CHAPTER 8 RAILWAY FACILITIES

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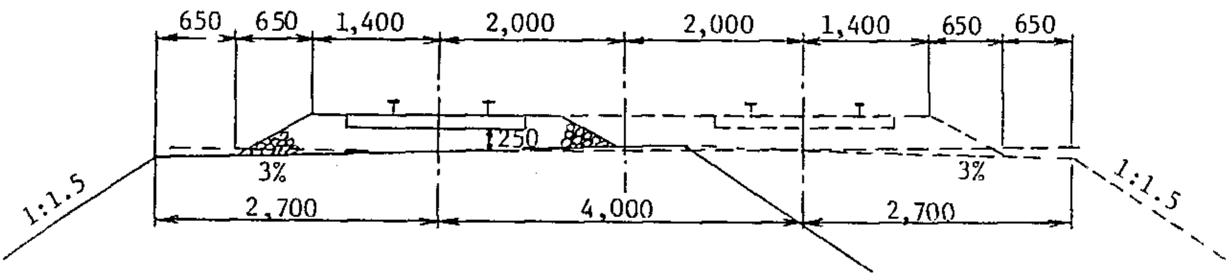
8.1 Track Structure

8.1.1 Present Status

(1) Road way dimension

The track for the Indonesian National Railways is designed at a narrow gauge of 1,067 cm. Fig. 8.1.1 shows the road way criteria under the provisions of the construction standards stipulated by the Indonesian National Railways. Ballast thickness is determined at the rate of running speed, for instance, 25 cm thickness at a speed of 100 km per hour.

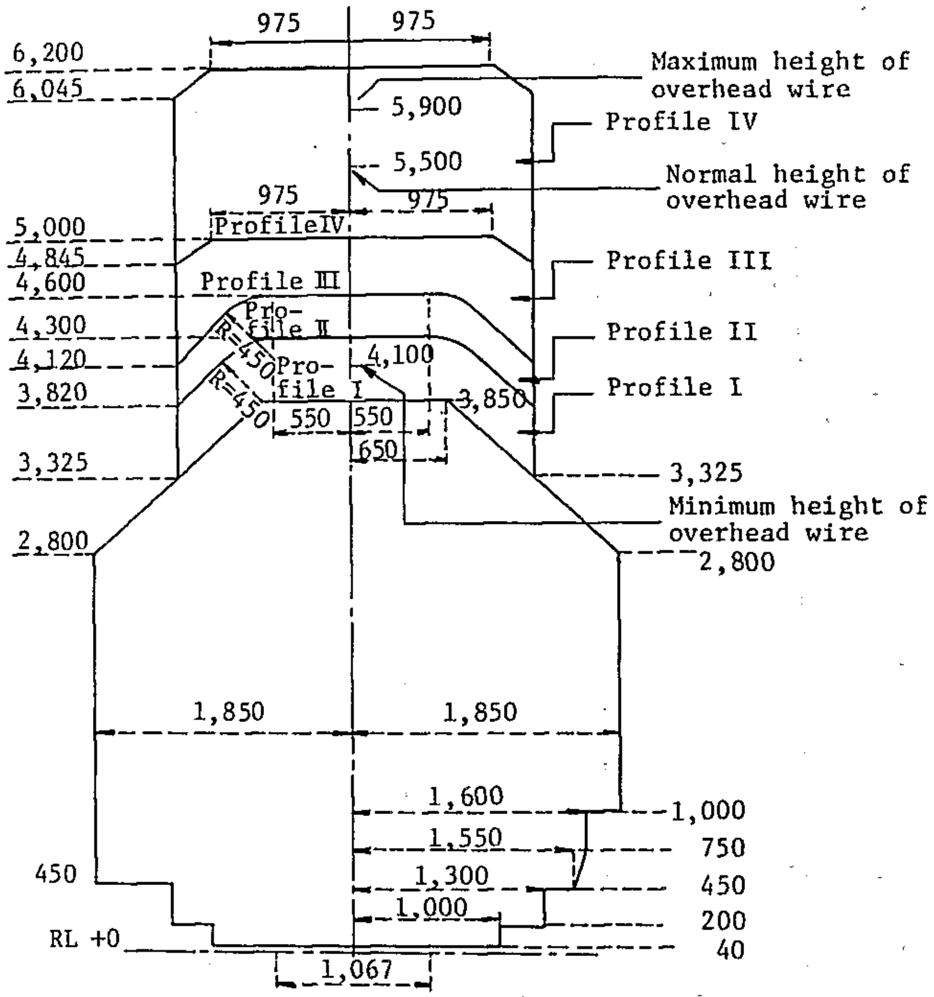


Note: For first class, second degree
Speed: 100 km/h
Straight track

Fig. 8.1.1 Roadway Dimension

(2) Construction gauge

The construction standard as stipulated by the Indonesian National Railways is as shown in Fig. 8.1.2.



Profile I : Minimum profile for Bridge with speed restriction 60 km/hour

Profile II : Minimum profile for Tunnel and Viaduct with speed restriction 60 km/hour and for Bridge, no restriction

Profile III: Minimum profile for New Viaducts and new Constructions, except tunnels and bridges

Profile IV : Normal profile for Electric Car

Fig. 8.1.2 Construction Gauge

(3) Bridges

Many of the existing bridges are designed for the through girder type. The bridges existing in the densely populated area have steel plates of girders severely corroded with remarkable rust. In the suburban area, those bridges are still in a relatively favorable condition.

The existing bridges of through girder and through truss between Jakarta Kota Station, Duri Station and Tanah Abang Station on Western Line have lower flanges and stiffeners corroded with rust to a considerable degree. All the other component members are still in nearly good conditions.

Same as on Western Line, each bridge existing between Duri Station and Rawa Buaya Station on Tangerang Line has its lower flanges and stiffeners corroded with rust. In the worst condition of rust there is partly lack of bolts for stiffeners.

(4) Plan and profile of track alignment

The sections between Jakarta Kota Station, Duri Station, Tanah Abang Station and Manggarai Station (15 km 628 in total length) are of double track system.

In respect of the plan curve, there are some curves of R = 200 m - 250 m, apparently below the stipulated minimum of 300 m (R = 300 m), in the sections between Jakarta Kota Station, Duri Station and Tanah Abang Station.

The profile alignment is ascending toward Manggarai with an elevation difference of about 10 m between Jakarta Kota Station, Duri Station, Tanah Abang Station and Manggarai Station. Throughout those sections, the steepest grade of 10 ‰ positioned at around 0 k 300 m as the starting point from Jakarta Kota Station.

Although some data available show both plan and profile views, they are rather outdated back to the period of 1973 to 1974 in publication. It is therefore necessary to make review of design factors in full particulars.

(5) Track maintenance condition

Still at the present time, R3 rail (33.4 kg per m) is used for a length of 4 k 600 m constructed in 1883 in the section between Jakarta Kota Station and Duri Station, 3 km 600 m in 1899 between Duri Station and Tanah Abang Station, 6 k 000m in 1922 between Tanah Abang Station and Manggarai Station and the Tangerang Line in 1899.

Because of poor track maintenance, there are observed many joint gaps between rails to an excessive degree, where some joints have an elevation difference of about 20 mm at the largest. Ballast is not maintained to a required thickness because of shortage in ballast supplement and lack of compactness by tamping. Track irregulaties are caused by such maintenance conditions. Together with this, failure in the use of due curve rail at the curved section makes it difficult or impossible to increase running speed of trains on the present track.

8.1.2 Alignment and Structure Plan

(1) Planning conditions

Planning for plan and profile alignment of track is based on the standard specified in Table 8.1.1.

Table 8.1.1 Standard for Plan and Profile

Item		Standard
Min. radius of curvature	Main track	600 m (300)
	Turnout curve behind frag	320 m (160)
	Section along platform	600 m (500)
	Side track	160 m (turnout curve behind frag)
Max. gradient*	Main track	10 o/oo
	Main track in station	1.5 o/oo
Track-center distance	Outside of station	4.0 m (3.8 m)
	Inside of station	4.0 m (3.8 m)
Track*	Bearing capacity K load	K-18
	Ballast thickness of track	250 mm
	Weight of rail	N50 kg/m equivalent
	Sleeper	Prestressed concrete tie
	Turnout	#12
	Gauge	1.067 m
Width of formation level (from track center; respectively)		2.70 m
Bridge bearing capacity*		KS-18
Platform	Between platform edge and track center	1.6 m
	Platform width	3.0 m minimum if both sides are used.
		2.0 m minimum in other cases
	Platform height	0.95 m
	Platform length	190 m

Item		Standard
Others	Maximum design speed	100 km/h
	Maximum cant	105 mm
	Transition curve	Cubic parabola $L_1 = 0.8$ C $L_1 \sim L_3$ whichever $L_2 = 0.01$ CV is the longest $L_3 = 0.009$ CdV L_1, L_2, L_3, is transition curve length (mm) C = net elevation (mm) Cd = elevation unfixed value (mm) V = maximum train running speed (km/h)
	Vertical curve	4000 m in the case where radius of horizontal curve R ≧ 800 m 3000 m in other cases
	Overhead clearance at the place of intersection with road	5.1 m or more
	Overhead clearance at the place of intersection with railway	4.6 m or more

Note 1. Inside of ( ) is applicable to an unavoidable cases.

* As this Report is in the stage of the feasibility study of the whole project, and it was seemed that the type of rails and number of sleepers did not exert great effects upon the results as far as the specifications were to allow the modern railway transportation.
In this Report the type of rails and number of sleepers, bridge bearing capacity (KS-18), and maximum gradient were agreed upon as indicated above between the Study Team and the Indonesian side. However, the final decision should be made through careful comparisons and calculations, in the study of the Detailed Design. With regard to ballast thickness the following study has been carried out, and the final decision should be also made after further review in the Detailed Design.

Study on ballast thickness

Study has been made on the two alternative cases of 250 mm and 300 mm of ballast thickness.

1) Premises

Car axle load:	12 tons
Passing tonnage:	11,000,000 tons/year
Max. speed:	100 km/h
Sleeper:	44 concrete sleepers/25 m
Rail:	50N

2) Study from aspects of track maintenance cost and construction cost

Firstly, the differences in maintenance and construction costs between two alternatives of 250 mm and 300 mm ballast thickness are calculated and then their ratio is compared to seek the efficiency of investment funds.

Such calculations have been made on the assumed basis as follows:

① To calculate the construction cost difference, only the difference in material cost is taken into account. The working cost for additional 5 cm layer of crushed stones are not included because of its insignificant contribution to the total cost.

② Equipment operating expenses and annual tamping volume are estimated from the existing data of Japanese National Railways.

Differences in crushed stone requirement for ballast and annual work volume of tamping are as shown in the following Table:

Thickness of ballast	Volume of crushed stone (per 1 km of single track)	Required annual tamping length (per 1 km of single track)
250 mm	1,400 m^3	490 m
300 mm	1,600 m^3	400 m
Difference	200 m^3	90 m

The investment efficiency may be attained from the following formula:

$$\text{Investment efficiency (\%)} = \frac{\text{Cost difference in maintenance work in a year}}{\text{Construction cost difference}} \times 100$$

$$= \frac{B}{A} \times 100$$

where

A = 200 y_1/km·year

y_1: Unit cost of crushed stone; 13×10^3 RP/m^3.

B = Difference of tamping work in a year × Tamping work cost per one meter of single track

= 90 m × (0.04 y_1 + 0.1 y_2 + y_3)

y_2: Labor unit cost; 5×10^3 RP/man·day

Labor unit cost includes overhead and all other allowances.

y_3: Equipment operating cost; 1×10^3 RP/m

$$\frac{B}{A} \times 100 \fallingdotseq \frac{182}{2,600} \times 100 = 7\%$$

3) Study of ballast thickness in view of roadbed pressure

The pressure P at the bottom surface of the tie can be calculated from the assumption of 12 tons axle load, 2 m wheel base, 7 m interval of the neighboring bogie, 100 km per hour speed of passing trains.

It was assumed that combined system of rail, fastening, sleeper and ballast would function as an elastic beam against the application of train live load.

$P = 1.6$ kg/cm^2 for 250 mm ballast thickness
$P = 1.7$ kg/cm^2 for 300 mm ballast thickness

From the above result, roadbed pressure q can be attained as follows:

$q = 1.1$ kg/cm^2 for 250 mm ballast thickness
$q = 0.9$ kg/cm^2 for 300 mm ballast thickness

The values of road pressure in each case are nearly half of allowable roadbed pressure of about $qa = 2$ kg/cm^2.

4) Conclusion

In the course of study of the additional cost for 300 mm ballast, the rate of the investment efficiency was estimated to be 7% which did not necessarily support the economic superiority of the deeper ballast.

However, since the calculation is based upon data of the Japan's operating experiences in regard to annual work volume of tamping and equipment operating expenses, final judgement should be made through careful comparison with the past operating available from PJKA and other conditions of the proposed line.

Because of relatively small axle load, roadbed pressure is far down below allowable roadbed pressure in either case of 250 mm or 300 mm of ballast thickness.

(2) Track profile plan

In determining the optimum track profile it is most advisable for the sake of construction cost saving that the height of structure should be kept as lowest as possible, the bridge of large span should not be constructed on any occasion and the embankment type structure should be used as much as possible.

The optimum profile gradient may be determined from a total height of 5.1 m space head under the girder plus girder height in addition to the surface elevation level at the road crossing. The gradient at the crossing with the existing line may be determined likewise from a total height of 4.6 m space head under the girder plus girder height.

The planned elevation at critical points which determine the longitudinal planning are described in the following Table. Elevation is indicated at rail top in terms of Priok Peil (P.P.).

Route	Post	Checked contents	Planned elevation
Route A	The point near 5.5 km	3.9 m (Ground height) + 0.5 m (Slab depth of box culvert) + 0.6 m (F.L.∿R.L.)	5.00 m
	The point near 9.2 km	4.0 m (Ground height) + 0.7 m (Leveled ground height) + 1.0 m (Embankment height) + 0.6 m (F.L.∿R.L.)	6.30 m
	The point near 17.5 km	2.5 m (Ground height) + 5.1 m (Clearance over road) + 1.89 m (Girder height) + 0.65 m (F.L.∿R.L.)	10.20 m
	The point near 18.7 km	2.34 m (Rail level of Western Line) + 4.6 m (Clearance over railway) + 2.0 m (Height of the horizontal member of the rigid pier) + 1.89 m (Girder height) + 0.65 m (F.L.∿R.L.)	11.50 m
	The point near 19.35 km	6.8 m (Rail level of Central Line) + 4.6 m (Clearance over railway) + 1.29 m (Girder height) + 0.65 m (F.L.∿R.L.)	13.34 m

Route	Post	Checked contents	Planned elevation
Route C	The point near 6.0 km	3.9 m (Ground height) + 0.5 m (Slab depth of box culvert) + 0.6 m (F.L. ∿ R.L.)	5.00 m
	The point near 8.5 km	6.4 m (Ground height) + 1.0 m (Embankment height) + 0.6 m (F.L. ∿ R.L.)	8.00 m
	The point near 10.1 km	7.8 m (Rail level of Tangerang Line) + 4.6 m (Clearance over railway) + 2.0 m (Height of the horizontal member of the rigid pier) + 1.89 m (Girder height) + 0.65 (F.L. ∿ R.L.)	17.00 m
	The point near 18.1 km	3.6 (Ground height) + 5.1 m (Clearance over road) + 2.0 m (Girder height) + 0.65 m (F.L. ∿ R.L.)	11.40 m
	The point near 18.6 km	5.1 m (Rail level of Tangerang Line) + 4.6 m (Clearance over railray) + 2.0 m (Height of the horizontal member of the rigid pier) + 2.0 m (Girder height) + 0.65 m (F.L. ∿ R.L.)	14.40 m
	The point near 19.6 km	3.7 m (Rail level of Western Line) + 4.6 m (Clearance over railway) + 2.0 m (Height of the horizontal member of the rigid pier) + 2.0 m (Girder height) + 0.65 m (F.L. ∿ R.L.)	13.00 m

All those things taken into consideration, the optimum gradient has been determined at less than 10 ‰ with insertion of the profile curve to enable smooth running of trains. However, any complexity between both easement curve and profile curve must be avoided in any event because of extreme danger to be anticipated.

Route A will be designed for embankment type in all the suburban area, where all the crossings with existing roads are designed for level crossing. In the urban area, however, the viaduct type has been adopted for all the crossings so as to smoothen the flow of vehicle traffic.

In the section there exist several roads and rivers in traverse to the Route. If roads are of wide width, the overbridge of 2 to 3 spans will be constructed to cross over the road by erection of bridge piers at the medial strip. To cross over the rivers the bridge will also be constructed at a span of 2 to 3 by erection of piers at the center of river or at the edge of embankment slope.

It is planned that near Jakarta Kota Station the Route will get into junction with Jakarta Station by grade separation with the Central Line after traverse over the existing line by way of the girder type viaduct.

Route C will also be designed for embankment type until it reaches Tangerang Line, get into junction with Rawa Buaya Station over Tangerang Line by way of the viaduct, again run across over Tangerang Line and then Western Line by way of the viaduct from the middle between Pesing Station and Grogol Station after passing through the existing lines and finally proceed toward Tanah Abang Station to get into junction over Western Line.

Required formation levels for main roads and rivers on each alternative Route are as shown in Tables 8.1.2 thru 8.1.5.

Table 8.1.2 Required Formation Levels of Main Overroad Bridges

Route A

Road Name	Road Width (including expansion planning)	Span × Number (kind of girder)	Required Formation Level (m)
JL. Jembatan Tiga	25.0	30 × 1 (PC)	4.60
JL. Gedung Panjang	26.0	30 × 1 (PC)	10.20
JL. Pangeran Jayakarta	24.0	30 × 1 (PC)	10.44

Table 8.1.3 Required Formation Levels of Main Overriver Bridges

Route A

River Name	River Width (including expansion planning)	Sapn × Number (kind of grider)	Required Formation Level (m)
Saluran Air (C.D.S.)	23.0	30 × 1 (PC)	6.30
Cengkareng Floodway	78.0	30 × 3 (PC)	7.80
C.D.S.	20.0	22.5 × 1 (PC)	6.50
C.D.S.	25.0	30 × 1 (PC)	6.50
K. Angke	44.0	30 × 2 (PC)	7.0
Bangir Kanal	75.0	30 × 3 (PC)	7.0
K. Muara Kareng	34.0	35 × 1 (PC)	7.0
K. Pasar Pagi (K. Sunter)	14.0	35 × 1 (PC)	10.2
K. Besar	25.0	35 × 1 (PC)	10.2
Sungai Ciliwung	29.0	35 × 1 (PC)	10.2

* C.D.S.: Cengkareng Drainage System (Future Planning)

Table 8.1.4 Required Formation Levels of Main Overroad Bridges

Route C

Road Name	Road Width (including expansion planning)	Span × Number (kind of girder)	Required Formation Level (m)
JL. Tj. Duren Utara	8.0	20 1 (PC)	11.40
JL. Prof. Dr. Latumeten	22.0	25 2 (PC)	11.40
JL. Dr. Muwardir	27.0	30 1 (PC)	13.0
JL. Kyai Tapa	20.0	30 1 (PC)	13.0

Table 8.1.5 Required Formation Levels of Main Overriver Bridges

Route C

River Name	River Width (including expansion planning)	Span × Number (kind of girder)	Required Formation Level (m)
	33.0	35 × 1 (PC)	5.0
K. Cisadane	84.0	35 × 3 (PC)	8.0
K. Grogol	22.0	25 × 1 (PC)	11.40
Banjir Kanal	64.0	(13 + 30 × 2 + 15) (RC + PC)	13.0

(3) Structure construction plan

The track structure for the ordinary section and near the station in the urban area is designed for reinforced concrete construction in view of needs to utilize space under the elevated track section, to control noise level and to facilitate maintenance service.

The superstructure at each crossing with roads and rivers will be made of reinforced concrete girders for any span below 20 m and prestressed concrete girders for the span above 20 m. The substructure will be designed for piers of rigid frame type and of semi-gravity type. The viaduct to be constructed for the ordinary section is designed for beam slab type of 30 m per each block (3.0 + 8.0 × 3 + 3.0) because of its most economic advantage.

In the suburban area, the structure for the ordinary section is designed at embankment. All the crossings with the existing roads are designed unexceptionally for level crossing. The crossings with rivers are same as designed in the urban area.

Outline areas and general arrangement drawings by different structural types are as shown in Fig. 8.1.3 thru 8.1.11.

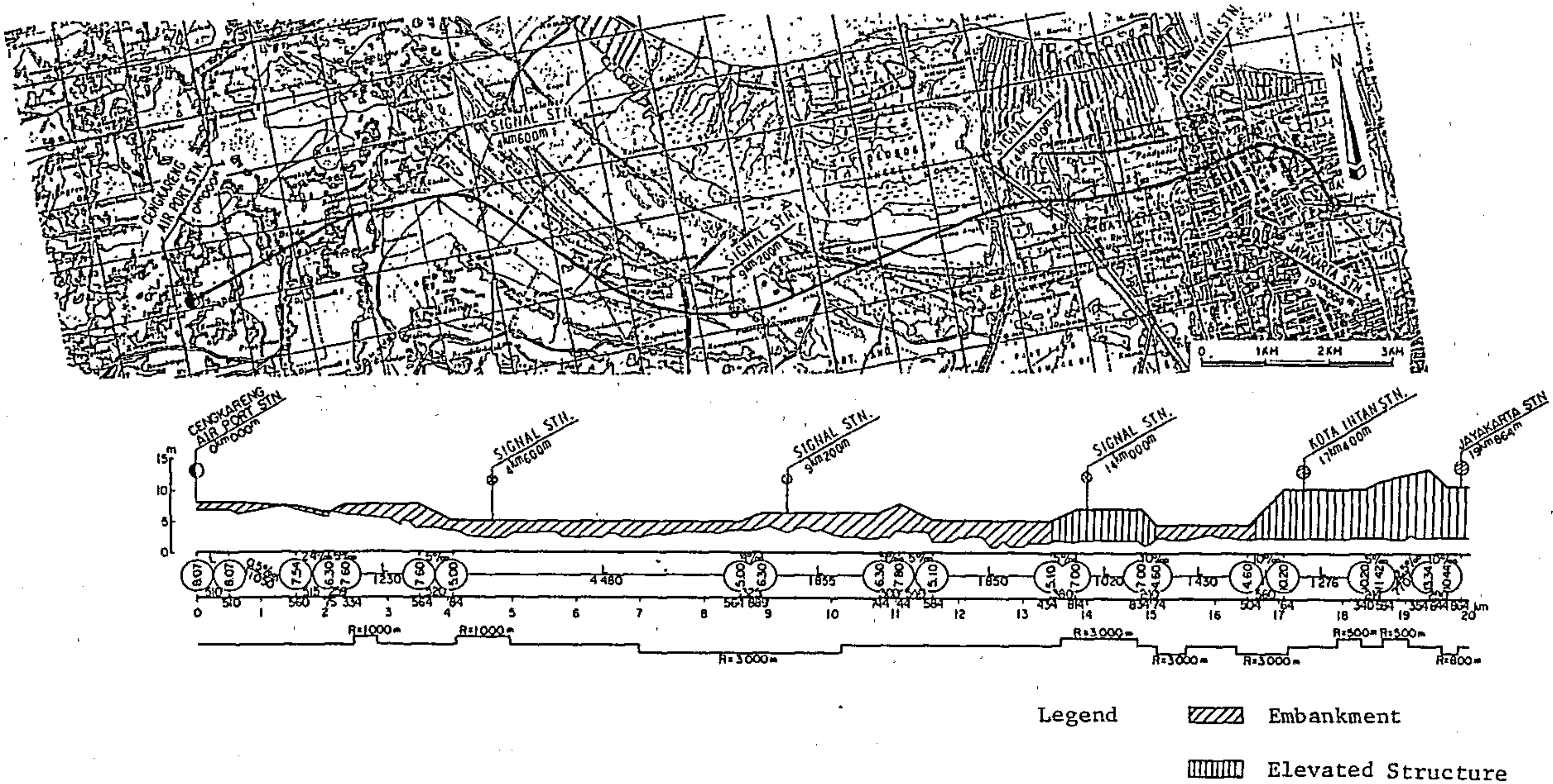


Fig. 8.1.3 Plan and Profile - Route A

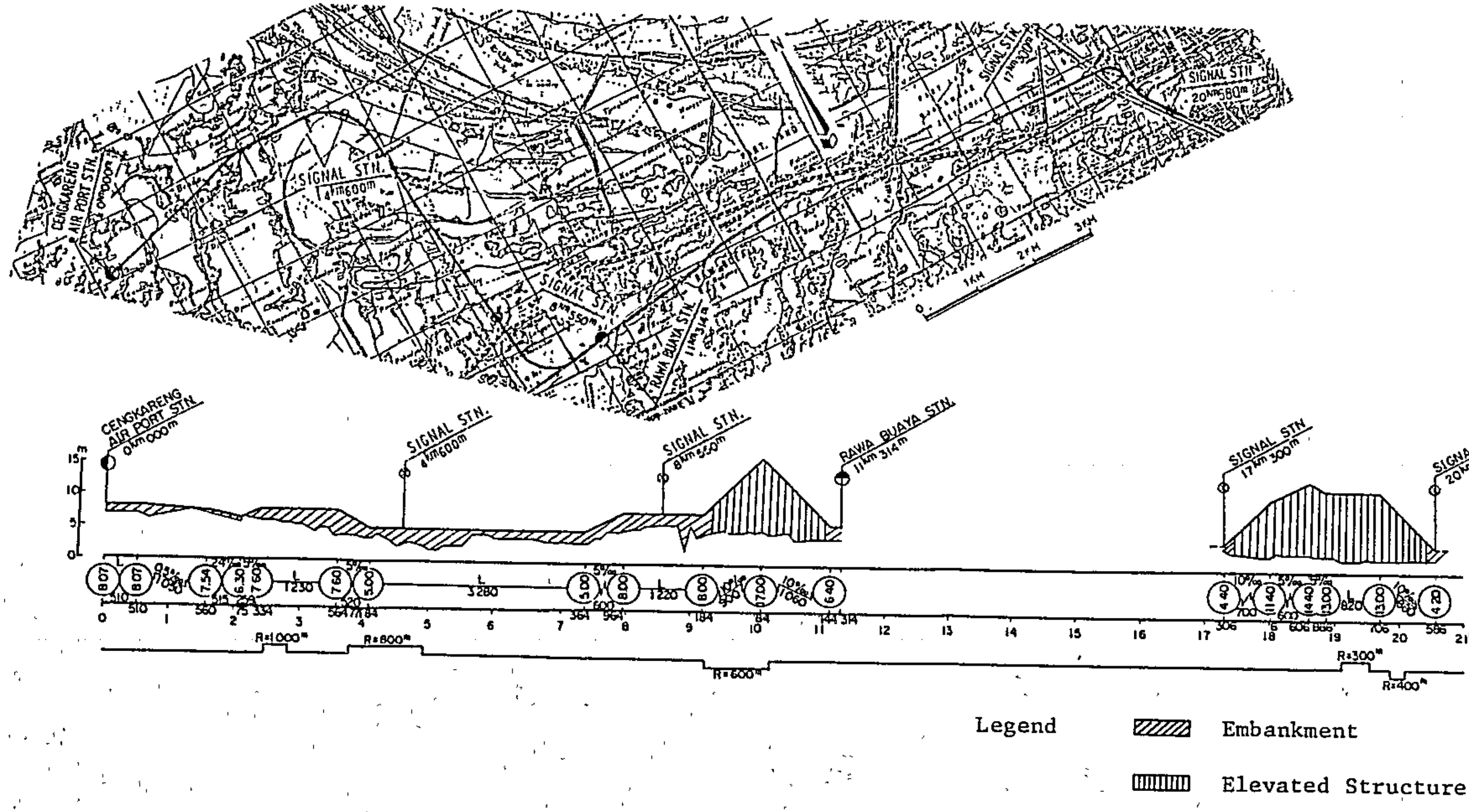


Fig. 8.1.4 Plan and Profile - Route C

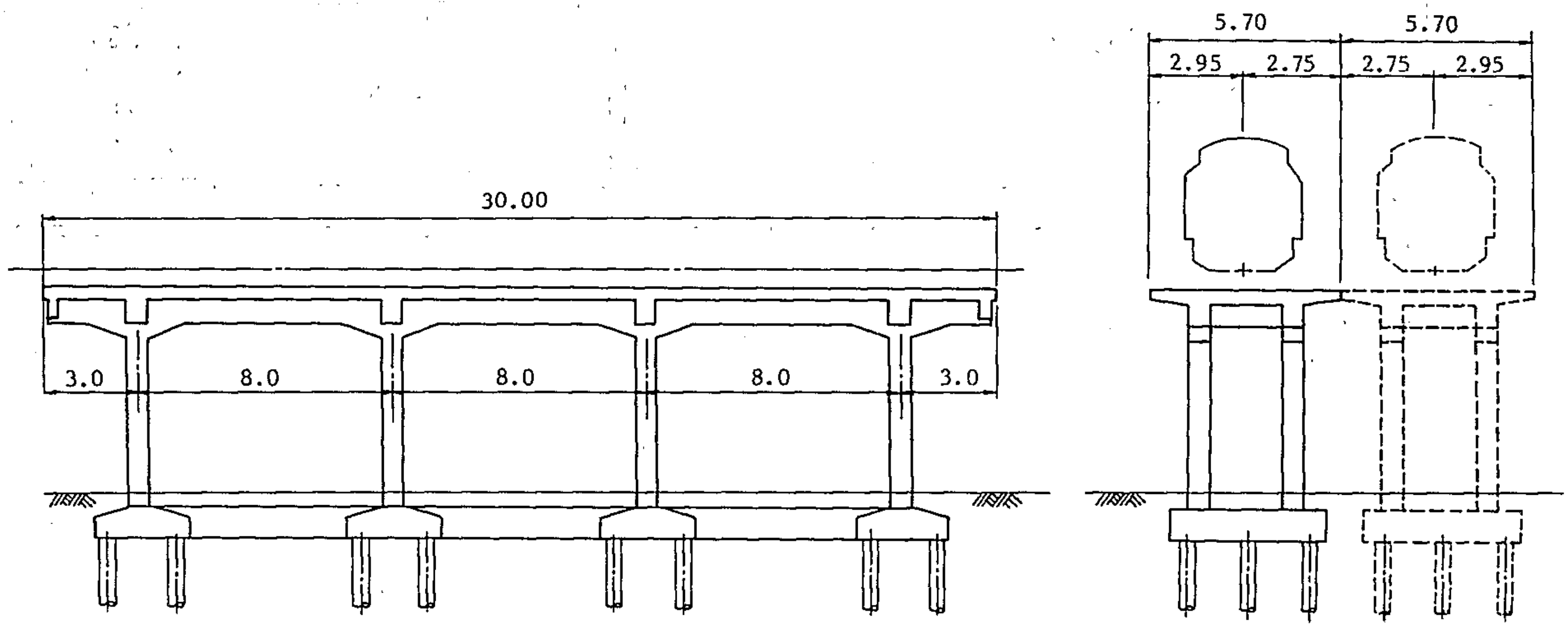


Fig. 8.1.5 Standard Structure for Elevated Tracks

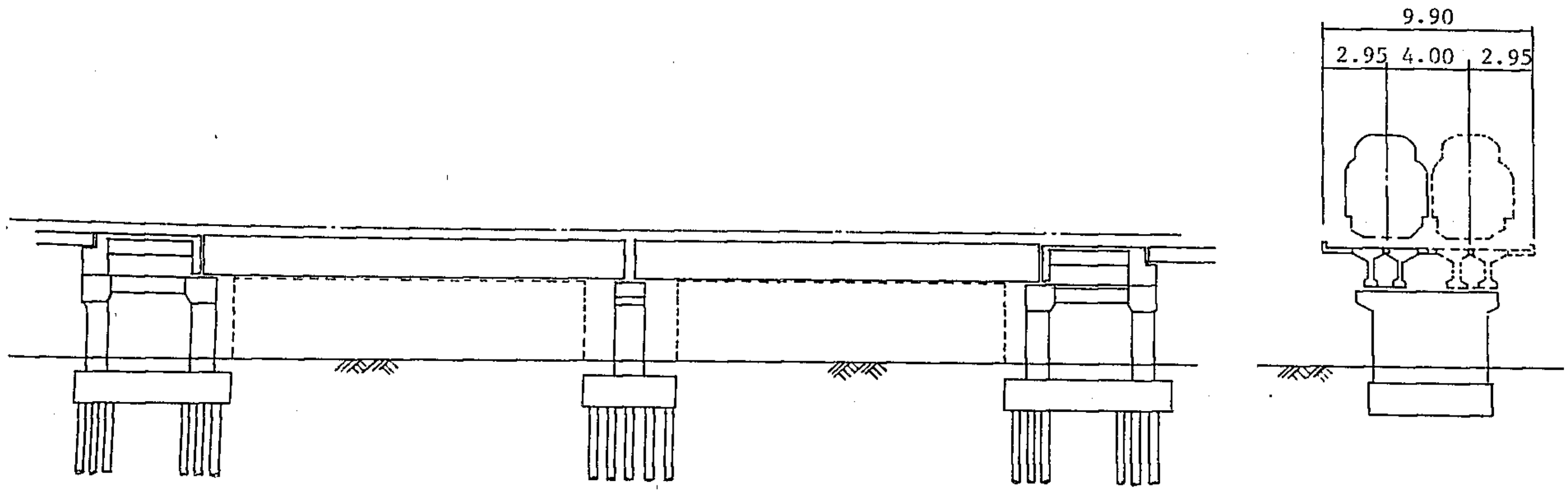


Fig. 8.1.6 Overroad Bridges

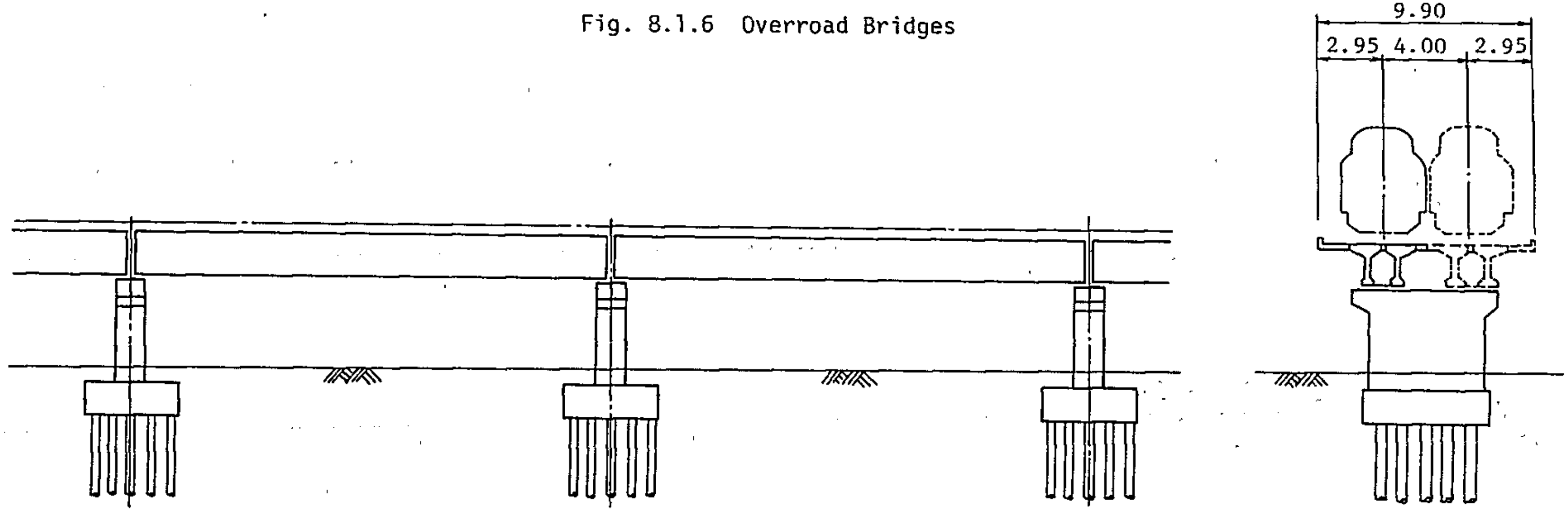


Fig. 8.1.7 Girder Bridges

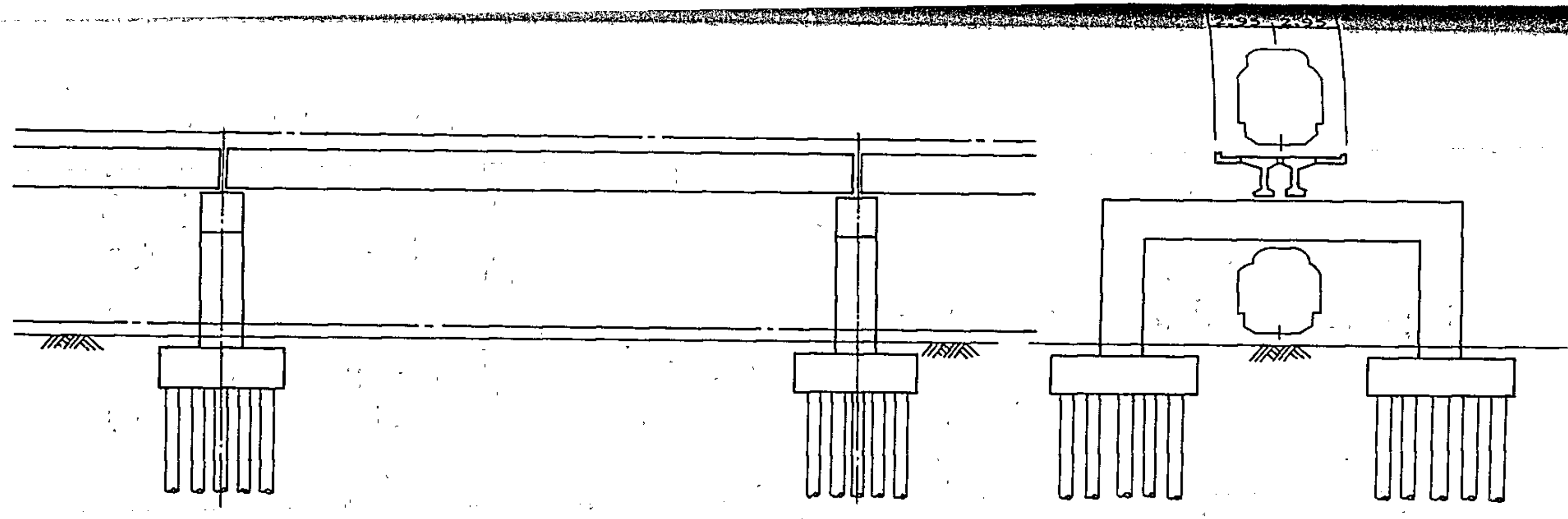


Fig. 8.1.8 Cross Over Bridges

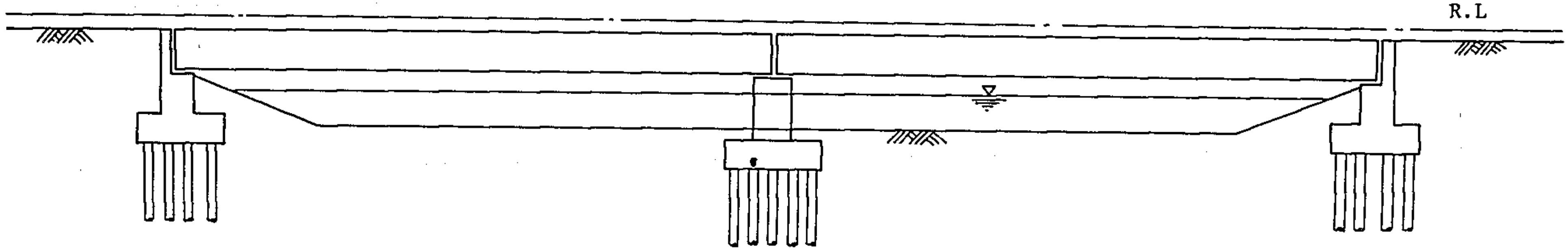


Fig. 8.1.9 Overriver Bridges

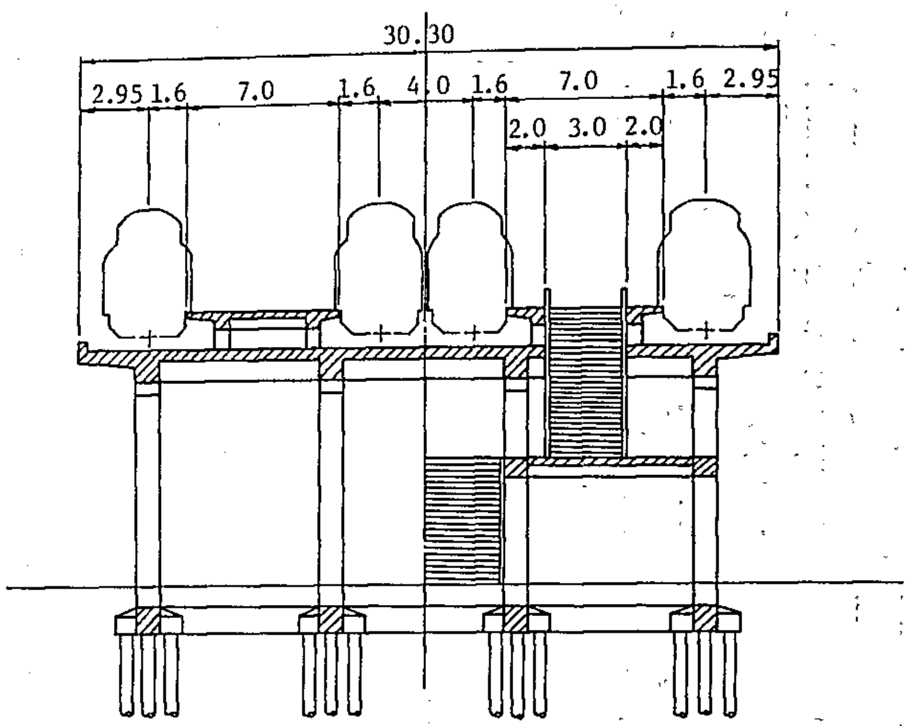


Fig. 8.1.10 Sectional View of Junction Station (Jayakarta)

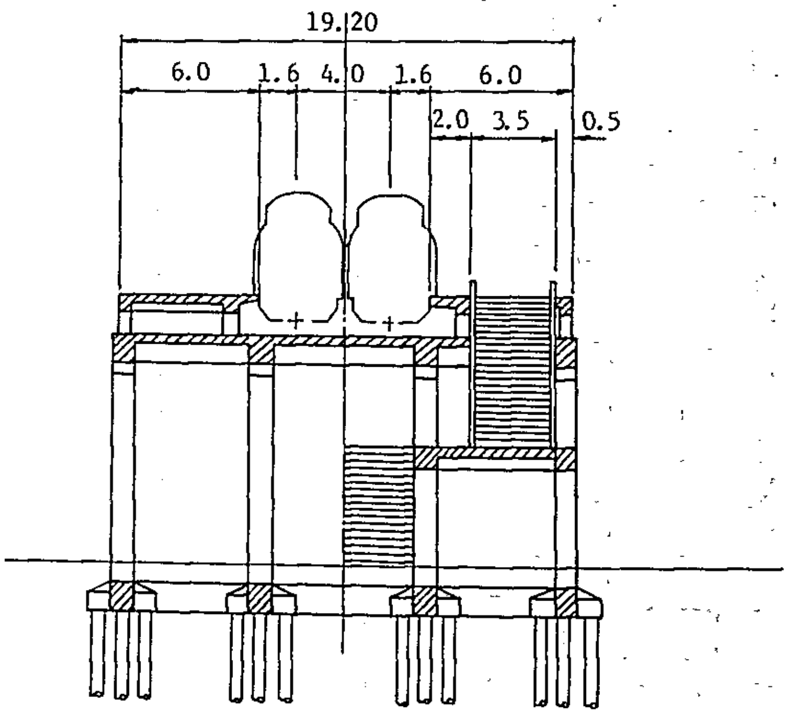


Fig. 8.1.11 Sectional View of Intermediate Station (Kota Intan)

8.1.3 Easiness in Construction Works

Route A has a total length of 19.8 km, in which the embankment accounts for about 76 percent with all the rest designed for the viaduct type. The embankment is designed at an average height of about 2 m.

Although there partially exist some soft grounds all the way alongside this proposed Route it would not affect the embankment work in the least by improvement of the ground stability. Ready-made piles will be driven into the viaduct foundation.

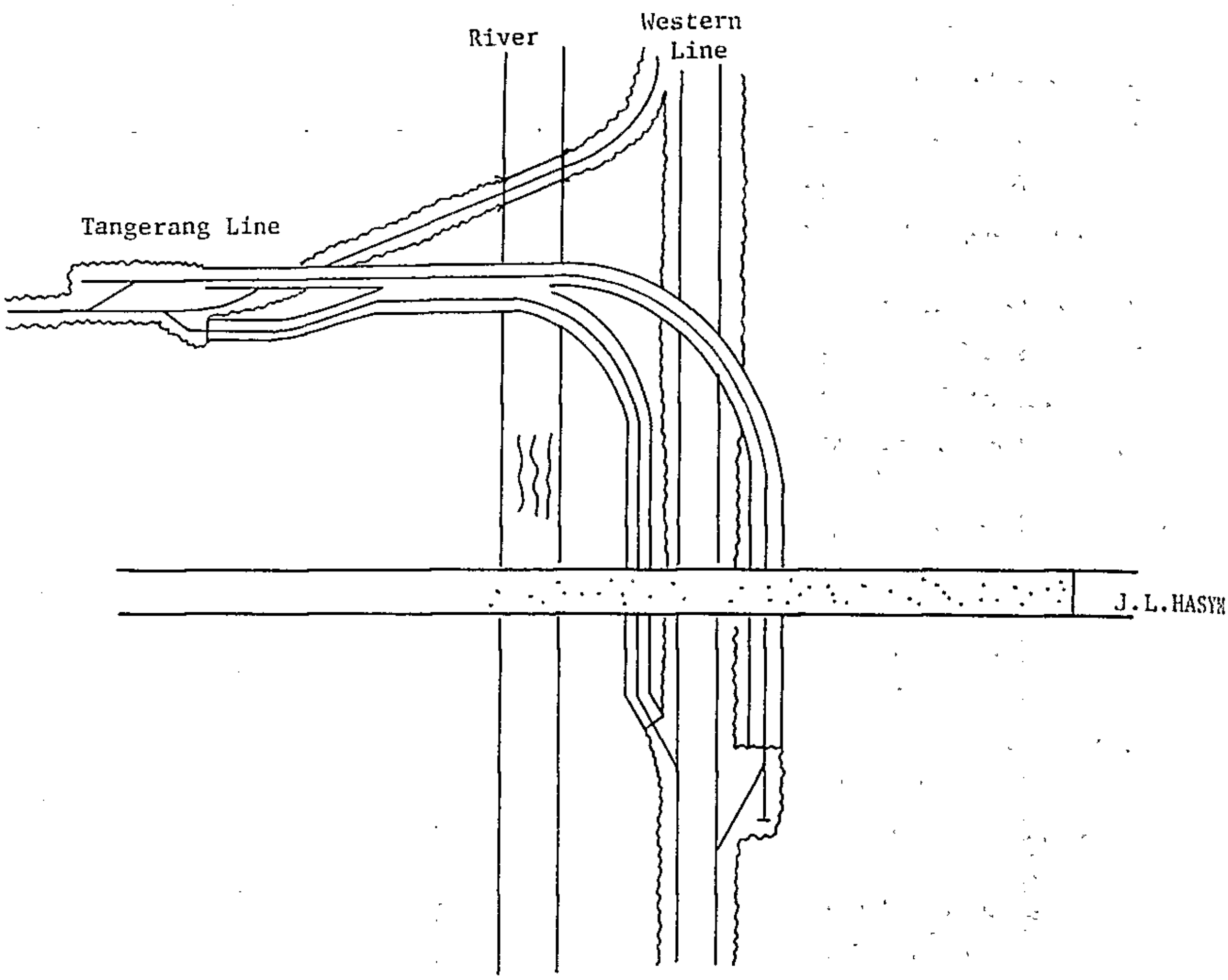
Since the New Airport Access Line will cross the existing line in grade separation near Jakarta Kota Station, it may become necessary to make some changes to the existing track arrangement at both freight yard and station yard of Kota.

Route A will present some complexity in the execution of construction work at the portion where the Route will cross the existing line at two levels and get into direct junction with Central Line.

In the meanwhile, Route C has a total length of 20.4 km including the overlapped section with the Tangerang Line. The net length for the new line alone is 14.6 km. The embankment accounts for 68 percent of the total new line length with all the rest designed for the viaduct structure. The construction method of embankment is same as outlined for Route A.

Route C provides three points of crossing by grade separation with the existing lines near Rawa Buaya Station to get into junction with Tangerang Line, near Grogol for junction with Western Line after separation from Tangerang Line and near Duri Station, together with overriver crossing near Grogol. This would make the construction work on Route C difficult with relative complication. The work for Route C may apparently be more complicated as compared with Route A.

Still more, if Route C should cross by grade separation with the railway of J.L. Hasym in the future, it would look like triplex crossing as shown in Fig. 8.1.12 which would accordingly require vast sum of construction costs.



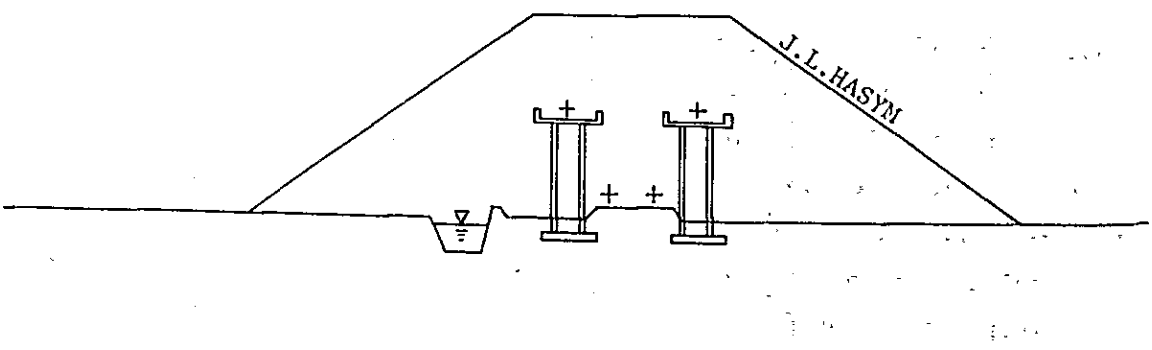


Fig. 8.1.12 Triplex Crossing with J.L. Hasym and Railway

8.2 Station Plan

8.2.1 Introduction

As a general principle, the New Railway Line will not be provided with any intermediate station in order to enable the new line to fully perform its function as the quickest way of access between the airport and the city center.

Exceptionally, Route A proposes construction of a new station at Kota Intan so as to offer convenience to those passengers on Western Line for their easy approach to the new railway line.

To ensure the track for refuge of two crossing trains at the stage of single track operation, three (3) signaling yards for Route A and two (2) signaling yards for Route C will be provided on the new railway line. In addition to those, Route C will be provided with two more signaling yards at each branch-off point with Tangerang Line and Western Line.

8.2.2 Station Facility Plan

(1) Track

The station will be provided with such track arrangement as to ensure equal speed level for passing trains on the turnout without any speed restriction.

(2) Passenger service facilities

1) Main station house (Figs. 8.2.1, 8.2.2, 8.2.3 and 8.2.4)

The layout for the main station house will be based on such design conception that it should be of easy access to all passengers, fully capable of smooth handling for movement of passengers, of simple design of a clearcut pattern and also of flexible design to provide for future expansion, directly linked to the station front square.

Space under the viaduct, side by side with the free concourse, will be utilized most effectively and well harmonized with the urban environment.

The station house will be provided mainly with the following facilities:

Movement	Concourse and passage, etc.
Passenger service	Ticket sales office and ticket barrier and fare adjustment booth, etc.
Utility service	Waiting room and toilet, etc.
Office facilities	Station master's room, service office and rest room, etc.

2) Platform

The platform is designed at an elevation of 950 mm from rail head surface, at a clearance of 1,600 mm from side face of platform to track center and at a length of 190 m to accommodate a train consisting of eight (8) cars. It is of separate platform type.

The platform of flat level type will be embanked with reinforced concrete of the retaining wall and finished with asphalt concrete. It will be built up in unity with the main structure and will be finished up with sheet asphalt by use of non-slip tile all over the platform surface.

3) Platform shed

The occupancy space for the shed will be limited to a half of total platform length after due consideration to passengers' conveniences and local climatic conditions etc.

4) Overbridge (Fig. 8.2.6)

Two platforms will be connected together by construction of the overbridge. In order to separate the passengers taking the train from those passengers getting off the train, the overbridge will be set in position on the right side as viewed from the station main house, so that the passengers out of the train can be led to the station square by walk to the left without traverse to the traffic line of passengers toward the train. Both ticket barrier and overbridge will be distanced to some extent from each other so as to ease congestion by crowded passengers going up and down to and from the train.

(3) Junction station (Figs. 8.2.7, 8.2.8 and 8.2.9)

Trackage into each junction station will be admitted once after crossing by grade separation with the existing line.

8.2.3 Station Plaza (Figs. 8.2.10 and 8.2.11)

The station plaza is designed as a part of the station house. On the other side it plays a role as the main gateway to each city. Naturally, greater importance is attached to its functional role as a point of contact between railway traffic and road traffic for smooth transfer from one to the other means of transport.

(1) Motor-car connection with the station and the lot for car parking

(2) Bus transfer system

(3) Side walk for passengers and general public

(4) Green zone

8.2.4 Associated Facilities Construction Plan

Necessary facilities associated with the station facilities may be summarized as follows.

(1) Passenger service facilities

Retail stores, restaurants and other commercial facilities

Travel agents and other service shops by personal contacts

Post office and other public service facilities

(2) Facilities incidental to station services and other associated business

Warehouse

Car parking lot

All those facilities are designed to perform the terminal functions in a unified body with the station plaze. General arrangement of those facilities may be varied depending upon local environmental conditions around the station and patterns of station plaza developed. However, it is most advisable to arrange all of them by effective use of space under the viaduct.

8.2.5 Outline on Facilities Associated with New Airport Access Railway within Station Yard of Jatinegara (Figs. 8.2.12 & 8.2.13)

Jatinegara Station is required to perform its dual functions as a station where the train on the urban line can turn back for shuttling service and as a station for stoppage or for transfer of trains operated over a long distance.

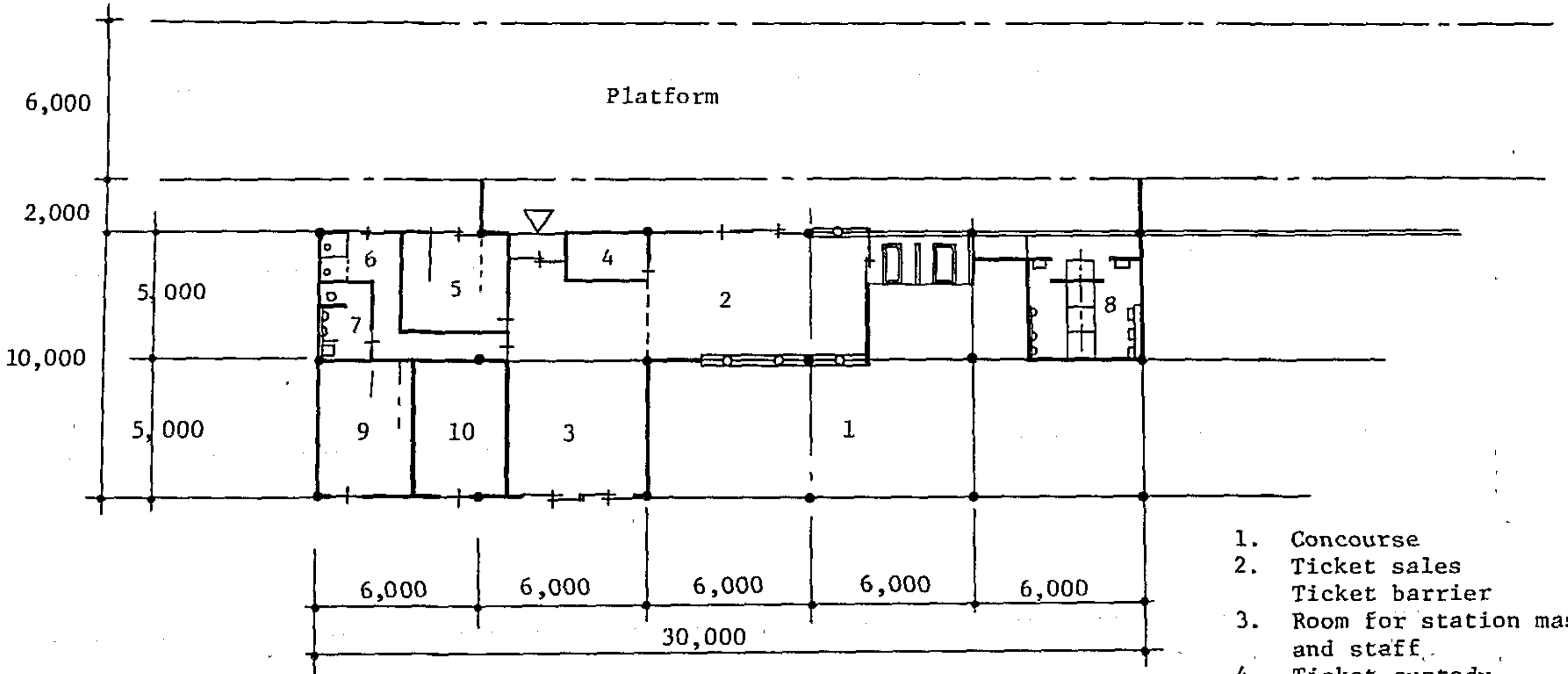
However, unless the present arrangement of track lines is improved, it would become more and more difficult for the existing station to perform those functional roles in the future with growing density of train operation. Since in many instances a station must be improved together with improvements of track structure, electrification and signalling systems, it is most advisable, especially from the economic aspect, that any improvement or expansion of a station should be made in parallel with all other related improvement projects together at the same time.

This is what is mentioned in the Master Plan for JABOTABEK Railway.

Until 1997 the New Airport Access Railway will be operated with each train consisting of four (14) cars at a headway of 20 minutes. Since it is estimated with assurance that the Station will still be capable of accommodating all those trains in accordance with the operation plan by the time all those improvement projects will be completed. Therefore, this study report proposes only one track improvement plan to provide for future operation of trains on the New Airport Access Line.

Fig. 8.2.12 shows a rough sketch of existing track arrangement within the station yard of Jatinegara.

The future track improvement plan is drafted in Fig. 8.2.13.



1. Concourse
2. Ticket sales
   Ticket barrier
3. Room for station master
   and staff
4. Ticket custody
5. Rest room
6. Shower
7. Toilet (for staff)
8. Toilet for passenger
9. Power distribution room
10. Signaling equipment

Floor area: $30.0 \times 10.0 = 300\ M^2$

Fig. 8.2.1 Ground Plan - Rawa Buaya

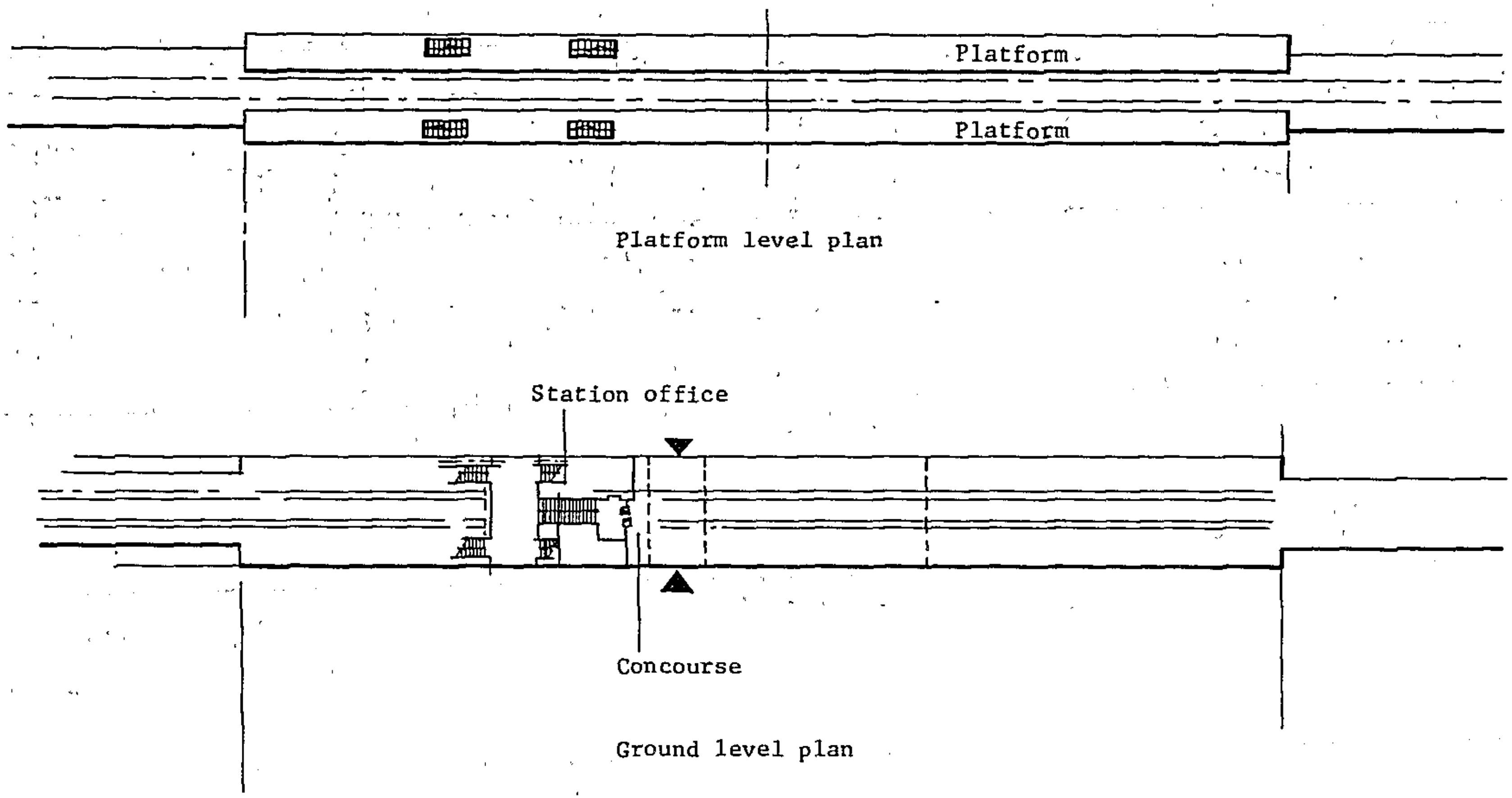
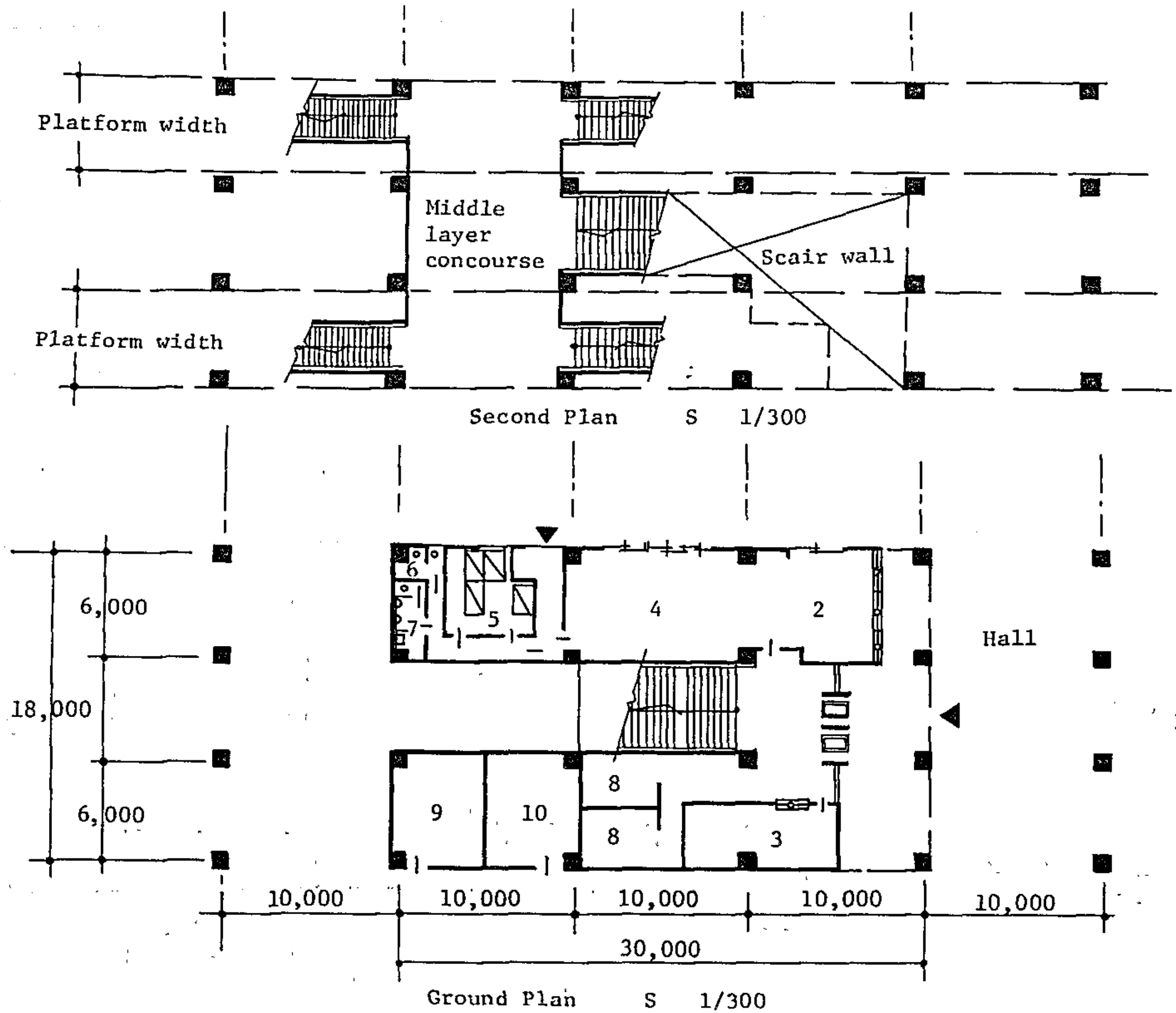


Fig. 8.2.2 Platform Level Plan and Ground Level Plan - Kota Intan



1. Concourse
2. Ticket sales
3. Ticket barrier
4. Room for station Master and staff
5. Rest room
6. Shower
7. Toilet for staff
8. Toilet for passenger
9. Power distribution room
10. Signaling equipment

Fllor area:

1F	$30.0 \times 6 \times 2 + 20 \times 6$	= 480
2F	$10 \times 18 + 3 \times 12.1 \times 4$	= 330
	Total	810 M^2

Fig. 8.2.3 Ground Plan - Kota Intan

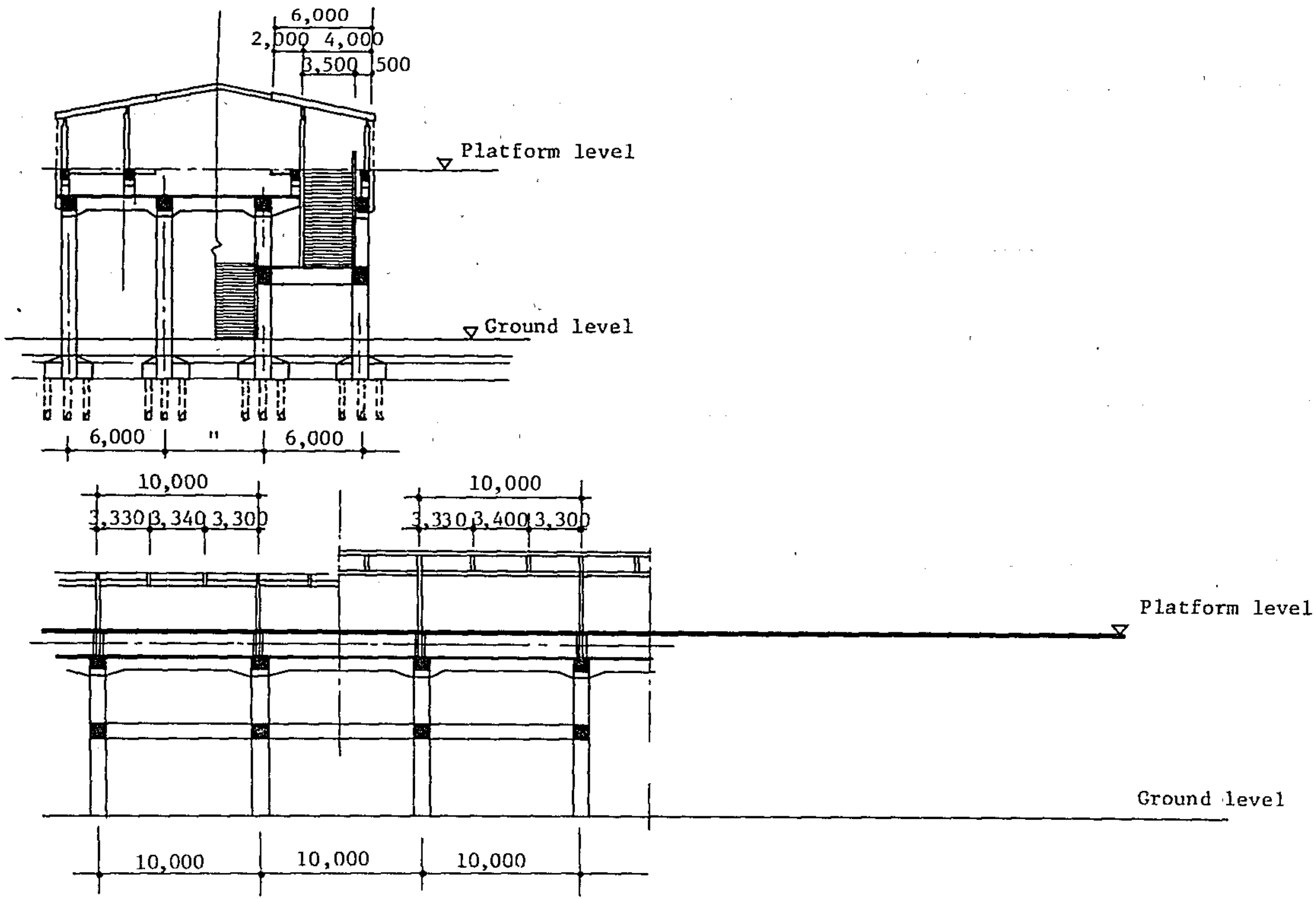
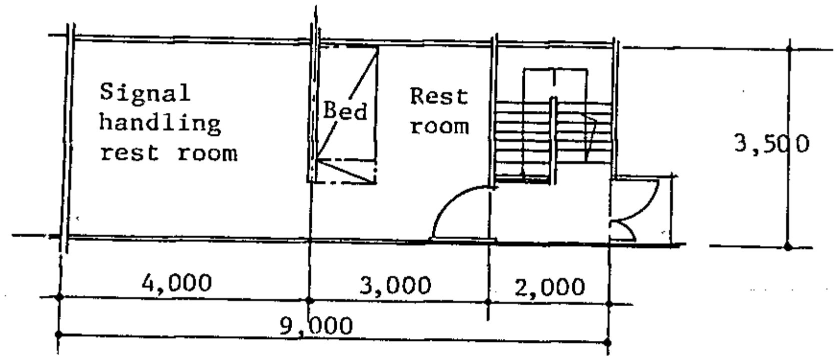
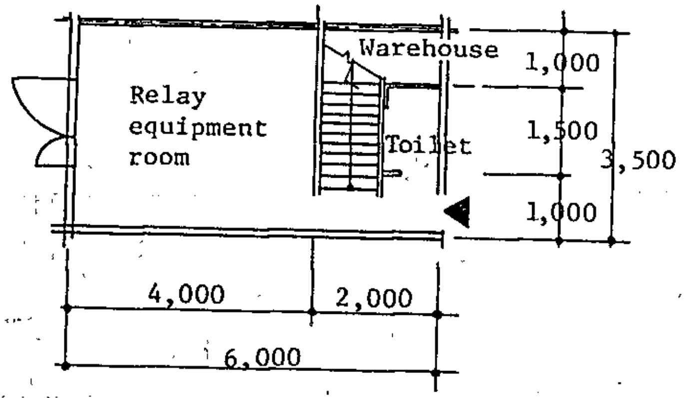


Fig. 8.2.4 Sectional View of Kota Intan Station



2F Plan



1F Plan

Floor area:

1F $6.0 \times 3.5 = 21.0$

2F $9 \times 3.5 = 31.5$

Total $52.5\ M^2$

Fig. 8.2.5 Signal Station

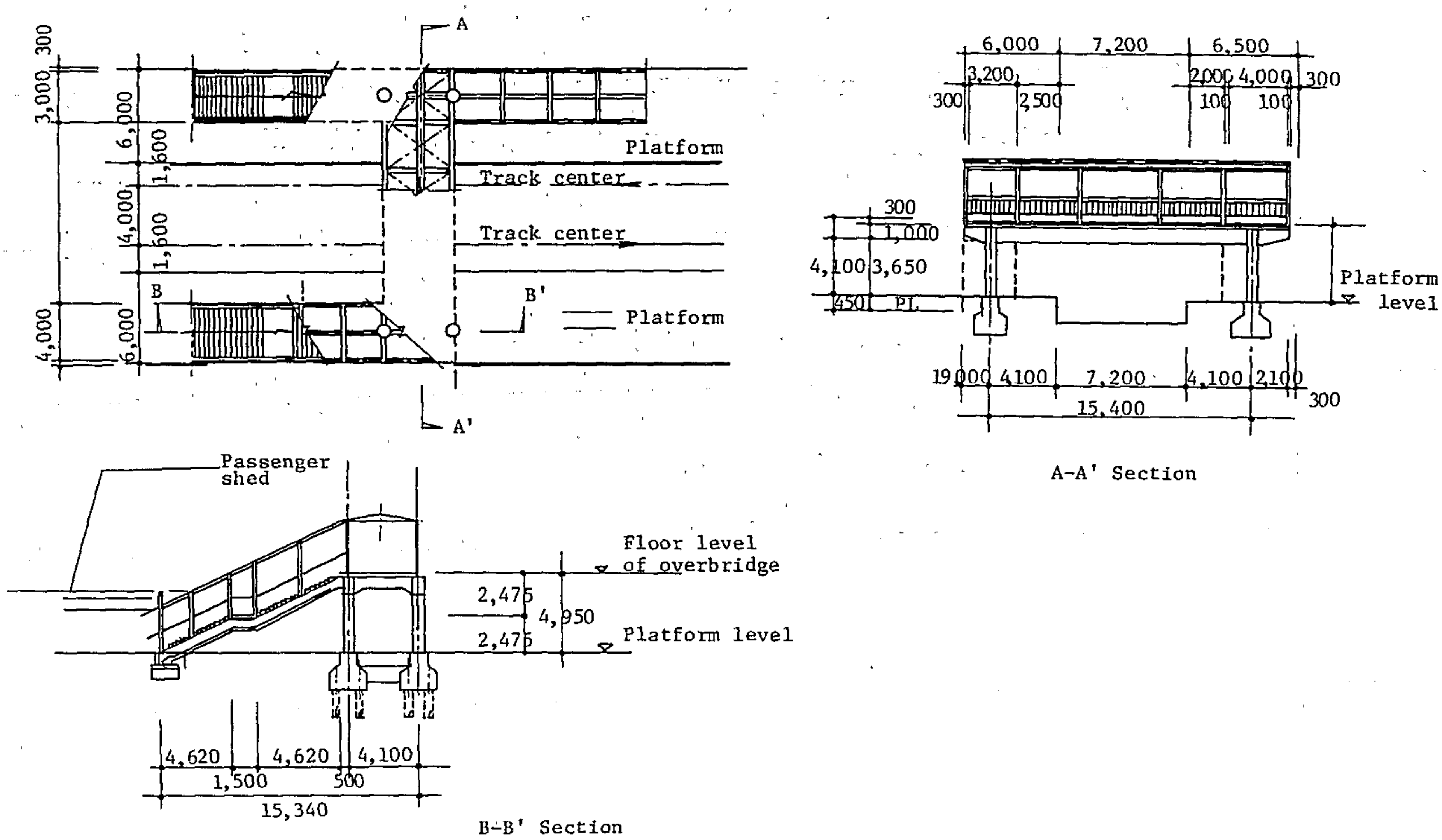


Fig. 8.2.6 Sectional View of Rawa Buaya Station

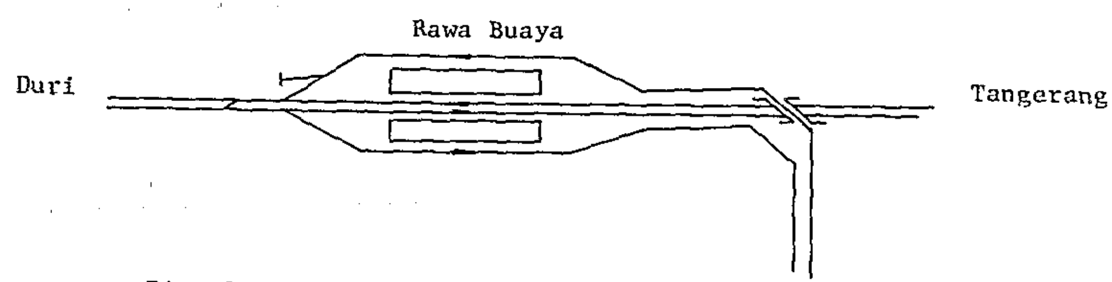


Fig. 8.2.7 Sketch of Track Layout (Rawa Buaya)

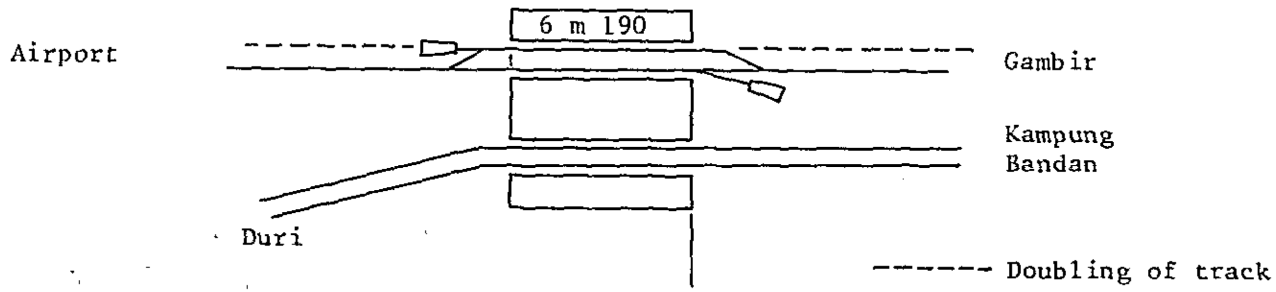


Fig. 8.2.8 Sketch of Track Layout (Kota Intan)

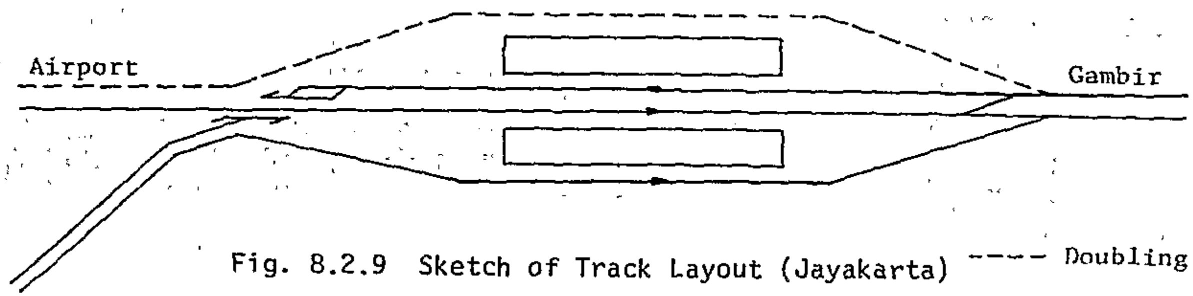


Fig. 8.2.9 Sketch of Track Layout (Jayakarta) ---- Doubling of track

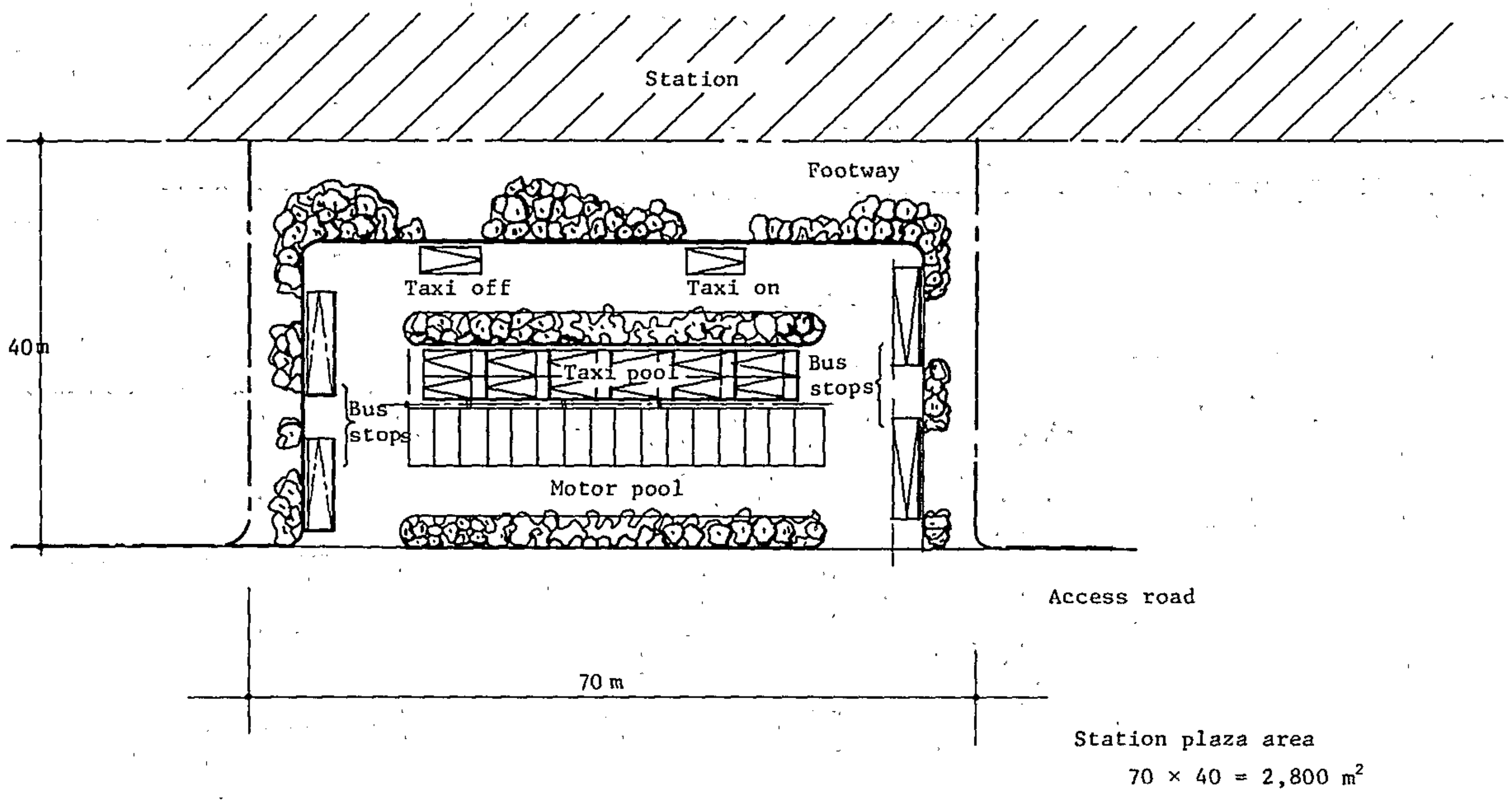


Fig. 8.2.10 Station Plaza - Kota Intan and Rawa Buaya

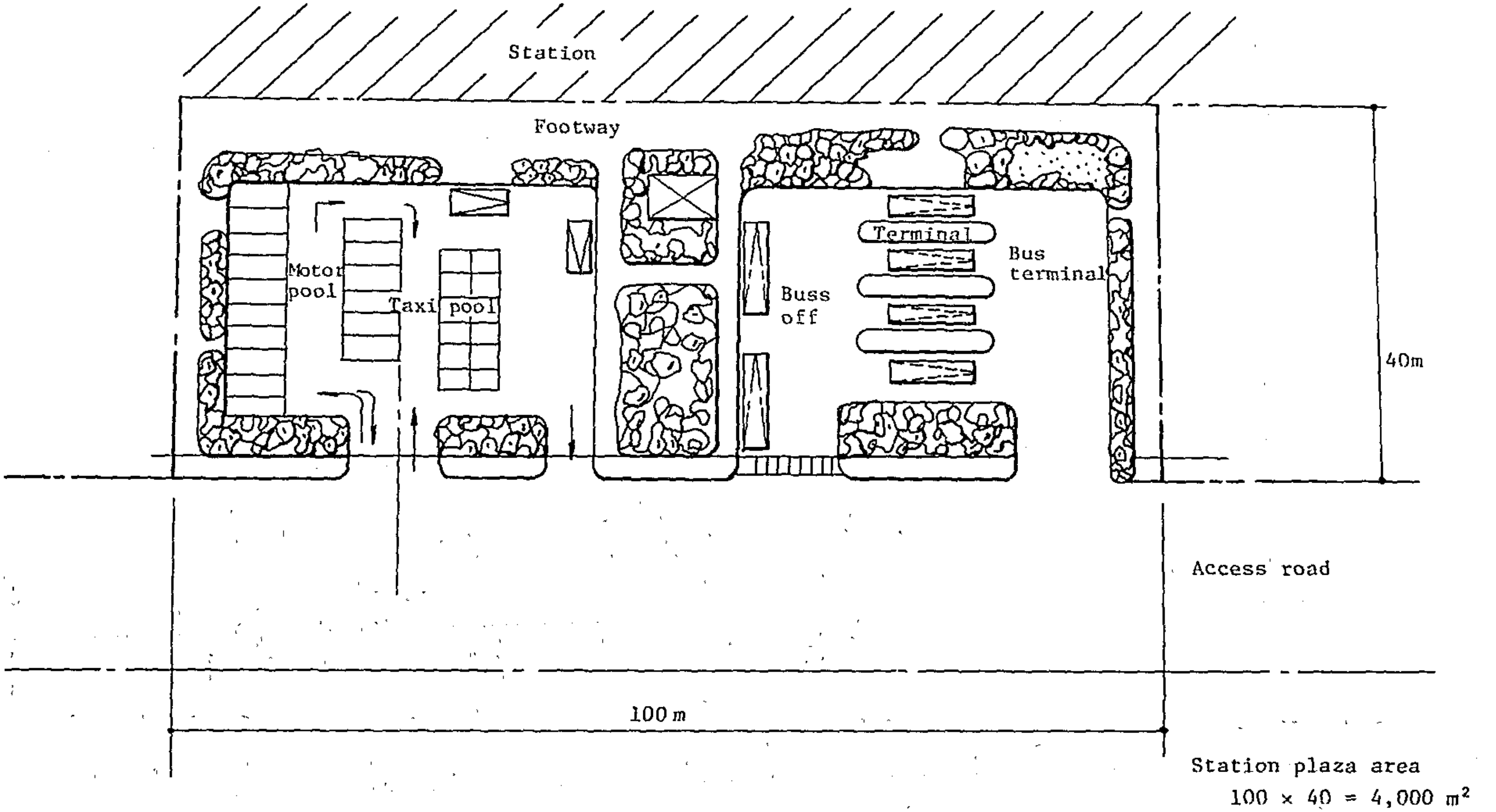
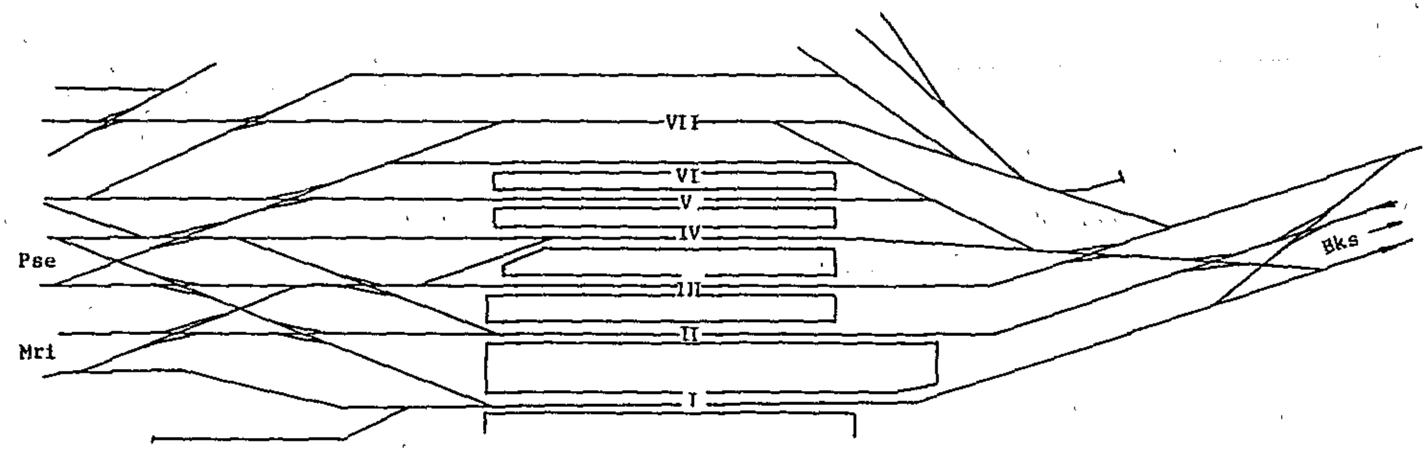


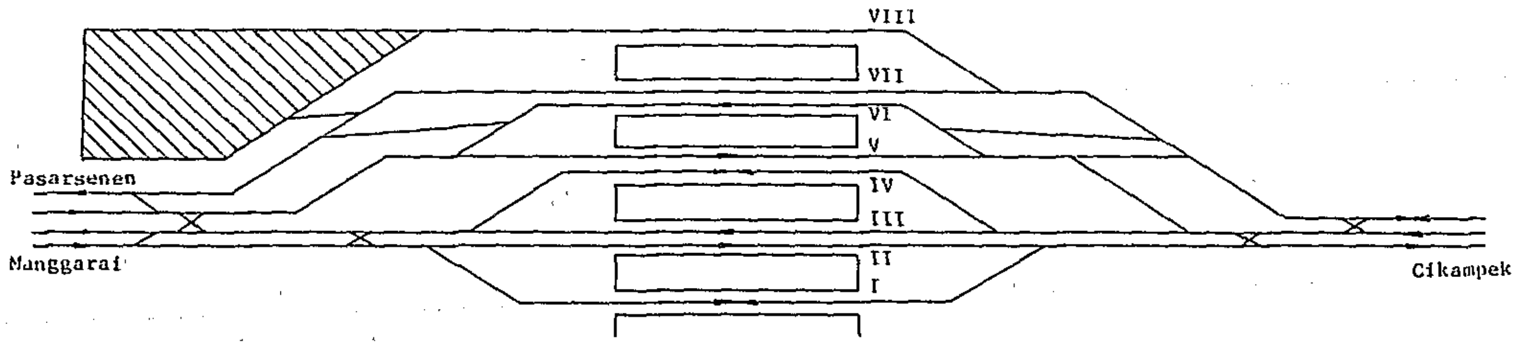
Fig. 8.2.11 Station Plaza - Jayakarta



	Transist train beyond station	Shut-tling train	Termi-nating train	Total	
I	19			19	Trains on Western Line (including freight)
II	18	4	3	25	
III	20	2	13	35	Trains on Eastern Line and terminating trains (including freight)
IV	19		2	21	
V			11	11	Terminating trains
VI	1		1	2	
VII			11	11	
Total	77	6	41	124	

I, II	Same as existing
III	Airport train (Shuttling)
IV	Same as existing train III
V	Same as existing train IV
VI	Same as existing trains V & VI
VII	Same as existing

Fig. 8.2.12 Track Arrangement within Station Yard of Jatinegara



I, IV: Turn-back track for airport train

Fig. 8.2.13 An Alternative for Future Track Rearrangement at JATINEGARA Station

8.3 Electrification Plan

8.3.1 Premises for Planning

(1) Electric traction system

In view of the facts that the new line to Cengkareng Airport is of a short length within a range of 10 to 20 km and the existing lines in the urban area of Jakarta are electrified by the DC 1500V system, it is advantageous, for the sake of economy and rolling stock assignment, to adopt the same electric traction system.

For this reason, the 'DC 1500V system' will be adopted for electrification of the new railway line.

(2) Single or double track

At the initial stage after start-up of commercial operation trains will be operated on a single track. Later, with increase of traffic demand a timing chance will be taken to start with the conversion work into doubling of track, so that trains will be operated on the double-track line.

Therefore, construction costs for electrification will be estimated on the alternative routes of A and C in each case of single track construction and double track conversion.

Furthermore, as for Route C construction costs for double track electrification on Tangerang Line associated with this Route will also be estimated.

(3) Selected route length

Length of alternative routes is as follows.

(a) Route A 19.8 km

(b) Route C (11.3 + 3.3) = 14.6 km

(4) Operation current of trains

Design elements for trains will be same as used for those trains now being operated within the JABOTABEK area. The new airport line will start with train formation consisting of four (4) cars, which will be eight (8) cars ultimately as future demand may furhter increase.

Amperage of a train at starting is as follows (445A in limit current of traction motor).

	Series notch	Parallel notch
4-car makeup (2M, 2T)	473A	945A
8-car makeup (4M, 4T)	945A	1890A

(5) Operation speed of trains

Maximum operation speed will be 100 km per hour.

(6) Operation headway of trains

Trains will be operated at a headway of 20 minutes for some years, which will be improved to a headway of 10 minutes on the double track in the future.

8.3.2 Electric Power Supply

(1) The power supply situation is in a favorable condition as notable from the 3-phase electric utility map. It is therefore conceivable that electric supply will be available readily for electric train operation on the new railway line.

(2) The content of power rate for electric power supply (1982) may be summarized as follows:

(a) The charge for power consumption is increased up to 50 percent as compared with the level in 1980.

(b) The guarantee to be paid at installation of electrical equipment may be charged in the amount proportionate to the installed capacity of the equipment.

(c) The fixed charge to be paid monthly for power demand may be charged in the amount proportionate to the installed capacity of the equipment.

Therefore, for planning of electrification, the economical method will be to restrain the installed capacity of substation to required minimum for operation of trains and, afterwards, to make additional installation of the equipment on a feeder circuit of the substation on a step-by-step basis abreast with increases of load by electric car/train.

8.3.3 Electrification System Outline

(1) Substations for electric train operation

(a) Positioning of substations

Substations must be distanced at a distance of less than 10 km from the viewpoints of voltage drop on a feeder line and limitation on rail potential.

When viewed from the aspects of application of propulsion power supply systems and protection systems of power feeding system, it is considered most desirable to construct a substation in close proximity to the point of branch-off from the existing line.

All those things taken into consideration, the suitable site for each substation has been determined as shown in Fig. 8.3.1.

i) It is advisable that the site for the substation on the airport side should be selected within a distance of 3 km from the airport station, and the other substation in close proximity to the branch-off from the existing line should be located less than 500 m apart from the existing line.

ii) Route A should require one more intermediate substation between the one on the airport side and the other close to the branch-off from the existing line because the one is too far distanced from the other.

iii) Route A will be provided with three (3) substations and Route C will be provided with two (2).

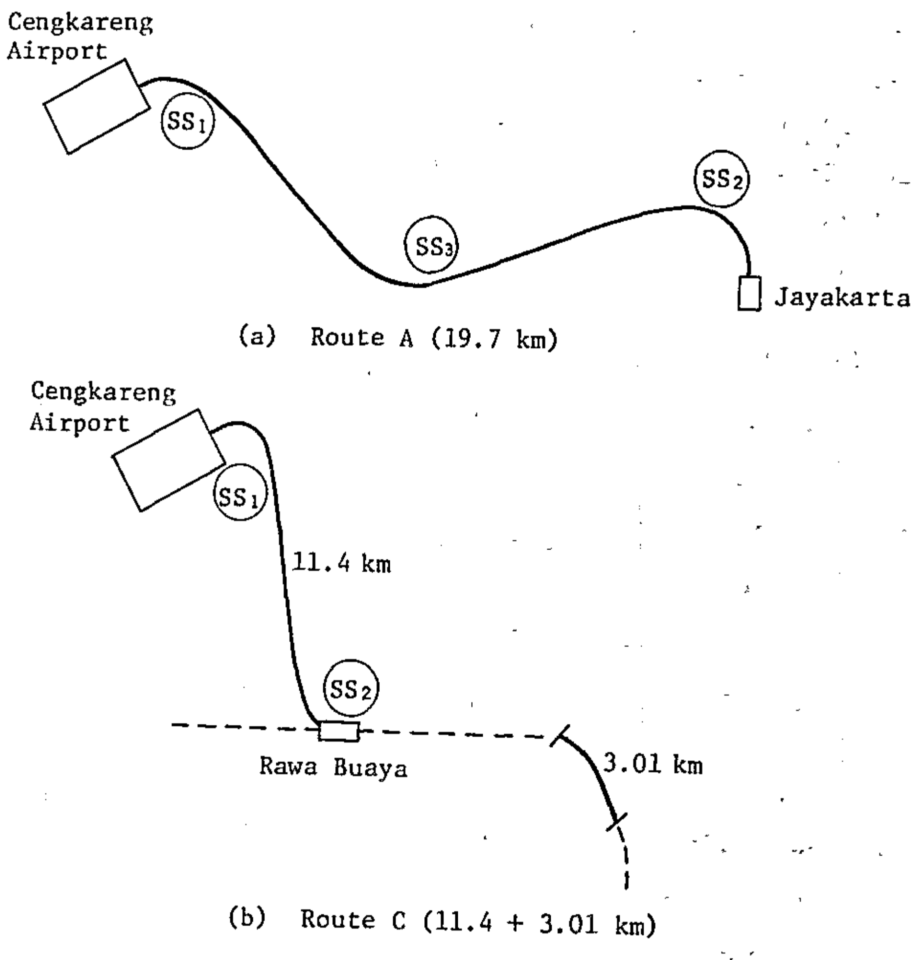


Fig. 8.3.1 Location of Substations

(b) Network of propulsion power feeding

Fig. 8.3.2 shows network diagrams for the power feeding on Route A and Route C.

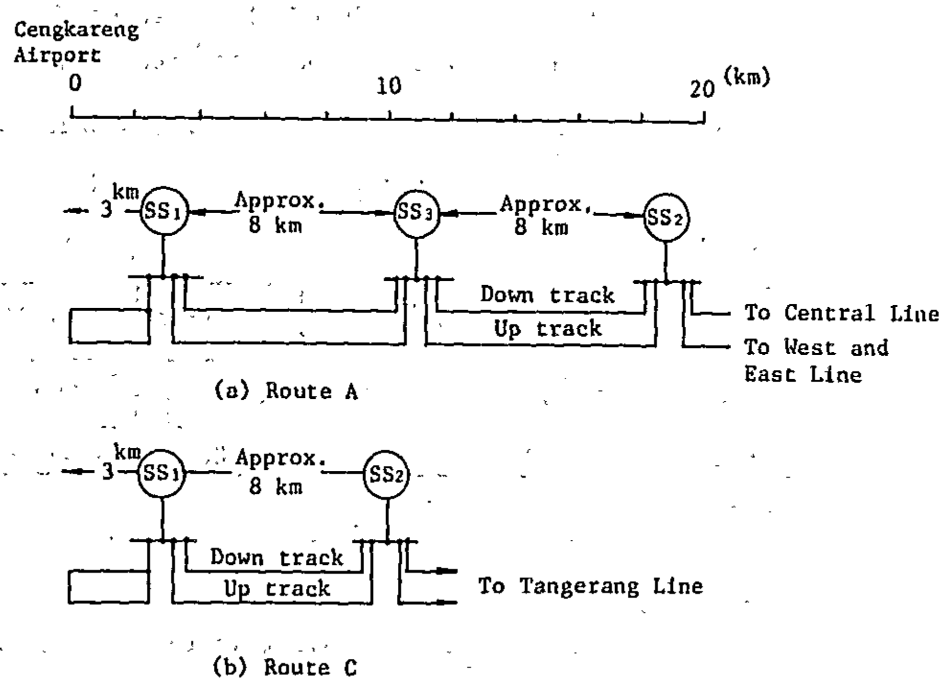


Fig. 8.3.2 Network Diagrams for Power Feeding
(at Completion of Double Track Conversion)

The power feeding system may be featured as follows:

i) Basically to be parallel feeding and π-figure feeding

ii) To be up and down bound commonly loop feeding on the airport station side because of a short feeding section

iii) To be separated from the feeding system for the existing line

(c) Calculation result of voltage drop on feeder lines

i) Circuit constant on feeders

Resistance value on feeder lines has been calculated at 0.062Ω per km from the composition of propulsion power feeding lines as mentioned in the later part (2).

ii) Capacity and rated current of rectifier in substation

It is planned that as the initial investment for inaugural operation the capacity of rectifier to be installed should be either 1,500 kW × 2 or 3,000 kW × 1 and should be strengthened at any future time when load will have been increased.

Rating of the rectifier and characteristic of current are as shown in the following Table:

• Rated current

Rectifier capacity	Continuous	2 hours	5 minutes	1 minute
1,500 kW	1,000 A	1,500 A	2,000 A	3,000 A
3,000 kW	2,000 A	3,000 A	4,000 A	6,000 A

iii) Internal resistance on main lines of substation

The values of internal resistance may be obtained as follows at a rate of 7% per voltage regulation inclusive of both transformer and rectifier together.

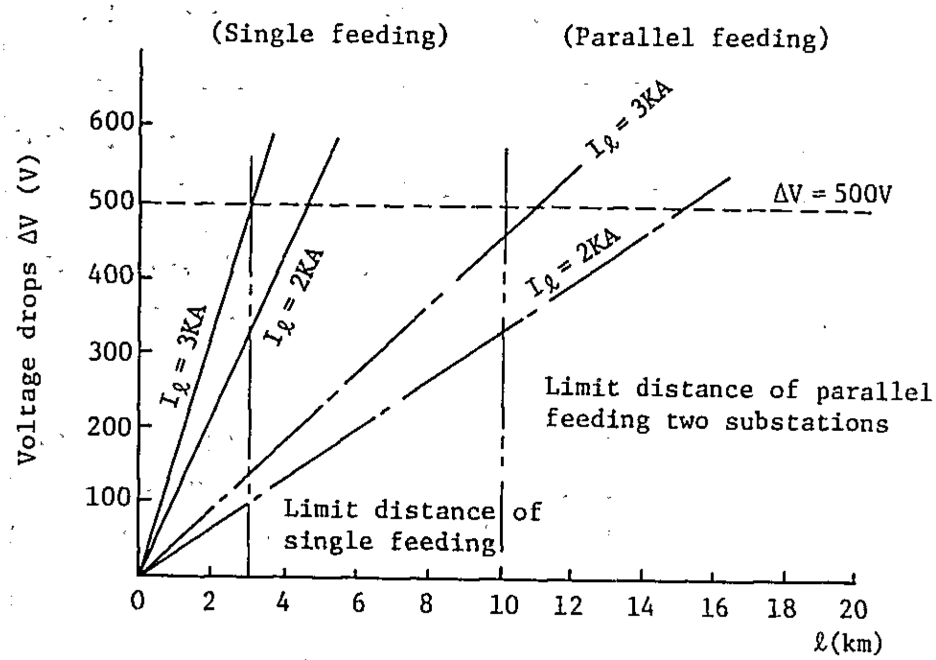
1,500 kW	0.105Ω
3,000 kW	0.0525Ω

iv) Voltage drop on feeder lines

The calculated result of voltage drop on feeder lines is as shown in Fig. 8.3.3.

The following conclusion can be reached from the preceding figure.

- In case of single feeding same as proposed for feeding to the airport the distance of such feeding is limited to about 3 km (load current I_{ℓ} = 3kA).
- In case of parallel feeding two substations will be distanced at less than 10 km (load current I_{ℓ} = 3kA).



Single feeding = Distance from substation to load point

Parallel feeding = Distance between substations (load at intermediate point)

Fig. 8.3.3 Limit Distance of Feeding under Voltage Drops

(d) Substation control

The preferrable type of substation control should be the centralized remote control system reflecting general consideration all over the whole district of JABOTABEK.

(2) Propulsion power feeding line

Standard pole assemblies of the propulsion power supply system are as shown in Fig. 8.3.4, whose components and wire types are classified as follows.

Feeder wire (hard-drawn copper standard wire)	325 mm^2 × 1
Messenger wire (galvanized steel standard wire)	90 mm^2 × 1
Contact wire (hard-drawn copper trolley wire)	110 mm^2 × 1
Ground wire (galvanized steel standard wire)	55 mm^2 × 1

For electrification poles either pre-stressed concrete poles or steel-tubed poles will be used.

The suspending method of overhead contact wires will be of simple catenary system by use of rigid cantilever arms as suports.

It can be assured that the propulsion power feeding system will be fully capable of train operation to the maximum speed of 100 km per hour.

Because the project area is noted for frequent emergence of thunder, grounding wires and lightning arrestors will be provided to protect high-voltage power distribution lines and propulsion power feeding lines from lightning strikes.

Grounding wires will be isolated by each length of about 200 m in the line direction, each wire being connected to a grounding device of 30Ω or below in each individual section.

The reason for isolation of grounding wires by each length of 200 m is because of necessity to prevent possible electrolytic corrosion due to return direct current.

(3) High-voltage power distribution lines

High-voltage power distribution lines will be installed all the way alongside the railway. The lines will be either suspended on poles or buried underground by use of high-voltage power cables.

Distribution voltage will be rated at AC 3-phase 6.6kV and power will be supplied to utility equipment for power and lighting at the airport station and the intermediate station and all signalling

facilities scattered over the wayside zone. To ensure such services the railway substation will be equipped with power transformers and switchboards for high-voltage distribution.

The high-voltage power distribution system as aforementioned has the following advantages as its characteristic features.

(a) High reliability in power service because of ability to receive power from two substations at the load point in the middle will insure.

(b) High economic advantage if power supply is not readily available from PLN in the sparsely populated area.

(c) The automatic signalling system, if adopted, may require in-phase of the neighboring power source for the signalling system. If so, this system will serve the purpose.

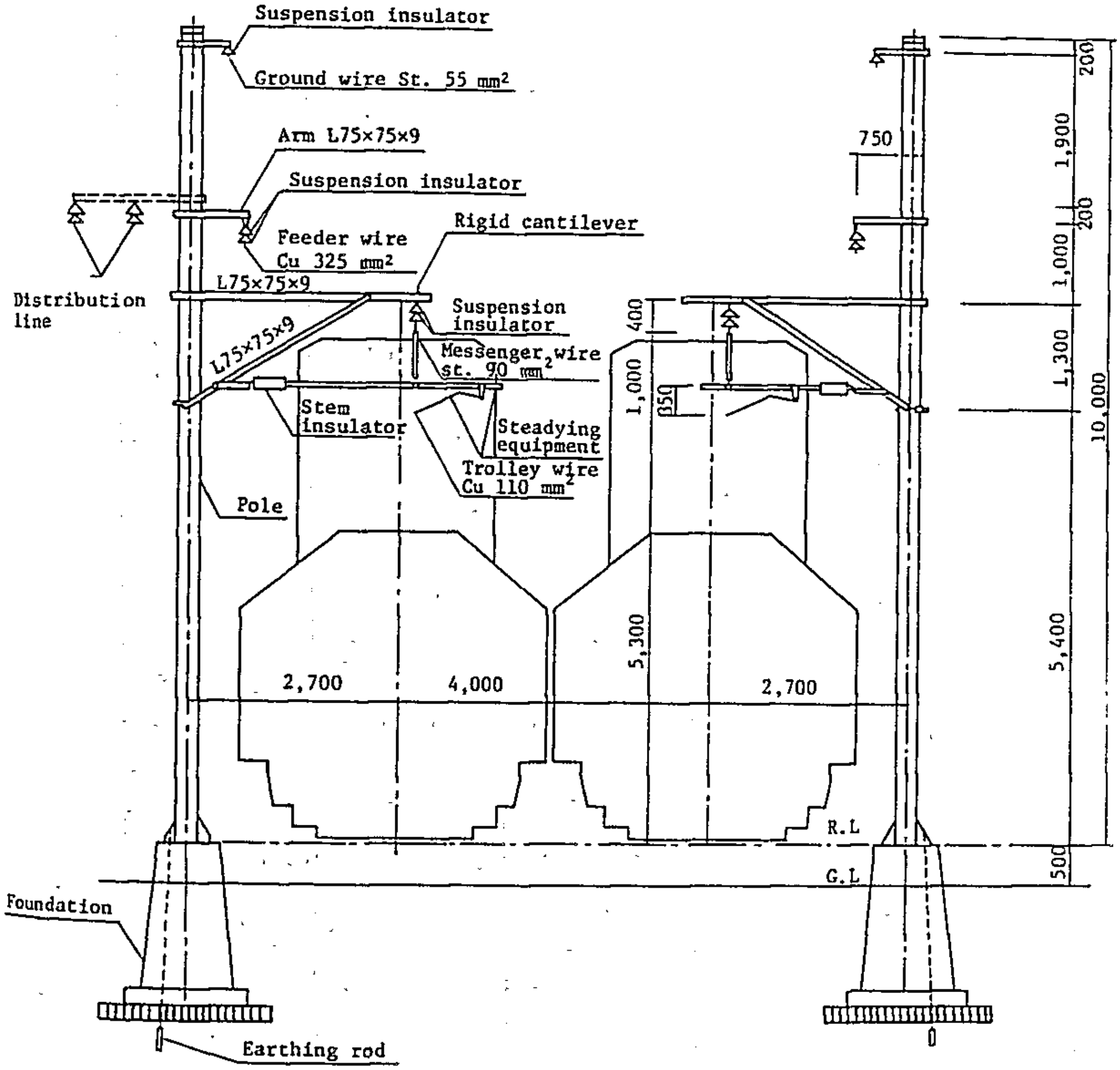


Fig. 8.3.4 Standard Mounting between Stations

8.4 Signalling & Telecommunication Systems

Planning of signalling and telecommunication systems were made based on the following preconditions.

(a) Direct current electrification

(b) Maximum operating speed 100 km/h

(c) Single track operation of 20 minute headway at the beginning

(d) Double track operation of 10 minute headway in the future

(e) Consideration of various environmental conditions based on the field survey

(f) Coordination with Intermediate Program

8.4.1 Signalling System

(1) Block system

(a) For single track operation

Automatic block system is adopted for shortening operation time and for securing safety. For headway of 20 minutes, it is sufficient if the section between two adjacent stations is set as one block.

The outline of the system is shown in Fig. 8.4.1. It is such a system that each train is detected by the track circuit provided between two adjacent stations and that traffic direction is determined by handling two traffic direction levers interlocked by the traffic direction control line.

(b) For double track operation

Automatic block signals will be located at suitable points between two adjacent stations.

(2) Signalling system

Color light signals are adopted based on the policy of Master Plan. Two aspects (G, R or Y, R) and three aspects (G, Y, R) are basic, and four aspects (Y, R, Y, G or Y, R, G, Y) etc. will be used as required. The outline of the signalling system is shown in Fig. 8.4. 2.a through f.

(3) Interlocking device

Relay interlocking device is adopted for increasing the efficiency of operation and for securing safety, and block operation, color light signals, electric switching machines and so forth are controlled.

(4) Track circuit

Track circuits are provided between stations and in station yards. Return circuits are constituted by impedance bonds at insulated rail joints because of being direct current electrification.

Track circuits for long length (25 Hz) will be adopted for single track operation, because distance between stations are long. They are of such a system that commercial frequency (50 Hz) is divided and is used for transmission and receiving.

Commercial frequency track circuits (50 Hz) are adopted in station yards and also between adjacent stations in short distance or in double track operation.

(5) Switching machine

Electric switching machines are used. They are controlled and locked by signal control console provided in station office.

(6) Signal cable

Signal cables are laid in station yards for controlling color signals, switching machines and so forth. It is desirable that armored cables are used for protection against damage caused by rats.

(7) Level crossing safety device

Alarm devices and automatic gates are installed at level crossings, and they are automatically controlled by electric treadles. It is important to obtain reliance from vehicle traffic by setting a suitable alarm time.

(8) Automatic train stop device (ATS)

It is considered necessary that ATS is provided for operation of trains at the maximum speed of 100 km/h.

8.4.2 Telecommunication System

(1) Telephone line

Telephone lines for exchange telephone, direct line telephone for train operation, and for telephone for track maintenance, electric power maintenance and signal and telecommunication maintenance are prepared. Telephone terminal boxes are provided at 500 m intervals between stations.

(2) Substation control line

Control lines required for remote control of substations are prepared.

(3) Loud speaker equipment for communication

Loud speaker equipment are provided at each station for operation and maintenance in yard.

(4) Loud speaker equipment for guiding passengers

The airport station is equipped with loud speaker equipment for guiding passengers.

(5) Facsimile equipment

A facsimile receiver is installed at each station for dispatch of operation.

(6) Communication cable

Communication cables are laid along the wayside of tracks for securing various lines stated above. Direct burial is probably suitable as the laying method, for protection against fire, theft and damage caused by rats.

(7) Carrier transmission system

PCM carrier transmission system planned by Intermediate Program is applied, and PCM terminal stations and PCM repeaters are installed at suitable locations.

(8) Train radio system

Train radio system planned by Intermediate Program is applied. The radio base station for the new line is constructed at a suitable location, and a radio way station is provided in the office of each station.

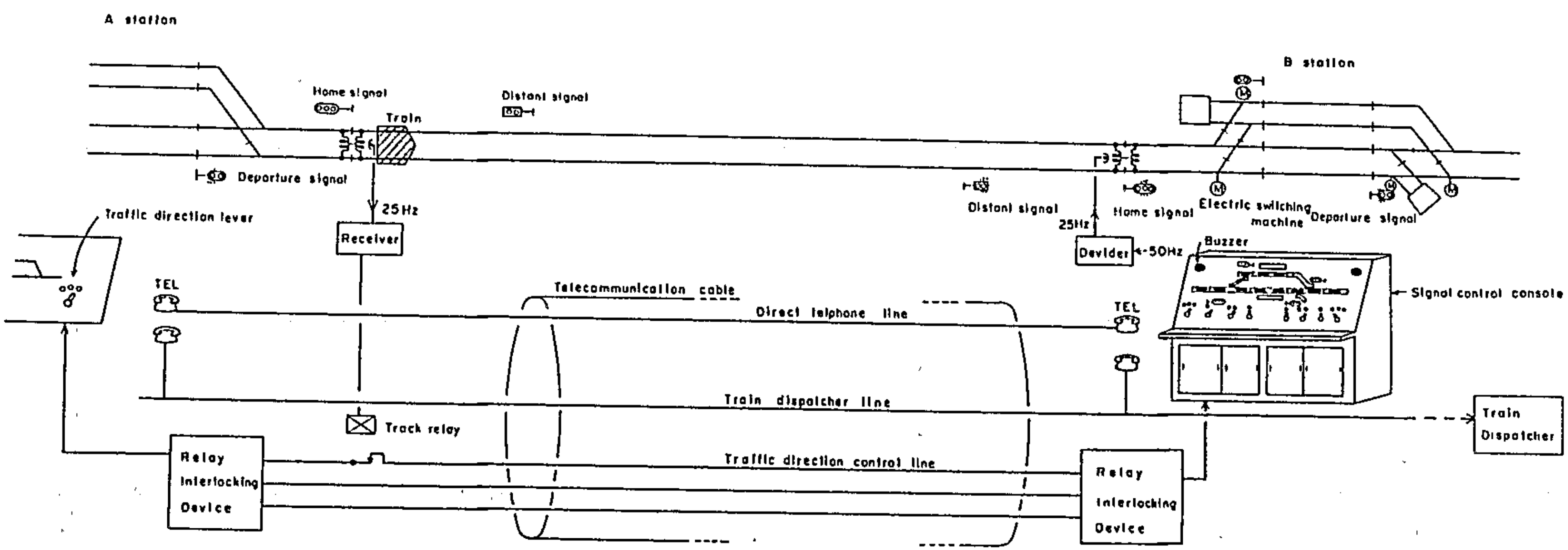


Fig. 8.4.1 Automatic Block System for Single Track Operation

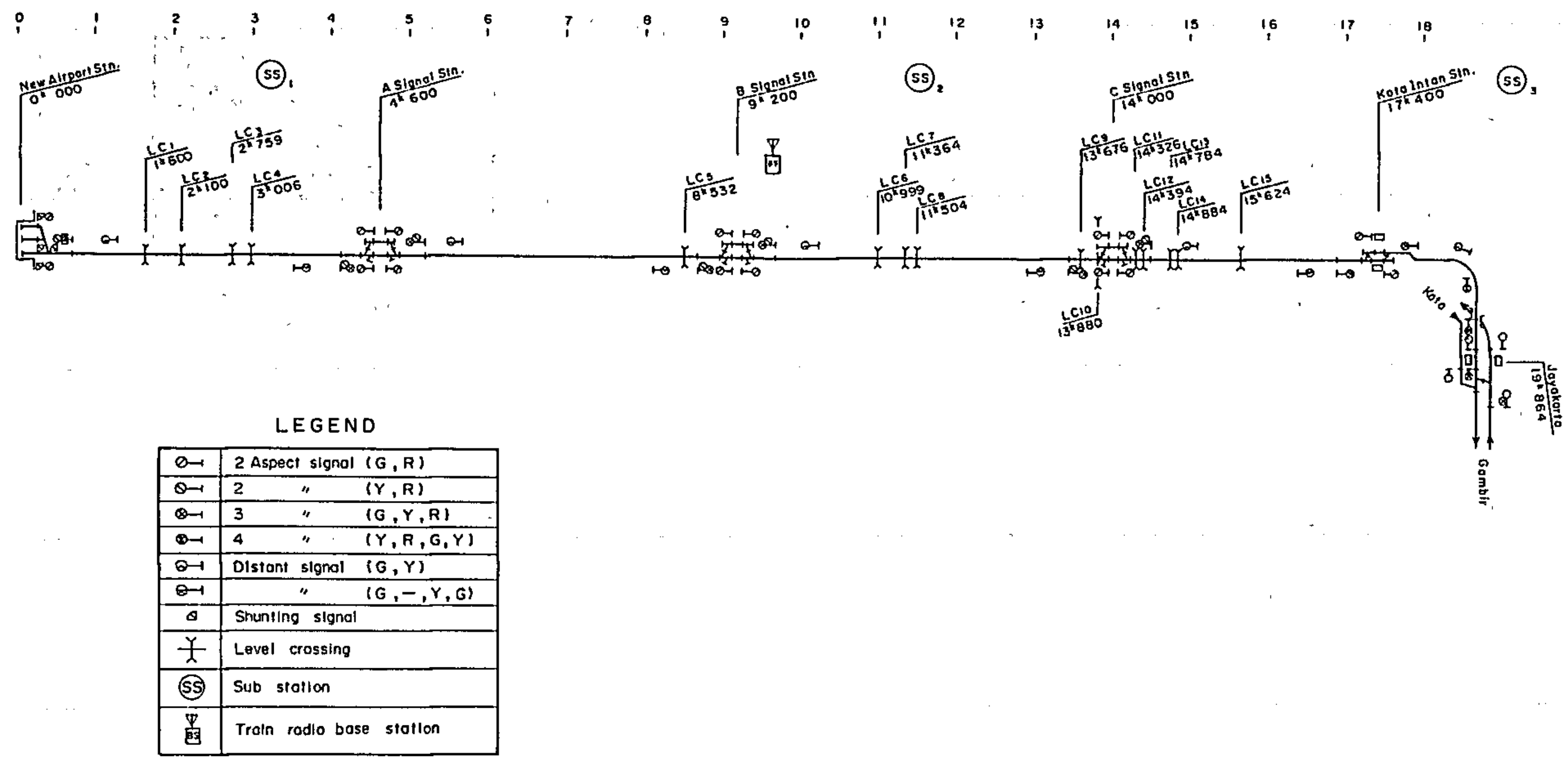
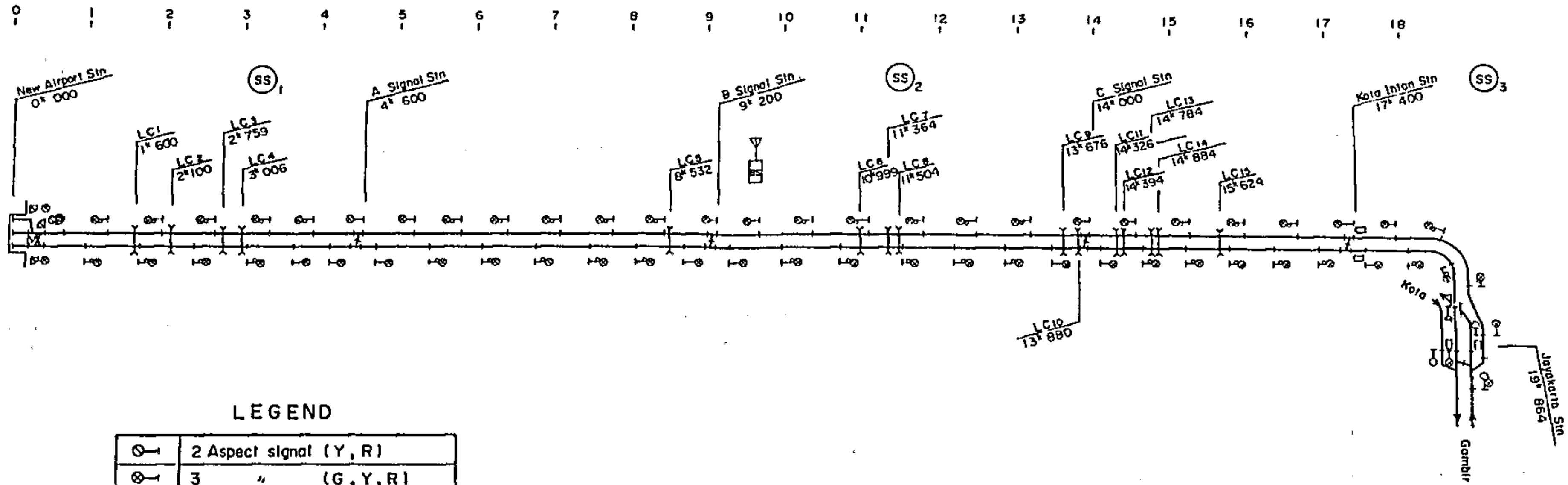


Fig. 8.4.2.a Outline of Signal System (Route A, Single Track)



LEGEND

	2 Aspect signal (Y, R)
	3 " (G, Y, R)
	4 " (Y, R, G, Y)
	4 " (Y, R, Y, G)
	Block signal marker
	Shunting signal
	Level crossing
	Sub station
	Train radio base station

Fig. 8.4.2.b Outline of Signal System (Route A, Double Track)

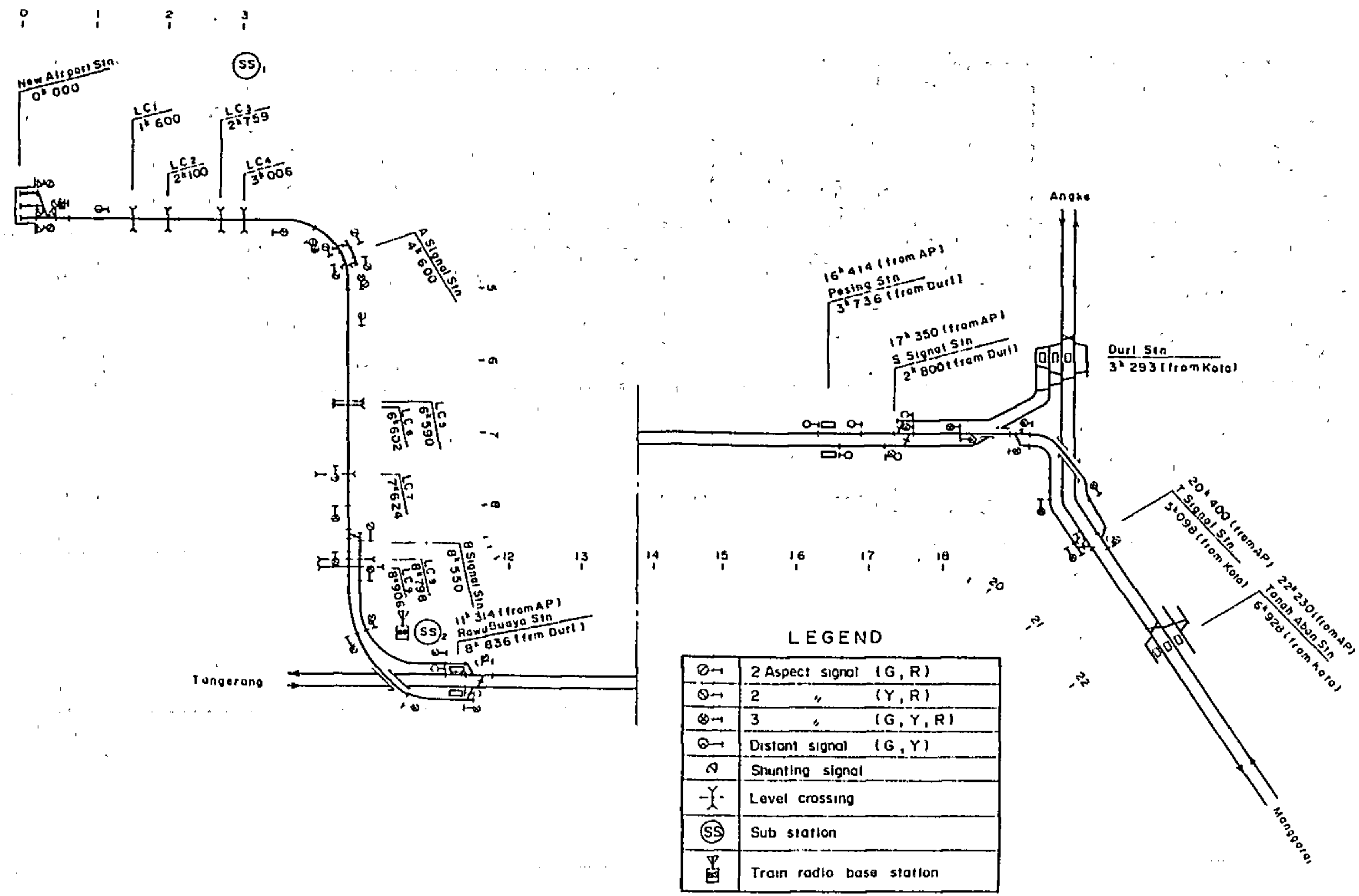


Fig. 8.4.2.c Outline of Signal System (Route C, Single Track)

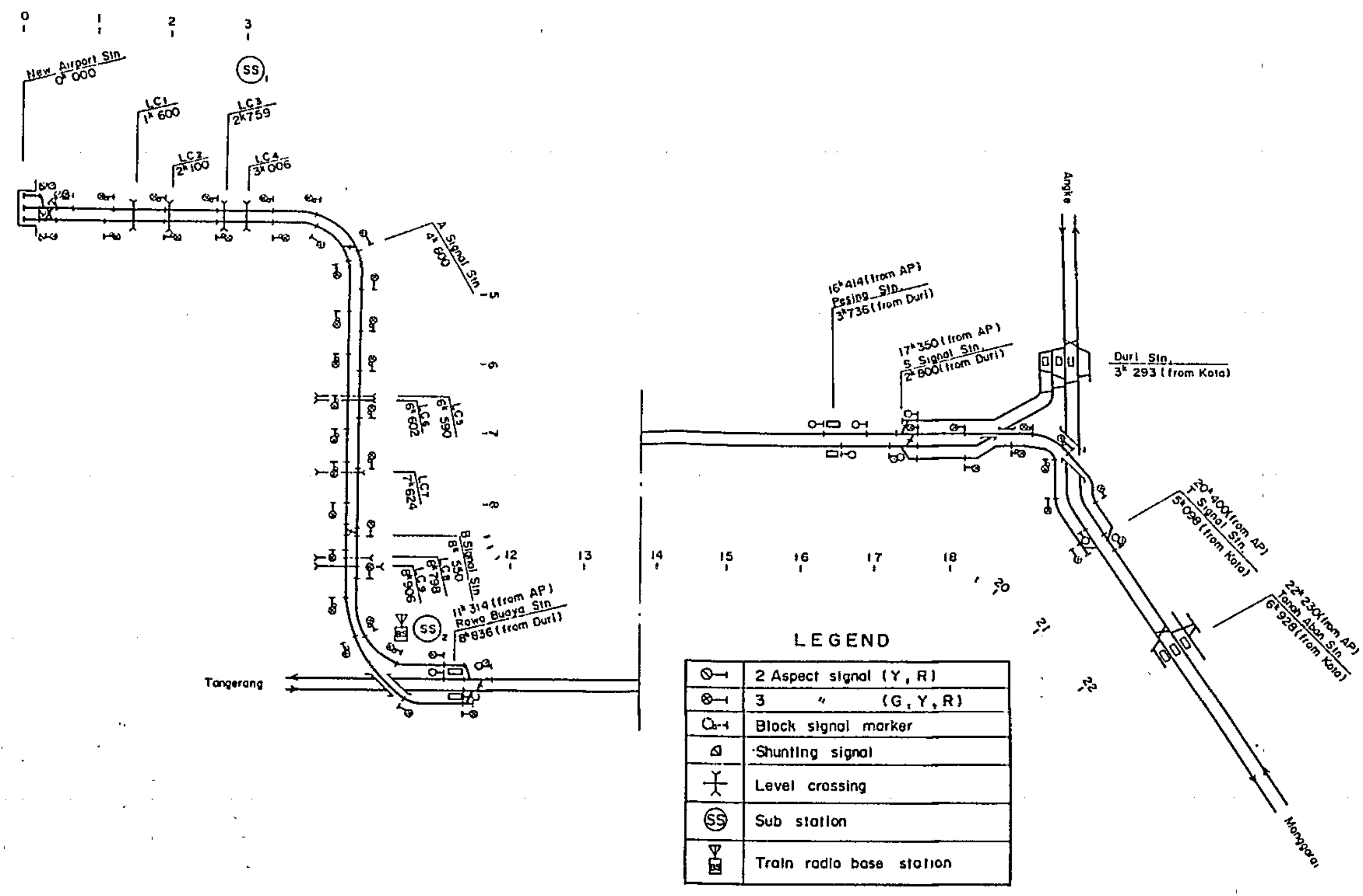


Fig. 8.4.2.d Outline of Signal System (Route C, Double Track)

8.5 Electric Railcar and Workshop

8.5.1 Electric Railcars

Electric railcars to be operated for the New Railway Line will be basically of same performance character as being operated in the area of JABOTABEK in order to seek advantages in both train operation and maintenance. Performance of railcars is specified as follows:

Table 8.5.1 Electric Railcar Performance

	Max. speed	Acceleration	Deceleration (Normal brake)	Deceleration (Emergency brake)
Performance	100 km/h	0.5 m/s^2 (1.8 km/h/s)	0.8 m/s^2 (2.88 km/h/s)	1.0 m/s^2 (3.6 km/h/s)

Special design consideration is required for air travel passengers in respect of railcar accommodation on the New Railway Line.

In view of the composite share ratio of air passengers, visitors and regular airport workers, it is considered most appropriate that the car with accommodation of such special design should be assigned at a rate of one car for a train consisting of four cars and two cars for a train of eight cars.

The basic design considerations for accommodation are as follows:

(1) Baggage accommodation

A baggage compartment will be provided near the doorway for baggages of larger size. The baggage rack will be widened to accommodate hand-carried ones.

(2) Air conditioning unit

The air conditioning unit of adequate cooling capacity will be installed so as to keep the passenger cabin at a comfortable temperature.

(3) Seating space

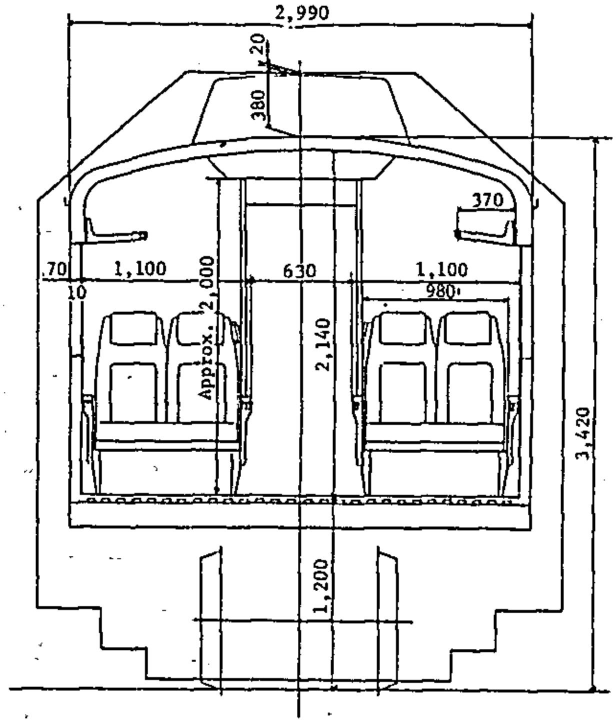
The seating space to the front seat will be arranged for convenience of passengers so that they can relax their seating pose most comfortably against the seat back.

(4) Interior arrangement of cabin

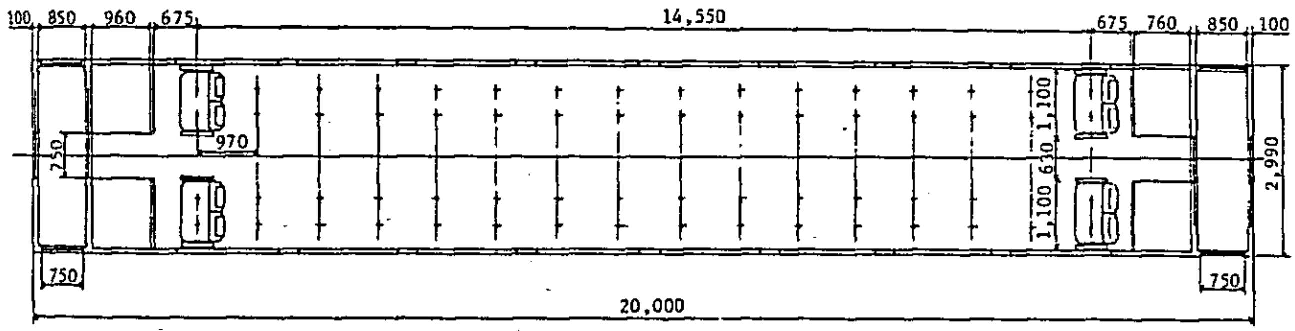
The aisle will be widened to such an extent that any passenger carrying the baggage can walk through the cabin without obstruction.

The window will be fixed rigidly with laminated glass by combined use of tempered glass and heat-absorbing glass, so that the effects of heat insulation and noise proof can be improved.

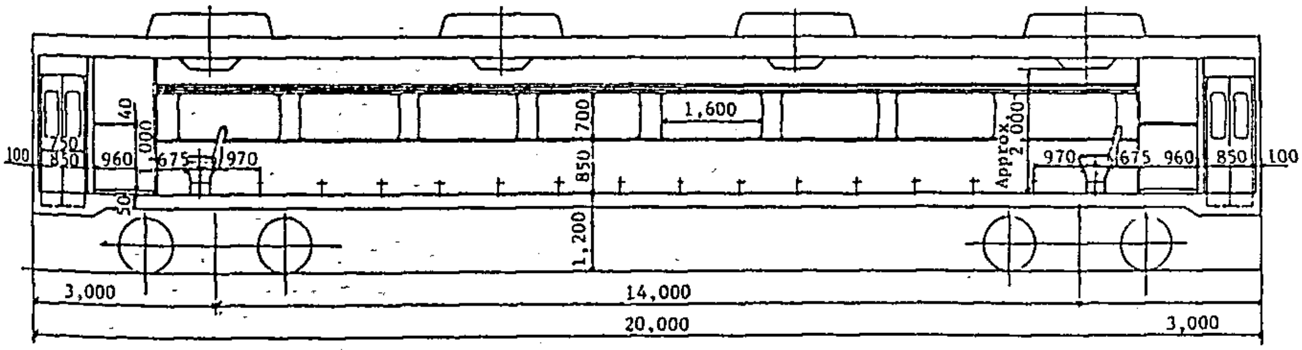
An example of car accommodation is illustrated as follows.



Cross Section



Plan



Profile

Traction motor: 120 kW (375 V, 360 A)

Gear ratio: 5.60 (84/15)

Wheel dia.: 820 mm (Cal. 820 mm)

Line voltage: 1,500 V

Series		Parallel			
		1 ~ 4 Motor		5 ~ 8 Motor	
Notch	Resistance value (at 170°C)	Notch	Resistance value (at 170°C)	Notch	Resistance value (at 170°C)
S1	8.028	P1	1.948	Q1	1.684
S2	5.338	P2	1.413	Q2	"
S3	4.044	P3	"	Q3	1.181
S4	3.245	P4	0.986	Q4	"
S5	2.519	P5	"	Q5	0.778
S6	2.003	P6	0.642	Q6	"
S7	1.602	P7	"	Q7	0.463
S8	1.193	P8	0.336	Q8	"
S9	0.890	P9	"	Q9	0.233
S10	0.536	P10	0.122	Q10	"
S11	0.245	P11	"	Q11	0.085
S12	0.000	P12	0.000	Q12	"
		P13	"	Q13	0.000

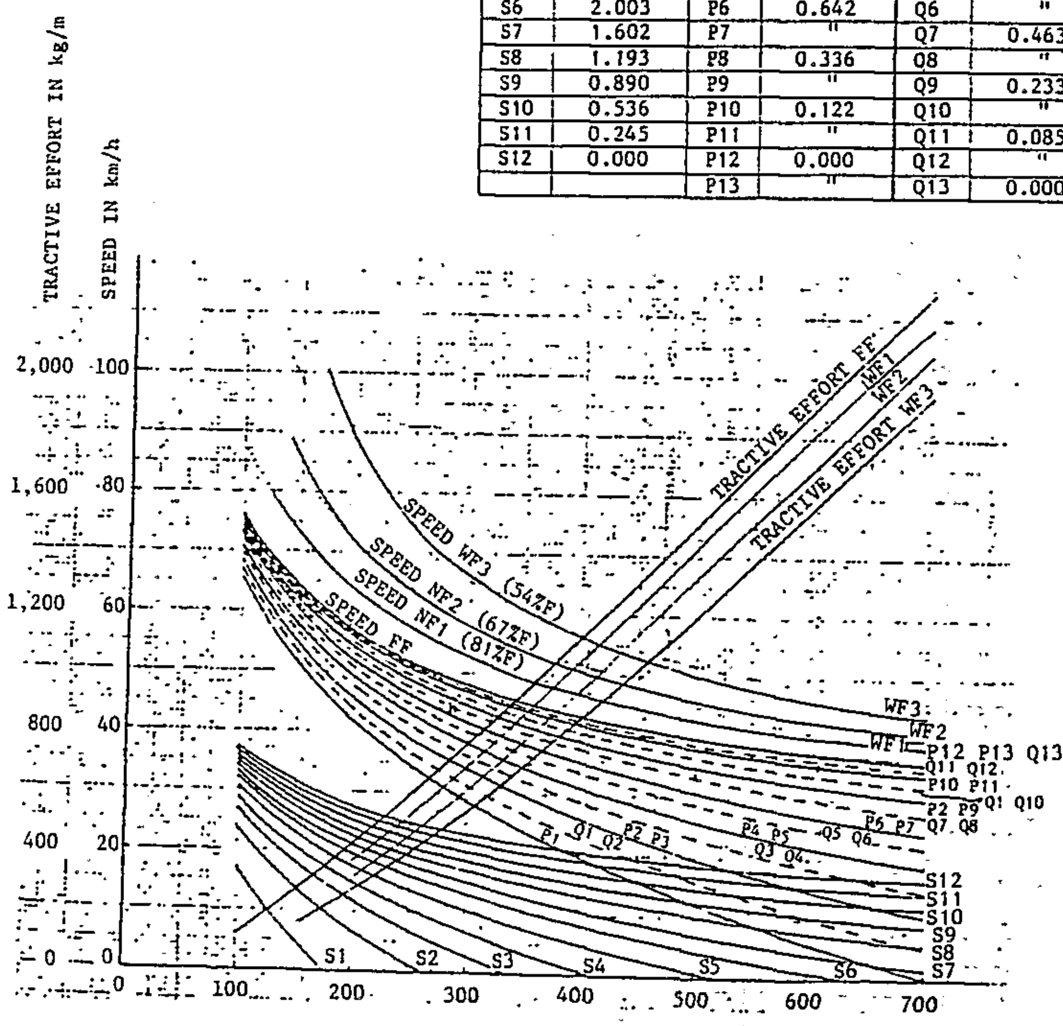


Fig. 8.5.1 Notching Curves for Powering

Traction motor: 120 kW (375 V, 360 A)
Gear ratio: 5.60 (84/15)
Wheel dia.: 820 mm (Cal. 820 mm)
Limit current: 335 A

Notch	Resistance value (at 170°C)
B1	10.462
B2	7.772
B3	6.478
B4	5.679
B5	4.053
B6	4.437
B7	4.036
B8	3.627
B9	3.323
B10	2.970
B11	2.678
B12	2.434
B13	2.254
B14	2.061
B15	1.876
B16	1.676
B17	1.487
B18	1.291
B19	1.082
B20	0.908
B21	0.730
B22	0.600
B23	0.485
B24	0.403

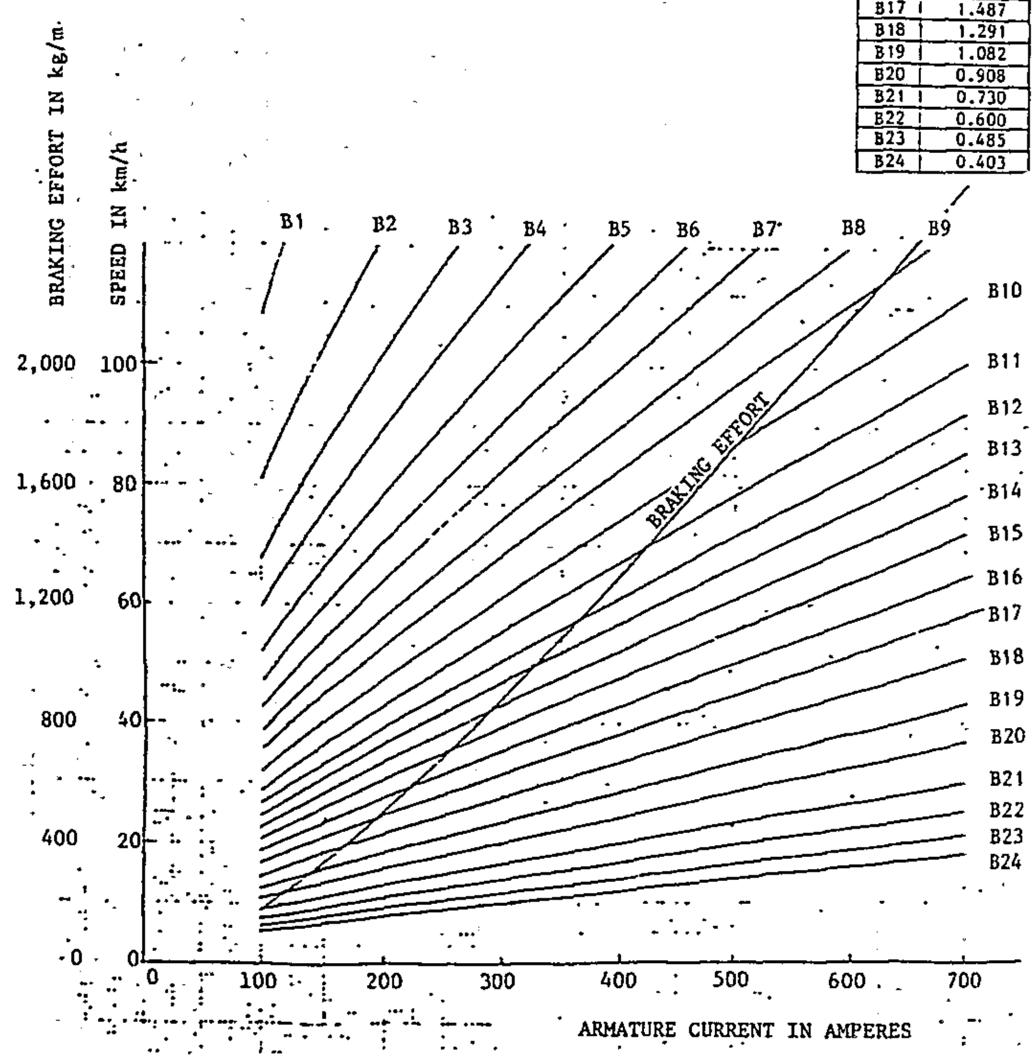


Fig. 8.5.2 Notching Curves for Dynamic Braking

8.5.2 Workshop Improvement Plan

(1) Inspection and repair system for electric cars

(a) Basic conception

Railcars tend to be declining both performance and function gradually because of abrasion, deterioration and corrosion with elapse of years in service. It is therefore necessary to check, inspect and repair every part of car after the prescribed period or distance of traveling in order to regain their original performance and function.

Required items and time cycling for such inspection and repair must be so determined as to enable both performance and function of railcars to be maintained at a required level, thus enabling the maintenance cost to be reduced to minimum. It is because of the fact that the maintenance cost for railcars takes a relatively larger share in the total operating expenditure of railway management.

To serve this purpose, the inspection and repair system has been classified into the following three categories by due reference to the experiences accumulated for many years in Japan and local specialities in Indonesia.

i) Routine check and adjustment ..... Daily inspection

ii) Inspection and repair to be conducted at a regular cycling period ..... General inspection, principal equipment inspection, bogie inspection and monthly inspection

iii) Inspection to be conducted temporarily if and when necessary ..... Extra inspection

(b) System of inspection (types, items, cycling periods and executing organizations)

The system of inspection is established for the purpose of defining the required cycling period of inspection and the role to be shared by field depot and workshop. It must be studied in details and summarized into rules and regulations.

Categories, items and cycling periods are determined so as to be able to guarantee performance and function of railcars inspected and repaired for the period until the time limit for next inspection and, still more, to avoid any repair work in redundancy.

Table 8.5.2 species types, details, cycles and inspection sites as prescribed by the Master Plan.

Table 8.5.2 Types, Details, Cycle and Site of Inspections (EC)

Types and Details of Inspection			Inspection Cycle		Site of Inspection
Types		Details	Intervals	Running Distance	
Periodical Inspection	General Inspection	Inspection conducted comprehensively in detail by dismantling each component part at prescribed intervals depending on the state of use of the electric car.	4 years or less	600,000 km or less	Workshop
Periodical Inspection	Principal Equipment Inspection	Inspection conducted at prescribed intervals depending on the state of operation of cars for the condition of Principal equipments such as traction motors, trucks, running gears, brake equipments, current collectors, auxiliary motors, relays, contactors, couplers, ATC devices, instruments etc., and by dismantling specified principal parts for details.	2 years or less	300,000 km or less	Workshop
Periodical Inspection	Bogie Inspection	Inspection conducted in detail at prescribed intervals depending on the state of operation of cars by dismantling specified principal equipments such as traction motors, trucks, running gears, brake equipments, etc., an by disassembling specified principal parts for details.	1 year or less	150,000 km or less	Depot
Periodical Inspection	Monthly Inspection	Inspection conducted at prescribed intervals depending on the state of operation of cars for the condition, actions and functions of pantagraphs, high tension circuits, main circuit system, rotary machines, door operating devices, brake equipment, trucks, running gears, ATC devices, instruments, etc. in as-installed state.	60 days or less	30,000 km or less	Car depot
Daily	Daily Inspection	Inspection conducted from outside in conformity to the state of operation of cars for replenishment and replacement of abrasive parts and for condition and action of pantagraph, door operating devices, interior equipment, tracks, running gears, cooupling devices, etc.	48 hours or less	3,000 km or less	Car depot
Occasional	Extra Inspection	Inspection conducted whenever need arises because of trouble of rolling stock.	Occasional	-	Workshop, Car depot

(2) Inspection and repair system at workshop

The inspection and repair services at workshop will include general inspection, principal equipment inspection and extra inspection. Those inspections must be conducted most accurately and efficiently to accord with both purposes and contents.

To satisfy such needs, the inspection must be carried out in accordance with the following guideline.

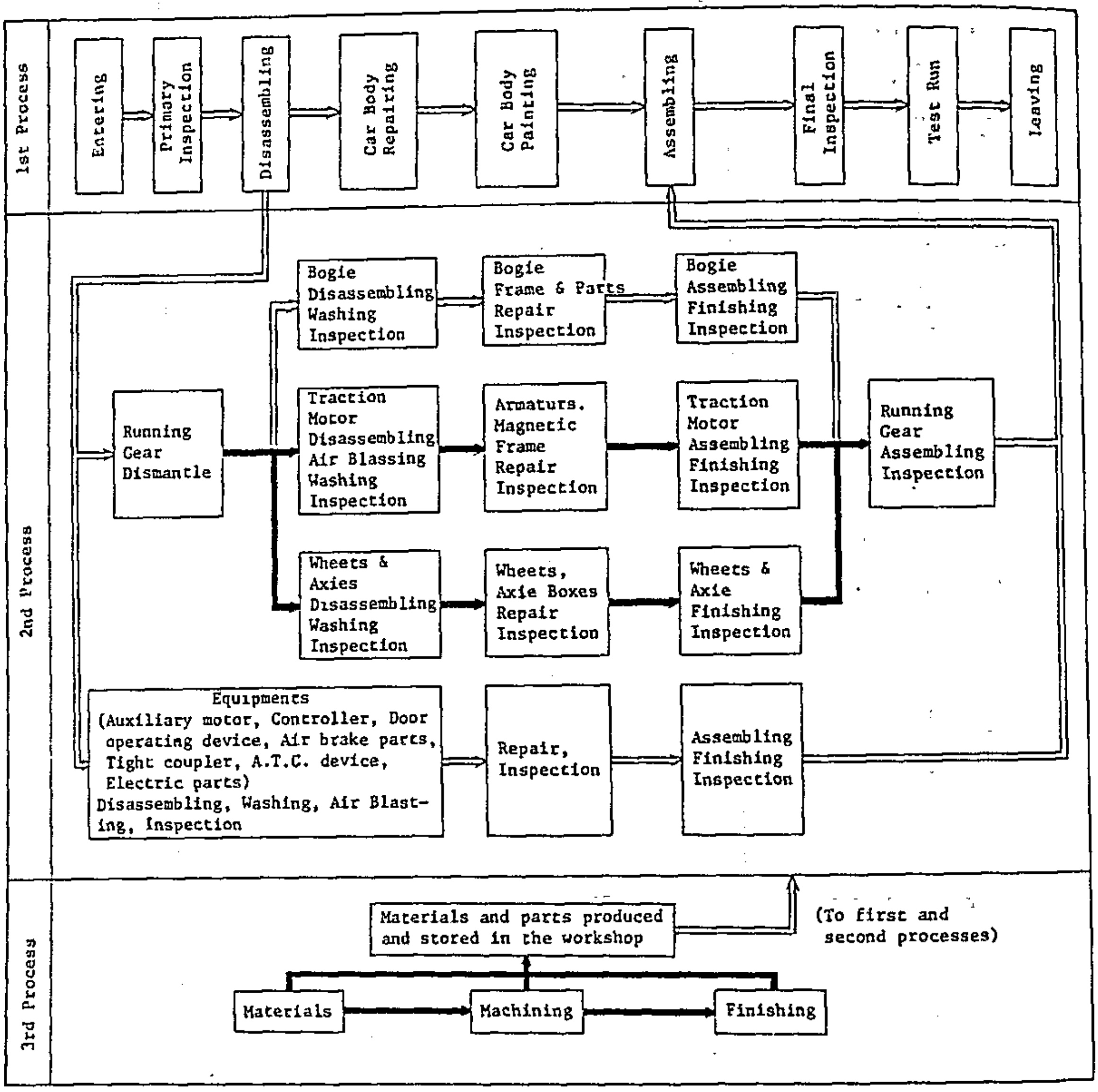
(a) Periodical inspection must be made in strict accordance with the time schedule as prearranged.

(b) Any railcars finished with periodical inspection and extra inspection on major components such as running device, control unit and brakes must be put into test operation.

(c) The process of inspection and repair for railcars must be divided as shown in Table 8.5.3. Each working process is as shown in Fig. 8.5.3. As noted from Fig. 8.5.3 each of those three working processes will be controled independently, so that time can be reduced and workload can be equalized flat.

Table 8.5.3 Process of Inspection and Repair

Processes	Work
No. 1	Body and equipment as assembled in body are inspected.
No. 2	Equipment disassembled from body are inspected.
No. 3	Necessary parts and materials for No. 1 and No. 2 processes are manufactured or prepared.



Note: ➡ indicates the flow not directly affected by the first process.
In the second process, recirculated spare parts are to be used.

Fig. 8.5.3 Basic Flow Chart in the Inspection and Repair Process

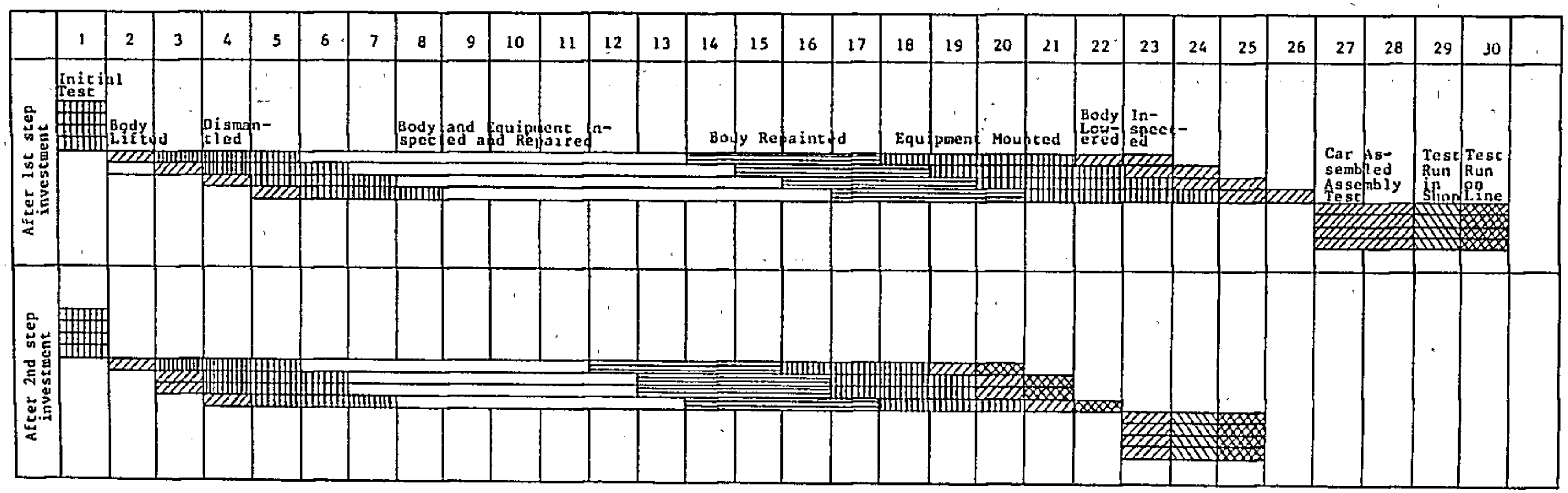


Fig. 8.5.4 Standard Work Time Schedule for General Inspection Process

(3) Required number of days for inspection and repair

All railcars will be admitted into workshop in a train formation. Required number of days for general inspection will be 30 days per each train set at the initial stage. However, the future aim will be set toward 25 days per each train set after completion of equipment improvement at the second step of development under the Master Plan. Fig. 8.5.5 shows the working process of a standard pattern.

Naturally, required number of days for inspection of each car will be varied depending upon equipment to be used for inspection, number of inspection staff, operated car conditions, technical skill of workers and availability of materials. However, each work process must be controled strictly so as to ensure completion of work by the scheduled time as prescribed for each type of inspection.

(4) Equipment for car inspection

(a) Introduction

The existing inspection facilities at Manggarai Workshop seem to be rather outdated with low efficiency, which would therefore make it difficult to provide proper inspection and repair services for electric railcars, not only for the New Railway Line, but also for the existing lines to be covered under the JABOTABEK Railway Master Plan.

For this reason, the Master Plan makes extensive study on the required main items of equipment for the workshop including those for passenger cars and diesel cars. This report therefore makes study on necessary equipment for shop inspection and repair from the viewpoint of required inspection for electric railcars and gives an outline of major component parts of railcars which may need such equipment items of inspection and repair.

(b) Inspection and repair of electric railcar main parts and major inspection equipment

i) Bogie

The flow chart for normal inspection of bogies is as shown in Fig. 8.5.5. The bogie shop will be responsible for repair of truck frame and its accessories.

The layout of major equipment for inspection and repair is as shown in Fig. 8.5.8. Wheels and axles taken apart from the bogie will be forwarded to the wheel and axle shop and traction motors will be transfered to the motor shop respectively for inspection and repair.

ii) Wheel and axle

Wheels and axles transfered from the bogie shop will undergo inspection and repair at the wheel and axle shop. The flow chart of its normal working process is as shown in Fig. 8.5.6. Shown at upper left in Fig. 8.5.8 is the shop where the normal work may be carried out near the center, except the replacement work of wheels to be performed by use of the wheel anand axle press machine.

iii) Traction motor and auxiliary motor

Traction motors will undergo inspection and repair at the motor shop. The flow chart of normal working process is as shown in Fig. 8.5.7. However, in the event of insulation failure with the motor, it should require repair work on a large scale, for which vacuum impregnating device and balancing tester must be used at the workshop after set in place. Auxiliary motors will also be inspected and repaired at the motor shop by use of the equipment of almost same kinds as used for inspection and repair of traction motors.

(c) Future problems

All as aforementioned are the method and equipment items of inspection and repair after study on major components of railcars. However, further study is required to a depth of details. Furthermore, extensive study on workshop equipment to be required for inspection and repair should naturally encompass all other car types such as diesel cars and passenger cars than electric railcars. Prompt action must be taken to make a broad scope of study covering the whole of the Manggarai Workshop.

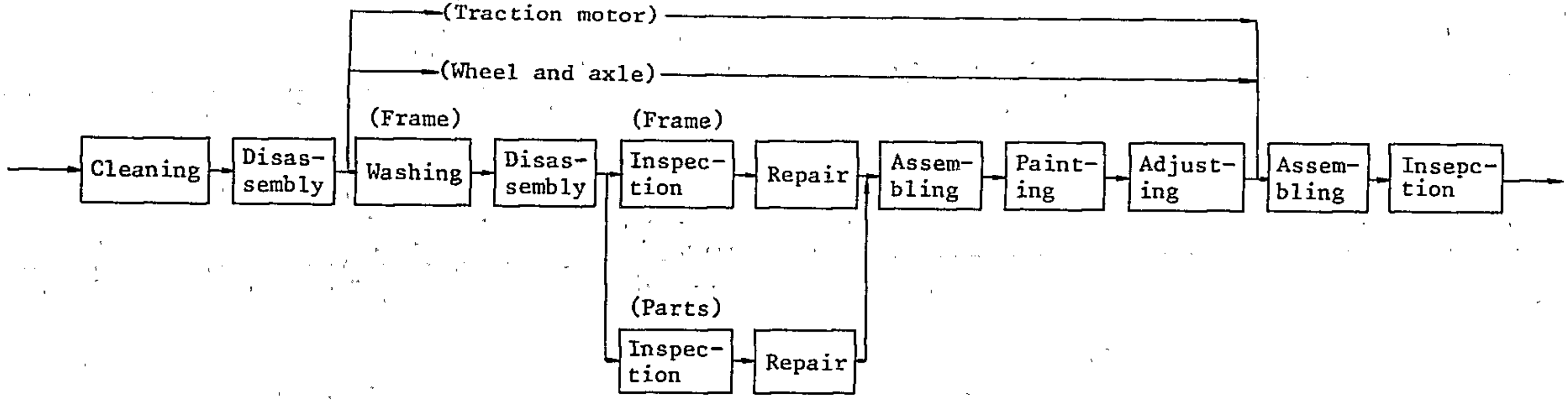


Fig. 8.5.5 Bogie Inspection Flow Chart

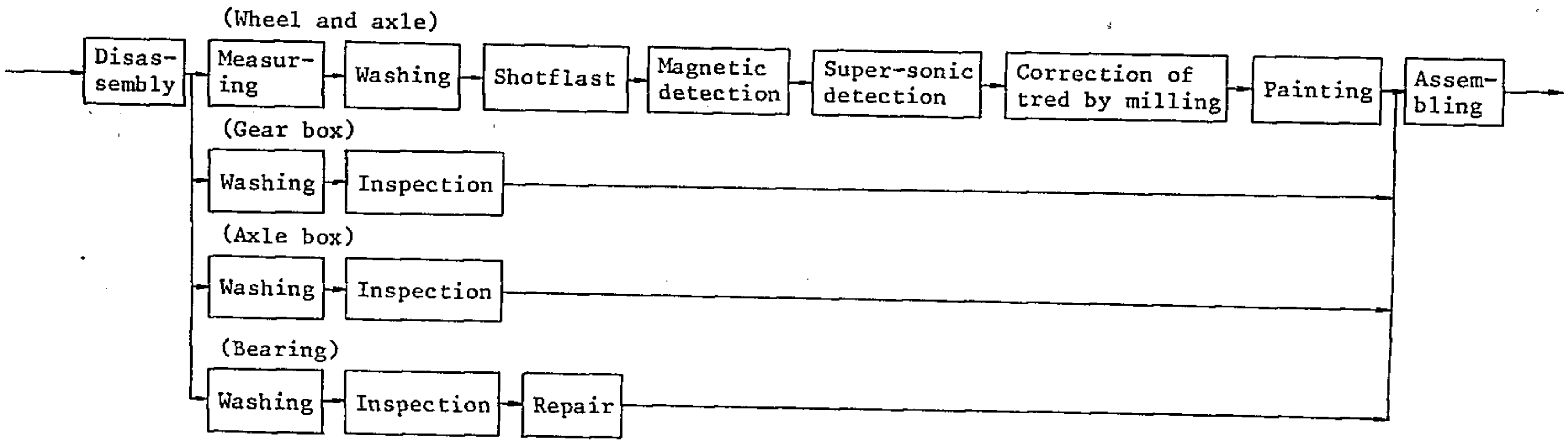


Fig. 8.5.6 Wheel and Axle Inspection Flow Chart

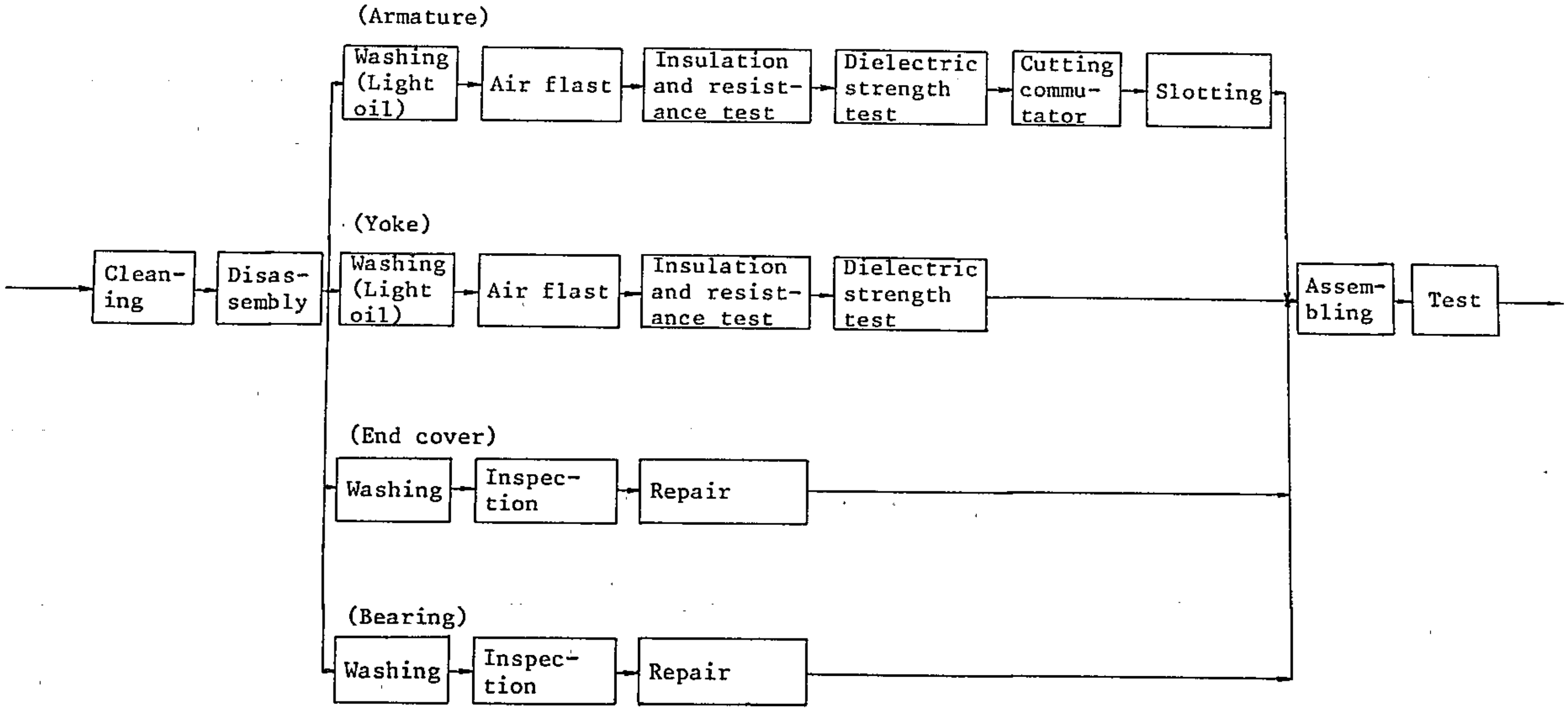
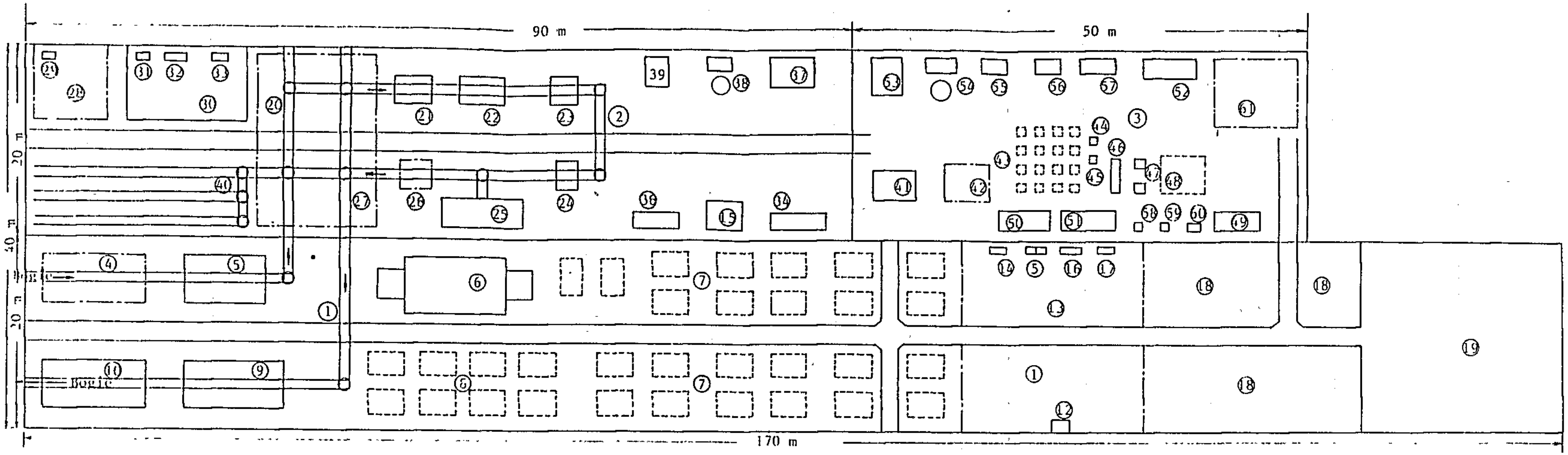


Fig. 8.5.7 Traction Motor Inspection Flow Chart



No.	Description	No.	Description	No.	Descripion
①	Bogie shop	㉑	Wheel and axle washing facilities	㊶	Motor cleaning position
②	Wheel and axle shop	㉒	Soft blast	㊷	Motor disassembly position
③	Motor ship	㉓	Magnetic flaw detecting facilities	㊸	Motor inspection and repairing position
④	Cleaning position	㉔	Ultrasonic flaw detecting facilities	㊹	Insulation and resistance measuring instrument
⑤	Truck disassembly position	㉕	Wheel lathe	㊺	Withstand voltage tester
⑥	Truck frame washing facilities	㉖	Wheel axle painting position	㊻	Armature lathe
⑦	Truck frame repairing position	㉗	Axle for assembling position	㊼	Armature slotting position
⑧	Truck frame printing position	㉘	Axle box inspection and repairing position	㊽	Motor assembling position
⑨	Truck testing position	㉙	Electric welder	㊾	Traction motor testing facilities
⑩	Truck testing position	㉚	Bearing inspection and repairing position	㊿	End cover inspection and repairing position
⑪	Truck frame heavy repair work position	㉛	Bearing washing position	51	End cover inspection and repairing position
⑫	Electric welder	㉜	Inspection table	52	Auxiliary motor testing facilities
⑬	Parts inspection and repairing position	㉝	Magnetic flaw detecting facilities	53	Drying facilities
⑭	Magnetic flaw detecting facilities	㉞	Wheel center lathe	54	Vacume impregnating device
⑮	Electric and gas welder	㉟	Vertical type turret lathe	55	Bind wire winder
⑯	Lathe	㊱	Wheel and axle press	56	TIG Welder
⑰	Hydraulic press	㊲	Tire boring machine	57	Balancing tester
⑱	Truck frame storage position	㊳	Tire heater	58	Tanô measuring instrument
⑲	Bogie storage position	㊴	Tire tightener	59	Layer short circuit test device
⑳	Axle box disassembly position	㊵	Wheel and axle storage position	60	Voltage drop tester for commutator segment
				61	Motor storage position

Fig. 8.5.8 Arrangement of Major Components at Bogie Shop, Wheel and Axle Shop and Motor Shop

8.6 City Terminal

8.6.1 Main Functions as City Terminal

It would be most convenient for air passengers who will utilize the airport access railway, if they can be served with check-in for air flight and other necessary informaiton services as they normally have at the airport terminal building. If this can be arranged, some people will probably utilize this railway station to meet or see of those air travelers and will require information service for their own purpose.

There are to be considered three different phases of such passenger services as classified hereunder:

(1) To provide various information services.

(2) To consign passengers' baggages besides such information services as mentioned above.

(3) To provide information services, consign baggages and check-in the flight for air passengers.

To consign baggages, extra facilities for baggage handling and conveyor belt would be required, together with management works of check and control of all those baggages to ensure their smooth transportation. In particular, in the worst case of such troubles as wrong or delayed delivery, measures to be taken would naturally be complicated and troublesome on any occasions.

Because of this, there are very few instances with exception of Victoria Station in England even abroad where the services for air passengers at the city station terminal handle consignment of baggages and check-in for flight embarkation.

All those things considered, it is advisable to limit the scope of service at the city terminal solely to the information service only.

Another important function of city terminal is the feeder mode service, so it needs to be equipped with bus terminal taxi berth and parking area.

8.6.2 Information Service

The information service may be classified into flight passenger service and train passenger service as follows:

(1) Flight information

Guide information as to earlier or delayed arrival or cancelation of flight and information as to booking for seat reservation.

(2) Train information

Guide information as to flight time schedule and time of arrival/ departure of connecting trains, together with guide for track number of platform for incoming or outgoing trains and delay of trains behind time schedule.

(3) Other service

Guide to check-in counter and boarding gate at the airport terminal building.

8.6.3 Other Recommended Functions of City Terminal

Following facilities for information and business services may be required to comply with passengers' demands at a city terminal:

- Domestic tour guide
- Hotel reservation
- Rental car service
- Travel agent office
- Airline service office
- Duty-free shop

8.6.4 Siting for City Terminal

The site should be situated at the city center where the largest number of passengers are expected, preferrably to be equipped with the feeder mode service such as the parking area.

For example, Gambir Station may be suitable as this typical pattern of a city terminal station.

CHAPTER 9 EDUCATION AND TRAINING

CHAPTER 9 EDUCATION AND TRAINING

To start the operation of the new railway for Jakarta International Airport Chengkareng, a group of new operators, conductors, station personnel (mainly for the new stations), maintenance personnel for facilities such as rolling stock, track, structures, buildings, electrification, signal and telecommunication facilities (mainly for the new facilities) are required, and they must be recruited and trained prior to the operation start.

This project is positioned as a part of the JABOTABEK Master Plan, and the schedule of the personnel recruitment and education and training are established in the Master Plan (JICA, March, 1981).

The schedule of this project calls for completion of the construction six months ahead of the operation start to allow practicing of the operation by the personnel for six months. Accordingly, the main portion of the personnel must have been completed the training by the time the operation practicing starts. It is desirable that the core personnel of the new railway system attend the actual railway operation by working on existing or the new organizations and master the operation skill for about half a year before the training of all personnel.

Since the training period concurs with the height of the new railway construction, it is very important and meaningful to have the maintenance personnel for facilities participate in the construction for the purpose of their becoming acquainted with handling of the equipment that they have to maintain and control in the actual operation. Since no equipment is used for train run during the construction period, the trainees can freely touch the equipment and this increases the value of the equipment as the training materials. In the case of the maintenance personnel for facilities related to electricity, it is recommendable plan for the training to have them experience on everything related to the electrification, signalling and telecommunication, so that the aptitude of individual trainees can be judged for the job to be assigned in the actual operation.

Since the technical contents of this projects are not substantially different from those of other railway sections of the JABOTABEK area, practice in existing railway sections is extremely effective and important in the training.

The responsible organizations for maintenance of the track and electrification, signalling and telecommunication facilities must be established six months ahead of the training start, with the core members being assigned to the pertinent positions, so that they can be developed to the extent of being able to receive the facilities with confidence. Such confidence can only be had by them through attendance to the tests and adjustment of the equipment that has been installed or through conducting these tests and adjustment themselves.

The period of operation practice is the period in which all related personnel actually work and handle the pertinent equipment in the same situation as they would face once the operation is started. On the work related to maintenance, the subjects of managing initial troubles, establishing maintenance periods and review of recovery systems from accidents are very important.

(The contents of "The Study on Electrification Project of Main Railway Lines in Java in the Republic of Indonesia (Master Plan)-JICA, March, 1983" may be used for reference on the training of the staff.)

Table 9.1.1 shows an outline of the training schedule.
Table 9.1.2 shows an outline of each curriculum.

Table 9.1.1 Training Schedule Outline

Job type	No. of personnel necessary at operation start	6 month	6 month	6 month	6 month	Remarks
		Construction	New organization start ▽	Operation practice start ▽	Operation practice	Operation start ▽
Driver	20		Training (Core personnel)	Attending actual operation / Training	Operation practice	
Conductor	35		Training (Core personnel)	Attending actual operation / Training	Operation practice	
Station personnel	120		Training (Core personnel)	Attending actual operation / Training	Operation practice	For the new stations
Rolling stock maintenance	25		Training	Attending actual operation / Training	Operation practice	
Track maintenance	30	Training (I) / Working on the installation (Core personnel)	Training (II)	Preventitive maintenance management	Operation practice	For the new facilities
Structure (building) maintenance	10					For the new facilities
Electrification facilities maintenance	35		Training (I) / Working on the installation (Core personnel)	Training (II) / Training	Operation practice	For the new facilities
Signal/telecommunication facilities maintenance	35				Operation practice	For the new facilities

Table 9.1.2 Training Curriculum Outline for Each Job Type

Operator

- Railway general
- Operation regulations
- Operation theory
- Rolling stock
- Rolling stock inspection & maintenance
- Signalling and safety device
- Railway electricity outline
- Track outline
- Safety of work
- Counteractions on accidents
- Practice

Conductor

- Railway general
- Operation regulations
- Signalling and safety device
- Railway rolling stock outline
- Operation laws & regulations
- Passenger transportation regulations
- Traffic geography
- Service for passengers
- Traffic receipt management regulations
- Safety of work
- Counteractions on accidents
- Practice

Station personnel

- Railway general
- Operation regulations
- Passenger transportation regulations
- Traffic geography
- Service for passengers
- Traffic receipt management regulations
- Operation outline
- Operation laws & regulations
- Signal and safety device
- Signalling system principle
- Interlocking device
- Safety of work
- Practice

Rolling stock maintenance

- Railway general
- Rolling stock inspection & maintenance
- Rolling stock materials
- Fabrication methods
- Abrasion reduction methods
- Railway electricity outline
- Drawing
- Safety of work
- Accounting and purchasing
- Practice

Track maintenance

- Railway general
- Track
- Track inspection
- Track maintenance equipment
- Safety management
- Accident prevention
- Disaster prevention
- Statistics
- Surveying
- Related laws and regulations
- Railway electricity outline
- Operation electricity outline
- Railway rolling stock outline
- Practice

Structure maintenance

- Railway general
- Structural mechanics
- Materials & soil
- Structure design
- Structure construction
- Structure inspection
- Disaster prevention
- Safety management
- Counteractions on accidents
- Surveying
- Related laws and regulations
- Practice

Building maintenance

- Railway general
- Structural mechanics
- Building design
- Building construction
- Building equipment
- Building laws & regulations
- Safety management
- Counteractions on accidents
- Surveying
- Related laws and regulations
- Practice

Electricity maintenance

- Railway general
- Electrification facilities
- Illumination and electricity power facilities
- Substation facilities
- Related laws & regulations
- Signalling system general
- Telecommunication general
- Rolling stock general
- Practice
- Safety of work

Signalling system maintenance

- Railway general
- Signalling system detailed
- Related laws & regulations
- Maintenance outline
- Telecommunication outline
- Substation outline
- Operation outline
- Rolling stock outline
- Track maintenance outline
- Safety of work
- Practice

Telecommunication maintenance

- Railway general
- Telecommunication detailed explanation
- Related laws & regulations
- Maintenance outline
- Signal outline
- Substation outline
- Safety of work
- Practice

CHAPTER 10 INVESTMENT SCALE AND WORK SCHEDULE

CHAPTER 10 INVESTMENT SCALE AND WORK SCHEDULE

10.1 Premises for Construction Cost Calculation

(1) Construction costs are calculated on the basis of labor cost, equipment cost, material cost and other necessary expenses.

- Costs are calculated on the assumed basis of international tendering for contracts.
- Each unit cost is based on the price level as of September, 1982, but not reflecting any price escalation.
- Costs for equipment and materials are calculated on such assumption that those imported items could be treated as 'duty-free'.
- Construction costs are divided largely into the portions of foreign currency and domestic currency.

(2) Both foreign and domestic currency are categorized on the following basis.

Foreign currency portion should include:

- Imported equipment and materials
- Foreign currency portion for procurement of specific items out of all equipment and materials locally available in Indonesia.

Domestic currency portion should include:

- Domestic currency portion for procurement of equipment and materials locally available in Indonesia
- Wages payable to local workers
- Tax payments
- Expenses for local contractors

(3) Labor cost, material cost and equipment price are estimated from past marketing record data in both Indonesian and Japan.

Major items of labor unit costs in Indonesia are as shown in Table 10.1.1.

Major items of materials unit prices in Indonesia are as shown in Table 10.1.2.

Table 10.1.1 Labor Unit Prices

September 1982

Type of Labor	Unit	Wage (Rp.)	
		Min.	Max.
Unskilled worker	man/day	1,800	2,100
Skilled worker	"	2,300	2,800
Electrician	"	2,500	3,000
Carpenter	"	3,000	3,500
Superintendent	"	5,000	6,500
Mason	"	2,500	3,000
Steel worker	"	2,500	3,000
Painter	"	2,300	2,800
Blacksmith	"	3,000	3,500

1 day = 7 hours

Data: Daftar Harga Satuan Bahan Bangunan DKI JAKARTA

Table 10.1.2 Material Cost for Construction

September 1982

Principal materials	Unit	Material cost Domestic supply	Remarks
1. Sand	Rp./m^3	9,000	For concrete, on site in Jkt.
2. Gravel	Rp./m^3	13,000	Crushing stone (20 mm) for concrete, on site in Jkt.
3. Cement	Rp./ton	53,750	In bag (40 kg/bag), on site in Jkt.
4. Ready mixed concrete	Rp./m^3	51,500	K225 (=Fc186) cement contents 320 kg, on site in Jkt.
5. Timber (hard wood)	Rp./m^3	160,000	Kamper timber, on site in Jkt.
Timber (soft wood)	Rp./ton	90,000	Borneo timber, on site in Jkt.
6. Steel	Rp./ton	H.I. 375,000 I.I. 450,000 D-bar 280,000 R-bar 310,000	L-50×50×6 L=6m on site in Jkt.
7. Gasoline	Rp./lit	240	
8. Heavy oil	Rp./lit	60	
9. Light heavy oil	Rp./lit	86	

Data: Market Price in Jakarta

(4) Land acquisition cost and compensation cost for house removal are estimated by reference to the recorded data available from DKI Jakarta.

(5) Construction supervision cost is estimated at 5 percent of total construction cost for the civil work and 10 percent for the electrical installation work.

(6) Contingency cost for civil work structures is estimated at 15 percent of a total of construction cost, land acquisition cost and compensation for house removal while contingency cost for electrical installation is estimated at 5 percent of construction cost.

(7) The exchange rate for foreign currency is set at Rp 670 = US$1.00 = ¥270.

10.2 Scale of Investment

- The scale of investment is calculated on Route A and Route C.

- The sum of initial investment for the Route A including the rolling stock cost for single-track construction is estimated at 67.6 billion Rupiah. The sum of initial investment for the Route C including the improvement of Tangerang Line amounts to a total of 70.6 billion Rupiah. though it is estimated at 56.5 billion Rupiah as initial investment including rolling stock cost for single-track construction on Route C.

Table 10.2.1 Investment Scale - Summary Table

Million Rp

		Stage	Phase 1		Phase 2	Total
		Track	Single track		Double track	
Route A	Construction cost	Foreign currency	24,674		13,652	38,326
		Domestic currency	35,208		14,513	49,721
		Sub-total	59,882		28,165	88,047
	Rolling stock stock cost	(No. of rolling stock)	(22)	(21)	(43)	(86)
		Foreign currency	7,465	7,125	14,590	29,180
		Domestic currency	302	288	590	1,180
		Sub-total	7,767	7,413	15,180	30,360
		Total	67,649	7,413	43,345	118,407
Route C	Construction cost	Foreign currency	20,582		6,922	27,504
		Domestic currency	28,133		7,415	35,548
		Sub-total	48,715		14,337	63,052
	Rolling stock cost	(No. of rolling stock)	(22)	(21)	(27)	(70)
		Foreign currency	7,465	7,125	9,161	23,751
		Domestic currency	302	288	370	960
		Sub-total	7,767	7,413	9,531	24,711
		Total	56,482	7,413	23,868	87,763

Table 10.2.2 Investment Scale - Construction Cost

Million Rp

	Foreign currency	Domestic currency	Total
Route A Single track	24,674	35,209	59,882
Route A Double track	13,652	14,513	28,165
Total	38,326	49,721	88,047
Route C Single track	20,582	28,133	48,715
Route C Double track	6,922	7,415	14,337
Total	27,504	35,548	63,052
Tangerang Line	6,741	7,328	14,069

Table 10.2.3 Investment Scale - Route A (Single Track)

Million Rp

Work classification	Unit	Quantity	Unit price 10^3Rp	Investment sum		
				Foreign currency	Domestic currency	Total
1. Civil structure & track construction						
Roadbed	m	11,500	347	1,977	2,014	3,991
Viaduct	m	4,200	2,743	4,963	6,559	11,521
Track	m	15,700	330	2,907	2,274	5,181
Sub-total				9,846	10,847	20,693
2. Electrification						
Substation	set	1	2,477,000	2,113	364	2,477
Catenary	km	23.1	148,000	2,175	1,244	3,419
Power & lighting	set	1	781,000	456	325	781
Sub-total				4,744	1,933	6,677
3. Signal & telecommunication						
Crossing safeguard	place	15	32,730	389	102	491
Signalling equipment	set	1	1,168,000	987	181	1,168
Signalling cable	km	79.8	19,490	1,126	429	1,555
Track circuit	km	21.2	20,600	350	87	437
Telecommunication equipment	set	1	600,000	478	122	600
Telecommunication cable	km	37.5	19,710	50	689	739
Sub-total				3,380	1,611	4,991
4. Station facilities						
Station	place	2	3,478,000	3,403	3,553	6,956
Signal station	place	3	843,000	1,091	1,438	2,529
Sub-total				4,494	4,991	9,485
5. Airport station						
Earthwork	m^3	51,000	47.6	830	1,598	2,428
Bridge	place	1	147,000	30	117	147
Platform	m^2	3,680	72	74	191	265
Building	m^2	4,040	413	814	855	1,669
Track	m	2,800	330	462	462	924
Sub-total				2,210	3,223	5,433
6. Compensation for land and house	m^2	346,000	36.42	0	12,603	12,603
Sub-total				0	12,603	12,603
Total				24,674	35,208	59,882

Table 10.2.4 Investment Scale - Route A Additional Cost for Double Track

Million Rp

Work classification	Unit	Quantity	Unit price 10^3 Rp	Investment sum		
				Foreign currency	Domestic currency	Total
1. Civil structure & track construction						
Roadbed	m	11,500	116	714	620	1,334
Viaduct	m	4,200	2,264	4,099	5,410	9,509
Track	m	15,700	330	2,907	2,274	5,181
Sub-total				7,720	8,304	16,024
2. Electrification						
Substation	set	1	960,000	806	154	960
Catenary	km	19.8	155,200	1,934	1,139	3,073
Power & lighting	set	1	186,000	121	65	186
Sub-total				2,861	1,357	4,218
3. Signal & telecommunication						
Crossing safeguard	set	1	40,000	25	15	40
Signalling equipment	set	1	734,000	570	164	734
Signalling cable	set	1	498,000	37	461	498
Track circuit	km	19	19,580	320	52	372
Telecommunication facilities and cable	set	1	82,000	5	77	82
Sub-total				957	769	1,726
4. Station facilities						
Station	place	2	914,000	938	890	1,828
Signal station	place	3	101,700	171	134	305
Sub-total				1,109	1,024	2,133
5. Airport station						
Earthwork	m^3	8,000	72.9	179	404	583
Bridge						
Platform	m^2	2,840	82	67	166	233
Building	m^2	3,000	288	416	448	864
Track	m	2,080	330	342	344	686
Sub-total				1,004	1,362	2,366
6. Temporary road for construction	m^2	57,000	29.8	0	1,698	1,698
Sub-total				0	1,698	1,698
Total				13,652	14,513	28,165

Table 10.2.5 Investment Scale - Route C (Single Track)

Million Rp

Work classification	Unit	Quantity	Unit price 10^3 Rp	Investment sum: Foreign currency	Investment sum: Domestic currency	Investment sum: Total
1. Civil structure & track construction						
Roadbed	m	8,200	280	1,217	1,079	2,296
Viaduct	m	6,200	2,726	7,301	9,600	16,901
Track	m	14,400	330	2,659	2,093	4,752
Sub-total				11,177	12,772	23,949
2. Electrification						
Substation	set	1	1,654,000	1,411	243	1,654
Catenary	km	16.3	149,700	1,538	902	2,440
Power & lighting	set	1	447,000	268	179	447
Sub-total				3,217	1,324	4,541
3. Signal & telecommunication						
Crossing safeguard	place	9	36,000	255	69	324
Signalling equipment	set	1	1,176,000	970	206	1,176
Signalling cable	km	65.7	13,290	618	255	873
Track circuit	km	19.2	19,270	293	77	370
Telecommunication equipment	set	1	618,000	496	122	618
Telecommunication cable	km	32.2	15,160	32	456	488
Sub-total				2,664	1,185	3,849
4. Station facilities						
Station	place	1	1,406,000	818	588	1,406
Signal station	place	2	499,500	496	503	999
Sub-total				1,314	1,091	2,405
5. Airport station						
Earthwork	m^3	51,000	47.6	830	1,598	2,428
Bridge	place	1	147,000	30	117	147
Platform	m^2	3,680	72	74	191	265
Building	m^2	4,040	413	814	855	1,669
Track	m	2,800	330	462	462	924
Sub-total				2,210	3,223	5,433
6. Compensation for land and house	m^2			0	8,538	8,538
Sub-total				0	8,538	8,538
Total				20,582	28,133	48,715

Table 10.2.6 Investment Scale - Route C Additional Cost for Double Track

Million Rp

Work classification	Unit	Quantity	Unit price 10^3 Rp	Investment sum		
				Foreign currency	Domestic currency	Total
1. Civil structure & track construction						
Roadbed	m	6,500	112	402	326	728
Viaduct	m	1,500	2,386	1,560	2,019	3,579
Track	m	8,000	330	1,476	1,164	2,640
Sub-total				3,438	3,509	6,947
2. Electrification						
Substation	set	1	483,000	409	74	483
Catenary	km	14.6	154,900	1,431	830	2,261
Power & lighting	set	1	104,000	62	42	104
Sub-total				1,902	946	2,848
3. Signal & telecommunication						
Crossing safeguard	set	1	24,800	15	10	25
Signalling equipment	set	1	347,000	268	79	347
Signalling cable	set	1	233,000	17	216	233
Track circuit	km	9.9	19,300	164	27	191
Telecommunication facilities and cable	set	1	42,000	2	40	42
Sub-total				466	372	838
4. Station facilities						
Signalling station	place	2	10,300	112	94	206
Sub-total				112	94	206
5. Airport station						
Earthwork	m^3	8,000	72.9	179	404	583
Bridge						
Platform	m^2	2,840	82	67	166	233
Building	m^2	3,000	288	416	448	864
Track	m	2,080	330	342	344	686
Sub-total				1,004	1,362	2,366
6. Temporary road for construction	m^2	38,000	29.8	0	1,132	1,132
Sub-total					1,132	1,132
Total				6,922	7,415	14,337

Table 10.2.7 Investment Sum - Improvement of Tangerang Line

Million Rp

Work classification	Unit	Quantity	Unit price 10^3 Rp	Investment sum		
				Foreign currency	Domestic currency	Total
1. Civil structure & track construction						
Roadbed, bridge	m	5,770	796	1,751	2,842	4,593
Track		11,540	330	2,130	1,678	3,808
Sub-total				3,881	4,520	8,401
2. Electrification						
Substation	set	1	714,000	627	87	714
Catenary	km	11.5	148,800	1,124	590	1,714
Power & lighting	set	1	310,000	82	228	310
Sub-total				1,833	905	2,738
3. Signal & telecommunication						
Crossing safeguard	set	1	151,000	117	34	151
Signalling equipment	"	1	355,000	300	55	355
Signalling cable	"	1	473,000	342	131	473
Track circuit	"	1	132,000	107	25	132
Telecommunication equipment	"	1	181,000	146	35	181
Telecommunication cable	"	1	226,000	15	216	226
Sub-total				1,027	491	1,518
6. Compensation for land and house	m^2	48,000	29.3	0	1,412	1,412
Sub-total				0	1,412	1,412
Total				6,741	7,328	14,069

Table 10.2.8 Investment Stock - Rolling Stock

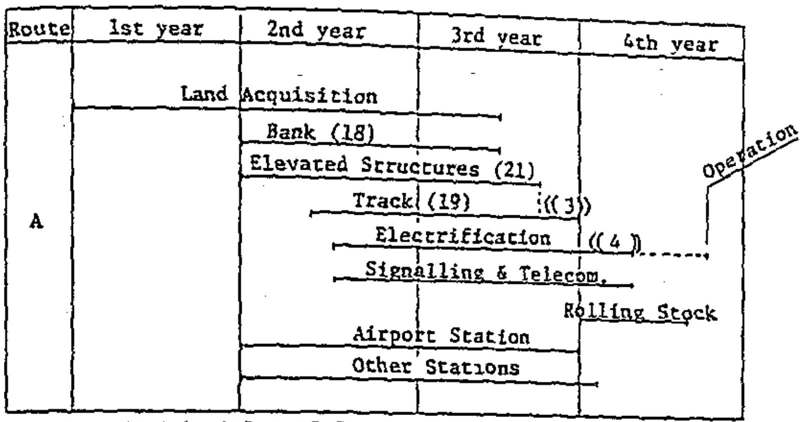
Route	Year	(No. of rolling stock)	Unit price 10^3 Rp	Investment sum (million Rp)		
				Foreign currency	Domestic currency	Total
Route A	1987	22	353,011	7,465	302	7,767
	1996	21	"	7,125	288	7,413
	2006	43	"	14,590	590	15,180
	Total			29,180	1,180	30,360
Route C	1987	22	"	7,465	303	7,768
	1997	21	"	7,125	288	7,413
	2008	27	"	9,161	370	9,531
	Total			23,751	960	24,711

10.3 Work Schedule (Fig. 10.3.1)

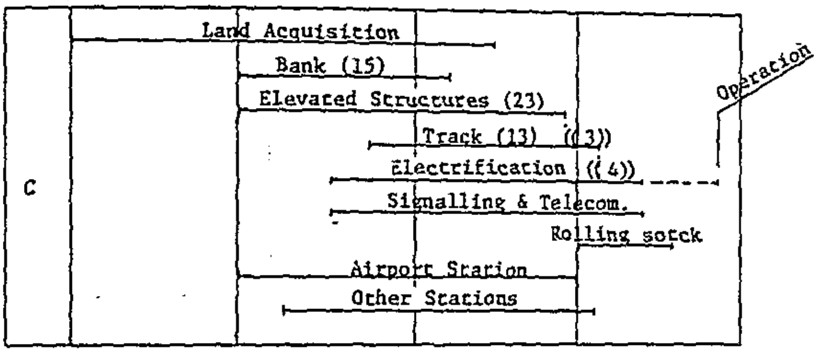
- Construction of the New Airport Access Railway is planned by two different phases. Phase 1 envisages construction on a single-track basis in comply with traffic demand. This work schedule is formulated for construction at a single-track system including acquisition of total land to be required for both Phase 1 and Phase 2. Therefore, the work schedule for Phase 2 does not include any other elements than the construction work.

- Alternative Route C presents two (2) patterns of work schedule. The one is based on such assumption that before scheduled completion of construction for the New Airport Access Railway all the improvement work including doubling of track and electrification of Tangerang Line would have been completed between Duri area and Rawa Buaya station. The other is the work schedule formulated on assumption that those improvement works for Tangerang Line would be executed as a part of construction for the New Airport Access Railway.

Work Schedule of Route A



Work Schedule of Route C



Work Schedule of Route C Included Tangerang Line

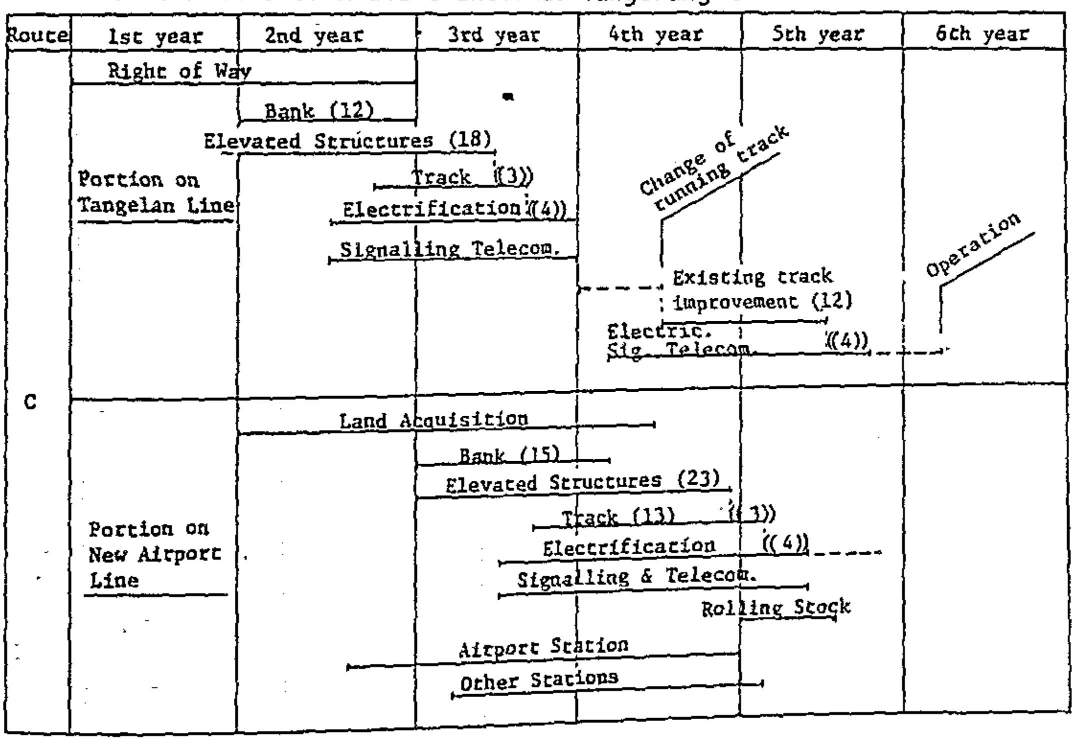


Fig. 10.3.1 Work Schedule