NO.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF PUBLIC WORKS
REPUBLIC OF INDONESIA

DETAILED DESIGN STUDY
OF
NORTH JAVA CORRIDOR FLYOVER PROJECT
IN THE REPUBLIC OF INDONESIA

FINAL REPORT
EXECUTIVE SUMMARY

DECEMBER 2006

KATAHIRA & ENGINEERS INTERNATIONAL

SD
CR(5)
06-090

PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct the “Detailed Design Study of North Java Corridor Flyover Project” and entrusted it to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a Study Team headed by Mr. Mitsuo Kiuchi of Katahira & Engineers International to the Republic of Indonesia, two times between October 2005 and December 2006.

The team held discussions with the officials concerned of the Ministry of Public Works as well as other officials concerned, and conducted field surveys in the Java Island. Upon returning to Japan, the team prepared this final report to summarize the results of the study.

I hope that this report will contribute to the development in the Republic of Indonesia, and 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 and those concerned in the Republic of Indonesia for the close cooperation they extended to the study.

December 2006,

Kazuhisa MATSUOKA,
Vice President
Japan International Cooperation Agency

Mr. Kazuhisa MATSUOKA,
Vice President
Japan International Cooperation Agency

December 2006

Dear Sir,

Letter of Transmittal

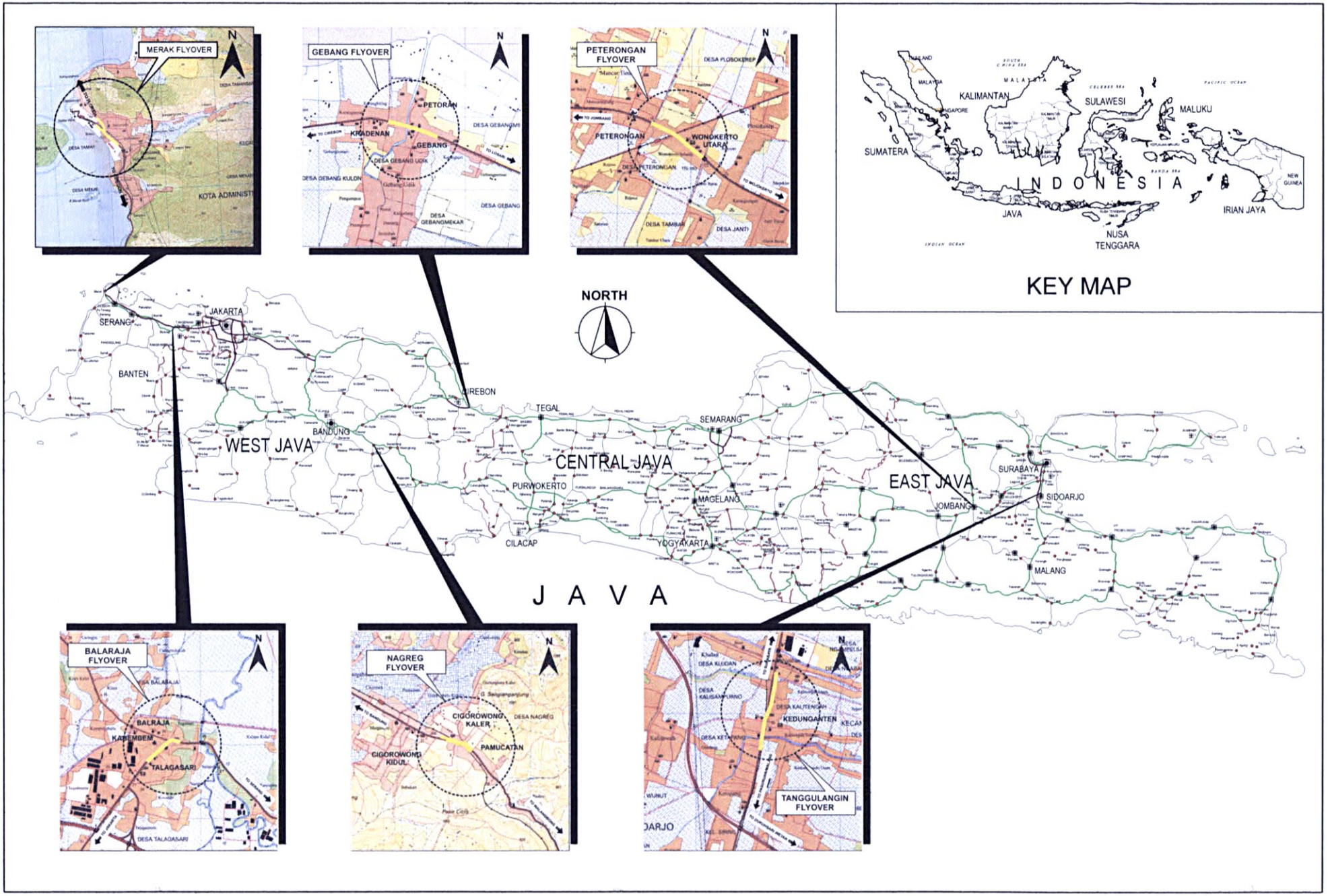
We are pleased to submit herewith the Final Report of the "Detailed Design Study of North Java Corridor Flyover Project". The report compiles the results of the Study and includes the advices and suggestions of the authorities concerned of the Government of Japan and your agency as well as the comments made by the Ministry of Public Works and other authorities concerned in the Republic of Indonesia.

The report studies the detailed design for flyovers at six priority locations along North Java Corridor in order to eliminate traffic bottlenecks. It presents the detailed design, cost estimate, construction planning, implementation planning and draft tender document under consideration of resettlement, ROW acquisition and environmental impact.
We hope this report will contribute to the implementation of this Loan Project.

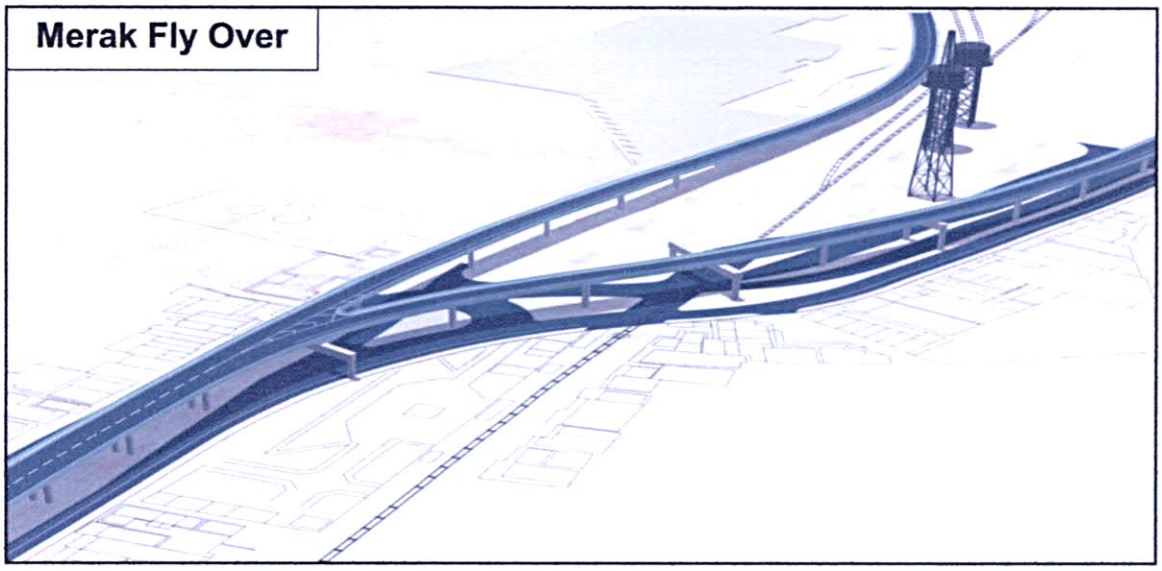
We wish to take this opportunity to express our sincere gratitude to your agency and the Ministry of Foreign Affairs. We also wish to express our deep gratitude to the Ministry of Public Works as well as other Governmental Agencies concerned in the Republic of Indonesia for the close cooperation and assistance extended to us during the Study.

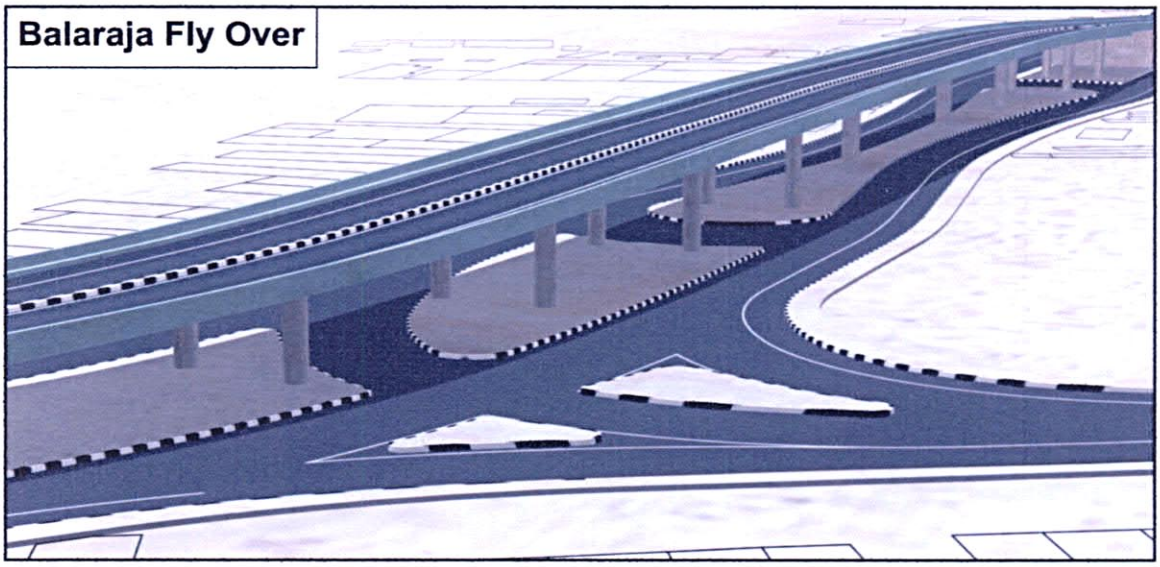
Very truly yours,

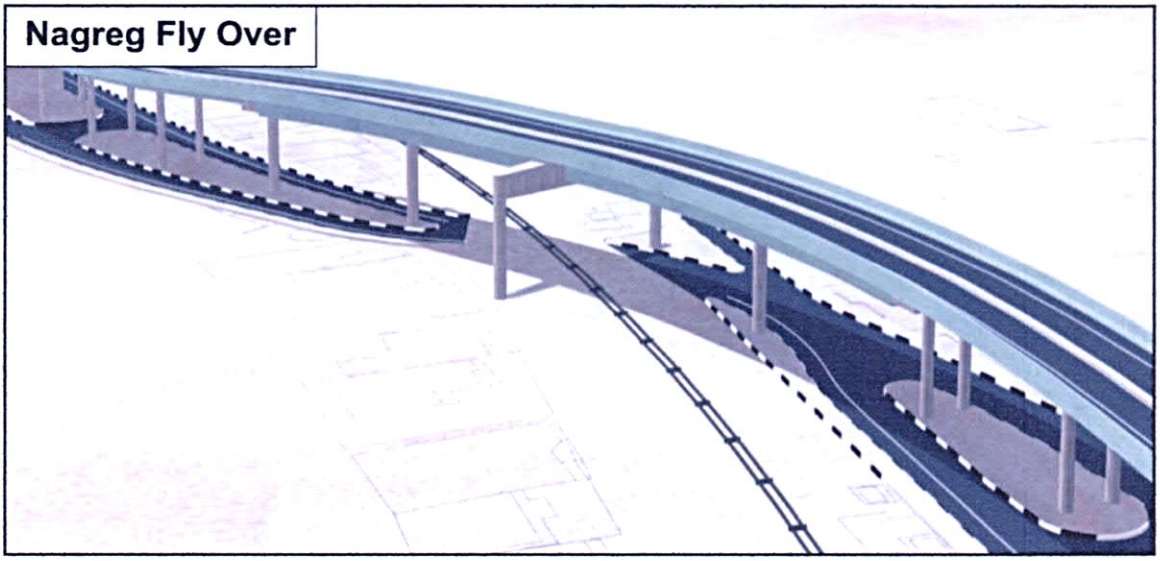
Mitsuo Kiuchi
Team Leader,
Detailed Design Study of North Java Corridor
Flyover Project in the Republic of Indonesia

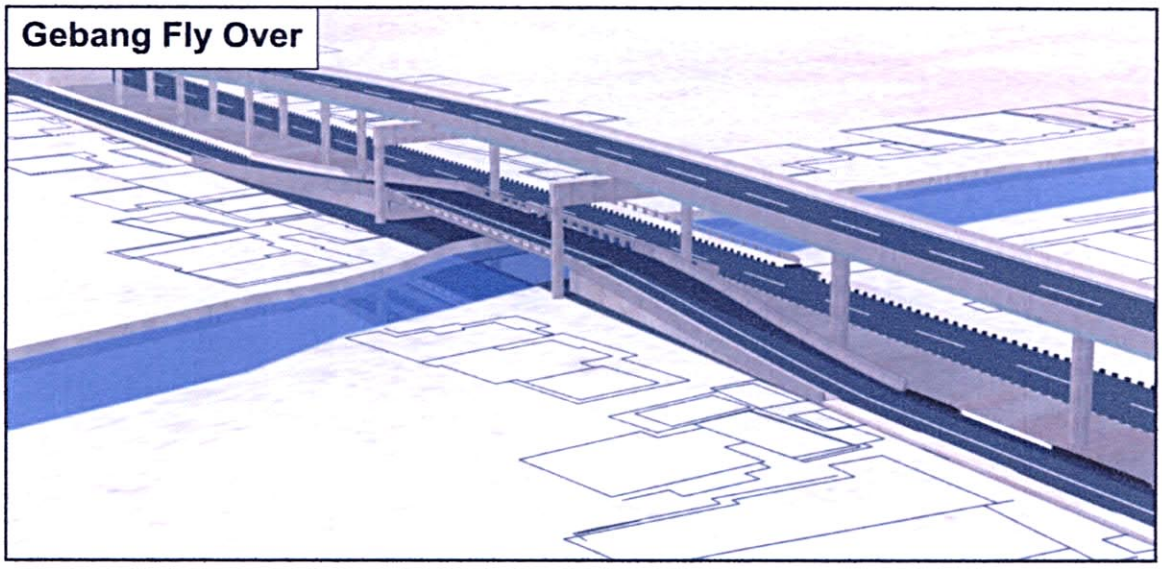


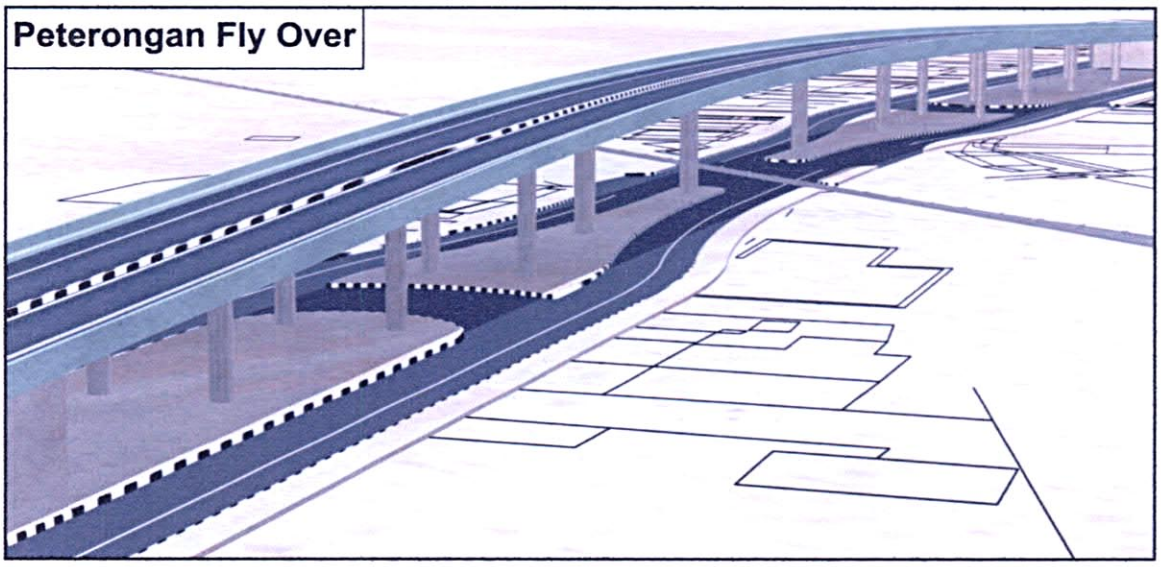
LOCATION MAP OF FLYOVERS FOR NORTH JAVA CORRIDOR PROJECT

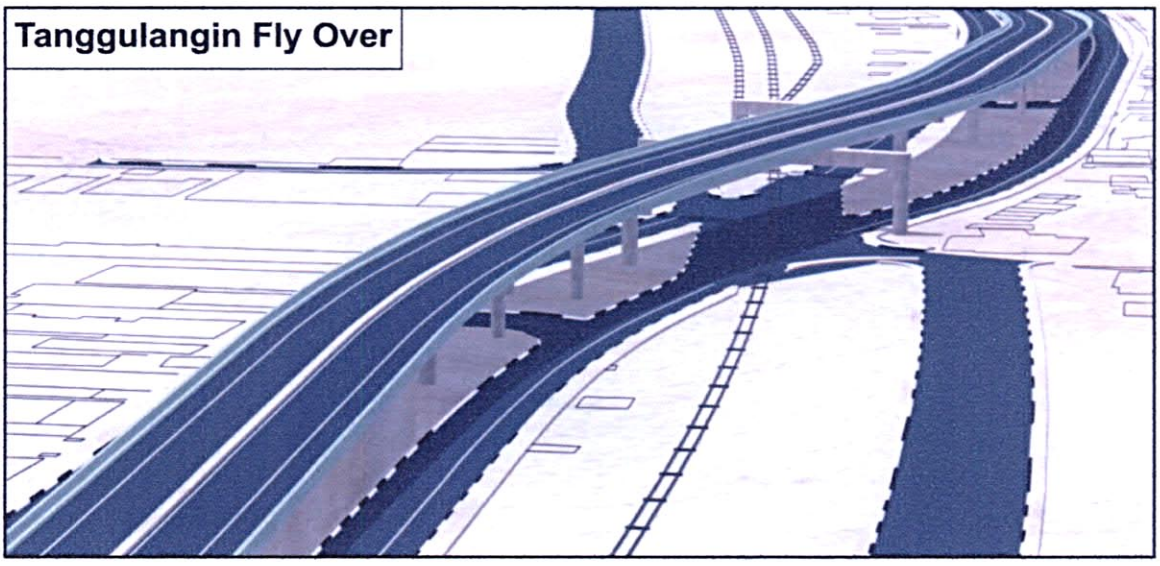

Merak Fly Over


Balaraja Fly Over


Nagreg Fly Over


Gebang Fly Over


Peterongan Fly Over


Tanggulangin Fly Over

SUMMARY

BACKGROUND

With the increasing traffic volume along North Java Corridor, transport efficiency is rapidly decreasing due to traffic bottlenecks particularly at urban intersections, railway crossings, etc. To cope with these problems, the Government of Indonesia has decided to construct flyovers at six priority locations (Merak, Balaraja, Nagreg, Gebang, Peterongan and Tanggulangin Flyovers). JBIC's STEP Loan was provided for the project.

OBJECTIVES OF THE STUDY

The objectives of the study are to undertake the detailed design based on the engineering surveys and to prepare the construction plan, cost estimates and draft tender documents.

PROJECT SITE CHARACTERISTICS

- The project site is located in the busy urban area with heavy traffic.
- The project site is narrow and a detour road is not available.
- Four flyovers are to be built over the railway.
- Gebang and Tanggulangin Flyovers are located at the deep soft ground area.
- Merak Flyover is located at loose sandy layer which would cause liquefaction during earthquake.
- All flyovers are located within seismic zone.

DESIGN CONCEPT

a) The following Japanese technologies shall be adopted:

- Fast construction method to minimize traffic congestion.
- Efficient construction method applicable to narrow construction area under urban environment.
- Construction method to realize efficient traffic management during construction.
- Anti-earthquake technology.
- Soft ground treatment technique and treatment against liquefaction.
- Steel bridges for safe, fast and easy construction over the railway.

b) To cope with external condition changes compared with the time of project appraisal by JBIC such as domestic construction price increase (1.4 times), Japan's steel material price increase (1.2 times) and Yen value depreciation (10%), cost reduction measures shall be focused in the detailed design.

c) STEP Loan requirement on Japan portion which shall not be less than 30% of the total amount of contract shall be satisfied.

d) Minimize land acquisition and relocation of families.

SCOPE OF CIVIL WORKS

Flyover		Total Length (m) (Approach + Bridge)	Width of Flyover (m)	Approach Section (m) (Type of Embankment)	Bridge Length (m)		
					Total	Steel Bridge	PC Bridge
Merak	National Road (Pulorida Side)	445.5	6.75	160.5 (MSE)	285.0	125.0	160.0
	National Road (Jakarta Side)	262.5	9.00	202.5 (MSE)	60.0	-	60.0
	Terminal Exit	346.9	7.00	176.9 (MSE)	170.0	60.0	110.0
Balaraja		520.0	13.00	299.0 (MSE)	221.0	81.0	140.0
Nagreg		734.0	13.00	510.0 (MSE)	224.0	104.0	120.0
Gebang		760.0	9.00	375.0 (LWE)	385.0	225.0	160.0
Peterongan		615.0	13.00	353.0 (MSE)	262.0	82.0	180.0
Tanggulangin		530.0	13.00	330.0 (LWE)	200.0	100.0	100.0
Total		**4,213.9**	**-**	**2,406.9**	**1,807.0**	**777.0**	**1,030.0**

Note: MSE = Mechanically Stabilized Earth
LWE = Light Weight Embankment

ESTIMATED COST

Unit: Billion Rp

Flyover	Civil Works	Utility Relocation	Tax	Total
Merak	69.42	0.83	7.02	77.27
Balaraja	40.55	3.92	4.45	48.92
Nagreg	54.89	10.44	6.53	71.86
Gebang	62.63	0.69	6.33	69.65
Peterongan	46.63	2.25	4.89	53.77
Tanggulangin	54.23	0.51	5.47	60.21
Total (Million Yen)	**328.35 (4,378)**	**18.64 (248)**	**34.69 (463)**	**381.68 (5,089)**

ECONOMIC EVALUATION RESULTS

Flyover	EIRR (%)	NPV (Billion Rp)	B/C Ratio
Merak	14.5%	17,1	1.30
Balaraja	23.0%	63,4	2.74
Nagreg	21.0%	71,1	2.33
Gebang	21.9%	80,8	2.56
Peterongan	17.3%	23,8	1.59
Tanggulangin	13.6%	8,1	1.18

Note: Discount rate at 12% per annum.

OPERATION AND EFFECT INDICATORS

The following operation and effect indicators were prepared and high positive effects were confirmed at each flyover:

- Operation Indicator - Average Daily Traffic (veh/day)
- Effect Indicators
  - Travel speed (km/hr)
  - Travel time reduction (veh hr/day)
  - Travel cost reduction (1,000 Rp/day)
  - Max. queue length at railway crossing (m)

LOAN AMOUNT VS ESTIMATED COST

JBIC loan was originally planned to cover 100% of construction cost (excluding tax). Due to drastic construction price increases, Yen depreciation, etc., shortage of loan is inevitable.

Estimated Cost Without Tax (Million Yen)

• Civil Works	4,293
• Utility Relocation	248

(Note: Utility relocation was decided to be implemented using local fund.)

Available Loan Amount (Million Yen)

• Base Cost	2,993
• Escalation	578
• Unused Balance of D/D	200
Total	3,771

Shortage of loan is estimated at 522 Million yen (39.2 Billion Rp.)

PROJECT IMPLEMENTATION

The implementing agency is the Directorate General of Highways, Ministry of Public Works. The project is divided into three contract packages:

Package 1 : Merak and Balaraja Flyovers (Bantan Province)

Package 2 : Nagreg and Gebang Flyovers (West Java Province)

Package 3 : Peterongan and Tanggulangin Flyovers (East Java Province)

The Consultant for the construction supervision will be employed.

IMPLEMENTATION SCHEDULE

			2005	2006	2007	2008
Detailed Design by JICA						
Selection of Supervision Consultant						
Land Acquisition						
Selection of Contractor						
Utility Relocation by Local Fund						
Consultancy Services						
Construction						
Annual Fund Requirement (Million Yen)	JBIC Loan + Local Fund	Consultancy Services			176	165
		Construction of Flyover			1,928	2,794
	Local Fund	Public Utility Relocation			273	-
	TOTAL				2,377	2,959

PREPARATION FOR IMPLEMENTATION

- Updated UPL and UKL were approved by respective local environmental agency, except Nagreg Flyover for which DGH is following up.
- Public hearing/socialization was undertaken at each flyover location with no major objection against the project.
- ROW acquisition for Balaraja and Gebang Flyovers has been completed. ROW acquisition of remaining four flyovers is on-going and scheduled to be completed by the end of 2006.
- ROW acquisition at Nagreg Flyover is being delayed due to prolonged negotiation on land/compensation value between the land acquisition committee and the affected people.

CONCLUSION

The Project was evaluated technically, economically, financially and environmentally feasible.

Technical Feasibility: the project utilizes Japanese technologies in line with STEP Loan condition. Construction will be implemented by Japanese Contractor or Japanese Contractor in joint venture with Indonesian Contractor (Japanese contractor as a lead firm) who can execute the work efficiently. Japan portion is estimated to be 31.1% which satisfies STEP Loan requirement.

Economic Feasibility: all flyovers were evaluated economically feasible.

Financial Feasibility: although the project requires additional local counterpart fund which is, however, not extensive and manageable by DGH.

Environmental Feasibility: the project is not environmentally critical, thus EIA (AMDAL) is not required for this project. The project should be implemented and operated in accordance with requirements of UPL and UKL.

RECOMMENDATION

1) The project must be implemented under the severe urban environment. Construction must be undertaken without major traffic disruption and be completed within the limited time frame. The construction plan prepared under this study should be carefully studied by contractors and supervision consultant and implemented.
2) Various technologies were adopted in the study which can be applicable to other similar projects. Such technologies should be positively considered for wide application.
3) Options were presented to cover shortage of loan. DGH should further study options and decision should be made as early as possible.
4) PT. KAI required closure of an at-grade road at railway crossing, however, it should be done at later stage with proper provisions for local traffic and pedestrians.
5) Effect of mudflows from natural gas well near Tanggulangin Flyover should be closely monitored, particularly traffic flow changes, diverted to the national road from the toll road. The effects of mudflows are getting worse, DGH should decide whether construction of this flyover be implemented or not.

EXECUTIVE SUMMARY

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Exchange Rates Used in the Study:

US$ 1.00 = Indonesian Rupiah 9,110
US$ 1.00 = Japanese Yen 116
Japanese Yen 1.00 = Indonesian Rupiah 75.0

1. INTRODUCTION

1.1 BACKGROUND

North Java Corridor Road connects major industrial cities of Java Island such as Jakarta, Surabaya, Semarang, etc. and is vitally supporting the country's socio-economic and industrial activities.

With the increasing traffic volume along North Java Road, transport efficiency is rapidly decreasing due to traffic bottlenecks formed particularly at intersections in urban sections, railway crossings and along urban sections where many street stalls are concentrated along the road sides, which are affecting sound socio-economic and industrial development.

To cope with the above problems, the Government of Indonesia (GOI) has decided to construct flyovers at six priority locations along North Java Corridor in order to eliminate traffic bottlenecks and to achieve smooth traffic movements. The project was appraised by the Japan Bank for International Cooperation (JBIC) and the loan agreement between GOI and JBIC applying the Special Term for Economic Partnership (STEP) was signed in March 2005.

In connection with the implementation of this STEP Loan, GOI requested the Government of Japan (GOJ) to provide the technical assistance for the detailed design of the project. In response to the request of GOI, GOJ has decided to conduct the Detailed Design Study of the North Java Corridor Flyover Project in Indonesia (the Study), and exchanged Notes Verbales with GOI concerning implementation of the Study. Accordingly, the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of the technical cooperation projects of GOJ decided to undertake the Study in close cooperation with concerned authorities of GOI.

On the part of GOI, the Directorate General of Highways (DGH), Ministry of Public Works acted as the counterpart agency to the Japanese study team and as the coordinating body in relation with other concerned governmental and non-governmental organizations for the smooth implementation of the Study.

1.2 OBJECTIVES OF THE STUDY

The objectives of the Study are:

1) To review previous studies and plans related to the project, analyze the most effective and efficient roads development of the project,

2) To carry out necessary engineering surveys,

3) To complete a detailed design of execution of the project,

4) To carry out construction planning and cost estimate, and

5) To prepare draft tender documents for execution of the project.

1.3 STUDY AREA

The study area shall cover the following construction sites of flyover along main roads in Java Island (refer to the location map):

Banten Province	West Java Province	East Java Province
• Merak Flyover	• Nagreg Flyover	• Peterongan Flyover
• Baralaja Flyover	• Gebang Flyover	• Tanggulangin Flyover

1.4 COMPOSITION OF REPORT

The final report is organized with the following:

- Executive Summary
- Main Text
- Drawings
- Draft PQ and Tender Documents
- Design Analysis Report
- Quantity Calculations Report
- Cost Analysis Report

2. OBJECTIVE OF THE PROJECT

The objective of the project defined by the Loan Agreement is

> "To provide flyovers as the most appropriate countermeasures to achieve sound improvement of road transportation network and substantial enhancement of physical distribution along North Java Corridor and in the inland areas of Java Island for vitalization of socio-economic activities in the pertinent regions through the establishment of smooth and reliable traffic network."

3. TRAFFIC AND ENGINEERING SURVEYS UNDERTAKEN

3.1 TRAFFIC SURVEY

The following traffic surveys were undertaken at each flyover location for two (2) consecutive days:

- 24-hour Traffic Count
- 14-hour Roadside OD Survey
- 14-hour Intersection Traffic Count
- Travel Speed Survey
- Vehicle Queue Length at Railway Crossing

At Balaraja Flyover location, the following additional surveys were undertaken:

- U-turn Traffic Count
- U-turn Traffic OD Survey

3.2 ENGINEERING SURVEY

Topographic Survey covering the following was undertaken at each flyover location:

- Road Survey
- Structure Survey
- Public Utility Survey
- River Survey (Gebang Flyover only)

Geotechnical Survey at each flyover location consisting of the following was undertaken:

- Boring (96 holes, L=2,937m)
- Sampling (361 samples)
- SPT (1,445)
- Laboratory Tests (2,252 tests)
- Soil Tests for Pavement Design (26 test pits)

Meteorological and hydrological data collection at each flyover location was undertaken.

4. PRESENT AND FUTURE TRAFFIC

4.1 PRESENT TRAFFIC CONDITION

Traffic survey results are summarized in **Table 4-1**. Existing traffic problems are summarized hereunder.

Merak Flyover

- Heavy roadside friction due to roadside business activities including illegal stalls/vendors within the road right-of-way, particularly at the opposite side of the Ferry Terminal Waiting Area, causing traffic congestion and disturbing traffic flow.

- Illegal parking of a lot of mini-taxis waiting for passengers within the carriageway of the national road.

- Traffic congestion at the intersection at the exit of the Ferry Terminal. Traffic from the exit of the Ferry Terminal concentrates at the intersection soon after a ferry boat arrives and conflicts with the traffic on the national road. The intersection is not channelized, neither signalized, which aggravates traffic congestion.

- Traffic queue is formed at the railway crossing during train passing (maximum queue length is 115m at Pulorida side).

- Due to above conditions, travel speed of this section is reduced to 19.5km/hour from 35km/hour of adjacent section.

Balaraja Flyover

- Heavy local traffic concentrates at this section.

- Heavy roadside friction due to roadside business activities.

- At the intersection between the national road and the intersecting road going to Kresek, right turn from the intersecting road to the national road is prohibited (or closed). Right turn traffic utilizes U-turn slot along the national road where traffic on the national road is heavily disturbed.

Table 4-1 SUMMARY OF TRAFFIC SURVEY RESULTS

		Daily Traffic Volume (4-wheel or more) (Both Direction)							Peak Hour Ratio (%) (By Direction)	Daily Traffic Volume (3 wheels or less) (Both Direction)	Traffic Characteristics By Direction				Travel Speed (km/hr)						Railway Crossing		
															Morning		Day time		Evening			Queue Length (m)	
		Car Jeep	Pick-up	Mini Bus (oplet)	Medium Bus	Large Bus	Truck Trailer	Total			Through Traffic	Local Traffic 4-wheels or more	Local Traffic 3-wheels or less	Local Traffic Total	Flyover Section	Outside F.O. Section	Flyover Section	Outside F.O. Section	Flyover Section	Outside F.O. Section	No. of Train Passing	Max	Average
Merak	Pulorida side (or from Pulorida)	1,306 (22%)	729 (12%)	2,016 (34%)	180 (3%)	101 (2%)	1,563 (27%)	5,895 (100%)	10.5	5,163	2,080 (70%)	878 (30%)	2,789	3,667	19.9	35.9	20.1	35.4	19.6	35.8	6	115	58
	Cilegon (or from Cilegon)	4,558 (24%)	1,633 (9%)	5,888 (31%)	581 (3%)	1,958 (10%)	4,410 (23%)	19,028 (100%)	6.4	12,109	2,344 (70%)	993 (30%)	2,357	3,350	19.1	34.4	20.8	35.9	20.7	36.7		80	48
Balaraja	Selang side (or from Selang)	2,083 (14%)	1,552 (10%)	8,443 (56%)	355 (2%)	523 (3%)	2,112 (14%)	15,068 (100%)	8.1	22,859	3,360 (43%)	4,490 (57%)	11,731	16,221	6.1	33.4	7.3	7.0	9.8	9.5			
	Tangerang side (or from Tangerang)	2,091 (18%)	1,591 (14%)	4,527 (40%)	466 (4%)	523 (5%)	2,240 (20%)	11,438 (100%)	9.7	18,900	2,100 (37%)	3,640 (63%)	11,129	14,769	4.8	24.2	4.8	29.4	9.8	33.4			
Nagreg	Bandung side (or from Bandung)	7,487 (39%)	2,879 (15%)	3,481 (18%)	88 (0%)	1,362 (7%)	3,688 (19%)	18,985 (100%)	7.4	8,895	5,920 (62%)	3,660 (38%)	4,307	7,967	23.9	49.0	29.1	56.6	23.9	49.9	18	430	258
	Malangbong (or from Malangbong)	5,765 (37%)	2,752 (18%)	1,755 (11%)	839 (5%)	1,295 (8%)	3,304 (21%)	15,710 (100%)	8.5	9,237	5,310 (64%)	2,950 (36%)	4,588	7,538	28.8	39.5	31.2	50.5	30.9	37.6		200	121
Gebang	Cirebon side (or from Cirebon)	4,636 (23%)	1,619 (8%)	1,823 (9%)	62 (0%)	2,923 (14%)	9,137 (45%)	20,200 (100%)	6.1	9,296	0	9,840 (100%)	3,471	13,311	22.9	44.9	24.8	43.7	28.6	43.9			
	Losari side (or from Losari)	3,466 (18%)	2,992 (15%)	1,394 (7%)	108 (1%)	3,468 (18%)	8,145 (42%)	19,573 (100%)	7.6	4,995	7,240 (68%)	3,400 (32%)	3,806	7,206	23.7	44.9	23.9	43.8	27.1	44.2			
Peterongan	Jombang side (or from Jombang)	5,686 (37%)	2,213 (14%)	867 (6%)	68 (0%)	1,356 (9%)	5,339 (34%)	15,529 (100%)	7.8	18,533	5,370 (69%)	2,360 (31%)	8,827	11,187	29.9	46.5	27.2	50.4	27.4	48.7	31	270	80
	Mojokerto side (or from Mojokerto)	6,568 (39%)	2,527 (15%)	1,059 (6%)	152 (1%)	1,332 (8%)	5,270 (31%)	16,908 (100%)	7.8	18,433	6,250 (73%)	2,330 (27%)	9,607	11,937	27.2	53.8	21.7	53.0	29.3	50.7		300	162
Tanggulangin	Porong side (or from Porong)	5,622 (36%)	2,578 (16%)	3,724 (24%)	30 (0%)	25 (0%)	3,706 (24%)	15,685 (100%)	7.1	50,692	5,060 (62%)	3,060 (38%)	34,999	38,059	60.0	62.5	52.5	60.6	54.8	59.0	28	110	42
	Sidoarjo side (or from Sidoarjo)	5,679 (36%)	2,753 (17%)	3,802 (24%)	54 (0%)	25 (0%)	3,656 (23%)	15,969 (100%)	8.5	55,783	4,900 (64%)	2,750 (36%)	28,385	31,135	48.5	57.3	43.4	60.2	49.4	59.3		160	56

- There is another U-turn slot along the national road where a turning radius is small, thus buses and tracks cannot make smooth U-turn which is severely affecting traffic on the national road.

- Illegal parking of a lot of mini-buses and mini-taxis waiting for passengers along the national road.

- Due to the effects of the above problems, travel speed at this section is reduced to 5 to 10km/hour from 30 to 35km/hour of the adjacent section.

Nagreg Flyover

- Heavy roadside friction due to vegetable/fruit stands within the road right-of-way.

- Traffic queue is formed at the railway crossing during the train passing (maximum queue length is 430m at Bandung side). Number of train passing is 18 times a day.

- Travel speed of this section is reduced to 24 to 30km/hour from 40 to 50km/hour of adjacent section.

Gebang Flyover

- A fishing port is located near the site. There are many stalls/vendors occupying shoulders and sometimes outer carriageway lane, which drastically reduce traffic capacity and disturb smooth traffic flow.

- Slow moving vehicles and pedestrians/shoppers are also causing heavy roadside friction.

- There is one T-shaped intersection accessing to the public market. Although traffic going to the public market is still light, this intersection will be a traffic bottleneck in the near future.

- Due to the effects of the above conditions, travel speed of th is section is reduced to 23 to 27km/hour from 44 to 45km/hour of the adjacent section.

Peterongan Flyover

- Due to roadside development and high composition of local traffic, travel speed of this section is reduced to 22 to 30 km/hour from 46 to 54 km/hour of adjacent section.

- Traffic queue is formed at the railway crossing during train passing (maximum queue length is 300m at Mojokerto side). Number of train passing is 31 times per day.

Tanggulangin Flyover

- Due to high composition of local traffic, particularly motorbikes, travel speed is slightly reduced to 43 to 60km/hour from 57 to 62km/hour of adjacent section.

- Traffic queue is formed at the railway crossing during train passing (maximum queue length is 160m at the Sidoarjo side). Number of train passing is 28 times per day.

4.2 FLYOVER TRAFFIC

During the OD survey, drivers were interviewed and asked whether they will stop within the flyover section or not. Those who answered "yes" are considered "local traffic", and those who answered "no" are considered "through traffic". It is assumed that "through traffic" will utilize a flyover and "local traffic" will utilize an at-grade road.

4.3 FUTURE TRAFFIC

By applying annual traffic growth rate by vehicle type which was used by the Feasibility Study, future traffic volume was estimated.

ESTIMATED FUTURE TRAFFIC VOLUME

Unit: veh/day

			Year		
			2005	2015	2025
Merak	National Road	Flyover	-	3,123	4,413
		At-grade	6,292	6,873	9,908
	Ferry Terminal Exit Road	Flyover	-	3,189	4,231
		At-grade	2,998	1,294	1,788
Balaraja		Flyover	-	8,446	12,120
		At-grade	14,607	14,863	21,517
Nagreg		Flyover	-	17,599	24,519
		At-grade	17,783	10,570	15,138
Gebang (Cirebon-bound Direction)		Flyover	-	11,488	16,448
		At-grade	10,338	5,020	7,267
Peterongan		Flyover	-	18,125	25,458
		At-grade	15,864	6,961	9,818
Tanggulangin		Flyover	-	15,359	21,665
		At-grade	15,572	9,370	13,551

4.4 LEVEL OF SERVICE OF EXISTING ROAD WITHOUT FLYOVER

Approximate year when traffic volume will reach to traffic capacity of the existing road in case of without flyover is summarized below.

Flyover	Approx. Year when Traffic Volume of Existing Road Reaches to Capacity
Merak (National Road, Pulorida Side)	2016
Balaraja	2015
Nagreg	2012
Gebang (Cirebon-bound Direction)	2012
Peterongan	2015
Tanggulangin	2014

4.5 NUMBER OF LANES REQUIRED

The number of lanes required is summarized below.

Flyover		No. of Lanes		V/C Ratio of Flyover in 2025
		Flyover	At-grade	
Merak	From Pulorida	1-lane 1-way	1-lane	0.43
	From Pulorida after merging with Exit Ramp	2-lane 1-way	1-lane	0.58
Balaraja	From Tangerang	1-lane 1-way	2-lane	0.51
	From Serang	1-lane 1-way	2-lane	0.63
Nagreg	From Bandung	1-lane 1-way	1-lane	0.85
	From Malangbong	1-lane 1-way	1-lane	0.91
Gebang	From Losari	2-lane 1-way	1-lane	0.80
Peterongan	From Morokerto	1-lane 1-way	1-lane	1.18
	From Jombang	1-lane 1-way	1-lane	1.07
Tanggulangin	From Porong	1-lane 1-way	1-lane	0.95
	From Sidoardjo	1-lane 1-way	1-lane	1.13

Traffic volume of Peterongan and Tanggulangin Flyovers will reach to its traffic capacity around year 2025. Widening of flyover will be required.

5. PROJECT SITE SETTING

The project site setting is summarized in **Table 5-1**.

6. DESIGN STANDARDS AND CRITERIA

1) Highway Design

The following Indonesian highway design standards and criteria were adopted:

- Standard Specifications for Geometric Design of Urban Roads, RSWI, T-14-2005
- Standard Specifications for Geometric Design of Urban Roads, 1992

In case that there are some lacking items or from the standpoint of economic consideration, other standards listed below were referred:

- A Policy on Geometric Design of Highways and Streets, 2004 (AASHTO)
- Road Structure Ordinance, Japan Road Association, 2004 (JRA)

Table 6-1 shows geometric design standards of flyovers and service roads.

2) Intersection Design

The same design standards mentioned in (1) above were used.

TABLE 5-1 PROJECT SITE SETTING

Flyover		Existing Road		Railway Crossing	Topography	Land Use	Geological Condition	New Road Right-of-Way	Critical Underground Utilities
		Flyover Section	Adjacent Section						
Merak	Pulorida Side	2-lane 2-way (13.95m)	2-lane 2-way (13.95m)	Yes	• Narrow coastal plain followed by mountain slope	• Right side is commercial area • Left side is Ferry Terminal Waiting Area	• Liquefaction layer (6~8m thickness)	• No action yet at the start of the Study	• Water pipeline for the Power Plant
	Jakarta Side	4-lane Divided (26.0m)	4-lane Divided (26.0m)	-		• Commercial/residential area • Vacant area			
Balaraja		4-lane Divided (18.4m)	2-lane 2-way (12.0m)	-	• Mostly flat • Jakarta side with slope of about 5%	• Commercial/residential • Industrial area near the flyover	• Hard layer 8~14m from ground surface	• New ROW acquired • Standard 29.1m • Narrow section 18.0m	• Gas pipeline • Many electrical, communication cables
Nagreg		2-lane 2-way (12.0m)	Bandung Side 4-lane (18.0m) Malambong Side 2-lane (12.0m)	Yes	• Bandung Side with slope of about 5% • Flat after railway	• Residential/commercial area • Vegetable selling stalls	• Hard layer 20~30m from ground surface	• New ROW acquisition started • Standard 29.1m • Narrow section 18.0m	• Oil pipelines (2 lines)
Gebang		4-lane Divided (20.5m)	4-lane Divided (20.5m)	-	• Flat • About 1km from the sea	• Residential commercial area • Many vendors along the road	• Soft ground with 10~15m thickness	• Cirebon-bound direction completed with 13.3~16.0m in width	• Water pipeline
Peterongan		4-lane Divided (15.5m)	4-lane Divided (15.5m)	Yes	• Flat	• Residential/commercial area	• Hard layer 14~16m from ground surface	• No action yet at the start of the Study	• Water pipelines
Tanggulangin		4-lane Divided (25.0m)	4-lane Divided (25.0m)	Yes	• Flat	• Residential/commercial area • One side is railway land	• Soft ground with 30~32m thickness	• No action yet at the start of the Study	• Water pipelines

Table 6-1 GEOMETRIC DESIGN STANDARDS OF FLYOVERS AND SERVICE ROADS

Requiring Items for Geometric Design				Unit	Merak			Balaraja	Nagreg	Gebang	Peterongan	Tanggulangin
Road Function					Arterial			Arterial	Arterial	Arterial	Arterial	Arterial
Design Speed based on Existing Alignment				km/hr	40			40	50	80	80	80
Minimum Radius of Curvature : Rmin (Based on SAPROF Drawing)			Existing	m	65			75	55	∞	500	270
			Flyover	m	106			85	150	∞	800	250
FLYOVER	General	Design Vehicle Type		=	WB-15			WB-15	WB-15	WB-15	WB-15	WB-15
		Type of Pavement		=	ACP			ACP	ACP	ACP	ACP	ACP
		Design Speed (*Vr*)		km/hr	40			40	50	60	60	60
	Cross Section	Number of Lane		=	1 (One way) From Pulorida	1 (One way) From Harbour	2 (One way) To Jakarta	2 (Two way)	2 (Two way)	2 (One way)	2 (Two way)	2 (Two way)
		Total Flyover Width		m	6.75	7.00	9.00	13.00	13.00	9.00	13.00	13.00
		Total Roadway Width			5.75	6.00	8.00	5.75 + 5.75	5.75 + 5.75	8.00	5.75 + 5.75	5.75 + 5.75
		Traffic Lane Width		m	3.50	3.50	7.00	3.50	3.50	7.00	3.50	3.50
		Shoulder Width		m	2.00	2.25	0.50	2.00	2.00	0.50	2.00	2.00
		Median	Total Width	m	-	-	-	1.00	1.00	-	1.00	1.00
			Marginal Strip (One side)	m	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
		Cross Slope		%	2.0			2.0	2.0	2.0	2.0	2.0
	Horizontal	Minimum Radius of Horizontal Curve (*Rmin*)		m	55			55	90	135	135	135
		Minimum Length of Horizontal Curve (*Lh min*)		m	70			70	85	105	105	105
		Super-elevation	Maximum (*emax*)	%	6.0			6.0	6.0	6.0	6.0	6.0
			Runoff (Δ)	=	1/143			1/143	1/150	1/167	1/167	1/167
		Widening on Curve		m	3) 0.25	0.00	0.00	3) 0.75	3) 0.5	0.00	0.00	3) 0.25
		Minimum Spiral Curve Length (*Ls min*)		m	22			22	28	33	33	33
	Vertical	Maximum Grade (*Gmax*)		%	8.0			8.0	8.0	7.0	7.0	7.0
		Grade to be adopted for Flyover		%	5.0			5.0	5.0	5.0	5.0	5.0
		Critical Length of Grade (*Lc*)		m	400 (8.0 %)			400 (8.0 %)	400 (8.0 %)	400 (7.0 %)	400 (7.0 %)	400 (7.0 %)
		Stopping Sight Distance (*Ss*)		m	50			50	65	85	85	85
		Minimum Radius of Vertical Curve	Crest	m	450			450	800	1,400	1,400	1,400
			Sag	m	450			450	700	1,000	1,000	1,000
SERVICE ROAD	General	Design Speed (*Vr*)		km/hr	40			40	40	40	40	40
		Type of Pavement		=	ACP			ACP	ACP	ACP	ACP	ACP
	Cross Section	Number of Lane		=	1			2	1	1	1	1
		Roadway Width (One side)		m	5.50			6.00	5.50	5.00 ~ 5.50	5.50	5.50
		Traffic Lane Width		m	3.50			3.00	3.50	3.50	3.50	3.50
		Loading / Unloading Lane		m	2.00			0	2.00	1.50 ~ 2.00	2.00	2.00
		Sidewalk		m	1.50			1.55	2.05	1.50	1.50	1.50
		Cross Slope		%	2.00			2.00	2.00	2.00	2.00	2.00
R O W Width				m	12.5 ~ 27.6			1). 18.7 ~ 29.1	2). 19.1 ~ 29.1	1). 13.3 ~ 16.0	20.1 ~ 28.0	19.5 ~ 28.0

Note : 1). R O W acquitted 2). R O W being negotiated 3). Within Shoulder Width
Design Vehicle Type ; WB-15 = Intermediate Semi Trailer (*l* = 16.8 m, *w* = 2.5 m)

3) Pavement Design

The following pavement design standards in Indonesia for flexible pavement and rigid pavement were adopted:

- Guide for Flexible Pavement Design (Pedoman Penetuan Tebal Perkerasan – Jalan Raja, No. 01/PD/b/1983) published by Bina Marga
- Guide for Rigid Pavement Design (Pedoman Perencanaan Perkerasan Kaku, No. 009/T/BNKT/1988) published by Bina Marga
- Road Design System (RDS) ver.5, one of the pavement design softwares developed by Bina Marga. This is usually used in the design of pavements of national and provincial roads.

4) Bridge Design

The following design codes and standards were followed:

- Bridge Design Code, Draft, Volume 1 and Volume 2 – Bridge Management System 1992, Direktorat Jenderal Bina Marga Departemen Pekerjaan Umum
- Bridge Design Manual, Draft, Volume 1 and Volume 2 – Bridge Management System 1992, Direktorat Jenderal Bina Marga Departemen Pekerjaan Umum
- Pembebanan untuk jembatan, RSNI4
  (*Loading for Bridges*)
- Standar perencanaan ketahanan gempa untuk jembatan, SNI
  (*Design Standard of Earthquake Resistance for Bridges*)
- Perencanaan struktur beton untuk jembatan, RSNI
  (*Design of Concrete Structure for Bridge*)
- Perencanaan struktur baja untuk jembatan, ASNI4
  (*Design of Steel Structure for Bridge*)
- AASHTO LRFD Bridge Design Specifications, 3rd Edition

For design requirements not covered by the above Codes and Standards, the following references will be used as required:

- Japanese Specifications for Highway Bridges
- AS S100 Bridge Design, Australian Standard, 2004
- FHWA-IF-99-025, “Drilled Shafts: Construction Procedures and Design Methods”, 1999
- FHWA-NHI-00-043, “Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Design and Construction Guidelines”, 2001
- NCHRP Report 529, “Guidelines and Recommended Standard for Geofoam Applications in Highway Embankments”, Transport Research Board, 2004

5) Drainage Design

The following Indonesian drainage design standards and criteria were followed:

- Manual of Design for Road Surface Drainage, 1990, Directorate General of Highways, Directorate of Freeway and Urban Road
- Guidelines of Design for Road Surface Drainage, 1994, Council of Indonesian National Standard
- Design of Road Drainage System, 2005, Department of Settlement and Infrastructure Region
- Calculation Method of Overflow Debit, 1991, Council of Indonesian National Standard

In case there were some lacking information, other standards listed below were referred:

- Highway Engineering, Seventh Edition, Paul H. Wright and Karen Dixon, 2003, John Wiley and Sons, Inc.
- Hydrology Analysis, Sri Harto Br, 1993, Gramedia Pustaka Utama, Jakarta
- Hydraulic for Open Channel, Ven Te Chow, 1992, Erlangga, Jakarta
- Hydrology for Irrigation, Suyono Sosrodarsono, 1993, Pradrya Paramita, Jakarta

6) Railway Crossing Requirements

According to the Ministry of Transportation Decree No. KM52, 2000, horizontal and vertical clearance for permanent structures is as follows:

Horizontal Clearance	:	10.0m from the rail to surface of pier or permanent structure for each side
Vertical Clearance	:	6.5m from the top of the rail

According to PT. KAI, clearance can be reduced to the following during construction:

Horizontal Clearance	:	3.0m from the centerline of the railway for each side
Vertical Clearance	:	5.0m from the top of the rail

7. DESIGN POLICY

7.1 Characteristics of the Project

This project must be implemented under the following conditions:

- The project site is located in the busy urban area with concentration of vehicular traffic as well as pedestrians.
- The project site is narrow and a detour road is not available.
- Commercial and business activities are active along the project site.
- Four flyovers are to built over the existing railway.
- All project sites are located within the seismic zone.
- Gebang and Tanggulangin Flyovers are located at the deep soft ground area.
- Merak Flyover is located at loose sandy layer which would cause liquefaction during the earthquake.

7.2 Japanese Technologies Utilized

The Project is financed under JBIC's STEP Loan. To cope with conditions mentioned in 7.1 above, Japanese technologies were fully utilized on the following:

- Fast construction method to minimize traffic congestion as well as adverse economic impacts during construction.
- Efficient construction method applicable to narrow construction area under urban environment.
- Construction method to realize efficient traffic management during construction.
- Anti-earthquake technology.
- Soft ground treatment technique and treatment against liquefaction.
- Steel bridges for safe, fast and easy construction over the existing railway where the alignment is curved.

Table 7-1 summarizes Japanese technologies adopted for this project which are eligible to STEP Loan technical requirements.

TABLE 7-1 JAPANESE TECHNOLOGY ADOPTED FOR THIS PROJECT

Objectives	Japanese Technology Adopted						
	Large Diameter Single Pile	Steel and Concrete Composite Pier	Integration of Super-structure and Pier	PC Deck Slab	Curved Steel Bridge	Soft Soil Improve-ment Around Single Pile	Light Weight Embank-ment
1. Fast Construction	○	○	△	○	○	–	○
2. Efficient construction at narrow area	○	○	△	–	○	–	○
3. Efficient traffic management	○	○	△	–	○	–	○
4. Improved seismic resistance	–	○	○	–		○	○
5. Efficient countermeasure against soft ground in urban area	–	–	–	–	–	○	○
6. Safe, fast and easy construction over railway	–	–	–	–	○	–	–

Objectives	Japanese Technology Adopted						
	Large Diameter Single Pile	**Steel and Concrete Composite Pier**	**Integration of Super-structure and Pier**	**PC Deck Slab**	**Curved Steel Bridge**	**Soft Soil Improve-ment Around Single Pile**	**Light Weight Embank-ment**
Applied section	• Section with narrow road ROW • Section near railway crossing to satisfy required horizontal clearance	• Pier with large diameter single pile	• All abut-ments and piers except pier with movable bearing shoe.	• All bridges	• Over the Railway	• Soft ground section	• Approach section at soft ground

7.3 MEASURES TO COPE WITH CONDITION CHANGES

From the time of project appraisal in October 2004 to the present, there are some drastic changes as follows:

- Domestic construction prices increased by 1.4 times due mainly to fuel price increase made in 2005.
- Japan's steel material price increased by 1.2 times.
- Yen Value depreciated by about 10%.
- Gebang and Tanggulangin Flyover locations were found to be soft ground area. Liquification layer exists at Merak Flyover.
- Public utilities relocation/protection cost was not estimated at the time of project appraisal.

Domestic price increase and Japanese yen value depreciation alone impacted about 43% price escalation, whereas price escalation during the project appraisal was assumed to be 19.1%. In view of such conditions, measures for cost reduction were considered as follows:

MEASURES FOR COST REDUCTION

- To reduce bridged length as much as possible (height of abutment was targeted between 6.5 m to 7.0 m)
- To reduce steel bridge length as much as possible (steel bridges are only adopted for limited sections such as railway crossing, and where single column pier with single pile is required at narrow construction space.
- To use short span length as much as possible (it was found that the shorter span length is more economical even at soft ground.)
- To study reduction of bridge width from 13.0m to 11.5m

7.4 CANDIDATE ITEMS FOR JAPAN PORTION

Requirement of STEP Loan on Japan portion is that "total cost of goods procured from Japan and Indonesia-Japan J.V. companies shall be not less than 30% of total amount of contract(s)". Candidate items for Japan portion is shown in **Table 7-2**.

TABLE 7-2 CANDIDATES OF JAPAN PORTION

Item			Judgement	Condition
Steel Bridge	Steel Material		Yes	• Procured in Japan
	Shipping (Japan ⟶ Indonesia)		Yes	
	Fabrication	In Japan	Yes	• Fabricated in Japan
		In Indonesia	Yes	• Fabricated by Indonesia-Japan J.V. company
		In Indonesia	No	• Local company other than above
	Local Transportation		No	
	Erection		No	
PC Bridge	PC wire/tendon, anchor		Yes	• Procured in Japan • Procured from Indonesia- Japan J.V. company
	Admixture for concrete		Yes	• Same as above
Pier	Steel coping		Yes	• Same as steel bridge
	Inner ribbed casing for pile head		Yes	• Same as steel bridge
Large Diameter Bored Pile	Inner ribbed casing for pile head		Yes	• Same as steel bridge
Miscellaneous Bridge Parts	Bearing shoe		Yes	• Same as steel bridge
	Fall-down Prevention Devices		Yes	• Same as steel bridge
Drainage	Precast concrete pipe		Yes	• Procured from Indonesia- Japan J.V. company
	Precast catch basin		Yes	• Same as above
Approach Embank-ment	Mechanically Stabilized Earth Wall	Strip	Yes	• Same as steel bridge
		Concrete Panel	Yes	Procured from Indonesia-Japan J.V. company
	Light Weight Embankment		No	

8. BRIDGE TYPE SELECTION

8.1 BRIDGE TYPE SELECTION PROCEDURE

Bridge type selection procedure is shown in **Figure 8-1**.

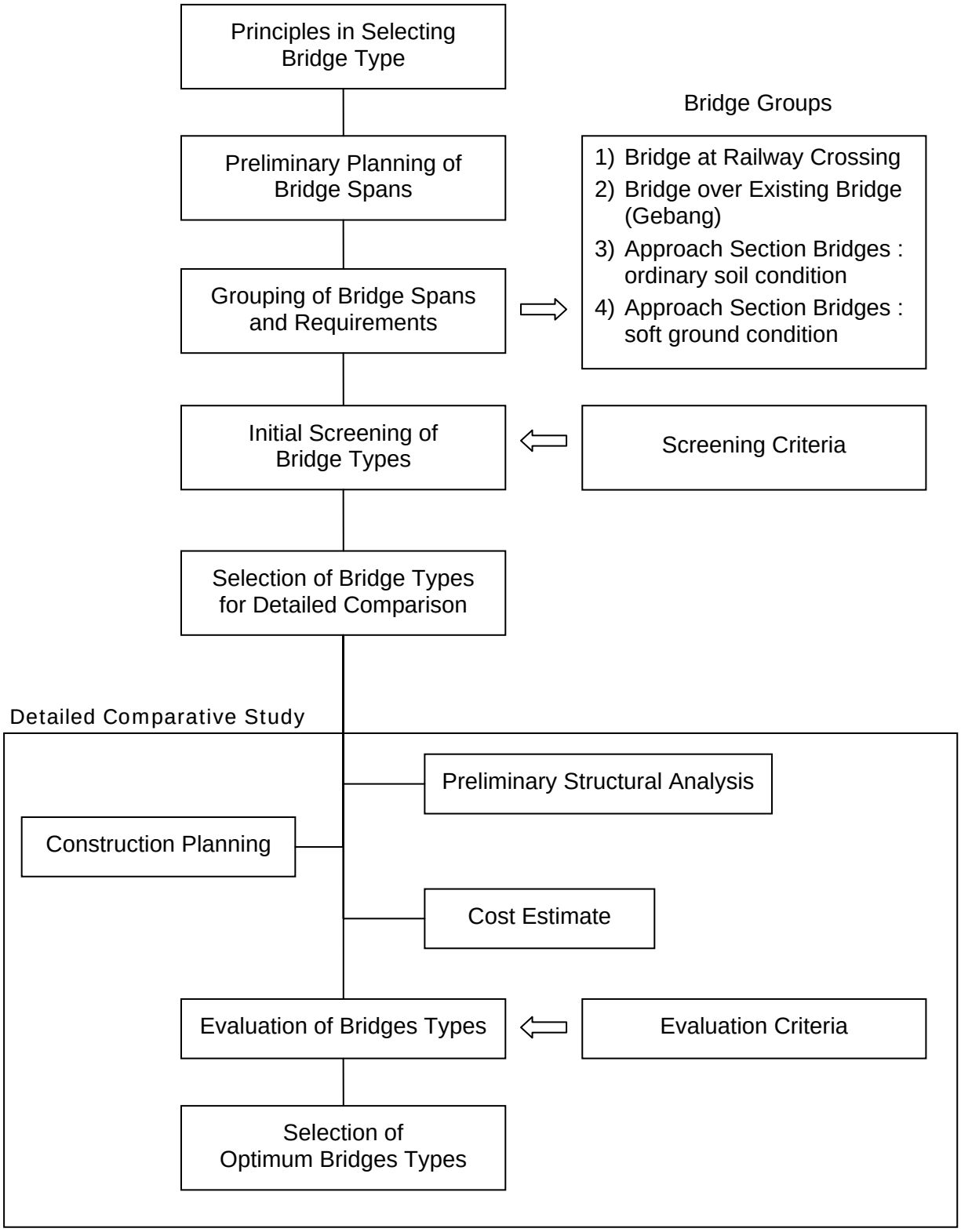


FIGURE 8-1 BRIDGE TYPE SELECTION PROCEDURE

8.2 PRINCIPLES IN SELECTING BRIDGE TYPE

Flyovers will be constructed in the urban areas with high traffic volume and narrow construction sites. Bridge type must be selected in due consideration of such conditions. Principles in selecting bridge type were established as follows:

Principles in Selecting Bridge Type

Primary Principle

- Must be economical.
- Fast construction is possible.
- Traffic disturbance can be minimized.
- Bridge system must be strong against earthquake.
  (integration of superstructure and substructure should-be achieved as much as possible)

Secondary Principles

- Maintenance is easy and less costly.
- Aesthetic consideration. (match with urban scenery)
- Introduction of new technology.

Special Consideration

- STEP Loan requirement must be satisfied.

8.3 BRIDGE GROUPS

Based on the preliminary planning of bridge spans and location conditions, bridges were grouped into 4 as shown in **Table 8-1**.

TABLE 8-1 BRIDGE GROUP

Bridge Group		Characteristics	Approximate Share in Total Bridge Length
1.	Approach Bridge (Standard Soil Condition)	• Any span length will applicable, however, shorter span length is usually more. • Almost straight alignment • Economical span length is usually 20m ~ 30m.	35%
2.	Approach Bridge (Soft Soil Condition)	• Any span length will be applicable. • Almost straight alignment • Economical span length need to be determined.	25%
3.	Railway Crossing	• Span length = 25 m ~ 35 m • Curved Alignment	35%
4.	Over the Existing Bridge (Gebang Flyover	• Span length = 35 m ~ 45 m • Almost straight alignment	5%

8.4 BRIDGE TYPE SELECTED

Through the initial screening and the detailed comparative study, bridge type was selected for each bridge group as shown below:

Bridge Group	Bridge Type Selected	Remarks
1. Approach Bridge (Standard Soil Condition)	PC Double Girder	**Table 8-2**
2. Approach Bridge (Soft Soil Condition)	PC Double Girder	**Same as 1 above**
3. Railway Crossing	Small Size Steel Box Girder	**Table 8-3**
4. Over the Existing Bridge	Small Size Steel Box Girder	**Same as 3 above**

9. DETAILED DESIGN

9.1 FLYOVER LAYOUT

Flyover layout is summarized in **Table 9-1**. General elevation and plan of flyovers are presented in the succeeding pages.

9.2 HIGHWAY DESIGN

Horizontal alignment and vertical alignment are summarized in **Table 9-2** and **9-3** respectively.

Typical cross sections are shown in **Figure 9-1** to **9-6**.

9.3 STRUCTURE DESIGN

Typical details of structure are shown in the following figures:

Figure 9-7 General Dimension of Steel Superstructure (1)

Figure 9-8 General Dimension of Steel Superstructure (2)

Figure 9-9 Pier Layout: Portal type

Figure 9-10 Arrangement of PC Cables

Figure 9-11 Typical Cross Section of PC Bridge

Figure 9-12 Typical Two Column Pier

Figure 9-13 Typical One Column Pier

Figure 9-14 Composite Column Socket Type Connection

TABLE 8-2 APPROACH SECTION OF FLYOVER AT STANDARD SOIL CONDITION, BALARAJA Flyover ; PILE LENGTH = 20m

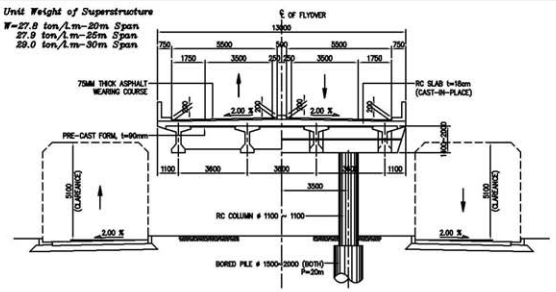
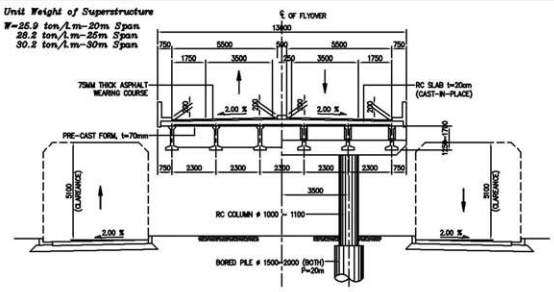
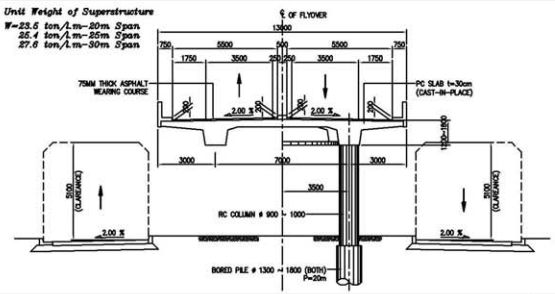
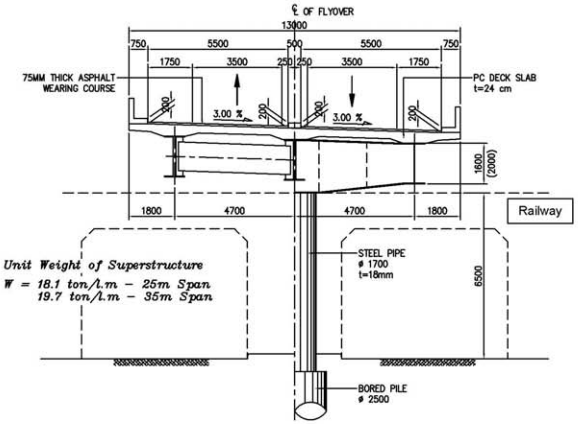
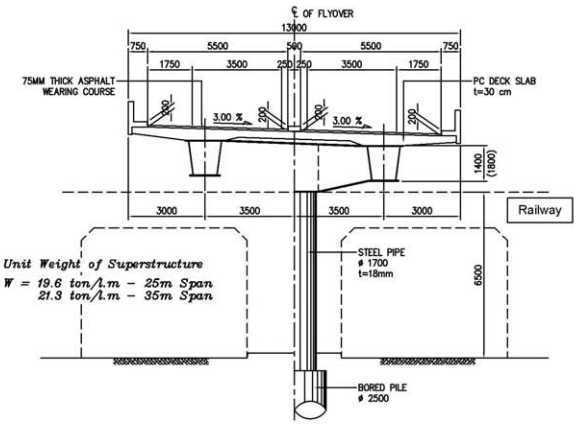
DESCRIPTION				SCHEME 6 PC T-GIRDER						SCHEME 6' PC I-GIRDER (Indonesia Standard)						SCHEME 9 PC DOUBLE GIRDER					
SECTION																					
Item No.	Criteria		Max Point	Evaluation LM : linear meter					Point	Evaluation LM : linear meter					Point	Evaluation LM : linear meter					Point
				Span Length	Cost M Rp /span	Cost /LM	LM Cost Ratio	Remarks		Span Length	Cost M Rp /span	Cost /LM	LM Cost Ratio	Remarks		Span Length	Cost M Rp /span	Cost /LM	LM Cost Ratio	Remarks	
1	Construction Cost / Economic Aspect (include substructure and pile foundation)		40	20m Span	1,378.5	68.93	1.00	Girder Height = 1.40m	40	20m Span	1,386.8	69.34	1.01	Girder Height = 1.25m	40	20m Span	1,361.9	68.10	0.99	Girder Height = 1.20m	40
				25m Span	1,749.0	68.96	1.00	Girder Height = 1.60m		25m Span	1,794.3	71.77	1.03	Girder Height = 1.60m		25m Span	1,839.8	73.59	1.05	Girder Height = 1.60m	
				30m Span	2,171.3	72.38	1.00	Girder Height = 2.00m		30m Span	2,130.1	71.00	0.98	Girder Height = 1.70m		30m Span	2,439.4	81.31	1.12	Girder Height = 2.00m	
2	Construction Difficulty / Effective Traffic Managment		10	Easy	– Erection of Girder by truck crane during night time. – Precast PC panel is used as forms for deck slab concreting between girders, which will also constitute a pant of deck slab. – Ordinary forms are used for cantilevered deck slab. – Several steps of concreting for coping, diaphragm and slab are involved.				8	Easy	– Erection of Girder by truck crane during night time. – Precast PC panel is used as forms for deck slab concreting between girders. – Ordinary forms are used for cantilevered deck slab. – Several steps of concreting for coping, diaphragm and slab are involved.				8	Easy but traffic is disturbed more than other types	– All concrete works are done by cast-in-situ using systematic form work (movable type), or by all-staging method. – Deck slabs is post-tensioned, girders is particial prestressed concrete. – Traffic will be disturbed not only night time but also day time.				6
	Construction Period (Fast Construction)		12	Need time for coping works	– Girders can be manufactured during construction of substructure. – Night time traffic is disturbed during girder erection. – Traffic disturbance during coping construction is expected.				10	similar to T-girder	– Girders can be manufactured during construction of substructure. – Night time traffic is disturbed during girder erection.				9	Faster than other schemes	– Superstructure work can start after completion of column, since no coping is required. – By using fast setting concrete and systematic form work, duration of. construction may be reduced.				11
3	Structural Aspect	Applicability to Horizontal Curvature	5	Rather difficult for sharp curve section	– Adjusted by width of cantilever portion of deck slab. – Trapezoidal shape (flared type) coping to be used for fitting curvature.				4	Rather difficult for sharp curve section	– Adjusted by width of cantilever portion of deck slab, however its difficult due to short cantilever. – Trapezoidal shape (flared type) coping is needed for fitting curvature.				3	Easy	– Curved girders can be possible. – Flyover can construct exactly with the smooth curve with stable flyover system.				5
		Applicability to Integrated Pier and Earthquake Resistance	10	Difficult	– Integration of girder and pier difficult. – Girder falling prevention devices needed. – Not ideal system for Bridge Type A (Bina Marga requirement).				6	Difficult	– Integration of girder and pier difficult. – Girder falling prevention devices needed. – Not ideal system for Bridge Type A (Bina Marga requirement)..				6	Easy	– Integration of girder and pier. – This system is fully comply with Bina Marga Requirement "Bridge Type A" (Integrated Bridge System).				10
4	Maintenance		3	Fair	– Expansion joint can be eliminated by connecting deck slab of neighbouring spans. – Need maintenance of bearing pads and girder falling prevention devices.				1	Fair	– Expansion joint can be eliminated by connecting deck slab of neighbouring spans. – Need maintenance of bearing pads and girder falling prevention devices.				1	Good	– Almost maintenance free. Structurally integrated, therefore after strong earthquake, damage of column will be located top of column where accessible and easy to repair.				3
5	Introduction of New Technology		5	No	– Slab with reinforced concrete is not highly durable. – Composite deck slab with PC precast panel between girders which also works as a form for deck slab concreting.				3	No	– Conventional type. – Slab with reinforced concrete is not highly durable. – Precast panel can be used as a form.				3	Yes	– New concept of prestressed concrete slab and integrated with slab and girder by Double T-Type Girder System. – This system is also verified in Japan as appropriate seismic system in earthquake country.				5
6	Aesthetics		10	Fair	– Commonly seen at flyover in the country, but not appreciated especially for STEP Loan Project Program.				5	Fair	– Commonly seen at flyover in the country, but not appreciated especially for STEP Loan Project Program.				5	Good	– Looks slender and gives impression of relived. Good view in urban area. – Using high strength concrete, view of concrete will be same as precast girder, solid and clean concrete colour.				8
7	STEP Loan Requirement Consideration (Japanese Contents)		5	Less Japan's Contents	– PC strands/ anchors and girder falling prevention devices will be japanese. – Difficult to comply with STEP Loan Requirement contents on Japanese Technology application.				3	Less Japan's Contents	– PC strands/ anchors & girder falling prevention devices will be Japanese contents. – Difficult to comply with STEP Loan Requirement on Japanese Technology application.				3	Higher Japan's Contents than other types	– PC strands/ anchors & both main girders & deck slab will be Japanese contents. – High strength concrete for fast construction is suitable for STEP. – Seismically highly stable structural system is one of the strongest justification of STEP Loan requirement.				5
Total Point			100						80						78						93
Evaluation				Not Recommended						Not Recommended						Recommended					
Remarks				• Unless coping and slab are precasted and be installed by segment method, precasting girder only is not effective in terms of faster construction concept.						• Unless coping and slab are precasted and be installed by segment method, precasting girder only is not effective in terms of faster construction concept.						• As STEP Loan Project, this scheme is the best option to apply seismically most stable and integrated flyover system using Japanese Technology, such as composite column and single bored pile (large size). For faster construction high performance concrete will be recommended.				

TABLE 8-3 RAILWAY CROSSING AT MERAK, NAGREG, PETERONGAN AND TANGGULANGIN FLYOVER

DESCRIPTION	SCHEME 1 STEEL I-GIRDER	SCHEME 2 SMALL SIZE STEEL BOX GIRDER
SECTION		

Item No.	Criteria		Max Point	Evaluation					Point	Evaluation					Point
1	Construction Cost / Economic Aspect		40	Span Length	Cost (M Rp)/span	Cost / LM	Cost Ratio	Remarks	40	Span Length	Cost (M Rp)/span	Cost / LM	Cost Ratio	Remarks	36
				25m Span	3,620.9	144.8	1.00	Girder Height = 1.60m		25m Span	3,699.5	148.0	1.02	Girder Height = 1.40m	
				35m Span	6,390.7	182.6	1.00	Girder Height = 2.00m		35m Span	6,937.5	198.2	1.09	Girder Height = 1.80m	
2	Construction Difficulty / Effective Traffic Management		10	Fair	Easy				9	Best	Suitable for curved girder and stable during erection, especially above railway.				10
	Construction Period (Fast Construction)		12	Fair	Needs longer construction period than scheme 2 due to increased small steel members.				7	Good	Less number of steel members for erection.				10
3	Structural Aspect	Applicability to Horizontal Curvature	5	Best	Need intermediate cross beam and full lower lateral bracing is required for curve section.				5	Best	No need intermediate diaphragm and most ideal structure system.				5
		Applicability to Integrated Pier and Earthquake Resistance	10	Good	Easy to integrate between steel I girder ad box pier coping.				10	Good	Easy to integrate beetween box–girder and box–pier coping.				10
4	Maintenance		3	Good	Presstresed concrete deck slab is durable and less maintenance.				2	Good	Appropriate slab system and less maintenance.				2
5	Introduction of New Technology		5	Fair	Rigid connection of girder and pier.				3	Good	Small size box girder and less number of girders with prestressed concrete slab. Rigid connection of girder and pier.				4
6	Aesthetics		10	Bad	Not appropriated for urban flyover.				4	Good	Most simple and appreciated view underneath.				8
7	STEP Loan Requirement Consideration (Japanese Contents)		5	Fair	Slightly heavier weight than straight girder for additional bracing member against tortional moment for curve girder.				3	Good	Slightly heavier weight than scheme 1 (5%).				4
Total Point			100						83						89
Evaluation				Not Recommend						Recommend					
Remarks				Rather complicated erection condition due to curved I-girder above railway						The best scheme for curve bridge over railway, and if bridge type which is PC 2-Girder is applied to approach section					

TABLE 9-1 SUMMARY OF FLYOVER LAYOUT

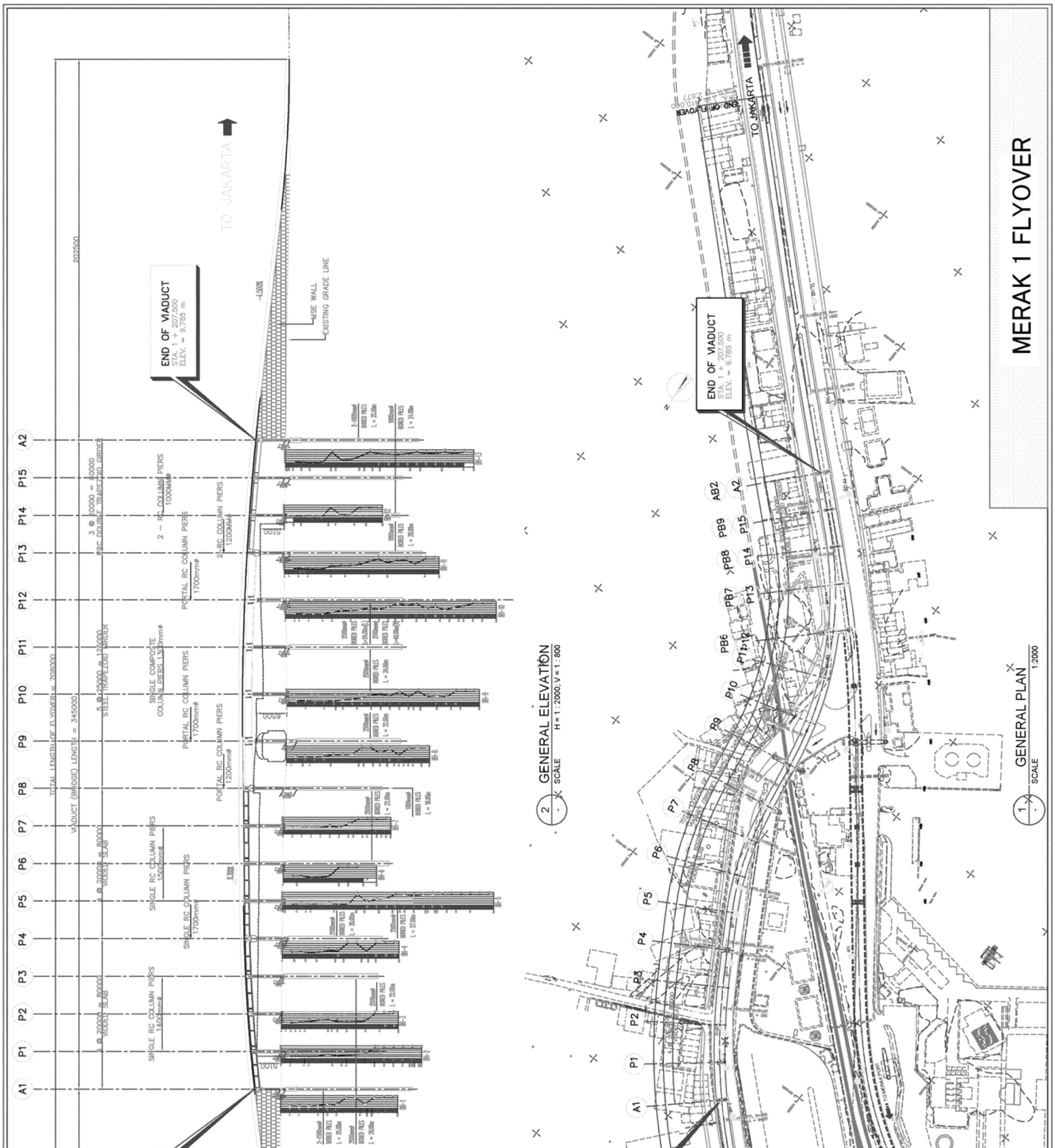
Flyover		Total Length (Approach + Bridge)	Width of Flyover	Approach Section		Bridges					
				Length (m)	Type of Embankment	Bridge Length	Span Composition and Type of Superstructure	Substructure / Foundation			
								Abutment and Foundation	Pier and Foundation		
									Two Column with Two Piles	Single Column with Single Piles	Portal Type
Merak	Pulorida Side	445.5 m	6.75 m	160.5 m	Mechanically Stabilized Embankment with Soil Improvement	285.0 m	PC Void Slab 4span@20m=80m, 4span@20m=80m Steel Box 5span@25m=125m	1-Abut (Integral Abutment) Bored Pile Φ2-1500,L = 30m		Bored Pile Φ=2500 mm N=9 ΣL=201m	Bored Pile Φ=2500 mm, N=4,ΣL=108m Φ=1800 mm, N=2,ΣL=36m
	Jakarta Side	262.5 m	9.0 m	202.5 m	Mechanically Stabilized Embankment with Soil Improvement	60.0 m	PC Void Slab 3span@20m=60m	1-Abut (Integral Abutment) Bored Pile Φ2-1800,L = 30m	Bored Pile Φ=1800 mm N=6, ΣL=152 m		
	Ferry Terminal Exit Ramp	346.9 m	7.0 m	176.9 m	Mechanically Stabilized Embankment with Soil Improvement	170.0 m	PC Void Slab 3span@20m=60m Steel Box 25m+30m +30m +25m =110m	1-Abut(Integral Abutment) Bored Pile Φ2-1500,L = 34m		Bored Pile Φ=2500 mm, N=4,ΣL=100m	Bored Pile Φ=2500 mm, N=2 ΣL=52m
Balaraja		520.0 m	13.0 m	159.0 m 140.0 m 299.0 m	Mechanically Stabilized Embankment	221.0 m	PRC Double 3span@20m=60m, 4span@20m=80m Steel Box 25m+31m +25m =81m	2-Abut (Integral Abutment) Bored Pile Φ3-1800,L = 20m Φ3-1800,L = 20m	Bored Pile Φ=1500 mm N=12,ΣL=298 m	Bored Pile Φ=2500 mm N=3, ΣL=79m	
Nagreg		734.0 m	13.0 m	355.5 m 154.5 m 510.0 m	Mechanically Stabilized Embankment	224.0 m	PRC Double 4span@20m=80m, 2span@20m=40m Steel Box 25m+27m +27m +25m =104m	2-Abut (Integral Abutment) Bored Pile Φ3-1800,L = 30m Φ3-1800,L = 30m	Bored Pile Φ=1500 mm N=8 ΣL=288 m	Bored Pile Φ=2500 mm N=4, ΣL=169m	Bored Pile Φ=2500 mm N=2 ΣL=52m
Gebang		760.0 m	9.0 m	168.0 m 207.0 m 375.0 m	Light Weight Embankment	385.0 m	PRC Double 4span@20m=80m, 4span@20m=80m Steel Box 27m+36m +27m =90m, 5span@27m=135m	2-Abut (Integral Abutment) Bored Pile Φ2-1800,L = 31m Φ2-1800,L = 31m	Bored Pile Φ=1500 mm N=12 ΣL=428 m	Bored Pile Φ=2500 mm N=7 ΣL=255m	Bored Pile Φ=2500 mm N=4 ΣL=140m
Peterongan		615.0 m	13.0 m	158.0 m 195.0 m 353.0 m	Mechanically Stabilized Embankment	262.0 m	PRC Double 4span@20m=80m,5span@20m=100m Steel Box 25m+32m +25m =82m	2-Abut (Integral Abutment) Bored Pile Φ3-1800,L = 18m Φ3-1800,L = 18m	Bored Pile Φ=1500 mm N=14 ΣL=324 m	Bored Pile Φ=2500 mm N=4 ΣL=132m	
Tanggulangin		530.0 m	13.0 m	162.0 m 168.0 m 330.0 m	Light Weight Embankment	200.0 m	PRC Double 2span@20m=40m, 3span@20m=60m Steel Box 25m+25m +25m +25m =100m	2-Abut (Integral Abutment) Bored Pile Φ3-1800,L = 40m Φ3-1800,L = 39m	Bored Pile Φ=1500 mm N=8 ΣL=384 m	Bored Pile Φ=2500 mm N=2 ΣL=100m	Bored Pile Φ=2500 mm N=4 ΣL=187m

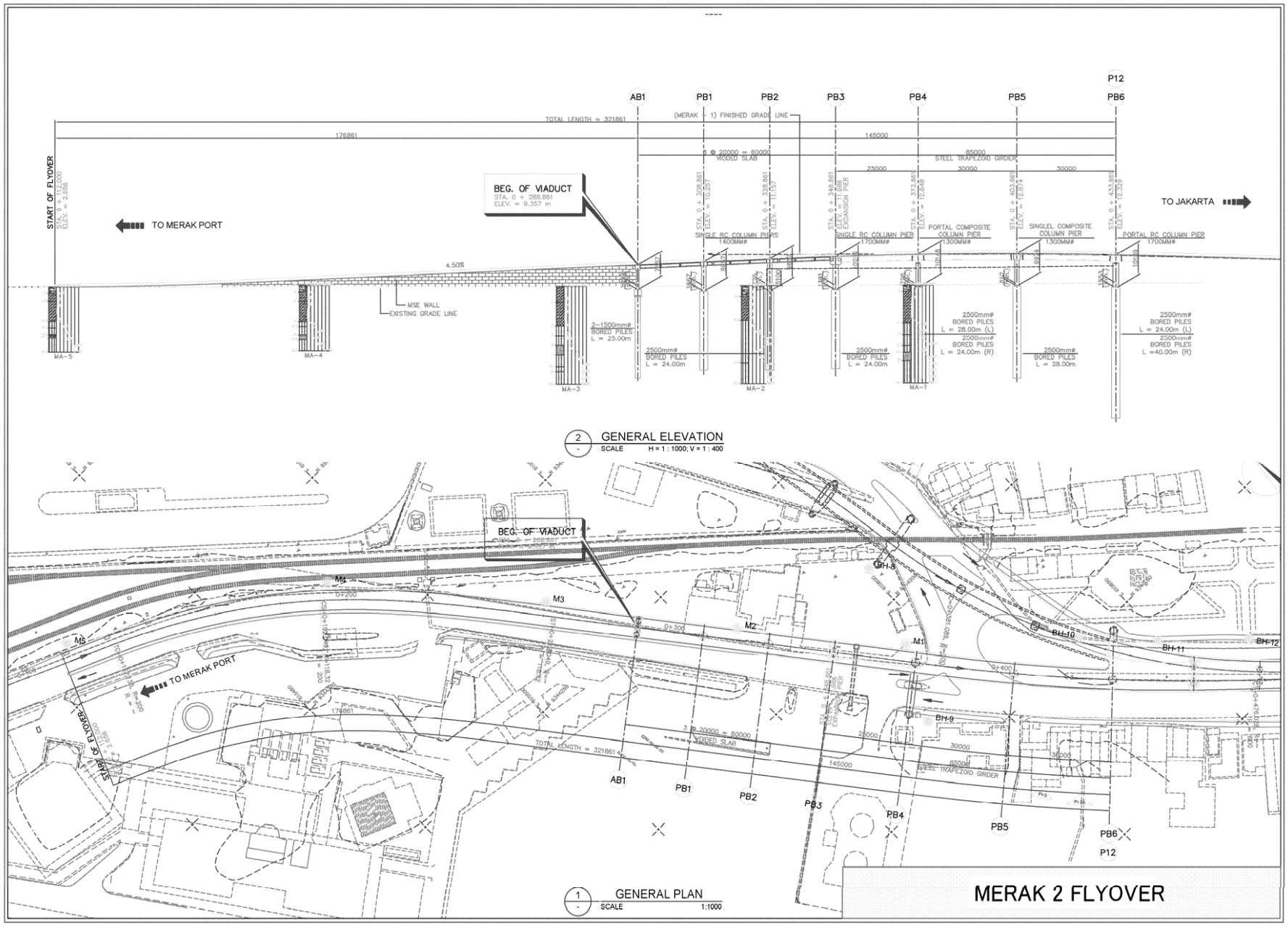
TABLE 9-2 HORIZONTAL ALIGNMENT

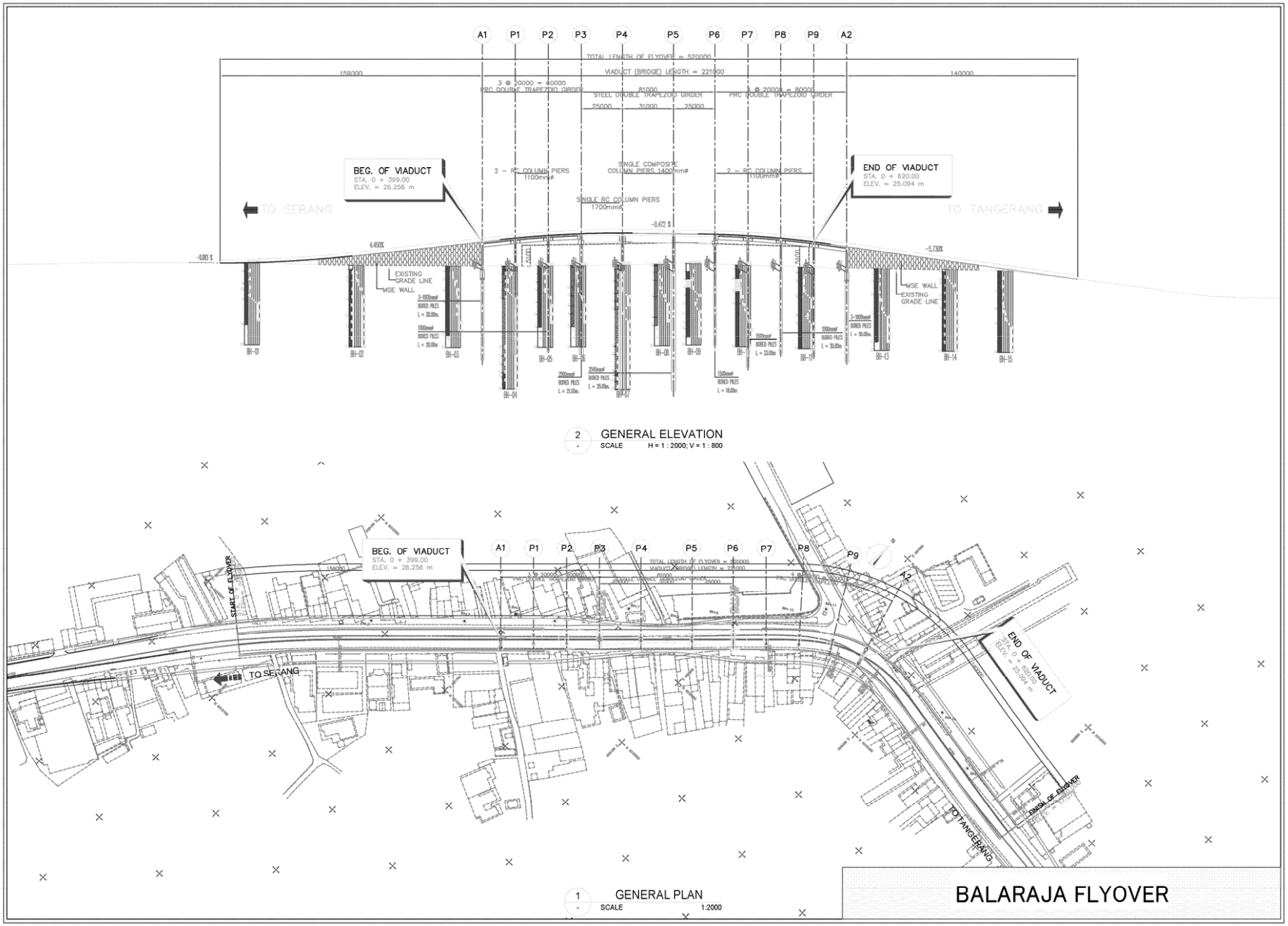
		Design Requirement		Horizontal Alignment Adopted				Remarks
		Design Speed	Min. Radius	Flyover Centerline	No. of curves	Min. Radius Adopted	Super-elevation	
Merak	Along National Road (Pulorida Side)	40 km/h	55m	- About 10m from right edge of existing ROW	4	150m	6.0%	S-curve at railway crossing
	Ferry Terminal Exit Ramp	40 km/h	55m	- About 4.0 m from left side boundary between ASDP and railway land for the first 100 m.	2	200m	5.5%	-
	Along National Road (Jakarta Side)	40 km/h	55m	- About 0.5 m left side of the existing road centerline.	1	1500m	2.0%	-
Balaraja		40 km/h	55m	- Centerline of acquired new ROW	4	75m	5.7%	Sharp curve
Nagreg		50 km/h	90m	- Centerline of being acquired new ROW	7	150m	5.3%	S-curve at railway crossing
Gebang		60 km/h	135m	- Left edge of flyover almost following existing road centerline	6	1200m	2%(Normal)	
Peterongan		60 km/h	135m	- Almost following existing road centerline	3	800m	2.5%	
Tanggulangin		60 km/h	135m	- Almost following existing road centerline	6	250m	5.0%	S-curve at railway crossing

TABLE 9-3 VARTICAL ALIGNMENT

		Design Requirement					Vertical Alignment Adopted			
		Design Speed	Max Gradient	Min. Radius		Vertical Clearance	Max Gradient	Min. Radius		Vertical Clearance
				Sag	Crest			Sag	Crest	
Merak	Along National Road	40 km/h	8.0%	450m	450m	Over Railway 6.5m Over At grade 5.1m	4.5%	2381m	1651m	0+880 – 1+020 (clearance 5.1m) 1+020 – 1+070 (clearance 6.5m) 1+070 – 1+167.5 (clearance 5.1m)
	Ferry Terminal Exit	40 km/h	8.0%	450m	450m	Over At grade 5.1m	4.5%	1431m	1451m	0+328 – 0+407 (clearance 5.1m)
Balaraja		40 km/h	8.0%	450m	450m	Over At grade 5.1m	5.73%	1765m	1521m	0+420 – 0+600 (clearance 5.1m)
Nagreg		50 km/h	8.0%	700m	800m	Over Railway 6.5m Over At grade 5.1m	5.0%	1618m	1215m	0+520 – 0+610 (clearance 5.1m) 0+610 – 0+640 (clearance 6.5m) 0+640 – 0+710 (clearance 5.1m)
Gebang		60 km/h	7.0%	1000m	1400m	Over At grade 5.1m	4.7%	1760m	1783m	0+370 – 0+680 (clearance 5.1m)
Peterongan		60 km/h	7.0%	1000m	1400m	Over Railway 6.5m Over At grade 5.1m	4.6%	1895m	1796m	0+360 – 0+444 (clearance 5.1m) 0+444 – 0+484 (clearance 6.5m) 0+484 – 0+545 (clearance 5.1m)
Tanggulangin		60 km/h	7.0%	1000m	1400m	Over Railway 6.5m Over At grade 5.1m	5.0%	1626m	1400m	0+550 – 0+730 (clearance 5.1m) 0+600 – 0+680 (clearance 6.5m) 0+680 – 0+730 (clearance 5.1m)


MERAK 1 FLYOVER
GENERAL ELEVATION
SCALE H = 1 : 2000; V = 1 : 800
GENERAL PLAN
SCALE 1:2000
END OF VIADUCT
STA. 1 + 207,500
ELEV. = 9,765 m
BEG. OF VIADUCT
STA. 0 + 862,500
ELEV. = 10,061 m
TO JAKARTA
TO PULORIDA
MSE WALL
EXISTING GRADE LINE

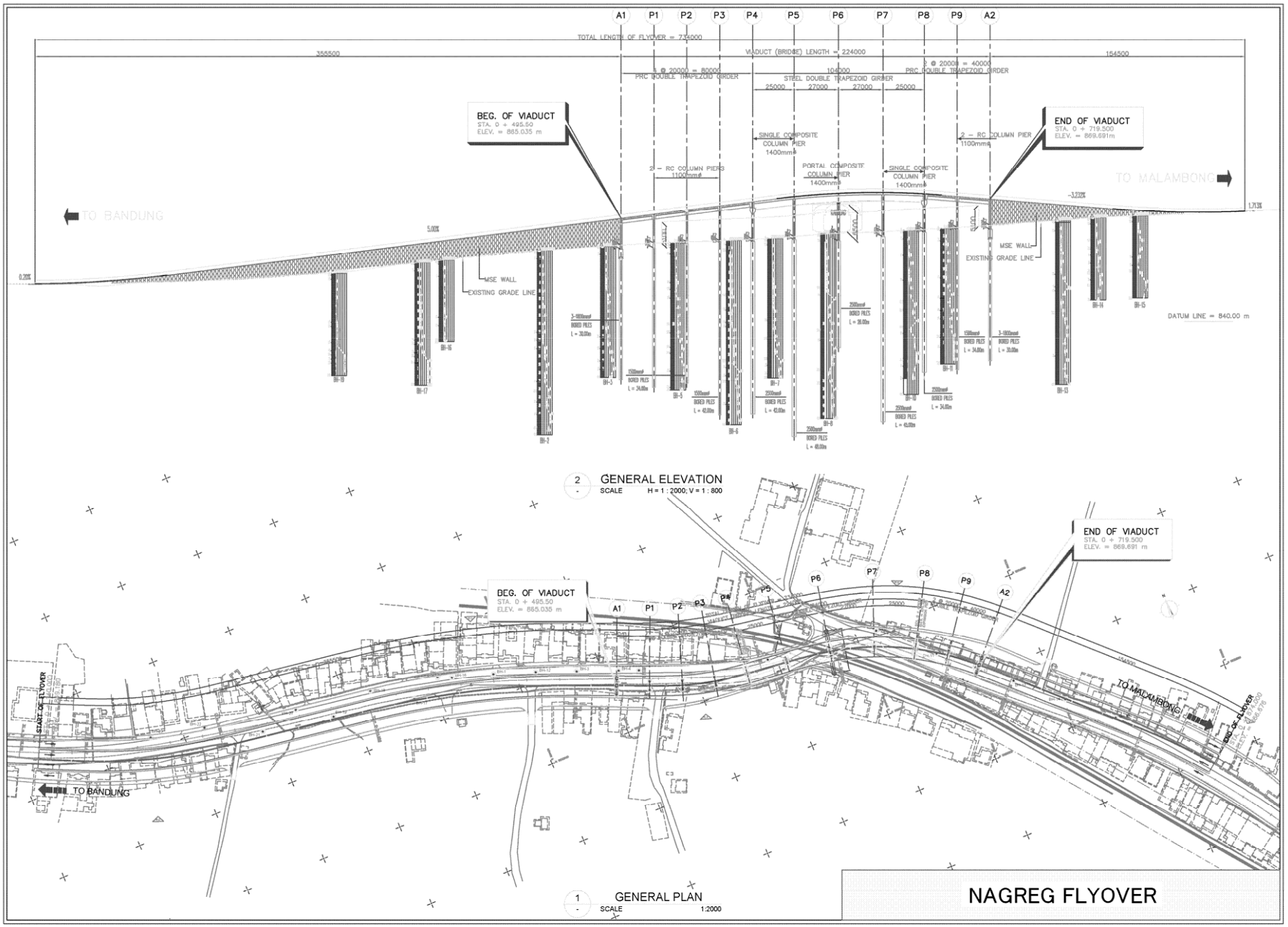

AB1
PB1
PB2
PB3
PB4
PB5
PB6
P12
TOTAL LENGTH = 321861
(MERAK - 1) FINISHED GRADE LINE
START OF FLYOVER
STA. 0 + 112.000
ELEV. = 2.066
TO MERAK PORT
TO JAKARTA
BEG. OF VIADUCT
STA. 0 + 288.861
ELEV. = 9.357 m
4.50%
MSE WALL
EXISTING GRADE LINE
MA-5
MA-4
MA-3
MA-2
MA-1
SINGLE RC COLUMN PIER
1400MM
PORTAL COMPOSITE COLUMN PIER
SINGLEL COMPOSITE COLUMN PIER
PORTAL RC COLUMN PIER
1700MM
1300MM
2-1500mmø BORED PILES L = 25.00m
2500mmø BORED PILES L = 24.00m
2500mmø BORED PILES L = 28.00m (L)
2500mmø BORED PILES L = 24.00m (R)
2500mmø BORED PILES L = 28.00m
2500mmø BORED PILES L = 24.00m (L)
2500mmø BORED PILES L =40.00m (R)
176861
145000
6 @ 20000 = 60000
VIODED SLAB
85000
STEEL TRAPEZOID GIRDER
25000
30000
30000
2 GENERAL ELEVATION
SCALE H = 1 : 1000; V = 1 : 400
BEG. OF VIADUCT
M4
M3
M2
M1
0+200
0+300
0+400
TO MERAK PORT
START OF FLYOVER
3 @ 20000 = 60000
VOIDED SLAB
BH-8
BH-9
BH-10
BH-11
BH-12
1 GENERAL PLAN
SCALE 1:1000
MERAK 2 FLYOVER

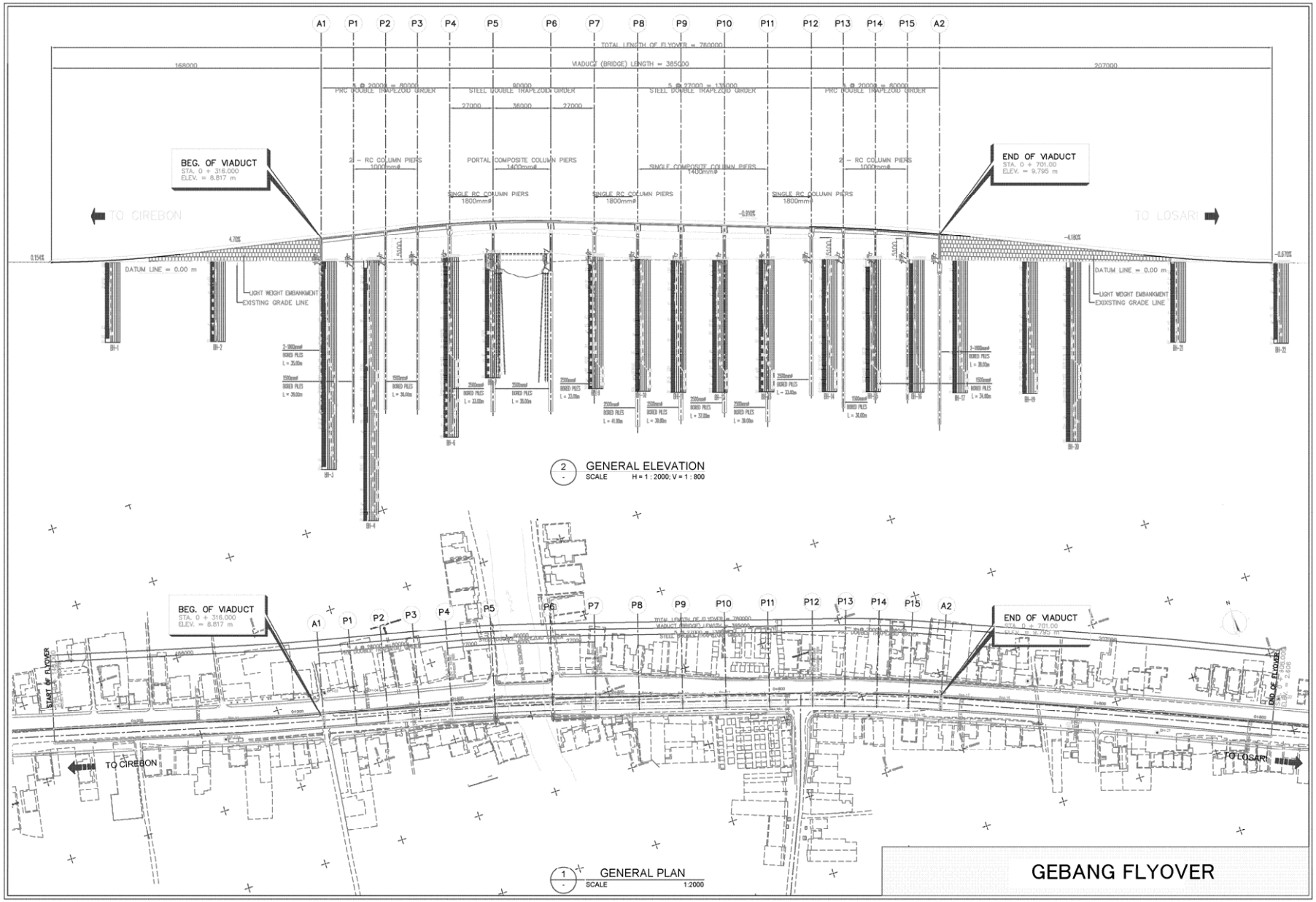


2 GENERAL ELEVATION
SCALE H = 1 : 2000; V = 1 : 800

1 GENERAL PLAN
SCALE 1:2000

BALARAJA FLYOVER

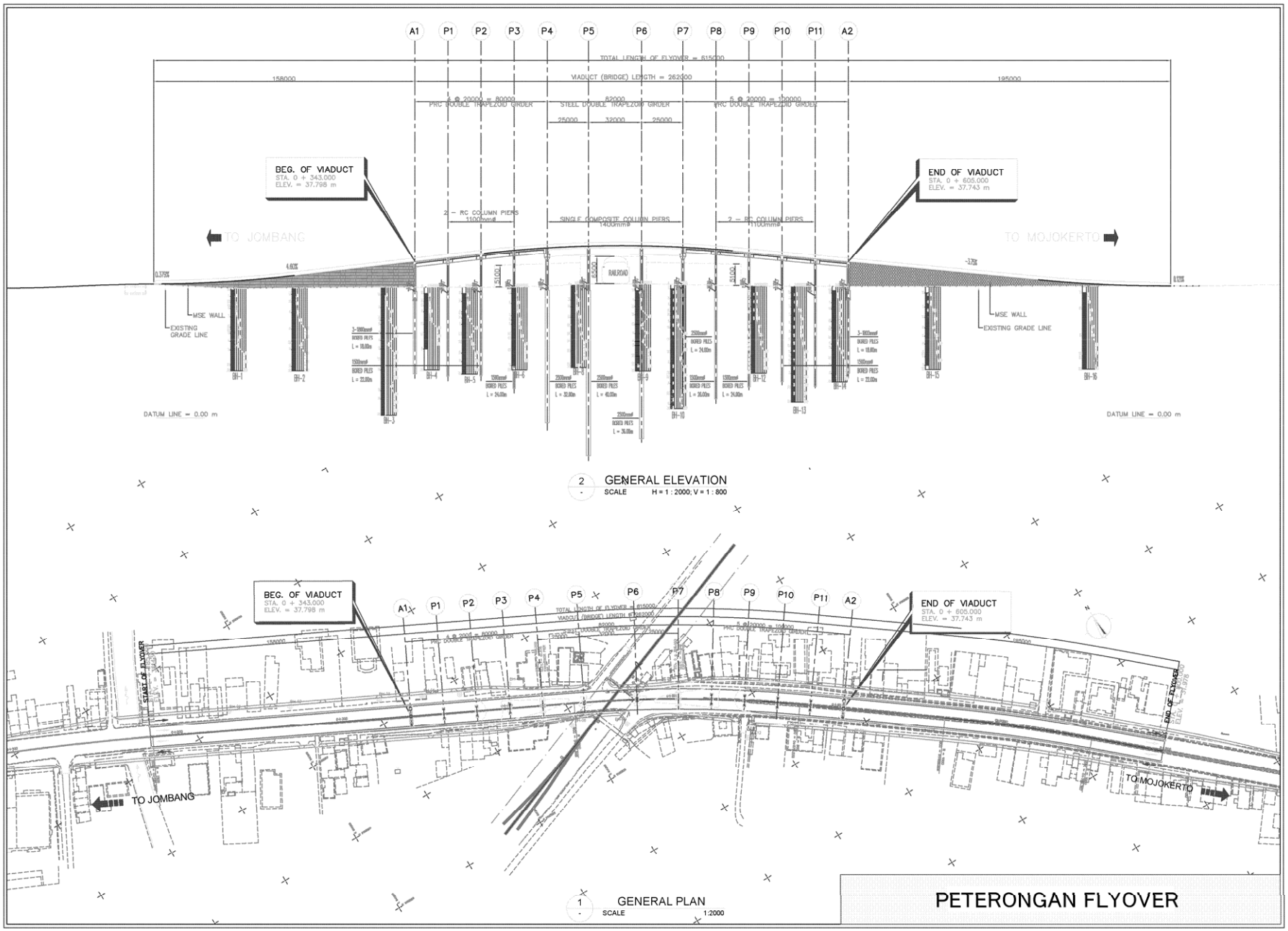

A1
P1
P2
P3
P4
P5
P6
P7
P8
P9
A2
TOTAL LENGTH OF FLYOVER = 734000
VIADUCT (BRIDGE) LENGTH = 224000
355500
154500
5 @ 20000 = 80000
PRC DOUBLE TRAPEZOID GIRDER
104000
STEEL DOUBLE TRAPEZOID GIRDER
25000
27000
27000
25000
3 @ 20000 = 40000
PRC DOUBLE TRAPEZOID GIRDER
BEG. OF VIADUCT
STA. 0 + 495.50
ELEV. = 865.035 m
END OF VIADUCT
STA. 0 + 719.500
ELEV. = 869.691m
SINGLE COMPOSITE COLUMN PIER 1400mmø
2 – RC COLUMN PIERS 1100mmø
PORTAL COMPOSITE COLUMN PIER 1400mmø
SINGLE COMPOSITE COLUMN PIER 1400mmø
2 – RC COLUMN PIER 1100mmø
TO BANDUNG
TO MALAMBONG
5.00%
0.20%
-3.232%
1.713%
MSE WALL
EXISTING GRADE LINE
DATUM LINE = 840.00 m
BH-1
BH-2
BH-3
BH-4
BH-5
BH-6
BH-7
BH-8
BH-9
BH-10
BH-11
BH-12
BH-13
BH-14
BH-15
BH-16
BH-17
BH-18
2 GENERAL ELEVATION
SCALE H = 1 : 2000; V = 1 : 800
START OF FLYOVER
END OF FLYOVER
1 GENERAL PLAN
SCALE 1:2000
NAGREG FLYOVER

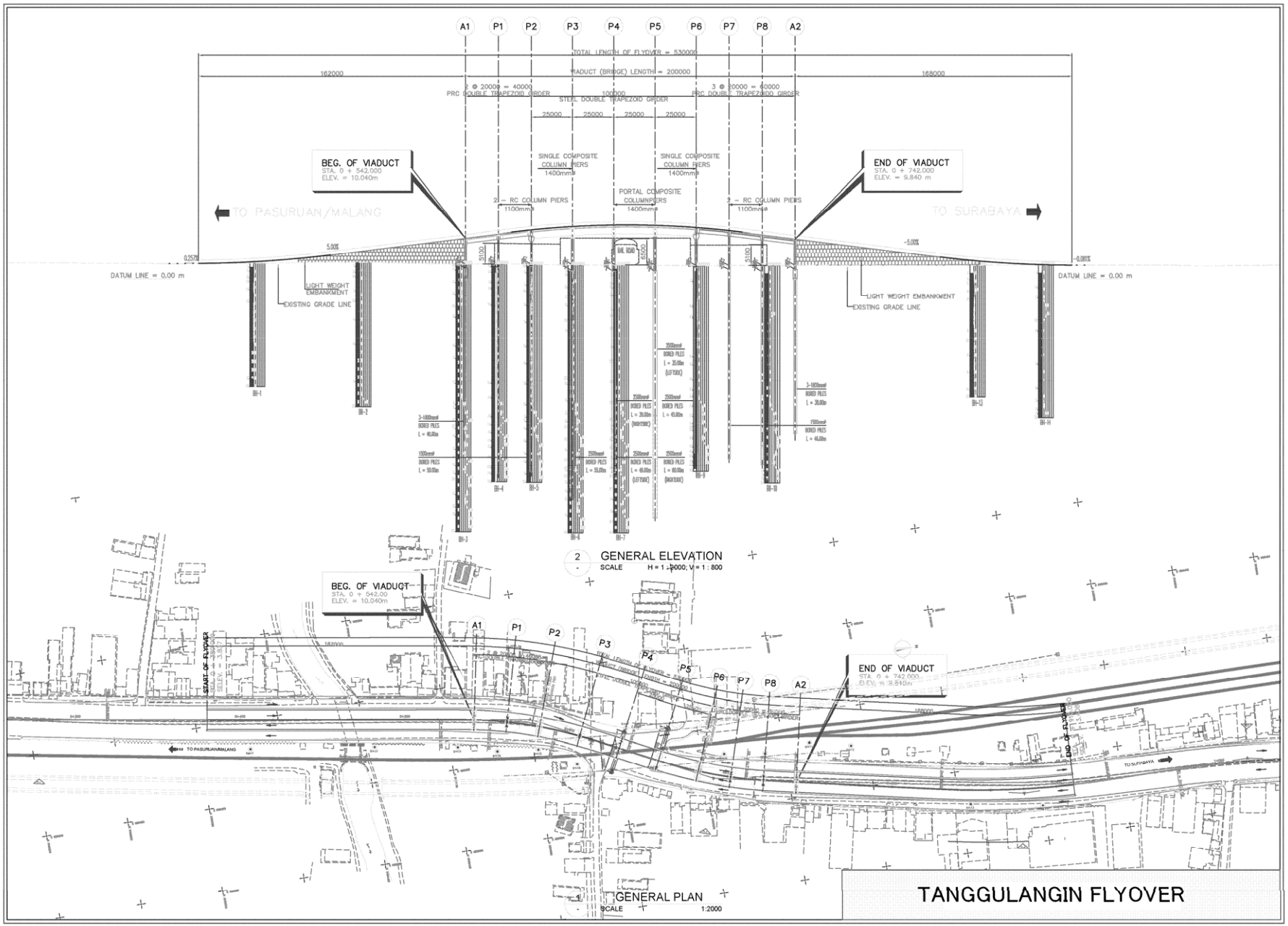


2 - GENERAL ELEVATION
SCALE H = 1 : 2000; V = 1 : 800

1 - GENERAL PLAN
SCALE 1:2000

GEBANG FLYOVER


A1
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
A2
TOTAL LENGTH OF FLYOVER = 615000
VIADUCT (BRIDGE) LENGTH = 262000
158000
195000
5 @ 20000 = 80000
PRC DOUBLE TRAPEZOID GIRDER
82000
STEEL DOUBLE TRAPEZOID GIRDER
5 @ 20000 = 100000
PRC DOUBLE TRAPEZOID GIRDER
25000
32000
25000
BEG. OF VIADUCT
STA. 0 + 343.000
ELEV. = 37.798 m
END OF VIADUCT
STA. 0 + 605.000
ELEV. = 37.743 m
2 – RC COLUMN PIERS
1100mm ø
SINGLE COMPOSITE COLUMN PIERS
1400mm ø
2 – RC COLUMN PIERS
1100mm ø
TO JOMBANG
TO MOJOKERTO
4.60%
0.375%
-3.2%
RAILROAD
MSE WALL
EXISTING GRADE LINE
MSE WALL
EXISTING GRADE LINE
BH-1
BH-2
BH-3
BH-4
BH-5
BH-6
BH-7
BH-8
BH-9
BH-10
BH-11
BH-12
BH-13
BH-14
BH-15
BH-16
DATUM LINE = 0.00 m
DATUM LINE = 0.00 m
2
GENERAL ELEVATION
SCALE H = 1 : 2000; V = 1 : 800
BEG. OF VIADUCT
STA. 0 + 343.000
ELEV. = 37.798 m
END OF VIADUCT
STA. 0 + 605.000
ELEV. = 37.743 m
START OF FLYOVER
END OF FLYOVER
TO JOMBANG
TO MOJOKERTO
1
GENERAL PLAN
SCALE 1:2000
PETERONGAN FLYOVER


A1
P1
P2
P3
P4
P5
P6
P7
P8
A2
TOTAL LENGTH OF FLYOVER = 530000
VIADUCT (BRIDGE) LENGTH = 200000
162000
168000
2 @ 20000 = 40000
PRC DOUBLE TRAPEZOID GIRDER
100000
STEEL DOUBLE TRAPEZOID GIRDER
3 @ 20000 = 60000
PRC DOUBLE TRAPEZOID GIRDER
25000
25000
25000
25000
BEG. OF VIADUCT
STA. 0 + 542.000
ELEV. = 10.040m
SINGLE COMPOSITE COLUMN PIERS 1400mm ø
SINGLE COMPOSITE COLUMN PIERS 1400mm ø
END OF VIADUCT
STA. 0 + 742.000
ELEV. = 9.840 m
TO PASURUAN/MALANG
2 – RC COLUMN PIERS 1100mm ø
PORTAL COMPOSITE COLUMNPIERS 1400mm ø
2 – RC COLUMN PIERS 1100mm ø
TO SURABAYA
5.00%
-5.00%
0.257%
-0.000%
5100
5100
6000
DATUM LINE = 0.00 m
LIGHT WEIGHT EMBANKMENT
EXISTING GRADE LINE
LIGHT WEIGHT EMBANKMENT
EXISTING GRADE LINE
DATUM LINE = 0.00 m
BH-1
BH-2
BH-3
BH-4
BH-5
BH-6
BH-7
BH-8
BH-9
BH-10
BH-11
BH-12
2500mmø BORED PILES L = 35.00m (LIFTING)
2500mmø BORED PILES L = 35.00m
2500mmø BORED PILES L = 45.00m
3-1800mmø BORED PILES L = 40.00m
1500mmø BORED PILES L = 50.00m
2500mmø BORED PILES L = 55.00m
2500mmø BORED PILES L = 60.00m (LIFTING)
2500mmø BORED PILES L = 60.00m (MONTORIC)
3-1800mmø BORED PILES L = 30.00m
1500mmø BORED PILES L = 40.00m
2 GENERAL ELEVATION
SCALE H = 1 : 2000; V = 1 : 800
BEG. OF VIADUCT
STA. 0 + 542.00
ELEV. = 10.040m
START OF FLYOVER
STA. 0+000
ELEV. = 3.840
END OF VIADUCT
STA. 0 + 742.000
ELEV. = 9.840m
END OF FLYOVER
TO PASURUAN/MALANG
TO SURABAYA
1 GENERAL PLAN
SCALE 1:2000
TANGGULANGIN FLYOVER

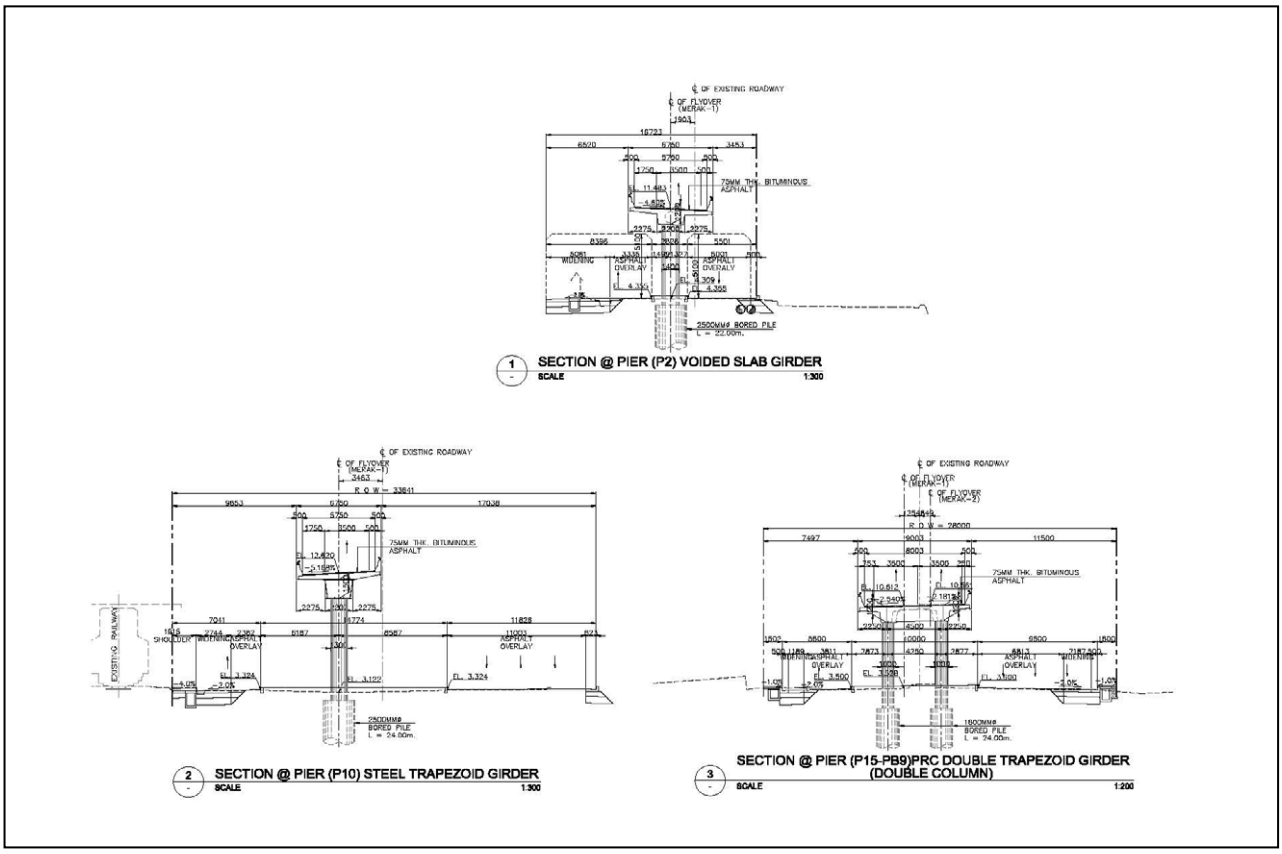


FIGURE 9-1 TYPICAL CROSS SECTION (MERAK)

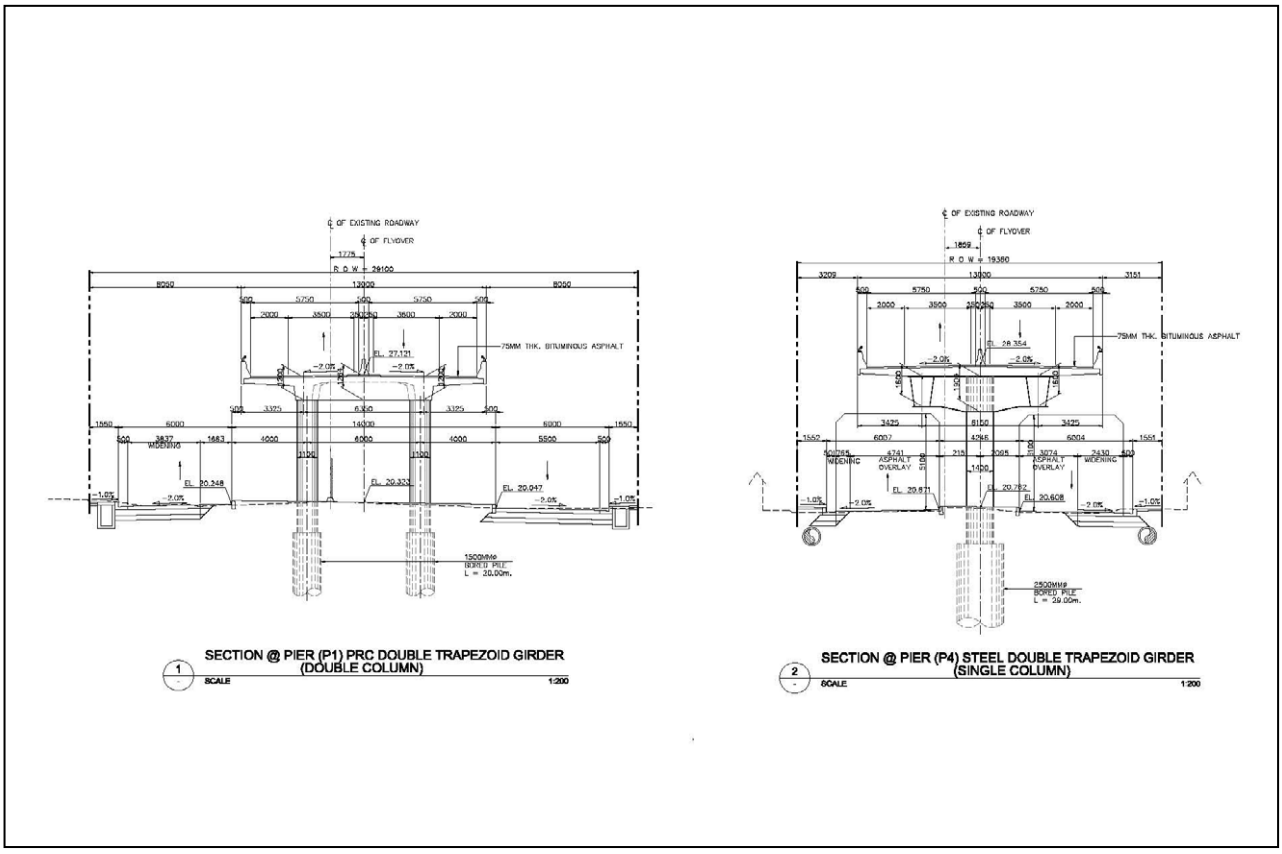


FIGURE 9-2 TYPICAL CROSS SECTION (BALARAJA)

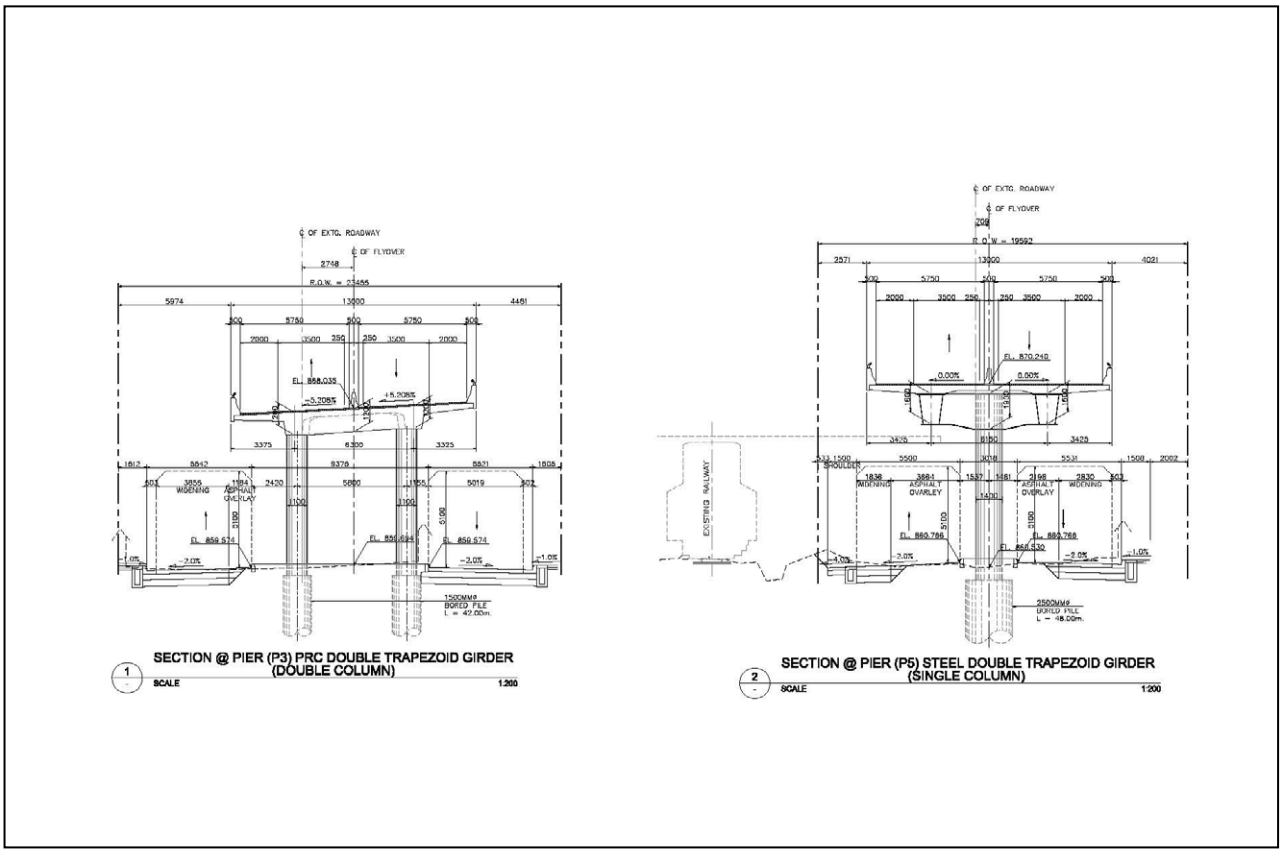


FIGURE 9-3 TYPICAL CROSS SECTION (NAGREG)

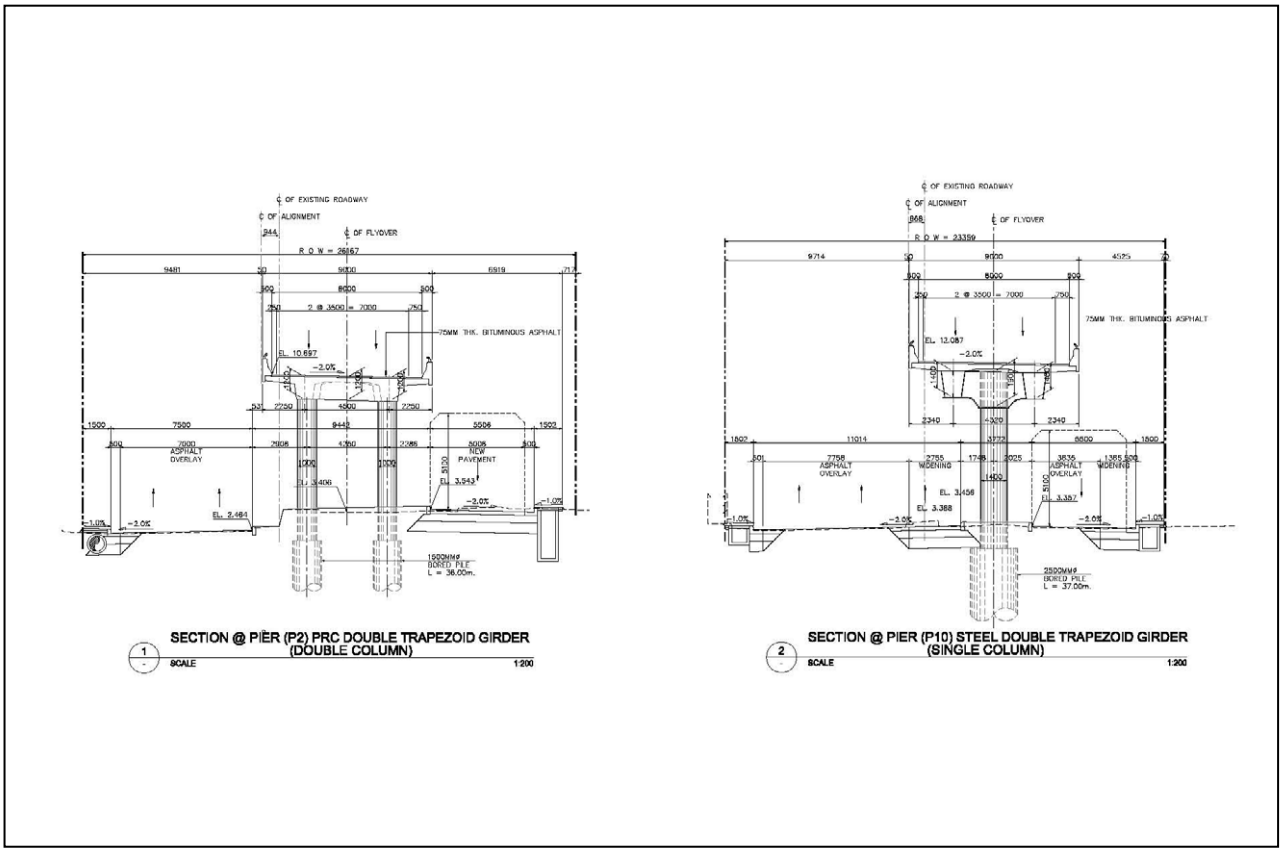


FIGURE 9-4 TYPICAL CROSS SECTION (GEBANG)

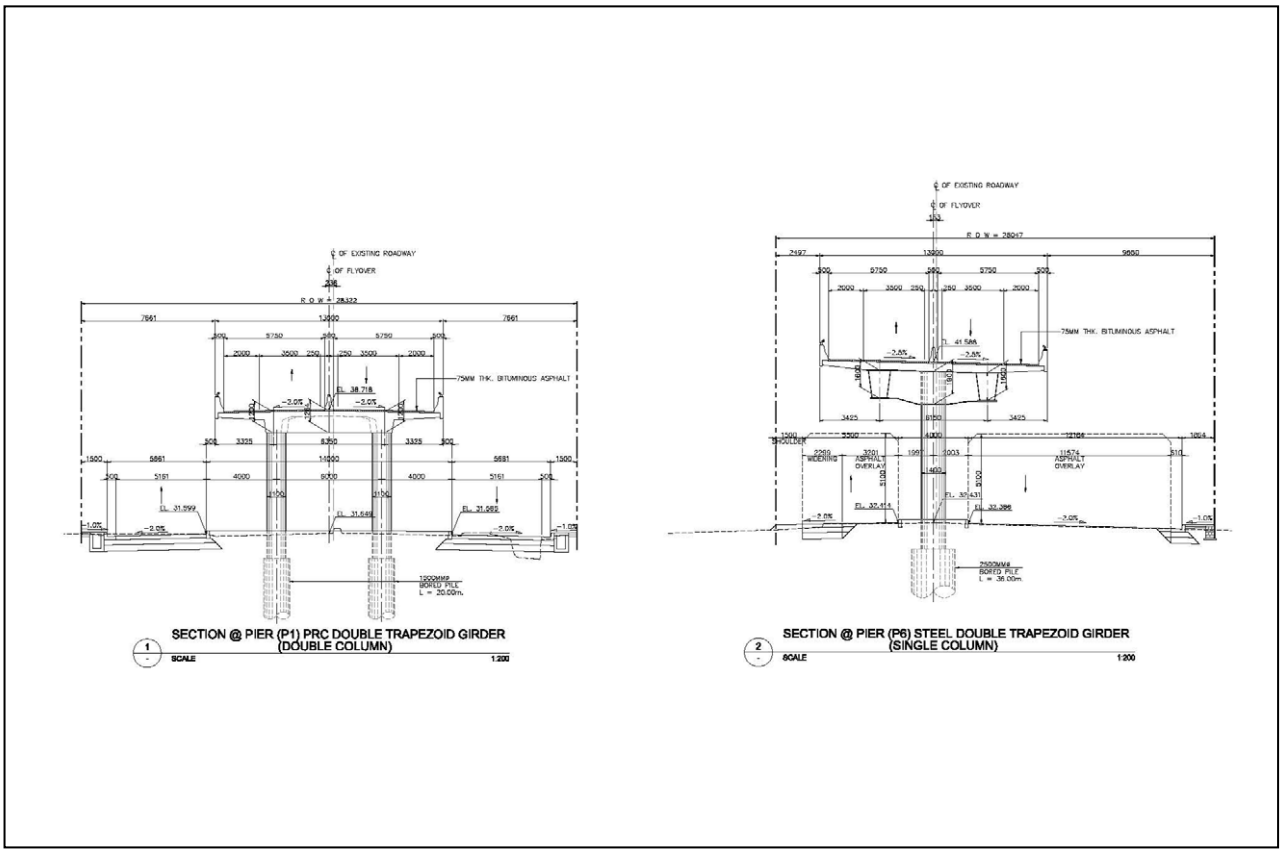


FIGURE 9-5 TYPICAL CROSS SECTION (PETERONGAN)

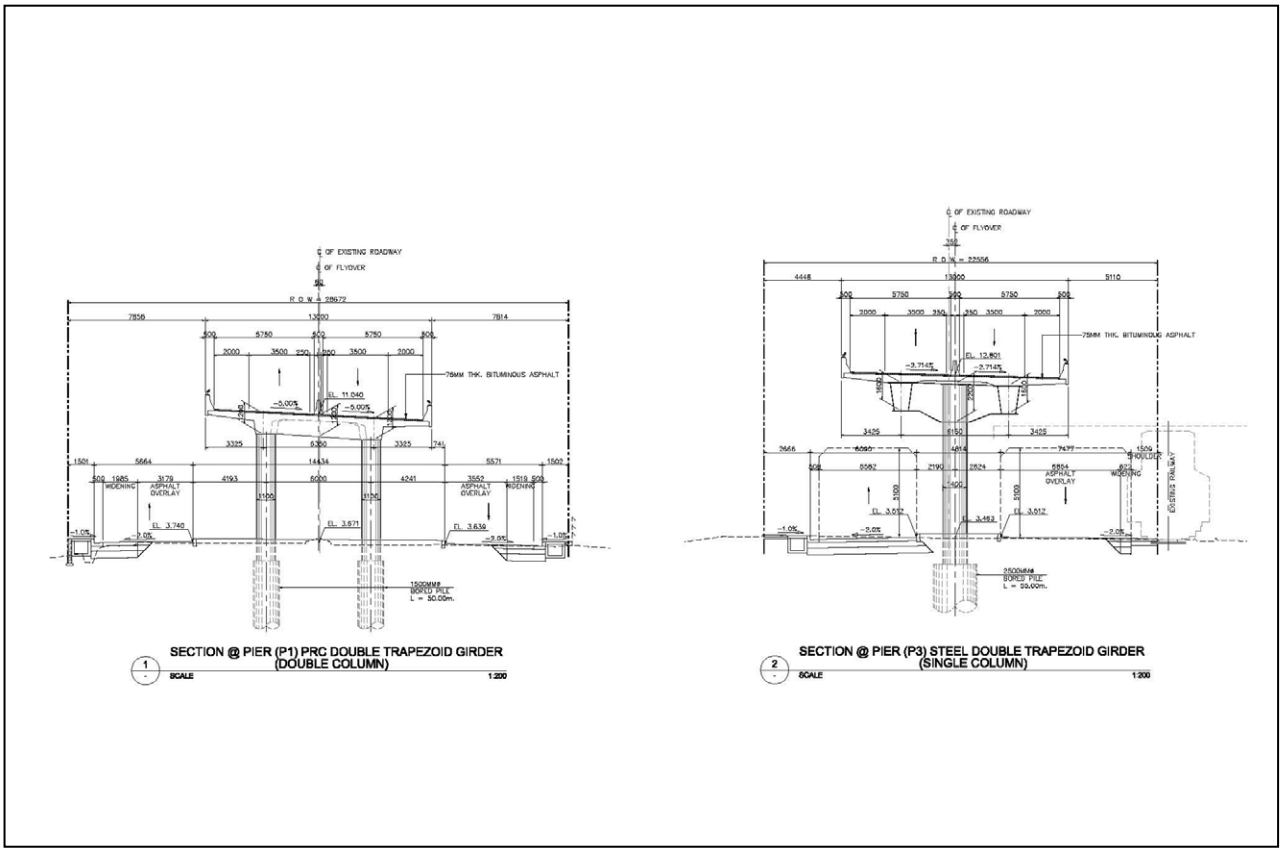


FIGURE 9-6 TYPICAL CROSS SECTION (TANGGULANGIN)

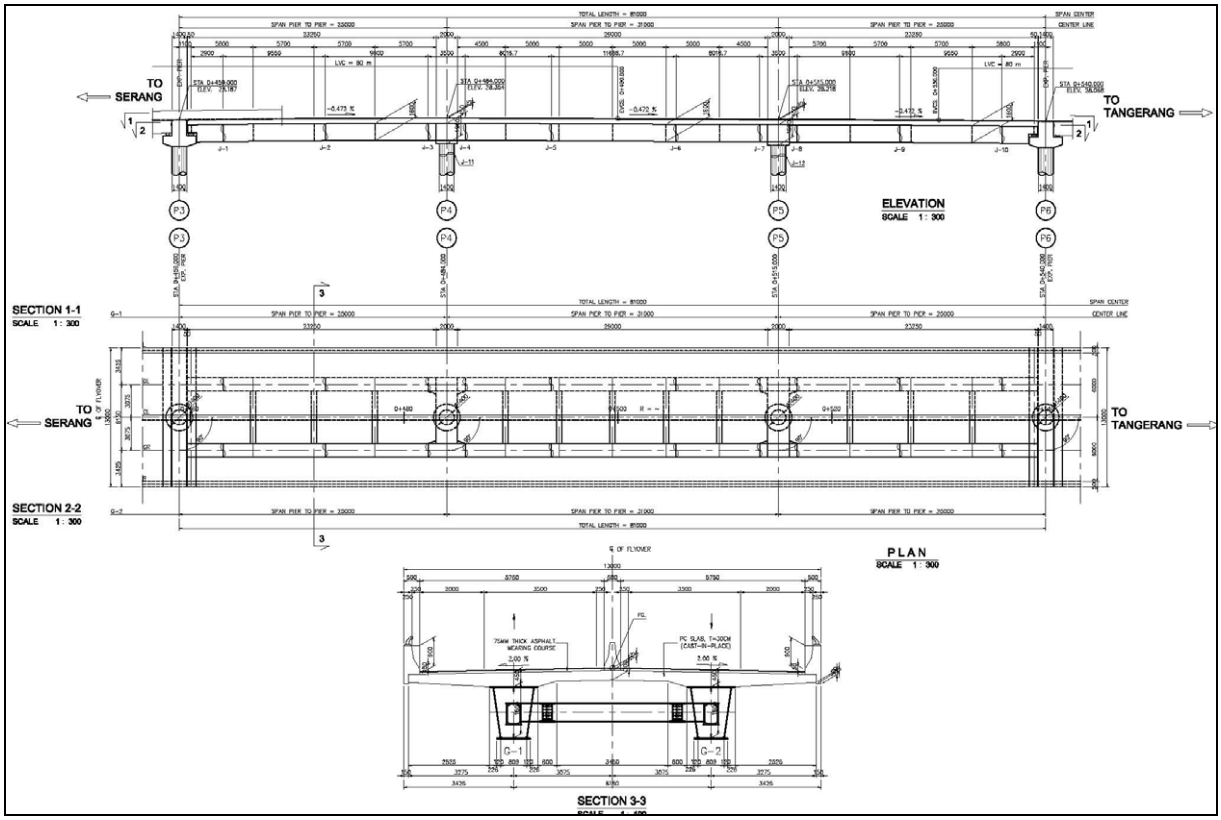


FIGURE 9-7 GENERAL DIMENSION OF STEEL SUPERSTRUCTURE (1)

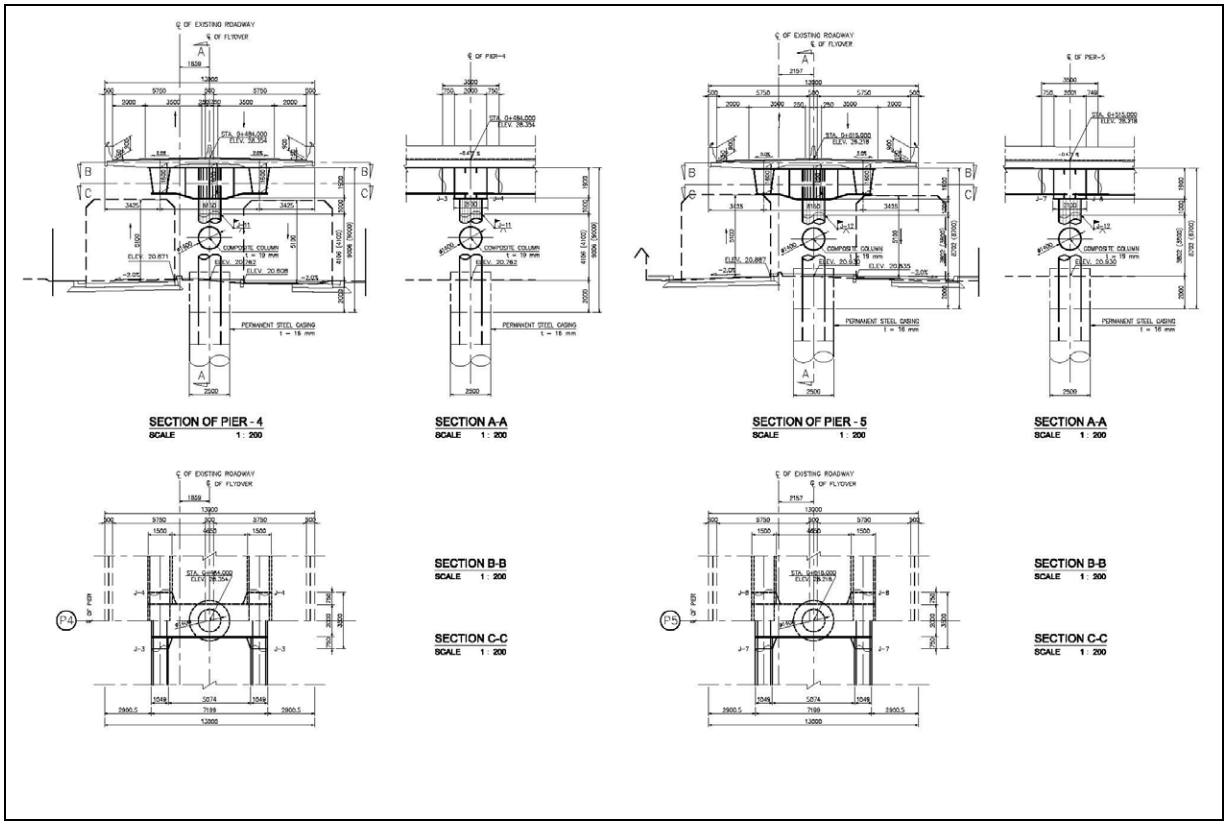


FIGURE 9-8 GENERAL DIMENSION OF STEEL SUPERSTRUCTURE (2)

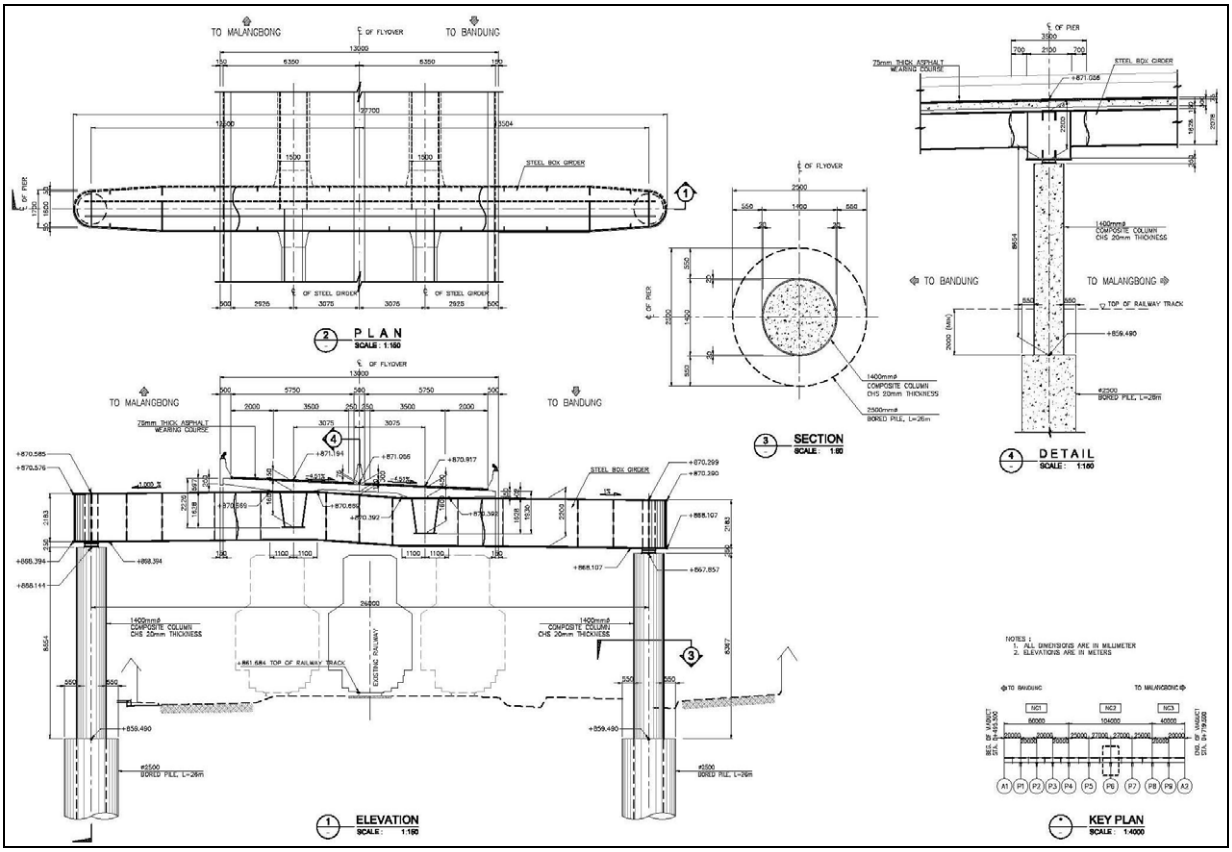


FIGURE 9-9 PIER LAYOUT: PORTAL TYPE

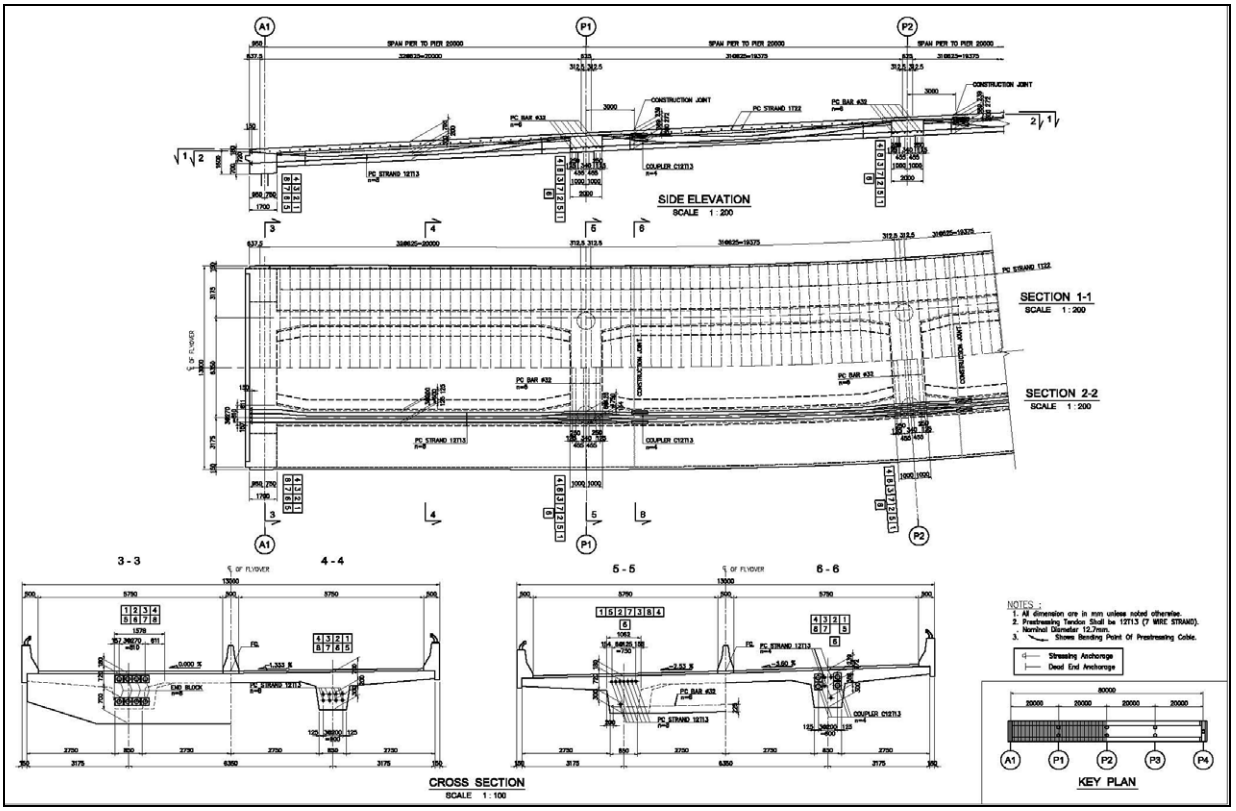


FIGURE 9-10 ARRANGEMENT OF PC CABLES

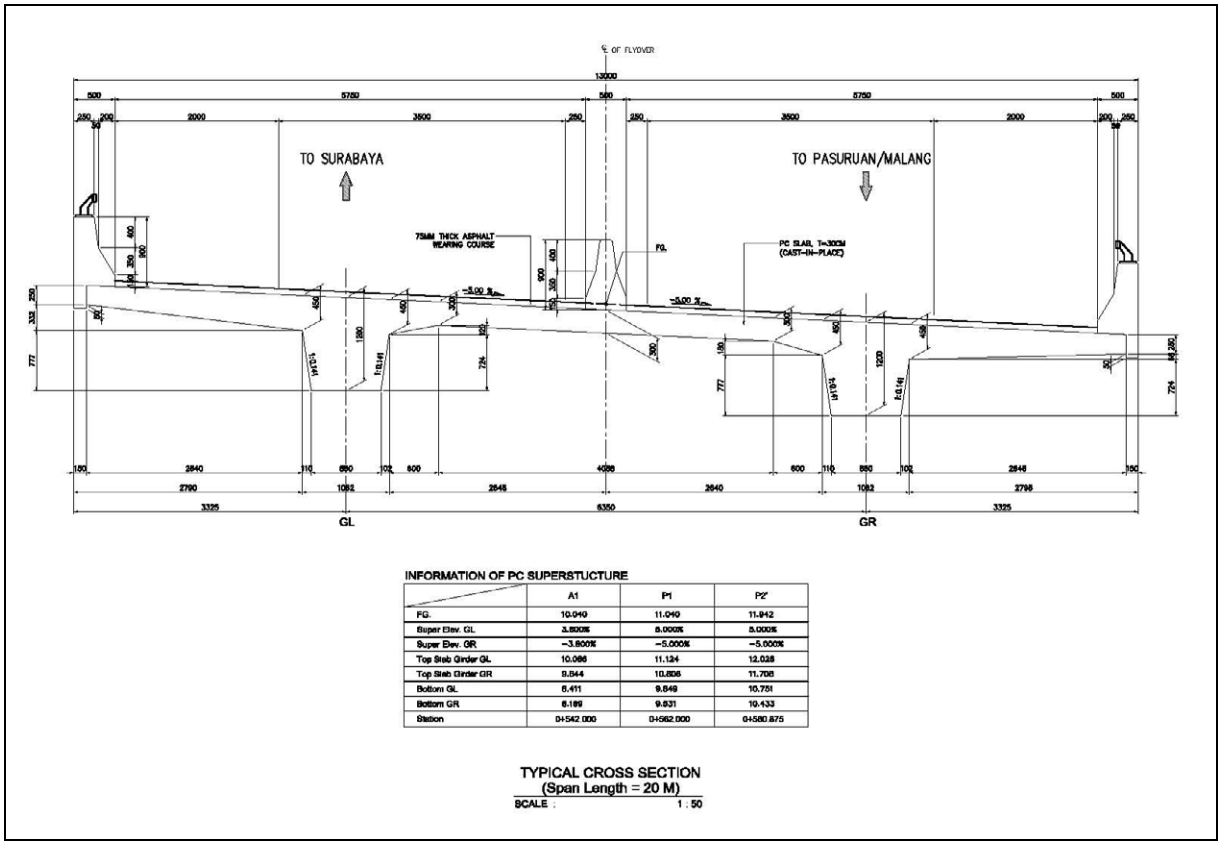


FIGURE 9-11 TYPICAL CROSS SECTION OF PC BRIDGE

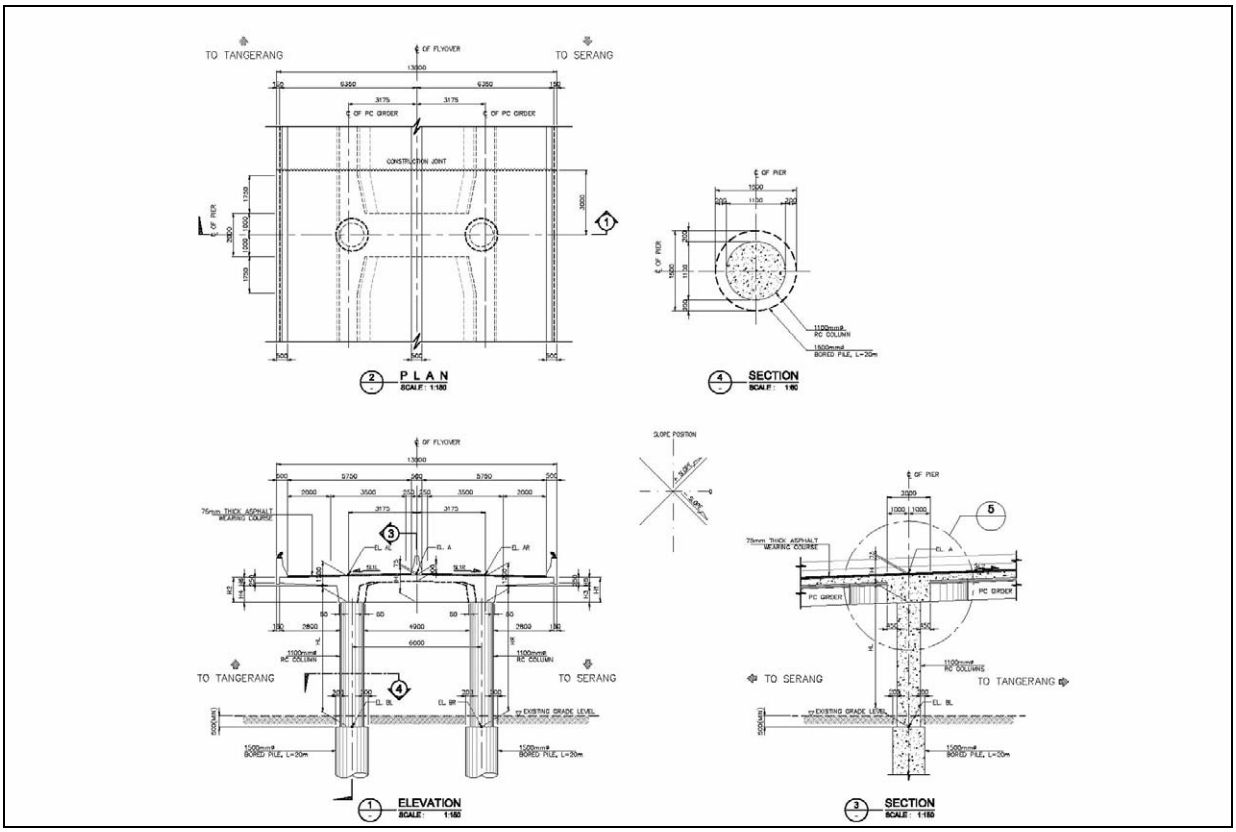


FIGURE 9-12 TYPICAL TWO COLUMN PIER

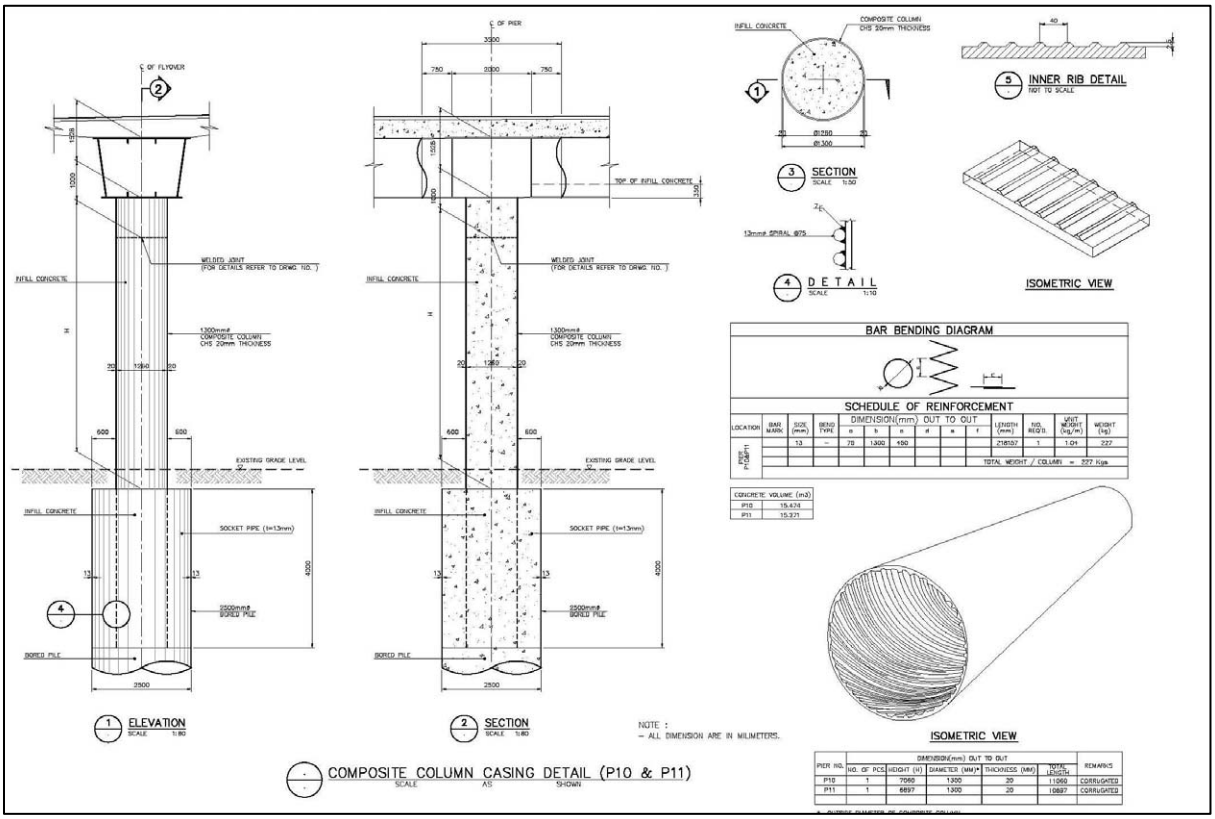


FIGURE 9-13 TYPICAL ONE COLUMN PIER

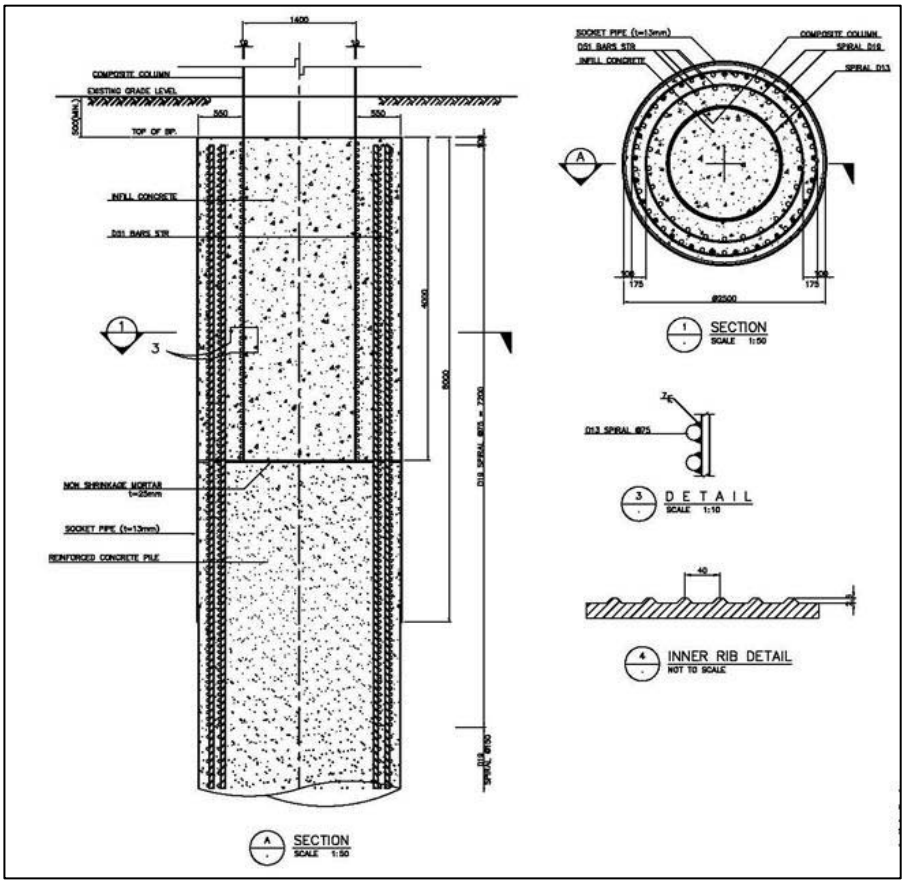


FIGURE 9-14 COMPOSITE COLUMN SOCKET TYPE CONNECTION

9.4 APPROACH EMBANKMENT DESIGN

Approach embankment type was selected focusing on the following:

- Fast construction method to achieve shorter construction period.
- Minimize traffic disturbance during construction (narrow construction space is required).

There are three types of soil conditions as follows:

- Ordinary soil condition (Balaraja, Nagreg, Peterongan)
- Soft soil condition (Gebang, Tanggulangin)
- Ordinary soil with liquefaction layer (Merak)

Embankment type selected for each soil condition is as follows:

- Ordinary soil condition: Mechanically stabilized Earth (MSE) Wall with back fill.
- Soft soil condition: Light Weight Embankment using expanded polystyrene (EPS) block.
- Ordinary soil with liquefaction layer: MSE with soil improvement.

Isometric view of EPS block is shown in **Figure 9-15**

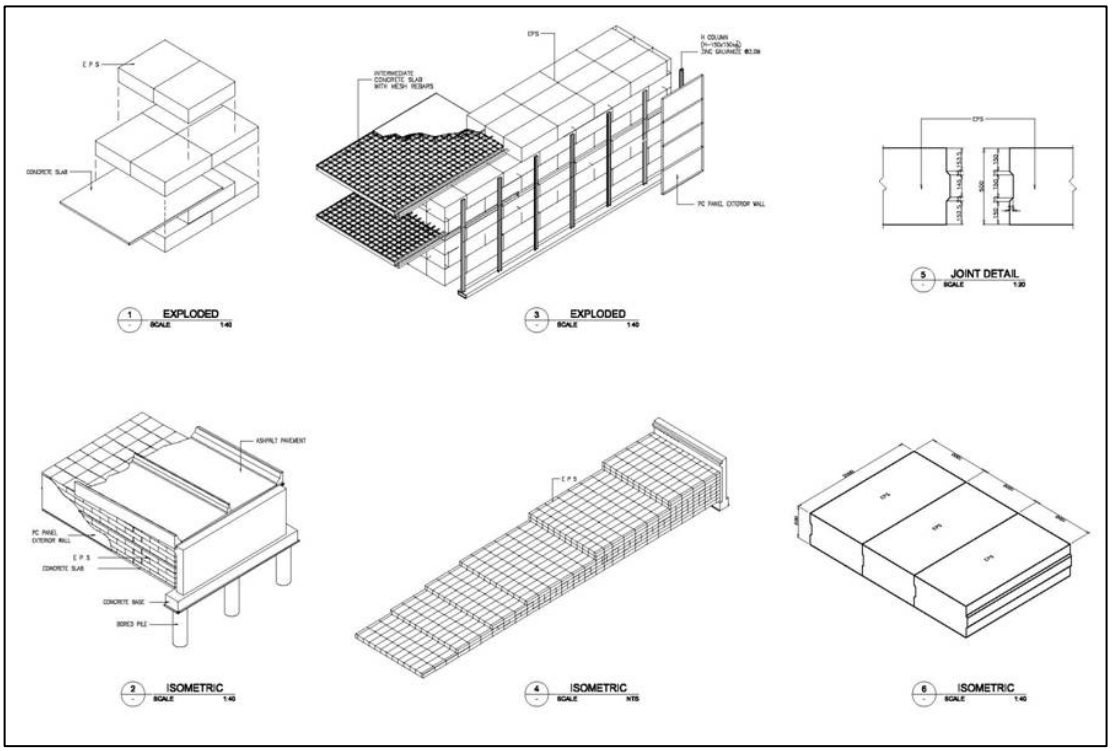


FIGURE 9-15 ISOMETRIC VIEW OF EPS BLOCK

10. PUBLIC UTILITY RELOCATION/PROTECTION PLAN

Following public utility surveys were undertaken:

- Location of overhead utilities such as electric/telecommunication posts were surveyed during the topographic survey.
- As-built drawings of underground utilities were collected from concerned public utility companies and agencies.
- Trial diggings were undertaken to confirm the kind of utilities, depth and sizes.

Although above surveys were undertaken, exact locations of underground utilities were still uncertain, since some of them are located under the existing pavement and as-built drawings are not always accurate. Prior to the start of construction work, exact locations should be confirmed by respective contractor.

OVERHEAD PUBLIC UTILITIES: all overhead public utilities within the project site shall be relocated.

UNDERGROUND PUBLIC UTILITIES: critical underground utilities are as follows:

CRITICAL UNDERGROUND UTILITIES

Flyover	Type of Utility	Name of Utility Company	Relocation is Possible or Not	Measures to be Taken
Merak	Water Pipe (ϕ200) for Power Plant	PT. PLTU SURALAYA (Power Indonesia)	No	• If it hits flyover foundation, location of foundation to be adjusted
Balaraja	Gas Pipe (ϕ200)	PN. GAS NEGARA	No	• Protection • If it hits flyover foundation, location of foundation to be adjusted
Nagreg	Oil Pipe (ϕ400)	PT. PERTAMINA	Yes	• Relocation
	Oil Pipe (ϕ250)	PT. PERTAMINA	Yes	• Protection, since it is located deep from the ground surface.
Gebang	(No critical underground utilities)			
Peterongan	(No critical underground utilities)			
Tanggulangin	Water Pipe (ϕ400)	PDAM, Surabya	Yes	• Relocation

11. CONSTRUCTION PLAN

Construction planning for the work will require due consideration of the following:

1) Appropriate and well considered traffic management plan to minimize traffic congestion.
2) Due safety for motorist, pedestrian and other road users, protection for existing adjacent houses and operating railway lines.
3) Relocation and protection of the overhead and underground utilities.
4) Least time consuming construction methodology.

11.1 CONSTRUCTION SCHEDULE

Non-working day ratio (P=0.29) due to Holiday, Sunday and Rainfall over 10mm/day are considered for construction plan.

Detailed construction schedules for each flyover are prepared. Summarized construction schedules for Merak Flyover and Balaraja Flyover are shown in **Figure 11-1.**

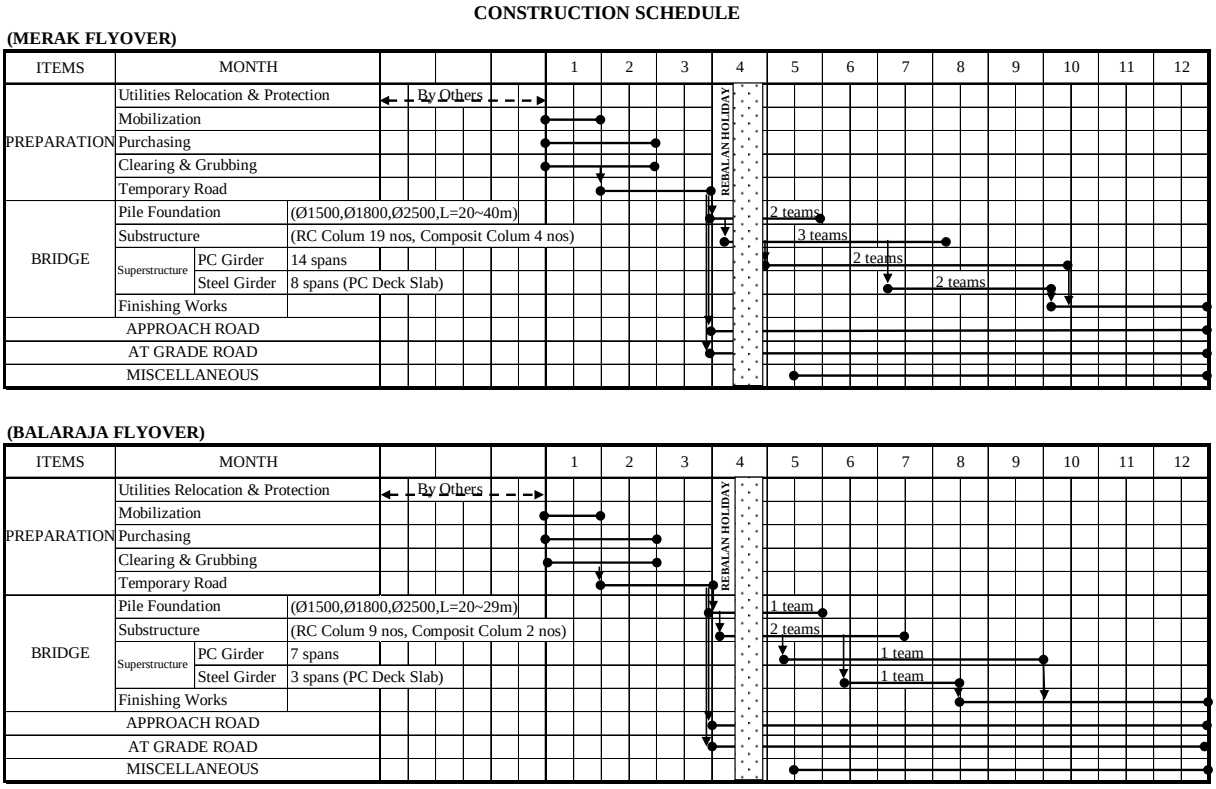


FIGURE 11-1 CONSTRUCTION SCHEDULE (MERAK, BALARAJA FLYOVER)

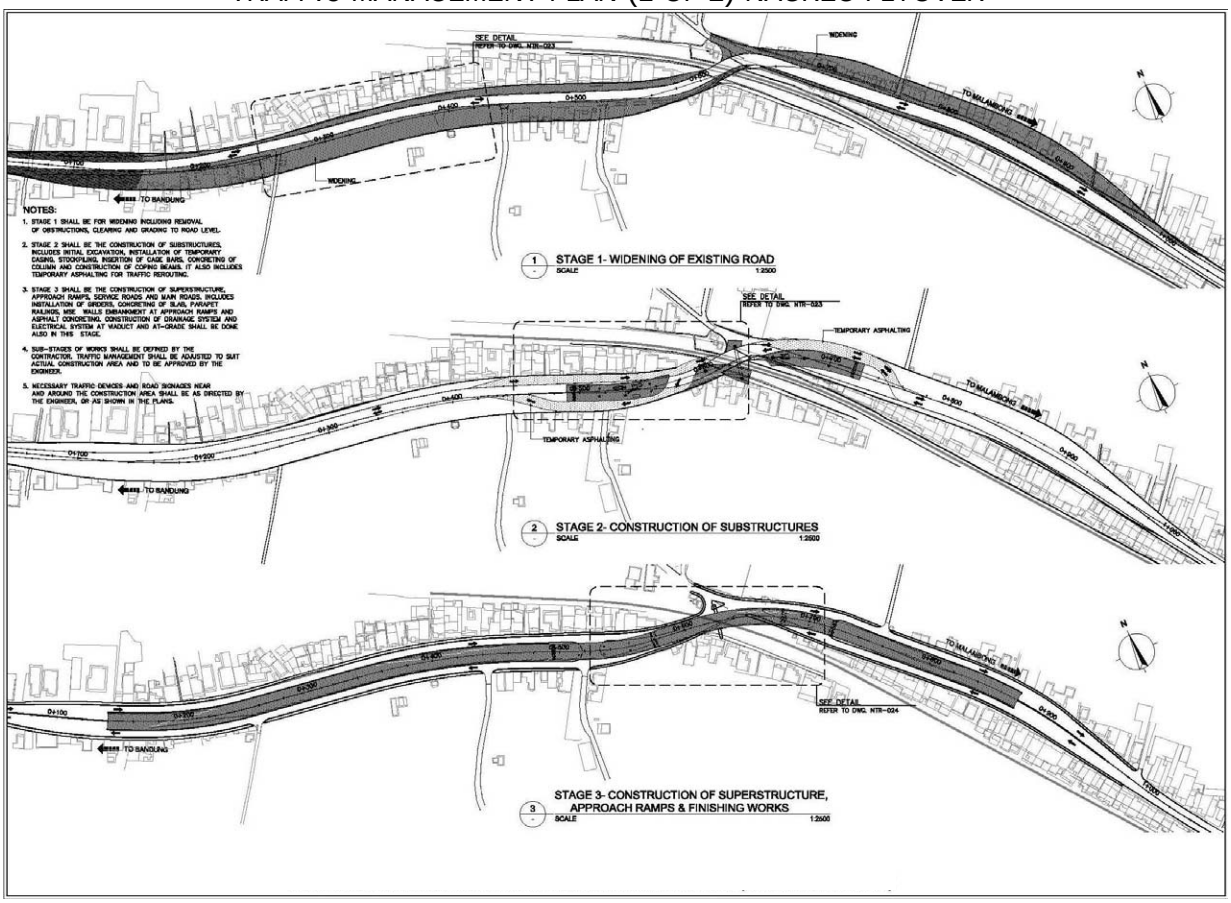
11.2 TRAFFIC MANAGEMENT PLAN

A plan for moving traffic through or around a construction zone must be developed for the project to assure that adequate consideration is given to the safety and convenience of motorist, pedestrians and all other road users, during the implementation of the project.

The detailed traffic management plans of each flyover for each construction stage are prepared.

The traffic management plan for Nagreg Flyover are shown in **Figure 11-2.**

TRAFFIC MANAGEMENT PLAN (1 OF 2) NAGREG FLYOVER



TRAFFIC MANAGEMENT PLAN (2 OF 2) NAGREG FLYOVER

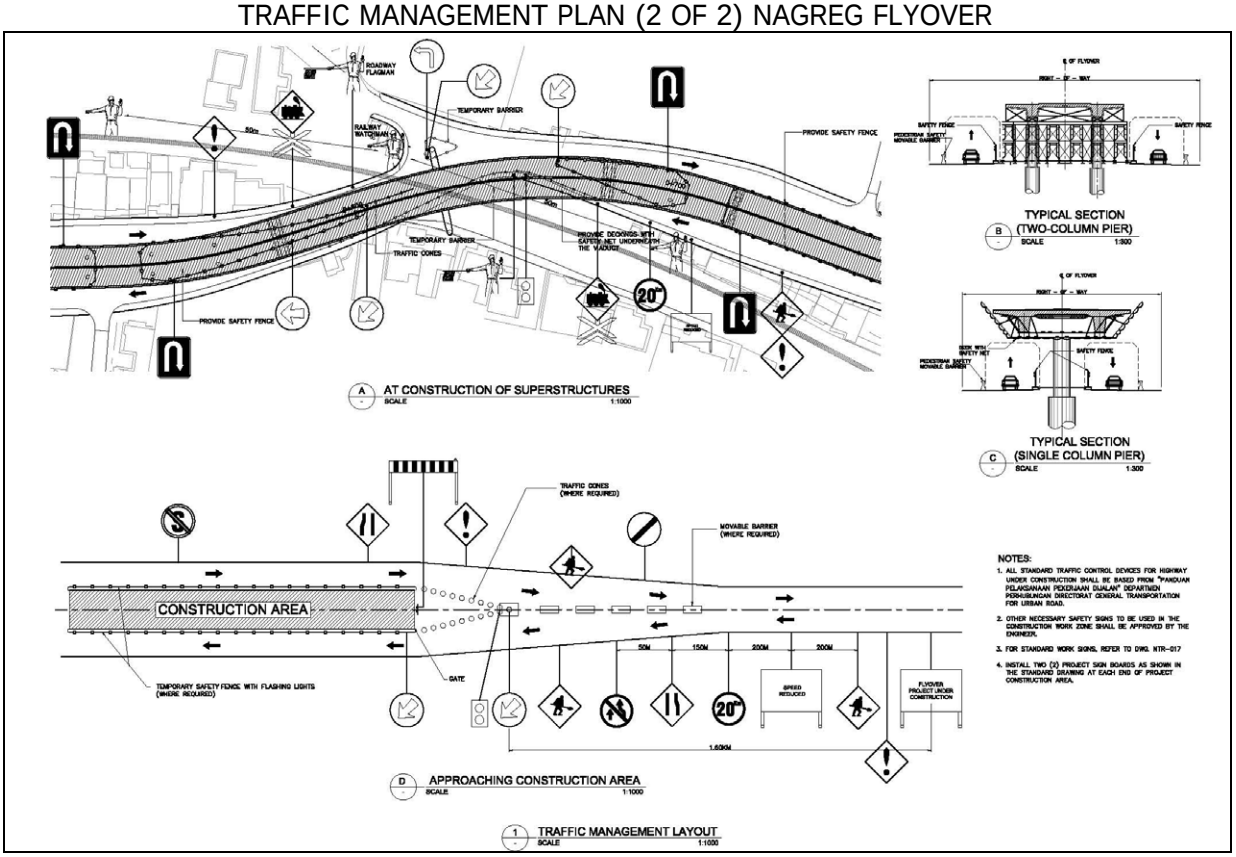


FIGURE 11-2 TRAFFIC MANAGEMENT PLAN (NAGREG FLYOVER)

12. COST ESTIMATE

The derivation of Unit Cost for each item in the BOQ is based on the PU Guide Book (BAHAN BACAAN DAN REFERENSI, ANALISA HARGA SATUAN).

The Unit Cost Analysis/development for pay items which are not included in the PU Guide Book are based on the Civil Works Cost Estimation Standard for Steel Bridges, (Ministry of Land and Transportation, Japan) and Cost Estimation Standard (Japan Construction Cost Investigation Association / Ministry of Land and Transportation, Japan).

12.1 Labor Cost

The basic labor cost is determined in accordance with the Indonesian Guide Books, which are published by each province. (PATOKAN HARGA SATUAN BAHAN DAN UPAH PEKERJAAN BIDANG PEMBORONGAN, DKI JAKARTA, BANTEN, WEST JAVA, EAST JAVA).

Cost of Social Charge, Bonus & Leaves are considered in the Unit Rates for Labour.

12.2 Material Cost

The monetary data used in establishing the Unit Cost of Major Items is based on the Indonesian Guide Book (PATOKAN HARGA SATUAN BAHAN DAN UPAH PEKERJAAN BIDANG PEMBORONGAN). These are for construction material, equipment rental and labor wages. The unit cost of materials is based on current market prices. This analysis is applied for local currency and for the construction components originating in Japan, an exchange rate of Rupiah 1.0 to Japanese Yen 0.0133 (1 Rp. = ¥ 0.0133) is applied.

12.3 Equipment Cost

Equipment Cost are derived based on PU Guide Book (BAHAN BACAAN DAN REFERENSI, ANALISA HARGA SATUAN). Equipment rental rates are calculated using the formula in the PU Guide Book, which include maintenance cost, fuel & lubricants and operation costs. Equipment prices are updated from the quotations from the manufactures. For the items which are not available in the PU Guide Book, the Construction Machines Depreciation Guide Book of Japan (Japan Construction Machine Association) is adopted.

12.4 Site Investigation

Current market prices for basic materials, labor and equipment are confirmed from the data gathered during the site visits and are incorporated in the estimates.

The locations of Concrete Batching Plant, Asphalt Mixing Plant and Quarry are also identified during the site visits.

12.5 Japan Component

The total costs of goods procured from Japan shall not be less than thirty percent (30%) of the total price of the contract.

The goods procured from the eligible local manufacturing companies invested by Japanese companies can be regarded and counted as Japanese origin if such companies satisfy the condition stated in the Loan Agreement.

12.6 Total Construction Cost

Total Construction Cost and Japan component are summarized in **Table 12-1** and **Table 12-2.**

TABLE 11-1 TOTAL CONSTRUCTION COST AND JAPAN COMPONENT (RUPIAH)

(UNIT ; Million Rupiah)

NO	DESCRIPTION	TOTAL CONSTRUCTION COST				TOTAL	UTILITIES RELOCATION		TOTAL	GRAND TOTAL
		JAPAN PORTION	LOCAL PORTION	SUB TOTAL	VAT (10%)	WITH VAT	LOCAL PORTION	VAT (10%)	WITH VAT	
		(Million Rupiah)	(Million Rupiah)	(Million Rupiah)	(Million Rupiah)	(Million Rupiah)	(Million Rupiah)	(Million Rupiah)	(Million Rupiah)	(Million Rupiah)
1	MERAK	24,630.32	44,008.38	**68,638.70**	6,863.87	75,502.57	826.96	82.70	909.66	**76,412.23**
2	BALARAJA	11,986.11	27,826.34	**39,812.45**	3,981.25	43,793.70	3,917.41	391.74	4,309.15	**48,102.85**
3	NAGREG	18,775.36	34,862.98	**53,638.34**	5,363.83	59,002.17	10,437.14	1,043.71	11,480.85	**70,483.03**
4	GEBANG	21,794.59	39,527.32	**61,321.91**	6,132.19	67,454.10	689.96	69.00	758.96	**68,213.06**
5	PETERONGAN	14,243.83	31,371.24	**45,615.07**	4,561.51	50,176.58	2,252.89	225.29	2,478.18	**52,654.76**
6	TANGGULANGIN	14,518.70	38,401.94	**52,920.64**	5,292.06	58,212.70	512.49	51.25	563.74	**58,776.44**
	TOTAL	105,948.91	215,998.20	**321,947.11**	32,194.71	354,141.82	18,636.85	1,863.69	20,500.54	**374,642.36**
	PORTION PERCENTAGE	32.9%	67.1%	100.0%						

JAPAN PORTION INCLUDING UTILITIES RELOCATION **31.11%**

TABLE 11-2 TOTAL CONSTRUCTION COST AND JAPAN COMPONENT (YEN)

(UNIT ; Million Yen)

NO	DESCRIPTION	TOTAL CONSTRUCTION COST				TOTAL	UTILITIES RELOCATION		TOTAL	GRAND TOTAL
		JAPAN PORTION	LOCAL PORTION	SUB TOTAL	VAT (10%)	WITH VAT	LOCAL PORTION	VAT (10%)	WITH VAT	
		(Million Yen)	(Million Yen)	(Million Yen)	(Million Yen)	(Million Yen)	(Million Yen)	(Million Yen)	(Million Yen)	(Million Yen)
1	MERAK	328.40	586.78	**915.18**	91.52	1,006.70	11.03	1.10	12.13	**1,018.83**
2	BALARAJA	159.81	371.02	**530.83**	53.08	583.92	52.23	5.22	57.46	**641.37**
3	NAGREG	250.34	464.84	**715.18**	71.52	786.70	139.16	13.92	153.08	**939.77**
4	GEBANG	290.59	527.03	**817.63**	81.76	899.39	9.20	0.92	10.12	**909.51**
5	PETERONGAN	189.92	418.28	**608.20**	60.82	669.02	30.04	3.00	33.04	**702.06**
6	TANGGULANGIN	193.58	512.03	**705.61**	70.56	776.17	6.83	0.68	7.52	**783.69**
	TOTAL	1,412.65	2,879.98	**4,292.63**	429.26	4,721.89	248.49	24.85	273.34	**4,995.23**
	PORTION PERCENTAGE	32.9%	67.1%	100.0%						

(NOTE) ; EXCHANGE RATE 1 Yen = 75 Rupiah

JAPAN PORTION INCLUDING UTILITIES RELOCATION **31.11%**

13. PREPARATION OF DRAFT P/Q AND TENDER DOCUMENTS

Draft Prequalification Documents and Tender Documents consisting of the following were prepared.

Prequalification Documents

- Glossary (Definition)
- Invitation for Prequalification
- Instructions to Applicants
- Application Data Sheet
- Prequalification Criteria
- Application Forms
- Scope of Contract

Tender Documents

- Invitation for Bids
- Instruction to Bidders
- Bidding Data
- General Conditions of Contract (FIDIC, 1999)
- Conditions of Particular Application
- Technical Specifications
- Drawings
- Bid Form, Appendices to Bid, Bid Security forms
- Bill of Quantities
- Schedule of Supplementary Informations
- Form of Agreement and Sample Forms of Securities
- Disputes Resolution Procedure
- Evaluation Procedure of Bid Proposals
- Post Qualification

14. UPDATING OF UPL AND URL

14.1 Social Survey

The public hearings (socialization) and negotiation with the affected families have been completed before the Study commenced at Balaraja and Gebang Flyovers and these activities were on-going at Nagreg Flyover, therefore, the social survey was undertaken at the remaining three flyovers, namely Merak, Peterongan and Tanggulangin Flyovers.

Number of respondents were as follows:

	Merak	Peterongan	Tanggulangin
No. of Respondents	165	118	88

Some of the results are summarized hereunder:

FAMILY STATUS

	Merak	Peterongan	Tanggulangin
1. No. of Families in One House			
1.1 One (1)	145	75	59
1.2 Two (1)	3	17	16
1.3 Three (3)	1	2	3
1.4 Four (4)	-	-	-
1.5 No answer	16	24	10
2. No. of Persons in One Family			
2.1 Two (2)	2	16	3
2.2 Three (3)	16	10	15
2.3 Four (4)	22	23	22
2.4 Five (5)	41	13	18
2.5 Six (6)	36	4	8
2.6 More than six	24	28	13
2.7 No answer	24	24	9
3. Monthly Family Income			
3.1 < Rp 500,000	22	25	18
3.2 500,000 – 1,000,000	62	27	26
3.3 1,000,000 – 2,000,000	37	19	24
3.4 2,000,000 – 3,000,000	21	9	4
3.5 > 3,000,000	14	14	3
3.6 No answer	9	24	13
4. Monthly Family Income			
4.1 < Rp 500,000	30	20	18
4.2 500,000 – 1,000,000	69	29	26
4.3 1,000,000 – 2,000,000	30	20	24
4.4 2,000,000 – 3,000,000	17	12	4
4.5 > 3,000,000	10	13	3
4.6 No answer	9	24	13

STATUS OF HOUSE

	Merak	Peterongan	Tanggulangin
1. Ownership of House Land			
1.1 Owned	49	80	64
1.2 Rental	72	6	3
1.3 Company Land	-	-	2
1.4 Parent's Land	-	3	14
1.5 Government Land	39	3	-
1.6 No Answer	5	26	5
2. Ownership of House			
2.1 Owned	103	80	70
2.2 Rental	42	6	1
2.3 Company House	1	3	1
2.4 Parent's House	-	3	10
2.5 Government House	8	3	-
2.6 No Answer	11	26	6

DISTANCE TO WORKPLACE AND TRANSPORTATION

		Merak	Peterongan	Tanggulangin
1.	Distance from Home to Workplace			
1.1	0-3 km	119	79	57
1.2	3-5 km	5	4	4
1.3	5-7 km	-	5	3
1.4	7-9 km	-	1	-
1.5	More than 9 km	15	5	16
1.6	No Answer	26	24	8
2.	Time Required to Workplace			
2.1	0 minute	12	65	20
2.2	1 – 20 minutes	62	13	15
2.3	20 – 30 minutes	2	9	39
2.4	More than 30 minutes	21	7	6
2.5	No Answer	18	24	28
3.	Means of Transportaiton			
3.1	Walking	58	55	12
3.2	Bicycle	6	2	3
3.3	Motorcycle	49	13	19
3.4	Motorbike Taxi (Ojek)	3	-	1
3.5	Private Car	27	6	3
3.6	Bus / Mini Bus	11	4	6
3.7	Train	-	-	1
3.8	Pedicab (Becak)	-	-	-
3.9	Government car	1	-	-
3.10	Others	-	-	14
3.11	No Answer	10	28	29

KNOWLEDGE AND OPINION ON THE PROJECT

		Merak	Peterongan	Tanggulangin
1.	Knowledge about the Project			
1.1	Have known	47	65	42
1.2	Do not know	112	53	34
1.3	No answer	6	-	12
2.	Source of Information			
2.1	Officer of Desa/Kecamatan	14	61	10
2.2	Neighbor	29	10	6
2.3	Radio / TV	1	-	-
2.4	Newspaper	-	1	3
2.5	Others	3	46	18
2.6	No Answer	118	-	51
3.	Opinion on the Project			
3.1	Give Benefit	20	36	17
3.2	Harming	122	47	41
3.3	No Change	14	35	24
3.4	No Answer	9	-	6

		Merak	Peterongan	Tanggulangin
4.	Reason Why the Project is Harming			
4.1	Increase noise	-	5	1
4.2	Increase air pollution	-	35	2
4.3	Land and/or house be taken	114	46	34
4.4	Decrease income	1	-	-
4.5	Less of business	1	-	-
5.	Reason Why Project is Benefecial			
5.1	Smooth Traffic Attained	26	13	7
5.2	Faster Travel	1	5	5
5.3	Increase of Land Price	2	15	5
5.4	New Business Opportunity	1	-	-
5.5	Obtaining Compensation	1	-	-
5.6	Others	-	3	-
6.	Expectation from the Project			
6.1	Job opportunity during construction	76	3	2
6.2	Obtain New Livelihood	35	9	12
6.3	No expectation	46	80	51
6.4	Smooth Traffic	1	-	-
6.5	Getting Compensation	2	-	16
6.6	Others	-	26	7
6.7	No Answer	4	-	-

METHOD OF COMPENSATION

	Method	Merak	Peterongan	Tanggulangin
1.	Money	153	94	61
2.	Alternative Land	5	-	4
3.	Up to the Government	1	24	16
4.	Do not know yet	2	-	-
5.	Business Place	-	-	-
6.	No Answer	4	-	7

14.2 Updating UKL and UPL

Original UKL and UPL

According to the decree of Ministry of Environment No. 17/2001, EIA (AMDAL) is not required for construction of flyover of less than 2 km in length, instead, the Environmental Management Plan (UKL) and the Environmental Monitoring Plan (UPL) are required. All flyovers have the length of less than 2 km, thus EIA is exempted, but UKL and UPL are required.

Based on the Feasibility Study undertaken in year 2003, original UKL and UPL were prepared and approved by the respective local environmental agency as follows:

Flyover	Original UKL & UPL Approved on :
Merak	October 8. 2003
Balaraja	October 6, 2003
Nagreg	February 16, 2005
Gebang	October 3. 2003
Peterongan	October 8. 2003
Tanggulangin	October 8. 2003

Updating of UKL and UPL

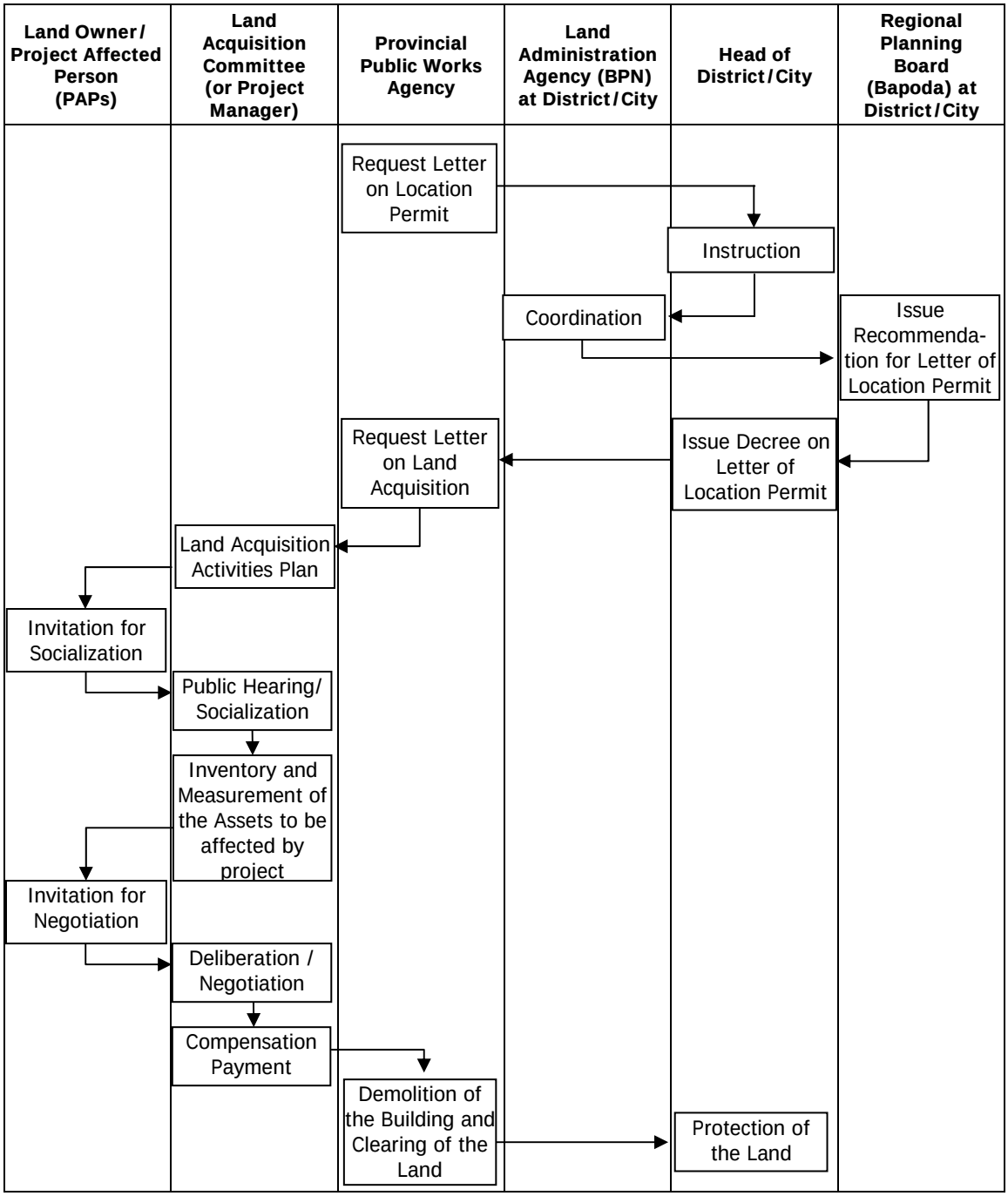
Based on the Basic Design of the project, original UKL and UPL were updated. Basic concept, nature of the Project and project site condition are almost the same as those of the feasibility study stage, updating was focused on the revision of the scope of work of the Project. Updated UKL and UPL were submitted to the respective local environmental agency and approved on the date as follows:

Flyover	Updated UKL & UPL Approved on
Merak	June 22. 2006
Balaraja	June 13, 2006
Nagreg	November 24, 2006
Gebang	July 6, 2006
Peterongan	June 13, 2006
Tanggulangin	June 16, 2006

15. DRAFT ROW ACQUISITION AND RESETTLEMENT PLAN

Right-of-way acquisition process is shown below:

ROW ACQUISITION PROCESS



Note: If land area to be acquired is less than 1 ha. Project Manager can undertake land acquisition.

ROW acquisition of Balaraja, Nagreg and Gebang Flyovers has started prior to the start of the study. ROW acquisition of Merak, Peterongan and Tanggulangin is being implemented simultaneously with the detailed design. Present status of ROW acquisition is shown in **Table 15-1**.

So far, all project affected peopled preferred to be compensated by money. Most of the case, only a partial of a house/store/building is affected, therefore, people still stay in the same place. Two school buildings were affected at Balaraja Flyover. The Local Government has already built alternate school building within the same school compound.

TABLE 15-1 PRESET STATUS OF ROW ACQUISITION

No.	Project Name	Land Acquisition Required (m2)	Phase of Activities						Budget for ROW Acquisition	Source of Fund (billion)			Remarks
			Inventory of The PAP Assets	Public Hearing (Socialization)	Measuring Affected Assets	Deliberation / Community Consultation	Payment Status	Demolition and Clearing		APBD-II	APBD-I	APBN	
PACKAGE - 1													
1.	Merak Flyover	3,670.00	Completed	Completed	OG	NY	NY	NY	24 Billion	-	24	-	1. Budget for land acquisition can be realized on Middle of August 2006 2. Socialization will be conduct with the Head of Sub District, Head of Village, Group of Neigbourhood, Group of Household 3. preparation of Location Permit Decree will be conducted
2.	Balaraja Flyover	2,620.74	Completed (Sept. 6, 2004)	Completed (June 10, 2005)	Completed (Dec 24, 2004)	Completed (July 15, 2005)	Completed (Oct., 2005)	OG	-	-	-	-	1. Execution for payment compensation already done 2. Land clearing of buildings and others asset is on going
PACKAGE - 2													
3.	Nagreg Flyover	5,677.36 148 5,529.36	Completed	Completed (Nov. 22, 2005)	Completed	OG	NY	NY	6 Billion	-	6	-	1. Negotiation to Project Affected Person (PAPs) is underway
4.	Gebang Flyover	3,928.51	Completed (March 10,2005)	Completed (March 5,2005)	Completed (March 30,2005)	Completed (June 23,2005)	Completed (Oct. - Dec.,2005)	OG	-	-	-	-	1. Execution for payment compensation already done 2. Land clearing of buildings and others asset is on going
PACKAGE - 3													
5.	Peterongan Flyover	7,509.27	Yes (August, 2006)	Yes (August 8,2006)	Completed	NY (Sept. 22,2006)	NY	NY	7 Billion	3.0	2	2.0	1. Estimated amount ROW by Project Manager, 2. Project socialization that given affect to person already done 3. Measurement of assets is under process 4. preparation of Location Permit Decree is under process
6.	Tanggulangin Flyover	4,357.50	Yes (July,2006)	Yes (August 4,2006)	Completed	NY (Sept. 15,2006)	NY	NY	3.5 Billion	1.5	-	2.0	1. Estimated amount by Project Manager. 2. Project socialization that given affect to person already done 3. Measurement of assets is under process 4. preparation of Location Permit Decree is under process

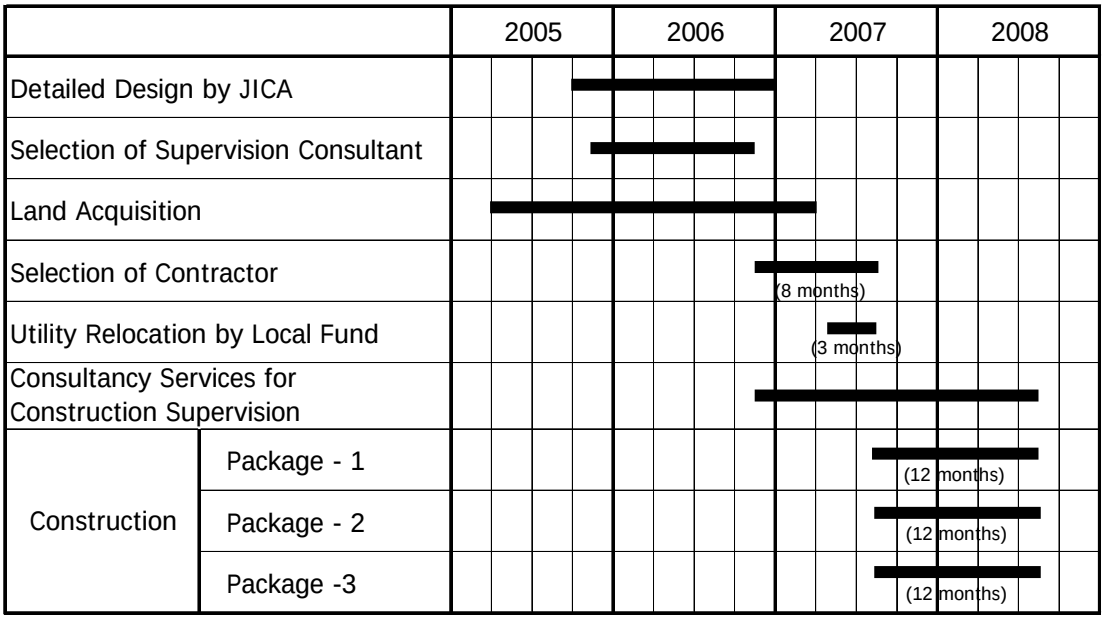
Note :
PAP = Project Affected Persc OG = On Going
NY = Not Yet

16. PROJECT IMPLEMENTATION PLAN

The implementing agency is the Directorate General of Highway (DGH), Ministry of Public Works. Project implementing organization is shown in **Figure 16-1**.

Implementation Schedule is shown in **Table 16-1**

TABLE 16-1 IMPLEMENTATION SCHEDULE



Annual fund requirement by source of fund for construction is estimated as shown below:

ANNUAL FUND REQUIREMENT BY SOURCE OF FUND

(UNIT : Million Yen)

Fund Source	Year		
	2007	**2008**	**Total**
A. Construction of Flyover			
A-1. Consultancy	176	165	341
- JBIC Loan	160	150	310
- Local Counterpart Fund (Tax)	16	15	31
A.2 Civil Work	1,928	2,794	4,722
	1,510	2,261	3,771
- Local Counterpart Fund			
Local Portion	243	279	522
Tax	175	254	429
Total	418	533	951
B. Utility Relocation			
- Local Fund	273	-	273

Note: 1¥ = 75 Rp.

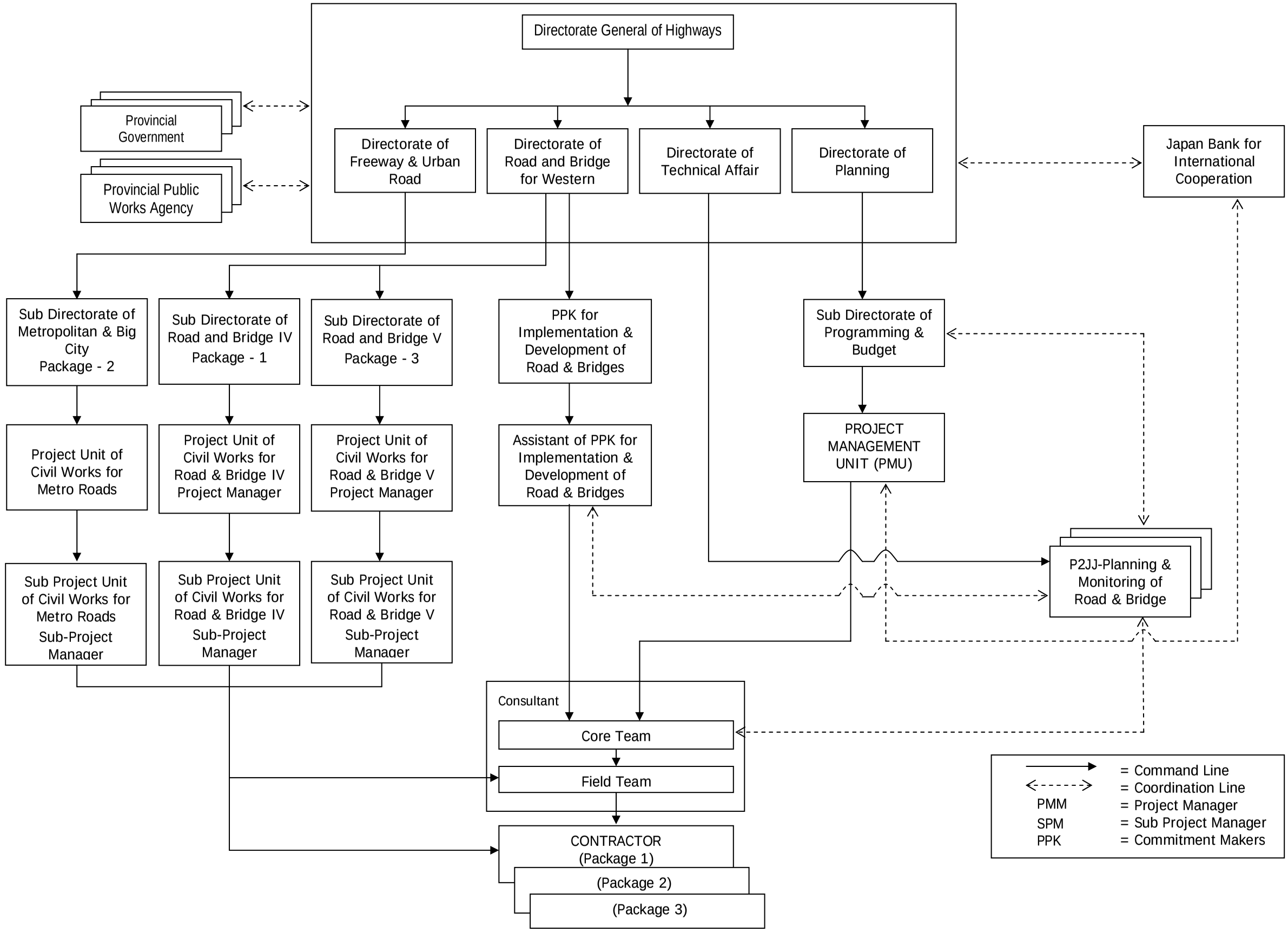


FIGURE 16-1 PROJECT IMPLEMENTATION ORGANIZATION

17. FLYOVER/BRIDGE MAINTENANCE PLAN

In recognition of the current inappropriate state of flyovers/bridge in Indonesia, and lack of appropriate management practices, effective and efficient flyover/bridge asset management system comprising of the following should be established:

Basic Components of a Flyover Management System

- A comprehensive, up-to-date inventory of Flyover.
- A system for inspection and a standard means of recording inspection results.
- A system for recording all flyovers and their associated cost.
- Procedures to establish priorities for maintenance, rehabilitation and improvement.
- A system of identifying, practical deterioration models and treatment options to minimize deterioration of the flyover structural component.
- System for production of reports for evaluating and supporting management decisions.

For better management of flyover/bridge, following should be undertaken:

For Better Management of Flyover/Bridge Assets

- Establish effective and efficient bridge asset management system.
- Develop flyover inventory system based on the typical data for a flyover/bridge inventory.
- Conduct initial condition assessments on all flyover/bridges.
- Determine from the initial condition surveys those flyover/bridge that require a detailed report from inspector. If further detailed inspection is required this should be undertaken by a qualified structural engineer.
- Based on the inspection reports received determine the nature of the problems and possible solutions.
- Undertake comparison between improvement and rehabilitation to establish the most appropriate actions to be taken.
- Report on the findings of the evaluation and put forward recommendations that are based on sound condition and economic assessment, social assessment.
- Monitor on a regular basis the condition of the flyover/bridge assets and ongoing management actions.

18. PROJECT EVALUATION AND RECOMMENDATIONS

18.1 PROJECT EVALUATION

1) Operation and Effect Indicators

Operation and effect indicators were prepared and high positive effect were confirmed at each flyover. Example of operation and effect indicators are shown in **Table 18-1**.

TABLE 17-1 OPERATION AND EFFECT INDICATOR: NAGREG FLYOVER

Operation / Effect Indicator		Year		
		2005	2008	2018
1) Daily Traffic Volume (veh/day)	At-grade	17,783	7,672	11,853
	Flyover	-	12,868	19,638
2) Travel Speed (km/hr)	At-grade	27.9	39.1	25.8
	Flyover	-	41.1	29.9
3) Travel Time Reduction (veh-hr/day)		-	293	1,752
4) Travel Cost Savings (1,000 Rp/day)		-	16,213	75,698
5) Maximum Traffic Queue Length at Railway Crossing during Train Passing (m)		430	185	288

2) Economic Evaluation

Economic evaluation results are shown in **Table 18-2**. All flyovers were evaluated economically feasible.

TABLE 17-2 SUMMARY OF COST BENEFIT ANALYSIS

Flyover	Economic Internal Rate of Return-EIRR	Net Present Value (Million Rp.)	Benefit Cost Ratio
Merak	14.5%	17,102	1.30
Balaraja	23.0%	63,371	2.74
Nagreg	21.0%	71,085	2.33
Gebang	21.9%	80,788	2.56
Peterongan	17.3%	23,833	1.59
Tanggulangin	13.6%	8,101	1.18

NPV and BCR are based on Discounted Rate 12%

3) Loan amount VS Estimated Cost

JBIC Loan consists of the following:

Unit: Million Yen

Base cost for civil work	2,993
Price escalation (19%)	578
Contingency (5%)	178
Total	3,749

In addition to above, the consultancy cost for the detailed design (200 Million Yen) is available. Contingency should be kept to cope with some changes during construction. Available amount of loan is as follows:

	Available Amount of Loan (Million Yen)
• Base cost for civil work	2,993
• Price escalation (19%)	578
• Unused cost for Detailed Design	200
Total	3,771

Estimated cost and shortage of loan amount is as follows:

Unit: Million Yen

	Estimated Cost		
	(Japan Portion + Local Portion)	**(Tax)**	**(Total)**
Civil Work	4,293	429	4,722
Available JBIC Loan	3,771	-	-
Shortage of JBIC Loan	522	-	-

Note: DGH decided to implement public utilities relocation (273 Million Yen or 20.5 B. Rp.) by using local fund prior to the start of flyover construction.

Options to cover shortage of loan are as follows:

Option	Measures to Cover Shortage of Loan	Remarks
Option – 1	The shortage is covered by the local counterpart fund	• This option is in accordance with the condition of Loan Agreement
Option – 2	The scope of work is to be slimed down (such as overlay of an at – grade road, lighting for an at –grade road). Such work is to be done after completion of the flyover by local fund. Work which can be slimed down is limited, thus the local counterpart fund is still needed.	• Amount of scope down is not extensive. • Scope down to be studied waiting for bid result.
Option – 3	Defer implementation of one of flyovers, which is to be constructed by new loan or local fund.	• Preparation for implementation such as socialization and ROW acquisition is being undertaken by respective local government • This option is possible when ROW acquisition of a certain flyover is not successful in time.
Option – 4	Defer implementation of Exit Ramp of Merak Flyover which is to be constructed by local fund. Cost reduction of this option is not enough, thus local counterpart fund is still needed.	• MoT and ASDP will not agree on this option.

In view of above, Option – 1 is recommended.

If Option – 1 is selected, amount and share of local counterpart fund will be as follows:

	Estimated Cost Excluding Utility Relocation	Amount covered by Loan	Local Counterpart Fund Required
Japan Portion and Local Portion	4,293	3,771	522 (39.2 Billion Rp.)
Tax	429	-	429 (32.2 Billion Rp.)
Total	4,722	3,771 (80%)	951 (71.3 Billion Rp.) (20%)

Note: At the time of the project appraisal, tax portion was estimated at 35.7 Billion Rp.

18.2 CONCLUSION

The Project was evaluated technically, economically, financially and environmentally feasible.

Technical Feasibility: the project utilizes Japanese technologies in line with STEP Loan condition. Construction will be implemented by Japanese Contractor or Japanese Contractor in joint venture with Indonesian Contractor (Japanese contractor as a lead firm) who can execute the work efficiently. Japan portion is estimated to be 31.1% which satisfies STEP Loan requirement.

Economic Feasibility: all flyovers were evaluated economically feasible.

Financial Feasibility: although the project requires additional local counterpart fund which is, however, not extensive and manageable by DGH.

Environmental Feasibility: the project is not environmentally critical, thus EIA (AMDAL) is not required for this project. The project should be implemented and operated in accordance with requirements of UPL and UKL.

18.3 RECOMMENDATIONS

1) The project must be implemented under the severe urban environment. Construction must be undertaken without major traffic disruption and be completed within the limited time frame. The construction plan prepared under this study should be carefully studied by contractors and supervision consultant and implemented.
2) Various technologies were adopted in the study which can be applicable to other similar projects. Such technologies should be positively considered for wide application.
3) Options were presented to cover shortage of loan. DGH should further study options and decision should be made as early as possible.
4) PT. KAI required closure of an at-grade road at railway crossing, however, it should be done at later stage with proper provisions for local traffic and pedestrians.
5) Effect of mudflows from natural gas well near Tanggulangin Flyover should be closely monitored, particularly traffic flow changes, diverted to the national road from the toll road. The effects of mudflow are getting worse, DGH should decide whether construction of this flyover be implemented or not.

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