

**THE DETAILED DESIGN STUDY OF
THE RAILWAY ELECTRIFICATION AND
DOUBLE-DOUBLE TRACKING OF JAVA MAIN LINE PROJECT
IN INDONESIA**



FINAL REPORT - DETAILED DESIGN

MARCH 2005



**Pacific Consultants International
Japan Railway Technical Service**



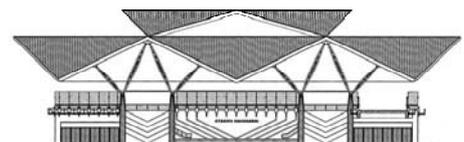
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Japan International Cooperation Agency (JICA)
Directorate General of Land Communications (DGLC)
Ministry of Communications
Government of the Republic of Indonesia

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PREFACE

In response to the request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct the Detailed Design Study of the Railway Electrification and Double-Double Tracking of Java Main Line Project in the Republic of Indonesia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a team to Indonesia between January 2002 and March 2005, which was headed by Mr. ISHIKAWA Tadashi of Pacific Consultants International. (PCI).

The team conducted the study in collaboration with the Indonesian counterpart team including field surveys on the study area, and planning works, and then held a series of discussions with the officials concerned of the Government of Indonesia. Upon returning to Japan, the team duly finalized the study and delivered this report.

I hope that this report will contribute to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the team.

March 2005

MATSUOKA Kazuhisa
Vice President
Japan International Cooperation Agency

March 2005

Mr. Matsuoka Kazuhisa
Vice President
Japan International Cooperation Agency

Dear Sir,

Subject: Letter of Transmittal

We are pleased to submit herewith the Final Report of "The Detailed Design Study of the Railway Electrification and Double-Double Tracking of Java Main Line Project in the Republic of Indonesia". The report contains results of the study which was carried out by Pacific Consultants International in association with Japan Railway Technical Service between January 20, 2002 and March 24, 2005.

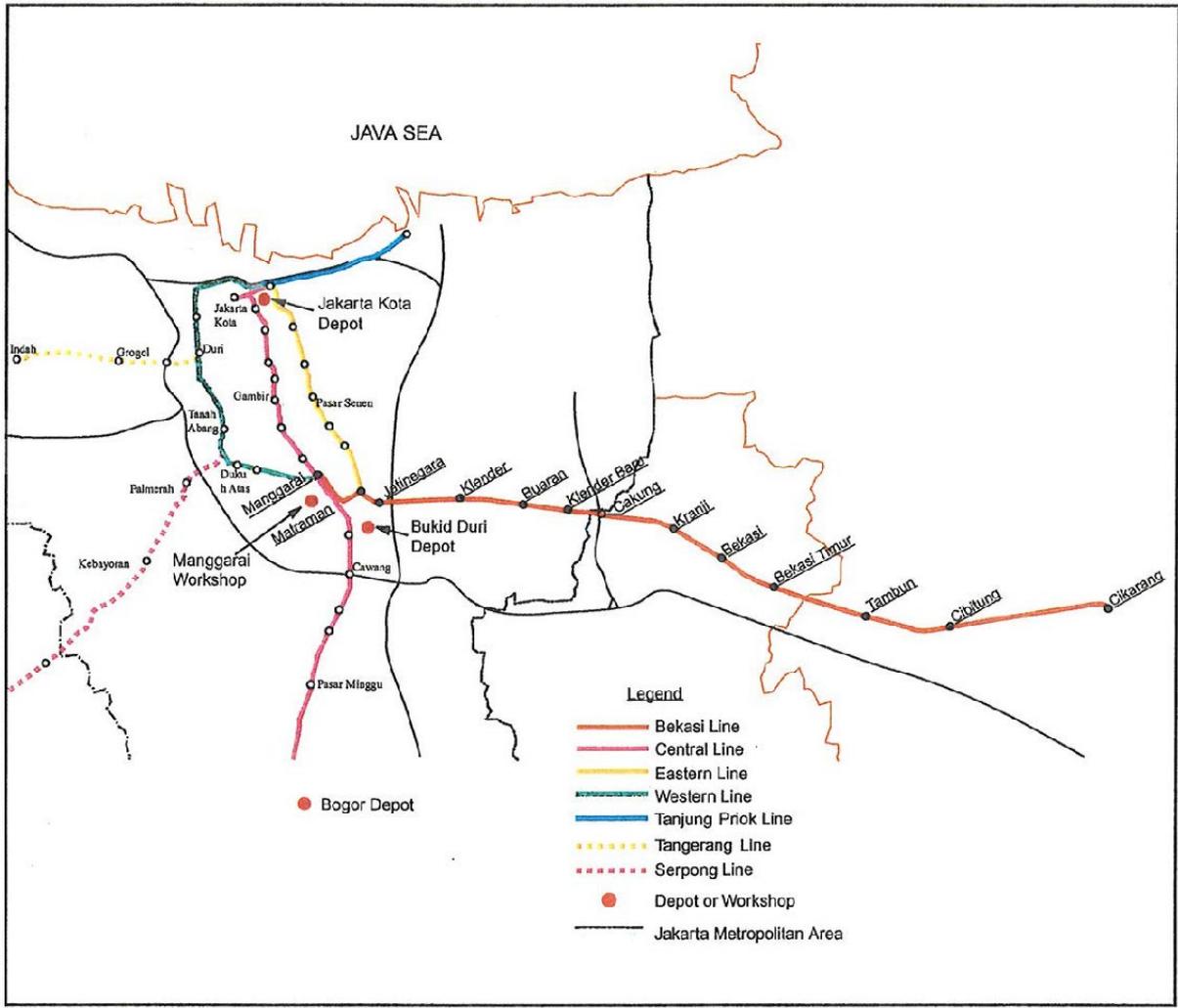
The JICA Study Team has submitted several reports to JICA and DGLC. Following discussions with the JICA Evaluation Team in June 2002 the Study Team submitted to the Government of Indonesia (GOI) the Basic Design Report. The Detailed Design for the section between Bekasi and Cikarang was submitted in March 2003, a report on a Comparison Study between "Manggarai Main Line Elevated" and "at Grade" Station was submitted in December 2003.

In order to expedite implementation of the Project, GOI has decided to reduce the land area to be acquired. Accordingly the track alignment was changed by taking 2 m from the original ROW. In a letter dated June 1, 2004, the GOI requested Government of Japan (GOJ) to review the Basic Design and to proceed with the Detailed Design based on this new land requirement. Between September 5, 2004 and March 11, 2005 JICA Study Team conducted the Basic Design and Detailed Design based on the new land plan and all results were submitted to DGLC in a Draft Final Report on February 11, 2005. Through several discussions with DGLC, the JICA Study Team explained such reports and prepared this Final Report.

We would like to express our appreciation to the personnel of JICA, DGLC and other concerned parties for their support during this long project.

Yours faithfully


Ishikawa Tadashi
Team Leader JICA Study Team



LOCATION MAP



MANGGARAI STATION



BEKASI STATION

THE PROJECT AND RECOMMENDATIONS

1. The Project

The Government of Indonesia (GOI) had already approved the Master Plan Study for Railway Electrification on Java Main Line conducted by the Japan International Cooperation Agency (JICA) with the technical assistance of the Government of Japan (GOJ). The Study was completed in 1983 with the conclusions placing a high priority on the electrification of the railways of Java.

Based on the Master Plan, a feasibility study was undertaken by JICA and completed in 1986 recommending railway electrification specifically of the Jakarta-Cikampek-Cirebon route (210km). This feasibility study also recognized the urgent need for capacity expansion on the route, namely double tracking on the main lines of Java.

With international finance support, the GOI has planned and implemented several double tracking projects to meet the increasing railway transport demand along main lines of Java. These developments (in a staged progress on certain parts of the main lines) began to put pressure on the line capacity of the Manggarai-Cikampek route. It has been increasingly recognized that the capacity expansion of this section should be undertaken prior to the main line electrification, and in a prompt manner.

Further to the improvement of the existing railway system in the Jakarta city area, the GOI had placed a high priority on improvement of the railway systems in the urban and suburban areas of Jakarta city. The total improvement plan of the railway system was established as the Master Plan of "Jabotabek Railway Improvement Program" by the Japan International Cooperation Agency (JICA) in 1981 including a Feasibility Study for the highest priority among 26 candidate sub-projects covering the scheduled years from 1981 to 2000.

While the various programs have been progressed and completed as described above, the railway passenger traffic in the Jabotabek area has been steadily increasing and the commuter train service is now performing an important role in the urban transport networks. Passenger volume on Bekasi Commuter Line also has been indicating the increase in ridership after electrification of this line, reflecting the expanding eastern suburban area development of Jakarta city.

As the total scheme to expand the transport capacity of the Java main and commuter lines between Manggarai and Cikarang, the GOI has planned and formulated the following scope of works for the Project:

- DC electrification and double-double tracking between Bekasi and Cikarang (17km), and
- Railway double-double tracking between Manggarai and Bekasi (18km)

The Manggarai-Cikarang section targeted by the Project is extremely important for the entire railway network in Java as well as for the commuter railway network in and around Jakarta. Thus the improvement of this section is an absolute prerequisite not only for the main line electrification, but also for upgrading the country's railway system as a whole.

All the train traffic, including the intercity passengers and freight on the Java main lines and the commuter passengers within the Jakarta metropolitan and Jabotabek areas, is currently handled by the heavy train operation on the section between Manggarai and Bekasi with one set of double tracks for both main line and commuter trains. Main line and commuter traffic, with the planned double-double tracking and the further extension of commuter system to Cikarang, is expected to grow rapidly. The double-double tracking along this route, therefore, is absolutely necessary for capacity expansion on the main and commuter lines. The latter will be extended from Bekasi to Cikarang with the same electrification system as the Jabotabek area.

This Project, once completed, will generate significant benefits to Indonesia's national economy. It will strengthen the Java main line and Jabotabek commuter line operations, thereby contributing to the improvement of the national transport system, as well as laying the ground-work for future system upgrading including the main line electrification

Due to difficulty of Budget Arrangement, the Project Contents were divided into two phases. The following items were categorized in Phase 2:

- Double-double tracking between Bekasi and Cikarang.
- Deletion of Level Crossing and construction of highway flyover at Bekasi and Cipinang, and
- Cikarang Rolling Stock Depot Construction

For purpose of earlier initiation of the Project, the GOI requested execution of the detailed design works including tender documents preparation through JICA in October 2000. Following this request, JICA dispatched the Mission for scope of works of the study in March 2001 and confirmed to undertake the detailed design works in accordance with the appraisal results agreed by JBIC and the Directorate General of Land Communications (DGLC) and the contents of JBIC Loan Agreement dated December 13, 2001.

JICA Study Team was dispatched to Indonesia in January 2002 to initiate the basic design for the Manggarai – Bekasi - Cikarang route as the first step of the works. The following steps of the work were conducted:

- 1st Step, Basic Design for Manggarai-Bekasi-Cikarang: January-August 2002

- 2nd Step, Detailed Design for Bekasi-Cikarang: November 2002-March 2003
- 3rd Step, Basic Design for At-grade Manggarai Station Plan: September 2003-January 2004
- 4th Step, Detailed Design for Manggarai-Bekasi: September 2004–March 2005 (Scheduled)

2. Project Cost

The total estimated cost for construction and equipment was some 39,633 Million Yen. The Amount for construction and equipment allocated in the Loan Agreement (Category (A)) is 37,542 Million Yen. With the addition of the amount for Loan Agreement Category C (Contingencies) the total amount increases to 38,376 Million Yen. Therefore the estimated construction cost is in excess of the available Loan Amount by 1,257 Million Yen.

3. Recommendations

The purpose of the Project is to develop public transportation and it will contribute not only to social and economic development of the region but also improvement of environment. On the other hand as a matter of fact, the Project requires resettlement of the affected people under the responsibility of the Implementation Agency. The JICA Study Team made recommendations on this issue in the Draft Final Report – Environment Impact Assessment (Stage 2).

The JICA Study Team made the following recommendations in the Draft Final Report during the 5th Study in Indonesia:

- (1) Countermeasure for Project Cost Increase
- (2) Suggestions for Finalization of Tender Documents
- (3) Suggestions for further Study for Construction Management
- (4) Other Recommendations

3.1. Countermeasure for Project Cost Increase

GOI were concerned that so many affected residents had to give up their land and property for the Project that they established a revised land plan for reducing the Right of Way (ROW) width by 2 m. In June 2004 GOI requested GOJ to review the previous Basic Design carried out in 2002 based on the revised land plan and make Detailed Design accordingly. JICA

Study Team duly reviewed the Basic Design based on such revised land plan and the findings were reported in the Basic Design Report Stage 2 that the revised land plan would increase costs by some 4,200 Million Yen compared with the amount of original Basic Design. In the design development, JICA Study Team managed to reduce project cost increase to 3,900 Million Yen.

However, DGLC wrote to the JICA Study Team advising that DGLC couldn't reverse the land plan to Original Land Plan; furthermore it was difficult to find funds from national budget. In the same letter DGLC requested JICA Study Team to study alternatives for further reduction of project cost. JICA Study Team reviewed the project contents and made recommendations to DGLC in order to reduce the Project Cost.

- To keep present track vertical alignment as much as possible in order to reduce ballast required.
- To minimize viaduct length using steep gradients
- To re-use existing track materials
- To set up longer window time for on-track construction
- To negotiate with Local Government for station buildings to be at ground level instead of elevated
- To reduce the length of platform shelters
- To reconsider provision of lifts, but to retain escalators

Through these measures, some 1,500 Million Yen may be saved. However, recently steel products have escalated in their market price, and oil products prices are also increasing. These factors will affect the Project Cost. JICA Study Team are of the opinion that further cost saving is necessary.

3.2. Suggestions for Finalization of Tender Documents

After completion of Detailed Design by JICA, the GOI shall carry out a review and finalisation of Tender Documents in accordance with Contract Packages. In reviewing and finalizing the documents, JICA Study Team suggests DGLC consider the following issues:

- To re-design Detailed Design Stage 1 between Bekasi and Cikarang
- To confirm Environment Impact Assessment validity
- To coordinate with Land Use Plan at station approaches, and

- To establish transitional Train Operation Plan between Phase 1 and 2, if needed.

3.3. Suggestions for further study for Construction Management

DGLC has been assigned as Project Implementation Agency for the Project and recognized by GOJ. Under Directorate of Railway, the Project Manager for the Project is allocated. And under the Project Manager a few clerks are assigned to the Project. In the course of finalizing the Tender Documents it will be necessary to study the method of construction management including responsibility allocation between the Employer, the Engineer and the Contractor. According to this construction management the Employer's organization should be developed.

3.4. Other Recommendations for Railway Operation

In order to achieve the Project Objectives, regular maintenance work is essential. From the viewpoint of financial feasibility it is important to obtain sufficient income, therefore PT.KAI should increase efforts to restrict passengers without tickets. The JICA Study Team made recommendations to meet these requirements.

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CHAPTER - 1
INTRODUCTION

CHAPTER - 1 INTRODUCTION

1.1. Study Objectives

The spread of the Jakarta Metropolitan Area (JMA) in both Eastern and Western directions, has changed the social conditions in these areas and increased road traffic has created chronic traffic congestion. It is therefore relevant that the most efficient and practical option is PT. KAI to provide efficient and safe commuter traffic along the corridors. The Manggarai – Bekasi – Cikarang Section is the focus for such development as it is the primary route taken by inter-city and freight traffic to Central and Eastern Java.

In response to the request of the Government of the Republic of Indonesia (GOI), the Government of Japan (GOJ) decided to conduct the Detailed Design Study of Railway Electrification and Double-Double Tracking of Java Main Line Project (the Project) (Manggarai – Bekasi – Cikarang Section) in Indonesia (the Study) in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of the technical co-operation programmes of the GOJ, has undertaken the Study in close co-operation with the concerned authorities of GOI.

For the purpose of urgent implementation of the Study, GOI requested the execution of the detailed design works, including draft tender document preparation, through JICA. The construction and procurement of the works will be through the use of the Special Yen Loan. The study for the Project shall be in accordance with the Memorandum concluded by JBIC and GOI in October 2001.

JICA, as the result of a selection process conducted in accordance with the regulations of JICA, appointed Pacific Consultants International of Tokyo, Japan together with Japan Railway Technical Service of Tokyo, Japan to perform the Study and to achieve its objectives.

The objective of the Study is to prepare draft tender documents for project execution. To achieve this objective the study has been divided into two Steps. Step 1 leads up to the formulation of a Basic Design from which Step 2, the Detailed Design will be prepared.

The objective of Step 1 was to:

- review the previous studies and plans related to the project, and conduct analysis for the most effective and efficient railway development programme for the project;
- develop land use plans in station areas to permit the integration of transport services and to provide for feeder services and inter-modal transfers;
- identify the crucial issues for the development of the designs;
- conduct basic design for the execution of the project with construction planning and

preparation of cost estimate;

- review economic and financial feasibility of the Project;
- review the EIA in terms of the Basic Design and to monitor the implementation of the LARAP process;
- provide an outline Maintenance Management and Operations Plan; and
- provide a Basic Design Report.

The objective of Step 2 was:

- to review the previous Basic Design Report with counterpart, including the final requirements of interfacing authorities, and the confirming the Design Criteria and the Scope of Work;
- to develop the detailed design from the Basic Design through Preliminary to Final Detailed Design;
- to prepare JICA Study Team's construction planning and erection sequences;
- to prepare Bills of Quantities and Cost Estimates;
- to prepare draft tender documents including pre-qualification documents for the contract packages;
- to evaluate and report on resettlement progress; and
- to prepare and submit Draft Final Tender Documents.

1.2. Methodology of Study

1.2.1. Basic Design

From broad topics the Study Team developed a Work Breakdown Structure as a management tool to organise and direct the activities of the Study Team. For the Basic Design eleven discrete Tasks with a total of 27 Sub-Tasks were identified and the appropriate staff assigned.

The ultimate objective of Basic Design Stage is to arrive at an Operations and Maintenance Management Plan that is the basis for the future train services on the Manggarai to Cikarang Section of the Java Main Line. Three phases of activities were performed; these were not carried out in a sequential series of individual activities, but overlapped in time considerably, thus requiring many activities to be performed simultaneously. The ability to do this was by using "Management by Tasks", and the frequent use of quality techniques through interface meetings between teams.

The first phase was characterised by establishing the results of previously accomplished Work and obtaining a full understanding of the previous objectives and the results obtained, paying particular attention to the recommendations made, and significantly the Issues raised. The reasons for these observations were fully considered so that advantage was taken of the

previous work and to avoid unnecessary duplication of effort. This stage included researching the physical nature of the route to understand the geo-technical aspects of the alignment and its physical characteristics.

The second phase was the engineering development resulting from the examination of the circumstances that cause the existing problems. In this the sequence commences with a confirmation of the traffic demand and the required size of stations. This then allows for the development of the Train Operation Plan. This is a major document that allows the Design Criteria to be finalised. The Train Operation Plan and the Design Criteria together form the basis for all the design work, both Basic and Detailed in the next Stage. All designs must satisfy both documents, they are inter-dependent and complement each other. The final work is to finalise Construction Planning that establishes the way the new works will be built without the disturbance to the operating lines.

The final phase of work in basic design stage was the confirmation of the feasibility of the Project through the analysis of the Economic and Financial Internal Rates of Return.

1.2.2. Detailed Design

To achieve the Objective of Detailed Design, 7 Tasks were identified, which are:

Task 12: Confirm the Design Criteria to be employed; freeze the Scope of Work and perform Detailed Design of all disciplines required for the contract package. (12 Sub-Tasks)

Task 13: Construction Work Implementation Plan

Task 14: Prepare Cost Estimates.

Task 15: Prepare Draft Pre-Qualification Documents and Draft Tender Documents for the contract package for all associated disciplines.

Task 17: Confirm the application of Resettlement Plans and evaluate progress under way.

Task 18: Presentation of Detail Design

Task 22: Draft Final Tender Documents for the contract package.

Figure 1.4-1 shows the Work Flow

1.3. Contents of Final Report

Final Report consists of following texts and drawings

- Final Report - Topographic Survey

- Final Report - Natural Condition Survey Geotechnical Investigations and Analysis
- Final Report - Railway Management and Maintenance
- Final Report - Detailed Design (with Summary in Indonesian and Japanese Language); subject to this report
- Final Report – Drawings
- Final Report – Design Analysis
- Final Report – Quantity Estimation
- Final Report – Cost Estimation
- Final Report – Pre-Qualification
- Final Report – Instruction to Tenderers
- Final Report – Conditions of Contract
- Final Report – Technical Specifications and
- Final Report – Bill of Quantities

1.4. Final Report - Detailed Design

The Main Report for the Detail Design has twelve Chapters:

Chapter 1: Introduction contains four Sections.

Chapter 2 is the Record of the Study in which discuss overview of past study record

Chapter 3 is the Project Plan which forms Demand Study, Train Operation Plan.

Chapter 4 is the Detailed Design of Alignment and Track Works

Chapter 5 is the Detail Design of Civil and Bridges.

Chapter 6 is Architectural Works.

Chapter 7 Railway System consists of Sub-station, Overhead Contact System (OHC), Power Distribution Line (PDL), Signal and Train Control, and Telecommunication

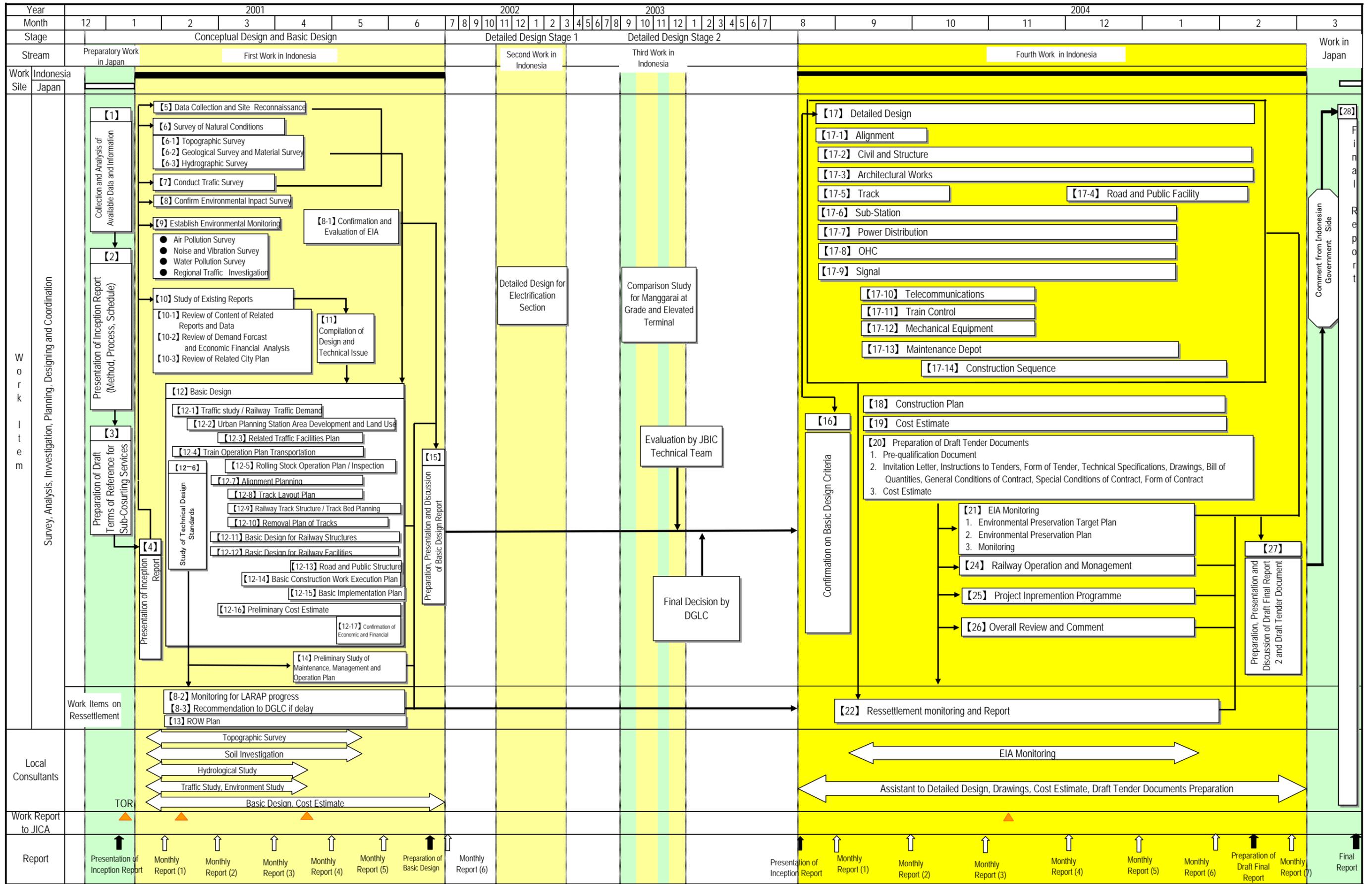
Chapter 8 Cipinang Depot

Chapter 9 Implementation Plan consists of Track Switch-over Plan, Construction Method and CPM

Chapter 10 Project Cost

Chapter 11 Tender Documents

Chapter 12 Comprehensive Evaluation and Recommendations



CHAPTER - 2
RECORD OF THE STUDY

CHAPTER - 2 RECORD OF THE STUDY

In response to the request of the Government of the Republic of Indonesia (GOI), the Government of Japan (GOJ) decided to conduct the Detailed Design Study of Railway Electrification and Double-Double Tracking of Java Main Line Project (Manggarai – Bekasi – Cikarang Section) in Indonesia (the Study) in accordance with the relevant laws and regulations in force in Japan.

For the purpose of urgent implementation of the Study, GOI requested the execution of the detailed design works, including tender document preparation, through JICA. The construction and procurement of the works will be through the use of the Special Yen Loan. The study for the detailed design for the Project shall be in accordance with the Memorandum concluded by JBIC and GOI in October 2001.

JICA, as the result of a selection process conducted in accordance with the regulations of JICA, appointed Pacific Consultants International of Tokyo, Japan together with Japan Railway Technical Service of Tokyo, Japan to perform the Study and to achieve its objectives.

The JICA Study Team consisted of Pacific Consultants International and Japan Railway Technical Service mobilized Indonesia on January 20, 2002 and duly commenced the Study. On January 23, 2002 steering committee meeting in attendance with the JICA Study Team was held and Study Team explained the Inception Report in which scope of work and methodology of the study was mentioned. According to the Inception Report and the Minutes of Steering Committee Meeting the Study was carried out.

The Basic Design covered the whole of the Project from Manggarai Station inclusive to Cikarang Station inclusive. The Detail Design was split into two Stages, Stage 1 and Stage 2 as a result of discussion with the counterpart on June 19, 2002. Stage 1 covered the Works from Bekasi Station inclusive, to Cikarang Station inclusive. Stage 2 will cover the remaining portion and the Cipinang locomotive and coach depots.

The Basic Design Report was completed and submitted to the DGLC at the end of June 2002 before the Study Team departed from Jakarta. A further development of the Bekasi Station Plaza Basic Design was requested by DGLC resulting from the decision to close the Coal Traffic Handling facility.

Between the 4th November 2002 and 11th March 2003 Detailed Design Stage 1 was carried out. At the beginning of the Detailed Design Stage 1, on November 25, 2002 a technical meeting was held in order to discuss the Inception Report which showed the scope and methodology for the Study. The Detailed Design Stage 1 was carried out based on basic

conditions agreed between JICA Study Team and DGLC during Basic Design Study. On February 26, 2003 result of the Detailed Design was presented to DGLC technical team. The Draft Final Report Stage 1 was submitted to JICA on March 12, 2003.

After the basic design was completed, Japan Bank for International Cooperation (JBIC) assumes the benefit and possibility of the development of Manggarai Station as the “at-grade” station. Upon suggestions and recommendation from JBIC to DGLC, GOI requested Japan International Cooperation Agency (JICA) to carry out the comparison study on the station development by the “elevated station” plan and the “at-grade station” plan (herein referred to as “the Comparative Study”), accordingly JICA Study Team has implemented such Comparison Study from September 2003 to December 2003.

The objectives of Comparison Study are to carry out the basic design for the development of Manggarai Station as the at-grade station, and to compare it with the elevated station plan that was prepared in the Basic Design Study including advantages and disadvantages of each plan, so that the GOI will be able to make a decision whether Manggarai Station should be developed as the elevated station or the at-grade station. The Comparative Study covered the section from two-level crossing with JABOTABEK Central Line to the approach to the elevated structures.

At the beginning of the works in Indonesia, the Study Team made a presentation to the Government of Indonesia on the Basic Design Concept, and the Minutes of Meeting was prepared with signature from both parties. (October 17, 2003)

After the works in Indonesia, the Basic Design for Manggarai At-grade Station was finalized in Japan, after several meetings with the relevant agencies in Japan. The Basic Design for the Manggarai At-grade Station was developed under the same condition as that for Manggarai Elevated Station. Then, the comparison study was carried out to clarify advantages and disadvantages of both plans. The draft comparison table was submitted to DGLC on 11 December 2003, and the presentation was made on 8 January 2004 by the Study Team to explain about the basic design for Manggarai At-grade Station and the draft comparison table. Receiving comments from DGLC on the draft comparison table, the Study Team finalized the comparison table incorporating DGLC's comments.

On June 1, 2004 DGLC transmitted their request to proceed Detailed Design Stage 2 based on the Manggarai Station Elevated Plan to JICA. In addition to this request, in another letter DGLC informed of their revised land plan reducing ROW by 2m between Cipinang and Cikarang.

According to DGLC's request JICA as official agency for the Japanese ODA implementation

dispatched the JICA Study Team on September 5, 2004 in order to carry out Detailed Design Stage 2 for the section between Manggarai and Bekasi. The Study includes preparation of whole set of Draft Tender Documents including Pre-qualification documents.

CHAPTER - 3
PROJECT PLAN

CHAPTER - 3 PROJECT PLAN

3.1. Demand Study

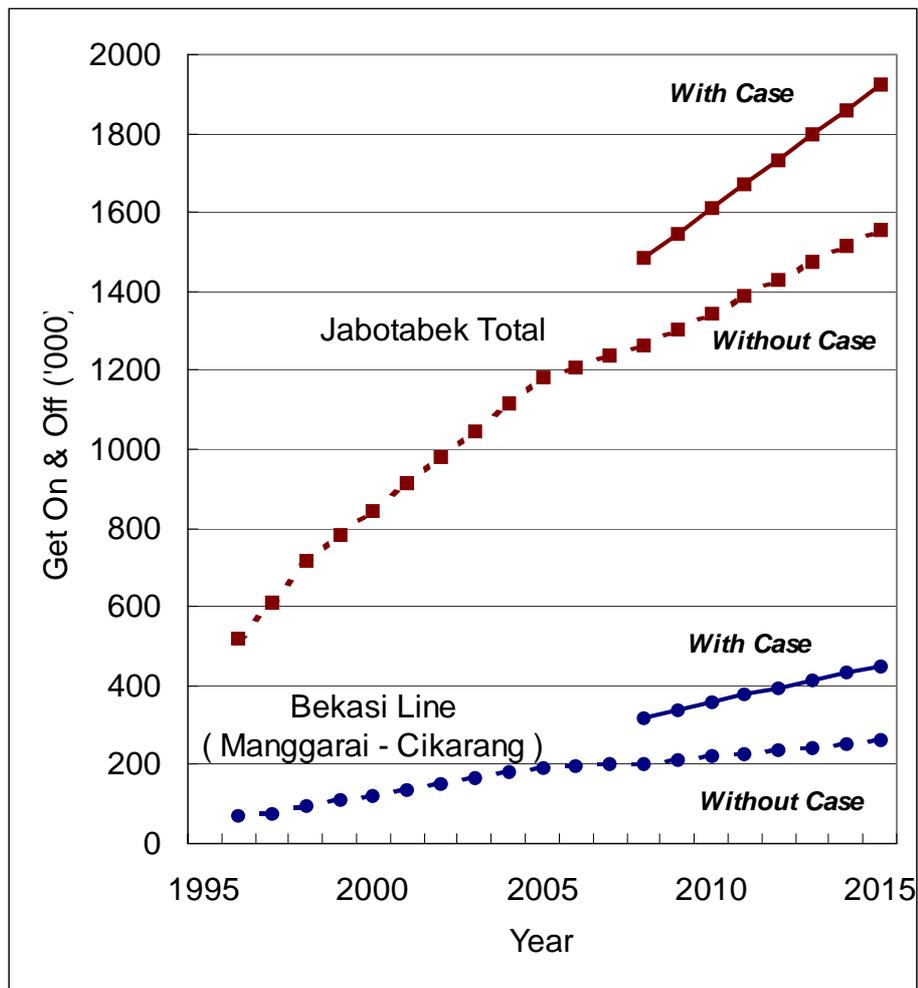
Railway transport demand was forecast for three groups; passenger demand on commuter and local trains, passenger demand on medium and long distance trains and commodity transport.

3.1.1. Passenger Demand on Commuter and Local Trains

Passenger demand was forecast by modal share model in order to reflect increase in service level. Forecast passenger demands on commuter trains as well as local trains are indicated in the Table 3.1-1 below for both “With Project” case and “Without Project” case. The Figure 3.1-1 on the next page illustrates the growth of passenger demand under “With Project” case in comparison with “Without Project” case.

Table 3.1-1 Estimated Number of Passengers on Commuter & Local Trains

Station	2000		2005		2008		2015	
	JICA Survey		Without Project		With Project		With Project	
	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting
Manggarai	10588	10362	15566	15811	23806	25351	33071	35889
Matraman	0	0	0	0	2628	3517	4339	5398
Jatinegara	5067	9686	7195	12642	15070	21228	21560	28913
Klender	3232	3949	3936	4711	7822	7950	10814	10490
Buaran	1656	1667	1992	2054	3761	3432	5251	4636
Klender Baru	3232	2565	4185	3009	6388	4519	8466	5811
Cakung	5891	4651	7256	5736	9914	8587	12473	11114
Kranji	6944	8523	11305	12313	15901	17921	21761	23695
Bekasi	20745	16629	34249	28041	40382	35978	55717	50536
Bekasi Timur	0	0	0	0	11494	9727	16249	13790
Tambun	3842	759	8331	1749	12425	3195	18583	5025
Cibitung	563	452	1765	1890	2649	2910	4272	4807
Cikarang	1373	1058	5836	4072	13027	10990	21223	18027



*) Without CASE indicates the case that this project is not carried out

Figure 3.1-1 Estimated Number of Passengers on Commuter & Local Trains

3.1.2. Passenger Demand on Medium and Long Distance Trains

Medium and Long Distance Passenger demand was estimated based on the growth of socio-economic indicators of the relevant regions and expected modal share between road transport and railway. The estimated number of boarding and alighting number of passenger on medium and long distance trains are shown in the Table 3.1-2.

Table 3.1-2 Estimated Medium and Long Distance Train Boarding (or Alighting)

Passengers per Day

From/To	2001	2005	2008	2010	2015	2020
Merak	1,599	1,927	2,113	2,236	2,656	3,085
Cirebon (Sub Total)	19,327	25,261	28,650	30,908	37,613	44,368
From Cirebon	2,225	2,765	3,148	3,404	4,483	5,575
from North Line (Semarang/Surabaya)	7,613	9,933	11,197	12,040	14,866	17,629
from South Line (Yogyakarta/Solo/Surabaya)	9,488	12,563	14,304	15,465	18,263	21,164
Bandung	5,927	7,231	8,025	8,554	10,418	12,312
Total	26,852	34,419	38,787	41,699	50,687	59,765
ratio p.a.		6.40%	4.06%	3.69%	3.98%	3.35%

3.1.3. Commodity Transport Demand

At present major commodity flows transported by rail is limited. Based on the present commodity flow pattern, future cargo demand by railway transport was forecasted as depicted in the Table 3.1-3.

Table 3.1-3 Projected Annual Railway Cargo Tonnage on Bekasi Line

Cargo by Negotiation	From	To	Km	2000 (Est.)	2005	2008	2010	2015	2020
Fertilizer	Dawuan	Cirebon	140	29,900	37,100	41,400	44,300	44,300	44,300
Coal	Cigading	Bekasi	161	624,700	708,900	759,400	793,000	793,000	793,000
Steal	Cilegon	SM.Poncol/ Waru SB	-	55,600	96,000	120,200	136,400	136,400	136,400
Container Cargo	JAK.Gudang	Surabaya Pasar Turi	725	146,600	189,900	219,300	238,800	316,900	393,000
Container Cargo (PK TOJB)	-	-	-	79,500	84,000	84,000	84,000	84,000	84,000
Parcel	JAK.Gudang	Surabaya Pasar Turi	725	27,100	36,100	41,400	45,000	45,000	45,000
Other Cargo	From	To	Km	2000 (Est.)	2005	2008	2010	2015	2020
Container Cargo	Pasoso (Tg.Priok)	Gede Bage	195	63,400	68,700	71,900	74,000	98,200	121,800
Sand	-	-	-	101,300	101,300	101,300	101,300	101,300	101,300
Animals	Kandangan/ Kalimas	Cipinang/ Cikarang	-	57,100	57,100	57,100	57,100	57,100	57,100
Money	-	-	-	1,300	1,300	1,300	1,300	1,300	1,300
Other Express Cargo	JAK.Gudang	Surabaya Pasar Turi	725	121,400	139,300	150,100	156,800	182,400	204,300
Baggage	-	-	-	11,100	14,300	16,100	17,300	21,000	24,700

3.2. Train Operation Plan

3.2.1. Calculation Method

There are many methods to calculate line capacity on a double track railway. A rough estimate method created by Dr. Yamagishi is proposed in this case. On a double track section, a higher speed train must keep a definite time interval with the same kind of train ahead of it. And that a higher speed train must also keep a definite time interval with a lower speed train that is waiting to be overtaken on a sidetrack. The line capacity is expressed with the number of total trains passing the concerned section in a day. The Capacity was calculated using two kinds of ratio of the number of higher/lower speed trains (v and v' below).

The formula is as follows.

$$N = f T / \{ h v' + (r + u + 1) V \}$$

N : Line Capacity (Total number of trains going on one way a day)

f : Ratio of total time per whole time a day. (Usual value is 0.6.)

T : 1,440 (The number of minutes in a day : 24*60)

h : Necessary time interval between higher speed trains.

r : Necessary minimum time interval between an arrived train and the following overtaking train at the station.

Jatinegara – Bekasi 2 minutes, existing.

Bekasi – Cikampek 3 minutes, existing; but 2 minutes, in 2008, due to improvement to the signalling system.

u : Necessary minimum time interval between a departed higher speed train and a following lower speed train at the station : 2 minutes.

V : Ratio of the number of higher speed trains per total number of trains.

v' : Ratio of the number of lower speed trains per total number of trains.

The classification of trains into higher and lower speed trains depends on their travelling times. Mainly, they are classified as passing trains or not.

3.2.2. Line Capacity of Project Section

Currently, although there are few commuter trains between Manggarai - Jatinegara, the line capacity can be assumed as same as the neighboring section between Jatinegara - Bekasi.

A few freight trains are operated in the project corridor, and they are spending so much traveling time that they are operated at night in and surround of Jakarta City. This calculation is made without freight trains, but the total number of trains includes freight trains. Line capacity is expressed in the number of daily train operations in one direction.

Table 3.2-1 Number of Trains between Jatinegara-Cikampek

With and Without Case

Year	Section	With or without	Track in use	EMU	L/M	Local	Freight Train	Total	Note	
2001	Jatinegara-Bekasi	-	Existing Track	34	66	11	18	129		
	Bekasi-Cikarang	-	Existing Track		66	11	8	85		
	Cikarang-Cikampek	-	Existing Track		66	6	8	80		
2008	Jatinegara and Bekasi	with	Existing Track	72				72	EMU trains/hour	
			New Main Line		90	33	10	133	5~9:7/h	
		without	Existing Track	72	90	33	10	205	9~21:4/h	
	Bekasi-Cikarang	with	Existing Track	36				36	1/2 of EMU	
			New Main Line		90	33	10	133	between Bks-Ckr	
		without	Existing Track	36	90	33	10	169	36=72/2	
	Cikarang-Cikampek	with	Existing Track					0		
			New Main Line		90	33	10	133		
		without	Existing Track		90	33	10	133		
	2015	Jatinegara-Bekasi	with	Existing Track	100				100	EMU Increase ratio
				New Main Line		115	35	11	161	Year of 2015/2008: 16/12
			without	Existing Track	100	115	35	11	261	100=72*16/12
Bekasi-Cikarang		with	Existing Track	50				50	1/2 of EMU	
			New Main Line		115	35	11	161	between Bks-Ckr	
		without	Existing Track	50	115	35	11	211	50=100/2	
Cikarang-Cikampek		with	Existing Track					0		
			New Main Line		115	35	11	161		
		without	Existing Track		115	35	11	161		

To increase line capacity it is necessary to improve the signalling system.

According to the formula in 3.2.1, the existing line capacity is calculated as follows.

$$N = f T / \{ h v' + (r + u + 1) V \}$$

$$N = 0.6 * 1,440 \{ 5 * v' + (r+2+1) * V \}$$

Table 3.2-2 Line Capacity according to the value of V, v', and r.

	Jatinegara-Bekasi		Bekasi-Cikarang		Cikarang-Cikampek	
Number of higher speed trains	87	V=0.68	65	V=0.86	65	V=0.92
Number of lower speed trains	41	v'=0.32	11	v'=0.14	6	v'=0.08
Total number of trains	128		76		71	
r	2		Existing : 3 Future : 2		Existing : 3 Future : 2	
Line Capacity	173		Existing : 148 Future:173		Existing : 146 Future : 173	

As shown in Table 3.2-1, in this study, two cases With and Without improvement are compared with the planned number of trains in 2008 and 2015. If double-double tracking between Manggarai-Bekasi can be finished by the year 2008, EMU trains must be operated on the existing double track, so the necessary number of trains on this section is 205 at 2008. The required train number is bigger than line capacity. At 2015, if double-double tracking between Manggarai-Bekasi is finished by the year 2015, the necessary number of trains is 261 between Jatinegara-Bekasi, and 211 between Bekasi-Cikarang on existing double track. Necessary number of trains in future is explained in this Chapter, Section 3.2.4 - Future Train Operation Plan in detail.

The Line Capacity and number of trains on the Main Line are shown in Figure 3.2-1.

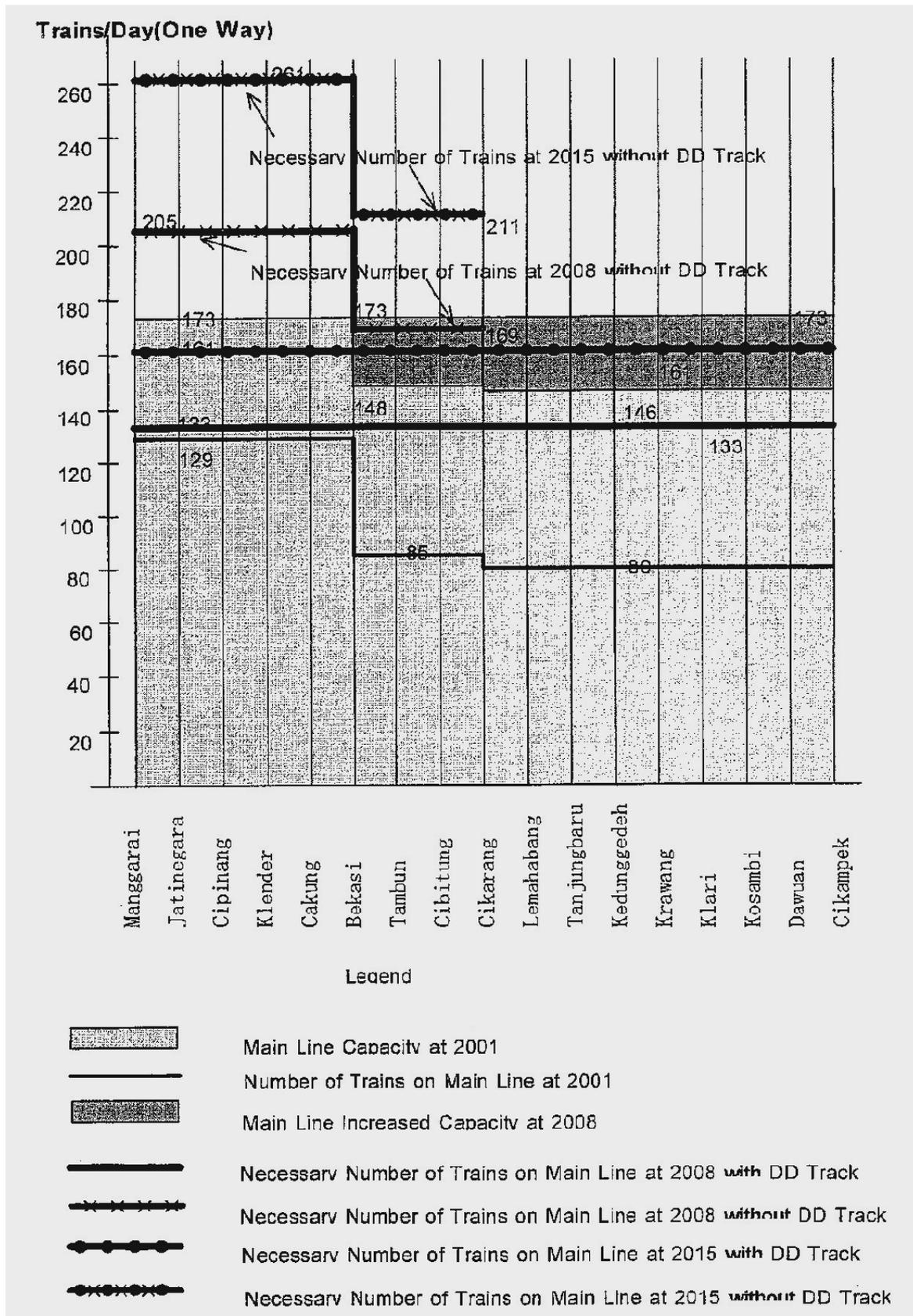
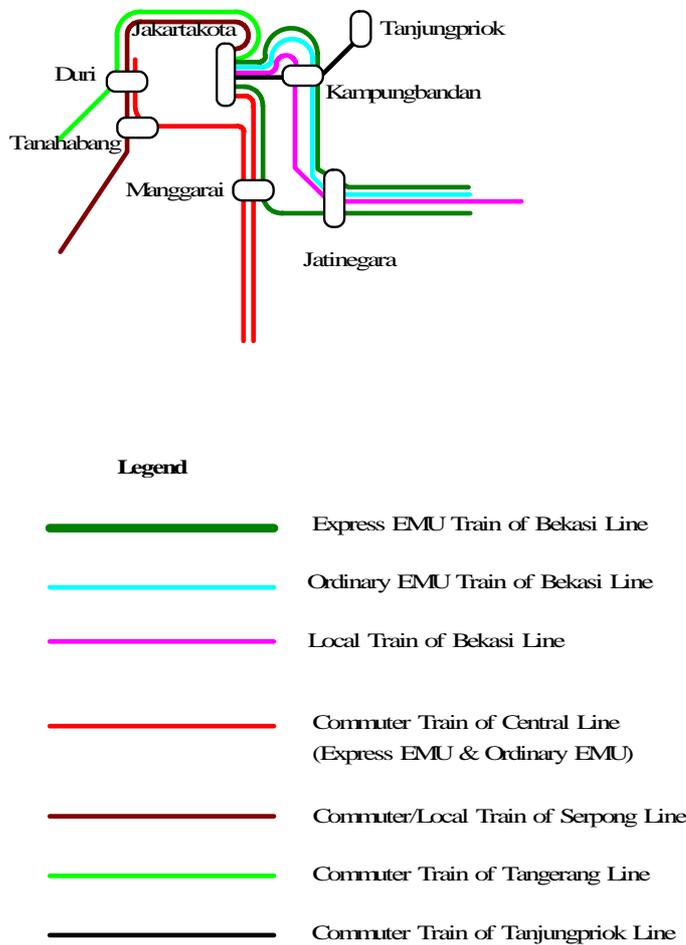


Figure 3.2-1 Line Capacity and Number of Trains on Main Line

3.2.3. Existing Train Operations

(1) Commuter Train, Local Train



Currently, most commuter and local trains (from/to outer zones of the Jabotabek Area) arrive and depart at Jakartakota Station as shown in Figure 3.2-2 and Figure 3.2-3. These trains are very crowded in the morning peak hours because of a shortage of number of trains resulted from shortage of rolling stock. Many express commuter trains operate on every line. Passengers pay a higher fare and get comfortable accommodation and rapid trip.

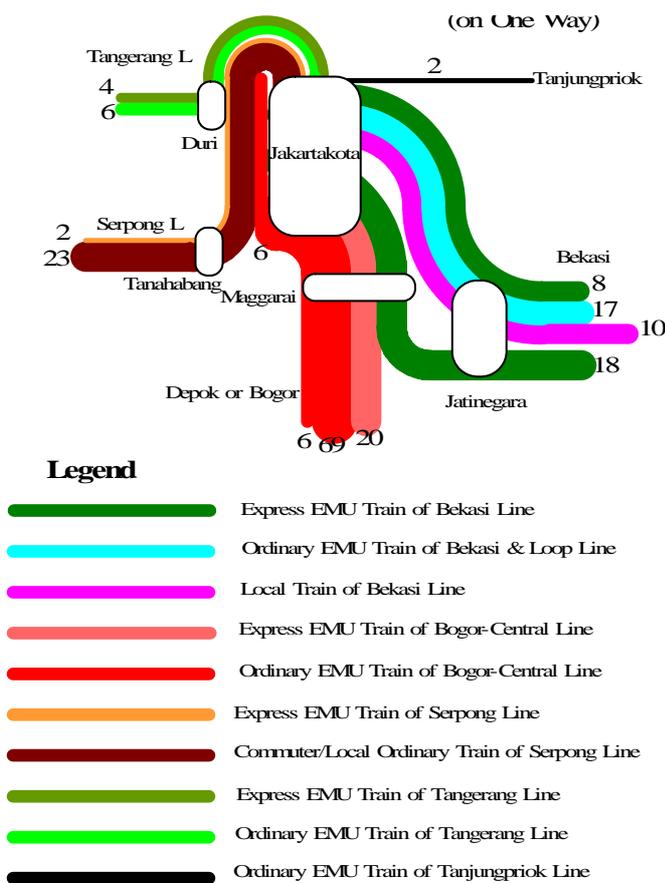
On the Western Line between Manggarai and Tanahabang, only a few trains operate. There are conflicting routes between the Western Line and the Central Line in Manggarai Station, and it is difficult to operate Western Line Trains into the time interval of the frequent Central Line Trains.

Figure 3.2-2 Existing Commuter/Local Train Route

On Bekasi Line there is so much confusion between commuter trains and long/middle distance trains on the same track, that many commuter trains are frequently delayed.

a) Bekasi Line and Suburban Area

Except EMU trains from Bekasi, DMU trains and diesel hauled trains are operated between Jakartakota and stations beyond Bekasi (Tambun-Purwakarta). Most trains run on the Eastern Line to Jakartakota. Part of middle distance trains stop at the small stations between Cikampek and Cirebon, and between Cikampek and Bandung.



Express EMU trains named “Bekasi Express” are operated between Jakarta Kota and Bekasi, 26 round trips a day. 18 trains are operating via Gambir, and 8 are via Eastern Line. They only stop at Gambir or Pasarsenen, and do not stop at Jatinegara.

The section where the maximum number of passengers passing through is between Klender-Buaran, the number of passengers is 34,950/day and 22,240 during morning peak 2 hours (bound for Jatinegara, one direction, year of 2001). Peak ratio is 63.6%.

Figure 3.2-3 Number of Existing Commuter/Local Train Route

b) Bogor - Central Line

This line is the biggest in Jabotabek commuter transport on both passenger volume and the number of trains. The section where the maximum number of passengers passing through is between Pasarminggubaru and Durenkalibata.

The number of passengers is 116,583/day and 51,744 during morning peak 2 hours (bound for Jakarta, one direction, year of 2001). Peak ratio is 44.4%. This section is far from city centre, but many passengers change to buses from the railway at Pasarminggu Station which is near a big city bus centre having many bus routes to Jakarta City Center. 191 round trip trains operate on this line every day, and 18 trains operate in morning peak 2 hours (between Manggarai-Depok, on one direction).

Express EMU trains named “Pakuan” and “Depok Express” operate between Jakarta Kota and Bogor or Depok 41 round trip a day. They only stop at Gambir. All of the ordinary trains pass through Gambir Station, because of avoiding conflict among long/middle distance passengers and commuter passengers. A part of ordinary trains go into Western Line from Manggarai.

c) Serpong Line

Most EMU trains terminate at Tanahabang, but a large number of diesel hauled ordinary trains are trains between Jakartakota and Rangkasbitung. Express EMU train is only one round trip. The section where the maximum number of passengers passing through is between Pondokranji and Kebayoran, the number of passengers is 18,231/day and 14,082 during morning peak 2 hours (bound for Tanahabang, one direction, year of 2001).

d) Tangerang Line

6 round trips EMU trains operate every day, besides 4 round trip trains are express train. Most of trains run between Jakartakota and Tangerang.

(2) Long/Middle Distance Train (Inter-City Train)

Railway between Capital Jakarta and other cities in Java Island, Bandung, Semarang, Yogyakarta, Solo and Surabaya etc. are the most important main lines for railway transport. Many inter-city express trains operate between centres. The three main routes from/to Jakarta are:

- North Line, via Cirebon and Semarang to Surabaya.
- South Line, via Cirebon, Yogyakarta and Solo to Surabaya.
- Bandung Line between Cikampek and Bandung.

The existing main terminal stations for inter-city trains in Jakarta are Gambir Station and Pasarsenen Station. The other terminal stations are Jakartakota, Tanahabang and Tanjungpriok Stations. Four Trains for the Merak Line depart from Jakartakota. 66 trains bound for many other cities in Java Island also depart from these terminal stations. Among the terminal stations, Gambir Station operates 42 outbound trains. This station has only two platforms for inter-city trains, so it is difficult to increase the number of trains. There are 92 commuter trains also operating outbound from Gambir Station, PT.KAI has been forced to cancel using this station for all ordinary commuter trains.

In this report, inter-city trains are classified as follows:

- (i) Super Express Train: new excellent type of high speed executive class train.
- (ii) Class A Express Train: train consists of executive class cars.
- (iii) Class B Express Train: train consists of executive and business class cars.
- (iv) Economy Express Train: train consists of economy class cars.

Trains of type (i)-(iii) have a terminal station at Gambir or Jakartakota via Gambir. Trains of type (iv) mainly have a terminal station at Pasarsenen or Jakartakota via Pasarsenen,

additionally a fewer number of trains use Tanjungpriok and Tanahabang. Existing inter-city train terminal stations in Jakarta City are mainly divided into Gambir for business passengers, Pasarsenen for economy passengers.

Gambir Station is situated near the government centre, however, it has only 2 platforms and 4 tracks, because it was constructed as a commuter station. Currently, the inner two tracks are used for commuter trains, outside two tracks used for long/middle distance trains. Due to geographic reason the platforms are so narrow and crowded that PT. KAI decided not to stop commuter train at Gambir station for the safety of long distance passenger.

The train capacity and passenger volume is shown in Table 3.2-3. The number of cars in a train set varies from 7 to 11, while eight on the Bandung Line. Lebaran is longest national holiday in Indonesia, and many people commonly move to their hometown in this period. The number of cars in train set and increased number of trains in Lebaran season in the year of 2001 is shown in Table 3.2-4. There is an increase in the number of cars on many train sets, and the maximum number is 12. Increased train numbers are mainly economy class express trains. Passenger volume is based on the actual results of selling tickets in 2001. Annual average boarding ratio is 80%.

Table 3.2-3 Main Line Train Capacity and Passenger Volume Year 2001

Kind	Train No.	Name of Train	Operating Section	No. of Train	No. of Car	Arrangement of Coaches	Capacity /train	Total Capacity	Number of seats	Passenger Volume/day
Cirebon										
Super Ex				8				3,070		
	1,3,2,4	Argo Bromo Anggrek	Gambir-Surabaya Ps Turi	2	10	1KZ-7K1K-1K1M1-1BP	394	788	S : 22	
	5,7,6,8	Argo Bromo	Gambir-Surabaya Ps Turi	2	10	8K1K-1KM1/MP1-1BP	408	816	KZ : 39	
	13,15,14,16	Argo Muria	Gambir-Semarang Tawang	2	9	7K1K-1KM1/MP1-1BP	350	700	K1K : 50	
	11,12	Argo Lawu	Gambir-Solo Balapan	1	10	8K1K-1KM1-1BP	400	400	K1S : 33	
	9,10	Argo Dwipangga	Gambir-Solo Balapan	1	10	2K1S-6KM1-1BP	366	366	K1 : 52	
ClassA Ex				7				2,676		
	65,66	Bima	Jakarta-Surabaya Gubang	1	11	1K1S-8K1-1K1M1/MP1-1BP	457	457	KM1 : 26	
	67,68	Sembrani	Jakarta-Surabaya Ps Turi	1	8	6K1-1KM1-1BP	348	348	M1 : 0	
	69,70,71,72	Taksaka	Gambir-Yogyakarta	2	10	8K1-1KM1-1BP	416	832	MP1 : 0	
	73,74,	Gumarang	Jakarta-Surabaya Ps Turi	1	10	1K1S-7K1-1KM1/MP1-1BP	403	403	K2 : 64	
	75,76	Gajayana	Gambir-Malang	1	7	2K1K-1KM2-4K2	324	324	KM2 : 26	
	79,80	Kamandanu	Gambir-Semarang Tawang	1	8	6K1-1KM1/MP1-1BP	312	312	KMP2 : 26	
ClassB Ex				15				8,156		
	83,84	Bangunkarta	Pasarsenen-Jombang	1	11	2K1-8K2-1MP2	642	642	BP : 0	
	85,86	Purwo Jaya	Gambir-Cilacap	1	11	1K1-8K2-1KM2-1BP	590	590		
	91,92	Cirebon Express	Jakarta-Cirebon	1	11	3K1-1KM2-6K2-1BP	566	566		
	89,90,93-96	Cirebon Express	Gambir-Cirebon	3	11	3K1-1KM2-6K2-1BP	566	1,698		
	101, 102	Senja Utama Yogyakarta	Gambir-Yogyakarta	1	10	8K2-1KM2-1BP	538	538		
	103, 104	Fajar Utama Yogyakarta	Gambir-Yogyakarta	1	9	8K2-1KM2/MP2	538	538		
	105, 106	Senja Utama Semarang	Gambir-Semarang	1	10	8K2-1KM2-1BP	564	564		
	107, 108	Fajar Utama Semarang	Gambir-Semarang	1	9	8K2-1KM2/MP2	564	564		
	109, 110	Sawong Galih	Pasarsenen-Kutoarjo	1	10	9K2-1KM2/MP2	602	602		
	111, 112	Kutojaya I	Pasarsenen-Kutoarjo	1	9	8K2-1KM2/MP2	538	538		
	115, 116	Jayabaya Selatan	Jakarta-Surabaya Gubang	1	8	7K2-1KM2/MP2	474	474		
	117, 118	Senja Utama Solo BLPN	Gambir-Solo Balapan	1	8	1KC-5K2-1KM2-1BP	406	406		
	119, 120	Matarmaja	Pasarsenen-Malang	1	9	8K2-1MP2	436	436		
Eco Ex				12			10,576	10,576		
	141, 142	Brantas	Tanahabang-Kediri	1	10	8K3-1KP3-1KM3	976	976	K3 : 80	
	143, 144	Kerta Jaya	Pasarsenen-Surabaya Ps Turi	1	10	8K3-1KP3-1KM3	870	870	K3 : 88	
	145, 146	Empu Jaya	Pasarsenen-Yogyakarta	1	10	8K3-1KP3-1KM3	976	976	K3 : 106	
	147, 148	Tawang Jaya	Pasarsenen-Semarang	1	10	8K3-1KP3-1KM3	976	976	KP3 : 80	
	149, 150	Bengawan	Tanahabang-Solo Jebres	1	10	8K3-1KP3-1KM3	976	976	KM3 : 48	
	151, 152	Kutojaya	Pasarsenen-Kutoarjo	1	11	10K3-1KP3	1,108	1,108	KMP3 : 48	
	153, 154	Gaya Baru Malam Selatan	Jakarta-Surabaya Gubang	1	10	7K3-1KP3-1KM3-1B	870	870	B : 0	
	155, 156	Gaya Baru Malam Utara	Tanjungpriok-Surabaya PS Turi	1	10	8K3-1KP3-1KM3	896	896		
	159, 160	Tirtonadi	Tanjungpriok-Solo Balapan	1	10	8K3-1KP3-1KM3	976	976		
	165, 166	Tawang Mas	Tanjungpriok-Semarang	1	10	8K3-1KP3-1KM3	976	976		
	177, 178	Tegal Arum	Jakarta-Tegal	1	10	8K3-1KP3-1KM3	976	976		

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Kind	Train No.	Name of Train	Operating Section	No. of Train	No. of Car	Arrangement of Coaches	Capacity /train	Total Capacity	Number of seats	Passenger Volume/day
Lugga	183, 184	Parcel	Jakarta Gd-Surabaya PS Turi	1	10	10B				
Total of Cirebon				42				24,478		19,327
Boarding efficiency								79		

Bandung										
Super Ex				4				1,200		
	17-24	Argo Gede	Gambir-Bandung	4	8	6K1K-1KM1-1BP	300	1,200		
ClassB Ex				17				3,566		
	34-56	Parahyangan	Gambir-Bandung	8	8	2K1-1KM1-4K2-1BP	384	3,072		
	31F-64F	Parahyangan	Gambir-Bandung	9	8	2K1-1KM1-4K2-1BP	384	494		
Eco Ex				3				2,136		
	167, 168	Cipuja	Jakarta-Kroya	1	8	6K3-1KP3-1KM3	764	764		
	169, 170	Citrajaya	Jakarta-Kroya	1	8	6K3-1KP3-1KM3	764	764		
	179, 180	Galuh	Tanahabang-Banjar	1	8	6K3-1KP3-1KM3	608	608		
Total of Bandung				24				6,902		5,927
Boarding efficiency								86		
Grand Total				66				31,380		25,254
Boarding efficiency								80		

Note (Figure shows number of seats)

S :Special sleeping car

KZ :Special executive class car

K1K :Executive class car

KM1 :Combined car with executive class seats and cooking cabin.

BP :Luggage car with electric power supply equipment.

K1 :Executive class lasscar

K2 :Business class car

KM2 :Combined car with business class seats and cooking cabin.

K3 : Economy class car

KP3 :Economy class car with electric power supply equipment

KM2 :Combined car with economy class seats and cooking cabin.

B :Luggage car

Table 3.2-4 Main Line Train Capacity on Lebaran Year 2001

Kind	Train No.	Name of Train	Operating Section	No. of Train	No. of Car	Arrangement of Coaches	Capacity /train	Total Capacity	Number of seats	Passenger Volume/day
Cirebon										
Super Ex										
	1,3,2,4	Argo Bromo Anggrek	Gambir-Surabaya Ps Turi	2	11	1KZ-8K1K-1K1M1-1BP	444	888	S : 22	
	5,7,6,8	Argo Bromo	Gambir-Surabaya Ps Turi	2	10	10K1K-1KM1/MP1-1BP	508	1,016	KZ : 39	
	13,15,14,16	Argo Muria	Gambir-Semarang Tawang	2	10	8K1K-1KM1/MP1-1BP	400	800	K1K : 50	
	11,12	Argo Lawu	Gambir-Solo Balapan	1	12	10K1K-1KM1-1BP	500	500	K1S : 33	
	9,10	Argo Dwipangga	Gambir-Solo Balapan	1	10	2K1S-6KM1-1BP	366	366	K1 : 52	
ClassA Ex										
	65,66	Bima	Jakarta-Surabaya Gubang	1	12	1K1S-9K1-1K1M1/MP1-1BP	509	509	KM1 : 26	
	67,68	Sembrani	Jakarta-Surabaya Ps Turi	1	10	8K1-1KM1-1BP	416	416	M1 : 0	
	69,70,7172	Taksaka	Gambir-Yogyakarta	2	10	8K1-1KM1-1BP	416	832	MP1 : 0	
	73,74,	Gumarang	Jakarta-Semarang Tawang	1	10	1K1S-7K1-1KM1/MP1-1BP	405	405	K2 : 64	
	75,76	Gajayana	Gambir-Malang	1	10	9K1K-1KMP2	602	602	KM2 : 26	
	79,80	Kamandanu	Gambir-Semarang Tawang	1	10	8K1-1KM1/MP1-1BP	416	416	KMP2 : 26	
ClassB Ex										
	83,84	Bangkunkarta	Pasarsenen-Jombang	1	11	2K1-8K2-1MP2	616	616	BP : 0	
	85,86	Purwo Jaya	Gambir-Cilacap	1	12	2K1-8K2-1KM2-1BP	642	642		
	91,92	Cirebon Express	Jakarta-Cirebon	1	12	3K1-1KM2-7K2-1BP	630	630		
	89,90,93-96	Cirebon Express	Gambir-Cirebon	1	12	3K1-1KM2-7K2-1BP	630	630		
	101, 102	Senja Utama Yogyakarta	Gambir-Yogyakarta	1	12	10K2-1KM2-1BP	666	666		
	103, 104	Fajar Utama Yogyakarta	Gambir-Yogyakarta	1	12	10K2-1KM2/MP2	666	666	?	
	105, 106	Senja Utama Semarang	Gambir-Semarang	1	12	10K2-1KM2-1BP	666	666		
	107, 108	Fajar Utama Semarang	Gambir-Semarang	1	12	10K2-1KM2/MP2	666	666	?	
	109, 110	Sawong Galih	Pasarsenen-Kutoarjo	1	11	10K2-1KM2/MP2	666	666		
	111, 112	Kutojaya I	Pasarsenen-Kutoarjo	1	10	9K2-1KM2/MP2	602	602		
	115, 116	Jayabaya Selatan	Jakarta-Surabaya Gubang	1	10	9K2-1KM2/MP2	602	602		
	117, 118	Senja Utama Solo BLPN	Gambir-Solo Balapan	1	9	1KC-6K2-1KM2-1BP	470	470		
	119, 120	Matarmaja	Pasarsenen-Malang	1	8	7K3-1KMP3	436	436		
	85L, 86L	Purwo Jaya Utama/Lebaran	Gambir-Cilacap	1	9	8K2-1KMP2	538	538		
	90L, 91L	Cirebon Express/Lebaran	Gambir-Cirebon	1	9	1KC-6K2-1KM2-1BP	470	470		
Eco Ex										
	141, 142	Brantas	Tanahabang-Kediri	1	10	8K3-1KP3-1KM3	976	976	K3 : 80	
	143, 144	Kerta Jaya	Pasarsenen-Surabaya Ps Turi	1	10	9K3-1KP3-1KM3	1,082	1,082	K3 : 88	
	145, 146	Empu Jaya	Pasarsenen-Yogyakarta	1	12	10K3-1KP3-1KM3	1,188	1,188	K3 : 106	
	147, 148	Tawang Jaya	Pasarsenen-Semarang	1	10	9K3-1KMP3	1,002	1,002	KP3 : 80	
	149, 150	Bengawan	Tanahabang-Solo Jebres	1	10	9K3-2KMP3	1,050	1,050	KM3 : 48	
	151, 152	Kutojaya	Pasarsenen-Kutoarjo	1	11	10K3-1KP3	1,108	1,108	KMP3 : 48	
	153, 154	Gaya Baru Malam Selatan	Jakarta-Surabaya Gubang	1	11	9K3-1KP3-1KM3	1,082	1,082	B : 0	
	155, 156	Gaya Baru Malam Utara	Tanjungpriok-Surabaya PS Turi	1	11	9K3-1KP3-1KM3	1,082	1,082		
	159, 160	Tirtonadi	Tanjungpriok-Solo Balapan	1	10	10K3-1KP3-1KM3	1,188	1,188		
	165, 166	Tawang Mas	Tanjungpriok-Semarang	1	10	9K3-1KMP3	1,002	1,002		

**The Detailed Design Study of Railway Electrification and
Double-Double Tracking of Java Main Line Project
Final Report**

Kind	Train No.	Name of Train	Operating Section	No. of Train	No. of Car	Arrangement of Coaches	Capacity /train	Total Capacity	Number of seats	Passenger Volume/day
	177, 178	Tegal Arum	Jakarta-Tegal	1	10	8K3-1KP3-1KM3	1,034	1,034		
	105L, 106L	Ekonomi Lebaran		1	11	10K3-1KMP3	1,108	1,108		
	107L, 108L	Ekonomi Lebaran		1	11	10K3-1KP3	1,140	1,140		
	151L, 152L	Ekonomi Lebaran		1	12	11K3-1KMP3	1,214	1,214		
	165L, 166L	Ekonomi Lebaran		1	10	9K3-1KP3	1,034	1,034		
	185L, 186L	Ekonomi Lebaran		1	9	9K3-1KP3	928	928		
	187L, 188L	Ekonomi Lebaran		1	8	8KD3	640	640		
	195L, 196L	Ekonomi Lebaran		1	10	8K3-1KP3-1KM3	976	976		
Luggage	183, 184	Parcel		1	10	10B				
Total of Cirebon				49				34,550		
Boarding efficiency										

Bandung								2,128		
Super Ex				4			266	1,064		
	17-24	Argo Gede	Gambir-Bandung	4	8	5K1K-1KM1-1BP	266	1,064		
ClassB Ex				17				3,566		
	34-56	Parahyangan	Gambir-Bandung	8	8	2K1-1KM1-4K2-1BP	384	3,072		
	31F-64F	Parahyangan	Gambir-Bandung	9	8	2K1-1KM1-4K2-1BP	384	494		
Eco Ex				3				2,136		
	167,168	Cipuja	Jakarta-Kroya	1	8	6K3-1KP3-1KM3	764	764		
	169,170	Citrajaya	Jakarta-Kroya	1	8	6K3-1KP3-1KM3	764	764		
	179,180	Galuh	Jakarta-Banjar	1	8	6K3-1KP3-1KM3	608	608		
Total of Bandung				21				6,766		
Boarding efficiency										
Grand Total				70				41,316		
Boarding efficiency										

Note (Figure shows number of seats)

S : Special sleeping car

KZ : Special executive class car

K1K : Executive class car

KM1 : Combined car with executive class seats and cooking cabin.

BP : Luggage car with electric power supply equipment.

K1 : Executive class lasscar

K2 : Business class car

KM2 : Combined car with business class seats and cooking cabin.

K3 : Economy class car

KP3 : Economy class car with electric power supply equipment

KM2 : Combined car with economy class seats and cooking cabin.

B : Luggage car

(3) Freight Train

The share of railway freight transportation is small. The number of freight train is only 18 round trips/day between Jatinegara and Bekasi.

a) Coal Train

Coal trains from/to Cigading on Merak Line operate through the Western Line and the Eastern Line via Tanahabang, Kampungbandan and Jatinegara to/from the Bekasi Station. Coal containers are loaded on trucks in Bekasi Station, and transported to the factory of Indocement near Citayam Station on Bogor Line. There were 10 round trips/day in 2001.

b) Marine Transportation Container Train

Trains loaded marine transportation container operate between Tanjungpriok-Gedebage (Bandung City). There were 4 round trips/day in 2001.

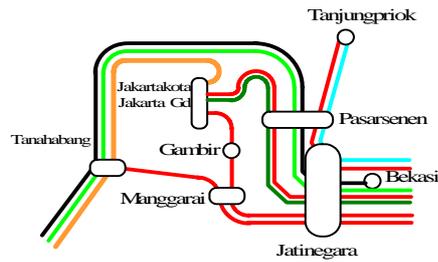
c) Express Freight Train

Between Jakarta Gudang-Surabaya and between Tonjongbaru (Merak Line)-Surabaya 2 and 1 round trip express freight trains operate respectively.

d) Others

1 round trip of freight train loaded steel coil is operated between Cilegon (Merak Line)-Surabaya.

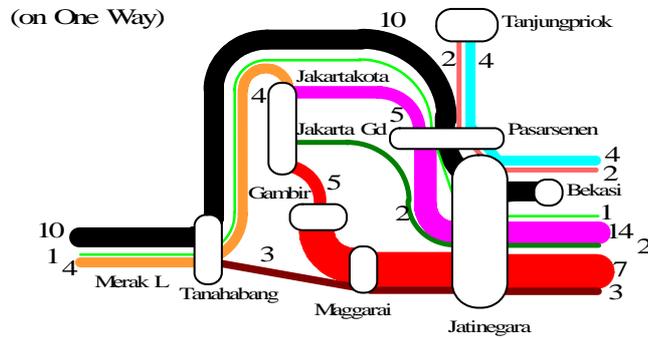
Figure 3.2-4 and Figure 3.2-5 show the operating route and the number of long/middle distance and freight trains.



Legend

- Long/Middle Distance Train on Merak Line
- Long/Middle Distance Train on the Other Line
- Coal Train
- Freight Train between Jakarta Gd and Surabaya
- Freight Train between Jakarta Gd and Surabaya
- Freight Train between Tanjungpriok and Gedebage

Figure 3.2-4 Existing Inter City & Freight Train Route



Legend

- Long/Middle Distance Train on Merak Line
- Long/Middle Distance Train from/to Central Line
- Long/Middle Distance Train from/to Eastern Line
- Long/Middle Distance Train from/to Tanjungpriok Station
- Long/Middle Distance Train from/to Tanahabang Station
- Coal Train
- Freight Train between Merak and Surabaya
- Freight Train between Jakarta Gd and Surabaya
- Freight Train between Tanjungpriok and Gedebage

Figure 3.2-5 Number of Existing Inter-City & Freight Trains

3.2.4. Future Train Operation Plan

(1) Commuter Train and Local Train

The maximum passenger volume is between Klender-Buaran in Bekasi Line, and Pasarminggubaru to Durenkalibata in Bogor Line. According to the demand forecast for 2008, passenger volumes on these sections are 48,428 and 62,182 in the morning peak 2 hours. They are 2.2 times and 1.2 times as much as the volume of 2001. Currently, congestion ratios on these sections are over 300%. It is desired that congestion ratio will be decreased to 200%. However, it may be difficult to have additional EMU, therefore the target was set as under 250% on ordinary trains.

a) Bekasi-Loop Line (Bekasi to Eastern & Western Line)

Development of industry and housing to the east and west of the Jabotabek Area has resulted in a increase in traffic demand so rapidly that road traffic has become congested along the east-west corridors of Jabotabek. As mentioned above, railway transport is also in high demand.

After this project, it will be possible to increase the number of commuter trains without conflicts with long/middle distance trains. Upon completion of expansion of electrification, electric ordinary trains starting from Cikarang or Bekasi can run through Manggarai-Tanahabang-Kampungbandan and arrive at Jatinegara. The train returns in the reverse order Kampungbandan-Tanahabang-Manggarai to Bekasi or Cikarang. (Figure 3.2-6)

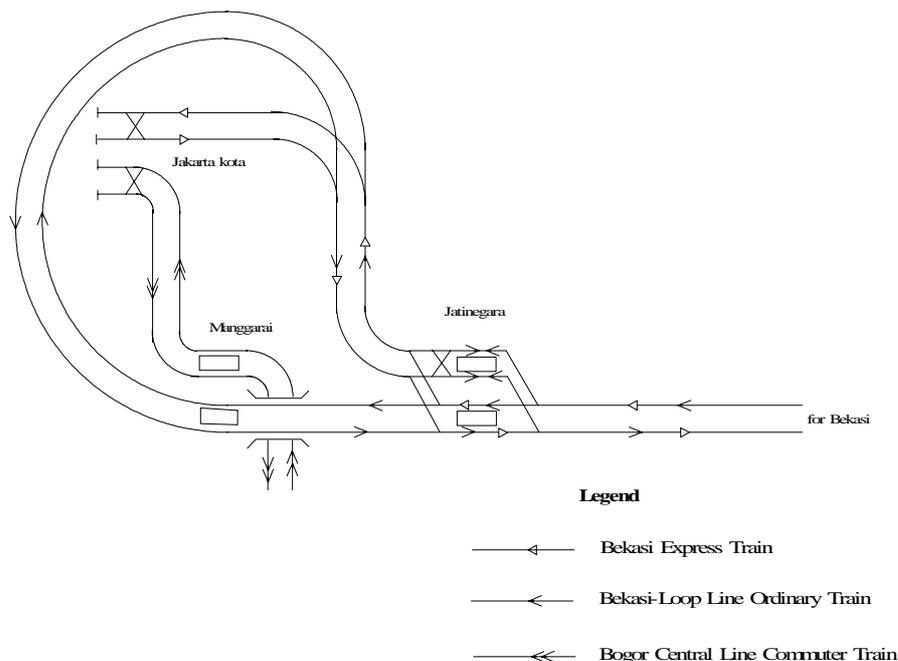


Figure 3.2-6 Future Bekasi Loop Line (Bekasi – Eastern & Western Line) Train Route

Express EMU trains operate on every Jabotabek Line. For the benefit of good passenger services and maintaining revenue, express trains are increasing in number every year. This trend may continue, and under this plan Express EMU trains will operate on every line.

Express EMU trains on this line will make round trips between Cikarang-Pasarsenen-Jakartakota. (cf. Figure 3.2-6) It is considered that express EMU trains will run through East-West Line, in future. At that time, train overtaking tracks will be necessary with the construction of more island platforms each with 2 tracks on the Western Line, and the necessary space is prepared below the high level platforms in Manggarai Station.

Six express EMU trains and 12 ordinary trains will operate with 6.7 minutes headway, in the morning peak 2 hours. The total passenger volume in the morning peak 2 hours is expected 48,428, and if express trains boarding ratio is 100%, the remaining ordinary trains will be so crowded and congestion ratio of ordinary trains will be 241%.

b) Bogor-Central Lines

Currently, the largest commuter transport line, and in future this situation will continue. For the sake of restraint on travel time for express train operating, construction of overtaking tracks at Univ. Indonesia Station must be considered in the near future.

It is considered that the train intervals on the Bogor Line will be reduced to four minutes in the future by decreasing the intervals between block signals.

Train operation plan is based on the condition mentioned above.

It is considered that the train make-up on Bogor-Central Line will increase to 12 cars in the future. The platform length at Manggarai is designed to meet 12 cars train. Grade separation in Manggarai Station between commuter train and long/middle distance trains on the Central Line will make a contribution to the safety and reliability of commuter transportation.

Seven Express EMU trains and 21 ordinary trains will operate with 4.3 minutes headway, in average in the morning peak 2 hours between Jakartakota-Depok. The total passenger volume in the morning peak 2 hours is expected to be 62,182, and if express trains boarding ratio is 100%, the volume for ordinary trains is 57,702, and congestion ratio of ordinary trains is 245%.

c) Serpong Line, and Tangerang Line

Most of the commuter and local trains operating on the Serpong Line depart or terminate at Jakartakota Station. All EMU trains on the Tangerang Line also operate to and from Jakartakota Station. However, after this project all trains except the long/middle distance trains will terminate at the Loop Line station, either at Tanahabang or Duri, where frequent

EMU train services will use the inner or outer loop line to Jatinegara or the Bekasi Line.

The demands will not increase so much that train operation will not change as existing situation on these lines.

d) Tanjungpriok Line

It is necessary to operate EMU trains on the Tanjungpriok Line at 20 minutes headway, because Jakartakota has to be connected to the Loop Line by this line.

Commuter transportation on each line are shown in Table 3.2-5 (year of 2008) and Table 3.2-6 (year of 2015) on the next sheet.

Table 3.2-5 Commuter Transport on Each Line (Morning Peak 2 Hrs) Year 2008

Line	Section	* Typical Section	Number Of train	Head-way	Capacity	Passenger Volume	Boarding Ratio
Western Line	Kampungbandan - Jatinegara	Kampungbandan -Angke	Ordinary 12	10	14,560	24,194	166%
Eastern Line	Kampungbandan -Jatinegara	Pondokjati -Jatinegara	Express 6 Ordinary 12	6.7	18,400	18,898	103%
Bekasi Line	Jatinegara - Bekasi	Klender -Buaran	Express 6 Ordinary 18	5	22,340	48,428	217%
	Bekasi -Cikarang	Bekasitimur -Bekasi	Express 3 Ordinary 6	13.3	9,200	17,905	195%
Central Line	Jakartakota Manggarai	Cikini-Manggarai	Express 7 Ordinary 21	4.3	28,000	46,067	165%
Bogor Line	Manggarai -Depok	Durenkalibata -Cawang	Express 7 Ordinary 21	4.3	28,000	62,182	222%
	Depok -Bogor	Depok -Citayam	Express 4 Ordinary 14	6.7	18,240	36,992	203%
Serpong Line	Tanahabang -Serpong	Kebayoran -Pondokranji	Express 1 Ordinary 6	17.1	6,800	9,600	141%
Tangerang Line	Duri -Tangerang	Pesing -Bojongindah	Express 1 Ordinary 2	40	1,360	1,845	136%
Tanjung priok Line	Jakartakota-Tanjungpriok	Jakartakota-Kampungbandan	Ordinary 6	20	6,720	13,622	203%

Note * Typical Section : Section where the maximum number of passengers pass through

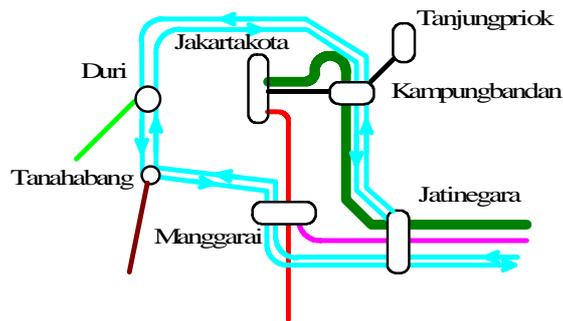
Table 3.2-6 Commuter Transport on Each Line (Morning Peak 2 Hrs) Year 2015

Line	Section	* Typical Section	Number Of train	Head-way	Capacity	Passenger Volume	Boarding Ratio
Western Line	Kampungbandan -Jatinegara	Jatinegara - Matraman	Ordinary 16	7.5	17,920	29,983	168%
Eastern Line	Kampungbandan -Jatinegara	Pondokjati -Jatinegara	Express 6 Ordinary 16	5.5	24,640	22,233	90%
Bekasi Line	Jatinegara -Bekasi	Klender -Buaran	Express 6 Ordinary 23	4.1	29,220	57,569	197%
	Bekasi -Cikarang	Bekasitimur -Bekasi	Express 3 Ordinary 15	6.7	16,900	17,905	195%
Central Line	Jakartakota -Manggarai	Cikini -Manggarai	*Express 7 Ordinary 17	5	33,040	51,447	156%
Bogor Line	Manggarai -Depok	Durenkalibata -Cawang	*Express 7 Ordinary 17	5	33,040	71,561	217%
	Depok -Bogor	Depok -Citayam	*Express 4 Ordinary 10	8.6	21,280	43,160	203%
Serpong Line	Tanahabang -Serpong	Kebayoran -Pondokranji	Express 1 Ordinary 6	17.1	6,800	9,636	142%
Tangerang Line	Duri -Tangerang	Pesing -Bojongindah	Express 1 Ordinary 2	40	1,360	1,909	140%
Tanjungpriok Line	Jakartakota-Tanjungpriok	Jakartakota-Kampungbandan	Ordinary 8	15	8,960	15,637	175%

Note:* Typical Section : Section where the maximum number of passengers pass through

On Bogor-Central Line Express train = 8 cars, Ordinary train = 12 cars

These Jabotabek train routes and local train routes are shown in Figure 3.2-7 on the next page.



Legend

-  Express EMU Train of Bekasi Line
-  Ordinary EMU Train of Bekasi Line
-  Local Train of Bekasi Line
-  Commuter Train of Central Line
(Express EMU & Ordinary EMU)
-  Commuter/Local Train of Serpong Line
-  Commuter Train of Tangerang Line
-  Commuter Train of Tanjungpriok Line

Figure 3.2-7 Future Commuter/Local Train Route

(2) Long/Middle Distance Train (Inter-City Train)

It is practical solution to give Manggarai Station most important role for inter-city trains in Jakarta City. The routes of the inter-city train will be arranged and simplified without conflict with the Jabotabek commuter trains. To make the best use of this advantage the inter-city train diagram will be made simpler and more efficient. Long distance trains will reduce trip-times. Passengers will be able to take many choices for a suitable train, should they be able to get more frequent transport services. A simple diagram brings safety and punctuality to the daily train operations.

Train Diagram Policy

Assumption:

- Train Route and Number of Trains
 Passenger's travel requirements will not change so much that existing train routes

can be maintained and there will be an increase in the number of trains. An increase will mainly be carried out on Super Express Train aiming at better passenger service and keeping revenue, but Economy Express Train also increase for sake of demand for lower income people.

Currently, the number of passenger cars per train varies between 7~10, however, the maximum number required will increase to 13 according to the growth in passenger demand on North and South Main Lines. It will increase to 10 on the Bandung Line with a demand for powerful locomotives.

- Convenience of arrival times in the morning instead of midnight
Many over-night trains arrive in Jakarta City between midnight and 5 a.m. in order to provide frequent commuter train services in the morning peak hours. If long distance trains are delayed, when in fact often occurs, these trains obstruct many commuter trains in the morning peak hours. As a result of this project, it will be possible for so many over-night trains to arrive in the morning peak hours, and many passengers will obtain good benefits.
- Middle distance trains depart/arrive at fixed intervals.
Many middle distance trains named “Parahyangan” are operated between Gambir and Bandung. Similar trains to the Parahyangan will increase in numbers between Jakarta City and Cirebon, Semarang, etc. they will depart/arrive at almost fixed intervals.

These trains should turn around quickly at Manggarai Station. Long distance trains should also be turned around quickly, because there will be few storage tracks available in the Jakarta Area.
- Local trains running more rapidly on new Main Line Track.
Most of the local trains on Bekasi Line are diesel multiple units. Some of the middle distance trains stop frequently at stations in the suburban area on the North Line and the Bandung Line. They will use the new double track between Manggarai and Bekasi, starting and terminating at Manggarai. They only stop at Jatinegara, Bekasi and Cikarang, and then every station beyond Cikarang. As a result, they can reduce the existing traveling time.
- Locomotive depot relocation, and new coach depot construction.
Prior to the improvements at Jatinegara Station, the locomotive depot has to be moved to Cipinang. Passenger coach storage tracks will also be constructed in Cipinang. It is considered that the construction of repair facilities is needed for passenger coaches in future.

- Temporary passenger train terminals
It is necessary to consider using Pasarsenen, Tanjungpriok and Jakartakota, as temporary terminal stations until the elevated Manggarai Station is completed, but it means that connection between road and railway shall be improved.
- New Main Line Operation Control Centre
There is an operation control centre (OCC) in Manggarai station. Daily operation control in the Jabotabek Area is carried out for train operations and electrical power supply by this OCC. After Track addition, it is necessary to carry out daily control on the new Main Line. A new Main Line Operation Control Centre will be constructed in Jatinegara Station Yard.

(3) Freight Train

Coal trains will be changed from Cigading – Tanahabang – Kampungbandan - Bekasi route to Cigading – Tanahabang – Manggarai - Citayam.

Based on demand forecast the number of freight trains is as shown in Table 3.2-7 on the next sheet. Figure 3.2-8 shows the long/middle train and freight train routes, and Figure 3.2-9 shows long/middle train routes using temporary sub-terminal station

Customer's requirements will not change so much that the train service will be maintained and an increase in the number of trains can be achieved.

Hauled load is unchanged.

Table 3.2-7 Freight Train Operation Plan

Year	Kind of Freight	From	To	Km	Traffic volume/ year	Traffic volume/ day	No. of Train	Traffic volume/ Train	No .of Necessary/ Train
2000	Coal	Cigading	Bekasi	161	624,700	2,225	10	222	
	Steal	Cilegon	SM. Poncol/ Waru SB	-	55,600	198	1	198	
	Container Cargo	JAK.Gudang	Surabaya Pasar Turi	725	146,600	522	1	522	
	Other Express Cargo	JAK.Gudang	SB. Pasar Turi	725	121,400	432	1	432	
	Container Cargo (PK TOJB)	-	-	-	79,500	283	1	283	
	Container Cargo	Tj. Priok	Gede Bage	195	63,400	226	4	56	
2001	Coal	Cigading	Bekasi	161	779,426	2,776	10	278	
	Steal	Cilegon	SM.Poncol/ Waru SB	-	33,448	119	1	119	
	Container Cargo	JAK.Gudang	Surabaya Pasar Turi	725	131,614	469	1	469	
	Other Express Cargo	JAK.Gudang	SB.PasarTuri	725	54,780	195	1	195	
	Container Cargo (PK TOJB)	-	-	-	5,094	18	1	18	
	Container Cargo	Tj. Priok	Gede Bage	195	95,772	341	4	85	
2008	Coal	Cigading	Bekasi	161	759,400	2,705		278	10
	Steal	Cilegon	SM.Poncol/ Waru SB	-	120,200	428		198	2
	Container Cargo	JAK.Gudang	Surabaya Pasar Turi	725	219,300	781		522	2
	Other Express Cargo	JAK.Gudang	SB.Pasar Turi	725	150,100	535		432	1
	Container Cargo (PK TOJB)	-	-	-	84,000	299		283	1
	Container Cargo	Tj. Priok	Gede Bage	195	71,900	256		85	4
2015	Coal	Cigading	Bekasi	161	793,000	2,824		278	10
	Steal	Cilegon	SM.Poncol/ Waru SB	-	136,400	486		198	2
	Container Cargo	JAK.Gudang	Surabaya Pasar Turi	725	316,900	1,129		522	2
	Other Express Cargo	JAK.Gudang	SB. Pasar Turi	725	182,400	650		432	2
	Container Cargo (PK TOJB)	-	-	-	84,000	299		283	1
	Container Cargo	Tj. Priok	Gede Bage	195	98,200	350		85	4

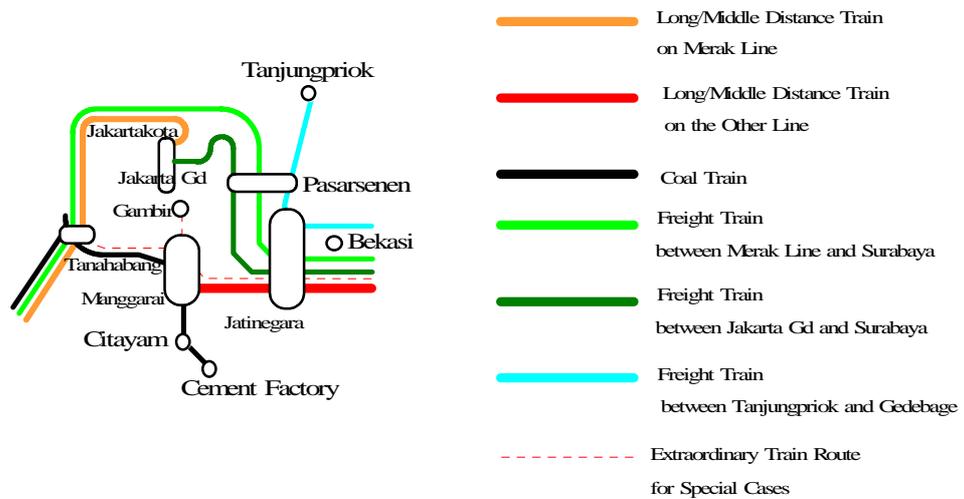


Figure 3.2-8 Future Inter City Train & Freight Train Route

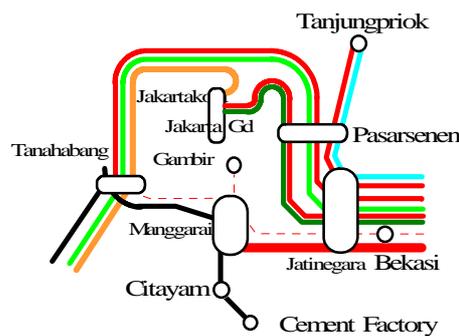


Figure 3.2-9 Future Inter City Train & Freight Train Route using other Terminals

(4) Train Diagram

a) EMU Train Diagram

Train diagram is made in order to analyse standard operating times and train intervals. The EMU performance was assumed as same as the existing one.

For each line an OD Table is made by the method of dividing the original Jabotabek total OD table, arranging it according to the order of train routes. Then the traffic volume for each section between stations is calculated. The traffic volume on Bekasi-Loop Line is shown in Figure 3.2-10. The maximum traffic volume section is between Klender - Buaran. The train capacity is decided that 2.5 times capacity is the same as the maximum passenger volumes on this line. This capacity must be kept during the peak 2 hours in the morning. (cf. Table 3.2-5).

b) Bekasi-Loop Line

Morning peak hour is specified as arrival time at Kampungbandan from 6:30 to 8:30 both on the inner and outer loop lines. In this hour express EMU trains operate with 20 minutes head-way, they take 41 minutes from Cikarang to Jakarta, 29 minutes from Bekasi to Jakarta. They stop only at Pasarsenen. Headway of ordinary trains on outer loop line is 8 and 12 minutes repeating to permit by express trains to overtake. The headway of ordinary trains on the inner loop line is 10 minutes. Owing to direct operation of Bekasi-Loop Line between Bekasi, Jatinegara, Manggarai, Dukuh and Tanahabang, passengers are given shorter travelling time, 10 minutes headway service. On Jakarta direct operating train services decrease, but Tanjungpriok Line EMU Train connects with Loop Line keeping 20 minutes interval in 2008.

c) Bogor-Central Line

According to Improvements in signalling systems and construction of loop track at Univ. Indonesia the standard type of diagram is made such as 3 ordinary trains between express trains with 17 minutes headway. It is possible to operate 7 express trains and 21 ordinary trains during peak 2 hours. This diagram has a maximum capacity and provides for express train operations. If express trains will continue operating after peak hours, the only way to increase line capacity is to increase cars by 4. Morning peak hour is arrival time at Jakarta 6:30-8:30.

Train diagram for the two lines are shown in Figure 3.2-11 and Figure 3.2-12.

d) Inter-City Train Diagram (include Local Train and Freight Train)

1. Conditions on Train Diagram

Maximum Train Speed : 70 km/h - between Manggarai-Jatinegara

120 km/h - between Jatinegara-Cikarang

105 km/h - between Cikarang-Cirebon

Train Time Interval (between Manggarai-Cipinang):

- | | |
|-----------|---|
| 3 minutes | between preceding/following train within Manggarai-Jatinegara |
| 4 minutes | between a departed train and an arriving train at Manggarai Station. |
| 4 minutes | between a departure train to Cipinang and an opposite passing train at Jatinegara Station. |
| 5 minutes | between a departing train to Cipinang and an opposite arriving train at Jatinegara Station. |

Train Time Interval (between Jatinegara-Cirebon)

5 minutes between higher speed trains.

2 minutes between an arrived train and the following passing train at the station.

2 minutes between a departed higher speed train and a following departing lower speed train at the station.

Locomotive CC201 – Passenger Coach 13

2. Train Set of Inter-City Train

The train set in 2008 and 2015 are assumed to be same two patterns now existing and Lebaran seasonal train. (cf. Table 3.2-5 and Table 3.2-6) The number of cars is 12 (13 in high demand season) bound for Cirebon, 8-10 bound for Bandung. The types of cars are as same as existing.

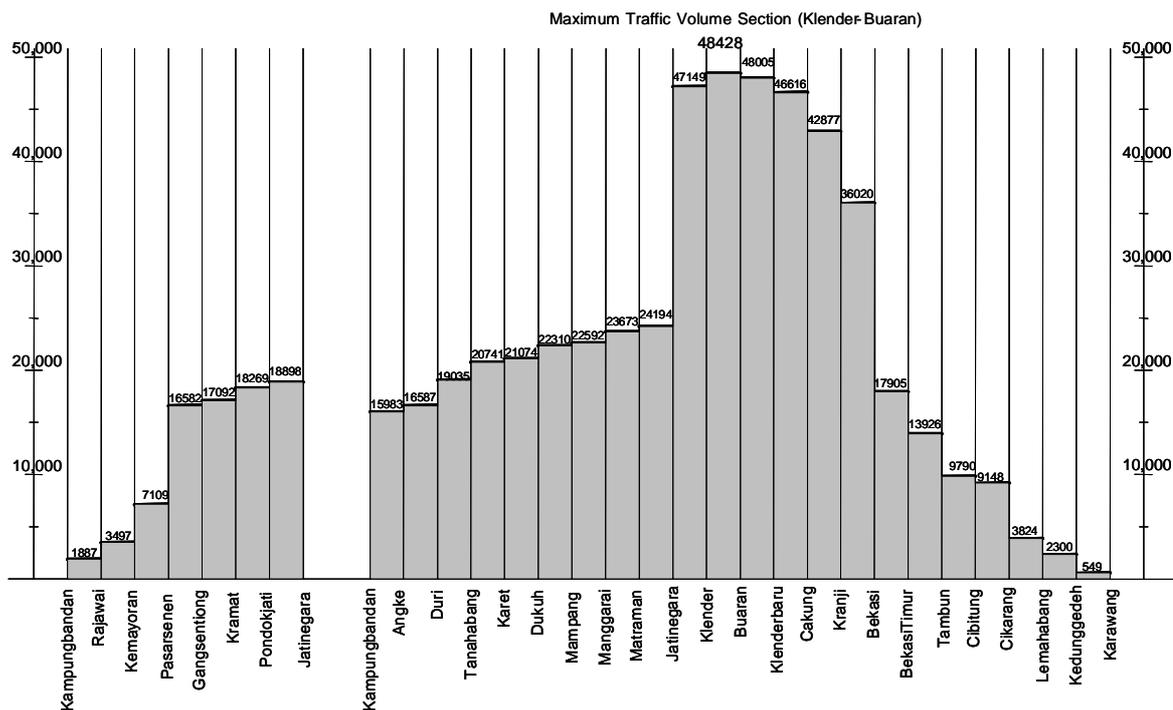


Figure 3.2-10 Commuter and Local Trains Traffic Volume between Stations on Bekasi Line (2008) Morning Peak 2 hours

3. Assumption for the number of Inter-City Train

The number of trains adapted to the demand in 2008 and 2015 is shown in Table 3.2-8. Currently, it became hard to get a train ticket, the boarding efficiency will be reduced from 80% to 70%. Increased numbers of trains are mainly Super Express Train and Economy Express Train.

4. Inter-City Train, Local Train Time Zone

Currently, arriving time of long distance trains are mainly assigned between 0.00 a.m. and 5.00 a.m. Many of long distance trains depart during 5 a.m.-9 a.m. Trains are relatively few in daytime. After this project, it is expected that only a few train arrive in midnight, and the number of trains per hour will be nearly equalized in daytime. As a result of this improvement, passengers may be more flexible in their travel schedule because they can select their train from various alternatives. Arriving/departing train time zone for each kind of train in the year of 2001 and 2008 is shown in Table 3.2-9.

New local trains on the North Line (bound for Cirebon) and local trains to Bandung Line both operate nearly 1 train each hour.

5. Train Operation of Inter-City Train, Local Train

All express trains Including Economy Express Train pass through every station between Manggarai and Cirebon and between Manggarai and Bandung. They are same speed and provide parallel paths on the train diagram.

Local trains stop at Jatinegara, Bekasi, Cikarang and every station beyond Cikarang between Manggarai and Cikampek. They stop at every station beyond Cikampek.

6. Freight Train Diagram

Freight trains operate at lower speeds so they cannot operate in the time zone 06.00 to 22.00 hrs when many passenger trains operate. They mainly operate at night time.

Main Line Diagram is shown in Figure 3.2-13 and Figure 3.2-14.

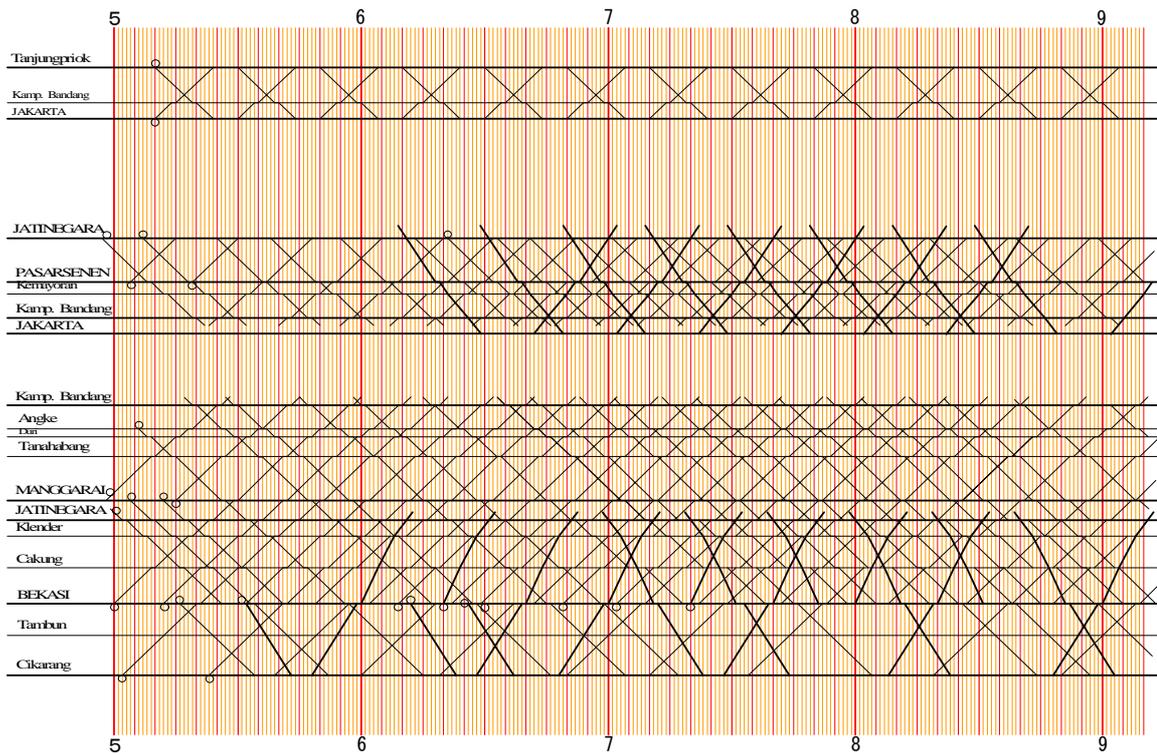


Figure 3.2-11 Train Diagram on Bekasi Line and Loop (2008)

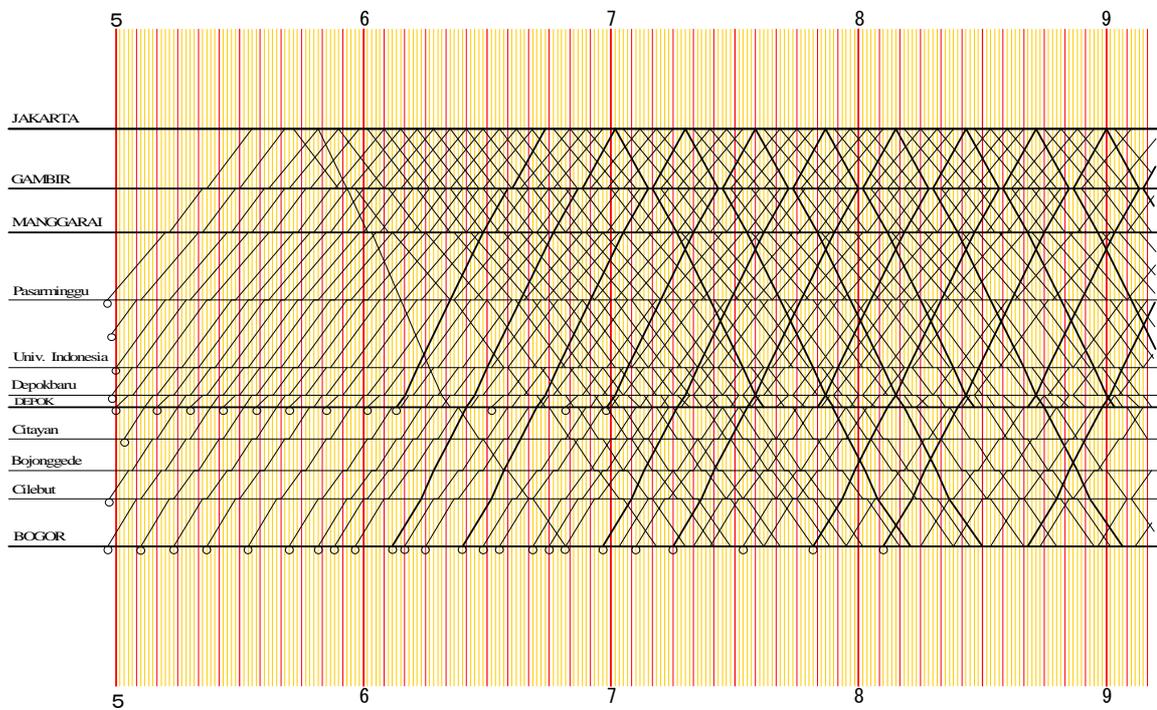


Figure 3.2-12 Train Diagram on Bogor Line (2008)

Table 3.2-8 Main Line Capacity and Passenger Volume 2001, 2008, 2015

Kind/Year	Train No.	Name of Train	Operating Section	Number of Train (one way)			No. of Car/Train	Arrangement of Coaches on 2008	Capacity /train	Total Capacity			Passenger Volume/day														
				2001	2008	2015				2008	2001	2008	2015	2001	2008	2015											
Cirebon																											
Super Ex														8	16	23				3,070	8,000	11,500					
	1,3,2,4	Argo Bromo Anggrek	Gambir-Surabaya Ps Turi	2	2	2	12	2KZ-8K1K-1K1M1-1BP	500	788	1,000	1,000															
	5,7,6,8	Argo Bromo	Gambir-Surabaya Ps Turi	2	2	2	12	10K1K-1KM1-1BP	500	816	1,000	1,000															
	13,15,14,16	Argo Muria	Gambir-Semarang Tawang	2	2	2	12	10K1K-1KM1-1BP	500	700	1,000	1,000															
	11,12	Argo Lawu	Gambir-Solo Balapan	1	1	1	12	10K1K-1KM1-1BP	500	400	500	500															
	9,10	Argo Dwipangga	Gambir-Solo Balapan	1	1	1	12	10K1K-1KM1-1BP	500	366	500	500															
	Increased, 2008				8	8			500		4,000	4,000															
	Increased, 2015					7			500			3,500															
ClassA Ex														7	9	11				2,676	4,500	5,500					
	65,66	Bima	Jakarta-Surabaya Gubang	1	1	1	12	10K1K-1KM1-1BP	500	457	500	500															
	67,68	Sembrani	Jakarta-Surabaya Ps Turi	1	1	1	12	10K1K-1KM1-1BP	500	348	500	500															
	69,70,71,72	Taksaka	Gambir-Yogyakarta	2	2	2	12	10K1K-1KM1-1BP	500	832	1,000	1,000															
	73,74,	Gumarang	Jakarta-Semarang Tawang	1	1	1	12	10K1K-1KM1-1BP	500	403	500	500															
	75,76	Gajayana	Gambir-Malang	1	1	1	12	10K1K-1KM1-1BP	500	324	500	500															
	79,80	Kamandanu	Gambir-Semarang Tawang	1	1	1	12	10K1K-1KM1-1BP	500	312	500	500															
	Increased, 2008				2	2			500		1,000	1,000															
	Increased, 2015					2			500			1,000															
ClassB Ex														15	18	20				8,156	11,676	13,008					
	83,84	Bangunkarta	Pasarsenen-Jombang	1	1	1	12	3K1-1KM2-7K2-1BP	630	642	630	630															
	85,86	Purwo Jaya	Gambir-Cilacap	1	1	1	12	3K1-1KM2-7K2-1BP	630	590	630	630															
	91,92	Cirebon Express	Jakarta-Cirebon	1	1	1	12	3K1-1KM2-7K2-1BP	630	566	630	630															
	89,90,93-96	Cirebon Express	Gambir-Cirebon	3	3	3	12	3K1-1KM2-7K2-1BP	630	1,698	1,890	1,890															
	101, 102	Senja Utama Yogyakarta	Gambir-Yogyakarta	1	1	1	12	2K1-1KM2-8K2-1BP	642	538	642	642															
	103, 104	Fajar Utama Yogyakarta	Gambir-Yogyakarta	1	1	1	12	2K1-1KM2-8K2-1BP	642	538	642	642															
	105, 106	Senja Utama Semarang	Gambir-Semarang	1	1	1	12	2K1-1KM2-8K2-1BP	642	564	642	642															
	107, 108	Fajar Utama Semarang	Gambir-Semarang	1	1	1	12	2K1-1KM2-8K2-1BP	642	564	642	642															
	109, 110	Sawong Galih	Pasarsenen-Kutoarjo	1	1	1	12	10K2-1KM2-1BP	666	602	666	666															
	111, 112	Kutojaya I	Pasarsenen-Kutoarjo	1	1	1	12	10K2-1KM2-1BP	666	538	666	666															
	115, 116	Jayabaya Selatan	Jakarta-Surabaya Gubang	1	1	1	12	10K2-1KM2-1BP	666	474	666	666															
	117, 118	Senja Utama Solo BLPN	Gambir-Solo Balapan	1	1	1	12	10K2-1KM2-1BP	666	406	666	666															
	119, 120	Matarmaja	Pasarsenen-Malang	1	1	1	12	10K2-1KM2-1BP	666	436	666	666															
	85L, 86L	Purwo Jaya Utama/Lebaran	Gambir-Cilacap		1	1	12	10K2-1KM2-1BP	666		666	666															
	90L, 91L	Cirebon Express/Lebaran	Gambir-Cirebon		2	2	12	10K2-1KM2-1BP	666		1,332	1,332															
	Increased, 2015					2			666			1,332															
Eco Ex														12	15	21				10,576	16,658	23,838					
	141, 142	Brantas	Tanahabang-Kediri	1	1	1	12	10K3-1KP3-1KM3	1,188	976	1,188	1,188															
	143, 144	Kerta Jaya	Pasarsenen-Surabaya Ps Turi	1	1	1	12	10K3-1KP3-1KM3	1,188	870	1,188	1,188															
	145, 146	Empu Jaya	Pasarsenen-Yogyakarta	1	1	1	12	10K3-1KP3-1KM3	1,188	976	1,188	1,188															
	147, 148	Tawang Jaya	Pasarsenen-Semarang	1	1	1	12	10K3-1KP3-1KM3	1,188	976	1,188	1,188															
	149, 150	Bengawan	Tanahabang-Solo Jebres	1	1	1	12	10K3-1KP3-1KM3	1,188	976	1,188	1,188															

**The Detailed Design Study of Railway Electrification and
Double-Double Tracking of Java Main Line Project
Final Report**

	Train No.	Name of Train	Operating Section	Number of Train (one way)			No. of Car/Train	Arrangement of Coaches on 2008	Capacity /train	Total Capacity			Passenger Volume/day		
	151, 152	Kutojaya	Pasarsenen-Kutoarjo	1	1	1	12	10K3-1KP3-1KM3	1,188	1,108	1,188	1,188			
	153, 154	Gaya Baru Malam Selatan	Jakarta-Surabaya Gubang	1	1	1	12	10K3-1KP3-1KM3	1,188	870	1,188	1,188			
	155, 156	Gaya Baru Malam Utara	Tanjungpriok-Surabaya PS Turi	1	1	1	12	10K3-1KP3-1KM3	1,188	896	1,188	1,188			
	159, 160	Tirtonadi	Tanjungpriok-Solo Balapan	1	1	1	12	10K3-1KP3-1KM3	1,188	976	1,188	1,188			
	165, 166	Tawang Mas	Tanjungpriok-Semarang	1	1	1	12	10K3-1KP3-1KM3	1,188	976	1,188	1,188			
	177, 178	Tegal Arum	Jakarta-Tegal	1	1	1	12	10K3-1KP3-1KM3	1,188	976	1,188	1,188			
	105L, 106L	Ekonomi Lebaran			1	1	12	10K3-1KP3-1KM3	1,188		1,188	1,188			
	107L, 108L	Ekonomi Lebaran			1	1	12	10K3-1KP3-1KM3	1,188		1,188	1,188			
	151L, 152L	Ekonomi Lebaran			1	1	12	11K3-1KMP3	1,214		1,214	1,214			
	165L, 166L	Ekonomi Lebaran				1	12	11K3-1KMP3	1,214		0	1,214			
	185L, 186L	Ekonomi Lebaran				1	12	11K3-1KMP3	1,214			1,214			
	Increased, 2015					4			1,188			4,752			
Luggage	183, 184	Parcel		1	1	1	10	10B							
Total of Cirebon				42	58	75				24,478	40,834	53,846	19,327	28,650	37,613
										79	70	70			
Bandung															
Super Ex				4	9	14				1,200	2,700	4,200			
	17-24	Argo Gede	Gambir-Bandung	4	4	4	8	6K1K-1KM1-1BP	300	1,200	1,200	1,200			
	Increased, 2008				5	5	8	6K1K-1KM1-1BP	300		1,500	1,500			
	Increased, 2015					5	8	6K1K-1KM1-1BP	300			1,500			
Boarding efficiency															
ClassB Ex				17	20	22				3,566	6,118	7,114			
	34-56	Parahyangan	Gambir-Bandung	8	8	8	10	3K1-1KM1-5K2-1BP	498	3,072	3,984	3,984			
	31F-64F	Parahyangan	Gambir-Bandung	9	9	9	10	3K1-1KM1-5K2-1BP	498	494	640	640			
	Increased, 2008				3	3	10	3K1-1KM1-5K2-1BP	498		1,494	1,494			
	Increased, 2015					2	10	3K1-1KM1-5K2-1BP	498			996			
Eco Ex				3	3	4				2,136	2,688	3,584			
	167, 168	Cipuja	Jakarta-Kroya	1	1	1	10	8K3-1KP3-1KM3	896	764	896	896			
	169, 170	Citrajaya	Jakarta-Kroya	1	1	1	10	8K3-1KP3-1KM3	896	764	896	896			
	179, 180	Galuh	Jakarta-Banjar	1	1	1	10	8K3-1KP3-1KM3	896	608	896	896			
	Increased, 2008					1	10	8K3-1KP3-1KM3	896			896			
	Increased, 2015														
Total of Bandung				24	32	40				6,902	11,506	14,898	5,927	8,025	10,418
Boarding efficiency										86	70	70			
Grand Total				66	90	115				31,380	52,340	68,744	25,254	36,675	48,031
Boarding efficiency										80	70	70			

Note : Kind of car and its numer of seats see Table 3.2-3

Table 3.2-9 Main Line Train Departure, Arrival Time Zone Year 2001, 2008

Time Zone	Arriving Train 2001											Departing Train 2001											
	Sp Ex	A Ex	B Ex	Eco Ex	Lug	Local	B Sp Ex	B B Ex	B Eco Ex	B Local	Total	Sp Ex	A Ex	B Ex	Eco Ex	Lug	Local	B Sp Ex	B B Ex	B Eco Ex	B Local	Total	
0-1				1				1			2												0
1-2			2	1				1			4												0
2-3			2	2						1	5												0
3-4		2	1	2							5												0
4-5	2	3	1	1							7								1				1
5-6	1			1							2								1				2
6-7		1	2					1		2	6	1		2	1								5
7-8			1					1		2	4	1	1	1					1				6
8-9			1					2		1	4	1	1	2	1				1				7
9-10								1		1	2	1		1					1		1		5
10-11	1									1	2			1				1	1				3
11-12				1	1			1	1		4			1								1	2
12-13											0							1	1				2
13-14								1		1	2			2					1				3
14-15			3					1			4			1					1			1	3
15-16	2			1				2	1	1	7			2									2
16-17	1		1					1			3								2		1		3
17-18	1	1		1				1	1	1	7	1	3	1	1					1		2	9
18-19			1								1		1	1	1				1	1		1	6
19-20								1	1		2			5					1		1		7
20-21										2	2	1	1	1				1					4
21-22											0	2		1	1					1			5
22-23									2		2									1			1
23-24									1		1									1			1
Total	8	7	15	11	1	0	4	17	3	12	78	8	7	15	11	1	0	4	17	3	11	77	

Time Zone	Arriving Train 2008											Departing Train 2008											
	Sp Ex	A Ex	B Ex	Eco Ex	Lug	Local	B Sp Ex	B B Ex	B Eco Ex	B Local	Total	Sp Ex	A Ex	B Ex	Eco Ex	Lug	Local	B Sp Ex	B B Ex	B Eco Ex	B Local	Total	
0-5																							
5-6		1		2						1	4				1					1	1		4
6-7	1	1	1	1		1				2	7			1	1		1	1	1			1	6
7-8	1	1	1	1		1			1	2	8	1	1	1	1					1		2	7
8-9	1	1	1	1		1			1	2	7	1	1	2			1	1	2			1	9
9-10	1	1	2			1	1	2		1	9	1	1	2	1		1	1	1			1	9
10-11	1	1	2	1		1	1	2		1	10	1	1	2			1	1	1			1	8
11-12	1	1	1		1	1		1		1	7	1	1	1	1		1		1			1	7
12-13	1		1	1			1	1		1	6	1		1			1	1	1			1	6
13-14	1		1			1		1		1	5	1	1	1	1				1			1	6
14-15	1		1	1			1	1		1	6	1		1			1	1	1			1	6
15-16	1		1			1		1		2	6	1	1	1	1				1			1	6
16-17	1		1	1		1	1	2		2	9	1		1			1	1	1			2	7
17-18	1		1	1				2		1	6	1		1	1		1		2			2	8
18-19	1	1	1	1		1	1	1		1	8	1					1	1	2			1	6
19-20	1	1		1		1		1		1	6	1		1	1		1		1			1	6
20-21	1		1	1			1	1		1	6	1		1	1			1	1			1	6
21-22	1		1	1		1	1	1	1	1	8	1		1	1	1	1		1			1	7
22-23			1					1	1	1	4	1	1		1						1	1	5
23-24								1			1		1	2							1		4
Total	16	9	18	14	1	12	9	20	3	21	123	16	9	18	14	1	12	9	20	3	21	123	

Note Sp Ex : Super Express Train. A Ex : Class A Express Train. B Ex : Class B Express Train. Eco Ex : Economy Express Train. Lug : Luggage Train. Local : Local Train (Cikampek-Cirebon). B Sp Ex : Bandung Line Super Express Train. B B Ex : Bandung Line Class B Express Train. B Eco Ex : Bandung Line Class B Express Train. B Local : Bandung Line Local Train.

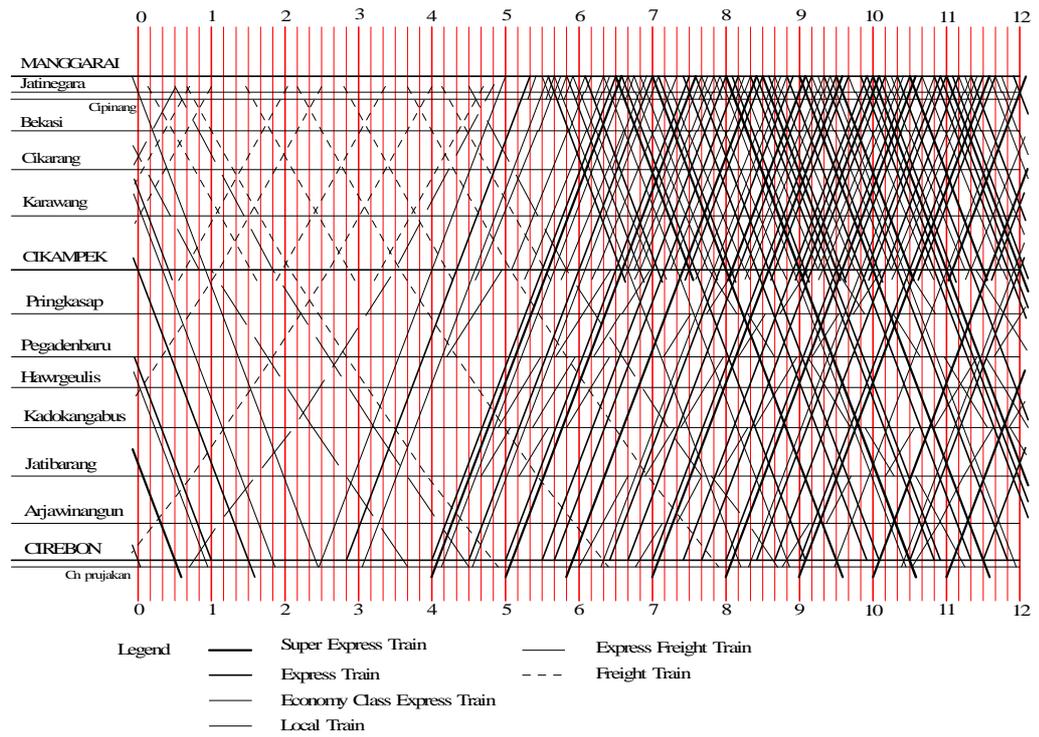


Figure 3.2-13 Train Diagram on Main Line (2008) 1/2

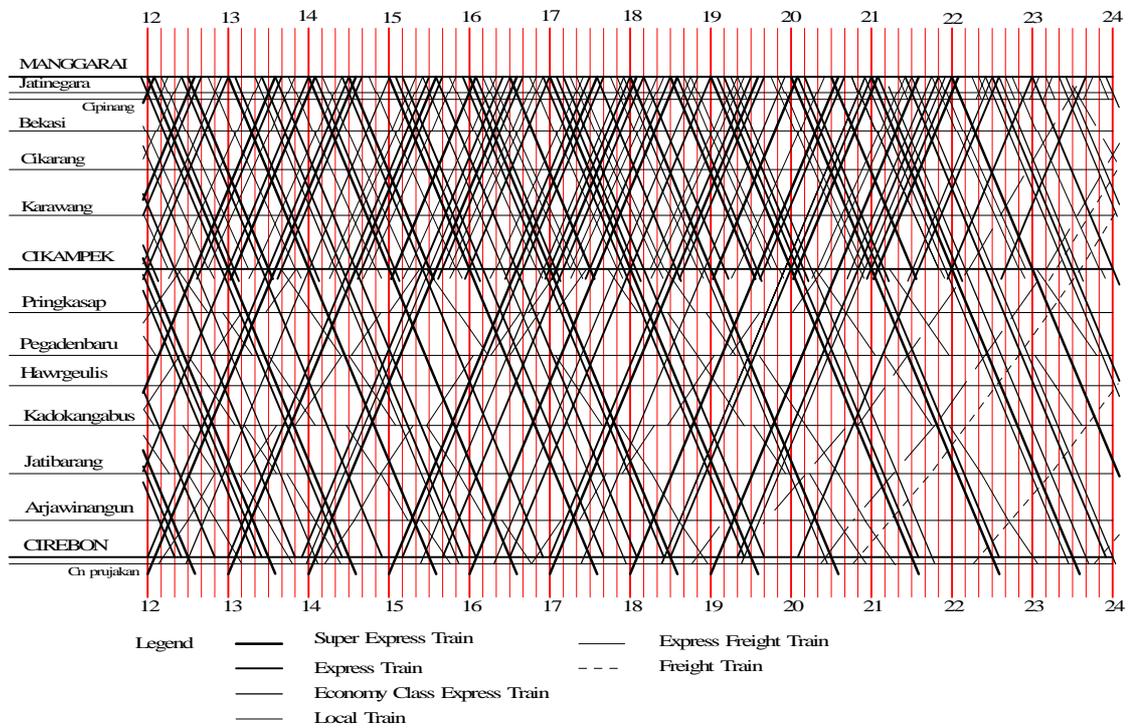


Figure 3.2-14 Train Diagram on Main Line (2008) 2/2

(5) Necessary Numbers of EMU

Necessary number of EMU is calculated based on the train diagram for 2008, and the number in 2015 was found in proportion of number of commercial operation trains. Necessary numbers of EMU is shown in Table 3.2-10.

Table 3.2-10 Necessary Numbers of EMU's

	2001	2008		2015	
Bekasi-Loop L		40	Express 8car x 5=40	40	Express 8car x 5=40
		160	8car x 20=160, No. of Train:12	216	160 x 16/12=216, No. of train:16
Bogor L		56	Express 8car x 7=56	56	Express 8car x 7=56
		280	8car x 35=280, No. of Train:21	340	No. of Train:17, 8car+4=12car 280 x (12 x 17)/(8 x 21)=340
Serpong L		24	8car x 3=24	24	8car x 3=24
Tangerang L		12	4car x 3=12	12	4car x 3=12
Tanjungpriok L		16	8car x 2=16	24	8car x 3=24
Operation Total	232	588		712	
Stand-by	48	120		144	
Total	280	708		856	

3.2.5. Main Line Terminal Operations and Facility Planning

(1) Terminal Operations on Manggarai Station

The Main Line terminates at elevated Manggarai Station, all the trains reverse the direction here. Most trains often cross the scissors crossing at the Jatinegara end. Necessary time interval between a departing train and an arriving train is less than two minutes, consequently the train headway of 5 minutes is adopted in train diagram.

There are 3 island platforms and 6 tracks, 2 draw out tracks, together with an engine run-round loop and 2 engine waiting tracks on the elevated structure. After arriving locomotive is dismantled from the train and runs to an engine waiting track near the dead end, and through an engine run-round loop the locomotive will be coupled to the coaches for departure.

If train turn-round time is less than 25 minutes plus an added operating margin for arrival and departure, then two trains per hour per one track can be operated. Theoretically, 12 trains per hour can be operated with 6 tracks. Practically, there are cases where a longer time than 25 minutes between arrival time and departure time is needed. Trains having a longer stopping time are required to stay on the draw out track.

Track occupied ratio generally follows this formula.

$$R = T_o / (T_u \cdot N)$$

R : Track Occupied Ratio

T_o : Total occupied time by trains.

i.e. Dwell time and necessary arrival and departure times.

T_u : Train operating time zone (05:00 to 24:00 at Manggarai Station, 1,140 minutes)

N : Number of tracks

Necessary train dwell time for turning reverse is a minimum 20 minutes except local train. It comprises passenger alighting and boarding, train cleaning, taking off and attaching seating covers, loading food, etc.

The number of trains anticipated in the year of 2008 and 2015 are 123 and 150 at Manggarai Station High Level Platform. If the average train occupy time is 30 minutes, track occupied ratio is:

Year of 2008: $R = T_o / (T_u \cdot N) = 30 \times 123 / (1,140 \times 6) = 0.54 = 54\%$

Year of 2015: $R = T_o / (T_u \cdot N) = 30 \times 150 / (1,140 \times 6) = 0.66 = 66\%$

These ratios show that the number of trains is very close to the capacity limit.

(2) Facility Planning

a) For Commuter Trains

- Stations

Manggarai: 2 island platforms and 4 tracks will be constructed for Bogor-Central Line.

Length of this platform subject to 12 cars train length

1 island platform and 2 tracks will be constructed for Bekasi-Loop Line.

For construction of additional island platform with 2 tracks of Western Line, in future, the necessary space will be prepared below the viaduct.

Matraman, Bekasi Timur: The new stations will be constructed.

Jatinegara: 2 island platforms and 4 tracks will be constructed.

Klender: 2 island platforms and 3 tracks will be constructed.

Bekasi: 2 island platforms and 4 tracks will be constructed, the track layout of the EMU stabling tracks will be altered.

Cikarang: 2 island platforms and 3 tracks will be constructed.

- Improvement of signalling system:

The signalling system between Bekasi-Cikarang and Manggarai - Bogor will be improved for the purpose of decreasing train time intervals to 4minutes, decreasing the interval to 2 minutes both between an arrived train and the following overtaking train and between a departure higher speed train and a following lower speed train from the station.

Following improvements will be requested on the facilities on Bogor Line.

Univ. Indonesia: 2 island platforms and 4 tracks will be constructed.

b) For Main Line Trains

- Standard length of Tracks:

The standard length of an inter-city train track is 320 metres to meet with a train consisting of 2 locomotives and 13 passenger cars.

- Improvement of signalling system:

The signalling system between Manggarai-Cikampek will be improved for the purpose of decreasing train time intervals to 4minutes, decreasing intervals to 2 minutes both between an arrived train and the following overtaking train and between a departed higher speed train and a following lower speed train at the station.

- Double Tracking:

The section between Cikampek and Cirebon will be a double track section, and the section between Cikampek and Bandung is expected to be double tracked in the near future.

- Stations

Manggarai: Will be constructed with 3 island platforms and 6 tracks, 2 draw out tracks, together with an engine run-round loop and 2 engine waiting tracks.

Jatinegara and Bekasi: 2 island platforms and 4 platform tracks each.

Cikarang: 1 island platform and 2 platform tracks and 2 pass through Tracks.