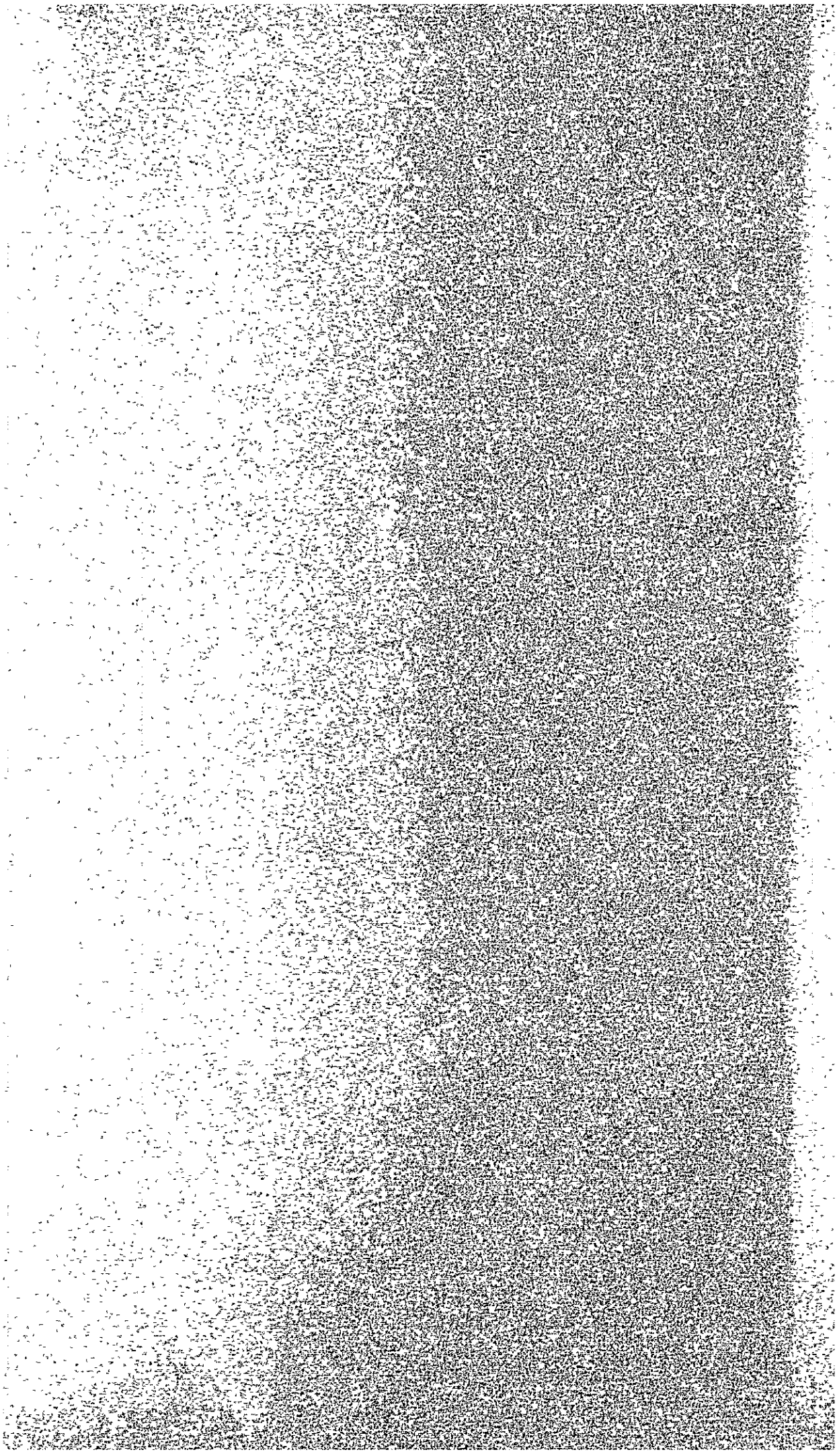
CHAPTER 7

TERMINAL CONCEPT



CHAPTER 7 TERMINAL CONCEPT

7.1 General

The basic requirements of terminal facilities are that aircraft should be parked on the apron safely and efficienty, connected to the terminal buildings and that terminal building should function satisfactorily to meet the facility requirements of passenger and cargo demand. Terminal facilities should also be planned to be easily expanded because future aircraft will tend to be wide-bodied aircraft in increasing numbers.
Process of terminal concept development is shown in Fig.7.1.1.

7.2 Zoning in the Terminal Area

7.2.1 General

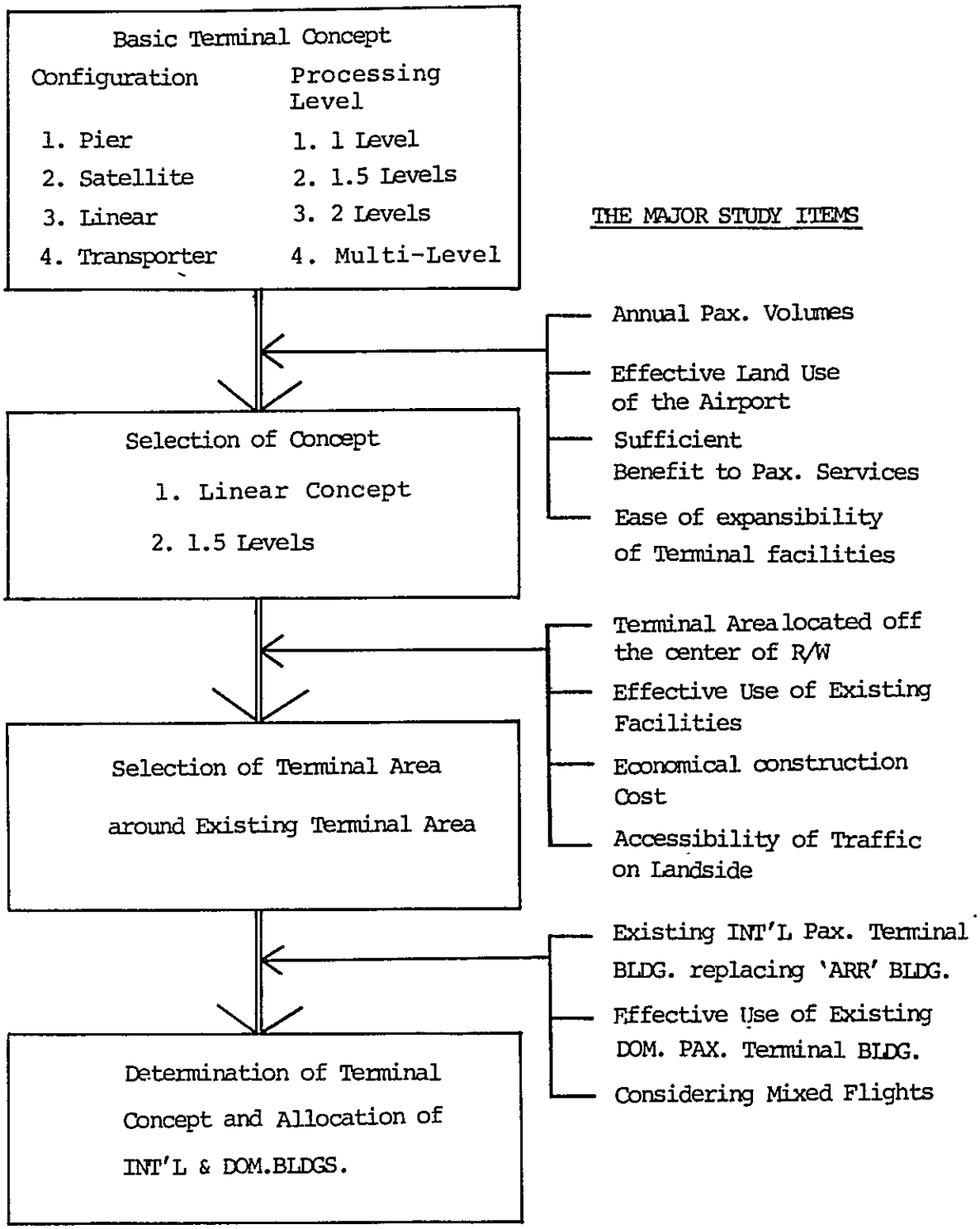
The facilities related to passenger handling occupy the major portion of the terminal area. At airline base airports like Jakarta/Halim, the maintenance area and the cargo terminal area occupy similar large areas.

At Bali International Airport, facilities other than the ones for passengers are small, and therefore this configuration will not be changed even in the future. The zoning of the terminal area is planned therefore emphasizing the passenger terminal since this is the main facility at BIA.

The following are the basic conditions to [illegible] suitable terminal zoning for the airport:

(1) The terminal area should be [illegible] the middle of the runway as [illegible]
(2) Existing airport land should be [illegible] airport effectively.
(3) Existing airport facilities [illegible] fully and effectively utilized.

FIG.-7.1.1 PROCESS OF TERMINAL CONCEPT DETERMINATION



(4) The construction costs should be low, especially the initial investment cost.

(5) The terminal area should be able to be expanded easily.

7.2.2 Zoning

The area zoning is planned as described below taking into account the existing facilities.

Figs. 7.2.1 and 7.2.2 show the proposed zoning.

(1) Passenger Terminal Area

The passenger terminal area will be developed by centering it on the present International Terminal Building and Apron B.

At present there is about 9 ha. of undeveloped area including reserved area for future expansion for car parking, and future development of the passenger terminal.

These two entities should be integrated in such a large area.

Government facilities such as the telephone office shall also be integrated in the passenger terminal area because these offices are planned to be moved in order to concentrate airport administrative functions into one building.

(2) Cargo Terminal Area

The cargo terminal area is to be located on the eastern side adjacent to the passenger terminal area in order to provide rapid handling of cargo by shortening the line of flow between parked aircraft at the loading apron and the cargo terminal building.

In addition, undesirable vehicular traffic in the passenger terminal area can be reduced when the cargo terminal area is located on the eastern

side as well as the maintenance area, and catering facilities which will be described later.

(3) Fuel Storage Area

The fuel storage facility can be expanded at its present location because the location of the facility will not affect the overall future development plan and it can accommodate future demand with expansion to the area north of the existing facility.

(4) Maintenance Area

Since there is no direct relationship between the daily operations of passenger aircraft and cargo handling, the maintenance facility has a low priority in the zoning plan. It would be preferable however, to locate it near the loading apron.

Therefore, the maintenance area should be located on the east side of the cargo terminal area.

(5) Others

The fire station, which is now under construction can accommodate the required service in the future by expansion.

The catering facility is planned to be located in the area between the new fire station and the maintenance area.

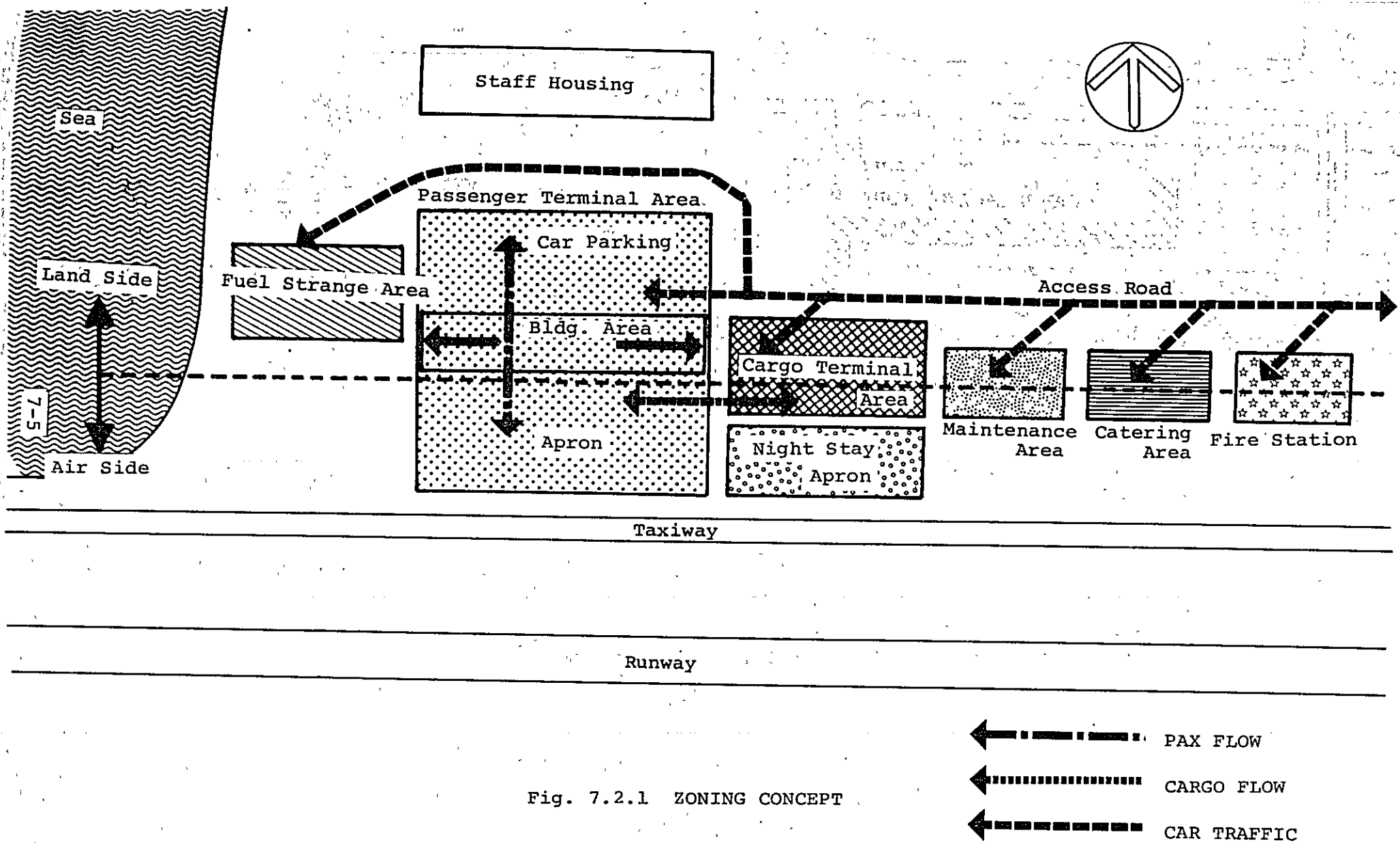


Fig. 7.2.1 ZONING CONCEPT

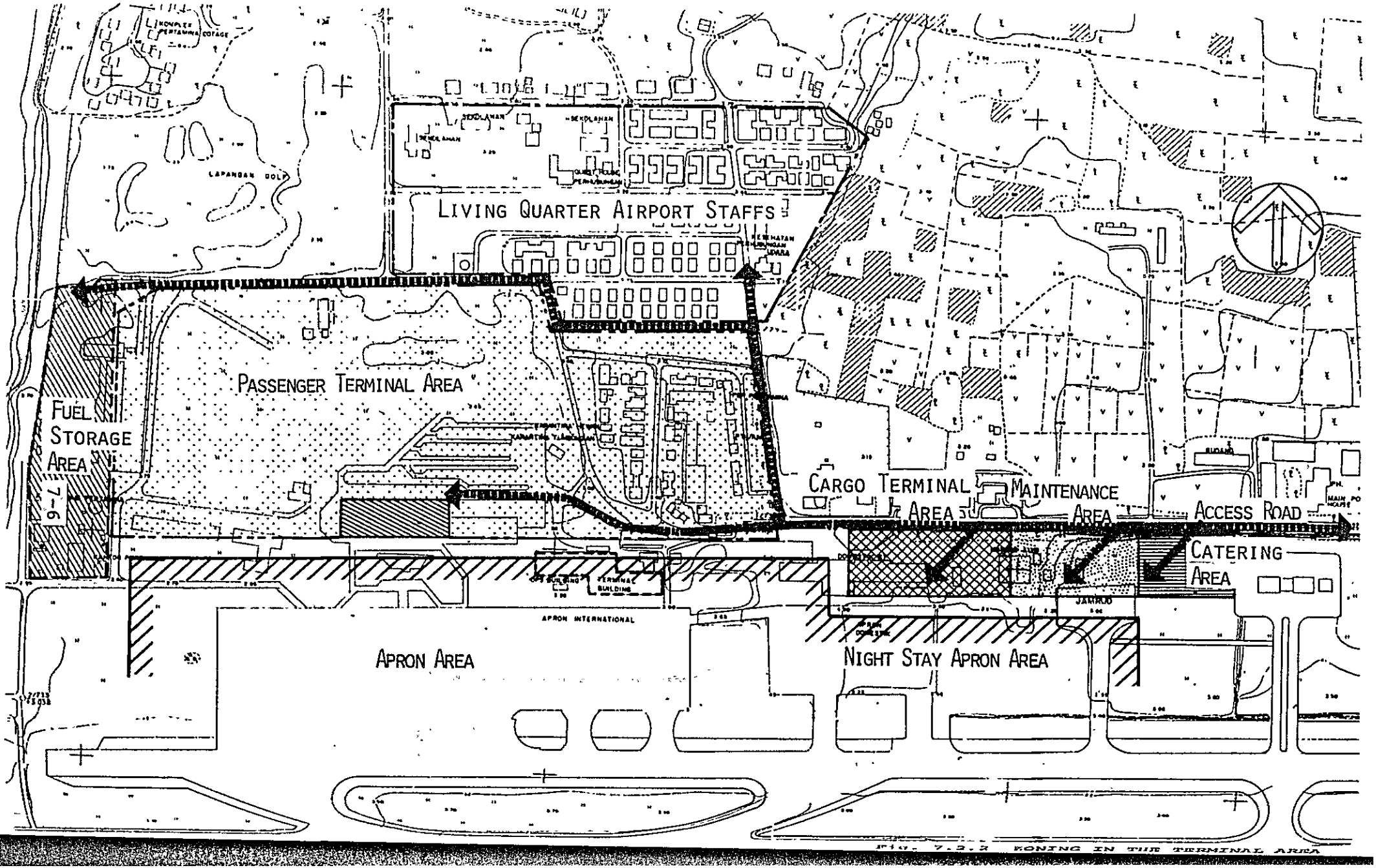


Fig. 7.2.2 ZONING IN THE TERMINAL AREA

7.3 Basic Concepts

In accordance with IATA, FAA and JCAB data, basic passenger terminal concepts are generally classified into four major types: namely Pier, Satellite, Linear and Transporter concept as shown in Fig.7.3.1.
The four basic concepts are outlined below.

(1) The Pier Concept

The piers are expanded to an apron to accommodate the required number of aircraft in a concentrated fashion. Because the pier concept can be designed to be Y-shape and L-shape bent at the middle of the pier, the pier concept has flexibility in terms of apron usage. However, walking distance from check-in counter to the farthest gate is longer. It is necessary that Moving-walk facilities are installed in order to make passenger flow smoothly.

(2) The Satellite Concept

For the Satellite concept, aircraft are normally parked in radial or parallel positions around the Satellite which is expanded to the apron. Walking distance to the Satellite is longer than in the Linear and the transporter concept. The Satellite concept is compatibile with a large volume of aircraft movements.

(3) The Linear Concept

Aircrafts are basically parked in parallel with the terminal building as shown in Fig. 7.3.1.
The Linear concept is compatible with future wide-bodied aircraft characteristics as well as with the forecast growth of passenger volumes.
Walking distance in the Linear concept is, in general, shorter than any of the other three basic concept.

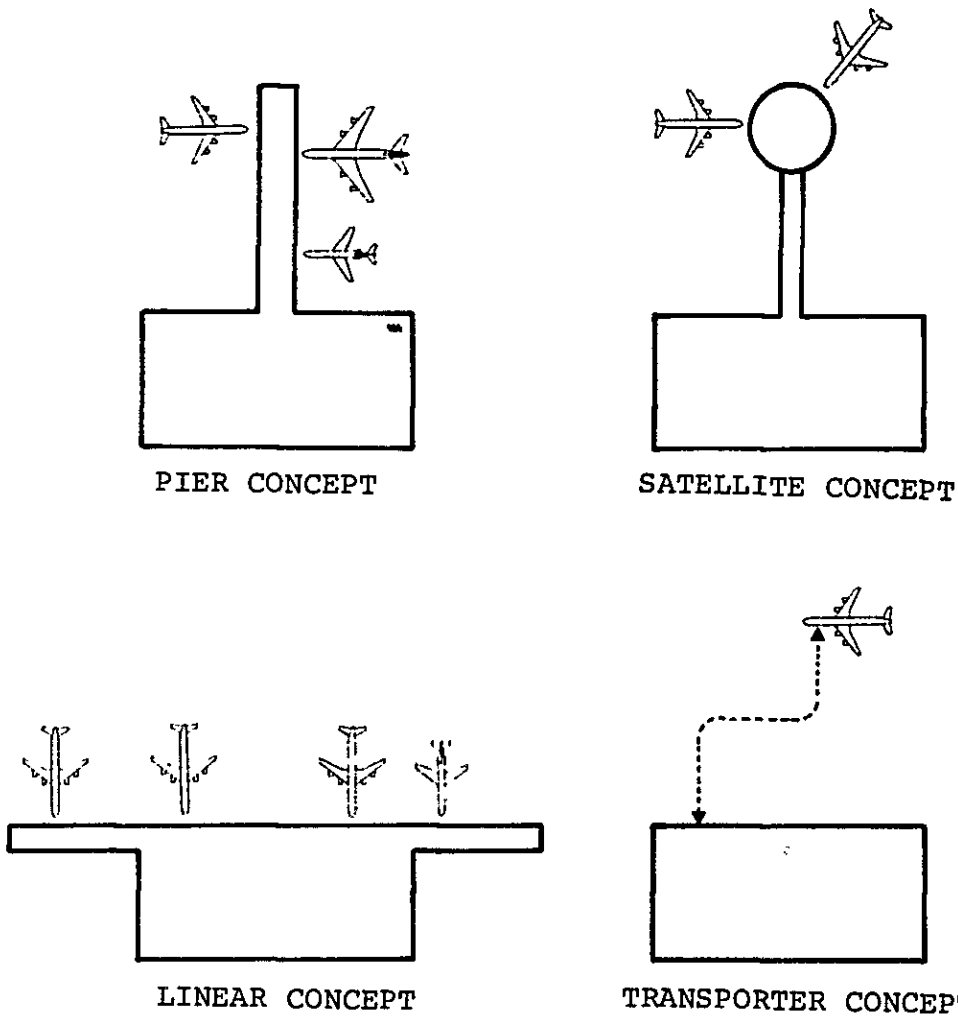
(4) The Transporter Concept

As shown in Fig. 7.3.1, aircrafts are parked in the apron facing the terminal building.

The Transporter concept is a recommendable solution for conditions that require many stands for aircraft and flexibility in apron usage. The passengers are carried by ramp buses or automobile lounges between the aircraft and the passenger terminal building.

In particular, in case of automobile lounges, the facilities are very expensive to procure and operate.

Fig. 7.3.1 TERMINAL CONCEPT



7.4 Processing Level Concept

As to terminal concept of Processing Levels, they are generally classified into four arrangements of passenger processing systems as illustrated in Fig.7.4.1 . There are some overlapping characteristics in these concepts.

(1) One Level

Flows of Pax. and baggages are carried on the same floor level - 1st floor. The concept is generally, a simple flow and is economical to construct. The concept is compatible with a small pax. volume airport.

(2) One and a Half Levels

There are two levels on the Airside and one level on the landside to make grade separation of pax. and baggages on the apron side. The concept can interface with wide-bodied aircraft using boarding bridge equipment. The concept is also less costly to construct than two levels or multi-levels.

(3) Two Levels

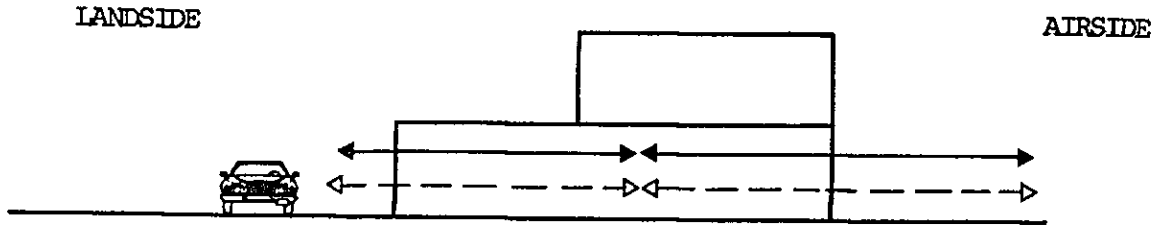
There are two levels on both the airside and the landside so that at the landside arrival and departure passenger flows can be completely separated. In other words, the concept has more effective pax. and baggage flows than in one and one and a half level concepts. The concept is compatible with a large pax. volume airport.

(4) Multi-Level

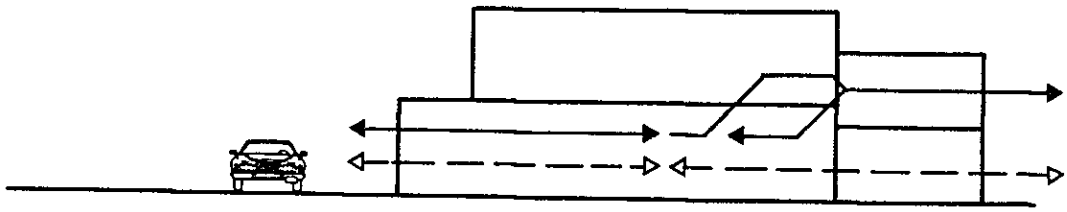
There are more than two levels. Unless the available land for the terminal area is very limited or other geographic factors are limitations, the concept generally will not be adopted. The reason is that there is no specific merit in the concept.

The most suitable terminal concept(s) will be selected based upon the following factors:

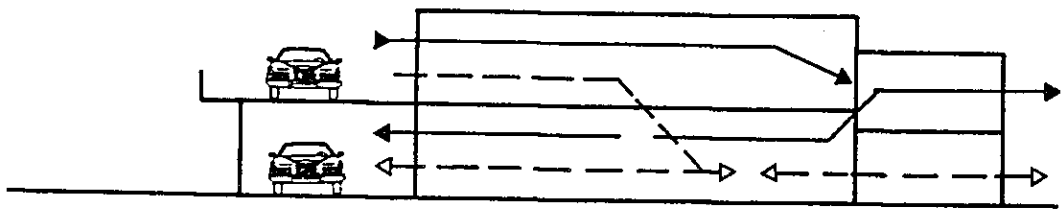
FIG.7.4.1 PROCESSING LEVEL CONCEPT



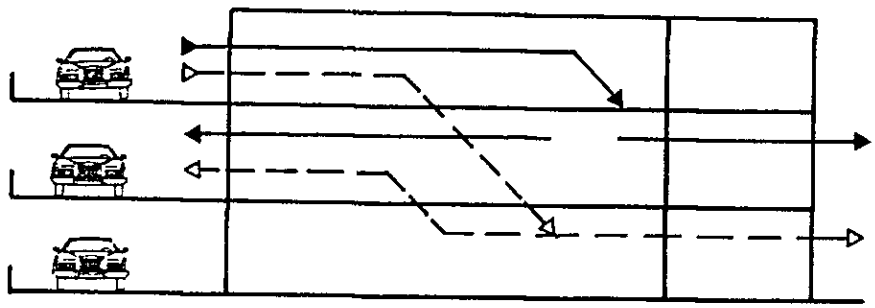
ONE LEVEL



ONE-AND-A-HALF LEVELS



TWO LEVELS



MULTI-LEVELS

LEGEND

PASSENGER FLOW

BAGGAGE FLOW

(a) Number of passenger to be served (No. of peak hour passengers)
(b) Configuration of airport land
(c) Number of runways and their configuration

7.5 Selection of Terminal Concept

The basic design conditions for selecting the terminal concept are as follows:

(a) Annually 7.8 million passengers are estimated at the year 2010 - the Long Term Plan.
(b) The effective use of land and facility of the airport are considered.
(c) The existing runway is able to be utilized sufficiently for the future.

The result of concept study taking into consideration the items above, the linear terminal is the most appropriate concept for Bali International Airport.

The reasons are listed below.

(a) Restriction on the airport land use
Four basic concepts are shown in Fig.7.3.1 and every one of them can be selected for BIA judging from the shape and the size of the airport terminal area.

(b) Evaluation based on future annual passenger volume
Judging from annual passenger volume expected, all the concepts also can be selected for BIA. However, in accordance with other existing airport data, the satellite concept will not be selected for BIA since the annual passenger volume is not sufficient for the satellite concept. Generally speaking, less than 10 million annual airport passengers seem to favor the linear terminal concept.

(c) Effective use of the existing facilities
Because the existing International Passenger Terminal Building is the most recent constructed facility in the airport, it should be compatible with the use pattern of selected concept. The results of the study on aircraft stands on the apron and transitional surfaces, suggest that only the linear or semi-linear concept modified from the linear concept should be adopted for BIA.

(d) Other airport references
Each concept has own advantageous and disadvantageous points respectively. Now-a-days, there is a world-wide tendency for other international airports to adopt the linear concept because the concept produces a lot of satisfaction in airport operation.

For example, the following airports have adopted the linear concept:

i) Dallas/Fort Worth Regional Airport (USA)
ii) Charles de Gaulle Airport (France)
Second Stage Construction
iii) Tokyo International Airport (Haneda)
Future Master Plan

(e) Others
Moreover, it can be seen that the linear concept has no disadvantageous points for Bali International Airport, nor do other concepts have advantages not present in the linear concept.

The basic module of linear concept selected is shown in Fig.7.5.1.

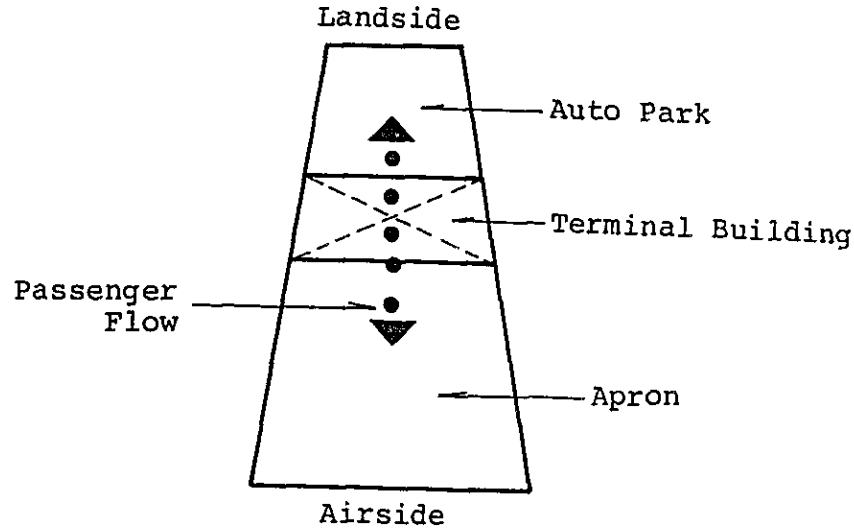


Fig. 7.5.1 THE BASIC MODULE OF LINEAR CONCEPT

The following are the merits of the linear concept:

(a) Passenger flow distance between landside and airside is shorter than in other concepts. Terminal facilities will basically be compacted accordingly.

(b) The linear concept will functionally benefit passengers because of simpler passenger flows.

(c) The linear concept will have less apron area compared with any other concepts so that apron construction will be more economical.

(d) Aircraft maneuvering in the linear concept will be simpler and more effective than in other concepts.

As to processing level concept, one and a half levels will be the most adequate processing level concept taking into consideration the number of passengers forecast, the world-wide tendency of services to passengers and the low construction costs compared with the two or multi-level concepts.

7.6 Selection of Terminal Layout

The process of terminal layout determination is shown in Fig.7.6.1. The selection of the terminal layout is based on the following assumptions:

(1) The existing International Passenger Terminal Building will be utilized as an arrival terminal because the building cannot be expanded on the second floor.
(2) The existing domestic passenger terminal building will be used for a departure terminal in order to effectively use the existing facilities.
(3) Garuda Airlines has been operating mixed flights between Depasar and Jakarta. It is expected that the mixed flights will continue operating in the near future.

As shown in Fig. 7.6.1, there are two alternative plans for the terminal layout in the 1990 development plan: PLAN-A and PLAN-B. Depending on which one is selected, the 2000 and 2010 development plans will either, be PLAN-A1 and PLAN-A2 or be determined as PLAN-B1.

- PLAN-A1

  The plan is designed to clearly divide a terminal into an arrival and a departure function. There will be passenger flow problems caused by mixing of domestic and international passengers when the mixed flights are cancelled. Accordingly, the plan cannot be adopted for BIA. However, there is one merit; that is, the plan is laid out in fanction at the landside.

- PLAN-A2

  The plan is so designed to divide a terminal into an international and a domestic function. The plan cannot be compatible with the mixed flights now or the future. However, when the mixed flights are cancelled, the plan may be adopted in complete since there will be separation of international and domestic functions. Moreover,

there will also be a complicated taxi flow on the landside as arrival terminals are separated from each other as shown.

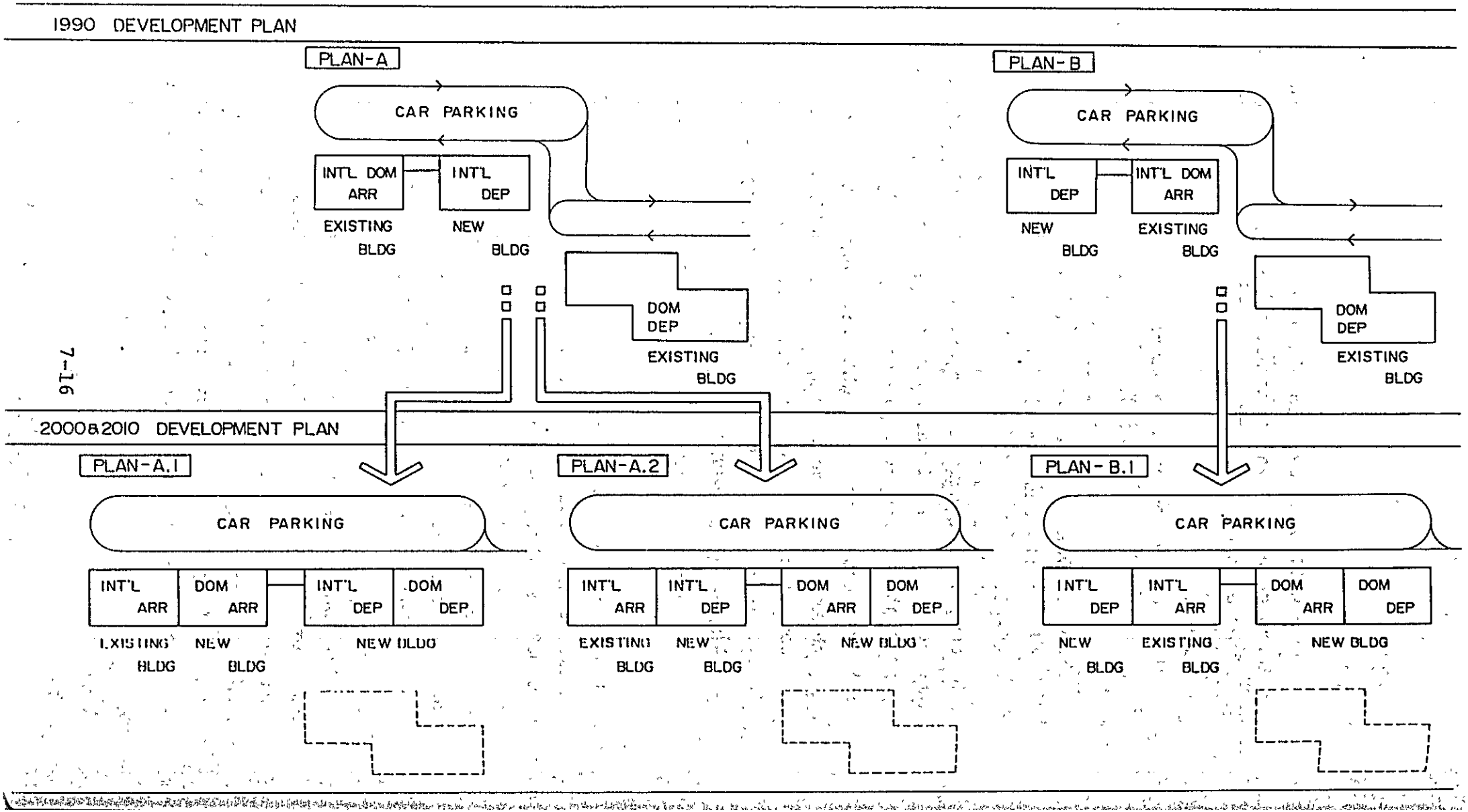
- PLAN-B1

  The plan is designed to improve the defective points of PLAN-A2. The plan is laid out to concentrate arrival areas for an international and a domestic function in order to make simple taxi flows on the landside. Other merits and demerits in the plan are the same as PLAN-A2.

The appropriate terminal layout is selected as PLAN-B1 in the 2000 and 2010 development plans based on the two important factors as follows:

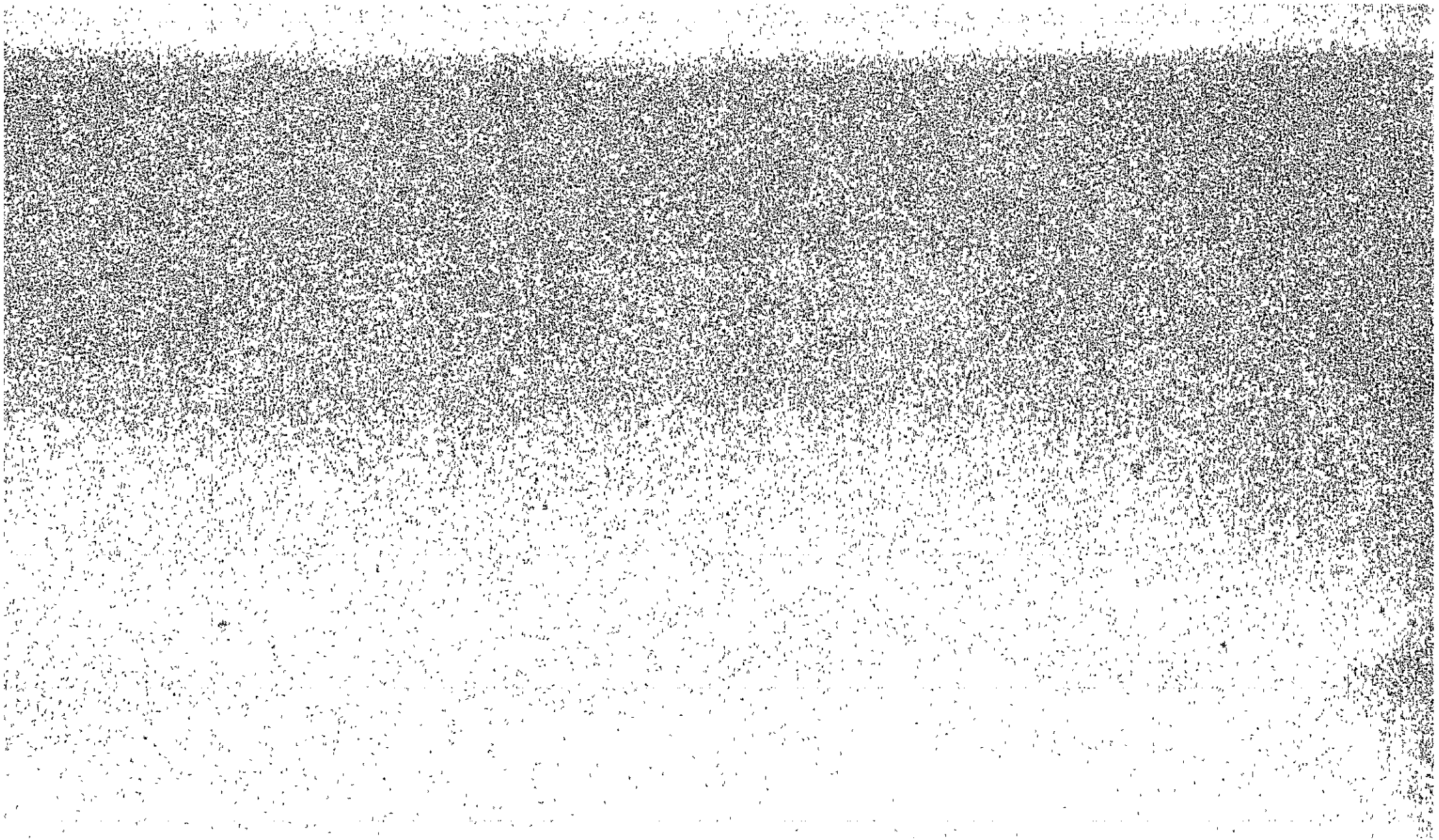
(1) Even though mixed flights are cancelled in the future, there will be no passenger flow problems between the domestic and international flows.
(2) Terminal layout is able to produce simpler traffic flows on the landside.

Fig. 7.6.1 **TERMINAL LAYOUT CONCEPT**



CHAPTER 8

ALTERNATIVE TERMINAL AREA PLAN



CHAPTER 8 ALTERNATIVE TERMINAL AREA PLAN

8.1 General

The results of the studies for the future facility requirements indicate that large scale development, including relocation of a parallel taxiway, full scale renovation and expansion of the existing buildings can be anticipated in the future.
It is, therefore, considered necessary to study a comparison of the altenatives in order to find the most suitable terminal plan to be recommended.

8.2 Alternative Terminal Area and Evaluation

8.2.1 Site Selection for Terminal Area

Taking into account the maximum utilization of the existing facilities and construction cost economy, the renovation and expansion of the existing terminal should obviously be recommended. Since, however, there is still ample space in the airport complex, other development plans can be established for the unused area.
In this chapter, the Southern Terminal site on the south side of the runway has been selected, because no interuption is expected to other facilities during its construction.

8.2.2 Layout Plan Based on "Southern Terminal Area"

The area anticipated for use on the south side of the runway has a triangular shape with an area of
There are two ponds which will remain, having been borrow pits for sand material when the runway was constructed.
Since this area is smaller than the terminal area of the 2010 year target plan, it is inevitable that

acquisition of land will be required.
During the planning of the new terminal area, the following facilities should be constructed for the year 1990 (Short Term Plan):

- International and Domestic Passenger Terminal Building
- International and Domestic Loading Apron
- Night Stay Apron
- Cargo Terminal Building
- Administration Building
- Catering
- Fuel Storage
- Access Road
- ILS/LLz, ILS/GP (Relocation)

The following existing facilities in the northern area will be included in this plan:

- Fire Station
- Hangar
- Some parts of the Apron
- NDB, PSR/SSR

The reason why the existing apron is no longer being used is that standing aircraft may interfere with the relocated ILS/LIZ.

A layout plan for the 'Southern Terminal Concept' in 1990 is shown in Fig. 8.2.1.

8.2.3 Comparison of Alternatives

The results of a comparison of two altenatives for the year 1990 are shown in Table 8.2.1. Their estimated construction costs are shown in Table 8.2.2.

Based on these tables, the new southern terminal development concept is recognized as being deficient considering the points of maximum utilization of existing facilities, relocation of facilities and construction cost; it is, therefore, not recommended.

8.2.4 The Cost Benefit Analysis on the Southern Development Plan

Tables 8.2.3 and 8.2.4 show the analysis results of the cost benefit analysis on the southern development plan to develop the new terminal facility wholly on the southside of the existing airport by 1986.

The construction cost is based on the estimated values in the Chapter 12. For the Operation and Maintenance and benefit, the values assumed in the northside development plan are used.

The analysis results are as follows:

EIRR: 11.9233%

Benefit-Cost Ratio
at Discount rate 15%: 0.795

Net Present Value (NPV)
at Discount rate 15%: -8089 MILLION RP.

As a result of this analysis, the Southern development plan is thought to be unfeasible.

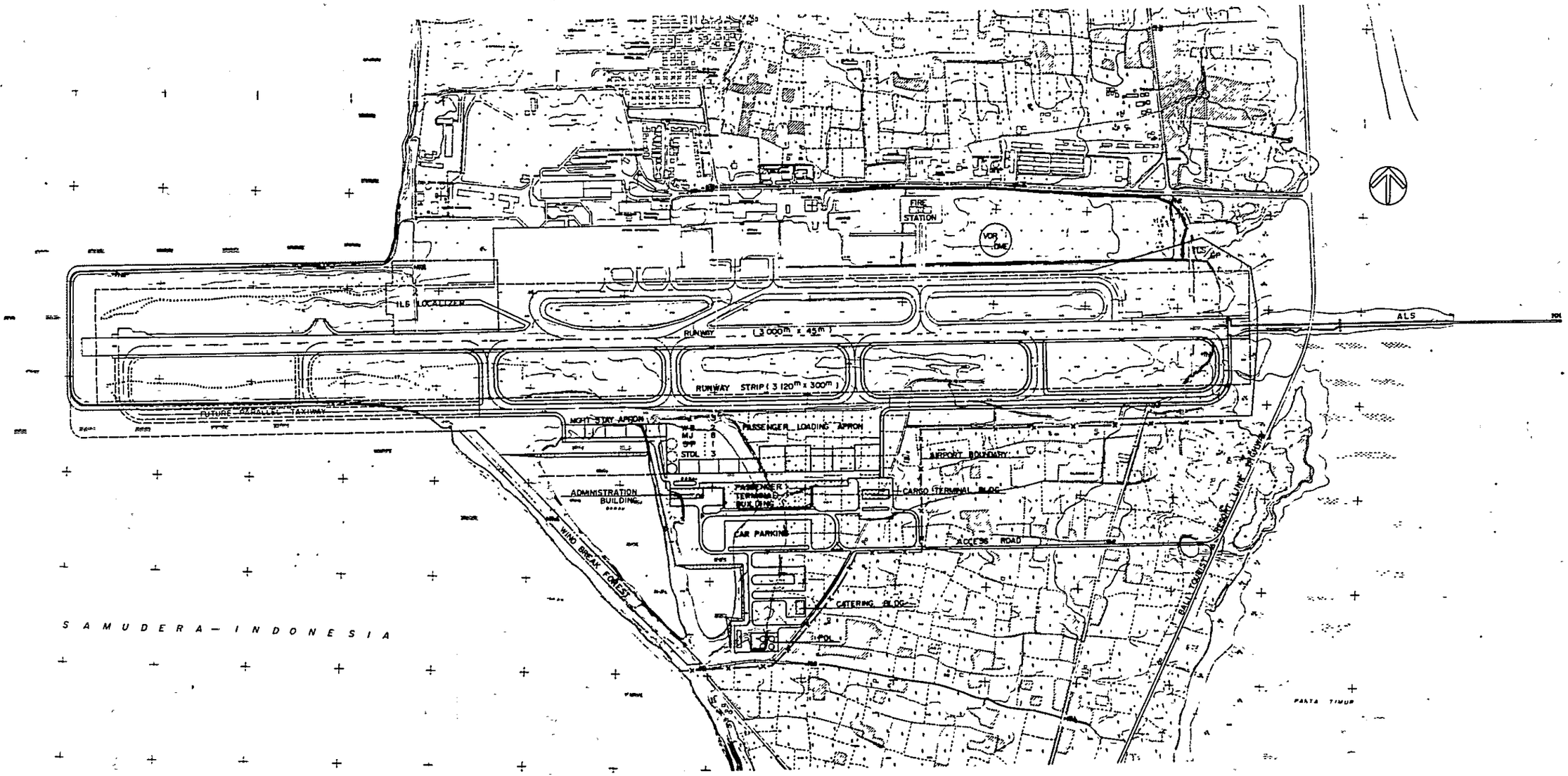


Fig. 8.2.1 SOUTHERN DEVELOPMENT PLAN (1990)

Table 8.2.1 THE COMPARISON TABLE OF DEVELOPMENT PLANS " NORTH " & " SOUTH "

STUDY ITEMS / PLAN	AREA "NORTH"	AREA "SOUTH"
1. EFFECTIVE LAND USE BY THE TERMINAL AREA	IT IS EASY TO DEVELOP TERMINAL FACILITIES WITHIN THE AIRPORT AREA.	AS A TRIANGULAR SHAPE, IT IS NOT EASY TO DEVELOP TERMINAL FACILITIES WITHIN THE AIRPORT AREA EFFECTIVELY. AN ADDITIONAL AQUISITION OF THE LAND WILL BE REQUIRED.
2. FLEXIBILITY FOR EXTENSION	TAKE INTO ACCOUNT EFECTIVE COOPERATION OF EXISTING FACILITIES, THE EXPANSION PLAN CAN BE EXECUTED	AS THERE IS NOT EXISTING FACILITY EXCEPT D-VOR ETC., THE EXPANSION PLAN WILL BE CARRIED OUT FLEXIBILITLY.
3. EFFECTIVE USE OF EXISTING FACILITIES	THE FOLLOWING FACILITIES WILL BE PROBABLY INTEGRATED: INT'L PAX BLDG. PARKING LOT, POL, FIRE STATION BLDG. ACCESS ROAD, HANGER. APRON B.	THE FOLLOWING FACILITIES MAY BE USED: A PART OF APRON FOR MAINTENANCE, NIGHT STAY, HANGER, FIRE STATION.
4. AIR NAV. EQUIPMENT	IT IS NOT NECESSARY TO INSTALL NEW EQUIPMENT.	IT IS NECESSARY TO INSTALL NEW VOR, LLZ AND G/P BECAUSE THE EXISTING EQUIPMENT CAN'T BE REINSTALLED DURING THE OPERATION OF THE AIRPORT
5. MAJOR CONSTRUCTION ITEMS REQUIRED	SOIL BORROWED FROM OUT OF THE AIRPORT : ABOUT 225,000 M^3 SOIL BORROWED IN THE AIRPORT : ABOUT 60,000 M^3	SOIL BORROWED FROM OUT OF THE AIRPORT : ABOUT 800,000M^3 SOIL BORROWED IN THE AIRPORT : ABOUT 32,000 M^3

Table 8.2.1.(CONT.)

STUDY ITEMS / PLAN	AREA I "NORTH"	AREA II "SOUTH"
	THE EXISTING APRON B WILL BE USED WITHOUT ADDITIONAL IMPROVEMENT WORKS "ABOUT 41,000 M^2" A NEW T/W WILL BE REQUIRED "1,090 M LONG"	A NEW LOADING APRON WILL BE REQUIRED. A NEW T/W ALSO WILL BE REQUIRED "1880 M LONG"
6. INITITAL CONSTRUCTION COST	LESS INVESTMENT	MORE INVESTMENT
7. ECONOMICAL & FINANCIAL EVALUATION (IN TERMS OF COST BENEFIT)	MORE FEASIBILITY	LESS FEASIBILITY
EVALUATION SUMMARY JUDGEMENT	RECOMMENDABLE	NOT RECOMMENDABLE

NOTE : IN COMPARISON WITH 1990 DEVELOPMENT PLAN

Table 8.2.2 CONSTRUCTION COST ESTIMATES OF ALTERNATIVE PLANS

Work Item	Items	Contents	CONSTRUCTION COST (X1,000,000 Rp)	
			Northern Development Plan	Southern Development Plan
Civil Work	Pavement Work	Runway	2,211	1,917
		Taxiway	2,189	4,172
		Apron	1,664	5,179
		Car Parking Area	205	468
	Drainage Work		701	690
	Earth Work		1,869	3,414
	Miscellaneous Work		438	469
	SUBTOTAL		9,277	16,309
Architectural Work	International PAX. Bldg.		10,162	10,746
	Domestic PAX. Bldg.		1,051	7,709
	Cargo Terminal Bldg.		993	993
	Others		818	2,686
	SUBTOTAL		13,024	22,134
Navigational Aids System Work	Navigational Aids		1,080	2,336
	Airfield Lighting		613	672
	SUBTOTAL		1,693	3,008
Services Facility Works	Power Supply & Generating System		295	2,044
	Others		584	1,168
	SUBTOTAL		879	3,212
Special Services Facility Works	Boarding Bridge		657	657
	SUBTOTAL		657	657
TOTAL			25,530	45,320

CONSTRUCTION COST UP 0.0%

	C O S T				B E N E F I T S				
	CONSTRUCTION COST	O & M	SAVED O & M	TOTAL COST	FOREIGN EXCHANGE BENEFIT	AIRPORT OPERATION (AIR)	AIRPORT OPERATION (LAND)	DOM.PAX TIME SAVE BENEFIT	TOTAL BENEFIT
1982	204.0	0.0	0.0	204.0	0.0	0.0	0.0	0.0	0.0
1983	1168.0	0.0	0.0	1168.0	0.0	0.0	0.0	0.0	0.0
1984	16551.0	0.0	0.0	16551.0	0.0	0.0	0.0	0.0	0.0
1985	27765.0	0.0	0.0	27765.0	0.0	0.0	0.0	0.0	0.0
1986	6227.0	921.0	0.0	7148.0	1156.0	311.0	17.0	60.3	1544.3
1987	0.0	921.0	0.0	921.0	3165.0	456.0	47.0	80.4	3748.4
1988	0.0	921.0	0.0	921.0	4990.0	498.0	74.0	80.4	5642.4
1989	0.0	921.0	0.0	921.0	6816.0	539.0	101.0	80.4	7536.4
1990	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
1991	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
1992	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
1993	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
1994	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
1995	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
1996	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
1997	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
1998	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
1999	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
2000	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
2001	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
2002	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
2003	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
2004	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
2005	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
2006	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
2007	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
2008	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
2009	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4
2010	0.0	921.0	0.0	921.0	9048.0	580.0	134.0	80.4	9842.4

DISCOUNT RATIO = 10.0 B/C RATIO = 1.1678 NPV = 7777.758

DISCOUNT RATIO = 15.0 B/C RATIO = 0.7950 NPV = -8089.223

DISCOUNT RATIO = 20.0 B/C RATIO = 0.5724 NPV = -14699.094

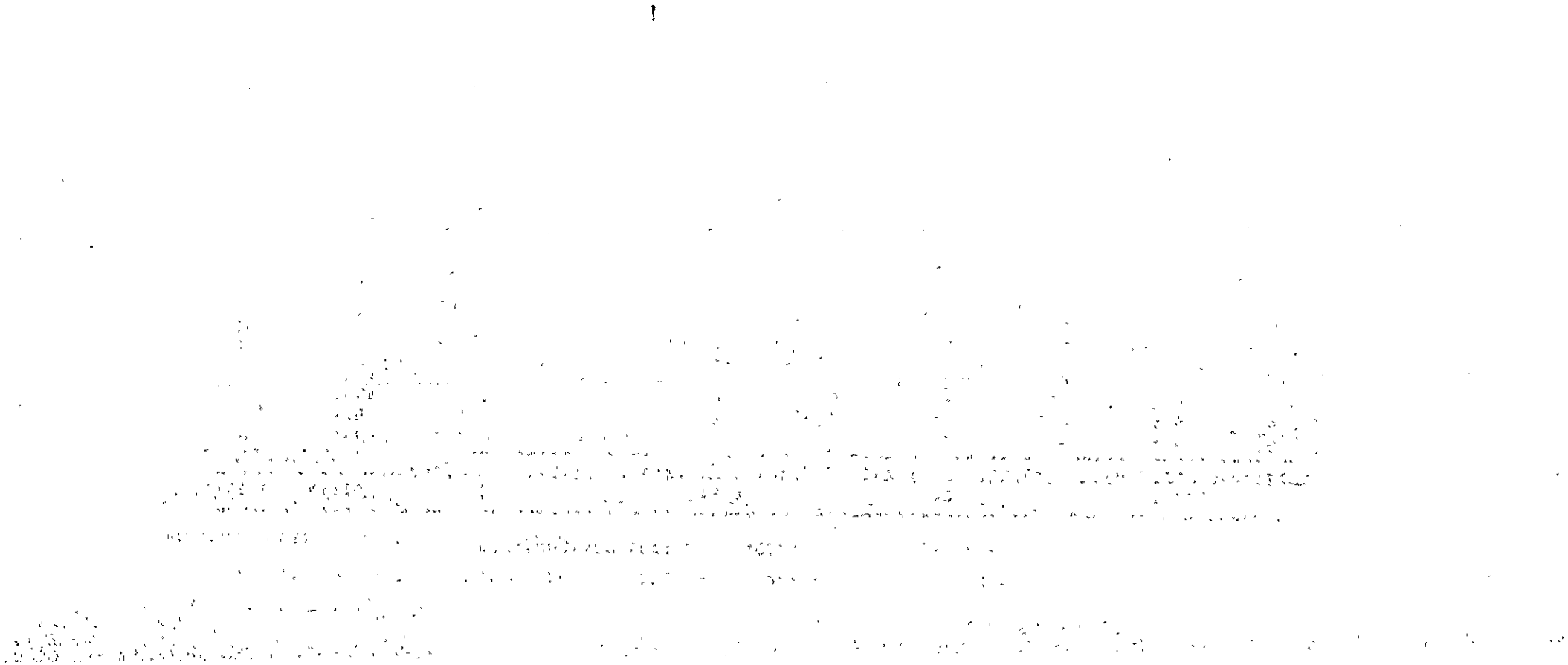
EIRR(%) = 11.9233

Table 8.2.3 CALCULATION OF COST-BENEFIT FLOWS

CONSTRUCTION COST UP 0.0%

DISCOUNT RATIO	10 %		15 %		20 %		11.9%	
	COST	BENEFIT	COST	BENEFIT	COST	BENEFIT	COST	BENEFIT
1982	204.0	0.0	204.0	0.0	204.0	0.0	204.0	0.0
1983	1061.8	0.0	1015.7	0.0	973.3	0.0	1043.6	0.0
1984	13678.5	0.0	12514.9	0.0	11493.8	0.0	13212.4	0.0
1985	20860.2	0.0	18255.9	0.0	16067.7	0.0	19803.2	0.0
1986	4882.2	1054.8	4086.9	883.0	3447.1	744.7	4555.1	984.1
1987	571.9	2327.5	457.9	1863.6	370.1	1506.4	524.4	2134.2
1988	519.9	3185.0	398.2	2439.4	308.4	1889.6	468.5	2870.4
1989	472.6	3867.4	346.2	2833.2	257.0	2103.3	418.6	3425.5
1990	429.7	4591.5	301.1	3217.5	214.2	2289.0	374.0	3997.0
1991	390.6	4174.1	261.8	2797.8	178.5	1907.5	334.2	3571.2
1992	355.1	3794.7	227.7	2432.9	148.7	1589.6	298.6	3190.8
1993	322.8	3449.7	198.0	2115.6	124.0	1324.7	266.8	2850.9
1994	293.5	3136.1	172.1	1839.6	103.3	1103.9	238.3	2547.1
1995	266.8	2851.0	149.7	1599.7	86.1	919.9	213.0	2275.8
1996	242.5	2591.8	130.2	1391.0	71.7	766.6	190.3	2033.4
1997	220.5	2356.2	113.2	1209.6	59.8	638.8	170.0	1816.7
1998	200.4	2142.0	98.4	1051.8	49.8	532.4	151.9	1623.2
1999	182.2	1947.3	85.6	914.6	41.5	443.6	135.7	1450.3
2000	165.6	1770.2	74.4	795.3	34.6	369.7	121.3	1295.8
2001	150.6	1609.3	64.7	691.6	28.8	308.1	108.3	1157.7
2002	136.9	1463.0	56.3	601.4	24.0	256.7	96.8	1034.4
2003	124.5	1330.0	48.9	522.9	20.0	213.9	86.5	924.2
2004	113.1	1209.1	42.6	454.7	16.7	178.3	77.3	825.7
2005	102.9	1099.2	37.0	395.4	13.9	148.6	69.0	737.8
2006	93.5	999.2	32.2	343.8	11.6	123.8	61.7	659.2
2007	85.0	908.4	28.0	299.0	9.7	103.2	55.1	589.0
2008	77.3	825.8	24.3	260.0	8.0	86.0	49.2	526.2
2009	70.3	750.7	21.2	226.1	6.7	71.6	44.0	470.2
2010	63.9	682.5	18.4	196.6	5.6	59.7	39.3	420.1
TOTAL	46338.6	54116.4	39465.4	31376.2	34378.8	19679.7	43411.2	43410.8

Table 8.2.4 CALCULATION OF EIRR



CHAPTER 9

DEVELOPMENT PLAN OF BALI INTERNATIONAL AIRPORT

CHAPTER 9 DEVELOPMENT PLAN OF BALI INTERNATIONAL AIRPORT

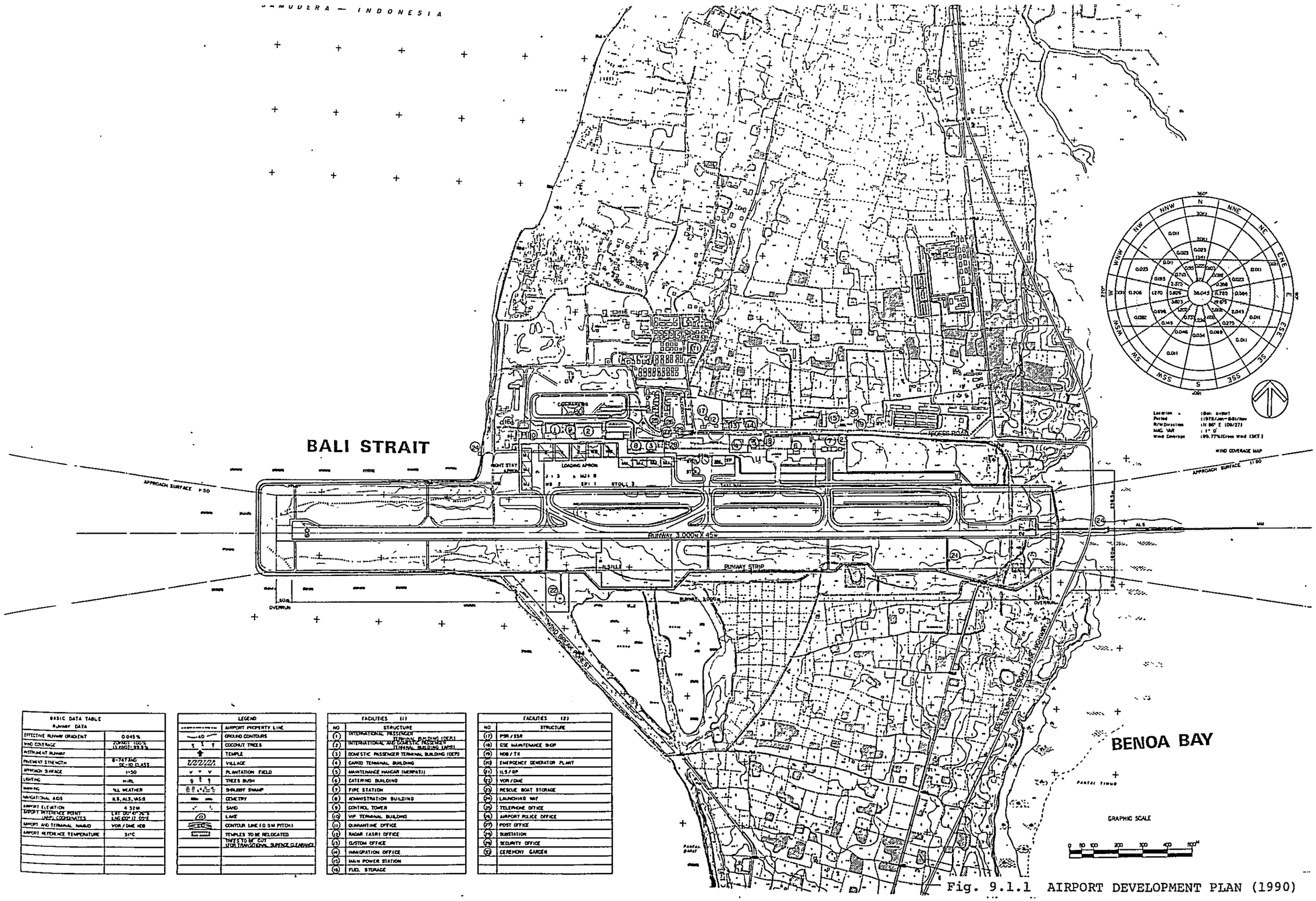
9.1 General

The development plan for improvements of Bali International Airport targetting the final completion in 2010 has been compiled on the basis of the scale of the required facilities mentioned in the Chapter 5 and on the evaluation made of the existing facilities discussed in the Chapter 6. The development plan is outlined in three phases, e.g. the Short Term Plan aimed at the year 1990, the Middle Term Plan for the year 2000 and the Long Term Plan targetting the year 2010, assessing the urgent necessities, the demand trends and other facotors.

The development plans are outlined in Table 9.1.1 and shown in Fig. 9.1.1 - 3 and 9.2.6 - 8.

Table 9.1.1 SUMMARY OF BIA's DEVELOPING PLAN

FACILITY \ TARGET YEAR		DEVELOPING PLAN			REMARK
		SHORT TERM PLAN (1990)	MIDDLE TERM PLAN (2000)	LONG TERM PLAN (2010)	
AIRSIDE INFRASTRUCTURES	RUNWAY	3.000^{m} x 45^{m}	3.000^{m} x 45^{m}	3.000^{m} x 45^{m}	
	RUNWAY STRIP	300^{m} x 3.120^{m}	300^{m} x 3.120^{m}	300^{m} x 3.120^{m}	
	TAXI WAY	2.050^{m} x 23^{m}	3.000^{m} x 23^{m}	3.000^{m} x 23^{m}	
	APRON	DOM 2: B - 747 1: DC - 10 8: DC - 9 1: SP,3:STOL INT'L 1: B - 747 1: DC - 10	DOM 3: B - 747 2: DC - 10 9: DC - 9 5: SP/STOL INT'L 3: B - 747	DOM 3: B - 747 5: DC - 10 2: DC - 9 2: SP/STOL INT'L 4: B - 747	
TERMINAL FACILITY	INTERNATIONAL PASSENGER TERMINAL BLDG.	18.400^{m2}	25.400^{m2}	35.000^{m2}	
	DOMESTIC PASSENGER TERMINAL BLDG.	13.200^{m2}	24.700^{m2}	38.000^{m2}	
	CARGO TERMINAL BLDG.	2.800^{m2}	4.400^{m2}	7.500^{m2}	
	ADMINISTRATION BLDG.	2.500^{m2}	3.500^{m2}	3.500^{m2}	
NAVIGATIONAL AIDS		Improve DME Relocate G/P Install M/M		Add ILS	
LAND SIDE FACILITY	CAR PARKING	325	540	800	
	ACCESS ROAD	1-lane	1-lane	1-lane	1-lane
UTILITY	AVIATION FUEL FACILITY (P.O.L.)	6.760 KL/WK	12.250 KL/WK	21.920 KL/WK	
	RESCUE&FIRE FIGHTING FACILITY	Cat-9	Cat-9	Cat-9	
	POWER SUPPLY FACILITY	3.500 KVA	5.600 KVA	8.100 KVA	



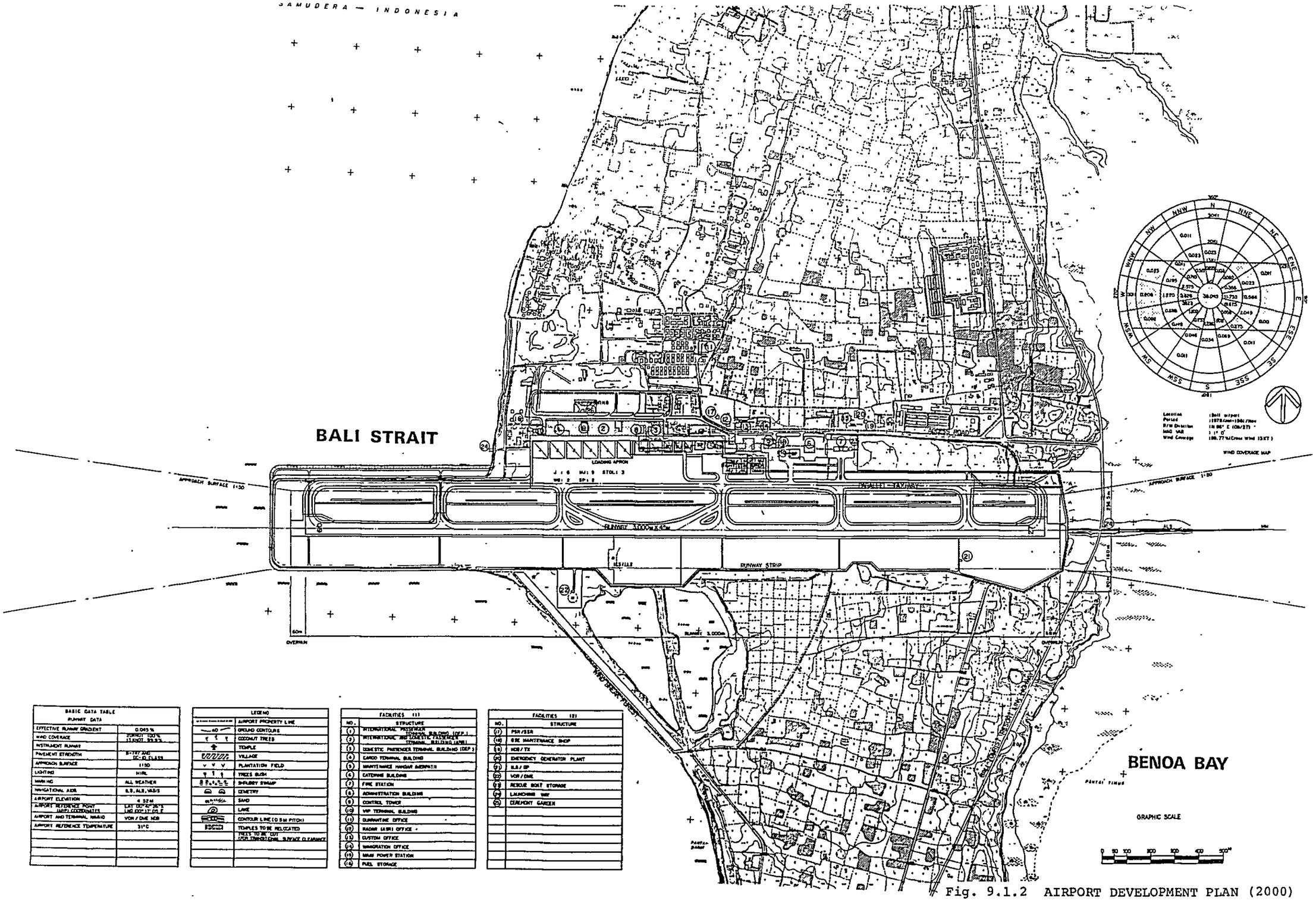
BASIC DATA TABLE Runway DATA	
EFFECTIVE RUNWAY GRADIENT	0.045%
WIND COVERAGE	20KNOT 100% (13KNOT) 99.8%
INSTRUMENT RUNWAY	
PAVEMENT STRENGTH	8-76 F/B/W/T PCN 50 R/B/W/T
APPROACH SURFACE	1:50
LIGHTING	HIRL
MARKING	ALL WEATHER
NAVIGATIONAL AIDS	ILS, ALS, VASIS
AIRPORT ELEVATION	4.32M
AIRPORT REFERENCE POINT (ARP) COORDINATES	LAT 08° 47' 16" S LONG 115° 10' 09" E
AIRPORT AND TERMINAL NAVAID	VOR / DME NDB
AIRPORT REFERENCE TEMPERATURE	31°C

LEGEND	
	AIRPORT PROPERTY LINE
40	GROUND CONTOURS
	COCONUT TREES
	TEMPLE
	VILLAGE
V V V	PLANTATION FIELD
	TREES BUSH
	SHALLOW SWAMP
	CEMETERY
	SAND
	LAKE
	CONTOUR LINE (0.5M PITCH)
	TEMPLES TO BE RELOCATED
	TREES TO BE CUT FOR TRANSITIONAL SURFACE CLEARANCE

FACILITIES (1)	
NO	STRUCTURE
(1)	INTERNATIONAL PASSENGER TERMINAL BUILDING (DEP.)
(2)	INTERNATIONAL AND DOMESTIC PASSENGER TERMINAL BUILDING (ARR)
(3)	DOMESTIC PASSENGER TERMINAL BUILDING (DEP)
(4)	CARGO TERMINAL BUILDING
(5)	MAINTENANCE HANGAR (MERPATI)
(6)	CATERING BUILDING
(7)	FIRE STATION
(8)	ADMINISTRATION BUILDING
(9)	CONTROL TOWER
(10)	VIP TERMINAL BUILDING
(11)	QUARANTINE OFFICE
(12)	RADAR (ASR) OFFICE
(13)	CUSTOM OFFICE
(14)	IMMIGRATION OFFICE
(15)	MAIN POWER STATION
(16)	FUEL STORAGE

FACILITIES (2)	
NO	STRUCTURE
(17)	PSR / SSR
(18)	GSE MAINTENANCE SHOP
(19)	NDB / TX
(20)	EMERGENCY GENERATOR PLANT
(21)	ILS / GP
(22)	VOR / DME
(23)	RESCUE BOAT STORAGE
(24)	LAUNCHING WAY
(25)	TELEPHONE OFFICE
(26)	AIRPORT POLICE OFFICE
(27)	POST OFFICE
(28)	SUBSTATION
(29)	SECURITY OFFICE
(30)	CEREMONY GARDEN

Fig. 9.1.1 AIRPORT DEVELOPMENT PLAN (1990)



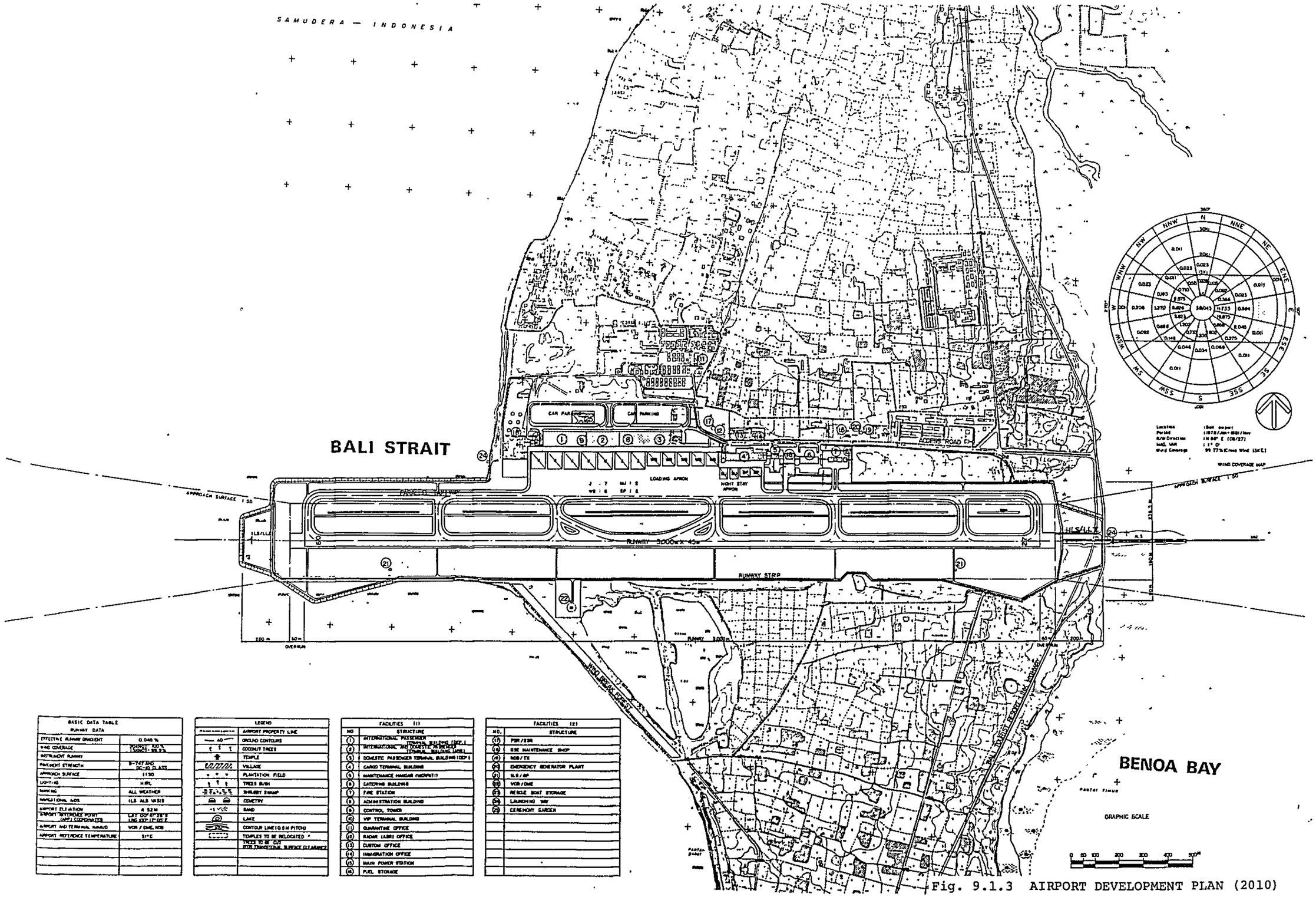
BASIC DATA TABLE (RUNWAY DATA)	
EFFECTIVE RUNWAY GRADIENT	0.045 %
WIND COVERAGE	20KNOT 100 % 13 KNOT 99.9 %
INSTRUMENT RUNWAY	
PAVEMENT STRENGTH	B-767 2ND DC-8 CLASS
APPROACH SURFACE	1:50
LIGHTING	HIRL
MARKING	ALL WEATHER
NAVIGATIONAL AIDS	ILS, ALS, VASIS
AIRPORT ELEVATION	4.32 M
AIRPORT REFERENCE POINT (ARP) COORDINATES	LAT 08°45'36"S LNG 115°10'05"E
AIRPORT AND TERMINAL RADIO	VOR / DME NDB
AIRPORT REFERENCE TEMPERATURE	31°C

LEGEND	
	AIRPORT PROPERTY LINE
60	GROUND CONTOURS
	COCONUT TREES
	TEMPLE
	VILLAGE
	PLANTATION FIELD
	TREES BUSH
	SHRUBBY SWAMP
	CEMETERY
	SAND
	LAKE
	CONTOUR LINE (0.5m PITCH)
	TEMPLES TO BE RELOCATED
	TREES TO BE CUT FOR TRANSITIONAL SURFACE CLEARANCE

FACILITIES (I)	
NO.	STRUCTURE
1	INTERNATIONAL PASSENGER TERMINAL BUILDING (DEP.)
2	INTERNATIONAL AND DOMESTIC PASSENGER TERMINAL BUILDING (ARR.)
3	DOMESTIC PASSENGER TERMINAL BUILDING (DEP.)
4	CARGO TERMINAL BUILDING
5	MAINTENANCE HANGAR (MERPATI)
6	CATERING BUILDING
7	FIRE STATION
8	ADMINISTRATION BUILDING
9	CONTROL TOWER
10	VIP TERMINAL BUILDING
11	QUARANTINE OFFICE
12	RADAR (ARR.) OFFICE
13	CUSTOM OFFICE
14	IMMIGRATION OFFICE
15	MINI POWER STATION
16	FUEL STORAGE

FACILITIES (II)	
NO.	STRUCTURE
17	PSR/SSR
18	GSE MAINTENANCE SHOP
19	MDB / TX
20	EMERGENCY GENERATOR PLANT
21	ILS / GP
22	VOR / DME
23	RESCUE BOAT STORAGE
24	LAUNCHING WAY
25	CEREMONY GARDEN

Fig. 9.1.2 AIRPORT DEVELOPMENT PLAN (2000)



BASIC DATA TABLE	
RUNWAY DATA	
EFFECTIVE RUNWAY GRADIENT	0.048 %
WIND COVERAGE	CROSS: 320 % LIMIT: 99.3 %
INSTRUMENT RUNWAY	
PAVEMENT STRENGTH	B-747 SAS DC-10 21.4%
APPROACH SURFACE	1:50
LIGHTING	HIRL
MARKING	ALL WEATHER
NAVIGATIONAL AIDS	ILS ALS VASIS
AIRPORT ELEVATION	4.52 M
AIRPORT REFERENCE POINT (APP.) COORDINATES	LAT 08° 45' 38" S LONG 115° 10' 05" E
AIRPORT AND TERMINAL NAVAID	VOR / DME, NDB
AIRPORT REFERENCE TEMPERATURE	31°C

LEGEND	
	AIRPORT PROPERTY LINE
	GROUND CONTOURS
	COCONUT TREES
	TEMPLE
	VILLAGE
	PLANTATION FIELD
	TREES BUSH
	SHRUBBY SWAMP
	CEMETRY
	SAND
	LAKE
	CONTOUR LINE (0.5 M PITCH)
	TEMPLES TO BE RELOCATED * TREES TO BE CUT FOR TRANSITIONAL SURFACE CLEARANCE

FACILITIES (1)	
NO	STRUCTURE
(1)	INTERNATIONAL PASSENGER TERMINAL BUILDING (EXIST.)
(2)	INTERNATIONAL AND DOMESTIC PASSENGER TERMINAL BUILDING (NEW)
(3)	DOMESTIC PASSENGER TERMINAL BUILDING (EXIST.)
(4)	CARGO TERMINAL BUILDING
(5)	MAINTENANCE HANGAR (NERPATI)
(6)	CATERING BUILDING
(7)	FIRE STATION
(8)	ADMINISTRATION BUILDING
(9)	CONTROL TOWER
(10)	VIP TERMINAL BUILDING
(11)	QUARANTINE OFFICE
(12)	RADAR (ARR) OFFICE
(13)	CUSTOM OFFICE
(14)	IMMIGRATION OFFICE
(15)	MAIN POWER STATION
(16)	FUEL STORAGE

FACILITIES (2)	
NO.	STRUCTURE
(17)	PSR / SSR
(18)	GSE MAINTENANCE SHOP
(19)	NDB / TX
(20)	EMERGENCY GENERATOR PLANT
(21)	ILS / GP
(22)	VOR / DME
(23)	RESCUE BOAT STORAGE
(24)	LAUNCHING WAY
(25)	CEREMONY GARDEN

Fig. 9.1.3 AIRPORT DEVELOPMENT PLAN (2010)