4.4 Aircraft Noise

The influence of aircraft noise was evaluated in WECPNL (Weighted Equivalent Continuous Perceived Noise Level) for the year 2010. Fig. 4.3 shows the existing land use around the new airport site and WECPNL contours in year 2010.

Many houses are scattered around the new airport site at present, though the site is designated as an agricultural area under the land utilization plan by BAPPEDA.

Therefore, control measures on land use will be necessary for the areas affected by aircraft noise in order to achieve environmental compatibility with the surrounding community.

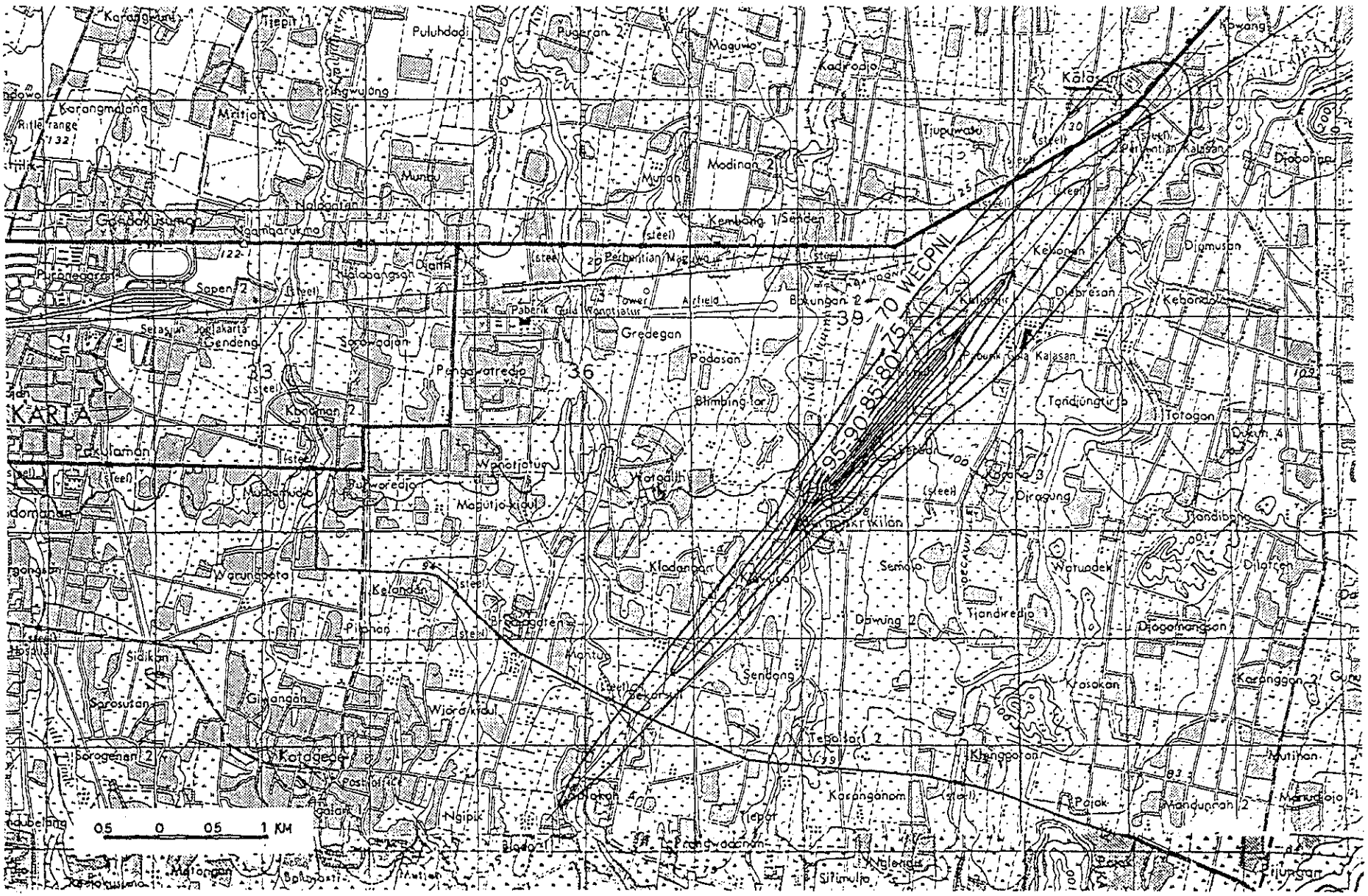


Fig. 4.3 Aircraft Noise Counters for New Yogyakarta Airport (Year 2010)

4.5 Land Use Planning for the Area Surrounding the New Airport

Land use planning should take the following 3 items into consideration.

(1) Aircraft Noise

Criteria for land use control were established and is proposed taking into account the local condition and current land use control practices for aircraft noise in Japan, France, etc.

- Proposed Criteria -

WECPNL $\geqq$ 70 : No school, hospital, mosque, church, etc., is permitted.

$\geqq$ 75 : No new residence is permitted in principle. Agricultural land use is recommended.

$\geqq$ 85 : No residence is permitted in principle.

Residences are recommended to be relocated. Exchange of noise affected residential area with agricultual area outside WECPNL 70 is recommended.

(2) Future Expansion of Airport Facilities

Land use planning for the surrounding areas should consider the future development of airport facilities.

Construction of buildings or houses in the areas shown in Fig. 4.4 are necessary to be restricted for future expansion of the terminal area and runway extension up to 3,000 m.

(3) Obstacle Control

Control of obstacles which hinder safe aircraft operation is necessary.

- Height Limitation

All the structures and trees are restricted in height so as not to infringe the obstacle limitation surfaces. As for the area for future runway extension, the height restrictions should be enforced in advance for the surfaces to be established when the planned 2,500 m

long runway is extended to 3,000 m.

- Obstacle Clearance

  From the standpoint of safe and efficient operations of aircraft and the air navigation system, all structures and trees should be avoided in the area indicated in Fig. 4.4.

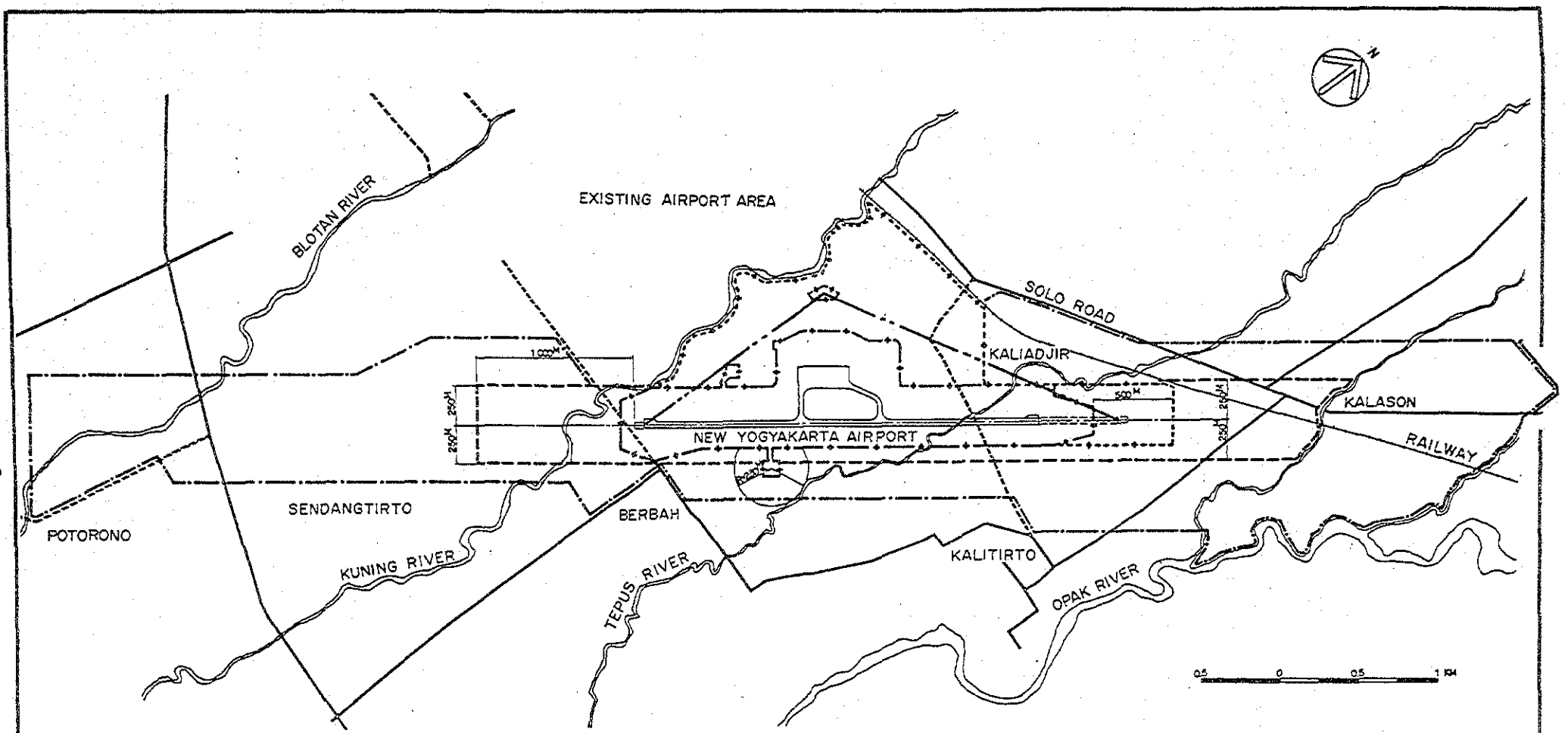


Fig. 4.4 Proposed Land Use Plan and Obstacle Clearance Zone - New Yogyakarta Airport

4.6 Airport Organization

Fig. 4.5 shows airport organization chart of the New Yogyakarta airport anticipated for Phase I and II developments. Compared with the existing Yogyakarta airport, air safety division which belongs to technical division at present will be an independent division due to the strengthening of the ATC function. The existing 3 division organizations will be revised to 4 division organizations, accordingly. The existing 124 DGAC staff is considered adequate to be increased to 285 and 355 staff numbers in Phases I and II, respectively.

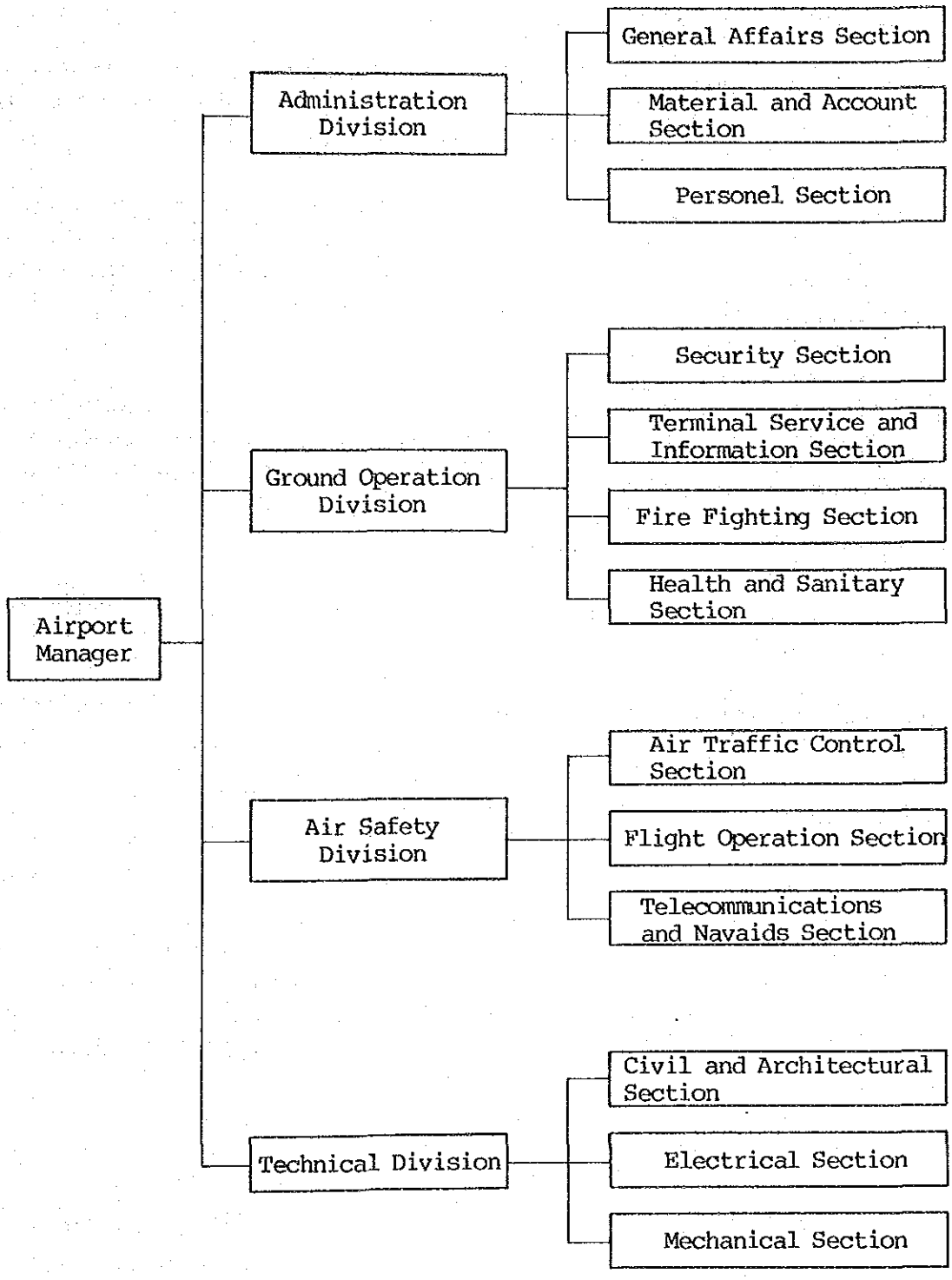


Fig. 4.5 Organization Chart of New Yogyakarta Airport

4.7 Construction Schedule and Cost Estimates

The construction schedule of the new Yogyakarta airport development was planned as indicated in Fig. 4.6. Construction works for the Phase I development will start in mid 1991 and end in mid 1994.

After that, about 6 months will be spent for such preparations as flight checks, training for navaids, test operation of airport facilities, maturity flights, issue of NOTAM, mobilization of control agency and airlines, etc. Inauguration date will be the beginning of 1995.

Within 4.5 years before the start of the construction works, the topographic survey, soil investigation, detailed engineering services, etc., should be completed. Compensation work related to land acquisition and relocation of houses is recommended to be started at an early date of this period, because it may take a long time for coordination and discussions.

The following works will be given first priority as regards the construction works.

- Access road which will be used as a temporary road for the construction works
- Diversion works of the Tepus River
- Diversion works of irrigation channels for the surrounding agricultural fields

Construction costs necessary for the Phase I and II developments are estimated to be 104 billion Rp. and 30 billion Rp. in 1986 price, respectively, as shown in Table 4.2. These costs include detailed engineering cost and a 10 % physical contingency.

Herein, the exchange rate is set at:

US$ 1.0 = Rp. 1,125
US$ 1.0 = ¥ 200

Fig. 4.6 Construction Schedule of New Yogyakarta Airport Development

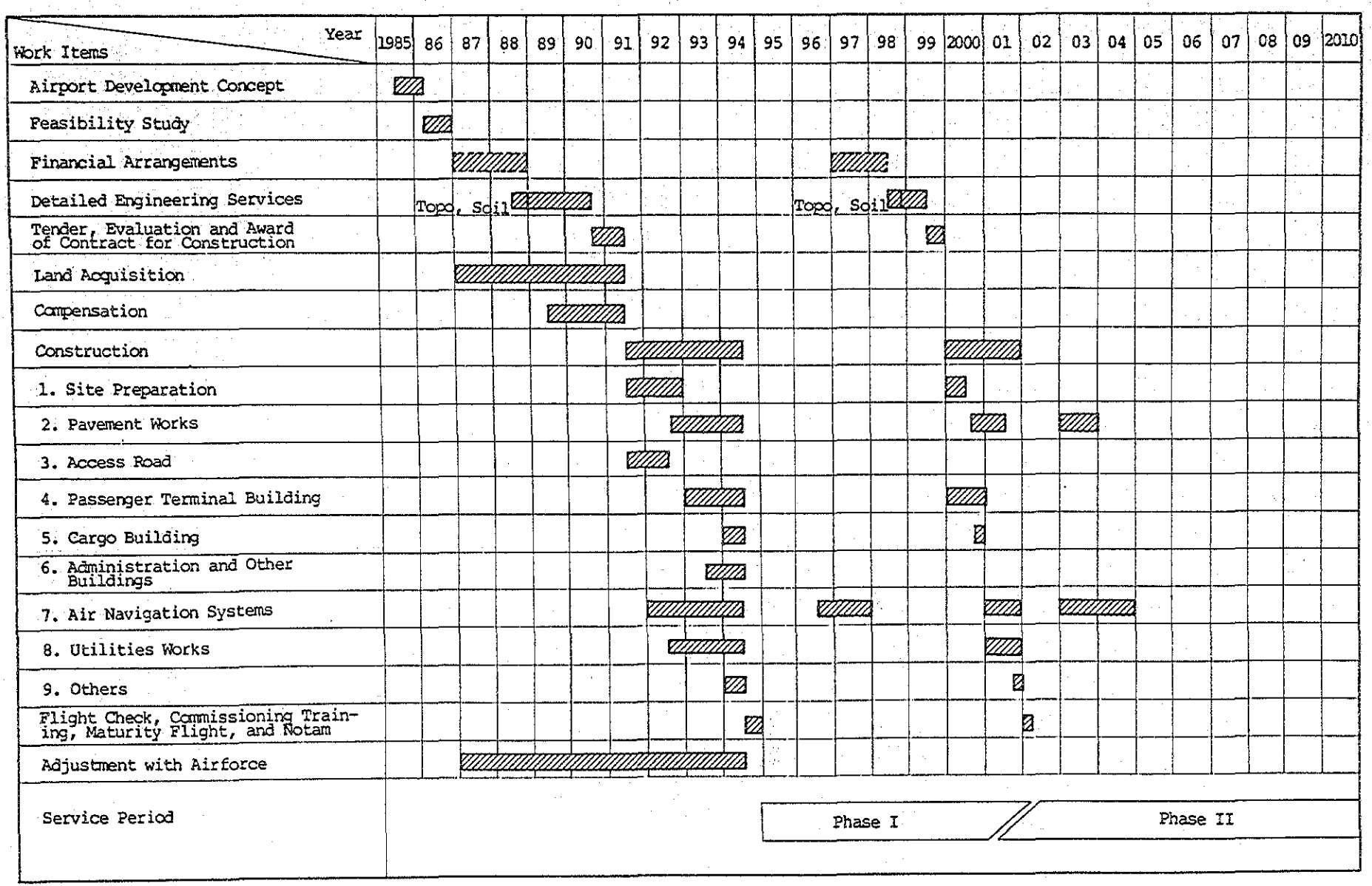


Table 4.2 Estimated Construction Cost for New Yogyakarta Airport Development

(Unit: million Rp.)

Work Item \ Phase of Construction		Phase I			Phase II			Total		
		Local Portion	Foreign Portion	Sub Total	Local Portion	Foreign Portion	Sub Total	Local Portion	Foreign Portion	Total
Land Acquisition	Land Acquisition	15,979	0	15,979	0	0	0	15,979	0	15,979
	Compensation	280	0	280	0	0	0	280	0	280
	Land Acquisition * (Ultimate Expansion Area)	(3,835)	(0)	(3,835)	(0)	(0)	(0)	(3,835)	(0)	(3,835)
	Sub Total	16,259	0	16,259	0	0	0	16,259	0	16,259
Civil Works	Earth Work	2,456	1,767	4,223	45	40	85	2,501	1,807	4,308
	Drainage Works	441	557	998	12	20	32	453	577	1,030
	Pavement Works	5,504	11,061	16,565	2,265	4,445	6,710	7,769	15,506	23,275
	Access Road	500	245	745	0	0	0	500	245	745
	River Diversion	222	422	644	0	0	0	222	422	644
	Sub Total	9,123	14,052	23,175	2,322	4,505	6,827	11,445	18,557	30,002
Architectural Works	Passenger Terminal Building	4,543	5,333	9,876	2,288	2,686	4,974	6,831	8,019	14,850
	Cargo Terminal Building	230	204	434	131	116	247	361	320	681
	Administration Building	473	579	1,052	139	170	309	612	749	1,361
	Other Buildings	322	285	607	0	0	0	322	285	607
	Special Equipment	0	4,462	4,462	0	1,498	1,498	0	5,960	5,960
	Sub Total	5,568	10,863	16,431	2,558	4,470	7,028	8,126	15,333	23,459
Air Navigation Systems	Radio Navigation Aids	501	4,888	5,389	81	1,862	1,943	582	6,750	7,332
	Air Traffic Control and Aeronautical Telecommunications	118	3,570	3,688	43	1,423	1,466	161	4,993	5,154
	ATC Radar System	254	8,928	9,182	99	3,570	3,669	353	12,498	12,851
	Aeronautical Ground Lights	1,262	3,514	4,776	248	699	947	1,510	4,213	5,723
	Meteorological System	62	1,955	2,017	19	582	601	81	2,537	2,618
	Sub Total	2,197	22,855	25,052	490	8,136	8,626	2,687	30,991	33,678
Utilities Works	Power Supply System	370	2,404	2,774	27	959	986	397	3,363	3,760
	Water Supply System	56	107	163	0	4	4	56	111	167
	Sewarage System	243	398	641	12	26	38	255	424	679
	Solid Waste Disposal System	30	131	161	0	0	0	30	131	161
	Telecommunication System	185	619	804	0	0	0	185	619	804
	Sub Total	884	3,659	4,543	39	989	1,028	923	4,648	5,571
Other Equipment	Vehicles for Fire Fighting Services, etc.	0	374	374	0	1,268	1,268	0	1,642	1,642
	Sub Total	0	374	374	0	1,268	1,268	0	1,642	1,642
Total of Construction Works		34,031	51,803	85,834	5,409	19,368	24,777	39,440	71,171	110,611
Engineering Services Cost		3,403	5,180	8,583	541	1,937	2,478	3,944	7,117	11,061
Sub Total		37,434	56,983	94,417	5,950	21,305	27,255	43,384	78,288	121,672
Contingency		3,743	5,698	9,441	595	2,131	2,726	4,338	7,829	12,167
Grand Total		41,177	62,681	103,858	6,545	23,436	29,981	47,722	86,117	133,839

* Land Acquisition Cost for Ultimate Expansion Area is not included in Total Cost.

Exchange Rate: US$ 1.00 = Rp 1,125, ¥ 1 = Rp. 5.625

4.8 Economic and Financial Analyses

Economic and financial feasibilty was examined for the new Yogyakarta airport development.

(1) Economic Analysis

Assessment for the economic feasibility was made in terms of EIRR (Economic Internal Rate of Return), B/C Ratio (Benefit Cost Ratio) and NPV (Net Present Value) as shown in Table 4.3.

Table 4.3 Economic Assessment

EIRR (%)	B/C Ratio*	NPV* (million Rp., 1985)
13.9	1.21	15,026

Note * : at discount rate 12%

The EIRR of 13.9 % indicates that this project is economically feasible because it exceeds 12 %, the opportunity cost of capital for airports project in Indonesia.

Sensitivity analysis was also made to provide a probablistic judgement on the feasibility. The results in Table 4.4 show that the EIRR almost satisfies the opportunity cost of capital even in case of the worst projection, 10 % increase in construction cost and 10 % decrease in traffic demand simultaneously.

Table 4.4 Sensitivity Analysis

Projections		EIRR (%)
Base Case		13.9
Case I	Construction Cost up by 10 %	12.9
Case II	Traffic Demand down by 10 %	12.9
Case III	Construction Cost up by 10 % Traffic Demand down by 10 % (simultaneously)	12.0

Along with the direct and tangible benefits, this project will bring about various indirect and/or intangible benefits, for instance, promotion of regional industries including the tourist industry, development of the regional economy, increase of employment opportunities, improvement of air safety, etc.

Consequently, economic and sensitivity analyses prove the rationality of investment for this project from the viewpoints of national economy and regional society as well.

(2) Financial Analysis

The results of the financial analysis show that airport revenues under the present charging system cannot cover the construction, maintenance and administration costs. It was also found that the level of charges needs to be increased by 30 % to cover only maintenance and administration costs of the airport.

As is well known, except for big airports it is very difficult for an airport to achieve a financial balance. Therefore, procurement of low interest funds and introduction of government subsidies are considered essential in order to implement this project as a social infrastructure.

At the same time, raising of the airport charges may be necessary to be considered through the evaluation of the existing charging system.

4.9 Conclusions and Recommendations

Part I of this report concluded that the long-term development of the major airports in the Central Java province and D.I. Yogyakarta should be implemented by the following development policies:

- Development of new Yogyakarta airport
- Redevelopment of the existing Surakarta airport
- Redevelopment of the existing Semarang airport after a review of the master plan already prepared

The feasibility study on the new Yogyakarta airport development project was executed based on the above conclusion.

After discussing the comprehensive study presented in Part II, Vol.1, the construction project for the new airport which is located 2 Km east of the existing Yogyakarta airport was judged feasible in terms of both engineering and national economy of Indonesia.

Implementation of the project will require the cost of approximately billion Rp. 104 and billion Rp. 30 in Phases I and II, respectively. The economic internal rate of return (EIRR) was estimated to be 13.9 %, and net present value (NPV) to be approx. billion Rp. 15.

By the implementation of this project, following can be expected for the air transportation and the socio-economic situation

- Unrestricted and flexible air transport services can be ensured to the increasing air traffic in future.
- Safe and efficient operations for aircraft can be promoted, especially for training aircraft and civil flights in the military training area.
- Aircraft noise influence within Yogyakarta city area can be largely reduced.
- Implementation of this project will contribute to the airlines' profitability by means of the introduction of medium and/or wide-body aircraft.

- Tourism development can be promoted by enabling the accommodation of the direct flights from neighboring countries.

- Implementation of this project will also contribute to the economic activities in the Yogyakarta region.

- Employment opportunity can be enlarged.

It is recommended that the following actions should be taken for the project implementation.

- Preparation of necessary negotiations for land acquisition and compensation should be initiated at the earliest possible stage so that Phase I project can be proceeded without any delay.

- Airspace above the new Yogyakarta airport should not be rearranged for itself solely but in relation with the redevelopment project of existing Surakarta airport. To do so, DGAC should establish a committee through which close coordination with the Indonesian Air Force can be made.

- Land acquisition, compensation, topographic survey, soil investigation and detailed engineering services should be completed by mid 1991 so that the construction work for the Phase I project can be started in 1991 and the airport can inaugurate its operations in early 1995.

- By the time of inauguration of the new airport operation, DGAC and BAPPEDA in D.I. Yogyakarta should prepare the land use plan in the vicinity of the airport which is to be executed after local communial agreement has been obtained.

- The Phase I facilities are to be designed to cope with the demand in the year 2000. The construction work for the Phase II project should be completed by 2000 to cope with the demand in the year 2010.

CHAPTER 5 MASTER PLAN FOR SURAKARTA AIRPORT DEVELOPMENT

CHAPTER 5 MASTER PLAN FOR SURAKARTA AIRPORT REDEVELOPMENT

5.1 General

This chapter summarizes the feasibility study for the Surakarta airport redevelopment which constitutes airports development concept-A selected in Chapter 3.

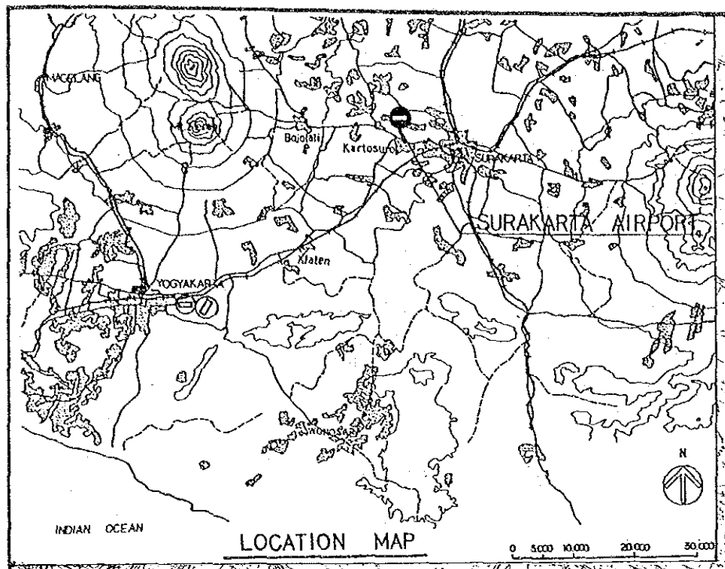
As discussed in Chapter 3, the existing Surakarta airport will be saturated due to the increase in passengers in 1993; and therefore, Phase I construction works should be completed by that time.

Phase I development is planned to accommodate the traffic demand anticipated in the year 2000 so that no major investiment may be required for at least 5 years after the completion of works. Phase II development will accommodate the traffic demand up to the year 2010.

5.2 Airport Master Planning

Redevelopment plan for Surakarta airport includes the eastward runway extension up to 2,150 m and relocation of the terminal area to the northern side of the runway where the transmigration terminal is located at present.

Layout plan and outline of the Phase I development are shown in Fig. 5.1 and Table 5.1, respectively.

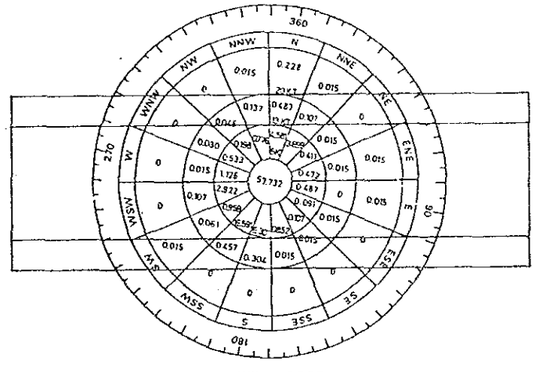


BASIC DATA TABLE	
RUNWAY DATA	
EFFECTIVE RUNWAY GRADIENT	0.470 %
WIND COVERAGE	20 KNOT 99.7 % 13 KNOT 98.4 %
INSTRUMENT RUNWAY	YES
PAVEMENT STRENGTH	PCN 48
APPROACH SURFACE	1/50
RUNWAY LIGHTING	HIRL
RUNWAY MARKING	ALL WEATHER
NAVIGATIONAL AIDS	ILS, ALS, PAPI

BASIC DATA TABLE	
AIRPORT DATA	
AIRPORT ELEVATION	118.6 m
AIRPORT REFERENCE POINT (ARP) COORDINATES	LAT 7°31'S LNG 110°45'E
AIRPORT AND TERMINAL NAVAIDS	VOR/DME NDB
AIRPORT REFERENCE TEMPERATURE	34.7°C

LEGEND	
	BUILDING / HOUSE
	PLANT BOARDER
	RICE FIELD
	FIELD
	TREES
	GRASS
	RIVER
	GROUND CONTOURS (0.5m PITCH)
	SECURITY FENCE
	AIR PORT BOUNDARY

BUILDINGS	
①	PASSENGER TERMINAL BUILDING
②	CARGO TERMINAL BUILDING
③	V.I.P. TERMINAL BUILDING
④	ADMINISTRATION BUILDING
⑤	CONTROL TOWER
⑥	FIRE STATION
⑦	GSE MAINTENANCE SHOP
⑧	AIRPORT MAINTENANCE BUILDING
⑨	TERMINAL BUILDING FOR TRANSMIGRATION



WIND ROSE

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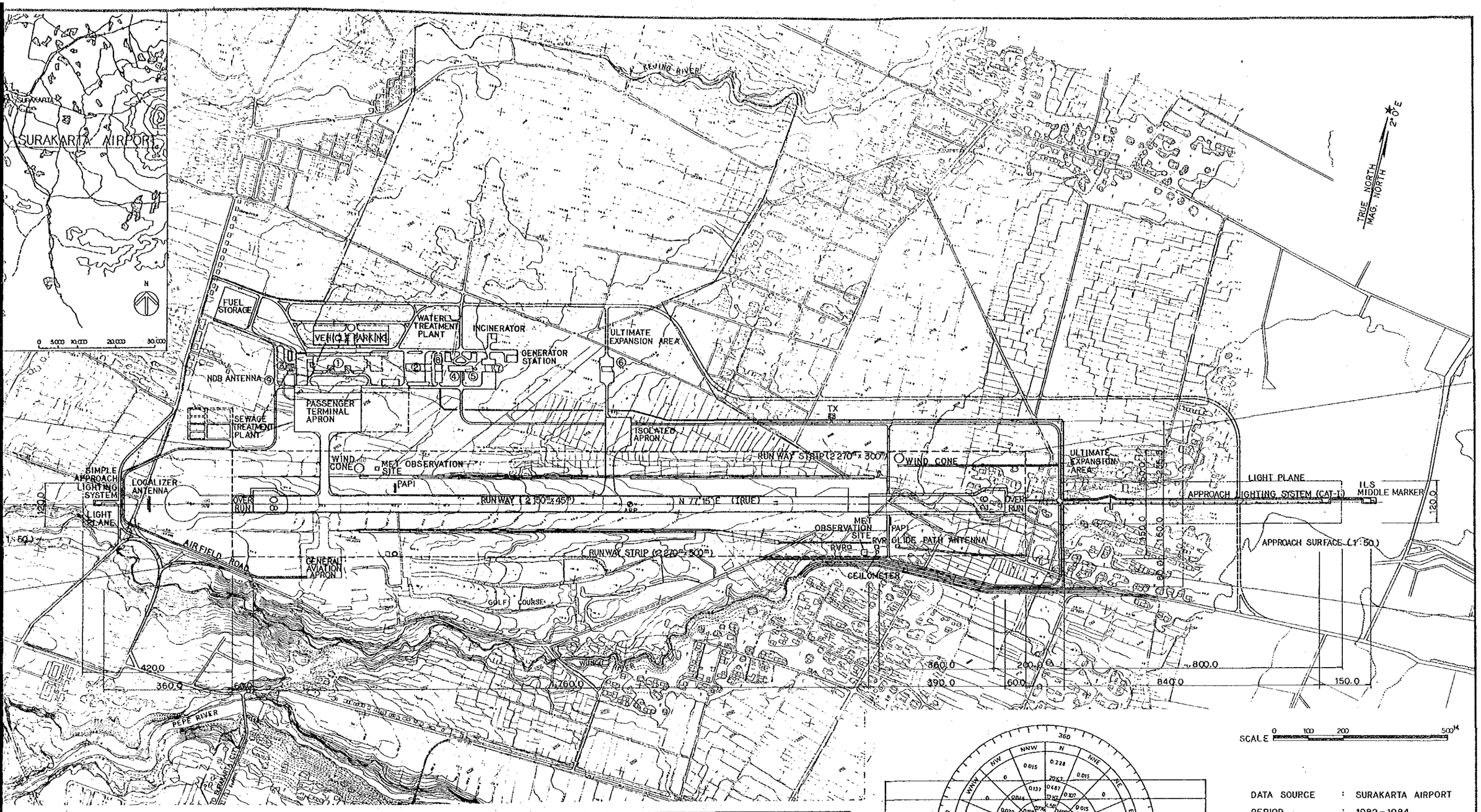

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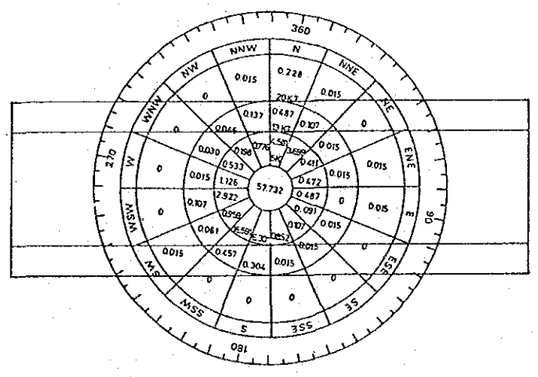
AIRPORT AND TERMINAL NAVAIDS	VOR/DME NDB
AIRPORT REFERENCE TEMPERATURE	34.7°C

LEGEND	
	BUILDING / HOUSE
	PLANT BOARDER
	RICE FIELD
	FIELD
	TREES
	GRASS
	RIVER
110	GROUND CONTOURS (0.5m PITCH)
	SECURITY FENCE
	AIR PORT BOUNDARY

BUILDINGS	
①	PASSENGER TERMINAL BUILDING
②	CARGO TERMINAL BUILDING
③	V.I.P. TERMINAL BUILDING
④	ADMINISTRATION BUILDING
⑤	CONTROL TOWER
⑥	FIRE STATION
⑦	GSE MAINTENANCE SHOP
⑧	AIRPORT MAINTENANCE BUILDING
⑨	TERMINAL BUILDING FOR TRANSMIGRATION



WIND ROSE

DATA SOURCE	:	SURAKARTA AIRPORT
PERIOD	:	1982 - 1984
RUNWAY DIRECTION	:	N 77° 15' E
WIND COVERAGE	:	99.7 % (CROSS WIND 20KT)
		98.4 % (CROSS WIND 13KT)

Fig. 5.1
Layout Plan of Surakarta Airport Redevelopment

Table 5.1 Outline of Surakarta Airport in the Phase I Development

"X" indicates services available

Country	Name of Airport	INTL/DOM. ICAO CODE	Commencement of Services	Airport Total Area	Aerodrome Ref. Point	Airport Elevation	Runway Orientation	Aerodrome Ref. Temp.	Operation Hours	Seasonal Availability	Note: Control Agency; DGAC
Republic of Indonesia	Surakarta (Adi Sumarmo)	Dom. 4C	1978	251 ha	7°31'3"S 110°45'19"E	118.6 m (389.1 ft)	N 77°15'6"E (True)	34.7°C		All Seasons	

City/Town		Transportation			Wind Coverage	Operating Minimum					Note: Approach Category; Instrument, Precision Approach
Name	Population	Distance to Airport	Railway	Taxi	Bus		Runway	Procedure	DH/MDA	vis		
Surakarta	0.5 Million (1983)	14 KM by Road	N.A.	X	X	98.4% (13kt) 99.7% (20kt)	Apch to 08	ILS VOR	- -	- -		
							Apch to 26	ILS VOR	587' 760'	800 m 1,200 m		

Air Navigation Systems

Navaids																					
NDB		VOR		DME		TACAN		ILS		LOCATOR		VHF D.F.									
X		X		X		-		X		X		-									
ATC/COM																					
ASR		SSR		PAR		ASDE		ARTS		VHF A/G		AFS		TTY		MICROWAVE		ATIS			
-		-		-		-		-		X		X		X		X		-			
Lights																					
ALS	SFL	SALS	ALB	CGL	RWL	RWCL	RWTL	ORL	TD2L	REIL	DML	PAPI	TWL	TWCL	TGS	ABN	IWDI	AFL	O.L.		
X	-	X	-	-	X	-	X	X	-	-	-	X	X	-	X	X	X	X	X		
MET																					
RWY Surface Sensors		RVR		Ceilometer		WX-FAX		APT-RX		Radiosonde		WX Radar		WX-TTY							
X		X		X		X		-		-		-		X							

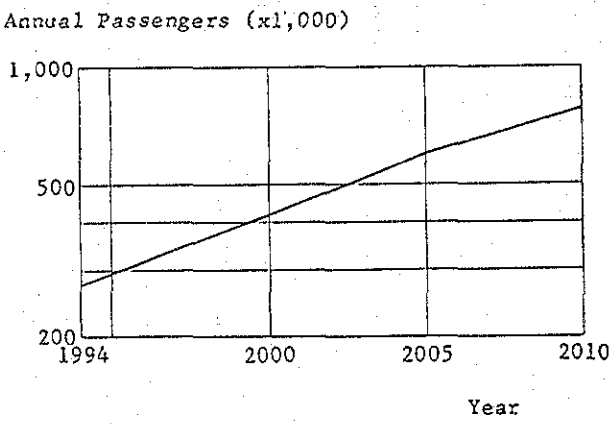
Basic Facilities

	Size	Pavement	Note
Runway Strip	2,270 m x 300 m	-	
Runway	2,150 m x 45 m	Asphalt	
Taxiway	285 m x 23 m	Asphalt	

	Design Aircraft	Nr. of Stands	Pavement	Area	Parking Configuration
Loading Apron	A320 class	3	Concrete/ Asphalt	20,460 m²	Self-maneuvering
	F-28 class	1			
Isolated Apron	B-767 class	1	Asphalt	5,760 m²	Self-maneuvering

Other Facilities

	Size	Structure	Note
Passenger Bldg.	7,700 m²	RC	
Cargo Building	800 m²	RC	
Administration Bldg.	1,200 m²	RC	
Control Tower	60 m²	RC	Height 23 m
Fire Station	400 m²	2 Air Crash Tenders 2 Fire Engines	CAT-7
Fuel Supply System	(Jet A1 520 kℓ)		PERTAMINA
Hangar	-		
Vehicle Parking Spaces	190 cars	Asphalt	
Access Road	2 lanes	Asphalt	



LDG AND TOF	3,388	3,900	4,500	5,500	6,400
Annual Freight (ton)	618	1,740	2,570	3,530	4,850
Annual Passengers	92,745	299,000	408,000	592,000	776,000
Year	1983	1995	2000	2005	2010

Note.
Complecion of Phase I development:
End of 1993

Drawn by JICA
As of 1986

(1) Airport Layout Planning

a) Runway, Taxiway and Apron

The required runway length for Phases I and II is to be 2,150 m. The existing Runway 08 threshold was planned to be displaced eastward by 250 m in order to provide the area necessary for ILS localizer antenna and MLS azimuth antenna, and also in order to avoid reclamation and diversion of the Wungu River which are very costly. Accordingly, the 1,760 m long east portion of the existing runway will be utilized as a part of the new runway and the remaining 390 m will be constructed as an eastern extension of the runway.

Although a parallel taxiway is not considered to be necessary even in the Phase II development, the area for a complete parallel taxiway should be reserved for future development.

The passenger terminal apron for the Phase I development will be constructed by an overlay and partial expansion of the existing transmigration apron taking into account the maximum utilization of existing facilities. It will be expanded to the east in Phase II.

b) Terminal Facilities and Access Road

The terminal facilities are laid out in the terminal area facing the passenger terminal apron by taking their functions and expansibility into consideration.

The passenger terminal building was planned to be located at a distance of 67.5 m from the passenger terminal apron so that the apron can be expanded toward terminal building in case of introduction of B-747 aircraft in the future.

The airport access road will run along the north side of the airport to connect with the existing road.

(2) Airport Facility Planning

a) Site Preparation

Site preparation will be required for runway extension area, new terminal area and runway strip in Phase I. Longitudinal slope for the runway extension portion was planned to be the same gradient of 0.26 % with the existing Runway 26 side.

The existing runway strip will be graded to ensure a 300 m wide strip required for the precision approach runway.

Earthwork volume (cut volume) for Phase I will be about 140,000 cu.m.

Wungu River running through the runway extension area will have to be diverted by about 900 m.

b) Building Facilities

The passenger terminal building will cater for the annual passengers of 408,000 and 776,000 and require floor areas of 7,700 sq.m. and 12,200 sq.m in Phases I and II, respectively.

The passenger terminal building is located 67.5 m away from the passenger terminal apron, and passengers will be transported by bus or on foot between them.

Simple flow of passengers and cargo which is one of the major elements for the functional design of the passenger terminal building were considered.

The cargo terminal building, administration building, control tower, fire station, VIP building, etc., will be planned taking into consideration their functions, expansibility and security requirements.

c) Air Navigation Systems

Air navigation systems were planned to meet the aircraft operational category of precision approach Category-I, ICAO.

The ILS will be replaced by a MLS in late 1990s in accordance with the ILS/MLS transition plan by ICAO.

d) Others

Airport utilities including power supply system, water supply system, sewerage system, solid waste disposal system and telecommunications system were planned based on the facility requirements. General services facilities including rescue and fire fighting facilities, airport maintenance equipment, fuel supply system and a heliport are also necessary as airport supporting elements.

5.3 Airspace Use

(1) Rearrangement of Corridor and Terminal Area

Aircraft departing from and arriving at Surakarta airport at present utilize the air routes protected by the Yogyakarta-Solo corridor which has been established in the military training area. The following rearrangement was proposed in this Study.

a. Establishment and Rearrangement of Corridors

Corridors in the training area were proposed to be established and/or rearranged along new Yogyakarta and Surakarta VOR/DMEs. Widening of the corridors will be also necessary.

b. Shift of the Training Area

The existing training area centered at "SO" NDB should be shifted as to be centered at the new Surakarta VOR/DME which is under construction at present for better self-recognition of aircraft position by air force trainees.

c. Establishment of Additional Control Airspaces

Additional control airspaces were proposed to be established in order to ensure the safety of IFR operations in the training area.

(2) Aircraft Operation Procedures

As basic instrument approach procedures, ILS approach for Runway 26, VOR/DME approach for Runway 08 and 26 were evaluated. Standard instrument departure routes for both Runway 08 and 26 were also studied. No problem has been seen for the establishment of procedures.

(3) Provision of Radar Monitoring

For the prevention against near collisions between civil and military training aircraft, radar monitoring and radar assistance were proposed to be provided using a terminal radar approach control facility which will be installed near Yogyakarta airport.

(4) Equipment of SSR Transponder

In order to promote the air traffic control services, SSR transponder on aircraft operating within the Yogya Military Controlled Airspace were proposed to be equipped.

5.4 Aircraft Noise

Aircraft noise influence was evaluated in WECPNL for the year 2010. WECPNL contours for the year 2010 were drawn on the existing land use map around the airport as shown in Fig. 5.2.

Many houses are scattered arround the airport, therefore, control measures on land use will be necessary for the areas affected by aircraft noise in order to achieve environmental compatibility with the surrounding community.

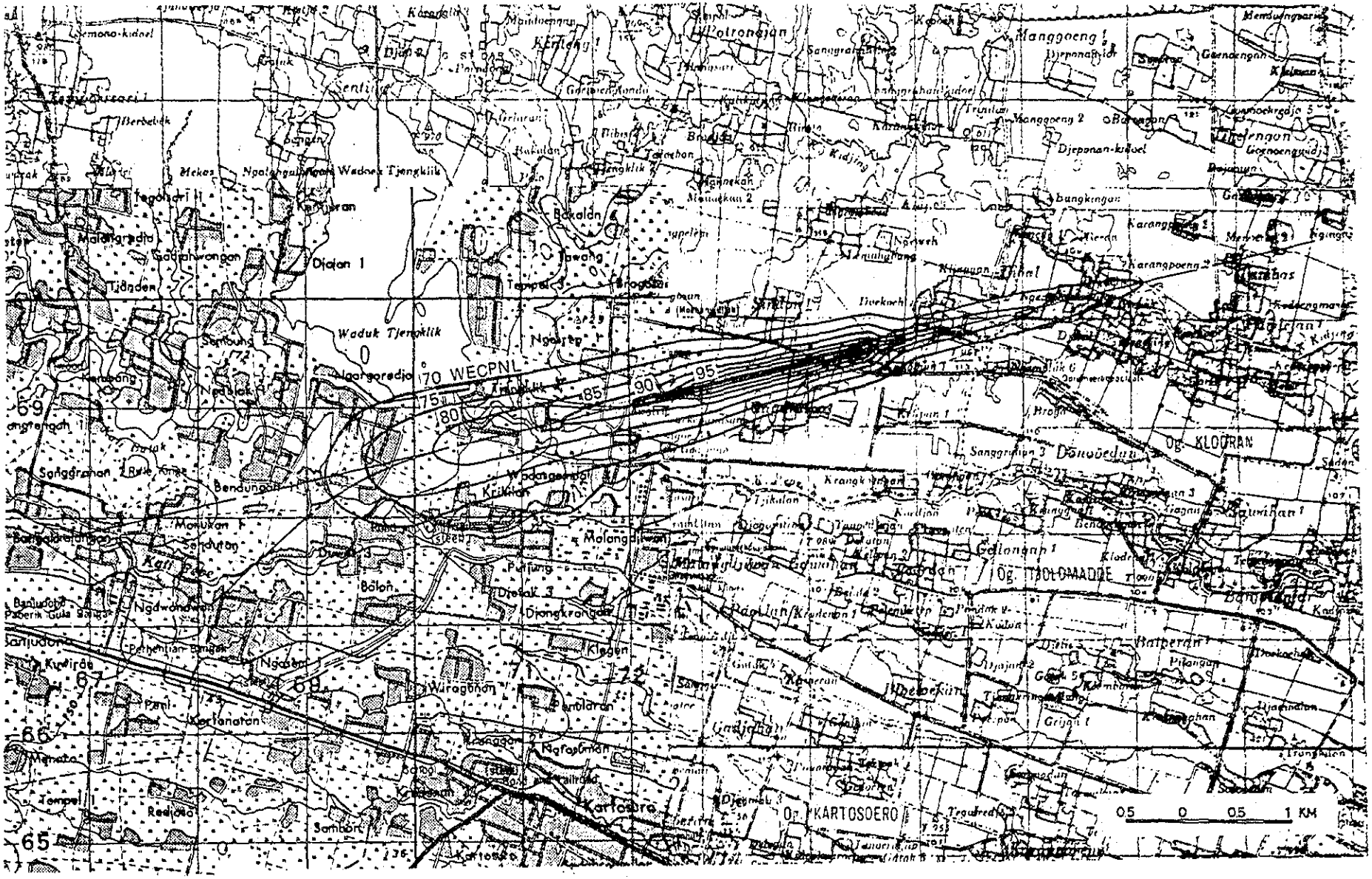


Fig. 5.2 Aircraft Noise Contours for Surakarta Airport (Year 2010)

5.5 Land Use Planning of the Area Surrounding the Airport

Land use planning surrounding the airport should take the following 3 items into consideration.

(1) Aircraft Noise

Criteria for land use control were established and is proposed taking into account the local condition and current land use control practices for aircraft noise in Japan, France, etc.

- *Proposed Criteria* -

WECPNL $\geqq$ 70 : No school, hospital, mosque, church, etc., is permitted.

$\geqq$ 75 : No new residence is permitted in principle.

Agricultural land use is recommended.

$\geqq$ 85 : No residence is permitted in principle.

Residences are recommended to be relocated. Exchange of noise affected residential area with agricultual area outside WECPNL 70 is recommended.

(2) Future Expansion of Airport Facilities

Land use planning for the surrounding areas should consider the future development of airport facilities.

Construction of buildings and houses in the area shown in Fig. 5.3 are necessary to be restricted for future runway extension up to 2,500 m.

(3) Obstacle Control

All the structures and trees are restricted in height so as not to infringe the obstacle limitation surfaces.

The height restrictions for the surfaces should be established in advance considering those surfaces established for 2,500 m long runway.

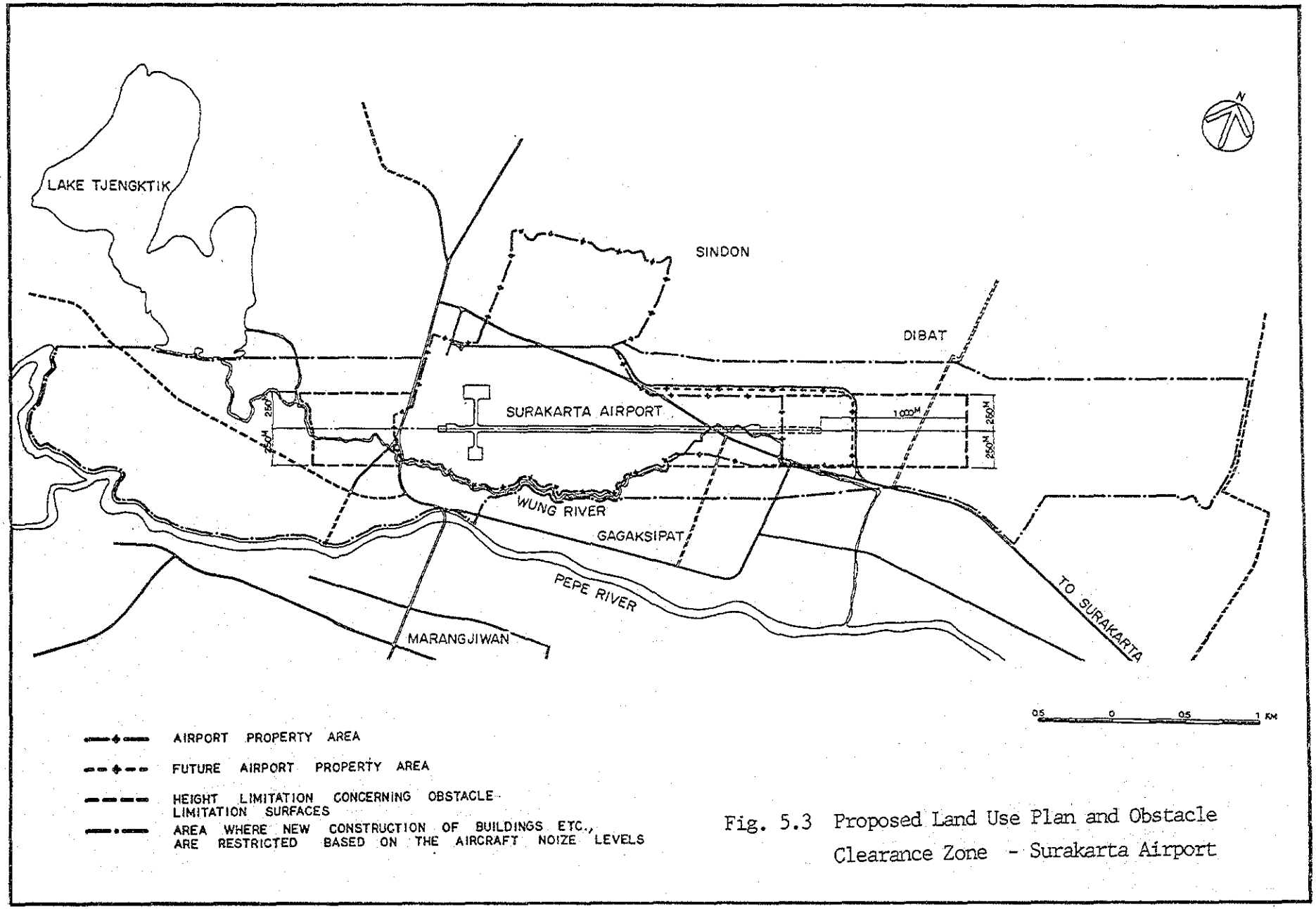


Fig. 5.3 Proposed Land Use Plan and Obstacle Clearance Zone - Surakarta Airport

5.6 Airport Organization

Fig. 5.4 shows the airport organization chart of Surakarta airport anticipated for the Phase I and II developments. The existing organization comprising of 3 divisions and 12 sections are to be kept the same in the future. The staff numbers is 76 at present, and this number will be increased to 210 and 265 numbers in Phases I and II, respectively, as airport facilities develop.

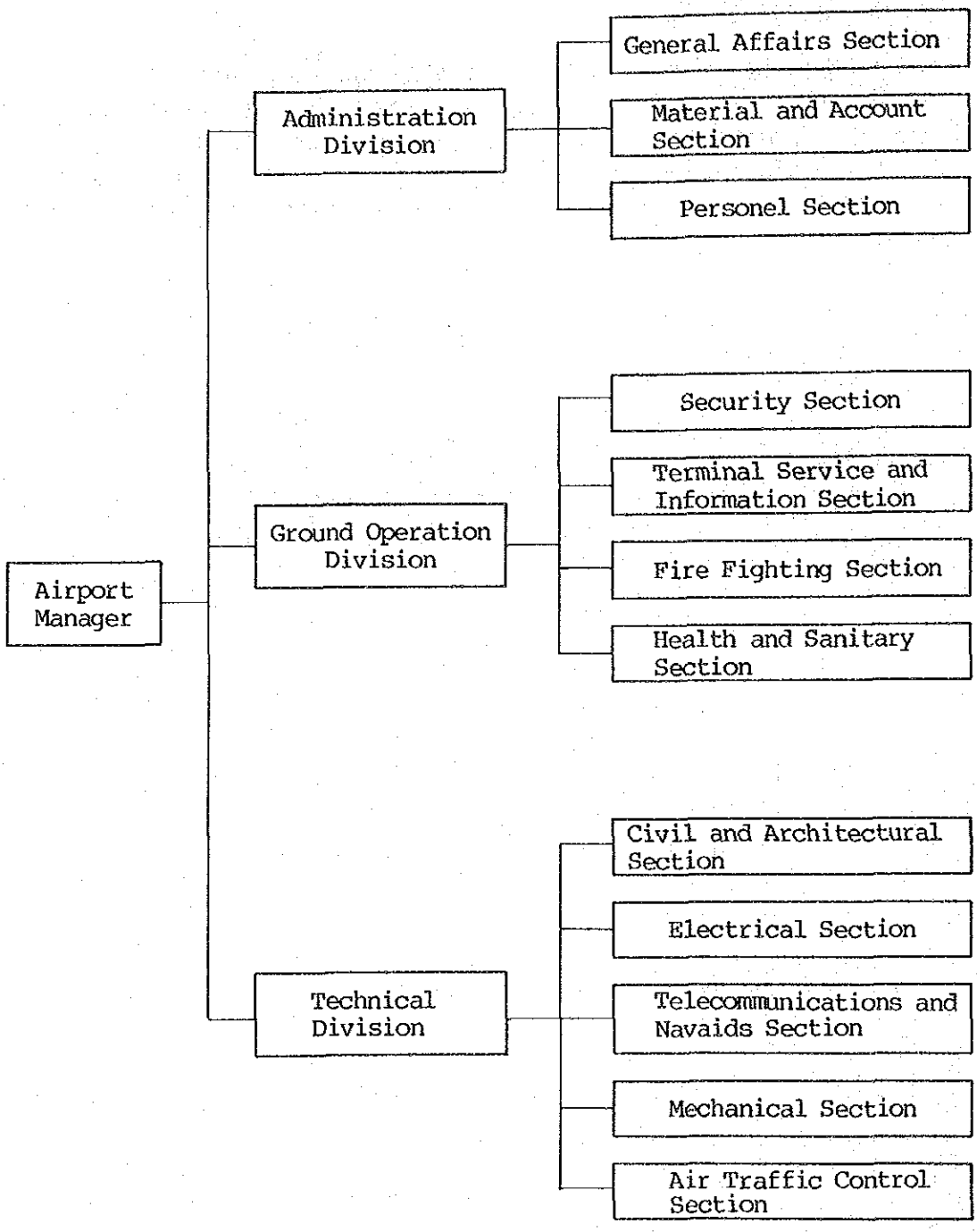


Fig. 5.4 Organization Chart for Surakarta Airport

5.7 Construction Schedule and Cost Estimates

The construction schedule of the Surakarta airport redevelopment was planned as indicated in Fig. 5.5. Construction works for the Phase I development will start at the beginning of 1990. Passenger facilities including a passenger terminal apron, passenger terminal building and vehicle parking will be completed by the end of 1991, and services will commence from the beginning of 1992. Runway extension and other works will be completed in mid 1993 and operations of the Phase I development will start at the beginning of 1994 after a 6 month period for flight checks, training for navaids, maturity flights, issue of NOTAM, etc.

Prior to the construction works, a 3 year period for a topographic survey, soil investigation, detailed engineering services, etc. will be required. The compensation work related to land acquisition and relocation of houses is recommended to be started at an early date of this period because it may consume a long time for coordination and discussion.

Construction costs necessary for the Phase I and II developments are estimated to be 52 billion Rp. and 15 billion Rp. in 1986 price, respectively, as shown in Table 5.2. These costs include detailed engineeringcostand10 % a physicalcontingency.

Herein, the exchange rate is set at:

US$ 1.0 = Rp. 1,125
US$ 1.0 = ¥ 200

Fig. 5.5 Construction Schedule of Surakarta Airport Redevelopment

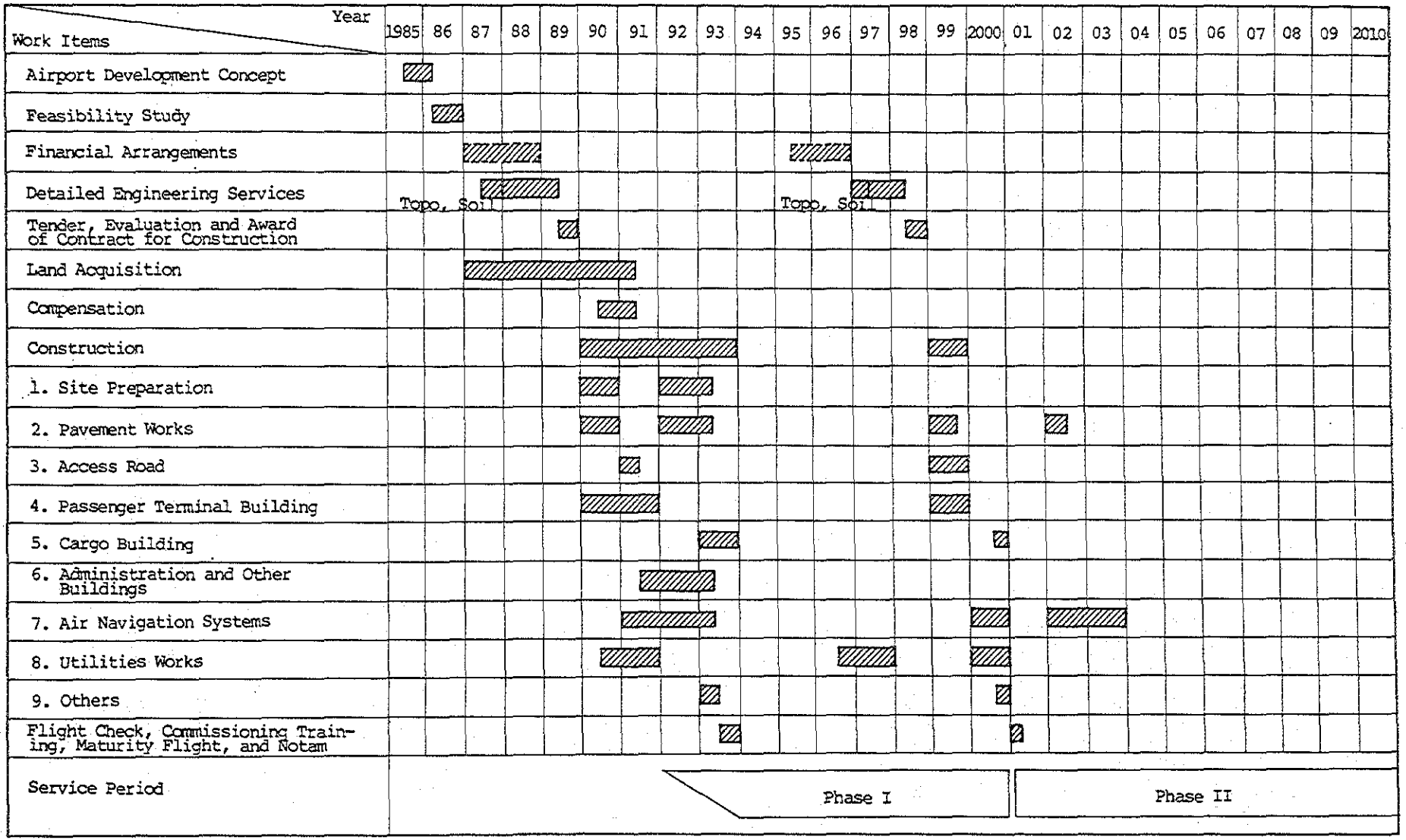


Table 5.2 Estimated Construction Cost for Surakarta Airport Redevelopment

(Unit: million Rp.)

Work Item		Phase I			Phase II			Total		
		Local Portion	Foreign Portion	Sub Total	Local Portion	Foreign Portion	Sub Total	Local Portion	Foreign Portion	Total
Land Acquisition	Land Acquisition	1,560	0	1,560	0	0	0	1,560	0	1,560
	Compensation	35	0	35	0	0	0	35	0.	35
	Land Acquisition * (Ultimate Expansion Area)	(1,654)	(0)	(1,654)	(0)	(0)	(0)	(1,654)	(0)	(1,654)
	Sub Total	1,595	0	1,595	0	0	0	1,595	0	1,595
Civil Works	Earth Work	966	502	1,468	10	39	49	976	541	1,517
	Drainage Works	529	730	1,259	0	0	0	529	730	1,259
	Pavement Works	2,777	5,581	8,358	955	1,771	2,726	3,732	7,352	11,084
	Access Road	235	122	357	470	250	720	705	372	1,077
	River Diversion	34	47	81	0	0	0	34	47	81
	Sub Total	4,541	6,982	11,523	1,435	2,060	3,495	5,976	9,042	15,018
Architectural Works	Passenger Terminal Building	2,106	2,473	4,579	1,366	1,604	2,970	3,472	4,077	7,549
	Cargo Terminal Building	262	233	495	230	204	434	492	437	929
	Administration Building	334	408	742	111	136	247	445	544	989
	Other Buildings	306	270	576	0	0	0	306	270	576
	Special Equipment	0	2,661	2,661	0	95	95	0	2,756	2,756
	Sub Total	3,008	6,045	9,053	1,707	2,039	3,746	4,715	8,084	12,799
Air Navigation Systems	Radio Navigation Aids	235	5,674	5,909	68	1,702	1,770	303	7,376	7,679
	Air Traffic Control and Aeronautical Telecommunications	87	2,555	2,642	37	1,021	1,058	124	3,576	3,700
	ATC Radar System	0	0	0	0	0	0	0	0	0
	Aeronautical Ground Lights	1,238	3,403	4,641	247	681	928	1,485	4,084	5,569
	Meteorological System	62	1,906	1,968	19	569	588	81	2,475	2,556
	Sub Total	1,622	13,538	15,160	371	3,973	4,344	1,993	17,511	19,504
Utilities Works	Power Supply System	479	2,518	2,997	23	947	970	502	3,465	3,967
	Water Supply System	44	90	134	0	4	4	44	94	138
	Sewarage System	257	397	654	12	3	15	269	400	669
	Solid Waste Disposal System	29	130	159	0	0	0	29	130	159
	Telecommunication System	260	619	879	0	0	0	260	619	879
	Sub Total	1,069	3,754	4,823	35	954	989	1,104	4,708	5,812
Other Equipment	Vehicles for Fire Fighting Services	0	1,086	1,086	0	0	0	0	1,086	1,086
	Sub Total	0	1,086	1,086	0	0	0	0	1,086	1,086
Total of Construction Works		11,835	31,405	43,240	3,548	9,026	12,574	15,383	40,431	55,814
Engineering Services Cost		1,184	3,141	4,325	355	903	1,258	1,539	4,044	5,583
Sub Total		13,019	34,546	47,565	3,903	9,929	13,832	16,922	44,475	61,397
Contingency		1,302	3,455	4,757	390	993	1,383	1,692	4,448	6,140
Grand Total		14,321	38,001	52,322	4,293	10,922	15,215	18,614	48,923	67,537

* Land Acquisition Cost for Ultimate Expansion Area is not included in Total Cost.

Exchange Rate: US$ 1.00 = Rp. 1,125, ¥ 1 = Rp 5.625

5.8 Economic and Financial Analyses

Economic and financial feasibility was examined for the Surakarta airport redevelopment.

(1) Economic Analysis

Assessment for the economic feasibility was made in terms of EIRR (Economic Internal Rate of Return), B/C Ratio (Benefit Cost Ratio) and NPV (Net Present Value) as shown in Table 5.3.

Table 5.3 Economic Assessment

EIRR (%)	B/C Ratio*	NPV* (million Rp., 1985)
14.0	1.23	9,800

Note * : at discount rate 12%

The EIRR of 14.0 % indicates that this project is feasible in terms of national economy because it exceeds 12 %, the opportunity cost of capital for airports project in Indonesia.

Sensitivity analysis was also made to provide a probablistic judgement on the feasibility. The results in Table 5.4 show that the EIRR almost satisfies the opportunity cost of capital even in case of the worst projection, 10 % increase in construction cost and 10 % decrease in traffic demand simultaneously.

Table 5.4 Sensitivity Analysis

Projections		EIRR (%)
Base Case		14.0
Case I	Construction Cost up by 10 %	13.1
Case II	Traffic Demand down by 10 %	13.1
Case III	Construction Cost up by 10 % Traffic Demand down by 10 % (simultaneously)	12.2

Along with the direct and tangible benefits, this project will bring about various indirect and/or intangible benefits, for instance, promotion of regional industries including the tourist industry, development of regional economy, increase in employment opportunities, improvement in air safety, etc.

Consequently, economic and sensitivity analyses prove the rationality of investment on this project when viewed nationally as well as regionally.

(2) Financial Analysis

The results of the financial analysis show that airport revenues under the present charging system cannot cover the construction, maintenance and administration costs. It is also found that when the new terminal will commence the operation, the level of charges needs to be increased by at least 30% to cover only maintenance and administration costs anticipated in a first few years.

As is well known, except for the big airports it is very difficult for an airport to achieve a financial balance. Therefore, procurement of low interest funds and the introduction of government subsidies are considered essential in order to implement this project as a social infrastructure.

At the same time, raising in airport charges may be necessary after an evaluation of the existing charging system is carried out. Furthermore, it is suggested that in the future, some countermeasures such subsidies of the government, etc., will be required.

5.9 Conclusions and Recommendations

It is concluded in Part I "Formation of the airports development concept" that the long-term development of the major airports in the Central Java province and D.I. Yogyakarta should be implemented by the following development policies:

- Development of the new Yogyakarta airport
- Redevelopment of the existing Surakarta airport
- Redevelopment of the existing Semarang airport after review of the master plan already prepared

The feasibility study on the redevelopment project of the existing Surakarta airport was executed in Part II based on the above conclusion.

Based on the comprehensive study presented in Part II, Vol. 2, the redevelopment project of the existing Surakarta airport is judged feasible in terms of both engineering and the national economy of Indonesia.

The cost of the project is estimated to be approximately billion Rp. 52 and billion Rp. 15 in Phases I and II, respectively and the economic internal rate of return (EIRR) is estimated to be 14.0 %, and net present value (NPV) to be approx. billion Rp. 10.

By the implementation of this project, the following can be expected for the air transportation and the socio-economic situation:

- Unrestricted and flexible air transport services can be ensured to the increasing air traffic demand in the future.
- Safe and efficient operations for aircraft can be promoted, especially for training aircraft and civil flights in the military training area.
- Implementation of this project will contribute to the airlines' profitability by means of introduction of larger aircraft.
- Development of the tourist industry can be promoted by the provision of unrestricted air transport services.

- Implementation of this project will also contribute to the economic activities in the Surakarta region.

- Employment opportunities can be enlarged.

It is recommended that the following actions should be taken for the project implementation.

- Preparation of negotiations necessary for land acquisition and compensation should be initiated at the earliest possible stage so that the Phase I project can be proceeded without any delay.

- Airspace above the Surakarta airport should not be rearranged for itself solely but in relation with the development project of the new Yogyakarta airport. To do so, DGAC should constitute a committee through which close coordination with the Indonesian Air Force can be maintained.

- Land acquisition, compensation, topographic survey, soil investigation and detailed engineering services should be completed by the end of 1989 so that the construction work for the Phase I project can be started in 1990 and completed in 1993. Since the existing passenger terminal building has already been saturated even for the present passengers, the new terminal building should be constructed prior to the other works by 1992.

- By the time of completion of the Phase I project, DGAC and BAPPEDA in Surakarta should prepare a land use plan, which requires the consensus of the regional society, in the vicinity of the airport.

- The Phase I facilities are to be designed to cope with the air traffic demand in the year 2000. The construction work for the Phase II project should be completed by 2000 to cope with the air traffic demand in the year 2010.