3.10 Peak Characteristics

3.10.1 Peak Month and Design Day

Monthly variations of all passengers and aircraft movements for the three year period from 1981 to 1983 are available, but it is not reasonable to estimate the future peak characteristics based on the above data at Nozha airport due to its small traffic. According to Egypt Air, they handled 19.2 percent of annual passengers in the peak month of August 1981, 14.5 percent in September 1982 and 10.7 percent in August 1983. These data indicate that as air passengers increase, the peak coefficient decreases. Peak coefficient at Alexandria airport is projected by the analyses of the past trend of monthly variation at Cairo airport for the following reasons.

i) Passenger demand at Alexandria airport has been projected at 2 million in year 2000 and 3 million in the year 2010 as the total for domestic and international traffic. It is expected that peak characteristics at Alexandria airport would become similar to those at Cairo airport according to the growth of demand .

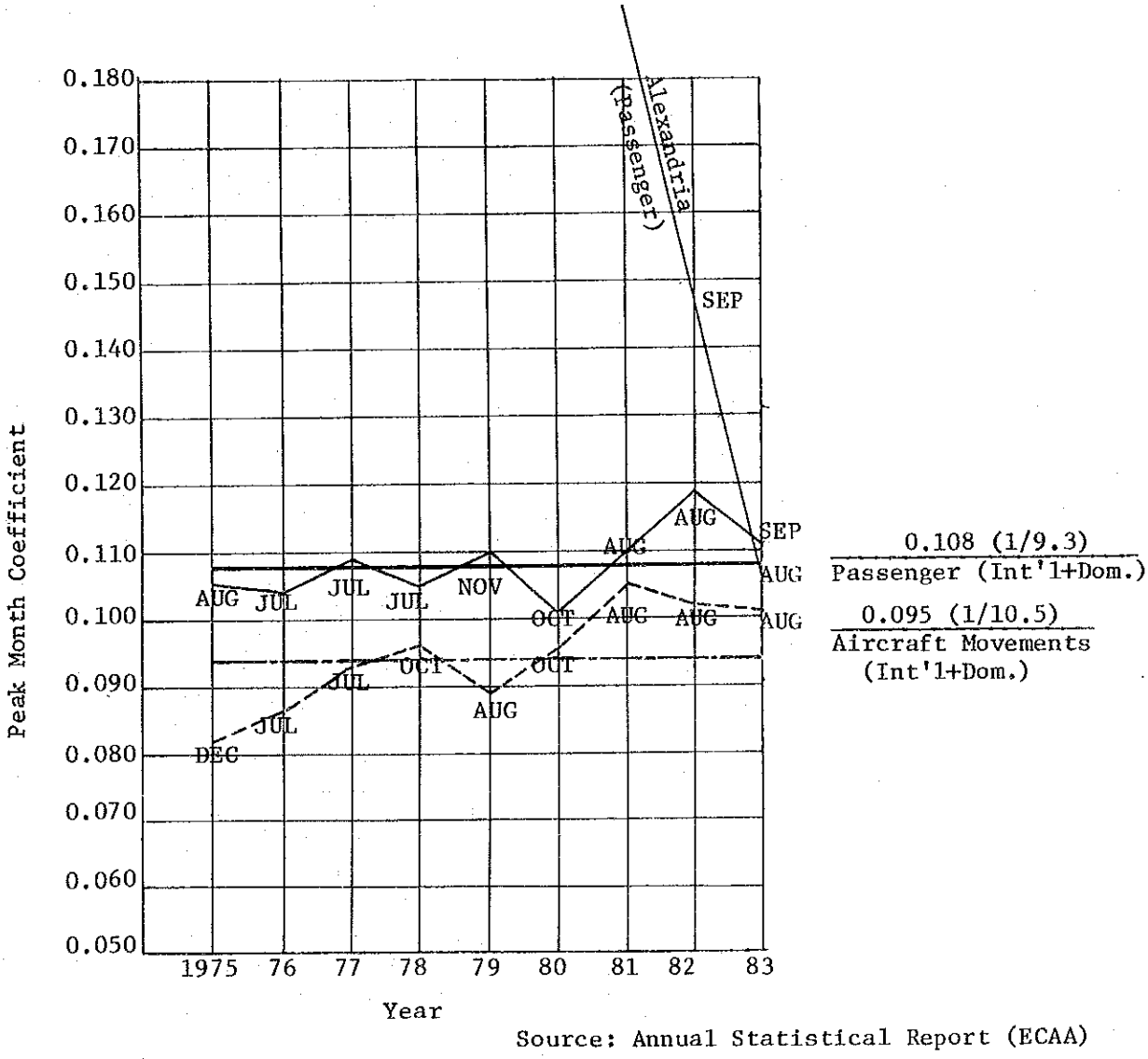
ii) Peak season in Alexandria is summer from July to September, and that in Cairo is summer too. Therefore it can be expected that both airports will show similar monthly variations.

Monthly peak characteristics of total airport traffic at Cairo airport are analyzed based on the Annual Statistical Report (ECAA) which contains data on non-scheduled flights, but does not divide into international and domestic categories. Monthly peak characteristics for domestic and international airport traffic are analyzed on the basis of the Airport Traffic (ICAO).

Fig. 3.10.1 shows peak month coefficients at Cairo airport for the period from 1975 to 1983. Average peak coefficient for passenger traffic is 10.8% (1/9.3) and 9.5% (1/10.5) for aircraft movements. At Cairo airport, peak month for both passengers and aircrafts is July, August or September during the summer season, and this feature is similar to Alexandria airport. Peak month coefficients at Alexandria airport for the period from 1981 to 1983 are also shown in Fig. 3.10.1. It indicates that peak month coefficient declined for these three years and approximately equaled that at Cairo airport in 1983.

As a result of the above analysis, it is reasonable to adopt the average peak month coefficient at Cairo airport as indicated in Fig. 3.10.1 in order to estimate the total traffic during the peak month at Alexandria airport.

Figs. 3.10.2 and 3.10.3 show the actual peak month coefficients for international and domestic traffic at Cairo airport respectively. In addition to the peak month coefficient for total airport traffic, the average values for international and domestic traffic at Cairo airport are adopted for the planning of Alexandria airport as shown in the Figs.



Source: Annual Statistical Report (ECAA)

Fig. 3.10.1 Peak Month Coefficient at Cairo Airport (International and Domestic)

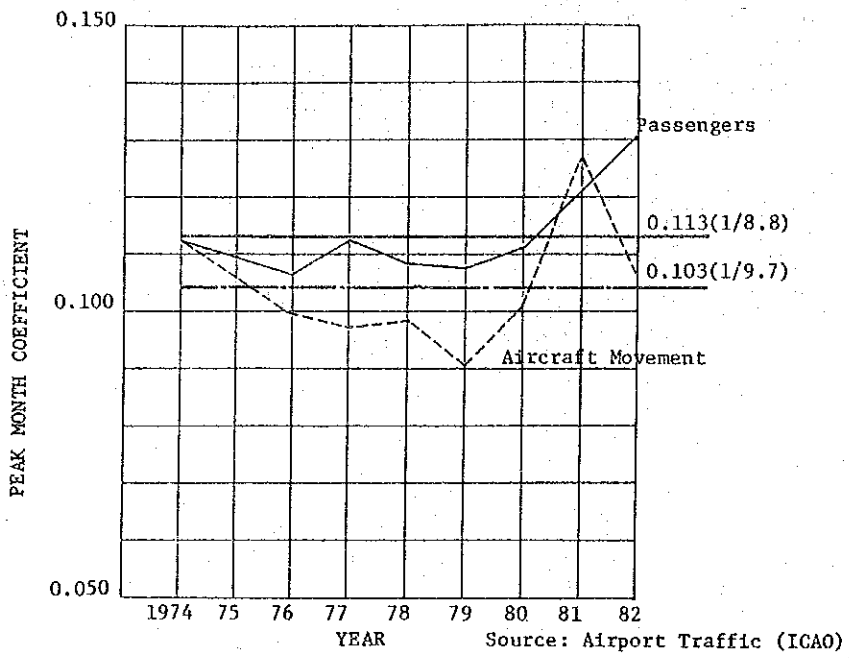


Fig. 3.10.2 Peak Month Coefficient at Cairo Airport (International)

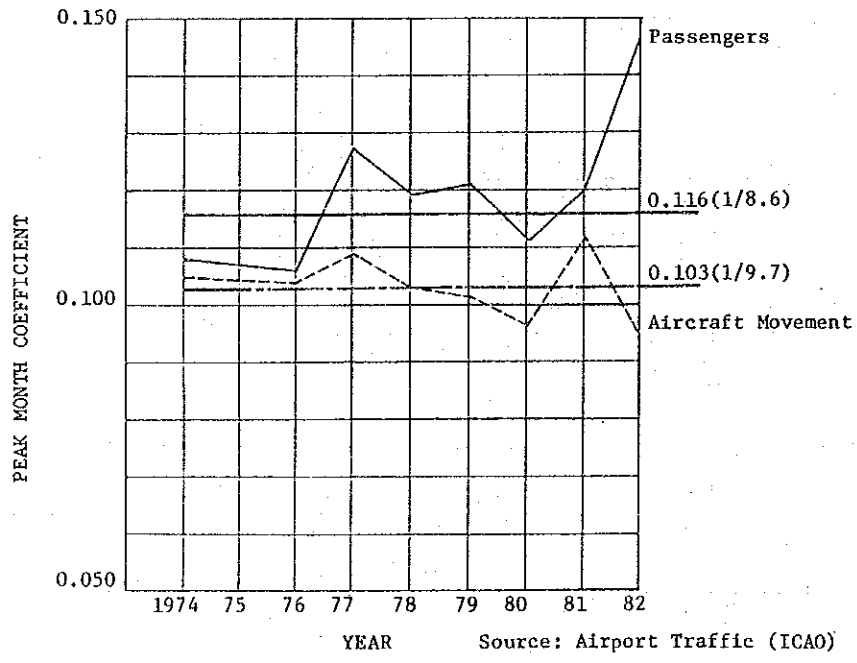


Fig. 3.10.3 Peak Month Coefficient at Cairo Airport (Domestic)

Design day coefficient is set in Table 3.10.1 as a product of peak month ratio and number of days in an average month.

Table 3.10.1 Adopted Peak Month and Peak Day Coefficient

Item		International	Domestic	Total Airport
Passenger	Peak Month	0.113	0.116	0.108
	Coefficient	1/8.8	1/8.6	1/9.3
	Peak Day Coefficient	1/265	1/260	1/285
Aircraft Movement	Peak Month	0.103	0.103	0.095
	Coefficient	1/9.7	1/9.7	1/10.5
	Peak Day Coefficient	1/295	1/295	1/325

3.10.2 Peak Hour Coefficient

Based on the flight schedules at five major airports in Egypt, the relation between daily aircraft movements and peak hour coefficient (peak hour movements divided by daily aircraft movements) is plotted together with the average characteristics of Japanese airports in Fig. 3.10.4. Among the 5 selected airports, Cairo and Luxor airports operate 24 hours a day. In this study, the curve indicated in Fig. 3.10.4 is utilized to obtain the peak hour coefficient.

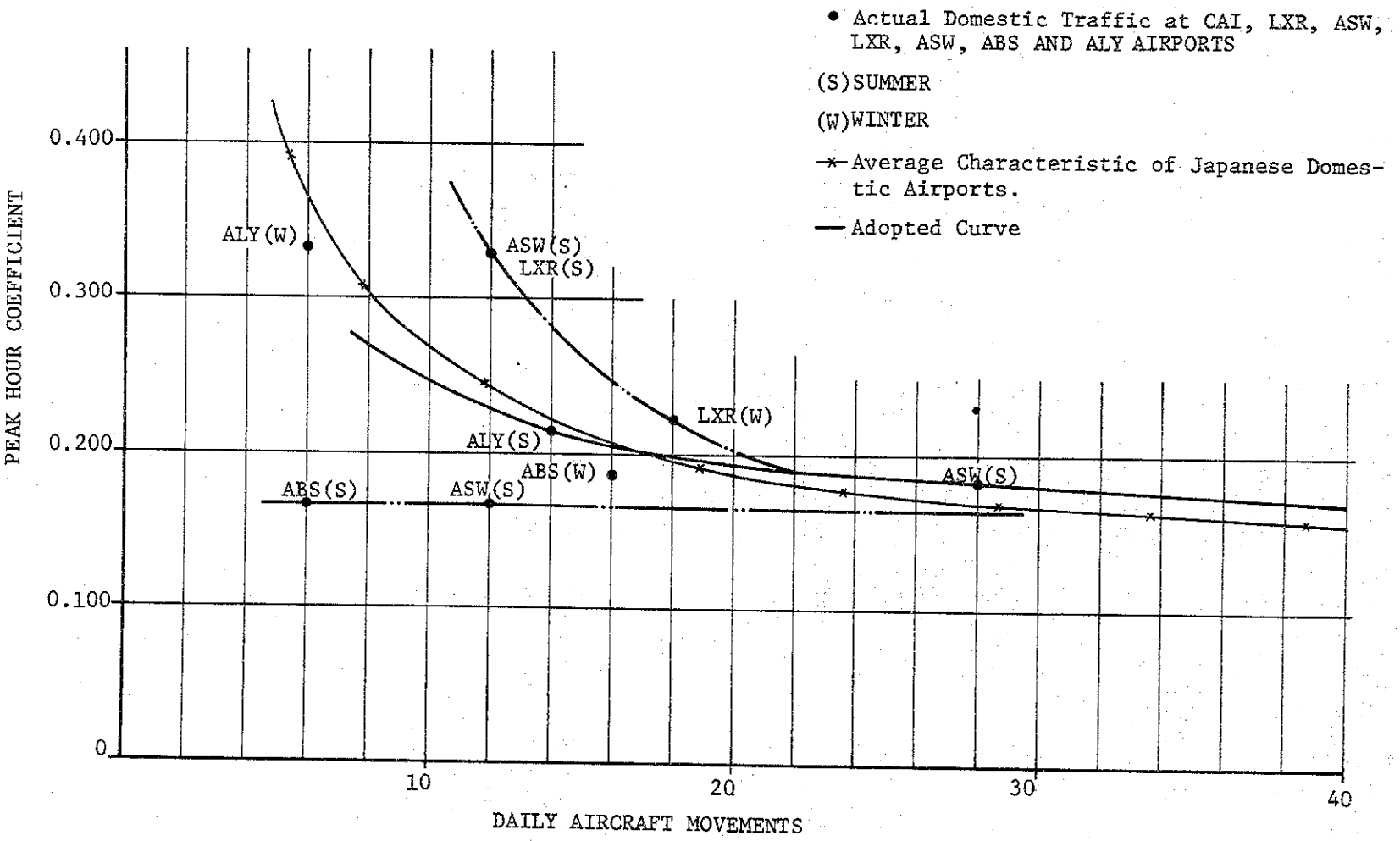


Fig. 3.10.4 Peak Hour Coefficient

3.10.3 Load Factor

According to the Yearly Report of Working Activity, 1983, issued by Egypt Air, the annual average load factors for domestic services in 1982 and 1983 were 70.3 percent and 73.2 percent, respectively.

The load factor for Cairo-Alexandria route was 77.6 percent in 1983. Taking into account the decrease of load factor by the increase of the flight service in the future, annual average load factor as a planning value is set at 70 percent. The annual average load factor for the international service is assumed to be 60 percent based on the average load factor of IATA international scheduled services (i.e. 61.7 percent in 1981 and 60.5 percent in 1982).

During the peak month, the above load factors for the planning are estimated to be increased to 80 percent and 70 percent for domestic and international services respectively based on Egypt Air's past record of the load factor during the peak month (i.e. August or September) in comparison to the annual average load factor.

3.10.4 Heavy Direction Ratio during Peak Hour

Heavy direction ratio is defined as the ratio of aircraft movements of the heavier direction (arrival or departure) divided by total peak hour movements. It is estimated to be about 0.60 based on the present operation at Cairo International Airport as indicated in Annual Statistical Report (ECAA).

3.11 Air Passengers and Aircraft Movements

The peak hour traffic volume for the key years are estimated as summarized in Tables 3.11.1 through 3.11.3 for Alt-A and B, and Tables 3.11.4 through 3.11.7 for Alt-C based on the target annual demand for planning, and the assumptions made in Sections 3.9 and 3.10. The estimated peak hour traffic is used as the planning basis for the airport facilities. The design peak hour is defined as the peak hour of an average day of the peak month.

Table 3.11.1 Summary of Air Traffic Demand

(International and Domestic for Alt-A and Alt-B)

Year	Period	Passengers		Cargo	Aircraft Movements								
		Embarked/ Disembarked	Transit	(ton)	JUMBO	LJ	MJ	NJ	SJ	P	Sub Total	Others	Total
1990	Annual	870,000	25,000	18,000		2,513	559	1,954	3,398	262	8,686	782	9,468
	Peak Month	93,960				239	53	186	324	25	817		
	Peak Day	3,050				8	2	6	10	2	28		
	Peak Hour	540				1.4	0.3	1.1	1.9	0.1	4.8		
	Heavy Direction Peak Hour	330									2.9		
1995	Annual	1,580,000	45,000	37,000	436	3,924	1,789	2,617	2,726	381	11,876	1,069	12,945
	Peak Month	170,640			42	374	170	249	260	36	1,131		
	Peak Day	5,540			2	12	4	8	8	2	36		
	Peak Hour	950			0.2	2.1	0.9	1.4	1.5	0.2	6.3		
	Heavy Direction Peak Hour	560									3.8		
2000	Annual	1,990,000	55,000	51,000	1,008	5,045	2,025	3,023	2,134	500	13,735	1,236	14,971
	Peak Month	214,920			96	480	193	288	203	48	1,308		
	Peak Day	6,980			4	16	6	8	6	2	42		
	Peak Hour	1,160			0.5	2.6	1.0	1.6	1.1	0.3	7.1		
	Heavy Direction Peak Hour	690									4.3		
2005	Annual	2,460,000	65,000	67,000	1,591	5,615	2,857	2,121	1,776	666	14,626	1,316	15,942
	Peak Month	265,680			152	535	272	202	169	63	1,393		
	Peak Day	8,630			6	18	8	6	6	2	46		
	Peak Hour	1,400			0.8	2.8	1.5	1.1	0.9	0.3	7.4		
	Heavy Direction Peak Hour	830									4.4		
2010	Annual	3,000,000	80,000	88,000	2,432	6,689	3,649	1,824	1,634	857	17,085	1,537	18,622
	Peak Month	324,000			231	637	347	174	156	82	1,627		
	Peak Day	10,530			8	20	12	6	4	2	52		
	Peak Hour	1,650			1.2	3.3	1.8	0.9	0.8	0.4	8.4		
	Heavy Direction Peak Hour	990									5.0		

Table 3.11.2 Summary of Air Traffic Demand

(Domestic for Alt-A and Alt-B)

Year	Period	Passengers: Embarked/ Disembarked	Passengers: Transit	Cargo (ton)	Aircraft Movements: JUMBO	LJ	MJ	NJ	SJ	P	Sub Total	Others	Total
1990	Annual	230,000		240					2,839	262	3,101	279	3,380
	Peak Month	26,680							292	27	319		
	Peak Day	880							10	2	12		
	Peak Hour	200							2.2	0.2	2.4		
	Heavy Direction Peak Hour	120									1.4		
1995	Annual	320,000		420			482		2,290	381	3,156	284	3,440
	Peak Month	37,120					50		236	39	325		
	Peak Day	1,230					2		8	2	12		
	Peak Hour	280					0.4		1.7	0.3	2.4		
	Heavy Direction Peak Hour	170									1.4		
2000	Annual	420,000		670		513	513		2,134	500	3,660	329	3,989
	Peak Month	48,720				53	53		220	51	377		
	Peak Day	1,620				2	2		8	2	14		
	Peak Hour	340				0.4	0.4		1.6	0.4	2.8		
	Heavy Direction Peak Hour	200									1.7		
2005	Annual	560,000		1,000		843	736		1,776	666	4,021	362	4,383
	Peak Month	64,960				87	76		183	69	415		
	Peak Day	2,150				4	2		6	2	14		
	Peak Hour	450				0.6	0.5		1.3	0.5	2.9		
	Heavy Direction Peak Hour	270									1.7		
2010	Annual	730,000		1,400		1,217	1,217		1,634	857	4,925	443	5,368
	Peak Month	84,680				126	126		168	88	508		
	Peak Day	2,810				4	4		6	2	16		
	Peak Hour	560				0.8	0.8		1.1	0.6	3.3		
	Heavy Direction Peak Hour	340									2.0		

Table 3.11.3 Summary of Air Traffic Demand

(International for Alt-A and Alt-B)

Year	Period	Passengers: Embarked/ Disembarked	Passengers: Transit	Cargo (ton)	Aircraft Movements: JUMBO	LJ	MJ	NJ	SJ	P	Sub Total	Others	Total
1990	Annual	640,000	25,000	18,000		2,513	559	1,954	559		5,585	503	6,088
	Peak Month	72,320				259	58	201	58		576		
	Peak Day	2,420				8	2	6	2		18		
	Peak Hour	470				1.6	0.4	1.3	0.4		3.7		
	Heavy Direction Peak Hour	290									2.2		
1995	Annual	1,260,000	45,000	37,000	436	3,924	1,307	2,617	436		8,720	785	9,505
	Peak Month	142,380			45	404	135	270	45		899		
	Peak Day	4,750			2	14	4	8	2		30		
	Peak Hour	860			0.3	2.4	0.8	1.6	0.2		5.3		
	Heavy Direction Peak Hour	510									3.2		
2000	Annual	1,570,000	55,000	50,000	1,008	4,532	1,512	3,023			10,075	907	10,982
	Peak Month	177,410			104	467	156	311			1,038		
	Peak Day	5,920			4	14	6	10			34		
	Peak Hour	1,030			0.6	2.7	0.9	1.8			6.0		
	Heavy Direction Peak Hour	620									3.6		
2005	Annual	1,900,000	65,000	66,000	1,591	4,772	2,121	2,121			10,605	954	11,559
	Peak Month	214,700			164	492	218	218			1,092		
	Peak Day	7,170			6	16	8	6			36		
	Peak Hour	1,240			0.9	2.8	1.2	1.2			6.1		
	Heavy Direction Peak Hour	740									3.7		
2010	Annual	2,270,000	80,000	87,000	2,432	5,472	2,432	1,824			12,160	1,094	13,254
	Peak Month	256,510			250	564	250	188			1,252		
	Peak Day	8,570			8	18	8	6			40		
	Peak Hour	1,440			1.4	3.0	1.4	1.0			6.8		
	Heavy Direction Peak Hour	860									4.1		

Table 3.11.4 Summary of Air Traffic Demand

(Domestic at Nozha Airport for Alt-C)

Year	Item / Period	Passengers		Cargo	Aircraft Movements								
		Embarked/ Disembarked	Transit	(ton)	JUMBO	LJ	MJ	NJ	SJ	P	Sub Total	Others	Total
1995	Annual	290,000		340			418		2,097	381	2,896	261	3,157
	Peak Month	33,640					43		216	39	299		
	Peak Day	1,120					2		6	2	10		
	Peak Hour	270					0.3		1.7	0.3	2.4		
	Heavy Direction Peak Hour	160									1.4		
2000	Annual	380,000		540			917		2,028	500	3,445	310	3,755
	Peak Month	44,080					95		209	52	355		
	Peak Day	1,460					4		6	2	12		
	Peak Hour	330					0.7		1.6	0.4	2.6		
	Heavy Direction Peak Hour	200									1.6		
2005	Annual	500,000		900		543	814		1,703	666	3,726	335	4,061
	Peak Month	58,000				56	84		176	69	384		
	Peak Day	1,920				2	2		6	2	12		
	Peak Hour	430				0.4	0.6		1.3	0.5	2.8		
	Heavy Direction Peak Hour	260									1.7		
2010	Annual	660,000		1,260		1,050	1,050		1,634	857	4,591	413	5,004
	Peak Month	76,560				108	108		168	88	473		
	Peak Day	2,540				4	4		6	2	16		
	Peak Hour	510				0.7	0.7		1.1	0.6	3.1		
	Heavy Direction Peak Hour	310									1.9		

Table 3.11.5 Summary of Air Traffic Demand

(International and Limited Domestic at New Airport for Alt-C)

Year	Period	Passengers		Cargo	Aircraft Movements								
		Embarked/ Disembarked	Transit	(ton)	JUMBO	LJ	MJ	NJ	SJ	P	Sub Total	Others	Total
1995	Annual	1,290,000	45,000	37,000	436	3,924	1,307	2,617	436	714	9,434	849	10,283
	Peak Month	139,320			42	374	124	249	42	68	898		
	Peak Day	4,530			2	12	4	8	2	2	30		
	Peak Hour	810			0.2	2.2	0.7	1.5	0.2	0.4	5.2		
	Heavy Direction Peak Hour	480									3.1		
2000	Annual	1,610,000	55,000	50,000	1,008	4,532	1,512	3,023		952	11,027	992	12,019
	Peak Month	173,880			96	432	144	288		91	1,050		
	Peak Day	5,650			4	14	4	10		2	34		
	Peak Hour	990			0.6	2.4	0.8	1.6		0.5	5.9		
	Heavy Direction Peak Hour	600									3.5		
2005	Annual	1,960,000	65,000	66,000	1,591	4,772	2,121	2,121	536		11,141	1,003	12,144
	Peak Month	211,680			152	454	202	202	51		1,061		
	Peak Day	6,880			6	14	6	6	2		34		
	Peak Hour	1,190			0.9	2.5	1.1	1.1	0.3		6.0		
	Heavy Direction Peak Hour	720									3.6		
2010	Annual	2,340,000	80,000	87,000	2,432	5,472	2,432	1,824	625		12,785	1,151	13,936
	Peak Month	252,720			232	521	232	174	60		1,218		
	Peak Day	8,210			8	16	8	6	2		40		
	Peak Hour	1,380			1.3	2.8	1.3	0.9	0.3		6.6		
	Heavy Direction Peak Hour	830									4.1		

Table 3.11.6 Summary of Air Traffic Demand

(Limited Domestic at New Airport for Alt-C)

Year	Period	Passenger		Cargo	Aircraft Movements								
		Embarked/ Disembarked	Transit	(ton)	JUMBO	LJ	MJ	NJ	SJ	P	Sub Total	Others	Total
1995	Annual	30,000		80						714	714	64	778
	Peak Month	3,480								74	74		
	Peak Day	120								2	2		
	Peak Hour												
	Heavy Direction Peak Hour												
2000	Annual	40,000		130						952	952	86	1,038
	Peak Month	4,640								98	98		
	Peak Day	150								4	4		
	Peak Hour												
	Heavy Direction Peak Hour												
2005	Annual	60,000		100					536		536	48	584
	Peak Month	6,960							55		55		
	Peak Day	230							2		2		
	Peak Hour												
	Heavy Direction Peak Hour												
2010	Annual	70,000		140					625		625	56	681
	Peak Month	8,120							64		64		
	Peak Day	270							2		2		
	Peak Hour												
	Heavy Direction Peak Hour												

Table 3.11.7 Summary of Air Traffic Demand

(International at New Airport for Alt-C)

Year	Item / Period	Passengers: Embarked/ Disembarked	Passengers: Transit	Cargo (ton)	Aircraft Movements: JUMBO	LJ	MJ	NJ	SJ	P	Sub Total	Others	Total
1990	Annual	640,000	25,000	18,000		2,513	559	1,954	559		5,585	503	6,088
	Peak Month	72,320				259	58	201	58		576		
	Peak Day	2,420				8	2	6	2		18		
	Peak Hour	470				1.6	0.4	1.3	0.4		3.7		
	Heavy Direction Peak Hour	290									2.2		
1995	Annual	1,260,000	45,000	37,000	436	3,924	1,307	2,617	436		8,720	785	9,505
	Peak Month	142,380			45	404	135	270	45		899		
	Peak Day	4,750			2	14	4	8	2		30		
	Peak Hour	860			0.3	2.4	0.8	1.6	0.2		5.3		
	Heavy Direction Peak Hour	510									3.2		
2000	Annual	1,570,000	55,000	50,000	1,008	4,532	1,512	3,023			10,075	907	10,982
	Peak Month	177,410			104	467	156	311			1,038		
	Peak Day	5,920			4	14	6	10			34		
	Peak Hour	1,030			0.6	2.7	0.9	1.8			6.0		
	Heavy Direction Peak Hour	620									3.6		
2005	Annual	1,900,000	65,000	66,000	1,591	4,772	2,121	2,121			10,605	954	11,559
	Peak Month	214,700			164	492	218	218			1,092		
	Peak Day	7,170			6	16	8	6			36		
	Peak Hour	1,240			0.9	2.8	1.2	1.2			6.1		
	Heavy Direction Peak Hour	740									3.7		
2010	Annual	2,270,000	80,000	87,000	2,432	5,472	2,432	1,824			12,160	1,094	13,254
	Peak Month	256,510			250	564	250	188			1,252		
	Peak Day	8,570			8	18	8	6			40		
	Peak Hour	1,440			1.4	3.0	1.4	1.0			6.8		
	Heavy Direction Peak Hour	860									4.1		

3.12 Phase of Airport Development

(1) Phase I Development (Medium term)

Taking into account the general condition of the project implementation and the improvement work thereafter in Egypt, Phase I development of the project* is planned based on the demand anticipated in 2000 so that no major improvement work will be required for about a 10-year period from the most likely date of completion of Phase I development.

(2) Phase II Development (Long term)

A rough approximation is to be made based on the forecast demand in 2010 in order to visualize the ultimate developments.

(3) Immediate Improvement Work (Short term)

Immediate improvement work on the existing facilities is to be made in order to expand their service time up to the early 1990's when Phase I development is to be completed.

*Note : In this report, the project is defined as the redevelopment of Nozha airport (Alt-A), the development of a new airport (Alt-B) or the development of both Nozha airport and a new airport (Alt-C), which is to be determined in this Study and to be implemented separately from and after the improvement work immediately necessary for Nozha airport.

CHAPTER 4 AIRPORT REQUIREMENTS ANALYSIS

CHAPTER 4 AIRPORT REQUIREMENTS ANALYSIS

4.1 General

This chapter explains the airport facility requirements which have been established or estimated based upon the demand forecast of air traffic (reported in Chapter 3), and also in compliance with the relevant standards, recommended practices, regulations and guidance materials of International Civil Aviation Organization (ICAO), the planning practices or demand unit used for airport planning in Japan, and Federal Aviation Administration (FAA).

The three alternative concepts are conceivable for the future airport development in Alexandria as explained in Section 3.8.

The airport facility requirements have been established for the following cases:

Alt-A and Alt-B

i) Development of an airport for international and domestic use
(Hereinafter referred to as International and Domestic case)

Alt-C

i) Development of an airport for international and limited domestic use
(Referred to as International case)

ii) Development of an airport for domestic use only
(Referred to as Domestic case)

Tables 4.1.1 through 3 show the results of the airport facility requirements which should be used as the bases for the subsequent planning and design.

Table 4.1.1 Air Traffic Demand vs. Airport Facility Requirements
(International and Domestic case)

	Item		Present Conditions (as of 1984)	1995	Phase I 2000	2005	Phase II 2010
Air Traffic Forecast	1. Annual Passenger [d]	Dom.	81,436 (1983)	320,000	420,000	560,000	730,000
		Int'l	1,705 (1983)	1,300,000	1,600,000	1,900,000	2,300,000
		Total	83,141 (1983)	1,620,000	2,020,000	2,460,000	3,030,000
	2. Annual Cargo(ton)	Dom.	13 (1983)	420	670	1,000	1,400
		Int'l	68 (1983)	37,000	50,000	66,000	87,000
		Total	81 (1983)	37,420	51,670	67,000	88,400
	3. Annual Aircraft [e] Movement (operation)	Dom.		3,160	3,660	4,020	4,930
		Int'l		8,720	10,080	10,610	12,160
		Total	5,526 (1983)	11,880	13,740	14,630	17,090
	4. Peak Hour Passenger [d]	Dom.		280	340	450	560
		Int'l		860	1,030	1,240	1,440
		Total [b]	200 [a]	950	1,160	1,400	1,650
	5. Peak Hour Aircraft Movement [e] (operation)	Dom.		2.4	2.8	2.9	3.3
		Int'l		5.3	6.0	6.1	6.8
		Total [b]	4 [a]	6.3	7.1	7.4	8.4
	6. Largest Aircraft		B737-ADV	B747 class	B747 class	B747 class	B747 class
	7. Longest Route		Jeddah	London	London	London	London
Facility Requirements	8. Runway (m x m)		R/W 04/22 2,200 x 45 R/W 18/36 1,440 x 30	3,000 x 45 (3,250 x 45)[c]	3,000 x 45 (3,250 x 45)[c]	3,000 x 45 (3,250 x 45)[c]	3,000 x 45 (3,250 x 45)[c]
	9. Runway Strip (m x m)		2,320 x 150 1,560 x 150	3,120 x 300 (3,370 x 300)[c]	3,120 x 300 (3,370 x 300)[c]	3,120 x 300 (3,370 x 300)[c]	3,120 x 300 (3,370 x 300)[c]
	10. Taxiway (m x m)		370 x 23		Parallel Taxiway Justified		
	11. Passenger Terminal Apron (gate position)		B737class:3	B747 class : 2 DC10 class : 4 F27 class : 1 7	B747 class : 2 DC10 class : 4 MD80 class : 1 F27 class : 1 8	B747 class : 2 DC10 class : 5 F27 class : 1 8	B747 class : 3 DC10 class : 5 F27 class : 1 9
	12. Passenger Terminal Building (sq. meter)	Dom.		2,800	3,400	4,500	5,600
		Int'l		21,500	25,800	31,000	36,000
		Total	2,400	24,300	29,200	35,500	41,600
	13. Cargo Terminal Building (sq. meter)		No Facility	5,600	7,500	10,100	13,200
	14. Administration Building (sq. meter)		1,500	2,700	2,700	2,700	2,700
	15. Air Navigation Systems		Instrument, Non-Precision	Instrument, Precision Approach Category - I			
	16. Car Parks (cars)		170 cars	770	930	1,120	1,330
	(sq. meter)		3,000	25,000	31,000	37,000	44,000
	17. Access Road (lane)		1 lane for each direction	1 lane for each direction	2 lanes for each direction		
	18. Fuel Supply (kl)		JET A1 51 KI	2,300	2,800	3,400	4,200
	(sq. meter)		2,100	8,500	8,500	11,000	11,000
	19. Rescue and Fire-fighting (category)		CAT. 5	CAT.8	CAT.8	CAT.8	CAT.8
	(cars)		4 cars	4 cars	4 cars	4 cars	4 cars
	(sq. meter)		590	400	400	400	400
	20. Utilities	Electricity (KVA)	400	2,500	2,900	3,400	4,000
		Water (ton/month)	5,000	18,800	22,300	27,000	31,000
		Waste Deposit (ton/month)	As of July, 1984 N.A.	80	100	120	150
	21. Airport Staff (ECAA)		168	230	270	310	360

Note : a. Estimated figure

b. Not mathematical sum of domestic and international, but overall figure of the total airport

c. New airport site

d. Excluding Transit

e. Excluding Other Flight

Table 4.1.2 Air Traffic Demand vs. Airport Facility Requirements
(International case)

	Item		Present Conditions (as of 1984)	1995	Phase I 2000	2005	Phase II 2010
Air Traffic Forecast	1. Annual Passenger [b]	Dom.	81,436 (1983)	30,000	40,000	60,000	70,000
		Int'l	1,705 (1983)	1,300,000	1,600,000	1,900,000	2,300,000
		Total	83,141 (1983)	1,330,000	1,640,000	1,960,000	2,370,000
	2. Annual Cargo(ton)	Dom.	13 (1983)	40	70	100	140
		Int'l	68 (1983)	37,000	50,000	66,000	87,000
		Total	81 (1983)	37,040	50,070	66,100	87,140
	3. Annual Aircraft Movement [c] (operation)	Dom.		710	950	540	630
		Int'l		8,720	10,080	10,610	12,160
		Total	5,526 (1983)	9,430	11,030	11,150	12,790
	4. Peak Hour [b] Passenger	Dom.					
		Int'l					
		Total	200 [a]	810	990	1,190	1,380
	5. Peak Hour [c] Aircraft Movement (operation)	Dom.					
		Int'l					
		Total	4 [a]	5.2	5.9	6.0	6.6
	6. Largest Aircraft		B737-ADV	B747 class	B747 class	B747 class	B747 class
	7. Longest Route		Jeddah	London	London	London	London
Facility Requirements	8. Runway (m x m)		R/W 04/22 2,200 x 45 R/W 18/36 1,440 x 30	3,250 x 45	3,250 x 45	3,250 x 45	3,250 x 45
	9. Runway Strip (m x m)		2,320 x 150 1,560 x 150	3,370 x 300	3,370 x 300	3,370 x 300	3,370 x 300
	10. Taxiway (m x m)		370 x 23	Only Exit Taxiways Required			Parallel Taxiway Justified
	11. Passenger Terminal Apron (gate position)		B737class:3	B747 class : 2 DC10 class : 4 F27 class : 1 7	B747 class : 2 DC10 class : 4 F27 class : 1 7	B747 class : 2 DC10 class : 5 MD80 class : 1 8	B747 class : 3 DC10 class : 5 8
	12. Passenger Terminal Building (sq. meter)	Dom.		500	500	1,300	1,300
		Int'l		21,500	25,800	31,000	36,000
		Total	2,400	22,000	26,300	32,300	37,300
	13. Cargo Terminal Building (sq. meter)		No Facility	5,600	7,500	9,900	13,000
	14. Administration Building (sq. meter)		1,500	2,700	2,700	2,700	2,700
	15. Air Navigation Systems		Instrument, Non-Precision	Instrument, Precision Approach CAtegory - I			
	16. Car Parks	(cars)	170 cars	650	790	950	1,110
		(sq. meter)	3,000	22,000	26,000	32,000	37,000
	17. Access Road (lane)		1 lane for each direction	1 lane for each direction		2 lanes for each direction	
	18. Fuel Supply	(kl)	JET A1 51 Kl	2,300	2,900	3,100	3,900
		(sq. meter)	2,100	8,500	8,500	8,500	11,000
	19. Rescue and Fire-fighting	(category)	CAT. 5	CAT. 8	CAT. 8	CAT. 8	CAT. 8
		(cars)	4 cars	4 cars	4 cars	4 cars	4 cars
		(sq. meter)	590	400	400	400	400
	20. Utilities	Electricity (KVA)	400	2,300	2,600	3,200	3,700
		Water (ton/month)	5,000	17,200	20,300	24,700	28,400
		Waste Deposit (ton/month)	As of July, 1984 N.A.	70	90	120	140
	21. Airport Staff (ECAA)		168	200	230	270	300

Note : a. Estimated figure
b. Excluding transit
c. Excluding other flight

Table 4.1.3 Air Traffic Demand vs. Airport Facility Requirements

(Domestic case)

	Item		Present Conditions (as of 1984)	1995	Phase I 2000	2005	Phase II 2010
Air Traffic Forecast	1. Annual Passenger	Dom.	81,436 (1983)	290,000	380,000	500,000	660,000
		Int'l	1,705 (1983)				
		Total	83,141 (1983)	290,000	380,000	500,000	660,000
	2. Annual Cargo(ton)	Dom.	13 (1983)	380	600	900	1,300
		Int'l	68 (1983)				
		Total	81 (1983)	380	600	900	1,300
	3. Annual Aircraft Movement (operation)	Dom.		2,900	3,450	3,730	4,590
		Int'l					
		Total	5,526 (1983)	2,900	3,450	3,730	4,590
	4. Peak Hour Passenger	Dom.		270	330	430	510
		Int'l					
		Total	200 [a]	270	330	430	510
	5. Peak Hour Aircraft Movement (operation)	Dom.		2.4	2.6	2.8	3.1
		Int'l					
		Total	4 [a]	2.4	2.6	2.8	3.1
	6. Largest Aircraft		B737-ADV	B767 class	B767 class	A300 class	A300 class
	7. Longest Route		Cairo	Aswan	Aswan	Aswan	Aswan
Facility Requirements	8. Runway (m x m)		R/W 04/22 2,200 x 45 R/W 18/36 1,440 x 30	2,200 x 45 1,440 x 30	2,200 x 45 1,440 x 30	2,200 x 45 1,440 x 30	2,200 x 45 1,440 x 30
	9. Runway Strip (m x m)		2,320 x 150 1,560 x 150	2,320 x 150 1,560 x 150	2,320 x 150 1,560 x 150	2,320 x 150 1,560 x 150	2,320 x 150 1,560 x 150
	10. Taxiway (m x m)		370 x 23	Only Exit Taxiways Required			
	11. Passenger Terminal Apron (Gate position)		B737class:3	B767 class : 2 2	B767 class : 2 F27 class : 1 3	DC10 class : 2 F27 class : 1 3	DC10 class : 2 F27 calss : 1 3
	12. Passenger Terminal Building (sq. meter)	Dom.		2,700	3,300	4,300	5,100
		Int'l					
		Total	2,400	2,700	3,300	4,300	5,100
	13. Cargo Terminal Building (sq. meter)		No Facility	30	50	80	110
	14. Administration Building (sq. meter)		1,500	1,500	1,500	1,500	1,500
	15. Air Navigation Systems		Instrument, Non-Precision	Instruement, Non-precision			
	16. Car Parks	(cars)	170 cars	220	260	340	410
		(sq. meter)	3,000	7,300	8,700	11,000	14,000
	17. Access Road (lane)		1 lane for each direction	1 lane for each direction			
	18. Fuel Supply	(kl)	JET A1 51 Kl	100	130	150	240
		(sq. meter)	2,100	2,800	2,800	2,800	3,200
	19. Rescue and Fire-fighting	(category)	CAT. 5	CAT. 6	CAT. 6	CAT. 6	CAT. 6
		(cars)	4 cars	4 cars	4 cars	4 cars	4 cars
		(sq. meter)	590	400	400	400	400
	20. Utilities	Electricity (KVA)	400	400	500	500	600
		Water (ton/month)	5,000	2,500	2,900	3,600	4,100
		Waste Deposit (ton/month)	As of July, 1984 N.A.	10	10	10	10
	21. Airport Staff (ECAA)		168	100	100	100	100

Note : a. Estimated figure

4.2 Airside Facilities and Obstacle Limitation Requirements

4.2.1 Aerodrome Reference Code and Operational Requirements

An aerodrome reference code - code number and code letter - will be established as shown in Tables 4.2.1 through 3 in accordance with the maximum aircraft anticipated. (Refer to the subsection 1.3 "Reference code" in Annex 14, Aerodromes, ICAO)

Table 4.2.1 Aerodrome Reference Code

(International and Domestic case)

Year	1995	2000	2005	2010
Code number	4	4	4	4
Code letter	E	E	E	E

Table 4.2.2 Aerodrome Reference Code

(International case)

Year	1995	2000	2005	2010
Code number	4	4	4	4
Code letter	E	E	E	E

Table 4.2.3 Aerodrome Reference Code

(Domestic case)

Year	1995	2000	2005	2010
Code number	4	4	4	4
Code letter	D	D	D	D

An operational category of the runway should be precision approach runway category-I for the International and Domestic Case and the International Case, and will be instrument - non precision approach runway for the Domestic Case.

4.2.2 Runway Length and Width

The runway length has been calculated for the critical aircraft anticipated by the demand forecast and for the longest design route i.e., Alexandria to Heathrow/London on the international route and Alexandria to Aswan in the domestic route.

The assumptions for the calculation are as follows;

Assumptions (International case)

i) Longest design route

Take-off: Alexandria —1870NM→ London --240NM→ (Alternate) Paris

Landing: London —1960NM→ Alexandria --102NM→ Cairo

Table 4.2.4 lists non-stop flight sectors from Cairo in order of distance together with respective stage distances and annual passengers. It is observed from this table that London is the furthest European city from Cairo and the second largest market in Europe on routes next to Athens. Hence, it is assumed that Alexandria will connect the Middle East and Europe in which London will be the furthest destination.

ii) Airport OAT : 30.6°C

iii) Payload: Maximum payload

iv) Elevation: Sea Level

v) Runway slope = Zero percent.

Assumptions (Domestic case)

i) Longest design route

Take-off: Alexandria —479NM→ Aswan --110NM→ Luxor

Landing: Aswan —479NM→ Alexandria --102NM→ Cairo

ii) Airport OAT : 30.6°C

Table 4.2.4 Stage Distances and Annual Passengers of Non-Stop Flight Sector from Cairo

Destination	Distance (NM)	Aircraft used by Egypt Air	Annual PAX in 1983
1) New York	4,845		101,087
2) Bangkok	4,204	MS 747	22,597
3) Accra	3,085	MS 707	3,838
4) Kano	2,407	MS 707	12,190
5) Bombay	2,344	MS 707	14,333
6) Dar Es Salaam	2,334	MS 707	10,537
7) Copenhagen	2,016	MS AB3	15,722
8) Nairobi	1,973	MS 707	27,014
9) London	1,972	MS AB3	209,354
10) Madrid	1,905	MS 707	28,952
11) Brussels	1,847	MS 707	32,863
12) Paris	1,792	MS AB3	197,124
13) Frankfurt	1,634	MS AB3	128,513
14) Geneva	1,582	MS AB3	38,283
15) Milan	1,542	MS AB3	27,302
16) Sharjah	1,524	MS 737	7,328
17) Dubai	1,517	MS AB3	67,304
18) Munich	1,503	MS 707	47,027
19) Doha	1,325	MS 707	78,383
20) Dhahran	1,245	MS AB3	N.A.
21) Sanna	1,229	MS 707	75,268
Reference Kuwait*	1,158	MS AB3	478,085
Reference Jeddah*	700	MS AB3	745,845
Reference Athens*	668	MS 737	303,582

Note: * Destinations are listed in order of distance.
After 21), destinations with relatively large amount of traffic are indicated for reference.

iii) Payload: Maximum

iv) Elevation: Sea level

v) Runway slope: Zero percent

The result of the runway length calculation is summarized in Tables 4.2.5 and 6.

Table 4.2.5 Runway Length Requirements by Aircraft

(International case)

Aircraft	Runway Field Length		
	Take-off	Landing	
		Dry	Wet
B747-300	2,430 meter	2,030 meter	2,320 meter
DC-10-30	2,420	1,890	2,160
A300-B4	3,000	1,470	2,100

Table 4.2.6 Runway Length Requirements by Aircraft

(Domestic case)

Aircraft	Runway Field Length		
	Take-off	Landing	
		Dry	Wet
A-300-B4	2,200 meter	1,470 meter	2,100 meter
B737	1,410	-	1,630

On Europe routes, more than 50 percent of all flights are presently operated by A300 which is a major aircraft of Egypt Air fleet for international service and with which Egypt Air operates Cairo-London sector. This tendency is considered to continue in the future.

3,000 meter long runway will therefore be required at Alexandria to accommodate the above condition when Alexandria-London flight service is started to

cope with air passenger demand.

It should be noted that the 3,000 m long runway is to be corrected to 3,250 m long for the new airport site, because of the corrections by runway slope (about 0.8 percent) and altitude (about 40 m).

For the domestic route, 2,200 meter long runway will be required at Alexandria to accommodate A300-B4 for the longest domestic route, i.e., Aswan with the maximum payload.

The width of the runway should be 45 m whereas the code letter of the runway is 4D/4E. (Refer to section 4.2.1).

4.2.3 Runway Strip

The runway strip should be 3,120 m x 300 m (3,370 m x 300 m for new airport site) for International and Domestic Case, and 2,320 m x 150 m for Domestic Case.

4.2.4 Obstacle Limitation Requirements

The operational category of the runway has been established as "Precision approach category-I" for International and Domestic case and International case, and "Non-precision approach" for Domestic case.

The aerodrome reference code is "4D/4E" for International and Domestic case and International case, and "4D" for Domestic case.

The dimensions and slopes of the obstacle limitation surfaces are shown in Figs. 4.2.1 and 2, and Tables 4.2.7 and 8.

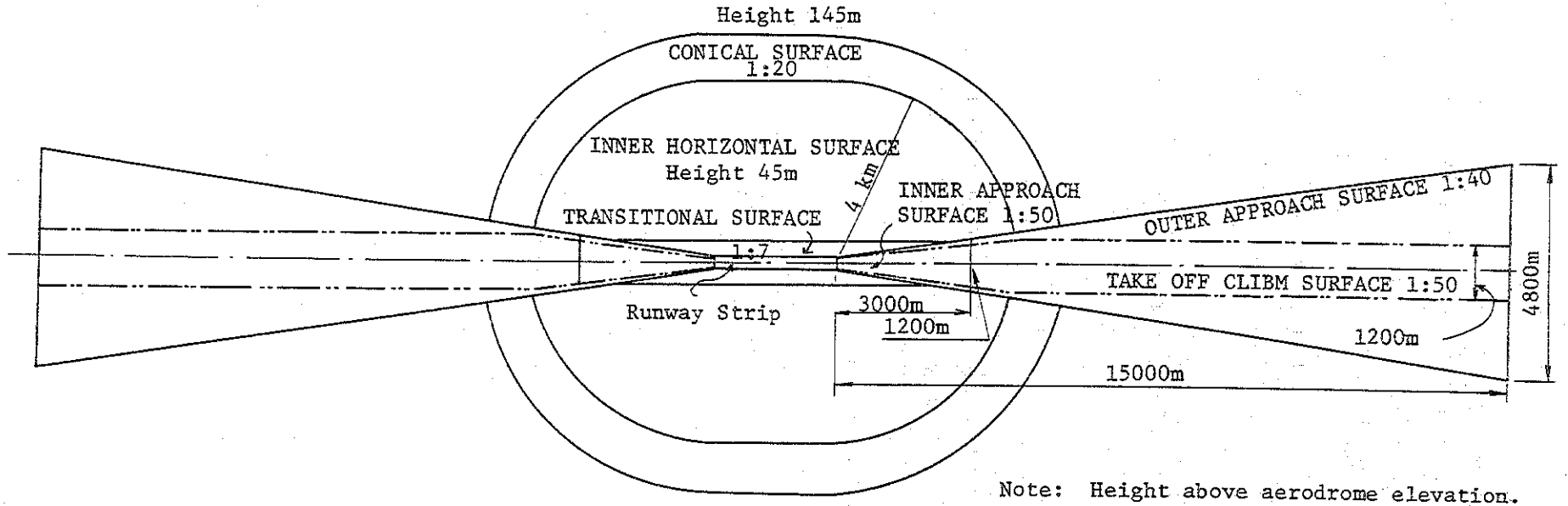


Fig. 4.2.1 Obstacle Limitation Surfaces (1)

(International and Domestic case, and International case)

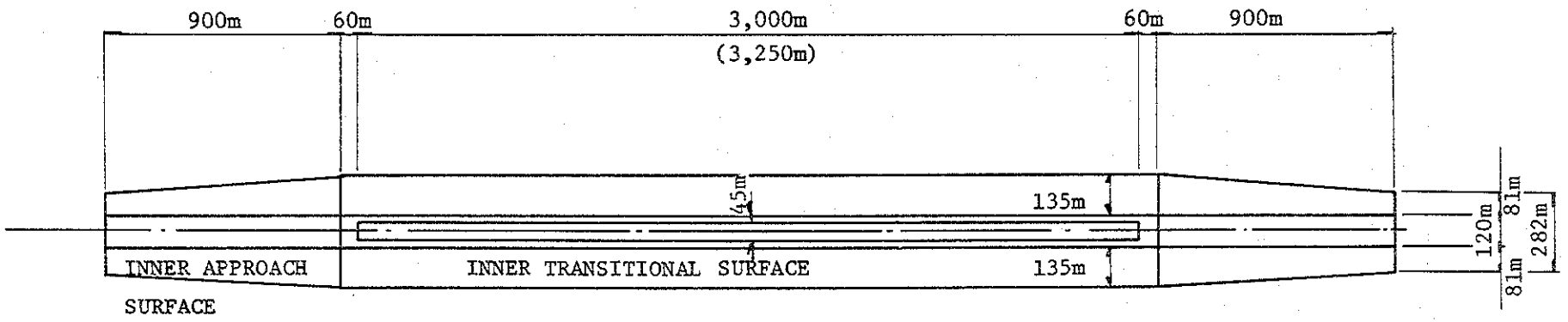


Fig. 4.2.2 Obstacle Limitation Surfaces (2)

(International and Domestic case, and International case)

Table 4.2.7 Dimensions and Slopes of Obstacle Limitation Surfaces

Surface and dimensions[a]	Runway classification									
	Non-instrument				Non-precision approach			Precision approach category I		Precision approach category II or III
	Code number				Code number			Code number		Code number
	1	2	3	4	1,2	3	4	1,2	3,4	3,4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONICAL										
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height	35 m	55 m	75 m	100 m	60 m	75 m	100 m	60 m	100 m	100 m
INNER HORIZONTAL										
Height	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m
Radius	2 000 m	2 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m
INNER APPROACH										
Width	–	–	–	–	–	–	–	90 m	120 m	120 m
Distance from threshold	–	–	–	–	–	–	–	60 m	60 m	60 m
Length	–	–	–	–	–	–	–	900 m	900 m	900 m
Slope								2.5%	2%	2%
APPROACH										
Length of inner edge	60 m	80 m	150 m	150 m	150 m	300 m	300 m	150 m	300 m	300 m
Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m
Divergence (each side)	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%
First section										
Length	1 600 m	2 500 m	3 000 m	3 000 m	2 500 m	3 000 m	3 000 m	3 000 m	3 000 m	3 000 m
Slope	5%	4%	3.33%	2.5%	3.33%	2%	2%	2.5%	2%	2%
Second section										
Length	–	–	–	–	–	3 600 m[b]	3 600 m[b]	12 000 m	3 600 m[b]	3 600 m[b]
Slope	–	–	–	–	–	2.5%	2.5%	3%	2.5%	2.5%
Horizontal section										
Length	–	–	–	–	–	8 400 m[b]	8 400 m[b]	–	8 400 m[b]	8 400 m[b]
Total length	–	–	–	–	–	15 000 m	15 000 m	15 000 m	15 000 m	15 000 m
TRANSITIONAL										
Slope	20%	20%	14.3%	14.3%	20%	14.3%	14.3%	14.3%	14.3%	14.3%
INNER TRANSITIONAL										
Slope	–	–	–	–	–	–	–	40%	33.3%	33.3%
BALKED LANDING SURFACE										
Length of inner edge	–	–	–	–	–	–	–	90 m	120 m	120 m
Distance from threshold	–	–	–	–	–	–	–	[d]	1 800 m[c]	1 800 m[c]
Divergence (each side)	–	–	–	–	–	–	–	10%	10%	10%
Slope	–	–	–	–	–	–	–	4%	3.33%	3.33%
							A		B	

a. All dimensions are measured horizontally unless specified otherwise.
b. Variable length (see 4.2.9 or 4.2.17).
c. Or end of runway whichever is less.
d. Distance to the end of strip.

(Source: Annex 14 - Aerodromes)

Note: A. Domestic case

B. International and Domestic case, and International case

Table 4.2.8 Take-off Runways

Surface and dimensions[a]	Code number		
	1	2	3 or 4
(1)	(2)	(3)	(4)
TAKE-OFF CLIMB			
Length of inner edge	60 m	80 m	180 m
Distance from runway end[b]	30 m	60 m	60 m
Divergence (each side)	10%	10%	12.5%
Final width	380 m	580 m	1 200 m 1 800 m[c]
Length	1 600 m	2 500 m	15 000 m
Slope	5%	4%	2%[d]

C

a. All dimensions are measured horizontally unless specified otherwise.
b. The take-off climb surface starts at the end of the clearway if the clearway length exceeds the specified distance.
c. 1 800 m when the intended track includes changes of heading greater than 15° for operations conducted in IMC, VMC by night.
d. See 4.2.24 and 4.2.26.

(Source Annex 14 - Aerodromes)

Note C: For all cases

4.2.5 Taxiway

A complete parallel taxiway with perpendicular exit taxiways may be justified when the number of instrument approaches exceed four instrument approaches during the peak hour and the operation of wide bodied jet aircraft becomes more frequent.

Table 4.2.9 Parallel Taxiway Requirements

Case	1995	2000	2005	2010
International and Domestic case	-	Parallel taxiway justified		
International case	-	-	-	Parallel taxiway justified
Domestic case	-	-	-	-

4.2.6 Apron

(1) Calculation Method for Required Number of Aircraft Stands

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

$$S = \sum_{i}^{n} \left(\frac{Ti}{60} \times Ni\right) + \alpha$$

Where S: Required number of aircraft stands

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

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

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

(2) Classification of Aircraft

Apart from the aircraft classification by seating capacity, the classifications as shown in Table 4.2.10 are made for the planning of aircraft parking area taking into account wing span, overall length, etc. of aircraft dimensions (Table 4.2.11).

Not only Egypt Air fleet but also foreign fleet are taken into consideration for the classifications for apron.

Table 4.2.10 Aircraft Classifications for Apron

(meter)

Category	Classification	Wing Span	Overall Length
JUMBO	B-747	60	70
LJ MJ	DC-10, L-1011, A-300 B-767, A-310	50	56
NJ SJ	B-757, MD80 B-727, B-737	38	47
P	F-27	29	25

Table 4.2.11 Size of Aircraft

(meter)

Aircraft Model	Wing Span	Overall Length	Height
B-747	59.6	70.5	19.3
DC-10	50.4	55.5	17.4
L-1011	47.4	54.2	16.9
A-300	44.8	53.6	16.5
B-767-200	47.2	48.5	15.9
B-707-320	44.4	46.6	12.9
A-310-200	43.9	46.7	15.8
B-757	38.0	47.3	13.6
B-727-200	32.9	46.7	10.5
B-737-300	28.9	33.4	11.1
A-320	34.5	37.4	11.8
B-737-200	28.4	30.5	11.3
F-27	29.0	25.1	8.7

(3) Gate Occupancy Time

Table 4.2.12 shows the gate occupancy time by aircraft, which is estimated by the actual parking time of aircraft in Egypt. The gate occupancy time for planning includes a margin for delay.

Table 4.2.12 Gate Occupancy Time

(Minute)

Aircraft		Actual Gate Occupancy Time [1]		Gate Occupancy Time for Planning	
		INT'L	DOM	INT'L	DOM
JUMBO	B-747	90	-	100	55
L J	A-300	90	45		
M J	B-767	90	-		
NJ		-	-	50	35
S J	B-737	40	15		
P	F 27	-	15		

Note 1) Based on the time table of Egypt Air excluding Cairo International Airport.

(4) Clearance between Aircraft

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

(5) Required Number of Aircraft Stands

The number of stands has been calculated based on the aforementioned assumptions and is summarized in Tables 4.2.13 through 15.

Table 4.2.13 Required Number of Aircraft Stands

(International and Domestic case)

YEAR	JUMBO	LJ/MJ	NJ/SJ	P	TOTAL
1995	2	4		1	7
2000	2	4	1	1	8
2005	2	5		1	8
2010	3	5		1	9

Table 4.2.14 Required Number of Aircraft Stands

(International case)

YEAR	JUMBO	LJ/MJ	NJ/SJ	P	TOTAL
1995	2	4		1	7
2000	2	4		1	7
2005	2	5		1	8
2010	3	5		1	9

Table 4.2.15 Required Number of Aircraft Stands

(Domestic case)

YEAR	JUMBO	LJ/MJ	NJ/SJ	P	TOTAL
1995		2			2
2000		2		1	3
2005		2		1	3
2010		2		1	3

4.3 Buildings

4.3.1 Passenger Terminal Building

The floor area required for the passenger terminal building has been calculated at 5 year intervals by multiplying the number of hourly peak passengers by the unit floor area.

For a domestic passenger terminal, the unit floor area is 9 to 11 sq.m per peak hour passenger by the planning value mainly used in Japan. An international passenger terminal requires C.I.Q (Customs, Immigration and Quarantine) facilities and larger passenger amenities compared to a domestic passenger terminal. The unit floor area of 25 sq.m is the planning practice for the international passenger terminal.

Accordingly, the unit floor area of 10 sq.m per peak hour passenger and 25 sq.m are applied for domestic passenger terminal building and international passenger terminal building, respectively.

Tables 4.3.1 through 3 show the required floor area for the passenger terminal building.

Table 4.3.1 Floor Area Requirements for Terminal Building

(International and Domestic case)

Terminal	Item	1995	2000	2005	2010
Domestic	Peak hour passenger (Persons)	280	340	450	560
	Required Floor area (sq.meter)	2,800	3,400	4,500	5,600
International	Peak hour passenger (persons)	860	1,030	1,240	1,440
	Required floor area (sq.meter)	21,500	25,800	31,000	36,000
Total floor area (sq.meter)		24,300	29,200	35,500	41,600

Table 4.3.2 Floor Area Requirements for Terminal Building

(International case)

Terminal	Item	1995	2000	2005	2010
Domestic	Peak hour passenger (Persons)	50	50	130	130
	Required Floor area* (sq.meter)	(500)	(500)	(1,300)	(1,300)
International	Peak hour passenger (persons)	860	1,030	1,240	1,440
	Required floor area (sq.meter)	21,500	25,800	31,000	36,000
Total floor area (sq.meter)		22,000	26,300	32,300	37,300

Note* Minimum floor area required accommodate passengers of one aircraft.

Table 4.3.3 Floor Area Requirements for Terminal Building

(Domestic case)

Terminal	Item	1995	2000	2005	2010
Domestic	Peak hour passenger (Persons)	270	330	430	510
	Required Floor area (sq.meter)	2,700	3,300	4,300	5,100
International	Peak hour passenger (persons)	-	-	-	-
	Required floor area (sq.meter)	-	-	-	-
Total floor area (sq.meter)		2,700	3,300	4,300	5,100

4.3.2 Cargo Terminal Building

The floor area for a cargo terminal building has been calculated at 5 year intervals by multiplying the forecast annual cargo volume by the unit cargo handing capacity.

Cargo handling capacity of 10 ton/sq.m will be applied for international cargo handling. For domestic cargo handling, 20 ton/sq.m will be applied.

The floor area of the cargo terminal building is usually required to be 1.5 times that of the cargo handling area, in order to accommodate the office area of airlines, cargo agents, etc.

Tables 4.3.4 through 6 show the required floor area for the cargo terminal building.

Table 4.3.4 Cargo Terminal Building Requirements
(International and Domestic case)

Item \ Year		1995	2000	2005	2010
Annual Cargo Volume (ton/year)	Dom.	420	670	1,000	1,400
	Int'l	37,000	50,000	66,000	87,000
Cargo Handling Area (sq.meter)		3,700	5,000	6,700	8,800
Cargo Terminal Building (sq.meter)		5,600	7,500	10,100	13,200

Table 4.3.5 Cargo Terminal Building Requirements
(International case)

Item \ Year		1995	2000	2005	2010
Annual Cargo Volume (ton/year)	Dom.	40	70	100	140
	Int'l	37,000	50,000	66,000	87,000
Cargo Handling Area (sq.meter)		3,700	5,000	6,600	8,700
Cargo Terminal Building (sq.meter)		5,600	7,500	9,900	13,100

Table 4.3.6 Cargo Terminal Building Requirements
(Domestic case)

Item \ Year	1995	2000	2005	2010
Annual Cargo Volume (ton/year)	380	600	900	1,300
Cargo Handling Area (sq.meter)	20	30	50	70
Cargo Terminal Building (sq.meter)	30	50	80	110

4.3.3 Administration Building and Control Tower

An independent administration building with a control tower is required for the airport administration, operation and maintenance.

The required floor area is shown in Table 4.3.7 in light of the planning practices used in Japan.

Table 4.3.7 Required Floor Area for Administration Building

(Unit: sq.meter)

Case	1995	2000	2005	2010
International and Domestic case	2,700	2,700	2,700	2,700
International case	2,700	2,700	2,700	2,700
Domestic case	1,500	1,500	1,500	1,500

A control tower cab with a floor area of about 60 sq.m will be necessary for air traffic controllers and control consoles. The height of the tower cab will be set at 20 to 25 m (depending on the tower location) based on FAA standards.

4.4 Landside Facilities

4.4.1 Car Parking

The following formula is used to calculate the required number of parking spaces.

$$V = P \times C$$

Where, V: Required number of parking spaces
P: Number of peak hour passengers
C: Number of parking spaces per peak hour passenger (0.7 by survey)

The required number of parking spaces is calculated based upon the result of the site survey at Nozha, which resulted in C = 0.7 (79 parked cars per 114 passengers) for cars and C=0.1 for taxis. Tables 4.4.1 through 3 show the requirements for car parking space.

Table 4.4.1 Parking Lot Requirements
(International and Domestic case)

Item	1995	2000	2005	2010
Number of Parking Lots for cars	670	810	980	1,160
Number of Parking Lots for taxis	100	120	140	170
Total	770	930	1,120	1,330
Required space (sq.m)	25,000	31,000	37,000	44,000

Table 4.4.2 Parking Lot Requirements
(International case)

Item	1995	2000	2005	2010
Number of Parking Lots for cars	570	690	830	970
Number of Parking Lots for taxis	80	100	120	140
Total	650	790	950	1,110
Required space (sq.m)	22,000	26,000	32,000	37,000

Table 4.4.3 Parking Lot Requirements

(Domestic case)

Item	1995	2000	2005	2010
Number of Parking Lots for cars	190	230	300	360
Number of Parking Lots for taxis	30	30	40	50
Total	220	260	340	410
Required space (sq.m)	7,300	8,700	11,000	14,000

4.4.2 Access Road

The required number of lanes for access roads is calculated by incoming and outgoing traffic from/to the airport terminal area. The generated car traffic is established to be 1 car per peak hour passenger.

The maximum capacity of an access road is usually considered to be approx. 1,000 cars/hour for 1 lane (each direction) and approx. 4,000 cars/hour for 2 lanes (each direction).

Tables 4.4.4 through 6 show the required number of lanes for the access road.

Table 4.4.4 Required Number of Lane

(International and Domestic case)

Item	1995	2000	2005	2010
Peak hour Passengers	950	1,160	1,400	1,650
Number of cars generated	950	1,160	1,400	1,650
Number of lanes (each direction)	1	2	2	2

Table 4.4.5 Required Number of Lane

(International case)

Item	1995	2000	2005	2010
Peak hour Passengers	810	990	1,190	1,380
Number of cars generated	810	990	1,190	1,380
Number of lanes (each direction)	1	1	2	2

Table 4.4.6 Required Number of Lane

(Domestic case)

Item	1995	2000	2005	2010
Peak hour passengers	270	330	430	510
Number of cars generated	270	330	430	510
Number of lanes (each direction)	1	1	1	1

4.5 Air Navigation Systems

Air navigation systems include radio navigation aids, air traffic control system, aeronautical telecommunications system, visual aids and meteorological system.

Air navigation systems should be designed to meet the operational requirements as follows, and to be sufficient to handle the forecast aircraft movements in safe and effective manner.

Table 4.5.1 Operational Requirements

Case	1995	2000	2005	2010
International and Domestic case	Instrument, Precision approach Cat.-I			
International case	Ditto			
Domestic case	Instrument, Non-precision approach			

4.6 General Services

4.6.1 Rescue and Fire-Fighting Station

The facility requirements for the rescue and fire-fighting services are estimated in compliance with the ICAO AIRPORT SERVICE MANUAL, Part I.

The facilities are calculated and tabulated in Tables 4.6.1 through 3. Airport category is determined by the largest aircraft movements for the busiest consecutive 3 months of the year.

Table 4.6.1 Required Fire-Fighting Facilities

(International and Domestic case)

Item	1995	2000	2005	2010
Airport Category	8	8	8	8
Extinguishing Agents				
- Water for Aqueous Film Forming Foam Production (ℓ)	18,200	18,200	18,200	18,200
- Dry Chemical Powders (kg), or	450	450	450	450
- CO_2 (kg)	900	900	900	900
Vehicles	4	4	4	4
- Rapid Intervention Vehicle	(1)	(1)	(1)	(1)
- Major vehicle	2	2	2	2
- Ambulance	1	1	1	1
- Command Car	1	1	1	1
Floor Space (sq.m)	400	400	400	400

Table 4.6.2 Required Fire-Fighting Facilities

(International case)

Item	1995	2000	2005	2010
Airport Category	8	8	8	8
Extinguishing Agents				
- Water for Aqueous Film Forming Foam Production(ℓ)	18,200	18,200	18,200	18,200
- Dry Chemical Powders (kg), or	450	450	450	450
- CO_2 (kg)	900	900	900	900
Vehicles	4	4	4	4
- Rapid Intervention Vehicle	(1)	(1)	(1)	(1)
- Major vehicle	2	2	2	2
- Ambulance	1	1	1	1
- Command Car	1	1	1	1
Floor Space (sq.m)	400	400	400	400

Table 4.6.3 Required Fire-Fighting Facilities

(Domestic case)

Item	1995	2000	2005	2010
Airport Category	6	6	6	6
Extinguishing Agents				
- Water for Aqueous Film Forming Foam Production(ℓ)	7,900	7,900	7,900	7,900
- Dry Chemical Powders (kg), or	225	225	225	225
- CO_2 (kg)	450	450	450	450
Vehicles	4	4	4	4
- Rapid Intervention Vehicle	(1)	(1)	(1)	(1)
- Major vehicle	2	2	2	2
- Ambulance	1	1	1	1
- Command Car	1	1	1	1
Floor Space (sq.m)	400	400	400	400

4.6.2 Aviation Fuel

The daily fuel consumption is accumulated by multiplying the trip fuel including that for an alternate airport, by the number of departing aircraft in respective type. The required fuel storage capacity is estimated as tabulated in tables 4.6.4 through 6 on the condition that the airport is provided with one week storage capacity.

Table 4.6.4 Aviation Fuel Storage Requirement

(International and Domestic case)

Item	1995	2000	2005	2010
Daily Fuel Consumption (kl)	330	400	490	590
7 days storage capacity (kl)	2,300	2,800	3,400	4,200
Area required	8,500	8,500	11,000	11,000

Table 4.6.5 Aviation Fuel Storage Requirement

(International case)

Item	1995	2000	2005	2010
Daily Fuel Consumption (kl)	330	410	450	550
7 days storage capacity (kl)	2,300	2,900	3,100	3,900
Area required	8,500	8,500	8,500	11,000

Table 4.6.6 Aviation Fuel Storage Requirement

(Domestic case)

Item	1995	2000	2005	2010
Daily Fuel Consumption (kl)	14	19	22	34
7 days storage capacity (kl)	100	130	150	240
Area required	2,800	2,800	2,800	3,200

4.7 Airport Utilities

The airport utilities requirements are calculated based on the unit demand established here as shown in Table 4.7.1.

Table 4.7.1 Unit Demand

Utilities	Unit demand/m^2		
Electricity	Passenger Terminal Building	:	100 VA/m^2
	Cargo Terminal Building	:	60 VA/m^2
	Administration Building	:	80 VA/m^2
	Equipment	:	Calculated by Equipment
Water	Passenger Terminal Building	:	0.023 ton/m^2/day
	Cargo Terminal Building	:	0.003 ton/m^2/day
	Administration Building and others	:	0.01 ton/m^2/day
Waste	Passenger Terminal Building	:	0.072 Kg/m^2/day
	Cargo Terminal Building	:	0.144 Kg/m^2/day
	Administration Building and others	:	0.024 Kg/m^2/day

(Source: Average unit demand of airports in Japan.)

Tables 4.7.2 through 4 show the demand of public utilities.

Table 4.7.2 Airport Utilities Demand

(International and Domestic case)

Utilities	1995	2000	2005	2010
Electricity Demand (KVA)	2,500	2,900	3,400	4,000
Water Demand (ton/month)	18,800	22,300	27,000	31,000
Waste Deposit (ton/month)	80	100	120	150

Table 4.7.3 Airport Utilities Demand

(International case)

Utilities	1995	2000	2005	2010
Electricity Demand (KVA)	2,300	2,600	3,200	3,700
Water Demand (ton/month)	17,200	20,300	24,700	28,400
Waste Deposit (ton/month)	70	90	120	140

Table 4.7.4 Airport Utilities Demand

(Domestic case)

Utilities	1995	2000	2005	2010
Electricity Demand (KVA)	400	500	500	600
Water Demand (ton/month)	2,500	2,900	3,600	4,100
Waste Deposit (ton/month)	10	10	10	10

4.8 Airport Organization

Number of airport employee is estimated based on the annual number of passengers applying the following formula:

$$Y = 2.8955 X^{0.71178}$$

Herein X : Passengers (1,000)
Y : Airport Employees

Table 4.8.1 Number of ECAA Staff

(International and Domestic case)

Item	1995	2000	2005	2010
Annual Passengers (x1,000)	1,670	2,100	2,590	3,160
Number of Airport Employee	570	670	780	900
Number of ECAA Staff	230	270	310	360

Table 4.8.2 Number of ECAA Staff

(International case)

Item	1995	2000	2005	2010
Annual Passengers (x1,000)	1,380	1,720	2,090	2,500
Number of Airport Employee	500	580	670	760
Number of ECAA Staff	200	230	270	300

Table 4.8.3 Number of ECAA Staff

(Domestic case)

Item	1995	2000	2005	2010
Annual Passengers (x1,000)	290	380	500	660
Number of Airport Employee	160	200	240	290
Number of ECAA Staff	100	100	100	100

PART III SELECTION OF ALTERNATIVE PLANS

CHAPTER 5 EVALUATION OF NOZHA AIRPORT

CHAPTER 5 EVALUATION OF NOZHA AIRPORT

5.1 General

Table 5.1.1 summarizes the results of the evaluation of the major existing facilities and the anticipated time of saturation when the existing facilities reach their respective capacities.

Although the saturation time varies on the facilities, the following points can be observed from Table 5.1.1.

- Most pavements will require overlay before introduction of A-300 in 1988.
- Passenger terminal building requires immediate improvement for the present needs.
- Other facilities will require improvement necessary for accommodation of A-300 non-stop flights between Alexandria and London which are expected in 1989.

In order to overcome the above capacity deficiency and meet the requirements in 1990's without any restraint, Nozha airport will require substantial redevelopment including extension of the runway to 3,000 m, new terminal complex, etc. This redevelopment is termed Phase-I development and is considered to be completed at earliest at the end of 1991 taking into account the period required for budgeting, design construction, etc. Therefore, it was studied in Section 5.9 to determine how most economically to accommodate the increasing traffic demand as much as possible during the transitional period until the inauguration of Phase-I development.

As indicated in Table 5.1.2, it is considered economically reasonable to stretch the structural capacity of the terminal building up to the equivalent level of the aircraft parking capacity of the existing apron and to accommodate an unrestrained domestic passenger volume of 250,000 and international passengers of 400,000 on short-haul major routes including Jeddah, Amman, Kuwait and Baghdad. (Note: the longer hauls would require a runway extension.)

Table 5.1.1 Anticipated Time of Saturation of the Existing Facilities

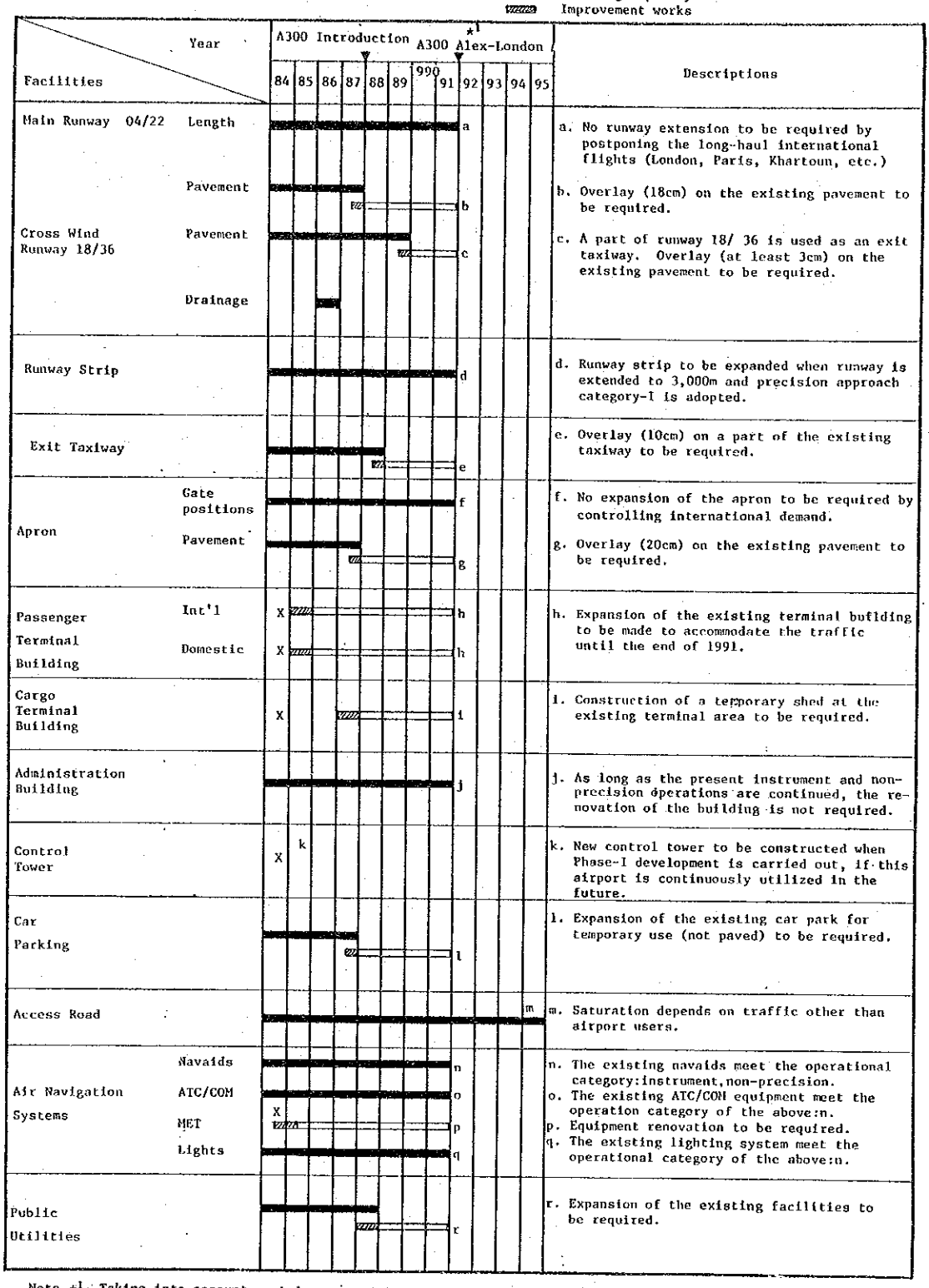
X = Already out of capacity
Existing capacity

Facilities	Year	84	85	86	87	88	89	90	91	92	93	94	95	Descriptions
		A300 Introduction				A300 Alex-London		1990						
Main Runway 04/22	Length						a							a. Runway extension to 3,000m to be necessary when Alexandria - London flight by A300-B4 be inaugurated.
	Pavement				b									b. Aircraft movement will exceed the repetition of design load for the existing pavement.
Cross Wind Runway 18/36	Pavement						c							c. A part of runway 18/36 to be used as an exit taxiway from the main runway. Overlay to be required by 1989.
Runway Strip							d							d. Runway strip to be expanded when runway is extended to 3,000m and precision approach category-I is adopted.
Exit Taxiway	Pavement					e								e. Aircraft movements will exceed the repetition of design load for the pavement.
Apron	Gate positions						f							f. Apron expansion to be required when 3 gate positions for LJ/MJ become necessary.
	Pavement				g									g. Aircraft movements will exceed the repetition of design load for the existing pavement.
Passenger Terminal Building	Int'l	X	h											h. The passenger terminal building is not sufficient for the present needs. Check-in lobby, departure hall, domestic gate lounge etc. are to be expanded.
	Domestic	X	h											
Cargo Terminal Building		X	i											i. No facility at present.
Administration Building							j							j. Renovation to be necessary to accommodate equipment for precision approach category-I.
Control Tower		X	k											k. Control tower does not meet the siting requirements.
Car Parking						l								l. Expansion to be necessary for the increasing demand.
Access Road													m	m. Saturation depends on traffic other than airport users
Air Navigation Systems	Navaids						n							n. Additional navaids (ILS, etc.) to be required for category-I operation.
	ATC/COM						o							o. Additional equipment to be required for category-I operation.
	MET	X	p											p. Equipment renovation to be required.
	Lights						q							q. Relocation of ALS/SALS and extension of runway edge lights to be required.
Public Utilities							r							r. Utilities demands will exceed the existing capacity.

Note : Besed on the demand forecast in Chapter 3, it is estimated that A300 will be introduced for domestic service in 1988 and Alexandria-London route will be inaugurated by A300 in 1989. Precision approach Category-I is considered to be a standard requirement for the international service.

Table 5.1.2 Necessary Improvement Works During the Transition Period

(Without Project Case) X Already out of capacity; Existing capacity; Improvement works



Note *1: Taking into account period required for budgeting, design, construction, etc. for the substantial development which is required to accommodate the anticipated international demands without any restraint, an accommodation of Alex-London flight is planned to be postponed to 1992 and accommodation of international demands is limited to major routes until 1992 which is the earliest possible inauguration time of the above major development.

The existing Nozha airport with the immediate improvement works necessary for the above is defined to be "Without Project Case (WOP)" in this Study.

The immediate improvement works will include the following works:

- Pavement overlay (18 cm) on the main runway 04/22
- Pavement overlay (at least 3 cm) on part of the cross-wind runway
- Pavement overlay (10 cm) on part of the existing taxiway
- Pavement overlay on the apron
- Expansion of the passenger terminal building
- Construction of a temporary shed for a cargo terminal building
- Expansion of the car parking area for temporary use (not-paved)

5.2 Airside Facilities

5.2.1 Runways

Nozha airport now has two intersecting runways. The extension of the main runway to 2,200 m was completed in 1983. The dimensions of the existing runways are shown in Table 5.2.1.

Table 5.2.1 Dimensions of the Existing Runways

Runway	Runway Designation	True Bearing	Dimensions	Pavement Strength
Main Runway	04/22	045 /225	2,200^{m} x 45^{m}	LCN49
Cross-wind Runway	18/36	178 /358	1,440^{m} x 30^{m}	LCN29

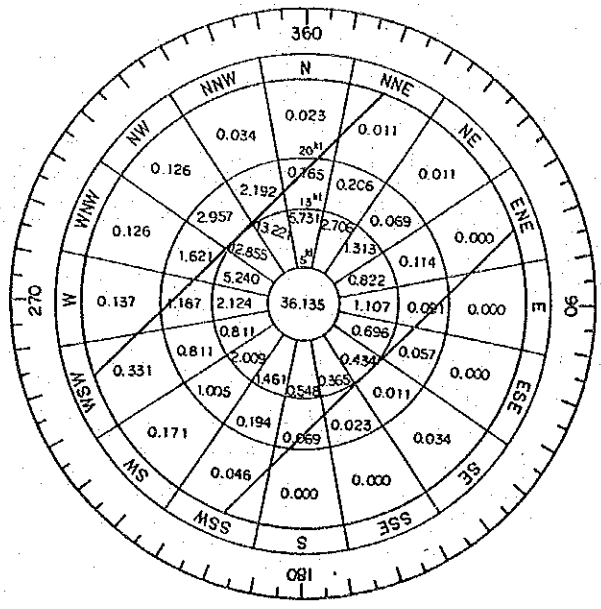
The largest aircraft operated at Nozha airport is at present B-737-200 Advanced (RWY04/22).

The existing cross-wind coverages have been analyzed based on 3 years data (1981-1983) observed at Nozha airport, and the results are shown in Table 5.2.2. The cross-wind coverages are shown in Figs. 5.2.1 through 6.

Table 5.2.2 Cross-wind Coverage of the Existing Runways

Runway	Cross-wind Coverage	
	Cross-wind Component less than 13kt	Cross-wind Component less than 20kt
Runway 04/22	92.6%	99.7%
Runway 18/36	94.5%	99.4%
Runway 04/22 and Runway 18/36	97.2%	99.9%

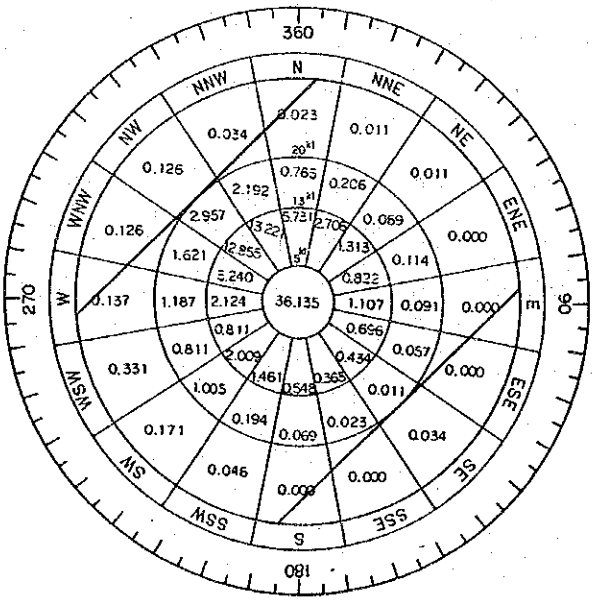
(JICA Analysis)



Location: Nozha airport
Period : 1981-1983 (3 years)
RWY Direction: N 45°30'E
Wind coverage: 92.6% (cross-wind 13kt)

Fig. 5.2.1 Wind Coverage Map of RWY04/22

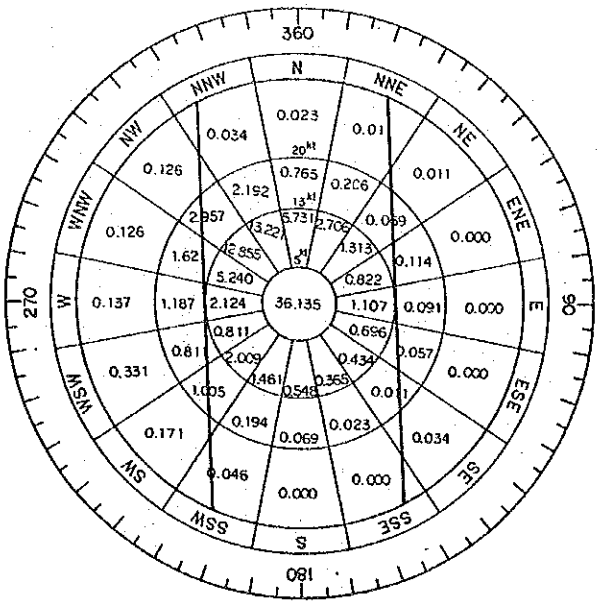
(Cross-wind component less than 13kt)



Location: Nozha airport
Period : 1981-1983 (3 years)
RWY Direction: N 45°30'E
Wind coverage: 99.7% (cross-wind 20kt)

Fig. 5.2.2 Wind Coverage Map of RWY04/22

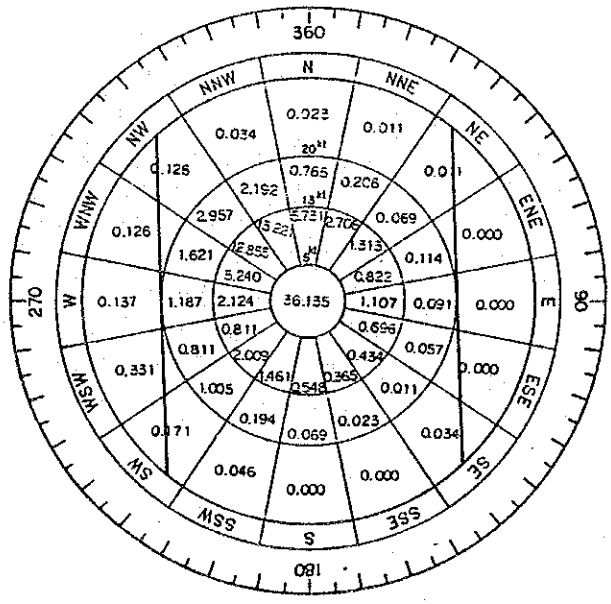
(Cross-wind component less than 20kt)



Location: Nozha airport
Period : 1981-1983 (3 years)
RWY Direction: N 178°10'E
Wind coverage: 94.5% (cross-wind 13kt)

Fig. 5.2.3 Wind Coverage Map of RWY 18/36

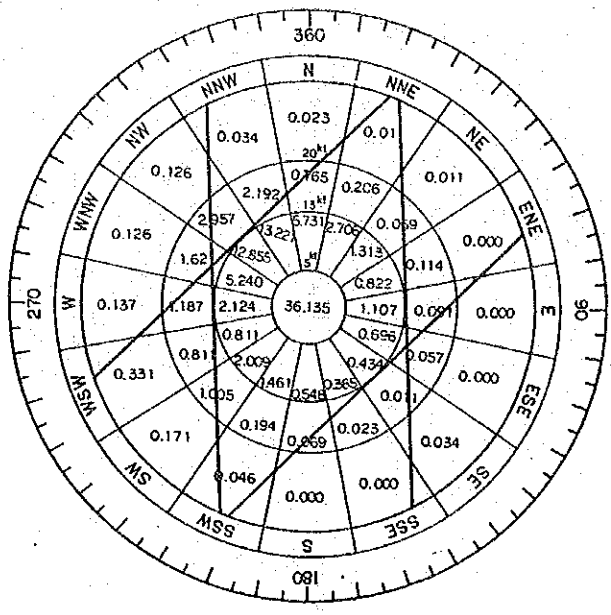
(Cross-wind component less than 13kt)



Location: Nozha airport
Period : 1981-1983 (3 years)
RWY Direction: N 178°10'E
Wind coverage: 99.4% (cross-wind 20kt)

Fig. 5.2.4 Wind Coverage Map of RWY 18/36

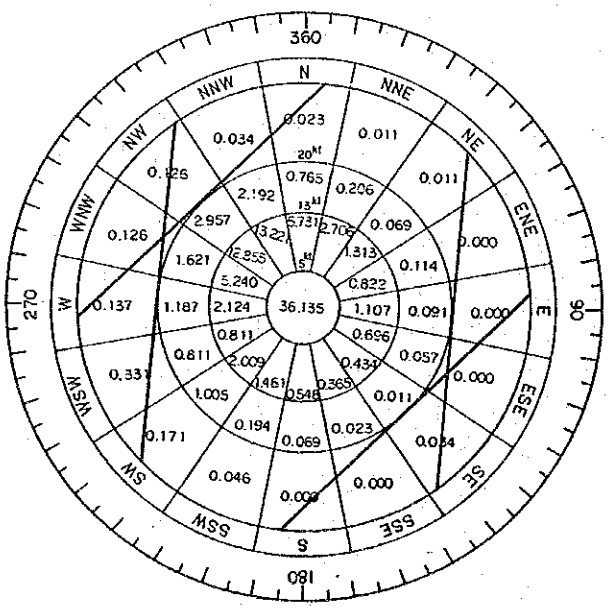
(Cross-wind component less than 20kt)



Location: Nozha airport
Period : 1981-1983 (3 years)
RWY Direction: N 45°30'E + N 178°10'E
Wind coverage: 97.2% (cross-wind 13kt)

Fig. 5.2.5 Wind Coverage Map of RWY 04/22 and RWY 18/36

(Cross-wind component less than 13kt)



Location: Nozha airport
Period : 1981-1983 (3 years)
RWY Direction: N 45°30'E + N 178°10'E
Wind coverage: 99.9% (cross-wind 20kt)

Fig. 5.2.6 Wind Coverage Map of RWY 04/22 and RWY 18/36

(Cross-wind component less than 20kt)

ICAO recommends that "the number and orientation of runways at an aerodrome should be such that the usability factor of the aerodrome is not less than 95 percent for the aeroplanes that the aerodrome is intended to serve." (Aerodromes, Annex-14).

The 13kt cross-wind coverage of runways 04/22 and 18/36 is less than 95 percent, for a cross-wind component not exceeding 13kt. Therefore both the runways are required for accommodation of F-27 class and smaller aircraft.

The cross-wind coverage of runway 04/22 meets the operational requirements for B-737 and the larger jet aircraft from the viewpoint of wind coverage.

The length of the existing main runway 04/22 will meet field length requirements for non-stop flights of A300-B4 to Cairo, Luxor, Aswan, Amman, Athens, Baghdad Jeddah, Kuwait, etc., with the limited payload which does not practically reduce the passenger seat. The introduction of non-stop flight to London by A300-B4 requires the extension of the main runway to 3,000 m.

The pavement strength is not sufficient for the aircraft movement (B-737-ADV and F-27) anticipated in the year 1986 before the introduction of A300-B4 for domestic flights. Thus, pavement overlay works will be required for the main runway.

The cross-wind runway 18/36 can be used only for non-instrument runway, and no take-off procedures by aircraft larger than DHC-5D and F-27 are permitted for the runway 36, since many obstructions which can not be removed easily protrude upon the approach surface of instrument approach runway.

5.2.2 Runway Strip

The existing runway strip is established for non-instrument runway and has a width of 75 m on each side of the runway center line. The width of the runway strip should be extended to a distance of 150 m on each side of the runway center line when the runway is extended to 3,000 m and the precision approach category-I operation is planned. Although the existing terrain mostly meets the grading requirements of the strip for precision approach category-I, fill of ditches, removal of obstructions, etc. will be necessary.

5.2.3 Taxiways

Nozha airport has two exit taxiways which connect runway 22 and runway 18 thresholds to the apron. The width of taxiways is 23 m and the pavement strength is LCN49. There is no parallel taxiway at present. Therefore, aircraft turn around using the turn-pad at the end of the runway.

It is evaluated that the existing pavement can bear aircraft movements up to the year 1987 and thereafter pavement overlay works will be required for the traffic anticipated.

5.2.4 Apron

The existing apron has a total area of 38,260 sq.m. Three angle-out parking positions for B737 and one heliport with dimension of 30 m by 30 m are provided on the apron. However, one of the above three B737 positions at the east end is usually used by helicopters and smaller aircraft. Thus, the existing heliport is not used at present. The capacity of the existing apron can be increased as planned in Fig. 5.9.2 in order to accommodate two A300 class aircraft and four B737. This layout can handle the traffic up to around 1989.

Aircraft loads will exceed the capacity of the existing pavement around 1987 and thus, asphalt overlay will be necessary.

5.3 Obstacle Limitation Surfaces and Aircraft Operations

5.3.1 Obstacle Limitation Surfaces

Figs. 5.3.1 and 2 show the existing obstacles and the limitation surfaces. The lamp posts along the desert road at the southwest of runway 04 threshold, and the trees at northeast of runway 22 threshold which protrude upon 1:50 approach surfaces and take-off climb surfaces should be removed as soon as possible in order to ensure safe aircraft operations of the present B737-ADV and F-27 (Non-precision approach).

For the cross-wind runway, the mosque, the trees in the palace and houses at the north of runway 18 threshold which could not easily be removed protrude upon 1:40 approach and take-off climb surfaces.

Hence, the cross-wind runway should be used only for non-instrument runway and take-off procedures using runway 36 should not be permitted for aircraft larger than DHC-5D and F-27 class.

The detail of the obstacles at Nozha airport are as follows:

a) Approach surface

i) Runway 04

The lamp posts (10.2 meters AGL, 8.7 meters AMSL) along the desert road approximately 550 meters southeast of runway 04 threshold protrude upon both the approach surface of 1:50 slope and the take off climb surface for runway 22.

ii) Runway 22

Trees of 4 to 5 meters height along the road approximately 250 meter northeast of runway 22 threshold protrude upon both the approach surface of 1:50 slope for runway 22 and the take-off climb surface for runway 04.

iii) Runway 18

The mosque (23.5 meters AMSL) and the trees in the palace (34.2 meters AMSL) located approximately 950 meters and 1,250 meters from runway 18 threshold protrude upon the approach surface of 1:40 slope for

runway 18. Furthermore, most of houses and buildings in densely populated area shaded by obique lines in Fig. 5.3.1 protrude upon the approach surface of 1:40 slope for runway 18.

iv) Runway 36

No obstacles protrude upon the approach surface of 1:50 slope for runway 36.

b) Transitional Surfaces

No obstacle other than houses and buildings located near the end of the approach area for runway 18 protrude upon the transitional surface for runway 18.

c) Inner Horizontal Surface and Conical Surface

Obstacles protruding upon the inner horizontal surface and conical surface are shown in Fig. 5.3.2.

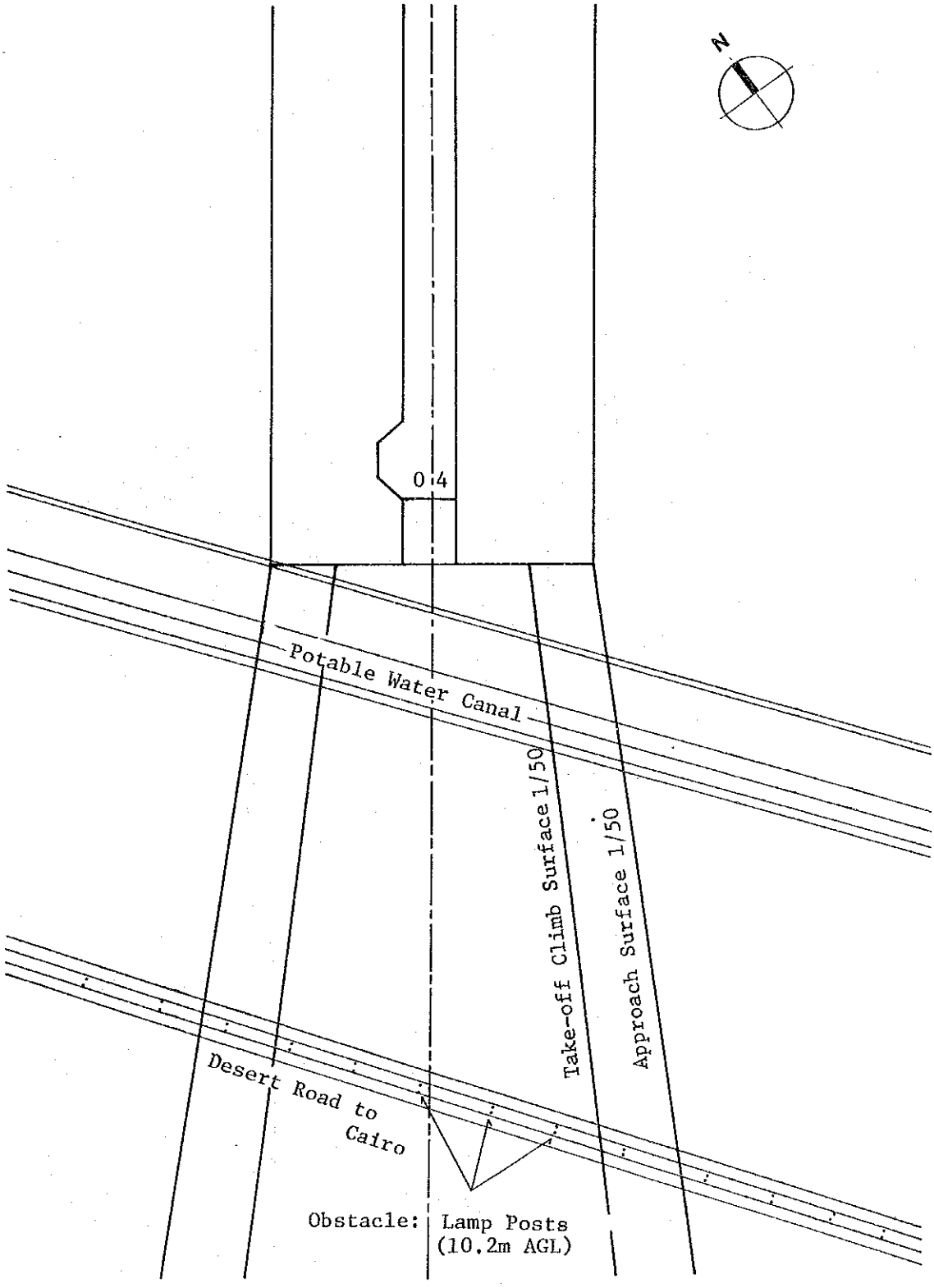


Fig. 5.3.1 (1) Obstacles in Final Segment of Approach Area for Runway 04

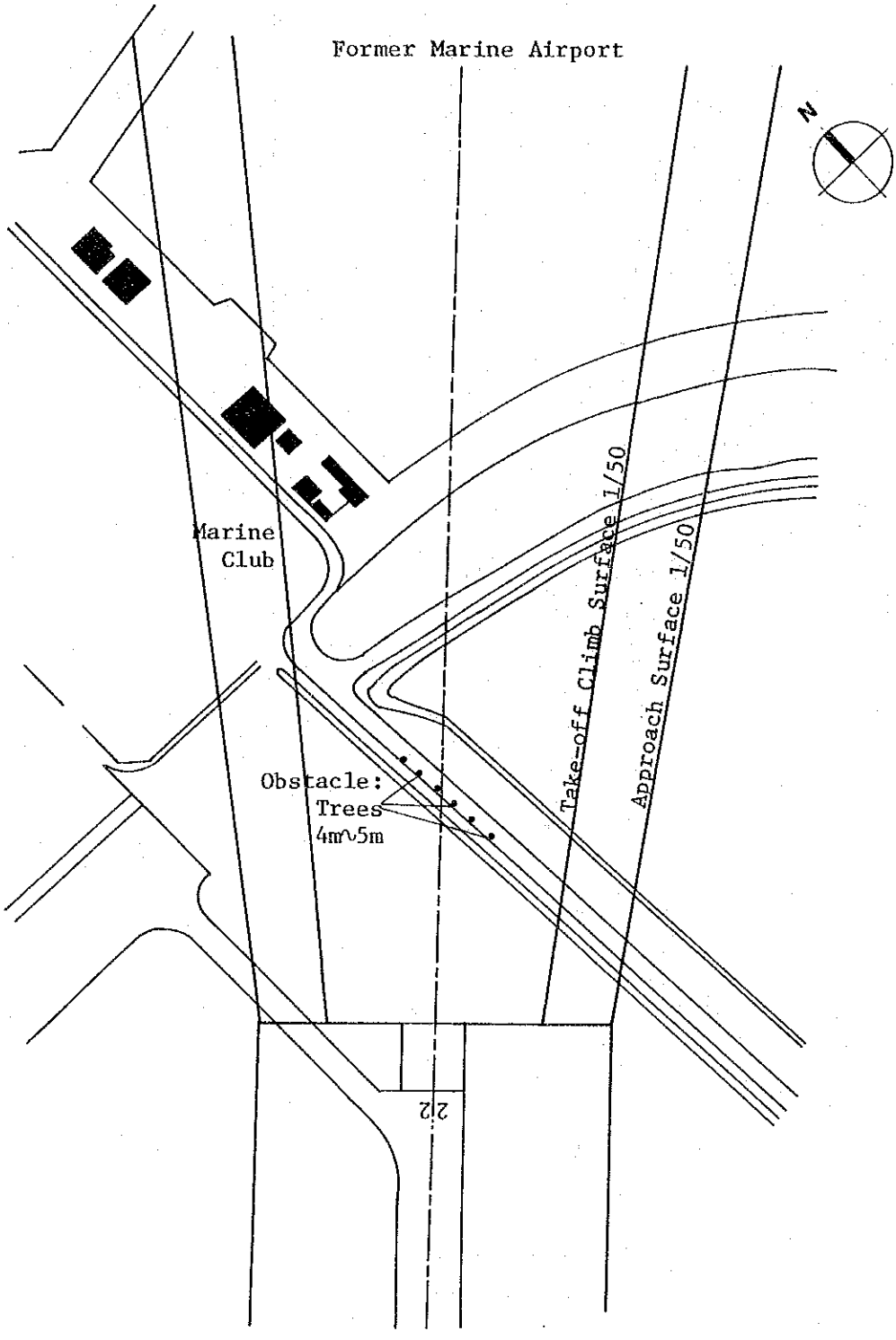


Fig. 5.3.1 (2) Obstacles in Final Segment of Approach Area for Runway 22

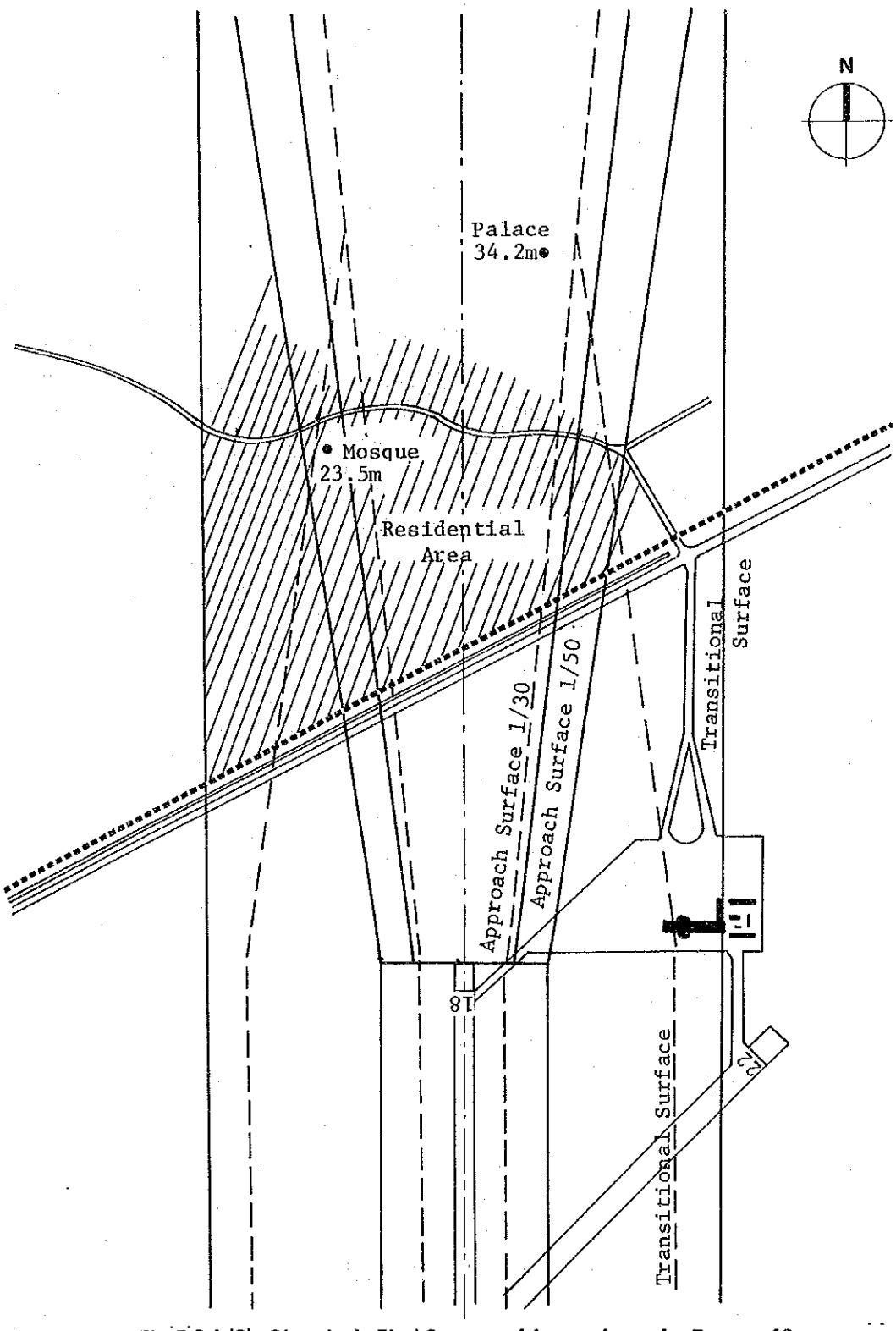


Fig. 5.3.1 (3) Obstacles in Final Segment of Approach area for Runway 18

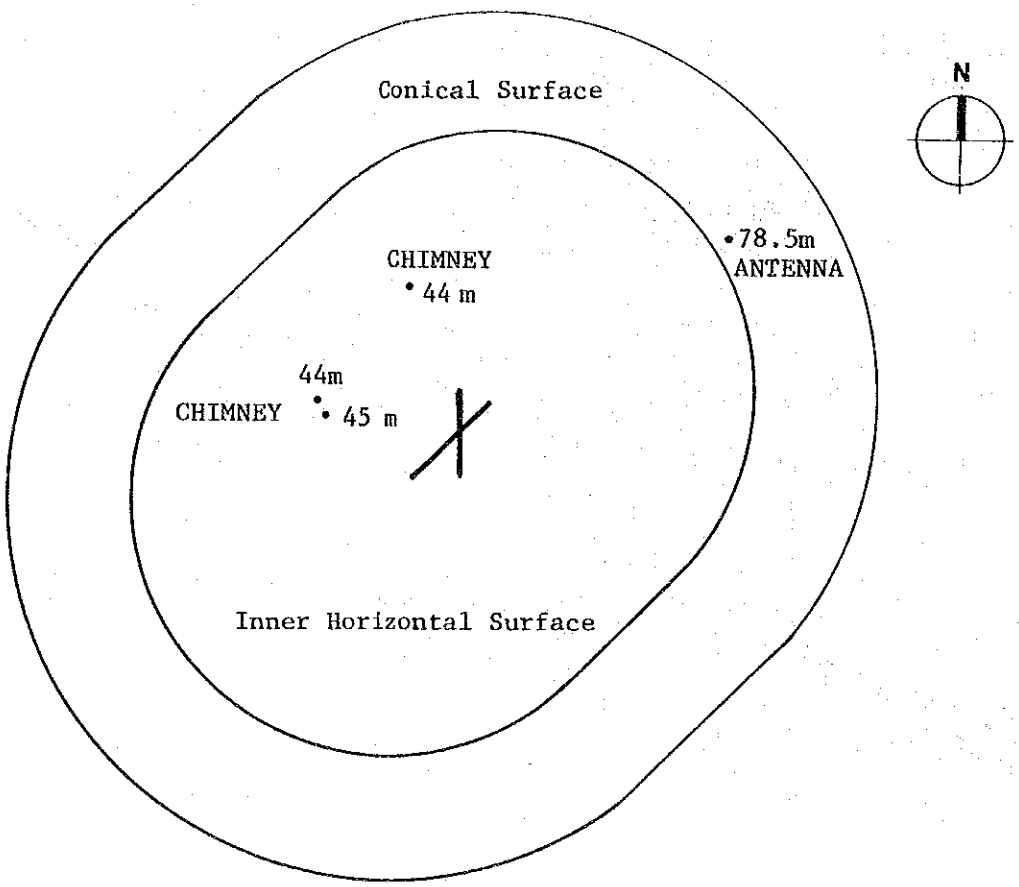


Fig. 5.3.2 Obstacles in Inner Horizontal and Conical Surfaces

5.3.2 Aircraft Operations Procedures

The existing approach and departure procedures are evaluated as follows:

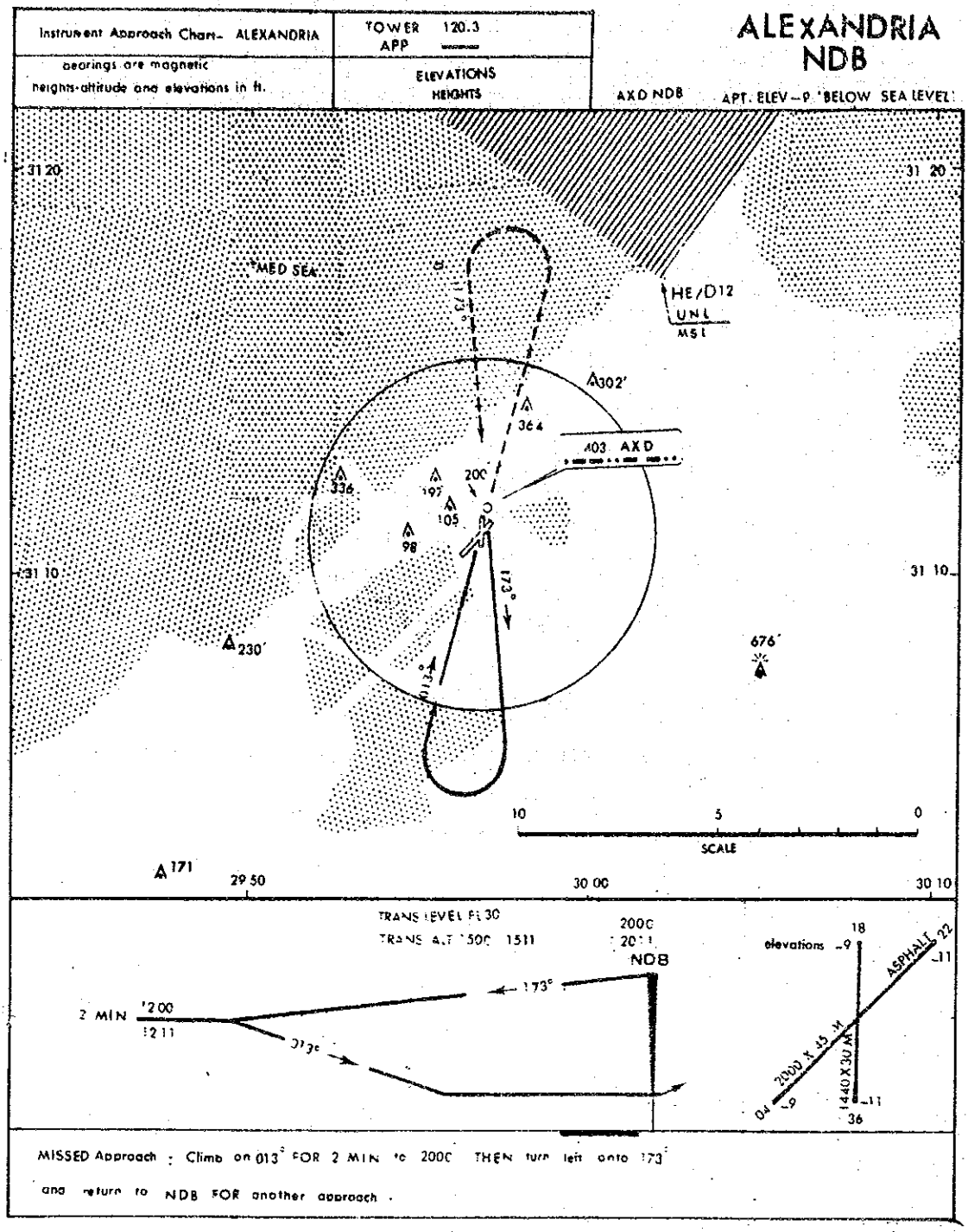
a) Instrument Approach Procedure

At present, instrument approach with circling approach as shown in Fig. 5.3.3 is established at Nozha airport. As a result of site investigation, it is judged that straight-in approach to runway 04 using Alexandria NDB can be established in accordance with ICAO PANS/OPS DOC 8168/OPS/611. It is considered important to establish the minimum sector altitude and OCL (Obstacle Clearance Limit) in order to ensure the safety of aircraft operations even though the present instrument approach chart does not indicate it.

For reasons of safety, it is recommended to alter the present missed approach course so that an adequate separation can be maintained between the protected area for missed approach course and the danger area, HE/D12.

b) Standard Instrument Departure (SID)

Standard instrument departure route is not presently established at Nozha airport. The establishment of SID in Aeronautical Information Publications is desirable in order to increase the safety and efficiency of aircraft operations.



(Source: Egyptian Civil Aviation Authority)

Fig. 5.3.3 Existing Instrument Approach Procedure

5.4 Passenger Terminal Building

The existing passenger terminal building is three storeys high and is made of reinforced concrete. The total floor area is 3,900 sq.m excluding VIP room. The building accommodates the airport administrative offices and meteorological offices. Fig. 5.4.1 shows the existing layout of the ground floor. The departure hall and domestic gate lounge were constructed in the 1940's and the building for international facilities was expanded in the 1950's.

The existing passenger terminal building capacity is considered to have already been saturated by the present passenger traffic demand for the following reasons:

i) The existing terminal building capacity can handle passengers of only one departure and one arrival of B737 aircraft at the same time.
   - Only 1 check-in counter is provided,
   - The check-in lobby (44 sq.m) and departure hall (247 sq.m) is too small.

ii) The floor space of the domestic gate lounge is 78 sq.m and this is about 65 percent of the required space for one B737 passengers.

iii) Only one baggage conveyer is provided and it can not serve simultaneous arrivals of domestic and international flights.

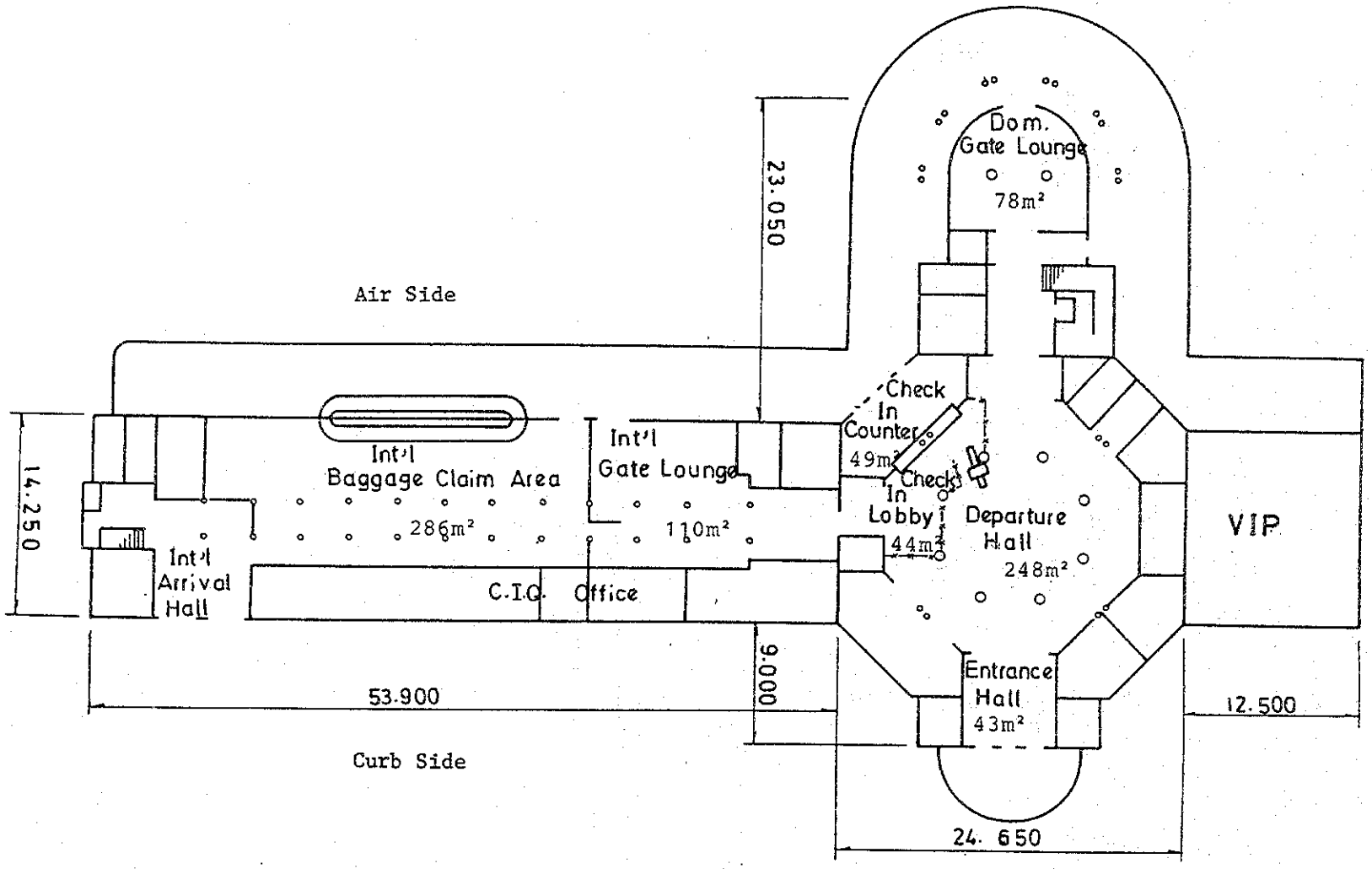


Fig. 5.4.1 Existing Layout of Passenger Terminal Building (Ground Floor)

5.5 Landside Facilities

The existing road in the airport property area which is connected to the Desert Road is 1 lane for each direction divided by a green belt. The road in the airport with a capacity of 1,000 cars/hour/one direction can be used until the end of 1991.

The traffic survey indicates that the car parking area can accommodate 174 cars and the parking rate is 0.7 cars/passenger during a peak hour. The car parking area capacity will be saturated around 1987 when 250 peak hour passengers are anticipated.

5.6 Air Navigation Systems

An outline of the existing air navigation systems is provided in Table 5.6.1. The existing air navigation systems are composed of the minimum equipment necessary for air traffic services.

a) The existing control tower does not meet the mandatory siting requirements including location, height, etc. Although a new control tower is required as soon as possible to overcome the present problem, it is planned to be constructed at the same time as the new terminal facilities and runway extension during Phase I development.

b) The complete replacement of the existing meteorological equipment and renovation of the telecommunications lines are immediately required.

c) The radio navigation aids (VOR/DME, NDB) are new and could continue to operate up to around 1993 with good maintenance. Additional navaids (ILS, etc.) will however, be required for precision approach category-I.

d) Installation of a new lighting system was recently implemented (approach lighting system is under construction) and it could be usable for about 15 years from now. Relocation of the existing approach lighting system, runway end lights, runway threshold lights, etc. and extension of the runway edge lights, however, will be necessary when the existing runway is extended to 3,000 m and precision approach category-I is applied.

Table 5.6.1 Outline of the Existing Air Navigation Systems

Equipment	Outline	Remarks
NAVAIDS		
NDB	"AXD" 403KHz	Terminal-use
VOR/DME	Conventional VOR and co-located DME	Airport and en route use
ATC/COM		
ATC console	1 position	
VHF A/G	4 frequencies; 119.8MHz, 120.3MHz 121.9MHz, 121.5MHz	
Radio teletype	SSB with Cairo	
Radio telephony	VHF Link with Cairo	to be replaced by a microwave link by the end of 1984
Magnetic tape recorder	ATC-use	
VISUAL AIDS		
Approach lighting system	RWY 22	Under construction
Simple approach lighting system	RWY 04/18/36	Ditto
Runway edge lights	RWY 04/22, RWY 18/36	
Runway threshold lights	Semi-flush type	
Runway end lights	Ditto	
Runway threshold wing bar lights		
Precision approach path indicator (PAPI)	RWY 04/22 RWY 18/36	
Taxiway lights		
Illuminated wind direction indicator	near cross-point of 2 runways	
Apron floodlights	on the building edge	
Aerodrome beacon	on the tower-top	

Table 5.6.1 Outline of the Existing Air Navigation System (Cont.)

Obstruction lights	On the top of the passenger terminal building	
MET. Wind vane, Barometer Thermometer/Radio Teletypewriter Facsimile	Wind-vane on the tower top.	 TTY: out of order
Others Transformer station Emergency generator Tower	400KVA x 2 for navaids and building use 250KVA x 2 sets Cab=37 sq.m, Height (eye level): 14m	

5.7 General Services

5.7.1 Rescue and Fire-Fighting Facility

The existing airport category of fire-fighting services at Nozha airport is calculated to be 5 by the length of aircraft (B737-ADV, F27) and present aircraft movements. The fire-station has a floor area of 590 sq.m and the following four vehicles are provided.

- 2 major vehicles with aqueous film forming foam (15,000 ℓ)
- 2 small fire engines for water only

The existing fire-fighting facility can meet the requirements necessary for the category-7 and it can be operated up to the end of 1991.

5.7.2 Fuel Supply System

The existing fuel supply facility has a storage capacity of approx. 50 k.liters (JET A-1). The existing fuel hydrant system is not operated due to a malfunction of the distribution pipes, and fuel is loaded in aircraft by refuelers.

The existing fuel storage capacity can only meet the demand anticipated up to the end of 1985. Expansion of the storage tank will be required.

5.8 Aircraft Noise Influence

Although there exist many measures in the world for evaluating noise, noise evaluation measurements aim to quantify the aircraft noise effect by noise level and its frequency.

WECPNL (Weighted Equivalent Continuous Perceived Noise Level), which is used in Japan, will be applied as the noise evaluation measurement in this study.

WECPNL is basically conducted from ECPNL (Equivalent Continuous Perceived Noise Level) which has been defined by ICAO so that independently obtained noise evaluation measurement in the world could be compared at the international level.

WECPNL is the ECPNL modified to reflect the perceived severity of flight noise at night with larger weightings on night flights than day-time flights.

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

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

N : Total weighted Number of flights ($= N_1 + 3N_2 + 10N_3$)

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

Fig. 5.8.1 shows the existing area influenced by aircraft noise level above WECPNL 70 on the basis of eight F-27 daily and two B737 daily operation in 1984.

At present there is no noise problem, but precise assessment must be carried out when take-off and landing operations of larger aircraft become more frequent in the future.

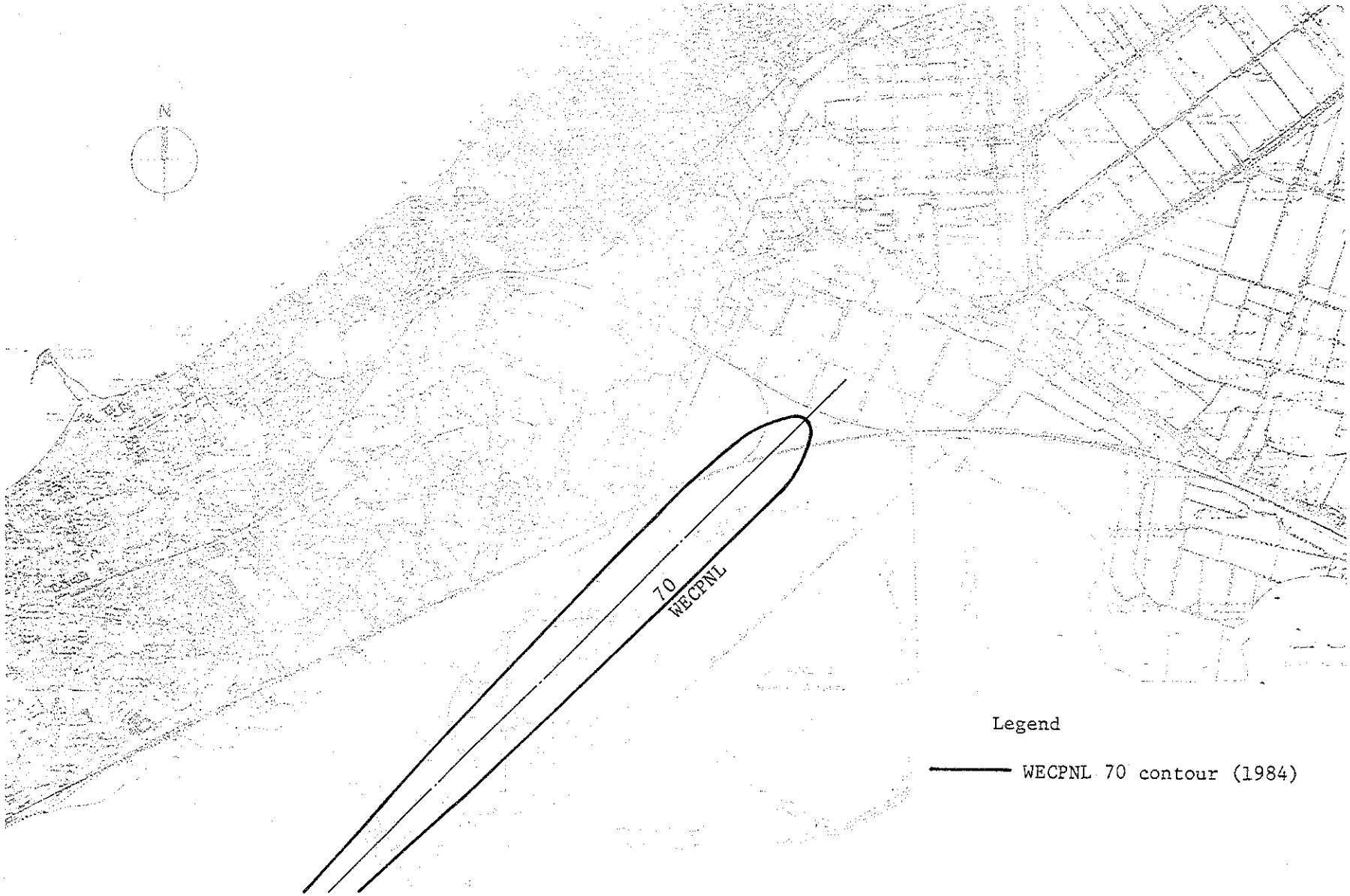


Fig. 5.8.1 Area Affected by Aircraft Noise
(s = 1:50,000)

5.9 Necessary Improvement for Nozha Airport during the Transition Period

5.9.1 Concept for the Improvement Works

Nozha airport capacity will be saturated before 1989 as evaluated in the previous sections 5.2 through 5.8.

Phase-I development (the substantial redevelopment for the target year 2000) can be completed by the end of 1991 (6 years from now) at the earliest possible as shown in Section 10.2. Accordingly, it is necessary to improve the existing facilities of Nozha airport in order to serve the increasing demand before 1991.

These improvement works should be limited and small-scale ones for the following reasons:

i) It is not considered economical to invest excessively in the existing terminal facilities, because completely new terminal facilities will be required for the target demand year 2000.

ii) The budget for Nozha airport up to the year 1987 has already been allocated in the present Five Year Plan by Egyptian Government and this does not include large-scale improvement works.

iii) The improved airport facilities need only serve the demand up to the year 1991 (7 years).

Hence, the improvement works during the transition period up to the year 1991 is intended to expand the passenger terminal building to the capacity equivalent to the apron, and to overlay the pavement, etc., without changing the basic dimensions of the airside facilities (refer to the basic concept below).

By the above improvement works, Nozha airport will be able to accommodate unrestrained domestic demand (250,000 passengers) and controlled international demand (400,000 passengers) on the limited routes to Amman, Athens, Baghdad, Jeddah and Kuwait.

The case covering the minimum improvement works for the existing Nozha airport, and accommodating the unrestrained domestic demand and the controlled international demand is defined as "Without Project Case" (WOP) in this study.

Basic concept for the improvement works:

i) The existing airport facilities will be maintained and/or improved in order to serve the anticipated demand as much as possible before the substantial completion of Phase-I development (the end of 1991). Expansion for the demand in the 1990's is, however, not considered.

ii) Construction works to extend/expand the basic dimensions of the airside facilities are not considered. However, improvement work such as pavement overlay which can extend the duration time by strengthening the structure is considered.

iii) The capacity of every facility is to be upgraded to a common level in order to maximize airport capacity since the existing capacity varies greatly per facilities.

5.9.2 Demand to be Accommodated at Nozha Airport during the Transition Period

(1) Control of the International Demand

The air traffic demand in 1991 at Alexandria airport has been forecast to be 1,030,000 annual passengers (250,000 domestic and 780,000 international passengers) excluding 30,000 transit passengers. This demand is about 13 times the demand as of 1983.

Table 5.9.1 shows the air traffic demand forecast in every year during the transition period.

Table 5.9.1 Air Traffic Demand at Nozha Airport

Unit : Passengers (x1,000)

Year	Embarked and Disembarked		Total	International Transit
	Domestic	International		
1984	(115)	(30)	(145)	N.A
1985	140	74	214	2
1986	160	150	310	5
1987	180	250	430	10
1988	200	370	570	15
1989	215	500	715	20
1990	230	640	870	25
1991	250	780	1,030	30

Note: ( ) indicates the estimated figure by the time table (1984) of Egypt Air.

Large-scale improvement works including extension of the runway, expansion of the terminal facilities, etc., will be required to serve the demand listed in Table 5.9.1.

It is accordingly assumed that domestic demand will be fully accommodated and the international demand will be controlled and limited to the routes of relatively short-range and higher demand, connecting to the neighbouring countries. No direct routes are considered for other international routes, which will require the runway extension.

It is also assumed that international flight schedule will be controlled and adjusted, in advance, in order to prevent overlapping of flights.

(2) Anticipated Demand during the Transition Period

Table 5.9.2 shows the most possible international routes from Alexandria in order of the route demand. It also shows the possible route and aircraft which can be operated on the existing runway (2,200 m).
Since no actual data for international traffic by various routes at Alexandria exists, the route shares for passengers in Cairo International Airport (1983) have been applied.

The results shown in Table 5.9.2 indicate that the possible international routes which can be operated by the existing runway will be Jeddah, Amman, Kuwait, Athens and Baghdad. The demand for a Riyadh route is assumed to be served by the Jeddah route (connecting flight via Jeddah airport).

As a result of such limitations mentioned above, international passenger traffic at Alexandria during the transition period (1985 - 1991) is assumed to be decreased to about 50 percent of the air traffic demand.

Table 5.9.3 indicates the anticipated demand during the transition period which will be used as a basis for the necessary improvement works.

Table 5.9.2 Assumption of the Possible International Routes during Transition Period

Item / Route	Annual Passenger at Cairo Airport 1983 (x1,000)	1/ Share (%)	2/ Anticipated International Passenger Traffic at Alexandria 1991 (x 1,000)	Aircraft Operated by the Existing Runway (2,200m) 3/				4/ Route Distance from Alexandria (km)	Remarks
				B-707	A-300	B-727 ADV	B-737 ADV		
1. Jeddah	746	13.8	110	o	o	o	o	1,490 (350)	
2. Amman	661	12.2	100	o	o	o	o	650	
3. Kuwait	478	8.9	70	o	o	o	o	2,310 (400)	
4. Athens	304	5.6	40	o	o	o	o	960 (300)	
5. Riyadh	294	5.4	40	o	o	o	o	1,810	
6. Baghdad	255	4.7	40	o	o	o	o	1,570 (640)	
7. London	209	3.8	(30)					3,460 (440)	
8. Khartoum	206	3.8	(30)					1,880 (1,030)	
9. Rome	200	3.7	(30)					2,040 (310)	
10. Paris	197	3.6	(30)					3,130 (440)	

Note 1 Share of the international passenger traffic by route for international passengers in Cairo airport.
2 Assumed that the share of the route passengers in Alexandria will be same as Cairo airport.
3 "o" indicates possible non-stop flight by aircraft with not less than 60 percent of maximum payload.
4 The above annual passenger volume excludes transit passengers. ( ) indicates additional distance to alternate airport.

Table 5.9.3 Anticipated Demand during the Transitional Period

Unit : Passengers (x1,000)

Item / Year	Embarked and Disembarked			Transit
	Domestic	International	Total	
1985	140	40	180	1
1986	160	80	240	3
1987	180	130	310	5
1988	200	190	390	8
1989	215	250	465	10
1990	230	320	550	13
1991	250	400	650	15

The anticipated demand during the transition period is broken down into the peak hour traffic as shown in Table 5.9.4. Herein, the anticipated aircraft is assumed to be A300 class for Jeddah (including the route demand of Riyadh), Amman, Kuwait routes, and B737 class for Athens and Baghdad routes. (A300 class aircraft is assumed where the route demand exceeds the passenger volume of one daily flight by B737 class aircraft.)

Table 5.9.4 Anticipated Demand for the Necessary Improvement Works during the Transition Period

INT'L /DOM.	Item / Period	Passengers		Cargo	Aircraft Movements								
		Embarked/ Disembarked	Transit	(ton)	JUMBO	LJ	MJ	NJ	SJ	P	Sub Total	Others	Total
INT'L	Annual	400,000	15,000	6,300		1,954			1,111		3,065	276	3,341
	Peak Month	45,440				201			115		316		
	Peak Day	1,510				6			4		10		
	Peak Hour	360				1.6			0.9		2.5		
	Heavy Direction Peak Hour	210									1.5		
DOM.	Annual	250,000		270					2,517	290	2,807	253	3,060
	Peak Month	29,070							259	30	289		
	Peak Day	960							8	2	10		
	Peak Hour	230							2.1	0.2	2.3		
	Heavy Direction Peak Hour	140									1.4		
TOTAL	Annual	650,000	15,000	6,570		1,954			3,628	290	5,872	529	6,401
	Peak Month	69,700				186			345	28	559		
	Peak Day	2,280				6			10	2	18		
	Peak Hour	440				1.2			2.2	0.2	3.6		
	Heavy Direction Peak Hour	260									2.2		

5.9.3 Facility Requirements for the Improvement Works

Improvement works of facilities are established for the year 1991 in order to cope with the demand during the transition period.

The calculation method of the facility requirements is the same as Chapter 4. Downgrading of service level is, however, considered to the extent it will not impede the airport functions.

For example, the unit floor area for the passenger terminal building (10 sq.m/peak hour passenger) is reduced to 7 sq.m/peak hour passenger.

Table 5.9.5 Facility Requirements during the Transition Period

	Item / Year		Present Conditions (as of 1984)	1991	Remarks
Anticipated Demand	1. Annual Passengers	Dom. Int'l Total	81,436 (1983) 1,705 (") 83,141 (")	250,000 400,000 650,000	
	2. Annual Cargo (ton)		13 (1983) 68 (") 81 (")	Dom. 270 Int'l 6,300 Total 6,570	
	3. Annual Aircraft Movements (Operation)		5,526 (1983)	Dom. 2,810 Int'l 3,070 Total 5,870	
	4. Peak Hour Passengers		(200)	Dom. 230 Int'l 360 Total 440	( )estimated
	5. Peak Hour Aircraft Movements		(4)	Dom. 2.3 Int'l 2.5 Total 3.6	( )estimated
	6. Largest Aircraft		B737-ADV	A-300 Class	
Facility Requirements	7. Runway (m x m)		2,200m x 45m 1,440m x 30m	2,200m x 45m 1,440m x 30m	
	8. Runway Strip (m x m)		2,320m x 150m 1,560m x 150m	2,320m x 150m 1,560m x 150m	
	9. Taxiway (m x m)		370m x 23m	370m x 23m	
	10. Passenger Terminal Apron (gate position)		3 gates for B737	LJ, MJ: 2 NJ, SJ: 1 Total : 3	
	11. Passenger Terminal Building (sq. meter)	Dom. Int'l Total	2,400	3,000	
	12. Cargo Terminal Building (sq. meter)		No Facility	900	
	13. Administration Building (sq. meter)		1,500	1,500	
	14. Air Navigation Systems		Instrument No Precision	Instrument No Precision	
	15. Car Parks (Car) (sq. meter)		170 cars 3,000 m^2	350 6,000	
	16. Access Road (lane)		1 lanes for each direction	1 lane for each direction	
	17. Fuel Supply (kl) (sq. meter)		JET A1 51 kl	800 7,000	
	18. Rescue and Fire-fighting (sq. meter)		CAT. 5 4 cars 590	CAT. 7 4 cars 400	
	19. Utilities	Electricity (KVA) Water (ton/month) Waste Deposit (ton/month)	400 5,000 (As of July) N.A.	600 15,800 18	

5.9.4 Necessary Improvement Works

The improvement works as explained hereunder and shown in Fig. 5.9.1 will be required for the existing facilities in order to balance the capacities of the existing facilities and to cope with the controlled demand during the transition period.

(1) Runway

The existing runway length (2,200 m) will meet operational requirements for controlled international routes (Amman, Athens, Baghdad, Jeddah and Kuwait) with practical reduction of the payload. Aircraft movement in 1988 of the controlled demand will exceed the repetition of the design load for the existing pavement.

Overlay of 18 cm thickness will be required for the main runway in 1987 in order to cope with the aircraft movements up to the end of 1991. A part of cross-wind runway 18/36 will be used as an exit taxiway from the main runway. Pavement overlay of at least 3 cm will be required for part of the cross-wind runway in 1989.

(2) Exit Taxiway

The aircraft movements in 1989 will exceed the repetition of design load for the exit taxiway on the end of runway 22, thus overlay of 10 cm thick will be required.

(3) Apron

Two gate positions will be required in 1991 for A-300 class (LJ) aircraft and 1 position for MD-80 or B-737 class (NJ/SJ) aircraft. These 3 gate positions can be obtained by re-arranging the existing apron use as shown in Fig. 5.9.2.

The existing heliport and the equipment yard (on the right edge in Fig. 5.9.2) should be re-located to the vacant area in the east side (on the left side in Fig. 5.9.2).

The apron area does not have a good connection with the terminal building, but it is acceptable during the transition period.

A pavement overlay of 20 cm thick on the apron will be required in 1987 in order to cope with the aircraft movement up to the end of 1991.

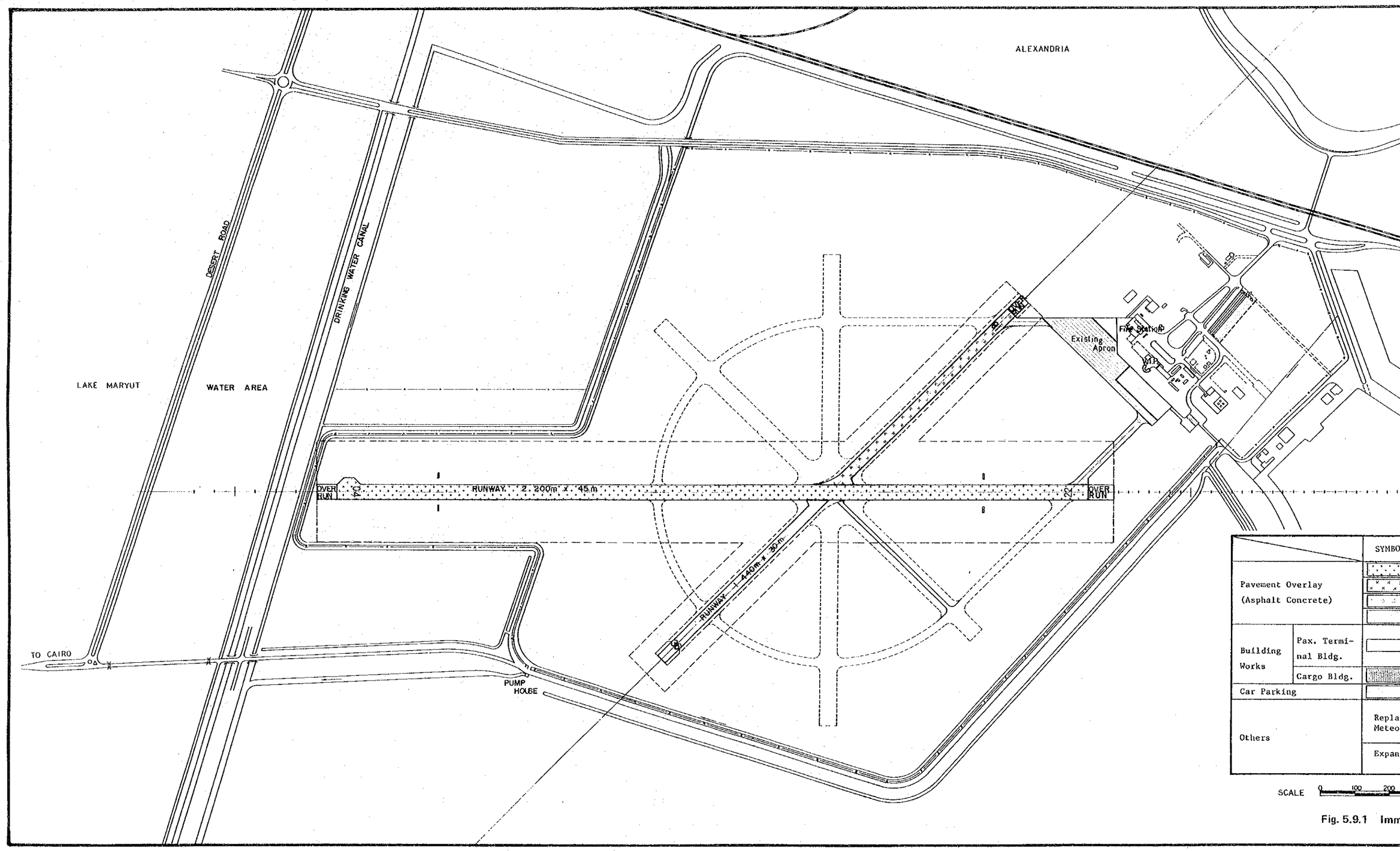
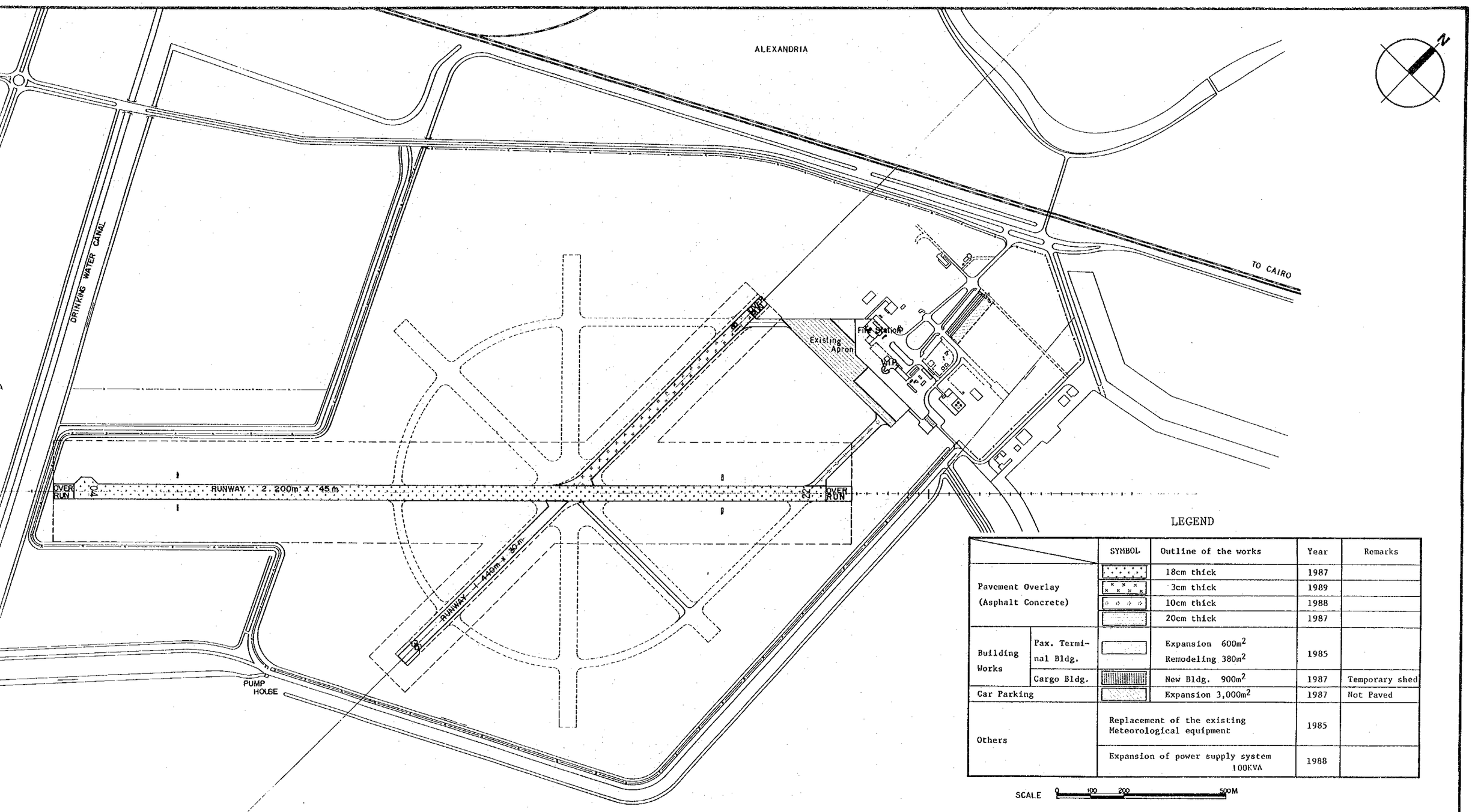

ALEXANDRIA
DESERT ROAD
DRINKING WATER CANAL
LAKE MARYUT
WATER AREA
Existing Apron
Fire Station
RUNWAY 2,200m x 45m
OVER RUN
OVER RUN
RUNWAY 1,440m x 30m
TO CAIRO
PUMP HOUSE
SYMBO
Pavement Overlay (Asphalt Concrete)
Building Works
Pax. Termi-nal Bldg.
Cargo Bldg.
Car Parking
Others
Repla
Meteo
Expan
SCALE
0
100
200

Fig. 5.9.1 Imm



LEGEND

		SYMBOL	Outline of the works	Year	Remarks
Pavement Overlay (Asphalt Concrete)			18cm thick	1987	
			3cm thick	1989	
			10cm thick	1988	
			20cm thick	1987	
Building Works	Pax. Terminal Bldg.		Expansion 600m^2 Remodeling 380m^2	1985	
	Cargo Bldg.		New Bldg. 900m^2	1987	Temporary shed
Car Parking			Expansion 3,000m^2	1987	Not Paved
Others			Replacement of the existing Meteorological equipment	1985	
			Expansion of power supply system 100KVA	1988	

SCALE 0 100 200 500M

Fig. 5.9.1 Immediate Work Plan of Nozha Airport

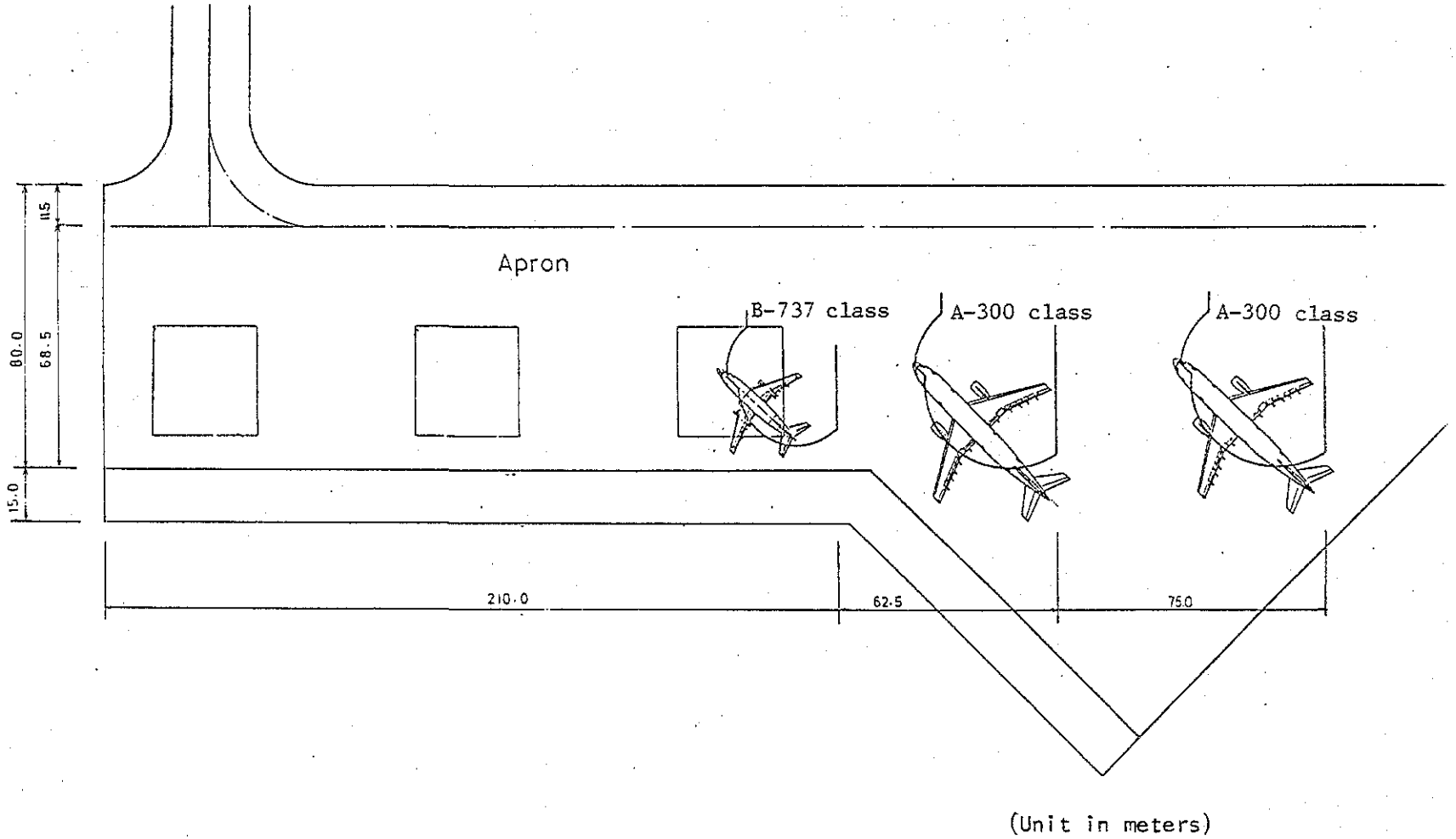


Fig. 5.9.2 Apron Use Plan during Transition Peirod

(4) Passenger Terminal Building

The existing passenger terminal building is not sufficient for the present needs. Improvement works especially for the narrow space in the passenger terminal building need to be implemented in order to expand the building capacity equivalent to the apron and to ensure cost-effectiveness.

From this viewpoint, the following improvement works will be made:

- The domestic gate lounge (78 sq.m) which is presently under-capacity will be expanded to 100 sq.m.
- A domestic baggage claim area of about 230 sq.m and one baggage claim counter with the capacity to handle one B737 arriving passenger will be newly constructed.
- The one existing ticket counter will be expanded and divided into 2 units for domestic and international use, respectively.
- An international gate lounge of 280 sq.m (including passport control area), which will accommodate the passengers of one A300 aircraft, will be newly constructed beside the domestic gate lounge.
- The existing departure lobby and check-in lobby (290 sq.m) will be expanded to 400 sq.m and this space will be used as a public hall serving for departure, arrival and check-in.

The improvement plan of the passenger terminal building is shown in Fig. 5.9.3. The remodeling area and expansion area will be 380 sq.m and 600 sq.m respectively.

(5) Cargo Terminal Building

A temporary shed of 900 sq.m for cargo handling will be newly constructed.

(6) Car Parking

The existing car parking area (3,000 sq.m) will be expanded to 6,000 sq.m for temporary use (not paved).

(7) Meteorological Equipment

Replacement of the existing meteorological equipment (radio teletypewriters and facsimile) by new ones is required.

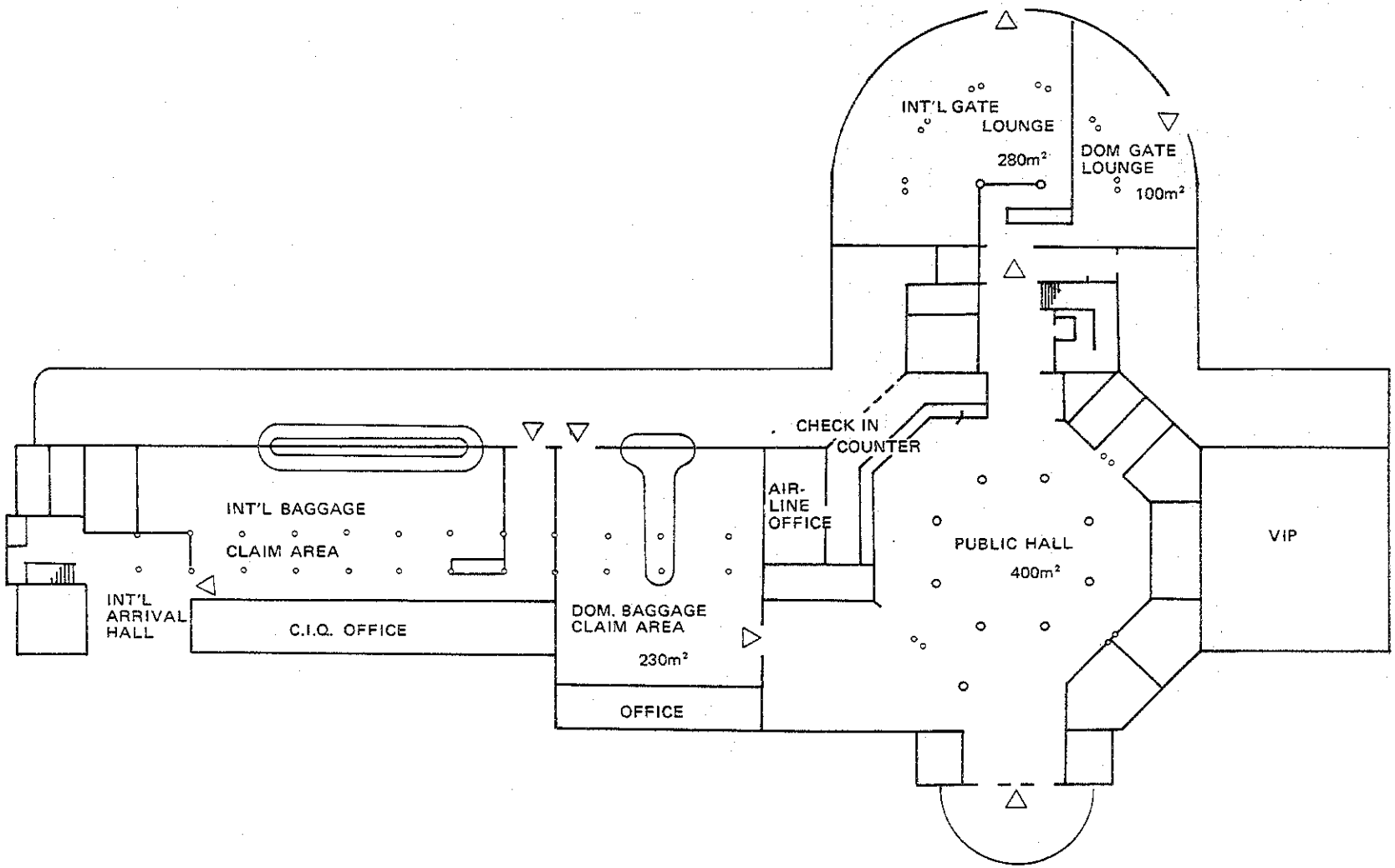


Fig. 5.9.3 Improvement Plan of Passenger Terminal Building

(8) Drainage System

Stone filled ditch with open-jointed drain pipes is to be laid down along the runway, taxiways and apron is order to lower the ground water table.

The overall drainage system should be reviewed carefully before the commencement of the above mentioned improvement works taking account of the ground settlement and the condition of the existing pump station.

5.9.5 Work Schedule and Cost for the Improvement Works

(1) Work Schedule

The work schedule for the improvement works is planned as shown in Table 5.9.6. The most immediate work is the expansion of the passenger terminal building, since the present building does not meet even present needs. The expansion will be completed by the end of 1985.

(2) Preliminary Cost Estimates for the Improvement Works

The cost required for the improvement works is preliminarily estimated to be 3.7 million Egyptian Pounds as shown in Table 5.9.7. Approx. 60 percent of the cost (2.2 million Egyptian Pounds) is required for the pavement overlay works.

Table 5.9.6 Necessary Improvement Works during Transition Period

Facility	Outline of the Improvement Works	Schedule							Remarks
		85	86	87	88	89	1990	91	
Main Runway 04/22	Pavement overlay (18cm)			■	■	□	□	□	All the improvement works for the demand up to the end of 1991.
Cross-wind Runway 18/36	Pavement overlay (at least 3cm)					■	□	□	
Exit taxiway	Pavement overlay (10cm)				■	□	□	□	
Apron	Pavement overlay (20cm)			■	■	□	□	□	
Passenger Terminal Building	Expansion of the check-in lobby, departure hall, domestic gate lounge, etc. (600m^2)	■	□	□	□	□	□	□	Remodeling 380m^2 Expansion 600m^2
Cargo Terminal Building	Construction of a temporary shed. (Approx. 900m^2)			■	□	□	□	□	
Car Parking	Expansion of car park for a temporary use (not paved: 350 cars/ 6,000m^2)			■	□	□	□	□	
Public Utilities	Expansion of power supply system (100KVA)				■	□	□	□	

■ Improvement Works
□ Service Period

Table 5.9.7 Estimated Construction Cost for Immediate Works
(Nozha Airport)

(Unit : 1,000 £E)

Work Item / Phase of Construction		1986-1991
Land Acquisition and Compensation	Land Acquisition	-
	Compensation	-
	Sub Total	-
Civil Works	Site Preparation	-
	Pavement Works	2,172
	Miscellaneous(Drainage System)	180
	Access Road	-
	Sub Total	2,352
Building and Equipment Works	Passenger Terminal Building	194
	Cargo Terminal Building	480
	Administration/Tower and Other Buildings	-
	Sub Total	674
Navaids Works	Radio Navaids, Telecommunications, Air-Traffic Control, Meteorological and Lighting Works	140
Utilities Works	Power Supply, Water Supply Sewage and Incinerator	200
Special Services Facility Works	Boarding Bridge	-
Total of Construction Works		3,366
Contingency (10%)		377
GRAND TOTAL		3,703

CHAPTER 6 REDEVELOPMENT PLAN OF NOZHA AIRPORT

CHAPTER 6 REDEVELOPMENT PLAN OF NOZHA AIRPORT

6.1 General

In order to compare the alternative airport development concepts, this chapter discusses the ability to expand and redevelopment concept of the existing airport (Alt-A), based on the demand forecast and airport requirements analysis described in the previous chapters.

This chapter consists of the following study items:

- Direction of runway extension
- Location of terminal area
- Airspace and aircraft operations
- Redevelopment concept
- Aircraft noise influence
- Construction schedule and cost estimates

6.2 Runway Extension

The most important factor to be considered for the extension of the runway to 3,000 m is that airspace should be completely free from obstacles in order to ensure safe aircraft operations.

As a result of the precise site survey, it is judged that 2 percent of approach surface required for precision approach category-I operations can not be established for runway 18 due to the existence of obstacles. If this runway is used for precision approach, the threshold of runway 18 should be displaced 600 m toward south as shown in Fig. 6.2.1. For other runways, no significant obstacle were found protruding upon approach surfaces, take-off climb surfaces, transitional surface etc. The main approach runway is considered to be runway 04 for runway 04/22 and runway 36 for runway 18/36 based on the wind analysis.

Critical Obstacle

Obstacle	Height (MSL)	1/50 Surface (MSL)	1/40 Surface (MSL)
PALACE	34.2m	22.3	28.6
MOSQUE	23.5m	6.3	21.1

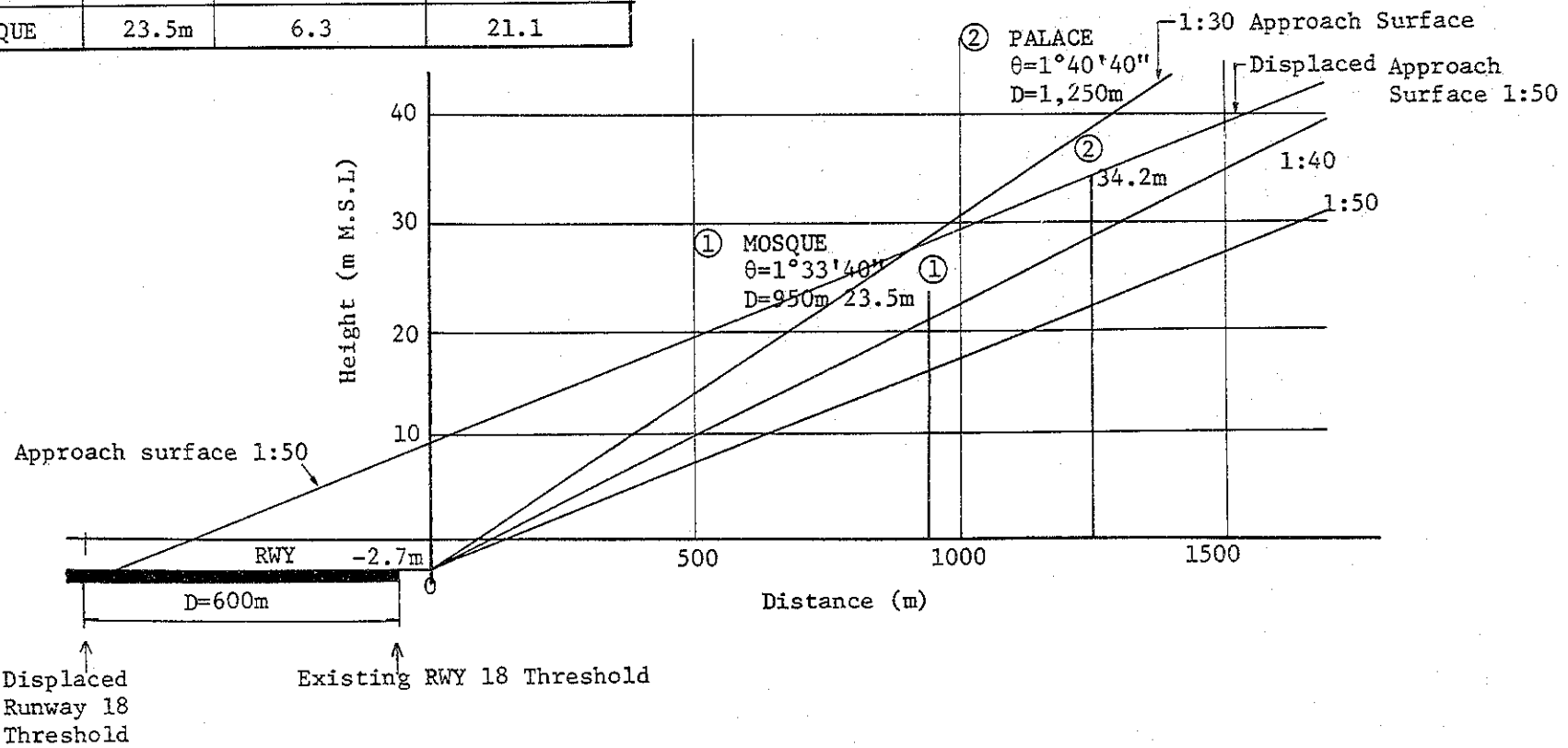


Fig. 6.2.1 Displacement of Runway 18 Threshold due to Obstructions

The following three alternatives were finally selected and compared with each other for the redevelopment plan of Nozha airport.

Alt.R1: Extension of RWY04 threshold to the southwest
Alt.R2: Extension of RWY22 threshold to the northeast
Alt.R3: Extension of RWY36 threshold to the south.

Although an extension of the old runway 13/31 is also conceivable, this scheme has been eliminated for the following reasons:

- Many obstacles protrude upon the approach surface (runway 13) and take-off climb surface (runway 31), the same as for runway 18.
- More serious aircraft noise pollution than Alt.R3 is foreseen because the flight path will more widely cover the densely populated residential area as shown in Figs. 6.7.1 and 2.
- This scheme will require a higher construction cost than that for the extension of runway 36 because the runway does not substantially exist, and thus, more construction work is necessary.

6.2.1 Alt.R1 : Extension of RWY04 Threshold to Southwest

Alt.R1 is a scheme to reclaim some of Lake Maryut, and to extend the existing runway toward the south west and across the potable water canal. The existing Desert Road to Cairo will be relocated. The reclamation is about 39 ha. in area, and requires an earthwork volume of about 1.8 million cu.m. Two existing canals (potable water and drainage) will be replaced with box culvert in order for them to pass under the extended runway. The Desert Road will be relocated outside the expanded airport area so that vehicle traffic and lamp posts along the road will not infringe on the obstacle limitation surfaces. The reclamation area in Lake Maryut is 1.5 m below water. The bottom is generally formed by two strata: i.e. the upper stratum of about 6 m thick is of silty clay (N = 0 to 3) and the lower stratum of stiff clay silt with N value of 14 to 26. Since reclamation on the weak foundation will cause adverse residual settlement, countermeasures will be required for the subgrading of runway and taxiway in order to minimize pavement overlay work after the completion of the construction. Replacement of weak soil by sand will be required under the pavement area taking into consideration the allowable residual settlement after the reclamation, cost-effectiveness of the construction and necessary period for the construction. The replacement will be carried out by filling sand after dredging out the weak soil under the pavement area as shown in Fig. 6.6.2. The required volume of sand is estimated to be 1.1 million cu.m in total.

For the bank around the extended area on which airport perimeter road is planned, the reclamation will be started from the shore by filling sand as is commonly practised in Lake Maryut. For the area other than the pavement, dredged soil will be used for reclamation.

The relocation of the Desert Road will extend for about 2.4 km and require 670,000 cu.m of borrowed sand for its reclamation.

Box culvert as pressure conduit will be necessary for the drinking water canal to cross the restricted area of the airport because the planned elevation of the runway is about the same as the water level.

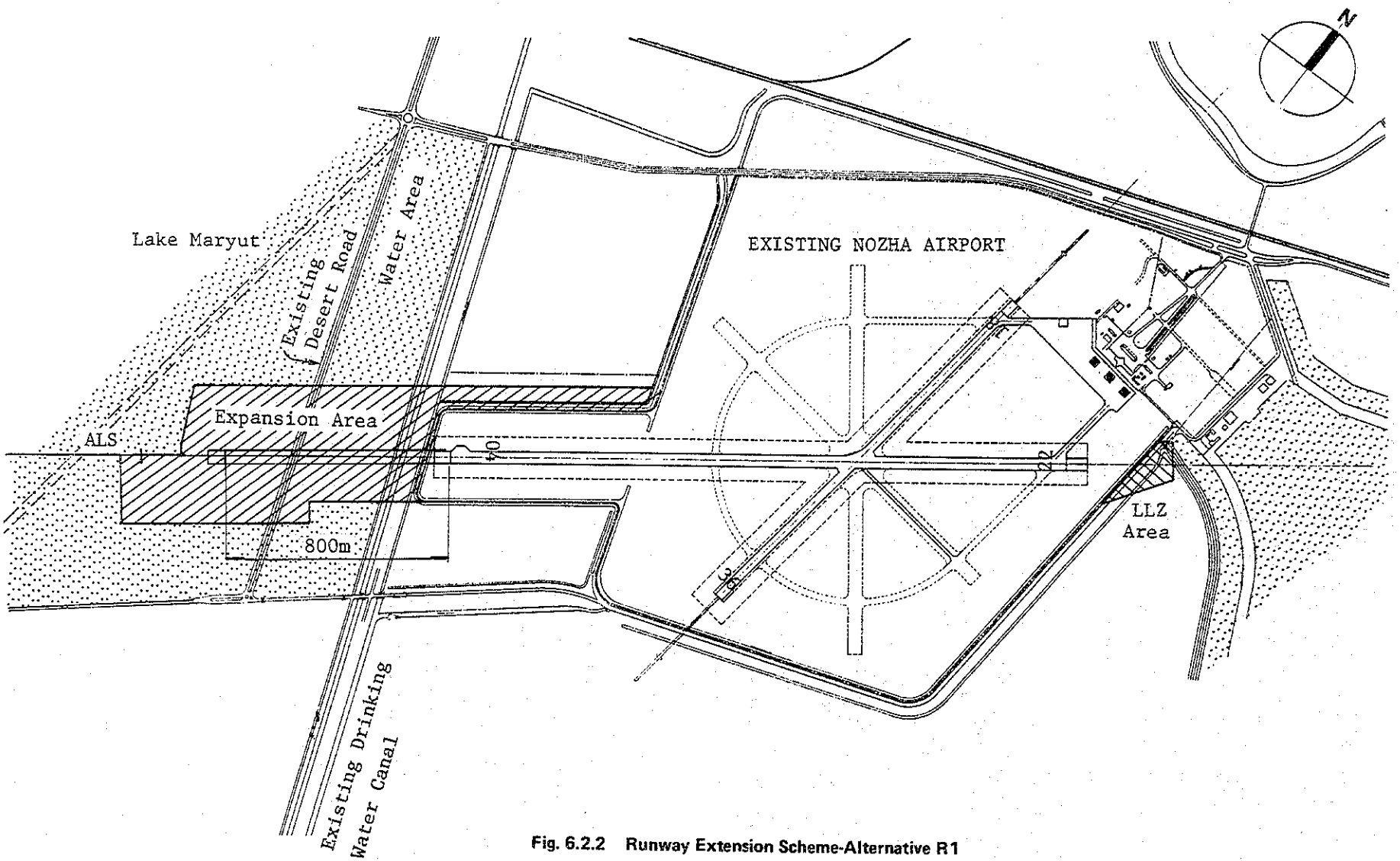


Fig. 6.2.2 Runway Extension Scheme-Alternative R1

6.2.2 Alt.R2: Extension of RWY22 Threshold to Northeast

Alt.R2 is a scheme to reclaim land from the former marine airport and to extend the existing runway by 500 m toward the northeast. A part of Lake Maryut will be also reclaimed in order to secure the critical area of ILS glide slope facility.

The reclamation area is about 24 ha in total and about 60 percent of Alt.R1. The earth volume necessary for the reclamation is about 1.3 million cu.m.

The reclamation method will be the same as Alt.R1 and the necessary sand volume will amount to 680,000 cu.m. The marine club, fish pond and houses in the runway 22 extension area and houses in the runway 04 extension area should be removed.

The existing drinking water canal near runway 04 threshold will be relocated outside ILS glide slope area.

It should be noted that strict control of obstacles (height restriction) will be necessary in the area marked (1) in Fig. 6.2.3, because the approach surface (1/50) and transitional surface (1/7) are only about 7 m away from the ground level. This area should be acquired and included in the airport property area if it is difficult to control the height of buildings. Alt.R2 will cause larger aircraft noise pollution to the township than Alt.R1, because the runway will be 800 m closer to the community.

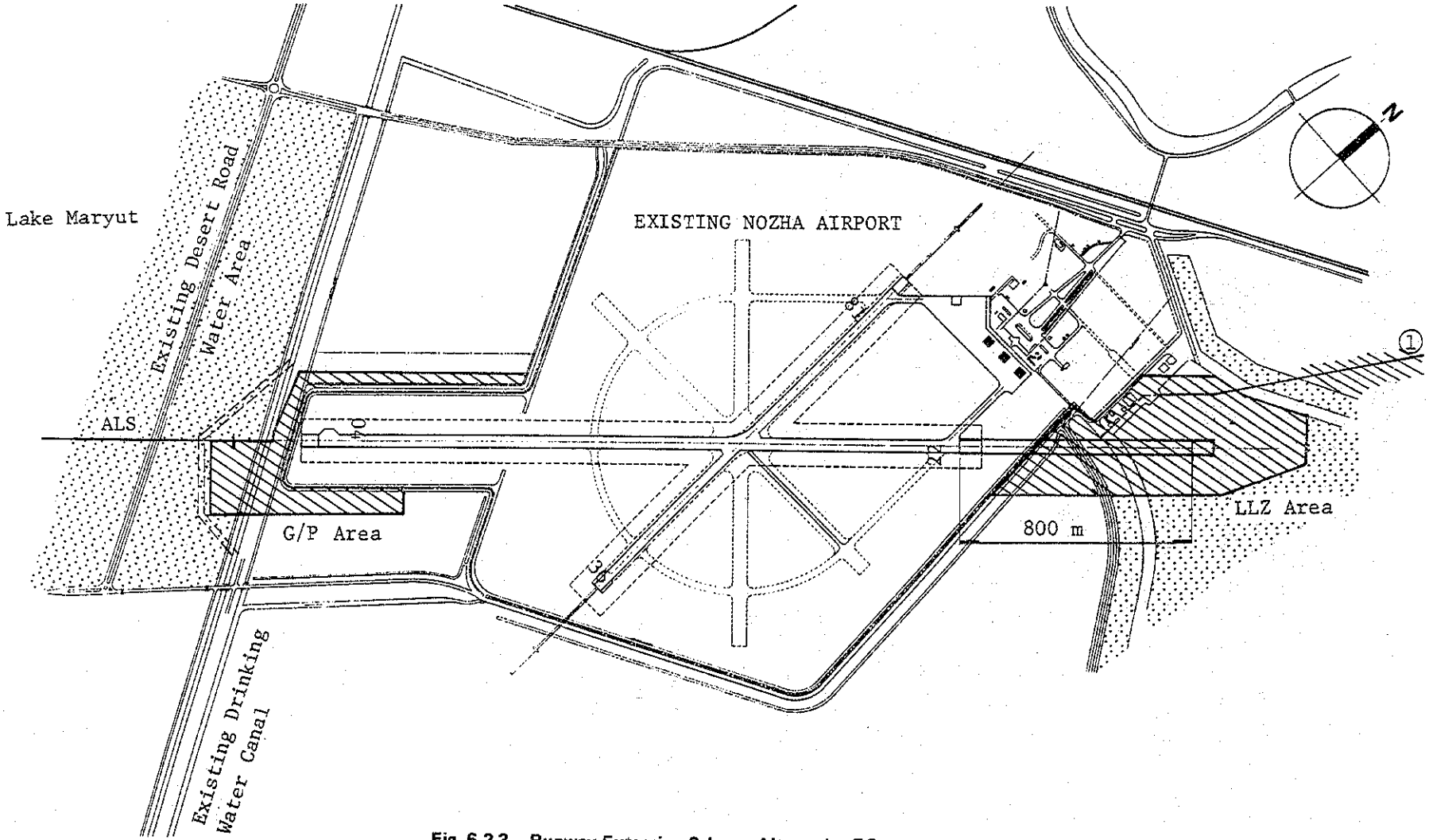


Fig. 6.2.3 Runway Extension Scheme-Alternative R2

6.2.3 Alt.R3: Extension of RWY36 Threshold to South

Alt.R3 is a scheme to extend runway 18/36 to the south. The threshold of runway 18 will be displaced 600 m to the south. Thus, more than the half of the runway length is projected outside the existing airport property area, as shown in Fig. 6.2.4. An area of about 92 ha, which is a paddy field at present, will be acquired for the extension. This area is also reclaimed land of Lake Maryut, thus the soil condition is judged to be very poor. The most adverse factor in Alt.R3 is aircraft noise pollution to the densely populated residential area along the extended center line of runway 18. (refer to Fig. 6.7.2).

Although there is a great potential of aircraft noise problem irrespective of concept of development as long as Nozha airport is considered to be further developed for the future traffic need, Alt.R3 will cause the most serious noise problem among the three alternatives.

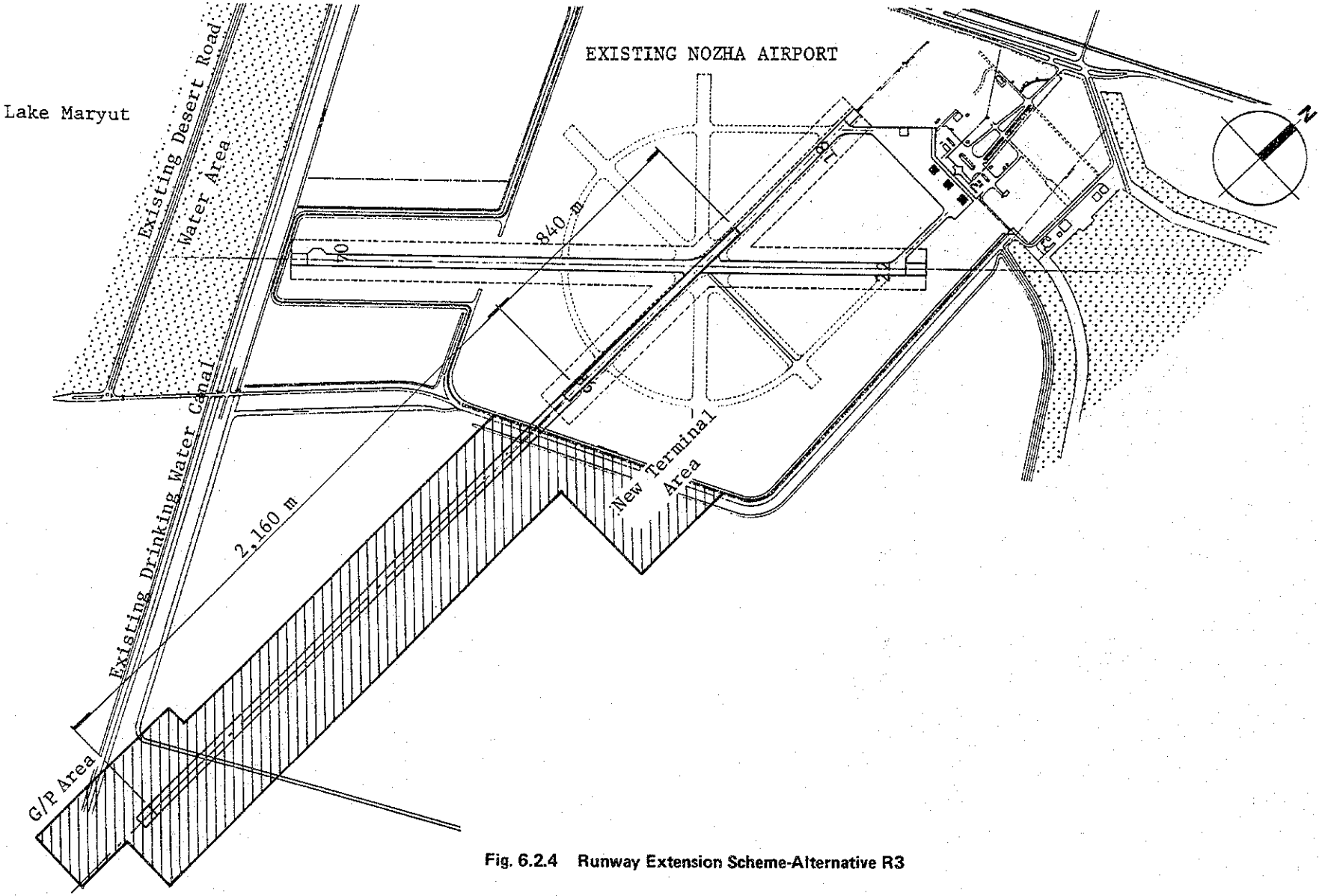


Fig. 6.2.4 Runway Extension Scheme-Alternative R3

6.2.4 Comparative Evaluation of Alternatives

Table 6.2.1 shows the comparative evaluation of the three alternatives. The preliminary cost estimate for civil works indicates that Alt.R1 (extension of runway 04 threshold to the south west) requires the highest cost (about 45 million Egyptian Pounds) while Alt.R3 (extension of runway 36 threshold to the south) requires the lowest cost (about 30 million Egyptian Pounds). However, Alt.R3 will influence the township of Alexandria by much greater aircraft noise. The influence area (more than WECPNL70, refer to the subsection 6.7) of aircraft noise will spread widely to 500 ha.

The most essential requisites in locating a new runway are the safety of aircraft operations and compatibility with airport surrounding area. Another requirement in airport planning today is to minimize aircraft noise influence to the airport vicinity.

The airport in Alexandria will play an important role as the gateway to both Egypt and Alexandria, and as an alternate airport for Cairo as well. Nozha airport will be required to operate for 24 hours a day if this airport is selected for future use. It is therefore, recommended that Alt.R3 with greater potential to cause noise problems in the future should not be selected.

Although Alt.R3 is 9 to 15 million Egyptian Pounds cheaper than the other alternatives, this difference will be offset and even reversed by possible noise compensation in the future. The extension of runway 18/36 will furthermore, require land acquisition of vast agricultural land (paddy field). The elimination of agricultural land for airport-use is not desirable in Egypt when other alternatives are possible.

Alt.R2 is 6 million Egyptian Pounds cheaper than Alt.R1. Therefore, Alt.R2, extension of runway 22, is selected as the most suitable scheme for the redevelopment of Nozha airport in order to be used as the basis for comparison with the development scheme for a new airport. However, it is noted that any substantial development of Nozha airport has a great potential to cause aircraft noise problem in the future.

Table 6.2.1 Comparative Evaluation of the Runway Extension

Item \ Alternative	Alt. R1 RWY 04 Extension	Alt. R2 RWY 22 Extension	Alt. R3 RWY 36 Extension	Remarks
1. Runway to be extended	800m toward the south west	800m toward north east	2,160m toward south*	* The Threshold of RWY 18 is displaced to the south by 600m
2. Pavement Overlay Length Required for the Existing Runway.	2,200m	2,200m	0*	* New pavement is required after removal of existing pavement
3. Necessary Land Acquisition	Approximately 1 ha	Approximately 5 ha	Approximately 105 ha	
4. Reclaimed Area	39 ha	24 ha	0	
5. Earthwork Volume Cut Fill (Including reclamation and sand mat)	---- 2,400,000 cu. m	100,000 cu.m 1,300,000 cu.m	---- 1,100,000 cu. m	
6. Other Major Works	Relocation of the desert road to Cairo (about 2.4km) and potable water canal	Relocation of potable water canal	Relocation of potable water canal	
7. Social Considerations	Greater noise pollution to the township at the north east and south west of airport	Greater noise pollution to the township at the north east and south west of airport. Height restriction in the industrial zone below RWY 22 approach surface strictly necessary	Greatest noise pollution to the township at the north of airport Land acquisition of paddy field to be necessary	
8. Preliminary Cost Estimate for Comparison, incl. Land Acquisition Removal and Civil Works	45 million Egyptian Pounds	39 million Egyptian Pounds	30 million Egyptian Pounds	

6.3 Terminal Area

The existing terminal facilities are located at the north end of the runway. The existing terminal facilities are not considered suitable for the expansion to cope with the future traffic demand because of their obsolescence, limited size and old system. Three alternative areas as shown in Fig. 6.3.1 can be considered for the development of the future terminal facilities.

Table 6.3.1 gives their comparative evaluation. As a result of the comparison, Alt.T2 is considered to be superior to the other alternatives in terms of location, expansibility and construction and is selected for development of new terminal area.

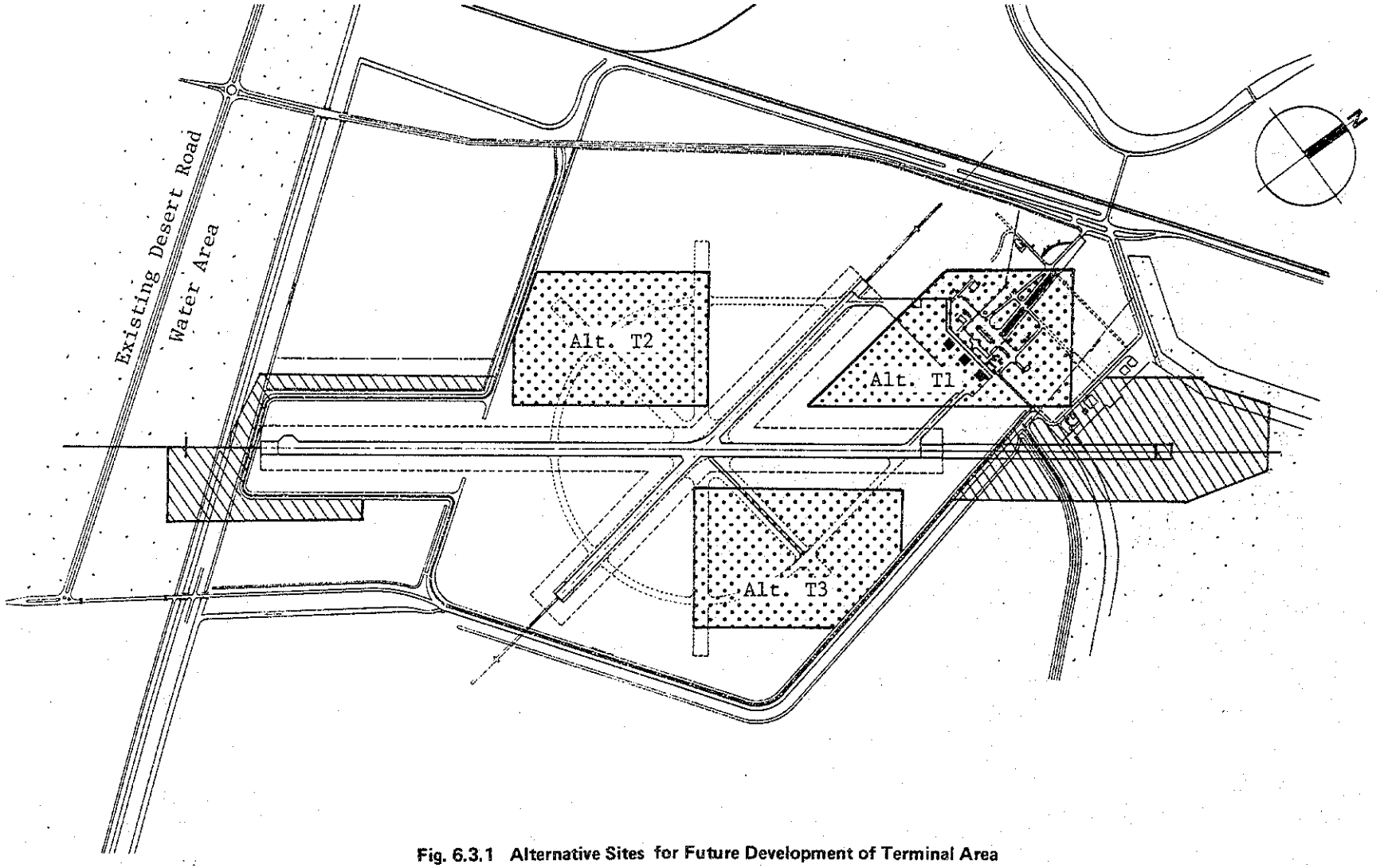


Fig. 6.3.1 Alternative Sites for Future Development of Terminal Area

Table 6.3.1 Comparative Evaluation of Terminal Area

Evaluation Item \ Alternatives	Alt. T1		Alt. T2		Alt. T3	
1. Location of Terminal Area (from the viewpoint of aircraft and airport operations)	Δ	-Area of the existing terminal facilities -North end of the main runway	o	-About gravity center of the airport and about midway of RWY 04/22	Δ	-About gravity center and midway of RWY 04/22 but communications to be made across runway if any facility remains on northwest
2. Effective Utilization of the Existing Terminal Facilities	×	-The existing terminal facilities to be demolished -No effective use of the existing terminal facilities is available	o	-The existing fire-station, heliport, and VIP building could be utilized -The existing apron and buildings could be used for small aircraft	o	-The existing fire-station, heliport, VIP building could be utilized -The existing apron and building could be used for small aircraft
3. Access Road inside Airport Property	o	Closest distance to the desert road	o	-About 0.2 km of new access road directly to the desert road to be constructed	×	-About 2.5 km of new access road detouring around the main runway to be constructed
4. Constructional Factor	×	-The construction may disrupt the operation of the existing terminal -Construction on weak foundation	Δ	-Construction on weak foundation	Δ	-Construction on weak foundation
5. Future Expansibility	o	-To be expanded to the former marine airport	o	-To be expanded on the north along RWY 18/36 -Larger expansibility	Δ	-To be expanded to the south along RWY 18/36 -The least expansibility

Legend
o Good
Δ Fair
× Poor

6.4 Obstacle Limitation Surfaces and Aircraft Operations

6.4.1 Obstacle Limitation Surface

An obstacle survey was carried out to confirm existence of obstacles in the approach area for runway 22 of Nozha airport. As a result of the obstruction survey, it was confirmed that nothing protrudes upon the 1:50 slope of approach surface for runway 22 even if runway 04/22 is extended by 800 meters toward the north east. However, an adjustment of the future land use for the north side of the former marine airport is considered necessary in order to ensure safety for aircraft operations in the final approach segment for runway 22 as shown in Fig. 6.4.1.

According to "Comprehensive Plan Alexandria 2005" issued by the Governorate of Alexandria, 1984, this area is included in the future industrial area.

Furthermore, visibility on approach end of runway 22 will be reduced by smoke of factories. It is, therefore recommended that a land use regulation should be established for the northern area of the airport so that buildings or factories may not constitute obstacle nor emit smoke in this area.

6.4.2 Aircraft Operational Considerations

The main approach direction to the runway 04/22 has been considered runway 22 by the previous study report (NACO) and the construction of approach lighting system for runway 22 is underway. The main approach direction to runway 04/22 has, however, been changed to runway 04 for the precision approach category-I operations for the following reasons:

a. ILS approach procedures to runway 22 conflict with the danger area: i.e. HE/D12 "El Maamura", a sector of a circle centered 311740N, 300200E, radius 20 km between directions 305° and 035° as shown in Fig. 6.4.2.

b. The wind analysis indicates that the usability factor of runway 04 exceeds that of runway 22 with the coverage of the cross-wind component less than 13kt and the tail wind component less than 5kt as shown in Figs. 6.4.3 and 4.

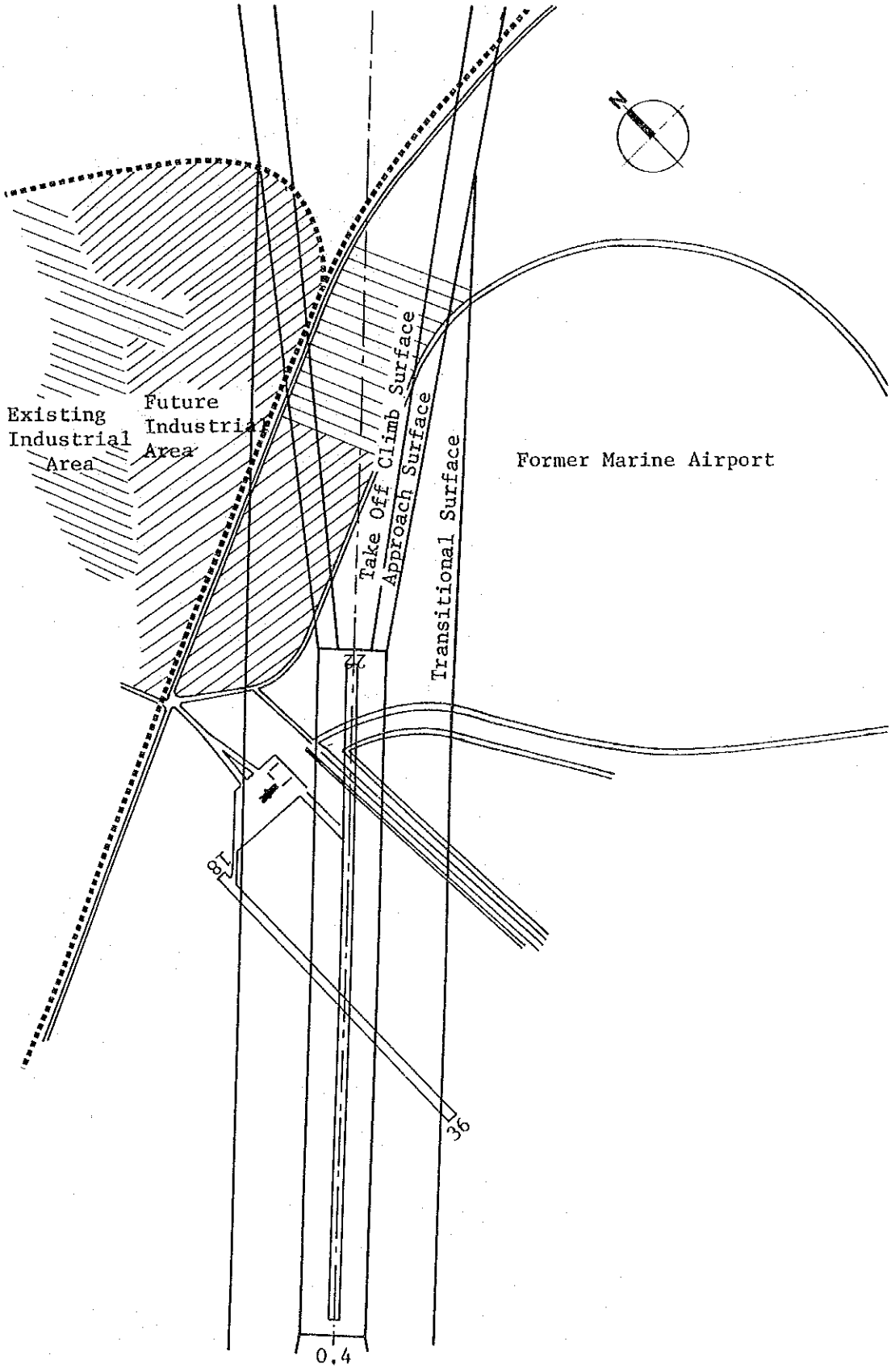


Fig. 6.4.1 Relations between Final Segment of Approach Area for Runway 22 and Future Industrial Area

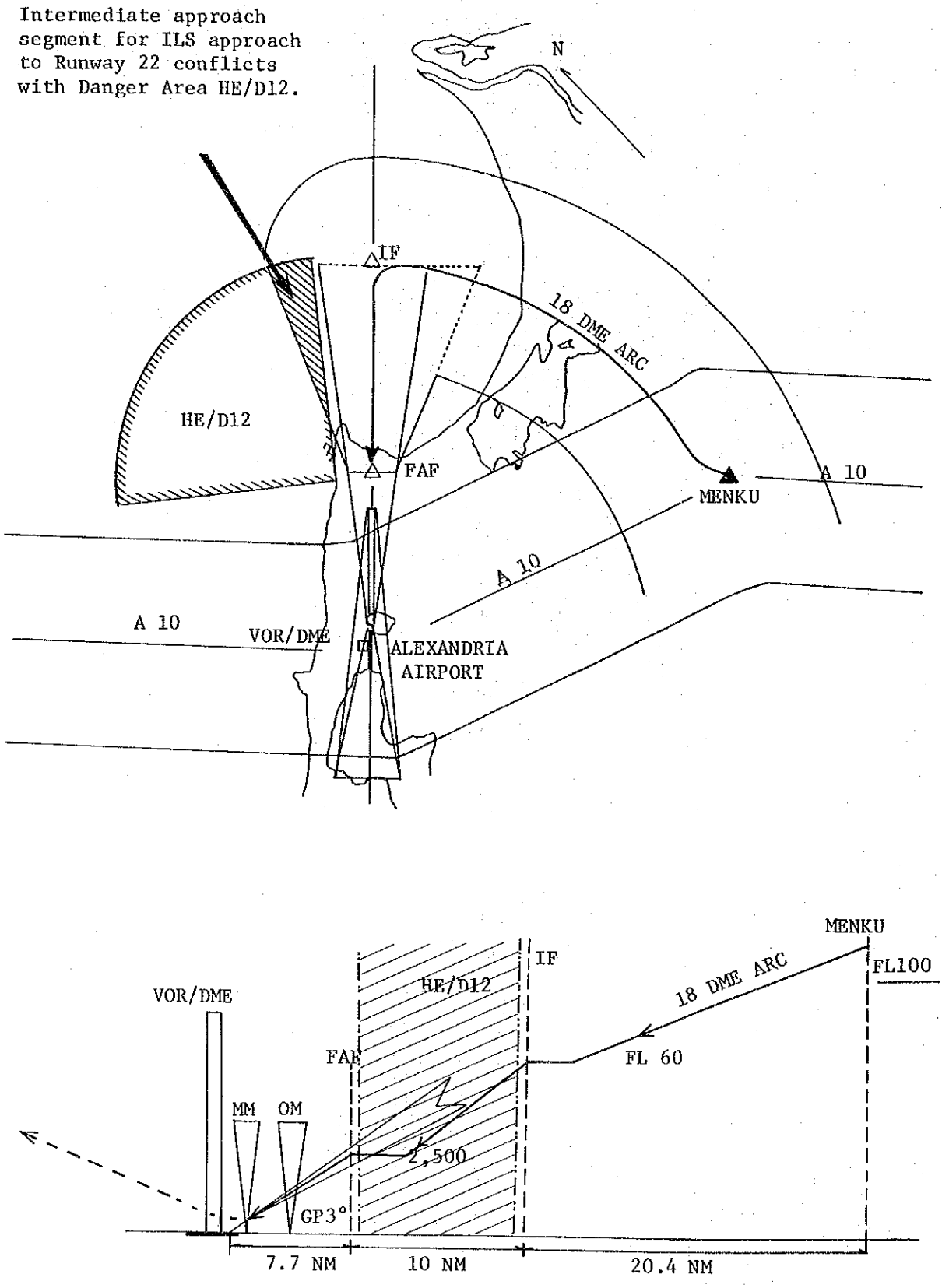
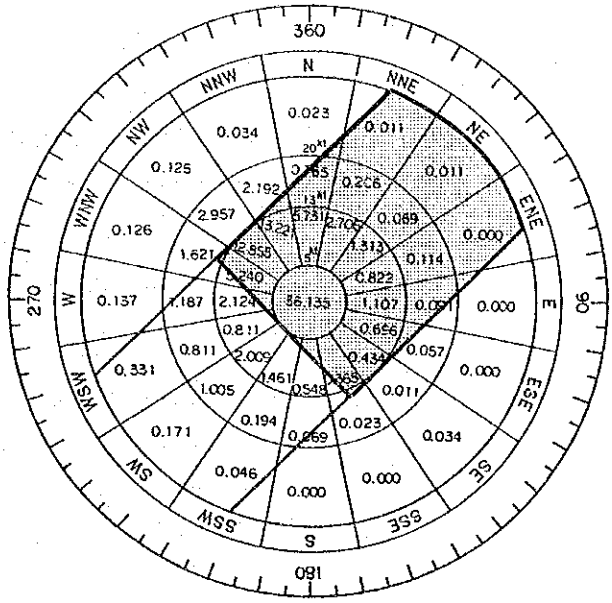
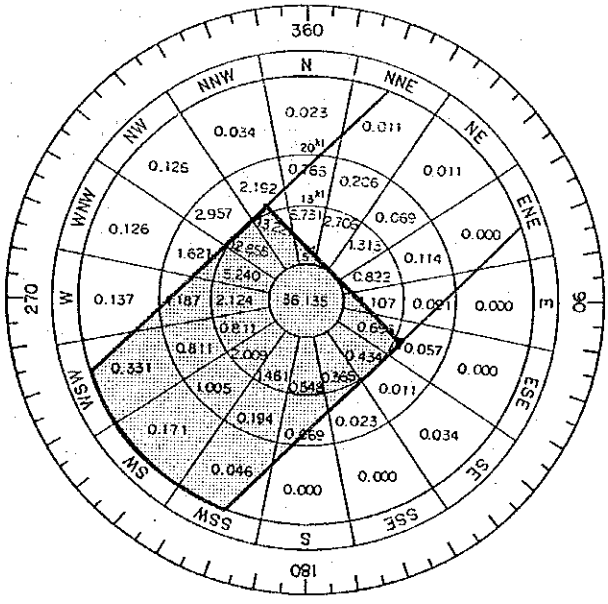


Fig. 6.4.2 Relations between Danger Area HE/D12 and Intermediate Segment for ILS Approach to Runway 22



Location: Nozha Airport
Period : 1981-1983 (3 years)
RWY Direction: N 45°30'E
Wind-coverage: 81.7% (Cross-wind 13kt)
(Tail wind 5kt)

Fig. 6.4.3 Usability Factor of RWY04



Location: Nozha Airport
Period : 1981-1983 (3 years)
R/W Direction: N 45°30'E
Wind-coverage: 78.6% (Cross-wind 13kt)
(Tail wind 5kt)

Fig. 6.4.4 Usability Factor of RWY22