PART II

DEVELOPMENT GUIDELINES

Chapter 11 Maritime Transport Network and Future Transshipment Container of the East Mediterranean Sea

11.1 Container Traffic of the East Mediterranean

(1) The Number of Containers Handled at Ports

The number of containers handled at the Mediterranean ports has increased at an annual growth of 12.7% from 1986 to 1995(see Table 11.1.1). Growth was especially pronounced in the East Mediterranean ports registering 15.3%. To put this figure into perspective, average container traffic growth of the world was only 9.2%. Piraeus, Damietta, Haifa and Marsaxlokk are recognized as key container ports (see Table 11.1.2).

Table 11.1.1 Annual Growth of Container Traffic

Area	Average 1986-1995
East Mediterranean	15.3 %
West Mediterranean	11.4 %
Mediterranean	12.7 %
World	9.2 %

(2) The Number of Containers by Country

Although world container cargo traffic has bee increasing on average, container traffic in some countries, for example, CIS countries and countries of the Balkan peninsula (excluding Greece), showed a recent tendency to decline. This is a reflection of the unstable economic situation caused by the collapse of communism in the early 90’s (see Table 11.1.3).

(3) Transshipment Container of the East Mediterranean

Transshipment container volumes of major Mediterranean ports in 1994 are obtained from “Containerization International July 1995”. Damietta, Port Said, Larnaca, Limassol, Piraeus and Marsaxlokk are major hub ports, transshipped containers originating from or destined to countries facing to the East Mediterranean or Black Sea. At each hub port, share of transshipment containers ranges from 4% to 95%(see Table 11.1.4). Annual transshipment traffic is estimated by transshipment rate in 1994 and shown in Table 11.1.5.

Table 11.1.4 Transshipment Container Traffic at the East Mediterranean Ports in1994

Port	Total Traffic (TEUs)	Transshipment Traffic (TEUs)	Transshipment Share (%)
Damietta	520,000	493,000	95
Port Said(in 1993)	171,000	109,000	64
Alexandria(in 1993)	258,000	11,000	4
Larnaca	105,000	82,000	78
Limassol	266,000	95,000	36
Piraeus	517,000	101,000	20
Marsaxlokk	383,000	343,000	90

Source: Containerization International July 1995

Table 11.1.5 Transshipment Container Traffic of the East Mediterranean and Black Sea

(unit: TEUs)

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
East Med	194,428	207,291	240,568	281,255	443,535	631,785	900,583	1,103,186	1,234,000	1,532,731

(4) The Number of Local Containers Handled at Ports of the East Mediterranean

The historical trend of the number of local containers originating from or destined to the hinterland of each port is shown in Table 11.1.6.

Table 11.1.6 Local Container Traffic of the East Mediterranean and Black Sea

(unit: TEUs)

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
East Med	1,107,737	1,189,870	1,458,971	1,761,846	1,984,604	2,390,354	2,502,983	2,981,489	3,131,211	3,756,574

11.2 Socio-economic Condition of the East Mediterranean Countries

(1) GDPs of the East Mediterranean

GDPs of the East Mediterranean countries are available in the Statistical Yearbook by the United Nations. These countries are divided into two groups. In case of East Med Group which consists of Cyprus, Egypt, Greece, Israel, Lebanon, Malta, Syria and Turkey, GDP has a strong correlation with container traffic in the historical trend. On the contrary, GDP of the Balkan and Black Sea Group which consists of Bulgaria, Croatia, Romania, Slovenia, Yugoslavia and Ukraine, is characterized by a stagnant trend and has no clear correlation with container traffic presumably reflecting economic and political turmoil in the first half of 1990s(see Table 11.2.1).

(2) GDPs of the Target Years

Growth rates of GDPs forwards target years of this study follow the OECD report, “The World in 2020”(refer to Table 5.3.9). The mean growth rate is applied for projection(see Table 11.2.2).

Table 11.1.2 Container Traffic of the East Mediterranean and Black Sea by Port (unit: TEU)

Port	Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Varna	Bulgaria	-	-	45,122	46,102	28,258	32,726	28,649	28,053	24,565	-
Famagusta	Cyprus	1,423	2,479	4,180	4,003	8,671	5,057	5,374	7,273	-	-
Larnaca	Cyprus	81,706	101,899	99,482	92,192	101,803	94,896	134,278	192,100	106,038	107,500
Limassol	Cyprus	123,773	141,245	187,867	273,096	273,805	228,567	218,296	221,300	266,199	266,496
Alexandria	Egypt	134,386	145,869	154,512	156,148	228,287	296,396	236,532	257,773	289,115	304,122
Damietta	Egypt	-	-	-	-	60,863	207,963	323,680	421,537	518,003	596,562
Port Said	Egypt	35,896	33,239	31,869	39,299	54,783	60,811	117,515	171,337	183,661	324,487
Herakilon	Greece	3,533	2,122	-	-	-	-	-	-	-	-
Piraeus	Greece	231,972	265,613	331,860	389,037	426,204	462,682	511,465	537,064	517,000	610,000
Thessaloni	Greece	13,198	20,913	39,491	44,911	53,809	85,944	133,585	166,186	173,733	211,153
Ashdod	Israel	129,856	136,702	147,366	173,791	179,000	156,990	181,941	227,450	305,000	346,250
Haifa	Israel	171,777	194,814	201,845	285,544	237,000	322,706	386,067	405,398	431,120	525,420
Rijeka	Croatia	32,281	43,744	48,493	52,031	47,857	37,973	44,563	49,913	53,000	40,000
Beirut	Lebanon	7,544	6,854	7,152	-	-	131,175	80,989	203,661	229,922	-
Maraaxlok	Malta	17,130	1,026	7,782	8,080	94,603	157,636	259,232	288,192	383,060	517,533
Valletta	Malta	-	-	47,485	32,359	41,187	39,571	28,896	30,636	45,245	38,129
Constantza	Romania	38,000	-	-	33,679	28,457	46,289	58,200	43,639	41,290	68,552
Koper	Slovenia	50,287	66,931	89,759	83,298	94,767	62,141	45,834	61,430	60,508	58,383
Lattakia	Syria	64,568	54,197	46,143	54,798	67,340	82,832	92,554	120,495	132,961	-
Bandirma	Turkey	-	-	-	-	-	1,886	1,117	1,950	2,117	1,500
Derince	Turkey	-	-	-	-	-	3,432	4,842	2,617	3,286	4,450
Gemport	Turkey	-	-	-	-	-	-	537	7,791	17,067	24,500
Haydarpas	Turkey	35,110	40,578	49,066	63,969	117,805	143,046	177,601	232,634	179,835	256,779
Iskenderun	Turkey	-	4,034	4,652	-	3,542	1,924	888	-	-	-
Izmir	Turkey	53,692	64,364	67,000	106,842	122,503	143,100	162,507	212,949	268,908	302,158
Mersin	Turkey	71,033	62,129	81,621	94,566	113,559	102,733	95,414	116,794	131,454	147,617
Samsun	Turkey	-	-	-	-	1,023	2,591	3,791	4,994	2,124	1,150
Ilyichevsk	Ukraine	-	-	-	-	-	72,347	54,112	52,452	-	-
Odessa	Ukraine	-	-	-	-	35,456	30,342	15,107	19,057	-	90,000
Bar	Yugoslavi	5,000	8,409	6,792	9,356	7,557	8,383	-	-	-	-
East Med		1,302,165	1,397,161	1,699,539	2,043,101	2,428,139	3,022,139	3,403,566	4,084,675	4,365,211	4,842,741

Source: Containerization International Yearbook

Table 11.1.3 Container Traffic by Country of the East Mediterranean and Black Sea
(unit: TEUs)

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Bulgaria	-	-	45,122	46,102	28,258	32,726	28,649	28,053	24,565	-
Cyprus	206,902	245,623	291,529	369,291	384,279	328,520	357,948	420,673	372,237	373,996
Egypt	170,282	179,108	186,381	195,447	343,933	565,170	677,727	850,647	990,779	1,225,171
Greece	248,703	288,648	371,351	433,948	480,013	548,626	645,050	703,250	690,733	821,153
Israel	301,633	331,516	349,211	459,335	416,000	479,696	568,008	632,848	736,120	871,670
Croatia	32,281	43,744	48,493	52,031	47,857	37,973	44,563	49,913	53,000	40,000
Lebanon	7,544	6,854	7,152	-	-	131,175	80,989	203,661	229,922	-
Malta	17,130	1,026	55,267	40,439	135,790	197,207	288,128	318,828	428,305	555,662
Romania	38,000	-	-	33,679	28,457	46,289	58,200	43,639	41,290	68,552
Slovenia	50,287	66,931	89,759	83,298	94,767	62,141	45,834	61,430	60,508	58,383
Syria	64,568	54,197	46,143	54,798	67,340	82,832	92,554	120,495	132,961	-
Turkey	159,835	171,105	202,339	265,377	358,432	398,712	446,697	579,729	604,791	738,154
Ukraine	-	-	-	-	35,456	102,689	69,219	71,509	-	90,000
Yugoslavia	5,000	8,409	6,792	9,356	7,557	8,383	-	-	-	-
East Med	1,302,165	1,397,161	1,699,539	2,043,101	2,428,139	3,022,139	3,403,566	4,084,675	4,365,211	4,842,741

Table 11.2.1 GDPs generated in the East Mediterranean and Black Sea Region

(unit: million USD in 1990 constant price)

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Cyprus	4,116	4,418	4,800	5,183	5,560	5,609	6,198	6,296	6,620	6,944
Egypt	33,017	35,612	36,738	40,407	43,871	45,445	47,263	48,114	48,691	53,024
Greece	62,421	62,132	64,898	67,195	66,560	68,709	69,275	69,661	70,897	72,244
Israel	46,576	49,893	51,126	51,359	54,698	58,862	63,177	65,571	69,831	74,789
Lebanon	3,016	3,717	2,872	3,064	3,325	4,088	4,287	4,587	4,977	5,325
Malta	1,781	1,855	2,011	2,175	2,312	2,457	2,572	2,688	2,804	2,971
Syria	21,133	21,536	24,393	22,208	23,904	25,614	28,315	29,425	30,408	31,928
Turkey	122,866	134,048	136,831	138,085	150,679	152,204	160,567	170,074	163,441	174,555
East Med Group	294,926	313,211	323,669	329,676	350,909	362,988	381,654	396,416	397,669	421,780
Bulgaria	23,412	24,597	25,190	25,116	20,726	18,301	17,258	16,999	16,985	17,410
Croatia	32,595	32,563	32,260	31,765	24,395	19,293	17,422	16,775	16,915	17,203
Romania	42,763	43,120	42,900	40,417	38,244	33,305	28,720	29,007	30,023	32,097
Slovenia	18,994	18,792	18,474	18,150	17,304	15,692	14,844	15,037	15,789	16,405
Yugoslavia	35,086	34,508	33,738	34,111	31,901	29,349	21,718	15,637	16,654	17,653
Ukraine	226,681	231,287	230,075	244,055	247,447	218,744	188,776	161,970	131,195	115,452
Balkan and Black Sea Group	379,531	384,867	382,637	393,614	380,017	334,684	288,738	255,425	227,561	216,220
East Mediterranean	674,457	698,078	706,306	723,290	730,926	697,672	670,392	651,841	625,230	638,000

Table 11.2.2 Future GDPs of the Mediterranean, Balkan and Black Sea Region

(unit: million USD in 1990 constant price)

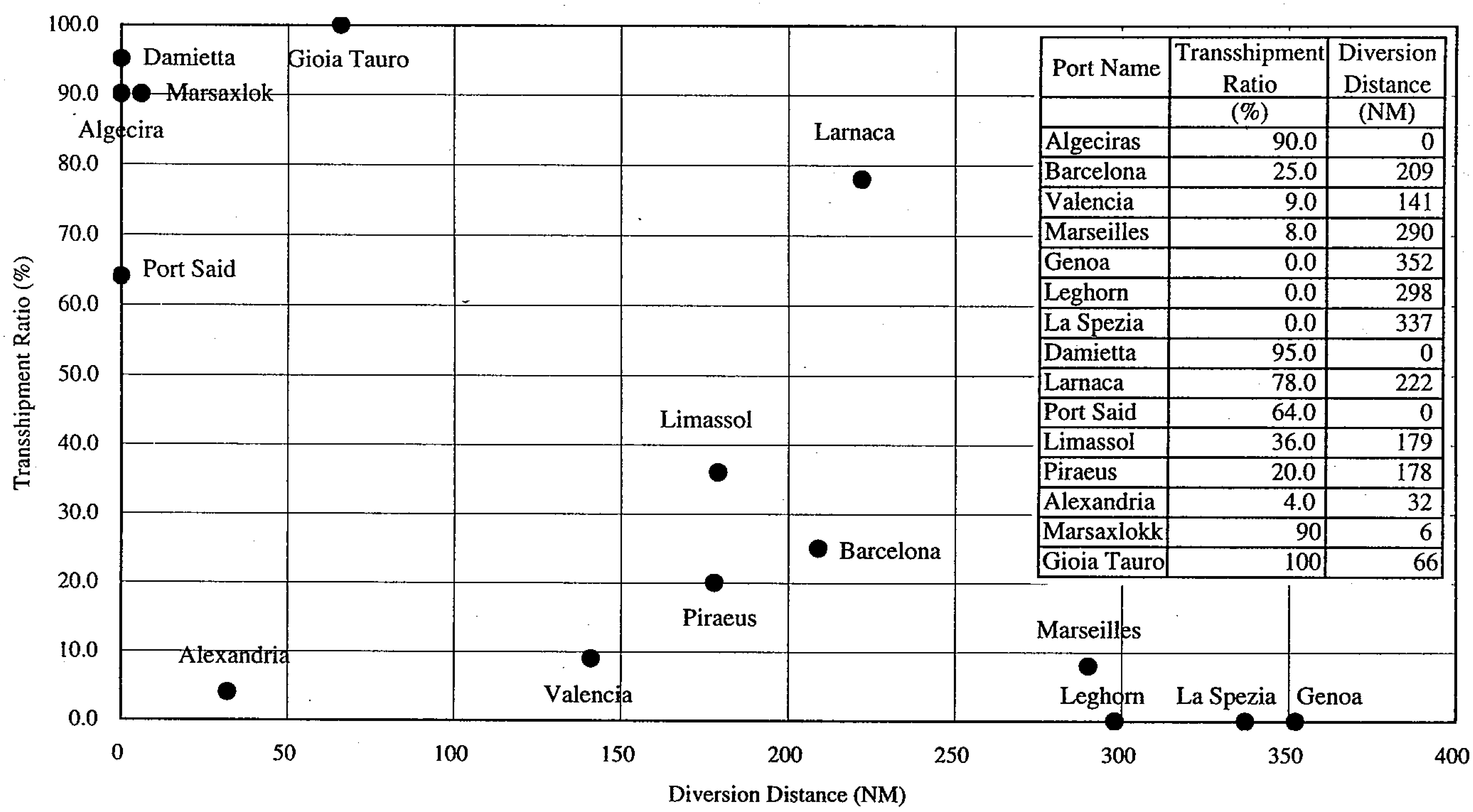
Country	1995	GDP (%)	2000	GDP (%)	2007	GDP (%)	2010	GDP (%)	2017
Cyprus	6,944	5.75	9,184	5.45	13,315	5.45	15,613	5.25	22,337
Egypt	53,024	3.55	63,128	4.65	86,776	4.65	99,452	4.55	135,795
Greece	72,244	2.40	81,340	2.35	95,701	2.35	102,608	1.70	115,459
Israel	74,789	3.55	89,041	4.65	122,395	4.65	140,275	4.55	191,535
Lebanon	5,325	3.55	6,340	4.65	8,715	4.65	9,988	4.55	13,637
Malta	2,971	5.75	3,929	5.45	5,697	5.45	6,680	5.25	9,557
Syria	31,928	3.55	38,012	4.65	52,251	4.65	59,885	4.55	81,768
Turkey	174,555	5.75	230,852	5.45	334,704	5.45	392,464	5.25	561,506
East Med Group	421,780	4.35	521,825	4.70	719,552	4.75	826,964	4.58	1,131,595
Bulgaria	17,410	3.75	20,929	4.65	28,768	4.65	32,971	3.35	41,525
Croatia	17,203	5.75	22,751	5.45	32,986	5.45	38,679	5.25	55,338
Romania	32,097	3.75	38,584	4.65	53,037	4.65	60,785	3.35	76,554
Slovenia	16,405	3.75	19,720	4.65	27,108	4.65	31,068	3.35	39,128
Yugoslavia	17,653	5.75	23,346	5.45	33,849	5.45	39,690	5.25	56,786
Ukraine	115,452	2.30	129,354	5.10	183,231	5.10	212,719	5.45	308,413
Balkan and Black Sea Group	216,220	3.33	254,684	5.03	358,979	5.03	415,912	4.81	577,744
East Mediterranean	638,000	4.01	776,510	4.81	1,078,531	4.84	1,242,876	4.66	1,709,339

11.3 Transshipment Container Transport Networking Scenario through the East Mediterranean

(1) Key Factors of Transshipment Container Network through the East Mediterranean[1)]

Carriers do not generally use ports just to tranship or interline. They need a significant local market which makes the call worthwhile and the transshipments are a bonus function. However, there are some ports in the Mediterranean, which receive mainly transshipped containers rather than local containers and enjoy their geographical advantages near the main shipping lanes; Algeciras is very close to the Straits of Gibraltar on the international trunk route, and Port Said and Damietta are similarly well-placed in relation to the Suez Canal. Marsaxlokk and Gioia Tauro are another typical examples which enjoy the geographical advantages at the center of the Mediterranean.

There are some requirements for a hub port serving as a successful transshipment port. The first one is minimum deviation from the trunk shipping lane. Figure 11.3.1 shows the deviation distances between the main shipping lane and the major hub-ports in the Mediterranean. Argeciras, Damietta, Port Said, Marsaxlokk and Gioia Tauro are dominated by the transshipment container traffic supposedly due to the less deviation distance. Alexandria is mainly serving main-line vessels for local container rather than transshipment.



Port Name	Transshipment Ratio (%)	Diversion Distance (NM)
Algeciras	90.0	0
Barcelona	25.0	209
Valencia	9.0	141
Marseilles	8.0	290
Genoa	0.0	352
Leghorn	0.0	298
La Spezia	0.0	337
Damietta	95.0	0
Larnaca	78.0	222
Port Said	64.0	0
Limassol	36.0	179
Piraeus	20.0	178
Alexandria	4.0	32
Marsaxlokk	90	6
Gioia Tauro	100	66

Source) "Containerization International" (July, 1995)

Figure 11.3.1 Relationship between Transshipment Ratio and Deviation Distance

[1)] "The battle for Med hub role", Containerization International (July 1995), pp. 95-99

Distance between a hub-port and feeder ports is a second important factor. Marsaxlokk and Gioia Tauro are centrally and well-located for interlining and serve the feeder service markets in the Mediterranean. The Mediterranean is too wide to cover economically from the east and west ends, totaling about 2,000 nautical miles by a single hub-port. Hence, shipping lines are generally using two or more hub-ports in the area instead of using several hub-ports for extending feeder services, some shipping lines make multiple calls with the main line vessels.

For example **CMA**, with its services between North America and the Mediterranean, calls at a range of ports including Valencia, Fos, Genoa, Leghorn, Piraeus and Damietta in both directions in some cases. Then those containers are transshipped by dedicated feeder services through Damietta to Beirut, Limassol, Lattakia, Mersin, Istanbul, Gemlik, Izmir, Varna, Trabzon, Salonica, Constantza and Odessa in the East Mediterranean and Black Sea. **Contship**, with its services between North Europe and the Mediterranean, calls at Gioia Tauro and Port Said only in both directions. Then Those containers are transshipped by dedicated feeder services through Gioa Tauro to Salerno, Piraeus, Salonica, Istanbul, Izmir, Mersin, Lattakia, Beirut and Alexandria in the East Mediterranean. **Hundai**, with its services between East Asia and the Mediterranean, calls at Genoa, Barcelona, Fos and Port Said in the Mediterranean in both directions in some cases. Then those containers are transshipped by dedicated feeder services through Port Said to Piraeus, Thessaloniki, Istanbul, Izmir and Mersin in the East Mediterranean.

A third condition necessary for a successful transshipment port is costs in the port. The costs are composed of port due, container-handling charges and ship costs at a port proportional to dwelling time at the port directly related to the container handling productivity. The successful transshipment port is supposed to at least perform at a productivity in a range from 25 to 30 (boxes/hour/crane).

(2) Transshipment Container Transport Networking Scenario through the East Mediterranean

As mentioned in Chapter 5.2, Damietta and Port Said have been functioning as transshipment ports where feeder vessels are extending their services to mainly the East Mediterranean.

For example percentages of one end of transshipment container flow via Damietta and Port Said are 81.8%, 7.1% and 4.4% for the East Mediterranean, the Black Sea and the West Mediterranean ports respectively. Thus, the Mediterranean and Black Sea ports accounted for approximately 90% of the total.

The newly-participating competitors, Marsaxlokk and Gioia Tauro, located at the center of the Mediterranean have geographical advantage for serving both the Central and East Mediterranean ports in transshipment. On the other hand the recently proposed Port Said East Port is expected to serve the East Mediterranean and Black Sea ports as well as Damietta.

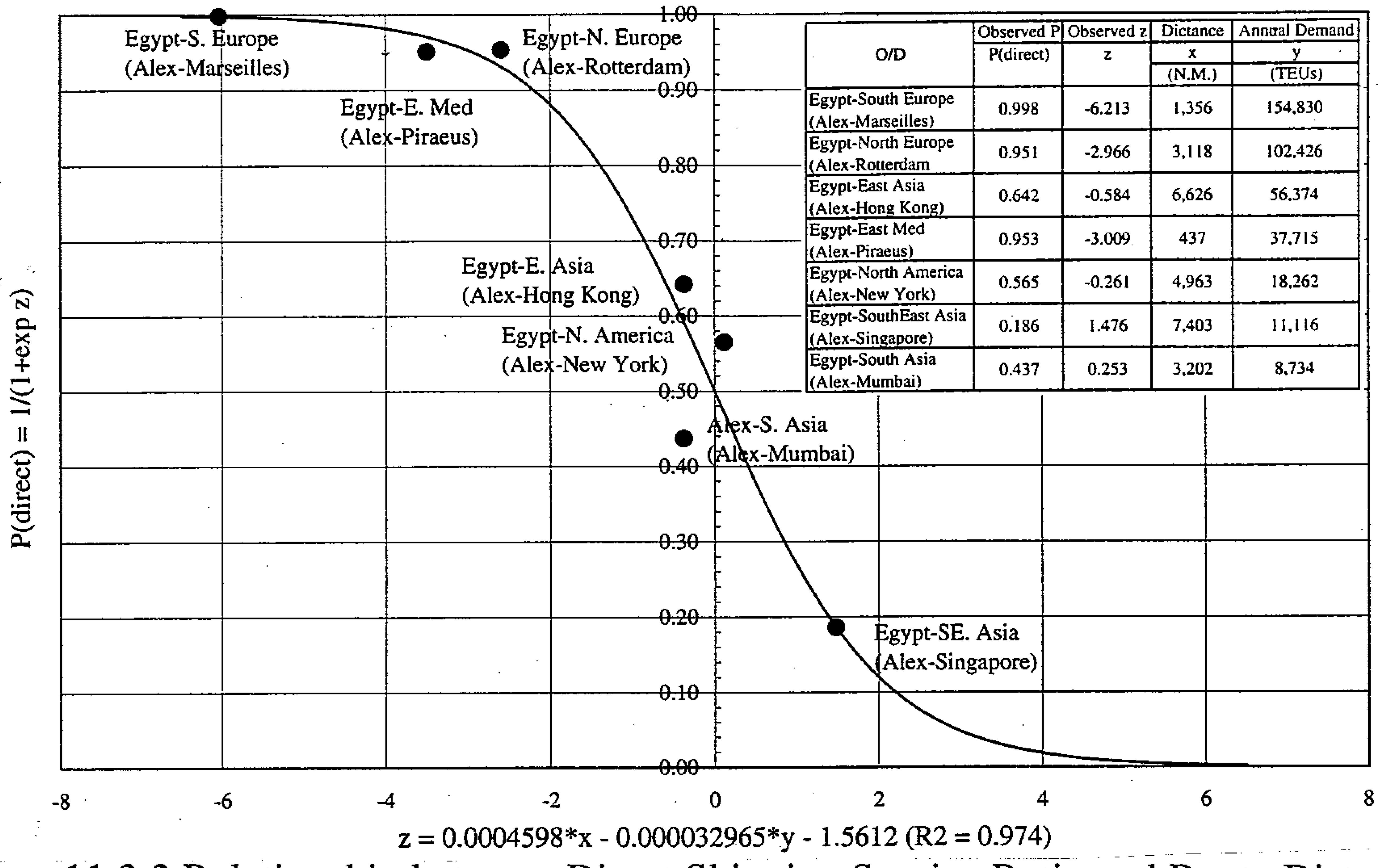
(3) Another Implications of Container Movement to and from Alexandria Port

Alexandria enjoys serving mainly local containers, though it has potentially the geographical advantage as a transshipment hub-port. As mentioned in Chapter 6.4, the number of containers transported by direct shipping services accounts for 87% of the total of local containers through Alexandria Port in 1997. The remaining 13% of the total local containers were transshipped at other ports such as Gioia Tauro and Marsaxlokk. Direct service ratio in local container transport by route seems to be closely related to both route distance and transport volume on routes between Alexandria and trading partners' ports. Figure 11.3.2 shows the relationship between direct shipping service ratio and index defined by both route distance and transport volume.

There seems two inverse relations at a same time. The longer route distance, the less direct shipping services. The more volume on a route, the more direct shipping services.

On a long sea route a larger container vessel carries at less unit container transport cost compared with a smaller vessel. Therefore, shipping lines generally tend to use larger vessels and collect more containers to fill on a long sea route. If the volume of collected containers are enough to justify using a larger container vessel, a shipping line tends to avoid costly transshipment services.

On the other hand, if the volume of containers are not enough to justify direct shipping between specific ports on a long sea route, a shipping line tends to choose transshipment services. In case on a short sea route, there is no significant difference between an economical main-line vessel and a feeder vessel in size. Hence, on a short sea route, a shipping line tends to choose multiple calling services by moderate-size main-line vessel avoiding costly transshipment regardless the transport volume (see Figure 11.3.2).



O/D	Observed P P(direct)	Observed z z	Dictance x (N.M.)	Annual Demand y (TEUs)
Egypt-South Europe (Alex-Marseilles)	0.998	-6.213	1,356	154,830
Egypt-North Europe (Alex-Rotterdam	0.951	-2.966	3,118	102,426
Egypt-East Asia (Alex-Hong Kong)	0.642	-0.584	6,626	56,374
Egypt-East Med (Alex-Piraeus)	0.953	-3.009	437	37,715
Egypt-North America (Alex-New York)	0.565	-0.261	4,963	18,262
Egypt-SouthEast Asia (Alex-Singapore)	0.186	1.476	7,403	11,116
Egypt-South Asia (Alex-Mumbai)	0.437	0.253	3,202	8,734

Figure 11.3.2 Relationship between Direct Shipping Service Ratio and Route Distance and Transport Volume on each Route in Alexandria in 1997

Furthermore, Alexandria is located only 32 NM away from the main shipping lane through the Mediterranean. Many main line vessels tend to make multiple calls at the ports (including Alexandria) closer to the main shipping lane, which provide direct shipment services for those ports. Consequently, Alexandria has also been playing a role of major container port in Egypt, serving local container market generated from Nile Delta including Cairo Metropolis.

11.4 Future Transshipment Container Traffic

(1) Co-relation between the Number of Local Containers and GDP

The number of local containers handled at each port includes containers transshipped at other ports and excludes containers transshipped at the port. Co-relation between the total number of local containers, which are counted at each port and then are summed up, and GDP of the East Med Group is analyzed as follows;

$$Y=A*X+B$$

Where, Y: Local Containers(TEU)
X:GDP (million US$ in 1990 constant price)
A:19.81
B:-5,068,000
R^2:0.97

Figure 11.4.1 indicates the relation between local container traffic and GDP of the East Med Group. Co-relation is easily identified for the East Med Group but is not apparent for the Balkan and Black Sea Group.

Table 11.4.1 Local Container Traffic generated in the East Mediterranean and Black Sea Region

Country	East Med Group (TEUs)	Balkan and Black Sea Group (TEUs)	East Mediterranean Total (TEUs)
1986	982,169	125,568	1,107,737
1987	1,070,786	119,084	1,189,870
1988	1,268,805	190,166	1,458,971
1989	1,537,380	224,466	1,761,846
1990	1,742,252	242,352	1,984,604
1991	2,100,153	290,201	2,390,354
1992	2,256,518	246,465	2,502,983
1993	2,726,945	254,544	2,981,489
1994	2,951,848	179,363	3,131,211
1995	3,459,361	297,213	3,756,574

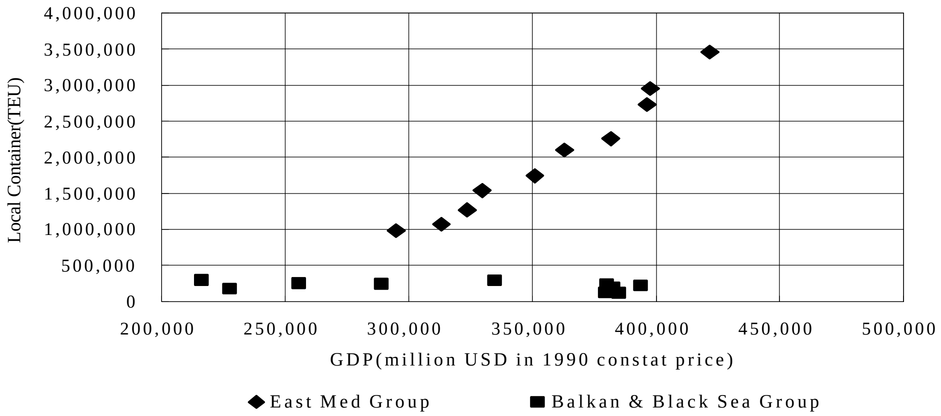


Figure 11.4.1 Co-relation Between Local Container and GDP

(2) The Number of Local Containers Handled at Ports

On the assumption that container traffic of the Balkan and Black Sea Group has the same growth rate as the East Med Group towards the target years, future local containers is forecast as in Table 11.4.2.

Table 11.4.2 Future Local Container Traffic of the East Mediterranean

Group	Item	Year 1995	Year 2007	Year 2017
East Med Group	Containers (TEU)	3,459,000	9,186,000	17,348,000
			8.5 %	6.6 %
	GDP (million USD)	422,000	720,000	1,132,000
			4.6 %	4.6 %
Balkan and Black Sea Group	Containers (TEU)	297,000	789,000	1,490,000
			8.5 %	6.6 %
	GDP (million USD)	216,000	359,000	578,000
			4.3 %	4.9 %
East Mediterranean	Containers (TEU)	3,757,000	9,975,000	18,839,000
			8.5 %	6.6 %
	GDP (million USD)	638,000	1,079,000	1,709,000
			4.5 %	4.7 %

Note: USD in 1990 constant price

(3) The Number of Containers Handled at Hub Ports in the Target Years

Local containers are carried partly by direct shipping service and partly by feeder shipping service. The share of containers by feeder shipping service in the future is projected as shown in Figure 11.4.2; the resulting figures are 26% in 2007 and 31% in 2017 respectively.

The containers transported by feeder shipping services are transshipped at hub ports serving for connecting feeder vessels and main line vessels. At the hub ports transshipped containers are doubly handled, discharging and loading. Thus, the number of containers handled at transshipment ports are estimated as 5.1 million TEUs in 2007 and 11.7 million TEUs in 2017 respectively (see Table 11.4.3).

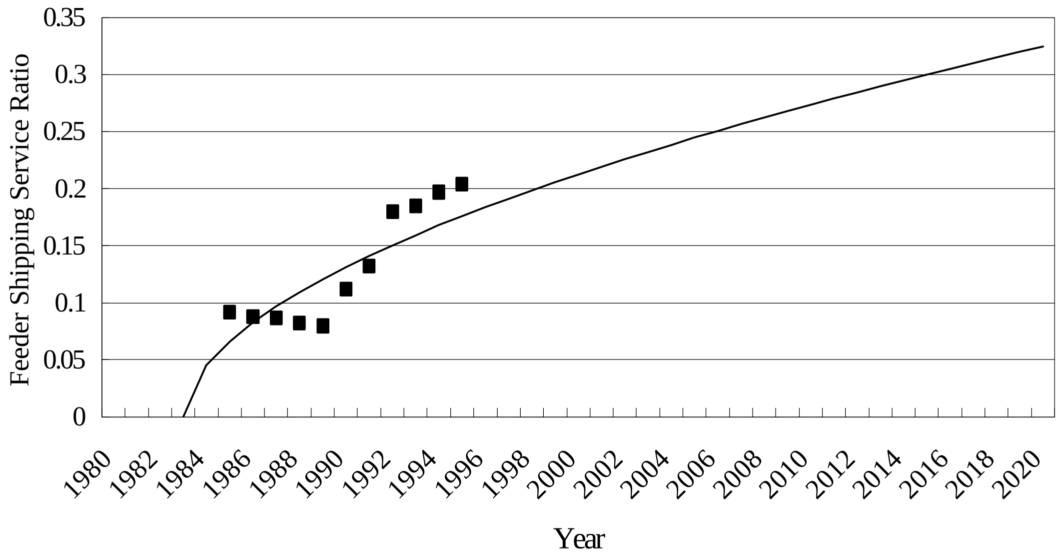


Figure 11.4.2 Feeder Shipping Service Ratio of Container Traffic

Table 11.4.3 The Number of Containers of the East Mediterranean (unit: TEUs)

	Year	1995	2007	2017	Remarks
Local Containers	Direct Shipping Service	2,991,000	7,421,000	12,999,000	A
	Feeder Shipping Service	766,000	2,554,000	5,840,000	B
	Sub Total	3,757,000	9,975,000	18,839,000	A+B
Containers Handled at Transshipment Port		1,532,000	5,108,000	11,680,000	2*B
Total Port Container		5,289,000	15,083,000	30,519,000	A+3*B

Suez Canal

	Km	Min. depth	Min. width
Port Said – Suez	161·6	19·5m	300m

Examples of largest vessel

Draught	Beam
16·1m	42·7m
11·6m	56·1m
10·1m	64·0m

loa.............................N/A Air draught..............N/A
Laden .... 150,000 dwt In ballast.... 370,000 dwt

24 hour lock-free ,transit. Passage by convoy system, 2 southbound and 1 northbound daily. Maximum of 40 vessels per convoy.

	Gibraltar							
Marseilles	690	**Marseilles**						
Naples	979	457	Naples					
Trieste	1648	1204	800	Trieste				
Piraeus	1481	1065	661	839	**Piraeus**			
Istanbul	1800	1378	974	1152	352	Istanbul		
Beirut	2004	1595	1189	1367	643	810	Beirut	
Port Said	1913	1512	1108	1294	593	786	228	**Port Said**
Tunis	794	472	309	921	729	1042	1252	1160

Figure 11.4.3 Major Transshipment Container Port in the East Mediterranean and the Black Sea

Chapter 12 Demand Forecast

12.1 Socio-economic Framework for the Target Year

12.1.1 Population

(1) The forecast is carried out under the following conditions.
The population of Egypt is 59.272 million in 1996 based on the "World Development Indicators 1998" issued by the World Bank.

(2) The average annual growth rate from 1996 to 2007 is set at 1.7% which is expressed in the "The Fourth Five Year Plan for Economic and Social Development (1997/98-2001/02) and the Plan of It's First Year" (hereinafter referred to as "The Fourth Five Year Plan") by the Ministry of Planning, and that from 2007 to 2017 is set at 1.2% based on "The National Strategy of Economic and Social Development of the Twenty First Century(1997/98-2016/17)" (hereinafter referred to as "The National Strategy") also by the Ministry of Planning.

The resulting figures in target years are shown in Table 12.1.1. The population will reach 71.348 million in 2007 and 80.387 million in 2017.

Table 12.1.1 Projected Population

(Unit: million)

	1996	2007	2017
Population	59.272	71.348	80.387
Annual Growth Rate	—	1.7%	1.2%

Note: Population in 2007 and 2017 is calculated by JICA Study Team based on the "World Development Indicators 1998" by the World Bank,
"The Fourth Five Year Plan", "The National Strategy" by the Ministry of Planning.

12.1.2 Economic Framework

(1) Gross Domestic Products (GDP)

The average annual growth rate of GDP during 1997 - 2002 is estimated as 6.9 % in the "The Fourth Five Year Plan" and 7.6% in the "The National Strategy" during 2003-2017. Referring to above figures, the average growth rate of GDP is set as 6.9 % in the period from 1997 to 2007 and as 7.6 % in the period from 2007 to 2017 in this study. The sectoral GDP of agriculture is estimated as 4.2% in the "The Fourth Five Year Plan", and this figure is used up to 2017 in this study.
The resulting GDP in the target years is shown in Table 12.1.2.

Table 12.1.2 Projected GDP at Target Years (factor cost, 1988 price)

(Unit: LE million)

	1996	1996-2007	2007-2017
GDP	69,891	145,605	302,899
GDP (Agriculture Sector) Average Annual Growth Rate	-	4.2%	4.2%

Source: "The Fourth Five Year Plan", "The National Strategy" by the Ministry of Planning

12.2 Methodology of Demand Forecast

There are two different methods of forecasting future port traffic in the target year. One is the so-called macro forecast method which estimates the cargo volume as a group including entire commodities regardless of the volume of each commodity. The other is the so-called micro forecast method which estimates the cargo volume of each commodity individually.

In the former method, the total cargo volume in the target year is forecast by using time series. In the latter one, the cargo volumes of major commodities in the target year are forecast individually based on the correlation analyses between cargo volumes and the corresponding indices of the historical records.

In the first step of the port traffic projection in Egypt, the total volume through five major ports (the Greater Alexandria, Damietta, Port Said, Suez and Safaga) is forecast taking account of the overlap of their hinterlands to a great extent. Next, cargo volume is allocated to the Greater Alexandria, Damietta and Port Said Port (hereinafter referred to as "the Mediterranean Ports") referring to the share of cargo volume in the year of 1997.Historical trend of cargo volume of major categories through the Mediterranean Ports is shown in table 12.2.1.

Table 12.2.1 Historical Trend of Cargo Volume of Main Categories
at the Mediterranean Ports in Egypt

(Unit: thousand tons)

Year	Conventional Cargo			Container Cargo			Dry Bulk Cargo			Liquid Bulk Cargo			Total		
	Import	Export	Total	Import	Export	Total	Import	Export	Total	Import	Export	Total	Import	Export	Total
1988	7,119	836	7,954	795	112	907	9,520	332	9,853	5,234	1,715	6,948	22,668	2,994	25,662
1989	6,969	901	7,870	1,035	251	1,287	7,510	229	7,739	5,459	1,710	7,169	20,973	3,091	24,064
1990	7,566	1,072	8,638	993	264	1,257	7,324	340	7,664	5,548	1,978	7,526	21,431	3,654	25,085
1991	6,961	1,114	8,074	1,041	331	1,372	7,220	365	7,585	5,490	2,497	7,987	20,712	4,307	25,018
1992	6,822	1,492	8,132	1,194	390	1,584	7,899	674	8,573	1,056	2,081	3,103	16,971	4,636	21,392
1993	9,738	1,257	10,995	1,497	482	1,978	7,463	614	8,078	1,117	3,060	4,177	19,814	5,413	25,227
1994	7,369	812	8,181	1,685	746	2,431	12,136	1,127	13,263	598	3,255	3,853	21,788	5,940	27,728
1995	8,164	957	9,122	2,120	776	2,895	14,453	906	15,359	726	2,898	3,624	25,463	5,537	31,000
1996	8,711	1,312	10,023	2,427	843	3,270	14,748	1,013	15,761	1,157	2,985	4,142	27,043	6,153	33,196
1997	8,495	921	9,416	2,863	1,177	4,040	17,361	1,058	18,419	1,151	3,849	5,000	29,870	7,005	36,875

Source: "10 Years Statistics Report (1988-1997), Vol. No.2-January 1998, English Edition"
Ministry of Maritime Transport, Egyptian Maritime Data Bank

12.3 Macro Forecast of Local Cargo through the Mediterranean Ports in Egypt

Time series is used as an index in the correlation analysis of the macro forecast in this study.

(1) Import

The correlation between the total volume of import cargo through the Mediterranean Ports and year from 1988 to 1997 is expressed as the following equation.

$$Y = 885.616 \times t - 5{,}234.202 \times D - 1{,}740{,}558.400$$

where, Y : Total import cargo volume

t : Target year (2007, 2017)

D : Dummy variable (1 for 1992-1994, 0 for 1988-1991, 1995-1997, and 2007,2017)

The resulting figures of the estimation using the above equation are shown in Table 12.3.1 and Figure 12.3.1.

Table 12.3.1 Forecast Volume of Import Cargo by Macro Forecast

(Unit : thousand tons)

	1997	2007	2017
Import Cargo Volume	29,870	36,872	45,729

Source: JICA Study Team

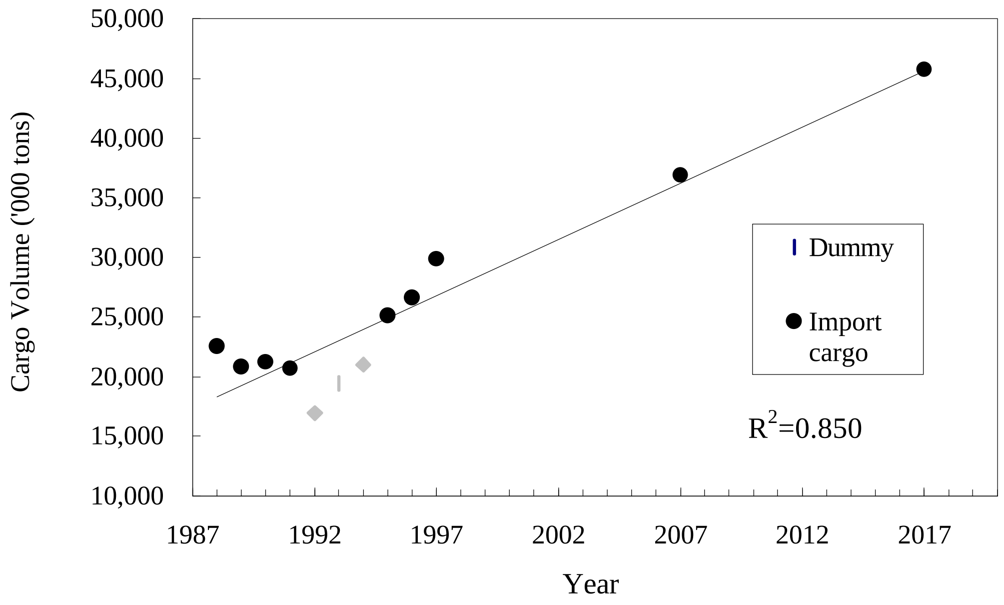


Figure 12.3.1 Forecast Volume of Import Cargo by Macro Forecast at the Mediterranean Ports

(2) Export

In case of export, the correlation between the total cargo volume through the Mediterranean Ports and year from 1988 to 1997 is expressed as the following equation.

$$Y = 439.182 \times t - 869{,}691.094$$

where, Y : Total export cargo volume
t : Target year (2007, 2017)

The resulting figures of the estimation using the above equation are shown in Table 12.3.2 and Figure 12.3.2.

Table 12.3.2 Forecast Volume of Export Cargo by Macro Forecast

(Unit : thousand tons)

	1997	2007	2017
Export Cargo Volume	7,005	11,747	16,139

Source: JICA Study Team

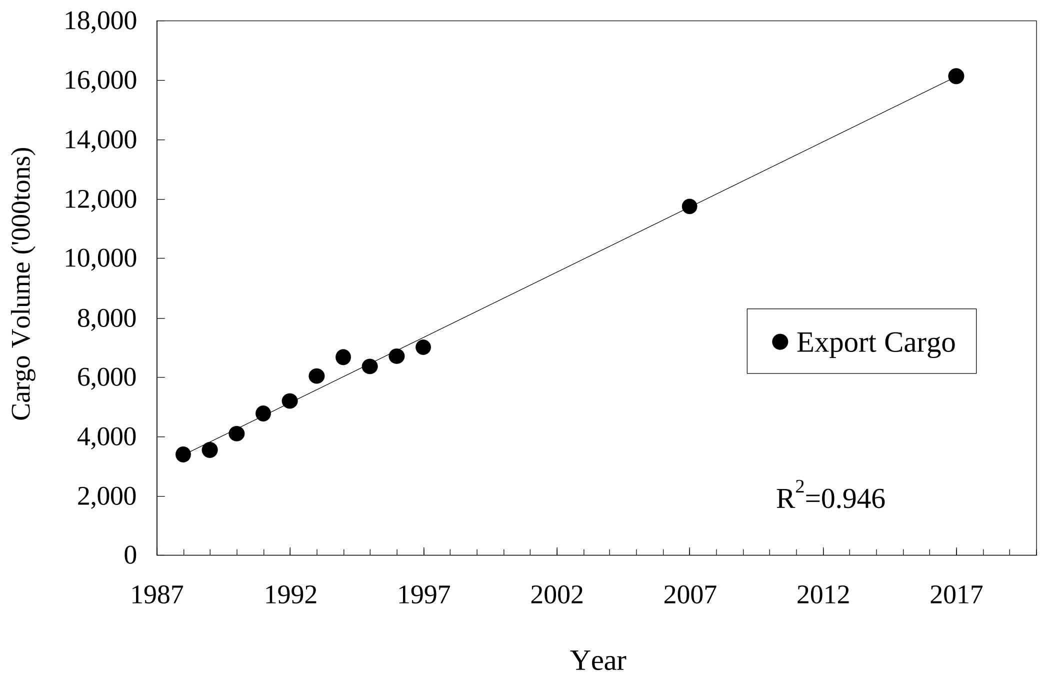


Figure 12.3.2 Export Cargo volume of Macro Forecast

(3) Result of Macro Forecast

The result of the macro forecast in target years is shown in Table 12.3.3.

Table 12.3.3 The Result of Macro Forecast at the Mediterranean Ports in Egypt

(Unit : thousand tons)

	1997	2007	2017
Import Cargo Volume	29,870	36,872	45,729
Export Cargo Volume	7,005	11,747	16,139
Total	36,875	48,619	61,868

Source: JICA Study Team

12.4 Micro Forecast of Local Cargo through the Mediterranean Ports in Egypt

12.4.1 Classification of the Major Commodity Groups

The cargo handled at the Mediterranean Ports, the Greater Alexandria, Damietta and Port Said Port, is classified into the following major commodity groups for the micro forecast.

Import Cargo

(1) Conventional Cargo
  1) Containerizable Cargo
    Miscellaneous/Frozen Food(Fish and Meat)/Lash Cargo/Others/Agricultural Products/General Cargo
  2)Statistically Mixed Cargo in Containerization
    Timber/Ro-Ro Cargo/Sugar/Paper/Flour
  3) Non-Containerizable Cargo
    Iron and Steel Products/Scrap/Car/Livestock/Special Cargo

(2) Dry Bulk Cargo
    Grains(Wheat and Maize)/Iron Pellet/Coal/Cement/Sulfur/Fertilizer/Soybean/Others

(3) Liquid Bulk Cargo
    Petroleum Oil/Edible Oil/Grease

Export Cargo

(1) Conventional Cargo
  1) Containerizable Cargo
    Miscellaneous/Citrus/Cotton and Fiber/Agricultural Products/General Cargo
  2)Statistically Mixed Cargo in Containerization

Ro-Ro Cargo/Rice
3) Non-Containerizable Cargo
Iron and Steel Products

(2) Dry Bulk Cargo
Coke/Fertilizer/Salt

(3)Liquid Bulk Cargo
Petroleum Oil/Molasses

12.4.2 Result of Micro Forecast at the Mediterranean Ports

The results of the micro forecast, showing import and export cargo volume by categories of the Mediterranean Ports, are given in Table 12.4.1. The detailed process is described in Appendix 12.

Table 12.4.1 Forecast Cargo Volume through the Mediterranean Ports by Micro Forecast

(Unit: thousand tons)

Category	1997	2007	2017
Import			
General Cargo	11,358	19,493	28,780
Dry Bulk	17,361	21,619	25,103
Liquid Bulk	1,151	698	1,127
Import Total	29,870	41,811	55,010
Export			
General Cargo	2,098	3,702	5,128
Dry Bulk	1,058	1,683	2,533
Liquid Bulk	3,849	5,025	6,503
Export Total	7,005	10,410	14,164
Import + Export			
General Cargo	13,456	23,197	33,909
Dry Bulk	18,419	23,302	27,636
Liquid Bulk	5,000	5,723	7,630
Import + Export Total	36,875	52,221	69,174

Source: JICA Study Team
Note: General cargo consists of conventional cargo and containerizable cargo.

12.4.3 Cross Check with the Result of Macro Forecast

Table 12.4.2 shows a comparison of cargo volume obtained by the macro and micro forecast methods described in section 12.3 and section 12.4.2

In case of import cargo, the micro forecast result is larger than that of the macro forecast, while export cargo by the macro forecast method is larger than that of the micro forecast. However, the total cargo volume forecast by the micro forecast method is larger than that of the macro forecast method. Herein, the cargo volume handled at the Mediterranean Ports for the target years will be forecasted by the micro forecast method.

Table 12.4.2 Forecast Volume of Total Cargo at the Target Year by Both Methods

(Unit: thousand tons)

	Forecast method	1997	2007	2017
Import	Macro method	29,870	36,872	45,729
	Micro method		41,811	55,010
Export	Macro method	7,005	11,747	16,139
	Micro method		10,410	14,164
Total	Macro method	36,875	48,619	61,868
	Micro method		52,221	69,174

Source: JICA Study Team

12.5 Forecast of Local Cargo Volume through the Mediterranean Ports in Egypt

12.5.1 Forecast of Container Cargo Volume

(1) Historical Trend of Containerization

The percentage of containerization is computed by using the volume of containerized cargo as numerator and the volume of containerizable cargo as denominator. Containerizable cargo means cargo already containerized or with the potential to be containerized in the future. Containerizable cargo items are selected and are checked by the actual percentage of containerization using the past traffic records. Cargo which is not selected as containerizable cargo is classified as non-containerizable cargo. Thus, non-containerizable cargo naturally includes bulky, long and heavy cargoes which can not be stuffed into container boxes physically and non-valuable cargo which can not burden costly container transport freight.

Actual port cargo statistics, however, have some cargo items containing both containerizable and non-containerizable cargoes. In this study, port cargo statistics are compiled according to the three categories, viz. containerizable cargo, non-containerizable cargo and statistically mixed cargo in containerization and cargo forecast is conducted according to these categories. The resulting classification of containerizable cargo and non-containerizable cargo is shown in Table 12.2.1. The historical trend of the percentage of containerization in the past five years is shown in Table 12.5.1.

Table 12.5.1 Historical Trend of Containerization

(Unit: %)

	1993	1994	1995	1996	1997
Import					
Containerizable Cargoes					
1.Miscellaneous (General Cargo)	9.9	19.3	24.1	20.5	29.5
2 Frozen Food (Fish and Meat)	15.1	16.7	20.7	28.8	33.4
3 Lash Cargo	19.5	U.N	17.3	16.2	22.3
4 Others	81.1	100.0	77.3	75.6	80.8
Statistically Mixed Cargo in Containerization					
1.Timber	1.3	1.6	1.6	1.9	2.1
2.Ro-Ro Cargo	55.1	42.4	38.9	48.9	50.0
3.Sugar	2.4	1.2	1.0	1.5	1.1
4.Paper	13.8	10.9	12.0	15.0	27.1
Export					
Containerizable Cargoes					
1.Miscellaneous (General Cargo)	23.9	61.1	48.7	49.8	89.3
2 Cotton and Fiber	90.0	89.2	88.7	98.3	100.0
3 Agricultural Products	45.9	43.0	22.1	16.8	25.9
Statistically Mixed Cargo in Containerization					
1.Ro-Ro Cargo	57.2	46.0	38.3	44.8	50.0

Source: Figures are calculated by JICA Study Team based on the data from Alexandria Port Authority, Damietta Port Authority and Port Said Port Authority.

(2) Estimation of Volume of Container Cargoes belonging to the Group of Containerizable Cargoes

The percentage of containerization for the target year is forecast by using the logistic curve expressed as the following formula.

$$\mathbf{P = 1 / \{ 1 + C^{(t - t0)}\}}$$

where; P : The percentage of containerization in **t** year (%)

C : Parameter prescribing curvature

t : Year

t_0 : Year in which the percentage of containerization reached 50%

Table 12.5.2 shows the future volume of containerized cargo and percentage of containerization which is calculated by above method.

Table 12.5.2 Volume of Containerized Cargo and the Percentage of Containerization of Containerizable Cargo

(Unit: thousand tons)

	2007		2017	
	Containerized Cargo	Average Percentage of Containerization	Containerized Cargo	Average Percentage of Containerization
Import	3,483	42.1%	6,719	62.1%
Export	2,066	80.9%	2,880	81.9%
Total	5,549		9,599	

Source: JICA Study Team

(3) Estimation Volume of Container Cargoes belonging to the Group of Statistically Mixed Cargo in Containerization

The following percentage of containerization of statistically mixed cargo in containerization is assumed consideration the past trend of percentage of containerization. Table 12.5.3 shows the volume of container cargo and the percentage of containerization in the target years.

Table 12.5.3 Volume of Containerized Cargo and the Percentage of Containerization of Statistically Mixed Cargo in Containerization

(Unit: thousand tons)

	2007		2017	
	Containerized Cargo	Average Percentage of Containerization	Containerized Cargo	Average Percentage of Containerization
Import	3,043	35.6%	6,460	49.8%
Export	340	53.4%	434	44.7%
Total	3,383		6,894	

Source: JICA Study Team

(4) Estimation of Number of Containers

Considering that the volume of imports exceeds that of exports in container transport through the Mediterranean Ports and assuming imported and exported container boxes will be balanced as is generally the case in world wide container ports, the number of containers is estimated as followed :

$$\mathbf{N = V_{imp} / W \times (1 / (1 - Ep)) \times 2}$$

where ; N : Number of containers (TEUs / year)

V_{imp} : Container import volume (tons / year)

W : Average cargo weight per TEU in laden container.

Ep : Ratio of empty container

The average weight of container cargo is assumed to be 9.96 tons / TEU referring to 1997 data. Empty container ratio is set as 5% in 2007 and 2017 referring to the actual data. The resulting number of containers in the target year is as follows.

Table 12.5.4 Number of Containers through the Mediterranean Ports in the Target Year

(Unit : thousand TEUs)

	1997	2007	2017
The Mediterranean Ports	558	1,528	2,944

Source: JICA Study Team

(5) Number of Container Handled at the Mediterranean Ports

Numbers of container handled at the Mediterranean ports, the Greater Alexandria, Damietta and Port Said, are estimated as shown in table 12.5.5 respectively.

Table 12.5.5 Number of Local Container Volume

(Unit: thousand TEUs)

Port	1997	2007	2017
Greater Alexandria	389	1,234	2,498
Damietta	65	205	266
Port Said	104	89	180
Total	558	1,528	2,944

Source: JICA Study Team

Allocation of total containers through the Mediterranean Ports at the target year of 2007 and 2017 are conducted in Section 13.4 of Chapter 13 considering functional allotment of the ports facing the Mediterranean Sea. The result of allocation of total container to the ports is shown in Table 12.5.6.

Table 12.5.6 Allocation of Local Container Volume

(Unit: thousand TEUs)

Port	1997	2007	2017
Greater Alexandria	389	1,234	1,500
Damietta	65	98	372
Port Said	104	98	700
East Port Said	-	98	372
Total	558	1,528	2,944

Source: JICA Study Team

12.5.2 Forecast of Conventional Cargo Volume at the Mediterranean Ports

The forecast volume of conventional cargo for the target year is computed by deducting containerized cargo volume from the total cargo volume. The resulting figures are shown in Table 12.5.7.

Table 12.5.7 Forecast Volume of Conventional Cargo at the Mediterranean Ports

Package Style	Containerizability	Commodity	Cargo Volume ('000tons)			Forecast Cargo Volume ('000tons)					
			1997			2007			2017		
			Import	Export	Total	Import	Export	Total	Import	Export	Total
Conventional Cargo	Containerizable	Miscellaneous	2,889	55	2,944	3,827	12	3,839	3,312	1	3,313
		Frozen Food	347	0	347	53	0	53	14	0	14
		Lash Cargo	122		122	0	0	0	0	0	0
		Citrus	0	12	12	0	441	441	0	632	632
		Agricultural Products	0	56	56	0	14	14	0	2	2
		General cargo	0	410	410	0	21	21	0	1	1
		Cotton	0	0	0	0	0	0	0	0	0
		Fiber	0	0							
		Others	314	0	314	903	0	903	782	0	782
		Sub-total	3,672	533	4,205	4,783	488	5,271	4,108	636	4,744
	Statistically Mixed	Timber	1,826	3	1,830	4,026	0	4,026	5,299	0	5,299
		Ro-Ro Cargo	625	133	758	0	0	0	0	0	0
		Sugar	969	0	969	404	0	404	768	0	768
		Paper	172	1	173	826	0	826	659		659
		Rice	1	49	50	0	297	297	0	537	537
		Flour	77	0	77	346	0	346	390	0	390
		Sub-total	3,671	187	3,858	5,602	297	5,899	7,116	537	7,653
	Non-Containerizable	Iron/Steel Products	1,033	192	1,225	2,467	500	2,967	4,669	630	5,299
		Scrap	16		16	201	0	201	201	0	201
		Car	10		10	36	0	36	36	0	36
		Special Cargo	88	9	97	138	11	149	138	11	149
		Livestock	6		6	70	0	70	79	0	79
		Sub-total	1,153	201	1,354	2,912	511	3,423	5,123	641	5,764
Total			8,496	921	9,416	13,297	1,296	14,593	16,348	1,814	18,162

Source: JICA Study Team

12.5.3 Forecast of Dry Bulk Cargo Volume at the Mediterranean Ports

The forecast volume of Dry Bulk cargo handled at the Mediterranean Ports at the target year is shown in Table 12.5.8.

Table 12.5.8 Forecast Volume of Dry Bulk Cargo at the Mediterranean Ports

Package Style	Containeri-zability	Commod-ity	Cargo Volume ('000tons)			Forecast Cargo Volume ('000tons)					
			1997			2007			2017		
			Import	Export	Total	Import	Export	Total	Import	Export	Total
Dry Bulk		Grains	9,794	18	9,811	11,999	0	11,999	13,404	0	13,404
		Iron Pellets	1,988	7	1,995	3,750	0	3,750	5,000	0	5,000
		Soybean	243	0	243	32	0	32	21	0	21
		Coal	1,659	0	1,659	1,300	0	1,300	1,500	0	1,500
		Coke	0	306	306	0	399	399	0	520	520
		Cement	2,668	0	2,668	3,108	0	3,108	3,321	0	3,321
		Sulpher	349	1	351	349	0	349	349	0	349
		Fertilizer	246	288	534	201	345	546	428	439	867
		Salt	0	374	374	0	912	912	0	1,547	1,547
		Others	416	63	479	580	27	607	580	27	607
Total			17,361	1,058	18,419	21,319	1,683	23,002	24,603	2,533	27,136

Source: JICA Study Team

12.5.4 Forecast of Liquid Bulk Cargo Volume at the Mediterranean Ports

Liquid bulk cargo handled at Alexandria Port consists of Petroleum products, Edible oil, Grease and Molasses, and that of Port Said Port consists of petroleum products. The forecast volume of liquid bulk cargo to be handled for the target year is shown in Table 12.5.9.

Table 12.5.9 Forecast Volume of Liquid Bulk Cargo at the Mediterranean Ports

Package Style	Containeri-zability	Commodity	Cargo Volume ('000tons)			Forecast Cargo Volume ('000tons)					
			1997			2007			2017		
			Import	Export	Total	Import	Export	Total	Import	Export	Total
Liquid Bulk		Petroleum Oil	614	3,660	4,274	488	4,676	5,164	906	5,974	6,880
		Edible Oil	480	3	483	124	0	124	135	0	135
		Grease	58		58	86	0	86	86	0	86
		Molasses	0	186	186	0	349	349	0	529	529
		Total	1,151	3,849	5,001	698	5,025	5,723	1,127	6,503	7,630

Source: JICA Study Team

12.6 Forecast Passenger Volume through the Mediterranean Ports in Egypt

Passenger volume was 97,000 persons through Greater Alexandria Port and 544,000 persons through Port Said Port in 1997. Most passengers through those ports were tourists using large passenger vessels cruising around the Mediterranean Sea and Suez Canal. The forecast passenger volume is shown in Table 12.6.1.

Table 12.6.1 Forecast Passenger Volume at Greater Alexandria and Port Said Port

(Unit: thousand persons)

Port	1997	2007	2017
Greater Alexandria	97	182	342
Port Said	544	1,021	1,917
Total	641	1,203	2,259

Source: JICA Study Team

12.7 Summary of Demand Forecast

Summaries of demand forecast, by commodity of the three ports in the target year, is shown in Table 12.7.1, Table 12.7.2, Table 12.7.3 and Table 12.7.4.

Table 12.7.1 Summary of Forecast Containers Handled at the Mediterranean Ports

Package Style	Port	Unit	Cargo Volume 1997 Import	Cargo Volume 1997 Export	Cargo Volume 1997 Total	Forecast Cargo Volume 2007 Import	2007 Export	2007 Total	2017 Import	2017 Export	2017 Total
Local Container	Greater Alexandria	('000 tons)	2,055	651	2,707	5,270	1,943	7,213	6,715	1,689	8,404
		('000 TEUs)	204	185	389	617	617	1,234	750	750	1,500
	Damietta	('000 tons)	271	317	588	419	154	573	1,665	419	2,084
		('000 TEUs)	27	38	65	49	49	98	186	186	372
	Port Said	('000 tons)	537	209	746	419	154	573	3,134	788	3,922
		('000 TEUs)	52	52	104	49	49	98	350	350	700
	East Port Said	('000 tons)	0	0	0	419	154	573	1,665	418	2,083
		('000 TEUs)	0	0	0	49	49	98	186	186	372
	Total	('000 tons)	2,863	1,177	4,041	6,526	2,406	8,932	13,179	3,314	16,493
		('000 TEUs)	283	275	558	764	764	1,528	1,472	1,472	2,944
Transship-ment Container	Greater Alexandria	('000 TEUs)	4	4	8	0	0	0	0	0	0
	Damietta	('000 TEUs)	273	269	542	-	-	974	-	-	1,328
	Port Said	('000 TEUs)	157	154	311	-	-	524	-	-	0
	East Port Said	('000 TEUs)	0	0	0	-	-	1,995	-	-	3,828
	Total	('000 TEUs)	435	427	862			3,493			5,156
Grand Total		('000 tons)	2,863	1,177	4,041	6,526	2,406	8,932	13,179	3,314	16,493
		('000 TEUs)	718	702	1,420	-	-	5,021	-	-	8,100

Source: Calculated by JICA Study Team based on the data from Egyptian Maritime Data Bank
and Greater Alexandria Port Authority, Dammietta Port Authority and Port Said Port Authority

Table 12.7.2 Summary of Forecast Volume Handled at Greater Alexandria Port
by Commodity in the Target Year

Package Style	Containeriza-bility	Commodity	Cargo Volume ('000tons) 1997 Import	1997 Export	1997 Total	Forecast Cargo Volume ('000tons) 2007 Import	2007 Export	2007 Total	2017 Import	2017 Export	2017 Total
Conventional Cargo	Containerizable	Miscellaneous	2,889	55	2,943	3,827	12	3,839	3,312	1	3,313
		Frozen Food	164		164	25	0	25	7	0	7
		Lash Cargo	122		122	0	0	0	0	0	0
		Citrus	0	12	12	0	441	441	0	632	632
		Cotton	0	0	0	0	0	0	0	0	0
		Fiber	0	0							
		Sub-total	3,175	67	3,241	3,852	453	4,305	3,319	633	3,952
	Statistically Mixed	Timber	1,629	3	1,633	3,634	0	3,634	4,783	0	4,783
		Ro-Ro Cargo	625	133	758	0	0	0	0	0	0
		Sugar	661		661	276	0	276	531		531
		Paper	172	1	173	826	0	826	659		659
		Rice	1	49	50	0	297	297	0	537	537
		Flour	53		53	238	0	238	268		268
		Sub-total	3,142	187	3,329	4,974	297	5,271	6,241	537	6,778
	Non-Containerizable	Iron/Steel Products	293	192	485	712	500	1,212	1,325	630	1,955
		Scrap	16		16	201	0	201	201	0	201
		Car	10		10	36	0	36	36	0	36
		Livestock	6		6	70	0	70	79	0	79
		Sub-total	325	192	517	1,019	500	1,519	1,641	630	2,271
	Total		6,641	446	7,087	9,845	1,250	11,095	11,201	1,800	13,001
Local Containers		'000 tons	2,055	651	2,707	4,578	1,688	6,266	6,715	1,689	8,404
		('000 TEUs)	204	185	389	536	536	1,071	750	750	1,500
Dry Bulk		Wheat	2,161	18	2,179	3,897	0	3,897	3,846	0	3,846
		Maize	2,264	0	2,264	1,524	0	1,524	2,210	0	2,210
		Iron Pellets	1,988	7	1,995	3,750	0	3,750	5,000	0	5,000
		Coal	1,659		1,659	1,300	0	1,300	1,500	0	1,500
		Coke	0	306	306	0	399	399	0	520	520
		Cement	976		976	1,137	0	1,137	1,215	0	1,215
		Sulpher	349	1	351	349	0	349	349	0	349
		Fertilizer	239	19	258	195	0	195	416	0	416
		Salt	0	235	235	0	573	573	0	972	972
		Others	413	1	414	413	0	413	413	0	413
		Total	10,048	588	10,636	12,565	972	13,537	14,949	1,492	16,441
Liquid Bulk		Petroleum Oil	614	2,956	3,570	488	3,777	4,265	906	4,825	5,731
		Edible Oil	480	3	483	124	0	124	135	0	135
		Grease	58		58	86	0	86	86	0	86
		Molasses	0	186	186	0	349	349	0	529	529
		Total	1,151	3,145	4,297	698	4,126	4,824	1,127	5,354	6,481
Grand Total			19,896	4,830	24,726	27,686	8,036	35,722	33,992	10,335	44,327

Source: Calculated by JICA Study Team based on the data from Egyptian Maritime Data Bank
and Greater Alexandria Port Authority

Table 12.7.3 Summary of Forecast Volume Handled at Damietta Port by Commodity in the Target Year

Package Style	Containeriza-bility	Commodity	Cargo Volume ('000tons)			Forecast Cargo Volume ('000tons)					
			1997			2007			2017		
			Import	Export	Total	Import	Export	Total	Import	Export	Total
Conventional Cargo	Containeriza-ble	Fish and Meat	138	0	138	21	0	21	6	0	6
		General cargo	0	378	378	0	16	16	0	1	1
		Others	71	0	71	309	0	309	268	0	268
		Sub-total	209	378	587	330	16	346	273	1	274
	Statistically Mixed	Timber	197	0	197	392	0	392	516	0	516
		Flour	0	0	0	0	0	0	0	0	0
		Sub-total	197	0	197	392	0	392	516	0	516
	Non-Containeriza-ble	Iron products	622	0	622	1,287	0	1,287	2,363	0	2,363
		Special Cargo	31	9	40	37	9	46	37	9	46
		Sub-total	653	9	662	1,324	9	1,333	2,400	9	2,409
	Total		1,059	387	1,446	2,047	25	2,072	3,190	10	3,200
Local Containers		Container ('000tons)	271	317	588	752	277	1,029	1,665	419	2,084
		('000TEUs)	27	38	65	88	88	176	186	186	372
Dry Bulk		Wheat	2,544	0	2,544	3,250	0	3,250	3,208	0	3,208
		Maize	1,147	0	1,147	1,272	0	1,272	1,844	0	1,844
		Soybean	243	0	243	32	0	32	21	0	21
		Cement	1,686	0	1,686	1,964	0	1,964	2,099	0	2,099
		Fertilizer	7	130	137	6	166	172	12	212	224
		Others	3	62	65	167	27	194	167	27	194
		Total	5,630	192	5,822	6,691	193	6,884	7,351	239	7,590
Grand total			6,960	896	7,856	9,490	495	9,985	12,206	668	12,874

Source: Calculated by JICA Study Team based on the data from Egyptian Maritime Data Bank and Damietta Port Authority

Table 12.7.4 Summary of Forecast Volume Handled at Port Said Port by Commodity in the Target Year

Package Style	Containeriza-bility	Commodity	Cargo Volume ('000tons)			Forecast Cargo Volume ('000tons)					
			1997			2007			2017		
			Import	Export	Total	Import	Export	Total	Import	Export	Total
Conventional Cargo	Containeriza-ble	Frozen	45	0	45	7	0	7	1	0	1
		Agricultural Products	0	56	56	0	14	14	0	2	2
		General Cargo	0	32	32	0	5	5	0	0	0
		Others	243	0	243	594	0	594	514	0	514
		Sub-total	288	88	376	601	19	620	515	2	517
	Statistically Mixed	Sugar	308	0	308	128	0	128	237	0	237
		Flour	24	0	24	108	0	108	122	0	122
		Sub-total	332	0	332	236	0	236	359	0	359
	Non-Containeriza-ble	Iron products	118	0	118	244	0	244	448	0	448
		Special cargo	57	0	57	101	2	103	101	2	103
		Sub-total	175	0	175	345	2	347	549	2	551
	Total		795	88	883	1,182	21	1,203	1,424	4	1,428
Local Containers		Container ('000tons)	537	209	746	753	277	1,030	3,134	788	3,922
		('000TEUs)	52	52	104	88	88	176	350	350	700
Dry Bulk		Wheat	1,678		1,678	1,478	0	1,478	1,458	0	1,458
		Maize	0		0	578	0	578	838	0	838
		Cement	6	0	6	7	0	7	7	0	7
		Coke	0	0	0	0	0	0	0	0	0
		Fertilizer	0	139	139	0	179	179	0	227	227
		Salt	0	139	139	0	339	339	0	575	575
		Others	0	0	0	0	0	0	0	0	0
		Total	1,684	278	1,962	2,063	518	2,581	2,303	802	3,105
Liquid Bulk		Petrol	0	704	704	0	899	899	0	1,149	1,149
		Total	0	704	704	0	899	899	0	1,149	1,149
Grand total			3,016	1,279	4,295	3,998	1,715	5,713	6,861	2,743	9,604

Source: Calculated by JICA Study Team based on the data from Egyptian Maritime Data Bank and Port Said Port Authority

Chapter 13 Functional Allotment of the Mediterranean Ports in Egypt

13.1 Transshipment Container Port Capacity in the East Mediterranean

There are eight major transshipment container ports in the East Mediterranean mainly handling the transshipment containers. Transshipment container shares to the total container throughput for those ports in 1994 are reported as 90% (Marsaxlokk), 36% (Limassol), 78% (Larnaca), 20% (Piraeus), 9% (Haifa), 89% (Damietta) and 75% (Port Said)[1)2)].

In addition, the Port Said East Port is currently proposed as a hub-port targeting transshipment containers at the area of Shark Al-Tafriaa, east of Port Said. According to the report[3)], 2.5 million TEUs of containers are planned to be handled at the Port Said East Port in 2011. In this study, it is assumed that at the Port Said East Port, the second stage project (total berth length of 4,800m, twelve (12) 400m-equivalent berths) will be completed by the year 2017 with the estimated annual capacity of 4.2 million TEUs.

Future container-handling capacities of Gioia Tauro, Marsaxlokk, Piraeus and Haifa are announced by the port authorities together with the future expansion plans. The future capacities of the other foreign hub-ports are estimated considering their future expansion plans if any.

As to container-handling capacities of the Egyptian ports are calculated using the computer simulation method (see Section 13.3). Thus, the resulting container-handling capacities of the East Mediterranean hub-ports in the future are shown in Table 13.1.1. Unit berth capacities are in the range of 225,000 - 369,000 TEUs.

Out of total capacities of approximately 18.3 million TEUs, the capacity of 10.9 million TEUs in total is estimated to be available for container transshipment in the East Mediterranean in 2017.

13.2 Origin and Destination Distribution of the Transshipment Container through the Mediterranean Ports in Egypt

Origin and destination of containers which were transshipped at Damietta or Port Said Ports in 1997 are revealed through the survey by the Study Team (see Table 5.2.1).

---

1) "The battle for Med hub role", Containerization International (July 1995), pp. 95-99
2) Percentages of Damietta and Port Said Ports in 1997 are obtained through Maritime Databank by the Study Team.
3) "Feasibility Study on Establishment of Sharq Al-Tafriaa Port and Free Zone at Greater Area of Port Said" (Research and Consultation Center of Maritime Transport Sector)

Table 13.1.1 Transshipment Container Port Capacity in the East Mediterranean in 2017

Port Name	Status	Berth Length	Berth Depth	Berth No.	Stacking Area	Total Port Capacity	Transship Share	East Med Share	Transship Port Capacity
		(m)	(m)	(Berths)	(Sq.m)	(TEUs)	(%)	(%)	(TEUs)
Gioia Tauro	Present	3,012	13.5	9	950,000				
	Additional	1,250	- 18.0	4	-----				
	Total	1,262		13		4,800,000	100	70	3,360,000
Marsaxlokk	Present	1,480	14.5	4	274,000				
	Additional	1,000	- 15.5	3	-----				
	Total			7		2,450,000	90	70	1,543,500
Limassol	Present	1,000	11.0	3	400,000				
	Additional	-----	- 14.0	-----	-----				
	Total			3		840,000	36	100	302,400
Larnaca	Present	340	12.0	1	100,000				
	Additional	-----	-----	-----	-----				
	Total			1		280,000	78	100	218,400
Piraeus	Present	1,500	12.0	4	-----				
	Additional	-----	- 16.5	-----	-----				
	Total			4		1,000,000	20	100	200,000
Haifa	Present	400	10.5	1	-----	200,000			
	Additional	700		2	700,000	700,000			
	Total			3		900,000	9	100	81,000
Alexandria	Present	560	14.0	2		450,000			
	Additional	-----		-----		-----			
	Total			2	163,000	450,000	0	-----	0
El Dekheila	Present	480	14.0	1	280,000				
	Additional	560	12.0	2	100,000				
	Total			3	380,000	1,000,000	0	-----	0
Damietta	Present	1,000	14.5	3	256,000				
	Additional	800	12.0	2	-----				
	Total			5		1,700,000	78	100	1,328,000
Port Said	Present	600	13.7	2	300,000				
	Additional	350	13.7	1	150,000				
	Total			3	450,000	700,000	0	-----	0
East Port Said Project	Present	-----		-----		-----			
	Additional	4,800	16.5	12		4,200,000			
	Total			12		4,200,000	91	100	3,828,000
The East Mediterranean Grand Total						18,320,000	-----		10,860,800

According to the results of the survey, the East Mediterranean, the Black Sea and the West Mediterranean accounts for 81.8%, 7.1% and 4.4% respectively in the volume of containers transshipped by the feeder vessels on short-sea routes. On the other hand, East Asia, West Europe, North America, Southeast Asia, South Asia and the Middle East accounts for 33.9%, 22.4%, 22.1%, 13.6%, 3.8% and 3.5% respectively by main-line vessels on long-sea routes.

This reveals that the East Mediterranean and Black Sea accounts for approximately 90% of the total volume of containers transported by feeder vessels on short-sea routes

Table 13.2.1 Regional Share of Origin and Destination of the Transshipment Container through the Mediterranean Ports in Egypt

On Short-sea Route (Feeder Vessels)	Regional Share (%)	On Long-sea Routes (Main-line Vessels)	Regional Share (%)
East Mediterranean	81.8%	West Europe	22.4%
Black Sea	7.1%	North America	22.1%
West Mediterranean	4.4%	The Middle East	3.5%
-----	-----	East Asia	33.9%
-----	-----	Southeast Asia	13.6%
-----	-----	South Asia	3.8%
Other region	6.7%	Other region	0.7%
Grand Total	100%	Grand Total	100%

13.3 Container Port Capacity of the Mediterranean Ports in Egypt

Container-handling capacities of the three ports, the Greater Alexandria Port (Alexandria and El Dekheila), Damietta and Port Said are separately estimated using computer simulation on the operational conditions which could be achieved in the future (see Table 13.3.1).

Table 13.3.1 Operational Condition of Container Handling for Computer Simulation

Item	Unit	Operational Condition
1. Net Productivity	(boxes/crane/hour)	30
2. Operational Factor of Handling	(-----)	0.8
3. Number of cranes per berth	(cranes/berth)	2
4. Non-operational hours at berthing and un-berthing	(hour/svessel)	3
5. TEU/Box Ratio (in 2017)	(TEUs/box)	1.67
6. CFS Container Ratio (Import)	(%)	5
7. CFS Container Ratio (Export)	(%)	40
8. Average Dwelling Time of Import Container at CY	(days)	3.5 (Maximum 7)
9. Average Dwelling Time of Export Container at CY	(days)	2.4 (Maximum 7)

(1) Alexandria Container Terminal

Container-handling capacity of Alexandria Container Terminal is estimated on the above-mentioned operational conditions. The resulting required number of ground slots of the container yard for laden and empty containers to handle 450,000 TEUs of containers per annum is 2,964 TEUs. Taking account of the maximum available ground slots of 3,000 TEUs in the terminal, the container-handling capacity is estimated as 450,000 TEUs per annum though the resulting berth occupancy shows some room (see Table 13.3.2).

Table 13.3.2 Annual Container Port Capacity of Alexandria Container Terminal

Item	Conditions	Resulting Peaking Factor	Results
1. Number of Berths (berths)	-----	-----	2 (550m in length)
2. Annual Maximum Container Capacity (TEUs/year)	-----	-----	450,000 TEUs/year
3. Berth Occupancy Ratio (%)	-----	-----	50.2 %
4. Average Berth Waiting Time (hours/vessel)	-----	-----	4.3 hours/vessel
5. Daily Maximum Number of Import Laden Container at Container Yard (TEUs/day)	2,050	1.69	3,459
6. Average Number of Stacking Tiers of Import Container (Tiers)	-----	-----	2.25 (=3*0.75)
7. Daily Maximum Number of Export Laden Container at Container Yard (TEUs/day)	562	1.19	669
8. Average Number of Stacking Tiers of Export Container (Tiers)	-----	-----	3.0 (=4*0.75)
9. Average Number of Empty Container at Empty Container Depot (TEUs/day)	-----	-----	3,622
10. Average Number of Stacking Tiers of Empty Container (Tiers)	-----	-----	3.0 (=4*0.75)
11. Required Number of Ground Slots (TEUs)	-----	-----	2,964
12. Available Ground Slots (TEUs)	-----	-----	3,000

(2) El Dekheila Container Terminal

Container-handling capacity of El Dekheila Container Terminal is similarly estimated on the above-mentioned operational conditions. There are 4,000 ground slots on the existing container yard and additional 1,430 ground slots could be prepared within its compound in the future.

The resulting required number of ground slots of the container yard for laden and empty containers to handle one million TEUs of containers per annum is 5,480 TEUs. Taking account of the maximum available ground slots of 5,430 TEUs in the terminal in the future, the container-handling capacity is estimated as one million TEUs per annum though berth occupancy shows some room (see Table 13.3.3).

(3) Damietta Container Terminal

Container-handling capacity of Damietta Container Terminal is also similarly estimated on the above-mentioned operational conditions. There are 11,935 ground slots on the existing and proposed container yard in the terminal in the future.

The resulting required number of ground slots of the container yard for laden and empty containers to handle 1.7 million TEUs of containers per annum is 11,690 TEUs. Taking account of the maximum available ground slots of 11,935 TEUs in the terminal in the future, the container-handling capacity is estimated as 1.7 million TEUs per annum though the resulting berth occupancy shows some room (see Table 13.3.4).

Table 13.3.3 Annual Container Port Capacity of El Dekheila Container Terminal

Item	Conditions	Resulting Peaking Factor	Results
1. Number of Berths (berths)	3 (990m in length)	-----	-----
2. Annual Maximum Container Capacity (TEUs/year)	1,000,000 TEUs/year	-----	-----
3. Berth Occupancy Ratio (%)	-----	-----	65.3 %
4. Average Berth Waiting Time (hours/vessel)	-----	-----	6.4 hours/vessel
5. Daily Maximum Number of Import Laden Container at Container Yard (TEUs/day)	4,555	1.36	6,202
6. Average Number of Stacking Tiers of Import Container (Tiers)	2.25 (=3*0.75)	-----	-----
7. Daily Maximum Number of Export Laden Container at Container Yard (TEUs/day)	1,249	1.11	1,392
8. Average Number of Stacking Tiers of Export Container (Tiers)	3.0 (=4*0.7)	-----	-----
9. Average Number of Empty Container at Empty Container Depot (TEUs/day)	-----	-----	6,785
10. Average Number of Stacking Tiers of Empty Container (Tiers)	3.0 (=4*0.75)	-----	-----
11. Required Number of Ground Slots (TEUs)	-----	-----	5,482
12. Available Ground Slots (TEUs)	-----	-----	5,430

Table 13.3.4 Annual Container Port Capacity of Damietta Container Terminal

Item	Conditions	Resulting Peaking Factor	Results
1. Number of Berths (berths)	6 (1,800m in length)	-----	-----
2. Annual Maximum Container Capacity (TEUs/year)	1,700,000 TEUs/year	-----	-----
3. Berth Occupancy Ratio (%)	-----	-----	64.6 %
4. Average Berth Waiting Time (hours/vessel)	-----	-----	4.9 hours/vessel
5. Daily Maximum Number of Import Laden Container at Container Yard (TEUs/day)	937	1.46	1,372
6. Average Number of Stacking Tiers of Import Container (Tiers)	2.25 (=3*0.75)	-----	-----
7. Daily Maximum Number of Export Laden Container at Container Yard (TEUs/day)	312	1.09	339
8. Average Number of Stacking Tiers of Export Container (Tiers)	3.0 (=4*0.75)	-----	-----
9. Average Number of Empty Container at Empty Container Depot (TEUs/day)	-----	-----	1,711
10. Average Number of Stacking Tiers of Empty Container (Tiers)	3.0 (=4*0.75)	-----	-----
11. Average Number of Transshipment Container at Container Yard (TEUs/day)	-----	-----	20,785
12. Average Number of Stacking Tiers of Transshipment Container (Tiers)	2.0 (=3*0.67)	-----	-----
13. Required Number of Ground Slots (TEUs)	-----	-----	11,686
14. Available Ground Slots (TEUs)	-----	-----	11,935

(4) Port Said Container Terminal

Container-handling capacity of Port Said Container Terminal is estimated on the above-mentioned operational conditions. Container-handling capacity is estimated as 700,000 TEUs keeping ship-waiting time less than 24 hours/vessel at the anchorage of the entrance of the port. Ship-waiting time or delay of more than 24 hours are not usually accepted for the container transport services. Because the container transport services generally require a regular schedule.

Port Said Port is located at the northern mouth of the Suez Canal. The length of an approach channel to the port (maintained at -16.5m) is approximately 11.4 km, which requires about one hour of navigation. Additionally, the channel is not allowed to pass vessels calling at the port for 8 hours (0 a.m.- 8 a.m.) a day due to the south-bound convoy passing through the approach channel during the period. This channel constraint makes the port less available even if its berth occupancy ratio shows some room.

Table 13.3.5 Annual Container Port Capacity of Port Said Container Terminal

Annual Throughput	Number of Berths	Berth Length	Channel Availability	BOR	Average Ship-Waiting Time
(TEUs/year)	(Berths)	(m)	(hours/day)	(%)	(hours/vessel)
600,000	3	950	16	66.2	13.1
700,000	3	950	16	69.9	15.8
800,000	3	950	16	74.5	25.4
900,000	3	950	16	80.6	161.1

13.4 Functional Allotment of Container Handling and Container Traffic Assignment among the Mediterranean Ports in Egypt

(1) Local Container Hinterland through the Mediterranean Ports in Egypt

According to the survey on inland hinterland share of the local containers handled at the Greater Alexandria, Damietta and Port Said Ports in 1997 presented in Tables 6.4.1, 7.4.1 and 8.4.1, their hinterlands are over-lapped. Overall inland hinterland share of those local containers can be gained as weighted average concerning the amount of local containers of those ports.

According to the overall average hinterland share, Cairo takes the first place followed by Alexandria area and Port Said area account for 53.6%. In addition to Cairo area, Alexandria Port (22.5%) and Port Said Port (9.1%) have their own hinterlands right behind those ports to a certain extent as shown in Table 13.4.1.

Table 13.4.1 Overall Inland Hinterland Share of the Local Containers handled at Mediterranean Ports in Egypt in 1997

Hinterland Area	The Greater Alexandria Port	Damietta Port	Port Said Port	Overall Average
Local Container Throughput	397,000 TEUs	65,000 TEUs	104,000 TEUs	566,000 TEUs
1. Cairo Area	68.3%	77.1%	38.7%	63.8%
2. Alexandria Area	28.3%	12.7%	6.6%	22.5%
3. Damietta Area	0.1%	4.7%	-----	0.6%
4. Port Said Area	0.3%	-----	48.1%	9.1%
5. Ismailia Area	0.3%	-----	6.6%	1.4%
6. Middle Delta Area	0.6%	3.8%	-----	0.9&
7. Other Area	2.1%	1.7%	-----	1.7%
Grand Total	100%	100%	100%	100%

(2) Functional Allotment of Container Handling among the Mediterranean Ports in Egypt

In the Greater Alexandria Port, berth nos. 97-1 and 97-2 of which water depth and length are 12.0m and 580m have almost been completed on an infrastructure basis. By preparing additional superstructures and container handling machines, container-handling capacity of Alexandria Port could increase up to 1.5 million TEUs in total (450,000 for Alexandria Terminal, 1.0 million for El Dekheila Terminal and 50,000 for Ro-Ro services towards the target years of 2007 and 2017.

On the other hand, concerning Damietta Port, four general cargo berths with 12.0m deep and 800m long could be converted into container berths on demand. Container-handling capacity of Damietta Port is estimated as 1.15 million TEUs in 2007 and 1.7 million TEUs in 2017, serving both local and transshipment containers.

At Port Said Port, a new multi-purpose berth of which water depth and length are 13.7m and 350m has almost been completed on an infrastructure basis. Container-handling capacity of Port Said Port is estimated as 700,000 TEUs towards the target years of 2007 and 2017 (see Section 13.3 (4)).

Both the Greater Alexandria Port and Port Said Port are expected to handle local containers with priority considering the present role and their own hinterland. Port Said Port will handle transshipment containers supplementally at the beginning stage of Port Said East Port, only if its port capacity is left available.

On the other hand, both Damietta Port and Port Said East Port are expected to attract transshipment containers with the geographical advantages and superior infrastructures existing or to be prepared, so as to contribute to the national economy through earning foreign currencies. Thus these two ports are supposed to mainly handle transshipment containers as regional hub-port, while approximately 20% of their capacity to local containers are assigned as a base cargo to stabilize terminal management.

(3) Future Container Traffic Assignment to the Mediterranean Ports in Egypt

The total amounts of local containers to be handled at the Mediterranean Ports in Egypt are forecast 1.53 million TEUs in 2007 and 2.94 million TEUs in 2017 respectively (see Chapter 12). These local containers are assigned to each port.

As mentioned above, local containers are assigned to the Greater Alexandria Port and Port Said Port with priority. The excess local containers from Alexandria is assigned first to Port Said, then to Damietta Port and Port Said East Port. After the assignment of excess containers to the two ports, the marginal capacities are expected to be used attract transshipment containers as much as possible. The resulting assignment among the Mediterranean ports is shown in Table13.4.2.

Table 13.4.2 Local and Transshipment Container Assignment to the Mediterranean Ports in Egypt in 2007 and 2017

(Unit: thousand TEUs)

Port Name	1997			2007			2017		
	Local	Transship	Total	Local	Transship	Total	Local	Transship	Total
Greater Alexandria	389	8	397	1,234	0	1,071	1,500	0	1,500
Damietta	65	542	607	98	974	1,150	372	1,328	1,700
Port Said	104	311	415	98	524	700	700	0	700
Port Said East	----	----	----	98	1,995	2,100	372	3,828	4,200
Egypt Total	558	861	1,419	1,528	3,493	5,021	2,944	5,156	8,100

13.5 Economical Size of Container Vessels calling at the Mediterranean Ports in Egypt by Shipping Route

Major factors to determine economical size of container vessels on some shipping routes connecting specific ports are navigational distance, the maximum permissible limits of vessel drafts at the ports and the sum of container traffic volume during a certain period in view of viability of direct shipping services. In order to search the most economical size of container vessels by shipping route, unit container transport costs on specific routes are calculated and those are compared using normalized cost indices for each route (see Table 13.5.1).

Table 13.5.1 Comparison of Normalized Unit Container Transport Costs by Shipping Route

Loading Capacity (TEUs)	DWT (tons)	Full Draft (m)	Long-Sea Route					Short-Sea Route	
			West and North Europe	North America	East Asia	Southeast Asia	South Asia	West Med	East Med and Black Sea
Representative Port			Rotterdam	New York	Hong Kong	Singapore	Mumbai	Marseilles	Piraeus
800	16,000	9.0	1.249	1.245	1.446	1.437	1.323	1.100	1.027
1,200	22,000	10.0	1.070	1.118	1.153	1.142	1.092	1.016	1.000
1,500	27,000	11.0	1.036	1.067	1.091	1.082	1.047	1.005	1.002
2,000	35,000	12.0	1.009	1.025	1.036	1.030	1.011	1.000	1.011
3,000	50,000	13.0	1.000	1.000	1.000	1.000	1.000	1.011	1.035

(1) The Most Economical Size for Local Container Traffic

The amount of transshipment container traffic on the long distance routes connecting Alexandria Port with trading partners such as West and North Europe, North America, East Asia, Southeast Asia and South Asia accounts for 51.5% of the total local container traffic handled in 1997 (see Table 6.4.2). On the above-mentioned long distance routes, large container vessels of 3,000 TEUs in loading capacity are revealed as the most economical size (see Table 13.5.1).

On the other hand, the amount of local container traffic on the short distance routes connecting Egypt with the West Mediterranean, the East Mediterranean and Black Sea accounts for the remaining 48.5% of the total local container traffic for the same year. Container vessels of 1,200 TEUs and 2,000 TEUs in loading capacity are revealed as the most economical sizes for the routes between Egypt and the West Mediterranean and between Egypt and the East Mediterranean and Black Sea (see Table 13.5.1).

(2) The Most Economical Size for Transshipment Container Traffic

The amount of transshipment container traffic on the long-sea routes connecting the ports of Damietta or Port Said with the one end of origin and destination accounts for 95.8% of a half of transshipment container traffic handled in 1997 (see Table 13.2.1). On the above-mentioned long-sea routes, large container vessels of 3,000 TEUs in loading capacity are also revealed as the most economical size (see Table 13.5.1).

On the other hand, the amount of transshipment container traffic on the short-sea routes connecting the ports of Damietta or Port Said with the other end of origin and destination accounts for the remaining 93.3% of the other half of the transshipment container traffic for the same year (see Table 13.2.1). Container vessels of 1,200 TEUs and 2,000 TEUs in loading capacity are also revealed as the most economical sizes for these routes between Egypt and the East Mediterranean and between Egypt and the West Mediterranean and Black Sea (see Table 13.5.1).

13.6 Functional Allotment of Conventional Cargo Handling among the Mediterranean Ports in Egypt

Conventional cargo is generally handled at ports adjacent to its dominant area of hinterland, mainly due to a less cost-bearing strength on inland transport of the cargo.

Total volume of conventional cargo through the Mediterranean Ports in Egypt of 9.4 million tons (Alexandria: 7.1 million, Damietta: 1.4 million and Port Said: 0.9 million) million tons in 1997 will increase up to 14.3 million tons (Alexandria: 11.0 million, Damietta: 2.1 million and Port Said:1.2 million) in 2007 and 17.4 million tons (Alexandria: 12.8 million, Damietta: 3.2 million and Port Said: 1.4 million) in 2017.

In principle, conventional cargo should be handled at each port as long as the demand does not exceed the port capacity which could increase economically through additional investment in improvement of port facilities, procurement of cargo handling equipment and improvement of operational productivity.

Table 13.6.1 Summary of Conventional Cargo Volume to be handled at the Mediterranean Ports in Egypt

(Unit: thousand tons)

Port \ Year	1997 (tons)	2007 (tons)	2017 (tons)
The Greater Alexandria	7,087	10,989	12,798
Damietta	1,446	2,072	3,200
Port Said	883	1,203	1,428
Grand Total	9,416	14,264	17,426

(1) The Greater Alexandria Port

The Greater Alexandria Port reveals considerably congested in conventional-cargo-handling causing a long ship-waiting time. Operational productivity of conventional cargo at present remain considerably low level. There are two ways to improve the low productivity.

One is that the productivity of conventional cargo which requires sheds could increase by 27% (= 3/11), if operational hours were to extend to 14 hours from 11 hours. The other is that the productivity of conventional cargo which requires open yard could increase up to the reasonable level, if required open yard space were to be additionally prepared.

Package style-wise operational productivity of conventional cargo at present and on improved basis is presented in Table 13.6.2. This improvement could be realized by adopting the conventional cargo handling ways presented in Section 14.2.7.

Table 13.6.2 Examples of Cargo Handling Productivity at Present and on Improved Basis

Cargo Item	Package Style	Present Productivity (tons/hour/vessel)	Improved Productivity (tons/hour/vessel)
Sugar, Rice, Flour, etc.	Bag	20	26
Sawn Timber	Bundle	47	100*
Roll Paper	Roll	35	70*
Steel Products	Bundle	48	70*
Miscellaneous (Shed)	Break Bulk	20	26
Miscellaneous (Open Yard)	Break Bulk	20	50*

Remarks) * indicates reasonable level to improve with an available adequate area of open yard

An expansive development plan will be necessary to meet the increasing conventional cargo demand in the future, even though the above-mentioned operational productivity is improved.

(2) Damietta Port

As to Damietta Port, four general cargo berths of which depth and length are 12.0m and 800m could be converted into container berths on demand. In that case to meet the increasing conventional cargo demand and to compensate the conversion of the existing conventional berths, it is necessary to implement the second phase development.

(3) Port Said Port

As to Port Said Port, forecast volume of conventional cargo can be handled at the present port facility on the improved level of operational productivity.

13.7 Functional Allotment of Dry Bulk Cargo Handling among the Mediterranean Ports in Egypt

Dry bulk cargo is generally handled at ports adjacent to its dominant area of hinterland, mainly due to a less cost-bearing strength on inland transport of the cargo.

Total volume of dry bulk cargo through the Mediterranean Ports in Egypt of 18.4 million tons (Alexandria: 10.6 million, Damietta: 5.8 million and Port Said: 2.0 million) million tons in 1997 will increase up to 23.3 million tons (Alexandria: 13.8 million, Damietta: 6.9 million and Port Said:2.6 million) in 2007 and 27.6 million tons (Alexandria: 16.9 million, Damietta: 7.6 million and Port Said: 3.1 million) in 2017.

In principle, dry bulk cargo should be handled at each port as long as the demand does not exceed the port capacity which could increase economically through additional investment in improvement of port facilities, procurement of cargo handling equipment and improvement of operational productivity.

Table 13.7.1 Summary of Dry Bulk Cargo Volume to be handled at the Mediterranean Ports in Egypt

(Unit: thousand tons)

Year / Port	1997 (tons)	2007 (tons)	2017 (tons)
The Greater Alexandria	10,635	13,837	16,941
Damietta	5,822	6,884	7,590
Port Said	1,962	2,581	3,105
Grand Total	18,419	23,302	27,636

(1) The Greater Alexandria Port

a) Maize
Forecast volume of 2.2 million tons of "Maize" can be handled at a gross productivity of 700 (tons/hour/vessel) resulting in reasonable berth occupancy ratio (BOR) of 52% at berth no. 94-2.

b) Wheat
Forecast volume of 3.9 million tons of "Wheat" can be handled at gross productivity of 700 (tons/hour/vessel) at berth no. 94-2, 250 (tons/hour/vessel) at berth no. 94-1 and 500 (tons/hour/vessel) at newly-proposed grain berth in Alexandria, resulting in reasonable range of BOR (between 40% and 50%).

c) Iron Pellet
Forecast volume of 5.0 million tons of "Iron Pellet" can be handled at a gross productivity of 100 (tons/hour/vessel) resulting in reasonable BOR of 62% at berth no. 90-1, considering the available pile yard.

d) Coal
Forecast volume of 2.0 million tons of "Coal" can be handled at a gross productivity of 780 (tons/hour/vessel) at berth no. 64 and 810 (tons/hour/vessel) at berth no. 90-1 resulting in reasonable BOR of 60% or less, considering the available pile yard.

e) Cokes
Forecast volume of 0.5 million tons of "Cokes" can be handled at a gross productivity of 180 (tons/hour/vessel) resulting in reasonable BOR of 60% or less at berth no. 62, considering the available pile yard.

f) Cement
Forecast volume of 1.2 million tons of "Cement" can be handled at a gross productivity of 90 (tons/hour/vessel) resulting in a reasonable BOR of 74% at berth nos. 55 and 67.

As a result, no additional expansive infrastructure development is required for handling dry bulk cargo at the Great Alexandria Port up to the year 2017.

(2) Damietta Port

a) Maize
Forecast volume of 1.8 million tons of "Maize" can be handled at a gross productivity of 600 (tons/hour/vessel) resulting in reasonable BOR of 55% at the two grain berths.

b) Wheat
Forecast volume of 3.2 million tons of "Wheat" can be handled at a gross productivity of 500 (tons/hour/vessel) resulting in reasonable BOR of 55% at the two grain berths.

c) Cement
Forecast volume of 2.1 million tons of "Cement" can be handled at a gross productivity of 270 (tons/hour/vessel) resulting in a relatively high BOR of 90% at the cement berth.

As a result, no additional expansive infrastructure development is required for handling dry bulk cargo at Damietta Port up to the year 2017.

(3) Port Said Port

a) Wheat
Forecast volume of 2.3 million tons of "Wheat" can be handled at a gross productivity of 270 (tons/hour/vessel) resulting in reasonable BOR of 50% at the two grain berths.

As a result, no additional expansive infrastructure development is required for handling dry bulk cargo at Port Said Port up to the year 2017.

13.8 Functional Allotment of Liquid Bulk Cargo Handling among the Mediterranean Ports in Egypt

Liquid bulk cargo is generally handled at ports adjacent to its dominant area of hinterland, mainly due to a less cost-bearing strength on inland transport of the cargo.

Total volume of liquid bulk cargo through the Mediterranean Ports in Egypt of 5.0 million tons (Alexandria: 4.3 million and Port Said: 0.7 million) million tons in 1997 will increase up to 5.7 million tons (Alexandria: 4.8 million and Port Said:0.9 million) in 2007 and 7.6 million tons (Alexandria: 6.5 million and Port Said: 1.1 million) in 2017.

In principle, liquid bulk cargo should be handled at each port as long as the demand does not exceed the port capacity which could increase economically through additional investment in improvement of port facilities, procurement of cargo handling equipment and improvement of operational productivity.

Table 13.8.1 Summary of Liquid Bulk Cargo Volume to be handled at the Mediterranean Ports in Egypt

(Unit: thousand tons)

Port \ Year	1997 (tons)	2007 (tons)	2017 (tons)
The Greater Alexandria	4,297	4,824	6,481
Damietta	-----	-----	-----
Port Said	704	899	1,149
Grand Total	5,001	5,723	7,630

(1) The Greater Alexandria Port

a) Petroleum Oil
Forecast volume of 5.7 million tons of "Petroleum Oil" can be handled at a gross productivity of 540 (tons/hour/vessel) resulting in reasonable BOR of 40% at the three liquid berths nos. 87-3, 87-4 and 87-5.

It is additionally examined if the total volume can be handled at the existing facility in case that the additional one unit of refinery were to start operation and produce 3.5 million tons of petroleum oil.

Total volume of 9.0 million tons of "Petroleum Oil" can be handled at a gross productivity of 540 (tons/hour/vessel) resulting in reasonable BOR of 64% at the three liquid berths nos. 87-3, 87-4 and 87-5.

b) Petroleum Oil (LPG, Butane, etc.)
Forecast volume of 0.2 million tons of "Petroleum Oil (LPG, Butane, etc.)" can be handled at a gross productivity of 350 (tons/hour/vessel) resulting in reasonable BOR of 38% at the two liquid berths nos. 87-1 and 87-2.

As a result, no additional expansive infrastructure development is required for handling liquid bulk cargo at the Great Alexandria Port up to the year 2017.

(2) Port Said Port

a) Petroleum Oil
Forecast volume of 1.1 million tons of "Petroleum Oil" can be handled at a gross productivity of 270 (tons/hour/vessel) resulting in reasonable BOR of 50% at the one petroleum berth.

As a result, no additional expansive infrastructure development is required for handling liquid bulk cargo at Port Said Port up to the year 2017.

Chapter 14 Development Guidelines of the Mediterranean Ports in Egypt

14.1 General Development Guidelines of the Mediterranean Ports in Egypt

14.1.1 General Principles of Development

The volume of the local cargo through the three ports is expected to continuously increase in the future; projected total volume of cargo in the year of 2017 are 69.2 million tons (1.9 times as much as the volume in 1997) and 2.9 million TEUs (5.2 times as much as the volume in 1997) in local containers. At the same time, the potential demand of transshipment containers to be transshipped at the East Mediterranean hub-ports is forecast as 11.7 million TEUs per annum in 2017.

There is a shortage of the required infrastructure or cargo-handling machines, resulting in inefficient, costly and time-consuming cargo-handling operations and consequent long berth-waiting time at the three major ports.

Thus to resolve the present problems and meet increasing demand for handling conventional cargo and local and transshipment containers in the future, it is necessary to develop, re-develop or rehabilitate the Mediterranean Ports in Egypt, the Greater Alexandria, Damietta and Port Said Ports through coordinated development in view of effective use of the limited resources.

14.1.2 The Greater Alexandria Port

(1) General

Alexandria Port is handling a great portion of the conventional cargo in the country. Long, bulky and/or heavy cargo such as iron billets, steel bars, scraps and plant components need deeper berths with spacious aprons and open storage yards right behind them in order to achieve efficient cargo-handling operations. However, these cargoes are currently handled at the existing berths in the harbor mostly with narrow aprons and aged sheds behind them together with other conventional cargoes to be stored in sheds. Thus, on-dock cargo-handling operations are conducted in chaotic condition at these berths which are already close to be saturated, resulting in intricate cargo-handling within the port. In addition, barge operations at anchorage within the harbor basin are done for handling goods such as sawn timbers and dust. Such cargo-handling results in inefficient, costly and time-consuming operations.

To resolve the present problems in conventional cargo-handling and meet the increasing demand for handling long, heavy and/or bulky conventional cargoes, it is necessary to construct a new multi-purpose terminal with deep berths and spacious open yards in Alexandria Port by re-developing the existing aged wharf. Consequently, the preparation of the new terminal will reduce the congestion in the existing berths and generate benefits mainly from savings of berth-waiting costs of vessels at the off-shore anchorage.

(2) Local Container Handling

In order to meet the potential demand of handling local containers, it is essential to increase the capacity of Alexandria Port as much as possible by investing additional super-structure and container-handling machines through making the most of the most of the existing infrastructure including berths, and then assign the excess containers to other Mediterranean ports including the Port Said East Port.

(3) Transshipment Container Handling

No transshipment containers will be assigned to Alexandria Port, considering its role of supporting the local container handling.

(4) Dry Bulk Cargo Handling

(Grain)
In the Greater Alexandria Port a large portion of grains are discharged at El Dekheila Port rather than Alexandria Port, due to the shallow berth at the Alexandria Harbor Grain Terminal. Since there are only two units of rail-mounted un-loaders at El Dekheila, however, a considerable volume of grains are discharged by using portable un-loaders in direct unloading onto truck wagons. This results in low grain-handling productivity less than 300 tons/hour/vessel, consequently all genera cargo berths except for container berths at El Dekheila are occupied by grain carriers.

In order to resolve the present problems and meet the increasing demand for handling grains, it is necessary to construct a new grain berth of 14m deep connected with the existing silos through conveyors to receive the Panamax-type grain carriers in the Alexandria harbors.

(Coal and Cokes)
The berth at the coal/cokes terminal are obsolete and shallow in the Alexandria Harbor. Nevertheless, Panamax-type coal carriers of around 69,000 DWT with a full draft of 13.3m and a length of 215 m once called the terminal in partly-loaded draft condition.

Coal/cokes could be transported inland by barges from/to El Dekheila by constructing new barge basin together with creation of new canals or breakwater between El Dekheila in the Alexandria Harbor. The plan, however, requires too gigantic resources compared with benefit to be justified.

It is advisable to prepare deeper berths in front the existing berth line with moderate investment so as to receive larger coal cokes carriers at the existing coal/cokes terminal in the Alexandria Port.

(5) Liquid Bulk Cargo Handling

The few marine oil berths in the Petroleum Basin within the Alexandria harbor have sufficient capacity for Alexandria Petroleum Company for time of being, if the existing broken-down loading/un-loading arms will be replaced together with installation of required new pipelines connecting the berths and back-side refinery plants as planned by the company.

Within the free zone at Al Amaria, south of Alexandria where another refinery using the petroleum terminal of Alexandria Petroleum Company in the Alexandria Harbor is in operation, a new refinery is planned to be operated by MEDOR (Mediterranean Oil Refinery) which is under establishment. The company also needs an outlet to export or import refined oil within the Greater Alexandria Port.

The petroleum terminal of Alexandria Petroleum Company in the Alexandria Harbor could receive petroleum from/to the new refinery to be installed at Al Amaria if required loading/un-loading arms and new pipelines connecting the existing berths and the refinery plant.

(6) Common Port Facility

To support quay-side cargo handling operations, it is necessary to rehabilitate, renew or construct common facilities such as port roads, open yards and vessel traffic management system (VTMS).

14.1.3 Damietta Port

(1) General

Damietta Port has several problems in container-handling , viz. insufficient specifications of container gantry cranes to accommodate the gigantic main-line container vessels, lack of efficient operation system using computers, resulting in low container-handling productivity, etc. However, they will be able to be solved by moderate investment.

Damietta Port Authority is also struggling to keep the depth by continuous maintenance dredging by contract dredging through the year, and hence studying the feasibility on the optimum extension lengths of the existing breakwaters. The present lengths of the existing breakwaters placed in the wave-breaking zones seem likely to be short to avoid continuous dredging. The adequate countermeasure is essential to support the above-mentioned expansion project by enabling container vessels operated on regular schedule to receive at the port on time.

(2) Local Container Handling

While Damietta Port is expected to function as an international hub-port for serving container transshipment as it does at present, it needs some amount of local containers to stabilize the port management with other hub-ports. Thus, a portion of the excess local containers from Alexandria Port will be required to assign to Damietta in the future as well as Port Said Port.

(3) Transshipment Container Handling

Damietta Port is expected to increase the capacity of container-handling by less investment costs through using the existing infrastructure so as to attract a some portion of the potential demand for handling transshipment containers towards the year 2017 in the East Mediterranean and the Black Sea. Needless to say, much more transshipment container demand is expected to be attracted by Port Said East Port.

14.1.4 Port Said Port

(1) Local Container Handling

Port Said Port is also requires to serve local containers with priority as well as Alexandria Port, because the port has it own hinterland, Port Said Port city, amounting to 48.1% in 1997 in its local container market and has some constraint in available navigational time causing from interference with south-bound convoy passing through Suez Canal in functioning as an international hub-port for container transshipment in the next century.

(2) Transshipment Container Handling

Port Said Port is expected to handle transshipment containers up to its container-handling capacity, only if there remains room except for handling local containers.

Figure 14.1.1 Development Guideline of the Great Alexandria Port (Alexandria Harbour)

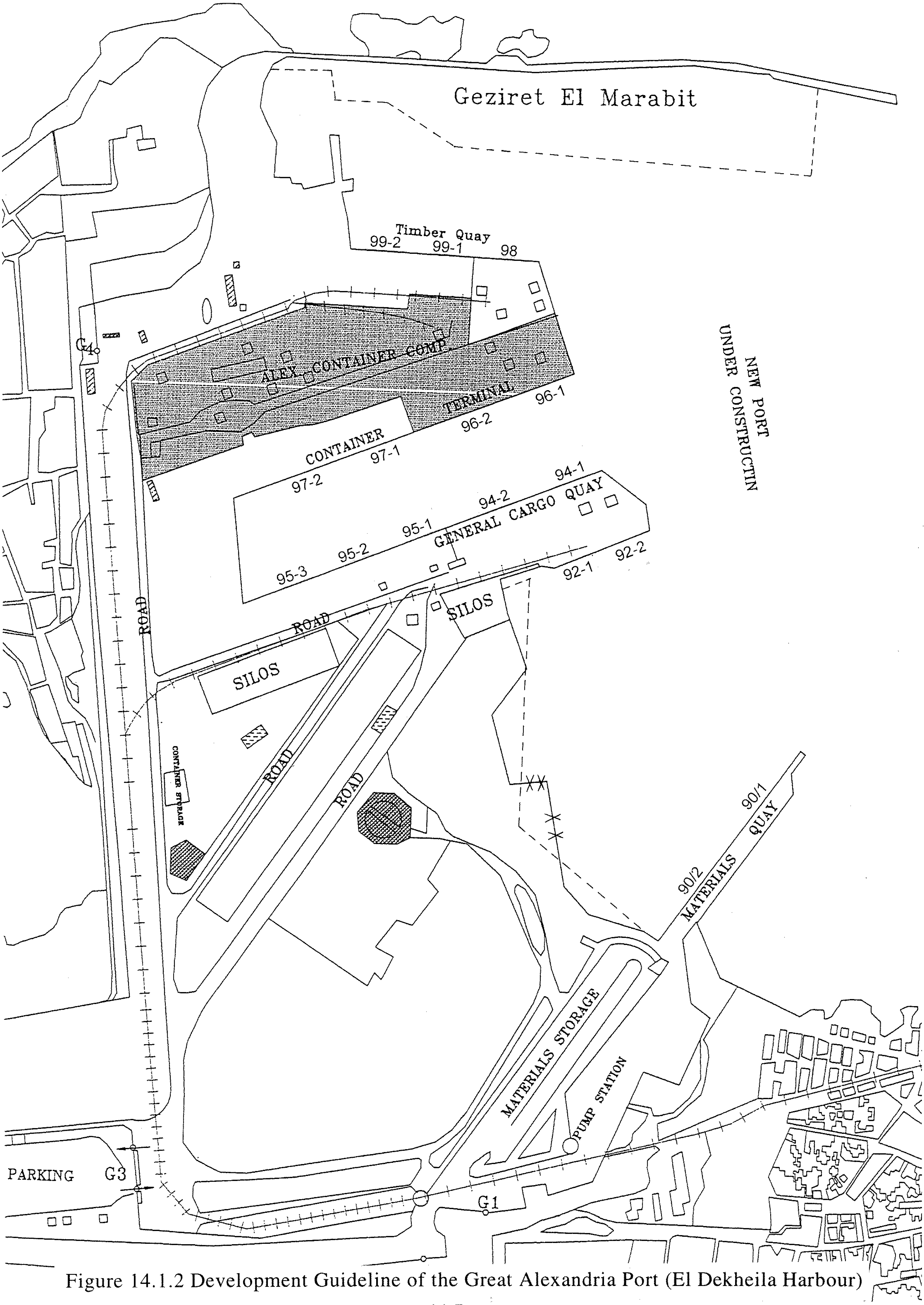


Figure 14.1.2 Development Guideline of the Great Alexandria Port (El Dekheila Harbour)

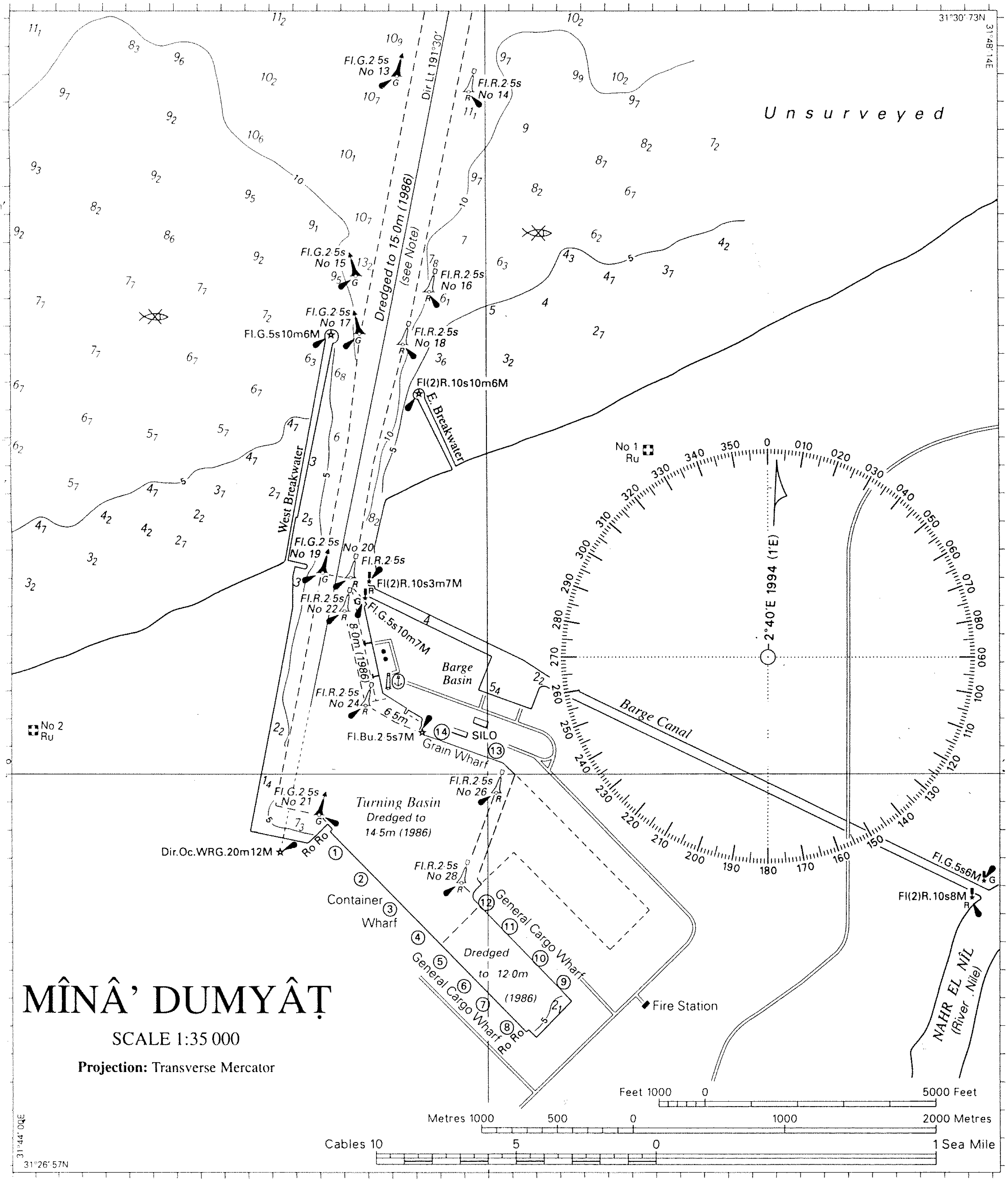


Figure 14.1.3 Development Guideline of Damietta Port

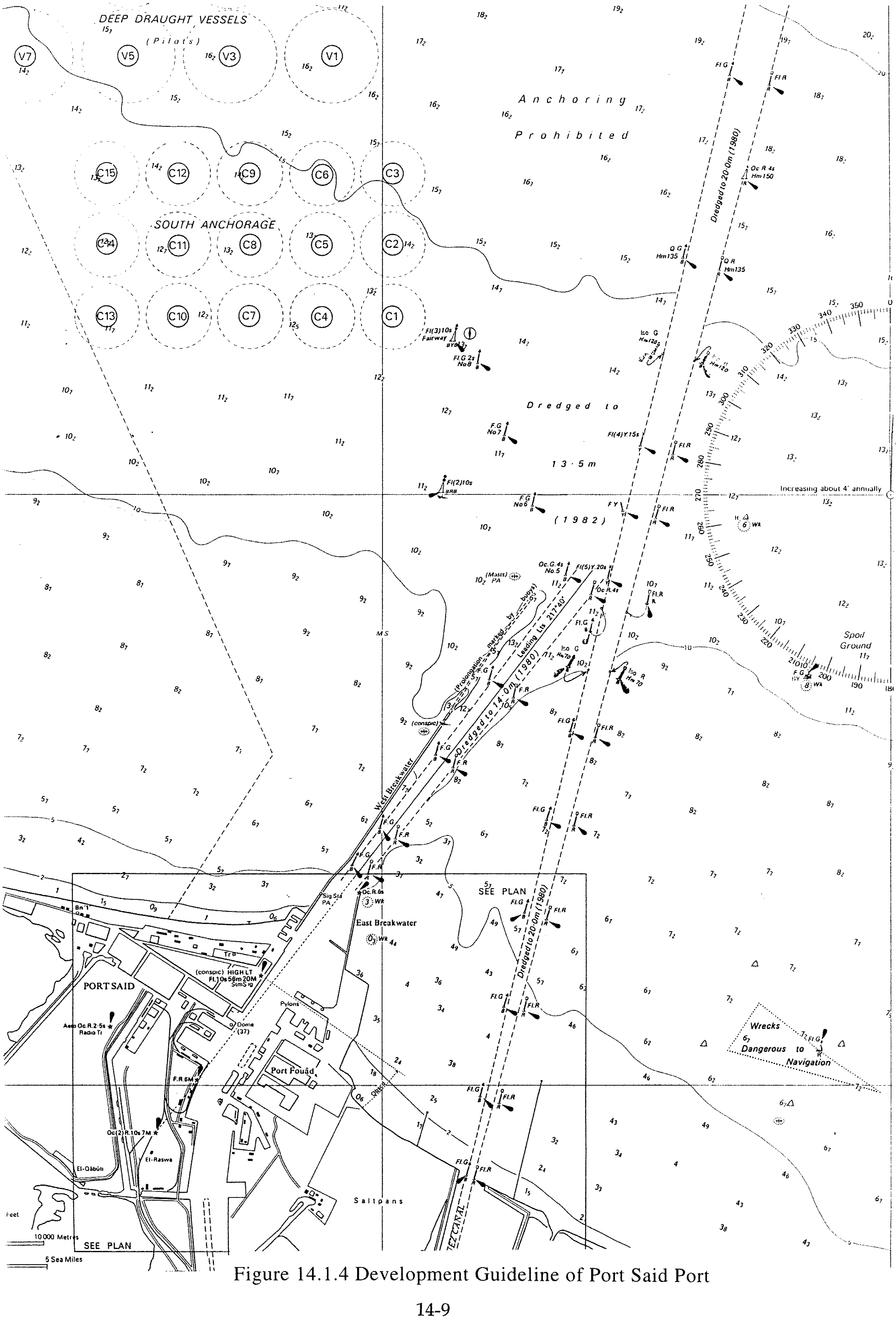


Figure 14.1.4 Development Guideline of Port Said Port

14.2 General Improvement Guidelines of Port Management and Operations

14.2.1 General Principles of Port Management and Operation

In Egypt, port authorities function as the Government's landlords over water, land and infrastructure of the ports. Therefore, the activities of port authorities are limited to the following areas:

- Making the overall plan of the port
- Owning the land and infrastructure of the port
- Supervising compliance with the port policies, such as charges for port services, observance of safety and environmental standards
- Reclaiming land in the port
- Maintaining and repairing port infrastructure
- Dredging to maintain access channel and basins in the port
- Controlling navigation traffic in and around the port area
- Monitoring the smooth functioning of the whole port operation
- Performing port services, such as berth assignment, navigation aid, pilotage, towage and security guard.

Port authorities should focus on the following three points for port management and operation to attract port users, especially foreign shipping lines.

(1) Efficient services
High productivity of cargo handling, seamless smooth operation and speedy procedure for cargo clearance are necessary. These encourage port users to minimize the cost of transport through a port.

(2) Reliability and availability of port facilities
Port facilities and cargo handling equipment must be well maintained so that port users can make full use of facilities and equipment. Breakdown time must be minimized. Storage facilities should be properly designed to prevent cargo damages. Security measures for cargoes or countermeasures against pilferage must be taken effectively. Cargo handling operation must be precise, careful and safe.

(3) Reasonable tariff
Port charges should be competitive but must cover the cost of construction, management and maintenance of port facilities. Furthermore, tariff structure should encourage port users to use port facilities efficiently.

14.2.2 Existing Problems in the Egyptian Ports

(1) Inefficient cargo handling
Productivity of container loading/unloading is lower than hub ports in the Mediterranean Sea. According to our survey, throughputs per hour per vessel are 15-17 boxes.

As for break bulk cargo handling, shortage of suitable equipment to handle various kinds of cargoes, for example, slings, forklifts and their attachments, results in low productivity and risks cargo damage.

Low productivity and inefficient cargo handling result in a long turn around time of vessels and high berth occupancy rate. Consequently, vessels have to wait for a long time in the waiting area and this situation is exacerbated by the shortage of general cargo berths.

(2) Time consuming procedures for cargo clearance
The dwelling time of containers or break bulk cargoes in the ports is long because of complicated and manual documentation and high ratio of physical inspection of cargoes.

(3) Uncompetitive tariff level
The level of port charges is not competitive considering the service level of the port activities, such as cargo handling efficiency and quickness of cargo release.

(4) Redundant gate operation
Customs officers check containers at the port gates. At the gate of the container terminal, personnel of the container terminal company checks containers for statistics. This overlapped check results in arrival delays and traffic congestion around the port gates and the container terminal gate.

(5) Poor maintenance of port facilities and equipment (Alexandria)
Port facilities such as quays, aprons, roads and a bridge are old and not maintained properly.

(6) Prevailing direct delivery and receiving (Alexandria)
Apron area of the general cargo berth is not large enough for a forklift to handle cargoes. This is the cause of prevailing direct delivery and receiving in Alexandria Port. Since a special waiting area for trucks is not provided, trucks form lines at quayside, resulting in traffic congestion at the quayside and delay of truck's arrival. Also, the irregular intervals of truck arrivals impede loading/unloading operation.
Furthermore, more time is required to land cargoes onto trucks/trailers' loading platforms with derrick/cranes compared to landing on a quay, and this is another factor in the cargo handling efficiency.

(7) Redundant transportation between quay and shed/warehouse (Alexandria)
Sheds or warehouses behind quays are not used for cargo discharged from/to be loaded onto vessels at the quays. Cargoes are transported from quays to other remote sheds, warehouses or open yards within the port area. This causes traffic congestion within the port area.

14.2.3 Promotion of Private Participation and Implementation of Privatization of the State-owned Companies in the Port Sector

Above mentioned problems are mainly derived from the monopoly of the state-owned companies. So far only one company has been allowed to perform the port service in each port sector. There is no competition with other private companies. No competition results in high port charges and low cargo handling productivity. Port users can not help using the Egyptian Ports even if they are not satisfied with the services. On the other hand, state-owned companies are enjoying profits and there is no incentive or motivation for them to improve the quality of the services. If a competitor emerges, port users are likely to receive an improved quality of services at lower costs. Recent decrees (including Decree No.30 May 1998) on private participation in the maritime sector have dramatically changed the monopolistic operations by the state-owned companies. Together with the promulgation of the decrees, the Government announced its intention to privatize the state owned companies in the maritime sector.

In deciding whether or not to permit a private company to participate in the port sector, the government must clarify the objective standard for giving permission. The period from applying to obtaining permission should be as short as possible by eliminating bureaucratic procedures.

14.2.4 Establishing of Integrated Terminal Operator

As for handling conventional general cargoes, it is essential to promote the establishment of integrated private terminal operators with enough capital and ability to perform comprehensive port terminal operations including stevedoring, warehousing and trucking. The port authorities should divide port areas into several zones and designate some zones as port terminals. Each terminal should have the appropriate size for such operations and include berths for preferential use and warehouses and open storage yards for exclusive use. Port authorities should give port terminal operators the concessions to use the terminals on an auction basis. They are expected to provide smooth and seamless operation with reduced costs for port users. If several port terminal operators emerge besides the existing state-owned stevedoring and warehouse companies to be privatized, competition among all of the port terminal operators will be activated and their service levels will be upgraded.

It is advisable to lease sufficient areas for private terminal operators enabling them to install their own work shops which are essential for successful cargo-handling operations.

14.2.5 Setting the Tariff Level Freely

To assure competition in the port sector, private companies should be entitled to decide the charges of their services freely based on negotiations with their customers, especially concerning the shipping agent fee/commission and other charges paid by a shipping line. Concerning the fees charged by a port authority, e.g. port dues, berthing dues, pilotage and towage, it is necessary for MOMT to set the upper limit of the charges. MOMT should allow port authorities to decide the charges freely below this maximum level considering those of the ports in the neighboring countries. It is also necessary to compete among Egyptian ports concerning the tariff level.

14.3 The Greater Alexandria Port

14.3.1 Review of Gate Inspection

To eliminate exchange of documents and speed up the clearance, a terminal computer linked to the computer system of container terminal or customs should be installed at a gate office. Through this computer system, information on containers to pass through the port gate will be exchanged in real time between the port gate office and the gate at the container terminal.

14.3.2 Introduction of VTMS (Vessel Traffic Management System)

At the control tower of APA, VTMS was installed and used. The system is out of order now. It has also become old-fashioned so there is no point in repairing it. Currently navigation control is conducted through VHF between the control center and ships. After vessels come into sight, it is possible to monitor the movement of vessels. But there is no visual aid while vessels are out of sight. Furthermore, it is very difficult to monitor the vessels' traffic during night time or bad weather. It is necessary to introduce an advanced VTMS to accommodate the increasing vessel traffic in the near future.

14.4 Damietta Port

14.4.1 Disposal of Deficit

According to the financial statements of Damietta Port Authority, the port authority is suffering from a deficit due to large depreciation costs and repayment of loans. So far there has been no shortage of cash flow since the port authority is receiving the subsidy from the Central Government to repay loans. Current situation prevents the port authority from investing in new facilities with internal funds. In particular, the maintenance dredging of the main channel must be conducted every year. It is necessary to lighten the financial burden of the port authority without relying on the subsidy from the Central Government by increasing the volume of port cargoes to generate more revenues.

14.4.2 Collecting Basic Information on Transshipment Containers

It is necessary to grasp the basic information, e.g. volume, size, origin and destination, on transshipment containers using unloading container lists from shipping lines. There has been and will be severe competition among transshipment ports in the Mediterranean Sea. To survive this competition and keep the status of hub port, it is essential to make the future strategy based on this information and the future prospect of container traffic in neighboring countries.

14.5 Port Said Port

14.5.1 Owning Pilots and Tugboats

Port Said Port Authority does not have its own pilots or tugboats. Suez Canal Authority carries out pilotage and tug assistance in the Port Said Port. Vessels to navigate through the canal must join the convoy according to the regulations of Suez Canal Authority. While the convoy is passing the Suez Canal, Suez Canal Authority's pilots and tugboats are engaged in service for vessels navigating through the canal. If vessels joining the convoy increase, no pilots or tugboats are available for berthing/unberthing vessels after the convoy passes through the port. This restricts the port activity. Port Authority should have its own pilots and tugboats.

14.5.2 Extending the Navigable Time for the Port

The Suez Canal gives Port Said Port both advantages and disadvantages. The advantage is so called "zero deviation" from the Canal. On the other hand, the disadvantage is constraint in navigable time for vessels entering or departing the port due to the interference with the convoy passing through the north entrance of the main canal which is used as the port entrance as well. The convoy has the priority to navigate the canal. During the convoy's passage from midnight to 8:00 AM, vessels to call at the port must stay at the outer anchorage area and vessels at berth can not leave the port even if cargo loading/unloading operation is completed. This prevents quick dispatch of vessels and discourages shipping lines to call at the port and consequently limits the number of calling vessels. Port Said Port Authority should have meetings with Suez Canal Authority to extend the time available for entering and departing the port as much as possible.

PART III

MASTER PLAN

Chapter 15 Master Plan of the Greater Alexandria Port

15.1 The Basic Concept for Master Plan of the Greater Alexandria Port

The purpose of the Master Plan (target year 2017) is to serve as a target and a guideline for phase plans including the Short-term Plan (target year 2007). The Master Plan shall be an integrated plan covering the layout plans for a multi-purpose terminal, a deep water coal berth, a grain terminal modernization, a new port road bridge and effective management and operation systems. In making the Master Plan of the Greater Alexandria Port, the following various aspects are recognized.

15.1.1 Local Container Handling

Local containers imported or exported to/from Egypt through the three Mediterranean ports increased at a high growth rate of 13.8% per annum in the past five years, recording 571,000 TEUs in total in 1997. In the same year, 68.2% of the total local containers were received by the Greater Alexandria Port.

It is essential to meet the future demand for handling local containers so as to support the national and regional economic growth. In this view, the Greater Alexandria Port whose hinterland extends over the Nile Delta including the second largest city, viz. Alexandria as its own back area and Cairo Metropolis, is expected to continue playing a major role in handling local containers.

The Greater Alexandria Port has a natural harbour with deep waters which is maintained without heavy maintenance dredging. The water depths of the existing container terminals are 14m in Alexandria Harbour and 12m (under construction) and 14m in El Dekheila Port, and seem to be sufficient to serve local container handling. In addition, El Dekheila Port has spacious land areas for future expansion. While the Greater Alexandria Port has a large potential capacity for handling local containers (estimated at 1.5 million TEUs in total), the existing container-handling capacity is insufficient to meet a large potential demand of 2.5 million TEUs in 2017.

Hence, so as to meet the large potential demand, it is necessary to increase the capacity of the Greater Alexandria Port as much as possible by investing additional super-structures and additional container-handling machines through making the most of the currently existing infrastructures including berths, and to allocate the excess containers to other Mediterranean ports including Port Said East Port.

15.1.2 Conventional General Cargo Handling

A great portion of the total conventional general cargo is being handled at the Greater Alexandria Port. Due to the lack of wharves for handling long, bulky and/or heavy cargo such as iron billets, steel bars, scraps and plant components which need deeper berths with spacious aprons and open storage yards right behind them to achieve efficient cargo-handling operations, these cargoes are handled together with other conventional cargoes which need to be stored in sheds. Thus, on-dock cargo-handling operations are conducted in chaotic conditions at these berths which are already close to being saturated, resulting in intricate cargo-handling within the port. In addition, barge operations at anchorage within the harbour basins are done for handling goods such as sawn timbers and dust cargo for the same reason mentioned above. Such cargo-handling results in inefficient, costly and time-consuming operations.

In the future, the above-mentioned conventional general cargoes required to be handled at the Greater Alexandria Port are expected to increase to a considerable extent (2.3 times as much as at present in the Greater Alexandria Port) whereas the remaining conventional cargoes are expected to remain at a moderate level (1.2 times as much as at present), reflecting the inverse effect of the anticipated further progress of containerization.

Hence, so as to resolve present problems in conventional-cargo handling and meet the increasing demand for handling long, heavy and/or bulky conventional general cargoes, it is necessary to construct a new multi-purpose terminal with deep berths and spacious open yards aiming at handling mainly long, heavy and/or bulky conventional cargoes in the Greater Alexandria Port by re-developing the existing berths, thereby reducing berth waiting costs of vessels in the off-shore anchorage.

15.1.3 Dry Bulk Cargo Handling

(1) Grain

In the Greater Alexandria Port, due to the shallow berth at Alexandria Harbour grain terminal, a great portion of grains is discharged at El Dekheila Port. Since there are only two units of rail-mounted grain unloaders at El Dekheila Port, however, a considerable amount of grain is discharged by using portable unloaders in direct unloading onto truck wagons. This results in low grain-handling productivity of less than 300 tons per hour per vessel and consequently all general cargo berths at El Dekheila Port are occupied by grain carriers.

Hence, so as to resolve present problems and meet the increasing demand for handling grains at the Greater Alexandria Port, it is necessary to construct a new 14m-deep-berth that will be connected with the existing silos through conveyors to receive panamax-type grain carriers in Alexandria Harbour.

(2) Coal and Coke

The berths at the coal/coke terminal in Alexandria Harbour are obsolete and shallow. Nevertheless, panamax-type coal carrier of around 69,000 DWT with a full draft of 13.3m and a length of 215m once called at the terminal on partially-loaded condition. Coal/coke could be transported inland by barges from/to El Dekheila Port by constructing new barge basins together with the creation of new canals or breakwaters in El Dekheila Harbour. The required gigantic resources, however, far outweigh the benefits to be obtained by such a plan.

Instead, it is advisable to prepare a deeper berth in front of the existing berth line with moderate investment so as to receive larger coal carriers at the existing coal/coke terminal in Alexandria Harbour.

15.1.4 Liquid Bulk Cargo Handling

The five marine oil terminals in the Petroleum Basin within Alexandria Harbour have sufficient capacity for the Alexandria Petroleum Company for the time being, if the existing broken-down loading/unloading arms are replaced together with the installation of new pipelines connecting the berths and back-side refinery plants of the company.

Within the free zone at Al Amrria, south of Alexandria, where another refinery in operation is using the petroleum terminal of the Alexandria Petroleum Company in Alexandria Harbour, MEDOR (Mediterranean Oil Refinery) is planning to operate a new refinery. The company also needs an outlet to export or import refined oil within the Greater Alexandria Port.

APA and MEDOR have recently agreed to have a new oil terminal at a basin between mineral quay (nos.90-1 and 90-2) and the berths (nos.92-1 and 92-2) in El Dekheila Port.

15.2 Zoning of Port Activities in Alexandria and El Dekheila Harbour

Each part of the port districts should be characterized by the future port activities and separately marked with zoning. This zoning will determine each port district characteristics. Seven types of zones: i) conventional cargo zone, ii) conventional cargo (long, heavy and bulky) zone, iii) container zone, iv) dry bulk cargo zone, v) liquid bulk cargo zone, vi) dangerous cargo zone, and vii) service boat zone are assumed so as to formulate Master Plan of the Greater Alexandria Port.

15.2.1 Alexandria Harbour

A basic concept for zoning of Alexandria Harbour is to separate conventional (long, heavy and bulky) cargo handling activities from the remaining conventional cargo handling activities. Because all conventional cargoes are mixed up and presently handled at the same general cargo berths with narrow aprons, which results in significantly low cargo handling productivity. Additionally, specialized cargoes such as dry bulk cargo and liquid bulk cargo should be handled separately from conventional cargo and containers as they are presently handled at the petroleum terminals, the grain terminals, and the mineral (iron pellet, coal and cokes) terminals.

It will be examined in the later section whether the additional berthing facilities are necessary for handling the future cargo volume in the target year 2017. If necessary, the additional berthing facilities and related cargo handling facilities will be also proposed in the later section.

Figure 15.2.1 shows zoning plan of port activities in Alexandria Harbour at a glance. Looking clockwise at Alexandria Harbour from the eastern to the western end, the berths (nos.2 through 44 and nos.65 through 66) are grouped and identified as the “conventional cargo zone” as those cargoes are presently handled. The berths (nos.49 through 53) are also grouped and identified as the “container zone” at Alexandria Container Terminal. The land and water areas adjacent to the existing berths (nos.55 through 60) are required to be grouped and identified as “conventional (long, heavy and bulky) cargo zone” to separately handle from the remaining conventional cargo. The berths (nos.62 through 64) are to be identified as “mineral (coal and cokes) zone”.

Since the berths (nos.73 through 80) were originally planed and completed for handling “timber”, and waiting for the commencement of operations, those berths are grouped and identified as “conventional (long, heavy and bulky) cargo zone”, which is mainly used by “timber”.

Since the existing grain terminals (berth nos.83 through 85) keep insufficient water depth of 10 meters, Grain Harbour is utilized as “service boats basin”. If grain handling capacity in the future is insufficient, however, a deeper grain terminal is to be proposed at the end of grain harbour breakwater. The petroleum berths (nos.87-1 through 87-5) are to be used by liquid bulk cargo (petroleum oil and edible oil) as they do at present.

Barge operations should be eliminated so as to perform an efficient conventional cargo handling.

According to the field survey on seabed materials, quality of the materials within Alexandria Harbour is categorized silt or soft clay and hence, it is considered to be unusable for reclamation. The dredged materials should be carefully dumped within an area enclosed by seawalls. In this study dumping area of dredged materials is planned behind the outer breakwater.

15.2.2 El Dekheila Harbour

A basic concept for zoning of El Dekheila Harbour is to continuously handle dry bulk cargo (iron pellet, coal and grain) and containers as they are handled at present. Since the berths (berth nos.92-1, 92-2 and 95-1 through 95-3) are to be available in the future, those berths are grouped and identified as “conventional cargo zone” to separately handle conventional (long, heavy and bulky) cargo from Alexandria Harbour. “Dangerous cargo zone” (sulfur, fertilizer, other liquid) is placed at the north end (berth nos.98, 99-1 and 99-2) of El Dekheila Harbour apart from the other cargo handling activities.

The large-scale reclaimed area which is not utilized yet between mineral storage and grain silos seems to be valuably spacious for the future industries. Therefore, this area should be reserved for those prospective development. As mentioned above, APA and MEDOR have recently agreed to have a new oil terminal for MEDOR in this area.

Figure 15.2.1 Zoning of Port Activities in Alexandria Harbour

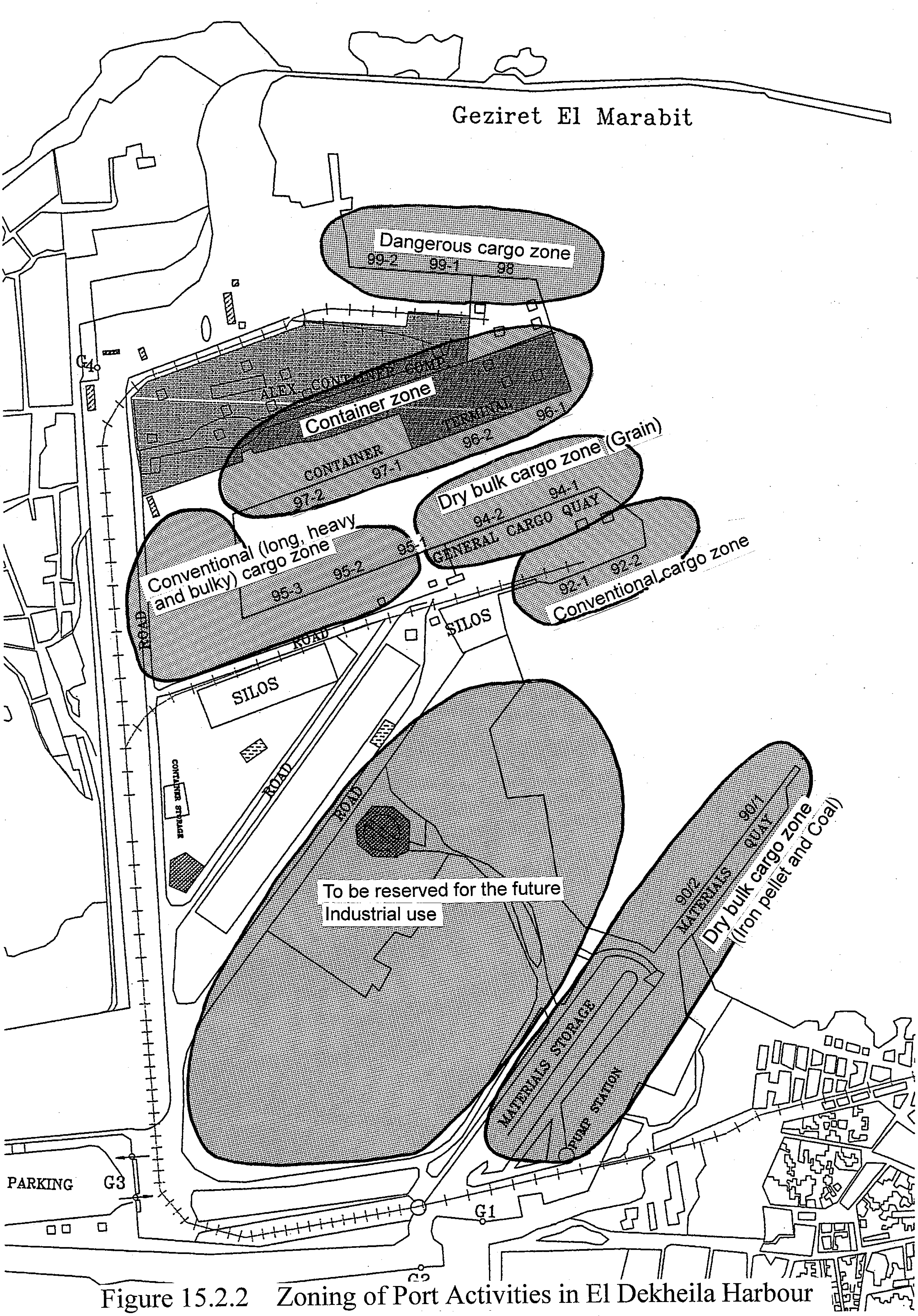


Figure 15.2.2 Zoning of Port Activities in El Dekheila Harbour

15.3 Container Handling

15.3.1 Target Volume of Containers to be handled at the Greater Alexandria Port in 2017

Total volume of containers to be handled at the Greater Alexandria Port is estimated at 1.2 million TEUs in 2007 and 1.5 million TEUs in 2017 (see Chapter 12). Concerning detailed assignment of containers among the container terminals and Ro-Ro berths within the Greater Alexandria Port in 2017, 0.45 million TEUs and 0.05 million TEUs of containers are expected to be handled at Alexandria Container Terminal and Ro-Ro berths respectively in Alexandria Harbour. The remaining one (1.0) million TEUs of containers are expected to be handled at El Dekheila Container Terminal.

15.3.2 The Existing Container Handling Facilities at the Greater Alexandria Port

(1) Alexandria Container Terminal

APA recognizes that there exist three (3) 14m-deep-berths whose length is 560m in total at Alexandria Container Terminal. Since standardized container berth length of a 14m-deep-berth is defined as 350m (see Table 15.2.1), however, those berths should be counted as two (2) berths: a 14m-deep-berth (berth length is 350m) and a 11m-deep-berth (berth length is 250m).

There are three (3) panamax-type QGCs (Quayside Gantry Cranes) and six (6) RTGs (Rubber-Tired Gantry Cranes) being operated at Alexandria Container Terminal.

Table 15.3.1 Dimensions of Standardized Container Vessels and Standardized Container Berths

Dimensions of Container Vessels					Dimensions of Container Berths		
Loading Capacity	DWT	Full Draft	LOA	Breadth	Berth Depth	Berth Length	Remarks
(TEU)	(tons)	(m)	(m)	(m)	(m)	(m)	
300	6,500	6.7	120	19.0	7.5	150	
500	12,000	8.0	140	21.0	9.0	170	
800	16,000	9.0	170	23.0	10.0	200	
1,200	22,000	10.0	210	31.0	11.0	250	
1,500	27,000	11.0	230	32.2	12.0	280	
2,000	35,000	12.0	260	32.2	13.0	300	
3,000	50,000	13.0	290	32.2	14.0	350	Panamax
4,500	60,000	13.5	290	39.4	15.0	350	Post-Panamax

(2) Ro-Ro Berths in Alexandria Harbour

There are five (5) Ro-Ro berths (berth depth is 10.2m) currently in operation: berth nos. 14, 18/16, 18/20, 25 and 26 in Alexandria Harbour. Those berths are commonly used by both Ro-Ro vessels and general cargo vessels.

(3) El Dekheila Container Terminal

APA also recognizes that there exist two (2) 14m-deep-berths: berth nos. 96-1 and 96-2, whose length is 620m in total at El Dekheila Container Terminal as well as another two (2) 12m-deep-berths: berth nos. 97-1 and 97-2 (almost completed) whose length is 420m in total at El Dekheila Container Terminal.

Since standardized container berth lengths for a 14m-deep-berth and a 12m-deep-berth are defined as 350m and 280m (see Table 15.2.1), however, those berths should be counted as three (3) berths: two (2) 14m-deep-berth (berth length is 700m in total) and one (1) 12m-deep-berth (berth length is 340m). However, the latter berth can accommodate partially-loaded 3,000 TEU-container vessels.

There are three (3) post-panamax-type QGCs being operated at El Dekheila Container Terminal. No RTGs are presently installed at El Dekheila Container Terminal.

15.3.3 Requirement of Additional Container Handling Facilities

(1) Infrastructure

Container-handling capacities of both terminals in the Greater Alexandria Port are estimated using computer simulation in Section 13.3. Highly efficient operational conditions are assumed for computer simulation, taking account that Egyptian container terminals could be operated efficiently to a certain extent in 2017. (Operational conditions and simulation results are presented in Table 13.3.2.)

The capacity of Alexandria Container Terminal is estimated at 0.45 million TEUs, taking account of two (2) container berths to be available at the terminal. The capacity of El Dekheila Container Terminal is estimated at one (1.0) million TEUs, taking account of three (3) container berths to be available at the terminal.

Since the future potential demand of local containers in Egypt in 2017 is assigned to both terminals up to their potential capacities as much as possible, however, no additional infrastructure such as berth is required.

(2) Superstructure

i) QGC (Quay-side Gantry Crane)

The available number of QGCs for handling containers at the terminals is a governing factor in determining the turnaround time of container ships. Hence, it is necessary to provide an optimum number of container handling equipment to ensure efficient loading and unloading operations within the shortest time possible. The required number of QGCs for handling containers can be estimated using the following formula on some assumptions.

$$Nqgc = A / (T \times \eta_1 \times \rho \times Pqgc \times \eta_2 \times E)$$

where,

Nqgc : Required number of quay side gantry crane (units),

A : Annual throughput in TEUs,

T : Maximum available working hours for the year (= 8,760 hrs/year),

ρ : Berth occupancy ratio,

(ρ = 0.50 for Alexandria Container Terminal: see Table 13.3.2)

(ρ = 0.65 for El Dekheila Container Terminal: see Table 13.3.3)

Pqgc : Net productivity of QGC (=30 boxes/hr/crane),

η_1 : Percentage of availability (=0.8),

η_2 : Cargo handling efficiency (=0.8), and

E : Conversion rate (=1.67 TEUs/box).

a) Alexandria Container Terminal

Assuming that the operational conditions above and a forecast annual throughput of 450,000 TEUs for Alexandria Container Terminal, the required number of QGCs is calculated as four (4) units for this terminal as below.

$$Nqgc\text{-}_{\text{Alexandria}} = A / (T \times \eta_1 \times \rho \times Pqgc \times \eta_2 \times E)$$

$$= 450{,}000 / (8{,}760 \times 0.8 \times 0.5 \times 30 \times 0.8 \times 1.67)$$

$$= 3.20 \rightarrow 4 \text{ (units)}$$

Since there are three (3) QGCs installed at the existing Alexandria Container Terminal, one (1) QGC is additionally required for this terminal.

b) El Dekheila Container Terminal

Assuming that the operational conditions above and a forecast annual throughput of 1,000,000 TEUs for El Dekheila Container Terminal, the required number of QGCs is calculated as six (6) units as below.

$$Nqgc\text{-}_{\text{El Dekheila}} = A / (T \times \eta_1 \times \rho \times Pqgc \times \eta_2 \times E)$$

$$= 1{,}000{,}000 / (8{,}760 \times 0.8 \times 0.65 \times 30 \times 0.8 \times 1.67)$$

$$= 5.48 \rightarrow 6 \text{ (units)}$$

Since there are three (3) QGCs installed at the existing El Dekheila Container Terminal, three (3) QGCs are additionally required for this terminal.

ii) RTG (Rubber-Tired Gantry crane)

The required number of RTGs in the on-dock marshaling yard is estimated using the following formula on an assumption that all containers loaded/unloaded are to be stacked once temporarily in the on-dock marshaling yard.

$$Nrtg = Nrtg1 + Nrtg2 + Nrtg3$$

$$= 2 \times Nqgc + (\lambda \times A) / (T \times \eta_1 \times Prtg \times \eta_2 \times E) + 2$$

where,

Nrtg : Required number of RTGs (units),

Nrtg1 : Required number of RTGs mainly for quay-side operations (units),

Nrtg2 : Required number of RTGs mainly for in-yard operations (units),

Nrtg3 : Required number of stand-by RTGs to cope with pre-marshaling operation, immobilization due to repairs or periodical maintenance or other unforeseen circumstances (assumed as 2 units),

A : Annual throughput in TEUs,

T : Maximum available working hours for the year (= 8,760 hrs/year),

λ : Peaking factor to the daily average handling demand

(λ = (3,459+669)/(2,050+562) = 1.58 for Alexandria: see Table 13.3.2)

(λ = (6,202+1,392)/(4,555+1,249) = 1.31 for El Dekheila: see Table 13.3.3),

Prtg : Net productivity of RTG (=20 boxes/hr/crane),

η_1 : Percentage of availability (=0.8),

η_2 : Cargo handling efficiency (=0.8), and

E : Conversion rate (=1.67 TEUs/box).

a) Alexandria Container Terminal

Assuming that the operational conditions above and a forecast annual throughput of 450,000 TEUs for Alexandria Container Terminal, the required number of RTGs is calculated as14 units for this terminal as below.

$$Nrtg\text{-}_{Alexandria} = Nrtg1 + Nrtg2 + Nrtg3$$

$$= 2 \times 4 + (1.58 \times 450{,}000) / (8{,}760 \times 0.8 \times 20 \times 0.8 \times 1.67) + 2$$

$$= 2 \times 4 + 3.80 + 2 = 13.80 \rightarrow 14 \text{ (units)}$$

Since there are six (6) RTGs installed at the existing Alexandria Container Terminal, eight (8) RTGs are additionally required for this terminal.

b) El Dekheila Container Terminal

Assuming that the operational conditions and a forecast annual throughput of 1,000,000 TEUs for El Dekheila Container Terminal, the required number of RTGs is calculated as 21 units as below.

$$Nrtg\text{-}_{El\ Dekheila} = Nrtg1 + Nrtg2 + Nrtg3$$

$$= 2 \times 6 + (1.31 \times 1{,}000{,}000) / (8{,}760 \times 0.8 \times 20 \times 0.8 \times 1.67) + 2$$

$$= 2 \times 6 + 7.00 + 2 = 21.00 \rightarrow 21 \text{ (units)}$$

Since there is no RTGs presently installed at El Dekheila Container Terminal, 21 RTGs are additionally required for this terminal.

iii) Yard tractor-trailers

Yard tractor-trailers with chassis run between the quay side apron and the marshaling yard, and transport containers for loading onto or unloading from the container ships. One job cycle time of the yard tractor-trailers largely depends on the travelling distance between quay side gantry cranes and marshaling yard. The required number (Nytt) of yard tractor-trailers for each QGC is estimated on the conditions below.

$$Nytt\text{-}_{Alexandria} = Nytt\text{-}_{El\ Dekheila}$$

$$= (4 + 1.5/(15/60))/(3 \times 0.7)$$

$$= 10/2.1 = 4.76 \rightarrow 5 \text{ (units/QGC)}$$

Average travel speed of yard tractor-trailers:	15 (km/hour)
Handling time under quay-side gantry crane:	3 (minute/cycle)
Handling time under RTGs:	4 (minutes/cycle)
Average travelling length of yard tractors:	1.5 (km/cycle)
Operational factor:	0.7

Therefore, the required numbers of yard tractor-trailers in total are estimated at 20 (=5 ×4) units and 30 (=5×6) units for Alexandria Container Terminal and El Dekheila Container Terminal respectively.

15.3.4 Summary

(1) Alexandria Container Terminal

There is no space to expand the existing container terminal at the same place. However, cargo handling equipment would be in short supply for efficient operations in 2017, even though no additional infrastructure is expected. It is recommended that one (1) additional QGC, eight (8) additional RTGs and 20 units of tractor-trailers should be installed so as to efficiently handle 450,000 TEUs of containers in 2017.

(2) El Dekheila Container Terminal

There is 12m-deep container berth of 480m in total length, which has been almost completed and will be available in the near future. Therefore, El Dekheila Container Terminal would be able to dramatically increase its capacity with a relatively-small amount of investment on handling equipment without infrastructure investment. It is recommended that three (3) additional QGCs, 21 additional RTGs and 30 units of tractor-trailers should be installed so as to efficiently handle 1.0 million TEUs of containers in 2017. Consequently, a relatively-small amount of investment on container handling equipment is essential for the future utilization and development of El Dekheila Container Terminal.

15.4 Conventional Cargo Handling

15.4.1 Target Volume of Conventional Cargo to be handled at the Greater Alexandria Port in 2017

Total volume of conventional cargo to be handled at the Greater Alexandria Port is estimated at 11.1 million tons in 2007 and 13.0 million tons in 2017 (see Chapter 12). Package style-wise and commodity-wise volumes of those conventional cargoes are presented in Table 15.4.1. Bagged cargo (sugar, rice, flour , etc.) and bundled cargo (sawn timber and steel products) are expected to increase steadily up to the year 2017. Rolled paper and miscellaneous conventional cargo are expected to increase steadily up to the year 2007, then to start decreasing moderately due to the further progress of containerization.

Table 15.4.1 Package/Commodity-wise Volume of Conventional Cargo in 2017

(unit: thousand tons)

Package Style	Commodity	1997	2007	2017
Bag	Sugar, Rice, Flour, etc.	940	1,277	1,975
Bundle	Sawn Timber	1,632	3,634	4,783
Bundle	Steel Products	485	1,212	1,955
Roll	Paper	173	826	659
Break Bulk	Miscellaneous (to be stored in Shed)	1,867	2,073	1,815
Break Bulk	Miscellaneous (to be stored at Open yard)	1,867	2,073	1,815
Total		7,087	11,095	13,001

15.4.2 The Existing Conventional Cargo Handling Facilities at the Greater Alexandria Port

(1) Berths

While some berths are relatively short in length compared with their depth, those berths are identified with independent berths by APA. Consequently, those berth lengths are re-evaluated in terms of practical operation-ability, taking account of the maximum vessel size which can be accommodated with the berth depth. In fact, there are 64 practically-operable existing berths (49 berths in Alexandria Harbour and 15 berths in El Dekheila Harbour) within the Greater Alexandria Port. Since some berths (berth nos. 73, 75, 77, 79, 80, 97-1 and 97-2) have been recently constructed while being not available yet at this moment, those berths are considered operable in the future and included in 64.

(2) Sheds and Spacious Open Yards

Sheds and warehouses currently available within the Greater Alexandria Port are listed in Table 15.4.2. There are 34 sheds and warehouses in the Greater Alexandria Port, and their total covered area is summed up at 110,222 sq.m.

Spacious open yards of 42,880 sq.m are available in total, which are suitable for handling and storing long, bulky and/or heavy cargo adjacent to the berths (Table 15.4.3).

Table 15.4.2 Sheds and Warehouses available within the Greater Alexandria Port

No.	Name	Floor Space (sq.m)	Place	Commodity	Lessee/Owner
1	Harvest	3,247	Quay No.5	Harvest	G.E.W.C.
2	No.41	4,141	Quay No.9/10	G.C.	G.E.W.C.
3	No.42	2,055	Quay No.11/12	G.C.	G.E.W.C.
4	No.43	2,706	Quay No.12/13	G.C.	G.E.W.C.
5	No.40	3,571	Quay No.14	G.C.	G.E.W.C.
6	No.14	1,744	Quay No.25	G.C.	G.E.W.C.
7	No.15	2,246	Quay No.25	G.C.	G.E.W.C.
8	No.16	2,832	Quay No.26	G.C.	G.E.W.C.
9	No.19	2,291	Quay No.27	Paper Roll	G.E.W.C.
10	No.22	2,217	Quay No.28	Paper Roll	G.E.W.C.
11	No.25	700	Quay No.32	G.C.	G.E.W.C.
12	No.47	4,140	Quay No.35/36	G.C.	G.E.W.C.
13	No.48	2,258	Quay No.35/36	G.C.	G.E.W.C.
14	No.46	---	Quay No.37	G.C.	G.E.W.C.
15	No.44	2,125	Quay No.39	G.C.	G.E.W.C.
16	No.45	1,666	Quay No.40	G.C.	G.E.W.C.
17	No.26	733	Quay No.42	G.C.	G.E.W.C.
18	No.27	1,980	Quay No.43	G.C.	G.E.W.C.
19	No.28	2,173	Quay No.44	G.C.	G.E.W.C.
20	No.1	---	Quay No.66	Fertilizer	A.P.A.
21	No.2	---	Quay No.66	Fertilizer	A.P.A.
Quay-side subtotal		43,825			
22	No.32	4,050	Gate No.27	CFS	G.E.W.C.
23	No.35	4,050	Gate No.27	Chemicals	G.E.W.C.
24	Roma	13,122	Gate No.17	Cars	G.E.W.C.
25	Cars	1,800	Gate No.17	Cars	G.E.W.C.
26	C	6,236	Gate No.14	G.C.	G.E.W.C.
27	Hems	7,245	Gate No.10	Tobaccos	G.E.W.C.
28	Tobacco	20,259	Gate No.13/14	Tobaccos	G.E.W.C.
29	Hanger	2,028	Gate No.12	G.C.	G.E.W.C.
30	Old Refrig.	2,654	Gate No.11	G.C.	G.E.W.C.
31	No.34	2,880	Gate No.34	G.C.	G.E.W.C.
32	No.36	976	Gate No.27	G.C.	G.E.W.C.
33	No.37	976	Gate No.27	G.C.	G.E.W.C.
34	No.40	121	Gate No.27	Films	G.E.W.C.
Back-side subtotal		66,397			
Grand Total		110,222			

Source) Alexandria Port Authority (A.P.A.)
Remarks) General Cargo (G.C.)
General Egyptian Warehousing Company (G.E.W.C.)

Table 15.4.3 Spacious Open Yards adjacent to Berths within the Greater Alexandria Port

No.	Place	Open Space (sq.m)	Commodity
1	Quay No.27/28	2,800	Container, General Cargo
2	Quay No.28/30	15,000	Container, General Cargo
3	Quay No.34	9,380	Container
4	Quay No.41	3,000	Container
5	Quay No.65	12,700	Container
Grand Total		42,880	

Source) Alexandria Port Authority (A.P.A.)

15.4.3 Requirement of Additional Conventional Cargo Handling Facilities

Various kinds of conventional cargoes need to be handled through the existing facilities such as berths, sheds, warehouses and open storage yards. Long, bulky and/or heavy cargo such as iron billets, steel bars, scraps and plant components are presently handled together with the other conventional cargoes at the relatively shallow existing berths with narrow apron. Consequently, those conventional cargoes are handled in a considerably inefficient way due to a shortage of suitable handling equipment, poorly-maintained facilities, direct loading/unloading etc.

Handling the future volume of conventional cargo in 2017 through the existing facilities in a present way reveals considerably high berth occupancy ratio and a consequent long turn around time of vessels. Therefore, a new multi-purpose terminal with deeper berths and spacious open yard are essential to enable an efficient cargo-handling operations of long, heavy and/or bulky conventional cargoes apart from the remaining conventional cargoes, resulting in a synergistic effect on efficient-cargo handling of the remaining conventional cargoes through the existing facility.

(1) Required Dimensions of Berths

The required dimensions of conventional cargo handling facilities are estimated using computer simulations on the future operational condition (Table 15.4.4).

Table 15.4.4 Package-wise Productivity of Conventional Cargo Operation for Computer Simulation

Package Style	Commodity	Present Productivity (tons/hr/vessel)	Future Productivity (tons/hr/vessel)
Bag	Sugar, Rice, Flour, etc.	20	25.5
Bundle	Sawn Timber	47	106.0
Bundle	Steel Products (at narrow Apron)	39	48.0
Bundle	Steel Products (at spacious Apron)	39	70.0
Roll	Paper	35	70.0
Break Bulk	Miscellaneous (to be stored in Shed)	20	25.5
Break Bulk	Miscellaneous (to be stored at Open yard)	30	53.0

Computer simulation result based on “without-case” scenario reveals significantly long offshore waiting time on average (see Table 15.4.5). The expected offshore waiting times of conventional cargo vessels are calculated at 4.9 hours per vessel for “bagged cargoes”, 261.3 hours per vessel (”sawn timber”), 177.8 hours per vessel (”steel products”), 16.8 hours per vessels (“paper”), 14.7 hours per vessel (”miscellaneous cargo to be stored in shed”) and 206.5 hours per vessel (”miscellaneous cargo to be stored at open yard”). Handling long bulky and/or heavy cargoes such as “sawn timber”, “steel products” and “miscellaneous cargo to be stored at open yard” requires significantly long waiting time beyond the tolerable range. This implies that some additional berth facilities are essential to avoid a long turn around time of the vessels on the long term basis.

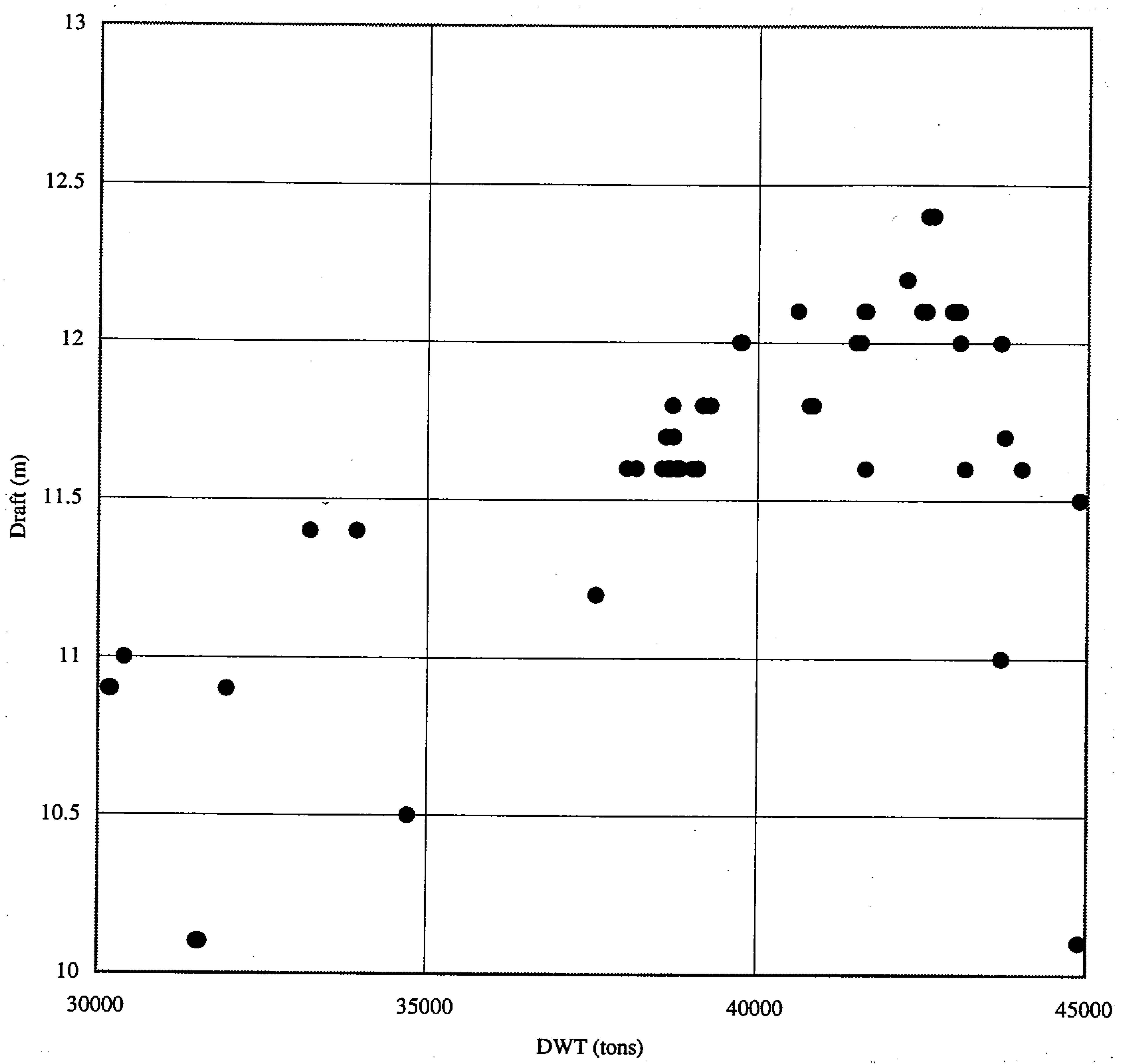
Table 15.4.5 Conventional Cargo Vessel Assignment and Simulation Results for Without-Case in 2017

Berth No.	Depth	Length	BOR	Other Cargo	Bag	Bundle	Bundle		Roll	Break Bulk	Break Bulk
	(m)	(m)	(%)		Sugar, etc.	Timber	Steel Prd		Paper	Misc-Shed	Misc-Yard
Conditions	Throughput in 2017 (tons/year)				1,975,000	4,783,000	1,955,000		659,000	1,815,000	1,815,000
	Unit Load (tons/vessel)				3,000	15,000	11,000		5,000	3,000	3,000
	Productivity (tons/hrs/vessel)				25.5	106.0	48.0	70.0	70.0	25.5	53.0
	No. of Assigned Berths				12	5	5	2	2	10	4
Simulation Results	No. of Vessels (vessels/year)				658	306	60	118	132	604	605
	BOR (%)				77.7	98.9	87.4	96.9	71.4	81.1	97.7
	Berthing Time (hours/vessel)				117.6	141.5	229	157	231.1	117.6	56.6
	Waiting Time (hours/vessel)				4.9	261.3	16.8	236	16.8	14.7	206.5
5/1-2	6.0	100	81.1							Misc-Shed	
5/3	6.0	100								Misc-Shed	
5/4	6.0	100								Misc-Shed	
10	8.0	130								Misc-Shed	
11	8.5	128								Misc-Shed	
12	8.5	100								Misc-Shed	
13	8.8	143								Misc-Shed	
14	10.0	180								Misc-Shed	
14-RoRo	10.2	-	---	Ro-Ro							
16	10.2	212	77.7		Sugar, etc.						
18-RoRo	10.2	-	---	Ro-Ro							
18	10.2	110	77.7		Sugar, etc.						
20	12.0	158			Sugar, etc.						
22	12.0	158			Sugar, etc.						
24	12.0	160			Sugar, etc.						
25-26	10.2	170			Sugar, etc.						
25-RoRo	10.2	-	---	Ro-Ro							
26-27	10.2	170	77.7		Sugar, etc.						
26-RoRo	10.2	-	---	Ro-Ro							
28	12.0	170	81.7				Steel		Paper		
34	6.5	125	71.4						Paper		
35-36	10.0	180	83.7		Sugar, etc.		Steel				
36-37	10.0	180			Sugar, etc.		Steel				
38	10.0	115	77.7		Sugar, etc.						
39	10.0	140	97.7				Steel				Misc-Yard
40	10.0	140					Steel				Misc-Yard
41	10.0	170	81.1							Misc-Shed	
42	7.5	138	77.7		Sugar, etc.						
43	7.5	138			Sugar, etc.						
44	6.5	150	81.1							Misc-Shed	
49-51	14.0	320	---	Container							
51-53	14.0	230	---	Container							
54-RoRo	14.0	160	---	Ro-Ro							
62-63	10.0	185	---	Coke							
63-64	10.0	270	---	Coal							
65	10.0	150	---	Salt, Others							
66	10.0	150	---	Salt, Others							
67	10.0	150	---	Cement							
71m	10.0	-	---	Molasses							
73	10.0	100	---	---							
75	10.0	185	97.7			Timber					
77	12.0	190				Timber					
79	12.0	190				Timber					
80	10.0	185				Timber					
82	10.0	190	---	Cement							
84	10.0	165	---	Barge							
85	10.0	130	---	Barge							
86	5.0	100	---	Barge							
87-1	10.0	236	---	Petroleum							
87-2	10.0	136	---	Petroleum							
87-3	12.0	148	---	Petroleum							
87-4	12.0	148	---	Petroleum							
87-5	12.0	94	---	Petroleum							
90-1	20.0	375	---	Iron /Coal							
90-2	14.0	255	---	---							
92-1	15.0	307	97.7								Misc-Yard
92-2	15.0										Misc-Yard
94-1	14.0	245	---	Wheat							
94-2	14.0	245	---	Maize/Wht							
95-1	12.0	500	96.5					Steel			
95-2	12.0							Steel			
95-3	12.0		98.9			Timber					
96	14.0	350	---	Container							
97-1	12.0	320	---	Container							
97-2	12.0	320	---	Container							
98	12.0	250	---	Sulfur, Fert							
99-1	12.0	300	---	Sulfur, Fert							
99-2	12.0		---	Other Liqd							

Table 15.4.6 Conventional Cargo Vessel Assignment and Simulation Results for With-Case in 2017

Berth No.	Depth	Length	BOR	OtherCargo	Bag	Bundle	Bundle	Roll	Break Bulk	Break Bulk
	(m)	(m)	(%)		Sugar, etc.	Timber	Steel Prd	Paper	Misc-Shed	Misc-Yard
Conditions	Throughput in 2017 (tons/year)				1,975,000	4,783,000	1,955,000	659,000	1,815,000	1,815,000
	Unit Load (tons/vessel)				3,000	15,000 – 35,000	11,000 – 35,000	5,000	3,000	3,000
	Productivity (tons/hrs/vessel)				25.5	106.0	70.0	70.0	25.5	53.0
	No. of Assigned Berths				12	7	4	2	10	6
Simulation Results	No. of Vessels (vessels/year)				658	319	178	132	605	605
	BOR (%)				73.6	73.6	80.0	53.8	82.9	65.2
	Berthing Time (hours/vessel)				117.6	141.5	157.1	71.4	120.0	56.6
	Waiting Time (hours/vessel)				3.4	14.4	12.4	1.1	14.9	1.6
Multi-P - 1	14.0	240	73.6			Timber				
Multi-P - 2	14.0	240				Timber				
Multi-P - 3	14.0	240	80.0				Steel Prds			
Multi-P - 4	14.0	240					Steel Prds			
Multi-P - 5	14.0	240	65.2							Misc-Yard
Multi-P - 6	14.0	240	81.1						Misc-Shed	
5/1-2	6.0	100	81.1						Misc-Shed	
5/3	6.0	100							Misc-Shed	
5/4	6.0	100							Misc-Shed	
10	8.0	130							Misc-Shed	
11	8.5	128							Misc-Shed	
12	8.5	100							Misc-Shed	
13	8.8	143							Misc-Shed	
14	10.0	180	73.6		Sugar, etc.					
14-RoRo	10.2	-	---	Ro-Ro						
16	10.2	212	73.6		Sugar, etc.					
18-RoRo	10.2	-	---	Ro-Ro						
18	10.2	110	73.6		Sugar, etc.					
20	12.0	158			Sugar, etc.					
22	12.0	158			Sugar, etc.					
24	12.0	160			Sugar, etc.					
25-26	10.2	170			Sugar, etc.					
25-RoRo	10.2	-	---	Ro-Ro						
26-27	10.2	170	65.2							Misc-Yard
26-RoRo	10.2	-	---	Ro-Ro						
28	12.0	170	53.8					Paper		
34	6.5	125						Paper		
35-36	10.0	180	73.6		Sugar, etc.					
36-37	10.0	180			Sugar, etc.					
38	10.0	115			Sugar, etc.					
39	10.0	140	65.2							Misc-Yard
40	10.0	140								Misc-Yard
41	10.0	170	81.1						Misc-Shed	
42	7.5	138	73.6		Sugar, etc.					
43	7.5	138			Sugar, etc.					
44	6.5	150	81.1						Misc-Shed	
49-51	14.0	320	---	Container						
51-53	14.0	230	---	Container						
54-RoRo	14.0	160	---	Ro-Ro						
62-63	10.0	185	---	Coke						
63-64	10.0	270	---	Coal						
65	10.0	150	---	Salt, Others						
66	10.0	150	---	Salt, Others						
67	10.0	150	---	Cement						
71m	10.0	---	---	Molasses						
73	10.0	100	---	---						
75	10.0	185	73.6			Timber				
77	12.0	190				Timber				
79	12.0	190				Timber				
80	10.0	185				Timber				
82	10.0	190	---	Cement						
84	10.0	165	---	Barge						
85	10.0	130	---	Barge						
86	5.0	100	---	Barge						
87-1	10.0	236	---	Petroleum						
87-2	10.0	136	---	Petroleum						
87-3	12.0	148	---	Petroleum						
87-4	12.0	148	---	Petroleum						
87-5	12.0	94	---	Petroleum						
90-1	20.0	375	---	Iron /Coal						
90-2	14.0	255	---	---						
92-1	15.0	307	65.2							Misc-Yard
92-2	15.0									Misc-Yard
94-1	14.0	245	---	Wheat						
94-2	14.0	245	---	Maize/Wht						
95-1	12.0	500	80.0				Steel Prds			
95-2	12.0						Steel Prds			
95-3	12.0		73.6			Timber				
96	14.0	350	---	Container						
97-1	12.0	320	---	Container						
97-2	12.0	320	---	Container						
98	12.0	250	---	Sulfur, Fert						
99-1	12.0	300	---	Sulfur, Fert						
99-2	12.0		---	Other Liqd						

Relatively large general cargo vessels are expected to transport long, heavy and/or bulky conventional cargo on the long-term basis. A maximum size of those general cargo vessels is expected at 45,000 tons in DWT and 12.5 meters in draft, which may need water depth of 14.0 meters for the additional berths. The relationship between draft and dead weight tonnage is illustrated in Figure 15.4.1. Again, computer simulation was made for searching the minimum requirement of the additional berths to mainly accommodate those relatively large vessels. Simulation result based on "with-case" scenario assuming six (6) additional 14.0 m-deep berths reveals a tolerable range of offshore waiting time on average (see Table 15.4.6). The expected offshore waiting times of commodity-wise conventional cargo vessels are calculated at 3.4 hours per vessel ("bagged cargoes"), 14.4 hours per vessel ("sawn timber"), 12.4 hours per vessel ("steel products"), 1.1 hours per vessels ("paper"), 14.9 hours per vessel ("miscellaneous cargo to be stored in shed") and 1.6 hours per vessel ("miscellaneous cargo to be stored at open yard"). If "with-case" scenario of five (5) additional berths is assumed, however, the expected offshore waiting time will increase beyond the tolerable limit which does not compensate the savings of berth construction costs.



Source) Lloyd's Electronic Maritime Directory (Issue 4: September 1998)

Figure 15.4.1 Relationship between DWT and Draft of General Cargo Vessels for Long, Heavy and/or Bulky Conventional Cargo

Consequently, in order to efficiently handle long, bulky and/or heavy cargoes such as “sawn timber”, “steel products” and “miscellaneous cargoes to be stored at open yard”, the optimum berth dimensions are estimated as six (6) 14.0 m-deep berths.

(2) Required Dimensions of Multi-purpose Quay-side Gantry Cranes

In case of conventional cargo handling, quay-side loading/unloading operations are generally performed with ship’s cranes/derricks or mobile shore cranes. However, two (2) units of multi-purpose QGCs are required to be installed to secure an efficient operation for handling extremely heavy cargoes and/or heavy bulky bare cargoes such as plant components, heavy vehicles, etc. Under-spreader lifting capacity of 30.5 tons is required to ensure to handle extremely heavy cargoes.

(3) Required Dimensions of Sheds and Warehouses

The required dimensions of commodity-wise sheds and warehouses are estimated using the following formula on the conventional cargo storage condition presented in Table 15.4.7.

$$A = (\lambda \times \delta \times V/T) / (\mu \times \xi \times \varepsilon)$$

where,

- V : Annual cargo-wise throughput of conventional cargo (tons),
- T : Maximum available working days for the year (= 365 days/year),
- λ : Cargo-wise peaking factor to the daily average handling demand,
- δ : Average dwelling time (=7 days),
- μ : Cargo-wise unit load per square meter for storage,
- ξ : Passage ratio (=0.5), and
- ε : Operational factor (=0.75).

Table 15.4.7 Package-wise Storage Conditions of Conventional Cargo for Computer Simulation

Package Style	Commodity	Average dwelling time (days)	Peaking factor to daily average	Unit weight / space (ton/sqm)	Operat-ional factor	Passage ratio	Storage place
Bag	Sugar, Rice, Flour, etc.	7	1.63	3.0	0.75	0.5	Shed
Bundle	Sawn Timber	7	1.32	2.5	0.75	0.5	Yard
Roll	Paper	7	1.43	2.5	0.75	0.5	Shed
Bundle	Steel Products	7	1.75	2.0	0.75	0.5	Yard
Break Bulk	Miscellaneous (Shed)	7	1.20	2.5	0.75	0.5	Shed
Break Bulk	Miscellaneous (Open yard)	7	1.29	1.5	0.75	0.5	Yard

Remarks) Peaking factor is estimated cargo-wise by computer simulation.

Required area of covered sheds and warehouses is calculated at 118,699 sq.m on the conditions below, and that is approximately equal to the existing covered area of 110,222 sq.m in total. However, the existing sheds (nos.44 and 45) whose covered area of 3,791 sq.m in total should be demolished so as to efficiently handle "long, heavy and/or bulky conventional cargoes" at the existing berths (nos.39 and 40). Consequently, there is a need for additional sheds of approximately 12,000 sq.m in total as a covered area.

$$A_{\text{-shed}} = (\lambda \times \delta \times V/T) / (\mu \times \xi \times \varepsilon)$$

$$= (1.63 \times 7 \times 1{,}975{,}000/365) / (3.0 \times 0.75 \times 0.5)$$

$$+ (1.43 \times 7 \times 659{,}000/365) / (2.5 \times 0.75 \times 0.5)$$

$$+ (1.20 \times 7 \times 1{,}814{,}500/365) / (2.5 \times 0.75 \times 0.5)$$

$$= 54{,}879 + 19{,}278 + 44{,}542$$

$$= 118{,}699 \text{ (sq.m)}$$

(4) Required Dimensions of Spacious Open Yard

The required dimensions of commodity-wise sheds and warehouses are estimated using the above formula. There will be some spacious open yards available behind or adjacent to the berths (nos.92-1, 92-1, 95-1, 95-2 and 95-3) where long, heavy and/or bulky conventional cargoes are to be assigned. The area of approximately 80,000 sq.m in total is expected be additionally available related to the above-mentioned berths. The existing spacious open yard is approximately 120,000 sq.m (= 42,880 sq.m + 80,000 sq.m), and the required area of spacious open yard is calculated at 290,156 sq.m on the conditions below.

$$A_{\text{-open yard}} = (\lambda \times \delta \times V/T) / (\mu \times \xi \times \varepsilon)$$

$$= (1.32 \times 7 \times 4{,}783{,}000/365) / (2.5 \times 0.75 \times 0.5)$$

$$+ (1.75 \times 7 \times 1{,}814{,}500/365) / (2.0 \times 0.75 \times 0.5)$$

$$+ (1.29 \times 7 \times 1{,}814{,}500/365) / (1.5 \times 0.75 \times 0.5)$$

$$= 129{,}154 + 81{,}197 + 79{,}805$$

$$= 290{,}156 \text{ (sq.m)}$$

Consequently, additional spacious open yard of 170,000 sq.m in total is essential to efficiently handle the future volume of conventional cargo.

(5) Required Dimensions of Conventional Cargo Handling Equipment

It is necessary to use pallets for landing cargoes on the quay so that forklifts could pick up, carry and sort the landed cargoes and store them in the sheds/warehouse behind the quay. In particular, bagged cargo, such as fertilizer and sugar, must be handled with pallets to increase the throughput. Concerning the unloading operation, commodity-wise cargo handling procedures of the typical conventional cargoes are summarized as below.

1) Bagged Cargo
Typical examples are sugar, rice, flour and fertilizer. These commodities are usually stuffed in bags made of hemp, vinyl or paper. Forklifts transfer cargoes from quayside to shed/warehouse and load cargoes onto trucks.

2) Steel bar, angle and beam
These commodities are unloaded with ship's gear and landed onto flat bed trucks. The cargo is transferred to open yards.

3) Steel sheet
Steel sheets are enveloped with tin plate and attached with wooden skid. Forklifts transfer this cargo from quayside apron to open yards.

4) Steel coil
Wooden skid is attached with steel coils. Steel ram forklifts, which have a special attachment for handling a steel coil, should be used to transfer cargo from quay side to open yards.

5) Steel wire
This cargo should be handled with steel ram forklifts.

6) Timber (Length 3', 6', 9' and 12')
Timber is usually bundled with steel bands. There are two ways to unload timber, unloading on quay or barges.

a) Unloading on quay
Forklifts are used to transfer timber from quayside to open yards.

b) Unloading into barges
Truck cranes are used to unload timber from barges onto quayside. Forklifts are used to transfer timber from quayside to open yards.

7) Paper Products (craft paper, newsprint paper)
These commodities are enveloped with paper. Roll clamp forklifts should be used to handle the cargoes both at quayside and in warehouses/sheds.

8) Paper pulp
This cargo is enveloped with paper. Bale clamp forklifts should be used to handle the cargoes both at quayside and in warehouses/sheds.

Consequently, it is essential to introduce the sufficient number of forklifts in order to perform an efficient cargo handling operation for conventional cargoes. The required dimensions of forklifts is calculated at the peak condition that all the conventional cargo berths with spacious apron (21 berths are specified in Table 15.4.8) are occupied simultaneously.

1) Required number of forklifts for receiving the cargoes on the apron
   2 (units/gang) x 1 (gang/vessel) x 21 (vessels/peak condition) = 42 (units).

2) Required number of forklifts for delivering the cargoes at the open yard
   2 (units/gang) x 21 (gang/vessel) = 42 (units).

3) Required number of forklifts for handling the cargoes in ship's hold
   1 (units/hold) x 2 (hold/vessel) x 21 (vessels/peak condition) = 42 (units).

Total required number of forklifts is calculated at 126 units based on the above-mentioned cargo handling procedures and conditions, and that for each zone/terminal is presented in Table 15.4.8.

Table 15.4.8 Required Number of Forklifts for Handling Conventional Cargo in 2017

No	Name of Zone/Terminal	No. of berths	Receiving at Apron	Delivering at Open Yard	Handling in Ship's Hold	Grand Total
Lifting Capacity of Forklift			5 tons +	5 tons +	3 tons +	
Alexandria Port						
1	Middle East Zone (Berth nos. 28, 34, 41, 44)	4	8	8	8	24
2	El Mahoudiya Quay (Berth nos. 39, 40)	2	4	4	4	12
3	Multi-purpose Terminal (6 Berths)	6	12	12	12	36
4	Timber Quay (Berth nos. 75, 77, 80, 82)	4	8	8	8	24
	Alexandria Port Sub Total	16	32	32	32	96
El Dekheila Port						
5	El Dekheila (Berth nos. 92-1, 92-2)	2	4	4	4	12
6	El Dekheila (Berth nos. 95-1, 95-2, 95-3)	3	6	6	6	18
	El Dekheila Port Sub Total	5	10	10	10	30
Grand Total		21	42	42	42	126

15.4.4 Summary

In order to achieve efficient conventional cargo handling operations and meet the future conventional cargo demand, it is essential to build six (6) 14 m-deep berths with spacious open yards of approximately 170,000 sq.m. Two (2) units of multi-purpose QGCs of which under-spreader lifting capacity is 30.5 tons are required to be installed to secure an efficient operation for handling extremely heavy cargoes and/or heavy bulky bare cargoes such as plant components, heavy vehicles, etc. While the requirement and the existing amount of covered area of sheds and warehouses nearly balances out, a covered area of approximately 12,000 sq.m is additionally required. One hundred twenty six (126) units of forklifts are also required to be introduced for an efficient cargo handling operation.

15.5 Dry Bulk Cargo Handling

15.5.1 Target Volume of Dry Bulk Cargo to be handled at the Greater Alexandria Port in 2017

Dry bulk cargo to be handled at the Greater Alexandria Port is expected to increase to 13.3 million tons (annual growth rate of 2.7% for the first ten years) in 2007 and 16.5 million tons (annual growth rate of 2.0% for the next ten years) in 2017 (see Chapter 12). Commodity-wise forecast volume of dry bulk cargoes such as grain, mineral, cement and others is also presented in Table 15.5.1.

Table 15.5.1 Commodity-wise Dry Bulk Cargo to be handled in 2007 and 2017

(unit: thousand tons)

Package Style	Cargo Type	Commodity	1997	2007	2017
Dry Bulk	Grain	Wheat	2,178	3,897	3,846
	Grain	Maize	2,264	1,524	2,210
	Grain Sub Total		4,442	5,421	6,056
	Mineral	Iron Pellet	1,995	3,750	5,000
	Mineral	Coal	1,659	1,300	1,500
	Mineral	Coke	306	399	520
	Mineral Sub Total		3,960	5,449	7,020
	Cement	Cement	976	1,137	1,215
	Cement Sub Total		976	1,137	1,215
	Others	Sulfur	351	349	349
	Others	Fertilizer	258	195	416
	Others	Salt	235	573	972
	Others	Others	414	413	413
	Others Sub Total		1,258	1,530	2,150
Grand Total			10,636	13,337	16,541

15.5.2 The Existing Dry Bulk Cargo Handling Facilities at the Greater Alexandria Port

(1) Grain

There are three grain berths (nos.82, 84 and 85) which are considerably less utilized mainly due to insufficient water depth of 10.0 meters of those berths in Alexandria Harbour, while two pneumatic unloaders are installed and operable. There are four (4) grain berths (nos.94-2, 94-1, 92-1 and 92-2 with water depth of 14.0 meters) which are fully utilized and reveal high berth occupancy ratio of more than 80% at present in El Dekheila Harbour.

Both partially-loaded 120,000 DWT-class bulk carriers transporting “maize” and fully-loaded 65,000 DWT-class bulk carriers transporting “wheat” presently make a full use of a berth (no.94-2 with water depth of 14.0 meters), on which two highly-efficient mechanical grain unloaders are installed. Those bulk carriers place a second priority to use the berth (nos.94-1, 92-1 and 92-2 with water depth of 14.0 meters) which are practically operated with six (6) comparatively less-efficient mobile unloaders.

(2) Mineral (Iron Pellet, Coal and Coke)

i) Alexandria Harbour

There is a coke berth (no.62 with water depth of 10.0 meters) which is mainly used by 15,000 DWT-class general cargo vessels exporting "coke". Berth nos. 63 and 64 are practically used as one coal berth (water depth of 10.0 meters) by partially-loaded 65,000 DWT-class bulk carriers transporting "coal" in Alexandria Harbour.

Cokes stockpile yard of approximate area of 14,000 sq.m (=50m*280m) is also located right behind the coke berth (no.62) and its stockpiling capacity is estimated at 45,000 tons. Coal stockpile yard of approximate area of 16,000 sq.m (=50m*320m) is located right behind the coal berths (nos.63 and 64) and its stockpiling capacity is estimated at 80,000 tons.

ii) El Dekheila Harbour

Both fully-loaded 65,000 DWT-class bulk carriers transporting "coal" and fully-loaded 120,000 DWT-class bulk carriers transporting "iron pellets" are able to use the berth (no. 90-1 with water depth of 20.0 meters) in El Dekheila Harbour.

Iron pellet stockpile yard of approximate area of 30,000 sq.m (=50m*600m) is located adjacent to the mineral berth (no.90-1) and its stockpiling capacity is estimated at 300,000 tons. Coal stockpile yard of approximate area of 30,000 sq.m (=50m*600m) is located adjacent to the mineral berth (no.90-1) and its stockpiling capacity is estimated at 150,000 tons.

15.5.3 Requirement of Additional Dry Bulk Cargo Handling Facilities

(1) Grain

Dry bulk grain cargo vessels are assigned so as to equally occupy the existing two grain berths (nos.94-1 and 94-2) for "without-case" scenario, and three berths (nos.94-1, 94-2 and a new grain berth proposed in this study) for "with-case" scenario in 2017. Highly-efficient unloading operation (gross productivity of 700 tons/hour/vessel) is expected at the berth (no.94-2) through mechanical grain unloaders installed on that. However, relatively-low unloading operation (gross productivity of 250 tons/hour/vessel) is expected at the berth (no.94-1) with mobile type unloaders.

The required dimensions of dry bulk grain cargo handling facilities are estimated by using offshore waiting time calculated based on UNCTAD study[1)]. The two existing berths (nos.94-1 and 94-2) are assumed available for "without-case" scenario. It is revealed that considerably high BOR (Berth Occupancy Ratio) of 72.8% and a consequent long offshore waiting time of 163 hours per vessel are beyond a tolerable limit (Table 15.5.2).

Table 15.5.2 Berth Assignment of Dry Bulk Grain Cargo for the "Without-case" and "With-case" Scenarios in 2017

Scenario	Items	Berth Name	No. 94-2	No. 94-2	No. 94-1	New Berth
		Commodity	Maize	Wheat	Wheat	Wheat
Without-case (2017)	Throughput	(tons/yr.)	2,210,000	2,252,000	1,594,000	---
	Vessel size	(DWT)	120,000	65,000	65,000	---
	No. of vessels	(Vessels/yr.)	38	39	27	---
	BOR	(%)	72.8	72.8	72.8	---
	Average unloading rate	(tons/hr/vessel)	700	700	250	---
	Average berthing hours	(hours/vessel)	83	83	232	---
	Average waiting hours*	(hours/vessel)	163	163	457	---
With-case (2017)	Throughput	(tons/yr.)	2,210,000	360,000	917,000	2,569,000
	Vessel size	(DWT)	120,000	65,000	65,000	65,000
	No. of vessels	(Vessels/yr.)	38	6	16	44
	BOR	(%)	41.9	41.9	41.9	41.9
	Average unloading rate	(tons/hr/vessel)	700	700	250	700
	Average berthing hours	(hours/vessel)	83	83	232	83
	Average waiting hours*	(hours/vessel)	43	43	121	43

Remarks) Average waiting hours* are estimated using waiting-time factor presented by UNCTAD ("Port Development - A handbook for planners in developing countries (Second edition) -", TD/B/C.4/175/Rev.1

For "with-case" scenario, the two existing berths (nos.94-1 and 94-2) and the additional new grain berth with two units of highly efficient grain unloaders (gross productivity of 700 tons/hour/vessel) are assumed available. Then, it is revealed that reasonable BOR of 41.9% and a reasonable offshore waiting time of only 43 hours per vessel remain within a tolerable range (Table 15.5.2).

Therefore, the new grain berth with two units of highly efficient grain unloaders (nominal productivity of 1,000 tons/hour/crane) is essential to minimize inefficient unloading operations through mobile type unloaders at berth no.94-1. The entering draft of fully-loaded 65,000 DWT-class dry bulk grain carriers require water depth of at least 14.0 meters for the new berth.

(2) Mineral (Iron Pellet, Coal and Cokes)

Fully-loaded 120,000 DWT-class bulk carriers transporting "iron pellets" and "coal" which require berth depth of 20.0 meters can be accommodated only at the berth (no.90-1). Gross productivity of 1,227 (tons/hour/vessel) for "iron pellets" and 810 (tons/hour/vessel) for "coal" are assumed respectively for two units of highly efficient mechanical unloaders at berth no.90-1.

On the other hand, fully-loaded 65,000 DWT-class bulk carriers transporting "coal" which require berth depth of 14.0 meters can not be accommodated at the existing berth (no.63/64) due to insufficient present water depth of 10.0 meters for "without-case" scenario. Consequently, the berth (no.63/64) whose present water depth of 10.0 meters should be deepened to water depth of 14.0 meters so as to accommodate fully-loaded 65,000 DWT-class bulk carriers for "with-case" scenario in 2017.

---

[1] "Port Development" - A handbook for planners in developing countries (Second edition) -", UNCTAD

Average BOR of the berth (no.90-2) is calculated at 56.4% remaining within a tolerable range and a consequent offshore waiting time is calculated based on UNCTAD study. Also, average BOR of the berth (no.62) is calculated at 32.8% within a tolerable range. Similarly, average BOR of the berth (no.63/64) is calculated at 11.6% which seems relatively low utilization of the berth. (Table 15.5.3)

However, fully-loaded 65,000 DWT-class bulk carriers transporting "coal" can not be accommodated at the existing berth (no.63/64) due to insufficient present water depth of 10.0 meters. It would be advisable to accommodate fully-loaded 65,000 DWT-class coal bulk carriers by deepening the existing berth (no.63/64) up to 14.0 meters.

Table 15.5.3 Berth Assignment of Dry Bulk Mineral Cargo for the "Without-case" and "With-case" Scenarios in 2017

Scenario	Items	Berth Name	No. 90-1	No. 90-1	No. 63/64	No. 62
		Commodity	Iron pellet	Coal	Coal	Cokes
Without-case (2017)	Throughput	(tons/yr.)	5,000,000	700,000	800,000	520,000
	Vessel size	(DWT)	120,000	120,000	65,000	15,000
	Berth depth	(m)	20.0	20.0	10.0	10.0
	No. of vessels	(Vessels/yr.)	46	7	14	39
	BOR	(%)	56.4	56.4	11.6	32.8
	Average unloading rate	(tons/hr/vessel)	1,227	810	786	181
	Average berthing hours	(hours/vessel)	88.0	133.3	49.6	74.6
	Average waiting hours*	(hours/vessel)	81.8	124.0	2.2	26.9
With-case (2017)	Throughput	(tons/yr.)	5,000,000	700,000	800,000	520,000
	Vessel size	(DWT)	120,000	120,000	65,000	15,000
	Berth depth	(m)	20.0	20.0	14.0	10.0
	No. of vessels	(Vessels/yr.)	46	7	21	39
	BOR	(%)	56.4	56.4	11.6	32.8
	Average unloading rate	(tons/hr/vessel)	1,227	810	786	181
	Average berthing hours	(hours/vessel)	88.0	133.3	74.4	74.6
	Average waiting hours*	(hours/vessel)	81.8	124.0	2.2	26.9

Remarks) Average waiting hours* are estimated using waiting-time factor presented by UNCTAD ("Port Development - A handbook for planners in developing countries (Second edition) -", TD/B/C.4/175/Rev.1

15.5.4 Summary

(1) Grain Handling

Grain terminals in El Dekheila Harbour would be over-utilized resulting in BOR of 72.8% and a consequent long turn-around time, if the existing grain terminals in Alexandria Harbour were not to be deepened to 14.0 meters and modernized with highly-efficient unloaders. Additionally, there exists available silos behind the existing grain terminals in Alexandria Harbour. Accordingly, <u>it is recommended that an additional 14.0 m-deep grain berth with two (2) units of highly efficient grain unloaders (nominal productivity of 1,000 tons/hour/unloader) should be built connecting to the usable existing silos.</u>

(2) Mineral (Iron Pellets, Coal and Cokes) Handling

Partially-loaded 65,000 DWT-class bulk carriers transporting "coal" could be fully loaded and save their transport costs, if the coal berth (no.63/64) were to be deepened to

14.0 meters. Consequently, it is recommended that the existing coal berth (no.63/64) should be deepened and utilize the existing structure with less investment.

(3) Dangerous Cargo (Sulfur and Fertilizer) Handling

Sulfur is presently handled together with fertilizer at the berths (nos. 65 and 66). These berths are located nearly at the center of the Alexandria Harbour and in front of the densely-populated city area. Dangerous cargo should be handled separately from flammable cargoes and located apart from the densely-populated area. Accordingly, it is recommended that those dangerous cargoes be assigned to the berths (nos.98 and 99-1) in the El Dekheila Harbour.

15.6 Liquid Bulk Cargo Handling

15.6.1 Target Volume of Liquid Bulk Cargo to be handled at the Greater Alexandria Port in 2007 and 2017

Total volume of liquid bulk cargo to be handled at the Greater Alexandria Port is estimated at 4.8 million tons in 2007 and 6.5 million tons in 2017 (see Chapter 12). Commodity-wise liquid bulk cargo volumes are presented in Table 15.6.1. Petroleum oil and Grease are expected to increase moderately up to 2017. Molasses are expected to increase relatively rapid, while edible oil seems to decrease in the future.

Table 15.6.1 Commodity-wise Liquid Bulk Cargo Volume in 2007 and 2017

(Unit: thousand tons)

Package Style	Commodity	1997	2007	2017
Liquid Bulk	Petroleum Oil	3,499	4,180	5,616
	Petroleum Oil (LPG, Butane, etc.)	71	85	115
	Edible Oil	483	124	135
	Grease	58	86	86
	Molasses	186	349	529
	Grand Total	4,297	4,824	6,481

15.6.2 The Existing Liquid Bulk Cargo Handling Facilities at the Greater Alexandria Port

There are five (5) oil terminals (three berths (nos.87-3, 87-4 and 87-5) with water depth of 12.0 meters / two berths (nos.87-1 and 87-2) with water depth of 10.0 meters) and one (1) molasses berth (no.71m / with water depth of 10.0 meters) as liquid bulk cargo handling facility in Alexandria Harbour, and no that kind facility in El Dekheila Harbour. Since the existing loading arms and pipelines are aged and partially broken down, however, petroleum oil (LPG, butane, etc.) is currently handled at a relatively-low operational productivity rate.

Relatively-large (35,000 DWT-class) liquid bulk carriers transporting “petroleum oil” are presently accommodated with the oil berths (nos.87-3, 87-4 and 87-5). Relatively-small

(15,000 DWT-class) liquid bulk carriers transporting "petroleum oil (LPG, butane, etc.)" presently use the relatively-shallow berths (nos.87-1 and 87-2). Also, relatively-small (10,000 DWT-class) liquid bulk carriers transporting "Molasses" presently use the relatively-shallow berths (nos.71m).

15.6.3 Requirement of Additional Liquid Bulk Cargo Handling Facilities

It is examined whether the existing berthing facilities for liquid bulk cargo would be sufficient to handle the future volume, assuming that the reasonable rate of future productivity in case that loading arms and pipelines are to be modernized (see Table 15.6.2). Estimated BOR (= 40.0%) and an average offshore waiting time (=3.5 hours/vessel) for "petroleum oil" handling indicate reasonable utilization and offshore waiting time.

Consequently, no additional berthing facility (infrastructure) is needed besides modernization of the existing aged loading arms and pipelines (superstructure).

Table 15.6.2 Berth Assignment of Liquid Bulk Cargo for "Without-case" Scenario in 2017

Scenario	Items	Berth Name	No.87-3, -4, -5 (3 berths/-12.0 m)	No.87-1, -2 (2 berths/-10.0 m)
		Commodity	Petroleum Oil	Petroleum Oil (LPG,Butane,etc.)
Modernization of loading arms and pipelines besides additional infrastructure (2017)	Throughput	(tons/yr.)	5,616,000	115,000
	Vessel size	(DWT)	35,000	15,000
	No. of vessels	(Vessels/yr.)	179	9
	BOR	(%)	40.0	3.8
	Average unloading rate	(tons/hr/vessel)	540	350
	Average berthing hours	(hours/vessel)	58.3	38.6
	Average waiting hours*	(hours/vessel)	3.5	0

Remarks) Average waiting hours* are estimated using waiting-time factor presented by UNCTAD ("Port Development - A handbook for planners in developing countries (Second edition) -", TD/B/C.4/175/Rev.1

15.6.4 Summary

<u>It is recommended that the existing aged loading arms and pipelines should be modernized without any additional berthing facilities.</u>

15.7 Common Port Facilities

15.7.1 Port Road Networking

It is recommended that a new bridge connecting the east and the central zones together with the development, re-development or renovation of the marine terminals.

(1) Present Port-related Cargo Flows to/from the Greater Alexandria Port

1) Containers
Origin and destination of containers handled at Greater Alexandria Port are accounted for 68.3% by the Cairo area, 28.3% by the Alexandria area and 3.4% by others. Approximately 70% of the containers handled at Alexandria Container Terminal are transported by trucks and the remaining 30% by rail. Almost all the containers handled at El Dekheila Container Terminal are transported by trucks.

2) General Cargo
Origin and destination of “agricultural products” are accounted for 65.4% by the Cairo area, 24.5% by the Alexandria area and 10.1% by others. On the other hand, origin and destination of “sawn timber” are accounted for 26.1% by the Cairo area, 66.1% by the Alexandria area and 7.8% by others. Almost all the general cargoes are transported by trucks.

3) Coal/coke
Imported coal through Alexandria Harbour is transported inland by rail (approximately 30%) and barges (the remaining 70%). On the other hand, imported coal through El Dekheila Harbour is transported inland by rail (100%).

4) Grain
Almost all the grains are imported and stored in silos temporarily and transported to the hinterland. Inland transportation to the hinterland is accounted for approximately 90% by trucks and 10% by rail.

5) Petroleum Oil
Ninety percent (90%) of petroleum oil handled at the Greater Alexandria Port is international and domestic outbound traffic. Most of the petroleum oil is refined at the refinery behind the port and transported to the port through pipelines.

(2) Present Problems to be resolved concerning Port-related Cargo Traffic in and around the Greater Alexandria Port

Port-related cargo traffic to/from the Greater Alexandria Port is suffering from heavy traffic congestion which is caused by together with heavy city traffic through downtown area in Alexandria city. Port-dedicated fly-over road behind the port from the gate no.27 to evacuate port-related cargo traffic apart from the heavy city traffic is now under construction so as to release both port-related and city traffic congestion.

Commodity-wise port cargo traffic is presently obliged to use the specific gate, which may cause redundant transportation between berths and gates or storage areas and gates, because the vessels are not always assigned to the berth closest to the expected gate. Furthermore, heavy weight cargo trucks are presently prohibited to run across the aged bridge between the berth no.32 and no.33 and consequently required to make a detour through downtown to avoid crossing the aged bridge.

(3) Port-dedicated Road behind the Port to Evacuate Port-related Traffic to/from Gate no.27

A new port-dedicated road behind the port is mostly available and being partly still developed between the port gate no.27 and the roundabout located adjacent to the Alexandria airport. This road leads to Cairo through either "the Agricultural Road" or "the Desert Road", and is expected to smoothly evacuate port traffic to/from the Alexandria Harbour. The final stage of this road development is presently under construction right behind the gate no.27.

When the port-dedicated road behind the port is to be completed, most of the port-related cargo traffic is expected to use this port-dedicated road so as to minimize the land transport time. However, if heavy weight trucks should be still prohibited to ran across the aged port road bridge, the expected benefit of this road would be lost to a considerable extent. Therefore, this aged port road bridge is required to be re-constructed.

15.7.2 Waste Oil Receiving Facility

The Greater Alexandria Port has no independent treatment facilities either to treat the bilge waste or the ballast waste from the ships and oil tankers. Consequently, the port waters is visibly polluted with floating oil and others, as mentioned in Section 3.3.

It is also required to introduce a waste oil processing plant at the Greater Alexandria Port in order to properly prevent the sea water pollution by processing the ship waste oil.

15.7.3 VTMS (Vessel Traffic Management System)

VTMS which covers all the area of the Greater Alexandria Port including El Dekheila Port was installed and used at the port control tower. However, the system is out of order now. It has also become old-fashioned so there is no point in repairing it. Navigation control is currently conducted through VHF between the control center and each ship. It is possible to monitor the movement of vessels after vessels come into sight. But there is no visual aid while vessels are out of sight. Furthermore, it is very difficult to monitor the vessels' traffic during night time and bad weather. It is necessary to introduce an advanced VTMS to accommodate the increasing vessel traffic in the near future.