CHAPTER 9 ECONOMIC AND FINANCIAL ANALYSES

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9-1 Purpose of the Analyses

The economic and financial analyses were based on the results of the transport demand forecast and the improvement investment plan.

There are several investment alternatives that satisfy the goals of improvement. The purpose of the economic analysis was to appraise these alternatives from a national economic point of view, with the financial analysis appraising their profitability and stability.

9-2 Methodology

The Economic Internal Rate of Return (EIRR) and Net Present Value (NPV) were adopted as the criteria for the economic appraisal in this study. These indices were calculated based on a cost-benefit analysis. For the financial appraisal, the Financial Internal Rate of Return (FIRR) and NPV for testing the profitability of the project and Debt Service Cover Ratio (DSCR*) for testing the stability were used. Prior to calculating these indices, the cash flow and financial statements such as profit and loss, balance sheets, and changes in financial position were projected.

The general procedures for the economic and financial analyses are shown in Fig. 9.2.1

9-3 Economic Analysis

9-3-1 Major Premises

The study was based on the following premises.

(1) Demand type

There will be three types of transport demand after the improvement, which were already mentioned in the report on the long-term modernization programme (hereinafter referred to as the LTMP).

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* DSCR = (Profit + Depreciation + Interest)/(Debt Service)

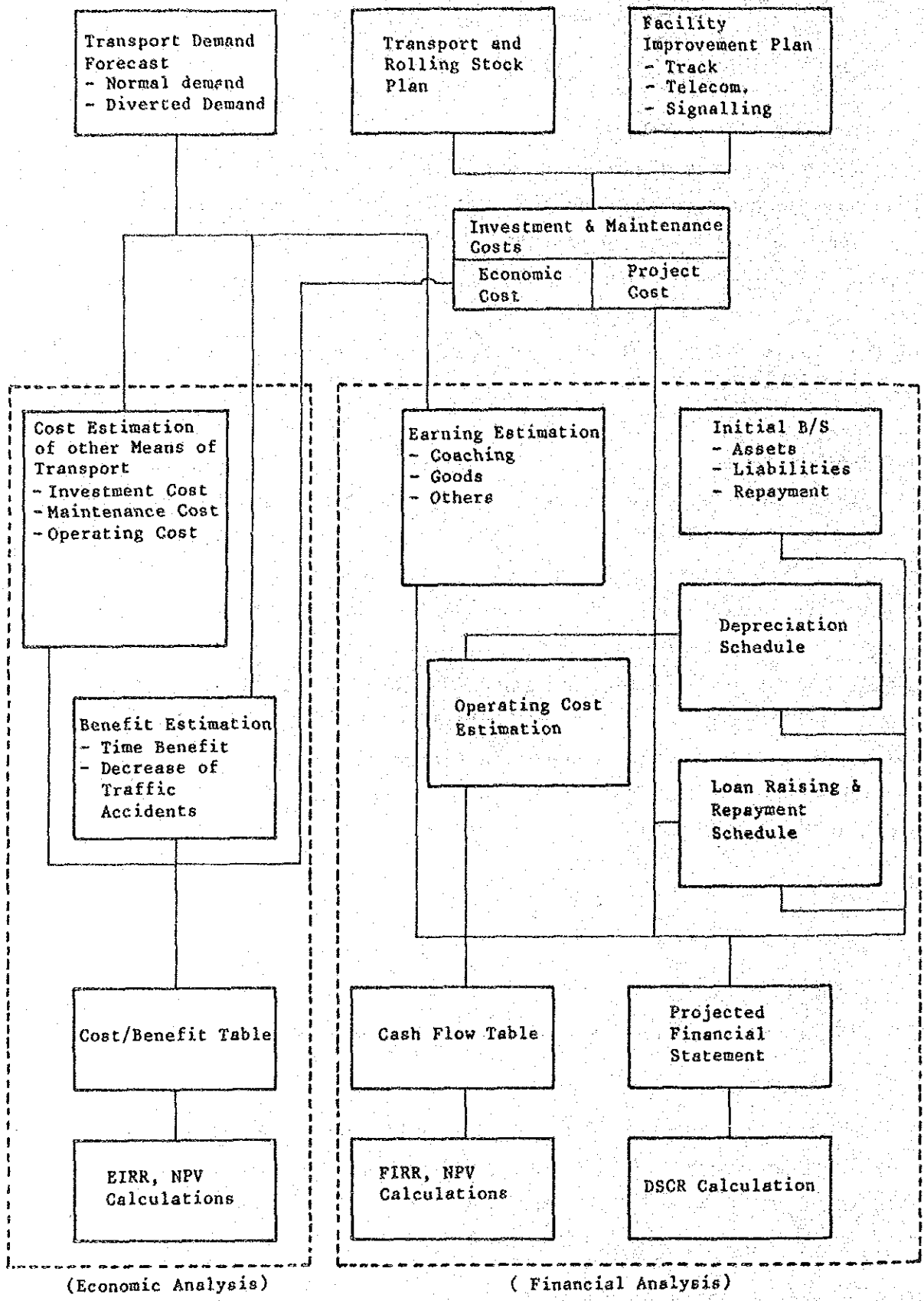


Fig. 9.2.1 Outline of Economic and Financial Analyses

- Normal Demand
- Diverted Demand
- Induced Demand

(2) With project/without project

The terms "with project" and "without project" are the same as those of the study on the LTMP.

(3) Price

The prices used in this report were set at the current prices as of the beginning of the feasibility study. Therefore, the exchange rate used in this study is 7.1 Kyats per U.S. dollar (21.6 Yen per Kyats), the average official rate in August 1986.

(4) Shadow price

As in the study on the LTMP, shadow prices were basically not used in this report.

(5) Tax, customs duties

In the economic analysis, tax and customs duties were excluded from the calculation of the costs and benefits.

(6) Calculation period

After taking into consideration the average life of the facilities, the costs and benefits of the project were estimated over a 30 year period beginning in 1987/88.

9-3-2 Benefit Estimation

(1) Benefit composition

The benefits listed below were considered in the feasibilty study on the Short-Term Improvement Project. Most of them were taken up in the LTMP with the exception of the "Contribution to industrial development" and the "Improvement of passenger comfort".

Effects of the Projects

- Decremental investment in rolling stock
- Timesaving
- Maintenance cost reduction
- Operating cost reduction
- Decremental investment in other means of transport
- Decrease in traffic accidents

. Contribution to industrial development

. Improvement of passenger comfort

(2) Decremental investment in rolling stock

The rolling stock operation will become efficient due to the increased train speed and punctual train operation. Accordingly, less investment for rolling stock will be required after the improvement is implemented.

However, the amount of rolling stock that should be purchased exceeds that of the without project, owing to the difference in the total amount of transport demand.

Therefore, the value of this benefit, decremental investment in rolling stock, is not directly expressed in the cost-benefit table (Table 9.3.1).

(3) Timesaving

1) Timesavings for passengers

Passengers will be able to save time due to the increase in train speed. Furthermore, establishment of punctual train operation will result in decreases in wasted time, due to train delays and also in waiting time for their train which is delayed by the deterioration of facilities.

The formula for the calculation is the same as that in the report on the LTMP.

$$\boxed{\text{Travel timesaving}} \times \boxed{\text{Passenger time value}} \times \boxed{\text{Growth rate of time value}}$$

Travel timesaving in this formula was calculated by multiplying the number of passengers by the unit time saved.

The number of passengers by year and O-D pairs were given by the transport demand forecast as mentioned before. Unit time saved by O-D pairs and type of train, such as express and local trains, was calculated with the following formula.

(Normal demand)

$$tij \times (1 + d) - Tij \times \{1 + d(1 - p)\} + \underbrace{\{tij \times d/2 - Tij \times d(1 - p)/2\}}_{\text{Reduction of waiting time}}$$

where,

Tij: Travel time from i area to j area by train in the case of the with project

tij: Travel time from i area to j area by train in the case of the without project

d : Average rate of delays in proportion to scheduled time

(Express) 8%

(Local) 12%

p : Improvement ratio of delays

(at the end of phase 1) 57%

(- do - 2) 90%

(Diverted demand)

$$tij - Tij \times \{1 + d(1 - p)\}$$

where,

tij: Travel time from i area to j area by bus

For diverted demand, the unit time saved excluded the waiting time for buses and trains due to the limitations of the field survey in Burma.

Passenger time value was calculated as 0.426 Kyats per person per hour in 1985/86.

Per capita GDP	1555.5 Ks/year	ⓐ
Active hours	10 hours per day x 365	ⓑ
Passenger time value	0.426 Ks/hour	ⓐ / ⓑ

Growth rates of the time value were calculated from the projections on GDP growth and population.

1986/87 - 1993/94	2.55%
1994/95 - 1997/98	2.47%
1998/99 - 2016/17	2.81%

2) Timesaving for freight

The concept and calculation formula are the same as those of the study on the LTMP.

Hauling timesaving	x	Freight value per ton	x	The rate of the opportunity cost of capital

Hauling timesaving in this formula was calculated by multiplying the amount of goods by unit time saved in the same way as that of the travel timesaving for passengers mentioned before.

Unit time saved by O-D pairs was calculated with the same formula used in the unit time saved for passengers. According to the Traffic Department of the BRC, the coefficient "d" for freight was estimated at approximately 160 percent in proportion to the scheduled time.

Freight value per ton was computed at 693.5 Kyats (see the report on the LTMP, Table 10.3.3).

The rate of the opportunity cost of capital was calculated at 0.00219 percent per hour, as referred to in the report on the LTMP.

(4) Maintenance cost reduction

Maintenance cost for the railway is referred to in Chapter 8. The following effects of the improvement was reflected in the estimation of the maintenance cost.

- Prevention of the wearing out of rails and fastenings and increasing their life due to the introduction of long rails.
- Decrease in the frequency of bogie breakdowns

The estimation also considered negative factors such as the heavy usage of rolling stock due to the increase in their efficiency.

In terms of economic cost, the maintenance costs per unit of other means of transport, are as follows (see the report on the LTMP, Table 10.3.4).

Bus 19.2 ks in Thousand/Unit/Year
Truck 13.2 ks in Thousand/Unit/Year

(5) Operating cost reduction

As referred to in the report on the LTMP, the BRC's major operating costs are fuel and labour. This report describes these two cost categories too.

1) Fuel cost reduction

Improvement of track facilities will result in a decreasing consumption ratio. Furthermore, owing to the diversion from road transport to the railway, the amount of fuel consumed per passenger-kilometer or ton-kilometer will certainly decrease, as mentioned in the report on the LTMP.

The benefit from the reduction in the fuel cost is calculated by the following formula.

$$\{(\Sigma fi \times \ell i + F \times \ell\ell) - F \times (1 - d) \times L\} \times P$$

where,

fi: Fuel consumption ratio of "i" means of transport such as bus and truck. (0.38 ℓ/km)

F : Fuel consumption ratio of the railway (3.36 ℓ/km)

ℓi: Kilometers of "i" means of transport

ℓℓ: Train kilometers in the case of without project

L : Train kilometers in the case of with project

d : Improvement ratio

- Track improvement plan A: 6%
- Track improvement plan B: 5%
- Track improvement plan C: 4%

P : Economic cost of diesel oil is 1.67 ks/ℓ
(see the report on the LTMP, Table 10.2.1)

2) Labour cost reduction

In this study, the crews of trains, buses and trucks, as well as shunting staff, are considered. The other personnel whose wages and salaries are counted as operating costs will not change even though the improvement investment is done.

The number of drivers and railway guards was calculated in proportion to train kilometers per year. In the case of with project, the efficiency ratio was multiplied after the implementation of the investment.

Efficiency Ratio

1993/94 - 95/96 : 0.845
1996/97 - 2016/17: 0.694

As for the other means of transport, the number of crew members per vehicle was decided as follows.

Bus : Driver 1 + Conductor 2
Truck: Driver 1 + Assistant 1

Furthermore, the coefficient (1.2) was multiplied with these figures. This coefficient was introduced from the actual number of crew members and vehicles.

(6) Decremental investment in other means of transport

As mentioned in the report on the LTMP, some of the transport demand for buses and trucks will divert to the railway after the implementation of the improvement. Therefore, the railway improvement will save on new investment for buses and trucks which would have to transport the diverted demand in the case of without project.

The number of buses and trucks was calculated as being directly proportional to passenger-kilometers and ton-kilometers, respectively, and further they were multiplied by the coefficient of 1.7, in consideration of the difference between the actual number registered and in use.

The results are unit prices in terms of economic cost as listed below.

Bus : 3,400 thousand pass.-km/vehicle/year
Truck: 150 thousand ton-km/vehicle/year

Bus : 200 Ks (in thousands)
Truck: 146 (in thousands)
(For further details, refer to LTMP, Appendix 10.3 (2))

(7) Decrease in traffic accidents

The benefits from the decrease in traffic accidents are expected to be the same as those of the study on the LTMP.

The frequency of traffic accidents is now 6.9 accidents per one million train kilometers per year. On the other hand, the improvement ratio was estimated at 35 percent at the end of phase 1 and 75 percent at the end of phase 2.

The restoration cost was decided to be 90 Kyat per one accident (in thousands of Kyats).

9-3-3 Results

(1) Benefit composition

Table 9.3.1 shows the compositions of the benefits. The figures in this table are expressed at present values discounted at a rate of 10 percent.

Table 9.3.1 Benefit Composition

(Million Ks, %)

Particulars	Alternative 1	2	3	4	5	6
1. Decremental investment in rolling stock 1/	-	-	-	-	-	-
2. Timesaving	104(20)	104(20)	104(21)	104(21)	104(22)	104(22)
3. Maintenance cost reduction 2/	138(27)	137(27)	133(26)	132(27)	119(25)	118(25)
4. Operating cost reduction 2/	179(34)	179(35)	170(34)	170(34)	162(33)	162(34)
5. Decremental investment in other means of transport	86(17)	86(17)	86(17)	86(17)	86(18)	86(18)
6. Decrease in traffic accidents	10(2)	6(1)	10(2)	6(1)	10(2)	6(1)
Total	517(100)	512(100)	503(100)	498(100)	481(100)	476(100)

Note: 1/ The benefit which will be caused by the efficiency of rolling stock is hidden due to the difference of the total amount of transport demand between with and without project.
2/ Benefits not only for railway but also for other means of transport are included.

Source: Study Team

As shown in this table, the benefit composition for each alternative is almost the same. The biggest benefit is the operating cost reduction, with maintenance cost reduction coming next.

As an example, the following figure shows the composition of alternative-1.

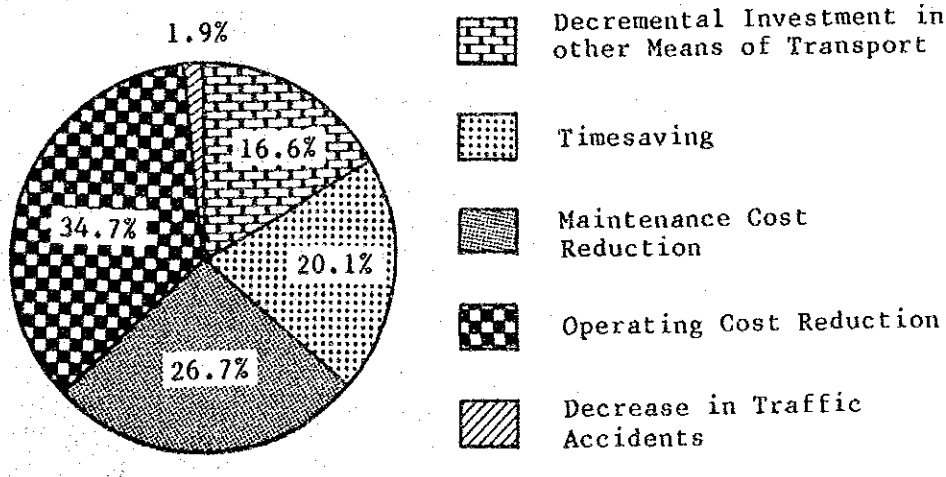


Fig. 9.3.1 Benefits (Alternative-1)

Source: Study Team

(2) EIRR and NPV

The EIRR and NPV of the six alternatives are listed in Table 9.3.2.

Table 9.3.2 EIRR & NPV

	EIRR	NPV 1/
	(%)	(Thousand Ks)
Alternative-1	9.5	-28,348
2	9.2	-45,659
3	9.7	-16,240
4	9.3	-33,551
5	10.7	29,103
6	10.3	11,791

Note: 1/ discounted at a 10 percent annual rate

Source: Study Team

As this table shows, alternative-5 has the highest EIRR and NPV, with alternatives-6 and 3 coming next. It is said that the EIRR guideline ranges from eight to twelve percent in developing countries. All these six alternatives are judged as feasible according to this criterion.

Incidentally, the calculation of NPVs for a varying discount rate of six to twelve percent was done. The results are shown in Table 9.3.3 and Fig. 9.3.2. As this table shows, the relations among these alternatives do not change even if the discount rate fluctuates.

Table 9.3.3 NPV (Economic)

(Million Kyats)

Discount rate	Alternative					
	- 1	- 2	- 3	- 4	- 5	-6
6 %	314	290	318	294	352	328
8	100	80	109	89	151	131
10	-28	-46	-16	-34	29	12
12	-105	-121	-92	-107	-45	-60

Source: Study Team

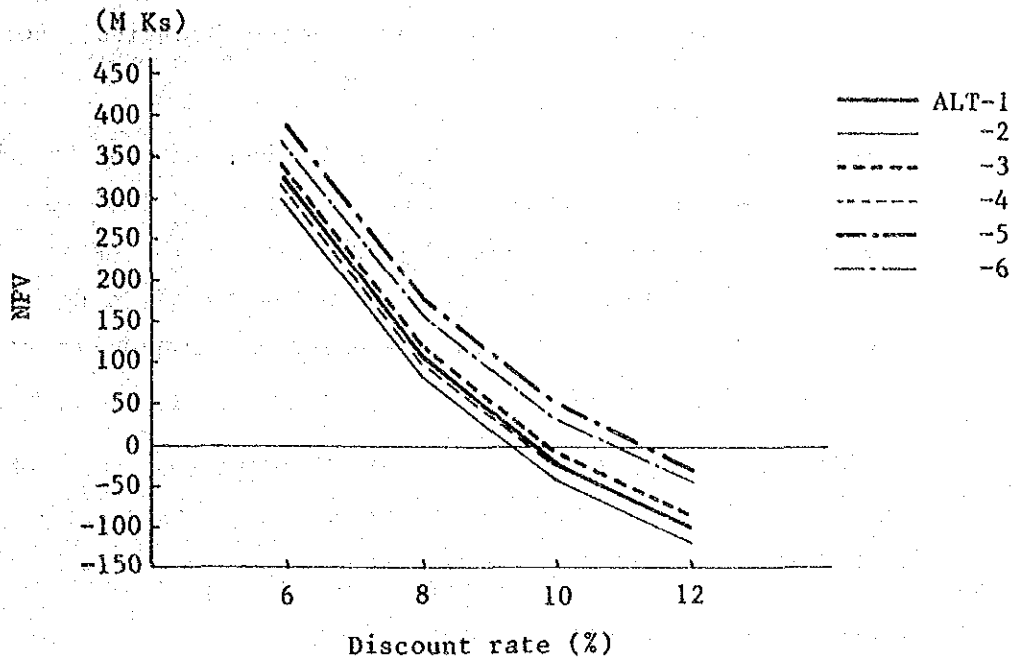


Fig. 9.3.2 NPV

Source: Study Team

(3) Other benefits

1) Contribution to industrial development

In the central area of Burma, there are three means of transport, rail, road, and inland waterways. The survey on the transport demand of goods revealed that the inland waterways did not compete with the railway, since they transport specific goods such as cement and oil over long distances. As for the railway and road transport, they compete for certain goods and do not compete for others. The typical goods of the latter category are forest products and minerals, which are usually hauled for long distances. According to our field survey, it is difficult to increase the production volume of forest products and minerals because of the shortage in locomotives and wagons.

Therefore, after the implementation of the railway improvement project, the transport capacity of the railway will increase and it will be possible for these industrial sectors to produce more.

In this study, the effect of industrial development was calculated. However, the calculations of the aforementioned IRR and NPV did not

include this benefit, because the reliability of its results are relatively low as compared with the other benefits, owing to the following assumptions.

- The categories of goods that will be induced by the railway improvement project are forest products and base metals & ores, according to the classification of goods in the BRC.
- Value-added ratios, which are computed by dividing net value by gross value, take into consideration the input-output tables of Thailand and Indonesia.

Incidentally, the EIRR result of 16.4 percent was obtained for alternative-5 when this benefit was taken into consideration, exceeding by 5.7 percent the EIRR for the case when it was omitted.

2) Improvement of passenger comfort

Changing to long-rails, which is the major improvement of the track facilities, will result in an increase in passenger comfort. However, the benefit was not considered in the calculations of the EIRR and NPV due to the difficulty of estimating its value.

(4) Sensitivity test

As mentioned before, the improvement project is feasible from a national economic point of view. It is necessary, however, to know how variations in some of the key assumptions, such as the investment cost and the amount of transport demand, could affect the results of the EIRR calculation.

The following tests were carried out.

Test 1 Increase of 10 percent in the initial investment costs
Test 2 Increase of 20 percent in the initial investment costs
Test 3 Decrease of 10 percent in the transport demand
Test 4 Decrease of 20 percent in the transport demand

In this study, sensitivity tests were conducted on alternatives 2 and 5. The following table shows the results of the tests.

Table 9.3.4 Sensitivity Test (Economic)

(%)

	Alternative-2	Alternative-5
Base case	9.2	10.7
Test 1	8.3	9.7
Test 2	7.5	8.8
Test 3	8.4	9.8
Test 4	7.5	8.8

Source: Study Team

The test reveals that the sensitivity to changes in the investment costs and transport demand are almost the same.

All of the six alternatives are feasible when the investment costs increase 10 percent or the transport demand decreases 10 percent. However, if there are serious changes (20%), alternative-5 will still be feasible while alternative-2 will not be.

In this test, the following assumptions should be noted:

- In tests 1 and 2, it was assumed that the maintenance costs didn't change and initial investment costs increased.
- In tests 3 and 4, the amount of transport demand in without project was assumed to decrease at the same rate as that of with project.

9-4 Financial Analysis

The major premises of the financial analysis were almost the same as those of the aforementioned economic analysis, except the concept of project cost was used instead of economic cost.

The existing financial position was reflected in the financial analysis.

9-4-1 Existing Financial Status

The annual profit and loss statement and balance sheet are shown in Table 9.4.1 and 9.4.2 respectively.

According to these tables, total earnings has increased by 7.5 percent per annum from 1976/77 to 1984/85. However, interest charges and depreciation have increased rapidly, while the annual rise in working expenses was only 3.5 percent in the same period. As a result, it should

be said that the financial position of the BRC cannot afford to be burdened with excess investment.

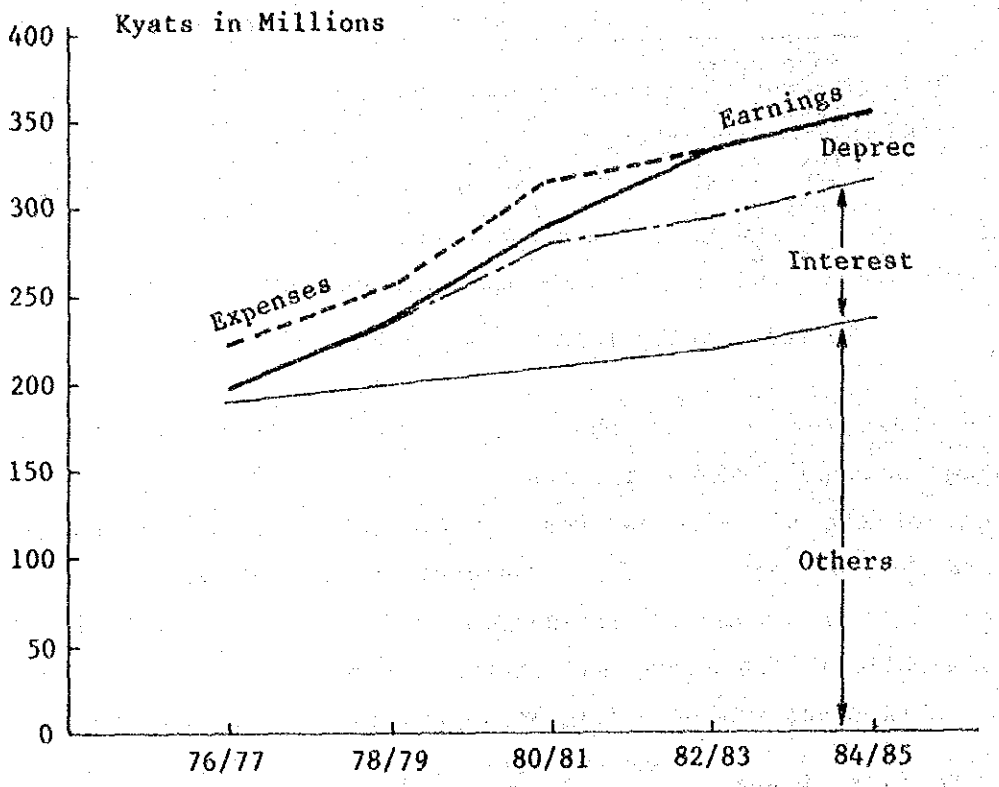


Fig. 9.4.1 Changes in Earnings and Expenses

Table 9.4.1 Consecutive Profit and Loss Statement

	1976/77	1978/79	1980/81	1982/83	1984/85
Earnings	199.2	235.8	291.4	333.5	356.0
Expenses	195.4	209.0	233.2	240.9	266.1
Working expenses	171.5	188.8	197.3	202.0	226.2
Depreciation	23.9	20.2	35.9	38.9	39.9
Other charges	19.5	46.9	83.3	92.4	97.8
Interest	9.0	34.1	68.4	75.4	79.9
Turnover tax	10.5	12.8	14.9	17.0	17.9
Profit on foreign exchange	-9.2				8.1
Profit	-24.9	-20.1	-25.1	0.2	0.2

Source: BRC

Table 9.4.2 Consecutive Balance Sheet

	1976/77	1978/79	1980/81	1982/83	1984/85
Total assets	1,047.2	1,672.0	1,894.7	2,154.3	2,260.7
Fixed assets	610.9	777.5	1,169.6	1,276.3	1,326.0
Current assets	436.3	894.5	725.1	878.0	934.7
Liability and equities	1,047.2	1,672.0	1,894.7	2,154.3	2,260.7
Total liabilities	360.9	975.1	1,248.6	1,508.0	1,617.0
Current liabilities	86.8	197.4	100.4	161.9	152.2
Deferred liabilities	274.1	777.7	1,148.2	1,346.1	1,464.8
Net worth	686.3	696.9	646.1	646.3	643.7

Source: BRC

9-4-2 Profitability

(1) Cash flow estimation

1) Earnings

a) Coaching

Earnings from passengers are composed of pure passenger earnings and other passenger earnings such as parcel and luggage charges.

Pure passenger earnings were calculated by multiplying the number of passengers by O-D pairs by the average fare of each O-D pair.

The composition of passengers by class was estimated to be as follows.

	Upper class	*Ordinary class*
Express train	8.7%	91.3%
Local train	5.6%	94.4%

Passenger fares by O-D pairs were computed with the following figures.

(Ks/person)

RN	PEGU	NLB	TGO	PMA	TZI	MDY	
-	8.13	12.70	23.05	28.92	37.05	45.22	RN
	-	8.13	17.18	23.48	32.52	40.22	PEGU
		-	11.74	18.52	26.65	36.13	NLB
			-	9.48	18.52	28.00	TGO
				-	12.65	20.78	PMA
					-	12.65	TZI
						-	MDY

Fig. 9.4.2 Passenger Fare (Express)

Source: Study Team

(Ks/person)

RN	PEGU	NLB	TGO	PMA	TZI	MDY	
1.32	3.52	7.03	12.59	17.06	23.12	28.21	RN
	1.41	3.51	9.06	13.53	19.67	25.24	PEGU
		2.40	5.55	10.03	16.16	22.19	NLB
			2.55	4.47	10.61	16.63	TGO
				3.72	6.14	12.16	PMA
					1.79	6.02	TZI
						1.46	MDY

Fig. 9.4.3 Passenger Fare (Local)

Source: Study Team

Other passenger earnings are 22 percent as compared with pure passenger earnings.

b) Goods

Earnings from transporting goods were calculated based on the weighted mean of freight fare by O-D pairs and are shown in Fig. 9.4.4.

(Ks/ton)

RN	PEGU	NLB	TGO	PMA	TZI	MDY	
3.9	17.4	19.1	28.1	16.3	42.1	41.5	RN
	6.6	4.9	15.1	31.4	31.9	36.6	PEGU
		10.3	13.2	26.7	30.8	29.4	NLB
			3.9	9.8	29.5	32.9	TGO
				5.5	17.6	31.1	PMA
					7.7	19.8	TZI
						9.8	MDY

Fig. 9.4.4 Tariff on Goods

Source: Study Team

In the calculation of these figures, the composition of commodity types and distance between each major station block were considered.

c) Others

The percentage share of other earnings was calculated at seven percent as compared with the earnings from coaching and transporting goods.

2) Expenses

a) Administration cost

The administration cost of 13.8 million Kyats for the Mandalay Line was allocated in proportion to the track length.

b) Fuel cost

The fuel cost estimate was based on the official fuel price (2.5 Kyats per gallon).

c) Turn over tax

The turn over tax is eight percent of the pure passenger earnings.

(2) Results

1) Cash flow

In accordance with the estimates mentioned above, the cash flow was calculated as shown in Table 9.4.3. (Refer to the Short-term Improvement Project, Appendix 9-4 (1)).

Table 9.4.3 Estimated Cash Flow

(Million Ks)

	Alternative					
	1	2	3	4	5	6
(With Project)						
Earnings	5,670	5,670	5,670	5,670	5,670	5,670
Expenses						
Investment Cost	1,581	1,604	1,537	1,559	1,444	1,467
Administration Cost	253	253	253	253	253	253
Maintenance Cost	716	720	727	730	758	762
Operating Cost	1,374	1,374	1,383	1,383	1,391	1,391
Turnover Tax	287	287	287	287	287	287
Cash Flow	1,458	1,432	1,483	1,457	1,536	1,510
(Without Project)						
Earnings	4,547	4,547	4,547	4,547	4,547	4,547
Expenses						
Investment Cost	573	573	573	573	573	573
Administration Cost	253	253	253	253	253	253
Maintenance Cost	796	796	796	796	796	796
Operating Cost	1,143	1,143	1,143	1,143	1,143	1,143
Turnover Tax	230	230	230	230	230	230
Cash Flow	1,551	1,551	1,551	1,551	1,551	1,551
Net Cash Flow (With - Without)	- 94	- 120	- 68	- 94	- 16	- 42

Note: Discounted at a 3.5 percent annual rate

Source: Study Team

2) FIRR and NPV

The FIRR and NPV, which were calculated based on the aforementioned cash flow table, are shown in Table 9.4.4 below.

Table 9.4.4 FIRR & NPV

	FIRR	NPV 1/
	(%)	(Million Ks)
Alternative - 1	2.9	- 94
- 2	2.8	-120
- 3	3.1	- 68
- 4	2.9	- 94
- 5	3.4	- 16
- 6	3.2	- 42

Note: 1/ discounted at a 3.5 percent annual rate

Source: Study Team

The alternative no. 5 is the best one among these six alternatives, with alternatives 6 and 3 coming next. The order of priority among these six alternatives is exactly the same as that of the economic appraisal.

If it is assumed that the interest rates for foreign and domestic loans are 2.75 and 5 percent respectively, the average interest rate for the alternatives is computed approximately at 3.6 percent. Furthermore, according to the financial statement of the BRC, the interest charges against total assets is approximately 3.5 percent for 1984/85.

Compared with these criteria, alternative-5 is barely feasible from the view point of financial profitability. As for alternatives-3 and 6, it is hard to say that they are not-feasible because of future considerations concerning uncertain transport demand, investment cost and other factors. Alternatives 1, 2 and 4 are not feasible.

3) Sensitivity test

The following tests were carried out.

Test 1 Increase of 10 percent in the initial investment costs

Test 2 Increase of 20 percent in the initial investment costs

Test 3 Decrease of 10 percent in the transport demand

Test 4 Decrease of 20 percent in the transport demand

Sensitivity tests were done on alternatives-2 and 5 and were the same as those for the economic appraisal.

The results are shown in Table 9.4.5

Table 9.4.5 Sensitivity Test (Financial)

(%)

	Alternative-2	Alternative-5
Base Case	2.8	3.4
Test 1	2.3	2.9
Test 2	1.9	2.4
Test 3	2.2	2.9
Test 4	1.7	2.2

Source: Study Team

According to the results of the tests, the changes in investment costs and transport demand affect the results of the FIRR seriously. Alternative-5, which is the best among the alternatives, cannot remain in a feasible position even when the change is only 10 percent.

9-4-3 Stability

In an aim to analyze the financial stability of the Mandalay Line, its financial statements were projected prior to computing the DSCR.

(1) Initial balance sheet

1) Fixed assets

The fixed assets of the Mandalay Line were estimated at 489.9 million Kyats in 1986/87. Each of the fixed assets was allocated in proportion to the indices shown in Table 9.4.6.

Table 9.4.6 Allocation of Existing Assets

Particulars	(Indices)	Service -km	Trackage	Train-km	Pass.-km	Ton-km
	(Percentage for Mandalay line)	20%	28%	49%	40%	50%
Structural engineering works	EARTH WORK	o				
	TUNNELS	(not allocated)				
	BRIDGE WORK	o				
	FENCING	o				
	BALLAST		o			
	RAIL & FASTENING		o			
	SLEEPERS		o			
	OVERHEAD POWER LINES	o				
	UNDERGROUND CABLES	(not allocated)				
	SERVICE BUILDINGS	o				
	RESIDENCIAL BUILDINGS	o				
	STATION MACHINERY	o				
Equipment	PLANT (ENGINE)	(allocated 100%)				
	LOCO (EQUIPMENT)			o		
	CARRIAGE & WAGON				o	o
	ELECTRIC	o				
	STATION & OFFICE	o				
	FURNITURE					
	MOTORLORRIES STEAMER	o				
Rolling Stock	STEAM LOCOMOTIVES			o		
	DIESEL LOCOMOTIVES			o		
	RAILCARS			o		
	CARRIAGES				o	
	WAGONS					o

Source: Study Team

2) Current assets

The current assets are composed of cash, traffic receivables, advance payments, and inventories.

According to the financial statement of the BRC, the total amount of current assets except cash, the advance payment of government contributions and commodity taxes is approximately two times that of the earnings for the same year. Therefore, in this study, the total amount of current assets at the end of 1986/87 was set at 346.6 million Kyats, which is equivalent to two times that of the earnings of the Mandalay Line for 1987/88.

3) Liabilities and equities

To estimate the initial balance sheet of the Mandalay Line, it was assumed that the Mandalay Line Corporation had been established. In this situation, there are three ways of estimating the amount of the liabilities and equities of the Mandalay Line and they are as follows.

① | Total Assets | Equities | — Equities equivalent to the value of the total assets is transferred from total BRC as investment in kind.

② | Total Assets | Loan Raised Newly | — The new corporation raises loans equivalent to the amount of the total assets.

③ | Total Assets | Liabilities / Equities | — Liabilities and equities are set in the same structure as that of the total BRC.

In this study, the third method was adopted in order to reflect the existing financial position in the stability analysis.

The deferred liabilities of the BRC are composed mainly of foreign and MEB loans, the Union Government Consolidated Fund, an IDA loan (government), and advances from the government. These deferred liabilities of the Mandalay Line were allocated in proportion to the number of locomotives registered (39 percent), since most of these loans have been raised for purchasing new rolling stock, especially locomotives.

The current liabilities, half of which are the result of local purchases, were set at 40 percent of the amount of earnings for the same year, according to the financial statement of the BRC.

The government equity was allocated in proportion to the amount of fixed assets (approximately 40 percent).

4) Others

(a) Depreciation

Depreciation was calculated using the straight line method for each fixed asset category. Incidentally, the depreciation of short rails and wooden sleepers, which will be taken away as a result of the track improvement, was deducted from the total amount of the depreciation.

(b) Repayment of term loans

The repayment of term loans raised were estimated based on the terms of repayment of each contract.

(2) Funding scheme

The funding for the investments decided to use only term loans. Furthermore, the foreign and local currency portions were raised by foreign loans and M.E.B. term loans respectively.

M.E.B working capital loans are assumed to be available whenever a working capital shortfall is incurred. Working capital surpluses are to be allocated to the repayments of the M.E.B. working capital loans until the balance is zero, while the remainder is retained as cash.

The following table shows the terms of the loans.

Table 9.4.7 Terms of Loans

Particulars	Grace Period	Repayment Period	Instalment	Interest Rate
Foreign Loan	5 years	20 years	equal annual	2.75%
M.E.B				
Term Loan	5	5	- ditto -	5.0
Working Capital Loan	-	-	-	8.0

Source: M.E.B., Study Team

(3) Results

In this report, the results of alternative-5 are referred to. Because this alternative is the most profitable among the six alternatives as mentioned before. If alternative-5 is not stable, the other five alternatives are also not stable.

1) Projected profit and loss

Fig. 9.4.5 shows the summary of profit and loss on the Mandalay Line (Refer to the Short-Term Improvement Project, Appendix 9-4 (2))

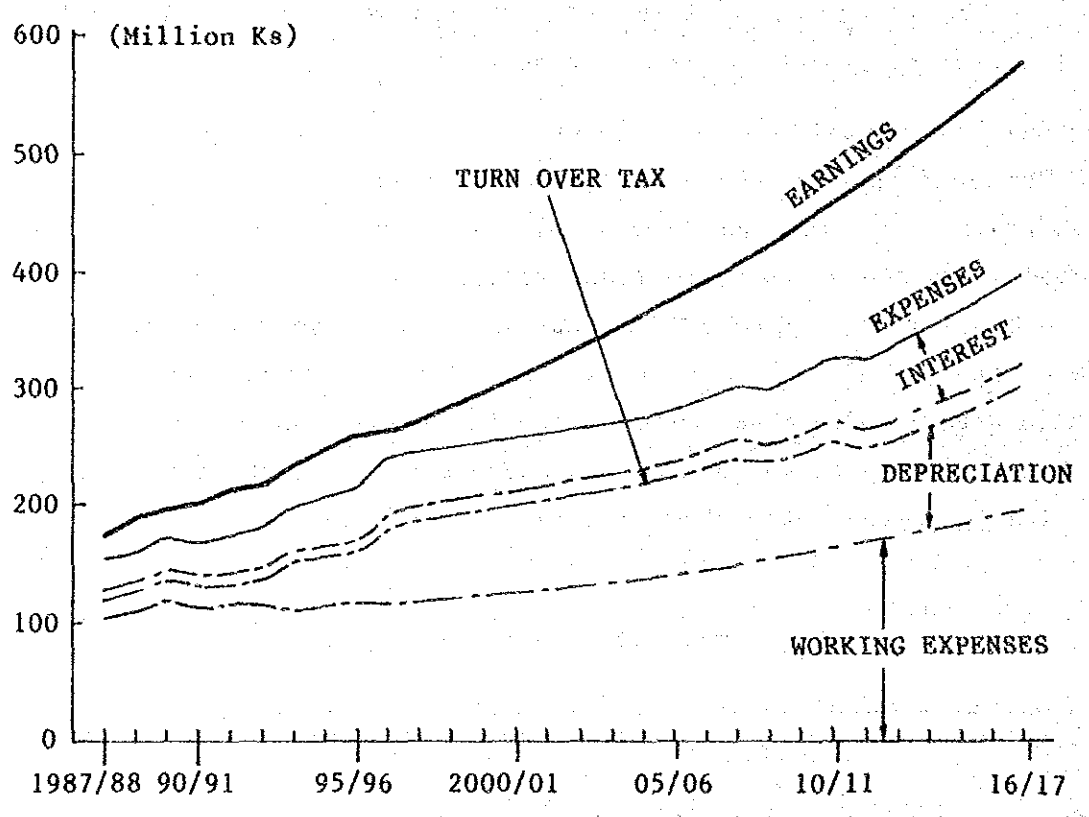


Fig. 9.4.5 Projected Profit and Loss

Source: Study Team

According to the figure, it is estimated that profits are relatively small against earnings from 1987/88 to 1995/96 due to increases in interest and depreciation. However, from 1996/97 profits will increase year by year, and in the final year of the calculation period, profit is estimated to be 30 percent of the total earnings.

2) Working capital shortfall

As shown in Table 9.4.6, the M.E.B working capital loan for the working capital shortfall will increase up until 1989/90. Owing to the increase in revenues, the balance of the working capital loan will decrease and the financial position improve year by year.

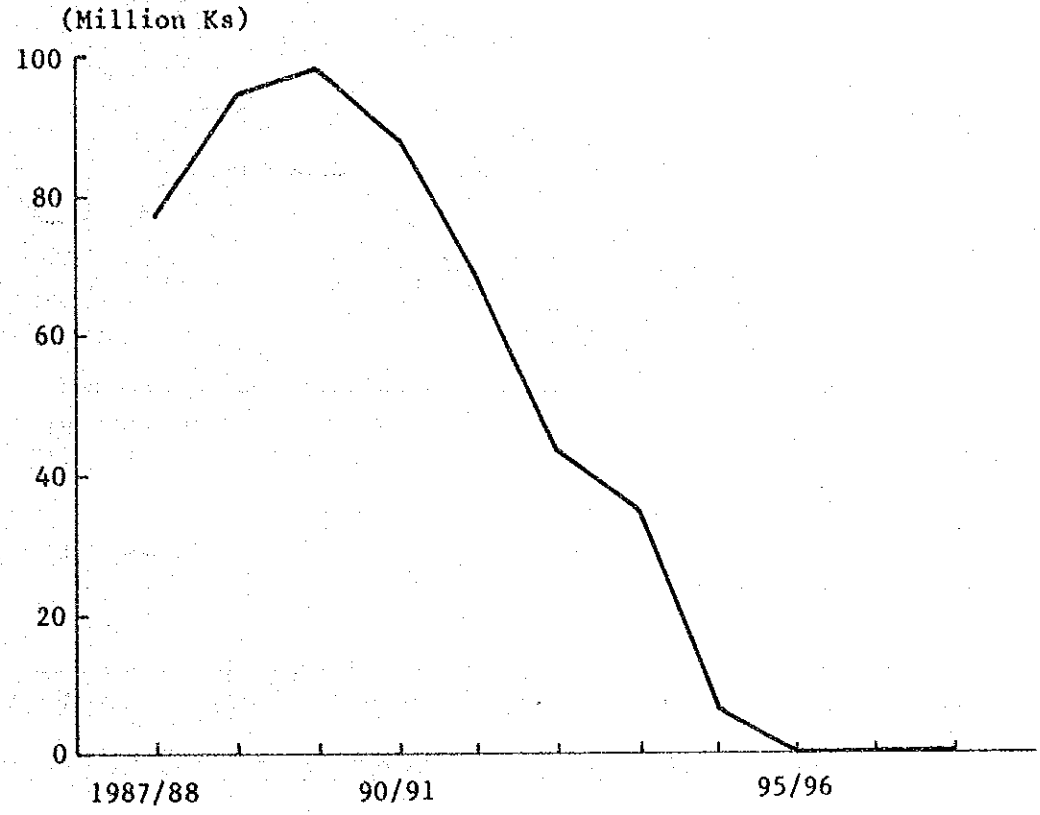


Fig. 9.4.6 Working Capital Loans Raised

Source: Study Team

3) Debt service cover ratio

Debt Service Cover Ratio (DSCR) indicates the financial stability of the Mandalay Line. Generally, it is said that the annual DSCR should exceed 1.0 and cumulative DSCR during this entire project period is desired to be around 2.0.

The results of the annual DSCR are below the affore-mentioned criteria up until 1992/93, and furthermore, the results decline from

1995/96 to 1999/2000. On the other hand, the cumulative DSCR is 1.21 and the figure is relatively low compared with the criterion mentioned above.

Therefore, the Mandalay Line, which is improved, was estimated as barely stable.

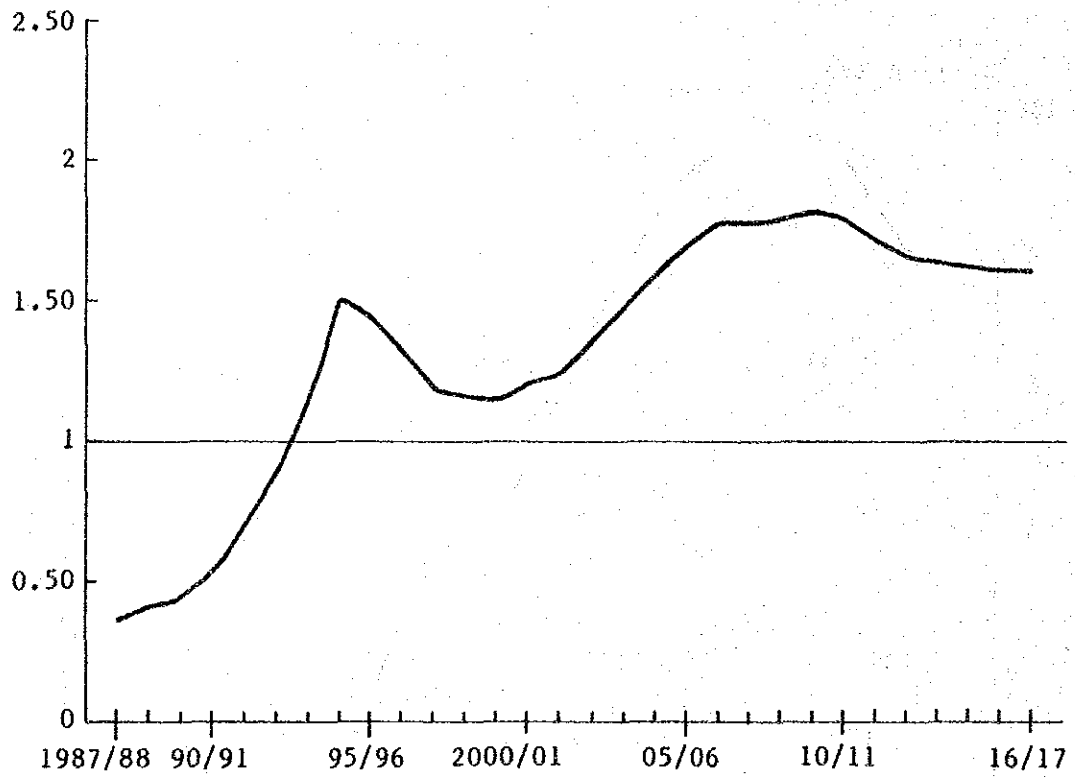


Fig. 9.4.7 Debt Service Cover Ratio

Source: Study Term

(4) Measures for financial improvement

As mentioned before, this improvement project is barely stable from a financial point of view. In this study, therefore, tests on two options were carried out for reference.

Option 1: Raising foreign loans for local currency (or harmonize the terms of the domestic loans with that of the foreign loans).

Option 2: Increasing the fare by 10 percent.

The results of the tests are shown in the following two figures, with the cumulative DSCR for options 1 and 2 computed at 1.35 and 1.6 respectively.

The measures, options 1 and 2, are effective for improving the financial position and stability of the improvement project.

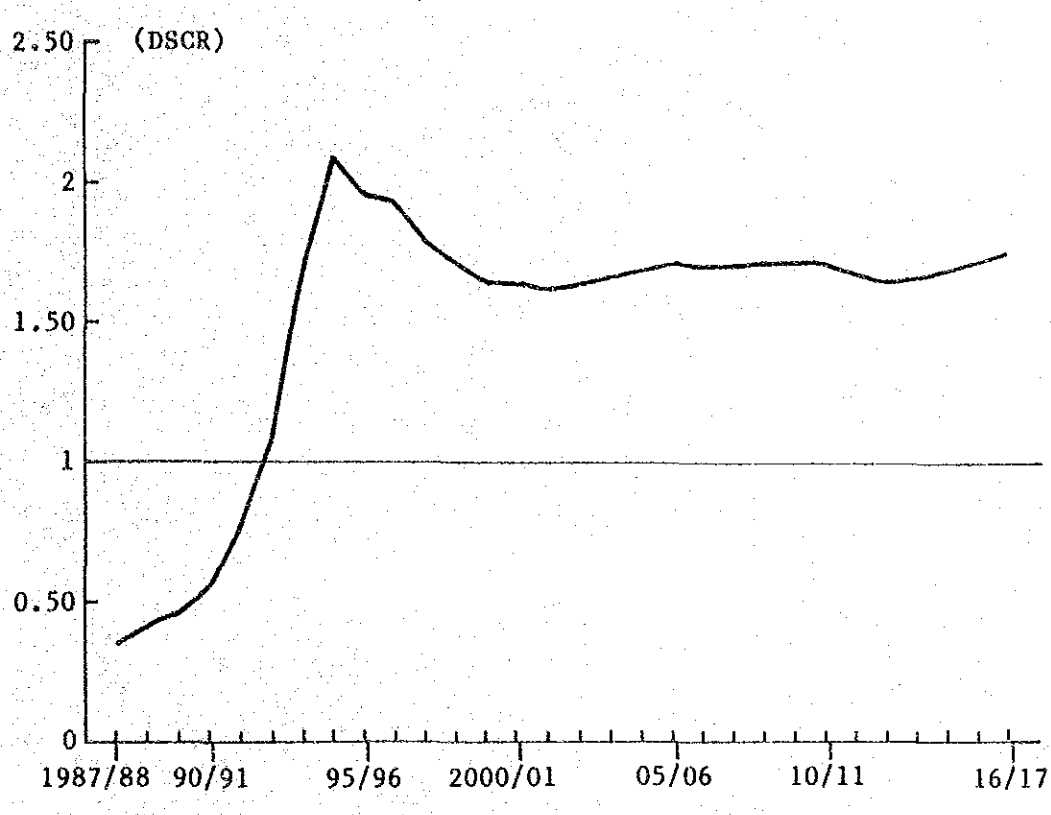


Fig. 9.4.8 DSCR (Option 1)

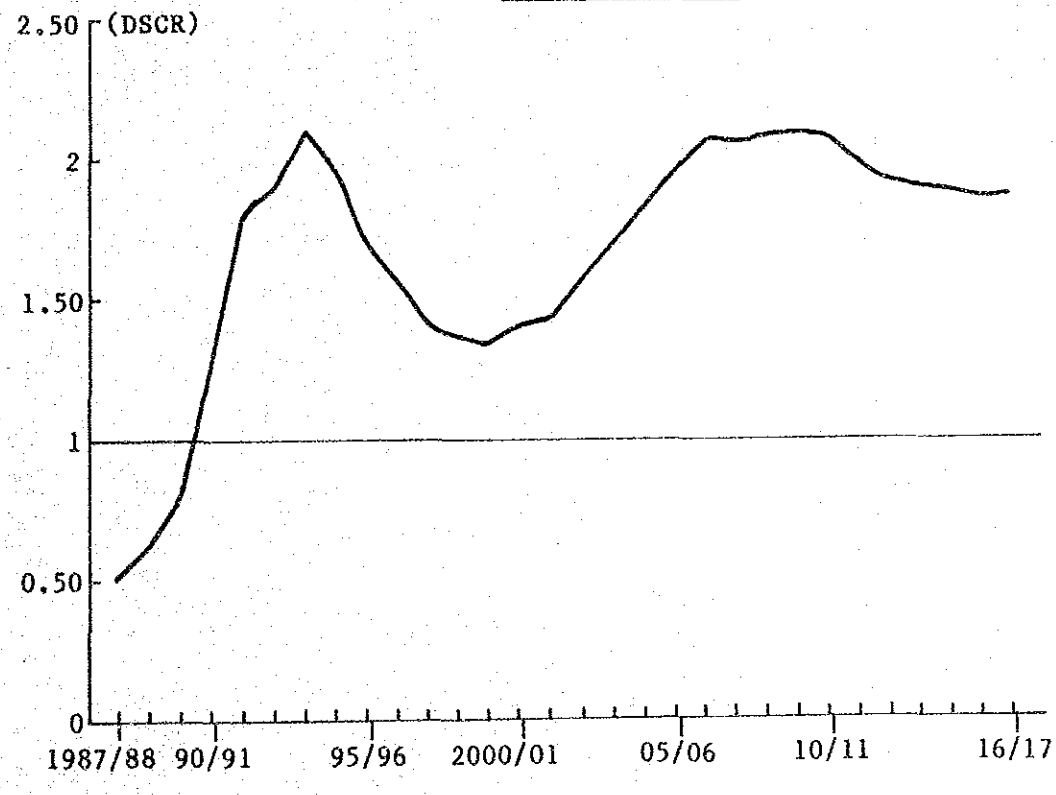


Fig. 9.4.9 DSCR (Option 2)

Source: Study Team

CHAPTER 10 OVERALL EVALUATION AND EXECUTION PLAN

CHAPTER 10 OVERALL EVALUATION AND EXECUTION PLAN

10-1 Overall Evaluation

In this feasibility study, economic and financial appraisal was carried out as mentioned in Chapter 9. The results are summarised as follows:

from a national economic point of view -

The improvement project is feasible even though any alternative among the six is adopted. Especially, alternative 5 is estimated as the best and is followed by alternative 6. Furthermore, according to the sensitivity tests, the alternatives 5 and 6 will be durable against the changes of investment costs and transport demand.

from a financial point of view -

According to the financial study, the project barely meets feasibility requirements in alternative 5, followed by alternative 6. Sensitivity tests shows that the results of FIRR will easily fail to keep the position even when the slight changes in investment costs and transport demand are made. On the other hand the study revealed that the stability will not reach an adequate level, if any measure for improving the financial position will not be taken.

Economic and financial analyses were made for six alternatives with a combination of three track plans, one telecommunication plan and two signalling plans.

As for the three track plans, the goal of 10-hour scheduled time between Rangoon and Mandalay will be attained by any of the three, and there are little differences among them in the contribution to the four fundamental goals of the Project, that is the increase or improvement of train speed, operational punctuality, safety and track capacity. The maintenance cost of the track will differ considerably; by 32 and 12 percent increase, as Plan C is compared with Plan B, and Plan B with Plan A, respectively. However, these differences are not so big compared with the cost of investment for the track; less than a half percent of it. The amount of the investment cost will increase by 11 percent and 28 percent, as Plan A is compared with Plan B, and Plan B with Plan C, respectively. This factor, of course, is incorporated in the economical and financial analyses.

Other factors, such as the decrease in the amount of rolling stock damage and reduced fuel consumption for train operation, which will differ to some extent among the three, are also included in the analyses. High grade of service, or comfortable ride, is expected by the track improvement, however, the difference in this factor is not fundamental to affect the ranking made by the analyses. Another factor, relative difficulty among the alternatives of the construction work resulting from construction capacity, should also be taken into consideration.

So, Plan C is recommended to be adopted in the execution plan.

Concerning the telecommunication, only Plan B is included in the six alternatives, the reason of which is explained in Chapter 5.

With regard to signalling, there is a characteristic difference in signalling and operational system between two alternatives. Plan A adopts cab signal system, while Plan B uses conventional wayside signal system, though both systems are based on the electronic token system.

Differences between the cab signal and wayside signal systems, which are not considered in the economic and financial analyses, are summarized as follows:

- The cab signal system will drastically change the present operational practice, requiring two different rules and regulations on train operation and signalling. Therefore, drivers and other related personnel should be trained for the new cab system.
- The cab signal system cannot become operational until the completion of the installation work on both the on-board and ground facilities over whole or considerably great part of the line.
- In case of the wayside signal system, each section can become operational one after another with the progress of the construction works.
- Failure of the on-board equipment will cause traffic disturbance to a greater extent than that of wayside signal.
- Wayside signal may be more vulnerable to theft or vandalism.

After comprehensive consideration of these factors as well as the result of the economic and financial analyses, Plan B is recommended to be adopted in the execution plan.

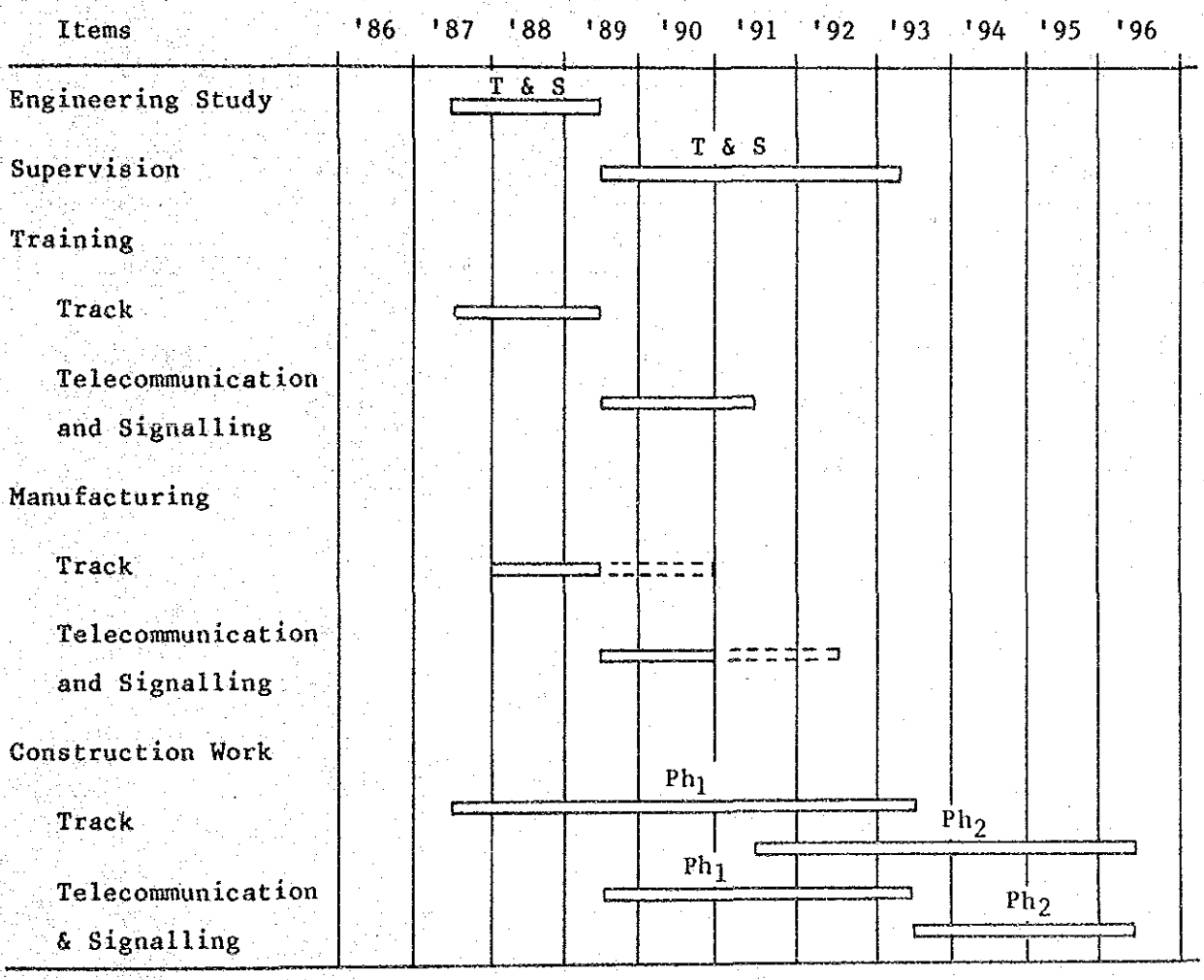
In conclusion, the alternative 6 is recommended to be adopted as the execution plan, composed of Plan C of track, Plan B of telecommunication and Plan B of signalling.

10-2 Execution Plan

The project schedule is planned for completion within nine years in two separate phases, from Rangoon to Toungoo and from Toungoo to Mandalay, as mentioned in Chapter 4.

The project schedule and project cost are shown in Table 11.2.1. and Table 11.2.2, respectively.

Table 11.2.1 Project Schedule



Note: Ph_1 and Ph_2 indicate phases of the short-term improvement project.
T & S mean telecommunication and signalling.

Table 11.2.2 Project Cost

(Thousand Kyats)

Item	Foreign	Local	Total
Track	281,400	205,900	487,300
Telecommunication	226,400	111,000	337,400
Signalling	197,400	88,000	285,400
Sub total	705,200	404,900	1,110,100
Engineering service	44,500	600	45,100
Contingency (10%)	70,500	40,500	111,000
Total	820,200	446,000	1,266,200

CHAPTER 11 CONCLUSION AND RECOMMENDATIONS

CHAPTER 11 CONCLUSION AND RECOMMENDATIONS

11.1 Conclusion

The study on establishing a short-term improvement project for track, telecommunication and signalling on the Mandalay line, whose selection is based on the priority given in the longOterm modernization program, has been carried out with the aim of increase in train speeds, improvement of punctuality and safety of train operation as well as in track capacity.

Inter-zonal railway transport demand on the Mandalay Line was forecast for both "With" and "Without the Project" cases, based on the scio-economic situations and transport conditions, at present and in future, of the areas served by the Mandalay Line.

This demand forecast was used as the basis for a technical study to formulate the transport and rolling stock plan, and then facility improvement plans on track, telecommunication and signalling.

The investment plan based on the technical study was then made as the basis for the economic and financial analyses. These show that the project would considerably contribute to the economic development of Burma, though it would not be surely expected to fetch a financial profit to BRC. FIRR of around three percent is, in general, not discouraging as compared with other projects for the infrastructure improvement in the developing countries.

This project should be promoted from the viewpoint that these facility improvements are essential for the railway to restore its inherent advantages and to play an important role as the main transport means in Burma.

The implementation of the project is, therefore, highly recommended.

11.2 Recommendation

Some recommendations are made in the following, to contribute to smooth implementation of this project and satisfactory operation thereafter.

(1) Organization for the project

It is recommended to set up a project team which is responsible for promoting of the project from the planning to the execution, because of would be a necessity to control the development of the project by the integrated management.

(2) Rolling stock

Rolling stock modernization is being carried out for the improvement of railway transport. This project on ground facility improvement will not bring about full effects without satisfactory progress of the rolling stock plan. So it would be better to revise the present rolling stock plan coordinating it with the ground facility improvement.

Also, further improvement in rolling stock availability is advised along with its modernization.

(3) Training

It is essential that the employees have specific knowledge, skill and experience required to perform their tasks effectively with positive motivation. The training plan, outlined in this report, covers only the minimum requirements in objective, duration and number of trainees for acquisition of advanced technology and new operation and maintenance system. It is, therefore, recommended that the training plan be continued on an expanded and long-term basis under a continuing collaboration of experts abroad after the commissioning of the project.

(4) Safety

1) Train accidents are expected to become fewer and fewer as the facility improvement progresses step by step; yet, some accidents caused by human error might still occur. Further cultivation of discipline of employees concerned is desired to eliminate such human errors.

2) Countermeasures necessary to ensure safety along with increases in train speed are to be fully taken, especially measures for preventing the free access of people to station yards and tracks.