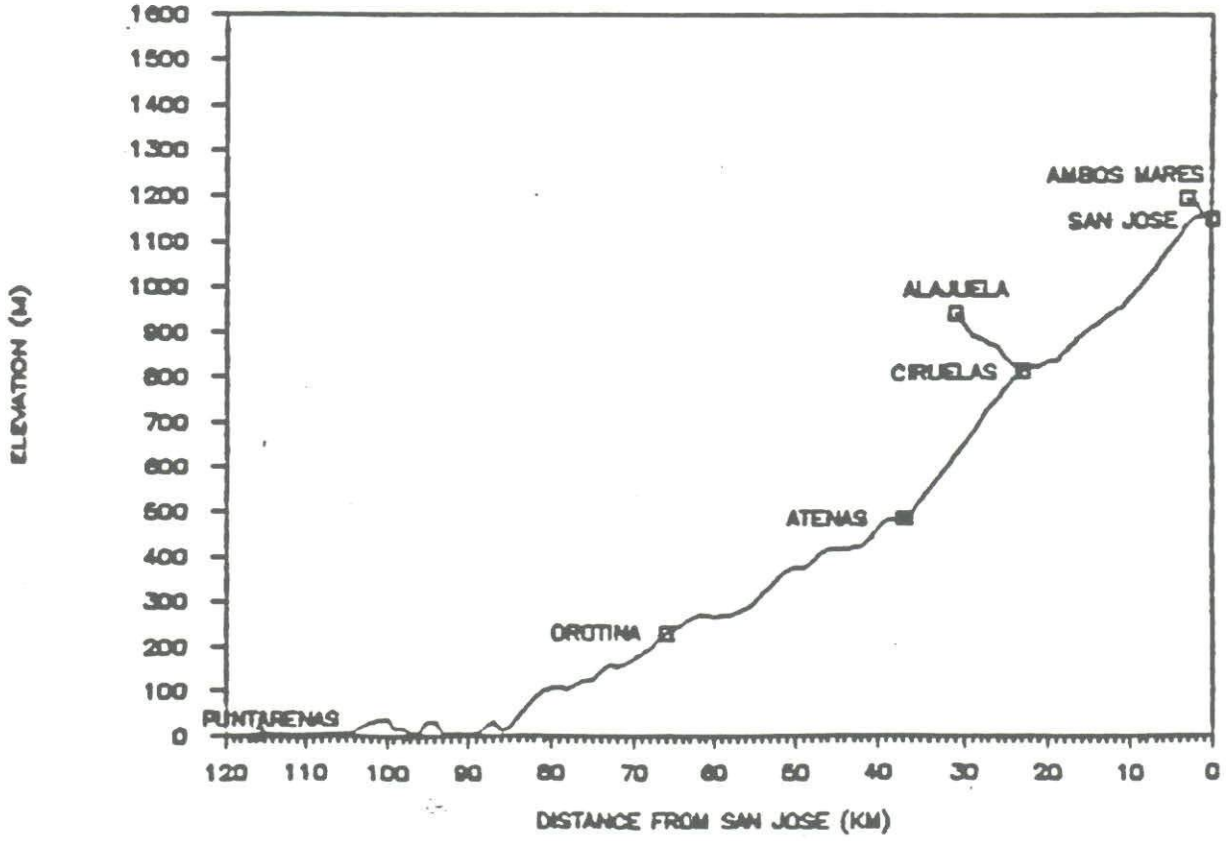
Horsepower Required = (4158*30)/305 = 410

Fuel Consumed = 60*(410/1000)* 2 hours = 49.2 imperial gallons

= 225 litres



PROFILE OF PACIFIC RAILWAY



Section 2: Peralta-Summit

Length 59 kms.

a) Assume 20% of the work is at gradient and curve resistance of 4.4%.

b) Assume 80% of the work is at mean gradient of 2.0%.

c) Speed on 4.4% gradient V = (305*H.P/)/Gross T.E.
= (305*2200)/57240 = 11.7 mph
= 19 km/hour

Distance 0.2*59 kms = 11.8 kms

Time on maximum gradient = 11.8/19 = 0.62 hours

Fuel Consumed = 50*(2200/1000)*0.62 = 68 imperial gallons
= 310 litres

d) Tractive Effort Required on 2.0% gradient
462*46 = 21,252 lbs.
plus locomotives 159*40 = 6,360 lbs.
27,612 lbs.

Speed = (305*2200)/27612 = 24 mph
= 38 km/hours

(This value is too high because of curvature so use 25 km/hour for calculations)

Distance: 0.8*59 kms = 47 kms

Horsepower at 25 km/hour = (27,612*15.5)/305
= 1403 H.P.

Time on Section 47 kms/25 km/hour = 1.88 hours
(say 2 hours)

Fuel Consumed = 50*(1403/1000)*2 hours = 140 imperial gallons
= 637 litres

Section 3: Summit - San José

Assume Track Speed limited to 30 km/hour descending

Time on Section 24 kms/30 km/hour = 0.8 hours

Assume 80% Idling - 20% Low Throttle Position

Fuel Consumed = (0.8(2*4I.G./hour)+0.2(20I.G./hour))*0.8
= (6.4 + 4.0)*0.8 = 8 imperial gallons
= 38 litres

Idling: Allow 2 hours idling on the trip = 2*(2*4IG/hour) = 16 imperial gallons
= 73 litres

GRAND TOTAL = 1,283 litres

Check: 2.8 imperial gallons/mile

8.1.3 Details of Fuel Consumption in Empty Direction

Assume 7 wagons @ 20 tonnes tare weight. This implies a gross trailing weight of 140 tonnes per train.

Section 1: Peralta-Moin

140 tonnes * 9 lbs./tonne = 1,260 lbs tractive effort
= say 1,400 lbs.

Horsepower at 50 km/hour = (1400*30)/305
= 140 H.P.

Transit Time = 2 hours

Fuel Consumed = 65*(140/1000)*2 = 18 imperial gallons
= 83 litres

Section 2: Summit-Peralta

Section is all downgrade so assume a maximum track speed of 25 km/hour.

Transit Time = 59 kms/25km/hour = 2.36 hours
= (say 2.5 hours)

Assume 80% Idling and 20% Low Throttle
= 11.4*2.5 hours = 28.5 imperial gallons
= 130 litres

Section 3: San José-Summit

Transit Time of 1 hour (24 kms)

Assume 4.0% gradient for the whole distance

Tractive effort = 140*86 = 12,040 lbs for wagons

+ 12,720 for locomotives

24,760 for train

Horsepower = (24,760*16)/305 = 1,300 HP

Fuel Consumed = (1300/1000)*55*1 = 71.5 imperial gallons
= 325 litres

Idling: Allow 2 hours idling for the trip = 73 litres

GRAND TOTAL = 611 litres

Check: 1.3 imperial gallons/mile

8.2 MECHANICAL OVERHAUL ESTIMATES

8.2.1 1200 kW Electric Locomotive

In order to estimate the overhaul cost of this locomotive class, the Consultant will use the GY09 class for comparison and make inferences from this base.

The average overhaul cost for this class was about $110,000 Cdn. in 1988. An electric locomotive should be about 50% of this - say $60,000 Cdn. If the units have not been properly maintained all motors will require repair - say $25,000 Cdn. Another component of the overhaul that will be necessary will be modifications and upgrading - say $15,000 Cdn.

The total direct cost is thus approximately $100,000 Cdn.

Shop Overheads:	50% on Labour = 0.5*45,000 =	$22,500
	15% of Labour on Material	6,750
	2% on Material	1,100
		30,350

Total shop cost to overhaul = $130,000 Cdn. per unit

8.2.2 1100 HP Diesel Electric Locomotive

Use $120,000 Cdn. per unit

8.2.3 640 HP and 820 HP Diesel Electric Switcher Units

Use $120,000 Cdn. per unit

8.2.4 Rolling Stock Fleet

General (not light) wagon repairs in 1986 on CP Rail totalled 1779 wagons. The main shops have 256 employees dedicated to the repair of wagons.

The tradesmen budget estimate of direct labour

= $15/hour*249 days*8 hours*256 = $7,649,280

This translates to $4,229 per wagon repaired

Main shops overhead = 50% of direct labour = $2,115

Material (50/50 labour/material) = $4,229

Overhead on Material (15% of direct labour) = $634

Overhead on Material (2% of Material) = $85

Shop Cost per Heavy Repair on CP Rail = $11,292

Update to 1988, Add 10% = $12,500 Cdn.

Box Cars: Use CP Rail Mean Price

Flat Cars: Use 80% of Mean Price - $10,000 Cdn.

Gondolas: Use CP Mean Price

TABLE H.2.4

ROLLING STOCK SUMMARY

TYPE	CONDITION 020%	2140%	4160%	6180%	81100%	TOTAL	AVERAGE CONDITION
Box	38	45	141	528	7	759	64.69%
Flat	8	15	75	253	39	390	68.83%
Tank	-	12	89	3	-	104	50.14%
Coach	4	8	33	37	-	82	57.26%
SideDump	7	5	28	7	-	47	48.14%
Campame	5	9	15	12	-	41	48.48%
Caboose	-	-	19	10	-	29	60.51%
Otros	-	3	1	23	-	27	63.03%
Stock	2	1	13	-	-	16	46.25%
Baggage	-	1	8	1	-	10	57.00%
Gondola	-	-	4	5	-	9	62.11%
TOTAL	64	99	426	879	46	1514	63.08%
%	4.23	6.54	28.13	58.06	3.04	100.00	

Table H.2.4 shows rolling stock fleet summarized by rated condition expressed in percentage of new equipment. The majority of all wagons in all classes fall predominantly in the 61-80% condition category. The only exceptions are side-dump and tank wagons. These two classes will be assumed to have an overhaul cost of 20% more than the CP Mean Price to reflect this deteriorated condition.

Side-Dumps: Use 120% of CP Mean Price - $15,000 Cdn.

Tanks: Use 120% of CP Mean Price - $15,000 Cdn.

8.3 ANNUAL MAINTENANCE COST ESTIMATES

8.3.1 1200 kW Electric Locomotives

For the 1200 kW electric locomotives use 50% of the average maintenance cost of 1200-1750 HP CP Rail diesel electric fleet.

Use $2500/month/unit direct

Overheads of $800/month

Total $3300/month - hence 50% = $1650 Cdn./month

Annual Cost per Unit = $1650*12 = $19,800 Cdn.

8.3.2 1100 HP Diesel Electric Locomotive

Use $24,000 Cdn./unit

8.3.3 640 HP and 820 HP Diesel Electric Switchers

Use $1200 Cdn./month

Annual Cost Per Unit = $1200*12 = $14,400 Cdn.

8.3.4 Rolling Stock Fleet

Estimated 20,000 miles/wagon/year

As of December 1986 the CP Rail Revenue Wagon Fleet numbered 52,057 wagons. These wagons operated a total of 1,747,000,000 miles during that year. On average each wagon operated 33,559 miles.

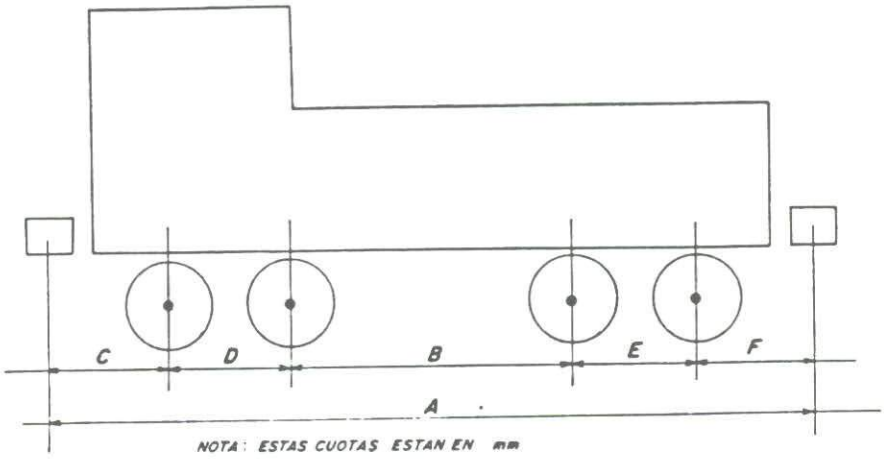
Based on this utilization the average costs were 6 cents per car mile direct and 1.5 cents per car mile overheads - Total 7.5 cents per car mile total

Annual Running Maintenance Cost per Wagon

= 20,000*$0.075 = $1,500 Cdn.

8.4 OPERATING COST/ENGINE HOUR FOR SWITCHERS

Figure H.4 summarizes the characteristics of the 640 HP and 820 HP locomotives under consideration.



NOTA: ESTAS CUOTAS ESTAN EN mm

SERIE	PESO	Nº EJES	POTENCIA (HP)	A	B	C	D	E	F
50-51-52 53-55-56 57-58-59	52	4	640	11.270	3.610	1.750	2.080	2.080	1.750
54-75-76 77-78-79	54.5	4	820	11.270	3.610	1.750	2.080	2.080	1.750
80-81-82 83-84-85 86-87-88 89	56.8	4	1.100	12.800	4.870	2.010	2.080	2.080	1.760

DATOS GENERALES
LOCOMOTORAS DIESEL-ELECTRICAS

A typical CP Rail yard engine/branchline engine operates approximately 2200 miles per month at an average speed of 6 miles/hour. This translates to a utilization of 367 engine hours per month.

Running Repair Costs:

-	Direct Labour and Material	$1,000/month
-	Overheads	$ 300/month
-	Total	$1,300 Cdn./month

Running Repair Cost per Hour used for 640 HP Locomotives: Say $4.00

(Overhauls not done, fire and wreck not included)

Increment for 820 HP over 620 HP say 30%

Assuming the same load factor, say 15% Say $4.50

Operating Costs: 367 hours per month

Fuel Consumption: 640 HP @ 20% Load Factor = 128 HP
820 HP @ 20% Load Factor = 164 HP

Per Hour 640 HP = 6.4 gallons
Per Hour 820 HP = 8.2 gallons

During Service Time: 640 6.4G*4.55L/G*$0.25/L = $7.28 Cdn./hour
820 8.2G*4.55/G *$0.25/L = $9.33 Cdn./hour.

During Idling Time: 10 litres/hour = $2.50 Cdn./hour

Lubricating Oil, Add 5% to Fuel Cost (i.e. $0.36 and $0.48).

8.5 INFRASTRUCTURE

In order to maintain the overhauled locomotives and rolling stock, a running repair facility will be required at Moin. The shop at Limon is beyond reasonable repair and is also badly situated to properly access the locomotives and rolling stock. Only those scenarios such as the Atlantic Line, the Banana Line and combinations which involve Moin Yard will have to address this improvement.

The shop has been estimated at 12,000 sq. ft. at an estimate cost of $50/sq. ft. or $600,000 Cdn. This estimate has a range of 25% plus or minus.

The equipment to be included is as follows:

15/3 t crane	$100,000
Fork-lift	20,000
Wheel lathe (used)	100,000
Office, stores	50,000
Portable 2t crane	15,000
Miscellaneous tools	100,000
Fuel tank and dropsiding equipment	75,000
	$460,000 Cdn.

An overall estimate of the cost of this installation for study purposes is $800,000 US.

Lubricating oil add 5% to fuel cost i.e. $0.36 and $0.48.

8.6 RADIO UNIT PRICES

Packset portable (lunch bucket) PX300 Motorola	
- 136-174 MHz synthesized, 10 watts output	$4,088 Cdn.
- Shoulder strap	12
- DTMF microphone	32
- NICAD battery pack	443
	$4,575 Cdn.
- 1 hour 4 unit rapid charger	$ 300 Cdn.
Handheld HT90 portable Motorola	
- 136-174 MHz, 5 watts output	$ 744 Cdn.
- Strap	20
- NICAD pack included	0
- Antenna included	0
- 2 channel operation included	0
- Squelch included	0
	$ 764 Cdn.
- 220 volt 50 Hz NICAD charger (1 hour rapid)	$ 166 Cdn.

Maintenance	10%	of total capital cost	for 1 year
	15%	" "	2 years
	20%	" "	3 years
	25%	" "	+5 years

9. TRACK CAPACITY AND CIRCUIT TIME MODEL

The maximum tonnage limits and the train turnaround times which have been integral to the development of railroad modal splits and to the establishment of rolling stock requirements under the conditions of each of the scenarios, have been determined utilizing a ''track capacity and circuit time'' model.

This is a mathematical model which incorporates Queueing Theory in order to estimate the total travel time over a railway line. The random variations which affect the movement of trains are consolidated into formulae for calculation.

The line consisting of single track sections and intermediate sidings can be likened to a series of 'service stations' in the queueing theory sense of the phrase. A track section is a service station, which performs the service of conveying trains from one end to the other, and a siding is a space, where trains can wait, while the track section ahead is occupied by a train. The service time is the average transit time in both directions over the track section and the inter-arrival time is the average interval between trains of either direction at any point on the system.

When a meet occurs between two trains one train decelerates to stop and waits at the siding until the meeting train has passed the siding then it accelerates to enter the now unoccupied track section. The total delay of the train at a meet where it stops is composed of two parts: 1) the meeting delay, which consists of the delay during deceleration and acceleration and 2) the waiting time at the siding while the approaching train is occupying the track section ahead, approaching the siding. The meeting delay's portion of the total transit time from one terminal to another is calculated from the average number of meets to stop multiplied by an estimated length of each meeting delay. The waiting time's portion of the total transit time is calculated by means

of the queueing theory's formula for waiting time at a single service station multiplied by a correction factor (less than unity) which is derived from the degree of regularity of travel times over the track section (standard deviation). These waiting times are calculated for each track section and integrated over all track sections. The average waiting time over a track section will increase with train density due to increased congestion. It should also be noted that as the service time per block approaches the average interarrival time, the queueing (waiting) delay on the block will go to infinity under the formula. This is interpreted to convey the notion that trains must be handled considerably faster than the rate at which they arrive or else the system will be unable to process then through the block efficiently.

The model estimates the resulting delay of a track section being closed for maintenance when trains would be held either at terminals or at sidings at either end of the closed section. In all cases, the block closure delay was determined over the block section with the longest travel time in order to ensure that sufficient track capacity remained under the worst case for the model. The block closure delay is calculated by the product of the following terms: 1) frequency of track closures; 2) the probability of encountering a closure, and 3) the average length of the closure. During the duration of the block closure, there will be temporary increased congestion in the neighbourhood of the closed block. This will increase the waiting times and is brought into the model by reducing the average interarrival time for trains on these neighbouring sections.

The model has also included all of the identifiable delays which may be encountered at and between terminals so that a complete turnaround time may be estimated.

One portion of the model calculates the average serving time of each of the block sections, analyzes the capacity as a per block basis and, yields the average single direction total trip time between the two

terminals under review. The other section is concerned with the calculation of the total turnaround time. Train delays in the turnaround time section are either estimated and input to the model or are calculated using formulae based on the service time portion.

The total turnaround time generated is meant to estimate the total time required for an average INCOFER train to begin a trip at any point on the system and return to its initial point traversing through both phases of its trip - loaded and empty.

APPENDIX D

ECONOMIC EVALUATION

APPENDIX D

TABLE OF CONTENTS

I RAIL COSTS

ECONOMIC RAIL COST (Banana Line)

DEVELOPMENT SCENARIO A-1

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						15451.0			15451.0	15451.0
2						2285.0			2285.0	2285.0
3						2285.0			2285.0	2285.0
4	40288	0.0523	2108.0			2285.0		800.0	3085.0	5193.0
5	40288	0.0523	2108.0	1881.1	1048.8	1523.0			4452.9	6560.9
6	33747	0.0794	2680.3				28.0		28.0	2708.3
7	33747	0.0794	2680.3						0.0	2680.3
8	33747	0.0794	2680.3						0.0	2680.3
9	33747	0.0794	2680.3				7.1		7.1	2687.4
10	33747	0.0794	2680.3						0.0	2680.3
11	33747	0.0794	2680.3						0.0	2680.3
12	33747	0.0794	2680.3				7.1		7.1	2687.4
13	33747	0.0794	2680.3						0.0	2680.3
14	33747	0.0794	2680.3						0.0	2680.3
15	33747	0.0794	2680.3				7.1		7.1	2687.4
16	33747	0.0794	2680.3						0.0	2680.3
17	33747	0.0794	2680.3						0.0	2680.3
18	33747	0.0794	2680.3				7.1		7.1	2687.4
19	33747	0.0794	2680.3						0.0	2680.3
20	33747	0.0794	2680.3	-376.2	-209.8				-586.0	2094.3
TOTAL	586781		44420.5	1504.9	839.0	23829.0	56.4	800	27029.3	71449.8

LIFE CYCLE AVG. COST

339167 PV @ 5% @ 5% 0.146794 PRESENT VALUE @ 5% 49787.7

ECONOMIC RAIL COST (Banana Line) DEVELOPMENT SCENARIO A-2

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST							TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track	(Thousands of US $) Bridges	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						8362.0				8362.0	8362.0
2						2487.0				2487.0	2487.0
3						2487.0			800.0	3287.0	3287.0
4	40288	0.0523	2108.0	1881.1	1048.8	622.0				3551.9	5659.9
5	33747	0.0701	2364.9					28.0		3579.9	5944.8
6	33747	0.0701	2364.9							0.0	2364.9
7	33747	0.0701	2364.9							0.0	2364.9
8	33747	0.0701	2364.9					7.1		7.1	2372.0
9	33747	0.0701	2364.9							0.0	2364.9
10	33747	0.070'	2364.9							0.0	2364.9
11	33747	0.0701	2364.9					7.1		7.1	2372.0
12	33747	0.0701	2364.9							0.0	2364.9
13	33747	0.0701	2364.9							0.0	2364.9
14	33747	0.0701	2364.9					7.1		7.1	2372.0
15	33747	0.0701	2364.9							0.0	2364.9
16	33747	0.0701	2364.9							0.0	2364.9
17	33747	0.0701	2364.9					7.1		7.1	2372.0
18	33747	0.0701	2364.9							0.0	2364.9
19	33747	0.0701	2364.9							0.0	2364.9
20	33747	0.0701	2364.9	-376.2	-209.8			7.1		-578.9	1786.0
TOTAL	580240		39946.4	1504.9	839.0	13958.0		63.5	800.0	20717.3	60663.7

LIFE CYCLE AVG. COST

334042	PV @ 5%	@ 5%	0.123948	PRESENT VALUE @ 5%	41403.9

ECONOMIC RAIL COST (Banana Line)

DEVELOPMENT SCENARIO A-1

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST (Thousands of US $)						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						15451.0			15451.0	15451.0
2						2285.0			2285.0	2285.0
3						2285.0			2285.0	2285.0
4	40288	0.0562	2264.0			2285.0		800.0	3085.0	5349.0
5	40288	0.0562	2264.0	1881.1	1048.8	1523.0			4452.9	6716.9
6	33747	0.0794	2680.3				28.0		28.0	2708.3
7	33747	0.0794	2680.3						0.0	2680.3
8	33747	0.0794	2680.3						0.0	2680.3
9	33747	0.0794	2680.3				7.1		7.1	2687.4
10	33747	0.0794	2680.3						0.0	2680.3
11	33747	0.0794	2680.3						0.0	2680.3
12	33747	0.0794	2680.3				7.1		7.1	2687.4
13	33747	0.0794	2680.3						0.0	2680.3
14	33747	0.0794	2680.3						0.0	2680.3
15	33747	0.0794	2680.3				7.1		7.1	2687.4
16	33747	0.0794	2680.3						0.0	2680.3
17	33747	0.0794	2680.3						0.0	2680.3
18	33747	0.0794	2680.3				7.1		7.1	2687.4
19	33747	0.0794	2680.3						0.0	2680.3
20	33747	0.0794	2680.3	-376.2	-209.8				-586.0	2094.3
TOTAL	586781		44732.5	1504.9	839.0	23829.0	56.4	800	27029.3	71761.8

LIFE CYCLE AVG. COST

211912.4	PV @ 10%	@ 10%	0.179654	PRESENT VALUE @ 10%	38071.1

ECONOMIC RAIL COST (Banana Line)

DEVELOPMENT SCENARIO A-2

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST							TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	(Thousands of US $)							(Thousands of US $)
				Wagons	Locos	Track	Bridges	Sig./Tel	Builds.	Sub-Total	
1						8362.0				8362.0	8362.0
2						2487.0				2487.0	2487.0
3						2487.0			800.0	3287.0	3287.0
4	40288	0.0562	2264.0	1881.1	1048.8	622.0				3551.9	5815.9
5	33747	0.0701	2364.9				28.0			3579.9	5944.8
6	33747	0.0701	2364.9							0.0	2364.9
7	33747	0.0701	2364.9							0.0	2364.9
8	33747	0.0701	2364.9				7.1			7.1	2372.0
9	33747	0.0701	2364.9							0.0	2364.9
10	33747	0.0701	2364.9							0.0	2364.9
11	33747	0.0701	2364.9				7.1			7.1	2372.0
12	33747	0.0701	2364.9							0.0	2364.9
13	33747	0.0701	2364.9							0.0	2364.9
14	33747	0.0701	2364.9				7.1			7.1	2372.0
15	33747	0.0701	2364.9							0.0	2364.9
16	33747	0.0701	2364.9							0.0	2364.9
17	33747	0.0701	2364.9				7.1			7.1	2372.0
18	33747	0.0701	2364.9							0.0	2364.9
19	33747	0.0701	2364.9							0.0	2364.9
20	33747	0.0701	2364.9	-376.2	-209.8		7.1			-578.9	1786.0
TOTAL	580240		40102.4	1504.9	839.0	13958.0	63.5		800.0	20717.3	60819.7

LIFE CYCLE AVG. COST

207851.0	PV @ 10%	@ 10%	0.148578	PRESENT VALUE @ 10%	30882.27

ECONOMIC RAIL COST (Banana Line)

DEVELOPMENT SCENARIO A-1

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST (Thousands of US $)						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						15451.0			15451.0	15451.0
2						2285.0			2285.0	2285.0
3						2285.0			2285.0	2285.0
4	40288	0.0603	2429.0			2285.0		800.0	3085.0	5514.0
5	40288	0.0603	2429.0	1881.1	1048.8	1523.0			4452.9	6881.9
6	33747	0.0794	2680.3				28.0		28.0	2708.3
7	33747	0.0794	2680.3						0.0	2680.3
8	33747	0.0794	2680.3						0.0	2680.3
9	33747	0.0794	2680.3				7.1		7.1	2687.4
10	33747	0.0794	2680.3						0.0	2680.3
11	33747	0.0794	2680.3						0.0	2680.3
12	33747	0.0794	2680.3				7.1		7.1	2687.4
13	33747	0.0794	2680.3						0.0	2680.3
14	33747	0.0794	2680.3						0.0	2680.3
15	33747	0.0794	2680.3				7.1		7.1	2687.4
16	33747	0.0794	2680.3						0.0	2680.3
17	33747	0.0794	2680.3						0.0	2680.3
18	33747	0.0794	2680.3				7.1		7.1	2687.4
19	33747	0.0794	2680.3						0.0	2680.3
20	33747	0.0794	2680.3	-376.2	-209.8				-586.0	2094.3
TOTAL	586781		45062.5	1504.9	839.0	23829.0	56.4	800	27029.3	72091.8

LIFE CYCLE AVG. COST

141174	PV @ 15%	@ 15%	0.219681	PRESENT VALUE @ 15%	31013.2

ECONOMIC RAIL COST (Banana Line) DEVELOPMENT SCENARIO A-2

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST							TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	(Thousands of US $) Wagons	Locos	Track	Bridges	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						8362.0				8362.0	8362.0
2						2487.0				2487.0	2487.0
3						2487.0			800.0	3287.0	3287.0
4	40288	0.0603	2429.0	1881.1	1048.8	622.0				3551.9	5980.9
5	33747	0.0701	2364.9					28.0		3579.9	5944.8
6	33747	0.0701	2364.9							0.0	2364.9
7	33747	0.0701	2364.9							0.0	2364.9
8	33747	0.0701	2364.9					7.1		7.1	2372.0
9	33747	0.0701	2364.9							0.0	2364.9
10	33747	0.0701	2364.9							0.0	2364.9
11	33747	0.0701	2364.9					7.1		7.1	2372.0
12	33747	0.0701	2364.9							0.0	2364.9
13	33747	0.0701	2364.9							0.0	2364.9
14	33747	0.0701	2364.9					7.1		7.1	2372.0
15	33747	0.0701	2364.9							0.0	2364.9
16	33747	0.0701	2364.9							0.0	2364.9
17	33747	0.0701	2364.9					7.1		7.1	2372.0
18	33747	0.0701	2364.9							0.0	2364.9
19	33747	0.0701	2364.9							0.0	2364.9
20	33747	0.0701	2364.9	-376.2	-209.8			7.1		-578.9	1786.0
TOTAL	580240		40267.4	1504.9	839.0	13958.0		63.5	800.0	20717.3	60984.7

LIFE CYCLE AVG. COST

137921	PV @ 15%	@ 15%	0.177881	PRESENT VALUE @ 15%	24533.6

ECONOMIC RAIL COST (Atlantico Line) DEVELOPMENT SCENARIO B-1

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST							TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Elect.	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						7396.0				7396.0	7396.0
2						9780.0	3360.0	1727.0		14867.0	14867.0
3						6012.0	5040.0	2590.0	800.0	14442.0	14442.0
4	43451	0.0357	1552.0	836.8	1186.0	2004.0	2100.0	1079.0		7205.8	8757.8
5	43687	0.0442	1929.3	9.5				22.0		31.5	1960.8
6	44421	0.0436	1936.8	11.4						11.4	1948.2
7	44421	0.0436	1936.8							0.0	1936.8
8	44421	0.0436	1936.8					7.1		7.1	1943.9
9	44421	0.0436	1936.8							0.0	1936.8
10	44421	0.0436	1936.8							0.0	1936.8
11	44421	0.0436	1936.8					7.1		7.1	1943.9
12	44421	0.0436	1936.8							0.0	1936.8
13	44421	0.0436	1936.8							0.0	1936.8
14	44421	0.0436	1936.8					7.1		7.1	1943.9
15	44421	0.0436	1936.8							0.0	1936.8
16	44421	0.0436	1936.8							0.0	1936.8
17	44421	0.0436	1936.8					7.1		7.1	1943.9
18	44421	0.0436	1936.8							0.0	1936.8
19	44421	0.0436	1936.8							0.0	1936.8
20	44421	0.0436	1936.8	-171.5	-237.2			7.1		-401.6	1535.2
TOTAL	753453		32533.3	686.2	948.8	25192.0	10500.0	5453.5	800.0	43580.5	76113.8

LIFE CYCLE AVG. COST

431241	PV @ 5%	@ 5%	0.133034	PRESENT VALUE @ 5%	57369.8

ECONOMIC RAIL COST (Atlantico Line) DEVELOPMENT SCENARIO B-2

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	(Thousands of US $) Bridges	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						4115.0				4115.0	4115.0
2						5126.0				5126.0	5126.0
3						2230.0			800.0	3030.0	3030.0
4	43451	0.0357	1552.0	836.8	1186.0	1300.0				3322.8	4874.8
5	43687	0.0396	1729.3	9.5			22.0			31.5	1760.8
6	44421	0.0391	1736.7	11.4						11.4	1748.1
7	44421	0.0391	1736.7							0.0	1736.7
8	44421	0.0391	1736.7				7.1			7.1	1743.8
9	44421	0.0391	1736.7							0.0	1736.7
10	44421	0.0391	1736.7							0.0	1736.7
11	44421	0.0391	1736.7				7.1			7.1	1743.8
12	44421	0.0391	1736.7							0.0	1736.7
13	44421	0.0391	1736.7							0.0	1736.7
14	44421	0.0391	1736.7				7.1			7.1	1743.8
15	44421	0.0391	1736.7							0.0	1736.7
16	44421	0.0391	1736.7							0.0	1736.7
17	44421	0.0391	1736.7				7.1			7.1	1743.8
18	44421	0.0391	1736.7							0.0	1736.7
19	44421	0.0391	1736.7							0.0	1736.7
20	44421	0.0391	1736.7	-171.54	-237.2		7.1			-401.6	1335.1
TOTAL	753453		29331.8	686.2	948.8	12771.0	57.5		800.0	15263.5	44595.3
	431241	PV @ 5%		@ 5%	0.070895	PRESENT VALUE @ 5%					30572.9

ECONOMIC RAIL COST (Atlantico Line) DEVELOPMENT SCENARIO B-1

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Elect.	Sig./Tel	Builds.	(Thousands of US $) Sub-Total	(Thousands of US $)
1						7396.0				7396.0	7396.0
2						9780.0	3360.0	1727.0		14867.0	14867.0
3						6012.0	5040.0	2590.0	800.0	14442.0	14442.0
4	43451	0.0383	1664.0	836.8	1186.0	2004.0	2100.0	1079.0		7205.8	8869.8
5	43687	0.0442	1929.3	9.5				22.0		31.5	1960.8
6	44421	0.0436	1936.8	11.4						11.4	1948.2
7	44421	0.0436	1936.8							0.0	1936.8
8	44421	0.0436	1936.8					7.1		7.1	1943.9
9	44421	0.0436	1936.8							0.0	1936.8
10	44421	0.0436	1936.8							0.0	1936.8
11	44421	0.0436	1936.8					7.1		7.1	1943.9
12	44421	0.0436	1936.8							0.0	1936.8
13	44421	0.0436	1936.8							0.0	1936.8
14	44421	0.0436	1936.8					7.1		7.1	1943.9
15	44421	0.0436	1936.8							0.0	1936.8
16	44421	0.0436	1936.8							0.0	1936.8
17	44421	0.0436	1936.8					7.1		7.1	1943.9
18	44421	0.0436	1936.8							0.0	1936.8
19	44421	0.0436	1936.8							0.0	1936.8
20	44421	0.0436	1936.8	-171.5	-237.2			7.1		-401.6	1535.2
TOTAL	753453		32645.3	686.2	948.8	25192.0	10500.0	5453.5	800.0	43580.5	76225.8

LIFE CYCLE AVG. COST

266594.2	PV @ 10%	@ 10%	0.173445	PRESENT VALUE @ 10%	46239.5

ECONOMIC RAIL COST (Atlantico Line) DEVELOPMENT SCENARIO B-2

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST (Thousands of US $)							TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						4115.0				4115.0	4115.0
2						5126.0				5126.0	5126.0
3						2230.0			800.0	3030.0	3030.0
4	43451	0.0410	1783.0	836.8	1186.0	1300.0				3322.8	5105.8
5	43687	0.0396	1729.3	9.5			22.0			31.5	1760.8
6	44421	0.0391	1736.7	11.4						11.4	1748.1
7	44421	0.0391	1736.7							0.0	1736.7
8	44421	0.0391	1736.7				7.1			7.1	1743.8
9	44421	0.0391	1736.7							0.0	1736.7
10	44421	0.0391	1736.7							0.0	1736.7
11	44421	0.0391	1736.7				7.1			7.1	1743.8
12	44421	0.0391	1736.7							0.0	1736.7
13	44421	0.0391	1736.7							0.0	1736.7
14	44421	0.0391	1736.7				7.1			7.1	1743.8
15	44421	0.0391	1736.7							0.0	1736.7
16	44421	0.0391	1736.7							0.0	1736.7
17	44421	0.0391	1736.7				7.1			7.1	1743.8
18	44421	0.0391	1736.7							0.0	1736.7
19	44421	0.0391	1736.7							0.0	1736.7
20	44421	0.0391	1736.7	-171.54	-237.2		7.1			-401.6	1335.1
TOTAL	753453		29562.8	686.2	948.8	12771.0	57.5		800.0	15263.5	44826.3

266594 PV @ 10% @ 10% 0.086244 PRESENT VALUE @ 10% 22992.3

ECONOMIC RAIL COST (Atlantico Line) DEVELOPMENT SCENARIO B-1

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elect.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						7396.0				7396.0	7396.0
2						9780.0	3360.0	1727.0		14867.0	14867.0
3						6012.0	5040.0	2590.0	800.0	14442.0	14442.0
4	43451	0.0410	1783.0	836.8	1186.0	2004.0	2100.0	1079.0		7205.8	8988.8
5	43687	0.0442	1929.3	9.5				22.0		31.5	1960.8
6	44421	0.0436	1936.8	11.4						11.4	1948.2
7	44421	0.0436	1936.8							0.0	1936.8
8	44421	0.0436	1936.8					7.1		7.1	1943.9
9	44421	0.0436	1936.8							0.0	1936.8
10	44421	0.0436	1936.8							0.0	1936.8
11	44421	0.0436	1936.8					7.1		7.1	1943.9
12	44421	0.0436	1936.8							0.0	1936.8
13	44421	0.0436	1936.8							0.0	1936.8
14	44421	0.0436	1936.8					7.1		7.1	1943.9
15	44421	0.0436	1936.8							0.0	1936.8
16	44421	0.0436	1936.8							0.0	1936.8
17	44421	0.0436	1936.8					7.1		7.1	1943.9
18	44421	0.0436	1936.8							0.0	1936.8
19	44421	0.0436	1936.8							0.0	1936.8
20	44421	0.0436	1936.8	-171.5	-237.2			7.1		-401.6	1535.2
TOTAL	753453		32764.3	686.2	948.8	25192.0	10500.0	5453.5	800.0	43580.5	76344.8

LIFE CYCLE AVG. COST

175703	PV @ 15%	@ 15%	0.221393	PRESENT VALUE @ 15%	38899.5

ECONOMIC RAIL COST (Atlantico Line) DEVELOPMENT SCENARIO B-2

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						4115.0				4115.0	4115.0
2						5126.0				5126.0	5126.0
3						2230.0			800.0	3030.0	3030.0
4	43451	0.0410	1783.0	836.8	1186.0	1300.0				3322.8	5105.8
5	43687	0.0396	1729.3	9.5			22.0			31.5	1760.8
6	44421	0.0391	1736.7	11.4						11.4	1748.1
7	44421	0.0391	1736.7							0.0	1736.7
8	44421	0.0391	1736.7				7.1			7.1	1743.8
9	44421	0.0391	1736.7							0.0	1736.7
10	44421	0.0391	1736.7							0.0	1736.7
11	44421	0.0391	1736.7				7.1			7.1	1743.8
12	44421	0.0391	1736.7							0.0	1736.7
13	44421	0.0391	1736.7							0.0	1736.7
14	44421	0.0391	1736.7				7.1			7.1	1743.8
15	44421	0.0391	1736.7							0.0	1736.7
16	44421	0.0391	1736.7							0.0	1736.7
17	44421	0.0391	1736.7				7.1			7.1	1743.8
18	44421	0.0391	1736.7							0.0	1736.7
19	44421	0.0391	1736.7							0.0	1736.7
20	44421	0.0391	1736.7	-171.54	-237.2		7.1			-401.6	1335.1
TOTAL	753453		29562.8	686.2	948.8	12771.0	57.5		800.0	15263.5	44826.3

175703 PV @ 15% @ 15% 0.104016 PRESENT VALUE @ 15% 18276.0

ECONOMIC RAIL COST (Pacifico Line) DEVELOPMENT SCENARIO C-1

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						7762.0				7762.0	7762.0
2						5410.0	5757.0	1620.0		12787.0	12787.0
3				759.4	767.6	2355.0	7037.0	1979.0		12898.0	12898.0
4	23877	0.0707	1687.0	114.0				14.2		128.2	1815.2
5	24993	0.0675	1687.0							0.0	1687.0
6	26217	0.0643	1687.0							0.0	1687.0
7	26387	0.0639	1687.0					7.1		7.1	1694.1
8	26448	0.0638	1687.0							0.0	1687.0
9	26448	0.0638	1687.0							0.0	1687.0
10	26448	0.0638	1687.0					7.1		7.1	1694.1
11	26448	0.0638	1687.0							0.0	1687.0
12	26448	0.0638	1687.0							0.0	1687.0
13	26448	0.0638	1687.0					7.1		7.1	1694.1
14	26448	0.0638	1687.0							0.0	1687.0
15	26448	0.0638	1687.0							0.0	1687.0
16	26448	0.0638	1687.0					7.1		7.1	1694.1
17	26448	0.0638	1687.0							0.0	1687.0
18	26448	0.0638	1687.0							0.0	1687.0
19	26448	0.0638	1687.0					7.1		7.1	1694.1
20	26448	0.0638	1687.0	-174.7	-153.5					-328.2	1358.8
TOTAL	445298		28679	698.72	614.08	15527	12794	3648.7		33282.5	61961.5

LIFE CYCLE AVG. COST

254105 @ 5% PV @ 5% 0.183242 PRESENT VALUE @ 5% 46563.0

ECONOMIC RAIL COST (Pacifico Line) DEVELOPMENT SCENARIO C-2

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST (Thousands of US $)						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Build.	Sub-Total	(Thousands of US $)
1						6085				6085.0	6085.0
2						4931				4931.0	4931.0
3						2714				2714.0	2714.0
4	29410	0.0357	1051.0	873.4	767.6	678				2319.0	3370.0
5	24993	0.0584	1459.4					14.2		14.2	1473.6
6	26217	0.0557	1459.4							0.0	1459.4
7	26387	0.0553	1459.4							0.0	1459.4
8	26448	0.0552	1459.4					7.1		7.1	1466.5
9	26448	0.0552	1459.4							0.0	1459.4
10	26448	0.0552	1459.4							0.0	1459.4
11	26448	0.0552	1459.4					7.1		7.1	1466.5
12	26448	0.0552	1459.4							0.0	1459.4
13	26448	0.0552	1459.4							0.0	1459.4
14	26448	0.0552	1459.4					7.1		7.1	1466.5
15	26448	0.0552	1459.4							0.0	1459.4
16	26448	0.0552	1459.4							0.0	1459.4
17	26448	0.0552	1459.4					7.1		7.1	1466.5
18	26448	0.0552	1459.4							0.0	1459.4
19	26448	0.0552	1459.4							0.0	1459.4
20	26448	0.0552	1459.4	-174.7	-153.5			7.1		-321.1	1138.3
TOTAL	450831		24401.4	698.72	614.08	14408		49.7		15770.5	40171.9

LIFE CYCLE AVG. COST

258657	@ 5%	PV @ 5%	0.109422	PRESENT VALUE @ 5%	28302.9

ECONOMIC RAIL COST (Pacifico Line) DEVELOPMENT SCENARIO C-1

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						7762.0				7762.0	7762.0
2						5410.0	5757.0	1620.0		12787.0	12787.0
3				759.4	767.6	2355.0	7037.0	1979.0		12898.0	12898.0
4	23877	0.0707	1687.0	114.0				14.2		128.2	1815.2
5	24993	0.0675	1687.0							0.0	1687.0
6	26217	0.0643	1687.0							0.0	1687.0
7	26387	0.0639	1687.0					7.1		7.1	1694.1
8	26448	0.0638	1687.0							0.0	1687.0
9	26448	0.0638	1687.0							0.0	1687.0
10	26448	0.0638	1687.0					7.1		7.1	1694.1
11	26448	0.0638	1687.0							0.0	1687.0
12	26448	0.0638	1687.0							0.0	1687.0
13	26448	0.0638	1687.0					7.1		7.1	1694.1
14	26448	0.0638	1687.0							0.0	1687.0
15	26448	0.0638	1687.0							0.0	1687.0
16	26448	0.0638	1687.0					7.1		7.1	1694.1
17	26448	0.0638	1687.0							0.0	1687.0
18	26448	0.0638	1687.0							0.0	1687.0
19	26448	0.0638	1687.0					7.1		7.1	1694.1
20	26448	0.0638	1687.0	-174.7	-153.5					-328.2	1358.8
TOTAL	445298		28679	698.72	614.08	15527	12794	3648.7		33282.5	61961.5

LIFE CYCLE AVG. COST

156573.3 @ 10% PV @ 10% 0.239706 PRESENT VALUE @ 10% 37531.57

ECONOMIC RAIL COST (Pacifico Line) DEVELOPMENT SCENARIO C-2

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Build.	Sub-Total	TOTAL (Thousands of US $)
1						6085				6085.0	6085.0
2						4931				4931.0	4931.0
3						2714				2714.0	2714.0
4	29410	0.0383	1126.0	873.4	767.6	678				2319.0	3445.0
5	24993	0.0584	1459.4					14.2		14.2	1473.6
6	26217	0.0557	1459.4							0.0	1459.4
7	26387	0.0553	1459.4							0.0	1459.4
8	26448	0.0552	1459.4					7.1		7.1	1466.5
9	26448	0.0552	1459.4							0.0	1459.4
10	26448	0.0552	1459.4							0.0	1459.4
11	26448	0.0552	1459.4					7.1		7.1	1466.5
12	26448	0.0552	1459.4							0.0	1459.4
13	26448	0.0552	1459.4							0.0	1459.4
14	26448	0.0552	1459.4					7.1		7.1	1466.5
15	26448	0.0552	1459.4							0.0	1459.4
16	26448	0.0552	1459.4							0.0	1459.4
17	26448	0.0552	1459.4					7.1		7.1	1466.5
18	26448	0.0552	1459.4							0.0	1459.4
19	26448	0.0552	1459.4							0.0	1459.4
20	26448	0.0552	1459.4	-174.7	-153.5			7.1		-321.1	1138.3
TOTAL	450831		24476.4	698.72	614.08	14408		49.7		15770.5	40246.9

LIFE CYCLE AVG. COST

160352	@ 10%	PV @ 10%	0.135749	PRESENT VALUE @ 10%	21767.8

ECONOMIC RAIL COST (Pacifico Line) DEVELOPMENT SCENARIO C-1

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						7762.0				7762.0	7762.0
2						5410.0	5757.0	1620.0		12787.0	12787.0
3				759.4	767.6	2355.0	7037.0	1979.0		12898.0	12898.0
4	23877	0.0707	1687.0	114.0				14.2		128.2	1815.2
5	24993	0.0675	1687.0							0.0	1687.0
6	26217	0.0643	1687.0							0.0	1687.0
7	26387	0.0639	1687.0					7.1		7.1	1694.1
8	26448	0.0638	1687.0							0.0	1687.0
9	26448	0.0638	1687.0							0.0	1687.0
10	26448	0.0638	1687.0					7.1		7.1	1694.1
11	26448	0.0638	1687.0							0.0	1687.0
12	26448	0.0638	1687.0							0.0	1687.0
13	26448	0.0638	1687.0					7.1		7.1	1694.1
14	26448	0.0638	1687.0							0.0	1687.0
15	26448	0.0638	1687.0							0.0	1687.0
16	26448	0.0638	1687.0					7.1		7.1	1694.1
17	26448	0.0638	1687.0							0.0	1687.0
18	26448	0.0638	1687.0							0.0	1687.0
19	26448	0.0638	1687.0					7.1		7.1	1694.1
20	26448	0.0638	1687.0	-174.7	-153.5					-328.2	1358.8
TOTAL	445298		28679	698.72	614.08	15527	12794	3648.7		33282.5	61961.5

LIFE CYCLE AVG. COST

102844 @ 15% PV @ 15% 0.307911 PRESENT VALUE @ 15% 31666.8

ECONOMIC RAIL COST (Pacifico Line) DEVELOPMENT SCENARIO C-2

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Build.	Sub-Total	(Thousands of US $)
1						6085				6085.0	6085.0
2						4931				4931.0	4931.0
3						2714				2714.0	2714.0
4	29410	0.0410	1207.0	873.4	767.6	678				2319.0	3526.0
5	24993	0.0584	1459.4						14.2	14.2	1473.6
6	26217	0.0557	1459.4							0.0	1459.4
7	26387	0.0553	1459.4							0.0	1459.4
8	26448	0.0552	1459.4						7.1	7.1	1466.5
9	26448	0.0552	1459.4							0.0	1459.4
10	26448	0.0552	1459.4							0.0	1459.4
11	26448	0.0552	1459.4						7.1	7.1	1466.5
12	26448	0.0552	1459.4							0.0	1459.4
13	26448	0.0552	1459.4							0.0	1459.4
14	26448	0.0552	1459.4						7.1	7.1	1466.5
15	26448	0.0552	1459.4							0.0	1459.4
16	26448	0.0552	1459.4							0.0	1459.4
17	26448	0.0552	1459.4						7.1	7.1	1466.5
18	26448	0.0552	1459.4							0.0	1459.4
19	26448	0.0552	1459.4							0.0	1459.4
20	26448	0.0552	1459.4	-174.7	-153.5				7.1	-321.1	1138.3
TOTAL	450831		24557.4	698.72	614.08	14408			49.7	15770.5	40327.9

LIFE CYCLE AVG. COST

106007 @ 15% PV @ 15% 0.167739 PRESENT VALUE @ 15% 17781.6

II ATLANTIC RAILWAY, PACIFIC RAILWAY, AND BANANA TRANSPORTATION SYSTEM: COST OF MOVING POTENTIAL RAIL TRAFFIC BY TRUCK

TRUCKING COSTS (BANANA TRAFFIC) SCENARIO A

(Economic Cost) (Avg. Cost Operator, 50% Load Factor, Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint./ Replacement	Vehicle Oper.	Vehicle Capital @ 5%	TOTAL
1					
2					
3					
4	40288	101	1578	430	2108
5	40288	101	1578	430	2108
6	40288	101	1578	430	2108
7	40288	101	1578	430	2108
8	40288	101	1578	430	2108
9	40288	101	1578	430	2108
10	40288	101	1578	430	2108
11	40288	101	1578	430	2108
12	40288	101	1578	430	2108
13	40288	101	1578	430	2108
14	40288	101	1578	430	2108
15	40288	101	1578	430	2108
16	40288	101	1578	430	2108
17	40288	101	1578	430	2108
18	40288	101	1578	430	2108
19	40288	101	1578	430	2108
20	40288	101	1578	430	2108
TOTAL	684896	1712	26818	7312	35842

PRESENT VALUE @ 5%	LIFE CYCLE AVG. COST	PV @ 5%
392363	0.05233239	20533

TRUCKING COSTS (ATLANTICO LINE) SCENARIO B

(Economic Cost) (Avg. Cost Operator, 75% Load Factor, Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint. & Replacement	Vehicle Oper.	Vehicle Capital @ 5%	TOTAL
1					
2					
3					
4	43451	109	1134	309	1552
5	44188	110	1154	314	1578
6	44946	112	1173	320	1606
7	44946	112	1173	320	1606
8	44946	112	1173	320	1606
9	44946	112	1173	320	1606
10	44946	112	1173	320	1606
11	44946	112	1173	320	1606
12	44946	112	1173	320	1606
13	44946	112	1173	320	1606
14	44946	112	1173	320	1606
15	44946	112	1173	320	1606
16	44946	112	1173	320	1606
17	44946	112	1173	320	1606
18	44946	112	1173	320	1606
19	44946	112	1173	320	1606
20	44946	112	1173	320	1606
TOTAL	761829	1905	19887	5422	27214

PRESENT VALUE @ 5%	LIFE CYCLE AVG. COST	PV @ 5%
435904	0.0357216	15571

TRUCKING COSTS (PACIFICO LINE) SCENARIO C

(Economic Cost) (Avg. Cost Operator, 75% Load Factor, Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint. & Replacement	Vehicle Oper.	Vehicle Capital @ 5%	TOTAL
1					
2					
3					
4	29410	74	768	209	1051
5	30693	77	801	218	1096
6	32080	80	837	228	1146
7	32318	81	844	230	1154
8	32392	81	846	231	1157
9	32392	81	846	231	1157
10	32392	81	846	231	1157
11	32392	81	846	231	1157
12	32392	81	846	231	1157
13	32392	81	846	231	1157
14	32392	81	846	231	1157
15	32392	81	846	231	1157
16	32392	81	846	231	1157
17	32392	81	846	231	1157
18	32392	81	846	231	1157
19	32392	81	846	231	1157
20	32392	81	846	231	1157
TOTAL	545597	1364	14242	3883	19490

PRESENT VALUE @ 5%	LIFE CYCLE AVG. COST	PV @ 5%
311395	0.0357216	11124

TRUCKING COSTS (BANANA TRAFFIC) SCENARIO A

(Economic Cost) (Avg. Cost Operator, 50% Load Factor, Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint./ Replacement	Vehicle Oper.	Vehicle Capital @ 10%	TOTAL
1					
2					
3					
4	40288	101	1578	586	2264
5	40288	101	1578	586	2264
6	40288	101	1578	586	2264
7	40288	101	1578	586	2264
8	40288	101	1578	586	2264
9	40288	101	1578	586	2264
10	40288	101	1578	586	2264
11	40288	101	1578	586	2264
12	40288	101	1578	586	2264
13	40288	101	1578	586	2264
14	40288	101	1578	586	2264
15	40288	101	1578	586	2264
16	40288	101	1578	586	2264
17	40288	101	1578	586	2264
18	40288	101	1578	586	2264
19	40288	101	1578	586	2264
20	40288	101	1578	586	2264
TOTAL	684896	1712	26818	9960	38491

PRESENT VALUE @ 10%	LIFE CYCLE AVG. COST	PV @ 10%
242804	0.05619933	13645

TRUCKING COSTS (ATLANTICO LINE) SCENARIO B

(Economic Cost) (Avg. Cost Operator, 75% Load Factor, Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint. & Replacement	Vehicle Oper.	Vehicle Capital @ 10%	TOTAL
1					
2					
3					
4	43451	109	1134	421	1664
5	44188	110	1154	428	1692
6	44946	112	1173	436	1721
7	44946	112	1173	436	1721
8	44946	112	1173	436	1721
9	44946	112	1173	436	1721
10	44946	112	1173	436	1721
11	44946	112	1173	436	1721
12	44946	112	1173	436	1721
13	44946	112	1173	436	1721
14	44946	112	1173	436	1721
15	44946	112	1173	436	1721
16	44946	112	1173	436	1721
17	44946	112	1173	436	1721
18	44946	112	1173	436	1721
19	44946	112	1173	436	1721
20	44946	112	1173	436	1721
TOTAL	761823	1905	19887	7386	29177

PRESENT VALUE @ 10%	LIFE CYCLE AVG. COST	PV @ 10%
269383	0.03829952	10317

TRUCKING COSTS (PACIFICO LINE) SCENARIO C

(Economic Cost) (Avg. Cost Operator, 75% Load Factor, Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint. & Replacement	Vehicle Oper.	Vehicle Capital @ 10%	TOTAL
1					
2					
3					
4	29410	74	768	285	1126
5	30693	77	801	298	1176
6	32080	80	837	311	1229
7	32318	81	844	313	1238
8	32392	81	846	314	1241
9	32392	81	846	314	1241
10	32392	81	846	314	1241
11	32392	81	846	314	1241
12	32392	81	846	314	1241
13	32392	81	846	314	1241
14	32392	81	846	314	1241
15	32392	81	846	314	1241
16	32392	81	846	314	1241
17	32392	81	846	314	1241
18	32392	81	846	314	1241
19	32392	81	846	314	1241
20	32392	81	846	314	1241
TOTAL	545597	1364	14242	5290	20896

PRESENT VALUE @ 10%	LIFE CYCLE AVG. COST	PV @ 10%
191911	0.03829952	7350

TRUCKING COSTS (BANANA TRAFFIC) SCENARIO A

(Economic Cost) (Avg. Cost Operator, 50% Load Factor, Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint./ Replacement	Vehicle Oper.	Vehicle Capital @ 15%	TOTAL
1					
2					
3					
4	40288	101	1578	751	2429
5	40288	101	1578	751	2429
6	40288	101	1578	751	2429
7	40288	101	1578	751	2429
8	40288	101	1578	751	2429
9	40288	101	1578	751	2429
10	40288	101	1578	751	2429
11	40288	101	1578	751	2429
12	40288	101	1578	751	2429
13	40288	101	1578	751	2429
14	40288	101	1578	751	2429
15	40288	101	1578	751	2429
16	40288	101	1578	751	2429
17	40288	101	1578	751	2429
18	40288	101	1578	751	2429
19	40288	101	1578	751	2429
20	40288	101	1578	751	2429
TOTAL	684896	1712	26818	12766	41297

PRESENT VALUE @ 15%	LIFE CYCLE AVG. COST	PV @ 15%
160189	0.06029604	9659

TRUCKING COSTS (ATLANTICO LINE) SCENARIO B

(Economic Cost) (Avg. Cost Operator, 75% Load Factor, Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint. & Replacement	Vehicle Oper.	Vehicle Capital @ 15%	TOTAL
1					
2					
3					
4	43451	109	1134	540	1783
5	44188	110	1154	549	1813
6	44946	112	1173	559	1844
7	44946	112	1173	559	1844
8	44946	112	1173	559	1844
9	44946	112	1173	559	1844
10	44946	112	1173	559	1844
11	44946	112	1173	559	1844
12	44946	112	1173	559	1844
13	44946	112	1173	559	1844
14	44946	112	1173	559	1844
15	44946	112	1173	559	1844
16	44946	112	1173	559	1844
17	44946	112	1173	559	1844
18	44946	112	1173	559	1844
19	44946	112	1173	559	1844
20	44946	112	1173	559	1844
TOTAL	761829	1905	19887	9467	31258

PRESENT VALUE @ 15%	LIFE CYCLE AVG. COST	PV @ 15%
177478	0.0410307	7282

TRUCKING COSTS (PACIFICO LINE) SCENARIO C

(Economic Cost) (Avg. Cost Operator, 75% Load Factor, Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint. & Replacement	Vehicle Oper.	Vehicle Capital @ 15%	TOTAL
1					
2					
3					
4	29410	74	768	365	1207
5	30693	77	801	381	1259
6	32080	80	837	399	1316
7	32318	81	844	402	1326
8	32392	81	846	403	1329
9	32392	81	846	403	1329
10	32392	81	846	403	1329
11	32392	81	846	403	1329
12	32392	81	846	403	1329
13	32392	81	846	403	1329
14	32392	81	846	403	1329
15	32392	81	846	403	1329
16	32392	81	846	403	1329
17	32392	81	846	403	1329
18	32392	81	846	403	1329
19	32392	81	846	403	1329
20	32392	81	846	403	1329
TOTAL	545597	1364	14242	6780	22386

PRESENT VALUE @ 15%	LIFE CYCLE AVG. COST	PV @ 15%
126082	0.0410307	5173

III COST FOR ALTERNATIVE RAIL SYSTEMS AND SENSITIVITY ANALYSES

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-1 & A-1

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Elect.	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						22847.0				22847.0	22847.0
2						12065.0	3360.0	1727.0		17152.0	17152.0
3						8297.0	5040.0	2590.0	800.0	16727.0	16727.0
4	80912	0.0440	3559.0	836.8	1186.0	4289.0	2100.0	1079.0		9490.8	13049.8
5	83975	0.0528	4437.5	1890.6	1048.8	1523.0		22.0		4484.4	8921.9
6	78168	0.0579	4522.4	11.4				28.0		39.4	4561.8
7	78168	0.0579	4522.4							0.0	4522.4
8	78168	0.0579	4522.4					7.1		7.1	4529.5
9	78168	0.0579	4522.4					7.1		7.1	4529.5
10	78168	0.0579	4522.4							0.0	4522.4
11	78168	0.0579	4522.4					7.1		7.1	4529.5
12	78168	0.0579	4522.4					7.1		7.1	4529.5
13	78168	0.0579	4522.4							0.0	4522.4
14	78168	0.0579	4522.4					7.1		7.1	4529.5
15	78168	0.0579	4522.4					7.1		7.1	4529.5
16	78168	0.0579	4522.4							0.0	4522.4
17	78168	0.0579	4522.4					7.1		7.1	4529.5
18	78168	0.0579	4522.4					7.1		7.1	4529.5
19	78168	0.0579	4522.4							0.0	4522.4
20	78168	0.0579	4522.4	-547.8	-447.0			7.1		-987.6	3534.8
TOTAL	1337407		75832.5	2191.0	1787.8	49021.0	10500.0	5509.9	800.0	69809.8	145642.3

LIFE CYCLE AVG. COST

768083	PV @ 5%	@ 5%	0.137953	PRESENT VALUE @ 5%	105959.7

ECONOMIC RAIL COST (Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-2 & A-2

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST (Thousands of US $)							TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						12477.0				12477.0	12477.0
2						7613.0				7613.0	7613.0
3						4717.0			800.0	5517.0	5517.0
4	80912	0.0440	3559.0	2717.9	2234.8	1922.0				6874.7	10433.7
5	77434	0.0516	3996.5	9.5			50.0			59.5	4056.0
6	78168	0.0512	4003.8	11.4						11.4	4015.2
7	78168	0.0512	4003.8							0.0	4003.8
8	78168	0.0512	4003.8				14.2			14.2	4018.0
9	78168	0.0512	4003.8							0.0	4003.8
10	78168	0.0512	4003.8							0.0	4003.8
11	78168	0.0512	4003.8				14.2			14.2	4018.0
12	78168	0.0512	4003.8							0.0	4003.8
13	78168	0.0512	4003.8							0.0	4003.8
14	78168	0.0512	4003.8				14.2			14.2	4018.0
15	78168	0.0512	4003.8							0.0	4003.8
16	78168	0.0512	4003.8							0.0	4003.8
17	78168	0.0512	4003.8				14.2			14.2	4018.0
18	78168	0.0512	4003.8							0.0	4003.8
19	78168	0.0512	4003.8							0.0	4003.8
20	78168	0.0512	4003.8	-547.8	-447.0		14.2			-980.5	3023.3
TOTAL	1330866		67612.5	2191.0	1787.8	26729.0	121.0		800.0	31628.9	99241.4

762957.5 PV @ 5% @ 5% 0.088534 PRESENT VALUE @ 5% 67547.75

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-1 & A-1

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elect.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						22847.0				22847.0	22847.0
2						12065.0	3360.0	1727.0		17152.0	17152.0
3						8297.0	5040.0	2590.0	800.0	16727.0	16727.0
4	80912	0.0472	3820.0	836.8	1186.0	4289.0	2100.0	1079.0		9490.8	13310.8
5	83975	0.0547	4593.5	1890.6	1048.8	1523.0		22.0		4484.4	9077.9
6	78168	0.0579	4522.4	11.4				28.0		39.4	4561.8
7	78168	0.0579	4522.4							0.0	4522.4
8	78168	0.0579	4522.4					7.1		7.1	4529.5
9	78168	0.0579	4522.4					7.1		7.1	4529.5
10	78168	0.0579	4522.4							0.0	4522.4
11	78168	0.0579	4522.4					7.1		7.1	4529.5
12	78168	0.0579	4522.4					7.1		7.1	4529.5
13	78168	0.0579	4522.4							0.0	4522.4
14	78168	0.0579	4522.4					7.1		7.1	4529.5
15	78168	0.0579	4522.4					7.1		7.1	4529.5
16	78168	0.0579	4522.4							0.0	4522.4
17	78168	0.0579	4522.4					7.1		7.1	4529.5
18	78168	0.0579	4522.4					7.1		7.1	4529.5
19	78168	0.0579	4522.4							0.0	4522.4
20	78168	0.0579	4522.4	-547.8	-447.0			7.1		-987.6	3534.8
TOTAL	1337407		76249.5	2191.0	1787.8	49021.0	10500.0	5509.9	800.0	69809.8	146059.3

LIFE CYCLE AVG. COST

476575.8 PV @ 10% @ 10% 0.175190 PRESENT VALUE @ 10% 83491.61

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-2 & A-2

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						12477.0				12477.0	12477.0
2						7613.0				7613.0	7613.0
3						4717.0			800.0	5517.0	5517.0
4	80912	0.0472	3820.0	2717.9	2234.8	1922.0				6874.7	10694.7
5	77434	0.0516	3996.5	9.5				50.0		59.5	4056.0
6	78168	0.0512	4003.8	11.4						11.4	4015.2
7	78168	0.0512	4003.8							0.0	4003.8
8	78168	0.0512	4003.8					14.2		14.2	4018.0
9	78168	0.0512	4003.8							0.0	4003.8
10	78168	0.0512	4003.8							0.0	4003.8
11	78168	0.0512	4003.8					14.2		14.2	4018.0
12	78168	0.0512	4003.8							0.0	4003.8
13	78168	0.0512	4003.8							0.0	4003.8
14	78168	0.0512	4003.8					14.2		14.2	4018.0
15	78168	0.0512	4003.8							0.0	4003.8
16	78168	0.0512	4003.8							0.0	4003.8
17	78168	0.0512	4003.8					14.2		14.2	4018.0
18	78168	0.0512	4003.8							0.0	4003.8
19	78168	0.0512	4003.8							0.0	4003.8
20	78168	0.0512	4003.8	-547.8	-447.0			14.2		-980.5	3023.3
TOTAL	1330866		67873.5	2191.0	1787.8	26729.0		121.0	800.0	31628.9	99502.4

472514.4 PV @ 10% @ 10% 0.106643 PRESENT VALUE @ 10% 50390.43

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-1 & A-1

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Elect.	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						22847.0				22847.0	22847.0
2						12065.0	3360.0	1727.0		17152.0	17152.0
3						8297.0	5040.0	2590.0	800.0	16727.0	16727.0
4	80912	0.0506	4096.0	836.8	1186.0	4289.0	2100.0	1079.0		9490.8	13586.8
5	83975	0.0567	4758.5	1890.6	1048.8	1523.0		22.0		4484.4	9242.9
6	78168	0.0579	4522.4	11.4				28.0		39.4	4561.8
7	78168	0.0579	4522.4							0.0	4522.4
8	78168	0.0579	4522.4					7.1		7.1	4529.5
9	78168	0.0579	4522.4					7.1		7.1	4529.5
10	78168	0.0579	4522.4							0.0	4522.4
11	78168	0.0579	4522.4					7.1		7.1	4529.5
12	78168	0.0579	4522.4					7.1		7.1	4529.5
13	78168	0.0579	4522.4							0.0	4522.4
14	78168	0.0579	4522.4					7.1		7.1	4529.5
15	78168	0.0579	4522.4					7.1		7.1	4529.5
16	78168	0.0579	4522.4							0.0	4522.4
17	78168	0.0579	4522.4					7.1		7.1	4529.5
18	78168	0.0579	4522.4					7.1		7.1	4529.5
19	78168	0.0579	4522.4							0.0	4522.4
20	78168	0.0579	4522.4	-547.8	-447.0			7.1		-987.6	3534.8
TOTAL	1337407		76690.5	2191.0	1787.8	49021.0	10500.0	5509.9	800.0	69809.8	146500.3

LIFE CYCLE AVG. COST

315260.2 PV @ 15% @ 15% 0.219858 PRESENT VALUE @ 15% 69312.66

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-2 & A-2

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						12477.0				12477.0	12477.0
2						7613.0				7613.0	7613.0
3						4717.0			800.0	5517.0	5517.0
4	80912	0.0506	4096.0	2717.9	2234.8	1922.0				6874.7	10970.7
5	77434	0.0516	3996.5	9.5			50.0			59.5	4056.0
6	78168	0.0512	4003.8	11.4						11.4	4015.2
7	78168	0.0512	4003.8							0.0	4003.8
8	78168	0.0512	4003.8				14.2			14.2	4018.0
9	78168	0.0512	4003.8							0.0	4003.8
10	78168	0.0512	4003.8							0.0	4003.8
11	78168	0.0512	4003.8				14.2			14.2	4018.0
12	78168	0.0512	4003.8							0.0	4003.8
13	78168	0.0512	4003.8							0.0	4003.8
14	78168	0.0512	4003.8				14.2			14.2	4018.0
15	78168	0.0512	4003.8							0.0	4003.8
16	78168	0.0512	4003.8							0.0	4003.8
17	78168	0.0512	4003.8				14.2			14.2	4018.0
18	78168	0.0512	4003.8							0.0	4003.8
19	78168	0.0512	4003.8							0.0	4003.8
20	78168	0.0512	4003.8	-547.8	-447.0		14.2			-980.5	3023.3
TOTAL	1330866		68149.5	2191.0	1787.8	26729.0	121.0		800.0	31628.9	99778.4

312008.2 PV @ 15% @ 15% 0.128581 PRESENT VALUE @ 15% 40118.47

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-1 & B-1 & C-1

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						30610.0				30610.0	30610.0
2						17475.0	9117.0	3347.0	800.0	30739.0	30739.0
3				759.4	767.6	10652.0	12077.0	4569.0		28825.0	28825.0
4	104789	0.0501	5246.1	950.8	1186	4289.0	2100.0	1093.2		9619.0	14865.1
5	108968	0.0521	5681.2	1890.6	1048.8	1523.0		22.0		4484.4	10165.6
6	104385	0.0592	6179.7	11.4				28.0		39.4	6219.1
7	104555	0.0591	6179.7					7.1		7.1	6186.8
8	104616	0.0591	6179.7					7.1		7.1	6186.8
9	104616	0.0591	6179.7					7.1		7.1	6186.8
10	104616	0.0591	6179.7					7.1		7.1	6186.8
11	104616	0.0591	6179.7					7.1		7.1	6186.8
12	104616	0.0591	6179.7					7.1		7.1	6186.8
13	104616	0.0591	6179.7					7.1		7.1	6186.8
14	104616	0.0591	6179.7					7.1		7.1	6186.8
15	104616	0.0591	6179.7					7.1		7.1	6186.8
16	104616	0.0591	6179.7					7.1		7.1	6186.8
17	104616	0.0591	6179.7					7.1		7.1	6186.8
18	104616	0.0591	6179.7					7.1		7.1	6186.8
19	104616	0.0591	6179.7					7.1		7.1	6186.8
20	104616	0.0591	6179.7	-722.4	-600.5			7.1		-1315.8	4863.8
TOTAL	1782705		103622.3	2889.76	2401.92	64549.0	23294	9158.6	800.0	103093.2	206715.5

LIFE CYCLE AVG. COST

1022187. @ 5% PV @ 5% 0.148670 PRESENT VALUE @ 5% 151969.0

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-2 & B-2 & C-2

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST Wagons	CAPITAL COST Locos	CAPITAL COST Track & Civil	CAPITAL COST Bridges	CAPITAL COST Sig./Tel	CAPITAL COST Builds.	CAPITAL COST Sub-Total	TOTAL (Thousands of US $)
1						18562.0				18562.0	18562.0
2						12544.0				12544.0	12544.0
3						7431.0			800.0	8231.0	8231.0
4	110017	0.0418	4599.0	3591.3	3002.4	2600.0				9193.7	13792.7
5	102427	0.0526	5387.8	9.5			64.2			73.7	5461.5
6	104385	0.0517	5395.1	11.4						11.4	5406.5
7	104555	0.0516	5395.1							0.0	5395.1
8	104616	0.0516	5395.1				21.3			21.3	5416.4
9	104616	0.0516	5395.1							0.0	5395.1
10	104616	0.0516	5395.1							0.0	5395.1
11	104616	0.0516	5395.1				21.3			21.3	5416.4
12	104616	0.0516	5395.1							0.0	5395.1
13	104616	0.0516	5395.1							0.0	5395.1
14	104616	0.0516	5395.1				21.3			21.3	5416.4
15	104616	0.0516	5395.1							0.0	5395.1
16	104616	0.0516	5395.1							0.0	5395.1
17	104616	0.0516	5395.1				21.3			21.3	5416.4
18	104616	0.0516	5395.1							0.0	5395.1
19	104616	0.0516	5395.1							0.0	5395.1
20	104616	0.0516	5395.1	-722.4	-600.5		21.3			-1301.6	4093.4
TOTAL	1781392		90912.76	2889.76	2401.92	41137.0	170.7		800.0	47399.38	138312.1

LIFE CYCLE AVG. COST

1021363.	@ 5%	PV @ 5%	0.093242	PRESENT VALUE @ 5%	95234.11

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-1 & B-1 & C-1

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						30610.0				30610.0	30610.0
2						17475.0	9117.0	3347.0	800.0	30739.0	30739.0
3				759.4	767.6	10652.0	12077.0	4569.0		28825.0	28825.0
4	104789	0.0526	5507.1	950.8	1186	4289.0	2100.0	1093.2		9619.0	15126.1
5	108968	0.0536	5837.2	1890.6	1048.8	1523.0		22.0		4484.4	10321.6
6	104385	0.0592	6179.7	11.4				28.0		39.4	6219.1
7	104555	0.0591	6179.7					7.1		7.1	6186.8
8	104616	0.0591	6179.7					7.1		7.1	6186.8
9	104616	0.0591	6179.7					7.1		7.1	6186.8
10	104616	0.0591	6179.7					7.1		7.1	6186.8
11	104616	0.0591	6179.7					7.1		7.1	6186.8
12	104616	0.0591	6179.7					7.1		7.1	6186.8
13	104616	0.0591	6179.7					7.1		7.1	6186.8
14	104616	0.0591	6179.7					7.1		7.1	6186.8
15	104616	0.0591	6179.7					7.1		7.1	6186.8
16	104616	0.0591	6179.7					7.1		7.1	6186.8
17	104616	0.0591	6179.7					7.1		7.1	6186.8
18	104616	0.0591	6179.7					7.1		7.1	6186.8
19	104616	0.0591	6179.7					7.1		7.1	6186.8
20	104616	0.0591	6179.7	-722.4	-600.5			7.1		-1315.8	4863.8
TOTAL	1782705		104039.3	2889.76	2401.92	64549.0	23294	9158.6	800.0	103093.2	207132.5

LIFE CYCLE AVG. COST

633149.1 @ 10% PV @ 10% 0.190584 PRESENT VALUE @ 10% 120668.5

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-2 & B-2 & C-2

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						18562.0				18562.0	18562.0
2						12544.0				12544.0	12544.0
3						7431.0			800.0	8231.0	8231.0
4	110017	0.0449	4935.0	3591.3	3002.4	2600.0				9193.7	14128.7
5	102427	0.0526	5387.8	9.5			64.2			73.7	5461.5
6	104385	0.0517	5395.1	11.4						11.4	5406.5
7	104555	0.0516	5395.1							0.0	5395.1
8	104616	0.0516	5395.1				21.3			21.3	5416.4
9	104616	0.0516	5395.1							0.0	5395.1
10	104616	0.0516	5395.1							0.0	5395.1
11	104616	0.0516	5395.1				21.3			21.3	5416.4
12	104616	0.0516	5395.1							0.0	5395.1
13	104616	0.0516	5395.1							0.0	5395.1
14	104616	0.0516	5395.1				21.3			21.3	5416.4
15	104616	0.0516	5395.1							0.0	5395.1
16	104616	0.0516	5395.1							0.0	5395.1
17	104616	0.0516	5395.1				21.3			21.3	5416.4
18	104616	0.0516	5395.1							0.0	5395.1
19	104616	0.0516	5395.1							0.0	5395.1
20	104616	0.0516	5395.1	-722.4	-600.5		21.3			-1301.6	4093.4
TOTAL	1781392		91248.76	2889.76	2401.92	41137.0	170.7		800.0	47399.38	138648.1

LIFE CYCLE AVG. COST

632658.5 @ 10% PV @ 10% 0.113468 PRESENT VALUE @ 10% 71786.67

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-1 & B-1 & C-1

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						30610.0				30610.0	30610.0
2						17475.0	9117.0	3347.0	800.0	30739.0	30739.0
3				759.4	767.6	10652.0	12077.0	4569.0		28825.0	28825.0
4	104789	0.0552	5783.1	950.8	1186	4289.0	2100.0	1093.2		9619.0	15402.1
5	108968	0.0551	6002.2	1890.6	1048.8	1523.0		22.0		4484.4	10486.6
6	104385	0.0592	6179.7	11.4				28.0		39.4	6219.1
7	104555	0.0591	6179.7					7.1		7.1	6186.8
8	104616	0.0591	6179.7					7.1		7.1	6186.8
9	104616	0.0591	6179.7					7.1		7.1	6186.8
10	104616	0.0591	6179.7					7.1		7.1	6186.8
11	104616	0.0591	6179.7					7.1		7.1	6186.8
12	104616	0.0591	6179.7					7.1		7.1	6186.8
13	104616	0.0591	6179.7					7.1		7.1	6186.8
14	104616	0.0591	6179.7					7.1		7.1	6186.8
15	104616	0.0591	6179.7					7.1		7.1	6186.8
16	104616	0.0591	6179.7					7.1		7.1	6186.8
17	104616	0.0591	6179.7					7.1		7.1	6186.8
18	104616	0.0591	6179.7					7.1		7.1	6186.8
19	104616	0.0591	6179.7					7.1		7.1	6186.8
20	104616	0.0591	6179.7	-722.4	-600.5			7.1		-1315.8	4863.8
TOTAL	1782705		104480.3	2889.76	2401.92	64549.0	23294	9158.6	800.0	103093.2	207573.5

LIFE CYCLE AVG. COST

418104.1 @ 15% PV @ 15% 0.240974 PRESENT VALUE @ 15% 100752.4

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-2 & B-2 & C-2

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						18562.0				18562.0	18562.0
2						12544.0				12544.0	12544.0
3						7431.0			800.0	8231.0	8231.0
4	110017	0.0481	5291.0	3591.3	3002.4	2600.0				9193.7	14484.7
5	102427	0.0526	5387.8	9.5			64.2			73.7	5461.5
6	104385	0.0517	5395.1	11.4						11.4	5406.5
7	104555	0.0516	5395.1							0.0	5395.1
8	104616	0.0516	5395.1				21.3			21.3	5416.4
9	104616	0.0516	5395.1							0.0	5395.1
10	104616	0.0516	5395.1							0.0	5395.1
11	104616	0.0516	5395.1				21.3			21.3	5416.4
12	104616	0.0516	5395.1							0.0	5395.1
13	104616	0.0516	5395.1							0.0	5395.1
14	104616	0.0516	5395.1				21.3			21.3	5416.4
15	104616	0.0516	5395.1							0.0	5395.1
16	104616	0.0516	5395.1							0.0	5395.1
17	104616	0.0516	5395.1				21.3			21.3	5416.4
18	104616	0.0516	5395.1							0.0	5395.1
19	104616	0.0516	5395.1							0.0	5395.1
20	104616	0.0516	5395.1	-722.4	-600.5		21.3			-1301.6	4093.4
TOTAL	1781392		91604.76	2889.76	2401.92	41137.0	170.7		800.0	47399.38	139004.1

LIFE CYCLE AVG. COST

417841.2 @ 15% PV @ 15% 0.137998 PRESENT VALUE @ 15% 57661.28

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-1 & C-1

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						23213.0				23213.0	23213.0
2						7695.0	5757.0	1620.0	800.0	15872.0	15872.0
3				759.4	767.6	4640.0	7037.0	1979.0		15183.0	15183.0
4	64165	0.0591	3795.1	114.0		2285.0		14.2		2413.2	6208.3
5	65281	0.0581	3795.1	1881.1	1048.8	1523.0				4452.9	8248.0
6	59964	0.0721	4321.5					28.0		28.0	4349.5
7	60134	0.0719	4321.5					7.1		7.1	4328.6
8	60195	0.0718	4321.5							0.0	4321.5
9	60195	0.0718	4321.5					7.1		7.1	4328.6
10	60195	0.0718	4321.5					7.1		7.1	4328.6
11	60195	0.0718	4321.5							0.0	4321.5
12	60195	0.0718	4321.5					7.1		7.1	4328.6
13	60195	0.0718	4321.5					7.1		7.1	4328.6
14	60195	0.0718	4321.5							0.0	4321.5
15	60195	0.0718	4321.5					7.1		7.1	4328.6
16	60195	0.0718	4321.5					7.1		7.1	4328.6
17	60195	0.0718	4321.5							0.0	4321.5
18	60195	0.0718	4321.5					7.1		7.1	4328.6
19	60195	0.0718	4321.5					7.1		7.1	4328.6
20	60195	0.0718	4321.5	-550.9	-363.3					-914.2	3407.3
TOTAL	1032079		72412.2	2203.6	1453.12	39356	12794	3705.1	800.0	60311.82	132724.0

LIFE CYCLE AVG. COST

593272.2 @ 5% PV @ 5% 0.161891 PRESENT VALUE @ 5% 96045.55

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-2 & C-2

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST Wagons	CAPITAL COST Locos	CAPITAL COST Track & Civil	CAPITAL COST Bridges	CAPITAL COST Sig./Tel	CAPITAL COST Builds.	CAPITAL COST Sub-Total	TOTAL (Thousands of US $)
1						14447.0				14447.0	14447.0
2						7418.0				7418.0	7418.0
3						5201.0			800.0	6001.0	6001.0
4	69393	0.0454	3148.0	2754.5	1816.4	1300.0				5870.9	9018.9
5	58740	0.0655	3846.2					42.2		42.2	3888.4
6	59964	0.0641	3846.2							0.0	3846.2
7	60134	0.0640	3846.2							0.0	3846.2
8	60195	0.0639	3846.2					14.2		14.2	3860.4
9	60195	0.0639	3846.2							0.0	3846.2
10	60195	0.0639	3846.2							0.0	3846.2
11	60195	0.0639	3846.2					14.2		14.2	3860.4
12	60195	0.0639	3846.2							0.0	3846.2
13	60195	0.0639	3846.2							0.0	3846.2
14	60195	0.0639	3846.2					14.2		14.2	3860.4
15	60195	0.0639	3846.2							0.0	3846.2
16	60195	0.0639	3846.2							0.0	3846.2
17	60195	0.0639	3846.2					14.2		14.2	3860.4
18	60195	0.0639	3846.2							0.0	3846.2
19	60195	0.0639	3846.2							0.0	3846.2
20	60195	0.0639	3846.2	-550.9	-363.3			14.2		-900.0	2946.2
TOTAL	1030766		64686.66	2203.6	1453.12	28366.0		113.2	800.0	32935.92	97622.58

LIFE CYCLE AVG. COST

592448.2 @ 5% PV @ 5% 0.113275 PRESENT VALUE @ 5% 67109.72

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-1 & C-1

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						23213.0				23213.0	23213.0
2						7695.0	5757.0	1620.0	800.0	15872.0	15872.0
3				759.4	767.6	4640.0	7037.0	1979.0		15183.0	15183.0
4	64165	0.0616	3951.1	114.0		2285.0		14.2		2413.2	6364.3
5	65281	0.0605	3951.1	1881.1	1048.8	1523.0				4452.9	8404.0
6	59964	0.0721	4321.5					28.0		28.0	4349.5
7	60134	0.0719	4321.5					7.1		7.1	4328.6
8	60195	0.0718	4321.5							0.0	4321.5
9	60195	0.0718	4321.5					7.1		7.1	4328.6
10	60195	0.0718	4321.5					7.1		7.1	4328.6
11	60195	0.0718	4321.5							0.0	4321.5
12	60195	0.0718	4321.5					7.1		7.1	4328.6
13	60195	0.0718	4321.5					7.1		7.1	4328.6
14	60195	0.0718	4321.5							0.0	4321.5
15	60195	0.0718	4321.5					7.1		7.1	4328.6
16	60195	0.0718	4321.5					7.1		7.1	4328.6
17	60195	0.0718	4321.5							0.0	4321.5
18	60195	0.0718	4321.5					7.1		7.1	4328.6
19	60195	0.0718	4321.5					7.1		7.1	4328.6
20	60195	0.0718	4321.5	-550.9	-363.3					-914.2	3407.3
TOTAL	1032079		72724.2	2203.6	1453.12	39356	12794	3705.1	800.0	60311.82	133036.0

LIFE CYCLE AVG. COST

368485.7 @ 10% PV @ 10% 0.204895 PRESENT VALUE @ 10% 75501.05

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-2 & C-2

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST Wagons	CAPITAL COST Locos	CAPITAL COST Track & Civil	CAPITAL COST Bridges	CAPITAL COST Sig./Tel	CAPITAL COST Builds.	CAPITAL COST Sub-Total	TOTAL (Thousands of US $)
1						14447.0				14447.0	14447.0
2						7418.0				7418.0	7418.0
3						5201.0			800.0	6001.0	6001.0
4	69393	0.0487	3379.0	2754.5	1816.4	1300.0				5870.9	9249.9
5	58740	0.0655	3846.2				42.2			42.2	3888.4
6	59964	0.0641	3846.2							0.0	3846.2
7	60134	0.0640	3846.2							0.0	3846.2
8	60195	0.0639	3846.2				14.2			14.2	3860.4
9	60195	0.0639	3846.2							0.0	3846.2
10	60195	0.0639	3846.2							0.0	3846.2
11	60195	0.0639	3846.2				14.2			14.2	3860.4
12	60195	0.0639	3846.2							0.0	3846.2
13	60195	0.0639	3846.2							0.0	3846.2
14	60195	0.0639	3846.2				14.2			14.2	3860.4
15	60195	0.0639	3846.2							0.0	3846.2
16	60195	0.0639	3846.2							0.0	3846.2
17	60195	0.0639	3846.2				14.2			14.2	3860.4
18	60195	0.0639	3846.2							0.0	3846.2
19	60195	0.0639	3846.2							0.0	3846.2
20	60195	0.0639	3846.2	-550.9	-363.3		14.2			-900.0	2946.2
TOTAL	1030766		64917.66	2203.6	1453.12	28366.0	113.2		800.0	32935.92	97853.58

LIFE CYCLE AVG. COST

367995.1	@ 10%	PV @ 10%	0.137376	PRESENT VALUE @ 10%	50553.99

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-1 & C-1

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST							TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						23213.0				23213.0	23213.0
2						7695.0	5757.0	1620.0	800.0	15872.0	15872.0
3				759.4	767.6	4640.0	7037.0	1979.0		15183.0	15183.0
4	64165	0.0641	4116.1	114.0		2285.0		14.2		2413.2	6529.3
5	65281	0.0631	4116.1	1881.1	1048.8	1523.0				4452.9	8569.0
6	59964	0.0721	4321.5					28.0		28.0	4349.5
7	60134	0.0719	4321.5					7.1		7.1	4328.6
8	60195	0.0718	4321.5							0.0	4321.5
9	60195	0.0718	4321.5					7.1		7.1	4328.6
10	60195	0.0718	4321.5					7.1		7.1	4328.6
11	60195	0.0718	4321.5							0.0	4321.5
12	60195	0.0718	4321.5					7.1		7.1	4328.6
13	60195	0.0718	4321.5					7.1		7.1	4328.6
14	60195	0.0718	4321.5							0.0	4321.5
15	60195	0.0718	4321.5					7.1		7.1	4328.6
16	60195	0.0718	4321.5					7.1		7.1	4328.6
17	60195	0.0718	4321.5							0.0	4321.5
18	60195	0.0718	4321.5					7.1		7.1	4328.6
19	60195	0.0718	4321.5					7.1		7.1	4328.6
20	60195	0.0718	4321.5	-550.9	-363.3					-914.2	3407.3
TOTAL	1032079		73054.2	2203.6	1453.12	39356	12794	3705.1	800.0	60311.82	133366.0

LIFE CYCLE AVG. COST

244017.4 @ 15% PV @ 15% 0.256925 PRESENT VALUE @ 15% 62694.39

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-2 & C-2

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						14447.0				14447.0	14447.0
2						7418.0				7418.0	7418.0
3						5201.0			800.0	6001.0	6001.0
4	69393	0.0522	3624.0	2754.5	1816.4	1300.0				5870.9	9494.9
5	58740	0.0655	3846.2					42.2		42.2	3888.4
6	59964	0.0641	3846.2							0.0	3846.2
7	60134	0.0640	3846.2							0.0	3846.2
8	60195	0.0639	3846.2					14.2		14.2	3860.4
9	60195	0.0639	3846.2							0.0	3846.2
10	60195	0.0639	3846.2							0.0	3846.2
11	60195	0.0639	3846.2					14.2		14.2	3860.4
12	60195	0.0639	3846.2							0.0	3846.2
13	60195	0.0639	3846.2							0.0	3846.2
14	60195	0.0639	3846.2					14.2		14.2	3860.4
15	60195	0.0639	3846.2							0.0	3846.2
16	60195	0.0639	3846.2							0.0	3846.2
17	60195	0.0639	3846.2					14.2		14.2	3860.4
18	60195	0.0639	3846.2							0.0	3846.2
19	60195	0.0639	3846.2							0.0	3846.2
20	60195	0.0639	3846.2	-550.9	-363.3			14.2		-900.0	2946.2
TOTAL	1030766		65162.66	2203.6	1453.12	28366.0		113.2	800.0	32935.92	98098.58

LIFE CYCLE AVG. COST

243754.5 @ 15% PV @ 15% 0.166630 PRESENT VALUE @ 15% 40616.89

01/06/89 - Bansens

Date last worked: 01-06-

ECONOMIC RAIL COST (Banana Line) DEVELOPMENT SCENARIO A-1 TRACK & INFRASTRUCTURE GRANT
(Sensitivity Analysis)

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0523	2108.0			0.0				0.0	2108.0
5	40288	0.0523	2108.0	1881.1	1048.8	0.0				2929.9	5037.9
6	33747	0.0794	2680.3					28.0		28.0	2708.3
7	33747	0.0794	2680.3							0.0	2680.3
8	33747	0.0794	2680.3							0.0	2680.3
9	33747	0.0794	2680.3					7.1		7.1	2687.4
10	33747	0.0794	2680.3							0.0	2680.3
11	33747	0.0794	2680.3							0.0	2680.3
12	33747	0.0794	2680.3					7.1		7.1	2687.4
13	33747	0.0794	2680.3							0.0	2680.3
14	33747	0.0794	2680.3							0.0	2680.3
15	33747	0.0794	2680.3					7.1		7.1	2687.4
16	33747	0.0794	2680.3							0.0	2680.3
17	33747	0.0794	2680.3							0.0	2680.3
18	33747	0.0794	2680.3					7.1		7.1	2687.4
19	33747	0.0794	2680.3							0.0	2680.3
20	33747	0.0794	2680.3	-376.2	-209.8					-586.0	2094.3
TOTAL	586781		44420.5	1504.9	839.0	0.0		56.4		2400.3	46820.8

LIFE CYCLE AVG. COST

339167.1 PV @ 5% @ 5% 0.080475 PRESENT VALUE @ 5% 27294.7

01/06/89 - Bansens

Date last worked: 01-06-8

ECONOMIC RAIL COST (Banana Line) (Sensitivity Analysis)

DEVELOPMENT SCENARIO A-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0523	2108.0	1881.1	1048.8	0.0				2929.9	5037.9
5	33747	0.0701	2364.9					28.0		2957.9	5322.8
6	33747	0.0701	2364.9							0.0	2364.9
7	33747	0.0701	2364.9							0.0	2364.9
8	33747	0.0701	2364.9					7.1		7.1	2372.0
9	33747	0.0701	2364.9							0.0	2364.9
10	33747	0.0701	2364.9							0.0	2364.9
11	33747	0.0701	2364.9					7.1		7.1	2372.0
12	33747	0.0701	2364.9							0.0	2364.9
13	33747	0.0701	2364.9							0.0	2364.9
14	33747	0.0701	2364.9					7.1		7.1	2372.0
15	33747	0.0701	2364.9							0.0	2364.9
16	33747	0.0701	2364.9							0.0	2364.9
17	33747	0.0701	2364.9					7.1		7.1	2372.0
18	33747	0.0701	2364.9							0.0	2364.9
19	33747	0.0701	2364.9							0.0	2364.9
20	33747	0.0701	2364.9	-376.2	-209.8			7.1		-578.9	1786.0
TOTAL	580240		39946.4	1504.9	839.0	0.0		63.5		5337.3	45283.7

LIFE CYCLE AVG. COST

334042.0 PV @ 5% @ 5% 0.081863 PRESENT VALUE @ 5% 27345.8

01/06/89 - Bansens

Date last worked: 01-06-8

ECONOMIC RAIL COST (Banana Line) (Sensitivity Analysis)

DEVELOPMENT SCENARIO A-1

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track & Civil	(Thousands of US $) Bridges	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0562	2264.0			0.0				0.0	2264.0
5	40288	0.0562	2264.0	1881.1	1048.8	0.0				2929.9	5193.9
6	33747	0.0794	2680.3					28.0		28.0	2708.3
7	33747	0.0794	2680.3							0.0	2680.3
8	33747	0.0794	2680.3							0.0	2680.3
9	33747	0.0794	2680.3					7.1		7.1	2687.4
10	33747	0.0794	2680.3							0.0	2680.3
11	33747	0.0794	2680.3							0.0	2680.3
12	33747	0.0794	2680.3					7.1		7.1	2687.4
13	33747	0.0794	2680.3							0.0	2680.3
14	33747	0.0794	2680.3							0.0	2680.3
15	33747	0.0794	2680.3					7.1		7.1	2687.4
16	33747	0.0794	2680.3							0.0	2680.3
17	33747	0.0794	2680.3							0.0	2680.3
18	33747	0.0794	2680.3					7.1		7.1	2687.4
19	33747	0.0794	2680.3							0.0	2680.3
20	33747	0.0794	2680.3	-376.2	-209.8					-586.0	2094.3
TOTAL	586781		44732.5	1504.9	839.0	0.0		56.4		2400.3	47132.8

LIFE CYCLE AVG. COST

211912.4 PV @ 10% @ 10% 0.081952 PRESENT VALUE @ 10% 17366.75

01/06/89 - Bansens

Date last worked: 01-06-8

ECONOMIC RAIL COST (Banana Line) (Sensitivity Analysis)

DEVELOPMENT SCENARIO A-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	(Thousands of US $) Wagons	Locos	Track	Bridges	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0562	2264.0	1881.1	1048.8	0.0				2929.9	5193.9
5	33747	0.0701	2364.9					28.0		2957.9	5322.8
6	33747	0.0701	2364.9							0.0	2364.9
7	33747	0.0701	2364.9							0.0	2364.9
8	33747	0.0701	2364.9					7.1		7.1	2372.0
9	33747	0.0701	2364.9							0.0	2364.9
10	33747	0.0701	2364.9							0.0	2364.9
11	33747	0.0701	2364.9					7.1		7.1	2372.0
12	33747	0.0701	2364.9							0.0	2364.9
13	33747	0.0701	2364.9							0.0	2364.9
14	33747	0.0701	2364.9					7.1		7.1	2372.0
15	33747	0.0701	2364.9							0.0	2364.9
16	33747	0.0701	2364.9							0.0	2364.9
17	33747	0.0701	2364.9					7.1		7.1	2372.0
18	33747	0.0701	2364.9							0.0	2364.9
19	33747	0.0701	2364.9							0.0	2364.9
20	33747	0.0701	2364.9	-376.2	-209.8			7.1		-578.9	1786.0
TOTAL	580240		40102.4	1504.9	839.0	0.0		63.5		5337.3	45439.7

LIFE CYCLE AVG. COST

207851.0	PV @ 10%	@ 10%	0.086333	PRESENT VALUE @ 10%	17944.46

01/06/89 - Bansens

Date last worked: 01-06-

ECONOMIC RAIL COST (Banana Line)
(Sensitivity Analysis)

DEVELOPMENT SCENARIO A-1

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST Wagons	CAPITAL COST Locos	CAPITAL COST Track & Civil	CAPITAL COST (Thousands of US $) Bridges	CAPITAL COST Sig./Tel	CAPITAL COST Builds.	CAPITAL COST Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0603	2429.0			0.0				0.0	2429.0
5	40288	0.0603	2429.0	1881.1	1048.8	0.0				2929.9	5358.9
6	33747	0.0794	2680.3					28.0		28.0	2708.3
7	33747	0.0794	2680.3							0.0	2680.3
8	33747	0.0794	2680.3							0.0	2680.3
9	33747	0.0794	2680.3					7.1		7.1	2687.4
10	33747	0.0794	2680.3							0.0	2680.3
11	33747	0.0794	2680.3							0.0	2680.3
12	33747	0.0794	2680.3					7.1		7.1	2687.4
13	33747	0.0794	2680.3							0.0	2680.3
14	33747	0.0794	2680.3							0.0	2680.3
15	33747	0.0794	2680.3					7.1		7.1	2687.4
16	33747	0.0794	2680.3							0.0	2680.3
17	33747	0.0794	2680.3							0.0	2680.3
18	33747	0.0794	2680.3					7.1		7.1	2687.4
19	33747	0.0794	2680.3							0.0	2680.3
20	33747	0.0794	2680.3	-376.2	-209.8					-586.0	2094.3
TOTAL	586781		45062.5	1504.9	839.0	0.0		56.4		2400.3	47462.8

LIFE CYCLE AVG. COST

141173.5 PV @ 15% @ 15% 0.083771 PRESENT VALUE @ 15% 11826.30

01/06/89 - Bansens

Date last worked: 01-06-8

ECONOMIC RAIL COST (Banana Line) (Sensitivity Analysis)

DEVELOPMENT SCENARIO A-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST (Thousands of US $)						TOTAL
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	Wagons	Locos	Track	Bridges	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0603	2429.0	1881.1	1048.8	0.0				2929.9	5358.9
5	33747	0.0701	2364.9					28.0		2957.9	5322.8
6	33747	0.0701	2364.9							0.0	2364.9
7	33747	0.0701	2364.9							0.0	2364.9
8	33747	0.0701	2364.9					7.1		7.1	2372.0
9	33747	0.0701	2364.9							0.0	2364.9
10	33747	0.0701	2364.9							0.0	2364.9
11	33747	0.0701	2364.9					7.1		7.1	2372.0
12	33747	0.0701	2364.9							0.0	2364.9
13	33747	0.0701	2364.9							0.0	2364.9
14	33747	0.0701	2364.9					7.1		7.1	2372.0
15	33747	0.0701	2364.9							0.0	2364.9
16	33747	0.0701	2364.9							0.0	2364.9
17	33747	0.0701	2364.9					7.1		7.1	2372.0
18	33747	0.0701	2364.9							0.0	2364.9
19	33747	0.0701	2364.9							0.0	2364.9
20	33747	0.0701	2364.9	-376.2	-209.8			7.1		-578.9	1786.0
TOTAL	580240		40267.4	1504.9	839.0	0.0		63.5		5337.3	45604.7

LIFE CYCLE AVG. COST

137921.4 PV @ 15% @ 15% 0.091034 PRESENT VALUE @ 15% 12555.66

ECONOMIC RAIL COST (Banana Line) DEVELOPMENT SCENARIO A-1 TOTAL CAPITAL COST GRANT
(Sensitivity Analysis)

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0523	2108.0			0.0				0.0	2108.0
5	40288	0.0523	2108.0	0.0	0.0	0.0				0.0	2108.0
6	33747	0.0794	2680.3					0.0		0.0	2680.3
7	33747	0.0794	2680.3							0.0	2680.3
8	33747	0.0794	2680.3							0.0	2680.3
9	33747	0.0794	2680.3					0.0		0.0	2680.3
10	33747	0.0794	2680.3							0.0	2680.3
11	33747	0.0794	2680.3							0.0	2680.3
12	33747	0.0794	2680.3					0.0		0.0	2680.3
13	33747	0.0794	2680.3							0.0	2680.3
14	33747	0.0794	2680.3							0.0	2680.3
15	33747	0.0794	2680.3					0.0		0.0	2680.3
16	33747	0.0794	2680.3							0.0	2680.3
17	33747	0.0794	2680.3							0.0	2680.3
18	33747	0.0794	2680.3					0.0		0.0	2680.3
19	33747	0.0794	2680.3							0.0	2680.3
20	33747	0.0794	2680.3	-376.2	-209.8					-586.0	2094.3
TOTAL	586781		44420.5	-376.2	-209.8	0.0		0.0		-586.0	43834.5

LIFE CYCLE AVG. COST

339167.1 PV @ 5% @ 5% 0.073601 PRESENT VALUE @ 5% 24963.2

01/06/89 - Bansens

Date last worked: 01-06-

ECONOMIC RAIL COST (Banana Line)
(Sensitivity Analysis)

DEVELOPMENT SCENARIO A-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0523	2108.0	0.0	0.0	0.0				0.0	2108.0
5	33747	0.0701	2364.9					0.0		0.0	2364.9
6	33747	0.0701	2364.9							0.0	2364.9
7	33747	0.0701	2364.9							0.0	2364.9
8	33747	0.0701	2364.9					0.0		0.0	2364.9
9	33747	0.0701	2364.9							0.0	2364.9
10	33747	0.0701	2364.9							0.0	2364.9
11	33747	0.0701	2364.9					0.0		0.0	2364.9
12	33747	0.0701	2364.9							0.0	2364.9
13	33747	0.0701	2364.9							0.0	2364.9
14	33747	0.0701	2364.9					0.0		0.0	2364.9
15	33747	0.0701	2364.9							0.0	2364.9
16	33747	0.0701	2364.9							0.0	2364.9
17	33747	0.0701	2364.9					0.0		0.0	2364.9
18	33747	0.0701	2364.9							0.0	2364.9
19	33747	0.0701	2364.9							0.0	2364.9
20	33747	0.0701	2364.9	-376.2	-209.8			0.0		-586.0	1778.9
TOTAL	580240		39946.4	-376.2	-209.8	0.0		0.0		-586.0	39360.4

LIFE CYCLE AVG. COST

334042.0	PV @ 5%	@ 5%	0.067654	PRESENT VALUE @ 5%	22599.5

01/06/89 - Bansens

Date last worked: 01-06-8

ECONOMIC RAIL COST (Banana Line)
(Sensitivity Analysis)

DEVELOPMENT SCENARIO A-1

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0562	2264.0			0.0				0.0	2264.0
5	40288	0.0562	2264.0	0.0	0.0	0.0				0.0	2264.0
6	33747	0.0794	2680.3						0.0	0.0	2680.3
7	33747	0.0794	2680.3							0.0	2680.3
8	33747	0.0794	2680.3							0.0	2680.3
9	33747	0.0794	2680.3						0.0	0.0	2680.3
10	33747	0.0794	2680.3							0.0	2680.3
11	33747	0.0794	2680.3							0.0	2680.3
12	33747	0.0794	2680.3						0.0	0.0	2680.3
13	33747	0.0794	2680.3							0.0	2680.3
14	33747	0.0794	2680.3							0.0	2680.3
15	33747	0.0794	2680.3						0.0	0.0	2680.3
16	33747	0.0794	2680.3							0.0	2680.3
17	33747	0.0794	2680.3							0.0	2680.3
18	33747	0.0794	2680.3						0.0	0.0	2680.3
19	33747	0.0794	2680.3							0.0	2680.3
20	33747	0.0794	2680.3	-376.2	-209.8					-586.0	2094.3
TOTAL	586781		44732.5	-376.2	-209.8	0.0			0.0	-586.0	44146.5

LIFE CYCLE AVG. COST

211912.4 PV @ 10% @ 10% 0.073254 PRESENT VALUE @ 10% 15523.46

01/06/89 - Bansens

Date last worked: 01-06-

ECONOMIC RAIL COST (Banana Line) (Sensitivity Analysis)

DEVELOPMENT SCENARIO A-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0562	2264.0	0.0	0.0	0.0				0.0	2264.0
5	33747	0.0701	2364.9					0.0		0.0	2364.9
6	33747	0.0701	2364.9							0.0	2364.9
7	33747	0.0701	2364.9							0.0	2364.9
8	33747	0.0701	2364.9					0.0		0.0	2364.9
9	33747	0.0701	2364.9							0.0	2364.9
10	33747	0.0701	2364.9							0.0	2364.9
11	33747	0.0701	2364.9					0.0		0.0	2364.9
12	33747	0.0701	2364.9							0.0	2364.9
13	33747	0.0701	2364.9							0.0	2364.9
14	33747	0.0701	2364.9					0.0		0.0	2364.9
15	33747	0.0701	2364.9							0.0	2364.9
16	33747	0.0701	2364.9							0.0	2364.9
17	33747	0.0701	2364.9					0.0		0.0	2364.9
18	33747	0.0701	2364.9							0.0	2364.9
19	33747	0.0701	2364.9							0.0	2364.9
20	33747	0.0701	2364.9	-376.2	-209.8			0.0		-586.0	1778.9
TOTAL	580240		40102.4	-376.2	-209.8	0.0		0.0		-586.0	39516.4

LIFE CYCLE AVG. COST

207851.0	PV @ 10%	@ 10%	0.067820	PRESENT VALUE @ 10%	14096.5

01/06/89 - Bansens

Date last worked: 01-06-

ECONOMIC RAIL COST (Banana Line)
(Sensitivity Analysis)

DEVELOPMENT SCENARIO A-1

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0603	2429.0			0.0				0.0	2429.0
5	40288	0.0603	2429.0	0.0	0.0	0.0				0.0	2429.0
6	33747	0.0794	2680.3						0.0	0.0	2680.3
7	33747	0.0794	2680.3							0.0	2680.3
8	33747	0.0794	2680.3							0.0	2680.3
9	33747	0.0794	2680.3						0.0	0.0	2680.3
10	33747	0.0794	2680.3							0.0	2680.3
11	33747	0.0794	2680.3							0.0	2680.3
12	33747	0.0794	2680.3						0.0	0.0	2680.3
13	33747	0.0794	2680.3							0.0	2680.3
14	33747	0.0794	2680.3							0.0	2680.3
15	33747	0.0794	2680.3						0.0	0.0	2680.3
16	33747	0.0794	2680.3							0.0	2680.3
17	33747	0.0794	2680.3							0.0	2680.3
18	33747	0.0794	2680.3						0.0	0.0	2680.3
19	33747	0.0794	2680.3							0.0	2680.3
20	33747	0.0794	2680.3	-376.2	-209.8					-586.0	2094.3
TOTAL	586781		45062.5	-376.2	-209.8	0.0			0.0	-586.0	44476.5

LIFE CYCLE AVG. COST

141173.5 PV @ 15% @ 15% 0.073333 PRESENT VALUE @ 15% 10352.73

01/06/89 - Bansens

Date last worked: 01-06-8

ECONOMIC RAIL COST (Banana Line)
(Sensitivity Analysis)

DEVELOPMENT SCENARIO A-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	40288	0.0603	2429.0	0.0	0.0	0.0				0.0	2429.0
5	33747	0.0701	2364.9						0.0	0.0	2364.9
6	33747	0.0701	2364.9							0.0	2364.9
7	33747	0.0701	2364.9							0.0	2364.9
8	33747	0.0701	2364.9						0.0	0.0	2364.9
9	33747	0.0701	2364.9							0.0	2364.9
10	33747	0.0701	2364.9							0.0	2364.9
11	33747	0.0701	2364.9						0.0	0.0	2364.9
12	33747	0.0701	2364.9							0.0	2364.9
13	33747	0.0701	2364.9							0.0	2364.9
14	33747	0.0701	2364.9						0.0	0.0	2364.9
15	33747	0.0701	2364.9							0.0	2364.9
16	33747	0.0701	2364.9							0.0	2364.9
17	33747	0.0701	2364.9						0.0	0.0	2364.9
18	33747	0.0701	2364.9							0.0	2364.9
19	33747	0.0701	2364.9							0.0	2364.9
20	33747	0.0701	2364.9	-376.2	-209.8				0.0	-586.0	1778.9
TOTAL	580240		40267.4	-376.2	-209.8	0.0			0.0	-586.0	39681.4

LIFE CYCLE AVG. COST

137921.4	PV @ 15%	@ 15%	0.068183	PRESENT VALUE @ 15%	9403.9

01/07/89 - Banatsen

Last Update: 01-07-89

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-1 & A-1

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elect.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	1727.0		1727.0	1727.0
3						0.0	0.0	2590.0		2590.0	2590.0
4	80912	0.0440	3559.0	836.8	1186.0	0.0	0.0	1079.0		3101.8	6660.8
5	83975	0.0528	4437.5	1890.6	1048.8	0.0	0.0	22.0		2961.4	7398.9
6	78168	0.0579	4522.4	11.4				28.0		39.4	4561.8
7	78168	0.0579	4522.4							0.0	4522.4
8	78168	0.0579	4522.4					7.1		7.1	4529.5
9	78168	0.0579	4522.4					7.1		7.1	4529.5
10	78168	0.0579	4522.4							0.0	4522.4
11	78168	0.0579	4522.4					7.1		7.1	4529.5
12	78168	0.0579	4522.4					7.1		7.1	4529.5
13	78168	0.0579	4522.4							0.0	4522.4
14	78168	0.0579	4522.4					7.1		7.1	4529.5
15	78168	0.0579	4522.4					7.1		7.1	4529.5
16	78168	0.0579	4522.4							0.0	4522.4
17	78168	0.0579	4522.4					7.1		7.1	4529.5
18	78168	0.0579	4522.4					7.1		7.1	4529.5
19	78168	0.0579	4522.4							0.0	4522.4
20	78168	0.0579	4522.4	-547.8	-447.0			7.1		-987.7	3534.7
TOTAL	1337407		75832.5	2191.0	1787.8	0.0	0.0	5509.9		9488.7	85321.2

LIFE CYCLE AVG. COST

768082.6 PV @ 5% @ 5% 0.067112 PRESENT VALUE @ 5% 51548.0

01/24/89 - Banatsen

Last Update: 01-07-89

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-2 & A-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	80912	0.0440	3559.0	2717.9	2234.8	0.0				4952.7	8511.7
5	77434	0.0516	3996.5	9.5					50.0	59.5	4056.0
6	78168	0.0512	4003.8	11.4						11.4	4015.2
7	78168	0.0512	4003.8							0.0	4003.8
8	78168	0.0512	4003.8						14.2	14.2	4018.0
9	78168	0.0512	4003.8							0.0	4003.8
10	78168	0.0512	4003.8							0.0	4003.8
11	78168	0.0512	4003.8						14.2	14.2	4018.0
12	78168	0.0512	4003.8							0.0	4003.8
13	78168	0.0512	4003.8							0.0	4003.8
14	78168	0.0512	4003.8						14.2	14.2	4018.0
15	78168	0.0512	4003.8							0.0	4003.8
16	78168	0.0512	4003.8							0.0	4003.8
17	78168	0.0512	4003.8						14.2	14.2	4018.0
18	78168	0.0512	4003.8							0.0	4003.8
19	78168	0.0512	4003.8							0.0	4003.8
20	78168	0.0512	4003.8	-547.8	-447.0				14.2	-980.5	3023.3
TOTAL	1330866		67612.5	2191.0	1787.8	0.0			121.0	4099.9	71712.4

762958 PV @ 5% @ 5% 0.055589 PRESENT VALUE @ 5% 42412.7

01/07/89 - Banatsen

Last Update: 01-07-89

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-1 & A-1

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elect.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	1727.0		1727.0	1727.0
3						0.0	0.0	2590.0		2590.0	2590.0
4	80912	0.0472	3820.0	836.8	1186.0	0.0	0.0	1079.0		3101.8	6921.8
5	83975	0.0547	4593.5	1890.6	1048.8	0.0	0.0	22.0		2961.4	7554.9
6	78168	0.0579	4522.4	11.4				28.0		39.4	4561.8
7	78168	0.0579	4522.4							0.0	4522.4
8	78168	0.0579	4522.4					7.1		7.1	4529.5
9	78168	0.0579	4522.4					7.1		7.1	4529.5
10	78168	0.0579	4522.4							0.0	4522.4
11	78168	0.0579	4522.4					7.1		7.1	4529.5
12	78168	0.0579	4522.4					7.1		7.1	4529.5
13	78168	0.0579	4522.4							0.0	4522.4
14	78168	0.0579	4522.4					7.1		7.1	4529.5
15	78168	0.0579	4522.4					7.1		7.1	4529.5
16	78168	0.0579	4522.4							0.0	4522.4
17	78168	0.0579	4522.4					7.1		7.1	4529.5
18	78168	0.0579	4522.4					7.1		7.1	4529.5
19	78168	0.0579	4522.4							0.0	4522.4
20	78168	0.0579	4522.4	-547.8	-447.0			7.1		-987.7	3534.7
TOTAL	1337407		76249.5	2191.0	1787.8	0.0	0.0	5509.9		9488.7	85738.2

LIFE CYCLE AVG. COST

476575.8 PV @ 10% @ 10% 0.071432 PRESENT VALUE @ 10% 34042.89

01/24/89 - Banatsen

Last Update: 01-07-89

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-2 & A-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	80912	0.0472	3820.0	2717.9	2234.8	0.0				4952.7	8772.7
5	77434	0.0516	3996.5	9.5					50.0	59.5	4056.0
6	78168	0.0512	4003.8	11.4						11.4	4015.2
7	78168	0.0512	4003.8							0.0	4003.8
8	78168	0.0512	4003.8						14.2	14.2	4018.0
9	78168	0.0512	4003.8							0.0	4003.8
10	78168	0.0512	4003.8							0.0	4003.8
11	78168	0.0512	4003.8						14.2	14.2	4018.0
12	78168	0.0512	4003.8							0.0	4003.8
13	78168	0.0512	4003.8							0.0	4003.8
14	78168	0.0512	4003.8						14.2	14.2	4018.0
15	78168	0.0512	4003.8							0.0	4003.8
16	78168	0.0512	4003.8							0.0	4003.8
17	78168	0.0512	4003.8						14.2	14.2	4018.0
18	78168	0.0512	4003.8							0.0	4003.8
19	78168	0.0512	4003.8							0.0	4003.8
20	78168	0.0512	4003.8	-547.8	-447.0				14.2	-980.5	3023.3
TOTAL	1330866		67873.5	2191.0	1787.8	0.0			121.0	4099.9	71973.4

472514.4 PV @ 10% @ 10% 0.057772 PRESENT VALUE @ 10% 27298.22

01/07/89 - Banatsen

Last Update: 01-07-89

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-1 & A-1

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC	OPERATING COST		CAPITAL COST							TOTAL	
	(Thousand of NTK)	($/NTK)	(Thousands of US $)	(Thousands of US $) Wagons	Locos	Track & Civil	Elect.	Sig./Tel	Builds.	Sub-Total	(Thousands of US $)	
1						0.0				0.0	0.0	
2						0.0	0.0	1727.0		1727.0	1727.0	
3						0.0	0.0	2590.0		2590.0	2590.0	
4	80912	0.0506	4096.0	836.8	1186.0	0.0	0.0	1079.0		3101.8	7197.8	
5	83975	0.0567	4758.5	1890.6	1048.8	0.0	0.0	22.0		2961.4	7719.9	
6	78168	0.0579	4522.4	11.4				28.0		39.4	4561.8	
7	78168	0.0579	4522.4							0.0	4522.4	
8	78168	0.0579	4522.4					7.1		7.1	4529.5	
9	78168	0.0579	4522.4					7.1		7.1	4529.5	
10	78168	0.0579	4522.4							0.0	4522.4	
11	78168	0.0579	4522.4					7.1		7.1	4529.5	
12	78168	0.0579	4522.4					7.1		7.1	4529.5	
13	78168	0.0579	4522.4							0.0	4522.4	
14	78168	0.0579	4522.4					7.1		7.1	4529.5	
15	78168	0.0579	4522.4					7.1		7.1	4529.5	
16	78168	0.0579	4522.4							0.0	4522.4	
17	78168	0.0579	4522.4					7.1		7.1	4529.5	
18	78168	0.0579	4522.4					7.1		7.1	4529.5	
19	78168	0.0579	4522.4							0.0	4522.4	
20	78168	0.0579	4522.4	-547.8	-447.0			7.1		-987.7	3534.7	
TOTAL	1337407		76690.5	2191.0	1787.8	0.0	0.0	5509.9		9488.7	86179.2	

LIFE CYCLE AVG. COST

315260.2	PV @ 15%	@ 15%	0.076371	PRESENT VALUE @ 15%	24076.74

01/24/89 - Banatsen

Last Update: 01-07-89

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-2 & A-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	80912	0.0506	4096.0	2717.9	2234.8	0.0				4952.7	9048.7
5	77434	0.0516	3996.5	9.5				50.0		59.5	4056.0
6	78168	0.0512	4003.8	11.4						11.4	4015.2
7	78168	0.0512	4003.8							0.0	4003.8
8	78168	0.0512	4003.8					14.2		14.2	4018.0
9	78168	0.0512	4003.8							0.0	4003.8
10	78168	0.0512	4003.8							0.0	4003.8
11	78168	0.0512	4003.8					14.2		14.2	4018.0
12	78168	0.0512	4003.8							0.0	4003.8
13	78168	0.0512	4003.8							0.0	4003.8
14	78168	0.0512	4003.8					14.2		14.2	4018.0
15	78168	0.0512	4003.8							0.0	4003.8
16	78168	0.0512	4003.8							0.0	4003.8
17	78168	0.0512	4003.8					14.2		14.2	4018.0
18	78168	0.0512	4003.8							0.0	4003.8
19	78168	0.0512	4003.8							0.0	4003.8
20	78168	0.0512	4003.8	-547.8	-447.0			14.2		-980.5	3023.3
TOTAL	1330866		68149.5	2191.0	1787.8	0.0		121.0		4099.9	72249.4

312008 PV @ 15% @ 15% 0.060209 PRESENT VALUE @ 15% 18786.0

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-1 & A-1

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elect.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	0.0		0.0	0.0
3						0.0	0.0	0.0		0.0	0.0
4	80912	0.0440	3559.0	0.0	0.0	0.0	0.0	0.0		0.0	3559.0
5	83975	0.0528	4437.5	0.0	0.0	0.0	0.0	0.0		0.0	4437.5
6	78168	0.0579	4522.4	0.0				0.0		0.0	4522.4
7	78168	0.0579	4522.4							0.0	4522.4
8	78168	0.0579	4522.4					0.0		0.0	4522.4
9	78168	0.0579	4522.4					0.0		0.0	4522.4
10	78168	0.0579	4522.4							0.0	4522.4
11	78168	0.0579	4522.4					0.0		0.0	4522.4
12	78168	0.0579	4522.4					0.0		0.0	4522.4
13	78168	0.0579	4522.4							0.0	4522.4
14	78168	0.0579	4522.4					0.0		0.0	4522.4
15	78168	0.0579	4522.4					0.0		0.0	4522.4
16	78168	0.0579	4522.4							0.0	4522.4
17	78168	0.0579	4522.4					0.0		0.0	4522.4
18	78168	0.0579	4522.4					0.0		0.0	4522.4
19	78168	0.0579	4522.4							0.0	4522.4
20	78168	0.0579	4522.4	-547.8	-447.0			0.0		-994.8	3527.6
TOTAL	1337407		75832.5	-547.8	-447.0	0.0	0.0	0.0		-994.8	74837.7

LIFE CYCLE AVG. COST

768082.6	PV @ 5%	@ 5%	0.055735	PRESENT VALUE @ 5%	42809.4

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-2 & A-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	80912	0.0440	3559.0	0.0	0.0	0.0				0.0	3559.0
5	77434	0.0516	3996.5	0.0				0.0		0.0	3996.5
6	78168	0.0512	4003.8	0.0						0.0	4003.8
7	78168	0.0512	4003.8							0.0	4003.8
8	78168	0.0512	4003.8					0.0		0.0	4003.8
9	78168	0.0512	4003.8							0.0	4003.8
10	78168	0.0512	4003.8							0.0	4003.8
11	78168	0.0512	4003.8					0.0		0.0	4003.8
12	78168	0.0512	4003.8							0.0	4003.8
13	78168	0.0512	4003.8							0.0	4003.8
14	78168	0.0512	4003.8					0.0		0.0	4003.8
15	78168	0.0512	4003.8							0.0	4003.8
16	78168	0.0512	4003.8							0.0	4003.8
17	78168	0.0512	4003.8					0.0		0.0	4003.8
18	78168	0.0512	4003.8							0.0	4003.8
19	78168	0.0512	4003.8							0.0	4003.8
20	78168	0.0512	4003.8	-547.8	-447.0			0.0		-994.8	3009.0
TOTAL	1330866		67612.5	-547.8	-447.0	0.0		0.0		-994.8	66617.7

762957.5	PV @ 5%	@ 5%	0.050128	PRESENT VALUE @ 5%	38246.3

01/07/89 - Banatsen Last Update: 01-07-89

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-1 & A-1

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elect. Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0			0.0	0.0
2						0.0	0.0	0.0	0.0	0.0
3						0.0	0.0	0.0	0.0	0.0
4	80912	0.0472	3820.0	0.0	0.0	0.0	0.0	0.0	0.0	3820.0
5	83975	0.0547	4593.5	0.0	0.0	0.0	0.0	0.0	0.0	4593.5
6	78168	0.0579	4522.4	0.0				0.0	0.0	4522.4
7	78168	0.0579	4522.4						0.0	4522.4
8	78168	0.0579	4522.4					0.0	0.0	4522.4
9	78168	0.0579	4522.4					0.0	0.0	4522.4
10	78168	0.0579	4522.4						0.0	4522.4
11	78168	0.0579	4522.4					0.0	0.0	4522.4
12	78168	0.0579	4522.4					0.0	0.0	4522.4
13	78168	0.0579	4522.4						0.0	4522.4
14	78168	0.0579	4522.4					0.0	0.0	4522.4
15	78168	0.0579	4522.4					0.0	0.0	4522.4
16	78168	0.0579	4522.4						0.0	4522.4
17	78168	0.0579	4522.4					0.0	0.0	4522.4
18	78168	0.0579	4522.4					0.0	0.0	4522.4
19	78168	0.0579	4522.4						0.0	4522.4
20	78168	0.0579	4522.4	-547.8	-447.0			0.0	-994.8	3527.6
TOTAL	1337407		76249.5	-547.8	-447.0	0.0	0.0	0.0	-994.8	75254.7

LIFE CYCLE AVG. COST

476575.8	PV @ 10%	@ 10%	0.055965	PRESENT VALUE @ 10%	26671.72

01/07/89 - Banatsen

Last Update: 01-07-89

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-2 & A-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	80912	0.0472	3820.0	0.0	0.0	0.0				0.0	3820.0
5	77434	0.0516	3996.5	0.0				0.0		0.0	3996.5
6	78168	0.0512	4003.8	0.0						0.0	4003.8
7	78168	0.0512	4003.8							0.0	4003.8
8	78168	0.0512	4003.8					0.0		0.0	4003.8
9	78168	0.0512	4003.8							0.0	4003.8
10	78168	0.0512	4003.8							0.0	4003.8
11	78168	0.0512	4003.8					0.0		0.0	4003.8
12	78168	0.0512	4003.8							0.0	4003.8
13	78168	0.0512	4003.8							0.0	4003.8
14	78168	0.0512	4003.8					0.0		0.0	4003.8
15	78168	0.0512	4003.8							0.0	4003.8
16	78168	0.0512	4003.8							0.0	4003.8
17	78168	0.0512	4003.8					0.0		0.0	4003.8
18	78168	0.0512	4003.8							0.0	4003.8
19	78168	0.0512	4003.8							0.0	4003.8
20	78168	0.0512	4003.8	-547.8	-447.0			0.0		-994.8	3009.0
TOTAL	1330866		67873.5	-547.8	-447.0	0.0		0.0		-994.8	66878.7

472514.4	PV @ 10%	@ 10%	0.050478	PRESENT VALUE @ 10%	23851.80

01/07/89 = Banatsen

Last Update: 01-07-89

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-1 & A-1

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elect.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	0.0		0.0	0.0
3						0.0	0.0	0.0		0.0	0.0
4	80912	0.0506	4096.0	0.0	0.0	0.0	0.0	0.0		0.0	4096.0
5	83975	0.0567	4758.5	0.0	0.0	0.0	0.0	0.0		0.0	4758.5
6	78168	0.0579	4522.4	0.0				0.0		0.0	4522.4
7	78168	0.0579	4522.4							0.0	4522.4
8	78168	0.0579	4522.4					0.0		0.0	4522.4
9	78168	0.0579	4522.4					0.0		0.0	4522.4
10	78168	0.0579	4522.4							0.0	4522.4
11	78168	0.0579	4522.4					0.0		0.0	4522.4
12	78168	0.0579	4522.4					0.0		0.0	4522.4
13	78168	0.0579	4522.4							0.0	4522.4
14	78168	0.0579	4522.4					0.0		0.0	4522.4
15	78168	0.0579	4522.4					0.0		0.0	4522.4
16	78168	0.0579	4522.4							0.0	4522.4
17	78168	0.0579	4522.4					0.0		0.0	4522.4
18	78168	0.0579	4522.4					0.0		0.0	4522.4
19	78168	0.0579	4522.4							0.0	4522.4
20	78168	0.0579	4522.4	-547.8	-447.0			0.0		-994.8	3527.6
TOTAL	1337407		76690.5	-547.8	-447.0	0.0	0.0	0.0		-994.8	75695.7

LIFE CYCLE AVG. COST

315260.2	PV @ 15%	@ 15%	0.056443	PRESENT VALUE @ 15%	17794.34

ECONOMIC RAIL COST
(Banana & Atlantic Lines Combined)

DEVELOPMENT SCENARIO B-2 & A-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	80912	0.0506	4096.0	0.0	0.0	0.0				0.0	4096.0
5	77434	0.0516	3996.5	0.0				0.0		0.0	3996.5
6	78168	0.0512	4003.8	0.0						0.0	4003.8
7	78168	0.0512	4003.8							0.0	4003.8
8	78168	0.0512	4003.8					0.0		0.0	4003.8
9	78168	0.0512	4003.8							0.0	4003.8
10	78168	0.0512	4003.8							0.0	4003.8
11	78168	0.0512	4003.8					0.0		0.0	4003.8
12	78168	0.0512	4003.8							0.0	4003.8
13	78168	0.0512	4003.8							0.0	4003.8
14	78168	0.0512	4003.8					0.0		0.0	4003.8
15	78168	0.0512	4003.8							0.0	4003.8
16	78168	0.0512	4003.8							0.0	4003.8
17	78168	0.0512	4003.8					0.0		0.0	4003.8
18	78168	0.0512	4003.8							0.0	4003.8
19	78168	0.0512	4003.8							0.0	4003.8
20	78168	0.0512	4003.8	-547.8	-447.0			0.0		-994.8	3009.0
TOTAL	1330866		68149.5	-547.8	-447.0	0.0		0.0		-994.8	67154.7

312008.2 PV @ 15% @ 15% 0.050985 PRESENT VALUE @ 15% 15907.83

01/07/89 - Bpatsens

Last Update:01-07-89

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-1 & B-1 & C-1

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	3347.0		3347.0	3347.0
3				759.4	767.6	0.0	0.0	4569.0		6096.0	6096.0
4	104789	0.0501	5246.1	950.8	1186.0	0.0	0.0	1093.2		3230.0	8476.1
5	108968	0.0521	5681.2	1890.6	1048.8	0.0		22.0		2961.4	8642.6
6	104385	0.0592	6179.7	11.4				28.0		39.4	6219.1
7	104555	0.0591	6179.7					7.1		7.1	6186.8
8	104616	0.0591	6179.7					7.1		7.1	6186.8
9	104616	0.0591	6179.7					7.1		7.1	6186.8
10	104616	0.0591	6179.7					7.1		7.1	6186.8
11	104616	0.0591	6179.7					7.1		7.1	6186.8
12	104616	0.0591	6179.7					7.1		7.1	6186.8
13	104616	0.0591	6179.7					7.1		7.1	6186.8
14	104616	0.0591	6179.7					7.1		7.1	6186.8
15	104616	0.0591	6179.7					7.1		7.1	6186.8
16	104616	0.0591	6179.7					7.1		7.1	6186.8
17	104616	0.0591	6179.7					7.1		7.1	6186.8
18	104616	0.0591	6179.7					7.1		7.1	6186.8
19	104616	0.0591	6179.7					7.1		7.1	6186.8
20	104616	0.0591	6179.7	-722.4	-600.5			7.1		-1315.8	4863.9
TOTAL	1782705		103622.3	2889.8	2401.9	0.0	0.0	9158.6		14450.3	118072.6

LIFE CYCLE AVG. COST

1022188 @ 5% PV @ 5% 0.070327 PRESENT VALUE @ 5% 71887.6

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-2 & B-2 & C-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	110017	0.0418	4599.0	3591.3	3002.4	0.0				6593.7	11192.7
5	102427	0.0526	5387.8	9.5				64.2		73.7	5461.5
6	104385	0.0517	5395.1	11.4						11.4	5406.5
7	104555	0.0516	5395.1							0.0	5395.1
8	104616	0.0516	5395.1					21.3		21.3	5416.4
9	104616	0.0516	5395.1							0.0	5395.1
10	104616	0.0516	5395.1							0.0	5395.1
11	104616	0.0516	5395.1					21.3		21.3	5416.4
12	104616	0.0516	5395.1							0.0	5395.1
13	104616	0.0516	5395.1							0.0	5395.1
14	104616	0.0516	5395.1					21.3		21.3	5416.4
15	104616	0.0516	5395.1							0.0	5395.1
16	104616	0.0516	5395.1							0.0	5395.1
17	104616	0.0516	5395.1					21.3		21.3	5416.4
18	104616	0.0516	5395.1							0.0	5395.1
19	104616	0.0516	5395.1							0.0	5395.1
20	104616	0.0516	5395.1	-722.4	-600.5			21.3		-1301.6	4093.5
TOTAL	1781392		90912.8	2889.8	2401.9	0.0		170.7		5462.4	96375.2

LIFE CYCLE AVG. COST

1021363. @ 5% PV @ 5% 0.055738 PRESENT VALUE @ 5% 56929.0

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Last Update:01-07-89

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-1 & B-1 & C-1

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	3347.0		3347.0	3347.0
3				759.4	767.6	0.0	0.0	4569.0		6096.0	6096.0
4	104789	0.0526	5507.1	950.8	1186.0	0.0	0.0	1093.2		3230.0	8737.1
5	108968	0.0536	5837.2	1890.6	1048.8	0.0		22.0		2961.4	8798.6
6	104385	0.0592	6179.7	11.4				28.0		39.4	6219.1
7	104555	0.0591	6179.7					7.1		7.1	6186.8
8	104616	0.0591	6179.7					7.1		7.1	6186.8
9	104616	0.0591	6179.7					7.1		7.1	6186.8
10	104616	0.0591	6179.7					7.1		7.1	6186.8
11	104616	0.0591	6179.7					7.1		7.1	6186.8
12	104616	0.0591	6179.7					7.1		7.1	6186.8
13	104616	0.0591	6179.7					7.1		7.1	6186.8
14	104616	0.0591	6179.7					7.1		7.1	6186.8
15	104616	0.0591	6179.7					7.1		7.1	6186.8
16	104616	0.0591	6179.7					7.1		7.1	6186.8
17	104616	0.0591	6179.7					7.1		7.1	6186.8
18	104616	0.0591	6179.7					7.1		7.1	6186.8
19	104616	0.0591	6179.7					7.1		7.1	6186.8
20	104616	0.0591	6179.7	-722.4	-600.5			7.1		-1315.8	4863.9
TOTAL	1782705		104039.3	2889.8	2401.9	0.0	0.0	9158.6		14450.3	118489.6

LIFE CYCLE AVG. COST

633149 @ 10% PV @ 10% 0.075522 PRESENT VALUE @ 10% 47817.23

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-2 & B-2 & C-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST Wagons	CAPITAL COST Locos	CAPITAL COST Track & Civil	CAPITAL COST (Thousands of US $) Bridges	CAPITAL COST Sig./Tel	CAPITAL COST Builds.	CAPITAL COST Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	110017	0.0449	4935.0	3591.3	3002.4	0.0				6593.7	11528.7
5	102427	0.0526	5387.8	9.5				64.2		73.7	5461.5
6	104385	0.0517	5395.1	11.4						11.4	5406.5
7	104555	0.0516	5395.1							0.0	5395.1
8	104616	0.0516	5395.1					21.3		21.3	5416.4
9	104616	0.0516	5395.1							0.0	5395.1
10	104616	0.0516	5395.1							0.0	5395.1
11	104616	0.0516	5395.1					21.3		21.3	5416.4
12	104616	0.0516	5395.1							0.0	5395.1
13	104616	0.0516	5395.1							0.0	5395.1
14	104616	0.0516	5395.1					21.3		21.3	5416.4
15	104616	0.0516	5395.1							0.0	5395.1
16	104616	0.0516	5395.1							0.0	5395.1
17	104616	0.0516	5395.1					21.3		21.3	5416.4
18	104616	0.0516	5395.1							0.0	5395.1
19	104616	0.0516	5395.1							0.0	5395.1
20	104616	0.0516	5395.1	-722.4	-600.5			21.3		-1301.6	4093.5
TOTAL	1781392		91248.8	2889.8	2401.9	0.0		170.7		5462.4	96711.2

LIFE CYCLE AVG. COST

632659 @ 10% PV @ 10% 0.057827 PRESENT VALUE @ 10% 36585.3

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-1 & B-1 & C-1

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	3347.0		3347.0	3347.0
3				759.4	767.6	0.0	0.0	4569.0		6096.0	6096.0
4	104789	0.0552	5783.1	950.8	1186.0	0.0	0.0	1093.2		3230.0	9013.1
5	108968	0.0551	6002.2	1890.6	1048.8	0.0		22.0		2961.4	8963.6
6	104385	0.0592	6179.7	11.4				28.0		39.4	6219.1
7	104555	0.0591	6179.7					7.1		7.1	6186.8
8	104616	0.0591	6179.7					7.1		7.1	6186.8
9	104616	0.0591	6179.7					7.1		7.1	6186.8
10	104616	0.0591	6179.7					7.1		7.1	6186.8
11	104616	0.0591	6179.7					7.1		7.1	6186.8
12	104616	0.0591	6179.7					7.1		7.1	6186.8
13	104616	0.0591	6179.7					7.1		7.1	6186.8
14	104616	0.0591	6179.7					7.1		7.1	6186.8
15	104616	0.0591	6179.7					7.1		7.1	6186.8
16	104616	0.0591	6179.7					7.1		7.1	6186.8
17	104616	0.0591	6179.7					7.1		7.1	6186.8
18	104616	0.0591	6179.7					7.1		7.1	6186.8
19	104616	0.0591	6179.7					7.1		7.1	6186.8
20	104616	0.0591	6179.7	-722.4	-600.5			7.1		-1315.8	4863.9
TOTAL	1782705		104480.3	2889.8	2401.9	0.0	0.0	9158.6		14450.3	118930.6

LIFE CYCLE AVG. COST

418104 @ 15% PV @ 15% 0.081481 PRESENT VALUE @ 15% 34067.95

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-2 & B-2 & C-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	110017	0.0481	5291.0	3591.3	3002.4	0.0				6593.7	11884.7
5	102427	0.0526	5387.8	9.5				64.2		73.7	5461.5
6	104385	0.0517	5395.1	11.4						11.4	5406.5
7	104555	0.0516	5395.1							0.0	5395.1
8	104616	0.0516	5395.1					21.3		21.3	5416.4
9	104616	0.0516	5395.1							0.0	5395.1
10	104616	0.0516	5395.1							0.0	5395.1
11	104616	0.0516	5395.1					21.3		21.3	5416.4
12	104616	0.0516	5395.1							0.0	5395.1
13	104616	0.0516	5395.1							0.0	5395.1
14	104616	0.0516	5395.1					21.3		21.3	5416.4
15	104616	0.0516	5395.1							0.0	5395.1
16	104616	0.0516	5395.1							0.0	5395.1
17	104616	0.0516	5395.1					21.3		21.3	5416.4
18	104616	0.0516	5395.1							0.0	5395.1
19	104616	0.0516	5395.1							0.0	5395.1
20	104616	0.0516	5395.1	-722.4	-600.5			21.3		-1301.6	4093.5
TOTAL	1781392		91604.8	2889.8	2401.9	0.0		170.7		5462.4	97067.2

LIFE CYCLE AVG. COST

417841 @ 15% PV @ 15% 0.060158 PRESENT VALUE @ 15% 25136.77

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ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-1 & B-1 & C-1

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST Wagons	CAPITAL COST Locos	CAPITAL COST Track & Civil	CAPITAL COST Elec. Sig./Tel	CAPITAL COST Builds.	CAPITAL COST Sub-Total	TOTAL (Thousands of US $)
1						0.0			0.0	0.0
2						0.0	0.0	0.0	0.0	0.0
3				0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	104789	0.0501	5246.1	0.0	0.0	0.0	0.0	0.0	0.0	5246.1
5	108968	0.0521	5681.2	0.0	0.0	0.0		0.0	0.0	5681.2
6	104385	0.0592	6179.7	0.0				0.0	0.0	6179.7
7	104555	0.0591	6179.7					0.0	0.0	6179.7
8	104616	0.0591	6179.7					0.0	0.0	6179.7
9	104616	0.0591	6179.7					0.0	0.0	6179.7
10	104616	0.0591	6179.7					0.0	0.0	6179.7
11	104616	0.0591	6179.7					0.0	0.0	6179.7
12	104616	0.0591	6179.7					0.0	0.0	6179.7
13	104616	0.0591	6179.7					0.0	0.0	6179.7
14	104616	0.0591	6179.7					0.0	0.0	6179.7
15	104616	0.0591	6179.7					0.0	0.0	6179.7
16	104616	0.0591	6179.7					0.0	0.0	6179.7
17	104616	0.0591	6179.7					0.0	0.0	6179.7
18	104616	0.0591	6179.7					0.0	0.0	6179.7
19	104616	0.0591	6179.7					0.0	0.0	6179.7
20	104616	0.0591	6179.7	-722.4	-600.5			0.0	-1322.9	4856.8
TOTAL	1782705		103622.3	-722.4	-600.5	0.0	0.0	0.0	-1322.9	102299.4

LIFE CYCLE AVG. COST

1022188 @ 5% PV @ 5% 0.057255 PRESENT VALUE @ 5% 58526.3

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-2 & B-2 & C-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST Wagons	CAPITAL COST Locos	CAPITAL COST Track & Civil	CAPITAL COST Bridges	CAPITAL COST Sig./Tel	CAPITAL COST Builds.	CAPITAL COST Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	110017	0.0418	4599.0	0.0	0.0	0.0				0.0	4599.0
5	102427	0.0526	5387.8	0.0				0.0		0.0	5387.8
6	104385	0.0517	5395.1	0.0						0.0	5395.1
7	104555	0.0516	5395.1							0.0	5395.1
8	104616	0.0516	5395.1					0.0		0.0	5395.1
9	104616	0.0516	5395.1							0.0	5395.1
10	104616	0.0516	5395.1							0.0	5395.1
11	104616	0.0516	5395.1					0.0		0.0	5395.1
12	104616	0.0516	5395.1							0.0	5395.1
13	104616	0.0516	5395.1							0.0	5395.1
14	104616	0.0516	5395.1					0.0		0.0	5395.1
15	104616	0.0516	5395.1							0.0	5395.1
16	104616	0.0516	5395.1							0.0	5395.1
17	104616	0.0516	5395.1					0.0		0.0	5395.1
18	104616	0.0516	5395.1							0.0	5395.1
19	104616	0.0516	5395.1							0.0	5395.1
20	104616	0.0516	5395.1	-722.4	-600.5			0.0		-1322.9	4072.2
TOTAL	1781392		90912.76	-722.4	-600.5	0		0		-1322.9	89589.86

LIFE CYCLE AVG. COST

1021364 @ 5% PV @ 5% 0.050308 PRESENT VALUE @ 5% 51383.1

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-1 & B-1 & C-1

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	0.0		0.0	0.0
3				0.0	0.0	0.0	0.0	0.0		0.0	0.0
4	104789	0.0526	5507.1	0.0	0.0	0.0	0.0	0.0		0.0	5507.1
5	108968	0.0536	5837.2	0.0	0.0	0.0		0.0		0.0	5837.2
6	104385	0.0592	6179.7	0.0				0.0		0.0	6179.7
7	104555	0.0591	6179.7					0.0		0.0	6179.7
8	104616	0.0591	6179.7					0.0		0.0	6179.7
9	104616	0.0591	6179.7					0.0		0.0	6179.7
10	104616	0.0591	6179.7					0.0		0.0	6179.7
11	104616	0.0591	6179.7					0.0		0.0	6179.7
12	104616	0.0591	6179.7					0.0		0.0	6179.7
13	104616	0.0591	6179.7					0.0		0.0	6179.7
14	104616	0.0591	6179.7					0.0		0.0	6179.7
15	104616	0.0591	6179.7					0.0		0.0	6179.7
16	104616	0.0591	6179.7					0.0		0.0	6179.7
17	104616	0.0591	6179.7					0.0		0.0	6179.7
18	104616	0.0591	6179.7					0.0		0.0	6179.7
19	104616	0.0591	6179.7					0.0		0.0	6179.7
20	104616	0.0591	6179.7	-722.4	-600.5			0.0		-1322.9	4856.8
TOTAL	1782705		104039.3	-722.4	-600.5	0.0	0.0	0.0		-1322.9	102716.4

LIFE CYCLE AVG. COST

633149.1 @ 10% PV @ 10% 0.057449 PRESENT VALUE @ 10% 36374.41

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-2 & B-2 & C-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	110017	0.0449	4935.0	0.0	0.0	0.0				0.0	4935.0
5	102427	0.0526	5387.8	0.0				0.0		0.0	5387.8
6	104385	0.0517	5395.1	0.0						0.0	5395.1
7	104555	0.0516	5395.1							0.0	5395.1
8	104616	0.0516	5395.1					0.0		0.0	5395.1
9	104616	0.0516	5395.1							0.0	5395.1
10	104616	0.0516	5395.1							0.0	5395.1
11	104616	0.0516	5395.1					0.0		0.0	5395.1
12	104616	0.0516	5395.1							0.0	5395.1
13	104616	0.0516	5395.1							0.0	5395.1
14	104616	0.0516	5395.1					0.0		0.0	5395.1
15	104616	0.0516	5395.1							0.0	5395.1
16	104616	0.0516	5395.1							0.0	5395.1
17	104616	0.0516	5395.1					0.0		0.0	5395.1
18	104616	0.0516	5395.1							0.0	5395.1
19	104616	0.0516	5395.1							0.0	5395.1
20	104616	0.0516	5395.1	-722.4	-600.5			0.0		-1322.9	4072.2
TOTAL	1781392		91248.76	-722.4	-600.5	0		0		-1322.9	89925.86

LIFE CYCLE AVG. COST

632659	@ 10%	PV @ 10%	0.050578	PRESENT VALUE @ 10%	31999.1

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ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-1 & B-1 & C-1

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	0.0		0.0	0.0
3				0.0	0.0	0.0	0.0	0.0		0.0	0.0
4	104789	0.0552	5783.1	0.0	0.0	0.0	0.0	0.0		0.0	5783.1
5	108968	0.0551	6002.2	0.0	0.0	0.0		0.0		0.0	6002.2
6	104385	0.0592	6179.7	0.0				0.0		0.0	6179.7
7	104555	0.0591	6179.7					0.0		0.0	6179.7
8	104616	0.0591	6179.7					0.0		0.0	6179.7
9	104616	0.0591	6179.7					0.0		0.0	6179.7
10	104616	0.0591	6179.7					0.0		0.0	6179.7
11	104616	0.0591	6179.7					0.0		0.0	6179.7
12	104616	0.0591	6179.7					0.0		0.0	6179.7
13	104616	0.0591	6179.7					0.0		0.0	6179.7
14	104616	0.0591	6179.7					0.0		0.0	6179.7
15	104616	0.0591	6179.7					0.0		0.0	6179.7
16	104616	0.0591	6179.7					0.0		0.0	6179.7
17	104616	0.0591	6179.7					0.0		0.0	6179.7
18	104616	0.0591	6179.7					0.0		0.0	6179.7
19	104616	0.0591	6179.7					0.0		0.0	6179.7
20	104616	0.0591	6179.7	-722.4	-600.5			0.0		-1322.9	4856.8
TOTAL	1782705		104480.3	-722.4	-600.5	0.0	0.0	0.0		-1322.9	103157.4

LIFE CYCLE AVG. COST

418104.1 @ 15% PV @ 15% 0.057821 PRESENT VALUE @ 15% 24175.21

ECONOMIC RAIL COST
(Banana, Atlantico & Pacifico Lines)

DEVELOPMENT SCENARIO A-2 & B-2 & C-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	110017	0.0481	5291.0	0.0	0.0	0.0				0.0	5291.0
5	102427	0.0526	5387.8	0.0				0.0		0.0	5387.8
6	104385	0.0517	5395.1	0.0						0.0	5395.1
7	104555	0.0516	5395.1							0.0	5395.1
8	104616	0.0516	5395.1					0.0		0.0	5395.1
9	104616	0.0516	5395.1							0.0	5395.1
10	104616	0.0516	5395.1							0.0	5395.1
11	104616	0.0516	5395.1					0.0		0.0	5395.1
12	104616	0.0516	5395.1							0.0	5395.1
13	104616	0.0516	5395.1							0.0	5395.1
14	104616	0.0516	5395.1					0.0		0.0	5395.1
15	104616	0.0516	5395.1							0.0	5395.1
16	104616	0.0516	5395.1							0.0	5395.1
17	104616	0.0516	5395.1					0.0		0.0	5395.1
18	104616	0.0516	5395.1							0.0	5395.1
19	104616	0.0516	5395.1							0.0	5395.1
20	104616	0.0516	5395.1	-722.4	-600.5			0.0		-1322.9	4072.2
TOTAL	1781392		91604.76	-722.4	-600.5	0		0		-1322.9	90281.86

LIFE CYCLE AVG. COST

417841 @ 15% PV @ 15% 0.050994 PRESENT VALUE @ 15% 21307.4

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-1 & C-1

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	1620.0		1620.0	1620.0
3				759.4	767.6	0.0	0.0	1979.0		3506.0	3506.0
4	64165	0.0591	3795.1	114.0		0.0		14.2		128.2	3923.3
5	65281	0.0581	3795.1	1881.1	1048.8	0.0				2929.9	6725.0
6	59964	0.0721	4321.5					28.0		28.0	4349.5
7	60134	0.0719	4321.5					7.1		7.1	4328.6
8	60195	0.0718	4321.5							0.0	4321.5
9	60195	0.0718	4321.5					7.1		7.1	4328.6
10	60195	0.0718	4321.5					7.1		7.1	4328.6
11	60195	0.0718	4321.5							0.0	4321.5
12	60195	0.0718	4321.5					7.1		7.1	4328.6
13	60195	0.0718	4321.5					7.1		7.1	4328.6
14	60195	0.0718	4321.5							0.0	4321.5
15	60195	0.0718	4321.5					7.1		7.1	4328.6
16	60195	0.0718	4321.5					7.1		7.1	4328.6
17	60195	0.0718	4321.5							0.0	4321.5
18	60195	0.0718	4321.5					7.1		7.1	4328.6
19	60195	0.0718	4321.5					7.1		7.1	4328.6
20	60195	0.0718	4321.5	-550.9	-363.3					-914.2	3407.3
TOTAL	1032079		72412.2	2203.6	1453.1	0.0	0.0	3705.1		7361.8	79774

LIFE CYCLE AVG. COST

593272.2 @ 5% PV @ 5% 0.080655 PRESENT VALUE @ 5% 47850.7

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-2 & C-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST Wagons	CAPITAL COST Locos	CAPITAL COST Track & Civil	CAPITAL COST Bridges	CAPITAL COST Sig./Tel	CAPITAL COST Builds.	CAPITAL COST Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	69393	0.0454	3148.0	2754.5	1816.4	0.0				4570.9	7718.9
5	58740	0.0655	3846.2					42.2		42.2	3888.4
6	59964	0.0641	3846.2							0.0	3846.2
7	60134	0.0640	3846.2							0.0	3846.2
8	60195	0.0639	3846.2					14.2		14.2	3860.4
9	60195	0.0639	3846.2							0.0	3846.2
10	60195	0.0639	3846.2							0.0	3846.2
11	60195	0.0639	3846.2					14.2		14.2	3860.4
12	60195	0.0639	3846.2							0.0	3846.2
13	60195	0.0639	3846.2							0.0	3846.2
14	60195	0.0639	3846.2					14.2		14.2	3860.4
15	60195	0.0639	3846.2							0.0	3846.2
16	60195	0.0639	3846.2							0.0	3846.2
17	60195	0.0639	3846.2					14.2		14.2	3860.4
18	60195	0.0639	3846.2							0.0	3846.2
19	60195	0.0639	3846.2							0.0	3846.2
20	60195	0.0639	3846.2	-550.9	-363.3			14.2		-900.0	2946.2
TOTAL	1030766		64686.66	2203.6	1453.12	0.0		113.2		3769.92	68456.58

LIFE CYCLE AVG. COST

592448 @ 5% PV @ 5% 0.068139 PRESENT VALUE @ 5% 40368.9

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ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-1 & C-1

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST Wagons	Locos	Track & Civil	Elec. Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0			0.0	0.0
2						0.0	0.0	1620.0	1620.0	1620.0
3				759.4	767.6	0.0	0.0	1979.0	3506.0	3506.0
4	64165	0.0616	3951.1	114.0		0.0		14.2	128.2	4079.3
5	65281	0.0605	3951.1	1881.1	1048.8	0.0			2929.9	6881.0
6	59964	0.0721	4321.5					28.0	28.0	4349.5
7	60134	0.0719	4321.5					7.1	7.1	4328.6
8	60195	0.0718	4321.5						0.0	4321.5
9	60195	0.0718	4321.5					7.1	7.1	4328.6
10	60195	0.0718	4321.5					7.1	7.1	4328.6
11	60195	0.0718	4321.5						0.0	4321.5
12	60195	0.0718	4321.5					7.1	7.1	4328.6
13	60195	0.0718	4321.5					7.1	7.1	4328.6
14	60195	0.0718	4321.5						0.0	4321.5
15	60195	0.0718	4321.5					7.1	7.1	4328.6
16	60195	0.0718	4321.5					7.1	7.1	4328.6
17	60195	0.0718	4321.5						0.0	4321.5
18	60195	0.0718	4321.5					7.1	7.1	4328.6
19	60195	0.0718	4321.5					7.1	7.1	4328.6
20	60195	0.0718	4321.5	-550.9	-363.3				-914.2	3407.3
TOTAL	1032079		72724.2	2203.6	1453.1	0.0	0.0	3705.1	7361.8	80086

LIFE CYCLE AVG. COST

368485.7 @ 10% PV @ 10% 0.085051 PRESENT VALUE @ 10% 31340.36

01/24/89 - Bpacsens

Last Update: 01-07-89

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-2 & C-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	69393	0.0487	3379.0	2754.5	1816.4	0.0				4570.9	7949.9
5	58740	0.0655	3846.2					42.2		42.2	3888.4
6	59964	0.0641	3846.2							0.0	3846.2
7	60134	0.0640	3846.2							0.0	3846.2
8	60195	0.0639	3846.2					14.2		14.2	3860.4
9	60195	0.0639	3846.2							0.0	3846.2
10	60195	0.0639	3846.2							0.0	3846.2
11	60195	0.0639	3846.2					14.2		14.2	3860.4
12	60195	0.0639	3846.2							0.0	3846.2
13	60195	0.0639	3846.2							0.0	3846.2
14	60195	0.0639	3846.2					14.2		14.2	3860.4
15	60195	0.0639	3846.2							0.0	3846.2
16	60195	0.0639	3846.2							0.0	3846.2
17	60195	0.0639	3846.2					14.2		14.2	3860.4
18	60195	0.0639	3846.2							0.0	3846.2
19	60195	0.0639	3846.2							0.0	3846.2
20	60195	0.0639	3846.2	-550.9	-363.3			14.2		-900.0	2946.2
TOTAL	1030766		64917.66	2203.6	1453.12	0.0		113.2		3769.92	68687.58

LIFE CYCLE AVG. COST

367995.1	@ 10%	PV @ 10%	0.070362	PRESENT VALUE @ 10%	25893.21

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-1 & C-1

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	1620.0		1620.0	1620.0
3				759.4	767.6	0.0	0.0	1979.0		3506.0	3506.0
4	64165	0.0641	4116.1	114.0		0.0		14.2		128.2	4244.3
5	65281	0.0631	4116.1	1881.1	1048.8	0.0				2929.9	7046.0
6	59964	0.0721	4321.5					28.0		28.0	4349.5
7	60134	0.0719	4321.5					7.1		7.1	4328.6
8	60195	0.0718	4321.5							0.0	4321.5
9	60195	0.0718	4321.5					7.1		7.1	4328.6
10	60195	0.0718	4321.5					7.1		7.1	4328.6
11	60195	0.0718	4321.5							0.0	4321.5
12	60195	0.0718	4321.5					7.1		7.1	4328.6
13	60195	0.0718	4321.5					7.1		7.1	4328.6
14	60195	0.0718	4321.5							0.0	4321.5
15	60195	0.0718	4321.5					7.1		7.1	4328.6
16	60195	0.0718	4321.5					7.1		7.1	4328.6
17	60195	0.0718	4321.5							0.0	4321.5
18	60195	0.0718	4321.5					7.1		7.1	4328.6
19	60195	0.0718	4321.5					7.1		7.1	4328.6
20	60195	0.0718	4321.5	-550.9	-363.3					-914.2	3407.3
TOTAL	1032079		73054.2	2203.6	1453.1	0.0	0.0	3705.1		7361.8	80416

LIFE CYCLE AVG. COST

244017.4 @ 15% PV @ 15% 0.090121 PRESENT VALUE @ 15% 21991.14

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-2 & C-2

TRACK & INFRASTRUCTURE GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	69393	0.0522	3624.0	2754.5	1816.4	0.0				4570.9	8194.9
5	58740	0.0655	3846.2						42.2	42.2	3888.4
6	59964	0.0641	3846.2							0.0	3846.2
7	60134	0.0640	3846.2							0.0	3846.2
8	60195	0.0639	3846.2						14.2	14.2	3860.4
9	60195	0.0639	3846.2							0.0	3846.2
10	60195	0.0639	3846.2							0.0	3846.2
11	60195	0.0639	3846.2						14.2	14.2	3860.4
12	60195	0.0639	3846.2							0.0	3846.2
13	60195	0.0639	3846.2							0.0	3846.2
14	60195	0.0639	3846.2						14.2	14.2	3860.4
15	60195	0.0639	3846.2							0.0	3846.2
16	60195	0.0639	3846.2							0.0	3846.2
17	60195	0.0639	3846.2						14.2	14.2	3860.4
18	60195	0.0639	3846.2							0.0	3846.2
19	60195	0.0639	3846.2							0.0	3846.2
20	60195	0.0639	3846.2	-550.9	-363.3				14.2	-900.0	2946.2
TOTAL	1030766		65162.7	2203.6	1453.1	0.0			113.2	3769.9	68932.6

LIFE CYCLE AVG. COST

243755	@ 15%	PV @ 15%	0.072844	PRESENT VALUE @ 15%	17756.2

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-1 & C-1

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec.	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	0.0		0.0	0.0
3				0.0	0.0	0.0	0.0	0.0		0.0	0.0
4	64165	0.0591	3795.1	0.0		0.0		0.0		0.0	3795.1
5	65281	0.0581	3795.1	0.0	0.0	0.0				0.0	3795.1
6	59964	0.0721	4321.5					0.0		0.0	4321.5
7	60134	0.0719	4321.5					0.0		0.0	4321.5
8	60195	0.0718	4321.5							0.0	4321.5
9	60195	0.0718	4321.5					0.0		0.0	4321.5
10	60195	0.0718	4321.5					0.0		0.0	4321.5
11	60195	0.0718	4321.5							0.0	4321.5
12	60195	0.0718	4321.5					0.0		0.0	4321.5
13	60195	0.0718	4321.5					0.0		0.0	4321.5
14	60195	0.0718	4321.5							0.0	4321.5
15	60195	0.0718	4321.5					0.0		0.0	4321.5
16	60195	0.0718	4321.5					0.0		0.0	4321.5
17	60195	0.0718	4321.5							0.0	4321.5
18	60195	0.0718	4321.5					0.0		0.0	4321.5
19	60195	0.0718	4321.5					0.0		0.0	4321.5
20	60195	0.0718	4321.5	-550.9	-363.3					-914.2	3407.3
TOTAL	1032079		72412.2	-550.9	-363.3	0.0	0.0	0.0		-914.2	71498

LIFE CYCLE AVG. COST

593272.2 @ 5% PV @ 5% 0.068933 PRESENT VALUE @ 5% 40896.58

01/07/89 - Bpacsens

Last Update: 01-07-89

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-2 & C-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	69393	0.0454	3148.0	0.0	0.0	0.0				0.0	3148.0
5	58740	0.0655	3846.2					0.0		0.0	3846.2
6	59964	0.0641	3846.2							0.0	3846.2
7	60134	0.0640	3846.2							0.0	3846.2
8	60195	0.0639	3846.2					0.0		0.0	3846.2
9	60195	0.0639	3846.2							0.0	3846.2
10	60195	0.0639	3846.2							0.0	3846.2
11	60195	0.0639	3846.2					0.0		0.0	3846.2
12	60195	0.0639	3846.2							0.0	3846.2
13	60195	0.0639	3846.2							0.0	3846.2
14	60195	0.0639	3846.2					0.0		0.0	3846.2
15	60195	0.0639	3846.2							0.0	3846.2
16	60195	0.0639	3846.2							0.0	3846.2
17	60195	0.0639	3846.2					0.0		0.0	3846.2
18	60195	0.0639	3846.2							0.0	3846.2
19	60195	0.0639	3846.2							0.0	3846.2
20	60195	0.0639	3846.2	-550.9	-363.3			0.0		-914.2	2932.0
TOTAL	1030766		64686.7	-550.9	-363.3	0.0		0.0		-914.2	63772.5

LIFE CYCLE AVG. COST

592448.2 @ 5% PV @ 5% 0.061674 PRESENT VALUE @ 5% 36538.73

ECONOMIC RAIL COST (Pacifico Line) DEVELOPMENT SCENARIO A-1 & C-1 TOTAL CAPITAL COST GRANT
(Banana & Pacific Lines Combined)

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Elec. Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0			0.0	0.0
2						0.0	0.0	0.0	0.0	0.0
3				0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	64165	0.0616	3951.1	0.0		0.0		0.0	0.0	3951.1
5	65281	0.0605	3951.1	0.0	0.0	0.0			0.0	3951.1
6	59964	0.0721	4321.5					0.0	0.0	4321.5
7	60134	0.0719	4321.5					0.0	0.0	4321.5
8	60195	0.0718	4321.5						0.0	4321.5
9	60195	0.0718	4321.5					0.0	0.0	4321.5
10	60195	0.0718	4321.5					0.0	0.0	4321.5
11	60195	0.0718	4321.5						0.0	4321.5
12	60195	0.0718	4321.5					0.0	0.0	4321.5
13	60195	0.0718	4321.5					0.0	0.0	4321.5
14	60195	0.0718	4321.5						0.0	4321.5
15	60195	0.0718	4321.5					0.0	0.0	4321.5
16	60195	0.0718	4321.5					0.0	0.0	4321.5
17	60195	0.0718	4321.5						0.0	4321.5
18	60195	0.0718	4321.5					0.0	0.0	4321.5
19	60195	0.0718	4321.5					0.0	0.0	4321.5
20	60195	0.0718	4321.5	-550.9	-363.3				-914.2	3407.3
TOTAL	1032079		72724.2	-550.9	-363.3	0.0	0.0	0.0	-914.2	71810

LIFE CYCLE AVG. COST

368485.7 @ 10% PV @ 10% 0.068999 PRESENT VALUE @ 10% 25425.40

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-2 & C-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	69393	0.0487	3379.0	0.0	0.0	0.0				0.0	3379.0
5	58740	0.0655	3846.2					0.0		0.0	3846.2
6	59964	0.0641	3846.2							0.0	3846.2
7	60134	0.0640	3846.2							0.0	3846.2
8	60195	0.0639	3846.2					0.0		0.0	3846.2
9	60195	0.0639	3846.2							0.0	3846.2
10	60195	0.0639	3846.2							0.0	3846.2
11	60195	0.0639	3846.2					0.0		0.0	3846.2
12	60195	0.0639	3846.2							0.0	3846.2
13	60195	0.0639	3846.2							0.0	3846.2
14	60195	0.0639	3846.2					0.0		0.0	3846.2
15	60195	0.0639	3846.2							0.0	3846.2
16	60195	0.0639	3846.2							0.0	3846.2
17	60195	0.0639	3846.2					0.0		0.0	3846.2
18	60195	0.0639	3846.2							0.0	3846.2
19	60195	0.0639	3846.2							0.0	3846.2
20	60195	0.0639	3846.2	-550.9	-363.3			0.0		-914.2	2932.0
TOTAL	1030766		64917.7	-550.9	-363.3	0.0		0.0		-914.2	64003.5

LIFE CYCLE AVG. COST

367995.1	@ 10%	PV @ 10%	0.061752	PRESENT VALUE @ 10%	22724.76

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-1 & C-1

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST Wagons	CAPITAL COST Locos	CAPITAL COST Track & Civil	CAPITAL COST Elec.	CAPITAL COST Sig./Tel	CAPITAL COST Builds.	TOTAL (Thousands of US $) Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0	0.0	0.0		0.0	0.0
3				0.0	0.0	0.0	0.0	0.0		0.0	0.0
4	64165	0.0641	4116.1	0.0		0.0		0.0		0.0	4116.1
5	65281	0.0631	4116.1	0.0	0.0	0.0				0.0	4116.1
6	59964	0.0721	4321.5					0.0		0.0	4321.5
7	60134	0.0719	4321.5					0.0		0.0	4321.5
8	60195	0.0718	4321.5							0.0	4321.5
9	60195	0.0718	4321.5					0.0		0.0	4321.5
10	60195	0.0718	4321.5					0.0		0.0	4321.5
11	60195	0.0718	4321.5							0.0	4321.5
12	60195	0.0718	4321.5					0.0		0.0	4321.5
13	60195	0.0718	4321.5					0.0		0.0	4321.5
14	60195	0.0718	4321.5							0.0	4321.5
15	60195	0.0718	4321.5					0.0		0.0	4321.5
16	60195	0.0718	4321.5					0.0		0.0	4321.5
17	60195	0.0718	4321.5							0.0	4321.5
18	60195	0.0718	4321.5					0.0		0.0	4321.5
19	60195	0.0718	4321.5					0.0		0.0	4321.5
20	60195	0.0718	4321.5	-550.9	-363.3					-914.2	3407.3
TOTAL	1032079		73054.2	-550.9	-363.3	0.0	0.0	0.0		-914.2	72140

LIFE CYCLE AVG. COST

244017.4 @ 15% PV @ 15% 0.069286 PRESENT VALUE @ 15% 16907.23

ECONOMIC RAIL COST (Pacifico Line)
(Banana & Pacific Lines Combined)

DEVELOPMENT SCENARIO A-2 & C-2

TOTAL CAPITAL COST GRANT

YEAR	TRAFFIC (Thousand of NTK)	OPERATING COST ($/NTK)	OPERATING COST (Thousands of US $)	CAPITAL COST (Thousands of US $) Wagons	Locos	Track & Civil	Bridges	Sig./Tel	Builds.	Sub-Total	TOTAL (Thousands of US $)
1						0.0				0.0	0.0
2						0.0				0.0	0.0
3						0.0				0.0	0.0
4	69393	0.0522	3624.0	0.0	0.0	0.0				0.0	3624.0
5	58740	0.0655	3846.2					0.0		0.0	3846.2
6	59964	0.0641	3846.2							0.0	3846.2
7	60134	0.0640	3846.2							0.0	3846.2
8	60195	0.0639	3846.2					0.0		0.0	3846.2
9	60195	0.0639	3846.2							0.0	3846.2
10	60195	0.0639	3846.2							0.0	3846.2
11	60195	0.0639	3846.2					0.0		0.0	3846.2
12	60195	0.0639	3846.2							0.0	3846.2
13	60195	0.0639	3846.2							0.0	3846.2
14	60195	0.0639	3846.2					0.0		0.0	3846.2
15	60195	0.0639	3846.2							0.0	3846.2
16	60195	0.0639	3846.2							0.0	3846.2
17	60195	0.0639	3846.2					0.0		0.0	3846.2
18	60195	0.0639	3846.2							0.0	3846.2
19	60195	0.0639	3846.2							0.0	3846.2
20	60195	0.0639	3846.2	-550.9	-363.3			0.0		-914.2	2932.0
TOTAL	1030766		65162.7	-550.9	-363.3	0.0		0.0		-914.2	64248.5

LIFE CYCLE AVG. COST

243754.5 @ 15% PV @ 15% 0.061988 PRESENT VALUE @ 15% 15109.88

IV COST OF MOVING POTENTIAL RAIL TRAFFIC BY TRUCK: ALTERNATIVE RAIL SYSTEMS EQUIVALENCE

TRUCKING COSTS SCENARIO A & B
(Banana & Atlantico Lines)

(Avg. Cost Operator, 50% Load Factor, Ban. Line,
75% Atlantico Line: Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint./ Replacement	Vehicle Oper.	Vehicle Capital @ 5%	TOTAL
1					
2					
3					
4	83739	209	2712	739	3660
5	84476	211	2732	744	3687
6	85234	213	2751	750	3714
7	85234	213	2751	750	3714
8	85234	213	2751	750	3714
9	85234	213	2751	750	3714
10	85234	213	2751	750	3714
11	85234	213	2751	750	3714
12	85234	213	2751	750	3714
13	85234	213	2751	750	3714
14	85234	213	2751	750	3714
15	85234	213	2751	750	3714
16	85234	213	2751	750	3714
17	85234	213	2751	750	3714
18	85234	213	2751	750	3714
19	85234	213	2751	750	3714
20	85234	213	2751	750	3714
TOTAL	1446725	3617	46709	12733	63059

PRESENT VALUE @ 5%	LIFE CYCLE AVG. COST	PV @ 5%
828267	0.04359229	36106

TRUCKING COSTS SCENARIO A & B & C
(Banana, Atlantico & Pacifico Lines)

(Avg. Cost Operator, 50% Load Factor, Ban. Line,
75% Atlantico & Pacifico Lines: Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint./ Replacement	Vehicle Oper.	Vehicle Capital @ 5%	TOTAL
1					
2					
3					
4	113149	283	3480	948	4711
5	115169	288	3533	962	4783
6	117314	293	3588	978	4859
7	117552	294	3595	980	4869
8	117626	294	3597	981	4872
9	117626	294	3597	981	4872
10	117626	294	3597	981	4872
11	117626	294	3597	981	4872
12	117626	294	3597	981	4872
13	117626	294	3597	981	4872
14	117626	294	3597	981	4872
15	117626	294	3597	981	4872
16	117626	294	3597	981	4872
17	117626	294	3597	981	4872
18	117626	294	3597	981	4872
19	117626	294	3597	981	4872
20	117626	294	3597	981	4872
TOTAL	1992322	4981	60957	16621	82559

PRESENT VALUE @ 5%	LIFE CYCLE AVG. COST	PV @ 5%
1139661	0.04144616	47235

TRUCKING COSTS SCENARIO A & C
(Banana & Pacifico Lines)

(Avg. Cost Operator, 50% Load Factor, Ban. Line,
75% Pacifico Line: Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint. & Replacement	Vehicle Oper.	Vehicle Capital @ 5%	TOTAL
1					
2					
3					
4	69698	174	2346	639	3159
5	70981	177	2379	648	3204
6	72368	181	2415	658	3254
7	72606	182	2422	660	3264
8	72680	182	2424	661	3267
9	72680	182	2424	661	3267
10	72680	182	2424	661	3267
11	72680	182	2424	661	3267
12	72680	182	2424	661	3267
13	72680	182	2424	661	3267
14	72680	182	2424	661	3267
15	72680	182	2424	661	3267
16	72680	182	2424	661	3267
17	72680	182	2424	661	3267
18	72680	182	2424	661	3267
19	72680	182	2424	661	3267
20	72680	182	2424	661	3267
TOTAL	1230493	3076	41074	11198	55348

PRESENT VALUE @ 5%	LIFE CYCLE AVG. COST	PV @ 5%
703758	0.04499458	31665

TRUCKING COSTS SCENARIO A & B
(Banana & Atlantico Line)

(Avg. Cost Operator, 50% LF Banana Line,
75% Atlantico Line: Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint./ Replacement	Vehicle Oper.	Vehicle Capital @ 10%	TOTAL
1					
2					
3					
4	83739	209	2712	1007	3928
5	84476	211	2732	1014	3957
6	85234	213	2751	1022	3986
7	85234	213	2751	1022	3986
8	85234	213	2751	1022	3986
9	85234	213	2751	1022	3986
10	85234	213	2751	1022	3986
11	85234	213	2751	1022	3986
12	85234	213	2751	1022	3986
13	85234	213	2751	1022	3986
14	85234	213	2751	1022	3986
15	85234	213	2751	1022	3986
16	85234	213	2751	1022	3986
17	85234	213	2751	1022	3986
18	85234	213	2751	1022	3986
19	85234	213	2751	1022	3986
20	85234	213	2751	1022	3986
TOTAL	1446725	3617	46709	17351	67677

PRESENT VALUE @ 10%	LIFE CYCLE AVG. COST	PV @ 10%
512189	0.04679055	23966

TRUCKING COSTS SCENARIO A & B & C
(Banana & Atlantico & Pacifico Lines)

(Avg. Cost Operator, 50% LF Banana Line,
75% Atlantico & Pacifico Lines: Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint./ Replacement	Vehicle Oper.	Vehicle Capital @ 10%	TOTAL
1					
2					
3					
4	113149	283	3480	1292	5055
5	115169	288	3533	1312	5133
6	117314	293	3588	1333	5214
7	117552	294	3595	1335	5224
8	117626	294	3597	1336	5227
9	117626	294	3597	1336	5227
10	117626	294	3597	1336	5227
11	117626	294	3597	1336	5227
12	117626	294	3597	1336	5227
13	117626	294	3597	1336	5227
14	117626	294	3597	1336	5227
15	117626	294	3597	1336	5227
16	117626	294	3597	1336	5227
17	117626	294	3597	1336	5227
18	117626	294	3597	1336	5227
19	117626	294	3597	1336	5227
20	117626	294	3597	1336	5227
TOTAL	1992322	4981	60957	22640	88578

PRESENT VALUE @ 10%	LIFE CYCLE AVG. COST	PV @ 10%
704100	0.04447817	31317

TRUCKING COSTS SCENARIO C & A
(Pacifico & Banana Lines)

(Avg. Cost Operator, 50% LF Banana Line,
75% Pacifico Line: Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint. & Replacement	Vehicle Oper.	Vehicle Capital @ 10%	TOTAL
1					
2					
3					
4	69698	174	2346	871	3391
5	70981	177	2379	884	3440
6	72368	181	2415	897	3493
7	72606	182	2422	899	3503
8	72680	182	2424	900	3506
9	72680	182	2424	900	3506
10	72680	182	2424	900	3506
11	72680	182	2424	900	3506
12	72680	182	2424	900	3506
13	72680	182	2424	900	3506
14	72680	182	2424	900	3506
15	72680	182	2424	900	3506
16	72680	182	2424	900	3506
17	72680	182	2424	900	3506
18	72680	182	2424	900	3506
19	72680	182	2424	900	3506
20	72680	182	2424	900	3506
TOTAL	1230493	3076	41074	15251	59401

PRESENT VALUE @ 10%	LIFE CYCLE AVG. COST	PV @ 10%
434716	0.04830814	21000

TRUCKING COSTS SCENARIO A & B
(Banana & Atlantico Lines)

(Avg. Cost Operator, 50% LF Ban. Line, 75% LF Atlantico Line
Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint./ Replacement	Vehicle Oper.	Vehicle Capital @ 15%	TOTAL
1					
2					
3					
4	83739	209	2712	1291	4212
5	84476	211	2732	1300	4243
6	85234	213	2751	1310	4274
7	85234	213	2751	1310	4274
8	85234	213	2751	1310	4274
9	85234	213	2751	1310	4274
10	85234	213	2751	1310	4274
11	85234	213	2751	1310	4274
12	85234	213	2751	1310	4274
13	85234	213	2751	1310	4274
14	85234	213	2751	1310	4274
15	85234	213	2751	1310	4274
16	85234	213	2751	1310	4274
17	85234	213	2751	1310	4274
18	85234	213	2751	1310	4274
19	85234	213	2751	1310	4274
20	85234	213	2751	1310	4274
TOTAL	1446725	3617	46709	22241	72567

PRESENT VALUE @ 15%	LIFE CYCLE AVG. COST	PV @ 15%
337668	0.05017818	16944

TRUCKING COSTS SCENARIO A & B & C
(Banana & Atlantico & Pacifico Lines)

(Avg. Cost Operator, 50% LF Ban. Line, 75% LF Atlantico Line
& Pacifico Lines: Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint./ Replacement	Vehicle Oper.	Vehicle Capital @ 15%	TOTAL
1					
2					
3					
4	113149	283	3480	1656	5419
5	115169	288	3533	1681	5502
6	117314	293	3588	1709	5590
7	117552	294	3595	1712	5601
8	117626	294	3597	1713	5604
9	117626	294	3597	1713	5604
10	117626	294	3597	1713	5604
11	117626	294	3597	1713	5604
12	117626	294	3597	1713	5604
13	117626	294	3597	1713	5604
14	117626	294	3597	1713	5604
15	117626	294	3597	1713	5604
16	117626	294	3597	1713	5604
17	117626	294	3597	1713	5604
18	117626	294	3597	1713	5604
19	117626	294	3597	1713	5604
20	117626	294	3597	1713	5604
TOTAL	1992322	4981	60957	29027	94965

PRESENT VALUE @ 15%	LIFE CYCLE AVG. COST	PV @ 15%
463749	0.04769501	22119

TRUCKING COSTS) SCENARIO C & A
Pacifico & Banana Lines

(Avg. Cost Operator, 50% LF Ban. Line, 75% LF Pacifico Lines: Rail Tonnes*Road Kilometres)

YEAR	TRAFFIC	COST (Thousands of US $)			
	(Thous. of NTK)	Hwy Maint. & Replacement	Vehicle Oper.	Vehicle Capital @ 15%	TOTAL
1					
2					
3					
4	69698	174	2346	1116	3636
5	70791	177	2379	1132	3688
6	72368	181	2415	1150	3746
7	72606	182	2422	1153	3757
8	72680	182	2424	1154	3760
9	72680	182	2424	1154	3760
10	72680	182	2424	1154	3760
11	72680	182	2424	1154	3760
12	72680	182	2424	1154	3760
13	72680	182	2424	1154	3760
14	72680	182	2424	1154	3760
15	72680	182	2424	1154	3760
16	72680	182	2424	1154	3760
17	72680	182	2424	1154	3760
18	72680	182	2424	1154	3760
19	72680	182	2424	1154	3760
20	72680	182	2424	1154	3760
TOTAL	1230303	3076	41074	19553	63703

PRESENT VALUE @ 15%	LIFE CYCLE AVG. COST	PV @ 15%
286177	0.05184060	14836

V PROJECTED RAIL REVENUES

Revenues Per Tonne/Kilometre
Based on INCOFER'S 1986 Results
==========

(Colones)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996-2008
Atlantico Line	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65
Pacifico Line	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
Banana Line	5.88	5.88	5.88	5.88	5.88	5.88	5.88	5.88	5.88

Revenues (Thousands of Colones)
==========

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996-2008
Atlantico Line	201582	200531	196579	199820	203145	206558	206558	206558	206558
Pacifico Line	67368	68393	69677	72825	76229	79962	80480	80666	80666
Banana Line	146459	165363	183221	198432	198432	198432	198432	198432	198432

Revenues Per Tonne/Kilometre
Based on INCOFER'S 1986 Results

Converted at 74.00

(US Dollars)

	1988	1989	1990	1991	1992	1993	1994	1995	1996-2008
Atlantico Line	0.063	0.063	0.063	0.063	0.063	0.063	0.063	0.063	0.063
Pacifico Line	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041
Banana Line	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079

Revenues (Thousands of US Dollars)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996-2008
Atlantico Line	2724	2710	2656	2700	2745	2791	2791	2791	2791
Pacifico Line	910	924	942	984	1030	1081	1088	1090	1090
Banana Line	1979	2235	2476	2682	2682	2682	2682	2682	2682

PROJECTED REVENUES FOR RAIL COMBINATIONS

Revenues (Thousands of US Dollars)

Year		1988	1989	1990	1991	1992	1993	1994	1995	1996-2008
Banana & Atlantic	- AB-1					2745	5473	5473	5473	5473
	- AB-2					5427	5473	5473	5473	5473
Banana & Pacific	- BP-1				984	1030	3763	3770	3772	3772
	- BP-2					3712	3763	3770	3772	3772
Banana, Pacific & Atlantic	- BAP-1				984	3775	6554	6561	6563	6563
	- BAP-2					6457	6554	6561	6563	6563

APPENDIX E

TERMS OF REFERENCE

1. FOREWORD

Canadian Pacific Consulting Services Ltd. (CPCS) has been active in Costa Rica's transportation sector since the late 1970's. In 1978-1980 CPCS successfully rehabilitated 110 kilometres of railway line between Rio Frio and Puerto Limón and in 1980-1982 constructed a railway marshalling yard in the new Port of Moin. In addition, in 1983 CPCS undertook a preliminary study, funded by CIDA, for the completion of the railway rehabilitation.

As a result of discussions held in Costa Rica in July 1986 between CPCS and Costa Rica's Minister of Public Works and Transport, the Minister made a verbal request for CPCS to undertake a study to determine the role of the railway and what additional rehabilitation is required in order for it to fulfill that role, and to assess the feasibility of an urban transit system serving San José.

In the following sections we describe the basic methodology to be followed by CPCS to achieve the above-mentioned objectives, the manpower effort and team proposed to undertake the project and the schedule of activities.

2. INTRODUCTION

In general, most railways have experienced the following evolution/pattern:

- The railways were built for the most part prior to the inception of road transport, originally enjoyed a transport monopoly, either nationally or regionally, and were oriented to generalized transportation and geographical penetration services.

- Under monopoly conditions, unjustified or misguided investments could and did take place, institutional devices to avoid their repeated occurrence were not developed and cross-subsidization among railway services became common practice.

- As road competition increased, the financial position of the railways deteriorated. The response in some cases was to regulate the transport sector, but a more common practice was to set up direct subsidies for the railways, giving government officials a measure of control on investments, pricing and hiring. Such measures were not able to prevent the financial decline and further affected the quality of operations.

- The standards of management declined at an accelerated pace as corporate, operational and broader economic objectives disappeared.

In such a situation, the economic role of railways (i.e. efficient use of resources and generation of economic surpluses in favor of productive activities) cannot be fulfilled.

Between 1978 and 1982 Canadian Pacific Consulting Services Ltd. rehabilitated 110 kilometres of railway line between Puerto Limón and Rio Frio, a section used mainly for the transportation of bananas. After the track was improved, the results were dramatic. There was an improvement to the level of service which allowed the railway to guarantee the

quality of the product it delivered and thereby regain a market in which it had comparative advantage. More recently, railway share of that market has been decreasing, mainly as a result of operating deficiencies which can be easily corrected.

The questions now are: Should other sections of the Costa Rican railway be rehabilitated? Should a modernization plan for the operating departments be undertaken? These are critical questions which the Ministry of Public Works and Transportation of Costa Rica is trying to answer.

The problems faced by the Ministry of Public Works and Transportation of Costa Rica are not different from those experienced by other countries:

- Should scarce capital resources be used to rehabilitate the railways or should they be invested in road projects or in the infrastructure of other modes which offer comparative advantage?

- Should the role of the railways be redefined towards new objectives or should the railways be slowly phased out?

- In the event that a new role is found for the national railways, how should their modernization be achieved? What are the priorities in their modernization?

Canadian Pacific's experience in dealing with similar questions on its own network may prove valuable to the Costa Rican Ministry of Public Works and Transportation. What appears to be needed is a very pragmatic examination of rail and road corridors in Costa Rica and the preparation of an action plan which will define the investments required to rehabilitate and modernize the railway so that it can function in a manner which maximizes its benefits to the country.

3. OBJECTIVES OF THE STUDY

The objectives of this study are:

> "To evaluate which sections and services of the Costa Rican railway should be rehabilitated by comparing its advantages and disadvantages with those of other modes, namely highway transportation. To recommend, if appropriate, the capital investments in infrastructure, rolling stock, management and training required to rehabilitate the sections which are economically advantageous for the country."

The economic evaluation should be done on a corridor-by-corridor basis for both freight and passenger traffic at both the intercity and suburban level.

Considerable attention should be devoted to the role of railways for suburban passenger service, in particular in the Alajuela-Heredia-San José-Cartago-Paraíso corridor where the feasibility of a Light Rail Transit system using the existing rail infrastructure should be compared with other alternatives.

4. METHODOLOGY

When assessing the advantages of rail over road and vice-versa the comparison should be made for specific classes of commodities and wherever possible, for specific corridors. Only in those terms will the comparison be meaningful because the comparative advantages of one mode over others is a function of the type of commodity carried, the topography of the terrain, the characteristics of the vehicles used and the distances involved; those factors have a direct bearing on the specific components of the level of service offered by each mode. Therefore, one of the first tasks of this study is to define road/rail corridors which will later be compared through economic evaluation.

The consultants will then obtain information on the present road and rail flows in each of the corridors and the level of service factors offered such as travel times, loss and damage, waiting times, reliability, tariff. Those levels of service characteristics will be tabulated using LOTUS 1-2-3. A good knowledge of the generalized transportation costs and of the modal split in each corridor for each main class of commodity should be known at the end of this task.

Each commodity in each corridor will then be examined and the consultants will determine the present modal split, i.e. the percentage of traffic carried by each mode, by analysing the cost and traffic data and by interviewing the shippers.

Because tariffs are only perceived by the user and may or may not reflect the economic cost of each mode, the consultants will determine the operating economic cost for the typical road and rail configurations used in each corridor. This implies the adjustment of financial costs by social conversion factors in order to eliminate taxes, duties and to reflect the shadow price of foreign exchange.

Once the basic costs for each mode and the present modal split are known, the consultants will prepare a 10-year forecast for each of the

commodities involved. The forecast will be based mainly on studies done by other ministries which regulate the production of those commodities. The forecast will be as specific as possible, indicating origins and destinations so that road and rail can be compared.

After the overall demand is known for each commodity within the area of influence of each of the corridors, the consultants will prepare several scenarios for the rail and road infrastructure in the corridor.

These scenarios will be either the do-nothing scenario, which is the existing infrastructure, or new scenarios such as rehabilitated track and improved signalling. In addition, for each scenario a hypothesis will be made about the operating characteristics of each mode. For example, should some products be transported in unit trains, or should a container-on-flat-car strategy be used between railheads? The impact of these strategies will be costed so that capital and operating costs for each scenario and operating strategy are obtained.

For the highway mode, the cost of excessive axle loading will be determined and the effect of shifting traffic from road to rail evaluated.

Once all economic costs (capital and operating) are obtained, i.e. after adjustment for taxes, subsidies and foreign exchange, the consultants will determine the breakeven point for each corridor in terms of annual tonnage. The idea is to find the tonnage at which one mode becomes more economically advantageous than the other by equalizing the respective discounted cash flows over a 20-year time horizon.

Such analysis will identify the more economic mode from the country's standpoint on a corridor-by-corridor basis and for each product.

Finally, after each corridor is studied, a global comparison of road and rail will be done by adding the results for the different corridors. The consultants will ensure that double counting of costs and benefits will not occur during this exercise.

The same procedure will be used for passenger services at the intercity level. Here the comparison will be with the intercity highway services, i.e. buses or in some cases air services. To avoid the controversy introduced by the "value of time" concept, the comparisons will be based on generalized transport costs with and without the value of time.

In the specific case of suburban services, CPCS will examine the feasibility of a Light Rail Transit System (L.R.T.) and a conventional rail commuter service between Alajuela-Heredia-San José-Cartago and Paraíso. The tasks to be undertaken in this subset of the project are:

- Review of other studies undertaken on this corridor.

- Examination of the existing infrastructure and in particular the grade crossings.

- Calculation of waiting times at peak hour for road vehicles at the grade crossings if an L.R.T. system is proposed.

- Estimation, based on demand analysis done in other studies, of the frequencies required. Estimation of the number and costs of L.R.T. sets required.

- Estimation of the track and signalling improvements and additions required to accommodate an L.R.T. system.

- Estimation of L.R.T. operating costs.

- Economic analysis of the L.R.T. system versus other alternatives, namely a conventional rail system and a bus system in reserved right-of-way.

The above-mentioned tasks will allow the consultants to prepare a series of conclusions on the economic role of the railway in Costa Rica. They will also produce one action plan for the capital investment required to

rehabilitate the sections of track that seem economically advantageous to the country.

Insofar as the suburban corridor between Alajuela and Paraíso is concerned, the objective is to assess the economic and technical feasibility of an L.R.T. versus other alternatives which have already been studied. The conclusions reached will dictate whether an L.R.T. alternative should be pursued or discarded and whether or not a conventional rail commuter system is a realistic alternative. In either case, preliminary specifications for the appropriate rolling stock for this service will be provided.