Chapter 4

Air Traffic Demand Forecast

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Chapter 4. Air Traffic Demand Forecast

4.1. Review of SAPROF Study

4.1.1. Procedure of Air Traffic Demand Forecast applied in SAPROF

The following figure outlines the procedure which had been applied in the previous SAPROF study, to forecast the air traffic demand. In the previous forecast two different approaches, namely, Top-down analysis and Bottom-Up analysis, were applied. Both analysis were computed with data available only until the year 2002.

The present facilities at Borg El Arab International Airport were planned and constructed on the basis of the air traffic demand which had thus been forecasted.

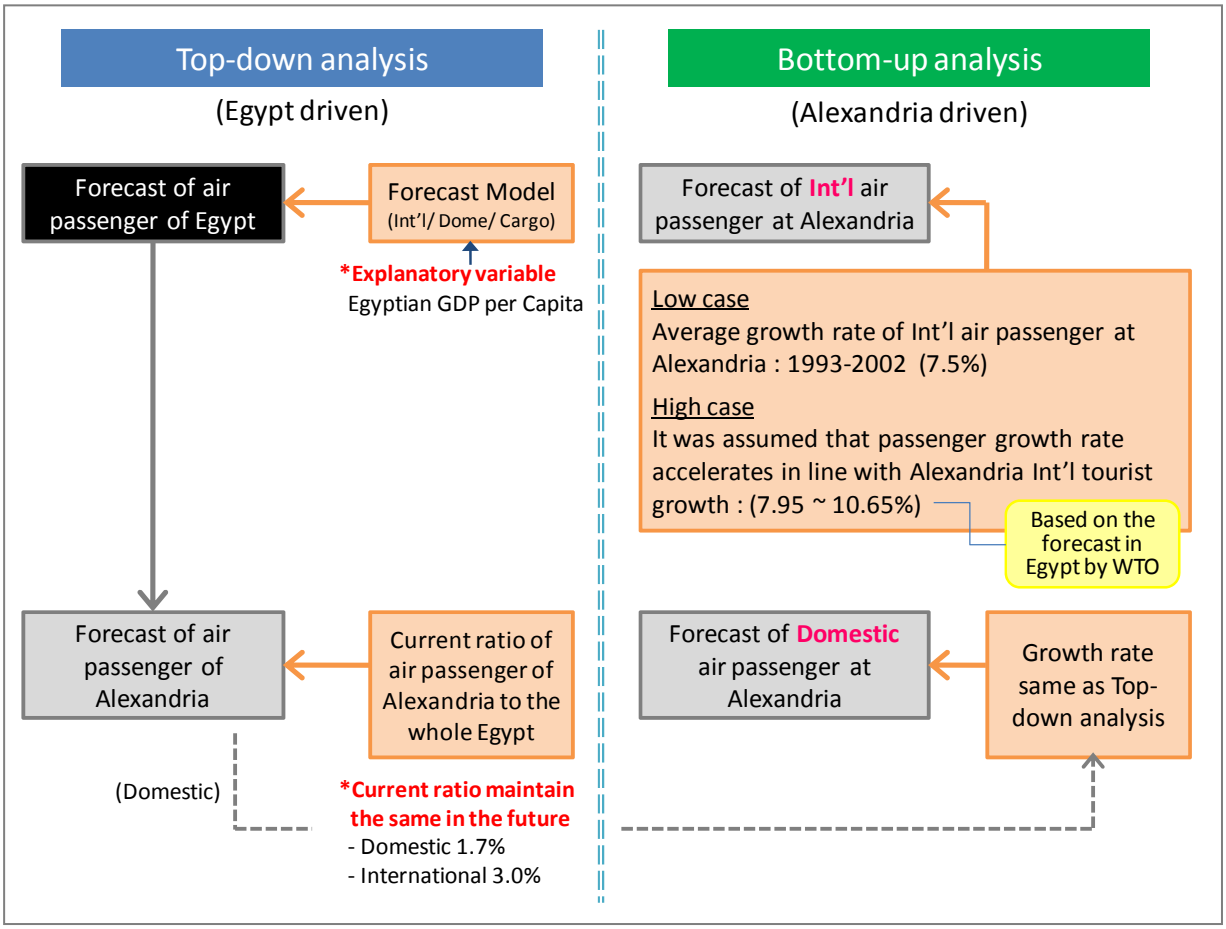


Figure 4.1-1 Procedure of Air Traffic Demand Forecast in SAPROF

In the Top-down analysis the international, domestic passengers and cargo volumes were predicted separately. First the number of air passengers for entire Egypt were computed by a linear regression model. Egyptian GDP per Capita was assumed to be the explanatory variable. In the next step the number of air passengers for Alexandria airport was computed by multiplying the ratio of air passengers at Alexandria to the entire Egypt. This ratio was assumed to be constant, because its trend had been consistent in the past, and was used to forecast the air traffic demand. A sensitive analysis was conducted by changing the assumption for Egyptian future GDP per Capita. Three cases were studied (High, Medium, and Low).

The Bottom-Up analysis was made by focusing on the air passengers in Alexandria. International and domestic passengers were forecasted separately. The future growth rate for international passenger was assumed based on the two scenarios, High and Low. The growth rate in the Low case was set based on the historical average annual growth rate of 7.5%. For the High case a gradually increasing growth rate was assumed according to Egypt tourism growth rate predicted by the World Tourism Organization (WTO). For domestic passengers, the results obtained in the Top-down analysis were adopted. In the previous SAPROF study the low case demand was used facility planning of the Borg El Arab International Airport.

4.1.2. Comparison between the Forecast in SAPROF Study with the actual Traffic

A Comparison has been made between the actual traffic recorded in 2010 and the number of passengers previously forecasted in the SAPROF Study for entire Egypt and Alexandria as shown in Table 4.1-1.

1) Top-down

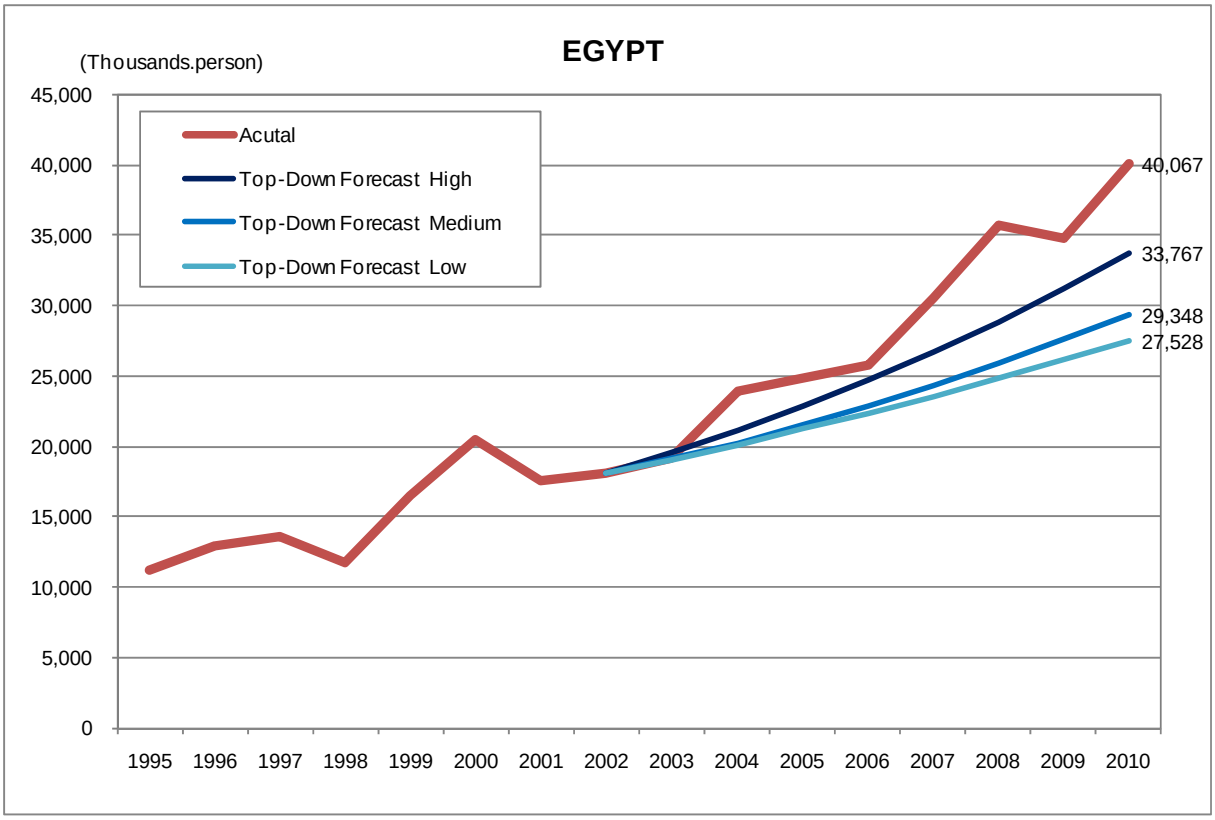
For example for the Medium case 2010, the actual traffic exceeded the previous forecast for Egypt by 27% and for Alexandria by 57%. The difference between the previous forecast and actual traffic becomes larger when the passenger demands only for Alexandria are considered.

2) Bottom-Up

The actual passenger traffic in 2010 in Alexandria was 55% higher than the Low case forecast.

Table 4.1-1 Actual and SAPROF Forecast Air Passenger Demand

	Egypt				Alexandria (ALY + HBE)					
	Acutal	Top-Down Forecast			Acutal	Top-Down Forecast			Bottom-UP Forecast	
		High	Medium	Low		High	Medium	Low	High	Low
1995	11,222				250					
1996	12,888				260					
1997	13,561				285					
1998	11,668				290					
1999	16,557				325					
2000	20,534				347					
2001	17,608				365					
2002	18,121	18,121	18,121	18,121	422	422	422	422	422	422
2003	19,103	19,561	19,117	19,082	449	476	465	464	474	471
2004	23,907	21,141	20,259	20,117	491	516	494	490	510	505
2005	24,811	22,850	21,544	21,208	609	558	525	517	550	541
2006	25,801	24,697	22,910	22,369	803	604	559	546	592	579
2007	30,610	26,694	24,364	23,573	962	654	596	576	638	621
2008	35,769	28,869	25,923	24,824	1,290	709	634	607	687	665
2009	34,835	31,221	27,582	26,141	1,469	767	676	640	740	713
2010	40,067	33,767	29,348	27,528	1,682	831	720	674	802	764
Difference in 2010		▲16%	▲27%	▲31%		▲51%	▲57%	▲60%	▲52%	▲55%



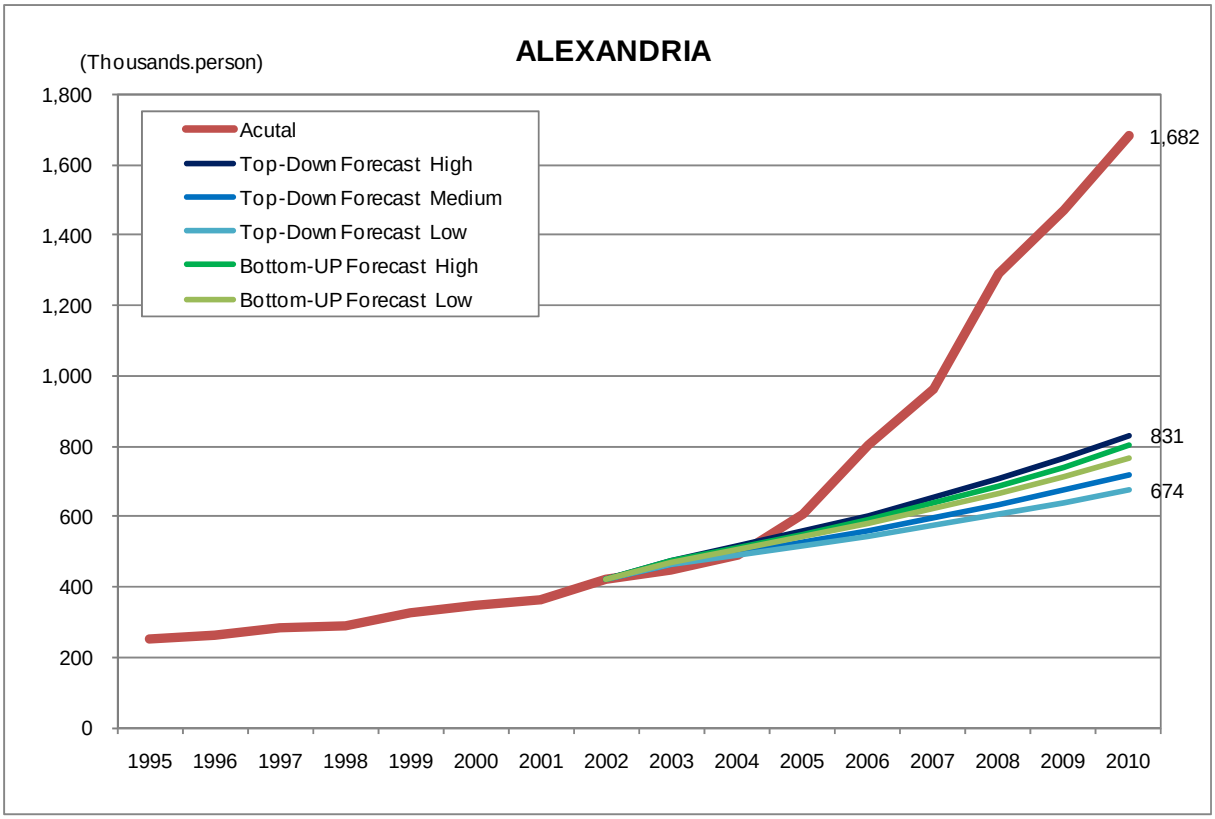


Figure 4.1-2 Comparison between Previous Forecasts and Actual Traffic

4.1.3. Comparative Analysis between SAPROF and Present

1) Socio-economic indices

In the Top-down analysis of SAPROF study, only Egyptian GDP per Capita was used in the forecasting models as an explanatory variable.

Chronological changes in the Egyptian GDP per Capita after 1995 (actual and assumed in SAPROF) are shown in the Table 4.1-2.

In the SAPROF study, a price of Egyptian GDP was expressed in USD, and the base year of the constant price was at 1995. Currently, Egyptian GDP at constant price is expressed as the base year of 2002.

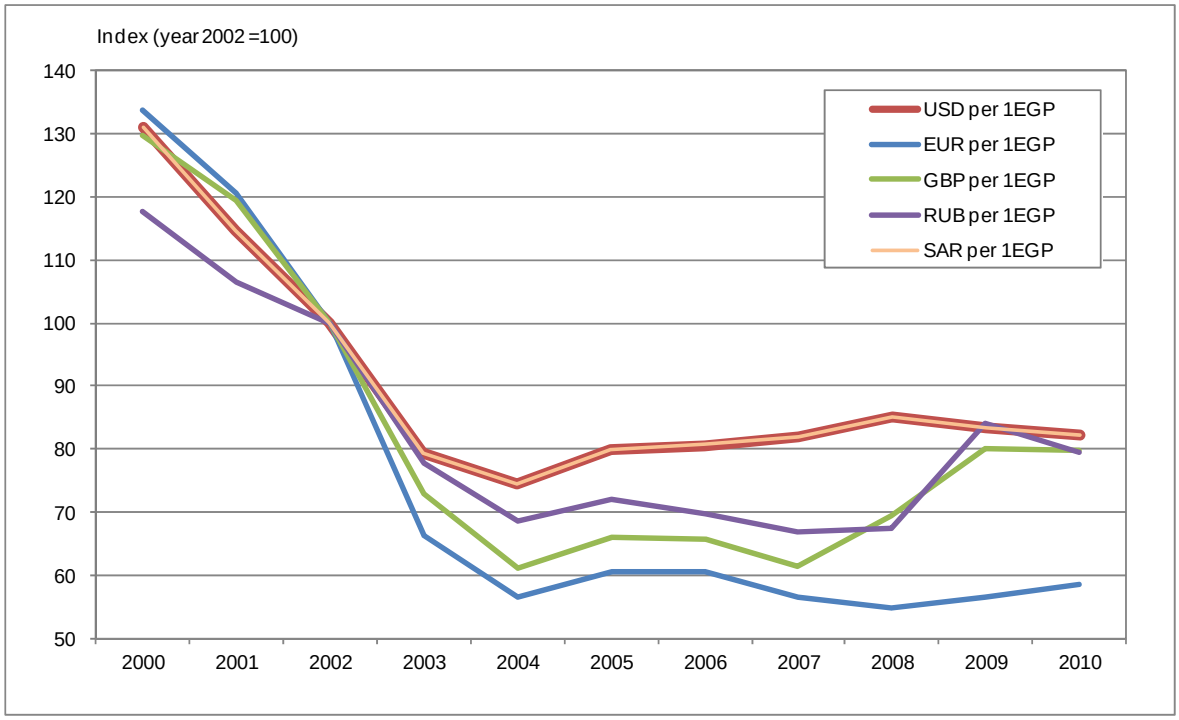
In the same Table below, the GDP and GDP per Capita after 2003 were estimated by transforming the base year, the GDP deflator, and the then prevailing Exchange Rate.

It should be noted that the Exchange Rate was depreciated after introduction of the floating rate system into Egyptian pound in January, 2003. Thereafter the Egyptian pound has depreciated against the USD, and the value of Egyptian pound has dropped by approximately 20%. Egyptian pound also depreciated against foreign currencies of major and neighboring countries as shown in Figure 4.1-3.

Table 4.1-2 Comparison of variables of forecast model at SAPROF

	X (explanatory variable) GDP per capita at 95 const (USD)		Egypt GDP at 95 const (Bill USD)		Egypt Population (Millions)		Exchange rate	
	Acutal (Estimate)	SAPROF Assumption	Acutal (Estimate)	SAPROF Assumption	Acutal	SAPROF Assumption	USD per 1EGP	EGP per 1USD
1995	1,057		60.163		56.90		0.2938	3.4037
1996	1,084		63.078		58.20		0.2939	3.4025
1997	1,125		66.844		59.40		0.2945	3.3956
1998	1,185		71.926		60.70		0.2931	3.4118
1999	1,220		75.615		62.00		0.2926	3.4176
2000	1,255		79.453		63.30		0.2830	3.5336
2001	1,160		75.034		64.70		0.2476	4.0388
2002	1,019		67.232		66.00		0.2161	4.6275
2003	870	1,276	58.560	86.376	67.30	67.70	0.1714	5.8343
2004	740	1,311	50.776	90.478	68.60	69.00	0.1612	6.2035
2005	778	1,351	54.474	95.002	70.00	70.32	0.1726	5.7937
2006	851	1,392	60.674	99.752	71.30	71.67	0.1743	5.7372
2007	889	1,432	65.415	104.740	73.60	73.05	0.1773	5.6402
2008	966	1,479	72.653	109.977	75.20	74.36	0.1838	5.4407
2009	988	1,525	75.872	115.476	76.80	75.70	0.1801	5.5525
2010	1,019	1,573	79.817	121.250	78.34	77.06	0.1776	5.6306
Difference in 2010		54%		52%		▲2%		

The actual Egyptian GDP per Capita in the year 2010 was 54% lower than the assumption of SAPROF.



[Note] EUE; EURO, GBP: Great Britain Pound, RUB: Russian Ruble, SAR: Saudi Arabian Riyal

Figure 4.1-3 Trend of a value of One Egyptian Pound against foreign currency

It is considered that the depreciation of the Egyptian pound is one of the factors in the increase of the foreign tourist in Egypt.

Though SAPROF assumed the average GDP growth rate from 2003 to 2010 to be 5.0% annually, in fact the average annual growth rate of 5.6% was achieved during the same period.

Elasticity of air passenger demand against Egyptian GDP growth for entire Egypt is shown in Table 4.1-3. The figure at the lower row in the Table expresses a demand elasticity against GDP growth. It is clear that demand elasticity after 2003 was higher than that before SAPROF.

Table 4.1-3 Elasticity of Air Passenger Demand against Egyptian GDP growth for Entire Egypt

	1995-2002	2003-2010
The number of increment air passenger per one billon GDP growth (persons)	69,123	104,014
Air passenger growth rate per GDP 1% growth (%)	1.46	1.72

2) Trend of air passenger movement in Egypt

In the Top-down analysis, future air traffic in Alexandria airports was computed by multiplying the ratio of air passengers of Alexandria in the entire Egypt. Meanwhile, in the Bottom-up analysis, future air traffic growth rate was assumed based on the past air traffic trend at Alexandria.

Trend of air passenger movements at each airport in Egypt are shown in Table 4.1-4.

Table 4.1-4 Trend of air passenger movement in Egypt

	Air passenger movement (persons)						Ratio of "ALY+HBE" against National total	
	Cairo	Sharm El-Shiekh	Hurghada	ALY + HBE	Others	Total	Actual	SAPROF Assumption
1995	7,035,002	633,550	1,112,531	250,042	2,190,417	11,221,542	2.23%	
1996	7,801,812	737,768	1,463,443	260,194	2,625,211	12,888,428	2.02%	
1997	8,015,942	935,304	1,432,223	284,685	2,893,315	13,561,469	2.10%	
1998	7,116,026	1,031,809	1,215,325	289,918	2,015,399	11,668,477	2.48%	
1999	8,302,212	1,677,770	2,092,194	325,209	4,159,888	16,557,273	1.96%	
2000	8,942,539	2,100,393	3,186,339	346,528	5,957,754	20,533,553	1.69%	
2001	8,318,643	2,068,866	2,926,148	365,431	3,929,152	17,608,240	2.08%	
2002	8,392,670	2,915,532	3,040,457	421,805	3,350,553	18,121,017	2.33%	2.33%
2003	8,337,152	3,418,808	3,396,354	449,090	3,501,168	19,102,572	2.35%	2.33%
2004	9,534,069	4,590,778	4,574,531	491,367	4,716,434	23,907,179	2.06%	2.33%
2005	10,218,369	4,750,089	4,524,022	609,212	4,709,775	24,811,467	2.46%	2.33%
2006	10,778,097	5,052,705	4,832,530	803,042	4,335,075	25,801,449	3.11%	2.33%
2007	12,577,456	6,415,017	5,945,254	962,392	4,709,552	30,609,671	3.14%	2.33%
2008	14,360,029	7,747,422	6,741,017	1,290,095	5,630,861	35,769,424	3.61%	2.33%
2009	14,378,842	7,419,467	6,728,291	1,469,059	4,839,087	34,834,746	4.22%	2.33%
2010	16,135,898	8,682,279	8,059,849	1,681,983	5,507,126	40,067,135	4.20%	2.33%
Average annual growth rate								
1995-2002	3%	24%	15%	8%	6%	7%		
2003-2010	10%	14%	13%	21%	7%	11%		

In the SAPROF study, the ratio of air passengers at Alexandria against those at entire Egypt was assumed constant because the ratio had been relatively stable before 2002, however in fact, the ratio has increased since 2005. The air passenger growth rate in Alexandria during the period from 2003 to 2010 was nearly double the rate of National total.

Average annual air passenger growth rate in Alexandria became higher after the SAPROF. While the rate from 1995 to 2002 was 8% per annum, the rate from 2003 to 2010 was 21% per annum. The growth rate was also higher, compared with the other airports.

Comparing air passenger growth rate from 2003 to 2010 at each airport, it is recognized that the growth rate of Sharm El-Sheikh is similar to that of Hurghada, and that the growth rate of Cairo is similar to that of the other airport.

It is certain that the expansion of Low Cost Carrier (LCC) business in Alexandria contributed to the higher passenger growth as described in Chapter3.

4.1.4. Principal Conclusion

Through review of the air traffic demand forecast in the SAPROF study, the following principal conclusions have been obtained which are relevant to the air traffic demand forecasting process in this study:

✓ The actual passenger number in 2010 at Alexandria was 55% higher than the Low Case forecast of the Bottom-up analysis which was used for facility planning of the Borg El Arab International Airport;

✓ Principal factors behind the difference between the actual number of passengers at Alexandria and the forecasted demand in SAPROF are

- Egyptian economy has grown more than expected;

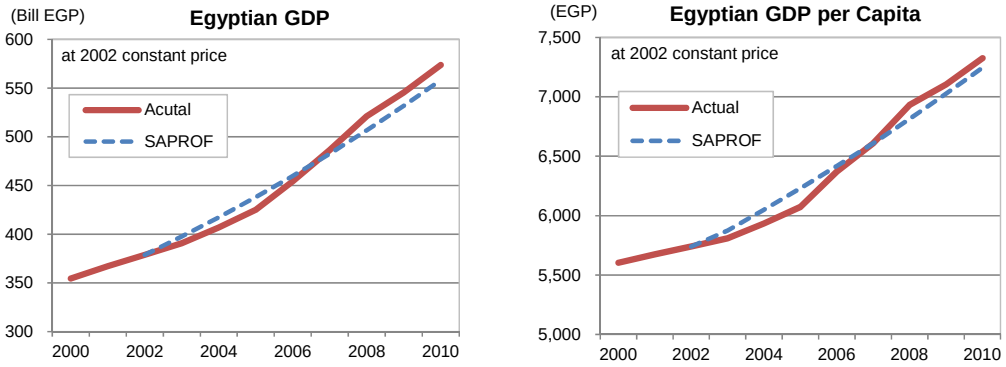


Figure 4.1-4 Comparison of Socio-economic indices

- The Low Cost Carrier (LCC) business has been expanded especially at Alexandria; and

- As stated earlier, the air passenger demand elasticity against Egyptian GDP growth for entire Egypt after SAPROF study (after 2003) was higher than that before SAPROF.

✓ The amount of Egyptian GDP converted to the USD equivalent fluctuated greatly after SAPROF study due to introduction of floating exchange rate system into Egyptian pound from January 2003. This suggests that Egyptian GDP of the national currency (EGP) is suitable for the explanatory variable of forecast models.

✓ Average annual air passenger growth rate in Alexandria has drastically increased after the SAPROF study, i.e. the rate between 1995 and 2002 was 8% per annum, while the rate after 2003 to 2010 was 21% per annum. The growth rate at Alexandria was the highest among Egyptian airports. In order to incorporate such trend into the revised traffic forecast, it is necessary to carefully observe the trend of air traffic movements specific to each of the Egyptian airports.

✓ Especially, the analysis of LCC business expansion trend is one of the most important issues for revising the future air traffic.

4.2. Forecasting Parameters

4.2.1. Air Traffic in Egypt

1) Passengers

- ✓ In general, air passenger demand in Egypt tends to increase constantly, except after negative internal and/or external events, e.g. terrorism or financial crisis, which temporarily decreases the demand.
- ✓ Internal and external events, which affected the air passenger demand between 1995 and 2010, are summarized below.

Table 4.2-1 Internal and External Events

Year	Month	Event
1997	November	Luxor Massacre (Internal)
2001	September	September 11 attacks (External)
2005	July	Sharm El-Sheikh attacks (Internal)
2008	October	World financial crisis (External/Internal)

- ✓ Average annual growth rate of air passengers increased after the SAPROF study, i.e. from 7.1% between 1995 and 2002 to 11.2% between 2003 and 2010.
- ✓ The number of air passengers at Sharm El-Sheikh and Hurghada International Airports as well as the total number of air passengers visiting Egypt increased unexpectedly.
- ✓ In Alexandria, the average annual growth rate of air passengers between 2003 and 2010 in Alexandria-Nozha International Airport (ALY) was 17.7%, and that in Borg El Arab International Airport (HBE) was 26.3%. When compared to other airports in Egypt these growth rates were remarkably higher. Hence, the ratio of air passengers at Alexandria airports to whole Egypt has increased from 2% in 2002 to 4% in 2010.

2) Cargo

- ✓ International air cargos are mostly handled in Cairo International Airport. The volume of domestic air cargos is assumed to be small, because domestic routes are mainly operated by small aircraft with small belly cargo space. At the moment no sufficient data are available related to the cargo traffic in Egypt.
- ✓ International air cargo had a tendency to decrease until 2003, but has been increasing thereafter.

3) Aircraft Movement

- ✓ The trend of aircraft movements is similar to the trend of air passengers.
- ✓ Average annual growth rates of the aircraft movements were less than those of air passengers (2.8% between 1995 and 2002; and 9.9% between 2003 and 2010), because the number of air passengers onboard was increasing (in other words, operating fleets are up-sizing).

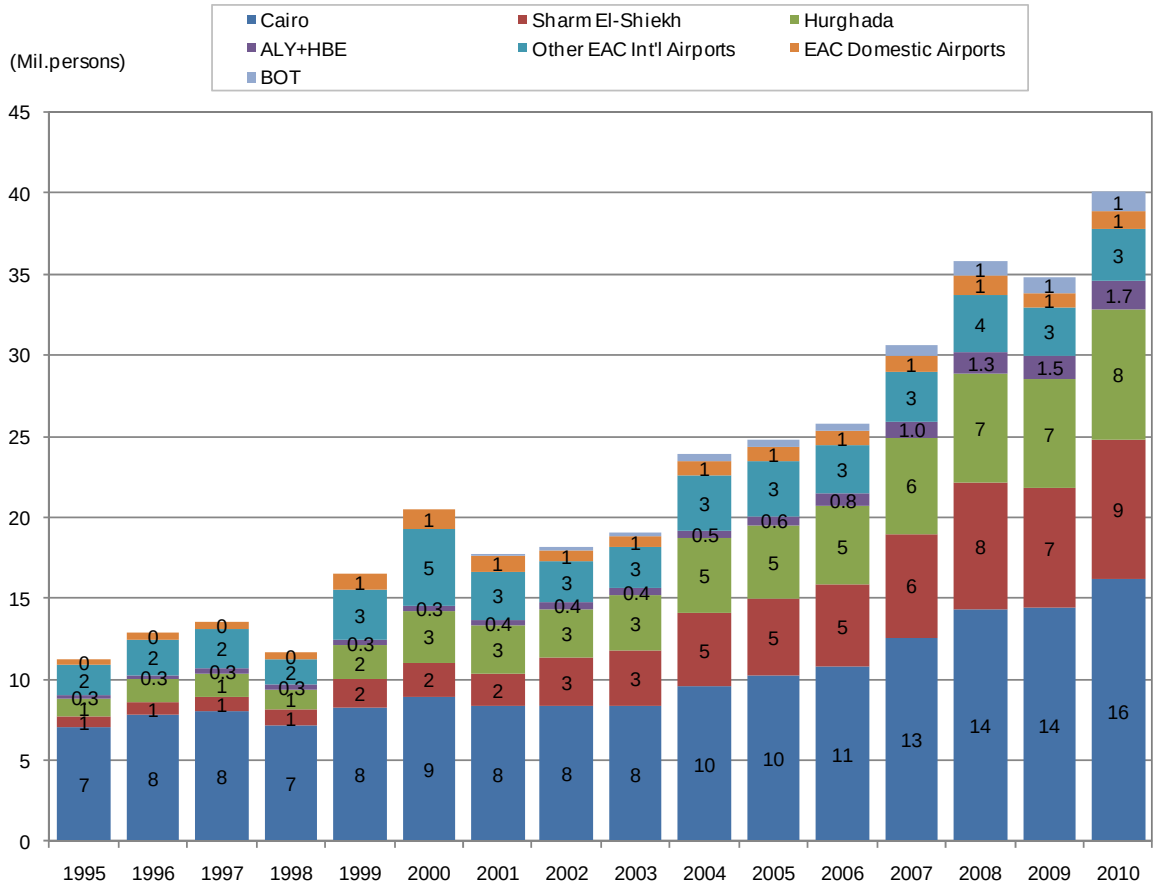


Figure 4.2-1 Air Passenger (Departure + Arrival) by Airports in Egypt

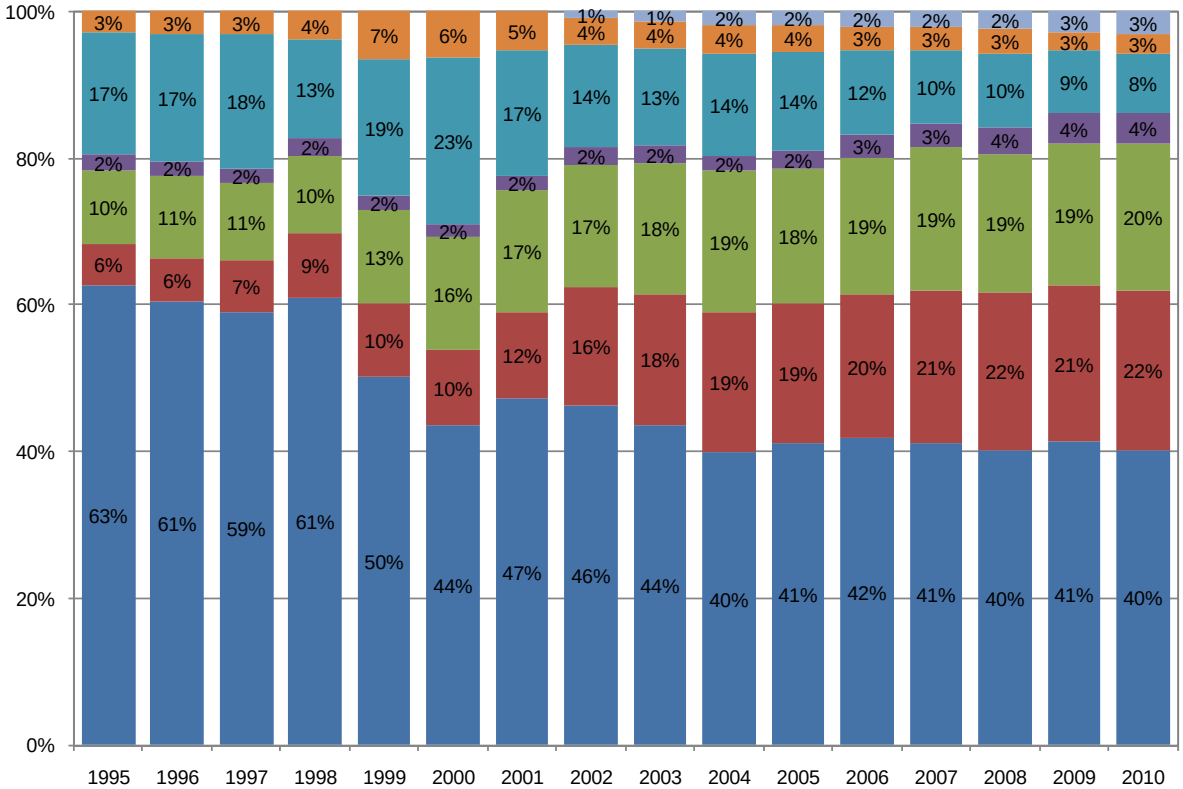


Figure 4.2-2 Distribution of Air Passenger by Airports in Egypt

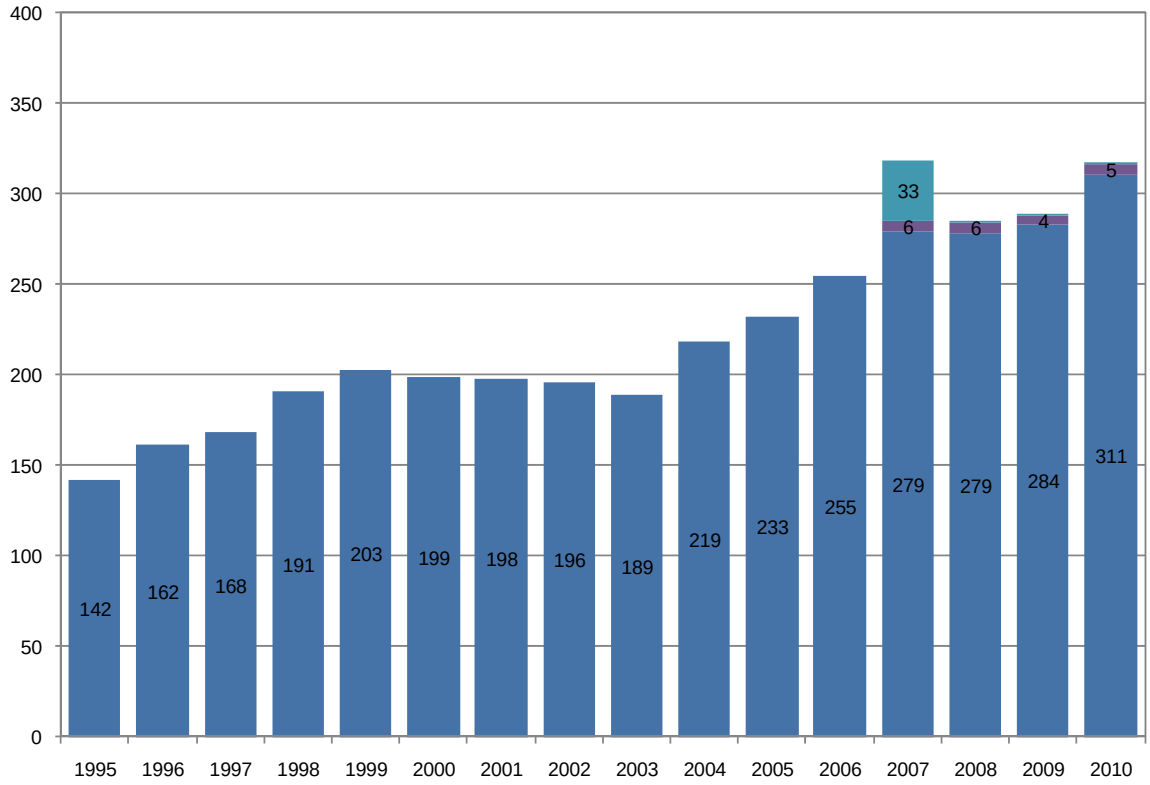
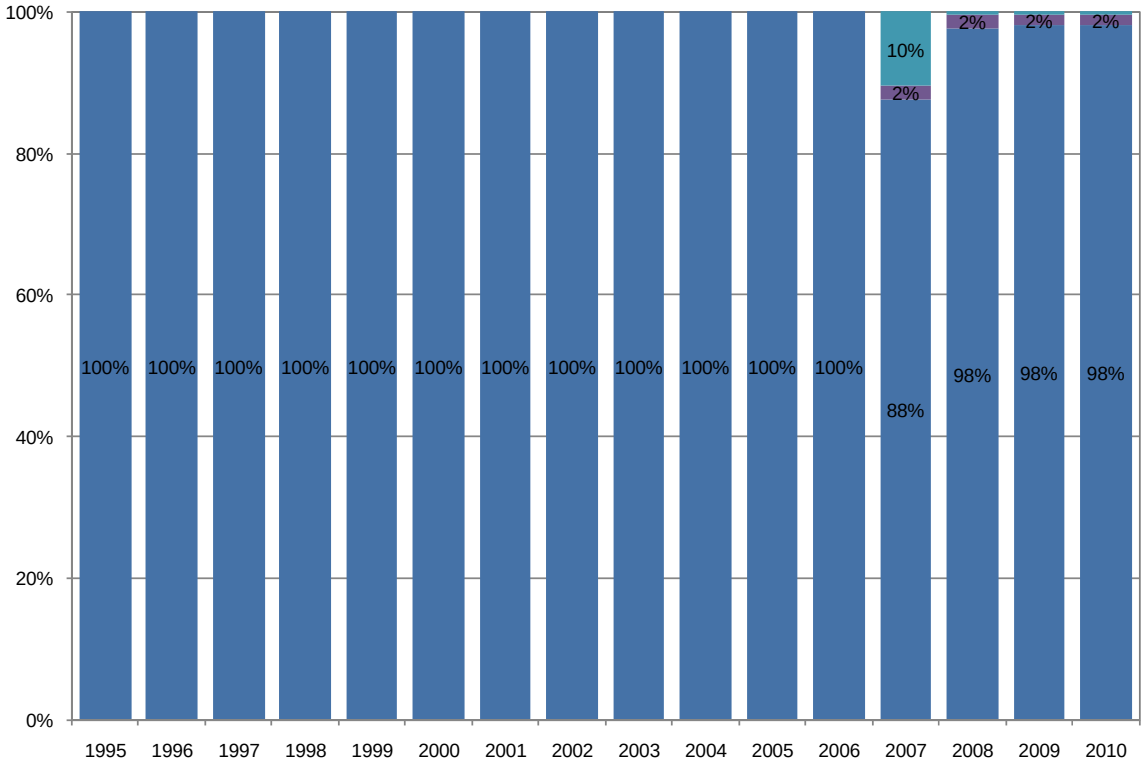


Figure 4.2-3 International Air Cargo (Export + Import) by Airports in Egypt



[Source] Egyptian Holding Company of Airports and Air Navigation website

Figure 4.2-4 Distribution of International Air Cargo by Airports in Egypt

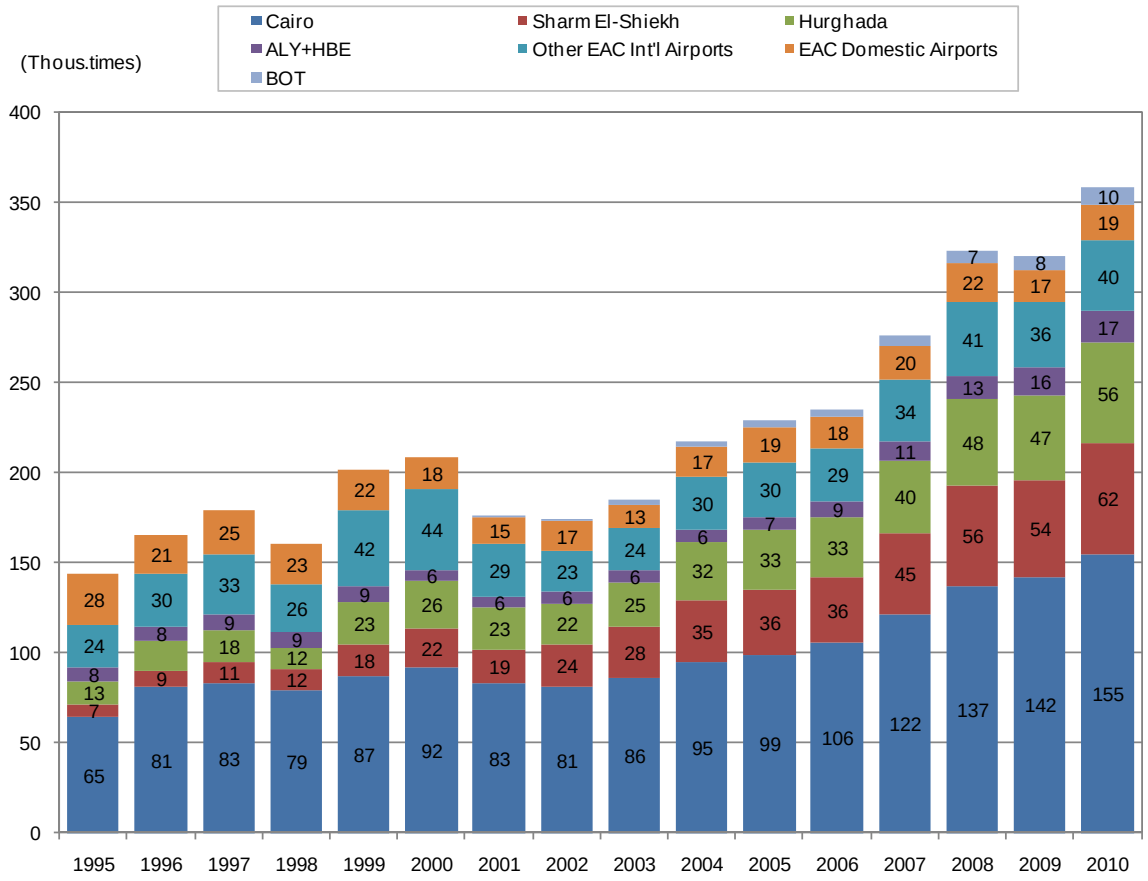
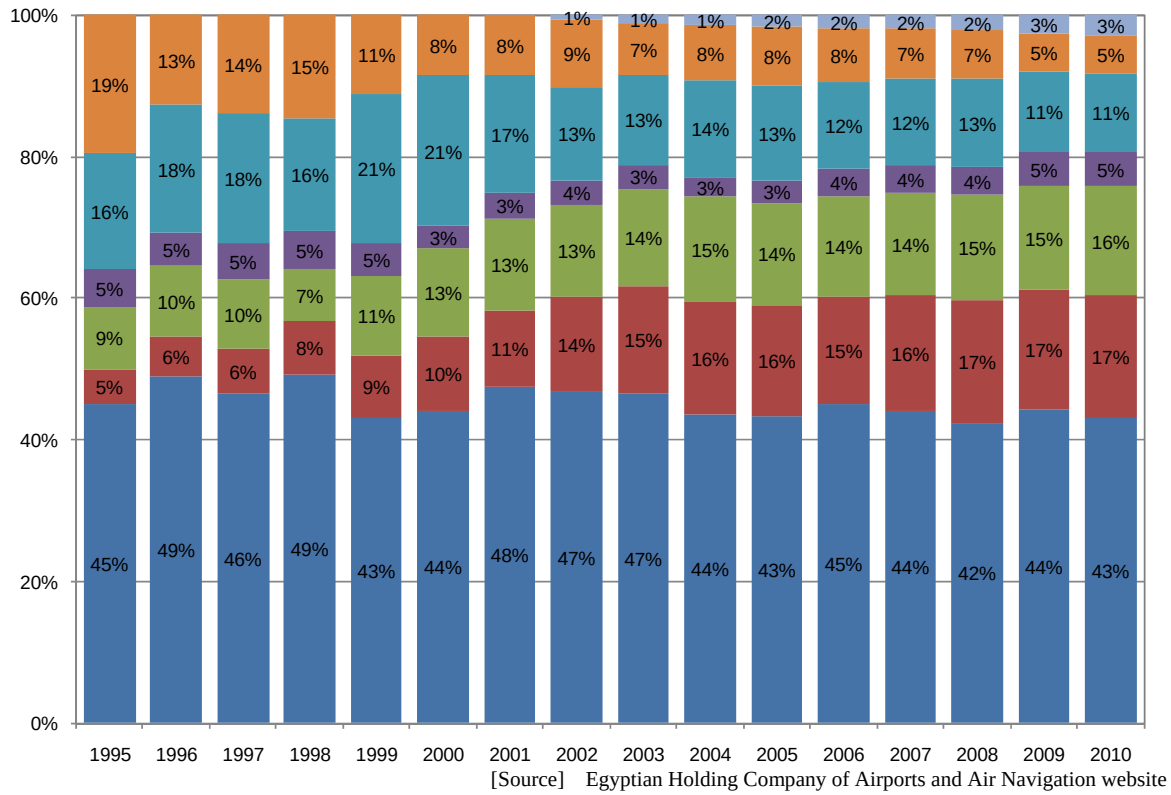


Figure 4.2-5 Aircraft Movements by Airports in Egypt



[Source] Egyptian Holding Company of Airports and Air Navigation website

Figure 4.2-6 Distribution of Aircraft Movements by Airports in Egypt

Table 4.2-2 Air Traffic by Airports in Egypt

Passenger (Thousand Persons)

	Cairo	Sharm El-Shiekh	Hurghada	Luxor	Aswan	Alexandria	Borg El-Arab	Asyut	EAC Int'l Airport	EAC Dome. Airport	Marsa Alam	El-Alamein	Total
1995	7,035	634	1,113	1,290	589	250	0	0	3,875	312	0	0	11,222
1996	7,802	738	1,463	1,481	748	260	0	0	4,691	396	0	0	12,888
1997	8,016	935	1,432	1,713	750	285	0	5	5,121	425	0	0	13,561
1998	7,116	1,032	1,215	919	628	290	0	24	4,108	444	0	0	11,668
1999	8,302	1,678	2,092	1,735	1,321	325	0	26	7,177	1,078	0	0	16,557
2000	8,943	2,100	3,186	2,270	2,356	255	92	25	10,284	1,307	0	0	20,534
2001	8,319	2,069	2,926	1,893	1,081	196	170	32	8,366	921	2	0	17,608
2002	8,393	2,916	3,040	1,635	834	304	118	47	8,894	665	170	0	18,121
2003	8,337	3,419	3,396	1,652	843	310	139	44	9,803	691	271	0	19,103
2004	9,534	4,591	4,575	2,124	1,167	412	79	62	13,010	933	430	0	23,907
2005	10,218	4,750	4,524	2,257	1,032	489	120	72	13,245	913	435	0	24,811
2006	10,778	5,053	4,833	2,033	874	573	230	89	13,684	822	500	18	25,801
2007	12,577	6,415	5,945	1,976	979	729	234	131	16,409	952	643	29	30,610
2008	14,360	7,747	6,741	2,160	1,107	1,102	188	328	19,374	1,177	820	39	35,769
2009	14,379	7,419	6,728	1,847	864	1,098	371	257	18,585	901	939	31	34,835
2010	16,136	8,682	8,060	1,935	954	972	710	313	21,626	1,099	1,182	24	40,067
Average Annual Growth Rate													
1995-2002	**2.6%**	**24.4%**	**15.4%**	**3.4%**	**5.1%**	**2.8%**	**-**	**-**	**12.6%**	**11.4%**	**-**	**-**	**7.1%**
2003-2010	**9.9%**	**14.2%**	**13.1%**	**2.3%**	**1.8%**	**17.7%**	**26.3%**	**32.4%**	**12.0%**	**6.9%**	**23.4%**	**-**	**11.2%**

Cargo (tons)

	Cairo	Sharm El-Shiekh	Hurghada	Luxor	Aswan	Alexandria	Borg El-Arab	Asyut	EAC Int'l Airport	EAC Dome. Airport	Marsa Alam	El-Alamein	Total
1995	141,813								0	0			141,813
1996	161,527								0	0			161,527
1997	168,058								0	0			168,058
1998	190,641								0	0			190,641
1999	202,867								0	0			202,867
2000	199,180								0	0			199,180
2001	197,937								0	0			197,937
2002	196,308								0	0			196,308
2003	189,343								0	0			189,343
2004	218,606								0	0			218,606
2005	232,548								0	0			232,548
2006	254,782								0	0			254,782
2007	279,319			33,421		5,844			39,265	0			318,584
2008	278,578			945		5,893			6,838	0			285,416
2009	283,502			1,035		4,402			5,438	0			288,940
2010	310,903			861		5,351			6,212	0			317,115
Average Annual Growth Rate													
1995-2002	**4.8%**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4.8%**
2003-2010	**7.3%**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**7.6%**

Aircraft Movements (times)

	Cairo	Sharm El-Shiekh	Hurghada	Luxor	Aswan	Alexandria	Borg El-Arab	Asyut	EAC Int'l Airport	EAC Dome. Airport	Marsa Alam	El-Alamein	Total
1995	64,628	7,283	12,612	14,624	9,085	7,607	0	0	51,211	27,908	0	0	143,747
1996	81,045	9,265	16,480	18,590	11,175	7,802	0	0	63,312	21,041	0	0	165,398
1997	83,299	11,457	17,610	20,477	11,729	9,331	0	556	71,160	24,863	0	0	179,322
1998	79,312	12,172	11,669	13,412	11,396	8,744	0	844	58,237	23,436	0	0	160,985
1999	86,953	18,135	22,695	20,540	19,145	9,250	0	2,792	92,557	22,465	0	0	201,975
2000	92,006	21,719	26,127	21,375	18,330	4,411	1,872	4,767	98,601	17,661	0	0	208,268
2001	83,293	18,788	22,860	16,603	11,553	2,945	3,149	1,171	77,069	14,740	15	0	175,117
2002	81,340	23,708	22,450	13,384	8,850	4,510	1,660	628	75,190	16,500	1,235	0	174,265
2003	86,175	27,899	25,367	14,445	8,472	4,396	1,979	646	83,204	13,144	2,290	0	184,813
2004	94,921	34,684	32,163	17,590	11,354	5,247	901	766	102,705	16,902	3,129	0	217,657
2005	99,204	36,029	32,824	19,079	10,605	5,920	1,494	776	106,727	19,151	3,661	8	228,751
2006	106,000	35,723	33,296	17,776	10,119	6,984	2,452	934	107,284	17,722	4,091	273	235,370
2007	121,845	44,884	39,992	20,476	12,001	8,251	2,350	1,402	129,356	19,556	4,871	344	275,972
2008	137,333	55,854	47,821	23,616	13,629	11,215	1,548	3,439	157,122	21,927	6,353	521	323,256
2009	142,355	53,807	46,925	21,652	11,857	12,313	3,544	2,764	152,862	17,372	7,489	619	320,697
2010	154,832	61,681	55,634	23,536	13,028	10,424	6,836	3,135	174,274	19,246	9,722	643	358,717
Average Annual Growth Rate													
1995-2002	**3.3%**	**18.4%**	**8.6%**	**-1.3%**	**-0.4%**	**-7.2%**	**-**	**-**	**5.6%**	**-7.2%**	**-**	**-**	**2.8%**
2003-2010	**8.7%**	**12.0%**	**11.9%**	**7.2%**	**6.3%**	**13.1%**	**19.4%**	**25.3%**	**11.1%**	**5.6%**	**22.9%**	**-**	**9.9%**

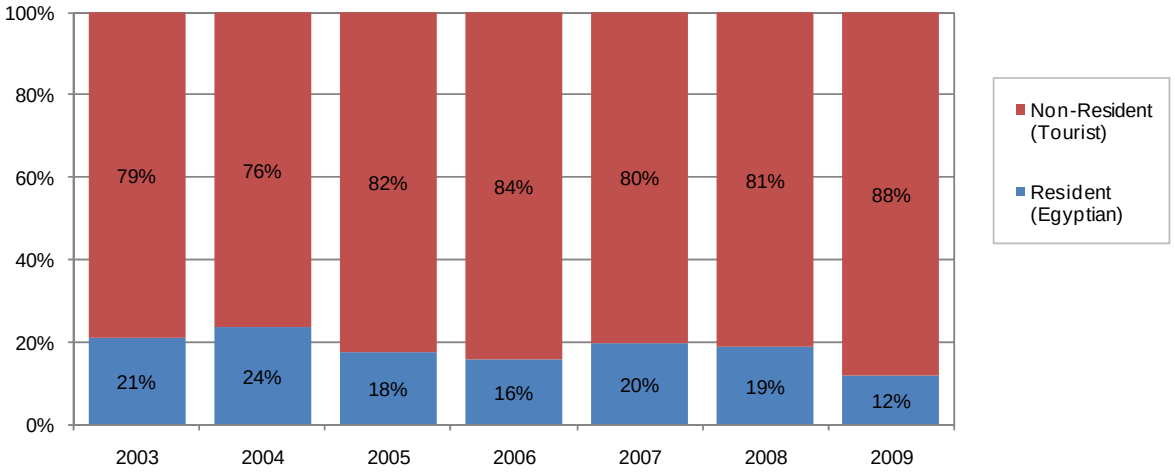
http://www.ehcaan.com/statistics.aspx

4.2.2. Origin & Destination / Nationality of Air passenger

1) Origin & Destination

"Tourism Fact Book" published by the World Tourism Organization (UNWTO) shows the origin & destination of passengers with Egyptian and non-Egyptian nationality.

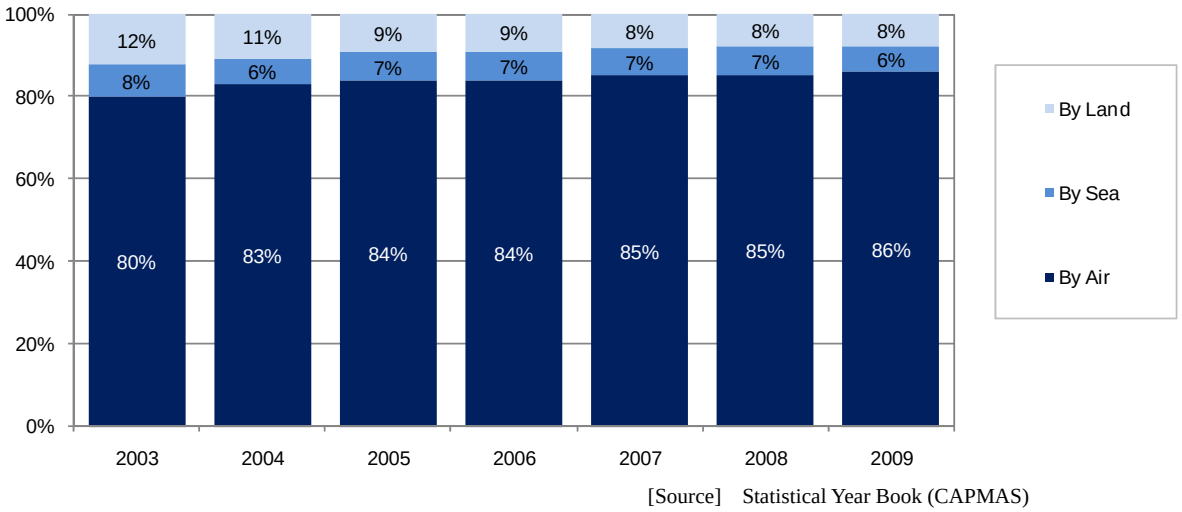
Share of Egyptian resident or non-resident visitors at the national borders to Egypt is shown in Figure 4.2-7. In average, the ratios of residents and non-residents have been approximately 20% and 80 % respectively.



[Source] World Tourism Organization (UNWTO)

Figure 4.2-7 Distribution of Resident/ Non-resident visitors at National borders

Figure 4.2-8 shows types of transportation used for tourists' entry to Egypt. The air transport accounted for more than 80 % which is similar to the share of foreign visitors in the total tourist arrivals shown in Figure 4.2-8.



[Source] Statistical Year Book (CAPMAS)

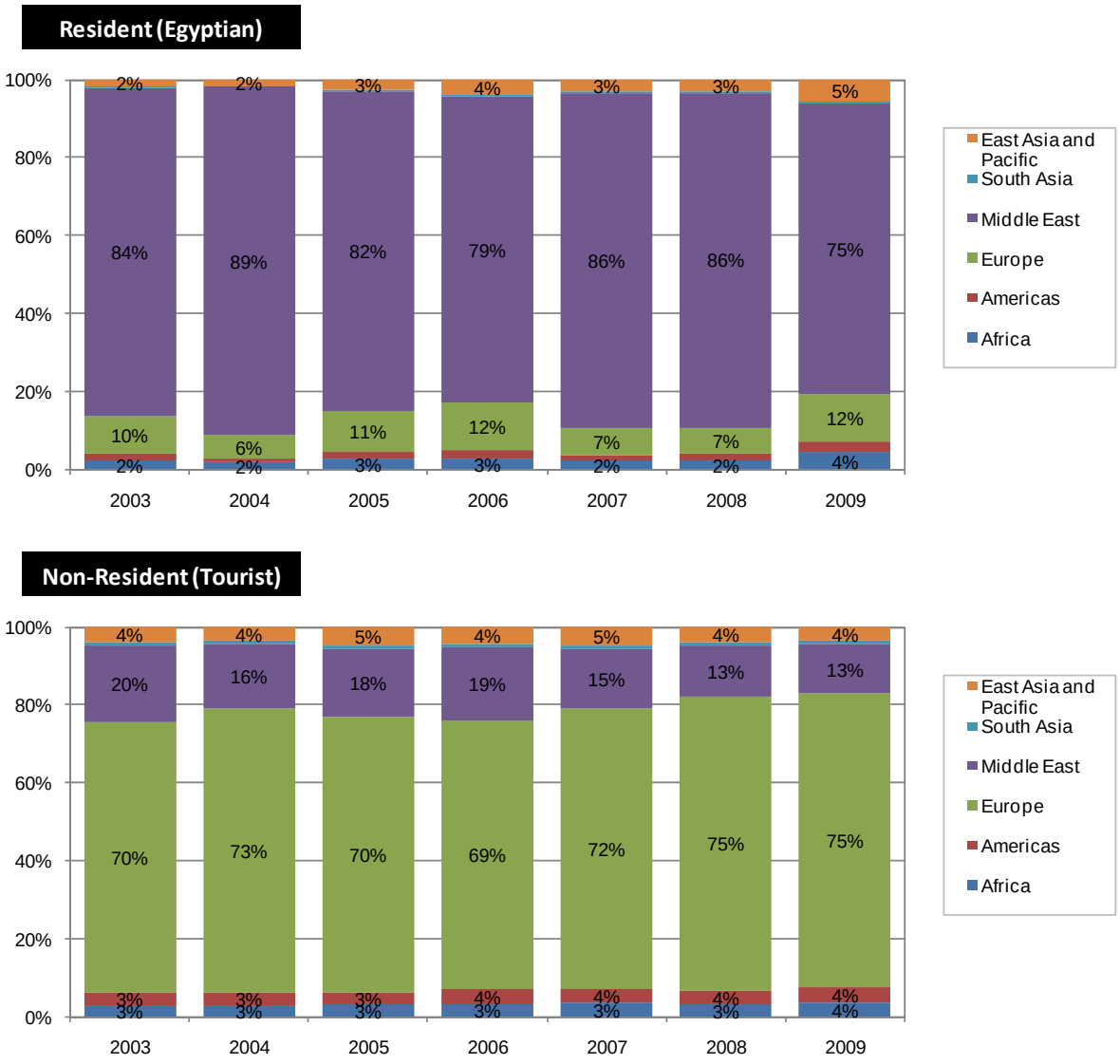
Figure 4.2-8 Tourist Distribution by Arrival Method

Major destinations of Egyptian and countries of non-Egyptian passengers are illustrated in Figure 4.2-9.

Around 80% of Egyptians are traveling to the Middle East. The second most popular travel

destination is Europe (approximately 10%), while the majority of nonresidents visiting Egypt were from European (75 %), followed by those from the Middle East (15%).

Hence, it can be concluded that Europe and Middle East are the major markets of the air traffic to/from Egypt for both Egyptian and non-Egyptian.



[Source] World Tourism Organization (UNWTO)

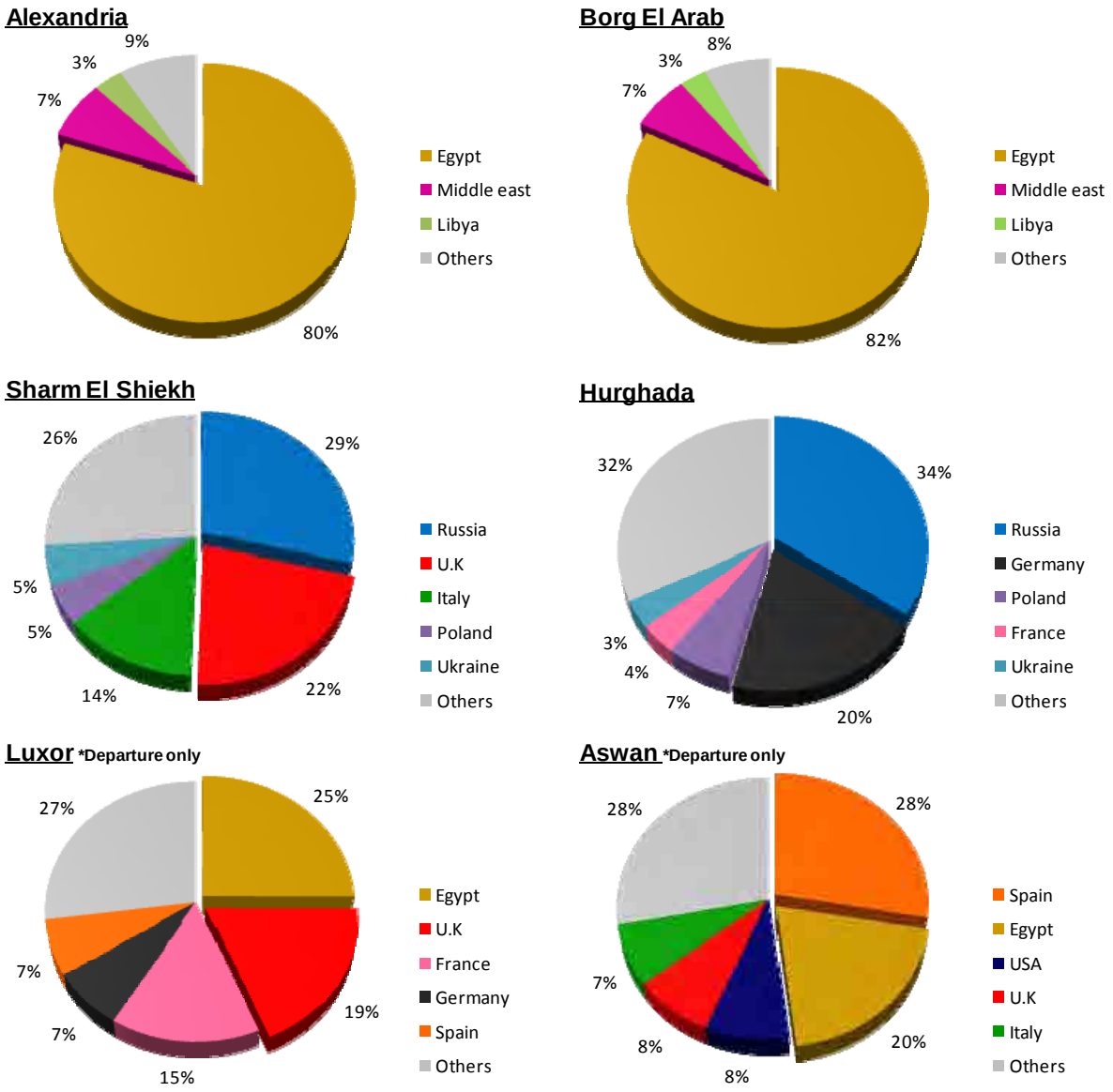
Figure 4.2-9 Distribution of Origin & Destination

2) Nationality of Air Passenger at Major EAC Airports

Share of air passengers by nationalities is different at each EAC Airport.

80% of the air passengers at two Alexandria's airports are Egyptian, followed by travelers from Middle-Eastern and Libyan nationals.

In Sharm El-Sheikh and Hurghada, which are resort places, most passengers are European, mainly Russian. In the upper Egypt (Luxor and Aswan), which are well-known great historical heritages, 40 to 50 % of travelers are European and 20% to 25% are Egyptian.



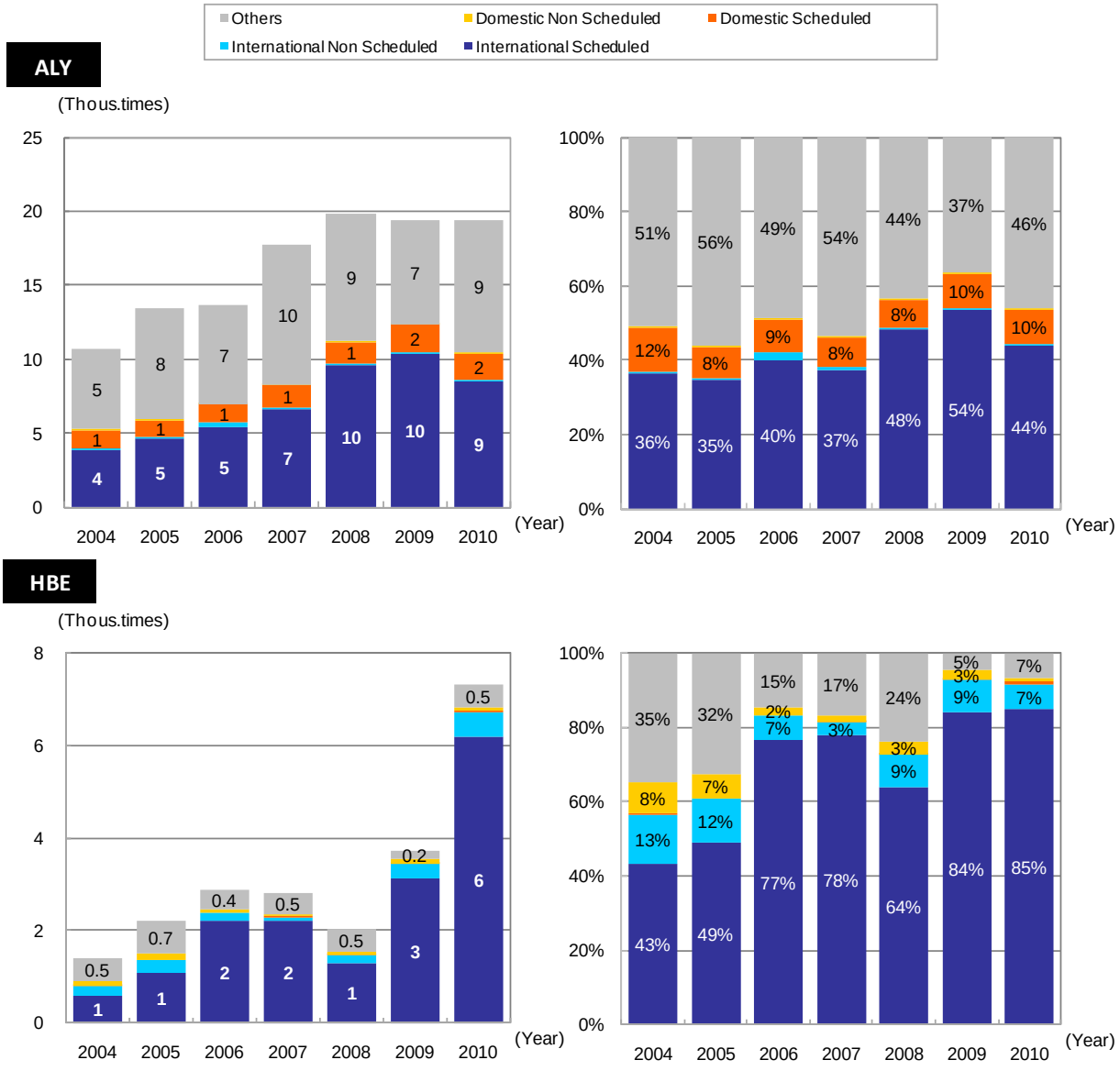
[Source] EAC (2010)

Figure 4.2-10 Share of Passengers by Nationality at Major EAC Airports

4.2.3. Trend of Scheduled Flights in Alexandria

The breakdown of aircraft movements at Alexandria-Nozha International Airport (ALY) and Borg El Arab International Airport (HBE) is shown in Figure 4.2-11. Most of the flights at both airports are of international scheduled and only a few are of non-scheduled. The "Others" marked/labeled grey are of petroleum and military flights from/to ALY and HBE.

In this section, the trend of scheduled flights at two Alexandria airports from 2002 to 2011 based on the time table is described.



[Source] Egyptian Holding Company of Airports and Air Navigation website

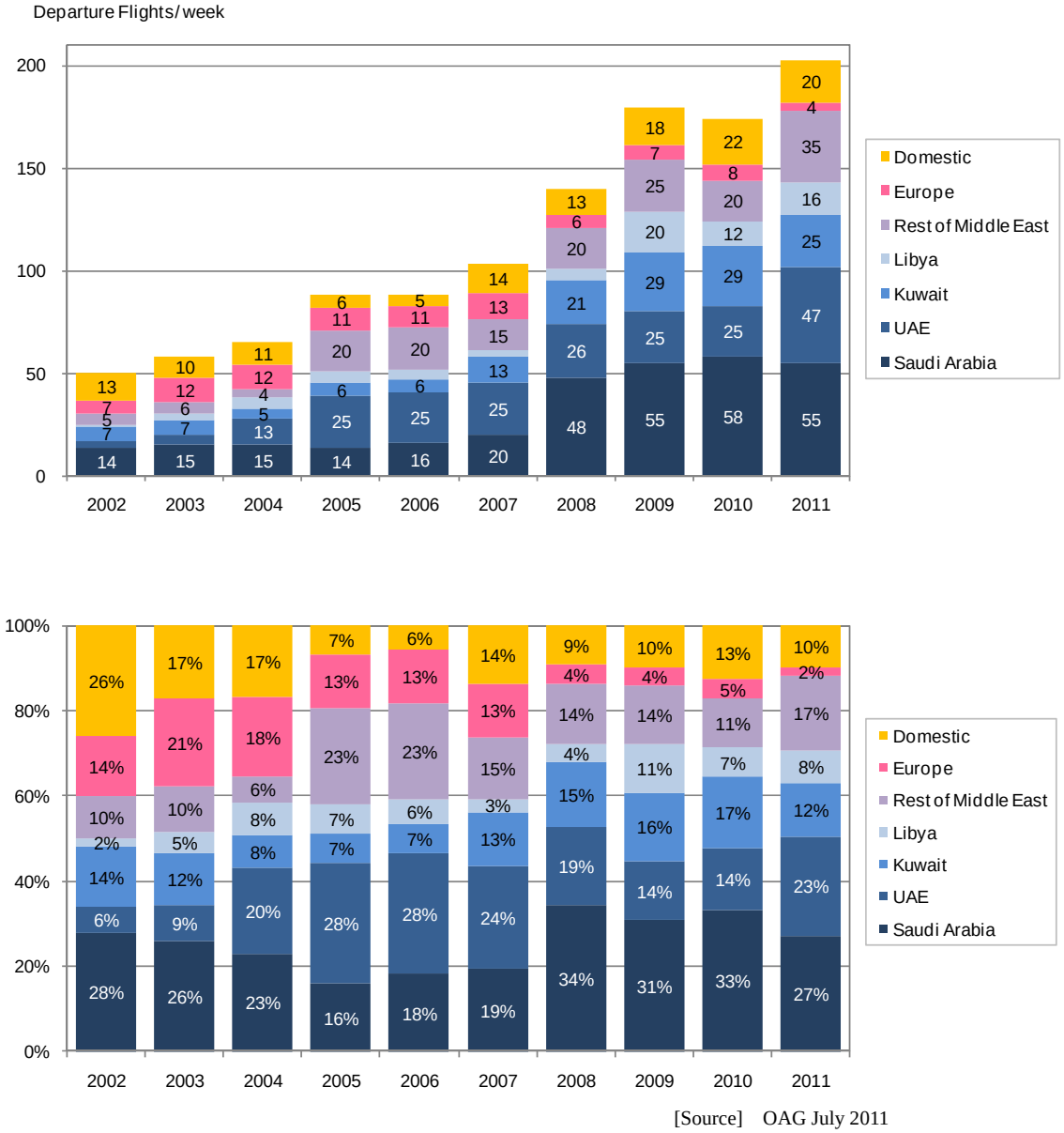
Figure 4.2-11 Aircraft Movements at ALY and HBE

1) Destinations

The most popular destination of travelers departing from Alexandria airports is the Middle East. This trend has been continuing in the past and the number of flights was increasing

since 2004. The main destinations in Middle East are Saudi Arabia, UAE and Kuwait. The number of flights to Saudi Arabia increased in 2008, to Kuwait in 2005 and to UAE in 2011 respectively. The increment of flights are due to the effect of new airlines recently established, which started to operate on these routes, especially of Low Cost Carriers (LCC).

The number of domestic flights from Alexandria has been increasing due to downsizing of aircraft, since Egypt Air replaced their A320 (150-seater) by EMBRAER (70-seater; of Egypt Air Express) from 2007.

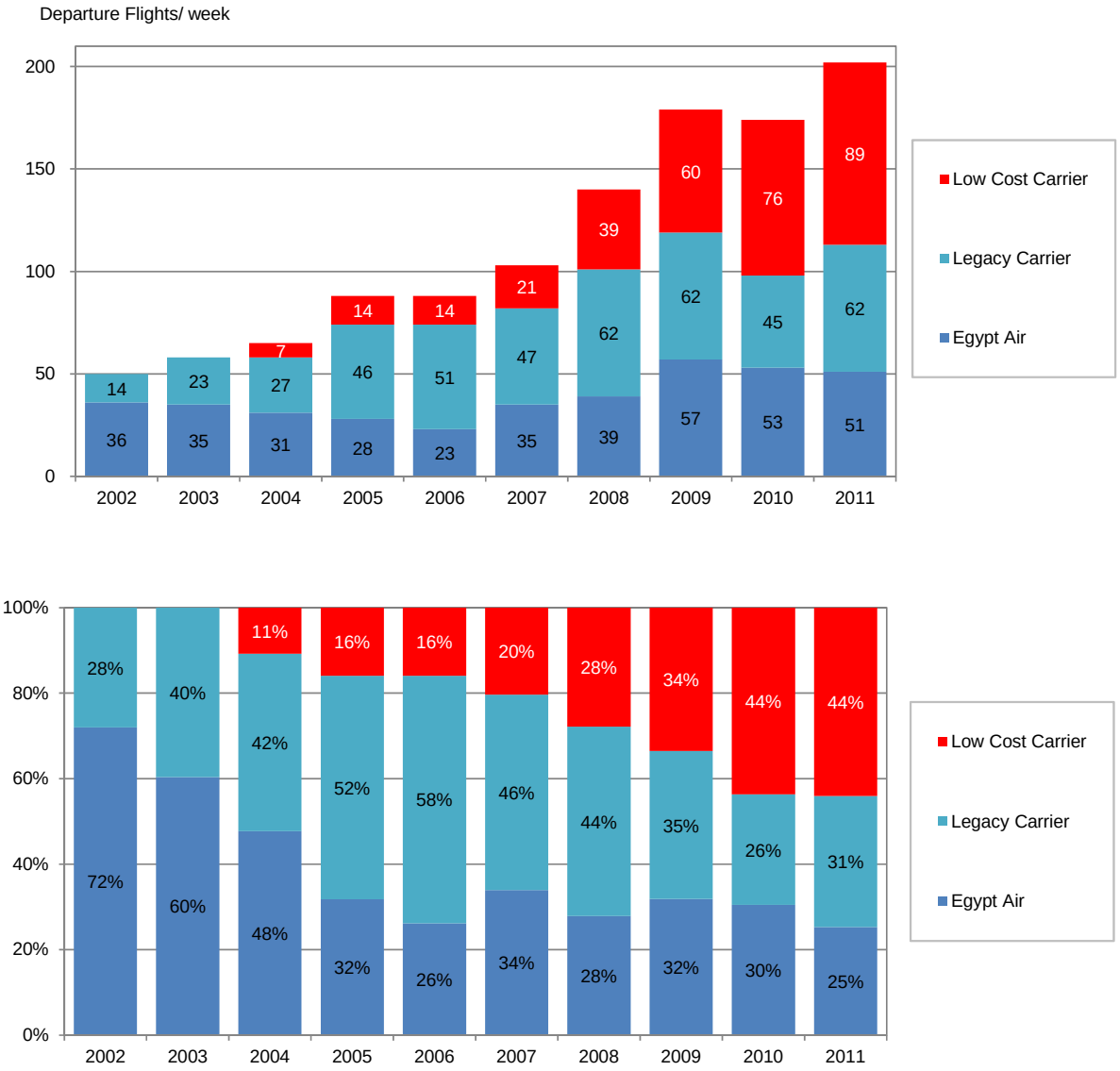


[Source] OAG July 2011

Figure 4.2-12 Departure flights by Destination from Alexandria Region

2) Airlines

From 2004 LCC started its operations at Alexandria's airports. Thereafter the number of LCC flights has been increasing gradually and reached approximately 45% of the total flights in 2010. (It should be noted that, as far as the international flight is concerned, the current ratio of LCC is 50%)



[Source] OAG July 2011

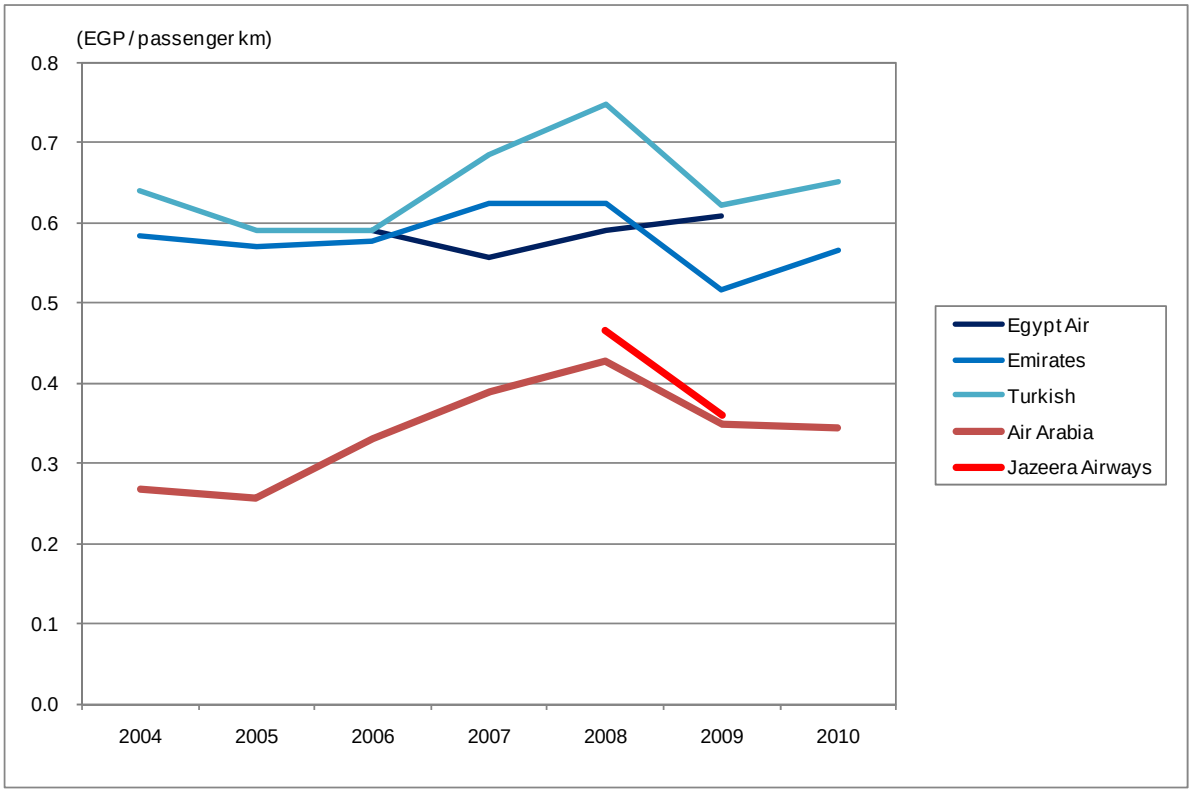
Figure 4.2-13 Departure flights by Type of Airline from Alexandria Region

The low-fares and high frequency of LCC flights are one of the factors that increased number of passengers in Alexandria.

Generally, the unit revenue, which is the amount of sales per passenger kilometer, of each airline is in proportion to its unit Air Fare. The unit revenue of LCC is generally smaller than that of Legacy Carriers as shown in Figure 4.2-14, although the figures indicated are only the airlines which financial data are available on their website, and the currency unit of their unit revenue was converted into EGP using the exchange rates for every year and every country.

The chronological trends of the unit revenue for each airline category are shown in the Figure below. The average unit revenue computed for each airline category shows, that in 2010 the unit revenue of LCCs seemed to be approximately 60% of that of Legacy Carrier. In other words, the air fare of LCC is considered 40% cheaper than that of Legacy carrier,

although the price difference between LCC and Legacy Carrier has gradually shrunken since 2004.



[Source] Financial report of each airline (Annual Passenger Revenue / Revenue Passenger Kilometer)

Figure 4.2-14 Comparison of Unit Revenue by Airlines

Table 4.2-3 Comparison of Average Unit Revenue by Airline Category

(EGP/ Passenger km)

	2004	2005	2006	2007	2008	2009	2010
Legacy Carrier	0.612	0.580	0.586	0.622	0.654	0.582	0.609
Low Cost Carrier	0.268	0.258	0.331	0.389	0.447	0.354	0.344
Ratio (LCC / LC)	**44%**	**44%**	**56%**	**63%**	**68%**	**61%**	**56%**

[Source] Financial or Annual report of each airline

4.2.4. Passenger survey at Borg El Arab International Airport

Behavioral characteristics, such as final destination, catchment area and purpose of travel, of air passengers using Borg El Arab International Airport were surveyed through questionnaires (hereinafter called "Passenger Survey" in cooperation with EAC).

1) Outline

Table 4.2-4 Outline of Passenger survey for Borg El Arab International Airport

Date	2011/6/12 ~ 6/18 (7 days) 2011/7/10 ~ 7/16 (7 days) 2011/8/07 ~ 8/13 (7 days)
Target	All Departing Flights from Borg El Arab International Airport. * We missed a few flights, because of the arrangement of staff.
Place	Departure Waiting Room
Sampling	More than 10 passengers per departing flight (including midnight and early morning flights)
Method	Interview with passengers and fill out the questionnaire sheet. (Prepared in Arabic and English)
Study Subject	The questionnaire sheet is shown in next page (English Version)

Table 4.2-5 Number of Samples per day

June	6/12	6/13	6/14	6/15	6/16	6/17	6/18	Total
	102	147	162	149	181	159	179	1,079
July	7/10	7/11	7/12	7/13	7/14	7/15	7/16	Total
	146	176	154	153	176	132	165	1,102
August	8/7	8/8	8/9	8/10	8/11	8/12	8/13	Total
	256	258	238	163	238	144	203	1,500

3,681

Questionnaire to Departing Passenger

This Questionnaire is conducted by Egyptian Airports Company (EAC) in association with Japan International Cooperation Agency (JICA) to collect basic data of departing passengers at Borg El Arab Airport. This survey is on a voluntary and anonymous basis, thus your answer will be analyzed statistically and remain anonymous. We highly appreciate your kind cooperation.

Q1. Flight No.

Airline	Number

Q2. Your country of birth (nationality)?

☐Egypt, ☐Saudi Arabia, ☐UAE, ☐Kuwait, ☐Jordan, ☐Qatar, ☐Turkey, ☐Others (.....)

Q3. Upon arrival of this flight, do you transit to another destination?

☐YES >>>>> Your final destination is : ☐Jeddah, ☐Riyadh, ☐Others (.....)
☐N O (This flight bounds for your final destination.)

Q4. Your current residence?

☐in Egypt, ☐the same as final destination, ☐Others ( )

Q4.1 for Egyptian, where (which Governorate) do you live in Egypt?

☐Alexandria Governorate >>>>> specify the District in Alexandria : .....
☐Beheira ☐Kafr el-Sheikh ☐Gharbia ☐Monufia ☐Matruh
☐6 of October ☐Giza ☐Cairo ☐Others (.....)

Q4.2 for Foreigner (non-Egyptian)

✓ Where did you visit this time? (mark multiple allowed)
☐Alexandria ☐Cairo ☐Giza(Pyramid) ☐El Alamein ☐Luxor ☐Aswan ☐Others (.....)

✓ Today, where did you come from? (mark multiple allowed)
☐Alexandria, ☐Cairo, ☐Giza(Pyramid), ☐El Alamein, ☐Others (.....)

✓ Where did you stay last night?
☐Hotel(name)..... , ☐house of relatives/friends, ☐Others (.....)

Q5. Purpose of this trip (mainly)

☐Vacation, ☐Business, ☐Pilgrimage, ☐Overseas Contract Worker, ☐Archaeology
☐Visiting friends or relatives, ☐Others ( )

Q6. Traveling alone, or with others?

☐Alone, ☐with colleague/family/friend/group (How many person with you?.....persons)

Thank you very much, we appreciate your cooperation

Date:	Day ( ) Month ( ), 2011

2) Survey Results

a) Tabulation Method

Ten samples per each of the departure flight were collected. The actual number of passengers was varied for each flight. In the case more than ten sheets per flight collected, the following procedure was applied:

- ✓ Analyzing and tabulating;
- ✓ Weighting one sample with the inverse of the extraction rate per flight;
- ✓ Extraction rate per departure flight was computed by the following formula.(Extraction rate ＝ The number of samples / Actual Boarding Passenger per Flight)

(Example)

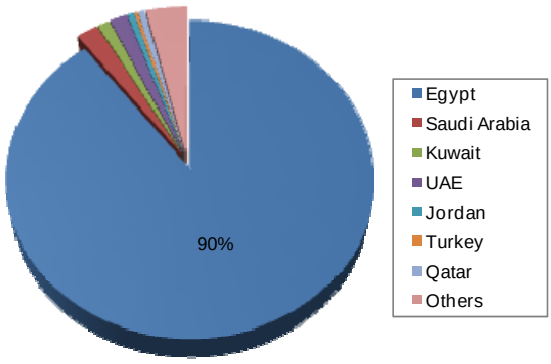
Date	Flight Number	The number of Samples	Actual Boarding Passenger	Extraction rate	1/ Extraction Rate
2011/6/12	E5 3131	11	21	0.524	1.909

For example the extraction rate was 0.524 (52.4%), then the collected samples for this flight were weighted with the inverse of the extraction rate (1.909) per sample. (i.e. one sample was regarded as 1.909 samples)

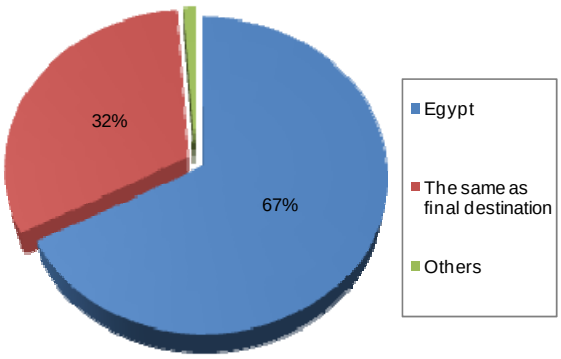
b) Behavioral characteristics of Air Passenger at Borg El Arab International Airport

✓ 90% of the air passengers at Borg El Arab International Airport were Egyptian. (This result was a little higher than the statistics of EAC.) But only 67% of these passengers were Egyptian residents, and the rest were living in foreign countries.

Country of Birth



Current Residence

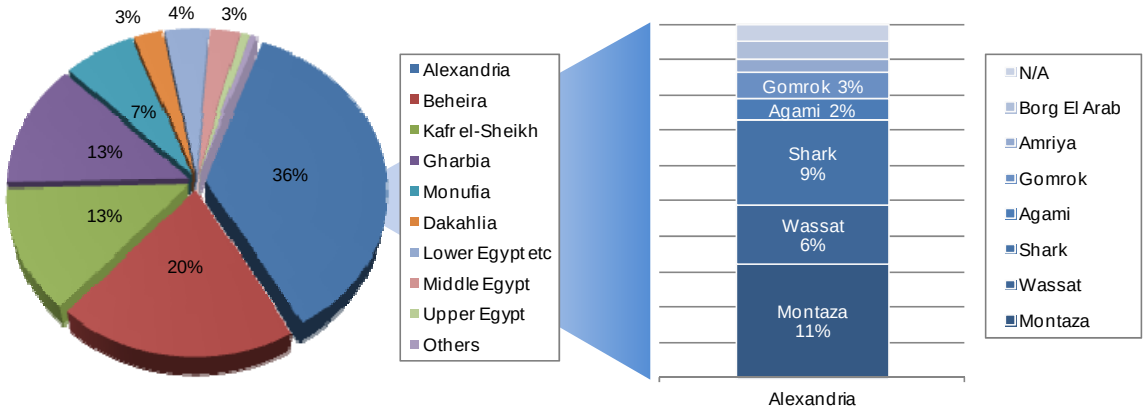


✓ The residence of Egyptian was distributed over the Nile Delta. 36% of air passengers were residents of Alexandria.

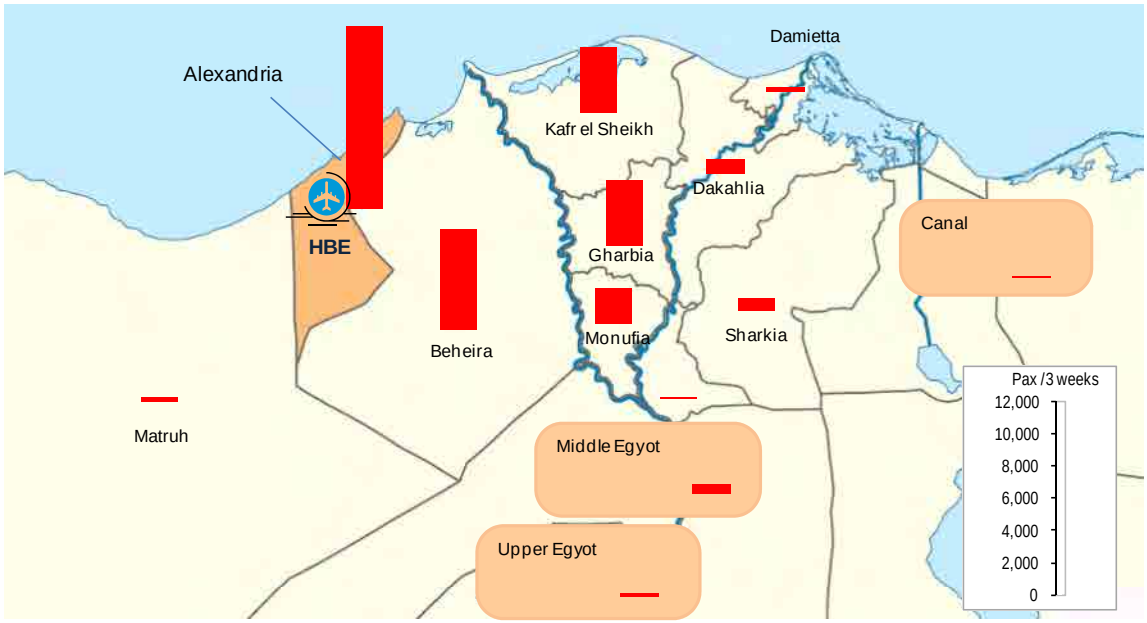
(For Egyptian)

Residence in Egypt

*Pie chart



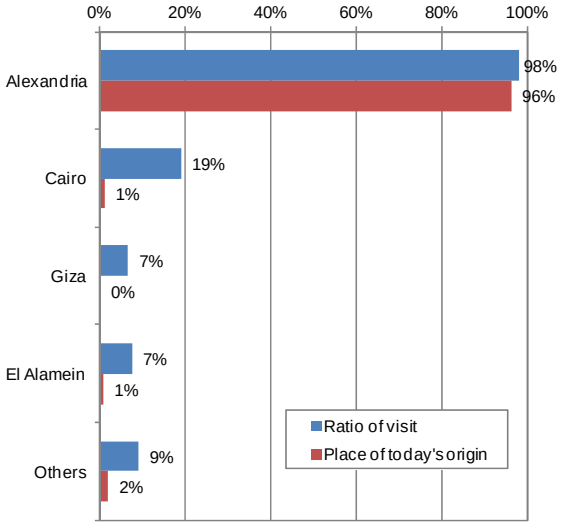
*Bar chart



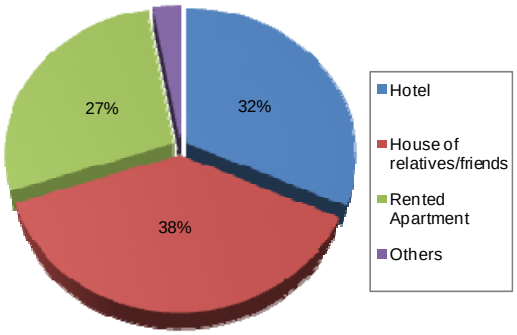
✓ Visiting places for foreigners: 98% visited Alexandria and 19% visited Cairo (This means 17% visit both Alexandria and Cairo). The lodging places in the last night of their departure were hotels, houses of relatives/friends and rented apartments; share of which was approximately 30% each.

(For Foreigner)

Visited Places & Today's Origin

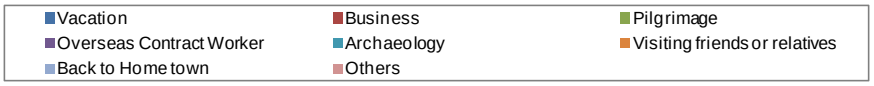


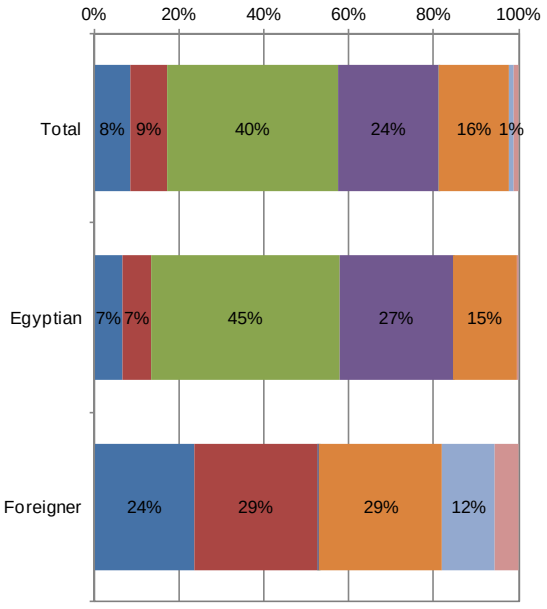
Lodging Place last night

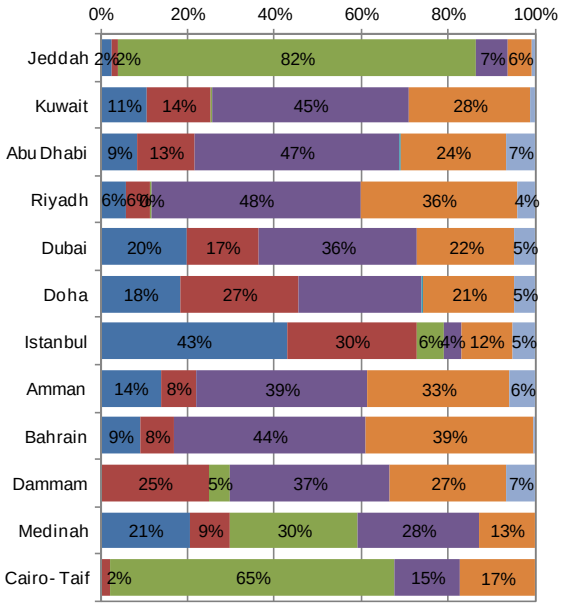


✓ 45% of the purpose of Egyptian travelers was for Pilgrimage, presumably because the survey was conducted over the month of August 2011, i.e. Ramadan period. The 2nd largest share of travelers was overseas contract workers, whose destinations were Middle East and Istanbul. The ratios of travelers for vacation and business were also high. The major purpose of foreigner to visit Egypt was business or visiting friends/relatives.

Purpose

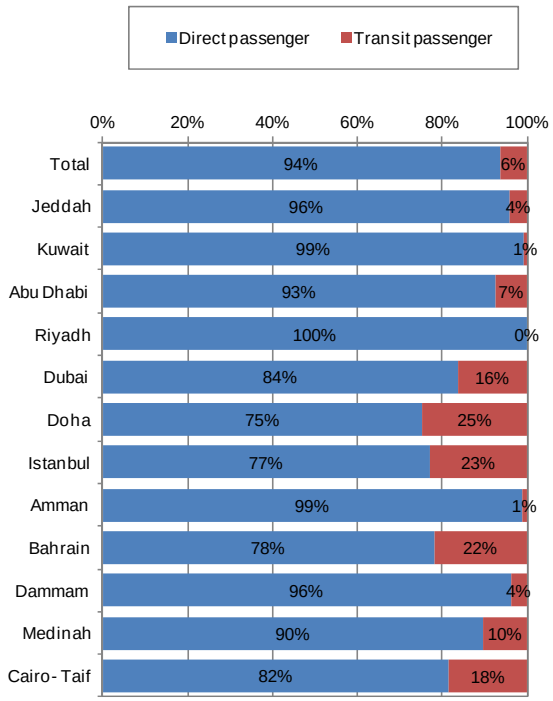






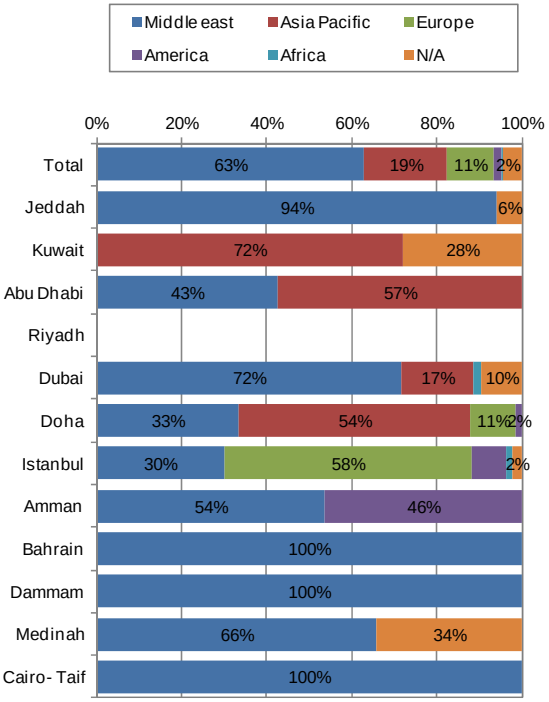
✓ The ratio of passengers who transit at their arriving airport was 6%. The ratio of passengers who transit at Doha, Istanbul, Bahrain and Dubai was high.

Content of Transit passenger



*Transit in arrival airport

Transit destination



* Country of birth

Q2	Estimate (Person/3w)	Ratio
1.Egypt	31,438	90%
2.Saudi Arabia	732	2%
3.UAE	413	1%
4.Kuwait	593	2%
5.Jordan	230	1%
6.Qatar	120	0%
7.Turkey	225	1%
8.Others	1,307	4%
Total	35,058	100%

** Detail of "8. Others"

Q2	Estimate (Person/3w)	Ratio
Bahrain	144	0.4%
U.S.A	103	0.3%
Libya	93	0.3%
Sudan	81	0.2%
Italy	77	0.2%
China	66	0.2%
India	66	0.2%
Oman	65	0.2%
Germany	62	0.2%
France	61	0.2%
Lebanon	54	0.2%
Britain	48	0.1%
Thailand	45	0.1%
Palestine	39	0.1%
England	38	0.1%
Russian	32	0.1%
Indonesia	31	0.1%
Japan	26	0.1%
Iraq	23	0.1%
Tunisia	19	0.1%
Korea	17	0.0%
Spain	17	0.0%
Bangladesh	11	0.0%
Pakistan	9	0.0%
Netherlands	8	0.0%
Bulgaria	8	0.0%
Sweden	6	0.0%
Australia	6	0.0%
Malaysia	6	0.0%
Ireland	5	0.0%
Syria	5	0.0%
Bolivia	5	0.0%
Jordan	5	0.0%
Canada	5	0.0%
SouthAfrica	4	0.0%
Philipine	4	0.0%
N/A	11	0.0%
	1,307	3.7%

* Transit

Q3	Estimate (Person/3w)				Ratio of transit passenger by destination		
Destination	1.Yes	2.No	Total	Destination	1.Yes	2.No	Total
Total	2,247	32,811	35,058	Total	6%	94%	100%
Jeddah	670	16,013	16,683	Jeddah	4%	96%	100%
Kuwait	38	5,319	5,357	Kuwait	1%	99%	100%
Abu Dhabi	219	2,720	2,939	Abu Dhabi	7%	93%	100%
Riyadh		2,382	2,382	Riyadh		100%	100%
Dubai	339	1,743	2,082	Dubai	16%	84%	100%
Doha	417	1,278	1,695	Doha	25%	75%	100%
Istanbul	343	1,148	1,491	Istanbul	23%	77%	100%
Amman	11	899	910	Amman	1%	99%	100%
Bahrain	138	487	625	Bahrain	22%	78%	100%
Dammam	19	452	471	Dammam	4%	96%	100%
Medinah	31	274	305	Medinah	10%	90%	100%
Cairo- Taif	22	96	118	Cairo- Taif	18%	82%	100%

Transit destination (Person/3w)

	Middle east	Asia Pacific	Europe	America	Africa	N/A	Total
Total	1,415	437	244	39	11	101	2,247
Jeddah	631					39	670
Doha	140	227	44	6			417
Istanbul	103		200	28	4	8	343
Dubai	244	57			6	33	339
Abu Dhabi	94	126					219
Bahrain	138						138
Kuwait		28				11	38
Medinah	21					11	31
Cairo- Taif	22						22
Dammam	19						19
Amman	6			5			11

	Middle east	Asia Pacific	Europe	America	Africa	N/A	Total
Total	63%	19%	11%	2%	0%	5%	100%
Jeddah	94%					6%	100%
Doha	33%	54%	11%	2%			100%
Istanbul	30%		58%	8%	1%	2%	100%
Dubai	72%	17%			2%	10%	100%
Abu Dhabi	43%	57%					100%
Bahrain	100%						100%
Kuwait		72%				28%	100%
Medinah	66%					34%	100%
Cairo- Taif	100%						100%
Dammam	100%						100%
Amman	54%			46%			100%

* Current residence

Q4		Estimate (Person/3w)	Ratio
1.in Egypt		23,582	67%
2.the same as final destination	Kuwait	2,978	8%
	Abu Dhabi	1,646	5%
	Jeddah	1,509	4%
	Riyadh	1,225	3%
	Dubai	1,045	3%
	Doha	901	3%
	Istanbul	460	1%
	Amman	385	1%
	Bahrain	384	1%
	Dammam	244	1%
	Ammam	166	0%
	Medinah	128	0%
	Cairo- Taif	10	0%
3.Others		363	1%
N/A		31	0%
Total		35,058	100%

*(For Egyptian) Residence in Egypt

Q4.1	Estimate (Person/3w)	Ratio
1.Alexandria	11,248	36%
2.Beheira	6,246	20%
3.Kafr el-Sheikh	4,039	13%
4.Gharbia	4,012	13%
5.Monufia	2,131	7%
6.Matruh	227	1%
7. 6th of October	7	0%
8.Giza	71	0%
9.Cairo	796	3%
10.Others	2,742	9%
Total	31,520	100%

** Detail of "1. Alexandria" (Destrict)

Q4.1Alexandria	Estimate (Person/3w)	Ratio
1.Montaza	3,617	11%
2.Shark (East)	1,868	6%
3.Wassat (Middle)	2,708	9%
4.Gomrok	677	2%
5.Agami	859	3%
6.Amriya	420	1%
7.Borg El Arab	542	2%
N/A	558	2%
Total	11,248	36%

** Detail of "10. Others"

Q4.1others	Estimate (Person/3w)	Ratio
Dakahlia	853	2.7%
Sharkia	740	2.3%
Mansoura	330	1.0%
Damietta	327	1.0%
Aswan	72	0.2%
Ismailia	62	0.2%
Suhag	51	0.2%
Port Said	41	0.1%
Fayoum	39	0.1%
Asyout	35	0.1%
Bani Suef	29	0.1%
Minya	27	0.1%
Kalyoubia	27	0.1%
Suez	23	0.1%
Qena	12	0.0%
N/A	73	0.2%
Total	2,742	8.7%

* (For Foreigner) Place of visited / Multiple

Q4.2.1	Estimate (Person/3w)	Ratio
Alexandria	3,457	98%
Cairo	684	19%
Giza	207	6%
El Alamein	205	6%
Luxor	33	1%
Aswan	60	2%
Others	225	6%
The number of respondents	3,510	-

** Detail of "Others"

Q4.2.1others	Estimate (Person/3w)	Ratio
Matruh	42	1.2%
Port Said	37	1.1%
Sharm El Sheikh	32	0.9%
Libya	31	0.9%
Kafr El Sheikh	24	0.7%
Hurghada	16	0.5%
Dakahlia	13	0.4%
Gharbia	7	0.2%
Sharkia	6	0.2%
Beheira	6	0.2%
Monufia	6	0.2%
Damietta	2	0.1%

* (For Foreigner) Place of today's origin / Multiple

Q4.2.2	Estimate (Person/3w)	Ratio
Alexandria	3,380	96%
Cairo	38	1%
Giza		
El Alamein	30	1%
Others	70	2%
The number of respondents	3,516	-

** Detail of "Others"

Q4.2.2others	Estimate (Person/3w)	Ratio
Libya	47	1.3%
Sharkia	6	0.2%
Dakahlia	6	0.2%
Matruh	4	0.1%
Gharbia	3	0.1%
Damietta	2	0.1%
Monufia	2	0.0%

* (For Foreigner) Where did you stay last night?

Q4.3	Estimate (Person/3w)	Ratio
1.Hotel	1,079	32%
2.House of relatives/friends	1,291	38%
3.Others	1,022	30%
Total	3,393	100%

** Detail of "1.Hotel"

1.Hotel	Estimate (Person/3w)	Ratio
Hilton Green Plaza	354	33%
Radisson Blu	148	14%
Sheraton Montazah	101	9%
Africana	76	7%
Regency	54	5%
Four Seasons	49	5%
Sheraton Montaza	40	4%
Plaza	39	4%
Lagoon Alex Resort & Spa	33	3%
Porto Marina	30	3%
Helnan Palestine	29	3%
Mercure	25	2%
Acacia	15	1%
El Haram	13	1%
Kaoud	13	1%
Adam	9	1%
Mirage	7	1%
Conrad Hotel Cairo	7	1%
Intercontinental Citystars Cairo	6	1%
Union	6	1%
Hilton Borg El Arab	5	0%
EL-Salamlek	5	0%
Maritim Jolie ville	4	0%
Semiramis Intercontinental Hote	2	0%
N/A	9	1%
Total	1,079	100%

** Detail of "Others"

Q4.3others	Estimate (Person/3w)	Ratio
Rented Apartment	933	27%
Alexandria's Port	49	1%
Car	13	0%
Hostel	11	0%
Transit to Libya	9	0%
N/A	7	0%
Total	1,022	30%

* Travel alone or not

Q6	Estimate (Person/3w)	Ratio
1.Alone	18,232	52%
2.with colleague/family/friend/group	16,826	48%
Total	35,058	100%

** Average the number of "colleague/family/friend/group."

Q6	Average
2.with colleague/family/friend/group	2.20 persons

* Purpose

Q5	Estimate (Person/3w)	Ratio
1.Vacation	2,952	8%
2.Business	3,083	9%
3.Pilgrimage	14,051	40%
4.Overseas Contract Worker	8,402	24%
5.Archaeology	15	0%
6.Visiting friends or relatives	5,753	16%
7.Others	802	2%
Total	35,058	100%

** Detail of "Others"

Q5others	Estimate (Person/3w)	Ratio
Back to Home tow n	432	1.2%
Conference	149	0.4%
Studying	77	0.2%
Transit In Egypt	20	0.1%
N/A	123	0.3%
Total	802	2.3%

Purpose by Nationality

Q5	Estimate		Ratio	
	Egyptian	Foreigner	Egyptian	Foreigner
1.Vacation	2,121	831	7%	24%
2.Business	2,075	1,008	7%	29%
3.Pilgrimage	14,046	5	45%	0%
4.Overseas Contract Worker	8,391	11	27%	0%
5.Archaeology	6	9	0%	0%
6.Visiting friends or relatives	4,735	1,018	15%	29%
7.Others	174	628	1%	18%
Total	31,548	3,510	100%	100%

Purpose by destination (Person/3w)

	1.Vacation	2.Business	3.Pilgrimage	4.Overseas	5.Archaeology	6.Visiting	7.Others	Total
Total	2,952	3,083	14,051	8,402	15	5,753	802	35,058
Jeddah	406	264	13,744	1,222		932	114	16,683
Kuw ait	573	775	20	2,431		1,502	56	5,357
Abu Dhabi	251	383		1,387	6	713	200	2,939
Riyadh	137	137	6	1,143		861	98	2,382
Dubai	411	347		760		465	99	2,082
Doha	309	464		476	9	356	81	1,695
Istanbul	638	448	90	60		175	80	1,491
Amman	91	54		261		216	39	662
Bahrain	58	48		275		242	3	625
Dammam		117	23	172		127	32	471
Medinah	63	28	90	84		40		305
Cairo- Taif		3	77	18		20		118

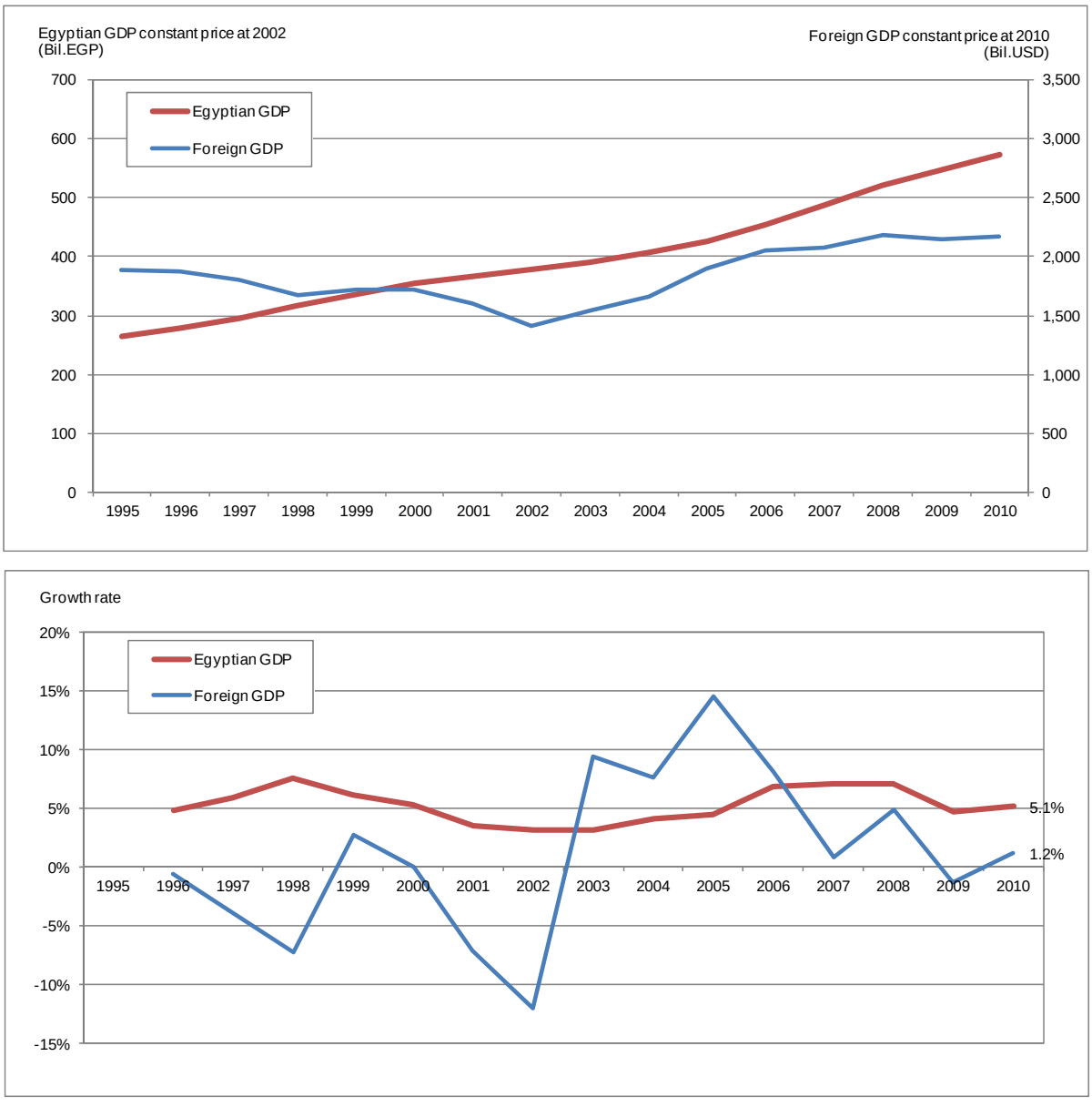
	1.Vacation	2.Business	3.Pilgrimage	4.Overseas	5.Archaeology	6.Visiting	7.Others	Total
Total	8%	9%	40%	24%	0%	16%	2%	100%
Jeddah	2%	2%	82%	7%		6%	1%	100%
Kuw ait	11%	14%	0%	45%		28%	1%	100%
Abu Dhabi	9%	13%		47%	0%	24%	7%	100%
Riyadh	6%	6%	0%	48%		36%	4%	100%
Dubai	20%	17%		36%		22%	5%	100%
Doha	18%	27%		28%	1%	21%	5%	100%
Istanbul	43%	30%	6%	4%		12%	5%	100%
Amman	14%	8%		39%		33%	6%	100%
Bahrain	9%	8%		44%		39%	0%	100%
Dammam		25%	5%	37%		27%	7%	100%
Medinah	21%	9%	30%	28%		13%		100%
Cairo- Taif		2%	65%	15%		17%		100%

4.2.5. Socio-Economic Indices

1) GDP

For the purpose of this Draft Final Report, the weighted GDP value of eleven major foreign countries has been defined as one of the explanatory indices for passenger demand forecast. GDP of foreign countries have been weighted by average number of passengers to/from eleven (11) major countries, namely Russian Federation, Germany, United Kingdom, Italy, France, United States of America, Saudi Arabia, Kuwait, Libyan Arab Jamahiriya, Jordan and Syrian Arab Republic. It should be noted that the majority (i.e. 60%) of all international passengers in Egypt have been originated from or destined to these eleven (11) countries.

The Egyptian GDP and the weighted Foreign GDP (Constant Price) defined above are shown in Figure 4.2-15.



[Source] IMF World Economic Outlook Database (September 2011 Edition)

Figure 4.2-15 GDP (Constant Price) and GDP Growth Rate

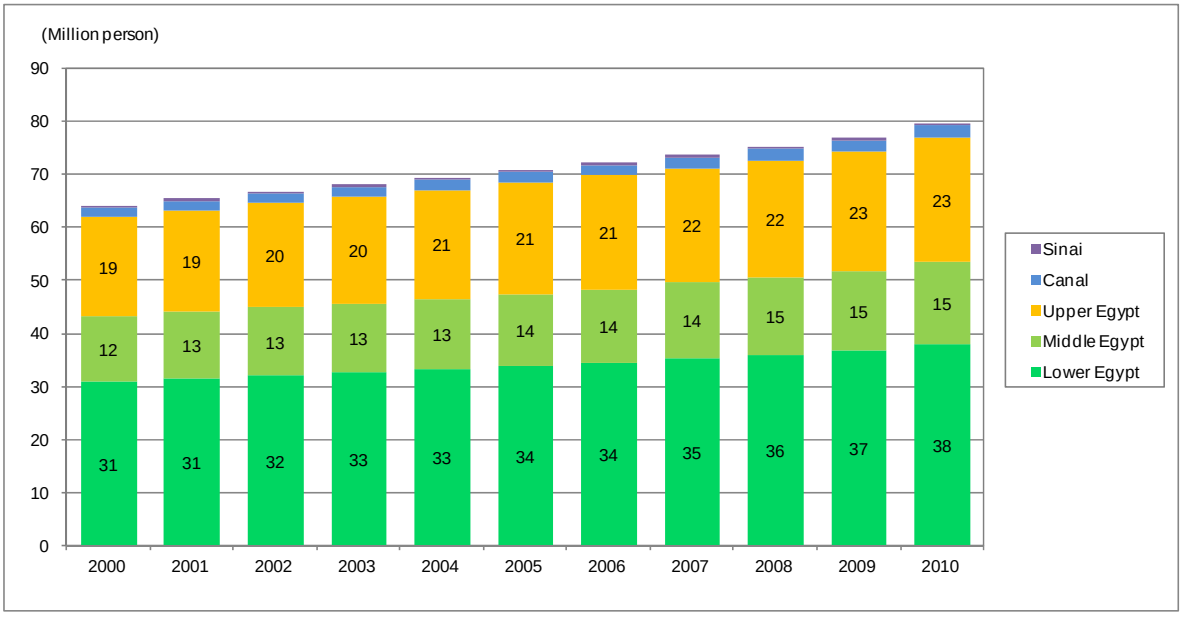
The Egyptian GDP tends to increase consistently with an average annual growth rate of 5.3% between 1995 and 2010. More specifically, the average annual growth rate between 2003 and 2010 was 5.6% which was a little bit higher than that between 1995 and 2002 (5.2%).

On the other hand, the weighted foreign GDP decreased until 2002, but afterwards, it tends to increase. One reason for the decrease until 2002 was presumably the fluctuation of currency exchange rate in each country against USD. The average annual growth rate of weighted foreign GDP between 2003 and 2010 was 5.0% despite the negative economic growth during the world financial crisis in 2008 and 2009.

2) Population

The population in Egypt has almost reached 80 million in 2010, at the average annual growth rate of 2.2 % between 2000 and 2010.

The population in Lower Egypt, which is the catchment area of Borg El Arab International Airport, was 38 million in 2010. This is nearly the half of Egypt's entire population. The growth rate in the Lower Egypt was similar to the growth rate for the entire Egypt. The region with the highest population growth at 4.9 % was Sinai.



[Source] Statistical year book

Figure 4.2-16 Population by Area in Egypt

4.3. Annual Air Passenger Demand Forecast

4.3.1. Procedure of Air Traffic Demand Forecast

Figure 4.3-1 represents the procedure used for the air traffic demand forecast discussed in this Chapter.

As shown, the latest trend of air traffic and socio-economic indicators have been incorporated in this forecast.

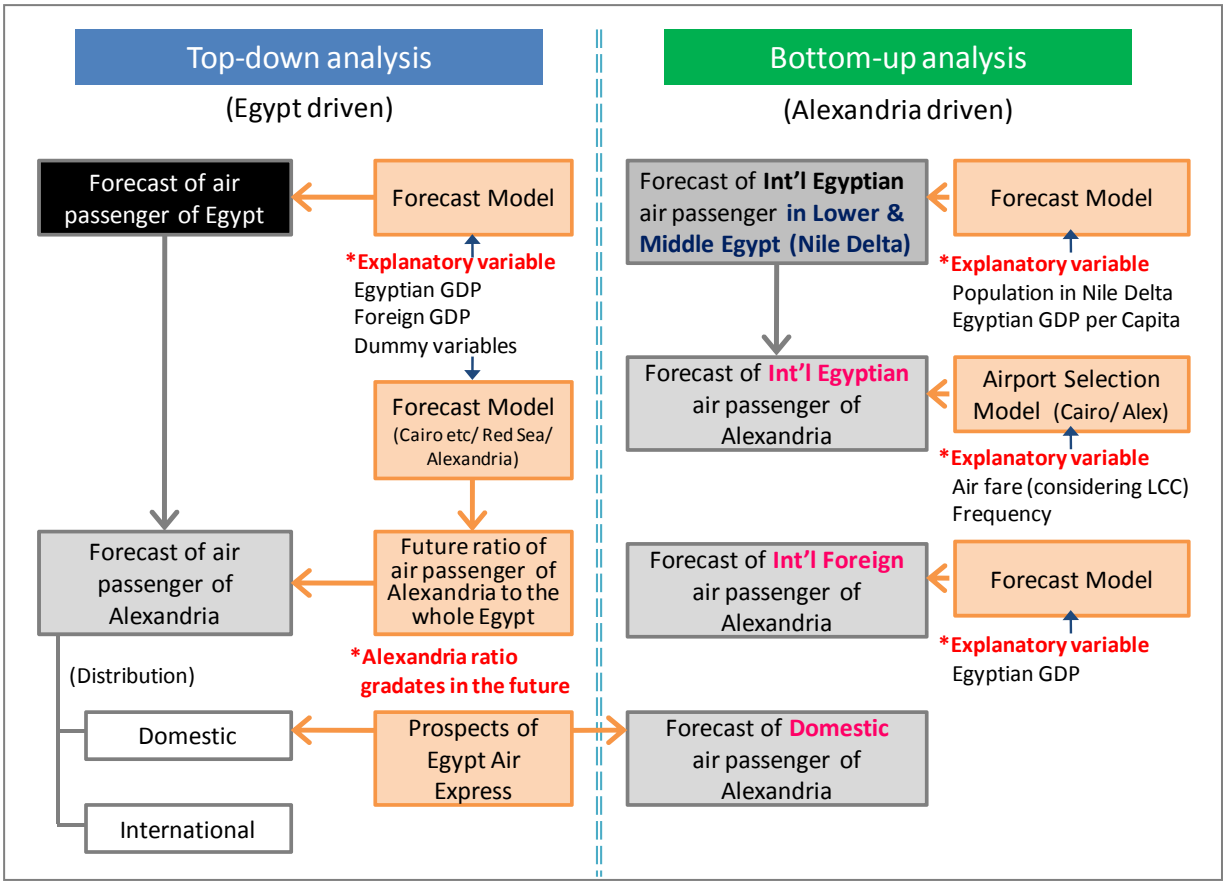


Figure 4.3-1 Procedure of Air Passenger Demand Forecast in SAPI

Table 4.3-1 Improvement to the SAPROF Study Method

Top-down Analysis	Bottom-up Analysis
➢ Selected explanatory variables for this forecast model consist of the weighted foreign GDP, Dummy variables and Egyptian GDP. ➢ An airport model, which computes the ratio of Alexandria's airports to Egypt's aviation activity, is developed. ➢ Domestic traffic forecast is based on the prospects (business plan) of Egypt Air Express (same as for the Bottom-up analysis).	➢ Air passenger demand is forecasted in respect of the three groups of passengers, namely, Int'l Egyptian, Int'l Tourist, and Domestic. ➢ Int'l Egyptian forecast is focused on the passenger demand in the Nile Delta. With the airport selection model, the probability of selecting one of Alexandria's airports is computed. ➢ The number of Int'l tourist is calculated by a forecast model, which is using chronological data.

Air cargo volume has been forecasted by qualitative analysis based on an interview survey. At present, only a few air cargo is handled in Alexandria airports and data to develop a reliable forecast model are not available.

4.3.2. Top-down Analysis

1) Forecast of Air Passengers for Egypt

a) Forecast Model

The forecast model of air passengers for Egypt (named as "Egypt Model") is as follows:

Forecast Model $$Y_t = a + \sum_j b_j \cdot X_{j_t}$$

Y_t : The number of air passengers for entire Egypt in the *year* ***t*** (persons)
X_{1t} : Egyptian GDP in the *year* ***t*** (Bill.EGP)
X_{2t} : Weighted Foreign GDP in the *year* ***t*** (Bill.USD)
X_{3t} : Dummy variable in the *year* ***t*** (0 or 1)
a, b_j : coefficients

The coefficients (a, b) have been estimated through regression analysis based on the relationship between the number of air passengers for the entire Egypt (Y: dependent variable) and explanatory variables, consisting of the weighted Foreign GDP, a Dummy variable and the Egyptian GDP (X: independent variables).

Data for estimating the coefficients and the results are shown in Table 4.3-2. A dummy variable is used to represent the occurrence of internal events in Egypt and to measure their impacts.

Table 4.3-2 Data for Estimating Coefficients (Egypt Model)

t	Y	X1	X2	X3
Year	Passenger Actual (persons)	Egyptian GDP (Bill.EGP)	Foreign GDP (Bill.USD)	Dummy Internal Event
1995	11,221,542	266	1,890	0
1996	12,888,428	278	1,880	0
1997	13,561,469	295	1,807	0
1998	11,668,477	317	1,677	1
1999	16,557,273	337	1,722	0
2000	20,533,553	355	1,724	0
2001	17,608,240	367	1,601	0
2002	18,121,017	379	1,409	0
2003	19,102,572	391	1,542	0
2004	23,907,179	407	1,661	0
2005	24,811,467	425	1,902	0
2006	25,801,449	454	2,055	1
2007	30,609,671	487	2,074	0
2008	35,769,424	521	2,176	0
2009	34,834,746	546	2,147	0
2010	40,067,135	574	2,173	0

Table 4.3-3 Result of Coefficients Estimation (Egypt Model)

	a	b1	b2	b3
	Constant	Egyptian GDP	Foreign GDP	Dummy
Coefficient	-21,689,155	83,436	5,981	-2,921,823
(t-value)	(-9.1)	(20.3)	(3.6)	(-3.3)

Correlation Coefficient: 0.9933 *t-value: a t-value corresponding to a coefficient estimate is a statistical measure of the confidence in the estimate. If the absolute value of t-value is more than approximately 2.0, it can be judged that an estimated coefficient is statistically significant.

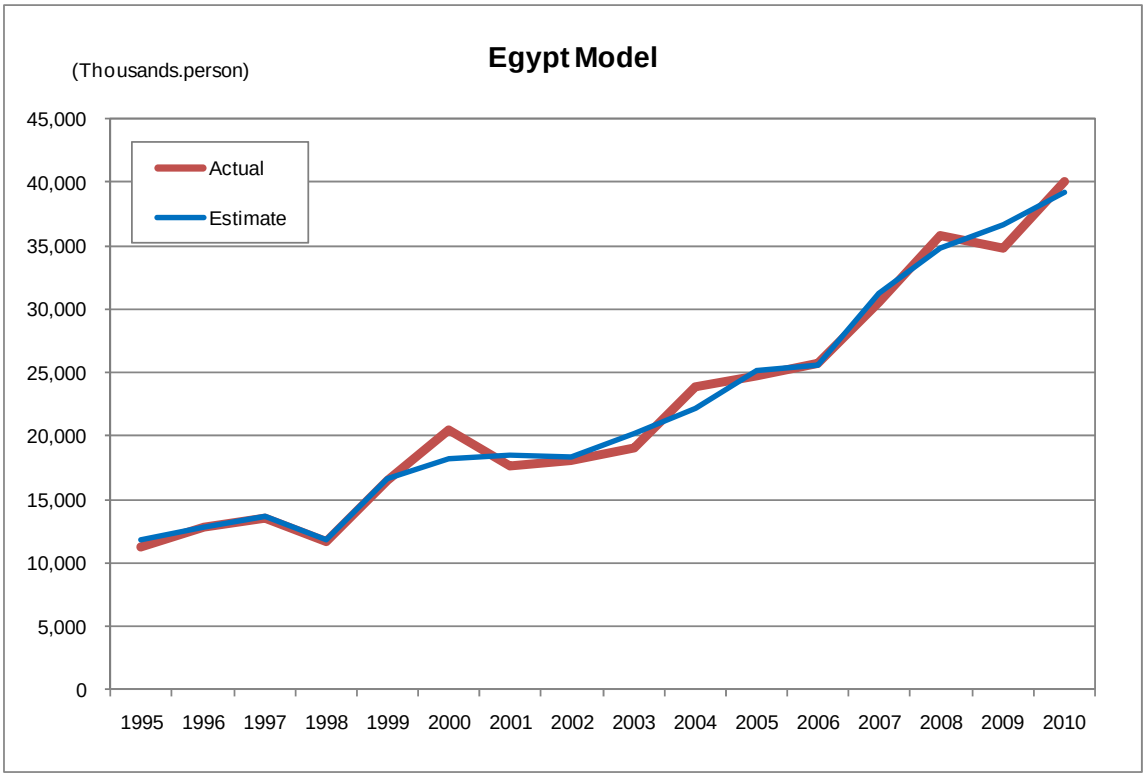


Figure 4.3-2 Comparison of Actual Passenger and Estimated

b) Future Assumption

Future values for explanatory variables (X) are set as follows.

Table 4.3-4 Future values for Explanatory Variables (Egypt Model)

t	X1		X2		X3
Year	Egyptian GDP (Bill.EGP)	Growth rate	Foreign GDP (Bill.USD)	Growth rate	Dummy Internal
2006	454	6.8%	2,055	8.1%	1
2007	487	7.1%	2,074	0.9%	0
2008	521	7.2%	2,176	4.9%	0
2009	546	4.7%	2,147	-1.3%	0
2010	574	5.1%	2,173	1.2%	0
2011	581	1.2%	2,316	6.6%	1
2012	591	1.8%	2,363	2.0%	0
2013	615	4.0%	2,408	1.9%	0
2014	650	5.8%	2,458	2.1%	0
2015	692	6.4%	2,510	2.1%	0
2016	737	6.5%	2,565	2.2%	0
2017	778	5.5%	2,596	1.2%	0
2018	820	5.5%	2,627	1.2%	0
2019	865	5.5%	2,659	1.2%	0
2020	913	5.5%	2,690	1.2%	0

[Source] IMF World Economic Outlook Database (September 2011 Edition)

The future Egyptian GDP and Foreign GDP have been set based on the outlook by the International Monetary Fund (IMF) until 2016. The Foreign GDP is an integrated value, which is computed by the weighted average of the numbers of tourists of major Origin & Destination countries. The values of IMF are useful, because the GDP for each country is obtained from one data source. In the calculation of the future Foreign GDP, the number of tourists has been assumed to be constant and the latest value has used (i.e. it has been assumed that the latest weight would remain steady in future).

The World Bank also has published its outlook on the future Egyptian GDP growth rate as shown in the Table below, but the outlook published by IMF after the World Bank has been adopted as the latest trend.

Table 4.3-5 Future Egyptian GDP Growth Rate

	2011	2012	2013	2014	2015	2016	Published in
IMF	1.2%	1.8%	4.0%	5.8%	6.4%	6.5%	Sep.2011
World Bank	1.0%	3.5%	5.0%				Jun.2011

The chronological change and future assumption of Egyptian GDP growth rates are shown in Table 4.3-6. It should be noted that in the past there was economic cycle periodically in 5 years but the average annual growth rate for 10 years was kept at approximately 5.0%.

Therefore, it has been assumed that the GDP growth rates until 2016 would follow the outlook of IMF, while those beyond 2017 have been set at 5.5 % so that the average annual growth rate between 2011 and 2020 would become around 5.0% (the Medium case).

Table 4.3-6 Chronological change /future assumption of Egyptian GDP growth rates

	t	Egyptian GDP (Bill.EGP)	Year-on-Year	Average Annual Growth Rate		
				5 years	10 years	10 years
Actual	1996	278	4.9%			
	1997	295	5.9%			
	1998	317	7.5%			
	1999	337	6.1%			
	2000	355	5.4%	6.2%		
	2001	367	3.5%			
	2002	379	3.2%			
	2003	391	3.2%			
	2004	407	4.1%			
	2005	425	4.5%	3.7%	4.8%	
	2006	454	6.8%			
	2007	487	7.1%			
	2008	521	7.2%			
	2009	546	4.7%			
	2010	574	5.1%	6.0%		5.1%
Predicted by IMF	2011	581	1.2%			
	2012	591	1.8%			
	2013	615	4.0%			
	2014	650	5.8%			
	2015	692	6.4%	4.5%	4.8%	
	2016	737	6.5%			
Assumption	2017	778	5.5%			
	2018	820	5.5%			
	2019	865	5.5%			
	2020	913	5.5%			5.2%

A sensitive analysis has been conducted by changing the assumption for the future GDP growth rate. A GDP with a 1.0% lower and higher growth rates than the Medium case have been defined as the “Low case” and the “High case” respectively.

A dummy variable has been applied to the year 2011 to represent the decrease in air traffic demand due to the outbreak of the Egyptian Revolution 2011.

It should be noted that an estimation of the future economic indices beyond 2020 is considered not reliable. For the purpose of approximation in this Study, the air traffic demand after 2020 has been assumed to increase every year by an annual air traffic average increment in the previous ten years (from 2020 to 2030), thus the annual increase after year 2020 is set constant.

c) Result

Based on the demand forecasting models as well as the assumed future socio-economic indices described above, the future air passenger demand in whole Egypt has been forecasted as follows.

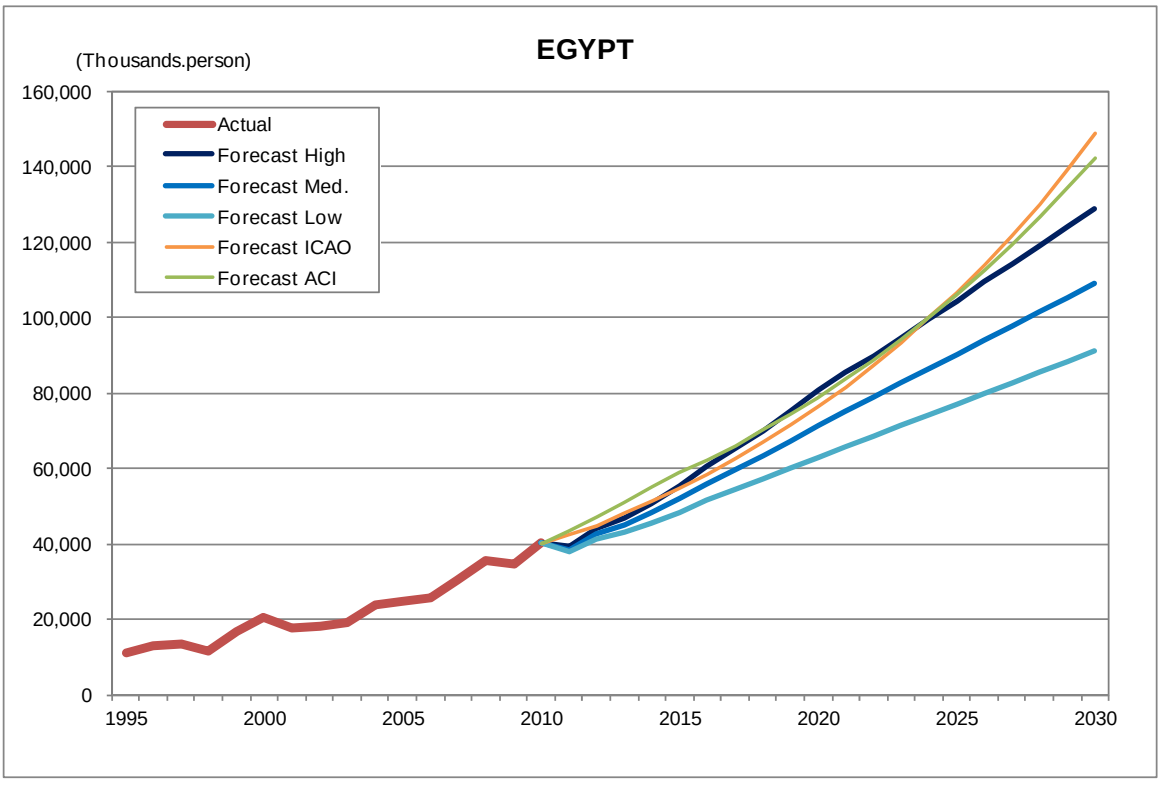


Figure 4.3-3 Result of Air Passenger Forecast in Whole Egypt

For reference the growth rates forecasts published by International Institutions are also shown in this Figure.

Table 4.3-7 Air Passenger Growth Rates forecasted by ICAO and ACI

ICAO		ACI	
2008-2012	**5.7%**	2009-2014	**8.4%**
2012-2028	**6.9%**	2009-2029	**6.1%**
	Africa		Egypt Int'l Passenger

[Source] ICAO: Africa-Indian Ocean Regional Traffic Forecasts 2008-2028
ACI: GLOBAL TRAFFIC FORECAST 2010 - 2029

2) Air Passenger Forecast for Alexandria

a) Forecast Model

The forecast model for computing the ratio of aviation activity in Alexandria to Egypt ("Airport Model") is as follows:

Forecast Model

$$S_{it} = \frac{Y_{it}}{\sum_i Y_{it}}$$

$$Y_{it} = a_i + \sum_j b_{ij} \cdot X_{j\,t}$$

S_{it} : Ratio of air passenger at ***i*** airport in the *year* ***t*** (%)
Y_{it} : The number of air passenger at ***i*** airport in the *year* ***t*** (persons)
X_{1t} : Egyptian GDP in the *year* ***t*** (Bill.EGP)
X_{2t} : Foreign GDP in the *year* ***t*** (Bill.USD)
X_{3t} : Dummy variable in the *year* ***t*** (0 or 1)
a_i, b_{ij} : coefficients

The coefficients (a and b) have been estimated by a regression analysis based on the relationship between air passenger number (Y) for each airport and economic indices (X). The explanatory variables (X) are the same as those in the Egypt Model i.e. Egyptian GDP, Foreign GDP and a dummy variable. The dummy variable has been excluded from the formula for Alexandria, because the internal events as observed seemed no effects on the traffic at Alexandria.

The airports in Egypt are differentiated into three categories based on their features: "Cairo etc.", "Red Sea (Sharm El-Sheikh and Hurghada)" and "Alexandria (Alexandria and Borg El Arab)". Comparing air passenger growth rate from 2003 to 2010 at each category, it has been recognized that the growth rate of Sharm El-Shiekh was similar to that of Hurghada, and that the growth rate of Cairo was similar to that of the other airport as shown in the Table 4.3-1.

The coefficients (a and b) have been estimated according to these categories.

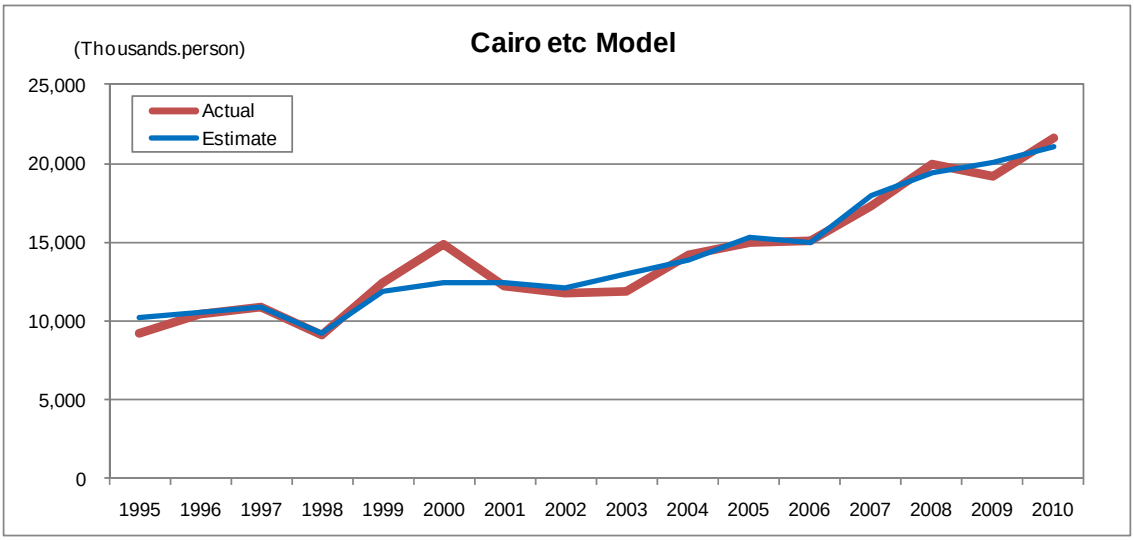
Data for estimating the coefficients and the results are shown in Table 4.3-8.

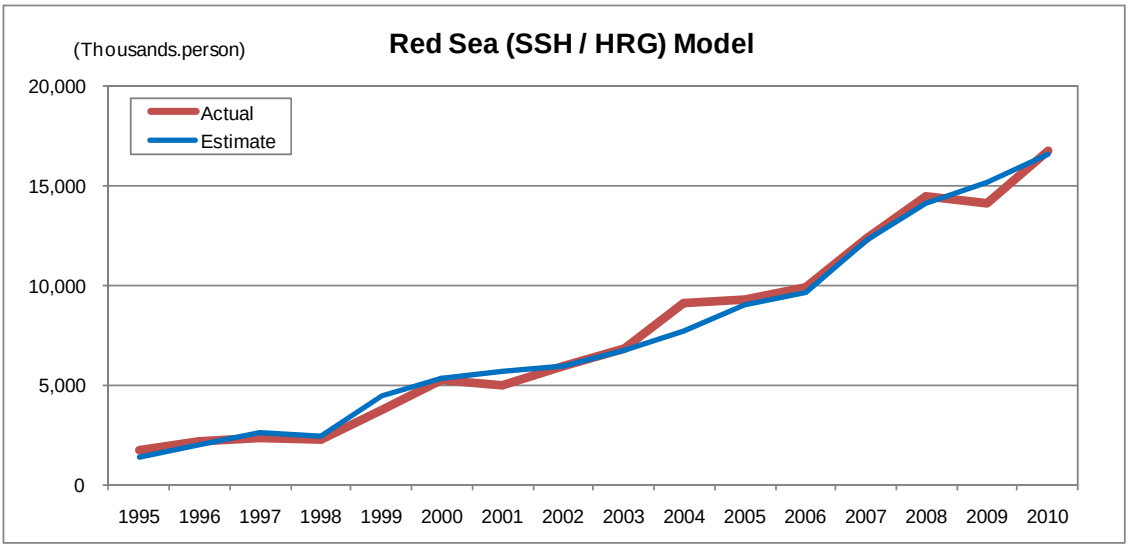
Table 4.3-8 Data for Estimating Coefficients (Airport Model)

t	Y1	Y2	Y3	X1	X2	X3
Year	Cairo etc (persons)	Red Sea (persons)	Alexandria (persons)	Egyptian GDP (Bill.EGP)	Foreign GDP (Bill.USD)	Dummy Internal
1995	9,225,419	1,746,081	250,042	266	1,890	0
1996	10,427,023	2,201,211	260,194	278	1,880	0
1997	10,909,257	2,367,527	284,685	295	1,807	0
1998	9,131,425	2,247,134	289,918	317	1,677	1
1999	12,462,100	3,769,964	325,209	337	1,722	0
2000	14,900,293	5,286,732	346,528	355	1,724	0
2001	12,247,795	4,995,014	365,431	367	1,601	0
2002	11,743,223	5,955,989	421,805	379	1,409	0
2003	11,838,320	6,815,162	449,090	391	1,542	0
2004	14,250,503	9,165,309	491,367	407	1,661	0
2005	14,928,144	9,274,111	609,212	425	1,902	0
2006	15,113,172	9,885,235	803,042	454	2,055	1
2007	17,287,008	12,360,271	962,392	487	2,074	0
2008	19,990,890	14,488,439	1,290,095	521	2,176	0
2009	19,217,929	14,147,758	1,469,059	546	2,147	0
2010	21,643,024	16,742,128	1,681,983	574	2,173	0

Table 4.3-9 Result of Coefficients Estimation (Airport Model)

	Correlation Coefficient		a	b1	b2	b3
			Constant	Egyptian GDP	Foreign GDP	Dummy
Cairo etc	0.9749	Coefficient	-5,179,106	32,017	3,634	-1,830,089
		(t-value)	(-2.7)	(9.6)	(2.7)	(-2.5)
Red Sea	0.9932	Coefficient	-14,614,763	47,702	1,770	-1,023,538
		(t-value)	(-11.4)	(21.4)	(2.0)	(-2.1)
Alexandria	0.9751	Coefficient	-1,893,914	3,751	564	
		(t-value)	(-8.4)	(9.7)	(3.6)	





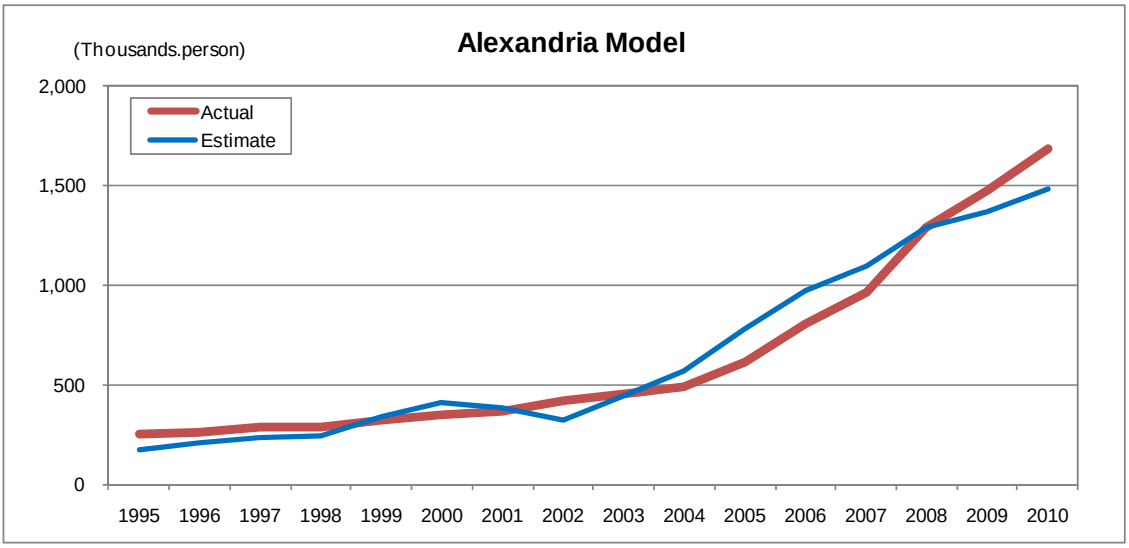


Figure 4.3-4 Comparison of Actual Passenger and Estimated

b) Future Assumption

Same as “Egypt Model”

c) Result

The air passengers ratio is computed by dividing the passengers at Alexandria’s airport by the sum of passengers of each passenger category. The results shows that the calculated ratio increases gradually from 4,2% in 2010 to 4,6% in 2030.

The air passenger in Alexandria airports is forecasted by multiplying the ratio of Alexandria’s airports with the air passenger of Egypt, which are calculated with the “Egypt Model”.

The following figures show the results of the passenger ratio for each airport category and the future passenger demand in Alexandria by Top-down analysis.

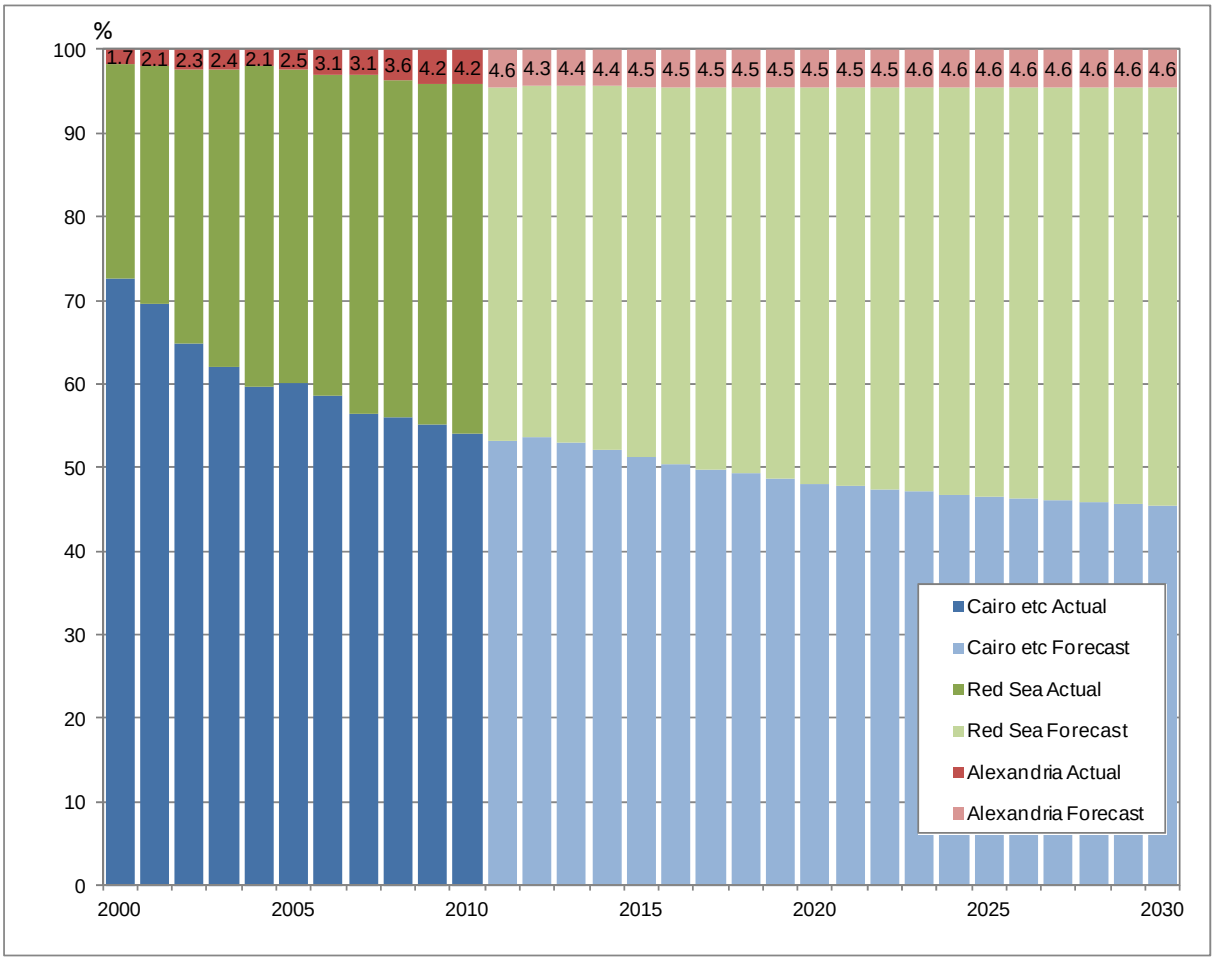


Figure 4.3-5 Future ratio of Air Passenger by Airport (Medium case)

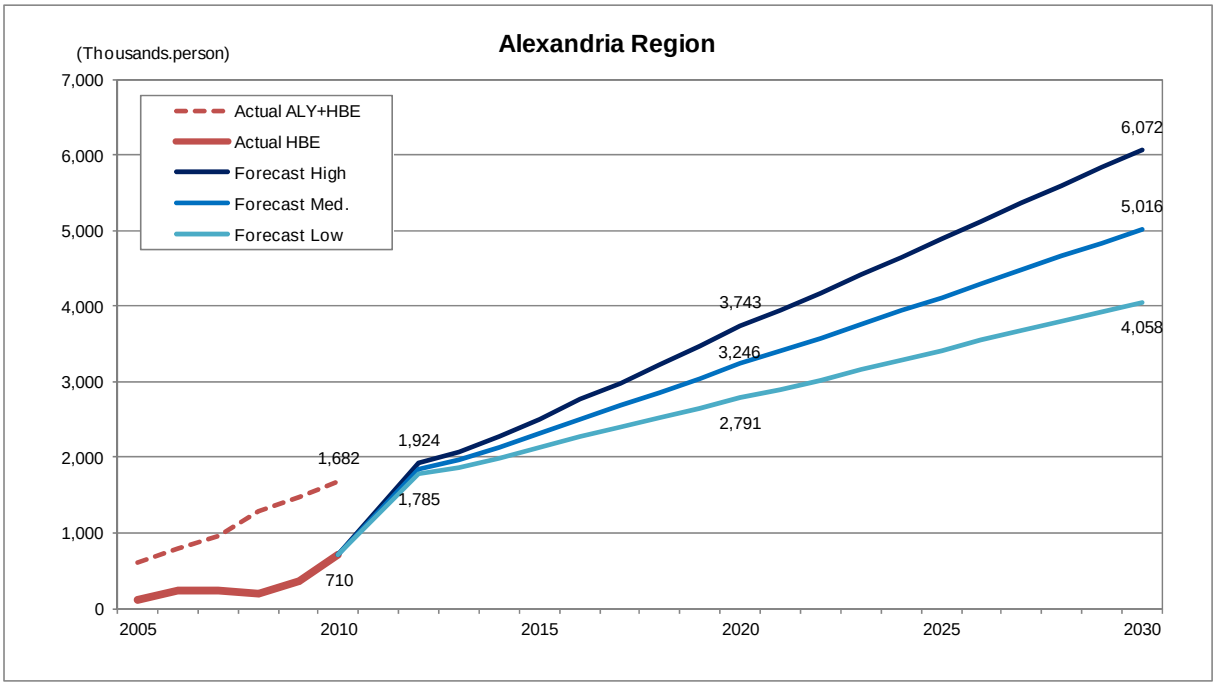


Figure 4.3-6 Air Passenger Forecast in Alexandria Region (Top-down)

4.3.3. Bottom-up Analysis

In the Bottom-up Analysis, the air passengers have been differentiated into three groups: 1) International Egyptian Air Passengers, 2) International Foreign Air Passengers, and 3) Domestic Air Passengers. These three passenger types are to be forecasted separately and finally to be summed up.

Alexandria airports have been mainly used by 1) International Egyptian Air Passenger. Hence, the forecast for this passenger category have great effects on the whole bottom-up analysis.

1) Forecast of Int'l Egyptian Air Passenger

a) Estimation of Int'l Egyptian Air Passengers in Lower /Middle Egypt

The catchment area of Borg El Arab International Airport is assumed to be the area of Lower /Middle Egypt based on the results of passenger survey. The number of Int'l Egyptian air passengers are estimated based on the following formulas:

Int'l Egyptian air passengers =
*Int'l air passengers in Egypt - (Tourist Arrivals by Air *2)*

Int'l Egyptian air passengers in Lower /Middle Egypt =
Int'l Egyptian air passengers -
Int'l Egyptian air passengers in Upper Egypt (Luxor and Aswan airports)

Table 4.3-10 Estimation of Int'l Egyptian Air Passengers in Lower /Middle Egypt

t	Whole Egypt			
Year	Whole Intl Air Passenger 1)	Tourist Arrival by Air 2)	Dep + Arr 3) = 2)*2	Intl Egyptian 4) = 1) - 3)
2001	11,513,925	3,800,000	7,600,000	3,913,925
2002	12,464,172	4,280,000	8,560,000	3,904,172
2003	13,533,738	4,841,000	9,682,000	3,851,738
2004	17,715,570	6,736,000	13,472,000	4,243,570
2005	18,631,565	7,210,000	14,420,000	4,211,565
2006	19,991,049	7,611,000	15,222,000	4,769,049
2007	23,414,344	9,436,000	18,872,000	4,542,344
2008	27,218,006	10,960,000	21,920,000	5,298,006
2009	27,058,111	10,774,000	21,548,000	5,510,111
2010	31,183,478	12,616,000	25,232,000	5,951,478

(person)

t	Upper Egypt				
Year	Luxor		Aswan		Intl Egyptian Passenger in Lower /Middle Egypt
	5)	Egyptian 25% 6) =5)*25%	7)	Egyptian 20% 8) = 7)*20%	9) = 4)- 6)-8)
2001	1,053,044	263,261	20,320	4,064	3,646,600
2002	811,060	202,765	28,755	5,751	3,695,656
2003	919,537	229,884	52,055	10,411	3,611,443
2004	1,234,892	308,723	100,544	20,109	3,914,738
2005	1,450,328	362,582	69,072	13,814	3,835,169
2006	1,278,240	319,560	56,143	11,229	4,438,260
2007	1,076,892	269,223	51,181	10,236	4,262,885
2008	1,130,275	282,569	44,324	8,865	5,006,572
2009	971,187	242,797	25,613	5,123	5,262,192
2010	946,129	236,532	32,734	6,547	5,708,399

*Ratios of Egyptian in Luxor and Aswan are based on the ratio in the year 2010 which were 25% and 20% respectively

b) Forecast Model

The forecast model for International Egyptian air passengers in Lower/Middle Egypt ("Egyptian Model") is as follows:

Forecast Model $$Y_t = POP_t \cdot (a + b \cdot X_t)$$

Y_t : The number of International Egyptian air passenger in Lower/Middle Egypt in the *year* ***t*** (persons)

POP_t : The population in Lower/Middle Egypt in the *year* ***t*** (persons)

X_t : Egyptian GDP per Capita in the *year* ***t*** (EGP/person)

a,b : coefficients

The coefficients (a, b) have been estimated through regression analysis based on the relationship between the air passengers (Y) and economic indices (X) such as the population in this area and Egyptian GDP per Capita.

Data for estimating coefficients and the results are shown in the tables below.

Table 4.3-11 Data for Estimating Coefficients (Egyptian Model)

t	Y			X
Year	Intl Egyptian Passenger (persons)	Population (persons)	Egyptian passenger per capita (persons)	Egyptian GDP per capita (EGP/person)
2001	3,646,600	43,958,938	0.0830	5,623
2002	3,695,656	44,791,600	0.0825	5,687
2003	3,611,443	45,646,281	0.0791	5,753
2004	3,914,738	46,476,757	0.0842	5,876
2005	3,835,169	47,390,322	0.0809	6,018
2006	4,438,260	48,259,733	0.0920	6,309
2007	4,262,885	49,547,606	0.0860	6,606
2008	5,006,572	50,533,789	0.0991	6,933
2009	5,262,192	51,598,724	0.1020	7,103
2010	5,708,399	53,359,000	0.1070	7,208

Table 4.3-12 Result of Coefficients Estimation (Egyptian Model)

	Correlation Coefficient		a	b
			Constant	Egyptian GDP per Capita
Egyptian Model	0.9237	Coefficient	-4.413E-03	1.489E-05
		(t-value)	(-0.3)	(6.8)

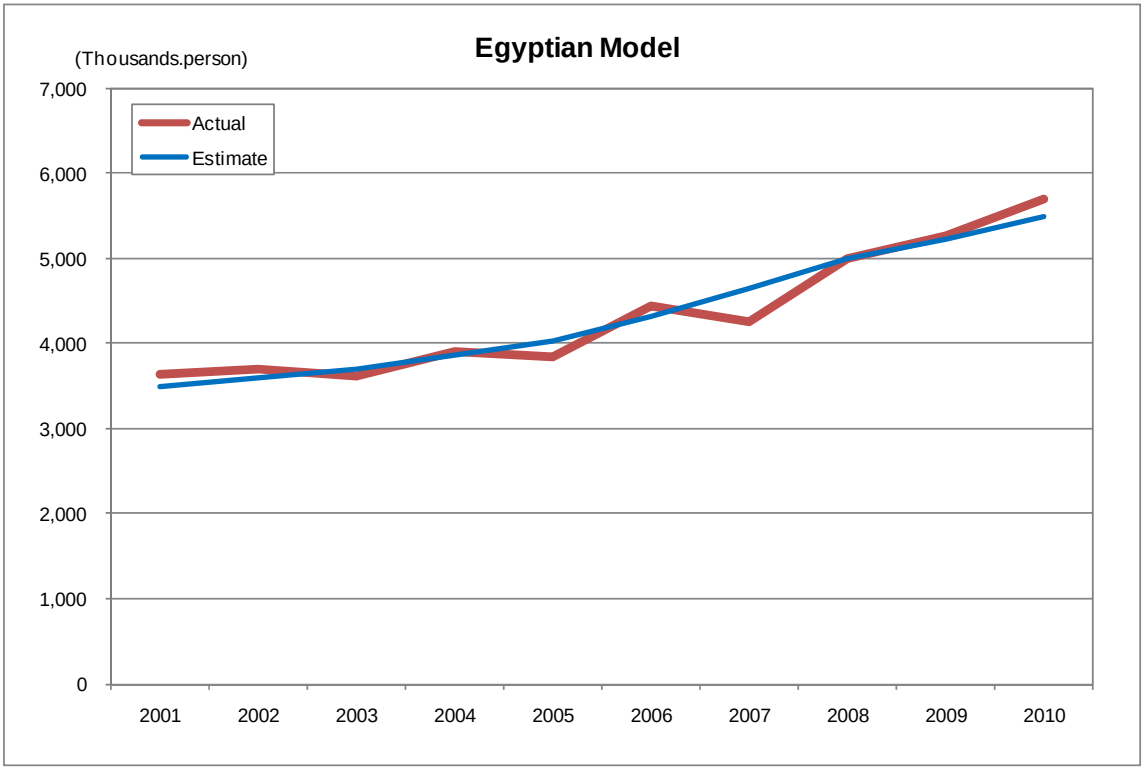


Figure 4.3-7 Comparison of Actual and Estimated Passengers

c) Future Assumption for Egyptian Model

Egyptian GDP per Capita is computed by the following formula:

Egyptian GDP per Capita = Egyptian GDP / the population in entire Egypt

The growth rate of Egyptian GDP is assumed to be the same as used for the medium case in the Top-down analysis.

The future population in Egypt have been predicted by public organizations such as United Nations and CAPMAS. But the predicted growth rates of population were lower than the recent actual growth rate.

Therefore the future population in entire Egypt has been computed by using the average annual growth rates between 2001 and 2010 (2.23%). The future population at Lower/Middle Egypt has also been computed by using the average annual growth rates between 2001 and 2010 (2.18%).

Table 4.3-13 Prediction of the Population in Egypt by Public Organizations

(000 persons)

	Actual		United Nation		CAPMAS	
		Growth rate		Growth rate		Growth rate
2001	65,298					
2002	66,628	**2.04%**				
2003	67,965	**2.01%**				
2004	69,264	**1.91%**				
2005	70,653	**2.01%**				
2006	72,009	**1.92%**				
2007	73,644	**2.27%**				
2008	75,194	**2.10%**				
2009	76,822	**2.17%**				
2010	79,602	**3.62%**				
2011			80,931	**1.67%**	79,680	**0.10%**
2012			82,283	**1.67%**	81,070	**1.74%**
2013			83,657	**1.67%**	82,340	**1.57%**
2014			85,054	**1.67%**	83,620	**1.55%**
2015			86,475	**1.67%**	84,880	**1.51%**
2016			87,728	**1.45%**	86,130	**1.47%**
2017			89,000	**1.45%**	87,380	**1.45%**
2018			90,291	**1.45%**	88,620	**1.42%**
2019			91,600	**1.45%**	89,850	**1.39%**
2020			92,928	**1.45%**	91,060	**1.35%**

*United Nations; The 2010 Revision

[Source] CAPMAS; Based on the Results of 2006 Population Census.

Table 4.3-14 Future Values for Explanatory Variables (Egyptian Model)

t	Population						X	
Year	Entire Egypt (person)	Growth rate	Lower/ Middle Egypt (person)	Growth rate	Egyptian GDP (Bill.EGP)	Growth rate	EG GDP per Captia (EGP)	Growth rate
2001	65,298,293		43,958,938		367		5,623	
2002	66,627,610	2.04%	44,791,600	1.89%	379	3.2%	5,687	1.1%
2003	67,965,096	2.01%	45,646,281	1.91%	391	3.2%	5,753	1.2%
2004	69,263,902	1.91%	46,476,757	1.82%	407	4.1%	5,876	2.1%
2005	70,653,326	2.01%	47,390,322	1.97%	425	4.5%	6,018	2.4%
2006	72,008,901	1.92%	48,259,733	1.83%	454	6.8%	6,309	4.8%
2007	73,643,587	2.27%	49,547,606	2.67%	487	7.1%	6,606	4.7%
2008	75,193,567	2.10%	50,533,789	1.99%	521	7.2%	6,933	4.9%
2009	76,822,251	2.17%	51,598,724	2.11%	546	4.7%	7,103	2.5%
2010	79,602,000	3.62%	53,359,000	3.41%	574	5.1%	7,208	1.5%
2011	81,373,313	2.23%	54,520,377	2.18%	581	1.2%	7,136	-1.0%
2012	83,184,041	2.23%	55,707,031	2.18%	591	1.8%	7,106	-0.4%
2013	85,035,061	2.23%	56,919,513	2.18%	615	4.0%	7,229	1.7%
2014	86,927,271	2.23%	58,158,386	2.18%	650	5.8%	7,482	3.5%
2015	88,861,587	2.23%	59,424,223	2.18%	692	6.4%	7,788	4.1%
2016	90,838,945	2.23%	60,717,611	2.18%	737	6.5%	8,113	4.2%
2017	92,860,303	2.23%	62,039,150	2.18%	778	5.5%	8,373	3.2%
2018	94,926,641	2.23%	63,389,453	2.18%	820	5.5%	8,642	3.2%
2019	97,038,959	2.23%	64,769,146	2.18%	865	5.5%	8,918	3.2%
2020	99,198,281	2.23%	66,178,869	2.18%	913	5.5%	9,204	3.2%

d) Forecast of Int'l Egyptian Air Passenger in Lower /Middle Egypt

Based on the future explanatory variables as well as the forecasting model, the number of future Int'l Egyptian air passengers in Lower /Middle Egypt has been forecasted as follows.

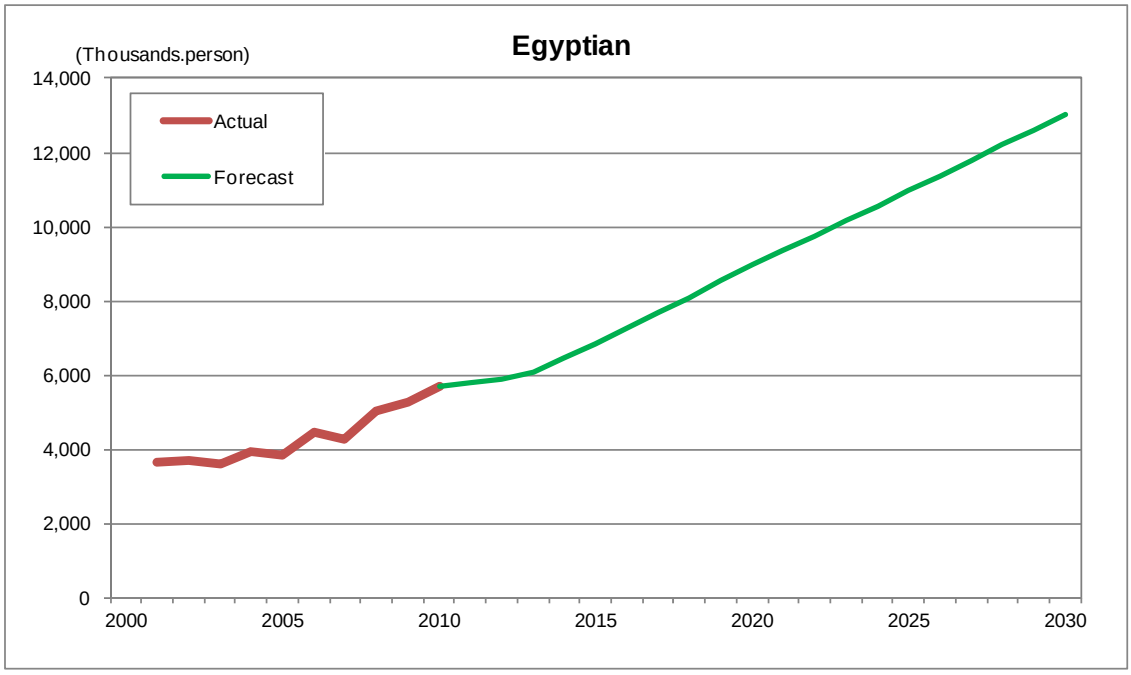


Figure 4.3-8 Forecast Int'l Egyptian Air Passengers in Lower /Middle Egypt

e) Airport Selection Model

To develop a forecast model to compute the selection probability between Alexandria airports and Cairo airport ("Airport Selection Model") , the logistic regression has been applied as illustrated below.

Forecast Model

$$P_{it} = \frac{e^{U_{it}}}{\sum_i e^{U_{it}}}$$

$$U_{it} = \sum_j b_j \cdot X_{ij\,t}$$

P_{it} : Selection probability of ***i*** airport in the *year* ***t*** (%)

U_{it} : Utility function of selecting ***i*** airport in the *year* ***t*** (index)

e : exponential

X_{i1t} : International Air fare of ***i*** airport in the *year* ***t*** (index)

X_{i2t} : International flight frequency of ***i*** airport in the *year* ***t*** (times/day)

b_j : coefficients

The explanatory variables of the utility function are the air fare and the frequency considered through the recently increasing Low Cost Carrier activities at Alexandria's airports.

Data for estimating coefficients and the results are shown below. These are the time-series data of the airport selection ratio, data of the average air fare and the daily frequency for each airport.

Table 4.3-15 Estimation of Airport Selection Probability

t Year	Intl Egyptian Passenger in Lower /Middle Egypt 9)	Alexandria (ALY+HBE) 10)	Egyptian 80% 11) =10)*80%	Cairo Egyptian 12) =9)-11)	Probability of Airport Selection Cairo 12) / 9)	Alexandria 11) / 9)
2001	3,646,600	161,087	128,870	3,517,730	96%	4%
2002	3,695,656	246,482	197,186	3,498,470	95%	5%
2003	3,611,443	246,608	197,286	3,414,156	95%	5%
2004	3,914,738	450,455	360,364	3,554,374	91%	9%
2005	3,835,169	575,513	460,410	3,374,758	88%	12%
2006	4,438,260	774,322	619,458	3,818,803	86%	14%
2007	4,262,885	922,288	737,830	3,525,054	83%	17%
2008	5,006,572	1,231,058	984,846	4,021,726	80%	20%
2009	5,262,192	1,402,917	1,122,334	4,139,858	79%	21%
2010	5,708,399	1,593,782	1,275,026	4,433,373	78%	22%

*Ratio of Egyptian in Alexandria was based on the ratio in the year 2010

The ratio for selecting Alexandria airports in the Lower /Middle Egypt Area in 2010 was estimated at 22%. This ratio is largely backed up by comparing the ratio of air ticket sales in the Lower Egypt at Alexandria airports and at Cairo airport, which was roughly 3 to 7 (3:7) as a result of an interview survey from travel agents.

The airfare of LCC is represented as a ratio of LCC airfare to Legacy Carrier airfare. The airfare of Legacy Carrier is regarded as "100". The integrated airfare is computed by the weighted average of air fares in each airline category and their aircraft

movements.

The natural logarithm (LN) represents the utility of flight frequency.

Coefficients have been estimated based on the data after the year 2005, which was one year after LCC had started operation at Alexandria's airports.

Table 4.3-16 Explanatory Variables for Establishing Utility Function

							X1	
t	Ratio of LCC International Flight				Airfare (Discount ratio) (Index)		Airfare (Weight Average) (Index)	
Year	Cairo		Alexandria					
	Legacy	Low Cost	Legacy	Low Cost	Legacy	Low Cost	Cairo	Alex
2001	100%		100%	0%	100		100	100
2002	100%		100%	0%	100		100	100
2003	100%		100%	0%	100		100	100
2004	100%		87%	13%	100	44	100	93
2005	100%		83%	17%	100	44	100	91
2006	100%		83%	17%	100	56	100	93
2007	100%		76%	24%	100	63	100	91
2008	100%		69%	31%	100	68	100	90
2009	100%		63%	37%	100	61	100	85
2010	100%		50%	50%	100	56	100	78

				X2	
t		Intl Frequency (Aircraft Movement)			
Year		Yearly (Times/Year)		Daily (Times/day)	
		Cairo	Alex	Cairo	Alex
2001		56,599	2,074	155	6
2002		55,287	2,876	151	8
2003		58,036	2,884	159	8
2004		64,895	4,747	178	13
2005		69,568	6,065	191	17
2006		75,348	8,127	206	22
2007		85,106	9,052	233	25
2008		93,889	11,171	257	31
2009		98,305	13,891	269	38
2010		107,505	15,264	295	42

Table 4.3-17 Result of Coefficients Estimation (Utility Function)

	Correlation Coefficient		b1	b2
			Air Fare	**LN**(Frequency)
Utility function	0.9973	Coefficient	-1.929E-02	8.337E-01
		(t-value)	(-1.9)	(13.5)

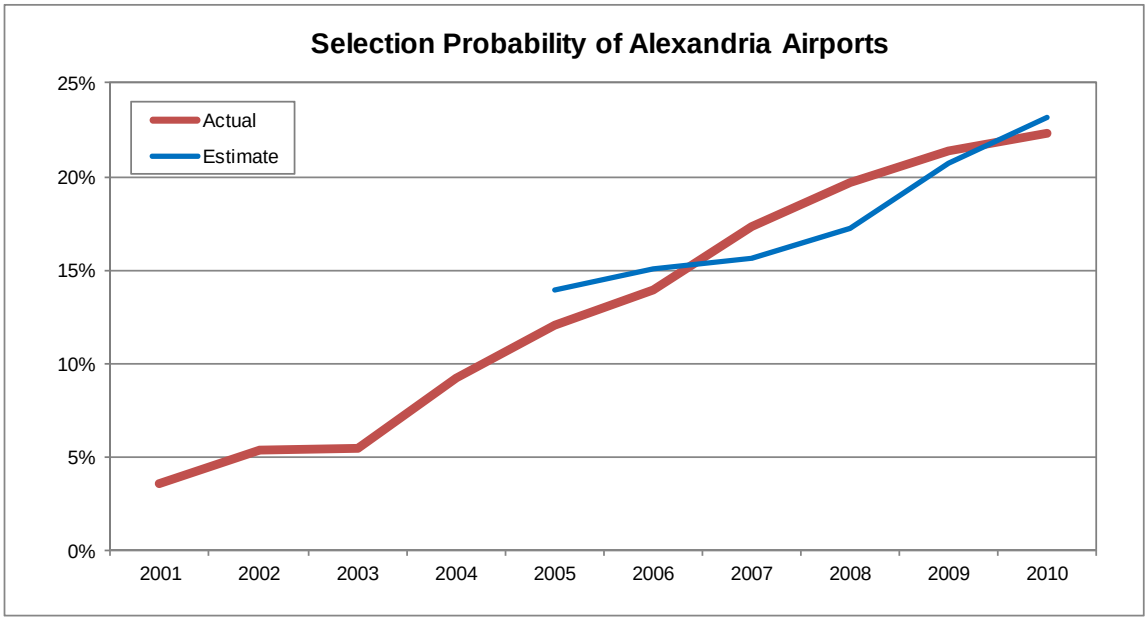


Figure 4.3-9 Comparison: Actual Probability of Alexandria Airports and Estimated

f) Future Assumption for Utility function

The future values of the explanatory variables (air fare and frequency), which are substituted into the utility function have been set as follows:

Air Fare: (**X1**)

The air fare is the integrated index. In the calculation, the following two factors need to be set:

The ratio of the airfare for LCC to Legacy Carrier: Between 2005 and 2010, the ratio of the airfare for LCC was in a range between 40～60 (Average :58) when the airfare for Legacy Carrier is regarded as ”100”. The latest index in 2010 was 56. Therefore, the future ratio of the air fare for LCC has been assumed to be 55, considering the recent trends.

Ratio of LCC flight number: The ratio of the number of LCC International flights in Alexandria’s airports was 50% in 2010. Air Arabia Egypt, the LCC based at Borg El Arab International Airport began to operate in June 2010 and so the current ratio is expected to be larger.

According to an interview survey to Air Arabia Egypt, their principal business plan was as shown below.

- ✓ Business and marketing plan of Air Arabia Egypt were linked to Air Arabia group.
- ✓ Air routes of Air Arabia Egypt were being focused on the southern Europe and Middle East.
- ✓ The number of aircraft are planned to increase one aircraft every year. (Currently, they have two A320 aircraft.)

Considering the business plan of Air Arabia Egypt , which is the most active LCC based at Borg El Arab International Airport as its hub airport, the ratio of the number of LCC international flights in Alexandria will certainly increase. But since the ratio depends on the business plan of each airline, the ratio can vary. Therefore, A sensitive analysis is conducted by changing the assumption for this ratio. The assumption of 60% is defined as “Medium case”. The case, in which the ratio is 5.0% lower, is defined as “Low case”, and “High case” is when the ratio is 5.0% higher.

On the other hand, the ratio of the number of LCC International flights in Cairo International airport has been assumed to remain at the current situation (i.e the ratio is 0%) due to the governmental regulation prohibiting LCCs flight at Cairo International airport.

Frequency: **(X2)**

The frequency of aircraft movements is generally the output index, which is computed from the forecast air passengers. However, the frequency can also be input and output elements in the competition between two airports, because the frequency is one of the factors for passengers when they select an airport to take a flight.

Therefore, the frequency has been estimated by an convergent calculation until the frequency of output corresponds to the input frequency as shown in Figure 4.3-10.

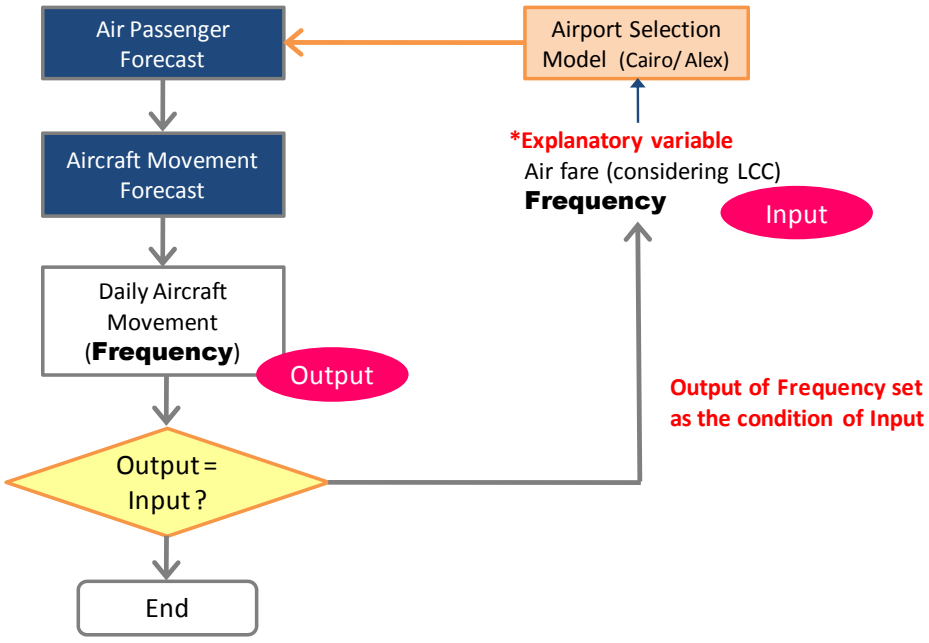


Figure 4.3-10 Procedure of Future Frequency Assumption

The method to forecast the aircraft movements (frequency) at Alexandria’s airports is described in details in the Section 4.5 hereafter.

The future frequency of flights form/to Cairo International Airport has been estimated by dividing the annual passengers of Cairo International Airport, computed by using the growth rate forecasted in the Top-down Analysis for “Cairo etc.” with the number of

passengers per flight.

Daily Frequency in Cairo International Airport =
(Annual Passenger Forecast / Passenger per Flight) / 365 days

Future values of the number of passengers per flight have been estimated assuming yearly increase by 1.3% , which is the growth rate between 2000 and 2010 for Cairo International Airport.

g) Forecast of the Probability to select Alexandria Airports

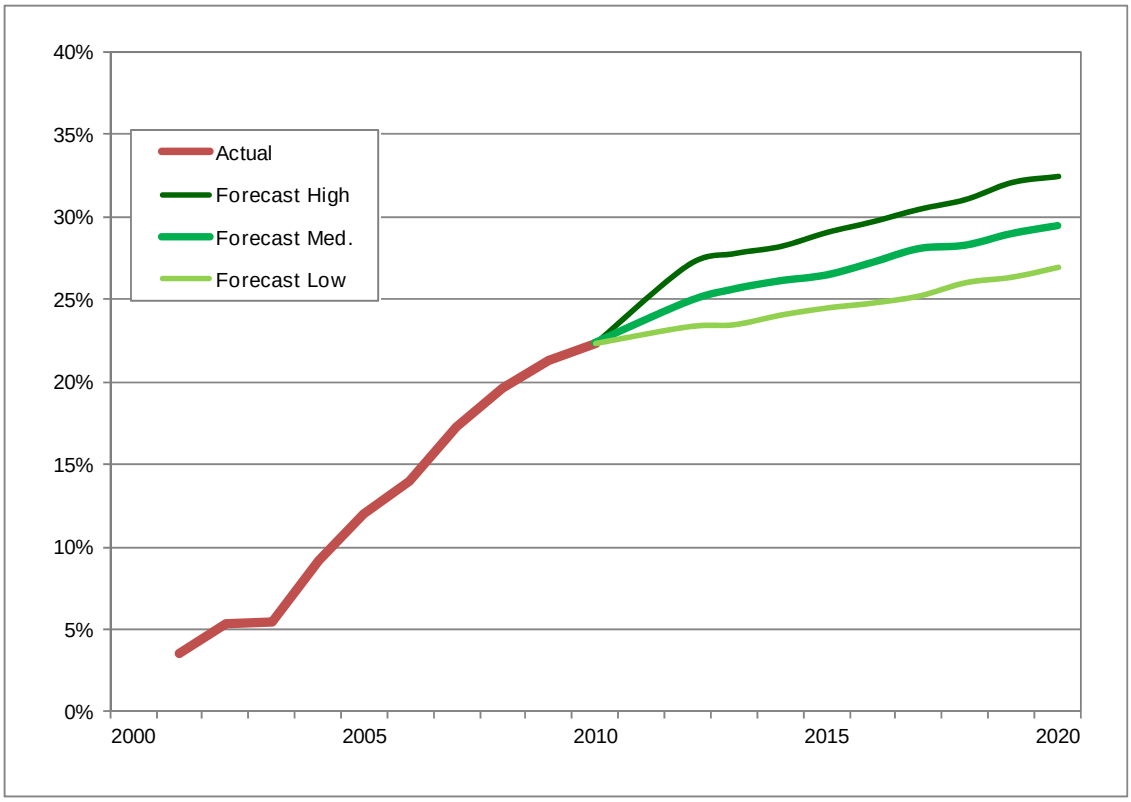


Figure 4.3-11 Forecast of the Probability to Select Alexandria Airports

h) Forecast of Int'l Egyptian Air Passengers at Alexandria Airports

The International Egyptian air passengers have been computed by multiplying the selection probability of Alexandria airports by the number of air passengers in the Lower /Middle Egypt Area, which have been calculated by the "Egyptian Model".

The result of the calculation is shown in 4) Sum of each element.

2) Forecast of Int'l Foreign Air Passenger

a) Forecast Model

The forecast model for International foreign air passengers to Alexandria ("Tourist Model") is as follows:

Forecast Model $Y_t = a + b \cdot X_t$

Y_t :The number of International foreign air passengers to Alexandria in the *year* ***t*** (persons)

X_t : Egyptian GDP in the *year* ***t*** (Bill.EGP)

a,b : coefficients

The coefficients (a, b) have been estimated through regression analysis on the relationship between the air passengers (Y) and Egyptian GDP (X). Data for estimating the coefficients and the results are shown in Table 4.3-16 and Figure 4.3-12.

Since there are no correct time-series data for international foreign tourists available, the number of tourists has been estimated by the following formula:

Int'l foreign air passengers to Alexandria region =
Int'l air passengers in Alexandria airports –
Int'l Egyptian air passengers in Alexandria airports

Int'l Egyptian air passengers in Alexandria airports in the past have been computed by the ratio of Egyptian in Alexandria (80%) in 2010.

Table 4.3-18 Data for Estimating Coefficients (Tourist Model)

			Y	X
t Year	Int'l air Passengers in Alex airports	Egyptian	Tourist (person)	Egyptian GDP (Bill.EGP)
2001	161,087	128,870	32,217	367
2002	246,482	197,186	49,296	379
2003	246,608	197,286	49,322	391
2004	450,455	360,364	90,091	407
2005	575,513	460,410	115,103	425
2006	774,322	619,458	154,864	454
2007	922,288	737,830	184,458	487
2008	1,231,058	984,846	246,212	521
2009	1,402,917	1,122,334	280,583	546
2010	1,593,782	1,275,026	318,756	574

Table 4.3-19 Result of Coefficients Estimation (Tourist Model)

	Correlation Coefficient		a Constant	b Egyptian GDP
Tourist Model	0.9979	Coefficient (t-value)	-4.831E+05 (-32.6)	1.396E+03 (43.4)

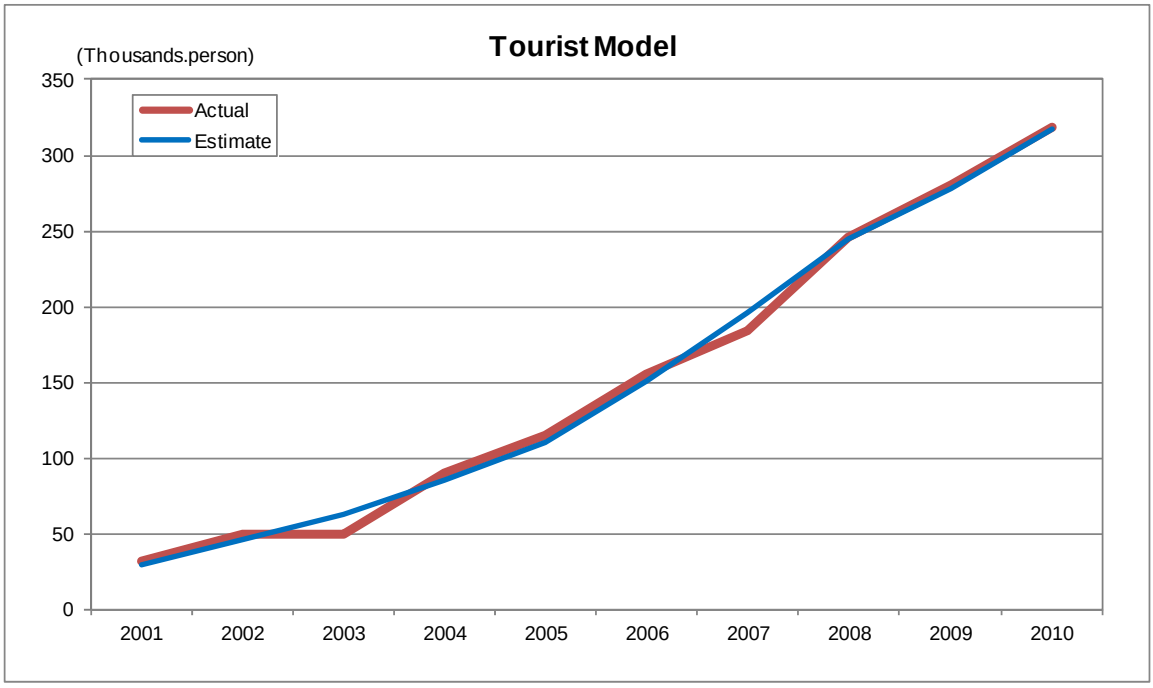


Figure 4.3-12 Comparison of Actual Tourist and Estimated

b) Future Assumption

The future Egyptian GDP assumed in the Top-down analysis has also been used for this analysis and a similar sensitive analysis has been conducted by changing the assumption for the future GDP growth rates.

c) Forecast of Int'l Tourist Air Passengers of Alexandria Airports

International tourist air passengers of Alexandria Airports have been computed by substituting the future Egyptian GDP into the forecast model.

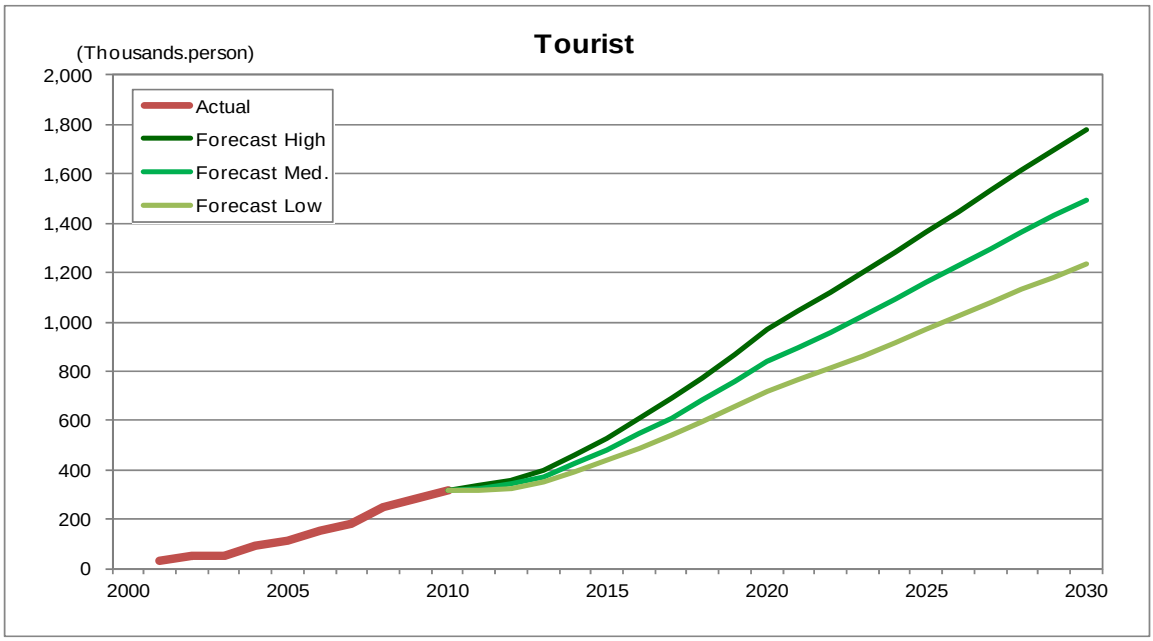


Figure 4.3-13 Forecast of Int'l Tourist Air Passenger of Alexandria Airports

3) Forecast of Domestic Air Passengers

The domestic air passengers have been estimated based on the result of interview survey of Egypt Air Express. At present, domestic air routes are operated by Egypt Air who entrust their operation to Egypt Air Express, which is a subsidiary of Egypt Air. Therefore, the business plan of Egypt Air Express affects the future demand greatly.

The domestic main route is between Alexandria and Cairo, but the usage is low, because Cairo downtown can be reached within three hours by land transportation. Increase in the frequency by using the same smaller aircraft of Egypt Air Express might hopefully create a new demand between Alexandria and Cairo.

The business plan of Egypt Air Express concerning domestic flights is shown in Table 4.3-20 below.

Table 4.3-20 Egypt Air Express Future plan of domestic flight to/from Alexandria

	Route	2011-2015	2016-2020	2021-2025
Flight / week	Cairo	7	14	21
	Sharm El-Sheikh	11	10	13
Fleet	Cairo	76	76	76
(Number of Seat)	Sharm El-Sheikh	76	100	100

The number of future domestic passengers have been computed based on the business plan (route, frequency and fleet) and an average load factor of Egypt Air Express (75%). It has been assumed that the number of flights per week would increase every year so that the total number of weekly flights would reach the target in the five-year term designated in the business plan.

The result of calculation is shown in 4) Sum of each element.

4) Sum of each element

The results for estimate of all three passenger categories of the Bottom-Up Analysis are shown below.

The conditions for the sensitive analysis conducted for the passenger category 1) International Egyptian Air Passenger and 2) International Foreign Air Passenger are summarized in the table below.

Table 4.3-21 Condition of Sensitive Analysis

		Low	Medium	High
1) Intl Egyptian Air Passenger	Ratio of LCC flight	**55%**	**60%**	**65%**
2) Intl Foreign Air Passenger	GDP growth rate	**Base -1%**	**Base**	**Base +1%**

Table 4.3-22 Result of Air Passenger Forecast (Medium case)

t	Nile Delta	Alexandria					
Year	International Egyptian		Intl Tourist	Domestic		Total	
	Estimate	Estimate	Estimate	Actual	Estimate	Actual	Forecast
2004	3,914,738	360,364	90,091	40,912		491,367	
2005	3,835,169	460,410	115,103	33,699		609,212	
2006	4,438,260	619,458	154,864	28,720		803,042	
2007	4,262,885	737,830	184,458	40,104		962,392	
2008	5,006,572	984,846	246,212	59,037		1,290,095	
2009	5,262,192	1,122,334	280,583	66,142		1,469,059	
2010	5,708,399	1,275,026	318,756	88,201		1,681,983	1,681,983
2011	5,769,243	1,334,370	328,367		91,902		1,754,638
2012	5,865,480	1,411,766	342,956		95,602		1,850,324
2013	6,093,005	1,515,283	375,960		99,303		1,990,546
2014	6,439,860	1,636,620	425,730		103,003		2,165,353
2015	6,845,716	1,767,221	483,834		106,704		2,357,758
2016	7,284,462	1,939,634	546,622		117,562		2,603,818
2017	7,678,424	2,111,962	613,492		128,419		2,853,872
2018	8,094,046	2,245,502	684,708		139,277		3,069,486
2019	8,532,514	2,430,353	760,553		150,134		3,341,040
2020	8,995,076	2,608,395	841,328		160,992		3,610,715

Table 4.3-23 Result of Air Passenger Forecast (Low case)

t	Nile Delta	Alexandria					
Year	International Egyptian		Intl Tourist	Domestic		Total	
	Estimate	Estimate	Estimate	Actual	Estimate	Actual	Forecast
2004	3,914,738	360,364	90,091	40,912		491,367	
2005	3,835,169	460,410	115,103	33,699		609,212	
2006	4,438,260	619,458	154,864	28,720		803,042	
2007	4,262,885	737,830	184,458	40,104		962,392	
2008	5,006,572	984,846	246,212	59,037		1,290,095	
2009	5,262,192	1,122,334	280,583	66,142		1,469,059	
2010	5,708,399	1,275,026	318,756	88,201		1,681,983	1,681,983
2011	5,769,243	1,334,370	320,358		91,902		1,746,629
2012	5,865,480	1,323,613	326,778		95,602		1,745,993
2013	6,093,005	1,384,502	351,046		99,303		1,834,851
2014	6,439,860	1,503,373	391,039		103,003		1,997,415
2015	6,845,716	1,630,527	438,190		106,704		2,175,421
2016	7,284,462	1,759,879	488,809		117,562		2,366,249
2017	7,678,424	1,890,313	542,211		128,419		2,560,942
2018	8,094,046	2,059,914	598,550		139,277		2,797,741
2019	8,532,514	2,202,233	657,988		150,134		3,010,356
2020	8,995,076	2,377,377	720,695		160,992		3,259,064

Table 4.3-24 Result of Air Passenger Forecast (High case)

t	Nile Delta	Alexandria					
Year	International Egyptian		Intl Tourist	Domestic		Total	
	Estimate	Estimate	Estimate	Actual	Estimate	Actual	Forecast
2004	3,914,738	360,364	90,091	40,912		491,367	
2005	3,835,169	460,410	115,103	33,699		609,212	
2006	4,438,260	619,458	154,864	28,720		803,042	
2007	4,262,885	737,830	184,458	40,104		962,392	
2008	5,006,572	984,846	246,212	59,037		1,290,095	
2009	5,262,192	1,122,334	280,583	66,142		1,469,059	
2010	5,708,399	1,275,026	318,756	88,201		1,681,983	1,681,983
2011	5,769,243	1,334,370	336,376		91,902		1,762,647
2012	5,865,480	1,542,430	359,295		95,602		1,997,327
2013	6,093,005	1,646,555	401,366		99,303		2,147,224
2014	6,439,860	1,770,598	461,445		103,003		2,335,046
2015	6,845,716	1,943,242	531,270		106,704		2,581,217
2016	7,284,462	2,118,228	607,276		117,562		2,843,065
2017	7,678,424	2,292,989	688,982		128,419		3,110,391
2018	8,094,046	2,467,087	776,816		139,277		3,383,180
2019	8,532,514	2,690,818	871,238		150,134		3,712,190
2020	8,995,076	2,872,064	972,741		160,992		4,005,797

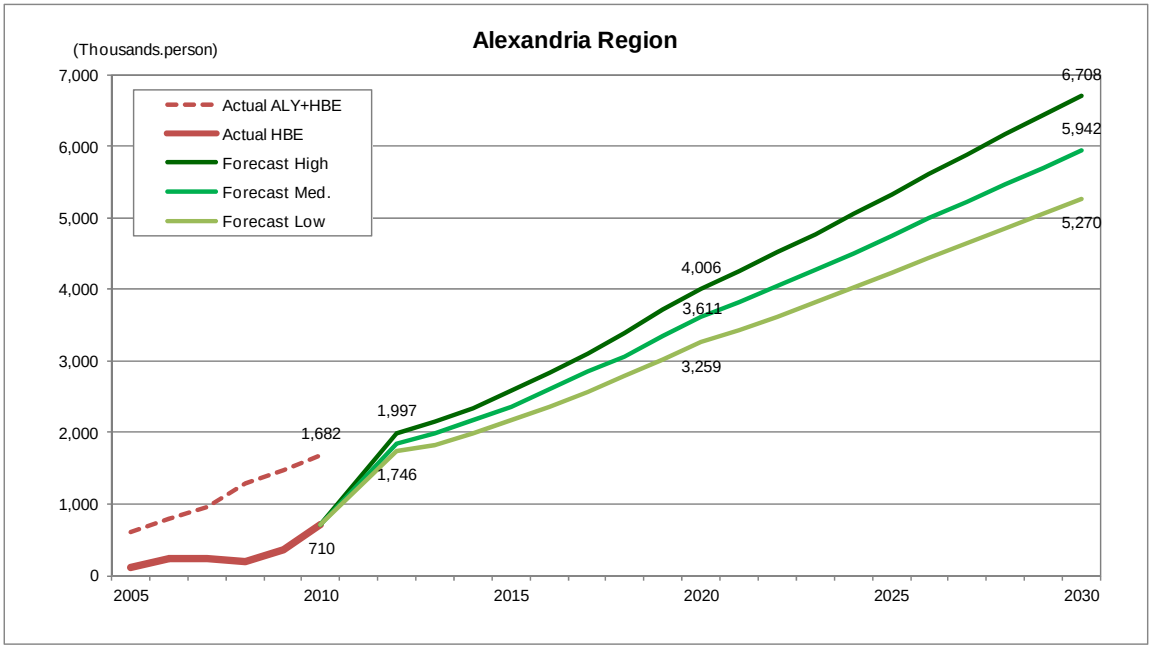


Figure 4.3-14 Air Passenger Forecast in Alexandria Region (Bottom-up)

4.3.4. Cross-examination

In this section the results of the forecasted air passengers in Alexandria by Top-down and Bottom-up Analysis are summarized. The number of forecast cases are six, as three sensitive analyses were conducted for each analysis.

As mentioned before, the estimation of the future economic indices beyond the year 2020 is not reliable. Therefore, the air traffic demand has been assumed to increase every year by an annual air traffic average increment in the previous ten years (from 2020 to 2030).

Table 4.3-25 Result of Air Passenger Forecast

(Thousand. person)

	Top-down Analysis			Bottom-Up Analysis		
	High	Medium	Low	High	Medium	Low
2010	1,682	1,682	1,682	1,682	1,682	1,682
2015	2,513	2,316	2,125	2,581	2,358	2,175
2020	3,743	3,246	2,791	4,006	3,611	3,259
2025	4,891	4,122	3,421	5,333	4,755	4,239
2030	6,072	5,016	4,058	6,708	5,942	5,270
Annual Average Growth Rate						
2010-2015	8.4%	6.6%	4.8%	8.9%	7.0%	5.3%
2015-2020	8.3%	7.0%	5.6%	9.2%	8.9%	8.4%
2020-2025	5.5%	4.9%	4.2%	5.9%	5.7%	5.4%
2025-2030	4.4%	4.0%	3.5%	4.7%	4.6%	4.5%
2010-2030	6.6%	5.6%	4.5%	7.2%	6.5%	5.9%

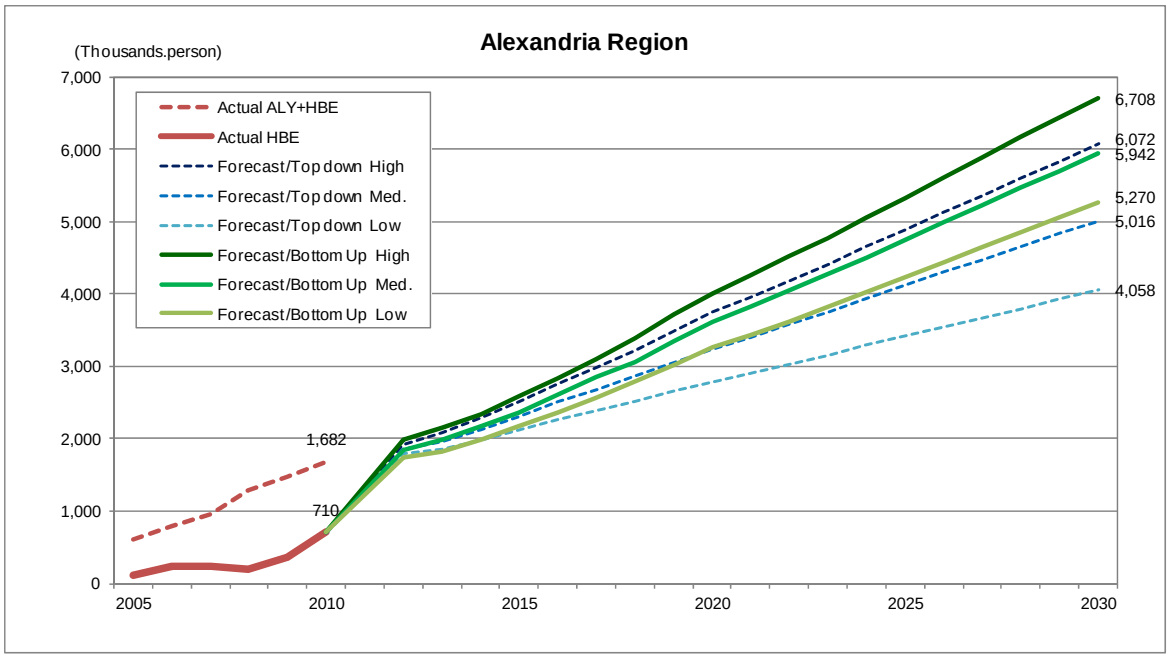


Figure 4.3-15 Air Passenger Forecast in Alexandria

According to the forecast, air passengers handled in Alexandria airports were predicted to increase from 1.7 million in year 2010 to a range between 2.8 and 4.0 million in year 2020. Furthermore, until 2030 the air passengers will increase to a range between 4.1 and 6.7 million. The annual average air passenger growth rate from 2010 to 2030 varies between 4.5 and 7.2% .

In general, the number of air passengers predicted by means of Bottom-up Analysis is higher than that by the Top-down Analysis.

The Top-down Analysis is a traditional method and can be used to reflect the trend of demand for entire Egypt. This method is usually applied when the characteristic is similar, but in case of Egypt's airports it is not the case. The following table shows monthly passenger traffic at Egyptian airports in 2011. The fluctuation of air traffic demand varied from airport to airport after the outbreak of the Egyptian Revolution. The traffic demand for example in Alexandria didn't much decrease, because most of the air passengers were Egyptian. On the other hand, the demand of the airports, where the passengers were mainly foreign tourists such as Sharm El-Sheikh and Hurghada, sharply decreased,.

Table 4.3-26 Year-on-Year of Passenger traffic in the year 2011

	Cairo	Red Sea	Alexandria	ALY	HBE	etc	Total
Jan	7%	9%	24%	28%	21%	12%	9%
Feb	▲ 54%	▲ 74%	▲ 17%	▲ 30%	▲ 4%	▲ 80%	▲ 66%
Mar	▲ 39%	▲ 71%	▲ 9%	▲ 33%	18%	▲ 63%	▲ 57%
Apr	▲ 26%	▲ 48%	1%	▲ 24%	31%	▲ 44%	▲ 37%
May	▲ 23%	▲ 44%	1%	▲ 32%	58%	▲ 51%	▲ 36%
Jun	▲ 11%	▲ 32%	▲ 20%	▲ 34%	3%	▲ 35%	▲ 23%
Jul	▲ 9%	▲ 21%	▲ 7%	▲ 36%	41%	▲ 36%	▲ 16%
Aug	▲ 13%	▲ 16%	2%	▲ 39%	61%	▲ 36%	▲ 16%
Sep	▲ 15%	▲ 10%	▲ 3%	▲ 41%	61%	▲ 41%	▲ 16%
Oct	▲ 25%	▲ 22%	▲ 4%	▲ 33%	33%	▲ 45%	▲ 26%
Nov	▲ 32%	▲ 20%	▲ 9%	▲ 37%	26%	▲ 46%	▲ 28%
Dec							
Total	▲ 21%	▲ 32%	▲ 4%	▲ 32%	33%	▲ 43%	▲ 28%

[Source] Egyptian Holding Company of Airports and Air Navigation website

The estimation of the passenger distribution according to the Airport Model used in this Study is important especially in the case of applying the Top-down analysis to forecast the air traffic demand in Egypt. The airport demand cannot be represented appropriately if the explanatory variables used for the forecast model depend specifically on each airport demand. It means that allocation of the total air traffic demand in Egypt to each of the airports cannot be made constantly but should be carried out considering variety of characteristics specific to the airport, that is almost equivalent to the bottom up analysis.

For those reasons, the results of the Bottom-up Analysis (the medium case), which focuses on the characteristics of the air passengers in Alexandria, has been adopted as the planning basis of this Study.

4.4. Annual Air Cargo Demand Forecast

4.4.1. Procedure of Air Cargo Demand Forecast

As described in Section 4.2.1, almost all air cargo traffic in Egypt was handled in Cairo International Airport. For the air cargo traffic in Alexandria, chronological data to develop a forecast model was not available. Accordingly, the forecast of air cargo was not possible in neither the Top-down nor Bottom-up analysis. Therefore, it has been assumed that the air cargo demand in Alexandria would likely to remain at the present level of traffic based on the result of interview surveys.

The interview survey were made to the following entities:

- ✈ Egypt Air Cargo
- ✈ Air Cargo Agent (Freight Forwarder)
- ✈ Ground Handling Service Agent

4.4.2. Current Situation of Air Cargo in Alexandria and its Outskirts

1) Loading/ Unloading Airport

- ✓ Most of the air cargos in Alexandria and its outskirts were transported to/from Cairo International Airport, because of the availability of quick delivery system and good customer services. Accordingly the air cargo business was concentrated at and around Cairo International Airport.
- ✓ There are historically-established roles at Cairo International Airport and Alexandria Port, respectively. Since many years air and marine cargos have been handled at Cairo International Airport and Alexandria port respectively.

2) Air Cargo Volume

- ✓ Most of the exported cargos from Egypt were produced in Cairo and Alexandria with their outskirts, however. the specific volume of air cargo produced/manufactured in and near Alexandria (the latent demand) is not known.
- ✓ Volumes of air cargo handled at Alexandria-Nozha International Airport (ALY) for the last three years are shown in Table 4.4-1.
- ✓ In 2010/2011 5,653 tons of air cargo were handled at Alexandria-Nozha International Airport (ALY). The average annual growth rate during this period was 11%.

Table 4.4-1 Air Cargo Volume at Alexandria Airport

(tons)	2008/2009	2009/2010	2010/2011	AAGR
Egypt Air	2,967	4,208	4,191	12%
Foreign A/L	1,174	1,011	1,462	8%
Total	4,142	5,219	5,653	11%

[Source] Egypt Air Cargo

- ✓ At Borg El Arab International Airport, the volume of air cargo is not known, because the statistics of air cargo is not available. But it is clear through the interview that air cargos are not handled regularly. There are a few charter flights by **Antonov** (this is an all-cargo aircraft; Maximum Payload: 150 t) for the transport of special machines by a petroleum company.

3) Items of Air Cargo

- ✓ It has been assumed that shares of general cargoes would be 60%, vegetables 30%, and textiles 10%
- ✓ General cargoes would be mainly machine parts.
- ✓ Vegetables, produced according to European requirements in mass farns, would be usually transported to Europe.

4.4.3. Air Cargo Forecast

1) Future Possibility

- ✓ For the accumulation of air cargo at Alexandria airports, following facilities, services and systems would need to be provided, like Cairo International Airport:
  - Warehouse;
  - Large-scale refrigerator for safe storage of fresh products (e.g. fruit, vegetable, meat, etc.);
  - Air cargo agent (freight forwarder) for the ground transportation;
  - Skilled customer services;
  - Low royalty fee and air fare.
- ✓ Even airlines were able to transport air cargo to Alexandria, the land transportation provided by air cargo agents (freight forwarder) was still underdeveloped. At the moment the improved and attractive services by air cargo agents is most important.
- ✓ Egypt Air Cargo is planning to launch their business at Borg El Arab International Airport.
- ✓ Freighter aircraft is expected at Alexandria in the future, because quick delivery especially of machinery parts is demanded.
- ✓ Strong incentives, warehousing facilities and a strong commitment to cargo handling should be considered to make Borg El Arab International Airport as one of the main cargo hubs in the region.

2) Conclusion

- ✓ Through the interview survey, it is confirmed that there is a strong air cargo demand in Alexandria and its outskirts.
- ✓ Air cargo demand at Borg El Arab International Airport may increase in future; considering the fact that Egypt Air Cargo is planning to launch their business to the airport and the recent growth rate is 10% per annum.
- ✓ At present it is difficult to quantitatively forecast air cargo demand even though air cargo demand tends to increase obviously.
- ✓ The current cargo terminal building at Borg El Arab International Airport has still space for further expansion. The influence of Egypt Air Cargo's business plan with their introduction of freighter aircraft and actual operations of the present cargo terminal should be observed in the meantime, so as to grasp future trends and be prepared to take necessary measures.
- ✓ In conclusion, the Study Team recommends that the planning and design of the cargo terminal be examined later again, when the cargo business would have significantly increased or decision of higher authority has been made to develop Borg El Arab International Airport to be cargo hub.

4.5. Annual Aircraft Movement Forecast

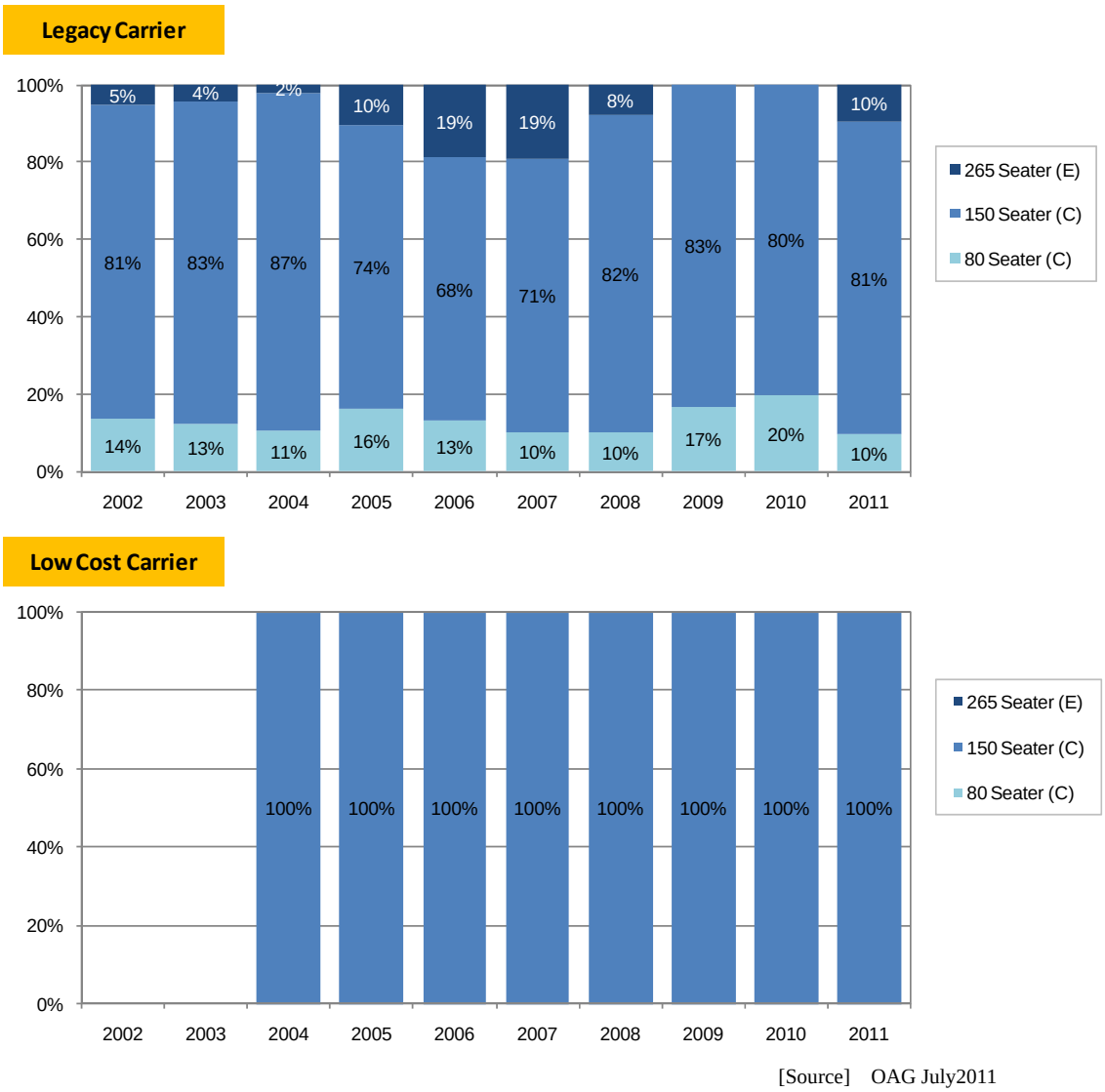
4.5.1. Passenger Aircraft Movements

1) International Aircraft Movement

a) Trend of Aircraft Configuration

The trends of the aircraft fleet configuration in Alexandria airports based on time-table for the past ten years can be summarized as follows.

The aircraft fleet configuration needs to be assumed in each of Legacy Carrier and Low Cost Carrier in Airport Selection Model of Bottom-up analysis, as shown in the following figures. The seating capacities of aircraft can be classified into three categories namely 265-Seater (E), 150-Seater (C) and 80-Seater (C). The alphabet in the parenthesis shows the aircraft classification according to ICAO.



[Source] OAG July2011

Figure 4.5-1 Trend of Aircraft Fleet Configuration in Alexandria Airports

150-Seater aircraft are principally operated by both Legacy Carrier and LCC to/from

Alexandria airports. Flights by aircraft over 150-seater are made only at Borg El Arab International Airport.

All Low Cost Carries are operating 150-seater aircraft. This is their "business model" because their costs of operation and maintenance can be reduced by unifying their aircraft.

b) Future Assumption

Regarding the aircraft configuration of Legacy Carrier, it is expected that the number of 265-seater aircraft will increase, because most of the flights from/to Alexandria are shifted to Borg El Arab International Airport, which have 3,400-m long runway for wide-bodied aircraft to land and takeoff. Accordingly, the ratio of 265-seater aircraft of Legacy Carrier is assumed to increase from 10% in 2010 to 15% in 2015 and 20% in 2020. The ratio of 80-seater aircraft is assumed to increase to 15% in 2015 considering the business plan of Egypt Air Express, which would establish new air routes. These ratios are estimated by linear interpolation.

It is assumed that LCCs will continue their operation with 150-seater aircraft in future.

Table 4.5-1 Future Assumption of International Aircraft Configuration

	Aircraft Configuration			
	Legacy			Low Cost
	265-seater	150-seater	80-seater	150-seater
2001				
2002	5%	81%	14%	100%
2003	4%	83%	13%	100%
2004	2%	87%	11%	100%
2005	10%	74%	16%	100%
2006	19%	68%	13%	100%
2007	19%	71%	10%	100%
2008	8%	82%	10%	100%
2009	0%	83%	17%	100%
2010	0%	80%	20%	100%
2011	10%	80%	10%	100%
2012	11%	78%	11%	100%
2013	13%	75%	13%	100%
2014	14%	73%	14%	100%
2015	15%	70%	15%	100%
2016	16%	69%	15%	100%
2017	17%	68%	15%	100%
2018	18%	67%	15%	100%
2019	19%	66%	15%	100%
2020	20%	65%	15%	100%

c) Forecast

Future aircraft movements have been computed as follows:

Aircraft Movements = Passenger Forecast / Passengers per Flight

Future "Passengers per flight" have been computed by using the growth rate of "Average seat capacity per flight". "Average seat capacity per flight" has been computed by the weighted average seat capacity for both Legacy Carrier and Low Cost Carrier, and the ratio of the flight number for both. (The ratio of the number of LCC

flight is different for each case of the sensitive analysis). "Passenger per flight" beyond 2020 has been computed based on the growth rates of the previous year.

Table 4.5-2 Forecast of International Aircraft Movement (Medium)

	Average Seat Capacity				passenger per Flight	Passenger	Aircraft Movements	
	Legacy	Low Cost	Weighted Average*	Growth rate	(person)	(persons)	(times)	per day
2002	147	150	147	0%	86	246,482	2,876	8
2003	146	150	146	-0.5%	86	246,608	2,884	8
2004	145	150	146	-0.3%	95	450,455	4,747	13
2005	151	150	150	3.3%	95	575,513	6,065	17
2006	163	150	160	6.6%	95	774,322	8,127	22
2007	165	150	161	0.5%	102	922,288	9,052	25
2008	152	150	151	-6.1%	110	1,231,058	11,171	31
2009	138	150	143	-5.8%	101	1,402,917	13,891	38
2010	136	150	143	0.3%	104	1,593,782	15,264	42
2011	155	150	152	6.4%	111	1,662,737	14,962	41
2012	155	150	152	-0.2%	111	1,754,722	15,818	43
2013	156	150	152	0.1%	111	1,891,243	17,023	47
2014	156	150	152	0.1%	111	2,062,350	18,536	51
2015	157	150	153	0.1%	111	2,251,054	20,202	55
2016	158	150	153	0.3%	112	2,486,256	22,246	61
2017	159	150	154	0.3%	112	2,725,453	24,313	67
2018	160	150	154	0.3%	112	2,930,210	26,062	71
2019	161	150	155	0.3%	113	3,190,906	28,296	78
2020	163	150	155	0.3%	113	3,449,723	30,501	84
Ratio	**40%**	**60%**						

*Weighted average of the ratio of Legacy Carrier Flight and LCC

Table 4.5-3 Forecast of International Aircraft Movement (Low)

	Average Seat Capacity				passenger per Flight	Passenger	Aircraft Movements	
	Legacy	Low Cost	Weighted Average*	Growth rate	(person)	(persons)	(times)	per day
2002	147	150	147	0%	86	246,482	2,876	8
2003	146	150	146	-0.5%	86	246,608	2,884	8
2004	145	150	146	-0.3%	95	450,455	4,747	13
2005	151	150	150	3.3%	95	575,513	6,065	17
2006	163	150	160	6.6%	95	774,322	8,127	22
2007	165	150	161	0.5%	102	922,288	9,052	25
2008	152	150	151	-6.1%	110	1,231,058	11,171	31
2009	138	150	143	-5.8%	101	1,402,917	13,891	38
2010	136	150	143	0.3%	104	1,593,782	15,264	42
2011	155	150	152	6.4%	111	1,654,728	14,890	41
2012	155	150	152	0.0%	111	1,650,391	14,853	41
2013	156	150	153	0.2%	111	1,735,548	15,593	43
2014	156	150	153	0.2%	111	1,894,412	16,992	47
2015	157	150	153	0.2%	112	2,068,717	18,525	51
2016	158	150	154	0.3%	112	2,248,687	20,069	55
2017	159	150	154	0.3%	112	2,432,523	21,636	59
2018	160	150	155	0.3%	113	2,658,464	23,567	65
2019	161	150	155	0.3%	113	2,860,221	25,271	69
2020	163	150	156	0.3%	114	3,098,072	27,281	75
Ratio	**45%**	**55%**						

*Weighted average of the ratio of Legacy Carrier Flight and LCC

Table 4.5-4 Forecast of International Aircraft Movement (High)

	Average Seat Capacity				passenger per Flight	Passenger	Aircraft Movements	
	Legacy	Low Cost	Weighted Average*	Growth rate	(person)	(persons)	(times)	per day
2002	147	150	147	0%	86	246,482	2,876	8
2003	146	150	146	-0.5%	86	246,608	2,884	8
2004	145	150	146	-0.3%	95	450,455	4,747	13
2005	151	150	150	3.3%	95	575,513	6,065	17
2006	163	150	160	6.6%	95	774,322	8,127	22
2007	165	150	161	0.5%	102	922,288	9,052	25
2008	152	150	151	-6.1%	110	1,231,058	11,171	31
2009	138	150	143	-5.8%	101	1,402,917	13,891	38
2010	136	150	143	0.3%	104	1,593,782	15,264	42
2011	155	150	152	6.4%	111	1,670,746	15,034	41
2012	155	150	152	-0.3%	111	1,901,724	17,172	47
2013	156	150	152	0.1%	111	2,047,921	18,468	51
2014	156	150	152	0.1%	111	2,232,043	20,102	55
2015	157	150	152	0.1%	111	2,474,513	22,257	61
2016	158	150	153	0.3%	111	2,725,503	24,450	67
2017	159	150	153	0.3%	112	2,981,971	26,680	73
2018	160	150	154	0.3%	112	3,243,903	28,948	79
2019	161	150	154	0.3%	112	3,562,056	31,704	87
2020	163	150	154	0.3%	113	3,844,805	34,131	94
Ratio	35%	65%						

*Weighted Average of the ratio of Legacy Carrier Flight and LCC

2) Domestic Aircraft Movements

Domestic passenger aircraft movements have been forecasted based on the business plan of Egypt Air Express for Alexandria airports. The forecast of aircraft movements is summarized below. The number of flights per week are shown in Table 4.5-5.

Annual aircraft movements are computed by multiplying by 52 weeks.

Table 4.5-5 Egypt Air Express Future plan of domestic flight to/from Alexandria

	Route	2011-2015	2016-2020	2021-2025
Flight / week (one-way)	Cairo	7	14	21
	Sharm El-Sheikh	11	10	13
Fleet (Number of Seat)	Cairo	76	76	76
	Sharm El-Sheikh	76	100	100

3) Result

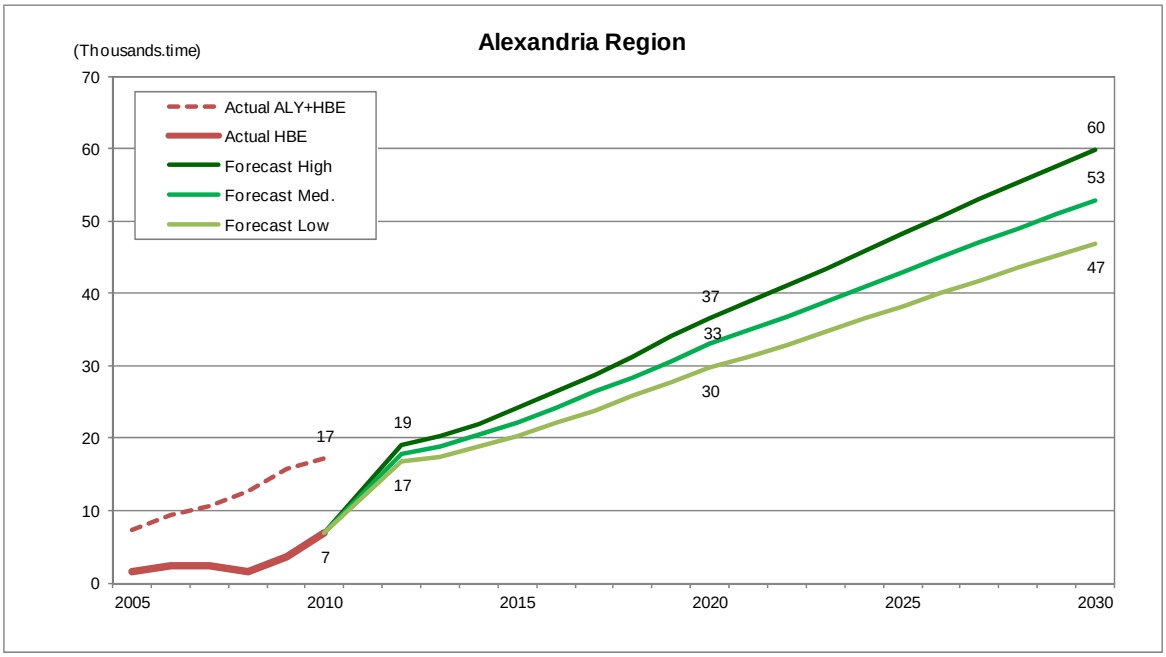
Future aircraft movements in Alexandria region are computed by summing International and Domestic as follows.

Table 4.5-6 Result of Passenger Aircraft Movement Forecast

(Times)

	Top-down Analysis			Bottom-Up Analysis		
	High	Medium	Low	High	Medium	Low
2010	17,260	17,260	17,260	17,260	17,260	17,260
2015	24,275	22,375	20,559	24,129	22,074	20,397
2020	34,920	30,146	25,841	36,627	32,997	29,777
2025	44,884	37,497	30,951	48,284	42,988	38,291
2030	54,570	44,463	35,657	59,978	52,975	46,886
Annual Average Growth Rate						
2010-2015	7.1%	5.3%	3.6%	6.9%	5.0%	3.4%
2015-2020	7.5%	6.1%	4.7%	8.7%	8.4%	7.9%
2020-2025	5.1%	4.5%	3.7%	5.7%	5.4%	5.2%
2025-2030	4.0%	3.5%	2.9%	4.4%	4.3%	4.1%
2010-2030	5.9%	4.8%	3.7%	6.4%	5.8%	5.1%

*Figures from Top-down Analysis are for Reference purpose.



*Commercial Flight Only

Figure 4.5-2 Passenger Aircraft Movement Forecast in Alexandria Region

4.5.2. Cargo Aircraft Movements

The trend of all cargo aircraft movement is expected to continue. A few more number of flights are expected in the future, but the quantitative forecast is difficult. To develop Borg El Arab International Airport to a main cargo hub, a more detailed and thorough survey and study should be conducted thus identifying potential cargo demand existing around Borg El Arab International Airport.

4.6. Peak Air Traffic Demand Forecast

4.6.1. Peak-day Air Traffic Demand Forecast

The peak day ratios are determined to forecast the peak-day air traffic. Four kinds of peak day ratios (international passenger, domestic passenger, international aircraft movements and domestic aircraft movements) are considered.

The daily traffic ratios have been computed by the following formula:

$$\textit{Daily traffic Ratio} = \frac{\textit{Monthly Traffic / The number of days}}{\textit{Annual Traffic}}$$

Table 4.6-1 Daily traffic ratio by month in past 3 years in Alexandria region

Day ratio by Month

Passenger

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Int'l	2008	1/ 500	1/ 455	1/ 550	1/ 422	1/ 430	1/ 319	1/ 275	1/ 257	1/ 304	1/ 356	1/ 395	1/ 353	1/ 365
	2009	1/ 483	1/ 428	1/ 508	1/ 407	1/ 437	1/ 319	1/ 267	1/ 273	1/ 291	1/ 368	1/ 389	1/ 405	1/ 365
	2010	1/ 562	1/ 430	1/ 478	1/ 408	1/ 469	1/ 325	1/ 250	1/ 266	1/ 263	1/ 414	1/ 343	1/ 471	1/ 365
	Average	1/ 515	1/ 438	1/ 512	1/ 412	1/ 445	1/ 321	1/ 264	1/ 266	1/ 286	1/ 379	1/ 375	1/ 410	1/ 365
Domestic	2008	1/ 361	1/ 351	1/ 396	1/ 361	1/ 370	1/ 325	1/ 338	1/ 295	1/ 453	1/ 347	1/ 431	1/ 413	1/ 365
	2009	1/ 552	1/ 420	1/ 600	1/ 434	1/ 441	1/ 363	1/ 289	1/ 298	1/ 314	1/ 277	1/ 329	1/ 332	1/ 365
	2010	1/ 534	1/ 382	1/ 459	1/ 375	1/ 422	1/ 363	1/ 262	1/ 407	1/ 302	1/ 322	1/ 288	1/ 439	1/ 365
	Average	1/ 482	1/ 384	1/ 485	1/ 390	1/ 411	1/ 350	1/ 296	1/ 333	1/ 356	1/ 316	1/ 349	1/ 395	1/ 365

Aircraft Movement

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Int'l	2008	1/ 492	1/ 477	1/ 498	1/ 381	1/ 399	1/ 342	1/ 298	1/ 293	1/ 308	1/ 341	1/ 365	1/ 339	1/ 365
	2009	1/ 466	1/ 442	1/ 439	1/ 413	1/ 406	1/ 326	1/ 279	1/ 278	1/ 315	1/ 359	1/ 402	1/ 391	1/ 365
	2010	1/ 475	1/ 451	1/ 440	1/ 412	1/ 452	1/ 336	1/ 277	1/ 282	1/ 289	1/ 370	1/ 348	1/ 409	1/ 365
	Average	1/ 477	1/ 457	1/ 459	1/ 402	1/ 419	1/ 335	1/ 285	1/ 284	1/ 304	1/ 357	1/ 372	1/ 380	1/ 365
Domestic	2008	1/ 345	1/ 335	1/ 363	1/ 419	1/ 395	1/ 379	1/ 392	1/ 374	1/ 304	1/ 371	1/ 349	1/ 380	1/ 365
	2009	1/ 480	1/ 420	1/ 465	1/ 418	1/ 391	1/ 396	1/ 337	1/ 297	1/ 301	1/ 300	1/ 337	1/ 356	1/ 365
	2010	1/ 384	1/ 394	1/ 418	1/ 410	1/ 433	1/ 422	1/ 321	1/ 371	1/ 314	1/ 314	1/ 310	1/ 358	1/ 365
	Average	1/ 403	1/ 383	1/ 415	1/ 416	1/ 406	1/ 399	1/ 350	1/ 347	1/ 306	1/ 328	1/ 332	1/ 365	1/ 365

Daily traffic ratios on the second peak month according to the tables above have been adopted:

Table 4.6-2 Peak Day Ratio (Adopted Ratio)

	International	Domestic
Passenger	**1/ 285**	**1/ 315**
Aircraft Movement	**1/ 300**	**1/ 330**

Table 4.6-3 Monthly Air Traffic in Alexandria Region

Passenger

International (person)

year	airport	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
2008	ALY	62,906	62,319	59,497	74,372	78,633	101,175	122,001	130,714	111,935	102,053	74,888	63,761	1,044,254
	HBE	13,454	13,516	9,936	13,112	10,172	14,514	16,789	17,627	9,702	5,101	18,676	44,205	186,804
	Total	76,360	75,835	69,433	87,484	88,805	115,689	138,790	148,341	121,637	107,154	93,564	107,966	1,231,058
2009	ALY	52,065	52,544	59,692	103,340	99,495	132,059	162,832	113,185	93,384	65,473	49,039	50,178	1,033,286
	HBE	37,904	39,171	25,913	0	0	0	0	46,093	51,354	52,835	59,200	57,161	369,631
	Total	89,969	91,715	85,605	103,340	99,495	132,059	162,832	159,278	144,738	118,308	108,239	107,339	1,402,917
2010	ALY	37,652	50,415	52,750	61,570	63,928	90,874	117,076	107,124	109,856	63,212	73,951	58,541	886,949
	HBE	50,322	53,388	50,602	55,758	41,405	56,463	80,176	78,383	72,220	56,217	65,478	46,421	706,833
	Total	87,974	103,803	103,352	117,328	105,333	147,337	197,252	185,507	182,076	119,429	139,429	104,962	1,593,782

Domestic (person)

year	airport	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
2008	ALY	5,064	4,707	4,626	4,759	4,580	5,235	5,418	6,193	3,903	5,268	4,055	4,435	58,243
	HBE	0	0	0	148	369	209	0	1	10	0	57	0	794
	Total	5,064	4,707	4,626	4,907	4,949	5,444	5,418	6,194	3,913	5,268	4,112	4,435	59,037
2009	ALY	3,476	4,405	2,234	4,571	4,650	5,472	7,099	6,875	6,308	7,397	6,038	6,094	64,619
	HBE	237	0	1,185	0	0	0	0	0	13	0	2	86	1,523
	Total	3,713	4,405	3,419	4,571	4,650	5,472	7,099	6,875	6,321	7,397	6,040	6,180	66,142
2010	ALY	4,094	6,080	5,959	6,256	6,485	7,290	10,453	6,726	8,756	8,451	8,381	6,142	85,073
	HBE	1,029	391	0	794	0	0	0	0	0	35	798	81	3,128
	Total	5,123	6,471	5,959	7,050	6,485	7,290	10,453	6,726	8,756	8,486	9,179	6,223	88,201

Aircraft Movements

International (time)

year	airport	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
2008	ALY	616	574	605	767	765	881	1,056	1,076	1,011	969	738	635	9,693
	HBE	88	82	90	113	104	98	106	106	76	48	181	386	1,478
	Total	704	656	695	880	869	979	1,162	1,182	1,087	1,017	919	1,021	11,171
2009	ALY	540	520	677	1,009	1,060	1,279	1,546	1,147	920	697	502	547	10,444
	HBE	385	359	305	0	0	0	0	404	405	501	534	554	3,447
	Total	925	879	982	1,009	1,060	1,279	1,546	1,551	1,325	1,198	1,036	1,101	13,891
2010	ALY	445	471	550	616	670	848	1,009	1,009	968	661	684	630	8,561
	HBE	552	477	525	496	378	515	697	670	618	618	630	527	6,703
	Total	997	948	1,075	1,112	1,048	1,363	1,706	1,679	1,586	1,279	1,314	1,157	15,264

Domestic (time)

year	airport	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
2008	ALY	143	133	136	111	116	121	126	128	136	127	121	124	1,522
	HBE	0	0	0	3	9	5	0	4	21	6	16	6	70
	Total	143	133	136	114	125	126	126	132	157	133	137	130	1,592
2009	ALY	121	126	73	141	156	149	181	205	195	203	165	154	1,869
	HBE	6	5	58	0	0	0	0	0	1	0	10	17	97
	Total	127	131	131	141	156	149	181	205	196	203	175	171	1,966
2010	ALY	117	128	142	137	143	139	190	159	191	188	176	153	1,863
	HBE	44	14	6	9	0	3	3	8	0	9	17	20	133
	Total	161	142	148	146	143	142	193	167	191	197	193	173	1,996

[Source] Egyptian Holding Company of Airports and Air Navigation website

4.6.2. Peak-hour Air Traffic Demand Forecast

Peak hour ratios have been calculated to forecast the peak-hour air traffic. The peak hour ratios have been estimated for the two-way (departure + arrival) and one-way (departure or arrival) traffic.

A peak hour ratio has been calculated based on the equation shown below. As the aircraft movement increases, the peak hour ratio decreases gradually. In this Study, the following forecast model has been assumed, and their coefficient has been estimated based on the hourly and daily aircraft movements at Alexandria airports.

$$\text{Peak Hour Ratio} = a + \frac{b}{\text{Daily Aircraft Movement}}$$

a, b : Coefficient

Table 4.6-4 Result of Coefficients Estimation (Peak Hour Model)

	Correlation Coefficient		a	b
			Constant	Daily Aircraft Movement
Two-ways	0.7095	Coefficient (t-value)	0.0754 (0.9)	1.3805 (15.7)
One-way	0.8551	Coefficient (t-value)	0.0405 (1.3)	1.3716 (15.8)

The peak hour ratio computed by the same forecast model is shown in Figure 4.6-1.

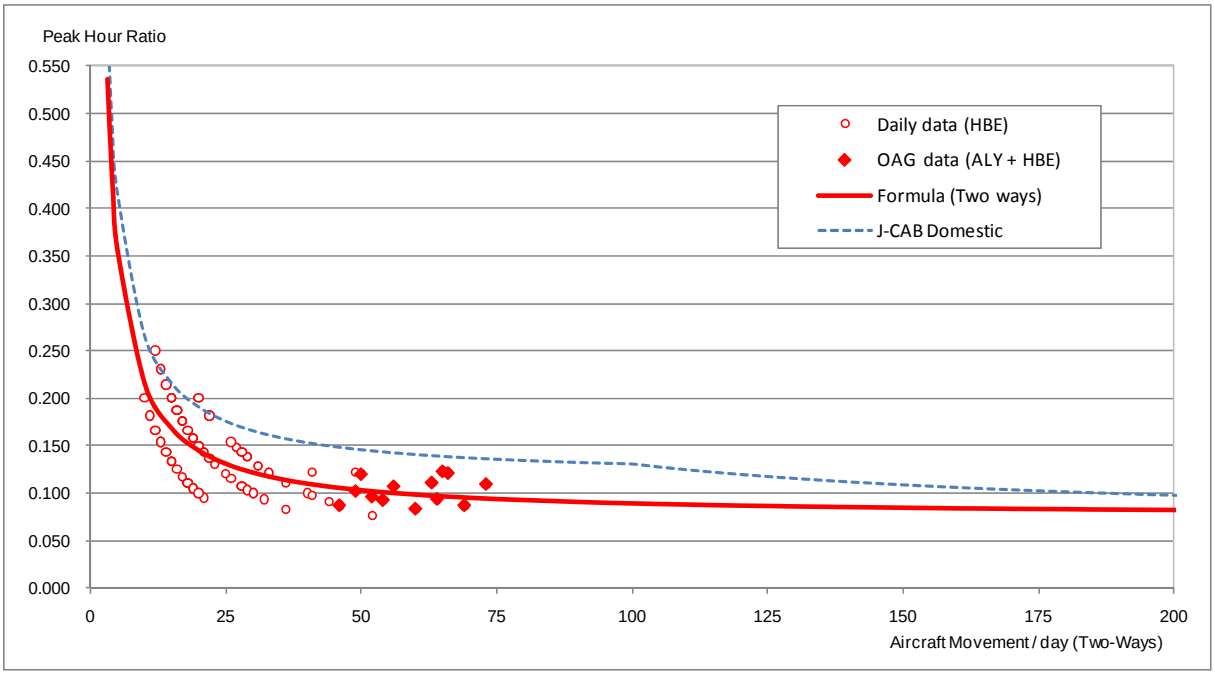


Figure 4.6-1 Peak Hour Ratio (Two-ways)

The above graph includes, for reference, the model published by Japan Civil Aviation Bureau for domestic flights (J-CAB model: as expressed in blue dotted line), which had been applied in the previous SAPROF study. Presumably, at the time of the previous SAPROF study, flight data at Borg El Arab International Airport had not been sufficient

enough and therefore the J-CAB model was only applied until such time that its reproducibility would have been confirmed. However, the peak-hour ratio based on the J-CAB model are generally higher than that forecasted in this study (expressed in red bold line). This is because in Japan the operations from midnight to early morning are restricted due to noise pollution, and also because more than half of domestic passengers are traveling for business purpose (of mostly one-day trip) hence they tend to select their trip in morning and evening time.

The following figure shows the result of peak hour ratios of one-way traffic. In 60 flights, which is the number of the currently average per day, the peak hour ratio for one way is 65% of two-ways.

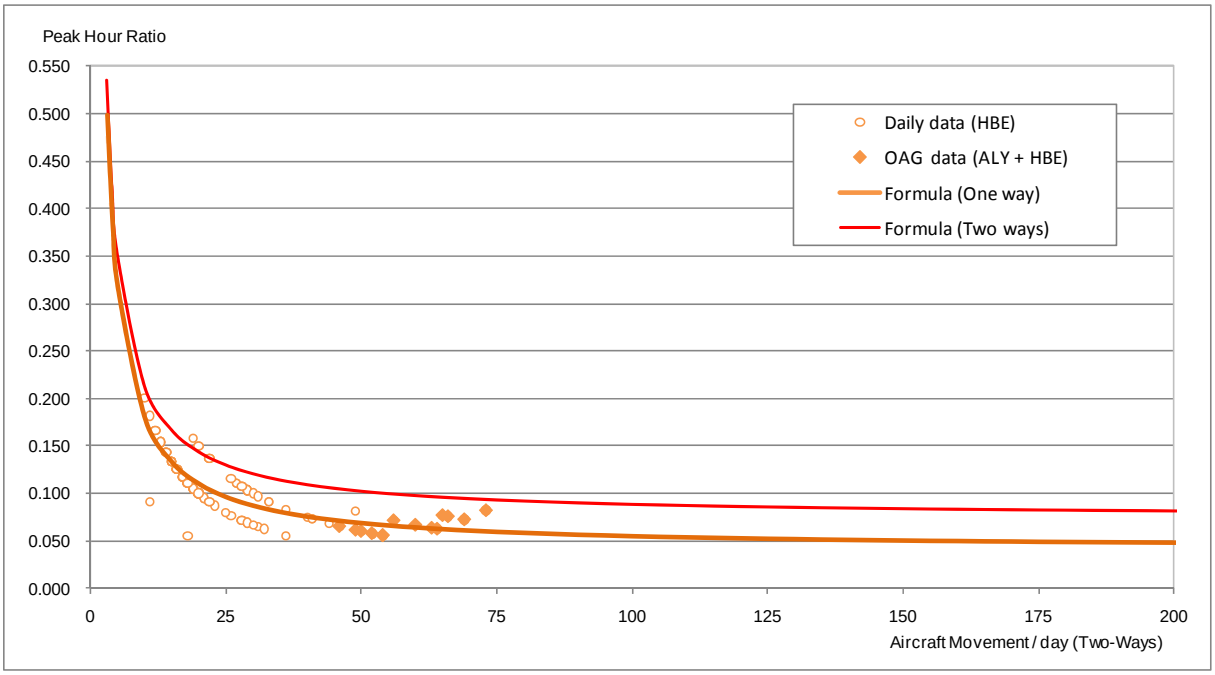


Figure 4.6-2 Peak Hour Ratio (One-way)

4.7. Summary of Air Traffic Demand Forecast

Meduim — All flight move to HBE

			(HBE)	(ALY+HBE)	(HBE)			
			Actual	Actual	Forecast			
		FACTOR	2010	2010	2015	2020	2025	2030
Annual								
Passenger			709,961	1,681,983	2,357,758	3,610,715	4,754,833	5,941,699
					(7.0%)	(8.9%)	(5.7%)	(4.6%)
	International		706,833	1,593,782	2,251,054	3,449,723	4,528,945	5,654,166
					(7.1%)	(8.9%)	(5.6%)	(4.5%)
	Domestic		3,128	88,201	106,704	160,992	225,888	287,533
					(3.9%)	(8.6%)	(7.0%)	(4.9%)
Aircraft Movement			6,836	17,260	22,074	32,997	42,988	52,975
					(5.0%)	(8.4%)	(5.4%)	(4.3%)
	: E				1,212	2,440	3,156	3,882
	: C		6,836	17,260	20,862	30,557	39,832	49,093
	International		6,703	15,264	20,202	30,501	39,452	48,527
					(5.8%)	(8.6%)	(5.3%)	(4.2%)
	: E				1,212	2,440	3,156	3,882
	: C		6,703	15,264	18,990	28,061	36,296	44,645
	Domestic : C		133	1,996	1,872	2,496	3,536	4,448
					(-1.3%)	(5.9%)	(7.2%)	(4.7%)
			Estimate		Forecast			
Typical Busy Day								
Passenger			2,490	5,872	8,237	12,615	16,608	20,752
	International	1/ 285	2,480	5,592	7,898	12,104	15,891	19,839
	Domestic	1/ 315	10	280	339	511	717	913
Aircraft Movement			22	57	73	110	143	175
	: E				4	8	11	13
	: C		22	57	69	102	132	162
	International	1/ 300	22	51	67	102	132	162
	: E				4	8	11	13
	: C		22	51	63	94	121	149
	Domestic : C	1/ 330	0.4	6	6	8	11	13
Peak Hour Ratio (Two ways)	International		0.138	0.102	0.096	0.089	0.086	0.084
			1/7	1/10	1/10	1/11	1/12	1/12
	Domestic		3.527	0.305	0.305	0.248	0.201	0.182
			1/0	1/3	1/3	1/4	1/5	1/6
Peak Hour (Two ways)								
Passenger			378	659	862	1,203	1,508	1,831
	International		343	573	758	1,076	1,364	1,665
	Domestic		35	86	104	127	144	166
Aircraft Movement			4.4	7.0	8.2	11.1	13.5	16.0
	: E				0.4	0.7	0.9	1.1
	: C		4.4	7.0	7.8	10.4	12.6	14.9
	International		3.0	5.2	6.4	9.1	11.3	13.6
	: E				0.4	0.7	0.9	1.1
	: C		3.0	5.2	6.0	8.4	10.4	12.5
	Domestic : C		1.4	1.8	1.8	2.0	2.2	2.4
Peak Hour Ratio (One way)	International		0.103	0.067	0.061	0.054	0.051	0.049
			1/10	1/15	1/16	1/19	1/20	1/20
	Domestic		3.470	0.269	0.269	0.212	0.165	0.146
			1/0	1/4	1/4	1/5	1/6	1/7
Peak Hour (One way)								
Passenger			290	452	572	761	927	1,104
	International		255	377	481	653	809	971
	Domestic		35	75	91	108	118	133
Aircraft Movement			3.7	5.0	5.7	7.2	8.5	9.8
	: E				0.2	0.4	0.5	0.6
	: C		3.7	5.0	5.5	6.8	8.0	9.2
	International		2.3	3.4	4.1	5.5	6.7	7.9
	: E				0.2	0.4	0.5	0.6
	: C		2.3	3.4	3.9	5.1	6.2	7.3
	Domestic : C		1.4	1.6	1.6	1.7	1.8	1.9

Note : Aircraft Movements is only Commercial Aircraft

Low — All flight move to HBE

			(HBE)	(ALY+HBE)	(HBE)			
			Actual	Actual	Forecast			
		FACTOR	2010	2010	2015	2020	2025	2030
Annual								
Passenger			709,961	1,681,983	2,175,421	3,259,064	4,238,918	5,270,045
					(5.3%)	(8.4%)	(5.4%)	(4.5%)
	International		706,833	1,593,782	2,068,717	3,098,072	4,013,030	4,982,512
					(5.4%)	(8.4%)	(5.3%)	(4.4%)
	Domestic		3,128	88,201	106,704	160,992	225,888	287,533
					(3.9%)	(8.6%)	(7.0%)	(4.9%)
Aircraft Movement			6,836	17,260	20,397	29,777	38,291	46,886
					(3.4%)	(7.9%)	(5.2%)	(4.1%)
	: E				1,112	2,182	2,780	3,395
	: C		6,836	17,260	19,286	27,595	35,511	43,491
	International		6,703	15,264	18,525	27,281	34,755	42,438
					(3.9%)	(8.0%)	(5.0%)	(4.1%)
	: E				1,112	2,182	2,780	3,395
	: C		6,703	15,264	17,414	25,099	31,975	39,043
	Domestic : C		133	1,996	1,872	2,496	3,536	4,448
					(-1.3%)	(5.9%)	(7.2%)	(4.7%)
			Estimate		Forecast			
Typical Busy Day								
Passenger			2,490	5,872	7,598	11,381	14,798	18,395
	International	1/ 285	2,480	5,592	7,259	10,870	14,081	17,482
	Domestic	1/ 315	10	280	339	511	717	913
Aircraft Movement			22	57	68	99	127	154
	: E				4	7	9	11
	: C		22	57	64	92	118	143
	International	1/ 300	22	51	62	91	116	141
	: E				4	7	9	11
	: C		22	51	58	84	107	130
	Domestic : C	1/ 330	0.4	6	6	8	11	13
Peak Hour Ratio (Two ways)	International		0.138	0.102	0.098	0.091	0.087	0.085
			1/7	1/10	1/10	1/11	1/11	1/12
	Domestic		3.527	0.305	0.305	0.248	0.201	0.182
			1/0	1/3	1/3	1/4	1/5	1/6
Peak Hour (Two ways)								
Passenger			378	659	813	1,111	1,373	1,655
	International		343	573	709	984	1,229	1,489
	Domestic		35	86	104	127	144	166
Aircraft Movement			4.4	7.0	7.9	10.2	12.3	14.4
	: E				0.4	0.7	0.8	1.0
	: C		4.4	7.0	7.5	9.5	11.5	13.4
	International		3.0	5.2	6.1	8.2	10.1	12.0
	: E				0.4	0.7	0.8	1.0
	: C		3.0	5.2	5.7	7.5	9.3	11.0
	Domestic : C		1.4	1.8	1.8	2.0	2.2	2.4
Peak Hour Ratio (One way)	International		0.103	0.067	0.063	0.056	0.052	0.050
			1/10	1/15	1/16	1/18	1/19	1/20
	Domestic		3.470	0.269	0.269	0.212	0.165	0.146
			1/0	1/4	1/4	1/5	1/6	1/7
Peak Hour (One way)								
Passenger			290	452	545	712	855	1,011
	International		255	377	454	604	737	878
	Domestic		35	75	91	108	118	133
Aircraft Movement			3.7	5.0	5.5	6.8	7.9	9.0
	: E				0.2	0.4	0.5	0.6
	: C		3.7	5.0	5.3	6.4	7.4	8.4
	International		2.3	3.4	3.9	5.1	6.1	7.1
	: E				0.2	0.4	0.5	0.6
	: C		2.3	3.4	3.7	4.7	5.6	6.5
	Domestic : C		1.4	1.6	1.6	1.7	1.8	1.9

Note : Aircraft Movements is only Commercial Aircraft

High — All flight move to HBE

			(HBE)	(ALY+HBE)	(HBE)			
			Actual	Actual	Forecast			
		FACTOR	2010	2010	2015	2020	2025	2030
Annual								
Passenger			709,961	1,681,983	2,581,217	4,005,797	5,332,875	6,708,254
					(8.9%)	(9.2%)	(5.9%)	(4.7%)
	International		706,833	1,593,782	2,474,513	3,844,805	5,106,987	6,420,721
					(9.2%)	(9.2%)	(5.8%)	(4.7%)
	Domestic		3,128	88,201	106,704	160,992	225,888	287,533
					(3.9%)	(8.6%)	(7.0%)	(4.9%)
Aircraft Movement			6,836	17,260	24,129	36,627	48,284	59,978
					(6.9%)	(8.7%)	(5.7%)	(4.4%)
	: E				1,335	2,730	3,580	4,442
	: C		6,836	17,260	22,794	33,897	44,704	55,536
	International		6,703	15,264	22,257	34,131	44,748	55,530
					(7.8%)	(8.9%)	(5.6%)	(4.4%)
	: E				1,335	2,730	3,580	4,442
	: C		6,703	15,264	20,922	31,401	41,168	51,088
	Domestic : C		133	1,996	1,872	2,496	3,536	4,448
					(-1.3%)	(5.9%)	(7.2%)	(4.7%)
			Estimate		Forecast			
Typical Busy Day								
Passenger			2,490	5,872	9,022	14,002	18,636	23,442
	International	1/ 285	2,480	5,592	8,683	13,491	17,919	22,529
	Domestic	1/ 315	10	280	339	511	717	913
Aircraft Movement			22	57	80	122	160	198
	: E				4	9	12	15
	: C		22	57	76	113	148	183
	International	1/ 300	22	51	74	114	149	185
	: E				4	9	12	15
	: C		22	51	70	105	137	170
	Domestic : C	1/ 330	0.4	6	6	8	11	13
Peak Hour Ratio (Two ways)	International		0.138	0.102	0.094	0.088	0.085	0.083
			1/7	1/10	1/11	1/11	1/12	1/12
	Domestic		3.527	0.305	0.305	0.248	0.201	0.182
			1/0	1/3	1/3	1/4	1/5	1/6
Peak Hour (Two ways)								
Passenger			378	659	921	1,308	1,661	2,033
	International		343	573	817	1,181	1,517	1,867
	Domestic		35	86	104	127	144	166
Aircraft Movement			4.4	7.0	8.8	12.0	14.8	17.7
	: E				0.4	0.8	1.0	1.2
	: C		4.4	7.0	8.4	11.2	13.8	16.5
	International		3.0	5.2	7.0	10.0	12.6	15.3
	: E				0.4	0.8	1.0	1.2
	: C		3.0	5.2	6.6	9.2	11.6	14.1
	Domestic : C		1.4	1.8	1.8	2.0	2.2	2.4
Peak Hour Ratio (One way)	International		0.103	0.067	0.059	0.053	0.050	0.048
			1/10	1/15	1/17	1/19	1/20	1/21
	Domestic		3.470	0.269	0.269	0.212	0.165	0.146
			1/0	1/4	1/4	1/5	1/6	1/7
Peak Hour (One way)								
Passenger			290	452	603	817	1,008	1,212
	International		255	377	512	709	890	1,079
	Domestic		35	75	91	108	118	133
Aircraft Movement			3.7	5.0	6.0	7.7	9.2	10.8
	: E				0.3	0.5	0.6	0.7
	: C		3.7	5.0	5.7	7.2	8.6	10.1
	International		2.3	3.4	4.4	6.0	7.4	8.9
	: E				0.3	0.5	0.6	0.7
	: C		2.3	3.4	4.1	5.5	6.8	8.2
	Domestic : C		1.4	1.6	1.6	1.7	1.8	1.9

Note : Aircraft Movements is only Commercial Aircraft

4.8. Principal Conclusions

4.8.1. Forecasting Parameters

In air traffic demand forecasting, it is extremely important to observe the relationship between the trend (or feature) of air traffic and socio-economic indices as well as the level of aviation services. Information being collected should include qualitative information as well as quantitative information for the definition of issues and the consideration of the possibility of the future demand.

Key forecasting parameters for Alexandria described in this Chapter are summarized as follows.

- ✓ Average annual growth rate of air passenger at Alexandria airports from 2003 to 2010 was 21%, the highest among all Egyptian airports.
- ✓ Air passenger characteristics in each Egyptian airport were individually different. Air passengers at Alexandria airports were mainly Egyptian, while alomost of those at Sharm El-Sheikh and Hurghada were tourists from Europe. Such difference could have affected instantly the variation of air passengers when internal termoil such as the outbreak of the Egyptian Revolution in 2011 occurred. The traffic demand in Alexandria haven't much decreased (almost same as the previous year)
- ✓ The residence of Egyptian using Borg El Arab International Airport was distributed over the Nile Delta.
- ✓ The population in Lower Egypt, the catchment area of Borg El Arab International Airport, was 38 million in 2010. This was nearly half of Egypt's entire population.
- ✓ 45% of the purpose of Egyptian travelers was for Pilgrimage. The 2nd largest share of travelers was overseas contract workers, whose destination was Middle East and Istanbul.
- ✓ Since LCC started its operations at Alexandria's airports from 2004, the number of LCC flights has been increasing gradually and reached approximately 45% of the total flights in 2010 (as far as the international flights are concerned, the current ratio of LCC is 50%). The air fare of LCC was 40% cheaper than that of Legacy carrier in average.

4.8.2. Air passenger demand forecast

The methodology of air passenger forecast in this Chapter follows two different approaches, namely a Top-down and a Bottom-up analysis, which are the same as SAPROF study.

The Top-down analysis, which can be seen as "Egypt driven", focuses on the trend of aviation activity for entire Egypt. The role (ratio) of Alexandria within Egypt was forecasted considering the difference of air passenger growth rates in each Egyptian airport.

The Bottom-up analysis, which can be seen as "Alexandria driven" focuses on the feature of

air passengers in Alexandria region. Air passenger demand has been forecasted in respect of the three groups of passengers, namely, International Egyptian, International Tourist, and Domestic. International Egyptian who were the main user of Alexandria airport has been forecasted considering the probability of selecting Alexandria airport. The probability has been computed through comparison on the level of aviation service (air fare price and frequency) between Alexandria and Cairo airport.

These approaches provide opportunity for integrating both national and regional perspectives into the forecasting process. But considering the recent high air passenger growth in Alexandria airport, it has been concluded that the results of the Bottom-up Analysis that focused on the feature of the air passengers in Alexandria, was more suitable.

In the Bottom-up analysis, the ratio of the number of LCC International flights at Alexandria's airports in the International Egyptian forecast, and the future Egyptian GDP growth rate in the International tourist forecast, have been assumed with its sensitive analyses of three cases (High, Medium, Low).

Air passengers handled in Alexandria airports were estimated to increase to 2.2 to 2.6 million (**2.4** million in medium case) in 2015 from 1.7 million passenger in 2010. Furthermore, in 2020 the air passengers would increase to 3.3 to 4.0 million (**3.6** million in medium case). The estimated average annual air passenger growth rates in medium case were 7.0% from 2010 to 2015, and 8.9% from 2015 to 2020 respectively.

4.8.3. Air Cargo Demand Forecast

Almost all air cargo traffic in Egypt has been handled at Cairo International Airport. For the air cargo traffic in Alexandria, chronological data to develop a forecast model was not available.

Current situation of air cargo in Alexandria and its outskirts are summarized as follows.

- ✓ Most export cargoes in Egypt have been produced in Cairo and Alexandria with their outskirts. But the air cargoes in Alexandria and its outskirts have been transported to Cairo International Airport, because of the availability of quick delivery system and good customer services.
- ✓ In 2010/2011, 5,653 tons of air cargos were handled at Alexandria-Nozha International Airport (ALY). At Borg El Arab International Airport, the volume of air cargo was not identified. But there were a few charter flights by Antonov (the largest all-cargo aircraft with its maximum payload of 150 t) for the transport of special machines by a petroleum company.
- ✓ Items of Air Cargo: It has been assumed that share of general cargoes are 60%, vegetables are 30%, and textiles are 10%. General cargoes are mainly machine parts.

Considering the current situation of air cargo and the future possibility of air cargo in Alexandria airport based on an interview survey, the prediction of the future air cargo

demand and the facility requirement are shown in below.

- ✓ At present it is difficult to quantitatively forecast air cargo demand even though air cargo demand tends to increase obviously. Through the interview survey, it has been confirmed that there should exist strong air cargo demand in Alexandria and its outskirts .
- ✓ Air cargo demand at Borg El Arab International Airport may increase in future; considering the fact that Egypt Air Cargo has been planning to launch their business to the airport and the recent growth rate of 10% per annum.
- ✓ The current cargo terminal building at Borg El Arab International Airport has still vacant space for further cargo to be handled. Then as a consequence, the Study Team recommends that the planning and design of the cargo terminal be examined later again, when the cargo business significantly increases or decision of higher authority is made to develop Borg El Arab International Airport to be cargo hub.

4.8.4. Aircraft movement forecast

The future aircraft movement is linked to the future air passenger demand and the aircraft fleet configuration.

Aircraft of 150 seats (ICAO Code C) has been the major type of aircraft being used at two Alexandria airports because of the LCCs business model unifying the aircraft type (i.e. A320 series) for the purpose of reducing operation and maintenance costs.

Accordingly, it has been expected that only Legacy carriers would introduce a larger aircraft whereas an aircraft for LCCs maintain the current situation in the future.

The number of aircraft movements in Alexandria airports were predicted to increase from 20 to 24 thousand (**22** thousand in Medium Case) in 2015 from 17 thousand in 2010. Further, in 2020 the aircraft movements would increase from 30 to 37 thousand times (**33** thousand in medium case). The average annual growth rate in the medium case has been estimated to be 5.0% from 2010 to 2015, and 8.4% from 2015 to 2020.

4.8.5. Peak air traffic forecast

Peak day ratios and assumed daily traffic ratios on the second peak month are shown in the Table below.

Table 4.8-1 Peak Day Ratio (Adopted Ratio)

	International	Domestic
Passenger	**1/ 285**	**1/ 315**
Aircraft Movement	**1/ 300**	**1/ 330**

The peak hour ratios have been estimated by a forecast model developed using daily traffic data in Alexandria airports. A forecast model was developed for two-way traffic (departure + arrival) and one-way traffic (departure or arrival).

Two-way peak hour ratio of International flight has been estimated to decrease to 0.096 (9.6%) in the medium case in 2015 from 0.102 (10.2%) in 2010. In 2015, one-way peak hour ratio would decrease to 0.067 (6.7%) corresponding approximately to 65% of two-way ratio. Furthermore these ratios in 2020 would be further decrease to 0.089 (8.9%; two-way) and to 0.054 (5.4%; one-way).

Chapter 5

Current Conditions of Borg El Arab International Airport

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Chapter 5. Current Conditions of Borg El Arab International Airport

5.1. Current Situation of Civil Aviation Operations in Alexandria Region

5.1.1. Current Air Transport at Borg El Arab International Airport

1) Current Flight Schedule at Borg El Arab International Airport

The new facility developed under the Project at Borg El Arab International Airport commenced its initial operations for civil aviation in December 2010.

Table 5.1-1 shows the destinations and number of flights per week as of September 2011.

Table 5.1-1 List of Destinations and Number of Flights at Borg El Arab International Airport as of September 2011

International/ Domestic	Airline		Destination	Flights/Week (One-way)	Aircraft	Remarks
International Service	FZ	flydubai	Dubai	14	B738	LCC
	J9	Jazeera Airways	Kuwait	7	A320	LCC
	TK	Turkish Airlines	Istanbul	4	B737	
	BN	Bahrain Air	Bahrain	2	A320	
	GF	Gulf Air	Bahrain	4	A319/A320	
	QR	Qatar Airways	Doha	7	A320	
	KU	Kuwait Airways	Kuwait	5	A320	
	EY	Etihad Airways	Abu Dhabi	4	A320	
	RJ	Royal Jordanian Airlines	Amman	5	E90/E95	
	NP	Nile Air	Ta'if	7	A320	
	SV	Saudi Arabian Airlines	Medina	1	A320	
			Riyadh	3	A320	
			Jeddah	7	A320	
	ES	Air Arabia Egypt (*Using Borg El Arab as a hub)	Riyadh	6	A320	LCC
			Kuwait	6	A320	
			Abu Dhabi	3	A320	
			Dammam	3	A320	
			Istanbul	3	A320	
			Jeddah	2	A320	
			Khartoum	3	A320	
Total number of weekly flights (new terminal)				**96**		
Average number of daily flights				**13.71**		
International	XY	NAS Air (operating in the old terminal)	Jeddah	7	A319/A320	LCC
			Riyadh	7	A320	
			Medina	3	A319/A320	
Total number of weekly flights (new and old combined)				**113**		
Average number of daily flights				**16.14**		
						Percentage of the total (%)
Total number by aircraft type	**Small aircraft (A321, A320, B737, E95) ※E90/E95: Embraer 190 or 195**			**113**	**100**	

* Operating schedule information from EAC data, airline websites and ADI (Airport Data Intelligence)
* Excluding code share services

- The number of flights has gradually increased since the new terminal was commissioned in December 2010. As of September 2011, 14 destinations were being serviced from the airport and 96 flights a week were using the new terminal. One company continues to use the old terminal, which brings the number of flights per week to 113 for both terminals combined. The political situation in Egypt has been unstable since the uprising of February 2011 as has the

situation in neighboring Libya. Undoubtedly this has affected demand for air transport, resulting in little growth in the number of flights and destinations compared to the projections in 2004.

- Comparison of the traffic recorded in 2010 and 2009 is made in Table 5.1-2, in which the number of passenger in 2010 has increased by 91% from 2009, and aircraft movements in 2010 increased by 97% from 2009 at Borg El Arab International Airport. The air traffic at Alexandria-Nozha International Airport has not much changed presumably because it has surpassed the physical capacity since long time ago.

Table 5.1-2 Passenger and Aircraft Traffic at Alexandria's Two Airports

Passenger and Aircraft Traffic at Borg El Arab International Airport (2009, 2010)

	2009	2010	Growth Rate
Aircraft Movements	3,717	7,312	196.7%
Passengers	371,154	709,961	191.2%

Passenger and Aircraft Traffic at Alexandria- Nozha International Airport (2009, 2010)

	2009	2010	Growth Rate
Aircraft Movements	19,405	19,364	99.7%
Passengers	1,097,905	972,022	88.5%

[Source] ACI World Airport Traffic Report 2010

2) LCCs (Low Cost Carriers) at Borg El Arab International Airport

LCCs are expanding their activities in Europe, the US, Asia and around the world. In Europe, for example, they have achieved high growth with a projected 40% share of the EU market in 2011. In Asia, low fare airlines such as Air Asia are continuing to emerge and grow to exploit demand by people who were unable to travel by aircraft before. In the Middle East as well, LCCs are expanding demand in the centers of Dubai and Saudi Arabia.

There are currently four (4) LCCs operating at Borg El Arab International Airport. Air Arabia Egypt, one of the four, operates 26 flights a week to seven destinations using Borg El Arab International Airport as its hub. The airline plans to increase its fleet and will probably expand its network further from Borg El Arab International Airport.

With LCCs expanding rapidly throughout the world, this expansion has not yet reached Egypt to the same extent as other regions. Therefore, further growth can be expected when this global trend reaches Egypt. Given the particularly close-knit links in the Middle East, as the LCCs continue to expand here, there is every possibility that they will have an influence on growth at Borg El Arab International Airport.

Airlines operating low-fare scheduled and non-scheduled (chartered) flights are continuing to increase in number in Europe as well with many flights operating to Sharm el-Sheikh and Hurghada as well as Luxor from the UK and Russia. There is the possibility that these airlines will launch new routes.

Enthusiastically enticing these airlines to actively exploit the latent demand among income earners who have never been able to travel by aircraft and expanding demand in Egypt for air transport could be a key factor that would lead to the growth at Borg El Arab International

Airport.

3) Current Destinations and Aircraft

The routes emanating from Borg El Arab International Airport are unique in that almost all are to the Middle East and many are short haul of a duration ranging from 1 to 3 hours. Previously there were routes from cities in Europe such as Germany and Greece but those airlines withdrew because of the current political unrest in Egypt.

All aircraft are small models with the majority being A320 and B737. However, there are some mid-size aircraft such as B767 operating on Hajj flights and other charter operations.

4) Connections

a) Present

Since all current flights to and from Borg El Arab International Airport are straight origin to destination (O&D) flights with no stopovers, there are no transit passengers.

b) Possible Strategies for the Future

- As mentioned previously, Air Arabia Egypt uses Borg El Arab International Airport as its hub. As it expands its operations in the future, there is every possibility that it would use its hub--Borg El Arab--as a transit hub. This would result in more transit passengers.
- More transit passengers would help boost retail and other non-aeronautical revenue. To achieve this, it would be necessary to first create transit demand at Borg El Arab by marketing to airlines such as Air Arabia Egypt, which use Borg El Arab as a hub, as well as other airlines that would use it as a node.

5) Old Terminal

a) Present

The old terminal at Borg El Arab International Airport had been operated before the new terminal opened. It was built in 1998. The facilities were not only run down due to inadequate maintenance but, at only 2,500 m^2 in area, are also too small to handle the present passenger traffic.

After the opening of the new terminal, the airlines transferred over in stages. As of September 2011, one airlines (NAS Air) operates in the old terminal and the other 12 are now operating in the new terminal. NAS Air also plans to begin operating in the new terminal as soon as all of the conditions are in place.

b) Problems with Using the Old Terminal

The two terminals are on either side of the runway. Operating two separated terminals means additional time assigning and relocating local EAC staff as well as other problems. To alleviate these problems, it might be easier for the airport operator to offer more assistance so that the remaining airlines can move to the new terminal as quickly as possible.

6) Aircraft Time (Turnaround Time) at the Airport per Flight

- According to the August 2011 schedule, the average aircraft time (turnaround time) at the Airport per flight using the new terminal was about 50 minutes (excluding Hajj flights and other non-scheduled flights and overnight stays).
- This is much less than the average time of 2 hours 35 minutes at Narita International Airport where the majority are large aircraft.
- The primary reason for the shorter turnaround time is that all of the aircraft are small models, which require less time to complete the preflight preparations. The second reason is that there are an increasing number of LCCs. LCCs minimize their turnaround time at the airport between arrival and departure and carry more passengers in their business models. Therefore, as LCCs grow in number, the average aircraft turnaround time at Borg El Arab International Airport becomes shorter.
- Because turnaround times will become shorter, time on the stand will also be shorter. It is conceivable, therefore, that there will be a higher occupancy rate (turnover ratio) per stand. The higher the turnover ratio, the more aircraft can use the same stand. This can be described as a good result in terms of accommodating new routes in the future.

5.1.2. Current Operation at Alexandria-Nozha International Airport

Alexandria-Nozha International Airport is located in Alexandria downtown.

Currently, Egypt Air (including Egypt Air Express) and AlMasria Universal Airlines operate at Alexandria-Nozha, destination and number of flights are shown in Table 5.1-3.

Table 5.1-3 List of Destinations and Number of Flights at Alexandria-Nozha International Airport

International / Domestic	Airline		Destination	Flights/Week (One-way)	Aircraft	Remarks
International Service	MS	Egypt Air	Dammam	1	A320	
			Jeddah	14	A320	
			Kuwait	2	A320	
			Medina	3	A320	
			Riyadh	4	A320	
	UJ	AlMasria Universal Airlines	Jeddah	7	A320	
			Kuwait	1	A320	
Total number of weekly flights				**32**		
Domestic Service	MS	Egypt Air	Cairo	11	A320 / B735	
			Hurghada	3	E70	
			Sharm El Sheikh	6	E70	
Total number of weekly flights				**20**		
Total number of weekly flights (International and Domestic)				**52**		

* Operating schedule information from EAC data, airline websites and ADI (Airport Data Intelligence)
* As of April 2011

However, the Airport has numerous problems as stated in Chapter 3.2.1, and all operations are due to transfer to Borg El Arab International Airport from December 2011 as described in Chapter 3.3.1.

5.2. Current Operational Status of Airport Facilities at Borg El Arab International Airport

5.2.1. Overview

The current status of operations at Borg El Arab International Airport is as described in Chapter 5.1-1. The following is a description of the current operational status of airport's main facilities. Key facilities which are closely related to airport congestion are explained in Chapter 5.2.5.

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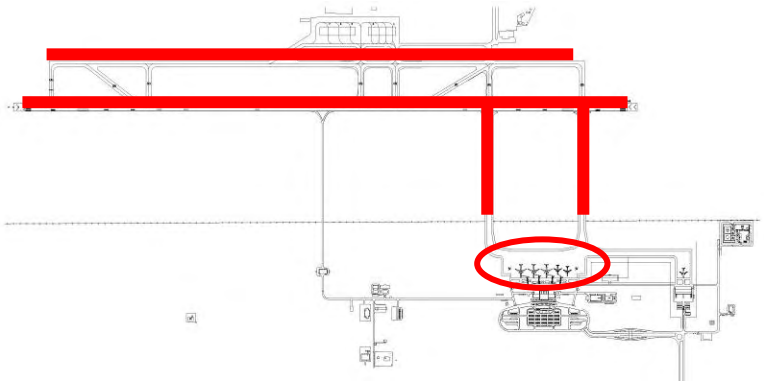
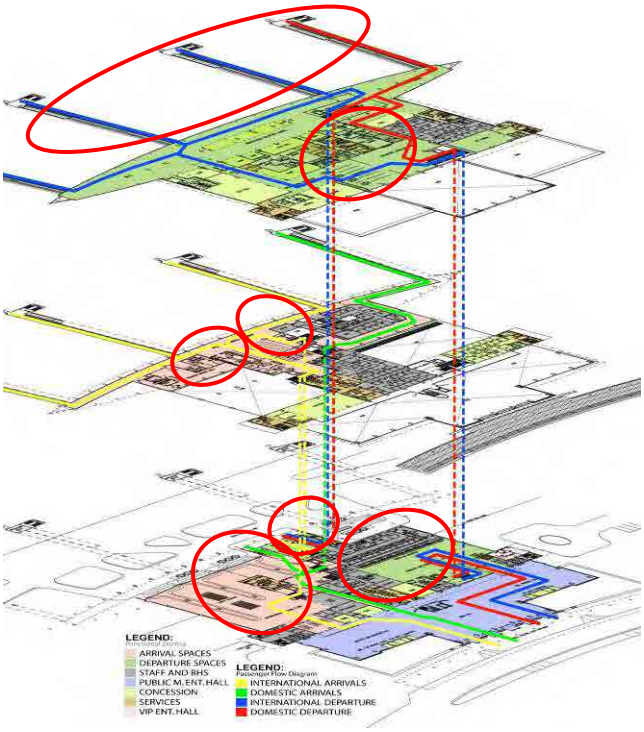
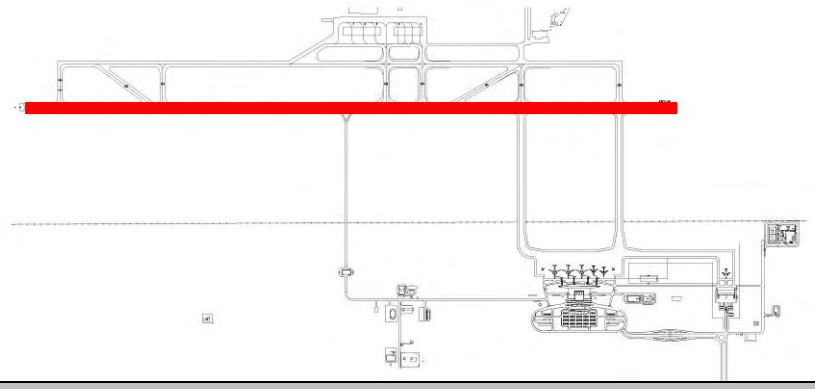
<td>  </td>
<td>[Airside Facilities]

a) Runway
b) Parallel Taxiway
c) Taxiways to New Terminal
d) Follow-me car Operation
e) Aircraft Stands</td>
</tr>
<tr>
<td> 
</td>
<td>[Passenger Terminal Building Facilities]

a) Boarding Bridges
b) International - International Transit Facilities
c) Departure Bus Gate
d) Inbound passport control
e) Baggage claim
f) Check-in counters
g) Outbound passport control.</td>
</tr>
</table>

5.2.2. Airside Facilities

Runway



Current Status

- ✓ As before, the airport continues to share the existing single 3,400-meter long runway with the military after the opening of the new terminal.
- ✓ The runway is owned by the military.
- ✓ The military presently only uses helicopters on the runway and there are only a few civil aviation movements at the moment. Therefore, the EAC says that there is not much hindrance to civil aviation operations.
- ✓ The runway's handling capacity is sufficient for 40 to 60 flights an hour under ICAO specifications. The airport currently handles 3 flights an hour at most so capacity is not a problem.

Operational Issues

- ✓ The three major prerequisites of airport operations are to ensure aircraft punctuality, safety and dependability.
- ✓ Although the military owns the runway, the EAC carries out the maintenance. At the moment the Airport is constrained by an inefficient maintenance management system in that the EAC not only must coordinate with the Civil Aviation Authority (CAA) when carrying out scheduled maintenance and essential emergency repairs, it must also gain approval from the military. Therefore, the process to carrying out maintenance is lengthy in terms of time. Correct management of facility maintenance draws the most out of runway functions at all times and contributes to safe, efficient airport operation.
- ✓ The runway must also be closed when emergency repairs are required or in the event of an aircraft accident. With a single runway operation, no aircraft can land or take off. This paralyzes the airport and poses a major hindrance to the operation of many aircraft. The airport might be, therefore, unable to contribute to punctuality that airlines require.
- ✓ Airlines are unable to continue operations when the only available runway shuts down. Consequently, they are unable to guarantee punctuality. Punctuality is one of the factors used by passengers to select an airline. Therefore, airlines have less confidence in airports where delays are frequent.

Possible Strategy for the Future

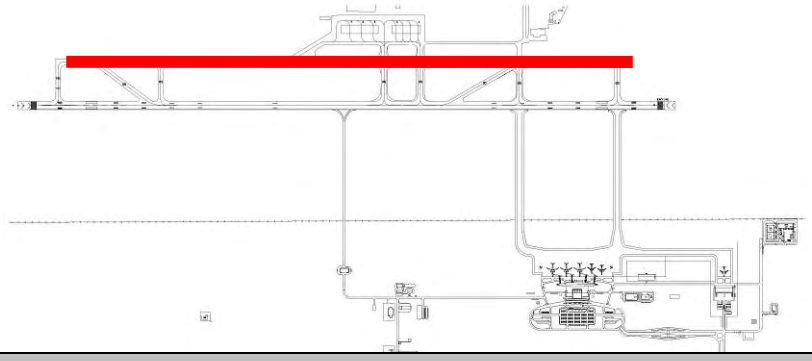
- ✓ Given the fact that demand for air transport in Egypt overall is expected to continue growing, it is expected that demand at Borg El Arab International Airport would grow and there is every possibility of a major increase in aircraft movements. Although continued shared use with the military would not pose a problem to capacity, the risk of interference to civil aviation during times of emergency is higher than use of a runway exclusively for civil aviation.
- ✓ A single runway system also poses the risk of not being able to guarantee punctuality, one of the core elements of air transport.
- ✓ With the current number of aircraft movements, it is relatively easy to carry out maintenance on the runway. However, with increases in demand on the single runway, it will become increasingly difficult to allocate time for maintenance. This could be the cause of inefficient and costly maintenance.
- ✓ Moreover, in the future, the airport will have to be closed for certain periods for major repairs to the single runway. During that time, all flights will need to be moved to another airport. However, bearing in mind future increases in traffic and aircraft size at Borg El Arab International Airport, it will be difficult to move all the flights at Borg El Arab International Airport to Alexandria-Nozha International Airport and Cairo International Airport because the capacity of those airports is limited, and there are also limitations on the size of aircraft that can be accommodated especially at Alexandria-Nozha International Airports.
- ✓ An additional runway and parallel taxiway to the existing runway is one of the best options for a solution. However, this will require careful decision-making with a lot of thought given to future facility and operations planning for the airport overall, particularly concerning an additional runway and terminal. Construction will also require massive investment costs and, bearing in mind that it will be an immense project to undertake while also maintaining airport operations, a long project period can be expected.
- ✓ It will ultimately be important to look at every aspect before making a decision. This includes future master plans for the airport, construction timing, costs, project length and demand.
- ✓ As a result, the airport loses its competitive edge. In an era of increasing competition between airports where airlines are able to select their airport of preference, a runway's reduced handling capacity in times of emergency and other situations is a negative influence on airport growth.
- ✓ On the other hand, given the immense cost of building another runway, a certain level of demand should be incorporated when looking at the cost effectiveness.
- ✓ Taking the above into overall consideration, a runway solely for the use of civil aviation will be essential for providing safe, efficient operations at all times, and improving and sustaining the airport's competitive edge. However, this will need an in-depth analysis and study on safety, punctuality, convenience, construction timing, construction period, cost and demand.

Table 5.2-1 Annual Aircraft Movements 2010

Flight Type	Aircraft		
	Arrival	Departure	Total
Regular International	3,086	3,113	6,199
Irregular International	254	250	504
Regular Domestic	20	21	41
Irregular Domestic	59	33	92
Military	4	4	8
Private	164	164	328
Others	70	70	140
Mixed	0	0	0
Total	3,657	3,655	7,312

[Source] EAC

Parallel Taxiway



Current Status

- ✓ The parallel taxiway was built on the western side of the runway. The old terminal was also built on the same side to contribute to efficiency of operations on the airside.

Operational Issues

- ✓ Because the new terminal was built on the opposite side of the runway, departing aircraft must cross the runway to enter the parallel taxiway.

[Landing Operations]

- ✓ Under the present situation where there is plenty of time between flights, when runway 14 is used landing aircraft can turn around on the turning pad at the runway end, backtrack along the runway and travel via the new terminal taxiway to their parking stand. That is how aircraft may operate at the moment.
- ✓ However, in future when the traffic increases significantly, the landing aircraft will need to exit the runway to the parallel taxiway immediately after landing.

[Departure Operations]

- ✓ When the runway 32 is used and departing aircraft use the parallel taxiway at the moment, they hold short of the runway until given clearance by air traffic control to cross the runway. This procedure causes not only a safety risk for pilots, but also results in long waiting times and affect punctuality of flight times.
- ✓ Under the current operational condition, this procedure is acceptable as the flight density is still very low, however again in future when the traffic increases significantly, another parallel taxiway exclusively for the civil aircraft operating at the new passenger terminal should be provided.

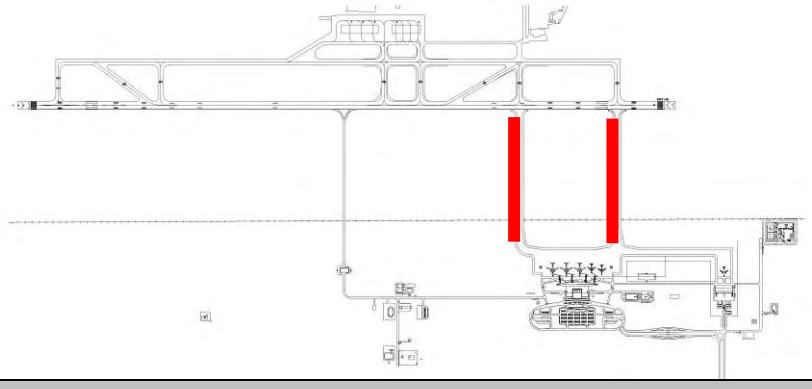
[Changes in Runway Direction Due to Wind Shifts]

- ✓ The operational direction from which aircraft arrive or take off is usually against the wind. When the direction changes due to the change in wind direction, and if the runway would be used for the aircraft taxing as described in Landing Operations, the runway has to be occupied by the aircraft for longer time. In the event, other arriving or departing aircraft may have to wait for longer. Therefore, if the direction change does not take place smoothly, it will interfere the flight times of subsequent aircraft. This would affect operational safety and efficiency and even lead to major accidents.
- ✓ These are factors that could prevent efficient use of the runway and taxiways. Not only will they affect aircraft safety and punctuality, they also stand in the way of improvements in passenger services.

Possible Strategy for the Future

- ✓ As with runways, the construction of new taxiways not only enables greater safety and efficiency in operations, it is also essential for lifting the competitive edge of the Airport.
- ✓ However, when undertaking this, the new taxiway should be so located that it provides an effective thoroughfare between the runway and the new terminal area.

Connecting Taxiways to New Terminal



Current Status

- ✓ The two connecting taxiways from the new terminal to the runway were built.
- ✓ The two taxiways enable the effective one-way directional operations when arrival and departure are made simultaneously.
- ✓ Because the terminal is closer to Runway 14 side the runway is some way from the terminal so taxiing takes a considerable amount of time when using Runway 32, which is used in most period of time.

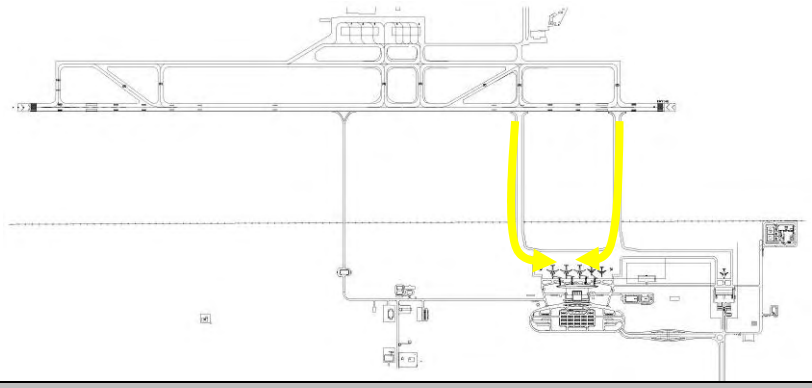
Operational Issues

- ✓ Should a malfunction or emergency situation occur on an aircraft on a taxiway, there is no place to enable that aircraft to be placed out of the way. Consequently, if a distressed aircraft has no option than to stop on the taxiway and there are aircraft behind it, those aircraft will also have to stand idle and this could also impede flight operations.
- ✓ Because there are adequate intervals between flights under the scheduling at this stage, the probability of this happening is low. However, when aircraft traffic increases in the future, the probability also increases.

Possible Strategy for the Future

- ✓ When the aircraft movements increase in future, operational safety can be safeguarded through secured provision of adequate intervals between taxiing aircraft.
- ✓ Regulation or emergency plan for those taxiways should be considered, and cooperation with airlines and air traffic control should be confirmed to project the plan smoothly.

Follow-me car Operation



Current Status

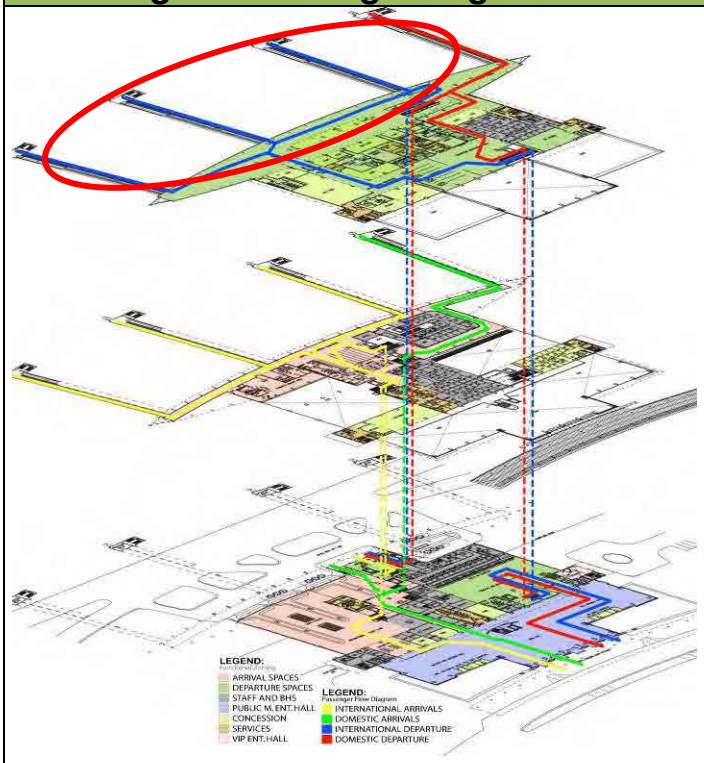
- ✓ Currently, when an aircraft lands, a follow-me car is used to lead the aircraft to its parking stand.
- ✓ Generally, the ground control officers in air traffic control give taxiing instructions to pilots to guide them to their parking stands but as there is no ground control officers and air traffic controllers do the duty at the Airport, a follow-me car waits at the designated position for the aircraft, makes contact with the pilot and guides him to the parking stand.

Possible Strategy for the Future

- ✓ This is fully feasible with the current level of aircraft traffic (around 14 flights a day) but as this traffic increases along with rising demand, the continuation of this method or another viable method will need to be examined. As aircraft traffic increases, there will be a flurry of vehicles, much smaller than aircraft and difficult to see from other taxiing aircraft. This will not only reduce operational safety on the airside, it will also mean that more marshalling vehicles and staff will be required. The need to provide operational safety training will also require additional costs.
- ✓ Conversely, ground control officers will be essential if the operation of follow-me cars is stopped. If ground control officers are provided, pilots will be able to receive their instructions from the controller and taxi themselves to their parking stands.

5.2.3. Passenger Terminal Building

Passenger Boarding Bridges



Passenger Boarding Bridge

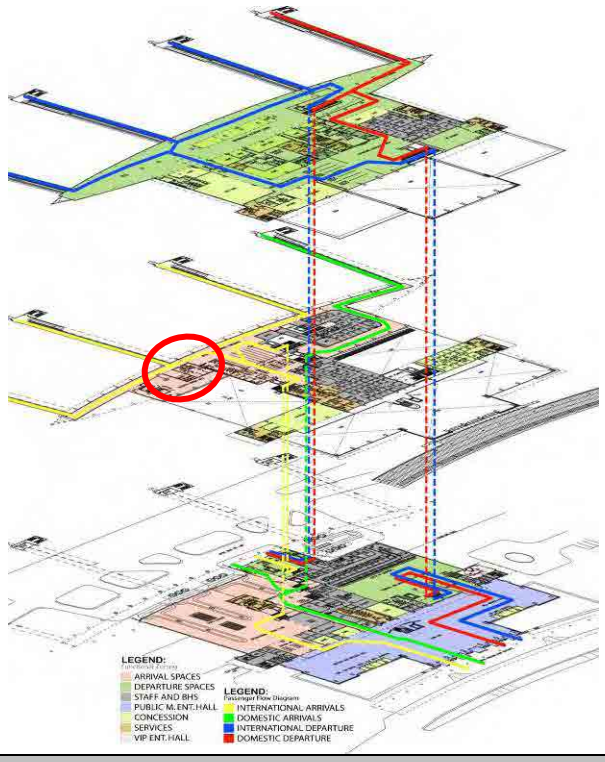
Current Status

- ✓ There are four passenger boarding bridges.
- ✓ Two of them are used for both international and domestic flights. Others are used only for international flight.

Operational Issues

- ✓ EAC staff is responsible for the operation of the passenger boarding bridges (PBB).
- ✓ They are generally operating problem free at the moment. There has been no evidence of incidents such as collisions with aircraft.

International - International Transit Facilities



International Transit Lounge

Current Status

- ✓ The transit facilities in the new terminal are located on the arrivals level of 1st floor.
- ✓ However, because transit passengers were not taken into consideration initially, the area is very confined, as is the waiting area for transit passengers

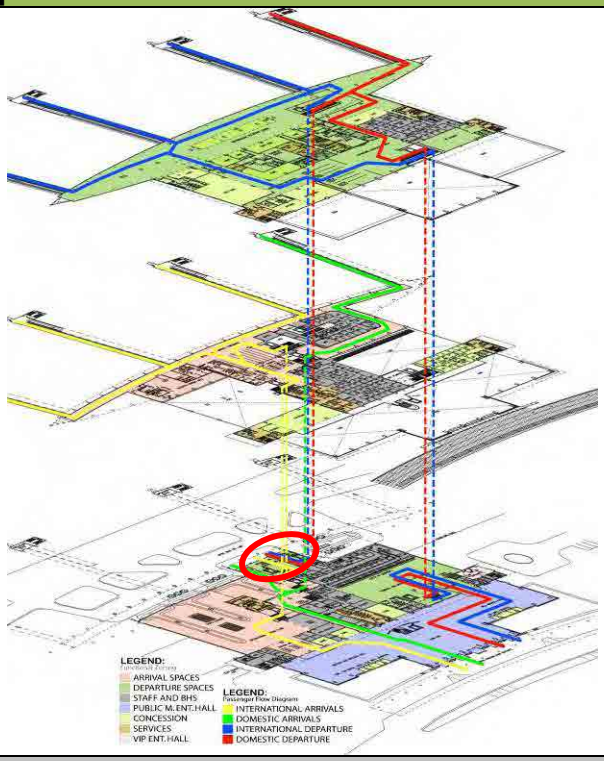
Operational Issues

- ✓ There is no route after security screening in the transit area to the departure gate lounges on the 2nd floor.
- ✓ Consequently, transit passengers have to emerge on the arrival passenger flow line, and go back up a fixed bridge to the departure level.
- ✓ Although the structure separates outbound and inbound passenger flows for improved security, transit-screened connecting passengers will have to re-enter the inbound passenger flow.

Possible Strategy for the Future

- ✓ As there are no transit passengers at present, this situation has not happened but in future transit passengers will temporarily be required to travel against the inbound passenger flow led by airline or EAC staff, through a fixed bridge and into the departure lobby.
- ✓ When transit passenger demand increases, it will not be feasible for staff to usher transit passengers in the above manner. Even if there is no increase in demand, it would not be possible to eliminate the risk of illegal entry and smuggling with a temporary solution.
- ✓ It is normally not accepted practice for transit passengers cleared by security and sent to the departure lobby via the arrival passenger flow. Therefore, if it is possible to provide a route to the departure lobby that does not threaten security and does not pass through the inbound passenger flow, it should be implemented as soon as possible.

Departure Bus Gate



Departure Bus Gate
(International and Domestic)

Current Status

- ✓ When departing from a remote stand, passengers should take bus to the aircraft for boarding.
- ✓ Only 1 bus gate with not enough space is available, passengers should wait at pre-departure lounge in the 2nd floor, and guided by airline in sequence to the ground floor for boarding.

Operational Issues

- ✓ The bus gate should not be simultaneously used for international and domestic services.
- ✓ When switching over between international and domestic use, all gate areas must be checked to prevent illegal entry to the country and terrorist hijacking.
- ✓ The bus gates should be empty before use, to confirm that no suspicious individual, unidentified objects, smuggling, .including the garbage containers is present.
- ✓ Each supervisor should ensure that all points must be checked in order to use a gate for international or domestic services, and this will take a certain amount of time. These checks require not only EAC staff but also the cooperation of Customs and Police supervisors.

Possible Strategy for the Future

- ✓ When the number of flights does increase, there will not be enough fixed gates, particularly during peak hours and there will be more frequent use of the bus gate. Therefore, passengers should be guided safely with customer service staff, playing a central role as well as the airline staff.
- ✓ Bearing in mind that the gate is to be used for international and domestic flights, from an operations point of view, schedules should be thoroughly checked before assigning stands. Due consideration should be given to the time required to switch the gate from domestic to international or vice versa so as to avoid overlapping flights on the gate. Care should also be taken to ensure that the switch does not take an unreasonable amount of time.

5.2.4. Terminal and Apron (Airside) Congestion

The hourly distribution of aircraft movements at Borg El Arab International Airport is graphically shown based on the September 2011 schedule to verify the level of terminal and airside congestion (please refer to Figure 5.2-1 and Figure 5.2-2).

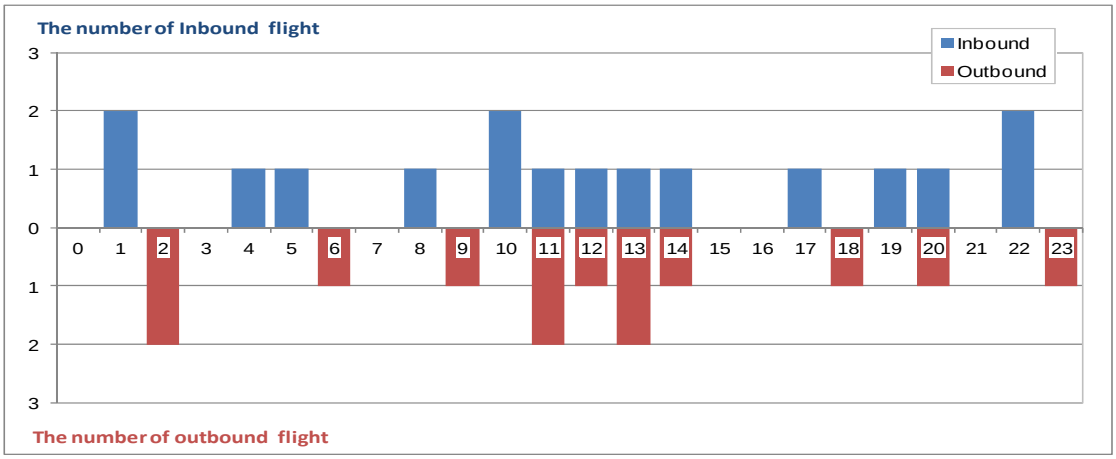


Figure 5.2-1 Flights per Hour (Inbound, Outbound) at Borg El Arab International Airport

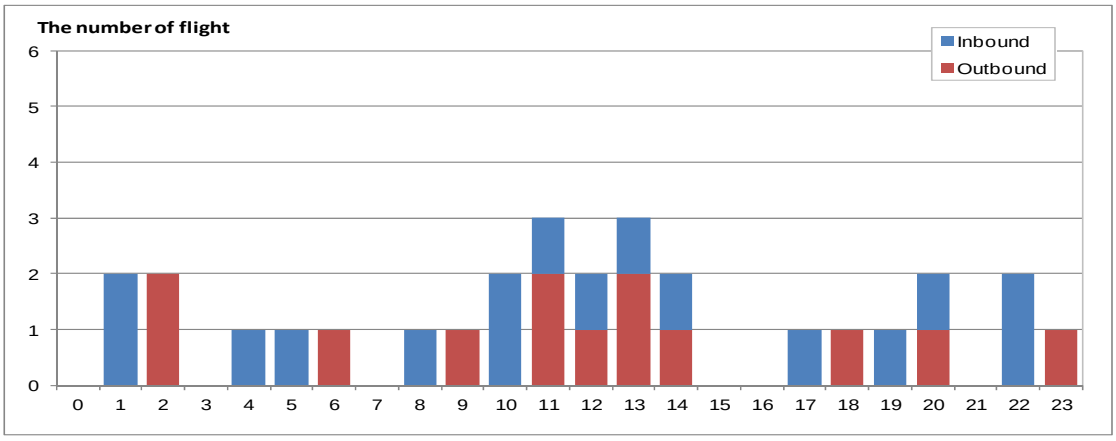


Figure 5.2-2 Flights per Hour (Inbound and Outbound Combined) at Borg El Arab International Airport

Because operational data have not been processed or not available, it is difficult to obtain historical statistics and, therefore, the graphs were prepared based on weekly schedules. The Figures show that:

- Currently 2 outbound and inbound flights are operated in an hour.
- Generally, there is not a big difference in the number of flights between peak and off peak periods. Therefore, the present schedule can be described as having a uniform traffic volume.
- Current peak appears from 10:00 am to 2:00 pm for inbound flights and 11:00 am to 2:00 pm for outbound flights.
- Current peak operations have no polarization in daily schedules, and plenty of rooms within the airport capacity.

5.2.5. Current Operational Status of Key Facilities related to Airport Congestion

The key facilities that are essential to aircraft operations are: a) Aircraft stands, b) Inbound passport control, c) Baggage claim, d) Check-in counters, e) Outbound passport control. Each of these facilities is limited in capacity and can become operational bottlenecks. Current congestion in each area can be calculated from the number of flights per hour.

Table 5.2-2 List of Compatible Aircraft for Stands at Borg El Arab International Airport

Main Gate Number			1		2	3	4		5		6		7	
Aircraft Type/ Parking Pattern			remote		remote	PBB	PBB		PBB		PBB		remote	
Large	B777		X		X	X	OK		OK		OK		X	
	B747		X		X	X	OK		OK		OK		X	
	A340		X		X	X	OK		OK		OK		X	
	A330		X		X	X	OK		OK		OK		X	
Medium	B767		OK		OK	OK	OK		OK		OK		OK	
	A300		OK		OK	OK	OK		OK		OK		OK	
	A310		OK		OK	OK	OK		OK		OK		OK	
Small	B737-	100 to 500	OK		OK	X	OK		X		OK		OK	
	B737-	600 to 900	OK		OK	X	OK		X		OK		OK	
	A320		OK		OK	OK	OK		OK		OK		OK	
	A319		OK		OK	OK	OK		OK		OK		OK	
Sub Gate Number			1A	1B	2A	3A	4A	4B	5A	5	6A	6B	7A	7B
Aircraft Type/ Parking Pattern			remote	remote	remote	bridge	bridge	bridge	bridge	bridge	bridge	bridge	remote	remote
Small	B737-	100 to 500	OK	OK	OK	X	OK	OK	X	X	OK	OK	OK	OK
	B737-	600 to 900	OK	X	OK	X	OK	X	X	X	OK	OK	X	OK
	A320		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
	A319		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

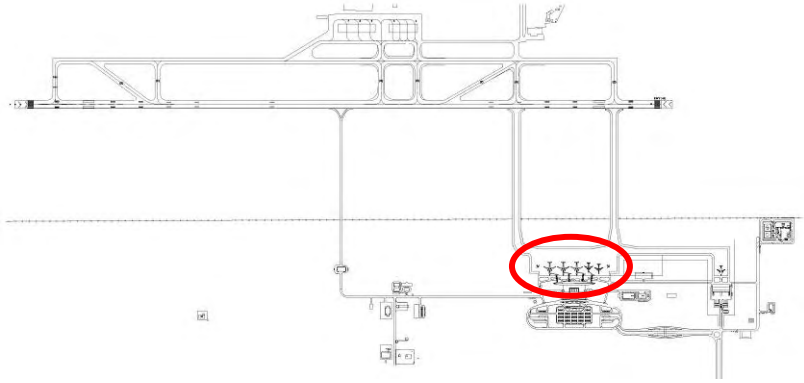
Table 5.2-3 Gate Plan Sheet

DATE: - 06-06-2011

AIRLINE	FLT NO.	DESTINATION		TIME		ST. NO	GATE NO.	REP
		ARR FROM	DEP TO	ARR	DEP			
Turkish Airlines	TK 696/7	Istanbul	Istanbul	01:30	02:40	4	4	
Nile Air	NP 2160	Jeddah		02:30		3	3	REP STD 2
Royal Jordanian	RJ 305/6	Amman	Amman	08:30	09:15	7	2	
Arabia Egypt	E5 3512/3213		Kuwait		09:35	4	4	
Quarter Airways	QR 510/1		Doha	10:10	11:10	6	6	
Kuwait Airways	KU 545/6	Kuwait	Kuwait	10:50	11:50	5	5	
Fly Dubai	FZ 177/8	Dubai	Dubai	11:15	12:00	4	4	
Etihad Airways	EY 663/2	Abu Dahby	Abu Dahby	12:20	13:15	6	6	
Arabia Egypt	E5 3558/3511	Kuwait	Abu Dahby	18:00	19:25	3	3	
Saudi Airways	SV 331/2	Jeddah	Jeddah	19:00	20:15	5	5	

[Source] EAC data

Aircraft Parking Stands



Current Status

- ✓ There are 4 stands with fixed passenger boarding bridges (fixed stands) and 3 remote stands with no fixed passenger boarding bridge where passengers are transported to the terminals by bus. In total, there are 7 stands which, depending on aircraft type, can accommodate up to 12 aircraft. One of the four fixed stands is a swing gate which can be used for both domestic and international flights.
- ✓ Figure 5.2-2 shows a maximum of 3 flights per hour for outbound and inbound flights combined at present. As long as there are no restrictions on aircraft type, all three flights will be able to use the fixed gates. Aircraft which are not compatible with the fixed gates will use remote stands. At present, there are plenty of stands available.
- ✓ shows the types of aircraft that can be accommodated by the stands.

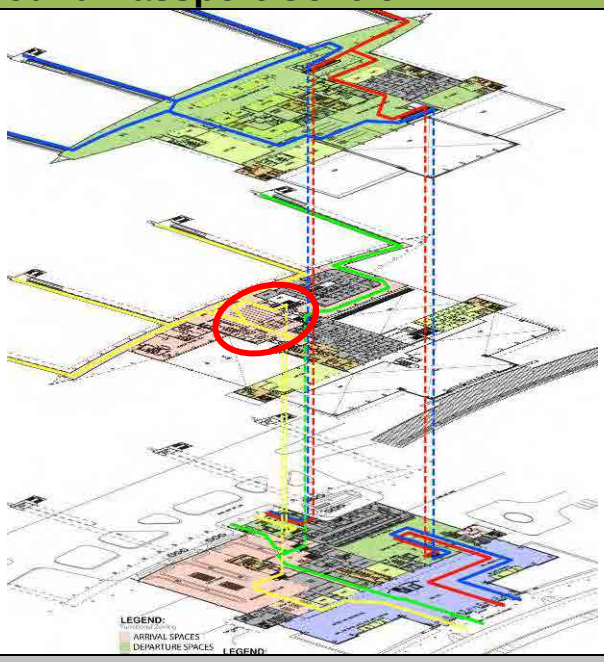
Operational Issues

- ✓ Gates are assigned at the discretion of the operations supervisor after having received flight information for the following day. This information is shared by way of the following plan sheet which is distributed by the relevant department.
- ✓ There are no specific regulations governing the stand assignment. This is decided at the discretion of the supervisor on the day.
- ✓ Similarly, no data on daily assignment statistics is kept so trends are not analyzed.
- ✓ There is no differentiation concerning delayed flights from the previous day or other irregular flights.

Possible Strategy for the Future

- ✓ Keeping assignment data is extremely important. This is because it can help analyze what kind of assignment patterns will facilitate safe, smooth operations on the apron and in the terminals.
- ✓ For example, allocating stands in the same area to an airline operating several flights at the same time can be easier for the airline to operate and also be more efficient.
- ✓ If aircraft with the same or similar schedules are parked next to each other, both of the aircraft may require to be pushed back at the same time. It may not be possible to simultaneously push-back the two aircraft side by side.
- ✓ Assigning stands that will allow both aircraft to leave their stands at the same time rather than making one wait, will help both flights to remain on time.
- ✓ Assigning a stand close to the transit area for flights with a large number of transit passengers will also enable passengers to be guided smoothly to the transit area.
- ✓ Maintaining data for regular discussions and improvements in the operations division is important for achieving safer and more efficient operations. With the current number of flights, assigning stands at the discretion of the supervisor is not a problem but as the number of flights increases, a tighter schedule will apply to the operation of the stands and a planned, efficient form of stand assignment will be essential to smooth operations.

Inbound Passport Control




Inbound Passport Control Line


Double Passport Checks
(Inbound Passport Control)

Current Status

- ✓ Inbound passport control has 10 booths occupying 405m^2.
- ✓ Inbound passport control is undertaken by Ministry of Internal Affair (police) by normally staffing 2 officers for each booth.

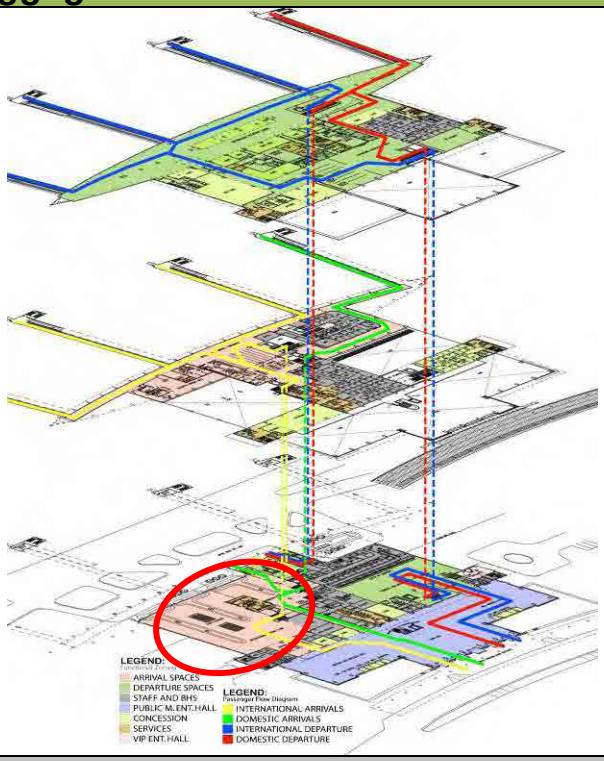
Operational Issues

- ✓ It is found that average processing time is approximately 75seconds per passenger.
- ✓ It is observed that, since currently 2 booths only are made available at peak hour, queuing lines used to stretch out of the passport control area into the arrivals concourse.
- ✓ It is Egyptian custom that another police is manned to double-check the visa and stamp immediately after passport control desks, but there is no queuing space for people to wait.
- ✓ It is difficult to get data on the shift system (number of personnel, shift hours, roster system) so there is no clear information available.
- ✓ It was informed that the same immigration officers cover Cairo and Alexandria-Nozha International Airports in shifts.

Possible Strategy for the Future

- ✓ Unlike outbound passport control, all passengers rush to the inbound passport control upon their arrival at once. Effort must be devoted for the police to timely assign more officers to open another booth, and for EAC to assist passengers while waiting to complete their procedures.
- ✓ An important step is to encourage the different groups and agencies to work together through frequent sharing of information among the organizations, including the EAC, airlines and police, and the designation of a liaison system and cooperative framework.
- ✓ Although no details on the shift system used by police are available, it is suggested for police to permanently assign more officers for inbound passport control desks, and for EAC to acquaint them with precise arrival time and numbers of arriving passengers so that they can timely open more booths when there are more flights with more number of passengers than normal.

Baggage Claim



Baggage Claim Area

Lost Baggage

Current Status

- ✓ The Airport has three carousels (2 international and 1 shared international / domestic). 1 carousel is dedicated to one flight at all times.
- ✓ Figure 5.2-1 shows a maximum of 2 arriving flights per hour at present. The two international carousels enable one to be used for each flight even if the two flights arrive at the same time.
- ✓ Therefore, no problems exist with peak hour capacity.

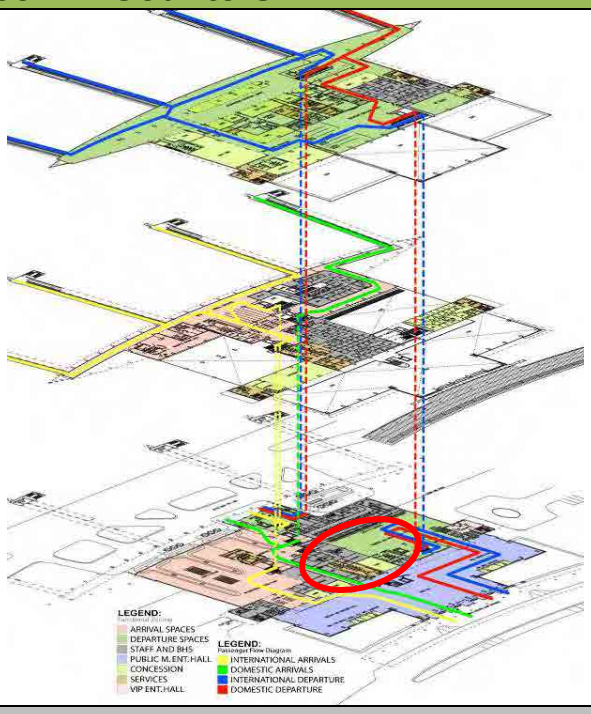
Operational Issues

- ✓ Misdirected or lost baggage is left in the baggage claim area or outside it at present. Anybody can get access to this baggage, a situation that has very dangerous implications for security.
- ✓ From a Customs perspective also, bonded storage measures should be enforced for lost baggage.

Possible Strategy for the Future

- ✓ With growth in demand and increases in the number of international flights per hour, when 3 or more flights arrive simultaneously, peak capacity will be at its limit.
- ✓ If 2 or more domestic flights arrive simultaneously, there could be problems with the current handling capacity.
- ✓ When this situation occurs, one carousel will need to be shared by two flights. This will require an operational strategy such as removing baggage from the first flight quickly off the carousel and placing it in one location identifiable with that flight.
- ✓ A dedicated storeroom should be provided for lost baggage. Ordinarily, lost baggage is kept in a bonded storage area. At other airports, for example, the airlines are responsible and take the baggage to bonded storage. A register entry is made when the baggage is submitted and when the owner appears, the airline is able to retrieve the baggage in exchange for the registration slip.

Check-in Counters



Check-in Counters

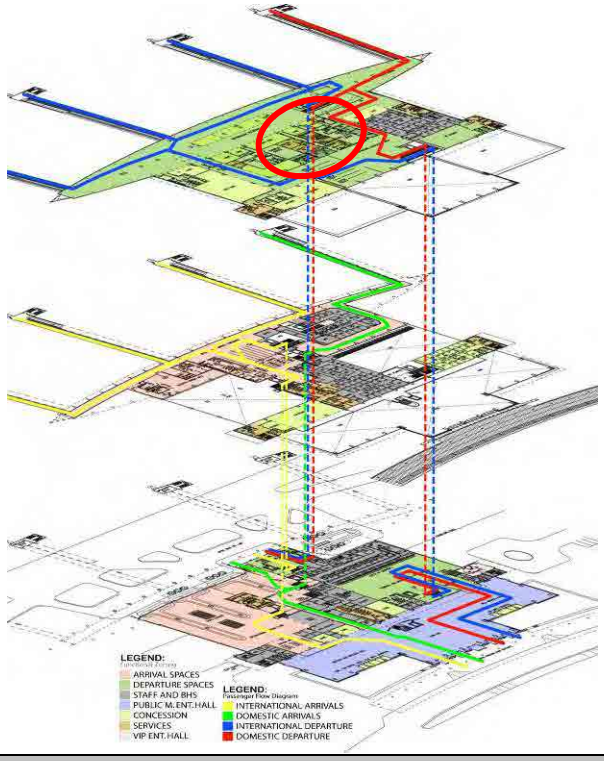
Current Status

- ✓ The departure check-in area is a spacious; 775m^2 with 20 check-in counters
- ✓ At present, 2 to 4 counters are used per flight. The number of counters is assigned by the Central Control Operation (CCO) of the airport, who is responsible for operations, depending on the prevailing circumstances for the day.
- ✓ Charges are not imposed for use of the counters.
- ✓ There are two different types in terms of passenger processing time.
- ✓ When the check-in for LCC flights, such as Air Arabia Egypt, was observed currently processing time was approximately from 3 to 5 minutes per passenger. On the other hand, when the check-in for Legacy airlines, such as Turkish Airlines, was observed currently processing time was approximately from 1 to 2 minutes per passenger. No congestion was evident for both operation and check-in operations went relatively smoothly without any operational problem, because there is plenty of margin for peak hour passenger numbers.

Possible Strategy for the Future

- ✓ Congestion may increase with future growth in the number of flights. Even if there is no increase in the number of flights, the use of bigger aircraft will produce more passengers per flight.
- ✓ To deal with this situation, airlines should be consulted on the assignment of check-in counters, which is presently unregulated, to achieve safe and efficient operations.
- ✓ For example, the position, number and open times of check-in counters and how to make a line with safe and efficient way for passengers flow for each flight could be decided based on weekly schedules.
- ✓ Current operational procedure will certainly cause congestion problems when the traffic increases in future.
- ✓ Designating counter use in advance will enable airlines to make simple preparations and check-in their passengers smoothly.
- ✓ These measures will improve the use of the overall check-in area, enabling greater handling capacity and resulting in more efficient operations in the check-in area.
- ✓ Especially check-in for LCC flights should be considered extra care since many passengers do not familiar with using air travel, and it results in more processing time for check-in, which has to be reduced for more safe and efficient use.

Outbound passport control




Outbound Passport Control


Passport Control Booth (Right)
and Security Screening (Left)

Current Status

- ✓ The outbound passport control area has a floor space of 360 m^2 with 8 booths. Adjacent to this is a 457 m^2 departure circulation area. Therefore, adequate space is provided at present.
- ✓ For the purpose of verification operations of the area was observed during peak hours (check-in for 3 flights were available) but, any congestion were not observed.
- ✓ With two flights per hour during peak periods at present, there would be up to 240 passengers. Since there was no congestion at the check-in counters either, there were no obvious deficiencies in operational safety or efficiency at passport control, the next step in passenger processing after checking in.

Operational Issues

- ✓ Most passengers using the airport seem to be unfamiliar with air travel since the survey team observed longer passenger processing time than normally observed.
- ✓ For example, many passengers didn't know how to proceed to the gates to board. They didn't know about passport control or how to fill out immigration cards. Therefore, it sometimes took longer to process one passenger.

Possible Strategy for the Future

- ✓ Security screening is immediately after passport control and the area is confined. Consequently, safety should be ensured by having passport control officers and security personnel attend to some of the finer points of operations such as ushering passengers.
- ✓ Since most of the passengers didn't know about the procedures to be followed, airport staff including immigration officials and airline personnel, need to provided more guidance and extend extra care to passengers.

5.3. Analysis on Egypt Air Relocation to Borg El Arab International Airport

5.3.1. Assumed Congestion

One of the prerequisites of the Project was that Alexandria-Nozha International Airport would be closed and all the flights from that airport would be transferred to Borg El Arab International Airport. Consequently, the Egypt Air flights have been added to the hourly distribution of the flights at Borg El Arab International Airport (shown in Figure 5.2-1 and Figure 5.2-2). Figures 5.3-1 and 5-3-2 show the hourly distribution of aircraft movements thus obtained.

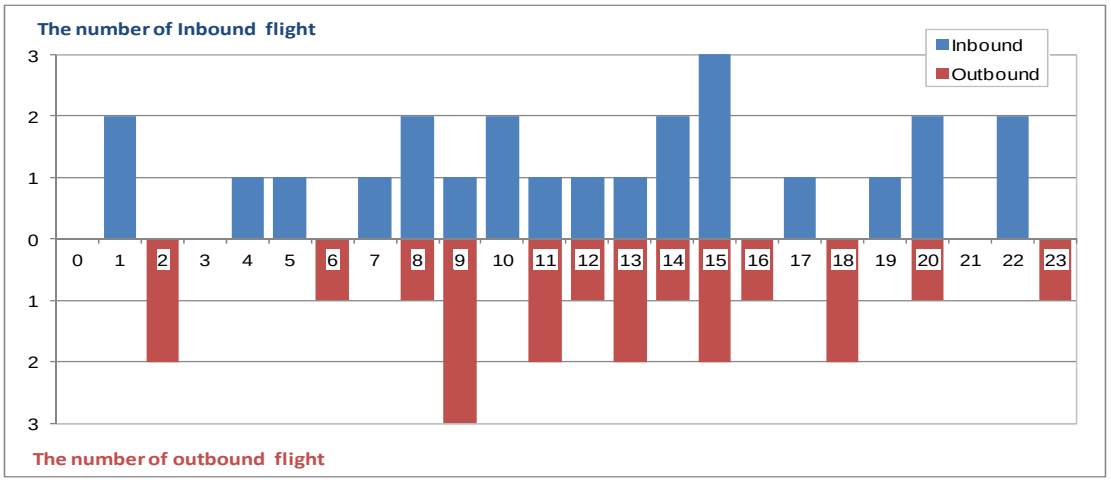


Figure 5.3-1 Hourly Number of (Inbound, Outbound) Flights
Combined Hourly Distribution of Flights at Borg El Arab and Alexandria-Nozha

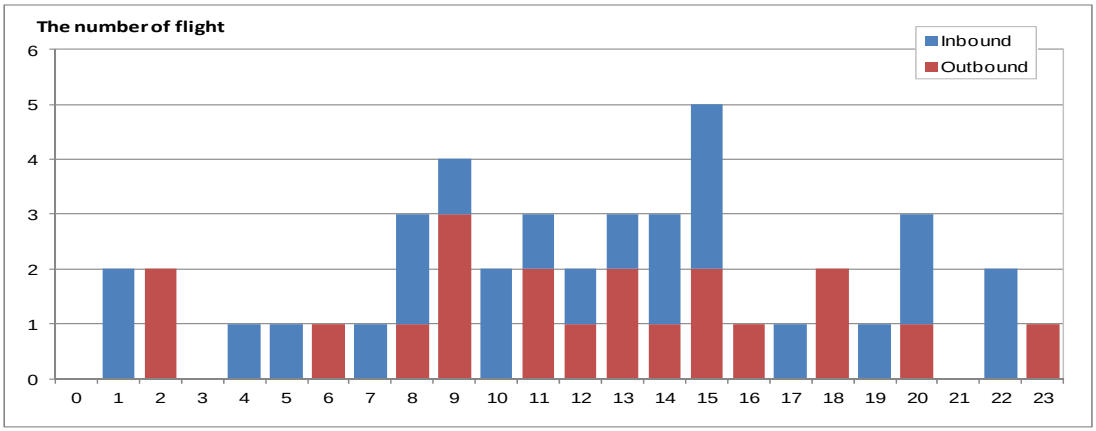
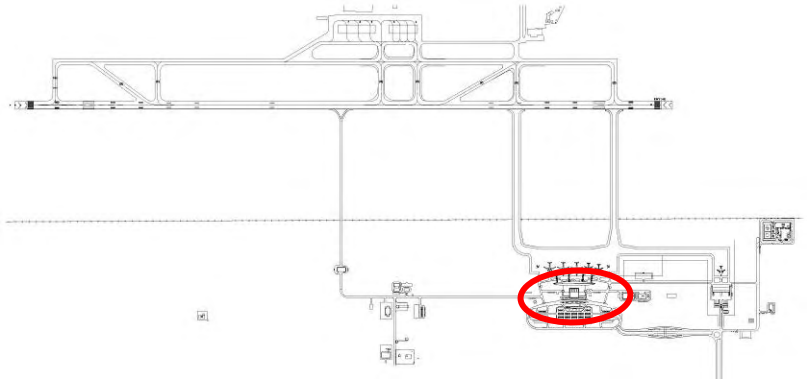


Figure 5.3-2 Hourly Total Number of (Inbound and Outbound) Flights
Combined Hourly Distribution of Flights at Borg El Arab and Alexandria-Nozha

- On an assumption that Egypt Air was operating at Borg El Arab International Airport, the peak arrival period was between 2:00 pm and 4:00 pm with up to 3 flights an hour.
- The peak departure period was between 9:00 am and 10:00 am with up to 3 flights an hour.
- Because there is only one make up conveyor for sorting baggage to be loaded onto aircraft, there is a possibility that the system would not be able to cope with the baggage from 3 to 4 flights an hour. Therefore, the Study Team considers that more efficient operations of what are required.

5.3.2. Operational Status of Key Facilities related to Assumed Congestion

Aircraft Parking Stands



Assumed Status

- ✓ Table 5.3-1 shows stand usage based on combined flight schedule. As this is merely a simulated assignment, actual conditions may mean aircraft on the stands of an hour or more in a real situation.

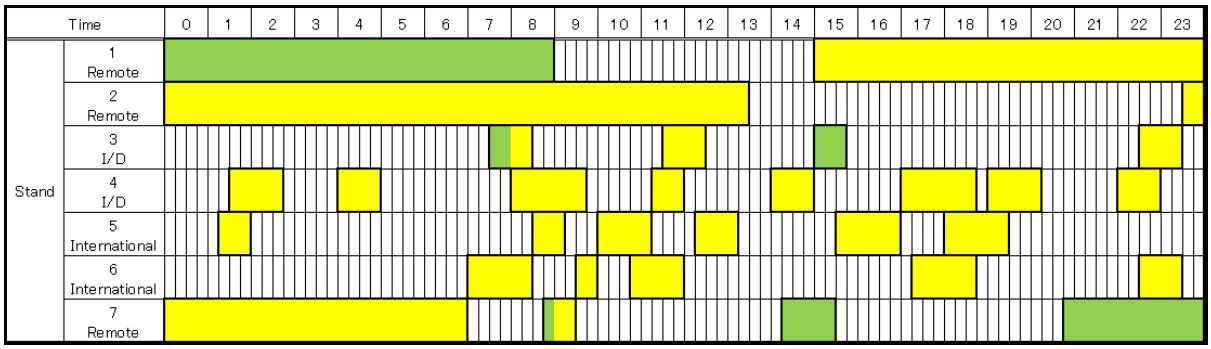
Operational Issues

- ✓ It has been estimated that the maximum number of simultaneously parked aircraft would be 7 (8:00am) including long-staying aircraft. As mentioned earlier, there are 4 stands with passenger boarding bridges (fixed stands of 3, 4, 5 and 6) and 3 remote stands without fixed boarding bridges to which passengers are transported by bus from the terminal (Stands 1, 2 and 7). In total, there are 7 stands (which can accommodate up to 12 small jet aircraft). These can accommodate 7 aircraft without any problem.
- ✓ However, only four stands can use fixed boarding bridges simultaneously and up to three departing or arriving flight could be assigned to a remote stand. Depending on the departure or arrival times of the flights, efficient operation of the stands could enable all flights to be serviced with four fixed gates.
- ✓ It is also worth considering that Air Arabia Egypt and Egypt Air as well as other airlines may park their aircraft for extended periods during the day or at night if they use Borg El Arab International Airport as their hub.
- ✓ Currently Air Arabia Egypt and Nile Air park their aircraft for extended periods at the Airport, and Egypt Air operates its aircraft in a similar way at Alexandria-Nozha International Airport. Therefore, it is assumed that the number of available stands would be limited by the time of day.

Possible Strategy for the Future

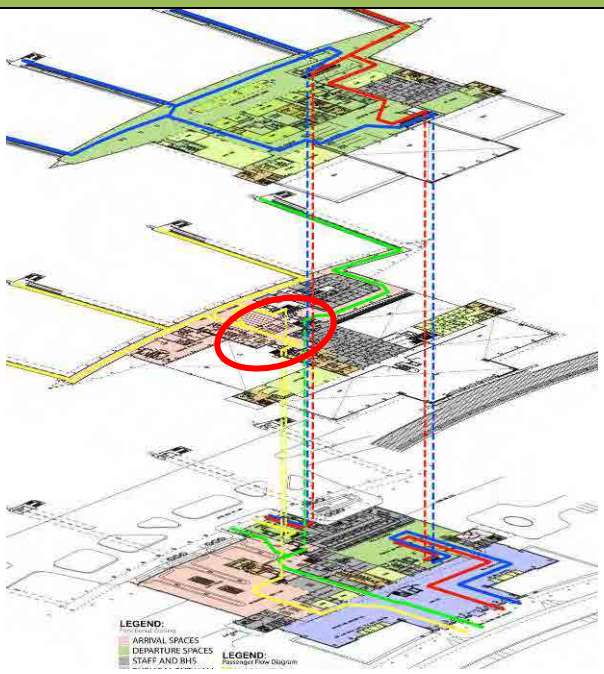
- ✓ In terms of the number of aircraft movements, there would still be enough stands available even if Egypt Air relocates to Borg El Arab International Airport.
- ✓ However, it is conceivable that both Air Arabia Egypt and Egypt Air will use Borg El Arab International Airport as a hub. Therefore, there will be more aircraft parked for extended periods or even overnight and we can assume a relative increase in time spent on the stand per aircraft.
- ✓ Consequently, when Egypt Air relocates, stand allocation should also take into consideration the airline's aircraft rotation.

Table 5.3-1 Diagram of Hourly Stand Usage Based on simulated flight schedule



* Yellow indicates international, green indicates domestic
* Stands 1, 2 and 7 are remote stands.
* Stands 3 and 4 are swing gates and can be used for both domestic and international flights.

Inbound Passport Control



Assumed Status

- ✓ Figure 5.3-1 shows up to 3 flights in the peak arrival time. Assuming the present small A320 class of aircraft, we can estimate 300 to 360 passengers.

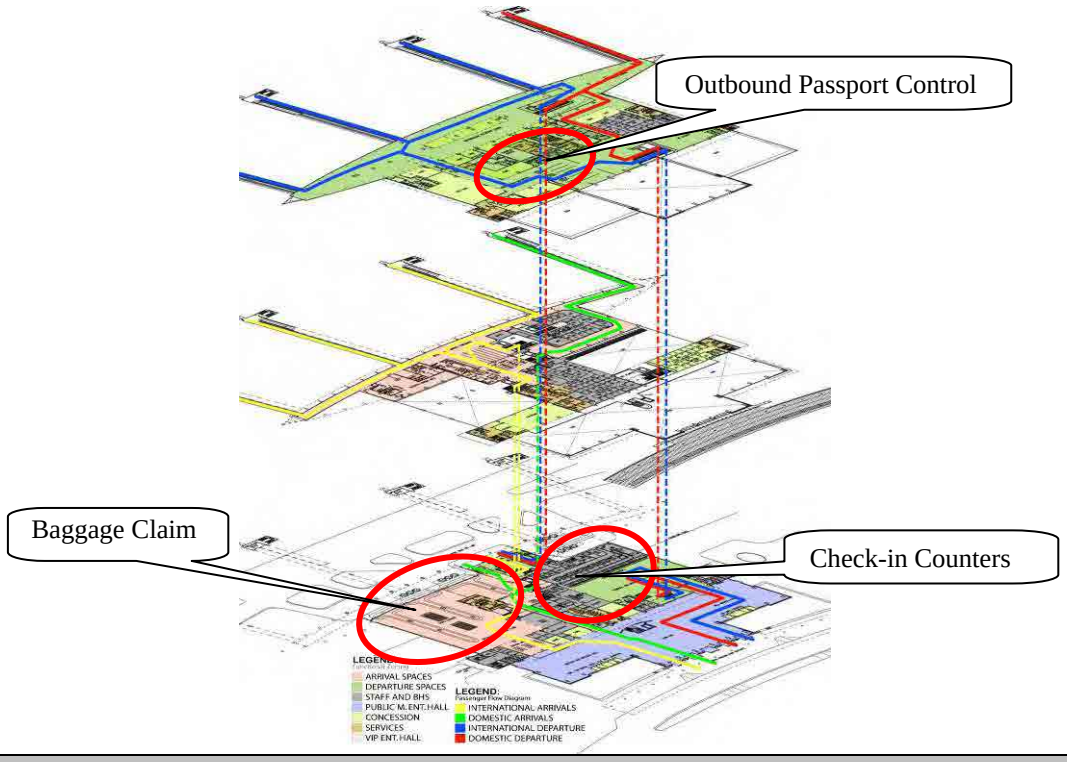
Operational Issues

- ✓ Assuming each passenger requires 1.2 m^2 of space, this would produce a maximum number of passengers of around 337, more than the capacity of the facilities. Since the inbound passport control space includes the area occupied by the inspection booth, we can assume an even smaller space available for passengers. Based on the assumption that passport control procedures would be carried out at only two booths, the arrival of only 1 flight (carrying approximately 100 - 120 passengers) would create a queue stretching from the Immigration area almost to the passenger boarding bridge exit. Compared to this, if three flights (carrying 300 - 360 passengers) arrived simultaneously, we predict congestion in the passport control area and a queue stretching as far as the arrival concourse.

Possible Strategy for the Future

- ✓ Similar to the present situation, after check-in, passengers would gradually filter through to outbound passport control. However, inbound passengers arrive en masse and proceed to the inbound passport control. Consequently, if there are more flights, we believe that remedial operational measures would be required.
- ✓ Assuming a minimum of 2 passport control booths for one flight as is the practice at present, a minimum of 6 booths would be required to accommodate the anticipated number of passengers of 3 simultaneous arrivals during the peak-hour.
- ✓ Passengers waiting for immigration clearance should also be ushered in an attempt to streamline operations.
- ✓ An important step in achieving this is to work to enable the different groups and agencies to work together through frequent sharing of information among the organizations, including the EAC, airlines and police, and the designation of a liaison system and cooperative framework. Because we foresee that Egypt Air will carry the most passengers, the cooperation of this airline in particular would be important in adopting any measures.

Baggage Claim, Check-in Counters, Outbound Passport Control



Assumed Status

[Baggage Claim]

- ✓ As mentioned before, one baggage claim carousel is being assigned to one flight each.
- ✓ There are three (3) carousels at the Airport, including one (1) for domestic and two (2) for international flights. Therefore, three flights can be accommodated simultaneously.
- ✓ Figure 5.3-1 shows up to three arriving flights during peak hours, therefore, the baggage claim facilities can adequately handle this level of traffic although all carousels would be operating.

[Check-in Counters, Outbound Passport Control]

- ✓ It is predicted that congestion would not be largely different to existing conditions and we believe that this would not pose a problem to the capacity of the facilities.

5.4. Mode of Access to / from Airport (Type of Transportation)

5.4.1. Operations

- Modes of access to the airport are as follows:
  - Car
  - Taxi
  - Bus
  - Hired Car (Chauffeur driven limousine services)
- Like other airports in Egypt, a toll is collected when entering Borg El Arab International Airport.
- Statistics commencing from the opening of the new airport in December 2010 to July 2011 are set out in the table below.

Table 5.4-1 Number of Vehicles Entering Airport and Charges Collected

Item	No. of Units (Dec 2010 - Jul 2011)	Daily Vehicle Avg.	Airport Entry Toll (Per Vehicle, EGP)	Total (EGP)	Remarks
Bus	1,670	6.9	15	25,050	
Mini bus (Share Ride Vehicles)	9,500	39.5	10	95,000	From Jun 2011
Car	153,835	640	5	769,175	

[Source] EAC Data

- Cars are the major form of transport accounting for more than 90% of the total.
- There is no category in the table for hired cars and taxis but we estimate that they would comprise a sizeable number.
- Buses are the cheapest (6 Egyptian pounds) form of transport but there are no timetables and they are difficult to use for those who are not familiar with them.
- Mini buses were added as a category from June 2011. Mini bus is a share ride vehicle (bus).
- Car hire is presently operated by one company. There is a reception desk in the arrivals lobby and they page a hired car from there. They are quite more expensive than buses, costing around 100 to 120 Egyptian pounds to Alexandria city.

5.4.2. Possible Strategies for the Future

- Information on hire cars and taxis, etc should be collected to obtain a more accurate understanding of the data. This will enable the airport operator to expand its facilities more efficiently to suit the number cars, taxis, hire cars, buses and other vehicles in the future and it will also help to construct facilities economically.
- It is also recommended to collect, analyze and keep past records of the access traffic so that they can be utilized for proper pricing, improvement of facilities and passenger

services.

- It would also be beneficial if availability of parking spaces could be shared with staff on duty at the gates to the airport. It is very possible that there will be more vehicles when there is growth in aircraft and passenger traffic. There could be a shortage of parking spaces at times resulting in an overflow of vehicles. If proper records are kept to include the different types of vehicle and the traffic by hour, it would help to calculate peak periods, etc. and improve car park safety and efficiency.

5.5. Non-Aeronautical Revenue at Borg El Arab International Airport

5.5.1. Main Revenue at Borg El Arab International Airport

The following table shows the main aeronautical and non-aeronautical revenue at Borg El Arab International Airport.

Table 5.5-1 Breakdown of Major Charges at Borg El Arab International Airport

Aeronautical Revenue	Non-aeronautical Revenue
Landing fees	Airport entry vehicle tolls (parking)
Aircraft parking charge (up to 5 hours)	Food & beverage outlets, merchandising, duty free
Aircraft layover charge (5 hours or more)	Advertising
Firefighting facility charge	Rent for offices, etc.
Follow-me car charge	Others
Fixed boarding bridge charge	
Others	

[Source] SAPI Study Team Survey

- Non-aeronautical revenue at the Airport comprises airport entry vehicle tolls, proceeds from food and beverage, retailing and duty-free sales, advertising and rental charges for offices, etc.
- EAC has no authority to change the tariff system of aeronautical revenues as such authority has rest with the government. As the air transport demand is expected to grow, the aeronautical revenue is also expected to increase, however, within the framework of tariff system the Government approved.
- It is important to ensure a source of revenue that is relatively unaffected by demand for air transport in order to sustain stable operations and management of the airport. More precisely, proactive expansion of non-aeronautical revenue is essential.

5.5.2. Non-aeronautical Businesses at Present

1) Airport Entry Vehicle Tolls

As mentioned in 5.3 above, tolls are imposed on vehicles entering the airport depending upon the category of vehicle.

2) Food & Beverage, Merchandise and Duty-free Concessions at Present

The following table shows food and beverage, merchandise and duty-free concessions at being operated at Borg El Arab International Airport at present.

Table 5.5-2 Food & Beverage, Merchandise and Duty-free Concessions at Present

	Business Type	Place		Remarks
1	Cafe	Ground floor	Landside	
2	Cafe	Ground floor	Landside	
3	Cafe	Ground floor	Landside	
4	Cafe	1st floor	Landside	
5	Restaurant	2nd floor	Departures gate area	Closed but opening preparations underway
6	Cafe	2nd floor	Departures gate area	
7	Cafe	2nd floor	Departures gate area	
8	Cafe	2nd floor	Departures gate area	Closed
9	Cafe	2nd floor	Departures gate area	Closed
10	Cafe	2nd floor	Departures gate area	Closed Shared with domestic area
11	Duty free shops	2nd floor	Departures gate area	
12	Duty free shops	Ground floor	Baggage claim area	Arrivals duty-free shops
13	Pharmacy		Public area	Scheduled to open (No details available)

[Source] SAPI Study Team Survey

There are six food and beverage outlets operating at present and two duty-free shops—one in the departures lobby (using two shop spaces) and the other in the arrival baggage claims area. There are no merchandise stores.

Most of the concessions are cafes with no merchandise shops. The number of closed shops is striking.

All the cafes and restaurants belong to an Egypt Air subsidiary (Egypt Air Catering Service) and the duty-free shops are operated by one duty free operating company “Dufry”.

In a conversation with a manager of a duty-free shop, the Study Team was informed that they would like Egypt Air to be transferred from Alexandria-Nozha International Airport because that would mean more passengers. It has been also informed that the company would welcome more competition as it would encourage them to offer better products and services.

There is no detailed information on the method of selecting tenants since no data was made

available. However, according to staff, tenders are invited by EAC head office, successful tenders are selected and contracts are concluded. Sales, etc. are also managed by the finance department in EAC head office.

a) Operational Issues

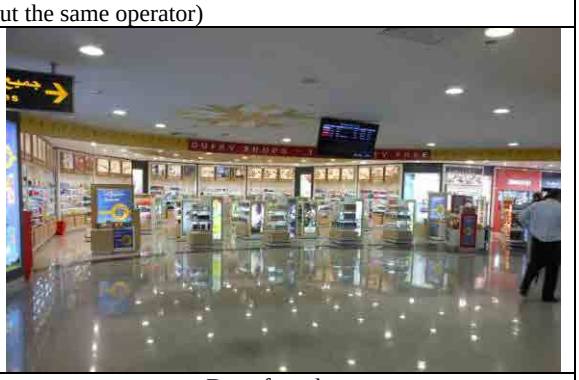
- The cafes and restaurants differ to one another but are all operated by the same company in a situation that is close to a monopoly. Consequently, it is difficult for the principle of competition to work and this could lead to problems with efficiency and service quality, etc.
- Dufry also has a monopoly on the duty free shops and this could work against the principle of competition.
- Furthermore, the shop hours are around the clock but in fact, they are able to close at their own discretion. However, in reality, none of the shops that are now operating closes.
- No details of the commercial provisions have been made available to the Study Team. However, it is envisaged that a concession fee should be payable by operators of duty free shops and food & beverage outlets, merchandising. It includes both sales-based commission fees and rental fee for space.

b) Possible Strategies for the Future

- In order to present more attractive retail facilities, the monopolies should be abandoned and at least two companies should be in operation to compete each other in terms of the service quality and product line up.
- It is also important to eliminate any tendency towards certain types of business and to respond more to the diversified passenger needs. With the exception of one restaurant, all of the food and beverage outlets are cafes. There is not one merchandise store where passengers can buy souvenirs. At Hurghada International Airport, for example, an area resembling an Egyptian market has been set up which offers a great selection of souvenirs.
- It is important for the officer in charge at Borg El Arab International Airport to liaise more closely with shop operators. At most of the leading airports around the world, tenants have banded together to form councils which exchange information at regular basis with airport operators. This enables the airport operator to understand the problems encountered by the tenants and is also useful for introducing improvements to retail areas.
- Full use of customer satisfaction surveys and feedback boxes at the airport to collect information on opinions concerning tenants and customer needs can be one method that will result in producing a more attractive retail area.

Cafes (Different shops but the same operator)

Closed restaurants



Duty-free shops

Figure 5.5-1 Shops at Borg El Arab International Airport

3) Advertising

Advertising is one of the main pillars of non-aeronautical revenue along with shop rental.

There are a lot of spaces ideal for surface advertisements but almost none are under contact and they are filled with tourism pictures.

Like the concession contracts, contracting is done by EAC head office but it seems that no detailed information is conveyed to the department in charge of advertising at the airport.

The department provides EAC head office with information on available media. The Study Team recommends that some further improvements are needed to increase advertising revenue.

Figure 5.5-2 Advertising under Contract (Right) and Vacant Space (Left)

4) Rents for Offices, etc. at Present

Offices are rented to airlines and airport businesses and this becomes revenue. No details are available because data were not disclosed. However, the rental of offices is contracted by EAC head office, therefore, we assume that head office also oversees the tenant selection method and revenue details.

In addition to the offices, there are ten counters for car hire companies and local hotels in the arrival lobby on the 1st floor; and 4 bank counters for inbound visas located before passport control.

Figure 5.5-3 Hotel and Hire Car Counters

5.5.3. Present Contracts (Concessions, Advertising, Office Rental)

All contracts are handled by EAC head office. The Study Team made inquiries concerning the contract formats and turnover, etc. but such information was not disclosed. Consequently, we have no detailed information.

With regard to advertising and concessions, it seems that a general tender is announced by EAC head office and successful tenderer is selected through that process.

1) Operational Issues

Because the contracts are handled by EAC head office, the department in charge of concessions at the airport is not familiar with the contract formats for each shop. There is even a prescribed procedure concerning turnover to be delivered to EAC head office. The procedure prescribed seems to very much complicated and time-consuming, and therefore it is difficult for the airport department to gain information on current conditions in a timely manner and renders it impossible to consider strategies for improving turnover.

2) Possible Strategies for the Future

Even if EAC head office continues to keep majority of authorities to handle any contracts,

some authority should be transferred to the Airport as incentive so that more productive business environment can be created at each of the airports, thus enabling expansion of the non-aeronautical revenue.

First and foremost, EAC head office and the airport should continually share information on monthly turnover figures, customer numbers and value of purchases per passenger, etc. This will enable staff at the airport to be conscious of goals in their work. With close communication between EAC head office and the airport departments, they should be able to work together to produce schemes for improvement.

5.6. Airport Marketing Activity at Borg El Arab International Airport

5.6.1. Current condition

EAC head office is responsible for all marketing activities for Borg El Arab and all other airports under EAC to ensure efficient commercial activities.

Airport Sales for airlines

Airport sales is under responsibility of the Commercial department in EAC head office.

The main activities for airport sales generally are that EAC head office attend conferences worldwide or regionally, such as "Routes Development Forum", which provides airports with opportunities to promote its airports and be able to negotiate with many airlines at once to expand its routes network.

For their marketing activities, there are brochures, DVD and so on to promote airports.

It seems that there are strategic airport marketing plan, for EAC's regional airports, such as Sharm El Sheikh and Hurghada, which includes incentive plan for airlines to launch new routes.

However, at the moment, such incentive plans are not applied to Borg El Arab International Airport since the number of passengers in Alexandria region is almost reaching its capacity.

Airport Marketing for non-aeronautical activities

As mentioned before, all the contracts, such as concessions and office rental are handled by EAC head office. So the marketing activities cannot be controlled by the airport itself.

5.6.2. Current issues to be addressed and possible strategy for the future.

Individual marketing plan for each airport should be considered.

As the marketing activities are done by EAC head office, most of activities seem to be applied equally to all airports managed by EAC. However, as there are different characteristics among the airports managed by EAC, individual marketing plan for each airport based on each airport's specialty should be introduced. For example, as mentioned before, there are difference between Sharm el-Sheikh, Hurghada and Borg El Arab International Airports in terms of characteristics of passengers, type of flights, and so on. Characteristics of industries for surrounding area of each airport or cities also differ from each other. Those differences should be taken into account carefully to make more effective marketing plan.

In addition, because airlines' strategy is different from airport to airport, each airport should consider each airline's perspective. For example, the needs of LCC and legacy airlines are different from each other.

Furthermore, marketing airport individually will create more responsible mind for each airport, and encourage each airport's autonomy. Creating a sense of ownership of the airport by each member of staff is one of the most important factors for pursuing further development of the airport.

Create more awareness for airport marketing by airport staff.

Because EAC head office deals with all marketing activities for the airport, detailed information about the marketing do not seem to be shared with staff at the airport. This will lead to loss of airport staff initiative and create lack of interest to improve their airports.

Sometimes staff working at the airport would find different idea and thoughts, which could be very important for the airport. It is important to give staff initiative and independence of mind.

Therefore, airport staff should be given the situation for marketing of the airport, which make airport staff aware more about the airport from the management point of view.

5.7. Management of Borg El Arab International Airport

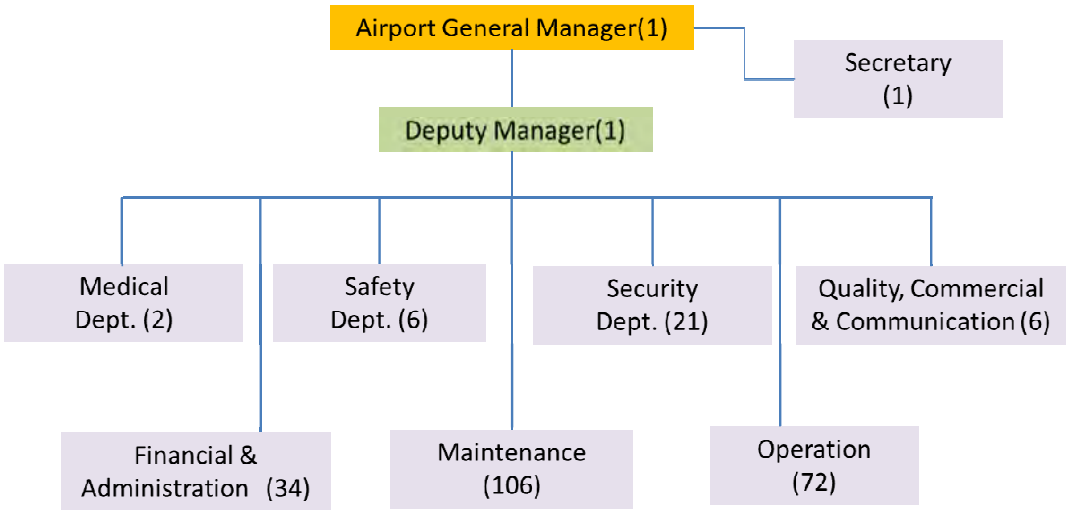
5.7.1. Current Organizational Structure of Borg El Arab International Airport

The operation of an airport requires a diverse range of management skills much like managing a city. These include facility maintenance and management, aviation security, airport security, airport operations, financial management, passenger service, communicating with local communities and environmental conservation, etc. Should any of these fall short, it becomes impossible to maximize facility functions and operations and sustain a smooth, successful airport operation. An organization format that is compatible with the circumstances of the airport, and the deployment of personnel and development of human resources are important in order to maximize the roles and functions of each of these.

1) Organization

Organization

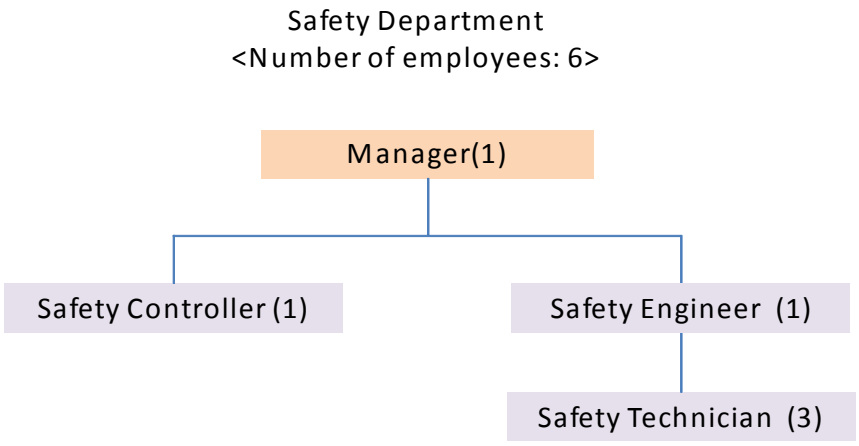
- ✓ The organization of Borg El Arab International Airport is structured in accordance with the stipulations of EAC head office. Please refer to the figure below for the organization chart. Figures in parentheses show the number of staff.
- ✓ Currently, there are 250 personnel at Borg El Arab International Airport. Approximately 42% are maintenance staff and about 30% are operations staff.
- ✓ According to interviews with EAC staff, the Study Team learned that the actual staff numbers in individual sections are sometimes not necessarily the same as the figures quoted in the organization chart. This is because the organization chart shows the number of staff under contract but, although they are employed in a particular section under the contract terms with EAC, some actually work in different departments. For example, a person employed in customer services is now working in Quality Control. In addition, some are working in another section temporarily because their section is still being established. It appears that transfers are ultimately decided by the airport director.



2) Analysis of Organizations at Present

Safety Department

- ✓ The Safety Department comprises six staff: Air traffic controllers responsible for aviation safety, and engineers and technicians responsible for the maintenance and management of facilities that are essential to safety.
- ✓ However, in interviews the Study Team learned that the work is being done by three people: a manager, a controller and an engineer.



Main Activities

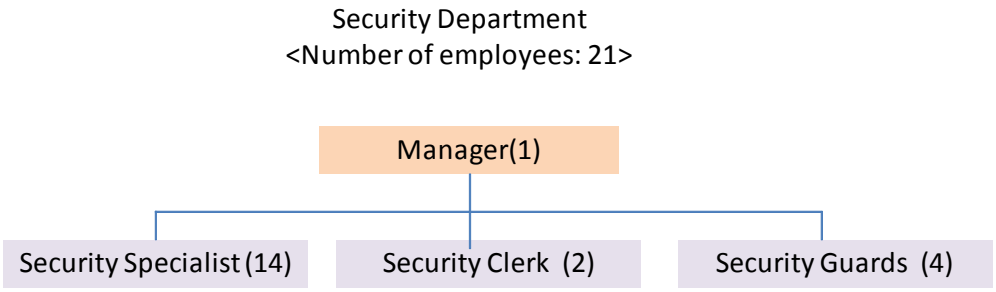
- ✓ The department is involved in the introduction of the Airport Safety Management System (SMS) and the supervision of compliance with the system.
- ✓ It oversees the maintenance of the runway, taxiway and apron areas to ensure airside safety.
- ✓ The department controls access inside the terminal by airport staff and passengers, oversees access to public areas and also restricted areas where only passengers and designated employees can enter, and also oversees facilities associated with access control, such as CCTV cameras.
- ✓ Familiarization of airport staff with the importance of safety
- ✓ Because safety is closely related to terminal and apron operations, this is done in conjunction with the Operation Department.

Possible Strategies for the Future

- ✓ Safety is one of the most important items in airport operations. The activities that come under the provisions of SMS, etc. are extremely far reaching, covering areas as wide apart as terminal safety and airside safety. It must be difficult for only three people to provide all of this work.
- ✓ Admittedly, this work is being done with the cooperation of the Operation Department but there are limits to this since department staff are not safety experts.
- ✓ Given the probability of further increases in flights and passengers, safety will become increasingly important. Therefore, it will be important to increase the number of safety officers, assign safety specialists to operations and maintenance and provide a stronger footing to safety activities in the landside, terminal and airside areas as well as the maintenance and management activities of the facilities.

Security Department

- ✓ The Security Department has 21 staff in its organization.
- ✓ The night shift consists of male staff only. As the information on this matter provided to the Study Team was very limited, a comprehensive analysis could not be conducted.



Main Activities

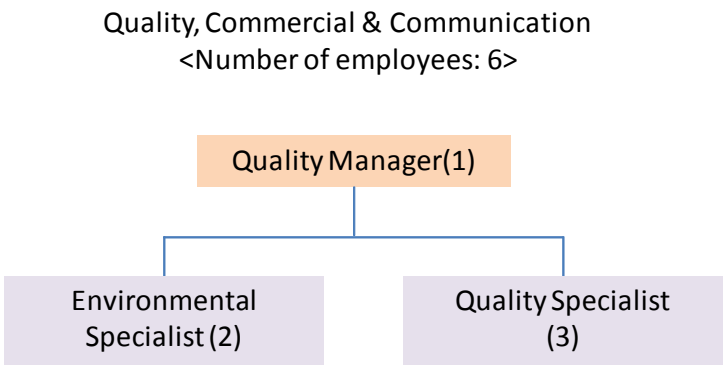
- ✓ To maintain safety in airport operations, security must be practiced throughout the airport, including the passenger terminals, car parks, curbside areas in front of the terminals, entrances to the airport and the airport perimeter.
- ✓ The figure above shows the structure of the Security Department. The tasks assigned to the Security Department are done in conjunction with the Operation Department. The close correlation with terminal and apron operations is necessary for safe and efficient airport operation.

Possible Strategies for the Future

- ✓ The activities of the Security Department assist in airport safety, the cornerstone of airport operations.
- ✓ It can be assumed that it already works closely with the Operation Department in relation to operations. Therefore, the Study Team assumes that at some point in the future, the organization will become part of the Operation Department, its role will be more clearly defined and, as a result, it can be expected that more effective activities and greater improvements will be acchieved in security.

Quality, Commercial & Communication

- ✓ The Quality, Commercial & Communication Department has a total of six personnel, including 1 manager, 3 quality officers, and 2 environmental specialists.
- ✓ It operates around the clock in two shifts, 8:00 am to 8:00 pm and 8:00 pm to 8:00 am. The night shift consists of male staff only.
- ✓ Despite the name, Quality, Commercial and Communication, at Borg El Arab, the environmental specialists belong to this department.



Main Activities

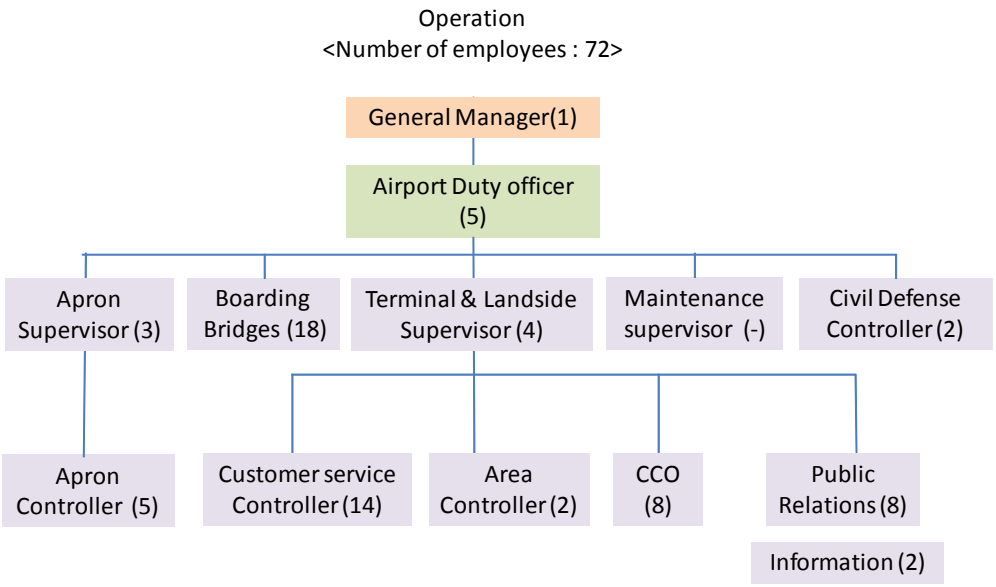
- ✓ The main quality activity is to gather and analyze customer feedback to identify the airport's strengths and weaknesses. Ultimately, it supports the creation of an airport that meets customers' expectations.
- ✓ The department carries out daily on-site inspections, promptly notifies the relevant department if it discovers a problem, and provides instructions or assistance for remedial action.
- ✓ The main activity of the environmental specialists is to maintain order in the terminals and the airport. For example, supervising the cleaning in the terminal comes under this heading. It also works in conjunction with the Safety Department in maintaining order on the airside.

Possible Strategies for the Future

- ✓ As shown in Chapter 5.6.1 - 1), this section is directly under the control of the airport director at present. In maintaining quality, it is essential to look at the quality related to the activities of all of the departments at the airport in an impartial manner. Therefore, it would be preferable to retain the present organizational format.
- ✓ However, the Study Team assumes that it would be better to have a more detailed demarcation of responsibilities in the section based on the type of quality under control. If there was a clear definition of responsibility, for example: operations quality, security quality, customer service quality, etc., goals would be much clearer. This would help produce more effective quality.

Operation Department

- ✓ There are 72 personnel in this organization, which is the seat of operations at Borg El Arab International Airport.
- ✓ The department works around the clock. The shifts are 8:00 am to 8:00 pm and 8:00 pm to 8:00 am. The night shift consists of male staff only.



Main Activities

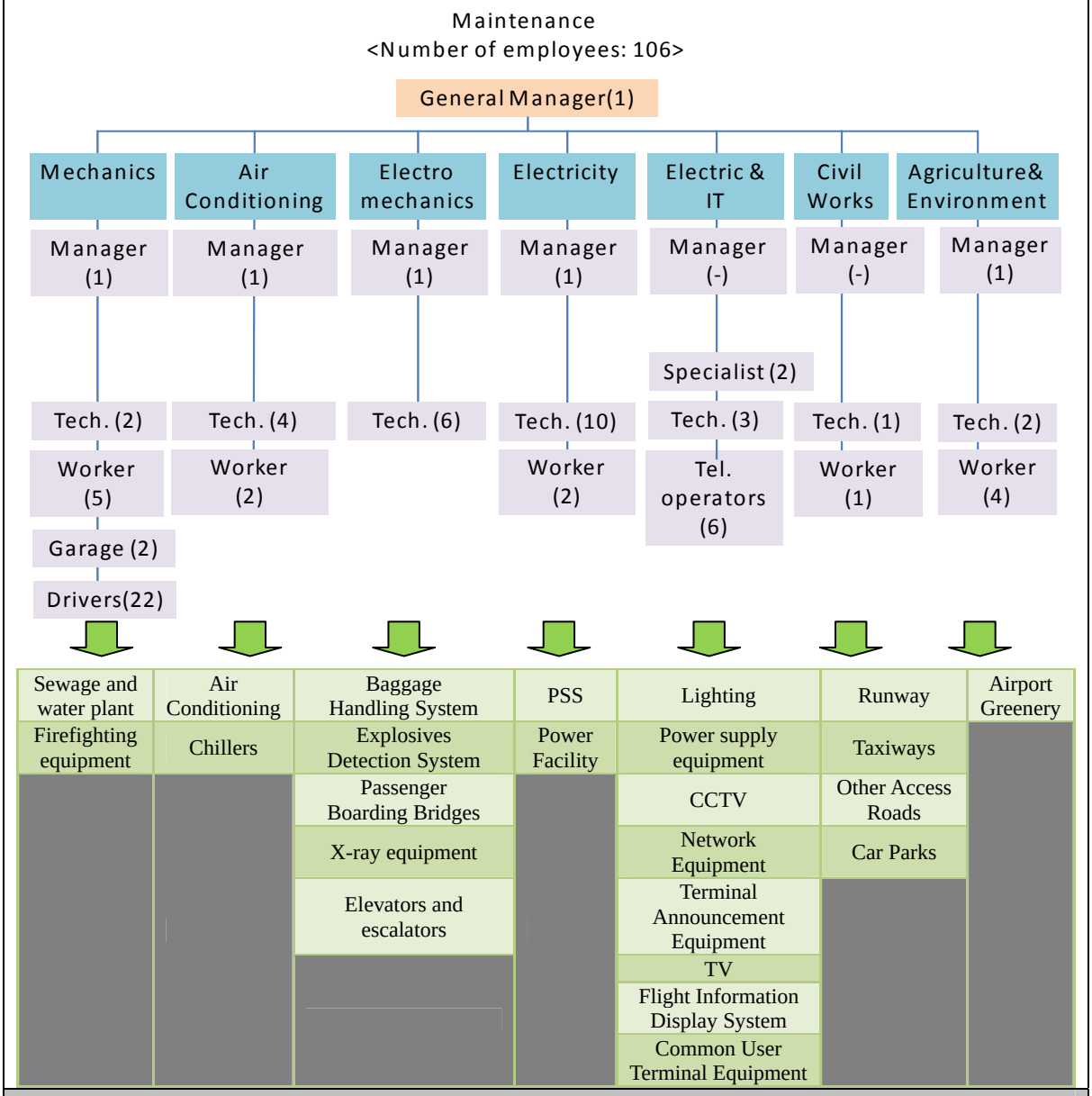
- ✓ The following activities are carried out under the control of the airport duty officer who supervises daily operations:
  1) Customer information, terminal announcements, call center, VIP lounge and other customer service operations;
  2) Management of apron operations, inspection and reporting of apron and runway conditions;
  3) Area control activities in charge of maintaining order in the terminals and car parks and the management of cart retrieval, etc;
  4) Aircraft stand assignment, check-in counter assignment;
  5) Operation of boarding bridges; and
  6) Providing daily operations status reports to staff in the role of operations leader and sharing information.
- ✓ It has overall control of terminal, runway, taxiway and apron operations and landside security and safety. On safety aspects it works in conjunction with the Safety Department and the Security Department and on matters related to maintenance in the event of a facility malfunction, it works with the Maintenance Department.
- ✓ It also helps to maintain smooth operations by exchanging information with the airlines and other related organizations.

Possible Strategies for the Future

- ✓ In reality, the airport duty officer takes command in the work place. More airport duty officers will be needed with future terminal expansion and the construction of Terminal 2. Experience in operations is important to be able to command in the work place. Experience cannot be acquired overnight and, therefore, staff now working under the airport duty officer will need to be promoted. Providing a system to develop the expertise of these individuals with an eye to the future would improve the quality of the Operation Department and lead to greater quality in operations.

Maintenance Department

✓ There are 106 personnel in this organization divided into individual specialist fields. Each field has a manager and personnel with specialist technological knowledge.



Main Activities

✓ The department repairs, maintains and manages each facility and piece of equipment.

✓ Personnel responsible for maintaining and managing the greenery in the Agriculture and Environment department are also in the Maintenance Department.

Possible Strategies for the Future

✓ Because of the clear definition of specialist fields, responsibilities are clear and the work is easy to undertake.

✓ It is important to continue developing the department's human resources through training to further enhance the quality of facility repairs, maintenance and management.

✓ It is important to work in conjunction with the Operation Department in particular to be aware how their repairs, maintenance and management reflect on operations.

5.7.2. Observations Concerning the Approach to the Future by All Organizations

1) Accurate Understanding of Personnel Numbers and Assignment System

It will be important to look at the personnel requirements for an increase in flights resulting from greater demand. To achieve this, it is also important to have an accurate understanding of how many employees are actually working in each section.

2) More Extensive Links in the Inter Organization Cooperative Framework

The present organization remains the same as when it was put together by EAC headquarters and staff carries out their work on the basis of individual responsibilities. However, as mentioned previously, the operation of an airport requires a diverse array of activities. Therefore, although it is important to have responsibilities for individual organizations and for those to be discharged as deemed appropriate, working together with other organizations at the same time makes it possible to achieve safer and more efficient airport operations.

For example, the quality of operations and efficiency are closely related to safety, security and the maintenance and management of facilities. Therefore, it may be desirable for those sections to be placed under the Operation Department and to create close links.

3) Continued Human Resources Development

Many of the staff at Borg El Arab International Airport was recruited when it opened. It has been only 10 months since then and they are still not experienced. Therefore, it would be advantageous to continue with human resources development, including training on the job and off.

4) Structuring of Shift Systems to Suit Work Place Conditions

It is reported that shift workers and systems are, in principle, the same number of workers on both day and night shifts. However, airports have peak and off-peak times and under the present circumstances, there is no difference in the number of shift workers during those two time periods. This is not efficient.

It is recommended that, for example, a more detailed shift system with an efficient rationalization of staff numbers on duty depending on flight schedules and peak operating seasons.

5.8. Existing Assistance by Narita International Airport

Borg El Arab International Airport has received the assistance of Narita International Airport Corporation (NAA) in airport management for 2 and half years since new facility construction stage in 2009. The Airport has been assisted in airport operation and management by the specialists from NAA and worked on preparation and proficiency before and after the opening of newly developed airport facilities. Moreover, the Airport dispatched about 100 staff to Japan, and NAA provided the training opportunities on airport operation and management of global standards at Narita International Airport.

The results for these airport assistances are reviewed as followings.

5.8.1. Assistance Items and Implementation

Specialists in each of the areas crucial to airport operation and management such as Airport Management, Airport Facilities Management, Airport Facilities Management (Civil Works) Airport Facilities Management (Equipment), and Airport Operation Management, were sent from NAA to Borg El Arab International Airport and training program for EAC staff was conducted in Japan. The assistance of NAA covered various aspects of airport operation and management. Most of the assistance offered was in the area of fundamental knowledge and operational skills because almost all of the staff were hired when the new terminal was commissioned.

The following are the main items of assistance provided.

1. Assistance with Start-up Preparations before the Opening of the New Terminal

✓ Many items needed to be undertaken before startup to ensure trouble free, smooth opening of the new airport (Terminal). Working groups (WG) were established for individual fields (organizations) consisting of EAC staff from the respective fields and assistance was provided on necessary items in preparation for the startup.

2. Assistance with Maintenance and Management of Runways Taxiways and Other Primary Airport Facilities As Well As Mechanical Facilities (BHS,EDS,PBB, elevators and escalators, etc.).

✓ Assistance was provided for the preparation and use of maintenance and management manuals, daily and scheduled maintenance practices, and quality improvement.

3. Assistance was provided with aviation and airport security through preparation of manuals etc.

✓ Assistance was provided in relation to the importance of passenger security screening and screening procedures etc.

✓ Issues and suggested improvements on site in relation to the management of apron area security were advised.

- ✓ Assistance was provided for the preparation of manuals for airport security.
- ✓ Suggestions were offered on preparations to conduct aircraft disaster rescue drills.

4. Assistance with Passenger Service Improvements

- ✓ Specialists provided lectures on the pursuit of customer satisfaction and the importance of customer services, and assisted in improving staff knowledge.
- ✓ Advice was given on frontline customer relations and assistance provided on creating an airport with a high level of satisfaction.

5. Assistance with Day-To-Day Operations

- ✓ Specialists offered advice on gate assignment plans in relation to aircraft operations and provided assistance with the management of check-in counters and other terminal facilities.

6. Staff Training Courses at Narita International Airport

- ✓ Nine courses comprising 90 airport staff have been held at Narita International Airport to date to assist EAC with capability development in airport staff.
- ✓ The courses comprise lectures on fundamental aviation and airport management knowledge such as airport security, airport safety, and customer services. The courses also consist of inspection tours of facility maintenance and management and customer service job site
- ✓ As mentioned above, most of the staff were recruited when the new terminal was commissioned and, therefore, they had little experience and knowledge of the aviation and airport industries. In addition, each course comprised 10 participants, and the teams were rather mixed since the departments were able to appoint several participants each. This is why the courses mainly consist of lectures on fundamental aviation and airport management, and facilities tours which allow the participants to see on-site activities.


Classroom Lecture


On-site Lecture


Airport Facility Inspection


Training on Customer Service

Figure 5.8-1 EAC Airport Staff Training in Japan

5.8.2. Effect of Assistance Project

It is not possible to quantitatively express the results of assistance with service aspects such as airport operations, maintenance and management and customer services but, through analysis, the following points appeared to have been particularly positive.

1. Improvements in Staff Knowledge of Airport Operations

✓ Many of the staff at Borg El Arab International Airport were recruited right before the opening of the new terminal and had little fundamental knowledge of airport management. However, they were able to acquire the essential basic knowledge in airport operation and management through the assistance provided at Borg El Arab International Airport and the courses at Narita International Airport. This could be attributed to the system of providing comprehensive assistance with all airport operations and management. That is to say, it was the integrated management assistance in particular, which provided the knowledge and skills that needed to be acquired by all staff while simultaneously improving the knowledge and skills in the individual specialist fields. This made it possible to improve airport operations skills overall in a more organized and effective way.

2. Smooth Startup and Trouble-Free Airport Operation

✓ Although there were several problems with facility maintenance and management, the smooth startup could be attributed to the assistance provided with advance preparations for operations and other essential items when the new terminal opened.

3. Airport Staff Motivation Improvement

✓ Staff motivation was improved by being able to come into direct contact with advanced airport operations through the courses at Narita International Airport. For example, following the courses, staff were observed cleaning up themselves, something they had not done before, and using their experience in the courses to deal with customers with more care. There has also been a change in staff thinking concerning the importance of aviation security and facility maintenance and management. Not only was there a greater feeling that many of the staff were proud of Borg El Arab International Airport, they expressed that sentiment in their work on site and got better each day.

4. Understanding the Japanese way of Airport Operation and Management

✓ Direct exposure to Japanese culture as well as a course in airport management, enables the individual to offer the high quality airport management elements that are unique to Japan through such as passenger services conceived from the customer's perspective, greater care in daily maintenance and management to prevent trouble beforehand, and the recognition of the need for improvements in the pursuit of offering the best at all times.

Passenger Assistance at Immigration Counter

Guidance at Information Counter

Figure 5.8-2 Customer Care by EAC Airport Staff at Borg El Arab International Airport

Chapter 6

Demand vs. Capacity Analysis

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Chapter 6. Demand vs. Capacity Analysis

6.1. Summary of Air Traffic Demand Forecast (Medium Case)

Air traffic demand forecast (of Medium Case) for the years 2015, 2020, 2025, and 2030 are summarized in Table 6.1-1.

Table 6.1-1 Summary of Air Traffic Demand Forecast for Borg El Arab International Airport

Item			SAROF	Actual (ALY+HBE)	Forecast Air Traffic Demand			
			for 2014	2010	2015	2020	2025	2030
Passenger Movements	1)	Annual Passengers	991,000	1,681,983	2,357,758	3,610,715	4,754,833	5,941,699
		1.1) International	839,400	1,593,782	2,251,054	3,449,723	4,528,945	5,654,166
		1.2) Domestic	151,600	88,201	106,704	160,992	225,888	287,533
	2)	Peak-day (2-way)	*3,980*	5,872	8,237	12,615	16,608	20,752
		2.1) International	*3,370*	5,592	7,898	12,104	15,891	19,839
		2.2) Domestic	*610*	280	339	511	717	913
	3)	Peak-hour (2-way)	567	659	862	1,203	1,508	1,831
		3.1) International	546	573	758	1,076	1,364	1,665
		3.2) Domestic	223	86	104	127	144	166
	4)	Peak-hour (1-way)	500	452	572	761	927	1,104
		4.1) International	*355*	377	481	653	809	971
		4.2) Domestic	*145*	75	91	108	118	133
Aircraft Movements	5)	Annual Flights	9,101	17,260	22,074	32,997	42,988	52,975
		5.1) International	7,614	15,264	20,202	30,501	39,452	48,527
		5.2) Domestic	1,487	1,863	1,872	2,496	3,536	4,488
	6)	Peak-day (2-way)	36	57	73	110	143	175
		6.1) International	30	51	67	102	132	162
		6.2) Domestic	6	6	6	8	11	13
	7)	Peak-hour (2-way)	9.3	7	8.2	11.1	13.5	16.0
		7.1) International	4.8	5.2	6.4	9.1	11.3	13.6
		7.2) Domestic	3.5	1.8	1.8	2.0	2.2	2.4
	8)	Peak-hour (1-way)		5.0	5.7	7.2	8.5	9.8
		8.1) International	*3.1*	3.4	4.1	5.5	6.7	7.9
		8.2) Domestic	*2.3*	1.6	1.6	1.7	1.8	1.9

In the SAPROF study, annual passenger demand for the year 2014 was forecasted at approximately 1 million. During the time of SAPROF study, even the then annual passenger volume was some 0.4 million, numbers of passengers were heavily concentrated in summer time (July and August) because Alexandria was likely nominated only as a resort city of relatively cooler than Cairo, where many Egyptians temporarily enjoyed their summer vacation along Mediterranean coast. Therefore, passengers' concentration in a

month (August) and on the day (Wednesday evening) was extremely high.

It is a normal practice that individual airport facility requirements are planned not based on the number of annual passengers but on the peak-hour passengers' volume. The facilities at Borg El Arab International Airport were supposedly so planned in consideration of such heavy concentration.

As air traffic increased, such originally assumed heavy concentration of passengers particularly at Alexandria-Nozha International Airport has gradually been evenly distributed through the year and through the day.

Meanwhile, actual number of annual passengers recorded in 2010 was 1,681,983, exceeding the nominal terminal capacity (1 million passengers per annum).

At a glance, the above Table implies that:

- ✓ The item 4) above, i.e. peak-hour (1-way) passengers, of SAROF study (forecasted at 500 for the year 2014) would fall between 2010 (452) and 2015 (572), although the number of annual passengers forecasted between 2010 and 2015 was estimated at around 2 million.
- ✓ Peak-day concentration of international passengers of the latest trend that Study Team analyzed in the foregoing Chapter 4 is 1/285 days of the yearly volumes while that originally assumed was 1/250 days.
- ✓ Peak-hour passenger concentration ratio assessed from the latest trend is approximately 9 % of the daily volume, while originally assumed in SAROF study was some 14 %.
- ✓ Such release of heavy concentration of airport passengers is just a normal trend when number of passenger is more than doubled.

Hence, it should be noted first in this Chapter 6 that, the airport could theoretically handle all the number of passengers currently being distributed to the 2 Alexandria's airports (at Alexandria-Nozha and Borg El Arab), i.e. 1.7 million passengers per annum.

6.2. Facility Requirements

Facility requirements had been originally established through the SAROF study.

Based on the same annual passenger volumes (i.e. 991,000) of the SAPROF study, the facility requirements were reviewed through the course of detailed design in 2006, which was conducted before the Bidding for the construction contract.

Major passenger processing facilities planned at SAPROF study, at detailed design stage and those actually constructed are summarized in Table 6.2-1.

Table 6.2-1 Major Airport Facilities previously planned and As-constructed

Description		2004 SAPROF study		2006 DD	As- constructed
1	Annual Passengers	991,000			
	1.1) International	839,400			
	1.2) Domestic	151,600			
A	Passenger Terminal	Total	20,840 m^2	Revised to 3-story	
	A.1) International	3.1) x 30m^2	16,380 m^2	building; for combined	24,277 m^2
	A.2) Domestic	3.2) x 20m^2	4,460 m^2	Int'l & Dom	
B	Check-in Counter	Total	15	Total	20
	B.1) International (2min/pax)	3.1) x 1/ 60 min	9	4.1) x 2/ 60 min x 1.1	15
	B.2) Domestic (2min/pax)	3.1) x 1/ 60 min	6	4.2) x 2/ 60 min x 1.1	5
C	Security Check	Check points	3	Check points	3
	C.0) Entrance (12sec/pax)	2 Int'l + 1 Dom	3	4) x 12/3600 sec	2 for common
	C.1) International (12sec/pax)	3 gates	3	4.1) x 12/ 3600 sec	2
	C.2) Domestic (12sec/pax)	1 gate	1	4.2) x 12/ 3600 sec	1
D	Passport Control				
	D.1) Departure (1min/pax)	4.1) x 1/ 60 min	6	4.1) x 1/ 60 min x 1.1	8
	D.2) Arrival (1min/pax)	4.1) x 1/ 60 min	6	4.1) x 1/ 45 min x 1.1	10
E	Customs Desks (1min/pax)	75%; 1min/ pax	6	4.1) x 1/ 60 min	6
F	Baggage Claim	Total	3	Total	3
	F.1) International (30min/flight)	1 for LJ, 1 for SJ	2	1 for LJ, 1 for SJ	2
	F.2) Domestic (30min/flight)	1 for LJ,	1	1 for SJ	1
G	Apron Spot (90min/flight)		8	3 for LJ, 4 for MJ	7
				If all SJ	12
H	Departure Lounge	Total	1,846 m^2	Total	2,095 m^2
	H.1) International	40 min. dwelling	1,497 m^2	Whole lounge can be	1,690 m^2
	H.2) Domestic	40 min. dwelling	349 m^2	used for Int'l or Dom	405 m^2
I	Public Concourse		2,876	Revised to common	
	I.1) International	2 well-wishers	2,001 m^2	concourse for	2,569 m^2
	I.2) Domestic	2 well-wishers	875 m^2	combined Int'l & Dom	

In the SAROF study, the passenger terminal building was planned to be a 2-story building and the international and domestic functions were individually enclosed in the same building.

Through the course of detailed design stage, the design of passenger terminal building was revised to be a 3-story building in due consideration of the vertical segregation of departing and arriving passengers for security reason as encouraged by ICAO/IATA. Those were main reasons that caused the floor area of the building increased.

Also in the detailed design, for the sake of effective use of entire building floor, common check-in area and swing pre-departure halls were provided, so that the whole areas could flexibly be utilized either for all international or domestic operations as required to accommodate the traffic at certain time of the day. The number of check-in counters was increased to meet IATA recommendations, i.e. a revised processing time of 2 minutes per passenger, instead of 1 minute adopted in the SAPROF study.

Also, the number of arrival passport control desks was increased through the course of the detailed design because the arriving passengers would be generally more time-concentrated than the departing passengers.

Those mentioned above are some reasons among others for the change in the numbers or areas of major facilities or functions constructed.

6.3. Demand vs. Capacity Analysis

6.3.1. Theoretical Future Requirements

Theoretical future requirements for major airport facility based on Table 6.1-1 (air traffic demand forecast) are summarized in Table 6.3-1.

Table 6.3-1 Theoretical Facility Requirements for Borg El Arab International Airport

Item			As-constructed	Future Requirements			
				2015	2020	2025	2030
1)	Annual Pax	Table 6.1-1	1,681,983	2,357,758	3,610,715	4,754,833	5,941,699
A	Passenger Terminal		24,277 m^2	24,820 m^2	34,820 m^2	43,800 m^2	53,270 m^2
	A.1) International	3.1) x 30m^2		22,740 m^2	32,280 m^2	40,920 m^2	49,950 m^2
	A.2) Domestic	3.2) x 20m^2		2,080 m^2	2,540 m^2	2,880 m^2	3,320 m^2
B	Check-in Counter	4) x 2 / 60 x 1.1	20	20	28	34	41
C	Security Check						
	C.0) Entrance	4) x 12/3600 sec	2	1.9	2.5	3.1	3.7
	C.1) International	4.1) x 12/ 3600 sec	2	1.6	2.2	2.7	3.2
	C.2) Domestic	4.2) x 12/ 3600 sec	1	0.3	0.4	0.4	0.4
D	Passport Control						
	D.1) Departure	4.1) x1/60 min x 1.1	8	8.8	12.0	14.8	17.8
	D.2) Arrival	4.1) x1/60 min x 1.1	10	8.8	12.0	14.8	17.8
E	Customs Desks	4.1) x 1/60 min	6	4	5.4	6.7	8.1
F	Baggage Claim	8) x 30/60 min.	3	2.9	3.6	4.3	4.9
G	Apron Spot (for all SJ)	8) x 90/60 min +1	12	9.6	11.8	13.8	15.7
H	Runway (m)						
	Runway 14R/32L	If 8) < 8	3,400 m	3,400 m	3,400 m	3,400 m	3,400 m
	Runway 14L/32R	If 8) > 8	none	none	2,500m	2,500 m	3,400 m

The Table implies that the major airport facilities constructed during the Borg El Arab International Airport Modernization Project would theoretically cover the requirements up to the year 2015 when the number of annual passengers is 2.35 million.

There are some rooms to shorten the processing time for each function from time to time by applying the latest models of CPU, scanner, or software (e.g. for immigration, check-in counter, CUTE, etc) or improved skills of airport staff, therefore it is hoped that the above-mentioned overall terminal capacity could be somehow improved, depending upon the specific behavior of passengers at this particular airport as mentioned in Chapter 6.3.2. 1) below.

At a moment, it is expected that those major facilities would be gradually congested as illustrated in Figure 6.3-1 and Figure 6.3-2.

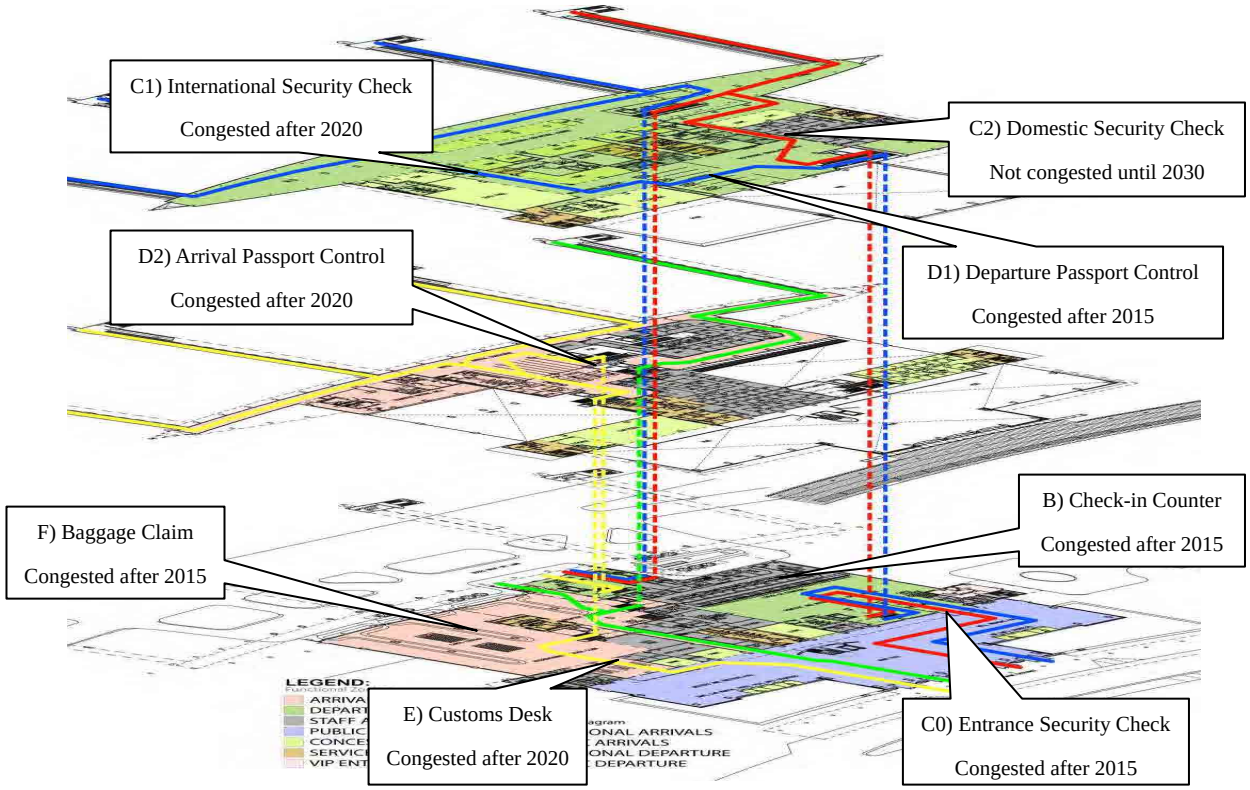

Figure 6.3-1 Years of Theoretical Congestion of Passenger Terminal Facilities

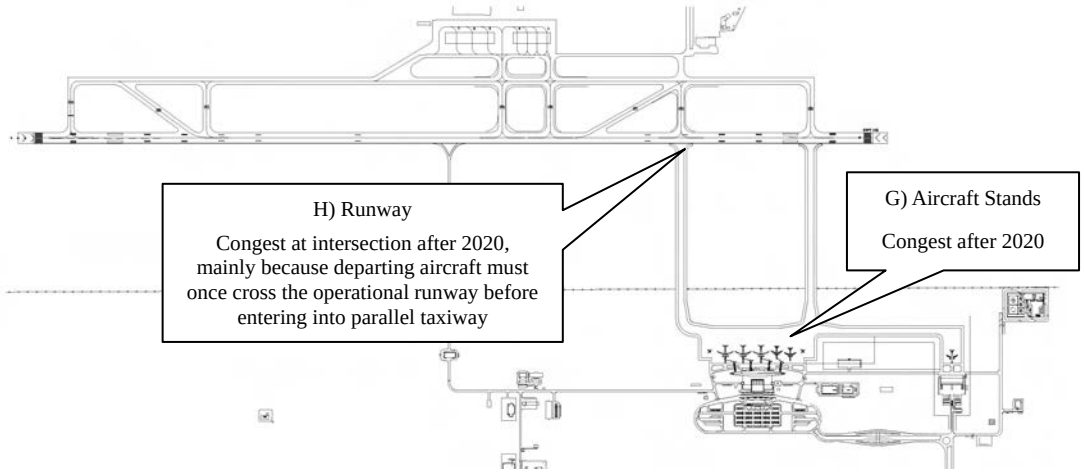

Figure 6.3-2 Years of Theoretical Congestion of Airfield Facilities

6.3.2. Specific Requirements at Borg El Arab International Airport

1) Behavior of Passengers

Main characters of passengers at Borg El Arab International Airport are overseas workers and pilgrims with family members bound for Middle-East, having many pieces of baggage with them. Percentage of well-wishers and greeters per passenger is high.

Owing to the fast growing trend of LCC industry, the cost of air travel has become much cheaper than using the legacy airlines, therefore, air passengers at Borg El Arab International

Airport currently include many Egyptian tourists who take international flights as their first experience.

As mentioned in Chapter 5, processing times for their check-in, passport controls or filling-up their immigration cards are much longer than the standard time suggested by IATA. Also, many arriving pieces of baggage are left behind in the international baggage claim hall, which is one of the serious problems encountered at the Airport.

The situation is totally different from those at Sharm El Sheikh or Hurghada International Airports where majority of the passengers are European tourists with small number of baggage although their carriers are mostly LCC. Seldom well-wisher or greeter appears in those airports.

When all flights currently operated at Alexandria-Nozha International Airport are transferred to Borg El Arab International Airport after December 2011, usage of the airport facilities at Borg El Arab will be suddenly increased. Unless such passengers' behaviors are improved or EAC staff would assist passengers to acquaint the standard processing manners and regulations of international flights, saturation of the airport facilities could be fast approaching.

2) Runway and Taxiway

ICAO suggests that a single runway is capable of accommodating jet aircraft operations of more than 40 (e.g. generally 20 landings and 20 takeoffs) in an hour where a suitable taxiway system including rapid exit taxiways of appropriate numbers and positions is provided. In case the hourly 40 operations are pursued, in-trail separation of approaching aircraft (at approaching speed of 100 to 110 knot) could be set at some 5 NM, then landing of 3-minute intervals (i.e. 20 landings in an hour) and takeoff of 3-minute intervals (i.e. 20 takeoffs in an hour) injected in-between are materialized. For reference, ICAO suggests 60 peak-hour operations at maximum for large crowded airport if the in-trail separation can be minimized to 3 NM.

One major concern that may limit the practical capacity of the present runway operations at Borg El Arab International Airport is, that the existing parallel taxiway is inconveniently located on the opposite side of the runway (in MOD premise). Since prevailing wind (95%) is from north direction, main runway operations are made from the south, i.e. Runway 32.

Consequently, great majority of departing aircraft with its heavy take-off weight (after refueled) are to start from the new PTB located at north-end of the runway, to move on the 1-km long connecting taxiway, possibly to hold for aircraft landing operations before entry to the runway, to cross over the runway, and to move on 3-km long parallel taxiway before entering into Runway 32 on the south-end.

The rapid exit taxiways are provided but towards the direction of opposite side of the new terminal, arriving aircraft could not use it because, if once exit, the aircraft is obliged to

occupy the runway once again when taxiing back towards the new terminal.

As the air traffic increases, this kind of nuisance would surely give hard burden to air traffic controller who decides the timing of the ground traffic of departing aircraft and its holding before crossing the runway, with a cross checking of the final approach and landing of arriving aircraft.

In this circumstance, operational bottleneck is departing aircraft that crosses the active single runway. Approaching aircraft should be held in the air due to the two (2) deferent activities of the departing aircraft, i.e. crossing the runway in addition to normal taking off from the runway. When 2 minutes are assumed to accomplish the individual activities, i.e. 1) to cross the runway, 2) to take-off the runway, and 3) to approach/landing/ exit the runway, then aircraft operations are made in 6-minute cycle time (i.e. 10 takeoffs, 10 landings, 10 crossing the runway, in an hour).

For the reason discussed above, it is assumed that the existing runway could accommodate 10 arrivals and 10 departures, or 20 aircraft operations in total during peak hour, as illustrated in Figure 6.2-3.

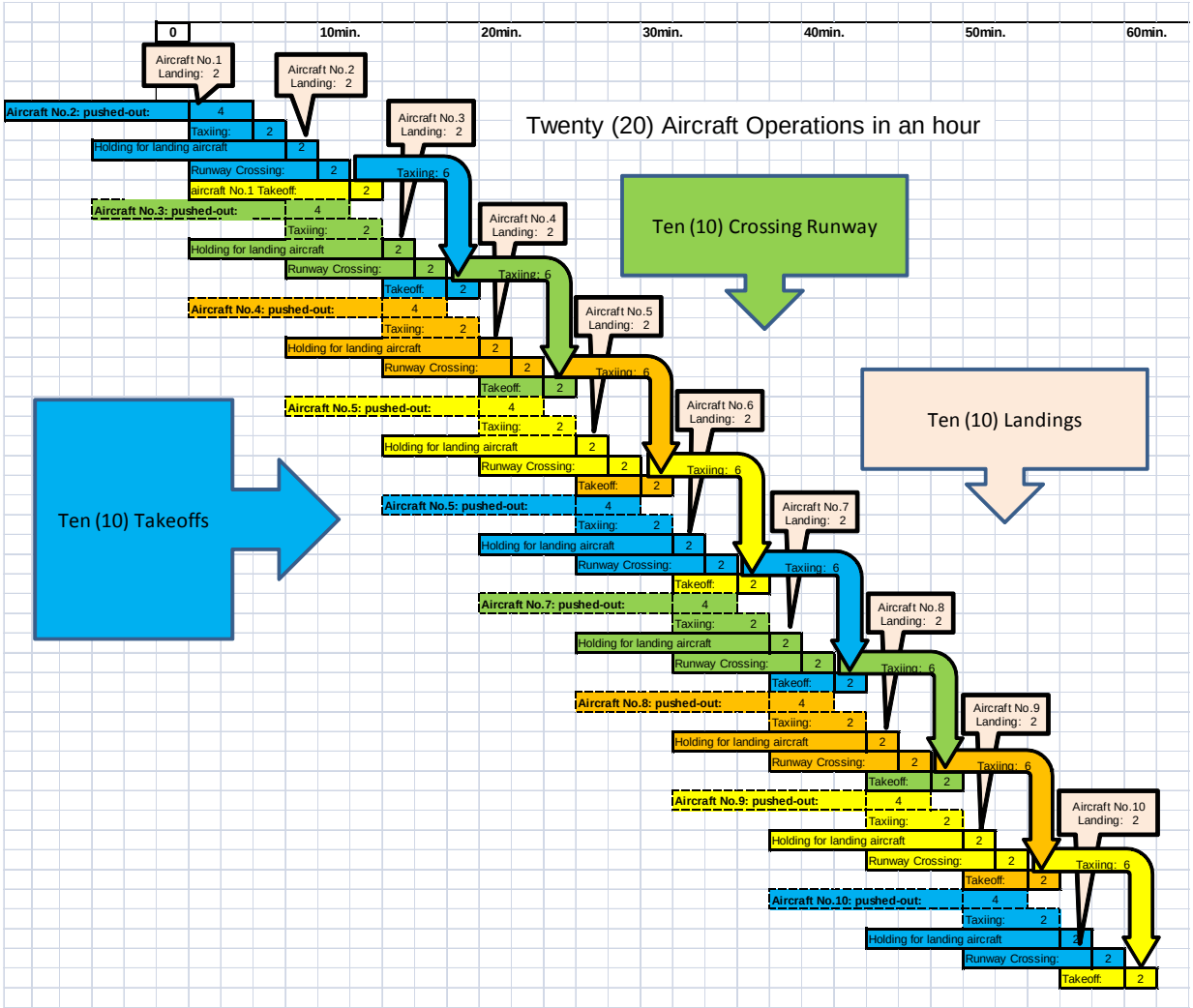

Figure 6.3-3 Simulated Aircraft Operations from Runway 32

In this connection, observation made by EAC Chairman was that the constant 2-minutes allocation particularly for landing aircraft is difficult since the existing rapid exit taxiway toward opposite direction can no longer be utilized, thus aircraft should make final approach, landing, taxiing and only exit from the right-angled connecting taxiway at 3-km ahead of touch-down point. Also, 2-minutes allocation for aircraft takeoff until its wake blast turbulence disappears before another aircraft to cross near the runway end is not realistic, although which is depending on the size of the aircraft in operations.

Therefore, it is conservatively discussed and assumed that, when departures and arrivals are made on the continuously-staggered basis, doable operations could be made probably at 80 % of the above-mentioned peak-hour capacity (with 6-minutes cycle time), namely, 8 departures and 8 arrivals.

As given in Table 6.1-1, the number of peak-hour one-way aircraft movements (departures or arrivals) at Borg El Arab International Airport is forecasted at 7.2 in 2020 (or 9.8 in 2030). By the time the second runway is desirable to be constructed.

In the past, the runways at the two (2) Alexandria Airports (Alexandria-Nozha and Borg El Arab) were alternately closed for maintenance and rehabilitation, during the time all flight operations of the one closed have transferred to the other airport and vice versa, as if maintenance of the two (2) runways is made synchronically.

Currently, EAC is imposed a limited ownership of the runway being used jointly with MOD. From January 2012, Alexandria-Nozha International Airport is closed for more than a year for the purpose of substantial repair and rehabilitation of the swampy runway. It was reported by EAC that once all commercial flights are moved to Borg El Arab International Airport this time, they would no longer come back to be operated at Alexandria-Nozha International Airport. In case of emergency or accident that might happen on the single runway at Borg El Arab International Airport there is no alternate runway to land in Alexandria region.

One solution to instantly double the runway capacity at Borg El Arab International Airport is to build another parallel taxiway between the runway and the new terminal, so that departing aircraft is no longer necessary to cross the runway as shown in Figure 6.3-4.

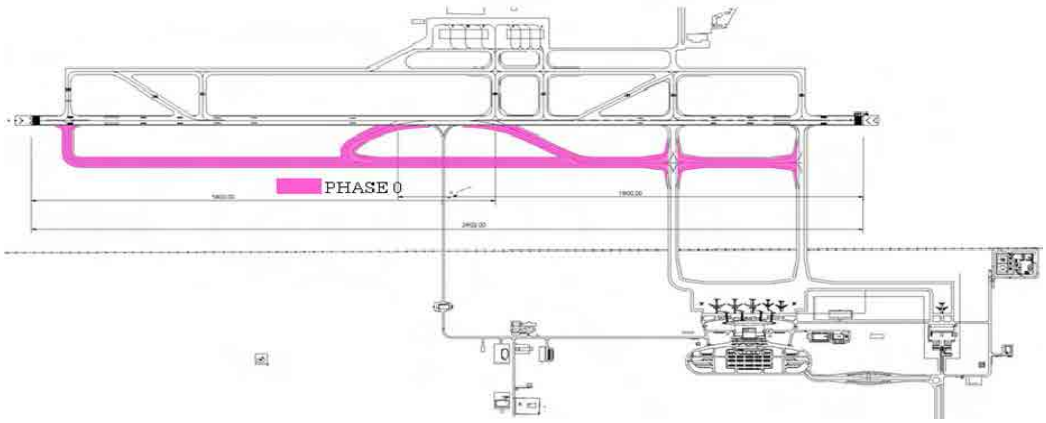

Figure 6.3-4 Possible Parallel Taxiway on the Side of New Terminal

However, construction of the parallel taxiway in the MOD premises depends upon the decision from Higher Authorities, and this cannot solve the potential deficiency that there would be no alternate runway at Alexandria region once Alexandria-Nozha International Airport is totally closed.

6.4. Future Strategy for Maximum Utilization of Existing Facilities

6.4.1. General

Major facilities at Borg El Arab International Airport completed in 2010 had been designed based on the analyses previously conducted during SAPROF Study (in 2004) in consideration of the then socio-economic background and projected air traffic demand. The completed facilities were aimed to meet the demand of 1 million passengers per annum previously forecasted for the year 2014.

Meanwhile, air traffic demand in Alexandria region has rapidly increased due to unexpected growth of economy in Middle-East countries and expansion of LCC industry which could not be predicted before. In 2010, the total numbers of air passengers recorded in the two (2) Alexandria airports (Alexandria-Nozha and Borg El Arab) have reached 1.68 million even before the completion of new facilities at Borg El Arab International Airport.

Because the heavy concentration of passengers in Alexandria airports, which had been previously observed only in summer months (i.e. July and August), was nowadays evenly distributed through the year, day and night, the completed facilities at Borg El Arab International Airport may still have some margin to accommodate further traffic volumes even after the current flight operations at Alexandria-Nozha are transfer to Borg El Arab.

As described in Chapter 6.3.1, JICA Study Team has analyzed the capacity of major facilities completed at Borg El Arab International Airport, e.g. key passenger processing facilities in the terminal building, aircraft parking apron and runway, by comparing with the common practice of IATA and ICAO, and has come up with the conclusion that the completed airport facilities could cope with 2.35 million passengers per annum for the year 2015 as forecasted in Chapter 4.

6.4.2. Barriers for Accommodating Future Capacity

Upon closure of Alexandria-Nozha International Airport, all commercial scheduled flight operations including Egypt Air flights would be transferred to Borg El Arab International Airport, where the completed facilities have to be fully utilized to accommodate probably over 2 million passengers expected after 2012.

The above conclusion of JICA Study Team was made through the comparative analysis of the future forecasted demand in line with international common practice (recommended by IATA or ICAO), which however is fully dependent on the solutions to the behavior of passengers and airfield issues as stated in Chapter 6.3.2.

The said IATA practice is based on general information collected from airports in the world, where business passengers and tourists are mainly being handled. Meanwhile, 80 % of the passengers at Borg El Arab International Airport are Egyptian, and their great majority

(some 70%) are pilgrims or seasonal contract workers who would spend longer life in the Middle-East countries, consequently volume of baggage or behaviors are somewhat unexpected in the international practice. Those unique issues e.g. passengers' behaviors or numerous well-wishers for Hajji-flight passengers rushing at public lobby at the Airport are based on historical and cultural backgrounds.

Key staffs in Borg El Arab International Airport are being periodically trained and progressively acquiring knowledge on airport operation, maintenance and management in cooperation with Narita International Airport Corporation (NAA). However, it is somewhat difficult for them or airport itself to manage such specific issue in this particular Airport.

6.4.3. Possible Future Strategy to cope with Future Growing Demand

From early 2012 after closure of Alexandria-Nozha International Airport, the Borg El Arab International Airport will handle over 2 million passengers, which exceeds the originally-planned airport capacity (1 million for the year 2014). In other words, the ongoing Borg El Arab International Airport Modernization Project (the "Project") would contribute to much higher economic benefit than expected in the SAPROF study.

To materialize such capacity that the Airport should possess to its maximum extent possible, or to maximize the effect upon the Project implementation, the careful attention should be paid to following issues by all staff at the Airport:

- Prevent passengers' stagnation in terminal building;
- Improve passenger service level in terminal building (through guidance and assistance);
- Manage, maintain in good condition and update the existing facilities and equipment (To prevent passenger stagnation due to equipment problems); and
- Address efficiency and safety in the aircraft operations at apron (to systemize aircraft operation).

In particular, the following items are required to consider for solving issues at the airport.

- Manage facility maintenance troubles due to passenger's manners;
- Improve service quality through cleaning and facility maintenance in the passenger terminal building;
- Manage passenger's stagnation due to passenger's lack of travel experience;
- Train the know-how, technical quality and service attitude of airport staff;
- Coordinate with airlines to secure smooth process and movement for the passengers;
- Minimize queuing of passengers through coordination with immigration, customs

and police;

- Prevent delay of aircraft operation due to inefficient operation on the apron;
- Systemize aircraft operations and airport operation plans in coordination with NANSC;
- Establish clear trouble shooting procedures;
- Clearly establish responsible area of each airport staff; and
- Improve operational organizations for efficient operation.

On the other hand, the Airport is desired to handle further numbers of passenger, as JICA Study Team forecasts the current high growth of air traffic demand in Alexandria region is likely to continue. Hence, the Airport is required to improve passenger service quality and access convenience to be dedicated to the growing passengers' volume. And also the Airport should cooperate with LCC that have drastically increased its passenger carrying capacity, and the development projects implemented in surrounding area of the Airport through to:

- Establish adequate airport marketing plan;
- Collaborate with local tourism industry in surrounding area of the Airport;
- Promote the Airport inside / outside of the country;
- Collaborate with LCC services and provide dedicated services for LCC passengers;
- Collaborate with local developments in surrounding area of the Airport; and
- Develop adequate access modes between the Airport and the city.

In relation to EAC's strategies to improve airport operational efficiency and to create new air traffic demand, EAC is currently having assistance from foreign airport operators. Management and operations at 5 major EAC airports including Sharm El Sheikh, Hurghada, Aswan, Luxor and Abu Simbel were assisted by ADPm (France) on a contract base. Management and operations at Cairo International Airport is being assisted by Fraport (Germany). Through those assistance contracts, the airports have been trying to achieve efficient operation of airport facilities, airport promotion to create new air traffic demand, and commercial business to increase revenue, and service enlargement for the passengers.

Meanwhile, the Borg El Arab International Airport should exercise its best effort to overcome the specific issues stated above, which are more challenging since characters of the great majority of the passengers at Borg El Arab (those specific to pilgrims and seasonal workers) are different from those of the above named 6 other airports (majority of them are business passengers or international tourists who know all the airport procedures and regulations).

Chapter 7

Recommendations on Future Airport Development

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Chapter 7. Recommendations on Future Airport Development

7.1. Basic Strategy

For the purpose of clear definition of each phase of the entire development for the Borg El Arab International Airport, the Modernization Project completed in year 2010 is hereby referred to as the Project Phase-1 Stage 1, and subsequent measures for maximization of its effect proposed herein are defined as the Phase-1 Stage 2 respectively. Further developments necessary to accommodate the medium to long-term future air traffic demand are defined as the Phase-2 and Phase-3.

Upon closure of Alexandria - Nozha International Airport, all scheduled flights including those of Egypt Air have been transferred to Borg El Arab International Airport as of the end of year 2011. Moreover, as stated in Chapter 3.2.1., several commercial flights are still operated at old terminal building which is the property of the Military of Defense (MoD) in the Airport. However that EAC currently plans to return its facilities to MoD in the near future when the Airport has ready to receive all flights at new passenger terminal building. As discussed in Chapter 6, it has been evaluated that the Airport, after completion of the development in year 2010, should be theoretically capable of accommodating the future air traffic demand of the entire Alexandria region until around year 2015 to 2020, however due to several reasons, such theoretical capacity has not yet been materialized and the Airport has been experiencing operational problems, in particular, serious congestion in the passenger terminal building. It has been understood that realization of the maximum capacity of the Airport should be the first priority and necessary measures therefore need to be implemented.

Addition of one each of the passenger boarding bridge to the existing three fixed gates as originally envisaged will improve the passenger handling capacity and service grade of the passenger terminal building.

Strengthening of the human resources as well as improvement of the passenger handling procedures, etc. through technical assistance by qualified service provider will also enhance the capacity development and upgrading of passenger services.

Namely the Phase-1 Stage 2 Project consists of the following two parts:

a) Addition of three (3) Passenger Boarding Bridges (PBBs) to the completed Passenger Terminal Building (see Chapter 7.2); and

b) Technical Assistance for Airport Operation and Management (see Chapter 7.3).

Further developments to accommodate the medium to long-term future traffic demand are discussed in Chapter 7.4 below.

7.2. Addition of Three (3) Passenger Boarding Bridges (PBBs)

The new passenger terminal building has been provided with 4 Passenger Boarding Bridges (PBBs), 1 each to the 4 fixed gates, as shown in Figure 7.2-1.

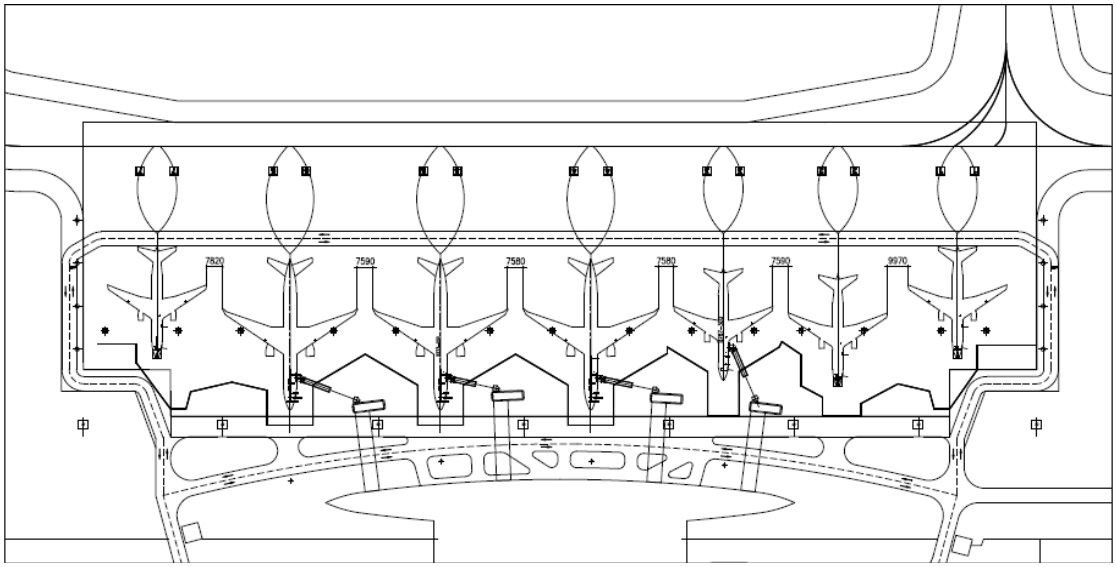


Figure 7.2-1 Position of the 4 PBBs; 1 each for 4 gates

In the history of the Project, number of PBBs to be installed has been discussed, chronologically as follows:

- ✓ In 2004, installation of 2 PBBs to 1 large jet (LJ), i.e. the 1st PBB to serve first or business class and the 2nd PBB to serve economy class door, as being a common practice, had been aimed in the SAPROF study. Hence, 7 PBBs in total had been originally proposed in the SAPROF study to be installed, 2 each to the planned 3 Large Jet (LJ; e.g. B 777) and 1 to Small Jet (SJ; e.g. A320) so as to efficiently manage passengers' embarkation or disembarkation operations.
- ✓ In 2006 it was decided through the course of detailed design that the Project package would only include 4 PBBs (1 each to the 4 fixed gates) to keep minimum required service level, and the installation of 3 other PBBs were deferred because it was anticipated that the Bid price might have exceeded the budgeted foreign portion of the then JICA fund; fortunately, it did not though.
- ✓ In 2007, when the number of air passengers at Alexandrian region was rapidly growing and it reached 1 million per annum, Emirates airlines operated its wide-bodied fleet B777-200 at Borg El Arab International Airport since in fact Emirates did not own small aircraft that could land at Alexandria – Nozha International Airport.
- ✓ In 2008, EAC once decided to procure additional 3 PBBs and deferred installation due to the then economic crisis in October 2008.

Now all airlines including Egypt Air have transferred their commercial aircraft operations to Borg El Arab International Airport, where sufficient runway length (3,400 m) for LJ to take

off and land is available. It is predicted that Legacy Airlines who were formerly restricted to use LJ due to the shortage of length and strength of the runway at Alexandria – Nozha International Airport, would have a choice to mobilize their LJ at Borg El Arab International Airport for the sake of operational efficiency. In case the operation of LJ at Borg El Arab International Airport is realized, it is considered useful if the 3 PBBs are added as originally planned in the SAPROF study, as shown in Figure 7.2-2.

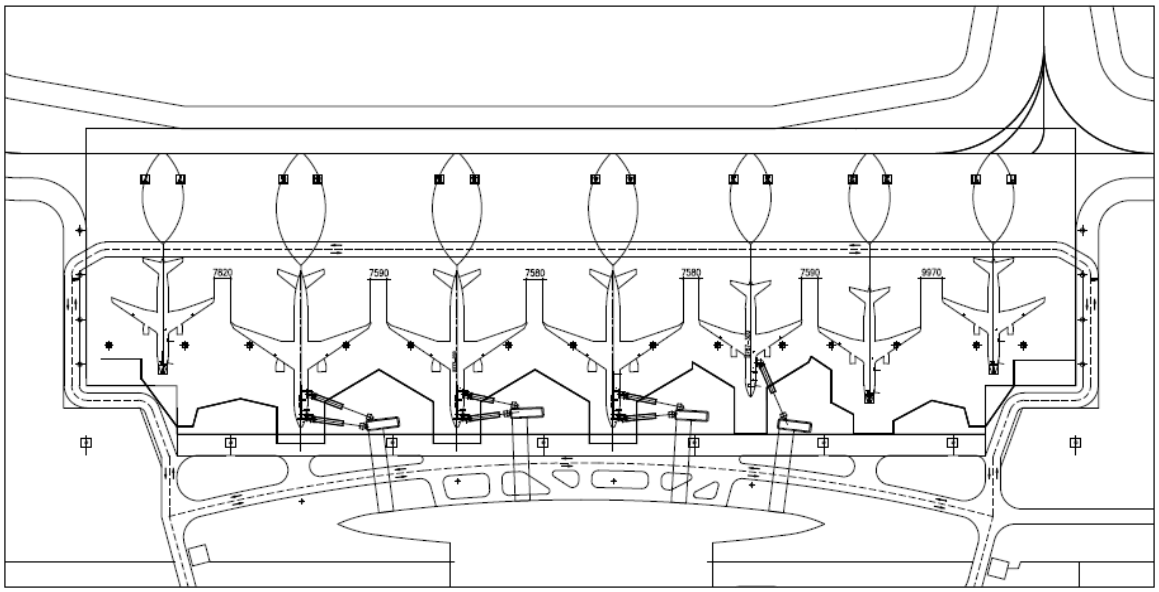


Figure 7.2-2 Position of 7 PBBs; 2 for 3 LJ, and 1 for 1 SJ

Meanwhile, according to the latest fleet plan of Egypt Air, it would operate regular frequent flight services by using numbers of SJ (e.g. E-170 of Egypt Air Express) for both domestic and regional international flights. Since the terminal building has only one (1) common departure bus-gate for domestic and international flight operations, it is now anticipated to encounter certain risk to mingle the international and domestic passengers at the common bus-gate when air traffic increases further.

When a fixed gate for LJ is used by 2 SJ (i.e. A320 or smaller), the 2 PBBs can individually contact either of the 2 flights separately, as shown in Figure 7.2-3.

When the 7 PBBs can handle the departing passengers for maximum 7 flights at departure level (all at 2nd floor), it would minimize the risk mentioned above without congesting the common bus-gate (at ground floor).

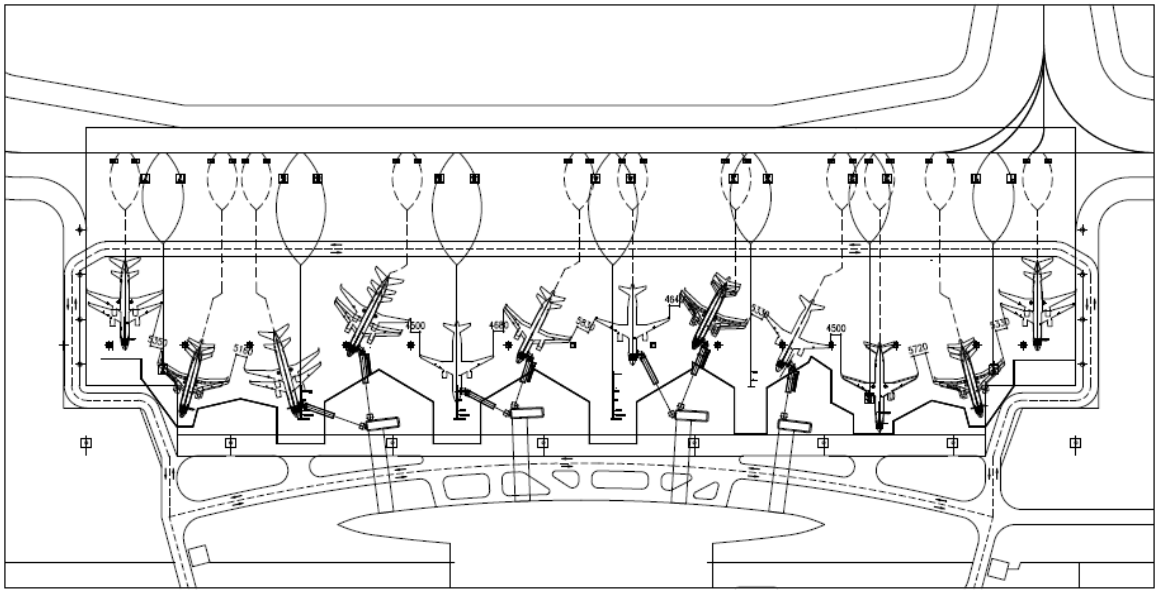


Figure 7.2-3 Position of 7 PBBs; 1 each for 7 SJ

In order to safely manage more than 2 million passengers after 2012, it is recommended that the 3 PBBs be added, each to the aircraft 1st-door position of the 3 fixed gates, foundations made of reinforced-concrete with anchor bolts of which were readily in place through the foregoing Project.

7.3. Technical Assistance for Airport Operation and Management

7.3.1. General

Generally, airports should continuously provide services to passengers, public end-users, airlines and other business entities with the following six (6) targeted objectives:

a) Safety;
b) Security;
c) Convenience;
d) Punctuality;
e) Functionality; and
f) Comfort.

To materialize the handling capacity (i.e. more than 2 million passengers per annum) that the Airport should already have theoretically possessed, or to maximize the effect by implementation of the Project Phase-1 Stage 1, the above targeted objectives should be achieved through the solutions thereof, and as summarized in the matrix shown in Figure 7.3-1.

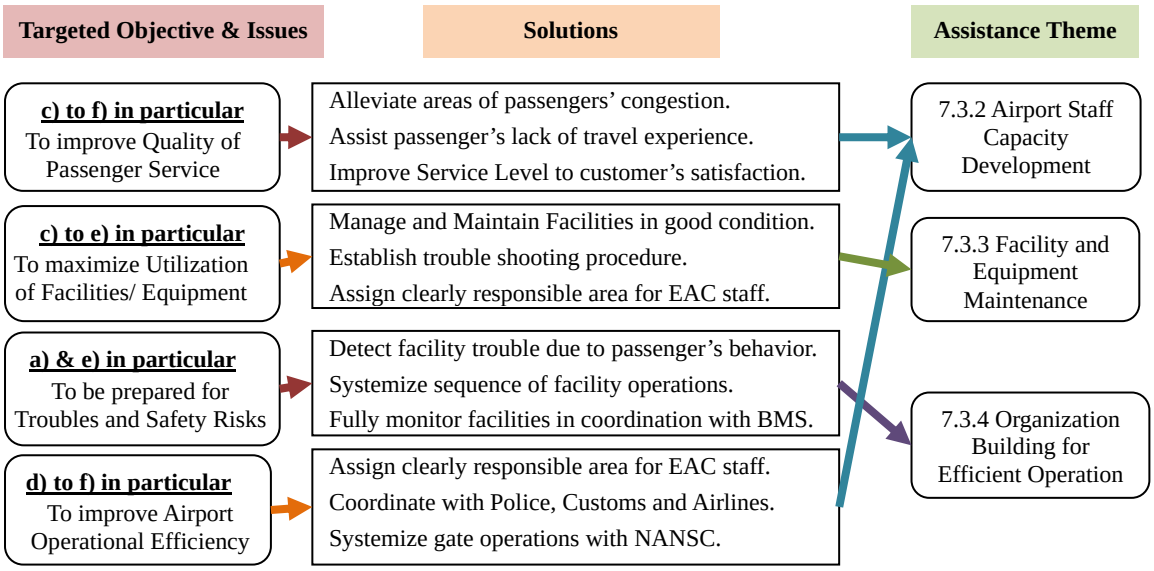


Figure 7.3-1 Matrix showing Solutions for Current Issues

Each theme for the assistance required is described hereunder.

7.3.2. Assistance in Airport Staff Capacity Development

To develop the capacity of airport staff, it is important not only to improve the ability of the individual airport staff, but also for them to be consciousness of their responsibility to operate the entire airport continuously for 24 hours as one team through collaboration among each airport staff.

Specifically, the following innovations are required for all airport staff so as to satisfy the

above targeted objectives for the Airport:

- Detect areas of congestion expected to occur due to the fast growing air traffic demand;
- Clearly assign their responsible area and functions to each EAC staff;
- Improve the level of services including support and information guidance to passengers;
- Constantly help passengers' lack of travel experience, particularly of the rapidly increasing overseas contract workers and/or pilgrims;
- Organize routine coordination with security police, immigration and customs officers to prevent bottle-neck points in the terminal building ;
- Organize daily coordination with airlines for smooth check-in processing of passengers and baggage;
- Be aware the external functions, e.g. supply networks, capacity limits and bottle-neck points of utilities (power and water), fuel hydrant, irrigation and sewage treatment systems; and
- Accumulate skills and experiences necessary for each airport staff.

Through these efforts, not only EAC staff but also all employees involved in the airport operations should work together cooperatively to improve the airport services.

For aircraft ground handling operations on the apron, it is required to systemize the daily gate assignment procedures in close coordination with NANSC so as to secure safe and efficient aircraft operations.

7.3.3. Assistance in Facility and Equipment Maintenance

The Airport is considered to secure all the targeted objectives mentioned above (i.e. safety, security, convenience, punctuality functionality and comfort),only through maintaining in good condition of all the installed facilities, equipment and utilities supply. Any failure in the airport functions would fall in the risks or claims to endanger or disturb passengers, or delay in their flight , and in the worst scenario, smuggling or hijacking.

After opening of the new terminal complex of the Airport, air traffic demand in Alexandria region was still evenly distributed to the two (2) international airports (Alexandria-Nozha and Borg El Arab) and therefore density of the aircraft operations at Borg El Arab International Airport was somehow low until the year 2011. However, upon closure of Alexandria – Nozha International Airport, all flights have been transferred to Borg El Arab International Airport. More numbers of air passengers and international flights than previously envisaged are now utilizing the airport facilities, where even small troubles in the airport facilities or overload in the utilities supply may cause fundamental risks or claims mentioned above.

To immediately remedy the facility trouble that might any time happen, each EAC staff should individually consider how to control the situation.

Specifically, the following efforts shall be regularly exercised so that facilities and equipment at the Airport are well maintained:

- Cross-examine the maintenance manuals of individual facilities and equipment;
- Cross-examine the physical capacities and bottle-necks of utilities supply and demand (i.e. power, water and sewage treatment);
- Establish overall maintenance and remedial procedures of entire facilities and equipment;
- Assign each EAC staff for their clearly responsible facilities and equipment (including external utilities networks);
- Establish clear trouble shooting procedures;
- Constantly clarify how and who in particular, should deal with a trouble upon occurrence in the airport facility;
- To regularly conduct onsite drills to simulate possible troubles and solutions; and
- Accumulate the daily record of the troubles with the solutions taken, and prepare monthly summary thereof, which would be a possible lifework of EAC staff to totally eliminate the risks.

Clear plans and continuous on-site drills for facility maintenance and management to manage the occurred troubles would contribute not only to avoid saturation or stagnation of functions in the Airport, but also to minimize risks in aviation security, safety of airport operations, or country's civil aviation activities as a whole.

7.3.4. Assistance in Organizational Building for Efficient Operation

The technical assistance in building a suitable airport organization shall include to detect appropriate routes of immediately conveying all decisions or directions from the Airport Director to all branch departments and up to the end-staff, including all staff of airlines, CIQ, NANSC, concessionaire and/or any outsourcing companies. The organization shall entail how the problems should be dealt with in every field throughout the numbers of work shift (or group) for 24 hours of airport operations.

For such purpose, it is considered essential to obtain necessary assistance of an experienced and qualified service provider such as foreign reputable airport operator. Appropriate authority should be vested in the service provider employed to directly assist relevant departments and the entire Airport organization as well.

Specifically, the following technical assistances are sought from foreign reputable airport

organization:

- Build cooperative frameworks to protect the Airport from any risk and claim (i.e. in relation to safety, security, convenience, punctuality, functionality and comfort at the Airport);
- Establish auditing rules on outsourcing companies, concessionaires, airlines, ground handlers, to check whether they comply with the rules and objectives of the Airport in terms of safety, security, convenience, punctuality, functionality and comfort;
- Support all programs for smooth implementation;
- Assist in re-structuring of the Airport organization from time to time to attain the then safe and efficient airport operations to maximum extent possible; and
- Ensure that the service provider shall be given by EAC headquarter an appropriate position and authority to issue necessary instructions.

7.3.5. Recommended Schedule and Scheme for Technical Assistance

Considering the evaluation result that the capacity of the existing passenger terminal building would be saturated around the year 2015, the assistance to be provided to EAC has been programmed in two (2) steps as shown in Figure 7.3-2 and discussed hereunder.

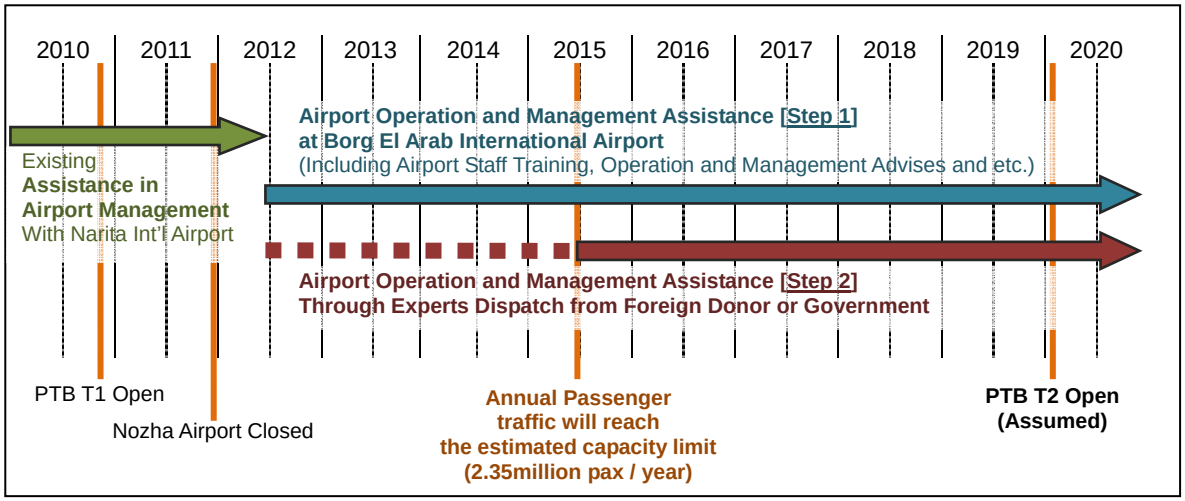


Figure 7.3-2 Proposed Schedule of Technical Assistance

To accommodate growing passengers as much as possible with existing terminal facilities up to the completion of additional new terminal building development, JICA study team recommends to operate the Airport with international assistance scheme for airport operation and management through following steps.

Technical Assistance - Step 1 will be contribute to enlarge airport staff capacity development. It will also contribute more efficient airport operation and improve passenger service quality. However that, this scheme should be not only assisted by foreigner's activities but also should be based on EAC's own proposing to effort to improve the Airport.

Technical Assistance – Step 2 will be consisted of public and governmental assistance in civil aviation sectors through the cooperation by foreign donor and government. To cope future issues assumed after the demand reaches to its capacity, the Airport may need to coordinate related agencies in the Airport such as immigration, customs or security police. During the assistance, foreign experts of these sectors will assist or advise to improve its service quality and operate more efficiently.

These 2 steps of international assistance scheme shall be considered to implement in parallel. For more detail recommendation on these assistances is shown in followings.

1) Technical Assistance - Step 1

Assistance in Airport Operation and Management

So far, assistance in airport operation and management has been provided by Narita International Airport Corporation (NAA) since 2009. At present, it is observed that:

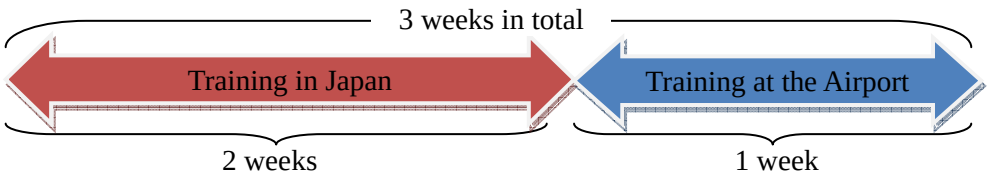
- Judging throughout the year 2011 when air traffic in Alexandria region was shared by the two (2) airports, operations at the Airport were on track, as the training provided by NAA through the Phase-1 Stage 1 Project has improved the fundamental knowledge of EAC staff; and
- In the next step, some selected EAC staff particularly should have a sort of advanced training course for high-quality airport operation and management, so that they would be able to obtain necessary skills and knowledge as the leader of the organization operating the prestigious international airport in Egypt.

It is recommended that the Airport should obtain further advanced technical assistance from a foreign reputable airport organization on a direct contract basis with EAC as the Step 1, in which the following approaches to the staff capacity development are deemed necessary so as to achieve efficient operations to the maximum extent possible at the Airport:

- Continue enhancing the specialist skills and knowledge of the organization leaders (including potential leaders of younger generation as well), which is the key to improve management and maintenance capability of the Airport;
- The advanced training course to the leaders should enhance skills and knowledge in the areas such as customer services, aviation security, airport safety, operations, and facility maintenance and management;
- The leaders who have participated in these courses should transfer on site what they have learned in these courses to other employees in their working environment. This would systematically create high quality of airport management practices.

Table 7.3-1 shows an example of assistance proposal for enhancing the specialist skills and knowledge of the organization leaders.

Table 7.3-1 Example of Assistance Plan of Leader Training Course

<table>
<tr><td colspan="2"><u>Overview of a Training Course</u>
 

✓ A training course consists of two-week training in Japan and one week training at Borg El Arab International Airport.
✓ One training course should be held for one field each.
✓ The number of course will depend on the field of assistance (Possible fields are listed below.)
✓ A maximum of only two training courses will be held at the same time because it is important that high quality, intensive courses are provided, which will lead fruitful outcome for trainees.</td></tr>
<tr><td>Possible Participants</td><td>Leaders or potential leaders in the individual fields which mentioned below.
✓ Number of trainee of each field will be one or two staff.</td></tr>
<tr><td>Possible Fields of the Course</td><td>1. Customer Services
2. Aviation Security,
3. Airport Safety
4. Operations (Airside & Passenger Terminal Building)
5. Maintenance</td></tr>
<tr><td>Outline of the Course</td><td>✓ A training course will consist of A) two weeks training in Japan and B) one week training at job site in Borg El Arab International Airport.
<u>A training Course for each specialized field (3 weeks in total)</u>
✓ One or two specialists will be in charge of each course.
A) Training in Japan (2 weeks)
More specialized training at a major airport in Japan related to the various activities of the individual fields. (Example: classroom lectures and site inspection)
+
B) Training at Borg El Arab International Airport (1 week)
On-site training at the Airport by experts in individual specialist fields (Example: hold working groups and conduct on-the-job training)</td></tr>
</table>

2) Technical Assistance - Step 2

Airport Operation and Management Assistance Through Expert Dispatch from Foreign Donor or Government

Even after the year 2015 when the traffic demand exceeds the estimated capacity limit of the passenger terminal building, the existing airport facilities will need to accommodate the traffic since development of the second runway and new passenger terminal building (tentatively called as Terminal 2), etc. would not be completed by then.

In this situation where significant capacity constraints are expected, it is suggested that appropriate specialists should be dispatched to provide direct advices and recommendation for safe and efficient airport operations as the Step 2 assistance.

Specifically, the following challenges are deemed necessary so as to accommodate passengers of more than the physical capacity:

- Continue the assistance in the capacity development of airport staff, and facility maintenance and management;
- Conserve energy and utilities volumes (i.e. power and water consumptions in the entire Airport);
- Assist in restructuring of organization from time to time of the Airport itself and EAC; and
- Keep regular collaboration between the relevant sub-organizations in the Airport.

Especially for solving passenger stagnation at bottle-necked key essential facilities, the coordination with governmental organizations in the airport including security police, immigration and customs officers is considered imperative. It is suggested that such assistance be implemented through JICA specialist dispatch program up to the completion of the new passenger terminal building.

JICA expert technical assistance team is suggested to be organized by following specialists.

Table 7.3-2 Suggested JICA Expert Technical Assistance Team

Specialty	Number	Target Issue
Airport Organization	1	Organization building
Terminal Operation	1	Passenger service / PTB operation / Customer's Satisfaction
Airside Operation	1	Aircraft operation / Gate planning / Coordination with Airlines
Airport Management	1	Trouble shooting procedure
Facility Management	1	Civil / Mechanical engineering
Capacity Building	1	Airport staff training
Airport Finance	1	Financial analysis
Airport Marketing	1	Commercial activity
Passenger Inspection	1	Coordination with Police (Immigration/ Security Check)
Baggage management	1	In-line Screening / Baggage Reconciliation / Lost Baggage

7.4. Future Development - Construction of Additional Facilities

7.4.1. Suggested Year of Capacity Saturation

1) Passenger Terminal

As stated in Chapter 6, the completed facilities at the Airport are assumed to be capable of accommodating 2.35 million passengers per annum forecasted for the year 2015, provided that the passengers and baggage are processed in the manner and time as recommended by IATA or ICAO.

Knowing the specific characters or behavior of passengers as discussed in the foregoing Chapters, passengers' congestion at this particular airport may appear somewhat at earlier stage.

For the time being, such congestion could be alleviated by systematic guidance and/or assistance by EAC staff jointly with airlines or Police department, or just in case by adding necessary numbers of counters, desks, seats, X-ray machines, etc.

When the passenger traffic reaches as many as 3million per annum, a shortage of the terminal space and equipment is expected to occur, and then the level of services at the Airport will gradually be downgraded and the terminal will reach its capacity limit around year 2020.

2) Airfield

As discussed in Chapter 6, bottleneck of airfield at the Airport is the parallel taxiway located on the opposite side of the new terminal as shown in Figure 7.4-1.

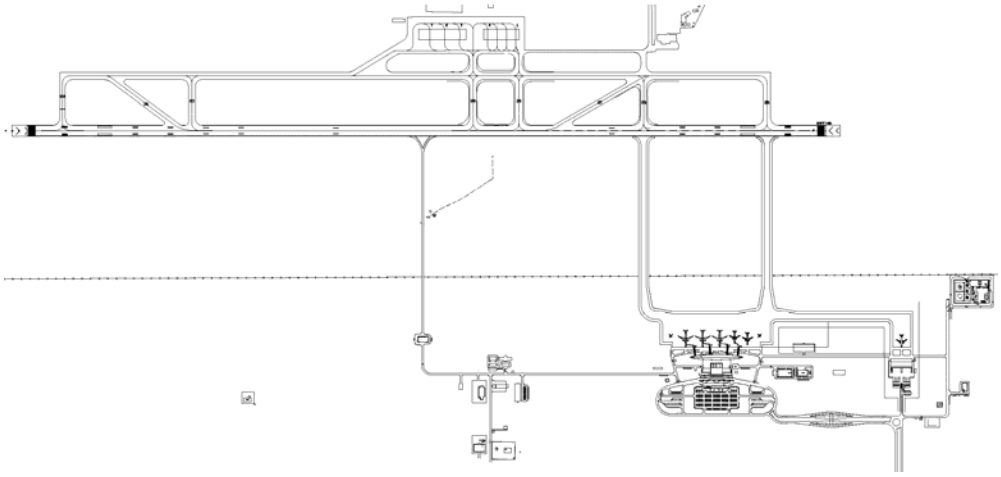


Figure 7.4-1 Existing Airport Layout Plan

Because of such opposite position of the parallel taxiway, a departing aircraft should be held at the holding position on a taxiway while approaching aircraft land and exit the runway, the existing runway may possess a capacity of hourly 20 aircraft movements (10 departures and 10 landings) at maximum, which is only a half of normal single runway capacity, and is considered to saturate around year 2020.

7.4.2. Basic Features of Phase-2 Development

1) Facility Requirements for Phase-2 Development

As discussed in Chapter 6, the completed Phase-1 passenger terminal building has an adequate floor space (about 24,000 m²) and internal functions to theoretically handle the forecast annual passengers of 2.35 million for the year 2015. Annual passengers are expected to be doubled (4.75 million) by 2025, therefore Phase-2 passenger terminal (Terminal 2) of similar floor space is necessarily to be constructed in a period from 2015 to 2020.

There are 7 aircraft parking stands (to accommodate 3 LJs and 4 MJs), or 12 stands (when all aircraft are SJ) in the existing aircraft parking apron. This dimension of apron may be able to cope with the parking of aircraft up to 2020, if all flights are of short-time turn-around flights. In line with the construction of Phase-2 terminal, additional aircraft parking apron should be constructed also in a period from 2015 to 2020.

Chronological summary of air traffic forecast, and corresponding requirements of airport facilities are given in Table 7.4-1.

Table 7.4-1 Chronological Facility Requirements for Passenger Terminal

Item			SAROF	actual	Air traffic demand forecast			
			2014	2010	2015	2020	2025	2030
Passengers	1)	Annual Pax ('000)	991	1,682	2,358	3,611	4,755	5,942
	2)	Peak-day (2-way)	*3,980*	5,872	8,237	12,615	16,608	20,752
	3)	Peak-hour (2-way)	567	659	862	1,203	1,508	1,831
	4)	Peak-hour (1-way)	500	452	572	761	927	1,104
Aircraft Movements	5)	Annual Flights	9,101	17,260	22,074	32,997	42,988	52,975
	6)	Peak-day (2-way)	36	57	73	110	143	175
	7)	Peak-hour (2-way)	9.3	7	8.2	11.1	13.5	16.0
	8)	Peak-hour (1-way)		5.0	5.7	7.2	8.5	9.8
Passenger Terminal (m²)	3) x 30 m²		20,840	24,277	24,820	34,820	43,800	53,270
Phase 1 (Terminal 1)	Completed by 2010			24,000 m²				
Phase 2 (Terminal 2)	To complete another 24,000 m² by 2020					Total 48,000 m²		
Apron Stand	8) x 90/60min + 1(Extra)		8	7	9.6	11.8	13.8	15.7
Phase 1	Completed by 2010			7 (or 12 if all SJ)				
Phase 2	To complete another 9 stands by 2020					Total 17 stands		

Meanwhile, the existing runway is 3,400 m in length which was planned in 1980's presumably to meet the requirement of the then heaviest aircraft, e.g. B747 to fly the longest range.

As discussed in Chapter 6.3.2.- 2). from January 2012, Alexandria-Nozha International Airport is closed for more than a year, and in case of emergency or accident that might happen on the single runway at Borg El Arab International Airport there would be no

alternate runway to land in Alexandria region, which might paralyze the entire air transportation system in Egypt.

Ministry of Civil Aviation (MCA) plans to construct the 2nd runway that forms an open parallel runway system with the 1st runway to enable simultaneous landing and takeoff, the layout of which has been announced in the latest AIP shown below as dotted lines.

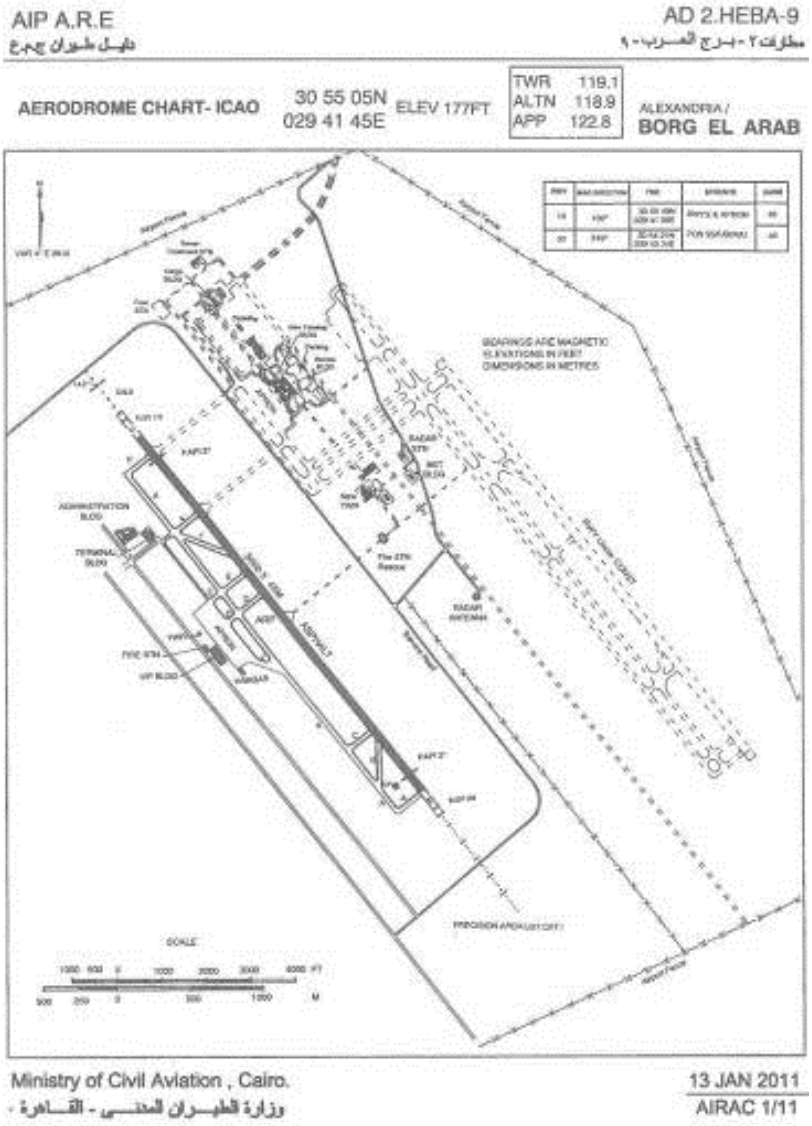


Figure 7.4-2 Aerodrome Chart in AIP for Borg El Arab International Airport

The 2nd runway is normally to have a consistent dimension with the 1st runway, so as not to mislead the pilots. However it is not a cost-effective way to pursue such full length if the actual aircraft envisaged in operations do not need it. It should be noted in this connection that the B747-type aircraft is being phased out and the latest generation of aircraft with a large fuselage does not necessarily require a longer runway length than B747 did, owing to its improved body structure and engine performance.

2) 2nd Runway

a) Runway Length

At present, almost all international flights at the Airport are made for short-range destinations to Middle East, Europe and North Africa, and great majority of the type of aircraft is SJ (small jet, such as A320, B737-800, and E-170), generally requiring the takeoff runway length of some 2,000 m.

Distance from the Airport to the main destinations in Middle East countries are within a range of 2,500 km, and to the current longest destination, i.e. Casablanca, is 3,600 km, and to London is 3,800 km, as shown in Figure 7.4-3.

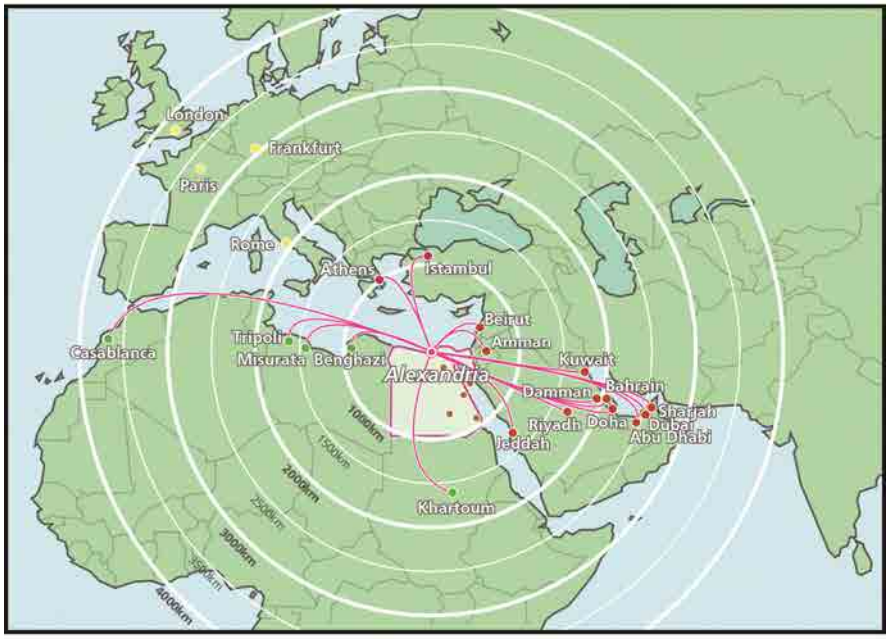


Figure 7.4-3 Distance to Major Destinations from Alexandria

As stated in Chapter 4, 50% of the flights at the Airport are currently operated by LCC whose main fleet is A320. Meanwhile, many European LCCs currently use A321 (7 m longer and 1 m wider than A320) for their flights for Sharm El Sheikh or Hurgahda. Since LCC normally operate a single type of aircraft family so that efficient routine maintenance with common spare parts is ensured, A320 and/or A321 are assumed to be predominantly operated at the Airport in the foreseeable future.

To date, main fleet of Legacy Airlines (e.g. Egypt Air, Saudi Arabian, Royal Jordan, Turkish, Qatar, Kuwait) operating at the Airport are SJ, such as A320, B737-800, and E-170, which were able to safely land at Alexandria - Nozha International Airport. Upon the transfer of all operations to Borg El Arab International Airport, numbers of Legacy Airlines are expected to mobilize MJ (e.g. B767) or LJ (e.g. A330 or B777) because the runway is sufficient in length and strength for their landing and takeoff. Therefore, the runway length requirements for those wide-bodied aircraft are necessarily ascertained.

According to AIP, the Reference Temperature at Borg El International Arab Airport is 30.6

degree Celsius, however, the daytime temperature in the hottest summer normally reaches 34 Celsius or more. For the purpose of computation of takeoff runway length requirements, it is assumed on safer side that the critical conditions occur when the temperature is 34 Celsius.

Based on the above consideration, runway length required for the above named aircraft with full payload to the current farthest destination (London) are tabulated in Table 7.4-2.

Table 7.4-2 Type of Aircraft and Required Runway Length

No	Description		Size	SJ			MJ	LJ			
			ICAO code	code C			code D	code E			
			Aircraft	A320	B737	A321	B767	A330	B777		B787
			Type	-200	-800	-200	-300	-300	-200	-300	-8
1	Turbo Engine			CFM56		CFM56	CF6	CF6	GE	GE	GE
	Wing Span		m	34.10	35.79	35.48	47.57	60.30	60.93	60.93	60.12
	Fuselarge Length		m	37.57	38.02	44.50	54.94	63.69	63.73	73.86	56.72
2	Seating Capacity		1 class	180	184	220	290	335	418	500	375
			2 classes	150	160	185	261	303	375	451	286
			3 classes	-	-		-	253	305	368	224
3	Max Takeoff Weight		lb	166,449	174,200	191,802	350,000	467,380	535,000	632,500	502,500
			kg	75,500	79,016	87,000	158,758	212,000	242,630	286,900	227,930
4	Max Landing Weight		lb	142,198	146,301	166,449	300,000	390,218	445,000	524,000	380,000
			kg	64,500	66,361	75,500	136,078	177,000	201,800	237,680	172,365
5	Max Zero Fuel Weight		lb	133,380	138,300	157,630	278,000	368,172	420,000	495,000	355,000
			kg	60,500	62,732	71,500	126,099	167,000	190,470	224,530	161,025
6	Operating Empty Weight		lb	90,927	91,300	103,300	189,750	264,182	299,550	353,800	N/A
			kg	41,244	41,413	46,856	86,069	119,831	135,850	160,530	N/A
7	Max Structural Payload		lb	42,452	47,000	54,331	88,250	103,990	120,450	141,200	N/A
			kg	19,256	21,319	24,644	40,230	47,169	54,620	64,000	N/A
8	Fuel	Maximum Usable (0.785 kg/l)	litter	23,667	26,022	23,700	63,216	97,530	117,300	169,210	126,903
			lb	40,959	46,063	41,015	119,890	168,788	207,700	299,490	224,638
			kg	18,579	20,894	18,604	50,753	76,561	94,240	135,880	101,894
9		consumption per km	litter/km	3.10	3.39	4.80	7.01	6.62	7.92	7.78	N/A
			lb/km	5.36	5.86	8.31	12.13	11.46	13.71	13.47	N/A
			kg/km	2.43	2.66	3.77	5.50	5.20	6.22	6.11	N/A
10		consumption to UAE (2,500km)	litter	1,919	2,101	2,978	4,344	4,107	4,913	4,826	N/A
			lb	13,393	14,661	20,779	30,314	28,660	34,282	33,676	N/A
			kg	6,075	6,650	9,425	13,750	13,000	15,550	15,275	N/A
11		consumption to London (3,800 km)	litter	9,596	10,504	14,888	21,720	20,535	24,563	24,129	N/A
			lb	20,357	22,284	31,583	46,077	43,563	52,108	51,187	N/A
			kg	9,234	10,108	14,326	20,900	19,760	23,636	23,218	N/A
12		for Takeoff, Diversion, Holding	litter	750	750	750	3,200	3,700	3,700	3,700	N/A
			lb	1,298	1,298	1,298	5,538	6,403	6,403	6,403	N/A
			kg	589	589	589	2,512	2,905	2,905	2,905	N/A
13		total for London (3,800 km)	litter	10,346	11,254	15,638	24,920	24,235	28,263	27,829	N/A
			lb	21,655	23,582	32,881	51,615	49,967	58,512	57,590	N/A
			kg	9,823	10,697	14,915	23,412	22,665	26,541	26,123	N/A
14	Takeoff Weight for London flight (3,800 km)		lb	155,035	161,883	190,512	330,056	418,139	478,426	552,594	N/A
			kg	70,323	73,429	86,415	149,711	189,665	217,011	250,653	N/A
15	Takeoff Runway Length	Elevation at sea level	15°C	1,600	1,920	1,920	2,012	1,829	1,783	2,377	N/A
			30 °C	1,707	2,042	2,042	2,118	1,905	1,890	2,499	N/A
			34 °C	1,736	2,075	2,075	2,146	1,925	1,919	2,532	N/A
16	Landing Runway Length	at sea level		1,463	2,042	1,661	1,820	1,707	1,768	2,134	N/A

The Table implies that the runway length required for the critical aircraft (i.e. B777-300) with its full payload to fly to the furthest destination (London) under the hottest daytime temperature (34 Celsius) is 2,500 m to 2,600 m.

b) Aerodrome Reference Code of Runway

In accordance with ICAO Annex 14 (abstracted in Table 7.4-3), the 2,500-m long runway is defined as ICAO Code Number 4, and the wingspan of B777 of less than 65 m is classified as ICAO Code Letter E. Corresponding runway width required is 45 m.

Table 7.4-3 Aerodrome Reference Code (ICAO Annex 14)

Code element 1		Code element 2		
Code number (1)	Aeroplane reference field length (2)	Code letter (3)	Wingspan (4)	Outer main gear wheel span[a] (5)
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1 200 m	B	15 m up to but not including 24 m	4.5 m up to but not including 6 m
3	1 200 m up to but not including 1 800 m	C	24 m up to but not including 36 m	6 m up to but not including 9 m
4	1 800 m and over	D	36 m up to but not including 52 m	9 m up to but not including 14 m
		E	52 m up to but not including 65 m	9 m up to but not including 14 m
		F	65 m up to but not including 80 m	14 m up to but not including 16 m

a. Distance between the outside edges of the main gear wheels.

c) Distance between the two (2) Runways

Abstracted below is the minimum separation between the parallel runways recommended in the ICAO Annex 14:

Minimum distance between parallel runways

3.1.11 **Recommendation.**— *Where parallel non-instrument runways are intended for simultaneous use, the minimum distance between their centre lines should be:*

— *210 m where the higher code number is 3 or 4;*

— *150 m where the higher code number is 2; and*

— *120 m where the higher code number is 1.*

3.1.12 **Recommendation.**— *Where parallel instrument runways are intended for simultaneous use subject to conditions specified in the PANS-ATM (Doc 4444) and the PANS-OPS (Doc 8168), Volume I, the minimum distance between their centre lines should be:*

— *1 035 m for independent parallel approaches;*

— *915 m for dependent parallel approaches;*

— *760 m for independent parallel departures;*

— *760 m for segregated parallel operations;*

d) Runway Strip

In accordance with ICAO Annex 14, the runway strip for a precision approach runway should extend laterally to a distance of at least 150 m to both sides of runway centerline, and longitudinally for a distance of 60 m before the threshold and beyond the end of the runway.

3) Taxiways

a) Width of Taxiway

ICAO Annex 14 recommends that a straight portion of a taxiway should have a width of not less than 23 m where the aerodrome code letter is E.

b) Width of Taxiway Shoulder

In accordance with the recommendations of ICAO Annex 14, the taxiway and shoulder should cover a total width of 44 m where the aerodrome code letter is 4. Consequently, the required width of the taxiway shoulder shall be 10.5 m (i.e. 10.5 m + 23 m + 10.5 m = 44 m).

c) Separation between Airfield (Runway and Taxiways)

Airfield separations are to be provided basically to follow the minimum separation distances recommended by ICAO Annex 14, shown in Table 7.4-4.

Table 7.4-4 ICAO Annex 14 (Taxiway Minimum Separation Distances)

Code letter	Distance between taxiway centre line and runway centre line (metres)								Taxiway centre line to taxiway centre line (metres)	Taxiway, other than aircraft stand taxilane, centre line to object (metres)	Aircraft stand taxilane centre line to object (metres)
	Instrument runways Code number				Non-instrument runways Code number						
	1	2	3	4	1	2	3	4			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
A	82.5	82.5	–	–	37.5	47.5	–	–	23.75	16.25	12
B	87	87	–	–	42	52	–	–	33.5	21.5	16.5
C	–	–	168	–	–	–	93	–	44	26	24.5
D	–	–	176	176	–	–	101	101	66.5	40.5	36
E	–	–	–	182.5	–	–	–	107.5	80	47.5	42.5
F	–	–	–	190	–	–	–	115	97.5	57.5	50.5

Note 1.— The separation distances shown in columns (2) to (9) represent ordinary combinations of runways and taxiways. The basis for development of these distances is given in the Aerodrome Design Manual *(Doc 9157), Part 2.*

Note 2.— The distances in columns (2) to (9) do not guarantee sufficient clearance behind a holding aeroplane to permit the passing of another aeroplane on a parallel taxiway. See the Aerodrome Design Manual *(Doc 9157), Part 2.*

The above minimum distances between the centerlines of runway and taxiway as well as between taxiways for Code E (182.5 m in column (5); and 80 m in column (10) respectively) are not exactly followed worldwide since the aircraft wingspan keeps changing in the aviation industry, and the operations of Code F aircraft are widely spread in a short period of time. Practically, the location of airfield facilities and buildings, once constructed, cannot be moved in the future even when an airport has to accommodate unforeseeable traffic

demand in 30 to 40 years. It is recommended therefore, that a distance of 200 m between centerlines of the runway and taxiway and 100 m between those of two taxiways (for Code F) be reserved, as are currently the cases worldwide.

ICAO notes that the distance between aircraft stand taxi-lane and object (42.5 m for Code E) may need to be increased if jet exhaust velocities cause hazardous conditions for ground service equipment, therefore a distance of 46.5 m is used in this Study.

In view of the above, separation distances between the runway, taxiways and objects have been set as shown in Figure 7.4-4.

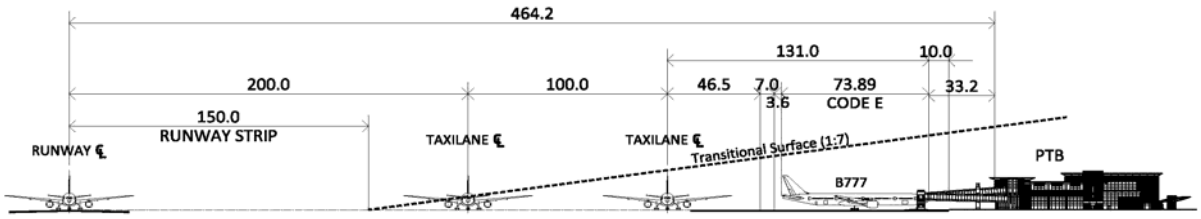


Figure 7.4-4 Airfield Separation Distances adopted in this Study

4) Apron

At a moment, the Terminal 2 is planned to have 4 fixed gates for wide-bodied aircraft, each equipped with 2 passenger boarding bridges. Each gate can serve 2 small aircraft (SJ) as shown in Figure 7.4-5.

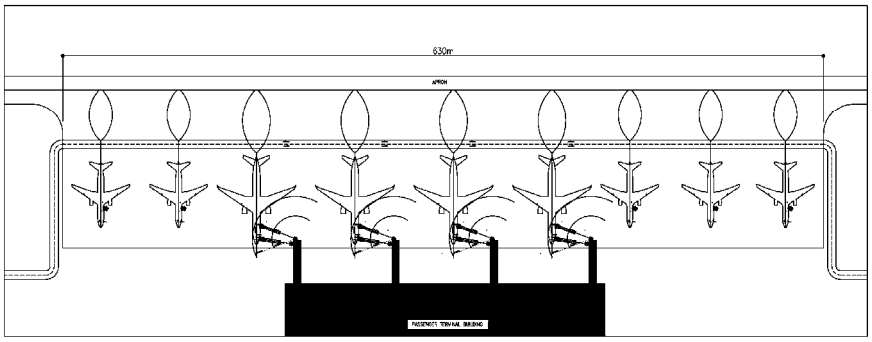
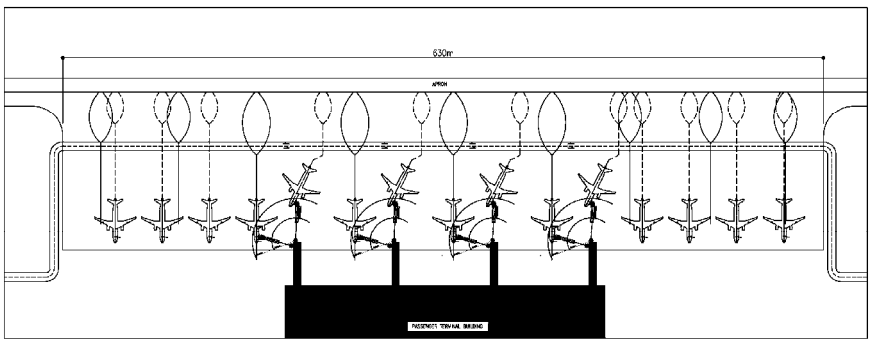
Basic Pattern Fixed Gates 4 B777-300 Remote Apron 5 B767-300 **9 in total**	
Variation Fixed Gates 8 A321-200 Remote Apron 7 A321-200 **15 in total**	

Figure 7.4-5 Aircraft Parking Pattern at Terminal 2 (Multi-aircraft Ramp System)

5) Airfield Pavement Structure

Airfield pavement structure has been designed for 20-year life based on FAA design program (FAARFIELD) based on the following design conditions:

- Expected Volume of Traffic;
- Design Aircraft; and
- Subgrade CBR and K values.

a) Annual Traffic

Annual aircraft movements for the international and domestic operations for the design years are given in Chapter 4-7, from which annual departures for the design aircraft have been computed as shown in Table 7.4-5.

Table 7.4-5 Annual Departures of Design Aircraft (One-way Aircraft Movement)

Aircraft/Years	2020	2030	Annual Growth
B777-200	1,220	1,941	4.75%
A320-200	15,279	24,547	4.86%

b) Pavement Thickness Calculation

Firstly, the annual departures of the design aircraft have been entered into the FAARFIELD Pavement Design Program as shown in Figure 7.4-6.

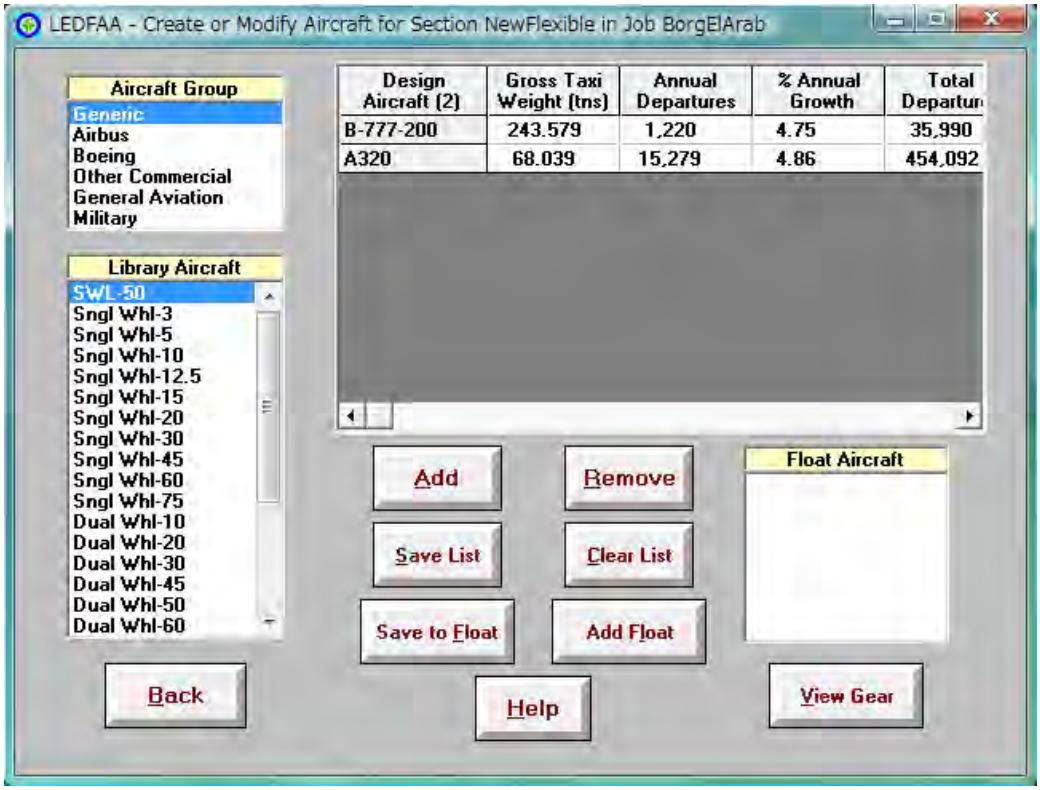


Figure 7.4-6 Inputting Annual Departures of Design Aircraft into Computer Program

Then, the material specifications have been entered into the FAARFIELD Pavement Design Program, which produces the required thickness of each of the flexible and rigid pavement layers, as shown in Figure 7.4-7 and Figure 7.4-8.

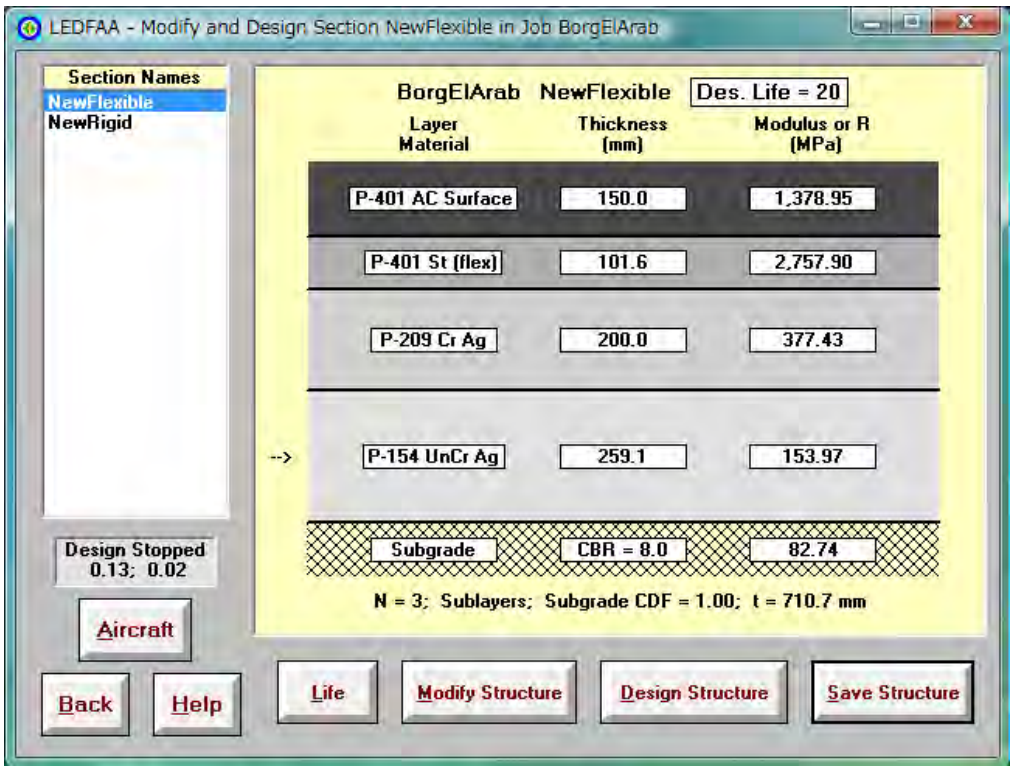


Figure 7.4-7 Specifications and Thicknesses of Flexible Pavement Layers

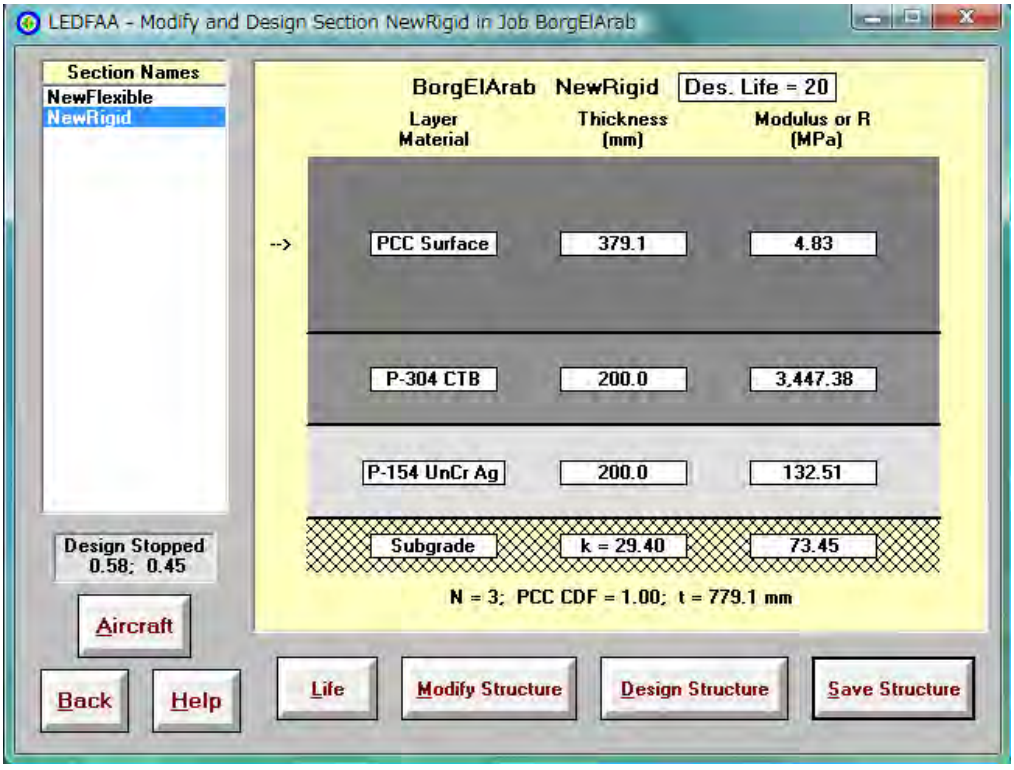


Figure 7.4-8 Specifications and Thicknesses of Rigid Pavement Layers

c) Pavement Structure

Based on the pavement thicknesses given from the FAARFIELD Pavement Design Program, pavement structures for runway, taxiways and apron have been preliminarily prepared as shown in Figure 7.4-9 to Figure 7.4-11.

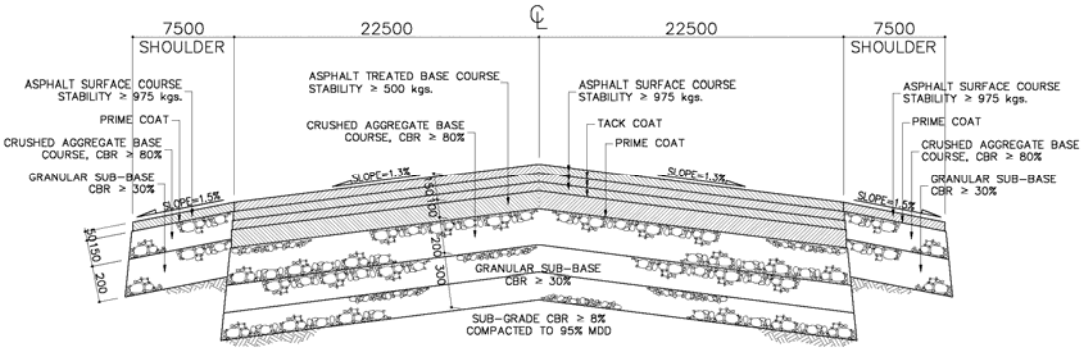


Figure 7.4-9 Preliminary Typical Runway Pavement Structure

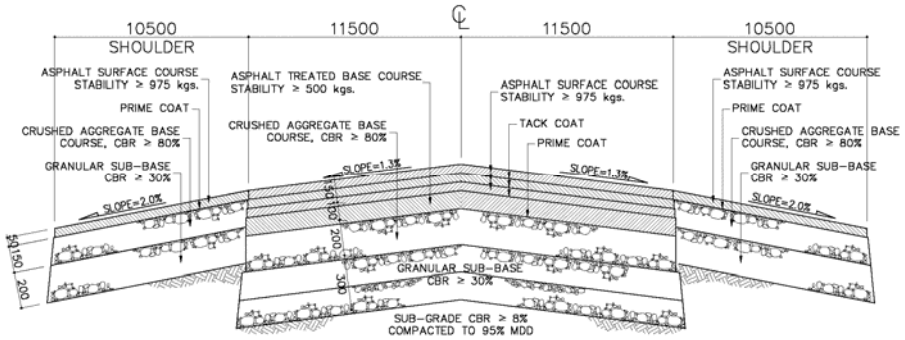


Figure 7.4-10 Preliminary Typical Taxiway Pavement Structure

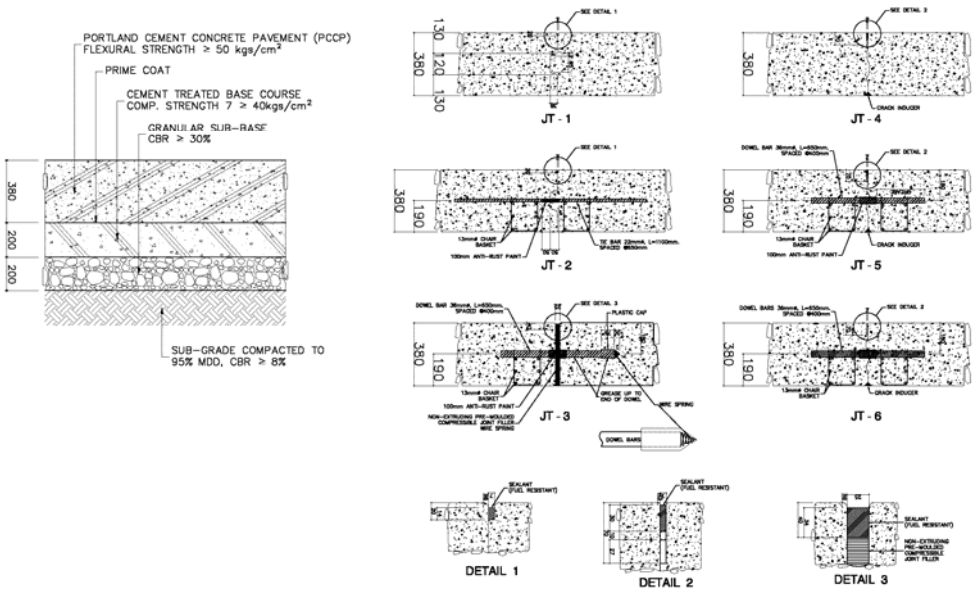


Figure 7.4-11 Preliminary Typical Apron Pavement Structure

6) Air Navigational Facility

a) Radio Navigational Aids

Instrument Landing System (ILS: CAT-I) consisting of the localizer, glide slope and terminal DME will be installed for the precision approach to Runway 32R. One set of Doppler VHF Omni-Directional Radio Beacon / Distance Measuring Equipment (DVOR/DME) will also be provided.

Remote Control Equipment will be installed at a Primary Substation (PSS) to be developed under the Phase-2.

b) Aeronautical Ground Lights

Following aeronautical ground lights will need to be installed:

- ✓ One set of the Precision Approach Lighting System (PALS) for the precision approach Runway 32R and one set of the Simple Approach Lighting System (SALS) for the non-precision approach Runway 14L;
- ✓ Two sets of the Precision Approach Path Indicator (PAPI) for both approach runways (32R and 14L);
- ✓ Runway Lighting System;
- ✓ Taxiway Lighting System;
- ✓ Wind Direction Indicator Lights (WDIL) for both approach runways (32R and 14L); and
- ✓ Constant Current Regulators (CCR) and Remote Control System at the new Primary Substation (PSS).

c) Meteorological Equipment

The following meteorological equipment will be installed at both ends of the approach runways:

- ✓ Transmission meter with RVR converter;
- ✓ Anemometer;
- ✓ Thermometer;
- ✓ Hygrometer; and
- ✓ Barometer.

The following equipment will be installed at the existing Meteorological building:

- ✓ Weather Data Processing and Display System.

7.4.3. Possible Options for Phase-2 Development Scheme

The Phase-2 Development scheme is wholly depending on where the 2nd runway is constructed. For the purpose of this Report, the following two (2) Options are considered:

Option 1: the 2nd runway is to be constructed between the completed terminal and the existing runway in MOD premise, which forms a closed parallel runway system.

Option 2: the 2nd runway is to be constructed in the EAC premises which forms an open parallel runway system.

Each Option is further described hereunder:

1) Option 1 - Closed Parallel 2nd Runway in MOD Premise

a) Possible Development Scenario

Minimum distance between the two (2) parallel runways is 210 m as referred to in the above Chapter 7.4.2.- 2) (c), in case the two runways are intended to be used for simultaneous non-instrument operations. It is preferable however to secure the distance of more than 300 m to separate the two (2) runway strips, each having the width of 150 m from the centerline of instrument landing runway, so that pavement rehabilitation of either runway can be made without jeopardizing transitional surface of the other.

It is further preferable if the two (2) runway strips are designated for either priority use of EAC or MOD independently, hence are segregated by the two perimeter roads (for MOD and EAC, respectively) and boundary fence between them.

Since the area between the existing runway and the apron taxi lane at the passenger terminal is measured at 786.5 m, the 2nd runway can be set at a distance of 320 m from the existing runway, with a provision of parallel taxiway at a distance of 200 m and another parallel taxiway at a distance of 100 m or remote aircraft parking stands as the case may be, as shown in Figure 7.4-12.

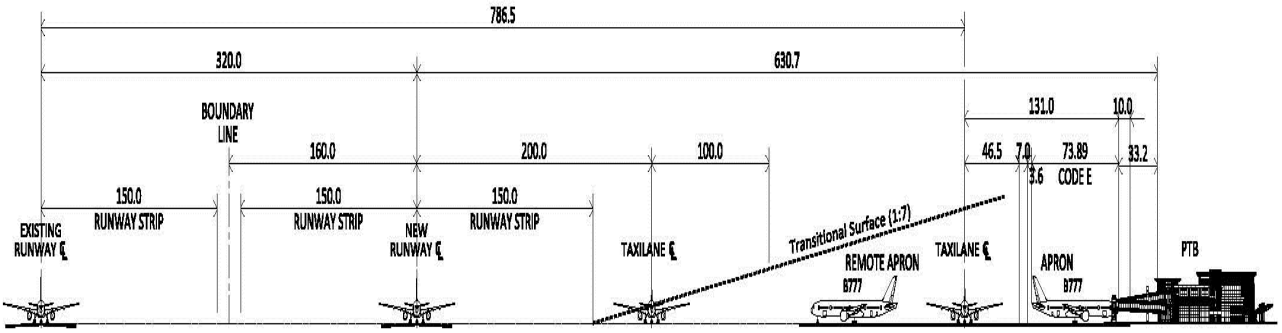


Figure 7.4-12 Option 1- Separation between the Closed Parallel Runways, Parallel Taxiway, and Apron Taxilane

The existing terrain at the planned area is highly undulating. The elevation at Runway14 end is 6 m higher than the new terminal area, while the elevation around the middle of the runway is 10 m lower than the area of control tower to fire station.

The difference in elevation between the new terminal apron and control tower area is 8 to 9 m. Therefore, when the Phase-2 terminal is aimed to be located in the middle between them, the Phase-2 terminal and aircraft parking apron should be planned at around 4 m higher than the completed apron, since the apron slope should be planned as very minimal (less than 1 % for combined longitudinal and lateral slope) in accordance with ICAO.

Those undulated major pavement areas, e.g. for the 2 runways, parallel taxiway and 2 isolated aprons, should be moderately connected with sloped taxiways, maximum longitudinal slope of which is 1.5 %.

Those spot elevations are preliminarily planned as shown in Figure 7.4-13.

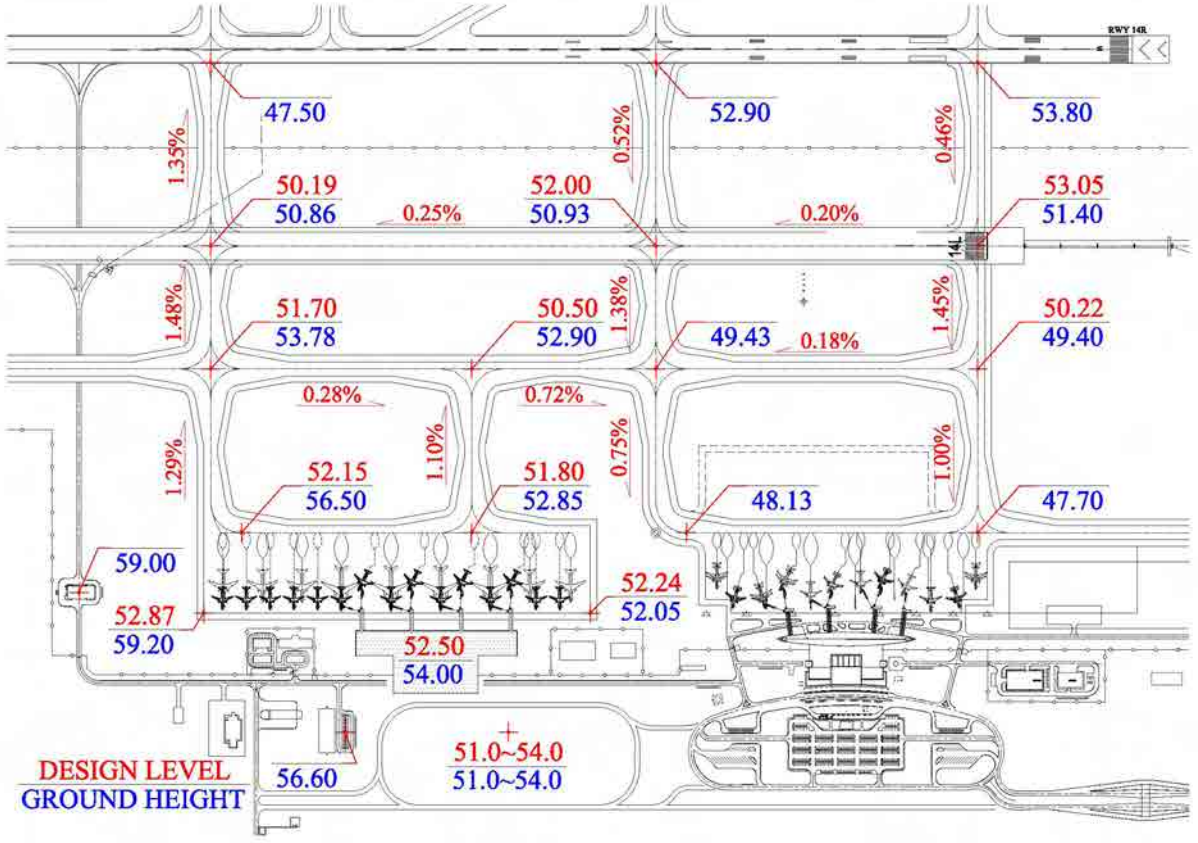


Figure 7.4-13 Option 1- Planned Elevation for the Closed Parallel Runways, Parallel Taxiway, Taxilane and Apron

b) Suggested Option 1 Phase-2 Development Plan

The layout plan for the Phase-2 Development with the closed parallel runway is suggested as shown in Figure 7.4-14.

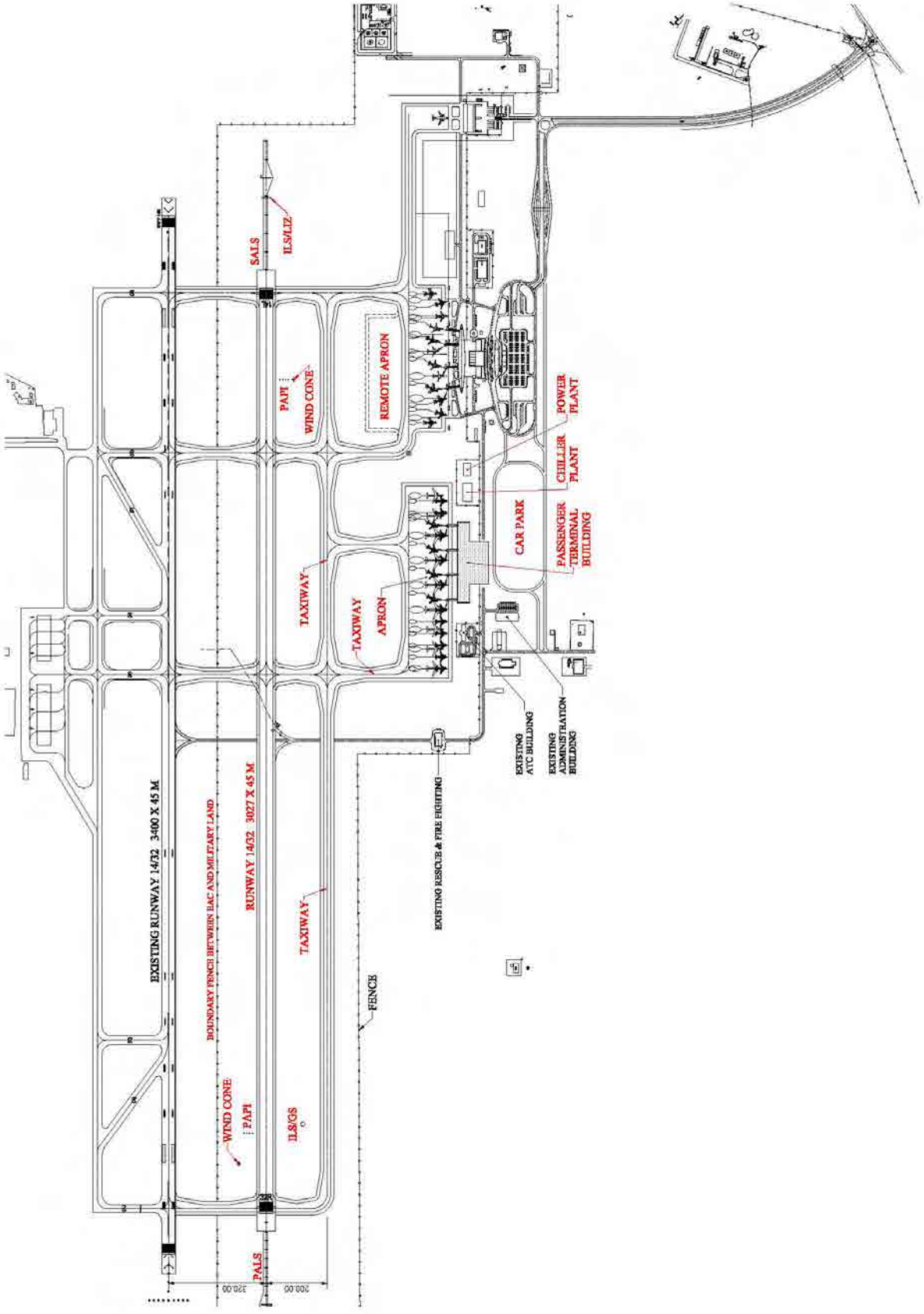


Figure 7.4-14 Suggested Option 1 for Phase-2 Development Plan with Closed Parallel 2nd Runway

c) Cost Estimate

Project cost for the Option 1 Phase-2 Development has been preliminarily estimated as shown in Table 7.4-6.

Table 7.4-6 Option 1 - Preliminary Cost Estimate for Phase-2 Development

Description			Unit	Qty	Amount (L.E)	Amount (Yen)	Conbined amount	
							in L.E.	in Yen
Exchange rate : Japanese Yen = EGP 0.0769								
A: Construction								
Part 1 General Requirements				1	**11,893,945.91**	**70,077,257**	**17,284,504.14**	**224,698,554**
Part 2 Civil Works					**396,811,780.45**	**86,177,651.76**	**403,440,830.58**	**5,244,730,798**
Earthwork								
Excavation			m3	3,800,000	67,469,923.40		67,469,923.40	877,109,004
Embankment			m3	3,800,000	69,851,915.40		69,851,915.40	908,074,900
Pavement								
Runway 3,027m			Sum	1	44,228,038.26		44,228,038.26	574,964,497
Taxiway 5,690m			Sum	1	64,978,937.13		64,978,937.13	844,726,183
Apron			Sum	1	73,108,303.76		73,108,303.76	950,407,949
Road and Car park			Sum	1	12,010,373.17		12,010,373.17	156,134,851
Other roads, marking and subgrade for pavement			Sum	1	24,367,908.93		24,367,908.93	316,782,816
Stormwater Drainage								
Manholes, inlets, pipes and open ditches			Sum	1	13,722,957.16	1,920,633	13,870,698.16	180,319,076
Miscellaneous								
Fences, Gates, road signs and flag poles			Sum	1	6,630,736.90	2,588,458	6,829,849.06	88,788,038
Landscaping			Sum	1	20,442,686.34	81,668,561	26,724,883.31	347,423,483
Part 3 Utility Works					**51,305,457.00**	**763,570,557.00**	**110,041,653.69**	**1,430,541,498**
Power Supply			Sum	1	43,321,776.64	362,851,223	71,233,409.18	926,034,319
Water/ Chiller Plant			Sum	1	3,766,339.59	298,701,868	26,743,406.36	347,664,283
Fire Fighting Facility			Sum	1	1,146,276.93	99,524,271	8,801,990.08	114,425,871
Sewage Treatment			Sum	1	3,071,063.84	2,493,195	3,262,848.07	42,417,025
Part 4 Building Works					**207,969,923.15**	**3,559,916,448.00**	**481,809,649.91**	**6,263,525,449**
Passenger Terminal Building (PTB)			Sum	1	185,628,499.08	3,448,612,562	450,906,388.46	5,861,783,050
Other Buildings			Sum	1	22,341,424.07	111,303,886	30,903,261.45	401,742,399
Primary substation(PSS)								
Chiller Plant & Water Tank Building (CHT)								
PTS Substation (PTS)								
Guard House(GDH)								
Part 5 Nav Aids Works			Sum	1	**1,173,312.00**	**221,012,720**	**18,174,290.46**	**236,265,776**
Part 6 Aeronautical Ground Lighting Works			Sum	1	**19,734,086.35**	**127,579,994**	**29,547,932.04**	**384,123,117**
Part 7 Road & Car Park Lighting Works			Sum	1	**3,860,160.84**	**76,650,584**	**9,756,359.61**	**126,832,675**
Subtotal of Construction works (Part 1 to 7)					**692,748,665.70**	**4,904,985,211.76**	**1,070,055,220.45**	**13,910,717,866**
Contingency		5% of subtotal			35,000,000.00	245,000,000	53,846,153.85	700,000,000
Price Escalation		10.0%			72,774,866.57			946,073,265
Total of Construction Cost A:					**800,523,532.27**	**5,149,985,211.76**	**1,196,676,240.87**	**15,556,791,131**
B: Consultancy Services		% of construction						
Preconstruction Stage	Part 1 Detailed Design	3.0%			8,975,071.81	350,027,800	35,900,287.19	466,703,734
	Part 2 Assistance in Bidding	1.0%			2,393,352.48	124,454,329	11,966,762.40	155,567,911
Construction Stage	Part 3 Construction Supervisio	8.0%			19,146,819.85	995,634,632	95,734,099.23	1,244,543,290
	Part 4 Maintenance Supervisio	2.0%			5,983,381.20	233,351,867	23,933,524.82	311,135,823
Contingency		5%			1,800,000.00	85,200,000.00	8,353,846.15	108,600,000
Total of Consultancy Cost B:					**38,298,625.34**	**1,788,668,628**	**175,888,519.79**	**2,286,550,757**
C: Grand Total Cost for A (Construction) and B (Consultancy)					838,822,157.61	6,938,653,840	1,372,564,760.66	17,843,341,889
D: Project Administration Cost		1.0%			8,388,221.58			109,046,881
E: Grand Total					**847,210,379.19**	**6,938,653,840**	**1,372,564,760.66**	**17,952,388,769**

Notes

1) Unit cost used is basically an average of the previously-offered prices of Besix-Orascom Joint venture (BOJV) and Taisei-TAV Joint venture (TTJV) as of the Bidding in 2007 for the Project.

2) Average inflation rate in Egypt for the past 7 years (from 2003 to 2010) was 9.4 %, therefore basic local costs have been escalated for 5 years after the Bidding (from 2007 to 2012) by 56.71 %.

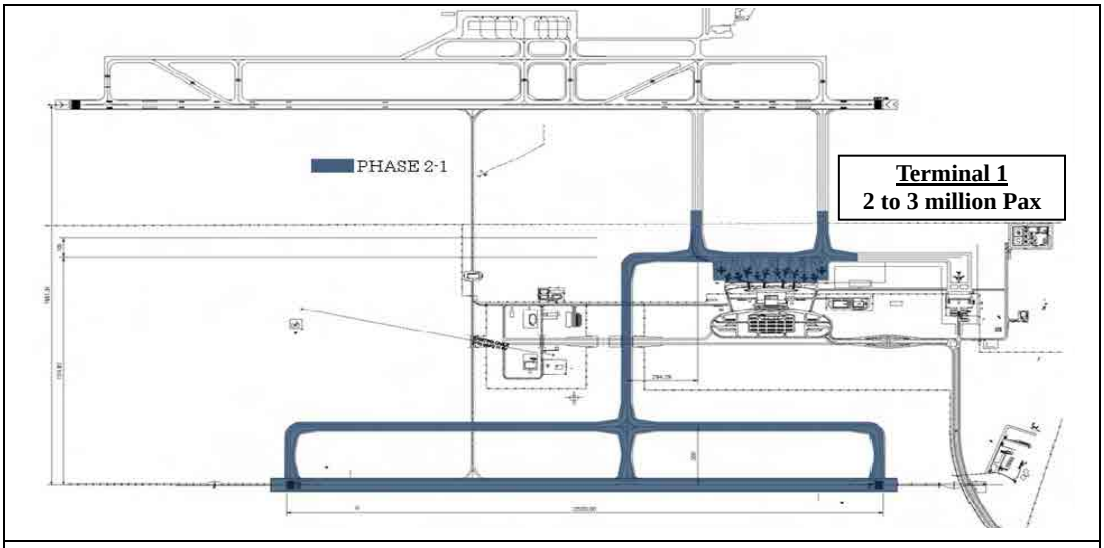
2) Option 2 - Open Parallel 2nd Runway in EAC Premise

a) Possible Development Scenario

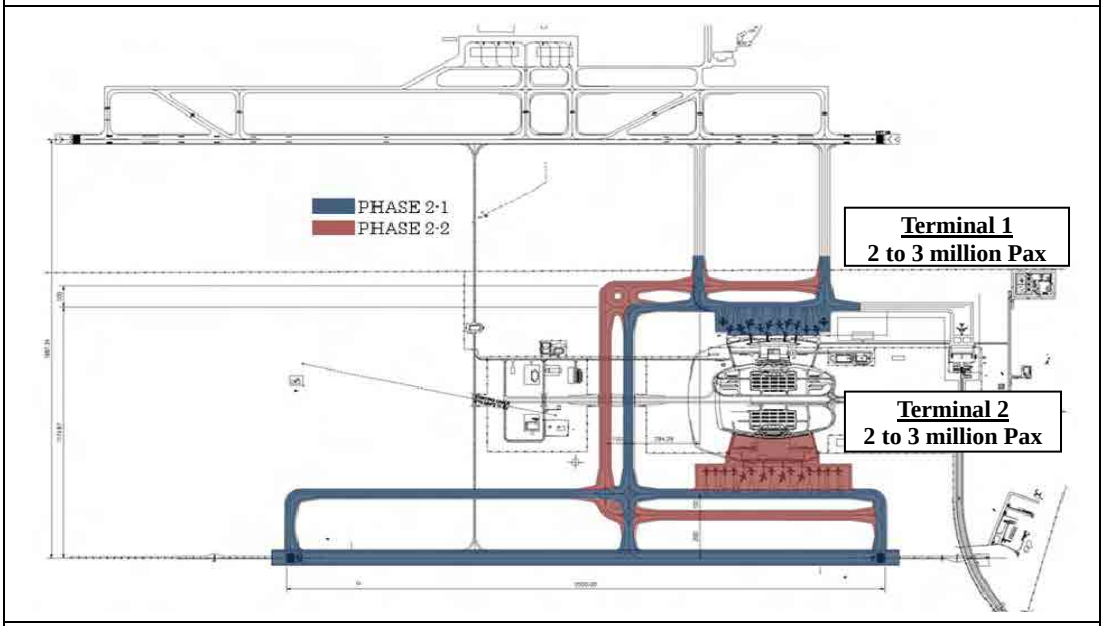
The length of the 2nd runway is provisionally proposed at 2,500 m, and separation between the two (2) runways is set at 1,960 m which can satisfy the ICAO's recommended minimum of 1,035 m allowing simultaneous operations on both runways.

In this circumstance, the construction of Terminal 2 is proposed to face at the 2nd runway.

Sequence for Phase-2 Development is suggested as shown in Figure 7.4-15.



Option 2 Phase 2-1: Construction of Runway & Taxiway to/from Terminal 1

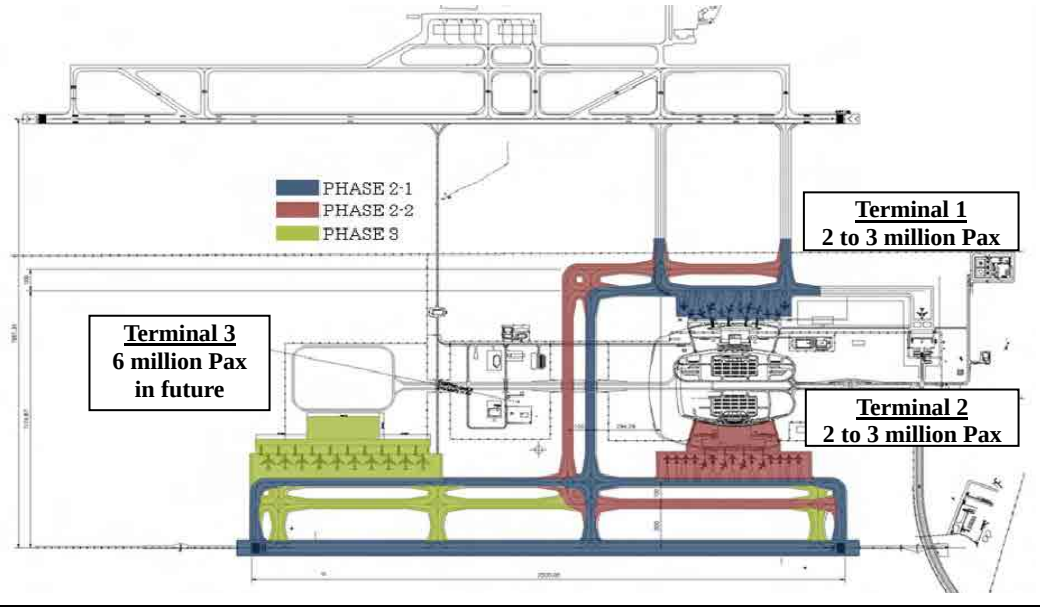


Option 2 Phase 2-2: Construction of Terminal 2 & Separate Taxiways between Terminals

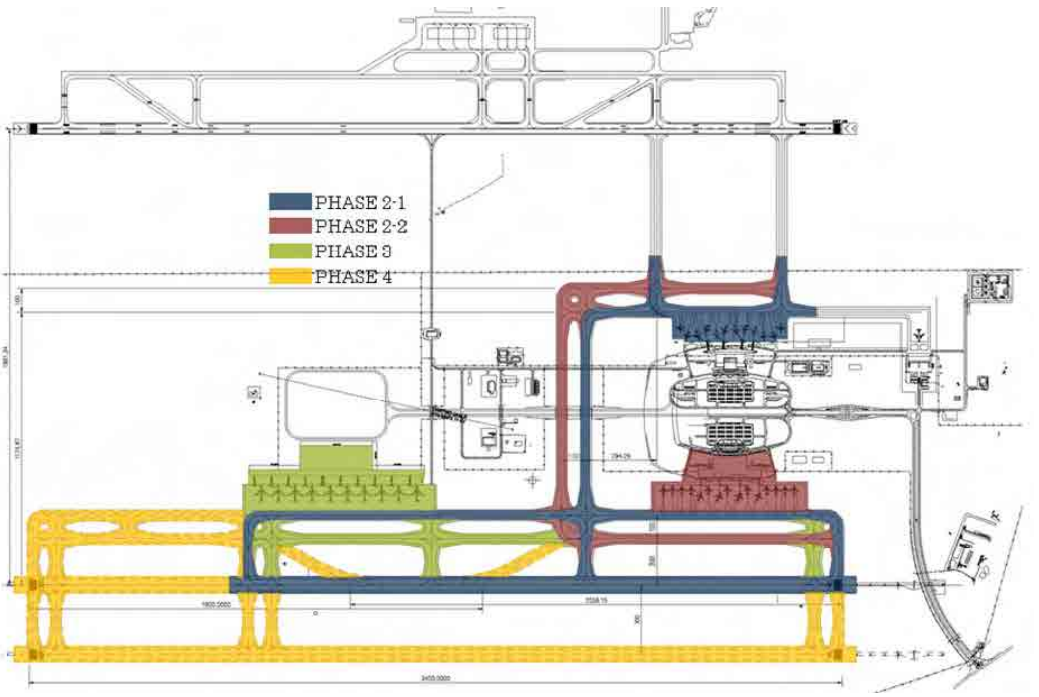
Figure 7.4-15 Suggested Phase-2 Development (Option 2: Open Parallel Runway)

Furthermore, when the number of annual passengers increases to, say over 6 million, another passenger terminal (Terminal 3) may have to be considered.

In this connection, direction for further development is suggested toward the south as shown in Figure 7.4-16. The length of the 2nd runway is assumed to be eventually extended to 3,400 m, the same as the 1st runway.



Option 2 Phase 3-1: Construction of Terminal 3



Option 2 Phase 3-2: Future Provision of Runway Extension to 3,400 m

Figure 7.4-16 Suggested Direction for Further Development (Option 2: Open Parallel Runway)

Location of the Terminal 3 shown above is just for future reference as an convenient location, insofar-as more than 90 % of aircraft takeoff operations are made from the runway 32.

b) Planned Elevation

The proposed Phase-2 development site is highly undulating terrain according to the initial topographic survey conducted in 2008.

The runway profile should be set in accordance with the requirements stipulated in ICAO Annex 14 as abstracted in Table 7.4-7.

Table 7.4-7 Longitudinal Profile of the Runway (ICAO Annex 14)

Clause No		Recommendation
3.1.13	Longitudinal slopes	The slope computed by dividing the difference between maximum and minimum elevation along the runway centerline by the runway length should not exceed 1 % where the code number is 3 or 4.
3.1.14		Along no portion of a runway should be the longitudinal slope exceed 1.25 % where the code number is 4, except that for the first and last quarter of the length of the runway the longitudinal slope should not exceed 0.8 %
3.1.15	Longitudinal slope change	Where slope change cannot be avoided, a slope change between two consecutive slopes should not exceed 1.5 % where the code number is 3 or 4.
3.1.16		The transition from one slope to another should be accomplished by a curved surface with a rate of change not exceeding 0.1 % per 30 m (minimum radius of curvature of 30,000 m) where the code number is 4.
3.1.17	Sight distance	Where slope changes cannot be avoided, they should be such that there will be an unobstructed line of sight from any point 3 m above a runway to all other points 3 m above the runway within a distance of at least half the length of the runway where code letter is C, D, E, or F

c) Runway Profile

In accordance with the above Annex 14 of ICAO, the longitudinal profile of the 2nd runway has been preliminarily planned as shown in Figure 7.4-17 (existing height: blue line and planned elevations: red line).

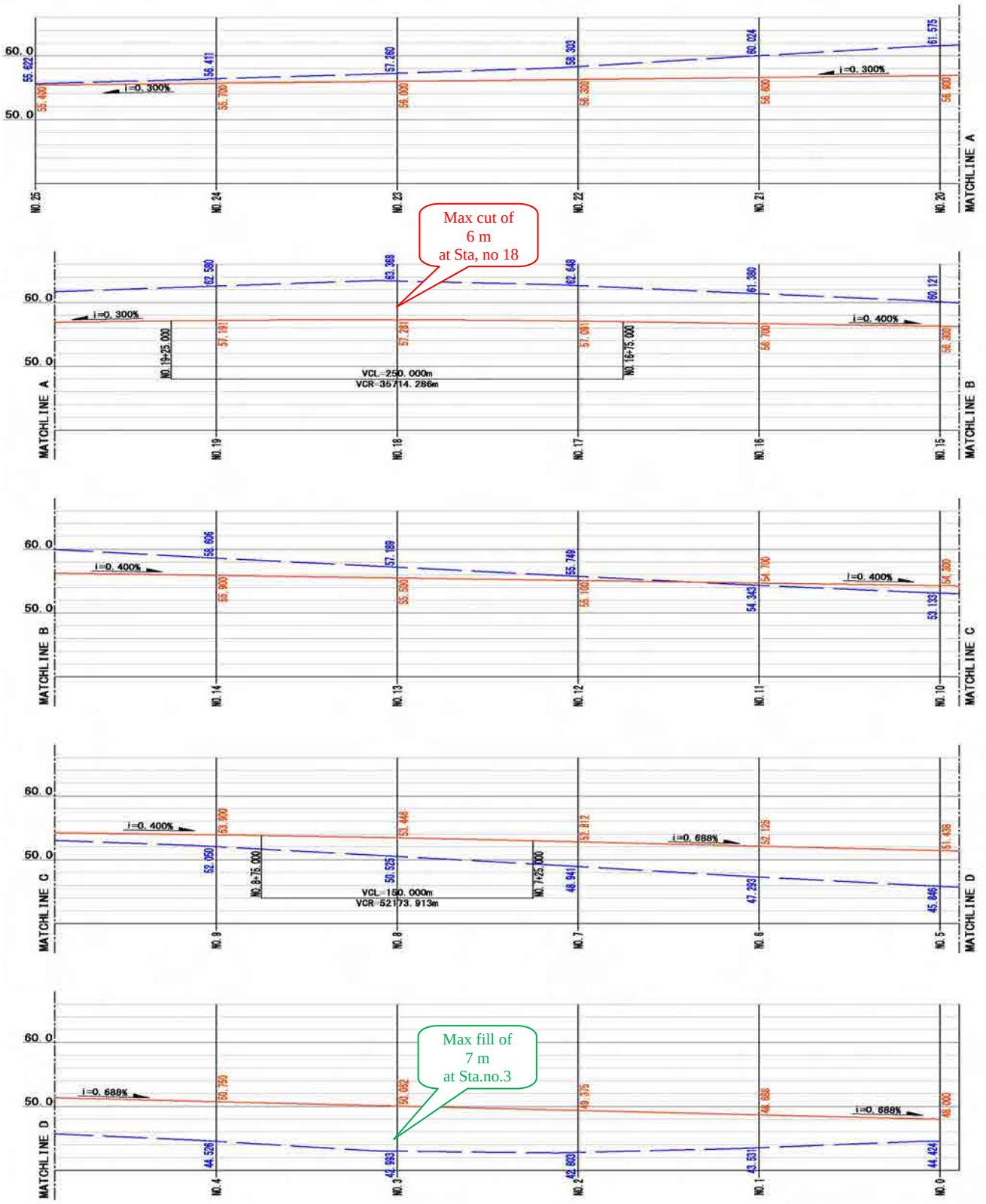


Figure 7.4-17 Option 2 - 2nd Runway Profile

Based on the runway profile, spot elevations for the site development has been preliminarily planned as shown in Figure 7.4-18 and Figure 7.4-19.

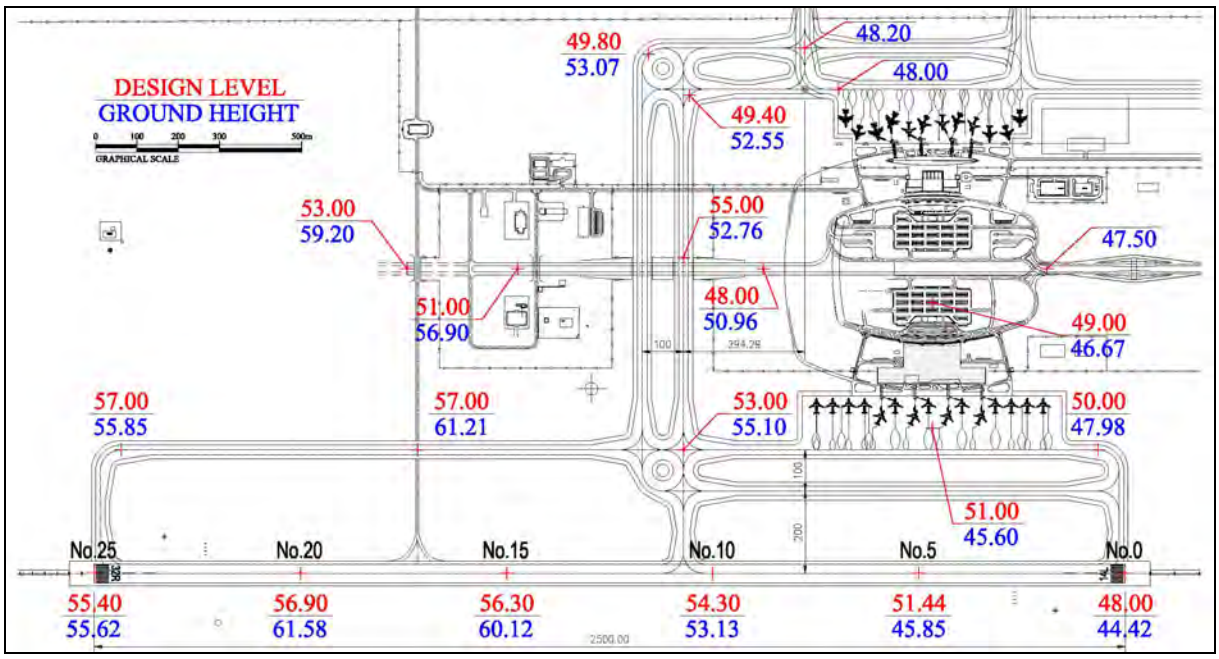


Figure 7.4-18 Option 2 - Planned Elevations for Phase-2 Facilities

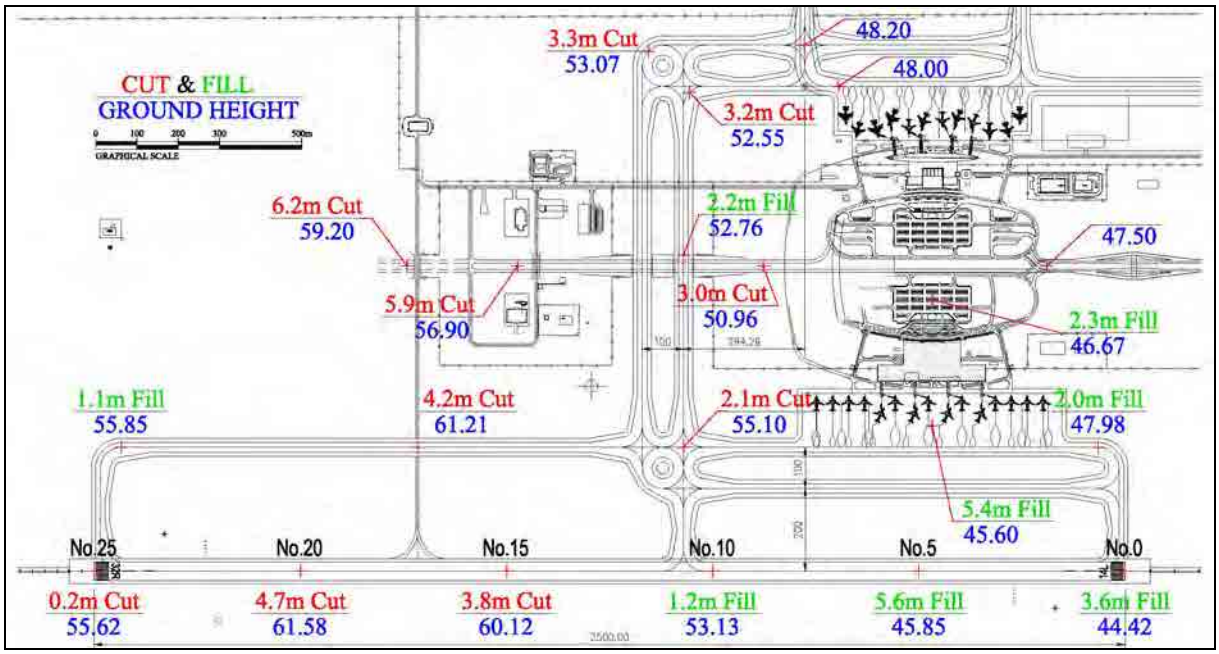


Figure 7.4-19 Option 2 - Planned Heights of Cut and Fill for Phase-2 Facilities

d) Area and Earthwork Volume for Site Development

The areas for the Phase-2 and Phase-3 development covers approximately 260 ha and 210 ha respectively as shown in Figure 7.4-20.

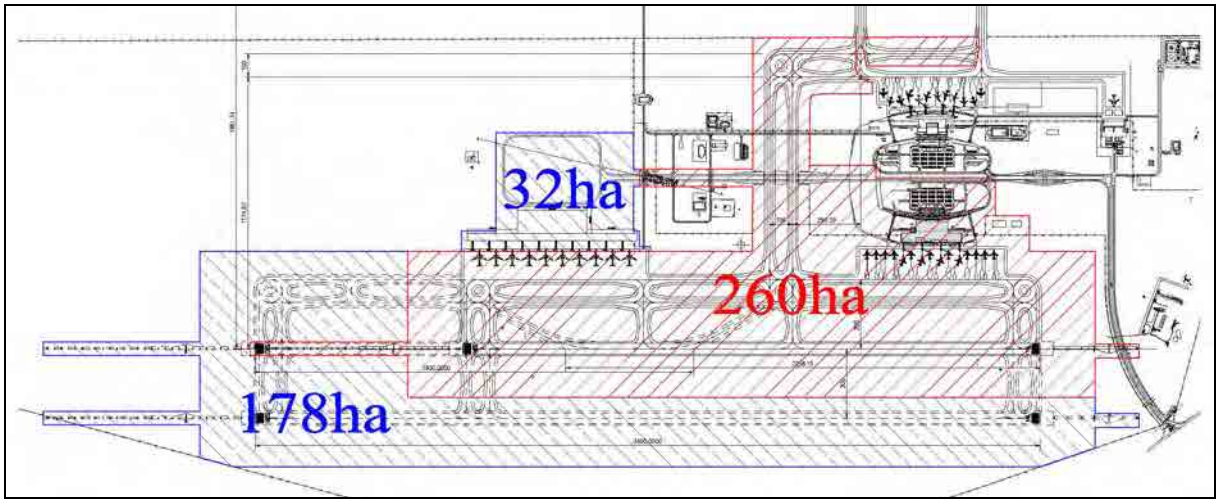


Figure 7.4-20 Option 2 - Areas for Site Development
(Red Zone: Phase-2, Green Zone: Phase 3)

As given in Figure 7.4-17 to Figure 7.4-19, the existing undulating terrain shall be cut and filled, and evenly compacted in consideration of well-balanced volumes for earthwork.

Generally, viewing along the 2nd runway profile (Figure 7.4-17) the area for northern 1 km (Sta. Nos. 0 to 10) is to be filled with a maximum height of 7 m (around Sta. No.3), while that for southern 1.5 km (Sta. Nos. 10 to 25) is to be cut with a maximum height of 6 m (at sta. No. 18).

Since the runway is to be filled by 7 m in some part or to be cut by 6m in other part, wide areas for the runway strip and its immediate vicinity for further extension or future runway shall be cut and filled and evenly moderated during the initial stage of the Phase-2 Development.

In the entire area of 470 ha, the area to be cut is approximately half (i.e. 230 ha) with an average excavation height of 3.5 m. The excavated soil of some 8 million m^3 will be filled in the remaining half of the area with similar average height (i.e. some 3.5 m) so that the entire earthwork volumes are balanced.

e) Location of Fire station and Distance to Runway ends

In accordance with ICAO Annex 14, the Aerodrome Category for fire-fighting services is to be determined based on the maximum aircraft size in operations. Since B777 is assumed to be used eventually for regular operations at the Airport, the Category for fire-fighting services should be Category 9, which requires a minimum of three (3) fire fighting vehicles, having a total water tank capacity of 24,300 liters with a foam solution discharge rate of 9,000 liters/minutes.

Those minimum required level of service has been already provided in the new fire station constructed at a location equidistant from the both of the existing 3,400-long runway. The entrance/exit of this fire station was provided on back-to-back arrangement which is therefore accessible to the 2nd runway.

Location of the fire station and distances to runway ends are shown in Figure 7.4-21.

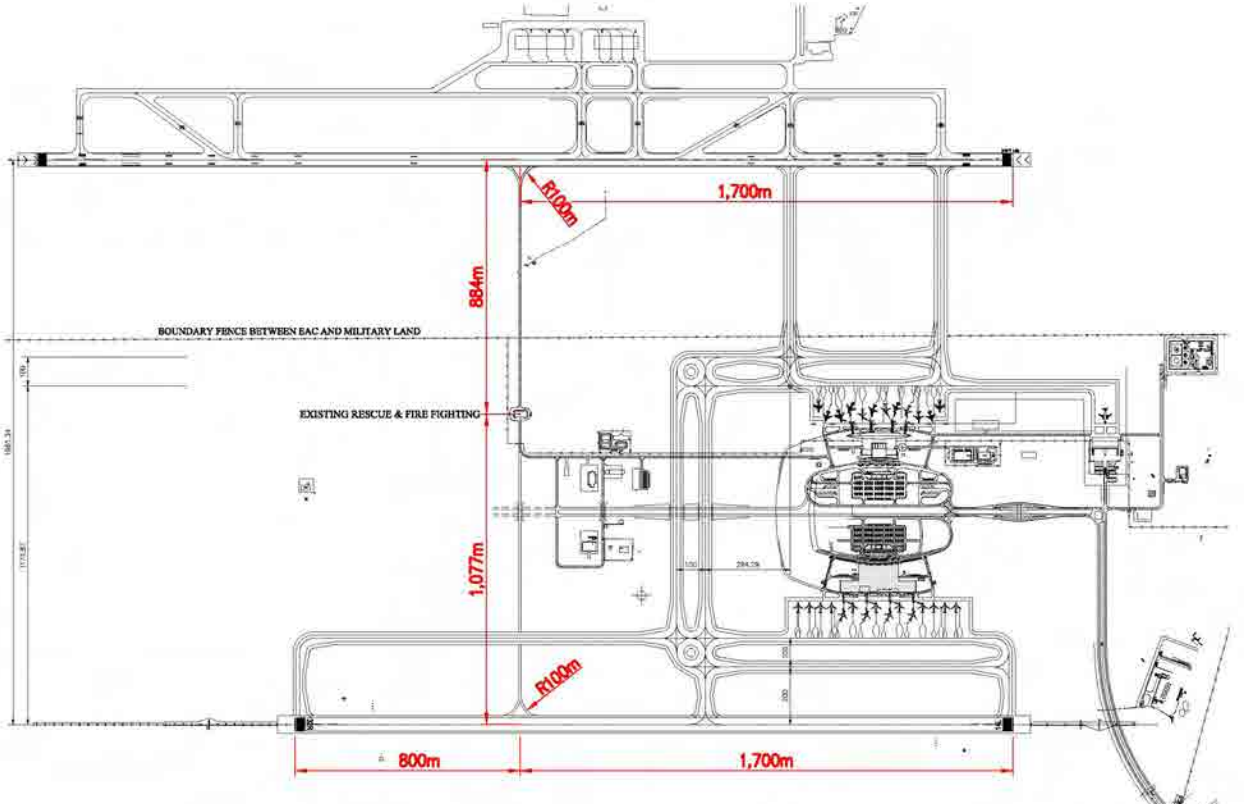


Figure 7.4-21 Location of Fire station and Distance to Runway ends

ICAO mandates that the response time of airport fire-fighting services should be less than 3 minutes, but further recommends to be minimized to be less than 2 minutes. The response time is considered to be the lapse of time from the initial call made to the rescue and fire-fighting service to the first vehicle being in position to apply foam at a rate of at least half the specified discharge rate.

Response time of fire fighting vehicle has been computed based on manufacturer's specification, acceleration/ deceleration length and time as shown in Table 7.4-8.

Table 7.4-8 Response Time of Fire Fighting Vehicles

	A. High-speed Fire Fighting Vehicle (6,000L water capacity)			B. Normal Fire Fighting Vehicle (10,000L water capacity)		
a Maximum Speed	**90 km/h**			**80 km/h**		
b Acceleration length & time		length	time		length	time
	0 - 90 km/h	461 m	29 sec	0 - 80 km/h	527 m	37 sec
	0 - 70 km/h	120 m	15 sec	0 - 70 km/h	400 m	25 sec
	0 - 50 km/h	76 m	11 sec	0 - 50 km/h	115 m	15 sec
	50 - 90 km/h	385 m	18 sec	50 - 80 km/h	412 m	22 sec
c Deceleration length & time						
	90 - 50 km/h	52 m	3.5 sec	80 - 50 km/h	48 m	3.5 sec
	70 - 50 km/h	20 m	1.5 sec			
	50 - 0 km/h	17 m	2.5 sec	50 - 0 km/h	19 m	3 sec
	90 - 0 km/h	68 m	4.5 sec	80 - 0 km/h	63 m	4.5 sec
d Curving speeed	50 km/h	R = 100 m		50 km/h	R = 100 m	
	90 km/h	R = 300 m		90 km/h	R = 300 m	

e Distance to runway end

Fire station to start of curve	977m	Straight
to end of Curve	157 m	Curve (R=100 m)
to Runway end	1600 m	Straight
Total distance from Fire Station	2,767 m	

A High-speed Fire Fighting Vehicle (Maximum Speed: 90 km/h)

Portion to run	Fire Station	Straight through Road 13			Curve (R=100) to Runway	Straight through Runway to end			at Site	Response Time (sec)	Response Time (min)
Length (m)	from fire call to start vehicle	977			157	1,600			to start dischrge foam at 50% rate of ICAO		
Speed (km/h)		0-90	90	90-50	50	50-90	90	90-0			
---in (m/sec)		varies	25.00	varies	13.89	varies	25.00	varies			
distance (m)		461	464	52	157	385	1,147	68			
Time (sec)	30.00	29.00	18.56	3.50	11.30	18.00	45.88	4.50	5.00	165.74	2.76

B Fire Fighting Vehicle (Maximum Speed: 80 km/h)

Portion to run	Fire Station	Straight through Road 13			Curve (R=100) to Runway	Straight through Runway to end			at Site	Response Time (sec)	Response Time (min)
Length (m)	from fire call to start vehicle	977			157	1,600			to start dischrge foam at 50% rate of ICAO		
Speed (km/h)		0-80	80	80-50	50	50-80	80	80-0			
---in (m/sec)		varies	22.22	varies	13.89	varies	22.22	varies			
distance (m)		527	402	48	157	412	1,125	63			
Time (sec)	30.00	37.00	18.09	3.50	11.30	22.00	50.63	4.50	5.00	182.02	3.03

The fire fighting vehicles provided through the Projects consist of one (1) high-speed rapid intervention vehicle (RIV) with a 6-ton water reservoir capacity and two (2) normal vehicles with a 10-ton water capacity, all of which were made in 2008 by IVECO Magirus of Italy.

The Table implies that if RIV type (maximum speed of 90 km/h) is used for the initial fire service the response time of 2.76 minutes is achievable satisfying the ICAO standard requirements of maximum 3 minutes.

If the response time of 2 minutes recommended by ICAO is to be pursued at the Airport, further solution should be discussed, e.g. fire engine and men should be ready to start before aircraft operations, or to construct another fire-fighting sub-station located closer to the runway ends.

f) Access Road Tunnel

When the Airport is provided with two open parallel runways and terminal complex is situated between them, connecting taxiways, fire access and other internal roads necessarily cross over the access road by means of taxiway bridges or underground road tunnels.

Figure 7.4-22 shows an example solution for the crossing by provision of the underground tunnels for the access road underneath the taxiway and the internal roads.

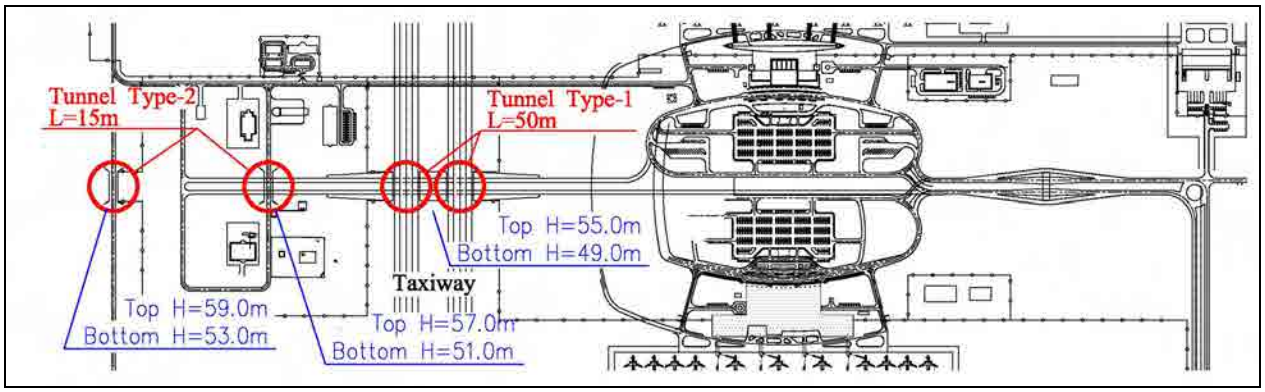


Figure 7.4-22 Option 2 - Location of Underground Road Tunnel

For the purpose of cost estimate, it has been preliminarily assumed that two (2) lanes of 130 linear m in total (i.e. 50 m + 50 m +15 m +15 m) of a consistent dimension (internal width of 8.5 m, and height of 5 m) of reinforced concrete box culverts should be constructed, of which typical cross section is shown in Figure 7.4-23.

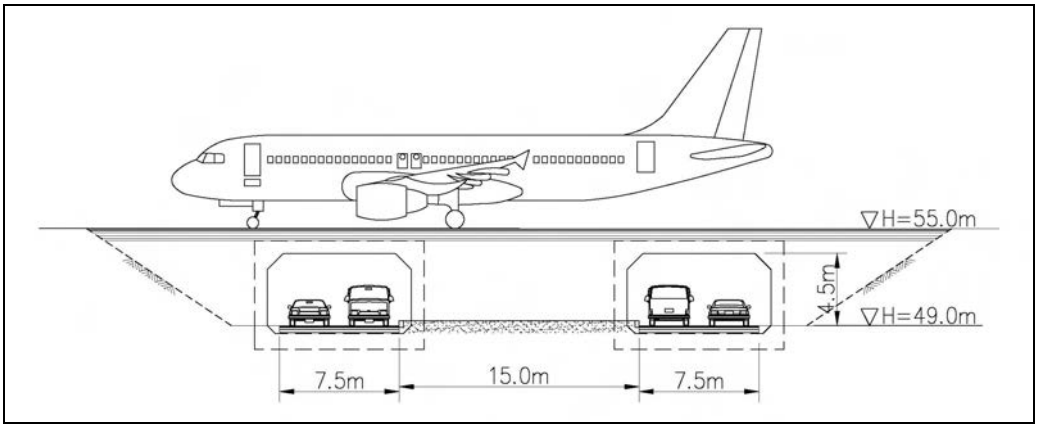


Figure 7.4-23 Option 2 - Typical Cross Section of Underground Road Tunnel

g) Suggested Option 2 Phase-2 Development Plan

As a result of the above discussion, the Phase-2 Development for the Airport has been proposed as shown in Figure 7.4-24.

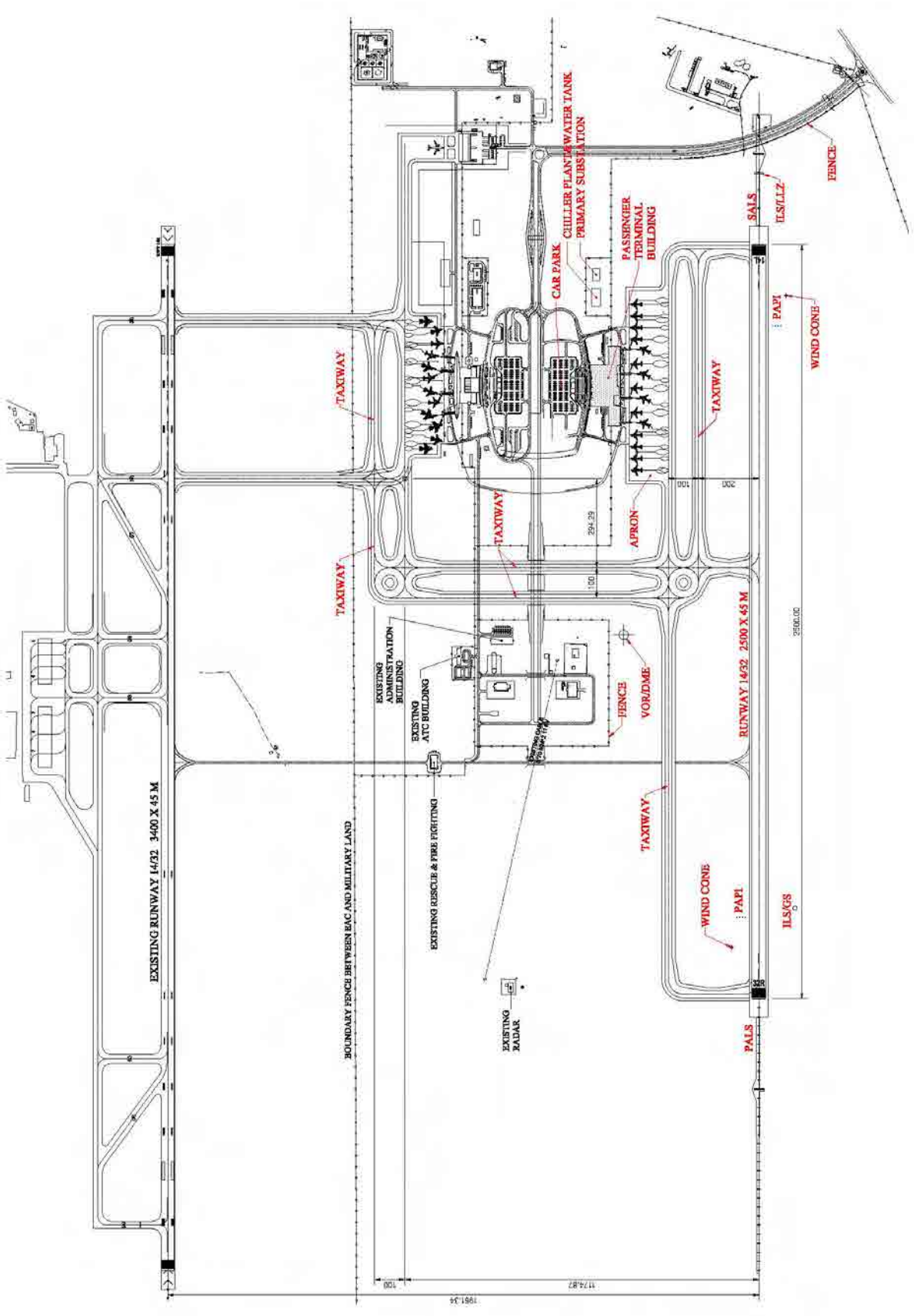


Figure 7.4-24 Suggested Option 2 Phase-2 Development Plan with Open Parallel 2nd Runway

h) Cost Estimate

Project cost for the Option 2 Phase-2 Development has been preliminarily estimated as shown in Table 7.4-9.

Table 7.4-9 Option 2 - Preliminary Cost Estimate for Phase-2 Development

Description			Unit	Qty	Amount (L.E)	Amount (Yen)	Conbined amount	
							in L.E.	in Yen
Exchange rate : Japanese Yen = EGP 0.0769								
A: Construction								
Part 1 General Requirements				1	**11,893,945.91**	**70,077,257**	**17,284,504.14**	**224,698,554**
Part 2 Civil Works					**536,947,264.03**	**86,400,352.00**	**543,593,444.95**	**7,066,714,784**
Earthwork								
Excavation			m3	7,750,409	137,610,395.14		137,610,395.14	1,788,935,137
Embankment			m3	7,665,595	140,909,603.53		140,909,603.53	1,831,824,846
Pavement								
Runway 2,500m			Sum	1	36,830,465.67		36,830,465.67	478,796,054
Taxiway 7,480m			Sum	1	78,331,910.94		78,331,910.94	1,018,314,842
Apron			Sum	1	56,525,001.88		56,525,001.88	734,825,024
Road and Car park			Sum	1	13,816,128.52		13,816,128.52	179,609,671
Other roads, marking and subgrade for pavement			Sum	1	18,758,336.36		18,758,336.36	243,858,373
Stormwater Drainage								
Manholes, inlets, pipes and open ditches			Sum	1	16,803,229.45	1,920,632	16,950,970.37	220,362,615
Miscellaneous								
Tunnnel			m	260	11,332,001.20		11,332,001.20	147,316,016
Fences, Gates, road signs and flag poles			Sum	1	4,730,621.97	2,588,458	4,929,734.12	64,086,544
Landscaping			Sum	1	21,299,569.37	81,891,262	27,598,897.22	358,785,664
Part 3 Utility Works					**51,305,457.00**	**763,570,557.00**	**110,041,653.69**	**1,430,541,498**
Power Supply			Sum	1	43,321,776.64	362,851,223	71,233,409.18	926,034,319
Water/ Chiller Plant			Sum	1	3,766,339.59	298,701,868	26,743,406.36	347,664,283
Fire Fighting Facility			Sum	1	1,146,276.93	99,524,271	8,801,990.08	114,425,871
Sewage Treatment			Sum	1	3,071,063.84	2,493,195	3,262,848.07	42,417,025
Part 4 Building Works					**207,969,923.15**	**3,559,916,448.00**	**481,809,649.91**	**6,263,525,449**
Passenger Terminal Building (PTB)			Sum	1	185,628,499.08	3,448,612,562	450,906,388.46	5,861,783,050
Other Buildings			Sum	1	22,341,424.07	111,303,886	30,903,261.45	401,742,399
Primary substation(PSS)								
Chiller Plant & Water Tank Building (CHT)								
PTS Substation (PTS)								
Guard House(GDH)								
Part 5 Nav Aids Works			Sum	1	**1,173,312.00**	**221,012,720**	**18,174,290.46**	**236,265,776**
Part 6 Aeronautical Ground Lighting Works			Sum	1	**18,271,857.83**	**117,916,478**	**27,342,356.14**	**355,450,630**
Part 7 Road & Car Park Lighting Works			Sum	1	**3,860,160.84**	**76,650,584**	**9,756,359.61**	**126,832,675**
Subtotal of Construction works (Part 1 to 7)					**831,421,920.76**	**4,895,544,396.00**	**1,208,002,258.91**	**15,704,029,366**
Contingency		5% of subtotal			42,000,000.00	245,000,000	60,846,153.85	791,000,000
Price Escalation		10.0%			87,342,192.08			1,135,448,497
Total of Construction Cost A:					**960,764,112.84**	**5,140,544,396.00**	**1,356,190,604.84**	**17,630,477,863**
B: Consultancy Services		% of construction						
Preconstruction Stage	Part 1 Detailed Design	3.0%			10,171,429.54	396,685,752	40,685,718.16	528,914,336
	Part 2 Assistance in Bidding	1.0%			2,712,381.21	141,043,823	13,561,906.06	176,304,779
Construction Stage	Part 3 Construction Supervisio	8.0%			21,699,049.68	1,128,350,583	108,495,248.37	1,410,438,229
	Part 4 Maintenance Supervisio	2.0%			6,780,953.02	264,457,168	27,123,812.10	352,609,557
Contingency		5%			2,100,000.00	96,500,000.00	9,523,076.92	123,800,000
Total of Consultancy Cost B:					**43,463,813.45**	**2,027,037,326**	**199,389,761.61**	**2,592,066,901**
C: Grand Total Cost for A (Construction) and B (Consultancy)					1,004,227,926.29	7,167,581,722	1,555,580,366.45	20,222,544,764
D: Project Administration Cost		1.0%			10,042,279.26			130,549,630
E: Grand Total					**1,014,270,205.55**	**7,167,581,722**	**1,555,580,366.45**	**20,353,094,394**

Notes
1) Unit cost used is basically an average of the previously-offered prices of Besix-Orascom Joint venture (BOJV) and Taisei-TAV Joint venture (TTJV) as of the Bidding in 2007 for the Project.
2) Average inflation rate in Egypt for the past 7 years (from 2003 to 2010) was 9.4 %, therefore basic local costs have been escalated for 5 years after the Bidding (from 2007 to 2012) by 56.71 %.

7.4.4. Project Implementation Scheme

The Phase-2 Development for Borg El Arab International Airport would involve construction of wide area of airfield pavement accompanied by a vast volume of earthwork (approximately 8 million-m^3 cut, and 8 million-m^3 fill), which necessitates considerable amount of initial investment.

Normally, the amount of revenues produced by the airfield facilities is smaller than those produced by terminal facilities thus requiring longer period of cost recovery for the initial investment. Besides, passenger terminal is a main revenue generating facility among others in the airport, therefore once proposals are solicited for investment among private sectors for construction, operation and management of a passenger terminal, there might exist some interested parties.

Meanwhile, the Borg El Arab International Airport is owned and operated by the Egyptian Airports Company (EAC) which is a company of self-accounting principle though for the moment organized wholly under the Government. The staff at the Airport are being trained to possess necessary knowledge to operate, maintain and manage the Airport by themselves.

Considering the magnitude of this particular Airport where LCCs and Egyptian pilgrimage passengers are main end-users, it is considered not feasible for private sector to undertake the project by means of PPP or BOT schemes. It is further anticipated that transfer of any part of the airport revenue (e.g. from Terminal 2) to private sectors could negatively affect the overall manner of airport operations or the EAC's cash-flow as a whole.

Hence, it is considered desirable for EAC to implement the Phase-2 development with an financial assistance of foreign soft loan.