

(2) Power source equipment for signalling facilities

The electric power for signalling facilities must be from a reliable source to enable smooth electric traction.

The power source for signalling facilities is tapped through 3 to 30 kVA line transformers (25 kV/230 V) from overhead contact wires at each point along lines where power supply is required.

8-4-6 Signalling Facilities

(1) Measures against inductive interference

When electrification is completed, the return current of electric rolling stock must be routed through the rail to the substation. The following measures are taken since the present double-rail DC track circuit with insulation to both rails cannot be used.

a. DC track circuits within stations

The present track circuits are improved to the single-rail track circuits (cf. Fig. 8.4.12), which use a single rail as a return circuit for the electric traction current. Jumper bonds (cf. Fig. 8.4.13) enable the adjacent rail to be used as a return circuit during rail breaks. Either the track circuit sending voltage is increased or the track circuit is divided when the track circuit is affected by the DC component contained in the rush current for AC electric rolling stock.

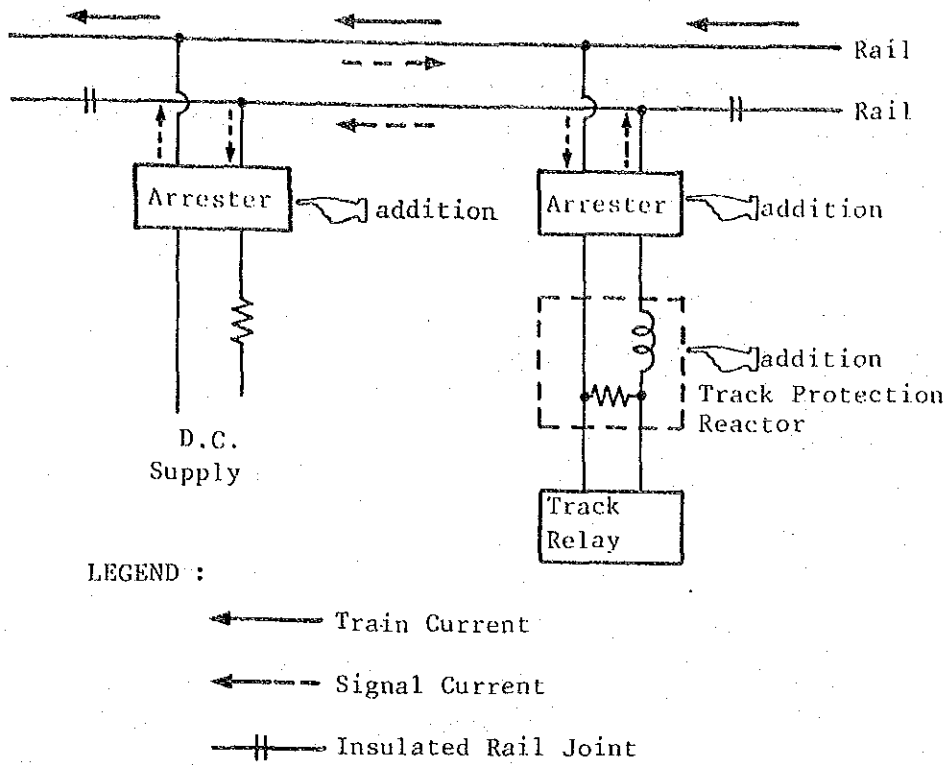


Fig. 8.4.12 Single-Rail Track Circuit for AC Electrification Section

Source: Study draws

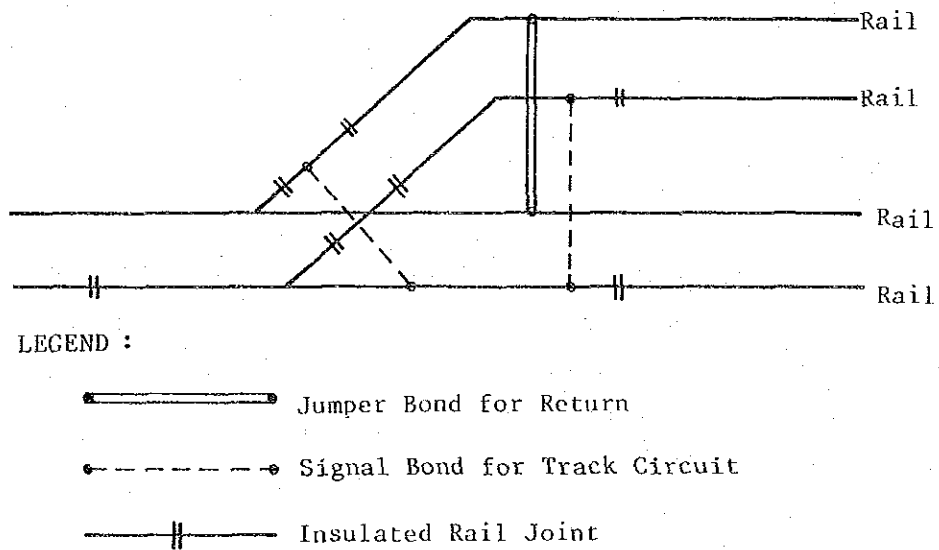


Fig. 8.4.13 Setting of Jumper Bond

Source: Study draws

b. DC track circuit between stations

DC track circuits between stations have no bypass to conduct the return circuit current when the rail is broken. The track circuit is therefore changed to the audio frequency (AF) non-insulated track circuit given in Fig. 8.4.14.

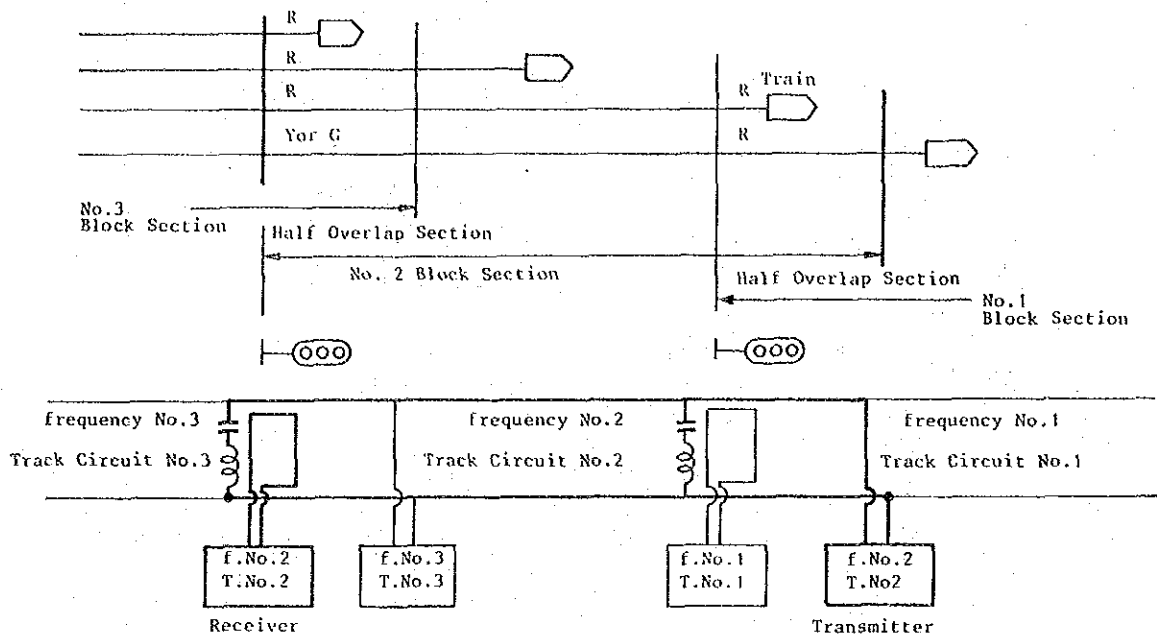


Fig. 8.4.14 Audio Frequency Non-Insulated Track Circuit

Source: Study draws

(2) Change of block system

The present lock and block system and the block system by telephone communication are not suited for this electrification for the following reasons.

- (a) Manual operation requires a longer time than automatic operation
- (b) Deterioration of devices and faulty P.T.C. communication circuit often require reoperation.
- (c) Length of block section (maximum seven kilometres) is too long to secure the minimum headway of 7.5 minutes.

Therefore, an automatic block system, setting one to three stations (maximum 2.8 kilometres) as one block is selected. This automatic block instrument includes a check-in check-out system or track circuit systems,

and the former is adopted because no equipment and rail insulation are necessary between stations.

The check-in check-out system has axle counters that can check the car separation between stations. An AF non-insulated track circuit for an overrun protection of 600 feet is installed inside signals. Fig. 8.4.15 shows the plan for the signal block section, and Fig. 8.4.16 shows the system structure.

(3) Changes to relay interlocking devices

The outmoded system is replaced with a modern computer-controlled interlocking at the Insein station. This system replaces the logic circuits used by relay contacts, with a computer program, and can easily cope with future route changes without hardware alterations. This is also economically suited to station having many routes.

The Mingaladon Bazaar and Togyauungale stations are shuttling stations, and are equipped with relay interlocking devices.

(4) Rail line level crossing removal

Changes of the track layout in the Rangoon station require the construction of new routes, and that the relay interlocking device is improved. Moreover, the relay interlocking device routes are reduced at the Pazundaung station, and the automatic block instruments are improved between the Rangoon and Pazundaung stations.

(5) Measures for level crossings

Level crossing signals are to be installed as a safety measure. The devices to be adopted have both lamp and sound alarm functions.

(6) Measures against rain

The track circuits are divided wherever possible to avoid forced "Emergency Supply" excitation during malfunction of the track circuits in the Rangoon station yard.

(7) Reinforcement of insulated rail joints

To improve the dielectric strength and to increase the durability, wood-insulated rail joints are replaced with new type ones.

(Unit: km)

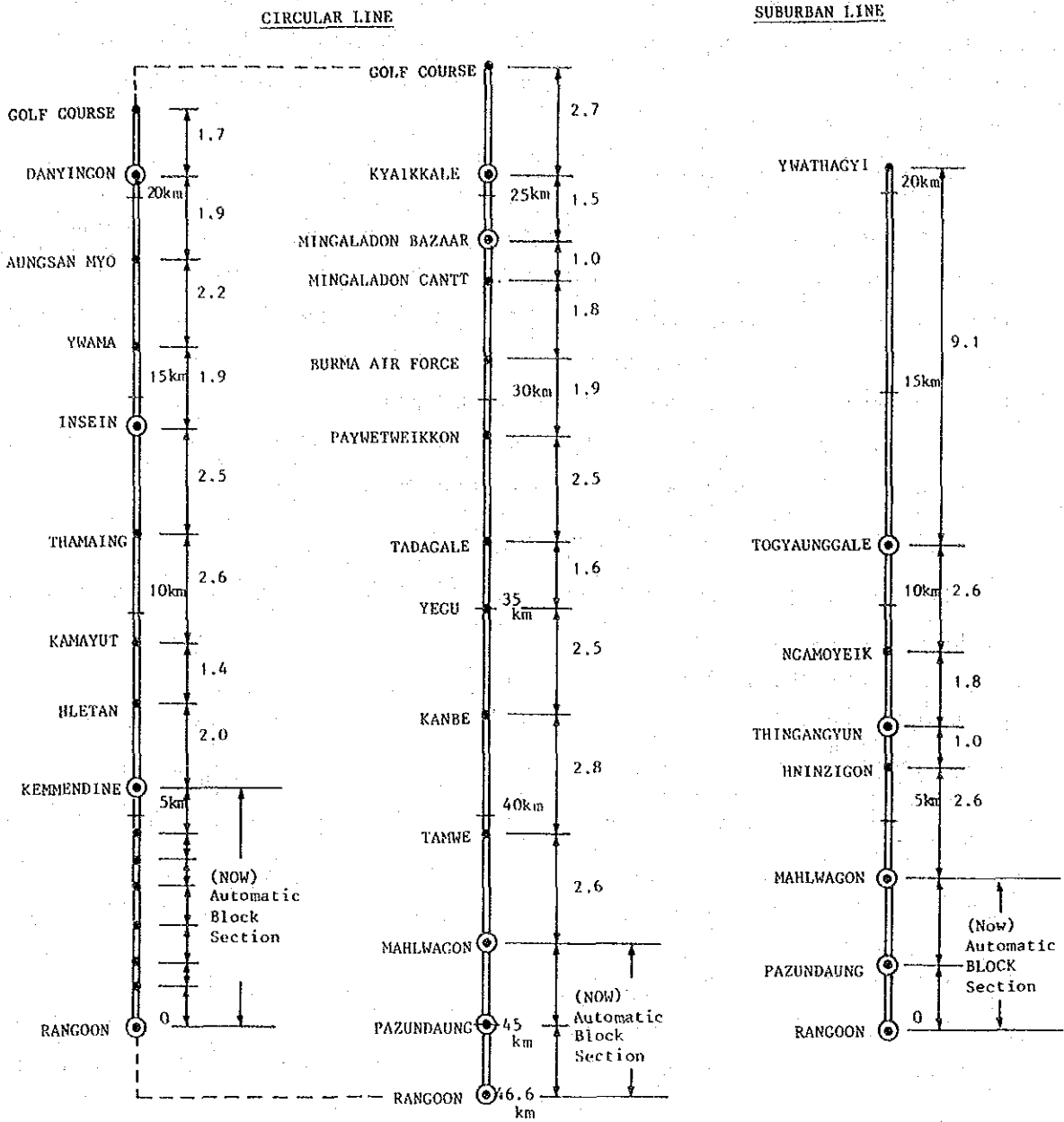


Fig. 8.4.15 Automatic Block Section

Source: Study draws

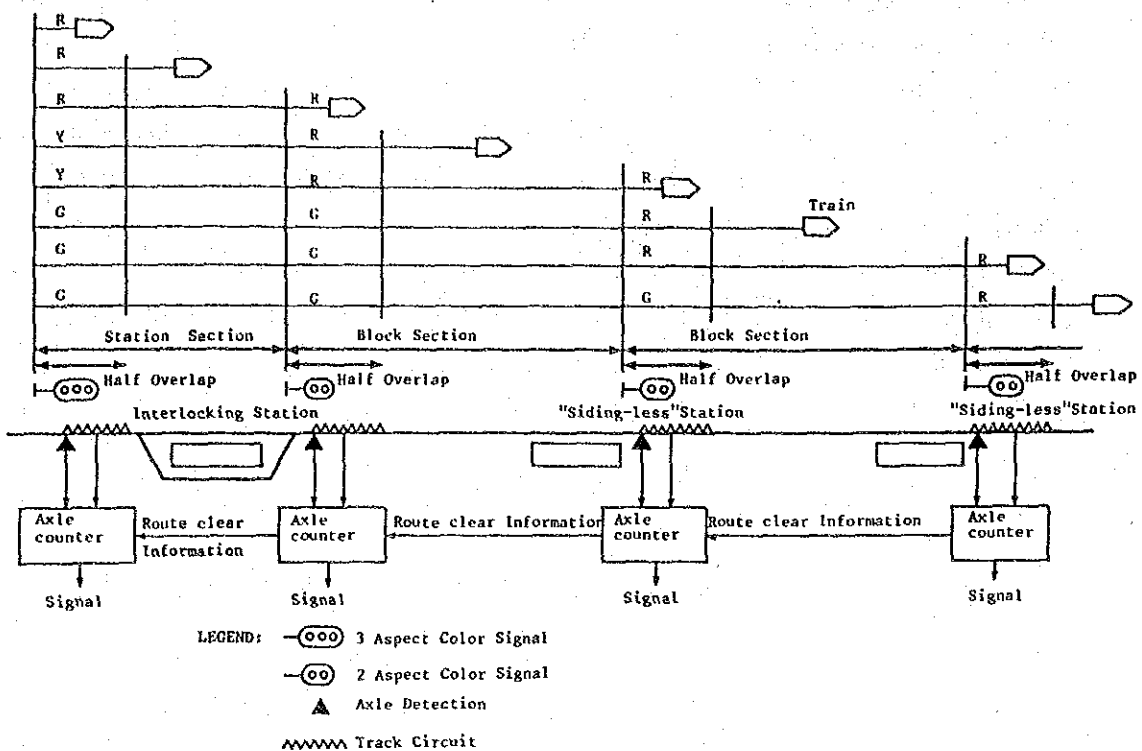


Fig. 8.4.16 Automatic Block Instrument by Axle Counter

Source: Study draws

(8) Education and training

To maintain the new and improved devices, a short course of study and training are required for the following devices.

- Single-rail track circuits
- Non-insulated track circuits
- Automatic block instruments using axle counters
- Computer-controlled interlocking system
- Level crossing signals
- Reinforced plastic-inserted or glass fiber insulated rail joints

## 8-4-7 Telecommunications Facilities

### (1) Measures against inductive interference

Inductive interference occurs on the P.T.C. overhead bare wires built along the Circular and Suburban Lines. As measures against this, overhead bare wires are either moved to positions where no inductive interference exists, replaced with cables having the function to shield inductive interference or otherwise replaced with a wireless system. The inductive prediction calculation is complex, and recalculation must be made at the detailed design stage when the preconditions become fixed.

The trial calculations on various cases, of electrostatic induction, electromagnetic induction and psophometric noise, have been conducted under the normal traction current and the fault. The results shown in Table 8.4.7 and Fig. 8.4.17 lead to the following measures to clear the limit specified by Comite Consultatif International Telegraphique et Telephonique (C.C.I.T.T.).

Table 8.4.7 Result of Trial Calculation for Inductive Interference Countermeasures

Section	Pre-condition	l [km]	Distance from Railway Center [metre] for Aerial Bare Wires		L = 4 metre Screening Factor of Buried Cable		L = Distance from Railway to P.T.C. Bare Wires Screening Factor of Buried Cable					
			Normal	Accident	Noise	Normal	Accident	Noise	Normal	Accident		
Mahlwagon Rangoon Insein		4	11	22	315 (252)	no-need	no-need	0.13	12.5	no-need	0.95	0.10
		14.3	115	250	480 (405)	0.55	0.36	0.053	15	0.50	0.33	0.043
		10	82	150	435 (370)	0.65	0.49	0.066	15	0.59	0.44	0.054
		5	23.5	35	350 (280)	no-need	0.92	0.10	15	0.93	0.83	0.087
Insein Danyong Mahlwagon		26.5	420	465	680 (560)	0.24	0.21	0.024	15	0.21	0.19	0.020
		20	370	375	640 (540)	0.26	0.26	0.027	15	0.24	0.24	0.022
		10	135	165	470 (405)	0.51	0.46	0.053	13	0.46	0.41	0.042
		5	23	42	350 (290)	no-need	0.87	0.106	12.5	0.92	0.77	0.083
Mahlwagon Ywathagyi		16.2	168	310	510 (435)	0.46	0.31	0.045	*23	0.46	0.31	0.043
		7.2	67	95	415 (350)	0.71	0.62	0.074	*22	0.71	0.61	0.069
		4.5	16	31	330 (270)	no-need	0.96	0.11	**15	0.65	0.56	0.060
		12	-	-	-	-	-	-	**27	no-need	0.99	0.12

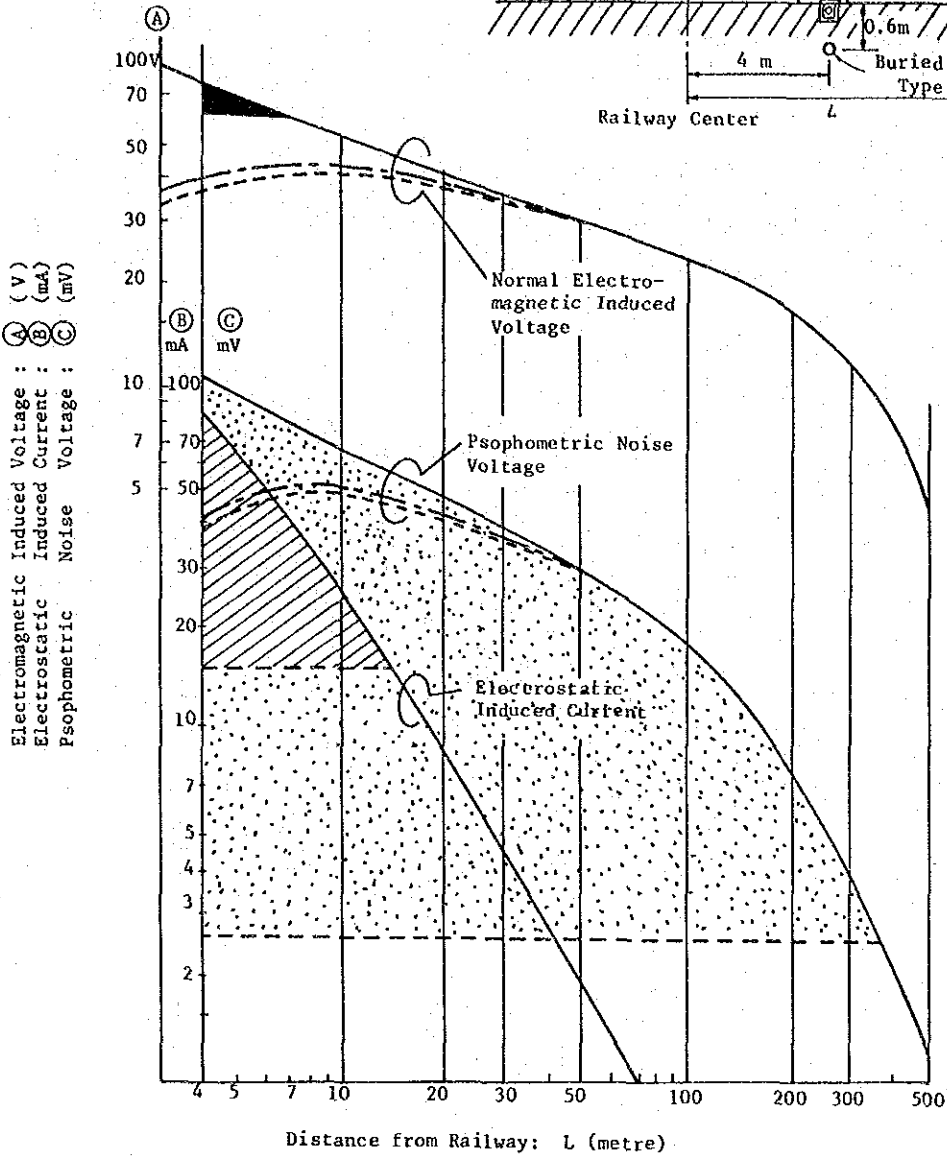
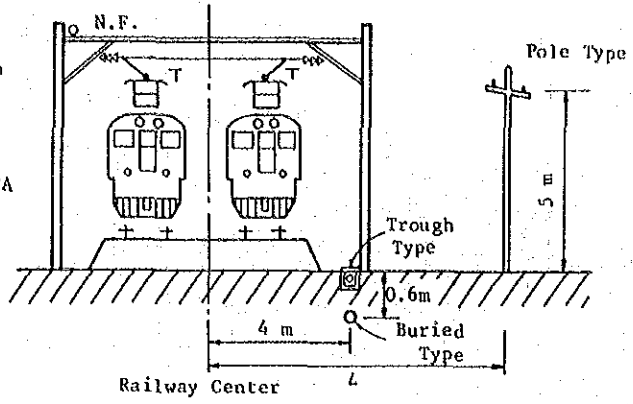
LEGEND: S.P.A : Sectioning Post  
 S.S. : Substation  
 : Electric locomotive  
 : Motor Road  
 ( ) : non-shielded cable  
 l : distance to parallel communication line  
 Normal: EMI voltage under normal condition  
 Accident: EMI voltage under faulty condition  
 Noise: psophometric noise voltage  
 \* : west side the line  
 \*\* : east side the line  
 \*\*\* : Motor Road along Mandalay Line in the case of bare wires and non-shielded cable

Source: Study estimates



Pre-Condition

Length of paralleled wire :  $l = 10\text{km}$   
 Contact wire : 25kv, 50Hz  
 Earth conductivity :  $\delta = 0.02 \text{ s/m}$   
 Rail leakage resistance :  $0.5\Omega\cdot\text{km}$   
 Train load :  $IP=60\text{A}$   
 Equivalent disturbing current :  $JP=2\text{A}$



Distance from Railway: L (metre)

LEGEND:	NF:	Negative Feeder		Limit Over Area
	T:	Contact Wire		Limit Over Area
		Pole Type Bare Wire		Limit Over Area
		Trough Type Non-Shielded Cable		Limit Over Area
		Buried Type Non-Shielded Cable		Limit Over Area

Fig. 8.4.17 Sample of Inductive Interference Area

Source: Study draws

(a) The P.T.C. cabling project will be carried out in 1986 between Rangoon and Danyingon via Insein, and a cable must have shielding characteristics according to the paralleling distance of the telecommunications line.

(b) As for other sections, telecommunications poles must be shifted over 300 metre apart from railway, however, there is no suitable route for the continuous shifting of poles. As a result buried cable is selected within the railway ground.

Between Mahlwagon and Ywathagyi the P.T.C. bare wires will be replaced by the buried cables at the expense of B.R.C. which is included in the electrification investment plan. After the commencement of electrification the P.T.C. will maintain these buried cables as the P.T.C.'s own property.

Between Mahlwagon and Danyingon via Mingaladon, since the B.R.C. telecommunications network as mentioned in the next section will be newly installed, the P.T.C. bare wires will be unnecessary for B.R.C.

(2) B.R.C. telecommunications network

The existing outmoded manual type telephone exchanges, at the Rangoon and Insein Stations are replaced with automatic ones.

The telecommunications circuit diagram is shown in Fig. 8.4.18.

This network will be constructed at the expense of B.R.C. and be also maintained by B.R.C. as its own property.

LEGEND:

- ⊙ Interlocking Station
- ⊠ Signal Control Station
- Other Station

- No.1 Train Dispatch Telephone Circuit
- No.2 Power Dispatch Telephone Circuit
- No.3 Block Telephone Circuit
- No.4 Maintenance Telephone Circuit
- No.5 Party Telephone Line
- No.6 Carrier Telephone Line

- ⤴ Dispatching Telephone (center)
- ⤵ Dispatching Telephone (station)
- ⤶ Electromagnetic Telephone
- ⤷ Terminal Box
- Automatic Telephone
- ⊠ Telephone Exchange

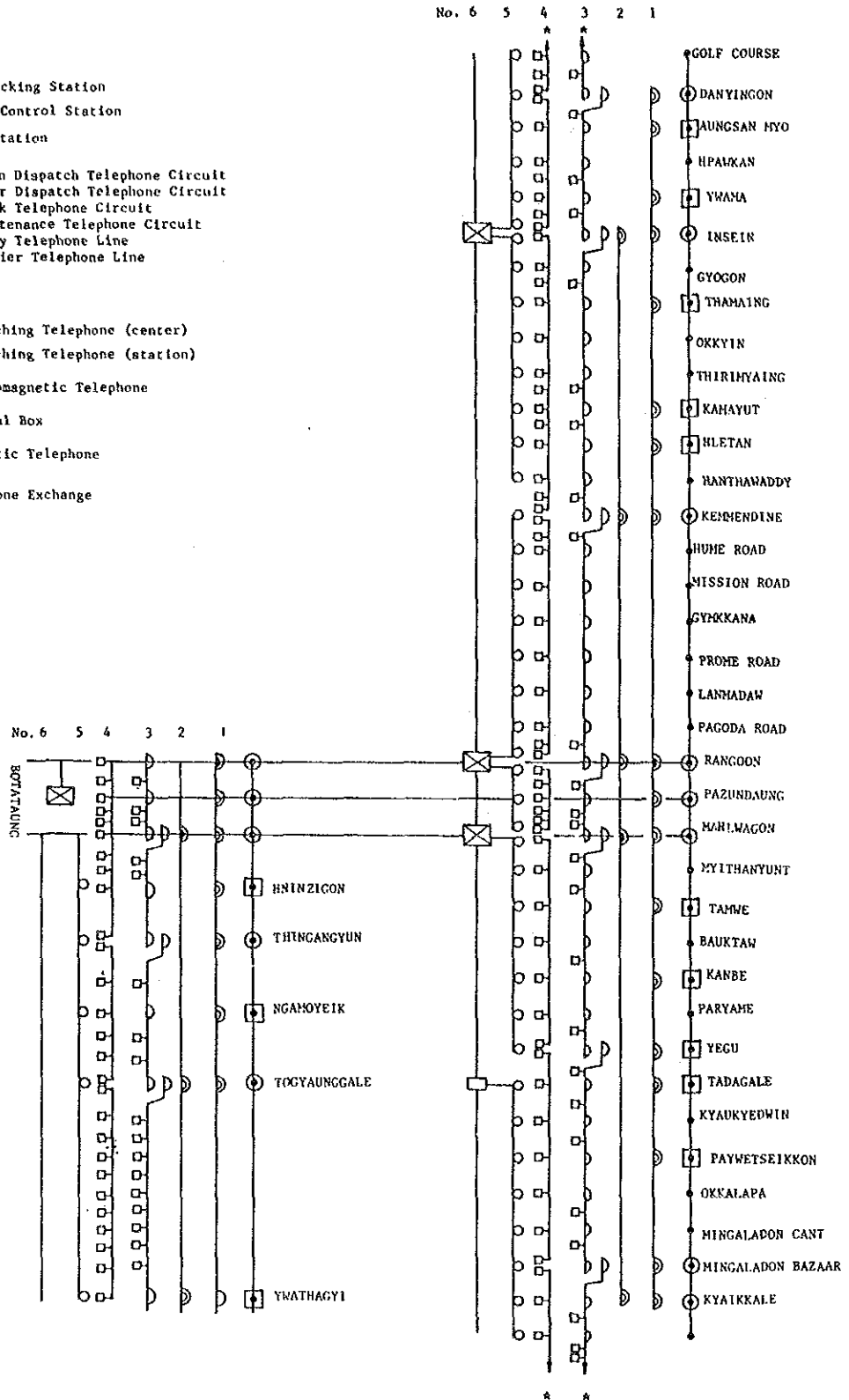


Fig. 8.4.18 Telecommunications Circuit Diagram

Source: Study draws

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**CHAPTER 9 INVESTMENT PLAN**

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## CHAPTER 9 INVESTMENT PLAN

### 9-1 Investment Costs

#### 9-1-1 Premises

Investment costs are estimated on the basis of following premises.

##### (1) Socio-economic factors

###### a. Prices

Prices are based on the April 1984 economic condition. An escalation factor will not be considered in the base cases of the economic and financial appraisal.

###### b. Exchange rate

The exchange rate of 100 Yen = 3.5 Kyats is used, based on the certified six month rate for April 1984.

###### c. Material procurement

Cement, ballast, wood, reinforced concrete pipes, sleepers and used rail will be procured on the domestic market while other materials will be imported.

###### d. Labour costs

The labour force will be procured in local currency, except for staff for education and training, design, engineering consultation and a part of the supervision work. These will be paid in foreign currencies. Domestic labour costs are as shown below.

unskilled labour: 170 Kyats/month (6.5 Kyats/day)  
(minimum wage guidelines)

skilled or supervisory labour: 474 Kyats/month  
(annual salary for B.R.C. employees above middle class)

###### e. Freight and insurance charges

The freight and insurance charges are 8% of FOB value and 1% of C&F value, respectively.

###### f. Customs duty

Customs duty is levied on imported goods, with the assessable value (100.5% of CIF value) multiplied by the following rates of customs duty.

Table 9.1.1 Rates of Major Commodities

(Unit: %)

Item	Rate
Electric facilities	20
Rolling stock	10
Civil engineering	10
Signalling facilities	15
Telecommunication facilities	15
Inspection and repair equipment	15

Source: Study estimates based on CUSTOMS TARIFF by CUSTOMS DEPARTMENT

g. Commodity tax

Commodity tax is levied on imported goods at 30% of the assessable values.

h. Site procurement

Costs for site procurement are not considered.

(2) Passenger volume and train operation

a. Passenger volume

The daily passenger volume is estimated at 233 thousand persons for 1990/91, and is expected to increase at the annual average rate of 2.9% during the project life.

b. Train operation plan

The train operating plan is formulated as follows.

Table 9.1.2 Train Operating Plan

	(Unit: Number)			
	1983/84	1990/91	2000/01	2010/11
Traction	DEL-6PC	EL-6PC	EL-6PC	EL-6PC
Train km/day	2664.8	3939.2	4952.6	6358.4
No. of Trains	13	19	24	31
(Maintenance and Stand-by)	(3)	(3)	(3)	(5)
No. of Carriage	84	105	136	173
(Maintenance and Stand-by)	(24)	(9)	(10)	(17)

Source: Study estimates

c. Procurement programme

Rolling stock will be purchased in the fiscal years of 1988/89, 1989/90, 1998/99, 1999/00 and 2009/10, on the basis of the train operating plan, the driver training programme and the utilization of the existing rolling stock. Of the existing rolling stock, 54 carriages reconstructed from diesel railcars will be used on the Circular and Suburban Lines, and others will be removed and utilized on the other lines. The rolling stock procurement programme is as shown below. In this programme, knocked-down production of carriages is planned after the initial procurements.

Table 9.1.3 Rolling Stock Procurement Programme

	1988/89	1989/90	1998/99	1999/00	2009/10
EL Purchasing Number	3	16	-	5	7
EL Cumulative Number	3	19	19	24	31
PC Purchasing Number	12	39	54	31	37
PC Cumulative Number	66	105	105	136	173

Source: Study estimates



(3) Description of major works

Works to be carried out before the initial year of the electrification are as follows.

a. Electricity facilities

- (a) Transmission facilities: Two circuits from Thaketa substation
- (b) Transmission lines: Two underground cables (5.95 km) between Thaketa substation and Mahlwagon railway substation.
- (c) Railway substation: Two banks of transformers, three feeding circuit breakers
- (d) Overhead contact system: 174 km length of simple catenary system, 2 km length of special overhead contact system
- (e) Power distribution facilities: 30 line transformers

b. Civil engineering

- (a) Track:

New construction	2.0 km
Removal	1.7 km
Track lowering	15.5 km
- (b) Passenger overbridges:

New construction	1
Bridge raising	10
- (c) Buildings:

New substations, sheds, etc.	5
Additional constructions	Insein workshop
Modifications	platform roofs
- (d) Rail-bed drains: Hanthawaddy-Rangoon-Mahlwagon

c. Signalling and telecommunications

- (a) Automatic block instruments: 46 sections
- (b) Computer-controlled interlocking system and relay interlocking devices: at 3 stations
- (c) Level crossing signals: 32 sets
- (d) Automatic exchangers: 2 sets
- (e) Aluminium shield cable: 6 circuits

d. Workshop facilities

Inspection and repair facilities for electric locomotives: new installation

e. Rolling stock shed

- (a) Pantograph inspection deck: 40 m
- (b) Inspection and repair instruments

(4) Future investment for the ground facilities

The rolling stock storage track will be extended at Insein shed as follows, according to the rolling stock procurement programme.

Table 9.1.4 Future investment for Insein Shed

(Unit: metre)

	1999/00	2009/10
Storage track	600	750
Overhead contact line	800	1200
Pantograph inspection deck		40

Source: Study estimates

(5) Engineering and education

Engineering costs include foreign technical assistance costs for study, design, supervision and education, as well as domestic administrative costs.

(6) Contingencies

A contingency fund is a fund provided to cover estimate overruns caused by unexpected conditions. The respective contingency funds for the local and foreign currency portions are estimated at 5% and 10% of the facility costs.

9-1-2 Investment Costs

The estimated investment costs are shown in Table 9.1.5.

Table 9.1.5 Initial Investment Costs

(Unit: Thousand Kyats)

	1986 - 1990		
	Local	Foreign	Total
<u>Rolling Stock</u>		216,775	216,775
Electric locomotives		123,315	123,315
Carriages		93,460	93,460
<u>Electric Facilities</u>	2,974	86,544	89,518
Transmission lines	501	10,586	11,087
Substation facilities	184	14,642	14,826
Overhead contact lines	2,268	59,949	62,217
Power distribution Lines	21	1,367	1,388
<u>Civil Engineering</u>	32,087	15,176	47,263
Earth work	19,469	1,826	21,295
Track	5,632	3,064	8,696
Station platforms	1,159		1,159
Bridge	21	202	223
Passenger overbridges	491	2,791	3,282
Buildings	5,315	7,293	12,608
<u>Inspection and Repair Equipments</u>	105	8,552	8,657
<u>Signalling Facilities</u>	814	29,772	30,586
Track circuits	247	3,920	4,167
Signalling instruments	487	23,409	23,896
Level crossing facilities	80	2,443	2,523
<u>Telecommunication Facilities</u>	202	24,015	24,217
Telecommunication instruments	32	11,207	11,239
Telecommunication lines	170	12,808	12,978
<u>Subtotal</u>	36,182	380,834	417,016
<u>Engineering and Education</u>	351	33,338	33,689
<u>Tariffs and Taxes</u>	164,926		164,926
<u>Contingencies</u>	1,827	18,374	20,201
<u>Grand total</u>	203,286	432,546	635,832

Source: Study estimates

## 9-2 Construction Schedule

### 9-2-1 Major Scheduling Policy

The construction programme is scheduled on the basis of the following policies.

- (a) An engineering study follows the completion of this feasibility study.
- (b) The construction efficiency is expected to be considerably reduced in the rainy season.
- (c) A part of the Suburban Line electrification facilities will be constructed as a pilot section for the purposes of prior training for the drivers of electric locomotives.
- (d) Maintenance and repair facilities will be installed at the Insein shed and workshop so that service staff and maintenance crew can be trained for the pilot operation.
- (e) Single track operation will be implemented while the track is being lowered to enable the overhead clearance.
- (f) The use of the interlocking system and the existing equipment will be partly suspended while the automatic block system is being installed.

### 9-2-2 Schedule

Table 9.2.1 shows the construction schedule, for the January 1990 as the commissioning.

Table 9.2.1 Schedule

Items	Fiscal Year							
	1984	1985	1986	1987	1988	1989	1990	
Feasibility Study	[Bar from 1984 to 1985]							
Engineering Study	[Bar from 1985 to 1986]							
Design, Supervision and Education	[Bar from 1986 to 1989]							
Procurement and Manufacture	[Bar from 1986 to 1988]							
Equipment	[Bar from 1986 to 1988]							
Rolling stock	[Bar from 1986 to 1989]							
Construction work	[Bar from 1986 to 1989]							
Track	[Bar from 1986 to 1988]							
Earthwork	[Bar from 1986 to 1988]							
Structures	[Bar from 1986 to 1989]							
Power source and transmission line	[Bar from 1987 to 1988]							
Substation	[Bar from 1987 to 1989]							
Overhead contact line	[Bar from 1987 to 1989]							
Signalling	[Bar from 1987 to 1989]							
Telecommunication	[Bar from 1987 to 1989]							
Workshop	[Bar from 1987 to 1988]							
Rolling stock shed	[Bar from 1988 to 1989]							
Pilot Section	[Bar from 1988 to 1989]							
Inspection	[Bar from 1988 to 1989]							
EL driver training	[Bar from 1988 to 1989]							
EL inspection and repair training	[Bar from 1988 to 1989]							
Main Section	[Bar from 1988 to 1989]							
Inspection	[Bar from 1988 to 1989]							
Training operation	[Bar from 1988 to 1989]							
Final preparation	[Bar from 1988 to 1989]							
Commissioning	[Bar from 1989 to 1990]							

Source: Study draws

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**CHAPTER 10 ECONOMIC AND FINANCIAL APPRAISALS**

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CHAPTER 10 ECONOMIC AND FINANCIAL APPRAISALS

10-1 Economic Appraisal

10-1-1 Purpose

The purpose of the economic appraisal is to assess whether the benefits justifiably exceed the costs from the viewpoint of the national economy.

10-1-2 Terms of Reference

(1) Definition of "effects"

The effects of the project are divided into the elements shown in Fig. 10.1.1.

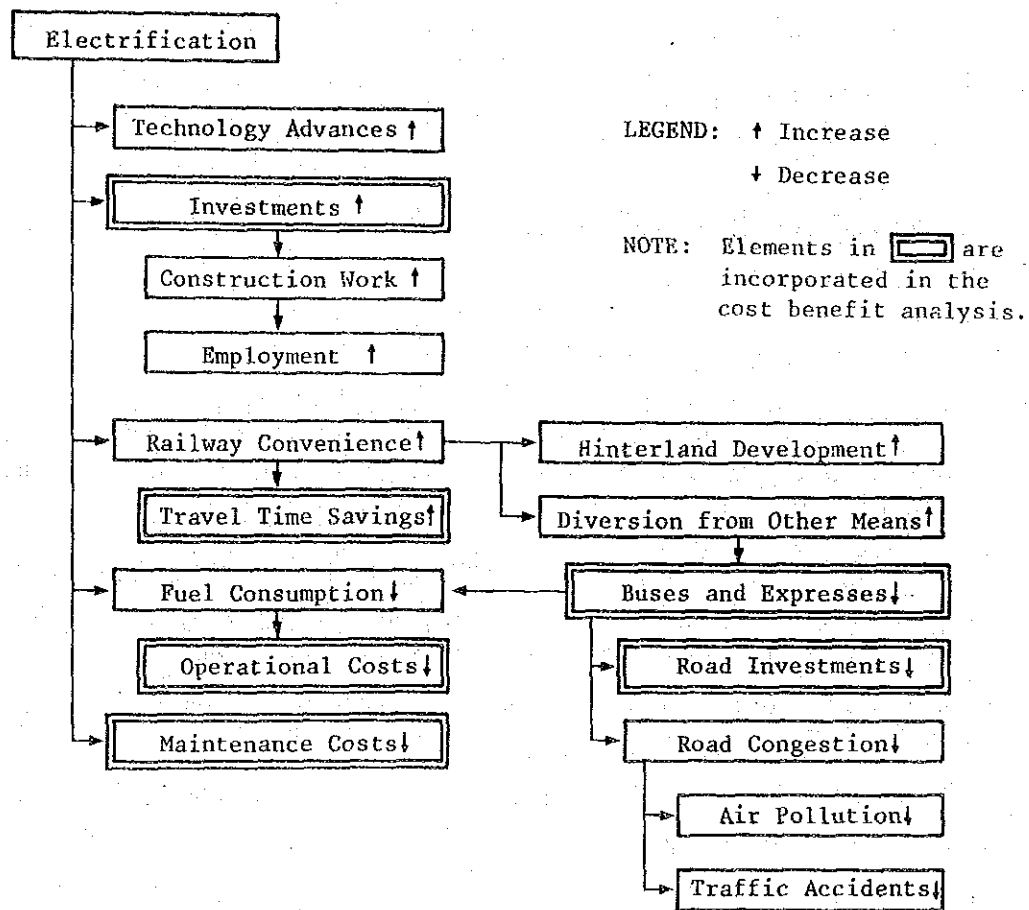


Fig. 10.1.1 Effects Caused by Electrification

Source: Study draws



## (2) Methodology

The economic internal rate of return (EIRR) based on cost-benefit analysis is used and other benefits are also considered in order to appraise the economic significance of the project.

### a. Cost benefit analysis

The EIRR is calculated on the basis of the incremental costs and benefits between the "with the project" and "without the project" cases. The following effects are taken into consideration.

- Travel time savings
- Railway investment
- Railway maintenance and operation costs
- Bus and express costs
- Road investment

### b. Other benefits

The following other benefits are also quantified.

- Fuel savings
- Road congestion alleviation
- Employment creation

## 10-1-3 Economic Cost-Benefit Analysis

### (1) Prerequisites

#### a. Determination of the "with the project" and "without the project" cases

A cost-benefit analysis is conducted for the incremental costs and benefits between the "with the project" and "without the project" cases for the entire life of the project. These costs and benefits include the costs for road transportation. In other words each case offers a different solution to the problem of the increasing traffic demand, and so the total transportation costs for both cases are taken into account in the following manner.

#### (a) "With the project" case

The railway investment for 1999/2000 and 2009/10 are planned in the "with the project" case to meet the increased demand in addition to the initial investment and its replacement.

Buses and expresses are assumed to be procured every year, accompanying the marginal road investment.

(b) "Without the project" case

The railway investment plan for the "without the project" case is based on a railway demand which is forecast to be steadily increasing on the assumption that the present modal split will not change. This investment plan includes the additional procurement of diesel electric locomotives and carriages for 1989/90, 1999/2000 and 2009/10 in addition to the replacement of the existing ones, as well as modifications to the track and the signalling and telecommunication facilities required for the increasing demand.

The costs for buses and expresses, and road investment are estimated on the corresponding assumptions for the "with the project" case. Other means of transportation such as taxis, private cars and trishaws are assumed to have the same numbers for both cases. The incremental costs of road transportation can therefore be estimated on the basis of the number of passengers diverted from buses and expresses due to the electrification.

b. Premises

(a) Project life

The construction work will commence in 1986/87 for commissioning in 1990 with the project life extending until 2019/20.

(b) Prices

Prices are based on the April 1984 economic condition, and assumed to be constant for the period for which the economic appraisal was conducted.

The escalation factor is not considered because:

- o Prices have been stable in Burma.
- o Long-term projection of the escalation is quite difficult.
- o Such a projection may exaggerate the project justifiable appraisal.

(c) Tariffs and taxes

Tariffs and taxes are excluded from the economic appraisal since those are transferred from the B.R.C. account to the national account.

(d) Fuel prices

The international price of oil is used as the basis for the fuel cost estimation.

(2) Cost and benefit estimation

a. Passenger time savings

Several methods for estimating the monetary value of the time saved (time value) are used in economic appraisal.

The GDP is used as the basis for the estimation of the time value in this study, because the Burmese government aims at doubling the standard of living (as measured by the per capita GDP), and because the available data was not obtained to classify the passengers with respect to the time value.

The passenger time savings are estimated as follows.

$$\text{Passenger Time Savings} = \text{Time Saved} \times \text{Time Value} \times \text{Growth Rate}$$

where, Time Saved: Total passenger travelling time for the "without the Project" case - That for the "with the project" case

Time Value: Study estimates

b. Railway investment

(a) Initial investment

According to the investment plan, the initial investment costs are indicated for each year.

(b) Additional investment

Additional investment is planned for 1999/2000 and 2009/10.

(c) Replacement

Assets will be replaced on the basis of the following useful life.

Table 10.1.1 Useful Life of Assets.

Item	Useful Life
<b>Rolling Stock</b>	
Electric locomotives	35
Diesel electric locomotives	30
Carriages	30
<b>Electric Facilities</b>	
Transmission lines	30
Substation facilities	30
Overhead contact lines	30
Power distribution lines	30
<b>Civil Engineering</b>	
Earth work	60
Track	50
Station platforms	50
Bridges	50
Passenger overbridges	50
Buildings	50
Inspection and Repair Equipment	20
<b>Signalling Facilities</b>	
Track circuits	15
Signalling instruments	25
Level crossing facilities	25
<b>Telecommunication Facilities</b>	
Telecommunication instruments	15
Telecommunication lines	30
Buses and Expresses	15

Source: Study estimates

(d) Existing rolling stock

The existing rolling stock will be transferred to other sections in the following numbers for the "with the project" case.

Table 10.1.2 Existing Rolling Stock Transferred

(Unit: Thousand Kyats)

Type	Number	Acquired Value/Unit	Acquired Year	Remaining Value
DEL	13	3,531	1978	27,540
LBTX	11	638	1973	3,043
LBPTZ	9	179	1975	804
BDTX(PP)	5	638	1973	1,383
LBBTE	2	26	1969	16
LBBTEZ	2	26	1969	16
Total	42	-	-	32,802

Source: B.R.C.

(e) Salvage values

The expected salvage values at the end of the project life, are deducted from the investment costs.

c. Railway maintenance costs

(a) Maintenance costs for newly invested assets

These maintenance costs are calculated by multiplying the investment costs by the following maintenance rates.

Table 10.1.3 Maintenance Rates

Item	Maintenance Rate
<b>Rolling Stock</b>	
Electric locomotives	0.01649
Carriages	0.00605
<b>Electric Facilities</b>	
Transmission lines	
Substation facilities	0.00065
Overhead contact lines	0.00054
Power distribution lines	0.00054
<b>Civil Engineering</b>	
Earth work	0.00010
Track	0.00298
Station platforms	0.00145
Bridges	0.00145
Passenger overbridges	0.00275
Buildings	0.00360
Inspection and Repair Equipment	0.02000
<b>Signalling Facilities</b>	
Track circuits	0.00076
Signaling instruments	0.00835
Level crossing facilities	0.00835
<b>Telecommunication Facilities</b>	
Telecommunication instruments	0.00490
Telecommunication lines	0.00121

Source: Study estimates

(b) Maintenance costs for the existing assets

The maintenance costs for the diesel electric locomotives in the "without the project" case, are estimated by using a unit cost per train km of 4.2125 thousand kyats in 1983/84.

The maintenance costs for the existing facilities are estimated by using a unit cost per track km, which covers the maintenance costs for the structural works and traffic facilities.

That for the "without the project" case is 900 thousand Kyats while that for the "with the project case" is 641 thousand Kyats, excluding the sections for lowering.

(c) Estimated results

The maintenance costs will be reduced by the electrification as shown in Table 10.1.4.

Table 10.1.4 Maintenance Costs

(Units: Thousand Kyats)

	1990 to 1999	2000 to 2009	2010 to 2019
"With the Project" case	4,427	5,311	6,476
Rolling Stock	3,198	4,076	5,236
Facilities	1,229	1,235	1,240
"Without the Project" case	7,677	9,700	12,252
Rolling stock	6,624	8,647	11,199
Facilities	1,053	1,053	1,053
Difference	-3,250	-4,389	-5,776

Source: Study estimates

d. Railway operation costs

The operation costs are determined as being the costs for operating trains, and are composed of fuel costs, electricity charges, driver, conductor and station staff costs.

(a) Fuel costs

The fuel costs for the "without the project" case are estimated by the following formula in which the values are calculated on the basis of the Circular and Suburban Lines' results for 1983/84.

**Fuel Costs**

$$= \text{Diesel Oil Consumption Rate} \times \text{Diesel Oil Price} \times \text{Train km}$$

where, Diesel Oil Consumption Rate (0.525 gallon/km): 1983 B.R.C  
results

Diesel Oil Price (2.95 Kyats/gallon): 1984 Rotterdam spot market  
price

(b) Electricity Charges

The electricity charges of the rolling stock are estimated by the following formula.

**Electricity Charges**

$$= \text{Power Consumption Rate} \times \text{Train Weight} \times \text{Unit Charge} \times \text{Train km}$$

where, Power Consumption Rate (21 kWh/1000 ton km): Study estimates  
Train Weight (243 tons): Study estimates  
Unit Charge (0.15 Kyat/kWh): E.P.C.'s industrial tariff

(c) Train driver and conductor costs

The driver and conductor costs are estimated by using a unit cost of 517.97 Kyats per train km per day (based on the Circular and Suburban Lines for 1983/84).

(d) Station staff costs

The station staff costs for the Circular and Suburban Lines are estimated by allocating the operation costs of the traffic department, in proportion to the track length. These costs are assumed to be constant for the project life.

(e) Estimated results

The estimated results shown in Table 10.1.5 show that the conversion from diesel oil to electric power results in a reduction in the operation costs.



Table 10.1.5 Operation Costs

	(Unit: Thousand Kyats)		
	1990	2000	2010
Train km for "With the Project" Case	3939.2	4952.6	6358.4
for "Without the Project" Case	3637.5	4772.7	6158.4
Track Kilometre	134.6	134.6	134.6
<b>"With the Project"</b>			
Electricity Charges	1,101	1,384	1,776
Drivers & Conductors	788	991	1,272
Station Staff	547	547	547
<b>Total</b>	<b>2,435</b>	<b>2,921</b>	<b>3,595</b>
<b>"Without the Project"</b>			
<b>Fuel Costs</b>			
International Price	4,382	5,749	7,419
Domestic Price	2,056	2,698	3,481
Drivers & Conductors	728	955	1,232
Station Staff	547	547	547
<b>Total for Economic Appraisal*</b>	<b>5,656</b>	<b>7,251</b>	<b>9,197</b>
for Financial Appraisal	3,331	4,200	5,260

Source: Study estimates

\* : 'International Oil Price' used

e. Bus and express costs

The decremental costs of buses and expresses are determined as costs for the diverted passengers by the electrification which are composed of procurement costs of buses and pick-ups, maintenance costs and operation costs.

(a) Procurement costs

The procurement costs of buses and expresses are respectively estimated by the following formula.

$$\text{Procurement Costs} = \frac{\text{Passenger km}}{\text{Transport Capacity}} \times \text{Unit Price}$$

where, Passenger km: Passenger km of diverted passengers

Transport Capacity: Study estimates on the basis of R.T.C. (passenger km/unit) results in 1982/83 (Bus 9.97, Express 5.80)

Unit Price: Study estimates on the basis of inquiries to the Japanese car manufacturers

(b) Maintenance costs

The maintenance costs are estimated by using the unit cost per vehicle obtained from R.T.C. (cf Table 10.1.6).

Table 10.1.6 Bus and Express Maintenance Cost Estimation

(Unit: Thousand Kyats)

Particular	Unit Cost
Parts	56.1
Personnel	7.3
Factory Supplies and Services	6.5

Source: Study estimates based on the R.T.C. data

(c) Operation costs

The operation costs of fuel and lubrication oil, tires, drivers and conductors and miscellaneous are estimated by using the unit costs per vehicle as follows.

Table 10.1.7 Bus and Express Operation Cost Estimation

Items	Base Unit	Unit Value
Fuel Oil	6.777 gallons/unit	6.3 Kyats/gallon
Lubrication Oil	234 gallons/unit	61.6 Kyats/gallon
Tires		15,083 Kyats/unit
Drivers	4.3 persons/unit	2,556 Kyats/year
Conductors	6.3 persons/unit	2,556 Kyats/year
Miscellaneous		15,602 Kyats/unit

Note: International prices are used for estimating the oil costs.

Source: Study estimates based on the R.T.C. data.

f. Road investment

The decremental costs of the road investment are determined as costs for the diverted buses and expresses. These are estimated by using the marginal cost of 1,602 Kyats per vehicle which is obtained by dividing the 1982/83 road investment by the annual increase in the number of vehicles.

At present, road investment in Rangoon is largely channelled towards maintenance and repair of existing roads, but this pattern of investment will have to change with the rapid increases in the number of vehicles in the long-term. This estimation is therefore rather conservative.

g. Cost and benefit estimation results (cf. Appendix 4)

Abovementioned costs and benefits for the project life are estimated as follows.

The time saving benefit is about half of the total benefit of the project. This means that the project can highly contribute to economic expansion and upgrading of the living standard of the people in Burma.

Table 10.1.8 Cost Benefit Estimation Results

(Unit: Thousand Kyats)

Item	With the Project	Without the Project	Difference
Time Savings			(+)1,410,613
Railway Investment	580,832	298,906	(-) 281,926
Maintenance	135,129	292,386	(+) 157,257
Operation	73,112	204,639	(+) 131,527
Bus and Investment			(+) 107,036
Express Maintenance			(+) 475,888
Operation			(+) 780,256
Road Investment			(+) 563
Benefits-Costs			2,781,214

Source: Study estimates

### (3) Results

The EIRR of the project is 15.4% for the base case (cf Table 10.1.9), while the opportunity cost of the capital in Burma is 10 to 12%. Therefore, this project can be judged as being quite feasible.

### (4) Sensitivity test

#### a. Identification of cases

The appraisal was conducted on the basis of the long-term projection in which various uncertain factors were present, and so several sensitivities for the factors were used to test whether the project would be still feasible.

The following cases are set for the sensitivity tests.

Case 1: The investment costs are overrun by 10%

Case 2: The investment costs are overrun by 20%

Case 3: The traffic demand decreases by 10%

Case 4: The prices are escalated at the annual rate of 5%

#### b. Results

The results of the sensitivity test reveal that even the lowest EIRR exceeds the abovementioned criterion.

Table 10.1.9 Results of EIRR Calculations

(Unit: %)	
Case	EIRR
Base Case	15.4
Case 1: 10% investment overrun	14.6
Case 2: 20% investment overrun	13.8
Case 3: 10% demand decrease	14.4
Case 4: 5% escalation	21.3

Source: Study estimates

## 10-1-4 Overall Evaluation

The project is evaluated as being greatly significant since it has an acceptable EIRR as well as the following other benefits which will contribute to the development of Rangoon and to Burmese modernization.

### (1) Fuel savings

The fuel savings were incorporated in the economic cost benefit analysis, and so the reduction volume is mentioned here. About 69 million gallons of fuel will be saved for the entire project period. This is equivalent to 19% of the 1982/83 crude oil production (367 million gallons).

### (2) Alleviation of road congestion

A cumulative total of 340 buses and expresses will be saved through the electrification. This will contribute to the alleviation of road congestion in Rangoon City, and also help reduce the air pollution as well as the incidence of vehicle traffic accidents.

### (3) Employment creation

The unemployment rate has been more than 10% in Rangoon urban areas, and so it is an important government policy to expand the employment opportunities. This project must be in accordance with this policy. The construction of facilities will provide employment to the extent of 331 thousand man-days, which is equivalent to 529 jobs for 2.5 years.

Table 10.1.10 Work Force Requirements

(Unit: Man·day)	
Work	Work Force
Electricity	114,746
Civil Engineering	97,470
Signalling	94,921
Telecommunications	23,632
Total	330,769

Source: Study estimates

(4) Technology advances

Various technology will be transferred as a result of electrification. These transfers will make a firm foundation for further technical advances for B.R.C.

(5) Hinterland development

This project will provide an incentive to the development of the hinterland along the lines, in that shortening the commuting time will expand the residential areas outward from the C.B.D. and so facilitate the siting of new industry.

10-1-5 Integrated Transportation System

The results of the economic cost benefit analysis indicate that electrified railways are more effective than other mass transportation means. Moreover the railways are expected to carry the suppressed passengers remaining from other means of transportation due to the limited capacity. The following integrated transportation system is recommended.

The Circular and Suburban Lines will play a major role in mass transportation between the C.B.D. and the suburban areas, while buses and expresses will provide feeder services linked with the major railway stations.

In order to develop this linkage system, modification of the station surroundings, train diagram integrated with other means of transportation, and other coordination will be necessary, with the possible result that the electrified lines may carry even more passengers than those specified therein.

## 10-2 Financial Appraisal

### 10-2-1 Purpose

The purpose of the financial appraisal is to provide a reference for the financial management of B.R.C. on this project.

### 10-2-2 Terms of Reference

The appraisal covers the financial profitability and stability of the project considering the present financial position of B.R.C.

#### (1) B.R.C. financial position

The financial constraints and criteria for the project are ascertained in the financial statement analysis of B.R.C. This analysis focuses on the following points.

- (a) Performance for generating own funds for the project in order to reduce the interest burden on the investment.

Indicators;

Debt Service Cover Ratio:  $(\text{Profit} + \text{Depreciation} + \text{Interest}) / \text{Debt Service}$

Debt Equity Ratio:  $\text{Total Debt} / (\text{Total Debt} + \text{Equity})$

- (b) Marginal capital cost for projects

Indicator;

B.R.C. Average Cost of Funds:  $\text{Interest} / \text{Total Assets}$

- (c) Operating efficiency of B.R.C.

Indicator;

Operating Ratio:  $\text{Current cost} / \text{Revenue}$

#### (2) Project profitability

The profitability of the project is appraised by the financial internal rate of return (FIRR) of the incremental cash flow between the "with the project" and "without the project" cases, which covers the Circular and Suburban Lines.

In this analysis, the "without the project" case is defined as the case where necessary investment is made in the railway to maintain its share in the total passenger demand increase, when the project is not implemented.

Moreover, the sensitivities for several cases are also tested.

### (3) Project stability

The stability of the project is appraised by the financial ratio based on the profit and loss statements, the cash flow and the balance sheets of the Circular and Suburban Lines when the project is implemented.

#### 10-2-3 B.R.C. Financial Position

##### (1) Revenue and cost structure

The consecutive profit and loss statements for B.R.C. (cf. Table 10.2.1) show that the profit has recovered with resulting constant surplus from 1981/82 through improvements to the operating ratio from 83.6% in 1979/80 to 70.9% in 1983/84.

On the contrary, the interest has increased yearly to reach 23.9% of the revenues for 1983/84.

##### (2) Funding Structure

The consecutive balance sheets for B.R.C. (cf. Table 10.2.2) show that the debt equity ratio rose to account for 69.8% in 1983/84, with an increase of the debt incurred by the Myanmar Economic Bank (hereinafter referred to as M.E.B.) loans.

According to the changes in financial position, (cf. Table 10.2.3) the amount of M.E.B. loans increased to finance the debt services of the foreign loans and the investments, while funds provided by operations have gradually increased. As a result, the M.E.B. loans have not been repaid, and the debt service cover ratio has been made less than 1.0.

The B.R.C. financial position seems to be too tight to allow the generation of their own funds for the project.

##### (3) B.R.C. average cost of funds

The B.R.C. average cost of funds was 3.8% in 1983/84. This is a criterion for the appraisal of the profitability of the project, and means that the project can be acceptable when the FIRR exceeds the criterion.



Table 10.2.1 Consecutive Profit and Loss Statements

(Unit: Million Kyats)

	1979/80	1980/81	1981/82	1982/83	1983/84
Earnings	262.9	291.9	307.0	333.9	340.0
Coaching	198.3	216.6	220.8	252.2	263.5
Goods	55.2	61.1	67.5	66.7	62.9
Others	9.4	14.2	18.7	15.0	13.6
Expenses	219.8	233.4	219.7	240.9	241.2
Working expenses	193.0	197.6	182.7	202.1	201.2
Administration	40.2	38.3	42.8	46.8	38.7
Maintenance	63.0	80.3	73.0	83.2	88.5
Rolling stock	36.7	52.8	45.7	53.9	58.7
Facilities	26.3	27.5	27.3	29.3	29.8
Operation	89.8	79.0	66.9	72.1	74.0
Fuel	62.0	52.5	40.8	41.3	41.5
Labour	16.2	14.9	18.1	20.4	25.2
Others	11.6	11.6	8.0	10.4	7.3
Depreciation	26.8	35.8	37.0	38.8	40.0
Other charges	68.9	83.6	87.1	92.8	98.6
Interest	54.8	68.7	71.9	75.8	81.1
Turn over tax	14.1	14.9	15.2	17.0	17.5
Profit	-25.8	-25.1	0.2	0.2	0.2
Government contribution					
Net profit	-25.8	-25.1	0.1	0.1	0.1
Retained profit	-73.5	-98.6	-98.5	-98.4	-98.3

Source: B.R.C.

Table 10.2.2 Consecutive Balance Sheets

	(Unit: Million Kyats)				
	1979/80	1980/81	1981/82	1982/83	1983/84
<b>Assets</b>					
Current assets	1848.4	1894.7	2017.6	2154.3	2138.3
Cash	844.8	725.2	845.5	878.0	810.1
Receivables	1.7	0.1	4.1	31.1	8.5
Inventories	162.7	331.7	397.9	436.0	408.5
Fixed assets	680.4	393.4	443.5	410.9	393.1
Total assets	1003.6	1169.5	1172.1	1276.3	1328.2
Land	1030.4	1205.3	1209.1	1315.1	1368.2
Permanentway & building	7.4	7.4	7.4	7.4	7.4
Equipments	339.0	353.2	363.4	380.7	380.7
Rolling stock	36.4	43.3	47.1	56.3	56.3
Less depreciation	647.6	801.4	791.2	870.7	870.7
Liabilities	26.8	35.8	37.0	38.8	40.0
<b>Liabilities</b>					
Account payable	1848.4	1894.7	2017.6	2154.3	2138.3
Deferred liabilities	112.5	100.4	123.3	161.9	140.8
Myama economic bank	1064.7	1148.2	1248.1	1346.1	1351.1
Other local loan	519.2	648.7	756.9	840.0	877.3
I.D.A. loan	149.6	147.9	142.9	135.1	124.5
Japanese loan	95.0	76.2	69.8	63.4	57.1
French loan	93.1	79.1	63.4	50.0	34.9
German aid & loan	108.1	94.2	118.3	166.3	171.3
Net worth	99.7	102.1	96.8	91.3	86.1
Government equity	671.2	646.1	646.2	646.3	646.4
Retained profit	744.7	744.7	744.7	744.7	744.7
Debt Equity Ratio	-73.5	-98.6	-98.5	-98.4	-98.3
Average Cost of Funds	63.7%	65.9%	68.0%	70.0%	69.8%
	3.0%	3.6%	3.6%	3.5%	3.8%

Source: B.R.C.

Table 10.2.3 Changes in Financial Position

	(Unit: Million Kyats)									
	1979/80	1980/81	1981/82	1982/83	1983/84					
Source of funds	330.0	147.8	187.3	186.3	99.0	100.0%	100.0%	100.0%	100.0%	100.0%
Funds provided by operations	1.0	10.7	37.1	38.9	40.1	0.3%	7.2%	19.8%	20.9%	40.6%
Profit	-25.8	-25.1	0.1	0.1	0.1	-7.8%	-17.0%	0.1%	0.1%	0.1%
Depreciation	26.8	35.8	37.0	38.8	40.0	8.1%	24.2%	19.8%	20.8%	40.4%
Proceeds from borrowing	329.0	137.1	150.2	147.4	58.8	99.7%	92.8%	80.2%	79.1%	59.4%
Foreign loan	80.2	7.6	39.2	64.3	21.5	24.3%	5.1%	20.9%	34.5%	21.7%
Japanese loan										
French loan	13.2		39.2	64.3	21.5	4.0%		20.9%	34.5%	21.7%
German aid & loan	67.0	7.6				20.3%	5.1%			
Local loan	248.8	129.5	111.0	83.1	37.3	75.4%	87.6%	59.3%	44.6%	37.7%
Myanma economic bank	248.8	129.5	108.2	83.1	37.3	75.4%	87.6%	57.8%	44.6%	37.7%
Other local loan			2.8					1.5%		
Use of funds	292.3	255.3	89.9	192.5	145.9	100.0%	100.0%	100.0%	100.0%	100.0%
Increase in fixed assets	253.0	201.7	39.6	143.0	91.9	86.6%	79.0%	44.0%	74.3%	63.0%
Loan repayments	39.3	53.6	50.3	49.5	54.0	13.4%	21.0%	56.0%	25.7%	37.0%
Foreign loan	36.6	51.9	42.5	41.7	43.4	12.5%	20.3%	47.3%	21.6%	29.7%
I.D.A. loan	6.4	18.8	6.4	6.4	6.4	2.2%	7.4%	7.1%	3.3%	4.4%
Japanese loan	13.6	14.0	15.7	13.4	15.1	4.7%	5.5%	17.5%	7.0%	10.4%
French loan	11.7	13.9	15.1	16.3	16.6	4.0%	5.5%	16.8%	8.5%	11.4%
German aid & loan	4.9	5.2	5.4	5.6	5.3	1.7%	2.0%	5.9%	2.9%	3.6%
Other local loan	2.7	1.7	7.8	7.8	10.6	0.9%	0.7%	8.7%	4.1%	7.3%
Increase in working capital	37.7	-107.5	97.4	-6.2	-46.9					
Cash	1.6	-1.6	4.0	27.0	-22.6					
Receivables	-8.9	169.0	66.2	38.1	-27.5					
Inventory	-42.4	-287.0	50.1	-32.6	-17.8					
Payable	84.9	12.1	-22.9	-38.6	21.1					
Debt Service Cover Ratio	0.59	0.65	0.89	0.92	0.90					

Source: Study estimates based on B.R.C. data

## 10-2-4 Project Profitability

### (1) Prerequisites

#### a. Cash flow determination

The FIRR is usually calculated for the cash flow excluding payments to the sources of financings (i.e. interest charges) and noncash charges, (i.e. depreciation). Thus, the incremental cash flow between the "with the project" and "without the project" cases is composed of cash outlay attributable to the investment, revenues, administrative, maintenance and operation expenses and the turn over taxes.

#### b. Premises

The FIRR calculations are conducted on the same basis as for the economic appraisal, except for the following premises.

##### (a) Tariffs and taxes

The customs duties, commodity tax and turn over tax are incorporated, while the government contribution is not considered because it is not levied on the project profit but on the total profit of B.R.C.

##### (b) Oil prices

Oil is estimated on the domestic price basis.

### (2) Cash flow estimation

#### a. Cash outlay attributable to the investment

The net cash outlay consists of the incremental investment cost, the proceeds from transferring the existing rolling stock to the other sections in the year of commissioning, and the expected salvage values at the end of the project life. The transfers of the existing rolling stock correspond to that for the economic appraisal while the salvage values include tariffs and taxes.

#### b. Revenues

The revenues which are composed of passenger earnings and the other earnings, are estimated on the basis of the forecast number of passengers.

(a) Passenger earnings

The passenger earnings are calculated by the following formula.

$\begin{aligned} &\text{Passenger Earnings} \\ &= \text{No. of Passengers} \times \text{Average Fare} \times \text{Season Ticket Adjustment} \end{aligned}$
---

where, Average Fare (0.46 Kyats): Study estimates based on the OD survey. Fare increase are not considered.

Season Ticket Adjustment (95%): Study estimates using a present percentage of season ticket passengers of 15%, and the present average discount rate of 35% provided by B.R.C.

(b) Other earnings

Other earnings are composed of parcel and luggage earnings and shop rentals in stations, set at 5% of the passenger earnings based on the B.R.C. results.

c. Expenses

The expenses are broken down into the administrative, maintenance and operation expenses, and the turn over tax. The maintenance and operation expenses have been already explained in the section of the economic appraisal. Accordingly, methods of definition and estimation for the other items can be shown as follows.

(a) Administrative expenses

The administrative expenses include the headquarter's costs. These for the Circular and Suburban Lines of 1,167 thousand Kyats are allocated in proportion to the track length. These expenses are the same for both cases.

(b) Turn over tax

The turn over tax is at 8% of the passenger earnings.

d. Cash flow estimation results (c.f. Appendix 5)

Abovementioned outlay, revenues and expenses are estimated as follows.

Table 10.2.4 Cash Flow Estimation Results

(Unit: Thousand Kyats)

	With	Without	Difference
Revenue	1,957,844	976,577	981,267
Expenses	1,261,650	933,108	328,542
Investment	779,013	352,694	426,319
Administration	40,845	40,845	0
Maintenance	190,904	325,057	-134,153
Operation	101,719	140,107	-38,388
Turn Over Tax	149,169	74,406	74,763
Gross Cash Flow	696,195	43,470	652,725

Source: Study estimates

(3) FIRR results

The FIRR is estimated at 5.1% for the base case (cf Table 10.2.5).

The prevailing interest rate is 8% for working capital and 5% for investment in Burma. If the FIRR is compared with these rates, the project would not be profitable. B.R.C. has, however, raised foreign concessional loans with lower interest rate, which might be available. The criteria for this project, therefore, are set as the B.R.C. average cost of funds of 3.8% and the weighted average interest rate of the project of 3.5%. The FIRR exceeds these criteria (the marginal capital costs).

(4) Sensitivity test

a. Identification of cases

The sensitivities for the following conditions are analysed in the light of the project profitability.

Case 1: The investment costs are overrun by 10%

Case 2: The investment costs are overrun by 20%

Case 3: The traffic demand decreases by 10%

Case 4: The prices escalate at an annual rate of 5%

b. Results

The project is feasible in terms of profit since the FIRR for each case exceeds the marginal capital costs mentioned above.

Table 10.2.5 Results of FIRR Calculations

(Unit: %)

Case	FIRR
Base Case	5.1
Case 1: 10% investment overrun	4.5
Case 2: 20% investment overrun	3.9
Case 3: 10% demand decrease	4.6
Case 4: 5% escalation	5.8

Source: Study estimates

#### 10-2-5 Project Stability

##### (1) Calculation basis

In this section the financial statement of the Circular and Suburban Lines is used as the basis for evaluation, and so the following items are to be determined in addition to the FIRR calculation basis.

##### a. Cash outlay

The cash outlay is determined here as that for the "with the project" case which consists of the investment costs of the "with the project" case and the proceeds from the transfers of the existing rolling stock. The salvage value is not incorporated.

##### b. Depreciation

The depreciation is calculated on the straight line method and a useful life corresponds to that for the economic appraisal.

Table 10.2.6 Depreciation Schedule

(Unit: Thousand Kyats)

Period	Yearly Costs
1990 - 1998	21,635
1999	24,209
2000 - 2009	27,532
2010 - 2019	31,757

Source: Study estimates

c. Initial balance sheet

The initial balance sheet of the Circular and Suburban Lines is estimated from the assets account, since liabilities are not distinguishable in the B.R.C. financial system. The facilities are allocated in proportion to the track length while the rolling stock is estimated by item. The liabilities corresponding to these assets are determined as the equity transferred from the total account of B.R.C.

d. Funding scheme

The investments are wholly financed by long-term loans, and so the debt equity ratio for the investment is 100%. The foreign and local currency portions are respectively financed by concessional loans and M.E.B. loans.

M.E.B. loans for the working capital are assumed to be available whenever a working capital shortfall is incurred. Working capital surpluses are to be allocated to repayments of the M.E.B. short-term loans until the balance is nil, while that afterwards is retained as cash.

The loan conditions are shown as follows.

Investment

Concessional Loan

- ° Maturity/Grace Period - 30 years including 10 years grace period
- ° Repayment - Equal annual instalments
- ° Interest Rate - 2.75% annually

M.E.B. Capital Loan

- ° Maturity/Grace Period - 10 years including 5 years grace period
- ° Repayment - Equal annual instalments
- ° Interest Rate - 5% annually

Working Capital

M.E.B. Financial and Revenue Loan

- ° Interest Rate - 8% annually

e. Interest charges

The interest charges are incorporated on the basis of the funding scheme.



(2) Financial model.

A financial model was constructed for the financial appraisal.

This financial model is composed of the profit and loss statement portion, the cash flow portion and the balance sheet portion with the items for each portion being linked together as shown in Fig. 10.2.1. Items at the destination of the arrows are added to (+) or deducted from (-) the items at the origin of the arrows.

Profit and Loss Statement

Cash Flow

Balance Sheet

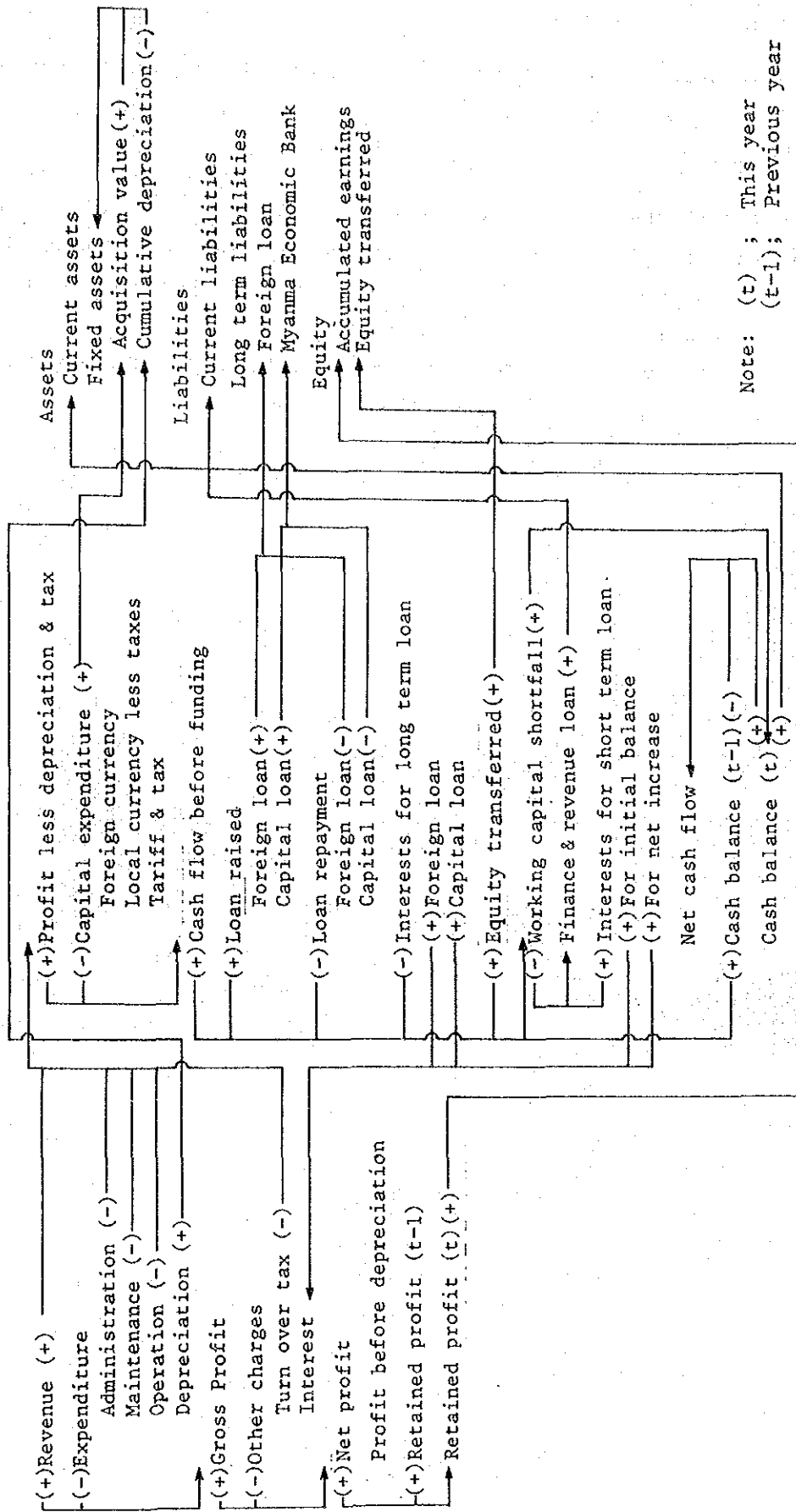


Fig. 10.2.1 Financial Model Linkages

Source: Study draws

(3) Results

This project is evaluated as being feasible from the viewpoint of financial stability.

a. Projected profit and loss

The profit and loss statements (cf. Appendix 6) were projected as shown in Fig. 10.2.2. They reveal that the Circular and Suburban Lines will show a first profit in 2007/08, and clear off the retained deficit in 2019/20 at the end of the project life.

The heavy burden of the interest charges and the depreciation costs lengthens the period required for recovery.

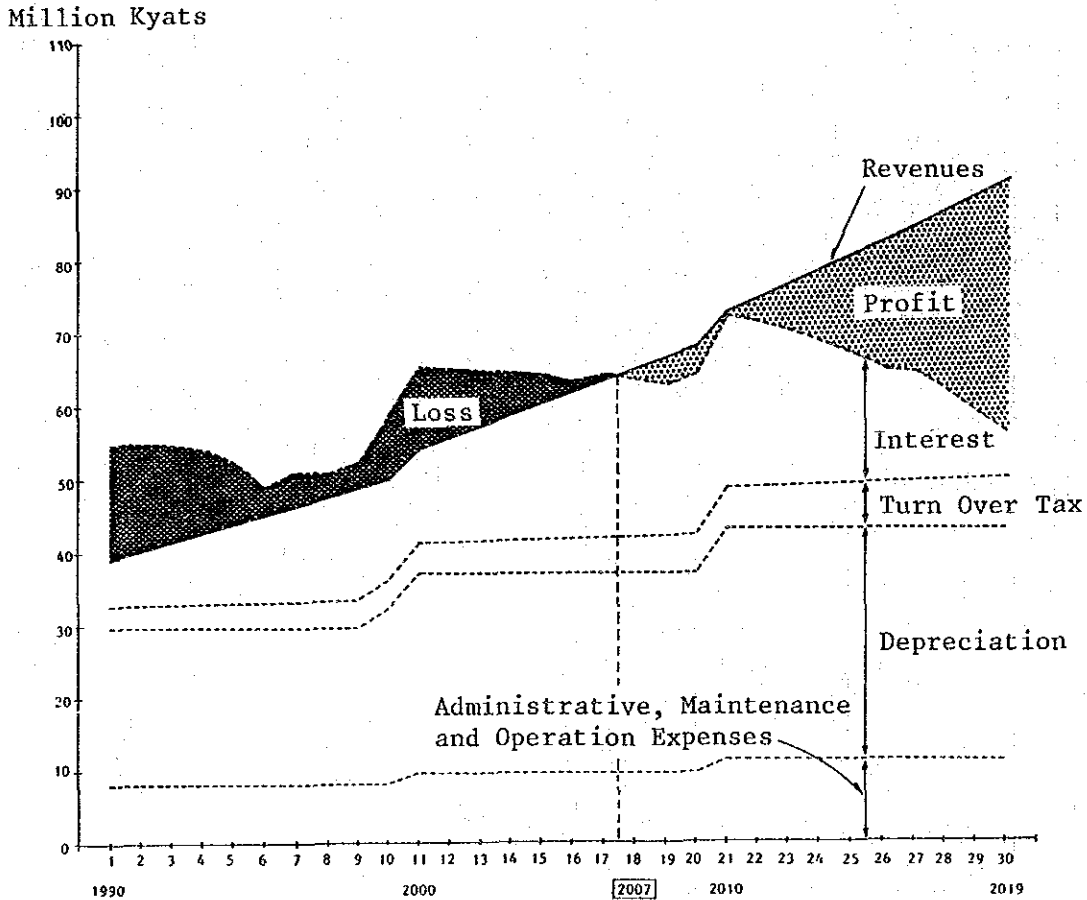


Fig. 10.2.2 Projected Profit and Loss

Source: Study draws

b. Operating ratio and interest revenue ratio

The operating ratio of the lines will be steadily improved to be less than 70% in 1993/94 and less than 60% in 2006/07.

The interest revenue ratio (Interest charges/Revenues) of the lines will remain higher than that for the B.R.C. (1983/84) up to the year 2014/15.

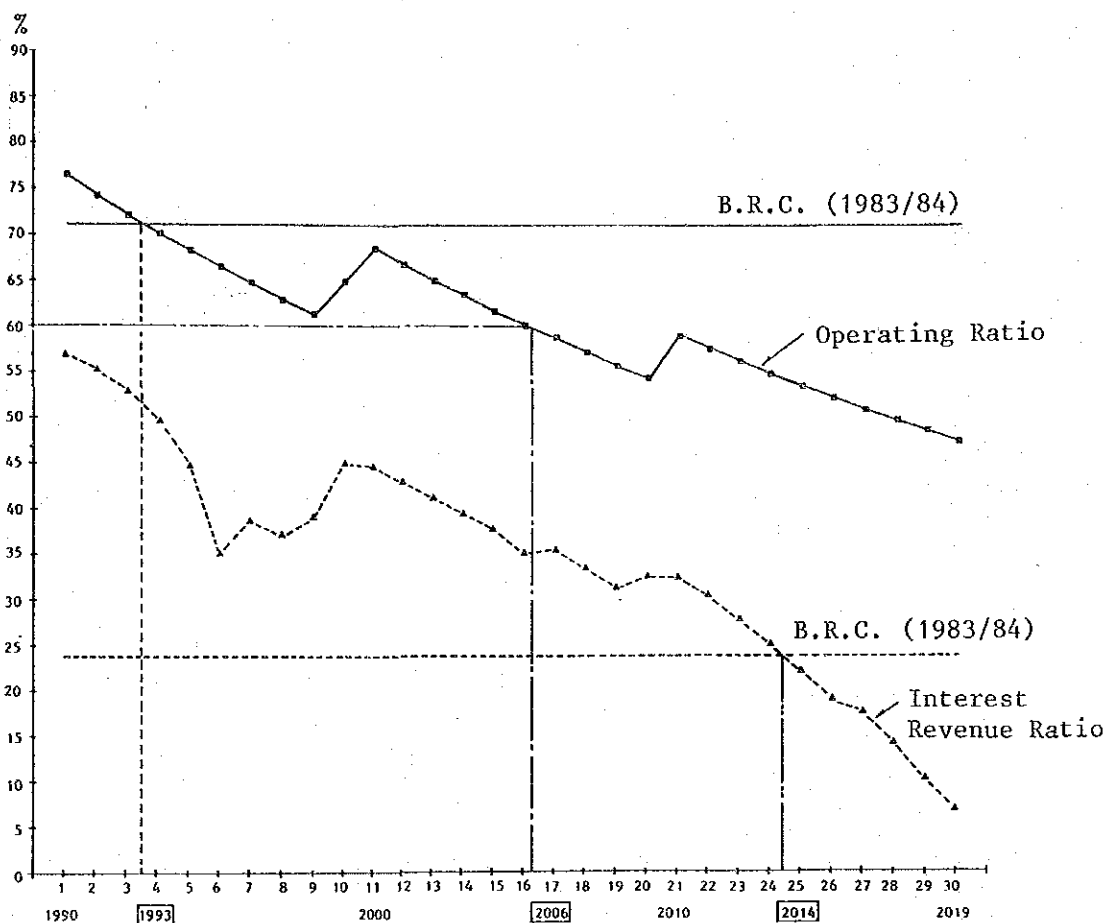


Fig. 10.2.3 Projected Operating Ratio and Interest Revenue Ratio

Source: Study draws

c. Working capital shortfall

The cash flow (cf. Appendix 7) shows that the lines will incur working capital shortfalls for 1995/96 to 1999/2000 and 2004/05 to 2005/06. The capital and revenue loans of M.E.B. will therefore make up for these shortfalls for 1995/96 to 2018/19.

d. Debt service cover ratio

Debt service cover ratios cover the solvency of an entity. The debt service cover ratio of the lines will fall below 1.0 in 1992/93 but revert to an upward trend in 1994/95, and ultimately exceed 1.0 in 2009/10 (cf. Fig. 10.2.4). This projection shows the severity of the fund management for the project.

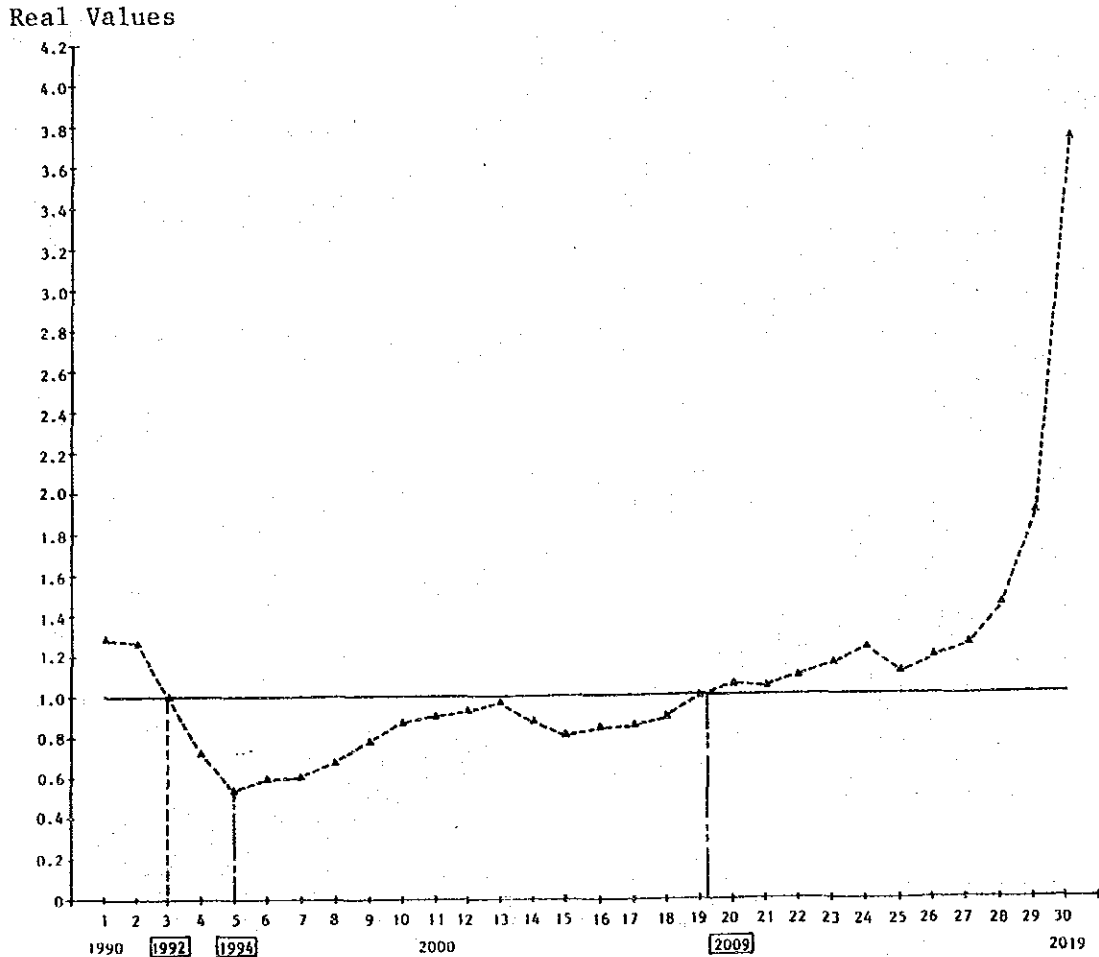


Fig. 10.2.4 Projected Debt Service Cover Ratio

Source: Study draws

e. Payback period

Since in this project additional investment is planned, it is difficult to compute the payback period strictly. The payback period is determined here as the period required for compensating the initial investment with the cash-in-flow (i.e. Profit less depreciation and taxes). The payback period for the initial investment is estimated as 15 years based on the cash flow (cf. Appendix 7).

(4) Sensitivities for measures

a. Identification of cases

The project is evaluated to be feasible for the base case, and it is possible to improve the financial stability by adopting several measures, for which the sensitivities are to be tested. The following cases are set for sensitivity tests.

Case 1: Traffic demand increase by 10%.

Case 2: Fare rises by 10% each 10 years.

Case 3: Tariffs and taxes are exempted by 50%.

b. Results

The measures for revenue increase (Case 1 and 2) will improve the financial stability, in that the debt service cover ratio will exceed 1.0 within 10 years after commissioning. It is quite a useful countermeasure to raise the fare by 10% every 10 years since the per capita GDP will rise at a much higher rate.

A 50% tariff and tax exemption will reduce the investment by about 13%, and therefore improve the financial stability. This will make the period necessary to exceed the debt cover ratio of 1.0, shorter by 12 years.

Table 10.2.7 Financial Projection Results

Case	Year of First Profit	Year of First Retained Profit	Year of DSCR > 1	Working Capital Shortfall
Base case	2007	2019	2009	7 years
Case 1: 10% traffic demand increase	1995	2006	1999	3 years
Case 2: 10% fare rises by 10 years	1995	2008	1999	4 years
Case 3: 50% exemption of tariffs and taxes	1995	2005	1997	Nil

Note: DSCR; Debt Service Cover Ratio

Source: Study estimates

c. Comments on escalation

It is difficult to predict the escalation factor and fare adjustment. Therefore, the escalation and fare adjustment are to be mentioned here without sensitivity testing. Should the fare be adequately adjusted proportional to the price escalation, the escalation will give an insignificant effect on the project stability.

(5) Funding policy

a. Funding options

The financial projection was conducted on a plausible funding scheme and so several options still remain possible in order to improve or maintain the financial stability. The funding scheme was therefore simulated with following options being set.

Option 1: Debt equity ratio for the local currency portion is set at 50%.

Option 2: Maturity/grace period of the M.E.B. loans is extended twice.

Option 3: Repayments of the M.E.B. loans are suspended.

Option 4: Interest rate of the foreign loans is set at 3.5%.

b. Results and comments

As regards the local currency portion of the investment, the lowering of the debt equity ratio to 50% (option 1) will improve the financial stability, in that the working capital shortfall will not be incurred and this option will therefore shorten the period to exceed the debt service cover ratio of 1.0, by 9 years. This electrification is a large project for B.R.C., and so an increase in the government equity can maintain the present level of the B.R.C. debt equity ratio. Extending the repayment schedule for the M.E.B. loan (option 2 and 3) will also improve the financial stability.

As regards the foreign currency portion of the investment, it is advisable that the interest rate for foreign loans be as low as possible. Concessional loans with interest rate of 2.75% are assumed to be raised for the base case, but the results of option 4 show that a rise in the interest rate for foreign loans would worsen the financial

stability. It is possible to improve the financial stability even in this case by the increase in the government equity and by extending the repayment schedule for the M.E.B. loans.

This project will be more feasible when the advantageous mix of funding options is applied.

Table 10.2.8 Simulated Results for Funding Options

Case	Year of First Profit	Year of First Retained Profit	Year of DSCR > 1	Working Capital Shortfall
Base case	2007	2019	2009	7 years
Option 1: 50% debt equity ratio	1997	2009	2000	Nil
Option 2: Twice lengthening M.E.B. loans	2004	2014	2008	3 years
Option 3: Suspending repayments of M.E.B. loans	2005	-	2003	Nil
Option 4: 3.5% interest rate for foreign loans	2019	-	2018	12 years

Source: Study estimates

#### (6) Evaluation

The results of the base case, the sensitivity tests for measures and the simulated funding options reveal that this project is viable from the viewpoint of financial stability.





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**CHAPTER 11 CONCLUSION AND RECOMMENDATIONS**

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## CHAPTER 11 CONCLUSION AND RECOMMENDATIONS

### 11-1 Conclusion

The railway transportation demand of the Circular and Suburban Lines is forecast on the assumption that the road transportation capacity of Rangoon City is not limited by road congestion and bus procurement delays. The forecast demand for railway transportation is therefore a conservative one.

This demand forecast was used as the basis for a technical study to formulate the electrification plan in consideration of present conditions. The technical study concluded that the project is technically feasible at the minimum cost.

The investment plan provided by the technical study was then used as the basis for the economic and financial appraisals. These showed that the project would greatly contribute to the development of Rangoon and to the economic development of Burma, and that it is financially viable for the Burma Railways Corporation.

The train diagram and the plan for the procurement of rolling stock can be modified to cover the increased railway demand in the case where the road transportation capacity does not increase greatly above the levels initially assumed.

This electrification plan provides the railway the prerogative to increase transport capacity to levels even greater than those specified therein.

The implementation of the project is therefore highly recommended.

## 11-2 Recommendations

The following supporting steps are recommended to be taken for smooth construction and the sound operation after commissioning.

### (1) Maintenance of the electrified railway

It is essential that the rolling stock and facilities be adequately maintained since electrification is only one of the effective means to recover the railway's reliability. If the electrified lines were not to meet passenger expectations of reliability due to troubles caused by insufficient maintenance, then the railway demand would decrease.

The Circular and Suburban Lines should be maintained as a reliable transport system, and it is advisable to make a continuous effort to maintain the condition of the lines through the proper allocation of funds, materials and personnel.

### (2) Safety assurance

Safety assurance is essential. Facilities and measures to achieve this are to be fully instituted.

The people will be encouraged not to walk on the tracks, or ride on the roofs of carriages. The installation of track fencing will also be recommended.

### (3) Electrification standards

The standard is to be established for the electrification prior to the implementation of the project. The standard is a basis for the appropriate procurements, construction and maintenance at the minimum cost. The standardization will be coherent to the present standards and practices in force in Burma.

### (4) Passenger information

The platform allocation at some main stations and some train operation patterns will have been changed. It will be necessary that clear and easy-to-read signs and indications be provided in order to minimize passenger confusion when boarding and changing trains.

(5) Education system

Since this is the first B.R.C. experience with electrification, the technical cooperation of other countries will be required for the smooth introduction of the new system.

On-the-job-training by foreign engineers and a programme of overseas study are essential in the education programme. Through the programme, Burmese instructors must be provided in the early stages of the project and an education system formulated on the basis of their knowledge and experience.

(6) Fare adjustment

In the financial calculations the fare remains constant while the national income increases at a high growth rate. Fare adjustment is a useful means of improving distribution of the national income as well as the financial position of B.R.C., since a relatively low fare places an extremely heavy burden on the rail sector.

Since prices will increase in actuality, and the foreign loan conditions will not be always advantageously fixed, fare adjustment will be inevitable in the long-term.

(7) Funding scheme

It is quite important that the funding conditions be relaxed.

As regards the local currency portion, simulated results show that lowering the debt equity ratio, and extending the repayment schedule for the Myanma Economic Bank loan will improve the financial position of the Circular and Suburban Lines.

It is advised that either the government equity be increased, or the M.E.B. loan repayment be extended in order to bolster the financial position of B.R.C.

On the contrary, rises in the interest rates for the foreign loans in the foreign currency portion, would reduce the financial feasibility of the project as shown by the simulated results. It is therefore advisable that concessional loans with low interest rates be raised.

(8) Coordination with other transportation

Total Transportation Plan is one of its most important factors in the Rangoon Development Plan.

The electrified Circular and Suburban Lines can play a major role in mass transportation between the CBD and the suburban areas, while buses and expresses will provide feeder services.

It is recommended that the Integrated Transportation Plan be established with the cooperation of the authorities concerned with due consideration given to the efficient linkage between railway and buses.

When implementing the linkage system, it is advisable that fare system among the various modes be carefully adjusted in a complementary manner.

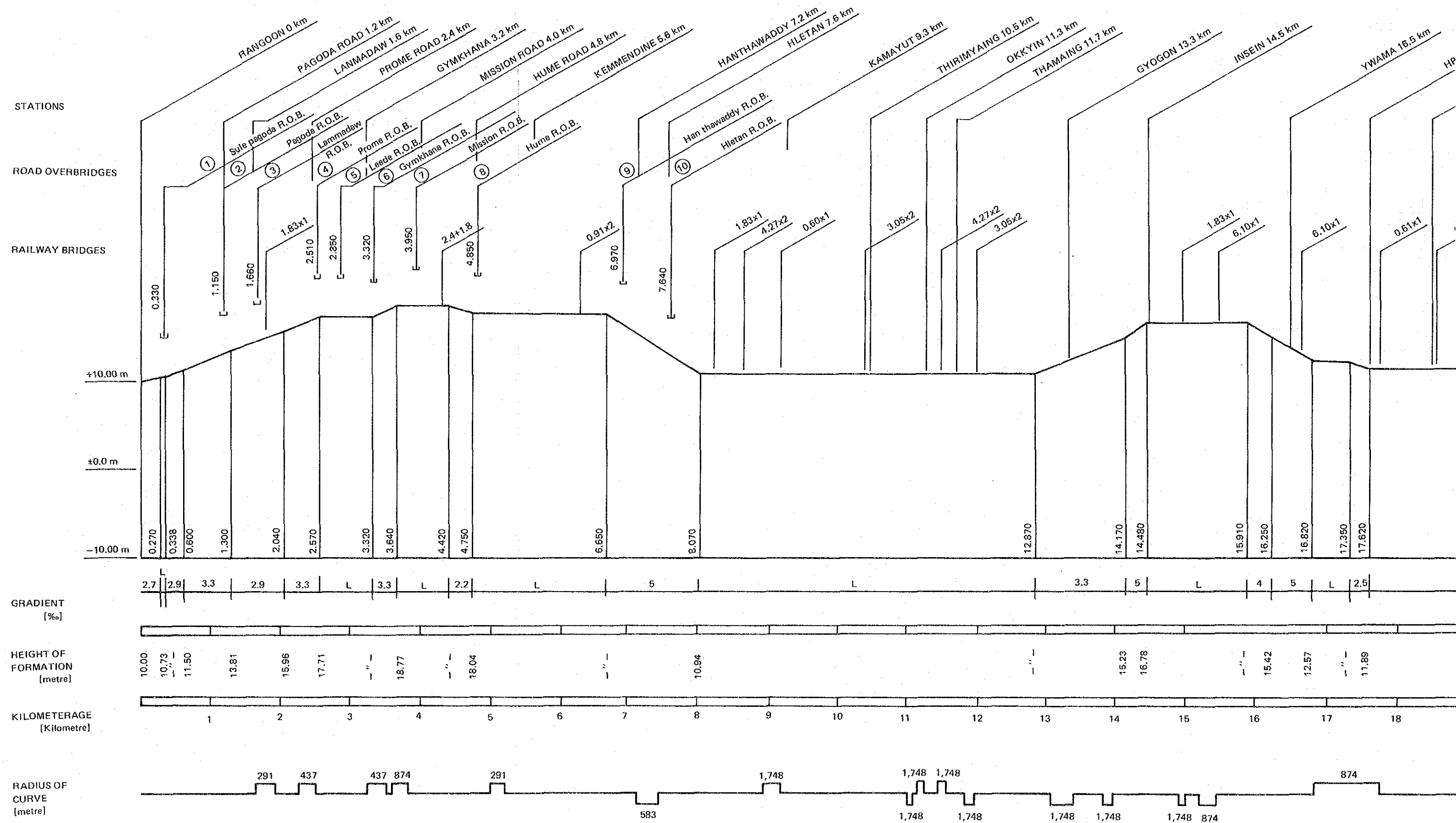
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APPENDIX

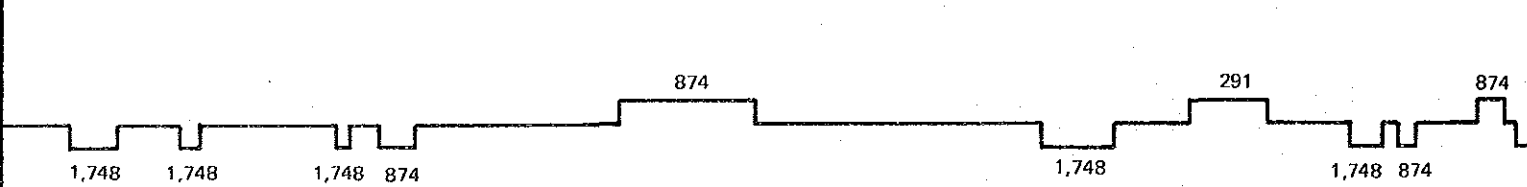
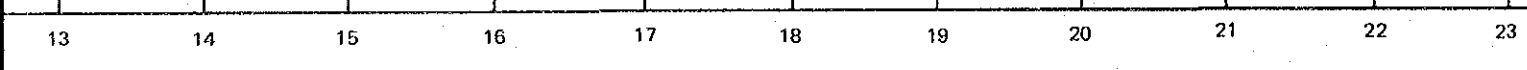
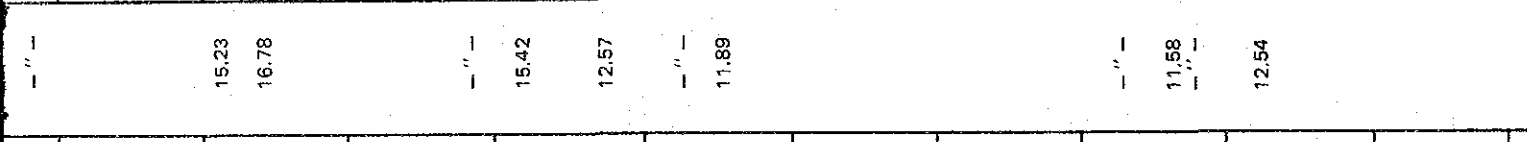
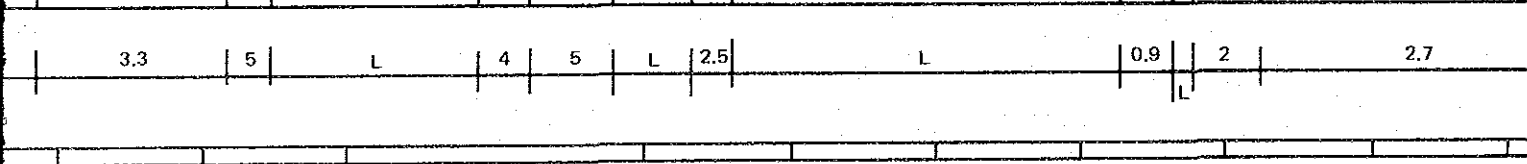
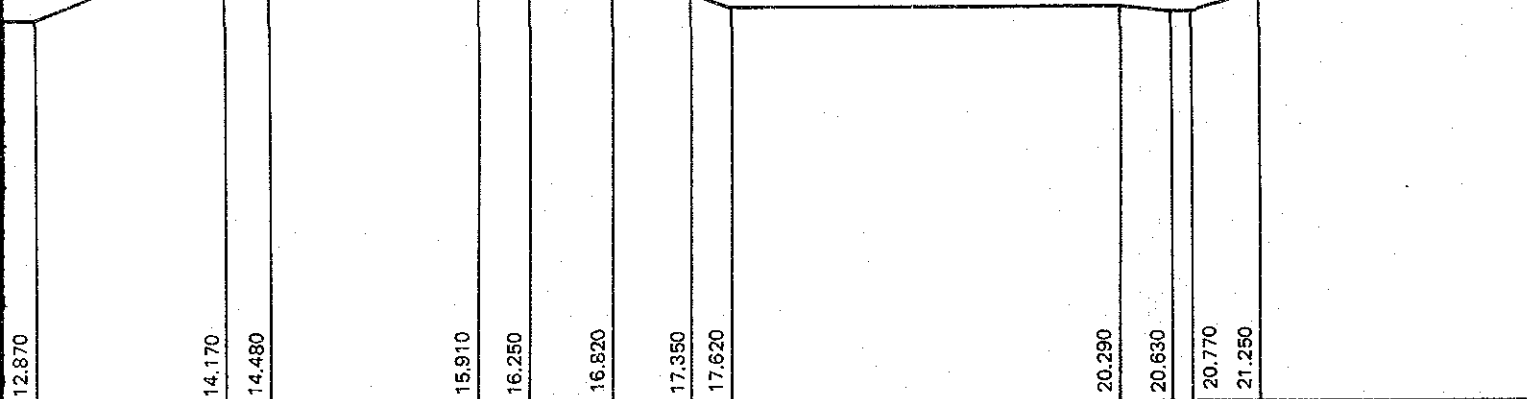
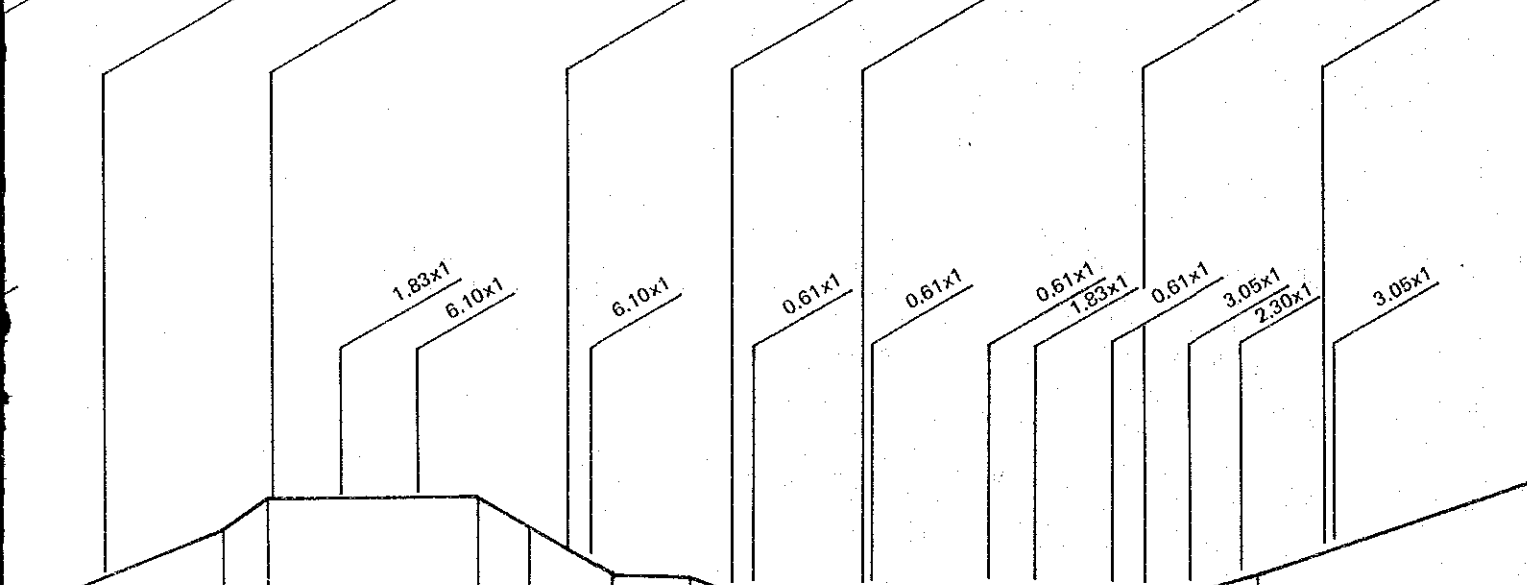
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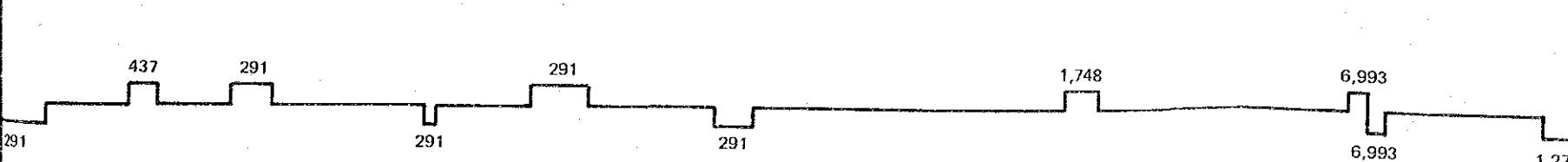
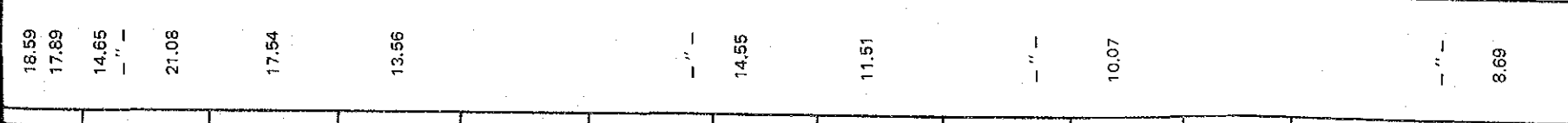
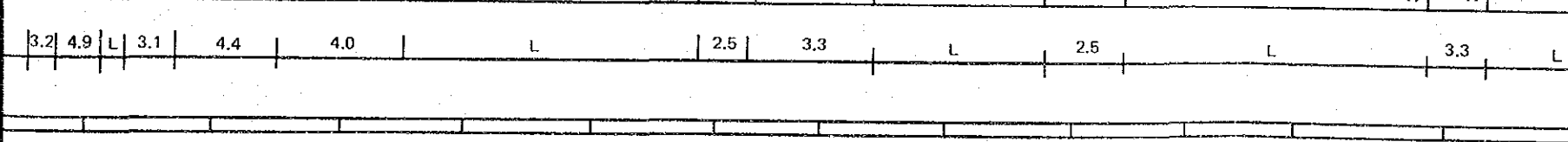
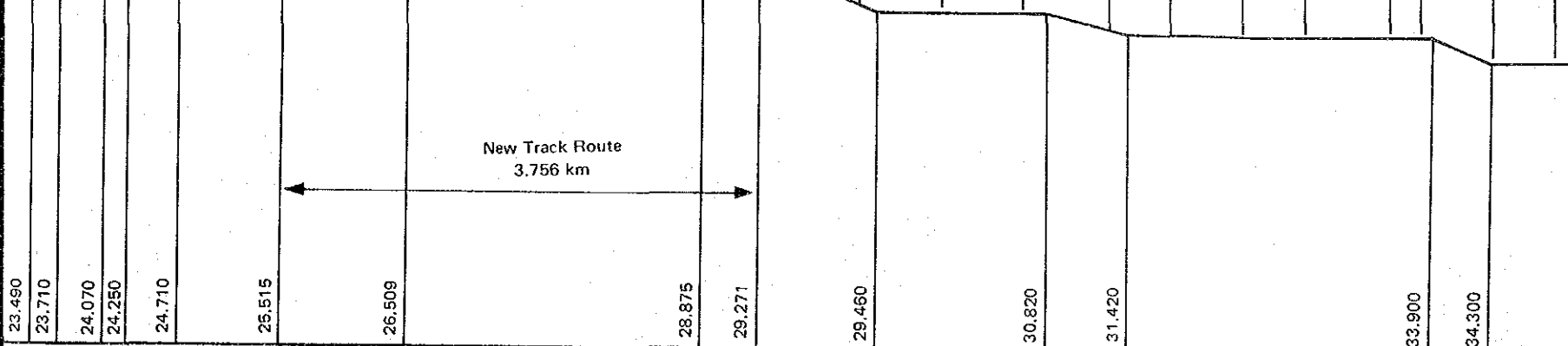
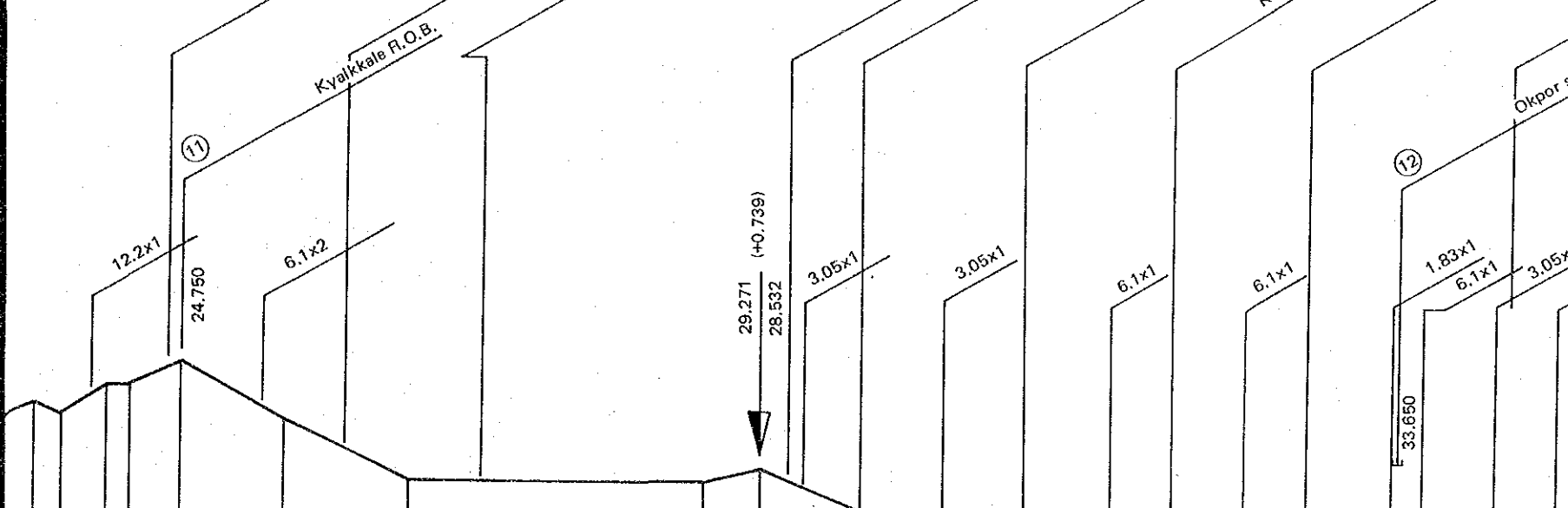
Appendix 1. Present Profile of the Circular and Suburban Lines

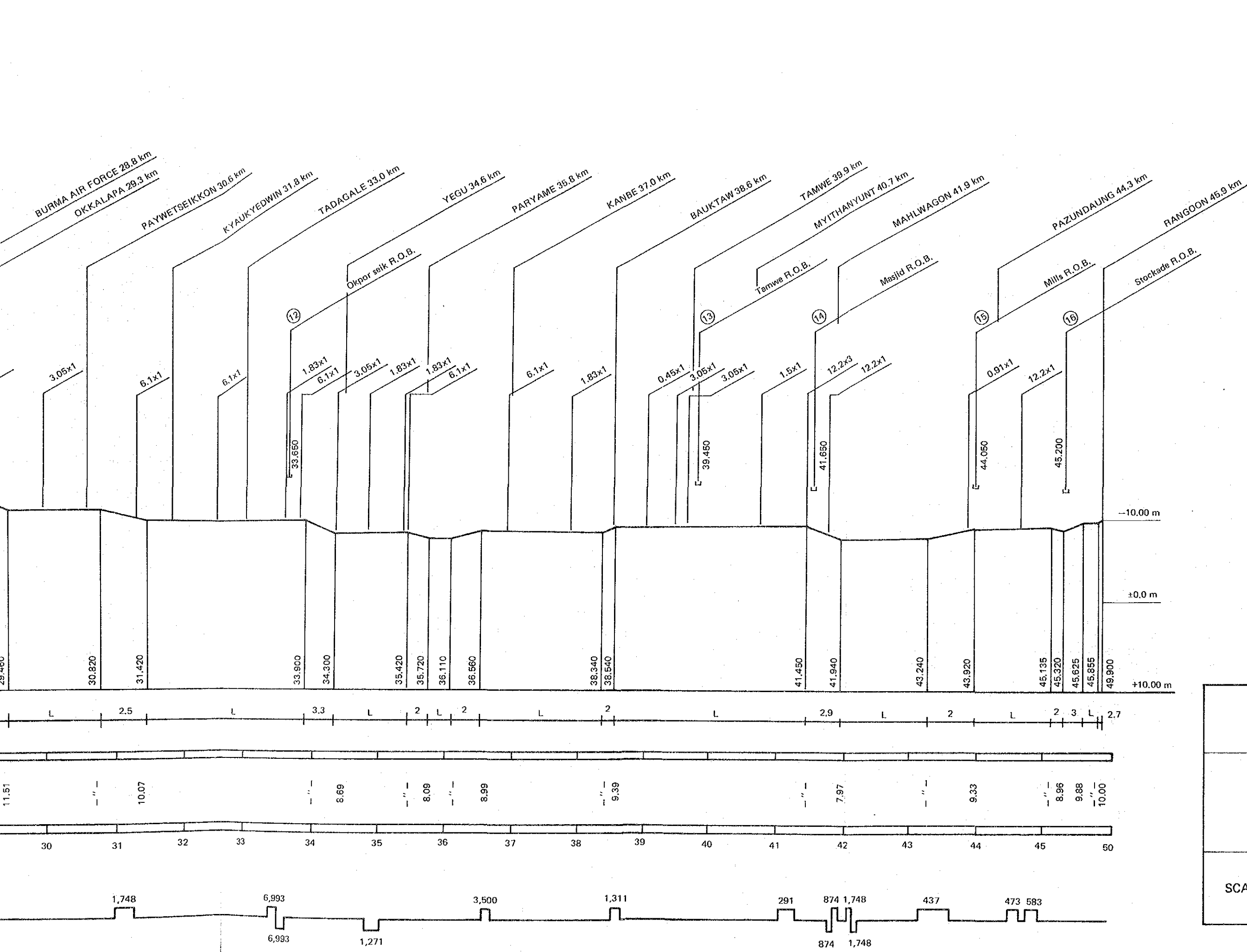


KYIN 11.3 km  
 THAMAING 11.7 km  
 GYOGON 13.3 km  
 INSEIN 14.5 km  
 YWAMA 16.5 km  
 HPAWKAN 17.6 km  
 AUNGSAN MYO 18.5 km  
 DANYINGON 20.5 km  
 GOLF COURSE 21.7 km



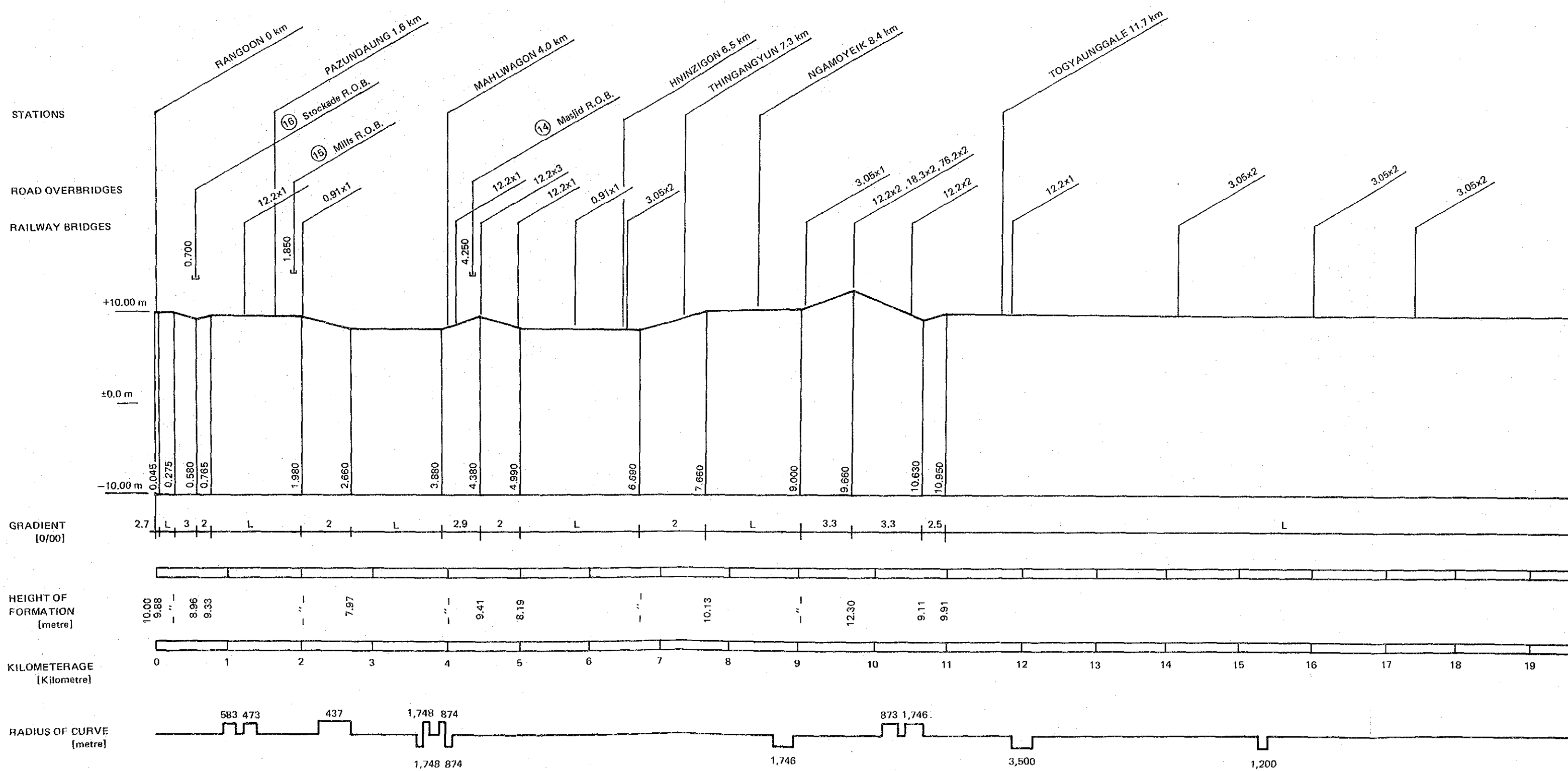
KYAIKKALE 24.5 km  
 Kyaukkale R.O.B.  
 MINGALADON BAZAAR 28.0 km  
 MINGALADON CANTT 27.0 km  
 BURMA AIR FORCE 28.8 km  
 OKKALAPA 29.3 km  
 PAYWETSEIKKON 30.6 km  
 KYAUKYEDWIN 31.8 km  
 TADAGALE 33



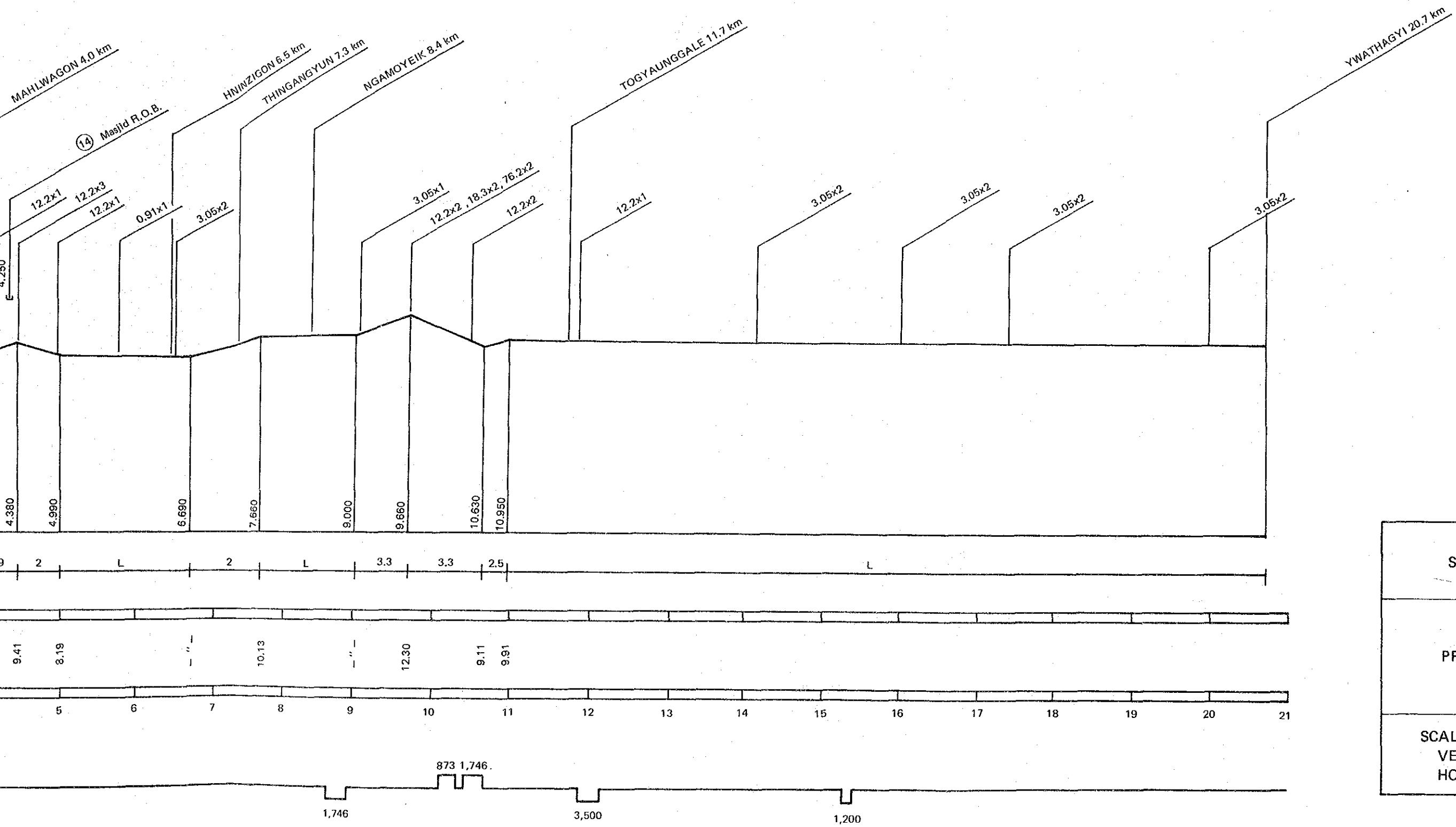


CIRCULAR LINE
PRESENT PROFILE
SCALE VERTICAL 1/4,000 HORIZONTAL 1/50,000

Source : B.R.C.



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SUBURBAN LINE

PRESENT PROFILE

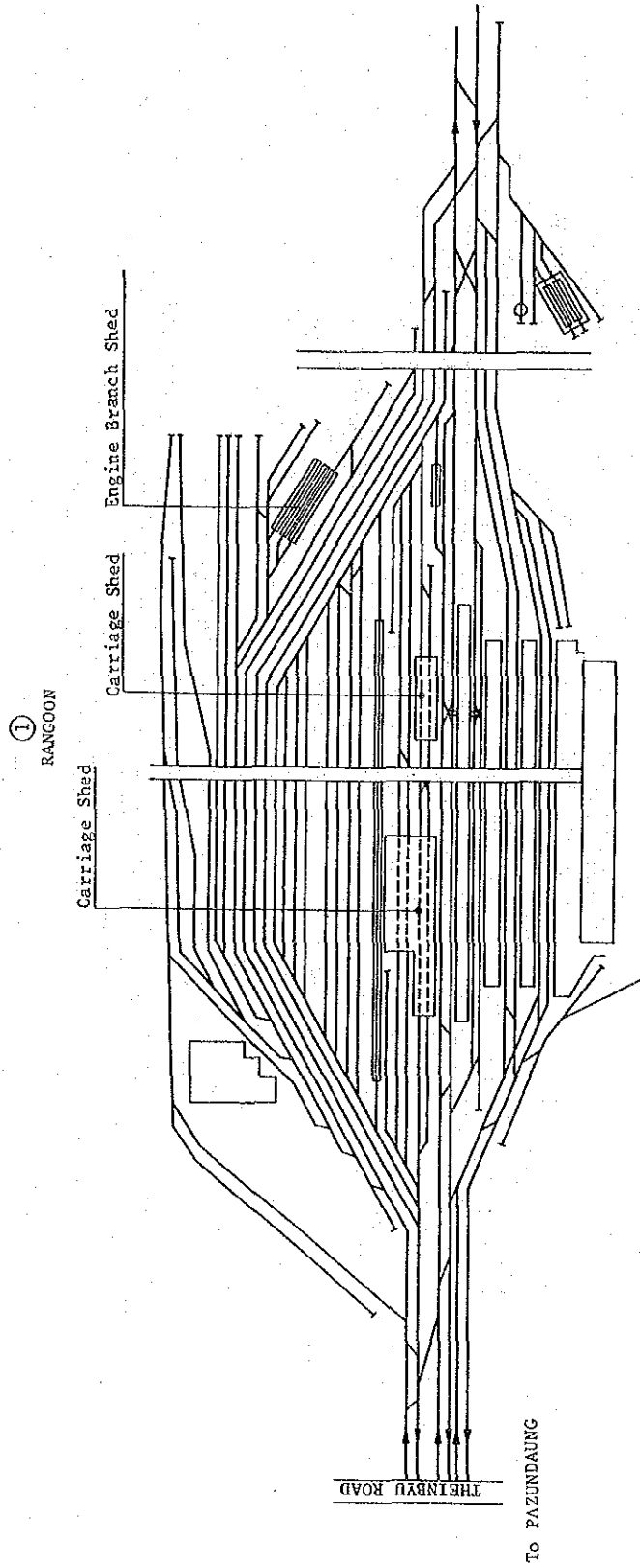
SCALE  
 VERTICAL 1/4,000  
 HORIZONTAL 1/50,000

Source : B.R.C.

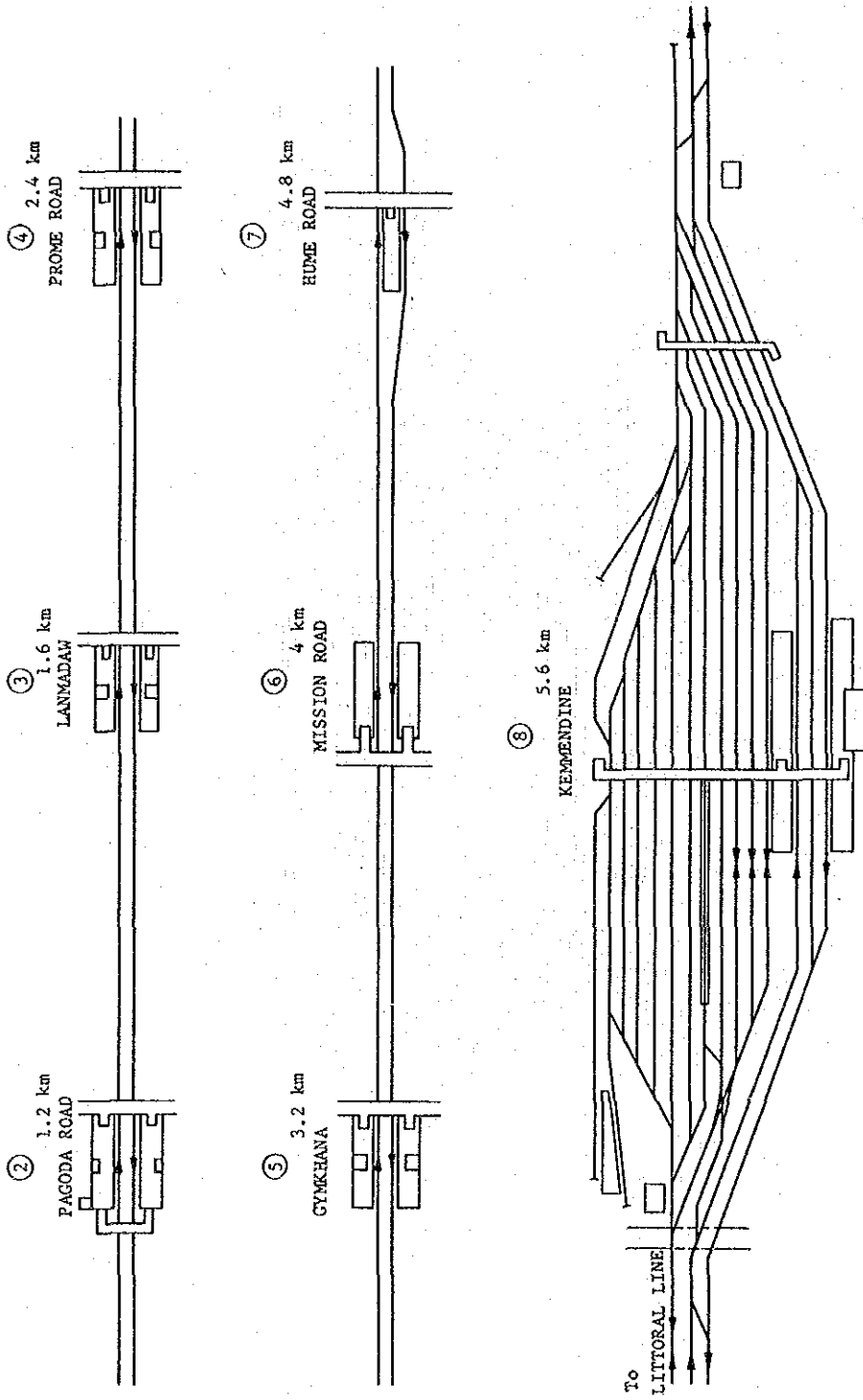


Appendix 2. Present Track Layout

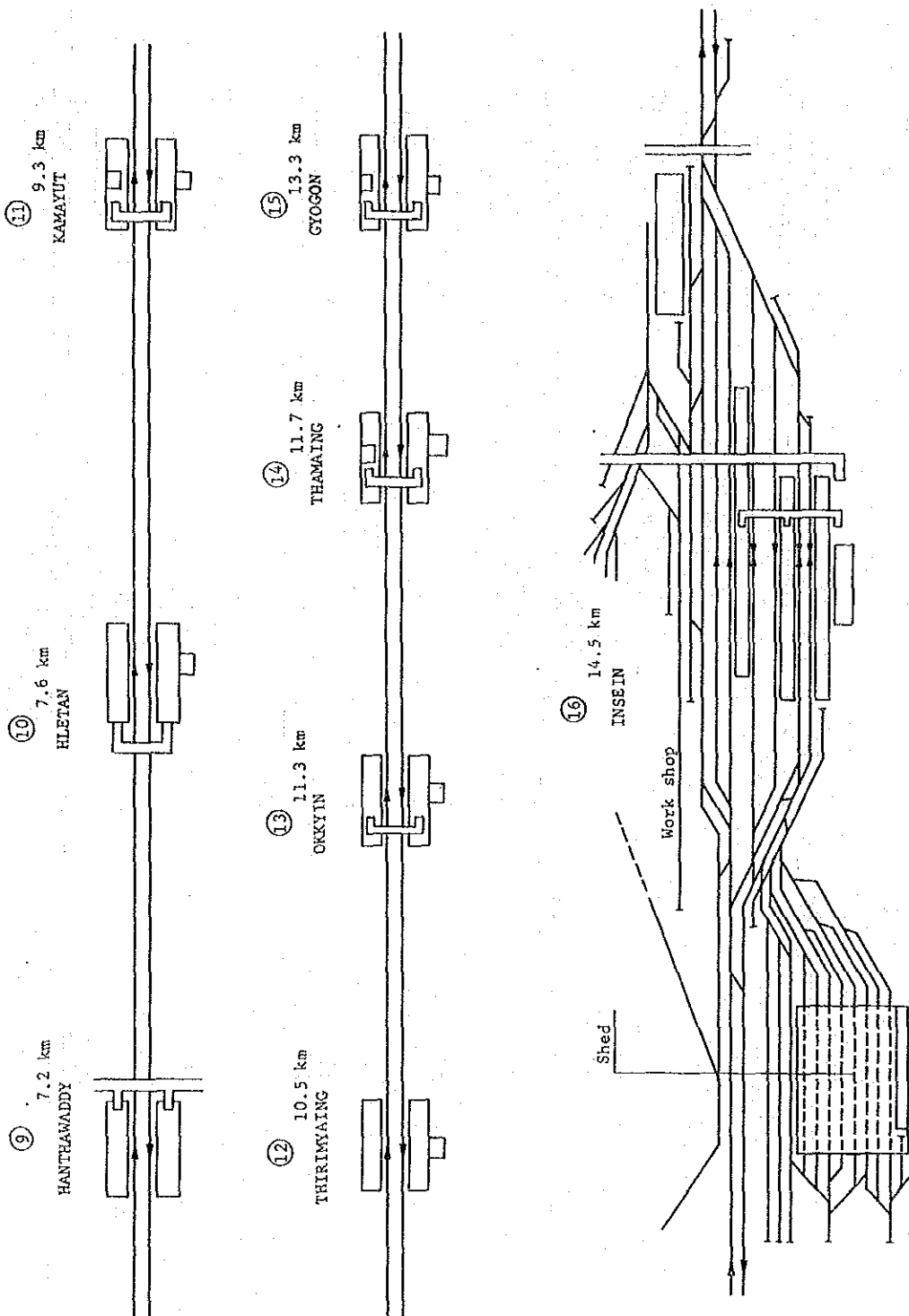
THE CIRCULAR LINE

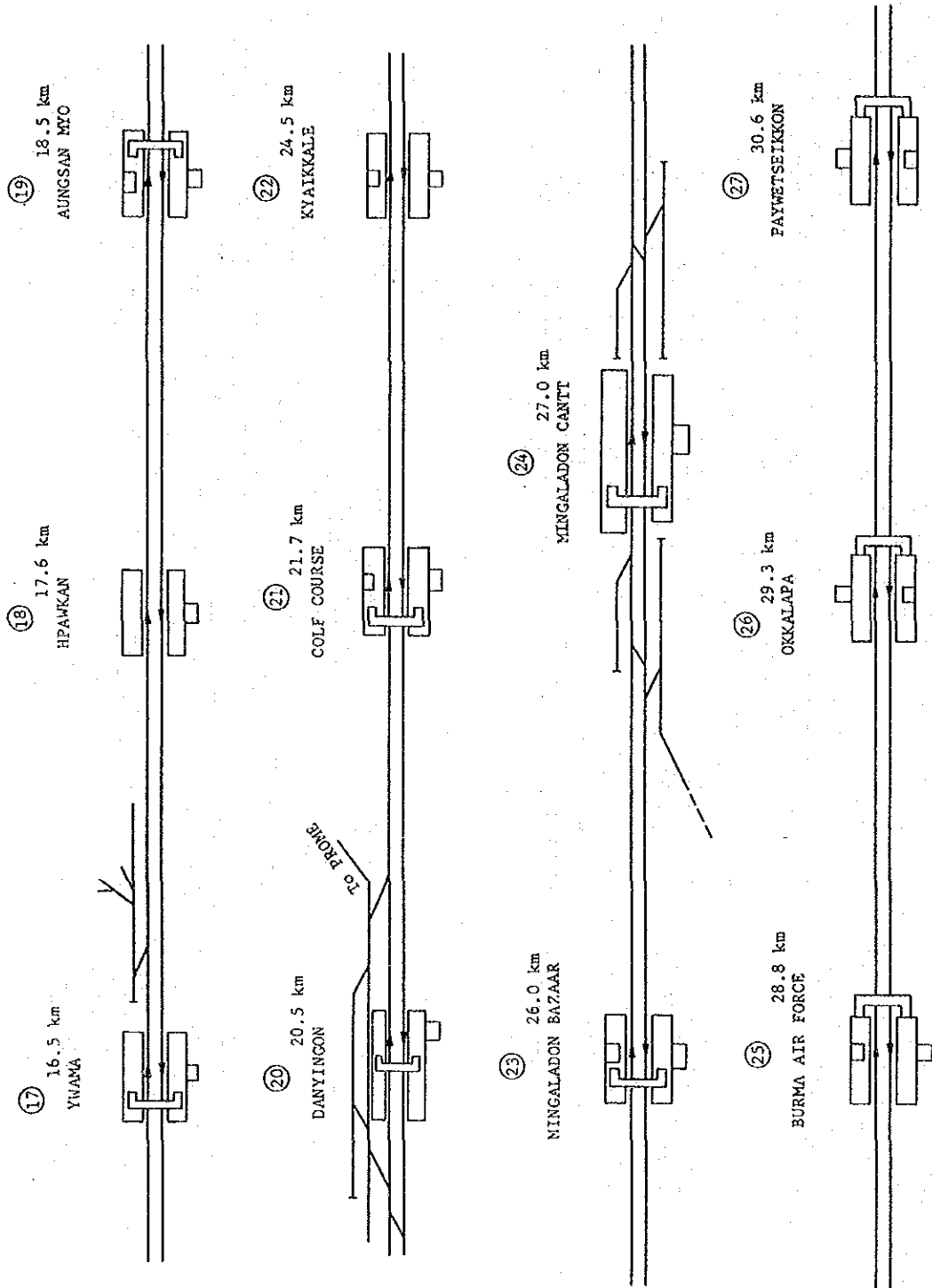


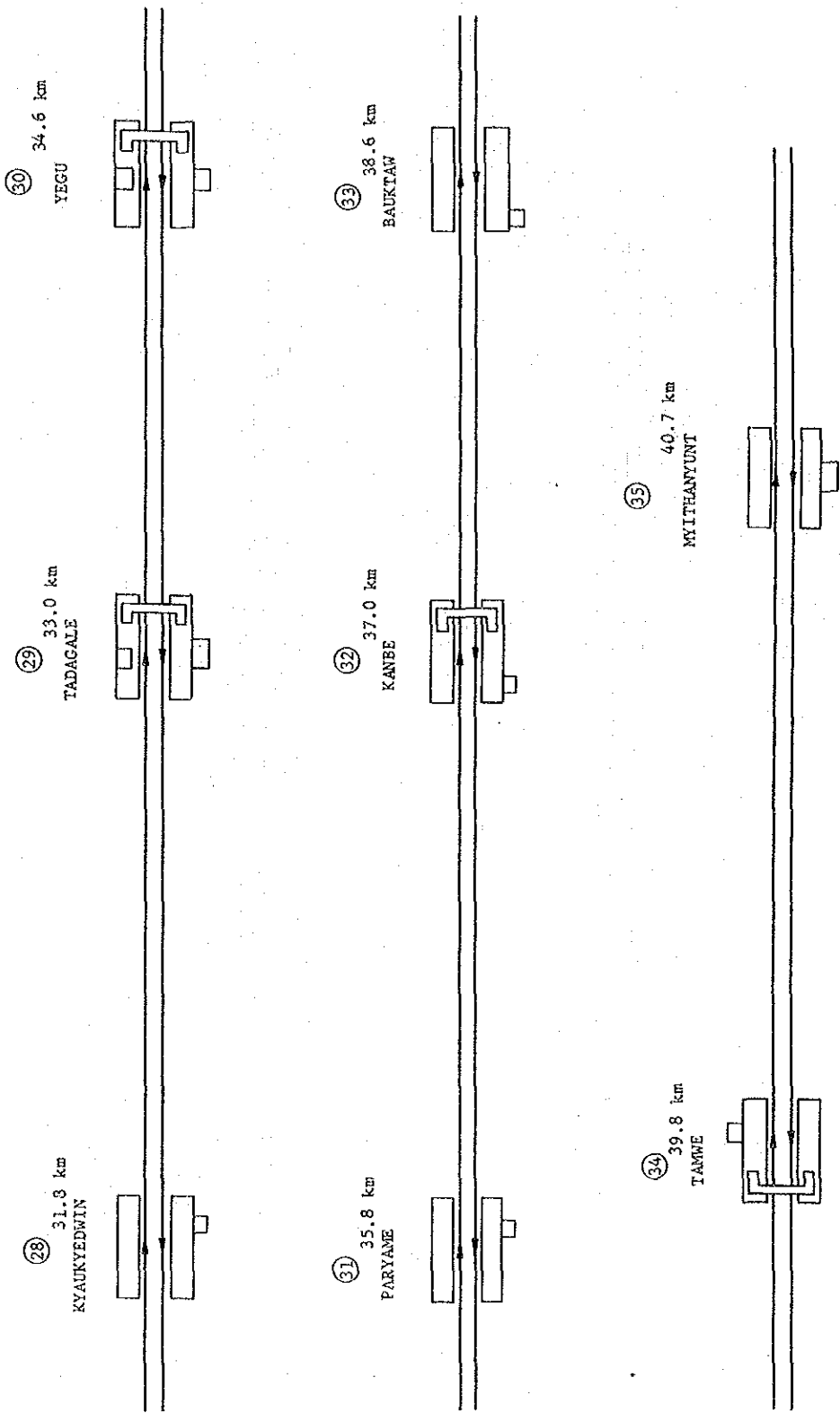
Source : B.R.C.



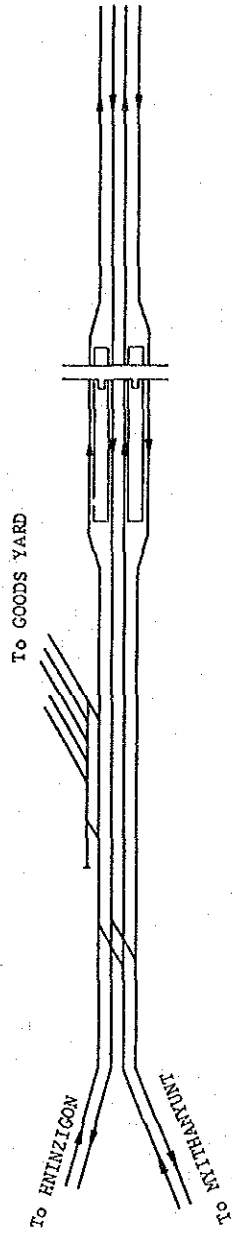




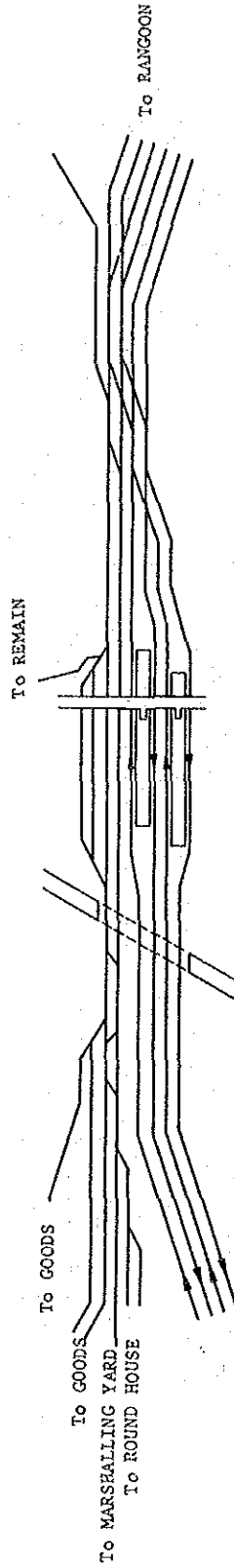




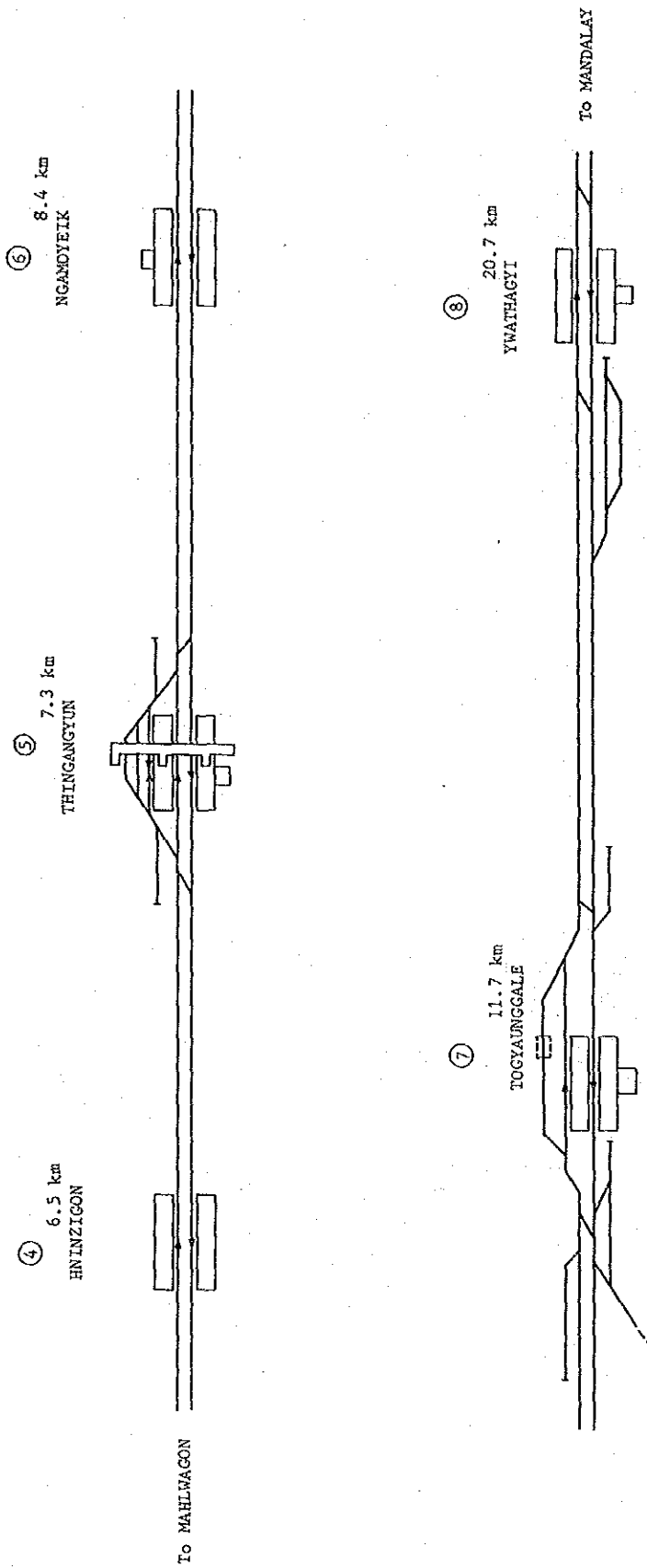
③⑥  
41.9 km  
MAHLWAGON



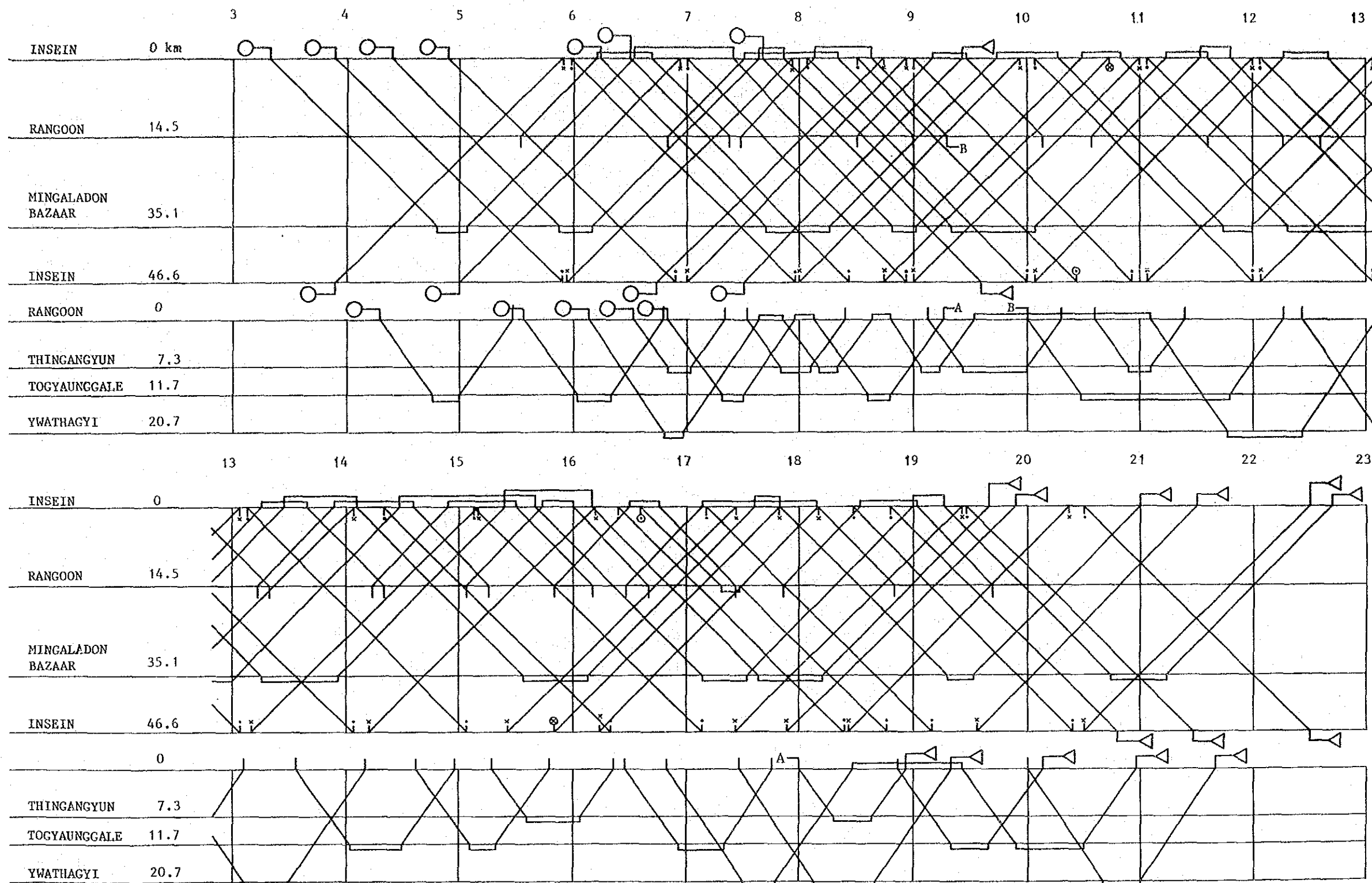
③⑦  
44.3 km  
PAZUNDAUNG



THE SUBURBAN LINE



Appendix 3. Train Diagram after Electrification (1990)



Source : Study draws



## Appendix 4. Cost Benefit Estimation

( Unit : Thousand Kyats )

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Cost (Investment)											
With	16,198	76,822	153,396	224,488	-32,802	0	0	0	0	0	0
Without	3,718	3,550	13,729	53,946	27,498	823	846	1,153	1,153	1,153	1,153
Railway	3,718	3,550	13,729	53,946	0	0	0	0	0	0	0
Bus & Express	0	0	0	0	27,297	817	840	1,145	1,145	1,145	1,145
Road	0	0	0	0	200	6	6	8	8	8	8
Benefit	0	0	0	0	42,006	43,759	45,597	47,709	49,917	52,231	54,638
Time Saving	0	0	0	0	12,471	13,500	14,599	15,788	17,075	18,465	19,950
Maintenance	0	0	0	0	11,988	12,262	12,542	12,892	13,241	13,591	13,940
With	0	0	0	0	3,527	3,527	3,527	3,527	3,527	3,527	3,527
Without	0	0	0	0	15,515	15,789	16,069	16,419	16,768	17,118	17,467
Railway	0	0	0	0	6,777	6,777	6,777	6,777	6,777	6,777	6,777
Bus & Express	0	0	0	0	8,738	9,012	9,292	9,641	9,991	10,340	10,690
Operation	0	0	0	0	17,547	17,997	18,456	19,029	19,602	20,175	20,748
With	0	0	0	0	1,889	1,889	1,889	1,889	1,889	1,889	1,889
Without	0	0	0	0	19,436	19,886	20,344	20,917	21,490	22,063	22,636
Railway	0	0	0	0	5,109	5,109	5,109	5,109	5,109	5,109	5,109
Bus & Express	0	0	0	0	14,326	14,776	15,235	15,808	16,381	16,954	17,527
Benefit-Cost	-12,481	-73,272	-139,667	-170,543	102,306	44,583	46,443	48,862	51,071	53,384	55,791
Discounted	-9,370	-47,667	-78,728	-83,296	43,236	16,348	14,757	13,452	12,183	11,035	9,992

Source: Study estimates



( Unit : Thousand Kyats )

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Cost(Investment)											
With	0	74,713	77,427	0	0	0	0	0	15,406	0	0
Without	1,153	75,866	63,087	5,235	1,270	1,270	23,407	1,270	42,939	2,086	2,109
Railway	0	74,713	61,934	0	0	0	22,137	0	14,372	0	0
Bus & Express	1,145	1,145	1,145	5,192	1,260	1,260	1,260	1,260	28,557	2,077	2,100
Road	8	8	8	43	10	10	10	10	10	19	10
Benefit	57,165	59,820	62,892	71,868	75,160	78,598	82,220	86,042	90,080	94,350	98,871
Time Saving	21,554	23,287	25,160	27,182	29,368	31,698	34,214	36,929	39,859	43,022	46,436
Maintenance	14,290	14,639	15,266	18,015	18,434	18,854	19,273	19,693	20,112	20,531	20,951
With	3,527	3,527	3,527	4,411	4,411	4,411	4,411	4,411	4,411	4,411	4,411
Without	17,817	18,166	18,793	22,426	22,845	23,265	23,684	24,103	24,523	24,942	25,362
Railway	6,777	6,777	7,054	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Bus & Express	11,039	11,389	11,738	13,626	14,045	14,465	14,884	15,304	15,723	16,142	16,562
Operation	21,321	21,894	22,467	26,670	27,358	28,046	28,733	29,421	30,109	30,796	31,484
With	1,889	1,889	1,889	2,374	2,374	2,374	2,374	2,374	2,374	2,374	2,374
Without	23,210	23,783	24,356	29,045	29,732	30,420	31,108	31,795	32,483	33,171	33,858
Railway	5,109	5,109	5,109	6,704	6,704	6,704	6,704	6,704	6,704	6,704	6,704
Bus & Express	18,100	18,673	19,246	22,341	23,028	23,716	24,404	25,091	25,779	26,467	27,154
Benefit-Cost	58,318	60,974	48,553	77,103	76,430	79,867	105,627	87,312	117,612	96,436	100,980
Discounted	9,050	8,199	5,657	7,784	6,686	6,054	6,937	4,969	5,799	4,120	3,738

RESTRICTED

( Unit : Thousand Kyats )

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>Cost(Investment)</b>												
With	0	98,794	8,657	0	0	0	0	26,419	0	0	0	-158,688
Without	86,788	100,730	7,495	2,838	2,838	2,838	2,838	24,063	5,720	2,953	2,953	-192,462
Railway	84,373	98,008	351	0	0	0	0	17,178	2,767	0	0	-180,366
Bus & Express	2,405	2,711	7,101	2,825	2,825	2,825	2,825	6,872	2,940	2,940	2,940	-12,110
Road	10	11	43	13	13	13	13	13	13	13	13	14
<b>Benefit</b>	103,614	109,247	120,696	126,730	133,122	139,899	147,090	154,729	162,851	171,397	180,489	190,353
Time Saving	50,072	53,992	58,220	62,779	67,694	72,995	78,710	84,873	91,519	98,588	106,204	114,408
Maintenance	21,370	22,281	25,135	25,694	26,253	26,812	27,371	27,931	28,490	29,049	29,608	30,237
With	4,411	4,411	5,575	5,575	5,575	5,575	5,575	5,575	5,575	5,575	5,575	5,575
Without	25,781	26,692	30,710	31,269	31,828	32,387	32,947	33,506	34,065	34,624	35,183	35,813
Railway	8,800	9,221	11,352	11,352	11,352	11,352	11,352	11,352	11,352	11,352	11,352	11,352
Bus & Express	16,981	17,471	19,358	19,917	20,476	21,036	21,595	22,154	22,713	23,272	23,832	24,461
Operation	32,172	32,974	37,341	38,258	39,175	40,092	41,009	41,925	42,842	43,759	44,676	45,708
With	2,374	2,374	3,048	3,048	3,048	3,048	3,048	3,048	3,048	3,048	3,048	3,048
Without	34,546	35,348	40,389	41,306	42,223	43,140	44,057	44,974	45,891	46,808	47,724	48,756
Railway	6,704	6,704	8,650	8,650	8,650	8,650	8,650	8,650	8,650	8,650	8,650	8,650
Bus & Express	27,842	28,644	31,739	32,656	33,573	34,490	35,406	36,323	37,240	38,157	39,074	40,105
<b>Benefit-Cost</b>	190,402	111,183	119,534	129,568	135,960	142,737	149,928	152,373	168,571	174,349	183,441	156,578
Discounted	6,108	3,090	2,879	2,704	2,458	2,236	2,035	1,792	1,718	1,540	1,404	1,038

## Appendix 5. FIRR Calculation

( Unit:Thousand Kyats )

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
<b>WITH CASE</b>										
Passenger (thousand/day)	97	101	105	109	113	233	240	247	254	261
Revenue	16246	16916	17585	18255	18925	39023	40195	41368	42540	43712
Expenses	10598	27353	110940	218762	321678	-21799	11092	11181	11271	11360
Investment	0	16704	100240	208011	310877	0	0	0	0	0
Salvage Value						-32802				
Administration	1167	1167	1167	1167	1167	1167	1167	1167	1167	1167
Maintenance	5753	5753	5753	5753	5753	4427	4427	4427	4427	4427
Operation	2440	2440	2440	2440	2440	2435	2435	2435	2435	2435
Turn Over Tax	1238	1289	1340	1391	1442	2973	3062	3152	3241	3330
Cash Flow	5648	-10437	-93354	-200506	-302753	60822	29103	30186	31269	32352
Discounted Cash Flow	5428	-9640	-82859	-171027	-248176	47915	22033	21963	21864	21739
<b>WITHOUT CASE</b>										
Passenger (thousand/day)	97	101	105	109	113	118	121	124	128	132
Revenue	16246	16916	17585	18255	18925	19763	20265	20768	21437	22107
Expenses	10598	15834	15757	27745	92996	13681	13719	13757	13808	13860
Investment	0	5185	5057	16994	82194	0	0	0	0	0
Salvage Value										
Administration	1167	1167	1167	1167	1167	1167	1167	1167	1167	1167
Maintenance	5753	5753	5753	5753	5753	7677	7677	7677	7677	7677
Operation	2440	2440	2440	2440	2440	3331	3331	3331	3331	3331
Turn Over Tax	1238	1289	1340	1391	1442	1506	1544	1582	1633	1684
Cash Flow	5648	1081	1829	-9490	-74070	6082	6546	7010	7629	8248
<b>WITH-WITHOUT</b>										
Cash Flow	0	-11519	-95183	-191017	-228683	54740	22557	23176	23640	24104
Discounted Cash Flow	0	-10428	-81985	-156544	-178315	40612	15923	15566	15107	14656

Source: Study estimates

( Unit:Thousand Kyats )

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
<b>WITH CASE</b>										
Passenger (thousand/day)	268	275	283	290	298	323	332	341	349	359
Revenue	4485	45057	47397	48569	49909	54096	55603	57111	58451	60125
Expenses	11449	11539	11641	114290	118795	13521	13636	13751	13853	13980
Investment Salvage Value	0	0	0	102560	106962	0	0	0	0	0
Administration Maintenance Operation	1167 4427 2435	1167 4427 2435	1167 4427 2435	1167 4427 2435	1167 4427 2435	1167 5311 2921	1167 5311 2921	1167 5311 2921	1167 5311 2921	1167 5311 2921
Turn Over Tax	3420	3509	3611	3701	3803	4122	4236	4351	4453	4581
Cash Flow	33435	34518	35756	-65721	-68885	40575	41968	43360	44598	46145
Discounted Cash Flow	21591	21422	21325	-37669	-37944	21479	21350	21199	20954	20836
<b>WITHOUT CASE</b>										
Passenger (thousand/day)	135	139	143	147	150	154	159	163	167	171
Revenue	22610	23280	23950	24620	25122	25792	26629	27299	27969	28639
Expenses	13898	13949	14000	116611	99867	17032	17095	17146	47585	17249
Investment Salvage Value	0	0	0	102560	85778	0	0	0	30388	0
Administration Maintenance Operation	1167 7677 3331	1167 7677 3331	1167 7677 3331	-1167 7677 3331	1167 7677 3331	1167 9700 4200	1167 9700 4200	1167 9700 4200	1167 9700 4200	1167 9700 4200
Turn Over Tax	1723	1774	1825	1876	1914	1965	2029	2080	2131	2182
Cash Flow	8712	9331	9950	-91991	-74745	8760	9534	10153	-19616	11391
<b>WITH-WITHOUT</b>										
Cash Flow	24723	25187	25806	26270	5860	31815	32434	33207	64214	34755
Discounted Cash Flow	14302	13863	13515	13090	2778	14351	13920	13560	24949	12848

( Unit: Thousand Kyats )

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>WITH CASE</b>										
Passenger (thousand/day)	368	377	387	397	407	436	447	458	469	481
Revenue	61633	63140	64815	66490	68164	73021	74864	76706	78548	80558
Expenses	36343	14210	14338	14465	151237	29326	16942	17082	17222	17375
Investment	22248	0	0	0	136644	12524	0	0	0	0
Salvage Value										
Administration	1167	1167	1167	1167	1167	1167	1167	1167	1167	1167
Maintenance	5311	5311	5311	5311	5311	6476	6476	6476	6476	6476
Operation	2921	2921	2921	2921	2921	3595	3595	3595	3595	3595
Turn Over Tax	4696	4811	4938	5066	5193	5564	5704	5844	5985	6138
Cash Flow	25290	48930	50477	52024	-83073	43696	57922	59624	61326	63183
Discounted Cash Flow	10974	20405	20230	20037	-30748	15543	19800	19588	19362	19170
<b>WITHOUT CASE</b>										
Passenger (thousand/day)	176	180	185	190	194	199	204	209	215	220
Revenue	29477	30146	30984	31821	32491	33329	34166	35003	36008	36846
Expenses	37684	17364	17428	135783	153410	21218	21282	21346	21422	21486
Investment	20371	0	0	118291	135867	0	0	0	0	0
Salvage Value										
Administration	1167	1167	1167	1167	1167	1167	1167	1167	1167	1167
Maintenance	9700	9700	9700	9700	9700	12252	12252	12252	12252	12252
Operation	4200	4200	4200	4200	4200	5260	5260	5260	5260	5260
Turn Over Tax	2246	2297	2361	2424	2476	2539	2603	2667	2743	2807
Cash Flow	-8207	12783	13556	-103961	-120919	12110	12824	13657	14586	15359
<b>WITH-WITHOUT</b>										
Cash Flow	33497	36147	36921	155986	37846	31585	45038	45966	46740	47823
Discounted Cash Flow	11782	12097	11756	47257	10909	8663	11753	11413	11042	10749

( Unit:Thousand Kyats )

	2015	2016	2017	2018	2019
<u>WITH CASE</u>					
Passenger (thousand/day)	492	505	517	529	542
Revenue	82400	84578	86587	88597	90774
Expenses	55626	17682	17835	17988	-224912
Investment	38111	0	0	0	0
Salvage Value					-243065
Administration	1167	1167	1167	1167	1167
Maintenance	6476	6476	6476	6476	6476
Operation	3595	3595	3595	3595	3595
Turn Over Tax	6278	6444	6597	6750	6916
Cash Flow	26774	66896	68752	70609	315686
Discounted Cash Flow	7807	18746	18515	18274	78516
<u>WITHOUT CASE</u>					
Passenger (thousand/day)	225	231	237	242	248
Revenue	37683	38688	39693	40530	41535
Expenses	46298	21627	21703	21767	-252895
Investment	24747	0	0	0	0
Salvage Value					-274739
Administration	1167	1167	1167	1167	1167
Maintenance	12252	12252	12252	12252	12252
Operation	5260	5260	5260	5260	5260
Turn Over Tax	2871	2948	3024	3088	3165
Cash Flow	-8614	17061	17990	18763	294430
<u>WITH-WITHOUT</u>					
Cash Flow	35388	49835	50763	51846	21256
Discounted Cash Flow	7568	10140	9828	9550	3725

## Appendix 6. Profit and Loss Statements and Balance Sheets

( Unit : Thousand Kyats )

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Revenues		16,916	17,585	18,255	18,925	39,023	40,195	41,368	42,540	43,712
Expenses	0	12,431	12,431	12,431	12,428	29,665	29,665	29,665	29,665	29,665
Administration		1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167
Maintenance		5,753	5,753	5,753	5,753	4,427	4,427	4,427	4,427	4,427
Operation		2,440	2,440	2,440	2,440	2,435	2,435	2,435	2,435	2,435
Depreciation		3,071	3,071	3,071	3,068	21,635	21,635	21,635	21,635	21,635
Gross profit	0	4,485	5,154	5,824	6,497	9,358	10,531	11,703	12,875	14,048
Other charges	0	1,588	3,743	9,244	18,220	25,032	25,091	24,929	24,229	22,732
Turn over tax		1,289	1,340	1,391	1,442	2,973	3,062	3,152	3,241	3,330
Interest	0	299	2,403	7,853	16,778	22,059	22,028	21,777	20,987	19,402
Net profit	0	2,897	1,411	-3,419	-11,723	-15,674	-14,560	-13,226	-11,353	-8,685
Profit before depreciation	0	5,968	4,482	-348	-8,655	5,961	7,075	8,409	10,282	12,950
Retained profit	0	2,897	4,308	889	-10,834	-26,508	-41,068	-54,294	-65,647	-74,332
Assets	58,176	77,777	179,428	384,019	683,173	667,499	651,706	629,654	595,542	546,200
Current assets	0	5,968	10,450	10,102	1,447	40,210	46,052	45,635	33,158	5,451
Fixed assets	58,176	71,809	168,978	373,918	681,726	627,289	605,654	584,020	562,385	540,750
Acquisition value	58,176	74,880	175,120	383,131	694,007	661,205	661,205	661,205	661,205	661,205
Cumulative depreciation	0	3,071	6,142	9,213	12,281	33,916	55,551	77,186	98,821	120,455
Liabilities	58,176	77,777	179,428	384,019	683,173	667,499	651,706	629,654	595,542	546,200
Current liabilities	0	0	0	0	0	0	0	0	0	0
Long term liabilities	0	16,704	116,944	324,955	635,831	635,831	634,598	625,773	603,014	562,356
Foreign loan	0	10,540	72,815	211,159	432,546	432,546	432,546	432,546	432,546	432,546
Myanma Economic bank	0	6,164	44,129	113,795	203,286	203,286	202,053	193,227	170,468	129,811
Equity	58,176	61,073	62,484	59,065	47,342	31,668	17,108	3,882	-7,471	-16,156
Accumulated earnings	0	2,897	4,308	889	-10,834	-26,508	-41,068	-54,294	-65,647	-74,332
Equity transferred	58,176	58,176	58,176	58,176	58,176	58,176	58,176	58,176	58,176	58,176

Source: Study estimates

( Unit : Thousand Kyats )

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Revenues	44,885	46,057	47,397	48,569	49,909	54,096	55,603	57,111	58,451	60,125
Expenses	29,665	29,665	29,665	29,665	32,239	36,931	36,931	36,931	36,931	36,931
Administration	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167
Maintenance	4,427	4,427	4,427	4,427	4,427	5,311	5,311	5,311	5,311	5,311
Operation	2,435	2,435	2,435	2,435	2,435	2,921	2,921	2,921	2,921	2,921
Depreciation	21,635	21,635	21,635	21,635	24,209	27,532	27,532	27,532	27,532	27,532
Gross Profit	15,220	16,393	17,732	18,905	17,670	17,165	18,672	20,180	21,520	23,194
Other charges	19,020	21,183	21,057	22,600	26,098	28,105	27,962	27,681	27,349	27,099
Turn over tax	3,420	3,509	3,611	3,701	3,803	4,122	4,236	4,351	4,453	4,581
Interest	15,601	17,674	17,446	18,899	22,296	23,983	23,725	23,330	22,896	22,518
Net profit	-3,800	-4,790	-3,325	-3,695	-8,428	-10,940	-9,290	-7,502	-5,830	-3,905
Profit before depreciation	17,835	16,844	18,310	17,940	15,781	16,592	18,242	20,030	21,702	23,627
Retained Profit	-78,132	-82,923	-86,247	-89,943	-98,371	-109,311	-118,600	-126,102	-131,932	-135,837
Assets	519,115	497,480	475,845	556,770	639,523	611,992	584,460	556,928	529,396	501,865
Current assets	0	0	0	0	0	0	0	0	0	0
Fixed assets	519,115	497,480	475,845	556,770	639,523	611,992	584,460	556,928	529,396	501,865
Acquisition value	661,205	661,205	661,205	763,765	870,727	870,727	870,727	870,727	870,727	870,727
Cumulative depreciation	142,090	163,725	185,360	206,995	231,204	258,736	286,268	313,799	341,331	368,863
Liabilities	519,115	497,480	475,845	556,770	639,523	611,992	584,460	556,928	529,396	501,865
Current liabilities	17,372	40,479	57,641	68,157	74,003	79,039	82,424	84,021	90,604	101,955
Long term liabilities	521,699	481,748	446,276	520,380	605,715	584,088	562,460	540,833	512,548	477,570
Foreign loan	432,546	432,019	428,378	487,090	538,962	517,334	495,707	474,080	452,452	430,825
Myanma Economic bank	89,154	49,729	17,898	33,290	66,753	66,753	66,753	66,753	60,095	46,745
Equity	-19,956	-24,747	-28,071	-31,767	-40,195	-51,135	-60,424	-67,926	-73,756	-77,661
Accumulated earnings	-78,132	-82,923	-86,247	-89,943	-98,371	-109,311	-118,600	-126,102	-131,932	-135,837
Equity transferred	58,176	58,176	58,176	58,176	58,176	58,176	58,176	58,176	58,176	58,176



( Unit : Thousand Kyats )

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Revenues	61,633	63,140	64,815	66,490	68,164	73,021	74,864	76,706	78,548	80,558
Expenses	36,931	36,931	36,931	36,931	36,931	42,995	42,995	42,995	42,995	42,995
Administration	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167	1,167
Maintenance	5,311	5,311	5,311	5,311	5,311	6,476	6,476	6,476	6,476	6,476
Operation	2,921	2,921	2,921	2,921	2,921	3,595	3,595	3,595	3,595	3,595
Depreciation	27,532	27,532	27,532	27,532	27,532	31,757	31,757	31,757	31,757	31,757
Gross profit	24,702	26,209	27,884	29,559	31,233	30,026	31,868	33,711	35,553	37,563
Other charges	26,167	27,076	26,517	25,763	27,247	29,157	28,351	27,098	25,588	23,937
Turn over tax	4,696	4,811	4,938	5,066	5,193	5,564	5,704	5,844	5,985	6,138
Interest	21,471	22,265	21,579	20,697	22,054	23,593	22,647	21,254	19,603	17,800
Net profit	-1,465	-867	1,367	3,796	3,986	869	3,518	6,612	9,965	13,626
Profit before depreciation	26,067	26,665	28,898	31,328	31,518	32,627	35,275	38,370	41,722	45,383
Retained profit	-137,302	-138,169	-136,802	-133,006	-129,020	-128,151	-124,633	-118,021	-108,056	-94,431
Assets	496,581	469,049	441,517	413,986	523,098	503,865	472,108	440,350	408,593	376,835
Current assets	0	0	0	0	0	0	0	0	0	0
Fixed assets	496,581	469,049	441,517	413,986	523,098	503,865	472,108	440,350	408,593	376,835
Acquisition value	892,975	892,975	892,975	892,975	1,029,620	1,042,144	1,042,144	1,042,144	1,042,144	1,042,144
Cumulative depreciation	396,395	423,926	451,458	478,990	506,521	538,279	570,036	601,794	633,551	665,309
Liabilities	496,581	469,049	441,517	413,986	523,098	503,865	472,108	440,350	408,593	376,835
Current liabilities	110,867	119,180	125,260	125,716	122,963	120,526	115,441	107,261	95,729	89,031
Long term liabilities	464,840	429,862	394,884	363,100	470,979	453,314	423,124	392,934	362,744	324,058
Foreign loan	424,325	402,698	381,071	355,980	421,379	401,165	372,400	343,634	314,868	286,103
Myanma Economic bank	40,515	27,164	13,813	7,121	49,600	52,148	50,724	49,300	47,876	37,956
Equity	-79,126	-79,993	-78,626	-74,830	-70,844	-69,975	-66,457	-59,845	-49,880	-36,255
Accumulated earnings	-137,302	-138,169	-136,802	-133,006	-129,020	-128,151	-124,633	-118,021	-108,056	-94,431
Equity transferred	58,176	58,176	58,176	58,176	58,176	58,176	58,176	58,176	58,176	58,176

( Unit : Thousand Kyats )

	2015	2016	2017	2018	2019
Revenues	82,400	84,578	86,587	88,597	90,774
Expenses	42,995	42,995	42,995	42,995	42,995
Administration	1,167	1,167	1,167	1,167	1,167
Maintenance	6,476	6,476	6,476	6,476	6,476
Operation	3,595	3,595	3,595	3,595	3,595
Depreciation	31,757	31,757	31,757	31,757	31,757
Gross profit	39,405	41,582	43,592	45,602	47,779
Other charges	21,884	21,364	18,899	15,787	13,112
Turn over tax	6,278	6,444	6,597	6,750	6,916
Interest	15,606	14,920	12,302	9,037	6,196
Net profit	17,521	20,219	24,693	29,815	34,667
Profit before depreciation	48,279	51,976	56,451	61,572	66,425
Retained profit	-76,909	-56,691	-31,998	-2,183	32,484
Assets	383,188	351,431	319,673	287,916	298,907
Current assets	0	0	0	0	42,749
Fixed assets	383,188	351,431	319,673	287,916	256,158
Acquisition value	1,080,255	1,080,255	1,080,255	1,080,255	1,080,255
Cumulative depreciation	697,066	728,824	760,581	792,339	824,096
Liabilities	383,188	351,431	319,673	287,916	298,907
Current liabilities	78,565	64,875	43,596	10,278	0
Long term liabilities	323,356	285,071	249,899	221,645	208,247
Foreign loan	282,432	253,437	227,556	208,592	195,989
Myamma Economic bank	40,924	31,634	22,343	13,053	12,259
Equity	-18,733	1,485	26,178	55,993	90,660
Accumulated earnings	-76,909	-56,691	-31,998	-2,183	32,484
Equity transferred	58,176	58,176	58,176	58,176	58,176

## Appendix 7. Cash Flow

( Unit : Thousand Kyats )

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Profit less depreciation & tax	0	6,267	6,886	7,504	8,123	28,020	29,103	30,186	31,269	32,352
Capital expenditure	0	16,704	100,240	208,011	310,877	-32,802	0	0	0	0
Foreign currency		10,540	62,274	138,345	221,386					
Local currency less taxes		5,658	14,548	15,052	3,102	-32,802				
Tariff & tax		505	23,417	54,614	86,388					
Cash flow before funding	0	-10,437	-93,354	-200,506	-302,753	60,822	29,103	30,186	31,269	32,352
Loan raised	0	16,704	100,240	208,011	310,877	0	0	0	0	0
Foreign loan	0	10,540	62,274	138,345	221,386	0	0	0	0	0
Capital loan	0	6,164	37,966	69,666	89,490	0	0	0	0	0
Loan repayment	0	0	0	0	0	0	1,233	8,826	22,759	40,657
Foreign loan							1,233	8,826	22,759	40,657
Capital loan										
Interests for long term loan	0	299	2,403	7,853	16,778	22,059	22,028	21,777	20,987	19,402
Foreign loan	0	145	1,146	3,905	8,851	11,895	11,895	11,895	11,895	11,895
Capital loan	0	154	1,257	3,948	7,927	10,164	10,133	9,882	9,092	7,507
Equity transferred	0	0	0	0	0	0	0	0	0	0
Working capital Shortfall	0	5,968	10,450	10,102	1,447	40,210	46,052	45,635	33,158	5,451
Finance & revenue loan	0	0	0	0	0	0	0	0	0	0
Interests for short term loan	0	0	0	0	0	0	0	0	0	0
For initial balance	0	0	0	0	0	0	0	0	0	0
For net increase	0	0	0	0	0	0	0	0	0	0
Net cash flow	0	5,968	4,482	-348	-8,655	38,763	5,842	-417	-12,477	-27,707
Cash balance	0	5,968	10,450	10,102	1,447	40,210	46,052	45,635	33,158	5,451

Source: Study estimates

( Unit : Thousand Kyats )

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Profit less depreciation & tax	33.435	34.518	35.756	36.839	38.077	40.575	41.968	43.360	44.598	46.145
Capital expenditure	0	0	0	102,560	106,962	0	0	0	0	0
Foreign currency				69,270	73,499					
Local currency less taxes				5,443	3,929					
Tariff & tax				27,847	29,534					
Cash flow before funding	33.435	34.518	35.756	-65,721	-68,885	40,575	41,968	43,360	44,598	46,145
Loan raised	0	0	0	102,560	106,962	0	0	0	0	0
Foreign loan	0	0	0	69,270	73,499	0	0	0	0	0
Capital loan	0	0	0	33,290	33,463	0	0	0	0	0
Loan repayment	40,657	39,951	35,472	28,456	21,627	21,627	21,627	21,627	28,285	34,978
Foreign loan		527	3,641	10,558	21,627	21,627	21,627	21,627	21,627	21,627
Capital loan	40,657	39,424	31,831	17,898	0	0	0	0	6,658	13,351
Interests for long term loan	14,906	15,360	13,521	13,867	16,609	17,862	17,267	16,672	15,911	14,816
Foreign loan	11,895	11,888	11,830	12,588	14,108	14,524	13,929	13,335	12,740	12,145
Capital loan	3,011	3,472	1,691	1,280	2,501	3,338	3,338	3,338	3,171	2,671
Equity transferred	0	0	0	0	0	0	0	0	0	0
Working capital Shortfall	-16,677	-20,793	-13,237	-5,484	-160	1,086	3,073	5,061	402	-3,649
Finance & revenue loan	17,372	23,107	17,162	10,516	5,846	5,035	3,385	1,597	6,583	11,351
Interests for short term loan	695	2,314	3,925	5,032	5,686	6,122	6,458	6,658	6,985	7,702
For initial balance	0	1,390	3,238	4,611	5,453	5,920	6,323	6,594	6,722	7,248
For net increase	695	924	686	421	234	201	135	64	263	454
Net cash flow	-5,451	0	0	0	0	0	0	0	0	0
Cash balance	0	0	0	0	0	0	0	0	0	0

( Unit : Thousand Kyats )

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Profit less depreciation & tax	47,538	48,930	50,477	52,024	53,572	56,220	57,922	59,624	61,326	63,183
Capital expenditure	22,248	0	0	0	136,644	12,524	0	0	0	0
Foreign currency	15,127				94,165	8,552				
Local currency less taxes	279				4,628	105				
Tariff & tax	6,841				37,851	3,868				
Cash flow before funding	25,290	48,930	50,477	52,024	-83,073	43,696	57,922	59,624	61,326	63,183
Loan raised	22,248	0	0	0	136,644	12,524	0	0	0	0
Foreign loan	15,127	0	0	0	94,165	8,552	0	0	0	0
Capital loan	7,121	0	0	0	42,479	3,973	0	0	0	0
Loan repayment	34,978	34,978	34,978	31,783	28,766	30,190	30,190	30,190	30,190	38,686
Foreign loan	21,627	21,627	21,627	25,091	28,766	28,766	28,766	28,766	28,766	28,766
Capital loan	13,351	13,351	13,351	6,693	0	1,424	1,424	1,424	1,424	9,920
Interests for long term loan	12,958	13,064	11,801	10,658	12,107	13,854	13,208	12,346	11,484	10,409
Foreign loan	11,758	11,372	10,777	10,134	10,689	11,310	10,637	9,845	9,054	8,263
Capital loan	1,200	1,692	1,024	523	1,418	2,544	2,572	2,501	2,429	2,146
Equity transferred	0	0	0	0	0	0	0	0	0	0
Working capital Shortfall	-398	889	3,698	9,583	12,699	12,177	14,524	17,088	19,652	14,088
Finance & revenue loan	8,911	8,313	6,080	456	-2,752	-2,437	-5,085	-8,180	-11,533	-6,697
Interests for short term loan	8,513	9,202	9,778	10,039	9,947	9,740	9,439	8,908	8,120	7,390
For initial balance	8,156	8,869	9,534	10,021	10,057	9,837	9,642	9,235	8,581	7,658
For net increase	356	333	243	18	-110	-97	-203	-327	-461	-268
Net cash flow	0	0	0	0	0	0	0	0	0	0
Cash balance	0	0	0	0	0	0	0	0	0	0

RESTRICTED

( Unit : Thousand Kyats )

	2015	2016	2017	2018	2019
Profit less depreciation & tax	64,884	66,896	68,752	70,609	72,620
Capital expenditure	38,111	0	0	0	0
Foreign currency	25,852				
Local currency less taxes	567				
Tariff & tax	11,692				
Cash flow before funding	26,774	66,896	68,752	70,609	72,620
Loan raised	38,111	0	0	0	0
Foreign loan	25,852	0	0	0	0
Capital loan	12,259	0	0	0	0
Loan repayment	38,812	38,285	35,172	28,254	13,398
Foreign loan	29,522	28,995	25,881	18,964	12,603
Capital loan	9,290	9,290	9,290	9,290	795
Interests for long term loan	8,902	9,182	7,963	6,882	6,196
Foreign loan	7,817	7,368	6,614	5,997	5,563
Capital loan	1,085	1,814	1,349	885	633
Equity transferred	0	0	0	0	0
Working capital Shortfall	17,170	19,428	25,618	35,473	53,027
Finance & revenue loan	-10,466	-13,691	-21,279	-33,318	-10,278
Interests for short term loan	6,704	5,738	4,339	2,155	0
For initial balance	7,123	6,285	5,190	3,488	822
For net increase	-419	-548	-851	-1,333	-822
Net cash flow	0	0	0	0	42,749
Cash balance	0	0	0	0	42,749

RESTRICTED







