CHAPTER 4

BASIC POLICY ON DEVELOPMENT OF BALI INTERNATIONAL AIRPORT

CHAPTER 4 BASIC POLICY ON DEVELOPMENT OF BALI INTERNATIONAL AIRPORT

4.1 Purpose and Policy of Planning

The establishment of a Development Plan for Bali International Airport Improvement and Expansion, aims at constructing a safe and pleasant user-oriented airport facility functional and attractive enough to be the main eastern gate way for Indonesia, providing safe operation for aircraft and the efficient utilization of the airport facilities. It is also designed to provide for expanding the scale of the facilities to meet the growing demand in air transportation for Indonesia.

To achieve this goal, the proposal for the Development Plan is outlined as follows:

(1) The location and the structure of the runway, the runway strip, the taxiway and the apron, the plan must be made to satisfy ICAO standards established for providing safe operation of aircraft, and to achieve operational efficiency.

(2) The runway should be constructed with sufficient length so as not to over restrict the weight limitation for wide-bodied aircraft take-offs.

(3) Based on the role of BIA as an international airport and the meteorological conditions surrounding the airport, it is planned to operate the runway with CAT-1 ILS.

(4) The terminal facilities including the apron and the passenger and cargo terminal buildings, are to be planned to provide adequate scale of facilities based on an assessment of the air transport demand for each target year. The facilities will be effectively laid out to offer advantages to users.

(5) Much consideration has been given to utilization of the existing facilities so that they will also be useful in the future and will be economically efficient.

(6) To prepare for the future expansion of the facilities, a certain flexibility is maintained in the plan.

4.2 Target Years

The target year is set for the year 2010, considering the limited accuracy of the forecast and the life-span for a project of this kind. The period up to the target year is divided into three phases: the Short Term Plan targetting the year 1990 (taking into account the Planned years for Repelita, the development plan which is compiled and will be implemented), the Middle Term Plan targetting the year 2000, and the Long Term Plan targetting the year 2010. All these phases will consider the necessary improvements which may arise in the immediate, in the Middle Term and in the Long Term

As mentioned earlier, since Bali International Airport currently has various problems (including the limited length of the runway, insufficiency of the runway strip to qualify under ICAO recommendation, and the limited capacity of the terminal buildings), the Short Term Plan targetting the year 1990 focuses on the solution of these immediate problems.

CHAPTER 5

AIRPORT FACILITY REQUIREMENTS

CHAPTER 5 AIRPORT FACILITY REQUIREMENTS

5.1 GENERAL

In this chapter, the required facilities and the scheme that will be staged in accordance with the target year of the development and its intermediate stages in light of future air traffic demand is studied.
The facilities will be established taking into consideration the importance of the Bali International Airport as the second largest international airport in Indonesia and the fact that it acts as the eastern gate way of Indonesia.
In order to determine the most appropriate scheme for the facilities, the applicable international standards and recommendations issued by ICAO (International Civil Aviation Organization), JCAB (Japan Civil Aviation Bureau) and FAA (Federal Aviation Administration) have been referred to in terms of development level, unit rate of facility requirements and design practice.
The most recent issue of the ICAO Annex 14 which will be in effect beginning in 1983 has been applied.

Table 5.1.1 indicates the results of the airport facility requirement study used later in the plans and studies on Bali International Airport Development, in five year stages up to the year 2010.

Table 5.1.1 AIR TRAFFIC DEMANDS AND FACILITIES REQUIREMENTS

	ITEM \ YEAR	Present Condition as of 1981	1990	1995	2000	2005	2010	REMARKS
AIR TRAFFIC FORECAST	1. Annual Passenger (x 1000)	DOM 554	2,021	2,838	3,962	4,960	6,145	See NOTE
		INT'L 316	574	886	1,261	1,727	2,320	
		TOTAL 870	2,595	3,724	5,223	6,687	8,465	
	2. Annual Cargo Volume (Ton)	3,000	9,300	14,500	22,300	33,000	49,100	
	3. Annual Aircraft Movement	19,300	25,100	25,800	30,700	35,500	42,600	
	4. Peak Hour Passenger		770	1,030	1,260	1,520	1,890	
	5. Peak Hour Aircraft Movement	12	12.7	13.2	13.4	14.3	18.2	
FACILITY REQUIREMENT	6. Runway	2,700^{m}x45^{m}	3,000^{m}x45^{m}	3,000^{m}x45^{m}	3,000^{m}x45^{m}	3,000^{m}x45^{m}	3,000^{m}x45^{m}	
	7. Runway Strip	200^{m}x2,900^{m}	300^{m}x3,120^{m}	300^{m}x3,120^{m}	300^{m}x3,120^{m}	300^{m}x3,120^{m}	300^{m}x3,120^{m}	
	8. Taxiway	P.T/W 1,750^{m}x30^{m}	P.T/W 2,050^{m}x23^{m}		P.T/W 3,000^{m}x23^{m}			
	9. Passenger Terminal Apron	DOM 2:DC-9 7:F-28 6:SP/STOL INT'L 1:B-747 2:DC-10	DOM 2:B-747 1:DC-10 8:DC-9 1:SP 3:STOL INT'L 1:B-747 1:DC-10	DOM 2:B-747 2:DC-10 10:DC-9 2:SP INT'L 3:B-747	DOM 3:B-747 2:DC-10 9:DC-9 5:SP INT'L 3:B-747	DOM 3:B-747 3:DC-10 2:DC-9 2:SP INT'L 3:B-747	DOM 3:B-747 5:DC-10 2:DC-9 2:SP INT'L 4:B-747	
	10. Passenger Terminal Building (m^{2})	DOM 3,350	13,200	18,600	24,700	30,000	38,000	
		INT'L 6,070	18,400	24,000	25,400	30,000	35,000	
	11. Cargo Terminal Building (m^{2})	1,800	2,800	4,400	4,400	5,000	7,500	
	12. Administration Building (m^{2})	2,450	3,530	3,530	3,530	3,530	3,530	
	13. Air Navigation Systems		DME G/P M/M	-	-	-	Add ILS at 09	
	14. Parking Lot (No.)	180	325	440	540	640	800	
	15. Access Road (For each direction)	2 lanes	1 lane	1 lane	1 lane	1 lane	1 lane	
	16. Fuel Supply (Storage Capacity)		kl 6,780	kl 8,490	kl 12,250	kl 16,540	kl 21,920	
	17. Rescue and Fire-Fighting	Cat-7	Cat-9	Cat-9	Cat-9	Cat-9	Cat-9	
	20. Utilities Electricity (KVA)	1,280	3,500	4,700	5,600	6,600	8,100	

NOTE: Mixed-flight between JKT-DPS is included in "DOM".

5.2 Airside Infrastructures

5.2.1 Runway

(1) Direction

The direction of the runway shall be located so that it shall accommodate more than 95% of the wind coverage in order to provide the greatest aircraft movement efficiency.

(2) Runway Length

For airport operations, the length of runway is a very important factor related to limitations on the operable type of aircraft which can land and/or take-off from the airport.
It determines any restriction on the take-off weight of the aircraft.
At the present time the longest international route from Bali International Airport is the route to Tokyo, the length of which is 3,224 NM (5,971 Km). Other international routes from BIA such as to Sydney, Melbourne, Perth and Darwin in Australia are shorter than the Tokyo route.
It is anticipated that no new routes longer than 6,000 Km from BIA will be opened in the future for the following reasons:

i The opening of a Honolulu route (DPS-HNL) in the future could be possible, however, its share of total movements is expected to be small.
It will not be necessary to develop a 3,600-meter runway for direct flights, because a technical landing could be made at BIAK airport.

ii Necessity of substitute airports:
Singapore and surabaya are designated ad

substitute international airports for Jakarta/Halim International Airport for B-747s and DC-10s. Taking this fact into consideration, there is no need to have an extension of Bali International Airport's runway.

The runway length to be required for the route between DPS-TYO is calculated on the basis of GIA information as follows.

Assumptions

a. Type of Aircraft: B-747-200B, DC-10-30

b. Design Route (Longest):

Destination Alternate

- Take-off; DPS $\xrightarrow[\text{3,224NM}]{}$ TYO ---515NM---> FUK
- Landing; TYO $\xrightarrow{\qquad}$ DPS ---------> SUB

c. OAT (out of Airport Temperature): 31°C

d. Payload: Maximum for both passenger and cargo

e. Elevation: Zero feet

f. RWY Slope: Zero percent

g. Wind: Zero wind

The length of the runway which is required under the above conditions is shown in Table 5.2.1. Here, the take-off of DC-10s is critical, justifying its extension to 3,200m. For the computation of Table 5.2.1, see APPENDIX 5.2.1 and 5.2.2.

Table 5.2.1 RUNWAY LENGTH REQUIREMENT

Aircraft	Runway Required	
	Take-off	Landing (wet)
B-747	2,800m (20° FL) 3,000m (10° FL)	2,600m (25° FL) 2,500m (30° FL)
DC-10	3,200m (12° FL)	2,300m (35° FL) 2,200m (50° FL)

As will be discussed in Chapter 9, however, there are obstacles or factors which make the extension difficult should the existing runway be extended east to west or vice versa. For this reason, an economical extension of the runway would be a length of 300m. If the runway length is 3,000m, then no weight restriction is required for B-747's and only 5% of weight restriction against payload would be required for DC-10 aircraft. It is very difficult to predict take-off or landing performance of the aircraft to be used 30 to 40 years in the future; however, since there are some difficulties in extending runway lengths at many airports in the world, these conditions must be taken into consideration in future aircraft design and development. From the reason mentioned above, it is our judgement that a 3,000m runway length is sufficient to accommodate wide bodied aircraft such as B-747 and DC-10 for the future.

(3) Width of Runway

The runway shall not be less than 45m in accordance with ICAO recommendations.

(4) Pavement Strength

Pavement strength for the runway shall be determined by the largest aircraft, that will take off from the airport, and LCN 100 shall be required for B-747 at BIA.

(5) Number of Runways

The capacity of the runway is considered to be about 40 movements per hour at IFR (Instrument Flight Rule) and about 420 movements per day, or about 80,000 to 140,000 movements per year. Therefore, one runway will be enough for the project year 2,010.

5.2.2 Runway Strip

A 300m wide is required for a CAT-I precision approach runway.

5.2.3 Taxiway

The width of the taxiway shall be 23m in compliance with ICAO recommendations, and the pavement strength shall be LCN 100 the same as the runway.

(1) Parallel Taxiway

A full parallel taxiway in 1990 is necessary based on yardsticks for the establishment of a parallel taxiway, such as the frequency of peak-hour movement and frequency of operations of wide-bodied aircraft.

The location of the parallel taxiway shall be in accordance with ICAO recommendations.

The prevailing recommendation requires a distance of more than 150 m between the edge of the runway pavement and edge of the taxiway pavement for CAT-I precision approach operations.

This recommendation will be amended in 1983, and according to the draft of this issue, the distance between runway center line and taxiway center shall be more than 180 m. This study will follow the draft of the 1983 ICAO issue.

As will be explained in Chapter 9, a full parallel taxiway will be constructed in the Middle Term Plan. However, in the Short Term Plan about 2000m long parallel taxiway will be carried out.

(2) High Speed Exit Taxiway

According to ICAO recommendation - Aerodrome Design Manual Part 2 (Taxiways, Aprons and Holding Bays), a high speed exit taxiway should be planned when the design peak hour movement is more than 25. However, the design peak hour movement in 2010 shown in Table 3.7.9 in page 3-48 is only 18.2. Therefore, it is not necessary to install high speed exit taxiway in BIA.

(3) Exit Taxiway

Locations of exit taxiway are dominated by its touch down, touch down speed and rate of declination when aircraft are in take-off or in landing. According to ICAO's information, the required length of runway for aircraft is outlined as follows:

Type of aircraft	the required length of runway
F-28	1,000 m
DC-9, B-737, B-727	1,800 m
DC-10	2,000 m
B-747-200	2,300 m

Taking into consideration various types of aircraft operation of BIA, some exit taxiways are necessary to provide in the parallel taxiway. Therefore, exit taxiways are planned to be installed at 500 m interval in the parallel taxiway based on JCAB standards.

5.2.4 Apron

(1) Aircraft Parking Configutation

Aircraft parking configutation on the apron is generally classfied into two parking methords namely; a nose-in parking and a self maneuvering parking. The characteristics of the two parking configurations are described below.

- In general a self maneuvering parking configuration requires a large apron area than a nose-in parking one.
- Nose-in parking configuration combined with pax. boarding bridges would be possible to handle a large number of pax. safely and to improve pax. service level and time control in operation.
- General speaking, a self maneuververing parking configuration has a serious problem that is, pax. are inconvenienced by having to cross the apron through the ground service equipment while it is in operation.

Taking into consideration BIA's apron characteristics, aircraft parking configuration on the apron is planned as follows.

(a) Short Term Plan

Nose-in parking is considered for widebodied large aircraft. The reason is that to shorten the time required for handling a large number of passengers and to reduce the required apron area.

With regard to other aircraft, the presently adopted self maneuvering parallel parking configuration will be continued.

(b) Middle and Long Term Plan

For the Middle Term Plan and the Long Term Plan, since the required number of aircraft stands and GSE will increase, an exclusive nose-in parking configuration should be adopted for jet airliners in the apron.

(2) Required Number of Aircraft Stands

(a) Loading Apron

The following formula is used to obtain the required number of aircraft stands for the key years.

$$s = \sum \left(\frac{Ti}{60} \times Ni\right) + \alpha$$

Where s: Required number of aircraft stands,

Ti: Gate occupancy time of aircraft of Category (i) in minutes,

Ni: Number of arriving aircraft of Category (i) during the peak hour,

α: One extra stand for the largest aircraft of the planning year for unexpected peaking occasion. (1 extra for each 10 stands)

(b) Night Stay Apron

At the present time, a maximum total of 14 aircraft, including one DC-10 (GIA), one DC-9 (GIA) and six F-28 (GIA) and six DHC-6 (MNA) remain overnight. Airline officials say that there will be no change in the overnight accommodation policy even after the New Chengkareng International Airport is opened.

The number of overnight aircraft is calculated based on the equation below. However, the number of overnight aircraft will presumably drop compared with the frequency of departures and arrivals on the peak day due to a rise in the frequency of operations in the future.

Sn = Md x C

Where; SN: Number of stands necessary for overnight accommodation of aircraft by size
Md: Frequency of departures and arrivals on the peak day
C: Coefficient

In this equation, the following values based on the actual records in December 1981 are used for.

The Coefficient (C)

	1985	1990	1995 and later
Large jets, wide-bodied jets	0.19	0.19	0.19
Medium, small jets	0.52	0.4	0.3
LS propeller-aircraft	0.47	0.4	0.3

(c) Classification of Aircraft

Apart from the aircraft classification by seating capacity, the following classification is made for planning the aircraft parking area taking into account wing span, overall length, etc. of aircraft as shown in Table 5.2.2.

Table 5.2.2 AIRCRAFT CLASSIFICATIONS FOR APRON

Category	Classification		Wing Span in meter		Overall Length(m)	
A	B 747		60		70	
B	DC10, A 300, B 767		51		56	
C	up to 1995 DC 9, F 28	after 1995 DC 9-80	29	33	37	46
D	F-27		30		32	
E	STOL		20		16	

(d) Gate Occupancy Time

The gate occupancy time for each category is estimated as shown in Table 5.2.3 , by considering the present parking time according to the current timetables, with some allowance for delay.

Table 5.2.3 GATE OCCUPANCY TIME

Category	Gate occupancy time (min.)	Actual parking time based on the timetables (min.)
INTERNATIONAL		
A	75	90. 60
B	90	60
C	55	45
DOMESTIC		
A	70	60
B	70	60
C	55	DC-9:45, F-28:45
D	45	HS-748:30, F-27:35
E	45	35

(e) Required Number of Aircraft Stands

The number of stands has been calculated and is shown in the APPENDIX 5.2.3 and 4 based on the aforementioned assumptions and is summarized in Table 5.2.4.

Table 5.2.4 REQUIRED NUMBER OF AIRCRAFT STANDS

Year	A	B	C	D	E	Total
INTERNATIONAL						
1985	1	1	*1			2
1990	1	1	*1			2
1995	3*2		*1			3
2000	3		*1			3
2005	3		*1			3
2010	4	*1				4
DOMESTIC						
1985	2	1	6(4)*3	2(1)	6(4)	17
1990	2	1	8(5)	1	3(2)	15
1995	2	2	10(6)	2(1)		16
2000	3	2	9(6)	5(4)		19
2005	3	3	2(1)	2(1)		10
2010	3	5	2(1)	2(1)		12

*1 Included in the surplus of A or B due to one return trip per day.

*2 The spare stands up to 1990 will be used in common for international and domestic routes. For international routes, separate spare stands will be planned beginning with 1995.

*3 Night stay stands are shown in the parenthses.

(3) Unit Parking Space Requirements

The dimensions of parking spaces for different aircraft types are as indicated in Table 5.2.5.

Table 5.2.5 AREA OF PARKING SPACE

Aircraft Classification	Nose-in Push-out	Self Maneuvering
A	68m x 190m	-
B	60m x 160m	93m x 110m
C	up to 1995 after 1995	55m x 100m
	37m x 75m 41m x 90m	
D	-	55m x 70m
E	-	25m x 40m

Note: The interval between aircraft wing tips will be set at 7.5m for a wing span of more than 30m and 4.5m for that of 15-23m based on ICAO recommendations.

5.3 Obstacle Limitation Surfaces

The obstacle limitation surface is to be established for a CAT-I precision approach runway (3,000m in length) in accordance with ICAO ANNEX 14.
The dimensions and slopes for each obstacle limitation surface are as shown in Figs. 5.3.1 and 5.3.2 and Table 5.3.1.

Table 5.3.1 DIMENSIONS AND SLOPES OF OBSTACLE LIMITATION SURFACE APPROACH RUNWAY

Runway Classification Surface and Dimensions	Precision Approach
	Category I
	Code Letter A (4)
CONICAL	
Slope	5%
Height	100 m (350 ft)
INNER HORIZONTAL	
Height	45 m (150 ft)
Radius	4,000 m (13,000 ft)
INNER APPROACH	
Width	120 m (400 ft)
Distance from threshold	60 m (200 ft)
Length	900 m (3,000 ft)
Slope	2%
APPROACH	
Length of inner edge	300 m (1,000 ft)
Distance from threshold	60 m (200 ft)
Divergence (each side)	15%
First Section	
Length	3,000 m (10,000 ft)
Slope	2%
Second Section	
Length	3,600 m (12,000 ft)
Slope	2.5%
Horizontal Section	
Length	8,400 m (28,000 ft)
Total Length	15,000 m (50,000 ft)
TRANSITIONAL	
Slope	14.3%
INNER TRANSITIONAL	
Slope	33.3%

(Continued)

TAKE-OFF RUNWAY

Runway Classification Surface and Dimensions	Main take-off runways
	Code Letter A (4)
TAKE-OFF CLIMB	
Length of inner edge	180 m (600 ft)
Distance from runway end	60 m (200 ft)
Divergence (each side)	12.5%
Final width	1,200 m (4,000 ft)
Length	15,000 m (50,000 ft)
Slope	2%

NOTE; Parenthesis " ( ) " shows code letters in ANNEX-14 which is to be amended in 1983.

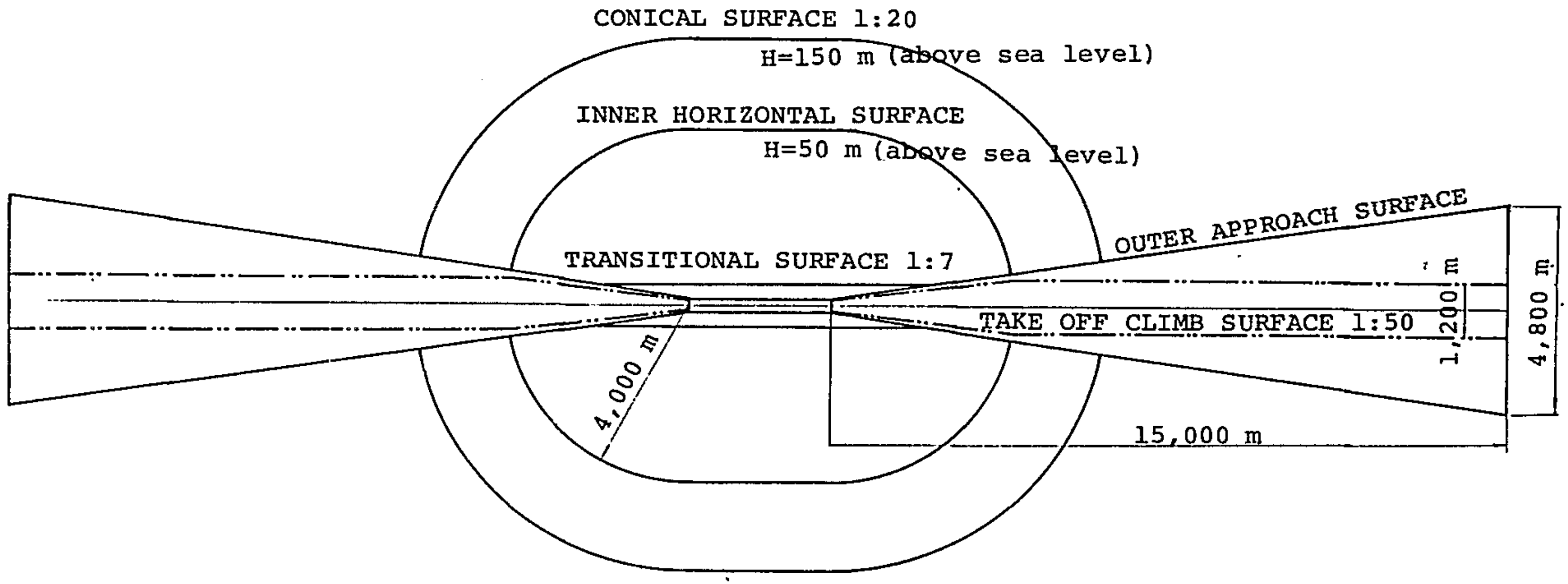


Fig. 5.3.1 OBSTACLE LIMITATION SURFACE (1)

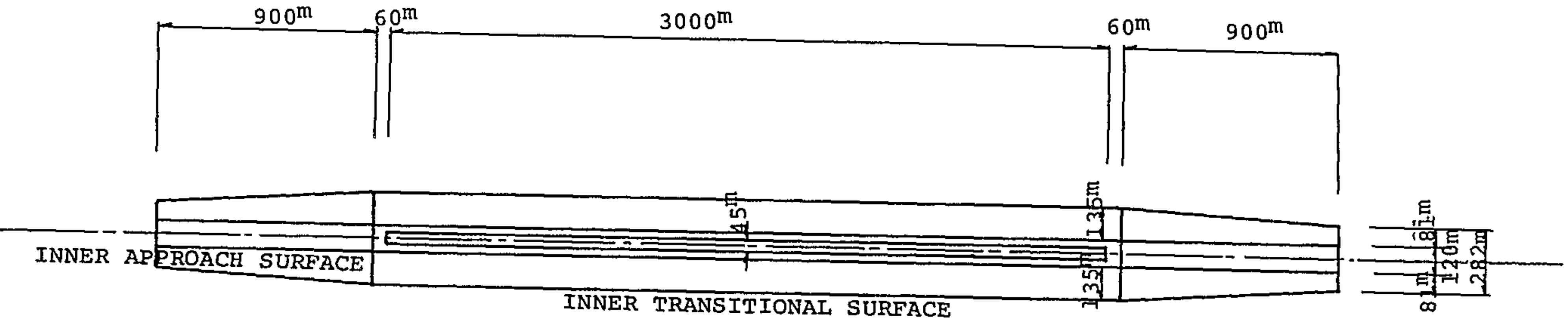


Fig 5.3.2 OBSTACL LIMITATION SURFACE (2)

5.4 Air Navigation Aids

The Air Navigation Aids system includes, Navigational Aids for Final Approach & Landing Aids, Terminal Aids and long-range Aids, Air Traffic Control System by the air communication, Visual Aids System and meteorogical system.

The Navigation Aids for CAT-I ILS Operation of BIA required for a forecast volume of 42,600 Annual Aircraft Movements at long term plan are as follows:

- Navigation aids
    - ILS
    - Middle Marker
    - Outer Marker or DME

- Visual Aids System (Airfield Lighting)
    - Runway Edge Lights
    - Runway End Lights
    - Runway Threshold Light
    - Runway Threshold Identification Light (only 09 Side)
    - Approach Lights
    - Visual Approach Slope Indication System
- Meteorogical System
    - Transmissometer (RWY Visual Range Meter)
    - Precipitation Gauge
    - Ceilometer
    - Wheather Data Collecting Equipment.

It is necessary to remove or modify the location of Glide Path Antenna, VASIS, ALS, Runway & Taxiway and Apron edge light and Apron floodlight in compliance with the developed plan of Runway & Taxiway and Apron.

5.5 Passenger & Cargo Terminal Facilities and Other Building

5.5.1 International Passenger Terminal Building

The floor area requirement for International passenger Terminal Building is calculated by the formula as follows.

The required
floor area = Number of the peak hour passengers
x the floor unit rate (m^2/PAX)

In accordance with JCAB standards, the standard floor unit rate is 35 m^2/PAX composed of 15m^2/PAX for Public area and 20m^2/PAX for C.I.Q area.

Since there were a few well-wishers at Bali International Airport based on inspection at the site, the standard floor unit rate 35m^2/PAX will be reasonable. Hence, the floor unit rate required for the Passenger Terminal Building is established at 35m^2/PAX. Facility requirements including calculation for length of conveyors are mentioned in the APPENDIX 5.5.1 -11.
The required floor areas are estimated and are tabulated in Table 5.5.1.

Table 5.5.1 REQUIRED FLOOR AREA FOR INTERNATIONAL PASSENGER TERMINAL BUILDING

YEAR / ITEMS	1990	1995	2000	2005	2010
PEAK HOUR PASSENGER	525	685	725	845	1,005
FLOOR AREA (M2)	18,400	24,000	25,400	30,000	35,000

5.5.2 Domestic Passenger Terminal Building

The floor area requirement for the Domestic Passenger Terminal Building is estimated by the same formula as the International Passenger Terminal Building.

As to the standard floor unit rate, it is in the range between 15m^2/pax and 20m^2/pax for the domestic passenger terminal building.

Hence, the floor unit rate required for the Passenger Terminal Building is adopted at 17.5m^2/pax.
Facility requirements including calculation for length of conveyors in the APPENDIX 5.5.11 - 12. The required floor areas are calculated and are shown in Table 5.5.2.

Table 5.5.2 REQUIRED FLOOR AREAS FOR DOMESTIC PASSENGER TERMINAL BUILDING

ITEMS \ YEAR	1990	1995	2000	2005	2010
PEAK HOUR PASSENGER	756	1,065	1,410	1,715	2,170
FLOOR AREA (M^2)	13,200	18,600	24,700	30,000	38,000

5.5.3 Cargo Terminal Building

The cargo handling area for a Cargo Terminal Building is estimated by multiplying the annual cargo volume ton by the cargo handling capacity (m^2/ton) taking into consideration the characteristics of cargoes. Total floor area for a Terminal Building is generally estimated to be 1.5 times the cargo handling area so as to include the floor area for airline offices, cargo agents, custom offices etc.

Since the existing Cargo Terminal Building is being managed manually, the manual handling capacity is generally calculated to be 5 ton/m^2. It is assumed that the manual handling system will be continued until 1995 and thereafter some mechanical handling system will be adopted.

Accordingly, the cargo handling capacity applied for the Cargo Terminal area is as follows.

Manual handling unit area	: 0.2 m^2/Ton Until 1995
Some simple mechanical handling unit area	: 0.1 m^2/Ton After 1995

The required floor areas are estimated as shown in Table 5.5.3.

Table 5.5.3 THE REQUIRED FLOOR AREAS FOR CARGO TERMINAL BUILDING BY KEY YEARS

YEAR / ITEMS	1990	1995	2000	2005	2010
ANNUAL CARGO VOLUME (TON)	9,300	14,500	22,300	33,000	49,100
CARGO HANDLING AREA (M^2)	1,860	2,900	2,900	3,300	5,000
CARGO TERMINAL BLDG. (M^2)	2,800	4,400	4,400	5,000	7,500

5.5.4 Maintenance Hangar

Based upon airline requests and plans, maintenance hangars are to be constructed at BIA.
Garuda Indonesian Airways and Merpati Nusantara Airline have their own development plan concerning the maintenance hangar at BIA:

Garuda Indonesian Airways (GIA):

At the present time, GIA has no intention of building their own maintenance hangar at BIA, however a new maintenance shop for ground service equipment (GSE) is requried.

Merpati Nusantara Airline (MNA):

About 18,000 sq.meter (150m x 120m) of land is required for the future development of maintenance base (apron, hangar, car parking, etc.) for MNA.

These facilities requested by the airlines as outlined above are considered for development during the Middle Term Plan .

5.6 Administration and Operational Facilities

5.6.1 Administration Building

An administration building will be required for the airport administration and the air traffic control staffs and also for the relevant air navigational equipment rooms after the Middle Term Plan.
The required floor area of the building will be about 3,500m^2 in accordance with JCAB standards.
Details are explained in Table 5.6.1 including JCAB Standards for the Administration Building.

5.6.2 Control Tower (TWR)

A control tower with a floor area of about 60m^2 will be provide in the Short Term Plan considering the posutions for aerodrome control, approach and FIS control, visual aids control and provisional surface movement. The height of the tower cab will be set around 27m based on FAA standards.

5.6.3 Rescue and Fire Fighting

The facility requirements for rescue and fire fighting services are estimated in compliance with ICAO AIRPORT SERVICE MANUAL, part I and the ammendmented to Annex 14 determined in the aerodrome, Air Routes and Ground Aids (AGA) Divissional Meeting (1981).
The facility requirement are calculated as shown in Table 5.6.2 and CAT-9 is required in the Short Term Plan.
The airport category is determined by the overall lenght of the longest aircraft normally using the airport and their maximum fuselage width. The frequency of aircraft operation are estimated to be in the busiest consecutive 3 months of 1985.

Table 5.6.1 JCAB STANDARDS FOR ADMINISTRATION BLDG.

Classification	A	B	C	D	E	F
Airport Operation	24h	13h	13h	11.5h	10h	—
Radar						
Scan	○					
ARTS	○	○				
ASR	○	○	○			
Meteorological Facilities	○	○	○	○	○	○
Tower						
Local Control	○	○	○	○	○	
Ground Control	○	○				
ATIS	○	○				
ILS	○	○	○	○		
VOR/DME	○	○	○	○	○	
Approx. Required Floor Area	5,500m^2	3,530m^2	2,310m^2	1,810m^2	730m^2	90m^2

APPLIED TO BALI INT'L AIRPORT

Classification	1990	2000	2010
Airport Operation	20h	20h	20h
Radar			
Scan	○	○	○
ARTS			
ASR	○	○	○
Meteorological Facilities	○	○	○
Tower			
Local Control	○	○	○
Ground Control	○	○	○
ATIS	○	○	○
ILS	○	○	○
VOR/DME	○	○	○
Approx. Required Floor Area	3,530m^2	3,530m^2	3,530m^2

Table 5.6.2 REQUIRED RESCUE & FIRE FIGHTING FACILITIES BY YEAR

YEAR	1985 - 2010
Airport Category	9
Extingushing Agents	
Water for Aquenos (1)	24,300
Dry Chemical Powder (Kg)	450
CO_2 (Kg)	900
Vehicles	
Rapid Intervention Vehicle	1
Major Vehicle	2 or 3
Ambulance	1
Command Car	1
Rescue Boats	3

5.7 Service Facilities

5.7.1 Aviation Fuel

The daily fuel consumption is accumulated by multiplying the trip fuel including that for an alternate airport, by the number of departing aircraft in respective type. The required fuel storage capacity is estimated as tabulated in Table 5.7.1 on the assumption that the airport is provided with a 7 days storage pacacity.

Table 5.7.1 AVIATION FUEL STORAGE REQUIREMENT

	1990	1995	2000	2005	2010
Daily Fuel Consumption (Kl)	775	970	1,400	1,890	2,505
7 days storage capacity (Kl)	6,780	8,490	12,250	16,540	21,920
Area required 1/	15,000m^2	21,000m^2	21,000m^2	27,000m^2	27,000m^2

1/Note: 4,000kl/Tank

5.7.2 Airport Utilities

The airport utilities requirements are calculated based on the unit demand as shown in Table 5.7.2.

Table 5.7.2 UNIT DEMAND OF UTILITIES

Utilities	Unit demand/m^2	
Electricity	- Passenger Terminal Building	: 100 VA/m^2
	- Cargo Terminal Building	: 60 VA/m^2
	- Administration Building	: 80 VA/m^2
Water	- Passenger Terminal Building	: 0.023 ton/m^2/day
	- Cargo Terminal Building	: 0.003 ton/m^2/day
	- Administration Building and others	: 0.01 ton/m^2/day
Sewage	- Passenger Terminal Building	: 0.017 ton/m^2/day
	- Cargo Terminal Building	: 0.002 ton/m^2/day
	- Administration Building and others	: 0.007 ton/m^2/day
Waste	- Passenger Terminal Building	: 0.072 kg/m^2/day
	- Cargo Terminal Building	: 0.144 kg/m^2/day
	- Administration Building and others	: 0.024 kg/m^2/day

Source: Average unit demand of airports in Japan

The utilities demand forecast in 5 years intervals from 1990 is shown in Table 5.7.3.

Table 5.7.3 AIRPORT UTILITIES DEMAND FORECAST

Year	1990	1995	2000	2005	2010
Electricity (KVA)	3,500	4,700	5,600	6,600	8,100
Water (tons/month)	23,700	31,700	37,300	44,400	54,000
Sewage (tons/month)	17,000	22,700	26,500	31,600	38,400
Waste (tons/month)	85	117	135	159	199

5.7.3 Catering

The floor area requirements of catering are calculated by the following formula:

The required floor area = No. of Peak monthly International departures x unit rate

Unit rate (3.0 m^2/flights/month) is adopted based upon existing catering study findings.

A total floor area of Catering Building is calculated to be 1.5 times net catering floor area in order to include floor areas for offices, locker rooms, shower rooms etc. The required floor areas are estimated as shown in Table 5.7.4.

Table 5.7.4 THE REQUIRED FLOOR AREA FOR CATERING

Items Year	1990	1995	2000	2005	2010
No. of Peak Monthly INT'L Departure Flights	155	185	280	340	465
Net Catering Area (M2)	450	550	800	1,000	1,400
Catering Building (m^2)	700	850	1,200	1,500	2,100

5.8 Access Road and Car Parking

5.8.1 Access Road

The results of a field survey on the traffic of the existing airport carried out in December 1981 indicate that the traffic influx per passenger at the peak hour stood at 0.16 auto/passenger, smaller than the actual figure of other international airports. One reason is that passengers are shuttled by hotel bus (about 60%) which is one feature of BIA. Here, the traffic influx is set at 0.20 auto/passenger as a rise in the ownership of autos in the future is taken into account.

The future traffic volume and the number of access road lanes required are forecast in Table 5.8.1 on the basis of the above findings. In addition, calculation for the length of curb is explained in the APPENDIX 5.8.1.

Table 5.8.1 PEAK HOUR CAR TRAFFIC VOLUME AND LANE OF ACCESS ROAD

Year	1990	1995	2000	2005	2010
Peak hour pax*1	1,290	1,750	2,145	2,560	3,175
Peak hour car traffic in both directions	260	350	430	510	640
Peak hour car traffic in heavy directions	145	190	235	280	350
Lane of Access Road (one direction)	1	1	1	1	1

*1 The peak-hour passenger volumes do not include transit passengers

5.8.2 Car Parking

The necessary capacity of the car parking is computed according to the following equation.

$$V = P \times C/R$$

where; V: required parking capacity

P: Number of passengers at the peak hour

C: Number of cars parked per passenger at the peak hour

R: Rate of occupancy at the peak hour (=0.8)

The number of cars parked per passenger at the peak hour was checked on the spot at the same as the aforementioned survey on the traffic volume, and the results indicate that C = 0.19 ≑ 0.20 cars/passenger. On the basis of this value, the parking capacity required in the future is forecast as indicated in Table 5.8.2 .

Table 5.8.2 PARKING LOT REQUIREMENTS

Year	1990	1995	2000	2005	2010
Peak hour pax.	1,290	1,750	2,145	2,560	3,170
No. of Parking lot	325	440	540	640	800

Incidentally, the following yardstick is adopted for the use rate of the parking lot as a result of the field survey.

Medium-size buses	0.30
Truck-buses	0.15
Taxis	0.40
Owner cars	0.15
Total	1.00

CHAPTER 6

EVALUATION OF EXISTING AIRPORT FACILITIES

CHAPTER 6 EVALUATION OF EXISTING AIRPORT FACILITIES

6.1 General

Various existing facilities are studied on the basis of location, configuration, strength and function. The facilities are evaluated as a part of facilities or complete ones for the year 2010 (Long Term Plan). Evaluation of the existing facilities is summarized in Table 6.1.1.

6.2 Airside Infrastructures

6.2.1 Runway

The existing runway is studied on the basis of its direction, length, width and pavement strength. As the result of study, it is recommended that the pavement strength be improved up to LCN 100. Therefore, it is our judgement that the existing runway of 2,700m can be used as one part of the runway for the future.

(1) Length, width and slopes of Runway

Since width and slopes of runway meet ICAO recommendations, those of runway can be utilized as one part of the future runway. With regard to runway length, it is discussed in the previous section 5.2.1. It is required that the runway be extended 300m.

(2) Pavement Strength

Both 300 meter ends of the existing runway are paved with cement concrete and the remaining portion is paved with asphalt concrete. The strength of the pavement stands at LCN 60 which is not strong enough to accommodate wide-bodied aircraft.

Table 6.1.1 EXISTING CONDITION AND EVALUTION OF AIRPORT FACILITIES

YEAR / FACILITY	OUTLINE	Present	1985	1990	1995	2000	2005	2010
LANDING STRIP	In line with ICAO precision Landing standards the present width of 200m must be expanded to 300m.	⬚						
RUNWAY	The length of 3000m is required for DC-10s and B-747 type aircrafts to take off without weight restriction on the longest non-stop route.	⬚						
TAXIWAY	In line with ICAO precision landing standards, it is neccessary to expand R/W center to T/W centerdistance from the existing 125m to 180m.	⬚						
APRON	The area must be expanded because of the carrently insufficient clearances the future increase of aircraft movement.	⬚						
INTERNATIOMAL PASSENGER TERMINAL B·L·D·G	The terminal expansion is necessary in the short-term plan to be able to offer ordinary passenger services.	▭	▼					
DOMESTIC PASSENGER TERMINAL B·L·D·G	The renovation is necessary to convert the the present facility into the terminal exclusively used for departing passenger in the short-term plan, and to be replaced for a new terminal in the middle term plan.	▭	▼					
CARGO TERMINAL B·L·D·G	The terminal has been obsolete,so that a new terminal must replace it.	▭	▼					
ADMINISTRATION B·L·D·G	The control tower and the administrative BLDG are cohoused in the existing domestic passenger terminal.A new administrative building will be required in the middle-term plan due to anticipated congestion.	▭	▼					
NAVIGATION AIDS	Some facilities are sufficient to meet the long term plan functionally, but most of the facility shall be replaced in near.	⇒	⇒					
AIR FIELD LIGHTING	The level of existing facility is adequate for the long-term plan.	⇒	⇒	⇒	⇒	⇒	⇒	
CAR PARKING	With a few years, it is presumed that the sufficient parking spaces cannot be secured with the present facility,so the expansion will be required.	▭▼						
ACCESS ROAD	The existing four-lane two-way road is sufficient for the demand in the long-term plan requirements.	⇒	⇒	⇒	⇒	⇒	⇒	⇒

LEGENT

1. ⬚ : Development works required urgently.
2. ▭ : Target year to be developed
3. ⇒ : Useful facility in long-term plan as it is.

(3) Runway direction

As the result of analysis of the airport's meteorogical data in the period 1978 - 1981, the wind coverage of the existing runway stands at about 99.8% as shown in Fig. 6.2.1. Hence, it is our judgement that the existing runway direction is the most suitable.

6.2.2 Runway Strip

According to Indonesia's AIP, the width of the existing Runway Strip is 200 m. The landing aid facility is CAT-I ILS. Under the CAT-I ILS system, there is a need to broaden the width to 300 m according to the ICAO standards.

In the eastern end of the existing Runway Strip, a temple (Pura) exists as an obstacle and it must be removed.

6.2.3 Taxiways

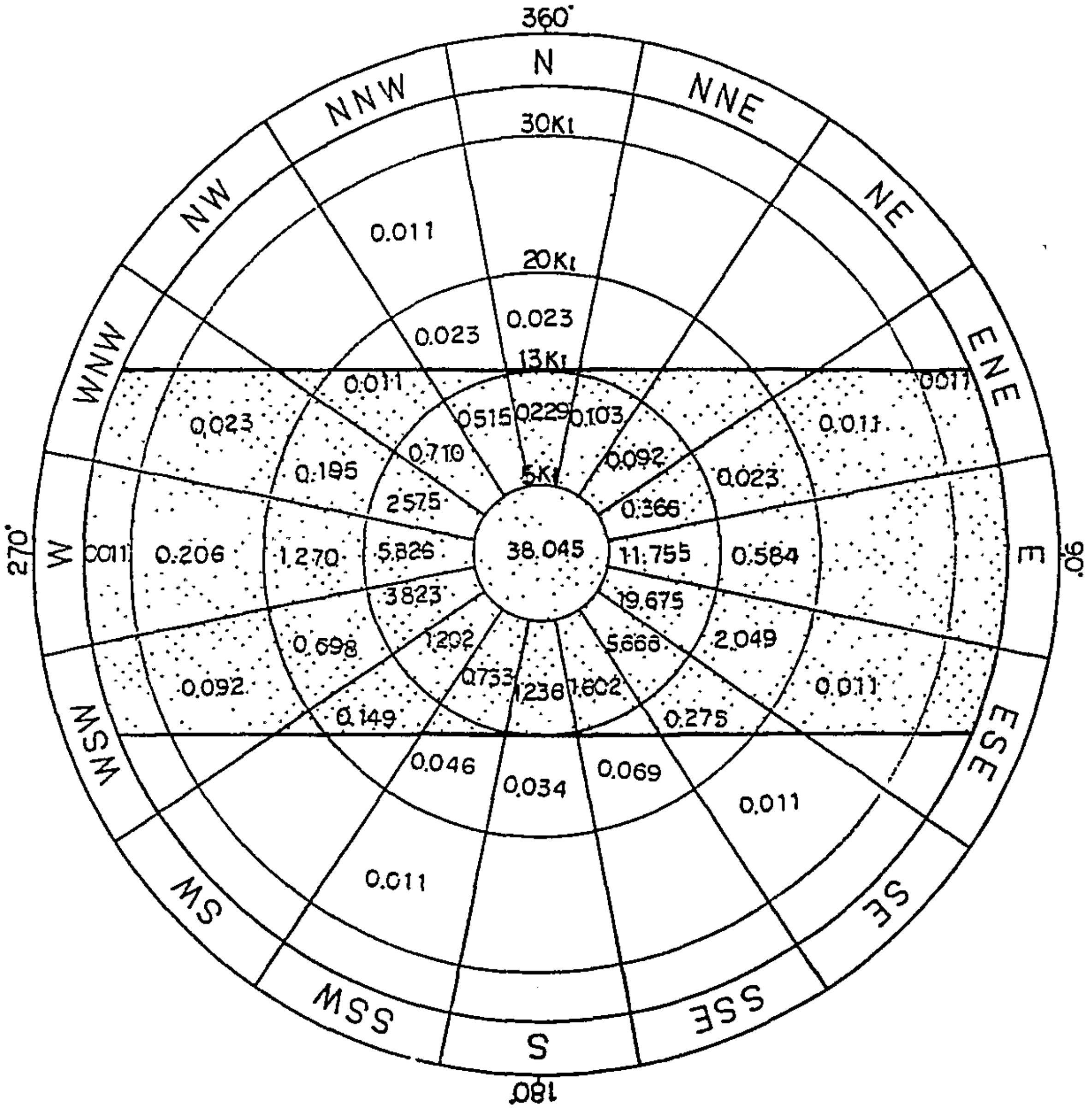
(1) Parallel Taxiway

The existing parallel taxiway is located in the north and the east side of the runway and is 1750m long. Distances between the runway and the parallel taxiway at paved edges and centerlines are 87.5m and 125m respectively.

Hence, the parallel taxiway cannot be utilized for the future because the distances do not meet ICAO standards.

(2) Exit Taxiway

The existing exit taxiways stand 30m wide with a pavement strength of LCN 60 and include two exit taxiways and two high speed exit taxiways. The four exit taxiways can be utilized for the future with the condition that the pavement strength must be improved to at least LCN 100.



LOCATION : BALI INTERNATIONAL AIRPORT
PERIOD : 1978/JAN-1981/NOV
R/W DIRECTION : N 86° E (09/27)
MAG. VAR : 1° 0'
WIND COVERAGE : 99.77% (CROSS WIND 13KT.)

Fig. 6.2.1 WIND COVERAGE MAP

6.2.4 Aprons

The existing aprons include April A for domestic routes and Apron B for international routes. All aircract are parked in parallel with the runway and use the self exit system. Based on the condition that the runway strip is 200m in width tails of wide-bodied aircraft will not come in contact with a transitional surface in the parallel parking system.

There are 5 stands for small propeller-driven planes and Stols and 6 stands for small jets in Apron A, totalling 11 stands in all. In Apron B, there are 3 stands for Jumbo and wide-bodied jets, 2 stands for medium jets and 2 stands for small jets, totalling 7 stands in all.

With regard to Apron A, it is judged that the apron stands offer impractical parking accommodation because they are overcrowded with 11 aircrafts as shown in the APPENDIX 6.2.1.

In the development plan, the runway strip should be 300m in width. If a wide-bodied aircraft is parked in a nose-in parking in Apron B, the aircraft will come in contact with transitional surface. Hence, there will be a need to extend the apron toward the terminal building.

The Apron B can be utilized as one part of the apron for the future if the pavement strength is improved up to LCN 100.

With regard to the Apron A, the apron also can be utilized as one part of the future apron assuming that aircraft have clearance between parked planes as specified by ICAO standards.

6.3 Air Navigation Aids

The BIA is now operated by CAT-I ILS. The classification and layout of facilities for navigation aids, communication for enroute and approach control and visual aids and meteorogical system are as follows:

(1) NDB

Installed at a location north of the runway, this system is used for instrument approaches and departures. It has an output of 2.8 KW and a coverage of about 300 nautical miles. The equipment was installed in 1971 and there is no problem for routine operation at present.

(2) VOR

(a) DPS VOR/DME

The DENPASAR VOR/DME (DPS, 115.5 MHz) situated on the top of a 663-foot mountain about 3.5 nautical miles south of the airport, was installed in 1969. This system serves as a pilot for airways over Bali International Airport and its periphery. It is used for approaches to, and departures from, the airport.

When the location of this system is taken into account for approaches to the airport, it is not considered favorable. There are many limits in terms of system operation.

(b) BLI VOR

A DVOR is already installed on the side south of runway in 1976, this is a doppler type system; however, it is put to little use because it is not equipped with a DME at present. If a DME is added to this VOR and this system is used for approaches to, and departures from, the airport, the system will be more ideal.

Consequently, it is considered desirable that a DME be installed with the VOR of the airport.

(3) ILS

Installed in 1976. In the light of topographical limitations, the localizer is offset at 1.2° as shown in Fig. 6.3.1.
For similar reasons, neither a middle marker nor an outer marker have been installed. For this reason, a DME has been added for glidepath.

A marker is installed on the Benoa Port at a point about 3 km from the threshold of Runway 27 side. It is, however, impossible to utilize for the middle or outer marker.

According to the analysis of weather data for the three years from January 1979 to November 1981, the availability of approach from each direction is 83% for 09 Side (West Side), and 61% for 27 Side (East Side), as shown on Fig. 6.3.2 & 6.3.3.

It is assumed that the existing location was established on 27's Landing runway in compliance with 75's Master Plan recommendation.

The main reason can be assumed to be a consideration of the depth of the ocean floor on the extended center line of the runway. The depth of the ocean floor at 09 Side is deeper, and therefore it is very difficult to install the foundation pile for the Approach Light System with a maximum hight of 20m.

The analysis of data related to Visibility and Ceiling at the same time as the wind coverage's data is shown in Table 6.3.1. According to the results of the analysis, the following assumptions can be made:

The capability range between ILS Approach and ADF or VOR Approach clearly indicates no difference with the relationship between visibility and ceiling under prevailing weather.

The existing location of the ILS performs its functions to secure safe operation of aircraft. In addition, its location makes the construction work for ILS easy and economical. It is better to install the Middle Marker for the establishement of missed approach point by ILS Approach, in case it is impossible to install the Outer Marker on the existing ILS in view of land conditions.

(4) Air to Ground Communication System

(a) BALI ACC

The existing BALI ACC was shifted from the Surabaya Airport to BIA with the modification of BALI FIR from Surabaya FIR on 15th August 1978.
The BALI ACC is allocated the following frequencies:

- (i) for Flight information of HF (8819, 3439, 5659, 13320, 2987, 5673, 8868 13288 and 17965 KHz)
- (ii) for Area control of VHF 128.3 MHz (East Sector) and 119.3 MHz (West Sector)

The communication between BALI ACC and aircraft is transmitted and received via Tx/Rx Station at the top of Mt. Kintamani (about 1250m) located about 60Km north of the airport.
The communication conditions are good.

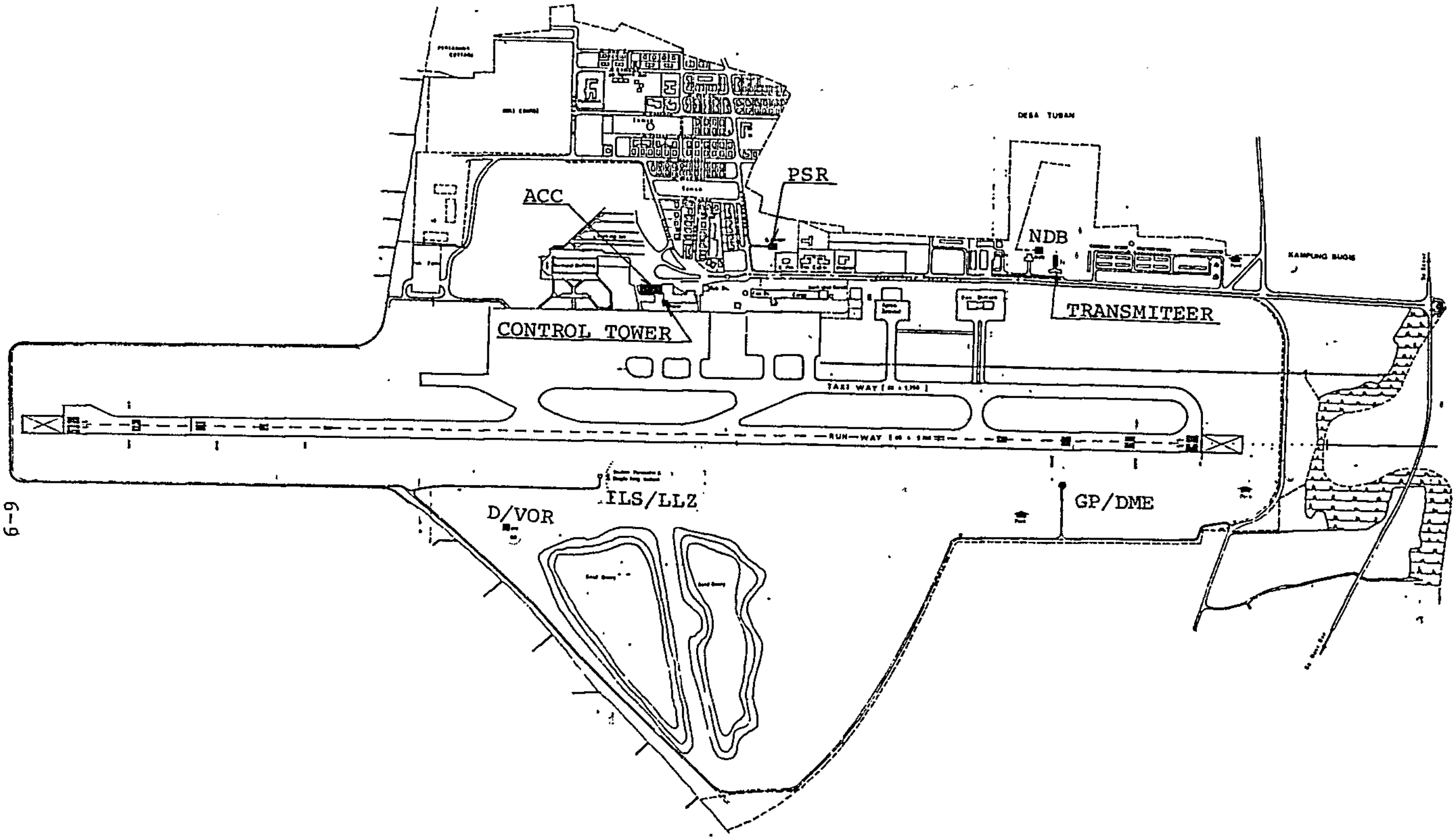
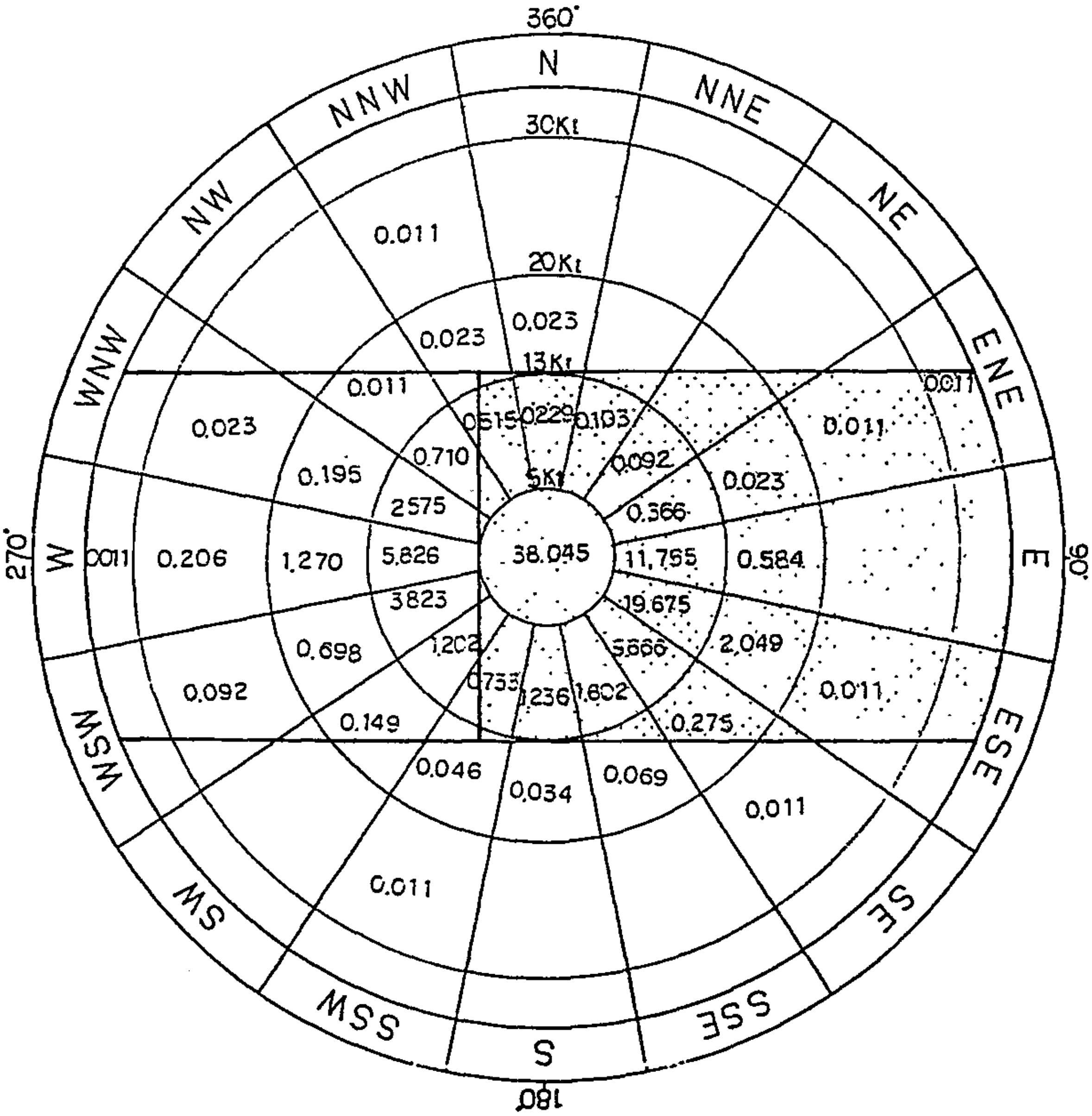


Fig. 6.3.1 LAYOUT PLAN OF EXISTING NAVIGATIONAL AIDS



LOCATION : BALI INTERNATIONAL AIRPORT

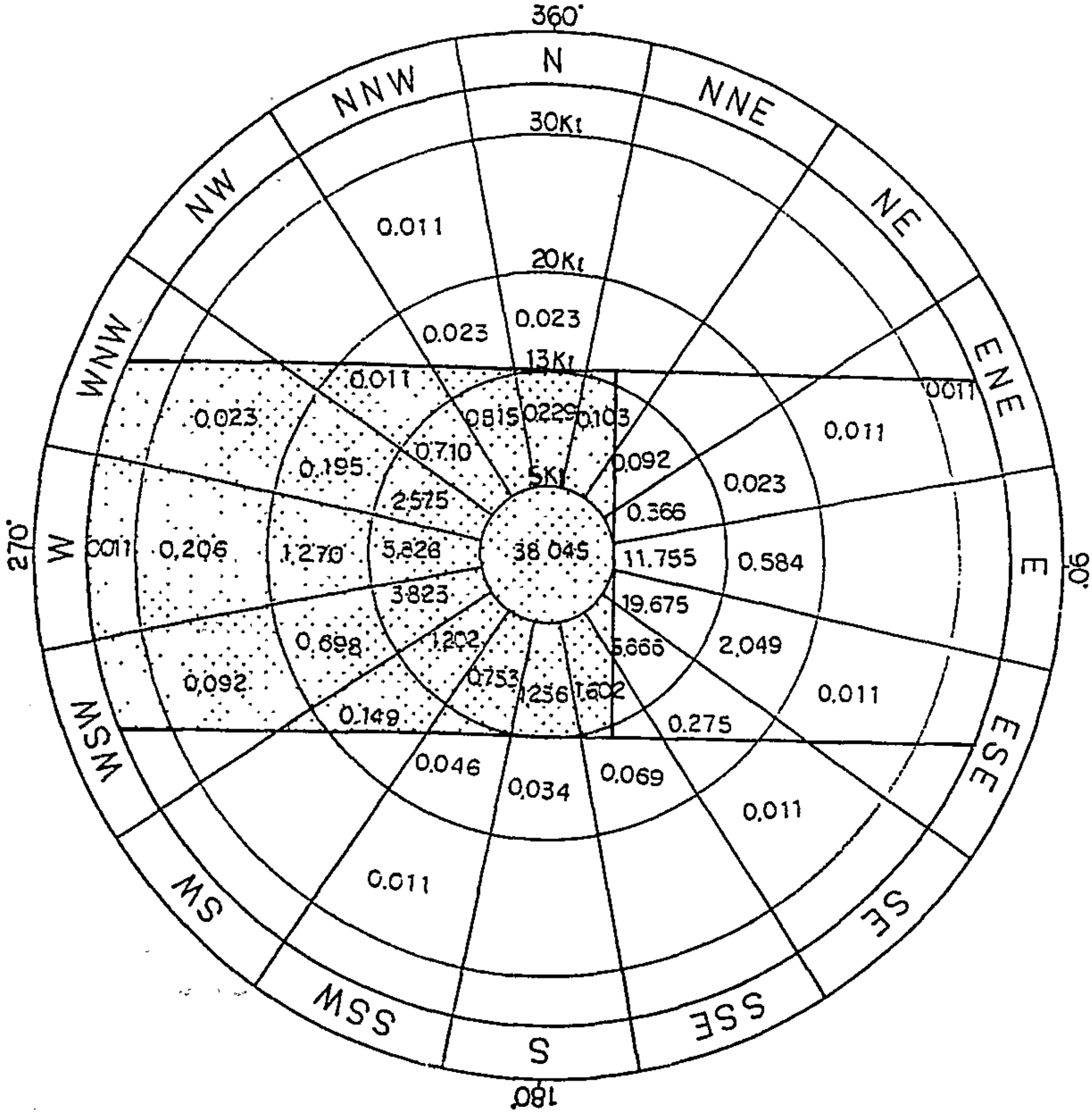
PERIOD : 1978-1981 (3 YEARS)

R/W DIRECTION : N 86° E (09/27)

MAG. VAR : 1.0 DEGREE

WIND COVERAGE : 61% (CROSS WIND 13KT)
(R/W 27 APP) (TAIL WIND 5KT)

Fig. 6.3.2 WIND COVERAGE MAP



LOCATION : BALI INTERNATIONAL AIRPORT
PERIOD : 1978-1981 (3YEARS)
R/W DIRECTION : N 86° E (09/27)
MAG.VAR : 1.0 DEGREE
WIND COVERAGE : 83% (CROSS WIND 13KT)
(R/W 09 APP) (TAIL WIND 5KT)

Fig. 6.3.3 WIND COVERAGE MAP

Table 6.3.1 CORRELATION TABLE OF CEILING HEIGHT AND VISIBILITY

(RUNWAY 27 APPROACH)

CLOUD Q'TY	VISIBILITY (m) / CEILING (ft)	-200	200 -400	400 -600	600 -800	800 -1000	1000 -1200	1200 -1400	1400 -1600	1600 -2000	2000 -2400	2400 -3200	3200 -4000	4000 -4800	4800 -5600	5600 -	Total
	0- 200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	200- 300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	300- 400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	400- 500	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	3
	500- 600	0	0	0	0	0	1	0	0	0	4	3	0	1	13	244	266
	600- 700	0	0	0	0	0	0	0	0	0	0	0	0	1	0	103	104
5/8-	700- 800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	800- 900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
	900-1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1000-1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	1100-1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1200-1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1300-1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1400-1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1500- 0	0	0	0	0	0	3	0	0	0	1	5	0	5	10	1096	1120
-5/8		0	0	0	0	0	1	0	0	0	1	1	0	1	9	7227	7240
	Total	0	0	0	0	0	5	0	0	0	8	9	0	8	32	8675	8737

Source:Bali Airport
Period:1978/Jan-1981/Nov

LEGEND

▬▬▬ Without VOR, ADF approach

▬ ▬ ▬ Without ILS approach

(b) Approach and Aerodrome Control

(i) Approach Control

Appraoch control is operated well at BIA with the allocated frequency of 119.7 MHz.

The Control Center is established at BALI ACC as a temporary basis.

(ii) Aerodrome Control

Aerodrome control is executed by 118.1 MHz and 121.5 MHz for Emergency. The existing facility and aerodrome control tower were installed in 1967, and it is considered desirable to renovate the facility and tower because of its superannuate condition as soon as possible.

(iii) Telecommunication network

The telecommunication network with Kupang Banjarmasin and Ujugpandang is by shortwave frequency via the Kintamani Station, and by land line between Bali and Surabaya.

(5) Telecommunication System

The telecommunications requirement for BIA should be based on:

- ICAO Regional Air Navigation Plan
- National (domestic) Plan

It will be divided into the following:

1) A F S

AFTN

ATS Direct speach

2) Intercommunication

Local Communication

3) A M S (Aeronautical Mobile Serivce)

VHF , APP , TWR and SMC

(a) AFTN

The BIA is link up with Jakarta and Surabaya on the current AFTN System. The network is very important to operate the aircraft safely and efficiently. It is recommended to install a computerized switching system instead of the present mechanical system on the system performance. To execute the improvement work on the System, it is necessary to study and arrange the network system in terms of relations with other stations.

(b) ATIS System

There is no problem in the current ATIS for the present use. It is, however, desirable to have a discrete VHF' Transmitter. The improvement work is required urgently.

(c) Others

Weather station is by SSB and CW using an independent line. The equipment of the Aerodrome Control and APP was installed in about 1967 and is superannuated. In view of this condition, it is desirable to replace it, together with the renovation work of the Control Tower.

(6) Radar System

Airport surveillance Radar consists of SSR (Secondary Surveillance Radar) and PSR (Primary surveillance Radar) and has an important role in the Terminal Radar System which operates the Approach, Aerodrome and Take-off Control safel safely and smoothly.

The JCAB have drafted an improvement plan for the terminal radar system of the airport to increase the efficiency of control and to ensure safety since the airport will experience more than 10,000 annual aircraft movements in the future.

The plan aims to automate the handling procedure of radar information by using of the Computer Equipment such as the Radar Data Processing System.

The current PSR will be, however, superannuated by the beginning of the Middle Term Plan.

Therefore, it is desirable to install a new system after establishement of the "the Radar Data Processing System" from the Middle Term Plan.

The current radar system is used for the enroute control of Bali ACC and the Bali APP simultaneously.

To ensure discovery of every target which approaches the Airport by use of the APP, it is recommended to modify the antenna scanning speed by more than 8 rpm.

It is, however, necessary to consider the modification of the antenna's rotating mechanism and minimal remodelling of the PRF (Pulse Repitition Frequency). A detailed survey should be made to finalize the matter.

(7) Airfield Lighting System

AIP (Aeronautical Information Publication) of Indonesia states that the airport category of Bali International Airport is CAT -I ILS Operation.

The following equipment are installed and are operational:

(a) Approach Lighting
  - Approach light

09 Side	None
27 Side	Precision Approach Light System

  - Visual Approach Slope Indicator System (VASIS)

09 Side	3-Bar
27 Side	3-Bar

(b) Runway Lighting
  - Runway Edge Lights
  - Runway Threshold Light
  - Runway Threshold Identification Light (only 09 Side)

(c) Taxiway Lighting
  - Taxiway Edge Light

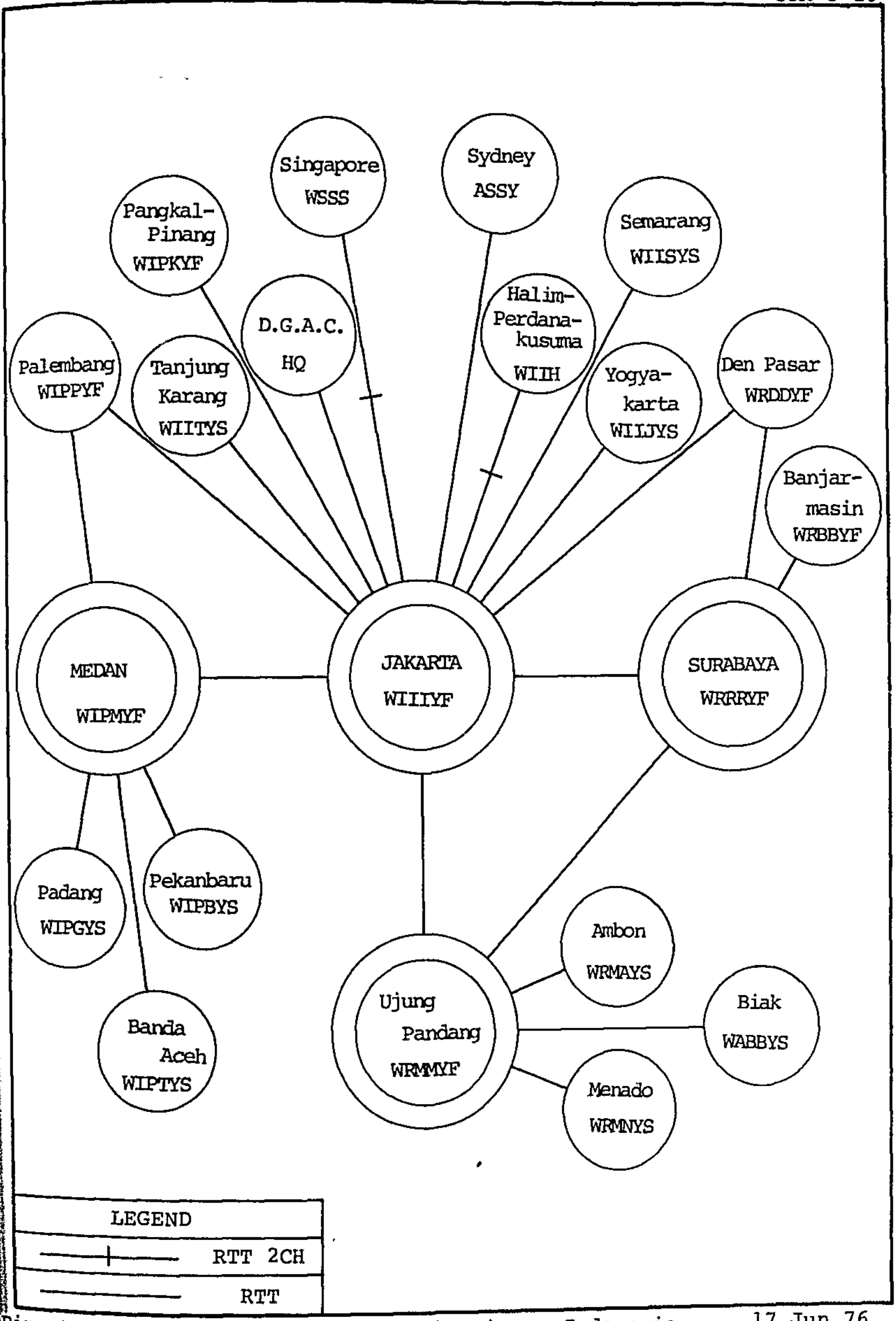
(d) Indicator
  - Illuminated Wind Directional Indicator
  - Landing Direction Indicator Lights
  - Airport Beacon

(e) Apron Flood Light

Runway edge lights, Taxiway edge lights and Threshold lights were installed in compliance with the new runway construction in 1969, and VASIS was installed in 1975. Approach Lights were installed in 1978 in connection with the development of the airport.
There are no problems with the existing system being operated at the airport by CAT.-I.
The control diagram for this system is shown in APPENDIX 6.3.1 and 6.3.6.

(8) Meteorological System
The precipitation gage and weather data collecting equipment for temperature, humidity, wind-direction and wind velocity is now operated, and a transmissometer and ceilometer is now being installed.

Fig. 6.3.4 RADIO TELETYPEWRITER CIRCUITS (Domestic & International)



6.4 Passenger & Cargo Terminal Facilities and Other Buildings

6.4.1 International Passenger Terminal Building

The existing International Passenger Terminal Building was built in 1978 based on the 75's Master plan prepared by a local consultant. The building is a reinforced concrete structure with two storeys : 1st floor area is 4,000 m^2, 2nd floor area is 2,070 m^2. The total floor area is 6,070 m^2. The present building is awfully overcrowded with passengers during the peak hour because the building was not planned for service of wide-bodied aircraft B-747. Hence passengers are forced to do with only a low degree of terminal facility services due to a lack of facilities and insufficient floor space. In order to deal with the overcroweded conditions, it is absolutely necessary that additional floor area be constructed as an immediate action. As the result of the structural study, the building cannot be expanded on the second floor. Consequently, the existing building can be used to replace an arrival terminal are a which is required to have a lot of 1st floor area, and moreover, the building will be able to be utilized as an arrival terminal area for future as well. In view of current peak-hour passenger demand, the new building should be built with 12,000 m^2 of total floor area in order to provide a normal level of passenger service. The relevant drawings (namely Existing Plans and 1981 Renovation Plans) also are shown in APPENDIX 6.4.1 - 3.

6.4.2 Domestic Passenger Terminal Building

The Domestic Passenger Terminal Building was constructed about fifteen years ago. The building is a two-storied reinforced concrete structure with a four-storey reinforced concrete Control Tower located so that it faces to the apron at the middle of the building.

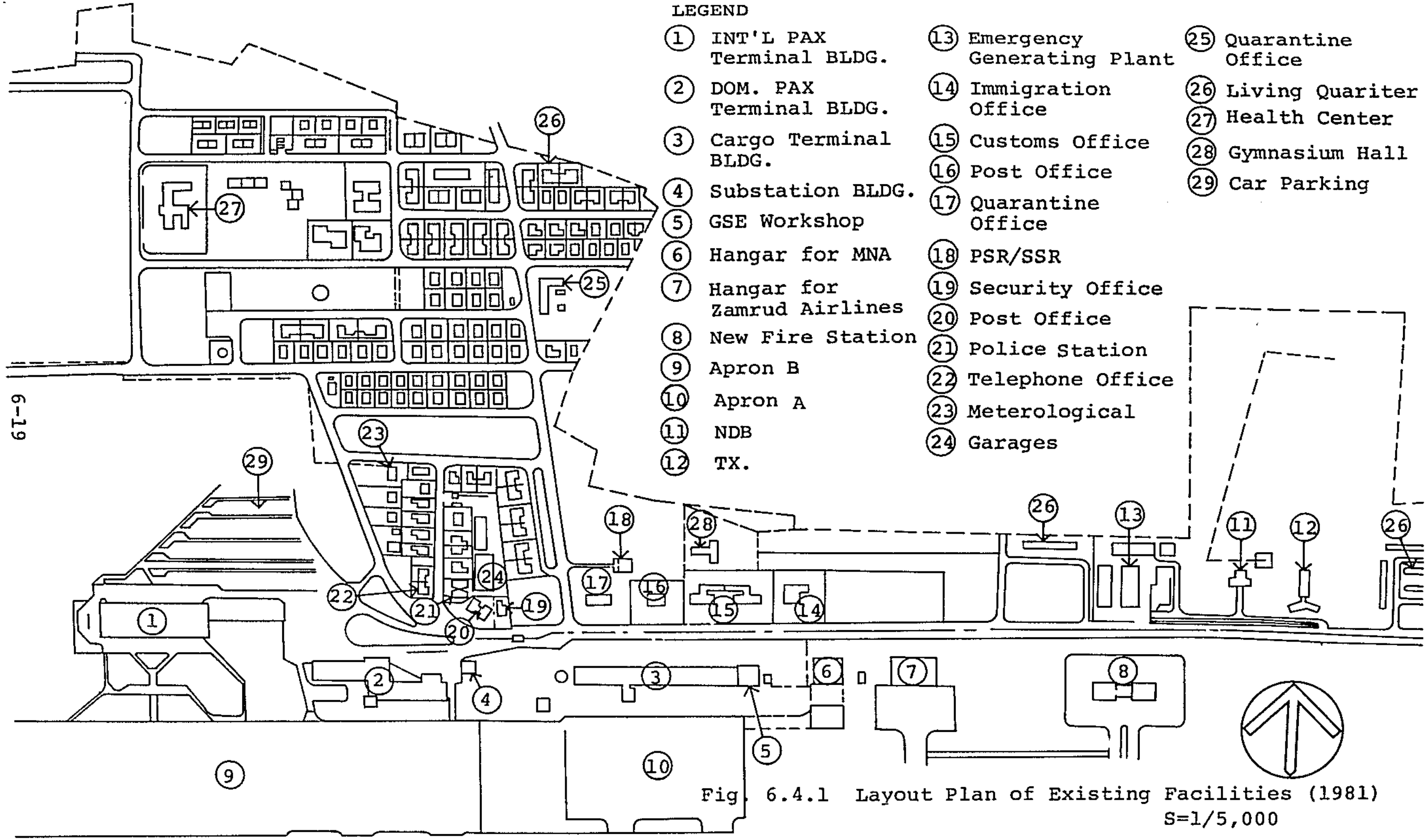


Fig. 6.4.1 Layout Plan of Existing Facilities (1981)
S=1/5,000

Administration and Passenger Terminal areas are occupied in the building. The building has 5,800 m^2 total floor area including Control Tower. The detailed floor area of Administration and Passenger Terminal area are as follows;

	1F	2F	3 & 4F	TOTAL
Administration area	950m^2	1,400m^2	–	2,350m^2
Passenger area	1,900m^2	1,450m^2	–	3,350m^2
Control Tower area	-	-	100m^2	100m^2
G. TOTAL	2,850m^2	2,850m^2	100m^2	5,800m^2

As to Control Tower, becuase its condition is deteriorated, a New Control Tower will be constructed.
The Passenger Terminal area has a total area of 3,350m^2 which is insufficient for servicing wide-bodied DC-10 aircraft. Therefore, passengers are forced to be overcrowded during the peak hours. At least 6,000 m^2 of additional floor area should be constructed in order to mitigate the overcrowded condition.
The relevant drawings are shown in the APPENDIX 6.4.4 - 5.

6.4.3 Cargo Terminal Building

The existing cargo Terminal Building was built in 1949 as the first-stage Passenger Terminal Building. The building is a one-storey wooden structure with a total floor area of 1,800 m^2. The building serves the multi-purposes of the Fire Station, Catering, Emergency Room (Trans-migration) and Cargo Terminal Area. The building is in deteriorated condition since it was built 30 years ago. Moreover, because the cargo volume is increasing annually, the cargo terminal floor area will gradually become more and more overcrowded. Consequently, a new

Cargo Terminal Building should be constructed. The layout of the Cargo Terminal Building is shown in the APPENDIX 6.5.6.

6.4.4 MNA Hangar

The MNA Hangar is located between the GSE Workshop Building and Zamrud Airline Hangar se shown in Fig. 6.4.1. The hangar also has a steel frame and is one storey with a total floor area of about 900m^2. The hangar is utilized to maintain DHC-6 aircraft. It is anticipated that the hangar will be used in the Short Term Plan judging from the present situation.

6.4.5 Zamrud Airline Hangar

This hangar is located between the MNA Hangar and the New Fire Station Building as shown in Fig. 6.4.1. The hangar is one storey with a steel frame. However, the roofing is not completely constructed yet due to financial problems of Zamrud Airline. Therefore, the hangar has not been utilized for a long time. It is suggested that the hangar be used by other airlines after its completion in order to make effective use of the existing facilities.

6.4.6 GSE Workshop

The Workshop Building is located next to the east side of the Cargo Terminal Building. The building has a steel frame and is one storey with a total floor area of 540m^2. The building contains the maintenance shop for Ground Service Equipment and is in good condition. The Buidling can be used as the workshop in the future.

6.5 Administration And Operational Facilities

6.5.1 Administration Building

As the existing administration building was already discussed in previous section 6.4.2 (Domestic Passenger Terminal Building). The administration building occupies one part of the Passenger Terminal Building. The administration building can be utilized until the year 1990 (Short Term Plan). In the year 2000 (Middle Term Plan) a new administration building will be constructed.

6.5.2 Control Tower

The existing Control Tower is also discussed in the previous section 6.4.2 the same as the administration building above.

The control tower is in deteriorated condition, and the facilities such as control consoles and panels installed in the control tower also have depreciated. Hence, a new control tower will be constructed in the year 1990 (Short Term Plan).

6.5.3 Fire Station

(1) Rescue & Fire Fighting

The present condition of the Rescue & Fire Fighting facilities at the airport are shown in Table 6.5.1. The capacity of existing facilities can serve up to CAT-7 in compliance with the level of protection specified in the ICAO AIRPORT SERVICES MANUAL.

The existing facilities and equipment are housed and maintained in the temporary fire station which is a located in the existing cargo terminal building.

(2) New Fire Station

The new Fire Station Building is located on the east side of the Zamrud Airline Hangar as shown in Fig. 6.4.1. The building is under construction and will be completed in May 1982. Fire fighting equipment will be moved from the fire station located in the

Table 6.5.1 EXISTING FIRE AND RESCUE EQUIPMENT LIST

EQUIPMENT	TYPE	SPECIFICATION
FOAM TENDER	TYPE-A	Tank Cap. : 9,000 liter Foam Cap. : 900 liter Discharge Rate: 5,000 liter/min.
	TYPE-B	Tank Cap. : 9,000 liter Foam Cap. : 900 liter Discharge Rate: 4,900 liter/min.
	TYPE-C	Tank Cap. : 3,750 liter Foam Cap. : 375 liter Discharge Rate: 1,600 liter/min.
	TYPE-D	Tank Cap. : 3,000 liter Foam Cap. : 500 liter CO_2 Cap. : 180 kg. Discharge Rate: 2,500 liter/min.
WATER TANK	-	Tank Cap. : 3,200 liter Discharge Rate: 1,600 liter/min.
RESCUE TENDER (X2)	-	Drypowder Cap.: 250 kg.
AMBULANCE	-	
JEEP COMANDO	-	
RESCUE BOAT	-	None

west part of Cargo Terminal Building to this new building. Part of the building is one storey with a steel frame for garages, and the other part, three storeys with reinforced concrete for the administration area. The building has a total floor area of about 1,000m^2 and is shown in the APPENDIX 6.5.7. In addition, it was confirmed that the administration area will not obstruct the transitional surface.

6.5.4 Other Facilities and Relevant Office Buildings

Location of other facilities (NDB, TX, PSR/SSR) and office Building (Immigration, Quarantine, Post, Security, Police, Meteorological offices, Living Quarters, Health center and Gymnasium) are shown in Fig. 6.4.1. The quarantion office Building which is under construction is located to the south of PSR/SSR next to the post office. The Building will be completed soon. Moreover, a cluster of buildings including the Security office,Post office, Telephone office, Meteorological office, Garages and Living Quarters is located to the north of Domestic Passenger Terminal Building and Substation. There will be removed in the Long Term Plan due to expansion of car parking facilities. There offices may be moved into new Domestic Passenger Terminal Building which will be located on the east side of INT'L Passenger Terminal Building.

6.6 Service Facilities

The evaluation of service facilities currently operated at the airport are sujmarized for the following systes:

- Aviation Fuel Supply System
- Power Supply and Generation System
- Water Supply System
- Sewage Treatment Facility
- Waste Disposal Facility
- Catering Service

6.6.1 Aviation Fuel Supply System

The aviation fuel supply system at the airport is operated by PERTAMINA, the government agency which handles oil and fuel supply in Indonesia. The supply of fuel for aircraft is served by tank lorrey. The airport authority has committed the total service work to the agent at the airport at the present time. Based on the current annual aircraft movement, there is no problem regarding the system.

6.6.2 Power Supply and Generating System

(1) Power Supply System

The schematic diagram of the current power supply system for the airport is shown in Fig. 6.6.1. The initial power supply system has been established in 1965, and is being expanded with the development of the airport.

Electricity is being generated from the Diesel Generating Station of PLN (Perusahaan Listrik Negara) located northwest from the airport, with 25 MVA of back-up power. The airport facility is supplied by one line with 3 phase 20 KV Power from the Generating Station.

The reliability of PLN's power supply system to airport facilities is adequate.

Within the airport, some substation distribute the electricity for each load. The distribution routes are shown in Fig. 6.6.2. The distribution network is a 6 KV ring system with direct buried cable. Substations have no space to expand in the future.

With regard to the future expansion of the airport, PLN's Generating Station have plans to expand the capacity of back-up power, and also to construct a new power station near the airport. The airport authority has an agreement with PLN to meet the increased demand from airport development requirements in the future.

Taking account of the above-mentioned current conditions and background, the Power Supply System to be adequate.
The Substation Building for the airport facility is situated at the east side of the Domestic Passenger Terminal Building as shown in Fig. 6.4.1. The building is one storey with a total floor area of about 230 m^2, and supplies electricity to the Domestic Terminal Building.
The building was constructed several years ago.
The building will be utilized up to 1990 (Short Term Plan).

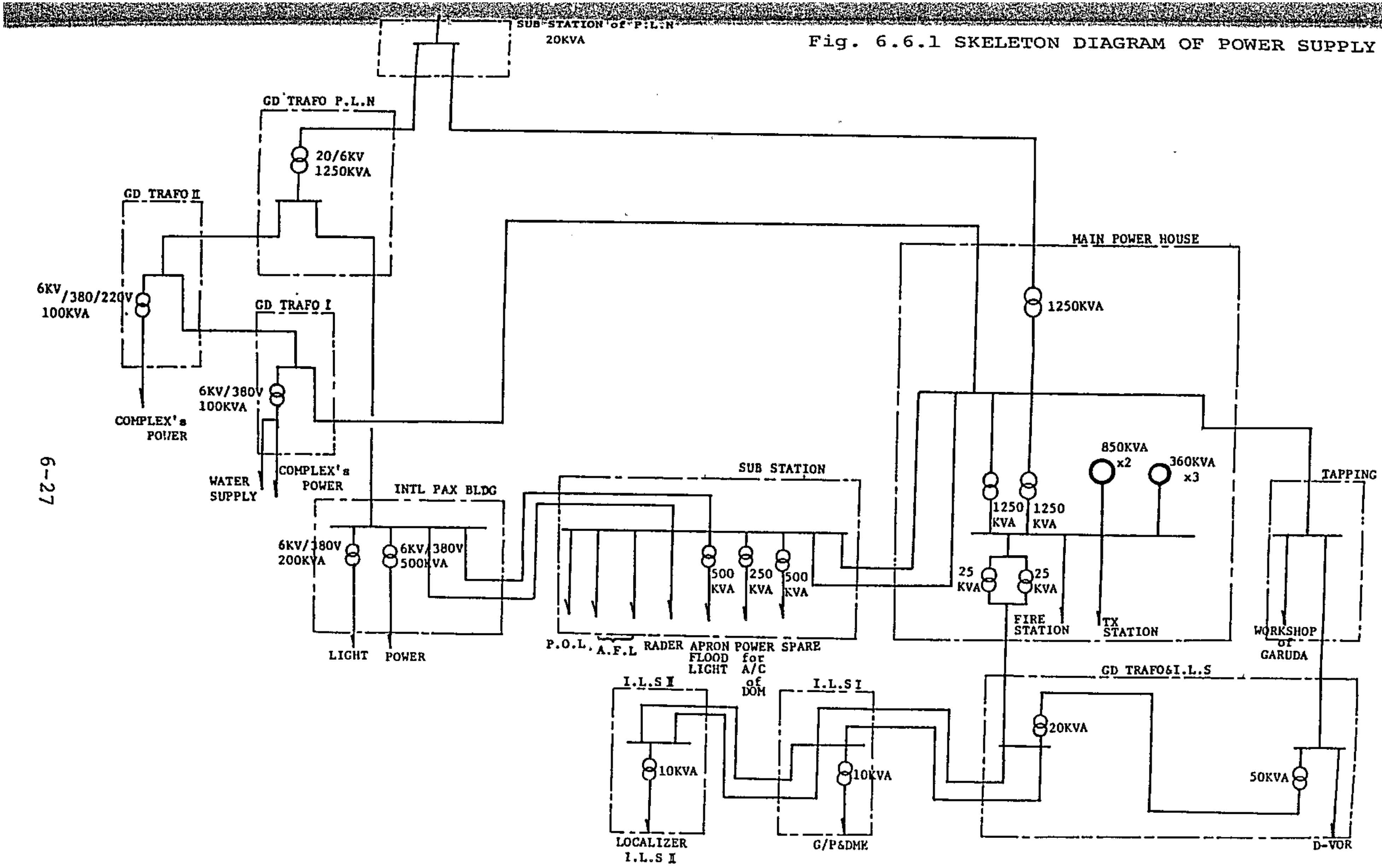
(2) Generating System
The generating System was established in 1965 when the airport commenced international operation. The Power Generating System for emergency and stand-by power supply has two types of generators. The total installed capacity of each generator is as follows:

3 units of 360 KVA generators
2 units of 850 KVA generators

During a power failure from PLN, one 850 KVA generator will be operated automatically with the other standing-by. In case one of the two big generators is out-of-orders, two sets of 360 KVA generator will be manually operated. This dual back-up system fosters high reliability in the generating system.

The Emergency Generating plant is installed at the Main Power House in the north side of new fire station between NDB and the Living Quarters as shown in Fig.6.4.1. The Main Power House is two storey, of reinforced concrete and has a total floor area of about 800 m^2. Five emergency generators with a total capacity of about 2,780 KVA are installed in the plant.

Fig. 6.6.1 SKELETON DIAGRAM OF POWER SUPPLY SYSTEM



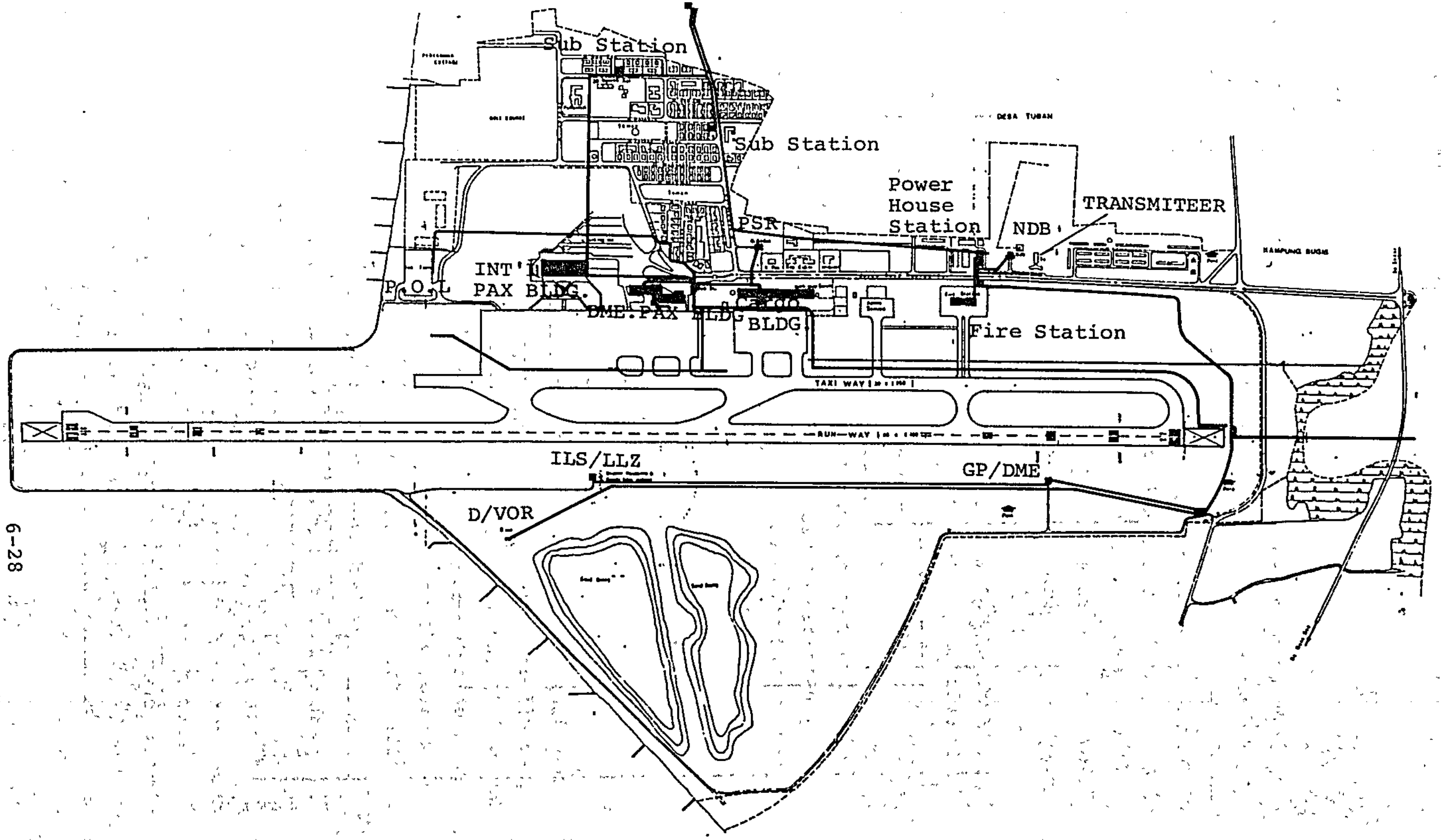


Fig. 6.6.2 MAIN CABLE ROUTE (Existing)

6.6.3 Water Supply System

There are two 40 m deep artesian wells on land side of the airport which supply the water for all of the airport vicinity. The capacity of each well is 970 M^3/day. The current demand is met by one well; however, the other well was constructed recently based on the recommendation of 75's Masterplan. Therefore, there is enough capacity to supply for the present load. Water from these wells is pumped into 4 elevated storage tanks before being distributed.

The water's quality control is not treated at present.

6.6.4 Sewage Treatment Facility

Sewage generated at each building in the airport area is disposed of in septic tanks and cesspools. This method is regarded as an old technique which should be modernized to meet increased demand.

It is necessary to develop the sewage treatment system in compliance with each stage of the development plan. The forecast volume of Sewage at each stage is shown as follows:

- Short Term Plan : 17,000 tons/month
- Middle Term Plan : 26,500 tons/month
- Long Term Plan : 38,400 tons/month

6.6.5 Waste Disposal Facility

There is no special waste disposal facility in the BIA at the present time.

Waste generated at the airport is carried out somewhere and disposed of.

6.6.6 Catering Service

Catering service is done only for international flights by the local hotel agent under contract with the airport authority. The base for catering service is part of the existing cargo terminal building. The handling volume is assumed to be approximately 550 - 600 units per day.

6.7 Access Road and Car Parking

6.7.1 Access Road

The existing access road is a four-lane road, about 1.65 km in length, leading to the airport terminal buildings from the two-lane Bali Tourist Resort Link Highway situated east from the airport.

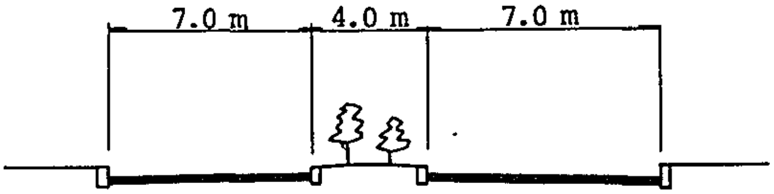


Fig. 6.7.1 TYPICAL CLOSS SECTION OF EXISTING ACCESS ROAD

With regard to traffic volume in the Long Term Plan, (the year 2010), about 680 car/hour is forecast. Consequently, there is no need to increase the capacity of the existing road. In addition to the above traffic volume generated by Pertamina cottage, Living Quarters and air administration staffs on the access road is a very small compared with airport passenger traffic volumes. Hence, it will not dominate access road in the future.

6.7.2 Car Parking

The existing car parking is situated in front of the international passenger terminal building, and no distinction is made for international and domestic flights, or for airport employees. The car parking is free of charge and 180 autos may be parked at one time.

The actual use of the car parking lot was surveyed at the same time as the traffic volume. The maximum number of cars parked at one time was 124 and the concentration index was 70%. In general, when the number of cars which may be parked as against the car parking capacity is up to 80% or so, it will presumably be necessary to increase the capacity for one or two years thereafter.

In addition to the above, the existing car parking will be partillay demolished and additional car parking be expanded to the existing international passenger terminal building as explained in Chapter 9.
The rest will be utilized as part of the car parking in the future.