5.8 ACCESS AND STATION FRONT PLAZA

(1) Access plan

As for detail, refer to 4.7.

As an example, Fig. 5.24 shows desirable location of access road and station front plaza of each station in DKI Jakarta.

(2) Station front plaza

As for detail and equation, refer to 4.7.

Using the equation, the approximate area required for each station front plaza of the Tangerang Line is calculated as shown in Table 5.10. Fig. 5.25 shows the layout of Grogol Station front plaza as an example.

Table 5.10 Number of Passengers Getting On and Off and Required Area of Station Front Plaza along Tangerang Line in 2005

	Number of passengers getting on and off (1000 persons/day)	Area of Station front plaza (1000 m^2)
Duri	150	7.7
Grogol	170	8.3
Pesing	100	6.8
New Station	80	5.6
Bojongindah	70	5.0
Rawabuaya	60	4.4
Kalideres	50	3.8
Polis	20	2.0
Batuceper	20	2.0
New Station	20	2.0
Tangerang	40	3.2

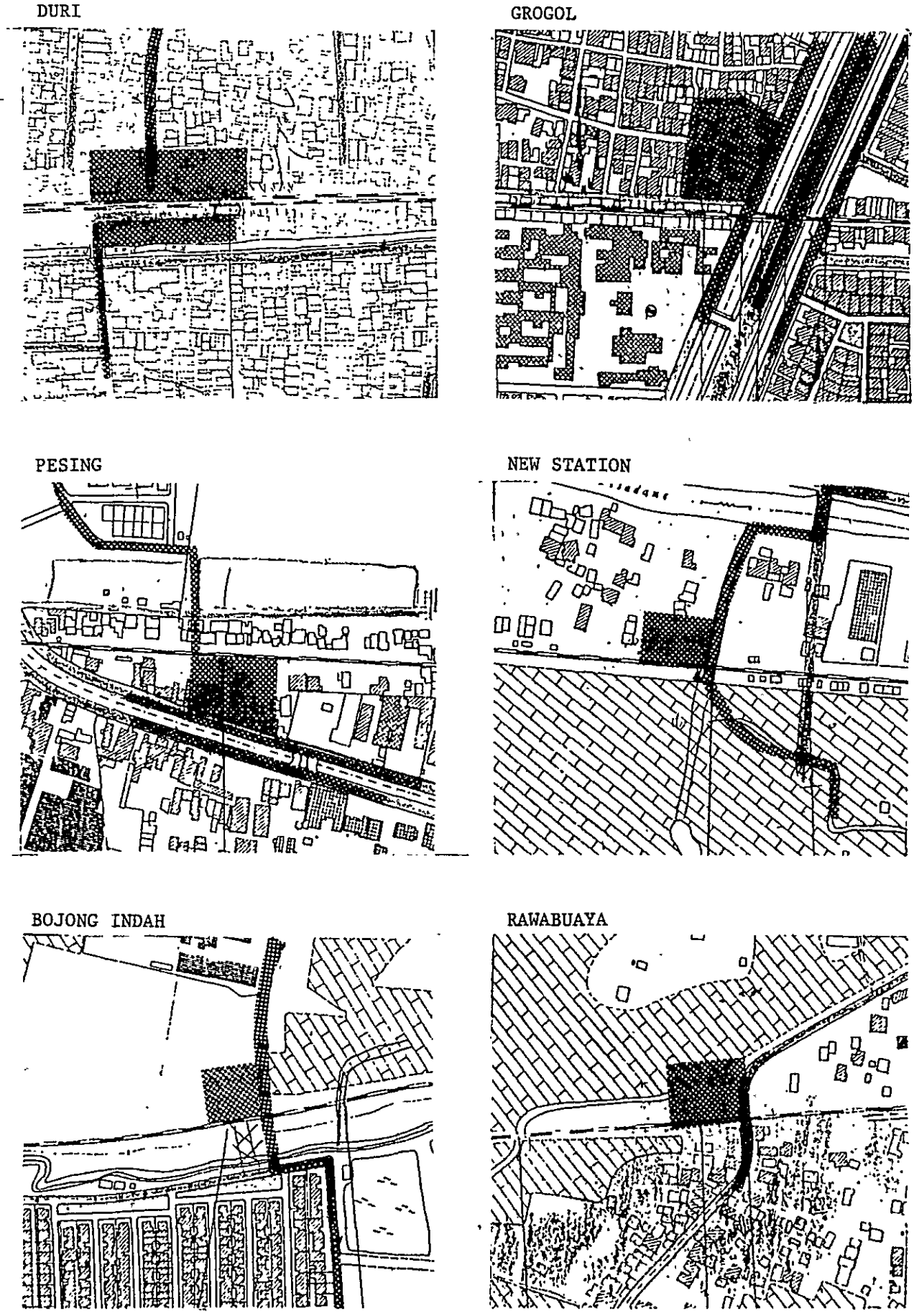

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Fig. 5.24 Desirable Location of Access Road and Station Front Plaza

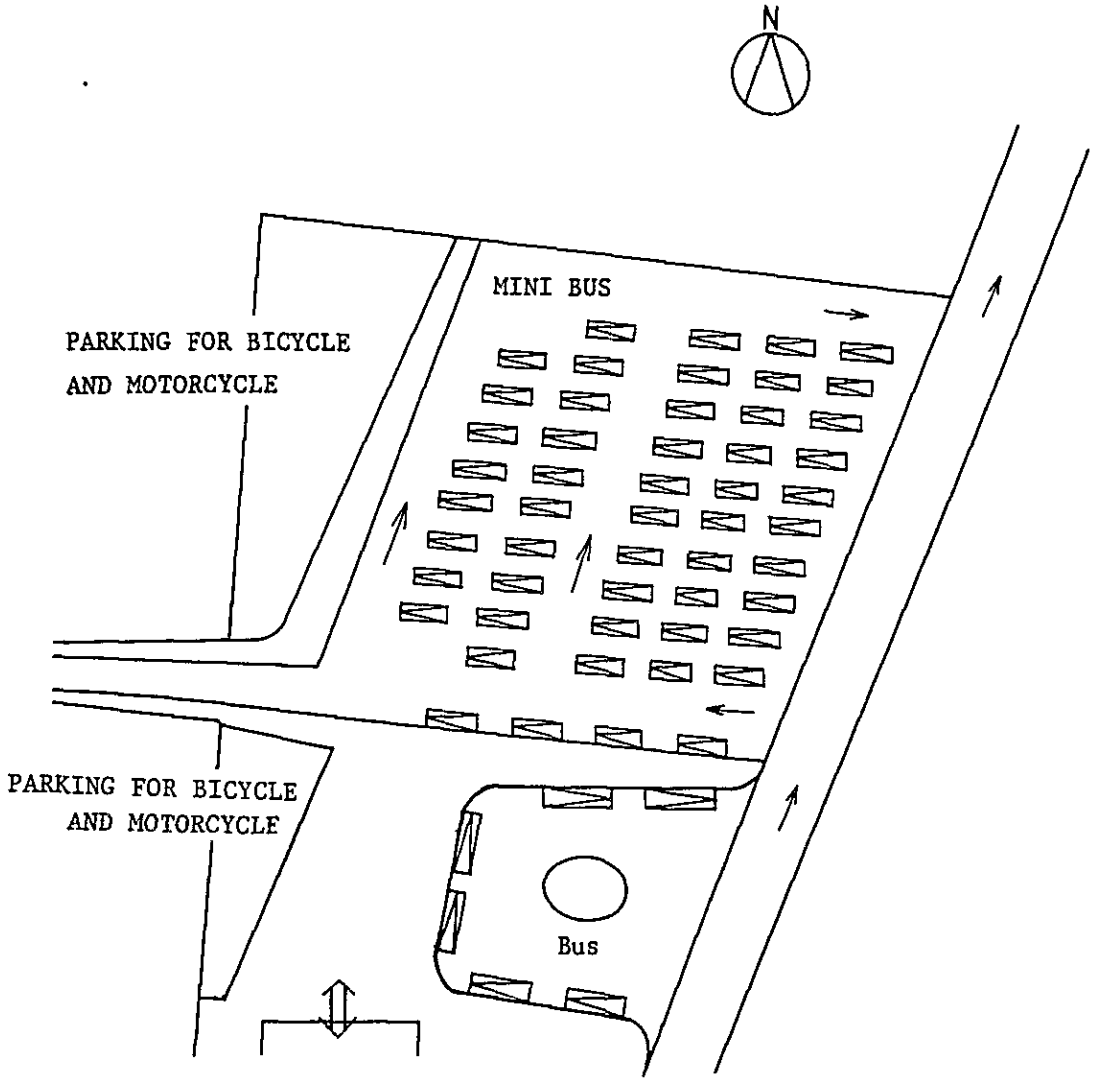


Fig. 5.25 Layout of Station Front Plaza at Grogol Station S=1:1000

5.9 IMPACT DUE TO IMPROVEMENT OF TANGERANG LINE

(1) Positive impact

The service level of the railway will increase, so part of the road traffic is transferred to rail. Consequently noise and pollution decrease and road congestion will be eased.

The benefit of cost-savings in time and operation can be calculated, Moreover, the cost of road maintenance will decrease due to the reduction in traffic volume.

Approximately 15800 man-year employment will be created by the construction work.

The placing of station front plazas will provide a better train-bus connection.

As accessibility to the surrounding area of a station increases, the area near the station will be developed as a commercial area and the area within approximately one km radius will be developed as a residential and industrial area. It will be effective in easing the over crowded areas of Jakarta.

(2) Negative impact

Noise and vibration along the railway will increase due to the increase in average train speed and reduction in headway. Usually the noise level of a train is between 75 and 85 dB. In some places, for example, near a hospital, a protection wall will be necessary in the future. Noise level will be reduced by about 7 dB with a protection wall of 1.9 m height.

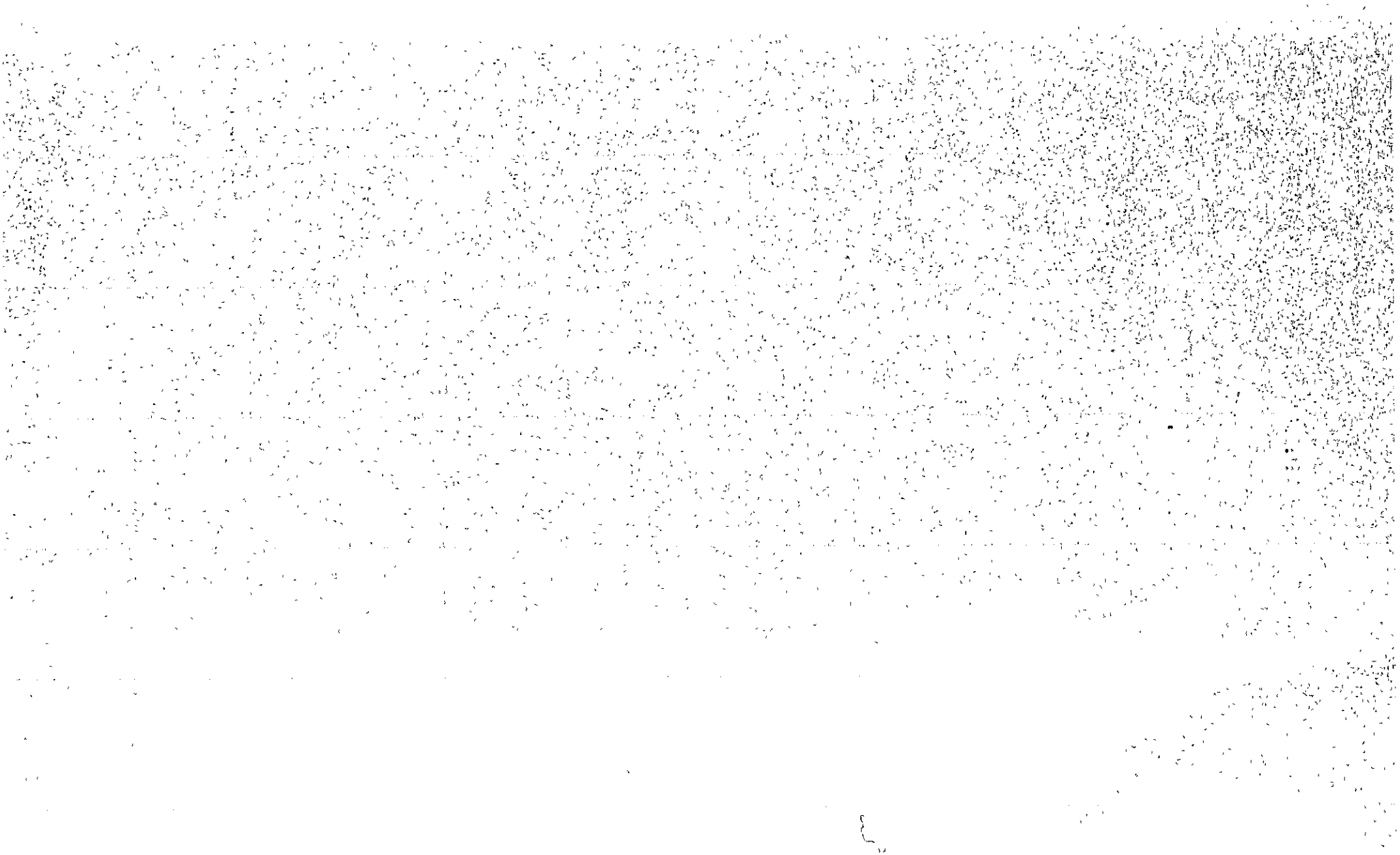
Interference time for road traffic at road level crossing over the Tangerang Line will increase in future. There is a possibility that crossing accidents will increase so that the improvement of crossing facilities is important. All sections of the line are at ground level so the line will separate the community.

At present the railway is used as a pedestrian way and as the axis for community. At sections where there is no access except the railway new access roads will be necessary.

Noise and dust during construction is temporary but it should be minimized by careful work methods.

CHAPTER 6

INVESTMENT SCALE



CHAPTER 6 INVESTMENT SCALE

6.1 PREMISES FOR CONSTRUCTION COST CALCULATION

(1) Construction cost

Construction costs have been calculated for each kind of construction works taking into consideration labor costs, material costs, machinery costs and other related expenses.

a) Construction costs are calculated based on the assumption of international tenders.

b) Unit prices for construction works do not include any element for escalation after September, 1983.

c) Imported materials and machinery were assumed to be non-taxable.

d) Construction costs were calculated separately for foreign and local currencies.

(2) Foreign currency and local currency

Foreign currency and local currency were calculated based on the following stipulations.

(a) Foreign currency

a) Imported materials and machinery

b) Foreign currency portion within materials and machinery supplied in Indonesia, such as imported machinery depreciation

c) Foreign labor costs

d) Foreign currency portion within construction services provided by foreign contractors

(b) Local currency

a) Materials and machinery supplied in Indonesia, excluding those which are calculated in foreign currency

b) Utilities and construction services provided by Indonesians

c) Indonesian labor costs and other related expenses

d) Taxes

(3) Unit price

Labor, material and machinery unit prices were established taking into consideration data from both Indonesia and Japan.

a) The major labor unit prices in Indonesia are shown in Table 6.1.

b) The major material unit prices in Indonesia are shown in Table 6.2.

(4) Land acquisition

Land acquisition costs and house compensation expenses are based on data from DKI Jakarta.

(5) Investigatory design and administration expenses

Investigatory design and administration expenses are estimated to be 12% of total construction costs.

Table 6.1 Labor Unit Prices September 1983

September 1983

Type of Labor	Unit	Wage (Rp.)	
		Min.	Max.
Unskilled worker	Man/Day	1,500	2,000
Skilled worker	Man/Day	2,500	3,000
Electrician	Man/Day	3,000	3,500
Carpenter	Man/Day	3,500	4,000
Superintendent	Man/Day	4,000	4,500
Mason	Man/Day	3,000	3,500
Steel Worker	Man/Day	3,000	3,500

1 day = 7 hours

Source: Daftar Harga Satuan Bangunan DKI JAKARTA.

(6) Contingency

Contingency for civil works is estimated to be 15% of the construction costs, land acquisition costs, house compensation expenses, investigatory design and administration expenses. The contingency for electric installation works is estimated to be 5% of the construction costs, investigatory design and administration expenses.

(7) Exchange rate

Foreign exchange rate is assumed to be

Rp. 980 = US$1.00 = Yen 245 .

Table 6.2 Material Costs for Construction Works

September 1983

Principal materials	Unit	Material Cost Local supply	Remarks
1. Sand	Rp./m3	11,500	For concrete on site in JKT
2. Gravel	Rp./m3	15,000	Crushing stone (20mm) for concrete on site in JKT
3. Cement	Rp./bag	3,000	In bag (40kg/bag), on site in JKT
4. Ready mixed concrete	Rp./m3	59,000	028-240 kg/cm2 on site in JKT
5. Timber (hard wood)	Rp./m3	195,000	Kamper timber, on site JKT
Timber (soft wood)	Rp./ton	97,500	Borneo timber, on site JKT
6. Steel	Rp./ton	H.I. 560,000 D-bar 350,000 R-bar 380,000	
7. Gasoline	Rp./lit	320	
8. Heavy oil	Rp./lit	125	
9. Light heavy oil	Rp./lit	145	

Source: Market Price in Jakarta

6.2 ESTIMATED COST

The estimated costs of each project are shown in Tables 6.3 - 6.9.

Table 6.3 Estimatee Construction Cost of Manggarai Station (Alternative G-14)

(Unit: Million Rp)

Work classificaction	Unit	Quantity	Investment Sum		
			Foreign	Local	Total
1. Civil structure of track construction					
Roadbed	m^3	21,500	780	1,510	2,290
Bridge	m	870	2,720	4,030	6,750
Platform	m^2	7,600	1,260	1,410	2,670
Track	m	8,400	2,830	1,110	3,940
Temporary track	set	1	1,720	1,670	3,390
Building	m^2	4,500	1,100	230	1,330
Sub-total			10,410	9,960	20,370
2. Electrification					
Over head catenary system	km	9.3	3,480	3,880	7,360
Power & lighting	set	1	90	110	200
Sub-total			3,570	3,990	7,560
3. Signal & telecommunication					
Signalling equipment	set	1	2,490	440	2,930
Signalling cable	km	76	790	190	980
Track circuit	Km	16	540	110	650
Telecommunication equipment	set	1	580	160	740
Sub-total			4,400	900	5,300
4. Compensation					
Land compensation	set	1		360	360
House compensation	set	1		1,170	1,170
Sub-total				1,530	1,530
5. Grand Total			18,380	16,380	34,760

Remarks: The exchange rate for foreign currency is set as Rp. 980 = US$1.00 = Yen 245

Table 6.4 Estimated Cost of Tangerang Line

(Unit: Million Rp)

		Stage	1st	2nd	3rd		Total
Construction Cost	Civil	Foreign	1,800	1,600	19,200		22,600
		Local	1,000	1,500	16,000		18,500
		Sub-Total	2,800	3,100	35,200		41,100
	Electri-fication	Foreign		6,700	4,800		11,500
		Local		5,900	5,200		11,100
		Sub-Total		12,600	10,000		22,600
	Signal and Tele-communi-cation	Foreign		4,200	5,000		9,200
		Local		1,500	1,100		2,600
		Sub-Total		5,700	6,100		11,800
	Total	Foreign	1,300	12,500	29,000		43,300
		Local	1,000	8,900	22,300		32,200
		Sub-Total	2,800	21,400	51,300		75,500
Rolling Stock		Foreign	900	40,500	13,700	67,600	122,700
		Local	600	1,100	400	1,800	3,900
		Sub-Total	1,500	41,600	14,100	69,400	126,600
Grand Total		Foreign	2,700	53,000	42,700	67,600	166,000
		Local	1,600	10,000	22,700	1,800	36,100
		Total	4,300	63,000	65,400	69,400	202,100

Remarks: 3rd Stage (left) Construction and rolling stock at the beginning
(right) Rolling stock increased after the beginning

The exchange rate for foreign currency is set as
Rp. 980 = US$1.00 = Yen 245.

Table 6.5 Estimated Construction Cost of Merak Line
(Breakdown, No.1)

(Unit: Million Rp)

	Work Classification	Unit	Quantity	Investiment Sum		
				Foreign Currency	Local Currency	Total
Civil Structure & Track Construction	1. Rehabilitation of Existing Track					
	Bridge	Place	20	370	230	600
	Track	m	23,900	7,200	3,400	10,600
	Level Crossing	Place	12	30	70	100
	Sub-Total			7,600	3,700	11,300
	2. Track Doubling					
	Roadbed	m^3	228,000	1,400	1,600	3,000
	Bridge	Place	20	1,770	1,630	3,400
	Platform	m^2	15,700	600	1,400	2,000
	Station Building & Others	m^2	12,700	3,000	2,200	5,200
	Track	m	27,700	7,200	4,700	11,900
	Level Crossing	Place	12	30	70	100
	Station Plaza	m^2	28,000	500	400	900
	Storage Track	Set	1	500	700	1,200
	Sub-Total			15,000	12,700	27,700
	3. Compensation for Land & House	m^2	46,000	0	2,100	2,100
	Sub-Total			0	2,100	2,100
	Total			22,600	18,500	41,100

Remarks: The exchange rate for foreign currency is set as Rp. 980 = US$1.00 = Yen 245.

Table 6.6 Estimated Construction Cost of Merak Line

(Breakdown, No.2)

(Unit: Million Rp)

	Work Classification	Unit	Quantity	Investiment Sum		
				Foreign Currency	Local Currency	Total
Electrification	1. Single Track					
	Substation	Place	3	3,000	800	3,800
	Overhead Catenary	km	23.3	2,800	4,200	7,000
	Power & Lighting	km	23.3	900	900	1,800
	Sub-Total			6,700	5,900	12,600
	2. Track Doubling					
	Substation	Place	3	1,600	500	2,100
	Overhead Catenary	km	23.3	3,000	4,500	7,500
	Power & Lighting	km	23.3	200	200	400
	Sub-Total			4,800	5,200	10,000
	Total			11,500	11,100	22,600
Signal & Telecommunication	1. Single Track					
	Signalling Equipment	Set	1	3,100	600	3,700
	Telecommunication Equipment	km	23.3	1,100	900	2,000
	Sub-Total			4,200	1,500	5,700
	2. Track Doubling					
	Signalling Equipment	Set	1	4,600	1,000	5,600
	Telecommunication Equipment	km	23.3	400	100	500
	Sub-Total			5,000	1,100	6,100
	Total			9,200	2,600	11,800
	Grand Total			43,300	32,200	75,500

Remarks: The exchange rate for foreign currency is set as Rp. 980 = US$1.00 = Yen245.

Table 6.7 Estimated Cost of Merak Line

(Unit: Million Rp)

		Stage	1st	2nd	3rd		Total
Construction Cost	Civil	Foreign	3,800	4,500	14,500		22,800
		Local	2,900	4,300	18,400		25,600
		Sub-Total	6,700	8,800	32,900		48,400
	Electri-fication	Foreign		6,100	4,400		10,500
		Local		5,600	4,400		10,000
		Sub-Total		11,700	8,800		20,500
	Signal and Tele-communi-cation	Foreign		3,500	3,800		7,300
		Local		1,200	900		2,100
		Sub-Total		4,700	4,700		9,400
	Total	Foreign	3,800	14,100	22,700		40,600
		Local	2,900	11,100	23,700		37,700
		Sub-Total	6,700	25,200	46,400		78,300
Rolling Stock		Foreign	800	33,800	16,200	49,300	100,100
		Local	500	900	700	1,100	3,200
		Sub-Total	1,300	34,700	16,900	50,400	103,300
Grand Total		Foreign	4,600	47,900	38,900	49,300	140,700
		Local	3,400	12,000	24,400	1,100	40,900
		Total	8,000	59,900	63,300	50,400	181,600

Remarks: 3rd Stage (left) Construction and rolling stock at the beginning
(right) Rolling stock increased after the beginning

The exchange rate for foreign currency is set as Rp. 980 = US$1.00 = Yen 245.

Table 6.8 Estimated Construction Cost of Tangerang Line
(Breakdown, No.1)

(Unit: Million Rp)

	Work classification	Unit	Quantity	Investiment Sum		
				Foreign Currency	Local Currency	Total
Civil Structure & Track Construction	1. Rehabilitation of Existing Track					
	Bridge	Place	28	570	230	900
	Track	m	19,800	4,900	3,700	8,600
	Level Crossing	Place	15	30	70	100
	Sub-Total			5,600	4,000	9,600
	2. Track Doubling					
	Roadbed	m^3	143,000	1,400	1,500	2,900
	Bridge	Place	29	1,170	1,030	2,200
	Platform	m^2	15,600	400	800	1,200
	Station Building & Others	m^2	13,000	3,200	2,300	5,500
	Track	m	21,300	6,400	3,900	10,300
	Level Crossing	Place	15	30	70	100
	Station Plaza	m^2	28,000	500	400	900
	Grade Separated Crossing	Place	2	3,700	6,600	10,300
	Storage Track	Set	1	400	600	1,000
	Sub-Total			17,200	17,200	34,400
	3. Compensation for Land & House	m^2	86,000	0	4,400	4,400
	Sub-Total			0	4,400	4,400
	Total			22,800	25,600	48,400

Remarks: The exchange rate for foreign currency is set as Rp. 980 = US$1.00 = Yen 245.

Table 6.9 Estimated Construction Cost of Tangerang Line
(Breakdown, No.2)

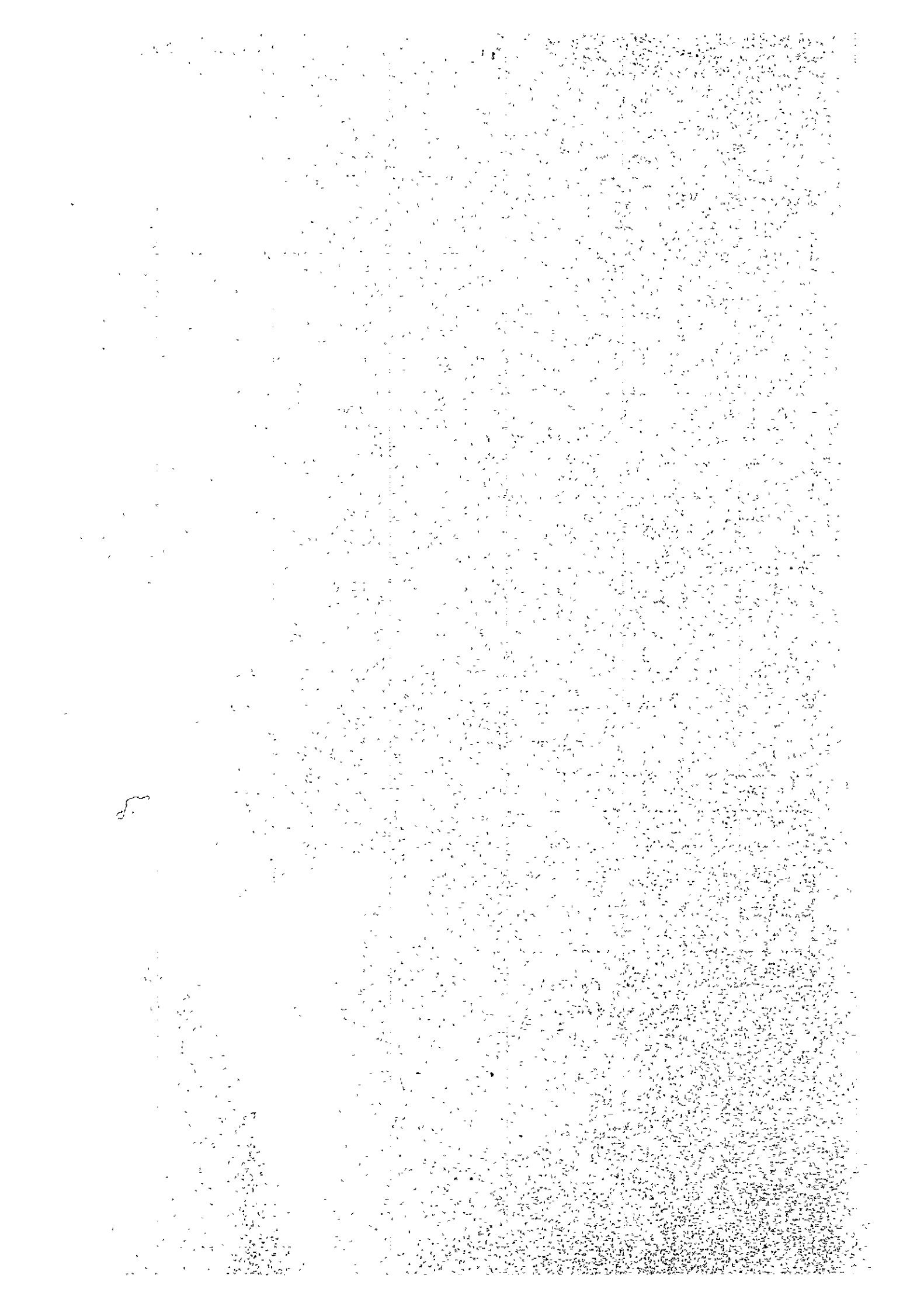
(Unit: Million Rp)

	Work classification	Unit	Quantity	Investiment Sum		
				Foreign Currency	Local Currency	Total
Electrification	1. Single Track					
	Substation	Place	3	3,000	800	3,800
	Overhead Catenary	km	19.3	2,300	3,900	6,200
	Power & Lighting	km	19.3	800	900	1,700
	Sub-total			6,100	5,600	11,700
	2. Track Doubling					
	Substation	Place	3	1,700	400	2,100
	Overhead Catenary	km	19.3	2,500	3,700	6,200
	Power & Lighting	km	19.3	200	300	500
	Sub-total			4,400	4,400	8,800
	Total			10,500	10,000	20,500
Signal & Telecommunication	1. Single Track					
	Signalling Equipment	Set	1	2,600	500	3,100
	Telecommunication Equipment	km	19.3	900	700	1,600
	Sub-total			3,500	1,200	4,700
	2. Track Doubling					
	Signalling Equipment	Set	1	3,800	900	4,700
	Sub-total			3,800	900	4,700
	Total			7,300	2,100	9,400
	Grand Total			40,600	37,700	78,300

Remarks: The exchange rate for foreign currency is set as Rp. 980 = US$1.00 = Yen 245.

CHAPTER 7

ECONOMIC ANALYSIS



CHAPTER 7 ECONOMIC ANALYSIS

7.1 METHODS OF ANALYSIS

7.1.1 With/Without Project

This analysis intends to evaluate the following three projects respectively.

(1) Grade separated crossing in Manggarai Station.

(2) Track addition and other improvements on Merak Line.

(3) Track addition and other improvements on Tangerang Line.

This analysis is implemented by the comparison of "with the project" (the case when the project is implemented) and "without the project" (the case when the project is not implemented).

In the case of "without the project", each project was assumed to remain as it is, but other projects were carried out as proposed in the JABOTABEK Master Plan.

In the case of "without the project", the future traffic exceeding the railway capacity is borne by the road traffic mode.

7.1.2 Evaluation

For the three projects respectively, the difference between with and without the project in investment cost, maintenance and operating costs, and benefits is calculated annually, and is seen as NET FLOW.

The EIRR (Economic Internal Rate of Return) is calculated on this net-flow and is used as an index for evaluation. The method of calculation for EIRR is as follows.

$$0 = \sum_{i=1}^{30} \text{NET FLOW}i/(1+\text{EIRR})^{i-1}$$

This index is a overall parameter which uses economic price for evaluating the following items.

(1) Investment

Investment cost and land acquisition cost for each project.

(2) Operating and maintenance costs

Increase of operating and maintenance costs for railway.
Decrease of operating and maintenance costs for road vehicles.

(3) Benefits

Time saving benefit for railway passengers and road traffic passengers.

7.1.3 Preposition

(1) Foreign exchange rate

Rp 980 = US$1 = ¥245

(2) Durable years and project life

JNR's durable years are used in this analysis, and were used in the analysis of the Track Elevation of Central Line and Cengkareng New Airport Line. The project life is set for 30 years.

(3) Inflation

Inflation is excluded for the following reasons:

(a) An inflation forecast of 30 years must incorporate various factors; therefore estimation using a simple estimated inflational rate could result in a significant error, and could have a serious impact on the economic evaluation.

(b) Inflation will have the same effect on investment cost, operating and maintenance costs, and benefits.

7.1.4 Economic Cost Estimation

(1) Capital cost

The tax and subsidy adjustments are made to determine the economic cost estimation.

(a) Foreign currency portion

Import duties and import sales tax are already excluded from the calculation of financial cost, so it is not necessary to make any adjustment for economic evaluation.

(b) Local currency portion (Material and Equipment)

The producer side tax (average 20%, including corporate tax), and MPO and PPN (average 4.5%) are deducted from the financial cost.

(c) Local currency portion (Labour)

The gross income of the average construction worker (one spouse and three dependents) is estimated at less than about one million Rp per year. He is not liable for income taxation because of the basic deduction for family dependents.

(2) Re-investment

In order to have a common basis for investment in the with/without cases, it is assumed that re-investment is made after the assets.

(3) Residual value (Salvage value)

The project life of 30 years is only used for the analysis, but the facilities of the railway will continue to be used. Therefore, residual values of assets are treated as a minus cost.

7.1.5 Operating and Maintenance Costs

(1) Railway

(a) Maintenance cost and replacement cost

For the calculation of maintenance cost and replacement cost, the JNR maintenance ratio is applied as was used for the Track Elevation of Central Line and Cengkareng New Airport Line.

(Methods of calculation)

Maintenance cost of depreciated assets
= Maintenance ratio × Total depreciated assets

Maintenance cost of replaced assets
= 0.95/durable years × Maintenance ratio × Total replaced assets

Replacement cost of replaced assets
= 0.95/durable years × Total replaced assets

(b) Energy cost

The Electricity cost necessary for train operation is calculated. Electricity consumption per one car-kilometre is 1.51 kwH, and the cost is 83.62 Rp.

Electricity contract charge and electricity bond money are both included in the electricity cost.

(c) Personnel cost

The increased personnel cost of PJKA workers is calculated.

(2) Road traffic

Maintenance cost and operating cost of road vehicles are calculated by the method used for the JABOTABEK Master Plan.

Road vehicles include sedens, buses, trucks and motorcycles.

Maintenance cost and operating cost include fuel cost, engine oil cost, tyre wear, maintenance cost, maintenance labour, vehicle cost and personnel cost (bus, truck).

7.1.6 Passenger Time Value

The passenger time value for this study is determined by an adjustment of the data for the Cengkareng New Airport Line and for the Track Elevation of Central Line.

7.1.7 Benefit

(1) Cost saving benefit

The difference between "with the project" and "without the project" in maintenance cost and operating cost is seen as a cost saving benefit.

(a) With

Maintenance cost and operating cost of the railway are calculated.

1) Ground facilities (maintenance cost, replacement cost)
2) Rolling stock (power cost, maintenance cost)
3) Personnel cost

(b) Without

The road traffic volume in the case of with the project will be reduced compared with the case of without the project. Maintenance cost and operating cost due to the reduction of the road traffic is calculated as the difference in PCU.km of with and without the project.

(2) Time saving benefit

The following time saving benefits are generated by the implementation of each project.

(a) Railway passenger

Time saving benefit due to the increased speed of railway transportation.

(b) Railway passenger

Time saving benefit due to the converted traffic.

(c) Road traffic passenger

Time saving benefit due to the easing of traffic congestion.
These time saving benefits are calculated by the following method.

{Road (without-with) PCU.hr x Time Value}
- {Railway (with-without) passenger.hr x Time Value}

Table 7.1 Basic Deductions for Personal Income

Item	Deduction Amount
Earner	300,000 Rp/year
Spouse	300,000 Rp/year
Dependent	150,000 Rp/year
(up to 5 Persons)	(Average 3 Dependent)

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Table 7.2 Maintenance Ratios and Life Expectancies of Assets

		Maintenance Ratio	Life Expectancy	Type of Assets
Civil work	Foundations	0.0004	57	Depreciated assets
	Elevated track structure	0.0027	50	Depreciated assets
	Platforms	0.0041	32	Depreciated assets
	Overbridges	0.0051	32	Depreciated assets
	Station buildings (RC)	0.0067	45	Depreciated assets
	Buildings (RC)	0.0057	45	Depreciated assets
	Tracks	0.15	25	Replacement assets
Signals and telecommunication	Safety measures at the railway crossings	0.0292	12	Depreciated assets
	Signals	0.0210	20	Depreciated assets
	Telecommunication equipment	0.0312	9	Depreciated assets
	Signal lines	0.035	35	Replacement assets
	Communication lines	0.12	35	Replacement assets
	Track circuits	0.035	19	Replacement assets
Electrical works	Transformer equipment	0.0008	20	Depreciated assets
	Building for transformer stations	0.0057	45	Depreciated assets
	Overhead contact wires	0.013	45	Replacement assets
	Electrical distribution wires	0.013	30	Replacement assets
Rolling stock	Machinery at workshop	0.05	20	Depreciated assets
	Electric car	0.035	20	Depreciated assets
	Machinery at depot	0.05	20	Depreciated assets

(Notes) o Depreciated assets are to be replaced after their durable years.

o Replacement assets are to be replaced by replacing a certain ratio of assets every year.

Table 7.3 Estimated Wage for PJKA Workers in JABOTABEK
(including family allowance, etc.)

(Unit: 1000 Rp/year)

Job	Level	Average wage
Driver	I, II	1,214
Conductor	I, II	1,282
Station Staff	I, II	1,073
Inspection Staff	I, II	1,073

Information from PJKA Inspection No. 1

Table 7.4 Economic Price of Road Vehicle

Mode	Market Price (Rp)	Economic Price (Rp)	Durable Years (Years)	Annual Running Distance (km)
Sedan	18,162,500	9,075,000	8	25,000
Bus	38,500,000	33,700,000	7	100,000
Truck	21,000,000	18,350,000	8	60,000
Motorcycle	920,000	705,000	10	10,000

Information from PHBD, PPD and Car Dealers. Economic price is calculated by deducting registration and taxes.

Table 7.5 Economic Price of Major Items

(Unit: Rp)

Item	Market Price	Economic Price
Gasoline	* 320/ℓ	300/ℓ
Diesel	* 145/ℓ	220/ℓ
Engine Oil (Sedan)	1,500/ℓ	1,200/ℓ
Engine Oil (Bus, Truck)	1,475/ℓ	1,180/ℓ
Tyre (Sedan)	38,500/pc	31,000/pc
Tyre (Bus, Truck)	118,000/pc	95,100/pc

Information from PHBD, PPD, Car Dealers, Tyre Dealers and Gas Station

* New Market Price effective on Jan. 12, 1984

Gasoline: 350Rp/ℓ, Diesel: 220Rp/ℓ

Table 7.6 Personnel Cost for Road Vehicles

Item	Personnel Cost
Bus (driver, conductor) per one unit	2,735,000 Rp/year
Truck (driver, assistant) per one unit	1,800,000 Rp/year
Maintenance Labour	248 Rp/hour

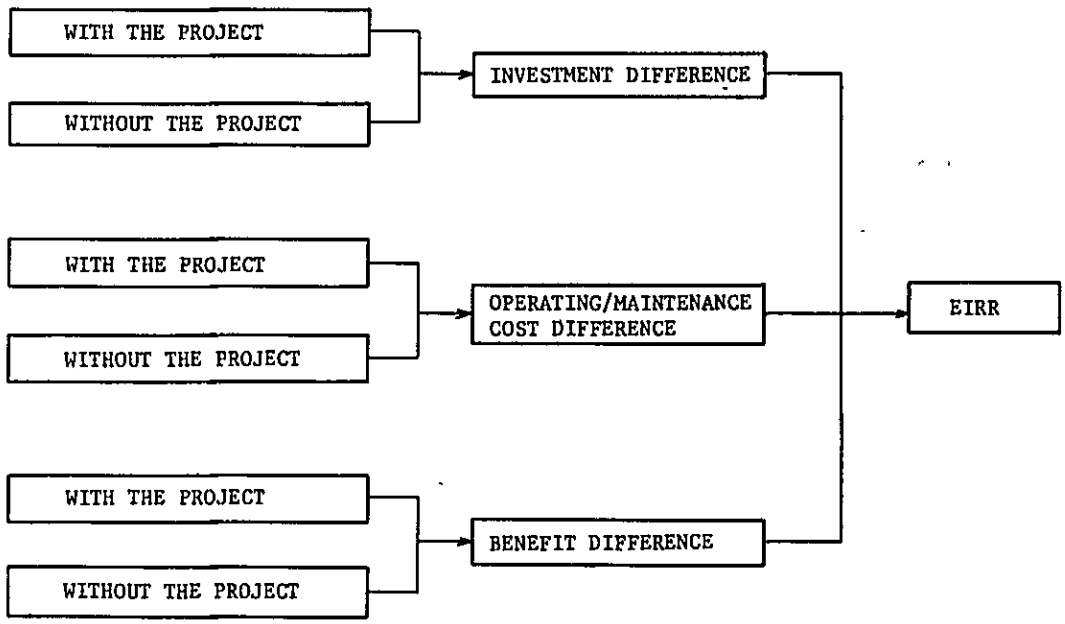
Information from PHBD, PPD.

Table 7.7 Passenger Time Value Per Person

Mode	Time value used for this study
	(Rp/Hour)
Sedan	1,077
Bus	180
Rail	180
Motorcycle	561

(Note) CPI 1982/9 193.41
1983/9 222.78 (assumed)

Fig. 7.1 Economic Analysis Flow Chart



7.2 ECONOMIC ANALYSIS FOR GRADE SEPARATED CROSSING IN MANGGARAI STATION

7.2.1 Characteristics of This Project

This project is a so-called "point project" which means the construction of a grade separated crossing in the yard of Manggarai Station. It is only one of the 26 projects in the JABOTABEK railway network. The best way to evaluate such a project is to evaluate costs and benefits as a whole in the JABOTABEK railway projects.

However, this approach must be limited to be carried out as far as the Scope of Work and the Terms of Reference are concerned.

In this analysis a comparison is made between "with the project" (the case when a grade separated crossing in Manggarai Station is implemented) and "without the project" (the case when a grade separated crossing in Manggarai Station is not inplemented). Next, the difference of investment costs, maintenance costs and operating costs, and benefits are considered.

Generally speaking, a supplementary investment to the existing facilities results in comparatively higher net benefits in this method of evaluating project. In this case such investment will play an important role in solving the problem peculiar to the whole project.

The grade separated crossing in Manggarai Station will, thus, play an important role in solving the critical railway traffic situation because Manggarai Station is a keystone of the JABOTABEK railway net work. Although this project shows higher benefits than other Indonesian railway projects, it is necessary to recognize the characteristics of this project and its fundamental differences compared with other railway projects for evaluating such project. However, it toes without saying that a grade separated crossing is the best way to eliminate the interference of the level crossing.

7.2.2 Evaluation

The methods of economic analysis are as aforementioned. The cost difference of rolling stocks which pass through Manggarai Station and the related personnel costs (drivers and conductors) between with and without the project in addition to the construction cost of Manggarai Station are included in the calculation of the economic analysis. But, the existing facilities are considered to be sunk costs. Therefore the sunk costs are not included for the calculation of EIRR (Economic Internal Rate of Return). Reference should be made to Table 7.8 Investment Cost (Economic Price) and to Table 7.9 Traffic Volume based on traffic demand forecast.

A cost saving benefit of 2,208.2 billion Rp (including fuel saving of 667.3 billion Rp) and a time saving benefit of 704.3 billion Rp can be obtained by the implementation of this project. The EIRR of this project is 37.2% and shows a higher figure compared with other Indonesian railway projects in consideration of the characteristics of this project.

Besides the direct benefits, such as cost savings and time savings, additional benefits such as traffic accident avoidance and economic development will be realized. But additional benefits are not included for the calculation of EIRR.

The following indices are used as additional indices.

(1) Fuel saving benefit

This benefit is a part of the maintenance cost and operating cost saving benefit.

(2) Job creation

1) Number of workers required for the construction

2) Increased number of PJKA workers

7.2.3 Sensitivity Analysis

In order to confirm the viability of this project, a sensitivity analysis was made assuming more pessimistic values for construction costs and traffic volumes.

The results show that even with a 20% cost overrun or with a decrease of 30% in traffic volume, the EIRR would be 35.1% and 31.1% respectively. Even with a 20% cost overrun and a decrease of 30% in traffic volume in extreme cases, the EIRR will be 29.2%. This indicates that this project is sufficiently viable to satisfy the sensitivity analysis in extreme cases.

Table 7.8 Investment Cost (Economic Price)

(Unit: Mil Rp)

	1984∿1989	1990∿1999	2000∿2013	Total
Electrification	7,186			7,186
Signals & Telecom.	5,122	715	3,552	9,389
Civil Works	18,849			18,849
Land	1,150			1,150
Rolling Stock		57,204	162,372	219,576
Total	32,307	57,919	165,924	256,150

(Note) Including re-investment, excluding residual value

Table 7.9 Traffic Volume

(per day)

	1995	2005
Road (Without-With) pcu·km	494,800	3,513,300
(Without-With) pcu·hr	29,700	116,400
Railway (With-Without) pass·km	2,095,100	9,845,300
(With-Wtihout) pass·hr	72,900	298,100

Table 7.10 Sensitivity Analysis

	Base Case	Case I	Case II	Case III
Investment	-	+20%		+20%
Traffic Volume	-		Δ30%	Δ30%
EIRR	37.2%	35.1%	31.1%	29.2%

Table 7.11 Additional Indices

1. Fuel Saving	
1) Gasoline (over 24 years) 1990 - 2013	1.29 Mil kℓ
2) Diesel (over 24 years) 1990 - 2013	1.27 Mil kℓ
2. Job Creation	
1) For construction	8,800 man-years
2) Operational PJKA workers	
year 1990	120 persons
year 2000	1,034 persons
year 2010	1,248 persons

7.3 ECONOMIC ANALYSIS FOR TRACK ADDITION AND OTHER IMPROVEMENTS ON MERAK LINE

7.3.1 Evaluation

The methods of analysis are as aforementioned. Reference should be made to Table 7.12, Investment Cost (Economic Price) and to Table 7.13, Traffic Volume based on traffic demand forecast.

A cost saving benefit of 1,065 billion Rp.(including fuel saving of 389.6 billion Rp) and a time saving benefit of 571.8 billion Rp. are obtained by the implementation of this project. The EIRR of this project is 24.8%, which exceeds the standard level of Indonesian railway projects and hence shows that this project is feasible.

Besides the direct benefits such as cost savings and time savings, additional benefits such as traffic accident avoidance and economic development will be realized. But additional benefits are not included for the calculation of EIRR.

The following indices are used as additional indices.

(1) Fuel saving benefit

This benefit is a part of the maintenance cost and operating cost saving benefit.

(2) Job creation

(a) Number of workers required for the construction

(b) Increased number of PJKA workers

7.3.2 Sensitivity Analysis

In order to confirm the viability of this project, a sensitivity analysis was made assuming more pessimistic values for construction cost and traffic volumes.

The results show that even with a 20% cost overrun or with a decrease of 30% in traffic volume, the EIRR would be 22.5% and 18.5% respectively.

Even with a 20% cost overrun and a decrease of 30% in traffic volume in extreme cases, the EIRR will be 16.6%. This indicates that this project is sufficiently viable to satisfy the sensitivity analysis in extreme cases.

Table 7.12 Investment Cost (Economic Price)

(Unit: Mil Rp)

	1984∿1988	1989∿1992	1993∿2013	Total
Electrification	11,772	9,382	3,504	24,658
Signals & Telecom.	5,333	3,141	7,509	15,983
Civil Works	5,946	31,058		37,004
Land	33	1,525		1,558
Rolling Stock	42,902	14,052	126,243	183,197
Total	65,986	59,158	137,256	262,400

(Note) Including re-investment, excluding residual value

Table 7.13 Traffic Volume

(per day)

	1995	2005
Road (Without-With) pcu·km	392,800	1,730,400
(Without-With) pcu·hr	41,400	65,700
Railway (With-Without) pass·km	2,873,400	6,263,600
(With-Without) pass·hr	40,100	99,300

Table 7.14 Sensitivity Analysis

	Base Case	Case I	Case II	Case III
Investment	-	+20%		+20%
Traffic Volume	-		Δ30%	Δ30%
EIRR	24.8%	22.5%	18.5%	16.6%

Table 7.15 Additional Indices

1. Fuel Saving	
1) Gasoline (over 25 years) 1989 - 2013	0.74 Mil kℓ
2) Diesel (over 25 years) 1989 - 2013	0.75 Mil kℓ
2. Job Creation	
1) For construction	17,300 man-years
2) Operational PJKA workers	
year 1990	253 persons
year 2000	453 persons
year 2010	559 persons

7.4 ECONOMIC ANALYSIS FOR TRACK ADDITION AND OTHER IMPROVEMENTS ON TANGERANG LINE

7.4.1 Evaluation

The methods of analysis are as aforementioned. Reference should be made to Table 7.16, Investment Cost (Economic Price) and to Table 7.17, Traffic Volume based on traffic demand forecast.

A cost saving benefit of 911.6 billion Rp (including fuel saving of 331.5 billion Rp) and a time saving benefit of 438.8 billion Rp are obtained by the implementation of this project. The EIRR of this project is 23.2%, which exceeds the standard level of Indonesian railway projects and hence shows that this project is feasible.

Besides the direct benefits such as cost savings and time savings, additional benefits such as traffic accident avoidance and economic development will be realized. But additional benefits are not included for the calculation of EIRR.

The following indices are used as additional indices.

(1) Fuel saving benefit

This benefit is a part of the maintenance cost and operating cost saving benefit.

(2) Job creation

1) Number of workers required for the construction

2) Increased number of PJKA workers

7.4.2 Sensitivity Analysis

In order to confirm the viability of this project, the sensitivity analysis was made assuming more pessimistic values for construction cost and traffic volumes.

The results show that even with a 20% cost overrun or with a decrease of 30% in traffic volume, the EIRR will be 21.2% and 17.6% respectively.

Even with a 20% cost overrun and a decrease of 30% in traffic volume in extreme cases, the EIRR will be 15.9%. This indicates that this project is sufficiently riable to satisfy the sensitivity in extreme cases.

Table 7.16 Investment Cost (Economic Price)

(Unit: Mil Rp)

	1984∿1991	1992∿1996	1997∿2013	Total
Electrification	10,922	8,239	3,526	22,687
Signals & Telecom.	4,481	2,311	6,096	12,888
Civil Work	13,411	27,429		40,840
Land	1,027	2,301		3,328
Rolling Stock	36,430	16,112	86,746	139,288
Total	66,271	56,392	96,368	219,031

(Note) Including re-investment, excluding residual value

Table 7.17 Traffic Volume

(per day)

	1995	2005
Road (Without-With) pcu·km	241,100	1,524,200
(Without-With) pcu·hr	35,300	57,300
Railway (With-Without) pass·km	1,910,600	5,570,100
(With-Wihtout) pass·hr	44,700	157,900

Table 7.18 Sensitivity Analysis

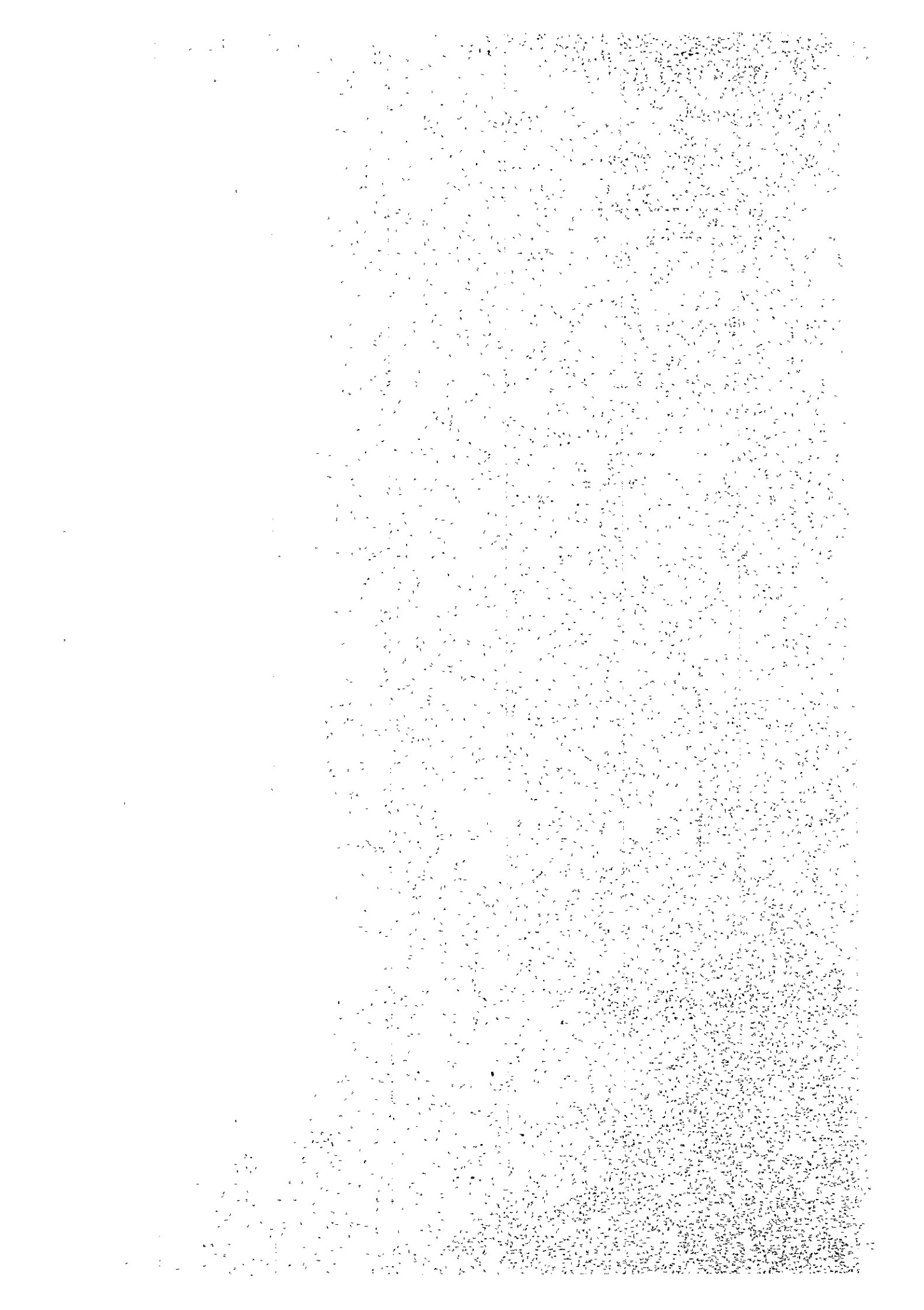
	Base Case	Case I	Case II	Case III
Investment	-	+20%		+20%
Traffic Volume	-		Δ30%	Δ30%
EIRR	23.2%	21.2%	17.6%	15.9%

Table 7.19 Additional Indices

1. Fuel Saving	
1) Gasoline (over 25 years) 1989∿2013	0.63 Mil kℓ
2) Diesel (over 25 years) 1989∿2013	0.64 Mil kℓ
2. Job Creation	
1) For construction	15,800 man-years
2) Operational PJKA workers	
year 1990	373 persons
year 2000	458 persons
year 2010	549 persons

CHAPTER 8

FINANCIAL EVALUATION



CHAPTER 8 FINANCIAL EVALUATION

8.1 PURPOSE AND PROPOSITION

8.1.1 Purpose of Financial Evaluation

In Indonesia at present, all the railway facilities and rolling stock investment is carried out by the Indonesian government, and PJKA is the operating agency of the railway system.

In principle, PJKA has to manage its operating expenses within its operating revenue.

But the fact is that PJKA's operating expenses surpass its operating revenue, thus creating operating losses. PJKA is subsidized by the Indonesian government to cover these losses.

Present railway fares in Indonesia are not set out to cover operating expenses and PJKA's interest payments to the government.

Therefore, although it is not necessary for PJKA to operate on a commercial basis, it is desirable for PJKA to balance operating expenses and operating revenue as closely as possible.

From the viewpoint mentioned above, the first objective of this financial evaluation is to study the following items:

1) From the profit and loss projection of each project, to determine the necessity of government subsidies.

2) To study the financing of debt for each project and debt repayment ability from the cash flow projection.

3) To determine the adequate fare level for each project.

8.1.2 Proposition for Cash Flow Projection

Based on the volume of passengers projected by the traffic demand forecast, the profits and expenses, and debt burden of each project are evaluated.

Project life, exchange rate of RP/US$/Yen, and concept of inflation are exactly the same as for the economic analysis.

As far as the economic analysis is concerned, for investment, operating and maintenance cost calculations economic price (excluding taxes) is used. But, for the financial analysis, all tax portions are added back to those costs.

(1) Foreign currency portion

Since PJKA is a governmental institution, it has been supposed that there will be no import duties imposed.

(2) Local currency portion (Material and Equipment)

A producer side-tax (including corporate tax) of 20% and an MPO, PPN of 4.5% are added back to the economic price.

(3) Local currency portion (Labour)

Based on the guideline of the Indonesian tax authorities, no tax adjustment is assumed to be necessary, therefore exactly the same data as for the economic analysis were used.

8.1.3 Items Composing Cash Flow Statement

(1) PJKA's items on revenue/expense

(a) Operating revenue

Based on the traffic demand forecast, annual operating revenue is calculated by applying present fares to the passenger volume (passenger kilometre).

Fares are determined by using Table 8.1. As a result, the fare for 1 passenger kilometre becomes 7.3 Rp.

It is assumed that there will be no increase in present fares.

(b) Operating expenses

Operating expenses are seen as the sum of operating and maintenance costs, depreciation for rolling stock, facilities, and also include personnel cost and electricity cost.

For calculation of depreciation, the number of durable years used for the economic analysis is applied here.

(c) Operating profit and net profit

Operating profit is calculated by deducting operating expenses from operating revenues.

According to Article 13 of the joint decree of the Minister of Finance and the Minister of Communications (issued on 30th March, 1970), in principle, PJKA has to pay 3% interest on its total assets to the Indonesian government.

Therefore, net profit is calculated after deducting that 3% interest on total assets from the operating profit.

8.1.4 Schedule for Investment and Debt Financing

(1) Investment

The same rule of investment used for the economic analysis was applied.

(2) Debt financing

It is assumed that all the investment and debt financing is implemented by the Indonesian government.

It is also assumed that the foreign currency portion of investment is serviced by overseas borrowing, and the local currency portion is financed by means of the Government budget or RP-denominated borrowing.

The following assumptions have been made in this financial evaluation.

(a) Overseas borrowing

1) Most standard terms and conditions are set for government-to-government base borrowing.

Interest: 4% p.a.
Term: 30 years (including a 10-year grace period)
Repayment: 20 years, equal semi-annual installments

2) Most standard terms and conditions are set for official overseas borrowing (including IBRD, ADB).

Interest: 9% p.a.
Term: 15 years (including a 3-year grace period)
Repayment: 12 years, equal semi-annual installements

(b) Local finance

1) Government budget
In this case, interest repayment and capital repayment are not necessary.

2) General terms and conditions are set for borrowing from financial institutions.

Interest: 20% p.a.
Terms: 10 years (including a 4-year grace period)
Repayment: 6 years, equal semi-annual installments

Three cases for financing each project in combination of foreign and local portions have been set. The three cases of likely financings are shown in Table 8.2, although case II is applicable only to the Manggarai Project.

Table 8.1 Present Railway Fare in JABOTABEK

Distance (km)	Passenger Fare (Rp)
1 ∿ 10	100
11 ∿ 20	150
21 ∿ 30	150
31 ∿ 40	250
41 ∿ 50	250
51 ∿ 60	300

PERUBAHAN DAN TAMBHAN No.3 PADA BUKU STP No. 2701/SK/83
BERIAKU MARAI TGU 1-2-1983

Table 8.2 Finance Programme

	Foreign Currency	Local Currency
BASE CASE	4% p.a. 30 years, including 10-year grace period	Government budget
CASE I	9% p.a. 15 years, including 3-year grace period	Government budget
CASE II	9% p.a. 15 years, including 3-year grace period	50% Government budget 50% 20% p.a. 10 years, including 4-year grace period

8.2 FINANCIAL EVALUATION FOR GRADE SEPARATED CROSSING IN MANGGARAI STATION

8.2.1 Investment

The same rule of investment used for the economic analysis was applied.

Total investment including the re-investment up to the year 2013 is 258,740 million Rp, with an annual average of about 8,625 million Rp.

The investment amount from 1984 to 1989 (grade separated crossing in Manggarai Station) is 34,744 million Rp, and the investment cost including rolling stock, additional investment cost and re-investment cost required between 1990 and 2013 is 223,996 million Rp.

8.2.2 Profitability

When the present rail fares in JABOTABEK are applied, in order to make the operating revenue and expenses balanced, it is not necessary to have the government subsidies on a cumulative basis under the assumption that the figure of traffic demand forecast will not change in future.

8.2.3 Cash Flow Analysis

(1) Base Case (foreign Currency Loan at 4% interest p.a., Government Budget for local currency)

Details of the Base Case are shown in Appendix 8. These details are summarized in Table 8.5.

Net cash flow of the Base Case shows a deficit throughout the project life, but shows a surplus at the end of the project life. The net cash flow/revenue ratio shows that if the financing for the Base Case is chosen, it will be necessary to increase present fares nearly 21% under the assumption that the figure of traffic demand forecast remains unchanged.

(2) Case I (Foreign Currency Loan at 9% interest p.a., Government Budget for local currency)

For Case I, in order to make net cash flow positive and service the debt, it is necessary to increase present fare by nearly 24%.

(3) Case II (Foreign Currency Loan at 9% interest p.a., Government Budget for 50% of local currency and 20% interest p.a. for 50% of local curency).

The negative net cash flow of Case II is the largest among all three cases, because the debt burden is the largest.

For this case it may be necessary to increase present fares by nearly 31% in order to service the debt burden.

8.2.4 Conclusion

If the present fares are applied, there will be no need for operating subsidies in cumulative basis because this case shows an operating profit throughout the project life.

Our study shows that the financing plan of the Base Case (concessional loan from overseas and government budget) is the most preferable financing if the project is to service the debt.

This evaluation shows that this project becomes viable if the following necessary measures are taken.

1) Local portion should be financed by means of the government budget.

2) Low interest and long-term concessional loans should be sought for the foreign currency portion.

3) If the project has to produce the funds for debt service, under the assumption that the most preferable funding is applied, it may be necessary to increase the present fares by 21%.

The above conclusions are based on the premise that all other projects in JABOTABEK railway network are implemented in addition to thus "point project."

Table 8.3 Financial Cost of Investment

(Unit: Mil.Rp)

		1984~1989	1990~1999	2000~2013	Total
Electrification	Foreign	3,564			3,564
	Local	3,992			3,992
Signals & Telecom.	Foreign	4,400	584	3,072	8,056
	Local	896	164	600	1,660
Civil Work	Foreign	10,408			10,408
	Local	9,960			9,960
Land	Local	1,524			1,524
Rolling Stock	Foreign		56,628	160,732	217,360
	Local		576	1,640	2,216
Total	Foreign	18,372	57,212	163,804	239,388
	Local	16,372	740	2,240	19,352
	Foreign & Local	34,744	57,952	166,044	258,740

(Note) Cost includes re-investment

Table 8.4 Government Subsidy for Necessary Operation

(Unit: Mil Rp)

Year	1990	1991	1992	1993	1994	1995	1996	1997
Subsidy	586	272	Nil	Nil	Nil	2,237	1,235	115

Year	1998	1999	2000	2001	2002	2003	2004	2005
Subsidy	Nil	Nil	Nil	Nil	560	Nil	Nil	Nil

Year	2006	2007	2008	2009	2010	2011	2012	2013
Subsidy	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

Table 8.5 Cash Flow for Base Case

(Unit: Mil Rp)

	1984 ∿ 1993	1994 ∿ 2003	2004 ∿ 2013	Total
Operating Revenue	12,411	92,977	223,586	328,974
Operating Profit	Δ351	4,267	29,710	33,626
Net Profit	Δ6,302	Δ21,777	Δ9,828	Δ37,907
Investment	54,968	127,292	76,480	258,740
Debt Service	3,241	12,610	14,079	29,930
Net Cash Flow	Δ17,652	Δ90,931	41,496	Δ67,087
Ratio (Net Cash Flow/ Operating Revenue)	Δ142.2%	Δ97.8%	18.6%	Δ20.4%

Table 8.6 Cash Flow for Case I

(Unit: Mil Rp)

	1984 ∿ 1993	1994 ∿ 2003	2004 ∿ 2013	Total
Operating Revenue	12,411	92,977	223,586	328,974
Net Cash Flow	Δ26,048	Δ105,576	55,575	Δ76,049
Ratio (Net Cash Flow/ Operating Revenue)	Δ209.9%	Δ113.6%	24.9%	Δ23.1%

Table 8.7 Cash Flow for Case II

(Unit: Mil Rp)

	1984 ∿ 1993	1994 ∿ 2003	2004 ∿ 2013	Total
Operating Revenue	12,411	92,977	223,586	328,974
Net Cash Flow	Δ33,428	Δ122,277	55,574	Δ100,131
Ratio (Net Cash Flow/ Operating Revenue)	Δ269.3%	Δ131.5%	24.9%	Δ30.4%

8.3 FINANCIAL EVALUATION FOR TRACK ADDITION AND OTHER IMPROVEMENTS ON MERAK LINE

8.3.1 Investment

The same rule of investment used for the economic analysis was applied.

The total investment including the re-investment up to the year 2013 is 267,924 million Rp, with an annual average of about 8,931 million Rp.

The investment amount from 1984 to 1988 (single track construction and rolling stock) is 67,644 million Rp, the investment amount from 1989 to 1992 (double track construction) is 62,164 million Rp, and the investment cost required between 1993 and 2013 is 138,116 million Rp.

8.3.2 Profitability

When the present rail fares in JABOTABEK are applied in order to make the operating revenue and expenses balanced, it is necessary to have the government subsidies annually from 1989 to 2013. In 1993, necessary government subsidy will be increased considerably compared with that of 1992, due to the increase of working cost for double track operation.

Under the assumption that the figure of traffic demand forecast will not change in future, if the present railway fares are increased by 38% on a cumulative basis, there will be no government subsidy necessary as far as operation is concerned. This increase is not enough to cover debt service, but is just enough to cover the operating expenses throughout the project life.

8.3.3 Cash Flow Analysis

(1) Base Case (Foreign Currency Loan at 4% interest p.a., Government Budget for local currency)

Details of the Base Case are shown in Appendix 8. These details are summarized in Table 8.10.

Net cash flow of the Base Case continues to show a deficit throughout the project life. The net cash flow/revenue ratio shows that if the financing for the Base Case is chosen, it will be necessary to increase the present fares by nearly 98% under the assumption that the figure of traffic demand forecast remains unchanged.

(2) Case I (Foreign Currency Loan at 9% interest p.a., Government Budget for local currency)

For Case I, in order to make net cash flow positive and service the debt, it is necessary to increase present fares by nearly 104%.

8.3.4 Conclusion

If the present fares are increased by nearly 38%, roughly speaking there will be no subsidies necessary at the operating profit and loss level. A 38% increase of fares will make cumulative operating revenue and operating loss equal by 2013.

Our study shows that the financing plan of the Base Case (concessional loan from overseas and government budget) is the most preferable financing if the project is to service the debt.

The evaluation shows that this project becomes viable if the following necessary measures are taken.

1) The local portion should be financed by means of the government budget.

2) Low interest and long term concessional loans should be sought for the foreign currency portion.

3) At least 38% increase of the existing fares will be necessary in order to produce operating profit on a cumulative basis.

4) If the project has to produce the funds for debt service, under the assumption that the most preferable funding is applied, it may be necessary to increase the present fares by 98%.

Table 8.8 Financial Cost of Investment

(Unit: Mil Rp)

		1984~1988	1989~1992	1993~2013	Total
Electrifi-cation	Foreign	6,664	4,824	2,968	14,456
	Local	5,920	5,200	688	11,808
Signals & Telecom.	Foreign	4,136	2,684	6,440	13,260
	Local	1,520	564	1,328	3,412
Civil Work	Foreign	3,452	19,116		22,568
	Local	2,776	13,668		16,444
Land	Local	44	2,020		2,064
Rolling Stock	Foreign	41,440	13,676	122,748	177,864
	Local	1,692	412	3,944	6,048
Total	Foreign	55,692	40,300	132,156	228,148
	Local	11,952	21,864	5,960	39,776
	Foreign & Local	67,644	62,164	138,116	267,924

(Note) Cost includes re-investment

Table 8.9 Government Subsidy Necessary for Operation

(Unit: Mil Rp)

Year	1989	1990	1991	1992	1993	1994	1995	1996
Subsidy	2,795	2,449	2,036	2,680	5,025	4,325	5,403	5,289

Year	1997	1998	1999	2000	2001	2002	2003	2004
Subsidy	4,783	4,222	4,781	4,466	5,416	5,231	4,352	3,401

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013
Subsidy	3,500	3,647	3,464	3,283	3,095	2,905	2,711	2,516	2,317

Table 8.10 Cash Flow for Base Case

(Unit: Mil Rp)

	1984 ∿ 1993	1994 ∿ 2003	2004 ∿ 2013	Total
Operating Revenue	20,378	84,553	142,864	247,795
Operating Profit	Δ14,985	Δ48,268	Δ30,840	Δ94,093
Net Profit	Δ29,435	Δ84,091	Δ66,456	Δ179,982
Investment	129,808	60,864	77,252	267,924
Debt Service	11.693	38,644	39,464	89,801
Net Cash Flow	Δ73,829	Δ92,880	Δ74,445	Δ241,154
Ratio (Net Cash Flow/ Operating Revenue)	Δ362.3%	Δ109.8%	Δ52.1%	Δ97.3%

Table 8.11 Cash Flow for Case I

(Unit: Mil Rp)

	1984 ∿ 1993	1994 ∿ 2003	2004 ∿ 2013	Total
Operating Revenue	20,378	84,553	142,864	247,795
Net Cash Flow	Δ103,218	Δ118,714	Δ34,982	Δ256,914
Ratio (Net Cash Flow/ Operating Revenue)	Δ506.5%	Δ140.4%	Δ24.5%	Δ103.7%

8.4 FINANCIAL EVALUATION FOR TRACK ADDITION AND OTHER IMPROVEMENTS ON TANGERANG LINE

8.4.1 Investment

The same rule of investment used for the economic analysis was applied.

The total investment including the re-investment cost up to the year 2013 is 225,900 million Rp, with an annual average of about 6,825 million Rp.

The investment amount from 1984 to 1997 (single track construction and rolling stock) is 68,664 million Rp, the investment amount from 1992 to 1996 (double track construction) is 60,196 million Rp, and the investment cost between 1997 and 2013 is 97,040 million Rp.

8.4.2 Profitability

When the present fares in JABOTABEK are applied in order to make the operating revenue and expenses balanced, it is necessary to have the government subsidies annually from 1989 to 2013. In 1997, necessary government subsidy will be increased considerably compared with that of 1996, due to the increase of working cost for double track operation.

Under the assumption that the figure of traffic demand forecast will not change in future, if the present railway fares are increased by 34% on a cumulative basis, there will no government subsidy necessary as far as operation is concerned. This increase is not enough to cover debt service, but enough to cover the operating expenses throughout the project life.

8.4.3 Cash Flow Analysis

(1) Base Case (foreign Currency Loan at 4% interest p.a., Government Budget for local currency)

Details of the Base Case are shown in Appendix 8. These details are summarized in Table 8.14.

Net cash flow of the Base Case continues to show a deficit throughout the project life. The net cash flow/revenue ratio shows that if the financing for the Base Case is chosen, it will be necessary to increase present fares by nearly 96% under the assumption that the figure of traffic demand forecast remains unchanged.

(2) Case I (Foreign Currency Loan at 9% interest p.a., Government Budget for local currency)

For the Case I, in order to make net cash flow positive and service the debt, it is necessary to increase present fares by nearly 104%.

8.4.4 Conclusion

If the present fares are increased by nearly 34%, roughly speaking there will be no subsidies necessary at the operating profit and loss level. A 34% increase of fares will make cumulative operating revenue and operating loss equal by the year 2013.

Our study shows that the financing plan of Base Case (concessional loan from overseas and government budget) is the most preferable financing if the project is to service the debt.

The evaluation shows that this project becomes viable if the following necessary measures are taken.

1) Local portion should be financed by government budget.

2) Low interest and long term concessional loans should be sought for the foreign currency portion.

3) At least a 34% increase of the existing fares will be necessary in order to produce operating profit on a cumulative basis.

4) If the project has to produce the funds for debt service, under the assumption that the most preferable funding is applied, it may be necessary to increase the present fares by 96%.

Table 8.12 Financial Cost of Investment

(Unit: Mil Rp)

		1984~1991	1992~1996	1997~2013	Total
Electrification	Foreign	6,212	4,340	3,004	13,556
	Local	5,508	4,456	668	10,632
Signals & Telcom.	Foreign	3,488	1,984	5,240	10,712
	Local	1,260	404	1,068	2,732
Civil Work	Foreign	8,348	14,540		22,888
	Local	5,840	15,264		21,104
Land	Local	1,360	3,048		4,408
Rolling Stock	Foreign	35,000	15,732	84,276	135,008
	Local	1,648	428	2,784	4,860
Total	Foreign	53,048	36,596	92,520	182,164
	Local	15,616	23,600	4,520	43,736
	Foreign & Local	68,664	60,196	97,040	225,900

(Note) Cost includes re-investment

Table 8.13 Government Subsidy Necessary for Operation

(Unit: Mil Rp)

Year	1989	1990	1991	1992	1993	1994	1995	1996
Subsidy	3,631	3,343	3,074	2,753	2,394	2,030	1,617	2,430

Year	1997	1998	1999	2000	2001	2002	2003	2004
Subsidy	4,111	5,064	4,808	4,134	4,073	3,434	2,459	3,071

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013
Subsidy	2,413	2,252	2,089	1,924	1,757	1,587	1,415	1,241	1,065

Table 8.14 Cash Flow for Base Case

(Unit: Mil RP)

	1984 ∿ 1993	1994 ∿ 2003	2004 ∿ 2013	Total
Operating Revenue	13,550	64,417	126,776	204,743
Operating Profit	Δ15,196	Δ34,160	Δ18,814	Δ68,170
Net Profit	Δ24,538	Δ65,392	Δ52,514	Δ142,444
Investment	80,300	81,248	64,352	225,900
Debt Service	11.109	36,716	37,494	85,319
Net Cash Flow	Δ27,268	Δ110,608	Δ57,759	Δ195,645
Ratio (Net Cash Flow/ Operating Revenue)	Δ201.3%	Δ171.7%	Δ45.6%	Δ95.6%

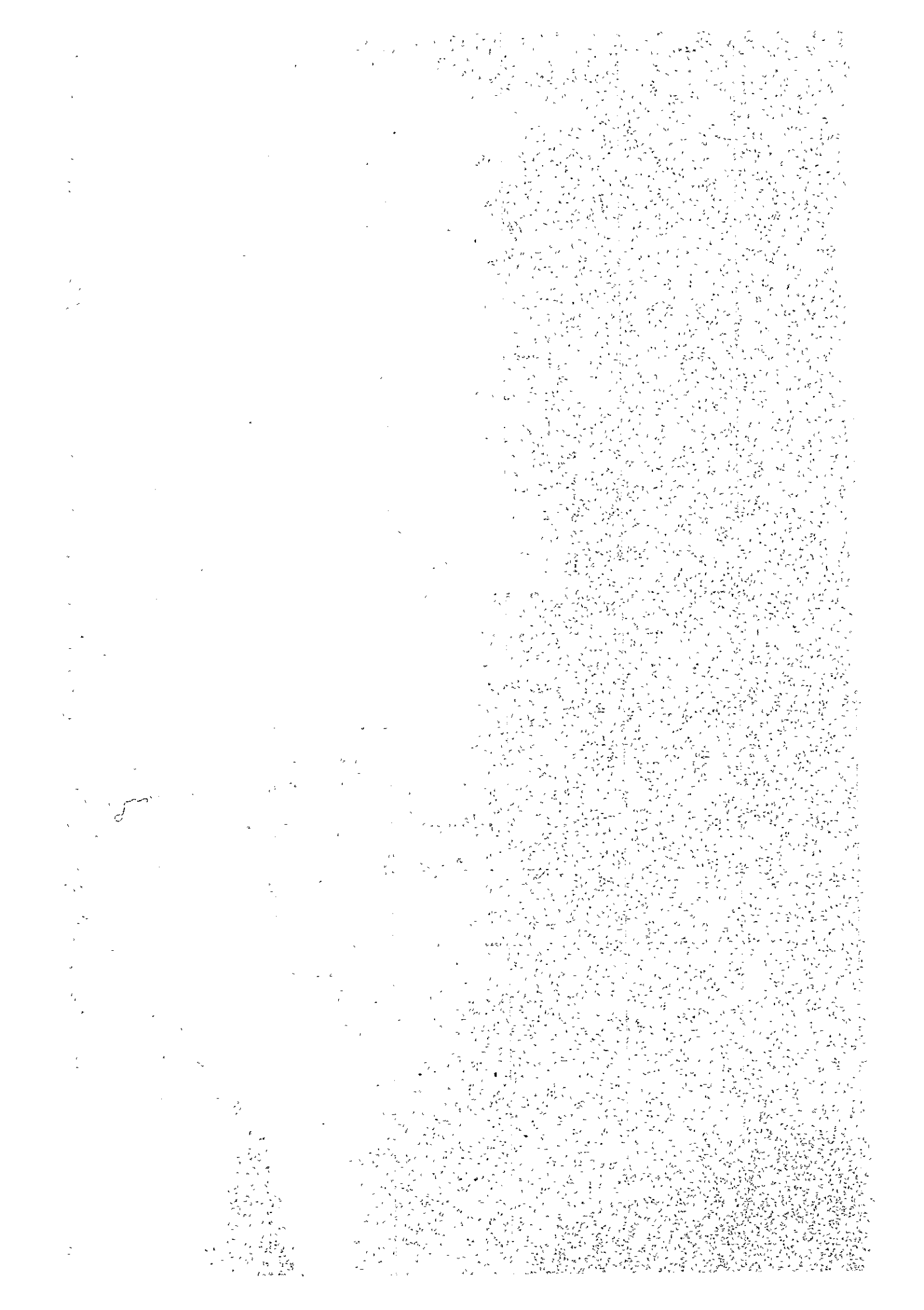
Table 8.15 Cash Flow for Case I

(Unit: Mil Rp)

	1984 ∿ 1993	1994 ∿ 2003	2004 ∿ 2013	Total
Operating Revenue	13,550	64,417	126,776	204,743
Net Cash Flow	Δ55,513	Δ135,645	Δ20,266	Δ211,424
Ratio (Net Cash Flow/ Operating Revenue)	Δ409,7%	Δ210.6%	Δ16.0%	Δ103.3%

CHAPTER 9

TOTAL EVALUATION



CHAPTER 9 TOTAL EVALUATION

9.1 TOTAL EVALUATION OF IMPROVEMENT PROJECT OF MANGGARAI STATION

(1) Significance of the project

Manggarai Station is the interchange station between the Central Line and Western Line, approximately 5 km from the city center. Therefore the surrounding area has potential for development as an urban sub-center. An urban renewal plan is being prepared for the over-crowded residential area on the west side of the station.

If Manggarai station is kept as it is, the interference rate of both lines at the flat junctions will be more than 60% in 1988 causing the capacity of rail transportation to stagnate. As a result, the other investments to improve the Central and Western Lines will not become effective as Manggarai Station will be the limiting point. Therefore it is necessary to do a grade separation of both lines to make the flow of railcars on both line smooth and efficient.

In addition, the surrounding area of Manggarai station will be promoted to be a city sub-center by the improvement.

(2) Technical and environmental evaluation

As an optimum plan for grade separation, G-14 plan is selected placing importance on the convenience of passengers, train operation and evaluating totally other conditions.

There is no technical problem for grade separation work. However, careful attention is needed for construction because execution will be done while trains are operating.

Access roads to the station and station front plaza must be arranged in accordance with the improvement project of Manggarai station.

The widening of JL Sultan Agung which is planned by the urban renewal project should be harmonized with this improvement project.

The safety of train operation will increase by grade separation.

As frequent service of Central Line and Western Line will be possible, part of the road traffic will transfer to the railway.

Consequently noise and pollution will decrease and road traffic congestion will be eased. On the other hand, noise along the railway will increase and interference time at the road level crossings will increase on both lines.

(3) Economic and financial evaluation

Total project cost of G-14 plan is estimated to be 34,440 million Rp (Local currency portion 16,340 mil. Rp and Foreign currency portion 18,100 mil. Rp).

This project represents only part of the total line investment. Therefore the EIRR obtained is 37.2%, so long as it was evaluated only from comparison between "With the project" and "Without the project".

The financial analysis also gives a good result calculated by the difference between "With the project" and "Without the project.

If this project is not implemented keeping pace with other improvement projects to the Central and Western Lines, other investments will not be effective.

Therefore, this project is certainly in this sense a key project.

Employment of 8,800 man-years can be expected by the construction of this project.

(4) Conclusion

This project is one of the most significant improvement projects of the Central and Western Lines and it should be implemented keeping pace with other improvement projects. The priority of this project's promotion is clearly recognized.

9.2 TOTAL EVALUATION OF IMPROVEMENT PROJECT OF MERAK LINE

(1) Significance of the project

At present the Merak Line is mainly used for long distance passenger and cargo transportation and does not function for urban traffic.

The surrounding area of the line outside DKI Jakarta area has potential for development as a desirable residential area because the ground conditions are suitable.

Road traffic is always congested and it will be difficult to deal with urban traffic only by roads in future.

It is expected that the Merak Line can be main axis for urban development by promoting the development of the area surrounding the line by providing for commuter traffic.

(2) Technical and environmental evaluation

This project involves electrification and track additions for the Merak Line (23.3 km between Tanah Abang Station and Serpong Station). Finally 8 car trains and a three minute headway train service will be possible.

There is no technical problem for electrification and track addition works.

It is necessary to remove squatters smoothly for the additional track. Access roads to the stations and station front plazas must be arranged in accordance with the improvement work.

When a frequent service will be possible, a part of the road traffic will be transferred to railway and congestion of the roads will be eased and noise and air pollution will decrease.

On the other hand, noise near the Merak Line will increase and the interference time of roads at level crossings will increase.

(3) Economic and financial evaluation

Total project cost is estimated to be 202,100 million Rp (Local currency portion 36,100 mil. Rp, Foreign currency portion 166,000 mil. Rp)

Investment for electrification and track addition will be done step by step, so in the economic evaluation a rather good result is obtained as EIRR = 24,8%

In the worst case of the sensitivity analysis, that is, cost 20% increase and traffic demand 30% decrease, it is still feasible as the EIRR = 16.6%.

In the case that a subsidy by the government is given to the local currency portion of initial investment, and the foreign currency portion is charged by a foreign soft loan but the railway makes repayment of the principal and interest, the rail fare level must increase 98% over the present fare level. A 98% fare increase is not realistic.

Fare levels of railways must be kept low politically. Consequently it is a world wide tendency that the initial cost of railway projects depends upon the subsidy by the government. In case that all initial cost is subsidized by the government, that is, repayment of soft loan for foreign currency portion and local currency portion are dependant upon a subsidy by government, the operation cost can be met from fare revenues if the fare level is set 40% higher than the present one.

This 40% higher fare level is almost the same as that of the bus. This plan is considered realistic and desirable.

Though principally, the initial construction cost is subsidized by the government, it is most desirable to decrease the initial cost. It is also neccessary to do a detailed stage construction. By the use of foreign loan of low interest, the interest burden to the government would be lightened.

At least, fare revenues must cover the daily train operation costs.

By the construction of this project, 17,300 man-years employment can be expected.

(4) Conclusion

This project has significant benefits to the nation and should be implemented.

9.3 TOTAL EVALUATION OF IMPROVEMENT PROJECT OF TANGERANG LINE

(1) Significance of the project

Tangerang Line is constructed as an urban railway. At present, it is not well utilized.

The surrounding area of Tangerang Line is developing as residential area and industrial area. Industries are rapidly developing. The area around Tangerang is also actively developing.

At present, road traffic is always congested and especially Tangerang highway is congested.

It will be difficult to deal with urban traffic only by road in future.

It is expected that the Tangerang Line can be main axis for urban traffic.

(2) Technical and environmental evaluation

This project involves electrification and track additions for the Tangerang Line (19.3 km between Duri Station and Tangerang Station). Finally 8 car trains and a three minute headway train service will be possible.

There is no technical problem for electrification and track addition works.

It is necessary to remove squatters smoothly for the additional track.

Access roads to the stations and station front plazas must be arranged in accordance with the improvement work.

When a frequent service will be possible, a part of the road traffic will be transferred to railway and congestion of the roads will be eased and noise and air pollution will decrease.

On the other hand, noise near the Tangerang Line will increase and the interference time of roads at level crossings will increase.

(3) Economic and financial evaluation

Total project cost is estimated to be 181,600 million Rp (Local currency portion 40,900 mil. Rp, Foreign currency portion 140,700 mil. Rp)

Investment for electrification and track addition will be done step by step, so in the economic evaluation a rather good result is obtained as EIRR = 23.2%

In the worst case of the sensitivity analysis, that is, cost 20% increase and traffic demand 30% decrease, it is still feasible as the EIRR = 15.9%.

In the case that a subsidy by the government is given to the local currency portion of initial investment, and the foreign currency portion is charged by a foreign soft loan but the railway makes repayment of the principal and interest, the rail fare level must increase 96% over the present fare level. A 96% fare increase is not realistic.

Fare levels of railways must be kept low politically, consequently it is a world wide tendency that the initial cost of railway projects depends upon the subsidy by the government. In case that all initial cost is subsidized by the government, that is, repayment of soft loan for foreign currency portion and local currency portion are dependant upon a subsidy by government, the operation cost can be met from fare revenues if the fare level is set 40% higher than the present one.

This 40% higher fare level is almost the same as that of the bus. This plan is considered realistic and desirable.

Though principally, the initial construction cost is subsidized by the government, it is most desirable to decrease the initial cost. It is

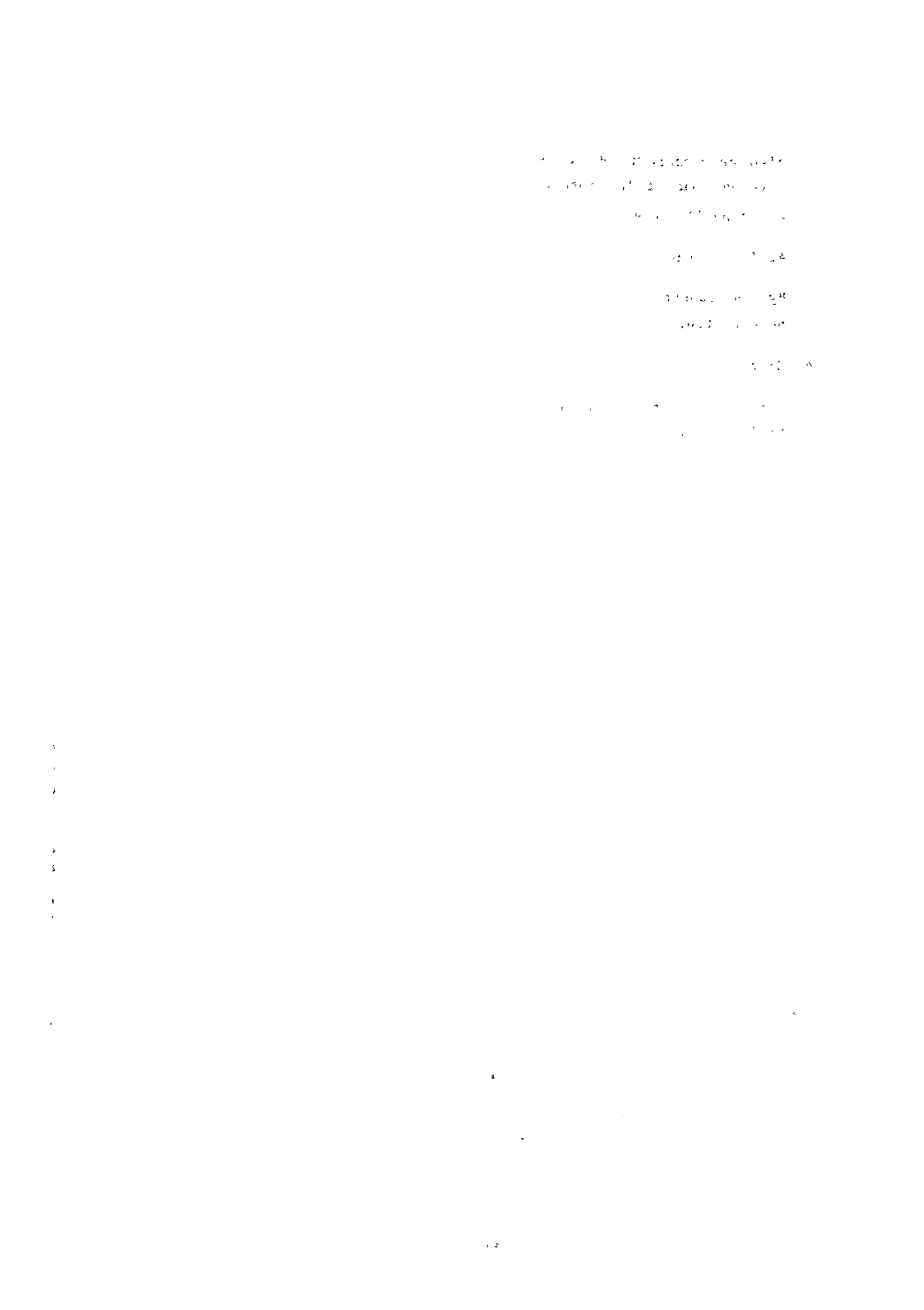
also neccessary to do a detailed stage construction. By the use of foreign loan of low interest, the interest burden to the government would be lightened.

At least, fare revenues must cover the daily train operation costs.

By the construction of this project, 15,800 man-years employment can be expected.

(4) Conclusion

This project has significant benefits to the nation and should be implemented.



APPENDIX

APPENDIX 1 LIST OF BOOK QUOTED

CHAPTER 1

(1) Statistical Yearbook of Jakarta 1982, 1981

(2) JABOTABEK Metropolitan Development Planning 1980
Prospect for Regional Development in JABOTABEK

(3) Statistical Yearbook of Indonesia 1982, 1981

(4) Pola Dasar Tata Ruang Daerah DKI Jakarta 2005 (Draft 1983)
(DKI Jakarta Master Plan 2005 (Draft))

(5) Urban Development Planning Study on Surabaya Metropolitan Area (March, 1981 JICA)

(6) Regional Income of Jakarta 1975 ∿ 1980

(7) Cost of Living Survey Jakarta 1977/1978

(8) Statistic Wilayah DKI Jakarta 1982

CHAPTER 2

(1) Report on Urban/Suburban Railway Transportation in "JABOTABEK" area, March, 1981 JICA

(2) Feasibility Study on Jakarta Harbour Road Project, 1981

(3) The Study on Electrification Project of Main Railway Lines in Java, March 1983

(4) Penduduk Jawa Barat per Kecamatan tahun 1980

(5) Travel Time Study & Traffic Volume Count, DKI JAKARTA, 1982/1983 by DLLAJR DKI JKT

CHAPTER 3

(1) Study on Urban Renewal Housing Project in Jakarta (JICA) 1983

CHAPTER 7

(1) Report on Urban/Suburban Railway Transportation in "JABOTABEK" area (Master Plan), March 1981 JICA

(2) Feasibility Study on Track Elevation of Central Line March 1982 JICA

(3) The Study on Electrification Project of Main Railway Lines in Java (Master Plan) March 1983 JICA

(4) Report on Feasibility Study on New Railway Line for Cengkareng Airport July 1983 JICA

(5) Feasibility Study on Jakarta Harbour Road Project November 1981 JICA

(6) STATISTICAL YEAR BOOK OF INDONESIA 1982 BIRO PUSAT STATISTIK

(7) INDIKATOR EKONOMI MEI 1983 BIRO PUSAT STATISTIK

(8) Indonesia 1981 AN OFFICIAL HANDBOOK DEPARTMENT OF INFORMATION

(9) INDONESIAN FINANCIAL STATISTICS APRIL 1983 BANK INDONESIA

(10) WEEKLY REPORT NO. 1265 BANK INDONESIA

(11) DAFTAR HARGA SATUAN BOHON BONGUNON DKI-JAKARTA JULY & AUGUSTUS 1983 DEPARTMENT PEKERJAAN UMUM DIRECTRAT JENDERAL CIPIA KARYA

(12) RAILWAYS STATISTICS 1981 BIRO PUSAT STATISTIK

(13) GUIDE TO THE WITHHOLDING OF THE WORKER'S/EMPROYEES'S INCOME TAX 1980 Weekly Review "BERITA PAJAK"

(14) PENUNTUN BAGI MAJIKAN/PENGUSAHA 1983 YAYASAN BINA PAJAK

(15) TARIP PAJAK PENJUALAN DALAM NEGERI MAJALAH MINGGUAM BERITA PAJAK

(16) LAPORAN PROYEK PENGURUSAN PERSYARATAN KERJA

DAN PENGUPAHAN DI DKI JAKARTA TAHUN 1982/1983

DEPARTEMEN TENAGA KERJA DAN TRANSMIGRASI KANTOR WILAYAH DIREKTORAT JENDERAL PEMBINAAN HUBUNGAN DAN PERLINDUNGAN TENAGA KERJA DKI JAKARTA

APPENDIX 2 TRAFFIC SURVEYS FOR RAILWAY PASSENGERS

(1) The purpose of the survey

The purpose of the traffic survey is to provide data compatible with the actual traffic situation and to ensure the method of traffic demand forecast.

The survey consists of an interview survey and a traffic count survey at railway stations in the JABOTABEK area.

The interview survey was planned to collect such trip information as origins and destinations of the railway passengers, trip purposes, access time and modes used to get to the stations.

The traffic count survey was carried out to provide the expansion factors to be applied for the sample data collected by the interview survey.

Based on the collected samples, a trip distribution pattern of railway passengers of Tangerang Line, Merak Line, Bogor Line and Bekasi Line was analysed in order to provide essential factors for forecasting future traffic demand.

(2) Survey locations and schedule

A preliminary site survey was conducted and some stations in the JABOTABEK area were found to be unused. Interviews with station masters or staff were also made to define the converage of the survey area. Survey stations were selected to include those of about 1 hour travel time to the urban center of Jakarta, and also those which produce a relatively higher proportion of commuters to the Jakarta area. As a result, the traffic survey was executed at the stations and at the times shown below:

1) Tangerang Line (05.00 ∿ 19.00, Monday, Sep. 19, 1983)

1. Grogol
2. Pesing
3. Bojongindah
4. Rawabuaya
5. Kalideres
6. Poris
7. Batuceper
8. Tangerang

2) Merak Line (05.00 ∿ 19.00, Tuesday, Sep. 20, 1983)

1. Sudimara
2. Rawabuntu
3. Serpong
4. Cisauk
5. Parung Panjang

3) Bekasi Line(5.00 ∿ 20.00, Wednesday, Sep. 21, 1983)

1. Klender
2. Klender Buru
3. Cakung
4. Kranji
5. Bekasi
6. Tambun
7. Cikarang
8. Lemahabang
9. Kedunggedeh
10. Karawang

4) Bogor Line (04.30 ∿ 21.00, Thursday, Sep. 22, 1983)

1. Tebet
2. Duren Kalibata
3. Pasar Minggu
4. Lenteng Agun
5. Pondok Cina
6. Depok Baru
7. Depok
8. Citayam
9. Bojonggedeh
10. Cilebut
11. Bogor

(3) Method of the survey

(a) Traffic count survey

Only the passengers getting onto trains in the Jakarta direction were counted at the respective survey stations.

The number of persons on the platform was counted before and after the train arrived and left the station respectively, and the difference was recorded as the number of boarding passengers.

(b) Interview survey

The interview was also made with persons waiting on a platform in the Jakarta direction. A target sample rate was planned to be 20% at the station of more than 100 passengers per train and 50% at those of less than 100 passengers per train.

The survey forms used for the traffic survey are presented in Fig. A.1 and Fig. A.2.

The questions to be filled out by the interview survey are as follows:

1) Survey hour
2) Trip purpose
3) Address of trip origin
4) Access mode to the station
5) Access time
6) Arriving railway station
7) Egress mode to trip destination
8) Egress time
9) Address of trip destination

In parallel with the traffic survey, a questionnaire about the number of tickets sold for trains in the Jakarata direction and also monthly commuter passes was sent to each of the survey stations.

Therefore, the Jakarta-bound passenger traffic on the survey date, daily data for the week of survey, monthly data from 1980 to 1983 were collected from the survey stations.

Hari/Tanggal : .....

Stasiun K.A. : .....

Nama Surveyor : .....

Nama Supervisor : .....

SURVEY PENUMPANG

NO: SAM-PEL	NO: KERETA	WAKTU KERETA BERANGKAT	SURVEYOR A		SURVEYOR B		SURVEYOR C		SURVEYOR D		JUMLAH
			SEBE-LUM	SESU-DAH	SEBE-LUM	SESU-DAH	SEBE-LUM	SESU-DAH	SEBE-LUM	SESU-DAH	
			SISA		SISA		SISA		SISA		
1.		jam menit									
2.		jam menit									
3.		jam menit									
4.		jam menit									
5.		jam menit									
6.		jam menit									
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18.		jam menit									
19.		jam menit									
20.		jam menit									

Fig. A.1 Passenger Count Survey Form

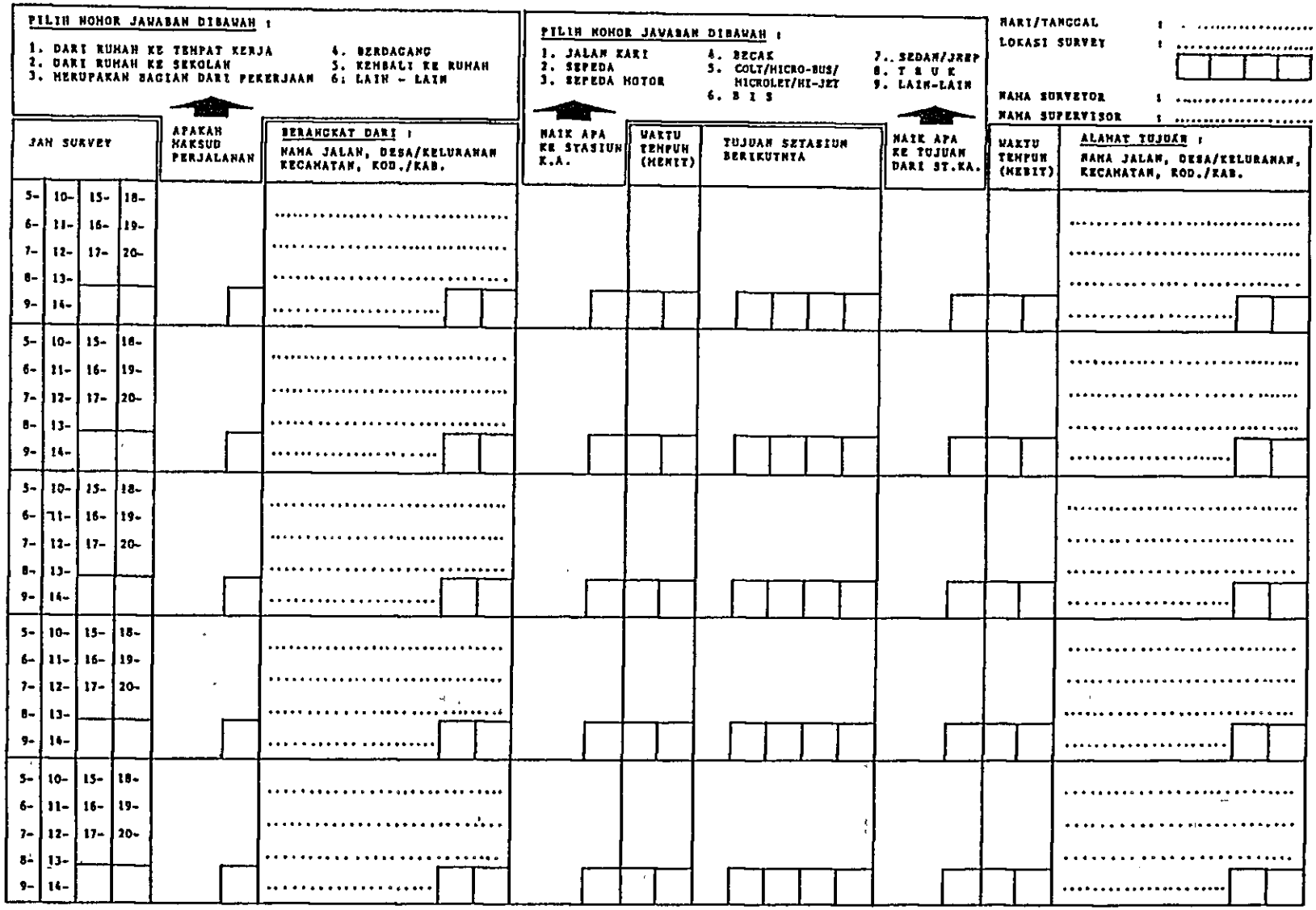


Fig. A.2 Passenger Interview Survey Form

(4) Zone division for traffic analysis

The study area was divided into traffic zones in consideration of the following conditions:

1) The administrative units of the Kalurahan districts are adopted as the basis for zones in DKI Jakarta with reference to the availability of data and information to be collected.

2) The Kecamatan districts which are higher administrative units of Desa districts are adopted as the basis for zones in BOTABEK area.

3) Zoning in the Feasibility Study on Jakarta Harbour Road Project was taken into account for the utilization of its 1980 person trip O-D matrix.

4) Zone division adopted in the "JABOTABEK Metropolitan Development Plan" was also considered so as to estimate future zonal indices.

Provision of traffic zones to each railway station is desirable in order to estimate the traffic flows between the two stations. However, to do this creates too small a zone for statistical data and future planning parameters be accurate.

Therefore, one representative railway station was assumed to be located in each zone through which a railway line is operated.

Consequently, zones of the study area are defined as follows:

DKI Jakarta:	30 zones	No. 1 - 30
BOTABEK:	23 zones	No. 31 - 53
Outside JABOTABEK:	3 zones	No. 54 - 56
Total:	56 zones	

The zoning maps for DKI Jakarta and outside Jakarta are shown in Fig. A.3 and Fig. A.4 respectively.

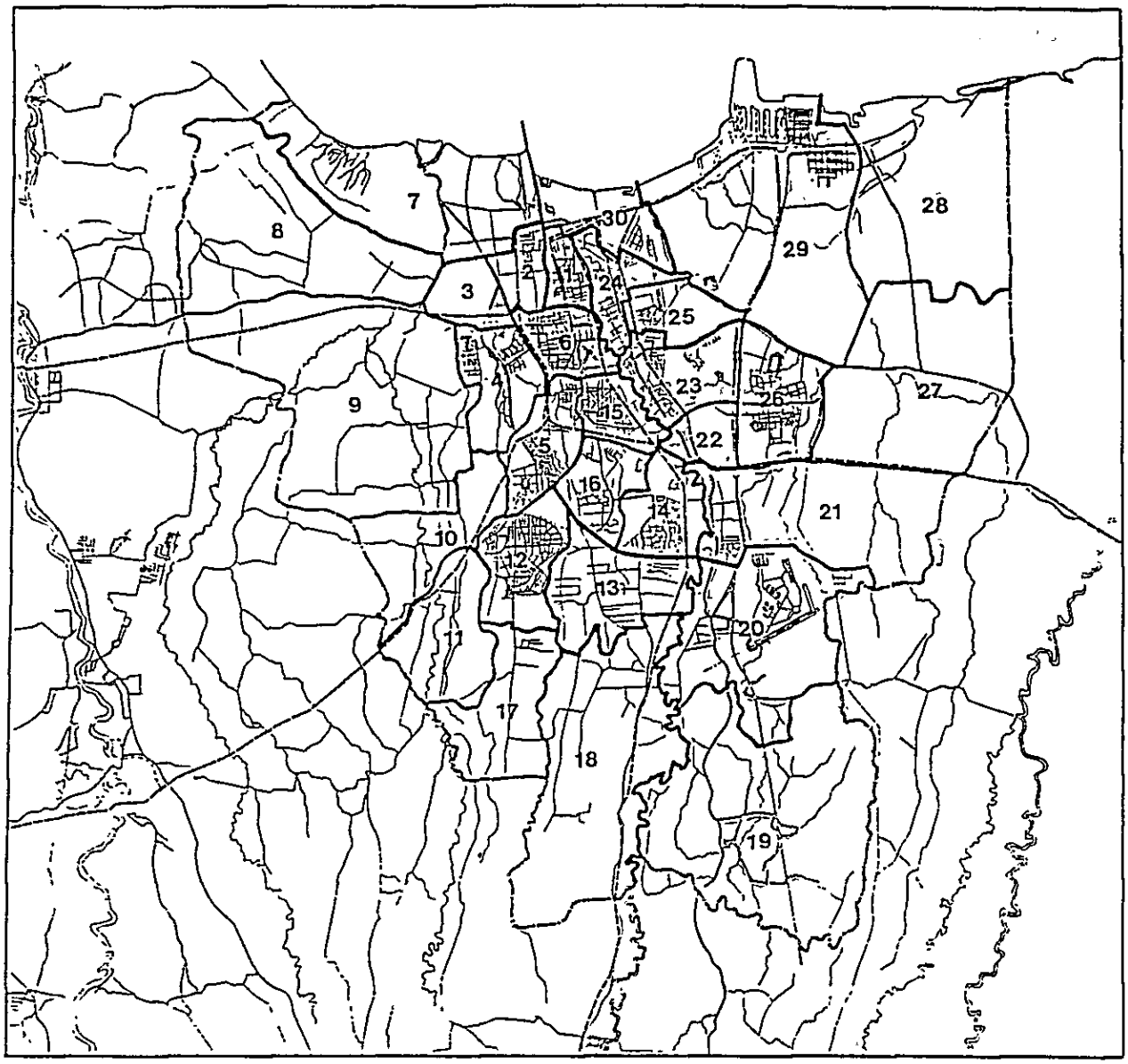


Fig. A.3 Zone Division of DKI Jakarta

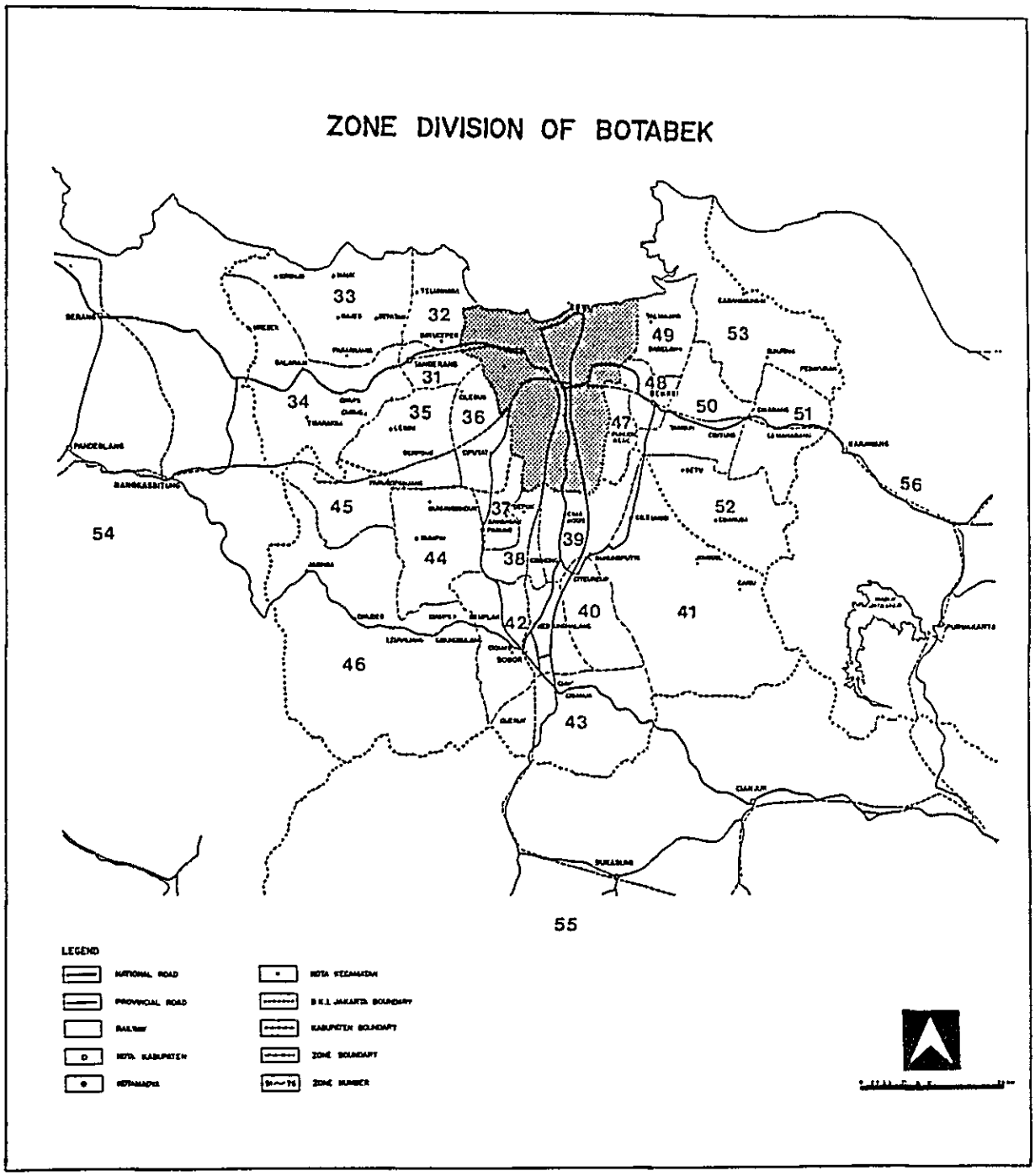


Fig. A.4 Zone Division Outside Jakarta

APPENDIX 3 CALCULATION OF RATE OF INTERFERENCE

As mentioned in this report, to measure interference of a train movement at crossing, a Rate of interference is applied, generally. The Rate of Interference is calculated as a quotient of time of Interference in a given time per given time in percentage.

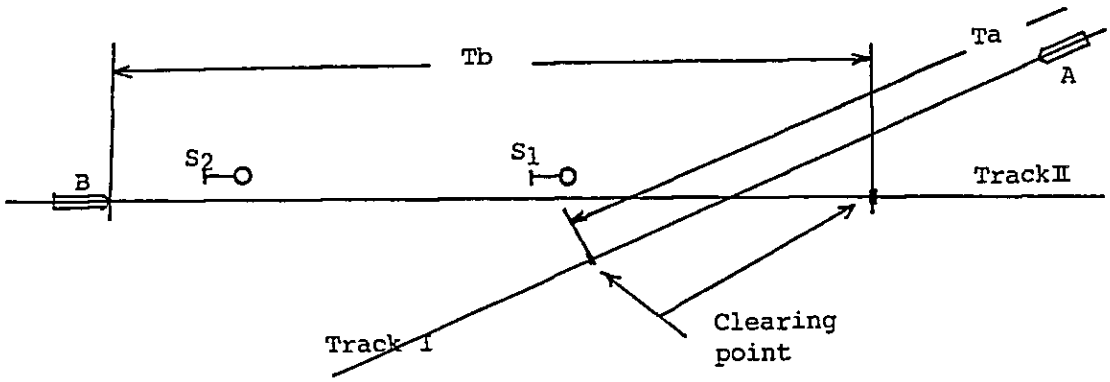


Fig. A.5 Track Level Crossing

In case of Train B

On calculation of Tb, those should be supposed that:

S_1 indicates Red

S_2 indicates Yellow

After train passes S_2, S_1 indicates Green

Train should reduce its operating speed on passing S_2 down to not more than 45 km/h to be able to stop before S_1. Therefore, counting of time of Interference (Tb) should be started at the time of brake application for this speed reduction. In case of Manggarai Station, there are many switches (double slip switch) between S_1 and the platform, hence the train should operate at no more than 25 km/h after passing S_1.

The time when the rear most part of train passes the clearing point, is the end of time of Interference (Tb). But after train passes the

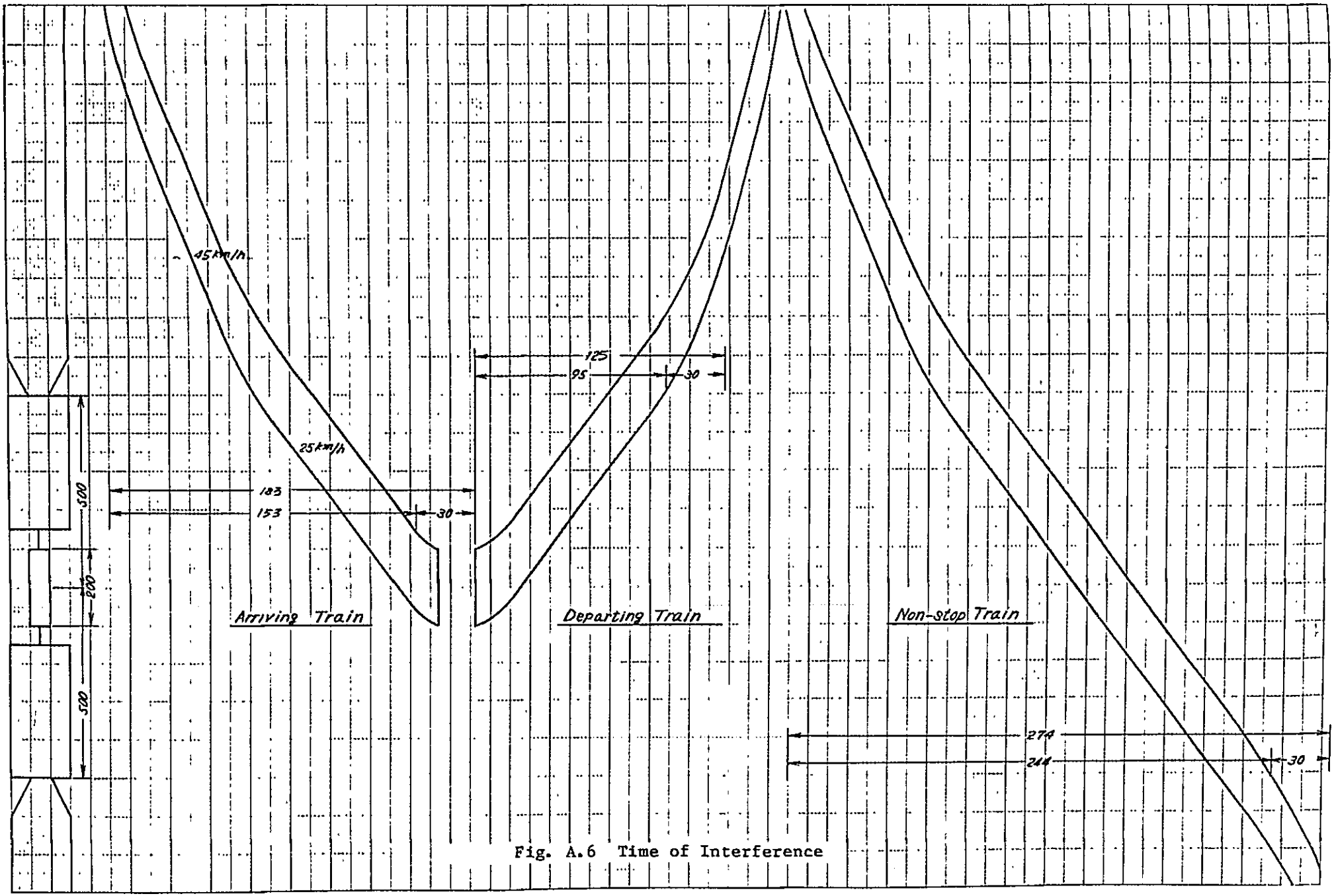


Fig. A.6 Time of Interference

clearing point, signals and turn-outs should be set back to normal position. This takes around 30 sec. and 10 sec. for manual interlock system and electric interlock system, respectively. Therefore, total time of Interference is

$$Tb + 30 \text{ or } Tb + 10 \text{ seconds.}$$

The same calculation should be carried out regarding Train A.
The time of Interference is illustrated in Fig. 2.

In case of Manggarai Station, turn-outs are grouped North End and South End, thus time of Interference of non-stop train can be divided into two.

Rate of Interference is calculated as $\Sigma\{(Tb+30) + (Ta+30)\}$/given time x 100(%) (Manual interlock system is provided at Manggarai Station.).

Generally, the Rate of Interference is considered as follows:-

Below 40% .....moderate value

40 ∿ 60% .....difficult to make the train operation plan depending upon the condition of train operation

over 60% .....impossible to make the train operation plan, so appropriate countermeasures to reduce the Rate of Interference below 60%

Notable point on evaluation of Rate of Interference is as follows:
In the extreme case that number of trains on track I in Fig. 1 is only one while that of track II is 15 and Rate of Interference is 50%. In this case, there is not any problem in achieving the train operation plan. But in case where the number of trains on track I is 8, whilst that of track II is also 8 with 50% of Rate of Interference, achieving the train operation plan might be difficult.

Therefore, on the evaluation of Rate of Interference, the number of conflicting train movements should be checked.

APPENDIX 4 TRAIN PERFORMANCE IN EXTRAORDINARY CONDITION

(a) Performance of Starting-torque on a 25% up-gradient

Extended operation at low speed causes overheating of the main resistor, so acceleration should be not less than 0.5 km/h/s, even in emergency situations. The normal train formation is 2M2T, or 4M4T, but when a motor car is defective, the train formation will change;

case (1) $\overset{\times}{T}MMT$ 1M3T
case (2) $\overset{\times\times}{T}MMT$ + TMMT 2M6T
case (3) $\overset{\times}{T}MMT$ + TMMT 3M5T

(X ..... defective motor car)

In these cases, climbing up a gradient by using the remaining traction motors requires more current. In the ordinary condition, the limiting current for step up is set at 365A for an empty train and 440A for a fully loaded train. However, in the extraordinary condition, to get an acceleration of 0.5km/h/s, the limiting current should be increased by using the H.A.S. (High Acceleration Control Switch).

The limiting current, when the H.A.S. is applied, is increased to 505A for an empty train and 580A for a fully loaded train.

Table A.1 shows train acceleration in the extraordinary condition of 1M3T train formation.

Table A.1 Train Acceleration on a 25% Gradient

Train formation	Condition	Limiting Current	Acceleration (km/h/s)
1M3T	Empty car	Normal set; 365A	- 0.05
		H.A.S: 505A	+ 0.58
	Full Load	Normal set; 440A	- 0.07
		H.A.S: 580A	+ 0.40

According to the Table A.1 application of the H.A.S gives an empty train an acceleration of 0.58 km/h/s but only 0.4 km/h/s for a fully

loaded train. Therefore it is necessary to remove all passengers from the train to obtain a minimum acceleration of 0.5km/h/s.

(b) Safety features of brake system

The air brake system of Electric Railcars for PJKA is the "SED" Brake System which has the function of the both Electro-Pneumatic Straight Air Brake Application and Automatic Brake Application. Brake performance mentioned in the Text is obtainable either with the Automatic Brake or the Electro-Pneumatic Straight Air Brake.

This system has the following safety features.
When the Dynamic Brake is effective, air of Straight Air Pipe (S.A.P) is supplied to the Inshot Valve through the Dobule Check Valve, and is suppressed to the inshot pressure and supplied to the "J" Relay Valve through the Lock-Out Magnet Valve and "J" Relay Valve supplies the air from Supply Reservoir (SR) to the Brake Cylinder proportional with the Inshot pressure.

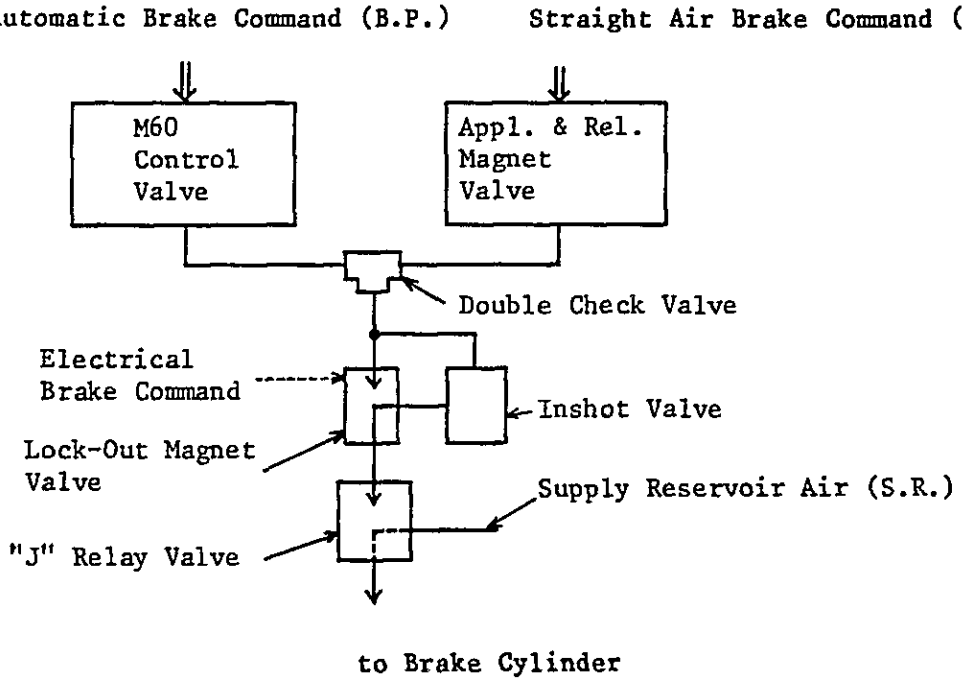


Fig. A.7 Brake System (When Dynamic brake is effective)

When the Dynamic brake is ineffective, air of Straight Air Pipe (S.A.P) is not suppressed to the inshot pressure because the Lock-Out Magnet Valve is not energized, and then S.A.P air is supplied to the "J" Relay Valve through the Lock-Out Magnet Valve not through Inshot Valve. "J" Relay Valve supplies the air from Supply Reservoir (S.R) to the Brake Cylinder.

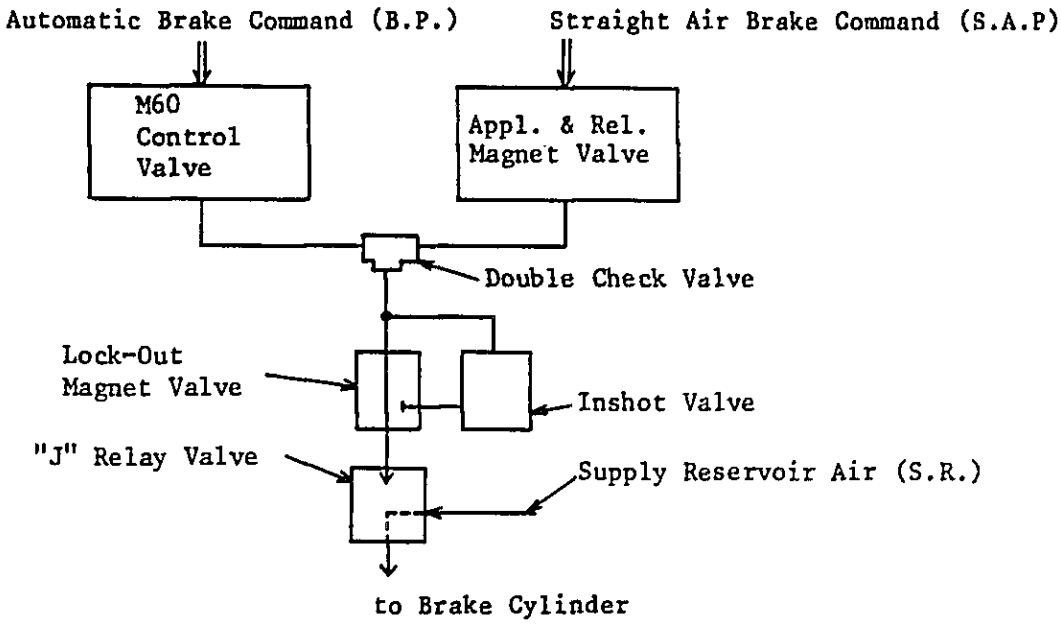


Fig. A.8 Brake System (When Dynamic brake is ineffective)

If the brake hose is cut in operation, the brake pipe pressure will rapidly drop, and will cause the automatic application of the Emergency Automatic brake, therefore the train will be secured from an accident.

APPENDIX 5 AXLE LOAD AND TRACK STRUCTURE

Axle load

R.M. load standard in P.J.K.A was fixed in the period of steam locomotives. The effective power of steam locomotives is not good, and so the wheel loads need to be high, moreover, a driving wheel has a counterweight, as a result the standard dynamic loads of steam locomotives become higher than other locomotives.

Axle loads are a concern in the design of bridges and tracks.
Reducing the axle load by 2 tons will reduce the cost of construction by 3% to 5%.

It is clear that a heavy locomotive destroys tracks, especially, in the section of curvature and in turnouts.

For these reasons, it is better to reduce axle loads to reduce the maintenance cost of tracks and bridges.

So every railway in the world makes an effort to reduce axle load.

On the other hand, the same tractive effort can be obtainable with lighter axle load by technical innovation recent days, especially, in the field of electrical devices.

Actual condition of locomotives axle load in the world is showed in Fig. A.9.

There are many kind of cars which have many kinds of axle load and arrangement of axles in railways, so it is necessary to standerdize live load for the design of bridges.

JNR has classified the loads considering actual axle load and arrangement of axles, this is KS load.

These loads affect to the design as the bending moment and shearing stress.

The calculation of K.S. load is considered in an axle load, the arrangement of axles and a length of locomotive, 18.9 ton axle load is composed of 18.0 ton and adding 0.9 ton which is 18 ton x 5%.

$$\frac{\text{Total weight}}{\text{Length of locomotive}} = \frac{18.9\text{t} \times 6 \text{ axles}}{17.7 \text{ m}} = 6.4 \text{ ton/m}$$

Axle load of 18.9 tons is the maximum load in J.N.R. A locomotive of axle load 18.9 tons is equivalent to K.S 16. (See Fig. A.10)

Track structure

The track structures are mainly designed according to traffic volume and train speed.

The tracks of JNR are classified into 4 classes shown in Table A.3

Actual model in J.N.R. is showed in Table A.2

Table A.2 Models of J.N.R

Type	maximum axle load	Max. Speed	Number in JNR (1981)
DD 13	14.15 ton	70 km/h	316
DD 14	15.03	70	43
DD 15	13.75	70	50
DD 16	13.	70	65
DD 51	15.0	95	640
DE 10	13.0	70	705
DE 11	13.2	70	116
DE 15	13.0	70	85
DF 50	14.3	90	25
EF 15	DC 14.3	75	70
EF 58	DC 14.4	100	110
EF 60	DC 16.0	90	134
EF 62	DC 16.0	100	52
EF 64	DC 16.0	100	111
EF 65	DC 16.0	100	309
ED 75	AC 16.8	100	300
ED 76	AC 16.0	100	139
EE 70	AC 16.0	100	81
EF 80	AC.DC 16.0	100	45
EF 81	AC.DC 16.8	100	156

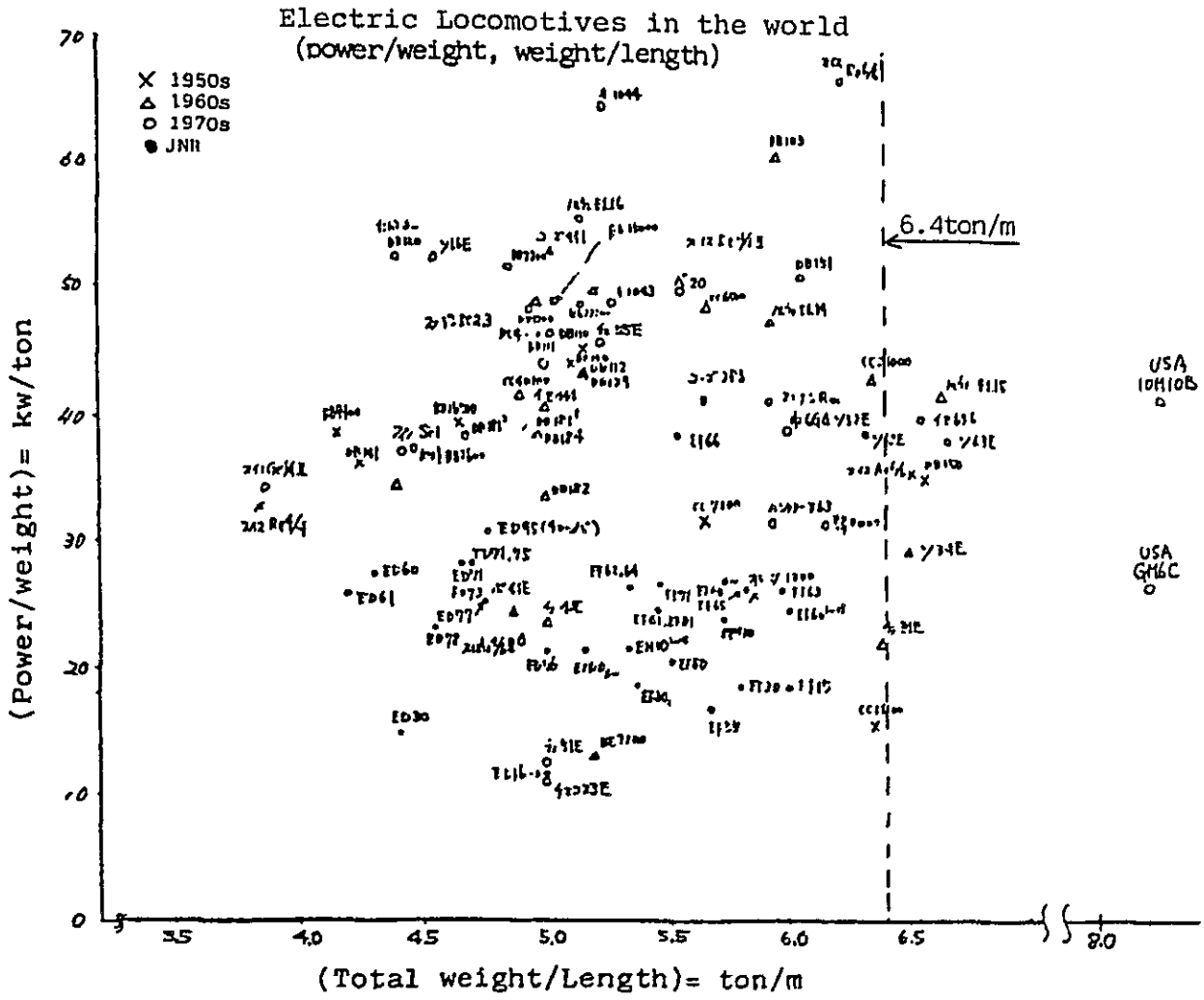
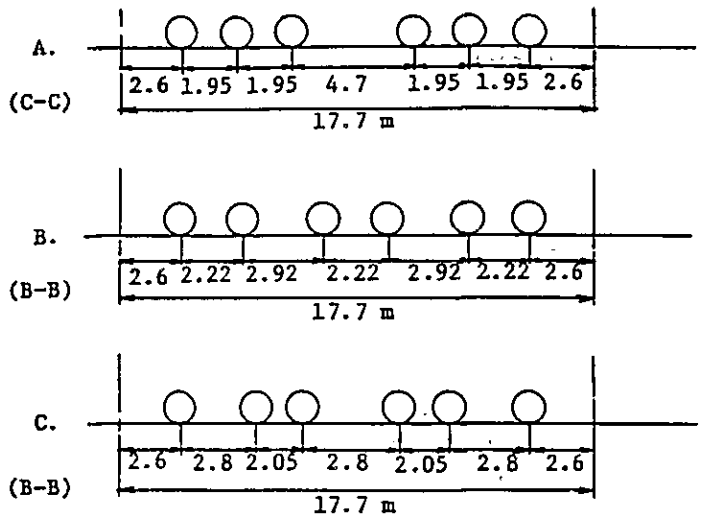


Fig. A.9 Axle Load in the World



(18.9 x 6)/6.4 = 17.72 m

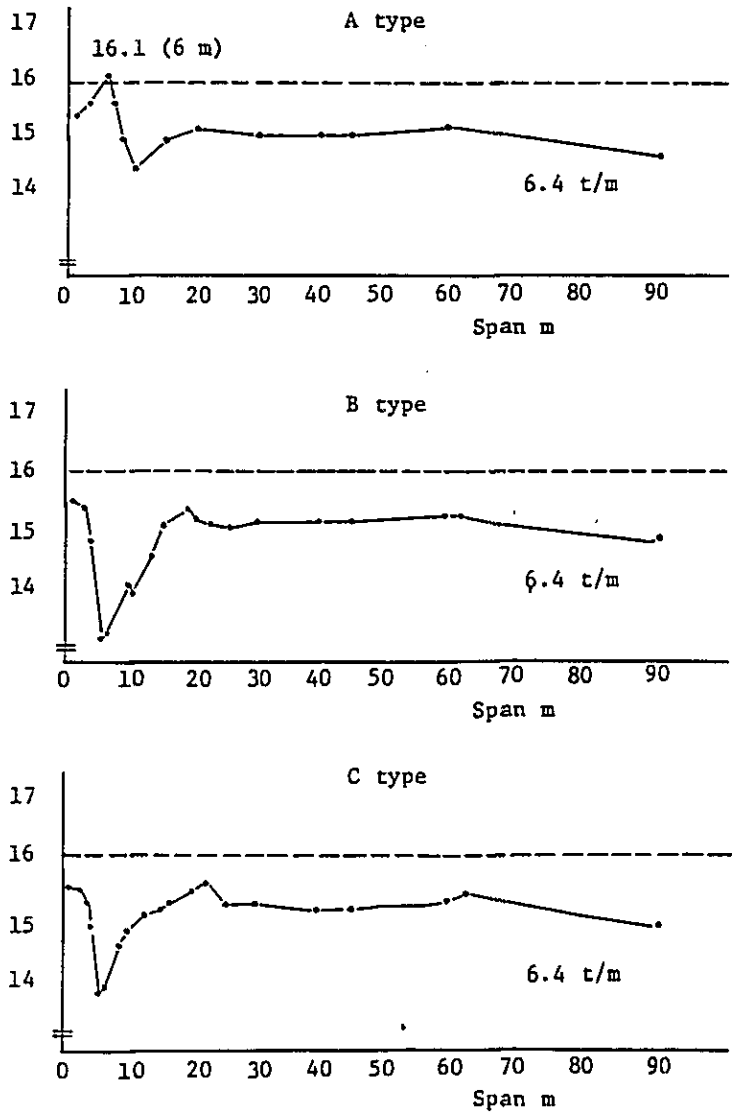


Fig. A.10 Axle Arrangement and K.S. Load

Table A.3. Truck structure

Track type	Passing tonnage million tons/year	Rail	Sleeper Pis/km	Ballast cm	Max Speed
A	3 - 5	40 N	Wooden 1480	20	85
B	5 - 8	50 N	Wooden 1560	25	95
C	8 - 10	50 N	P C 1560	25	100
D	10 - 20	50 N	P C 1760	25	110

APPENDIX 6 RESULT OF STANDARD PENETRATION TEST

PROJECT ..... Grade Separated Crossing F/S
LOCATION ..... Manggarai Station
BORE HOLE B-1
TOTAL DEPTH ... 22.50 M
TEST METHOD ... Rotary Drilling, SPT, Sampling
TYPE OF MACHINE ... Tone/UD-5

COMMENCING DATE ... 23 August 1983
COMPLETION DATE ... 25 August 1983
DRILLED BY ..... Sjachrul/Sutarno
LOGGED BY ..... Idi Sadono

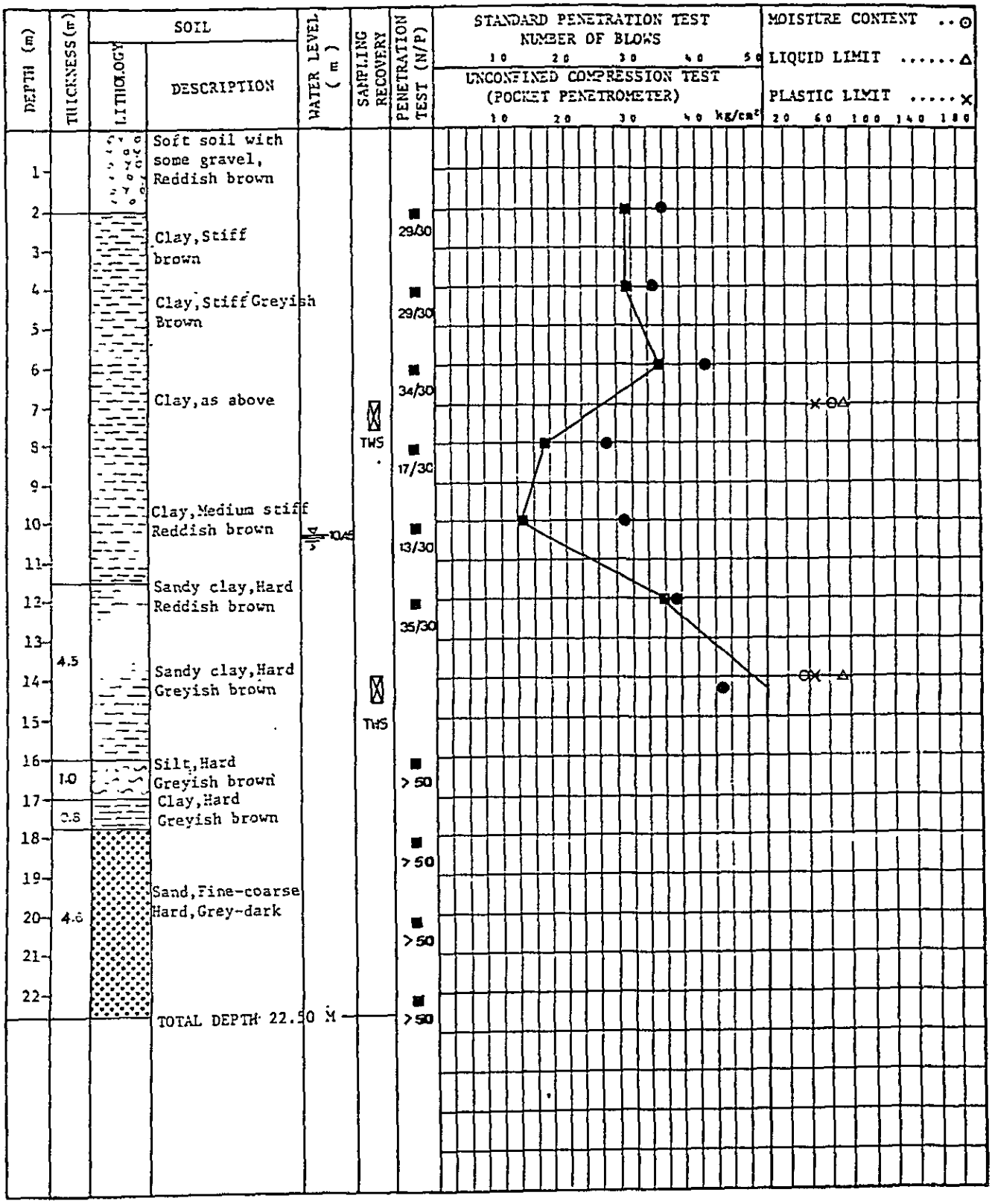


Fig. 3.27 Result of S.P.T (B-1)

PROJECT ..... Grade Separated Crossing F/S
LOCATION ..... Manggarai Station
BORE HOLE B-2
TOTAL DEPTH ... 13.30 M
TEST METHOD ... Rotary Drilling, SPT, Sampling
TYPE OF MACHINE ... Tone/UD-5

COMMENCING DATE ... 26 August 1983
COMPLETION DATE ... 28 August 1983

DRILLED BY ..... Sjachrul/Sutarno

LOGGED BY ..... Idi Sadono

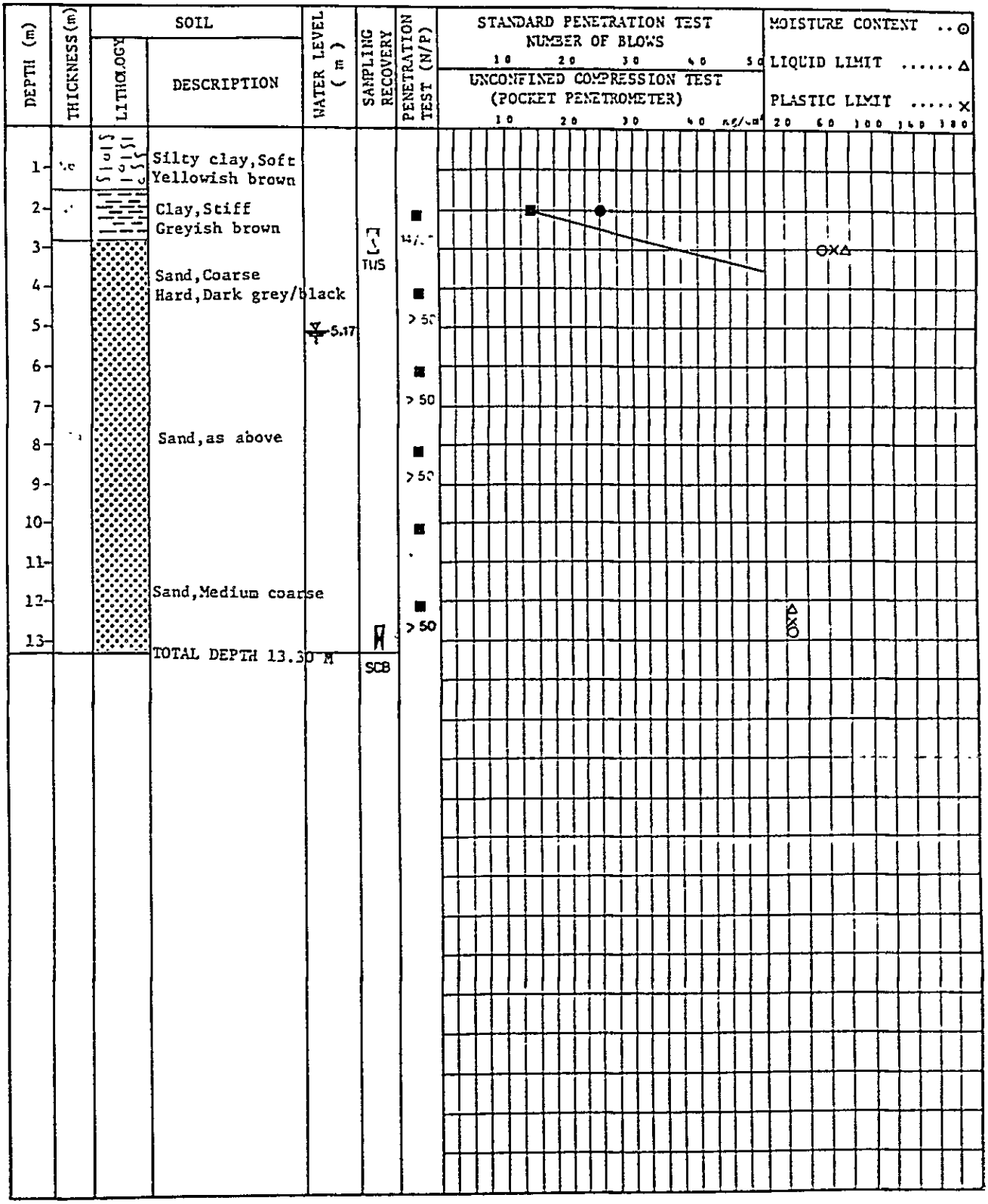


Fig. 3.28 Result of S.P.T (B-2)

PROJECT ..... Grade Separated Crossing F/S
LOCATION ..... Manggarai Station
BORE HOLE B-3
TOTAL DEPTH ... 18.40 M
TEST METHOD ... Rotary Drilling, SPT, Sampling
TYPE OF MACHINE ... Tone/UD-5

COMMENCING DATE ... 30 August 1983
COMPLETION DATE ... 1 September 1983

DRILLED BY ..... Sjachrul/Sutarno

LOGGED BY ..... Idi Sadono

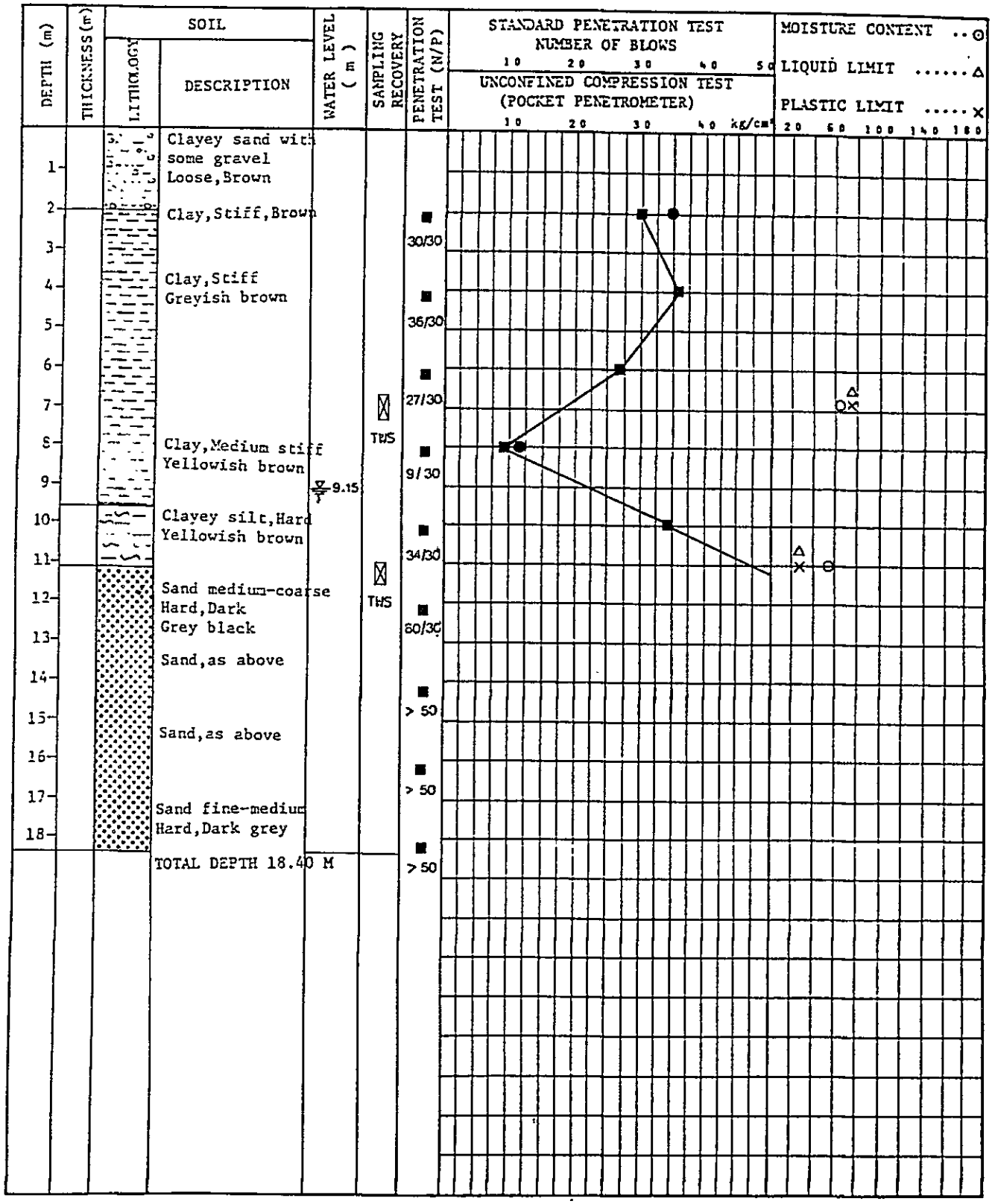


Fig. 3.29 Result of S.P.T (B-3)

PROJECT ..... Grade Separated Crossing F/S
LOCATION ..... Manggarai Station
BORE HOLE B-4
TOTAL DEPTH ... 24 M
TEST METHOD ... Rotary Drilling, SPT, Sampling
TYPE OF MACHINE ... Tone/UD-5

COMMENCING DATE ... 19 August 1983
COMPLETION DATE ... 21 August 1983

DRILLED BY ..... Sjachrul/Sutarno

LOGGED BY ..... Idi Sadono

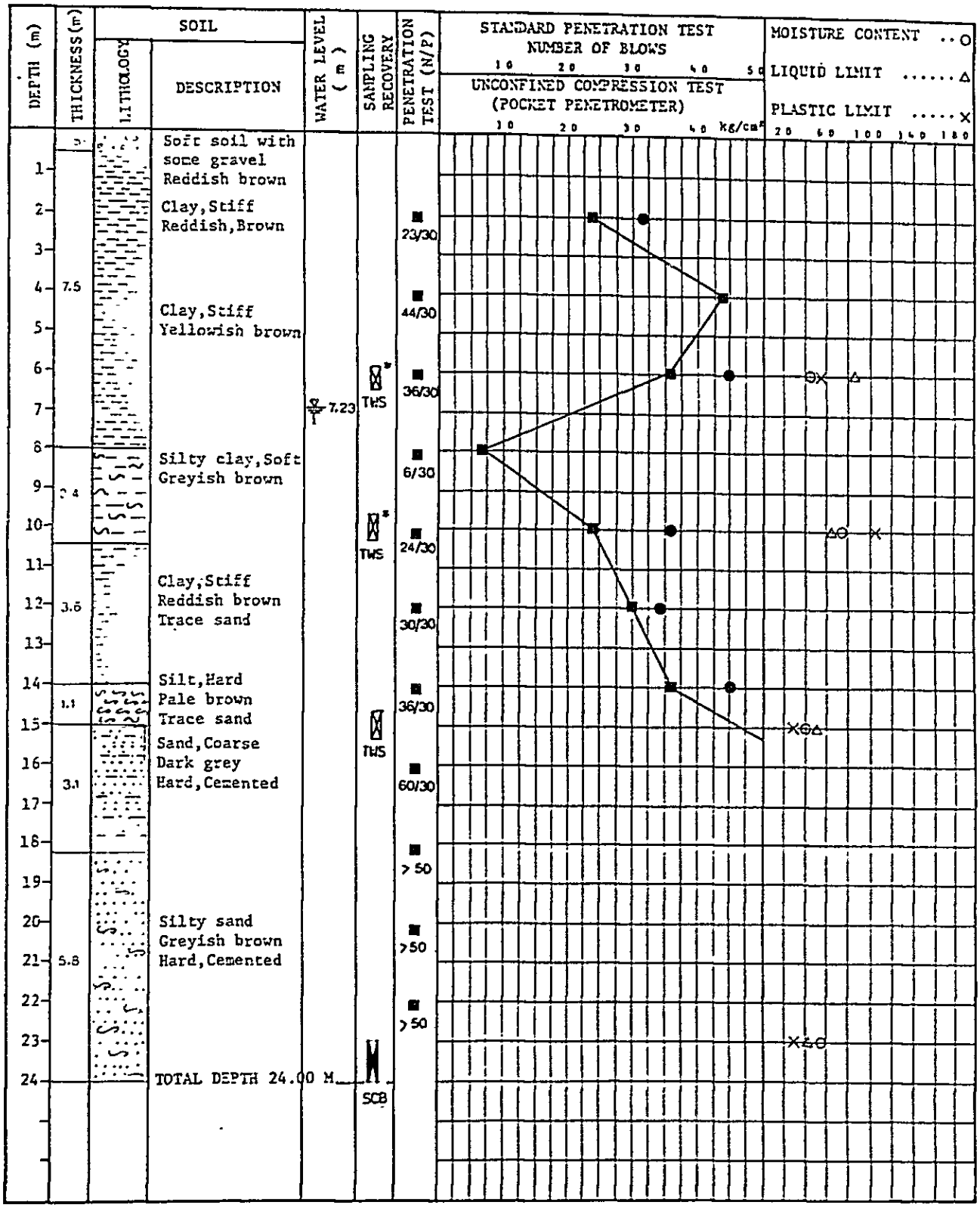
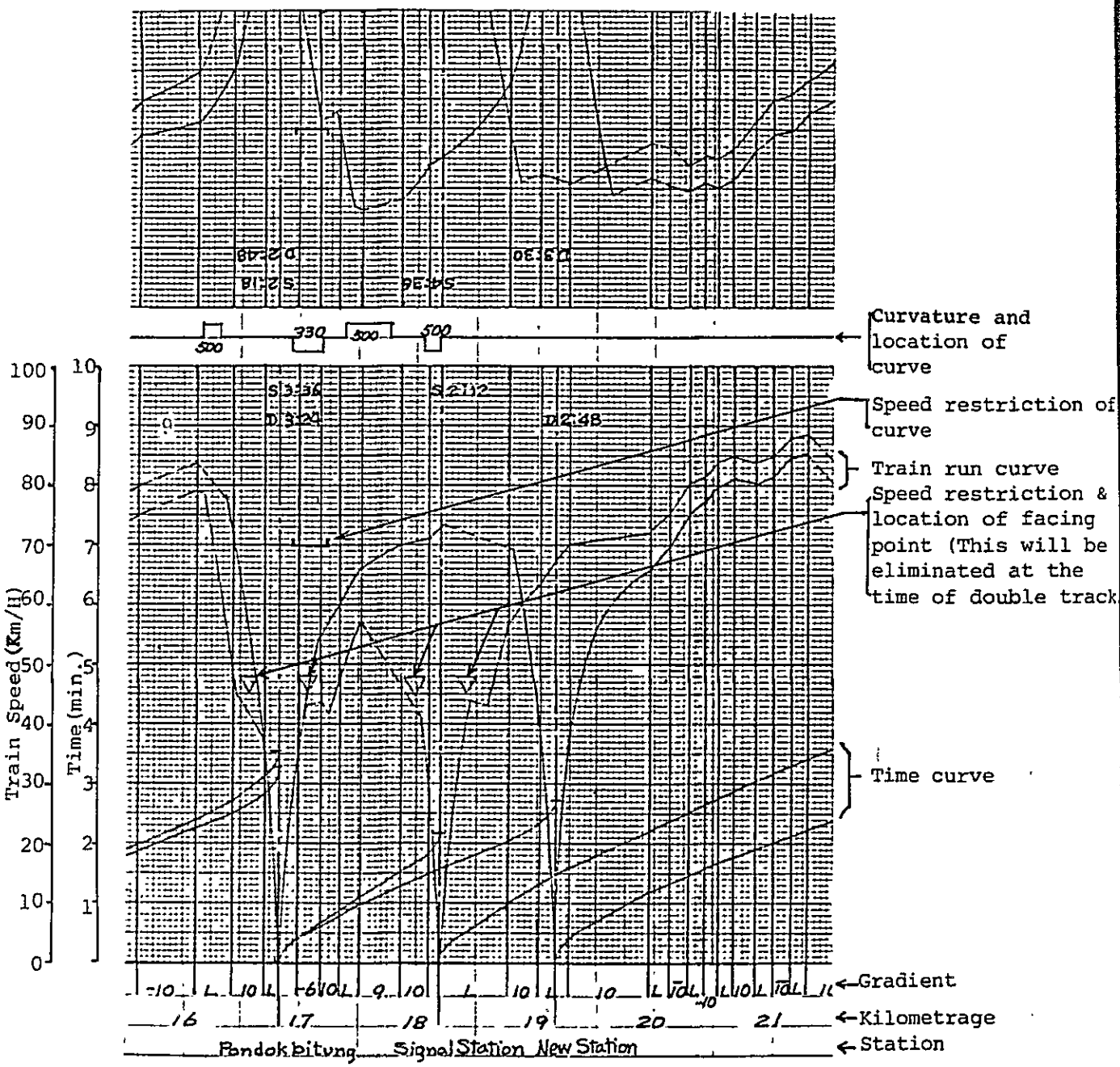
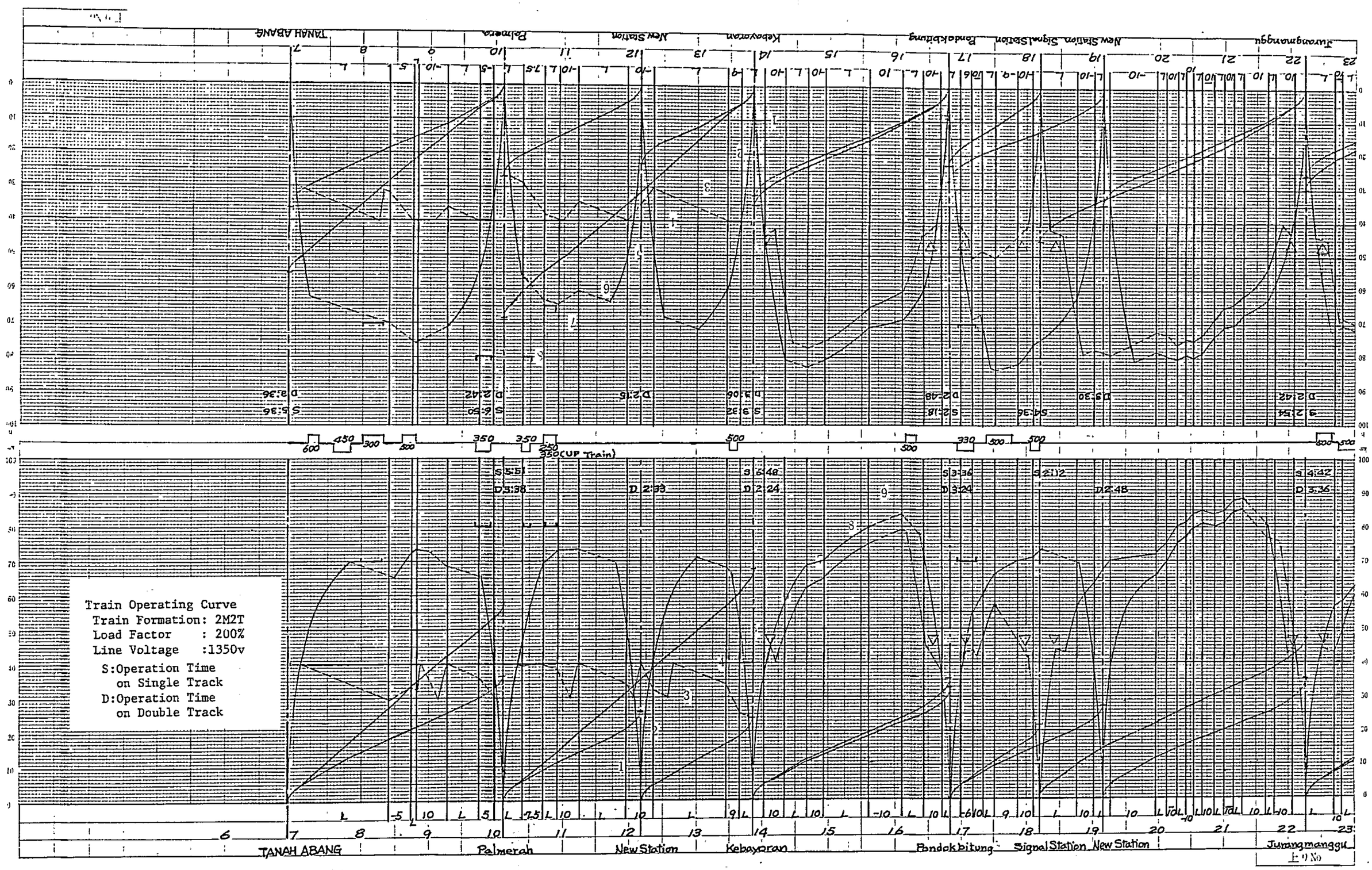
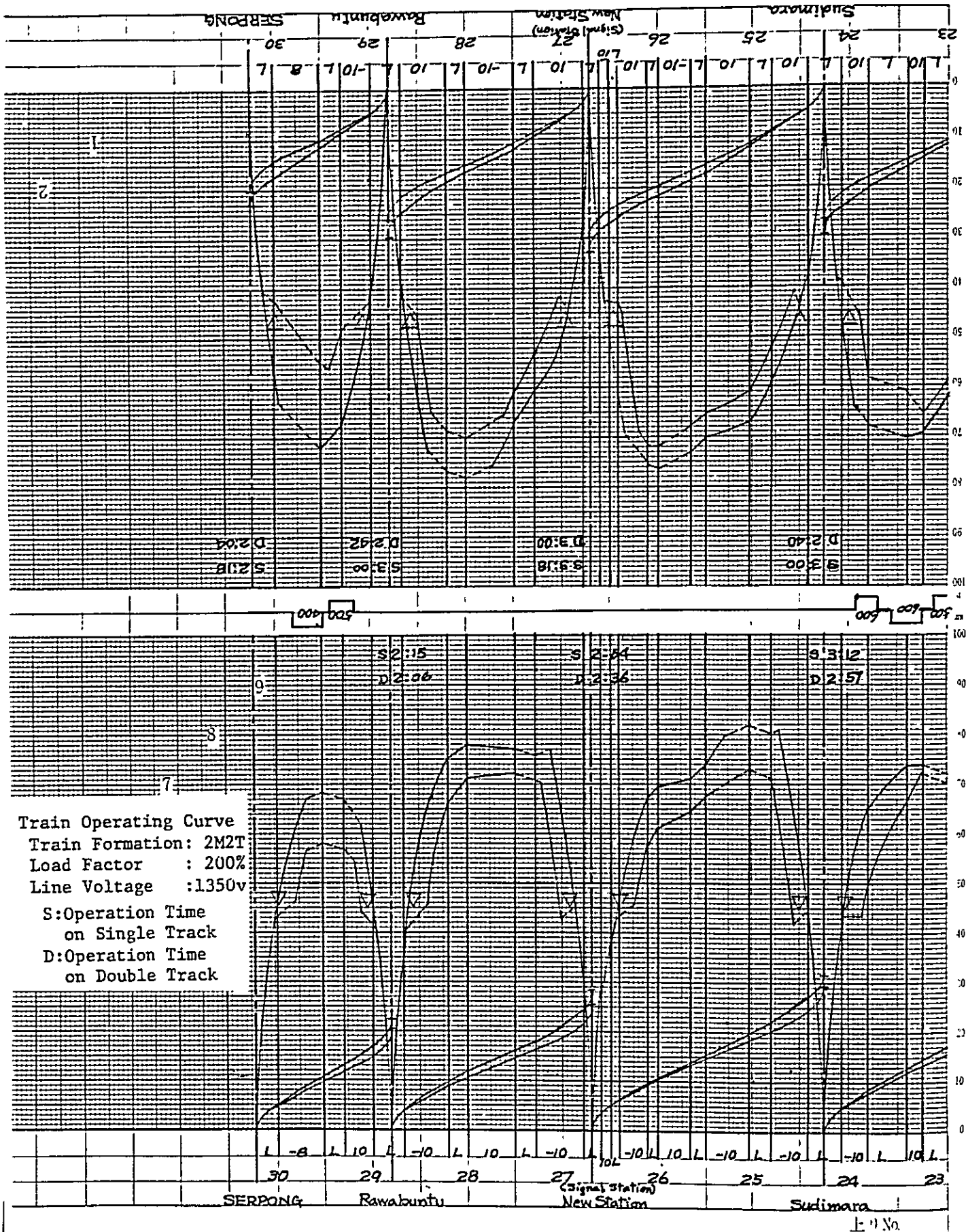


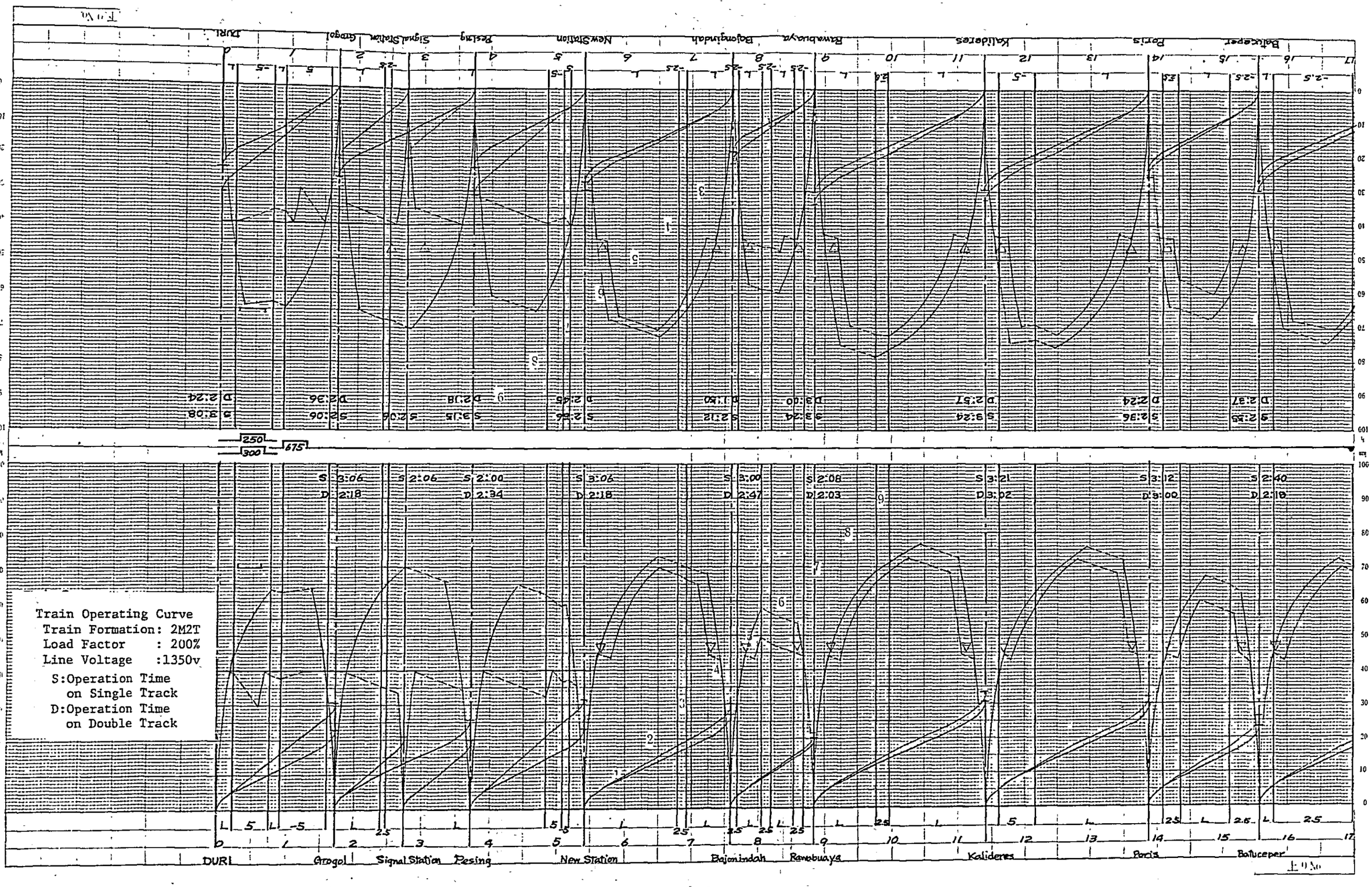
Fig. 3.30 Result of S.P.T (B-4)

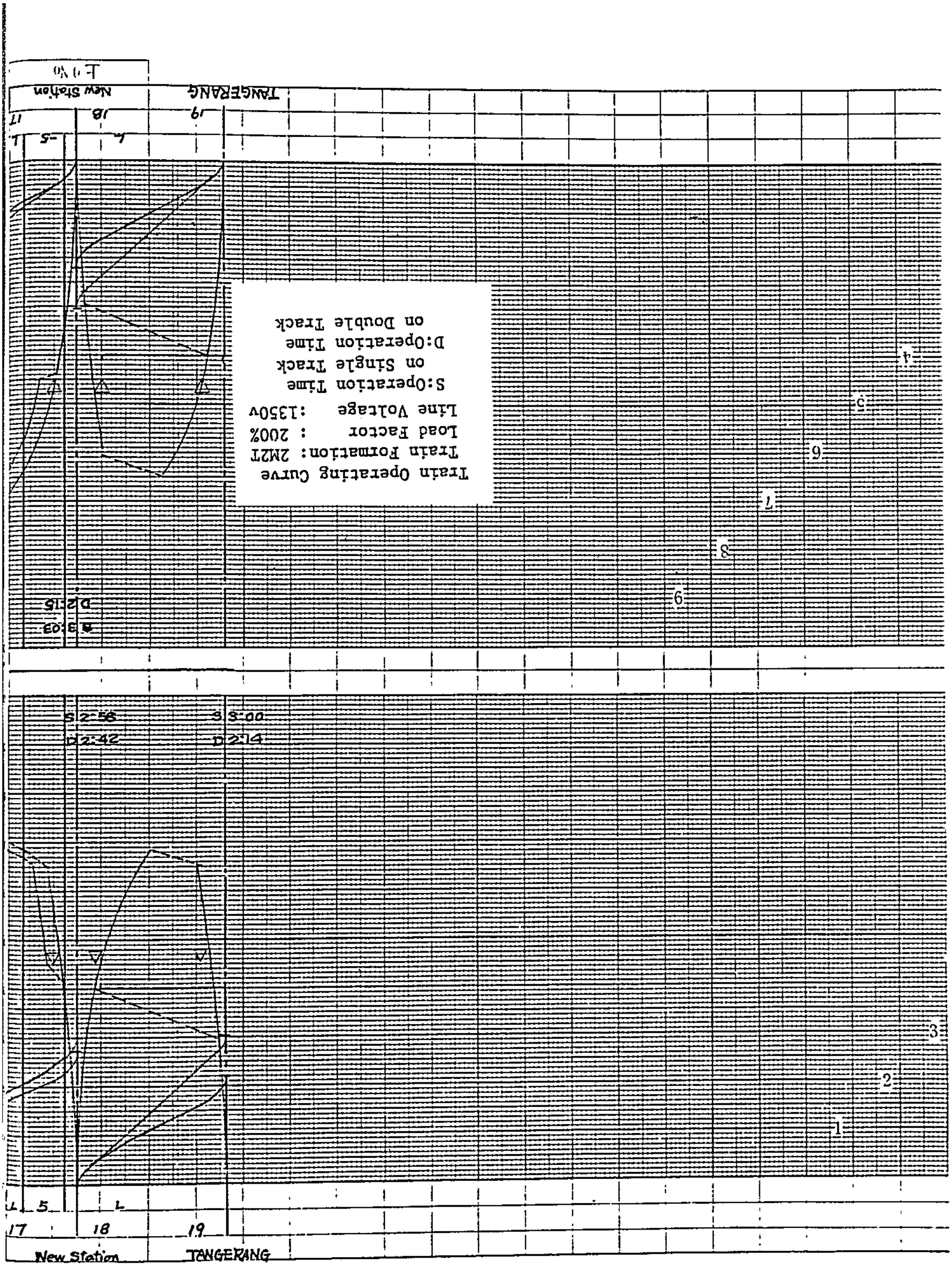
APPENDIX 7 TRAIN OPERATION CURVE OF MERAK LINE AND TANGERANG LINE

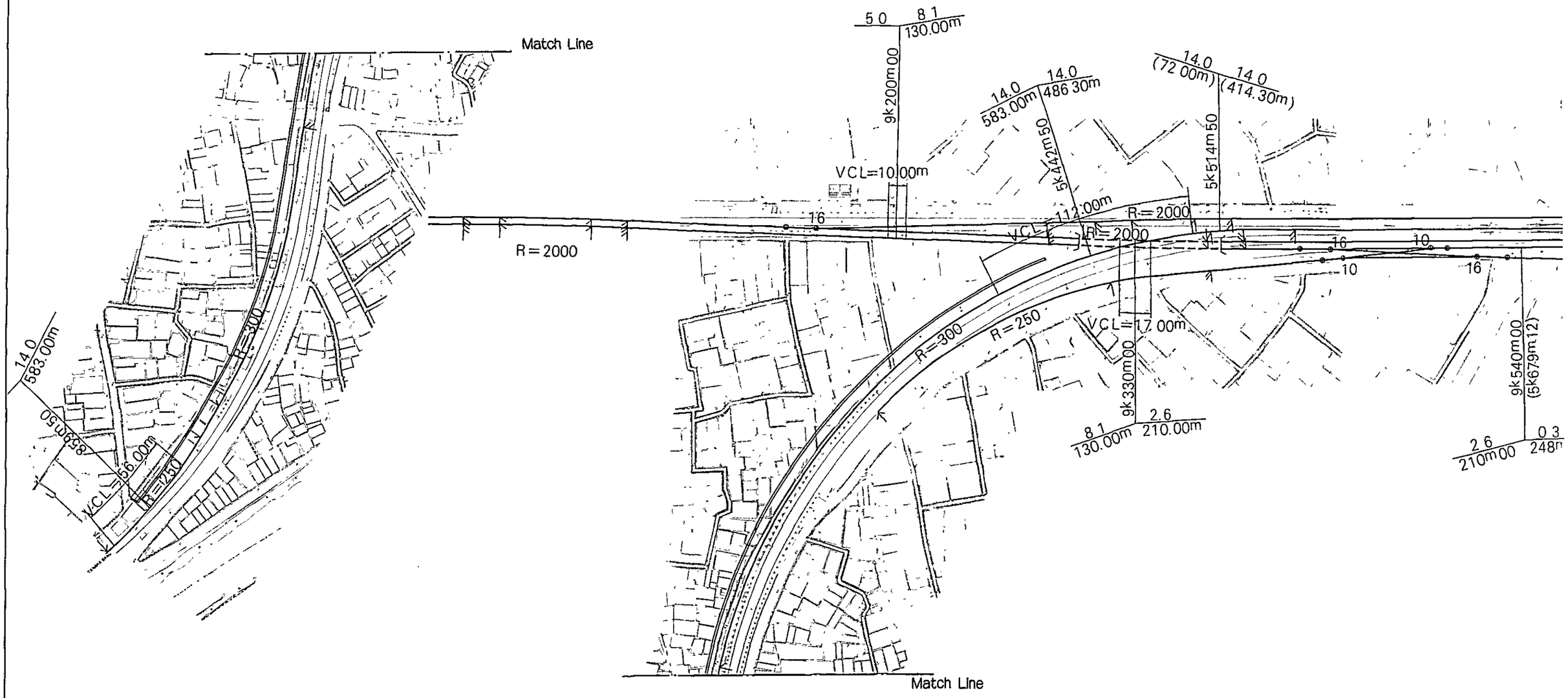



Train Operating Curve
Train Formation: 2M2T
Load Factor : 200%
Line Voltage :1350v
S:Operation Time
on Single Track
D:Operation Time
on Double Track
TANAH ABANG
Palmerah
New Station
Kebayoran
Pondokbitung
Signal Station
New Station
Jurangmangu
(UP Train)

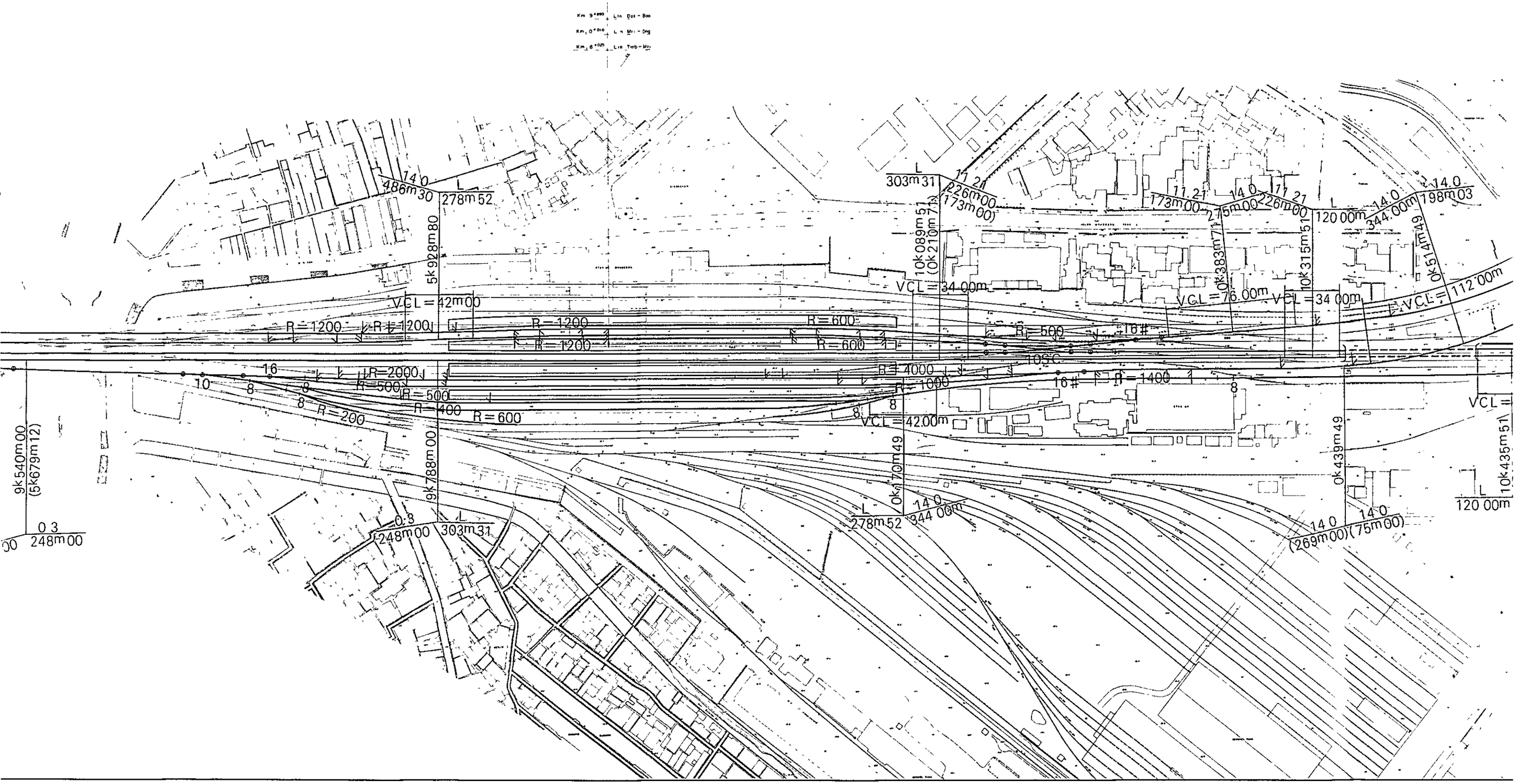

Train Operating Curve
Train Formation: 2M2T
Load Factor : 200%
Line Voltage :1350v
S:Operation Time
on Single Track
D:Operation Time
on Double Track
SERPONG
Rawabuntu
New Station
(Signal station)
Sudimara
S 2:15
D 2:06
S 2:54
D 2:36
S 3:12
D 2:57

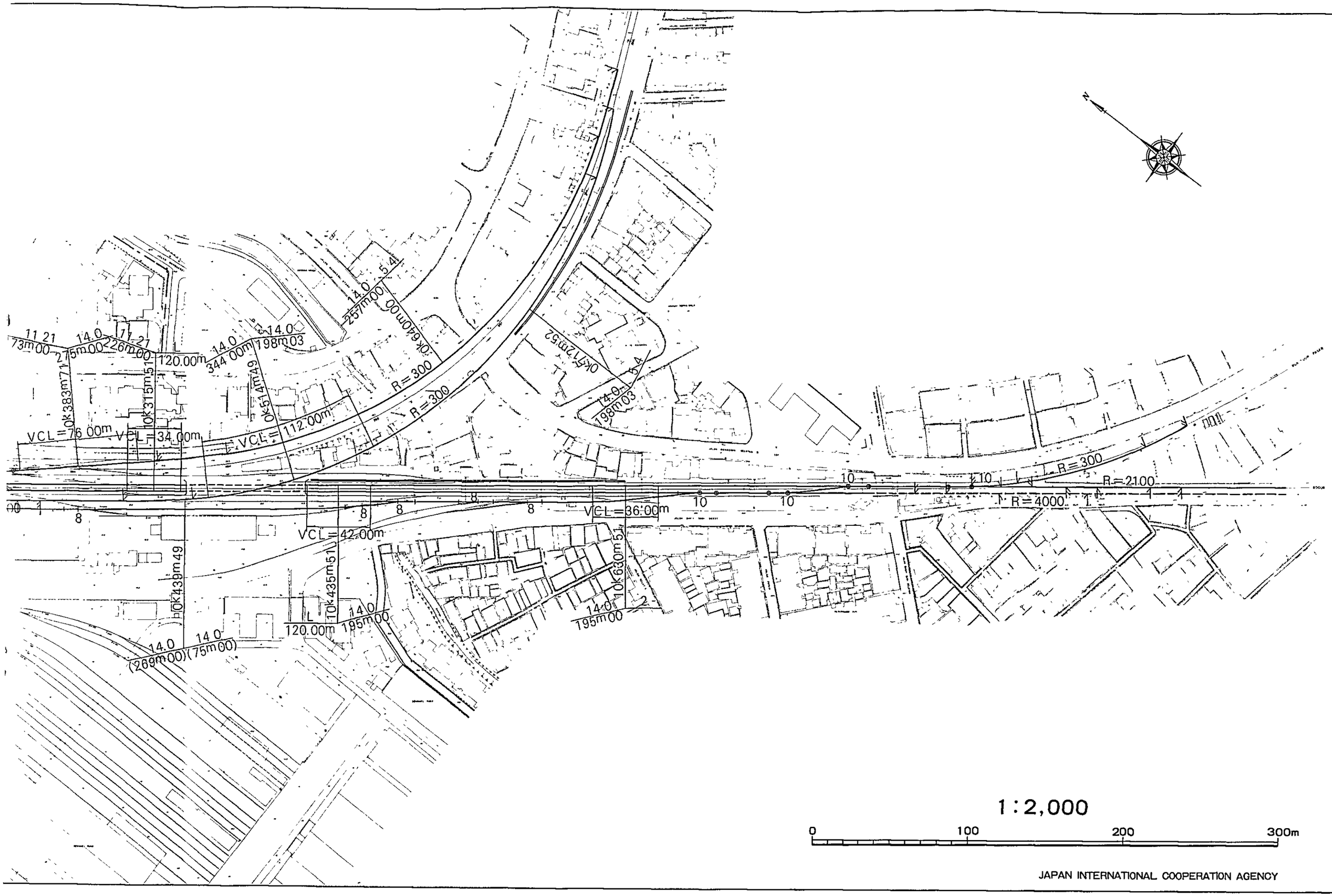

Train Operating Curve
Train Formation: 2M2T
Load Factor : 200%
Line Voltage :1350v
S:Operation Time
on Single Track
D:Operation Time
on Double Track
DURI
Grogol
Signal Station
Pesing
New Station
Bojomindah
Rawabuaya
Kalideres
Poris
Balluceper


Train Operating Curve
Train Formation: 2M2T
Load Factor : 200%
Line Voltage :1350v
S:Operation Time on Single Track
D:Operation Time on Double Track
S 2:58
D 2:42
S 3:00
D 2:14
1
2
3
17
18
19
New Station
TANGERANG


Match Line
5 0
8 1
130.00m
9k200m00
14.0
583.00m
14.0
486 30m
14.0
(72 00m)
14.0
(414.30m)
5k442m50
5k514m50
VCL=10 00m
16
R=2000
112.00m
R=2000
VCL
R=2000
16
10
10
16
R=300
R=250
VCL=17 00m
9k330m00
2.6
8 1
130.00m
210.00m
9k540m00
(5k679m12)
2 6
210m00
0 3
248m
14 0
583.00m
659m50
VCL=56.00m
R=250
R=300
Match Line

Dwg. 1.1 PROPOSED TRACK LAYOUT FOR GRADE SEPARATED CROSSING(G-14)




N
11.21
73m00
14.0
275m00
11.27
226m00
120.00m
14.0
344.00m
14.0
198m03
14.0
257m00
0k640m00
0k514m49
0k383m71
10k315m51
VCL=76.00m
VCL=34.00m
VCL=112.00m
R=300
R=300
0k712m52
14.0
198m03
10
10
R=300
R=2100
R=4000
8
8
8
8
VCL=36.00m
10
10
VCL=42.00m
0k439m49
10k435m51
14.0
120.00m
14.0
195m00
14.0
195m00
10k630m51
14.0
14.0
(269m00)(75m00)
1:2,000
0
100
200
300m
JAPAN INTERNATIONAL COOPERATION AGENCY