PART Ⅲ SELECTION OF THE AIRPORT DEVELOPMENT SCHEME

CHAPTER 5 REDEVELOPMENT OF TABING AIRPORT

5.1. General

The Table 5.1.1. summarizes the estimated saturation time for each existing facility of Tabing Airport. Since GIA has a plan to start a A-300-B4 operation at Padang early in 1983, the table is prepared under the assumption that the introduction of A-300 will take place in 1983. Thus it is assumed that minimum modifications such as overlaying the pavements, expanding the passenger terminal, etc. will be carried out by 1983 to accommodate the A-300 operation planned by GIA.

As is clear from Table 5.1.1., although the above improvement works will be carried out, the existing facilities will reach their capacities around 1987. Therefore, based on the Air Traffic Demand Forecast and Airport Facilitity requirements described in previous chapters of the Report, this chapter discusses the ability to expand and redevelopment concept of the existing airport, using the following procedure:

i) Evaluation of airspace

ii) Evaluation of airport facilities

iii) Study on redevelopment concept

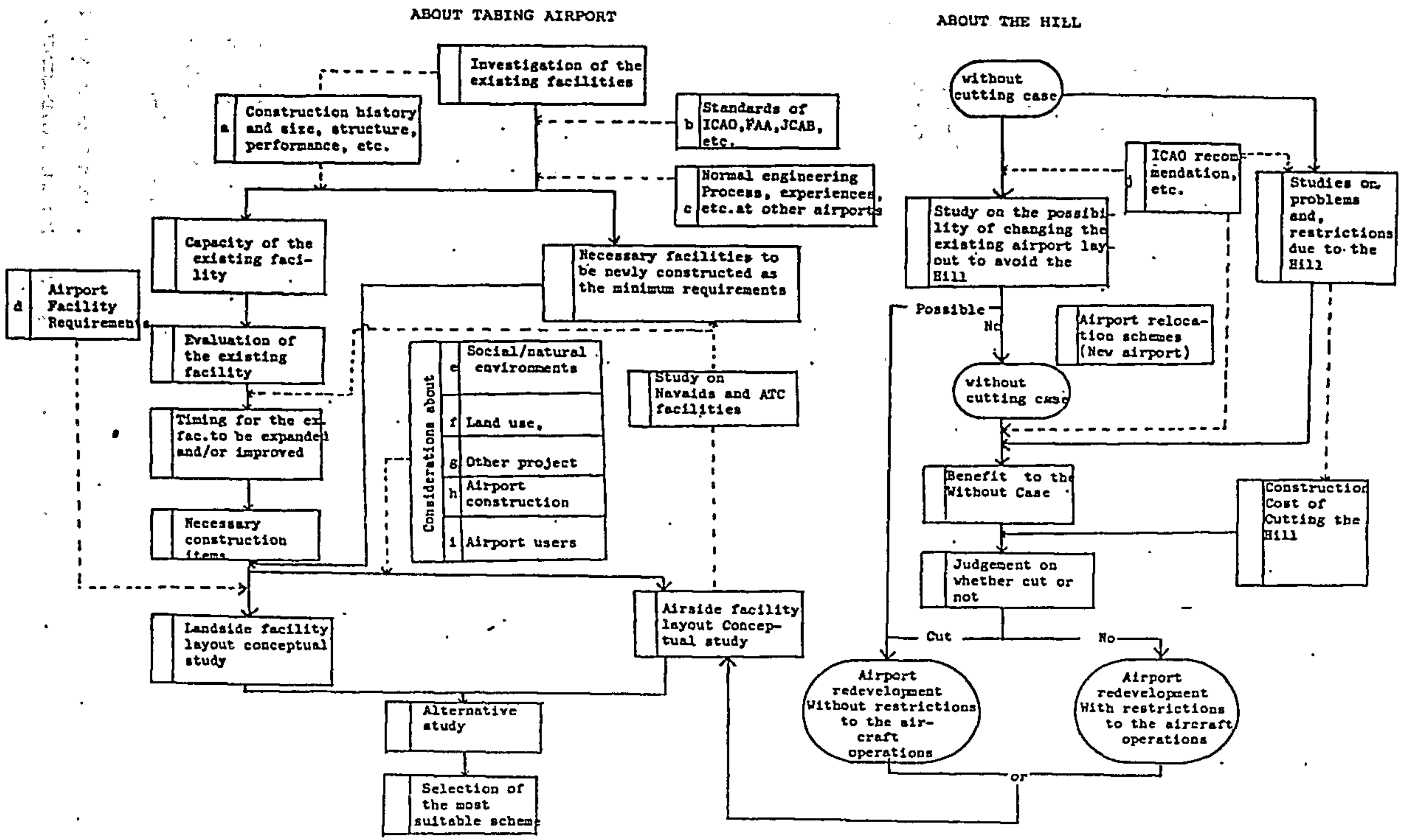
iv) Result of the redevelopment study

The work flow chart for the redevelopment study is shown in Figure 5.1.1.

Table 5.1.1 SATURATION TIME OF FACILITY

FACILITY \ YEAR	Introduction of A-300 ▼ — 1981, 85, 90	REMARKS
1 RUNWAY	2150m	Payload restriction necessary for A300 and DC-9
2 TAXIWAY		Parallel TWY justified after 1990, IFR approaches exceed 4/Pk.Hr.
3 APRON		Expansion necessary
4 PAVEMENT	OVERLAY	DC-10 requires re-overlay
5 PASSENGER TERMINAL	EXPANSION	Traffic requires a new terminal
6 CAR PARKING		Expansion necessary
7 CARGO TERMINAL	NO FACILITY NOW	New terminal to be provided within the airport
8 CONTROL TOWER		TWR console need to be replaced
9 ADMINISTRATION BUILDING		Reaches capacity when equipment replacement will take place
10 ATC and COMMUNICATIONS	*	* Some replacements are required (EQPT only)
11 NAVAIDS	**	** VOR/DME replacement is required around 1986
12 MET. FACILITIES		(This assessment is based on Non-Precision Operation)
13 LIGHTING		
14 UTILITIES	ELECTRICITY WATER	Water supply from city centre is required as soon as possible
15 ACCESS ROAD		Widening necessary after 1995

Figure 5.1.1. FLOW CHART FOR THE REDEVELOPMENT STUDY OF TABING AIRPORT



5.2 Evaluation of Airspace

5.2.1 Present Airspace

The plan depicting the airport surrounding area is shown in Figure 5.2.1. As can be seen in the Figure 5.2.1., the hill consisting of three peaks exists to the south of runway end 34. The distances and heights of these peaks in relation to runway end 34 are illustrated in Figure 5.2.2. together with the approach and take-off climb surfaces. These three peaks apparantly protrude as obstructions above the 1: 40 slope of take-off climb surface and the second section of approach surface of instrument runway. The DGAC has not set forth any rules covering instrument approach for RWY 34 or instrument take-off from RWY 16.

The current approach and take-off procedures practices by GIA at Tabing Airport are as follows:

i) Approach

As is shown in Figure 5.2.3. circling approach precedures utilizing VOR/DME and NDB are practiced for instrument approach. Non-instrument straight in approaches by 2.7 degree glide path with aid of the VASIS are put into practice for RWY 16 and 34 under VMC.

ii) Take-off

The Standard Instrument Departure (SID) procedure is illustrated in Figure 5.2.4. As is clear in Figure 5.2.4., aircraft taking-off from runway 16 toward the south must make a right turn immediately after taking-off, to avoid collision with the existing hills.

In general, a runway usage pattern of an airport is very closely related to its available airspace and prevailing wind direction.

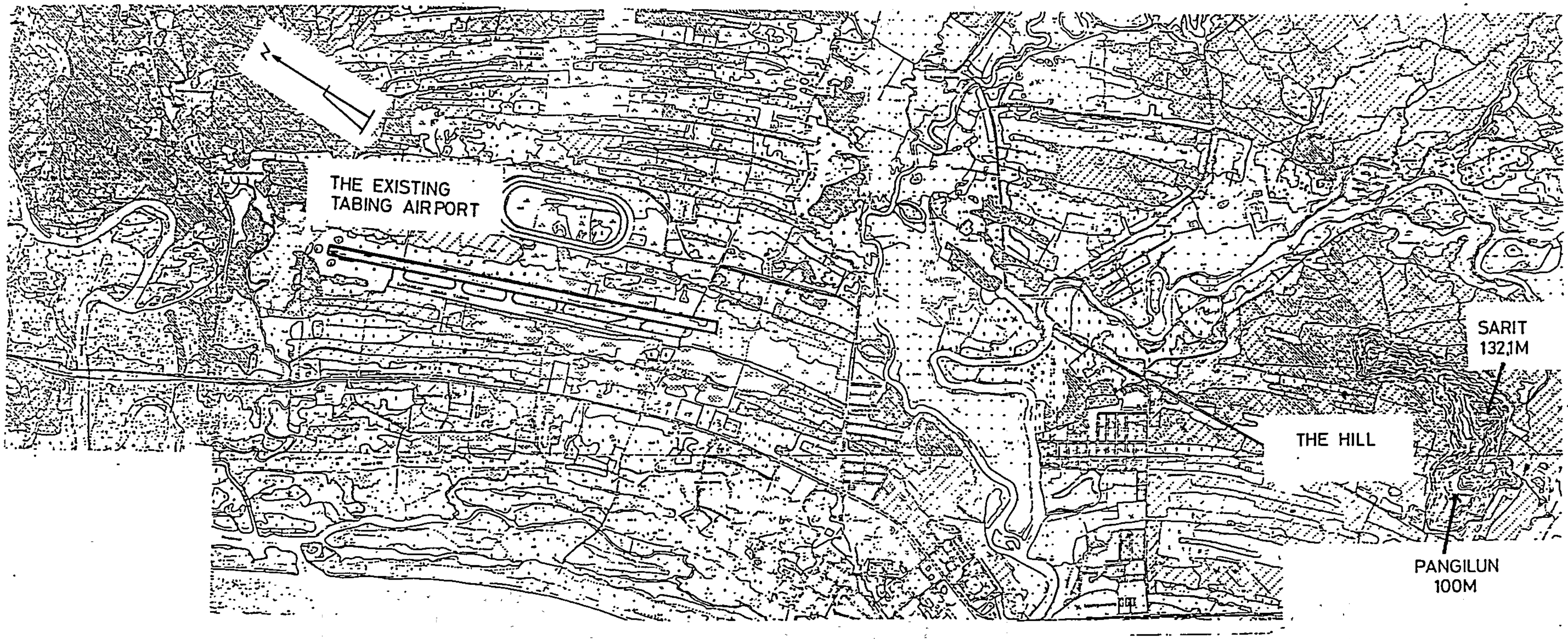


Figure 5.2.1 PLAN OF TABING AIRPORT AND SURROUNDING AREA

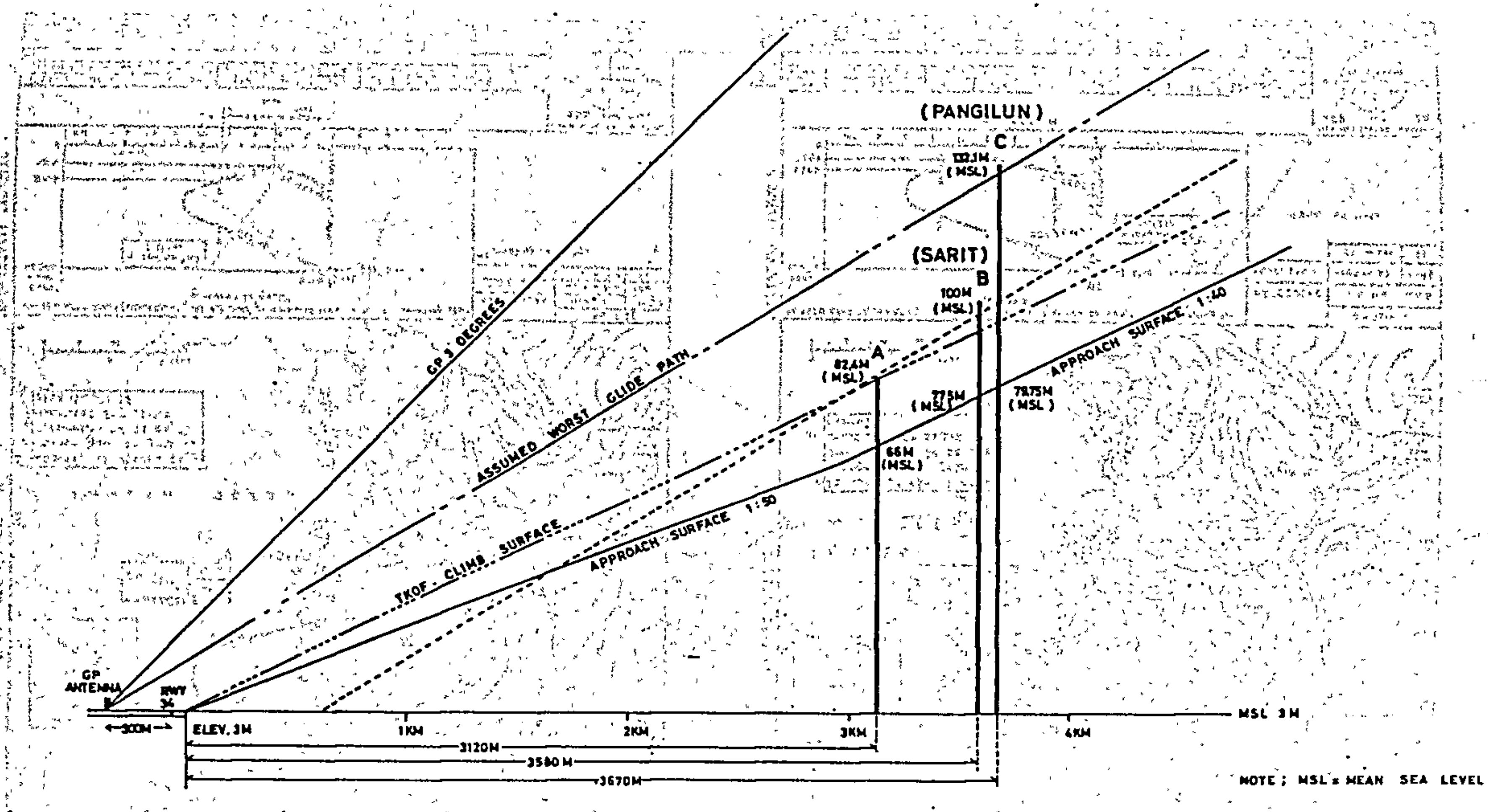
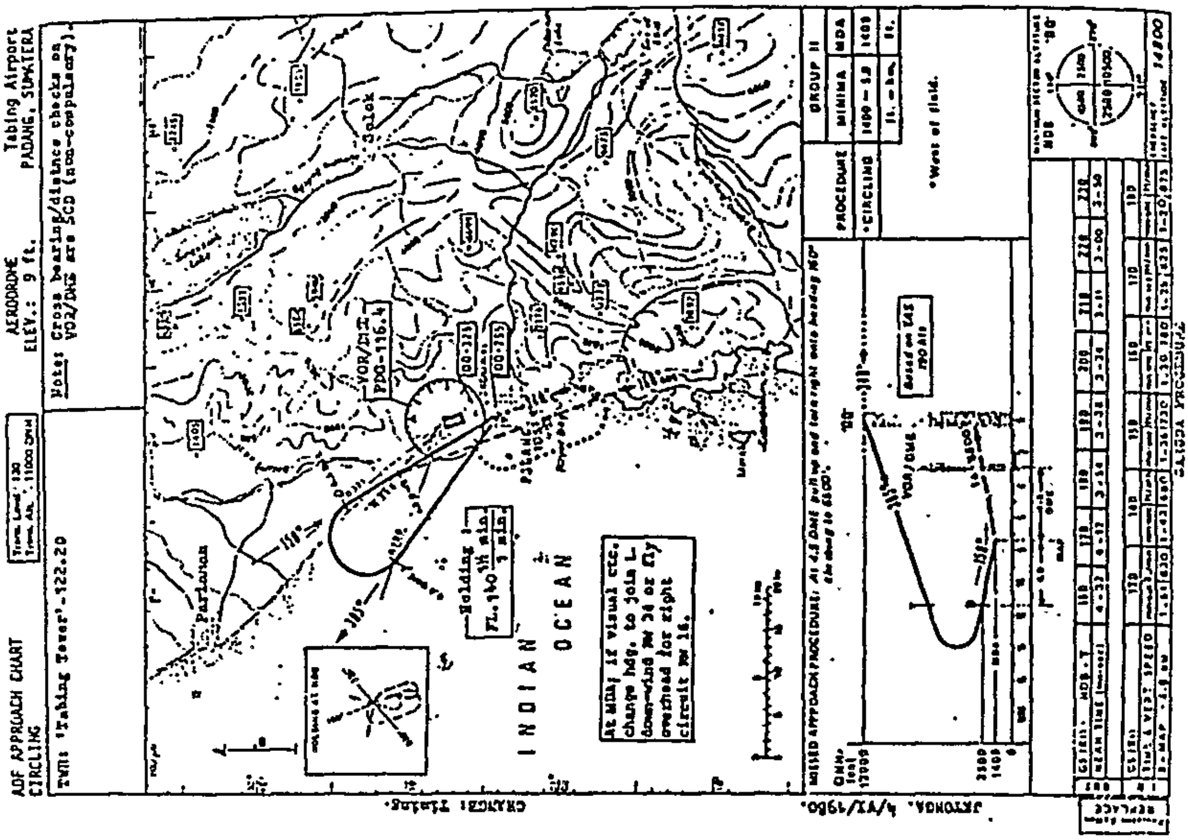


Figure 5.2.2 OBSTRUCTION IN APPROACH AND TAKE-OFF CLIMB SURFACES
SCALE: H=1/20,000 , V=1/1,000



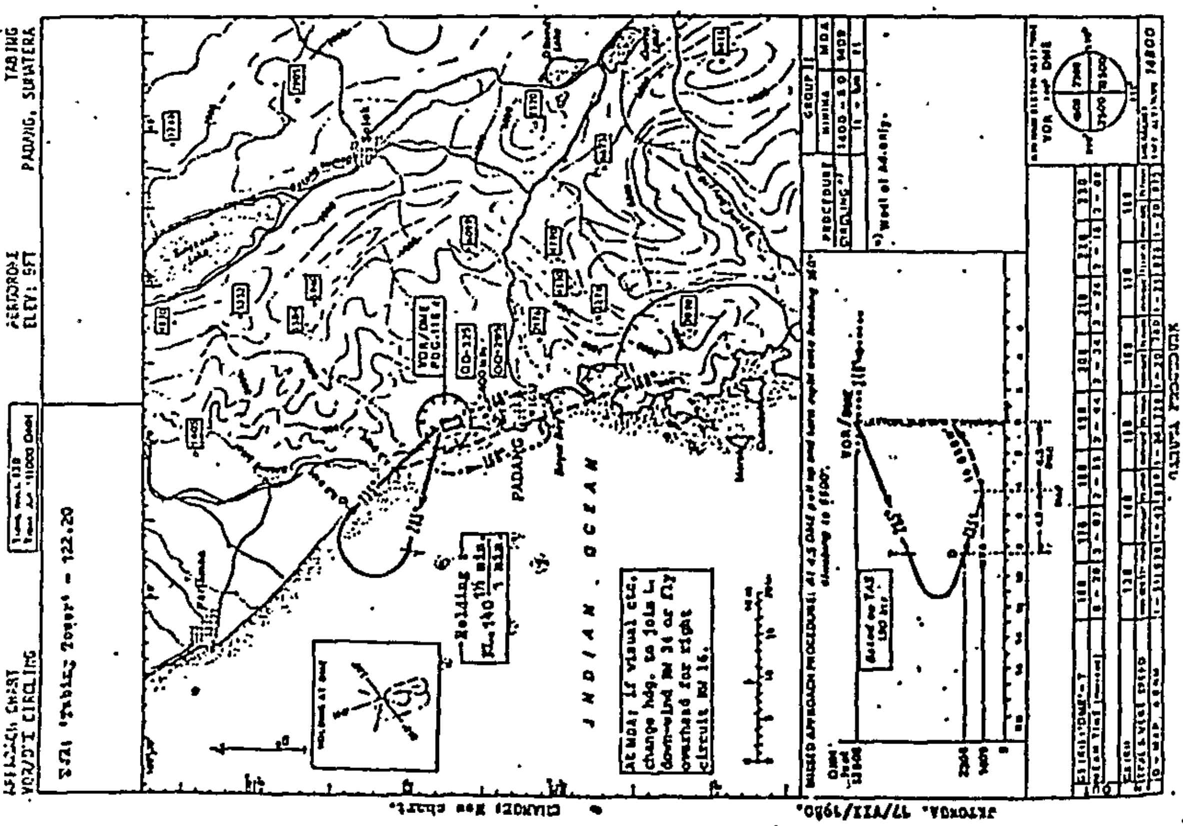


Figure 5.2.3. CURRENT CIRCLING APPROACH PROCEDURES AT TABING

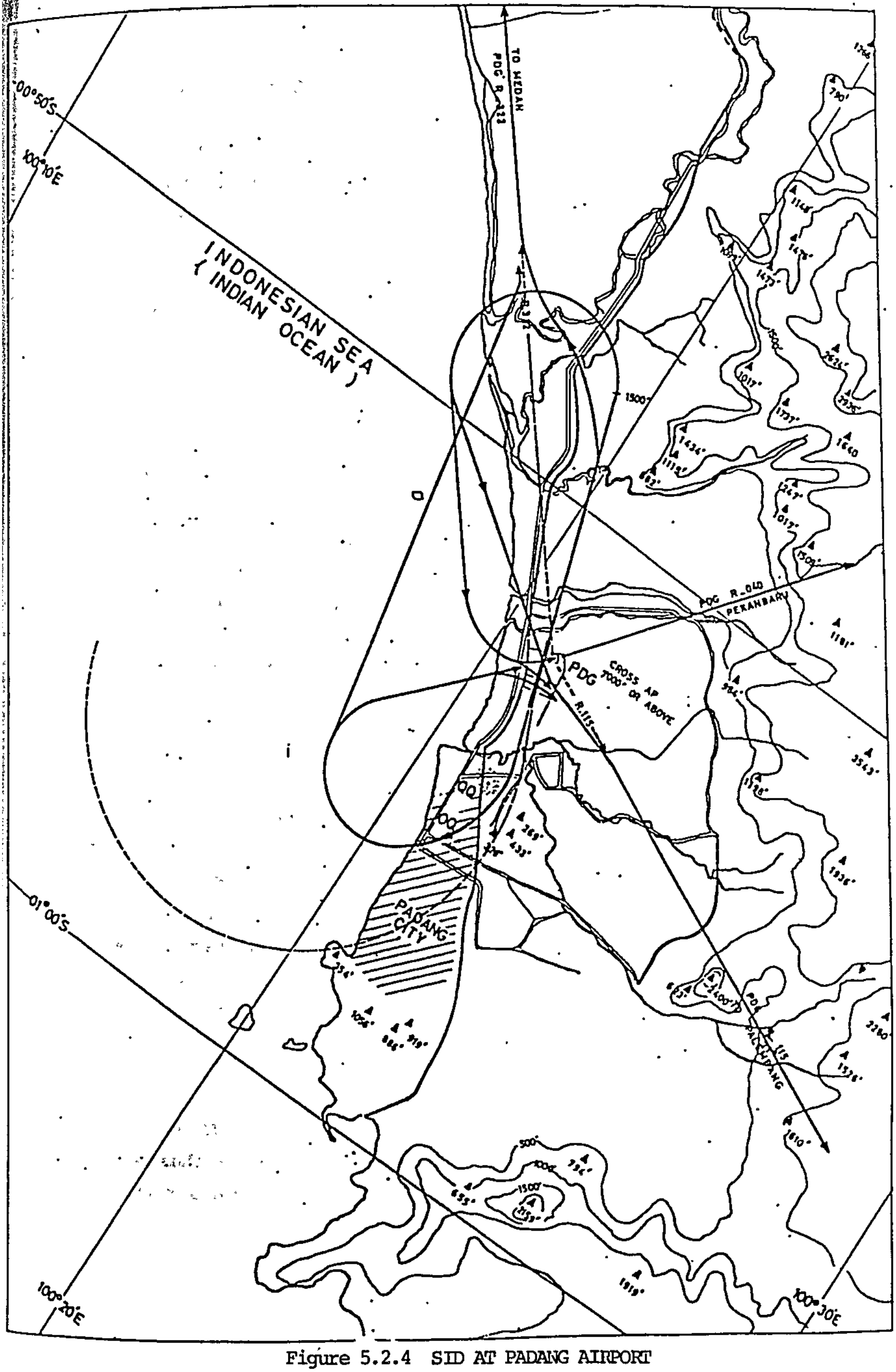


Figure 5.2.4 SID AT PADANG AIRPORT

In the case of Tabing Airport both RWY 16 and RWY 34 have more than 90 percent wind coverage for 5 Knots tail wind and 13 Knots cross wind, as shown in Figure 5.2.5 and 5.2.6, respectively. Thus the wind direction does not really dictate the runway usage pattern at Tabing. Where as the record of actual runway usage at Tabing in the three years (1976-1978) indicates that RWY 34 is used more frequently than RWY 16 for approaches and departures (RWY 34 Usage 86% vs RWY 16 Usage 14%). The reasons for this strong preference of RWY 34 over RWY 16 are considered to be as follows:

i) Air route structure and prevailing weather condition

The present air route structure at Tabing consists of more than 75 percent of south traffic from Jakarta, Palembang, Pekanbaru, etc. Because of the relatively smaller size of aircraft used and prevailing fair weather conditions at most times of the year (occurence of traffic deversion due to poor visiblity/low ceiling in the years from 1976 through 1978 is less than 1 percent annually), most traffic from the south seems to prefer non-instrument, straight in approaches with the aid of VASIS.

ii) SID turn and hills at the south

As can be seen in Figure 5.2.4, aircraft taking off from Tabing Airport must a turn for SID procedure no matter what runway end is used. There is a slight difference in turning distance between RWY 16 take-off and RWY 34, however, it is apparent that by using RWY 34 the hills to the south which protrude into the take-off climb surface for RWY 16 take-off, can be avoided. At present RWY 16 take-off for DC-9 is limited to 44,680 kg due to the hill, as compared to 45,360 kg for RWY 34 take-off.

iii) Apron proximity to RWY 34

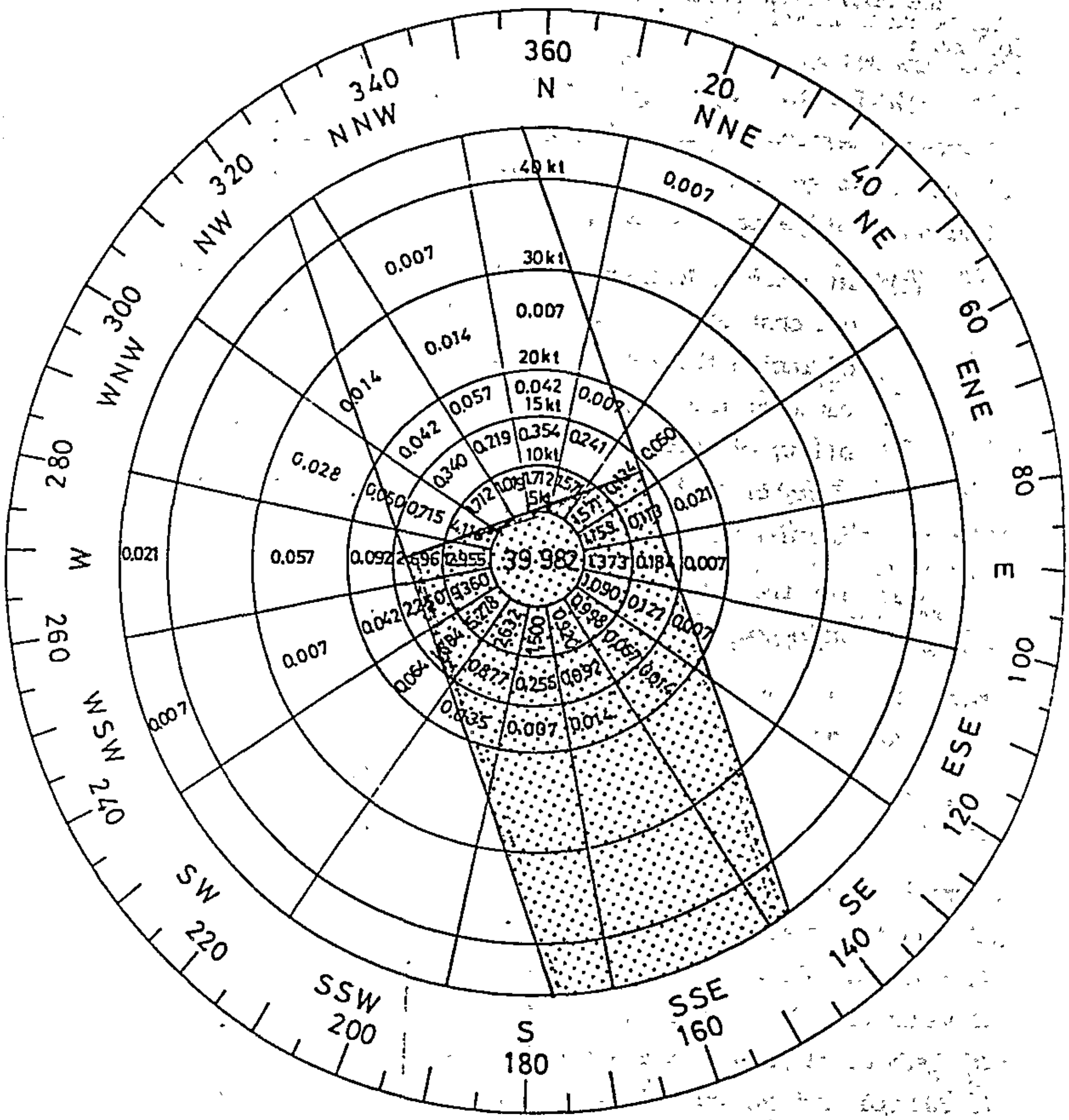
Since the existing apron is close to the RWY 34, it is prefereble for take-off aircraft to use RWY 34 thus minimizing taxiing distance to save time and fuel consumption.

The above mentioned current airspace use may be evaluated as follows :

i) For the sake of safe aircraft operation, it is strongly desired to solve the obstruction problem caused by the hills to the south. This in turn will relieve take-off weight limitation for RWY 16.

ii) In general, Minimum Descent Altitude (MDA) for airports without obstructions is set at 400 - 800 ft above ARP. In the case of Tabing the MDA is 1409 ft (1400 ft above ARP of 9 ft) because of the said obstacles. This higher MDA increases possibility of encountering low ceilings which would affect punctuality of airline operation. This problem could be solved by installing ILS.

iii) For the safe operation of aircraft, especially for forecast wide-body aircraft, ILS installation is desirable.



LOCATION : PADANG AIRPORT

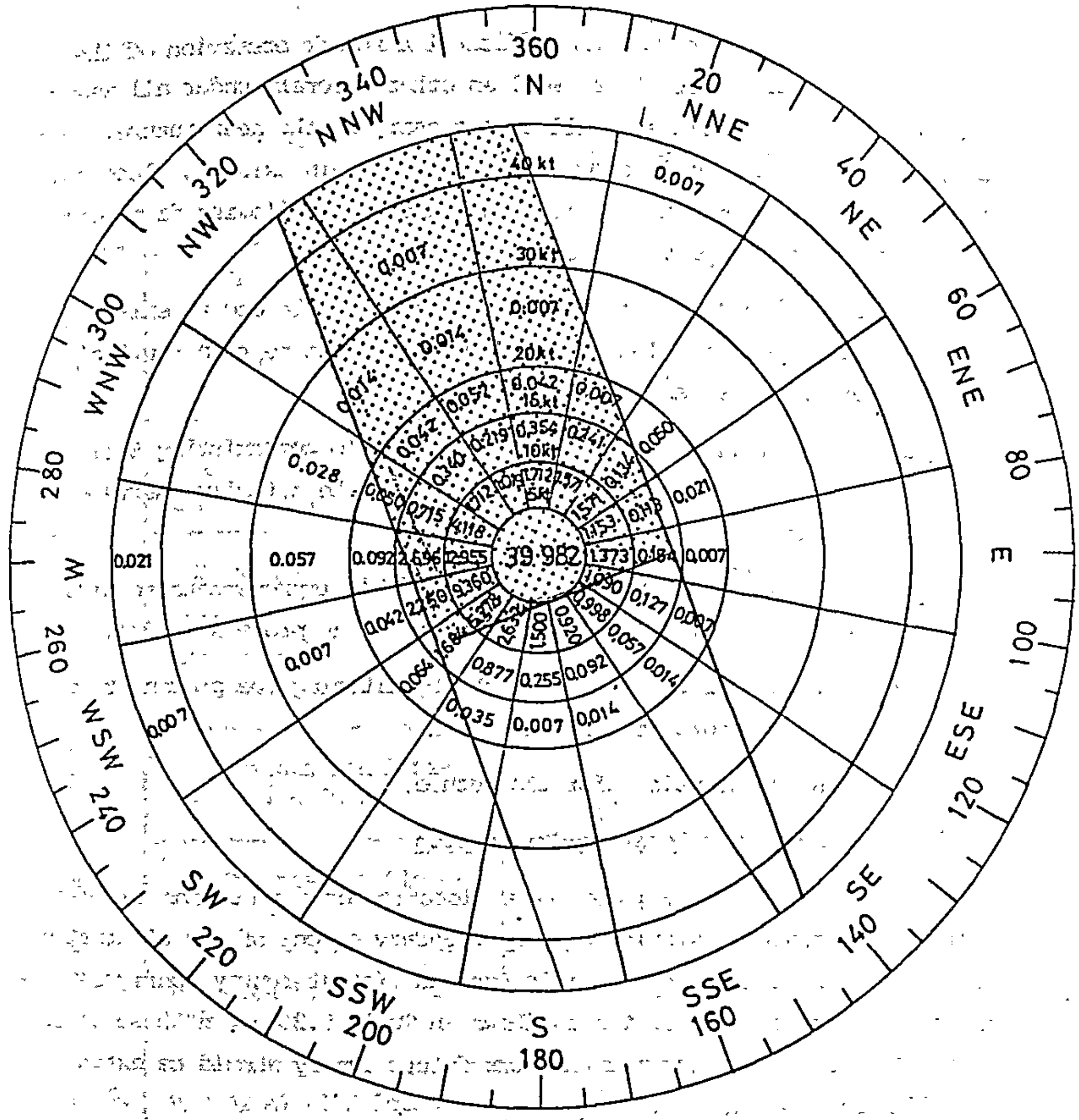
PERIOD : 1976 - 1978 (3 YEARS)

RWY DIRECTION : N 160°E (16/34)

MAG. VAR : 0 DEGREE

WIND COVERAGE (RWY 16 APP) : 87.5 % CROSS WIND 13 KT TAIL WIND 5 KT

Figure 5.2.5 WIND COVERAGE MAP



LOCATION	:	PADANG AIRPORT
PERIOD	:	1976 – 1978 (3 YEARS)
RWY DIRECTION	:	N 160° E (16/34)
MAG. VAR	:	0 DEGREE
WIND COVERAGE	:	90% (CROSS WIND 13 KT)
(RWY 34 APP.)		(TAIL WIND 5 KT)

Figure 5.2.6 WIND COVERAGE MAP

5.2.2. Study on Possible Improvements of Airspace

In order to secure safe and efficient aircraft operation of the forecast wide-body aircraft, as well as other aircraft under all weather conditions, ILS installation will be necessary in the near future. However, as long as the hills and mountaineous terrain exist in place and the present runway orientation is maintained, the following facts have been revealed by the previous section:

i) ILS installation for RWY 34 is not feasible due to existing Sarit and Pangilun hills and mountaineous terrain south of Padang city; and

ii) ILS installation for RWY 16 is feasible but existing Sarit and Pangilun hills intrude into the take-off climb surface for RWY 16.

Therefore this section investigates possible improvements to airspace and studies the solution at Tabing airport in the process as follows:

i) Possible airspace improvements by altering the present runway location and/or orientation; and

ii) Airspace solutions for the future.

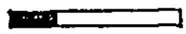
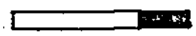
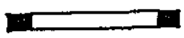
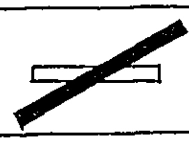
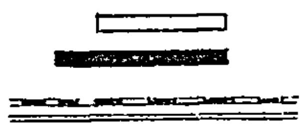
1) Altering Runway Location/Orientation

Assuming that altering the runway location or orientation can take place basically within the existing airport boundary as one of the alternative layouts of Tabing Airport, possible basic different runway configurations may be illustrated by skeleton as shown in Table 5.2.2. In these configurations, it is also assumed that the future runway should be extended to 2,500m in total length.

In these runway configurations, four alternative cases i.e., Case 1, 5, 6, and 7 are finally selected for the detail study since the other cases are judged to be impractical for obvious reasons as stated in the Table 5.2.2.

The result of the detailed study and its assessment are reported hereinunder and also tabulated and depicted in Table 5.2.3. and Figure 5.2.8. to 5.2.11.

Table 5.2.2 BASIC RUNWAY CONFIGURATION

Case	RWY Arrangement		Remarks
Case 1	RWY Extension to North		Prepared as base case.
Case 2	RWY Extension to North W/RWY 34 threshold shift to North		2 km RWY shift impractical
Case 3	RWY Extension to South		No betterment
Case 4	RWY Extension to North and South		No betterment
Case 5	RWY Orientation Anti-Clock-wise Shift		
Case 6	RWY Orientation Clock-wise Shift		
Case 7	RWY Parallel to East Relocation		
Case 8	RWY Parallel Relocation to West		No adequate space between exist. RWY & R.R./HWY

Case 1 (Refer to Table 5.2.3. and Figure 5.2.8.)

RWY 34:

Sarit and Pangilun hills infringe the second section of approach surface and also ILS obstacle clearance surface. The mountainous terrain south of Padang city make the ILS intermediate approach impossible. Hence, ILS approach procedure could not be established.

RWY 16:

A part of the northerly mountainous terrain infringes slightly the second section of approach surface, however the ILS obstacle clearance surface is maintained free of obstacles. Hence, RWY 16 ILS approach is feasible. Sarit and Pangilun hills infringe the take-off climb surface, thus force abnormal take-off procedure and also a take-off weight restriction.

Case 5 (Refer to Table 5.2.3. and Figure 5.2.9.)

RWY 32:

Sarit and Pangilun hills are located outside of the approach and ILS final approach area. However the mountainous terrain to the south-east of Padang city still exists as an obstruction to the approach surface (2nd section) and also to ILS intermediate procedure. Hence, ILS RWY 32 procedure could not be established.

RWY 14:

Approach surface and ILS obstacle clearance surface is maintained clear. There are no constraints for the establishment of ILS RWY 14 appraoch procedure. For take-off RWY 14, it is possible to establish take-off procedure avoiding the Sarit and Pangilun hills by straight take-off to 1,000 ft. and turn-to-right procedures. As a result, runway 16 take-off procedure in Case 1 is improved in Case 5.

Thus airspace-wise it may appear that the Case 5 is preferable than Case 1. However, this Case 5 is abandoned for the following reasons:

i) Constructing the new runway across the existing runway will disrupt normal airport operation;

ii) Existing apron becomes too remote from the new runway;

iii) Although the required clearance above railroad and highway can be secured for approach path at both thresholds, each runway end becomes very close to the existing highway, railroads or roads as seen in Figure 5.2.7. This gives adverse effects on operational safety as well as to residents along the highway and roads.

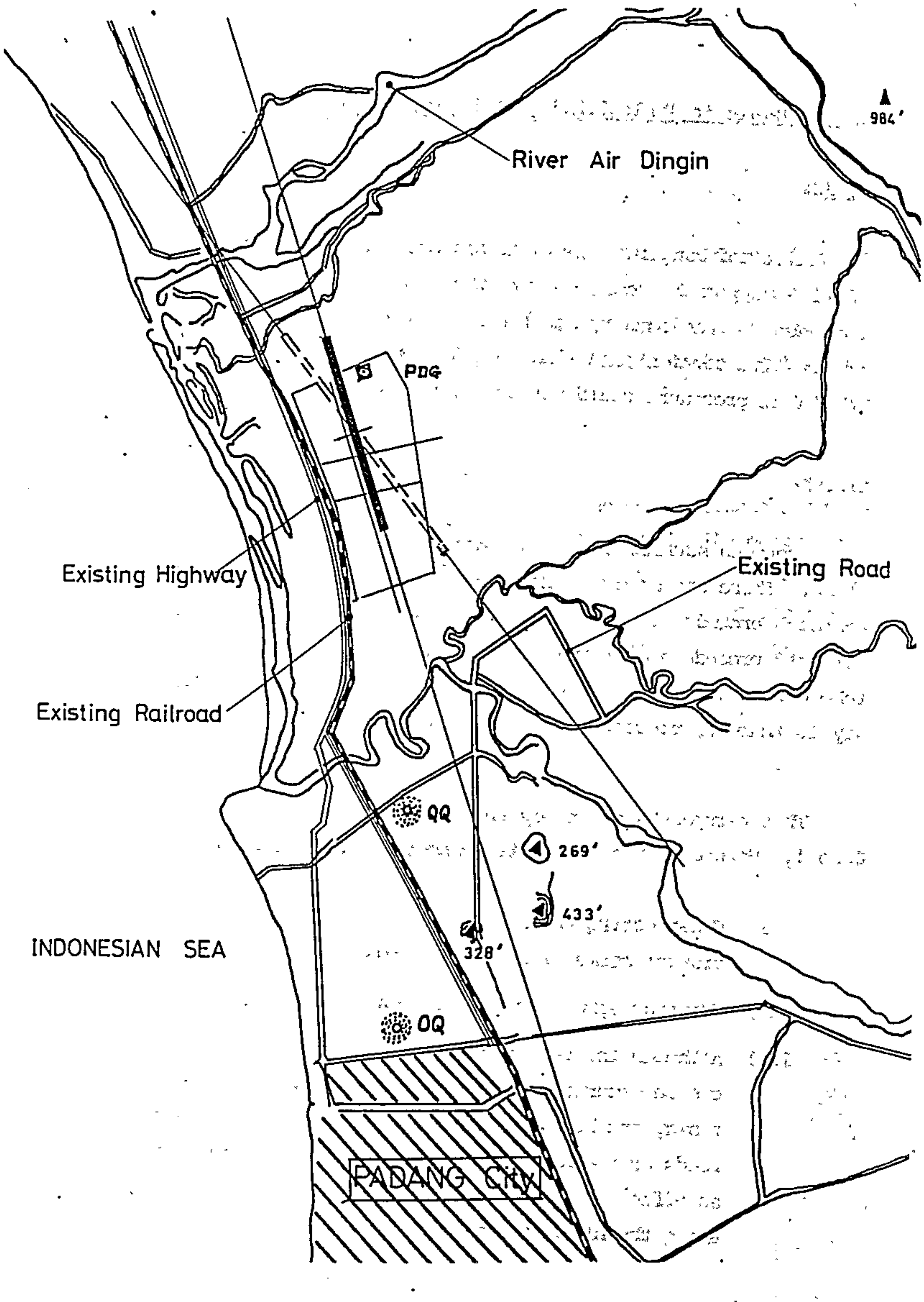


Figure 5.2.7. RUNWAY AND SURROUNDING AREA FOR CASE 5

Case 6 (Refer to Table 5.2.3. and Figure 5.2.10.)

RWY 35:

By changing RWY orientation to RWY 17/35, the hills are cleared from the approach and ILS obstacle clearance surface. However, a mountain of 1,056 ft. (322 m), located some 9 km south from the threshold infringes the ILS obstacle clearance surface. Thus ILS approach procedure could not be established. For take-off runway 35, mountainous terrain could be scarcely be avoided by a left turn.

RWY 17:

Runway 17 could not be used for an approach runway other than by visual circling.

Case 7 (Refer to Table 5.2.3. and Figure 5.2.11.)

RWY 34/16:

The hills and southern mountainous terrain still remain obstructions. Accordingly, the airspace constraints are not cleared away and remain under the same condition as with Case 1.

2) Result of the Airspace Improvement Study

As the result of the airspace improvement study, it is understood that there is no better runway configuration and development other than that of Case-1, (Case-7) which maintains the existing runway orientation and extends to the north. This is mainly because, in any case, at least one part of mountainous terrain (north mountainous terrain, south mountainous terrain, 1,056 ft. mountain to the south of Padang city and Sarit/Pangilun hills) jeopardizes the airspace partly or totally.

Table 5.2.3 RESULTS OF AIRSPACE IMPROVEMENT STUDY

Case No. (Fig. No.)	RWY Designation	Obstacle Limitation Surfaces			ILS Approach Procedure			VOR Approach Procedure	Remarks
		Approach		Take-off Climb	Inter-mediate	Final	Missed		
		1st Sec.	2nd Sec.						
CASE 1	RWY 34	O	X	O	X	X	O	Circling	O means no obstruction and surfaces/procedures could be established. X means obstacle(s) infringe limitation surface(s), and procedures could not be established.
	RWY 16	O	X	X	O	O	O	Circling	
CASE 5	RWY 32	O	X	O	X	O	O	Circling	
	RWY 14	O	O	O	O	O	O	Straight-in	
CASE 6	RWY 35	O	X	O	X	O	O	Circling	
	RWY 17	O	X	O	X	X	O	Circling	
CASE 7	RWY 34	O	X	O	X	X	O	Circling	
	RWY 16	O	X	X	O	O	O	Circling	

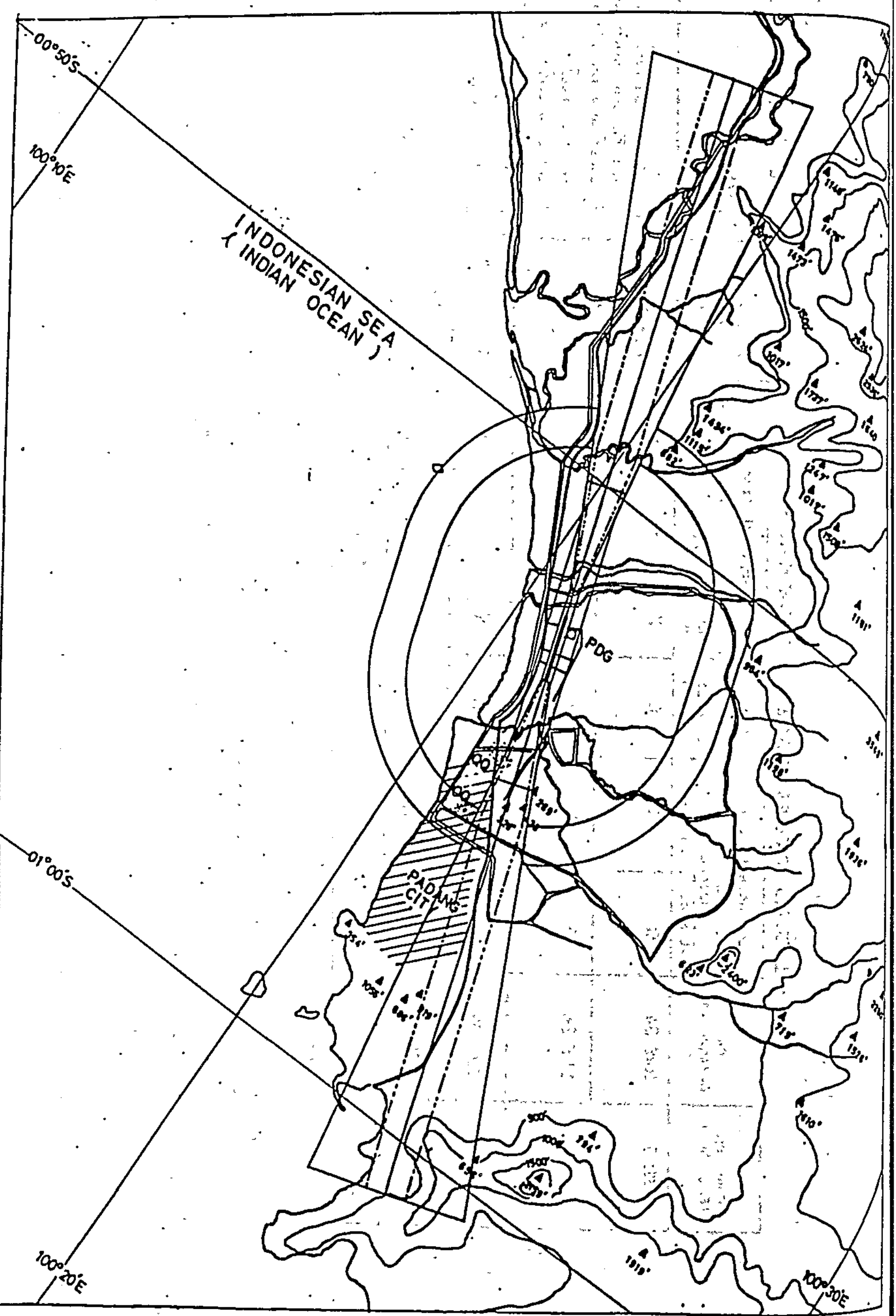


Figure 5.2.8. RUNWAY LOCATION CASE I (RWY 16/34)

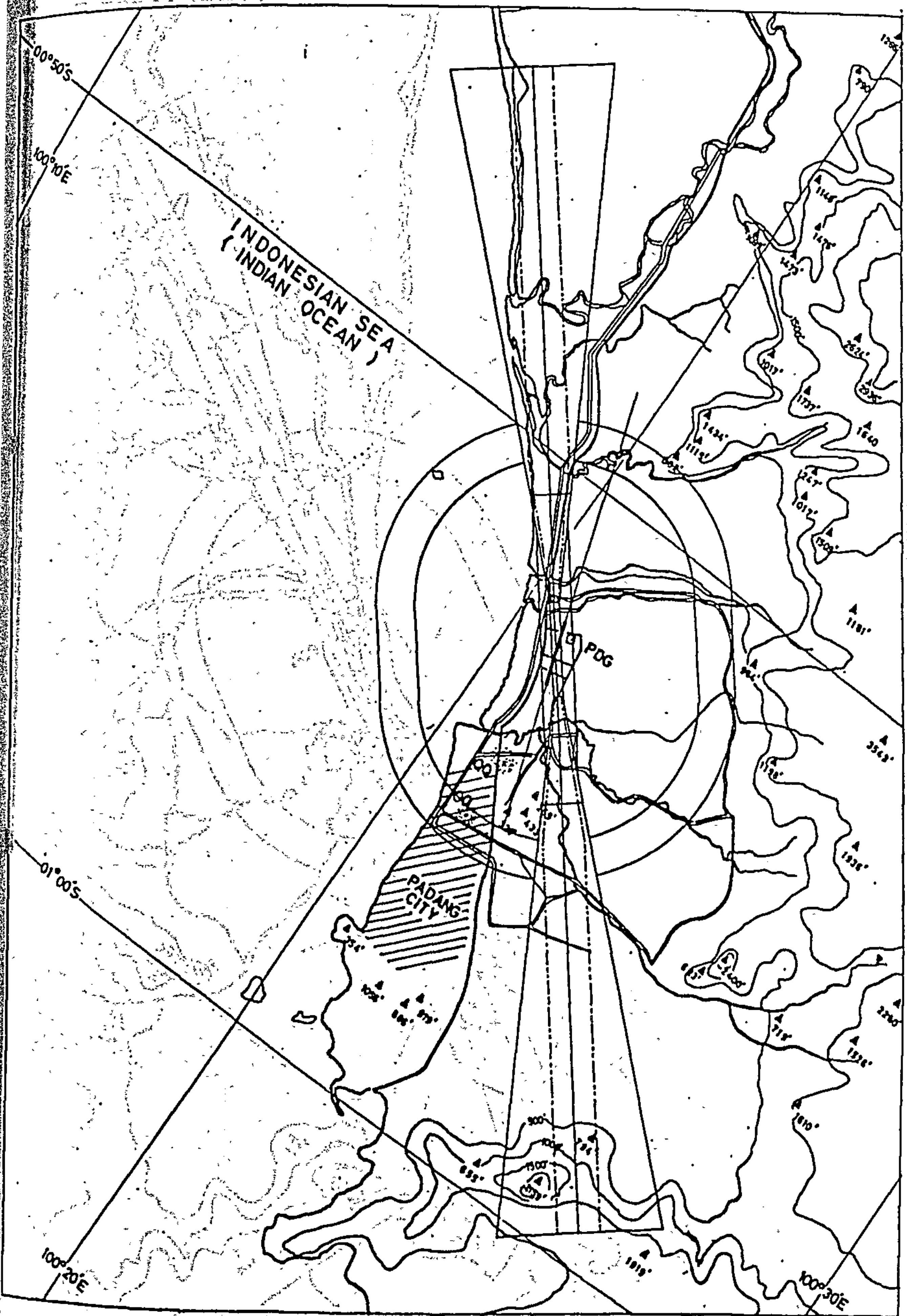


Figure 5.2.9. RUNWAY RELOCATION CASE 5 (RWY 14/32)

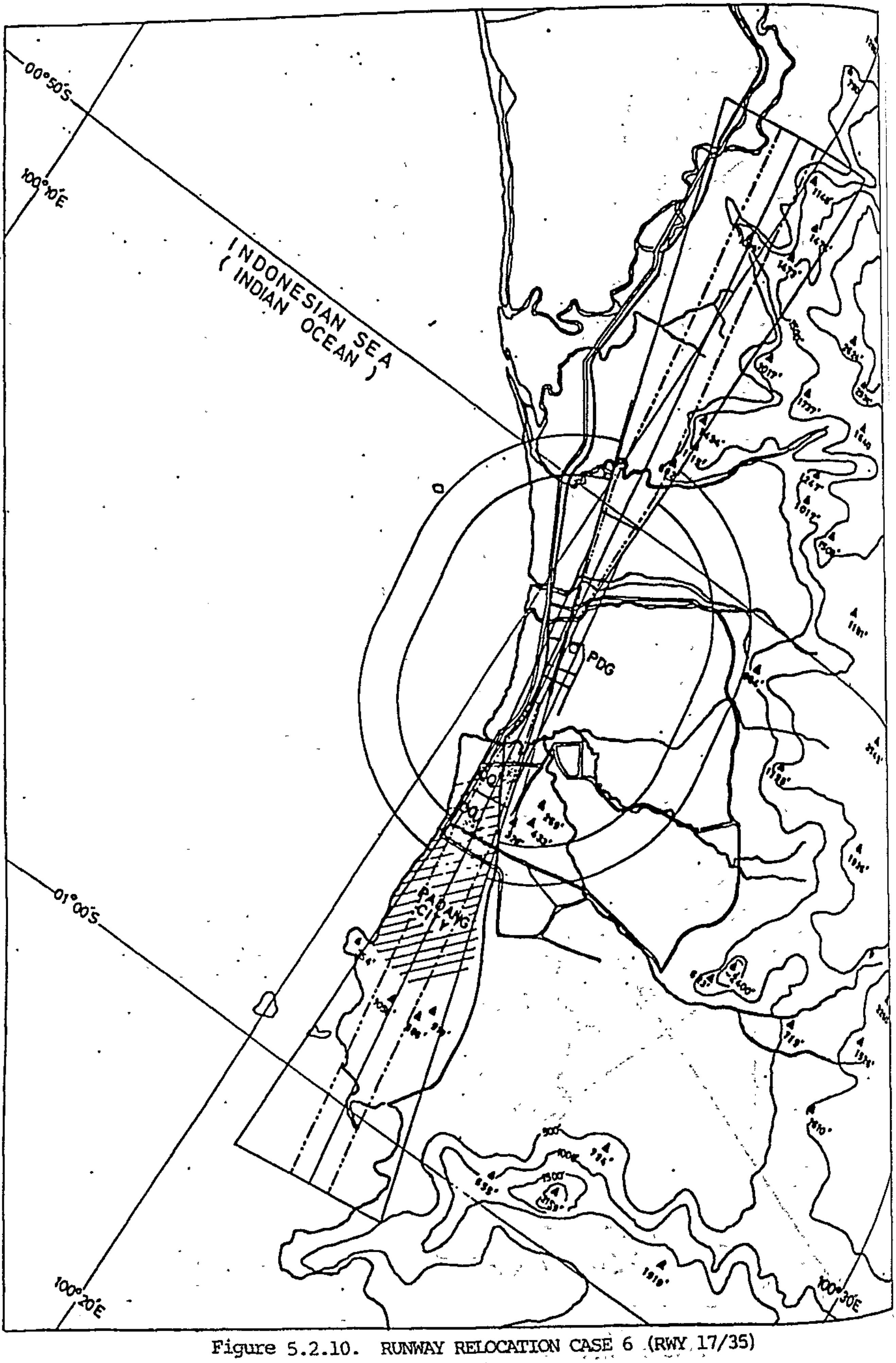


Figure 5.2.10. RUNWAY RELOCATION CASE 6 (RWY 17/35)

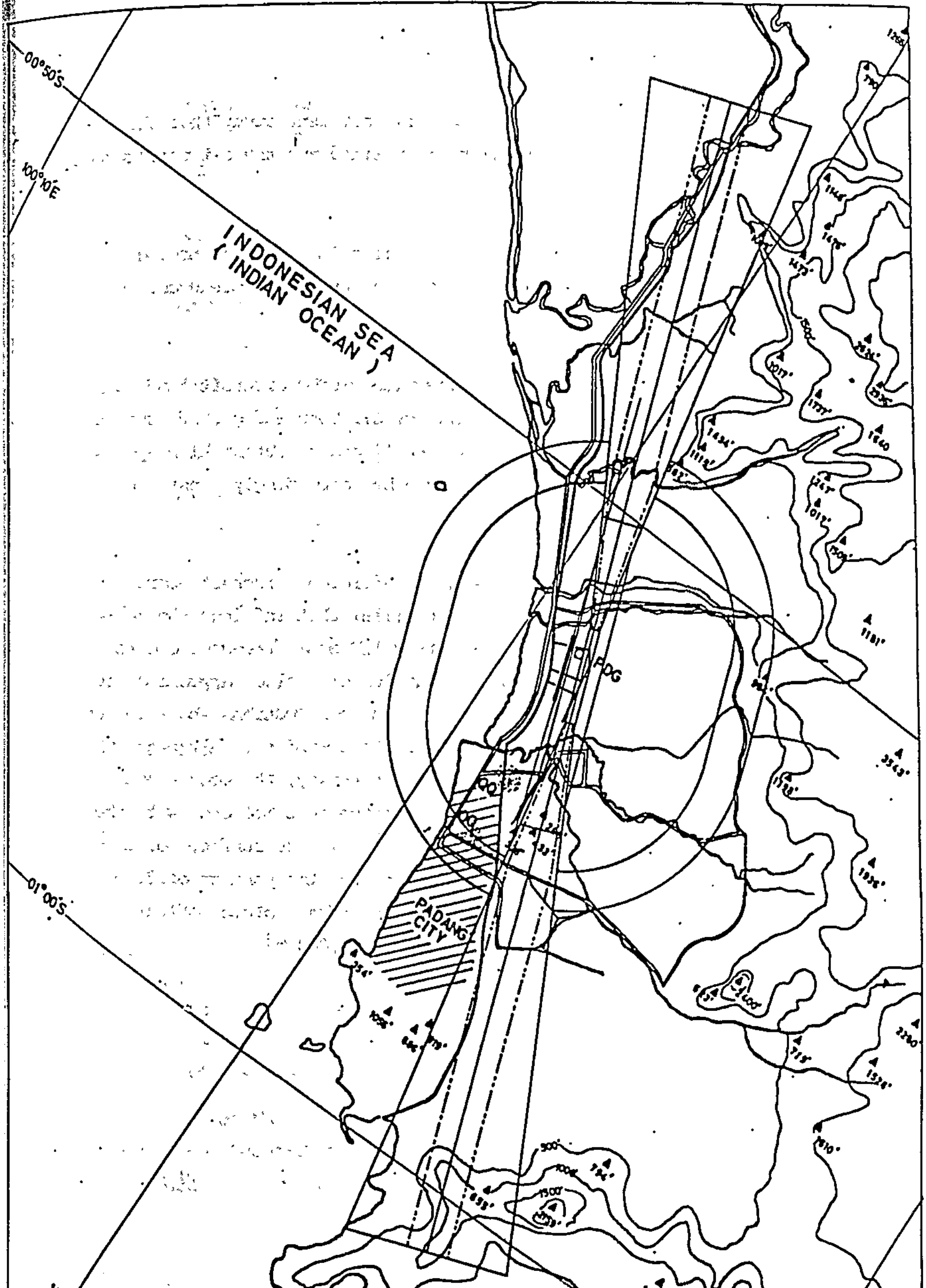


Figure 5.2.11. RUNWAY RELOCATION CASE 7 (RWY 16/34)

5.2.3. Solution for the Future

It is understood from the airspace imrprovement study that the existing runway orientation should be maintained and the extension should be made to north.

In this case, it is possible to establish ILS approach procedure, consisting of intermediate, final and missed approach procedures, for runway 16.

It is also obvious that especially wide-bodied aircraft tend to be operated not manually but automatically by air-born and ground equipment so as to reduce dependability on pilot skill and to obtain high operational safety and efficiency. ILS should be, accordingly, installed on runway 16.

The other constraint to the safe and efficient aircraft operation is the obstructions (Sarit and Pangilun hills) that infringe the take-off climb surface. Since runway 16 take-off will become frequent due to ILS installation on RWY 16 and the wind condition will allow approximately 87% of RWY 16 take-off (5 kt tail wind), the obstructions shall be cut so as not to infringe the 1 : 40 take-off climb surface. Although ICAO defines a 1 : 50 surface for a main take-off runway, the most economical and practical solution will be a 1 : 40 surface in compliance with the JCAB and FAA standards both of which define a 1 : 40 surface for take-off climb surface. For this implementation, the top portion of 37 m in height (up to 95 m MSL) must be removed. The total volume of this excavation is estimated to be approximately 170,000 m^3.

5.3. Evaluation of the Existing Facilities

5.3.1. Runway

The existing runway oriented 16 - 34 is 1850 m in length and 45 m in width with pavement strength of LCN 60. It has almost 99 percent wind coverage for cross-wind not exceeding 13 Knot as shown in Figure 5.3.1.

The 1850 m runway length is not quite sufficent for full load take-off of DC-9 especially for RWY 16 take-off due to the hills.

When the 300 m runway extension work which is currently underway is completed, take-off weight restriction for DC-9 will be relieved from 45,360 kg to 46,000 kg.

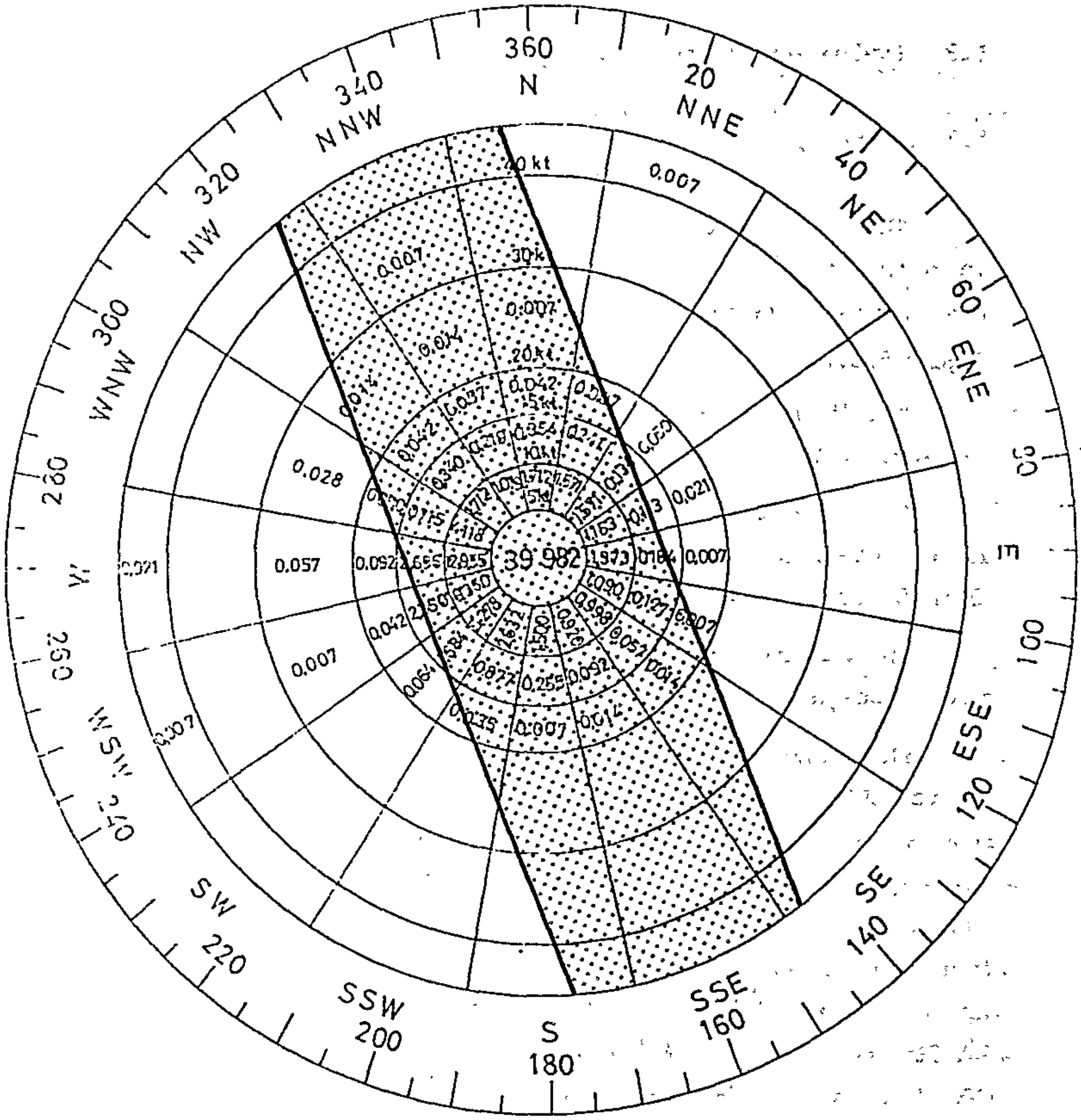
The bearing capacity of the existing runway is good for DC-9 maximum weight.

When A-300 will be introduced it is necessary to extend the runway to 2500 m to enable A-300 to land with maximum payload from Jakarta. However, A-300 can be operated at 2150 m runway by reducing the following weights from the maximum payload. (Refer to Appendix 5.3.1)

	Take-off (Slats 16°, Flaps 8°)	Landing (wet) (Slats 16°, Flaps 15°)
RWY 16	3,420 kg	10,440 kg
RWY 34	No restriction	10,440 kg

Furthermore the existing runway shall be overlayed by 10 cm as minimum to accommodate A-300. This overlay work must be executed extraordinary working hours so that the normal airport traffic is not interrupted by construction work.

As for the runway capacity, no problem is expected for years to come since forecast demands are 11 and 19,150 aircraft movements for peak hour and annual respectively in 2005.



LOCATION	:	PADANG AIRPORT
PERIOD	:	1976 – 1978 (3 YEARS)
RWY DIRECTION	:	N 160 E (16/34)
MAG. VARIATION	:	0 DEGREE
WIND COVERAGE	:	98.56 % (cross wind 13 kt)

Figure 5.3.1 WIND COVERAGE MAP

5.3.2. Taxiway

There is a 1400 m long partial parallel taxiway on west side of the existing runway with 110 m center to center (CTC) separation. Mainly because of the weak pavement strength this taxiway is not utilized at present. Besides this weak strength, the 110 m CTC separation does not meet ICAO requirements for taxiway minimum clearance for instrument runway and thus it cannot be utilized as a part of future parallel taxiway.

The present system, i.e. one stub taxiway connecting the runway and apron with the cul-de-sac at each runway end, is deemed to be sufficient as a minimum facility to handle forecast traffic in near future within a decade. However, a complete parallel taxiway system will be required after 1990 when the instrument approaches during the normal peak hour exceeds four movements.

5.3.3. Apron

The existing apron is located on west side of the existing runway with some 160 m edge to edge separation. It is connected to the runway with stub taxiway at 420 m away from the RWY 34 threshold.

The apron area of 235 m x 90 m is sufficient to accommodate 4 DC-9 class aircraft by self-maneuvering nose-out parking configuration.

When A-300 is introduced to Tabing Airport, it is necessary to adopt the 45° nose-out parking angle for A-300 so as to meet the clearance criteria between the maneuvering aircraft on the apron taxiway and parked aircraft as shown in Figure 5.3.2. By applying this method, the existing apron is considered to be capable to afford the required number of aircraft stands upto 1987. The extention of existing apron will be required to meet the traffic demands beyond 1987. The apron pavement strength is discussed under the succeeding section 5.3.4.

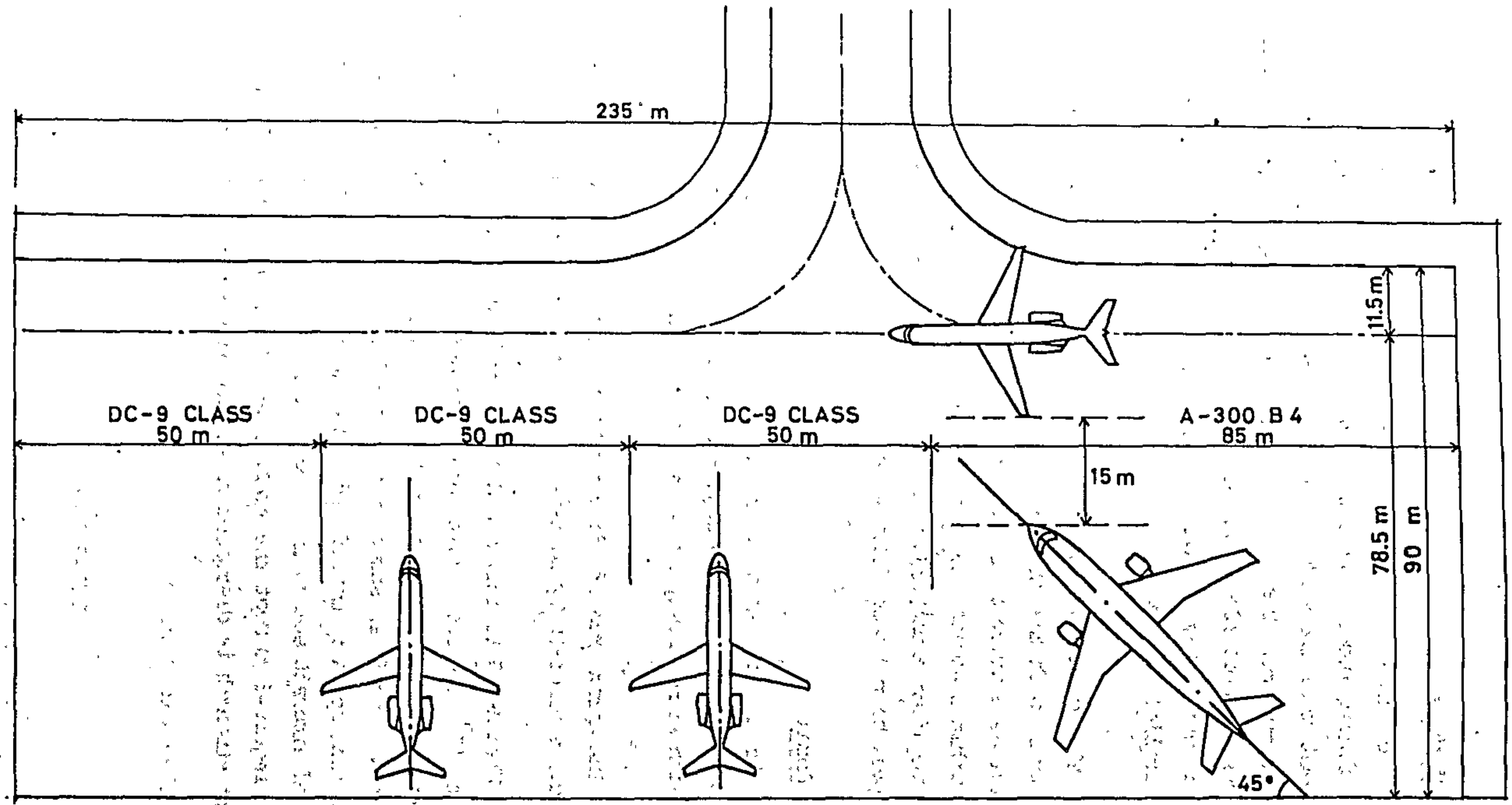


Figure 5.3.2 APRON PARKING CONFIGURATION UP TO 1987

5.3.4 Pavements

This section evaluates the existing pavement whether to be able to accommodate A-300B4 which is said to be introduced to Tabing Airport in 1983.

1) Characteristics of the Existing Pavement.

Characteristics of the existing runway pavement is summarized as follows:

Type of Pavement: Rigid Pavement

Strength of Pavement: LCN60 (Design Aircraft: DC-9)

Compressive Strength of Cement concrete: 350 kg/cm^2 flexural Strength is assumed to be 50 kg/cm^2

Subgrade Bearing Strength:
CBR: 7% or K75=2.2 kg/cm^3

2) Existing Pavement Structure

The existing runway pavement structure is as shown in Figure 5.3.3.

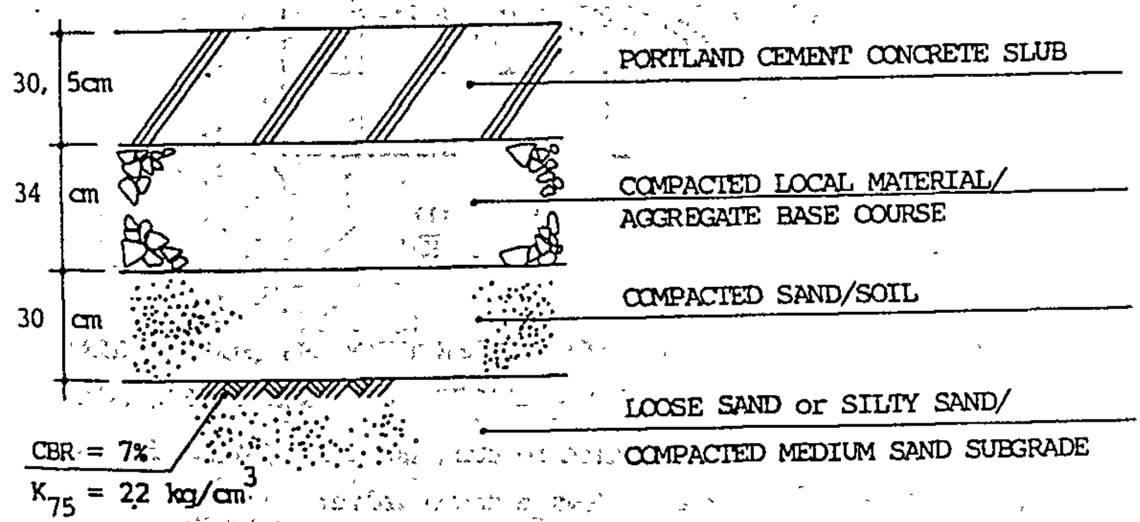


Figure 5.3.3. EXISTING RUNWAY PAVEMENT STRUCTURE

3) Modulus of Subgrade Reaction for the existing Base Course.

Due to a lack of data availability, modulus of subgrade reaction on the base course may be estimated from Figure 5.3.4. based on the actual value on the subgrade. Assuming that the total thickness 64 cm of subbase and base course are equivalent to about 55 cm graded gravel sand layer, the modulus of subgrade reaction K_{75} is estimated as 6 kg/cm^3.

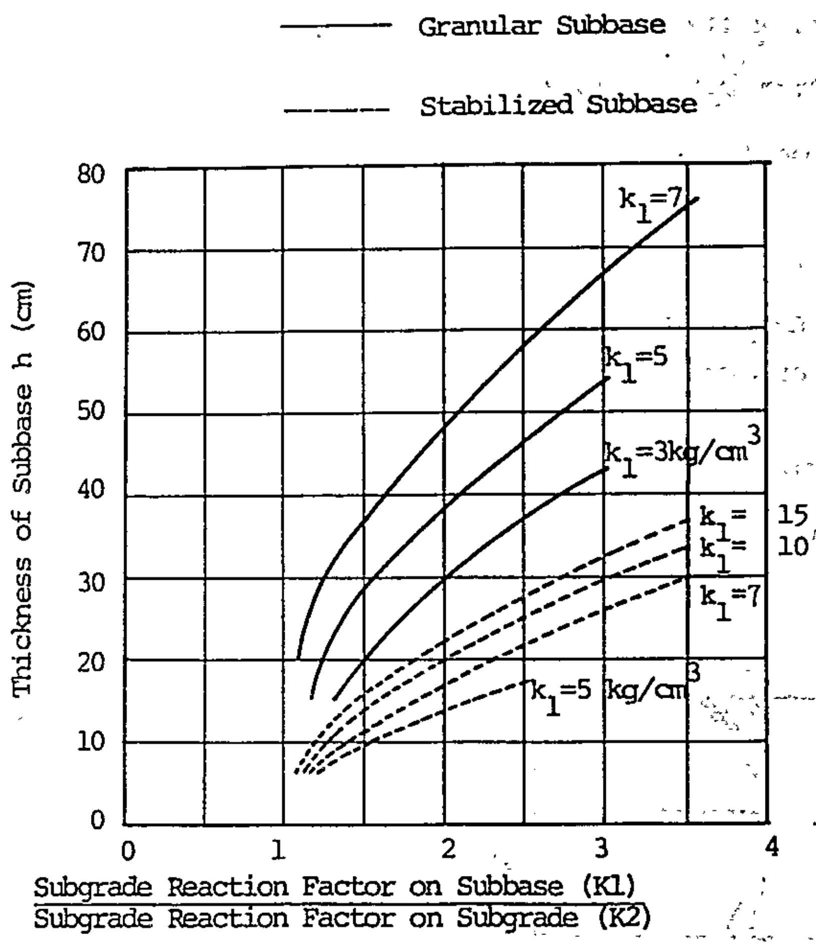


Figure 5.3.4 DESIGN CURVE FOR SUBBASE THICKNESS (SOURCE: AIRPORT CONCRETE PAVEMENT STRUCTURAL DESIGN MANUAL, JCAB)

The value of 6 kg/cm^3 can also be confirmed from Figure 5.3.5, which indicates 6.5 kg/cm^3 for the following known value:

- allowable working stress = 25 kg/cm^2 (50 kg/cm^2/2.0 (safety factor))
- LCN 60
- slab thickness = 30.5 cm

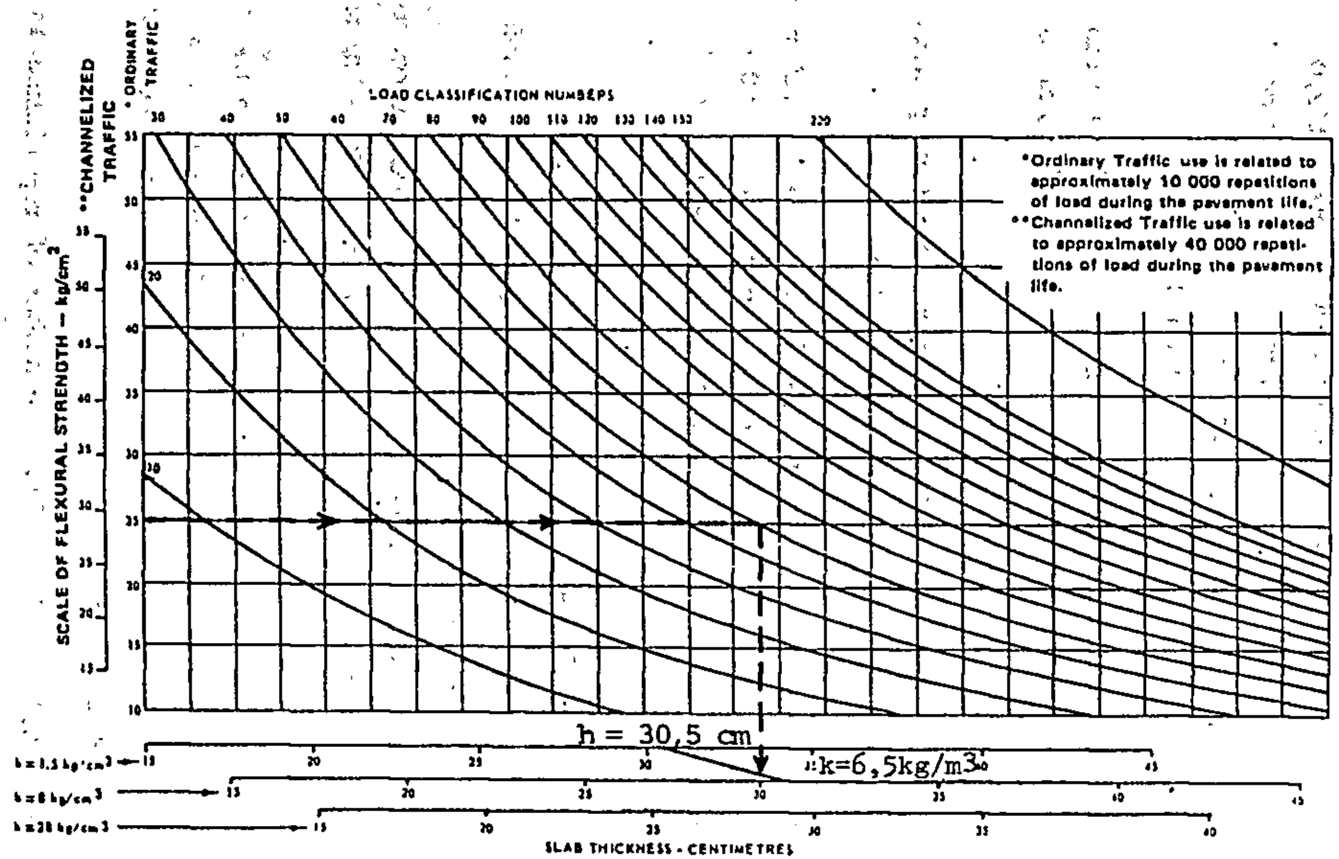


Figure 5.3.5.DESIGN CHART FOR FULLY DOWELLED RIGID PAVEMENTS

(SOURCE : ICAO AERODROME DESIGN MANUAL PART 3)

4) Evaluation of the Existing Pavement

i) Evaluation of LCN method

The characteristics of A-300-B4 are as follows :

Max. Take-off Weight for PDG-JKT route : 142,000 kg
Load distributed on nose wheels in percentage: 9%
Max. Total main gear load :
142,000 x (1-0.09) = 129,220 kg.

The radius of relative stiffness "l" of the slab is calculated as 110 cm for K_{75} value of 6 kg/cm^3 and the slab thickness of 30.5 cm.

The LCN value of A-300-B4 of the existing pavement is estimated as 82 from Figure 5.3.6.

In this case, the aircraft LCN 82 lies between 1.25 times and 1.5 times the Pavement of 60. Therefore, A-300-B4 movements up to 300 is judged to be permitted according to United Kingdom Method.

ii) Evaluation by PCA method.

Pavement evaluation method developed by PCA (Portland Cement Association, is based on the fatigue concept.

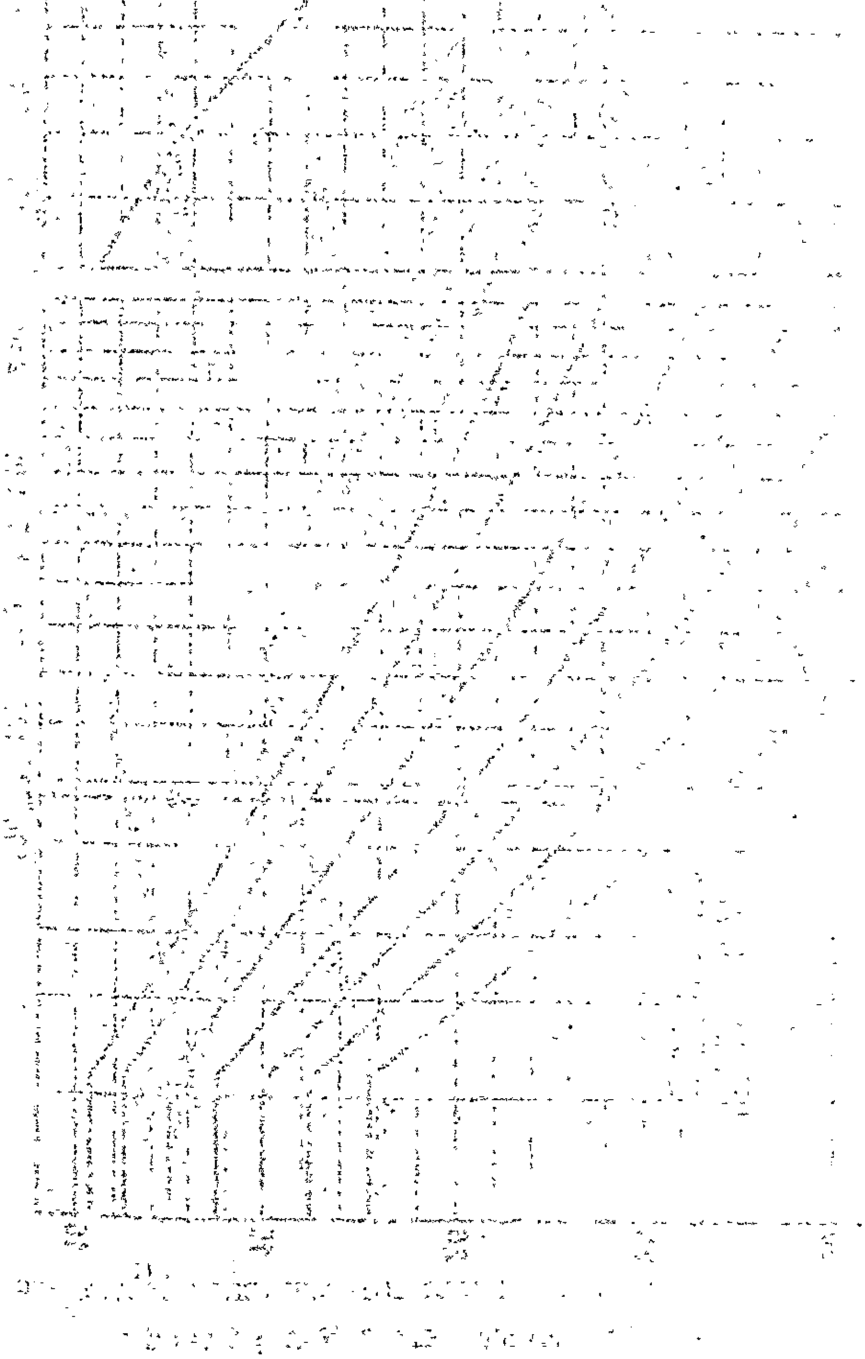
The actual working stress on the existing cement concrete slab created by A-300-B4 is estimated to be 37.5 kg/cm^2 from Figure. 5.3.7.

The stress ratio (ratio of the working stress to the flexural strength) is calculated to be 0.75 by dividing 37.5 kg/cm^2 by the flexural strength of the existing cement concrete slab of 50 kg/cm^2.

From Table 5.3.1. , allowable number of repetitions by A-300-B4 is estimated to be up to about 500.

iii) Conclusion

Based on the above evaluations, the existing pavement designed for DC-9 is judged to be able to accommodate only 300 to 500 movements of A-300-B4. Therefore, the pavement should be overlayed for the scheduled operations of A-300-B4.



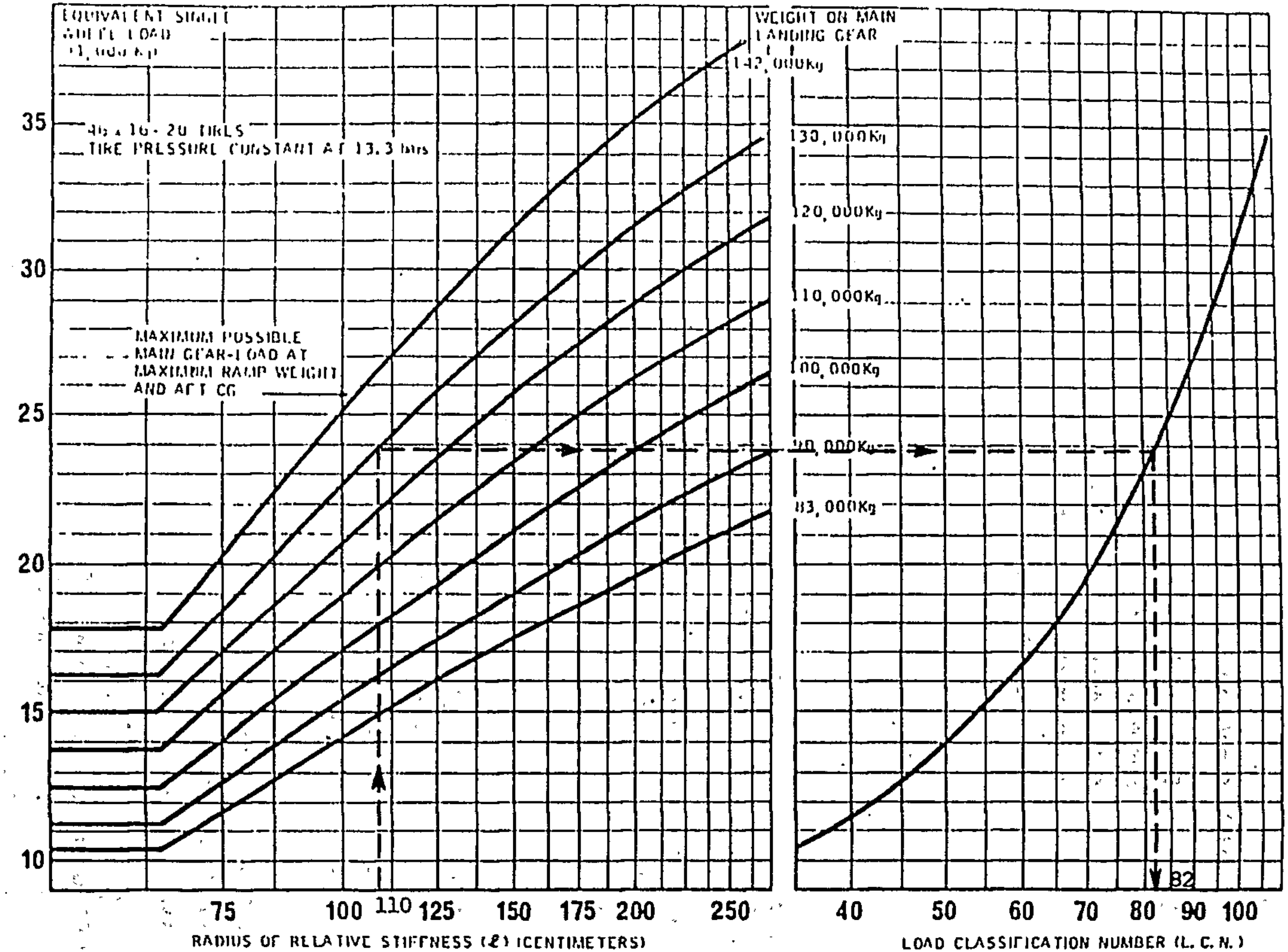


Figure 5.3.6. LCN CONVERSION FOR RIGID PAVEMENTS
(SOURCE : A-300B AIRPLANE CHARACTERISTICS)

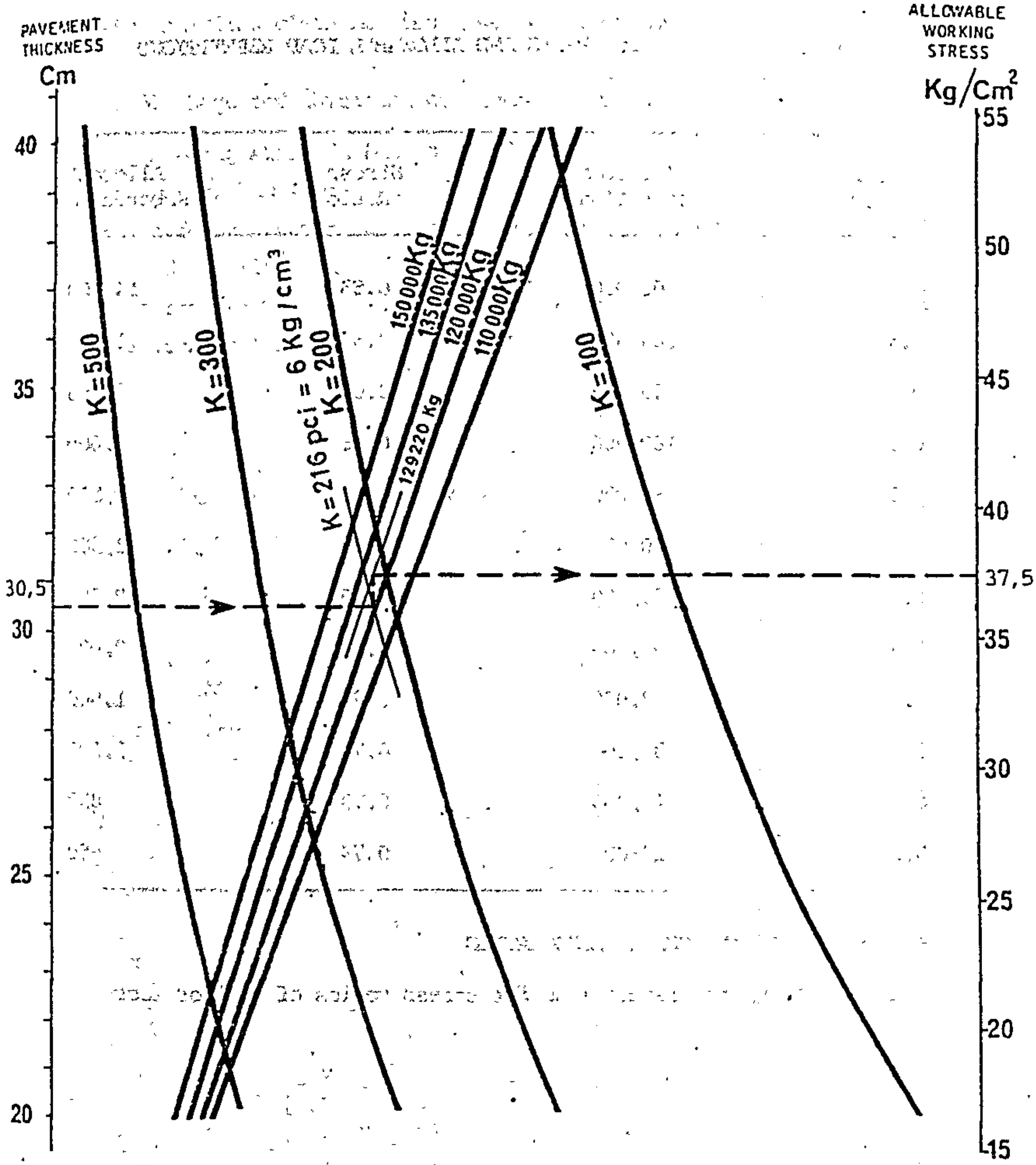


Figure 5.3.7. RIGID PAVEMENT DESIGN CHART BY PCA
(SOURCE : A-300B AIRPLANE CHARACTERISTIC)

Table 5.3.1. STRESS RATIO AND ALLOWABLE LOAD REPETITIONS

Stress Ratio	Allowable Repetitions	Stress Ratio	Allowable Repetitions
0.51	400,000	0.63	14,000
0.52	300,000	0.64	11,000
0.53	240,000	0.65	8,000
0.54	180,000	0.66	6,000
0.55	130,000	0.67	4,500
0.56	100,000	0.68	3,500
0.57	75,000	0.69	2,500
0.58	57,000	0.70	2,000
0.59	42,000	0.71	1,500
0.60	32,000	0.72	1,100
0.61	24,000	0.73	850
0.62	18,000	0.74	650

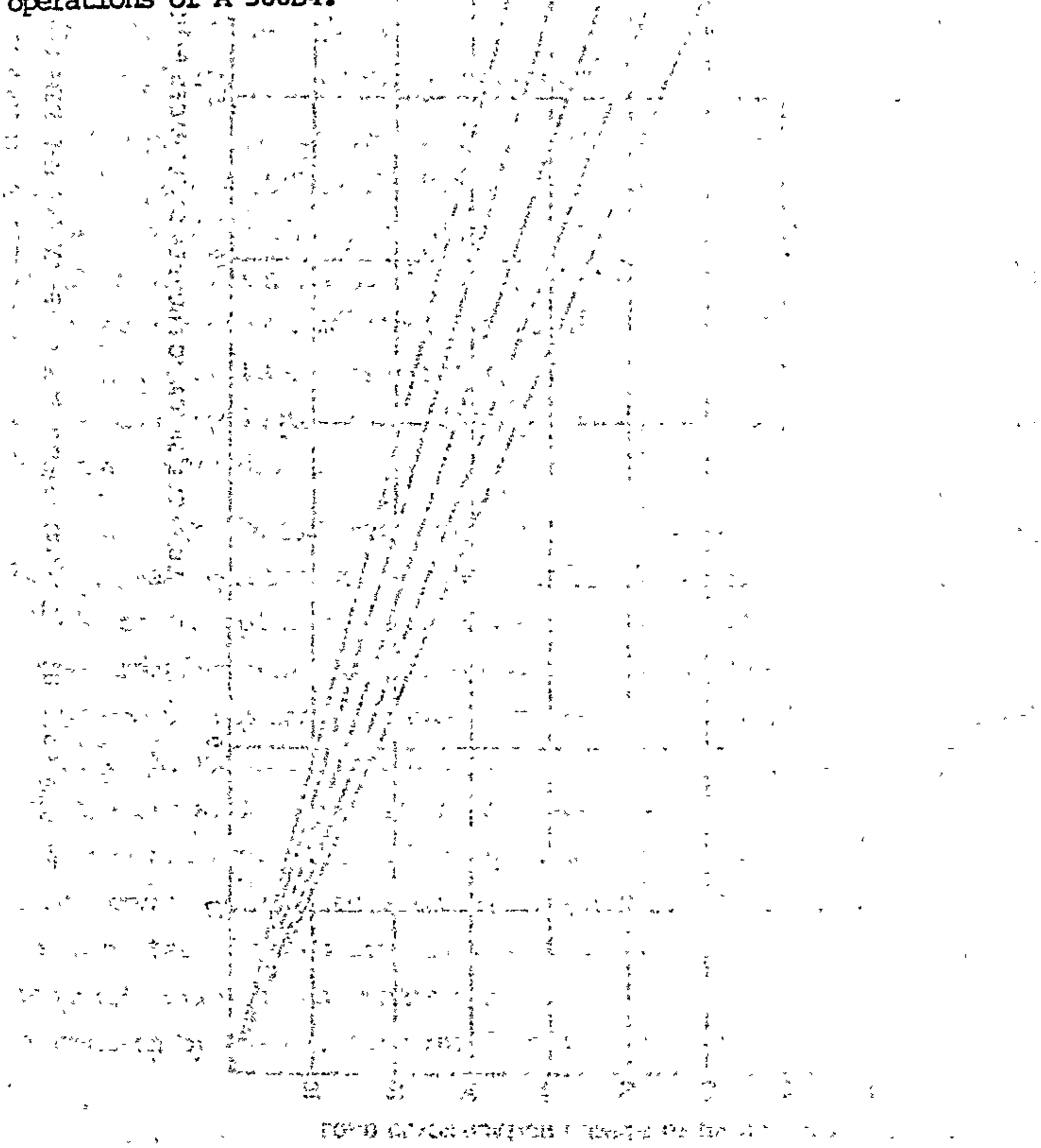
SOURCE : PORTLAND CEMENT ASSOCIATION

Note : Unlimited repetitions for stress ratios of 0.50 or less

However, since the evaluations are based on the assumed strengths of the existing slab, subgrade, etc. it should rest with DGAC to make the final judgement which should be based on the actual investigation and tests including plate bearing tests, extractions of cores, etc.

5) Required Thickness of Pavement Overlay.

Assuming Aircraft LCN to be 82 and Pavement LCN to be 60, overlay thickness of 7cm is obtained from Figure 5.3.8. Therefore, it is recommended to overlay at least 10cm, which may be the minimum thickness to avoid a reflection crack due to joints, on the existing runway, connecting taxiway and parking position in order to permit the scheduled operations of A-300B4.



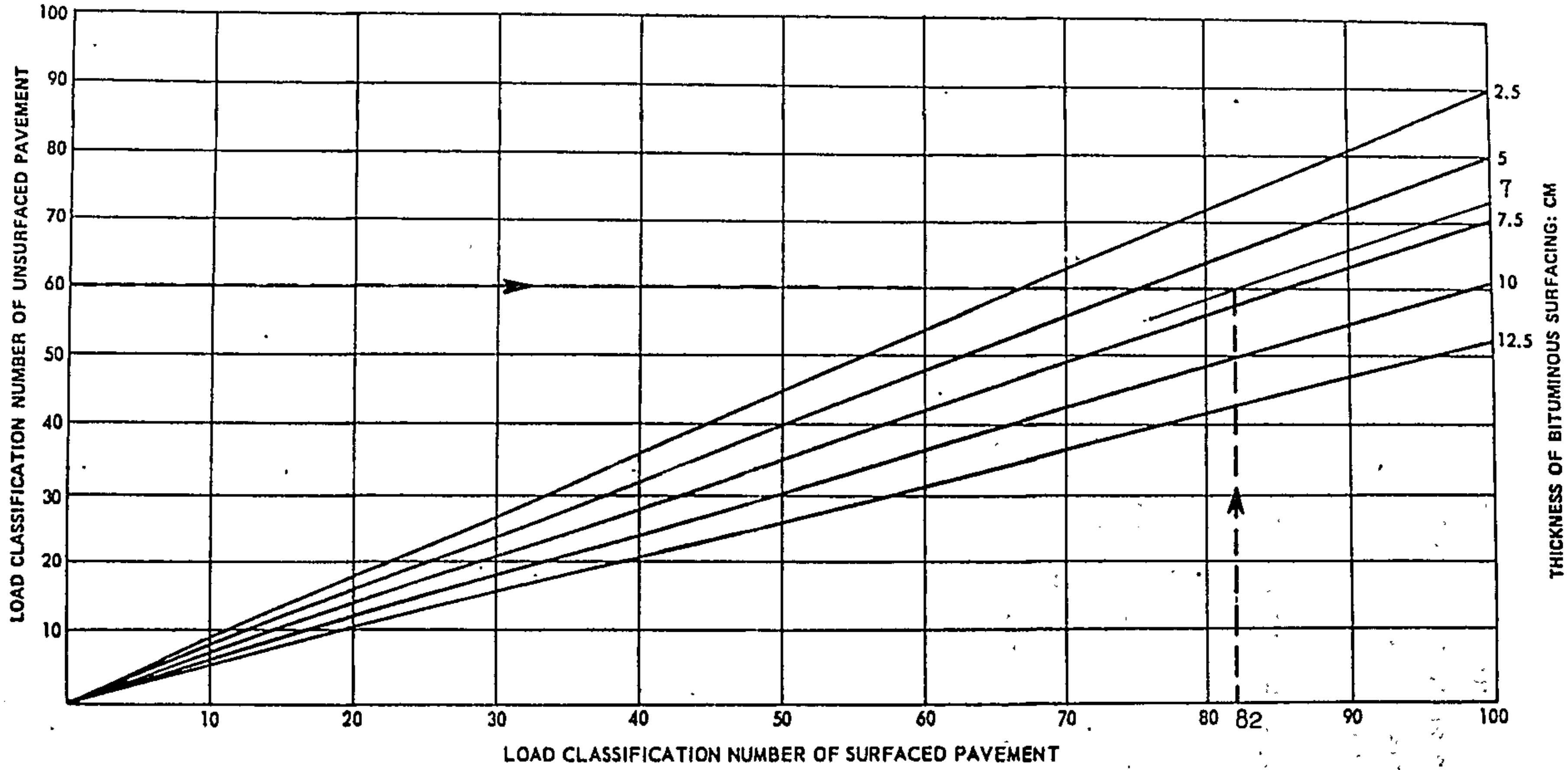


Figure 5.3.8. DESIGN CHART FOR OVERLAY ON THE RIGID PAVEMENTS
(SOURCE : ICAO AERODROME DESIGN MANUAL PART 3)

5.3.5. Passenger Terminal Building

1) General

The existing terminal building is not considered to be suitable for expanding to the future demands, judging from the system, the fuction, and the space of the existing facility as compared to the future requirements. Therefore, a new terminal building together with other terminal facilities will be planned to cope with the medium and long range requirements, while a minimum renovation will be made on the existing terminal building to meet present and short term requirements such as introduction of A-300. The existing terminal can thus be utilized until completion of a new terminal complex.

The peak hour passenger as of 1981 is estimated to be about 300 total, or about 160 in the heavier direction based on the current time table. Based on this peak hour traffic, the unit space of the existing building is estimated as $5m^2$ per peak hour passenger which is judged as an overcrowded condition. It is also confirmed from the actual operation that the existing facilities have already reached their capacities and the public hall is especially overcrowded with passengers and their friends.

Although the present high peak hour concentration at Tabing Airport (6peak hour movements; one third of 18 daily aircraft movements) should be reduced as much as possible, an expansion together with internal modifications for the present needs are judged necessary. Therefore an expansion of about at least $360m^2$ is planned taking into account the internal renovations necessary for introduction of A-300, the traffic anticipated in around 1987, and the intervals of the existing pillars. Although this expansion will not offer a comfortable service level, the existing building can continue to operate for a number of years from now, as this will be required until a new terminal building can become operational. A schematic concept for the renovation of the existing building is shown in Figure 5.3.10.

2) Public Hall

The existing public hall of about 375 m^2 is too small to accommodate the current traffic demand and is to be expanded to at least 650m^2 as calculated as follows.

$$A = \frac{a.b.P \ (1 + g)}{60 \text{ min.}}$$

Where
- A : Public hall (m^2)
- a : space required for 1 persons (m^2)
  1 m^2 for normal season
  0.75 m^2 for special season
- b : Staying time, 30 min.
- P : Peak hour passengers
- g : Friends / Passengers,
  2 for normal season
  4 for special season

$$A = \frac{1 \text{ or } 0.75 \times 30 \times 375 \ (1\text{–}2 \text{ or } 4)}{60} = 562 \text{ or } 704 \ \overline{AV} = 650 \ m^2$$

3) Domestic Passenger Portion

Departure lounge, baggage claim area with baggage break-down area and ticket counter with baggage make-up are to be expanded and improved to accommodate A-300 as follows :

- Departure lounge to be expanded to about 300m^2 and to be provided with a baggage break-down area and an conveyor.
- At least one ticket counter to be added together with a provision of baggage conveyor and baggage make-up area.

4) International Passenger Portion

The both departure and arrival facilities are considered to be capable handling the anticipate passengers and baggages.

Figure 5.3.9 PASSENGERS DURING PEAK HOUR

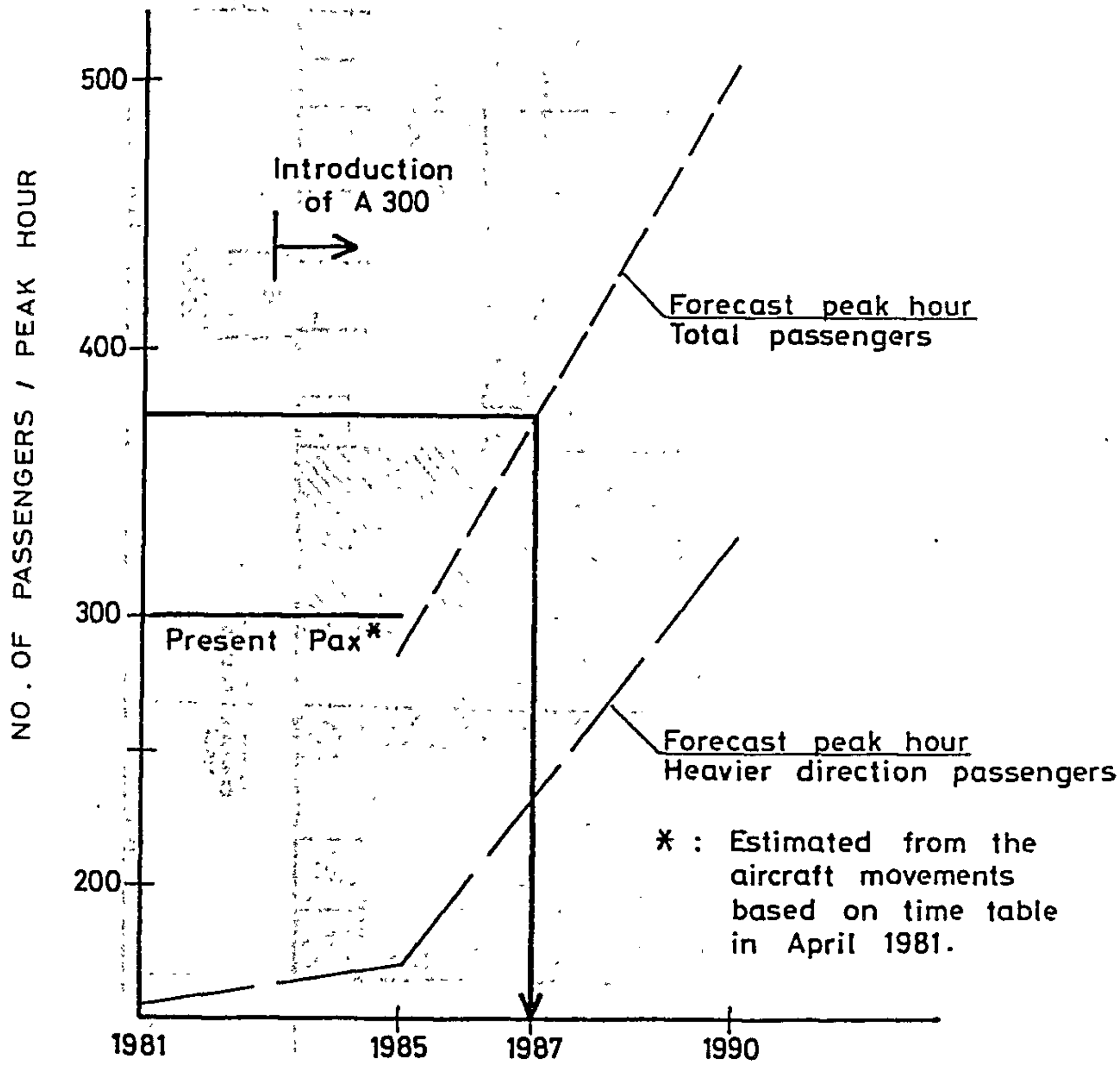
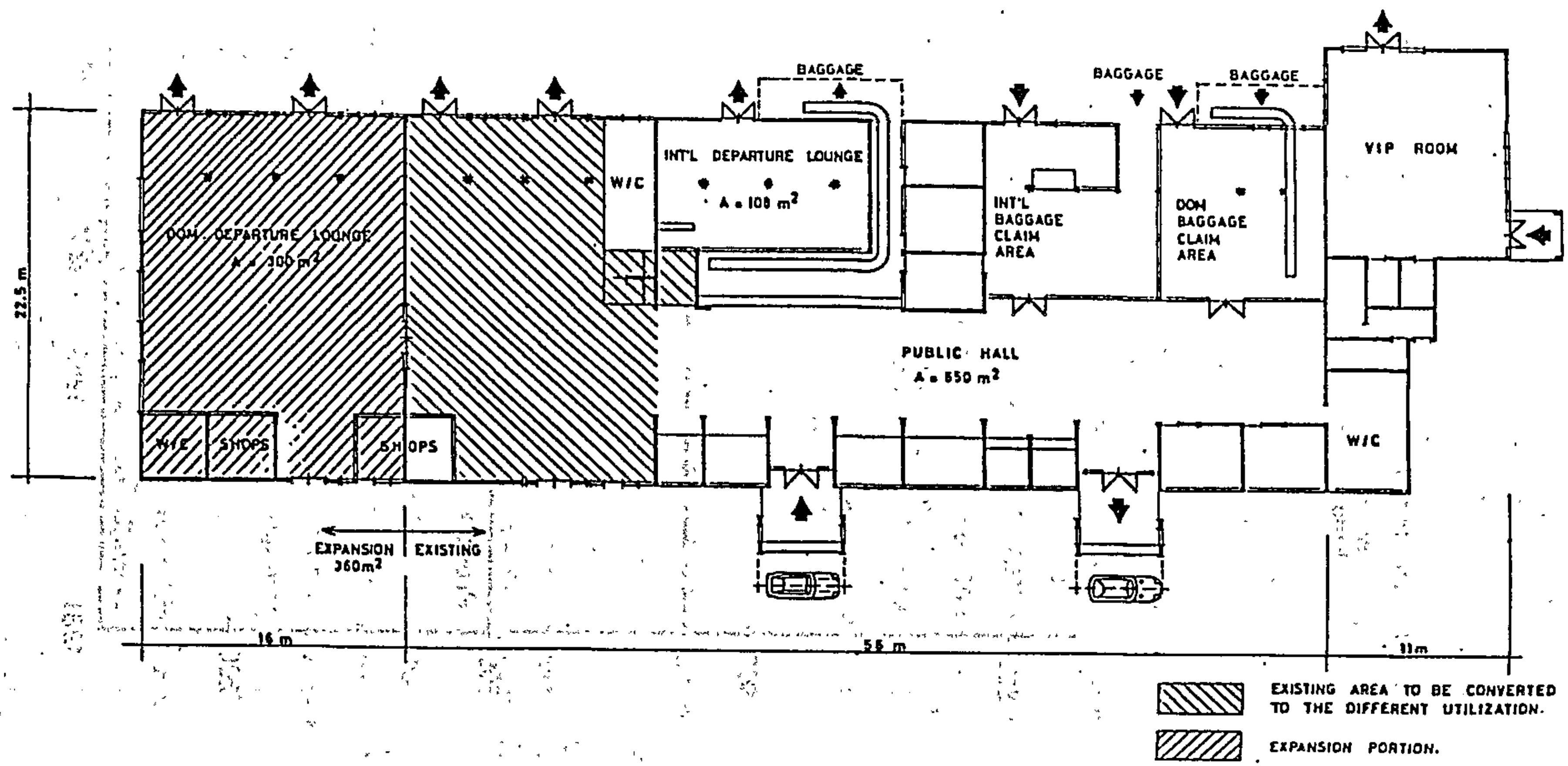


Figure 5.3.10 RENOVATION CONCEPT FOR THE EXISTING TERMINAL BUILDING
(FOR THE SHORT RANGE USE)



5.3.6. Cargo Terminal Building

There is virtually no terminal building to be indentified as a cargo terminal. The air cargo carried by GIA is handled by the agency at small hut besides the parking lots, whereas that of Merpati and Mandala is handled at their checking counter within the passenger terminal building.

As the air cargo volume increases in coming years it will be necessary to build a terminal destined for handling air cargo only at the boundary of air side and land side.

5.3.7. Air Navigation Systems

The existing air navigation systems currently operated at Tabing airport are summarized in Table 5.3.10 and the major evaluation is made hereinunder.

1) Navigational Aids

After VOR/DME was installed within the airport confine, the NDB and Locator located at west side of Pangilun hill are not used so frequent because these HF navaids are not so reliable due to interferances by thunderbolt. The VOR/DME is a reliable navaid at Tabing, however, the operational service is limited especially at easterly area due to the high mountainous terrain.

New ILS installation will allow a lower setting of operational minimum and contribute to a safe operation in the mountainous terrain.

2) ATC and Telecommunications

The only one A/G VHF radio is used for aeronautical mobile services together with the one-position control console. These facilities are considered to be sufficient for the current aircraft movement. When aircraft movement would once exceed the capability of one air traffic controller, up-grading of control capacity will require complete replacement of these facilities.

3) Visual Aids

The existing aeronautical ground lights are considered to be sufficient at this moment in connection with the VOR/DME circling procedure which is mostly used under instrument meteorological conditions.

4) Meteorological System

There is no automatic weather data collecting equipment nor runway visual range/ceiling height measuring equipment, thus the observation relies on the skilled staff. When category I operation would commence by an introduction of ILS and approach lighting system, meteorological services will require full introduction of new meteorological equipment.

Table 5.3.10. OUTLINE OF THE EXISTING AIR NAVIGATION SYSTEMS

Equipment	Outline	Year Installed
NAVAIDS		
NDB	"OQ" 295 KHZ	1971
Locator	"QQ" 325 KHZ	1972
VOR/DME	Doppler 116.4 MHZ (VOR) 1198 MHZ, 1135 MHZ (DME)	1976
ATC/COM		
ATC console	1 position	
VHF A/G	1 channel	1973
AFS (Teletype)	HF, RTT, Medang	1972
AFS (Telephony)	HF, RTF, Medang, Palembang	1972
AFS (Telephony)	HF, RTF, Siberut	1978
M.T. Recorder	ATC Recording	
VISUAL AIDS (LIGHTING)		
Aerodrome Beacon	On tower top	1976
RWY Light	Elevated type	1976
RWY THR Light	Elevated type	1976
TWR Light	Elevated type	1976
VASIS	16/34 VASIS Angle	1979
Approach Light	RWY 34, SALS (420m)	1976
Apron Flood Light		1978
REIL	RWY 16 End	1979
Others	Air traffic light gun, Landing Tee,	1976 1978
METEOROLOGICAL EQPT		
None	Mannual observation No RVR/Ceiling height Observation Equipment	-

BUILDINGS			
Operation Building	ATC/Administration	$600m^2$	1971
Power house (Lighting)	CCR	$400m^2$	1975
Power house	3 Separated Bldg.		
	Total	$150m^2$	1970 – 73
Tx Station	HF – Tx	$108m^2$	1970
Control Tower	15m high		
	(Floor Level)	$25m^2$	

5.4. Study on Redevelopment Concepts

5.4.1. Requirements

In order to solve the current problems and to cope with future traffic demand, various improvements will be required for Tabing Airport. The major requirements revealed by the previous studies on the airspace and airport facilities may be summarized as follows:

i) The runway needs to be extended to north to become 2,500 M in total length and to be strengthened to accommodate forecast aircraft.

ii) Parallel taxiway to be provided for the 1st phase development.

iii) Apron needs to be expanded and strengthened.

iv) The passenger terminal building including parking lot needs to be expanded.

v) Cargo building be constructed.

vi) ILS be installed for the RWY 16.

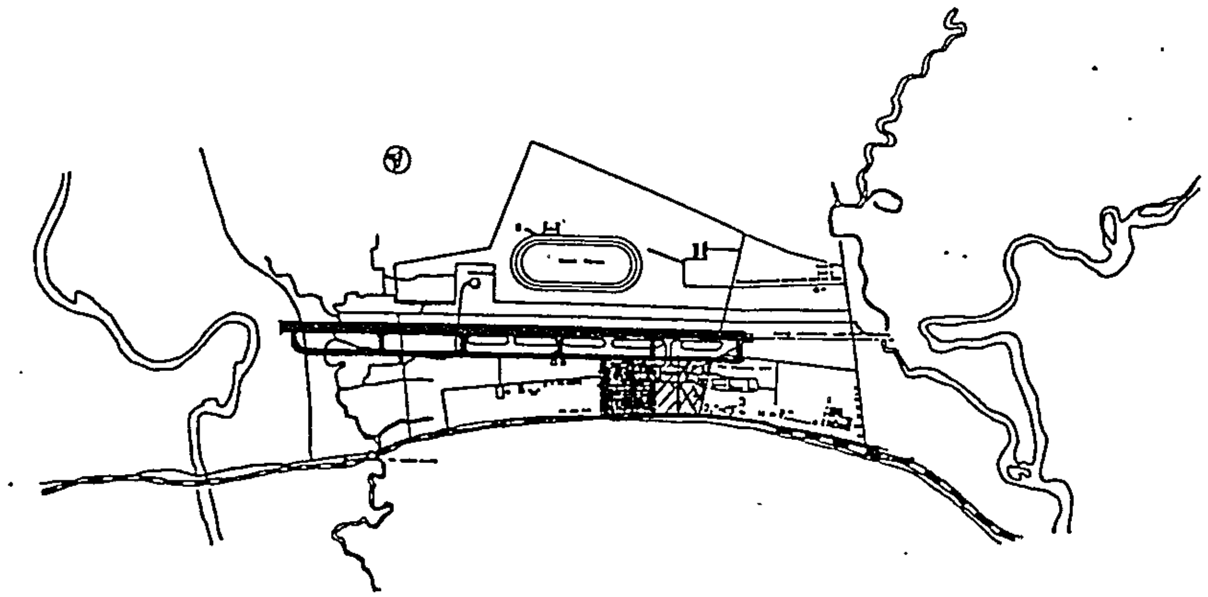
5.4.2. Basic alternative schemes

There may be various alternative schemes to fulfil the above mentioned requirements. However, as it is clear in airspace study, the prevailing terrain surrounding the airport as well as the man-made features in the airport vicinity restricts alteration of the runway orientation. Thus the probable alternative schemes are basically classified into four schemes as shown in Figure 5.4.1 which may be identified as follows:

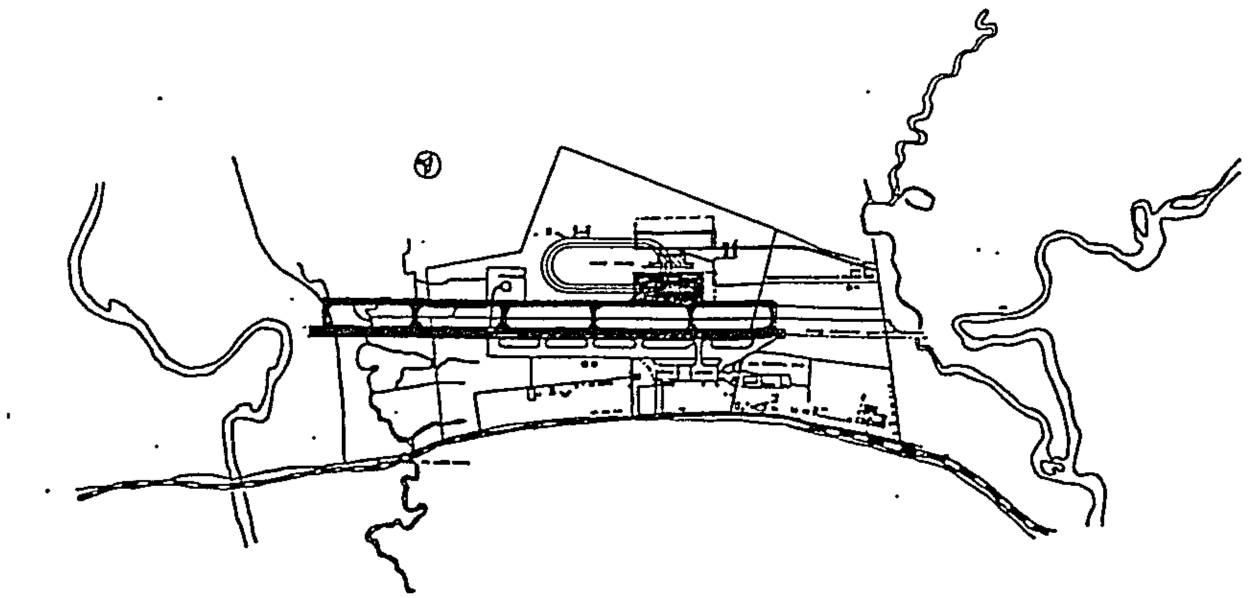
i) Scheme-1 Utilize existing runway as future runway and construct new taxiway and terminal area on west side of the runway.

ii) Scheme-2 Utilize existing runway as future runway and construct new taxiway and terminal area on east side of the runway.

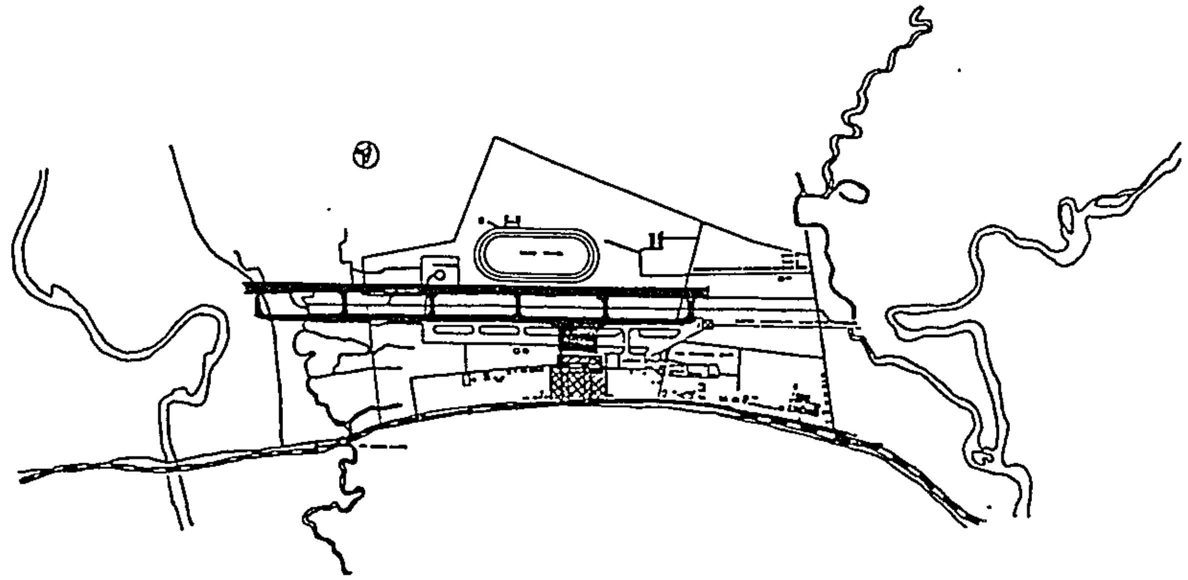
SCHEME 1



SCHEME 2



SCHEME 3



SCHEME 4

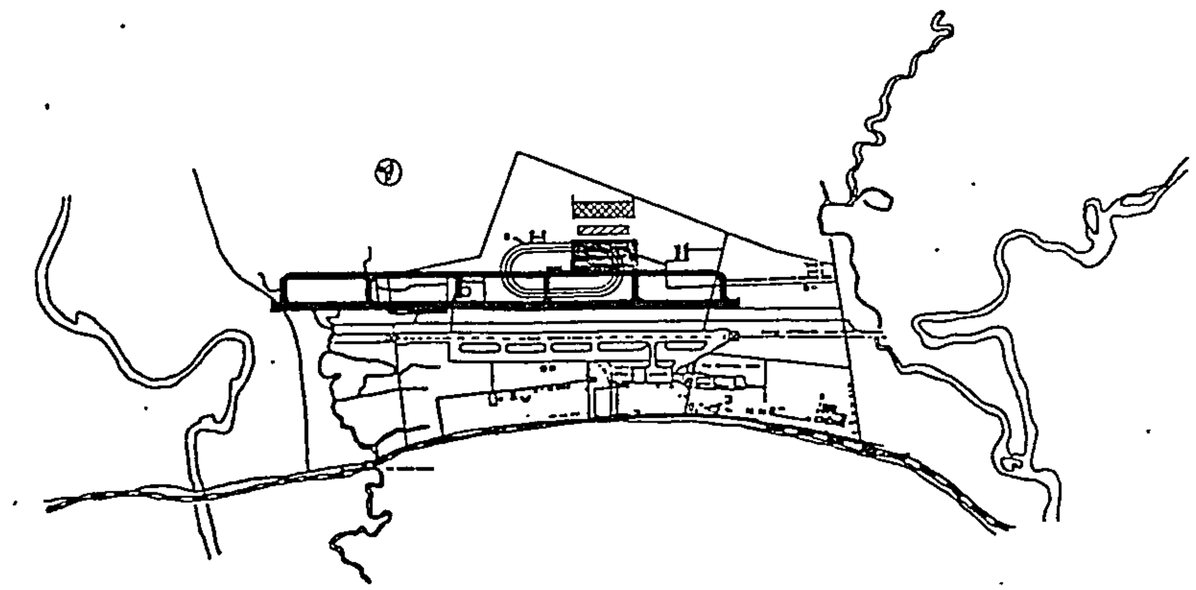
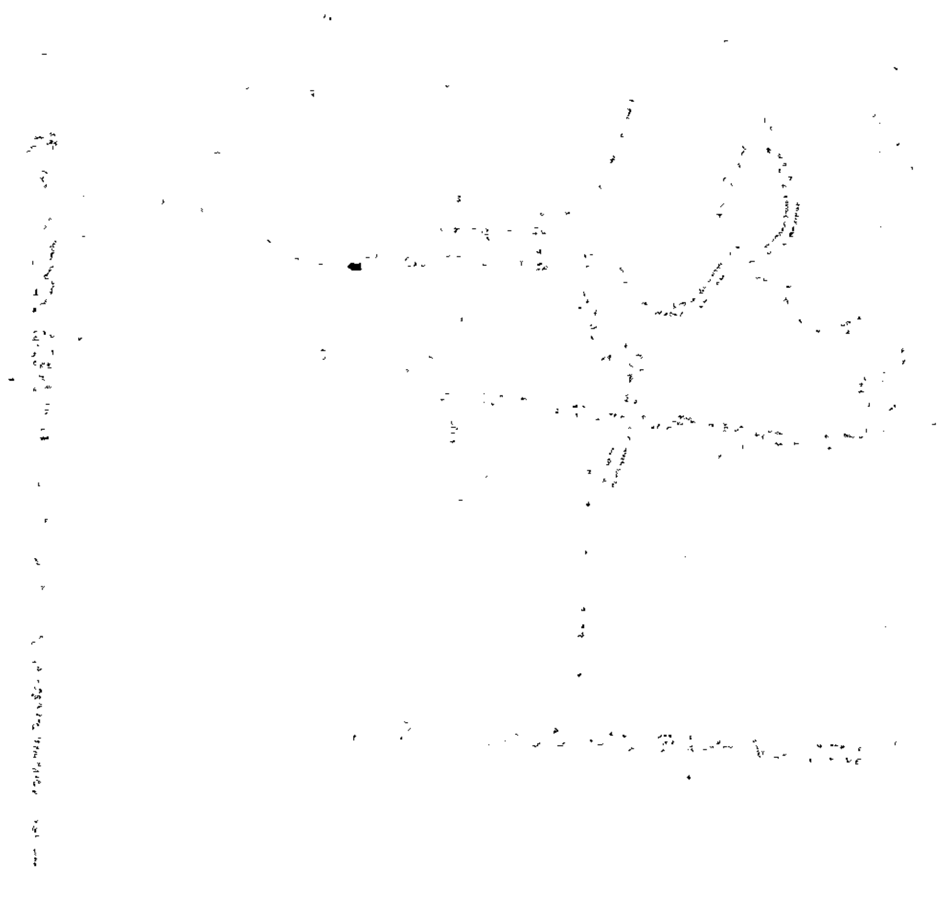


Figure 5.4.1. BASIC ALTERNATIVE SCHEME



iii) Scheme-3 Construct new runway on east side and parallel to the existing runway. Convert existing runway into new taxiway and develop terminal area on west side of the runway.

Scheme-4 Construct new runway on east side and parallel to the existing runway. Construct new taxiway and terminal area on east side of new runway.

In these four basic alternatives the Scheme-4 is abandoned for further investigation since it is considered to be almost entirely new airport development without taking advantage of utilizing the existing facilities.

The typical layout plan of each scheme are shown in Figure 5.4.2. to Figure 5.4.4.

The principle applied in developing layout schemes are summarized as follows :

i) Utilize existing facilities as much as possible and practical.

ii) Utilize the area managed by DGAC as much as possible to minimize land acquisition cost.

Among those three basic schemes, the Scheme-3 has been selected for further consideration because of the reasons as follows :

i) Scheme-3 provides the least interruption to the aircraft traffic during the construction as compared with the other schemes.

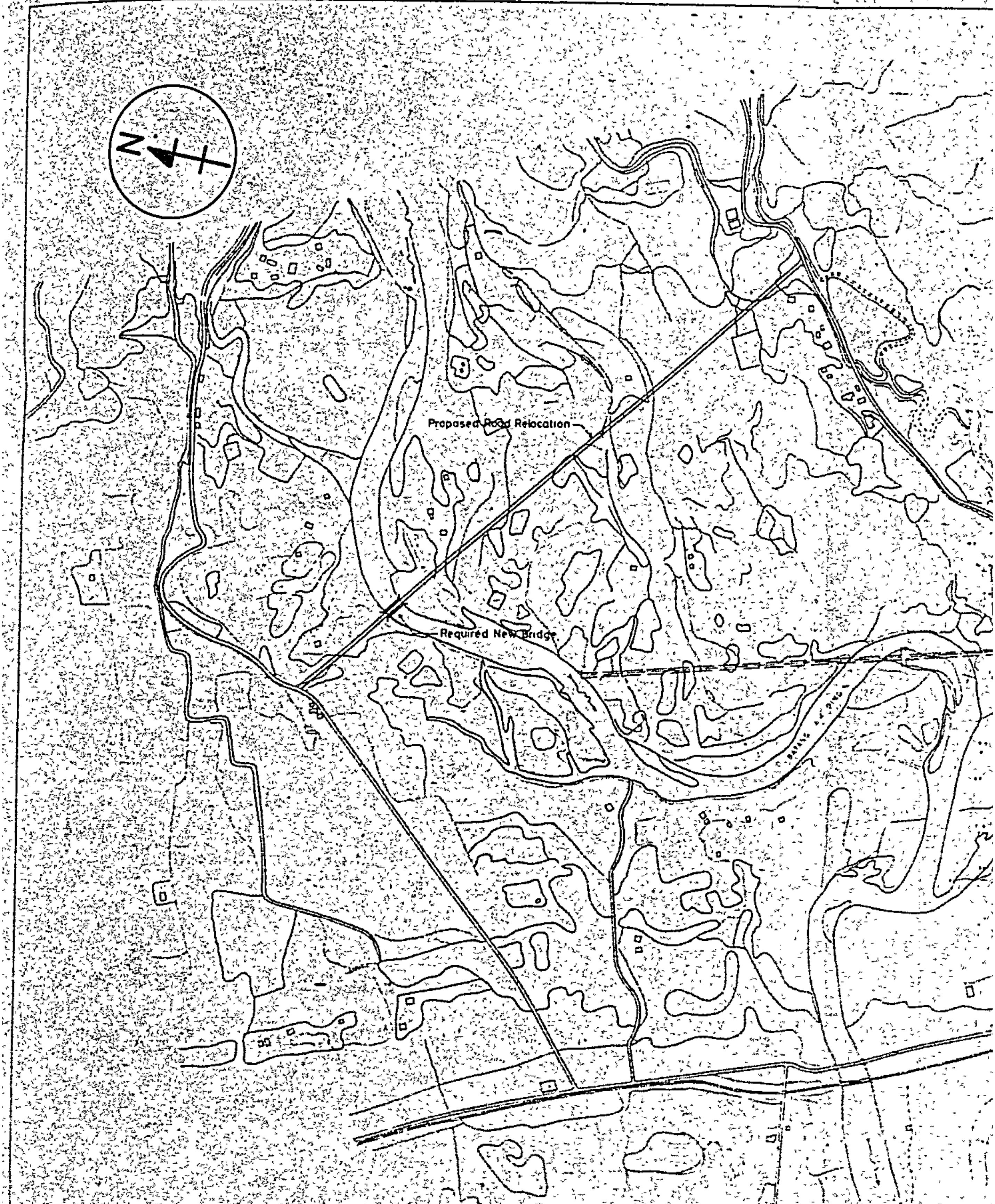
ii) By adopting Scheme-3, an ample space can be provided for the new terminal development on west side which will be capable of coping with unexpected demand change.

iii) Because of the closeness of RWY 16's threshold to River Air Dingin, only 150 m long runway safety area an be provided for Scheme-1 and -2. Although this 150 m long runway safety area is within the ICAO requirement which states that such area should be extended to a distance of between 90 m and 300 m beyond the end of the runway, it is obvious that Scheme-3 is in better position in this regard as seen in Figure 5.4.4.

iv) Scheme-1 affords very limited area for terminal development.

v) Scheme-2 requires almost all facilities to be developed on the east side of the runway and results in abandonning usable existing facilites such as apron.

vi) By shifting runway location to east and thus becoming relatively remote from the residential zone along the highway, the Scheme-3 minimize the aircraft noise impact on the existing residential zone than Scheme-1 and -2.


N
Proposed Road Relocation
Required New Bridge

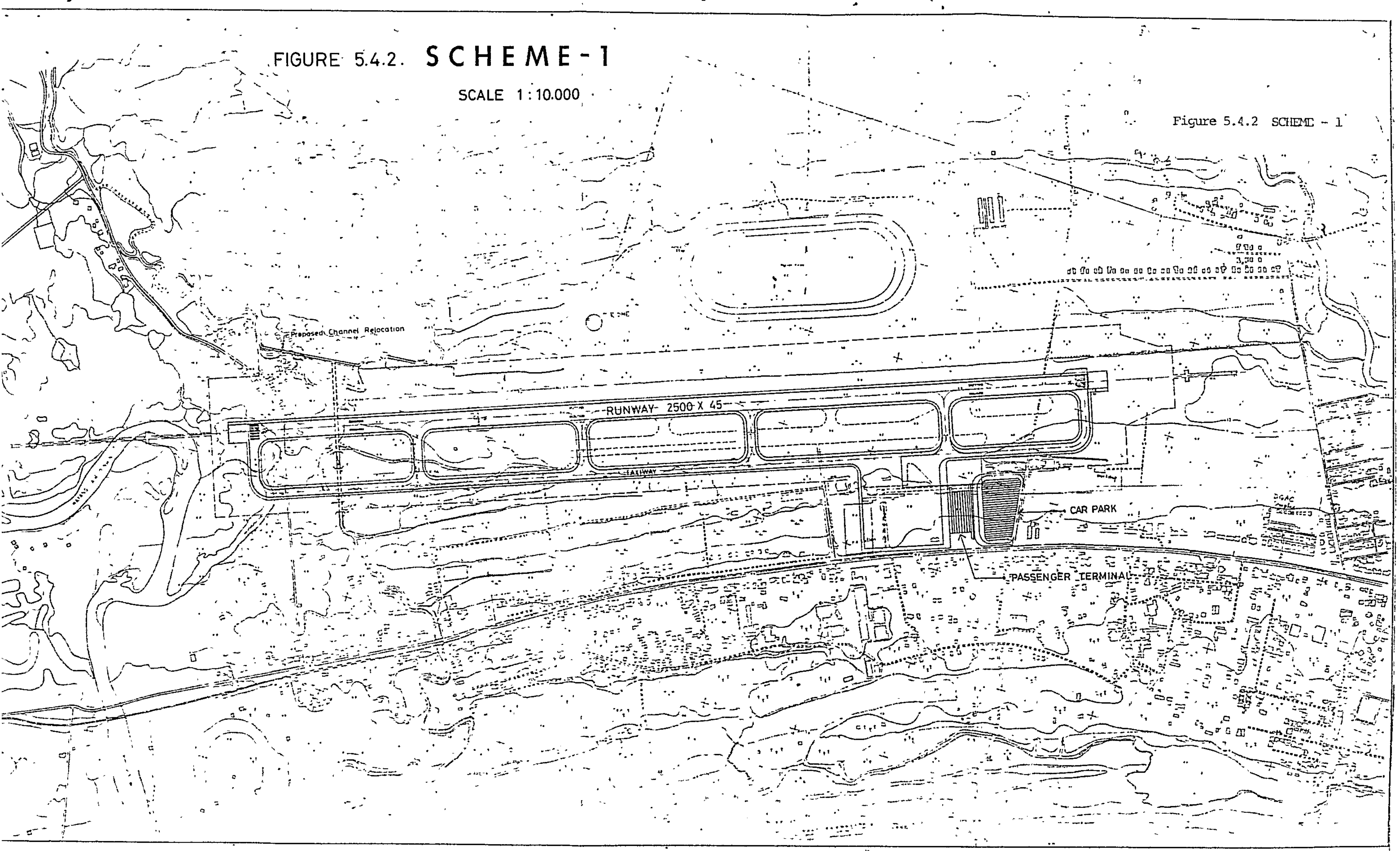


FIGURE 5.4.2. SCHEME-1
SCALE 1:10.000
Figure 5.4.2 SCHEME - 1
Proposed Channel Relocation
RUNWAY 2500 X 45
TAXIWAY
CAR PARK
PASSENGER TERMINAL

FIGURE 5.4.3. SCHEME-2

SCALE 1:10,000

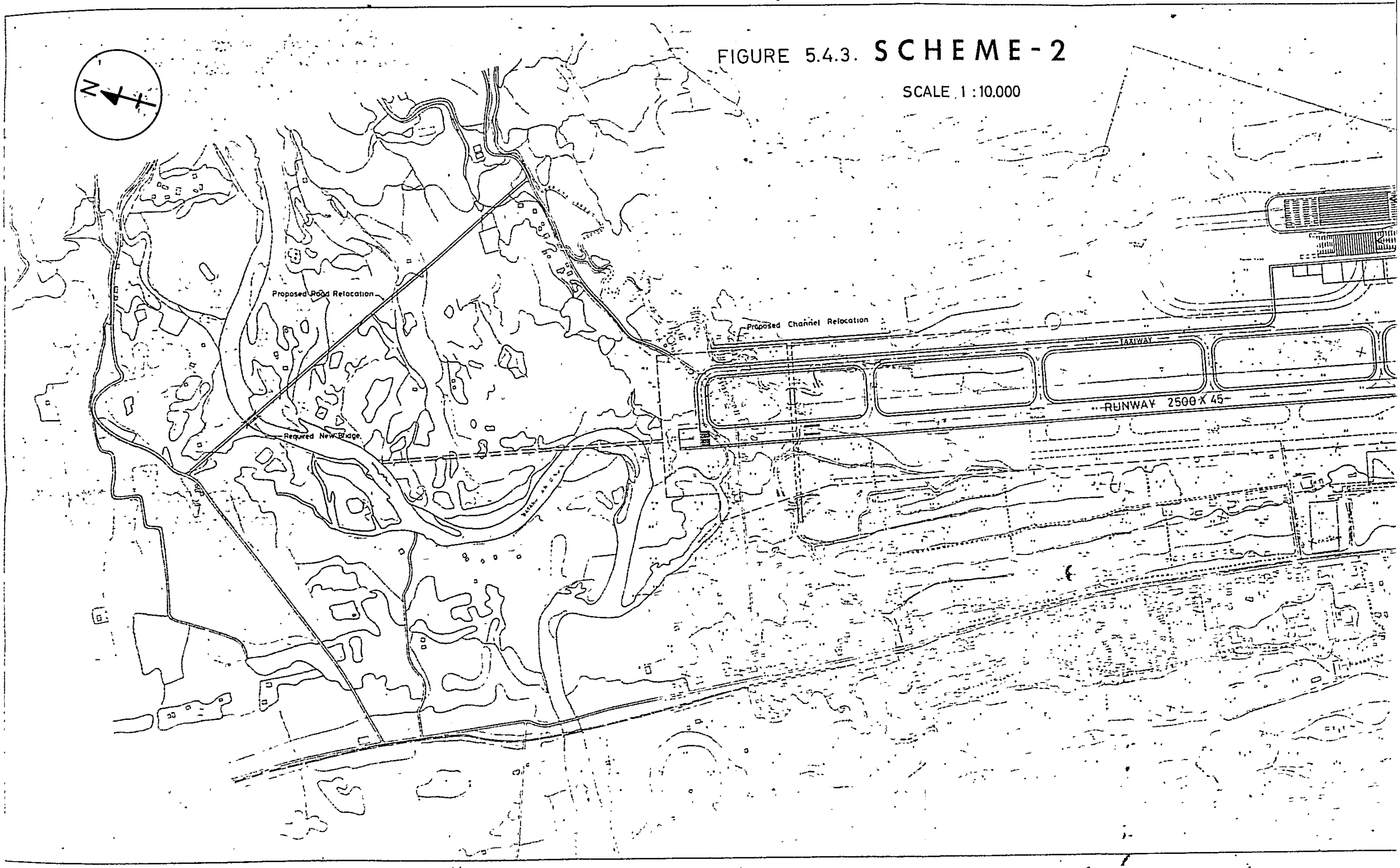


FIGURE 5.4.3. **SCHEME-2**

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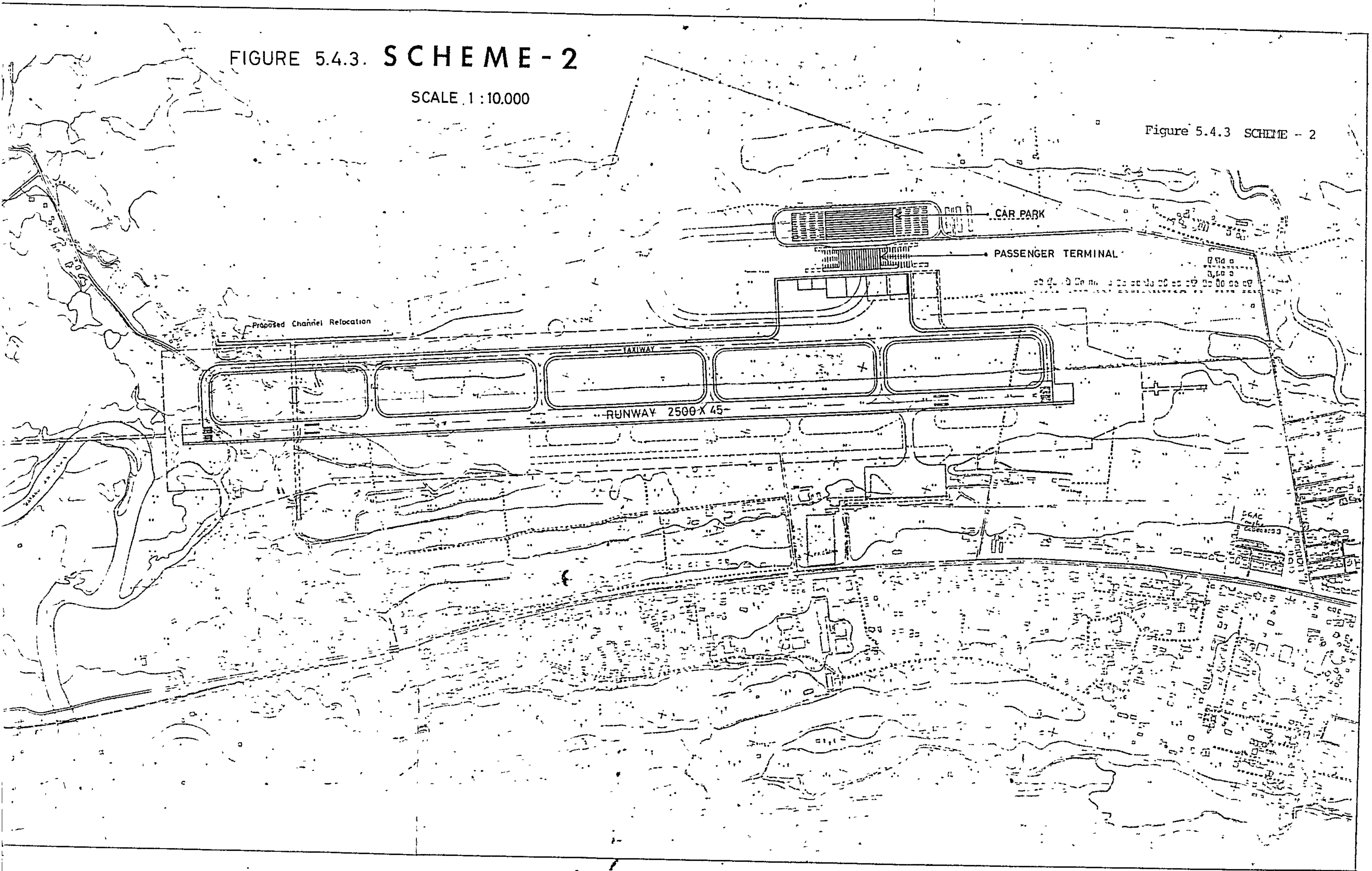


FIGURE 5.4.4. SCHEME-3

SCALE 1:10.000

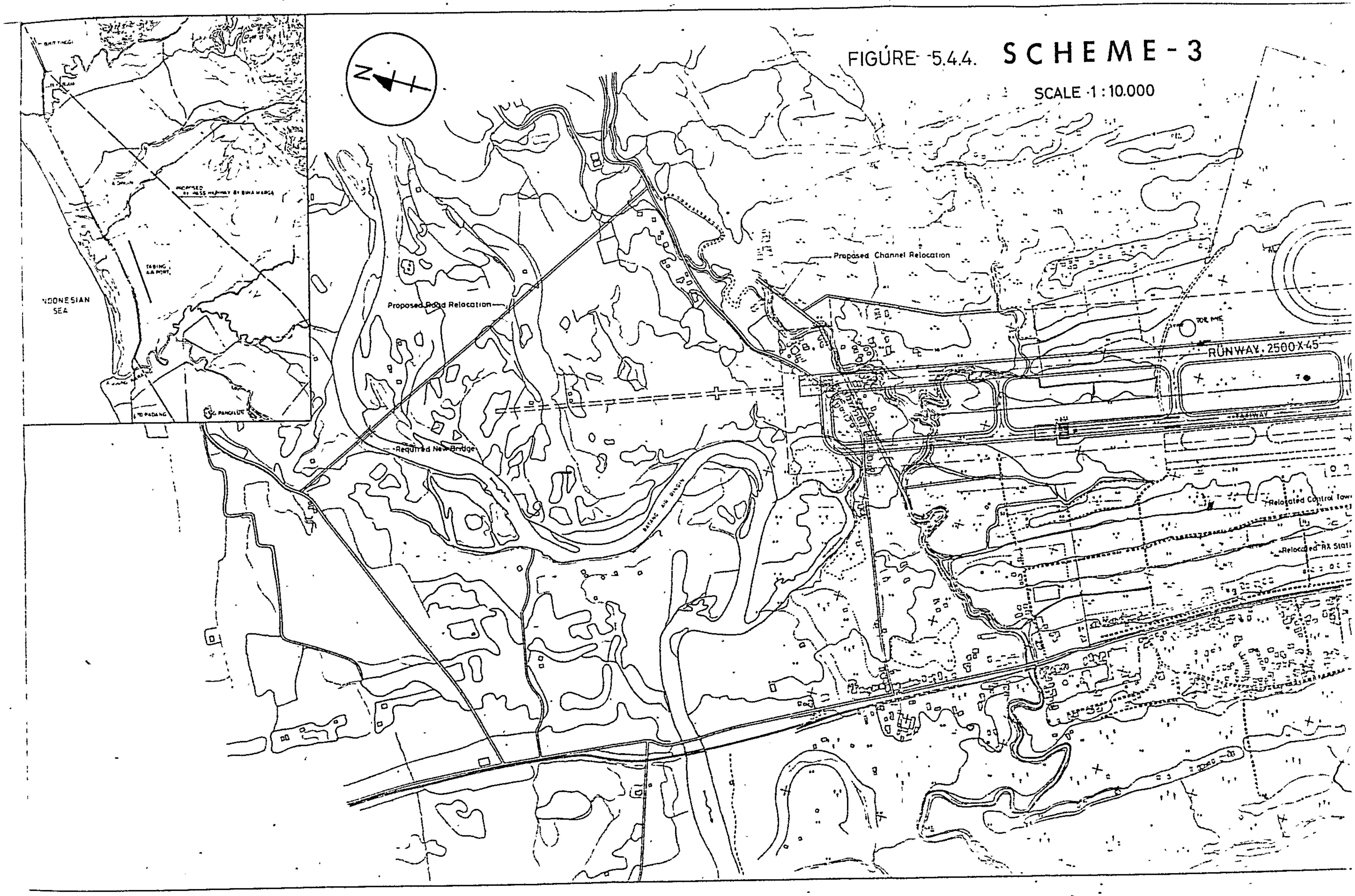
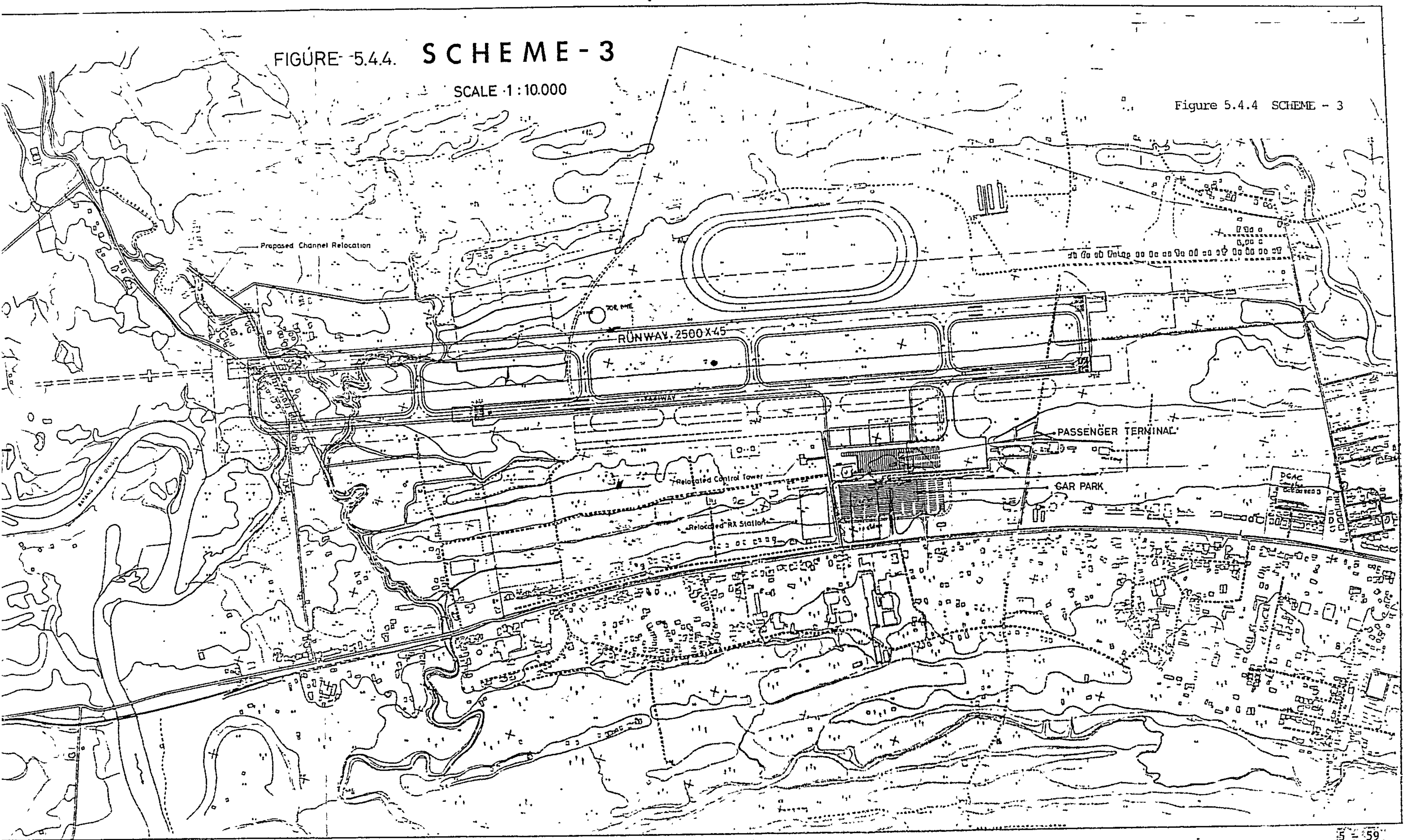


Figure 5.4.4 SCHEME - 3



5.4.3. Alternative Terminal Area Concept

Under Scheme-3, three alternative terminal area development plans are prepared which are designated as Scheme-3A, -3B and -3C and shown in Figure 5.4.6, -5.4.7 and -5.4.8 respectively.

The Figure 5.4.5. depicts those three alternative together with the original Tabing Development Plan prepared a decade ago. The original plan with very limited area for expansion is now apparently out of date plan at present. It reminds the importance to reserving expansibility and flexibility on long term planning in order that the plan will be adaptable for future demand changes.

The comparison of the three alternatives are shown in Table 5.4.1. The characterisric of each scheme may be summarized briefly as follows:

Scheme-3A : New terminal area is sought close to the airport gravity point, i.e. place facing to runway middle point thus reserving at most expansibility to both north and south along the parallel taxiway. Since the new development area does not conflict with existing facilities such as rx-station, administration building, control tower, this scheme offers easiest constructibility among three alternatives.

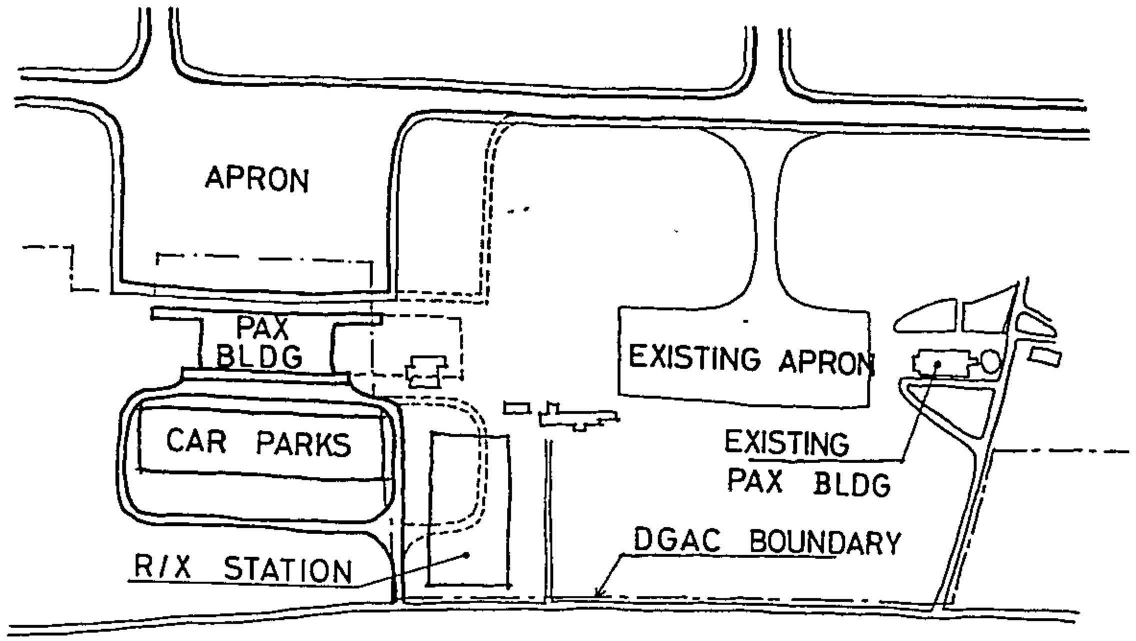
Scheme-3B : The linear passenger terminal concept and its land side arrangemenet is as same as Scheme-3A, however the area is sought next to existing apron. In this way, the exsiting apron will be utilized efficiently once the new terminal is completed. The disadvantage of this scheme is that it requires to relocate existing control tower, rx-station, etc. in the area prior to the new terminal construction and thus it may take longer period to complete the new development than Scheme-3A.

Scheme-3C : Emphasis is placed to develop the new area within the area presently managed by DGAC thus requirs no land acquisition for terminal development. The finger passenger terminal concept will accomplish this aim and offers very compact terminal area development. The disadvantage of this scheme is that it lacks orderly expansibilty and disturbs the airport operations during the construction.

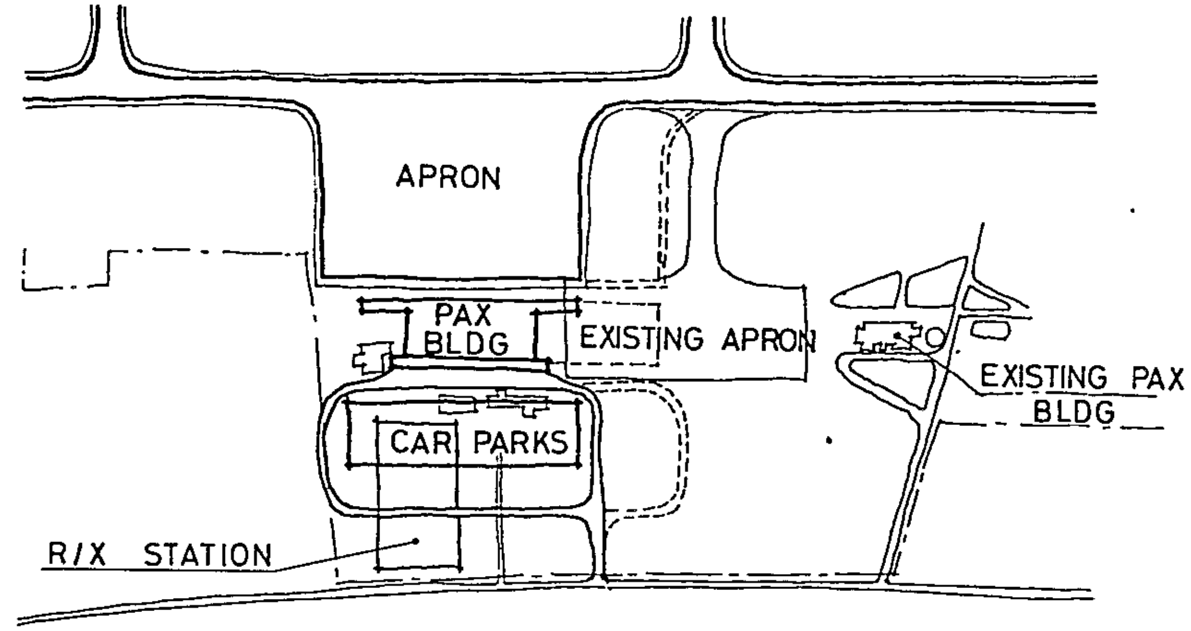
Considering the construction easiness, shorter period required before opening the new terminal for the traffic, and the capability to cope with unexpected demand change in the future, the Scheme-3A has been selected for the redevelopment of Tabing Airport.

Table 5.4.1 COMPARISON TABLE OF ALTERNATIVE TERMINAL CONCEPTS

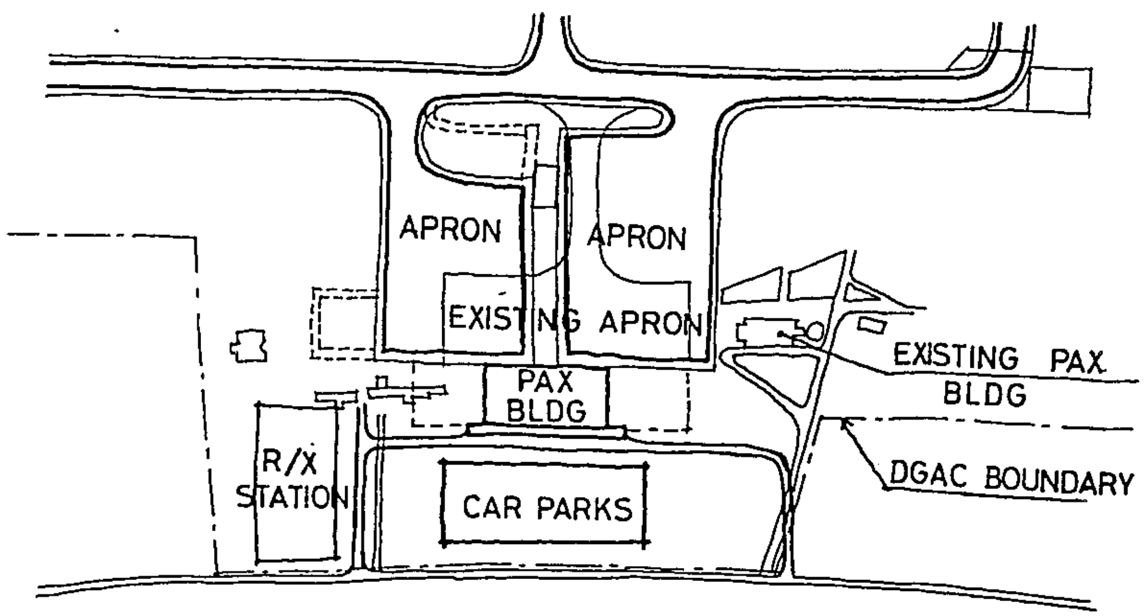
	Scheme - 3A	Scheme - 3B	Scheme - 3C
1. Required Land Acquisition for Terminal Area	Some 80,000 m^2	Some 30,000 m^2	N o n e
2. Compatibility with Existing Facilities and Airport Operation during Construction	- Administration building, control tower, fire station and rx-station can be maintained in place. - Existing apron can be maintained. - Existing passenger terminal may be converted as cargo terminal. - Least disturbance to airport operation during construction period.	- Administration building, control tower, fire station and rx-station must be relocated prior to new terminal area cons - truction. - A part of existing apron must be abandoned. - Same as 3 A - Tolerable disturbance to airport operation during construction period.	- Same as 3 A - Existing apron must be modified and overlayed but utilized at most - Same as 3 A - Construction work disturbs airport operation.
3. Airport Operational Considerations after Construction	- Existing apron is remote (500m) from new passenger terminal as compared with 3 B. - Passenger and cargo terminals are apart (650m). - New apron is closest to future prime take-off end RWY 16(1750m) - New apron is farthest from existing fuel station (750m).	- Existing apron is close to new terminal area. - Passenger and cargo terminals are apart (430m). - New apron is closer to future prime take-off end RWY 16 (2000m). - New apron is far from existing fuel station (530m).	- Modified single-apron affords easy total control and efficient. ground service for aircraft. - Passenger and cargo terminals are close (200m). - New apron is fartherst to future prime take-off end RWY16 (2200m). - New apron is closest to existing fuel station (300m).
4. Expansibility & Flexibility	- Ample expansibility. - Most flexibility for unforeseen future demand change.	- Future expansion possible. - Flexible for unforeseen future demand change.	- Limited land side expansibility. - Less flexibility for unforeseen future demand change.



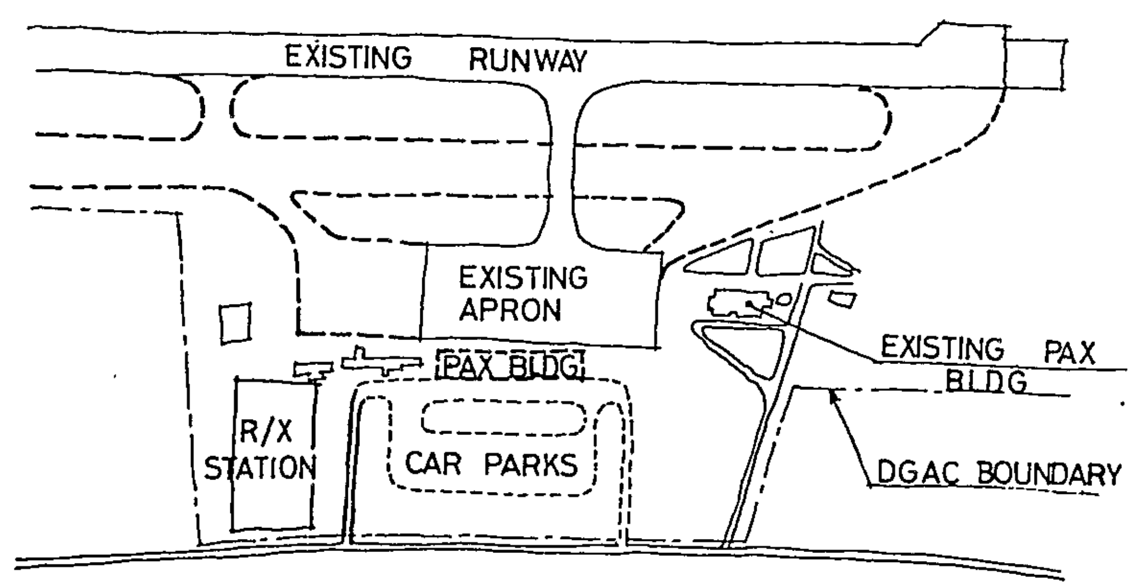
SCHEME - 3A



SCHEME - 3B



SCHEME - 3C



ORIGINAL SCHEME

Figure 5.4.5 ALTERNATIVE TERMINAL AREA CONCEPT

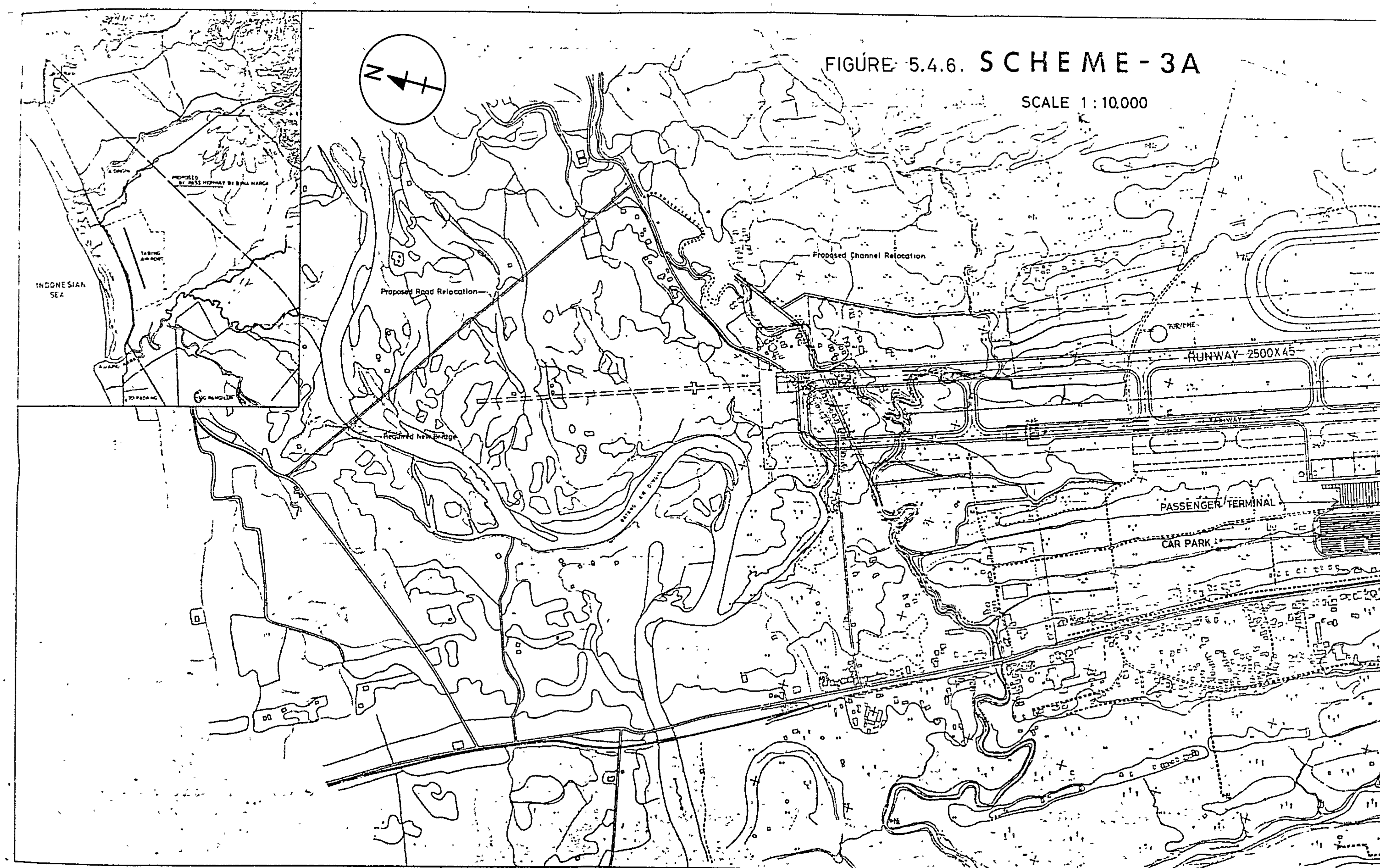


FIGURE 5.4.6. SCHEME-3A

SCALE 1 : 10,000

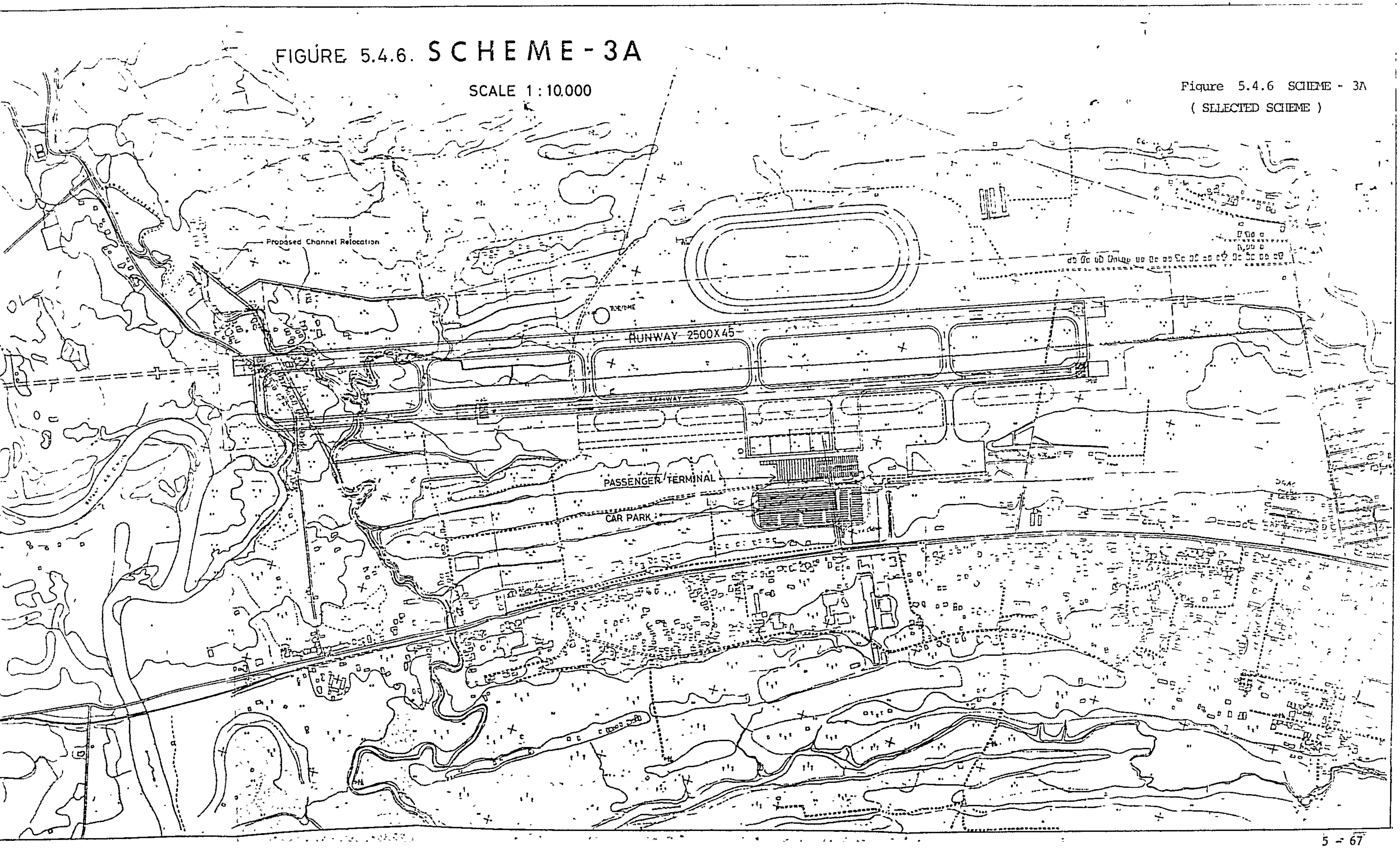


Figure 5.4.6 SCHEME - 3A
(SELECTED SCHEME)

FIGURE 5.4.7. SCHEME - 3B

SCALE 1 : 10.000

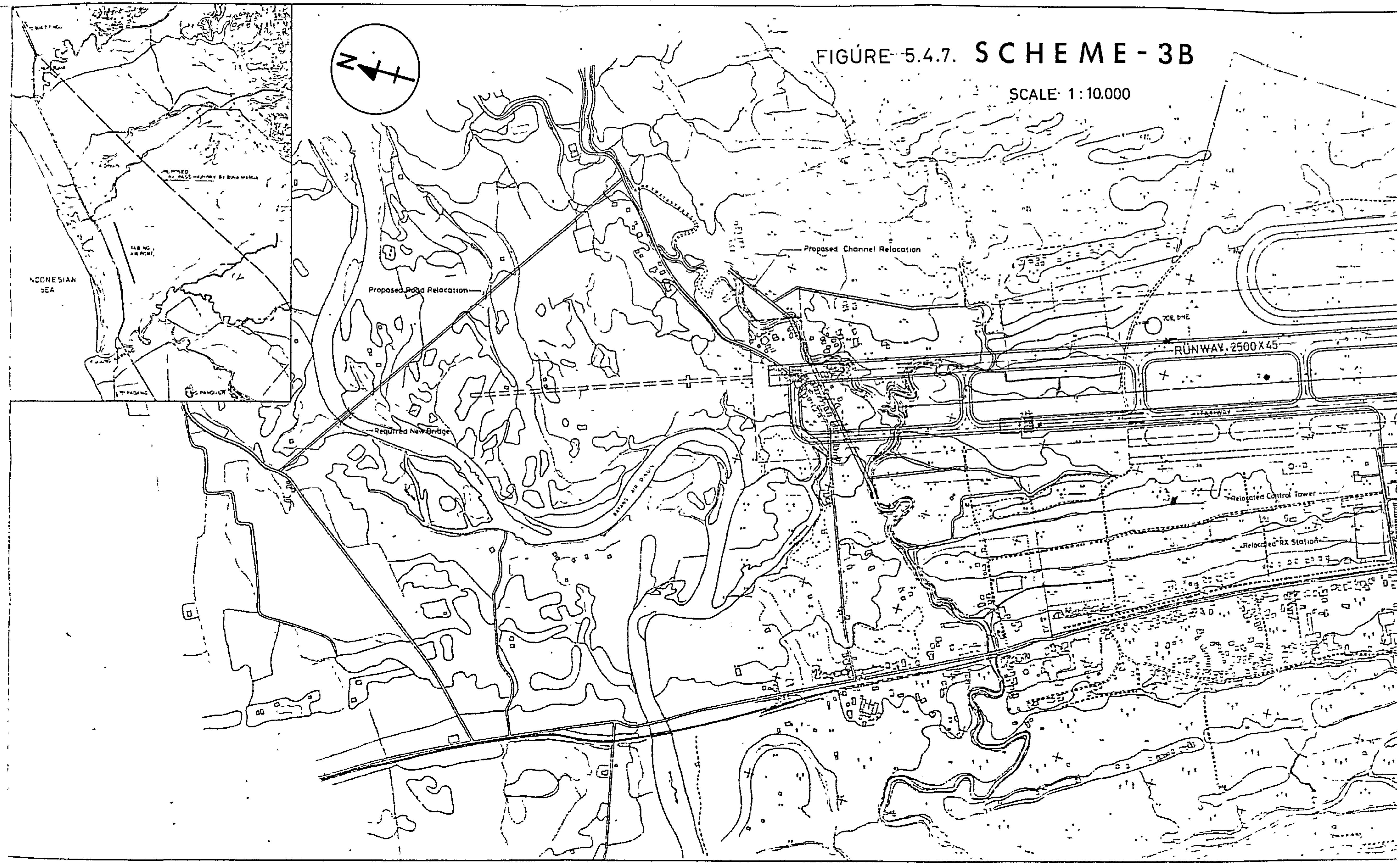
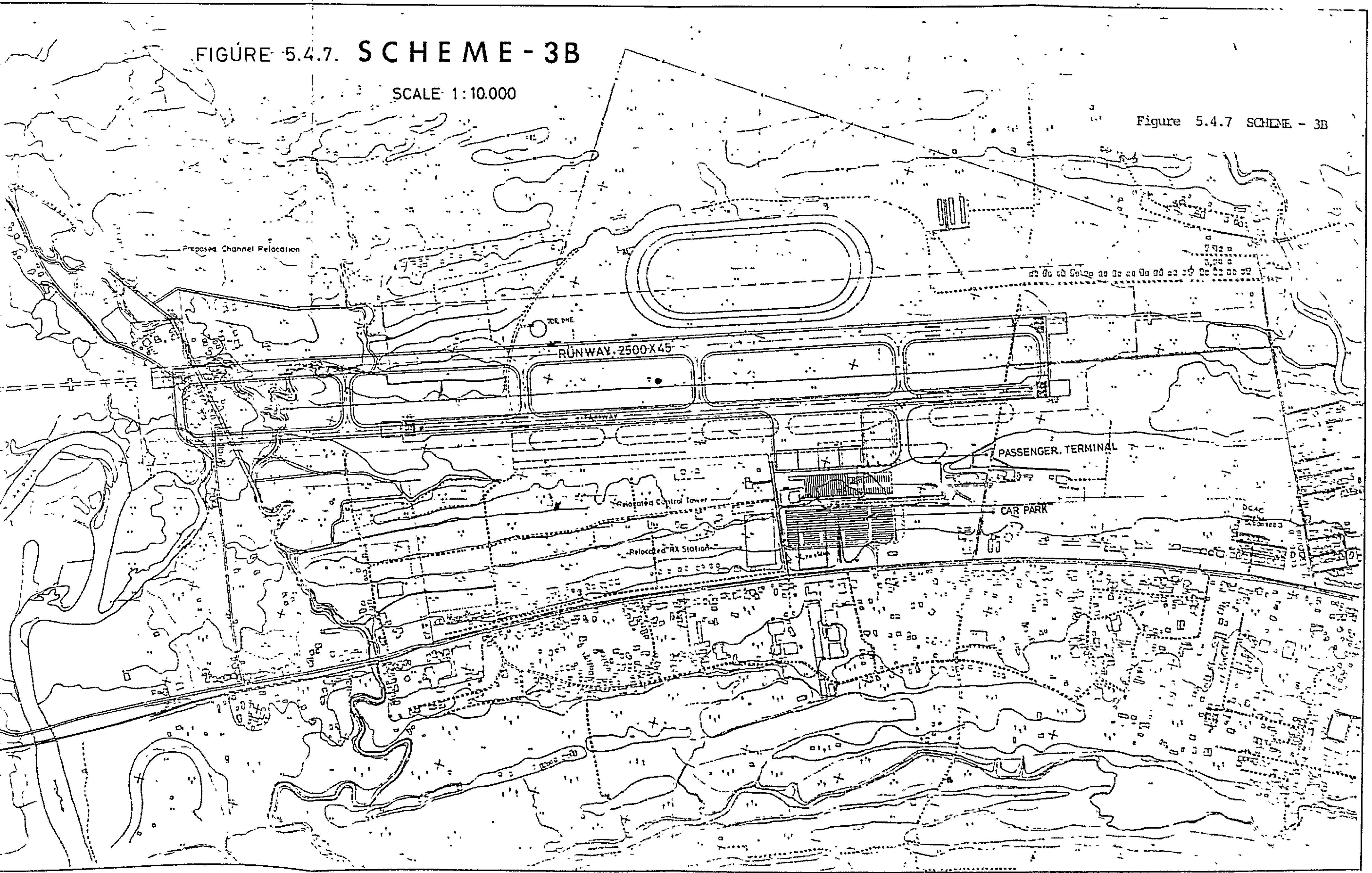


FIGURE 5.4.7. SCHEME - 3B

SCALE 1:10.000

Figure 5.4.7 SCHEME - 3B



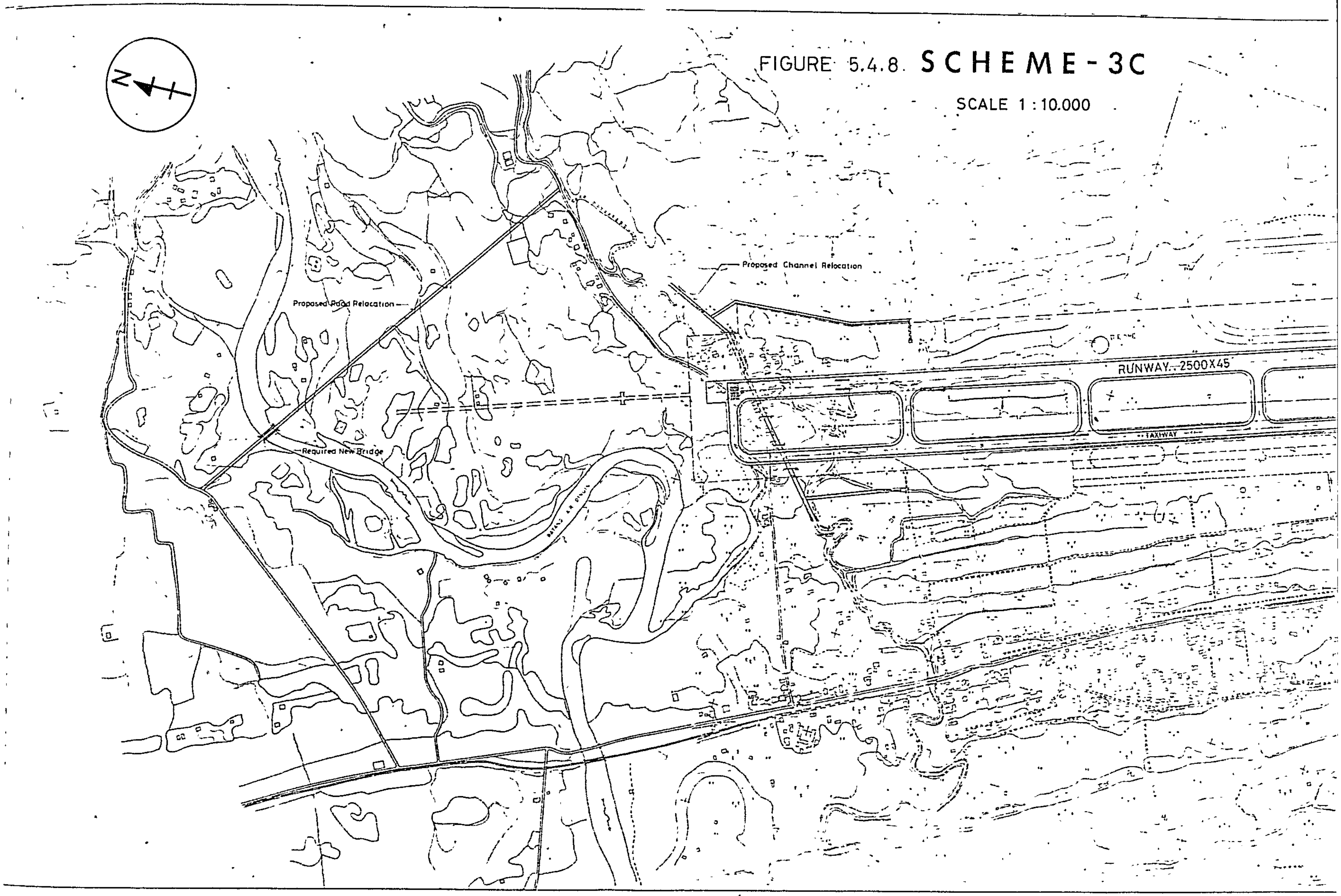


FIGURE 5.4.8. **SCHEME-3C**

SCALE 1 : 10.000

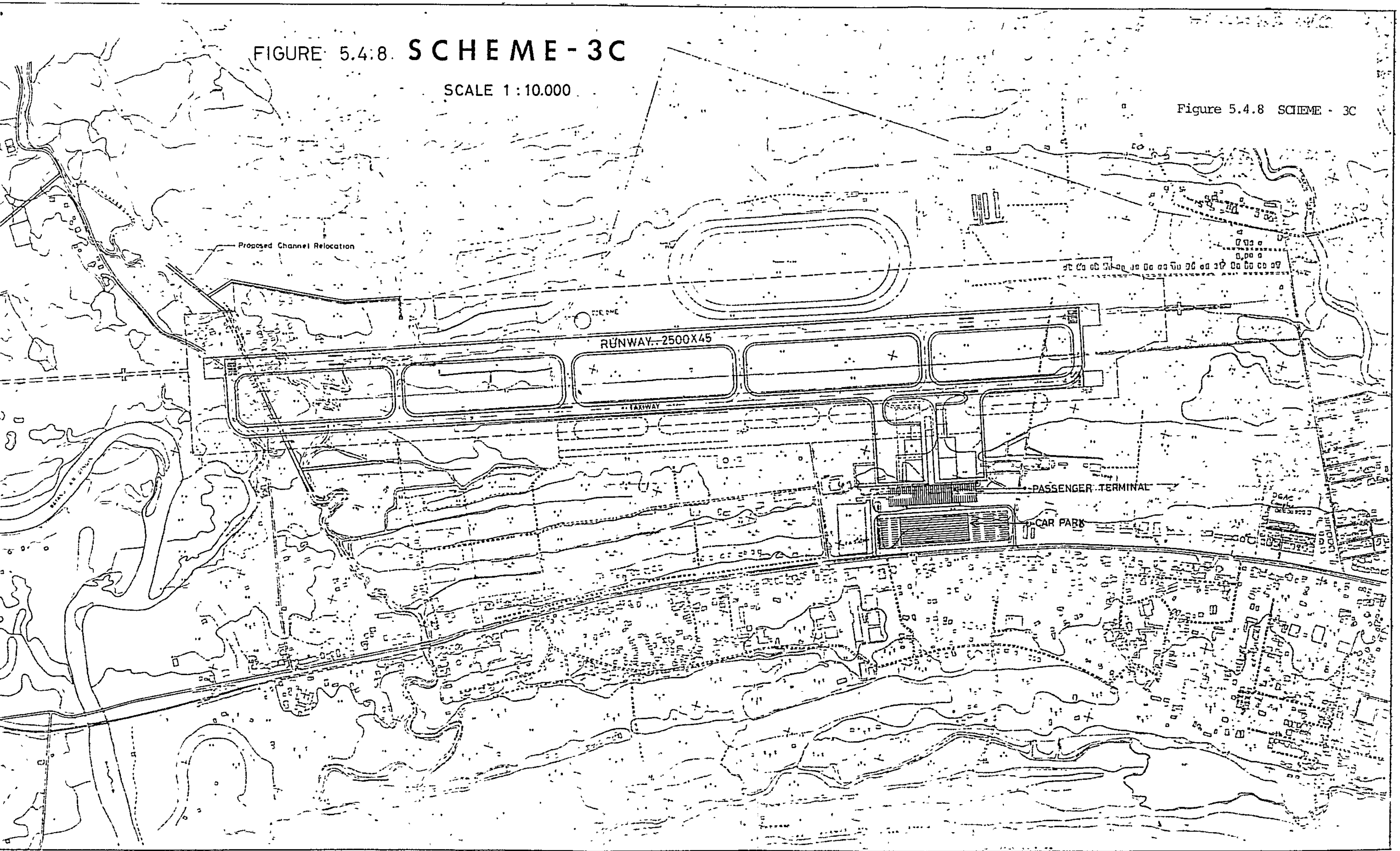


FIGURE 5.4.8. SCHEME-3C
SCALE 1:10.000
Figure 5.4.8 SCHEME - 3C
Proposed Channel Relocation
RUNWAY 2500X45
TAXIWAY
PASSENGER TERMINAL
CAR PARK