GOVERNMENT OF THE REPUBLIC OF INDONESIA

IMPLEMENTATION PROGRAM FOR RAILWAY TRANSPORTATION IMPROVEMENT PLAN (GALUNGGUNG SAND TRANSPORTATION)

SEPTEMBER 1991

Japan International Cooperation Agency (JICA)

PREFACE

This report has been written by JICA EXPERT (Short Term) in cooperation with PERUMKA officials.

The contents are as follows:

The first chapter [INTRODUCTION] summarizes the present situation of the project.

The second chapter [SUMMARY and CONCLUSION] outlines an action program.

The following chapters provide additional explanation to the second chapter, where various data produced in the process of compiling the second chapter are arranged to correspond to each article of the second chapter.

Accordingly, the Feasibility Study is completed in the second chapter.

The study indicates that the railway transportation improvement plan for the increase of sand transportation is feasible and that the project does not fall into deficit, but that profitability is quite low. However the beneficial effects to the public should be considered as well as the fact that this project represents the first step for drastically improving the Southern Trunk Line.

CONTENTS

Att-1 Table of Main Imports

Att-2 Data on the Rolling Stock

Att-3 Itemized Price List

Att-4 Summary of Investment at Each Places

Att-5 Financial Policy of Indonesia

Att-6 ２０００年までの設備投資計画 (RENCANA PEMBANGUNAN PERKERETAAPIAN SAMPAI TAHUN 2000)

1. INTRODUCTION

1-1. Background

The Eruption of Mt. Galunggung in 1982 has covered the mountain area near Tasikmalaya with debris from the volcano. Since then sediment inflow into the sandpockets has continued making urgent excavation necessary.

In order to prevent disaster and to utilize the sediments as aggregate for construction, Indonesian State Railways has been transporting about 1,300 m^3/day of sand since 1988 from Pirusa station in Tasikmalaya to Cipinang station in Jakarta. Travel time for the distance of about 280 km is half a day.

According to the new disaster prevention project, the transportation capacity will be increased to 3,000 m^3/day for sediment volume management in the Mt. Galunggung area.

Based on the above requirement, a transport plan, which will increase the present capacity, is expected to be realized as early as possible.

1-2. Formation Policy for Action Program

Based on TOR from the Indonesian Government, the objectives of this technical cooperation are to establish an "action plan" to have the capacity on the Southern Trunk Line increased to enable the transport of 3,000 m^3/day of Galunggung sand between Tasikmalaya and Jakarta.

(Fig. 1-1, 1-2)

Therefore, the study team shall investigate how to increase its capacity-up to 3,000 m^3/day step by step with the minimum investment, through the review of the study "studi peningkatan angkutan pasir galunggung menuji volume 3,000 m^3/hari" September 1989, taking the following studies into consideration.

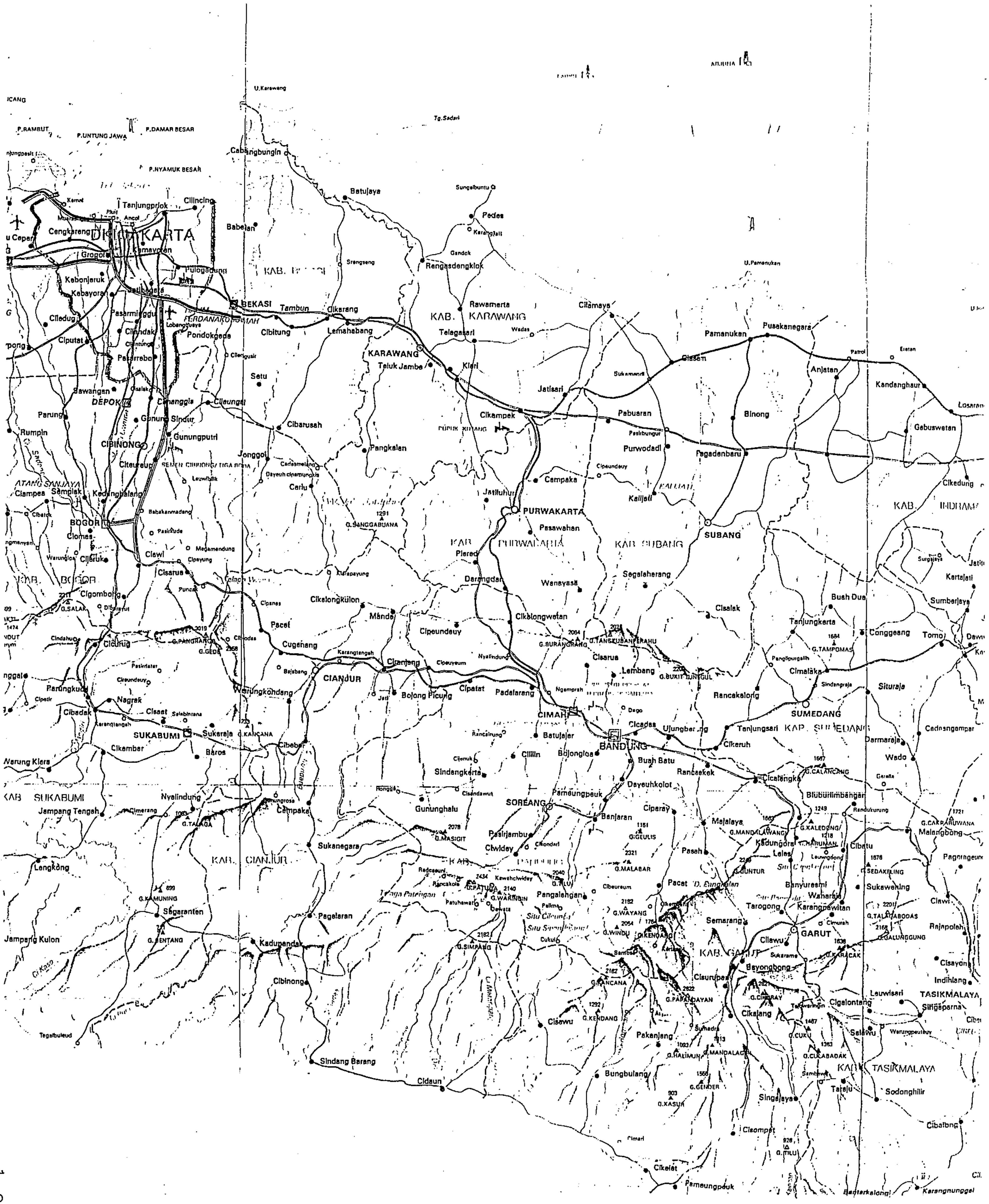
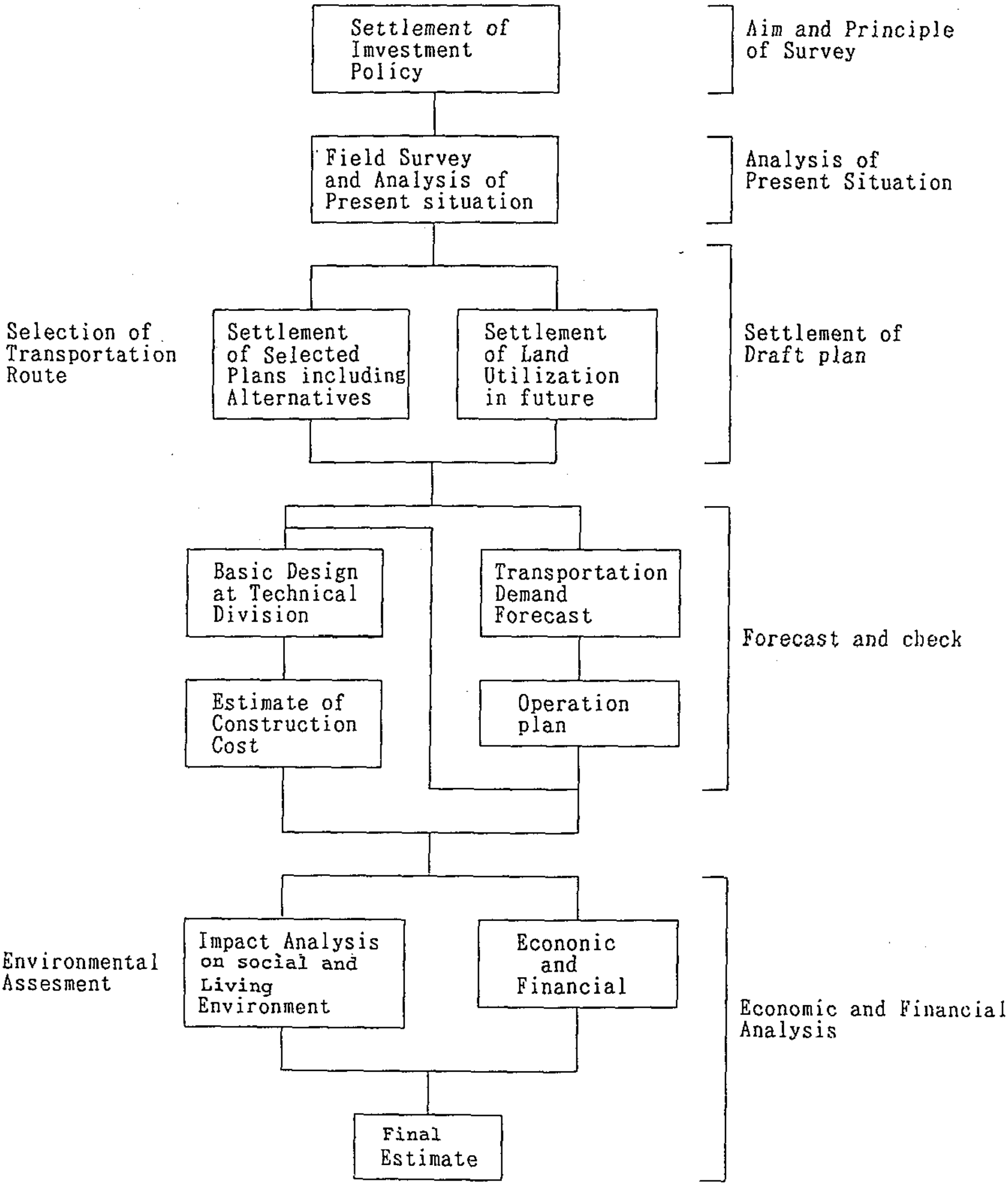


FIG 1－1 LAND MAP

Fig1-2 Flow chart of F/S



The Feasibility Study of the Disaster Prevention Project in the Southern Slope of Mt. Galunggung by JICA.

Feasibility Study of Railway Passenger Shuttle Services between Jakarta and Bandung by BECEOM (France).

1-3. Scope of Work of the Study Team

Based on the above policy, the study team will provide a report to feasibility study standard including the following items, in cooperation with Indonesian counterparts:

(1) Route survey of Southern Trunk Line including Bogor Line and comparison with highway transportation as one of the alternatives.

(2) Transportation planning by means of a step by step increase from 1,300 m^3/day up to 3,000 m^3/day in accordance with an excavation plan considering other simultaneous transportation demands.

(3) Improvement planning based on the above,

① Purchase of locomotives and freight cars and refurbishment of freight cars.

② Rehabilitation of tracks and construction of new infrastructure.

③ Improvement of signal and communication systems at the intermediate stations.

④ Improvement of car depot and freight stations for loading and unloading of aggregate.

(4) Financial analysis of improvement plan based on the interrelationship between investment, operation cost and income.

The study team will make a letter of recommendation in English at the end of this spot investigation and explain it to Indonesian officials, wherein the following items are selected from the prearranged contents of the final report and described as the action program.

1. Introduction
2. Summary and Conclusion

The final report shall be completed in Japan.

1-4. Organization of the Study

For the purpose of carrying out the study, PERMUKA has created a cooperative committee with Drs. Anwar Supriadi. Msc as chairman.

The committee members and their assignment are as follows:

1) Japanese professionals

Name	Assignment	Organization
Hideo Yokota	Vice Chairman Financial Analysis Summary	Yachiyo Eng.
Takayuki Yamashita	Rolling Stock, Depot	JARTS
Sueo Aoyama	Signal and Communication	JR West
Muneo Koseki	Civil Works	JRCC
Masahiro Suzuki	Operation	JR East
Kiyoharu Takagi	Adviser	JICA
Hiroyuki Yoshida	Adviser	JICA

2) Indonesian Counterparts

Anwar Supriadi	Chairman	Director of Operation
Gatot k Mashuri	Vice Chairman Summary	Sub-director of Traffic

Name	Assignment	Organization
Soegeng G	Summary	Sub-director of Development
Abdurahman	Financial Analysis	Sub-director of Transport Economy
Soeprapto	Rolling Stock, Depot	Sub-director of Rolling Stock Maintenance
Nana Sumarna	Rolling Stock, Depot	Sub-director of Traction
A M Anggadikarja	Signal and Communication	Sub-director of Signal & Telecom
Soetojo	Signal and Communication	Chief of Section of Planning for Signal & Telecom
P Y Suyatno	Civil Works	Sub-director of Ways & Works
Budiarjo	Civil Works	Sub-director of Bridges
Helmy Azis	Operation	Sub-director of Sales
Kunsabdono Inpasiarto	Operation	Sub-director of Program Preparing Rolling Stock
Soemino eko Saptro	Adviser	Director of Technic
Soemarno	Adviser	Chief of Center of planning

2. SUMMARY AND CONCLUSION

The purpose of this project is not only to prevent the mountain area near Tasikmalaya from volcano disaster but to utilize the sediment as aggregate for construction works by transporting it to construction centers in Jakarta.

2-1. Outline of Present Transportation

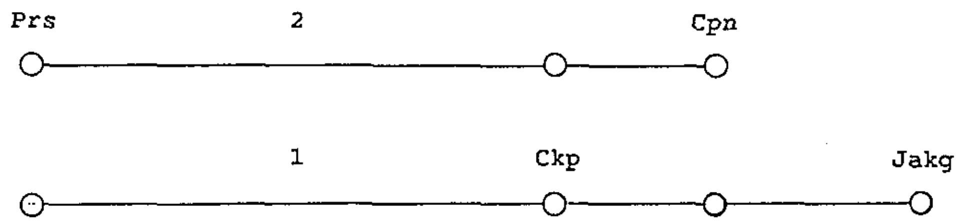
As part of the disaster prevention program concerning the Galunggung volcanos, the sand discharged from the volcano's fan is transported from Pirusa near Tasikmalaya to Cipinang and Jakarta Gudang freight station via Cikampek, the junction of the Northern and Southern Trunk Lines.

Each basic train formation consists of one diesel locomotive (DEL) with a 1950 horse power engine and 14 sand freight cars (FC) with a loading capacity of 30 ton (15m^3) of sand. The braking system of FC is manual, but now has been improved by an air brake system. The trains had to be connected to an assisting locomotive between Prs and Kac, where heavy gradients of 250/00 exist.

Six sand trains/day were driven between Prs - Bd - Ckp of the Southern Trunk Lines during the year 1988.

However, lately only three trains/day are driven owing to the shortage of locomotives and they are limited to five wagons owing to the poor condition of bridges and lack of assisting locomotives. This transportation system utilizes 204 wagons of which 30 wagons are in operation and the remainder are parked at freight stations.

Locomotives are maintained at the Bandung car depot and wagons are maintained at Cibatu.



At Pirusa sta. according to the present scheduled train diagram, the empty sand trains successively arrive from early morning so that the loading operation can be carried out without interruption and the loaded trains start from the afternoon. (Necessary waiting time is about five hours)

At the Jakarta end the loaded trains arrive near midnight and the departure of empty trains is delayed to avoid the heavy traffic time zone at the northern end of Bandung.

It is characteristic that arrival trains at Jakarta Gudang must be switched back at Jakarta kota and Kampung Bandan stas.

The Southern Trunk Line is double tracked in the Pdl - Bd - Kac section and single tracked in other sections. The number of scheduled trains at present is shown in Fig. 2-1-1 which shows the track capacity of the line, according to the newest installation of passing stations which has solved the problem of track capacity for the present.

The effective length of the main track at the main stas. must be not less than 300 m, so that trains with 14 wagons loading 420 tons of sand can pass each other.

An increase in the length of train formation would necessitate an increase in the effective length of the main tracks in the main station not only for the Southern but also for the Northern trunk lines, and this is not recommendable.

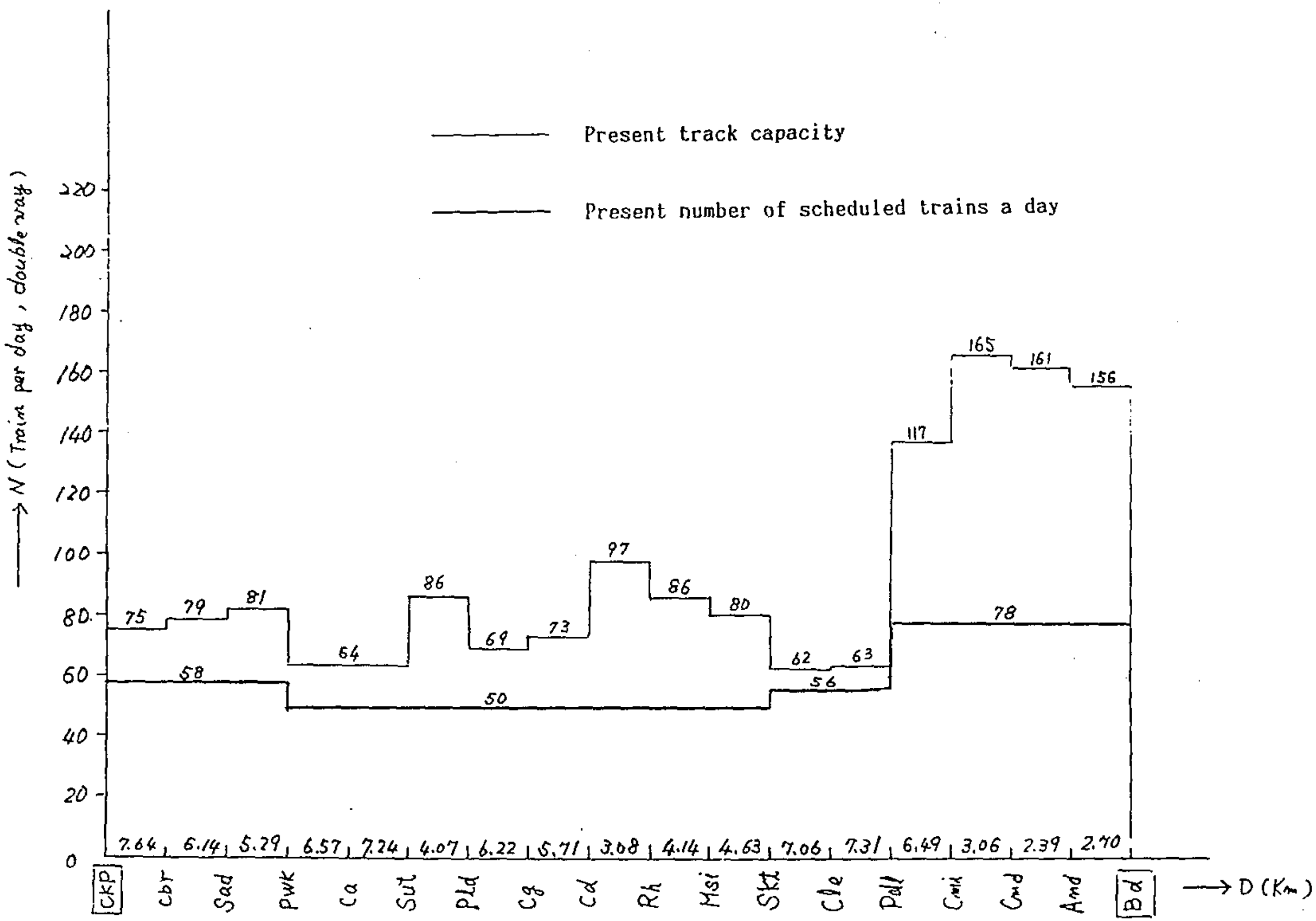
The track structure uses 42 kg/m rail but the corrosion of sleepers and the shortage of ballast are endemic. Furthermore, the deterioration of bridges is another factor. However, PERUMKA is considering their renovation.

Signal security system is composed of mechanical signal and interlocking at each sta except Bd sta. It forms one block section between the adjacent two stations and the blocking procedure to the next sta. depends on Morse telegraph system or (tokenless) system.

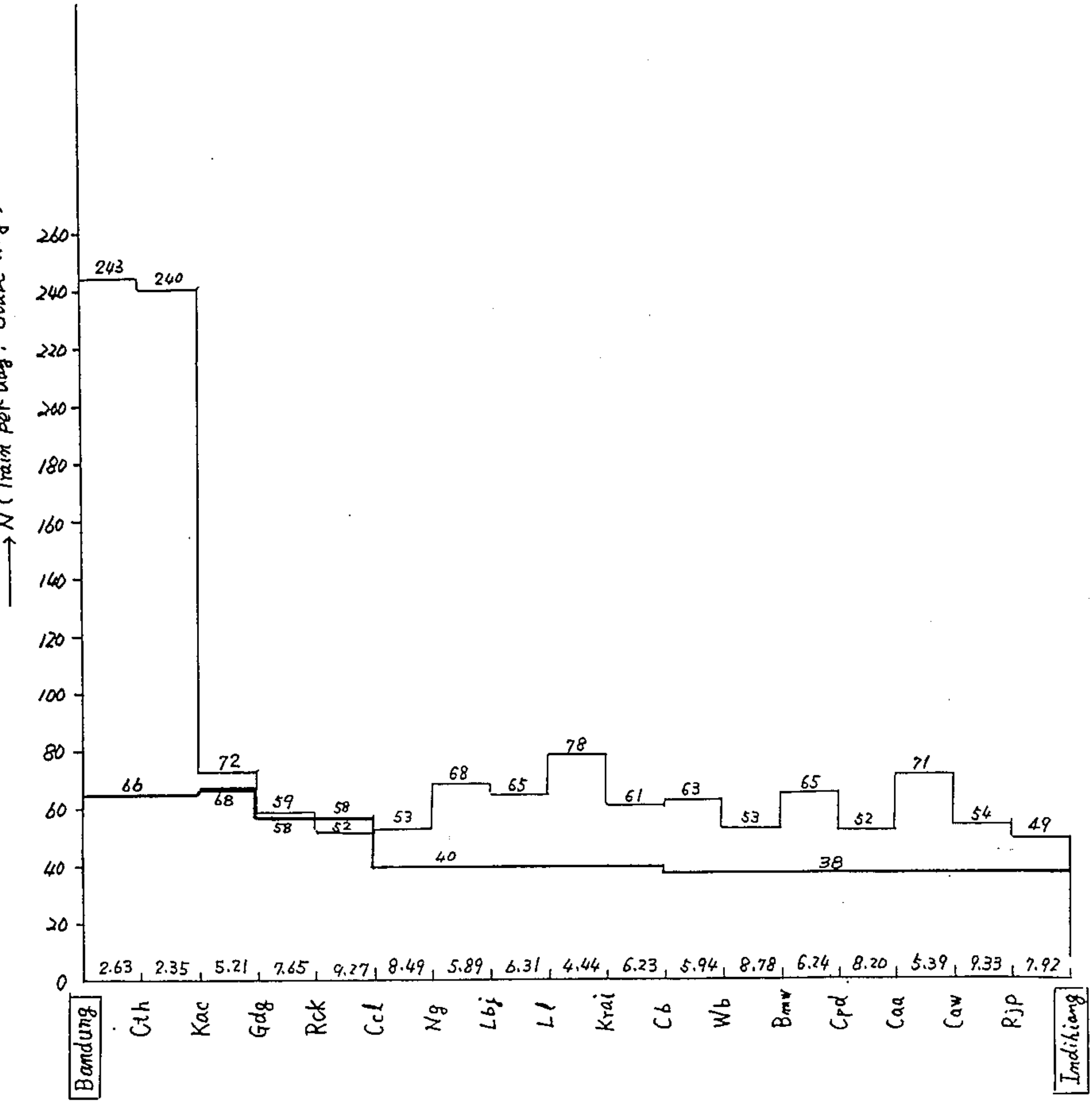
This makes the time interval between successive arrival trains much longer and reduces the track capacity.

The demand for sand in Jakarta, where the excavation of sand is strictly regulated, amounts to about 10,000 m^3/day and the present sand transportation volume to Jakarta from the Tasikmalaya district is estimated at about 1,000 m^3/day.

Fig 2-1-1 Track Capacity of the Southern Trunk Line
(1) CIKAMPEK-BANDUNG



(2) Bandung —— Indihiang



The share between highway and railway transportation of sand in Tasikmalaya is almost fifty-fifty. The former suffers from deficiencies in environment, stability and security conditions, therefore the users hope that railway transportation will be encouraged.

2-2. Selection from Transportation Alternatives

2-2-1 Highway Transportation

At first we must make a comparison between highway and railway as a means of transportation for the erupted sand from Galunggung volcano to Jakarta.

If the additional transportation of sand should depend on highway in future, the following must be considered:

(1) The additional transportation of 2400 m^3/day of sand necessitates 480 trucks/day, round trips of 10 ton capacity, which would run at 3 min. intervals.

These would not only cause traffic jams at the steep grades in mountainous districts but environmental problems like vibration, noise, air pollution, which have unfavorable effects on dwellers along the highway.

(2) We tried comparing the tariff between Tsm and Jak based on field surveys and interviews with users. Results are shown in Table 2-2-1 where transport costs by highway would be more expensive by about 30% than railway costs so it is better to give priority to railway transport. Accordingly the users reduced their sand screening operations in accordance with the decline of railway transportation.

Based on the above, the rehabilitation of railway transportation is expected to be realized as soon as possible.

2-2-1 Railway Transportation

For the transportation route there exists three draft plans as shown in Fig. 2-2-1. The second and third routes appear adapted for the utilization of the Bogor Line.

However we decided not to use the Bogor route and have adopted the first proposed route and dropped the 2nd and 3rd alternatives for the following reasons:

(1) The design allowable axle load of Bogor line is 13 tons, the mean axle load of the scheduled locomotives CC201 (1950 HP) is a little heavier than the above limit. However the mountainous section is disastrous and has outdated inferior facilities, e.g. temporarily restored bridges and collapsed banks.

Utilization for sand transportation after the restoration of this line would be expensive.

(2) The single track line between Bogor and Depok will be overloaded owing to the additional trains. (15 trains)

(3) The use of Cipinang-Jatinegara-Manggarai-Depok route leads to difficulties in train handling at Manggarai station. (Fig. 2-2-2)
Due to the arrival or departure across many tracks and the turn-around of locomotives, the operation of other trains using Manggarai Sta. is disturbed.

(4) At a slope of 400/00, it is possible to operate trains composed of 14 empty trains. (200 TONS)

However for this purpose, it is necessary to have an air brake system in order to regulate the operating speed and to improve sleepers, fastenings etc. since the track condition is very poor.

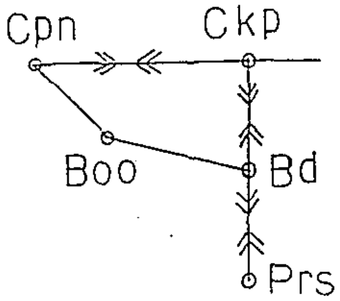
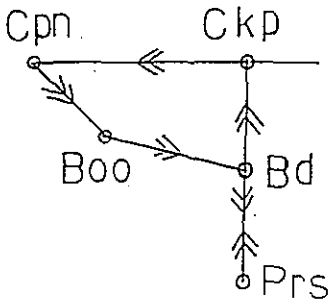
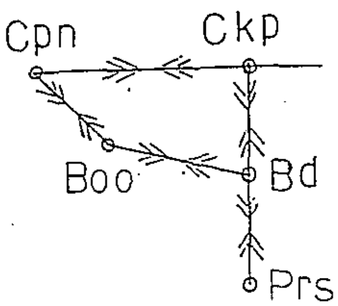
Tab 2－2－1 Comparison Table of Gross Sand Transportation Price between Jakarta and Tasikmalaya (RP per m^3)

Transportation System	Until loading	Net transportation	Handling & delivery	Others with profit	Total
Railway	5600	16000	1000	4400 ～ 7400	27000 ～ 30000
Highway	* 2800	22000		2200 ～ 5200	27000 ～ 30000
Market price in Jakarta					27000 ～ 30000 RP

* Londing 22000 RP
Tax 2500
Maintenance 3000

Total 27500 RP/Truck

Fig 2－2－1 Comparison of Transportation Routes

Transportation route	Investment items	Remarks
1、Same route for round trip, for all trains  	·To modify to automatic signalling ·To install new equipment for the passing stations ·To reinforce the curved track structure ———— · ———— · ———— Ditto	Effective to the increase of passenger transportation
2、One way route, for all trains  	·To modify to automatic signalling ·To reinforce the curved track structure ———— · ———— · ———— ·To modify to automatic signalling ·To install new equipment for the passing station ·To reinforce the curved track structure	Necessary to study the equipments for the passing station
3、Another round trip route, for increased trains *only*  	·To modify to automatic signalling ·To install new equipment for the passing station ·To reinforce the curved track structure	Necessary to study the utilization of double tractive system on heavy gradient section (40‰) between Boo~Bd

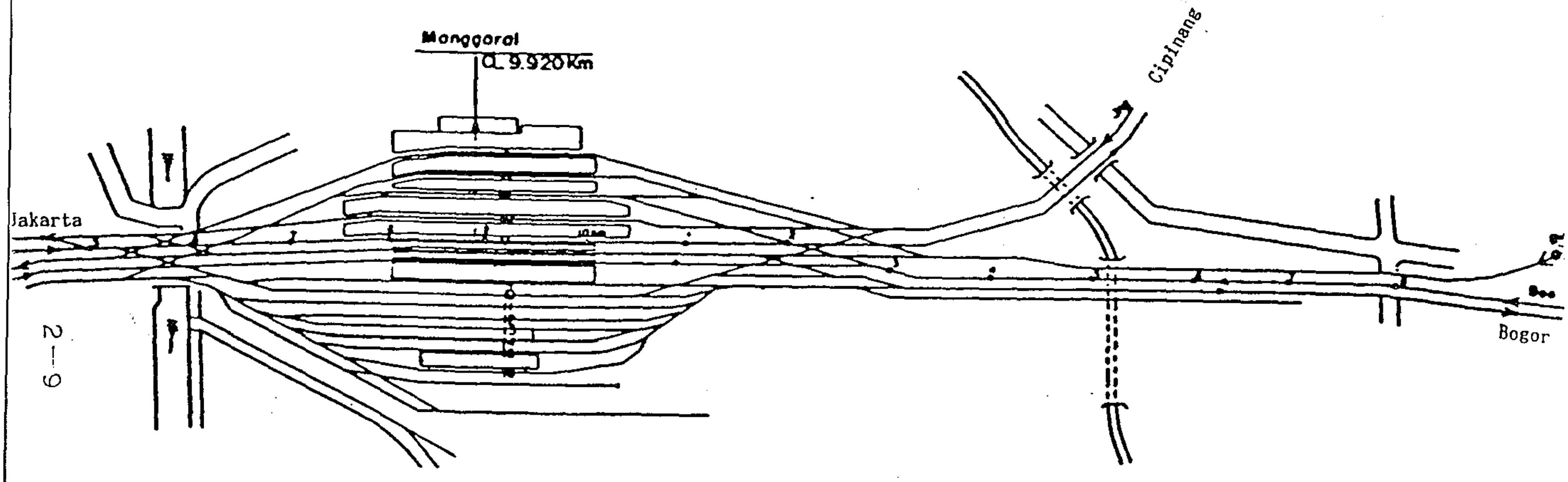


Fig 2-2-2 **Existing Track Layout of Manggarai Station**

2-3. Traffic Demand and Bottle-necks on the Southern Trunk Line

2-3-1 Traffic Demand Forecast

This study aims at making traffic demand forecasts and improvements for the purpose of sand transportation only as part of a F/S.

Therefore, the traffic forecast by other freight and passenger services would utilize the improved track capacity wherever possible.

(1) Sand transportation demand

The demand forecast is clear, namely 3000 m^3/day of sand to be transported from Pirusa to Jakarta. The total number of necessary sand trains is 30 in both directions whereas 12 trains are used for the present operation plan.

(2) Other transportation demand

(a) Passenger demand

A formal report concerning the demand forecast of the Southern Trunk Line has not been completed yet except for the express passenger demand between Jakarta and Bandung.

Because the shortage on the supply side is so remarkable, the demand side would be sure to follow the growth of supply, as long as an increase in train operation is possible.

The following factors are taken into consideration for the supply forecast:

① The number of Parahyangan Express passengers has been showing an annual increase of 7%. Moreover, the profitability was so good that the demand has led to an increase in the number of trains.

② Commuter passengers in the Bandung district, where a lot of new factories are going into operation, eagerly request the increase of commuter trains.

③ The potential demand from local passengers has been so strong but so deficient in income that the increase of local trains has been ignored.

(b) Freight demand

The main service, apart from sand transportation, is for ship containers. The contents are textiles and miscellaneous goods produced in the district for export and the service is profitable.

Based on the above, we tried to forecast the supply side based on PERUMKA's findings, the result at the bottle-necked section is shown in Table 2-3-1.

The table shows that sand transportation, when combined with passenger and container traffic etc. exceeds the capacity in 1996, and that the increase of sand transportation only meets the capacity in 1998 and necessitates new additional improvements.

2-3-2 The bottle-neck caused by sand transportation amounts to 3000 m^3

(1) Old type facilities and the shortage of track capacity

Almost all the stations are equipped with old mechanical interlocking and interstational blocking devices.

They require not only more handling time for switches, signals and blockings, but have block sections with longer passing time for the trains.

These deteriorated security devices and naked communications cables, not only limit the number of operating trains but seem also to disturb normal operation.

So we can see 12 sections of running track which are overloaded in Fig. 2-5-2. (Pwk-Ca, Ca-Sut, Skt-Cle, Cle-Pdl, Kac-Gdg, Gdg-Rck, Rck-Ccl, Ccl-Ng, Wb-Bmw, Cpd-Caa, Caw-Rjw, Bjw)

The countermeasure is to construct passing stations in the middle of the overloaded sections in order to resolve the overload.

However in case the new installation of passing stations is difficult, the section of running track is systematized with automatic blocking and all relevant stations are electronically-interlocked for the same reason.

If automatic blocking systems alone are more economical than the new passing station, for sections having a capacity shortage, they are adopted in place of passing station.

(2) Shortage of rolling stock

Diesel locomotives (DL) and freight wagons (FC) have deteriorated and some of them are out of order. The quantity of DLs is deficient and they do not run on schedule.

The facilities for inspection and repair work for rolling stock have detiorated and cannot support the increase of transportation.

Two hundred and four FC are assigned for sand transportation, but many of them remain unused and dispersed at the freight stations. In case 15 trains are operated, additional FCs would be necessary.

Tab 2-3-1 TABLE FOR TRANSPORTATION DEMAND BASED ON SCHEDULED TRAIN DIAGRAM

Unit ; Train Numbers/day

ITEM	Cikampek-Cibungur (Ckp) (Cbr)			Plered-Cisomang (Pld) (Cg)		
	9/1990	1996	1998	9/1990	1996	1998
1. Passenger Train	32	42	46	26	34	38
1) Express	16	22	24	16	22	24
2) Fast	10	12	14	8	10	12
3) Local	6	8	8	2	2	2
4) Commuter	-	-	-	-	-	-
2. Freight Train	26	38	50	24	40	52
1) Container	6	8	10	6	8	10
2) Galunggung Sand	12	20	30	12	20	30
3) Other Freight	8	10	10	6	12	12
3. Ground Total	58	80	96	50	74	90
Traffic Capacity	75			69		
Increase of sand train only considered	58	66	76	50	58	68

(3) The shortage of handling capability at the freight stations

The handling facilities for sand at the loading or unloading stations are adequate only for six trains.

It is necessary to check for more than six trains whether sidings are required for parking FCs at the freight stations.

(4) The deterioration of railway facilities

The deterioration of track parts like rails and sleepers on the Southern Trunk Line is remarkable. Moreover there are some places where the trains are forced to reduce speed, because the existence of many curves of small radius and steep gradients results in low speed operation.

However the rehabilitation of tracks and bridges will be implemented based on another program, they should be rehabilitated before this project becomes operational.

2-4. Outline of Improvement Plan

2-4-1 Assumptions

(1) This plan has not been designated for drastic improvement of the Southern trunk line, but is only the first stage. We can anticipate such increase of train numbers on this line in the near future that we have to pay attention to avoid a deficiency caused by overlapping with other imaginable important improvements like double tracking or automatic blocking works in making this plan.

(2) PERUMKA is trying to restore sand transportation to the volumes moved in 1988 by the following means before carrying out this project.

① The operating trains are increased from three trains to six/day during the rehabilitation of locomotives and adjustment of dispersed wagons based on this project.

(5 wagons*3, 230m^3/day$14 wagons*6, 1300m^3/day)

② The track of the concerned section is renovated by a separate repair plan.

③ Bridges with appreciable vibration will be repaired before this project become operational.

2-4-2 The fundamentals of the improvement plan

Countermeasures for the increase of up to 15 trains (3000m^3/day) start from four sand trains a day and the various requirements of other transport demands are not included they should be met by other projects.

(1) The restored ground facilities would make possible the operation of six sand trains/day.

(2) The step by step increase from six trains necessitates the following measures.

① The necessary number of rolling stock are rehabilitated upto six trains and purchased step by step upto 15 trains.

② To increase track capacity of the over-loaded sections of running track, as a basic principle passing stations with electronic interlocking between signals and swithes should be installed.

But in case the location of new passing stations is difficult because of the existence of curves of small radius or steep grade etc., the increase of track capacity is achieved by means of executing automatic block systems at the sections of running track including the above-mentioned stations.
(Pwk-Ca-Sut, Kac-Gdg-Rck-Hrp-Ccl-Ng)

Accordingly seven new passing stations are executed. (Skt-Cle, Cle-Pdl, Rck-Ccl, Wb-Bmw, Cpd-Caa, Caw-Rjp, Bjw)

Bjw sta which faces the highway, is improved as passenger station.

The other passing stations except Hrp sta (Rck-Ccl) are improved as signal stations.

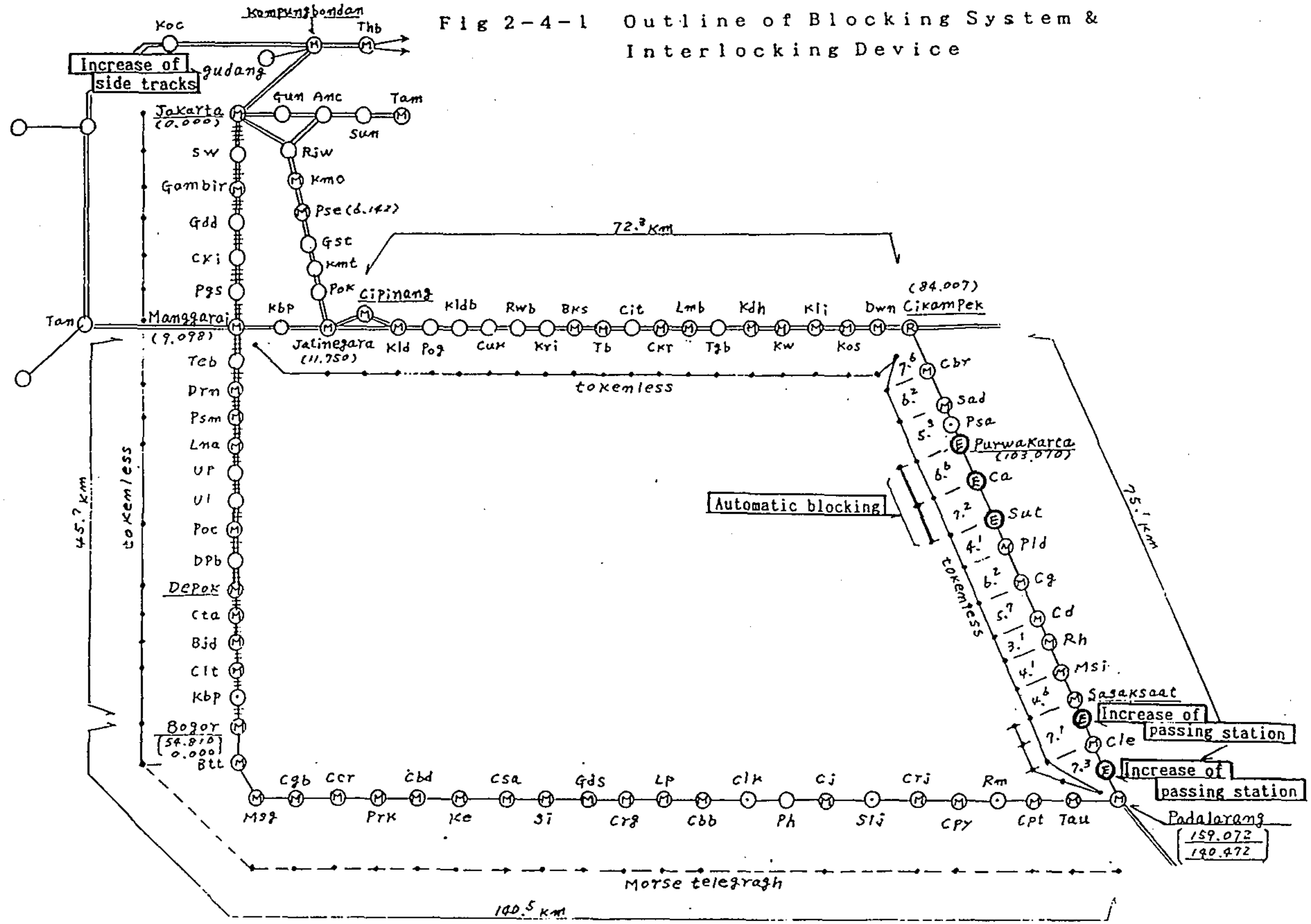
These improvements are shown in Fig. 2-4-1.

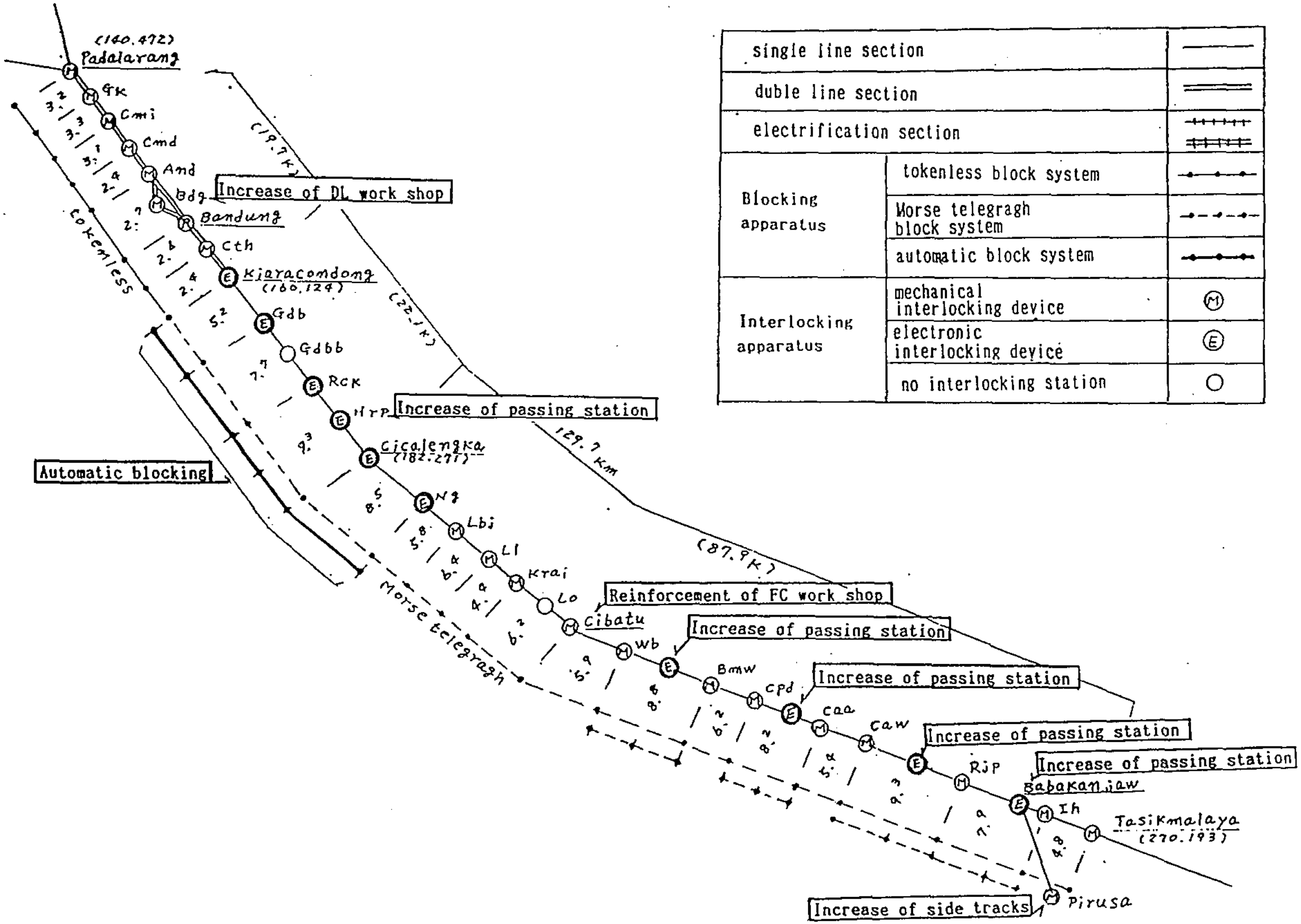
③ The increase in the number of rolling stock necessitates a new locomotive shop for intermediate inspection and temporary repair works in Bandung car depot. The old shop will be used for daily inspection.

The shop for wagons will be sufficient to reinforce repair machines in the present workshop at Cibatu.

④ An increase of sidings at the freight stations is necessary in accordance with the increased number of parked wagons.
(Pirusa, Cipinang, Jakarta Gudang)

Fig 2-4-1 Outline of Blocking System & Interlocking Device




single line section
duble line section
electrification section
Blocking apparatus
tokenless block system
Morse telegragh block system
automatic block system
Interlocking apparatus
mechanical interlocking device
electronic interlocking device
no interlocking station
(140.472)
Padalarang
Gk
Cmi
Cmd
And
Bdg
Bandung
Cth
Kiaracondong
(160.124)
Gdb
Gdbb
RcK
Hrp
Cicalengka
(182.277)
Ng
Lbj
Ll
Krai
Lo
Cibatu
Wb
Bmw
Cpd
Caa
Caw
RJP
Babakanjaw
Ih
Tasikmalaya
(270.193)
Pirusa
Increase of DL work shop
Increase of passing station
Reinforcement of FC work shop
Increase of passing station
Increase of passing station
Increase of passing station
Increase of passing station
Increase of side tracks
Automatic blocking
tokenless
Morse telegragh
(19.7K)
(22.1K)
129.7 Km
(87.9K)

2-5. Train Operation Plan and Estimate of Daily Income and Output

2-5-1 Train Operation Plan

We make the increased train operation plan, for the purpose of checking track capacity and settling parked rolling stock at the freight station according to the present transportation route.

As the basis for carrying out the plan, it seems that the establishment of a dispatch system and the review of the train diagram system are required to reduce delays, for the exact management of train operations.

(1) The assumptions in making the train operation plan

① The study of sand train operation involves interpolating new train operations with existing train operations.

② The change in time schedule for passenger trains should be aboided if possible.

③ Assisting locomotives are used between Pirusa and Kiaracondong.

④ The sand trains operate between Pirusa and Cipinang or Jakartagudang. The proportion of trains to Cipinang and Jakartagudang is 2:1.

(2) Necessary train numbers

The sand transportation volume of 3,000m^3 requires 15 trains. The present scheduled diagram covers six trains, therefore nine additional trains are required.

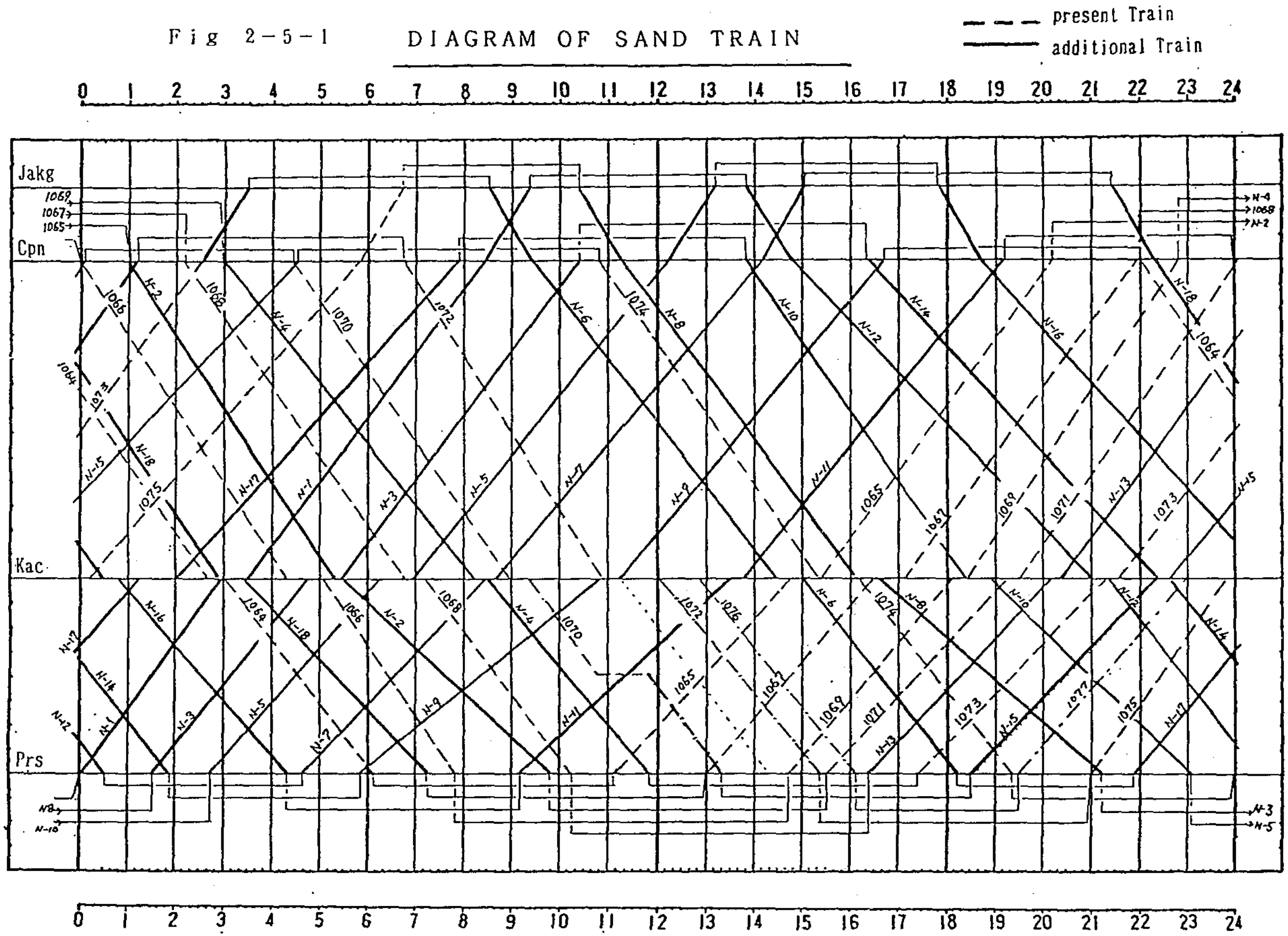
(3) Freight handling

Pirusa Sta. has three possible loading places, Cipinang Sta. has two unloading places, and Jakarta-gudang Sta. has one unloading place. It takes two hours for one handling cycle and 24 hour/day operation is applicable to each station.

Based on the above conditions, the rough diagram for sand train operation is shown in Fig. 2-5-1.

The diagram requires an increase of rolling stock, improvement of freight stations and the security of necessary track capacity on the Southern trunk line.

Fig 2-5-1 DIAGRAM OF SAND TRAIN



2-5-2 The study of track capacity

Fig. 2-5-2 shows the track capacity at present and in future between Cikanpek, Bandung and Pirusa.

The increased track capacity in future is planned so that 18 additional sand trains in both directions may be possible to operate with other seasonal trains.

The overload of track capacity requires various improvements.

The calculation of the capacity is based on the following:

(1) We utilize the train diagram dated 1990.9. All trains on it are included.

(2) The necessary time for signal and blocking operations is as follows:

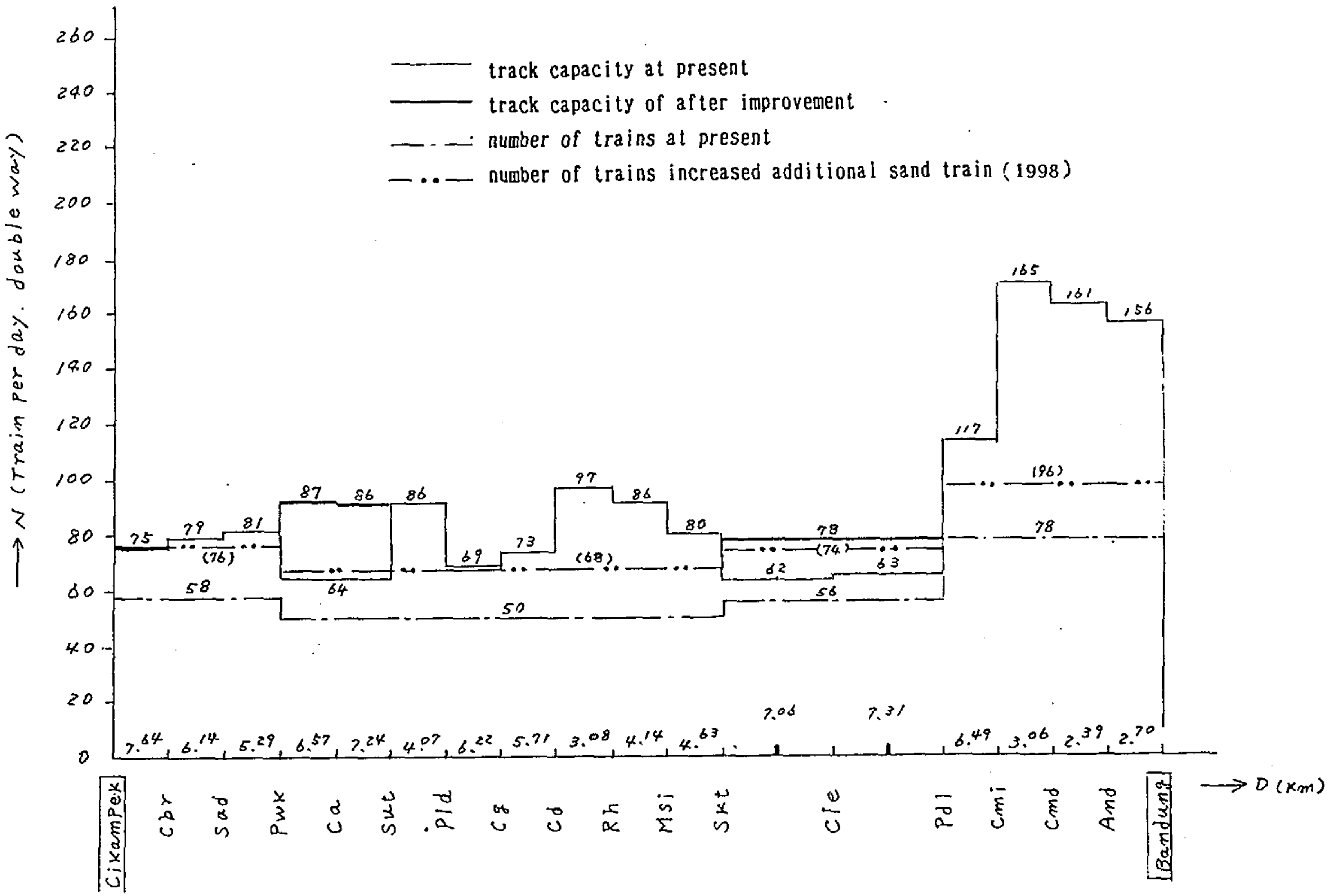
mechanical signal and telegraph block	6.0 minutes
mechanical signal and tokenless block	5.5 minutes
electric signal and automatic block	1.5 minutes

(3) Utilization factor adopted is 0.68

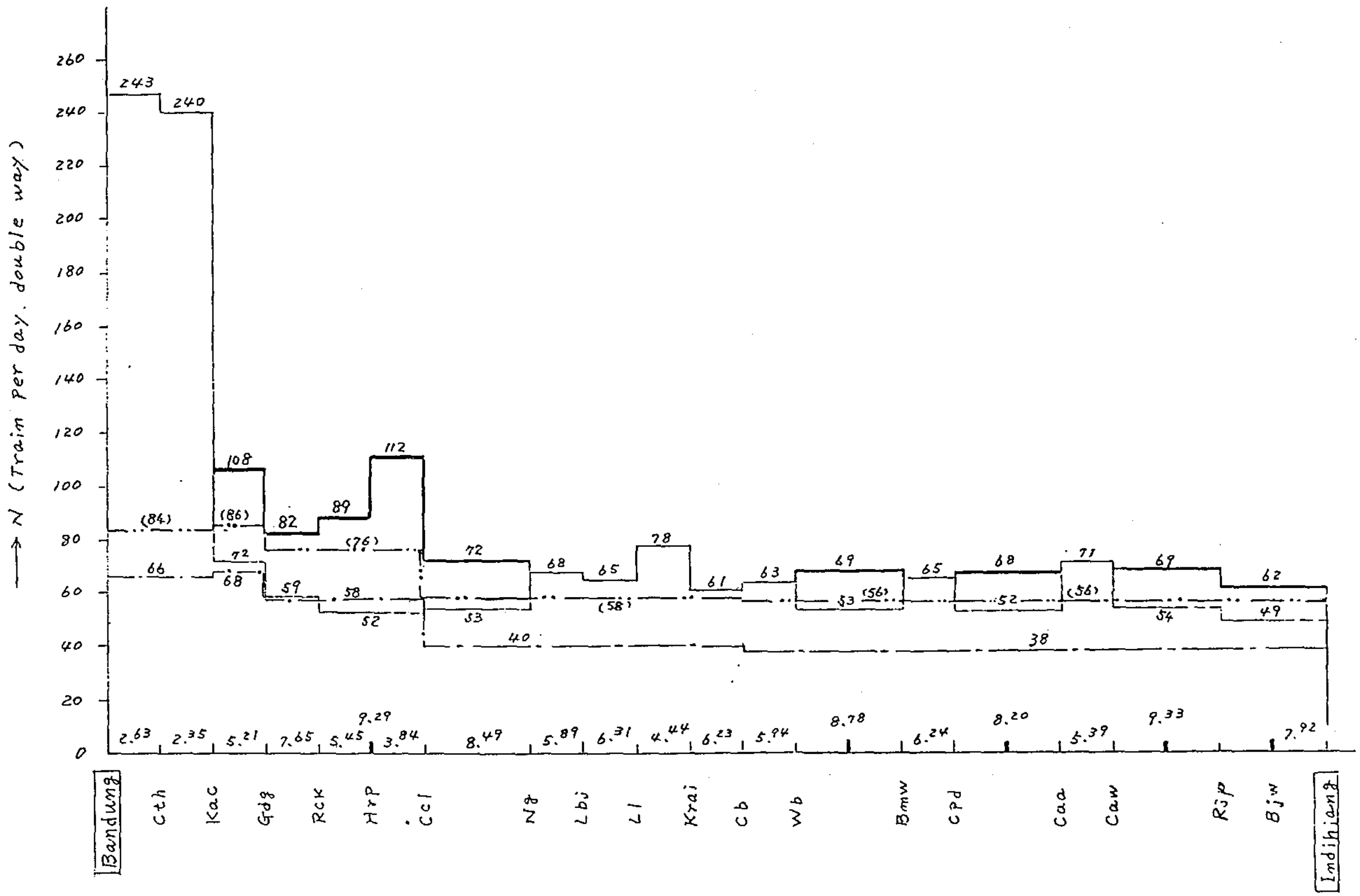
(4) We use the track capacity of the double track section as given in the PERUMKA report.

Fig 2-5-2 Track capacity of the Southen Trunk Line after Improvement

(1) Cikampek — Bandung



(2) Bandung —— Indihiang



2-5-3 Estimate of Daily Income

The tariff for sand transportation from Pirusa to Jakarta area is RP 16,000 per m^3 at present.

The income in the case of 15 trains, 10 trains and 3 trains is calculated from the above unit price as follows:

① In case of 15 trains, 3,000 m^3

$3,000\ m^3 \times 16,000\ Rp/m^3$ = 48 mill.Rp/day = 17,520 mill.Rp/year

② In case of 10 trains, 2,000 m^3

$2,000\ m^3 \times 16,000\ Rp/m^3$ = 32 mill.Rp/day = 11,680 mill.Rp/year

③ In case of 3 trains, 600 m^3

$600\ m^3 \times 16,000\ Rp/m^3$ = 9.6 mill.Rp/day = 3,504 mill.Rp./year

2-5-4 Estimate of Daily Output

Based on the cost data submitted by PERUMKA, 1990, the operation cost without depreciation and interest costs, have been calculated.

The cost items are classified as follows:

" Fuel cost

" Rolling stock maintenance cost

" Operation cost

" Facility and Infrastructure maintenance cost

" Administration cost

Generally speaking, administration cost is usually regarded as a constant cost and infrastructure maintenance cost includes a constant cost consisting of cost of maintaining structures.

Accordingly, we adopt the following policy.

Tab. 2-5-1 omits administration cost, because it has almost no relation to the change of transportation volume. But infrastructure maintenance cost is included because it is related to transportation volume.

Tab 2-5-1

Operation Cost for Galunggung Sand Freight Train without Depreciation

[unit; ×10³ RP/day]

	15 trains	10 trains	3 trains
Fuel	10,281.7	6,854.5	2,056.4
Maintenance for Rolling stock	3,810.4	2,988.8	966.8
Personnel	6,006.9	4,119.5	1,254.0
Maintenance for Infrastracture and Facility	7,832.1	5,221.4	1,566.3
Total	27,931.1	19,184.2	5,843.5

TOTAL (mil Rp/year)	10,194.8	7,002.2	2,132.9

2-6. Plan and cost Estimate for track and Civil works Construction

2-6-1 Plan

(1) As mentioned in 2-4-2 seven new passing stations are installed.

Bjw is a signal station at present, but as the present track layout causes a shortage of track capacity, it is moved to the Bandung side on account of the lay of the land, and installed as a passenger station with passing facility located adjacent to the highway for convenience of passengers.

Two sections of running track with steep gradients in mountainous district install new passing stations respectively by means of changing the main track to a slight gradient.

(Skt-Cle, Cle-Pdl)

(See Fig.2-6-1)

(2) The two freight stations of Pirusa and Jakarta gudang increase sidings in accordance with the number of parked wagons.

① Cipinang

A marshalling yard long ago, it is now used as the sand unloading station.

Sidings which are out of operation, are renovated for the increase of parked wagons.

② Pirusa (Fig. 2-6-2)

ⓐ The maximum number of parked trains on the 15 train operation, are five. The improved siding have an effective length sufficient for simultaneous loading at three places.

ⓑ Engine turn-around track route is arranged for efficient operation.

③ Jakarta Gudang (Fig. 2-6-2)

ⓐ The Kampung bandan Connection permits the direct arrival and departure of sand. trains.

ⓑ The maximum number of parked trains are two. The present track layout is short of parking track, shunting track and lead track. Therefore, two shunting side tracks and a parking track for shunting locomotives, will be installed as an improvement.
Whereas the existing unloading places are sufficient.

(3) Following the increase of sand locomotives, a shop for medium inspection and repair works is built in Bandung car depot by means of utilizing the unused work space.

2-6-2 Construction Cost

Based on the above plan, a rough estimate of cost is as follows:

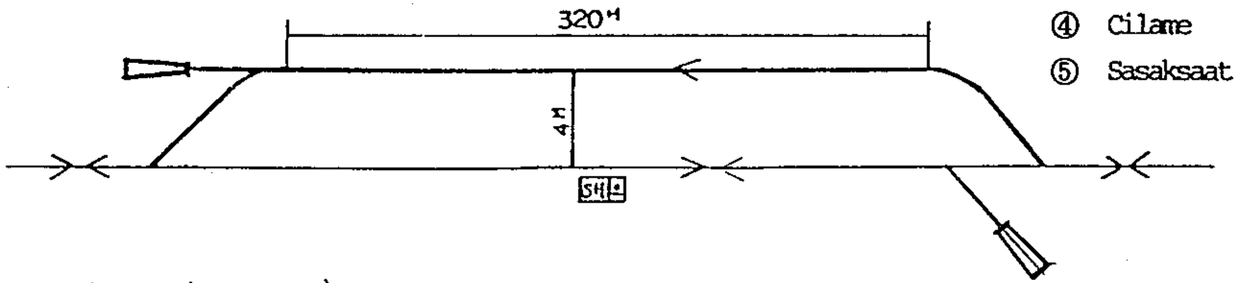
Unit: million RP

ITEMS	QUANTITY	AMOUNT	NOTE
New installation of passing station	Seven stations	4,960	Land, Earthwork, Building, Track, Platform
Addition of siding at the freight stations	Two stations	640	Land, Earthwork, Track (PIRUSA, JAKARTA GUDANG)
New installation of repair shop	one depot	3,440	Building, Pit, Track (BANDUNG)
Total		9,040	

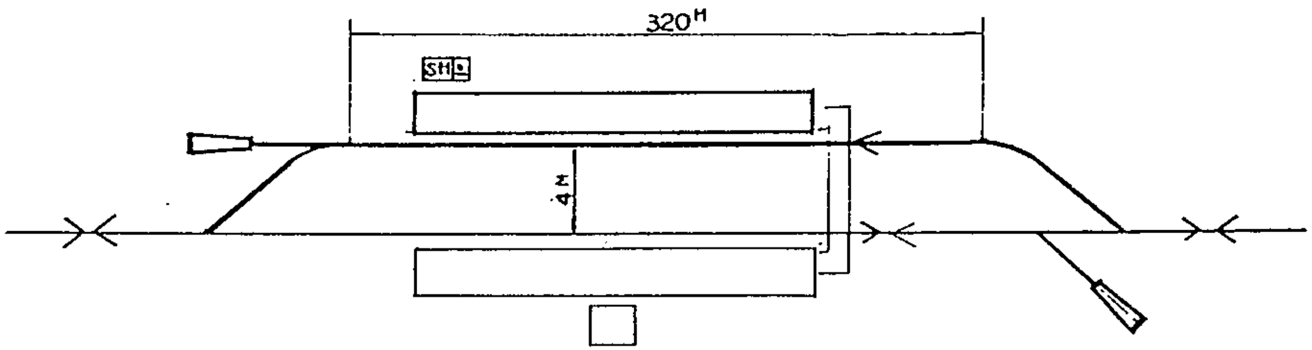
Fig 2-6-1 PASSING STATION

① Ciawl — Rajapolah
② Cipeundeuy — Cirahayu
③ Warungbandrek — Rumiwaluya
④ Cilame — Padalarang
⑤ Sasaksaat — Cilame

(1) New installation signal station



(2) In crease of passing facility (Haurpugur)



(3) New passenger station with passing facility (Babakanjawa)

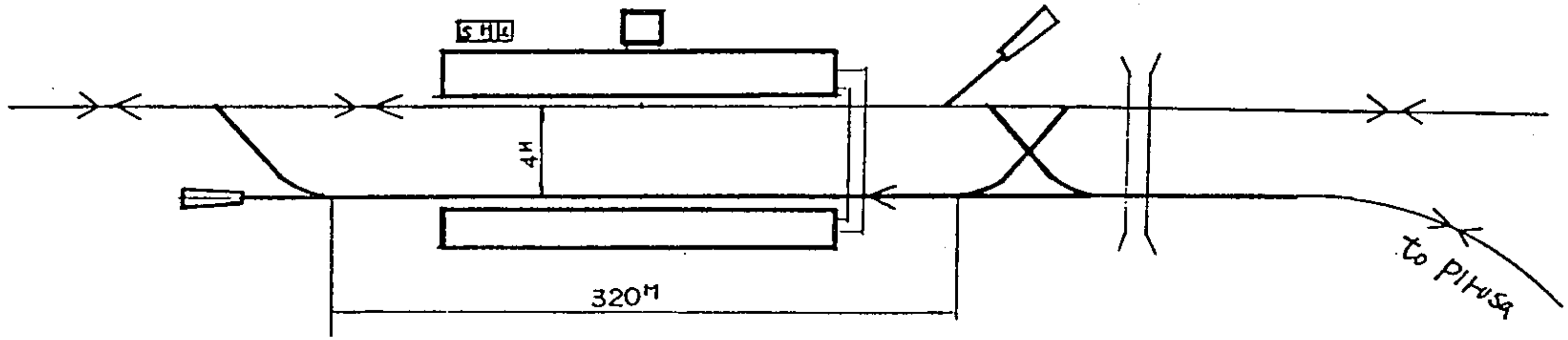
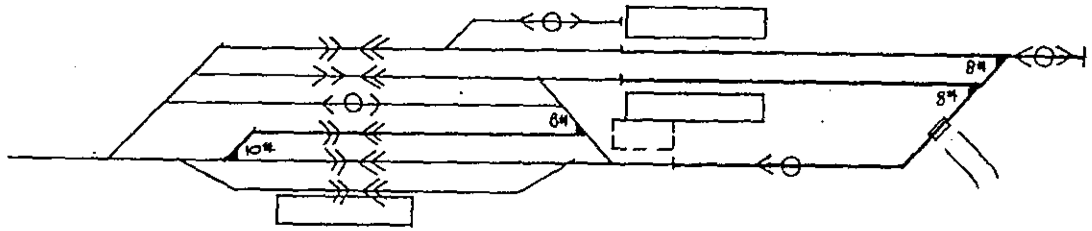


Fig 2-6-2 TRACK LAYOUT SKETCH MAP

(1) PIRUSA



(2) JAKARTAGUDANG

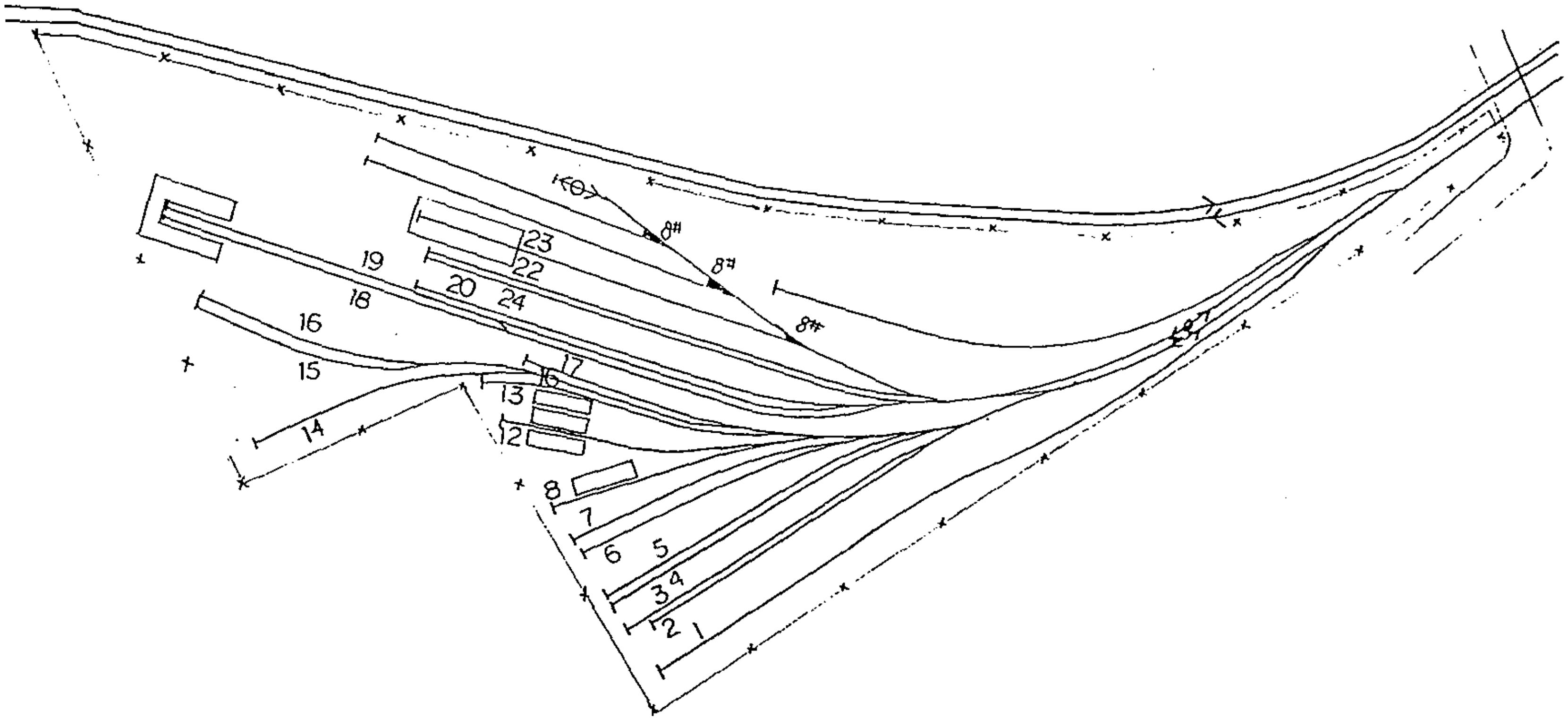
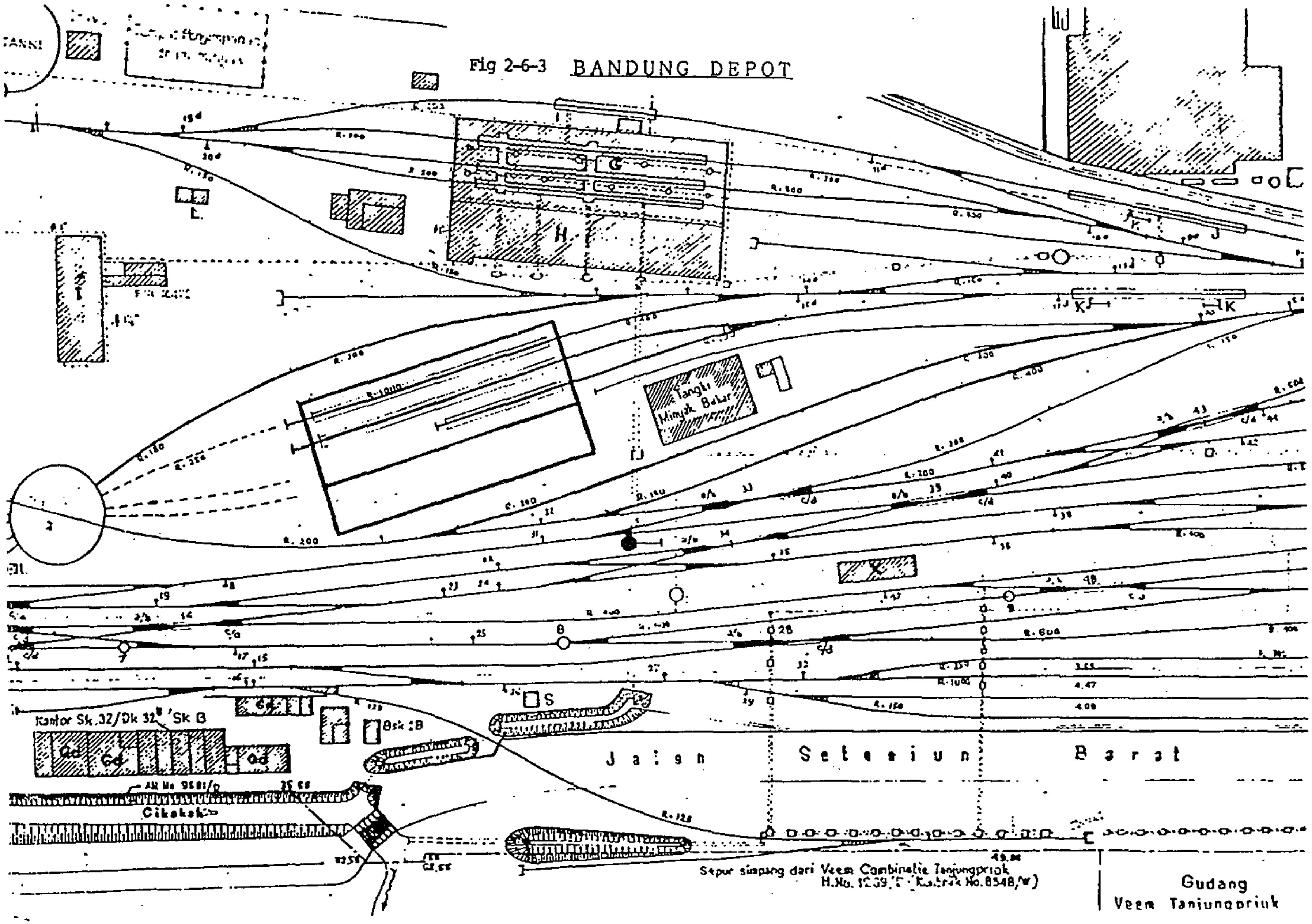


Fig 2-6-3 BANDUNG DEPOT



2-7. Plan and cost Estimate for Rolling Stock and Car Depots

2-7-1 Present Situation of Rolling Stock and Depots

(1) The sand transportation is carried out by dedicated freight trains

These are composed of a diesel locomotive CC201 (1950 HP) and 14 freight wagons in the normal situation. The former is representative of the locomotives used by PERUMKA which has 80 locomotives, the latter are drawn from 204 wagons which break down into 169 flatbed type YYW (loading capacity 15 m^3, 30 ton) and 35 container type PPCW (loading capacity 15 m^3, 30 ton)

The steep grade of 25 0/00 requires each train to connect an assisting locomotives CC201 between Pirusa and Bandung.

Six trains a day were operated during the peak year 1988, but now only three trains are in operation owing to the increase of mechanical problems.

(2) Depots

① Locomotive shed

The locomotive shed at the Bandung car depot is utilized for servicing locomotives engaged in sand transportation. There are a total of 53 locos consisting of 33 CC201 and 20 of other types and they receive daily to yearly inspections. Sixteen of these locos are used for sand transportation.

The facilities are old and decrepit and cannot cater to the future increase in locos.

② Freight wagon shed

The freight wagon shed in Cibatu which handles 204 wagons, is mainly utilized for sand transportation and wagons receive here from monthly to yearly inspection.

The equipment for inspection and repair is old and deteriorated and cannot take care of the future increase in working wagons.

2-7-2 Plan for Rolling Stock and Car Depot

(1) Required rolling stock

The increase of transportation capacity is accomplished both by reconditioning existing rolling stock below standard and the purchase of new rolling stock.

The former consists of three trains at present operating upto six trains/day realized in 1988, the latter will be applied to more than six trains. Dispersed dedicated wagons up to the existing 204 will be utilized and any additional wagons will be newly purchased.

The required transportation volume is as follows:

Transportation ability per train

$15\ m^3/\text{wagon} \times 14\ \text{wagons/train} = 210\ m^3/\text{tain}$

Required trains per day

3,000 m3 / day / 210 m3 / train = 14.3 ≑ 15 trains/day

The numbers of required rolling stock are estimated based on the rolling stock operation plan and the dedicated use for sand transportation. In addition, spares for inspection and repair (15%) requirements and standby spares are included. (Fig. 2-7-1, 2-5-1)

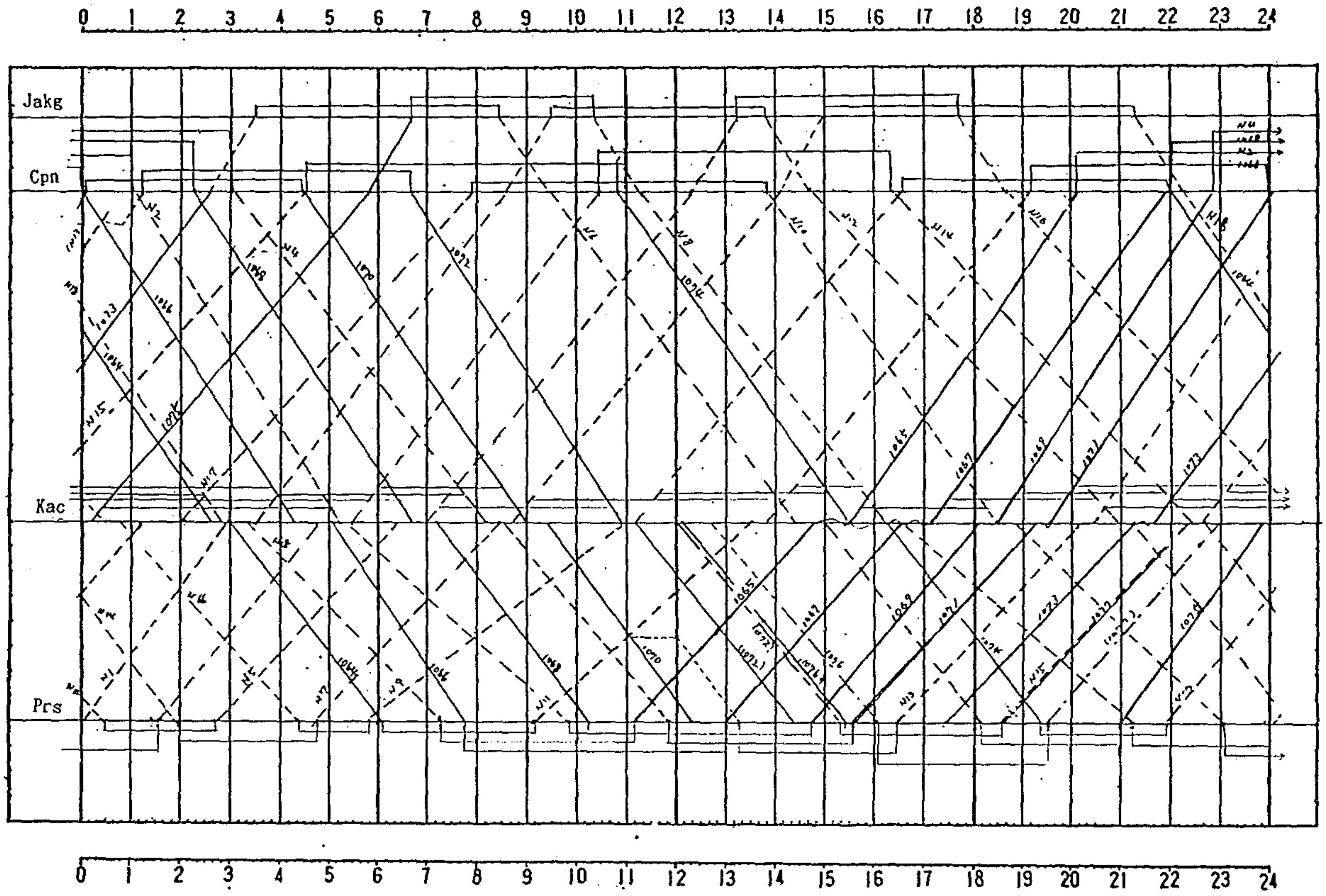
Required locos are shown in Table 2-7-1.

Table 2-7-1 Required Locomotive numbers

	Present condition 3 trains/day	Transportation results 6 trains/day	First stage 10 trains/day	Second stage 15 trains/day
Required numbers based on the locomotive operation plan				
Between terminals	4	6	12	17
For pushing up	3	6	10	10
For inspection and maintenance (15%)	2	3	4	5
standby spares	Included in the above	1	2	2
* Sub total	9	16	28	34
Loco. numbers for sand transportation at present	9	9	16	28
Loco. numbers to be rehabilitated	—	7	—	—
Loco. numbers to be purchased newly	—	—	12	6

Fig 2-7-1 Locomotive Operation Plan

(15 trains/day)



The table shows that seven locomotives are to be rehabilitated, and 18-consisting of 12 for the first stage and six for the second stage, are to be newly purchased.

Required wagons are shown in Table 2-7-2.

Table 2-7-2 Required freight wagon numbers

	Present condition 3 trains/day	Transportation results 6 trains/day	First stage 10 trains/day	Second stage 15 trains/day
Required numbers based on the locomotive operation plan	4 units 56	8 units 112	12 units 168	18 units 252
For inspection and maintenance	10	20	30	45
standby spare	0.5 units 7	1 unit 14	2 units 28	2 units 28
* Sub total	73	146	226	325
Freight wagon numbers for sand transportation at present	204	204	204	226
Freight wagon numbers to be arranged in the above	63	Estimation 73	0	0
Freight wagon numbers to be arranged	--	73	--	--
Freight wagon numbers to be purchased newly	--	--	22	99

The table shows that 121 freight wagons are to be newly purchased of which 22 for the first stage and 99 for the second stage. Apart from this presently operating wagons are to be rehabilitated before the 1st stage.

(2) Depot

① The locomotive shed at the Bandung depot has insufficient capacity for servicing the increased no. of locomotives for sand transportation and a new locomotive shed is required. The new shed will take care of monthly to yearly inspection and 71 locos will be assigned to it composed of 34 locos for sand and 37 for other purposes. All necessary equipment will be installed in it. (Fig. 2-6-3, Tab 2-7-4)

② The freight wagon shed in Cibatu has insufficient capacity for the increased number of wagons for sand transportation. The shed has enough space, but lacks modernized machines and tools to provide adequate maintenance capability.
For this shed it is necessary to arrange efficient equipment for inspection and repair. (Table 2-7-4)

2-7-3 Estimation of Cost

The estimated cost based on the above is shown in Table 2-7-3, 2-7-4.

Tab 2-7-3 Estimate of Rolling stock

Unit: million Rp

	First stage	Second stage	Total	Remarks
New locomotive	36,343	18,171	54,514	18 including spare parts(8%)
New freight wagon	2,200	9,900	12,100	121 including spare parts(5%)
Sub total	38,543	28,071	66,614	
Rehabilitation of locomotive	5,814	——	5,814	7
Adjust ment of freight wagon	443	——	443	73
Sub total	6,257		6,257	
Total	44,800	28,071	72,871	

Tab.2-7-4 The Cost Estimate for Depot Unit of cost: Million Rp

Items	Cost	Notes
1. Bandung Loco Depot		
(1) Utilities of Building	729	Air compressor & supply piping Water supply Sewage treatment equip., Others
(2) Handling equipment	914	Overhead crane 15t, Lifting jack Forklift Truck(electric), Others
(3) Inspection & Testing equipment	471	Engine testing equip. Ultrasonic flaw detector, Others
(4) Maintenance	1,172	Jig & tool, Battery charging equip, Welding equip, Gas cutting equip, Combined turret lathe, Lathe, Drilling machine, Milling machine, Others
(5) Machine installation cost	443	
Sub Total	3,729	
2. Cibatu Wagon shop		
(1) Equipment	1,329	Air compressor & supply piping Overhead crane 15t Jig & tool(Impact wrench etc.) Electric welding equip. Gas cutting equip., Lathe Drilling machine, Others
(2) Machine installation cost	171	
Sub Total	1,500	
Total	5,229	

2-8. Plan and Cost Estimate for Signal and Telecommunication Equipment

2-8-1 Plan

As a basic principle, electronic interlocking device with automatic block system should be installed throughout the whole line for the sake of quick response and security of train operation.

However, this solution requires much expense and a long construction period. Therefore the following partial improvement scheme for this project is proposed.

(1) In order to establish a passing station for securing adequate track capacity, the electronic interlocking device, colour light signal, electric switch, track circuit, communication facilities etcetera are installed. (7 stations)

The outline is shown in Fig. 2-8-1.

(2) Establishment of passing stations as described above, realizes the alternation (share) of block section. (7 stations)

However, the present block system will be kept as it is (tokenless or Morse telegraph).

(3) In case the section does not permit installation of the new passing station, at the 2 adjacent stations an electronic interlocking device and automatic block system (restricted automatic block system) will be installed.

In accordance with the above, communication cable will be installed between the stations.

(8 stations and 7 sections of running track)

(4) With increase of arrival and departure track, the interlocking device is partially installed at the freight station. (Pirusa station)

(5) Jakarta Gudang is a non-interlocking station at present, but partial installation of interlocking devices followed by the increase of side tracks should be installed as the interlocking device in the plan of "Kampung Bandan connection".

2-8-2 Cost

The above mentioned construction cost is as follows:

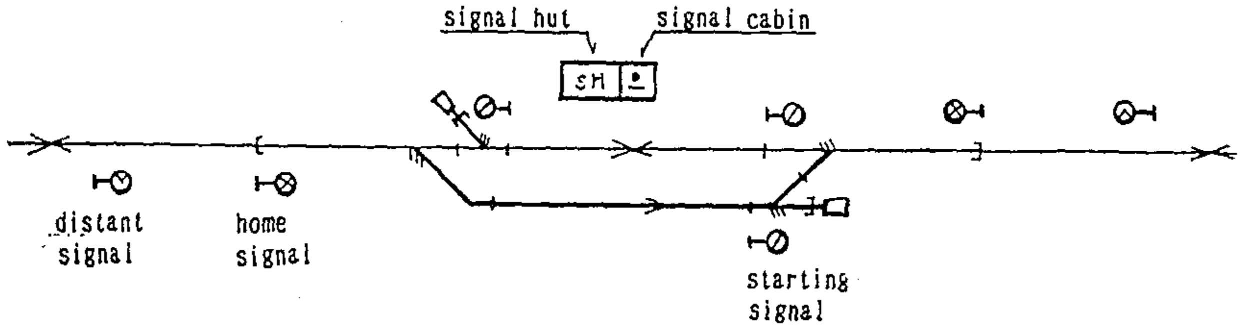
Unit of Cost: Million Rp

Item		Quantity	Cost	Notes
(1) (2)	The electronic interlocking device at the passing station	Seven stations	7,171	Including track circuit,
(3)	Automatic blocking	Eight stations and Seven interstations		Including interlocking device and telecommunication cable
(4)	Interlocking device to Arrival and departure track	One station	71	
Total			23,299	

Fig 2-8-1 Outline of new installation of passing station

(1) Inter-station

- Sasaksaat —— Cilame
- CiLame . —— Padalarang
- Rancaekek —— Cicalengka, (Haurpugur)
- Warungbandrek — Bumiwaluya
- Cipeundeuy —— Cirahaya
- Ciawi —— Pajapolah



(2) Upgraded signal station

- Babakan

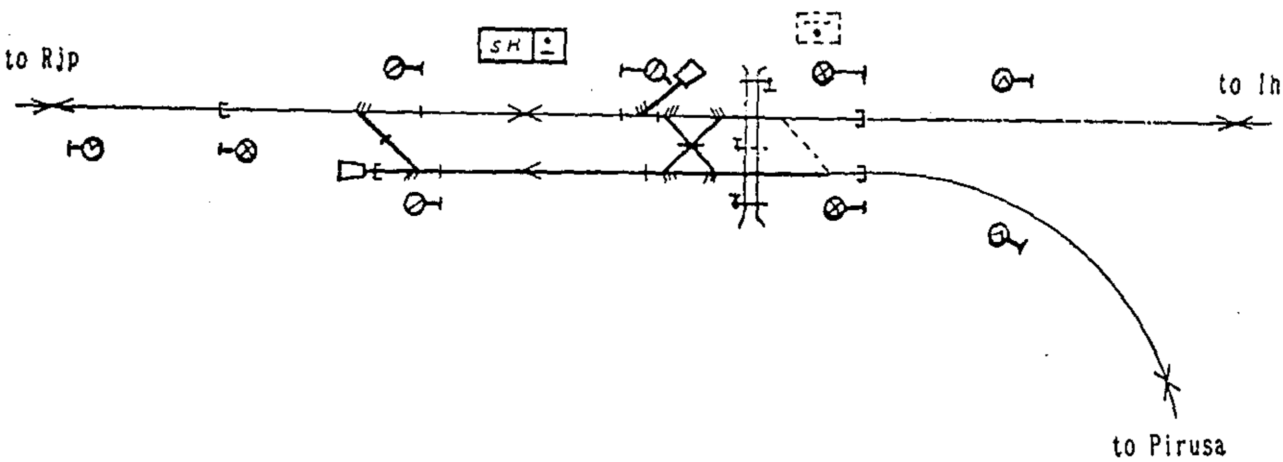
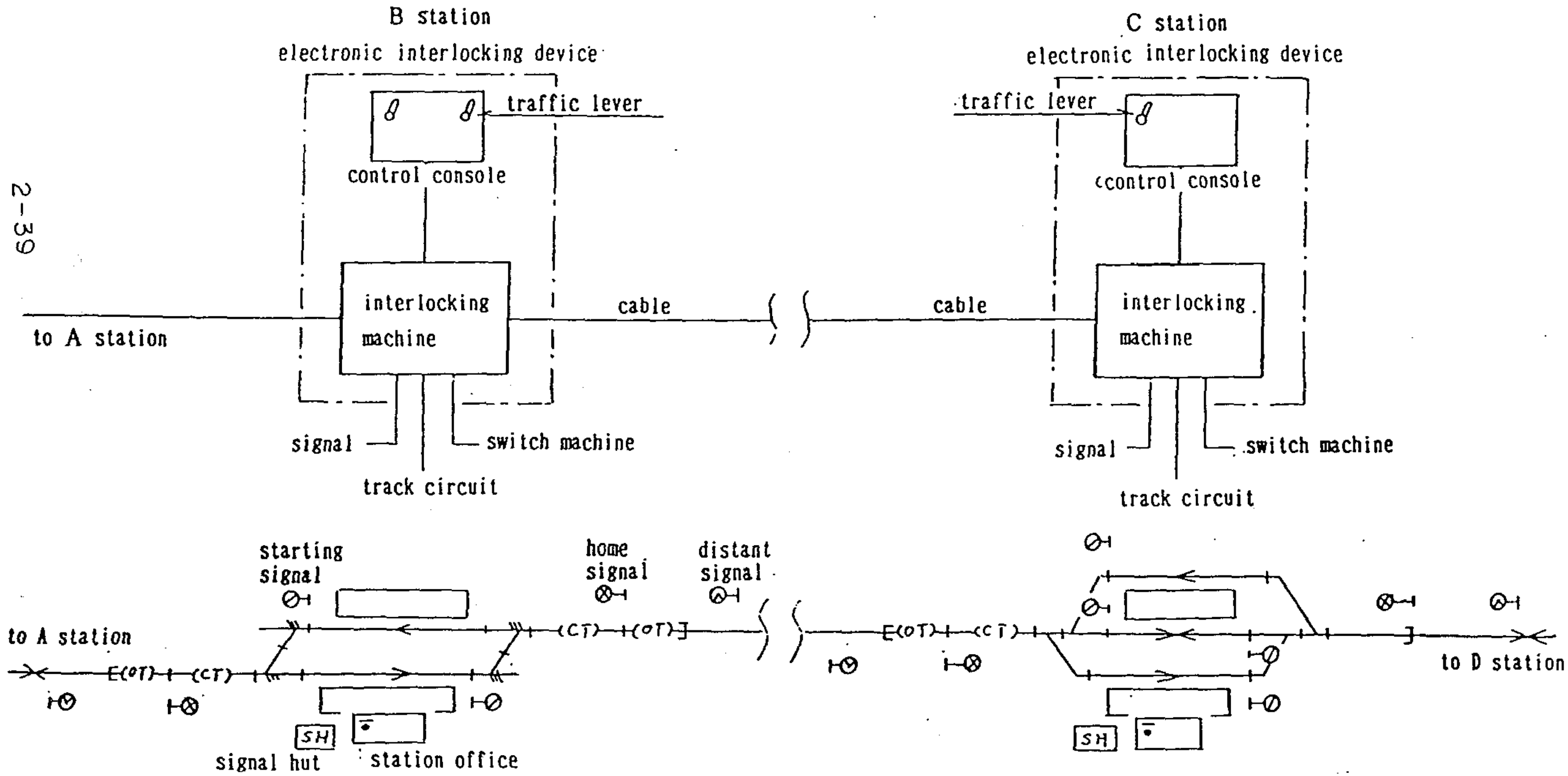


Fig 2-8-2 Outline of restricted autmatic block system

Inter-station

- ○ Purwakarta —— Cigana —— Sukatami
- ○ Kiaracondong—Gedebage—Rancaekek —Haurpugur —Cicalengka—Negreg



2-9. Construction Schedule and Cost Estimate of the Project

2-9-1 Construction Schedule

The construction schedule is shown in Fig. 2-9-1, where for the first stage, only urgently required facilities are installed to resolve the overload on track capacity.

2-9-2 Assumptions used in making the Cost Estimate for the Project

① Construction cost is calculated for each item and then totalled. The breakdown of each item is shown in Table 2-9-1.

② The construction cost is based on present prices in 1991.6. However the inflation rate has been partially applied to it only for the financial evaluation.

③ The cost breakdown calculated for each item is based on the breakdown by domestic and foreign currency requirements.

④ The exchange rate used for foreign currency is fixed at 1RP=0.07 YEN.

⑤ The cost of imported equipment which must be paid in foreign currency is the estimated CIF price.

⑥ Domestic products were given preference in making the cost estimate.

Based on the above assumptions, a summary of the investment is shown in Table 2-9-2. The result is as follows:

Total investment :	123 billion RP	at 1991.6 prices
Foreign currency included:	89 billion RP	ditto

The foreign currency content is shown in Att-1.

Fig 2-9-1 Construction Schedule

	1	2	3	4	5	6	7
	1994	1995	1996	1997	1998	1999	2000
Trains	6		10 (+4)		15 (+5)		
1. Loco wagon		Purchase Rehabili		Purchase			
2. Passing stations		Sasaksaat —Cilame Cilame —Padalarang Babakanjawa		Rancaekek —Cicalengka Warungbandrek —Bumiwaluya Cipeundeuy —Cirahayu Ciawi —Rajapolah			
3. Autmatic block system		purwakarta —Ciganed —Sukatani		Kiaracondong — Gdb - Rck — Hrp - Ccl —Nagreg			
4. Freight station				Siding Jakartagudang Pirusa			
5. Car depot	Loco shop Bandung	Loco shop Bandung Wagon machine Cibatu					
Set up time of main facilities			Set up				

Table 2-9-1 The composition of each item for on land facilities

1) Land cost
   - Land acquisition
   - Removal of obstacles

2) Construction cost (*by contractor*)
   - Direct cost
     - Material cost
     - Labour cost
     - Maintenance cost for machines
     - Temporary installation
   - Indirect cost for contractor
     - Field management by contractor
     - Administration by contractor
     - Profit

3) Contingency 5% except on rolling stock

4) Management cost
   - Engineering service 10% except on rolling stock
   - Overheads 5%
     - Technical supervision
     - Administration

5) Taxation neglected owing to government purchase

Tab 2-9-2 Summary of Investment

* foreign : foreign currency, rerecordin

[Unit: mil RP]

		The first stage				The second stage			Total
		1994	1995	1996	Subtotal	1997	1998	Subtotal	
Land			14		14	43		43	57
*	foreign		0		0	0		0	0
Civil			757		757	157		157	914
	foreign		0		0	0		0	0
Building		3,286	328		3,614	343		343	3,957
	foreign	0	0		0	0		0	0
Track		157	1,586		1,743	2,371		2,371	4,114
	foreign	143	1,371		1,514	2,014		2,014	3,528
Electric Power			571		571	129		129	700
	foreign		343		343	0		0	343
Signal	Equipment		7,457		7,457	10,243		10,243	17,700
	foreign		6,000		6,000	8,171		8,171	14,171
	Line		1,286		1,286	1,929		1,929	3,215
	foreign		514		514	771		771	1,285
Communication	Equipment		143		143	186		186	329
	foreign		114		114	143		143	257
	Line		643		643	1,414		1,414	2,057
	foreign		257		257	571		571	828
Machine			5,229		5,229				5,229
	foreign		4,314		4,314				4,314
Engineering		344	1,800		2,144	1,677		1,677	3,821
	foreign	344	1,800		2,144	1,677		1,677	3,821
Rolling stock			44,800		44,800	28,071		28,071	72,871
	foreign		40,700		40,700	18,171		18,171	58,871
Contingency		172	900		1,072	839		839	1,911
	foreign	172	900		1,072	839		839	1,911
Overhead		198	3,276		3,474	2,370		2,370	5,844
	foreign	0	0		0	0		0	0
Total	domestic	3,498	12,447		15,975	17,415		17,415	33,390
	foreign	659	56,313		56,972	32,357		32,357	89,329
		4,157	68,790		72,947	49,772		49,772	122,719

2-10. Financial Evaluation

As the basis for this financial evaluation, the sand transportation is continued for at least the project life which depends on the sand reserves.

2-10-1. The object of the analysis

Financial analysis aims at analysing the feasibility of the project to determine its profitability and the stability of the day to day operation.

The financial internal rate of return (FIRR) is one of the indexes for the above.

(1) FIRR

Based on the discounted cash flow method, FIRR adopts the discount rate which makes the present value of total cost equal to that of total income where both may occur at different periods employed.

FIRR which takes the gross capital including outside capital into consideration will be compared with the growing city market interest level. (here a soft loan level is expected)

(2) The value of construction cost

The value of construction cost is composed of the sum of the direct construciton cost and management cost as a % of construction cost.

(3) The depreciation

The annual depreciation value of fixed assets is calculated by the fixed amount method, the remaining value at the end of the depreciation period is ignored here.

The mean depreciation years are classified as follows:

Civil works, buildings	40 years	Land-no depreciation
Tracks, Equipments	20 years	
Rolling stocks	(loco 25 years, wagon 40 years)	

(4) The unit costs

The unit costs for the calculation adopt present costs, but take annual inflation rate (the mean inflation rate : 7%) into consideration both of the construction costs and fares, and operation costs only up to the set-up time at the end of the first stage to avoid implicit future inflation rate.

(5) The calculation term T

The calculation term T is the sum of the construction period at the first stage and one project life.

One project life consists of the weighted average of each durable term length classified by the various kinds of depreciation.

Here one project life is calculated as 25 years.

2-10-2 The calculation of FIRR

The financial analysis has been made keeping the following in mind.

This improvement plan contributes not only to the promotion of an aggregate transportation system, but also to the modernization of transportation facilities between Cikampek and Tasikmalaya in the Southern Trunk Line.

The calculation is limited only to sand transportation.

The parameters for calculation based on annual income, expenditure and investment, are obtained from the preceding article and Articles 2-5-3, 2-5-4. The result is shown in Table 2-10-1.

FIRR=0.014 considering inflation up to the end of construction of the first stage seems not so feasible.

But the result should not lead to discouragement because the railway tariff has a preferential allowance of 30% over the highway as stated in Article 2-2-1.

A sensitivity analysis based on 10% increased income shows that railway transport is competitive with highway transport.

The result is shown in Table 2-10-2.

FIRR=0.032 is feasible.

Tab 2-10-1 Calculation of FIRR

pro life	income	inflate revised	output	inflate revised	invest	inflate revised	profit	inflate revised
					4157	5030	-4157	-5030
					68790	88051	-68790	-88051
1	8176	11038	4869	6573	0	0	3307	4464
2	8176	11038	4869	6573	49772	67192	-46465	-62728
3	14016	18922	8062	10884	0	0	5954	8038
4	14016	18922	8062	10884	0	0	5954	8038
5	14016	18922	8062	10884	0	0	5954	8038
6	14016	18922	8062	10884	0	0	5954	8038
7	14016	18922	8062	10884	0	0	5954	8038
8	14016	18922	8062	10884	0	0	5954	8038
9	14016	18922	8062	10884	0	0	5954	8038
10	14016	18922	8062	10884	0	0	5954	8038
11	14016	18922	8062	10884	0	0	5954	8038
12	14016	18922	8062	10884	0	0	5954	8038
13	14016	18922	8062	10884	0	0	5954	8038
14	14016	18922	8062	10884	0	0	5954	8038
15	14016	18922	8062	10884	0	0	5954	8038
16	14016	18922	8062	10884	0	0	5954	8038
17	14016	18922	8062	10884	0	0	5954	8038
18	14016	18922	8062	10884	0	0	5954	8038
19	14016	18922	8062	10884	0	0	5954	8038
20	14016	18922	8062	10884	20614	27829	-14660	-19791
21	14016	18922	8062	10884	0	0	5954	8038
22	14016	18922	8062	10884	19648	26525	-13694	-18487
23	14016	18922	8062	10884		0	5954	8038
24	14016	18922	8062	10884		0	5954	8038
25	14016	18922	8062	10884	-38427	-51876	44381	59914
								0
						FIRR	0.01090	0.01354

Total investment in a project life	billion	162.981	214.627
Gross investment for the project	billion	122.719	160.273

Tab 2-10-2 Calculation of FIRR

10% RISE IN INCOME

pro life	income	inflate revised	output	inflate revised	invest	inflate revised	profit	inflate revised
					4157	5030	-4157	-5030
					68790	88051	-68790	-88051
1	8994	12141	4869	6573	0	0	4125	5568
2	8994	12142	4869	6573	49772	67192	-45647	-61623
3	15418	20814	8062	10884	0	0	7356	9930
4	15418	20814	8062	10884	0	0	7356	9930
5	15418	20814	8062	10884	0	0	7356	9930
6	15418	20814	8062	10884	0	0	7356	9930
7	15418	20814	8062	10884	0	0	7356	9930
8	15418	20814	8062	10884	0	0	7356	9930
9	15418	20814	8062	10884	0	0	7356	9930
10	15418	20814	8062	10884	0	0	7356	9930
11	15418	20814	8062	10884	0	0	7356	9930
12	15418	20814	8062	10884	0	0	7356	9930
13	15418	20814	8062	10884	0	0	7356	9930
14	15418	20814	8062	10884	0	0	7356	9930
15	15418	20814	8062	10884	0	0	7356	9930
16	15418	20814	8062	10884	0	0	7356	9930
17	15418	20814	8062	10884	0	0	7356	9930
18	15418	20814	8062	10884	0	0	7356	9930
19	15418	20814	8062	10884	0	0	7356	9930
20	15418	20814	8062	10884	20614	27829	-13258	-17899
21	15418	20814	8062	10884	0	0	7356	9930
22	15418	20814	8062	10884	19648	26525	-12292	-16595
23	15418	20814	8062	10884	0	0	7356	9930
24	15418	20814	8062	10884	0	0	7356	9930
25	15418	20814	8062	10884	-38427	-51876	45783	61807
								0
						FIRR	0.02896	0.03199

Total investment in a project life	billion	162.981	214.627
Gross investment for the project	billion	122.719	160.273

2-11. Conclusion and Suggestions

(1) FIRR is 1.4% which is not far from the interest rate for soft loans of 3%.

However, the increase in income of 10% at present prices is competitive with highway transportation. It leads to a better result of FIRR=3.2% which is regarded as feasible.

(2) This project has high public appeal as a part of the volcano disaster prevention project for Galunggung district.

On the other hand, PERUMKA, a private enterprise, assigns spare rolling stock and train schedules to sand transportation for the public good, in spite of low profitability.

We expect the government to appreciate the above circumstances and to provide sufficient funds for the realization of this project.

(3) PERUMKA is conducting the rehabilitation of infrastructure like track and bridges of the Southern trunk line at present.

We strongly wish for the smooth promotion of this program.

Especially, the bridges between Purwakarta and Padalarang appear to require drastic renovation including some substitution where route changes might be considered. Therefore, a careful improvement plan which takes a double tracking plan into consideration for the future is suggested.

(4) Speaking generally, an intercity railway like construction of a new line or double tracking, requires a huge investment.

A situation of low profitability is achieved with difficulty after a long depreciation period.

Many countries in the world alleviate the burden of capital cost to the concerned enterprises by means of financial aid considered normal for public works.

The Southern Trunk Line can be considered to be in this situation.

After the improvement for sand transport, all sections between Bandung and Cikampek will reach the upper limit of track capacity. (The upper limit is 90 - 100 trains 2 ways a day on the single line)

The improvement measures for the single track line are no longer only the automatic blocking and the speed up of all operating trains. The latter is impossible to realize in view of the present condition of the rolling stock.

The final improvement is doubling tracking whose execution will come in the near future.

On the other hand, the construction of the express highway between Bandung - Jakarta will be completed sooner or later. Express buses which will operate on the above will require less time than the now profitable Parahyangan express which takes more than three hours.

This critical situation requires a huge investment. We expect the government to approve the investment for doubling track of the Southern Trunk Line which is fundamental to the survival of the railway. This is the only way to make sure of an increase in train speed, punctuality and frequency on the concerned line.

(5) Recently, the transportation demand of the Southern Trunk Line is increasing enormously not only the Parahyangan express service but also due to both container and commuter services owing to industrial development around Bandung.

Nevertheless, the forecasts of the transportation demand for the above have not been realized, and an overall improvement plan for the Southern Trunk Line does not yet exist. It is desirable to complete such an overall masterplan as soon as possible.

(6) The Bogor detour route should be studied from another view point taking the urban transportation plan (Jabotabek) into consideration.

For example, a new unloading station for sand near the outer ring road after improvement of this mountaineous section, would reduce traffic jams in the Jabotabek system.

3. DESCRIPTION OF PROJECTED TERITORRIES

3-1 Utilization of Accumlated Sediment around Mt. Galunggung.

Mt.Galunggung(2168m in height, the volcano located 280 km away from the Southeast of the Capital Jakarta) has erupted in April of 1982.
The eruption has brought great damage not only to the surroundings of Tasikmalaya but to the other Prefectures (Kabpatens) until the next January. (Fig 3-1-1)

The sediment ejected by the volcanic activities is estimated as about 370 million m^3 The Indonesian government established the Mt.Galunggung Projct Office in 1982 to treat this matter. The Emergency disaster prevention facilities including sandpockets and check dams, have been constructed and completed in 1983.

The run-off of sediment has been continued on, since it had deposited on the slope of the mountain, where had been washed down during the rainy season as laher.

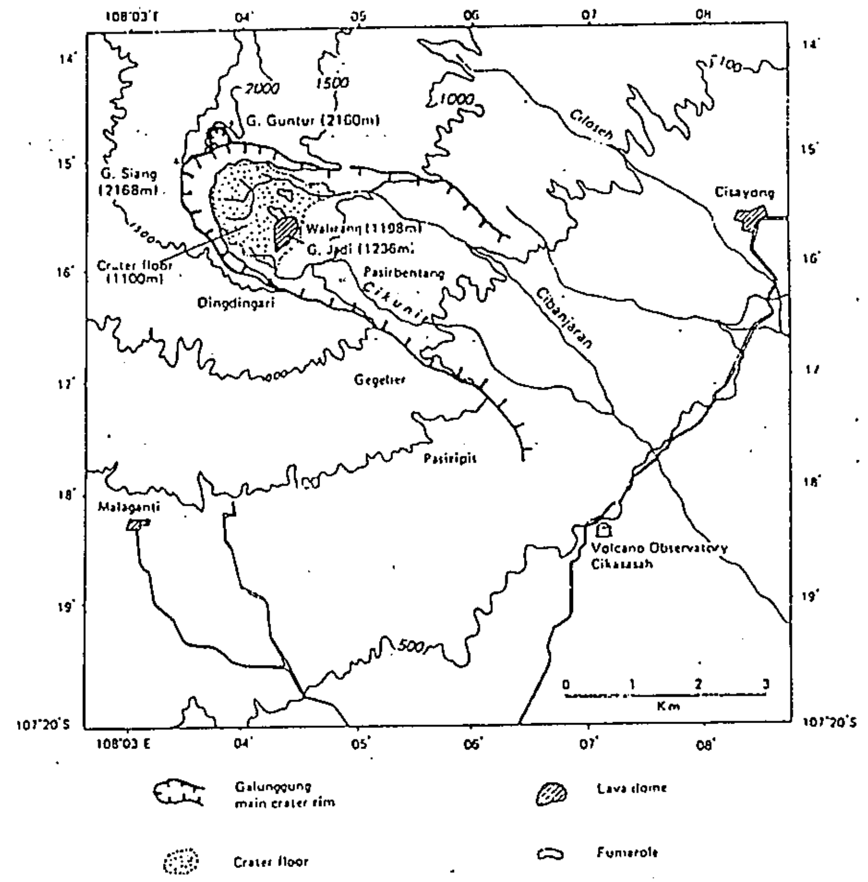
The sediment volume in the sandpockets would reach sooner or later upto the limit of the capacity ,unless this new prevention policy were implemented.

The present disaster prevention project for the southeast slope basin of Mt Galunggung is available to restore and maintain the proper function of the sandpockets in the S.Cikunir and S.Ciloseh river basins,and for these aims the followings are to be carried out: the check of dyke reinforcement works, the sediment management works, the excavation and hauling of deposited sediment, the raising of dikes and the construction of dams. (Fig 3-1-2)

Annual sediment volume at Ciknir river in 1986/1987 is estimated as 1,236 ×10**3 m^3/year, which had been gradually decreasing every year.

Accordingly,the annual mean sediment volume is calculated as 614×10**3 m^3/ year in the project terms of ten years.

The designed management sediment volume to be hauled at each sandpockets



The lahar deposits from the 1982 eruption (Galunggung Lahar 3 Deposits - Glh3) and the lahar deposits from the 1822 eruption (Galunggung Lahar 2 Deposits - Gap2) are distributed on the inner wall of the crater rim of Mt. Galunggung.

Fig 3-1-1 LOCATION MAP of Mt. Galungung

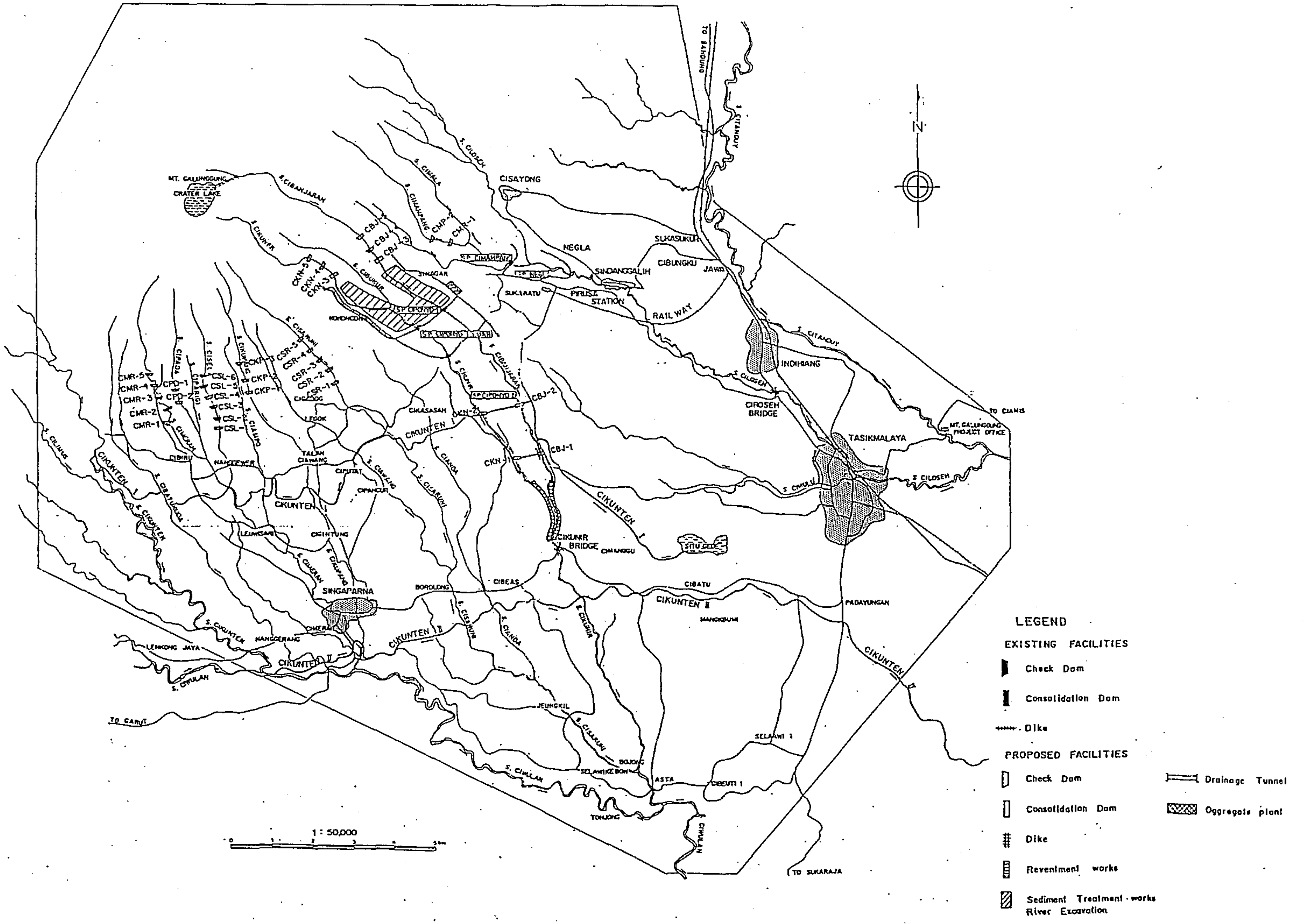


Fig 3－1－2　Location Map of Proposed Facilities of The Disaster Prevention Project in the next decade from now ,will reach as follows.

at Cikunir river 6,141 $\times$10**3 m^3/ decade

(annual sedimented volume in 1986/1987 1,236$\times$10**3 m^3/year)

at Ciloseh river 394 $\times$10**3 m^3/ decade

Total 6,535 〃 =654$\times$10**3 m^3/year

When the above total amount of the sediment was excavated and carried out to aggregate plants,the railway transportation volume as aggregate, considering loss rate 6% at the plants ,is calculated as follows.

654 $\times$10**3 m^3 $\times$0.94=614$\times$10**3 m^3 /year

The aggregate volume transported on railway at present, 428 $\times$ 10**3 m^3/year has been excavated in another area.

Therefore, total amount of necessary transportation volume is calculated as follows.

(428+614) $\times$ 10**3 m^3/year=1,042 $\times$ 10**3 m^3/year

=2,854 m^3/day

≒3000 m^3/day

Still more, the deposited sediment of 40,000 $\times$10**3 m^3 in the past keeps remained at the sandpockets, where 20,000$\times$10**3 m^3 are demanded to be hauled for maintaining the security of the public facilities.

The above volume is expected to be hauled through the project life period on and after the next decade in accordance with sand transportation gaps.

3-2 Present transportation and facilities of the concerned lines

The railway Operation network in Indonesia is limited only in Java and Sumatra islands and has total route length of about 6,460 km , which consists of about 5,000 km of main lines and about 1,400 km of branch lines with narrow track gauge 1,067 mm (170 kms double track whose 160 kms are electrified by means of 1,500 Volt DC),where the network penetrating into Java- Madura has the route length of 4,967 km. (Fig 3-1-3)

Indonesian Railways (PERUMKA) earns more than half of total income from

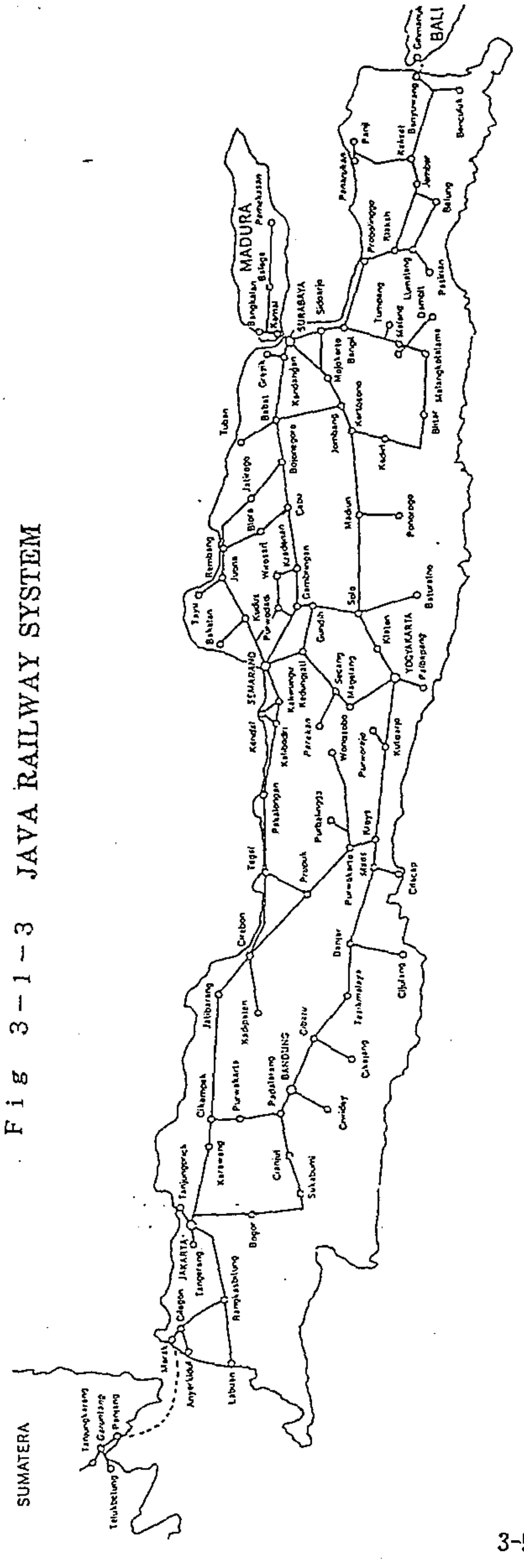
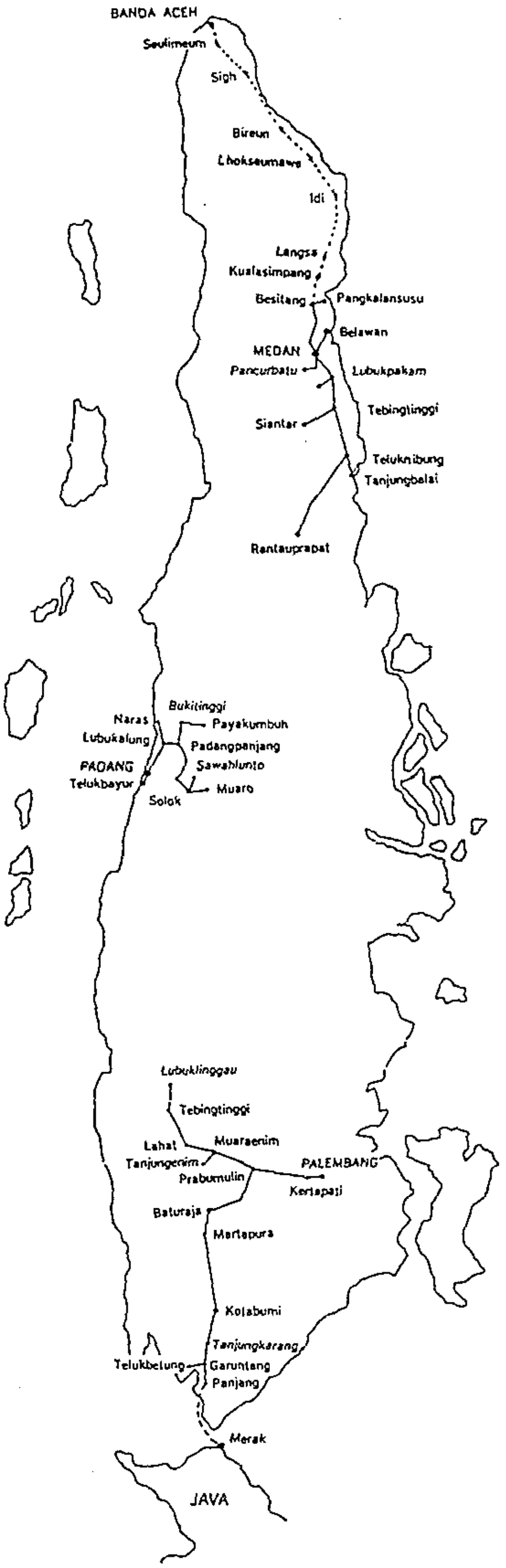


Fig 3-1-3 JAVA RAILWAY SYSTEM

SUMATRA RAILWAY SYSTEM



passenger transportation that has been steadily increased since the 1970s.

However annual freight transportation have soared up from 800 million tonne-km in 1982-83 to 3181 million tonne-km in 1990-91 because of the depressed tariff and coal transportation as some of various reasons.

Year	1984	1985	1986	1990	
Total freight tonnage	6.2	7.0	7.9	12.4	(million)
Total freight tonne-km	1200	1270	1600	3181	ditto
Revenue by freight RP		33386		89035	ditto
Total passenger journeys	46.2	48.8	48.3	56.2	ditto
Total passenger-km	6425	6343	7300	8908	ditto
Revenue by passenger RP		74600		118477	ditto

The population in Jabotabek Area is annually increasing owing to the urbanization by the inflow of rural people looking for jobs in large cities who may demand transportation service.(Fig 3-1-4)

The present population of about 14.5 million people in Jabotabek Area is forecasted to reach about 23.5 million people in the year 2005 and for DKI Jakarta Area itself, the population will increase from 8 million to 12 million people during the same period.

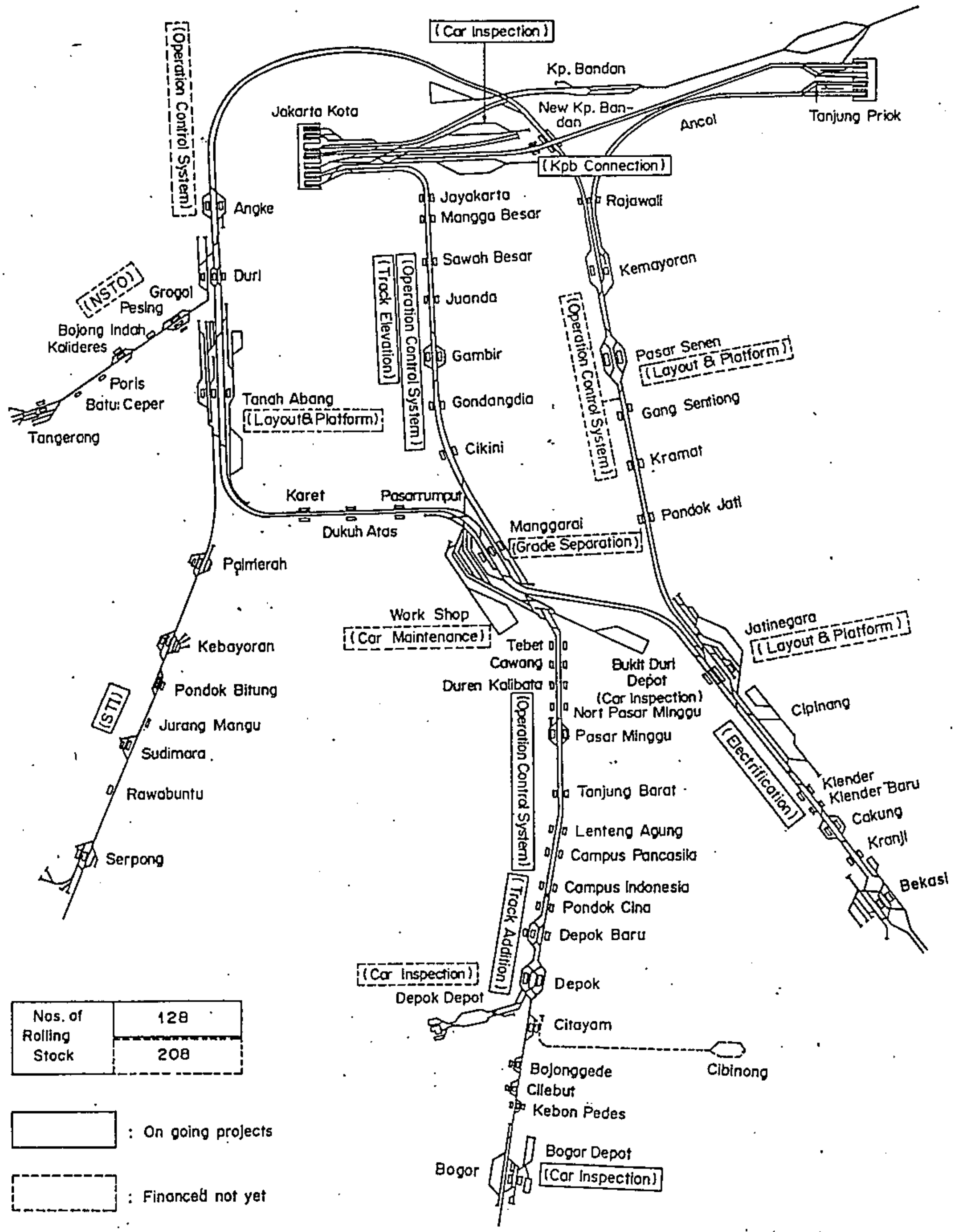
The demand for transportation has had a trend to be done with private motorization, until eventually it caused serious problems such as traffic jams or environmental damage by the increasing fuel consumption already closed to the threshold limit for health and other factors.

Meanwhile,the commuter service by railway in Jakarta has only the share of 1.4% at present.

It means that not only passenger transportation but also freight one in Jabatabek shall be transfered to railway as the government policy.

3-2-1 Northern Trunk Line (Jakarta-Surabaya about 850 km)

Fig 3-1-4 CONCEPTUAL RAILWAY LAYOUT
for 6'/10' Commuter train operation



The condition of infrastructure of this line is relatively better than the other lines ,because a part of it was already improved as double track section(Jakarta-Cikampek) and single track sections(Cikampek-Cirebon-Semarang and Semarang-Surabaya) were rehabilitated ,where permit an possible axle load of 18 tons.

Next to the Jabotabek lines consisted of double tracks and electrification ,the Northern Trunk Line between Jakarta and Cikampek, holds almost level along the rural districts and none-electrified.

The signal system is composed of mechanical interlockings, semaphor signals and mechanical point switches. Each stations install electro-mechanical tokenless block instruments of German S-H type with a hand generator.(Fig 3-1-5)

The effective length of the main tracks at each stations holds more than 200 m ,capable for the passenger trains composed of eight cars or the freight trains with 300m train length.

3-2-2 Southern Trunk Line (Cikampek- Bandung- Yogyakarta- Surabaya)

The condition of infrastructure in this line is not necessarily good where has single track sections except between Padalarang and kiaracondong (18.3 km) with an possible axle load of 15 tons.

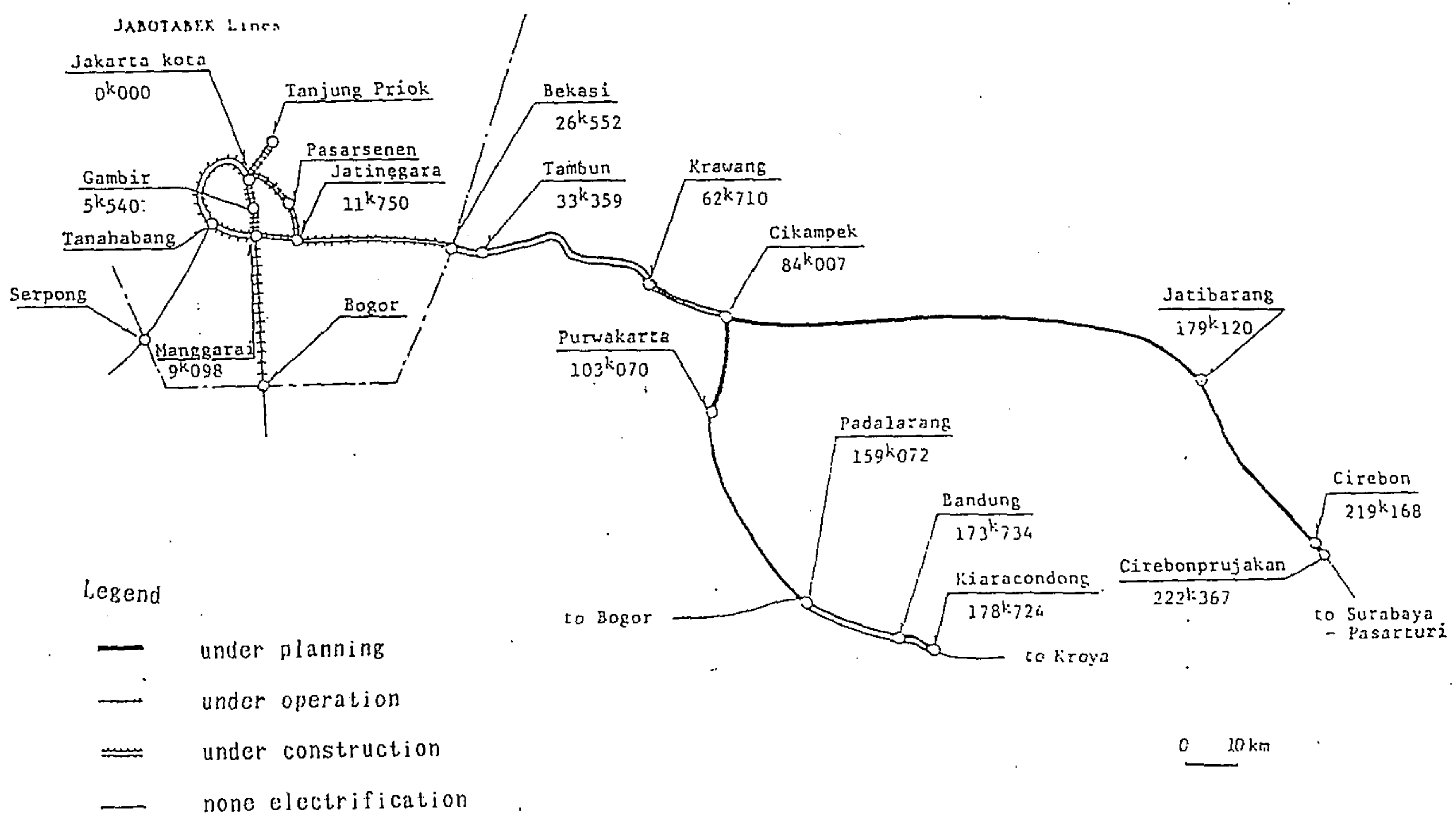
The line runs along the mountaineous districts ,where form the grades of 15～16 ‰between Cikampek and Bandung and of 25‰ between Bandung and Tasikmalaya, still more have the curves with radius of curvature of 200 ～300m in both sections.

The effective length of the main tracks at each stations is the same as the Northern Trunk Line. The signal system is as well except at the Bandung Station, where installs relay interlocking machines, electric signals and switch machines.

Fig 2-1-1 shows the relation between track capacity at present and the scheduled number of the operating trains in Southern Trunk Line at present.

The track capacity indicates comparatively lower value because of the

Fig 3-1-5 Railway Map in Electrification Area



long interstation distances and the big handling time for blocking and signal handling.

However we can notice the critical sections have been resolved owing to newly installed passing stations.

3-2-3 Bogor line

This line has single track with the length of 185 km from Manggarai to Padalarang, where 45 km distance runs plane field from Manggarai to Bogor and is electrified, and 25km to Depok are being doubled, remainder of 20km to Bogor can not afford to the upper limit of track capacity.

The section between Bogor and Bandung where have big population, are mountaineous where the max grade is 40‰ .

Though the highway is not arranged enough, the railway passengers have transfered bus service and so decreased that only two trains per single way are operating.

The infrastructures like bank or bridge had been damaged by flood and temporarily recovered, track condition are kept as it was long before, so each stations are kept possible to pass each other.

3-3 The Present Facilities of the Concerned Stations

3-3-1 The Present Sand Transportation System

The contents are same as section 2-1.

3-3-2 Cipinang

Cipinang was previously utilized as a marshaling yard but is now used as a freight handling depot. A part of the wide yard is used to unload sand, to shunt freight trains and to park freight wagons. The task No. 19 and 20 have already been abolished and other lines have not been used for a long time except for four transit lines, sand unloading track No. 16 and 18 and some parking tracks. For this reason, tracks, turnouts and sleepers are severely corroded and damaged and many places have been already buried by sediment.

The outline of present tracks is shown in Fig. 3-3-1.

3-3-3 Jakarta Gudang

This station has been newly established so as to assume the important mission of being a base station for freight handling. The present annual amount handled has reached 150,000 tons. Further, the depot of PC and FC has also been established. The line facility is comparatively new and contains a wide yard.

However, when viewing the track utilization situation, the sand is unloaded in three lines and four sides. This occasions some disadvantages. The effective length of each track is short and there are no correcting tracks, parking tracks, lead tracks or draw-up tracks.

In addition, since the route from the Eastern Truck Line runs via Jakarta and Kampung Bundan, the train travelling direction is reversed necessitating the relocation of the locomotive. However, this situation may be improved by the Kampung Bundon connection plan and relay interlocking in this station.

The outline of the present tracks is shown in Fig. 3-3-2 (1).

3-3-4 Pirusa

This station is an important one which is exclusively used to load sand. With respect to the present track layout, the five tracks of the transit line cannot adequately be used because of the lack of engine turn-around track. Further, a part of the loading area is limited to a train having only a few freight wagons. In this connection, sand amounting to 1,300 m^3/day was handled at two loading places during peak times in the past.

An outline of the present tracks is shown in Fig. 3-3-2 (2).

3-3-5 Car Depot

(1) Locomotive shed

The locomotive shed at the Bandung car depot is utilized for servicing locomotives engaged in sand transportation. There are a total of 53 locos consisting of 33 CC201 and 20 of other types and they receive from daily to yearly inspections. Sixteen of these locos are used for sand transportation.

The facilities are old and decrepit and cannot cater to the future increase in locos..

(2) Freight wagon shed

The freight wagon shed in Cibatu which handles 204 wagons, is mainly utilized for sand transportation and wagons receive here from monthly to yearly inspection.

The equipments for inspection and repair are old and deteriorated and cannot take care of future increase in working wagons.

Fig. 3-3-1 Cipnang

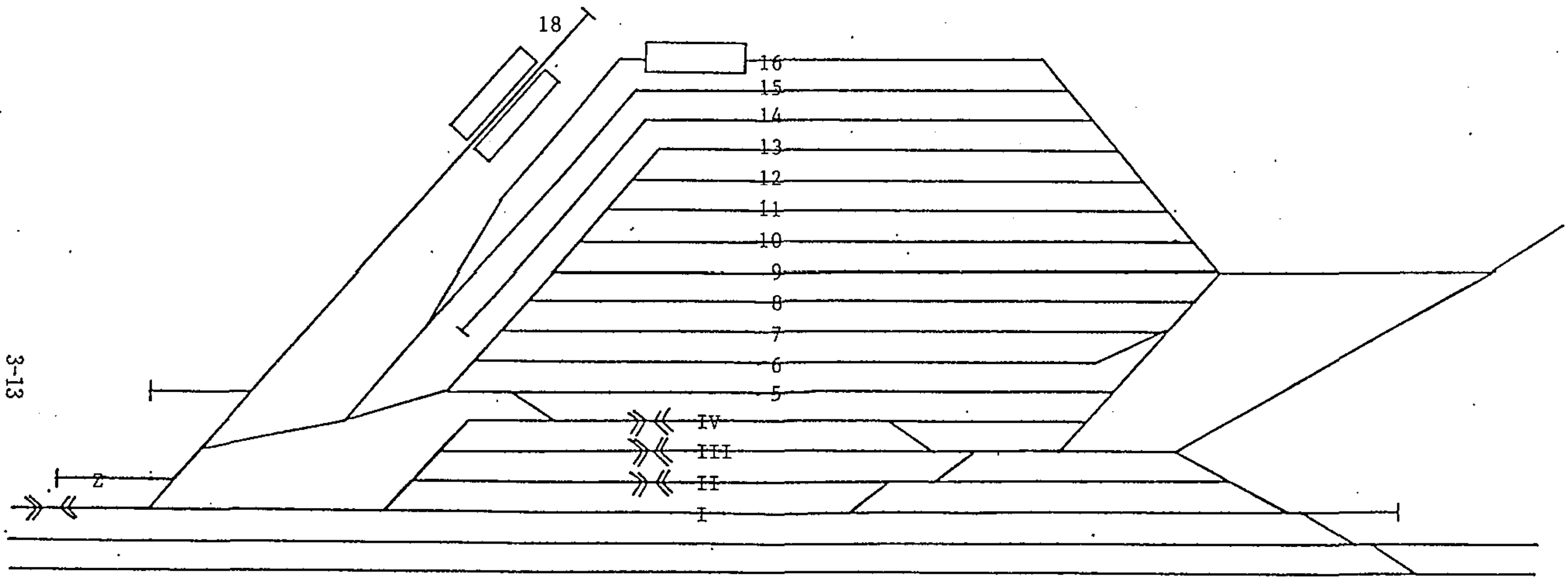
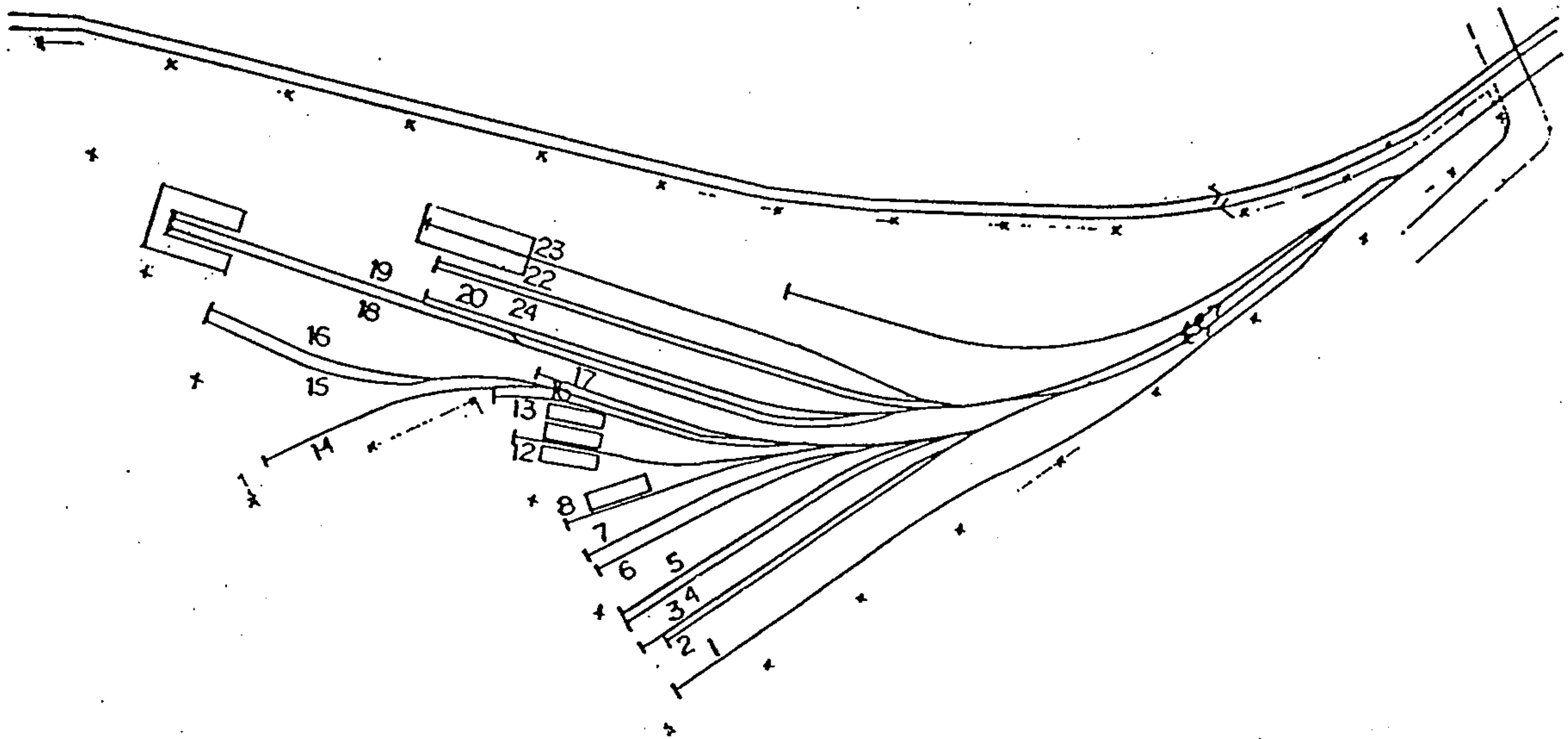
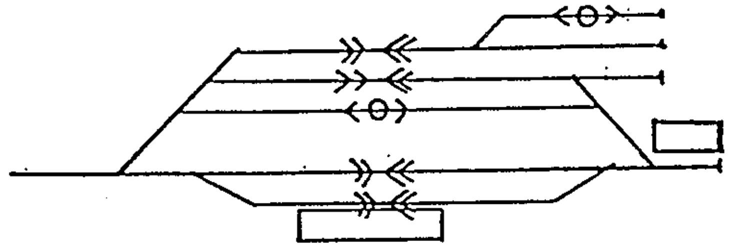


Fig. 3-3-2 (1) Jakarta Gudang



(2) Pirusa



4. TRANSPORTATION DEMAND AND BOTTLENECKS

4-1 Selection of Transportation Alternatives by Highway and Railway

Aggregate excavation in Jakarta is now limited by the Government and the present demand of about 10,000 m^3/day is transported from Tangeran, Bogor and Sukabumi, etc. by trucks. Since sand from these production sites is mixed with soil originating in their strata, the demand for sand produced at Galunggung is strong. The sand can meet the consistency required for ready mixed concrete from the viewpoint of concrete quality. The sand production at Galunggung is running at a rate of 1,000 m^3/day and being screened manually because mechanical screening is uneconomical even in case of 2,000 m^3/day.

Sand is transported by trucks and trains at the equivalent rate.

Transportation costs by truck are estimated by 30% more expensive than by trains at the normal freight rate. Whenever the overloading is found, a fine is imposed on the trucking company. The reforce of the operation lacks stability, so that sand manufacturers reduce production. A comparison table of costs is shown in Tab. 2-2-1.

4-2 Transportation Demand in Future concerning the Southern Trunk Line

Total traffic volume by Indonesian Railways (PERUMKA) is tending to increase in both passenger and freight amount. When viewing transportation share as a whole in Indonesia, road transportation occupies the overwehlming share for both passengers and freight and the railway occupies only 11% for passengers and 3% for freight.

Tab. 4-2-1 Change in traffic volume by railway

	1985	1987	1988	1989	1990
Passengers (unit: million)	48.8	50.1	53.6	54.6	58.1
Freight (unit: million tons)	7.0	9.1	10.8	11.9	13.5

Tab. 4-2-2 Transportation share classified by mode in 1984

(km-tom, and km-passenger) (unit: %)

Transportation mode		Road	Railway	Marine	Air
Share	Freight	70	3	27	1
	Passengers	82	11	2	5

Source: World Yearbook for Statistics

The traffic in any urban area is mainly handled by motorcars, of which autobicycles play the major role. Interurban transportation is mainly done by buses and passenger cars and exhibits the features of railway transportation.

(1) Transportation of passengers in the Southern Trunk Line

1) Limited express train

The limited express Parahyangan is now being operated between Jakarta and Bandung and the traffic volume is tending to increase. Recent results are shown below:

	Traffic volume (thousands of passengers/year)	Frequency of trains (1 day)
1988	1,374.0	6 shuttles, increase of 3 shuttles during holidays
1989	1,397.2	6 shuttles, increase of 3 shuttles during holidays
1990		7 shuttles, increase of 4 shuttles during holidays

According to the French study, the annual rate of traffic volume increase in the limited express parahyangan during 1982 to 1987 was 7.5% on average, and the share was about 10.1%.

The annual increase rate thereafter was 7% and the annual number of passengers in 1995 will become 2,100,000 persons. The share will amount to 13.1%. It is assumed that the service level in the case of the operation of three hours will be necessary for the section between Jakarta and Bandung when using DL traction.

Traffic volume is assumed to be 2,400,000 passengers in 1997 and 3,000,000 passengers in 2000. To respond to this increase, the number of carriages making up a train will be increased, and extra atrains will be operated at the rate of 1 shuttle in 1995, 2 shuttles in 1997 and 4 shuttles in 2000.

2) Transportation for commuters and students

Nowadays, the urban area of Bandung is tending to expand and the traffic jams are especially severe in the east region, so that the expectation for railway transportation increases year by year.

The railway transportation for both commuters and students in this region, is composed of 9 shuttles of commuter trains and 1 shuttle of local trains. They are planned to operate between Padalarang and Cicalengka, and 8 practical shuttles of commuter trains and 1 shuttle of local trains are running.

Since the number of railway carriages is lower and the operation is non-profitable, the operation of extra trains is difficult.

(2) Freight transportation in the Southern Trunk Line

1) Container freight train

Two shuttles are now being operated and three shuttles are to be operated beginning July, 1991. The traffic volume has increased each year as follows:

1986	2,500 units/year
1987	8,000
1988	14,000
1989	23,000

A plan to make the suburb of Bandung city industrial estages has advanced, the area near Rancaekek St. has reached 300 ha and the total area is to reach 5,500 ha.

When the industrial estates are operating, container transportation will increase rapidly.

2) Sand freight train

As described in Chapters 1 and 2, three shuttles of trains are now running to transport sand from Pirusa St. to the Jakarta region and it is being requested to increase sand transportation at the rate of 3,000 m^3/day to the Jakarta region in the future. Therefore, a plan is being studied to increase sand transportation facilitate to 10 shuttles in 1996 and to 15 shuttles in 1998.

Since this sand transportation is being undertaken to prevent disasters in the Galunggung region and to respond to the demand for construction aggregate in the Jakarta region, the plan has strong public appeal. The profitability of the train operation would not be so good even if equipment and trains were increased.

(3) Increase of transportation capacity

The traffic volume may increase hereafter by through limited expresses. Parahyangan and commuter transportation by passenger trains, and container transportation for freight trains may also increase volume. In addition, the profits of operating the limited Parahyangan express and container freight trains is large and this transportation is sure. Since the construction of an expressway is planned between Cikampek and Padalarang, an increase in transportation capacity of the whole Southern Trunk Line may be required. To respond to these requirements, it will be necessary to undertake signal automation, track intensification, the intensification of transportation management, and repair and increase in the number of carriages. It will necessary to raise train speed and improve capabilities in order to keep to scheduled times; and to improve the service level related to transportation needs.

4-3 The Anticipated Bottlenecks Based on the Transportation Demand

There is an intensifying need for more transportation capacity based on an increase in transportation demand. Problems may occur with respect to track capacity, train speed, carriage increases and personnel.

The single track line in the Southern Trunk Line is a problem when considering the track capacity shown in Fig. 2-5-2. The intensification of track capacity based on an increase in sand freight trains in this plan will be done by setting up new passing stations and automatic blocking.

(1) Track capacity

The track capacity of a single track section can be calculated using the following formula:

$$N = \frac{1{,}440 \times f}{t + C}$$

where, N: track capacity (frequency)

t: means operating time for all trains between two stations (min.)

C: signal handling and blocking time (min.)

f: track utilizing factor

Factors C and f used in this calculation are shown in subsection 2-5-2 (2). The track utilization factor is in general 0.6 to 0.7 because this includes track maintenance time and a loss in diagram formation.

Track capacity can be increased by reducing t and C in the above formula. The time that will be increased by reducing t through setting up passing stations and by reducing C through the automatic blocking is evident.

In order to increase track capacity by operating extra trains, it may be necessary to undertake the following measures:

1) the automatization of signal handling and blocking,
2) raising train speed by improving carriage performance, track conditions, using electrification, and etc.
3) converting some single track sections to double track sections.

The calculation of track capacity by automatic blocking between single track sections which have been reviewed are shown in Tab. 4-3-1.

This plan includes new passing stations and increases in track capacity of 20 to 30 times by automatic blocking. In addition, to the improvements in the level of safety in train operation and rapid handling may become possible at the same time.

(2) Raising train speed

It is necessary to improve maximum speed and to eliminate sections requiring speed restriction to raise train speed. Each measure may require enormous expense.

The failure rate of carriages used by the present Indonesian Railways is high. For example, the motor of an electric locomotive is driven using 2/3 capacity of the original one. DL (diesel locomotive) is used in some places for the DC train, so that the urgent problem is to repair broken carriages, restoring them to normal condition. One hundred years have passed since the track was constructed and the track has barely been replaced or improved during this period. Drastic improvements must be undertaken, especially at curved sections and bridges necessitating huge equipment investment.

Table 4-3-1 Table showing track capacities (1/3)

t: mean operating time, C: signal handling and blocking time, f=0.68

Section	km	Present operat-ing freq.	Present case				Case for setting up new passing stations				Case for automatic blocking			
			t	C	t+C Total	Track capacity	t	C	t+C Total	Track capacity	t	C	t+C Total	Track capacity
Kiaracondong - Gedebage	5.208	68	7.49	6.0	13.5	72					7.49	1.5	8.99	108
Gedebage - Rancaekek	7.645	58	10.4	6.0	16.4	59					10.4	1.5	11.9	82
Rancaekek - Haurpugur	5.45	58	12.65	6.0	18.65	52	8.4-9.4	6.0	14.4-15.5	63-68	8.4-9.4	1.5	9.9-10.9	89-98
Haurpugur - Cicalengka	3.844						6.2-7.2	6.0	12.2-13.2	74-80	6.2-7.2	1.5	7.7-8.7	112-127
Cicalengka - Negreg	8.485	40	12.1	6.0	18.1	53	7.19-8.19	6.0	13.19-14.19	69-74	12.1	1.5	13.6	72
Negreg - Lebakjero	5.894	40	8.34	6.0	14.34	68	5.17-6.17	6.0	11.17-12.17	80-87	8.34	1.5	9.84	99
Lebakjero - Leles	6.308	40	8.85	6.0	14.85	65	5.4 - 6.4	6.0	11.4-12.4	78-85	8.85	1.5	10.35	94
Leles - Karangsari	4.442	40	6.54	6.0	12.54	78					6.54	1.5	8.04	121
Karangsari - Cibatu	6.231	40	9.99	6.0	15.99	61					9.99	1.5	11.49	85
Cibatu - Warungbandrek	5.944	38	9.34	6.0	15.34	63					9.34	1.5	10.84	90
Warungbandrek - Bumiwaluya	8.775	38	12.32	6.0	18.32	53					12.32	1.5	13.82	70
							7.16-8.16	6.0	13.16-14.16	69-74	7.16 - 8.16	1.5	8.66-9.66	101-113
Bumiwaluya - Cipeundeuy	6.238	38	9.04	6.0	15.04	65					9.04	1.5	10.54	92
Cipeundeuy - Cirahayu	8.197	38	12.61	6.0	18.61	52					12.61	1.5	14.11	69
							7.3-8.3	6.0	13.3-14.3	68-73	7.3-8.3	1.5	8.8-9.8	99-111
Cirahayu - Ciawi	5.393	38	7.68	6.0	13.68	71					7.68	1.5	9.18	106

Table 4-3-1 Table showing track capacities (2/3)

t: mean operating time, C: signal handling and blocking time, f=0.68

Section	km	Present operat-ing freq.	Present case				Case for setting up new passing stations				Case for automatic blocking			
			t	C	t+C Total	Track capacity	t	C	t+C Total	Track capacity	t	C	t+C Total	Track capacity
Ciawi - Rajapolah	9.332	38	11.91	6.0	17.91	54					11.91	1.5	13.41	73
							7 - 8	6.0	13.0-14.0	69-75	7 - 8	1.5	8.5-9.5	103-115
Rajapolah - Indihiang	7.915	38	13.89	6.0	19.89	49					13.89	1.5	15.39	63
(Rajapolah - Babakanjawa)	5.965	38					9.29	6.0	15.29	64	9.29	1.5	10.79	90
Rajapolah - Bjw - Pirusa	10.925	14	19.82	6.0	25.82	37					19.82	1.5	21.32	45
(Babakanjawa - Pirusa)	4.960	14					12.5	6.0	18.5	52	12.5	1.5	14.0	69

Table 4-3-1 Table showing track capacities (3/3)

t: mean operating time, C: signal handling and blocking time, f=0.68

Section	km	Present operat-ing freq.	Present case				Case for setting up new passing stations				Case for automatic blocking			
			t	C	t+C Total	Track capacity	t	C	t+C Total	Track capacity	t	C	t+C Total	Track capacity
Cikampek - Cibungur	7.636	58	7.47	5.5	12.97	75	4.7~5.7	5.5	10.2-11.2	87~96	7.47	1.5	8.97	109
Cibungur - Sadang	6.135	58	6.88	5.5	12.38	79					6.88	1.5	8.38	116
Sadang - Purwakarta	5.29	58	6.50	5.5	12.05	81					6.05	1.5	7.55	129
Purwakarta - Ciganea	6.565	50	9.73	5.5	15.23	64					9.73	1.5	11.23	87
Ciganea - Sukatani	7.236	50	9.80	5.5	15.30	64					9.80	1.5	11.30	86
Sukatani - Plered	4.07	50	5.83	5.5	11.33	86					5.83	1.5	7.33	133
Plered - Cisomang	6.22	50	8.52	5.5	14.02	69					8.52	1.5	10.02	97
Cisomang - Cikadongdong	5.705	50	7.74	5.5	13.24	73					7.74	1.5	9.24	105
Cikadongdong - Rendeh	3.077	50	4.57	5.5	10.07	97					4.57	1.5	6.04	162
Rendeh - Maswati	4.14	50	5.76	5.5	11.23	86					5.76	1.5	7.26	134
Maswati - Sasaksaat	4.625	50	6.62	5.5	12.12	80					6.62	1.5	7.12	136
Sasaksaat - Cileme	7.056	56	10.29	5.5	15.79	62					10.29	1.5	11.79	83
Cileme - Padalarang	7.305	56	9.99	5.5	15.45	63					9.99	1.5	11.45	76

4-4 Other Relevant Improvement Plans

(1) Other existing plans relating to this transportation plan are as follows:

1) Plan relating to the Southern Trunk Line

Rehabilitation of bridges and tracks proceeds due to the sector loan.

2) Plan relating to Jabotabek

Kampung-Bandan connection plan

Scheduled term of work: January, 1991 - December, 1992

Fund source: OECF

As a part of the plan to construct the future loop line, this plan aims to construct a route by connecting the east line and the west line of Jabotabek thus enabling through operations. Accompanied by this plan, the Kampung Bandan Station will become a passenger station.

Sand trains can directly arrive at the Jakarta Gudan Station using this route (see Fig. 4-4-1).

(2) Improvement plans with high priority are as follows:

1) Plan to renovate the present rails for heavier rails between Bandung and Cikanpek

Ballast renewal and the exchange of sleepers for concrete ones are to be done on the basis of the present rehabilitation plan. Thereafter, 42-kg weight rails are to be exchanged for 54-kg weight rails.

2) Plan to promote color light signals between Bekasi-Cikampek and Bandung

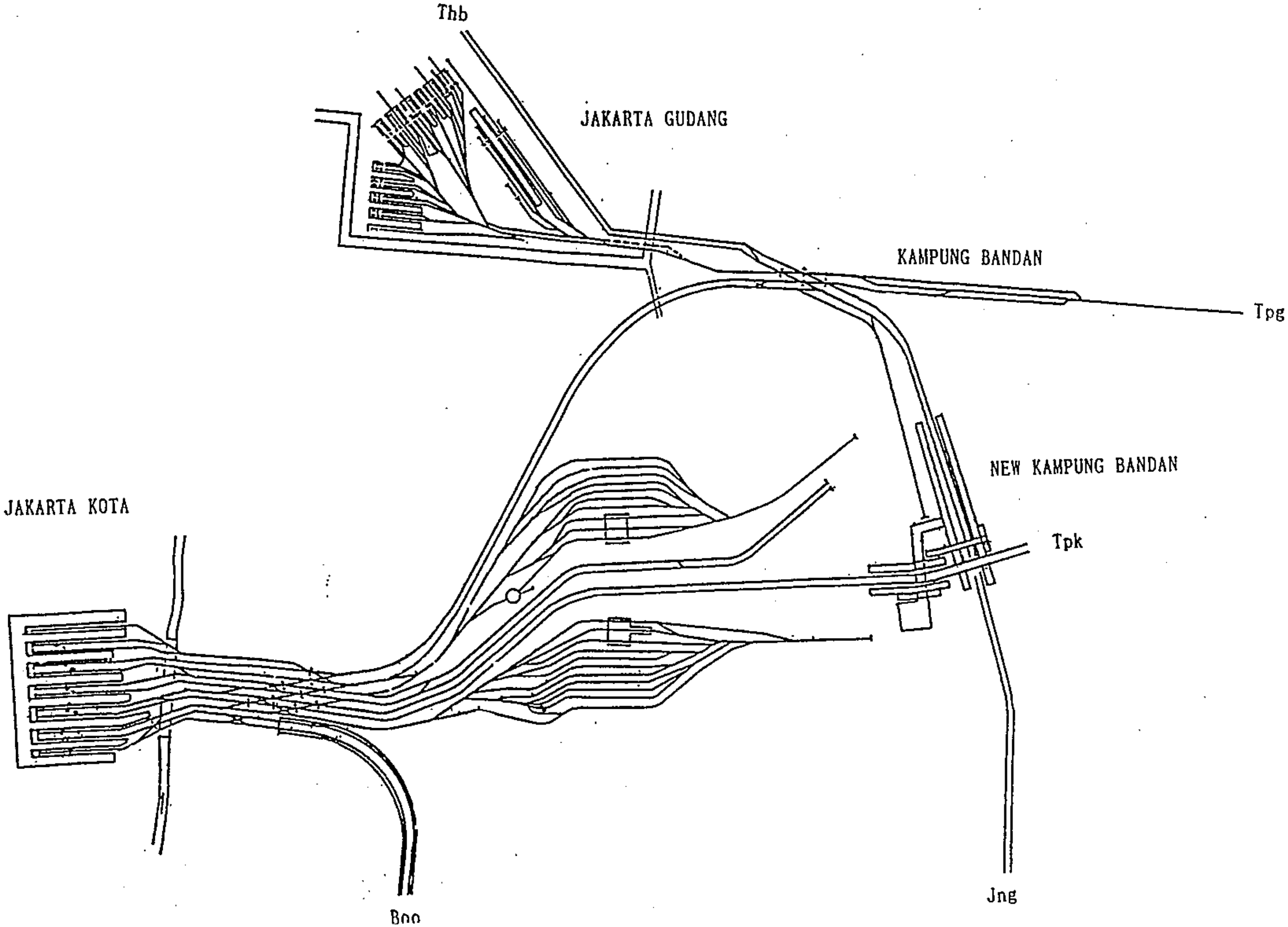
The relay interlocking system in each station and automatic blocking over the whole line will be adopted.

3) Plan to improve single track to double track between Bandung and Chikampek

In this plan, two sections of 25.8 km length between Cipampek and Purwakarta and between Cisomang and Rendeh are to be improved to double track so as to respond to the increased operation of Parahyangan express and container trains.

Other than the above mentioned, there are some lower priority plans. The contents are shown in Att-6.

Fig. 4-4-1 Kampung Bandan connection



5. IMPROVEMENT PLAN

5-1 Methods of Improvement

In formulating a new improvement plan, it is necessary to clarify the purpose of the present improvement plan and to examine the propriety to utilize both of the Northern and Southern trunk lines between Pirusa and Jakarta via Cika mpek as the transport routes as it is.

(1) As described in Section 1.3, "Scope of Work," the purpose of the present improvement is to reinforce rolling stocks and surface facilities so as to enable to transport 3000 m^3 per day of volcanic sand around Mt. Galunggung from Tasikmalaya to Jakarta.

This improvement is also expected to serve the transport of passengers and containers on related lines.

(2) For the above purpose, we shall put forth three proposals including the Bogor line to be an opposing transport route as shown in Fig. 2-2-1, and then examine which of the three proposals should be given priority to. Finally, we shall examine how and to what extent the best transport route selected should be improved.

Regarding item (2) above, we have already obtained the conclusion in Items 2-2-2 and 2-4-1.

5-2 Construction Standards

Track construction shall conform to Indonesia National Railroad Track Construction Standards, established under the Governance of the national Railroads' edict of April 2, 1986.

(1) Passing stations

1) The required effective length of a passing station was set at 320 m in accordance with the Northern Trunk Line Track Project, although 250 m is theoretically enough because the required effective length is the sum of a

double-heading locomotive length of 15.2 m × 2, a freight wagon length of 13.2 m × 14, and a marginal train length of 35 m.

2) The rails used in newly laid passing tracks shall be R54, but the rails used in the mainline shall not be changed.

3) The turnouts for passing tracks shall be R54 simple turnout #10.

4) The routing shall allow for simultaneous inbound/outbound traffic through newly laid safety sidings.

(2) Sidings

1) The rails for sidings shall be R42.

2) The turnouts for the siding at Pirusa shall be R42 simple turnout #8 and R42 simple turnout #10, whereas those at Jakartagudang shall be R42 simple turnout #8.

3) Regarding the feeder lines to the Bandung Depot, the rails shall be R42, and the turnouts shall be R42 simple turnout #8.
(See Figs. 5-2-1, 5-2-2, and 5-2-3.)

(3) Formation level

The formation level width and track structure requirements for the construction of the above-mentioned items shall be as shown in Fig. 5-2-4.

(4) Grade at the station

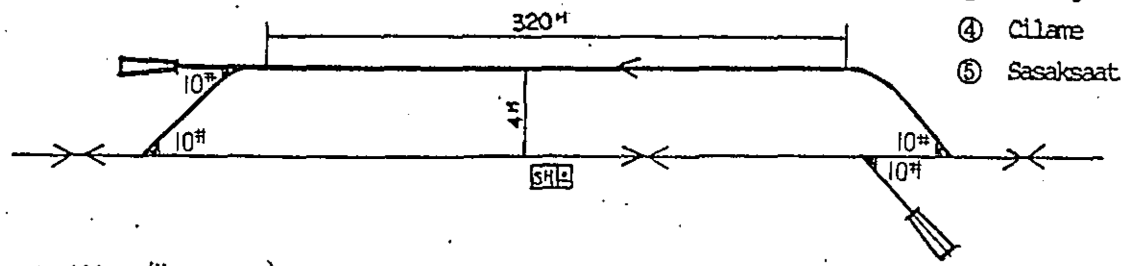
The grade at each station is supposed to be standard 0 to 1.5‰, though even 10‰ would be tolerable from a practical point of view as far as stations where no vehicles are coupled or decoupled are concerned.

Fig. 5-2-1

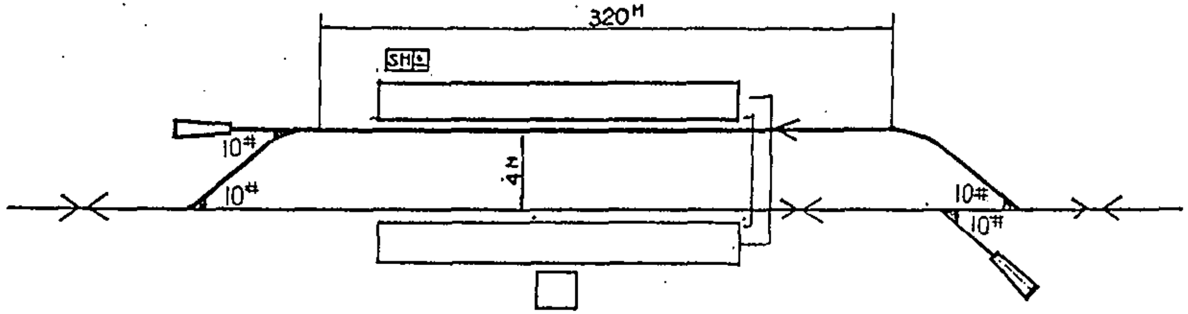
PASSING STATION

① Ciawi — Rajapolah
② Cipeundeuy — Cirahayu
③ Warungbandrek — Rumiwaluya
④ Cilame — Padalarang
⑤ Sasaksaat — Cilame

(1) New installation signal station



(2) Increase of passing facility (Haurpugur)



(3) New passenger station with passing facility (Babakanjawa)

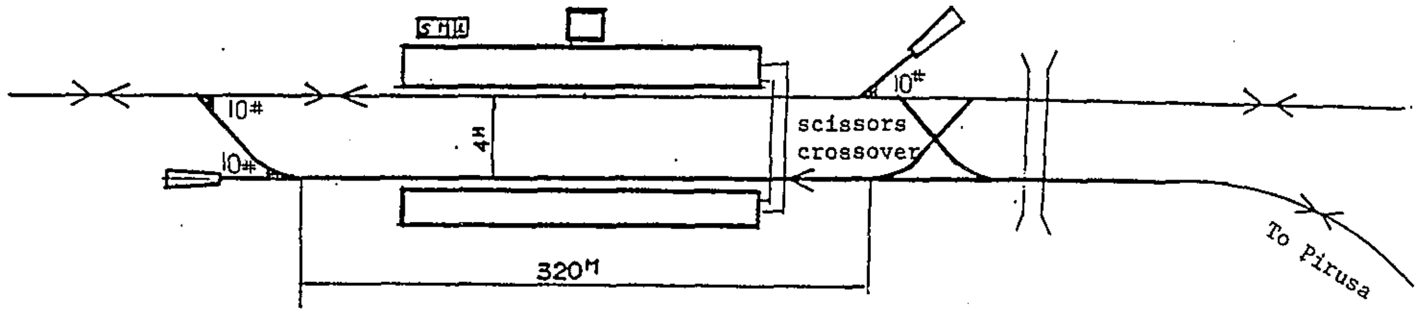
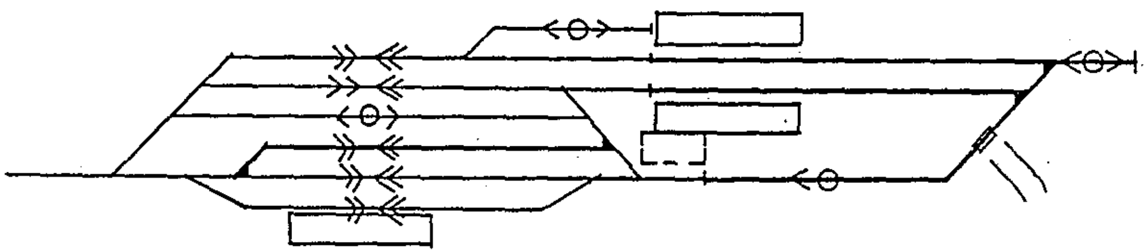


Fig. 5-2-2

TRACK LAYOUT SKETCH MAP

(1) PIRUSA



(2) JAKARTAGUDANG

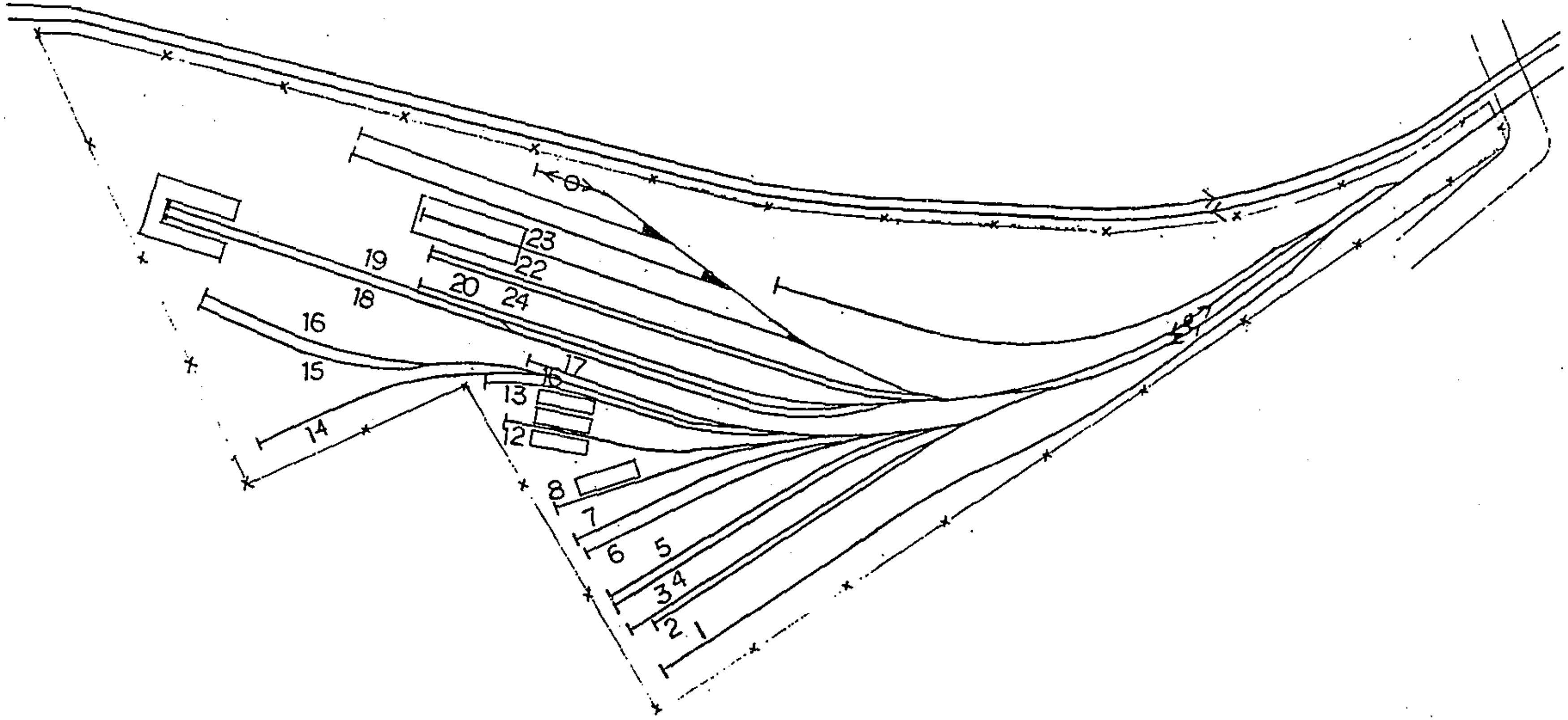


Fig. 5-2-3 BANDUNG DEPOT

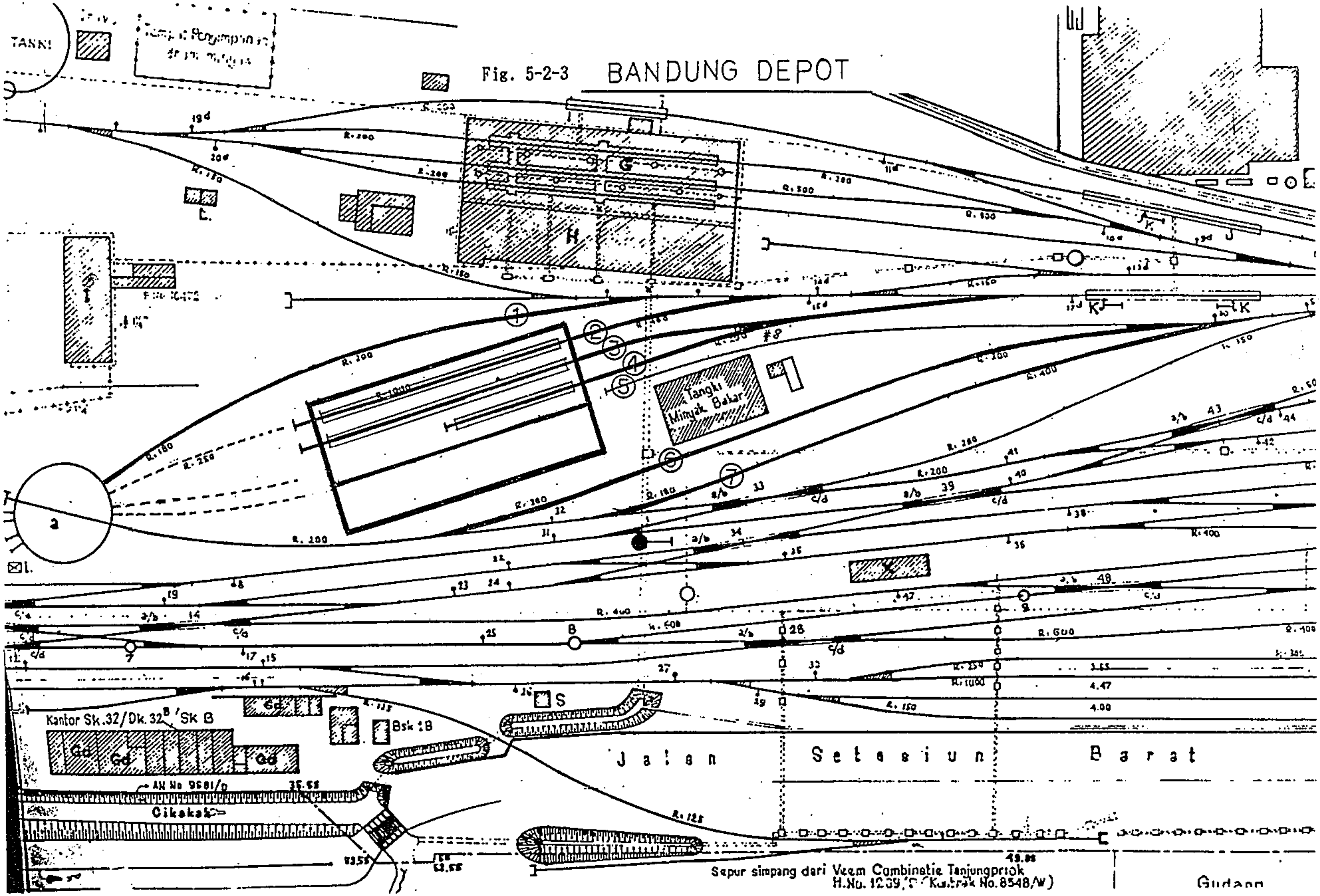
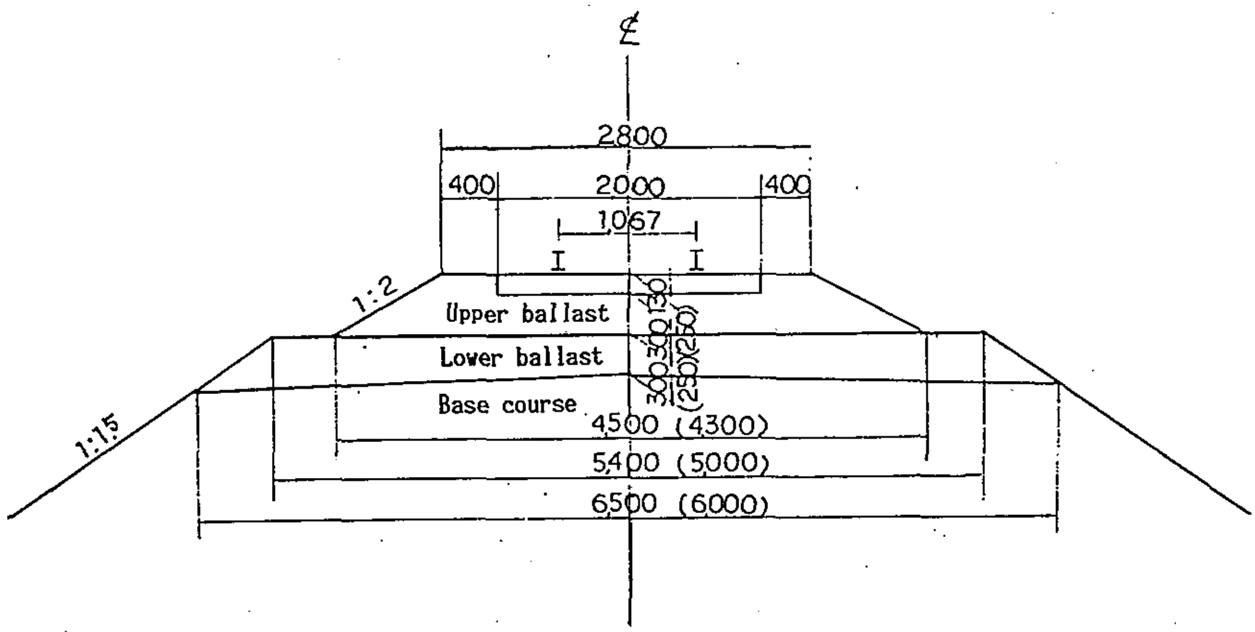


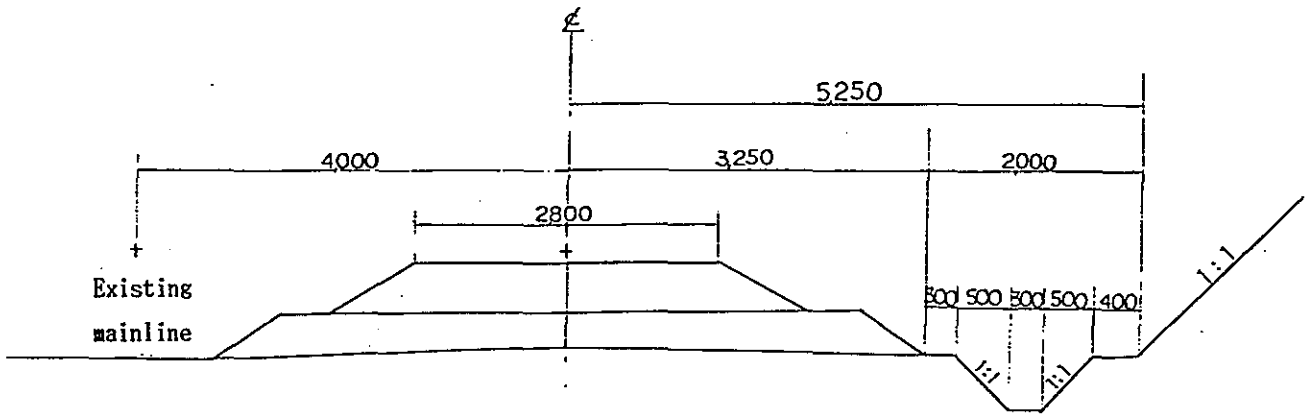
Fig. 5-2-4 STANDARD DIAGRAM

(1) Banking



Note: The figures in parentheses are siding design values.

(2) Cutting



5-3 Transportation Plan and Organization for the Operation

5-3-1 Transportation plan

(1) Train operation plan

The train operation plan is part of the present improvement plan described in outline in Item 2-5-1. However, while the train operation plan is, to be put into operation seven years from now, it is presently envisaged that in the interim, the traffic volumes of passenger and freight trains will increase a great deal. With such prospect the traffic volume and equipment status throughout the Southern Trunk Line will necessarily have to be reviewed in the present operation plan.

Also with regard to the current reference train operation time schedules, they should be reviewed taking into consideration the actual equipment status and rolling stock performance before implementation of the plan.

(2) Costs of a sand train

An estimate of daily output for a sand train is given in Item 2-5-4. The raw data for the calculations was collected at PERUMKA in 1989 and 1990. (See Fig. 5-3-1.)

(a) Fuel cost

The fuel cost per sand train described below was calculated on the basis of available data concerning the average fuel consumption rates, unit fuel prices, and locomotive travel distances in kilometers by rolling stock type at PERUMKA in 1990. (Tab. 5-3-1)

Fig. 5-3-1 Operation cost at PERUMKA in 1989, 1990, without depreciation

(unit: 10^3 Rp/year)

	1989	1990
Direct Operation Cost		
1. Fuel	30,500,000	35,250,130
2. Maintenance for rolling stock		
(1) Locomotive	10,869,502	
(2) Passenger	8,588,835	39,004,525
(3) Wagon	6,541,673	
3. Personnel		
(1) Operation	15,824,440	27,854,166
(2) Rolling work shop	8,820,160	
Non Direct Operation Cost		
1. Facility at Terminal Station	48,641,027	59,604,096
2. Infrastructure		
Administrational	91,848,763	92,437,236

Tab. 5-3-1

RENCANA BIAYA TENAGA GERAK UNTUK PERUMKA TAHUN ANGGARAN 1990

BAHAN BAKAR DAN PELUMAS	KILOMETER LOKOMOTIF	PEMAKAIAN LITER/KM	PEMAKAIAN LITER(+KWH)	HARGA SATUAN (RUPIAH)	JUMLAH HARGA (RIBU)
		(Consumption rate)		(Unit cost (Rp/lit.))	
I. LOKOMOTIF					
a. BAHAN BAKAR Fuel oil					
1. DIESEL	10.091.000	2,85	28.759.350	200	5.751.870
Item used → 2. DIESEL CC201 type	17.085.865	3,52	60.142.245	200	12.028.449
3. DIESEL	7.280.000	3,90	28.392.000	200	5.678.400
4. K R D	2.878.000	2,18	6.274.040	200	1.254.808
5. K R L	1.800.000	8,08	14.544.000	200	2.908.800
JUMLAH : Ia	39.134.865		138.111.635	200	27.622.327
b. PELUMAS Lubricant					
1. DIESEL	10.091.000	0,70	706.370	2.000	1.412.740
Item used → 2. DIESEL CC201 type	17.085.865	0,85	1.452.299	2.000	2.904.597
3. DIESEL	7.280.000	0,85	618.800	2.000	1.237.600
4. K R D	2.878.000	0,53	152.534	2.000	305.068
5. K R L	1.800.000	0,12	21.600	2.000	43.200
JUMLAH : Ib	39.134.865		2.951.603	2.000	5.903.205
JUMLAH : I					33.525.532
II. BUKAN LOKOMOTIF					
a. BAHAN BAKAR			2.558.780	200	511.756
b. PELUMAS			231.356	2.000	462.712
JUMLAH : II					974.468
JUMLAH : I + II					34.500.000
SUB TOTAL BY + DIPO ALAT MEKANIK					2.136.495
JUMLAH					36.636.495

KETERANGAN :
KILOMETER LOK DARI BUKU BIRU PERUMISASI
PLAFON ANGGARAN DARI DIRKU

TABP1-57

Fuel cost = {unit price of fuel oil & lubricant per unit running distance (km) of locomotive} × (locomotive travel distance in kilometers)

1) 15-sand-train locomotive travel distance per day: 11,764 km/day
2) Fuel and lubricant consumption rate:

The fuel cost per unit running distance (km) of loco-CC201 is calculated as follows:

$(3.52\,\ell/\text{km} \times 200\ \text{Rp}/\ell) + (0.085\,\ell/\text{km} \times 2000\ \text{Rp}/\ell) = 874\ \text{Rp/km}$,

based on data available in 1990, that is:

3.52 ℓ/km with respect to the fuel oil consumption rate of loco-CC201; 200 Rp/ℓ with respect to the unit price of fuel oil;

0.085 ℓ/km with respect to the lubricant consumption rate of loco-CC201; 2,000 Rp/ℓ with respect to the unit price of lubricant.

Thus, the fuel costs of making as many as fifteen sand train round trips is:

$874\ \text{Rp/km} \times 11{,}764\ \text{km/day} = 10281.7 \times 10^3\ \text{Rp/day}$.

Similarly, two-thirds of the above value if ten round trips; a fifth of the above value if three round trips.

(b) Rolling stock maintenance cost

Since the rolling stock inspection and repair system of the Indonesia National Railroads (PERUMKA) is traditionally based on the operation period, we calculated a repair cost per vehicle and estimated the total repairing cost for the required number of vehicles. We calculated a per-vehicle repair cost for each locomotive or wagon by distributing the 1990 cost data involving only the total vehicle repair costs of that year in proportion to the corresponding ratios of the 1989 data classified according to vehicle type, as in the following:

(Rolling stock maintenance cost)

$$= [(\frac{\text{locomotive maintenance cost}}{\text{all loco. number}}) \times (\text{required number of locomotives})]$$

$$+ [(\frac{\text{wagon maintenance cost}}{\text{all wagon number}}) \times (\text{required number of wagons})]$$

1) Locomotive maintenance cost in 1990

Tab. 5-3-2

(unit: 10^3 Rp)

	Year 1989	Year 1990 (Rp)	Year 1990 (vehicles)
Rolling stock cost	26,000,010 A	39,004,525 D	
Loco.	10,869,502 B	D × (B/A) 16,303,891	548
Passen.	8,588,835		
Wagon	6,541,673 C	D × (C/A) 9,829,140	8423

$$\text{Loco. cost} = (39{,}004{,}525 \times 10^3\ \text{Rp}) \times \left(\frac{10{,}869{,}502}{26{,}000{,}010}\right)$$

$$= 16{,}303{,}891 \times 10^3\ \text{Rp/year}$$

$$\text{Repair cost per loco.} = (16{,}303{,}891 \times 10^3\ \text{Rp}) \div 548$$

$$= 29{,}751.6 \times 10^3\ \text{Rp/year}$$

2) Wagon maintenance cost

From Table 5-3-2 above, we obtain:

$$\text{Wagon cost} = (39{,}004{,}525 \times 10^3\ \text{Rp}) \times \left(\frac{6{,}541{,}673}{26{,}000{,}010}\right)$$

$$= 9{,}829{,}140 \times 10^3\ \text{Rp/year}$$

$$\text{Repair cost per wagon} = (9{,}829{,}140 \times 10^3\ \text{Rp}) \div 8423$$

$$= 1{,}166.9 \times 10^3\ \text{Rp/year}$$

Inasmuch as the number of locomotives and the number of wagons required for 15 sand trains are 34 and 325 respectively, we obtain the following total rolling stock maintenance cost from the unit costs shown in 1) and 2) above:

$$(29.75 \times 10^6\ \text{Rp}) \times 34 + (1.17 \times 10^6\ \text{Rp}) \times 325$$

$$= 1{,}390.8 \times 10^6\ \text{Rp/year} = 3{,}810.4 \times 10^3\ \text{Rp/day}$$

The table below lists the estimated costs involved in making a 10 and 3 times a day train shuttle.

	10 sand trains	3 sand trains
Repair cost per locomotive	(29,751.6 × 10^3 Rp/year) = 826.4 × 10^3 Rp/day	
Required number of vehicles	28	9
Loco. maintenance cost	2,282.3 × 10^3 Rp/day	733.4 × 10^3 Rp/day
Repair cost per wagon	(1,166.9 × 10^3 Rp/year) ≒ 3.2 × 10^3 Rp/day	
Required number of vehicles	226	73
Wagon maintenance cost	706.5 × 10^3 Rp/day	233.4 × 10^3 Rp/day

(c) Personnel cost

The personnel cost largely divides into transportation-related expenses (for station attendants and crewmen) and rolling workshop expenses. Transportation-related expenses are assumed to be proportional to train traffic, whereas rolling workshop expenses are assumed to be proportional to the number of vehicles.

Insofar as the cost data for 1990 are available there was little distinction mode between operational expenses and rolling workshop expenses. We calculated a unit cost by distributing the cost data in proportion to 1989's corresponding ratios, and multiplied the unit cost by the train-kilometer of a sand train and the required number of vehicles to estimate the expenses related to the two types.

We disregarded expenses related to the employment of personnel to be assigned to five new stations, because those expenses would be compensated for by manpower saving through the installation of automatic block systems.

According to 1989 data, the ratios of operational expenses and rolling workshop expenses to the total personnel cost of that year are 0.642 and 0.358 respectively.

Distributing the 1990's personnel cost, 27,854,166 × 10^3 Rp in proportion to the above ratios, we obtain:

Operational expenses: 17,882,374.5 × 10^3 Rp;

Rolling workshop expenses: 9,971,791.4 × 10^3 Rp.

On the other hand, we calculated the expenses for sand trains using the following formula:

$$\left(\frac{\text{Transportation expenses}}{\text{Total train-kilometers}}\right) \times (\text{Service train-kilometers})$$

$$+ \left(\frac{\text{Rolling workshop cost} \times \text{Locomotive repair cost ratio}}{\text{Total number of locomotives}}\right)$$

$$\times (\text{Required number of locomotives})$$

$$+ \left(\frac{\text{Rolling workshop cost} \times \text{Wagon repair cost ratio}}{\text{Total number of wagons}}\right)$$

$$\times (\text{Required number of wagons}),$$

where,

- Total train-kilometers: 29,712,438 km/year
- Train-kilometers for 15 sand trains: 8,363 km/day
- Locomotive repair cost ratio: 0.418 ($= \frac{10,869,502}{26,000,010}$)
- Wagon repair cost ratio: 0.252 ($= \frac{6,541,673}{26,000,010}$)
- Total number of locomotives: 548
- Total number of wagons: 8,423
- Required number of locomotives for 15 sand trains: 34
- Required number of wagons for 15 sand trains: 325

Substituting the above values for the corresponding variables of the formula, we obtain:

A personnel cost for 15 sand train runs of 6006.9 × 10^3 Rp/day

$$(= \frac{17,882,374.5 \times 10^3}{29,712,438} \times 8363 + \frac{9,971,791.4 \times 0.418 \times 10^3}{548} \times \frac{34}{365 \text{ days}}$$

$$+ \frac{9,971,791.4 \times 0.252}{8,423} \times \frac{325}{365 \text{ days}}$$

$$= 5032.8 \times 10^3 \text{ Rp} + 708.5 \times 10^3 \text{ Rp} + 265.6 \times 10^3 \text{ Rp} = 6006.9 \times 10^3 \text{ Rp/day}).$$

Similarly, we calculated the personnel costs for 10 sand trains and 3 sand trains under the following conditions:

1) 10 sand trains
   - Train-kilometers: 5,575 km/day
   - Required number of locomotives: 28
   - Required number of wagons: 226

2) 3 sand trains
   - Train-kilometers: 1,672.6 km/day
   - Required number of locomotives: 9
   - Required number of wagons: 73

(d) Maintenance cost for infrastructure and facilities

No detailed data on infrastructure maintenance cost by section is available. Tracks and other equipment are not PERUMKA's property but are state-owned. According to PERUMKA's comments, certain part of the infrastructure entails fixed costs, which mostly account for expenses per sectional working kilometer. We based our estimate of the infrastructure maintenance cost on the above data.

Formula for infrastructure maintenance cost estimation:

$$In = (A \times \frac{l}{L}) \div (P \times \alpha + F)$$

where, In: cost per freight wagon train

A : overall facility cost ($59,604,096 \times 10^3$ Rp)

l : total working kilometer of service section

L : total working kilometer throughout country (5,051 + 205.5 = 5,256.5 km)

P : number of passenger trains

F : number of freight trains

α: passenger/freight ratio $= (\frac{\text{Passenger ton-kilometer}}{\text{Passenger train-kilometer}}) \div (\frac{\text{Freight ton-kilometer}}{\text{Freight train-kilometer}}) = 0.45$

• Unit cost per extension working kilometer $= \frac{A}{L} =$

$= 11,339.1 \times 10^3$ Rp/km·year

• Passenger ton-kilometer = $5,015,757 \times 10^3$ ton-kilometers/year

• Passenger train-kilometer = 20,631,395 km/year

• Freight ton-kilometer = 5,762,355,563 ton-kilometers/year

• Freight train-kilometer = 10,758,983 km/year

The following is an estimate of infrastructure costs per freight train according to sections:

Section	Extension working km	Number of passenger trains	Number of freight trains	Infrastructure cost per freight train
				$\times 10^3$Rp/Y
Cipinang - Cikampek	150.4	106	46	18,351.6
Cikampek - Purwakarta	19.063	32	26	5,360.8
Purwakarta - Padalarang	56.002	26	24	17,786.8
Padalarang - Bandung	14.7	30	24	8,889.8
Bandung - Kiaracondong	4.99	17	29	3,087.7
Kiaracondong - Gedebage	5.208	15	30	1,606.9
Gedebage - Cibatu	48.3	16	24	17,553.8
Cibatu - Babakanjawa	49.8	14	24	18,636.5
Babakanjawa - Pirusa	4.96	0	14	4,017.3
Total				95,291.2

Multiplying the above total infrastructure and facility cost by each corresponding number of sand trains, we obtain:

for 15 sand trains: $30 \times 95,291.2 \times 10^3$ Rp $= 2,858,736.0 \times 10^3$ Rp/year

$= 7,832.1 \times 10^3$ Rp/day

for 10 sand trains: $20 \times 95,291.2 \times 10^3$ Rp $= 5,221.4 \times 10^3$ Rp/day

for 3 sand trains: $6 \times 95,291.2 \times 10^3$ Rp $= 1,566.3 \times 10^3$ Rp/day

5-3-2 Organization for the Operation

Indonesian railroads, which date back to a hundred years ago, have been in the control of PJKA (Persahaan Jawatan Kreata Api, the National Railroads Company) since 1971, and have been in the control of PERUMKA (Persahaan Vmum Kreta Api; the Railroads Corporation) since January 1991.

The organization of PERUMKA has a four level hierarchy (the Head Office, Railroad Supervision Bureaus, Local Supervision Offices, and operational organs) under the directorship of the Chief Director, as shown in Fig. 5-3-2. PERUMKA has some 40,000 personnel, a fourth of whom are engaged in everyday train transport and service.

Although some department may require increase of persons because of this sand train increase project, the current organization shall be maintained.

(1) Traffic control

Traffic control at the Head Office, which is only attended to by a small number of duty persons, does not include the direct issuance of train control commands. Traffic control at the Local Supervision Offices seems to be less efficient in operational arrangement than is the case in Japan. This low efficiency in traffic control is considered, in part, attributable to the obsolescence of telecommunication equipment and consequent inability to adapt flexibly to changing circumstances.

It cannot be denied that these unfavorable conditions lead to delays in train runs and impairment in regularity. These are advantages of railroads. Thus lowers the service level. (See Fig. 5-3-3.)

In this sense, it is undoubtedly necessary to establish a system for ensuring efficient traffic control. To improve the reliability of railroads no delays can be brooked.

(2) Operational facilities

Few telecommunication cables are in service along the railroads, and no leased lines are available for communication between the Local Supervision Offices and the operational organs. These inferior conditions often occasion difficulties in establishing an emergency liaison between the offices and the operational organs and in the issuance of commands or directions from the offices to the operational organs.

At stations as well, signals and block instruments are mostly mechanical, so that they require a great deal of manpower and are inferior with respect to safety and speed.

For instance, home signals are almost invisible at night, so in most cases, crewmen are forced to halt their trains to ensure safety. Moreover, deferred liaison often make it almost impossible to control train runs.

In view of these situations, it is necessary to automate signal equipment and to consolidate telecommunication facilities as early as possible in order to derive the full advantages of railroads.

Fig. 5-3-2 Organization of PJKA

as of November 1989

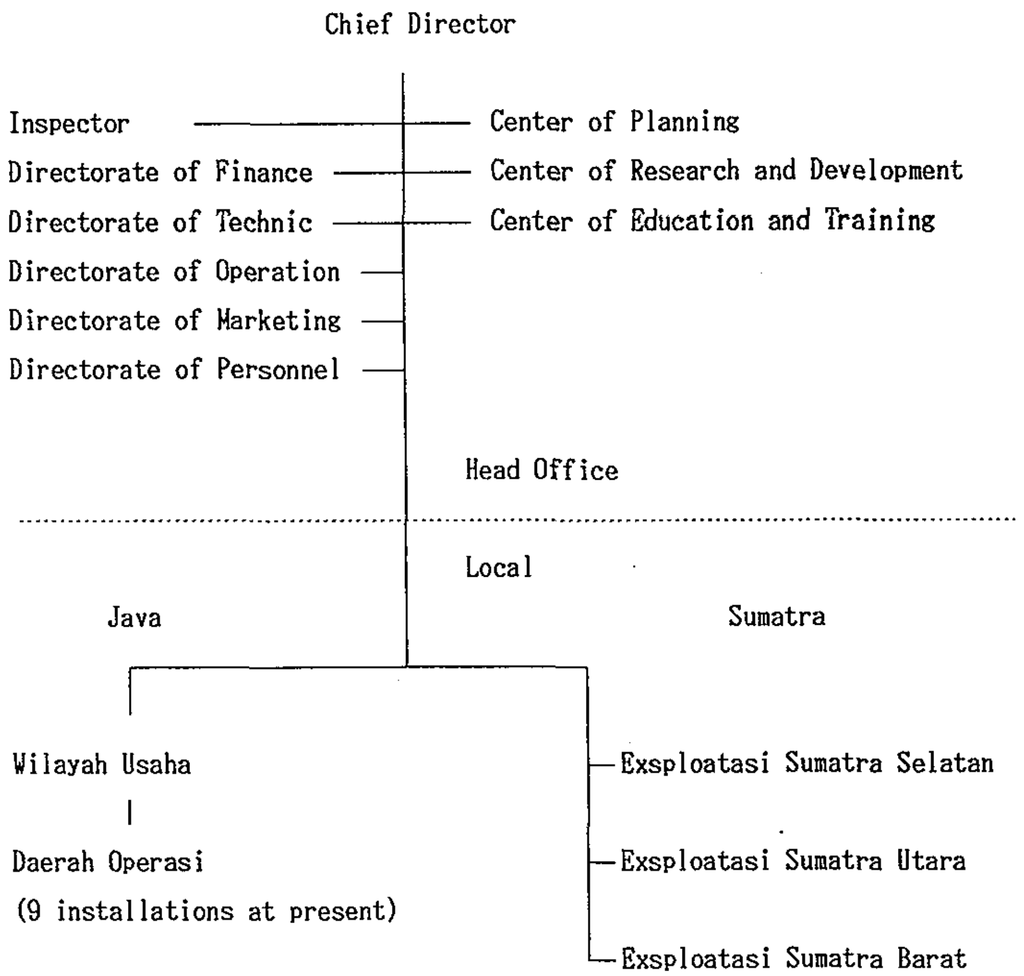


Fig. 5-3-3 Normal service rates and average delays of trains and number of serious accident occurrences

Type		2nd half of 1988	1st half of 1989	2nd half of 1989	C : A	C : B
		A	B	C	(%)	(%)
Normal service rate				(%)		
Passenger trains	Departure	78	74	85	109	115
	Arrival	13	9	13	100	144
Freight trains	Departure	7	7	15	214	214
	Arrival	2	3	6	300	200
Delay time				(minutes)		
Passenger trains	Departure	6	7	5	83	71
	Arrival	77	83	69	90	83
Freight trains	Departure	124	91	84	68	92
	Arrival	211	219	185	88	84
Serious accidents (occurrences)		121	88	114	94	130

5-4 Outline of Improved Facilities

5-4-1 Stations

Inasmuch as the replacement of rails and the repair of bridges along the present tracks are being done according to a separate plan, these matters are outside the scope of the present plan.

(1) Passing stations

In considering the construction of new passing stations in eight sections with a view to the present deficiencies in track capacity, we have set the effective length of tracks alongside those passing stations at 320 m, the distance from the existing tracks at 4 m, and the track gradient at zero with the exception of a setting at 8‰ with regard to two stations (Skt - Cle and Cle - Pdl) in the mountainous terrains in order to save on the cost of bridge reconstruction, as shown in Fig. 5-2-1. Tab. 5-4-1-1 lists the results of our examination with respect to the possibility of constructing new passing stations.

Tab. 5-4-1-1 Passing stations

	Location	Inter-sectional distance	Possibility of constructing new stations	Remarks
1	Skt - Cle	7.06 km	Possible	It is necessary to change the gradient of the mainline. (L=670m)
2	Cle - Pdl	7.31 km	"	" (L=505m)
3	Rck - Ccl (Hrp)	9.29 km	"	
4	Ccl - Ng	8.49 km	Impossible	It is impossible to construct new station because the entire section has a steep gradient of 22 to 25‰.
5	Wb - Bmw	8.78 km	Possible	
6	Cpd - Caa	8.20 km	"	
7	Caw - Rjp	9.33 km	"	
8	Babakanjawa	—	"	

1) There seems no problem with respect to geographical aspects as far as the five stations (Hrp, Wb - Bmw, Cpd - Caa, Caw - Rjp and Babakanjawa) are concerned.

2) Two mountainous sections (Skt - Cle and Cle - Pdl) with a steep gradient should be improved by new passing stations after the gradient of the mainline is reduced.

The gradient in those passing station territories was set at 8‰. Consequently, the section Skt - Cle underwent a gradient modification along the mainline over a distance of 670 m, and the section Cle - Pdl over a distance of 505 m. To make these modifications, we designed the structure so that cuts could be temporarily sustained with 5-m-long girders so as to lower road-beds and embankments. They could be raised while ballasts were manually inserted. These operations should be done during the intervals when train traffic does not run.

3) With regard to the section Ccl - Ng, having no room for new stations because of its steep gradient of 22 to 25‰, its terminal stations should be electronically interlocked, and an automatic blocking system should be installed to resolve the problem of insufficient track capacity.

4) For details about passing stations, see section 5.2, "Construction Standards." (Figs. 5-2-1 and 5-2-4)

The existing tracks in passing station territories should be used in through mode.

(2) Sidings

1) Pirusa

One loading track is enough to bear a workload for five trains (2 hours × 5). Therefore, the installation of three unloading tracks is necessary.

Since the conventional routing is not equipped with any engine turn-around track for use by traction engines, it is necessary to install new ones.

It is also necessary to park one new arrival/departure track in consideration of five simultaneous parking trains.

2) Jakarta Gudang

Two new shunting tracks should be laid to smoothen switching operations. An engine parking track should be laid in consideration of switching.

The existing loading and unloading tracks can cope with five trains with the aid of the above shunting tracks.

3) Cipinang

The existing facilities are capable of coping with loading/unloading for ten trains. It is necessary to repair and maintain the sidings because they have been left unused for a long period.

(3) Repair shops

New repair shop should be installed in the Bundung depot in order to cope with increased amounts of rolling stock. For details see section 2-4-4 and Fig. 5-2-3.

5-4-2 Equipments (Signals, telecommunication facilities, etc.)

(1) Present status

Inasmuch as the existing equipment at and between stations is, for the most part, composed of outdated mechanical interlocking and blocking systems, it will take a lot of time to manipulate point switch movements, signals, and block systems. There are many installations running at long blocking sections, so that the number of train runs is unavoidably restricted to a narrow limit. Moreover, those obsolete mechanical signaling systems, communication facilities, and messenger wires seem liable to failure.

To improve on such inefficiency and device defects, it is advisable to introduce electronic interlocking at station level first, and then to lay communication cables between stations, and to establish a systematic automatic blocking system throughout the territories. This will speed up operations and manipulation and improve safety and security. Implementation of this grand plan entails a great deal of cost and a long period of work.

It is necessary to install automatic train stops (ATS) for safety assurance in order to prevent serious accidents such as rear-end collisions likely to increase in line with the growing number of extra trains and high-speed trains in the future.

(2) Equipment improvements (See section 2-8)

The present Southern Trunk Line transportation reinforcement plan includes the installation of new electronic interlocking devices and partial automatic blocking systems necessitated by the installation of passing stations to ensure larger track capacity. Those installations should be equipped with signals and communication facilities, as specified below. Fig. 5-4-2-1 shows an outline of this project.

It is also necessary to examine the installation of automatic train stops (ATS) as a safety measure in the near future. This is outside the scope of the present plan. If we could decide on a suitable system before the present plan is put into operation, it would at least be possible to mount train-borne ATSs on new locomotives at a low cost. For surface facilities, ATS should be gradually installed in the future. (The ATS-S type in point-control mode is recommended.)

1) Interlocking devices

Although PERUMKA intends to install standardized electronic interlocking devices in step with the installation of new passing stations and automatic blocking systems in future, it seems best to adopt relay interlocking in consideration of maintenance, repairs, and improvements after installation. All the same, electronic interlocking devices (K5-type) may be permissible in exceptional cases for medium and small size stations (at most 60 routes). Electronic interlocking (I-type) at large stations presupposes train service on schedule as an absolute prerequisite because it is interlocked with automatic route control according to train number and arrival/departure time. It also necessitates using special techniques and tools to modify hardware and software. For this reason, it seems better to use relay interlocking as far as large stations are concerned.

2) Blocking instruments

Inasmuch as the installations inside the scope of the present automatic blocking plan presuppose single-track territories, each station interval should be defined as one block territory judging from the status of each track territory. The restricted automatic blocking system, in which no signals or track circuits are installed between stations, should be introduced.

- Track circuits for train sensing should be installed in series in stations in order to ensure automatic blocking.
- Train sensing track circuits OT and CT should be installed near home signals at both ends of each station in order to detect incoming and outgoing trains and to ensure automatic blocking.
- Train driving directions should be set with a couple of traffic levers installed at both end stations of blocking section by mutual arrangement between two stations.

Fig. 2-8-2 shows an outline.

3) Signals

Each station should be equipped with one or more home and starting signals, and should also be equipped with one or more distant and repeating signals if necessary. These signals should all be color-light signals.

Stations with shunting operations should be equipped with shunting signals.

4) Point switch movements

Electric point switch movements should be used within each interlocking range, but YS-type trailable electric point switch movements may be used for shunting turnouts only.

5) Track circuits

Track circuits (AC 50 Hz) should be installed within the interlocking range in stations.

6) Communication equipment

Telephone sets for communication with adjacent stations and related installations and shunting stations should be equipped with talk-back or telephone speakers.

Also, communication cables should be laid anew between stations into which automatic blocking is being introduced.

7) Miscellaneous

- The existing blocking areas should be changed (partitioned) as passing stations are installed anew. However, the current mode should be adopted (tokenless or Morse telegraph).
- The existing level crossing control systems should be modified as new passing stations are installed in line with the spread of automatic blocking.
- Part of the current mechanical interlocking system should be improved in step with the increase of arrival/departure tracks at Pirusa Station.

Fig. 5-4-2-1 Outline of signal/communicatin facility construction (No. 1)

Station name		Automatic blocking						Passing station		Passing station		Automatic blocking				
		Pwk		Ca		Sut	Skt		Cle		Pdl	Kac		Gdb		Rck
Block system	Old	Tokenless					Tokenless					Morse telegraph				
	New	Automatic					Tokenless					Automatic				
Interlocking system	Old	Ⓜ		Ⓜ		Ⓜ	Ⓜ		Ⓜ		Ⓜ	Ⓜ		Ⓜ		Ⓜ
	New	Ⓔ		Ⓔ		Ⓔ		Ⓔ		Ⓔ		Ⓔ		Ⓔ		Ⓔ
Electronic interlocking New installation	Motor generator	1 (80 routes)		1 (8 routes)		1 (12 routes)		1 (6 routes)		1 (6 routes)		1 (40 routes)		1 (12 routes)		1 (12 routes)
" Modification	Mechanical															
" Removal	"	1		1		1						1		1		1
Signal New installation	Shunting signal	30		8		10		7		7		26		10		10
Point switch movement		30		3		7		4		4		20		7		7
Track circuit		40		8		11		6		6		40		13		11
Miscellaneous	Blocking system Level crossing control	1		1		1		1		1		1		1		1
Signal cable New installation		12		4		6		4		4		10		6		6
Communication facilities "	Telephone Talk-back, etc.	1		1		1		1		1		1		1		1
Communication cable "			7		8								6		8	
Total																
		First stage					First stage					Second stage				

Automatic blocking																		Total	
	(Passing station) Hrp		Ccl		Ng	Wb	Passing station	Bmw	Cpd	Passing station	Caa	Caw	Passing station	Rjw	Passing station BjW	Ih	Pirusa		
Morse telegraph																		Quantity	
Automatic																			
			Ⓜ		Ⓜ	Ⓜ		Ⓜ	Ⓜ		Ⓜ	Ⓜ		Ⓜ	Ⓜ	Ⓜ	Ⓜ		
	Ⓔ		Ⓔ		Ⓔ		Ⓔ			Ⓔ			Ⓔ		Ⓔ				
	1 (6 routes)		1 (30 routes)		1 (8 routes)		1 (6 routes)			1 (6 routes)			1 (6 routes)		1 (8 routes)			15 sets	
																	1	1 "	
			1		1										1			9 "	
	7		24		8		7			7			7		9			177 units	
	4		12		7		4			4			4		7			124 sets	
	7		20		14		6			6			6		7			201 locations	
	1		1		1		1			1			1		1			1 set	
	4		10		6		4			4			4		6			90 km	
	1		1		1		1			1			1		1			15 locations	
6		4		9														48 km	
Second stage						Second stage									1st stage		2nd stage		

5-4-3 Rolling Stock

The improvement of rolling stock necessitated by the rapid growth of sand transport should be achieved by (1) the rehabilitation of dormant rolling stock (or unrepaired rolling stock) and (2) the purchase of new rolling stock.

The former corresponds to a current operation plan of 3 trains/day (each train consisting of 14 freight wagons) to 6 trains/day, which has prevailed since 1988. The latter corresponds to not fewer than 7 trains/day. As far as freight wagons are concerned, the wagons below standard should be arranged (or adjusted) before being put into service again if the required number of vehicles in total is fewer than the existing 204 vehicles. Otherwise, it is advised to plan ahead the purchase of new ones.

The number of vehicles to be rehabilitated (or arranged) or purchased new should be estimated according to an established train operation plan and those vehicles should be used exclusively for sand transport. (Figs. 5-4-3-1 (1)-(4) and 5.4.3.2 (1)-(4)). Allowances should be made for inspection and maintenance spares (15%) and standby spares.

Tab. 2-7-1 lists the required numbers of locomotives estimated according to the above principles. According to this table, the number of locomotives to be rehabilitated is seven; the number of locomotives to be purchased new is 12 in the first stage of the project and 6 in the second stage, or 18 in total.

Tab. 2-7-2 lists the required numbers of freight wagons. According to this table, the number of freight wagons to be arranged is 73; the number of freight wagons to be purchased new is 22 in the first stage and 99 in the second stage, or 121 in total.

Tab. 2-7-3 lists an estimate of the costs.

Fig 5-4-3-1 (1) Locomotive Operation Plan

(15 trains/day)

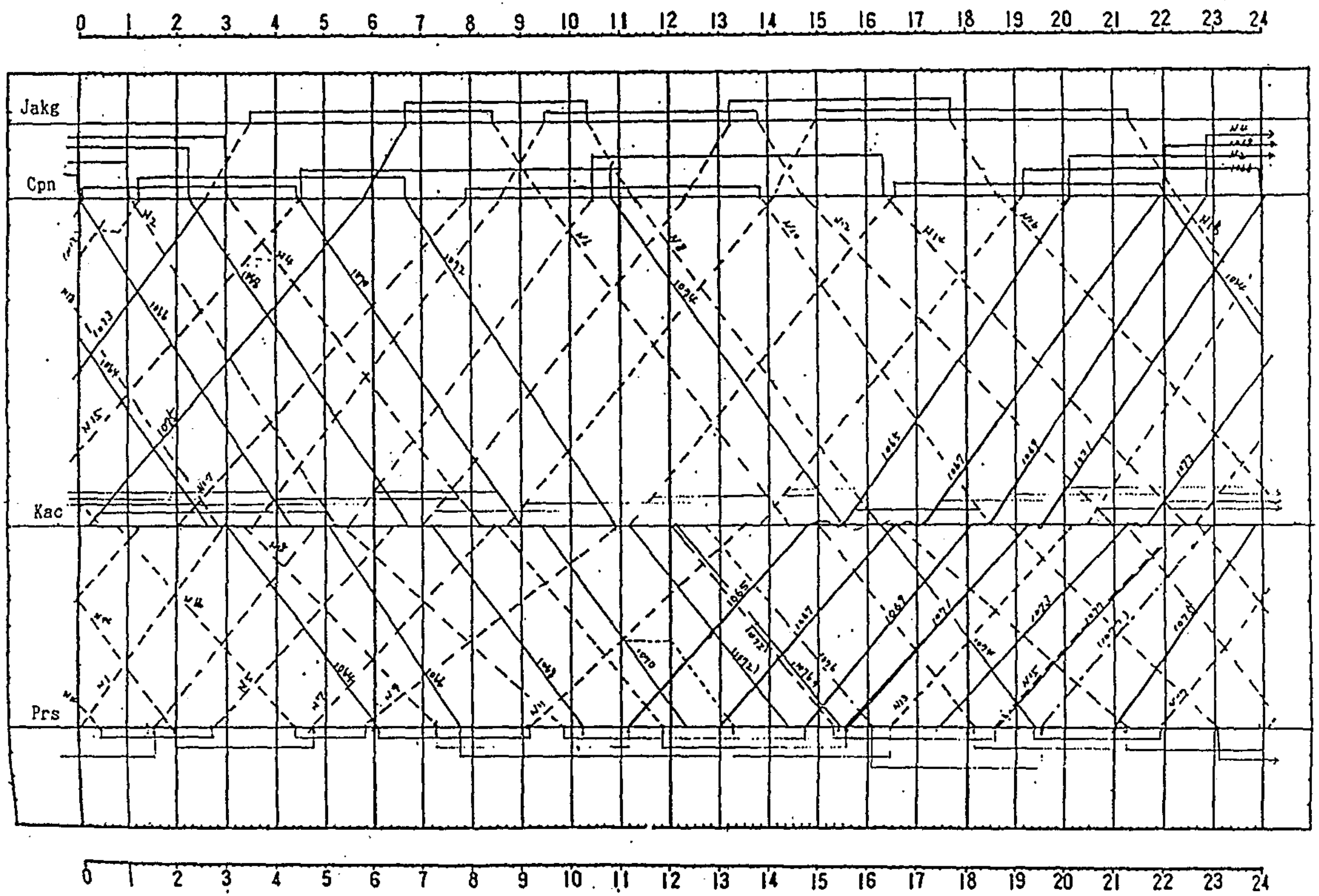


Fig 5-4-3-1 (2) Locomotive Operation Plan
(10 trains/day)

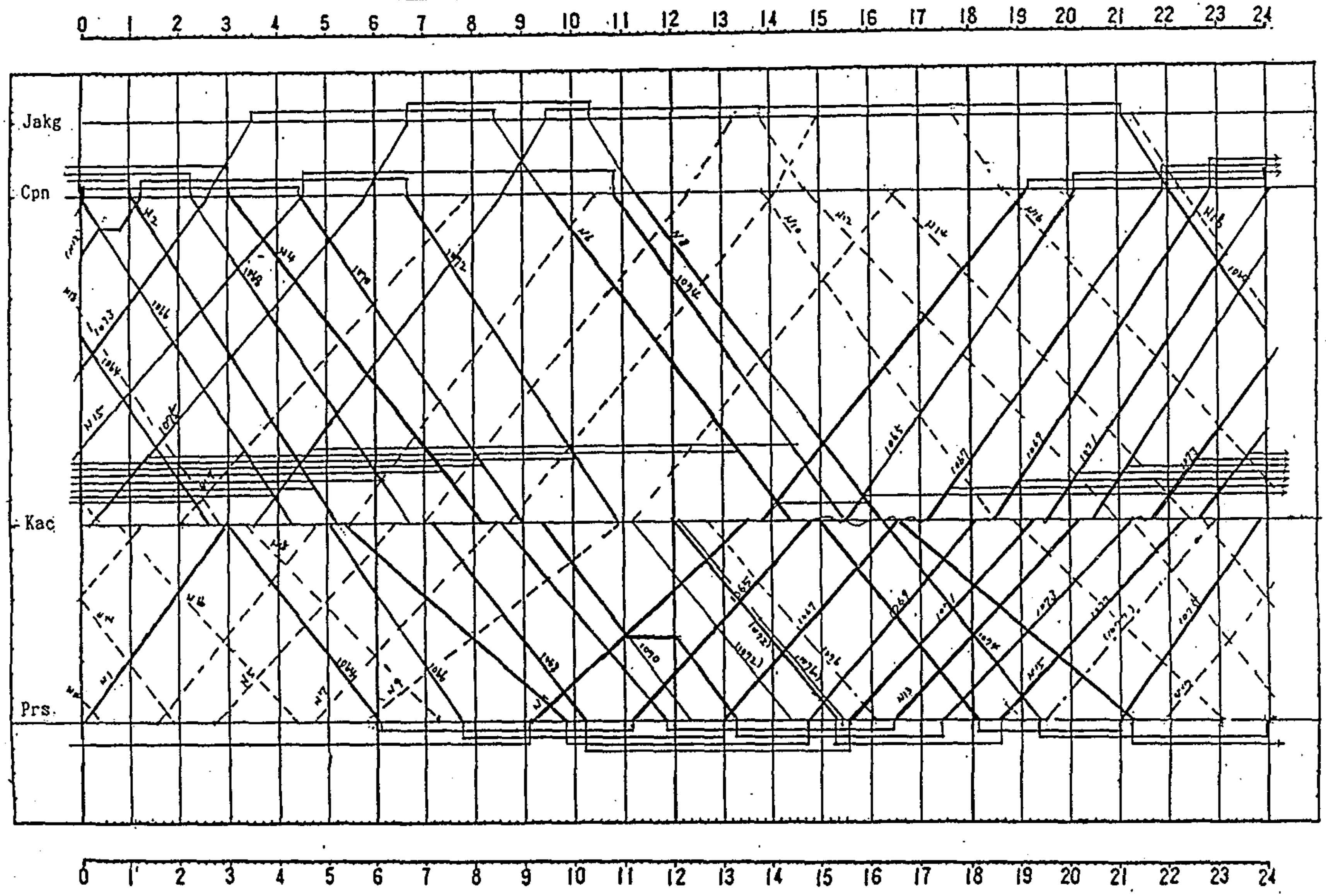


Fig 5-4-3-1 (3) Locomotive Operation Plan

(6 trains/day)

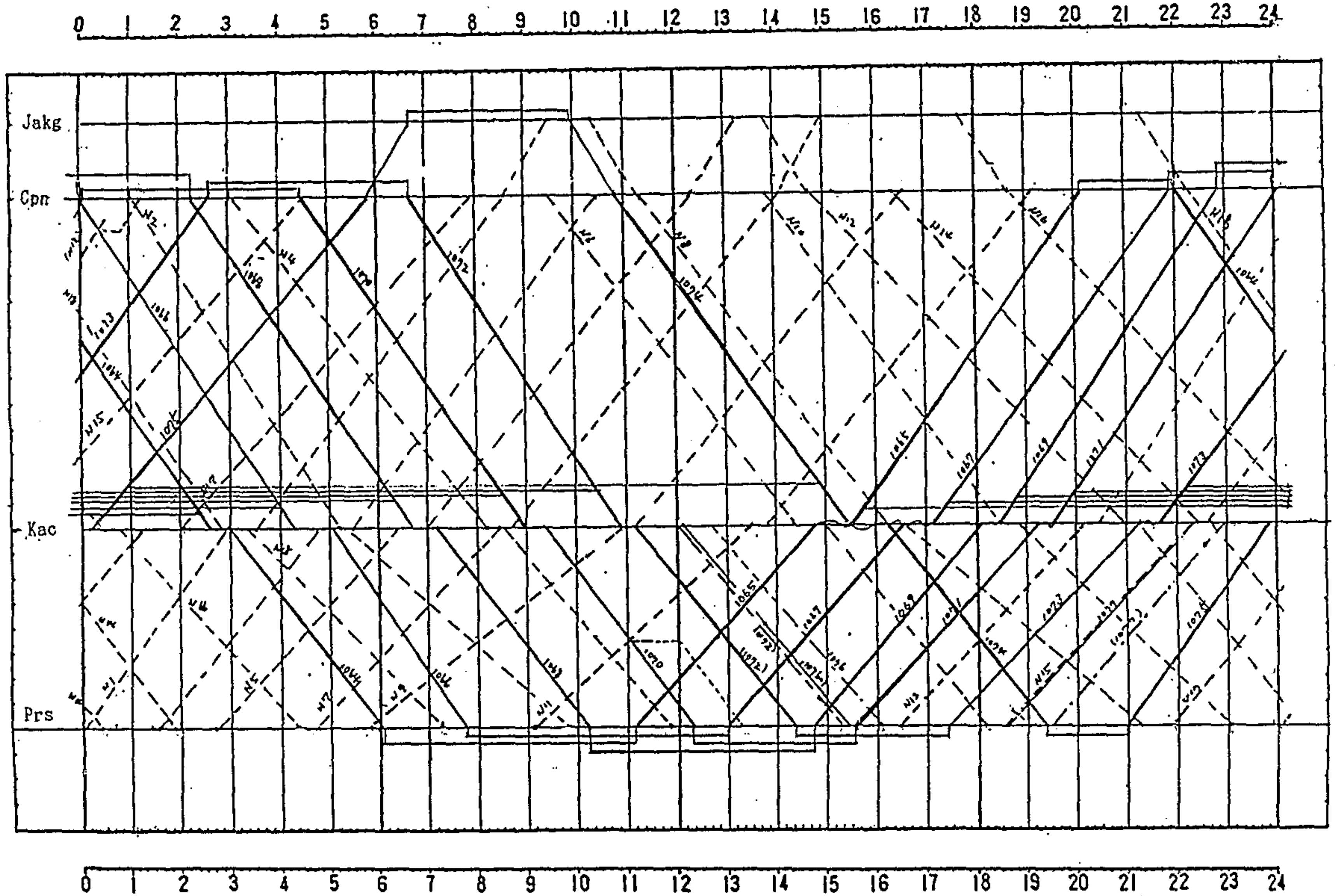


Fig 5-4-3-1 (4) Locomotive Operation Plan

(3 trains/day)

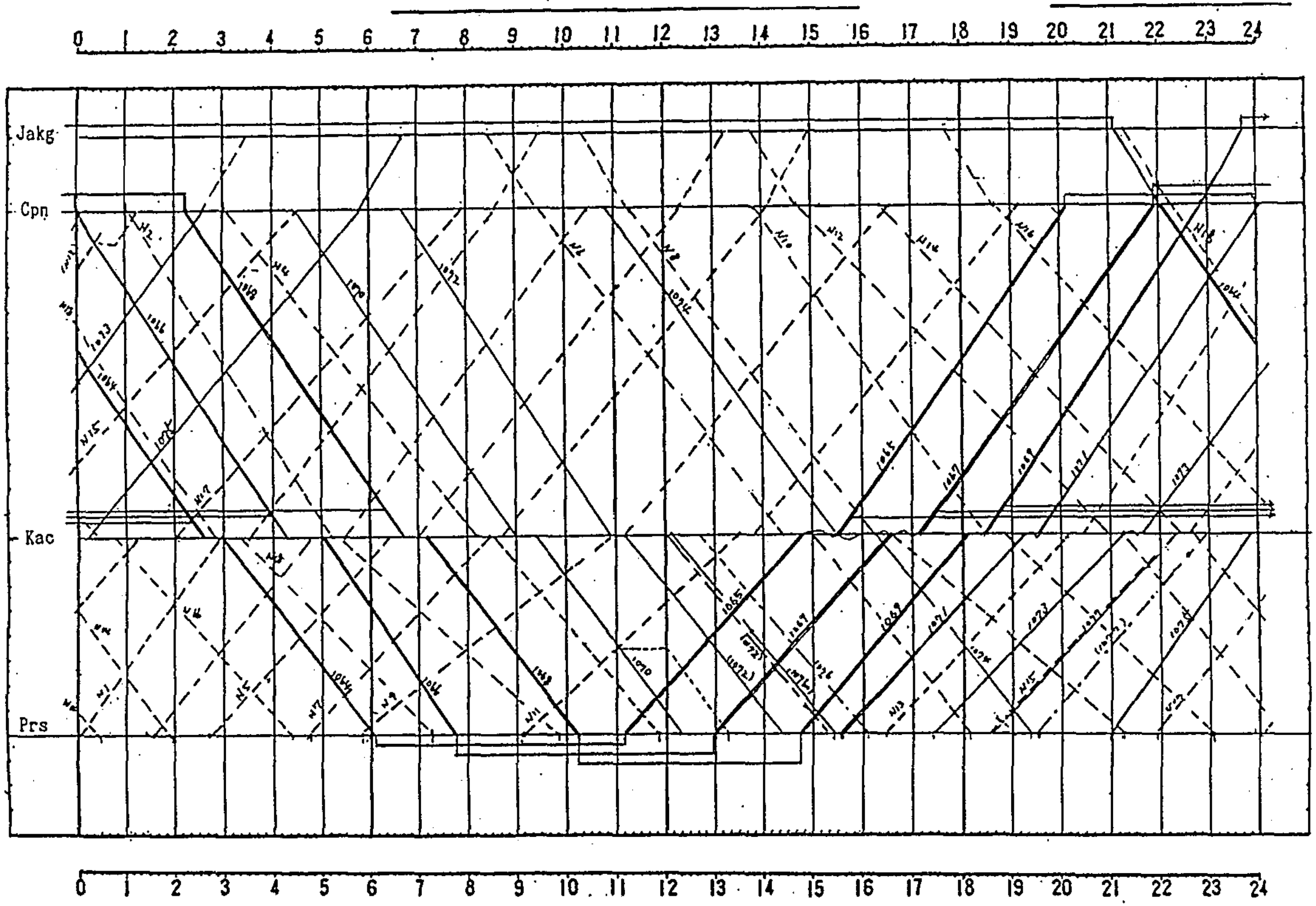


Fig 5-4-3-2 (i) Freight Wagon Operation Plan

(15 trains/day)

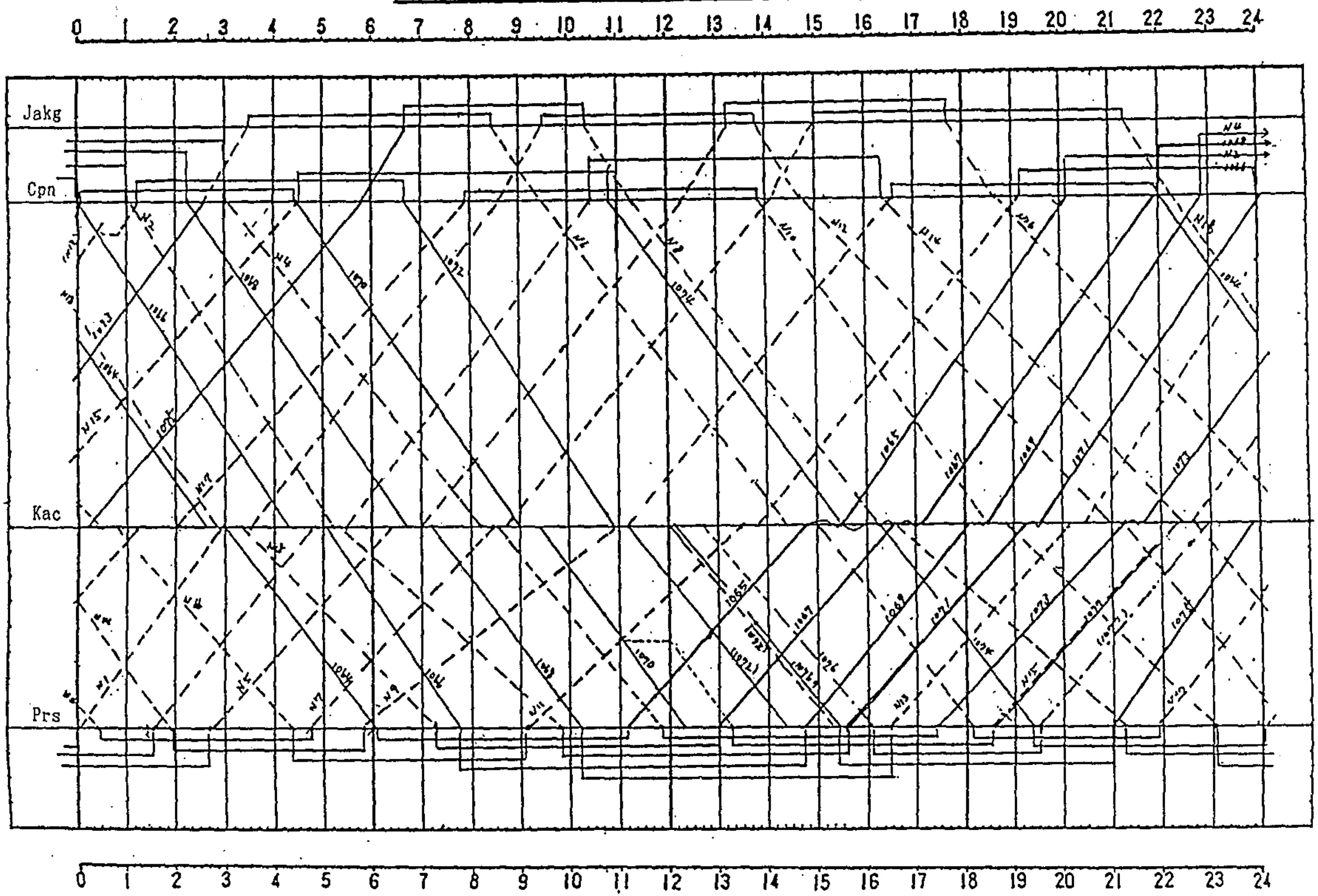


Fig 5-4-3-2 (2) Freight Wagon Operation Plan

(10 trains/day)

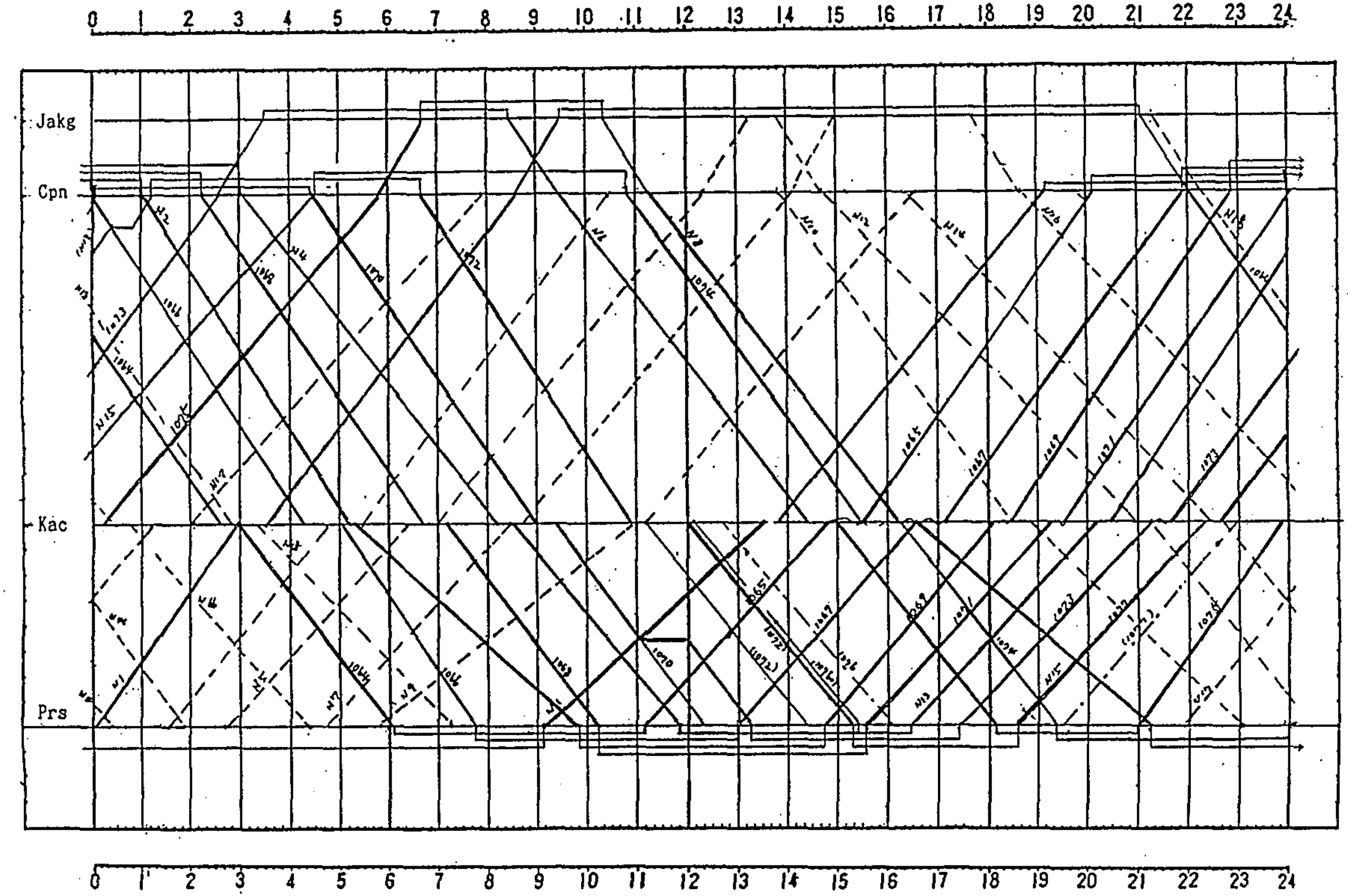


Fig 5-4-3-2 (3) Freight Wagon Operation Plan

(6 trains/day)

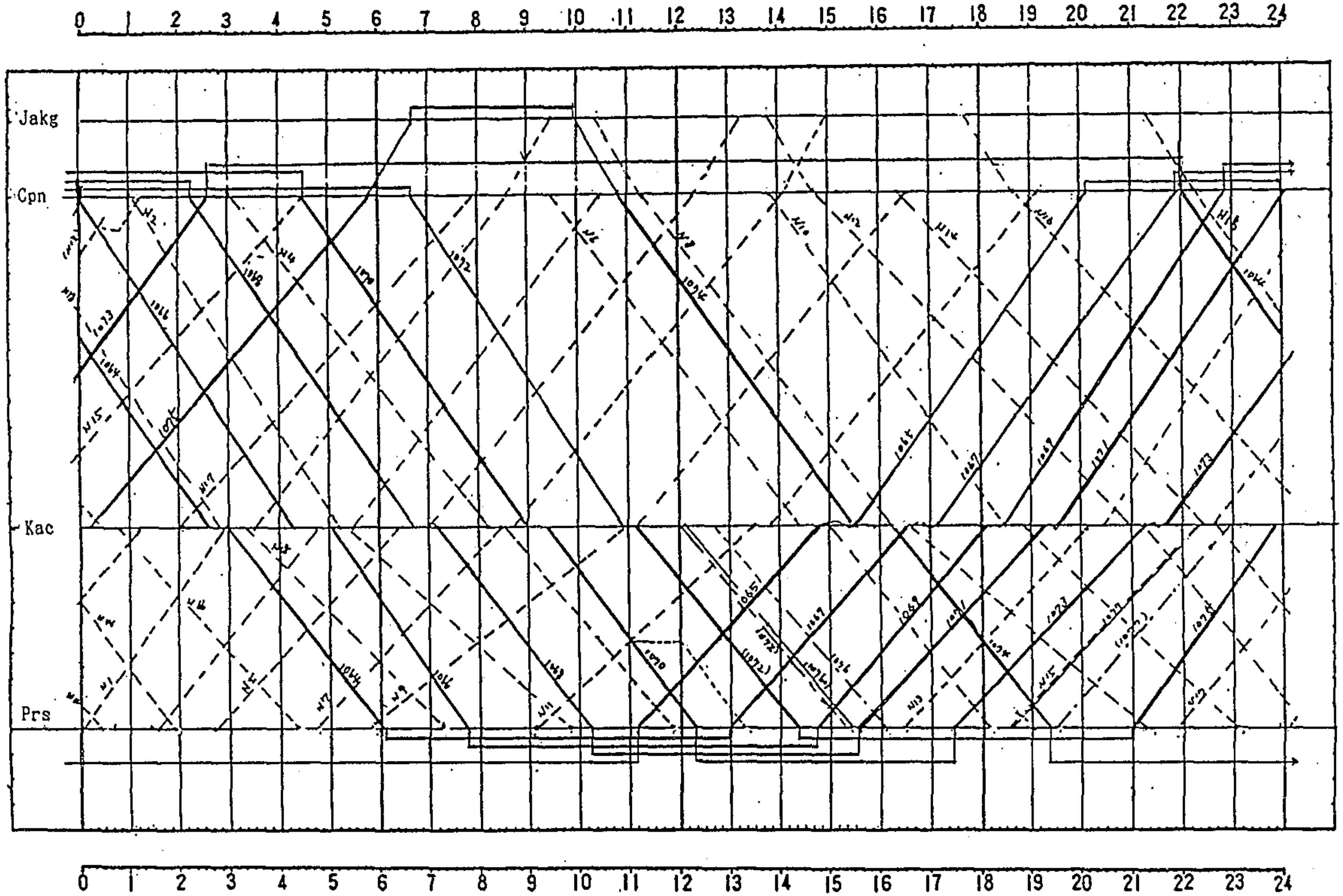
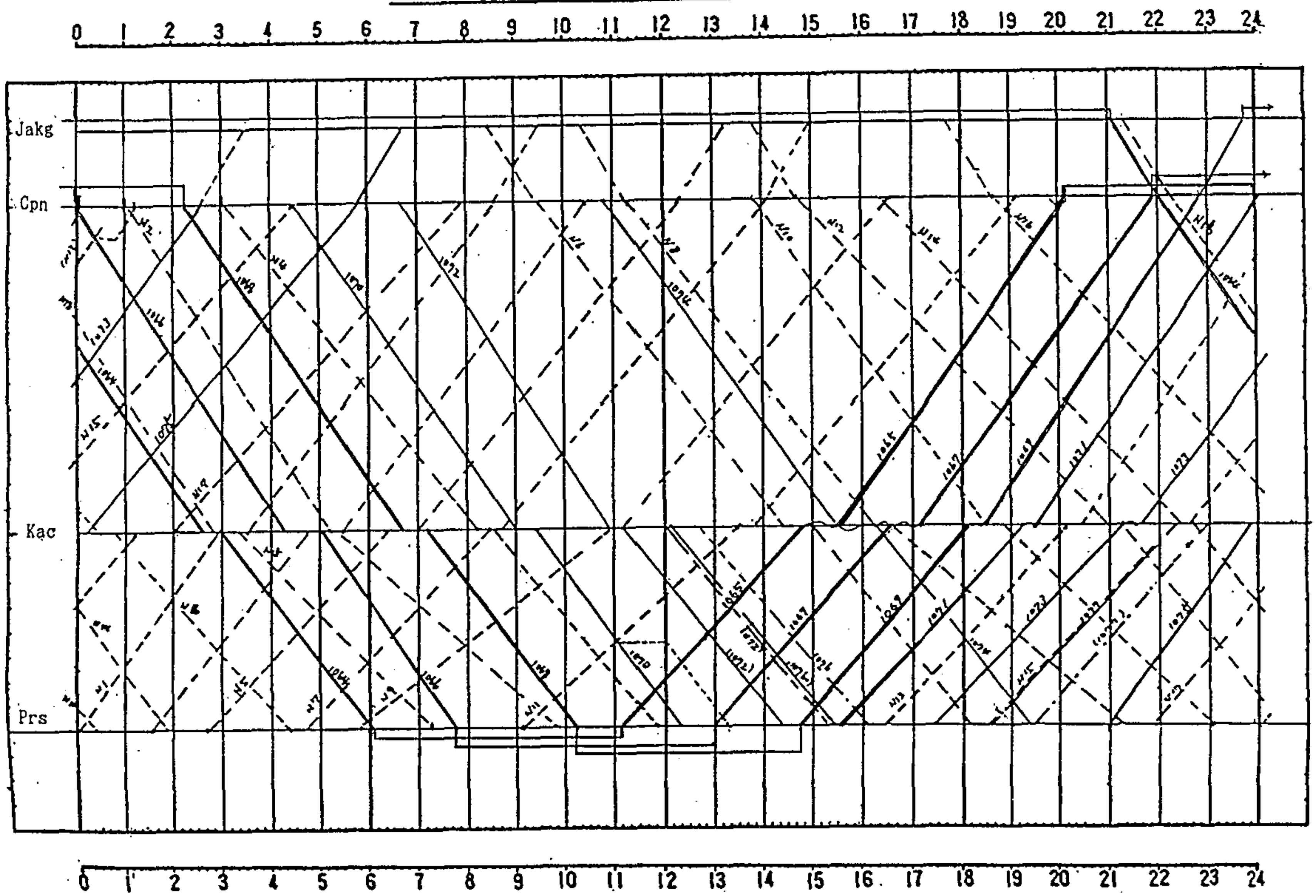


Fig 5-4-3-2 (4) Freight Wagon Operation Plan

(3 trains/day)



5-4-4 Car Depots

(1) Locomotive depot

The locomotive depot at Bandung is now servicing for 51 CC201-type locomotives and 20 other kinds of locomotives. This is 71 locomotives in total if the transport capacity were increased for sand transport. Tab. 5-4-4-1 below lists an estimate of the inspection and maintenance capacity of the locomotive depot.

Tab. 5-4-4-1 Inspection & maintenance capacity of the locomotive depot at Bandung

<table>
<tr><th rowspan="2">Kind of inspection</th><th rowspan="2">Period of inspection</th><th rowspan="2">Required time for inspection</th><th colspan="4">Annual</th><th rowspan="2">Remarks</th></tr>
<tr><th>Inspection No./Loco.</th><th colspan="2">Inspection time in total</th><th>Inspection capacity</th></tr>
<tr><td>Daily</td><td>every day</td><td>2 hrs</td><td>344</td><td colspan="2">2 hrs x 344 x 67 units
= 46,096 hrs</td><td>3 lines x 2 units x 24 hrs x 365 days = 52,560 hrs</td><td>The inspection is possible in the condition of 3 inspection lines and 6 units inspection</td></tr>
<tr><td>Monthly</td><td>every month</td><td>1 day</td><td>8</td><td>8 days</td><td rowspan="4">Total 21 days x 67 units = 1,407 days</td><td rowspan="4">3 lines 5 units x (365-52 days) = 1,565 days</td><td rowspan="4">The inspection is possible in the condition of 3 inspection lines and 5 units inspection.</td></tr>
<tr><td>3M</td><td>every 3 months</td><td>3 days</td><td>2</td><td>6 days</td></tr>
<tr><td>6M</td><td>every 6 months</td><td>4 days</td><td>1</td><td>4 days</td></tr>
<tr><td>Yearly</td><td>every year</td><td>6 days</td><td>0.5</td><td>3 days</td></tr>
</table>

Note: The number of locomotives to be inspected and repaired excludes the number of vehicles to be overhauled, thus:

71 vehicles x 0.95 ≒ 67 vehicles

This table suggests that it is necessary to construct a new shed because the existing inspection shed for three tracks and one outdoor inspection track are no longer sufficient with respect to inspection and maintenance capacity.

A new shed should be constructed for monthly to yearly inspections and have enough equipment for these purposes. (See Fig. 2-6-3 and Tab. 2-7-4.)

The existing shed should be converted into a shed for daily inspection.

Also, two parking tracks (each for two locomotives) should be laid to park standby spares and for locomotives waiting to enter or exit from the shed. (See Fig. 2-6-3.)

(2) Freight wagon depot

The freight wagon depot at Cibatu would be capable of handling a maximum of 325 freight wagons (= existing 204 units + new 121 units) if the transport capacity were increased for sand transport. In this case, it is necessary to modernize the inspection and maintenance facilities. Tab. 5-4-4-2 lists an estimate of the required inspection and maintenance capacities of the freight wagon shed.

Tab. 5-4-4-2 Inspection & maintenance capacity of freight wagon shed

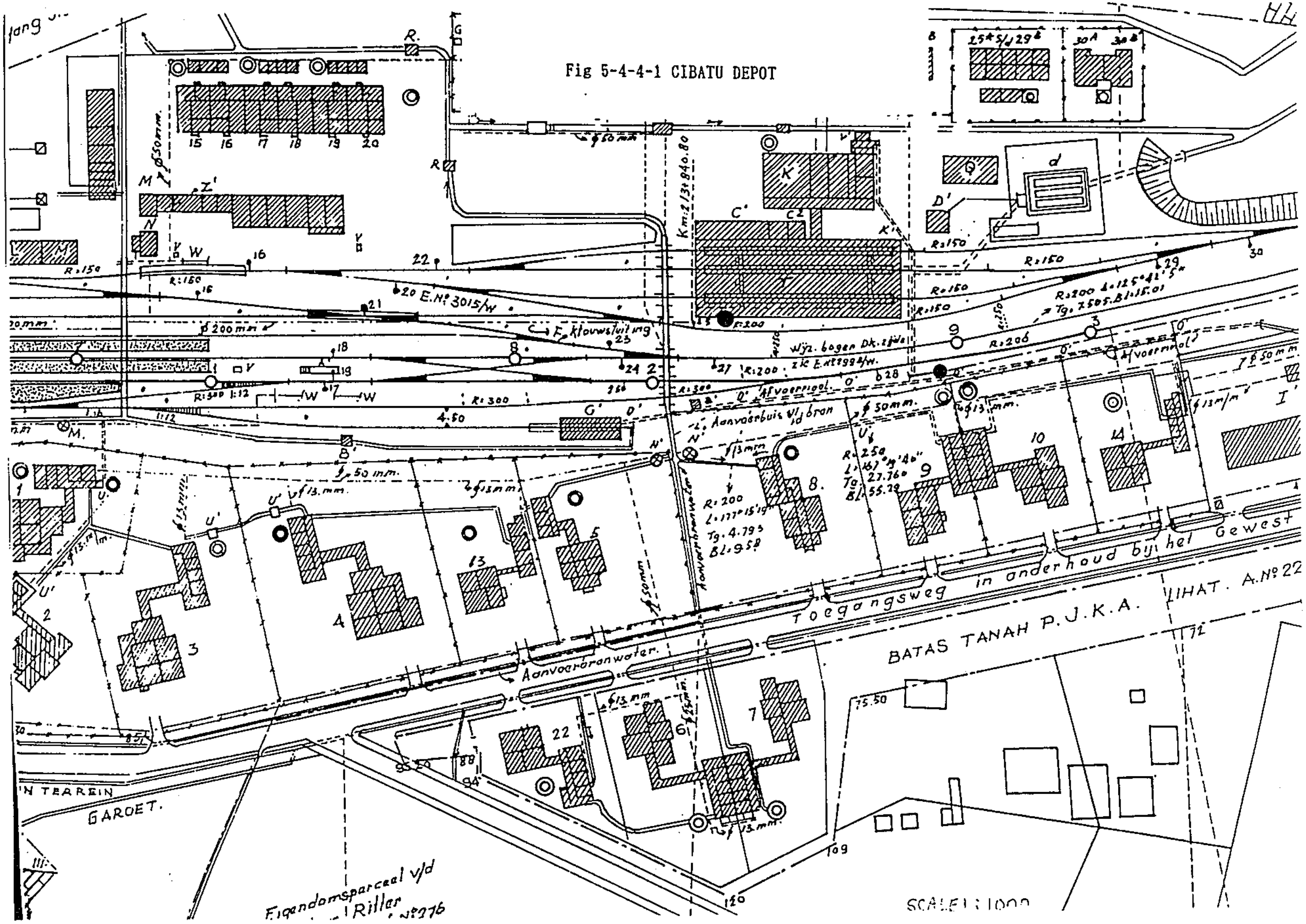
Kind of inspection	Period of inspection	Required time for inspection original -> upgrade	Annual				Remarks
			Inspection No./wagon	Inspection time in total		Inspection capacity	
Monthly	every month	1 day -> 0.5 day	9	4.5 days	Total 6 days x 309 units = 1,854 days	3 lines 2 units x (365-52 days) = 1,878 days	The existing three tracks could suffice to cope with the likely growth of sand transport if the equipment were improved and upgraded.
4M	every 4 months	2 days -> 0.5 day	2	1 day			
Yearly	every year	4 days -> 1 day	0.5	0.5 days			

Note: The number of freight wagons to be inspected and repaired excludes those to be overhauled, thus:

(204 units + 121 units) x 0.95 = 309 units

This table suggests that the existing equipment is not capable of these inspection and maintenance purposes. All the same, the existing three tracks could suffice to cope with the likely growth of sand transport if the equipment were improved and upgraded. Hence, it is absolutely necessary rationaliztion of the inspection and maintenance process by installing effective equipment. (Fig. 5-4-4-1 and Tab. 2-7-4)

Fig 5-4-4-1 CIBATU DEPOT



5-5 Construction Schedule

The entire term of the project is divided into a first and a second stage in order to equalize the increase in the number of trains throughout the entire term. The first stage was allotted to such urgent work as inspection and maintenance sheds for the accommodation of purchased locomotives and rehabilitation of defective rolling stock.

The commencement was set for 1994 at the earliest with consideration for relevant loan procedures and lead time.

The first two-year stage of the project, which was allotted to the civil engineering work, building work, track laying work, and electrical engineering work, is slated to finish at the beginning of 1996. Fig. 2-9-1 shows estimated results.

6. THE COST ESTIMATE OF THE PROJECT

6-1 The Assumptions of Cost Estimate

1) The cost of construction will be calculated separately according to break down, such as labor expenses, material costs (machinery hire included) and overhead expenses.
2) The cost of construction will be calculated based on prices as of June, 1991. Escalation of the prices will also be taken into account. The average annual rate shall be 7%. Since this rate is rather high, the calculation period shall be until the first-stage opening of the project. After this initial opening no consideration of the rate will be given, since there are so many elements of uncertainty in the future. (Att.-5)
3) The cost of construction for each different stage will be calculated classified by local and foreign currencies.
4) The costs of imported construction material and machinery will be calculated on the basis of CIF.
5) The foreign exchange rate shall be 1 Rp = 0.07 yen.
6) All of the labor expenses accrued in all stages of construction will be calculated in the local currency.
7) The unit costs at different stages of construction such as labor expenses and material cost shall be designated as those prevailing in Indonesia. Those unit costs which are not available in Indonesia shall be established in reference to the costs that can be obtained in Japan.
8) Engineering services arising from construction (excluding the purchase of locos and wagons) will be included and calculated as 10% of the construction cost.
9) Contingency (excluding the purchase of locomotives and wagons) will also be included and calculated as 5% of the construction cost.
10) Five percent of the total construction cost will be considered as overall expenses.
11) In making these calculations, the use of the prices of local goods is highly recommended.

The breakdown of the construction costs thus calculated will be found in Tab. 2-9-1. The results were confirmed by PERUMKA.

6-2 Project Cost and Loan Amount

The result of the estimate based on the F/S report submitted by the Indonesian side reflects that the scope of possible investment might be limited to around 100 billion Rp. or 7 billion yen at most, even if the revise of sand transportation fare is anticipated for sand transportation up to 3,000 m^3/day. With this estimate in mind, investment items are to be carefully screened and selected.

Based on the lists of unit costs of various construction items prepared by the Indonesian and Japanese sides staying in Indonesia a new unit cost will be determined. The exchange rate between local and foreign currencies will also be incorporated in this new unit cost. As for the unit costs of various construction items which were not available from Indonesia, Japanese costs will be translated into Indonesian values using the exchange rate of 1 Rp = 0.07 yen. As for labor expenses, relevant information obtained in Indonesia will be referred to because in this matter there is a great gap between Japan and Indonesia.

The above-mentioned lists of unit costs of various construction items and quantities based on Att.-3. Att.-4 shows the calculations for each construction site.

Tab. 2-9-2 is a summary of the whole discussion related to construction costs. As of June, 1991, some costs are as follows:

Total construction cost	122,719 M Rp. (100%)
Included cost as foreign currency	89,329 M Rp.
Rolling stock	76,515 M Rp. (62.3%)
Electricity (Power, signals, communication)	28,980 M Rp. (23.6%)
Civil work, buildings	5,881 M Rp. (4.8%)
Tracks, machinery, etc.	11,343 M Rp. (9.3%)

As can be seen, the cost of rolling stock occupies more than half of the total construction cost.

7. PROJECT EVALUATION

7-1 Financial Evaluation

7-1-1 The object and the formula of the analysis

Financial analysis aimes at analysing the feasibility of the project, where it is profitable and the steady management is possible or not.

Financial internal rate of return (FIRR) is one of the indexes for the above.

(1) FIRR

Based on discounted cash flow method, FIRR adopts the discount rate which makes the present value of total cost equal to that of total income where the the both may have different occurrence time each other.

FIRR which takes the used gross capital including outsider capital into consideration will be compared with substantial city market interest level.

$$I_o = \sum_{t=0}^{T} \frac{(R_{nt} - R_{ct}) - (O_{nt} - O_{ct})}{(1 + r)^t} + \frac{S}{(1 + r)^T} \qquad (7\text{-}1)$$

I_o : Investment amount including net investment and its surcharges

T : An aimed term which means the sum of initial construction period and object life

t : Arbitrary duration years in the process of T

$R_{nt} - R_{ct}$: The difference of income between new and old facilities in the t-th year

$O_{nt} - O_{ct}$: The difference of expenditure between new and old facilities in the t-th year, which excludes interest and depreciation and includes tax payment

S : The estate value of the new facilities left in the T-th year (include land estate value)

r : FIRR (the discount rate for present value)

(2) The value of fixed estate

The value of fixed estate composed of the sum of direct construction cost and its management cost, whose ratio is called overhead ratio.

(3) The depreciation

The annual depreciation value of real estate is calculated by fixed amount method the remained value just at the end of the depreciation term is ignored here. The mean depreciation years are classified as follows:

Civil works, buildings	40 years	Lands no depreciation
Tracks, equipments	20 years	
Rolling stocks (loco.)	25 years	
(wagon)	40 years	

(4) The unit costs

The unit costs for the calculation adopt present costs, but take annual inflation rate (the mean inflation rate: 7%) into consideration either of construction cost, fare and operation cost only up to the set up time at the first stage to avoid implicit future inflation rate.

(5) The calculation term T

The calculation term T are the sum of construction period at the first stage and one project life.

One project life is consisted of the weighted average of each durable term length classified by the various kind of depreciation properties.

Here one project life is resulted in 25 years.

(6) Facility investment value

a) Equation

$$I_o = \sum_{k=0}^{K} I_k \frac{1}{(1+r)^k} + \sum_{k=0}^{K} Ca_k \times \frac{1}{(1+r)^k} \qquad (7\text{-}2)$$

Notice: I_o : Initial investment used for discounted cash flow method

r : Internal rate of return

I_k : Facility investment value in K-th year counted from the original year

Cak: Rolling stock investment in K-th year counted from the original year

The amount of annual investment will be determined from Tab. 2-9-2 based on Fig. 2-9-1.

Internal rate of return is expected to be more than interest rate of soft loan (annual interest rate: 3%).

7-1-2 The calculation for FIRR

(1) Premise

We study this financial analysis under the following concept. That is, this improvement plan attributes not only to the promotion of aggregate transportation system, but consequently to the modernization of transportation facilities between Cikanpek and Tasikmalaya i Southerm trunk line.

The parameters for calculation based on annual income, expenditure and investment, are obtained from the preceding chapter, the summary is as follows.

(2) Revenue

As for the revenue difference based between new and old facilities, only the direct result of effects caused by facility investment will be added to revenues. These are revenues received from consignors when PERUMKA transports their goods and can be calculated through multiplying the present transport fare of sand by the quantity of transport.

(3) Costs

As for the cost difference between new and old facilities, only the direct costs, which may increase or decrease according to facility investment, shall be added as a part of costs.

1) Management cost

Management costs will be calculated in the following way, using the basic unit of the line concerned or of the similar line. Relative material concerning this matter is also expected from PERUMKA. See Tab. 2-5-1.

a) Facility/Electricity

Labor expenses, repair costs, business fees will be calculated separately in accordance with an increase or decrease in track kilometers.

b) Station cost

The number of personnel, which fluctuates in accordance with the level of facility investment, will be estimated, and labor expenses, repair costs and business fees calculated separately.

c) Conductor cost/Running trains

Labor expenses and business fees are to be calculated separately, in accordance with an increase or decrease in train kilometers.

d) Power cost/Train maintenance cost

These costs are to be calculated in accordance with an increase or decrease in train kilometers.

e) Administration cost

Labor expenses, repair costs and related business fees will be calculated separately in accordance with an increase or decrease in the number of engine personnel at work.

As for the contents of the costs, see 2-5-3.

2) Taxes

A corporate income tax, a tariff for imported material and a commodity tax are considered. As for the corporate income tax, there is no need to make provision for it, because this calculation aimes to measure the effectiveness of the investment prior to taxation. As for the tariff and commmodity tax, no taxes will be levied because the construction material is to be purchased by the Indonesian Government.

(4) Application of formula

"r" or internal rate of return will be calculated in such a way that Io in the formula 7-1 and I_o' in the formula 7-2 reach the same amount, that is, $I_o - I_o' = 0$.

Instead of the real interest rate in the market (the nominal interest rate minus the rate of inflation), a soft loan at an annual interest rate of 3% will be used as a standard of estmating the project's feasibility. If the internal rate of return is expected to exceed 3%, the project can be considered to be feasible.

7-1-3 Result of calculation

The result of calculation is shown in Section 2-10-2. Tabs. 2-10-1 and 2-10-2 show the results of calculation in both cases: inflation-adjusted and non inflation-adjusted. It can be seen, that there is an improvement in the value of FIRR as compared with the rate of price inflation.

As far as the present freight charges go, there will be almost no factors contributing to the financial in provement on the Southern Trunk Line. However, it was found that if the charges were to be raised by 10%, more or less, the project would become feasible for the 3% interest rate of soft loans because the railways can compete fare-wise with truck transportation.

7-2 Environmental and Social Impact

This project uses the routes of already-constructed railways, which means there will be no environment-related changes along the lines.

This project was initially conceived as a means of preventing from natural disasters in the Galunggung district and is recommended as being the best measure that can be taken for environmental protection in the area.

Ready mixed concrete factories in Jakarta have constant demand for aggregate which has, to date, been transported by road. Transportation by railway, as compared with truck transportation, will greatly cut down on the number of public hazards which have afflicted the local people living along the truck roads.

8. CONCLUSION AND SUGGESTIONS

(1) For the railway transportation route Northern and Southern Trunk Lines were selected.

(2) The improvement plan to cater to the sand transportation of 3000 m^3/day consists of;

a) Rehabilitation of 7 locomotives and 73 freight wagons and purchase of 18 new locomotives and 121 freight wagong.

b) Installation of seven new passing stations with electronic interlocking between signals and switches.

c) Installation of automatic block system in 8 stations and 7 sections of running track.

d) Construction of a new locomotive shop in Bandung car depot.

e) An increase of sidings in terminal stations.

(3) The total investment amount is about 123 billion Rp of which the cost for rolling stock is about 73 billion Rp, foreign currency component is 89 billion Rp and domestic 34 billion Rp.

(4) FIRR is 1.4% which is not far from the interest rate for soft loans of 3%.

However, the increase in income of 10% at present prices is competitive with highway transportation. It leads to a better result of FIRR=3.2% which is regarded as feasible.

(5) This project has high public appeal as a part of the volcano disaster prevention project for Galunggung district.

On the other hand, PERUMKA, a private enterprise, assigns spare rolling stock and train schedules to sand transportation for the public good, in spite of low profitability.

We expect the government to appreciate the above circumstances and to provide sufficient funds for the realization of this project.

(6) PERUMKA is conducting the rehabilitation of infrastructure like track and bridges of the Southern trunk line at present.

We strongly wish for the smooth promotion of this program.

Especially, the bridges between Purwakarta and Padalarang appear to require drastic renovation including some substitution where route changes might be considered. Therefore, a careful improvement plan which takes a double tacking plan into consideration for the future is suggested.

(7) Speaking generally, an intercity railway like construction of a new line or double tracking, requires a huge investment.

A situation of low profitability is achieved with difficulty after a long depreciation period.

Many countries in the world alleviate the burden of capital cost to the concerned enterprises by means of financial aid considered normal for public works.

The Southern Trunk Line can be considered to be in this situation.

After the improvement for sand transport, all sections between Bandung and Cikampek will reach the upper limit of track capacity. (The upper limit is 90 - 100 trains 2 ways a day on the single line.)

The improvement measures for the single track line are no longer only the automatic blocking and the speed up of all operating trains. The latter is impossible to realize in view of the present condition of the rolling stock.

The final improvement is doubling tracking whose execution will come in the near future.

On the other hand, the construction of the express highway between Bandung - Jakarta will be completed sooner or later. Express buses which will operate on the above will require less time than the now profitable Parahyangan express which takes more than three hours.

This critical situation requires a huge investment. We expect the government to approve the investment for doubling track of the Southern Trunk Line which is fundamental to the survival of the railway. This is the only way to make sure of an increase in train speed, punctuality and frequency on the concerned line.

(8) Recently, the transportation demand of the Southern Trunk Line is increasing enormously not only the Parahyangan express service but also due to both container and commuter services owing to industrial development around

Bandung.

Nevertheless, the forecasts of the transportation demand for the above have not been realized, and an overall improvement plan for the Southern Trunk Line does not yet exist. It is desirable to complete such an overall masterplan as soon as possible.

(9) The Bogor detour route should be studied from another view point taking the urban transportation plan (Jabotabek) into consideration.

For example, a new unloading station for sand near the outer ring road after improvement of this mountaineous sections, would reduce traffic jams in the Jabotabek system.

(10) Greater efforts should be undertaken to give customers better service and to improve the availability of rolling stocks. It is necessary that trains can depart and arrive on scheduled times. For this purpose, the management of operating trains should be improved.

Secondly, the management of track maintenance should also be improved, because it is difficult to make speed-up of the trains when the tracks are in bad condition. This makes the rolling stock wear out quickly.

Thirdly, the management of car maintenance cannot be stressed too much. There are many rolling stock which requires reconditioning. Some locomotives were found running under the condition that one out of its six motors was out of order. Another freight cars were found running with the brake connection hose missed. No normal functioning of the cars can be guaranteed if such a situation is continued.

In order to accomplish these better maintenance just relying only upon imported parts for repair is not enough. Rather, they should promote their own maintenance technology so that they can repair by themselves, and also they should be equipped with better facilities for maintenance.

In accordance with the improvement of roads competition will be inevitably intensified between railway and vehicular transportation. Accordingly, a speed-up of the trains will be required so as to maintain the competitiveness of railways. As for new rolling stock to be purchased in the future, the specifications for the purchase that the ATS system can be mounted on the locomotives for security will be required.

Table of Main Imports

Unit: thousand Rp

Article	Specification	Unit	Q'ty	Unit Price	Price	Notes
Facilities						
(Track)						
Rail	R 42	m	2,130	121	257,730	
−〃−	R 54	−〃−	3,350	136	455,600	
Turnout	R 42, 8# Simple turnout	Set	7	37,714	263,998	
−〃−	R 42, 10# −〃−	−〃−	1	44,286	44,286	
−〃−	R 54, 10# −〃−	−〃−	26	80,928	2,104,128	
Scissors Crossing	R 54, 10# −〃−	−〃−	1	402,258	402,258	
					(3,528,000)	
Electric equip.						
(Electric power)						
High voltage transformer	100~500KVA Cubicle type	Set	2	85,710	171,420	Bdg, Cb
Switch board		−〃−	2	42,935	85,870	−〃−
Power cable		Km	3	28,570	85,710	−〃−
					(343,000)	
(Signal)						
Electronic interlocking	80~100route	Set	1	885,700	885,700	Rwk
−〃−	30~ 40r−〃−	−〃−	2	428,500	857,000	Ccl, Kac
−〃−	4~ 10r−〃−	−〃−	12	314,000	3,768,000	
Electric Source	Rf, Batt, AVR, ZT etc.	−〃−	15	35,700	535,500	
Terminal board		−〃−	15	28,500	427,500	
Equip. panel		−〃−	15	42,800	642,000	
Generator	5-30KVA	−〃−	15	100,000	1,500,000	
Signal		−〃−	177	7,140	1,263,780	
Electric switch machine		−〃−	124	11,430	1,417,320	
Track circuit		−〃−	201	5,710	1,147,710	
Signal box		−〃−	44	5,700	250,800	
Signal cable		Km	95	7,150	679,250	
Trough		−〃−	30	17,140	514,200	
Others	Wiring, Test & adjust etc.	Set	1	1,568,240	1,568,240	
					(15,457,000)	

Article	Specification	Unit	Q'ty	Unit Price	Price	Notes
(Telecommunication)						
Talk back		Set	3	14,280	42,840	Pwk, Ccl, Kac
Telephone		—〃—	60	710	42,600	
Wiring box		—〃—	15	7,140	107,100	
Communication cable		Km	50	17,140	857,000	
Others		Set	1	36,460	36,460	
					(1086,000)	
(Mechanical equip.)						
[Loco. depot facilities]						
(Secondary construction)						
Air compressor	Including reservoir	Set	1	74,000	74,000	
Sewage treatment equip.		—〃—	1	316,000	316,000	
					(390,000)	
(Handling, Lifting)						
Overhead crane	15t	Set	1	420,000	420,000	
Lifting jack		—〃—	1	284,000	284,000	
Fork lift (electric)		—〃—	1	60,000	60,000	
Others		—〃—	1	195,000	195,000	
					(959,000)	
(Inspection & Test)						
Engin testing equip.		Set	1	284,000	284,000	
Ultrasonic testing equip.		—〃—	1	76,000	76,000	
Others		—〃—	1	134,000	134,000	
					(494,000)	

Article	Specification	Unit	Q'ty	Unit Price	Price	Notes
(Maintenance)						
Jig & tool		Set	1	134,000	134,000	
Battery charging equip.		—〃—	1	120,000	120,000	
Welding machine		—〃—	1	76,000	76,000	
Gas cutting eqip.		—〃—	1	74,000	74,000	
Lathe		—〃—	1	150,000	150,000	
—〃—		—〃—	1	90,000	90,000	
Drilling machine		—〃—	1	194,000	194,000	
Milling machine		—〃—	1	180,000	180,000	
Others		—〃—	1	210,000	210,000	
					(1,228,000)	
[Loco. depot facilities]	Total				((3,071,000))	
[F.C. depot facilities]						
Air compressor	Including reservoir	Set	1	74,000	74,000	
Overhead crane	15t	—〃—	1	420,000	420,000	
Jig & tool		—〃—	1	30,000	30,000	
Welding machine		—〃—	1	76,000	76,000	
Gas cutting eqip.		—〃—	1	74,000	74,000	
Lathe		—〃—	1	150,000	150,000	
Drilling machine		—〃—	1	194,000	194,000	
Others		—〃—	1	225,000	225,000	
					(1,243,000.	
Rolling stock						
New locomotives	Including spare parts	Unit	18	3,028,560	54,514,000	
Parts for Rehebilitation		—〃—	7	622,430	4,357,000	
					(58,871,000)	
Others	Engineering	Set	1	3,821,000	3,821,000	
Contingency		—〃—	1	1,909,000	1,909,000	
					(5,730,000)	
	Total				89,329,000	

Att.-2 Data on the Rolling Stocks

1. Locomotives in Java, at April 1991
2. General Drawing & Main Spec. of the Loco. CC201
3. Tractive Effort of the Loco. CC 201
4. General Drawing & Main Spec. of the Freight Wagon YYW
5. General Drawing of the Freight Wagon PPCW

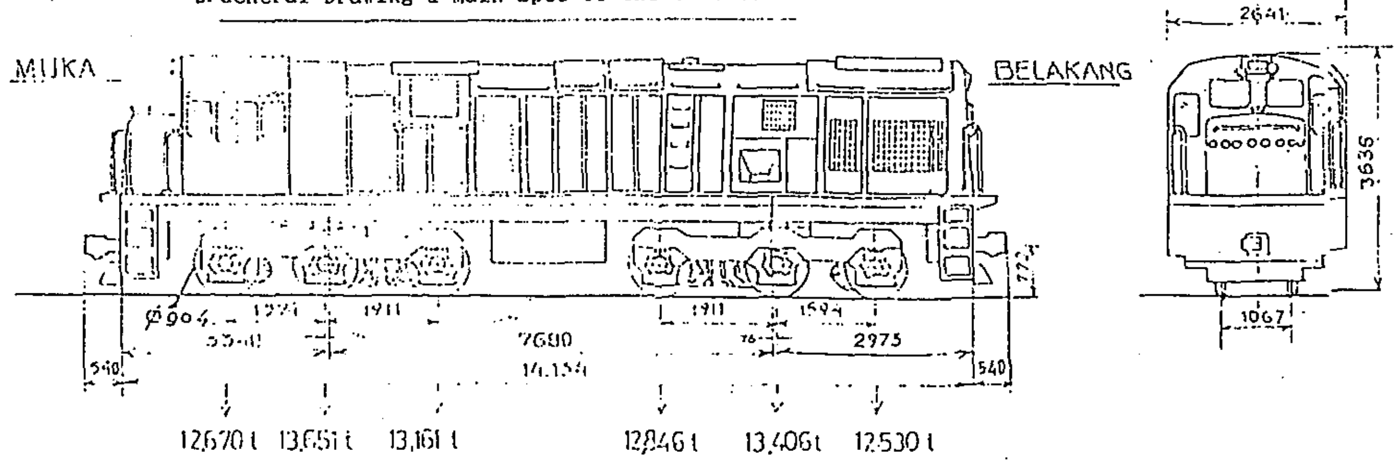
1. <u>Locomotives in Java, at April 1991</u>

( ) shows locomotives in Bandung depot.

Class	Wheel arrange-ment	Trans-mission	Rated power hp	Max. speed km/h	Total weight tons	Length mm	No. in 1991	Year first built
CC200	Co-Co	Elec	1600	90	96	17,000	10	1951
CC201	Co-Co	Elec	1950	100	78.2	14,134	80 (33)	1976
BB200	AIA-AIA	Elec	875	120	74.8	14,006	26	1956
BB201	AIA-AIA	Elec	1310	120	78	14,026	11	1964
BB203	AIA-AIA	Elec	1730	100	78	14,133	10	1978
BB300	B-B	Hyd	680	75	36	11,890	21	1956
BB301	B-B	Hyd	1500	120	52	13,380	48 (7)	1962
BB303	B-B	Hyd	1150	90	44	12,320	24	1971
BB304	B-B	Hyd	1500	120	52	13,380	25	1974
BB306	B-B	Hyd	857	75	40	-	8	1983
C300	C	Hyd	350	30	30	8,020	20 (13)	1964
D300	D	Hyd	340	50	34	9,279	29	1956
D301	D	Hyd	340	50	28	8,980	76	1960
Total							388 (53)	

2. General Drawing & Main Spec of the Loco CC201

D, 2196-53B



LOK.DE SERI CC.20101 - 20172

Berat siap ....78.2 ton
Berat kosong ....73.3 ,,
Muatan tiap gandar penggerak ....13.58 ton
Berat adhesi ....78.2 ton
Berat tiap meter lurus(siap) .... 5.074 kg

UKURAN² UTAMA :

Lebar sepur	1067 mm
Panjang lok	14.134 ,,
Lebar badan	2.641 ,,
Tinggi lok	3636 ,,
Garis tengah roda penggerak	904 ,,
Jarak pivot	7806 ,,
Jumlah jarak antara roda²	,,
Tinggi perangkaian	770 ,,
Jari² lengkung terkecil	56.700 ,,

Daya mesin	1950 hp
Daya mesin di generator	1812.5 hp
Gaya tarik maks dengan 30% adhesi	24.445 ton
Gaya tarik Kontinyu, Pada V=18 km/h	24.290 ton
Kecepatan maks yang diperkenankan	100 Km/jam
Bahan bakar	3028 L
Minyak pelumas	984 L
Air	684 L
Pasir	510 L
Gear Ratio, dgn ϕ roda 904 mm	93:18

ALAT 2 (EQUIPMENT)

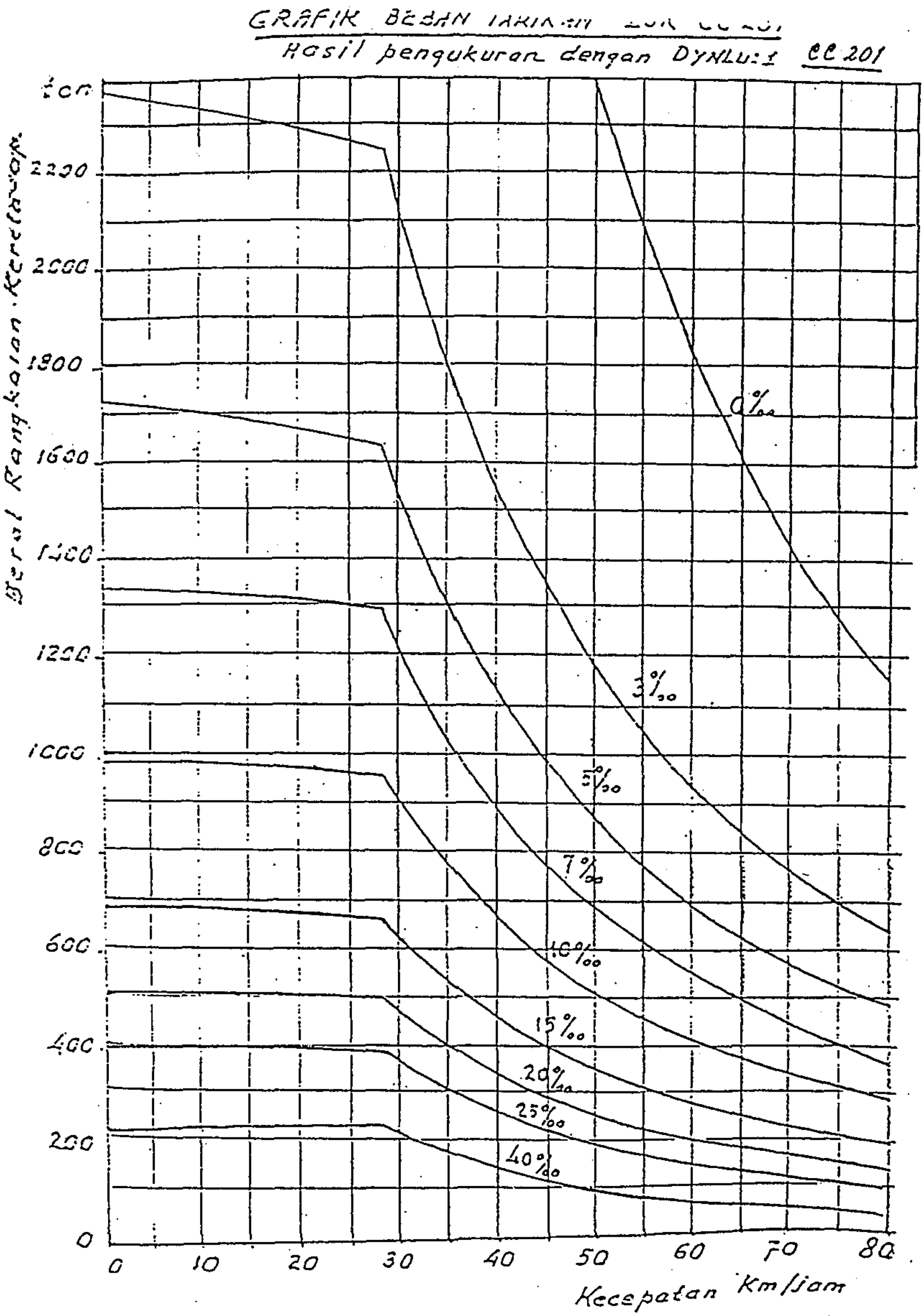
1 Mesin disel model 7FDL 8
6 Motor traksi Type 4 stroke Turbocharger GE 76
1 Generator utama Type GT 581
1 Generator pembantu Type Gy 27
1 Aruplyne Exciter Type Gv 50

Kompressor : Gardner-Denver Type WBO
Perabaran : 1. Abar udara tekan
2. Abar dynamika
3. Abar tangan
Pabrik : General Electric

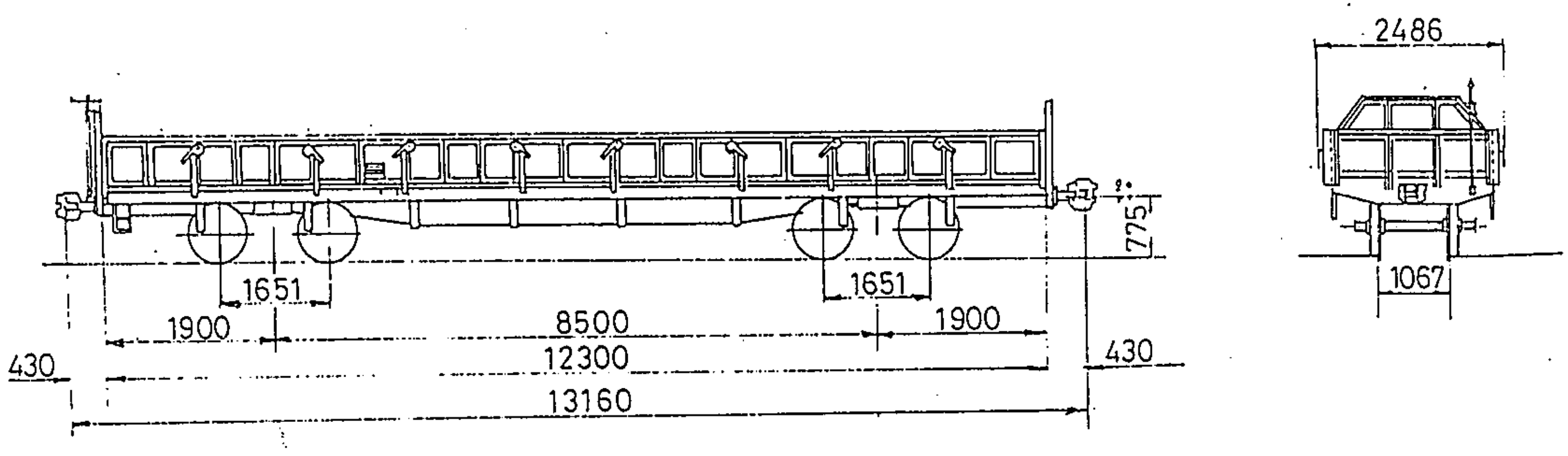
Dibuat berdasarkan Pesanan/Kontrak
NO. Tib/10/2 ; Tgl. 5-5-1976. ; CC 20101 .. 20124.
NO. Tib/10/3 ; Tgl. 5-5-1976 ; CC 20125 - [illegible] *
Mulai dinas. thn. 1977.
NO. Tib/11/8 ; Tgl. 8-8-1977 ; CC 20129 - [illegible]
Mulai dinas, thn. 1978.

*) PUSRI

3. Tractive Effort of the Loco CC201

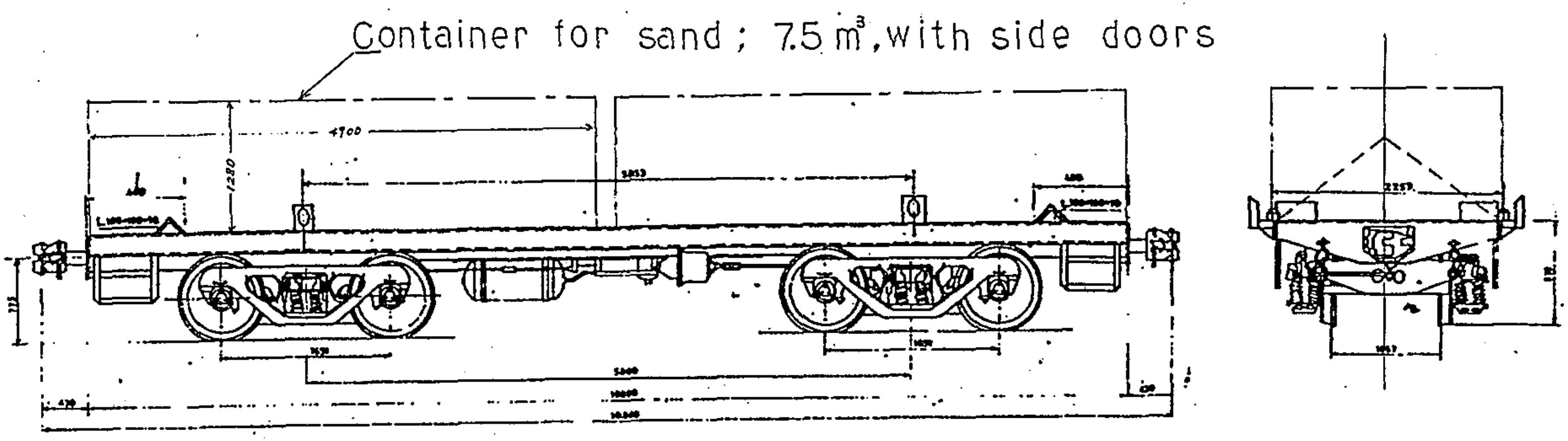


4. General Drawing & Main Spec of the Freight Wagon YYW



Berat muat	30,5 ton	Dibuat menurut gambar	APPROVED NO 35200/0
Berat kosong	14,5 ton	Dibuat oleh pabrik	ARAD RUMANIA
Kecepatan maksimum	80 km/j	Airbrake type	KE-G-12"
Isi gerobak	26 m^3	Distributor	KECSL(g)A
for sand (with overflow holes)	15 m^3	Mulai dinas	Th 1984

5. General Drawing & Main Spec of the Freight Wagon PPCW



P.J.K.A.
KANTOR PUSAT
KR / RKD
BD. 17-7-1985
SKALA
Dipola
Digambar
Direncana
Diperiksa
Diketahui
Disyahkan
Lembar

PERUBAHAN GRB TTW EX RUMANIA MENJADI GRB PPCW BERIKUT POSISI PEMASANGAN KUNCINYA

Att.-3 Itemized Price List (Facilities) (1/2)

unit: thousand Rp

Items	Unit	Unit price	Foreign %	Domestic		Q'ty	Total price	Items		Remarks
				Labor charge %	Others %			Foreign	Domestic	
(Land)										
Land acquisition	m^2	4.3	0	0	100	13,700	59,000	0	59,000	Eight stations (passing station and Pirusa)
Land (Total)							59,000	0	59,000	
(Civil engineering)										
Cutting	m^3	5.7	0	100	0	24,300	139,000	0	139,000	Three stations
Banking	m^3	4.3	0	100	0	29,100	124,000	0	124,000	Eight stations (passing station and Pirusa)
Change in gradient of main line (cutting)	m	611.7	0	10	90	855	523,000	0	523,000	Skt - Cle - Pdl
" (banking)	m	137.5	0	70	30	320	44,000	0	44,000	Cle - Pdl
Bank with relating wall	m^2	42.8	0	10	90	1,800	77,000	0	77,000	Babakanjawa, Haurpugur
Platform concrete	m^3	72.2	0	10	90	180	13,000	0	13,000	"
Civil engineering (total)							920,000	0	920,000	
(Building)										
Station and signal cabin	m^2	751.1	0	10	90	900	676,000	0	676,000	Fifteen place and Babakanjawa
Locomotive shed	m^2	1,857.0	0	10	90	1,110	2,061,000	0	2,061,000	Bandung car depot
Office	m^2	1,430.0	0	10	90	690	985,000	0	985,000	"
Engine pit	m	1,430.0	0	10	90	165	236,000	0	236,000	"
Building (total)							3,958,000		3,958,000	

Att.-3 Itemized Price List (Facilities) (2/2)

unit: thousand Rp

Items	Unit	Unit price	Foreign %	Domestic		Q'ty	Total price	Items		Remarks
				Labor charge %	Others %			Foreign	Domestic	
(Track)										
Rail R42	m	211.3	57	8	92	2,130	450,000	257,000	193,000	Bandung, Pirusa, Jakartagudang
Rail R54	m	237.0	57	8	92	3,350	794,000	453,000	341,000	Seven stations
R42, 8# simple turnout	Set	38,570	98	100	0	7	270,000	264,000	6,000	Bandung, Pirusa, Jakartagudang
R42, 10# simple turnout	Set	46,000	98	100	0	1	46,000	45,000	1,000	Pirusa
R54, 10# simple turnout	Set	82,580	98	100	0	26	2,147,000	2,104,000	43,000	Seven stations
R54, 10# scissors crossing	Set	413,000	98	100	0	1	413,000	404,000	9,000	Babakanjawa
Track (total)							4,120,000	3,527,000	593,000	
Sum							9,057,000	3,527,000	5,530,000	

(Att.-3) Itemized Price List (Electric equipment)

unit: thousand Rp

Item	Unit	Unit price	Foreign %	Domestic		Q'ty	Total price	Items		Remarks
				Labor charge %	Others %			Foreign	Domestic	
(Electric power)										
Installation of electric light	Set	14,000	0	60	40	16	224,000	0	224,000	Building, electric sources, and light
"	"	359,000	70	90	10	1	359,000	257,000	102,000	Depo (Bd) Ditto
"	"	117,000	70	90	10	1	117,000	86,000	31,000	Wagon maint (Cb) Ditto
Electric power total							700,000	343,000	357,000	
(Signal)										
Installation of interlocking device	Set	722,000	90	100	0	15	10,830,000	9,747,000	1,083,000	Including motor generator
Improvement of interlocking device	"	70,000	0	60	40	1	70,000	0	70,000	Mechanical (Pirusa)
Disuse of interlocking device	"	28,000	0	100	0	9	252,000	0	252,000	Mechanical
Installation of signal	"	11,000	70	90	10	177	1,947,000	1,363,000	584,000	
Installation of switch machine	"	19,000	70	80	20	124	2,356,000	1,650,000	706,000	
Installation of track circuit	"	10,000	70	100	0	201	2,010,000	1,410,000	600,000	
Others	"	235,000	0	60	40	1	235,000	0	235,000	Level crossing control Block system
Subtotal							17,700,000	14,170,000	3,530,000	
Installation of signal cable	km	35,700	40	60	40	90	3,213,000	1,286,000	1,927,000	
Signal total							20,913,000	15,456,000	5,457,000	
(Telecommunication)										
Installation of communication facilities	Set	22,000	80	100	0	15	330,000	264,000	66,000	
Installation of communication cable	km	43,000	40	90	10	48	2,064,000	825,000	1,239,000	
Telecommunication total							2,394,000	1,089,000	1,305,000	
Total							24,007,000	16,888,000	7,119,000	

(Att.-3) Itemized Price List (Rolling stock) (1/1)

unit: thousand Rp

Items	Unit	Unit price	Foreign %	Domestic		Q'ty	Total price	Items		Remarks
				Labor charge %	Others %			Foreign	Domestic	
New locomotives	Unit	3,028,600	100			18	54,514,000	54,514,000		
New freight wagons	Unit	100,000	0			121	12,100,000		12,100,000	
Rehabilitation of locos.	Unit	830,570	75	80	20	7	5,814,000	4,357,000	1,457,000	
Adjustment of freight wagons	Unit	6,068	0			73	443,000		443,000	
Total of rolling stock							72,871,000	58,871,000	14,000,000	

(Att.-3) Itemized Price List (Mechanical equipment) (1/2)

unit: thousand Rp

Items	Unit	Unit price	Foreign %	Domestic		Q'ty	Total price	Items		Remarks
				Labor charge %	Others %			Foreign	Domestic	
[Loco. depot facilities]										
(Secondary construction)										
Air compressor & supply piping	Set	224,000	33	80	20	1	224,000	74,000	150,000	
Water supply	"	14,000	0	70	30	1	14,000		14,000	
Swege treatment equipment	"	476,000	70	60	40	1	476,000	316,000	160,000	
Others	"	72,000	0	70	30	1	72,000		72,000	
Subtotal							786,000	390,000	396,000	
(Handling, lifting)										
Overhead crane 15t	Set	463,000	91	90	10	1	463,000	420,000	43,000	
Lifting jack	"	312,000	91	90	10	1	312,000	284,000	28,000	
Fork lift (electric)	"	66,000	91	90	10	1	66,000	60,000	6,000	
Others	"	214,000	91	90	10	1	214,000	195,000	19,000	
Subtotal							1,055,000	959,000	96,000	
(Inspection & test)										
Engine testing equipment	Set	313,000	91	90	10	1	313,000	284,000	29,000	
Ultrasonic testing equipment	"	83,000	91	90	10	1	83,000	76,000	7,000	
Others	"	147,000	91	90	10	1	147,000	134,000	13,000	
Subtotal							543,000	494,000	49,000	
(Maintenance)										
Jig & tool	Set	147,000	91	90	10	1	147,000	134,000	13,000	
Battery charging equipment	"	131,000	91	90	10	1	131,000	120,000	11,000	

(Att.-3) Itemized Price List (Mechanical equipment) (2/2)

unit: thousand Rp

Items	Unit	Unit price	Foreign %	Domestic		Q'ty	Total price	Items		Remarks
				Labor charge %	Others %			Foreign	Domestic	
Welding machine	Set	83,000	91	90	10	1	83,000	76,000	7,000	
Gas cutting equipment	"	81,000	91	90	10	1	81,000	74,000	7,000	
Lathe	"	164,000	91	90	10	1	164,000	15,000	14,000	
Ditto	"	99,000	91	90	10	1	99,000	90,000	9,000	
Dorilling machine	"	213,000	91	90	10	1	213,000	194,000	19,000	
Milling machine	"	197,000	91	90	10	1	197,000	180,000	17,000	
Others	"	230,000	91	90	10	1	230,000	210,000	20,000	
Subtotal							1,345,000	1,228,000	117,000	
[Loco. depot facilities total]							3,729,000	3,071,000	658,000	
[FC depot facilities]										
Air compressor & supply piping	Set	224,000	33	80	20	1	224,000	74,000	150,000	
Overhead crane 15t	"	457,000	91	90	10	1	457,000	420,000	37,000	
Jig & Tool	"	33,000	91	90	10	1	33,000	30,000	3,000	
Welding machine	"	83,000	91	90	10	1	83,000	76,000	7,000	
Gas cutting equipment	"	81,000	91	90	10	1	81,000	74,000	7,000	
Lathe	"	164,000	91	90	10	1	164,000	150,000	14,000	
Drilling machine	"	213,000	91	90	10	1	213,000	194,000	19,000	
Others	"	245,000	91	90	10	1	245,000	225,000	20,000	
Subtotal							1,500,000	1,243,000	257,000	
[Mechanical equipment total]							5,229,000	4,314,000	915,000	

Att.-4 Summary of Investment at Each Places

unit: million Rp

			First stage			Second stage	Total	Remarks
			1994	1995	Total	1997		
Purwakarta (Pwk) - Clganea (Ca) - Sukatani (Sut)				6,457	6,457		6,457	Automatic blocking
Sasaksaat (Skt) - Cilame (Cle)				1,971	1,971		1,971	Passing station
Cilame (Cle) - Padalarang (Pdl)				1,686	1,686		1,686	Ditto
Kiracondong (Kac) - Gedebage (Gdb) - Gedebagebaru (Gdbb)						6,072	6,072	Automatic blocking
Rancaekek (Rck) - Cicalengka (Cal)						1,571	1,571	Passing station
Haurpugur (Hrp) - Cicalengka (Ccl) - Nagreg (Ng)						3,914	3,914	Automatic blocking
Warungbandrek (Wb) - Bumiwaluya (Bmw)						1,500	1,500	Passing station
Cipeundeuy (Cpd) - Cirabaya (Caa)						1,543	1,543	Ditto
Ciawi (Caw) - Rajapolah (Rjp)						1,500	1,500	Ditto
Babkan				2,200	2,200		2,200	Ditto
Jakartagudang						229	229	Addition of side track
Pirusa						486	486	Ditto
Bandung			3,443	4,086	7,529		7,529	Depot
Cibatu				1,614	1,614		1,614	Depot
Rolling stock	New	Loco.		36,343	36,343	18,171	54,514	18 locos.
		Wagon		2,200	2,200	9,900	12,100	121 wagons
		Subtotal		38,543	38,543	28,071	66,614	
	Rehabilitation	Loco.		5,814	5,814		5,814	7 locos.
		Wagon		443	443		443	73 wagons
		Subtotal		6,257	6,257		6,257	
	Total			44,800	44,800	28,071	72,871	
Total			3,443	62,814	66,257	44,886	111,143	

Att-5. Financial Policy in Indonesia

A tight money policy has been maintained in Indonesia since the beginning of the latter half of 1990. This was due to the fact that there had been an upward trend in prices. Land speculation came to be noticed as a social problem in the nation. Some bankers had been running their businesses haphazardly. As a result of the restrictive policy, the prime rate, which had been 16% in February, reached nearly 25% in December, 1990. It continued to rise and at one time was as high as 30%, particularly after the introduction of the tight money policy in February, 1991. However, the mitigation of this monetary policy is now expected to continue by degrees. This takes into account the three reasons detailed below.

Firstly, the tight money policy has worked effectively to bring prices down. In actuality, the growth rate of the consumer price index (CPI) was 5.4% in May, 1990, as compared with the same month of the previous year. It continued to rise to a point as high as 10.9% in December the same year. The factors contributing to the rise of prices were: (1) a sudden increase in the money supply, (2) a rise in prices of construction materials due to a construction boom (office buildings, hotels, industrial complexes, etc.), (3) a violent rise in land prices in city areas caused by investment expansion and land speculation, and (4) a rise in public fares. Beginning in 1991, however, consumer prices were down to 8.7% in February, owing to the tight money policy.

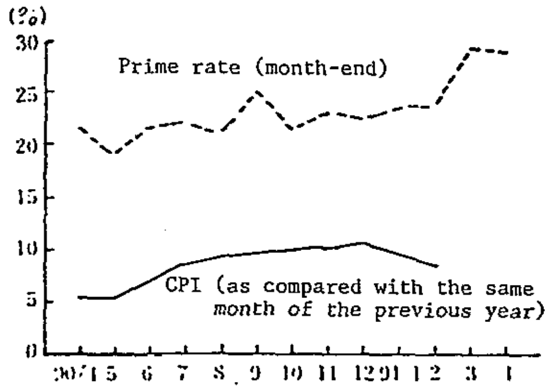
Secondly, the Bank of Indonesia (the Central Bank) has tightened its regulations vis-a-vis commercial banks. A certain framework has been formed in order to control the banks' loan business.

Since October, 1988, the Indonesian financial authorities have been implementing financial deregulation including decontrol of foreign banks. Therefore, rush to establish new banks and branches both at home and abroad took place throughout the nation. In the meantime, some private banks were found to have suffered a tremendous amount of losses in wild and unregulated foreign exchange speculation. The haphazard management on the part of the banks as a whole was pointed out. Consequently, the Bank of Indonesia strengthened its supervisory activities towards the commercial banks. In March of 1991, in order to make banking management more effective and efficient, the central bank took some measures to limit the banks' margin transactions and use of offshore markets, etc.

Thirdly, due to a corresponding rise in interest rates, the emergence of some negative effects such as unpaid loans, the putting-off of new development projects and a drop in automobile sales were reported.

Thus, the tight money policy has certainly achieved its initial objectives. However, its negative effects also appeared. We can now expect a gradual relaxation of the Central Bank's tight money policy in the near future.

Transition of Economic Indicators
in Indonesia



Quoted from Telerate, "Overseas Economic Data", Economic Planning Agency

Att-6

２０００年までの鉄道設備投資計画

RENCANA
PEMBANGUNAN PERKERETAAPIAN
SAMPAI TAHUN 2000

鉄道公社本社

KANTOR PUSAT
PERSAHAAN UMUM KERETA API

BANDUNG, JANUARY 1991

抄訳 ； ＪＩＣＡ専門家 高木 清晴

目　　次

I, はじめに

この資料は、ＰＥＲＵＭＫＡ（Ｐｅｒｓａｈａａｎ　Ｕｍｕｍ　Ｋｅｒｅｔａ　Ａｐｉ）鉄道公社が、公社として健全な事業経営を行い、かつ、インドネシアにおける輸送の一翼を担っている鉄道が社会・経済のニーズに対応できる安全・正確並びに大量輸送可能な交通機関として存続・発展するために必要な鉄道施設計画をまとめたものである。今まで５ケ年計画はあったものの、それ以上の長期計画は抽象的で優先度などもはっきりしていなかったが、今回は一応２０００年まででまとめたものであり、公社の意志がよりはっきりしたものと思われる。今後はこれを基に運輸省・バペナスなどの上位官庁に説明・理解を求めることになる。資料自体は２００ページに及ぶものであるが、その中から、日本側にとり重要と思われる今後のプロジェクト・金額などを抜粋し、日本語に訳したものである。。

大きな項目のわけ方は以下のとうりで、この順番がそのまま優先度になっているが、計画年度の順番を示すものではない。

１］　強化策
安全の確保・輸送力の維持並びに社会ニーズに最低限対応できる輸送力増強のために必要な車両更新・部品購入などの強化策

１］－１　強化策－１
世界銀行との間で、一応項目として認められているもの

１］－２　強化策－２
世界銀行との間で認められているものでないが、強化策として必要なもの

２］　収益路線
輸送力増強・スピードアップすることによって確実に収益の増加が見込まれる路線の改良など

４］　その他
収益の増加にすぐには結び付かないものの、今後の経済・社会のニーズ、鉄道公社の近代化などに必要なもの

Ⅱ. 投資額一覧

優先度	項目	投資額			
		実施中		計画	
		US$	RP	US$	RP
		千ドル	百万Rp	千ドル	百万Rp
1	強化策－1 13案件			187,740	
2	強化策－2 10案件	100,755		203,768	
3	収益路線 19項目	278,854	11,276	233,390	576,763
4	その他	152,222	47,124	1,599,331	2,448,953
	合計	531,831	58,400	2,224,229	3,025,716

日本円に換算すると； 実施中　約　７００億円
計画　約　５０００億円

注－１；ジャボタベック関係は除かれている。

２；US$は外国からのローンなどによる製品購入・工事施工および外国製品の購入などに対する投資額である。

３；RPはプロジェクトにおける内貨分あるいは自国製品の購入・自国通貨による工事施工などの投資額である。

Ⅲ，強化策

Ⅲ－1、 強化策－1

１）．	ＧＥ／ＧＭ社製機関車160 両分の部品購入	US$ 13,900,000
２）．	ＫＲＵＰＰ社製機関車15両分の部品購入	US$ 5,100,000
３）．	ＨＥＮＥＣＨＥＬ社製機関車77両分の部品購入	US$ 5,200,000
４）．	貨車部品購入	US$ 9,800,000
５）．	デイーゼル電気機関車１９５０ＨＰ10両購入	US$ 14,000,000
６）．	ジャワ島内、車輪4000個購入	US$ 3,240,000
７）．	有蓋貨車75両購入	US$ 8,000,000
８）．	コンテナー貨車150 両購入	US$ 10,300,000
９）．	ＧＭ製機関車35両のリパワーリング	US$ 20,900,000
10）．	潤滑油分析機とクレーンの購入	US$ 1,200,000
11）．	貨車用エアーブレーキ部品購入	US$ 9,800,000
12）．	デイーゼル電気機関車１９５０ＨＰ30両購入	US$ 42,000,000
13）．	客車57両購入と客車63両の改造	US$ 44,300,000
	計	US$ 187,740,000

（実施中のものなし）

Ⅲ-2. 強化策-2

1).	デイーゼル電気機関車１９５０ＨＰ20両購入	US$ 28,000,000
2).	客車58両購入と客車62両の改造	US$ 44,300,000
3).	デイーゼル電気機関車１９５０ＨＰ20両購入	US$ 28,000,000
4).	デイーゼル機関車１５００ＨＰ25両購入	US$ 30,000,000
5).	貨車140 両、一体車輪140 個、駆動モーター６セット、空気ブレーキ７セットの購入およびPURWAKARTA-PADALARANG間４橋梁の改修（砂輸送のため）	US$ 41,437,707
6).	貨車150 両の標準化およびＫＫＢＷ型貨車190 両の補修	US$ 2,890,000
7).	西スマトラ機関車６両の部品購入	US$ 3,000,000
8).	車輪1800個購入（機関車100,客車700,貨車1000)	US$ 1,460,000
9).	CIREBON-SEMARANG間ＣＴＣ機器購入・敷設	US$ 24,680,000
10).	西スマトラKAYUTANAM-BATUTABAL(39km) ラック鉄道整備 車両；９両のラック用機関車(BB204) 修繕と新車７両の購入、PADANG車輌工場の拡張とPADANGPANJANG機関車区の設置 施設；レールＲ４２に取替え （実施中、スイス政府援助）	US$100,755,200

計		US$ 304,522,907
	実施中	US$ 100,755,200
	計画	US$ 203,767,707
Ⅲ、強化策の合計		US$ 492,262,907
	実施中	US$ 100,755,200
	計画	US$ 391,507,707

Ⅳ, 収益路線

1）．　ＪＡＫＡＲＴＡ－ＢＡＮＤＵＮＧ

BEKASI-CIKAMPEK-BANDUNG 間色灯信号化	US$ 27,500,000
PURWAKARTA-PADALARANG 間ショートカット測量・設計	＋α

2）．　ＪＡＫＡＲＴＡ－ＣＩＲＥＢＯＮ

CIKAMPEK-CIREBON(135km) 間の複線化・	US$ 21,932,500
重軌道（Ｒ５４，コンクリート枕木）・	RP 182,944,000,000
橋梁・色灯信号化	

3）．　ＣＩＲＥＢＯＮ－ＹＯＧＹＡＫＡＲＴＡ－ＳＯＬＯ

CIREBON-KROYA 間橋梁取替え	US$ 10,108,000
	RP 98,445,000,000
CIREBON-SOLO間色灯信号化	US$ 70,023,000

計　US$ 80,131,000　RP 98,445,000,000

4）．　ＣＩＲＥＢＯＮ－ＳＥＭＡＲＡＮＧ

SEMARANGTAWANG-SEMARANGPONCOL(2km)間複線化，	US$ 317,000
重軌道（Ｒ５４，コンクリート枕木、分岐器）	RP 1,673,000,000
・色灯信号	

5）．　ＣＩＲＥＢＯＮ－ＳＥＭＡＲＡＮ間２００ｋｍの
レール取替え

Ｒ５４レール・分岐器購入	US$ 14,100,000
同上敷設	US$ 27,147,088
計	US$ 41,247,088

6）．　２００ｋｍのレール取替え(BANDUNG-BANJAR/77km,
BRUMBUNG-SOLO/94km,GUNDIH-GAMBRINGAN/10km,
BRAMBANAN-GAWOK/19km)

Ｒ５４レール・分岐器購入　US$ 14,100,000
同上敷設　US$ 27,147,088

計　US$ 41,247,088

７）．ＣＩＧＡＤＩＮＧ－ＳＥＲＰＯＮＧ(115km)、ＣＩＴＡＹＡＭ－ＣＩＢＩＮＡＮＧ(17km)およびＰＲＵＮＰＡＮＪＡＮＧ－ＣＩＴＡＹＡＭ　US$ 104,545,900　RP 11,275,762,700

CIGADING-SERPONGおよびCITAYAM-CIBINONG間軌道(R42)・橋梁・信号通信器材購入，76両の石炭貨車購入を含む
PRUNPANJANG-CITAYAM 間新線（軌道・建物・橋梁・信号通信）調査・設計

（実施中、イギリス政府援助）

８）．CIKAMPEK-CIREBON-SEMARANG 間のうち131km の軌道修復、R54 レール・コンクリト枕木　US$ 72,217,000（9,682百万円）

（実施中、日本政府援助）

９）．マルチプルタイタンパー１２両の購入　US$ 78,022,100

（実施中、オーストリー政府援助）

10）．CIKANPEK-CIREBON間信号近代化（18駅）　US$ 24,069,100

（実施中、オランダ政府援助）

11）．CIKAMPEK-BANDUNG(105km) 間重軌道化（Ｒ５４レール、コンクリート枕木、分岐器）　US$ 7,402,250　RP 26,894,000,000

12）．港、貨物基地、コンテナー基地

－１．TANJUNG PRIOK コンテナー基地移設　US$ 141,000
約２ｋｍの路線新設　RP 1,836,000

－２．BEKASI(LEMAHABANG)コンテナー基地新設と　US$ 282,000
LEMAHABANG駅までの４ｋｍの路線新設　RP 3,443,590,000

−３．BANDUNG(GEDEBAGE) コンテナー基地の改良　RP 1,000,000,000

−４．SEMARANGGUDANG（貨物駅）-TANJUNG EMAS　US$ 211,500
(SEMARANG 港）間約３ｋｍの路線新設　RP 2,754,870,000

−５．SURABAYA(SIDOTOPO)貨物基地改良　RP 1,000,000,000

−６．南スマトラ・PANJANG コンテナー基地　US$ 141,000
（約２ｋｍの路線新設を含む）　RP 1,862,580,000

−７．北スマトラ・BELAWAN-GABION（新港）間　RP 14,182,900,000
約１２ｋｍの路線新設

計　US$ 755,000　RP 26,054,520,000

13）．南スマトラTANJUNGKARANG-MUARAENIM 間150km 分の　US$ 5,499,000
レールR42 からR54 に取替え　RP 21,979,000,000

14）．南スマトラ分岐器100unit 購入（オランダ政府承認済）　US$ 4,300,000
およびTANJUNGENIM-TARAHAN 間への敷設　US$ 253,000

15）．南スマトラKERTAPATI 駅およびコンテナー基地移設　RP 2,000,000,000

16）．西スマトラINDARUNG-TELUKBAYUR 間改良

−重軌道化（R54 レール，コンクリート枕木、分岐器）　US$ 1,269,000
18km間　RP 4,611,000,000

−INDARUNG-BUKITPUTUS(14km) 間複線化　US$ 1,516,667
（R54 レール、コンクリト枕木、橋梁、信号）　RP 15,069,445,000

計　US$ 2,785,667　RP 19,680,445,000

17）．北スマトラKISARAN-RANTAUPRAPAT間114km 分の　RP 29,200,000,000
軌道改良（R42 レール、コンクリート枕木、分岐器）

18）．CIGADING-SERPONG(115km),CITAYAM-CIBINONG(17km)　RP 75,660,000,000
間レール、橋梁、信号などの敷設（Ⅳ−７案件と関連）

19）． 車両工場・区の施設改良など

－１．機関車区改良　RP 22,700,000,000
SEMARANG, YOGYAKARTA, BANDUNG, CIREBON, MADIUN
南スマトラ－KERTAPATI, TANJUNGENIM, LAHAT,
北スマトラ－kisaran

－２．客車区改良　RP 12,000,000,000
BANDUNG, CIREBON, PURWOKERTO, YOGYAKARTA,
SURABAYAPASSARTURI
南スマトラ－REJOSARI

－３．貨車区改良　RP 2,500,000,000
JAKARTAGUDANG, SIDOTOPO

－４．車輌工場改良・拡張　RP 4,890,000,000
YOGYAKARTA, MANGGARAI, TEGAL, SURABAYAGUBENG

－５．車輌工場機械・装備　RP 45,532,025,000
MANGGARAI, TEGAL, YOGYAKARTA, SURABAYAGUBENG
西スマトラ－PADAN, 南スマトラ－LAHAT
北スマトラ－PULUBRAYAN

a)車輪研削機	RP	33,218,000,000
b)エアーブレーキ	RP	8,884,025,000
c)駆動モーター	RP	3,430,000,000

計　RP 87,622,025,000

合計	実施中	US$	278,854,100
		RP	11,275,762,700
	計画	US$	233,389,893
		RP	576,762,989,300
	合計	US$	512,243,993
		RP	690,387,520,000

V, その他

－a. 鉄道施設　合計　US$ 685,076,919
RP 998,641,626,000

a－1. 軌道　計　US$ 136,297,059
RP 393,164,626,000

ジャワ；	CIKAMPEK-SEMARANG のうち30km, BANDUNG-KROYA のうち176km, SEMARANG-SOLO のうち5km,計 211kmの軌道改良	US$ 14,875,500 RP 54,044,021,000
	MALANG-KERTOSONO間166km, KANDANGAN-GRESIK間10km, BANJIL-JEMBER および KALISAT-GARAHAN 間 170.5km,BOGOR-PADALARAND間140.5km の内、計351km 軌道改良	US$ 34,333,500 RP 124,736,679,000
	CIREBON-YOGYAKARTA(298km) 間重軌道化（R54 レール、コンクリート枕木、分岐器）	US$ 21,009,000 RP 76,327,575,000
	計　US$ 70,218,000	RP 255,108,275,000
南スマトラ；	LAHAT-LUBUKLINGGAU間115km 軌道改良	US$ 18,107,500 RP 29,455,400,000
	PRABUMULIH-KERTAPATI間78km重軌道化（R54レール、コンクレート枕木、分岐器）	US$ 5,499,000 RP 19,979,000,000
	計　US$ 23,606,500	RP 49,434,400,000
西スマトラ；	SAWAHLUNTO-BATUBATAL間61km, KAUTANAM-BUKITPUTUS 間54km, LUBUKALUNG-NARAS間28kmの計143km 軌道改良	US$ 10,081,500 RP 36,626,992,000
北スマトラ；	BELAWAN-MEDAN-TEBINGTINGGI間102km, MEDAN-BISITANG間101km の軌道改良	US$ 14,311,500 RP 51,994,959,000
軌道保守機械；	ＭＴＴ(7),バラストレギュレーター(3), バラストコンパクター(7),保線作業車,	US$ 18,079,559

溶接器，バラストクリーニング，
４機械保守区備品など

ａ－２．	橋梁	計	US$ 86,023,300 RP 242,810,000,000

ジャワ；以下の区間の橋梁改修 US$ 51,402,000
CIKAMPEK-CIREBON-SEMARANG, CIREBON-KROYA, YOGYAKARTA-SOLO, BRUMBUNG-SOLO, KANDANGAN-GRESIK, MALANG-KERTOSONO, TEGAL-PURPUK RP 180,956,000,000

ジャワ橋梁取替え（実施中、オランダ政府援助） US$ 5,721,000
RP 15,874,000,000

西スマトラ；INDARUNG-BUKITPUTUS-TELUKBAYUR 間橋梁改修 US$ 681,000
RP 2,270,000,000

北スマトラ；TEBINGTINGGI-RANTAUPRAPAT, TEBINGTINGGI-SIANTAR, KISARAN-TANJUNGBALAI, BINJAI-KUALA間橋梁改修 US$ 9,871,300
RP 12,460,000,000

橋梁取替え（実施中、オランダ政府援助） US$ 9,907,000
RP 19,670,000,000

南スマトラ；橋梁取替え（実施中、オランダ政府援助） US$ 8,441,000
RP 11,580,000,000

ａ－３．	信号	計	US$ 157,599,000 RP 4,875,000,000

ジャワ；SEMARANG-SURABAYA, BANDUNG-TASIKMALAYA 間色灯信号化 US$ 52,335,000

同区間のＡＴＣ（ＡＴＳ）化 US$ 71,350,000

JAKARTA-CIKAMPEK-SEMARANG 間ＡＴＣ化 US$ 20,000,000

ジャワ信号・通信部品購入（オランダ政府承認済）US$ 1,300,000

KERTOSONO-WONOKROHO 間色灯化（実施中、イタリア政府援助） US$ 12,614,000

計 US$ 157,599,000

南スマトラ；LAHAT-LUBUKLINGGAU間機械式信号化 RP 1,200,000,000

西スマトラ；PADANG-SAWAHLUNTO 間機械式信号化 RP 800,000,000

北スマトラ；BELAWAN-MEDAN-RANTAUPRAPAT間ケーブル敷設 RP 2,875,000,000

ａ－４． 通信 計 US$ 87,366,400

ジャワ；ラジオ通信ネットワーク拡大 US$ 8,010,000

西スマトラ；ラジオ通信ネットワーク敷設 US$ 15,000,000

ジャワ；通信設備近代化（Ｔ－０３）（実施中、オーストラリア政府援助） US$ 64,356,400

ａ－５． 新線建設等 計 US$ 352,570,360
RP 357,792,000,000

ジャワ；PARUNGPANJANG-CITAYAM 間新線建設 US$ 4,278,000
ARJAWINANGUN-PALIMANAN(8.5km) 間新線建設 RP 51,837,000,000
（セメント輸送，CIREBON 近郊）
KIARACONDONG-CICALENGKA(22km) 間複線化
RANCAEKEK-JATINAGOR(11.5km) 間再営業

南スマトラ；スララヤ火力発電用石炭輸送（1000万ｔ／年）のため，TANJUNGENIM-TARAHAN間施設整備・車両増強 US$ 81,375,000
RP 281,963,000,000

西スマトラ；SOLOK-INDARUNG間新線建設 US$ 265,000,000

北スマトラ；MEDAN-BELAWAN(22km) 間複線化		US$ 1,917,000
BISITANG-LHOKSEUMAWE(59km)間再営業		RP 23,992,000,000
LHOKSEUMAWE-BIREUN間調査・設計		
RANTAUPRAPAT-KOTAPINANG 間新線建設調査・設計		

－b．車　両	合計	US$ 1,169,500,786 RP 1,437,785,100,000
b－1．部品	計	RP 1,383,353,000,000
機関車・デイーゼルカー・電車・客車・貨車用部品購入		RP 1,257,703,000,000
貨車標準化のための部品購入		RP 125,650,000,000
b－2．機関車	計	US$ 223,739,900
新車105 両の購入(CC201-80, BB303-25)		US$ 152,000,000
118 両の再活生化(BB301-25, D300/D301-28, BB302/BB303-30, BB200/BB201/BB202-25)		US$ 71,739,000
b－3．客車	計	US$ 562,082,200
新車741 両の購入(EKSEKUTIF-55, BISINIS-245, EKONOMI-420,荷物車-21)		US$ 432,271,000
626 両の改造(EKSEKUTIF-63, BISNIS-115, EKONOMI-38, 小包／荷物車-67)		US$ 129,811,200
b－4．貨車	計	US$ 332,496,000
新車5240両の購入（コンテーナー車-350, 石炭車-1354, その他貨車-3536)		US$ 332,496,000
b－5．機関車、デイーゼルカーのリハビリ	計	US$ 51,182,000
D301機関車、28両のリハビリ（実施中、ドイツ政府援助）		US$ 15,220,000

デイーゼルカー96両のリハビリ（実施中、日本政府援助） US$ 35,962,656
(4,819 百万円)

b－6． 工場・区の施設	計	RP	54,432,100,000
機械・器具購入		RP	14,232,100,000
区の補修	小計	RP	40,200,000,000
7－機関車区		RP	16,700,000,000
7－客車区		RP	11,500,000,000
7－貨車区		RP	12,000,000,000

－c． 人材育成 合計 RP 60,650,000,000

このために必要な施設・器具等

c－1．	教育・訓練センター（JAKARTA 地区センター）	RP	3,020,000,000
c－2．	教育・訓練センター（信号・通信－BANDUNG)	RP	4,810,000,000
c－3．	教育・訓練センター（行政－BANDUNG)	RP	12,250,000,000
c－4．	教育・訓練センター（橋梁－BANDUNG)	RP	10,820,000,000
c－5．	教育・訓練センター（運転－BANDUNG)	RP	6,630,000,000
c－6．	教育・訓練センター（地方行政－MALANG)	RP	6,320,000,000
c－7．	教育・訓練本部－BANDUNG	RP	4,000,000,000
c－8．	教育・訓練センター（機関－YOGYAKARTA)	RP	4,500,000,000
c－9．	教育・訓練センター（MEDAN 地区センター）	RP	2,800,000,000
c－10．	教育・訓練センター（TANJUNGKARANG または PALEMBANG 地区センター）	RP	3,000,000,000
c－11．	衛生保健試験所－本社	RP	500,000,000
c－12．	地区運動施設拡充	RP	500,000,000
c－13．	フィットネスセンター建設－本社、ジャワ支社	RP	500,000,000

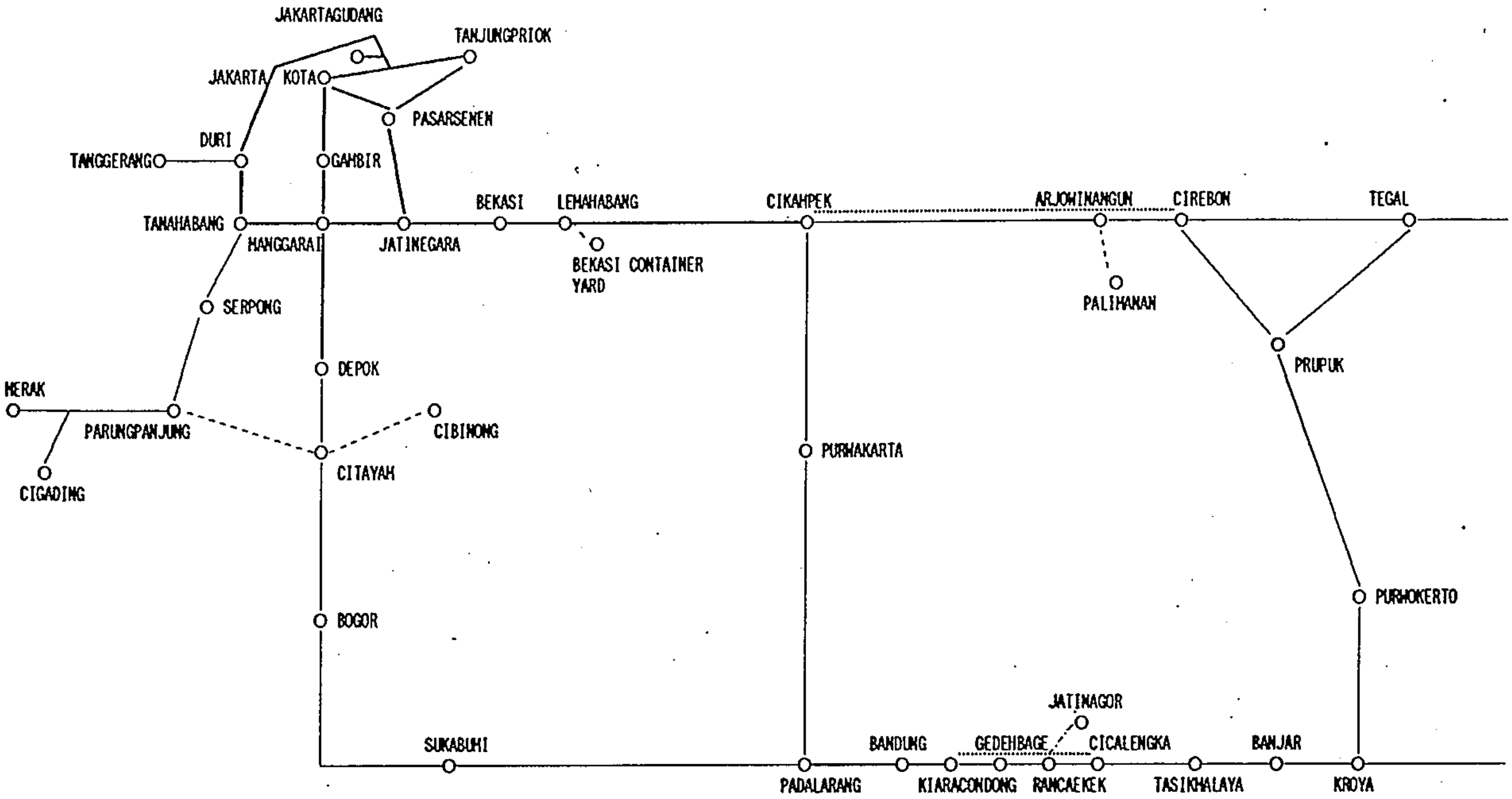
V．その他合計	実施中	US$	152,222,000
		RP	47,124,000,000
	計画	US$	1,599,330,819
		RP	2,448,952,726,000

Ⅵ, 実施中のプロジェクト

−1.	イギリス	CIGADING-SERPONG(115km) 間 軌道・橋梁・信号器材購入 CITAYAM-CIBINONG間17kmの新線区間 器材購入、76両の石炭貨車購入を含む PARUNGPANJANG-CITAYAM 間の 新線建設調査・設計	US$104,545,900 RP11,275,762,700
−2.	スイス	西スマトラKAYUTANAM-BATUTABAL(39km) ラック鉄道修復 ９両のラック用機関車リハビリと BB204, ７両の購入 PADANG車輌工場の拡張とPADANGPANJANG 機関車区設置，レールR42 に取替え	US$100,755,200
−3.	日　本	CIKAMPEK-CIREBON-SEMARANG 間131km の 軌道修復、R54 レール・コンクリート枕木	US$72,217,000 (9,682百万円)
−4.	日　本	９６両のデイーゼル動車修復	US$35,962,656 (4,819百万円)
−5.	オーストリ	マルチプルタイタンパー１２両の購入	US$78,022,100
−6.	オランダ	橋梁取替え（ジャワ、南・北スマトラ）	US$24,069,000 RP 47,124,000,000
−7.	オランダ	CIKAMPEK-CIREBON間信号近代化（18駅）	US$24,069,100
−8.	イタリア	KERTOSONO-WONOKROMO 間信号近代化（12駅）	US$12,614,000
−9.	オーストラリア	ジャワ島通信設備近代化（Ｔ－０３）	US$64,356,400
−10.	ドイツ	機関車（Ｄ３０１）２８両の再活生化	US$15,220,000

合　計　US$ 531,831,356　RP 58,399,762,000

JAWA RAILWAY NETWORK (2-1)

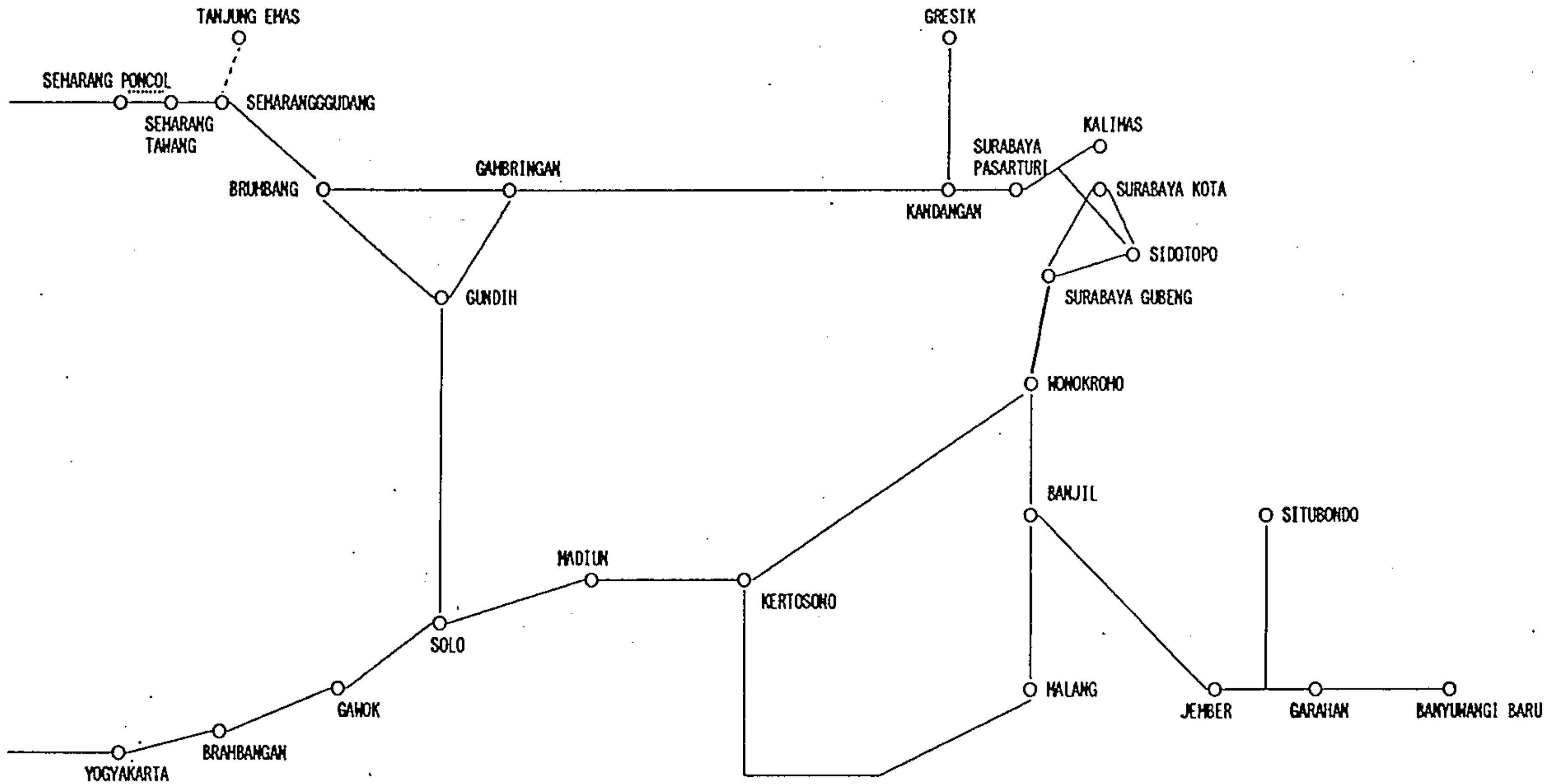


Note; Single Track ——— Plan of new line - - - - -

Double Track ——— Plan of reoperation ·-·-·-·-·

Plan of double track ··········

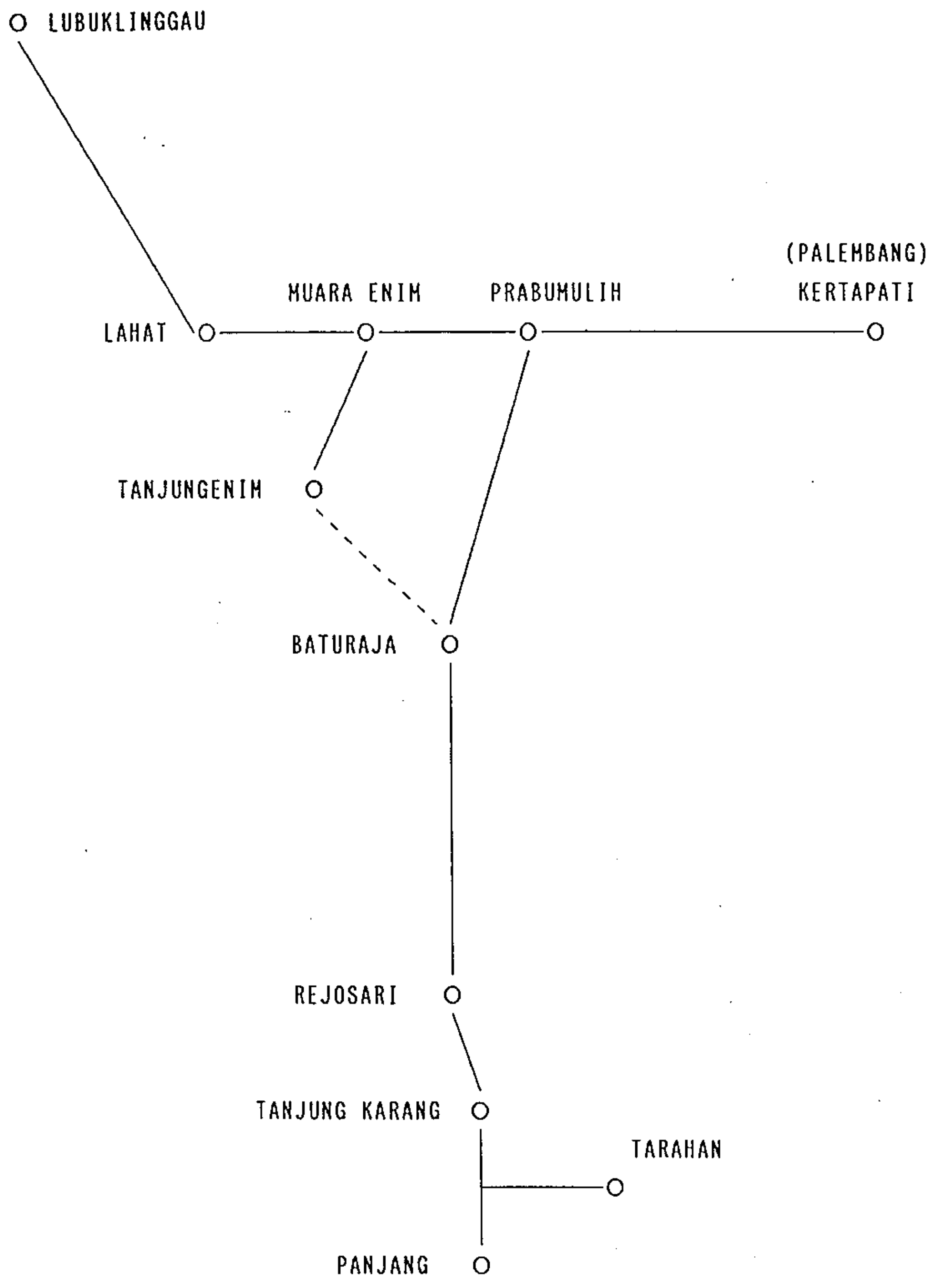
JAWA RAILWAY NETWORK 2-2



Note: Single Track ——— Plan of new line - - - - - - - - -

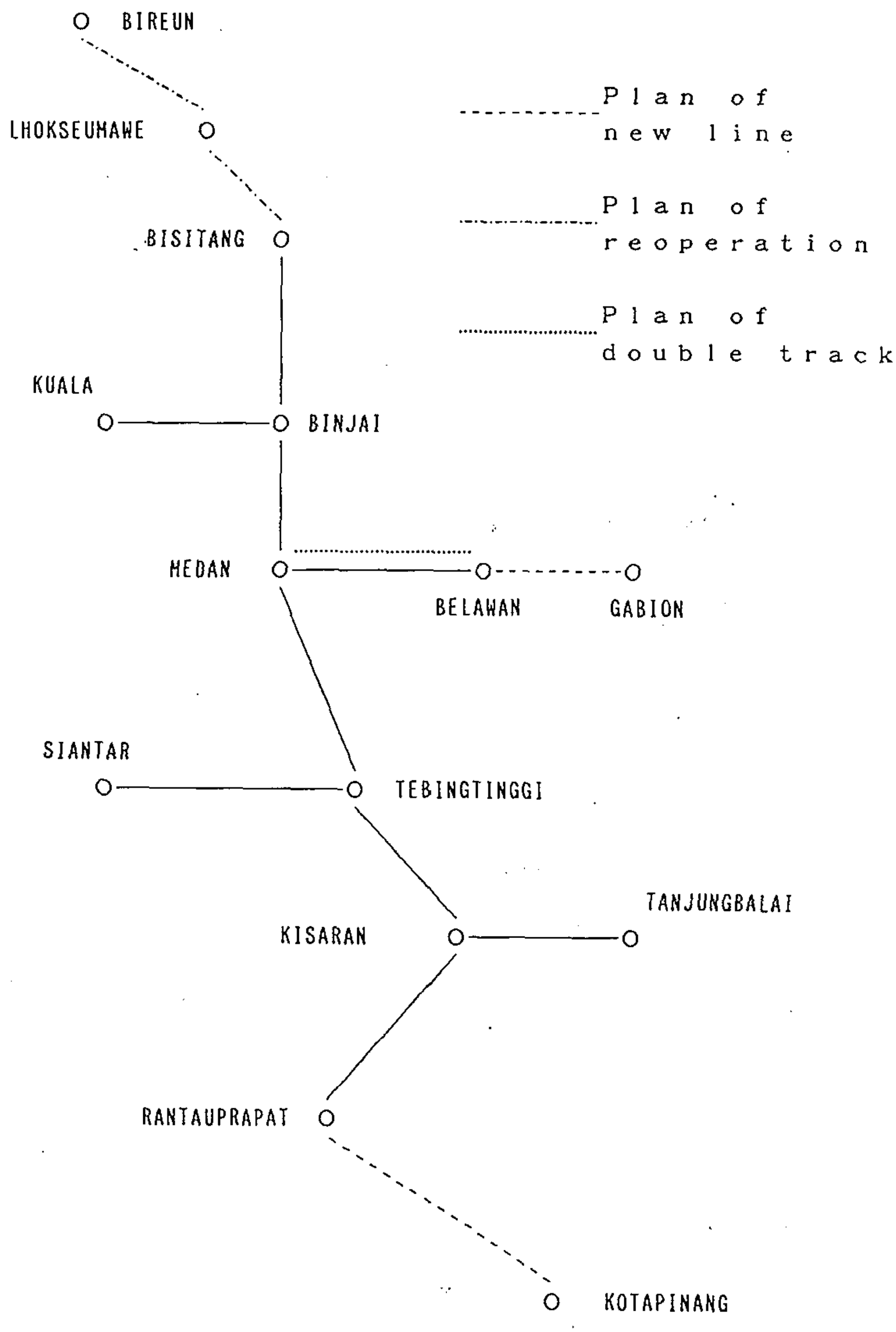
Double Track ——— Plan of double track ··················

SOUTH SUMATRA RAILWAY NETWORK



Plan of new line --------------

NORTH SUMATRA RAILWAY NETWORK



WEST SUMATRA RAILWAY NETWORK