JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DIRECTORATE GENERAL OF HUMAN SETTLEMENTS
MINISTRY OF PUBLIC WORKS
REPUBLIC OF INDONESIA

THE DETAILED DESIGN FOR URBAN DRAINAGE PROJECT IN THE CITY OF JAKARTA

FINAL REPORT

VOLUME II

SUPPORTING REPORT

ANNEX-III

No. 7 Construction Plan and Schedule
No. 8 Cost Estimate
No. 9 Breakdown of Unit Cost

NIPPON KOEI CO., LTD.
TOKYO, JAPAN

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DECEMBER 1997

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URBAN DRAINAGE PROJECT
IN THE CITY OF JAKARTA

COMPOSITION OF DESIGN REPORT

EXECUTIVE SUMMARY

VOLUME I MAIN REPORT

VOLUME II SUPPORTING REPORT

ANNEX-I
- No. 1 Meteorology and Hydrology
- No. 2 Topographic Survey
- No. 3 Geo-technical Investigation

ANNEX-II
- No. 4 Design Criteria
- No. 5 Design and Structural Calculation
- No. 6 Work Quantity Calculation

ANNEX-III
- No. 7 Construction Plan and Schedule
- No. 8 Cost Estimate
- No. 9 Breakdown of Unit Costs

ANNEX-IV
- No. 10 Environmental Impact Assessment
- No. 11 Social Impact Management Plan

VOLUME III DESIGN DRAWINGS

COMPOSITION OF TENDER DOCUMENTS

Prequalification Documents

Tender Documents:
- VOLUME I Instructions to Tenderers & others
- VOLUME II General and Special Conditions of Contract
- VOLUME III General and Technical Specifications
- VOLUME IV Tender Drawings

IMPLEMENTATION PROGRAM

The cost estimate is based on the price level of June 1997 and the monthly mean exchange rates in June 1997. The monthly mean exchange rates in June 1997 are:

US$ 1.00 = ¥ 115.00 = Rp. 2,350

ABBREVIATIONS

(1) Local Terms

BAKOSURTANAL	Badan Koordinasi Survei dan Penetaan Nasional	:National Mapping Agencies
BAPPENAS	Badan Perencanaan Pembangunan National	:National Planning and Development Board
BPS	Biro Pusat Statistic	:Central Bureau of Statistics
BINA MARGA		:Directorate General of Road Development
CIPTA KARYA		:Directorate General of Human Settlements
DGWRD		:Directorate General of Water Resources Development
DINAS TATA KOTA		:Department of City Planning, DKI Jakarta
DKI Jakarta	Daerah Khusus Ibukota Jakarta	:Special Region of Capital City Jakarta
DPMA	Direktorat Penyelidikan Masalah Air	:Directorate of Hydraulic Engineering
DPU	Departmen Pekerjaan Umum	:Ministry of Public Works
DPU DKI Jakarta	Dinas Pekerjaan Umum DKI Jakarta	:Department of Public Works, DKI Jakarta
DPUP	Dinas Pekerjaan Umum Propinsi	:Provincial Department Office of Public Works
JABOTABEK		:Jakarta-Bogor-Tangerang-Bekasi
JASA MARGA		:Indonesia Highway Corporation
Kabupaten		:Regency
Kecamatan		;Sub-district
Kelurahan		:District
Kotamadya		:Municipal City
PELITA	Pembangunan Lima Tahun	:Five-Year Development
PERUM PERUMNAS		:National Urban Development Corporation

PMG	Pusat Meteorogi dan Geofisika	:Meteorological and Geophysical Center
P.P.	Priok Pile	
P.T.	Perusahaan Terbatas	: Private Estate Enterprise (Company Ltd.)
PWSCC	Proyek Pengembangan Wilayah Sungai Ciliwung-Cisadene	: Ciliwung-Cisadane River Basin Development Project Office
RKL		:Environmental Management Program
RPL		:Environmental Monitoring Program
REPELITA	Rencana Pembangunan Lima Tahun	:Five-Year Development Plan
TTG.	Tanda Tinggi Geodesi	

(2)International or Foreign Organization

GOI	:Government of the Republic of Indonesia
GOJ	:Government of Japan
IBRD	:International Bank for Reconstruction and Development
JICA	:Japan International Cooperation Agency
OECF	:Overseas Economic Cooperation Fund

(3) Foreign Terms

EIRR	:Economic Internal Rate of Return
FIRR	:Financial Internal Rate of Return
GDP	:Gross Domestic Product
GNP	:Gross National Product
GRP	:Gross Regional Product
PMF	:Probable Maximum Flood
NPV	:Net Present Value
O&M	:Operation and Maintenance
IEI	:Initial Environmental Evaluation
B/Q	:Bill of Quantities
TOR	:Terms of Reference

B/C	:Box Culvert
CAD	:Computer-aided Design
EIA	:Environmental Impact Assessment
ICB	:International Competitive Bidding
LCB	:Local Competitive Bidding
JIS	:Japan Industrial Standards
ASTM	:American Society for Testing and Materials

(4) Numerical Units

Length

mm	millimeter
cm	centimeter
m	meter
km	kilometer

Area

mm^2	square millimeter
cm^2	square centimeter
m^2	square meter
km^2	square kilometer
ha	hectare

Volume

cm^3	cubic meter
m^3	cubic meter
Ltr	liter

Weight

gr	gram
kg	kilogram
ton	metric ton

Time

sec	second
min	minute
hr	hour
yr	year

Others

%	percent
℃	degree centigrade
10^3	thousand
10^6	million
10^9	billion

Money

Exchange Rate

Rp.	Indonesian Rupiah	Official rate as of June, 1997
¥	Japanese yen	US$ 1= Rp 2,350 = ¥ 115
US$	US dollar	

No. 7

Construction Plan and Schedule

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 GENERAL

This report presents the proposed construction plan and construction schedule necessary to implement the construction works. The objectives of this report is to provide a guide for the implementation of the construction works and for the construction cost estimate.

The construction plan is summarized on the basic assumptions made in the preparation of the construction schedule. The construction plan gives an outline of possible procedures, construction methods, types of construction equipment and plant which is conventional and prevailing. Furthermore, the construction plan for the major permanent structures required for the project is studied in accordance with the final plans, designs and specifications.

The construction method and equipment described herein are developed by assuming that the construction works are performed by international contractors to be selected on an international competitive tender who should be fully capable of employing modern construction methods taking consideration of local conditions, managing proper and sufficient equipment to complete the constructions works of this scale.

In the execution of actual construction works, the construction plan and construction equipment should be prepared by the selected contractors based on their own idea.

2 OUTLINE OF THE PROJECT

The feasibility study on the urban drainage project for four objective areas, namely, Cengkareng west area, Sepak area, Bojong area and Meruya area was carried out by JICA and completed in 1991,namely 5 years ago. Since then, land utilization condition has largely changed due to mainly rapid urbanization represented by house development on the land created by land reclamation in the depression areas located in the project areas. The house development has rapidly progressing in many places, especially in the Cengkareng west area, Sepak area and Meruya area. The private developer themselves have constructed the drainage channels for drainage of housing areas in accordance with the Indonesian regulation that the private developer should construct the drainage facilities to drain the housing areas to the main drainage

networks.

In the Cengkareng west area ,many depression areas and swampy areas are located and all of these areas have already acquired by private house developers or private enterprise. It is anticipated that these depression and swampy areas will be utilized as house development areas by creating the lands by means of land reclamation. In the Sepak and Meruya areas, a large scale house complex has completed and further extension is progressing at present.

In the Bojong area, rehabilitation works of the existing drainage facilities have completed. In addition to the rapid urbanization in the objective areas, interchange works for Jakarta ring road have been progressing at the northern part of the Cengkareng west area and eastern part of the Meruya area. Due to construction of these interchanges, present drainage networks were largely changed compared with the situation investigated in the feasibility study stage.

Discussion meeting on basic concept for determination of the proposed drainage channels was carried out and it was determined that detailed design works for the Sepak and Bojong areas were canceled from the scope of works because objected drainage channels in the Sepak area have already constructed and being scheduled to be improved by private housing developers, and the drainage facilities in the Bojong area have recently rehabilitated and no further drainage works are needed. Due to change of the scope of works, basic study and definitive planning for the urban drainage plan were carried out for the Cengkareng west and Meruya areas.

The objectives of the Study are:

(a) to formulate definitive plan of the urban drainage projects in the Cengkareng west area and Meruya area through review of Study and execution of additional surveys and investigation,

(b) to prepare detailed design documents and tender documents for the project, and

(c) to transfer relevant planning and designing technologies to Indonesian counterpart in the course of the design works.

3 IMPLEMENTATION OF THE PROJECT

The project will be implemented by the Government of Indonesia and assisted by consulting engineers of international standing. The construction works of the project will be divided into three (3) packages and carried out by a selected contractor through an international competitive tender for each package in accordance with the standard international guidelines. The execution of the works are to be made based on the following basic implementation plan.

3.1 Implementing Agency

The proposed organization for implementation of the project is shown in Fig. 7.3.1. An Implementing Agency of the project will be Directorate General of Human Settlements (CIPTA KARYA), Ministry of Public Works, the Republic of Indonesia, which is responsible for management of the project works including loan appraisal, loan agreement and overall management of the project works.

Upon approval of the loan project fund, DPU DKI Jakarta will carried out land acquisition and compensation works for households with assistance and cooperation of department of housing.

The implementation of the project works will be administrated by DPU DKI Jakarta. The construction works will be entrusted and carried out by Project Management Office, DPU DKI Jakarta, which will be controlled by steering committee and technical committee. The Project Management Office, DPU DKI Jakarta will also be controlled by Director General of CIPTA KARYA. KANWIL PU will function as administrative support which will be instructed by Minister, PU. Overall management by Director General of CIPTA KARYA will be transmitted to the Project Manager of Project Management Office, DPU DKI Jakarta through the Steering Committee. The technical management by DPU DKI Jakarta and DINAS PU will also be transmitted to the Project Management Office, DPU DKI Jakarta, through the Technical Committee.

Consultant will function as technical assistance for staff of the Project Management Office, DPU DKI Jakarta for construction works of the project and coordination between Project Management Office and official foreign loan agency. For technical aspects.

3.2 Financial Source

The foreign currency portion of the construction cost is expected to be financed by an international organization with its soft loan. On the other hand, the local currency portion will be covered by the Indonesian national budget.

3.3 Engineering services

A selected competitive bid will be applied for procurement of engineering consultant for assistance of the tendering matters during pre-construction period and construction supervision matters during construction period.

3.4 Contract Package

In consideration of large budgetary amount of compensation by the Government as well as development priority, the project will be divided into three (3) packages as shown below.

Package 1
- Kamal drainage channel (main)
- Kamal drainage channel (branch)

Package 2
- Tanjungan drainage channel
- PIK Junction drainage channel

Package 3
- Saluran Cengkareng drainage channel
- Gede/Bor drainage channel
- Meruya drainage channel

The reliable contractor for a package will be selected through an international tender in accordance with the implementation schedule.

3.5 Implementation Schedule

The overall project implementation schedule is shown in Fig. 7.3.2.

Upon approval of the project loan, selection of consultant for tendering and construction supervision, selection of contractor including pre-qualification and tendering will be carried out.

It is generally specified in an international financing agency that a loan validity is around 6 - 7 years including pre-construction activities. While, special consideration for longer loan validity may grant, if such period should be necessary taking into account the nature of the project. In the case of the Project, particular nature for the implementation of the Project is observed that much higher cost of compensation is estimated tan that of construction cost. In this connection, stepwise construction method is adopted in order to reduce peak compensation cost as much as possible. Therefore, total implementation schedule is recommended to be around 8 years, comprising pre-construction period of 1.5 years and construction period of 6.5 years.

The project works will be executed dividing into three packages. The Package-1 work which include construction of Kamal drainage channel consists mainly of widening of the existing drainage channel and construction of earth type levee, concrete parapet, revetment and bridges and installation of spindle type gates and flap gates. The Package-2 works which include construction of Tanjungan and PIK Junction drainage channels comprise excavation of the drainage channels, construction of revetment and bridges and installation of spindle type gates and flap gates. The Package-3 works which include construction of Gede/Bor, Saluran Cengkareng drainage channels and drainage channel in Meruya area comprise excavation of the drainage channels, construction of revetment, concrete parapet, open culvert with mesh, bridges, and sluiceways and installation of spindle type gates and flap gates. It is scheduled to execute the drainage works from year, 2000 from Package-1 as initial phase, Package-2 from 2003 as second phase and Package-3 from 2004 as last phase.

As seen in Fig. 7.3.2. the key event dates in the schedule are summarized below.

Pre-construction activities
- Detailed design : by Mid. Jan. 1998
- Loan application and appraisal : Jul. 1997 - Oct. 1998
- Loan agreement : by Dec. 1998
- Selection of consultant : By Jan. 1999
- Review of the detailed design : Feb. - Jun. 1999

- Prequalification	: Feb. - Apr. 1999
- Tendering procedure	:
- Package 1	: May 1999 - Apr. 2000
- Package 2	: Jan. 2002 - Dec. 2002
- Package 3	: Jan. 2003 - Dec. 2003
Compensation	
- Kamal (main and branch)	: Apr. 1997 - Jun. 2003
- Tanjungan	: Apr. 2001 - Mar. 2004
- Gede/Bor	: Apr. 2003 - Mar. 2005
- Saluran Cengkareng	: Apr. 2003 - Mar. 2006
- Meruya	: Apr. 2004 - Mar. 2005
Construction activities	
- Construction, Package 1	: May 2000 - Apr. 2004 (48 months)
- Construction, Package 2	: Jan. 2003 - Mar. 2005 (27 months)
- Construction, Package 3	: Jan. 2004 - Dec. 2006 (36 months)

In referring to the above key dates of events, land compensation and resettlement will be made timely in advance of commencement of construction works at each site as scheduled.

4 SITE CONDITIONS

In examination of actual construction works by contractors in Jakarta city, infrastructures in the project area and availability of construction resources, the following site conditions are obtained and taken into account for the construction method to be described in sub-chapter 7.5:

4.1 Access to the Site

Local roads are well distributed in both the sites of Cengkareng west and Meruya areas. Access to each drainage channel may use public and toll roads as shown below.

Drainage channel	Access road
Package 1	
Kamal (main)	Kapuk Kamal, Kamal, Tegal Alur, etc.
Kamal (branch)	Outer Ring Road,
Package 2	
PIK Junction	Jl. Tol Prof. Sediyatmo, Outer Ring Road
Tanjungan	Kapuk Kamal
Package 3	
Saluran Cengkareng	Outer Ring Road, Raya Tanggul Barat
Gede/Bor	Daan Mogot, Sumur Bor, Utan Jati Raya
Meruya	Jl. Tol Jakarta-Merak, Meruya,

However, many narrow roads are observed in the upper stream part of Kamal drainage channel (Branch) and Saluran Cengkareng drainage channel. In this connection, additional land acquisition will be made along Kamal drainage channel (Branch) at the locations, where no inspection road are planned or there is no existing road with sufficient work width. On the other hand, the land for the planned embankment type levee or inspection road may be utilized for an access route in Saluran Cengkareng drainage channel.

4.2 Site Topography

The Cengkareng west area is located in the north-western part of the city of Jakarta and bounded by highway connecting an international airport and city of Jakarta in west, Mookervaat channel in south, Cengkareng floodway in east and Jakarta bay in north. The Cengkareng west area is characterized by remarkably low land elevation in a range of EL 0m to EL 5m, existence of several large scale depression and swampy areas and rapid urbanization represented by house development on the land created by land reclamation for these depression and swampy areas. Due to these topographic characteristics, habitual inundation takes place in several low land areas. In the northern part of this area, the highway is located by heightening the road. In its northern part, a large scale fish pond is extending to the Jakarta bay. Four primary drainage channels are located in this area and majority of drainage water is discharged to the Jakarta bay through the largest Kamal drainage channel. The remaining three drainage channels are located to direction of southwards and eastwards.

The Meruya drainage area is located at the southern part of highway connecting Jakarta and Merak harbor and bounded by existing drainage in the west, higher elevated area in the south, and higher elevated street in the east. Drainage area of the Meruya

drainage system is about 1.5 km^2 and all of this area has been utilized as residential area. This drainage area is located on the elevation of 8 - 9 m, but complicatedly undulated. Center part of this area is elevated and low land areas are located in its both sides. Due to these topographic characteristics, habitual inundation occurs in these depression areas in every rainy seasons.

4.3 Site Geology

(1) General

The sub-surface of the Jakarta plain consists of 250 m thick, Quaternary soils. Clays represent more than 70% of the soil cover. Thin sand layers are intercalated but laterally they are not continuous. The sands are fine grained and silty. The ground water is distributed over several thin and discontinuous layers and a clear distinction of aquifers is difficult. In general, the ground water level lies 2 m below the ground surface. The geological characteristics based on the geotechnical investigation consisting of Dutch cone sounding and drilling in the Cengkareng west area and Meruya area are as follows:

(2) Characteristics of the soils in the investigation area

The consistence of the soils in the Cengkareng area increases with the distance from the coast. Very soft and soft, clayey and silty soils, SPT-value 0 to 3 blows, occur in the lower Kamal and Tanjungan areas, till the level of the highway. Their thickness is 9 to 11 m. Underneath, the soils are more consistent, SPT-values gradually increase to 20 and 30 blows, for an investigation depth of 35 m.

South of the highway, towards the Daan Mogot road, mixed or clayey soft soils, where the SPT-value is less than 10 blows, extend from the ground surface to 5 or 7 m of depth. Underneath, 1.5 to 7 m thick, cemented sands, SPT-value more than 50 blows, have been found. This bed is not continuous over the entire area. The sands are underlain by stiff to hard clays, SPT-values 15 to 30 blows.

The Meruya area is covered by red soils. These are mixed type of soils, containing equal amounts of clay, silt and sand, locally with gravel. Such soils are generally stiff to hard. From the sounding data a hard layer, possibly cemented sands, underlies the soil cover, at an average depth of 5 m.

(3) Physical properties of the soils

Most of the soils analyzed in the laboratory are high plastic CH clays. The liquid limits are higher than 100 %, the natural water contents 50-60% in average and the degree of saturation is close to 100%. The wet unit weights are close to the saturated unit weights, 1.654 t/m^3. The soils referred to as "sandy" are composed 67% of fines in average, belong to the MH class of soils and have natural unit weights of 1.775 t/m^3.

(4) Mechanical properties of the soils

The shearing strength characteristics of the saturated, clayey soils have been estimated from triaxial unconsolidated undrained tests. The mean values obtained were 0.6 Kg/cm^2 for the cohesion and 6° for the angle of friction. For the sandy soils (54-65% of fines) triaxial consolidated drained tests have been done. The obtained shearing strength parameters were 0.45 Kg/cm^2 for the cohesion and 25° for the internal angle of friction.

The consolidation characteristics of the clayey soils show that most soils can be considered overconsolidated, with consolidation yield stresses ranging from 0.6 to 3 Kg/cm^2. The consolidation index values are generally higher than 0.4, indicating highly compressible soils.

(5) Structure foundations

A soft layer covers the west Cengkareng area, its thickness decreasing from the coast, towards the south (Daan Mogot area). The low SPT- test values (less than 10), indicate that the soils have low bearing strength, in case a spread footing is considered. The measured compression indexes correspond to highly compressible soils. After loading, settlement by consolidation will occur. Considering the nature of the soil, pile foundations are recommended, especially for bridges.

From the coast to the area of Kapuk-Kamal, the upper soft soil is underlain by stiff clayey soils and friction piles, 12 - 15 m deep shall be considered. In the south part of the study area, Mookervaat Canal, a more competent cemented sand bed, in average 5 m thick, underlies the 5 to 7 m thick soft soil. This bed can be used as a

rigid substratum for end bearing piles. Nevertheless it has to be considered that this bed is not always continuous and at some locations very thin and not sufficient to be taken as a substratum.

(6) Land subsidence

Besides the settlement after the construction, the project area and the entire Jakarta plain is affected by subsidence, due to self-weight consolidation in the deeper soil beds (40-250 m). This process is triggered by groundwater pumping from the deeper, confined aquifer and its impact on the sub-surface is far more important and the counter-measures imply long term decisions, on regional scale. At present there are 300 deep well in the Cengkareng area, were groundwater is pumped for industrial purposes.

Several studies on the subsidence have been done in the past. Most of them are based on repeated bench mark elevation surveys. The same method has been adopted in the present study. Changes in elevations of existing bench marks have been evidenced in the Daan Mogot area, for the period 1981-1996. Based on former studies and the present observations, the subsidence rate of 8 cm/year (suggested by the DKI Jakarta) can be adopted for the Daan Mogot area, which is the most developed part of the study area. Other, more recent wells are concentrated along the Kapuk Kamal road and a few along Kamal Raya, which will be developed in the near future. In these areas as well as along the Salurang Cengkareng drainage channel the subsidence rate is lower, in average 6 cm/year.

4.4 Meteo-Hydrogical Conditions

(1) Air temperature

Annual average of air temperature at an international airport located at southern part of the project area is in the range of 26° C and 27° C throughout a year. Extremely maximum and extremely minimum are 35.2° C and 17.4° C respectively in November and August.

(2) Relative humidity

Monthly mean relative humidity at the international airport ranges from 75% to

89% throughout a year. Monthly maximum and monthly minimum occur in February and September respectively.

(3) Surface wind

Wind speed is generally calm to 10 knots from a.m. 1 to a.m.10. The wind speed becomes higher, more than 10 knots at a.m. 11 to p.m. 3. After p.m.3, the wind speed usually decreasing except bad weather.

(4) Rainfall

Annual rainfall during the period from 1986 to 1995 at the international airport is around 1,800 mm. The monthly maximum rainfall is 644 mm in January and monthly minimum is 1 mm in October. The highest frequency and lowest frequency of rainy day occur in January and September respectively.

4.5 Power Source

Power cable are well distributed in the project area by PT. PLN in Tangerang office. However, it may need long time to obtain approval for installation of large capacity of electric power from the PT. PLN office.

4.6 Water Source

No clean water for construction and living purposes is available from rivers in the project area. However, water in large bottle is available for drink and cooking purposes, and water, which is supplied by a tank lorry, is also available for construction and living purposes.

4.7 Telecommunication System

Public telephone line is well distributed in the project area, however it may take long time to obtain necessary numbers of telephone line because of many waiting potential users. On the other hand, mobile telephone is easily available in Jakarta city area.

4.8 Construction Resources

(1) Labor forces

All kinds of skilled workers and common labor are available in and around Jakarta city areas because of large population as well as large potentiality of construction projects.

(2) Construction materials

Almost all construction material can be obtainable in Jakarta city because there are many agents dealt with not only domestic construction materials but also imported construction materials. Some of manufacturers produce high quality construction materials, such as precast pre-stressed concrete products, under licenses and/or technical guidance from foreign manufacturers. There are many suppliers of earth and stone materials with royalty for development of those materials. The products by constructional plants, such as hot-mix asphalt and fresh concrete, are also easily obtainable in various kinds of type from manufacturers.

(3) Construction equipment

Various kinds of construction equipment can be procured from lease company in daily, weekly or monthly basis. Repair costs are usually inclusive in a lease contract. The models of construction equipment for lease are commonly new in Jakarta city area.

In this connection, contractors in Indonesia do not own every kinds of construction equipment in types and numbers, and such matter does not a cause of serious problem of delay in construction works.

5 CONSTRUCTION METHOD STATEMENT

5.1 Basic Conditions

In studying the proposed construction method, the following basic conditions are taken into account.

(1) Structure feature and major work quantities

The structure feature and major work quantities are calculated based on the detailed design as summarized below and tabulated in Tables 7.5.1 to 7.5.3 for Packages 1 to 3, respectively. The locations of structures subject to construction are illustrated in Figs. 7.5.1 to 7.5.3 for Packages 1 to 3, respectively.

(a) Package 1

Kamal drainage channel (main) : 4,463 lin.m

- Excavation in drainage channel	4,463	lin.m
- Levee embankment	5,568	lin.m
- Inspection/relocation road	733	lin.m
- Concrete Parapet wall	484	lin.m
- Concrete wall	-	lin.m
- Heightening of exist. masonry	-	lin.m
- Revetment, type I	1,741	lin.m
- Revetment, type II	1,591	lin.m
- Concrete ditch	-	lin.m
- Sluiceway	15	nos.
- Sluice culvert	-	nos.
- Sluice ditch	-	nos.
- Roadway girder bridge	6	nos.
- Pedestrian girder bridge	3	nos.
- Roadway in-situ bridge	-	nos.
- Pedestrian in-situ bridge	-	nos.

Kamal drainage channel (branch) : 2,755 lin.m

- Excavation in drainage channel	2,755	lin.m
- Levee embankment	1,528	lin.m
- Inspection/relocation road	595	lin.m
- Concrete Parapet wall	-	lin.m
- Concrete wall	-	lin.m
- Heightening of exist. masonry	624	lin.m
- Revetment, type I	1,714	lin.m
- Revetment, type II	1,629	lin.m
- Concrete ditch	452	lin.m
- Sluiceway	8	nos.
- Sluice culvert	2	nos.

- Sluice ditch	2	nos.
- Roadway girder bridge	14	nos.
- Pedestrian girder bridge	3	nos.
- Roadway in-situ bridge	2	nos.
- Pedestrian in-situ bridge	-	nos.

(b) Package 2

Tanjungan drainage channel : 2,536 lin.m

- Excavation in drainage channel	2,536	lin.m
- Levee embankment	3,531	lin.m
- Inspection/relocation road	495	lin.m
- Concrete Parapet wall	-	lin.m
- Concrete wall	1,134	lin.m
- Heightening of exist. masonry	-	lin.m
- Revetment, type I	-	lin.m
- Revetment, type II	347	lin.m
- Concrete ditch	-	lin.m
- Sluiceway	7	nos.
- Sluice culvert	-	nos.
- Sluice ditch	-	nos.
- Roadway girder bridge	4	nos.
- Pedestrian girder bridge	1	nos.
- Roadway in-situ bridge	-	nos.
- Pedestrian in-situ bridge	-	nos.

PIK Junction drainage channel : 765 lin.m

- Excavation in drainage channel	765	lin.m
- Levee embankment	-	lin.m
- Inspection/relocation road	-	lin.m
- Concrete Parapet wall	-	lin.m
- Concrete wall	-	lin.m
- Heightening of exist. masonry	-	lin.m
- Revetment, type I	-	lin.m
- Revetment, type II	-	lin.m
- Concrete ditch	765	lin.m
- Sluiceway	1	no.

- Sluice culvert	-	nos.
- Sluice ditch	-	nos.
- Roadway girder bridge	-	nos.
- Pedestrian girder bridge	-	nos.
- Roadway in-situ bridge	4	nos.
- Pedestrian in-situ bridge	-	nos.

(c) Package 3

Saluran Cengkareng drainage channel : 4,213 lin.m

- Excavation in drainage channel	4,213	lin.m
- Levee embankment	4,589	lin.m
- Inspection/relocation road	1,188	lin.m
- Concrete Parapet wall	1,285	lin.m
- Concrete wall	-	lin.m
- Heightening of exist. masonry	-	lin.m
- Revetment, type I	2,388	lin.m
- Revetment, type II	1,800	lin.m
- Concrete culvert, 3-lane	391	lin.m
- Sluiceway	15	nos.
- Sluice culvert	-	nos.
- Sluice ditch	-	nos.
- Roadway girder bridge	9	nos.
- Pedestrian girder bridge	4	nos.
- Roadway in-situ bridge	-	nos.
- Pedestrian in-situ bridge	-	nos.

Gede/Bor drainage channel : 1,203 lin.m

- Excavation in drainage channel	1,203	lin.m
- Levee embankment	265	lin.m
- Inspection/relocation road	-	lin.m
- Concrete Parapet wall	-	lin.m
- Concrete wall	-	lin.m
- Heightening of exist. masonry	-	lin.m
- Revetment, type I	265	lin.m
- Revetment, type II	2,101	lin.m
- Concrete ditch	-	lin.m

- Sluiceway	5	nos.
- Sluice culvert	-	nos.
- Sluice ditch	1	nos.
- Roadway girder bridge	9	nos.
- Pedestrian girder bridge	1	nos.
- Roadway in-situ bridge	-	nos.
- Pedestrian in-situ bridge	-	nos.

Meruya drainage channel : 2,269 lin.m

- Excavation in drainage channel	2,269	lin.m
- Levee embankment	-	lin.m
- Inspection/relocation road	-	lin.m
- Concrete Parapet wall	-	lin.m
- Concrete wall	-	lin.m
- Heightening of exist. masonry	-	lin.m
- Revetment, type I	-	lin.m
- Revetment, type II	-	lin.m
- Concrete culvert, open	1,986	lin.m
- Concrete culvert, box	812	lin.m
- Sluiceway	-	nos.
- Sluice culvert	-	nos.
- Sluice ditch	-	nos.
- Roadway girder bridge	-	nos.
- Pedestrian girder bridge	-	nos.
- Roadway in-situ bridge	16	nos.
- Pedestrian in-situ bridge	-	nos.

(2) Workable day and hour

The annual rainfall in the project area is 1,800 mm on an average for the last 10 years recorded at Soekarno-Hatta International Airport gauge station as summarized in Table 7.5.4 and tabulated in Table 7.5.5. This station is selected because of the nearest one to the project site. The year having annual rainfall less than 1,500 mm and the year having missing data in monthly rainfall data are omitted for construction planning purpose to avoid optimistic estimate of unworkable days. In this calculation, average rainfall days are tabulated in Table 7.5.6. The workable day for construction works is estimated on the basis of the daily rainfall data at the said gauge station, holidays and

national holidays. The results of workable day are summarized in each work category as shown below and tabulated in Table 7.5.7.

Work	Dry Season May - Oct.	Rainy Season Nov. - Apr.	Annual Total
Excavation, earth	24	18	252
Filling, earth	22	16	228
Concrete	23	23	276
Piling	24	24	288

The criteria for the calculation of workable days are assumed as shown below, considering annual average rainfall of 1,800 mm.

Rainfall Range *1	Excavation, earth	Filling, earth	Concrete	Piling
0 to 5	0.0	0.0	0.0	0.0
5 to 10	0.0	1.0	0.0	0.0
10 to 20	1.0	1.0	0.0	0.0
20 to 30	1.0	1.0	1.0	0.0
30 to 50*2	1.5	2.0	1.0	1.0
50 over	2.0	2.0	1.0	1.0

Note : *1 ; Unit is mm/day.
*2 ; Example : more than 30 mm/day up to 50 mm/day

The actual operation hour is assumed to be 8 hours per day out of 10-working hour per shift in principle from Monday to Saturday. Night work is principally prohibited to avoid noise trouble with surrounding inhabitants.

(3) Earth volume conversion factor and unit weight

The following earth volume conversion factor and unit weight will be applied in calculation of production rate of construction equipment.

Material	Bank		Loose/Bank		Compact./Bank	
	Factor	Unit Weight	Factor	Unit Weight	Factor	Unit Weight
Common soil	1.00	1.65	1.20	1.38	0.95	1.74
Sand & gravel	1.00	1.90	1.15	1.65	0.90	2.11
Concrete	-	-	-	-	-	2.40
Wet masonry	-	-	-	-	-	2.16

(4) Hauling distance

The material subject to transportation will be excavated material to be disposed and demolished structures. The planned spoil bank is located at Teluknaga area in Tangerang region. Hauling distance for disposal is assumed at around 15 km on an average for each package.

(5) Production rate of construction equipment

The hourly production rate of the major construction equipment is estimated and shown in Table 7.5.8 with a formula used for such calculation. These rates are estimated with the factor of hauling distance to meet the site conditions and the coefficient of earth volume conversion.

(6) Traffic control

During the reconstruction of bridge on the same alignment, traffic control is necessary to guide passengers to detour route without confusion. For such purpose, guide board shall be provided at both ends of bridge with recruitment of traffic control staff. In addition to this countermeasure, guide devices will be also provided with flushing devices in order to keep safety throughout night.

The bridges having heavy traffic condition shall provide temporary bridges with temporary relocation roads. The list of bridges subject to provision of the temporary bridges and temporary relocation roads is shown below.

Bridge Name	Temporary Bridge	Temporary Relocation Road
Package 1		
BKM 1	Steel girder	Gravel pavement
BKM 3	Steel girder	Asphalt pavement
BKM 5	Steel girder	Asphalt pavement
Package 2		
BTM 3	Steel girder	Asphalt pavement
Package 3		
BCM 11	Steel girder	Asphalt
BCM 12		
BGM 8	Steel girder	Asphalt pavement

Detour ways for the other bridges are planned to utilize neighboring bridges.

Therefore, those neighboring bridges shall not be constructed at the same time.

(7) Plan of procurement method of major construction materials

(a) Embankment and back filling materials

Excavated earth materials in every sites may not be suitable for embankment and filling works. Furthermore, embankment materials are restricted to be procured in DKI Jakarta area by the local government. In this connection, embankment materials for levee and pavement foundation is planned to be procured from Serpong in Tangerang region at around 20 km far from the project sites. Such material is scheduled to be procured to necessary sites through licensed suppliers.

Excavated materials above water level will be selectively utilized for back filling. Excavated earth material will be selected and stocked just beside excavated site till back filling is carried out.

(b) Aggregates and stone materials

Aggregates for concrete and pavement works and stone materials for masonry and drainage works will be procured through licensed suppliers due to costly quarry development in West Java because of small work quantities.

(c) Precast concrete products

Precast concrete products to be used in the project are listed below.
- Pre-stressed concrete pile
- Pre-stressed concrete beam
- Concrete U-type ditch

Those precast concrete products are satisfactorily available in Jakarta city with various kinds of dimensions and suppliers by a ready-made or an order-made system.

(d) RC piles

Reinforced concrete pile is available in various kinds of dimensions and suppliers. However, it was clarified that local contractors can produce those piles at their work shop. Therefore, it is assumed that those piles to be used for sluiceway foundation will be produced at the contractor's work shop.

(e) Wooden piles

Wooden piles has been commonly designed by local consultants and used in the foundation of revetments and sluiceways in Jakarta city. In this connection, wooden piles can be procured from suppliers in Jakarta city.

(f) Fresh concrete

Total volume of concrete in each package has small quantities. Therefore, large scale construction method, such as provision of central concrete mixing plant, cannot be employed for each package. Furthermore, economic concrete with using chemical agents may not be produced in case of site mix of concrete with a portable mixer because of no strict measuring system of those chemical agents. In this connection, ready-mixed concrete is planned to be principally used for each package.

Various kinds of ready-mixed concrete are available in Jakarta city. There are many suppliers owing their own modern concrete plants.

However, concrete to be placed in a small work quantity cannot be delivered by a ready-mixed concrete company, therefore concrete placement quantity having less than 4 cu.m is assumed to be placed at site by employing a portable mixer. In this connection, base and leveling concrete, type 5, will be produced by a portable mixer at sites. The other types of concrete are procured from ready-mixed concrete companies for each package.

5.2 Temporary Works

(1) Contractor's temporary yard and buildings

No office building for temporary use during construction period is constructed for consultant, however such facility is planned to be provided in or around the project area to rent a house.

Temporary office for government staff will be provided in an existing government office utilizing a certain open space after recruitment of staff in the office for the Project.

To proceed the construction activities, the contractor shall provide the temporary office buildings and yards in his temporary yard by himself. Other temporary facilities such as the Engineer's site office, laboratory, production and stock yard, repair shop and motor pool, warehouses, work shops, power supply system with generator sets and houses and water supply system shall be established in the Contractor's temporary yard. The contractor's temporary yard area is estimated at around 13,000 sq.m for each package as shown in Fig. 7.5.4.

The required area of those temporary buildings are listed in Table 7.5.9 with demands of power and water.

(2) Power supply system

Diesel generator set for the construction purpose is planned to be provided at necessary sites for power supply taking into account short term construction period and small scale construction feature at each site. Power demand at each site is estimated on conditions that demand and load factors are assumed to be 0.7 and 0.8, respectively.

(3) Water supply system

Water for construction purpose at each necessary site will be procured from water suppliers by tank lorry. The supplied water is tentatively stocked in a water tank.

(4) Telecommunication system

Mobile telephone sets are provided at necessary sites to keep close contact among every sites, government office and the consultant's office for each package, taking into account short term construction period and small scale construction feature. Those mobile telephone sets can be used for emergency cases such as flood, injury, etc.

(5) Spoil bank

Spoil bank is planned at Sepatan in Tangerang region, which land has been

utilized as public dump. Hauling distance to the spoil bank from the project site is estimated at around 15 km on an average for each package.

(6) First aid, safety and security control

Public hospitals are available at the Jakarta city. In case of emergency, ambulance shall be immediately called from a hospital by using mobile telephone set of the contractor.

Safety devices shall be provided at necessary sites by the contractor's expense, and safety lecture shall be given to new laborers. The contractor shall establish safety control organization, which is subject to approval by the employer. Security control will be important to protect properties such as equipment and stocked construction materials from damage. Fencing, fire fighting and provision of night watchman shall be taken into account by the contractor.

(7) Relocation of public utilities

There are many public utilities crossing the existing drainage channel and just along the channel to be widening as shown in Tables 7.5.9 and 7.5.10. Such facilities is planned to be relocated/reconstructed under full responsibility of concerned agency or company with survey, design, selection of contractor and construction supervision. The employer shall be responsible to coordinate works between the relocation and project activities under assistance of the consultant, referring to construction time schedule and compensation schedule.

5.3 Construction Works

Outline of construction plan of major structures described herein is developed taking into account the present site conditions and assuming that the construction works will be performed by an international contractor for each package employing mechanized construction methods. On the same time, conventional construction methods are also considered taking into account capability of local labors. Construction works of river structures will be principally done from downstream part. Construction of sluiceways is done at the location where land compensation completed.

The standard cycle time for each type of structure is shown in Fig. 7.5.5.

(1) Levee and parapet wall

Levee embankment material is procured from a licensed supplier and stocked along levee to be constructed. Embankment material will be spread by a 15 ton class bulldozer and mainly compacted by a 8 ton class vibration roller. Side slope of levee will be compacted by a plate compactor or tamper. Gabion mattress at the bottom part will be installed on the riverside slope of levee during dry season. Gabion mattress installation may be continued during rainy season, if water level would be lower than the installation level. Levee embankment above pavement level shall start after all embankment works up to the pavement level are completed to avoid uneven settlement of levee embankment body. Consequently, upmost layer of gabion mattress on the slope of levee is placed in parallel with pavement works. The construction equipment to be employed for the work is listed below.

(daily work volume : up to 784 cu.m)

Equipment	Capacity	Production Rate	Nos.	Work
Bulldozer	15 t	202 cu.m/hr	1	Spreading
Vibration roller	8 t	98 cu.m/hr	1	Compaction
Plate compactor	60 kg	-	2	Compaction
Sprinkler truck	4 kl	-	1	Moist control

Dump fill type levee embankment in Tanjungan drainage channel shall provide steel sheet piles to carry out embankment work in a dry condition. Driving of steel sheet piles is carried out in water, therefore self-climbing type pile driver and crane are employed. The unit closing length of levee embankment shall be around 100 m. Therefore, total horizontal length of steel sheet piles is assumed to be 230 m long for one unit. The steel sheet piles are of type II (W=400mm) with 6 m in length (penetration : 4 m + water depth : 1.5 m + freeboard : 0.5 m). Then, required steel sheet piles shall be 575 (=230 m / 0.4 m) sheets. After driving of those steel sheet piles, dewatering in the closed area is carried out by using 2 sets of 6 inch submersible pump. During construction of levee embankment, 1 set of the pump is used for dewatering, and the other set is a stand-by unit. Immediately after driving of steel sheet piles in one unit of levee, steel sheet piles in neighboring unit shall be driven because pile driving work is the critical path for the levee construction. After construction of a unit length of levee, driven sheet piles in the unit shall be removed, and those piles are driven at neighboring section with a overlapping length of 5 m. Then, considering continuous driving of steel sheet piles, additional steel sheet piles of

250 (=5 days x 50 sheets/day) sheets are necessary during the period of dewatering and levee embankment. The construction period of the levee is scheduled for 11 months for the total length of 3,117 m in the left bank between TM 00+0m and TM 16+58m (1,454m) and in the right banks between TM 00+0m and TM 16+47m (1,442m) as well as between TM 19+0m and TM 20+80m (221m), though construction period for one unit requires for 14 workable days. In this connection, required steel sheet piles and driving equipment shall be of 2 sets by the calculation result as shown below.

Description	Calculation
Required period for 1 unit	
Pile driving	
Nos. of piles	575 sheets
Production rate	40 sheets/day
Required period	14 workable days
Construction period	
Month	11 months
Monthly workable days	24 days/month
Total workable days	264 days
Nos. of unit	
Total length of levee	3,117 lin.m
Unit length	100 lin.m
Nos. on unit	35 units
Required sets of piles and equipment	
Requirement	1.9 sets
Installation	2 sets

The construction materials and equipment to be employed for the work are listed below.

(daily work volume : up to 784 cu.m)

Equipment	Capacity	Production Rate	Nos.	Work
Bulldozer	15 t	202 cu.m/hr	1	Spreading
Vibration roller	8 t	98 cu.m/hr	1	Compaction
Plate compactor	60 kg	-	2	Compaction
Sprinkler truck	4 kl	-	1	Moist control

(for 2 units)

Description	Class	Production Rate	Nos.	Work
Steel sheet pile	type II	-	1,650	-
Self-climbing drive	-	40 sheets/day	4	Driving piles
Self-climbing crane	-	40 sheets/day	4	Supply of piles

The construction of parapet wall begins with excavation in the foundation of the parapet wall. Following that, reinforced concrete piles and steel sheet piles are

penetrated to the designated depth by a 4-5 ton class hydraulic pile driver . Parapet wall concrete is placed by a 60 m^3/hr class concrete pump car and compacted by 45 mm class flexible concrete vibrators. Power source shall be taken from a 20 kVA diesel generator set for concrete vibrators.

(1 block (= 10 m) basis)

Equipment	Capacity	Production Rate	Nos.	Work
Backhoe	0.2 cu.m	11 cu.m/hr	1	Excavation
Dump truck	8 t	4.8 cu.m/hr	3	Hauling
Bulldozer, LGP	16 t	76 cu.m/hr	1	Compaction
Pile driver	4-5 t	17 nos./day	1	Pile driving
Concrete pump car	60 cu.m/hr	36 cu.m/hr	1	Concrete placement
Concrete vibrator	45 mm	1 no. per 10 cu.m		Compaction of concrete
Diesel generator	20 kVA	-	1	Power source

(2) Revetments

Structural excavation for revetments is principally done by a 0.2 m^3 class backhoe after excavation in the channel banks. Excavated material in the drainage channel may be used for coffering structure for construction of revetments. The coffering structure shall be provided for a length of 100 m in principal. Wooden piles are penetrated by the back side of backhoe bucket after excavation finished. Masonry revetment is constructed by manual with mortar to be mixed at site by using a 0.2 m^3 class portable mixer. During construction of revetment, dewatering shall be done by 2 sets of 4-inch and 2-inch submersible pumps. The coffering structure shall remove after completion of revetment construction in each section.

(3) Concrete wall and open culvert

The construction of concrete wall in Tanjungan drainage channel is carried out in half portion of the wall at first with provision of coffering structure. After construction of the half portion, the remaining half portion of the wall shall be constructed with provision of coffering structure to guide water flow to the constructed half portion of the wall.

Open culvert in PIK Junction and Meruya drainage channels is constructed with provision of small coffer at both ends of a span during construction works in the span. Concrete placement is principally done from downstream part for a span length of 8 m.

The required equipment for the works is listed below.

(1 block (= 8 m) basis)

Equipment	Capacity	Production Rate	Nos.	Work
Backhoe	0.2 cu.m	11 cu.m/hr	1	Excavation
Dump truck	8 t	4.8 cu.m/hr	3	Hauling
Bulldozer, LGP	16 t	76 cu.m/hr	1	Compaction
Concrete pump car	60 cu.m/hr	36 cu.m/hr	1	Concrete placement
Concrete vibrator	45 mm	1 no. per 10 cu.m		Compaction of concrete
Diesel generator	20 kVA	-	1	Power source

(4) Open culvert in Saluran Cengkareng drainage channel

The construction of the open culvert having 3 lanes shall employ diversion system because of insufficient flood flow width in the existing channel. Accordingly, additional land area is required to provide the diversion channel on the left bank for whole length of the culvert. The work sequence is shown on Drawing No. *****.

The required equipment for the works is listed below.

(1 block (= 10 m) basis)

Equipment	Capacity	Production Rate	Nos.	Work
Backhoe	0.8 cu.m	45 cu.m/hr	1	Excavation
Dump truck	8 t	4.8 cu.m/hr	10	Hauling
Bulldozer, LGP	16 t	76 cu.m/hr	1	Compaction
Pile driver	4-5 t	17 nos./day	1	Pile driving
Concrete pump car	60 cu.m/hr	36 cu.m/hr	1	Concrete placement
Concrete vibrator	45 mm	1 no. per 10 cu.m		Compaction of concrete
Diesel generator	20 kVA	-	1	Power source

(5) Box culvert in Meruya drainage channel

Box culverts in Meruya drainage channel are constructed under existing roads. During construction of a box culvert, the road shall be closed, and detour way shall be clearly shown on board and by traffic control persons. The roads in Meruya area are well distributed, therefore serious traffic trouble may not occur.

For the construction of box culverts, suspension of earth pressure by employing steel sheet piles and supporting beams shall be taken into account, if the excavation height becomes more than 5 m. In case of the excavation height of less than 5m,

wooden plates and steel pipe support shall be employed to suspend earth pressure as well as to keep safety during construction activities.

Penetration depth below the excavated bottom level shall have the length of more than 3 m. The driving of those sheet piles is carried out by a 4-5 ton class hydraulic pile driver. The installation of H-shape steel beams is made by a 15 ton class truck crane. After driving of steel sheet piles, excavation in the box culvert is carried out by a 0.8 m^3 class backhoe in parallel with installation of supporting beams between steel sheet piles. The installation of wooden plates and steel supports is carried out by manual in parallel with excavation work.

Concrete in a box culvert is placed in the span length of 8 m with provision of small coffer on both the ends of the span, if casual water is observed. Ready-mix concrete is placed by a 60m^3/hr class concrete pump car and compacted by 45 mm class concrete vibrators.

The required equipment for the works is listed below.

(1 block (= 10 m) basis)

Equipment	Capacity	Production Rate	Nos.	Work
Backhoe	0.8 cu.m	45 cu.m/hr	1	Excavation
Dump truck	8 t	4.8 cu.m/hr	10	Hauling
Bulldozer, LGP	16 t	76 cu.m/hr	1	Compaction
Pile driver	4-5 t	17 nos./day	1	Pile driving
Truck crane	15 t	-	1	H-beam installation
Concrete pump car	60 cu.m/hr	36 cu.m/hr	1	Concrete placement
Concrete vibrator	45 mm	1 no. per 10 cu.m		Compaction of concrete
Diesel generator	20 kVA	-	1	Power source

(6) Drainage structures

There three (3) types of drainage structures as categorized below.

- Sluiceway having concrete conduit with provision of gate at where inland ground level is lower than the design high water level (HWL)
- Drain ditch having precast concrete ditch without provision of gate at where inland ground level is higher than the design high water level (HWL)
- Culvert having concrete box culvert without provision of gate at where inland ground level is higher than the design high water level (HWL)

The outlet sluiceway in Saluran Cengkareng drainage channel is the special type of sluiceway because of its scale having 5 lane conduits with provision of slide gates at each lane in size of 2.3 m (W) x 2.3 m (H).

Temporary coffer shall be constructed at both ends of inlet and outlet portions in principal. No temporary coffer will be provided, if no water flow would be observed. Existing water is drained by pump facilities, if enough space for water diversion cannot be provided because of limited working space. Excavation in the coffer starts and is carried out by 0.8 m^3 class backhoe for a large scale sluiceway and 0.2 m^3 class backhoe for a small scale sluiceway. In case of excavation in ditch and culvert, manual excavation is employed. Excavated material shall be hauled to the designated spoil bank by 8 ton class dump trucks. After finishing of foundation excavation in conduit, reinforced concrete piles is driven at necessary sites by employing 4-5 ton class hydraulic pile driver. Concrete in sluiceway conduit and culvert is placed by a 60 m^3/hr class concrete pump car and compacted by 45 mm class concrete vibrators. Fresh concrete will be procured by ready-mixed concrete supplier. Prior to placement of concrete in conduit, guide frame for slide gate or flap gate shall be set at right position for gated sluiceways.

The required equipment for the works is listed below.

Equipment	Capacity	Production Rate	Nos.	Work
Backhoe	0.8 cu.m	45 cu.m/hr	1	Excavation
Dump truck	8 t	4.8 cu.m/hr	10	Hauling
Bulldozer, LGP	16 t	76 cu.m/hr	1	Compaction
Pile driver	4-5 t	17 nos./day	1	Pile driving
Concrete pump car	60 cu.m/hr	36 cu.m/hr	1	Concrete placement
Concrete vibrator	45 mm	1 no. per 10 cu.m		Compaction of concrete
Diesel generator	20 kVA	-	1	Power source

(7) Bridge and approach roads

New bridge construction shall begin with removal of existing bridge by a 800 kg class hydraulic breaker. In order to keep detour way, neighboring bridges shall never be constructed on the same time. For those bridges having heavy traffic condition, temporary bridge and relocation road may be provided prior to demolition of the existing bridge.

A precast pre-stressed concrete (PC) pile is driven in the foundation of abutment or pier by employing a 4-5 ton class hydraulic pile driver as for a test piling. The pile used for the test shall employ 2 m longer than that of originally planned pile length. In accordance with the testing results, appropriate dimension of pile will be directed by the Engineer. Driving of scheduled piles will be done by same manner with test piling. After driving of piles, pile head treatment is done. If the work level would be higher than 2 m, filling with earth material will be done with compaction to erect work platform with scaffolding.

Placement of ready-mix concrete in abutments and piers is carried out by a 60 m^3/hr class concrete pump car. The placed concrete is compacted by 45 mm class concrete vibrators.

After construction of sub-structures, rubber shoes and anchors, precast concrete girders are erected by employing a 100 ton class truck crane. Following that, PC cable in a sheath is placed at both sides of bridge to introduce force to bind precast concrete girders. Ready-mix concrete in the voids between those girders is placed by employing a 60 m^3/hr class concrete pump with compaction by 45 mm class concrete vibrators. After hardening of concrete in the voids, PC tendon is introduced by using a hydraulic pump.

The construction of approach roads is progressed in parallel with the construction of superstructures of bridge. Embankment in sub-grade and pavement in sub-base and base courses are done by employing a 3.1 m class motor grader, 10-12 ton class macadam roller and 8-20 ton class tire roller. A water tanker of 4 kl class is employed for moist control of the sub-base and base course pavements.. Surface course pavement on approach roads and bridge is spread by a 2.4 m class asphalt finisher applying ready-mix asphalt and compacted by a 10-12 ton class macadam roller and 8-20 ton class tire roller.

After finishing of the construction of a bridge, temporary bridge and relocation road, if provided, shall be removed to start drainage channel works.

(Earth works)

Equipment	Capacity	Production Rate	Nos.	Work
Backhoe	0.8 cu.m	45 cu.m/hr	1	Excavation
Dump truck	8 t	4.8 cu.m/hr	10	Hauling
Bulldozer, LGP	16 t	76 cu.m/hr	1	Compaction

(Substructure works)

Equipment	Capacity	Production Rate	Nos.	Work
Pile driver	4-5 t	7-10 nos./day	1	Pile driving
Concrete pump car	60 cu.m/hr	36 cu.m/hr	1	Concrete placement
Concrete vibrator	45 mm	1 no. per 10 cu.m		Compaction of concrete
Diesel generator	20 kVA	-	1	Power source

(Superstructure works)

Equipment	Capacity	Production Rate	Nos.	Work
Truck crane	100 t	-	1	Installation of PC girder
Truck crane	15 t	-	1	General purposes

(Pavement works)

Equipment	Capacity	Production Rate	Nos.	Work
Motor grader	3.1 m	100 sq.m/day	1	Spread of base & sub-base
Macadam roller	10-12 t	100 sq.m/day	1	Comp. of base & sub-base
Macadam roller	10-12 t	1,900 sq.m/day	1	Comp. of surface
Tire roller	8-20 t	100 sq.m/day	1	Comp. of base & sub-base
Tire roller	8-20 t	1,900 sq.m/day	1	Comp. of surface
Asphalt finisher	2.4 m	1,900 sq.m/day	1	Spread of hot-mix asphalt
Water sprinkler	4 kl	-	1	Moisture control

6 CONSTRUCTION TIME SCHEDULE

The drainage channel stretches are divided into several sections for construction purpose in consideration of characteristics of compensation as well as construction orders of river structures in drainage channel and bridges.

In viewpoint of compensation, construction priority is given to the section having fewest number of households. In this sense, embankment type levee has priority over parapet type levee, because parapet wall will be constructed at the sections having dense households.

While, in viewpoint of construction purpose, construction priority is given by the criteria shown below.

- Construction of river channel structures shall be progressed toward upstream

stretch in principal.

- Revetments shall be constructed prior to the construction of levee.
- Sluiceway under revetment shall be constructed during revetment construction period.
- Sluiceway under levee shall be constructed during levee construction period.
- River structures under and around a bridge shall complete prior to commencement of the bridge construction at least for 10 m long in both the upstream and downstream parts of the bridge.
- Bridge construction in each section shall be made from downstream part in order to follow river structure construction.
- The construction periods of neighboring bridges shall not be overlapped.

The construction time schedules for Package 1 to 3 are shown on Drawings Nos. J-95-00-001 to 003, respectively, considering the above mentioned construction orders.

6.1 Construction Time Schedule for Package 1

The construction order among work sections is given below.

Section	Length (m)	Priority	Work Period
1. Kamal drainage channel (main)	4,299		
Stage I			
KM 00+0m - KM 15+0m	1,257	1	Aug. 2000 - Aug. 2003
Stage II			
KM 16+0m - KM 21+0m	312	3	Jan. 2001 - Sep. 2002
KM 21+0m - KM 26+0m	434	2	May 2001 - Jul. 2002
KM 26+0m - KM 40+32m	992	4	Jul. 2001 - Sep. 2003
KM 40+32m - KM 48+0m	542	5	Aug. 2001 - Jan. 2004
Stage III			
KM 48+0m - KM 57+0m	762	6	Jun. 2002 - Apr. 2004
2. Kamal drainage channel (branch	2,755		
KE 00+0m - KE 10+7m	626	1	Apr. 2000 - Oct. 2003
KE 10+7m - KE 21+34m	905	2	Jul. 2001 - Mar. 2004
KE 31+34m - KE 30+4m	772	3	Jan. 2002 - Feb. 2004
KE 30+4m - KE 33+0m	452	4	Nov. 2002 - Feb. 2004

No critical path works are identified in the construction time schedule, because the total construction period of 48 months does not aim at shortest completion of the works in Package 1 but considers enough compensation period and minimum inconvenience of detour ways during bridge construction.

6.2 Construction Time Schedule for Package 2

The construction order among work sections is given below.

Section	Length (m)	Priority	Work Period
1. Tanjungan drainage channel	2,610		
KM 00+0m - KM 15+0m	1,530	1	May 2003 - Oct. 2004
KM 16+0m - KM 21+0m	527	3	Jan. 2004 - Jan. 2005
KM 21+0m - KM 26+0m	553	2	Aug. 2003 - Feb. 2005
2. PIK Junction drainage channel	716		
KE 00+0m - KE 10+7m	455	1	Apr. 2003 - Mar. 2004
KE 30+4m - KE 33+0m	261	2	Apr. 2003 - Jan. 2004

No critical path works are identified in the construction time schedule. However, construction of the embankment type levee by dump fill method between TM 00 + 0m and TM 20+80m shall require careful observation , because one (1) set of self-climbing pile driver and crane can be only utilized for steel sheet pile driving work.

6.3 Construction Time Schedule for Package 3

The construction order among work sections is given below.

Section	Length (m)	Priority	Work Period
1. S. Cengkareng drainage channel	4,214		
CM 01+0m - CM 07-4m	548	3	Apr. 2004 - Sep. 2006
CM 07-4m - CM 15+0m	672	5	Aug. 2004 - Nov. 2006
CM 15+0m - CM 29+0m	1,362	2	Apr. 2004 - Sep. 2006
CM 29+0m - CM 32+101m	435	1	Apr. 2004 - Oct. 2005
CM 32+101m - CM 36-4m	57	4	Jul. 2004 - May 2006
CM 36-4m - CM 49+1m	1,140	6	Dec. 2004 - Oct. 2006
2. Gede/Bor drainage channel	1,182		
GM 00+0m - GM 03+0m	47	1	Apr. 2004 - Apr. 2005
GM 03+10m - GM 10+0m	570	2	Apr. 2004 - Dec. 2006
GM 10+0m - EP	565	3	May. 2005 - Nov. 2006
2. PIK Junction drainage channel	2,269		
MM 101+0m - MM 302+6m	520	1	Jan. 2005 - Oct. 2005
MM 302+6m - MM 310+5m	348	4	Nov. 2005 - Sep. 2006
MM 310+5m - MM 14+0m	328	3	Jul. 2005 - Oct. 2006
MM 14+0m - MM 21+46m	548	2	Feb. 2005 - Oct. 2006
MM 21+46m - EP	525	5	Nov. 2005 - Oct. 2006

No critical path works are identified in the construction time schedule.

However, construction of the open culvert in Saluran Cengkareng drainage channel between CM 02+12m and CM 05+20m shall require careful observation on the work progress, because delay of construction works in the culvert may depress the construction of bridge BCM-2 at CM 05+2m.

Tables

Table 7.5.1 STRUCTURE FEATURE IN PACKAGE 1 (1/4)

Bill No.	Structure / Location	Dimension / Work Quantities
2	DRAINAGE CHANNEL	
2.1	Drainage Channel Excvavation	Length
	Total	7,218 lin.m
	Kamal drainage channel (main)	
	BP(KM 00-62m) - KM 57+0m	4,463 lin.m
	Kamal drainage channel (branch)	
	KE 00+0m - KE 33+0m	2,755 lin.m
2.2	Levee and Inspection/relocation Road	Length
	Total	8,424 lin.m
	Kamal drainage channel (main)	6,301 lin.m
	Levee L, 01+16m-14+23m	1,223
	Levee L, 26+0m-35+141m	803
	Levee L, 45+2m-48+122m	350
	Levee R, 00+73m-14+23m	1,289
	Levee R, 16+23m-35+136m	1,538
	Levee R, 38+90m-45+2m	365
	Relocation road R. 45+2m-46+30m	101
	Inspection road R, 48+131m-57+0m	632
	Kamal drainage channel (branch)	2,123 lin.m
	Levee L, 23+0m-30+5m	766
	Levee R, 23+4m-30+5m	762
	Inspection Road R, 01+0m-10+2m	595
2.3	Concrete Parapet Wall	Length
	Total	484 lin.m
	Kamal drainage channel (main)	484 lin.m
	L, 35+141m-43+54m	484 lin.m
	Kamal drainage channel (branch)	0 lin.m
	Nothing	0 lin.m
2.4	Concrete Wall	Length
	Total	0 lin.m
	Kamal drainage channel (main)	0 lin.m
	Nothing	0 lin.m
	Kamal drainage channel (branch)	0 lin.m
	Nothing	0 lin.m
2.5	Heightening of Existing Masonry Revetment	624 lin.m
	Kamal drainage channel (main)	0 lin.m
	Nothing	0 lin.m
	Kamal drainage channel (branch)	624 lin.m
	R, 12+48m-20+36m	624 lin.m

Table 7.5.1 STRUCTURE FEATURE IN PACKAGE 1 (2/4)

Bill No.	Structure / Location	Dimension / Work Quantities
2.6 Masonry Revewtment, Type I		Length
Total		3,455 lin.m
Kamal drainage channel (main)		1,741 lin.m
w/o levee	L, 16+37m-18+13m	145 lin.m
w/levee	L, 32+61m-35+141m	288 lin.m
w/parapet	L, 35+141m-45+2m	493 lin.m
w/o levee	L, 48+93m-54+0m	288 lin.m
w/o levee	R, 35+107m-38+90m	162 lin.m
w/levee	R, 38+90m-45+2m	365 lin.m
Kamal drainage channel (branch)		1,714 lin.m
w/levee	L, 23+0m-30+5m	766 lin.m
w/o levee	R, 04+70m-10+2m	186 lin.m
w/levee	R, 23+4m-30+5m	762 lin.m
2.7 Masonry Revewtment, Type II		Length
Total		3,220 lin.m
Kamal drainage channel (main)		1,591 lin.m
	L, 18+13m-26+0m	594 lin.m
	R, 45+2m-47+71m	234 lin.m
	R, 48+0m-57+0m	763 lin.m
Kamal drainage channel (branch)		1,629 lin.m
	L, 00+8m-02+50m	176 lin.m
	L, 08+42m-23+0m	927 lin.m
	R, 00+0m-04+70m	443 lin.m
	R, 20+36m-23+4m	83 lin.m
2.8 Concrete Ditch and Culvert		Length
Total		452 lin.m
Kamal drainage channel (main)		0 lin.m
Nothing		0 lin.m
Kamal drainage channel (branch)		452 lin.m
Ditch	L, 30+5m-33+0m	452 lin.m

Table 7.5.1 STRUCTURE FEATURE IN PACKAGE 1 (3/4)

Bill No.	Structure / Location	Dimension / Work Quantities		
3	DRAINAGE FACILITIES			
3.1	Sluiceway	Conduit Lane x Width x Height x Length	Type of Gate	
	Kamal drainage channel (main)			
	SKM-1L at KM 20+16m	1no.x1.2x1.2x9.671m	Slide G.	
	SKM-2L at KM 24+35m	1no.x1.1x1.1x6.564m	Slide G.	
	SKM-3L at KM 26+2m	1no.x1.5x1.3x0.300m	Slide G.	
	SKM-4L at KM 29+19m	1no.x0.8x0.8x6.309m	Slide G.	
	SKM-5L at KM 31+56m	1no.x1.0x1.0x6.324m	Slide G.	
	SKM-6L at KM 38+3m	1no.x1.0x1.0x5.700m	Slide G.	
	SKM-7L at KM 42+7m	1no.x0.7x0.7x5.700m	Slide G.	
	SKM-8L at KM 46+35m	1no.x1.0x1.0x6.426m	Slide G.	
	SKM-1R at KM 17-20m	2nos.x1.1x1.1x4.362m	Slide G.	
	SKM-2R at KM 21+6m	1no.x1.2x1.2x4.331m	Slide G.	
	SKM-3R at KM 27+42m	1no.x1.3x1.3x4.284m	Slide G.	
	SKM-4R at KM 40+32m	1no.x0.8x0.8x3.692m	Slide G.	
	SKM-5R at KM 45+6m	1no.x0.8x0.8x5.544m	Slide G.	
	SKM-6R at KM 50+31m	1no.x0.8x0.8x5.542m	Slide G.	
	SKM-7R at KM 54-26m	1no.x1.0x1.0x6.536m	Slide G.	
	Kamal drainage channel (branch)			
	SKE-1L at KE 01+5m	1no.x0.8x0.8x0.300m	Slide G.	
	SKE-2L at KE 12-32m	1no.x.0.4x0.4x0.300m	Flap G.	
	SKE-3L at KE 13+0m	1no.x.0.4x0.4x0.300m	Flap G.	
	CKE-1L at KE 15-8m	1no.x.0.6x0.6x7.100m	-	
	DKE-1L at KE 18+54m	1no.x.0.8x0.8x3.000m	-	
	DKE-2L at KE 21-37m	1no.x.0.6x0.6x3.000m	-	
	SKE-4L at KE 25-5m	1no.x0.8x0.8x3.557m	Slide G.	
	SKE-5L at KE 31-43m	1no.x0.4x0.4x0.300m	Flap G.	
	CKE-1R at KE 01+5m	1no.x0.8x0.8x7.100m	-	
	SKE-1R at KE 21+5m	1no.x0.8x0.8x0.300m	Slide G.	
	SKE-2R at KE 25-5m	1no.x0.9x0.9x6.557m	Slide G.	
	SKE-3R at KE 31+0m	1no.x0.4x0.4x0.300m	Flap G.	

4. BRIDGE AND ROAD				
Name	Dimension	Foundation PC pile(Length x Nos.)		
	Span x Girger Nos.x Length x Width	350A	350B	400B
Kamal drainage channel (main)				
BKM-1 at KM 05-1m	3nos.x6nos.x14.9mx4.0m PC girder Road bridge w/o sidewalk	17m x 8	17m x 12	-
BKM-3 at KM 20-3m	3nos.x12nos.x13.35mx7.0m PC girder Road bridge w/sidewalk(1m x 2)	12m x 16	-	12m x 16
BKM-4 at KM 31-1m	3nos.x3nos.x13.1mx1.9m PC girder Pedestrian bridge	12m x 4	-	12m x 4
BKM-5 at KM 38-31m	4nos.x12nos.x14.15mx7.0m PC girder Road bridge w/sidewalk(1m x 2)	14m x 16	-	14m x 24
BKM-6 at KM 40+0m	3nos.x3nos.x12.15mx1.9m PC girder Pedestrian bridge	11m x 4	-	11m x 4

Table 7.5.1 STRUCTURE FEATURE IN PACKAGE 1 (4/4)

Bill No.	Structure / Location	Dimension / Work Quantities		
BKM-7 at KM 42+0m	3nos.x3nos.x12.15mx1.9m PC girder Pedestrian bridge	11m x 4	-	11m x 4
BKM-8 at KM 45-1m	3nos.x6nos.x12.9mx4.0m PC girder Road bridge w/o sidewalk	11m x 20	-	-
BKM-10 at KM 50-5m	3nos.x12nos.x11.9mx7.0m Road bridge w/sidewalk(1m x 2)	12m x 16	12m x 16	-
BKM-11 at KM 54-4m	3nos.x12nos.x11.9mx7.0m Road bridge w/sidewalk(1m x 2)	12m x 16	12m x 16	-
Kamal drainage channel (branch)				
BKE-1 at KE 01-1m	2nos.x4nos.x8.4mx2.4m PC girder Road bridge w/o sidewalk	10m x 8	-	-
BKE-2 at KE 07-24m	2nos.x6nos.x8.4mx4.0m PC girder Road bridge w/o sidewalk	11m x 12	-	-
BKE-3 at KE 10-2m	2nos.x8nos.x8.4mx5.4m PC girder Road bridge w/curb stone	12m x 6	12m x 6	-
BKE-4 at KE 12+2m	2nos.x8nos.x8.4mx5.4m PC girder Road bridge w/curb stone	13m x 6	13m x 6	-
BKE-5 at KE 14+1m	2nos.x8nos.x8.4mx5.4m PC girder Road bridge w/curb stone	13m x 6	13m x 6	-
BKE-6 at KE 15+0m	2nos.x6nos.x8.4mx4.0m PC girder Road bridge w/o sidewalk	13m x 12	-	-
BKE-7 at KE 16-2m	2nos.x8nos.x8.4mx5.4m PC girder Road bridge w/curb stone	13m x 6	13m x 6	-
BKE-8 at KE 17+6m	2nos.x3nos.x8.4mx1.9m PC girder Pedestrian bridge	13m x 4	13m x 2	-
BKE-9 at KE 18-2m	2nos.x6nos.x8.4mx4.0m PC girder Road bridge w/o sidewalk	13m x 6	13m x 6	-
BKE-10 at KE 20-2m	2nos.x8nos.x7.3mx5.4m PC girder Road bridge w/curb stone	13m x 12	-	-
BKE-11 at KE 21+2m	2nos.x6nos.x7.3mx4.0m PC girder Road bridge w/o sidewalk	12m x 12	-	-
BKE-13 at KE 23-3m	2nos.x10nos.x7.3mx7.0m PC girder Road bridge w/curb stone	12m x 8	12m x 6	-
BKE-14 at KE 25+1m	2nos.x4nos.x7.3mx2.4m PC girder Road bridge w/o sidewalk	15m x 8	-	-
BKE-15 at KE 26+1m	2nos.x4nos.x7.3mx2.4m PC girder Road bridge w/o sidewalk	18m x 8	-	-
BKE-16 at KE 26+31m	2nos.x3nos.x7.3mx1.9m PC girder Pedestrian bridge	18m x 4	18m x 2	-
BKE-17 at KE 27-36m	2nos.x3nos.x7.3mx1.9m PC girder Pedestrian bridge	18m x 4	18m x 2	-
BKE-18 at KE 28+2m	2nos.x6nos.x7.3mx4.0m PC girder Road bridge w/o sidewalk	18m x 12	-	-
BKE-19 at KE 30+3m	1no.x3.8mx4.0m In-situ slab Road bridge	16m x 6	-	-
BKE-20 at KE 32-4m	1no.x3.8mx4.0m In-situ slab Road bridge	16m x 6	-	-

Table 7.5.2 STRUCTURE FEATURE IN PACKAGE 2 (1/3)

Bill No.	Structure / Location		Dimension / Work Quantities
2	DRAINAGE CHANNEL		
2.1	Drainage Channel Excvavation		Length
	Total		3,301 lin.m
	Tanjungan drainage channel		
	TM 00+0m - EP		2,536 lin.m
	PIK Junction drainage channel		
	BP - EP		765 lin.m
2.2	Levee and Inspection Road		Length
	Total		4,026 lin.m
	Tanjungan drainage channel		4,026 lin.m
	Levee, dump fill	L, 00+0m-16+58m	1,454
	Levee	L, 18+28m-21+44m	309
	Levee, dump fill	R, 00+0m-16+47m	1,442
	Levee, dump fill	R, 19+0m-20+80m	221
	Levee	R, 20+80m-22+10m	105
	Inspection road	R, 26+29m-EP	495
	PIK Junction drainage channel		0 lin.m
	Nothing		0
2.3	Concrete Parapet Wall		Length
	Total		0 lin.m
	Tanjungan drainage channel		0 lin.m
	Nothing		0 lin.m
	PIK Junction drainage channel		0 lin.m
	Nothing		0 lin.m
2.4	Concrete Wall		Length
	Total		1,134 lin.m
	Tanjungan drainage channel		1,134 lin.m
	L-shape wall	L, 23+16m-EP	567 lin.m
	L-shape wall	R, 23+16m-EP	567 lin.m
	PIK Junction drainage channel		0 lin.m
	Nothing		0 lin.m
2.5	Heightening of Existing Masonry Revetment		Length
	Total		0 lin.m
	Tanjungan drainage channel		0 lin.m
	Nothing		0 lin.m
	PIK Junction drainage channel		0 lin.m
	Nothing		0 lin.m
2.6	Masonry Revewtment, Type I		Length
	Total		0 lin.m
	Tanjungan drainage channel		0 lin.m
	Nothing		0 lin.m
	PIK Junction drainage channel		0 lin.m
	Nothing		0 lin.m

Table 7.5.2 STRUCTURE FEATURE IN PACKAGE 2 (2/3)

Bill No.	Structure / Location	Dimension / Work Quantities
2.7 Masonry Revewtment, Type II		Length
Total		347 lin.m
Tanjungan drainage channel		347 lin.m
	L, 21+19m-23+16m	204 lin.m
	R, 21+79m-23+16m	143 lin.m
PIK Junction drainage channel		0 lin.m
Nothing		0 lin.m
2.8 Concrete Ditch and Culvert		Length
Total		765 lin.m
Tanjungan drainage channel		0 lin.m
Nothing		0 lin.m
PIK Junction drainage channel		765 lin.m
Ditch, B=2.2m	BP - EP	765 lin.m

3 DRAINAGE FACILITIES		
3.1 Sluiceway	Conduit Lane x Width x Height x Length	Type of Gate
Tanjungan drainage channel		
STM-1L at TM 25-13m	1no.x0.8x0.8x0.300m	Slide G.
STM-2L at TM 30-10m	2nos.x1.0x1.0x0.300m	Slide G.
STM-3L at TM 30+16m	1no.x0.8x0.8x0.300m	Slide G.
STM-4L at TM 33+13m	1no.x1.0x1.0x0.300m	Slide G.
STM-1R at TM 25-13m	1no.x0.8x0.8x0.300m	Slide G.
STM-2R at TM 30+3m	1no.x0.4x0.4x6.050m	Flap G.
STM-3R at TM 35+0m	1no.x0.8x0.8x5.700m	Slide G.
PIK Junction drainage channel		
SNM-1R at NM 34+0m	1no.x1.1x1.1x0.300m	Slide G.

4. BRIDGE AND ROAD				
Name	Dimension Span x Girger Nos.x Length x Width	Foundation PC pile(Length x Nos.) 350A	350B	400B
Tanjungan drainage channel				
BTM-1 at TM 10+16m	3nos.x8nos.x13.5mx5.4m PC girder Road bridge w/curb stone	17m x 12	17m x 12	-
BTM-3 at TM 25-4m	2nos.x14nos.x11.9mx8.0m PC girder Road bridge w/sidewalk(1m x 2)	13m x 16	13m x 8	-
BTM-4 at TM 30-6m	2nos.x16nos.x9.6mx11.0m PC girder Road bridge w/curb stone	12m x 10	12m x 8	-
BTM-5 at TM 33-4m	2nos.x16nos.x9.6mx11.0m PC girder Road bridge w/curb stone	11m x 10	11m x 8	-
BTM-6 at TM 35+1m	2nos.x3nos.x8.4mx1.9m PC girder Pedestrian bridge	11m x 4	11m x 2	-

Table 7.5.2 STRUCTURE FEATURE IN PACKAGE 2 (3/3)

Bill No.	Structure / Location	Dimension / Work Quantities		
PIK Junction drainage channel				
BNM-1 at NM 32-13m	1no.x2.8mx7.0m In-situ slab Road bridge	11m x 8	-	-
BNM-2 at NM 33+7m	1no.x2.8mx4.0m In-situ slab Road bridge	12m x 6	-	-
BNM-3 at NM 34-2m	1no.x2.8mx4.0m In-situ slab Road bridge	13m x 6	-	-
BNM-4 at NM 34+38m	1no.x2.8mx4.0m In-situ slab Road bridge	13m x 16	-	-

Table 7.5.3 STRUCTURE FEATURE IN PACKAGE 3 (1/5)

Bill No.	Structure / Location		Dimension / Work Quantities	
2	DRAINAGE CHANNEL			
2.1	Drainage Channel Excvavation		Length	
	Total		7,703	lin.m
	Gede/Bor drainage channel			
	BP - EP		1,203	lin.m
	Saluran Cengkareng drainage channel			
	BP - EP		4,231	lin.m
	Meruya drainage channel			
	MM 101+0m - EP		2,269	lin.m
2.2	Levee and Inspection/relocation Road		Length	
	Total		6,042	lin.m
	Gede/Bor drainage channel		265	lin.m
	Levee	L, 10+0m-12+99m	265	
	Saluran Cengkareng drainage channel		5,777	lin.m
	Inspection road	L, 07+0m-15-1m	655	
	Levee	L, 15+6m-26+108m	1,168	
	Levee	L, 29+5m-30+63m	158	
	Levee	L, 34-4m-43+83m	829	
	Levee	L, 45+0m-49+1m	315	
	Inspection road	R, 02+10m-07-4m	533	
	Levee	R, 17+65m-23+73m	570	
	Levee	R, 29-3m-43+77m	1,234	
	Levee	R, 45+0m-49+1m	315	
	Meruya drainage channel		0	lin.m
	Nothing		0	
2.3	Concrete Parapet Wall		Length	
	Total		1,285	lin.m
	Gede/Bor drainage channel		0	lin.m
	Nothing		0	
	Saluran Cengkareng drainage channel		1,285	lin.m
		L, 26+98m-27+146m	192	
		L, 30+53m-32+98m	280	
		R, 15+6m-17+75m	278	
		R, 23+63m-27+142m	535	
	Meruya drainage channel		0	lin.m
	Nothing		0	
2.4	Concrete Wall		Length	
	Total		0	lin.m
	Gede/Bor drainage channel		0	lin.m
	Nothing		0	
	Saluran Cengkareng drainage channel		0	lin.m
	Nothing		0	
	Meruya drainage channel		0	lin.m
	Nothing		0	

Table 7.5.3 STRUCTURE FEATURE IN PACKAGE 3 (2/5)

Bill No.	Structure / Location		Dimension / Work Quantities
2.5 Heightening of Existing Masonry Revetment			Length
Total			0 lin.m
Gede/Bor drainage channel			0 lin.m
Nothing			0
Saluran Cengkareng drainage channel			0 lin.m
Nothing			0
Meruya drainage channel			0 lin.m
Nothing			0
2.6 Masonry Revewtment, Type I			Length
Total			2,653 lin.m
Gede/Bor drainage channel			265 lin.m
w/levee		L, 10+0m-12+99m	265
Saluran Cengkareng drainage channel			2,388 lin.m
w/parapet wall		L, 26+83m-29+24m	235
w/parapet wall		L, 30+42m-34+16m	324
w/levee		L, 42+88m-43+83m	120
w/levee		L, 45+0m-49+1m	315
w/parapet wall		R, 15+6m-17+85m	288
w/parapet wall		R, 23+53m-29+19m	564
w/levee		R, 38+35m-40+21m	114
w/levee		R, 42+88m-43+77m	113
w/levee		R, 45+0m-49+1m	315
Meruya drainage channel			0 lin.m
Nothing			0
2.7 Masonry Revewtment, Type II			Length
Total			3,901 lin.m
Gede/Bor drainage channel			2,101 lin.m
		L, 02+0m-10+0m	600
		L, 12+99m-EP	318
		R, 02+0m-EP	1,183
Saluran Cengkareng drainage channel			1,800 lin.m
		L, 05+20m-15+26m	851
		L, 43+83m-45+0m	56
		R, 05+20m-15+6m	831
		R, 43+77m-45+0m	62
Meruya drainage channel			0 lin.m
Nothing			0

Table 7.5.3 STRUCTURE FEATURE IN PACKAGE 3 (3/5)

Bill No.	Structure / Location		Dimension / Work Quantities
2.8	Concrete Ditch and Culvert		Length
	Total		3,189 lin.m
	Gede/Bor drainage channel		0 lin.m
	Nothing		0
	Saluran Cengkareng drainage channel		391 lin.m
	Open culvert, 3-lane	02+2m-05+20m	391
	Meruya drainage channel		2,798 lin.m
	MOC-1, W=8.6mx1	101+0m-104+65m	359
	MBC-1, W=3mx2	104+65m-302+6m	161
	MBC-2, W=3mx1	302+6m-310+10m	333
	MBC-3L, W=1.5mx1	310+10m-310+5m	15
	MBC-3R, W=1.5mx1	310+10m-310+5m	15
	MOC-2L, W=1.5mx1	310+5m-15+121m	509
	MOC-2R, W=1.5mx1	310+5m-15+121m	504
	MOC-3L, W=1.25mx1	15+121m-19+6m	141
	MOC-3R, W=1.25mx1	15+121m-19+6m	167
	MOC-4L, W=2.5mx1	19+6m-21+46m	89
	MBC-4L, W=2.2mx1	21+46m-25+90m	288
	MOC-5R, W=1.2mx1	25+90m-EP	217
3	DRAINAGE FACILITIES		
3.1	Sluiceway	Conduit Lane x Width x Height x Length	Type of Gate
	Gede/Bor drainage channel		
	SGM-1L at GM 12+0m	1no.x0.8x0.8x6.607m	Slide G.
	SGM-2L at GM 14-5m	2nos.x1.0x1.0x6.704m	Slide G.
	SGM-3L at GM 15+24m	1no.x0.8x0.8x9.000m	Slide G.
	SGM-1R at GM 04+44m	1no.x0.8x0.8x0.300m	Slide G.
	DGM-2R at GM 06+13m	1no.x0.6x0.8x3.000m	-
	SGM-2R at GM 12+0m	1no.x0.8x0.8x0.300m	Slide G.
	Saluran Cengkareng drainage channel		
	SCM-1L at CM 05-5m	1no.x1.3x1.3x0.300m	Slide G.
	SCM-2L at CM 16+12m	2nos.x1.2x1.2x5.939m	Slide G.
	SCM-3L at CM 20+10m	1no.x1.0x1.0x5.958m	Slide G.
	SCM-4L at CM 27-21m	1no.x1.1x1.1x0.300m	Slide G.
	SCM-5L at CM 30+0m	1no.x1.0x1.0x4.018m	Slide G.
	SCM-6L at CM 37+30m	1no.x1.1x1.1x6.082m	Slide G.
	SCM-7L at CM 41+0m	1no.x1.1x1.1x6.118m	Slide G.
	SCM-8L at CM 47+34m	1no.x0.9x0.9x3.618m	Slide G.
	SCM-1R at CM 15-10m	1no.x1.2x1.2x0.300m	Slide G.
	SCM-2R at CM 16-4m	1no.x1.2x1.2x0.300m	Slide G.
	SCM-3R at CM 26+1m	1no.x1.0x1.0x0.300m	Slide G.
	SCM-4R at CM 30+0m	1no.x1.0x1.0x6.018m	Slide G.
	SCM-5R at CM 37+0m	1no.x1.0x1.0x4.076m	Slide G.
	SCM-6R at CM 43-30m	1no.x1.1x1.1x4.138m	Slide G.
	SCM-7R at CM 47+53m	1no.x0.8x0.8x6.617m	Slide G.
	Meruya drainage channel		
	No sluiceway		

Table 7.5.3 STRUCTURE FEATURE IN PACKAGE 3 (4/5)

Bill No.	Structure / Location	Dimension / Work Quantities		
4.	BRIDGE AND ROAD			
	Name	Dimension	Foundation PC pile(Length x Nos.)	
		Span x Girger Nos.x Length x Width	350A	350B	400B
	Gede/Bor drainage channel				
	BGM-1 at GM 02+5m	1no.x12nos.x15.8mx8.0m PC girder Road bridge w/sidewalk(1m x 1)	10m x 16	-	-
	BGM-2 at GM 03-7m	1no.x12nos.x15.8mx8.0m PC girder Road bridge w/sidewalk(1m x 1)	10m x 16	-	-
	BGM-3 at GM 04+1m	1no.x3nos.x15.8mx1.9m PC girder Pedestrian bridge w/o sidewalk	10m x 4	-	-
	BGM-4 at GM 05-2m	1no.x8nos.x15.8mx5.4m PC girder Road bridge w/curb stone	10m x 12	-	-
	BGM-5 at GM 05+43m	1no.x6nos.x15.8mx4.0m PC girder Road bridge w/o sidewalk	11m x 8	-	-
	BGM-6 at GM 06-24m	1no.x6nos.x15.8mx4.0m PC girder Road bridge w/o sidewalk	11m x 8	-	-
	BGM-7 at GM 06+5m	1no.x6nos.x15.8mx4.0m PC girder Road bridge w/o sidewalk	11m x 8	-	-
	BGM-8 at GM 07-3m	1no.x8nos.x15.8mx5.4m PC girder Road bridge w/curb stone	11m x 12	-	-
	BGM-9 at GM 10-3m	1no.x8nos.x15.8mx5.4m PC girder Road bridge w/curb stone	11m x 12	-	-
	BGM-10 at GM 11-2m	1no.x4nos.x15.8mx2.9m PC girder Road bridge w/o sidewalk	9m x 4	-	-
	Saluran Cengkareng drainage channel				
	BCM-2 at CM 05+2m	1no.x12nos.x15.8mx7.0m PC girder Road bridge w/sidewalk(1m x 2)	7m x 16	-	-
	BCM-3 at CM 07-2m	1no.x6nos.x15.8mx4.0m PC girder Road bridge w/o sidewalk	7m x 8	-	-
	BCM-4 at CM 08+1m	1no.x3nos.x14.6mx1.9m PC girder Pedestrian bridge	8m x 4	-	-
	BCM-5 at CM 12-3m	1no.x8nos.x15.8mx5.4m PC girder Road bridge w/curb stone	9m x 12	-	-
	BCM-6 at CM 15+3m	1no.x8nos.x14.1mx5.4m PC girder Road bridge w/curb stone	11m x 12	-	-
	BCM-7 at CM 19-6m	1no.x3nos.x15.8mx1.9m PC girder Pedestrian bridge	11m x 4	-	-
	BCM-8 at CM 24+42m	1no.x3nos.x12.6mx1.9m PC girder Pedestrian bridge	10m x 4	-	-
	BCM-9 at CM 27-4m	1no.x3nos.x12.6mx1.9m PC girder Pedestrian bridge	9m x 4	-	-
	BCM-10 at CM 29-4m	1no.x8nos.x14.9mx5.4m PC girder Road bridge w/curb stone	10m x 12	-	-
	BCM-11 at CM 34-10m	1no.x16nos.x13.5mx11.0m PC girder Road bridge w/curb stone	10m x 16	-	-
	BCM-12 at CM 36-10m	1no.x16nos.x13.5mx11.0m PC girder Road bridge w/curb stone	9m x 16	-	-

Table 7.5.3 STRUCTURE FEATURE IN PACKAGE 3 (5/5)

Bill No.	Structure / Location	Dimension / Work Quantities		
BCM-13 at CM 40-2m	1no.x10nos.x11.3mx7.0m PC girder Road bridge w/curb stone	8m x 8	-	-
BCM-14 at CM 45-5m	1no.x12nos.x10.5mx7.0m PC girder Road bridge w/sidewalk(1m x 2)	-	9m x 8	-
Meruya drainage channel				
BMM-1, Left	1no.x1.9mx10m			
at MM 10-5m	In-situ slab Road bridge			
BMM-2, Right	1no.x1.9mx15m		-	-
at MM 11-8m	In-situ slab Road bridge			
BMM-3, Right	1no.x1.9mx15m		-	-
at MM 12+15m	In-situ slab Road bridge			
BMM-4, Left	1no.x1.9mx15m		-	-
at MM 12+15m	In-situ slab Road bridge			
BMM-5, Left	1no.x1.9mx15m		-	-
at MM 13+8m	In-situ slab Road bridge			
BMM-6, Right	1no.x1.9mx15m		-	-
at MM 14+0m	In-situ slab Road bridge			
BMM-7, Right	1no.x1.9mx10m		-	-
at MM 15+63m	In-situ slab Road bridge			
BMM-8, Left	1no.x1.9mx10m		-	-
at MM 17-10m	In-situ slab Road bridge			
BMM-9, Left	1no.x1.6mx10m		-	-
at MM 17-8m	In-situ slab Road bridge			
BMM-10, Left	1no.x1.6mx10m			
at MM 18-7m	In-situ slab Road bridge			
BMM-11, Left	1no.x1.6mx10m			
at MM 19-12m	In-situ slab Road bridge			
BMM-12	1no.x1.6x?m			
at MM 19+2m	In-situ slab Road bridge			
BMM-13, Left	1no.x2.9x10m			
at MM 20-27m	In-situ slab Road bridge			
BMM-14, Left	1no.x2.9x10m			
at MM 21+2m	In-situ slab Road bridge			
BMM-15, Right	1no.x1.6mx10m			
at MM 26+8m	In-situ slab Road bridge			
BMM-16, Right	1no.x1.6mx10m			
at MM 27+52m	In-situ slab Road bridge			

Table 7.5.4 MONTHLY REINFALL AT SOEKARNO-HATTA INTERNATIONAL AIRPORT
FOR RECENT 10 YEARS FROM 1986 TO 1995

MONTH	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Average*1	Average *2
JAN.	512.2	626.9	281.2	209.0	508.7	346.0	388.5	485.7	433.9	395.9	418.8	417.5
FEB.	368.3	367.0	229.9	386.3	173.1	294.6	156.0	343.7	367.1	282.9	296.9	280.5
MAR.	195.0	103.7	106.1	153.2	71.7	196.6	241.5	79.8	266.8	195.1	161.0	152.3
APR.	149.4	108.2	71.4	68.4	105.5	225.9	111.2	112.1	141.0	125.1	121.8	105.6
MAY	77.0	87.8	276.5	207.6	159.2	22.8	150.7	74.5	33.9	98.8	118.9	151.1
JUN.	24.2	10.4	67.2	41.8	56.4	29.8	77.6	52.4	40.4	115.6	51.6	56.2
JUL.	91.3	68.0	17.4	50.7	123.7	25.0	35.6	41.2	0.0	112.8	56.6	71.4
AUG.	267.0	0.0	50.4	3.9	153.2	9.7	113.7	60.3	0.0	18.1	67.6	86.6
SEP.	116.1	4.4	17.3	63.2	57.4	0.0	87.5	37.3	0.0	48.6	43.2	56.4
OCT.	58.0	5.8	97.2	30.4	35.3	6.4	88.4	71.3	1.0	102.5	49.6	59.7
NOV.	111.9	81.1	45.7	32.1	40.1	89.7	122.6		102.7	248.9	97.2	97.5
DEC.	237.4	273.8	312.6	283.5	328.1	114.7	277.9	179.5	55.1	239.5	230.2	279.0
TOTAL	2,207.8	1,737.1	1,572.9	1,530.1	1,812.4	1,361.2	1,851.2		1,441.9	1,983.8	1,713.4	1,813.8

NOTE : *1 ; Monthly average rainfall except missing month's data

*2 ; Monthly average rainfall only on the hatched years (Omit the years having less annual rainfall than 1,500 mm for construction purpose)

Rain distribution : Rainy season ; from November to April												
Rainy	1,574.2	1,560.7	1,046.9	1,132.5	1,227.2	1,267.5	1,297.7		1,366.6	1,487.4	1,325.9	1,332.4
Dry	633.6	176.4	526.0	397.6	585.2	93.7	553.5		75.3	496.4	387.5	481.2
Ratio in rainy	0.71	0.90	0.67	0.74	0.68	0.93	0.70		0.95	0.75	0.77	0.74

Table 7.5.5 RAIFALL DATA AT SOEKARNO-HATTA INTERNATIONAL AIRPORT (1/10)

YEAR : 1986

Day	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1		7.5									6.2	
2	0.8		110.3	31.3				2.5				
3	9.0	2.4	1.2	2.2				7.2			18.7	
4	1.1		15.0	15.8		0.5			4.5		4.7	1.2
5	3.4	0.2		46.2				26.0		2.4	6.9	
6			14.0					41.8			1.2	
7	7.8		8.1		8.6				5.4		1.1	
8	28.8		3.4					12.3	47.0		0.5	
9		20.5	0.3	2.0			28.4					0.2
10		4.0		4.6		6.2			18.4		3.7	
11		132.6		7.4		5.1		36.6	0.3	0.4	6.3	
12	4.8	4.5				1.3			0.2	25.7		
13	4.4	16.5	1.0		4.2			76.6			22.7	39.9
14	24.1	19.8					22.5	22.8				78.8
15	31.6	45.1	11.7			4.6	0.2		1.4			47.8
16		6.3				0.8	0.3	41.2	13.7			40.8
17	7.6	3.4										
18	1.9			1.6		0.6						
19	20.4			0.4								
20	6.1						0.6		4.1			
21	15.8		2.4				2.1		0.3			0.4
22	16.2			5.6						3.2		0.6
23	15.6	12.6	4.6	5.6					13.7	0.5		
24	1.3	46.2	0.8		58.4	1.8	0.3		2.5		11.7	5.2
25	32.4			4.7					2.9	3.3	8.2	
26	53.6	2.0	0.2						1.7	5.1		14.8
27	28.6	44.7	22.0				32.0			2.6	2.1	
28	184.6					2.4	3.1			13.0	16.2	
29	12.3			22.0			1.8				1.7	
30					5.8	0.9				1.6		
31										0.2		7.7
Total	512.2	368.3	195.0	149.4	77.0	24.2	91.3	267.0	116.1	58.0	111.9	237.4
Annual	2,207.8											

Table 7.5.5 RAIFALL DATA AT SOEKARNO-HATTA INTERNATIONAL AIRPORT (2/10)

YEAR : 1987

Day	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	3.6	0.4	35.0				1.1				11.0	
2	188.8	31.1	13.3	6.3			26.0			5.8		0.2
3	12.8	1.0	0.7		4.4	0.2					4.0	
4	5.3	1.8			4.0							
5	68.0	1.2			0.4							2.4
6	2.7	1.8		45.0		10.2						
7	9.4	23.6		0.5								28.0
8	2.6	118.3			0.2						4.3	
9	6.0	13.1	0.3		23.2						34.0	2.5
10	25.4	1.1	10.0		0.2		13.7				0.6	13.0
11	11.2	19.2										
12	6.1											
13	5.8			5.0								20.8
14	5.2	40.0									8.4	19.0
15	48.0	0.7										70.4
16		7.5		1.3								1.1
17	27.6	2.7	7.8				27.2					21.1
18	1.5			3.2							16.0	12.4
19	2.6	27.4		6.1								17.0
20	0.4	22.2	0.5									8.1
21	2.0	3.7		1.3								22.9
22	40.0	0.2	4.5									1.1
23	4.1	24.1	12.4									19.8
24	21.0	4.3	1.2	23.2							2.8	
25	38.5											
26	47.6	7.2										
27	6.2	4.4	8.2									
28	7.6	10.0		16.3	55.4							
29	24.2		9.8						0.6			
30	2.7								3.8			
31												14.0
Total	626.9	367.0	103.7	108.2	87.8	10.4	68.0	0.0	4.4	5.8	81.1	273.8
Annual	1,737.1											

Table 7.5.5 RAIFALL DATA AT SOEKARNO-HATTA INTERNATIONAL AIRPORT (3/10)

YEAR : 1988

Day	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	8.8	22.7		6.8	0.8	18.5						
2		3.8	12.2	15.2	71.2	30.0						0.6
3		4.6			13.5					4.7		
4	2.0	46.7	42.4					0.2				
5	0.3	15.0						5.8				
6						2.3					0.6	
7		1.4			5.3	6.3	3.3	4.2			1.9	
8		28.0	13.2			6.9						7.4
9		12.2	1.7			1.2		2.3				0.3
10	100.8	38.0			18.2							2.7
11	6.0	1.2							6.3			0.4
12		9.7			9.3						5.8	7.0
13	2.9	4.2		26.6	2.2			1.1	7.4		2.9	26.9
14	5.1							11.4		13.9		42.6
15		10.2					14.1			3.8		7.3
16		2.3		0.5						2.4	1.3	21.0
17	3.7	0.5	5.1		2.0	0.2				12.9	1.6	14.8
18	2.4	26.9				1.8				15.9	2.2	57.5
19	1.1				56.4					10.9		0.9
20	12.8		0.4	0.5				22.4		0.3		86.7
21	10.7		1.4					1.6		1.8	6.5	0.7
22	1.0		2.6							22.7		14.2
23	14.1	2.5	2.1		56.5							
24	4.3		3.8		32.3			0.8			0.6	
25	0.6		1.7					0.6			2.9	1.8
26	0.4				6.7						15.1	
27	3.9								3.6			
28	9.7		0.9	0.6							1.3	1.9
29	43.2		5.6	21.2	0.5						0.6	12.2
30	0.8				1.6					6.5	2.4	2.5
31	46.6		13.0							1.4		3.2
Total	281.2	229.9	106.1	71.4	276.5	67.2	17.4	50.4	17.3	97.2	45.7	312.6
Annual	1,572.9											

Table 7.5.5 RAIFALL DATA AT SOEKARNO-HATTA INTERNATIONAL AIRPORT (4/10)

YEAR : 1989

Day	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1		6.4	2.8		1.0	0.6				3.2		11.0
2		0.5			4.7						6.0	7.2
3	6.1	53.4			6.9	13.2	0.5					
4	18.4	7.6		0.4		0.8						2.2
5	24.2	28.0	2.4	2.4				0.3				
6		17.4			12.4							2.9
7	4.2	12.3			39.0		3.6					12.3
8		4.6	27.0	8.3	15.6			2.1				29.1
9	14.6	4.0	30.8	6.4	8.0				50.0		8.2	
10			6.6	7.8			0.3		1.6			1.6
11		15.8	2.2	7.0								40.6
12	3.0	1.6	2.6				21.8					85.9
13		31.2	12.0	4.3								11.4
14		7.4		1.8	1.8	6.4	7.0					3.3
15		8.3	3.0		2.2					1.1	2.1	6.1
16		1.8									2.0	
17		9.4		0.8								17.8
18		11.1			0.3		2.4					2.6
19		22.5	1.2		33.4				11.6			
20		1.0	17.2	10.8	0.4			1.1		1.4		4.3
21	13.8	70.6									4.9	
22	56.3	12.0					0.4					
23	13.5	8.9	2.7			14.2						
24	20.0	9.2			1.1		12.2				0.5	
25	13.3	14.3				2.6					2.0	5.6
26	1.3	27.0	1.5	14.6						0.8		0.8
27	15.6		0.7			0.7	0.7			23.1	5.0	2.6
28			0.5	3.0		3.3	1.8					
29					2.8			0.4		0.8	0.3	2.2
30				0.8	78.0						1.1	
31	4.7		40.0									34.0
Total	209.0	386.3	153.2	68.4	207.6	41.8	50.7	3.9	63.2	30.4	32.1	283.5
Annual	1,530.1											

Table 7.5.5 RAIFALL DATA AT SOEKARNO-HATTA INTERNATIONAL AIRPORT (5/10)

YEAR : 1990

Day	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1		7.2					3.0					
2	0.8	5.8	6.8	4.6				3.6		0.8	1.8	24.0
3	1.8	1.1	20.3	1.0								8.3
4	1.5		7.9								0.7	12.8
5	21.6	35.6				15.7	38.0					1.0
6	35.3	17.7			3.7	2.5	0.7					4.8
7	0.2	0.5	0.4	2.9					2.0		7.3	6.7
8	0.1				1.7			43.3	55.0			13.2
9	7.4		3.7				3.0	7.1				9.4
10	40.6		5.7									
11	35.0											48.3
12	1.8	3.3			33.3			0.6				
13	9.4			2.9	0.8	0.7						
14	7.1				2.8		0.3	23.1			4.0	
15	2.2											
16	6.2	4.0	0.7		3.7	5.0						
17	0.3	19.2	5.2	3.5								
18	34.2		15.8	0.2			6.6	0.1			0.3	
19	8.1	11.0					0.2				0.8	1.7
20	24.1	0.9		2.0			0.9	1.8		3.0		
21	69.9			26.8		0.4	38.7		0.4			1.6
22	34.7					1.4		1.0			11.0	13.8
23	15.2					29.2					14.0	2.9
24	2.6	6.8		3.2	2.0			29.1		3.2		7.4
25	3.4	28.4		16.2	56.2			19.0				
26	11.1	25.5	2.9	4.0	2.3	0.4	7.0					5.7
27	83.0	6.1	2.3	12.2	1.5	0.5		3.3				59.9
28	41.6			26.0				14.0		8.8		26.1
29					49.0	0.6		0.4		19.2		77.5
30	1.8				1.4		24.9	6.8			0.2	2.0
31	7.7				0.8		0.4			0.3		1.0
Total	508.7	173.1	71.7	105.5	159.2	56.4	123.7	153.2	57.4	35.3	40.1	328.1
Annual	1,812.4											

Table 7.5.5 RAIFALL DATA AT SOEKARNO-HATTA INTERNATIONAL AIRPORT (6/10)

YEAR : 1991

Day	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	2.9	20.9		8.8								8.9
2		6.6		4.6								18.7
3		18.2										
4		23.9		0.2				9.7			51.7	4.0
5	16.3	35.2	14.3		15.2						2.4	
6	5.2	15.8		49.1	2.7							1.6
7	33.6										13.2	3.0
8	16.1	19.1			2.6							0.8
9	31.2	0.7			2.3	0.2					1.8	4.7
10	16.0	0.9		2.0								0.6
11				0.7							7.5	23.6
12	3.6					3.5					0.4	
13	21.1										1.0	
14	13.2	0.9		3.1							5.2	
15	16.4	0.3	90.0	8.2								1.0
16	12.2	90.2	0.2	20.8		24.2						
17	57.6	7.6	17.0	17.1		1.9						
18	19.3	4.9										
19	0.2	2.6	0.5	11.0								
20	7.4	5.3	13.1									
21		5.4	21.3	32.2								28.0
22	0.8	4.8										
23	10.8	6.6	19.4								3.5	
24	1.6	15.9		10.1							2.4	
25	2.7	8.8									0.6	6.7
26	4.5		0.3									0.2
27	20.0											0.5
28	11.0											6.1
29	17.7		8.6									
30	4.0		7.6	58.0						6.4		
31	0.6		4.3									6.3
Total	346.0	294.6	196.6	225.9	22.8	29.8	0.0	9.7	0.0	6.4	89.7	114.7
Annual	1,336.2											

Table 7.5.5 RAIFALL DATA AT SOEKARNO-HATTA INTERNATIONAL AIRPORT (7/10)

YEAR : 1992

Day	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1		30.0	28.4				1.0			14.2	11.0	108.3
2	7.6	0.3		48.1		0.6			1.5	3.0	5.4	72.4
3				0.2		39.0	6.0		36.1	4.0		0.2
4	6.6				14.2			6.2		5.2		2.7
5					3.2	16.2			5.2	2.0		11.0
6		13.0			3.0					6.4		
7	10.3	0.6		2.7		1.2				12.0		
8		0.4			50.3					10.7	14.8	0.8
9		2.0				0.2		9.2		0.6	20.8	16.0
10	60.1		3.6		19.0				0.3		3.5	3.0
11	3.8	10.0	7.2	4.6	3.7							1.0
12	49.2	16.4	15.8	3.1	5.1	3.2	13.0			3.2	0.6	0.7
13	17.6		0.4	5.4	0.3		15.3			3.6		6.2
14	8.4	0.4	4.0		1.1	1.7				1.2		4.0
15	1.2		57.5		23.3	4.4						2.0
16			1.2								0.3	
17									14.0		2.2	
18										3.2	22.0	
19			29.4			0.8				0.3		
20	75.3								13.6		7.0	0.2
21	2.2	5.7	0.2	37.8							7.7	
22	0.3	18.4			23.3			8.0				
23	115.9	20.2	0.2								4.0	
24	19.1		30.9	0.7		1.1		9.5		5.6		
25		4.2	28.5						16.8			3.6
26		23.9				9.2		11.0		6.1	2.3	
27		1.3						2.8				
28	7.8	2.2	20.8	8.6				66.8			1.0	2.6
29	1.8	7.0	10.3				0.3			1.1	7.1	0.1
30			2.8		4.2					6.0	12.9	4.0
31	1.3		0.3					0.2				39.1
Total	388.5	156.0	241.5	111.2	150.7	77.6	35.6	113.7	87.5	88.4	122.6	277.9
Annual	1,851.2											

Table 7.5.5 RAIFALL DATA AT SOEKARNO-HATTA INTERNATIONAL AIRPORT (8/10)

YEAR : 1993

Day	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	19.8	2.4	3.7		4.0			39.0		2.0		
2		5.8										
3	0.8	17.3										15.0
4		12.2			12.2	0.5						1.0
5		17.4			36.6		8.2	0.6				
6	56.0	80.6	8.0	7.2			2.7	5.3				
7	27.0	136.3		2.7		7.1		0.8	5.3			
8	6.2	2.9	8.8		0.4	0.6						
9	101.2		2.6	2.3	0.3							
10	6.7				5.1							
11	4.2				7.3				1.4			1.8
12	47.0	9.0		8.8		15.0						4.0
13	5.0									13.2		
14				1.4				10.0		4.0		
15						9.6				50.2		
16				7.5		18.0	0.6					16.7
17	0.8	27.7						1.0				
18	0.5		1.3									
19	41.6			1.2		1.6						
20		14.8			0.7		0.7		17.7			11.4
21	3.8	1.2	12.2		7.9		0.4		0.3			
22	2.4	2.1	17.2	9.6								39.4
23		14.0		16.9								19.3
24	29.5			0.5						0.3		20.5
25	22.0		4.0									5.2
26	10.2		6.4	20.5								12.4
27	6.4			0.4				3.6		1.0		
28	27.8		11.4				10.2		12.2	0.6		0.3
29	38.8			7.1					0.4			3.0
30	18.6			26.0								28.4
31	9.4		4.2				18.4					1.1
Total	485.7	343.7	79.8	112.1	74.5	52.4	41.2	60.3	37.3	71.3		179.5
Annual												

Table 7.5.5 RAIFALL DATA AT SOEKARNO-HATTA INTERNATIONAL AIRPORT (9/10)

YEAR : 1994

Day	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	2.2	5.8	31.5									
2	13.4	23.8	4.3	12.5							25.2	
3	17.1		5.3	15.6								
4			4.0	18.1								0.7
5	57.9	11.0	5.0									1.6
6	15.6	16.2			0.4							0.9
7	66.8	8.0				2.6						
8	9.0		2.0			0.4						3.1
9			4.0									0.9
10			26.9		20.9							13.0
11												
12		6.8	7.4									
13	11.3		26.0							1.0		
14	5.0	28.7		19.7							3.2	3.0
15	27.4	4.5		2.1		27.0						7.2
16	1.0		48.2			9.2					0.4	16.0
17	0.5	0.4		3.6								1.3
18	3.2											
19	37.6			5.0		1.2						
20	4.8	1.3	1.4	18.9							5.4	2.1
21	14.9		4.4	31.1								5.3
22	0.4		19.6	2.7								
23	9.1		44.8									
24	17.4	85.3		1.2							8.3	
25	29.8	4.7	1.6	9.5							12.7	
26	21.6	57.8		1.0								
27	3.8	27.8									6.3	
28	1.0	85.0	24.2									
29			6.0								41.2	
30	18.9				12.6							
31	44.2		0.2									
Total	433.9	367.1	266.8	141.0	33.9	40.4	0.0	0.0	0.0	1.0	102.7	55.1
Annual	1,441.9											

Table 7.5.5 RAIFALL DATA AT SOEKARNO-HATTA INTERNATIONAL AIRPORT (10/10)

YEAR : 1995

Day	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1		50.2	43.5	7.0								1.0
2	2.8	21.4	1.4		21.3		1.2					
3	18.4	1.0	30.8	8.1	1.1			17.7	18.2		1.5	
4		1.4	9.0	35.4	1.2		3.8			4.0	1.7	
5	0.7	0.8	8.1	20.2	0.1		7.0					
6	18.4	2.2	1.8	17.4				0.2				7.0
7	3.9	22.4	8.1	2.0		11.4	76.2					27.7
8		49.8	0.6		4.4		1.4	0.2			4.3	9.0
9	9.7	23.0	0.8	9.1						38.0	4.0	6.1
10	3.0	14.2	10.0		38.0				4.8	36.2		1.0
11	56.8						4.3				17.6	1.7
12	2.0				0.4		4.7				59.5	65.6
13	76.9	0.4	7.3			0.2					4.1	36.8
14	11.9	0.6	3.2								69.7	2.0
15	35.8		10.0							5.1		
16	1.6	0.4	33.9	2.8							5.8	
17	27.4	45.4		1.2		24.8				2.0	2.3	
18	12.3	3.2	0.6		25.2	9.9						
19	13.0		1.5			1.3	14.2				16.0	
20	19.4					0.3						
21			1.5	19.7		1.8			0.7			
22		11.4	1.2		7.1	36.8						
23	2.8	0.4	2.6	2.2								
24	12.1								22.4	0.4	11.0	
25	3.1		12.2							1.6		1.5
26										0.6	9.4	10.1
27	6.3	26.4									29.5	
28	24.9	8.3				21.6				6.6	9.7	
29	15.8					4.3			2.5		2.8	4.1
30	11.3					3.2						39.7
31	5.6		7.0							8.0		26.2
Total	395.9	282.9	195.1	125.1	98.8	115.6	112.8	18.1	48.6	102.5	248.9	239.5
Annual	1,983.8											

Table 7.5.6 ANNUAL AVERAGE RAINFALL DAYS

RAINFALL DAYS FOR OBJECTED YEARS FROM 1986 TO 1995

Rainfall Range*	Month											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
0 to 5	114	120	166	173	183	190	196	192	193	191	172	149
5 to 10	30	21	20	15	9	7	5	8	4	12	17	17
10 to 20	30	21	14	9	6	7	6	6	8	9	14	20
20 to 30	13	20	7	7	5	4	6	5	1	3	4	11
30 to 50	17	11	8	6	6	2	3	4	3	2	1	10
50 over	13	5	2	0	8	0	1	2	1	0	2	10

Note : * ; Rainfall range is shown in the unit of mm/day.
Example : more than 30 mm/day up to 50 mm/day

AVERAGE RAINFALL DAYS FOR OBJECTED YEARS FROM 1986 TO 1995

Rainfall Range*	Month											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
0 to 5	16.3	17.1	23.7	24.7	26.1	27.1	28.0	27.4	27.6	27.3	24.6	21.3
5 to 10	4.3	3.0	2.9	2.1	1.3	1.0	0.7	1.1	0.6	1.7	2.4	2.4
10 to 20	4.3	3.0	2.0	1.3	0.9	1.0	0.9	0.9	1.1	1.3	2.0	2.9
20 to 30	1.9	2.9	1.0	1.0	0.7	0.6	0.9	0.7	0.1	0.4	0.6	1.6
30 to 50	2.4	1.6	1.1	0.9	0.9	0.3	0.4	0.6	0.4	0.3	0.1	1.4
50 over	1.9	0.7	0.3	0.0	1.1	0.0	0.1	0.3	0.1	0.0	0.3	1.4

Table 7.5.7 CALCULATION OF WORKABLE DAYS

EXCAVATION	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Monthly days	31	28	31	30	31	30	31	31	30	31	30	31	365
Holidays	5	6	6	5	5	6	5	6	4	4	5	5	62
Rainy days	13.6	9.7	5.3	3.7	5.2	2.1	2.6	3.1	2.0	2.2	3.4	9.4	62.3
Unworkable days	11.4	7.6	4.3	3.1	4.4	1.7	2.2	2.5	1.7	1.9	2.8	7.9	51.5
Workable days	15	14	21	22	22	22	24	23	24	25	22	18	252
Modified workable days	18	18	18	18	24	24	24	24	24	24	18	18	252

FILLING	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Monthly days	31	28	31	30	31	30	31	31	30	31	30	31	365
Holidays	5	6	6	5	5	6	5	6	4	4	5	5	62
Rainy days	19.1	13.5	8.7	6.2	6.9	3.2	3.5	4.5	2.8	4.0	5.8	12.5	90.7
Unworkable days	16.0	10.6	7.0	5.2	5.8	2.6	2.9	3.6	2.4	3.5	4.8	10.5	74.9
Workable days	10	11	18	20	20	21	23	21	24	24	20	16	228
Modified workable days	16	16	16	16	22	22	22	22	22	22	16	16	228

CONCRETE	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Monthly days	31	28	31	30	31	30	31	31	30	31	30	31	365
Holidays	5	6	6	5	5	6	5	6	4	4	5	5	62
Rainy days	6.2	5.2	2.4	1.9	2.7	0.9	1.4	1.6	0.6	0.7	1.0	4.4	29.0
Unworkable days	5.2	4.1	1.9	1.6	2.3	0.7	1.2	1.3	0.5	0.6	0.8	3.7	23.9
Workable days	21	18	23	23	24	23	25	24	26	26	24	22	279
Modified workable days	23	23	23	23	23	23	23	23	23	23	23	23	276

PILING	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Monthly days	31	28	31	30	31	30	31	31	30	31	30	31	365
Holidays	5	6	6	5	5	6	5	6	4	4	5	5	62
Rainy days	4.3	2.3	1.4	0.9	2.0	0.3	0.5	0.9	0.5	0.3	0.4	2.8	16.6
Unworkable days	3.6	1.8	1.1	0.8	1.7	0.2	0.4	0.7	0.4	0.3	0.3	2.3	13.6
Workable days	22	20	24	24	24	24	26	24	26	27	25	24	290
Modified workable days	24	24	24	24	24	24	24	24	24	24	24	24	288

Table 7.5.8 PRODUCTION OF EQUIPMENT (1/4)

Amount of bulking as % of original volume

Material	Bulking factor				
	L	C	1/L	1/C	C/L
Sand	1.15	0.90	0.870	1.111	0.783
Gravel	1.15	0.90	0.870	1.111	0.783
Clayey soil	1.35	0.90	0.741	1.111	0.667
Clayey	1.35	0.90	0.741	1.111	0.667

1.Bulldozer, LGP 16 t Dozing

Q = 60 x Q1 x E x F / CM

Where,
- Q ; Hourly production (m3/hr)
- Q1 ; Mouldboard capacity (m3)
- E ; Job-management factor
- F ; Soil conversion factor
- CM ; Cycle time (min.)

Material	Q1	E	F	CM	Q
(Bank measurement)			(1/L)		
Earth	2.67	0.70	0.741	1.09	76
(Embankment measurement)			(C/L)		
Earth	2.67	0.70	0.667	1.09	69

2.Bulldozer, LGP 16 t Spreading

Q = W x V x D x E x F / N1

Where,
- Q ; Hourly production (m3/hr)
- W ; Effective spreading width (m)
- V ; Working speed (m/hr)
- D ; Work distance (m)
- E ; Job-management factor
- F ; Soil conversion factor
- N1 ; Passing time (time)

Material	W	V	D	E	F	N1	Q
(Bank measurement)					(1/C)		
Earth	3.84	2,000	0.30	0.70	1.111	6	299
(Embankment measurement)					(1/1)		
Earth	3.84	2,000	0.30	0.70	1.000	8	202

Table 7.5.8 PRODUCTION OF EQUIPMENT (2/4)

3.Backhoe 0.2 m3 Loading

Q = 3600 x Q1 x B x E x F / CM

Where,
- Q ; Hourly production (m3/hr)
- Q1 ; Mouldboard capacity (m3)
- B ; Coefficient of bucket
- E ; Job-management factor
- F ; Soil conversion factor
- CM ; Cycle time (sec.)

Material	Q1	B	E	F	CM	Q
(Bank measurement)				(1/L)		
Earth	0.2	0.70	0.70	0.741	23	11
(Embankment measurement)				(C/L)		
Earth	0.2	0.70	0.80	0.667	23	12

4.Backhoe 0.8 m3 Loading

Q = 3600 x Q1 x B x E x F / CM

Where,
- Q ; Hourly production (m3/hr)
- Q1 ; Mouldboard capacity (m3)
- B ; Coefficient of bucket
- E ; Job-management factor
- F ; Soil conversion factor
- CM ; Cycle time (sec.)

Material	Q1	B	E	F	CM	Q
(Bank measurement)				(1/L)		
Earth	0.8	0.70	0.70	0.741	23	45
(Embankment measurement)				(C/L)		
Earth	0.8	0.70	0.80	0.667	23	47

5.Dump truck 8 t Hauling

Q = 60 x Q1 / VW x E x F / CM

Where,
- Q ; Hourly production (m3/hr)
- Q1 ; Maximum loading weight (ton)
- VW ; Unit weight of bank (ton/m3)
- B ; Loading factor of vessel
- E ; Job-management factor
- F ; Soil conversion factor
- CM ; Cycle time (min.) = T1 + T2 + D / VH + D / VR

Table 7.5.8 PRODUCTION OF EQUIPMENT (3/4)

$$CM = T1 + T2 + (D - 100) / VH + (D - 100) / VR + 200 / VP$$

Where, T1 ; Net loading time by loader (min.)
T2 ; Spotting time (min.)
D ; Hauling distance (m)
VH ; Hauling speed (m/min.)
VR ; Return speed (m/min.)
VP ; Speed in pit (m/min.)

CM ; cycle time

Distance	T1	T2	VH	VR	VP	CM
500 m	4.00	1.7	333	417	250	8.66
1,000 m	4.00	1.7	500	583	250	9.84
1,500 m	4.00	1.7	500	583	250	11.70
2,000 m	4.00	1.7	500	583	250	13.56
2,500 m	4.00	1.7	500	583	250	15.42
3,000 m	4.00	1.7	500	583	250	17.27
3,500 m	4.00	1.7	500	583	250	19.13
15,000 m	4.00	1.7	583	667	250	54.40

Q ; Hourly production

Distance	Q1	VW	E	F	CM	Q
500 m	8	1.65	0.9	1.00	8.66	30.2
1,000 m	8	1.65	0.9	1.00	9.84	26.6
1,500 m	8	1.65	0.9	1.00	11.70	22.4
2,000 m	8	1.65	0.9	1.00	13.56	19.3
2,500 m	8	1.65	0.9	1.00	15.42	17.0
3,000 m	8	1.65	0.9	1.00	17.27	15.2
3,500 m	8	1.65	0.9	1.00	19.13	13.7
15,000 m	8	1.65	0.9	1.00	54.40	4.8

6. Vibrating roller 8 t Compacting of filter

$$Q = V \times B \times D \times E \times F / N$$

Where, Q ; Hourly production (m3/hr)
V ; Working speed (m/hr)
B ; Effective spreading width (m)
D ; Compaction depth (m)
E ; Job-management factor
F ; Soil conversion factor
N ; Passing time (time)

Table 7.5.8 PRODUCTION OF EQUIPMENT (4/4)

Material	V	B	D	E	F	N	Q
(Embankment measurement)					(1/1)		
Earth	2,000	1.40	0.30	0.70	1.000	6	98

7. Concrete pump car 60m3/hr Placement of concrete

Q = Q1 x E

Where, Q ; Hourly production (m3/hr)
Q1 ; Nominal hourly production (m3/hr)
E ; Job-management factor

Site	Q1	E	Q
At any sites	60	0.6	36

8. Hydraulic pile driver 4-5 ton Pile driving

Td = a x Ta

Where, Td ; Total time for driving of 10 piles (day/10 nos.)
a ; Coefficient of foundation depends on N-value
Ta ; Driving time per 10 piles (day/10 nos.)

Material	a	Ta	Td
Steel sheet pile, L<10m	1.00	0.2	0.2
RC, L<11m	1.00	0.3	0.3
PC, L<12m	1.00	1.0	1.0
PC, L<22m	1.00	1.5	1.5

9. Self-climbing pile driver Pile driving

Td = a x Ta

Where, Td ; Total time for driving of 10 piles (day/10 nos.)
a ; Coefficient of foundation depends on N-value
Ta ; Driving time per 10 piles (day/10 nos.)

Material	a	Ta	Td
Steel sheet pile, L=6m	0.60	0.3	0.2

Table 7.5.9 SUMMARY OF PUBLIC UTILITIES TO BE RELOCATED/RECONSTRUCTED

No.	Structure		Unit	Work	Relate Agency	Kamal		Tanjungan	PIK	Cengkareng	Gede/bor	Meruya	Total
						(KM)	(KE)	(TM)	(NM)	(CM)	(GM)	(MM)	
1-6	Bridge	Gate	nos.	Reconstruction	Local Govern.						1		1
3-1	Electric pole	Concrete, Left bank	nos.	Relocation	PT. PLN	1		2		4	13	4	24
3-2		Concrete, Right bank	nos.	Relocation		11		1		2		14	28
3-3		Steel, Left bank	nos.	Relocation		1	1	2		1	1	2	8
3-4		Steel, Right bank	nos.	Relocation		11	2	9		1		8	31
4-1	Electric cable	Cable & duct	lane	Reconstruction	PT. PLN	12	3	5		10	10	1	41
4-2		Steel girder	nos.	Reconstruction		4		1		2	1		8
6-1	Telephone pole	Concrete, Left bank	nos.	Relocation	Telkom							4	4
6-3		Steel, Left bank	nos.	Relocation			4				4	22	30
6-4		Steel, Right bank	nos.	Relocation						2		8	10
7-1	Telephone line	Steel pipe duct	nos.	Reconstruction	Telkom	3	8	2		2	4	1	20
7-2		Concrete duct	nos.	Reconstruction		1					1		2
7-3		Steel girder	nos.	Reconstruction		2					1		3
7-4		Manhole&conduit	nos.	Reconstruction								3	3
8	Water tank	Steel	nos.	Reconstruction	PAM JAYA	1							1
9	Water pipe	Steel pipe	nos.	Reconstruction	PAM JAYA					2	2		4
10	Gas pipe line		nos.	Reconstruction	Perum Gas			1					1

Table 7.5.10 DETAILS OF PUBLIC UTILITIES TO BE RELOCATED/RECONSTRUCTED (1/5)

No.	Facility	Category	Bank	Dimension/Capacity	Responsible Agency	Work	Remarks
KAMAL DRAINAGE CHANNEL, MAIN							
Stege I							
KM 1	Electric pole	3-4	Right	Steel, 9 nos.	PLN	Relocation	
KM 3	Electric pole	3-2	Right	Concrete, 1 no.	PLN	Relocation	
KM 4	Electric pole	3-2	Right	Concrete, 2 nos.	PLN	Relocation	
KM 7	Water tank	8	Left	-	PAM JAYA	Reconstruction	
KM 8	Electric pole	3-2	Right	Concrete : 1 no.	PLN	Relocation	
Stage II							
KM 11-2	Electric cable duct, w/steel girder	4-1, 4-2	-	3 lanes	PLN	Reconstruction	Extend to 43 m
KM 13	Electric pole	3-2	Right	Concrete, 2 nos.	PLN	Relocation	
KM 14	Electric pole	3-2	Right	Concrete, 5 nos.	PLN	Relocation	
KM 16	Electric pole	3-1, 3-3	Left	Conc.: 1no. + Steel: 1no.	PLN	Relocation	
KM 17-1	Electric cable duct, w/steel girder	4-1, 4-2	-	3 lanes	PLN	Reconstruction	Extend to 40 m
KM 17-3	Telephone line duct, w/steel girder	7-1, 7-2	-	Concrete cover	Telkom	Reconstruction	Extend to 40 m
KM 17-4	Electric pole	3-4	Right	Steel : 2 nos.	PLN	Relocation	
KM 21-1	Telephone line duct, w/steel girder	7-1, 7-3	-	-	Telkom	Reconstruction	Extend to 32 m
Stage III							
KM 22-1	Electric cable duct, w/steel girder	4-1, 4-2	-	4 lanes	PLN	Reconstruction	Extend to 32 m
KM 22-2	Telephone line duct, w/steel girder	7-1, 7-3	-	-	Telkom	Reconstruction	Extend to 32 m
KM 23-1	Electric cable duct, w/steel girder	4-1, 4-2	-	2 lanes	PLN	Reconstruction	Extend to 32 m
KAMAL DRAINAGE CHANNEL, BRANCH (Stage III)							
KE 1-2	Electric cable duct, steel	4-1	-	Angle: 1 lane	PLN	Reconstruction	Extend to 15 m

Table 7.5.10 DETAILS OF PUBLIC UTILITIES TO BE RELOCATED/RECONSTRUCTED (2/5)

No.	Facility	Category	Bank	Dimension/Capacity	Responsible Agency	Work	Remarks
KE 3-1	Electric cable duct, steel	4-1	-	Angle:2 lanes	PLN	Reconstruction	Extend to 15 m
KE 3-3	Telephone line duct, steel pipe	7-1	-	D=14cmx6nos.,10cmx1no.	Telkom	Reconstruction	Extend to 15 m
KE 10-2	Telephone line duct, steel pipe	7-1	-	Diam.:12.5cm x 1 no.	Telkom	Reconstruction	Extend to 15 m
KE 13-1	Electric pole, between KE 3 and 14	3-4	Right	Steel:2nos.	PLN	Relocation	
KE 13-2	Telephone pole, between KE 3 and 14	6-3	Left	Steel:2nos.	Telkom	Relocation	
KE 17-2	Electric pole	3-3	Left	Steel:1no.	PLN	Relocation	
KE 20-2	Telephone pole	6-3	Left	Steel:1no.	Telkom	Relocation	
KE 21	Telephone pole	6-3	Left	Steel:1no.	Telkom	Relocation	
TANJUNGAN DRAINAGE CHANNEL, MAIN							
TM 2-2	Electric pole between TM 2-1 drain	3-3	Left	Steel : 2 nos.	PLN	Relocation	
	and 3-4bridge	3-4	Right	Steel : 9 nos.	PLN	Relocation	
TM 2-3	Electric pole between TM 2-1 drain	3-1	Left	Concrete : 2 nos.	PLN	Relocation	
	and 3-4bridge	3-2	Right	Concrete : 1 no.	PLN	Relocation	
TM 2-4	Gas pipe line	10	Left	underground	Perum Gas	Reconstruction	
TM 3-1	Electric cable duct, w/steel girder	4-1, 4-2	-	4 lanes	PLN	Reconstruction	Extend to 22 m
TM 3-2	Electric cable duct, steel angle	4-1	-	Steel angle duct x 1lane	PLN	Reconstruction	Extend to 22 m
TM 3-3	Telephone line duct, steel pipe	7-1	-	Diam.12.5cm, 1 lane	Telkom	Reconstruction	Extend to 22 m
TM 3-5	Telephone line duct, steel pipe	7-1	-	Diam.5cm, 1 lane	Telkom	Reconstruction	Extend to 22 m
PIK JUNCTION DRAINAGE CHANNEL							
	Nothing						
GEDE/BOR DRAINAGE CHANNEL							
GM 1-1	Electric cable duct, steel	4-1	-	steel angle box, 2 lanes	PLN	Reconstruction	Extend to 14 m

Table 7.5.10 DETAILS OF PUBLIC UTILITIES TO BE RELOCATED/RECONSTRUCTED (3/5)

No.	Facility	Category	Bank	Dimension/Capacity	Responsible Agency	Work	Remarks
GM 1-3	Electric cable duct, w/H-steel girder	4-1, 4-2	-	1 lane	PLN	Reconstruction	Extend to 14 m
GM 1-3A	Telephone line duct, w/steel girder	7-1, 7-3	-	with cover	Telkom	Reconstruction	Extend to 14 m
GM 1-3B	Electric cable duct	4-1	-		PLN	Reconstruction	Extend to 14 m
GM 1-3D	Water pipe	9-1	-		PAM JAYA	Reconstruction	Extend to 14 m
GM 1-4A	Telephone line duct, steel pipe	7-1	-		Telkom	Reconstruction	Extend to 14 m
GM 10-1	Electric cable duct, steel	4-1	-	Angle:2 lanes,Cable:1 lane	PLN	Extension	Extend to 14 m
GM 10-3	Gate with concrete posts	1-6	Left	-	Local Govn.	Reconstruction	
GM 10-4	Telephone line duct, concrete	7-2	-	W=1.04m	Telkom	Reconstruction	Extend to 14 m
GM 10-5	Telephone pole	6-3	Left	Steel : 1 nos.	Telkom	Relocation	
GM 11-1	Electric cable duct	4-1	-	Steel angle:2 lanes	PLN	Reconstruction	Extend to 13 m
GM 11-3	Telephone line duct, steel pipe	7-1	-	Diam.:12.5cm	Telkom	Reconstruction	Extend to 13 m
GM 11-4	Electric cable duct	4-1	-	Steel angle:1 lane	PLN	Reconstruction	Extend to 13 m
GM 12-1	Electric pole	3-1, 3-3	Left	Concrete:13nos., Steel:1no.	PLN	Relocation	
GM 12-2	Telephone pole	6-3	Left	Steel : 3 nos.	Telkom	Relocation	
GM 13-2	Telephone line duct, steel pipe	7-1	-	Diam.:10.5cm	Telkom	Relocation	Extend to 12 m
GM 14-3	Water pipe with valve, steel	9-1	Left	Diam.:20cm, L:7.9m	PAM JAYA	Relocation	
SALURAN CENGKARENG DRAINAGE CHANNEL							
CM 1-1	Water supply pipe, steel	9-1	-	Diam.45cm	PAM JAYA	Reconstruction	Extend to 16 m
CM 5	Telephone line duct, steel pipe	7-1	-	Diam. 11.5 cm	Telkom	Reconstruction	Extend to 12 m
CM 12	Electric pole between CM 11 and 13	3-1	Left	Concrete : 2 nos.	PLN	Relocation	
CM 14	Electric pole	3-1, 3-3	Left	Conc.:2nos. + Steel:1no.	PLN	Relocation	
CM 17-2	Telephone pole	6-4	Right	Steel : 1 no.	Telkom	Relocation	

Table 7.5.10 DETAILS OF PUBLIC UTILITIES TO BE RELOCATED/RECONSTRUCTED (4/5)

No.	Facility	Category	Bank	Dimension/Capacity	Responsible Agency	Work	Remarks
CM 17-3	Electric pole	3-4	Right	Steel : 1 no.	PLN	Relocation	
CM 17-4	Telephone line duct, steel pipe	7-1	-	Diam.12cm	Telkom	Reconstruction	Extend to 16 m
CM 18-1	Electric cable duct, w/steel girder	4-1, 4-2	-	6lanes:10.7m, 2lanes:15.2m	PLN	Reconstruction	Extend to 14 m
CM 18-2	Water supply pipe, steel	9-1	-	Diam.36cm	PAM JAYA	Reconstruction	Extend to 14 m
CM 18-3	Electric pole	3-2	Right	Concrete : 1no.	PLN	Relocation	
CM 18-4	Telephone pole at NM 18	6-4	Center	Steel : 1 no.	Telkom	Relocation	
CM 19-2	Electric pole	3-2	Right	Concrete : 1no.	PLN	Relocation	
CM 19-3	Electric cable duct, w/steel girder	4-1, 4-2	-	2lanes:14.7m	PLN	Reconstruction	Extend to 14 m
MERUYA DRAINAGE CHANNEL, MAIN							
MM 1-2	Electric pole	3-3	Left	Steel, 1 no.	PLN	Relocation	
MM 2-1	Electric pole	3-2, 3-4	Right	Steel:1no., Conc.:1no.	PLN	Relocation	
MM 2-2	Electric cable duct, steel angle	4-1	-	1 lane	PLN	Reconstruction	
MM 2-4	Steel pipe under bridge for (**)	7-1	-	1 lane	(**)	Reconstruction	
MM 3	Telephone pole between MM 2 and 4	6-4	Right	Steel : 1 no.	Telkom	Relocation	
MM 4-1	Electric pole	3-4	Right	Steel, 1 no.	PLN	Relocation	
MM 4-2	Telephone pole	6-3, 6-4	Both	Steel : 2 nos.	Telkom	Relocation	
MM 5	Telephone pole between MM 4 and 6	6-3	Left	Steel : 2 nos.	Telkom	Relocation	
MM 7	Telephone pole between MM 6 and 9	6-3	Left	Steel : 2 nos.	Telkom	Relocation	
MM 8-1	Electric pole	3-2, 3-4	Right	Steel:3nos., Conc.:1no.	PLN	Relocation	
MM 8-2	Telephone pole	6-3	Left	Steel : 2 nos.	Telkom	Relocation	
MM 9-1	Telephone cable manhole & conduit	7-4	Left	1 set (no function)	Telkom	Reconstruction	
MM 9-2	Telephone pole between MM 9-1 and 10	6-3	Left	Steel : 5 nos.	Telkom	Relocation	

Table 7.5.10 DETAILS OF PUBLIC UTILITIES TO BE RELOCATED/RECONSTRUCTED (5/5)

No.	Facility	Category	Bank	Dimension/Capacity	Responsible Agency	Work	Remarks
MM 9-3	Telephone pole between MM 9-1 and 10	6-4	Right	Steel : 1 no.	Telkom	Relocation	
MM 9-4	Electric pole	3-2, 3-4	Right	Steel:1no., Conc.:5nos.	PLN	Relocation	
MM 11-1	Electric pole between MM 10 and 12	3-1	Left	Concrete :1no.	PLN	Relocation	
	Electric pole between MM 10 and 12	3-2, 3-4	Right	Steel:2nos., Conc.:7nos.	PLN	Relocation	
MM 11-2	Telephone pole between MM 10 and 12	6-1, 6-3	Left	Steel:7nos., Conc.:3nos.	Telkom	Relocation	
	Telephone pole between MM 10 and 12	6-4	Right	Steel : 2 nos.	Telkom	Relocation	
MM 11-3	Telephone cable manhole & conduit	7-4	Left	Concrete	Telkom	Reconstruction	
MM 13-1	Electric pole between MM 12 and 14	3-1, 3-3	Left	Steel:1no., Conc.:3nos.	PLN	Relocation	
MM 13-2	Telephone pole between MM 12 and 14	6-3	Left	Steel:3nos.	Telkom	Relocation	
	Telephone pole between MM 12 and 14	6-4	Right	Steel:3nos.	Telkom	Relocation	
MM 13-3	Telephone cable manhole & conduit	7-4	Left	1 set	Telkom	Reconstruction	
MM 15	Telephone pole between MM 14 and 16	6-1	Left	Concrete : 1 no.	Telkom	Relocation	