CHAPTER 6 AIRPORT STATION

CHAPTER 6 AIRPORT STATION

6.1 Airport Terminal Planning

According to the master plan of Cengkareng Airport, basic concept on the terminal planning and the airport station is as follows.

6.1.1 Terminal Planning

The layout of the airport is shown in Fig. 6.1.1

The arrangement of terminal buildings is a unit system. The center of the terminal area is the administration area, where the airport office, control tower, and so forth are located. Spaces that permit construction of four passenger terminal building units are provided. Phase I calls for the construction of one unit which handles nine million passengers a year. One unit of the terminal building is semi-circular, and composed of three subunits. Two subunits are for domestic lines and one subunit is for international lines. One subunit has a satellite and passengers embark on aircraft through boarding bridges.

The access road is a two-lane, one-way road of loop form that connects all terminal buildings. Car parks are located in front of each terminal building, and capacity at each location is 2,400 cars.

Although the same type of terminal buildings have been planned for the second and subsequent phases, modification of future buildings is under examination at the present time.

6.1.2 Basic Concept of Airport Station

According to the master plan of the airport, access transportation has been planned with an emphasis on road traffic such as cars and buses. However, when traffic volume increases and roads are saturated with motor vehicles, the only alternative means of transportation will be railway. Railway is used as a means of access transportation for such principal airports in the world as Frankfurt, Charles de Gaulle, Brussels, and Heathrow.

The railway station is located at the center of the terminal area, and bus transportation provide main access services between the station and each terminal building.

6.1.3 Progress of Construction

Construction of Cengkareng Airport commenced in December 1980 and is about 50 percent complete in May 1983.

Earth works have been almost completed by this time in the terminal area. Pile foundations have been completed for the passenger terminal buildings, for the cargo terminal buildings, and for general buildings in the administration area.

Steel works are in progress at the present time. Underground conduits and pipes for drinking water, sewage, fuel, electricity, etc., are in progress.

It is planned that consturction completes by the end of 1984, and the airport will open in April 1985.

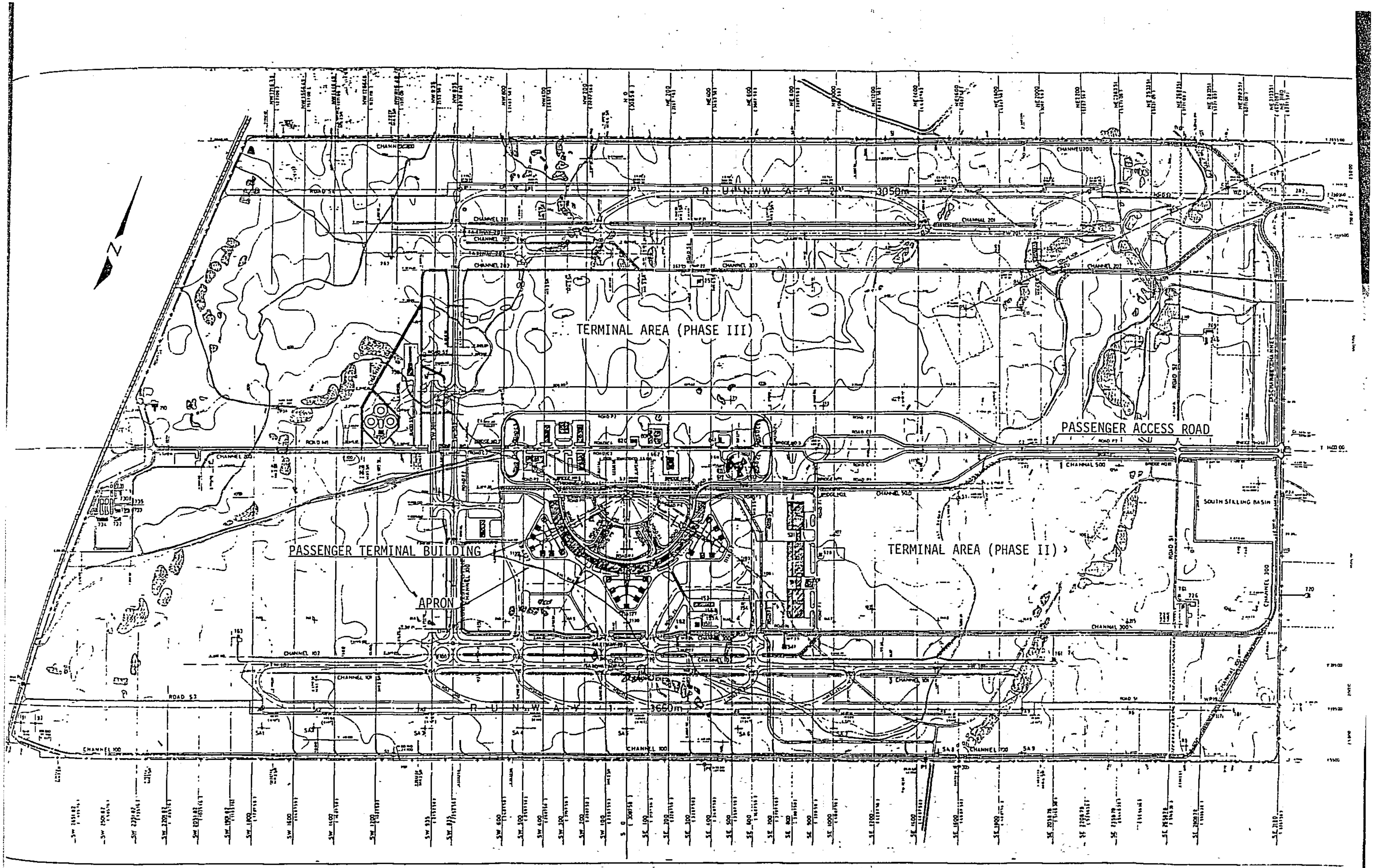


Fig. 6.1.1 Layout Plan of Cengkareng Airport

6.2 Basic Conditions for Location of Station

The following conditions should be taken into consideration in locating a station site in the airport:

(1) Convenience of passengers

It is considered desirable in airport terminal planning that air-passenger walking distances - for example, from car parks to check-in counter, from baggage claim to car parks - are less than 300m. (Airport Terminal Reference Manual, International Air Transport Association) The layout of the terminal buildings, aprons, and car parks have been determined in such a manner that this condition could be satisfied.

It is desirable from the standpoint of convenience of air passengers that planning of the railway station will also satisfy this condition and permit easy movement of passengers between the station and the terminal buildings.

(2) Construction conditions and costs

The master plan of the airport had already been determined and its construction has already commenced. Even if the railway station is selected at a different location from what is indicated in the master plan, it is desirable that the influence over the progress of airport construction work is minimum, and that additional construction cost are minimized.

In the assumed case where railway facilities are constructed in the terminal area or particularly in the case where an elevated railway system is adopted, aesthetic problems may also arise.

6.3 Station Location Alternatives

Five station location alternatives including the original plan are proposed for examination.

Location alternative 1

This is the location planned in the master plan for the airport. The tracks are constructed on the ground. Passengers are transported by buses to terminal buildings. There are two level crossing with roads in the airport, but both of these roads are service roads for a meteorological station and so forth and the traffic volume is extremely small. Therefore, the level crossing causes no problems.

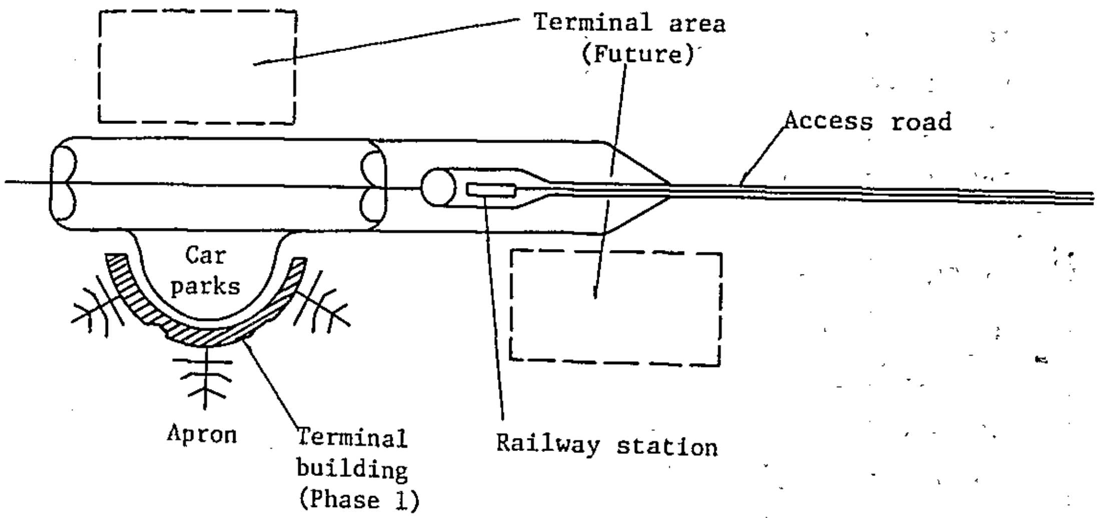


Fig. 6.3.1 Location Alternative 1

Location alternative 2

The railway track in the airport is aligned in loop form along the passenger access road in the terminal area, and stations are provided for each terminal building.

If the track were constructed on the ground, level crossings with the passenger access road would become necessary at the entrances of terminal buildings, interfering with the smooth movement of passengers. Accordingly, an elevated track system has been adopted.

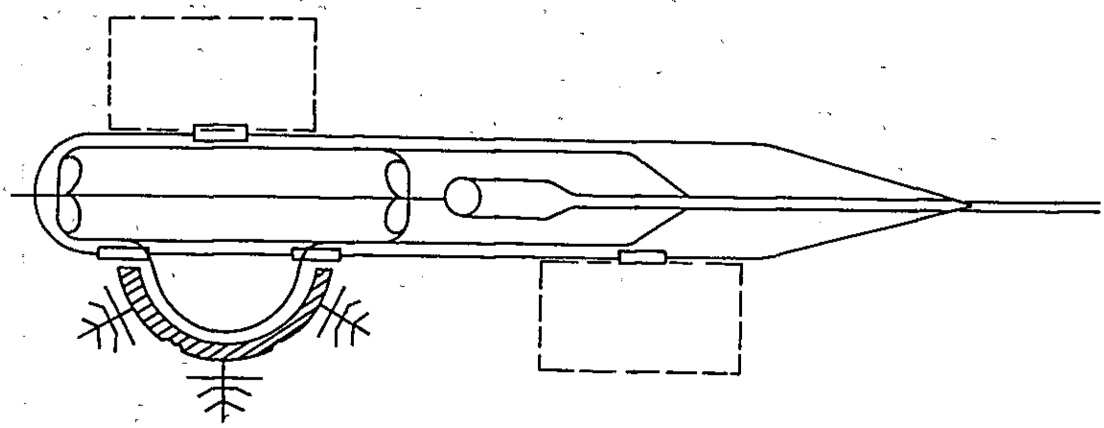


Fig. 6.3.2 Location Alternative 2 and 3

Location alternative 3

The alignment of the railway line is same as in Location Alternative 2, but the tracks and stations are constructed underground. A semiunderground track system may also be considered to reduce the construction cost of a completely underground track system. But the track level can be lowered by only around 1m from ground level due to the presence of underground buried facilities.

Location alternative 4

This plan locates stations as close as possible to check-in lobbies of terminal buildings. Because of restrictions in the minimum curvature radius of railway track, stations are located under the car parks along the looped alignment.

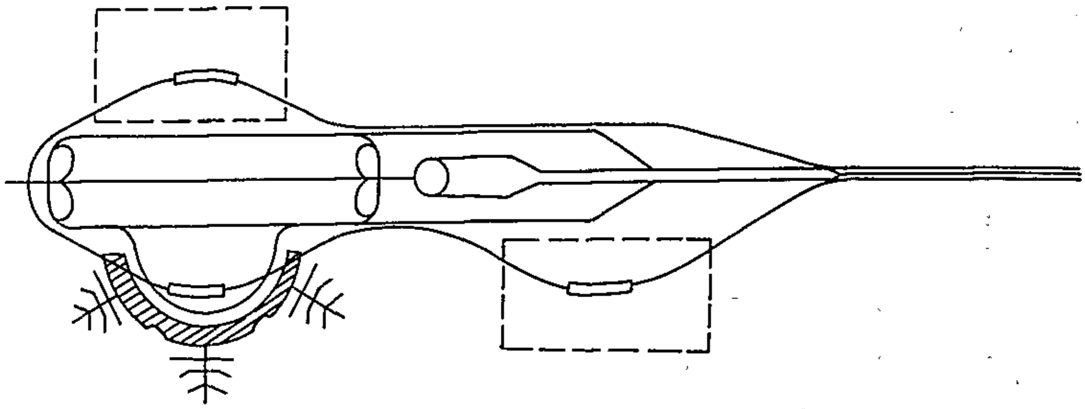


Fig. 6.3.3 Location Alternative 4

Location alternative 5

The track of the master plan is linearly extended to a place near the terminal building of Phase I.

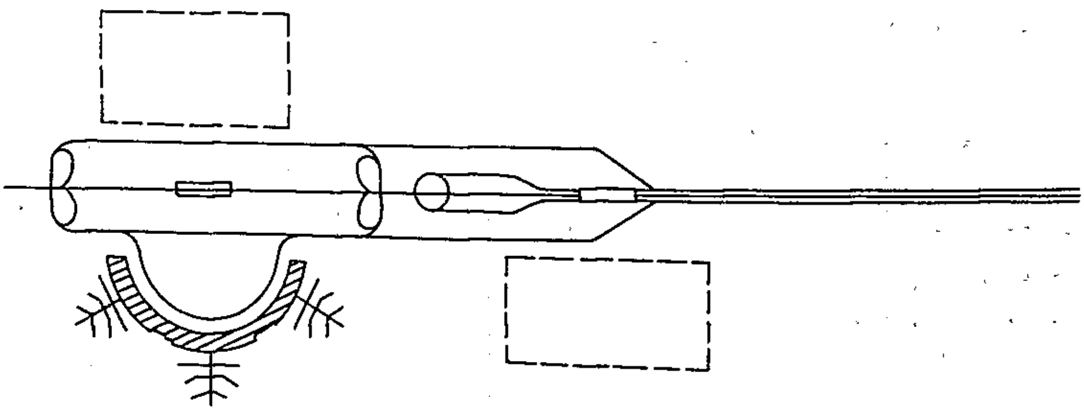


Fig. 6.3.4 Location Alternative 5

6.4 Selection of Recommended Plan

6.4.1 Examination of Location Alternatives

Location alternatives 1 to 5 are examined below on such criteria as passenger convenience, construction difficulties, cost, and so forth.

Phase I construction is in progress in the airport terminal area, and Phases II and III are in the planning stage. Changes in the layout of the terminal area in Phase II and subsequently are under examination and there is a possibility that the layout of terminal buildings, aprons, and car parks will be different from that of Phase I. Because Location alternative 4 could obstruct future modifications of the layout of the terminal area by locating stations under terminal buildings or car parks, it has been judged undesirable and eliminated.

As for Location alternative 5, the location of the station is nearer to the terminal buildings than that of Location alternative 1. However, the maximum distance from the terminal building is 500m and connection by buses is still required. Accordingly, there is almost no merit in extending the track of Location alternative 1. Accordingly, Location alternative 5 is also eliminated. Location alternatives 1, 2, and 3 are compared in detail in the following table. The routes of each alternative are shown in Fig. 6.4.1.

Table 6.4.1 Comparison of Routes

Location alternative	Railway length in airport	Alignment		No. of station	Between station and terminal building			Method of operation	No. of tracks at station	Airport facilities obstructed	Station plaza	Susceptibility to flood damage	Construction cost	Advantages	Disadvantages
		Min. radius	Steeplest gradient		Distance	Means of access	Difference in height								
Location alternative 1	2.1 km	Truck section: linear Station section: 400 m	Almost level	Phase 1 - III: 1	Max. 1.5 km Min. 0.9 km	Buses	-	Single-track: Single-track shuttling Double-track: Double-track shuttling	3 tracks (2 arrival/departure tracks & 1 storage track)	None	Can be provided	Equal to that of roads	9 bil. Rp.	No obstruction to other facilities. Low construction cost. Short construction period.	Requires bus transportation. Level crossing with roads is made at 2 points.
Location alternative 2 (elevated)	7.9 km	210 m	25‰	Phase I: 2 Phase II: 3 Phase III: 4	Max. 0.5 km Min. 0.1 km	Walking or moving walk	About 8 m (escalators are used)	Single track: Single-track shuttling Double-track: Single-track loop	1 track	Green zone	Cannot be provided	safe	45 bil. Rp.	Minor obstruction to other facilities.	Undesirable appearance. Involves maximum walking distance of 500 m. Trainpassing facilities for single-line work will be useless when track is doubled. Provides no space for maintenance facility.
Location alternative 3 (underground)	7.9 km	210 m	25‰	Phase I: 2 Phase II: 3 Phase III: 4	Max. 0.5 km Min. 0.1 km	Walking or moving walk	About 13 m (escalators are used)	Single-track: Single-track shuttling Double track: Single-track loop	1 track	Roads, Green zone	Cannot be provided	Entry of water occurs if the flood level becomes higher than the Fl. on the ground.	100 bil. Rp.	Good appearance.	High construction cost. Long construction period. Maximum walking distance of 500 m. Trainpassing facilities for single-line work will be useless when track is doubled. Provides no space for maintenance facility.

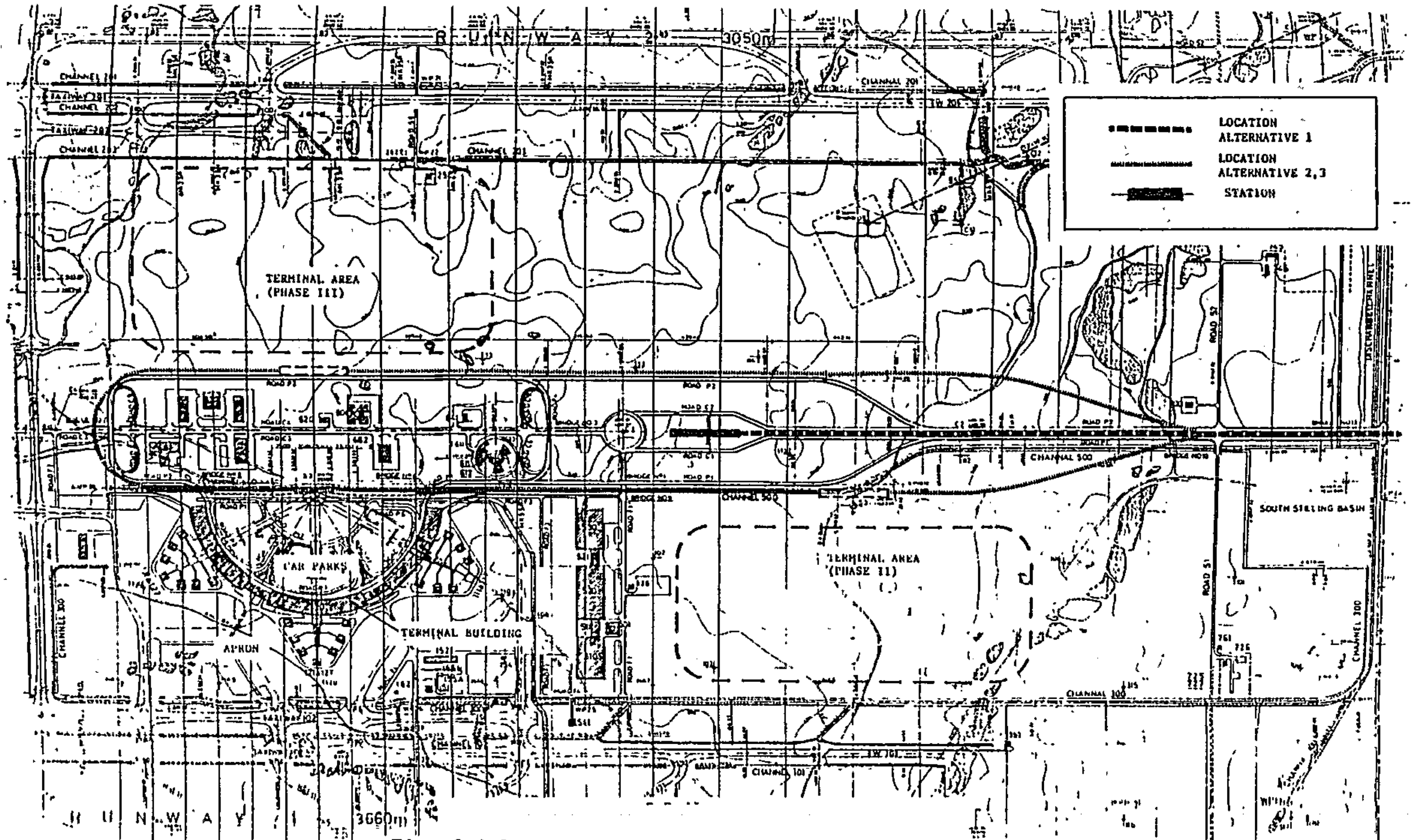


Fig. 6.4.1 Routes of Railway Tracks in the Airport
(Location Alternative 1, 2 and 3)

6.4.2 Compatibility with Airport Terminal Planning

The route of the railway track and location of the station in the airport should be well matched with the airport terminal layout plan.

The airport terminal area is the junction point of two means of aerial and ground transportation, where easy transit should be provided to passengers. The layout of terminal facilities, therefore, should be planned in such a manner that permits full function of each facility.

The railway station is one of the terminal facilities, and the location of the railway station should be determined with due consideration given to terminal buildings and other facilities.

It is a basic concept in the planning of the terminal area of a large airport that the traffic of air passengers is separated from the traffic of employees and air cargo. The layout of the terminal area of this airport has also been planned in accordance with this concept, and traffic flows of motor vehicles are as shown in Fig. 6.4.2.

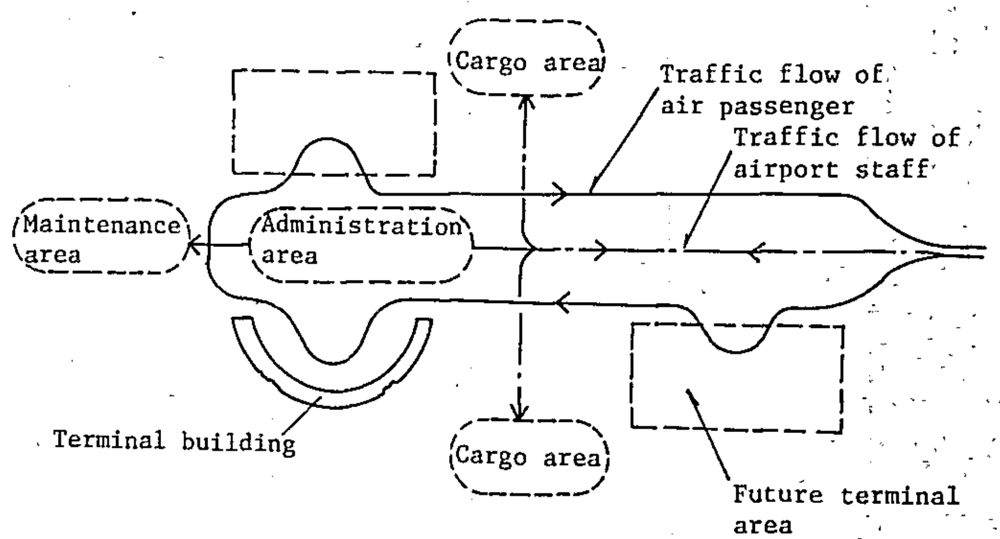


Fig. 6.4.2 Flow of Traffic in Terminal Area

The flow of traffic in the entire terminal area should be considered in determining of the location of the station. In the case of Location Alternative 1, air-passenger traffic is almost entirely separated from staff traffic.

In the case of Location Alternatives 2 and 3, on the other hand, employees who use the railway, take buses to their offices after arrival at stations in terminal buildings. Therefore, employee traffic is congested in roads in front of terminal buildings, and space for buses may be required.

Considering the fact that railway users include both employees and air passengers, even if stations are located near terminal buildings, it is necessary for employees to take buses and convenience for them is not improved. For these reasons, Location Alternative 1 is recommended from the viewpoint of railway-user convenience as a whole.

6.4.3 Result of Selection

The evaluation of alternatives is as shown in Table 6.4.2.

Location Alternative 1 is less difficult to construct than the other two alternatives, and its construction cost is lower, as shown in Table 6.4.1. Furthermore, Location Alternative 1 does not cause any disturbance of the airport construction now in progress.

The elevated structure of Location Alternative 2 is undesirable since it tends to make the international airport less attractive. Location Alternative 3 requires underpinning of the airport terminal building because of its underground structure. Measures for drainage are also required to cope with heavy rain.

Therefore Location Alternative 1 is recommended for the airport station.

Table 6.4.2 Evaluation of Location Alternatives

Location alternative	Air-passenger convenience	Disturbance to airport construction work	Construction cost	Susceptibility to flood damage	Contribution to airport's appearance	Coordination with terminal planning	Evaluation
1	Δ	◎	◎	○	○	◎	Recommended
2	○	×	×	◎	×	×	Not recommended
3	○	×	×	×	◎	×	Not recommended

◎ : Excellent ○ : Good Δ : Fair × : Not good

Since the airport station and terminal buildings are separated in Location Alternative 1, due consideration should be paid to the connection to the terminal building in planning the airport station,

In other words, the station layout must guarantee substantially easy transit from train to bus service. Particularly for air passengers, a layout involving long walking distances and climbing stairs is undesirable.

In other to allow the railway to achieve the utmost efficiency as an airport access railway, due consideration must be given not only to the station facility but also to the traffic system connecting the railway station and terminal building. Namely, there should be a bus service for the convenience of passengers. For example, three direct bus routes should be established for passengers toward the terminal building, each route connected to each building. Other bus routes should also be established to the cargo area and maintenance area respectively for the convenience of airport employees, with increased bus operations at peak commuting times. The bus service, in short, must comply with the passenger demand. It should be noted here that the mean passengers per train arriving at the airport station is about 800 and the number of buses required for their transport is 16 (assuming the capacity of one bus is 50 passengers) on year 2000. It is essential to operate these buses in each route according to the number of passengers.

6.5 Layout of Airport Station

6.5.1 Preconditions for Planning

Planning of the airport station is based on the following conditions:

(1) There should be three tracks in total, two main tracks with platforms and one stabling track. The platform length should be sufficient for eight-car train make-up.

(2) Movement of passengers between train and bus should be easy and efficient. Walking distance of passengers should be as short as possible and vertical movement by staircases, etc., should be minimized.

6.5.2 Layout Alternatives

Layout Alternative 1

This plan provides train platforms and bus platforms adjacent to each other and regulates bus circulation according to the times of departures and arrivals of trains.

Platforms are side platforms used for both boarding and alighting, and bus platforms are provided adjacent to the outside of train platforms.

The moving distance of passengers for exchanging from trains to buses and vice versa is short and vertical movement is not involved.

As the platform to alight from buses varies corresponding to the departure of trains, a system that indicates the platform from which the next train departs is required. As booking offices are necessary at two places, the number of required personnel is large.

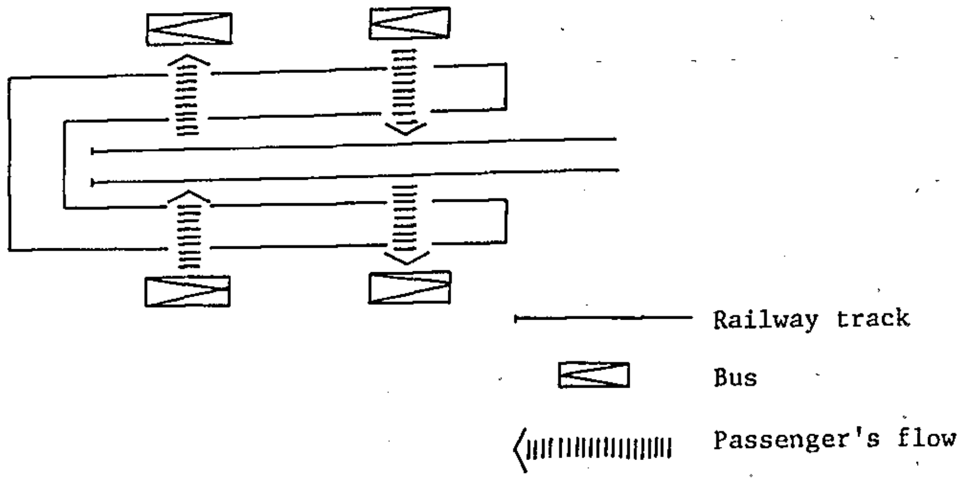


Fig. 6.5.1 Layout Alternative 1

Layout Alternative 2

Each of the platforms is used exclusively for departure or arrival in order to avoid irregularity of bus-alighting platforms.

Two-track, tooth-shaped platforms are provided; the central platform is used as the boarding platform and both outside platforms are used as alighting platforms. Platforms for boarding buses are provided parallel to train-alighting platforms. The bus-alighting platform is located in front of the station main building and passengers board trains from the central platform.

The moving distance for changing from trains to buses is short, the moving distance for changing from buses to trains is long, and mechanical equipment (e.g., moving walk) is required for solving this problem.

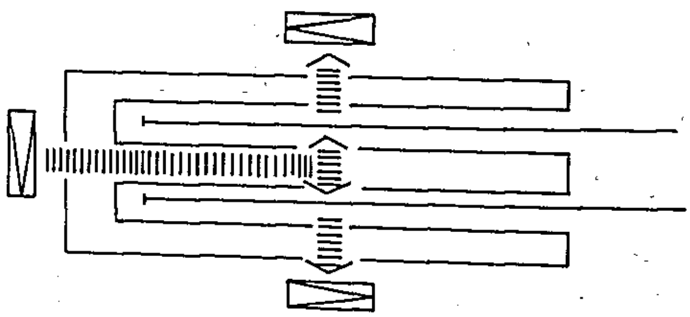


Fig. 6.5.2 Layout Alternative 2

Layout Alternative 3

This plan provides a bus platform inside and train platforms outside, contrary to the layout of Alternatives 1 and 2.

A bus passage is provided between two train platforms and passengers board and alight in this passage. Buses having doors on both sides are used.

The moving distance of passengers is short regardless of the platform of arrival and departure of trains and buses.

However, it is undesirable from a safety viewpoint that passengers must cross a bus passage and that the bus route crosses the railway line at the same level thus disturbing train operations.

The station main building is divided into two sections by the bus passage. In addition, special buses having doors on both sides are required.

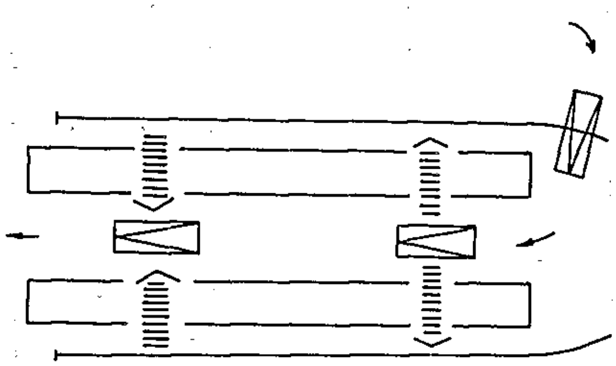


Fig. 6.5.3 Layout Alternative 3

Layout Alternative 4

A bus terminal is provided between the two train platforms. Train platforms are used for both boarding and alighting.

The moving distance of passengers for changing from trains and buses and vice versa is short. It is necessary to coordinate departures and arrivals of buses with those of trains. If the announced departure or arrival platform is changed for some reason, confusion may occur in guiding passengers and buses.

As the booking office and other facilities are divided into two areas, the number of required personnel is large.

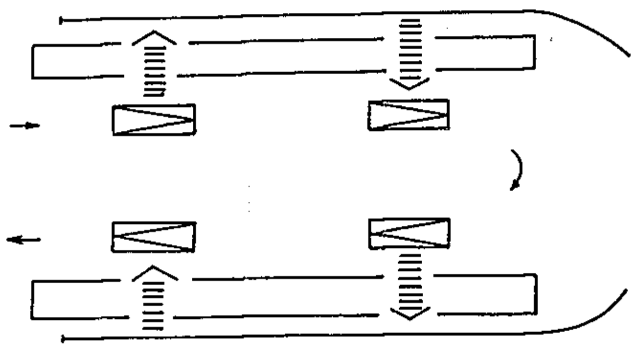


Fig. 6.5.4 Layout Alternative 4

Layout Alternative 5

This plan separates trains and buses with the train platform located on the ground floor and the bus platform located on the second floor.

The train and bus platforms are directly connected by escalators and stair-cases. One common tain platform for two tracks is used for both boarding and alighting.

Although this plan provides the shortest horizontal moving distance of passengers but vertical movement is required. Construction cost is the highest among the Layout alternatives. In addition, maintenance of escalators is required.

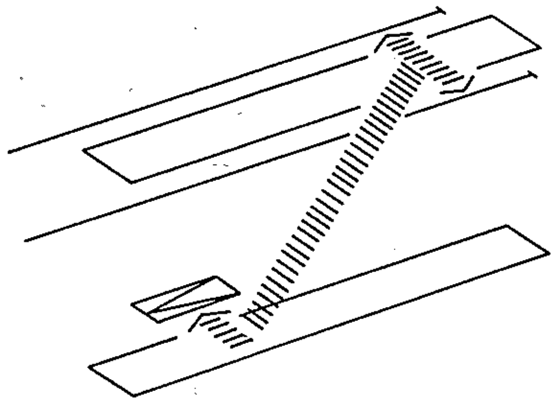


Fig. 6.5.5 Layout Alternative 5

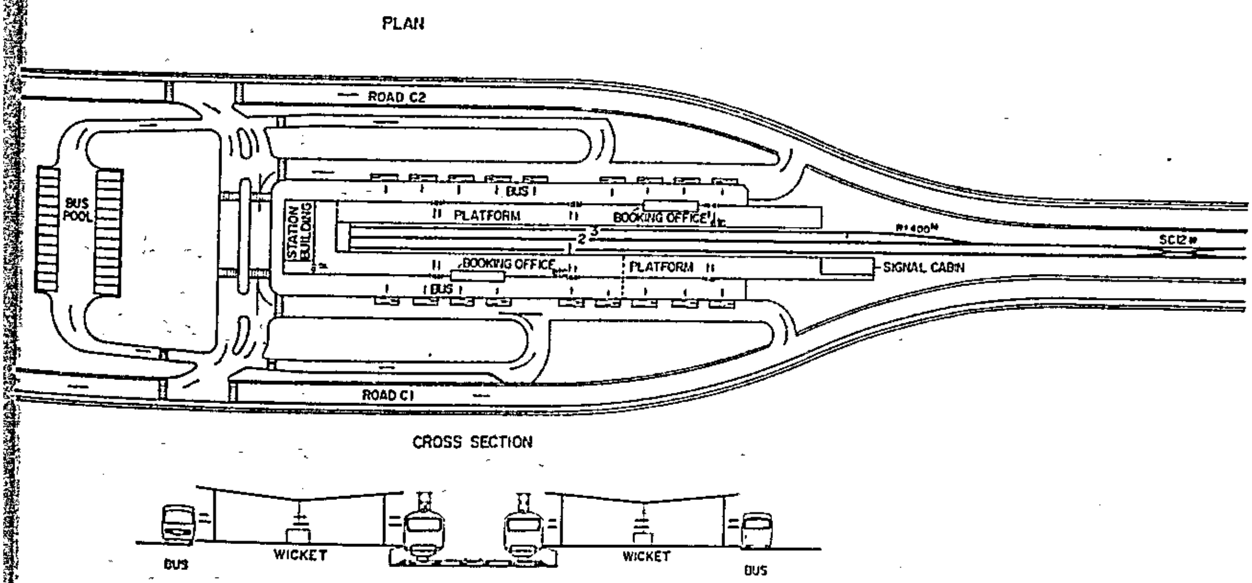


Fig. 6.5.6 Layout Alternative 1

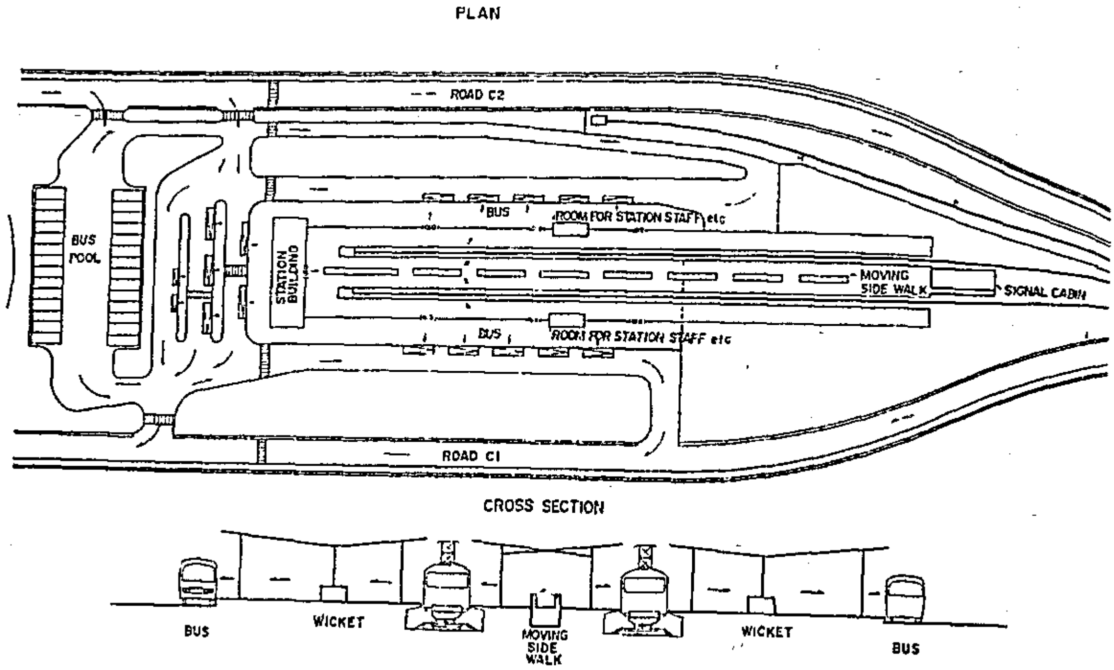


Fig. 6.5.7 Layout Alternative 2

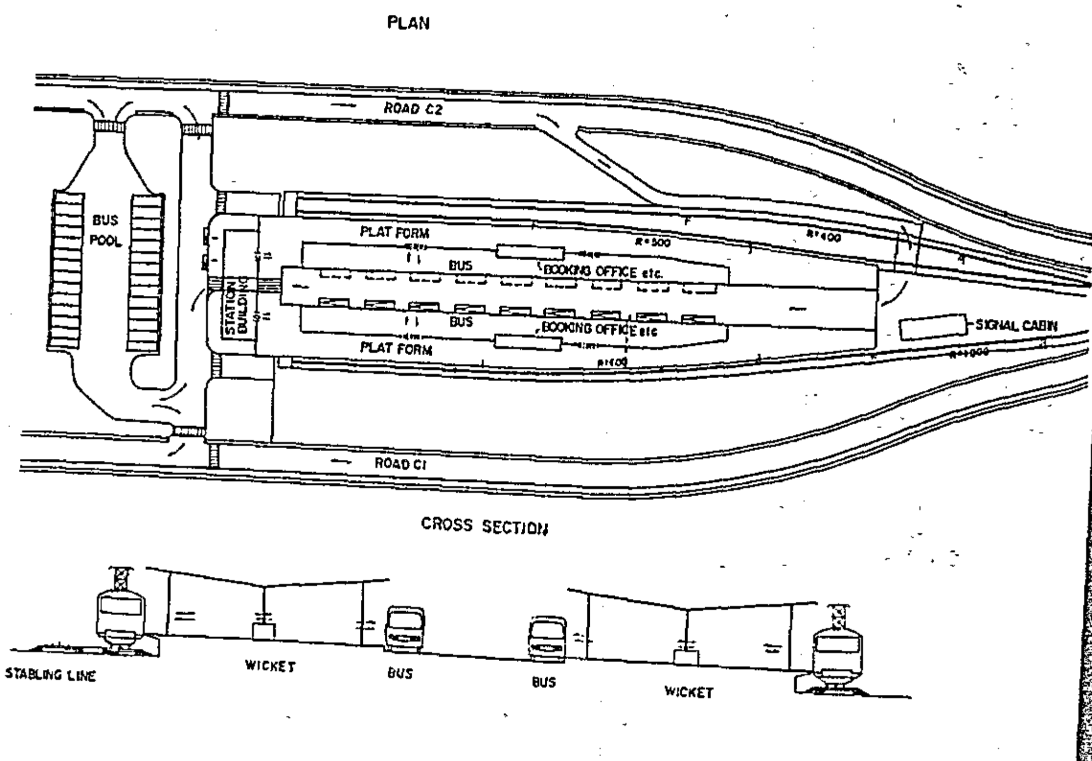


Fig. 6.5.8 Layout Alternative 3

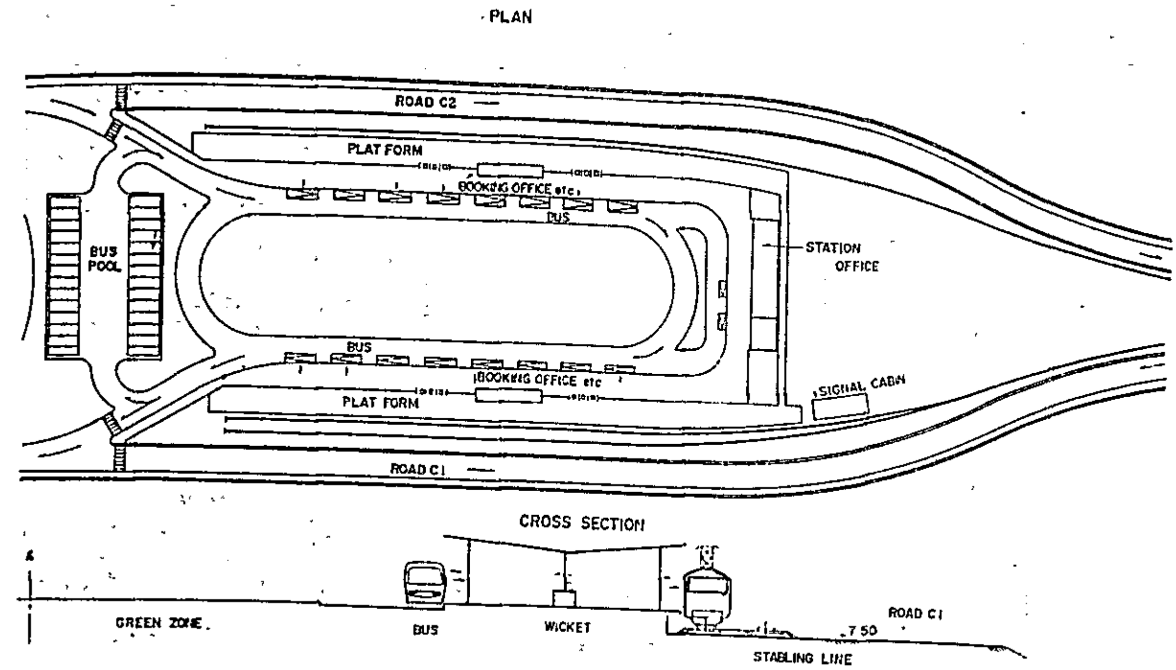


Fig. 6.5.9 Layout Alternative 4

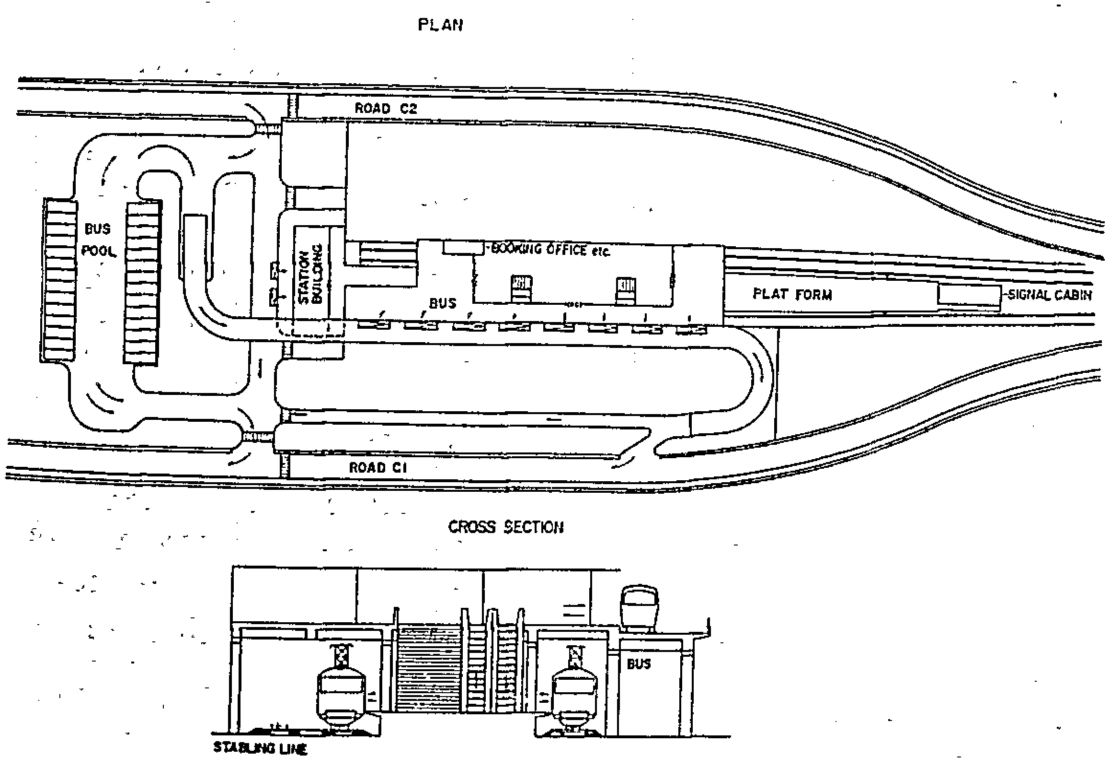


Fig. 6.5.10 Layout Alternative 5

6.5.3 Conclusion

The following conditions must be taken into account in determining the layout of the airport station:

(1) Boarding and alighting procedures should guarantee convenience and safety of passengers. In other words, the walking distance should be short and traffic lines of passengers should be simple.

(2) Construction cost should be reasonable.

(3) Maintenance after completion should be easy.

Comparing the five layout alternatives on these criteria, and particularly from the viewpoint of passenger safety, Layout Alternative 3 is undesirable because it involves the crossing of the bus passage by passengers, although the walking distance is short.

From the viewpoint of construction cost, Layout Alternative 5 requires the most expenditure because of its elevated structure and expenses for mechanical equipment such as escalators.

Also from the viewpoint of maintenance, Layout Alternative 5 requires maintenance of escalators and the cost is high.

Accordingly, Layout Alternatives 3 and 5 involve problems in planning.

Layout Alternative 4 includes station management of a broad area and a large number of personnel, as platforms are separated into two sections with a long distance each other.

Layout Alternative 2 is not desirable from the viewpoint of passenger convenience, as the traffic line of passengers on the central platform (boarding passengers) is long, although traffic lines of passengers are separated. Provision of a moving walk on the platform can be considered for passenger convenience, but it involves problems in the cost and maintenance.

With Layout Alternative 1, on the other hand, the walking distance is short and passenger convenience and safety is relatively good, although boarding and alighting take place on the same platform. Construction cost is also relatively low. As a layout for the airport station, therefore, Layout Alternative 1 can be considered the most appropriate.

The construction and annual maintenance costs of Layout Alternatives 1, 2, and 4 were calculated as shown in Table 6.5.1. Layout Alternative 2 has significantly higher construction and maintenance costs than Layout Alternatives 1 and 4.

Table 6.5.1 Construction Cost and Annual Maintenance Cost

($\times 10^6$ Rp)

	Layout Alternative 1	Layout Alternative 2	Layout Alternative 4
Construction cost	5,400	6,400	5,600
Annual maintenance cost	28	57	29

Table 6.5.2 Evaluation of Layout Alternatives

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
1. Passenger convenience	◎	◎	◎	◎	○
2. Passenger safety	◎	◎	×	×	◎
3. Management of station	○	◎	○	×	◎
4. Train operation	◎	◎	×	○	◎
5. Bus operation	Δ	○	×	Δ	◎
6. Maintenance	◎	Δ	◎	◎	×
7. Construction cost	◎	×	◎	Δ	×
Evaluation	Highly recommended	Recommended	Not recommended	Not recommended	Not recommended

◎ : Excellent ○ : Good Δ : Fair × : Not good

CHAPTER 7 TRAIN OPERATION

CHAPTER 7 TRAIN OPERATION

7.1 Basic Concept of Train Operation Plan

7.1.1 Concept

As the role of Train in this project is to offer convenience for passenger going to or coming back from Jakarta International Airport, Cengkareng (JIAC), the Train Operation Plan is built up under following concept.

a. New railway under this project is to be a expanded system of JABOTABEK Railway system, not to be an independent railway system apart from JABOTABEK Railway system.

- If new railway under this project is an independent system, the railway would be a transportation system between only two terminals, Airport and a point of City, thus other access system to this independent transportation system will be necessary.

  If new railway is an expanded system of existing JABOTABEK Railway system, JABOTABEK Railway system can be an access system to new railway. Accordingly, contributed area can be expanded widely.

b. The Train (Airport Access Train) operating section is to be between Airport and Jatinegara via Manggarai running on existing JABOTABEK network.

- Maximum train headway is 20 minutes. The train does not run into any radiating line (Merak, Bekasi and Bogor line), because if the train run into radiating lines, the train headway in respective line becomes large, more than 20 minutes.

- Northern part of Duri in Western line has so high traffic demand that trains other than existing train cannot be accommodated.

- In case, the train operates upto Jatinegara applying Central line, passengers go for Merak or Tangerang can change train at Kota Intan, from Western line to Airport line, they don't need to make de-tour, via Manggarai.

  Meanwhile, Central line is passing through CBD, hotel area and government office area, thus it can be said that this route is the best access route to JIAC.

- In case, the train operates upto Jatinegara applying southern part of Duri in Western line, all passenger for Merak, Bogor, Central, Eastern and Bekasi line can reach to their destination with only one train exchange.

  With allocation of new station between Tanah Abang and Manggarai, Dukuh, which is suggested by Master Plan, connection with CBD, hotel area and governmental office area can be obtainable by provision of proper surface transportation means.

- As Manggarai is considered as future railway terminal of Jakarta, no alteration of route of the train is required even in future, if the Train operates via Manggarai.

c. To cope with expansion of transportation demand, scale of train formation and train headway will be adjusted.

d. Design criteria of new track is same as one stated in Master Plan, but care is taken on train operation planning not to require very high technic on driving train but to give remaining power for recovering train delay.

e. To secure high speed operation with safety, automatic blocking system, automatic signalling system and ATS (Automatic Train Stop device) are adopted.

f. Railcar which has same characterestics as existing railcar in JABOTABEK network is adopted for the train formation.

- From view point of technic of drying and maintenance, spare parts, and maintenance facilities, application of railcar with same characteristics as existing railcar is the most advantageous.

7.1.2 Premising Conditions

Above concept is subjected to completion of following projects.

a. Improvement and electrification of Western line (JABOTABEK Master Plan item No. 7, 16 and 18)

b. Track elevation of Central line and grade separated crossing of Manggarai (M/P No.9 and 10)

c. Improvement, electrification and track doubling of Tangerang line (M/P No.4 and 21)

d. Improvement of Jakarta Kota Depot (M/P No.6) and construction of Depok Depot (M/P No.22)

e. Rehabilitation of Manggarai Workshop (M/P No.5 and 23)

7.2 Train Operation Plan

Train Operation Plan per respective route alternatives are as follows:

a. Train operating section

Route A: Section length: 31.0km

JIAC Jayakarta Manggarai Jatinegara

(New line: 19.8km, Existing line: 11.2km)

Route C: Section length: 31.0km

JIAC Rawabuaya Tanah Abang Manggarai Jatinegara

(New line: 14.6km, Existing line: 16.4km)

(═══ New line, ─── Existing line)

b. Train headway and train formation

At the first stage of the Train operation, train headway is 20 minutes with 4 railcar formation. (upto 1997 for route A and upto 1998 for route C)

To meet with increased transportation demand, train formation is enlarged to 8 railcars. (1998 - 2006 for route A and 1999 - 2008 for route C)

For further expanded transportation demand, train headway is shortened to 10 minutes with 8 railcar train set. When train headway is shortened, Airport line should be double tracked.

c. Stopping station of the Train

Stations which are expected as many airport passenger generating stations, are decided as stopping station of the Train as follows:

Route A: Kota Intan, Jayakarta, Sawah Besar, Gambir, New Cikini, Manggarai

Route C: Rawabuaya, Tanah Abang, Dukuh, Manggarai

d. Travel time

Travel time from key station in Jakarta City to JIAC is as follows:

Table 7.2.1 Travel Time between JIAC to City (2010)

(minutes: seconds)

	Tanah Abang	Gambir	Manggarai	Jatinegara
Route A	-	25:00	32:00	36:30
Route C	21:30		30:30	35:00

e. Transportation capacity by respective stage

Transportation capacity of respective stage of the Train is as follows:

Table 7.2.2 Transportation Capacity (1000 person/day, one way)

Stage	Transportation Capacity	Period		Remark
		Route A	Route C	
1990	30.6	- 1997	- 1998	4 railcar formation, 20' headway, single line
2000	61.2	1998 - 2006	1999 - 2008	8 railcar formation, 20' headway, single line
2010	122.3	2007 -	2009 -	8 railcar formation, 10' headway, double line

f. Service time

Service time of the Train is from 4:30 in the morning to 22:30 in the evening (18 hours) in response to Airplane schedule.

7.3 Relation between Existing Train and the Train

7.3.1 Number of Train and Train Headway in Existing Line

Train headway of the Train is as stated in 7.2.b. But the Train runs into existing line where existing train is operated. Especially, during peak 2 hours, big number of train is operated on existing line, consequently, train headway is very short. Thus, total number of train and train headway with the Train on busy sections of existing line should be checked.

Following links are estimated as the busiest section by transportation demand.

Route A: Kampun Bandan - Duri, Duri - Tanah Abang,
Tanah Abang - Manggarai, Manggarai - Depok

Route C: Kampung Bandan - Duri, Duri - Tanah Abang,
Tanah Abang - Manggarai, Manggarai - Depok,
Tanah Abang - Serpong

(High transportation demand is observed on Bogor and Merak line even without Airport Access Train. Additional passenger, namely air passenger is generated by operation of the Train.)

As seen in Table 7.3.1, no problem is contained in case of route A but in case of route C, overlapped section with the Train and existing train, Duri - Tanah Abang, requires 3 minutes headway which is considered as limit, consequently, punctuality of train operation is strongly required. Furthermore, route C has longer link of existing line compared with route A, the Train has higher probability of interference by existing trains, thus, to secure punctuality of the Train, puncutality of all JABOTABEK train is strongly required.

Fig. 7.3.1 and Fig. 7.3.2 indicate number of tarin and headway in JABOTABEK are including the Train.

Table 7.3.1 Number of Train and Headway During Peak 2 Hours

Link	Year	Route A		Route C	
		Number of train	Headway	Number of train	Headway
Kampung Bandan	1990	20	6.0	20	6.1
-	2000	26	4.6	25	4.8
Duri	2010	37	3.3	35	3.5
Duri	1990	16	7.5	21	5.7
-	2000	21	5.8	26	4.7
Tanah Abang	2010	30	4.0	41	3.0
Tanah Abang	1990	15	8.0	24	4.9
-	2000	20	5.9	31	3.8
Manggarai	2010	28	4.3	37	3.2
Tanah Abang	1990	14	8.3	15	8.3
-	2000	19	6.4	19	6.4
Serpong	2010	28	4.3	28	4.3
Manggarai	1990	13	9.4	13	9.4
-	2000	24	5.0	24	5.0
Depok	2010	33	3.7	32	3.7
Gambir	1990	16	7.5	10	11.8
-	2000	21	5.6	15	7.9
Manggarai	2010	33	3.6	21	5.7
Manggarai	1990	13	9.1	13	9.0
-	2000	17	7.1	17	7.0
Jatinegara	2010	26	4.6	26	4.6

Remark: Duri - Tanah Abang, in case of Route C, means the section from the junction of New Airport Line and Wester Line, to Tanah Abang.

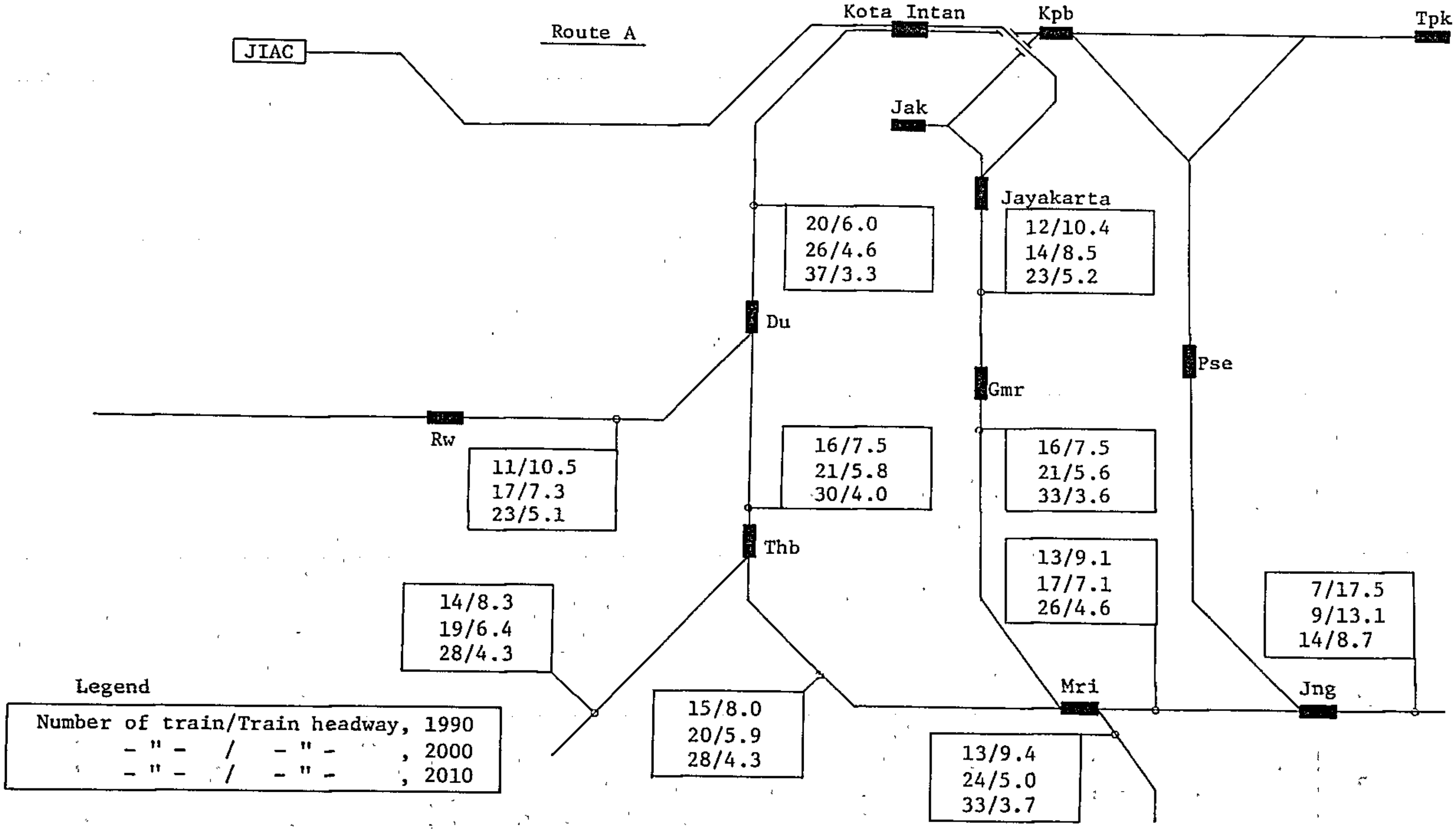


Fig. 7.3.1 Number of Train and Headway (Route A)

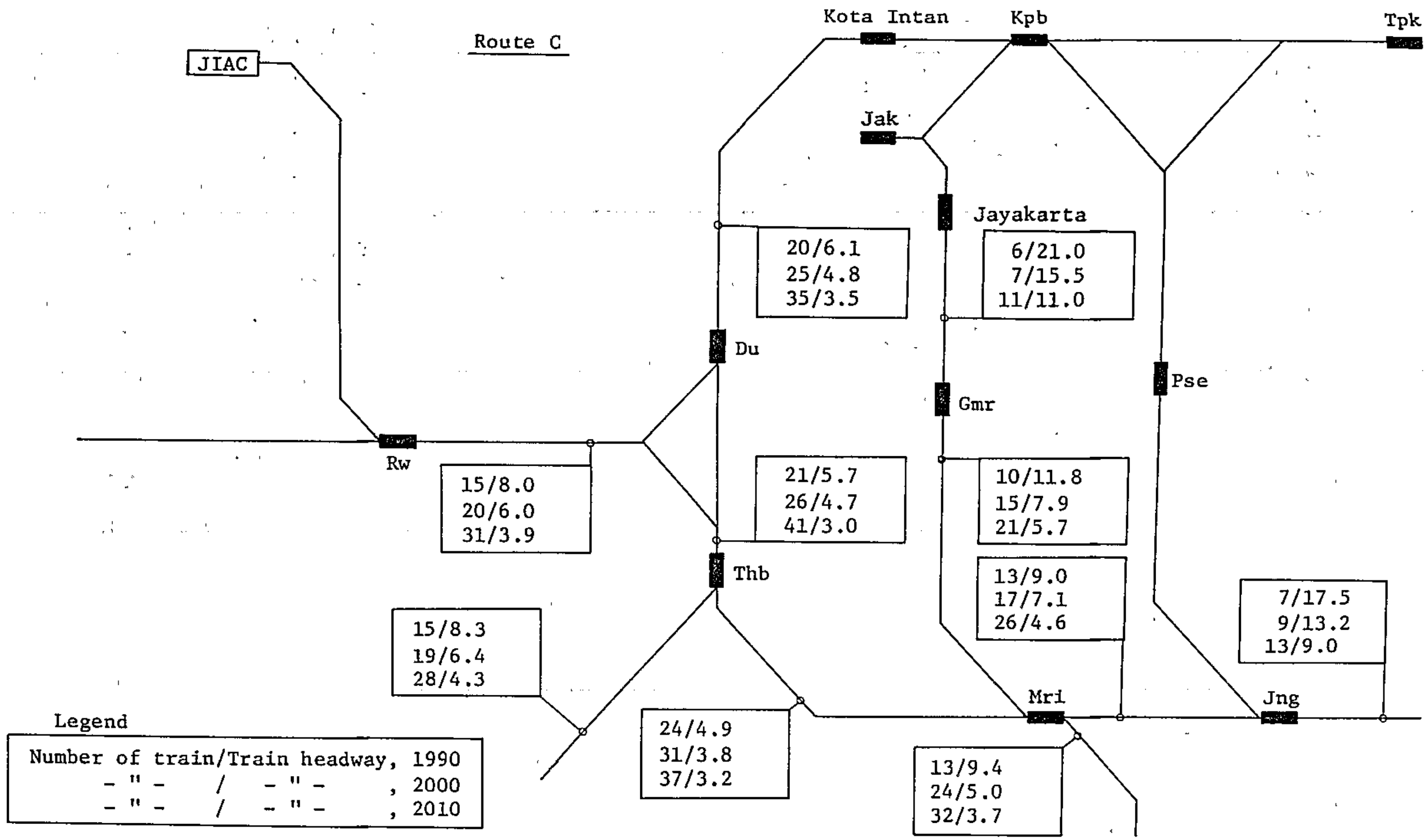


Fig. 7.3.2 Number of Train and Headway (Route C)

7.3.2 Train Operation Route

Train operation route should be so decided as to obtain number of trains indicated in Fig. 7.3.1 and Fig. 7.3.2 considering passenger flow. But there are stations which have no facilities for shuttling train. Thus, train operation route is to be so decided to obtain number of trains which is very close to required number of train but not far below required number of train for respective link.

Train operation routes with the Train are indicated in Fig. 7.3.3 and Fig. 7.3.4.

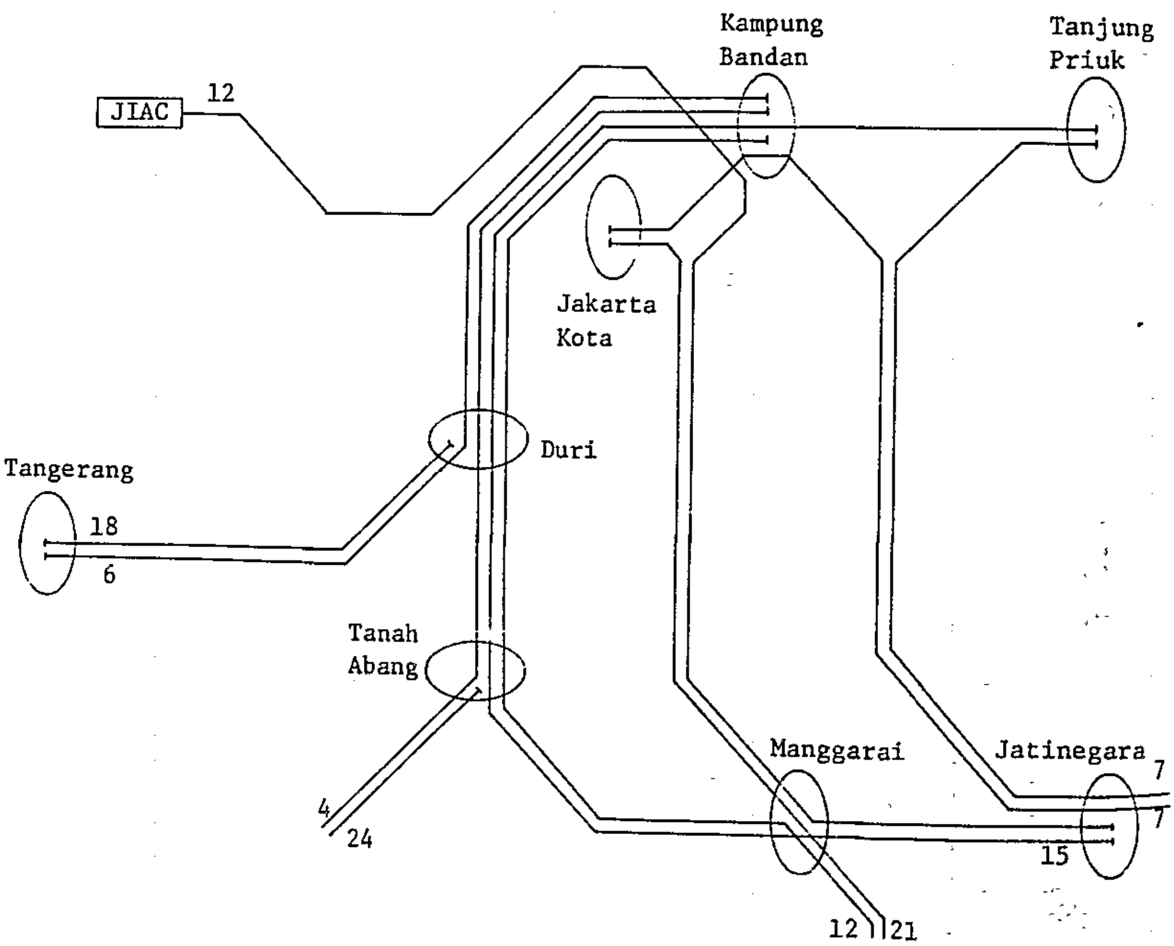


Fig. 7.3.3 Train Operation Route (Route A)
(Peak 2 hours, 2010)

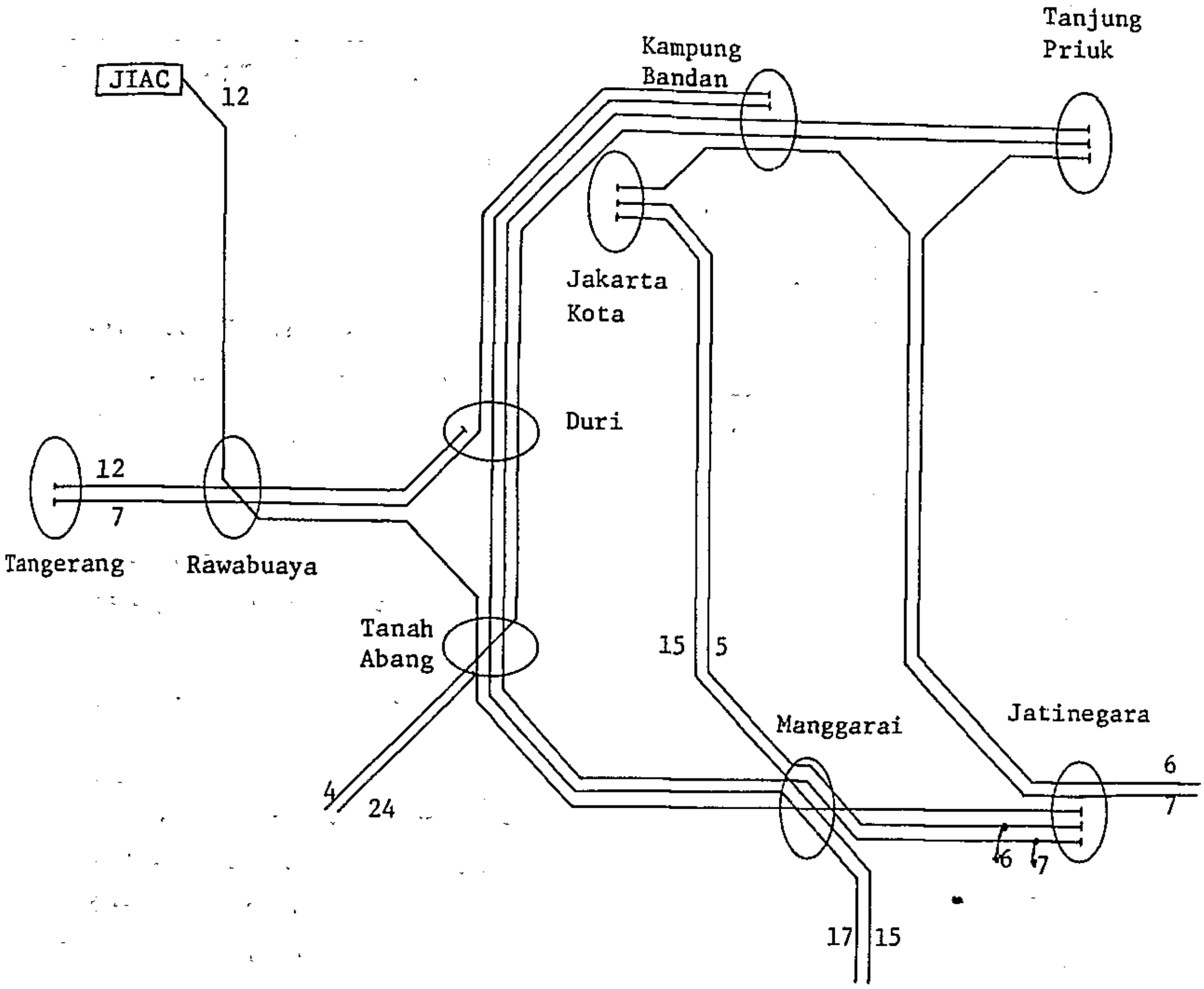


Fig. 7.3.4 Train Operation Route (Route C)
(Peak 2 hours, 2010)

7.4 Signal Station

Provision of two types of signal station is necessary on this project, namely,

1) Signal station for train crossing on single line

2) Signal station at junction of two lines

   If junction of two lines is located inside of station yard, this kind of signal station is not required as train route can be controlled by signal cabin in station

a. Signal station for train crossing

The first stage of Airport Railway line is constructed as single track, so signal station for train crossing is necessary at point of train crossing indicated on train operation diagram which is attached herewith. With different train operation diagram, location of signal station should be also different.

Provision of signal stations decided only by train operation diagram is not good enough from view point of train operation flexibility. Additional two signal stations for route A and one for route C should be provided to minimize effect of delayed train onto other train.

b. Signal station at junction

Junction point of new line and existing line, in case of route A is Jayakarta. But in case of route C, junction points of new line and existing line are as follows:

- o Rawabuaya,
- o Point of 17.3km from JIAC, between Pesing and Grogol in Tangerang line,
- o Point of 20.6km from JIAC, between Duri and Tanah Abang in Western line (1.7km from Tanah Abang).

In case of Jayakarta and Rawabuaya, train route can be controlled by signal cabin which is located inside of respective stations. But in case of 17.3km point and 20.6km point, those points are intermediate position of stations. Thus, for control of train route, independent signal stations are necessary.

While, allocation of new station is suggested by Master Plan between Duri and Tanah Abang because of too long station distance. Accordingly, if position of new station in Western line improvement plan is closed to 20.6km from JIAC (1.7km from Tanah Abang), signal station at 20.6km can be inside of new station.

7.5 Train Operation Curve and Train Diagram

7.5.1 Train Operation Curve

Train operation curve between JIAC and Jatinegara are illustrated on Fig. 7.5.1 and 7.5.2.

Train running time obtained from train operation curves is re-arranged in unit of 30 seconds with allowance, 3% of each time, to make train schedule. Table 7.5.1 and 7.5.2 indicate running time for train schedule.

7.5.2 Train Diagram

Pattern train diagrams are indicated in Fig. 7.5.3 ~ 7.5.8 which are drawn applying running time in Table 7.5.1 and 7.5.2. Train shuttling time at terminal of train operating section is to be not less than five minutes. (In case of Airport Train, Airport station and Jatinegara station are terminal where train is shuttled.)

Fig. 7.5.5 and Fig. 7.5.8 indicate pattern train diagram of Airport Train and existing train during peak 2 hours. During off peak hour, train headway of Airport Train is not change but one of existing train can be extended to meet with traffic demand.

Time for station stop is one minute for all intermediate stations, but time for station stop directly affects train schedule speed, it is preferable to shorten time for station stop to 30 seconds where less number of passengers are entrain and detrain.

Table 7.5.1 Train Running Time (Route A)

Station	Kilometrage from JIAC	Station distance	Running time (min. sec.)		Stopping time (min.)	Schedule speed (km/h)	
			Down	Up			
JIAC	0						
		17.4	(15:30) 13:30	13:30		77.3	
Kota Intan	17.4				1:00		
		2.4	3:00	3:00			
Jaya Karta	19.8				1:00		
		2.4	3:00	3:00			
Sawah Besar	22.2				1:00		
		1.8	2:30	2:30			51.0
Gambir	24.0				1:00	37.1	
		2.8	3:00	3:00			
New Cikini	26.8				1:00		
		1.5	2:00	2:00			
Manggarai	28.3				1:00		
		2.7	3:30	3:30			
Jatinegara	31.0						
Total		31.0	(32:30) 30:30	30:30			

Remark: ( ) indicates running time for single line (1990 and 2000)

Table 7.5.2 Train Running Time (Route C)

Station	Kilometrage from JIAC	Station distance	Running time (min. sec.)		Stopping time (min.)	Schedule speed (km/h)	
			Down	Up			
JIAC	0						
		11.3	(11:30) 9:00	9:30		73.4 (JIAC–Rawa buaya)	
Rawa buaya	11.3				1:00		
		11.0	11:00	10:30			
Tanah Abang	23.3				1:00		
		2.8	3:30	3:30			53.1 (JIAC–Jati negara)
Dukuh	25.1				1:00	47.8 (Rawa buaya–Jati negara)	
		3.2	4:00	4:00			
Mang garai	28.3				1:00		
		2.7	3:30	3:30			
Jati negara	31.0						
Total		31.0	(33:30) 31:00	31:00			

Remark: ( ) indicates running time for single line (1990 and 2000)

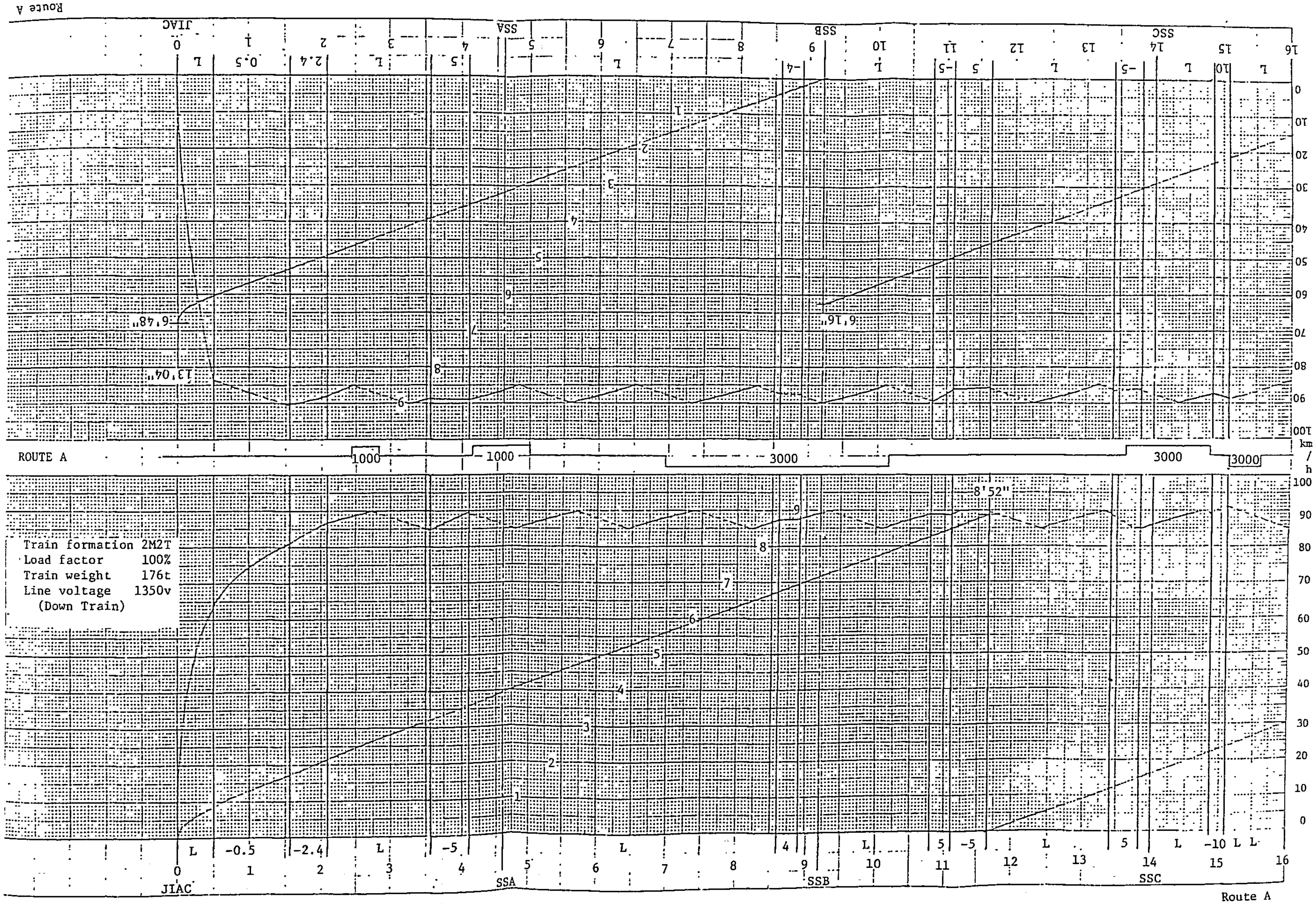


Fig. 7.5.1-1 Train Run Curve (Route A)

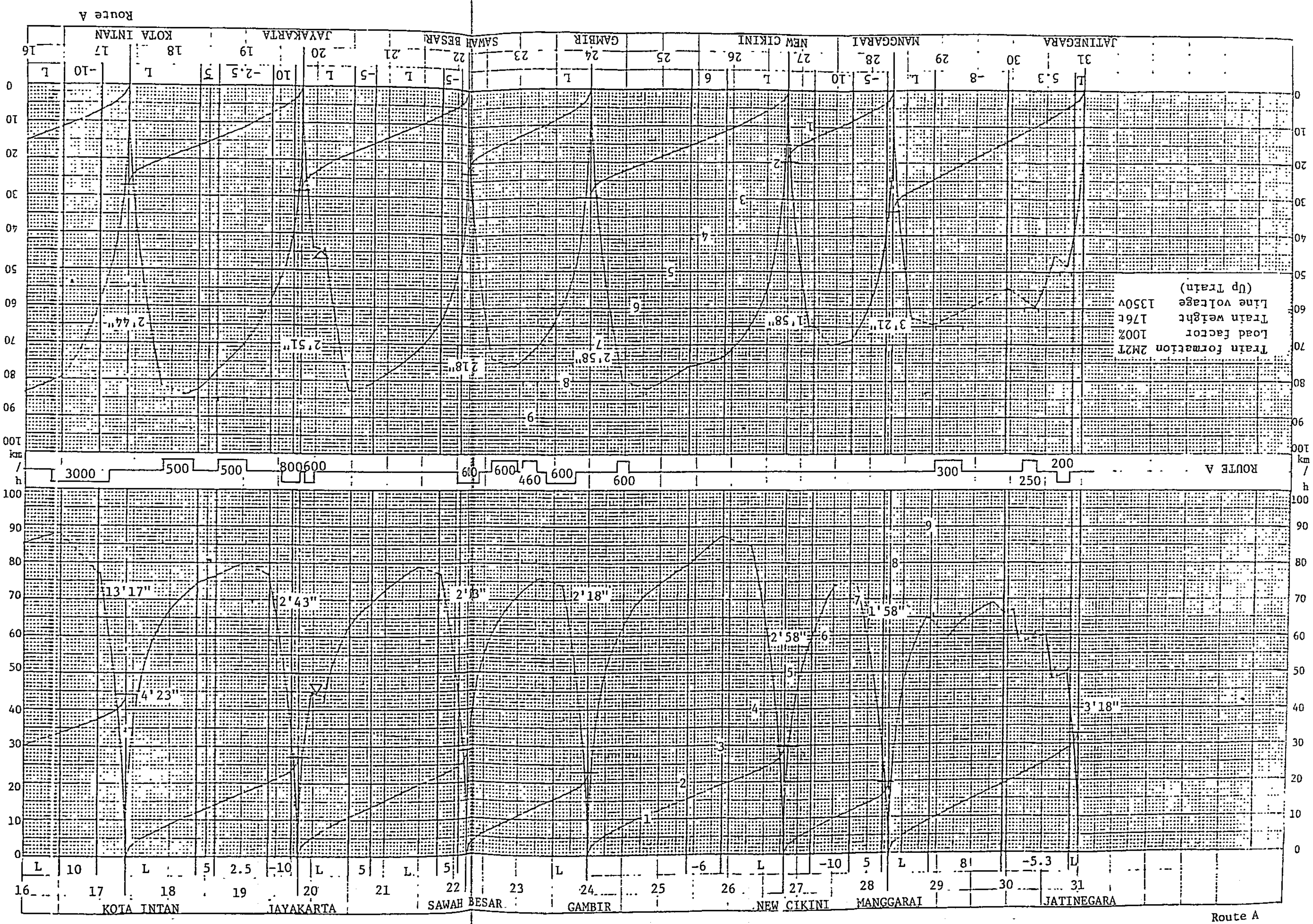


Fig. 7.5.1-2 Train Run Curve (Route A)

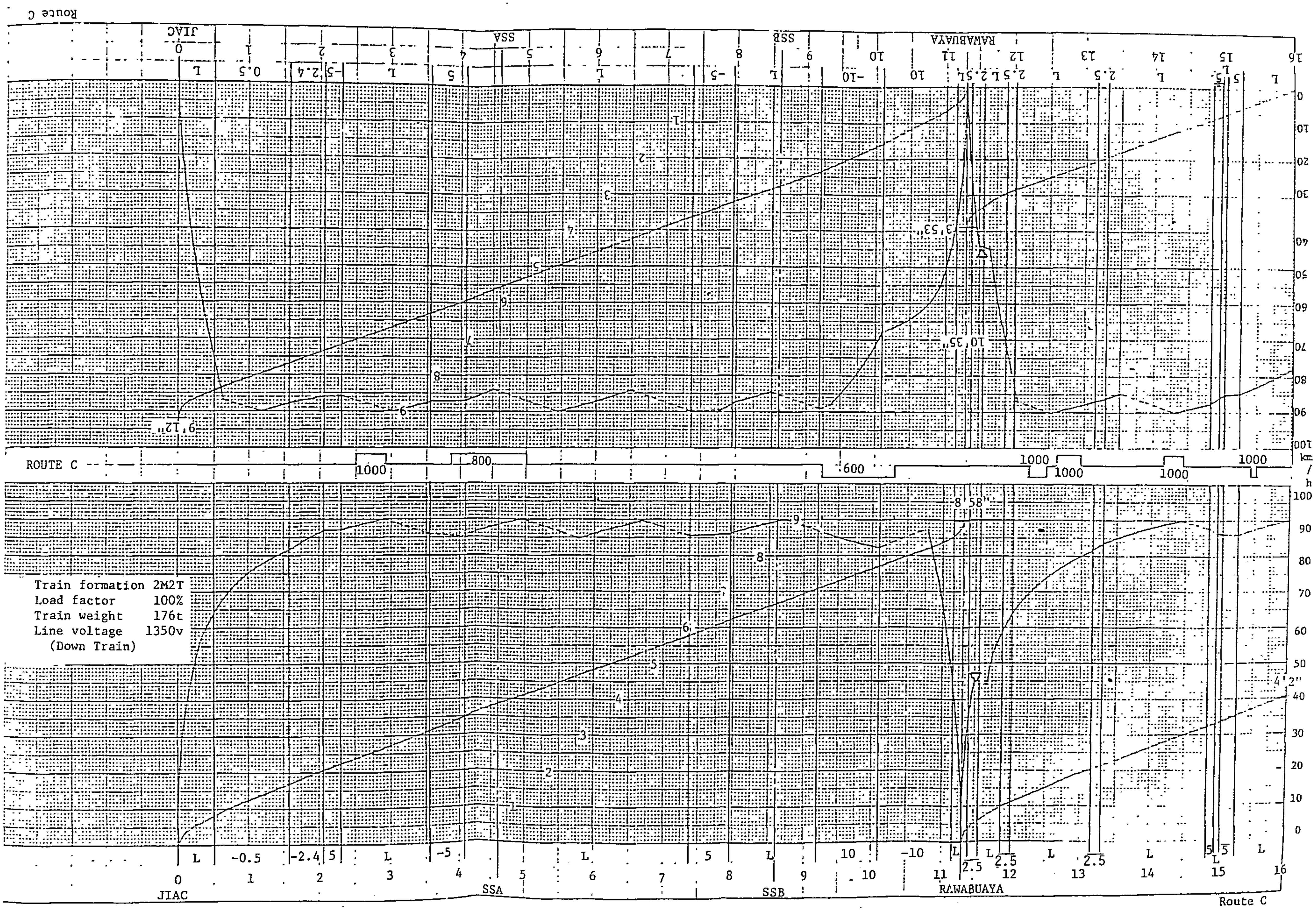


Fig. 7.5.2-1 Train Run Curve (Route C)

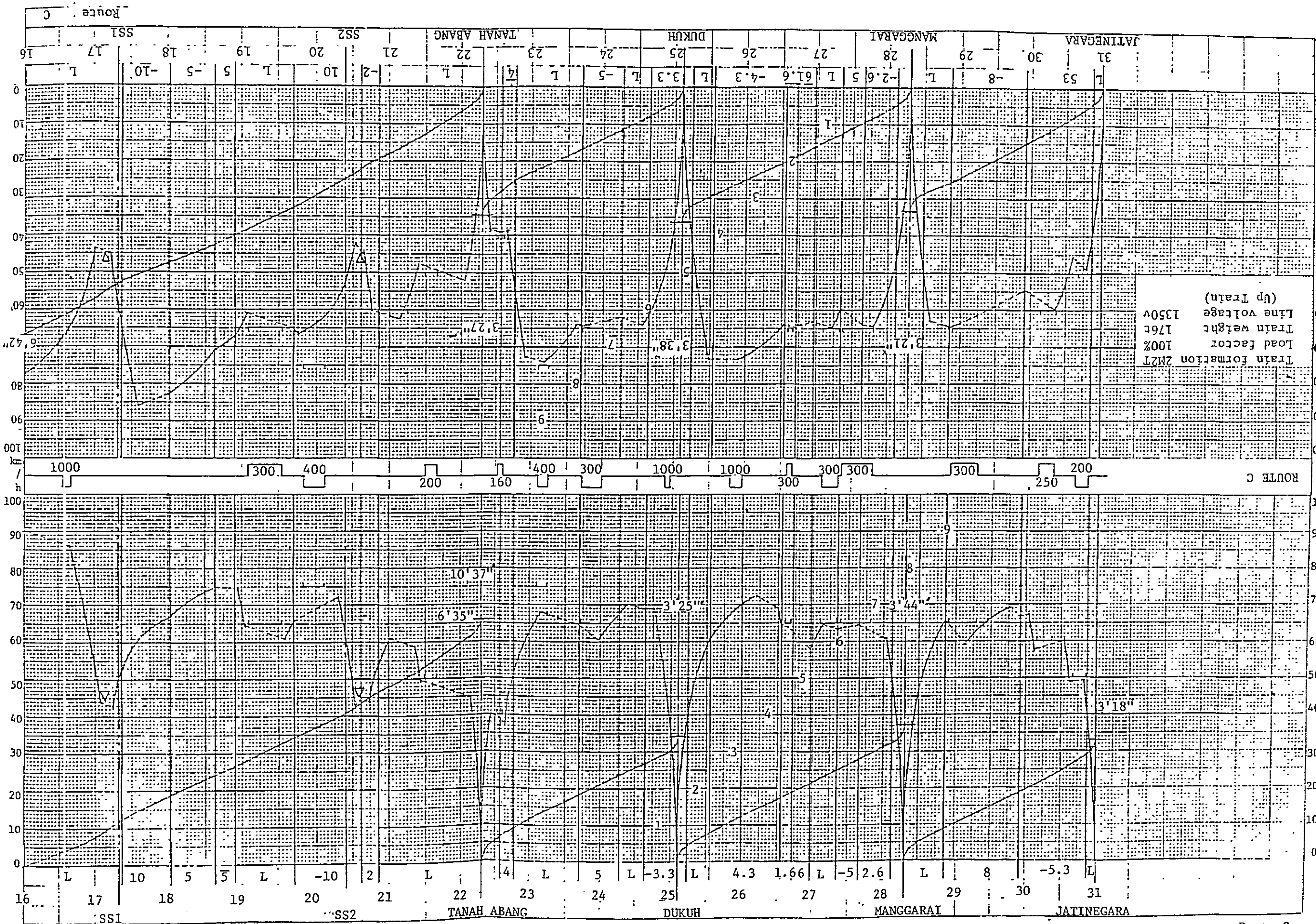


Fig. 7.5.2-2 Train Run Curve (Route C)

Route C

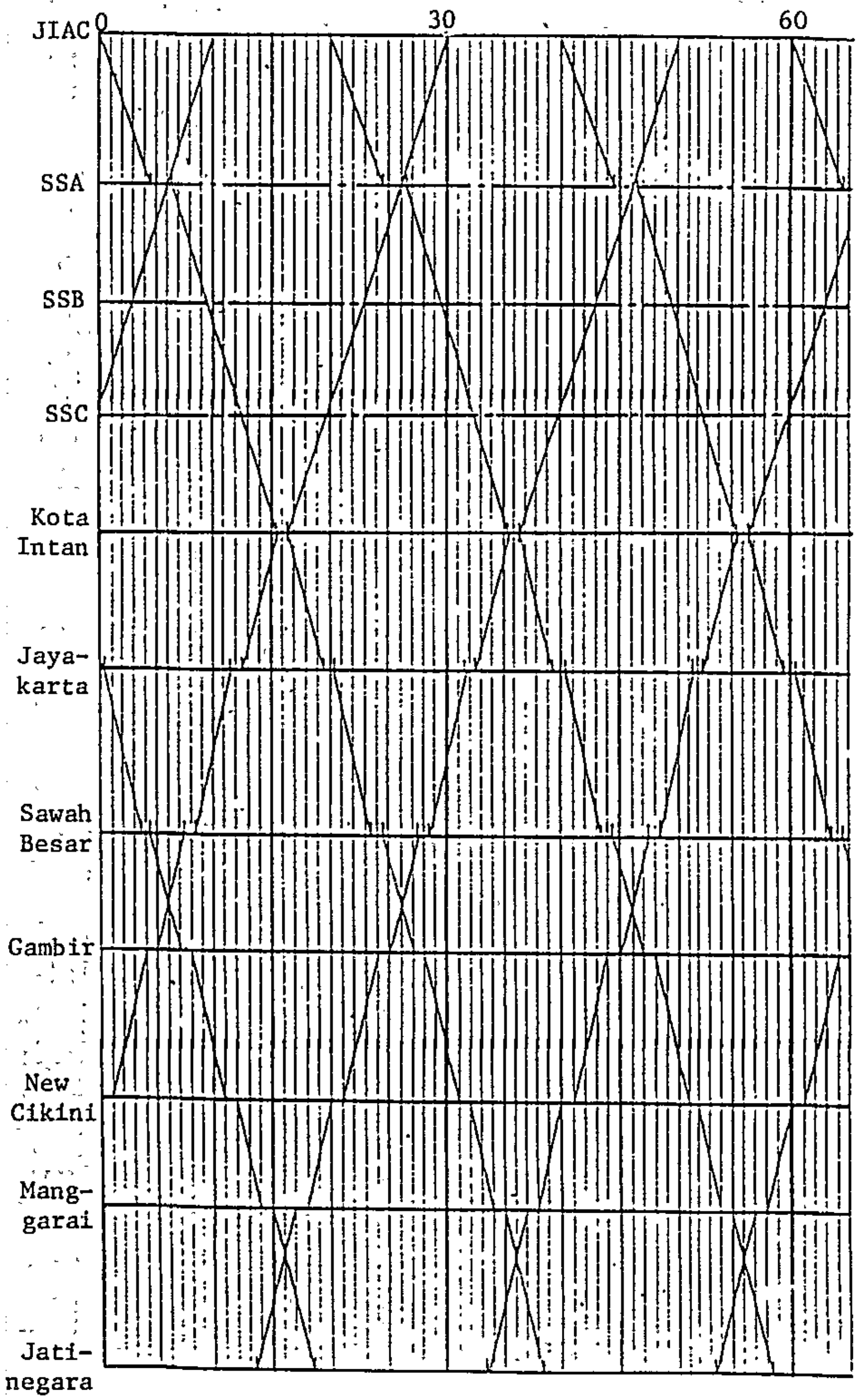


Fig. 7.5.3 Train Diagram (Route A, 1990 & 2000)

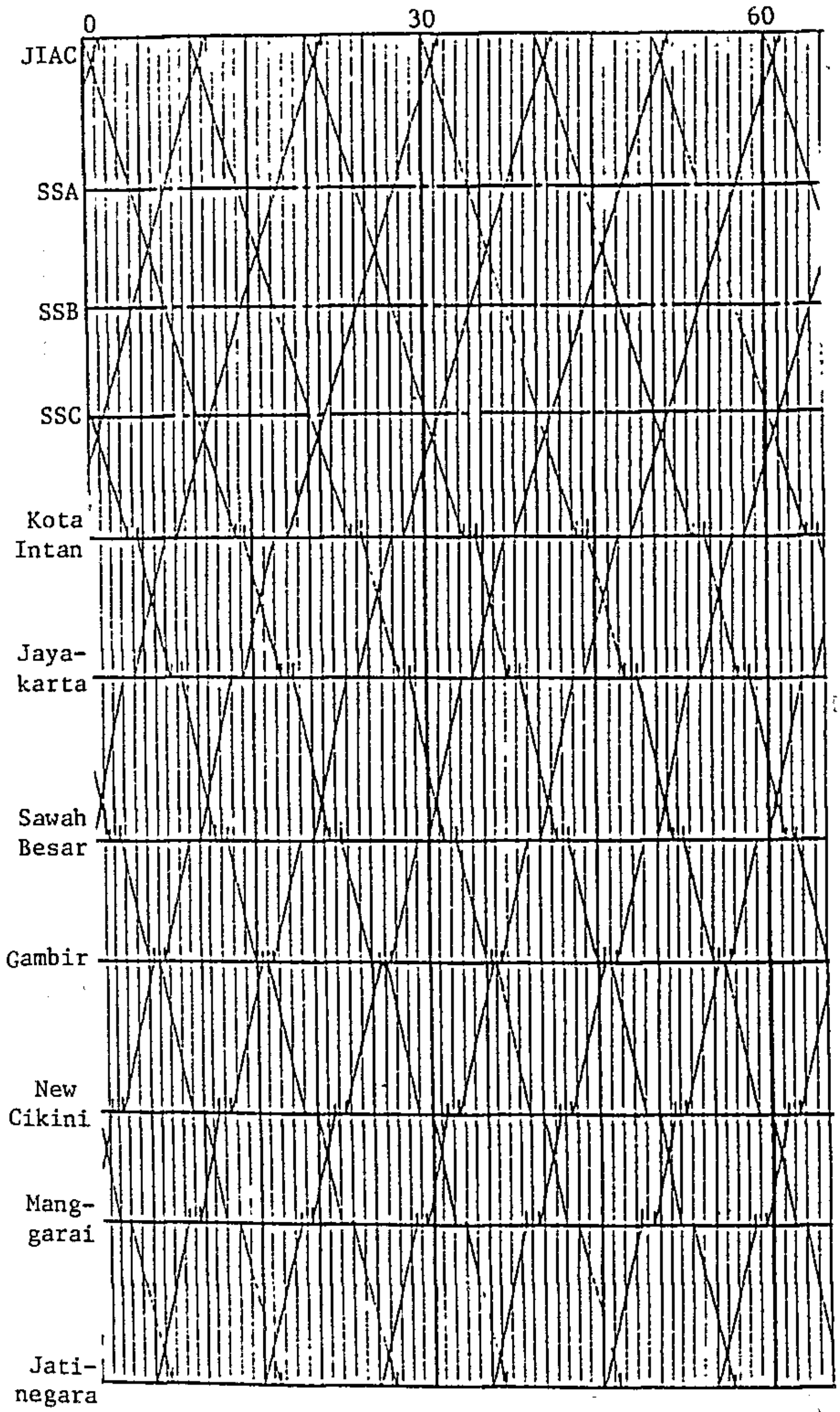


Fig. 7.5.4 Train Diagram (Route A, 2010)

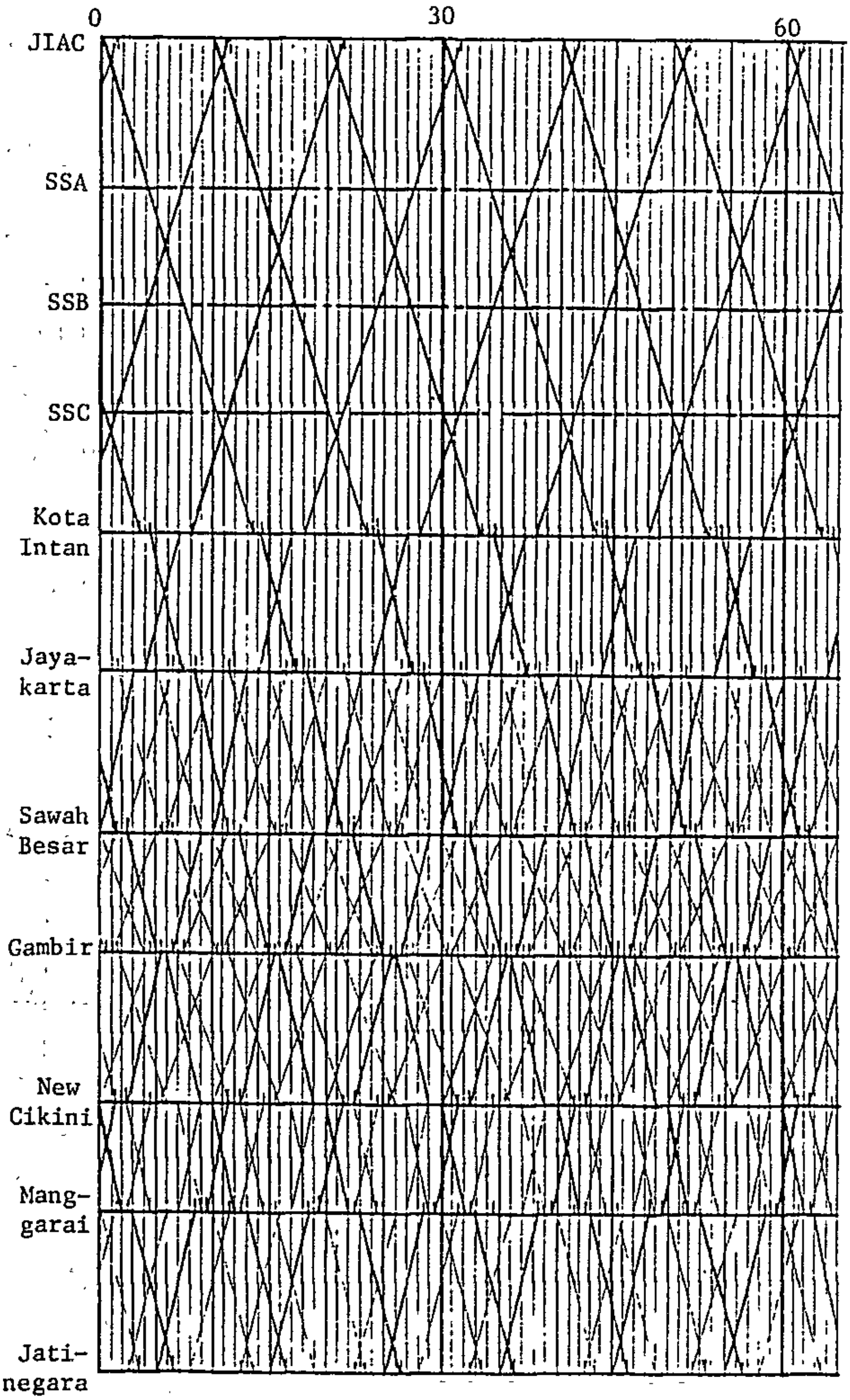


Fig. 7.5.5 Train Diagram (Route A, 2010)
(with JABOTABEK train)

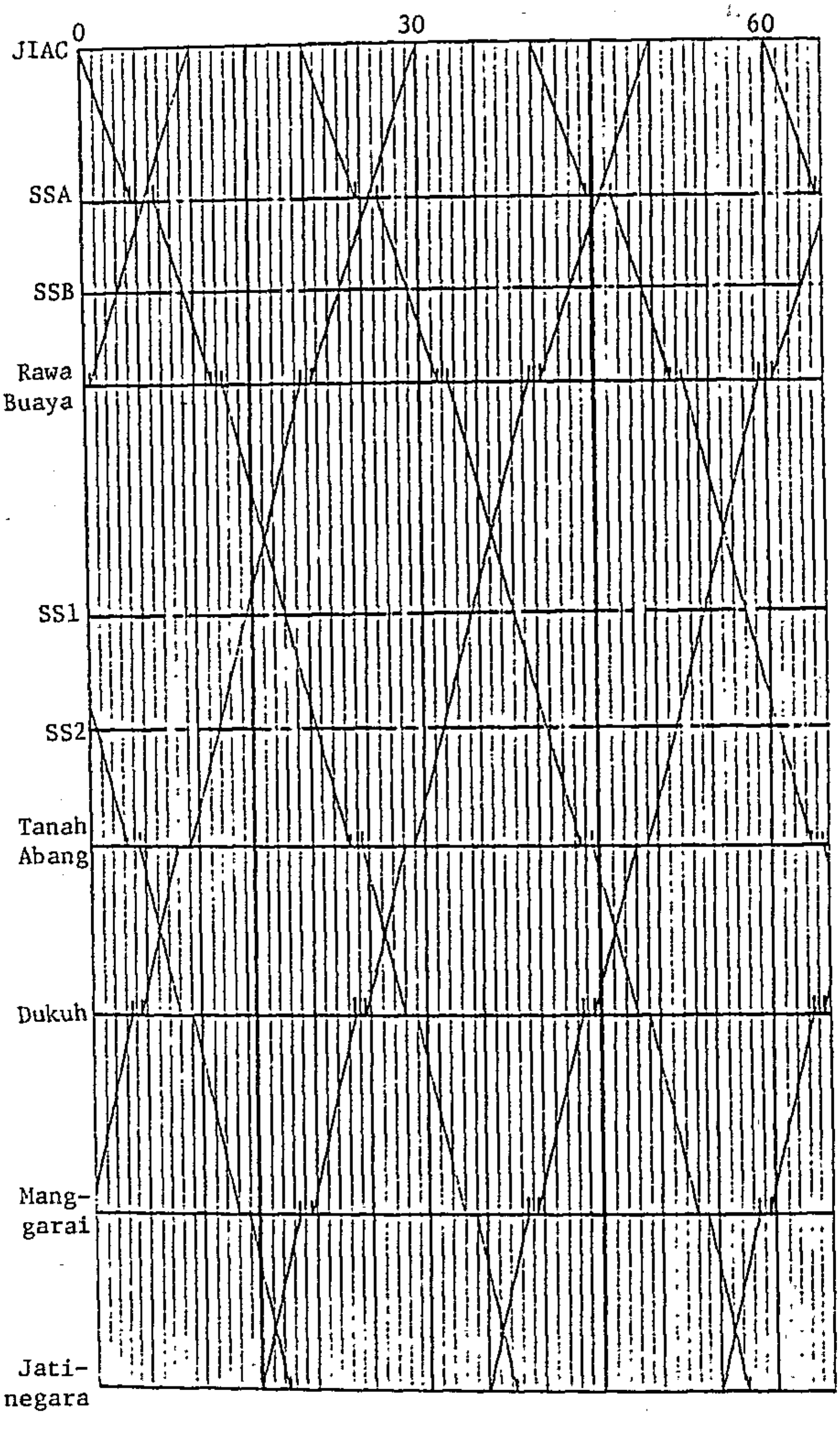


Fig. 7.5.6 Train Diagram (Route C, 1990 & 2000)

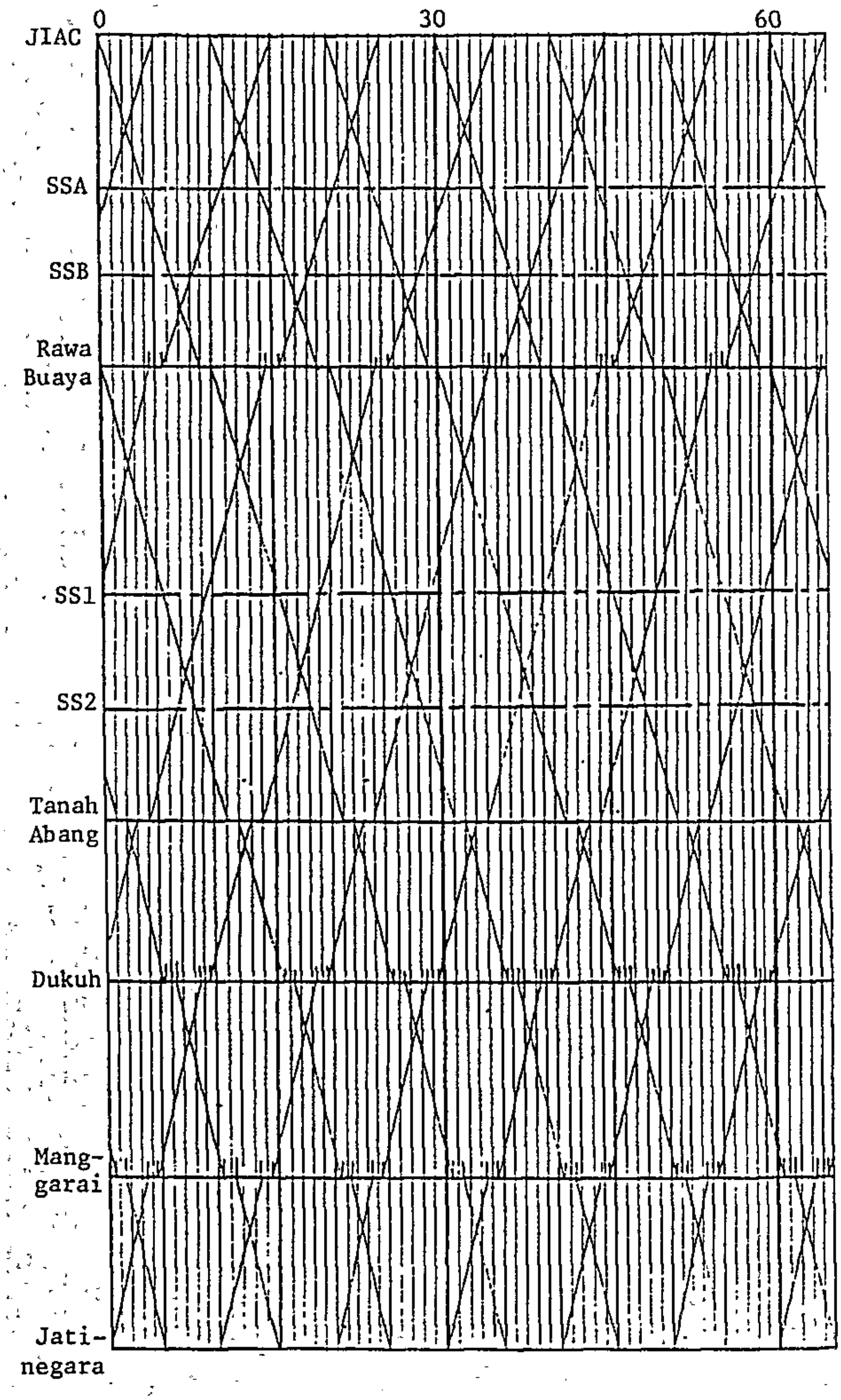


Fig. 7.5.7 Train Diagram (Route C, 2010)

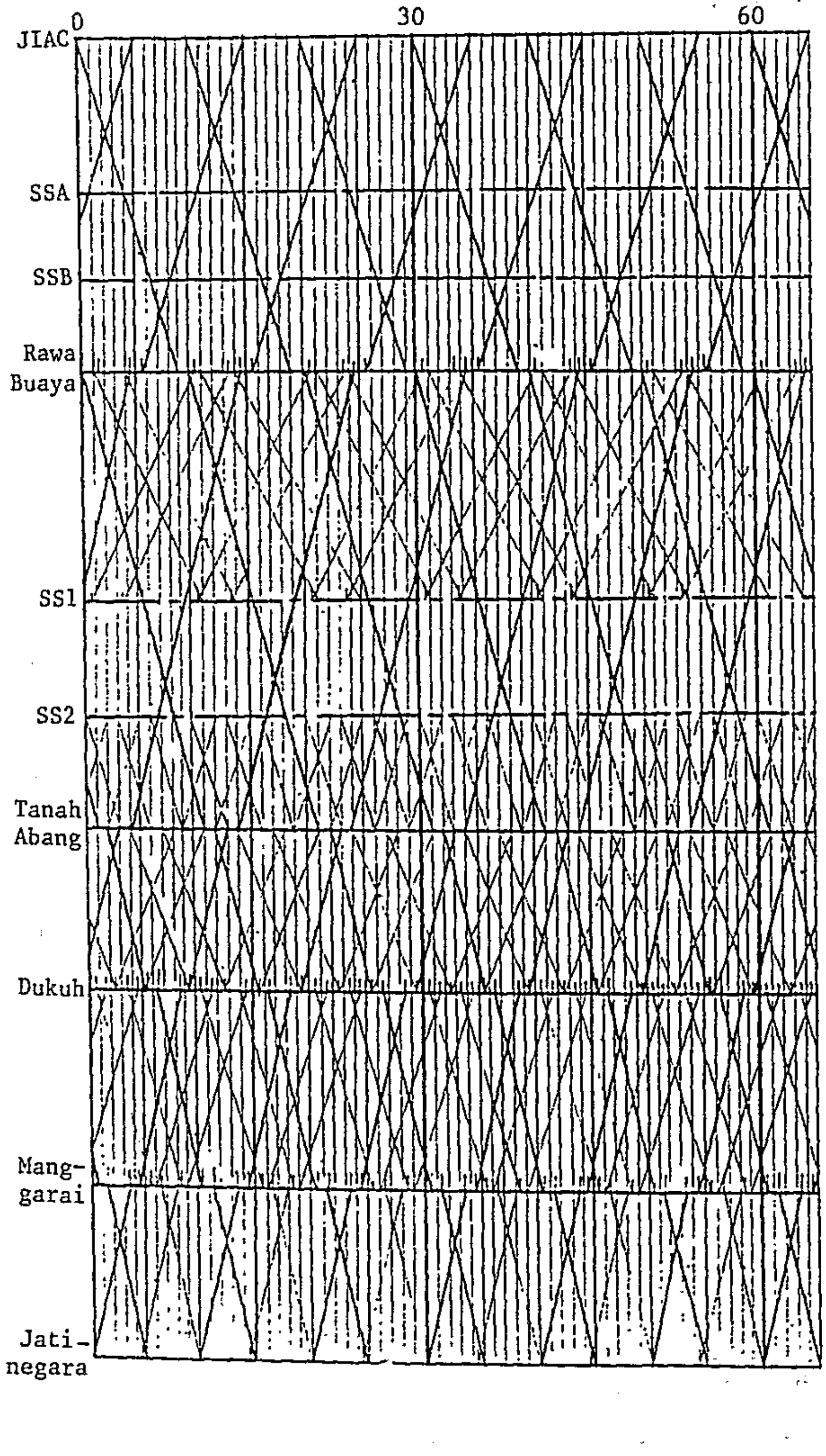


Fig. 7.5.8 Train Diagram (Route C, 2010)
(with JABOTABEK train)

7.6 Railcar Depot and Maintenance

7.6.1 Number of Railcar

Master Plan requires 52 railcars for Airport Access Train at time of 2000. But number of railcars required is decided by length of operating section, train schedule speed, train headway and scale of train formation.

Airport Access Train in Master Plan is that operating section is Airport to Duri through Tangerang line, 20.7km, train headway is 15 minutes and train formation is 8 railcars.

On the otherhand, the Train operation plan in this study is that train operating section is Airport to Jatinegara through of JABOTABEK network, 31km, train headway is 10 minutes on year of 2010 and train formation is 8 railcars. Consequently, number of railcars required is increased.

Table 7.6.1 Number of Railcars

	1990	2000	2010
Route A	22	43	86
Route C	22	43	70

Route C has less number of stations compared with Route A although the length of both routes are same. Travel time by Route C is shorter than that by Route A, accordingly.

For double track operation, one cycle time of train set in case of Route C is calculated at 80 minutes, including the time necessary for shuttling at both terminals. At the train headway of 10 minutes the train set which left JIAC railway station 80 minutes before, is again ready to leave JIAC railway station. On the otherhand, one cycle time of train set in case of Route A is calculated at 83 minutes. The train set which left JIAC railway station 80 minutes before is now on the way back to

JIAC railway station. Therefore, one additional train set is necessary for Route A.

For single track operation, one cycle time of train set needs additional 2 ~ 2.5 minutes for train crossing work. Therefore, one cycle time exceeds 80 minutes on both case. Consequently, same number of train set is required.

7.6.2 Depot

Basically, depot is to be preferably located at terminal of train operating section. But, following depots for railcar are existing in JABOTABEK area with suggestion of improvement by Master Plan. Not only that, construction of new depot is suggested by Master Plan. After completion of improvement and construction program, total capacity of depots is 850 railcars. While, required number of railcars in JABOTABEK area is 653 on year 2000 including Airport Access Train and Cibinong line. (At time of 2010, as required number of railcar for the Train in this project is 70 or 86, total number of JABOTABEK railcar is 680 or 696 if railcar for existing line is not increased.) Thus, new railcar depot special for the Train is not necessary.

Table 7.6.2 Capacity of Depot

Depot	Capacity
Jakarta Kota	80
Bukit Duri	70
Depok	700
Total	850

But, considering efficiency of railcar operation, it is preferable that the Train is to be stabled at Airport station or Jatinegara station as far as possible and others, depot for night stay. Concretely, 2 trains be stabled at Airport station, and others, at Bukit Duri Depot on single line stage, and 3 trains, at Airport, 2 trains, at Jatingara and others, at Bukit Duri Depot on double line stage.

Daily inspection of railcar (it should be carried out daily before year 2000 and every other day, after year 2000.) should be carried out at Bukit Duri Depot.

Railcar, not finished daily inspection, can be changed with railcar, daily inspection is completed at Bukit Duri.

Not inspected railcar can be dead head run to Bukit Duri from Jatinegara and inspected railcar can be run to Jatinegara from Bukit Duri to take place of not inspected railcar, during off peak hour.

7.6.3 Maintenance of Railcar

Rationalization of railcar maintenance system is suggested by Master Plan targeting at year 2000. According to rationalization program in Master Plan, interval of maintenance is extended roughly twice as much as present. To meet with this extended maintenance interval, level of respective maintenance work should be up graded. This up graded maintenance work needs improvement and strengthening of maintenance facilities in depot and workshop, unlessotherwise, maintenance system can not be shifted to new system which is suggested by Master Plan.

Table 7.6.3 Comparison of Maintenance System

	General Inspection	Principal equip, Inspection	6 months (Bogie) Inspection	Monthly Inspection	Daily Inspection
Present System	2 years/ 260,000km	1 year/ 130,000km	6 months/ 65,000km	1 month/ 10,000km	48 hrs/ 600km
Master plan	4 years/ 600,000km	2 years/ 300,000km	1 year/ 150,000km	60 days/ 30,000km	48 hrs/ 3,000km

Inspection which should be executed frequently, such as daily, monthly and 6 monthly (Bogie) inspection, should be carried out at depot, while inspection which has many disassembling work such as Principal Equipment Inspection and General Inspection, should be carried out at workshop.

In case of the Train, to maintain efficiency of railcar operation (shortening distance of deadhead run), daily and monthly inspection which have high frequency, should be carried out at Bukit Duri Depot, and maintenance work which is not able to execute at Bukit Duri Depot and Bogie inspection of all JABOTABEK railcar should be carried out at Depok Depot. To secure Airport Train operation, allocation of trouble shooter at Airport station would be effective.

7.7 Selection of Double or Single Track in the Stage Wise Construction Program According to an Increase in the Volume of Trains

The major merits of new airport railway are rapidity, punctuality and safety.

The capacity of single track is calculated by station (including signal station) distance, train speed and time required for train crossing work. However, practical limiting capacity of single track is assumed as 100 trains a day with automatic signalling system.

As seen in Attached Sheets, six signal stations are inevitable between JIAC and Jayakarta with train headway of 10 minutes in case of single track.

To accommodate increased number of train, merits of railway mentioned above could not fully obtained on single track by following factors.

(1) Train stop at every station (including signal station) for train crossing reduced train schedule speed. Accordingly, travel time between JIAC and city is increased. Increased travel time deteriorates the premising condition of the demand forecast prescribed in the Draft Final Report, and economic benefits of the Project will be adversely affected.

At the stage of double track with 10 minutes train headway, travel time between JIAC and Jayakarta is scheduled as 17.5 minutes, while in case of single track, the above travel time will be increased to 33.5 minutes which is 1.9 times of the original schedule. The delay of 16 minutes are theoretical as mentioned in Attached papers, and do not include the waiting time for delayed train of opposite direction.

(2) A delayed train affects other punctual trains and it is very difficult to recover train operation to normal.

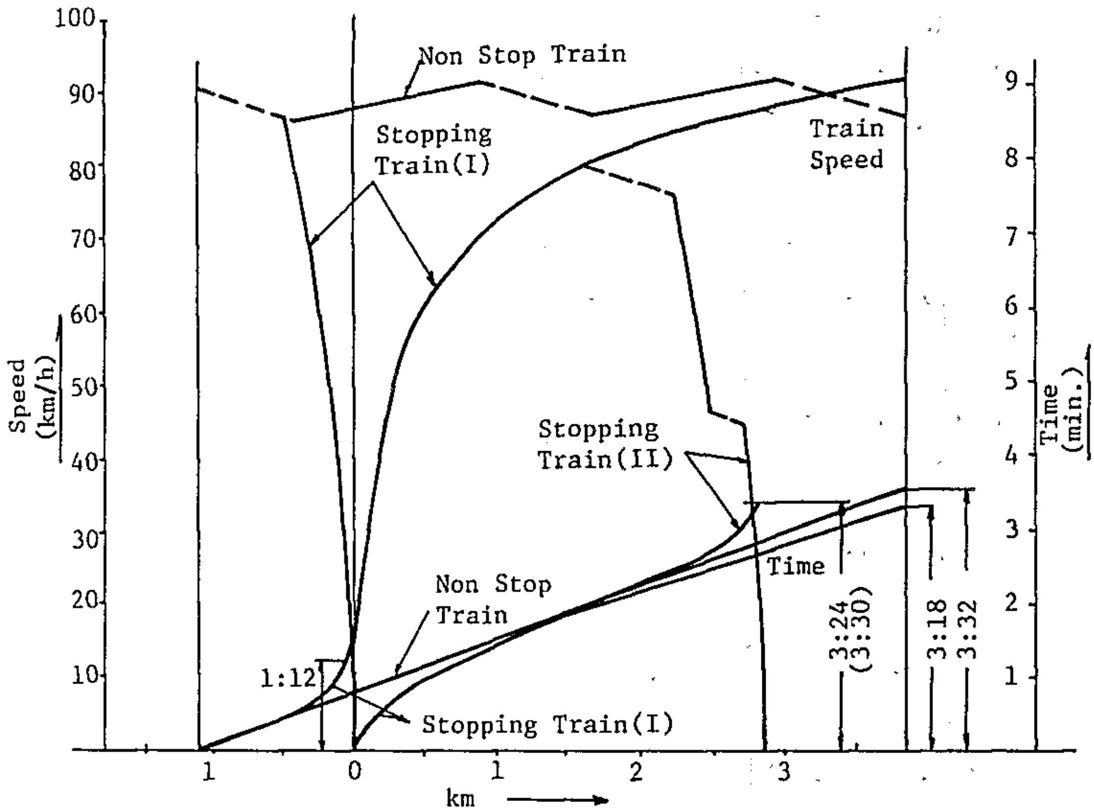
(3) In order to cope with the planned demand forecast, longer travel time necessitate more number of train sets and more number of staff.

(4) Full maximum speed of 90 km/h of electric railcar cannot be expected with short station (including signal station) distance.

Furthermore, by adoption of double track, it is possible not only to avoid above-mentioned demerits but also to increase traffic capacity to cope with the future increase of demand.

Attached Sheet 1

Time loss of stopping train



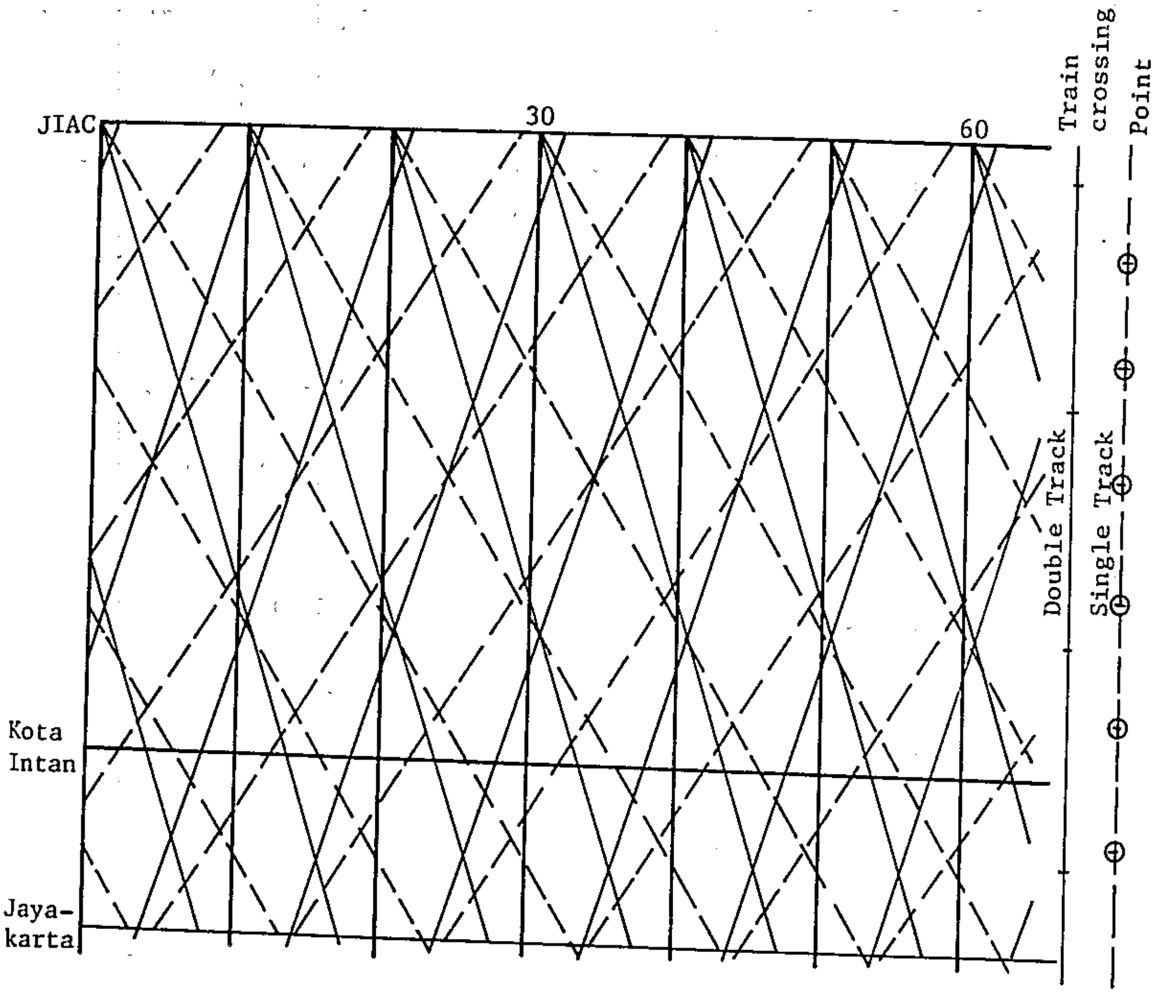
o Time required for 90 km/h → Stop → 90 km/h:
1'12" + 3'32" = 4'44"

o Time required for passing train on above section: 3'18"

Time saving of passing train is (4'44" - 3'18") = 1'26". This means that train, running with 90 km/h, takes additional 1'26" to get running speed of 90 km/h after stop of train (Loss time for stopping). At signal station, train crossing work (blocking, routing and signalling) needs 1.5 minutes as a general. Therefore, train which is running with 90 km/h, loses around 3 minutes for train crossing work at signal station. But this assumption is effective only when all trains are operating punctually.

If 6 signal stations are installed between JIAC and Jayakarta, average signal station distance will be 2.8 km. In this case, running time for 2.8 km distance is 3'30" as in above illustration (Stopping Train II). Each signal station needs 1.5 minutes for train crossing work. Therefore, travel time between JIAC and Jayakarta will be 33.5 minutes.

Attached Sheet 2



——— Train Diagram on Double Track

– – – Train Diagram on Single Track

This train diagram is drawn on the supposition that in case of single track, travel time between JIAC and Jayakarta needs 16 minutes more than travel time on double track for train crossing. There are 6 train crossing points, i.e. six signal stations are required. And train crosses at every signal station if track is single. Therefore, delay of one train affects other trains, not only that it is very difficult to restore train operation to scheduled train diagram.

Average signal station distance is around 2.8 km. As seen in illustration of previous page, train cannot accelerate up to 90 km/h with short distance. Driver should prepare to stop before train reach to 80 km/h.

7.8 Others

Along with execution of Master Plan, number of train is increase and train operation speed is also increase. To cope with this condition, Master Plan suggested strengthening of train dispatcher for controlling of all trains in JABOTABEK railway system. Of course, the Train should be under this train dispatcher system to ensure proper train operation and prevention of train accident.

Full function from invested facilities cannot be pulled out without proper application of facilities. For this purpose, necessary education is essential. To maintain 3 minutes train headway, even without the Train, there are many points which are depending upon "man". In this connection, training of relevant staff is inevitable.

Increase of train density and train speed cause raising up of probability of accident at level crossing. Level crossing will be "unmanned" year by year and level crossing of Airport line are all automatic level crossing. Thus, for prevention of level crossing accident, PR for public is also inevitable.