CHAPTER 10 FINANCIAL ANALYSIS

10.1. Introduction

Financial analysis is to project future financial inflows and outflows arising from an airport operation, both for currrent and invesment expenditures, and to determine what financial policies should be made to make the airport operation financially viable. Such policies involve decisions on the size of staff manning the airport, their salary levels, the level of various airport charges, the size and timing of investment in airport facilities, and financing policy for such investment.

To make financial analysis, it is first necessary to identify the entity which undertakes the airport operation. Second it needs to identify and determine the financial activities necessary for the operation.

Since the purpose of the present study is to analyse the financial conditions related to Padang airport, it would be ideal to seperate the Padang airport authority as a financially independent entity and to make the financial analysis on it. This, however, is not practical considering the administrative and financial structure of airport operation in Indonesia.

Airport authorities are local branches of DGAC, Department of Communications. As such airports do not have authority to plan their own financial conditions. As a local branch of the central government, airports receive budgetary allocations for current and capital expenditures. Revenues at airports comprise landing fees, parking fees, air route navigation aid charges, and passenger surcharges. They are collected by airport authorities, but they are non-tax revenues of the central government. Hence there is no direct financial relation between revenues and expenditures at an airport.

The current various airport charges are kept low. At Padang Airport, they can barely cover the current expeditures. If this condition were to continue, it is difficult to treat and analyse the airport as financially independent and viable organization. In addition, policy recommendations concerning various airport charges cannot be made solely based on the financial analysis at Padang Airport.

For the reasons discussed above, the current revenues and and expenditures structure at Padang Airport is analysed and projected in the following analysis.

Although financial analysis should be done in current prices (that is, nominal monetary terms), the present analysis is made in real terms (that is, in constant prices). Financial analysis is primarily to analyse the financial planning, which includes the financing plan of a project. Financing terms are normally given in monetary, and hence nominal terms. Therefore it is necessary to project fund requirement and hence financial projections in current prices. However, the present analysis is limited to only the constant price projections for the the following reasons. First, as discussed earlier, the analysis will be limited primarily to the current accounts. Second, projecting price changes in airport charges and other expenditure items would involve too much uncertainty. Airport charges are determined by a government policy hence any assumption concerning the charges would be subject to wild speculation. This also holds for salary level of airport employees. Utility price projections would also involve unusually high uncertainty. Third, although fixed price projection may have only a limited use as mentioned earlier, they can still show the implications of the project on the government budgetary resources.

The first part of this chapter briefly analyses the present financial structure at Tabing Airport. The second part describes the financial projections at Padang Airport in 1981 prices, based on the traffic forecast and facility planning discussed in the previous chapters.

10.2. Financial Situation at the Present Tabing Airport

Current revenues at the present Tabing airport consist of airport charges from airlines and other airplanes, passenger service charges, and concessionary rents at the terminal. They are non-tax revenues of the central government. Current expenditures at the airport are personnel, material, and maintenance costs.

Table 10.2.1. summarizes the current revenues and expenditures of the present airport for the fiscal years 1980/81 - 1981/82. For the year 1981/82, it is budget figures. Current expenditures in past few years exceeded current revenues.

As stated earlier revenues at Tabing Airport comprise landing charge, route air navigation facility charge, passenger service charge, and rents on consessionary terminal areas. Since there is no scheduled flights which park more than 2 hours, there is no parking fee collected except for occasional non-scheduled flights. There is no general aviation which is permanently stationed at Tabing, except for occasional temporary stay by chartered airplanes.

Table 10.2.2. summarises various airport charges currently in force in Indonesia. The present Tabing Airport is classified as Class I. For landing charge, as stated in the note, 75 percent of the stated charge is applied at Tabing airport.

Current expenditures comprise personnel salaries, materials purchases, and maintenance cost of buildings, and equipments. Material purchases cover office supplies, utilities, etc.

Table 10.2.1. CURRENT REVENUES AND EXPENDITURES, TABING AIRPORT

(THOUSAND RUPIAH)

	1980/81	Budget 1981/82
Revenues	153,000	220,000
Expenditures	165,413	283,204
Personnel	51,324	89,319
Materials	50,973	99,569
Maintenance	62,663	93,866
Transport	450	450

Source : Padang/Tabing Airport

Table 10.2.2. : AIRPORT CHARGES

	International	Domestic
1. Landing Charges		
i) For each 1,000 kg or its part of MTOW up to 40,000 kg	US $ 3.00	Rp 855
ii) For each 1,000 kg or its part of MTOW above 40,000 kg but below 100,000 kg	US $ 3.50	Rp 1,140
iii) For each 1,000 kg or its part of MTOW above 100,000 kg	US $ 4.60	Rp 1,330
2. Lighting Charge	n.a.	Rp 13,800
3. Parking Charge (for each 1,000 kg of MTOW)	US $ 0.30	Rp 145
4. Overnight Stay Charge (for each 1,000 kg of MTOW)	US $ 0.60	Rp 290
5. Route Air Navigation Facility Charge (for each Route Unit)	US $ 0.30	Rp 185
6. Air Passenger Service Charge		
Halim, Kemayoran and Denpasar	Rp 2,000	Rp 1,000
Class I Airport	Rp 1,700	Rp 900
Class II Airport	Rp 1,500	Rp 700
Class III Airport	Rp 1,200	Rp 600

Note :

i) Landing Charge : For domestic flight by foreign registered airplanes, the international charge shall be charged.

ii) Landing, Lighting and Parking Charges : The full charges shall be levied only at Halim, Kemayoran and Denpasar airports. 75% of them are applied to Class I airports.

iii) Parking Charge : Parking less than 2 hours shall be exempted from this charge.

iv) Route Air Navigation Facility Charge : Route Unit equals to Distance Factor multiplied by Weight Factor.

v) Distance and Weight Factors : For air routes and aircrafts studied in this report, distance factors and weight factors are shown in Table 10.2.2.

vi) MTOW : Maximum Take - Off Weight.

10.3. Financial Projections

This section describes the financial projections based on the traffic forecast (aircraft movements and passenger traffic), and facility requirements (personnel planning, material cost, and maintenance costs). The first part describes revenue and expenditure projections in the fixed 1981 price. The second part is to :
(Case 1) analyse effects of personnel cost raises so that personnel remunerations are allowed to increase in pace with the per capita GDP increases ; (Case 2) estimate necessary airport charge increases to raise current revenues so that current revenues cover current expenditures under Case 1 ; (Case 3) estimate necessary airport charge increases so that current revenues cover both current and capital expenditures.

10.3.1. Base Case Projections

Base case projections are made based on the traffic forecast and personnel and facility planning using the 1981 price both for revenues and expenditures. This implies that there is no real price increase assumed for each component.

1) Revenue Projections

Revenue projections are made for each year at five year intervals as presented in Section 3.5. (Tables 3.5.4,, 3.5.5., and 3.5.6.). Then the intermediate years are interpolated as they are necessary. Projection procedures for each item of the current revenues and expenditures are explained below.

i) Landing Charges

Aircraft movements of each category of airplanes are given in Table 3.5.5. Based on this table, and based on the present tariff structure, landing charges are estimated for years 1985, 1990, 1995, 2000, and 2005. Number of landings is assumed to be the half of aircraft movements in the table. For various aircrafts in the given categories, maximum take-off weights and domestic landing fees are presented in Table 10.3.1. Landing fees applied at Padang is 75 percent of the figures. Currently there is no foreign scheduled aircrafts landing at Padang, and the traffic forcast assumes no foreign scheduled aircrafts to be in service. For certain categories such as Wide Body, shares of each aircraft in the category is either what is assumed in the Table 3.5.5., or equal share is assumed when Table 3.5.5. does not specify such share.

ii) Route Air Navigation Facility Charge (RANFaC)

This is estimated also for the five years of Table 3.5.5. Weight factors of each aircraft category are presented in Table 10.3.1. Distance factors of each route connecting Padang are shown in Table 10.3.2. Route structure for each aircraft category and for each year are given in Table 3.5.6. Unit charge is given in Table 10.2.2.

Table 10.3.1. MTOW, WEIGHT FACTOR, AND AIRPORT CHARGES

Aircraft	MTOW (1000 kg)	Landing Fee Domestic	Weight Factor
1. Jumbo			
B747-203B	351.9	437,760	109
2. Wide Body			
A300-B2	137.0	151,810	52
DC-10-30	253.1	307,420	84
3. New Medium Jet			
B767	127.0	138,510	49
DC-9-80	63.5	61,560	28
4. Medium Jet			
DC-9-30	44.4	39,900	21
5. Small Jet			
F28-1000	29.5	25,650	15
F28-4000	32.2	28,215	17
6. Large Propeller			
VC-9	66.6	64,980	29
7. Medium Propeller			
L-188	51.3	47,880	24
8. Small Propeller			
F27	19.7	17,100	11
VC-8	32.9	28,215	17
9. STOL			
DHC-6	5.67	5,130	5
DC-3	12.7	11,115	8

Source: DGAC, and calculation from Table 10.2.2.

Table 10.3.2. DISTANCE FACTOR

Route	Distance (km)	Distance Factor
JKT - PDG	927	9
MES - PDG	532	5
PKU - PDG	185	2
PLM - PDG	528	5

Source : DGAC

iii) Passenger Service Charge (PSC)

Based on the total passengers in Table 3.5.5, PSC is projected. It is first assumed that number of arriving and departing passengers are equally divided. Transit passengers are considered very few and ignored. Division between domestic and foreign passengers is also assumed in Table 3.5.5. It is assumed in the table that 3.5 percent of the total passengers are foreign passengers. Utilizing these assumptions and passenger service charge in Table 10.2.2. passenger surcharge is projected.

iv) Rents on Concessions at Terminal

Based on the designed area of the passenger terminal building in Table 4.1.1. rentable area is estimated to be 50 percent of the passenger terminal area. Projected rent is estimated on the basis of Rp2,500 per month per sq.m.

2) Cost Projections

Cost projections are made based on facility requirements and construction cost estimates in the previous chapters.

i) Personnel Cost

Personnel cost is projected to grow in accordance with the personnel planning projected in Chapter 4.

PROJECTED DGAC EMPLOYEES

(NUMBER)

	1981	1985	1990	1995	2000	2005
DGAC Staff	109	165	260	410	605	880

Source: Chapter 4 and Table 12.3.1.

ii) Materials Cost

This comprises various office supplies and other goods and services necessary to maintain the office. It is assumed that their cost is 1.12 times the personnel cost estimated in i).

iii) Utilities

This is projected based on the projected electricity and other utility use multiplied by unit cost. Projected utilities demand is shown in Table 4.8.2.

iv) Maintenance Cost

They are estimated as follows. For runway and buildings, maintenance cost is estimated to be 1 percent of the construction cost for the portion which needs maintenance. For equipment, the maintenance cost is estimated as 5 percent of purchase price.

3) Base Projections

On the basis of the assumptions described in 1) and 2), current revenues and expenditures are projected. They are presented in Table 10.3.3. It must be remembered that all prices are fixed in the projections at 1981 Rupiah. This may be unrealistic for some components. For personnel cost, for example, it is realistic to expect unit salaries may increase as per capita income rises. Nevertheless, this is presented as base projections in order to analyse impacts of price changes in various component and to make policy analysis on pricing.

Table 10.3.3: PROJECTED REVENUES AND EXPENDITURES

(1981 Rp. Million)

	Actual	Projected				
	FY 1981	1988	1990	1995	2000	2005
Revenues	220	634	1,004	1,618	2,328	3,310
Land. Fee		208	388	596	795	1,091
R.A. Nav. Fee		89	140	201	251	347
P S C		239	344	597	940	1,399
Rent		98	132	224	342	473
Expenditures	283	848	945	1,240	1,937	2,499
Personnel	89	180	212	335	494	719
Materials & Utilities	100	279	344	516	730	1,067
Maintenance	94	389	389	389	713	713

Source : JICA estimates

10.3.2. Case 1 Projection with Real Salary Growth

Case 1 projection analyses impacts of real salary growth in order to keep pace with the general progress in the standard of living as measured in per capita GDP.

Per capita GDP is projected to grow at an average growth rate of 5.5 percent annually between 1980 - 2005 as shown in Table 3.2.2. Salaries of airport personnel may have to grow at the same pace. Otherwise airport personnel will not share with the fruits of economic development, which is unrealistic and unfair.

It is assumed that the average salary level of airport personnel in constant 1981 Rupiah will increase at 5.5 percent per annum on average during the projected period (1980 - 2005). For materials, it is assumed in the Base Case that material cost is 1.12 times personnel cost. Although prices of office supplies are fixed in the projections, it is nonetheless realistic to assume some improvements in real prices in office supplies as real income level increases. Offices may install carpeting as the standard of living improves. To reflect this, it is assumed that the real improvement in office supplies will increase with an elasticity 0.5 with respect to the standard of living (i.e. per capita GDP). In the present case real prices of materials expenditures will increase at 2.25 percent annually during the projected period. There is no real price increase assumed for other components.

Table 10.3.4. summarises the resulting projections. The Case 1 projection shows a quite different financial situation from Base Case projection. The present financial condition at Tabing where the current expenditure substantially exceed the current revenues would continue on this assumption. The impact is particularly significant beyond 1995.

Table 10.3.4. CASE 1 PROJECTIONS
(1981 Rp million)

	Actual	Projected				
	FY 1981	1988	1990	1995	2000	2005
Revenues	220	634	1,004	1,618	2,328	3,310
Expenditures	283	984	1,152	1,803	3,193	5,132
Personnel	89	262	343	709	1,366	2,599
Materials	100	333	420	705	1,114	1,820
Maintenance	94	389	389	389	713	713

Source : JICA estimate

10.3.3. Case 2 Projection

Case 1 Projection clarified that the present various airport charge rates were not sufficiently high to cover the projected current expenditures. This section estimates the necessary charge increases in order to cover the projected expenditures.

Table 10.3.5. presents the projected expenditures in Case 1 and necessary revenues to cover them. The revenue estimates are rounded to the nearest Rp50 million.

Table 10.3.5. REQUIRED REVENUES

(1981 Rp million)

	Actual	Projected				
	FY 1981	1988	1990	1995	2000	2005
Revenues	220	1,000	1,200	1,850	3,200	5,150
Expenditures	283	984	1,152	1,803	3,193	5,132

Based on the projections and assuming that all necessary revenue increase should come from increases in airport charges with the same increase rate across-the-board, the airport charges are estimated so as to produce the necessary revenue growth as indicated in Table 10.3.5. They are estimated by multiplying the individual airport charges by the ratio of the revenues in Table 10.3.5. to the revenues in Table 10.3.4. Such necessary across-the-board fare increase ratios are estimated as follows.

	1981	1988	1990	1995	2000	2005
Ratios	1.00	1.58	1.20	1.14	1.37	1.56

However, such necessary increase rates of airport charges do not move monotonically from year to year. The largest increase is necessary in 1988, but much smaller increases are sufficient for 1990 and 1995. This may not be pragmatic if such charge increase are to be designed and implemented. As one of the many possibilities, the following increase ratio of the various airport charges is proposed.

INCREASE RATIO OF AIRPORT CHARGES

	1981	1988	1990	1995	2000	2005
Increase ratio	1.00	1.15	1.20	1.25	1.40	1.55

Based on the above increase ratios, the current revenues and expenditures projections are prepared as shown in Table 10.3.6.

Table 10.3.6. CASE 2 PROJECTIONS

(1981 Rp million)

	Actual		Projected			
	FY 1981	1988	1990	1995	2000	2005
Revenues 1/	220	729	1,205	2,023	3,260	5,131
Expenditures 2/	283	984	1,152	1,803	3,193	5,132
Memo items:						
Increase Ratio	1.00	1.15	1.20	1.25	1.40	1.55

1/ Revenues in Table 10.3.4. multiplied by increase ratio

2/ Expenditures from Table 10.3.4.

Airport charges which are necessary to produce the above revenues are projected in Table 10.3.7. The table indicates that the

Table 10.3.7. PROPOSED AIRPORT CHARGE INCREASES AT PADANG (CASE 2)

(IN 1981 Rp)

	Actual	Projected				
	1981	1988	1990	1995	2000	2005
Increase Ratio	1.00	1.15	1.20	1.25	1.40	1.55
Landing Fee						
(1)	855	980	1,020	1,070	1,200	1,330
(2)	1,140	1,310	1,360	1,425	1,600	1,770
(3)	1,330	1,530	1,590	1,660	1,860	2,060
RANFaC	185	210	220	230	260	285
P S C						
International	1,700	2,000	2,000	2,100	2,400	2,635
Domestic	900	1,000	1,100	1,150	1,260	1,400
Rents	2,500	2,875	3,000	3,125	3,500	3,875

See Table 10.2.2. for detailed description of the charges. Landing fee charged at Padang is 75 percent of the figure shown here.

Source : JICA estimates

various airport charges ought to be raised across-the-board by 20 percent by 1990 and 40 percent by 2000 in constant 1981 prices. The average growth rate of the fare increases is 1.8 percent per year for 24 years between 1981 - 2005. The resulting passenger service charge in 2000 will be Rp2,400 for international departures. This is equivalent to US$ 3.80 in 1981 prices at the present exchange rate. This is reasonable price compared with the current surcharge at US airports of US$ 3.00, or at Narita/Tokyo of some US$ 7.00.

10.3.4. Case 3 Projections

Projected revenues and expenditures in the previous section with the proposed airport charges in Table 10.3.7. only assure that the current accounts be more or less balanced. This section estimates the necessary revenue increases to cover the current expenditures and capital expenditures.

To do the further analysis, it needs to make assumptions on two aspects : first on the revenue policy, and second on borrowing policy and terms. Expenditures are those which are used in Case 1 and Case 2 projections. The revenue policy has two factors to be determined. First, it is assumed that revenues will be raised by increasing the airport charges at a same rate as assumed in the previous section. Second, it is assumed that revenues to be raised so that they cover approximately 100 percent of necessary funds, holding either surplus or deficit as small as possible.

As for borrowing, it is assumed that long term loans will be borrowed to cover only capital expenditures. The borrowing term is assumed that it would be with real interest rate of 3 percent per annum, maturity 20 years including 5 years grace period. Real interest rate is defined as monetary interest rate less expected inflation rate. This loan term may be slightly harder than that of conventional loans by international lending agencies such as the World Bank and the Asian Development Bank.

The analysis of this section will be made as follows. First, fund outflows will be projected as a sum of the projected current expenditures in 10.3.3. and the projected loan repayments. Loan repayments are calculated on an assumption that a loan will be disbursed on the necessary capital outlay based on the construction schedule. Then the necessary airport charge increases are estimated invoking the assumptions discussed above.

The analysis here is made only for the Redevelopment case. It is because the total construction cost for this case is substantially lower than the other case, hence revenue requirements for the latter will be apparently much higher.

Table 10.3.8. presents the projected fund source and use. Necessary revenues are those which are necessary to meet the current expenditures and loan repayment requirements. Loan repayments are both for interest and amortization. Necessary revenues are substantially higher than the base revenues.

Increase ratios are calculated. They are ratios of the necessary revenues to the base revenues. They indicate that steep increase in airport charges are necessary if the current revenues are required to cover the current and capital expenditures. Even disregarding the fund requirements for interests during the construction, a steep charge increase will be necessary in the first year of the operation, or 2.90 times of the present charges. After that if charges are maintained at the level, it would be more or less enough to generate necessary revenues.

Increase ratios indicated in Table 10.3.8. are very steep. If they are implemented immediately it implies that the airport charges are required to increase sharply. Taking the average of these ratios, which is 2.65, the necessary landing fees, and passenger surcharges are estimated as in Table 10.3.9.

As shown in Table 10.3.9, international passenger service charge will be Rp4,505, or US$ 7.20, which will be one of the highest in the World.

Table 10.3.8 CASE 3 PROJECTIONS (1981 Rp MILLION)

	Fund Use			Fund Source		Base Revenues 3/	Increase Ratio from Base revenues
	Capital Exp. 1/	Current Exp. 2/	Loan Amt + int.	Loan Disb.	Necessary Revenues		
1981							
1982							
1983	1,053			1,053			
1984	1,779		32	1,779	32		
1985	7,524		15	7,524	85		
1986	13,027		311	13,027	311		
1987	5,210	70	702	5,210	772		
1988		984	858		1,842	634	2.90
1989		1,065	914		1,979	789	2.48
1990		1,152	1,010		2,162	1,004	2.15
1991		1,260	1,415		2,675	1,105	2.42
1992		1,378	2,115		3,493	1,215	2.87
1993		1,507	2,394		3,901	1,337	2.92
1994	634	1,648	2,394	634	4,042	1,471	2.74
1995	4,304	1,803	2,413	4,304	4,216	1,618	2.60
1996	9,652	2,021	2,542	9,652	4,563	1,740	2.62
1997		2,266	2,832		5,098	1,871	2.72
1998		2,540	2,832		5,372	2,013	2.67
1999		2,848	2,832		5,680	2,165	2.62
2000		3,193	2,866		6,059	2,328	2.60
2001		3,511	3,098		6,609	2,498	2.65
2002		3,860	3,617		7,477	2,680	2.79
2003		4,245	3,617		7,862	2,875	2.73
2004		4,667	3,528		8,195	3,084	2.66
2005		5,132	3,379		8,511	3,310	2.57

1/ From Chapter 9
2/ From Table 10.3.4. Intermediate years are interpolated
3/ From Table 10.3.3.

Source : JICA estimates

Table 10.3.9. TYPICAL AIRPORT CHARGES (CASE 3)

(in 1981 Rp)

	Present Charges	Necessary Charges
Landing (Domestic)		
A-300	151,810	402,296
DC-9-30	39,900	105,735
F 28-4000	28,215	74,769
Passenger Service Charge		
International	1,700	4,505
Domestic	900	2,385
Rent	2,500	6,625

CHAPTER 11 ECONOMIC ANALYSIS

11.1 General

The objective of an economic analysis is to identify and estimate economic cost and benefits arising from a project and compare them to assess the net contribution of the project to the national economy. Economic costs and benefits have to be valued at economic prices. Economic analysis also has to be made by comparing costs and benefits in the situation "with the project" with those "without the project". This is to measure additional benefits to the national economy which will be realized by investing and utilizing additional resources.

11.1.1 Methodology

Detailed discussions on methodology and each component of cost and benefit items are presented in APPENDIX 11.

Specifications of "without the project" case (WOP case)

The present project is designed to expand the airport service at Padang by either redeveloping the existing Tabing Airport, or constructing a new airport. Hence the "without the project" case (termed as the WOP case) is specified as maintaining the existing airport in the present condition with the minimum maintenance and replacement.

With the WOP case, it is next necessary to determine the capacity of the existing Tabing Airport with the present condition. The present apron cannot handle more than one A-300 at one time. The terminal building can handle no more than 370 passengers at the peak hour. Comparing these with the projected traffic, it is estimated that the present airport will be saturated in 1987 for both passenger and cargo. It is hence assumed that in the WOP case, the traffic for both passenger and cargo will remain constant after 1987.

Economic Prices

Economic benefits and costs are evaluated at prices which are often different from the financial or market prices. This is because there often exists price distortions in the economy.

This section briefly describes the economic prices used for economic benefit and cost evaluation in this report. To state the conclusion first, the economic prices are considered to be the same as the prevailing market prices in the present economic conditions in Indonesia, in particular in West Sumatra.

Labor Cost: The present labor market does not present any apparent disequilibrium. In particular in the construction labor market, there is often an excess demand which becomes severe especially during the harvesting seasons. Hence it is assumed that the market wage rate reflects the economic cost of labor.

Foreign exchange cost: Rupiha was substantially devalued in 1978. In addition, the present balance of payments situation is comfortably strong. This condition is expected to continue at least in the near future. For these reasons, the current market exchange rate is considered to reflect the economic cost of the foreign exchange.

Land Price: Land price may be best determined as opportunity cost, which will be reflected in the market prices when there is a perfect market of land transactions. However land is not traded as frequently as other goods. Hence other considerations than the prevailing market prices may be necessary to evaluate the economic land cost. Unfortunately it is very difficult to estimate such opportunity cost. In the present report, such analysis is limited only to qualitative considerations. The land surrounding the existing Tabin Airport is traded mostly as residential land. While the opportunity cost should reflect the possibility of the industrial land use, or commercial land use in the future, the present prevailing residential land prices are considered to reflect the lower bound of the economic cost. As for the Ketaping area,the land is not fertile agricultural land and is to be left mostly as wild land if the airport is not constructed. Because of the possible salinity, it is not suitable for rice production. Hence there is no active trading of land in this area. The present market prices are very low, but due to the facts listed above, they are considered to reflect the opportunity cost hence the appropriate economic price.

11.1.2 Project costs

Project costs will be next evaluated. They consist of (a) construction and installation cost of the airport facilities and equipment , and the peripheral facilities (such as an access road); and (b) operating and maintenance cost. These cost items are listed in Table 11.1.1. They have to be estimated for: i) the WOP case; ii) the redevelopment of Tabing Airport case; and iii) a new airport case.

11.1.3 Project benefit

Incremental project benefits will be evaluated for the project, by comparing economic benefits (consisting of incremental final consumption and saved intermediate inputs to the economy). Detailed discussion is given in Appendix 11. Items included in benefits are listed in Table 11.1.2. Each item and its estimation procedure are explained briefly in the following.

For passengers and cargoes, the projected traffic will exceed the capacity of the existing airport after 1987. Hence in the WOP case, passengers and cargoes which exceed the capacity cannot enjoy the air transport service. This is called the overflowing traffic. With the project, requirement of those overflowing passengers would be satisfied. This will constitute the major part of the economic benefit of the project.

i) Benefits to the accomodated overflowing passengers

This item consists of two components: benefits to overflowing personal trip passengers and benefits to business trip passengers. For personal trip passengers, benefits are measured in terms of incremental consumption. For business trip passengers, benefits are measured in reduction of travel cost which comprises transportation cost and time value.

Table 11.1.1 : COST ITEMS

I. Investment Cost Items

A. Airport

1. Construction

Land Acquisition and Clearing		
Runway, taxiway, apron		
Buildings	Passenger terminal building	
	Cargo terminal building	
	Administration building	
	Other	
Other	Car parking area	
	Service road	
	Fences	

2. Equipments

Navigation
Utilities
Ambulance, fire-engines, pick-ups
Office equipment
Other

Replacement

B. Peripheral

Access Road
Utility branch lines

Table 11.1.1 (Continued)

II	Operating and Maintenance Cost Items
A.	Operating Cost
	1. Personnel and general administration
	2. Materials
	3. Utilities
B.	Maintenance Cost
	1. Runway, taxiway, and apron
	2. Buildings
	3. Equipment
	4. Peripheral facilities

Table 11.1.2 : ECONOMIC BENEFIT ITEMS

Direct	Tangible	Passengers
		Personal trip passenger
		Additional consumption
		Business trip passenger
		Savings in travel time
		Cargoes
		Perishable consumer goods
		Other
		Time savings at the Airport
		Passenger
		(Access time)
		Airlines
		(Saved operating cost of airlines)
	Intangible	Increase in air safety
		Environment Impact
Indirect	Tangible	Increase in regional income
	Intangible	Income distribution, etc.

ii) Benefits to accommodated overflowing cargoes

This item is also measured in terms of reduction in transportation cost. However this is difficult as there is no standard estimate for time values of different kind of cargoes. Therefore in the present case, these benefits are measured by a different approach. It is assumed that most of the cargoes air lifted to and from Padang are high valued, perishable consumer goods. In the absence of air transportation, these commodities may not be delivered and made available for final consumption. Therefore cargo fare should represent a part of additional consumption realized with the project, hence a part of the benefits to the project.

iii) Time savings at the airport

Passenger terminal areas of the existing airport will be saturated to the capacity in 1987. Waiting time at the airport will increase until then. By constructing a new terminal area , and by introducing more efficient check-in and baggage handling procedures, waiting time both before boarding and after deplaning could be substantially reduced. It is assumed that waiting time will be reduced from the currently prevailing two hours to one hour, which is an average waiting time at airports of most industrialized countries. It should be noted, however, that this benefit will be realized only to the traffic which would have utilized the air traffic in WOP case and not to the overflowing passengers. This reduction of waiting time is then converted to monetary values by multiplying time value of each passenger who would have used the existing airport with the WOP case.

iv) Additional access time

A new airport at Ketaping is about 23 km from the center of Padang, compared with 7 km for Tabing Airport. Therefore those passengers who would have flown from the existing airport with the WOP case, would have to travel an extra 16 kilometers. This incurs additional time and fuel cost. They are evaluated and added as additional disbenefits for the new airport case.

v) Other benefits

There are other benefits or disbenefits, but they are not included in the present analysis for various reasons. Net foreign exchange earnings may increase after the expansion of air transportation. West Sumatra is in particular endowed with tourism potential. However the primary purpose of the airport is to serve for domestic passengers. Even if Padang should remain a relatively difficult place to visit for foreigners in the WOP case, foreign tourists would go to other tourist attractions throughout Indonesia, hence there will be little difference in foreign exchange earning between "with" and "without" the project. With a new airport, regional income could increase by additional investment and increased economic activities made possible by improved accessibility to the region. However this analysis would require either a full scale macroeconomic model or an intersectional model, which is beyond the scope of this study. Other benefits are mostly intangible or difficult to quantify. With a new airport, an advanced navigation aid system such as ILS will enchance the air safety at Padang.

Noise pollution: The impact of noise upon the surrounding community is not analyzed in monetary terms. However comparing the redevelopment case with the new airport case, it is clear that the redevelopment case will incur higher noise abatement cost than the new airport case, because the former is located in the edge of the still expanding Padang city while the latter location is far away enough from the densely populated areas.

Utilization of the present airport site: If the new airport should be chosen, the use of the present airport site would become an important subject of future planning at Padang. This will also have important implication on the airport development project. However this factor has not been evaluated in this analysis. First, the existing facilities on the existing airport site should be considered as sunk cost whichever of the two alternatives are chosen. Second, Ketaping areas has little value as agricultural land or any other industrial development site, while the present airport site could be utilized for useful and purposeful development which contributes to Padang city growth. Hence the new airport development may add further economic benefits. However evaluation of such benefits is subject to a wild speculation and a wide margin of error. Moving to a new airport site only generates additional benefits regarding the land use: utilization of a wild land which otherwise has little economic value while making available a land conveniently located near the city for other useful development. Therefore excluding the evaluation will not bias the analysis in the wrong direction.

11.2. Redevelopment of the Existing Airport

Project costs and benefits are estimated for the redevelopment of the existing airport case. Both project cost and benefits are evaluated as additional cost and benefits over the WOP case.

Table 11.2.1 summarises costs and benefits of the redevelopment of the existing airport.

11.3. A New Airport Construction

Table 11.3.1 summarises the cost and benefits of a new airport construction in Ketaping area. Compared with the redevelopment case, the cost of the new airport is substantially lower. This is due to the difference in land aquisition cost. The benefits for the new airport would be somewhat reduced when compared with the redevelopment case because of the extra access time.

11.4 Comparison

Table 11.4.1 compares the result of economic analysis of the two alternatives. The two alternatives show significantly different economic returns and benefit cost ratios. As mentioned earlier, in the present study noise impact is not considered. In addition a possibility of

Table 11.2.1 COST AND BENEFITS REDEVELOPMENT SCHEME (1981 Rp MILLION)

	COST			BENEFITS				Net Benefits
				Benefits to overflowing Traffic.		Saved time and fuel cost		
	Construction	O + M Cost	Saved O + M Cost	Pax	Cargo	Pass.	Access time	
1981								
1982								
1983	5,841	0	0	0	0	0		- 5,841
1984	11,579	0	0	0	0	0		-11,579
1985	6,413	0	0	0	0	0		- 6,413
1986	14,718	0	0	0	0	0		-14,718
1987	4,308	70	0	0	0	0		- 4,378
1988	0	843	-896	3,025	195	267		3,540
1989	0	905	-896	6,445	413	267		7,117
1990	0	940	-896	10,347	658	267		11,229
1991	0	992	-896	14,162	923	267		15,256
1992	0	1,044	-896	18,458	1,215	267		19,794
1993	0	1,079	-896	23,194	1,545	267		24,823
1994	630	1,139	-896	28,543	1,918	267		29,874
1995	4,197	1,235	-896	34,462	2,317	267		32,551
1996	9,697	1,304	-896	39,592	2,704	267		32,458
1997	0	1,494	-896	45,160	3,130	267		47,959
1998	0	1,564	-896	51,255	3,595	267		54,450
1999	0	1,633	-896	57,919	4,107	267		61,557
2000	0	1,720	-896	65,154	4,669	267		69,267
2001	0	1,833	-896	72,564	5,298	267		77,192
2002	0	1,937	-896	80,588	5,989	267		85,803
2003	0	2,024	-896	89,269	6,749	267		95,158
2004	0	2,128	-896	98,740	7,586	267		103,361
2005	0	2,282	-896	108,999	8,507	267		116,388
2006	0	2,404	-896	108,999	8,507	267		117,058
2007	0	2,508	-896	108,999	8,507	267		117,821

Table 11.3.1 COST AND BENEFITS FOR NEW AIRPORT SCHEME (1981 Rp MILLION)

	COST			BENEFITS				Net Benefits
	Const-ruction	O + M Cost	Saved O + M Cost	Benefits to over-flowing Traffic.		Saved time and fuel cost		
				Pax	Cargo	Pass.	Access time	
1981								
1982								
1983	1,053	0	0	0	0	0	0	- 1,053
1984	1,779	0	0	0	0	0	0	- 1,779
1985	7,524	0	0	0	0	0	0	- 7,524
1986	13,027	0	0	0	0	0	0	-13,027
1987	5,210	70	0	0	0	0	0	- 5,280
1988	0	848	-896	3,015	196	267	- 165	3,360
1989	0	910	-896	6,423	413	267	- 165	6,925
1990	0	945	-896	10,312	659	267	- 165	11,024
1991	0	997	-896	14,114	923	267	- 165	15,038
1992	0	1,049	-896	18,396	1,216	267	- 165	19,561
1993	0	1,084	-896	23,115	1,545	267	- 165	24,575
1994	634	1,144	-896	28,447	1,910	267	- 165	29,577
1995	4,304	1,240	-896	34,346	2,317	267	- 165	32,117
1996	9,652	1,309	-896	39,458	2,703	267	- 165	32,116
1997	0	1,500	-896	45,008	3,130	267	- 165	47,636
1998	0	1,570	-896	51,082	3,596	267	- 165	54,106
1999	0	1,639	-896	57,724	4,108	267	- 165	61,191
2000	0	1,726	-896	64,934	4,670	267	- 165	68,876
2001	0	1,836	-896	72,319	5,298	267	- 165	76,777
2002	0	1,943	-896	80,316	5,989	267	- 165	85,360
2003	0	2,030	-896	88,968	6,750	267	- 165	94,685
2004	0	2,134	-896	98,406	7,586	267	- 165	104,857
2005	0	2,288	-896	108,631	8,507	267	- 165	115,849
2006	0	2,410	-896	108,631	8,507	267	- 165	116,519
2007	0	2,514	-896	108,631	8,507	267	- 165	117,282

utilizing the present airport site for other productive purpose is not considered. These factors may add economic profitability to the new airport case.

Table 11.4.1 SUMMARY OF ECONOMIC ANALYSIS

	Redevelopment Scheme	New Airport Scheme
EIRR (%)	27.0	35.0
At Discount Rate 13 percent		
NPV	94,655	105,279
B/C Ratio	3.77	5.69

Calculated from Tables 11.2.1, 11.3.1

11.4.1. Some Redesigning of the Project

As shown above, and as will be provided later comparing the various aspects of the two schemes, the New Airport scheme seems to be a better project of the two.

In this section, it is analysed whether redesigning of the project increase the rate of the return.

In the New Airport Case, the construction of the following items are moved from the first phase development to the second phase development. They are :

i) Parallel taxiway;

ii) Passenger boarding bridge; and unit area of passenger terminal building (in the first phase 15 sq. m per passenger instead of 17.5 sq. m. In the second phase, 17.5 sq.m is used)

These rescheduling should not adversely affect the function of the airport. Based on this development schedule, cost of the New Airport Scheme is re-estimated. Other cost and benefit itens are not affected. This will reduce the first phase construction cost by 14 percent from Rp 28,593 million to Rp 25,096 million.

The internal rate of return of this case is estimated to increase to 37 percent.

CHAPTER 12 SUBSIDIARY CONSIDERATIONS

12.1. Aircraft Noise

Although many evaluation measures exist in the world, all these noise evaluation measures are aimed quantifying the aircraft noise effect by noise level and frequency.

WECPNL (Weighted Equivalent Continuous Perceived Noise Level) which is used in Japan was applied as a noise evaluation measure in this study.

The evaluation measure, WECPNL is basically obtained from ECPNL (Effective Perceived Noise Level) which has been defined by ICAO so that the independently developed noise evaluation measure in the world can be compared on an international basis.

WECPNL is a modified version of ECPNL reflecting the perceived severeness of flight noise at night with larger weights on night flights than daytime flights.

$$WECPNL = dB(A) + 10 \log N - 27$$

Where, dB (A) ; A weighted sound pressure level

N ; Number of flight

$(= N_1 + 3 N_2 + 10 N_3)$

N_1 = Number of flights from 7 am to 7 pm

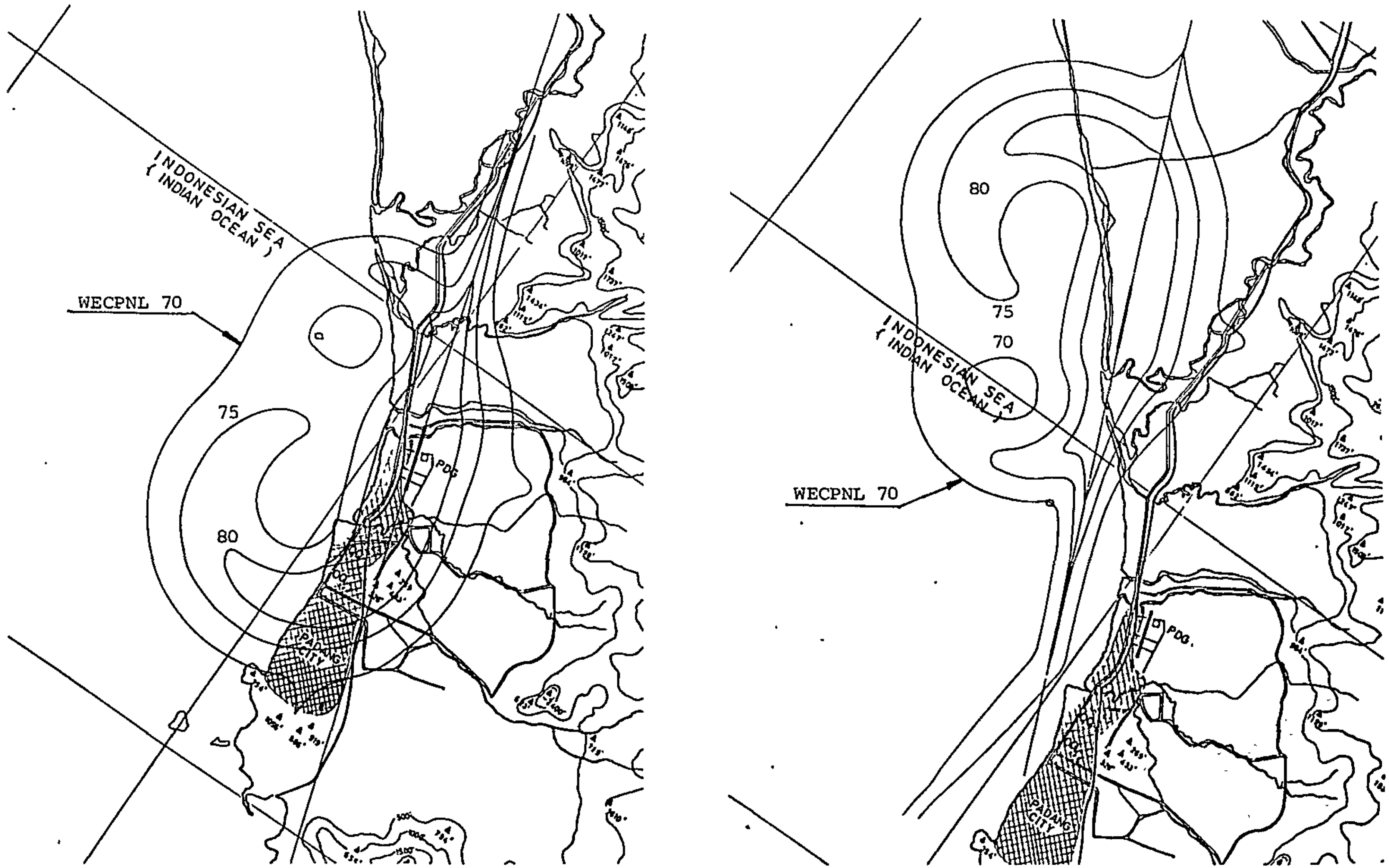
N_2 = Number of flights from 7 pm to 10 pm

N_3 = Number of flights from 10 pm to 7 am

The following consideration may be applicable to the future Land Use in the area surrounding the airport.

Land Use	WECPNL
No schools, hospitals, etc, are permitted.	More than 70
No new residences are basically permitted. Continuation of the existing agricultural use is recommended.	" 75
Prohibited area for new residences. Further agricultural use is recommended.	" 85

Noise contour was precisely calculated and shown on Figure 12.1.1. Here the major difference of the contours between the new site scheme and the redevelopment scheme is that the main approach and departure is considered for runway 34 for the new site scheme, but for runway 16 in the redevelopment scheme. The detailed calculation model and conditions,are discussed in Chapter 16, Section 1.



REDEVELOPMENT OF THE EXISTING AIRPORT

NEW AIRPORT CONSTRUCTION

Figure 12.1.1 COMPARISON OF THE TWO SCHEMES FOR AIRCRAFT NOISE

As seen from the figure, the new airport at KETAPING does not affect the densely populated area of Padang.

On the other hand, the noise contours above WECPNL 70 cover most of the developed area of Padang City to be used for the redevelopment of the existing airport.

The area covered by the noise level above WECPNL 70 is considered not suitable for comfortable living and community services such as schools, hospitals, etc.

Therefore, the airport would sooner or later suffer from serious problems related to compensation for the airport noise including removal of houses and sound-proof construction. Sound-proof construction, however, is not considered suitable for the existing houses judging from their structure.

In this respect, it is strongly recommended to construct a new airport at KETAPING where this adverse noise effect can be avoided.

12.2 Other Environmental Considerations

The environmental factors to be taken into account and the views on the same related to Padang case are summarized as follows :

1) Influence of aircraft noise

   Chapter 16 elabolates on the influence area, WECPNL contours, and some requirements for land use.

2) Influence on ecology such as vegetation, animals, etc.

   No preserved species of vegetation or animal are located in this Study area.

3) Influence to water in terms of quality and natural water source and distribution system.

   There is no necessity to change any natural water system for the airport developments. For the preservation of the natural water quality, the system and the standard should be deter-mined when the designs of the storm water drainage and the se-wage treatment system are carried out in the later stage.

4) Influence to air

   No significant influence is foreseen judging from the anticipate traffic volume.

5) Adjustment with land use plan

   The neighboring land use plan should be made based on the requi-rements of the airport. These include, zoning by noise level, height restrictions, exclusion of electrical interruption, res-triction on similar lighting, airport expansion, etc. For the new airport, any necessary requirements can be incorporated in the future land use plan while the existing airport will requ-ire a large amount of compensation in order to improve the land use and set forth the zoning standard by noise level, in the future. The requirements of noise and heights derived from the selected scheme are discussed in Section 16.2 of this Report.

6) Other factors

A bird hazard and corrosion of airport facilities due to salt particles may be relevant for new airport. However, it is not considered necessary to give special attention to these matters because no bird inhabitants were seen during the site investigations and the terminal area which accommodates most of the building facilites will be located some 1,200 meters away from the sea.

For the existing airport, the excavation of the hill will change the existing scenery and the construction may disturb the surrounding area by noise, vibration, dump truck traffic, etc.

12.3 Airport Employee

DGAC staff stationed in the airport and the total number of airport employees are estimated based on the forecast of air traffic volume as tabulated in Table 12.3.1.

The correlation between the number of passengers and airport operation staffs of DGAC is based on that of coefficient in Indonesian airports, which is reported in the sectorial study of Tabing Airport by DGAC.

The total number of airport employees is estimated by assuming the employee rate to be about 0.73 persons per 1000 annual passengers taking into account the existing conditions at Tabing airport, and other similar Indonesian and Japanese airports.

Table 12.3.1 AIRPORT EMPLOYEE

	1985	1990	1995	2000	2005
Total Number of Airport Employees	290	550	950	1,470	2,220
DGAC Staff	165	260	410	605	880

CHAPTER 13 OVERALL COMPARISON OF THE TWO SCHEMES

13.1. Conclusion

Even without carrying out the economic analysis, the evaluations on all other important criteria indicate that the new airport construction is far more suitable not only as the gateway of West Sumatra, but also for the future development of Padang city, than the redevelopment of the existing airport.

Therefore all necessary action should be taken for the earliest completion of the new airport as scheduled in Table 9.3.1. The investment on the existing airport should be limited to the minimum necessary to maintain the present airport in operation until the inauguration of the new airport.

13.2. Comparative Evaluation

The two schemes are evaluated and compared to each other on five important criteria as tabulated in Table 13.1.

The result of the comparison on each criteria is summarized as follows :

1) Aircraft Operational Factor

While the existing airport permits the establishment of straight-in approaches (including ILS approach) only from the north due to the mountains on the south, the new airport will permit any preferable procedures.

2) Social Factor

While the existing airport will sooner or later involved in the noise problem and other problems, as airport activity grows and the city expands, the new airport will be compatible with the surroundings if the proper regulation on land use can be set forth at the beginning.

3) <u>Constructional Factor</u>

Although the existing facilities are to be utilized as much as possible, most of these facilities will need to be replaced with new facilites due to the demand for higher quality facilities. The existing airport therefore requires investment comparable to a new airport construction and the total cost will be even higher than the new airport because of land acquisition and compensation.

4) <u>Ease of Further Airport Expansion</u>

It will be economically very difficult to expand the existing airport beyond expectations, if the need arises to meet unforeseen demand changes.

5) <u>Economic Rate of Return</u>

There is a significant difference between the two schemes.

Table 13.1 COMPARISON OF THE TWO SCHEMES

	COMPARISON CRITERIA	REDEVELOPMENT OF THE EXISTING TABING AIRPORT	NEW AIRPORT CONSTRUCTION
1.	Aircraft Operational factor 1-1 Obstacle	(1) A 132m hill is located some 3700m to the south of the runway. (2) A 335m hill is located 11,000m to the north of the runway. (3) The 132m hill should be excavated so as not to infringe the take off climb surface (1 : 40).	None
	1-2 Flight procedure	It is not possible to establish a straight in approach procedure from the south.	Any procedure can be established.
	1-3 Wind	13 knot cross wind coverage : 99 %.	The same as the existing airport.
	1-4 Navigational aids	(1) ILS can not be installed for RWY 34 approach. (2) ILS can be used for RWY 16 approach if glide slope of 3° 22' is adopted.	No problem
2.	Social factor 2-1 Aircraft Noise	The population of the surrounding area is increasing and it is foreseen that the airport will suffer from complaints about noise and be obliged to carry out the necessary compensation works.	There are a few houses in the surrounding area. By making a proper land use plan, any future conflict with the surroundings can be eliminated.
	2-2 Airport distance from Padang City	7 Km	23 Km
	2-3 Airport Access	The existing coastal road to be utilized.	The existing and the new by-pass road planned by Bina Marga, to be utilized.
	2-4 Land use of the airport surroundings	(1) The airport is surrounded by built up area and rice fields. (2) There will be conflict with future city development.	(1) Wasteland but partially utilized for coconut plantation. (2) Irrigational work is planned by PWD.
	2-5 Natural environs	The excavation of the Hill may cause destruction of natural environs.	The environs of the waste-land will be changed.
	2-6 Relocation of residents	Difficult as compared with a new airport.	Easy.
3.	Constructional factor 3-1 Ease of construction	The construction is to be carried out while the existing facility is in operation.	A lot of freedom in construction planning.
	3-2 Land acquisition cost	Rp 15,000 – Rp 40,000/m²	Rp 100 – 150/m²
	3-3 Utilization of the existing airport facilities.	Possible, but limited to the existing runway, apron, fire station, rx-station, and terminal building.	Not applicable
	3-4 Access road and utilities	Although power supply, water supply (ground water), etc. are provided at the present, construction comparable to the new one will be required to meet the future demands.	About 4.5 km airport access road (100 m of bridges), power supply by PLN, and water supply and treatment system are newly required.
	3-5 Compensation works	Relocation of the existing road on the north is necessary.	
	3-6 Others	About 120 houses to be removed.	10 houses.
	3-7 Total Implementation Cost	63.1 billion Rupiahs	47.5 billion Rupiahs
	1st Phase Implementation Cost	47.1 billion Rupiahs	31.5 billion Rupiahs
	Construction work	23.9 billion Rupiahs	24.4 billion Rupiahs
	Land acquisition and compensation	15.4 billion Rupiahs	0.6 billion Rupiahs
	Others	7.8 billion Rupiahs	6.5 billion Rupiahs
4.	Ease of further airport expansion	Economically limited after 2000 if compared with a new airport.	No significant limitation.
5.	Economic Rate of Return (up to the year 2007)	27.0 percent	35.0 – 37.0 percent

PART IV AIRPORT MASTER PLANNING FOR THE SELECTED SCHEME

CHAPTER 14 AIRPORT FACILITIES

14.1 General

This chapter sets forth the planning concept for the physical facilities, as part of the airport master plan, for the new Padang Airport at Ketaping.

The physical planning includes a study of;

- airspace and air traffic control,
- airfield configuration,
- terminal complex,
- circulations (traffic, etc.) utilities,
- support and service facilities, and
- ground access system.

This chapter also presents basic assumption and considerations, applied standards and regulations, solutions, and also the results of the planning.

This chapter consists of the following ten (10) sections;

i) General Layout Concept

ii) Site Preparation

iii) Runway, Taxiway and Apron

iv) Passenger Terminal Building

v) Roads and Carparking Area

vi) Other Buidlings

vii) Utilities

viii) General Service and Others

ix) Air Navigation Systems, and

x) Airport Property Area

14.2 Airport Layout Concept

14.2.1 Airport layout

The new airport site has been selected in the Ketaping area based on the previous site selection studies, as reported in Chapter 6, "Site Selection for a New Airport". This subsection describes the detailed studies for the determination of the airport layout at the Ketaping site.

The following factors have been carefully studied and considered for the determination of the airport layout.

i) Airspace and obstructions

ii) Aircraft noise

iii) Geography and geology at Ketaping

iv) Compatibility with land use plan

v) Future expansion

vi) Airport Access, and

vii) Other factors - Approach lighting system area
- Glide slope critical area

1) Airspace and obstructions

There will be no obstructions which affect the establishment of standard aircraft operating procedures, provided that the runway orientation is parallel to the seashore or is declined in a clockwise direction. Although coconut trees exist at the site, these trees can easily be removed as required, thus providing no obstructions to the obstacle limitation and clearance surfaces.

Hence, there is no critical condition for the runway orientation and location in this regard.

2) Aircraft noise

Figure 14.2.1 indicates conditions that restrict the runway orientation due to aircraft noise. The runway shall be oriented less than 24 deg. west from north as a mandatory condition for both Phases I and II, since the developed area of Padang City will be affected by aircraft noise (measured and assessed by WECPNL 70 contour) if a more counter-clockwise orientation than the abovementioned angle is used. Although the actual instrument traffic pattern (take off and approach course) will not be straight as shown in Figure 14.2.1, this contour was applied because it is considered safer.

This means that using the marginal runway orientation, the developed area of Padang City will never be affected by aircraft noise even if aircraft would take a direct course, by chance, under VFR (Visual Flight Rules) conditions.

3) Geographic and geological conditions

Although the terrain at Ketaping has a slight down slope from the east side to the seashore on the Indonesian Sea, the terrain is considered mostly flat. At the southern end of the new airport site, a large river exists, the so called "Batang Anai" with a width of approximately 80 meters. At the western end, an irrigation canal exists along the seashore, which is called, Talao Bunga. It has been straightened by the Public Works Department of West Sumatra and connected to the mouth of the Batang Anai.

A flat plain extends towards the eastern side. A shrubby strip, however, is located across the site running parallel to Talao Bunga and at a distance of about 500 m from the sea. This strip area is lower in elevation than other areas and, thus is considered a wettish area.

According to the soil investigation (see Appendix 8.3.1 thru 4) which were made as a part of this study, the subsoils existing in this area are poorly graded sands (SP) with a 20% CBR value except for the wettish area, where a 9% CBR value is reported. The area is however generally consists of extremely good soil conditions for subgrade.

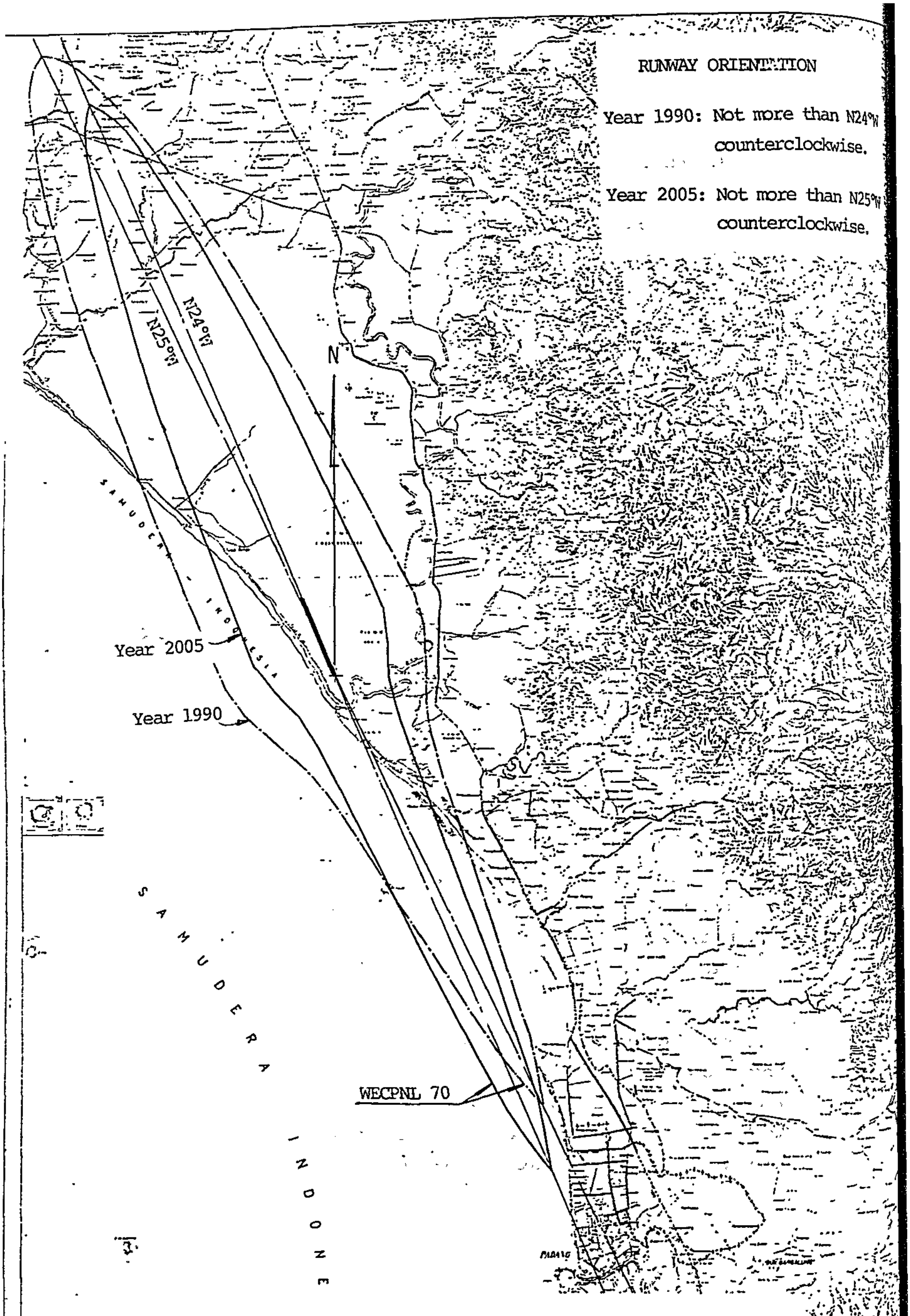


Figure 14.2.1 RUNWAY ORIENTATION BY AIRCRAFT NOISE

Although there will be no problem for pavement subgrade even in the wettish area, it will be desirable to site the airport facilities outside the wettish area in view of the reduction in construction cost which would result due to a lower cost for structural foundations and pavements

4) Compatibility with land use

The new airport site is used mainly for coconut plantation and rice field, at the present time as reported previously in Chapter 6, Section 2. The land is very sparcely inhabited and undeveloped. The following factors, however, shall be taken into consideration for the determination of airport location.

i) The land which is not effectively used at the present time shall be utilized for the airport property. Namely, a barren land shall be actively used.

ii) Triangler dead area between Talao Bunga and airport property area shall be reduced as least as possible, whereas there will be no effective land use in this space.

iii) The rice field in Ketaping shall be conserved as much as possible. The airport property area shall be so located that it does not conflict with the rice field unnecessarily.

5) Future expansion

It is necessary to consider a future expansion of the airport property in order to cope with unexpected increased demand. It is usual and also easier to expand the runway to the non-precision approach side (to the north).

Small villages, so called "Pasar Ketaping", exist at a distance of about 8 km north of Batang Anai. Also an irrigation canal exists perpendicular to Talao Bunga at a distance of about 5 km north of Batang Annai.

Accordingly, the runway shall be located as much in the sourthern area as possible in order that a future runway extension would not conflict with the small villages and the irrigation canal.

6) Airport Access Road

Airport shall be located as much in the southern area as possible in order to reduce the distance of the new access road and also access time from/to Padang City.

7) Other factors

a) Approach lighting system area

An area for the approach lighting system will be one of the factors which will determine the location of the airport.

The area for the approach lighting system category - I shall not cross Batang Anai River, since it would increase the construction cost for the center bar and center bar structures and also would cause maintenance difficulties.

b) Glide slope critical area

An uniformly graded area is required for the glide slope area to minimize the course-bend and to meet the standard of category-I operations as defined in Annex. 10, ICAO.

The FAA standard is, however, applied for the condition of runway location, since there is no detailed criteria available from ICAO on this matter.

The area shown in Figure 14.2.2 is defined on the basis that the first Fresnel Zone will be less than 2,200 ft in case of a 3.0 degree glide slope.

The hill and ditch should be avoided in area "C". Hence, area "C" has been located to avoid conflict with the canal Talao Bunga.

Also in area "B", the terrain shall be smoothly graded. Hence, the old irrigation canal perpendicular to the Talao Bunga has also been avoided in this area.

As a result of the above mentioned considerations, the following conditions will be itemized for the determination of the airport layout.

- Runway shall be oriented less than 24 degree West from North based on the aircraft noise conditions.

- Runway shall be oriented as parallel as possible, to the sea-shore to avoid the wettish strip and also to reduce the triangler dead area.

- Airport shall be located in the sourtherly area as much as possible in order to avoid a future conflict with the small villages and to allow for future expansion.

- Airport shall be located in the southerly area as much as possible to reduce the distance between Padang City.

- Airport shall be so located that the area for the approach lighting system will not cross Batang Anai.

- Airport shall be so located that the critical area for the glide slope facility will be prepared in accordance with FAA Standards and it will be kept away from ditches.

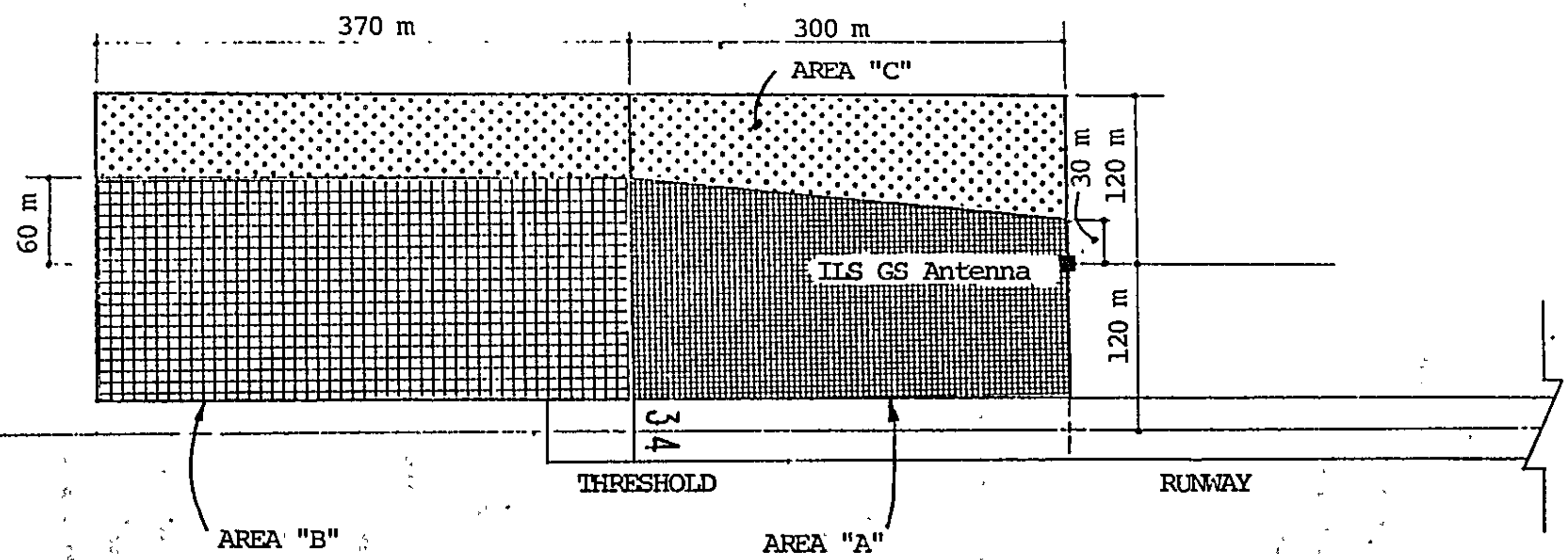
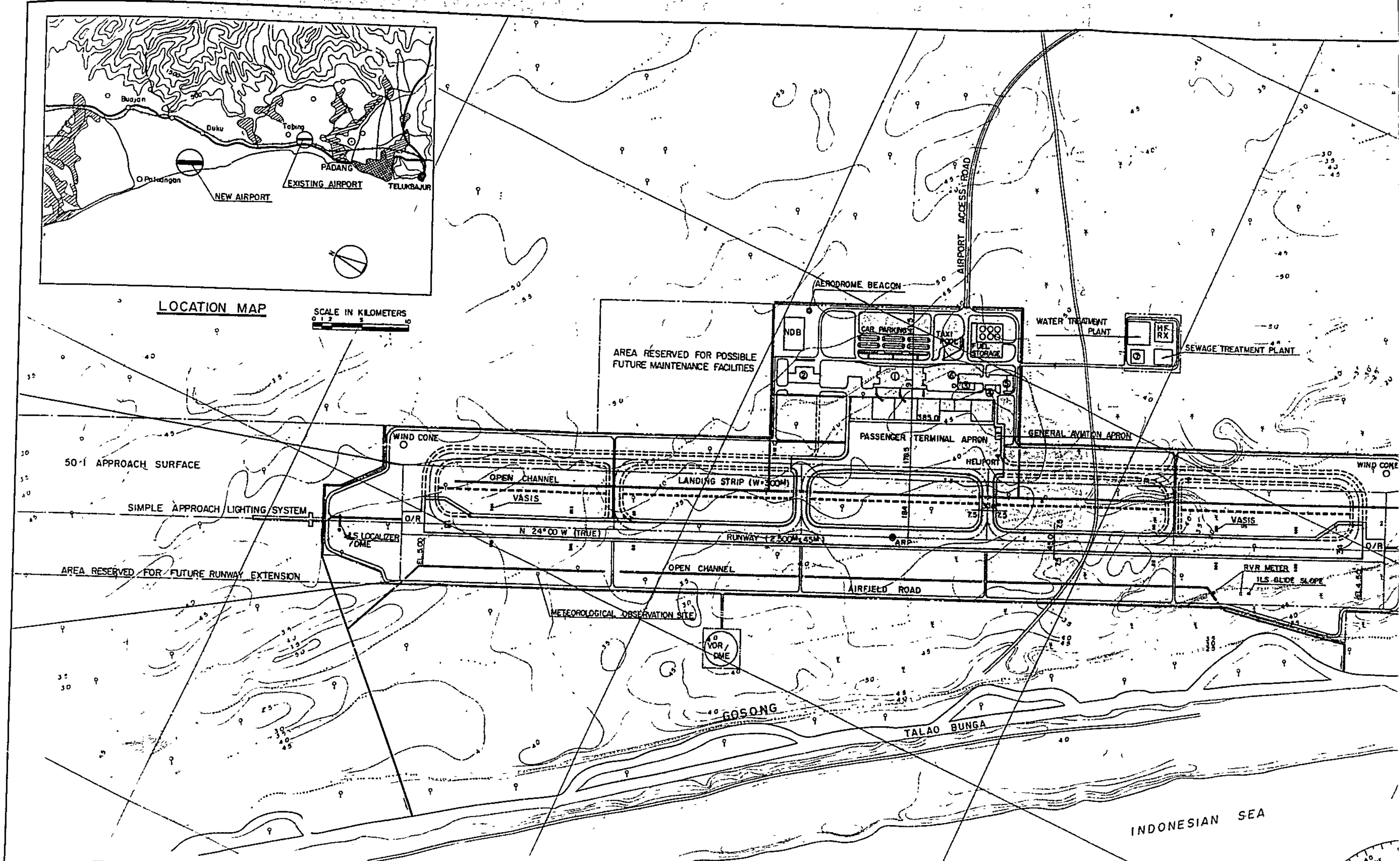


Figure 14.2.2 ILS GLIDE SLOPE CRITICAL AREA

Finally the new airport layout has been determined in the Ketaping area as shown in Figure 14.2.3.

The airport location is as follows;

Runway Orientation	:	N 24° W
Airport Reference Point	:	S 00°47'26"
	:	E 100°17'05"

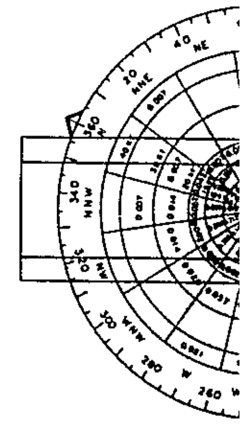


BASIC DATA TABLE	
RUNWAY DATA	
EFFECTIVE RUNWAY GRADIENT (IN%)	0 020
% WIND COVERAGE	20 KNOT . 99.9% 13 KNOT 98.0%
INSTRUMENT RUNWAY	✓
PAVEMENT STRENGTH	B 747 AND DC 10 CLASS
APPROACH SURFACES	1 50
LIGHTING	HIRL
MARKING	ALL WEATHER
NAVIGATIONAL AIDS	ILS, ALS, VASIS

BASIC DATA TABLE	
AIRPORT DATA	
AIRPORT ELEVATION	4 87 M
AIRPORT REFERENCE POINT(ARP) COORDINATES	LAT 00°47'26"S LNG 100°17'05"E
AIRPORT AND TERMINAL NAVAID	VOR/DME
AIRPORT REFERENCE TEMPARATURE	33° C

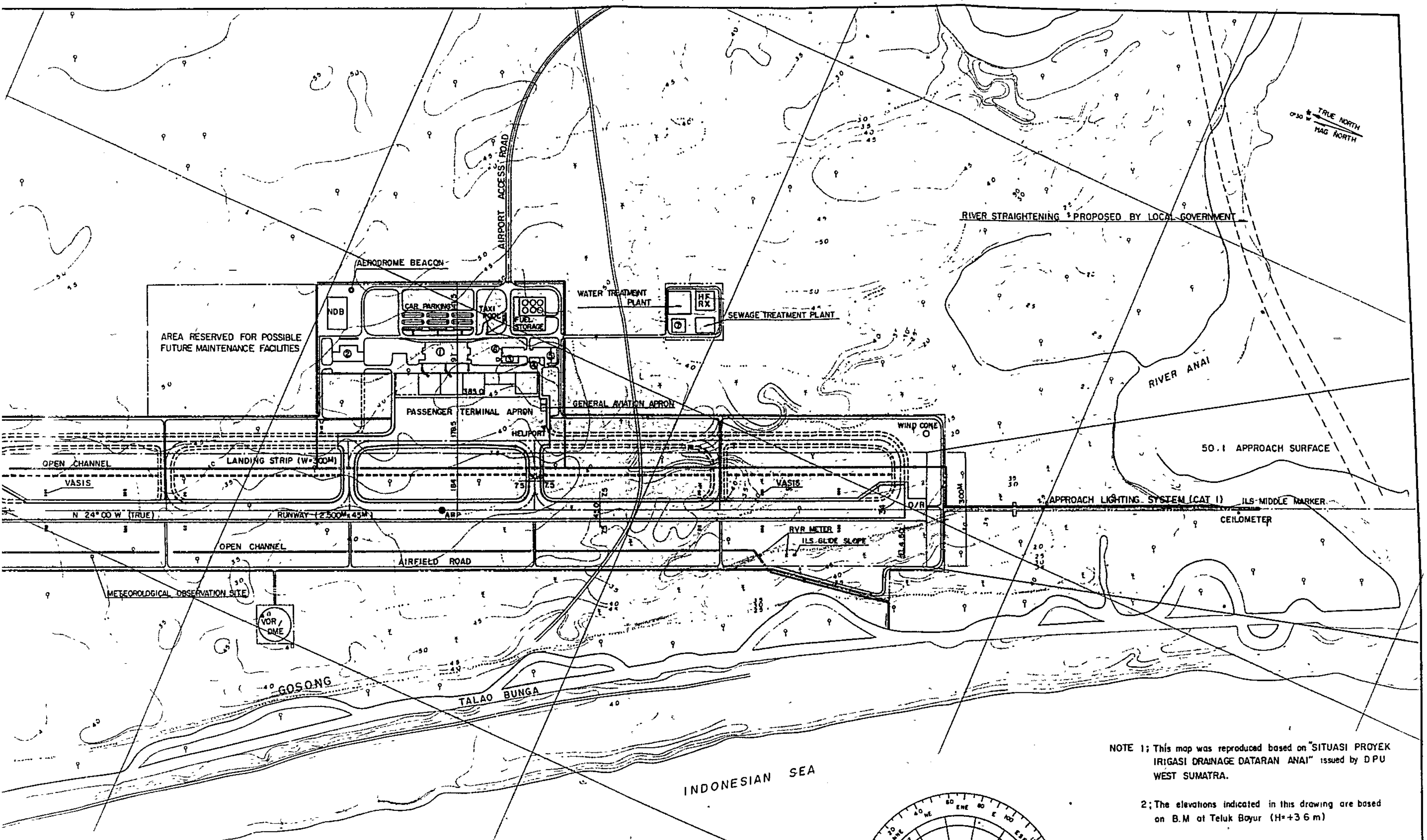
LEGEND	
—·—·—	AIRPORT PROPERTY LINE
~40~	GROUND CONTOURS
	COCONUTS TREES
	BUSH AND FOREST
	RICE FIELD
O/R	OVER RUN
	PHASE I
	PHASE II

BUILDINGS	
NO	STRUCTURE
①	PASSENGER TERMINAL BUILDING
②	CARGO TERMINAL BUILDING
③	ADMINISTRATION BUILDING
④	FIRE STATION
⑤	MAINTENANCE WORKSHOP
⑥	CONTROL TOWER
⑦	MAIN SUBSTATION



SOURCE : PUSAT METEOROLOGI DA
TABING AIRPORT
PERIOD : 1976 - 1978

WIND



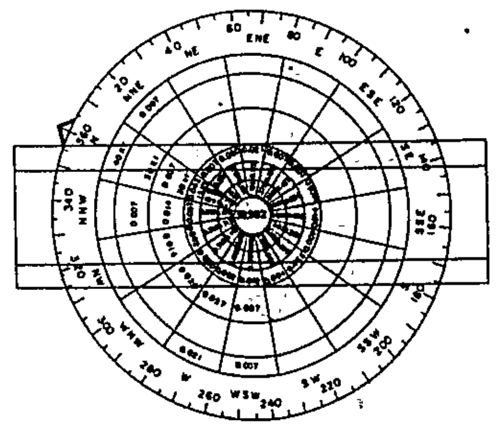
NOTE 1; This map was reproduced based on "SITUASI PROYEK IRIGASI DRAINAGE DATARAN ANAI" issued by DPU WEST SUMATRA.

2; The elevations indicated in this drawing are based on B.M at Teluk Bayur (H=+3 6 m)

BASIC DATA TABLE	
AIRPORT DATA	
ELEVATION	4 87 M
REFERENCE POINT(ARP) COORDINATES	LAT 00°47'26"S LNG 100°17'05"E
AND TERMINAL NAVAID	VOR/DME
REFERENCE TEMPARATURE	33° C

LEGEND	
- - -	AIRPORT PROPERTY LINE
~40~	GROUND CONTOURS
҂ ҂	COCONUTS TREES
♀ ♀	BUSH AND FOREST
ⅱ ⅱ	RICE FIELD
O/R	OVER RUN
▭	PHASE I
⬚	PHASE II

NO.	STRUCTURE
①	PASSENGER TERMINAL BUILDING
②	CARGO TERMINAL BUILDING
③	ADMINISTRATION BUILDING
④	FIRE STATION
⑤	MAINTENANCE WORKSHOP
⑥	CONTROL TOWER
⑦	MAIN SUBSTATION



SOURCE : PUSAT METEOROLOGI DAN GEOFISIKA TABING AIRPORT
PERIOD : 1976 - 1978

20 KT CROSS WIND COVERAGE 99.9 %
13 KT CROSS WIND COVERAGE 98.0 %

WIND ROSE

SCALE IN METERS
0 100 200 500

Figure 14.2.3 AIRPORT LAYOUT PLAN

14.2.2 Terminal Area Layout

The terminal area consists of the apron, passenger terminal building, cargo terminal building, administration building, control tower, car parking and other necessary terminal facilities. It has been located at the central section of the runway in order to provide functional and efficient operation of aircraft and the airport facilities.

The terminal area layout has been planned and is shown in Figure 14.2.4, taking into consideration the following factors:

1) Passenger Terminal Apron

The passenger terminal apron which is connected to the runway by two exit taxiways is located at the midpoint of the runway length in order to provide efficient operations for taxiing aircraft.

Small aircraft stands are positioned at the southern end of the apron and large aircraft stands, at the northern end in order to avoid any conflict at the apron taxiway.

The same layout criteria will be applied in Phase II, thus the extension of the apron will be towards the north.

2) Passenger Terminal Building

The passenger terminal building has been located in front of the large aircraft gate positions taking into consideration ease of installation for passenger boarding bridges and also efficiency of passenger and baggage handlings.

3) Cargo Terminal Building

The cargo terminal building has been located on the north side of the passenger terminal keeping the future expansion spaces in between for both the cargo and the passenger terminal buildings. This siting will bring efficient cargo handling as compared with the cargo terminal sited on the south because of the proximity of the terminal to the large aircrafts.

4) Administration Building and Control Tower

The administration building and control tower are located near the center of gravity for the runway, but this location will not affect any future expansion area for the passenger terminal building. This position meets the FAA siting criteria for the control tower and minimizes the tower height.

5) Other Buildings

The fire station and maintenance workshop buildings were located in the same zone with the control tower.

- The location of fire station meets the ICAO requirements with respect to response time for aircraft accidents being not more than 3 minutes.
- Maintenance workshop building is also located next to the fire station in the administration block. This facility consists of garages, maintenance facilities, fueling and lubrication facilities, etc. for airport service and maintenance equipment.

6) Car Parking

The public car parking area was located in front of the passenger terminal building in order to minimize walking distance for passengers and visitors. Staff car parking stalls were also provided in front of each building.

7) Fuel Storage

A refueling system is considered for the new airport. The basic approach for this facility is to minimize the transportation distance between the fuel storage and aircraft. It is also important to separate the traffic flow of refueler from that of public and private vehicles.

The fuel storage facility was located at the southern end of the terminal area so that a fuel car can reach the fuel storage directly without passing through the main road in front of the passenger terminal building. Refuelers also can gain access to the aircraft by an independent service road. This facility will be provided by Pertamina.

8) Vital Installation

Although the airport utilities plants are generally recommended to be located in the proximity of the load center and the airport administration area, in order to minimize the length of cables and pipes required, and to implement the effective administration of the facilities with a reasonable number of staff, etc., the major airport utility plants were consolidated and located within the special area isolated from the terminal area, the so called Vital Installation Area, in order to effect better security protection. This was done taking into account the opinions of DGAC. This area accommodates the main substation, the substation for airfield lighting, the emergency generators, the water treatment facility and pump house for water supply, the wastewater treatment plant, and HF RX station.

9) Future Maintenance Area

The area of 350 meters by 450 meters adjoining the northern boundary of the terminal area should be reserved by regulating the land use in order to accommodate a possible future aircraft maintenance facility and to cope with any unexpected requirements for the development of the terminal facilities in the future.

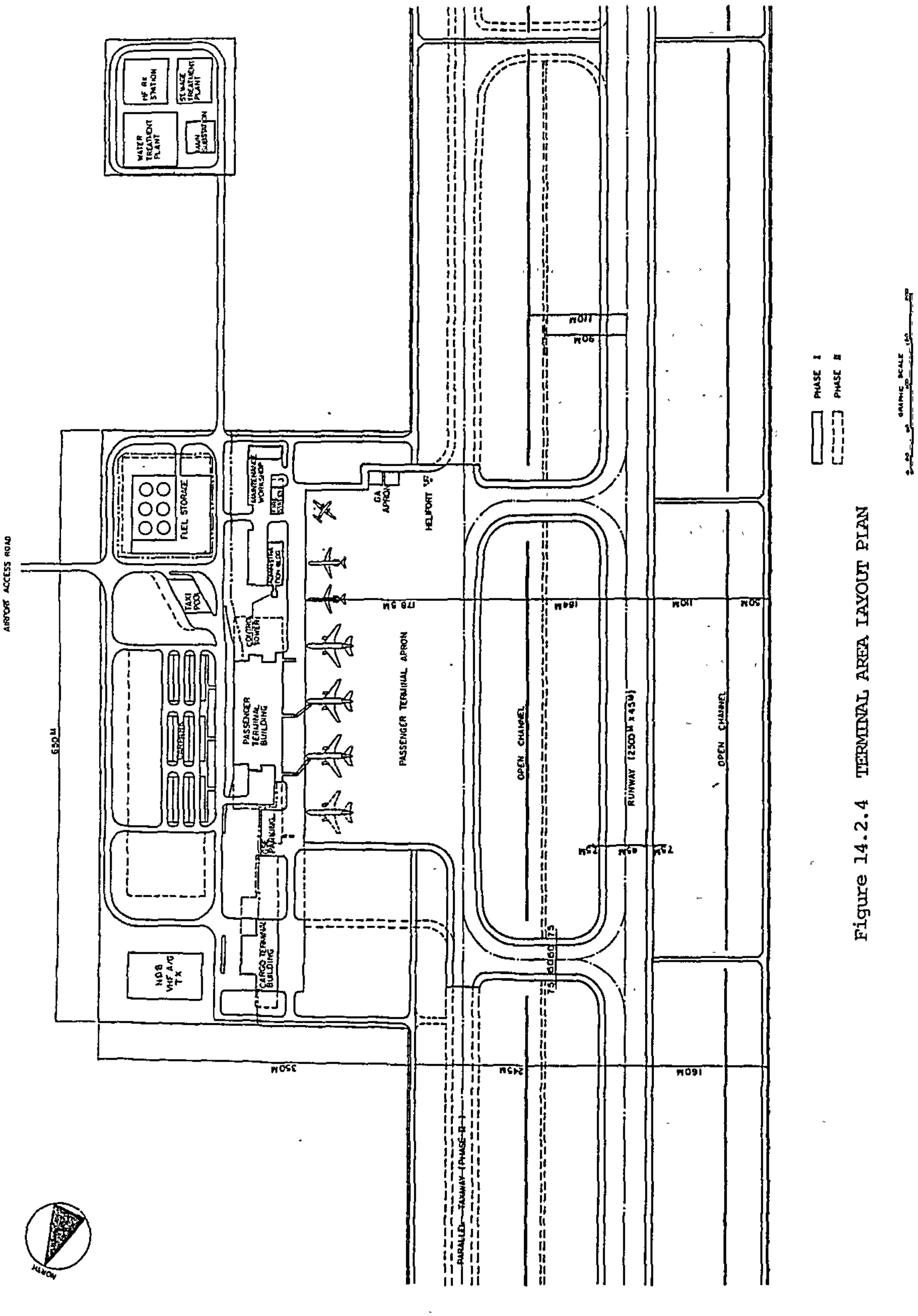


Figure 14.2.4 TERMINAL AREA LAYOUT PLAN

14.3 Site Preparation

14.3.1 Grading Plan

The grading plan for the airport is generally established so as to achieve the least quantity of and a balanced earth work volume, and an adequate storm water drainage system.

The runway profile and typical cross sections for the new airport have been planned and are indicated in Figure 14.3.1 and 2. These sections are the result of trial studies on the vertical alignments in terms of economy of earth work and adequate storm water drainage.

The major planning criteria and policies are summarized in 1) and 2).

The total earth work volume for the total airport construction up to the second phase is estimated to be about 380,000 cu.m of cut and about 550,000 cu.m of fill. The cut and fill volumes for the first phase are estimated to be about 290,000 cu.m and about 370,000 cu.m respectively.

1) The existing topographic conditions and drainage system

The existing conditions related to storm water drainage are summarized as follows:

(1) The new airport site is almost flat and lies between about elevation 2.5 meters and 4.5 meters above mean sea water level (MSWL). The terrain slopes slightly down generally toward the runway 34 from the runway 16.

(2) The proposed elevation of the airport is closely related to the proposed elevation of storm water drainage facilities which is determined from the water level of the rivers to which the airport storm water is discharged.

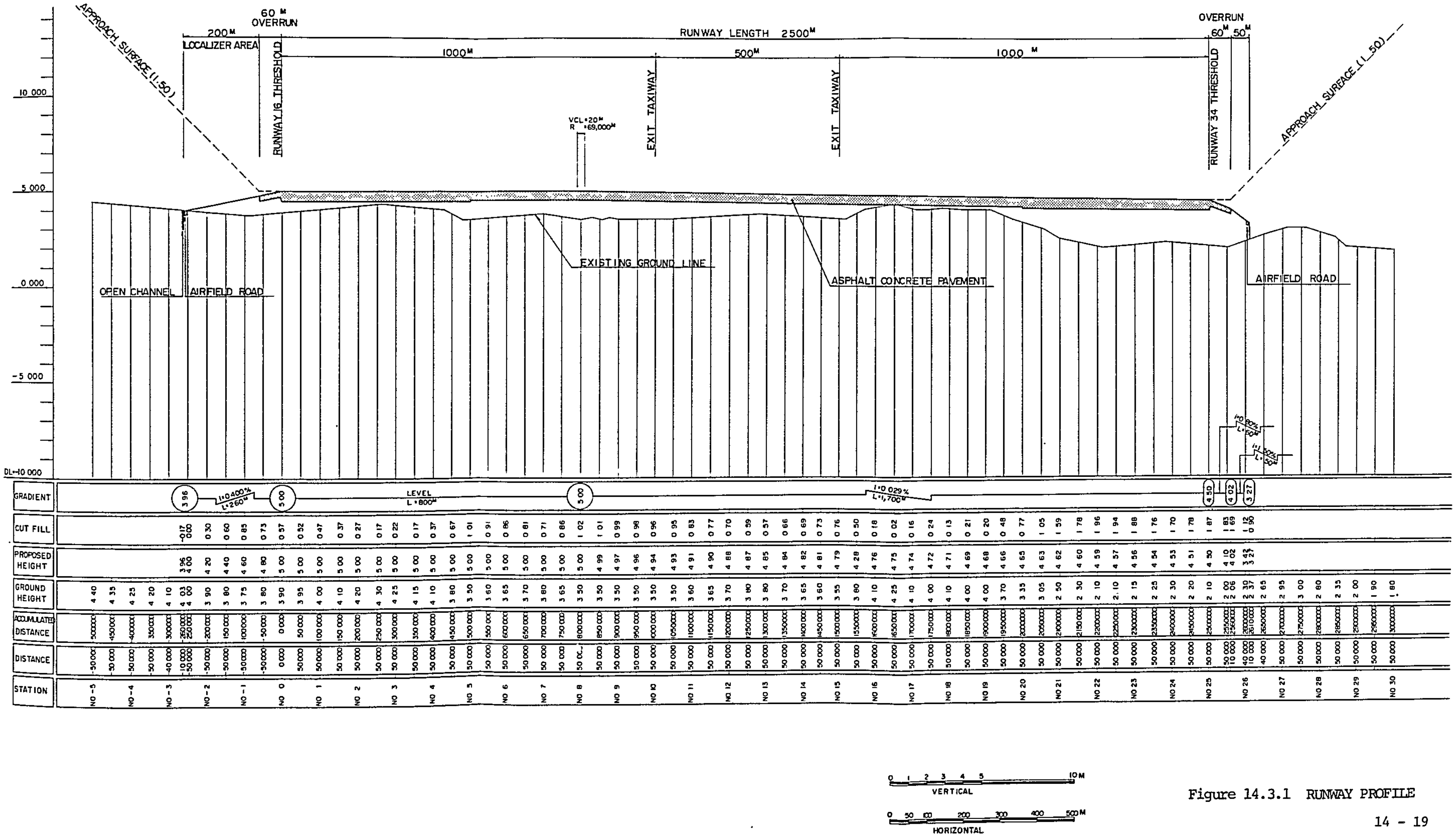
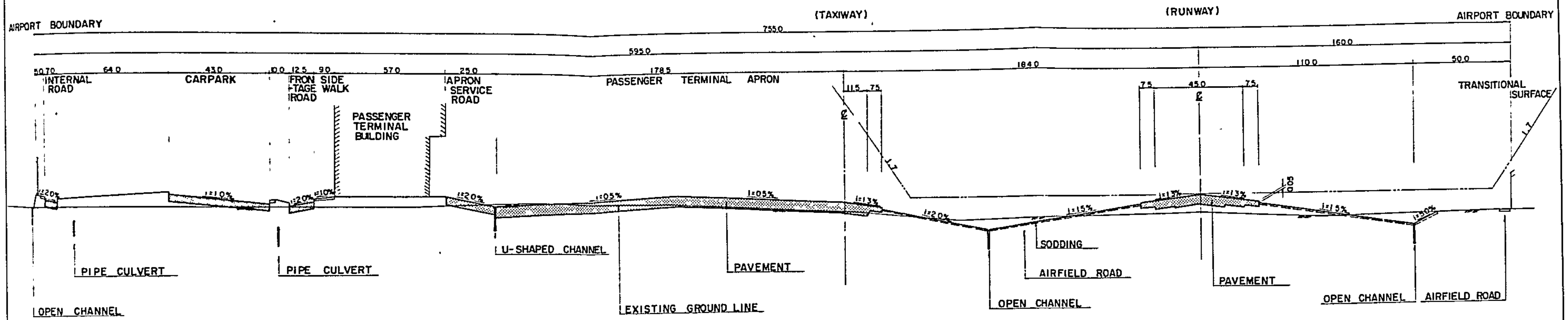
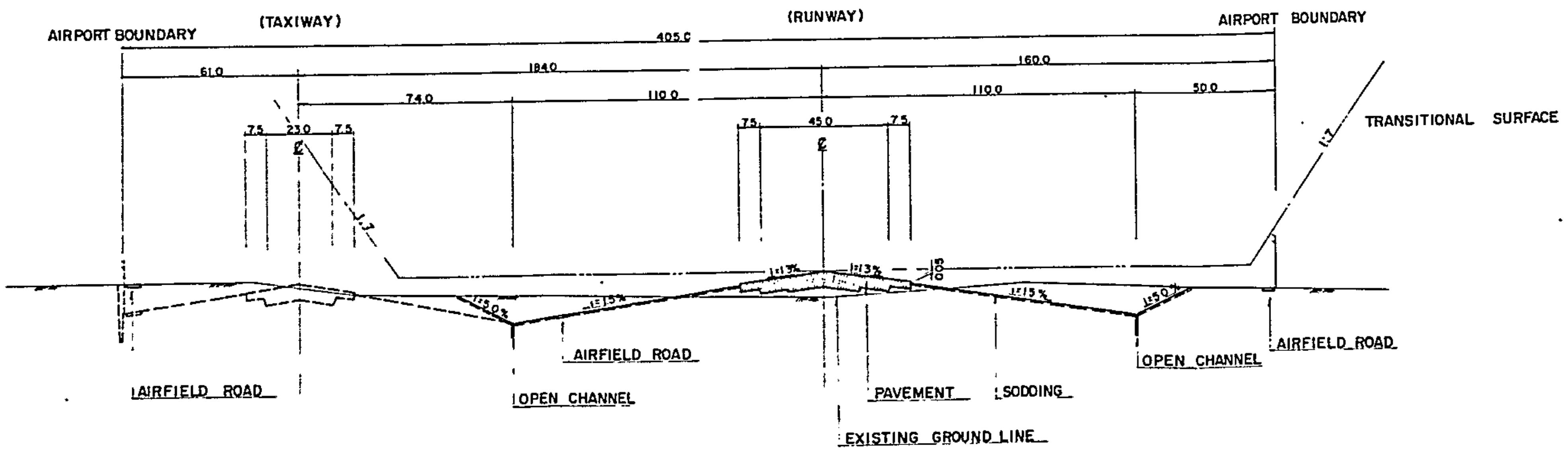


Figure 14.3.1 RUNWAY PROFILE



RUNWAY STRIP, TAXIWAY, APRON, PASSENGER TERMINAL AREA



RUNWAY STRIP, TAXIWAY

Figure 14.3.2 TYPICAL CROSS SECTION

(3) The high water level (HWL) for Batang Anai, to which the airport storm water is discharged, is about 1.5 meters. The HWLs of Talao Bunga are about 2.4 meters and about 3.3 meters near the glide path and localizer of the airport respectively according to PWD, West Sumatra.

Therefore, regardless of which river is selected for discharge, it is difficult to plan adequate gradient for the drainage facilities because of the small difference between the existing ground level and the high water level.

Table 14.3.1 shows the lowest ground level as related to the water level at several Japanese airports built in the sea. It can be seen from this table that the lowest ground level surface for the airport is generally designed 10 to 60 cm above the highest water level.

Taking into account the conditions at Japanese airports and the amount of head loss between the airport and Batang Anai, the lowest ground level, i.e., the lowest top of open ditch, was planned to be 2.2 meters (70 cm above HWL of Batang Anai).

In order to plan the runway level as low as possible and to achieve an economical construction, a ponding system has been adopted for the intermediate area between the runway and the parallel taxiway and the water is planned to be discharged to Batang Anai by gravity flow. Using this drainage system, the economic runway elevations with relatively small amount of earth work volume as compared to the plan utilizing only Talao Bunga will be designed.

2) Planning criteria related to slopes

In addition to the planning policy derived from the existing conditions at the new airport site, the following criteria in accordance with ICAO are employed for the grading plan.

(1) The area to be cleared and graded for the runway strip is basically the area shown in Figure 14.3.3.

(2) The open ditch for surface water drainage is located along a line parallel to and 110 meters from the runway center so as not to encroach upon the area indicated in 1) above.

(3) Within the above area, a transverse gradient of 1.5 percent is adopted toward the open ditch as the minimum slope considering adequate water flow toward the open ditch and to minimize the earth work by reducing the runway elevation.

(4) The allowable maximum gradient of 5 percent is basically adopted for grading the area beyond 110 meters distance from the runway in order to minimize the earth work volume and operation.

(5) A transverse gradient for the runway and the taxiway is planned to be 1.3 percent considering the tolerance of the pavement works and the ease of installation of overlay works in the future.

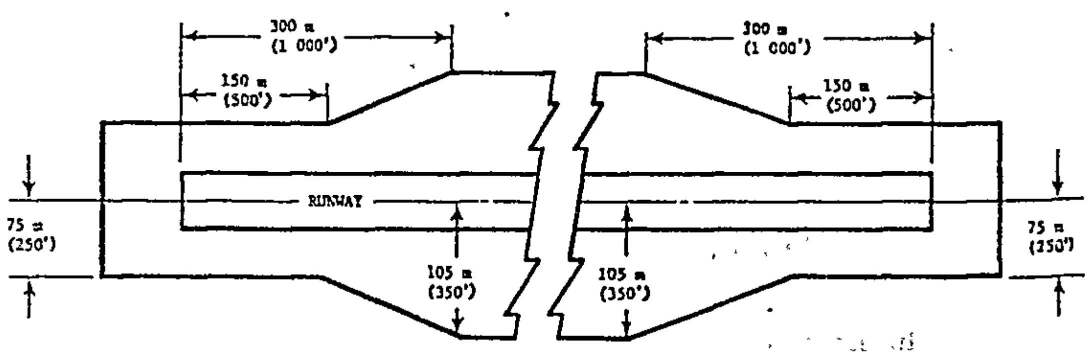


Figure 14.3.3 THE AREA TO BE CLEARED AND GRADED

Table 14.3.1 RELATIONS BETWEEN WATER LEVEL AND PROPOSED ELEVATION

Airport	Water Level	Lowest Ground Level
NAGASAKI	HHWL = +0.67 HWL = +0.37	+1.00
YAMAGUCHI-UBE	HHWL = +4.370 HWL = +3.840	+4.970
SHIMOJISHIMA	HHWL = +2.80 HWL = +1.90	+3.00
TOKUNOSHIMA	HHWL = +1.40 HWL = +0.80	+1.50
HIROSHIMA	HHWL = +3.90 LWL = +0.00	+4.00
TOKYO INT'L	HWL = +0.920 LWL = -1.230	+1.143
NAHA INT'L	HWL = +2.10	+2.30
PADANG	HWL = +1.50 (BATANG ANAI)	+2.20

14.3.2 Storm Water Drainage System Plan

Although the airport surface water is discharged to Batang Anai which has a lower HWL as described in the previous section, the storm water collected on the west side of and along the runway and around the localizer area will be divided into two branches of flow and discharged into Talao Bunga.

The overall storm water drainage system and the outline of drainage facilities are planned as indicated in Figure 14.3.4.

The planning criteria employed for the drainage facility requirements are summarized as follows:

1) Run off

Rational formula is utilized to estimate the run off.

$$Q = \frac{1}{360} C.I.A.$$

Where Q: Run off (m^3/sec)

C: Run off coefficient

I: Rainfall intensity (mm/hr)

A: Catchment area (ha)

2) Run off coefficients

Pavement area: 0.95
Building area: 0.90
Sodded area : 0.30

3) Rainfall intensity

The rainfall intensity for "t" time period is estimated by the following formula as the basis for master planning.

$$It = \frac{R24}{24} \left(\frac{24}{t}\right)^{\frac{2}{3}}$$

Where It : Average rainfall intensity for "t" time period (mm/hr)

R_{24}: 235 mm/day for 5 year frequency is estimated from the maximum rainfall per day in the past 10 years from 1971 to 1980 (obtained from Tabing Airport records)

t : Inlet time (hr.)

The one hour rainfall intensity is calculated from this formula to be about 80 mm/hr. This figure is considered reasonable as the planning basis at this stage compared with the design value employed for other projects in Sumatra i.e. 87 mm/hr for Banda Aceh and 100 mm/hr for Teluk Betung.

The ponding which will occur beyond 23 meters from the pavement edge and within a duration of two hours is considered permissible according to FAA standards.

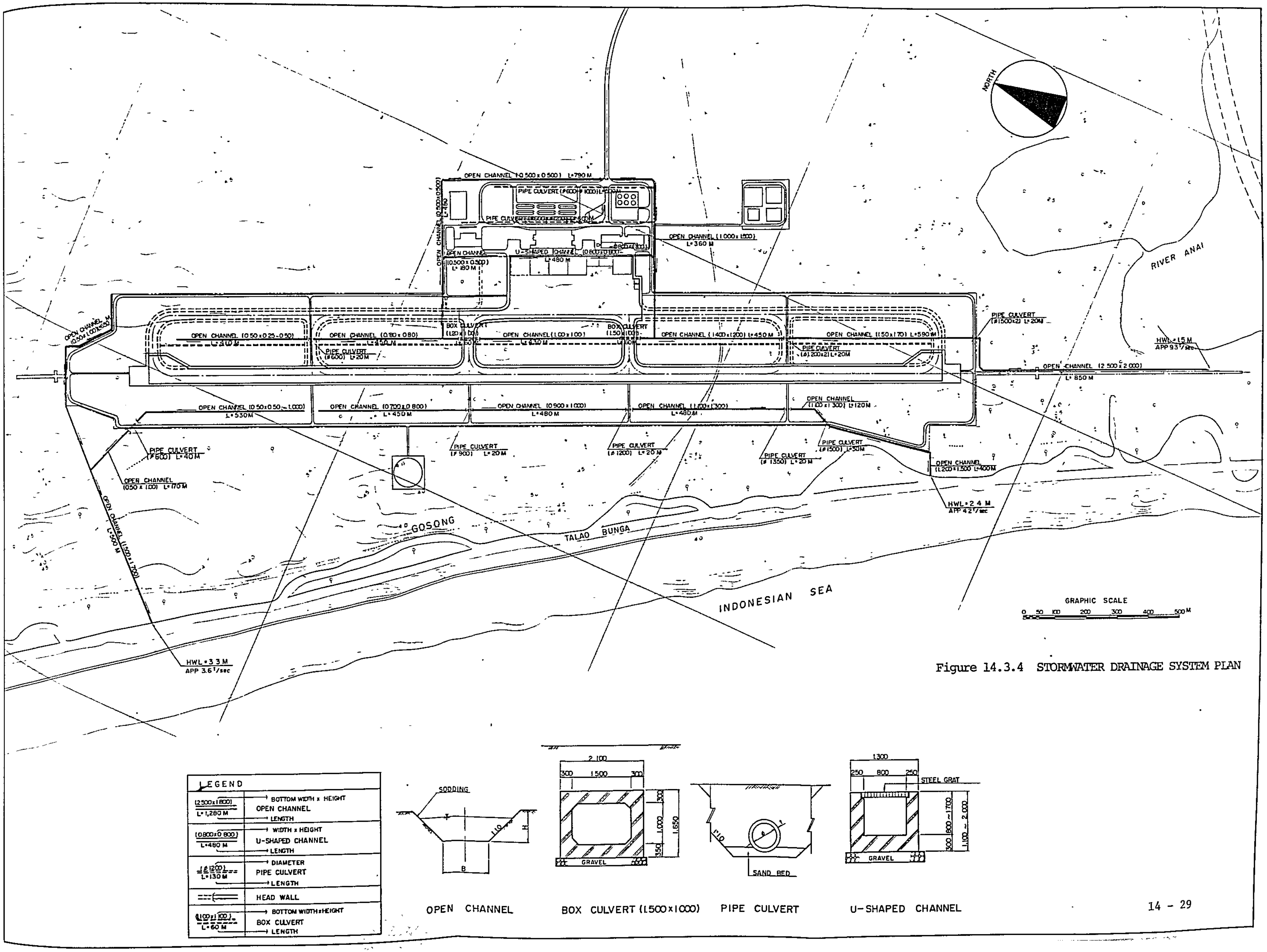


Figure 14.3.4 STORMWATER DRAINAGE SYSTEM PLAN

14.4 Runway, Taxiways and Apron

14.4.1 Runway

As described in Chapter 4 "Airport Facility Requirement", a runway 2,500 m long and 45 m wide with a 7.5 m wide shoulder, is planned in Phase I. Since a complete parallel taxiway will not be planned for Phase I, turnpads are required at both ends of the runway in order to allow for manuevering of DC-10 which will be the largest aircraft before 1995.

Although no extension will be required for the runway based on the demand forecast, the possibility of a runway extension up to 3500 meters toward the north will be considered.

The future land use plan for the airport vicinity must consider this in order to cope with the uncertain change of demand.

14.4.2 Taxiways

Although the IFR arriving will exceed 4 which justify a complete parallel taxiway according to ICAO, only two right angle exit taxiway connecting the ends of the apron are to be constructed in Phase I for the economic reasons.

The dimensions of these taxiways, namely width, radius of taxiway centerline, radius of fillet, etc., must be determined based on the wheel tracks of the DC-10.

In Phase II, the complete parallel taxiway, 23 m wide with 7.5 m wide shoulder, will be constructed with a separation of 184 m from centerline to runway centerline in compliance with the minimum separation requirements specified by ICAO.

Four additional right angle exit taxiways accommodating the B-747 will be constructed at 500 m intervals.

14.4.3 Apron

The passenger terminal apron is located at the midpoint of the runway length considering efficient operation of aircraft and airport facilities and construction economy (by avoiding bush or forest areas).

The apron is designed to accommodate four DC-10 class, two DC-9 class adopting a nose-in parking configuration and one small aircraft adopting a 45 degree nose-out parking configuration in Phase I. In Phase II, three aircraft stands for B747 class, two for DC-10 class, two for DC-9 class and one for small aircraft are to be provided.

The apron edge alongside the passenger terminal building is set at 190 m from the edge of the apron taxiway so that the tail wing of B747 does not infringe on the transitional surface.

Layout of parking positions is planned taking into account the exit taxiways utilized by the respective aircraft, unidirectional traffic movement along the apron taxiway and the tendency of aircraft type in service.

Therefore, the larger aircraft will be parked on the north side while the smaller on the south side, and the apron is to be expanded toward the north side.

14.4.4 Pavement

Asphalt concrete pavements are adopted for runway, taxiways, and apron with the exception of the jet aircraft loading apron where cement concrete pavement is adopted to avoid rutting from heavy gear loads.

The total thickness of the asphalt concrete pavement is established in section 8.3.2., to be 53 cm based on 5,000 repetitive loading from DC-10 class aircraft.

This standard thickness can be reduced by 10 to 20 percent considering the actual load application characteristics according to the "airport pavement design manual" of JCAB* as indicated in Figure 14.4.1.

The pavement for each specific area is planned on the basis of the above thickness reduction and is shown in Figure 14.4.2

Although the intermediate portion of the runway without parallel taxiway is desirable to be provided with the standard pavement thickness, the usual reduction is employed to this portion considering the traffic volume anticipated until the completion of the parallel taxiway in Phase II.

A 38 cm thick cement concrete pavement slab can be planned for the loading apron, as determined in 8.3.2.

The apron slab can be placed directly on the existing subgrade based on consideration of the modulus of subgrade reaction estimated to be 7 kg/cm^3 from CBR 20 percent for the proposed site with sand foundation, however, graded aggregate base course of 15 cm will be provided beneath the slab based on the soil classification of SP for the existing subgrade.

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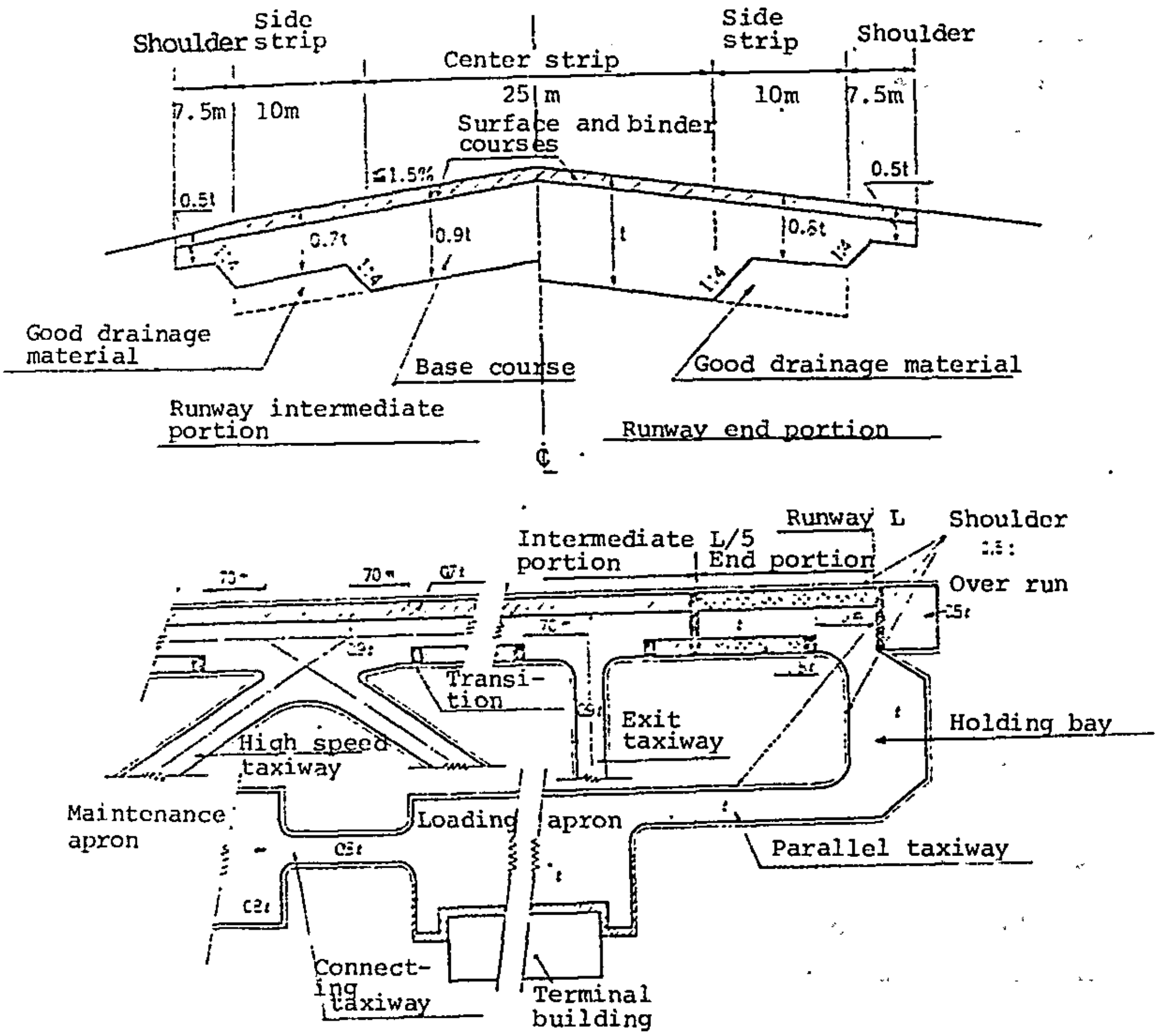
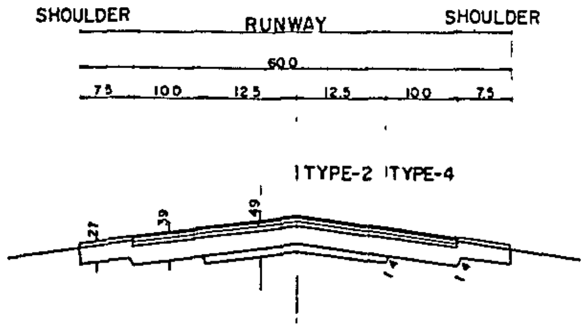
*JCAB: CIVIL AVIATION BUREAU OF JAPAN



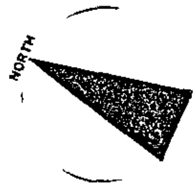
t: Standard pavement thickness

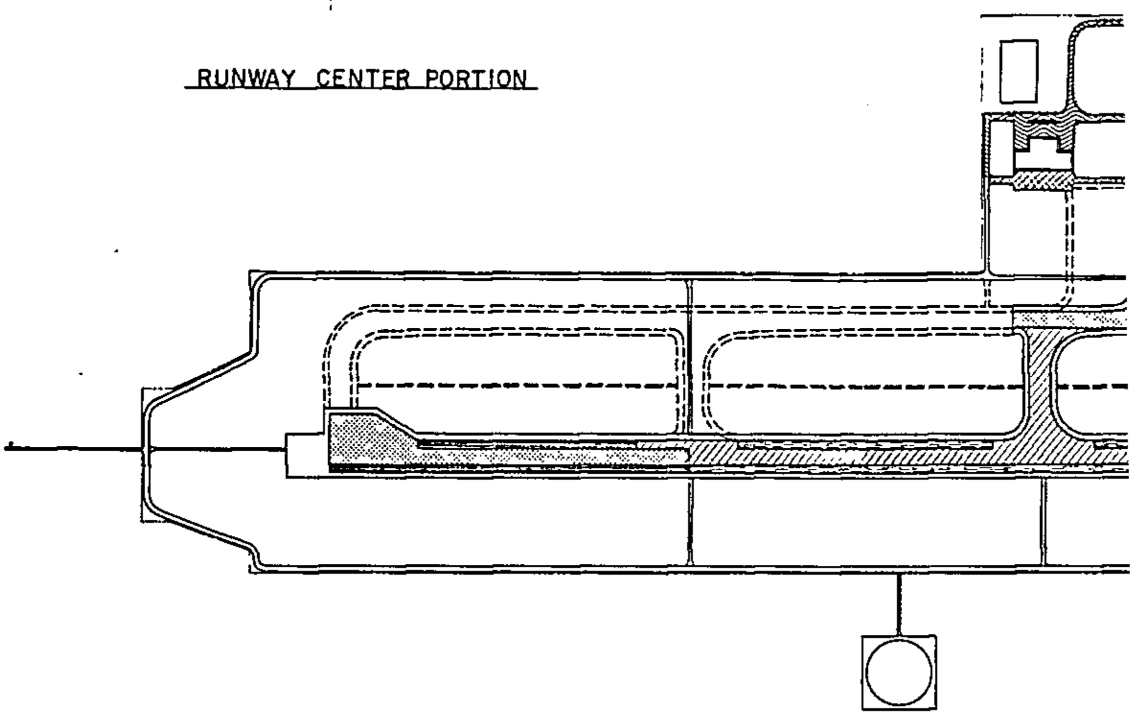
L: Runway length

Figure 14.4.1 REDUCTION OF STANDARD PAVEMENT THICKNESS



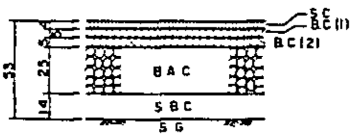
RUNWAY CENTER PORTION



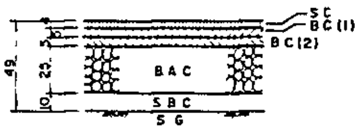


LEGEND

SYMBOL	ITEMS	
	AIRFIELD PAVEMENT	TYPE-1 (RUNWAY, TAXIWAY)
	"	TYPE-2 (")
	"	TYPE-3 (RUNWAY)
	"	TYPE-4 (RUNWAY)
	"	TYPE-1 (APRON)
	"	TYPE-2 (APRON)
	"	(SHOULDER OVERRUN)
	AIRFIELD ROAD	
	GSE SERVICE ROAD	
	CARPARKING AREA, INTERNAL ROAD	
	ACCESS ROAD	



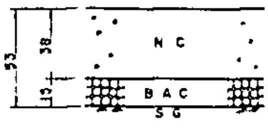
TYPE-1



TYPE-2

RUNWAY TA

SHOULDER(RUNWAY TAXIWAY APRON)
OVERRUN



APRON (TYPE-I)

GRAPHIC SCALE

GSE SERVICE ROAD

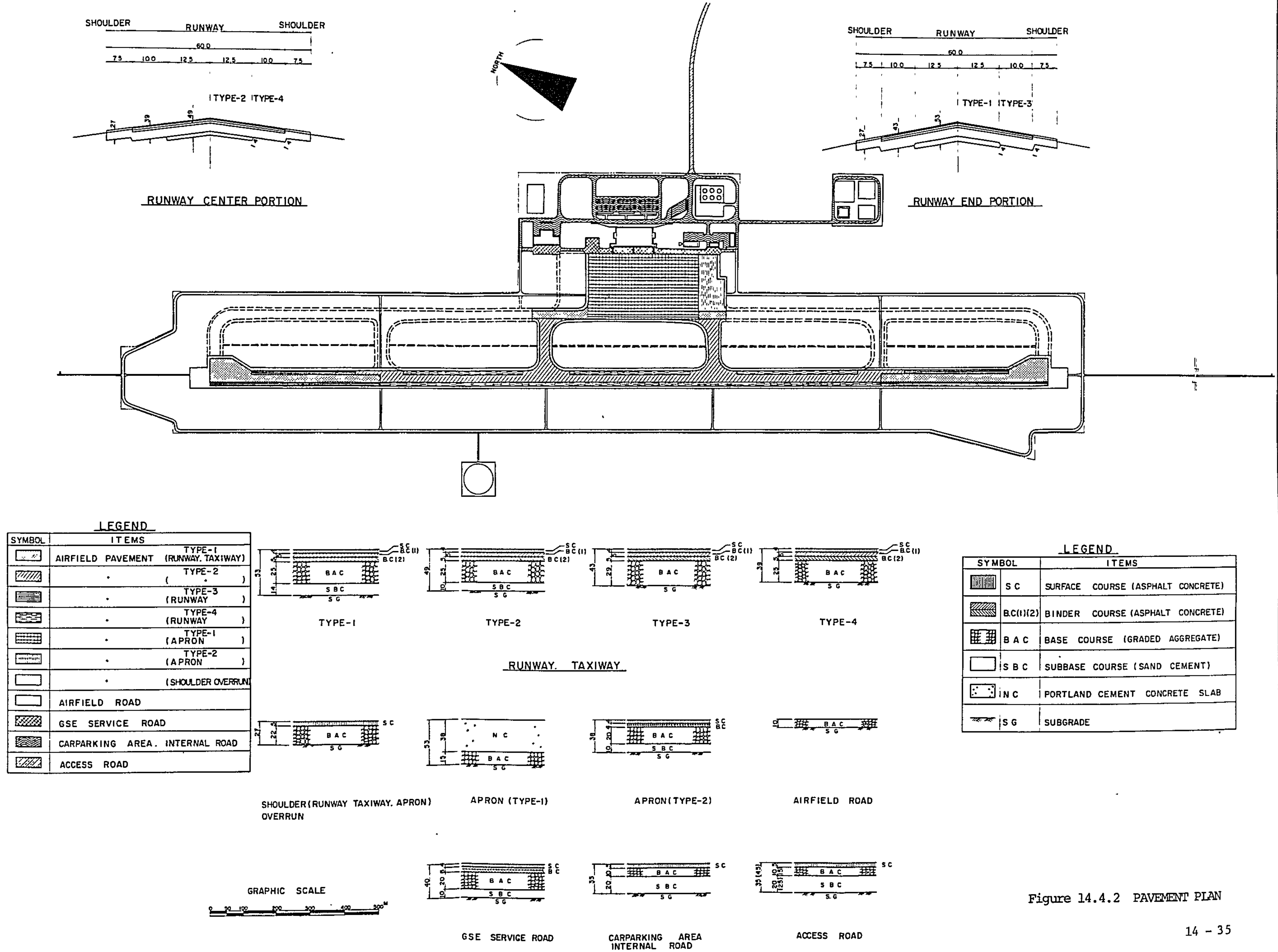


Figure 14.4.2 PAVEMENT PLAN

14.5 Passenger Terminal Building

14.5.1 General Concept

The handling of both international and domestic passengers is planned to be accommodated in one passenger terminal building as the existing building although these passengers processing areas are divided into two service blocks.

A linear type with one-and-half floor level concept will be employed for the terminal building considering the number of aircraft stands and the number of passengers to be handled.

As the installation of boarding bridges is considered necessary for Phase I taking into account the international tendency for service level for the passenger, and the traffic volume similar to the same anticipated in Phase I, two boarding bridges will be initially installed for two wide-bodied aircraft stands which may be occupied simultaneously, and a third boarding bridge will be provided for another fixed gate of wide bodied aircraft by the end of the Phase I period.

The flow of passengers and baggage is planned as shown in Figure 14.5.1 for the gates equipped with boarding bridge.

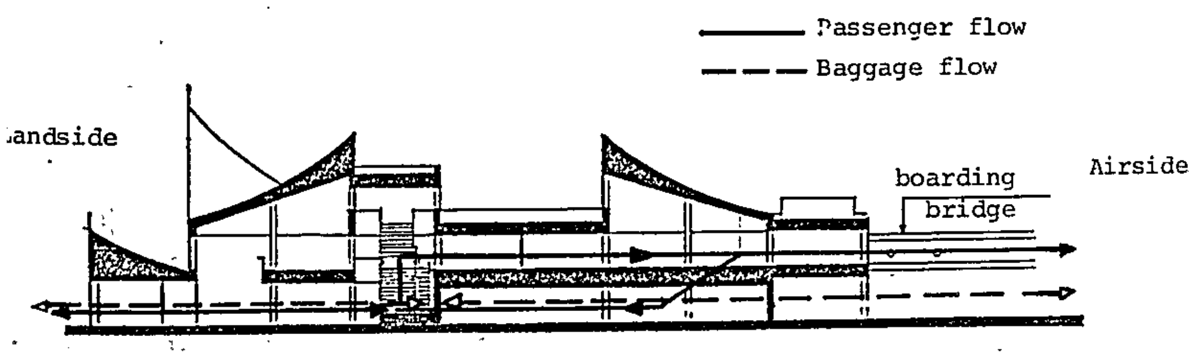
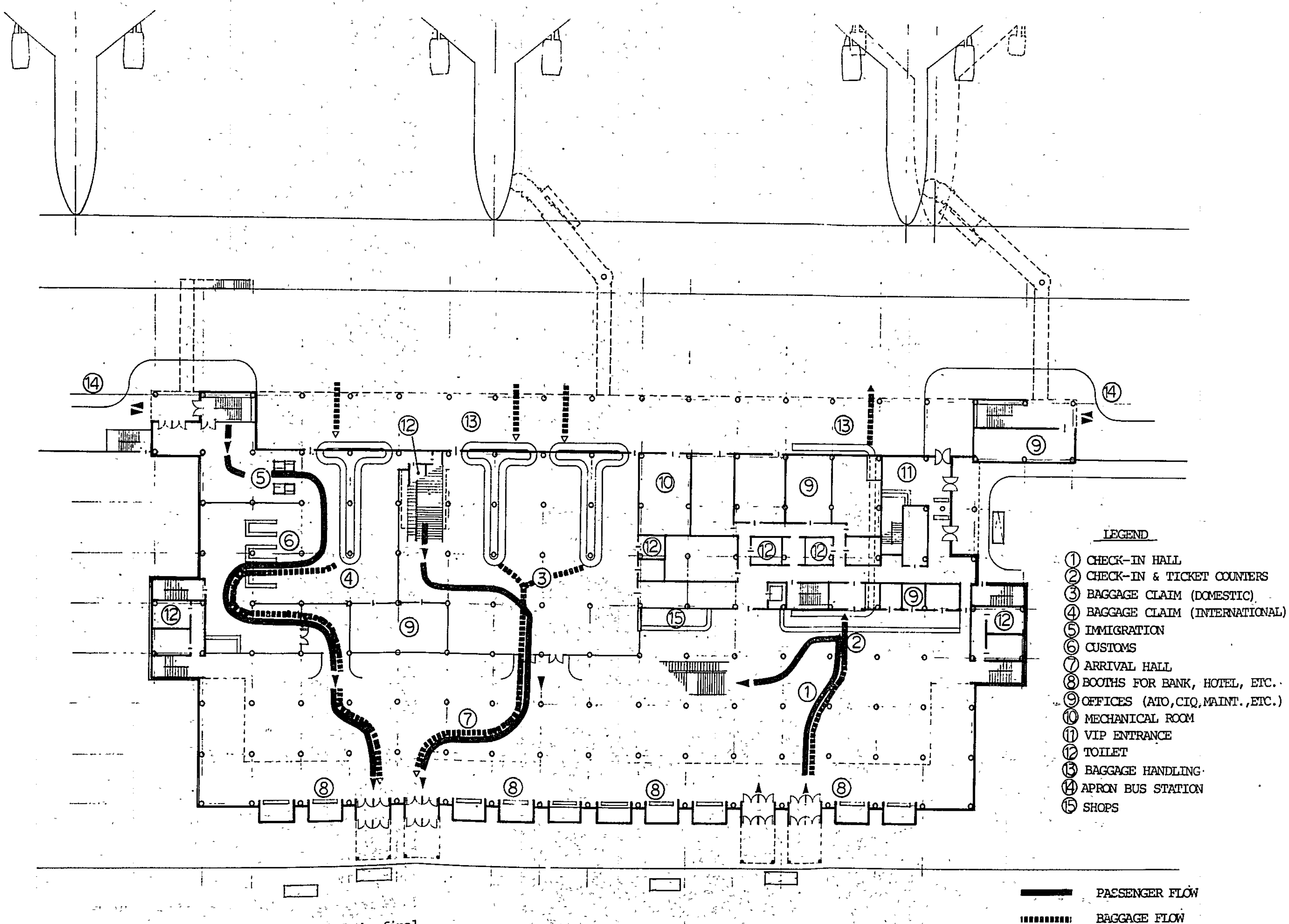


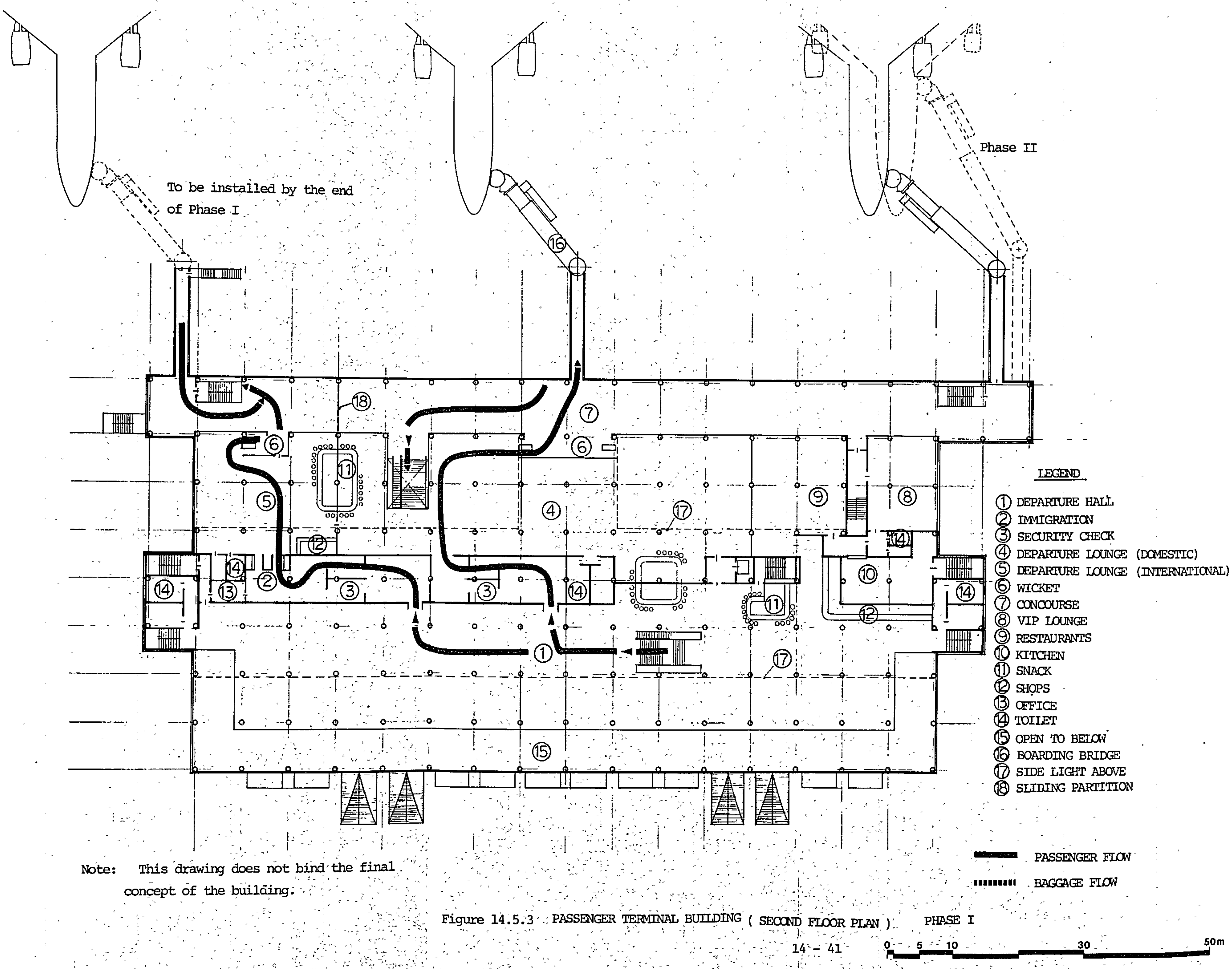
Figure 14.5.1 PASSENGER AND BAGGAGE FLOW



Note: This drawing does not bind the final concept of the building.

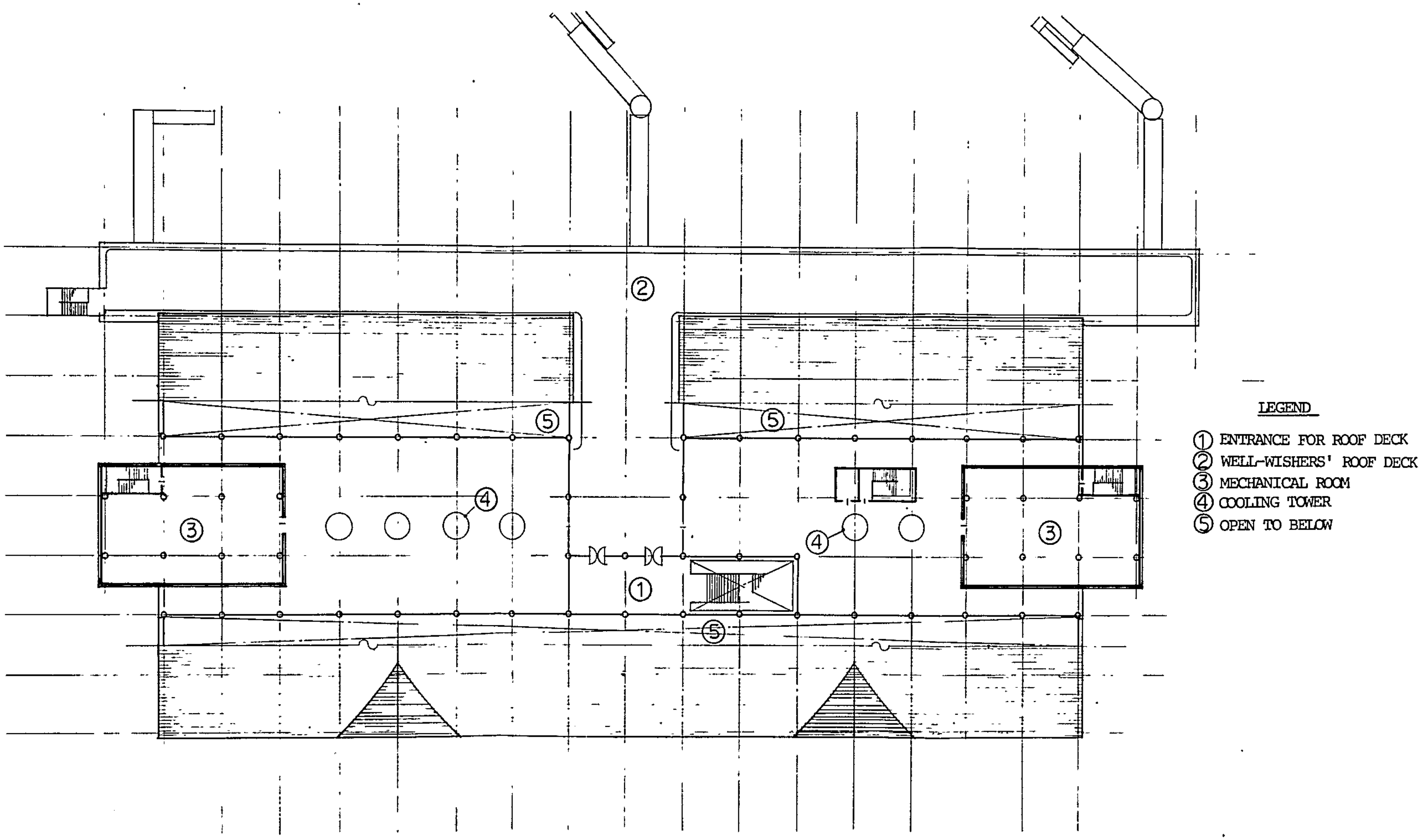
Figure 14.5.2 PASSENGER TERMINAL BUILDING (FIRST FLOOR PLAN) PHASE I

0 5 10 30 50m



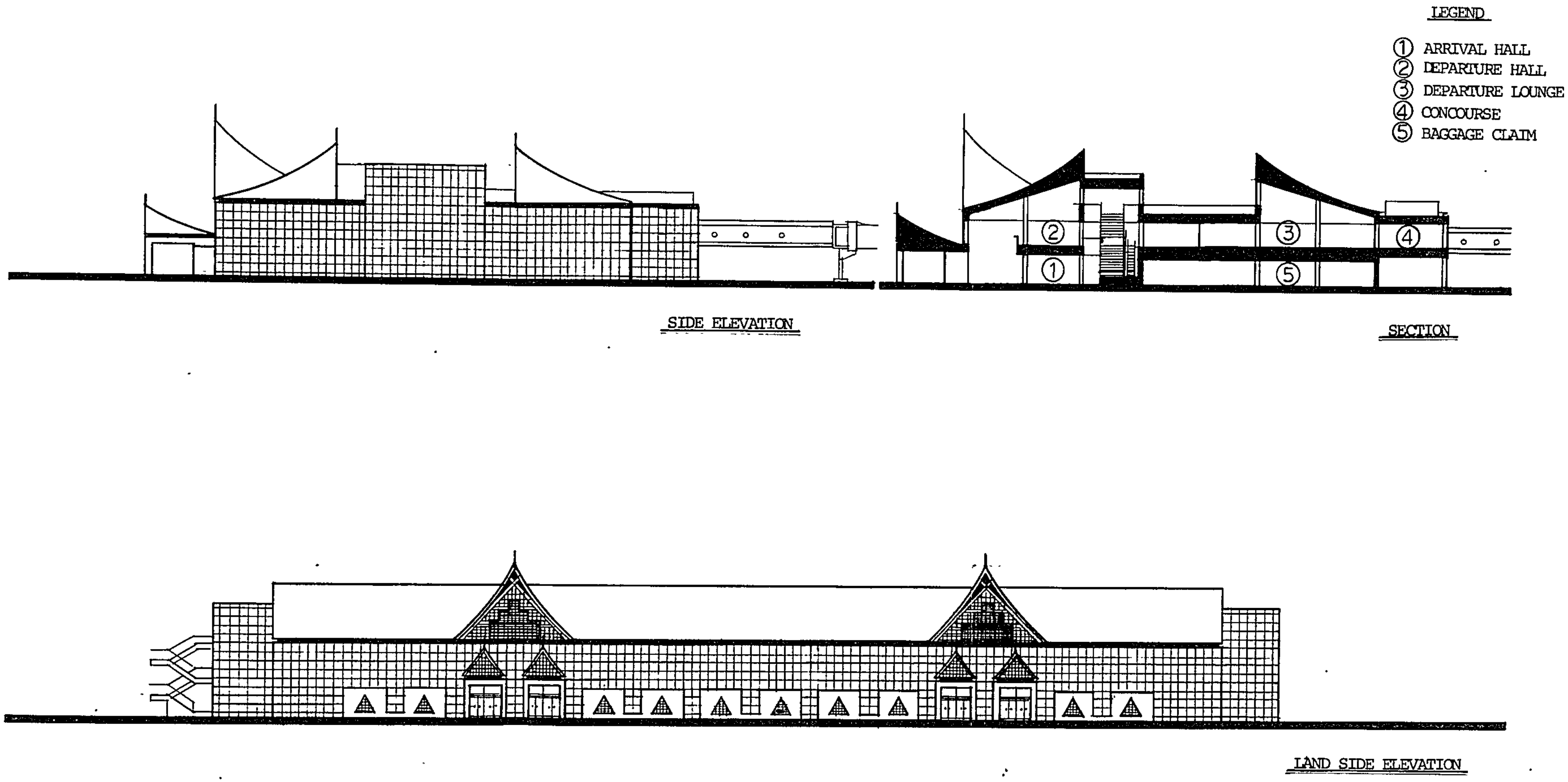
Note: This drawing does not bind the final concept of the building.

Figure 14.5.3 PASSENGER TERMINAL BUILDING (SECOND FLOOR PLAN) PHASE I



Note: This drawing does not bind the final concept of the building.

Figure 14.5.4 PASSENGER TERMINAL BUILDING (ROOF FLOOR PLAN) PHASE I



Note: This drawing does not bind the final concept of the building.

Figure 14.5.5 PASSENGER TERMINAL BUILDING (ELEVATION PLAN) PHASE I

The aesthetic design should be a combination of the Minangkabau traditional features and modern architecture with modern functions which will be created with the close coordination of Indonesian architects taking into account the characteristics of this airport as the gateway to West Sumatra and the entry port for regional international flights.

The internal arrangement is planned to be as flexible as possible in order to cope with the extreme seasonal peaking conditions and with future expansion and/or internal rearrangement as well.

14.5.2 Planning

Although the planning of the terminal building in this Report does not dictate the final concept, the passenger terminal building is planned for the purpose of cost estimation as shown in Figures 14.5.2 thru 5 and will be 13,480 sq. m in total floor area for Phase I.

In this building area, the passengers and visitors for two simaltaneous departing and arriving wide bodies jets can be handled.

The structure of the building is planned to be designed as a RC structure with 7 m x 7 m spans which will provide for economy of construction.

The building will be divided into two zones, i.e. air side and land side as shown in Figure 14.5.6.

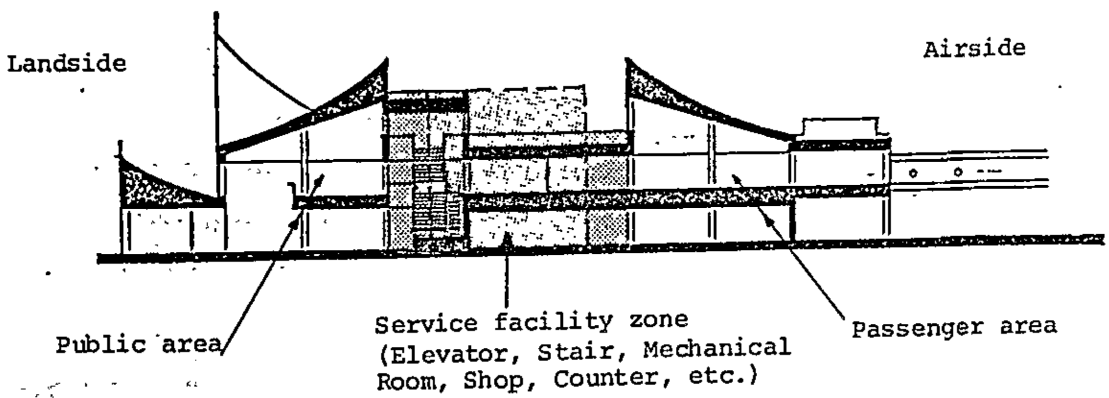


Figure 14.5.6 ELEVATION CONCEPT

The land side zone will be utilized as a public area and the air side zone as a passenger area. In between these two zones, the service facility zone will be provided where facilities serving both areas will be located. Using this concept, the obstacles to future expansion in both longitudinal directions can be eliminated as much as possible.

The traditional roof will be designed in order to take the natural sunshine into the 57 meter wide building through decorative grates.

This will convey the local atmosphere and environmental effects to the passengers.

14.6 Road and Corparking Area

14.6.1 Airport access road

As explained in Chapter 4, the airport access road to connect the new airport and existing highway with two lanes one in each directions is required in Phase I, however, land for a 20 m width must be acquired in advance for future widening to a four lane divided highway.

The principal design criteria for the access road are as follows:

* Design speed : 60 km/hour
* Min. radius of curvature : 150 m
* Max. longitudinal slope : 5%
* Min. vertical curve length: 50 m

Considering these criteria and the following requirements, the route selection and alignment were planned on the 1:5,000 scale topographic map.

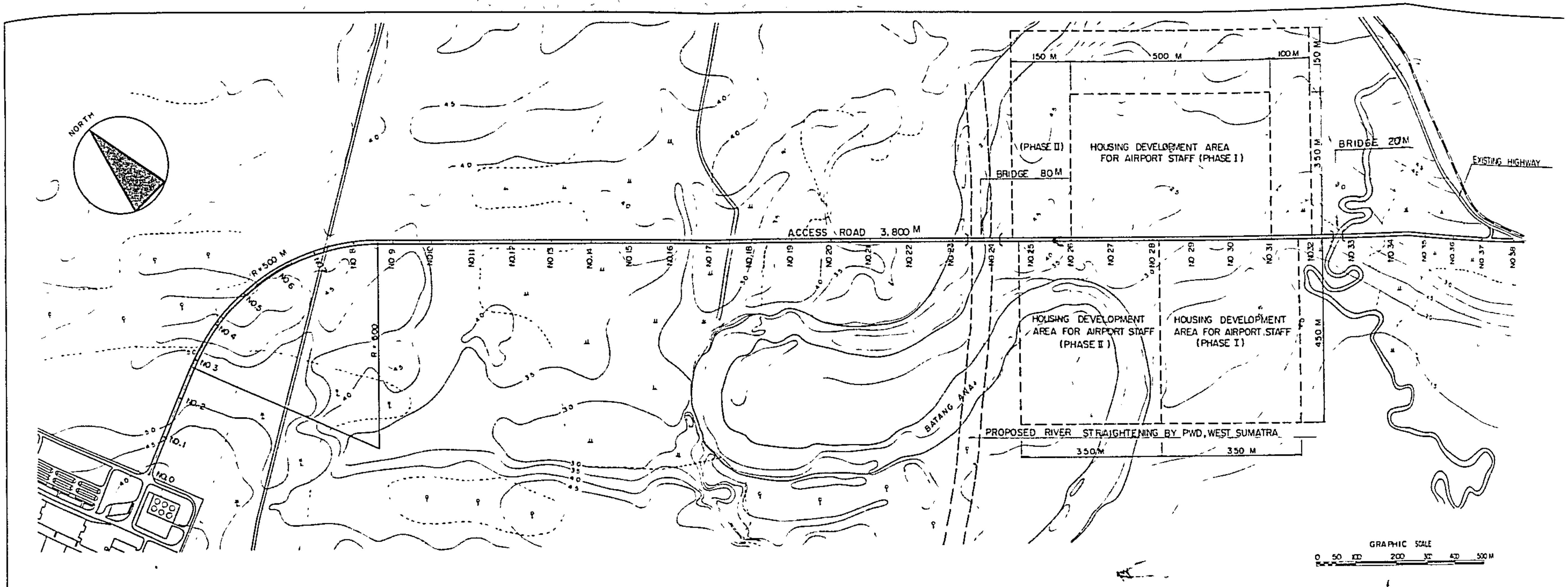
- Access road is basically constructed on fill so as to provide good drainage in flat land and rice field.

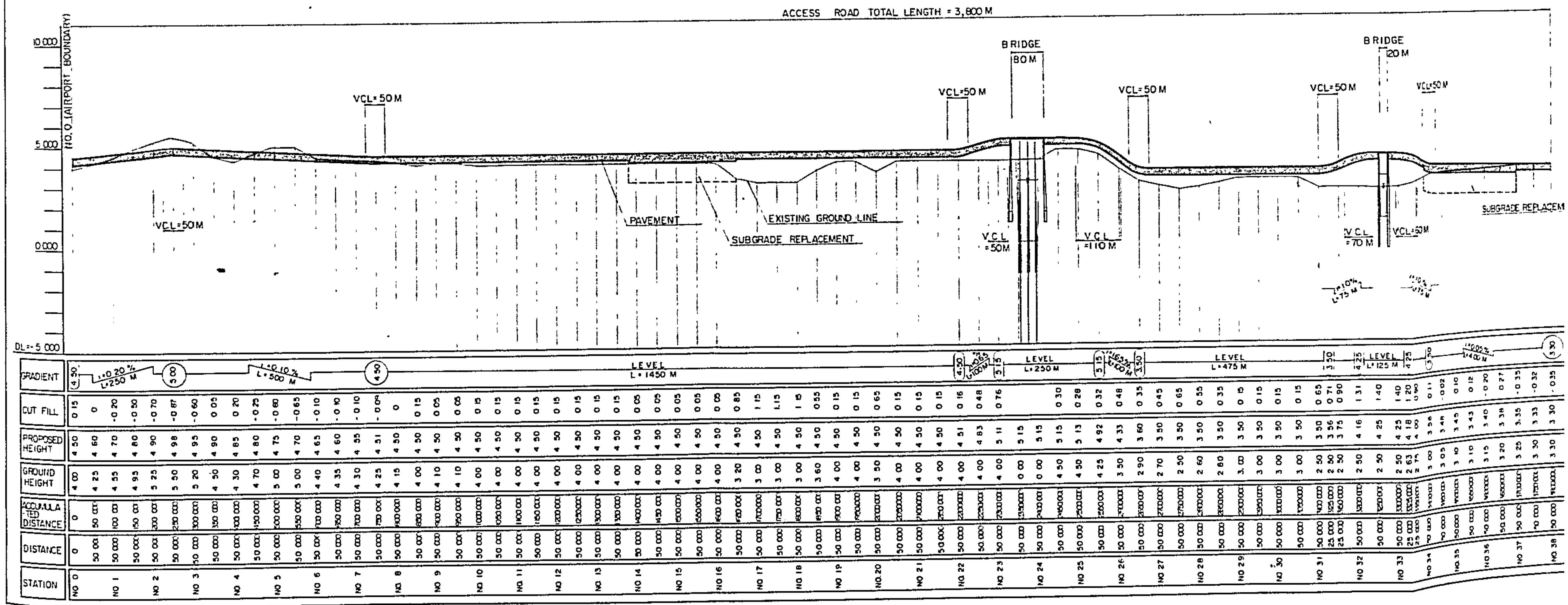
- The route of the access road shall be selected to avoid rice field, as much as possible, where weak foundation soils may exist.

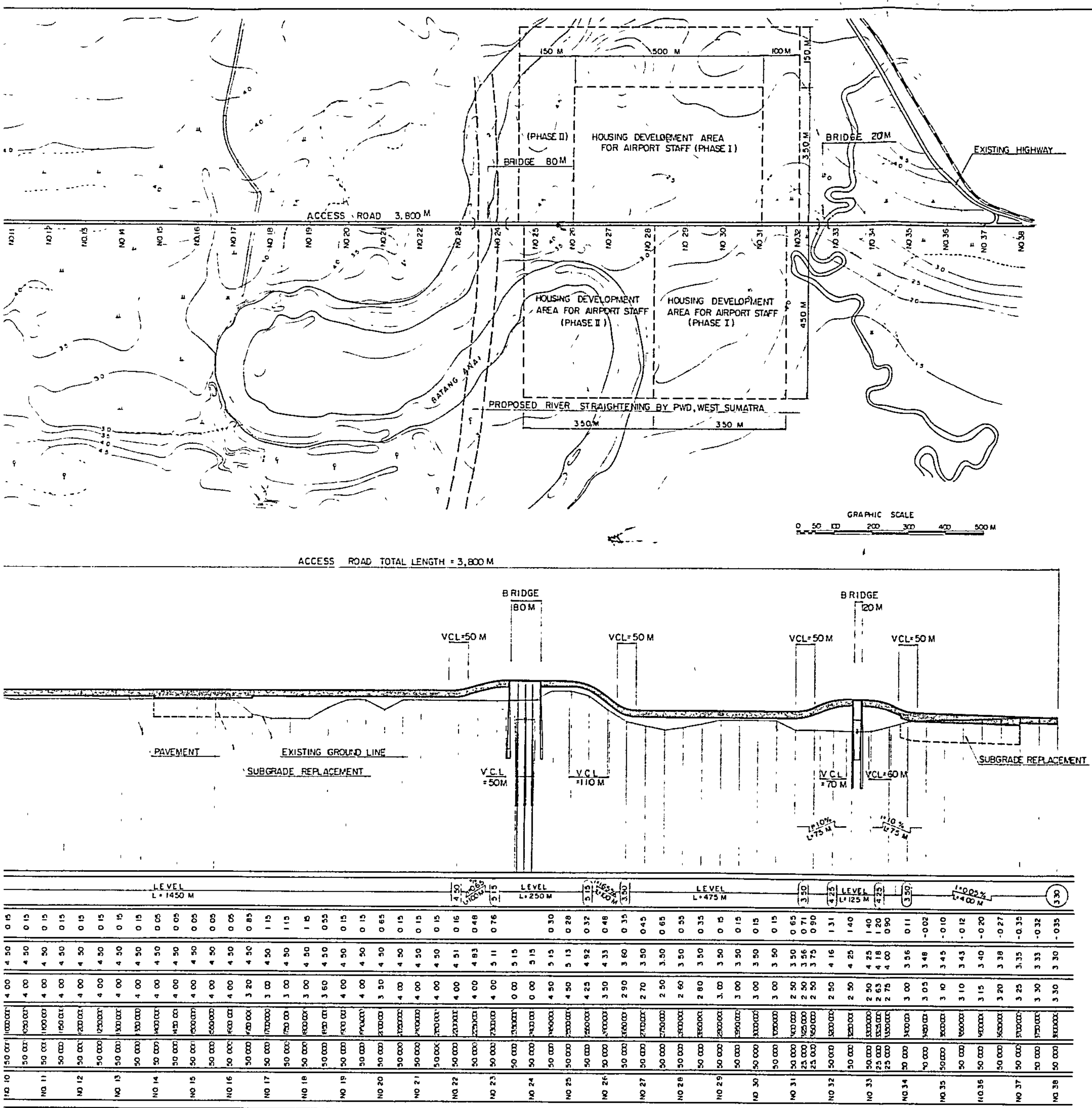
- Access road shall be connected smoothly with the existing highway.

- In order to reduce the invetment cost of a bridge across the river Anai which is to be straightened by DPU (Departmen Pekerjaan Umum) before 1986, the bridge shall be located at a narrow section of this river.

The selected route for the access road is shown in Figure 14.6.1 and its total length is 3.8 km; with two bridges, one 80 meters long and the other 20 meters long.


NORTH
ACCESS ROAD 3.800 M
R=500 M
HOUSING DEVELOPMENT AREA FOR AIRPORT STAFF (PHASE I)
(PHASE II)
BRIDGE 80 M
BRIDGE 20 M
EXISTING HIGHWAY
HOUSING DEVELOPMENT AREA FOR AIRPORT STAFF (PHASE II)
HOUSING DEVELOPMENT AREA FOR AIRPORT STAFF (PHASE I)
BATANG ANAI
PROPOSED RIVER STRAIGHTENING BY PWD, WEST SUMATRA
150 M
500 M
100 M
150 M
350 M
450 M
350 M
350 M
GRAPHIC SCALE
0 50 100 200 300 400 500 M


ACCESS ROAD TOTAL LENGTH = 3,800 M
NO. 0 (AIRPORT BOUNDARY)
10.000
5.000
0.000
DL=-5.000
BRIDGE
80 M
BRIDGE
20 M
VCL=50 M
VCL=50 M
VCL=50 M
VCL=50 M
VCL=50 M
VCL=110 M
VCL=70 M
PAVEMENT
EXISTING GROUND LINE
SUBGRADE REPLACEMENT
GRADIENT
LEVEL
L=1450 M
L=250 M
L=475 M
L=125 M
CUT FILL
PROPOSED HEIGHT
GROUND HEIGHT
ACCUMULATED DISTANCE
DISTANCE
STATION



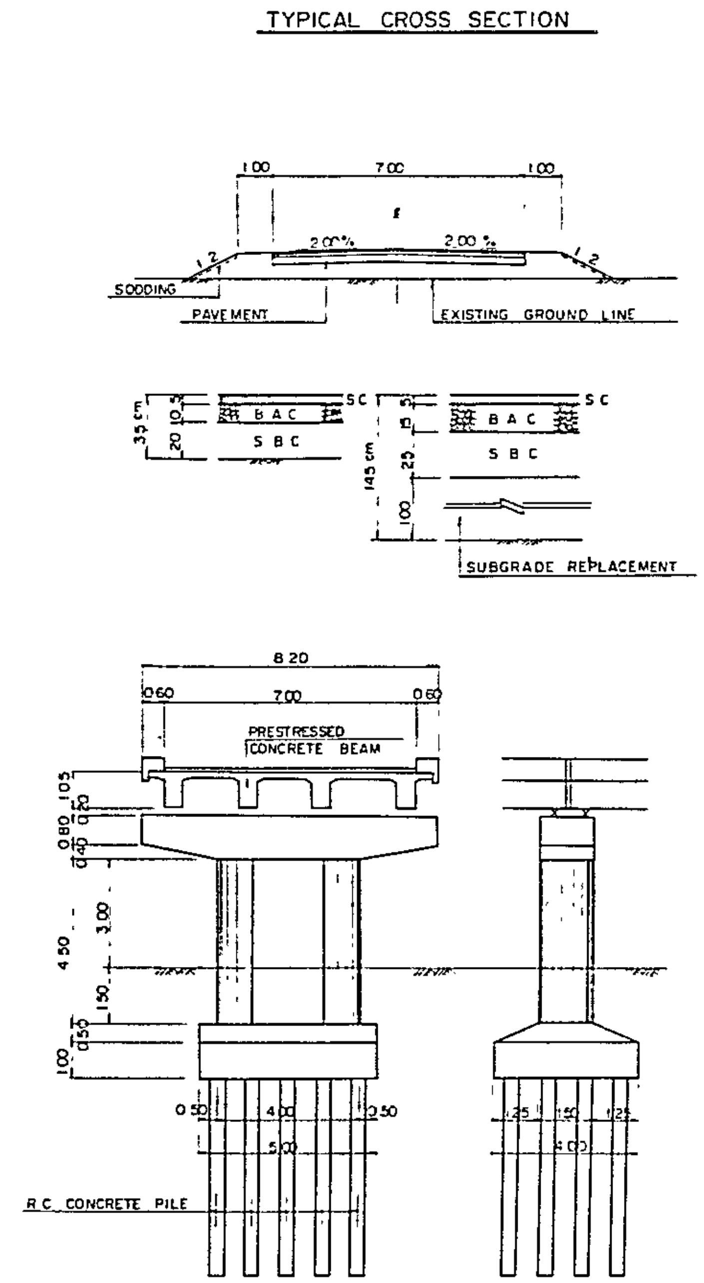


Figure 14.6.1 PLAN OF ACCESS ROAD AND HOUSING AREA FOR AIRPORT EMPLOYEES

The superstructure of the bridge is a prestressed concrete T beam type with a 20 m span. This type is considered to be the most economical structure. Concrete piles will be required for foundations judging from the available soil data.

The pavement structure will be the same as the terminal internal road. Replacement of the subgrade soil is to be considered, however, where weak foundation soils are encountered in rice fields and bush areas.

14.6.2 Carparking area and internal road

A public carpark will be located in front of the passenger terminal building in order to minimize the walking distance between the terminal building and carpark for the convenience of pedestrians and passengers.

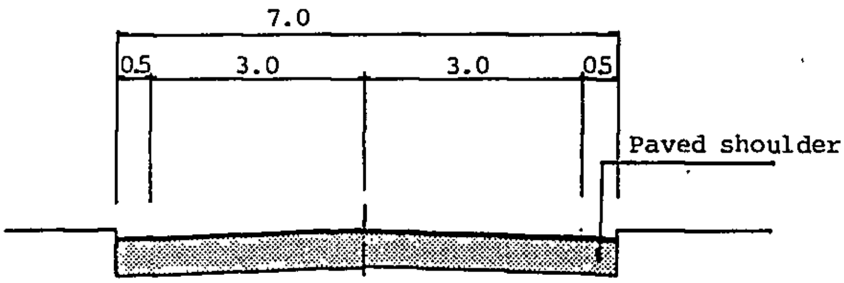
There are various kind of parking configuration which can be considered i.e. 90° parking, 45° parking, 60° parking etc. however, 90° parking configuration is adopted for this project because it requires the smallest unit parking space.

The dimensions for unit parking space are 5 m x 2.5 m and the width of the aisle in the parking area is determined to be 6 meters.

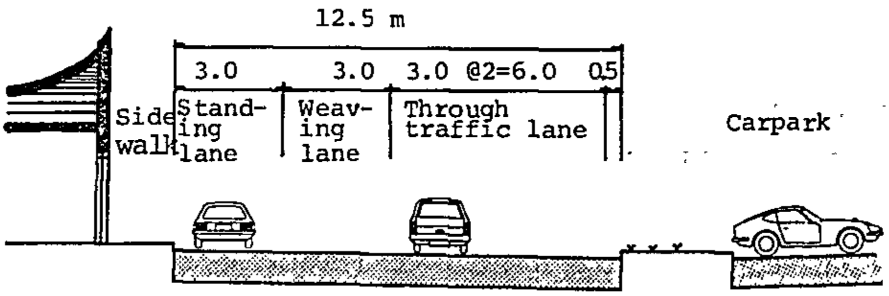
A taxi pool is located to the left of public carpark facing the terminal building so that not only incoming taxi without passenger can enter the taxi pool directly but waiting taxi can easily reach the taxi stand and pick up passengers.

The traffic on the internal road should be basically regulated in a one way - clockwise direction - in order to provide orderly vehicular movements and to ease pedestrian crossing.

The width of the internal road with two lanes will be 7 m except for the terminal frontage road. Terminal frontage road consists of two through traffic lanes, one weaving lane and one standing lane and is 12.5 m in width as shown in Figure 14.6.2.



(a) Typical Section (General)



(b) Terminal Frontage Road

Figure 14.6.2 TYPICAL CROSS SECTIONS FOR INTERNAL ROADS

The pavement for the carparking area and the internal road, will be an asphalt concrete with a total thickness of 35 cm. This thickness will consist of 5 cm surface, 10 cm base course and 15 cm subbase course. The thickness has been designed assuming 100 to 200 daily tracks with a 5 ton wheel load and CBR 20 percent for the subgrade in accordance with design criteria stated in the asphalt pavement manual issued by Japan Road Association.

14.6.3 Airfield Road

The airfield road, consisting of a perimeter road and security road, shall be constructed for both of airport maintenance and security patrol.

The airfield road is constructed with a 10 cm thickness of graded aggregate because the frequency of traffic is expected to be low and the traffic for heavy-weight vehicles will be limited.

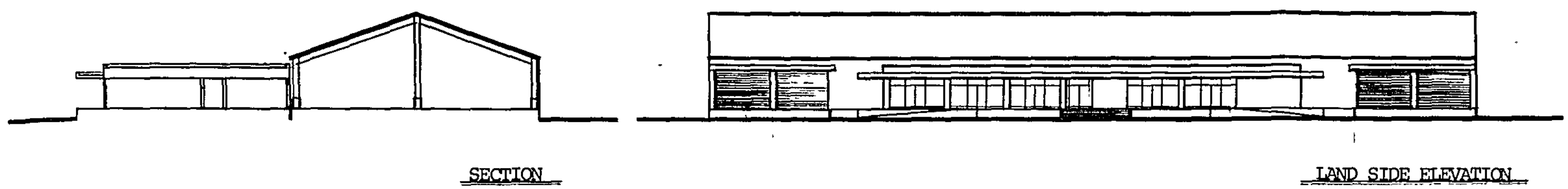
14.7 Other Buildings

14.7.1 Cargo building

The cargo building is located on the north side of the passenger terminal building close to the stands for large aircraft which are the center of gravity for loading and unloading belly cargo.

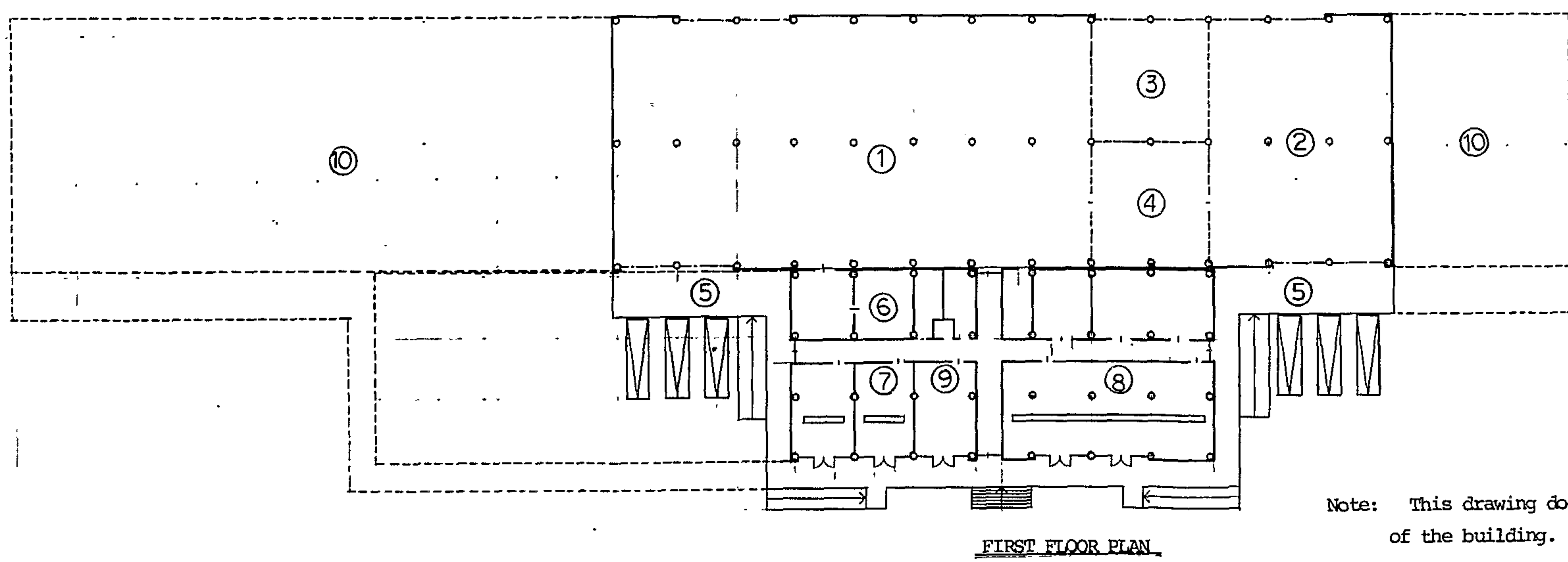
The cargo building with 2,630 sq.m in total floor area is planned as shown in Figure 14.7.1 and consists mostly of storage and office area. The storage area is divided into inbound storage located on the left and outbound storage on the right with bonded storage in between.

The structure housing these storage areas will be built as a steel frame with high ceilings for the least obstruction, flexibility in internal rearrangement, and provision for future possible mechanization. The office area, however, will be a typical RC structure.



LEGEND

① STORAGE (IN-BOUND)
② STORAGE (OUT-BOUND)
③ TRANSIT STORAGE
④ BOND STORAGE
⑤ TRACK DOCK
⑥ FREEZED & COLD STORAGE
⑦ AGENT OFFICE
⑧ AIRLINE OFFICE
⑨ CUSTOMS OFFICE
⑩ FUTURE EXTENSION



Note: This drawing does not bind the final concept of the building.

Figure 14.7.1 CARGO TERMINAL BUILDING

14.7.2 Control Tower and Administration Building

a. Control Tower

The height of control tower cab was determined to be approximately 20 m in compliance with FAA standards. This height is mandatory under the planned layout for the 2,500 m length of runway.

The height of tower has, however, been increased to 25 meters for the following reasons:

i) Once the control tower is constructed, it would be difficult to increase the effective height.

ii) Future extension of the runway to 3,500 m or more has been considered in the facility planning and the airport layout plan to cope with unexpected demand or direct long-haul flights.

iii) Therefore, a height of about 25m for the control tower has been established considering a future runway length of 3,500 m or more.

b. Administration Building

An administration building separated from the passenger terminal building is planned as shown in Figure 14.7.2.

The administration building will have a total floor area of 1,800 m^2 and 2,800 m^2 in Phases I and II respectively.

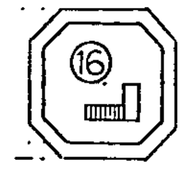
The total floor area was determined based on the number of staff working simultaneously and the floor area required for equipment rooms.

The building will be made of reinforced concrete and will consist of 2 floors.

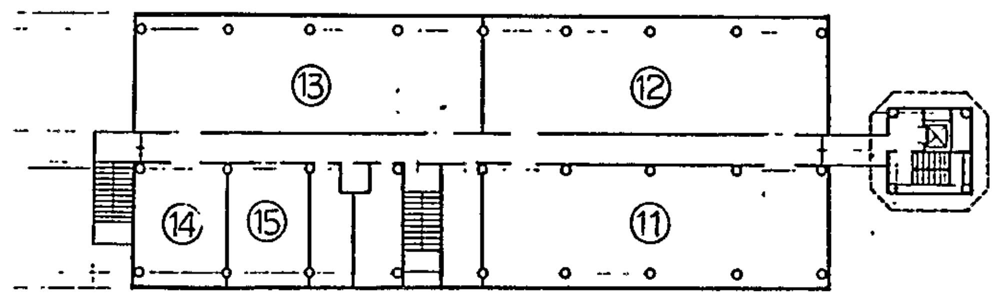
LEGNED

① LOUNGE
② STORAGE
③ MECHANICAL ROOM
④ ATC RM
⑤ OPERATION RM
⑥ BRIEFING RM
⑦ METEOROLOGICAL RM
⑧ RADIO RM
⑨ RADIO EQUIPMENT RM
⑩ STORAGE
⑪ MAINTENANCE RM
⑫ ENGINEERS RM
⑬ ADMINISTRATION RM
⑭ NIGHT DUTY RM
⑮ STORAGE
⑯ VFR RM

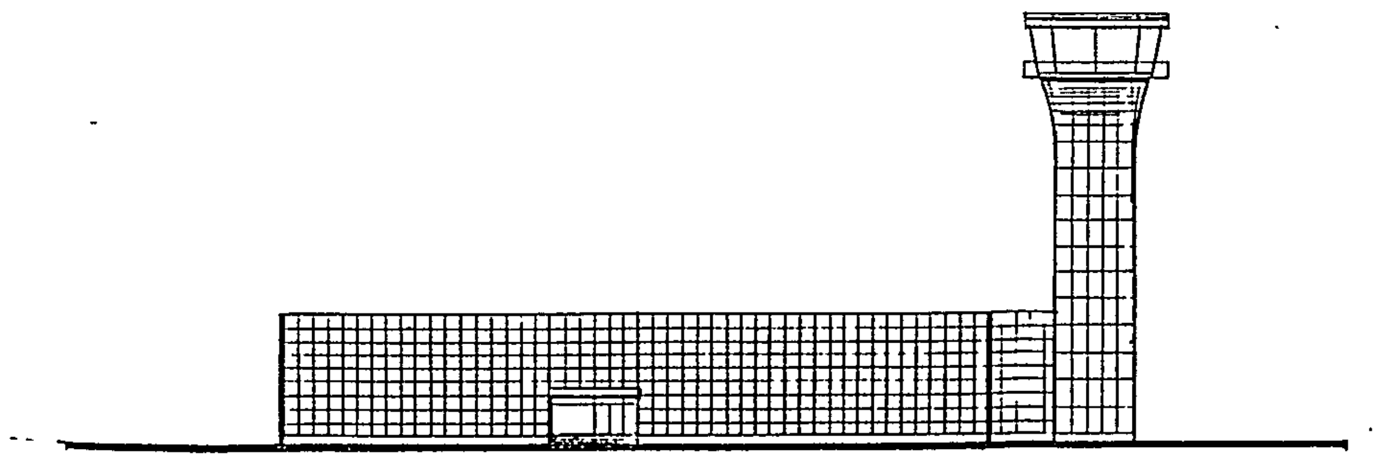
Note: This drawing does not bind the final concept of the building.



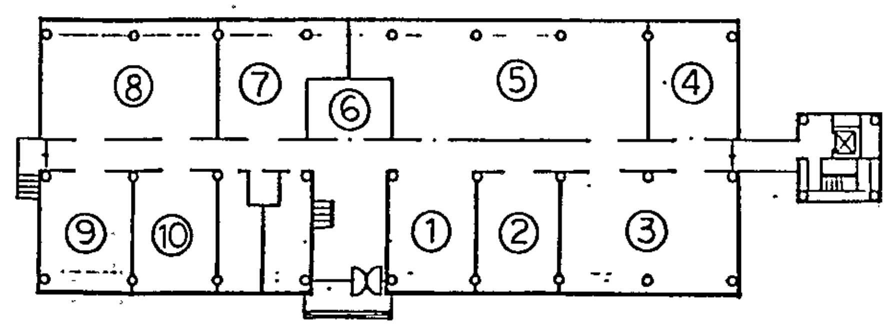
VFR PLAN



SECOND FLOOR PLAN



LAND SIDE ELEVATION



FIRST FLOOR PLAN

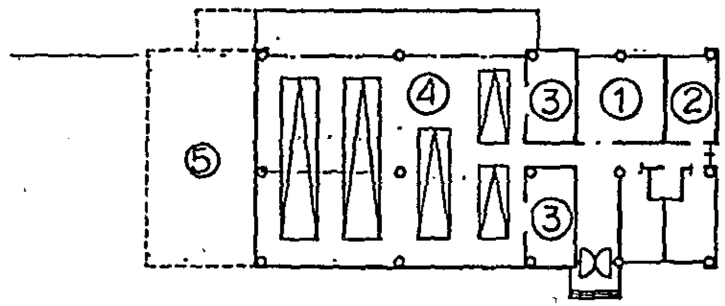
Figure 14.7.2 ADMINISTRATION BUILDING AND CONTROL TOWER PHASE I

0 5 10 30 50m

14.7.3 Fire Station

The fire station was planned to meet the facility requirements reported in Chapter 4, Section 9. The fire station will have floor area of approximately 400 m^2 and 500 m^2 in Phases I and II, respectively. The fire station will be made of reinforced concrete and has one floor. The outline of the building is shown in Figure 14.7.3.

AIR SIDE ELEVATION



FIRST FLOOR PLAN

LEGEND

① OFFICE
② NIGHT DUTY RM
③ STORAGE
④ GARRAGE
⑤ FUTURE EXTENSION

Note: This drawing does not bind the final concept of the building.

Figure 14.7.3 FIRE STATION

14.8 Utilities

This section describes the master plan for the airport utilities which includes the following systems;

i) Electric Power Supply

ii) Water Supply System, and

iii) Sewerage System

14.8.1. Power Supply System

Figure 14.8.1 shows the existing power supply to Padang City and also the current plan now being implemented by P.L.N. (Government Electricity Enterprise).

Electricity is at this moment being generated locally by two diesel generators (6.3MVA x 2), which are located in Padang City, and fed to consumers through 22 kv medium tension lines.

After the completion of the construction of the new transmission network which is now underway by P.L.N., the Maninjau hydroelectric power plant (HPP) will supply electric power to Padang City and other areas of West Sumatra via Lubuk Alung, Bandar Buat, etc.

The construction of Maninjau HPP, Lubuk Alung S.S., Bandar Buat S.S. and power plant, and the connecting high tension transmission lines will be completed and in operation by the end of December, 1983. Hence, the electricity to the new airport site could be supplied very reliably from Lubuk Alung S.S. by constructing a 22 kv medium tension line, as shown in Figure 14.8.2. The 22 kv line will be constructed along the airport access road for ease of construction and maintenance.

The construction cost of the 22 kv line and also the airport main substation is included to the project cost estimation based on the request of the Indonesian Steering Committee. It is reported, however, that the construction cost of main substation(s) and transmission line(s) will be budgeted by P.L.N. in case of a government project such as this airport project.

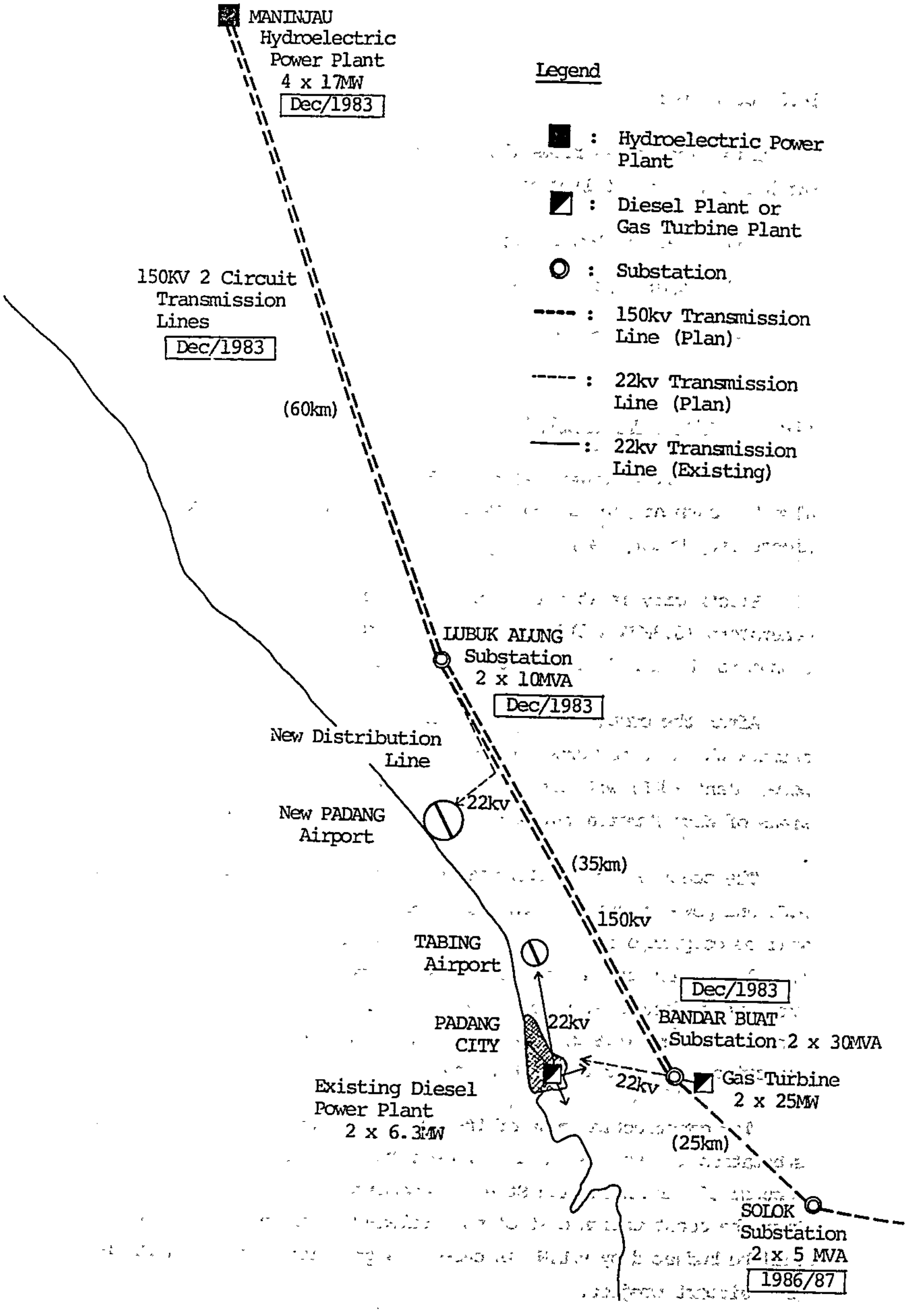
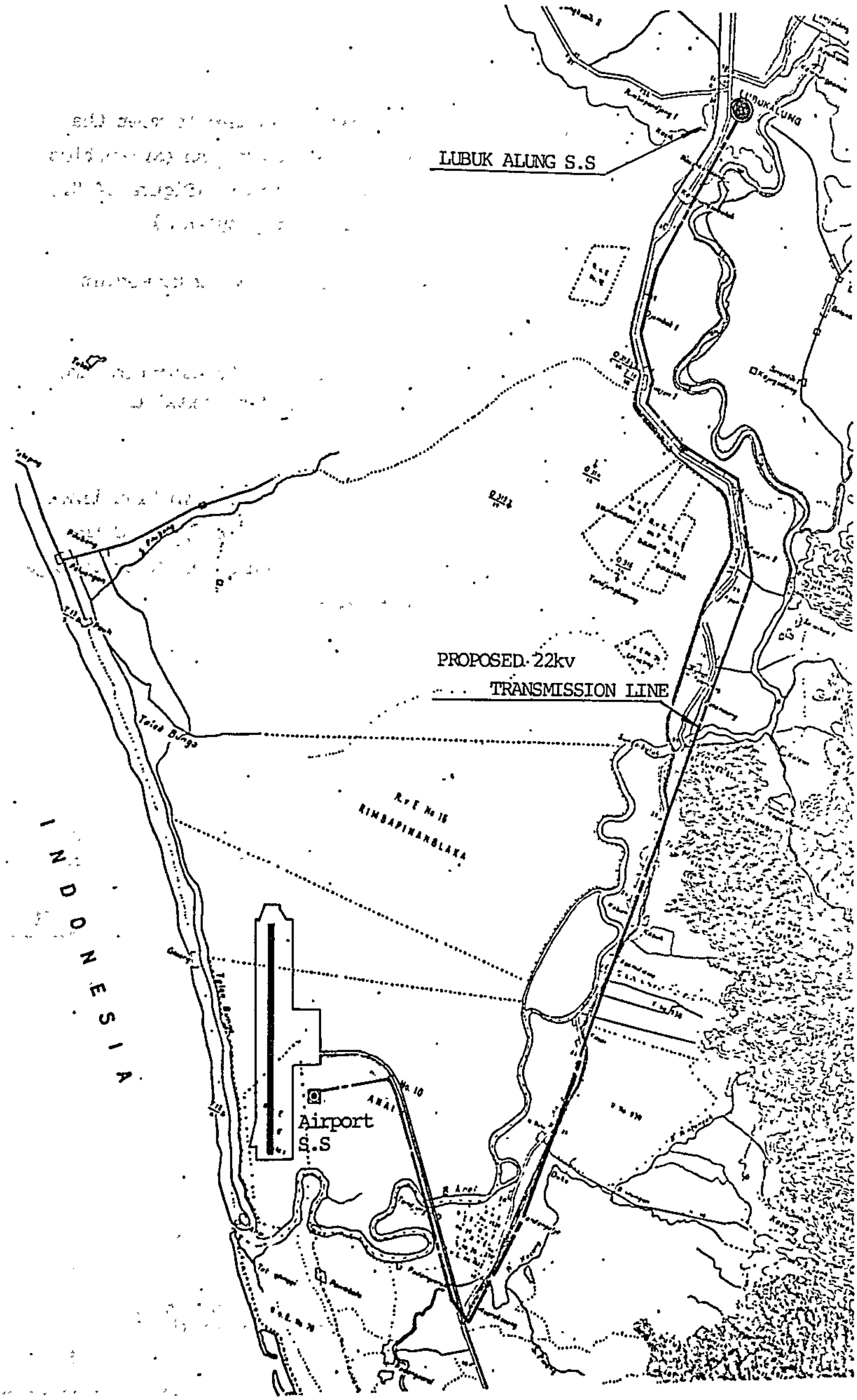


Figure 14.8.1 POWER SUPPLY NETWORK



Figuer 14.8.2 22kv TRANSMISSION LINE ROUTE

The power supply system in the airport is planned to meet the target demands as estimated in Chapter 4, Section 8. An explanation of the main points of the system plan is as follows: (Figure 14.8.3 and 4 show the block diagram for the power supply system.)

1) Power is fed to the airport by means of the 22 kv medium tension transmission line.

2) As main transformers, 2 sets of 2,000 KVA transformers are planned for Phase I and 1 set of same rating will be added in Phase-II.

3) 6.6 kv of medium voltage is used for the distribution lines in the airport, since the investment cost for power cables and the local substations will increase substantially should the 22 kv voltage be used for the airport distribution voltage.

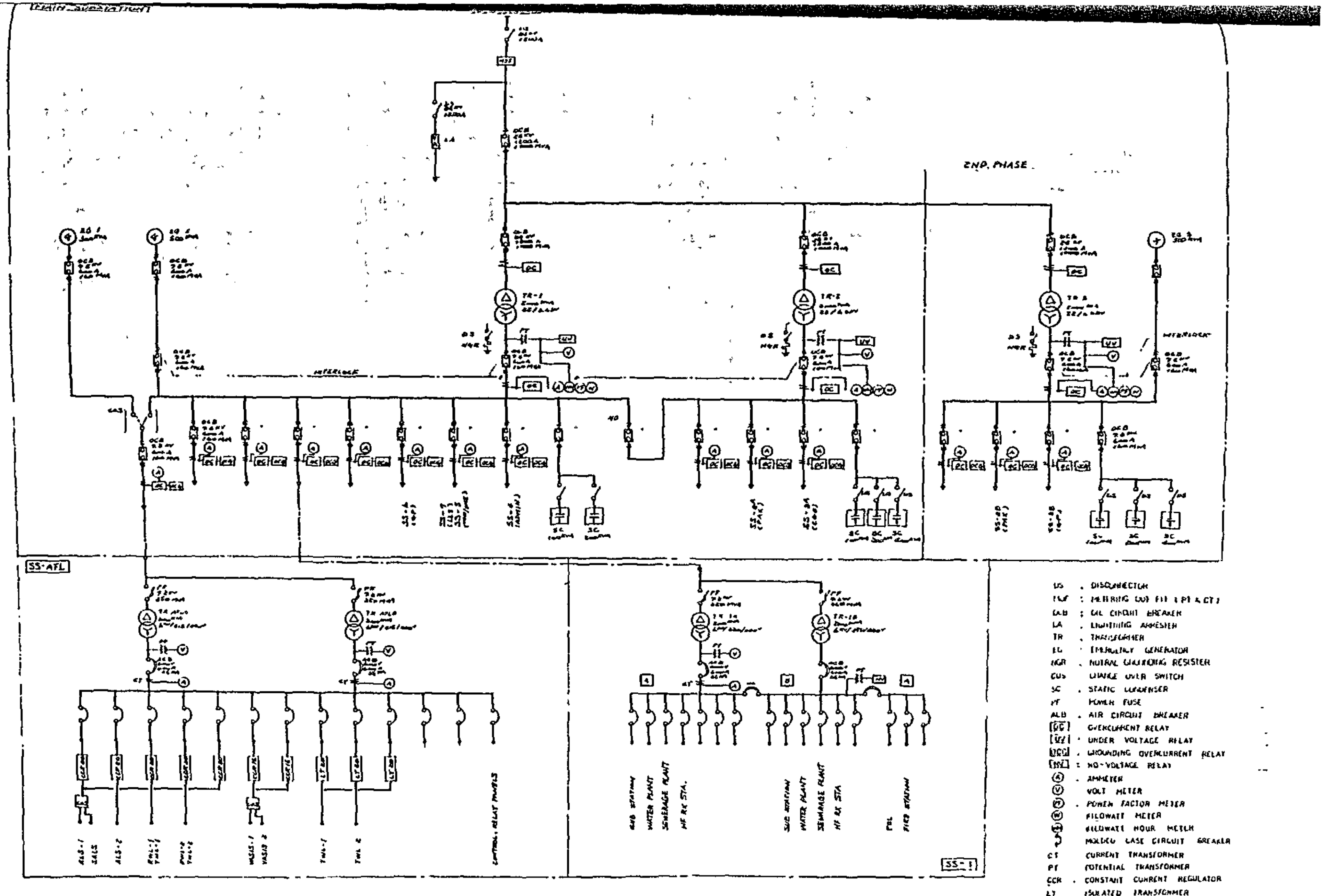
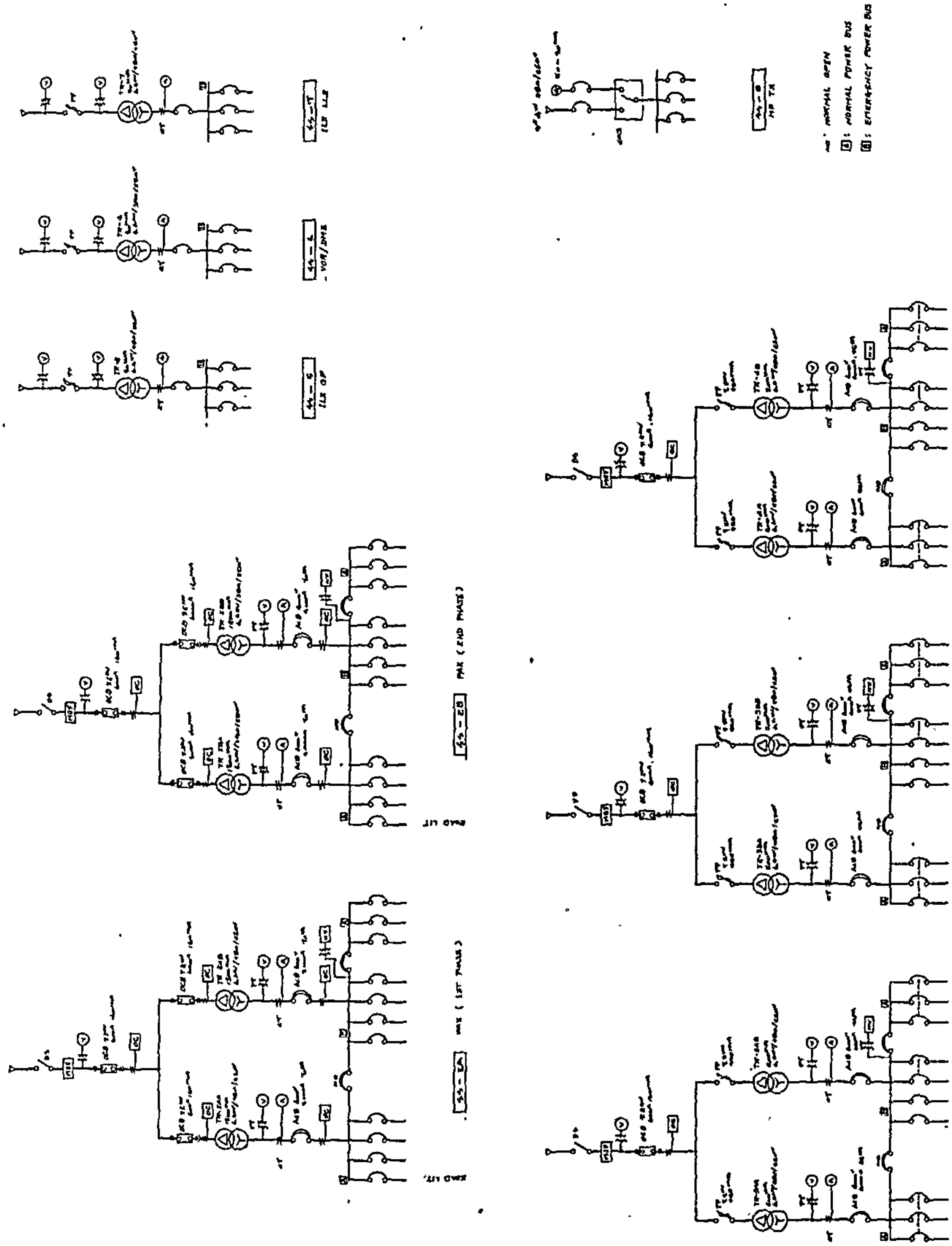


Figure 14.8.3 POWER SUPPLY SYSTEM (BLOCK DIAGRAM - 1)



4) 22 kv voltage is received at the main substation and then transformed to the distribution voltage, 6.6 kv. The power is fed to the local substations by 6.6 kv underground cables.

5) The following local substations are needed. Suffix "A" means Phase-I and "B", Phase-II.

Substation	Main Load
Main Substation	Supply
Substation AFL	Aeronautical Ground Lights
Substation - 1	Main substation building, Water treatment plant, Sewarage treatment plant, HFRX station
Substation - 2A 2B	Passenger Terminal Building, Internal roads and car parking area
Substation - 3A 3B	Cargo Terminal Building, NDB
Substation - 4	Administration Building/Tower, Fire station, Maintenance workshop
Substation - 5	ILS GS Site
Substation - 6	VOR/DME Site
Substation - 7	ILS LLZ Site
Substation - 8	HF TX Site (Outside of Airport)

6) Emergency generators are to be installed in the main substation. Since a "black-out" time of not more than 15 seconds is only allowed for the aeronautical ground lights by ICAO Standards, the emergency generator for them must be provided independent from that for the ordinary load such as emergency building lightng, air conditioning etc. The allowable "black-out" time for the normal load will be 30 seconds.

The emergency generator plan is as follows:

The emergency loads are limited to the least mandatory loads required for building use. Thus, the emergency load for the building is planned to be approximately 20 % of the normal load.

Generator	Use	Phase-I	Phase-II
Generator-A	Lighting,Navaids	300KVA x 1 set	300KVA x 1 set
Generator-B	Building, etc.	500KVA x 1 set	500KVA x 1 set
Generator-C	Building, etc.	-	500KVA x 1 set
Total Capacity		800KVA	1,300KVA

14.8.2 Water Supply System

The water supply system for the airport facilities was planned based on the following demands as stated in Chapter 4, Section 8.

	Phase - I (m^3 /day)	Phase - II (m^3/day)
Intake Water	460	940
Treated Water	440	890
Distributed Water	420	850

There will be two kind of water resources which could be considered for the airport , i.e., surface water and ground water.
The surface water was adopted as a water source for the airport, since the ground water quality is not guaranteed yet at this moment, and the surface water is safer side in the cost estimate.

Raw water is transferred from an intake site of the River Batang Anai, as shown in Figure 14.8.5. A water treatment plant and an elevated tank are located in Vital Installation area.

The treatment plant was planned on the preliminary assumptions that the raw water of River Batang Anai is not good enough in quality and requires water purification facilities, although a further study will be necessary to determine the actual quality.

The system configuration is shown in Figure 14.8.6. The potable water for the buildings and water supply for fire fighting on aircraft are to be distributed separately.

The construction plan of the system including the intake and transmission main facilities will be planned based on the Phase-II demands, while the treatment plant will be planned based on Phase-I demand and later expanded to satisfy the Phase-II requirements.

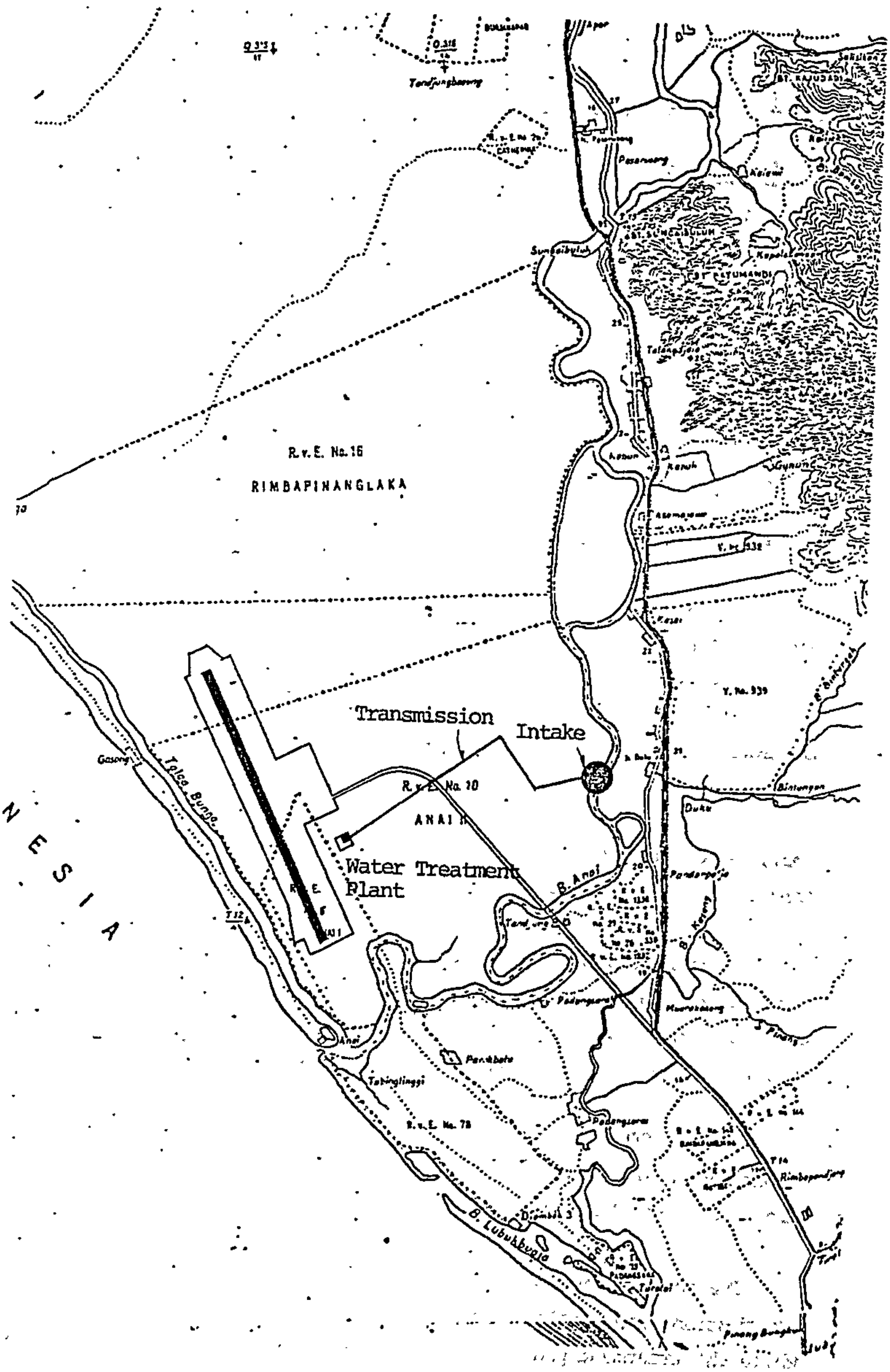


Figure 14.8.5 WATER INTAKE AND TRANSMISSION PLAN

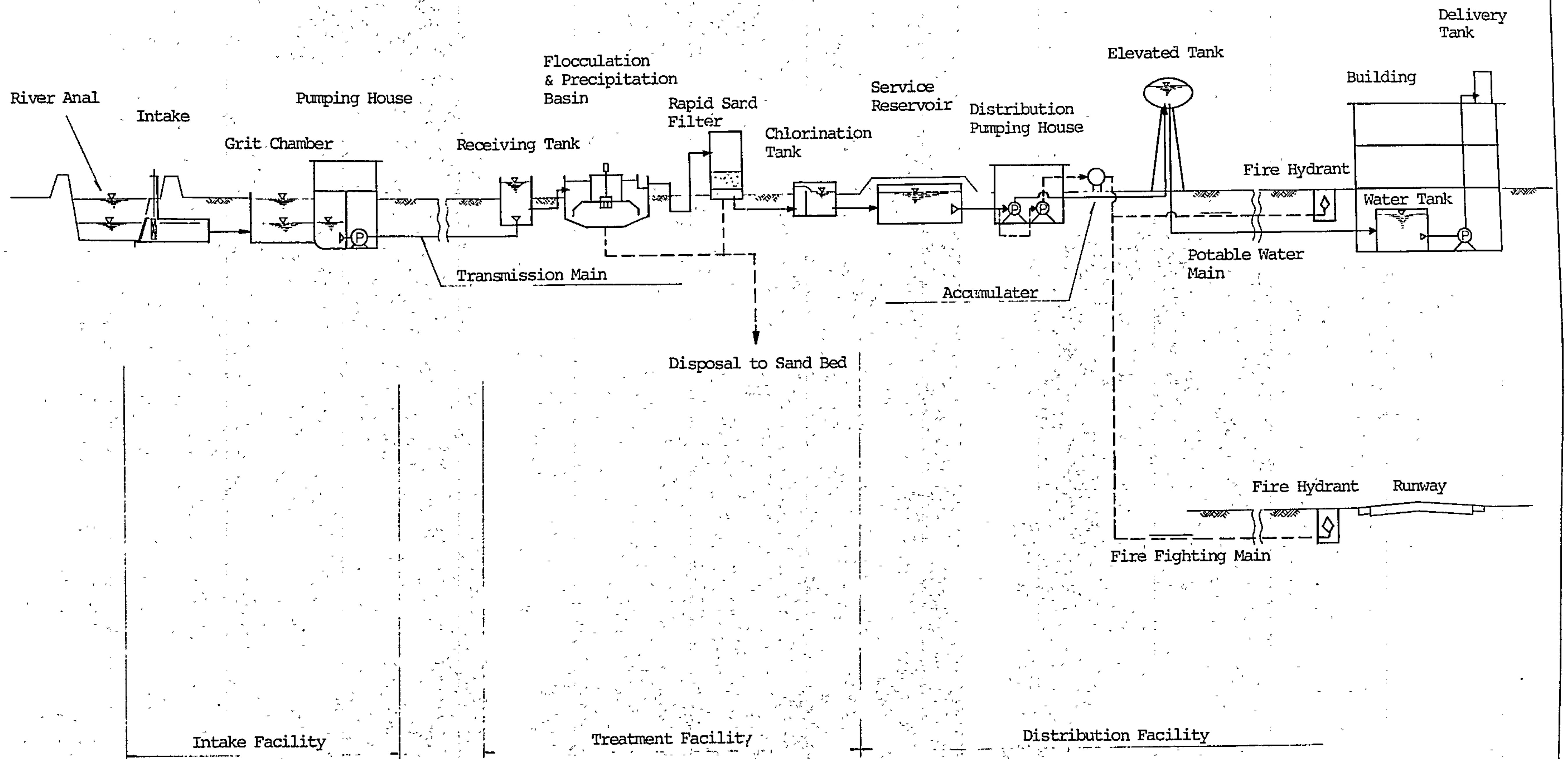


Figure 14.8.6 WATER SUPPLY SYSTEM PLAN

14.8.3 Sewerage System

The wastewater treatment and the collection system are planned based on the following conditions;

	Phase - I	Phase - II
(1) Quantity of Wastewater	420 m^3/day	850 m^3/day

(2) Quality of Wastewater (Influent)

BOD5	:	200 mg/ litter
SS	:	250 mg/ litter

(3) Quality of Wastewater (Effluent)

PH	:	More than 5.8 but less than 8.6
BOD5	:	Less than 30 mg/ litter
SS	:	Less than 70 mg/ litter
No. of Coliform Germs Group	:	Less than 3,000 MPN/cm^3

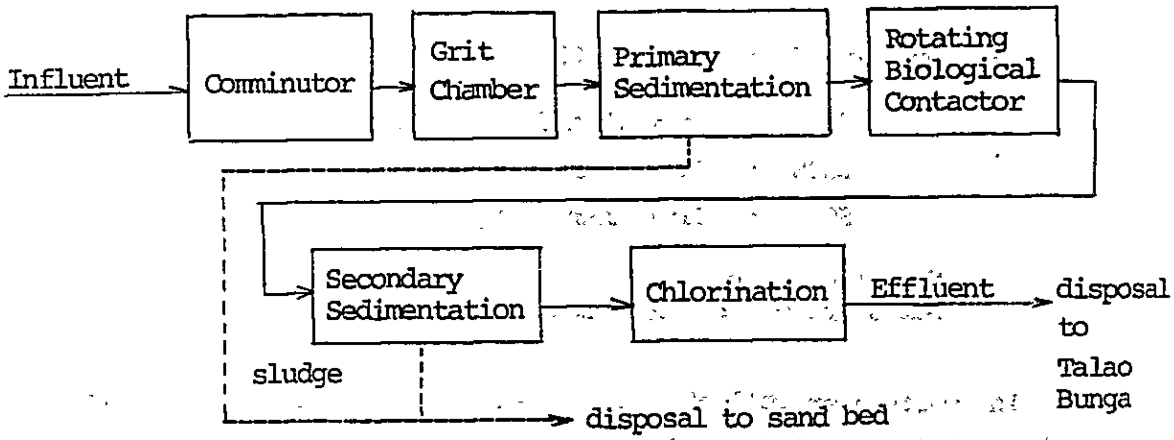
The wastewater collected from the buildings will be treated by the wastewater treatment located in Vital Installation area.
The effluent will be discharged into Talao Bunga.

The following treatment methods were studied for the airport:

i) Extended aeration
ii) Rotating biological contactor
iii) Oxidation ditch, and
iv) Oxidation pond

The rotating biological contactor can be considered as the most suitable method at present stage and the preliminary cost estimate includes a marginal value. Although the oxidation pond method is also considered as a possibility, because oxidation pond system could reduce the construction and operation and maintenance cost for the wastewater treatment system, a further study will be necessary whether or not the airport landscape and land use in the vicinity will be affected from an environmental standpoint and whether or not the algae can be effectively prevented from draining from the pond.

An outline of the rotating biological contactor system is shown below;



14.9 General Services and Others

14.9.1 GSE parking area

The parking area for the ground service equipment (G.S.E.) such as towing tractors, passenger stair cars, power supply cars, etc. will require about 2,500 m^2* for Phase I. The parking space (10 m wide) is located at the apron edge alongside the passenger terminal building and additional space will be located on the side of the passenger terminal building.

* GSE parking area for local airport = $S_1a_1 + S_2a_2$

Where: S_1: No. of large aircraft stands

S_2: No. of small aircraft stands

a_1: 780 sq.m for one large aircraft stand

a_2: 100 sq.m for one small aircraft stand

(Based on survey results at Japanese airports by JCAB.)

14.9.2 General aviation apron

It is rather difficult to estimate the number of aircraft stands required for general aviation because it involves too much uncertainty.

Since, Minas Lumbar Company and Aero Club are based at the existing airport and own one PA-23 and Cessna C-182 respectively, at least two aircraft stands must be planned.

These two stands will be located adjacent to the passenger terminal apron and administration building taking the function of these facilities into account.

Furthermore, the stands will be located so that the tail wing of the small aircraft does not encroach upon the obstacle limitation surfaces of the heliport as discussed in 14.9.3.

14.9.3 Heliport

A heliport will be located adjacent to the general aviation apron for the convenience of users and to facilitate easy administration. The clearance between the heliport and the runway center is planned to be 210 meters considering simultaneous operations under VFR conditions for the helicopter and the aircraft in accordance with FAA standards. The size of helicopter being considered in the planning is established with an overall length of about 15 meters and one roter.

14.10 Air Navigation System

This section describes the masterplan for Air Navigation Systems which will consist of the following facilities:

i) Radio Navigational Aids (Navaids)

ii) Air Traffic Control Facilities

iii) Aeronautical Telecommunications System

iv) Meteorological System, and

v) Aeronautical Ground Lights

The planned air navigation systems for Phase I are tabulated in Table 14.10.1 and the configurations and layout plan are shown in Figures 14.10.1 to 14.10.3.

For Phase II, the renewal of the electronics and lighting equipment will be necessary.

Table 14.10.1 AIR NAVIGATION SYSTEM PLAN

Radio Navaids:	- Terminal VOR/DME (Doppler)	1 set
	- NDB	1 "
	- ILS, Localizer/DME	1 "
	- ILS Glide Slope	1 "
	- ILS Middle Marker	1 "
	- Locator	1 "
Air Traffic Control Facilities:	- ATC Console (3 position)	1 "
	- ATC Telephone Exchange	1 "
	- Air Traffic Light Gun	2 sets
	- Magnetic Tape Recorder	1 set

" continued "

Aeronautical Telecommunication Facilities:	- VHF A/G Transmitter	4 sets
	- VHF A/G Receiver	4 "
	- VHF A/G Transceiver	1 set
	- VHF FM Transceiver	1 "
	- NDB Monitor Receiver	1 "
	- HF Transmitter	3 sets
	- HF Receiver	3 "
	- Teletypewriter	10 "
Meteorological Facilities:	- Runway Visual Range Meter	1 set
	- Ceilometer	1 "
	- Anemometer	2 sets
	- Thermometer	1 set
	- Precipitation Gauge	1 "
	- Weather Data Collecting Equipment	1 "
	- Weather Fax Receiver	1 "
	- Weather TTY Receiver	5 sets
Aeronautical Ground Lights	- Approach Lighting System RWY 34 Category I (900 m) Calvert	1 set
	RWY 16 SALS (420 m)	1 "
	- Visual Approach Slope Indicator	2 sets
	- Runway Edge Light	1 set
	- RWY Threshold Light	2 sets
	- RWY End Light	2 "
	- Overrun Light	2 "
	- Taxiway Light	1 set
	- Aerodrome Beacon	1 set
	- Illuminated Wind Cone	2 sets
	- Apron Flood Light	1 sum
	- Control Console	"
	- Control Equipment	"

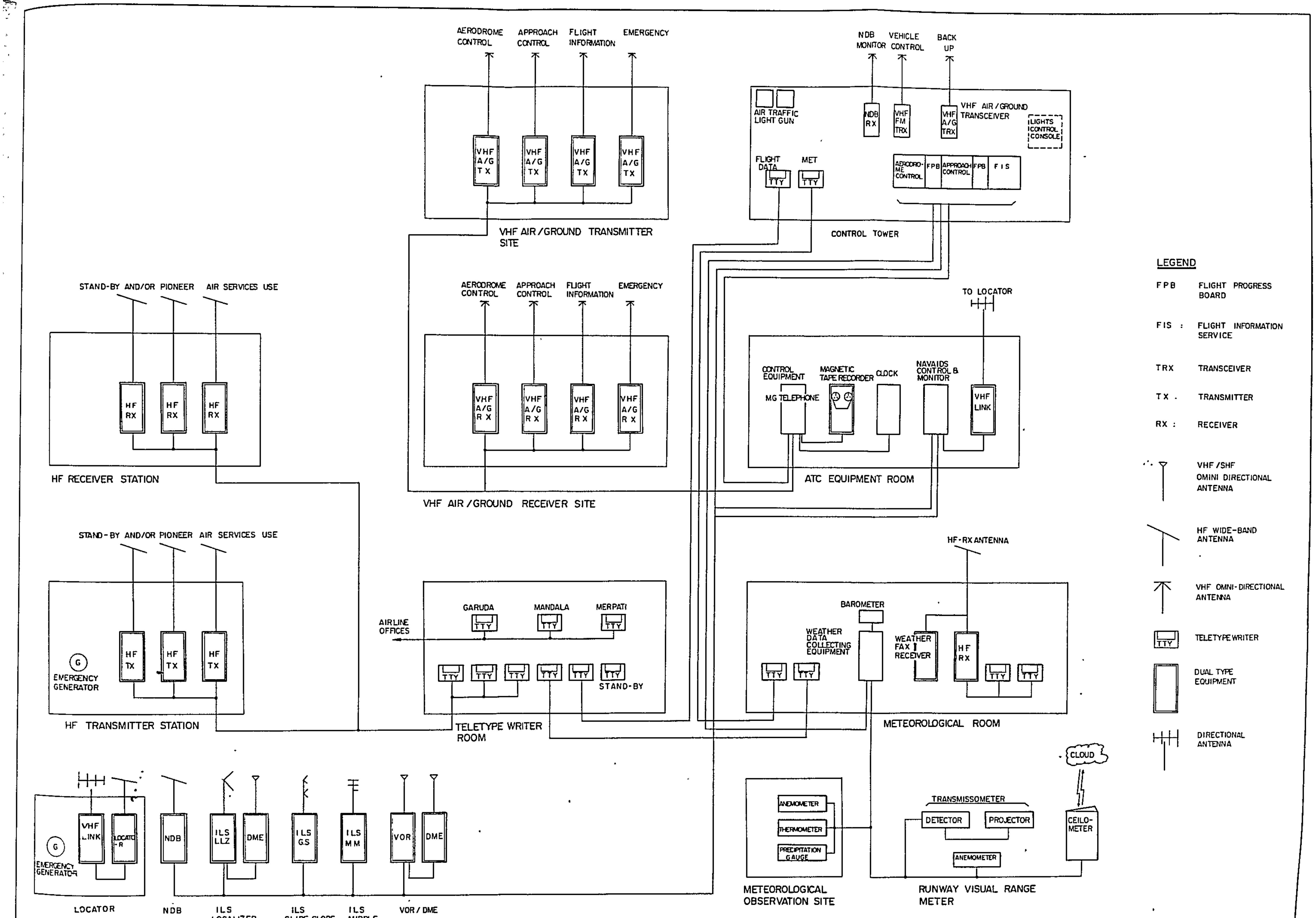


Figure 14.10.1 AIR NAVIGATION SYSTEM CONFIGULATION

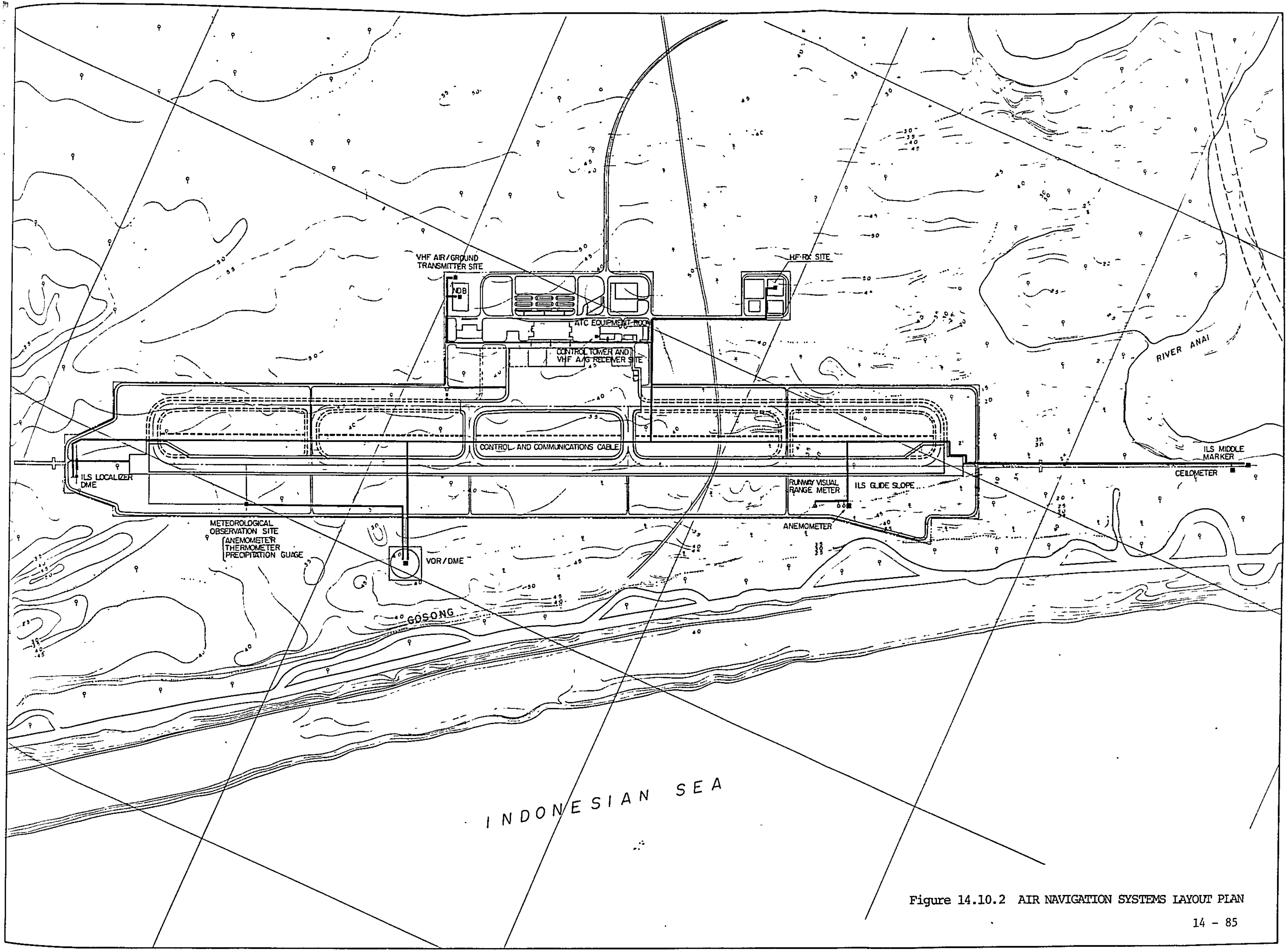
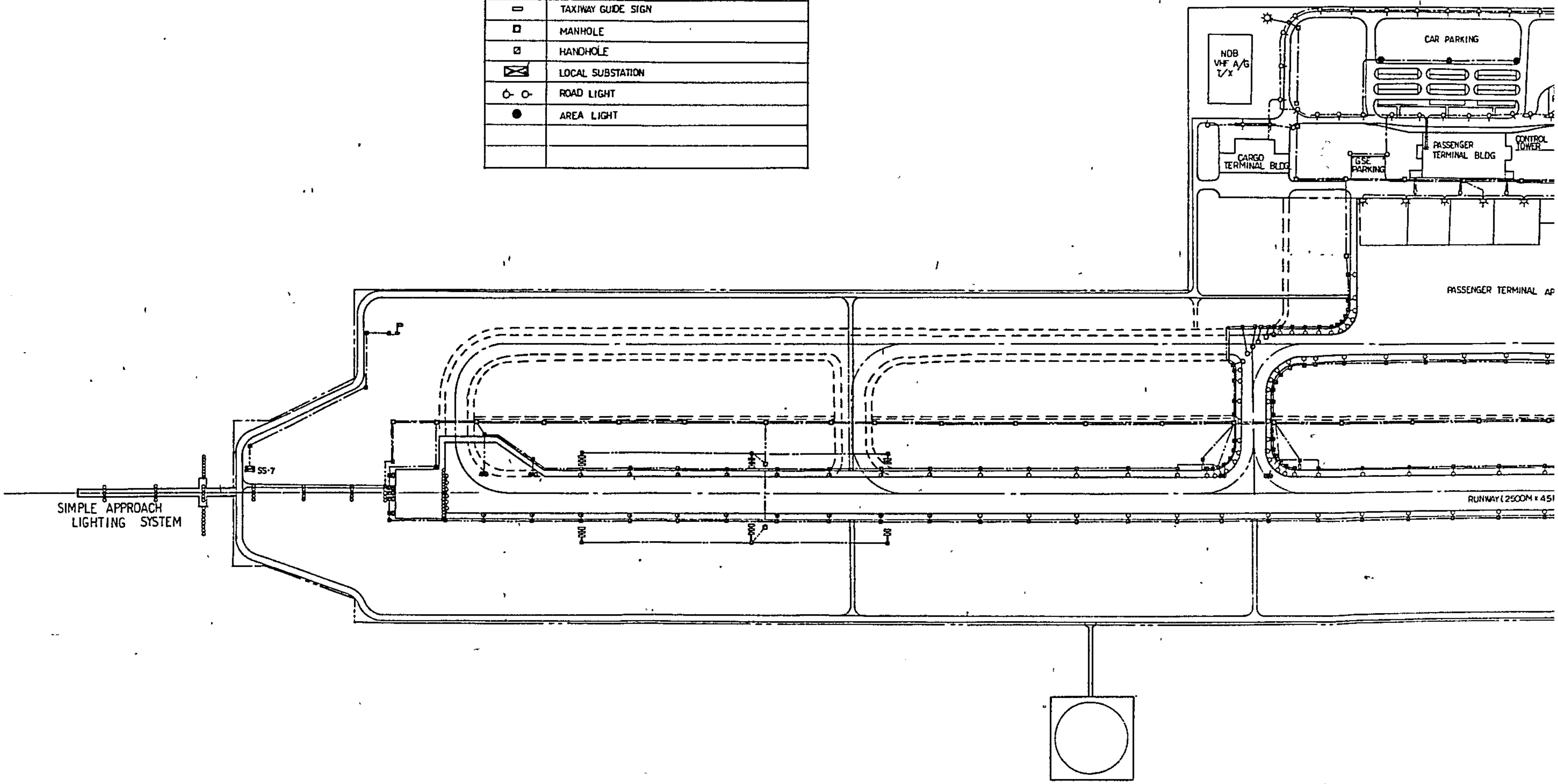


Figure 14.10.2 AIR NAVIGATION SYSTEMS LAYOUT PLAN

LEGEND

SYMBOL	DESCRIPTION
○ ◐ ○○	RUNWAY EDGE LIGHT
	APPROACH LIGHT
	VISUAL APPROACH SLOPE INDICATOR
	RUNWAY THRESHOLD LIGHT AND END LIGHT
	OVER RUN LIGHT
○	TAXIWAY EDGE LIGHT
	AERODROME BEACON
	WIND DILECTIONAL INDICATOR
	APRON FLOOD LIGHT
	TAXIWAY GUIDE SIGN
	MANHOLE
	HANDHOLE
	LOCAL SUBSTATION
	ROAD LIGHT
●	AREA LIGHT



14-87 (88)

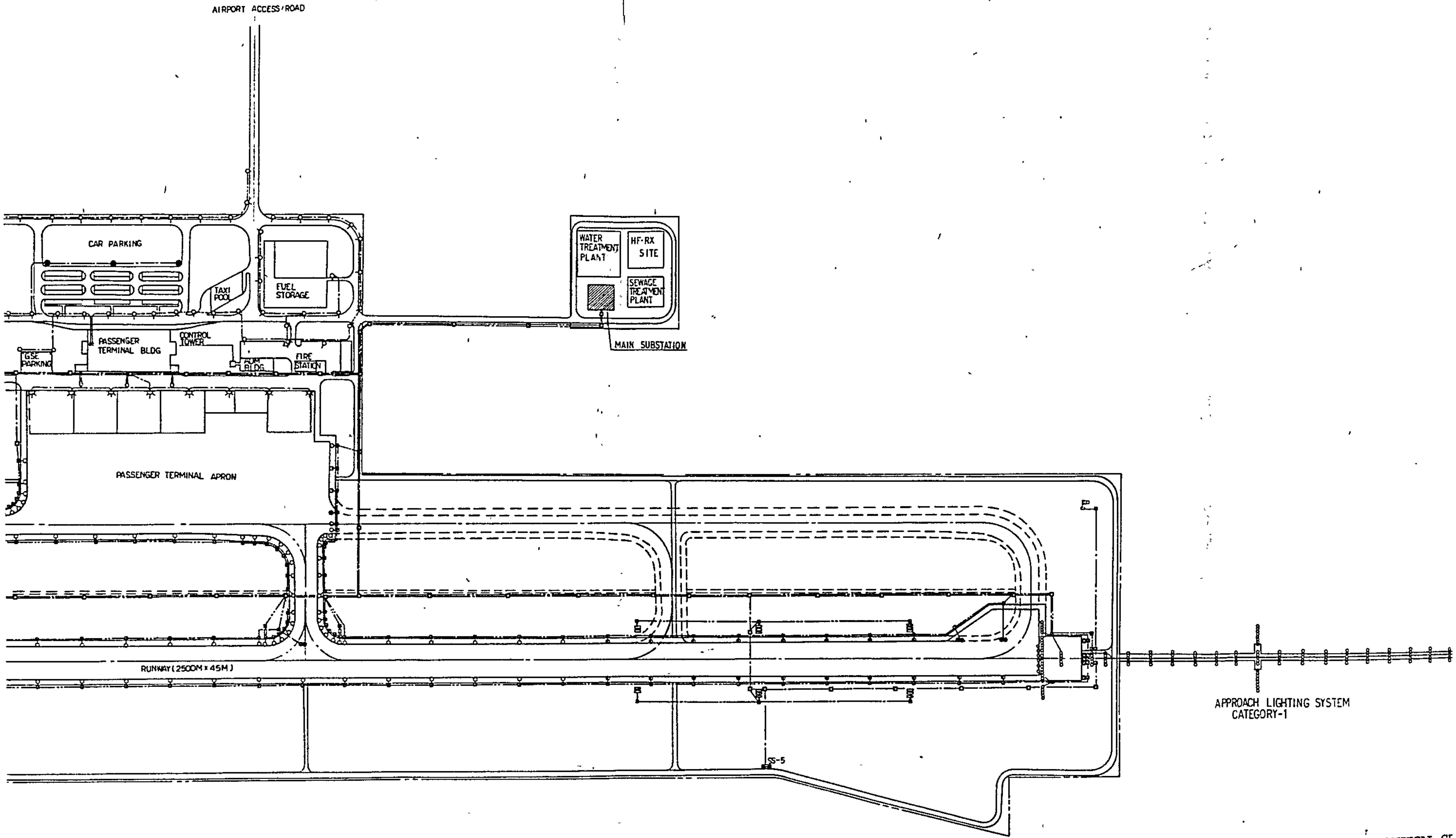


Figure 14.10.3 AERONAUTICAL GR

14-87 (88

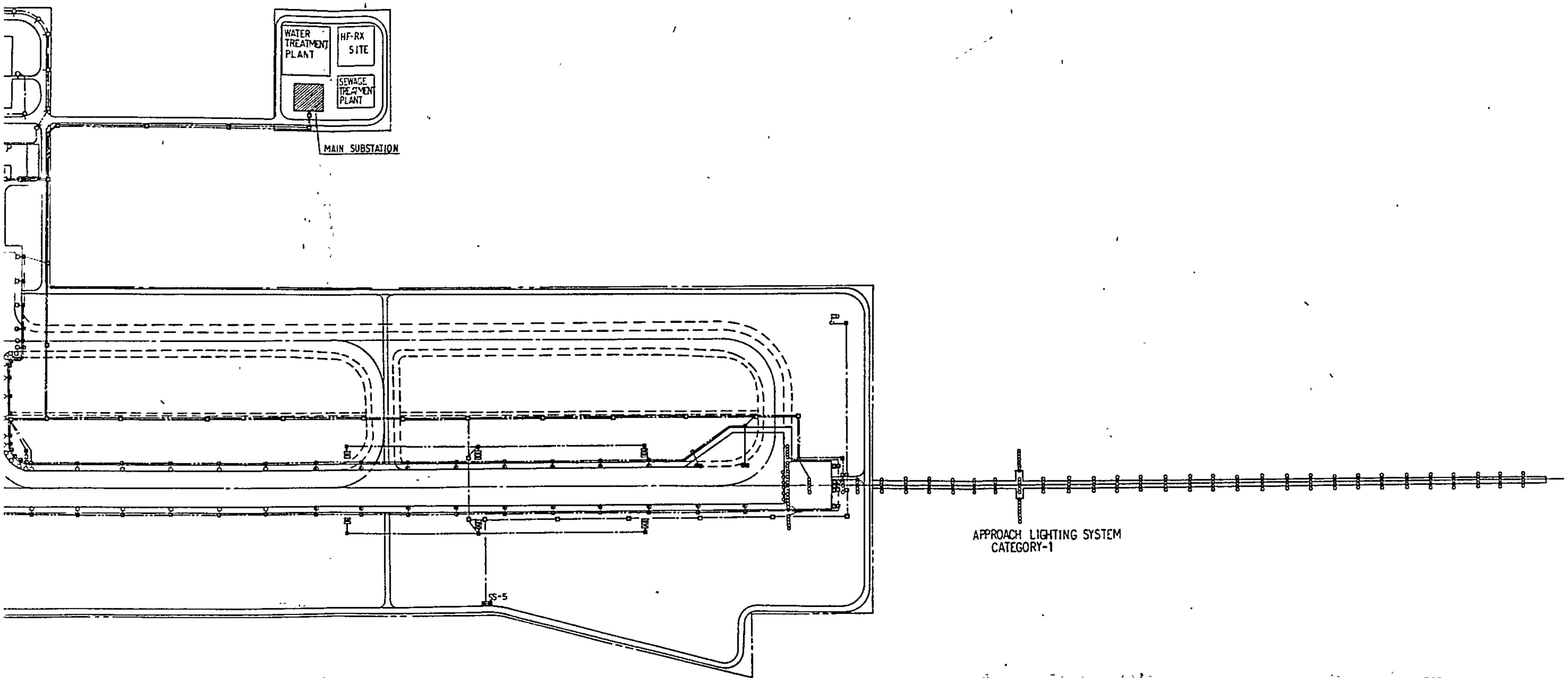


Figure 14.10.3 AERONAUTICAL GROUND LIGHTS LAYOUT PLAN

14.10.1 Radio Navaids

The following navaids are planned as terminal navaids and will also be used for the operation of precision approach category-I.

i) ILS Category-I

ii) VOR/DME, and

iii) NDB

ILS Category-I is planned for Runway 34 since the use of Runway 34 is a major part of the route structure and also the meteorological conditions make it more favorable.

The glide slope will be 3.0 degree based on international standards. A 3.0 degree glide slope is also desirable from the point of view of aircraft noise reduction.

Since the outer marker for the ILS is located on the Indonesian Sea, it can not be installed economically. Hence, a DME other than a VOR/DME is to be installed and colocated with ILS Localizer, to establish a precise final approach fix instead of using the outer marker. (The precise approach fix can be established by the localizer course center and the DME.)

A compass locator is also planned in order to provide a course guidance for the final approach fix as a standard approach route. The compass locator will be located on the extended center line of the approach fix course as shown in Figure 14.10.4.

A doppler type VOR and colocated DME as terminal navaids will be positioned at the west side of the runway to avoid course error due to the reflection from any obstructions nearby.

A terminal NDB is planned as a back-up facility for the VOR/DME and it will also be used as a terminal navaid for small aircraft.

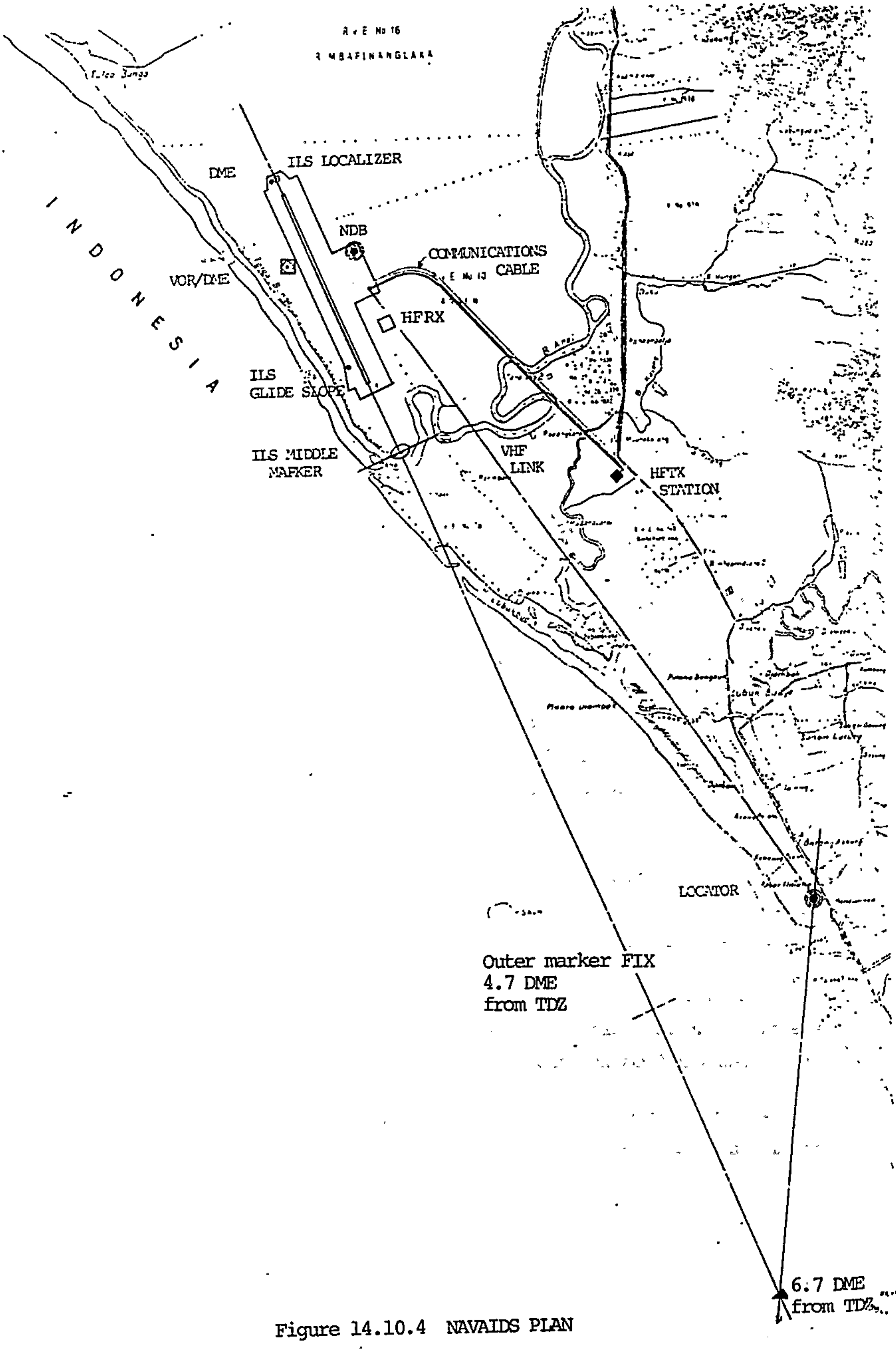


Figure 14.10.4 NAVAIDS PLAN

14.10.2 Air Traffic Control and Aeronautical Telecommunications Facilities

The following 3 control positions are planned for the air traffic control:

i) Aerodrome Control

ii) Approach (Departure) Control

iii) Flight Information Service

These control positions are to be provided in the control tower.

The following 4 VHF air to ground (VHF A/G) telecommunications facilities are needed for these control positions:

i) Padang Tower (Aerodrome Control)

ii) Padang Approach (Approach and Departure Control)

iii) Padang Radio (Flight Information Services)

iv) Emergency Radio

The VHF A/G receivers are planned for the ATC equipment room in the Administration Building. The VHF A/G transmitters, however, shall be located at the NDB site separated from the receivers in order to avoid interference between radio channels.

Although AFTN service will be made by either a common carrier or satellite according to DGAC, 3 HF radios are planned for stand-by and/or pioneer air service use. The receiver station is located in a Vital installation area. The transmitter station is located near the entrance of the airport access road separated approx. 4 km from the receiver station.

14.10.3 Meteorological System

The following pieces of meteorological equipment are required for the operation of precision approach category-I.

i) RVR meter (Runway Visual Range)

ii) Ceilometer (Cloud Height)

iii) Anemometer (Surface Wind)

iv) Thermometer (Air Temperature)

v) Precipitation Gauge (Rain Fall)

vi) Barometer (Barometric Pressure)

The RVR meter is located near the touch down zone for Runway 34 in order to indicate the runway visual range for the precision approach runway.

The ceilometer is located near the middle marker to measure the cloud height of the decision height point.

The meteorological observation station is located near the touch down zone for Runway 16. At this station, observation sensors such as anemometer, thermometer, and precipitation gauge are to be installed.

All the airfield meteorological data is to be collected automatically using weather data collection equipment and distributed to the control tower, etc.

The weather FAX receiver and teletypewriter receiver will be provided for receiving air route meteorological data.

14.10.4 Aeronautical Ground Lights

Aeronautical ground lights are planned for the precision approach category-I based on ICAO standards.

Table 14.10.2 shows the outline of the plan and Figure 14.10.3, the layout plan for the lighting fixtures.

All the lights are to be controlled from the control console, which will be installed in the control tower.

Power supply and control equipment for the aeronautical lights such as Constant Current Regulator, L.T. transformer, Logical Control Equipment, are to be installed at the main substation.

The emergency generator for the aeronautical lights will also be installed in the main substation. This generator has a capacity of 300 KVA, can detect a commercial power failure, and starts up automatically. It begins to supply emergency power to the lights within 15 seconds after a commercial power black-out, as defined for Category-I Operations by ICAO Standards.

Table 14.10.2 AERONAUTICAL GROUND LIGHTS PLAN

Runway Direction / Operation Category / Lights	Outline	RWY 34	RWY 16	Others
	-	Precision Approach Category - I	Instrument Non Precision	-
Approach Lighting System	Category-I Calvert System	O	-	
Simple Approach Lighting System	-	-	O	
3 Bar VASIS	VASIS Angle 3.0 deg.	O	O	
RWY Edge Light	Elevated Type			O (RWY Edge)
RWY Threshold Light	Inset Type	O	O	
RWY End Light	Inset Type	O	O	
Overrun Light	Elevated Type	O	O	
Taxiway Light	Elevated Type			O (Taxiway)
Aerodrome Beacon	-			O
Illuminated Wind Cone	-	O	O	
Apron Flood Light	-			O (Apron)
Control Console	-			O (Tower)
Control Equipment	-			O (Main Sub-station)

14.11 Airport Property Area

Based on the abovementioned airport facility planning, the overall dimensions for the land to be aquired were determined as shown in Figure 14.11. 1.

All areas to be acquired which are concerned with the airport construction can be broken down as tabulated below.

	Unit: m^2
Airport site (including ALS, SALS)	1,384,100
VOR/DME site	10,000
Vital Installation Area	22,500
HF Transmitter site	12,000
Access road site	75,000
Temporary road site	18,000
Total	1,521,600

There are some areas where coconut trees should be cut down in accordance with the criteria related to obstacle limitation surfaces recommended by ICAO and siting criteria for various navaids in order to provide the safety and efficiency of airport and aircraft operations. The details about these areas are discussed in "16.2 Considerations on Future Land Use".

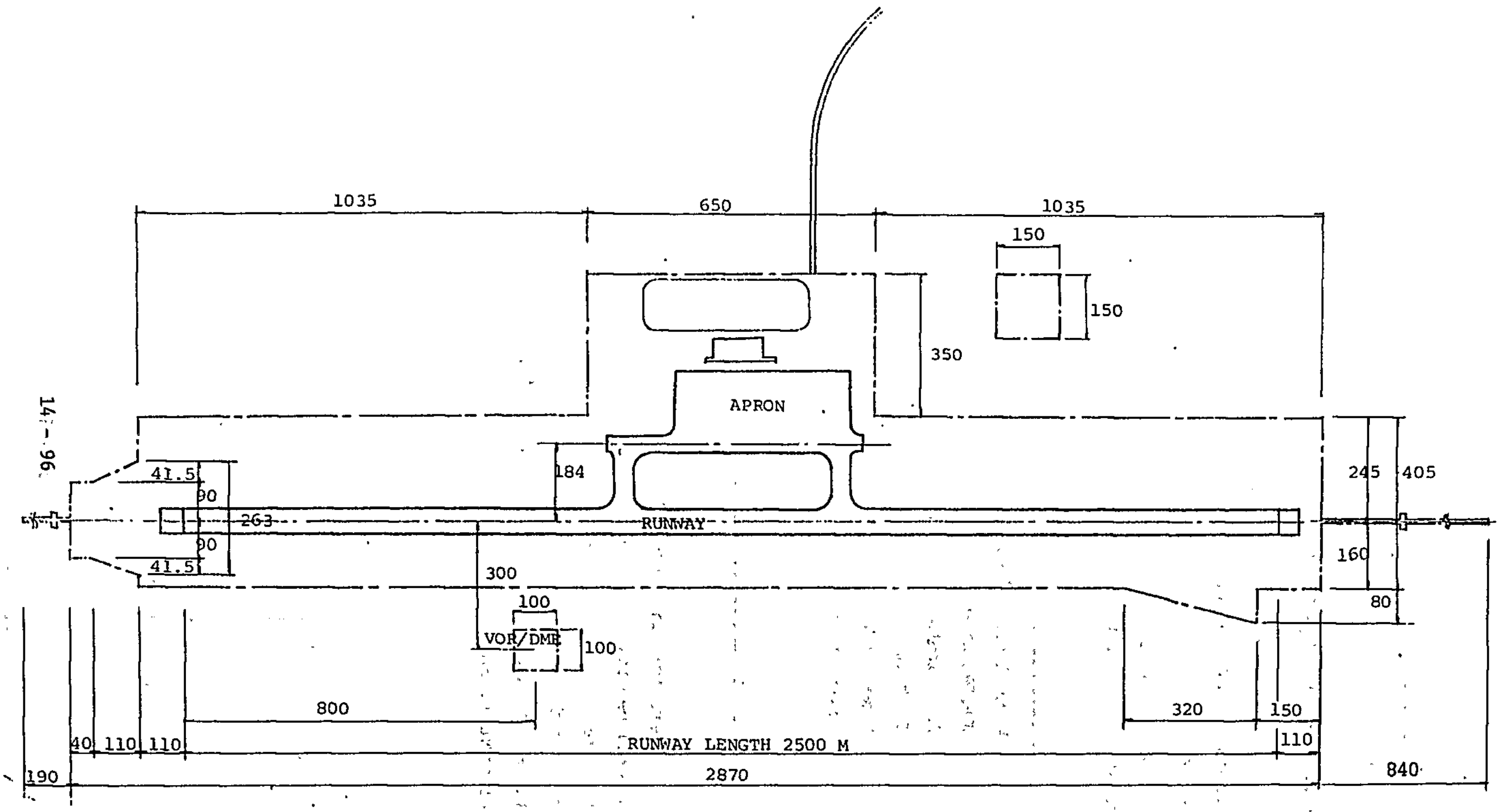


Figure 14.11.1 GENERAL DIMENSIONS OF THE AIRPORT