Table 11.4.1 Rainfall Records for Jakarta

Month	1	2	3	4	5	6	7	8	9	10	11	12
Rainfall (mm)	426	355	277	125	113	93	37	43	64	92	123	173

Table 11.4.2 Number of Days with Rainfall in Jakarta (1961-1976)

Month	1	2	3	4	5	6	7	8	9	10	11	12
Rainy days	12.7	17.9	16.8	11.2	9.8	6.2	3.2	3.8	4.3	7.8	11.	4.7

Note : Data for Tables 11.4.1 and 11.4.2 from Directorate of Meteorology and Geophysics (1961-1976), Department of Communications.

Table 11.4.3 Number of Working Days in a Month

Description	Dry Season May-Oct. (6 months)	Rainy Season Nov.-Apr. (6 months)	Annual
Average number of rainy days in a month	6 days	12 days	109.5 days
Working efficiency on a rainy day	65%	35%	
Number of holidays in month	5 days	5 days	60 days
Number of actual working days in a month	23 days	17 days	20
Working efficiency in a month	73% (23/30)	56% (17/30)	67%(20/30)

11.4.2 Construction Schedules

The construction time schedule for the North-South Axis and for the four sub-sections of the East-West Axis have been prepared based on the assumptions described above. The schedules are shown in Tables 11.4.4, 11.4.5, 11.4.6, 11.4.7 and 11.4.8 respectively.

The times allowed have been checked according to estimated productivity rates for the work items and also by comparing the overall time allowed with actual times taken by similar projects in Indonesia. Construction within the times allowed is quite feasible but requires an experienced contractor with skilled construction managers.

FIG. 11.4.4 CONSTRUCTION TIME SCHEDULE - NORTH-SOUTH AXIS

STATION STA. -770 - STA. 18+400

LENGTH 17.630 km

	WORK ITEM	QUANTITY
1	MOBILISATION	
2	TEMPORARY TRAFFIC DIVERSIONS	
3	ROAD EARTHWORKS	Fill = 387,200 m3
4	DRAINAGE	Pipe = 30,112 m
5	ROAD PAVEMENT	Area = 390,300 m2
6	STRUCTURAL EXCAVATION	Vol. = 467,259 m3
7	PILING	Length = 380,726 m
8	CONCRETE PIERS & ABUTMENTS	Vol. = 304,754 m3
9	PRECAST BEAMS: a) FABRICATION b) ERECTION	No. = 3,437 beams
10	DECK FOR CONCRETE BRIDGES	Vol. = 100,968 m3
11	STEEL PIERS: a) FABRICATION b) ERECTION	Wt. = 10,826 t
12	STEEL GIRDERS: a) FABRICATION b) ERECTION	Wt. = 47,123 t
13	CONC. DECK FOR STEEL BRIDGES	Vol. = 43,839 m3
14	UTILITY DIVERSIONS	
15	MISCELLANEOUS	

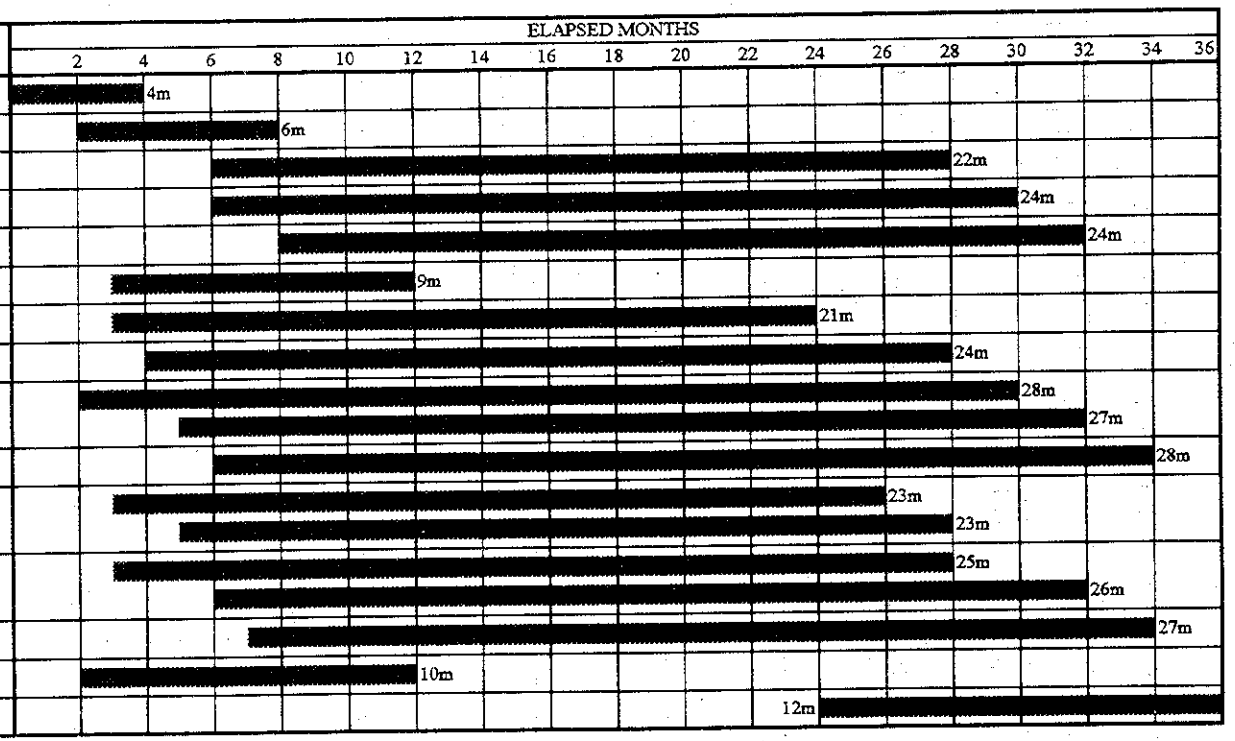


FIG. 11.4.5 CONSTRUCTION TIME SCHEDULE - EAST-WEST AXIS - SECTION EW-1

STATION STA. 0+500 - STA. 9+200

LENGTH 8.700 km

	WORK ITEM	QUANTITY	ELAPSED MONTHS (2 4 6 8 10 12 14 16 18 20 22 24)
1	MOBILISATION		4m
2	TEMPORARY TRAFFIC DIVERSIONS		4m
3	ROAD EARTHWORKS	Fill = 1,028,742 m3	14m
4	DRAINAGE	Pipe = 21,109 m	15m
5	ROAD PAVEMENT	Area = 477,672 m2	14m
6	STRUCTURAL EXCAVATION	Vol. = 145,955 m3	7m
7	PILING	Length = 177,039 m	11m
8	CONCRETE PIERS & ABUTMENTS	Vol. = 105,498 m3	12m
9	PRECAST BEAMS: a) FABRICATION b) ERECTION	No. = 926 beams	16m 15m
10	DECK FOR CONCRETE BRIDGES	Vol. = 36,241 m3	16m
11	UTILITY DIVERSIONS		6m
12	MISCELLANEOUS		8m

FIG. 11.4.6 CONSTRUCTION TIME SCHEDULE - EAST-WEST AXIS - SECTION EW-2

STATION STA. 9+200 - STA. 11+700

LENGTH 2.500 km

	WORK ITEM	QUANTITY
1	MOBILISATION	
2	TEMPORARY TRAFFIC DIVERSIONS	
3	ROAD EARTHWORKS	Fill = 73,845 m3
4	DRAINAGE	Pipe = 2,678 m
5	ROAD PAVEMENT	Area = 74,013 m2
6	STRUCTURAL EXCAVATION	Vol. = 42,718 m3
7	PILING	Length = 46,653 m
8	CONCRETE PIERS & ABUTMENTS	Vol. = 33,333 m3
9	PRECAST BEAMS: a) FABRICATION b) ERECTION	No. = 491 beams
10	DECK FOR CONCRETE BRIDGES	Vol. = 15,849 m3
11	STEEL GIRDERS: a) FABRICATION b) ERECTION	Wt. = 1,098 t
12	CONC. DECK FOR STEEL BRIDGES	Vol. = 772 m3
13	UTILITY DIVERSIONS	
14	MISCELLANEOUS	

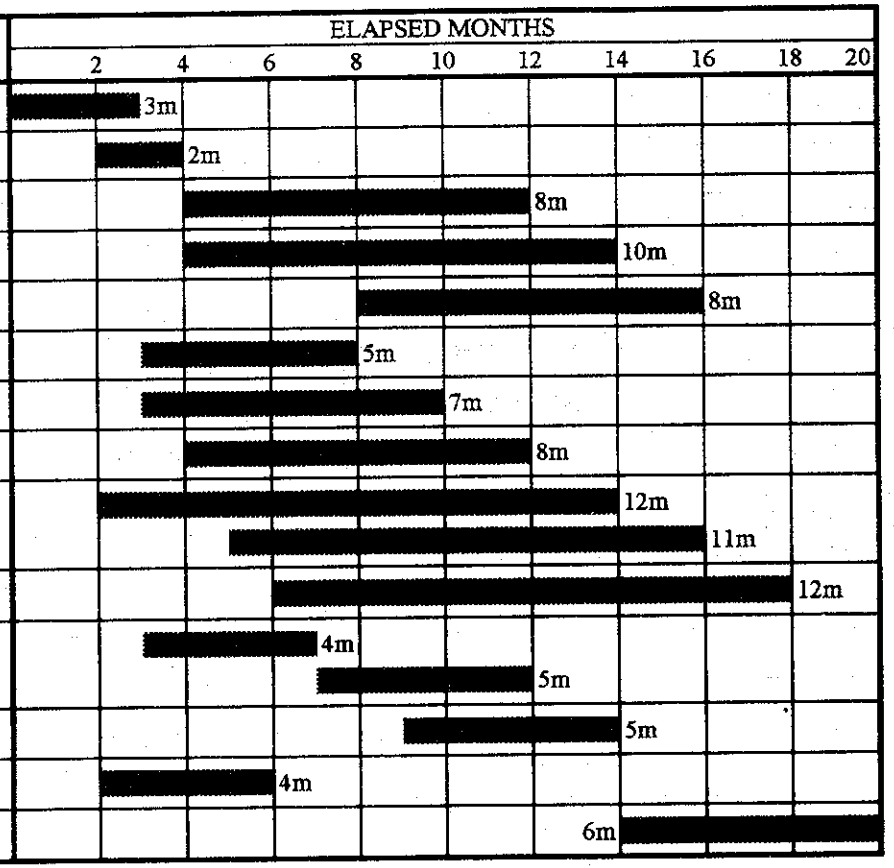


FIG. 11.4.7 CONSTRUCTION TIME SCHEDULE - EAST-WEST AXIS - SECTION EW-3

STATION STA. 11+700 - STA. 20+150

LENGTH 8.450 km

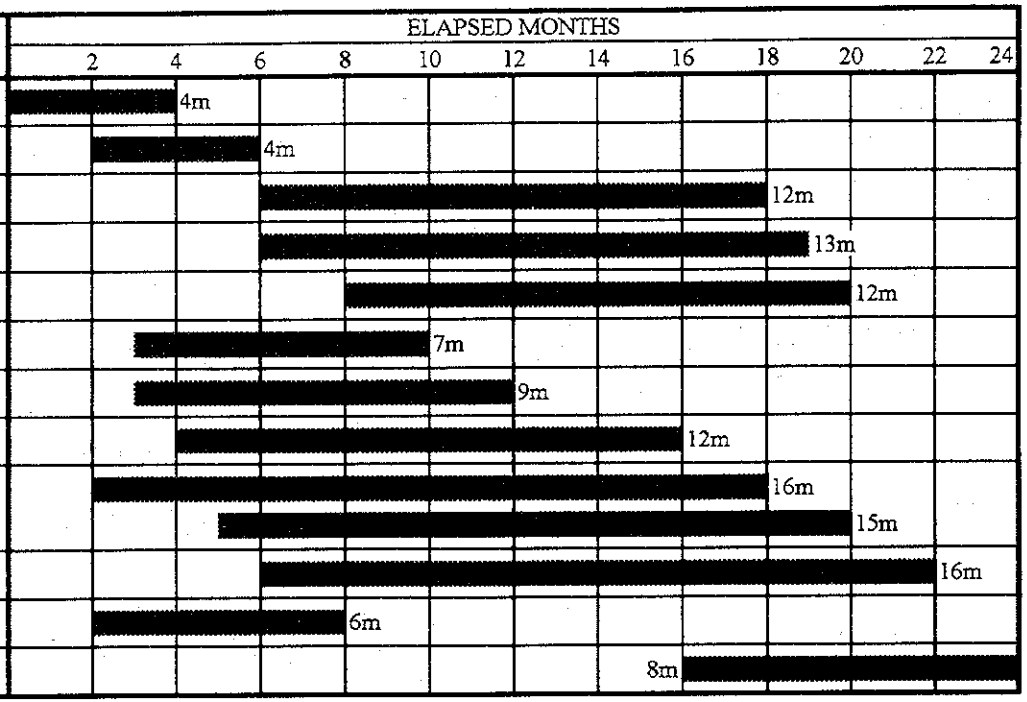
	WORK ITEM	QUANTITY	ELAPSED MONTHS
1	MOBILISATION		4m
2	TEMPORARY TRAFFIC DIVERSIONS		4m
3	ROAD EARTHWORKS	Fill = 149,509 m3	10m
4	DRAINAGE	Pipe = 5,022 m	12m
5	ROAD PAVEMENT	Area = 111,774 m2	10m
6	STRUCTURAL EXCAVATION	Vol. = 170,497 m3	8m
7	PILING	Length = 136,507 m	13m
8	CONCRETE PIERS & ABUTMENTS	Vol. = 133,525 m3	16m
9	PRECAST BEAMS: a) FABRICATION b) ERECTION	No. = 1,909 beams	20m 21m
10	DECK FOR CONCRETE BRIDGES	Vol. = 57,287 m3	22m
11	STEEL GIRDERS: a) FABRICATION b) ERECTION	Wt. = 1,918 t	5m 7m
12	CONC. DECK FOR STEEL BRIDGES	Vol. = 1,968 m3	7m
13	UTILITY DIVERSIONS		8m
14	MISCELLANEOUS		8m

FIG. 11.4.8 CONSTRUCTION TIME SCHEDULE - EAST-WEST AXIS - SECTION EW-4

STATION STA. 20+150 - STA. 31+250

LENGTH 11.100 km

	WORK ITEM	QUANTITY
1	MOBILISATION	
2	TEMPORARY TRAFFIC DIVERSIONS	
3	ROAD EARTHWORKS	Fill = 564,760 m3
4	DRAINAGE	Pipe = 15,532 m
5	ROAD PAVEMENT	Area = 365,293 m2
6	STRUCTURAL EXCAVATION	Vol. = 165,554 m3
7	PILING	Length = 85,545 m
8	CONCRETE PIERS & ABUTMENTS	Vol. = 120,936 m3
9	PRECAST BEAMS: a) FABRICATION b) ERECTION	No. = 1,688 beams
10	DECK FOR CONCRETE BRIDGES	Vol. = 37,803 m3
11	UTILITY DIVERSIONS	
12	MISCELLANEOUS	



CHAPTER 12 ENVIRONMENTAL IMPACT STUDY

CHAPTER 12 ENVIRONMENTAL IMPACT STUDY

12.1 Present Environmental Conditions

1) Climate

JABOTABEK has a tropical climate. The climate of JABOTABEK area can be divided into two seasons as follows:

- East monsoon or dry season from May to October
- West monsoon or rainy season from November to April

The southern trade winds carry dry air from the Australian continent between May and October. From November to April, the west monsoon causes heavy rain in the JABOTABEK area.

Climate data between 1983 and 1992 from the following three weather stations in the JABOTABEK area are shown in Fig. 12.1.1 and Table 12.1.1.

- West JABOTABEK (Curug, Tangerang)
- Central JABOTABEK (Office of Meteorology and Geophysical Agency)
- East JABOTABEK (Bandara Halim, Jakarta Timur)

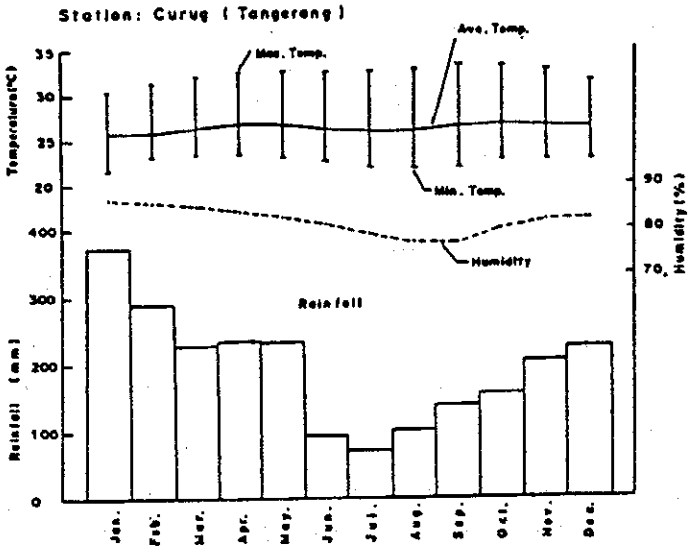
In Central JABOTABEK, the mean annual temperature is about 27 °C. The highest mean monthly temperature of 27.8 °C is in May and June. The lowest mean temperature of 26.6 °C is in January and February. Monthly mean humidity ranges from 72 to 83 %.

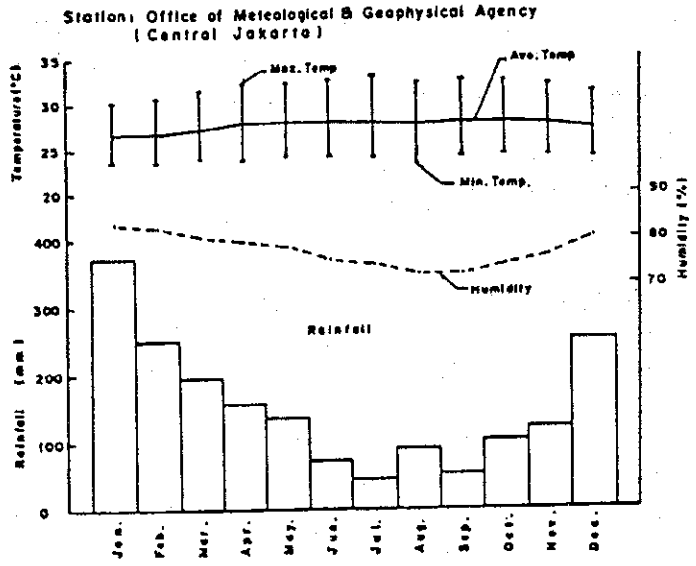
The average annual rainfall from 1983 to 1992 was 1880 mm. The maximum mean monthly rainfall is over 250 mm in January and February. In west and east JABOTABEK, however, the average annual rainfall is 2,340 and 2,300 mm respectively. The maximum mean monthly rainfall is 370 mm in January, and the minimum rainfall is 40 mm in July.

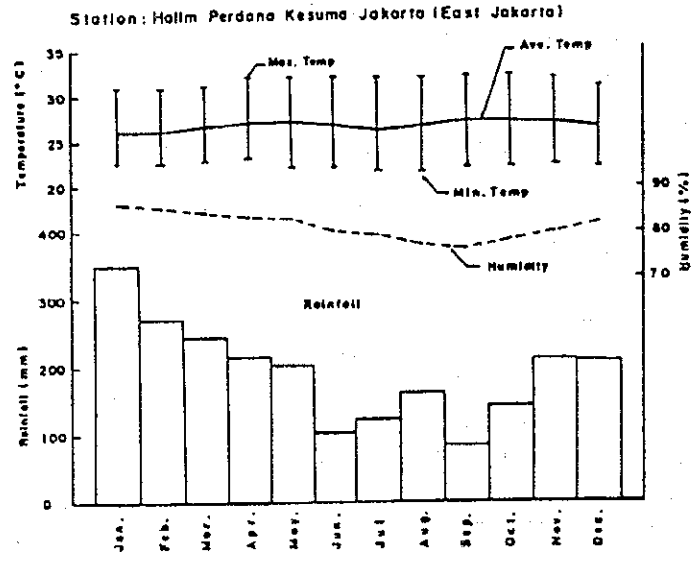
2) Topography/Geology

The JABOTABEK area is in West Java. This area is bounded to the north by the Java Sea. The JABOTABEK area lies on a lowland that is 5000 years old. The lowland is known as Dataran Puing Berkipas, and was formed by volcanic deposition, from Gedeh, Pangrango and Salak volcanoes. This deposit formation fans towards the north, and is separated by rivers. The Cisadane river flows to the west, the Ciliwung river flows to the north and the Bekasi river flows to the east.

These rivers carried sediments which were continuously deposited to the surface of "endapan puing berkipas (the deposit of the ruins on a form of a







FEASIBILITY ON URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT IN JAKARTA METROPOLITAN AREA	Fig. 12.1.1 Monthly Climate in JABOTABEK, 1983-1992

Table 12.1.1 Monthly Climate Data in JABOTABEK, 1983-1992

Station: Curug (Tangerang)

Parameter	unit	January	February	March	April	May	June	July	August	September	October	November	December	year
Temperature														
Ave.	C	25.9	25.8	26.3	26.7	26.7	26.3	25.9	26.0	26.3	26.7	26.4	26.3	26.3
Max.		30.5	31.3	31.9	32.6	32.6	32.6	32.7	32.8	33.3	33.2	32.8	31.5	32.3
Min.		23.1	23.0	23.2	23.2	23.0	22.4	21.6	21.6	21.9	22.7	22.7	22.9	22.6
Humidity	%	87	86	85	84	83	81	79	78	78	80	81	83	82.1
Sunshine duration ratio	%	35	45	57	68	67	70	78	79	72	61	54	45	60.9
Rainfall	mm	373	289	228	232	231	92	69	101	138	157	204	225	2339
Rain day	days	24	20	19	16	13	7	7	7	9	13	16	19	14.2
Wind														
Average wind Speed	knot	3.3	3.4	3.4	3.5	3.3	3.4	3.4	3.4	3.6	3.7	3.4	3.5	3.4
Max. wind speed	knot	15.1	13.8	14.9	16.9	13.9	11.3	16.5	13.6	16.0	16.9	16.9	15.1	15.1

Station: Central Jakarta

Parameter	unit	January	February	March	April	May	June	July	August	September	October	November	December	year
Temperature														
Ave.	C	26.6	26.6	27.2	27.7	27.8	27.8	27.7	27.5	27.7	27.7	27.5	26.9	27.4
Max.		30.1	30.6	31.7	32.3	32.4	32.6	32.9	32.4	32.5	32.4	32.0	31.2	31.9
Min.		23.8	23.8	24.2	24.4	24.4	24.2	24.0	23.7	24.0	24.4	24.3	23.9	24.1
Humidity	%	83	82	80	79	78	75	74	72	72	74	76	80	77.1
Sunshine duration ratio	%	29	36	50	54	51	59	73	73	67	55	43	38	52.3
Rainfall	mm	369	246	192	153	136	70	41	91	53	101	121	251	1824
Rain day	days	24	22	17	16	14	8	6	7	8	11	16	20	14.1
Wind														
Average wind Speed	knot	3.0	3.2	3.2	3.0	3.0	3.4	4.0	3.4	3.4	3.2	3.1	3.4	3.3
Max. wind speed	knot	12.3	14.2	14.1	12.2	13.6	14.3	16.1	14.9	14.9	14.6	14.6	13.9	14.1

Station: Halim Perdana Kesuma Jakarta (East Jakarta)

Parameter	unit	January	February	March	April	May	June	July	August	September	October	November	December	year
Temperature														
Ave.	C	26.1	26.2	26.7	27.0	27.0	26.7	26.4	26.5	27.1	27.3	27.0	26.5	26.7
Max.		30.1	30.9	31.2	32.1	32.2	32.0	32.0	32.0	32.4	32.7	32.1	31.3	31.8
Min.		22.7	22.5	22.9	23.1	22.4	22.1	21.6	21.5	21.9	22.4	22.8	22.2	22.3
Humidity	%	86	85	84	83	83	80	79	77	76	78	80	82	81.1
Sunshine duration ratio	%	36	44	54	61	68	68	77	79	70	62	51	46	59.7
Rainfall	mm	349	271	245	216	203	103	121	161	85	141	212	210	2317
Rain day	days	21	17	16	13	12	8	6	6	7	10	14	17	12.3
Wind														
Average wind Speed	knot	2.6	2.9	2.6	2.4	2.3	2.4	2.4	2.7	2.9	2.7	3.3	3.0	2.7
Max. wind speed	knot	14.0	14.1	13.1	17.0	13.1	11.3	12.6	14.1	13.2	14.6	14.6	12.9	13.7

Source: Meteorology and Geophysical Agency

Max. and Min. Temperature: monthly max. and min. mean data
Sunshine duration ratio: 8 hr (8:00-16:00)=100%
Rainfall: year means total amount of a year
Average wind speed: 1 knot= 1.8 km/h= 0.5 m/s

fan). Gradually the Jakarta Bay was formed, followed by the appearance of an atoll.

It is known that the change of the direction of river currents create sand banks. The estuaries of the Cisadane, Angke, Ciliwung, Bekasi and Citarum rivers that lie on the lowland, bend to the west. The sand bank at the eastern part of the coast, is deposited by ocean currents. During the rainy season, sediments carried by the rivers are continuously deposited to form the JABOTABEK lowland.

3) Land Resources

(1) Land Use

According to statistics, the JABOTABEK area has an area of approximately 6,800 km^2 (see Table 12.1.2). Present land use and land status in the JABOTABEK area are shown in Fig. 12.1.2.

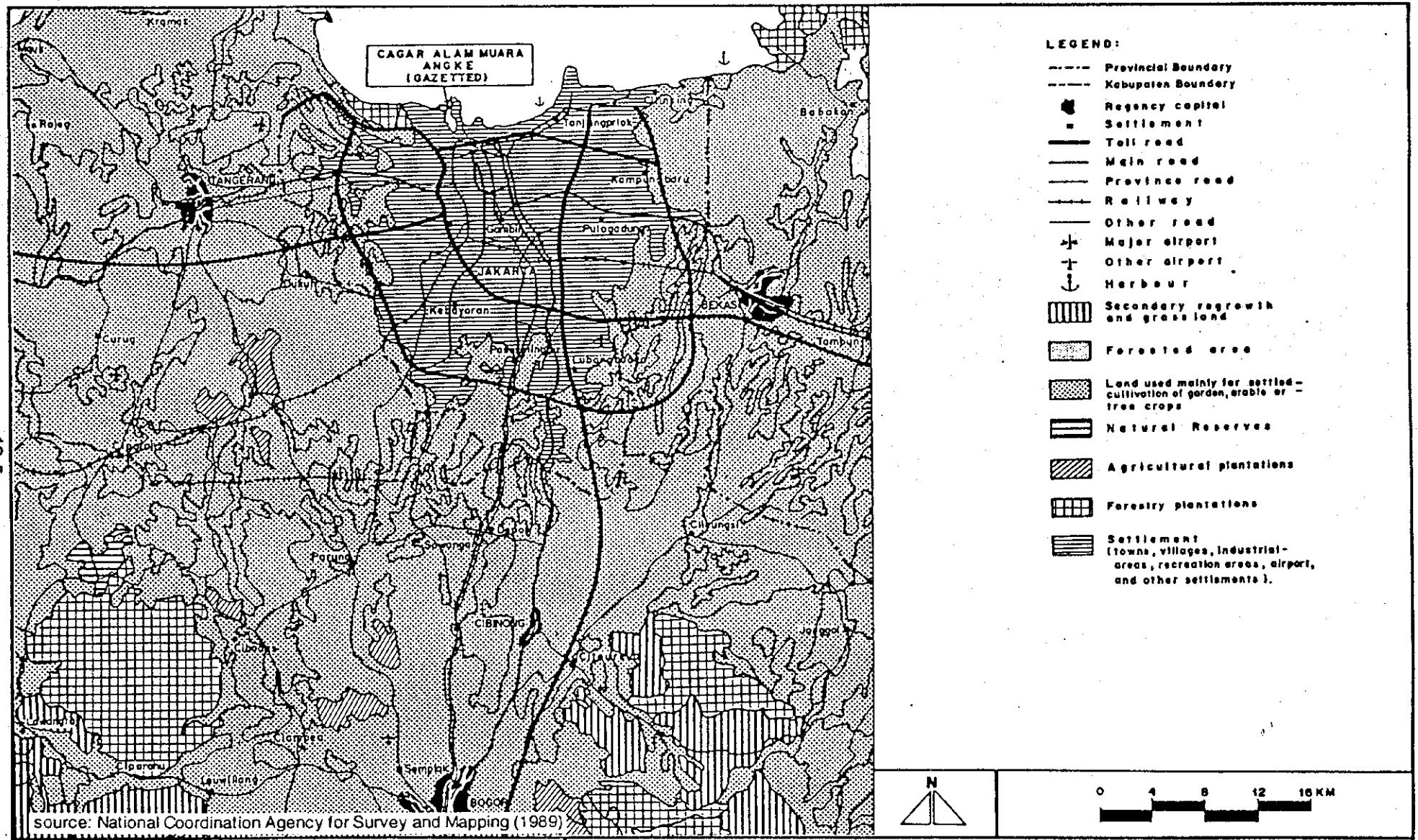
Jakarta is categorized as a settlement area which includes housing, towns, villages, industrial areas and other settlement areas. Jakarta is surrounded by cultivated areas, and arable or tree crops areas. Forest and secondary regrowth and grass land areas are located to the south in the hilly area around Bogor.

Table 12.1.2 Administrative Area in JABOTABEK

Name of Area		Area (km2)	
Jakarta*1	Jakarta Selatan	142.73	600.54
	Jakarta Timur	160.52	
	Jakarta Pusat	48.68	
	Jakarta Barat	111.80	
	Jakarta Utara	136.81	
Bogor	Kotamadya Bogor*2	21.56	3366.43
	Kabupaten Bogor*3	3,344.87	
Bekasi*4			1,400.53
Tangerang*5			1,398.57
Total			6766.07

*1: Jakarta Statistical Office, Jakarta Dalam Angka 1992
*2: Kantor Statistik Kotamadya Bogor, Dalam Angka 1990
*3: Kantor Statistik Kabupaten Bogor, Dalam Angka 1990
*4: Kantor Statistik: Kabupaten Daerah TKII Bekasi, Dalam Angka Tahun 1990
*5: Kantor Statistik Kabupaten Tangerang, Dalam Angka 1990

Land use along the North-South Axis and East-West Axis is shown in Fig. 12.1.3 and Fig. 12.1.4 respectively.



source: National Coordination Agency for Survey and Mapping (1989)

FEASIBILITY STUDY ON
URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT
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Fig. 12.1.2 Present Land Use and Land Status in JABOTABEK

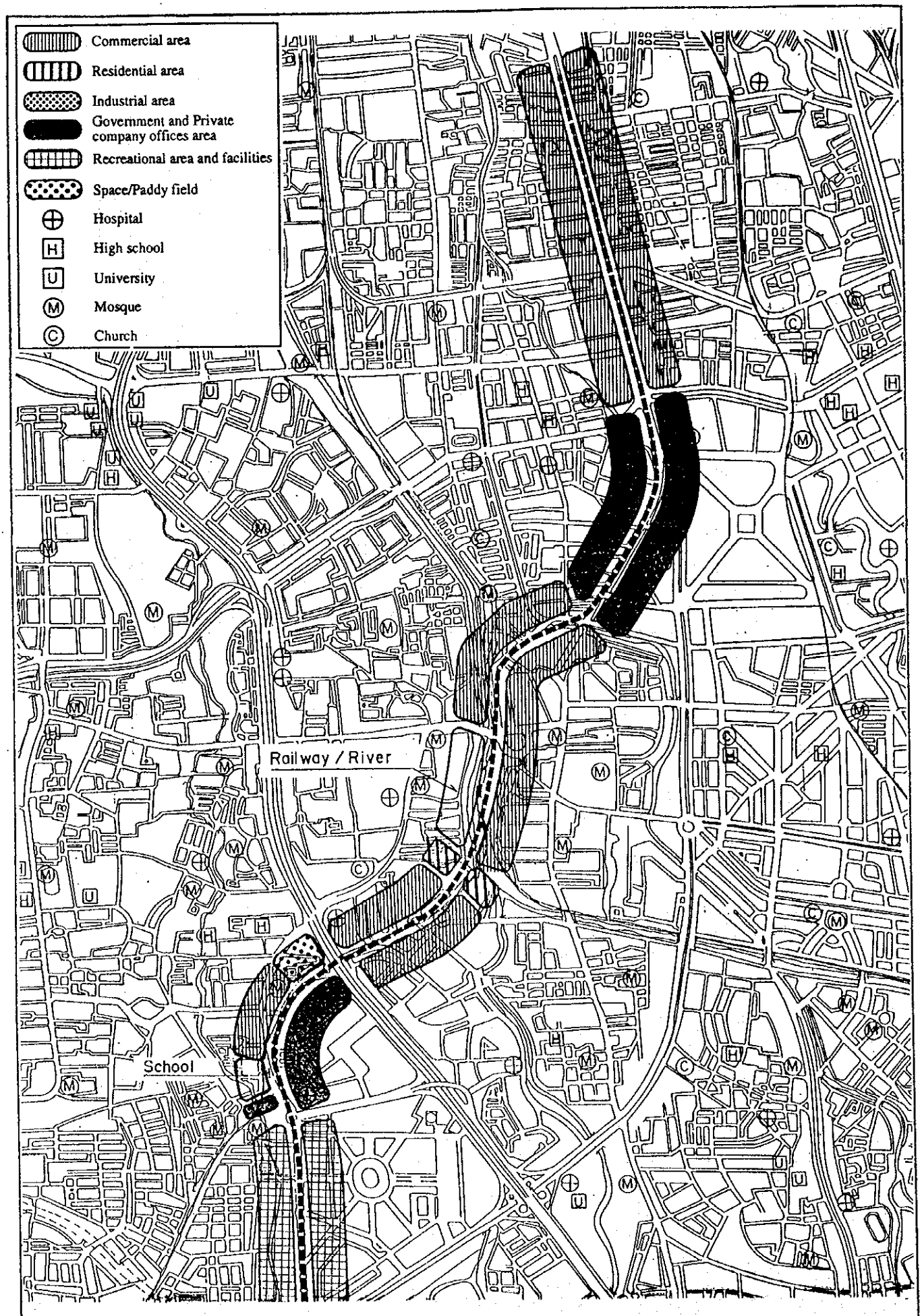

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Fig. 12.1.3 (1) Land Use along North-South Axis

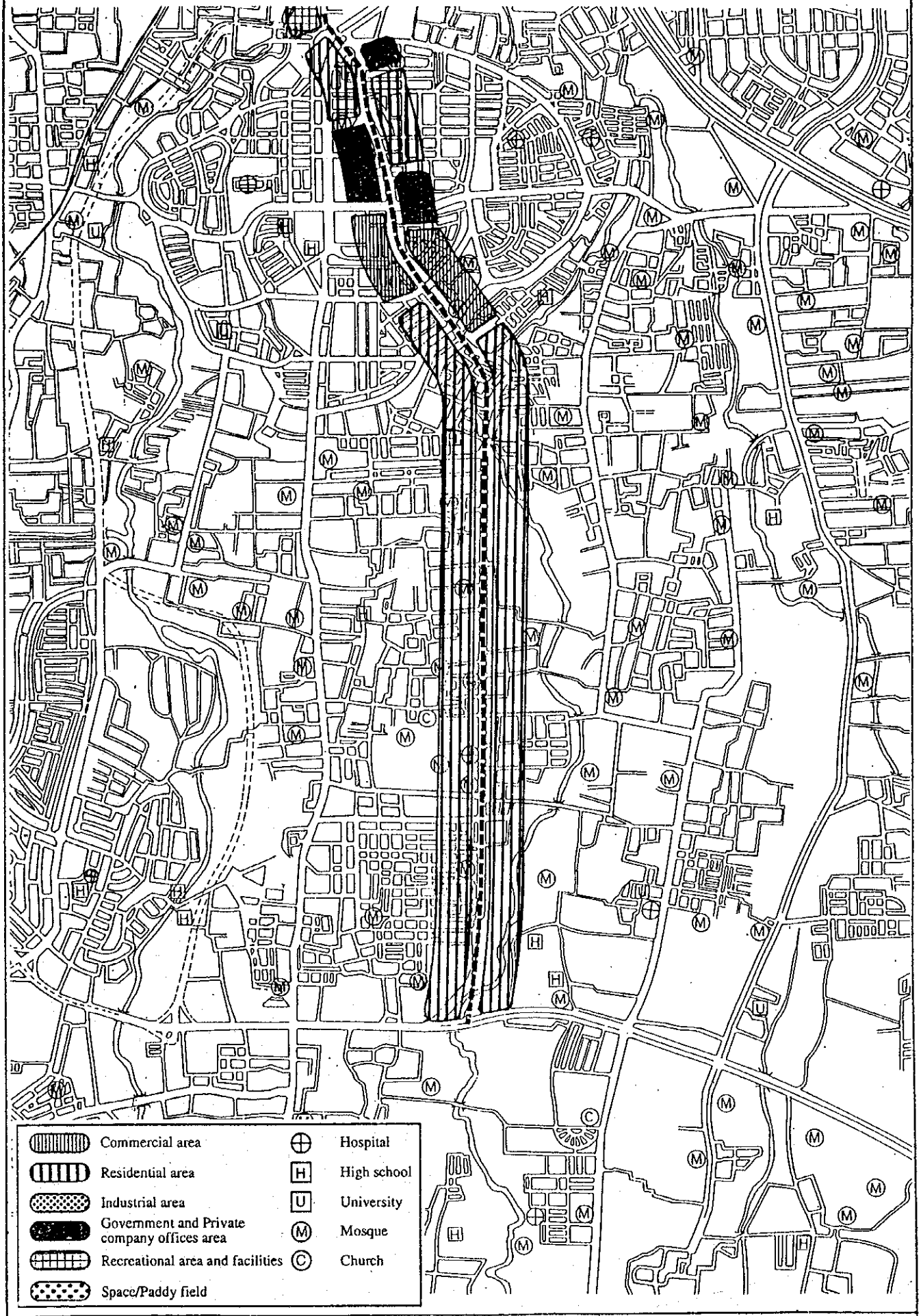

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Fig. 12.1.3 (2) Land Use along North-South Axis

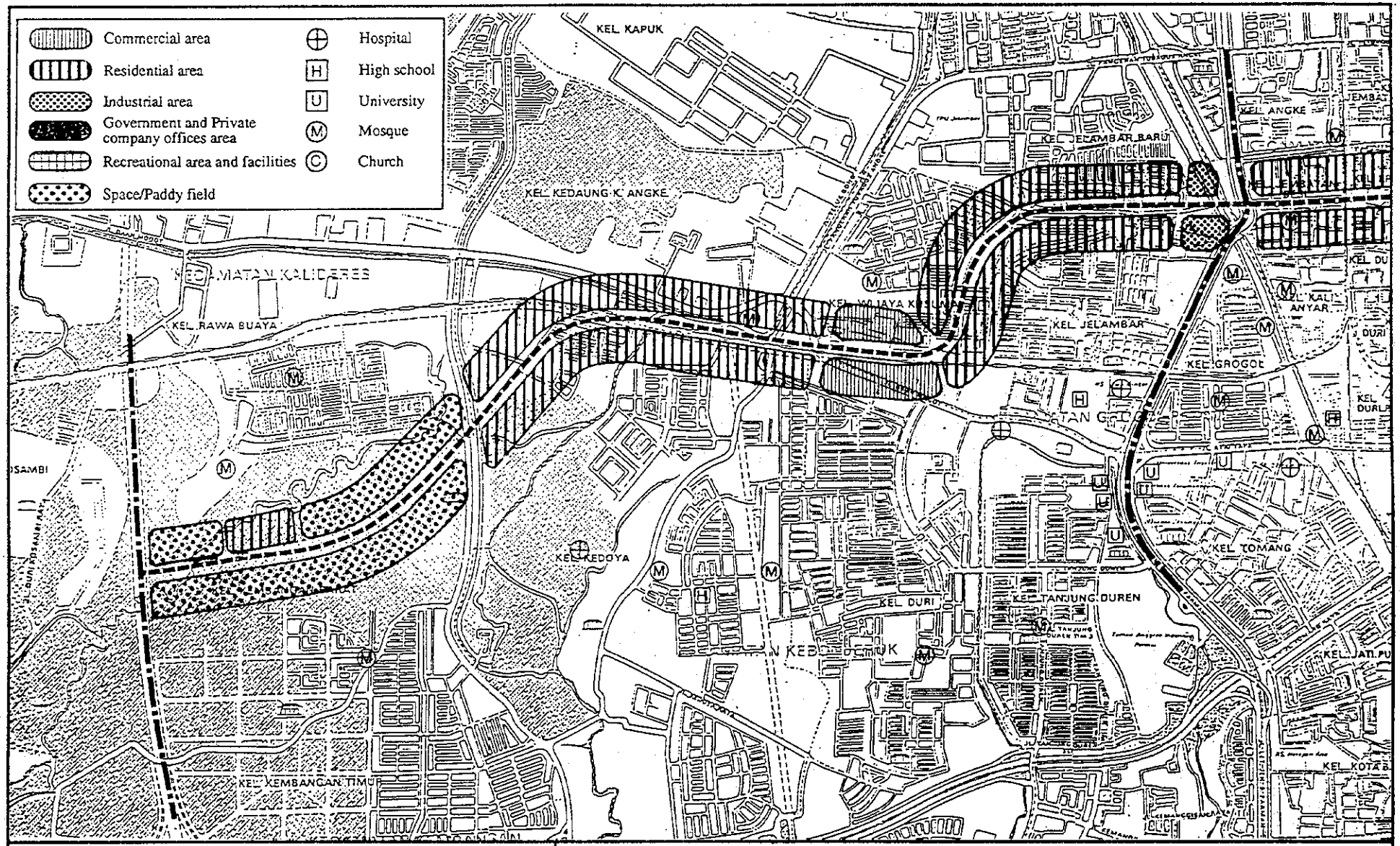

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Fig. 12.1.4 (1) Land Use along East-West Axis

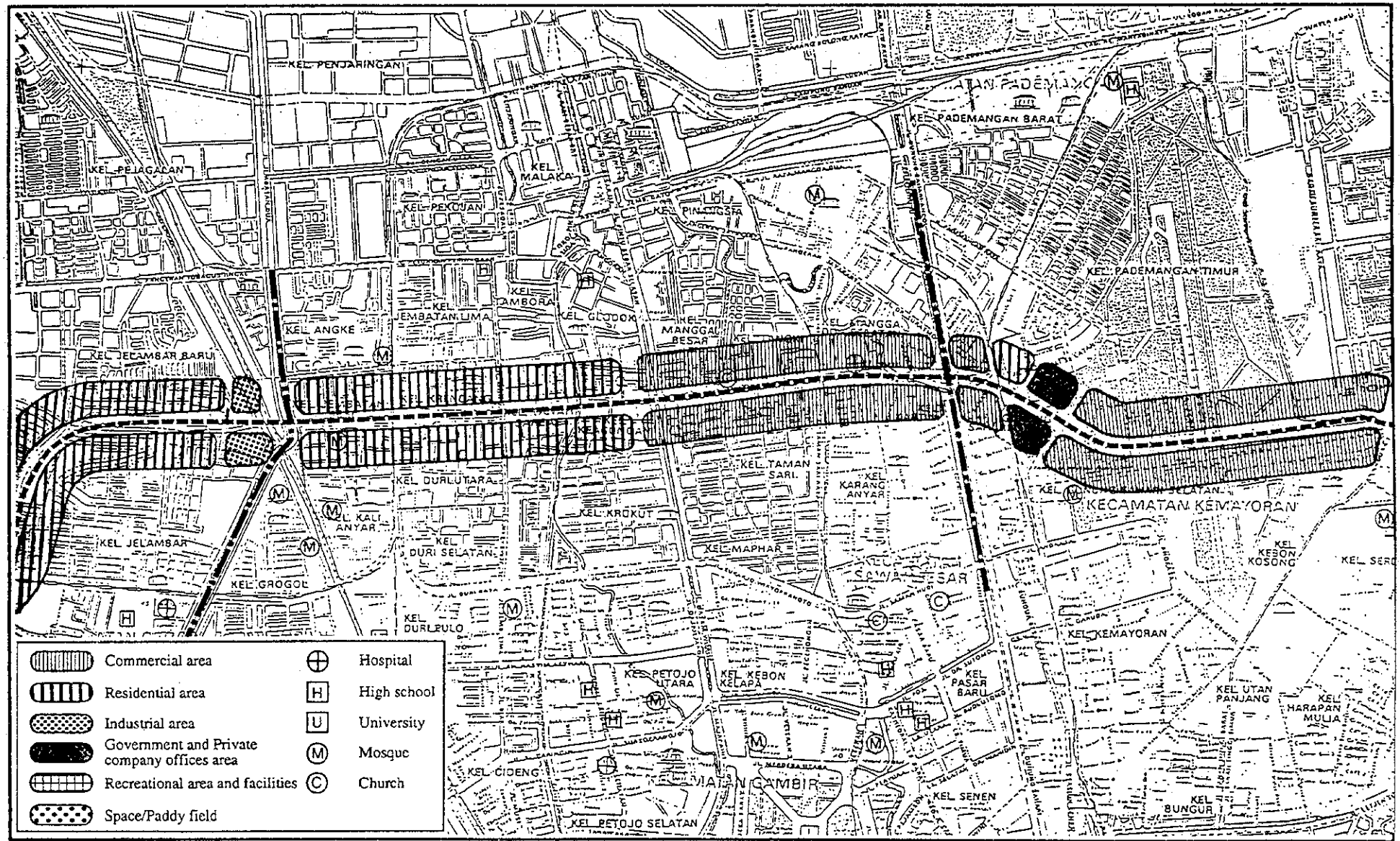

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Fig. 12.1.4 (2) Land Use along East-West Axis

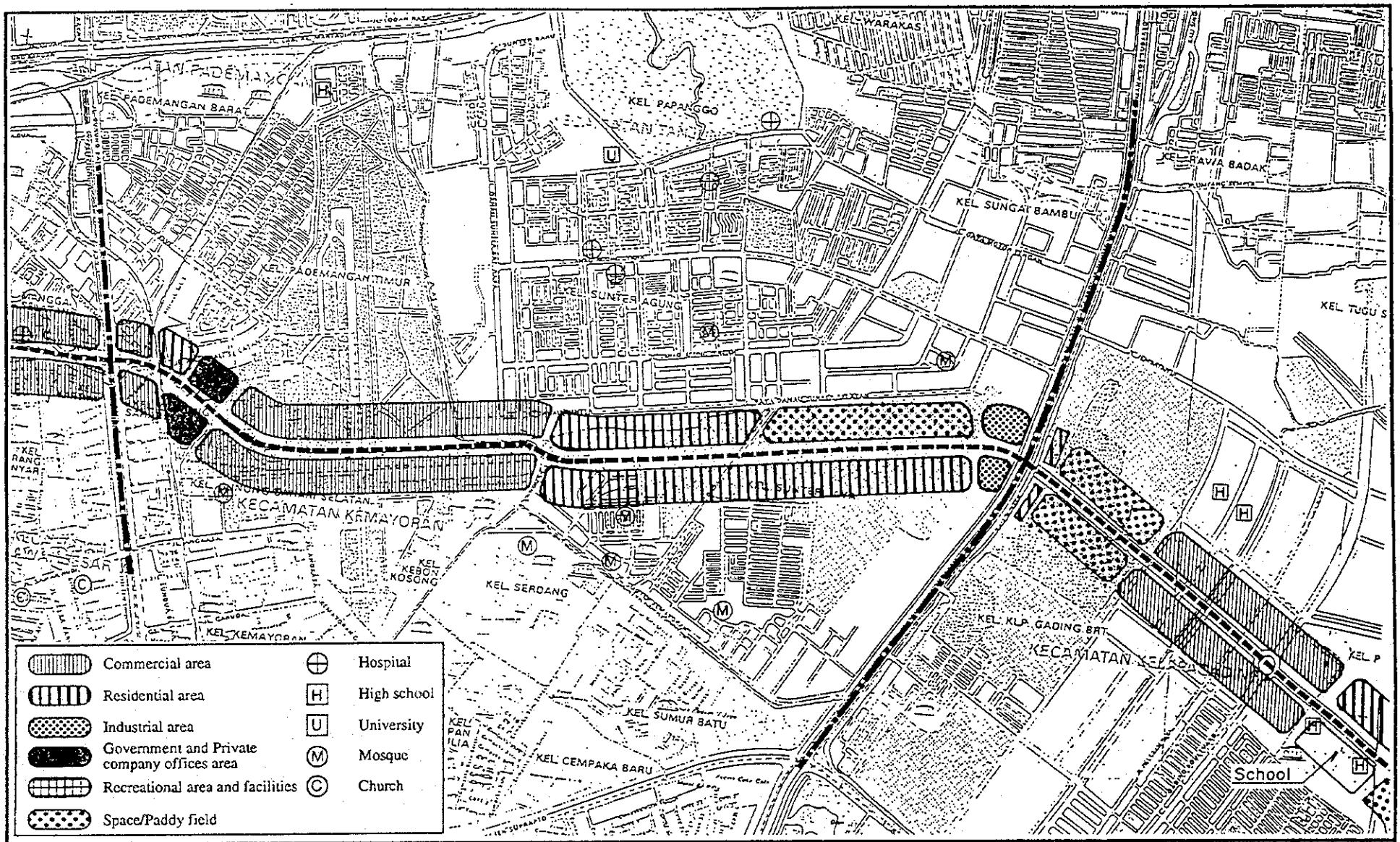

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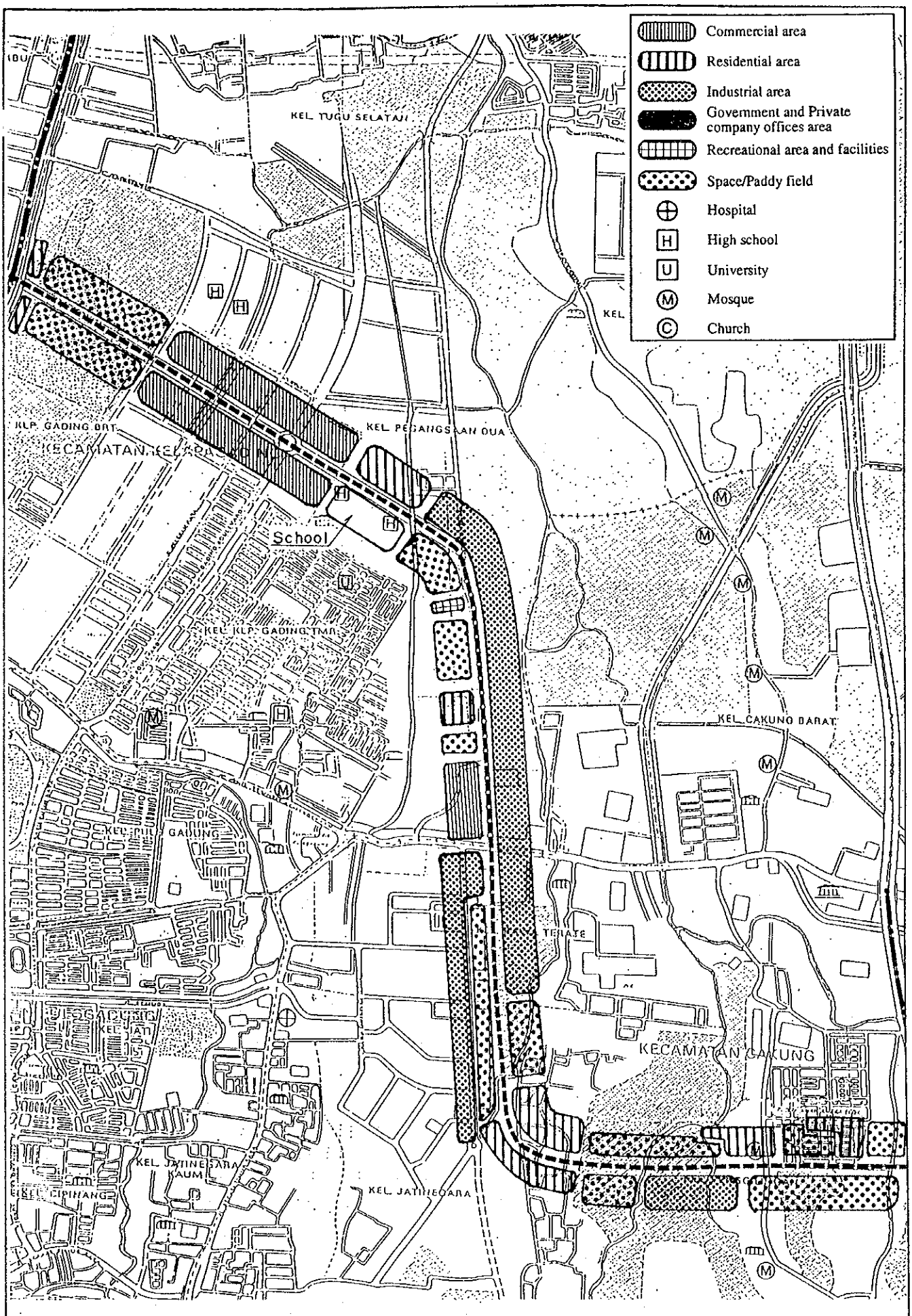
Fig. 12.1.4 (3) Land Use along East-West Axis



FEASIBILITY STUDY ON URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT IN JAKARTA METROPOLITAN AREA	Fig. 12.1.4 (4) Land Use along East-West Axis

North-South Axis

The northern terminus is to the north of Jl. Mangga Besar on Jl. Gajah Mada/Hayam Wuruk. To the north of the northern terminus is the commercial area, named Kota, where there are historical buildings.

The North-West Axis goes on Jl. Gajah Mada/Hayam Wuruk, a commercial area. There is residential area with small shops and workshops behind this main road. Jl. Gajah Mada/Hayam Wuruk is always crowded by vehicles. From southern Jl. Abdul Muis the axis connects with Tanah Abang. The North-South Axis goes through a residential area at Tanah Abang. There are small shops and a shopping center around Tanah Abang. This area is crowded with vehicles in daytime and evening. The North-South Axis continues on Jl. Asia Afrika. The Senayan Olympic Stadium is located on the east side of Jl. Asia Afrika.

The North-South Axis continues to Jl. Pattimura, which lies to the east side of the Department of Public Works, and connects with Jl. Sulatan Iskandarsyah around the shopping center, named Block M.

The southern section of the North-South Axis is located on Jl. Pangeran Antasari, which is a residential area.

East-West Axis

The East-West Axis passes from the west side of Jakarta to the east side of Jakarta. The East-West Axis passes paddy field areas to the east of this axis. To the west of the East-West Axis between the JORR and Jl. Daan Mogot, residential areas are distributed among open space and paddy fields.

Jalambar Baru and Mangga Besar Extension are categorized as high density residential and commercial areas. There are small streets in this area. The East-West Axis goes along Jl. Mangga Besar from Gajah Mada/Hayam Wuruk, which is a commercial area. There are office buildings and shopping centers along the main roads in this area.

From Jl. Gaunung Sahari to Jl. Landasan Timur is a redevelopment area. The East-West Axis is located to the south of the Indonesia International Trade Center. In Sunter Jaya, the East-West Axis goes through a high density residential area.

To the area east of Jl. Laks M. Yos Sudarso, is cultivated land and space which is to the west of Jl. Raya Barat Boulevard. Between Jl. Laks M. Yos Sudarso and Jl. Pangeran Dua there are high income and middle income residential areas. There is a shopping mall along Jl. Raya Barat/Timur Boulevard.

The east side of Jl. Pangeran Dua is used for agriculture. The area to the west of this road is under development. Heavy industrial factories are located in southern Jl. Pegangsaan Dua and around Jl. Bekasi Raya. In the south of Jl. Bekasi Raya, the East-West Axis goes through the east of Pulo Gadung industrial area. Between Pulo Gadung and JORR are residential areas with open space and paddy fields.

(2) Land Suitability

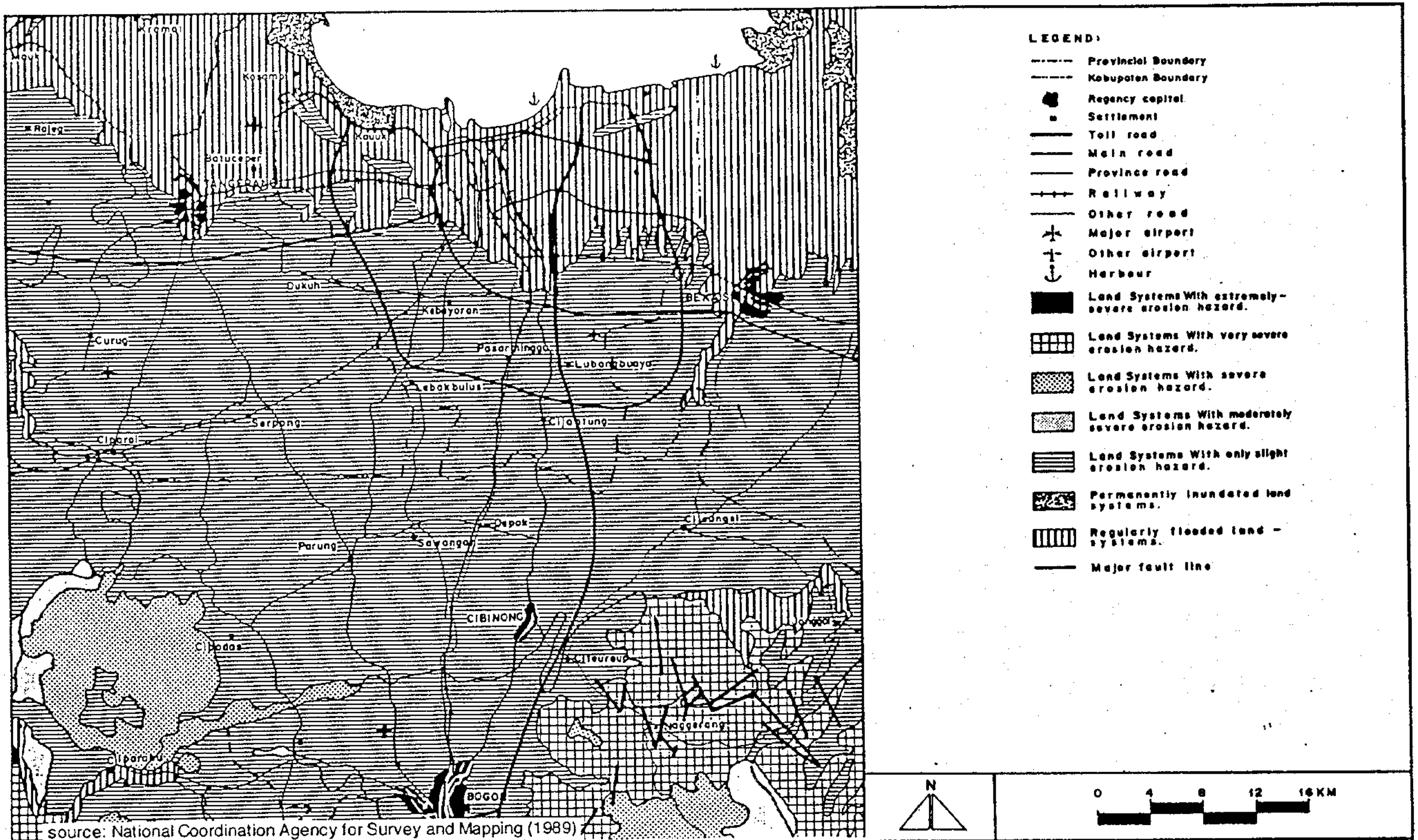
A land suitability map that was prepared by the National Coordination Agency for Survey and Mapping is shown in Fig. 12.1.5. According to this map, there are permanently inundated land along the coasts of Tangerang and Bekasi. Regularly flooded areas cover the north of the JABOTABEK area. In the south of the JABOTABEK area is an area of erosion hazard.

4) Air Quality

(1) Sources of Air Pollution

Jakarta is the biggest city in Indonesia where most activities are centralized, including administration, industries and major trade. The Bandung Institute of Technology (Institut Teknologi Bandung) estimated the load of air pollutants in Jakarta. Results of the estimation are shown in Table 12.1.3.

According to this study, the transportation sector is the major source of carbon monoxide (CO), oxides of nitrogen (NOx) and hydrocarbon (HC). The transportation sector contributes about 98 % of the total amount of CO, and 89 % of HC. More than 70 % of NOx is also derived from the transportation sector, while 27% of Oxides of Sulfur (SOx) is from transportation. Major sources of SOx are in the industrial sector, including power stations.



FEASIBILITY STUDY ON
URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT
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Fig. 12.1.5 Land Suitability in JABOTABEK

Table 12.1.3 Sectoral Contribution of Air Pollutants in Jakarta

	Transportation	Domestic	Waste	Industry	total
	ton/year				
CO	373,662	378.20	3,782.00	378.20	378200.4
NOx	15,388	2,012.64	230.62	3,333.44	20964.7
SOx	7,476	3,018.47	56.42	17,687.67	28238.56
HC	13,717	339.46	1,188.11	185.16	15429.73

	%				
CO	98.8	0.1	1.0	0.1	100
NOx	73.4	9.6	1.1	15.9	100
SOx	26.5	10.7	0.2	62.6	100
HC	88.9	2.2	7.7	1.2	100

Source : BAPEDAL, Status Ciliates Udara Di Kota Medan, Jakarta, Bandung, Semarang

(2) Ambient Air Quality

DKI Jakarta has a monitoring system for ambient air quality. This monitoring system covers SOx, NOx, NH_3 and dust. Locations of monitoring station are shown in Fig. 12.1.6 and are located in the following areas:

- Pulo Gadung : residential area
- Bandengan : residential and commercial area
- Pasar Ikan : residential and warehouse area
- Mangga Besar : commercial area
- Pasar Senen : commercial area
- Pasar Baru : commercial and residential area
- Tebet : residential area
- Cilitan Terminal : bus terminal

DKI Jakarta ambient air quality standards are shown in Table 11.1.4. Results of the monitoring are described in "Balance of Pollution and Environment in Regional Area (Biro Bina KLH, Jakarta, Neraca Kependudukan dan Lingkungan Hidup Daerah, 1990)". The result are outlined as follows:

<u>SOx</u>

It can be concluded that in general the SOx concentration has not exceeded the ambient air quality standards that were established by the Governors Decree No. 587, 1980. The highest concentration is at Mangga Besar (0.012 ppm) and lowest one is at Tebet (0.004 ppm) during a 24 hours measuring period.

NOx

The highest NOx is at Cililitan Bus Terminal, which is 0.018 ppm/24 hours, and lowest is at Tibet at 0.008 ppm/24 hours. The maximum NOx limit desired is 0.02 ppm/24 hours. So the NOx measured has not exceed the maximum concentration desired.

NH_3

The results from all stations show that NH_3 has not exceeded the maximum concentration permissible (2 ppm/24 hours). The average highest NH_3 is at Mangga Besar, at 0.0004 ppm, and the lowest is at Pasar Baru, at 0.0021 ppm, for a 24 hours measuring period.

Dust

Average concentration at Bandengan Selatan is 495 $\mu g/m^3$, Pasar Senen 279 $\mu g/m^3$ and Pasar Baru 353 $\mu g/m^3$. The lowest concentration is at Tebet (190 m^3), which is a residential area.

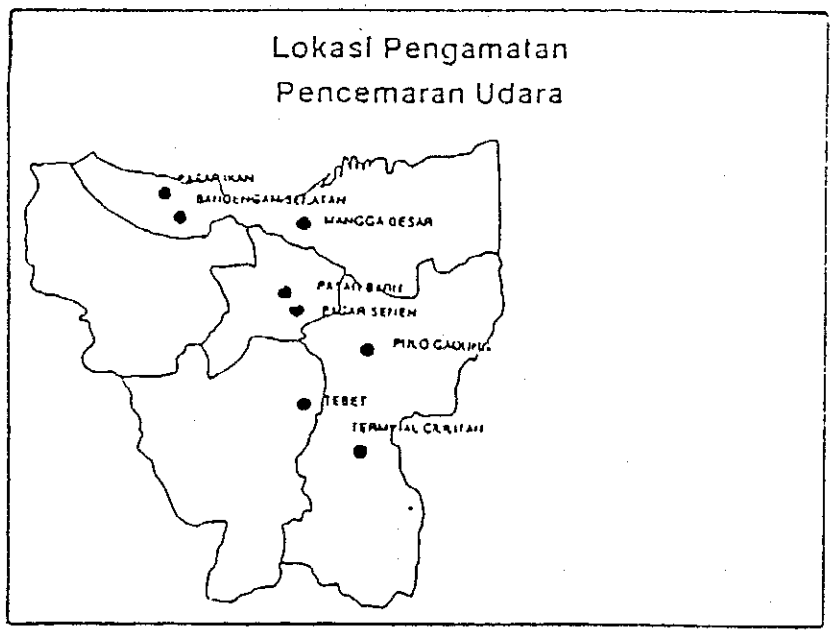

Fig. 12.1.6 Locations of Air Quality Monitoring Station by DKI Jakarta

Table 12.1.4 Ambient Air Quality Standards

Pollutants	Standard	Maximum Permissible
Carbon monoxide (CO)	-	20 ppm/8 hr.
Sulfur dioxide (SO2)	-	0.1 ppm/hr.
Oxides of nitrogen (NOx)	0.02 ppm/24 hr.	0.05 ppm/24 hr.
Ammonia (NH3)	-	2 ppm/24 hr.
Lead (Pb)	0.02 mg/m3	0.06 mg/m3
Hydrogen sulfide (H2S0	-	0.03 ppm/30 min.
Oxidant	-	0.08 ppm/hr
Dust	-	0.26 ppm/m3
Hydrocarbon (HC)	-	0.24 ppm/3hr.

Decree on Criteria of Ambient Air Quality and Ambient Noise Level, DKI Jakarta No.587, 1980

The JICA Study Team also surveyed air quality at seven stations along the North-South Axis and East-West Axis for the ANDAL Study in January, 1994. The results and locations of the air quality survey are shown in Table 12.1.5 and Fig. 12.1.7. Results of air quality survey are summarized as follows:

SO_2 ranges from 0.04 - 0.007 ppm, and SPM ranges from 0.2 - 0.4 mg/m^3. They are not different by location and time of survey. NOx and CO at day time are higher than at night time. Stations in commercial and industrial areas and along main roads showed higher NO ratios than NO_2. NOx consists of NO and NO_2. Burning of fuels produces NO, and NO converts NO_2 in air.

The data of air quality was compared with the ambient air quality standards, Decree on Criteria of Ambient Air Quality and Ambient Noise, DKI Jakarta No. 587, 1980 (Table 12.1.4). SO_2 and CO do not exceed environmental standards. However, NOx exceed ambient air quality standards. SPM was surveyed at four points. Some residential areas (A-1, A-6) are below environmental standards all day. However, survey points at commercial and industrial areas also exceed environmental standards.

5) Noise/Vibration

Central and local governments of DKI have never monitored noise and vibration levels. According to Neraca Kependudukan dan Lingkungan Hidup Daerah, however, it is presumed that the source of traffic contributes to increasing the noise level.

The JICA Study Team surveyed noise levels along main roads and streets. Results and locations of the noise level survey are shown in Table 12.1.6

Table 12.1.5 Results of Air Quality Survey

SO2 unit: ppm

Stations	Location	Time			
		6:00	12:00	18:00	24:00
A-1	Kedoya	0.006	0.004	0.004	0.005
A-2	Hayam Wuruk	0.006	0.005	0.006	0.005
A-3	Kelapa Gading	0.006	0.005	0.006	0.006
A-4	Pulogadung	0.006	0.005	0.006	0.006
A-5	Manggala Wanabakti	0.006	0.004	0.005	0.006
A-6	Cipete Utara	0.006	0.005	0.007	0.005
A-7	Outer Ring Road	0.005	0.005	0.007	0.005

NO unit: ppm

Stations	Location	Time			
		6:00	12:00	18:00	24:00
A-1	Kedoya	0.017	0.019	0.025	0.021
A-2	Hayam Wuruk	0.186	0.216	0.274	0.116
A-3	Kelapa Gading	0.137	0.133	0.115	0.038
A-4	Pulogadung	0.156	0.164	0.299	0.097
A-5	Manggala Wanabakti	0.131	0.122	0.160	0.054
A-6	Cipete Utara	0.158	0.165	0.242	0.131
A-7	Outer Ring Road	0.159	0.101	0.113	0.044

NO2 unit: ppm

Stations	Location	Time			
		6:00	12:00	18:00	24:00
A-1	Kedoya	0.021	0.028	0.015	0.012
A-2	Hayam Wuruk	0.022	0.033	0.017	0.015
A-3	Kelapa Gading	0.018	0.024	0.015	0.017
A-4	Pulogadung	0.019	0.030	0.021	0.014
A-5	Manggala Wanabakti	0.021	0.028	0.015	0.015
A-6	Cipete Utara	0.029	0.034	0.019	0.024
A-7	Outer Ring Road	0.025	0.031	0.019	0.026

NOx unit: ppm

Stations	Location	Time			
		6:00	12:00	18:00	24:00
A-1	Kedoya	0.038	0.056	0.040	0.033
A-2	Hayam Wuruk	0.207	0.249	0.289	0.124
A-3	Kelapa Gading	0.155	0.186	0.131	0.053
A-4	Pulogadung	0.175	0.194	0.322	0.111
A-5	Manggala Wanabakti	0.158	0.114	0.175	0.082
A-6	Cipete Utara	0.187	0.246	0.262	0.155
A-7	Outer Ring Road	0.184	0.132	0.132	0.070

CO unit: ppm

Stations	Location	Time			
		6:00	12:00	18:00	24:00
A-1	Kedoya	2.931	3.061	4.447	2.673
A-2	Hayam Wuruk	7.464	9.844	11.840	6.801
A-3	Kelapa Gading	4.470	4.881	6.564	4.506
A-4	Pulogadung	7.584	8.331	7.386	3.550
A-5	Manggala Wanabakti	10.483	11.766	5.677	4.141
A-6	Cipete Utara	6.589	8.494	10.959	4.016
A-7	Outer Ring Road	8.467	6.586	10.750	5.779

SPM unit: mg/m3

Stations	Location	Time			
		6:00	12:00	18:00	24:00
A-1	Kedoya	0.206	0.206	0.206	0.206
A-2	Hayam Wuruk	0.392	0.392	0.392	0.392
A-4	Pulogadung	0.386	0.386	0.386	0.386
A-6	Cipete Utara	0.222	0.222	0.222	0.222

Land Use
A-1: Residential area
A-2: Commercial area
A-3: Commercial area alon Jl.Raya Boulevard
A-4: Industrial area
A-5: Residential area
A-6: Residential area alon road side
A-7: Intersection of Jl.Pangeran Antasari and Jakarta Outer Ring Road

Date of Field Survey: January 6, 7, 11, 12, 16, 17 ,22, 1994
Laboratory analysis: DKI Jakarta

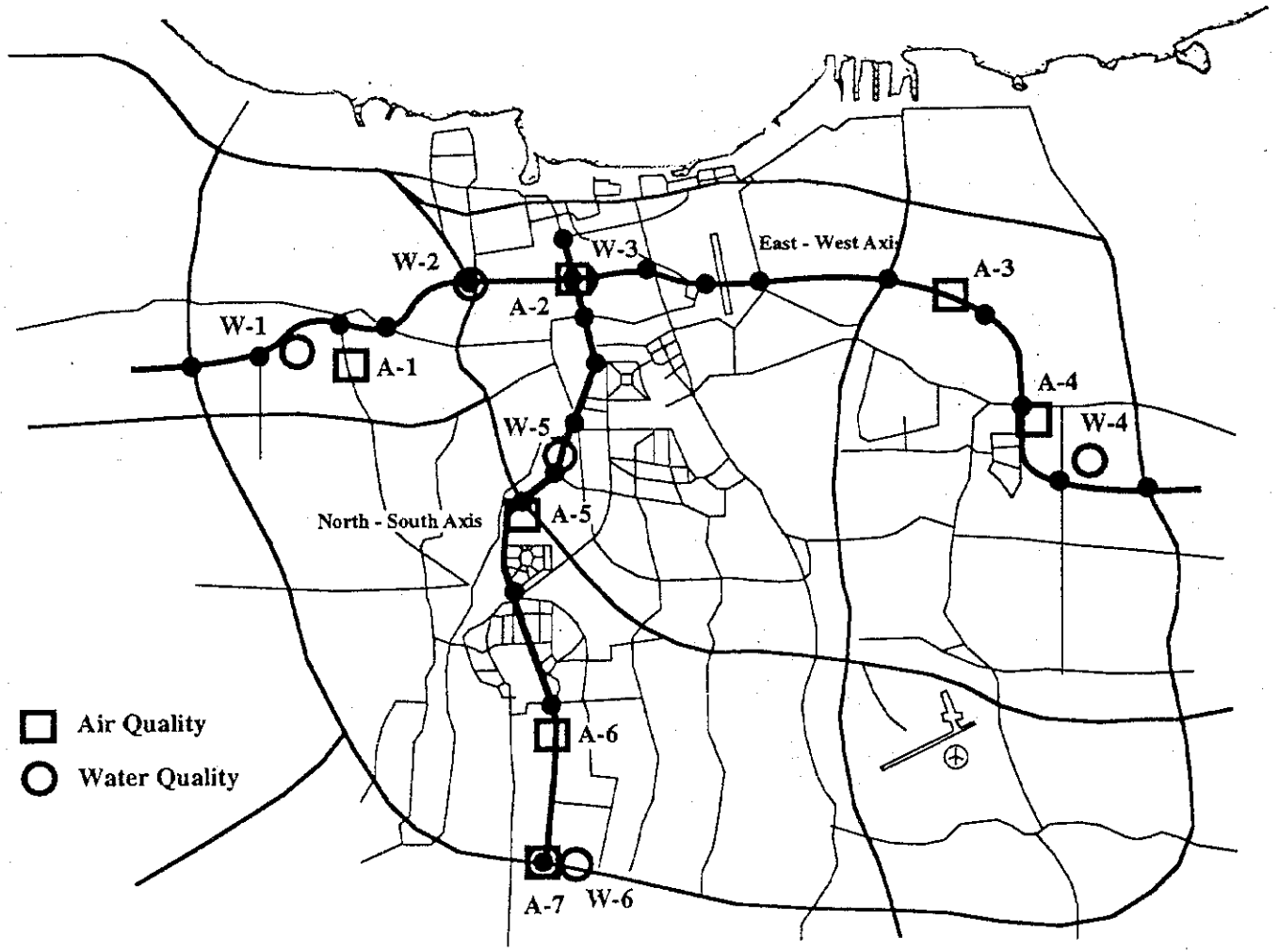

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Fig. 12.1.7 Locations of Air Quality and Water Quality Surveys

and Fig. 12.1.8. The noise levels of all survey points are almost the same. Each survey point has a range of 20 dB between lower and higher noise levels. The noise level during the night time (23:00 - 4:00) at each survey point is lower than in the morning, day time and evening.

The DKI Jakarta environmental noise standard is named Decree on Criteria of Ambient Air Quality and Ambient Noise No. 587, 1980. The Ambient Noise Standards are shown in Table 12.1.6. The noise levels of all survey points of residential areas exceed environmental standards all day, and office areas exceed the standards from 6 o'clock to 22 o'clock. The noise levels of commercial areas are the same as other areas, however, they are below the standard, which is set at 85 dB.

Table 12.1.6 Ambient Noise Standards by DKI Jakarta

Land Use	Normal Level	Maximum Permissible
Residential area	45	60
Industrial area/Office area	70	70
Commercial area	75	85
Recreation area	50	60
Residential and Industrial areas	50	50

Decree on Criteria of Ambient Air Quality and Ambient Noise Level, DKI Jakarta No. 587, 1980

6) Hydrology/Water Quality

The are no less than 19 rivers and 20 large scale lakes in Jakarta. The rivers in Jakarta which flow more than $1m^3/s$ are as follows:

River	Flow Rates	
- Ciliwung river	5.9 - 6.97	m^3/s
- Krukut river	1.24 - 1.34	
- Mookervart river	4.97 - 6.10	
- Pesanggrahan river	2.78 - 3.77	
- Angke river	1.06 - 4.85	
- Sunter river	0.86 - 1.19	
- Mampang river	0.64 - 1.12	

Source: Biro Bina KLH, Jakarta, Neraca Kependudukan dan Lingkungan Hidup Daerah, 1990.

Other rivers have flow volumes less than $1m^3/s$ in the dry season. The water quality of these rivers are bad. The quality of river water is related to flow volume. In general, when flow volume is low in the dry season, river water quality deteriorates. According to "Balance of Pollution and Environment in Regional Area (Biro Bina KLH, Jakarta, Neraca

Table 12.1.7 Results of Noise Level Survey

unit: L50 dB

Station	Land Use	Environmental Standards	Time																					
			6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00	1:00	2:00	3:00	4:00	5:00
N-1	Residential	60	75	78	78	78	78	75	74	76	75	75	76	74	74	74	73	73	72	69	68	63	59	57	62	62
N-2	Residential	60	69	76	74	76	74	75	76	73	75	74	74	72	72	71	72	71	70	71	66	62	60	58	54	65
N-3	Residential	60	75	76	74	76	74	75	77	77	77	77	77	76	75	75	73	71	71	72	65	61	61	55	63	61
N-4	Office	70	71	69	71	71	70	71	72	70	70	72	71	70	71	71	70	68	65	63	61	59	55	56	51	59
N-5	Industry/Office	70	66	76	76	76	76	75	76	74	75	75	64	72	73	72	72	72	71	69	67	65	61	61	63	65
N-6	Industry/Office	70	72	74	75	76	75	75	74	74	74	75	74	74	74	73	72	70	69	67	62	52	47	50	50	58
N-7	Commercial	85	73	75	78	76	75	75	76	76	74	75	74	76	72	72	71	70	66	65	62	59	57	57	60	58
N-8	Commercial	85	72	76	75	74	77	77	77	75	75	75	75	76	75	75	72	71	70	69	67	62	61	61	65	69
N-9	Office	70	67	77	76	77	76	76	75	76	76	74	76	73	75	74	74	73	73	72	70	60	67	64	64	67
N-10	Office	70	76	77	77	77	77	77	76	76	77	77	77	75	75	74	73	73	72	70	68	67	66	63	64	66
N-11	Industry/Office	70	61	66	66	66	66	66	64	74	75	75	76	75	74	74	73	73	73	71	68	68	66	66	67	69
N-12	Commercial	85	72	73	74	75	75	76	75	74	75	75	74	74	73	72	71	71	71	68	67	66	66	65	64	65
N-13	Commercial	85	75	79	79	77	77	78	78	78	78	78	78	77	77	75	74	74	74	72	71	66	67	67	66	71
N-14	Commercial	85	75	78	65	68	78	79	78	78	76	77	78	77	78	76	76	75	74	72	70	66	62	65	67	70
N-15	Commercial	85	72	77	77	76	75	74	75	76	76	76	77	74	81	73	71	71	67	65	-	60	58	59	61	70
N-16	Commercial	85	74	79	78	80	80	79	78	79	79	78	79	78	78	78	78	76	75	72	70	66	66	66	66	69
N-17	Industry	70	83	83	83	78	77	77	78	78	77	76	76	77	76	75	76	76	73	71	71	69	67	69	70	74
N-18	Commercial	85	68	72	73	71	73	72	72	73	72	72	72	72	71	72	70	66	66	60	57	54	55	47	50	56

Environmental Standards (Decision on Criteria of Ambient Air Quality and Ambient Noise Level, No.587, 1980, DKI Jakarta

Residential Area	: 60 dB
Industry/Office Area	: 70 dB
Commercial Area	: 85 dB
Recreation Area	: 60 dB
Residential and Industry Area	: 50 dB
North-South Axis	: N-1, N-2, N-3, N-4, N-5, N-6, N-7, N-8, N-11, N-12
East-West Axis	: N-12, N-13, N-16, N-17, N-18

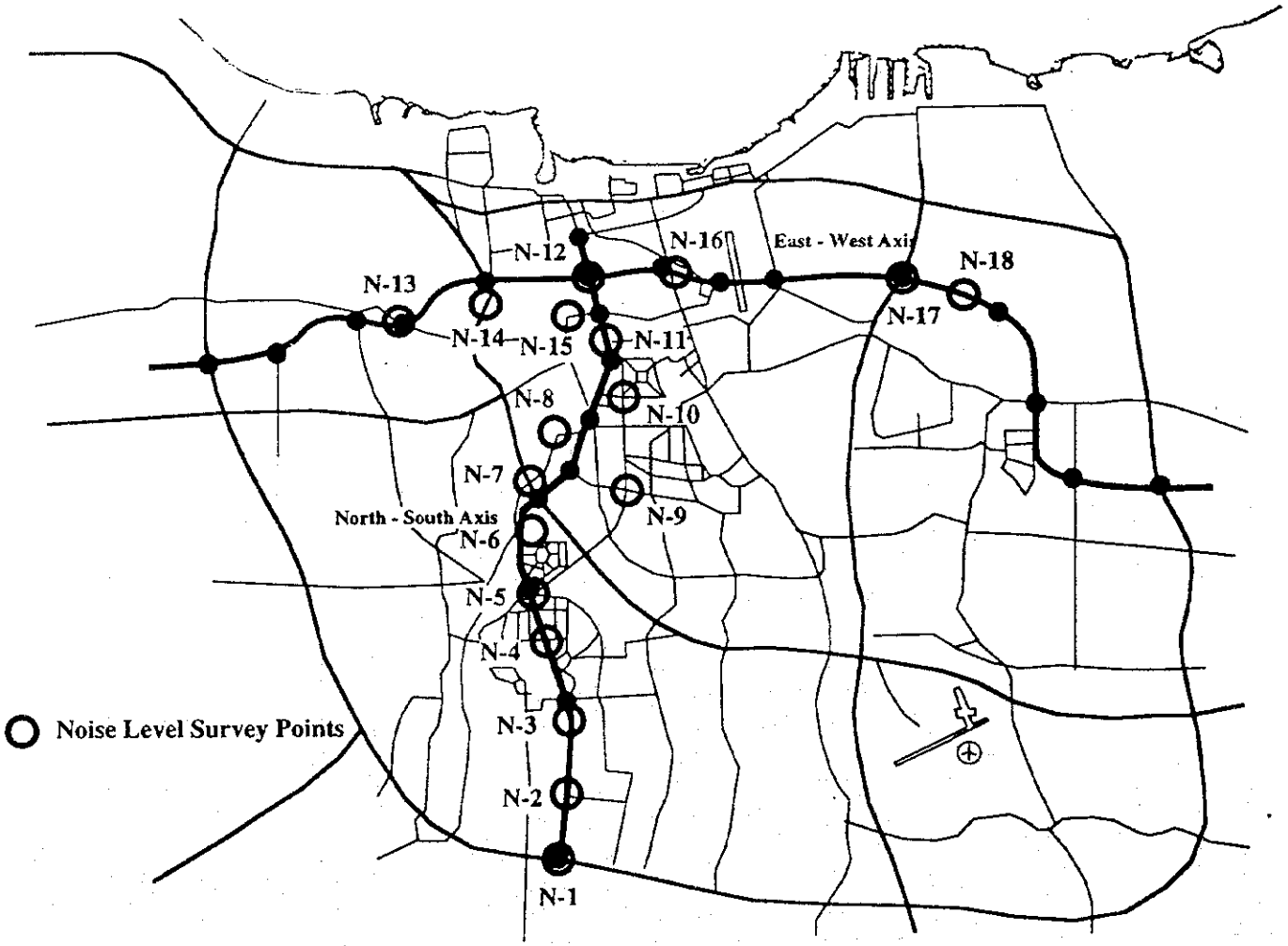

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Fig. 12.1.8 Locations of Noise Level Survey

Kependudukan dan Lingkungan Hidup Daerah, 1990)", the deterioration of river water quality gives rise to obstruction of water use, such as for drinking.

The JICA Study Team surveyed water quality at six points along rivers and canals along the North-South Axis and East-West Axis. Results and locations of the water quality survey are shown in Table 12.1.8 and Fig. 12.1.7.

Water quality at all survey points is bad, especially Banjir Kanal and Buran river. Dissolved oxygen and organic matters at these points are higher than other points.

Table 12.1.8 Results of Water Quality Survey

Survey Date: December 31, 1993

Station	Name of Rivers & Canals/Location	Water Temp. °C	Cl mg/l	pH -	DO mg/l	BOD mg/l	COD mg/l	SS mg/l
W-1	Cengkareng Drain	24.8	7.3	6.7	4.8	11.0	15.7	284.0
W-2	Banjir Kanal / Penjernihan IV	25.9	7.2	6.8	4.3	10.0	20.5	186.0
W-3	Ciliwung	26.8	10.9	6.7	1.0	18.0	26.9	7.2
W-4	Buaran	28.0	29.1	2.9	28.0	42.6	540.0	6.8
W-5	Banjir Kanal/Latumeten	26.2	9.1	2.4	16.0	24.6	158.0	6.0
W-6	Krukut	26.4	10.9	6.0	8.8	5.2	7.4	248.0

The rivers and canals in Jakarta have some allotment for water use (Decree on Use and Quality Standards of River Water and Waste Water in Jakarta Area, No. 1608, 1988). The rivers and canals are grouped into four, as follows:

<u>for drinking water</u>
- Krukut river to Banjir Kanal
- Mampang river to Krukut river
- Cideng river to Banjir Kanal
- Kalibaru Barat river to Banjir Kanal
- Ciliwung river to the confluence of Angke river

<u>for fishery</u>
- Mookervart river to Cengkareng drain
- Angke river to Cengkaren drain
- Pesanggrahan river to Cengkaren drain
- Sepak River to Cengkaren drain
- Grogol river to Pesanggrahan river inceptor
- Cengkaren drain to water gate II at Pesing
- Kalibaru Timur to Cipinang Kramat Jati inceptor

for Agriculture
- Cengkaren drain water gate II up to Muara Cengkaren drain
- Ciliwung river to Banjir Kanal Timur
- Sunter river to Banjir Kanal Timur
- Buaran river to Banjir Kanal Timur
- Jati Kramat river to Banjir Kanal Timur
- Cipinang Banjir Kanal Timur river to Sunter
- Cipinang Sunter Banjir Kanal Timur river to PAM Pulo Gadung
- Cakung Banjir Kanal Timur river to Cakung drain
- Buran Banjir Kanal Timur river to Cakung drain
- Jati Kramat Banjir Kanal Timur river to Buaran river
- Marunda drain Banjir Kanal Timur to Cakung drain
- Cakung drain to Polder water gate

The following rivers are not intended for drinking water, fishery and agriculture use, but they still meet the life of aquatic biota
- Banjir Kanal Barat water gate II to Muara Angke river water gate at Cengkareng drain up to Muara Angke
- Pesanggan river, the branch of Angke river to Angke river
- Mookervart river water gate at Cengkareng drain to Angke river
- Sekretaris river to Grogol inceptor to Angke river
- Grogol river inceptor to Pesanggrahan river up to Grogol inceptor to Angke river
- Ciliwung Gajah Mada river, Istiqlal branch up to Pluit drain
- Krukut Banjir Kanal river Ciliwung to Pluit drain
- Ciliwung water gate Manggarai river to Muara Marina
- PAM Pulogadung to Muara Marina

7) Conservation Area for Wildlife

DKI Jakarta has four conservation areas, namely Pulau Rambut, Pulau Bokor, Muara Angke, and Pancoran Mass. Outlines of these conservation areas are described as follows:

Pulau Rambut (45 ha)
It is botanical, zoological and ecological conservation area, located at Jakarta bay. This conservation area was established in 1939. The dominant function of this area is as a place to protect various kinds of coastal birds. The Eagle, which is named Elang Bondos (*Heliastur indus*), was used as the DKI Jakarta mascot and lives in this conservation area. This area has specific natural characteristics, chiefly suitable for birds, swamp forest and ecosystem of coral reef.

Pulau Bokor (18 ha)
It is botanical, zoological and ecological conservation area, located 3.5 miles to the northwest of Pulau Rambut. This conservation area was established in 1939. This area is not a salty area. There are not so many kinds of flora and fauna as in Pulau Rambut Conservation Area.

Muara Angke (25 ha)

It is located at the bank of the Angke river. This conservation area was established in 1939 under Governor General Decree. It has a forest that is always flooded with the tide and functions as a ecological conservation area. A special flora growing here is a type of rattan (*Calanus sp.*) and a specific fauna is Monyet Ancol (*Ancol ape*) In recent years the surrounding area has been developed for residential areas, thus disturbing this conservation area.

Pancoran Mass (6 ha)

It is located in the Depok administrative area. This conservation area was established in 1926 under Governor General Decree. The Monument Alam (Natural Monument) for DKI Jakarta is located here. This area functions as a botanical, geological and ecological conservation area. The vegetation is dominated by low growth plants.

12.2 Summary of ANDAL Study

12.2.1 Basis of Legal Environmental Impact Study

The Indonesian Government has an Environmental Impact Assessment System. In 1982, the principles of Environmental Management, which is prescribed in Act No. 4 "Basic Provisions for the Management of the Living Environment", was established.

Environmental Impact Assessment is prescribed in Regulation of "The Analysis of Environmental Impact" No. 29, 1986. Regulation No. 29, 1986 was amended to Government Regulation No. 51, 1993.

An environmental impact study has the following objectives:

- to identify the proposed project activities which may have significant impacts on the environment
- to identify the existing environmental conditions which may be impacted by the proposed project
- to estimate and evaluate the significant environmental impacts
- to provide recommendations of environmental management and monitoring

According to Government Regulation No. 51, the following activities and projects require an environmental impact assessment:

- change in the land structure and landscape,
- exploitation of renewable and non-renewable natural resources,
- processes and activities which can potentially create depletion, degradation, and deterioration of natural resources,
- processes and activities which may affect the social and cultural environment,
- processes and activities which can interfere with the protection of natural resources or the conservation of natural heritage,
- introduction of plants, animals, and micro-organisms,
- production and use of biotic and non-biotic materials,
- application of technology which is predicted to have potential affect to the environment,
- high risk activities which affects the state defense.

According to regulation No. 51, 1993, environmental impact study at the feasibility phase can be divided into "need ANDAL study", "need Standard Operation Procedure (SOP)", and "no need environmental study". A project at the feasibility study phase requires screening by the project proponent. ANDAL means Environmental Impact Analysis (Analisis Dampak Linkungan).

The Central AMDAL (Analisa Mengenai Dampak Lingkungan: Environmental Impact Assessment) Commission suggested that the project, Urban Arterial Road System Development Project in Jakarta Metropolitan Area, requires an ANDAL Study.

12.2.2 Implementation of ANDAL Study

The procedure of an ANDAL Study is shown in Fig. 12.2.1. An ANDAL study requires the following steps:

- the project proponent presents TOR of ANDAL study to Working Group/Technical Team and Central AMDAL Commission
- the project proponent carries out ANDAL study
- the project proponent presents result of ANDAL study to Working Group/Technical Team and Central AMDAL Commission

The JICA Study Team prepared the TOR of the ANDAL Study (KA-ANDAL) and submitted the TOR to the Central ANDAL Commission. The TOR of the ANDAL Study was approved by the Central AMDAL Commission. The JICA Study Team entrusted to a local consultant, PT. Lestari Bangundesa Sejahtera, to carry out the ANDAL Study under the supervision of the JICA Study Team. The local consultant began the ANDAL Study in December 1993. The Directorate General of Highways and the JICA Study Team submitted the Draft ANDAL Report to the Central AMDAL Commission. From an environmental point of view, the project was approved by the Central AMDAL Commission after discussing the ANDAL Study in July 1994. The JICA Study Team has received the approval letter from the Minister of Public Works.

12.2.3 Study Items

Items for ANDAL Study are as follows:

Physical-Chemical Environmental Components

- Climate
- Topography/Geology/Soil
- Hydrology and Water Quality
- Air Quality
- Noise

Biological Components

- Fauna/Flora

Socio-Economic and Socio Cultural

- Demography and Community
- Economic Activities
- Land Use
- Transportation
- Public Facilities and Infrastructure
- Archaeology and Cultural Property

12.2.4 Results of ANDAL Study

The results of the ANDAL Study Report are summarized as follows:

(1) Pre-Construction phase

In the Pre-Construction Phase, the significant impacts will be in relation to the community, such as community unrest, resettlement and disagreement over compensation. These impacts can be caused by unclear and ambiguous information. It is estimated that 389 buildings for North-South Axis and 3,281 buildings for the East-West Axis will be affected by the project. From the viewpoints of environmental impacts of socio-economic and socio-culture, it is likely that the project will affect people and facilities within 200 m wide in the both sides of road. It is estimated that 18,318 units for the North-South Axis and 28,276 units for the East-West Axis are located in 400 m wide corridor. It accounts for 56,220 persons and 84,330 persons respectively who are not only residents but also commuters.

(2) Construction phase

The activities of the construction may not have a serious impact on the environment. However, pollution and traffic congestion caused by construction are critical issues. Residents will be affected by gas emission and noise generated by heavy equipment. The project proponent should pay attention to the impact on residents.

(3) Operation and Maintenance Phase

In general, the existence of roads create better conditions in terms of decreasing transportation time, decreasing traffic accident, and growing economic activities. However, land use along the proposed road sides will be changed, which may be serious and significant problems for some people.

The ANDAL Study for this feasibility study was officially approved on August 29, 1994 by Minister of Public Works following the recommendation letter by the central committee.

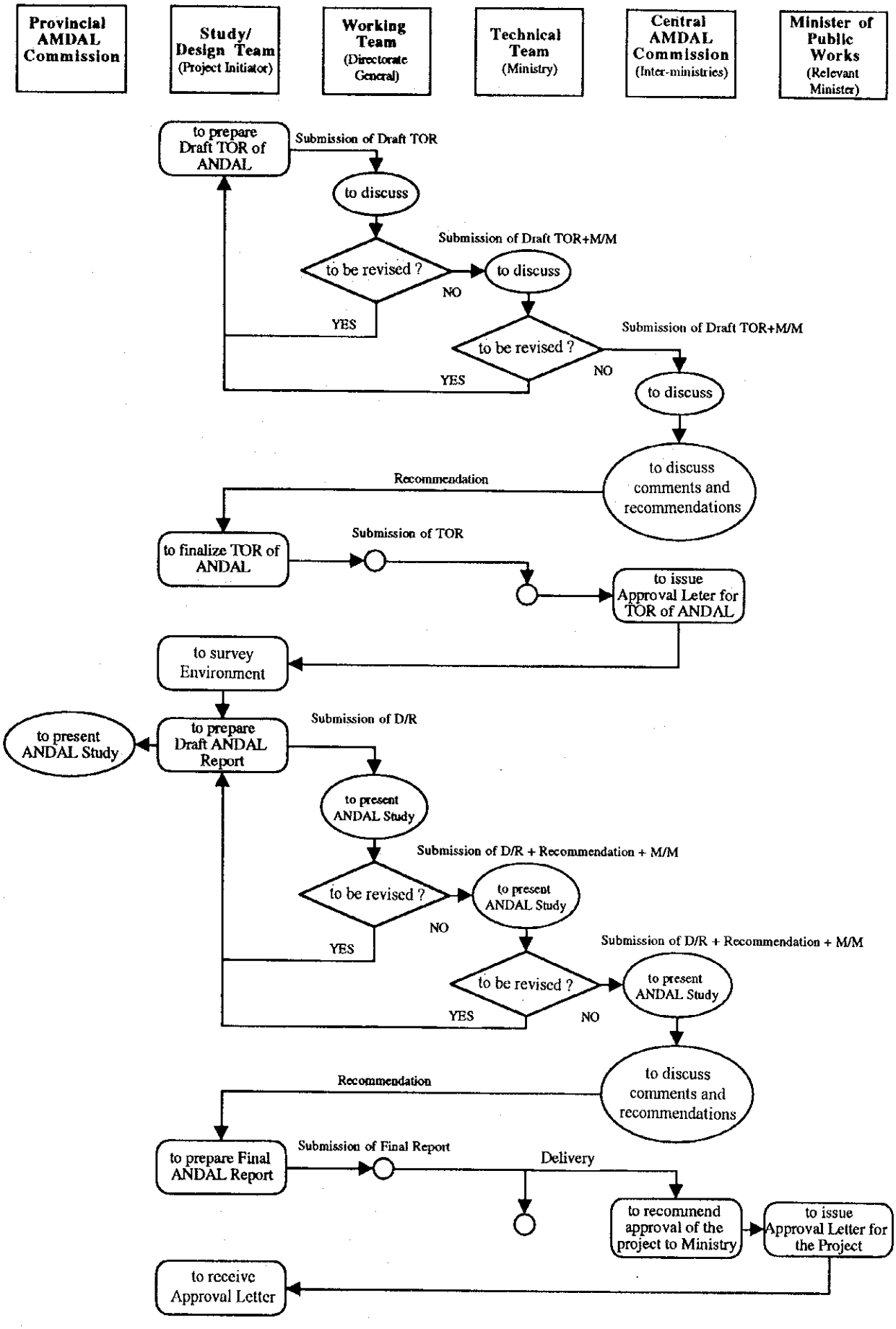


Fig. 12.2.1 Procedure of ANDAL Study

12.3 Identification of Environmental Impact

12.3.1 Targets of Environmental Impact Study

In this section the environmental impact by the project is identified based on the environmental study by the JICA Study Team and the result of the ANDAL study. This section is also the premise of environmental considerations at the next section.

Environmental Study for feasibility study covers selected priority sections of the North-South Axis and East-West Axis. The North-South Axis is between Kota and the Jakarta Outer Ring Road (JORR) (18 km in length), and the East-West Road is between the western section of JORR and the eastern section of JORR (31 km in length). An outline of the project follows:

(1) North-South Axis

a) Function
The North-South Axis has a function for a higher degree of mobility for diversion of traffic from the existing north-south thoroughfare. The North-South Axis is a freeway that has full access control and constant serviceability and safety.

b) Route and interchanges
The proposed route of the North-South Axis is shown in Fig. 12.3.1. The route is about 18 km in length and passes through the following existing roads :

Jl. Gajah Mada/Hayam Wuruk
Jl. Abdul Muis
Jl. Jati Baru
Jl. Pejompongan - Pondok Pinang (Simpruk Bypass)
Jl. Gelora
Jl. Asia Afrika
Jl. Pattimura
Jl. Sultan Iskandarsyah
Jl. Prapanca
Jl. Pangeran Antasari

The North-South Axis has 11 interchanges as follows:

1.	Glodok IC	the northern terminus
2.	Mangga Besar IC	On/Off ramp
3.	Sukarjo IC	On/Off ramp
4.	Abdul Muis IC	On/Off ramp
5.	Kebon Sirih IC	semi-directional ramp
6.	Kebon Kacang IC	semi-directional ramp
7.	Pal Merah IC	On/Off ramp

8.	Senayan IC	semi-directional ramp
9.	Kemang Raya IC	On/Off ramp
10.	Pangeran Antasari IC	On/Off ramp
11.	South JORR	Y-type junction with tollway of JORR

c) Structures

The North-South Axis is an elevated toll road on viaduct for the whole stretch, and has two typical cross sections, namely single deck and double deck, as follows:

single deck
- from Sukarjo IC to the front of the Ministry of Public Works on Jl. Pattimura (the south of Senayan IC) (ROW=28.11 m)
- from Jl. Cipete Raya on Jl. Pangerang Antasari to South JORR (ROW=60 m)

double deck
- from Glodok IC to Sukarjo IC (ROW=61.5 m)
- from the front of the Ministry of Public Works on Jl. Pattimura to Jl. Cipete Raya on Jl. Pangerang Antasari (ROW=13.85)

The typical cross sections of the North-South Axis are shown in Fig. 12.3.2.

Number of lanes is:

4 lanes: from Glodol IC to Kebon Sirih IC
6 lanes: from Kebon Sirih IC to Pangeran Antasari IC

(2) West-East Axis

a) Functions

The East-West Axis is a major arterial road, and has the following functions:

- to stimulate the development of the planned east and west primary centers
- to enhance the road capacity in the new housing development areas
- to support through traffic in the central urban areas

b) Route and interchanges

The proposed route of the East-West Axis is shown in Fig. 12.3.1. The route is about 31 km in length as follows :

The Western section of JORR
The City Planning Road Route K
The City Planing Road along the Tangerang Railway Line
Jl. Utama Sakti
Jl. Jalambar Selatan 2
The City Planning Road Mangga Bear Extension

Jl. Mangga Besar
Jl. Industri
Jl. Landasan Barat/Timur
Jl. Sunter Jaya
The City Planning Road in the north of Sunter Mas
Jl. Taman Suter Indah
Jl. Danau Indah Raya
Jl. Raya Barat/Timur Boulevard
Jl. Pegangsaan Dua
The City Planning Road in the east of Pulogadung Industrial Estate
The City Planning Road Route AA
The eastern section of JORR

East-West Axis has 14 interchanges as follows:

1.	West JORR IC	Half Cloverleaf
2.	Kembangan IC	Diamond
3.	Perjuangan IC	Diamond
4.	Daan Mogot IC	Diamond
5.	Latumeten IC	Diamond + Semi-Directional
6.	Mangga Besar IC	Loop + Semi-Directional
7.	Gunung Sahari IC	Diamond + Semi-Directional
8.	Kemayoran West IC	Half Diamond
9.	Kemayoran East IC	Half Diamond
10.	Sunter IC	Diamond
11.	Kelapa Gadung East IC	Diamond
12.	Bekasi Raya IC	Diamond
13.	Buaran IC	Diamond
14.	East JORR IC	Diamond + Frontage Road Flyover

c) Structures

The East-West Axis has separated lanes; fast-moving lanes and slow-moving lanes. The East-West Axis has two typical cross sections; namely, at-grade type (embankment) and viaduct type. These sections are:

embankment type : from West JORR IC to from Mangga Besar IC
from Bekasi Raya IC to East JORR IC

viaduct type : from Mangga Besar IC to Bekasi Raya

The typical cross sections of the East-West Axis are shown in Fig. 12.3.3.

The number of lanes of the East-West Axis is 10 lanes. However, ROW is as follows:

ROW= 70 m : from west JORR IC to Mangga Besar IC and from Kelapa Gading East IC to East JORR IC
ROW= 40 m : from Mangga Besar IC to Kelapa Gading East IC

12.3.2 Project Activities

The major activities of the project are as follows:

Pre-Construction Phase
- Design and procurement
- Site exploratory survey
- Land acquisition/Property compensation
- Utility networks removal and installed
- Employment of labour

Construction Phase
- Mobilization of heavy equipment and construction plants
- General haulage
- Construction of site office
- Demolition of existing structures
- Site preparation
- Construction of main structures
- Road excavation and pavement
- Construction of access roads
- Construction of accessory structures
- Installation of new drainage system

Operation and Maintenance Phase
- Existence of road structures
- Travelling of traffic vehicles
- Maintenance

12.3.3 Sources of Environmental Impact

Project activities will cause environmental impact. The project will have not only negative impacts, but also positive impacts. These impacts depend on location, size and shape of structures, traffic volume, and work schedule. Sources of environmental impact are described in three phases as follows:

(1) Pre-Construction Phase

Sources of environmental impact from preparing construction work are as follows:

- increasing employment opportunities of labor

- occupying land for structures
- increasing community unrest
- moving residents
- removing infrastructure

(2) Construction Phase

Sources of environmental impact from the construction works are as follows:

- increasing traffic volume around the access roads by transportation of construction equipment and materials
- changing of existing land use in the proposed road area
- generating noise, vibration and air pollution by operation of heavy equipment and transportation of construction materials
- generating turbid water
- generating construction waste
- temporary occupation of existing roads and space for construction works
- hindering traffic around construction sites

(3) Service and Maintenance Phase

The purpose of a road development project is to increase traffic capacity in order that traffic flows smoothly. This is a positive environmental impact. However, if road structures exist, structures and activities may causes changing environmental conditions.

It is expected that the service and maintenance will cause the following environmental impacts.

- changing landscape
- changing existing land use
- generating noise and vibration by traffic vehicles
- generating air pollution by traffic vehicles
- increasing traffic volume around interchange including queues at toll gates
- increasing drainage of rain water
- occurrance of pollutants through traffic accidents and spills of transported materials

12.3.4 Environmental Impact by the Project

Possible environmental impact matrix is shown in Table 12.3.2. Environmental impact matrix covers the possible impacts on environmental elements in Pre-Construction Phase, Construction Phase, Operation and Maintenance Phase. Major environmental impacts by the implementation of the project are as follows:

(1) Pre-Construction Phase

Positive Impacts

The detailed design for the structures and improvement plan along the proposed routes will be needed before the construction work. Land readjustment will be carried out along high density residential areas, especially the Mangga Besar Extension, at the same time as land acquisition. At present, the East-West Axis along Mangga Besar Extension area is far from being safe. Streets in this area are very narrow and complicated. Fire fighting is very difficult as a result. After implementation of a readjustment plan, which includes construction of streets, parks, and rivers/channels, these areas will be improved in terms of amenities, infrastructure, and public facilities.

Negative Impacts

Land acquisition is a very important activity. The North-South Axis and East-West Axis will require resettlement, especially from Tanah Abang on the North-South Axis and Jalambar, Mangga Besar Extension and Sunter Jaya on the East-West Axis, with a large number of residents being resettled. The number of buildings requiring resettlement was estimated by the JICA Study Team as shown in Table 12.3.1.

At present, land readjustment will be required in this area. If land readjustment is carried out, toll apartment houses will be built for resettled residents in readjustment areas. Therefore, no serious environmental problems will come out of the land acquisition.

Table 12.3.1 Number of Required Resettled Buildings

North-South Axis

Section	Length of Land Acquisition Area (m)	Number of Resettled Building
NS-1	0	0
NS-2	820	185
NS-3	0	0
NS-4	620	24
NS-5	1,320	180
Total	2,760	389

East-West Axis

Section	Length of Land Acquisition Area (m)	Number of Resettled Building
EW-1	4,085	1,215
EW-2	2,190	1,290
EW-3	0	0
EW-4	2,010	437
EW-5	1,210	339
Total	9,495	3,281

Estimated by acrial Photograph (1993)
Location of secitons are shown in Fig. 12.3.4

(2) Construction Phase

Positive Impacts

Implementation of the project requires a large workforce such as road engineers, vehicle and heavy equipment operators, and laborers. Many workers gather at construction sites, and small service sectors eventually will find themselves in these sites. Employment of labor contributes to the local economy.

Negative Impacts

It may be possible that ambient air quality will be influenced and that the following activities will generate air pollutants:

- mobilization of heavy equipment and construction plants
- general haulage
- demolition of existing structures
- construction of main structures
- road excavation and pavement
- construction of accessory structures
- installation of new drainage system

Air pollution sources from the above activities are:

- travelling construction vehicles
- operation of heavy equipment
- demolition of existing structures

Traveling construction vehicles and operation of heavy equipment will generate emission gases such as CO and NOx. Demolition of existing structures will generate dust. The dispersion of emission gas and dust are influenced by a number of conditions such as wind, atmosphere (temperature and sunshine ration), and operation. However, generated air pollution such as CO and NOx is not expected to influence the ambient air quality, because vehicles and equipment will not operate for a long time, and emission gas can be dispersed by the wind (yearly average wind speed: 1.6 m/s).

Dust will be generated by the demolition of existing structures, especially on windy days. Measures on generating dust are required (see 12.4 Environmental Consideration).

The following activities will raise noise levels.

- mobilization of heavy equipment and construction plants
- general haulage
- demolition of existing structures
- construction of main structures
- road excavation and pavement
- construction of accessory structures
- installation of new drainage system

Traveling construction vehicles and operation of heavy equipment will raise the noise level from the background level. Pile driving work is the most major noise source. It is possible that pile driving work will intermittently raise noise levels.

Construction activities will influence traffic conditions. The following activities need to occupy space for construction:

- demolition of existing structures
- construction of structures
- construction of access roads

If the project proponent does not operate a traffic management system around construction sites, these activities will obstruct transportation and cause traffic congestion. It is a very serious problem.

Traffic volume also will increase on account of conveyance of labour, construction equipment, materials and waste. However, the period of transportation will not be long, and some detours will be provided, so environmental impact caused by construction is predicted not to be serious.

(3) Operation and Maintenance Phase

Positive Impacts

Many vehicles will shift to the proposed roads from existing roads which are crowded with traffic. Service of the North-South Axis and East-West Axis will bring about smooth driving on existing roads and raising economic activities. Furthermore, pollutants from traveling vehicles, such as CO and NOx, will decrease in wide areas.

Negative Impacts

After construction, the road structures that are at-grade type on the East-West Axis may hinder the residents from crossing the proposed roads. Split of communities depends on the distribution of pedestrian bridges and tunnels.

Travelling vehicles on the proposed roads will raise air pollution and noise levels from the background level. Protection from noise levels from traveling vehicle is required around residential areas, schools and others. It is not expected that rising air pollution from travelling vehicles will be serious.

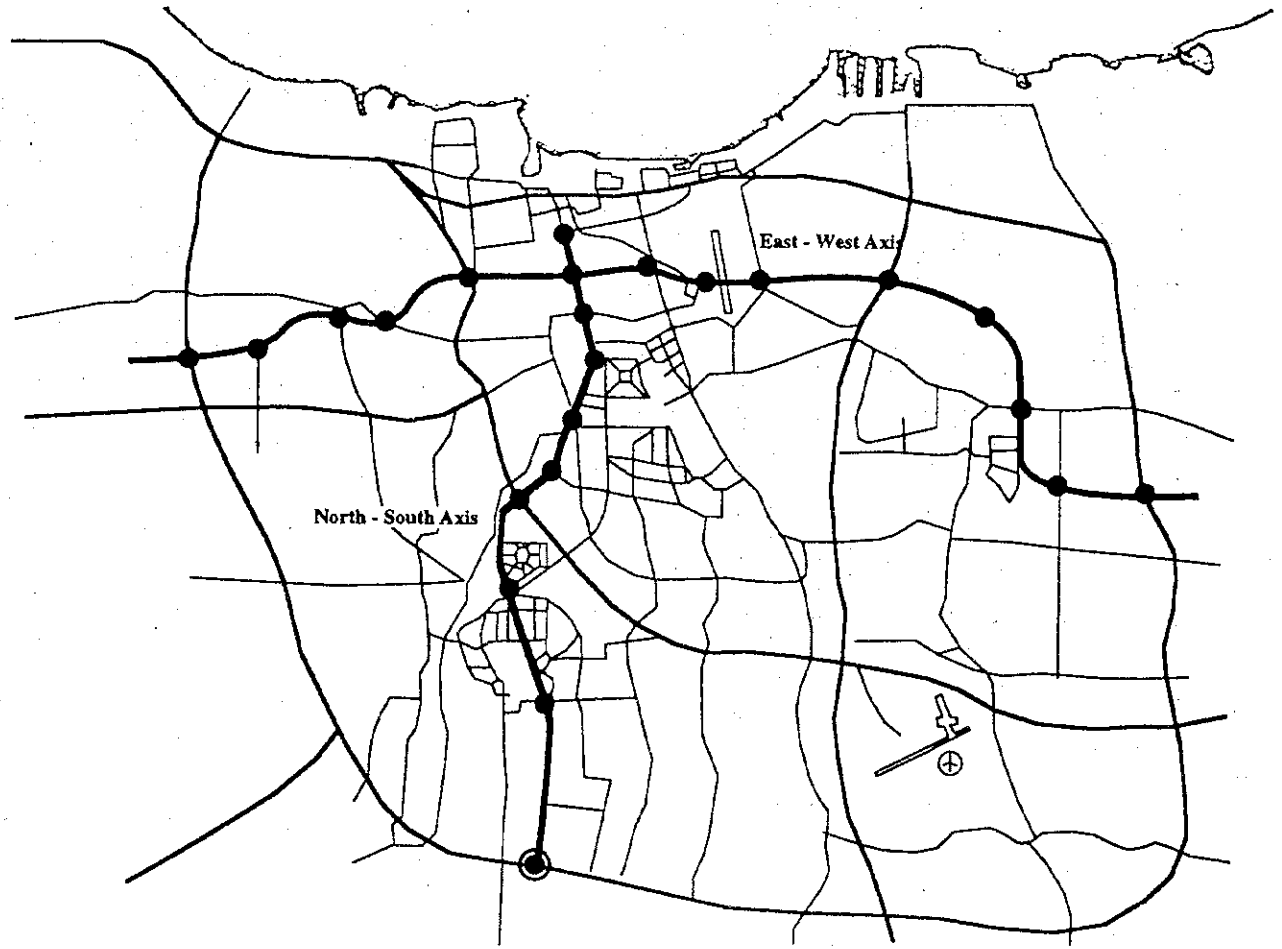
It may be possible that travelling vehicles on the proposed roads will generate emission gas. Emission factors by vehicles for prediction have not been analyzed in Indonesia, so air pollution by the project can not be calculated. However, rising air pollution from travelling vehicles will not be serious.

Table 12.3.2 Possible Environmental Impact Matrix of the Project

Environmental Elements / Project Activities	Physics and Chemistry																Biology		Social and Economic												
	Climatic	Slope stabilities	Ground substance	Soil erosion	Soil contamination	Hydrology	Water quality	Groundwater use/quality	Water Resources	Air pollution	Noise	Vibration	Offensive odor	Disaster	Aesthetic	Flora	Fauna	Local Administration	Community Unrest	Split of communities	Resettlement	Land Use	Economic activities	Employment	Traffic	Infrastructures	Public Health	Archaeology/Cultural sites	Human Safety	Amenity
Pre-Construction Phase																															
1 Design and procurement														+				–								+				+
2 Site exploratory survey																			–											
3 Land acquisition / Property Compensation																		–	–		–					–		–		
4 Utility networks removal and installed																									–	–				
Construction Phase																															
1 Employment of Labor																						+	+							
2 Mobilization of heavy equipment and construction plants										–	–	–												–					–	
3 General Haulage										–	–	–												–					–	
4 Construction of site office																															
5 Demolition of existing structures							–			–	–	–														–				
6 Site preparation							–																								
7 Construction of main structures										–	–	–			–					–					–					–
8 Road Excavation and Pavement										–	–	–								–										
9 Construction of access roads										–	–	–			–					–					–					–
10 Construction of accessory structures										–	–	–			–										–					
11 Installation of new drainage system						–	–			–	–																			
Operation and Maintenance Phase																															
1 Existence of road structures						–								+	+/-					–										
2 Travelling of traffic vehicles										+/-	–	–										+	+		+					+
3 Maintenance																								+	+	+			+	+

+ : Positive Environmental Impact

– : Negative Environmental Impact



FEASIBILITY STUDY ON
URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT
IN JAKARTA METROPOLITAN AREA

Fig. 12.3.1 Proposed Route of North-South Axis and East-West Axis

12.4 Environmental Consideration

As a result of the environmental study, the following items are considered importent for the Preliminary Engineering Design.

12.4.1 Proper Land Acquisition

1) North-South Axis

Land acquisition is the most critical issue. The North-South Axis is to pass the built-up areas in Jakarta. It is inevitable that land acquisition will be required for road widening, construction of on/off ramps and cornering of shape curves.

It is estimated that 390 building should be demolished on the North-South Axis (Table 12.3.1). Two major sections are located at Tanah Abang and in the south of Jl. Pangeran Antasari. The number of demolished buildings are 185 and 180 buildings respectively. These areas are residential. The residents need an understanding of the project, so the project proponent should inform potentially affected residents about the project soon. And the project proponent should also compensate resettled persons for lost assets.

A high school, named SMA 82, is located in front of Jl. Pattimura. The proposed road goes through the playground of this high school. It is recommended that the project proponent provide a substitute playground close to this school.

2) East-West Axis

Many residents will need to be resettled and many buildings will need to be demolished for construction of East-West Axis. It is estimated that 3,300 building will be demolished on the East-Wcst Axis. On the Section of Mangga Besar Extension (Jl. Gajah Mada/Hayam Wuruk - railway), approximately one thousand buildings will be demolished. Saying that one thousand buildings should be demolished is like saying that one thousand households will be resettled, because this area is residential. Jelambar to the west of Prof. Dr. Latumeten and Sunter Section also requires resettlement of 700 and 400 households respectively.

Land acquisition is the most critical issue for the project, especially for residents involuntarily displaced, resulting in economic, social and environmental problems. To overcome this difficulty, a proper resettlement plan should be prepared.

According to the Decree of the President No. 55, 1993 concerning Preparing Land in the Implementation of Development for Public Interest, the base and method of compensation is stipulated as follows:

- The price of the land is based on the sale price, current tax on land and building of the related land.

- The value of sale price of the building is that estimated by the Regional Government Agency that is responsible in the construction field.

The Project proponent should provide residents, who are right holder or not, with the following assistance :

- enable those effected to reconstruct a land-based or employment-based productive existence
- compensate for their losses at replacement cost
- assist with the move and during the transition period at the relocation site
- assist in their efforts to improve their former living standards, income earning capacity and production levels, or at least to restore them to the previous levels.

A recommend resettlement plan is as follows:

Multiple dwelling houses should be constructed for resettled persons. Provided that multiple dwelling houses will be provided for resettled persons, they can secure original jobs. However, these are not adequate countermeasures.

This area is a residential area with small shops and small workshops. The roads in this area are very narrow, complicated and congested with traffic. This area is far from being safe.

A land adjustment concept is shown in Fig.12.4.1. Land adjustment includes the following:

- improvement of the road network with major roads and small roads
- construction of parks
- planting
- improvement of river and channel for urban drainage and landscape
- development of sewage system

Provided that there will be persons who disagree on resettlement to multiple dwelling houses, or who live in other resettlement areas, the project proponent should compensate resettled persons for lost assets.

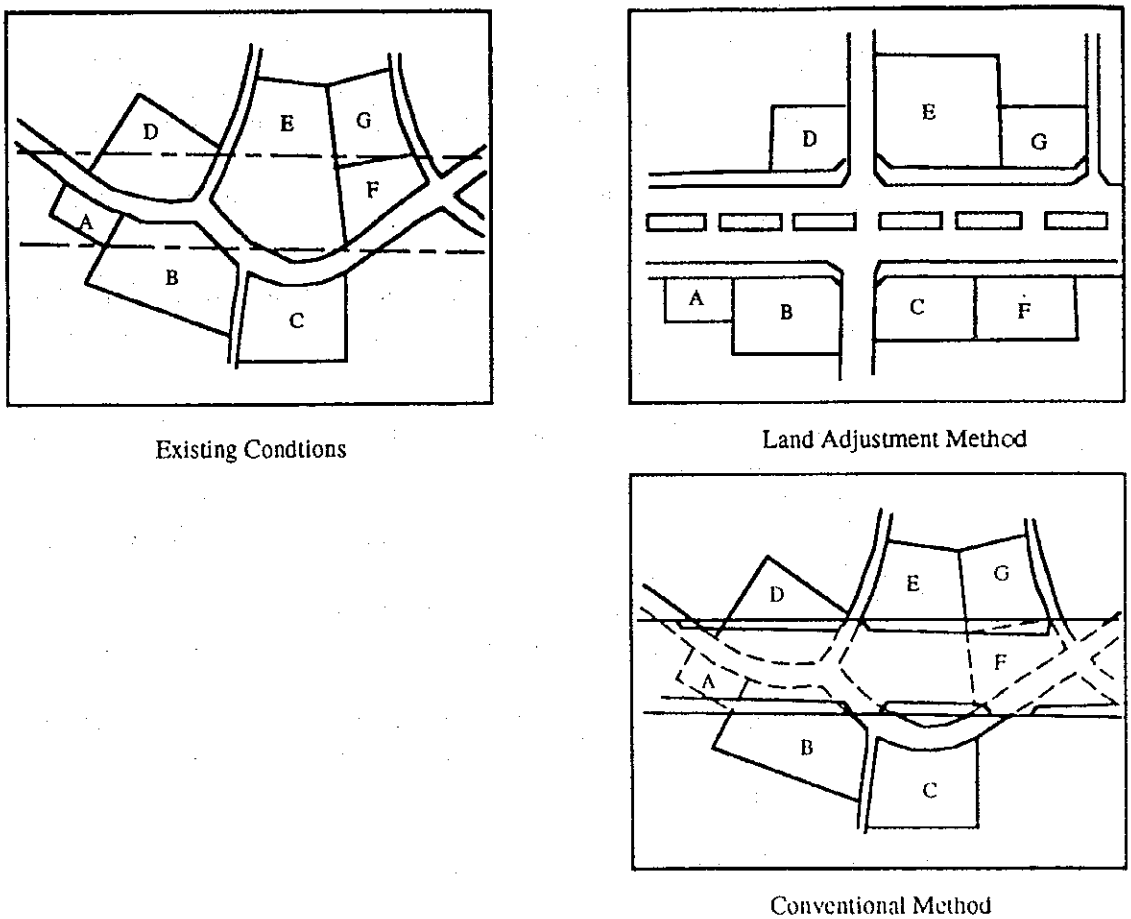


Fig.12.4.1 Land Adjustment Concept

11.4.2 Traffic Control

Construction activities will influence existing traffic conditions. In the construction phase, the proposed road sides and the vicinity will be occupied. And construction vehicles will carry labour, construction equipment, materials and waste. These activities will cause traffic congestion. Traffic congestion will occurr in active commercial areas and on narrow road areas.

The Project pr. ponent should consider construction methods and the work schedule, especially on Jl. Gajah Mada/Hayam Wuruk and Jl. Mangga Besar, which are commercial areas. These roads are always crowded with heavy traffic. It is expected that construction work will affect traffic vehicles on these roads. It is possible that secondary streets in high density residential areas such as Mangga Besar Extension and others will be crowded.

The appropriate construction method for minimizing construction site area should be considered. If existing traffic conditions will be obstructed by construction activities, it is recommend that the contractor should manage traffic and provide public information of construction schedules and detours.

12.4.3 Measures of Air Pollution

It may be that the major air pollution is dust during construction. Dust will be generated by demolition of existing structure. It is recommend that the following activities be taken as countermeasures for generated dust in high density residential areas and commercial areas:

- demolition work and are not carried out on windy days
- water is sprinkled at the work sites

1) North-South Axis

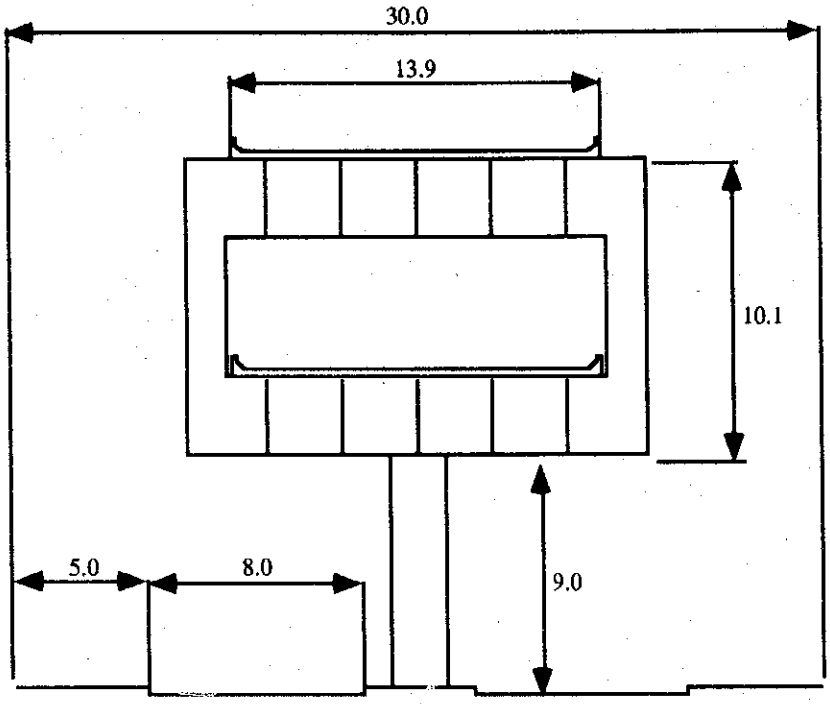
The Indonesian Steering Committee was concerned that the configuration of the viaduct on Jl. Pangeran Antasari will aggravate air quality, because emission gas will accumulat under the viaduct. However, the team choose a double deck type on this section (see Fig.12.4.2). In case of the double deck type on Jl. Pangeran Antasari, wind can blow in from out side. Therefore, emission gas from vehicles can be diffused by wind, so that there will not be serious air pollution.

12.4.4 Measures of Construction Noise

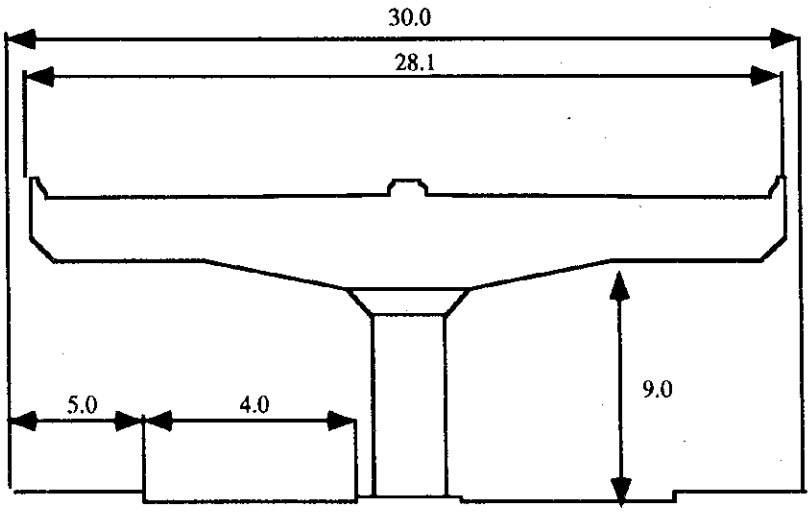
Operation of heavy equipment will raise the noise level from the background level. Construction of viaduct structures requires piling work. Piling work causes large and intermittent noise. The North-South Axis is a viaduct type, so piling work will be a major noise source during the construction phase.

Construction activities in residential areas, schools, hospitals and others need to be considered. In view of securing understanding and decreasing unrest of residents, the contractor should inform residents on construction activities. Public relations are very important for the development of roads. It can be said that complaints from residents can delay the work schedule. It is very important that the Project proponent and contractor secure understanding and cooperation from residents.

The contractor should use soundproof equipment, such as pile drivers with soundproof coverings in residential areas, and close to offices, schools and hospitals. For example, a pile driver with soundproof covering can reduce the generated sound level to 70 dB at 30 m from the noise source. This noise level is 20 dB lower than a diesel hammer without soundproof covering. Noise levels from typical heavy equipment are shown in Table 12.4.1 and Fig.12.4.3.



Double Deck Type



Single Deck Type

Fig. 12.4.2 Road Structure Types on Jl. Pangeran Antasari

Table 12.4.1 **Noise Level by Construction Heavy Equipment**

unit: dB

Heavy Equipment	Distance (m)														
	5	10	20	30	40	50	60	70	80	90	100	150	200	250	300
Diesel Hamer															
without Soundproof Covering	109	103	97	93	91	89	87	86	85	84	83	79	77	75	73
with Soundproof Covering	86	80	74	70	68	66	64	63	62	61	60	56	54	52	50
Bulldozer	83	77	71	67	65	63	61	60	59	58	57	53	51	49	47

PWL: Diesel Hamer without Soundproof Covering 134 dB
Diesel Hamer with Soundproof Covering 111 dB
Bulldozer 108 dB

The contractor should make appropriate work schedules based on land use. In the case where heavy equipment that generates high noise level will be used in residential areas and others, construction time should be property managed. The contractor should consider the following area and time:

- residential area : evening and night time
  : Sunday (full time)
- school, office area : day time excluding Sunday
- hospital with beds : full time
- mosque : pray time

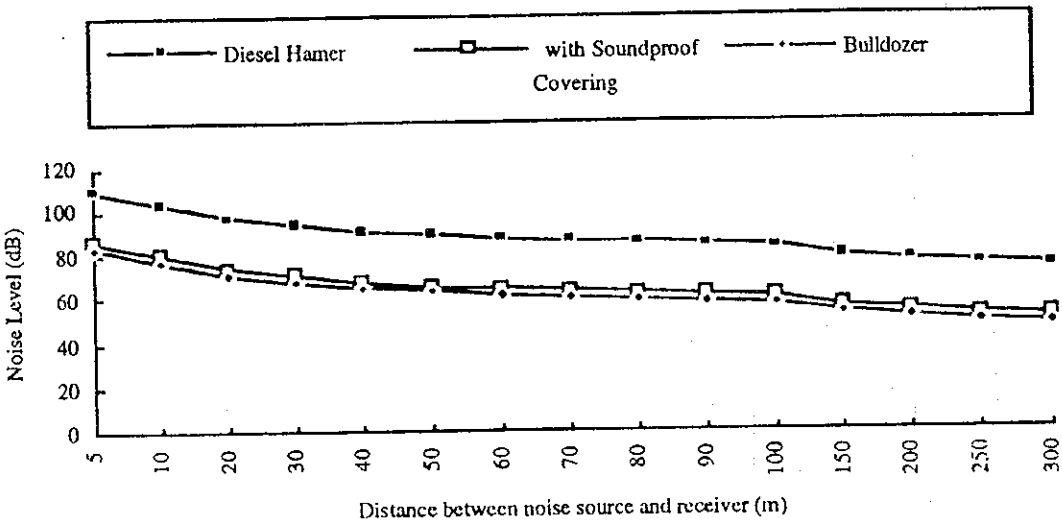


Fig.11.4.3 Prediction of Construction Noise Reduction by Heavy Equipment

11.4.5 Measures of Traffic Noise

1) North-South Axis

Traffic noise is one of the major environmental problems of residents in an urban area. Measures of traffic noise can be divided into three, as follows:

- Structure of vehicles such as engine and tires, control of traffic vehicles such as travel speed, overloaded vehicles, and vehicle to be repaired, and development of signal system etc.

- Improvement of road structures, construction of sound insulating walls, dikes and buffer zones, and development of by-pass road

- Environmental conservation along the road, changing land use for road development, construction of buffer building and sound proof buildings and parks

Travelling vehicles on the proposed road will raise the noise level from the background level. Noise from vehicles impact on residential area, schools, hospitals and others.

The procedure of measures for traffic noise is shown in Fig.12.4.4. The JICA Study Team surveyed the noise level in Jakarta for the ANDAL Study in January 1994. The results of the noise level survey are shown in Table 12.1.7. Required measures of traffic noise are based on environmental standards (Decision on Criteria of Ambient Air Quality and Ambient Noise, DKI Jakarta No. 587, 1980). The following require measures of traffic noise:

- existing noise level exceeds environmental standards
- noise level will exceed environmental standards by traffic vehicles on proposed road

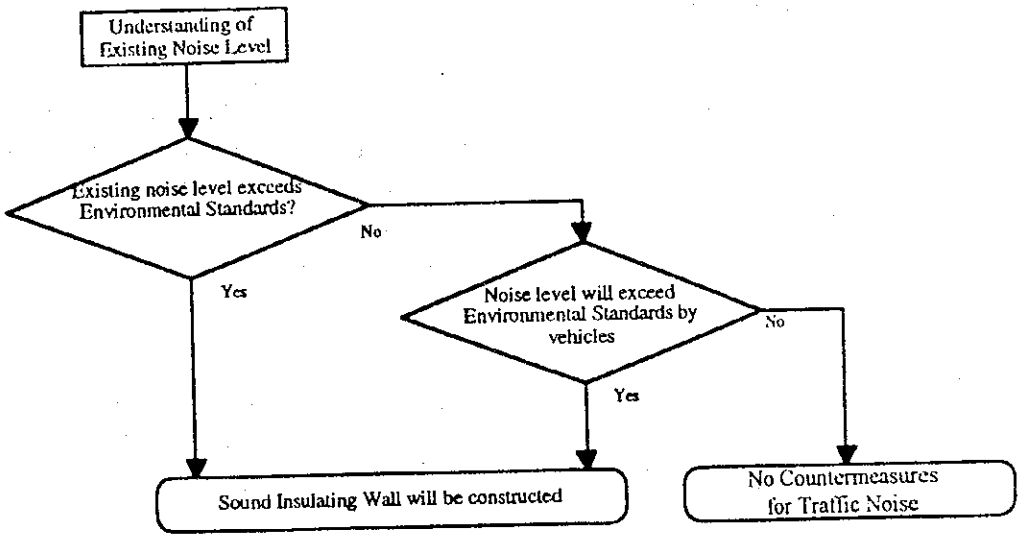


Fig.12.4.4 Procedure of Selection of Area for Measures of Traffic Noise

The following sections, that are typical road structures and land use on the North-South Axis, are compared by noise level.

- Jl. Gajah Mada/Hayam Wuruk
- Jl Abdul Muis
- Jl. Patimura
- Jl. Pangeran Antasari

The existing and predicted noise levels on four sections of the North-South Axis are shown in Table 12.4.4 and Fig.12.4.6. It is predictable that the noise level in four sections generated by operation of the North-South Axis will be the same as the existing noise level at peak hour. It is estimated that the noise level composition with background and loaded noise will increase by approximately 3 dB from background. Therefore, commercial areas do not need measures of traffic noise, because composition noise levels will be below environmental standards. In office areas, existing noise levels are almost the same as environmental standards.

According to the noise level survey, noise levels exceed environmental standards in residential areas. The section of Jl. Pangeran Antasari is located a residential area. The existing noise level also exceeds environmental standards (60 dB).

It is predicted that the noise level composition with a viaduct and frontage road in this section will be 73 dB on the boundary of the road. The noise level is the same as the existing noise level. Composition of the noise level is made up of two noise sources: viaduct and frontage road (Table 12.4.2). It can be said that the noise from the frontage road contributes to ambient the noise level on road boundary.

Table 12.4.2 Composition of Predicted Noise on Jl.Pangeran Antasari, 2010

unit: dB

Noise sources	Peak hour	Night time
Viaduct road	73.3	69.9
Frontage road	56.7	69.9
Composition of noise level	73.4	50.3

Receiver is located on boundary of road.

Generated noise level for two cases is compared on Jl. Pangeran Antasari: with North-South Axis and without North-South Axis. The case of with North-South is to construct viaduct. The case of without North-South Axis is to use city planning road on Jl. Pangeran Antasari by future traffic volume in 2010, and to construct East-West.

The cases of with and without North-South Axis in 2010 are shown in Table 12.4.3. Noise level with the project of North-South is the same as without the project. And frontage road with North-South Axis will not be covered by the project. Therefore, measures of facilities for traffic noise are not required in the project.

In terms of interchanges, the traffic volume of the On/Off ramps will be lower than that of the road way, and the noise level from the road way will be relatively higher than that from the ramp area. It is predictable that the area where noise level is higher is located on only ramps, and this area is small. Additional noise from traveling vehicles on interchanges can be neglected, because it is relatively small.

Table 12.4.3 Noise Level of With and Without North-South Axis, 2010

unit: dB

Cases	Peak Hour	Night Time
With North-South Axis	73.4	69.9
Without North-South Axis	73.3	69.8

Calculation Conditions of Without North-South Axis on Jl. Pangeran Antasari

Items	Unit	With North-South Axis		Without North-South Axis	
		Peak hour	Night time	Peak hour	Night time
Road Type		Viaduct type		At-grade type	
Number of lanes		6 + 4		6	
Daily Traffic Volume	veh./day	121,000		66,000	
Hourly Traffic Volum Ratio	%	8	1.5	8	1.5
Hourly Traffic Volume	veh./hr	9,700	1800	5,300	990
Heavy Vehicle Ratio	%	12	20	12	20
Average Travel Speed	km/h	50 , 30	80 , 60	30	60

With North-South Axis: Daily Traffic Volume: Viaduct 55,000 veh./day, Frontage road 66,000 veh/day
Average Traffic Speed: the former Viaduct type, the latter Frontage road

2) East-West Axis

The East-West Axis has two types of road structures; at-grade type and viaduct type. The procedure of measures of traffic noise is the same as for the North-South Axis based on Fig.12.4.4.

The following sections, that are typical of road structures and land use on the East-West Axis, are compared by noise level.

- Jelamber Baru
- Mangga Besar Extention

- Jl. Mangga Besar
- Kelapa Gading

The existing and predicted noise levels of four sections on the East-West Axis are shown in Table 12.4.5 and Fig.12.4.7. The existing noise level around Jelambar and Mangga Besar Extention has not been surveyed. However, it is predictable that the noise level of these residential area also exceed environmental standards based on the results of other survey points (Table 12.1.7).

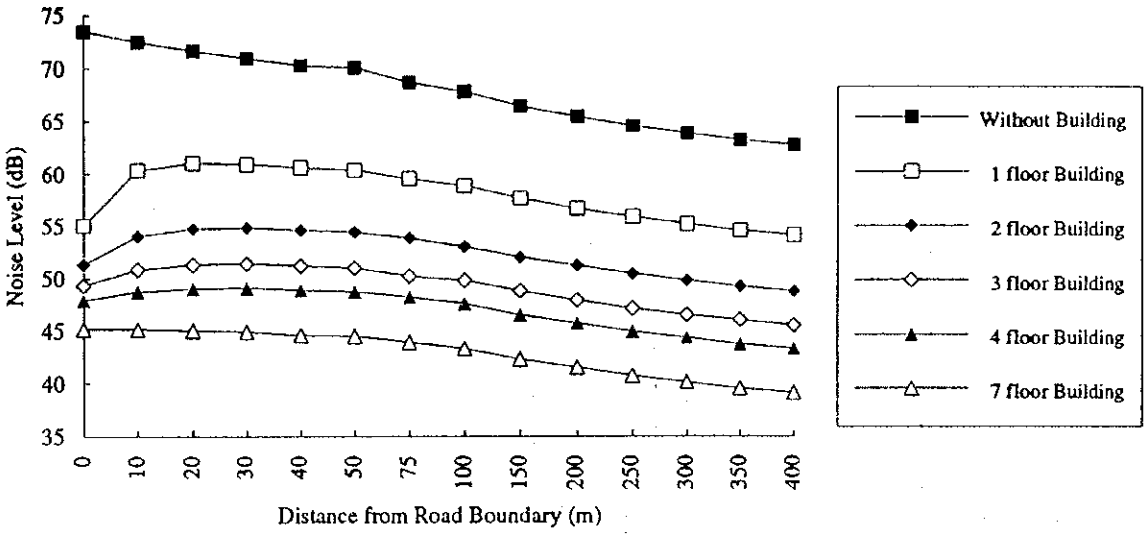
It is predictable that the noise level in commercial areas generated by operation of the East-West Axis is the same as the existing noise level or below. Therefore, the viaduct type road in commercial areas do not need measures of traffic noise.

In residential areas, noise level from the East-West Axis should be kept at the existing noise level, because the existing noise level exceed environmental standards. In case of at-grade type and viaduct type, vehicles travelling on the frontage roads contrbute to ambient noise level on the road sides.

It is recommended that noise buffer buildings be constructed along the road sides of the East-West Axis. The area along the East-West Axis has a high potential, so commercial and office areas will be established along the East-West Axis. Therefore, office buildings and others should be attracted to build on road sides.

It is expected that buffer buildings can be used as noise intercepts, similar to large sound insulating walls. City planner should promote development along the East-West Axis.

Effects of buffer buildings are shown in Fig.12.4.5. These results lead to the conclusion that more than a three floor building (12 m high) is an effective structure for diminution of noise. Provided that three stories buffer buildings will be constructed along at-grade type road (ROW = 70 m), the noise level will be 51 dB at 10 - 50 m from the road boundary. This noise level is 20 dB below the case of without buildings. It is recommend that buildings higher than three stories be constructed along at-grade type road.



Calculation Conditions		
ROW	70	m
Hourly traffic ratio	13,000	veh./hr
Heavy vehicle ratio	12	%
Travelling speed	30	

- It is assumed that the buffer building is wall, and has no depth in calculation.
- Sound source is at center of road.

Fig.12.4.5 Effect of Buffer Building for Measures of Traffic Noise

[Memo]

Calculation Model for Traffic Noise

Noise level by vehicles can be obtained by the following formula:

$$L50 = Lw - 8 - 20 \log_{10} L + 10 \log_{10} (\pi \cdot (L/d) \cdot \tan h \cdot 2\pi \cdot (L/d) + ad + ai$$

where

L50	:	average noise level at received point	(dB)
Lw	:	average power level	(dB)
L	:	distance between noise source and receiver	(m)
d	:	average space head way	(m)
		$d = 1000 \cdot V/N$	
		V : average travel speed	(km/h)
		N : hourly traffic volume	(vehicle/h)
ad	:	attenuation due to acoustic shielding	(dB)
ai	:	adjustment to account for the road type and the height of receiver	(dB)

Lw is calculated following formula:

$$Lw = 87 + 0.2V + 10 \log_{10} (a_1 + 8a_2)$$

Table 12.4.4 Comparison of Existing and Predicted Noise Level on North-South Axis, 2010

[Peak Hour]

Sections	Existing Land Use	Structure Type	Environmental Standards	Conditions of Noise Level	Predicted Noise Level	Daily Traffic Volume	
						High Level Road	Frontage Road
Jl. Gajah Mada/Hayam Wuruk	Commercial	Viaduct/Double deck	85	74 - 76	74	42,000	94,000
Jl. Abdul Muis	Office	Viaduct/Single deck	70	-	71	69,000	36,000
Jl. Patimura	Office	Viaduct/Single deck	70	70 - 72	73	11,000	68,000
Jl. Pangeran Antasari	Residential	Viaduct/Double deck	60	73 - 76	73	55,000	66,000

[Night Time]

Sections	Existing Land Use	Structure Type	Environmental Standards	Conditions of Noise Level	Predicted Noise Level	DailyTraffic Volume	
						High Level Road	Frontage Road
Jl. Pangeran Antasari	Residential	Viaduct/Double deck	60	57 - 73	69.9	55,000	66,000

Conditions of noise level: noise level surveyed in January 1994 by JICA Study Team
Jl. Gajah Mada/Hayam Wuruk: N-12, Jl. Pattimura: N-4, Jl. Pangeran Antasari: N-2
Predicted noise level: year 2010
Location of predicted noise level: boundary of road

Calculation Conditions

Parameters	High level road	Frontage Road
Average Travel Speed		
Peak hour (km/h)	50	30
Night time (km/h)	80	60
Ratio of Traffic Volume		
Peak Ratio (%)	8.0	8.0
Night Hour Ratio (%)	1.5	1.5
Heavy Vehicle Ratio		
Peak hour (%)	12	12
Night time (%)	20	20

Table 12.4.5 Comparison of Existing and Predicted Noise Level on East-West Axis, 2010

[Peak Hour]

Sections	Existing Land Use	Structure Type	Environmental Standards	Conditions of Noise Level	Predicted Noise Level	Daily Traffic Volume	
						High Level Road or Fast Lane	Frontage Road
Jelambar Baru	Residential	At-Grade	60	-	76	71,000	71,000
Mangga Besar Extention	Residential	At-Grade	60	-	77	89,000	89,000
Jl. Mangga Besar	Commercial	Viaduct/Single deck	85	74 - 76	75	78,000	78,000
Kelapa Gading	Comme/Residen	Viaduct/Single deck	85/65	71 - 73	73	54,000	54,000

[Night Time]

Sections	Existing Land Use	Structure Type	Environmental Standards	Conditions of Noise Level	Predicted Noise Level	Daily Traffic Volume	
						High Level Road or Fast Lane	Frontage Road
Jelambar Baru	Residential	At-Grade	60	-	70	71,000	71,000
Mangga Besar Extention	Residential	At-Grade	60	-	72	89,000	89,000
Kelapa Gading	Comme/Residen	Viaduct/Single deck	85/65	67 - 76	66	54,000	54,000

Traffic volume Ratio: Fast lane (50%) : Frontage road (50%)
Conditions of noise level: noise level surveyed in January 1994 by JICA Study Team
Jl. Gajah Mada/Hayam Wuruk: N-12, Kelapa Gading: N-18
Predicted noise level: year 2010
Location of predicted noise level: boundary of road

Calculation Conditions

Parameters	At-Grade Road (ROW 70 m)		Viaduct Type (ROW 40 m)	
	Fast Lanes	Frontage Road	High level road	Frontage Road
Traffic Voulme Ratio (%)	50	50	50	50
Average Travel Speed				
Peak hour (km/h)	45	30	45	30
Night time (km/h)	60	60	60	60
Ratio of Traffic Volume				
Peak Ratio (%)	8.0	8.0	8.0	8.0
Night Hour Ratio (%)	1.5	1.5	1.5	1.5
Heavy Vehicle Ratio				
Peak hour (%)	12	12	12	12
Night time (%)	20	20	20	20

Table 12.4.6 **Prediction of Traffic Noise Reduction on North-South Axis**

[Peak Hour]

Distance (m)	0	10	20	30	40	50	75	100	150	200	250	300	350	400
Jl.Gajah Mada/Hayam Wuruk														
for the East Side	74.1	71.9	70.5	69.6	68.9	68.3	67.1	66.2	64.8	63.9	63.1	62.4	61.7	61.3
for the West Side	74.0	71.8	70.5	69.5	68.9	68.3	67.0	66.2	65.2	63.8	63.0	62.3	61.7	61.2
Jl. Abdul Muis	70.5	68.5	67.3	66.4	65.8	65.2	64.3	63.5	62.3	61.4	60.7	59.9	59.4	58.9
Jl. Patimura	73.2	71.1	69.6	68.7	67.8	67.1	65.8	64.8	63.3	62.2	61.3	60.6	60.0	59.4
Jl. Pangeran Antasari	73.1	71.3	69.9	68.9	68.2	67.5	66.4	65.5	64.1	63.2	62.3	61.6	61.1	60.5

[Night Time]

Distance (m)	0	10	20	30	40	50	75	100	150	200	250	300	350	400
Jl. Pangeran Antasari	69.9	68.1	66.8	65.9	65.2	64.6	63.4	62.6	61.8	60.3	59.5	58.8	58.2	57.7

Table 12.4.7 **Prediction of Traffic Noise Reduction on East-West Axis**

Peak Hour

Distance (m)	0	10	20	30	40	50	75	100	150	200	250	300	350	400
Jelambar Baru	76.1	73.6	72.2	71.3	70.6	70.0	68.8	67.8	66.4	65.3	64.5	63.8	63.2	62.6
Mangga Besar Extension	77.2	74.6	73.3	72.4	71.6	71.0	69.8	68.8	67.4	66.4	65.6	64.8	64.2	63.7
Jl. Mangga Besar	74.7	71.9	70.5	69.5	68.8	68.2	67.1	66.2	64.7	63.9	63.1	62.5	61.9	61.4
Kelapa Gading	73.2	70.4	69.0	68.0	67.2	66.7	65.6	64.7	63.4	62.4	61.6	60.9	60.4	59.9

Night Time

Distance (m)	0	10	20	30	40	50	75	100	150	200	250	300	350	400
Jelambar Baru	70.3	69.4	68.4	67.6	66.9	66.3	65.1	64.1	62.7	61.7	60.8	60.1	59.5	58.9
Mangga Besar Extension	71.6	70.5	69.4	68.6	67.8	67.2	65.9	65.0	63.6	62.5	61.7	61.0	60.4	59.8
Kelapa Gading	66.4	65.8	65.1	64.4	63.8	63.3	62.1	61.2	59.8	58.8	58.0	57.3	56.8	56.3

12.4.6 Slope Protection

1) North-South Axis

The North-South Axis is a viaduct type, so soil erosion will not occur. Therefore, the North-South Axis does not need slope protection.

2) East-West Axis

At-grade type sections on the East-West Axis have a height of embankment of approximately 1 m. Turf will be planted on slopes, median and separators, and concrete drainage ditches for rain water will be installed on the road sides. For the reason given above, soil erosion will not occur. Planting on the road is recommended in section "12.4.9 Aesthetics"

12.4.7 Measures of Drainage

Issues concerning drainage can be divided into two, surface drainage for rain water and urban drainage.

Rain water is collected on the roadway. Collected rain water is discharged into canals and rivers. Locations of discharge points should be considered. If the flow capacity of outlets are smaller than the volume of discharged water, canals and rivers will be flooded. Collected rain water should be discharged into proper canals and rivers that have enough flow capacity. Detail design should consider relation of hydraulic requirement and road grading.

It was pointed out that at-grade sections on the East-West Axis will obstruct urban drainage, because rain water flows to rivers and canals from the south to the north in Jakarta. In at-grade sections, however, there will be several flyovers. As a result it should be considered to build bridges across rivers and canals, so rain water can flow under the East-West Axis. For the above reason, the East-West Axis will not obstruct urban drainage.

12.4.8 Construction Waste and Waste Water

Demolition work will generate construction waste. Construction waste consists of:

- concrete debris
- wood
- soil
- furniture etc.

It is recommendable that generated waste be recycled. Wood and furniture can be used again. If resettled residents carry recyclabe waste to new houses by themselves, the volume of construction waste can be reduced. The contractor should make an effort to reduce the volume of construction waste. The remaining of construction waste should be disposed by an appropriate method at legal disposal sites.

The concrete plant will generate waste water, which includes mud. If untreated waste water is discharged into rivers, river water will be polluted, and mud will be deposited on the river bed. The contractor should install waste water treatment facilities, such as detritus tanks.

The Indonesian Government does not have the standard of waste water for construction sites. However, the Study Team can adopt "Waste Water Quality Standards of Industry and Enterprises, No. 1608, 1988, that was established by DKI Jakarta. The quality of effluent should be below waste water standards as follows:

	Environmental Standards	
pH	6 - 9	
BOD	75	mg/1
COD	100	mg/1
Suspended Solids	100	mg/1

These parameters are several parts of all parameter.

12.4.9 Aesthetics

The visual quality of public facilities can and should contribute to the quality of life. Road structures are very large and prominent, and are part of the urban landscape. Therefore, landscaping should create the best possible urban environment that harmonizes roads with the city environment.

Landscape can be divided into two categories: internal landscape and external landscape. Internal landscape is the view as seen from drivers. On the other hand, external landscape is the view of structures as seen from people who are out side of the road.

Factors of visual quality consist of form, size, texture and color. Aesthetics depend on a combination of structure and the surrounding landscape. Aesthetic is defined as improvement of the landscape.

1) North-South Axis

The aesthetics of shopping districts, large intersections, park/recreational area, and redevelopment areas should be considered. Recommended aesthetics of structures on the North-South Axis are shown in Table 12.4.8. Road structure should not cause people feel uneasy. Piers and

beams should be make a neat form. Structure of drainage pipes and sound insulating wall should not spoil aesthetics. The color of road structure also should be harmonized with the surrounding landscape. Samples of beautified beams with cover are shown in Fig.12.4.8.

The Senayan Statue is a remarkable memorial and historical monument, and located at the Senayan round-about. The North-South Axis passes behind the Senayan Statue. Road structures in this section should be of neat form and not complicated.

Jl. Pangeran Antasari has a width of 30 m and is located in a residential area. If a single deck viaduct type structure is constructed, it will darken the frontage road and footpath under beam. Therefore, a double deck viaduct type has been recommended. A comparison of double and single deck viaduct structures is shown in Fig.12.4.2.

Table 12.4.8 Consideration of Aesthetics on North-South Axis

Location	Consideration of Aesthetics
Jl. Gajah Mada/Hayam Wuruk	Road structure does not cause people to feel uneasy.
Slipi Flyover	Form of Flyover should be beautified.
Jl. Asia Afrika	This area is recreational area. Senayan Olympic Stadium is located. The structure is not conspicuous form. The structure goes well with surroundings where there are many trees.
Senayan Round-about	Senayan Statue is a memorial and historical monument. Road structure should be harmonized with Senayan Statue
Jl. Pattimura - Jl. Pangeran Antasari	Road structure does not cause the people to feel uneasy.

2) East-West Axis

The East-West Axis goes through commercial, industrial, redevelopment and rural areas, so the road structure should go well with the environment. The East-West Axis has two types of structures; viaduct type and at-grade type. Structures of each type should match the surrounding landscape. However, the viaduct type has comparatively more negative aspects than the at-grade type, because the viaduct type has three dimensions. Aesthetics of the viaduct type road should be considered the same as the North-South Axis. Recommended aesthetics of structures on the East-West Axis are shown in Table 12.4.9.

The subject of internal landscape and external landscape was touched upon at the beginning of this section. It is recommend that the internal landscape be considered on the East-West Axis.

Table 12.4.9 Consideration of Aesthetics on East-West Axis

Location	Consideration of Aesthetics
West JORR IC - North-South Axis	Alignment of road and IC should be beautified. Turf and shrub are planted.
North-South Axis - Jl. Mangga Besar	Road structure does not cause people to feel uneasy.
Jl.Industri - Jl.Landasan	This is redevelopment area; Indonesia International Trade Center. Road structure should be beautified.
Jl.Yos Sudarsono IC	Forms of flyover should be beautified. This flyover should match Jl.Yos Sudarso IC.
Jl.Raya Barat/ Timur Boulevard	Road structure does not cause people to feel uneasy. Structures should be a continuous form
Jl.Pegangsaan Dua - Buaran IC	Turf and shrub are planted for improvement of visual quality.
East JORR IC	Alignment of road and IC should be beautified. Turf and shrub are planted.

Planting is one of the several methods used to improve visual quality on roads. Appropriate planting can enhance the visual quality on roads.

Planting on the road is not only an environmental mitigation measure an and amenity, but planting also increases the level of safety. Planting benefits driver and others in matters of safety, comfort and pleasure. Planting has three functions, as follows:

- environmental mitigation
  revegetation, securing habitat, mitigation of noise, diffusion and purification of air quality
- aesthetics
  improvement of landscape, amenity of drive, harmony with landscape on road sides, screening undesirable views and objects
- safety
  sight line guidance, light and headlight glare screening, land mark, channelization, shock mitigation for traffic accident

The selection of suitable species for planting is very important in urban areas, and should be based on experience in similar areas. Planting trees are selected based on the following requirement.

- to suit existing vegetation
- to suit with and climate conditions
- to match landscape
- to resist air pollution and wind
- to be easily maintained
- resistant to insects
- to grow quickly
- to be easy to procure

The following plants are popular species for planting in Jakarta according to the Directorate General of Highways:

Turf

- Poly trias amaura	(Rumput Embun)

Shrub

- Bougainvillea sp.	(Bugenvil)
- *Gardenia augusta*	(Kaca piring)
- Cassia glauca	(Hujan mas: Golden flower)
- Acalypha microphlia	(Teh-tehan pangkas)

Tall Tree

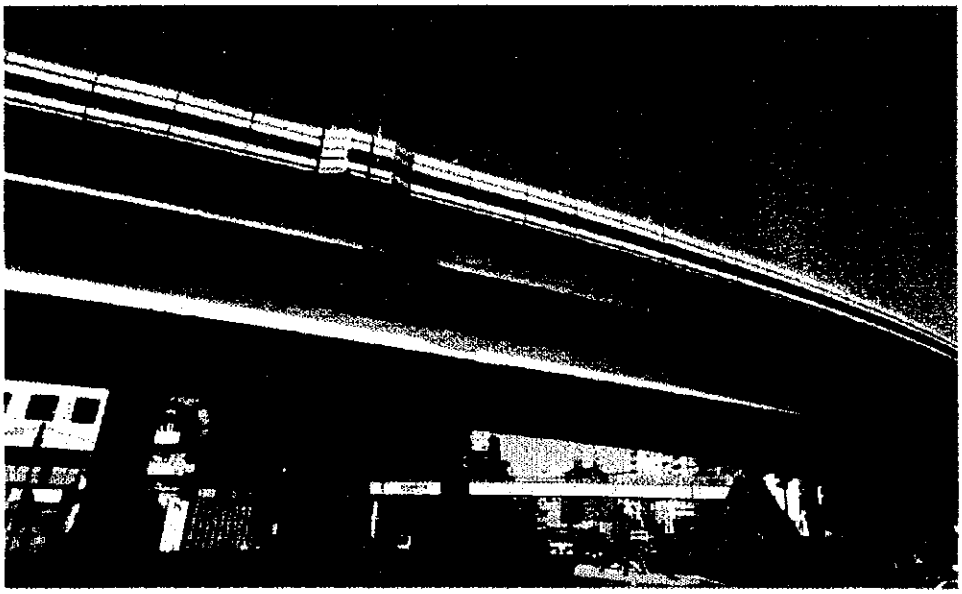
- Swietenia mahagoni	(Mahoni)
- Pterocarpus indicus	(Angsana)
- Cupressus papuana	(Cemara gembel)
- Oreodoxa Regia	(Palem ruja)
- Cocos nucifiera	(Kelapa)

It is recommended that street trees are planted on at-grade road sections and at the West Jakarta Outer Ring Road IC. Several types of trees should be combined for planting, such as turf, shrub and taller trees. The arrangement of trees in at-grade roads and that at the West Jakarta Outer Ring Road IC are shown in Fig.12.4.9, and 10. Proposed plants are shown in Fig. 12.4.11.

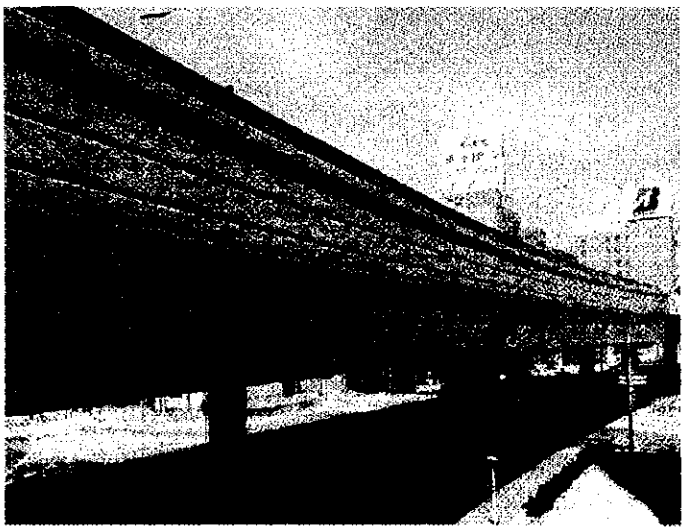
For the viaduct type, plant boxes and flower pot can be used for planting on the medians of frontage roads. However, road administrator should sprinkle water, because rain may not be blown into the median under the viaduct structure.

Planting strips are not the same as for other road structures. Trees that are used for planting strips should be maintained to control growth.

Hanshin Expressway source: Hansin Expressway Public Corporation, 1993

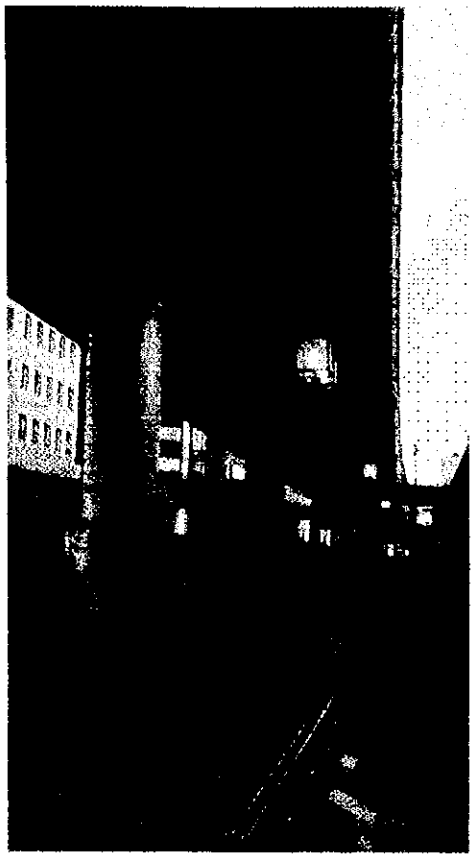


Metropolitan Expressway No.2 source: Metropolitan Expressway Corporation, 1993



Hanshin Expressway
source: Hansin Expressway Public Corporation, 1993

Fig. 12.4.8 (1) Samples of Beautified Beams



Hanshin Expressway
source: Hansin Expressway Public Corporation, 1993

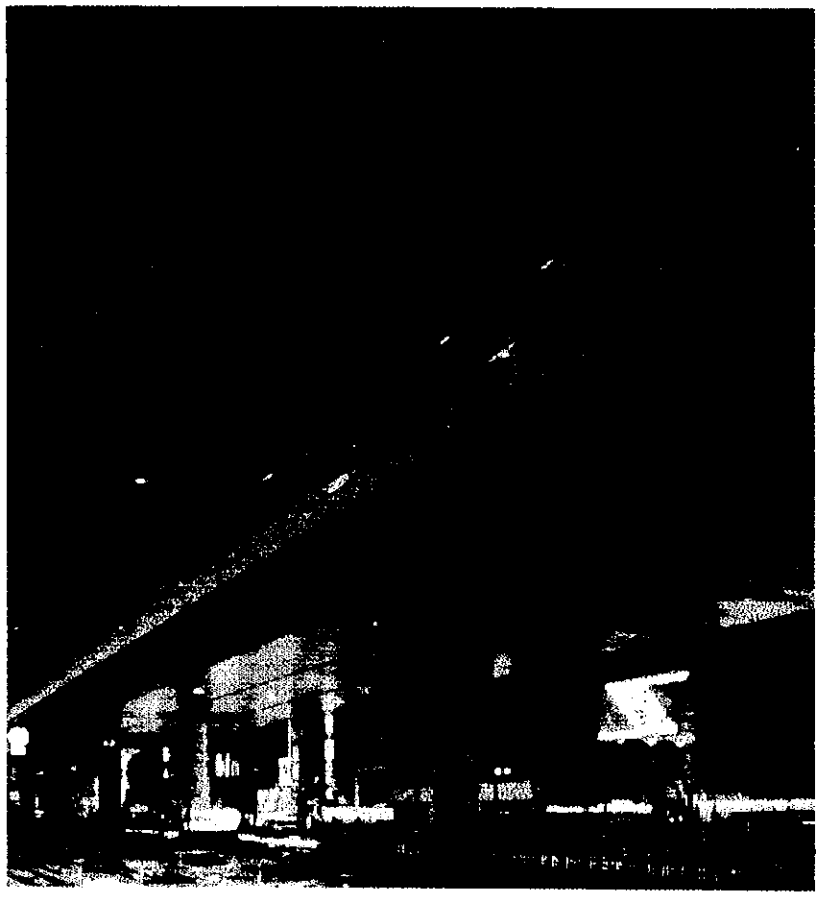
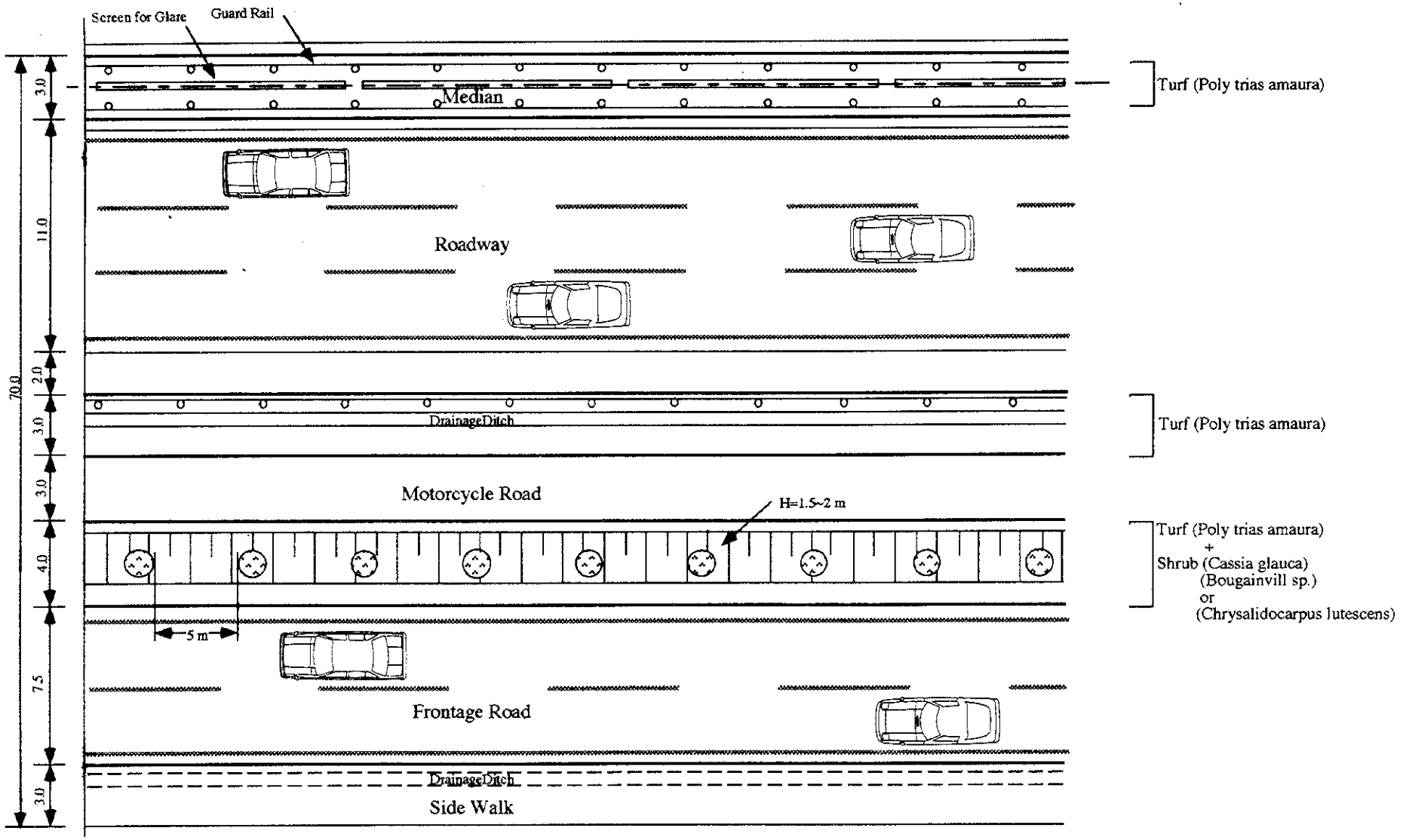


Fig. 12.4.8 (2) Samples of Beautified Beams



FEASIBILITY STUDY ON
URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT
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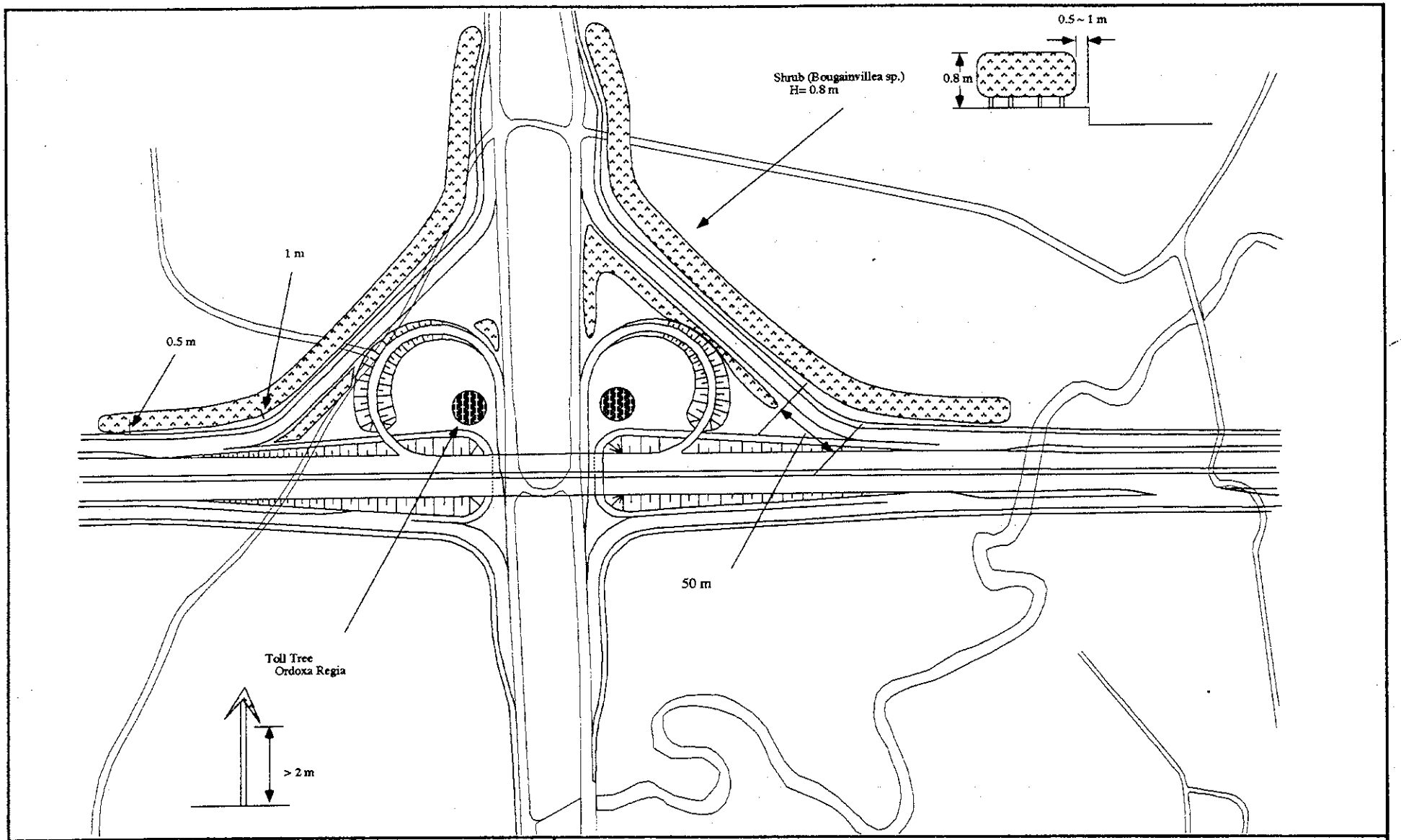
Fig. 12.4.9 Arrangement of Planting Strips on East-West Axis



FEASIBILITY STUDY ON
URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT
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Fig. 12.4.10 Arrangement of Planting in West Jakarta Outer Ring Road IC on East-West Axis

Turf

Polytrias amaura

(Rumput Embun)

Shrub

Bougainvillea sp.

(Bugenvil)

Cassia glauca

(Hujan Mas)

Tall Tree

Oreodxa regia

(Palem Raja)

Fig. 12.4.11 Proposed Plants for Aesthetics

12.5 Environmental Monitoring

The aims of environmental monitoring are:

- to obtain information on existing environmental conditions
- to obtain information on changes in environmental conditions as a result of the project
- to optimize positive environmental impact and to minimize negative impacts by the project
- to use environmental considerations for new road development projects

Environmental monitoring can be used for not only understanding the environmental conditions, but also for judging if measures of environmental impact are required. For example, if dust will be generated during the construction phase, the contractor carries out implementation of measures such as the sprinkling of water.

Environmental monitoring covers construction phase, and operation and maintenance phase. Monitoring elements are selected from possible impact elements. The proposed environmental monitoring plan and monitoring stations are shown in Table 12.5.1 and Fig. 12.5.2. Monitoring of Operation and Maintenance Phase should be integrated with Ambient Air Quality Monitoring Network by DKI Jakarta. It is likely that implementation will be shifted from the road administrator to DKI Jakarta after several years.

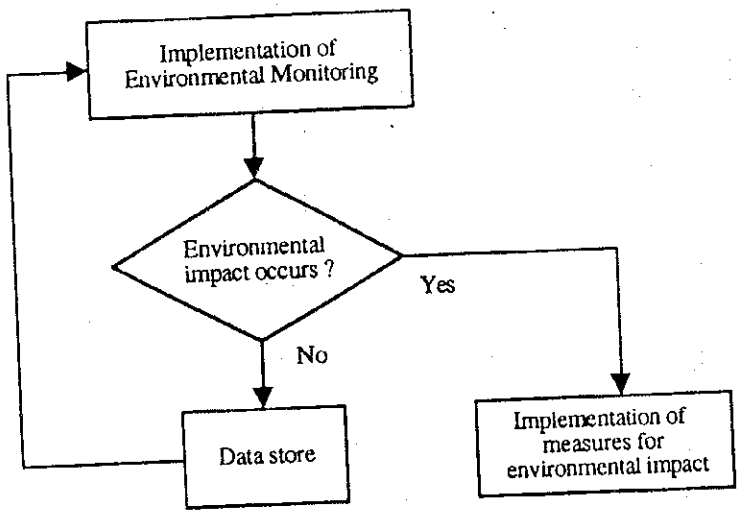


Fig. 12.5.1 Environmental Monitoring Flow

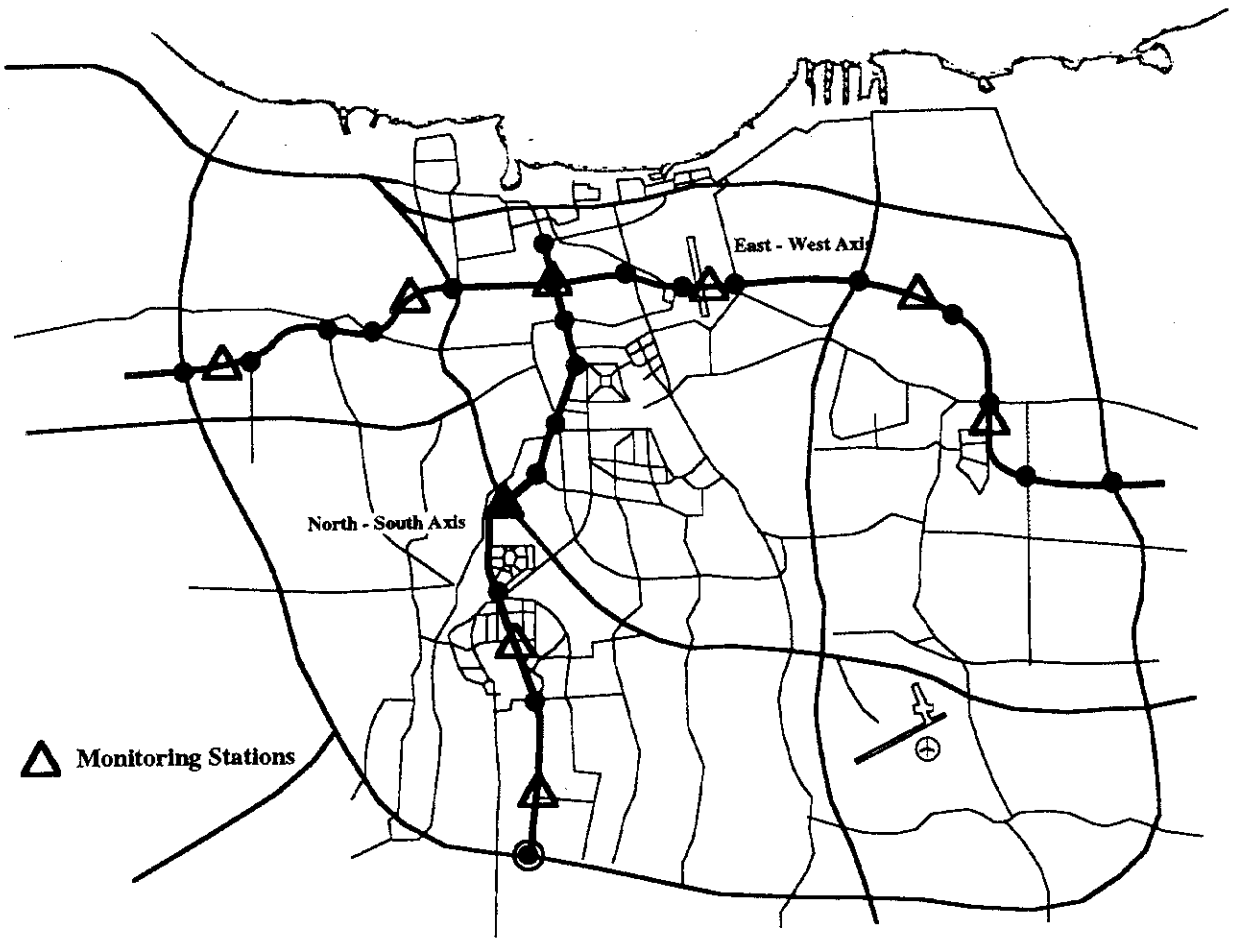
Table 12.5.1 Proposed Environmental Monitoring Plan

[Construction Phase]

Targets	Indicators	Monitoring Area	Methods	Frequency	Proposed Implementation Sectors
Complain from residents	number of complain type of complain	whole area	checking record book based on telephones, letters, hearing and others from residents	to take proper measures	Project proponent
Traffic congestion	conditions of congestion	around construction sites	watching	during construction work	Contractor
Noise Level	noise level	around construction sites	measurement by noise level meter	Contractor Noise level by new activities will be monitored for several days. If noise level will not be high by this construction activities, constructor can finish monitoring. Project proponent: to take proper frequency	Contractor Project proponent
Air quality	dust (a cloud of dust)	construction sites	watching	during construction work	Contractor

[Operation and Maintenance Phase]

Targets	Indicators	Monitoring Area	Methods	Frequency	Implementation Sectors
Noise level	noise level L50 or Leq	along road sides North-South Axis 4 stations East-West Axis 6 stations one station overlaps with both axes:	measurement by noise level meter	before operation: 3 days (one day includes 2 times: day time, evening) beginning of operation (for 3 months) 1 day/2 weeks (one day includes 2 times: day time, evening) after 3 months 1 day/3 months (one day includes 2 times: day time, evening)	Road Administrator
Air quality	CO NOx	along road sides North-South Axis 6 stations East-West Axis 6 stations one station overlaps with both axes:	CO: Air bag sampler NDIR Analyzer sampling period 1 hour NOx: Batch type sampler sampling period 1day	before operation: 3 times beginning of operation (for 3 months) 1 time/month After 3 months 1time/3 months	Road Administrator



FEASIBILITY STUDY ON URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT IN JAKARTA METROPOLITAN AREA	Fig. 12.5.2 Locations of Environmental Monitoring Stations for Air Quality and Noise

CHAPTER 13 IMPLEMENTATION PLAN

CHAPTER 13 IMPLEMENTATION PLAN

13.1 General

There are three governmental agencies involved in the development of roads in Jakarta Metropolitan area, according to Indonesian government regulation regarding roads;

1) The Directorate General of Highways (Bina Marga), Ministry of Public Works is responsible for the execution of the construction of National Road which includes primary arterial roads, primary collector roads and roads that assure strategic value in the national interests.

2) The Indonesian Highway Corporation (PT. Jasa Marga), the state-owned public corporation, is responsible for the execution of the construction of toll road, which the President determines at a proposal of the Minister of Ministry of Public Works.

3) Jakarta City, the local government of DKI Jakarta, is responsible for the execution of the construction of Provincial Road which includes secondary roads except the roads under the jurisdiction of 1).

4) Private developer who is designated by Decree of the President at a proposal of the Minister of Ministry of Public Works and is granted the concession to operate a toll road can develop a toll road under the scheme of the BOT (Build, Operation and Transfer) and can operate a toll road as the concessionaire within a concession period.

As the North - South Axis is designated as a freeway, it seems to be developed by one of three agencies of 1), 2) and 4) or its combination because a freeway may fall under the category of toll road in Indonesia.

On the other hand, the East - West Axis is designated as an major arterial street so that it will be developed by one of two agencies of 1) and 3) or its combination.

13.2 Implementation Plan for the North - South Axis\

13.2.1 Executing Body of the Project

There are three possible agencies involved in the development of toll road in Indonesia as mentioned above. According to the policy of the Indonesia's sixth Five-Year Development Plan and based on actual practices of tollway development in Jakarta Metropolitan area, the following three most probable

implementation methods are delineated under different financial alternatives;

Option - 1 : Public Corporation Method by Government subsidiary finance

The Directorate General of Highways (Bina Marga), Ministry of Public Works is responsible for the execution of land acquisition and the construction/improvement of related arterial street and frontage road, and Indonesian Highway Corporation (PT. Jasa Marga) is responsible for the execution of the construction of toll road by a government subsidiary finance.

Option - 2 : Joint-venture Method by Government Subsidiary Finance and Private Investment

The Directorate General of Highways (Bina Marga), Ministry of Public Works is responsible for the execution of land acquisition and the construction/improvement of related arterial street and frontage road, and Indonesian Highway Corporation (PT. Jasa Marga) in joint-venture with private investors is responsible for the execution of the construction of toll road by a government subsidiary finance and private investment.

Option -3: Build Operation and Transfer (BOT) Method by Private Sector

Private investors or the consortium of investors including Jasa Marga are responsible for the execution of land acquisition and the construction of toll road and the Directorate General of Highways (Bina Marga), Ministry of Public Works is responsible for the execution of the construction of related arterial street and frontage road. The concept of each responsibility by options is illustrated in Fig. 13.2.1.

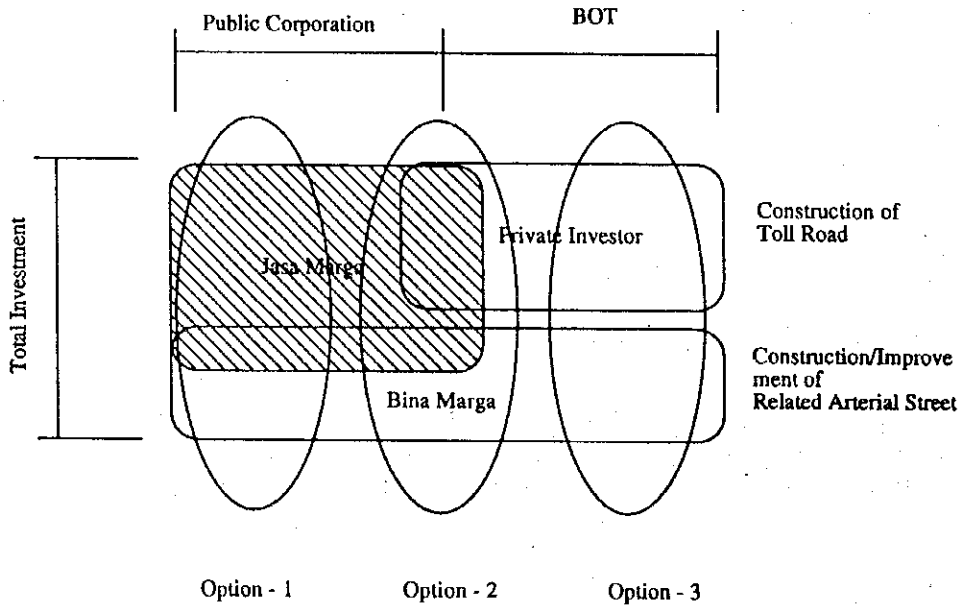


Fig. 13.2.1. CONCEPT OF EACH RESPONSIBILITY BY OPTIONS

These three schemes have the following salient features;

Option - 1 : Public Corporation Method by Government Subsidiary Finance

1) Source of Finance
Project loans from the international lending agencies may be inevitable such as the Overseas Economic Cooperation Fund of Japan (OECF), the World Bank (IBRD) and the Asian Development Bank (ADB) as the official development aids (ODA).

2) Terms and Conditions of Loans

(a) OECF Loan
The loan proceeds shall be appropriated to the case which is smaller, i) or ii).

i) 85% of total construction costs including land acquisition and property compensation costs, administration cost are covered by loan proceeds.

ii) 100% of direct construction cost excluding land acquisition and property compensation costs, administration cost is covered by loan proceeds.

The loan proceeds are pledged in terms of Japanese Yen with the interest rate of 2.75%. The amortization period is thirty (30) years with the grace period of ten (10) years.

(b) IBRD/ADB Loan
The loan proceeds shall cover only foreign currency portion and local currency portion usually is appropriated by the loan from the Export-Import Bank of Japan.

3) Implementing Agency
PT. Jasa Marga, the State-owned public corporation, is the implementing agency for the project. The government of Indonesia will convert the project loans from international lending agencies into the equity of Jasa Marga as step loans.

4) Source of Amortization
The sources of repayment are toll revenues, government equity and bonds.on domestic financial market.

5) Effects
i) The debt service ratio (DSR) will increase because of lower level of taxation and bigger demand of social welfare.

ii) Project which is financed by international lending agencies is to be implemented steadily in accordance with its committed financial program. It will stimulate economic development by the development of better infrastructure which will induce more foreign investment and will create job opportunity.

Option - 2 : Joint-venture Method by Government Subsidiary Finance and Private Investment

1) Source of Finance

As alternatives for fund raising sources, loans to corporation and/or equity investment from the international lending agencies such as the Overseas Economic Cooperation Fund of Japan (OECF), other international lending agencies and local banking companies are considered possible to be introduced.

2) Terms and Conditions of Financing

(Case of Loans to Corporations and Equity Investment from OECF)

For example as one of alternatives, the case of OECF is shown below:

OECF has the following general guidelines:

a) Loans to Corporations

i) Project to be eligible

Project is anticipated to make a contribution to the economic development of developing countries. The objective sectors include the sector of infrastructure. Project deemed difficult to implement effectively, if usual terms and conditions of other financial institutions are applied. Projects involving technical assistance or other forms of assistance by the Japanese or other advanced countries' private sector are desirable.

ii) Implementing entity (borrower)

- Corporations registered in developing countries.
- Joint venture or any type of corporation with any type of share structure is acceptable.
- Participation of Japanese corporations and/or international financial institutions (ex. Asian Development Bank) is desirable.

iii) Loan conditions

- Loan coverage : Maximum of 70% of total financial requirement
- Interest rate : 4.0% (as of the end of September 1994); fixed at commitment according to OECF's borrowing rate.
- Repayment period : Maximum of twenty (20) years with grace period of maximum of five (5) years.

b) Equity Investment

i) Project to be eligible

- Projects which make a contribution to the economic development of developing countries.
- Projects recognized as contributing to promoting multilateral cooperation.
- Projects deemed difficult to implement with financial assistance in the form of loan.
- Projects for which OECF's participants as a catalyst is essential in order to promote private-sector equity participation.

ii) Implementing entity

- An investment corporation in which two (2) or more private Japanese corporations must participate should be newly established in Japan especially for the project.
- An implementing entity should be newly established by the above investment corporation and local corporations and/or governmental agencies. (Participation of local public sector and/or an international institution is desirable).

iii) OECF's share

- Maximum of fifty (50) percent of the investment corporation in Japan.
- Maximum of twenty five (25) percent of total equity of the implementing entity.

It is noted that the combination of this equity investment and the above-mentioned OECF loans to corporations is possible to be introduced as a financial source for a project in case by case.

Eligibility of the objective project is to be examined by the OECF's project appraisal for the cases of the loan to corporation and/or the equity investment.

3) Implementing Agency

PT. Jasa Marga, the state-owned public corporation, in Joint-venture with local investors is the implementing agency for the project.

4) Source of Amortization

The source of repayment are toll revenues, government equity, bonds and private investment from joint-venture of the project.

5) Effects

i) The increase of debt service ratio (DSR) will be limited to a minimum extent.
ii) Project which is financed by international lending agencies is to be implemented steadily in accordance with its committed financial program.

Option - 3 : Build Operation and Transfer (BOT) Method by Private

1) Source of Finance
Private investors including PT. Jasa Marga are entirely responsible for funding, construction, operation and management of the Project.
In this case, the fund raising scheme using the loans to corporations and/or equity investment from OECF previously-mentioned in Option-2 are considered as one of alternatives of financial sources to the new company as an implementing agency.

2) Terms and Conditions of Financing
Equity : 30% of the project costs
Credit : 70%
Maximum Concession Period : 30 years

3) Implementing Agency
A concessionaire will establish a new company. Although Bina Marga is responsible for land acquisition and property compensation, a new company may bear these works in lieu of Bina Marga to extend their concession period.

4) Source of Amortization
The source of repayment are toll revenues and private investment from joint-venture or joint-operation of the BOT project.

5) Effects

i) The debt service ratio (DSR) will not increase because of no governmental subsidy or subsidiary finance.

ii) Project is feasible only if the financial viability is sufficient and the public service requirements are warranted.

It is concluded that Option - 3 is the most suitable scheme for the development of the North - South Axis. The following points are to be noted;

1) Only Option - 3 can meet the policy of the sixth Five-Year Development Plan to reduce the DSR as high development potential is retained.

2) It is possible to implement the project in accordance with the prevailing regulations regarding roads.

3) Present traffic congestion is so serious that public requirements warrant the project.

4) PT. Jasa Marga will be involved in a new concessionaire to keep consistency of toll road development in Jakarta Metropolitan area.

13.2.2 Implementation Time Schedule for the North - South Axis

The ideal implementation time schedule otf the North - South Axis is proposed for the purpose of economic and financial evaluation as discussed in Chapter 11 : Construction Planning. Based on the implementation time schedule, annual required funds are tabulated in Table 13.2.1.

Table 13.2.1. Annual Required Funds for the Development of the North - South Axis

Name of Link	Section	Activity	Cost (M.Rp)	YEAR						Total (M. Rp)
				1	2	3	4	5	6	
				1995	1996	1997	1998	1999	2000	
N-S AXIS		Engineering Services	27,232	16,339	10,893					27,232
		ROW Acquisition	79,400		51,610	27,790				79,400
		Construction	998,516			149,777	349,481	349,481	149,777	998,516
		Supervisory Services	36,310			5,447	12,709	12,709	5,447	36,310
Total			1,141,458	16,339	62,503	183,014	362,189	362,189	155,224	1,141,458