

**CHAPTER 8    DESIGN OF PORT INNER ROAD  
AND FLYOVER**

## **8. DESIGN OF PORT INNER ROAD AND FLYOVER**

### **8.1 Design of Port Inner Road**

#### **8.1.1 Design Standard Reference**

The following design standards have been referred to for the Project.

Geometry:

- 1) Standard Specifications for Geometric Design of Urban Roads, MoPW, Indonesia, 1992
- 2) A Policy on Geometric Design of Highways and Streets, AASHTO, 2004
- 3) Road Structure Ordinance, Japan Road Association, 2005

Pavement:

- 1) Perencanaan Dan Pelaksanaan Perkerasan Jalan Beton Semen, Departemen Permukiman Dan Prasarana Wilayah, 2002
- 2) Tata Cara Perencanaan Tebal Perkerasan Lentur Jalan Raya Dengan Metode Analisa Komponen, Dewan Standardisasi Nasional-DSN, 1987
- 3) Guide for Design of Pavement Structures, AASHTO, 1993
- 4) Manual for Design and Construction of Pavement, Japan Road Association, 2002

Miscellaneous:

- 1) Produk Standar Untuk Jalan Perkotaan, Departemen Pekerjaan Umum, Direktorat Jenderal Bina Marga, 1987

#### **8.1.2 Classification of the Project Road and Geometric Design Criteria**

The port inner roads are currently opened to public with entrance charge (1,000Rp). Although, as clearly identified through the result of traffic survey, the traffic of the port inner roads consists mainly of heavy vehicles handling port logistic activities. Consequently the port inner roads have an exceptional character different from public roads. And there is no particular design standard for port inner roads in Indonesia and it is a common practice to refer to the design standards for public roads such as MoPW(PU) standards for designing port inner roads.

Referring to the design standard of MoPW, the JICA Study Team has assessed that it is reasonable to apply “Type-II, Class-III” road classification for the port inner roads considering the actual speed limit inside the port area (“30km/h” speed limit traffic sign at the site).

The geometric design criteria of “Type-II, Class-III” road and the applied design values of the port inner roads are summarized below.

Item		Design Standard Value	Applied Value
Road Classification		Type-II, Class-III	
Design Speed		30km/h	
Cross-section	Carriageway Width	3.0~3.25m	3.5m (considering heavy vehicles)
	Shoulder Width	0.5m	0.5m
	Emergency Parking Strip	2.5m	2.5m
	Sidewalk Width	1.5m	2.0m (considering utilities)
Horizontal	Min. Radius	30m	100m (except intersections)
Alignment	Min. Curve Length	50m	33m (*1)
	Omission of Transition	>150m	>100m (*2)
Vertical	Min. Curve Length	25m	25m
Alignment	Cross-fall	1.5%-2.0%	1.50%

Note: Exceptional case is applied to minimize land acquisition following the existing alignment.  
(\*1: 1 location, \*2: 2 locations)

### 8.1.3 Cross Sectional Elements

#### (1) Number of Lanes and Width of Carriageway

The number of lanes of the Project Road was determined based on the results of traffic analysis as stated in Chapter 7. The required number of lanes is summarized in Table 8.1.1.

**Table 8.1.1 Required Number of Lanes**

Road Name	Number of Lanes	Remarks
Jl. Pulau Payung	3	2 ways: 2 lanes (eastbound) + 1 lane (westbound)
Jl. Penjalai	3	1 way: northbound
Jl. Palmas	3	1 way: eastbound
Jl. Raya Pelabuhan	4+1	1 way: eastbound, 1 additional lane for gate queue
Jl. Bangka	3	1 way: southbound
Jl. Banda-Pasoso	4	1 way: westbound
Jl. Panaitan Timur	2	1 way: northbound
Jl. Panaitan Barat	1	1 way: southbound
New Road 1	1	1 way: westbound
New Road 2	2	1 way: westbound
New Road 3	1	1 way: westbound
New Road 4	1	1 way: westbound
Jl. Ayung	1	1 way: southbound

Source: JICA Study Team

The width of each carriageway and the outer paved shoulder was designed to be 3.5m and 0.5m respectively referring to the design standard of MoPW. However it is noted that the full shoulder (2.5m wide) has been applied for single lane roads such as Jl. Panaitan Barat, New Road 1, New Road 2 and New Road 3 in order to secure emergency parking spaces.

#### (2) Land Acquisition for Proposed Roads

The widening width has been estimated by the required number of lanes and width of carriageway. The land acquisition area was proposed by the JICA Study Team to minimize the land as much as practical. This has been carefully discussed between IPC-II officials and the JICA Study Team and the final acquisition maps were submitted to IPC-II via a letter No.

LJICATP-05-122 dated on 27th December 2005. Table 8.1.2 shows the summary of the land acquisition area.

**Table 8.1.2 Land Acquisition Area**

Road Name	Widening toward	Affected Building
Jl. Pulau Payung	north	part of 2 army buildings and 2 security gate houses
Jl. Penjalai	no widening	- none -
Jl. Palmas	no widening	- none -
Jl. Raya Pelabuhan	north	part of 1 building
Jl. Bangka	no widening	- none -
Jl. Banda-Pasoso	north	part of 2 buildings
Jl. Panaitan Timur	east	- none -
Jl. Panaitan Barat	west	part of 2 restaurants
New Roads	new construction	- none -

### (3) Cross Slope of Carriageway

The cross slope of carriageway for “Type-II” road is recommended to be 2.0% for rigid or bituminous surface in the standard of MoPW. However, in accordance with the result of cross section survey at the site, the existing cross slope is approximately 1.5% and applying 2.0% slope will result in cost increment due to larger leveling material amount.

In the Japanese design guidelines, 1.5% and 2.0% slopes are recommended for cement concrete and asphalt concrete surface respectively. Also AASHTO states that the accepted rate of cross slope is from 1.5% to 2.0% for urban roads.

Thus the cross slope to be applied for the Project Road has been finally determined to be 1.5% taking into above consideration.

### (4) Sidewalk Design

The minimum width of sidewalks is specified to be 1.5m in the design standard of MoPW. However the width of sidewalks for the Project shall be determined taking into consideration the utilities to be placed underneath sidewalk. The JICA Study Team and IPC-II officials have jointly investigated underground utilities and held several meetings regarding the utility layout underneath sidewalk. Table 8.1.3 shows the agreed utility layout.

**Table 8.1.3 Agreed Utility Layout underneath Sidewalk**

Utility	Required Width	Remarks
Telephone and CCTV	400 mm	with PVC ducts and hand holes
Water Distribution	400 mm	Upper for feeder lines and lower for main lines
Electric Line	400 mm	with PVC ducts and hand holes
Road Lighting/Wall	600 mm	Foundation of road lighting poles or retaining walls
Space for Kerb Stone	200 mm	
Total	2,000 mm	

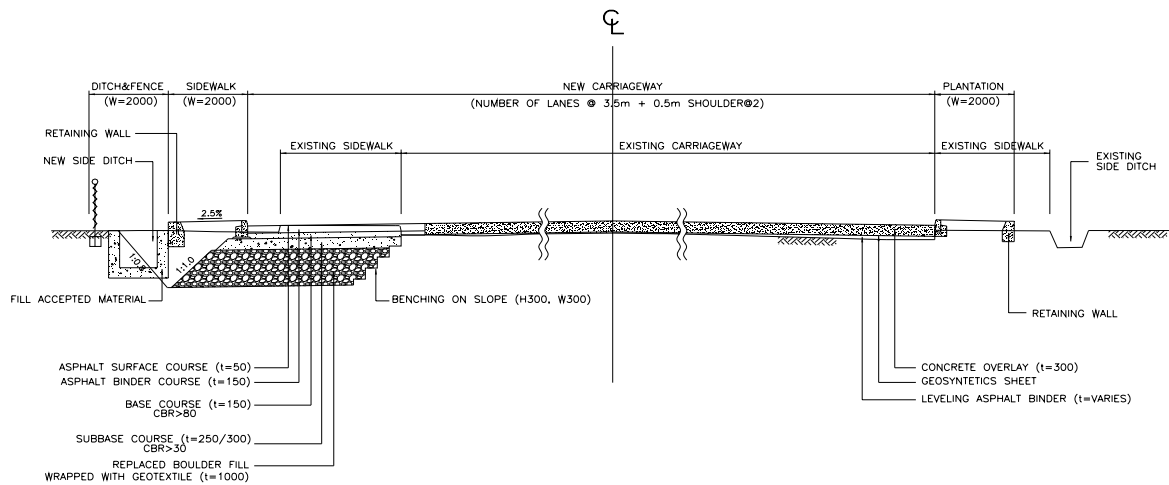
Source: Minutes of Discussion on 5th October 2005 (Letter No. LJICATP-05-098)

Thus the width of sidewalks in the Project has been determined as 2.0m and the cross slope on the sidewalk has been designed as 2.5% in conformity with the design standard of MoPW.

Concrete paving block shall be placed on the sidewalk. However it shall not be placed on both sides (northern and southern) of Jl.Raya Pelabuhan and the southern side of Jl.Banda-Pasoso because IPC-II has its own plantation plan for these locations.

**(5) Typical Cross Section**

Based on the cross-sectional design study, the typical cross section was proposed as typically shown in Figure 8.1.1.



**Figure 8.1.1 Typical Cross Section (Jl. Raya Pelabuhan)**

**8.1.4 Horizontal Alignment**

**(1) Horizontal Curve and Superelevation**

Except for the intersections, the minimum radius of curvature has been determined to be 40m for the Project considering the minimum radius (30m) and the desirable minimum radius (65m) for the design speed of 30km/h for “Type-II” roads in the design standard of MoPW.

The maximum superelevation has been designed as 1.5% applying the exceptional cases in the design standard of MoPW in view of the actual super-elevation and vehicle speed at the site.

**(2) Widening on Curves**

Widening of curves has been applied as shown in Table 8.1.4 in conformity with the design standard of MoPW.

**Table 8.1.4 Widening of Lanes**

Radius of Curve (m)	Widening per Lane (m)
160-90	0.25
90-60	0.50
60-45	0.75
45-40	1.00

Source: Standard Specifications for Geometric Design of Urban Roads, MoPW, 1992

Widening has been omitted for the curves with a 100m radius at Sta.0+200 on Jl.Pulau Payung and Sta.0+500 on Jl.Banda-Pasoso, applying the exceptional cases in the design standard of MoPW for the reason that these IP angles are not sharp and the available lands for widening are limited. “Vehicle’s Motion Simulation (VMS)” has been carried out for these places and the omission has been confirmed to be technically acceptable. Also the layout of

the kerb stones and lane markings at the intersections has been designed based on VMS. The results of VMS are shown in Appendix 8A.

### **8.1.5 Vertical Alignment**

According to the topographic survey results, the existing profile of the port inner roads is nearly level (0.0 - 0.1%) and it is assumed that surface water is mainly drained by cross slope (approx.1.5%) toward inlet holes on the kerb stone. Also there are many premises along the project roads and access thereto shall be carefully considered. Thus the vertical alignment of the project roads has been designed following the existing ground in principle. Surface water on the carriageway will be drained by new cross slope (1.5%) and sufficient inlet holes have been provided at the edge of carriageway.

### **8.1.6 Pavement Design**

Indonesian design standards for pavement were established based on AASHTO (USA) and AUSTRROAD (Australia) standards. In the detailed design of the project roads, the pavement design was carried out in conformity with Indonesian design standards. Other design methods such as AASHTO and Manual for Design and Construction of Pavement published by the Japan Road Association will also be referred to wherever relevant.

#### **(1) Pavement Type**

The JICA Study Team initially proposed asphalt overlay in consideration of the unit cost in the Loan Agreement (L/A) on the Project. However IPC-II strongly requested the JICA Study Team to study the possibility of applying cement concrete overlay. In the Basic Design of the Project, it was confirmed that the additional cost resulting from cement concrete pavement would be compensated and the total estimated cost of the Project will be unchanged.

However, through the soil investigation and analysis, it has been confirmed that there may be differential settlement due to consolidation.

The project roads are located close to the coast of which subgrade layer mainly consists of clay and silt layer (N-value = 0 to 4, approx. 10m thick) and CBR of the subgrade soil is 1.32 to 3.02. In the case additional weight is loaded, settlement of such soft layer will occur especially at the widening area because any traffic has not been loaded on the proposed widening area.

Generally cement concrete pavement has a strength against rutting and it has long durability. However it has some disadvantages compared to asphalt pavement, such as higher cost, difficulty of repair and weakness against differential settlement. Thus asphalt pavement is generally more recommendable in the case of the Project Roads.

Table 8.1.5 shows the comparison of the pavement alternatives.

**Table 8.1.5 Pavement Type Alternatives**

	Pavement Type		Technical Advantage	Technical Disadvantage	Cost
	Existing Carriageway (overlay)	Widening Area (new const.)			
<b>Alt. 1</b>	Cement Concrete	Cement Concrete	- Long durability - Resistance against rutting	- Crack due to settlement - Construction period - Difficulty of repair	High
<b>Alt. 2</b>	Asphalt	Asphalt	- Flexibility (against settlement) - Workability	- Rutting	Low
<b>Alt. 3</b>	Cement Concrete	Asphalt	- Flexibility (against settlement)	- Surface appearance (black and white)	Moderate

Prior to determining the type of pavement, the prediction of settlement due to consolidation has been calculated based on the soil test results and ordinary design values. The consolidation settlement can be calculated using the following formula.

$$S = \frac{(e_0 - e_1)}{(1 + e_0)} \times H$$

where;

$S$  = consolidation settlement (cm)

$e_0$  = void ratio in initial overburden pressure ( $P_0$ )

$e_1$  = void ratio in increased pressure ( $P_0 + \Delta P$ )

$H$  = thickness of consolidation layer (cm)

Table 8.1.6 and Table 8.1.7 summarize the settlement analysis results for concrete pavement and asphalt pavement respectively.

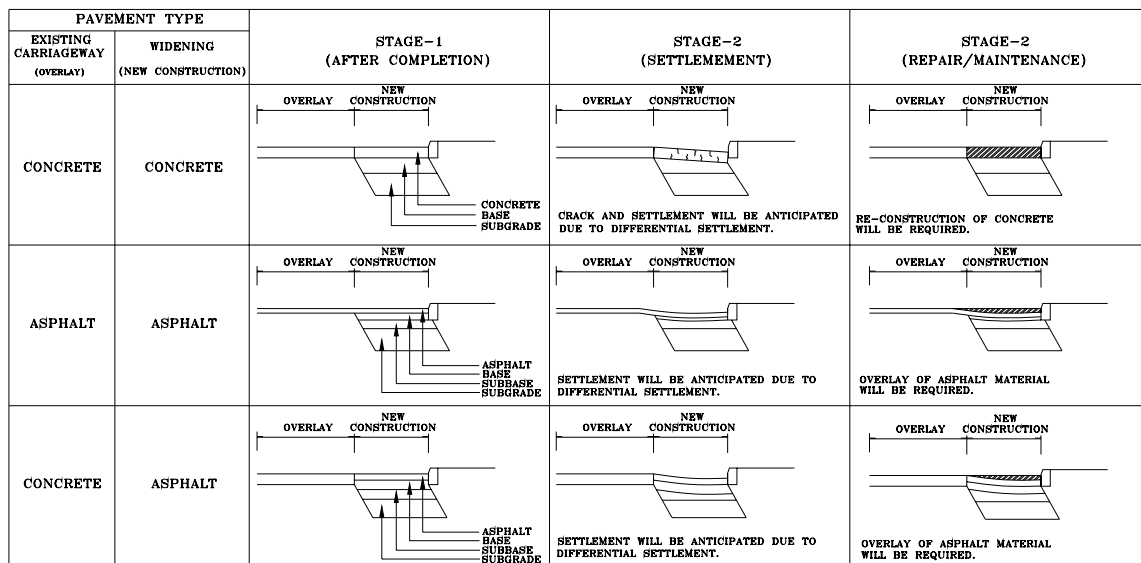
**Table 8.1.6 Settlement Analysis Result (In case of Cement Concrete Pavement)**

Analysis Case		Jl.Pulau Payung	Jl.Raya Pelabuhan	Jl.Banda -Pasoso	Jl.Panaitan	New Roads
Concrete	2.30(t/m3)	t=30(cm)	t=30(cm)	t=30(cm)	t=30(cm)	t=30(cm)
Base	1.76(t/m3)	t=50(cm)	t=50(cm)	t=50(cm)	t=50(cm)	t=50(cm)
Replaced Subgrade	1.80(t/m3)	t=100(cm)	t=100(cm)	t=100(cm)	t=100(cm)	t=100(cm)
Traffic Load		2.5(t/m2)	2.5(t/m2)	2.5(t/m2)	2.5(t/m2)	2.5(t/m2)
Paved Width		2.5(m)	6.5(m)	7.0(m)	4.0(m)	8.0(m)
Final (100%) Settlement		4.7(cm)	9.6(cm)	10.2(cm)	6.5(cm)	10.9(cm)
90% Settlement	period of time	561(days)	562(days)	562(days)	562(days)	562(days)
	S (cm)	4.2(cm)	8.6(cm)	9.1(cm)	5.9(cm)	9.8(cm)

**Table 8.1.7 Settlement Analysis Result (In case of Asphalt Pavement)**

Analysis Case		Jl.Pulau Payung	Jl.Raya Pelabuhan	Jl.Banda -Pasoso	Jl.Panaitan	New Roads
Asphalt	2.25(t/m3)	t=10(cm)	t=10(cm)	t=10(cm)	t=10(cm)	t=10(cm)
Base	1.76(t/m3)	t=40(cm)	t=45(cm)	t=45(cm)	t=40(cm)	t=40(cm)
Replaced Subgrade	1.80(t/m3)	t=100(cm)	t=100(cm)	t=100(cm)	t=100(cm)	t=100(cm)
Traffic Load		2.5(t/m2)	2.5(t/m2)	2.5(t/m2)	2.5(t/m2)	2.5(t/m2)
Paved Width		2.5(m)	6.5(m)	7.0(m)	4.0(m)	8.0(m)
Final (100%) Settlement		4.2(cm)	8.3(cm)	8.6(cm)	6.0(cm)	9.3(cm)
90% Settlement	period of time	562(days)	562(days)	562(days)	562(days)	562(days)
	S (cm)	3.8(cm)	7.4(cm)	7.7(cm)	5.4(cm)	8.4(cm)

The future settlement has been calculated to be 4.7(cm)-10.9(cm) in the case of cement concrete pavement and 4.2(cm)-9.3(cm) in the case of asphalt pavement. Also it will take 1.5 years to achieve 90% of these settlements in both cases. There are several commonly known methods to expedite the settlement such as pre-loading, sand piling, paper drain etc. However these will be impractical for the Project in consideration of the site situation (i.e. construction space, cost, period and traffic disturbance). Thus the settlement issue of the Project shall be dealt with by subsequent maintenance and future improvement. Figure 8.1.2 shows the required repair/maintenance measures for each alternative.



**Figure 8.1.2 Settlement and Required Repair/Maintenance Method**

Cracks/deformations may occur in the slab of cement concrete pavement after construction due to the foundation settlement, therefore a flexible structure would be suitable for the widening area. Through the several official meetings among DGSC, IPC-II and the JICA Study Team, the above issues were discussed and the alternative-3 (cement concrete pavement for overlay and asphalt pavement for widening area) was finally agreed.

## (2) Pavement Structure

Based on the agreed design policy regarding the type of pavement mentioned above, the type of pavement for each port inner road has been determined as given in Table 8.1.8.

**Table 8.1.8 Pavement Type for Each Port Inner Road**

Type of Pavement	Jl.Pulau Payung	Jl.Penjalai	Jl.Raya Pelabuhan	Jl.Bangka	Jl.Banda -Pasoso	Jl.Panaitan	Jl.Ayung	New Roads
Overlay	none	cement concrete	cement concrete	cement concrete	cement concrete	cement concrete	cement concrete	cement concrete
Widening	asphalt	none	asphalt	none	asphalt	asphalt	none	none

### 1) Cement Concrete Pavement

The cement concrete pavement design has been carried out in conformity with Indonesian design standards which were established based on AASHTO and AUSTROAD, and the calculation based on the standards included several assumed values with the limited actual values obtained through the Study. Thus the JICA Study Team has also carried out the calculation/analysis by using both AASHTO and Japanese Standard.

The details of calculation for each port inner road using these standards are presented in Appendix 8A.

The calculated thickness of cement concrete pavement is summarized in Table 8.1.9.

**Table 8.1.9 Summary of Design Thickness of Cement Concrete Pavement**

Applied Standard	Jl.Penjalai	Jl.Raya Pelabuhan	Jl.Bangka	Jl.Banda -Pasoso	Jl.Panaitan	Jl.Ayung	New Roads
Indonesian Standard	220(mm)	230(mm)	230(mm)	230(mm)	220(mm)	210(mm)	210(mm)
AASHTO	304(mm)	327(mm)	347(mm)	336(mm)	293(mm)	238(mm)	287(mm)
Japanese Standard	300(mm)	300(mm)	300(mm)	300(mm)	300(mm)	280(mm)	300(mm)

It is natural to simply apply the calculation results from Indonesian design standards to the Project. However, through the calculations by other standards, it has been found that there is a range of estimated design thickness among the design standards as shown in Table 8.1.9. The JICA Study Team has assessed that this is due to the design method, cumulated traffic axles, usage of monogram charts/graphs and assumed values recommended in each standard. At the same time, IPC-II has requested to raise and thicken the carriageway as much as practical to strengthen the pavement and to prevent eventual flooding during the monsoon. Considering all the various factors together, the concrete slab thickness has been determined to be 300(mm) as an intermediate value among the results for all port inner roads.

In general, the spacing of both transverse and longitudinal contraction joints depends on local conditions of materials and the environment, whereas expansion and construction joints are primarily dependent on layout and construction capabilities. In AASHTO, it is suggested that the local service records (such as existing roads' condition) are the best guide for establishing joint spacing. Through the site investigation, it has been found that the existing transverse joint spacing on Jl. Pulau Payung is generally 6.0m. Thus the JICA Study Team has adopted the transverse joint of 6.0m for the Project.

The spacing of longitudinal joints depends on the lane width and it has been generally determined to be 3.5m or 4.0m for the Project. The number of transverse expansion joints shall be minimized due to cost, complexity and performance problems. Referring to the Japanese Standard, the maximum spacing of transverse expansion joints has been determined to be 200m. Also they are used at the end of a day's placement and around intersections where the joint layout is exceptional.

Pavement Slab Dimension (general)	3.5m or 4.0m (transverse), 6.0m (longitudinal)
Pavement Slab Dimension (curve and intersection)	Varies (depending on the site condition)
Spacing of Longitudinal Joints	3.5m or 4.0m
Spacing of Transverse Joints	6.0m
Spacing of Transverse Expansion Joints	At the end of a day's placement and around intersections (maximum spacing < 200m).

## 2) Asphalt Pavement

Asphalt pavement will be applied for the widening area subjected to future settlement. It will require overlay or replacement by concrete pavement after termination of the settlement. As such, AASHTO design standard of asphalt pavement has been simply applied for sake of easiness of calculation. Details of calculation of asphalt pavement are provided in Appendix 8A.

The design thickness of asphalt pavement is summarized in Table 8.1.10.

**Table 8.1.10 Summary of Design Thickness of Asphalt Pavement**

Applied Standard	Jl.Pulau Payung	Jl.Raya Pelabuhan	Jl.Banda -Pasoso	Jl.Panaitan	New Road
Surface Course	200(mm)	200(mm)	200(mm)	200(mm)	200(mm)
Base Course	150(mm)	150(mm)	150(mm)	150(mm)	150(mm)
Subbase Course	250(mm)	300(mm)	300(mm)	250(mm)	250(mm)
Replaced Subgrade	1000(mm)	1000(mm)	1000(mm)	1000(mm)	1000(mm)

### 8.1.7 Drainage Design

Most of the existing drainage system in the Project area was built during the Dutch era. It is essential for the Project to re-evaluate its condition. Through the site investigation, it has been found that most of existing drains are not functioning well due to the lack of maintenance and cleaning. Also it has been identified that the ground level of the Project area is low and flat, and drainage water cannot flow smoothly due to the influence of sea tide and small gradient of the drains. Besides, the recent development in and around the port area largely increases the runoff demand.

The discharge capacity of drainages has been designed for a flood return period of 5 years. The rainfall intensity in Tanjung Priok was referred to the Master Plan for Drainage and Flood Control of Jakarta, NEDECO based on the data collected from 27 rainfall observation stations. The rainfall intensity has been calculated by the following formulas based on the duration of rainfall and the flood return period:

$$I_5 = \frac{7,946}{t^{1/1} + 48.8} \quad \text{in case of } (t \leq 180 \text{ minutes})$$

$$I_5 = \frac{8,756}{t^{1/1} + 93.5} \quad \text{in case of } (t \geq 180 \text{ minutes})$$

where;

$I_5$  = rainfall intensity for a 5 year return period (mm/hour)

$t$  = duration time of rainfall (minutes)

The runoff of storm from a certain area has been calculated by the following formula:

$$Q = \frac{1}{360} \times C \times I \times A \quad (\text{Rational Formula})$$

where;

$Q$  = runoff (m<sup>2</sup>/sec)

$C$  = runoff coefficient in Tanjung Priok = 0.80

$I$  = rainfall intensity (mm/hour)

$A$  = catchment area (ha)

The discharge capacity of design ditches has been determined by the following formula.

$$Q_{design} = A_{flow} \times \frac{1}{n} \times R^{2/3} \times I^{1/2}$$

where;

$Q_{design}$  = discharge capacity (m<sup>3</sup>/sec)

$A_{flow}$  = flow section area of ditch (m<sup>2</sup>)

$R$  = A/P (mm/hour)

The minimum velocity of water flow inside ditches is generally recommended to be 0.6 m/sec which is determined to prevent sedimentation in ditches.

The type of ditches has been designed in consideration of the above calculations. The calculation result of the drainage system is presented in Appendix 8A. Also the interval of inlet holes for surface water on the carriageway has been calculated to be 5.0m with  $\phi$  150mm PVC holes.

Even though a new drainage system is provided, proper maintenance is essential to maintain its expected function. Proper maintenance shall be carried out by IPC-II periodically.

### 8.1.8 Traffic Lighting System

The traffic lighting system has been designed in reference to the design standards (Peraturan Umum Instalasi Listrik, 2000, SNI 04-22-1922-2002, SNI 04-6292.1-2001). The required lux capacity is summarized as given below.

- 20-25 lux at the area of the gates
- 15 lux at the area approaching the gates
- 7 lux for other locations (requirement of city area)

The interval of each traffic lighting pole has been determined as 30m to 45m based on the results of lux calculations.

### 8.1.9 Miscellaneous Items

The miscellaneous items such as kerb stones, paving blocks and etc. have been designed in conformity with the design standards and the local available manufactures in the construction market.

### 8.1.10 Utility Relocation Plan

In the Basic Design Stage, the layout maps of the existing utilities were provided by IPCII. According to the maps and the information from IPCII, it was found that the following utilities are currently installed in the Project site.

- 1) Electric power supply line (owner: IPC-II and PLN)
- 2) Water supply line (owner: IPC-II)
- 3) Telephone line (owner: IPC-II, JICT, PT.Telkom)
- 4) CCTV line (owner: IPC-II, JICT)

However the layout maps had not been updated for years. Thus the JICA Study Team has updated the maps through site reconnaissance conducted together with IPC-II officials in the stage of Basic Design. The updated maps have been accepted and signed by IPC-II, utility agencies and the JICA Study Team.

Based on the updated utility maps, the JICA Study Team has prepared the utility relocation plan drawings in cooperation with IPC-II and utility agencies. Through discussions with IPC-II officials, a demarcation of utility relocation works was agreed as follows.

Items	Owner	Work Demarcation
Electric Line	IPC-II PLN	implemented by the Project implemented by IPC-II/PLN
Communication Line (telephone/CCTV)	IPC-II PT.Telkom, JICT	implemented by the Project implemented by IPC-II/PT.Telkom/JICT
Water Supply Line	IPC-II	implemented by the Project

The space for relocated utilities underneath the new sidewalk was agreed by IPC-II as shown in Table 8.1.3.

## 8.2 Design of Pasoso Flyover

### 8.2.1 General

In the proposed road network, the proposed flyover (“Pasoso Flyover”) is expected to handle a part of the exit traffic from the port area to the western regions instead of Gate-3, which has been proposed to be closed. Based on the proposed plan of the Pasoso Flyover in F/S, the alignment of the Pasoso Flyover has been reviewed in this Study and planned from the port inner road (end of Jl.Pasoso) to the road outside the port area (Jl.Laks RE.Martadinata) crossing over it.

### 8.2.2 Design Standard

The following design standards have been applied in the design of the Pasoso Flyover.

- (1) Standard Specifications for Geometric Design of Urban Road (hereinafter to as “GDUR” MoPW, Indonesia, 1992.
- (2) Bridge Design Manual Section 2 in Bridge Management System, “BMS”, (BinaMarga, Indonesia), 1992.
- (3) Standard Specifications for Highway Bridges, 17th Edition, “AASHTO”, 2002.
- (4) Tata Cara Perencanaan Ketahanan Gempa Untuk Bangunan Gedung, “SKS”, (Directorate General of Regional Infrastructure, Indonesia), 2002.
- (5) Uniform Building Code “UBC”, (International Conference of Building Official, California), 1997.
- (6) Building Code Requirements for Reinforced Concrete, “ACI” 318-92. , (American Concrete Institute).

### 8.2.3 Cross Section of Pasoso Flyover

#### (1) Direction

Based on the proposal in F/S and the results of the traffic survey analysis in this Study, the traffic direction on the Pasoso Flyover has been determined to be one-way from the port inner road to Jl.Laks.RE.Martadinata which is located outside the port.

#### (2) Number of lanes

The future traffic volume on the Pasoso Flyover has been estimated as presented in Chapter 7 and it is summarized below.

**Table 8.2.1 Future Traffic Volume**

Target Year	2005	2015	2020	2025
Daily Traffic Volume	8,233	11,600	13,580	15,700

Source: JICA Study Team

The necessary number of lane for the Pasoso Flyover has been determined to be one-lane as presented in Chapter 7.

### (3) Left Shoulder Width

The width of the left shoulder has been determined to be 2.5m in conformity with the design standards. It is expected to be used as a parking lane in case of emergencies such as vehicle accident, breakdown etc.

### (4) Right Shoulder Width

The width of the right shoulder has been designed to be 1.0m in conformity with the geometric design standards.

### (5) Summary of Geometric Design

The geometric design criteria for the Pasoso Flyover are summarized in Table 8.2.2. Though the road classification of the port inner roads is “Type II, Class III”, the road classification of the Pasoso Flyover has been applied to be “Type II, Class II” in consideration of its direct connection to Jl.Laks. RE. Martadinata (this is an arterial road outside the port and is classified as “Type II, Class II”.)

**Table 8.2.2 Summary of Geometric Design Criteria of Pasoso Flyover**

Items	Design Standard	Remarks
Road Class	Type II, Class II	
Design Speed	50–60km/h	
Lane Width	3.5m	1 lane, 1 way
Shoulder Width(Left)	2.5m	
Shoulder Width(Right)	1.0m	
Height Clearance	5.1m	on Jl.RE.Martadinata
Minimum Curve Radius	60m	
Minimum Curve Length	70m	
Maximum Super Elevation	5.0%	
Minimum Spiral Curve Length	35m	
Maximum Grade	7.0%	
Minimum Vertical Curve Length	35m	

Source: Standard Specifications for Geometric Design of Urban Roads, MoPW, 1992

Table 8.2.3 shows the geometric design criteria for Jl.Laks RE.Martadinata.

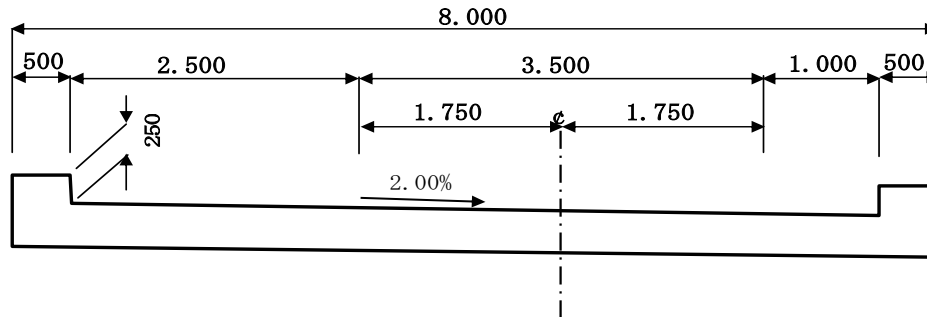
**Table 8.2.3 Summary of Geometric Design Criteria for Jl.Laks. RE. Martadinata**

Items	Design Standard	Remarks
Road Class	Type II, Class II	
Design Speed	40km/h	
Lane Width	3.0-3.5m	4 lanes, 2 ways
Shoulder Width(Left)	1.0m	
Shoulder Width(Right)	5.1m	
Height Clearance	60m	
Minimum Curve Radius	70m	
Minimum Curve Length	5.0%	
Maximum Super Elevation	25m	
Minimum Spiral Curve Length	7.0%	
Maximum Grade	35m	

Source: Standard Specifications for Geometric Design of Urban Roads, MoPW, 1992

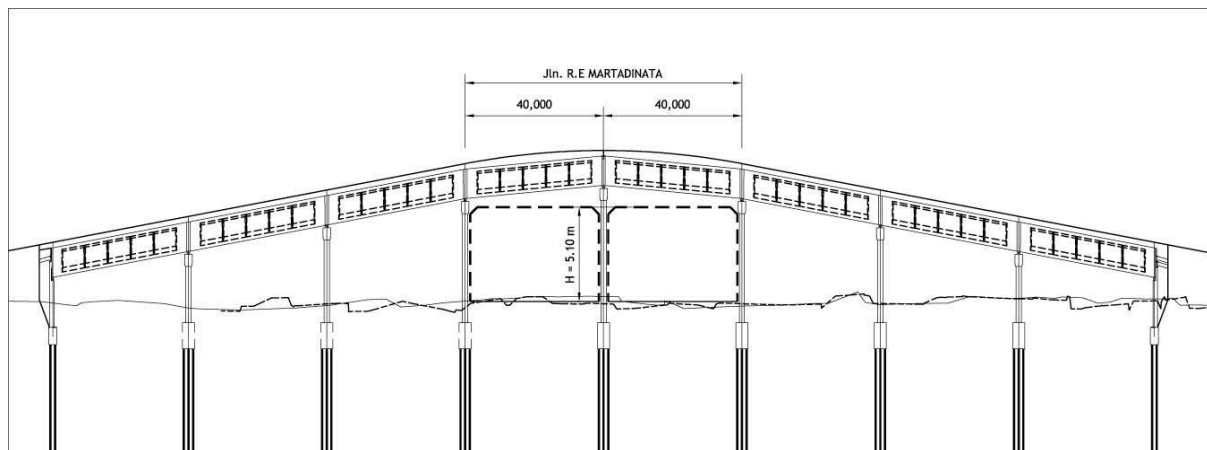
## (6) Cross Section

The cross sectional elements of the Pasoso Flyover have been designed in accordance with the geometric design criteria as given in Table 8.2.2. The typical cross section of the Pasoso Flyover is shown in Figure 8.2.1.



**Figure 8.2.1 Cross Section of Pasoso Flyover**

The Pasoso Flyover has been planned to pass over Jl. Laks. RE. Martadinata. And the clearance height between Jl.Laks. RE. Martadinata and the Pasoso Flyover is presented in Figure 8.2.2.



**Figure 8.2.2 Height Clearance for Jl.Laks RE.Martadinata**

### 8.2.4 Geometric Design

The alignment of the Pasoso Flyover has been designed considering the following design control points.

- |   |                          |
|---|--------------------------|
| 1) Buildings of Bank Mandiri                        | (Sta.0+040, LHS)         |
| 2) Buildings of Mosque                              | (Sta.0+160, RHS)         |
| 3) Pedestrian sidewalk of Jl. Laks. RE. Martadinata | (Sta.0+160, LHS)         |
| 4) Clearance for Tanjung Priok Access Road (JORR)   | (under-pass section)     |
| 5) Clearance for Jl. Laks. RE. Martadinata          | (over-pass section)      |
| 6) Minimum acquisition of PT.KAI container yard     | (Sta.0+450 to Sta.0+700) |

## 8.2.5 Span Layout and Bridge Length

### (1) Implication of Future Tanjung Priok Access Road

The design process for the Tanjung Priok Access Road (“TgPA”) is underway under a JBIC loan and its alignment is planned to cross over the Pasoso Flyover and Jl.Laks RE.Martadinata as shown in Figure 8.2.3. Thus the alignment of the Pasoso Flyover should be carefully designed in consideration of the future alignment of TgPA. Also there are many alternatives of alignment of TgPA. In the Feasibility Study of JORR and Tanjung Priok (JETRO, 2004), the height clearance under the viaduct structure of TgPA was designed to be around 8 m.

IPC-II has strongly insisted that the height clearance of TgPA around the port area shall be around 15 m considering this port’s activities by special vehicles such as cranes, container loaders etc. An alternative alignment of TgPA was planned by Jasa Marga and its height clearance around the port area was designed to be about 13 m. The final alignment of TgPA will be determined during the detailed design of TgPA.

In the alignment study for the Pasoso Flyover, the JICA Study Team has examined the above mentioned alternatives as summarized in Table 8.2.4. As a result, it has been concluded that a 13 m height clearance under TgPA is required for the Pasoso Flyover to pass under TgPA.

**Table 8.2.4 Height Clearance of TgPA**

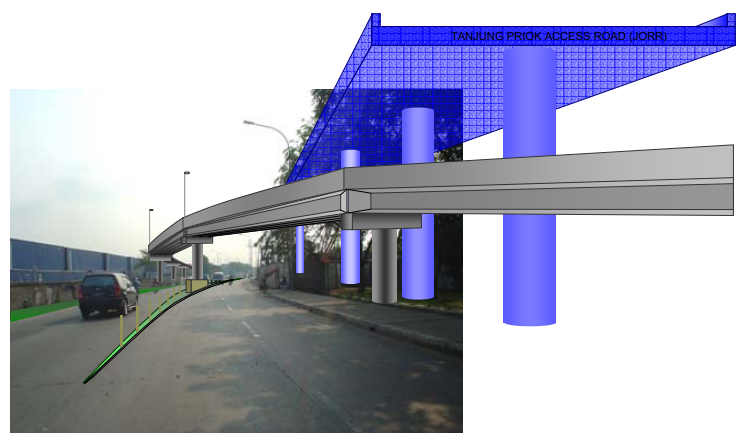
Alternatives	Clearance under TgPA around Port Area	Possible Route of Pasoso Flyover
JETRO F/S	8m	If the alignment of TgPA is not modified, Pasoso Flyover can not pass under TgPA.
Alternative of JasaMarga	13m	No problem
Request by IPCII	15m	No problem

Following photo images are prepared based on the design drawings of the Pasoso Flyover and the latest TgPA alignment (alternative of Jasa Marga).

(After Completion of Pasoso Flyover)



(After Completion of TgPA)



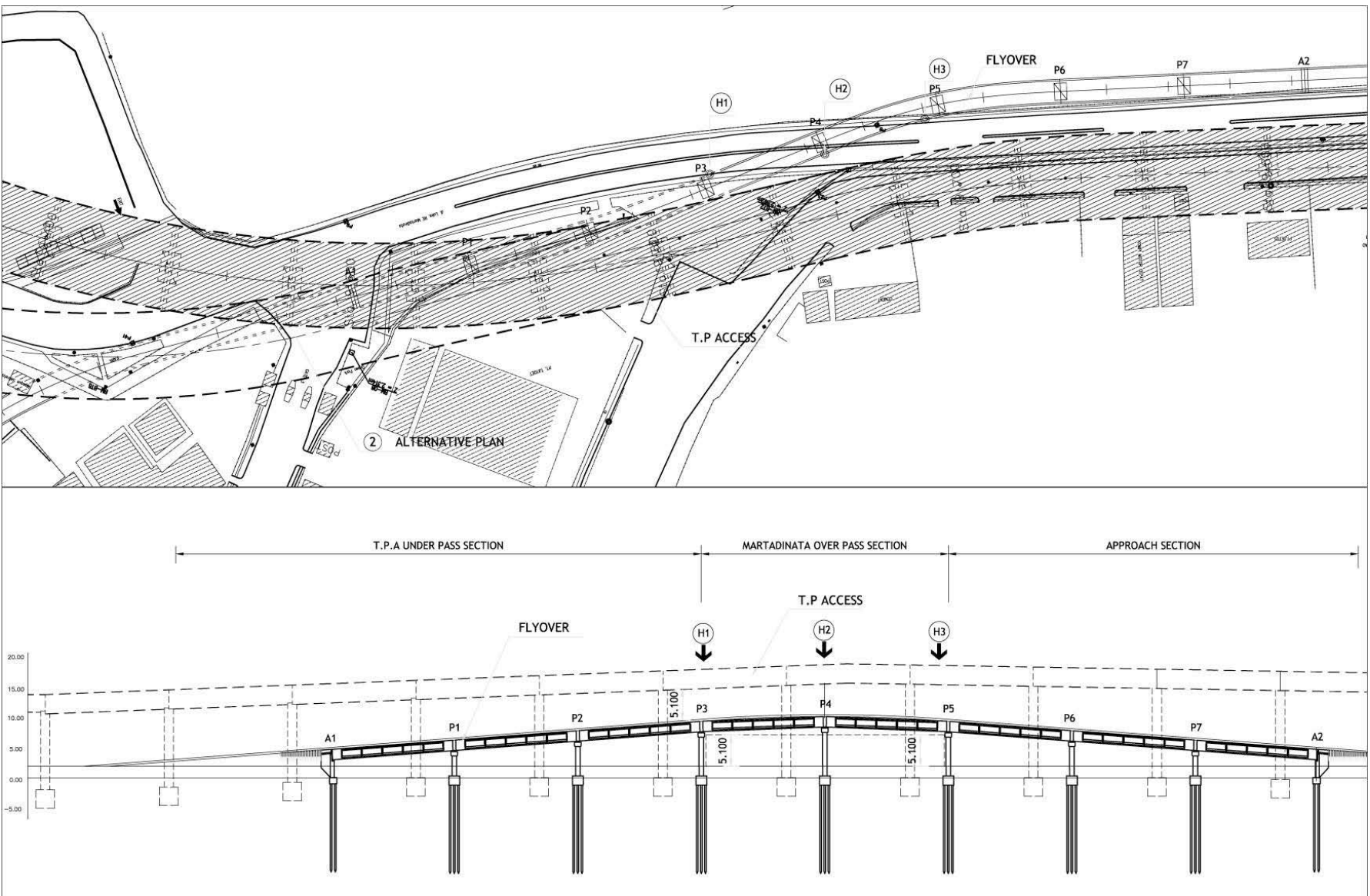


Figure 8.2.3 Relation between Pasoso Flyover and TgPA

## **(2) Span Arrangement and Bridge Length**

### **1) Overpass Section on Jl.Laks RE.Martadinata**

The span arrangement to cross over Jl.Laks RE. Martadinata is one of the dominant factors to determine the length and the span of the Pasoso Flyover. In the case of crossing over with 1 span (80m long), steel girder (approximately 3.0m girder depth) will be required and it is difficult to secure the necessary clearance between the Pasoso Flyover and the future TgPA.

Jl.Laks RE.Martadinata is a 4-lane road with a 50cm center median. If the center median is widened, the Pasoso Flyover can cross over Jl.Laks RE.Martadinata with 2 spans (40m×2) and the maximum girder depth to secure a clearance underneath TgPA can be reduced to around 2.0m. Through several official discussions with DGSC, IPC-II, DKI and PT.KAI, it was agreed to apply the alternative of 2 spans (40m×2) in designing of the Pasoso Flyover.

Figure 8.2.4 shows the results of selection of span arrangement.

Type of Bridge	PC-I Girder(Alternative Plan-1)	PC-I Girder and Steel Girder(Alternative Plan-2)
Length of Bridge	8 - Span 40m Total=320m	9-Span (4span-40m*2=320m+ 1-span 80m ) Total=400m
Girder Depth	PC-I Girder:1.70m	PC-I Girder: 1.70m Steel-Girder:3.00m
Longitudinal Profile		
Control Points (Design Condition)	Clearance for TgP-A will be <b>more than 5.1m</b> (Minimum requirement of BinaMarga standard)	Clearance for TgPA will be <b>4.1m only</b> (less than Bina Marga Standard requirement.).
	Clearance for Jl.RE.Martadinata will be 5.10m(minimum requirement of BinaMarga standard).	TgPA proposed height must be raised (at least 1.0m). Clearance for Jl.RE.Martadinata will be 5.1m (minimum requirement of Bina Marga standard).
Workability/Construction Period	Shifting of Jl.RE.Martadinata during the construction will expedite the construction period.	All staging construction will be possible if Jl.RE.Martadinata can be shifted during the construction period.
	Construction period :approx.28 month	Construction period :approx.28 month
Construction Cost	Jl.RE.Martadinata Overpass Section	Cost Ratio <b>(1.00)</b>
	Total Length of Flyover	Cost Ratio <b>(1.00)</b>
Necessity and Advantage of Center pier(Middle) Construction at Jl.RE.Martadinata	1. Girder depth of Pasoso flyover shall be less than 2.0m in order to avoid the modification of TgPA plan.	
	2. One-span structure "Without a Center Pier"requires 3.0m of girder depth, which will be managed only by raising the planned elevation of TgPA.	
	3. The bridge length of "With a Center Pier" will be 80m shorter than that of "With a Center Pier", and it will ensure 40% of cost saving than "With a Center Pier" (It is very economical.).	
	4. "With a Center Pier" will require the land acquisition but it will be nearly same of "Without a Center Pier"case.	
	5. Repainting the steel girder once every five years will be required because it is located near the sea.	

**Figure 8.2.4 Overpass Section on Jl.RE.Martadinata of the Span Arrangement**

The alternative of 2-spans arrangement will require widening of Jl.Laks RE.Martadinata towards PT.KAI land (southward) and land acquisition from PT.KAI. The required land is currently used as a container yard. During official meetings with PT.KAI and IPC-II, the necessity of PT.KAI land was explained and there were no objections from them. Thus it is recommended that IPC-II proceed with necessary negotiations with PT.KAI to acquire the land as soon as possible.

Also the spans of other sections have been determined to have the same length as the overpass section (40m) considering the construction workability and the re-use of girder construction materials such as formworks.

## 2) Abutment Position

Prior to determining the position of both abutments, a consolidation analysis has been carried out to determine the positions of abutments and to design approach roads. Based on the results of calculation, embankment settlement has been estimated to be 165mm in the case of 3.5m high embankment filling. 132mm (80% of the total settlement) will be settled within about 200 days and it can be terminated during the construction period by applying certain surcharge embankment.

Therefore, the position of abutments has been determined to be 3.5m maximum, considering the above condition.

The approach roads to the Pasoso Flyover will be connected to the port inner road (Jl.Pasoso) and Jl.Laks RE.Martadinata which is located outside the port area. The length of the approach roads has been designed to be 165m and 205m connecting with Jl.Pasoso and Jl.Laks. RE.Martadinata, respectively.

## 3) Total Length of Pasoso Flyover

Based on the above studies and the vertical gradient which has been discussed with IPCII and finally consented to be less than 4%, the total length and span layout of the Pasoso Flyover has been determined as follows.

$$\underline{8 \text{ spans} \times 40\text{m long} = 320\text{m}}$$

### 8.2.6 Comparison of Structural Types

#### (1) Comparison of Superstructure Types

##### 1) Preliminary Comparison of Superstructures

The span length has been determined at 40m through the span arrangement study as described above. Thus the following types of superstructure have been initially selected.

- PC post-tension simply supported T-girder (girder depth=2.1m)
- PC post-tension continuous I girder (girder depth=1.7m)
- PC-Box (girder depth=1.6m)
- Steel-I Girder (girder depth=1.7m)
- Plate Girder with PC Slab (girder depth=2.5m)

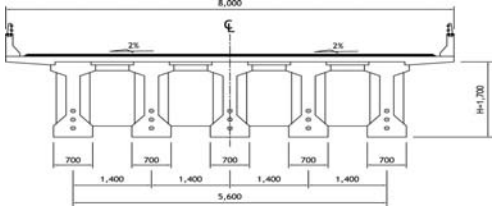
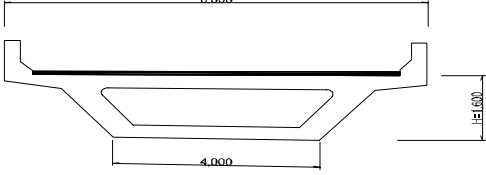
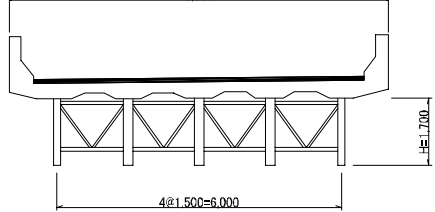
Considering the required maximum girder height (2.0m) to pass under the Tanjung Priok Access Road (TgPA) and to cross over Jl.Laks RE.Martadinata, the following 3 alternatives of superstructure have been selected in the preliminary comparison.

- PC post-tension continuous I girder (girder depth=1.7m)
- PC Box (girder depth=1.6m)
- Steel-I Girder (girder depth=1.7m)

## **2) Selection of Superstructures**

Table 8.2.5 shows a comparison among the alternatives which were selected preliminarily and the PC-I girder type has been selected as the most suitable.

Table 8.2.5 Comparison of Alternative Superstructure Type

	Alternative 1 PC I Girder		Alternative 2 PC Box Girder		Alternative 3 Steel I Girder	
Sections						
Structural Aspect	Number of girder : 5 girders / Girder Depth : 1.70m	**	Number of girder : 1 box girder / Girder Depth : 1.60m	***	Number of girder : 5 girders / Girder Depth : 1.70m	***
	Structural aspect is good due to continuous girder bridge. There are many experiences for the same type of bridge in Jakarta.		Structural aspect is superior due to continuous girder. This type of bridge is normally adopted for viaduct in Jakarta city in case the span length exceeds over 50m long. This is advantageous due to shorter girder depth among alternatives.		Structural and seismic matters are superior to other alternatives due to continuous girder with light weight. The quality control of the girder is quite easy due to the factory make. Both curved girder and skewed girder are available.	
Workability	The girders are to be erected after fabricating at the yard. Fabrication yard of the girders is required to be near the construction site.	***	Detour is needed during construction because of using clear headway under girder for erection.	*	Crane erection with temporary bent	***
	Construction term : approx. 160 days		Construction term : approx. 240 days		Construction term : approx. 160 days	
	All of the materials and equipment for the girder construction are available in Indonesia.		All of the materials and equipment for the girder construction are available in Indonesia.		All of the materials and equipment for the girder construction are available in Indonesia.	
Maintenance	This type of girder is basically maintenance free due to concrete structure.	***	This type of girder is basically maintenance free due to concrete structure.	***	Repainting once five years is required throughout the bridge girder because it is the steel girder and is located near the costal area.	*
Aesthetics	Inferior to the others when the curved girder is not applied.	**	Good due to its smooth exterior in a curve	***	Good due to its smooth exterior in a curve and colored exterior	***
Economic Aspect	It is most economical type than the others.	***	Cost of traffic diversion will be high and complicated.	**	This is the most uneconomical type of bridge considering price hike in Indonesian market.	*
	Cost Ratio : 1.00		Cost Ratio : 1.24		Cost Ratio : 1.65	
Overall Evaluation	It is popular and economical than the others.	***	Inferior to Alternative 1 with regard to cost, construction period and traffic diversion under the construction	*	Inferior to the others with regard to cost and maintenance.	*
Recommendation	Recommended		-----		-----	

Note: \*\*\* Good, \*\* Fair, \* No Good

## (2) Comparison of Foundation Types

### 1) Subsoil Conditions

The subsoil condition along the proposed Pasoso Flyover is shown in Appendix 8A in the Basic Design Report.

### 2) Comparison of Alternatives of Foundation Piles

According to the soil investigation results, the bearing layer is at around 15m depth. Also N-value of the medium layer is expected to be 0 to 2.

Based on the subsoil condition, the following 3 alternative foundation piles have been initially selected to be suitable.

- PC-Pile
- Steel Pile
- RC cast-in-situ Pile

Table 8.2.6 shows the result of comparison of foundation types. Among those types the alternative of PC-Pile (Ø500mm) has been selected as the optimum alternative for the Pasoso Flyover.

**Table 8.2.6 (a) Comparison of Alternative Foundation Piles**

		Alternative plan	Alternative 1	Alternative 2	Alternative 3
Item	Sub Item	Site Conditions	PC-Pile	Steel Pile	Cast-in-situ Pile (Augered)
Application	Diameter Depth Allowable bearing capacity	Good Good Good	35-70 (cm) 15-25 (m) 35-90 (t)	50-80 (cm) 25-40 (m) 100-160 (t)	100-150 (cm) 25-50 (m) 200-250 (t)
Structural Feature			Quality control aspect and workability aspects are good because it is a pre-cast material.	It has strong rigidity. If the medium layer is hard, it will be effective.	In case that N-value is more than 50, it is most effective.
Workability/ Construction Period	Method of piling	Drop hammer Vibro- hammer	*** **	*** **	* *
	All Casing		*	*	***
	Dept	15.0m	***	***	***
	Bearing layer	N>50	**	***	***
	Construction speed		***	***	**
Cost	Cost ratio		1.00	1.13	4.85
Environmental Effect	Noise, Vibration, Sludge	Near Mosque	**	**	***
			***	***	** *
			***	***	*
Recommendation			<b>Recommended</b>	Discarded	Discarded

Note: \*\*\* Good, \*\* Fair, \* No Good

**Table 8.2.6 (b) Cost Comparison of Pile Types**

Item	PC Piles			Steel Pile		
	Ø 450	Ø 500	Ø 600	Ø 450	Ø 500	Ø 600
Diameter of Pile (mm)	Ø 450	Ø 500	Ø 600	Ø 450	Ø 500	Ø 600
Length (m)	15	15	15	15	15	15
Pcs/Pier	18	15	12	18	15	12
Total Amount Ratio	1.10	1.00	1.12	1.16	1.13	1.32

Item	Bored Piles		
	Ø 1000	Ø 1100	Ø 1200
Diameter of Pile	Ø 1000	Ø 1100	Ø 1200
Length (m)	15	15	15
Pcs/Pier	6	5	4
Total Amount Ratio	7.30	6.10	4.85
Pcs/Pier	6	5	4
Total Amount Ratio	7.30	6.10	4.90

### (3) Comparison of Substructures

There are no restricted factors that will affect construction workability at the site. Thus, the reversed T-type abutment and the column type have been selected for abutments and piers respectively. These structures are popularly constructed in Indonesia and local contractors are well familiar with these structures.

### (4) Selected Structure Type for Pasoso Flyover

The types of structures which have been finally selected for the Pasoso Flyover are summarized below.

- 1) Foundation piles.  
PC-Pile (Ø 500mm)
- 2) Substructure  
Abutment: Reversed T-type  
Piers: Column type
- 3) Superstructure.  
PC I girder (40m span)

The general view drawing of the Pasoso Flyover is attached in the following page.



## 8.2.7 Structural Analysis of Bridge Structure

The result of the structural analysis is summarized in Appendix 8A.4.

## 8.2.8 Design of Approach Roads

### (1) Gate Layout Plan

As requested by IPC-II, the facility of gate and booth for checking of entrance tickets have been planned at Sta. 0+100. The facilities have been designed referring to the existing gate facilities of the port.

### (2) Structure of Junction

The traffic regulations in the vicinity of the entrance of the Pasoso Flyover after completion of the Project are shown in Figure 8.2.5. Three types of structures have been planned to regulate the traffic flow.

#### Rubber Cones

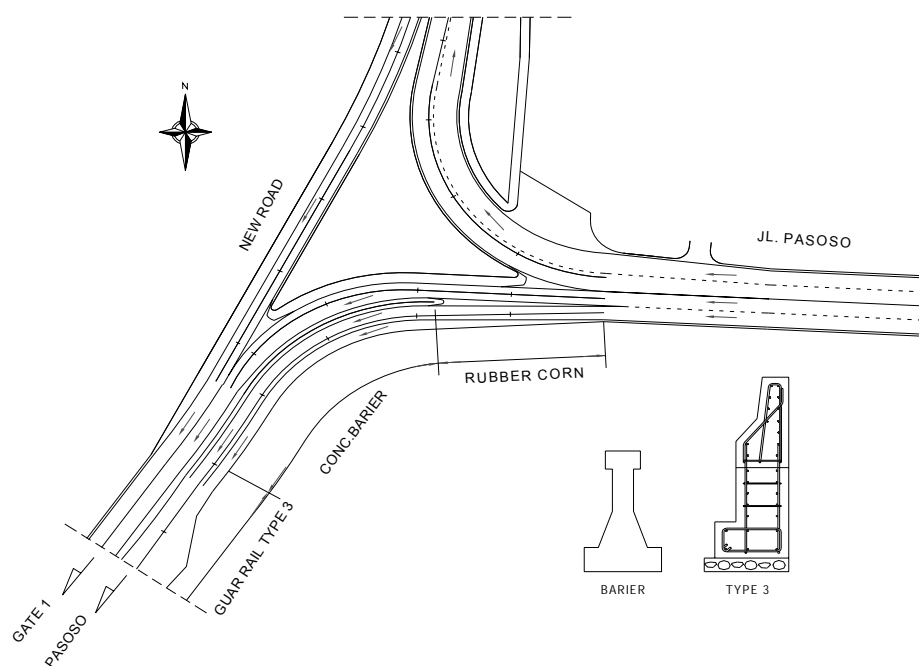
Coloured rubber cones will be provided from Sta.0+000 to Sta.0+040 to separate the traffic toward Gate-1 (New Road) and the Pasoso Flyover.

#### Concrete Barriers

Occasionally, the traffic through Jl.Panaitan Barat will enter the Pasoso Flyover. Thus the middle section of the entrance alignment of the Pasoso Flyover shall be able to accommodate a flexible traffic operation. Therefore concrete barriers that can be removed easily will be placed from Sta.0+040 to Sta.0+100.

#### Guard Rail Structure

Guard rails have been designed from Sta.0+100 to the A1 abutment.



**Figure 8.2.5 Plan of Junction**

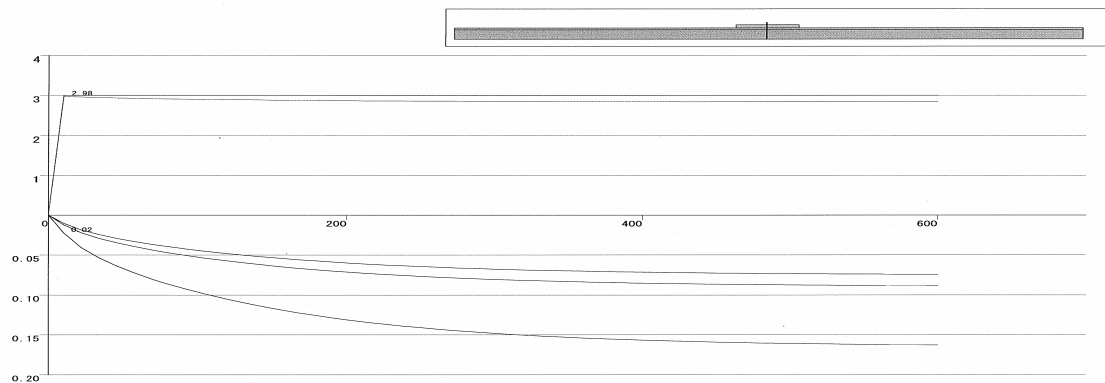
### (3) Settlement Analysis at the Embankment Section

As stated in the previous section, the settlement analysis has been carried out for the embankment section. The results of analysis indicated that the total settlement will be 165 mm with 3.5m height of embankment filling, and it will take about 200 days to achieve the 80 % of the consolidation (132 mm). It will take further 600 days to terminate the residual settlement of 33 mm.

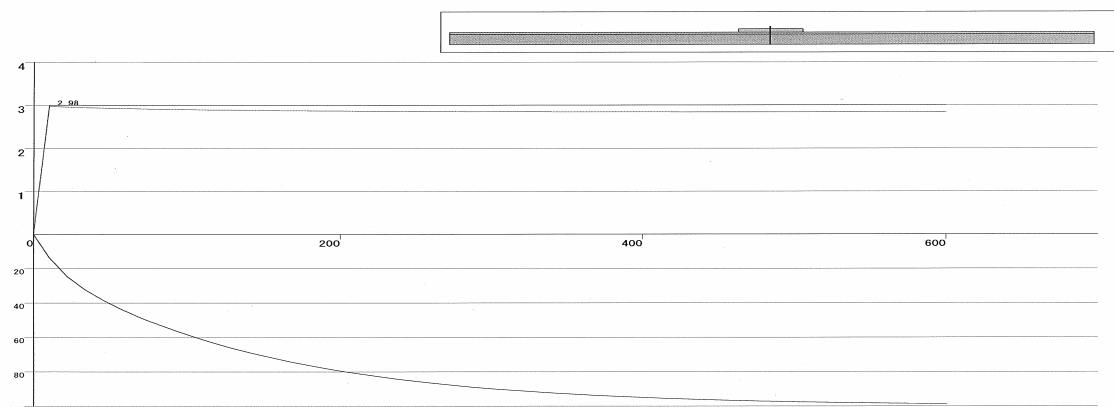
Since the residual settlement is not significant amount, no special soil improvement would be required. It has been determined that the surcharge of equal weight of the embankment shall be applied at least for 200 days (Refer to Table 8.2.7 and Figure 8.2.6).

**Table 8.2.7 Analysis of Settlement Volumes**

Layer	Calculation Code	Layer Thickness (m)	Overboard $p_0$ (kg f/c m <sup>2</sup> )	Increased Stress $\Delta p$ (kg f/c m <sup>2</sup> )	Pre-consolidation $q_0$ (kg f/c m <sup>2</sup> )	Final Settlement (cm)
2	$\Delta e$	2.000	0.061	0.520	0.000	7.528
1	$\Delta e$	9.000	0.334	0.333	0.000	8.970



**Figure 8.2.6 (1) Time-Settlement Curves**



**Figure 8.2.6 (2) Time-Consolidation Curves**

#### (4) Design of Pavement

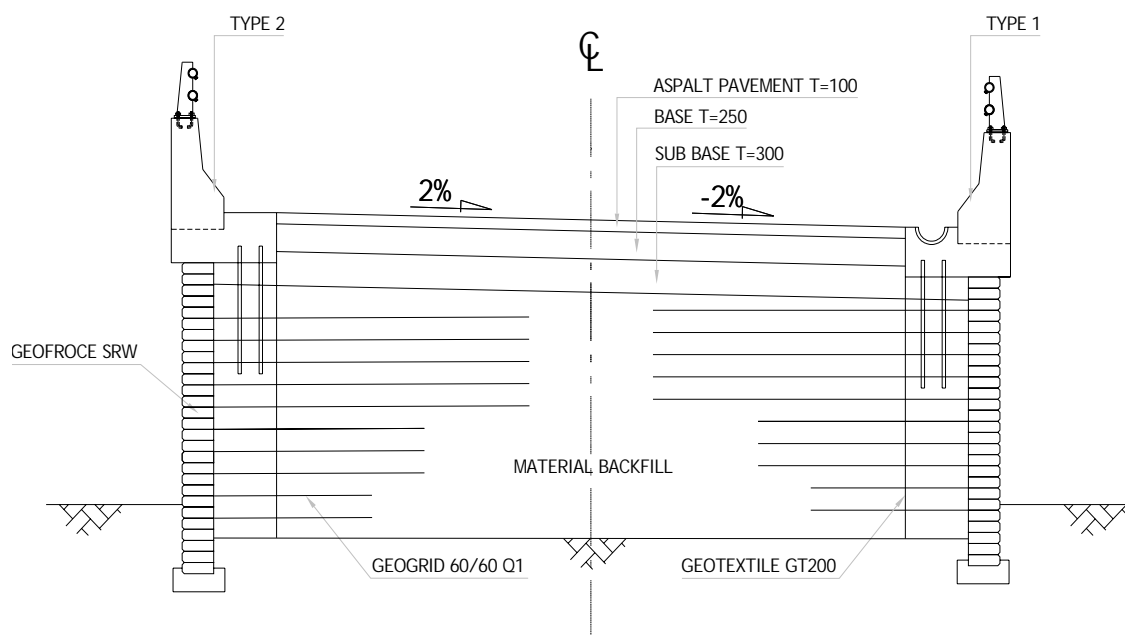
As stated above, the residual settlement after completion of the Project (assumed to be 2 years) will be 33 mm. Thus flexible asphalt pavement has been selected.

#### (5) Side Retaining Wall of the Embankments

The following constrain factors have been considered to design the side retaining wall of the embankment section:

- minimum consolidation settlement (the weight of the structure shall be light.)
- Vertical retaining wall shall be required due to the land limitations at the site.

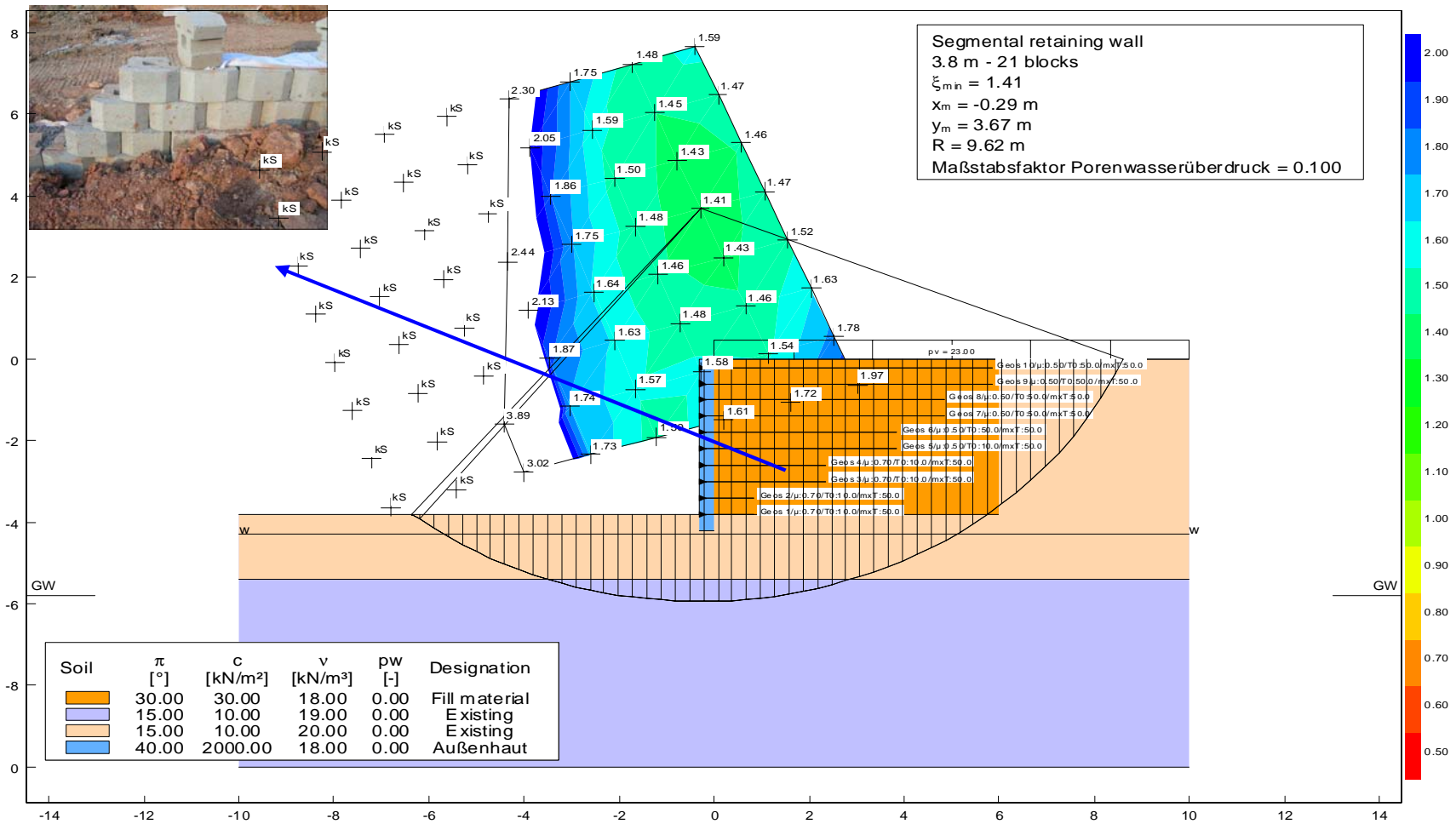
In due consideration of the above, Mechanical Stabilized Wall structure has been selected as the most suitable method because it is the most popular method in Indonesia. The stability analysis of the structure is shown in Figure 8.2.8.



**Figure 8.2.7 Cross Section of Mechanical Stabilized Wall**

Figure 8.2.8 Stability Analysis of Mechanical Stabilized Wall

8-28



## **8.3 Construction Plan of Port inner Road and Pasoso Flyover**

### **8.3.1 General**

The construction plan shall be formulated so as to ensure completion of the works safely and practically, paying attention to such local condition as topography, geology, workable days and etc.

The construction work items of the improvement of port inner road and Pasoso Flyover are popularly practiced in Indonesia and local contractors are well familiar with these works. In this sense, it is considered reasonable to implement the Project under LCB procurement. The construction materials which will be procured for the Project is commonly available through the construction market in Indonesia because there will be no special construction material.

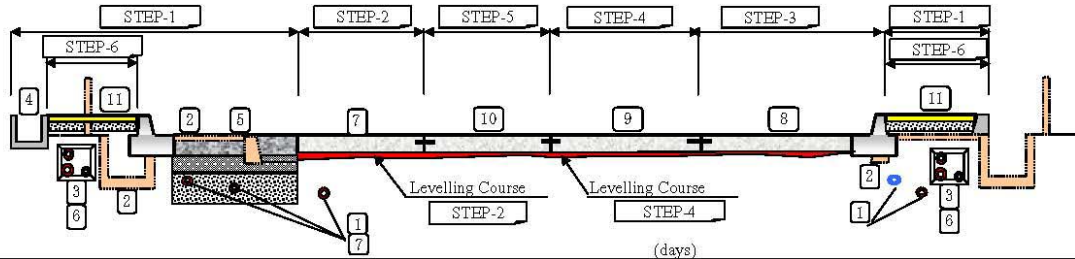
### **8.3.2 Construction Plan**

The major control issues of the construction plan of the port inner road improvement including the construction of Pasoso Flyover are described below.

#### **(1) Traffic Diversion during the Pavement Works on the Port Inner Roads**

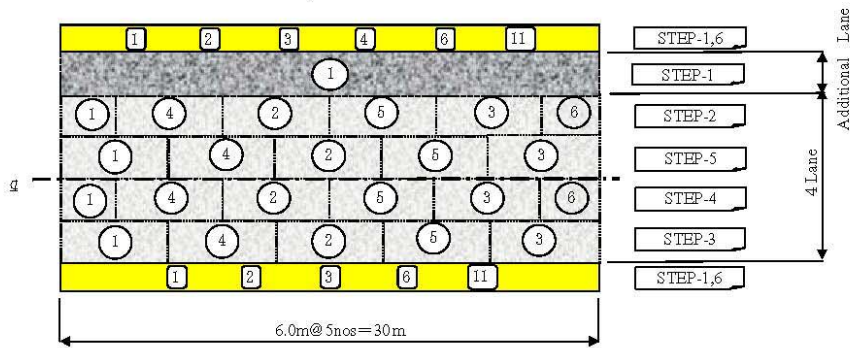
Tanjung Priok Port is operated for 24 hours and there is constant traffic flow on the port inner road. It is virtually impossible to totally close the roads even during the construction. Thus traffic diversion during the construction period shall be implemented carefully. In this Study, the construction work schedule of the port inner roads has been planned opening at least 2 lanes width (7m) of each port inner road. The work flow of the port inner roads considering required traffic diversion is presented in Figure 8.3.1, 8.3.2 and Table 8.3.1 shows the construction schedule of the port inner roads.

ROAD WORK SCHEDULE (TYPE 1: WIDENING AND OVERLAY, NEW CONSTRUCTION)



Location	Works Item	unit	(days)											Work Procedure	Remarks		
			1	2	3	4	5	6	7	8	9	10	11				
1	Utility Survey	100m	█														
2	Removal Existing Pedestrian and Drainage	200m		█													
3	New Utility Construction (Hand Hole and PVC Duct)	200m			█												
4	New drainage Construction	100m				█									STEP-1		
5	Asphalt Pavement	100m					█										incl. Base and Sub-base Course
6	Utility Installation (by Contracor or Utility Agencies)	100m						█									Cabling and Connection
7	Levelling and Concrete Overlay	100m							█						STEP-2		
8	Levelling and Concrete Overlay	100m								█					STEP-3		
9	Concrete Overlay	100m									█				STEP-4		
10	Concrete Overlay	100m										█			STEP-5		
11	New Pedestrian Construction	200m											█		STEP-6		

Standard of Daily Works



ROAD WORK FLOWCHART

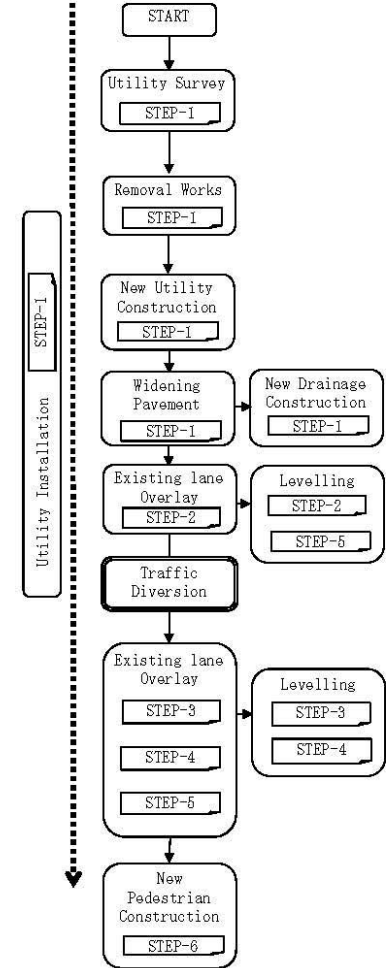
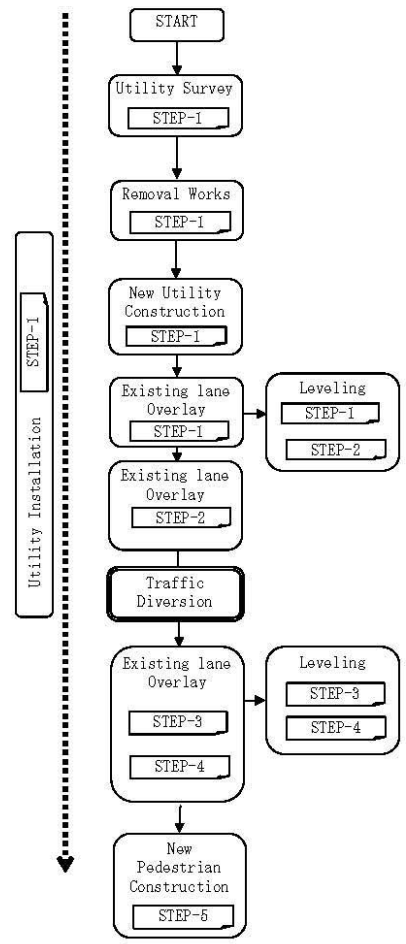
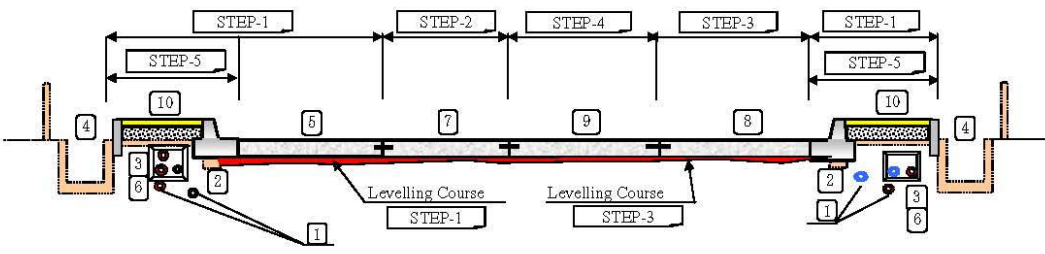


Figure 8.3.1 Road Work Flow (Type 1)

ROAD WORK FLOWCHART



ROAD WORK SCHEDULE (TYPE 2: OVERLAY)



Location	Works Item	unit	1	2	3	4	5	6	7	8	9	10	11	Work Procedure	Remarks
1	Utility Survey	100m	█												
2	Removal Existing Pedestrian (and Drainage, if require)	200m		█	█	█	█	█	█	█	█	█	█		
3	New Utility Construction (Hand Hole and PVC Duct)	200m			█	█	█	█	█	█	█	█	█		
4	New Drainage Construction, if require	100m			█	█	█	█	█	█	█	█	█	STEP-1	
5	Levelling and Concrete Overlay	100m			█	█	█	█	█	█	█	█	█		incl. Base and Sub-base Course
6	Utility Relocation (by Contractor or Utility Agencies)	100m			█	█	█	█	█	█	█	█	█		Cabling and Connection
7	Concrete Overlay	100m			█	█	█	█	█	█	█	█	█	STEP-2	
8	Leveling and Concrete Overlay	100m			█	█	█	█	█	█	█	█	█	STEP-3	
9	Concrete Overlay	100m			█	█	█	█	█	█	█	█	█	STEP-4	
10	New Pedestrian Construction	200m			█	█	█	█	█	█	█	█	█	STEP-5	

Standard of Daily Works

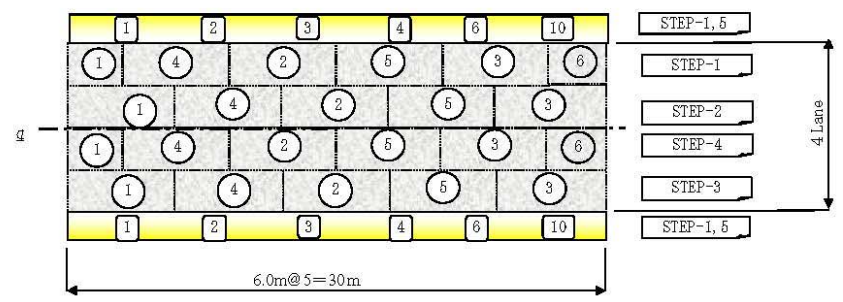


Figure 8.3.2 Road Work Flow (Type 2)

Table 8.3.1 Work Schedule of Port Inner Road

PORT INNER ROAD AND FLYOVER WORKING SCHEDULE

Road Location	Lane Number (Work Type)	Length	Step	Efficiency	Working Day	1M	2M	3M	4M	5M	6M	7M	8M	9M	10M	11M	12M	13M	14M	15M	16M	17M	18M	19M	20M	21M	22M	23M	24M	25M	26M	27M	28M	29M	30M						
Jl.Pelabuhan Raya	4or 5lane (TYPE 1: Widening and Overlay)	900m	1:11*9	0.70	140	.....																																			
			2:5*9	0.70	65		.....																																		
			3:5*9	0.70	65			.....																																	
			4:5*9	0.70	65				.....																																
			5:5*9	0.70	65					.....																															
			6:10*9	0.70	130						.....																														
			<b>Total</b>						.....																																
Jl.Bangka	Average 4lane (TYPE 2: Overlay)	240m	1:11*2.4	0.70	40																																				
			2:5*2.4	0.70	20																																				
			3:7*2.4	0.70	25																																				
			4:5*2.4	0.70	20																																				
			5:10*2.4	0.70	35																																				
			<b>Total</b>																																						
Jl.Banda	4lane (TYPE 1: Widening and Overlay)	360m	1:11*3.6	0.70	60																																				
			2:5*3.6	0.70	30																																				
			3:5*3.6	0.70	30																																				
			4:5*3.6	0.70	30																																				
			6:10*3.6	0.70	55																																				
			<b>Total</b>																																						
Jl.Pasoso	4lane (TYPE 1: Widening and Overlay)	540m	1:11*5.4	0.70	85																																				
			2:5*5.4	0.70	40																																				
			3:5*5.4	0.70	40																																				
			4:5*5.4	0.70	40																																				
			6:10*5.4	0.70	80																																				
			<b>Total</b>																																						
Jl.Panaitan	3 carriageway+1shoulder (TYPE 1: Widening and Overlay)	140m	1:11*1.4	0.70	25																																				
			2:5*1.4	0.70	10																																				
			3:5*1.4	0.70	10																																				
			4:5*1.4	0.70	10																																				
			6:10*1.4	0.70	20																																				
			<b>Total</b>																																						
Jl.Palmas	4lane (TYPE 2: Overlay)	280m	1:5*2.8	0.70	20																																				
			2:4*2.8	0.70	16																																				
			3:5*2.8	0.70	20																																				
			4:4*2.8	0.70	16																																				
<b>Total</b>																																									
Jl.Penjalai	3lane (TYPE 2: Widening only)	470m	1:11*4.7	0.70	75	.....																																			
			2:5*4.7	0.70	35		.....																																		
			6:10*4.7	0.70	70			.....																																	
<b>Total</b>					.....																																				
New Road	2lane (TYPE 2: New Construction)	450m	1:11*4.5	0.70	75																																				
			2:5*4.5	0.70	35																																				
			6:10*4.5	0.70	65																																				
			<b>Total</b>																																						

## (2) Utility Relocation Works for the Port Inner Road Construction

There are utilities inside the Project area which is owned by IPC-II and other utility agencies as shown below.

Items	Owner
Electric Line	IPC-II PLN
Communication Line (Telephone, CCTV)	IPC-II PT. Telkom JICT
Water Supply Line	IPC-II

The utilities which are owned by IPC-II shall be relocated by the Project and the others which are not owned by IPC-II shall be relocated by IPC-II in cooperation with utility agencies. The work flow regarding utility works is presented in Figure 8.3.3.

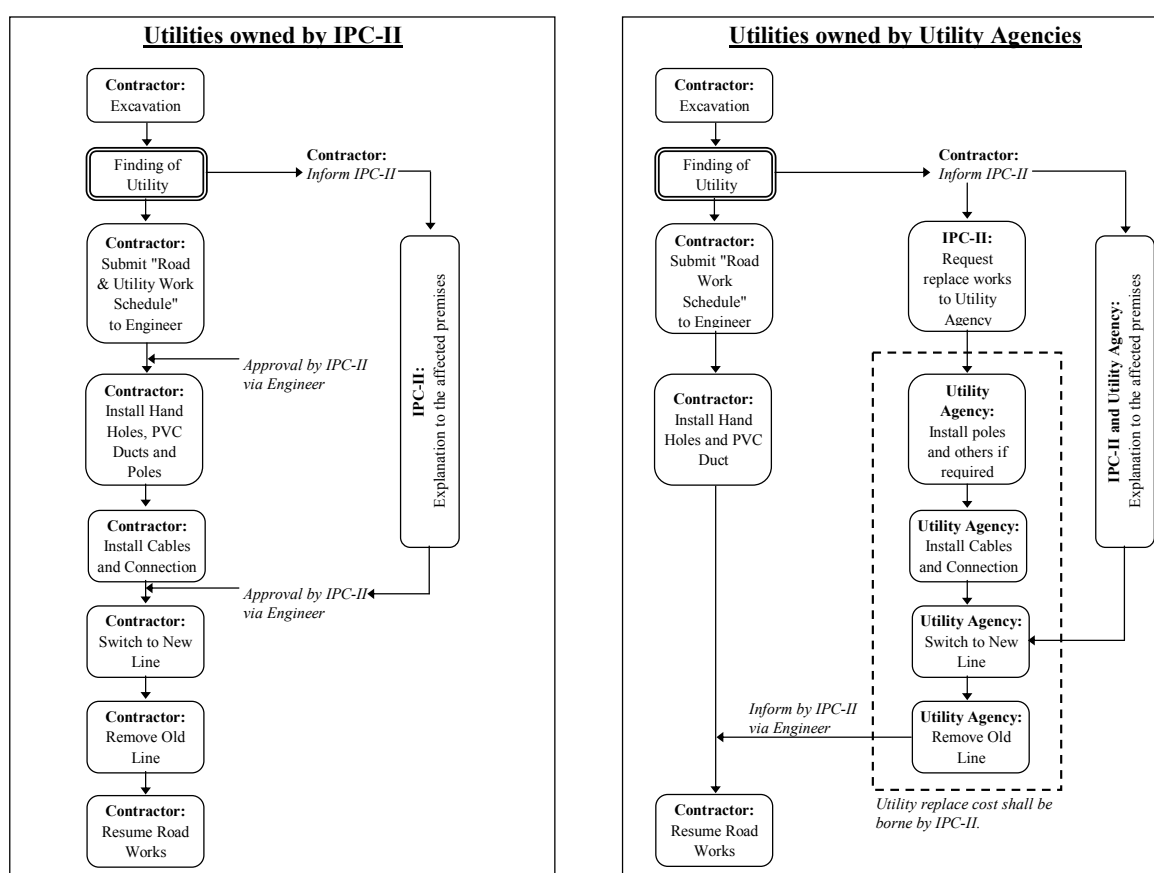
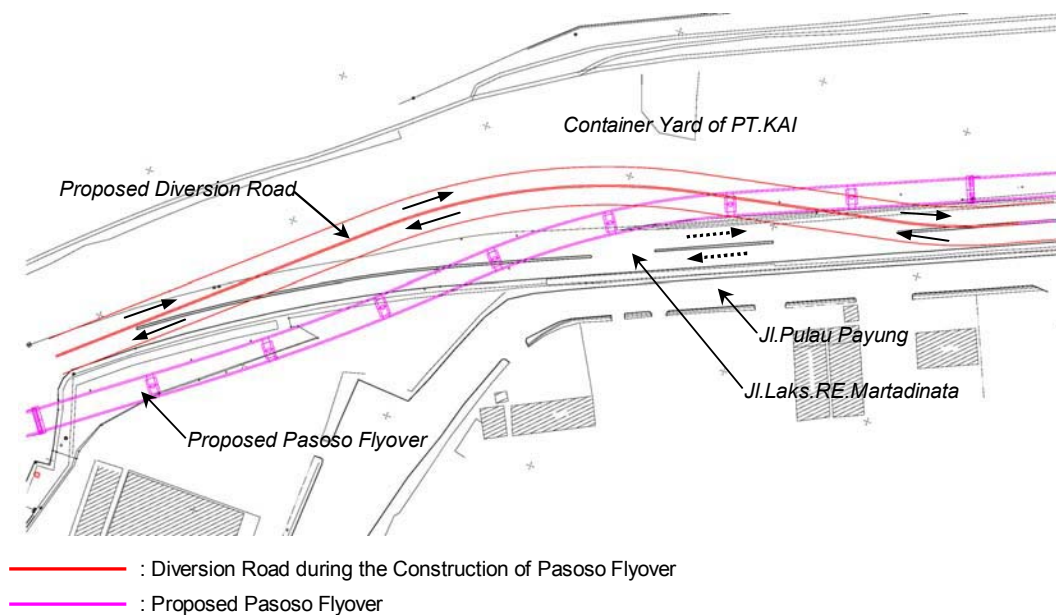


Figure 8.3.3 Work Flow of Utility Works

## (3) Traffic Diversion during the Construction of Pasoso Flyover

Pasoso Flyover (from Pier 3 to Pier 5) has been designed to overpass Jl.Laks.RE. Martadinata which is one of the arterial roads surrounding the port area. During the construction of Pier 4 and the erection of girders from Pier 3 to Pier 5, a diversion road shall be provided for the traffic of Jl.Lals.RE.Martadinata. The proposed diversion road is shown in Figure 8.3.4. The proposed diversion road will be located inside PT. KAI property which is currently used for a container yard and IPC-II shall borrow the land from PT.KAI for 10 months (including the construction of the diversion road).

Necessity of the land for the diversion road was officially explained to the officials of PT.KAI during the joint meeting which was held on 11th October 2005 and 20th October 2005 and there was no objection from them. Prior to the construction of Pasoso Flyover, IPC-II shall proceed with the necessary arrangement for the land in cooperation with PT.KAI.



**Figure 8.3.4 Proposed Diversion Road during the Construction of Pasoso Flyover**

**(4) Land Acquisition from PT.KAI for the Construction of Pasoso Flyover**

Part of Pasoso Flyover structure (Sta.0+440 to Sta.0+760) has been planned on the container yard of PT. KAI. Prior to the commencement of the construction, IPC-II shall proceed with the necessary arrangement to expedite the land acquisition from PT. KAI land as soon as possible. The land acquisition map, i.e. coordinate and area, was officially submitted to IPC-II in October 2005.

The land acquisition will be most critical control point to establish the construction plan of Pasoso Flyover. The construction schedule of Pasoso Flyover shown in Table 8.3.2 has been estimated on condition that the land acquisition will be completed prior to the construction.



### (5) Required Land for the Port Inner Road Construction and Construction Yard

As mentioned in Chapter 8, the widening of the carriageway shall be required for the Project. The required land for the widening is owned by IPC-II, though most of the land is currently used by the private companies under land lease contracts. The Project road has been designed not to affect buildings as much as practical and the affected buildings will be gate houses and part of the building as shown in Table 8.1.2, Chapter 8.

Necessary space for the construction yard has been estimated to be 4,000m<sup>2</sup> including site office (300m<sup>2</sup>), motor-pool (800m<sup>2</sup>), material stock/product yard (1,000) and parking/other activity space. The proposed location is shown in Figure 8.3.5. Also a girder construction yard for Pasoso Flyover shall be required separately. The proposed location is shown in the drawings (IP521/TGP/F114 and No. IP521/TGP/F118).

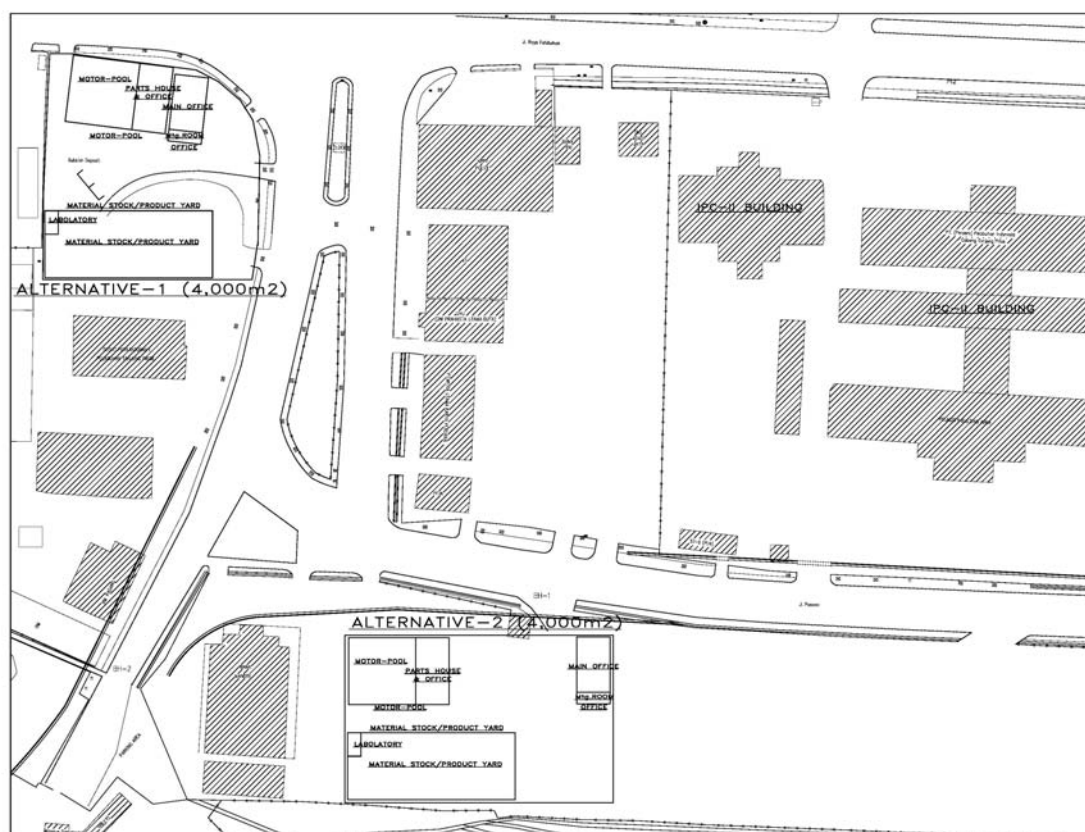


Figure 8.3.5 Proposed Location of Construction Yard for Port Inner Road

### 8.3.3 Construction Schedule

The construction period of the port inner road improvement has been estimated to be 36 months including the construction of the Pasoso Flyover. The overall construction schedule is shown in Table 8.3.3.

**Table 8.3.3 Overall Construction Schedule of Port Inner Road and Pasoso Flyover**

Works Item	Road Location	1st year												2nd year												3rd year											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Mobilization		█																																			
Temporary Works		█																																			
Road Works	Port Inner Road																																				
	JL.Raya Pelabuhan	█																																			
	JL.Bangka	█																																			
	JL.Banda	█																																			
	JL.Pasoso	█																																			
	JL.Panaitan	█																																			
	JL.Palma	█																																			
	JL.Penjalai	█																																			
	New Road	█																																			
Flyover Works	█																																				
Demobilization	█																																				