Chapter 3 Natural Conditions in and around Ghana Sea Ports

3.1 Climatic Conditions

(1) General

The study area falls within the tropical zone, in which each year has rainy and dry seasons.

Tema area, which is part of the Accra Plains, is one of the driest parts of the country. It experiences two rainfall maxima in the months of May/June and September/October. The dry season (Harmattan) occurs in the months of December/January with minimum rainfall.

Takoradi area is one of the Moderate rainfall parts of the country. The main rainy season is in May and June, followed by a late minor rainy season lasting form October to November. The dry season lasts from around December to around March.

Details of data on Temperature, Rainfall and Wind are presented in the following sections.

(2) Temperature

The hottest periods of the year in Tema and Takordi are in the months of February and March, The mean monthly temperature during this time is about 29℃. July and August are relatively cooler months with mean temperatures of 26℃.

(3) Rainfall

The rainfall data such as mean monthly and mean yearly rainfall are collected as to the past 25 and 31 years and for the last 3 years recorded at the Tema and Takoradi Meteorological Stations. The rainy season begins around March and reaches its peak of about 200 mm at Tema, 300 mm at Takoradi in the month of June. The mean yearly rainfall at the Tema and Takoradi area is 700 mm and 1,100 mm respectively.

(4) Wind

According to the wind data compiled by Meteorological Services Department, the prevailing wind influencing the study areas is south to south-west. The monthly average wind velocity of the Tema and Takoradi were 4.0 – 6.0 kots in the last 11 years (1990-2001) at Tema and in the last 27 years (1973-1999) at Takoradi.

3.2 Marine Conditions

(1) Tide Level

The tide pattern of Ghana is semidiurnal tide. There is no time difference between Tema and Takoradi Ports. The tide level of Tema and Takoradi Ports are shown in the Table 3.2.1.

Table 3.2.1 Tide Levels of Tema Port and Takoradi Port

(Unit: m)

	Tema Port (5 ° 52 ′ N. 0 ° 00 ′)	Takoradi Port (4 ° 53 ′ N. 1 ° 45 ′ W)
MHMS	1.6	1.5
MHWN	1.3	1.2
MLWN	0.7	0.6
MLWS	0.3	0.2

Source: Tide Tables 2,001 (GPHA)

(2) Tidal Current

The direction of tidal current around the coast in Ghana is mostly North or North-East. The velocity of the tidal current is generally less than 0.1 m/sec. The maximum velocity of tidal current is about 0.5 m/sec which observed the day of strong winds.

(3) Wave Condition

There are no wave observation data available locally for Tema and Takoradi Ports.

The wave characteristics for this study are derived from The Global Wave Statistics for last 40 years published by British Maritime Technology.

The frequency distribution of the concluded wave （1960－2000）is shown in Table 3.2.2.

Table 3.2.2 The Frequency Distribution of Wave at offshore of Ghana (1960-2000)

(Unit: %)

HIGHT	N	NE	E	SE	S	SW	W	NW	TOTAL
0.0-1.0	2.45	2.00	1.84	4.38	10.55	10.30	7.48	3.98	42.97
1.0-2.0	1.69	0.84	0.92	5.04	19.85	7.82	2.98	2.84	41.98
2.0-3.0	0.24	0.17	0.19	1.36	6.93	2.15	0.60	0.62	12.44
3.0-4.0	0.07	0.02	0.03	0.22	1.36	0.41	0.08	0.09	2.28
4.0-5.0	0.00	0.00	0.00	0.02	0.19	0.04	0.01	0.01	0.29
5.0-6.0	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.04
TOTAL	4.63	3.04	2.99	11.03	38.92	20.72	11.15	7.54	100.00

Number of Observations: 267,326

Source: “The Global Wave Statistics” published by British Maritime Technology

(4) Sand Drift

The West African coast extending from Cape Palmas to The Niger Delta generally has an accretion tendency in the eastern section near Cape Three Points in Ghana and an erosion tendency in the West around the Niger Delta. Shoreline recession has been recorded at various locations along the East Coast of Ghana. The worst hit areas are the shores of Atorkor and Ada. The shoreline was found to have receded about 10 m in some areas, and Erosion of another area was about 7 m in Ada.

3.3 Topography

The Bathymetric Survey covering at the Tema and Takoradi Ports were carried out in the Study. The Bathymetric Charts at Tema and Takoradi ports are shown in Figure 3.3.1 and Figure 3.3.2 respectively.

3.4 Geological Condition

The Study Team has carried out the seismic profiling and the geotechnical investigation by rock boring at Tema and Takoradi Ports to examine the geological conditions for the future development areas. The results of the geotechnical investigation by rock borings are indicated in Table 3.4.1 and Table 3.4.2, Table 3.4.3 show the rock characteristics defined by the past investigation by GPHA at Tema and Takoradi Ports basin.

Table 3.4.1 Geotechnical Investigation Result (Tema Port)

Bore Hole No.	Ground Elv. / End of Drill (C.D.)	Rockhead Level	Specific Gravity	Compressive Strength (MPa)	Rock Type Description
No. 1	-4.50 / -13.80	-12.90	(No core sample recovered)		Completely to highly weathered Gneiss
No. 2	-5.50 / -14.00	-9.50	(No core sample recovered)		Completely to highly weathered Gneiss
No. 3	+4.00 / -6.20	-	2.72	4.4~13.8	Granitic Gneiss boulder - bouldery
No. 4	-2.50 / -1.30	+1.70	2.67~2.73	2.9~32.4	Completely to highly weathered Gneiss

Source: Study Team

Table 3.4.2 Geotechnical Investigation Result (Takoradi Port)

Bore Hole No.	Ground Elv. / End of Drill (C.D.)	Rockhead Level	Unit Weight (KN/m^3)	Compressive Strength (MPa)	Rock Type Description
TK-1	-7.40 / -13.80	-9.10	23.0~25.0	13.2~22.7	Highly to moderately weathered Fine-graded SAND STONE, Moderately weak to moderately strong
TK-2	-7.30 / -14.00	-8.90	23.0~26.0	11.9~30.3	Ditto

Source: Study Team

Table 3.4.3 Rock Characteristics defined by the Past Investigation at the Tema and Takoradi Ports

Location	Tema				Takoradi		
Rock Type	A1	A2	A3	B1	A1	A2	B
Unit weight(kg/m^3)	2,500	2,650	3,050	-	2,460	2,465	2,110
Mean compressive (MPa)	38.2	253	152	-	80.3	43.6	17.1
Max compressive strength (MPa)	58.9	253	152	-	86.4	46.7	35.8

Source : GPHA

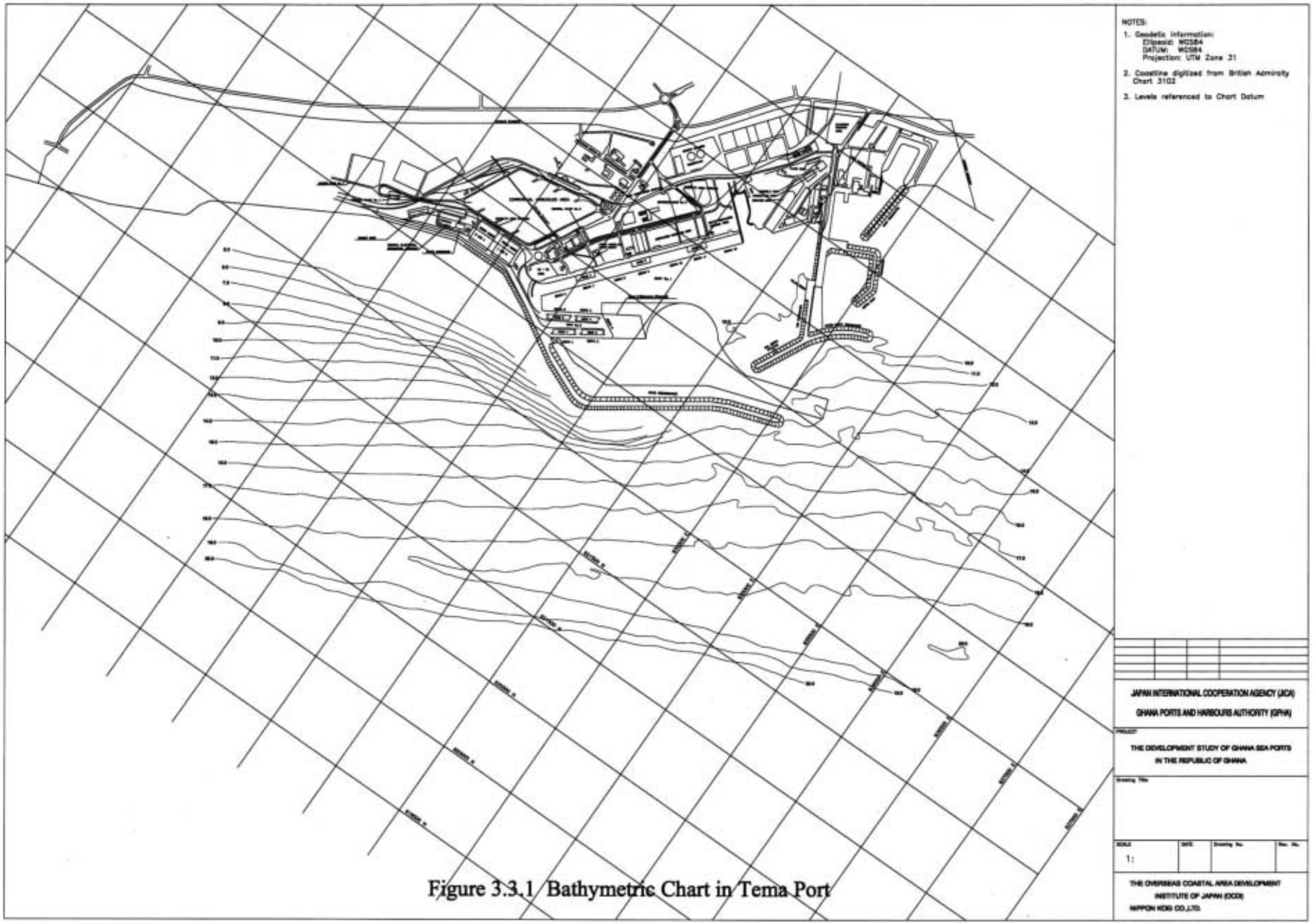


Figure 3.3.1 Bathymetric Chart in Tema Port

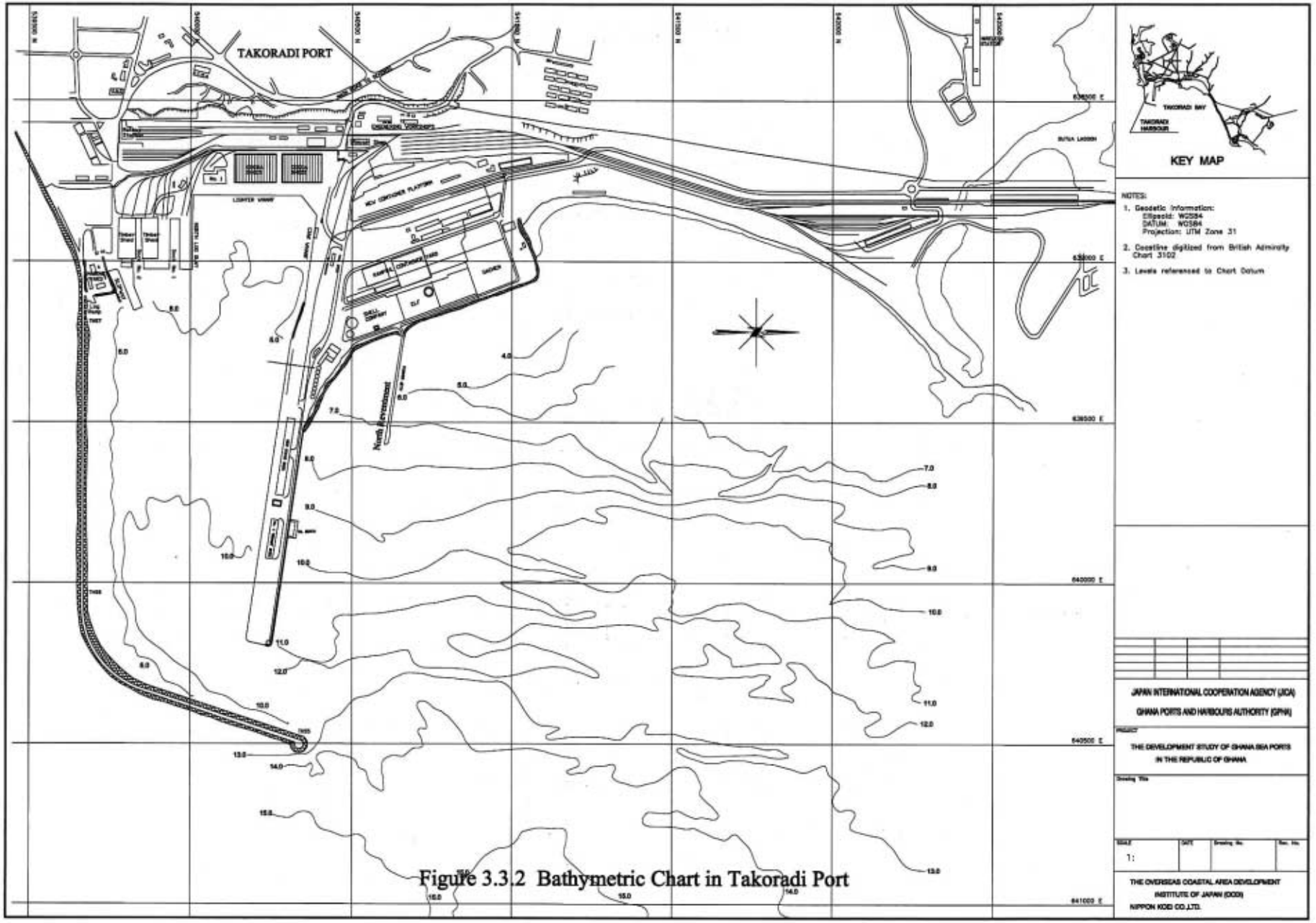


Figure 3.3.2 Bathymetric Chart in Takoradi Port

3.5 Seismic Condition and Earthquakes

The Seismic activity in southern Ghana is believed to be caused by movement along two active fault systems, namely the Akwapim Fault Zone along the Akwapim mountain range which trends approximately NE-SW and is located about 20 km to the west of Accra and The Coastal Boundary Fault which lies some 3 km offshore and runs almost parallel to the coastline in the vicinity of the Tema port. This fault is confirmed by the seismic profiling. The fact that these two fault systems intersect at near the village of Nyanyanu, to the west of Accra, is believed to be responsible for the seismic activity experienced in Tema port and Takoradi port.

Chapter 4 Environmental Condition in and around Ghana Sea Ports

Under the Environmental Impact Assessment (EIA) system in Ghana, a detailed EIA is mandatory for all new port construction or development projects involving an increase of 25% or more in yearly handling capacity. The present study was conducted following the said system. The existing environmental conditions were studied through literature, statistics, field reconnaissance and field surveys. The following environmental concerns were identified.

Takoradi Port: Dust dispersal in certain areas of the port area.
Water quality (Concentration of oil and organic matter)
Bottom sediment quality (Concentration of lead and mercury)
Erosion in the port area
Waste management

Tema Port: Water quality (Concentration of oil and organic matter)
Bottom sediment quality (Concentration of lead)
Noise due to road traffic
Conservation of the Ramsar Site
Waste management

Chapter 5 Port Administration and Management System

5.1 Laws and Regulations

(1) Basic law on management body of Ghana Sea Ports

Ghana Ports and Harbours Authority (GPHA) was established by the "Ghana Ports and Harbours Authority Law, 1986 "(PNDC Law 160). This law defines the Board and function of the GPHA, the assets made available to it, the staff and its personnel and the financial organization of GPHA.

(2) Landlord Port Bill (Basic law upcoming)

The main features of Port Development Policy based on Ghana Trade and Investment Gateway Project (GHATIG) are:

i) Changing the status of GPHA from that of a service port to that of a Landlord Port
ii) Introduction of more competition into port operations by increasing private sector participation.

(3) Port related acts and legislation

5.2 Organization of Ghana Ports and Harbours Authority (GPHA)

5.2.1 Historical Background

In 1978, Ghana Ports Authority (GPA) was spun off from Ghana Ports and Railway Authority.
In 1986, Ghana Ports and Harbours Authority (GPHA) was set up by the above mentioned PNCD Law 160 as a statutory government corporation. It constituted the merger of the GPA and the two public cargo handling companies - the Ghana Cargo Handling Company (GCHC) and the Takoradi Lighterage Company (TLC).

5.2.2 Board of Directors at Present and in Future

Under PNDC Law 160, GPHA owns and operates the ports of Tema, Takoradi and Fishing Harbour at Tema. The present GPHA is under the Ministry of Roads and Transport (MORT) and it is administrated by an eleven-member Board of Directors. According to Final Draft Landlord Ports Bill, July 2000 (submitted to GPHA), the governing body of a port authority upcoming shall be the Board, which shall consist of no more than eleven (11) members.

5.2.3 Function of GPHA at Present and after Passage of Landlord Port Bill

According to PNDC Law 160 in 1986, the present functions of GPHA are to make plans for development, management and operation of the ports, and to build and develop the port, to manage, to operate and to maintain the ports.

On the other hand, according to the draft final Landlord Port Bill, July 2000 Port authorities shall

prepare and update a port master plan, regulate and control the development within ports, maintain and deepen the approaches and navigable waters, enhance safety and security of vessels and maintain navigational aids and equipment, promote the use, improvement and development of the port and participate in the activities and meeting on ports.

The above mentioned port authorities as Landlord Port may carry on the business of pilotage, operate crafts for towage, fire-prevention and the protection of life, engage in operations for salvage of ships and cargo;

5.2.4 GPHA Personnel

(1) Permanent staff

In 1986, GPA, GCHC and TCL appear to have had a combined employment of 5,682 permanent staff and 2,200 casual workers and GPHA reduced permanent staff gradually. Furthermore, GPHA laid off 1,439 individuals, or 32% of its labour force.

(2) Casual labour

Casual labour employed by GPHA is classified into pure casuals and permanent casuals. The gangs are classified into three groups: 1) stevedoring gangs which consist of 16 workers; 2) shore handling gangs which consist of nine workers; and 3) cocoa shed gangs which consist of 17 workers. At Takoradi Port, permanent casuals work only in the cocoa sheds.

5.2.5 Present Organization of Port Administration

5.3 Privatization of Port Activities

5.3.1 Privatization of Port Activities at Present

As for the privatization of Tema port, three private companies, namely Speedline Stevedoring Company Limited (SSC), Atlantic Port Services Limited (APS) and Express Maritime Service Limited (EMS) are engaged in stevedoring works. Detail of the shares of the cargo handling volume for these companies are shown in Table 5.3.1

Table 5.3.1 Share of Stevedoring Work for Licensed Companies in Tema Port

	Container (%)	General cargo(%)	Total (%)
SSL	10	10	10
APS	15	15	15
EMS	-	25	(25 of GC)
(GPHA)	75	50	(75 of Cont., 50 of GC)

Source: GPHA

GPHA plans to transfer it share of stevedoring works to several private companies and this

privatization by 2002.

5.3.2 Port Privatization Regulated by Landlord Port Bill (Draft)

Landlord Port Bill (Draft) specifies the procedures and types of private sector participation.

(1) Private sector participation plan

GPHA formulates the plan and based on it private sector participation is carried out. Three types of private sector participation are explained blow:

i) Build-Operate-Transfer scheme (BOT scheme)
ii) Concession
iii) Lease

5.4 Current Status of Computerized Information System

The United Nations Conference on Trade and Development (UNCTAD) has developed ASYCUDA (Automated System for Customs Data) to bring about a better management of Government finances through an institutional strengthening of Customs Administrations. The Customs Exercise and Preventive Service (CEPS) modified ASYCUDA to suit the Ghana customs clearance system, and was reviewed along the lines of EDI networks of Singapore and Mauritius and the outcome was the adoption of the Ghana Community Network (GCNET). GCNET is an autonomous body with stakeholders from CEPS, GPHA, Ministry of Finance, Ministry of Trade and Industry, Ghana Statistics Service, Ghana Shippers Council, Social General de Surveillance (SGS) and so on.

This EDI network is linked to all stakeholders and the shipping lines with the main purpose of facilitating port activities vis-a-vis import and export procedures, documentation, clearance of goods, warehousing and so on.

5.5 Safety and Maritime Accident

5.6 Port Promotion

5.6.1 Marketing Section of GPHA

Takoradi and Tema Port now has a marketing section which is headed by a Marketing Officer who reports to the Port Personnel Administrative Manager. Functions of the marketing section are analysing, planning, implementing and controlling marketing activities of the ports, conducting marketing research and information gathering activities.

5.6.2 Current Activities for Port Promotion/Sales

Current activities for Port Promotion/Sales include the following:

i) Advertising in International Maritime Trade journal to attract vessels to Ports of Ghana
ii) Exhibiting port facilities and services at local and International fairs.
iii) Occasional Trade Mission to landlocked countries (Burkina Faso) to attract their trade through the Ghanaian corridor.
iv) Trade visit to shippers in Kumasi and Northern parts of the country to attract shippers to use Takoradi Port.
v) Trade visits to shipping companies/agents to identify their problems and propose measures to resolve them.

5.7 Present and Anticipated Problems

(1) Activities for Privatization

Following problems should be considered while GPHA will be privatized as landlord port.

①Promoting competition in cargo handling business

Even after the seaports become completely autonomous, the situation may not substantially change if the port authority permits only one private entity to act as port operator
GPHA should have some control over the private companies to ensure that monopolistic or oligopolistic tendencies are not pursued.

②Treatment of workers dismissed due to reform

Many workers of GPHA will lose their jobs when GPHA will be transformed from a service port to a landlord port. Job opportunities as dockworkers would be decreased due to the rationalization of cargo handling operations by private companies. Without their cooperation, the reform could not be promoted smoothly. Adequate measures should be taken to deal with workers who will loose their jobs.

(2) Introduction of port EDI system

(3) Port promotion efforts by Takoradi port

The cargo traffic flow would likely concentrate at Tema Port which is close to Accra, the largest commercial area in Ghana. To compete successfully with Tema Port, it is important for Takoradi Port to immediately attempt to attract shipping companies through sales and promotion efforts.

Chapter 6 Present Conditions of Takoradi Port

6.1 General

The original Takoradi Port was constructed in the 1920s as the base of navy operations and trade (1st Stage). From 1947-1953, major parts of the present breakwaters were constructed (2nd Stage). From 1953-1958, breakwaters together with berths were extended to complete the present framework of the Port. Design and supervision was carried out by a British consultant, Nasars Taylor Woodrow Limited. Contractors were also British. Takoradi Port is located about 250km west of Accra. Most of the main export products of Ghana such as bauxite, manganese, wood, and cocoa are shipped from this port.

6.2 Existing Facility and its Physical Conditions

Main port facilities of Takoradi Port are shown in Table 6.2.1. There are 9 berths, Berth No.1 to No.6, Oil Berth, Bauxite Berth and Clinker Jetty. Berth No.1 is used for the export of manganese and Berth No.5 and No.6 are usually used as one berth because the length of Berth No.5 is not long enough to accommodate Ro/Ro vessels and container vessels. In addition to berths, Buoy No.1 and No.3 are also used for loading and discharging cargoes.

The existing port layout plan of the Takoradi Port is shown in Fig. 6.2.1.

Table 6.2.1 Main Facility of Takoradi Port

(Breakwater, Berth)

Area	Facilities	Dimensions	Main Vessel Type
	Main Breakwater	L=2,360m	
	Lee Breakwater	L=1,830m	
	Channel	W=150m, D=11.3m	
	Turning Basin	A=84ha	
Deep Water Area	Berth No.1	L=159m, D=8.5m	BU(Manganesea)
	Berth No.2	L=168m, D=7.9m	GC, CO, CM, RO
	Berth No.3	L=152m, D=7.9m	CO, GC
	Berth No.4	L=182m, D=8.5m	RO, GC, CM, CO
	Berth No.5	L=82m, D=8.5m	
	Berth No.6	L=152m, D=8.9m	RO, CO
Inner Port Area	Buoy No.1	195m, 10.36m	BU
	Buoy No.3	193m, 9.2m	BU, GC
	Buoy No.4	181m, 8.4m	
	Buoy No.5	176m, 7.7m	
	Buoy No.6	174m, 7.5m	
	Buoy No.7	150m, 7.0m	
	Buoy No.8	91m, 6.0m	
	Buoy No.9	96m, 5.5m	
	North Lighter Wharf	80m, 3m	Small boat
	West Lighter Wharf	340m, 2m	
	North Log Quay	220m, 1.5m	
	Dock No.1		
	Dock No.2		
Seaward Side Area of	Oil Berth	L=183m, D=8.8m	TK(Oil)
	Bauxite Berth	L=154m, D=9.1m	BU(Bauxite)
	Clinker Jetty	L=137m, D=7.4m	BU(Clinker, Bauxite)

BU: Bulk carrier, CM: Conteiner/Multipurpose, CO: Container cellular,
GC: General cargo carrier, RO: RoRo vessel, TG: Tugbaot, TK: Tanker

(Storage Facility)

Area	Facilities	Dimensions	Main use
Deep Water Area	Unicontrol Shed		Cocoa
	Shed No.4		General cargo
	Shed No.5		
Inner Port Area	Copra Shed	562m2	Copra
	Cocoa Shed No.1	130m x 88m	Cocoa
	Cocoa Shed No.2	124m x 88m	Cocoa
	Shed No.1	2,313m2	Cocoa
	Sawn Timber Shed No.1	124m x 46m	Timber
	Sawn Timber Shed No.2	124m x 46m	Timber
	Shed No.7		CFS
	Container Yard		Container

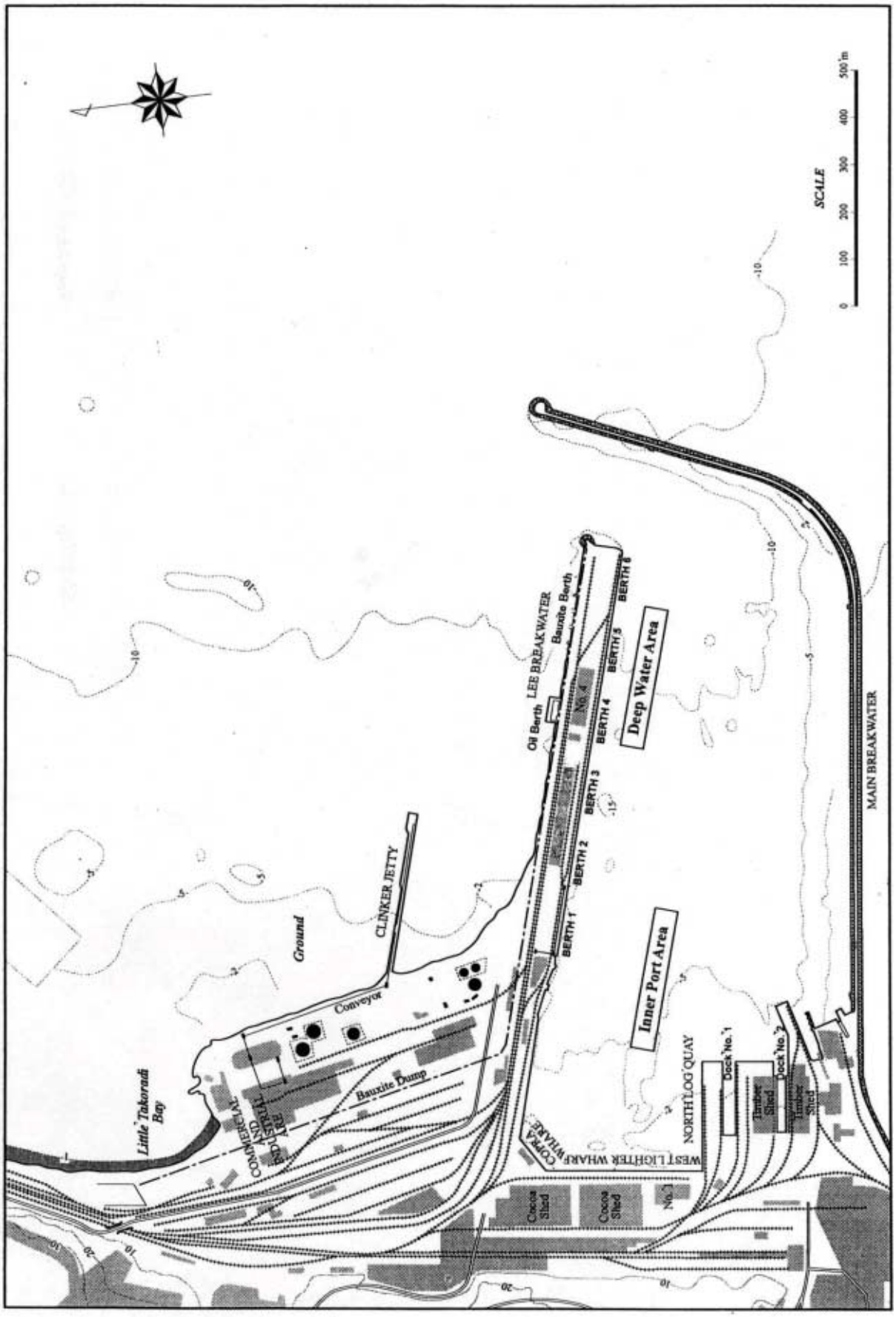


Fig. 6.2.1 Existing Port Layout (Takoradi Port)

6.3 Cargo Traffic

6.3.1 Cargo Traffic

Table 6.3.1 shows cargo handled at Takoradi Port from 1991 to 2000. Takoradi Port functions as the main export port in Ghana and exports typical Ghanaian products such as cocoa beans, sawn timber, manganese and bauxite. Ratio of export cargo traffic to import cargo traffic is about 6 : 4.

During this period, imports have been increasing at an average annual rate of 9%, which translated to a volume of 1,14 million tons in 2000. Major import cargoes are bulk cargoes such as clinker, wheat and petrol products. The share of bulk cargoes is 83% in 2000.

Table 6.3.2 shows container cargo traffic in TEU basis. In the recent 10 years period, number of containers handled at the port increased by 4.4 times. Number of full containers for import is much less than that of export, that is one fifth of export container. Main commodities of export containerized cargo are cocoa beans, cocoa product, sawn timber and veneer.

Table 6.3.2 Container Cargo at Takoradi Port

(TEUs)

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
IMPORT	**4,422**	**4,126**	**5,450**	**8,352**	**8,525**	**8,930**	**11,914**	**12,637**	**16,023**	**15,387**
full	1,828	2,003	2,354	2,703	2,781	3,450	5,328	5,994	5,101	4,660
empty	2,594	2,123	3,096	5,649	5,744	5,480	6,586	6,643	10,922	10,727
EXPORT	**4,690**	**4,016**	**5,274**	**8,384**	**11,958**	**14,091**	**17,229**	**16,704**	**21,820**	**24,418**
full	3,634	3,074	3,859	6,703	10,411	12,277	14,579	14,624	19,986	22,914
empty	1,056	942	1,415	1,681	1,547	1,814	2,650	2,080	1,834	1,504
TOTAL	**9,112**	**8,142**	**10,724**	**16,736**	**20,483**	**23,021**	**29,143**	**29,341**	**37,843**	**39,805**
full	5,462	5,077	6,213	9,406	13,192	15,727	19,907	20,618	25,087	27,574
empty	3,650	3,065	4,511	7,330	7,291	7,294	9,236	8,723	12,756	12,231

Source: GPHA

Table 6.3.1 Cargo Traffic at Takoradi Port

IMPORT	CODE	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CEMENT	BC	350		3,335	1,545		6,001		35,450		999
FERTILIZER	BC						4,268	2,950	3,230	6,356	4,771
GRAIN (CORN)	BC										
GYPSUM	BC										
MALT	BC										
OTHER	BC	90	5,404	203		19					
RICE	BC	1,988	4,506	1,703	5,157				5,500	5,488	
SOYA MEAL	BC										
SUGAR	BC	86		96							
WHEAT	BC					11,113					
TEU NETWEIGHT	CT	20,610	24,408	26,279	31,921	33,525	37,016	68,786	79,731	69,419	62,102
ALUMINA	DB										
CEMENT	DB	26,950	500					1,498			
CLINKER	DB	323,538	489,541	444,755	525,093	451,612	527,108	503,220	599,214	737,652	694,374
GRAIN (CORN)	DB	3,191									
OTHER	DB					64,933	65,915				
WHEAT	DB	59,361	53,691	91,478	82,048	56,575	41,346	65,806	99,724	89,120	102,371
CARS	GC	1,019	434	1,194	326	418	513	682	356	680	399
CHEMICALS	GC	507	6,107	5,026	73,509	3,885	29,402	10,579	12,272	34,884	18,061
LIME PRODUCTS	GC							76,471	101,709	43,205	95,070
MACH/EQUIPM.	GC	1,696	1,076	4,034	2,593	3,556	5,469	5,342	4,617	1,327	1,769
OTHER	GC	7,312	3,475	26,380	5,000	5,680	6,078	4,990	19,920	32,122	3,233
PAPER REELS	GC	5,710	7,801	2,431	2,701	3,205	2,899	1,763	1,727	50	571
PLATES	GC	74	208	128	159	424	795	1,255	6,779	867	1,554
RODS/PIPES	GC	2,343	1,290	2,257	1,492	440	6,017	3,167	5,567	2,306	293
STEEL/WIRE COILS	GC	486	896	1,558	492	2,014	330	1,314	1,574	4	
VEHICLES	GC	1,721	2,083	1,325	2,996	2,134	1,693	1,492	2,411	696	739
CHEMICALS	LB										
OTHER	LB										
PETROL PRODUCTS	LB	92,284	100,981	109,927	75,435	17,263	20,143	93,667	107,878	130,069	157,012
TOTAL IMPORT		**549,316**	**702,401**	**722,109**	**810,467**	**656,796**	**754,993**	**842,982**	**1,087,659**	**1,154,245**	**1,143,318**
EXPORT	**CODE**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
COCOA BEANS	BC	103,765	85,583	107,921	56,848	43,805	68,939	57,300	90,930	57,871	65,467
COFFEE	BC	258	311	155							
OTHER	BC	2,749	1,820	1,684	5,586	2,996	4,842	1,082	10,828	7,860	2,901
SHEANUTS	BC			3,749	11,142	12,645	11,600	15,710	6,200	1,401	2,000
TEU NETWEIGHT	CT	46,182	38,315	48,938	86,512	133,972	151,759	176,074	172,409	238,929	271,889
BAUXITE	DB	324,313	399,155	364,643	451,593	531,260	380,370	536,722	341,119	355,255	503,823
MANGANESE	DB	319,997	284,055	305,366	245,423	166,913	269,233	340,180	382,226	656,684	929,296
OTHERS	DB										23,097
WHEAT PELLETS	DB										5,516
LOGS	FP	163,520	121,804	362,748	425,605	62,255			9		
OTHER (e.g. Curls)	FP	4,981	1,865	11,587	25,769	43,955	10,555	10,670	14,386	16,152	9,287
SAWN TIMBER	FP	117,012	144,239	160,221	188,804	196,546	137,264	149,227	133,784	117,413	90,593
CARS	GC	16	7		3	1	1			4	2
COCOA PRODUCTS	GC	6,345	3,380	3,172	103						
LOCAL FOOD STUFF	GC					49	17	157	441	1,531	140
OTHER	GC	1,006	11,518	24,948	3,720	744	3,327	8,730	8,820	12,396	2,561
VEHICLES	GC	8	2		41					220	75
OTHER	LB		4,896		2,993		6,086			2,744	
PALM OIL	LB		3,339	5,858		4,977		9,095			6,551
TOTAL EXPORT		**1,090,152**	**1,100,289**	**1,400,990**	**1,504,142**	**1,200,118**	**1,043,993**	**1,304,947**	**1,161,152**	**1,468,460**	**1,913,198**
TOTAL IMPORT+EXPORT		**1,639,468**	**1,802,690**	**2,123,099**	**2,314,609**	**1,856,914**	**1,798,986**	**2,147,929**	**2,248,811**	**2,622,705**	**3,056,516**

Source: GPHA

6.3.2 Physical Distribution of Port Cargoes

According to the manifest of Takoradi Port on July/2000, the ports in Western Europe share 68 % of imported container cargoes in Ghana. Jebel Ali in Middle Eastern Asia accounts for 9.4 % of the total. Cargoes of 23 % of the total are shared by 11 ports including Japan. (See, Table 6.3.2.1) These imported general cargoes are distributed in Ghana locally. In the case of Takoradi Port, more than half of these cargoes are destined to Western Region (54 %). Greater Accra and Ashante followed to Western Region with 29 % and 14 % respectively. Some cargoes are transited to Burkina Faso. According to the manifest, cargo volume for Burkina Faso is less than 1 % of the total. However, its volume could not be confirmed by port statistic. It is said that the transit cargo to the landlocked countries via Takoradi Port will increase in the future.

Exported general cargoes are widely distributed to 31 ports in the world. Singapore functions supposedly as a hub port for cargoes from Ghana in the South-Eastern Asian area.

According to the above manifest, commodities of imported containers include many kind of daily necessities such as clothes, imported food stuffs, materials for housings, utensils, medicines, electric appliances etc. Ghana relies on the imported goods largely.

While, the exported containers consist of major local products such as wood products, cocoa beans, cocoa products, sawn timber, local food stuff and so on. Cargo types of these commodities shift from bagged cargo/break bulk cargo to container cargo.

Table 6.3.2.1 Origin Ports of Imported Containers
Takoradi Port

Origin	Cargo Volume (MT)	Share (%)
Hamburg	1,884	20.7
Bremerhaven	1,013	11.1
Antwerp	945	10.4
Jebel Al	852	9.4
Teesport	707	7.8
Marseille	541	6.0
Amsterdam	517	5.7
Dunkerque	279	3.1
Rotterdam	155	1.7
Felixstowe	103	1.1
Others	2,093	23.0
Total	9,089	100.0

Note: "Others" include 11 ports.
Source: Takoradi Port, Manifest/July 2000

6.4 Navigation and Calling Vessels

(1) Navigation

Pilotage is compulsory for all vessels except those exempted by the Harbour Master at Takoradi Port. As vessels approach the port, a pilot comes on board at a point 2.5 km northeast of the port entrance. After the pilot boards vessels go west and then turn by 90 degrees to enter the port. Vessels enter the port from the north and after entering turn by 90 degrees to berth. When vessels depart the port, vessels turn around at the turning basin between buoy 1 and buoy 4 and then leave the port. The pilot leaves vessels at a point 1 km north of the port entrance. Usually two tugboats are used for berthing and de-berthing. Vessels can enter and depart 24 hours a day.

The entrance channel is 185m wide and 11.3m deep. The deepest berth is berth No. 6 with a depth of 9.5m and the deepest buoy is Buoy No.1 with a depth of 10.4m.

(2) Calling Vessels

Table 6.4.1 shows the number of vessels calling at Takoradi Port in the last 10 years. About 500 vessels called at the port annually.

Table 6.4.1 Number of Calling Ships by Type at Takoradi Port

SHIP TYPE		**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
GENERAL CARGO	GC	144	148	132	108	90	64	95	96	109	67
RO-RO	RO	46	47	57	89	67	98	109	116	133	104
CONT. MULTIP.	CM	31	22	17	26	41	52	60	67	51	60
CELL. CONTAINER	CO	20	35	75	66	88	99	84	90	83	103
BULKCARRIERS	BU	76	90	125	109	94	83	87	82	101	106
OTHER	OT	61	57	38	70	73	94	70	5	4	-
TANKER	TK	17	40	57	40	17	10	19	24	29	45
TOTAL		**395**	**439**	**501**	**508**	**470**	**500**	**524**	**480**	**510**	**485**

Source: GPHA

6.5 Port Operation

6.5.1 Outline of Port Operations

(1) Determination of cargo handling system

To determining which the cargo handling systems to employ for each vessel calling at the port is finally decided at the Berth Meeting. The Berth Meeting takes place once daily from Monday to Friday and is attended by POM who acts as a chairman, Harbor Master, Pilot, Shipping Agency, Customs, Immigration, Police, Shippers' Council, Stevedoring Company, Ministry of Agriculture, Timber of Commerce, Forest Product Inspection Division (FPID) and others.

(2) Documentation flow for import cargo and export cargo

(3) Condition of cargo handling equipment

There are no quay side crane in good condition for cargo handling at Takoradi Port, and ship gears are mainly used for cargo handling activities.

Approximately 7% of all handling equipment owned by GPHA at Takoradi Port requires repair and is not available for service. Among types of equipment, tractors appear to be in the worst state of disrepair as 30% of the total are not in service.

(4) Present Maintenance System

All preventive maintenance and most corrective maintenance of the equipment possessed by the port authority is carried out at the maintenance shop. The number of workers in the shop is 50 persons. The shop is equipped with a lathe, shaping machine, milling machine, hack-sawing machine, drilling machines, bench grinding machines and so on.

(5) Working time

Normal working time of the GPHA staff except shift staff (the sections of shore handling, stevedoring, fire service, security office, medical office, and harbor master office) is from 8:00a.m. to 12:30p.m. and from 1:30p.m. to 5:00p.m. from Monday to Friday.

The current time schedule of 1st shift and 2nd shift of cargo handling workers is shown in Table 6.5.3.

Table 6.5.3 Overtime Schedule of the Cargo Handling Staff

1st Shift	07:30 - 12:30 and 14:00 - 17:00 with overtime period 17:00 - 19:30
2nd Shift	19:30 - 03:30 with overtime period 03:30 - 07:30.

Source: GPHA

6.5.2 Cargo Handling System

(1) Container

In the case of Takoradi port, Full Container (CO), Semi Container (CM) and Ro-Ro (RO) type vessels transport more than 90% of the total container traffic in the port. In particular, Ro-Ro type (RO) vessels transport more than 50% of the total container traffic.

The above mentioned vessels usually berth from No.2 to No.6 (depth: -8.0m to –9.6m) of the main wharf of Takoradi port. Container handling (except on Ro-Ro vessels) from/to ship is carried out mostly by ship gear, and yard handling is done mainly by a combination of forklift trucks and trailers.

(2) Clinker

Clinker is imported as dry bulk cargo in Takoradi port. The cargo is handled by a private company, Ghana Cement Company Limited (GHACEM), and all required handling equipment belongs to the company.

The imported clinker is usually transported by means of lighterage in the port. The cargo is unloaded from ship to lighter by the ship gear using grab bucket at the No.1 buoy which is the deepest in the port (depth: -10.4m). Clinker lighters move to the clinker jetty which is located to the north of the main wharf of Takoradi port. Clinker is lifted up from the lighter to the belt conveyors, which are installed on the jetty, by the crane on the jetty by using grab bucket. Storage area for clinker provided in the port are is 80,000t and productivity of conveyor belt system for clinker is 700 t/hour.

(3) Bauxite

Bauxite is exported as dry bulk cargo from the port. The cargo is handled by a private company, Ghana Bauxite Company (GBC), and all equipment for handling is owned by the company.

The vessels for export of bauxite usually berth at the Bauxite Berth (depth: -9.3m) at first, and then shift to Buoy No.1 directly or via Berth No.6. When Buoy No.1 (depth: -10.4m) is available, vessels berth there from the beginning. The cargo is usually transported from land to the vessel by means of lighterage in the port. Storage capacity of bauxite provided in the port area is 400,000t and productivity of conveyor belt for bauxite is 300-400 t/hour using a single belt.

(4) Manganese

Manganese is exported as dry bulk cargo from the port. The cargo is handled by a private company, Ghana Manganese Company Limited (GMC), and the equipment is possessed by the company.

The vessels for export of manganese usually berth at the No.1 berth (depth: -8.5m) of the main wharf, and then shift to Buoy No.1 directly or indirectly through Berth No.6 or the Bauxite Berth. Manganese is transported from land to the vessel at Buoy No.1 by means of lighterage.

At the berth side, conveyor belt system for manganese can load 6,000 t/day (about 300 t/hour) to vessels using a single belt. For direct loading to vessels, improvement works for conveyor belt system is under implementation (conveyor belt will be raised to a suitable height for lager vessels) by GMC.

(5) Sawn Timber

Sawn Timber is exported mainly as general cargo (by Ro-Ro) or containerized cargo from the port. The exported cargo is controlled by the Timber Export Development Board (TEDB).

The vessels for export of sawn timber usually berth from Berth No.2 to No.6 (depth: -8.0m to -9.6m) of the main wharf. Occasionally, cargoes are transported from land to the vessel by means of lighterage in the port.

(6) Cocoa

All cocoa is already bagged at the production site. Then many of the bags are stuffed into containers in the port. In 1999, 65% of cocoa beans was exported as containerized cargo. UNI CONTROL of private sector exports the cocoa beans as grain bulk. All the exported cocoa is controlled under the Ghana Cocoa Board (COCOBOD) of the public sector.

The cocoa is taken in and piled in the shed manually or sometime belt conveyors are used. Fumigation by powder method is carried out in the shed for seven days. After fumigation, the bags are stuffed in containers in front of the shed and moved to the quay side directly (not to the container yard) and loaded to ship by ships gear.

In the case of UNI CONTROL, the bulk cocoa is moved from the front of their own shed (where Berth No.2 to No.3 are located) to the vessel by belt conveyers directly.

All vessels, regardless of whether they transport cocoa as container cargo or as bulk, usually berth from Berth No.2 to No.6 of the main wharf.

(7) Wheat and Feedstuff (Pellet)

Wheat and feedstuff (pellet) as dry bulk cargo are handled by TAKORADI FLOUR MILL. The discharging of wheat is handled by hoppers and ship gear with productivity of 2,500 t/day and the loading of feedstuff (pellet) is handled by ship gear at a productivity of 700 t/day. Average handling period is 5-6 days for discharging (14,000 t/vessel) at berths 2-6.

(8) Quick Lime

Quick lime is imported by CARMEUSE. The discharging of Quick lime is handled by hoppers and ship gear with grabs (3.2 m^3 and 8 m^3) with a productivity of as 5,000-6,000 t/day. Average handling period is 1-2.5 days for discharging (7,000-15,000 t/vessel) at berth 6 and 4.

6.5.3 Cargo Handling Productivity

According to container handling data of GPHA from January to December 2000, the target and actual labor productivity of container handling is 28TEUs/ gross gang hour and 10TEUs/ gross gang hour to CO, 20TEUs/ gross gang hour and 6TEUs/ gross gang hour to CM, and 10TEUs/ gross gang hour and 18TEUs/ gross gang hour respectively to Ro. The target is achieved only in the case of RO.

6.5.4 Customs Inspection

In the case of Takoradi and Tema port, most imported containers are opened at the container yard for customs inspection. Most of the time that imported cargoes spend in the port area is a result of customs inspection.

Customs inspection in Ghana sea ports is described in detail in subsection 7.5.4.

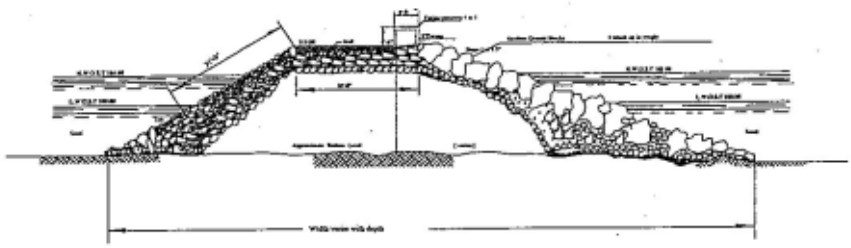
6.6 Engineering and Construction Aspects

(1) Structural Conditions of Port Main Facilities

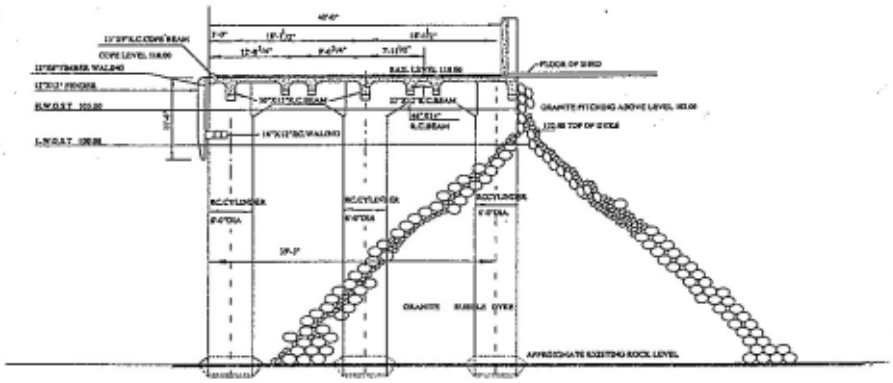
The structural conditions of the port main facilities are summarized in Table 6.6.1, and typical sections of the port main facilities are shown in Figure 6.6.1.

Table 6.6.1 Structural Conditions of Port Main Facilities

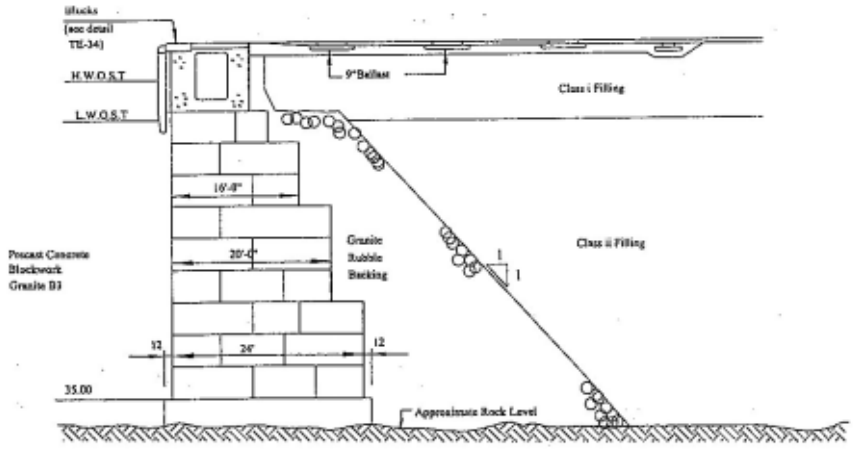
Facilities	Structural Type	Present Conditions	Remarks
1. Breakwaters -Main Breakwater -Lee Breakwater	 Rubble Mound Rubble Mound	Regular repair is required to maintain the both breakwaters. The lee side of the main breakwater, at several locations, are damaged and become steeper than originally designed. The lee breakwater is suffered from scoring and requires a periodical filling at the deeper area. Although the breakwaters are functioning well it is necessary to restore/ improve both structures from long term view point.	Major repair work on the breakwaters took place during the rehabilitation project period. Armor rock sizes be examined.
2. Mooring Facilities (Inner Harbour) -Main Wharf	 BerthNo.1-3 (Stamp piled open wharf) BerthNo.4-6 (Concrete block)	Berths 2&3 were reconstructed during the rehabilitation project period (1986-1995), whilst berths No.4~6 were constructed under the port expansion project (1952-1956). Those berths are currently in good condition though some minor damages (cracks and chipping) are seen at several locations.	Berth No. 1 (manganese berth) is seen with some deterioration thus need to be examined for a long term use.
-N. Lighter Wharf -W. Lighter Wharf -N. Log Quay -Docks/ Marine Yard	Open wharf Open wharf Open wharf Concrete	N. Lighter wharf is seriously deteriorated and dangerous conditions thus not used at present except the west end portion where used only for small port services boats. To use this wharf a reconstruction is needed. The west lighter wharf and the north log quay are not so seriously deteriorated but too shallow to use for loading cargoes.	
(Outer Harbour) -Oil Berth -Clinker Jetty	 R.C Pier & bridge Open wharf	Oil berth is well maintained and in good condition. Some deterioration is observed at several locations of Clinker jetty	Operated by private companies.
3. On-land Facilities -Sheds	 All steel frame work except a copra shed and other small sheds.	Mostly old construction however well maintained.	
-Yard and Paving	Concrete block paving	Well maintained and generally in good conditions.	



Main Breakwater



Berth No2 & No3



Berth No4 ~ No6

Figure 6.6.1 Typical Sections of Port Main Facilities

(2) Construction Materials and Equipment

1) Construction Materials

In Ghana locally available construction materials are generally limited to those such as cement, asphalt, timbers, aggregates, sand and stone materials. No steel material is locally available except for mild steel rods and the related products.

Around Takoradi area a few asphalt plants are operated and commercially available, however no commercially operated concrete plant exists. Concrete products such as concrete blocks for wall, kerb and paving woks, or concrete pipes are available however mostly for the use of road and building works.

Rock materials for use as armor rock, road chippings and for structural concrete works may be obtained from quarries exploiting a massive outcrop of granitic gneiss at Essipojn. Haulage distances are of the order of 10 km on the average.

2) Construction Equipment

Construction equipment for onshore works (mostly road and buildings works) are locally available however, no floating construction equipment for marine works other than small barges, anchor handling barges or tug boats is available locally. And the most of contractors have no experience of marine construction.

3) Unit Prices of Workers, Construction Materials and Equipment

Unit prices of locally available workers, construction materials and equipment are shown in Tables 6.6.2, 6.6.3 and 6.6.4 respectively. The unit prices indicated in those tables are based on;

- the lowest or average of lower prices obtained from various sources, and
- 1 USD = 6,700 Cedis

The prices of gasoline, diesel oil, water supply and electricity are currently controlled by the Government thus no difference between Tema and Takoradi areas.

Table 6.6.2 Construction Workers Wage (Base Wage)

Classification	Unit	Cedi	USD	Remarks
Foreman	per day	12,850	1.92	
Technician	per day	12,250	1.83	Grade1
Electrician	per day	12,250	1.83	
Operator, heavy	per day	11,600	1.73	Grade2
Driver, dump truck	per day	10,100	1.51	
Driver, ordinary	per day	10,400	1.55	
Carpenter	per day	11,600	1.73	
Form worker	per day	11,600	1.73	Grade2
Mason	per day	11,600	1.73	Grade2
Plumber	per day	11,600	1.73	Grade2
Painter	per day	11,600	1.73	Grade2
Welder	per day	11,600	1.73	Grade2
Skilled worker	per day	10,100	1.51	
Seme-skilled worker	per day	9,750	1.46	
Common labor	per day	9,450	1.41	

Table 6.6.3 Unit Costs of Construction Materials

	Unit	Cedi	USD	Remarks
Gasoline	liter	1420	0.21	
Diesel Oil	liter	1325	0.2	
Electricity	kwh	85	-	
Asphalt(MC2)	ton	2,000,000	298.5	
Asphalt(S125)	ton	1,800,000	268.7	
Sand(Quarry sand)	m^3	22,000	3.2	
Sand	m^3	27,000	4.0	
Gravel (Natural)	m^3	33,300	4.9	
Coarse aggregate	m^3	62,600	9.3	
Crushed stone for subbase	m^3	41,000	6.1	
Crushed stone for base course	m^3	45,000	6.7	
Rubble stone(50kg-500kg)	m^3	50,000	7.5	
Rubble Stone(1,000kg)	m^3	60,000	9.0	
Portland cement	ton	500,000	74.6	
Ready-mixed concrete	m^3	-	-	Not available
Reinforcing bar (Mild steel rod)	ton	2,800,000	417.9	
Welded wire mesh	ton	100,000	14.9	
Timber,plank	m^3	900,000	134.3	
Timber,square	m^3	900,000	134.3	
Plywood (12.5mmTHK)	m^3	24,000	3.6	

Table 6.6.4 Costs of Construction Equipment

Equipment	Capacity	Cedi/day	USD/day	Remarks
Bulldozer	21 ton	3,500,000	522.4	
Backhoe	0.7m^3	3,500,000	522.4	
Trailer truck	20 ton	2,500,000	373.1	
Payloader	125 HP	2,000,000	298.5	
Excavator	0.6m^3	3,500,000	522.4	
Macadam roller	10-15 ton	1,600,000	238.8	
Tire roller	8-15 ton	1,600,000	238.8	
Motor grader	3.7m	700,000	1044.8	
Vibro-roller	1 ton	2,000,000	298.5	
Truck	6 ton	2,000,000	298.5	
Truck	11 ton	2,600,000	388.1	
Dump truck	11 ton	2,600,000	388.1	
Tire-mounted crane	30 ton	9,600,000	1432.8	
Asphalt distributor	1-1.5m	2,600,000	388.1	
Asphalt finisher	1.6-3.0m	2,600,000	388.1	
Concrete finisher	3-4.5m	-	-	
Concrete mixer	0.5m^3	300,000	44.8	
Microbus	15 persons	300,000	44.8	
Off-road car	2,500cc	450,000	67.2	
Light vehicle		270,000	40.3	
Diesel generator	250KVA	250,000	37.3	
Compressor	2.0m^3/min	200,000	29.9	

Note: Fuel cost not included.

6.7 Bottlenecks of Takoradi Port

(1) Shortage/Lack of Deep Berths

- Insufficient draft of berths prevents vessels from calling Takoradi Port with full draft.
- Shortage of deep berths forces vessels to wait a long time for berthing and/or to shift to shallow berths when vessels' drafts are less.
- Double handling of cargoes. As the deepest berthing facility is Buoy No.1, many vessels use it. When the buoy is used, loading and unloading are carried out by using barges. This means that in order to load or unload cargoes to/from vessels, cargo operations are done twice. Cargo must be transported between berths and barges and then again between barges and vessels. In 2000, 74 vessels used Buoy No.1 and most of them were bulk carriers which carried clinker, manganese and bauxite.

Table 6.7.1 Distribution of Vessel Size at Takaradi Port in 2000

D.W.T	No. of Vessels	Standard Dimensions of Cargo Vessel by DWT			
		DWT	LOA (m)	Beam (m)	Draft (m)
More than 50,001	6				
40,001 - 50,000	40	40,000	200	29.9	11.8
30,001 - 40,000	39	30,000	185	27.5	11.0
18,001 - 30,000	202	18,000	161	23.6	9.6
12,001 - 18,000	93	12,000	144	21.0	8.6
Less than 12,000	225				
Total	506				

Source: Study team

(2) Space Restriction

- Narrow apron and limited space for cargo handling hamper efficient cargo handling.
- Shortage of container yard and segmentation of them hampers efficient operation
- Shortage of parking space for trucks and number of gates and insufficient gate operation causes long queue of trucks and make the port area more congested.
- As access roads to the port are very steep, heavy haulage vehicles sometimes get stalled. A new access road which has a gentler slope and detours the city center would have to be considered.

(3) Low Productivity of Cargo Handling

- Shortage of workable cargo handling equipment is one of main reasons for the low productivity.
- Because of Lack of shore cranes cargo handling productivity is limited to the permissible limits of ship gears, some of which are very slow.
- Direct loading/unloading between vessels and trucks is another reason of low productivity for break-bulk cargo.
- Customs physical inspection in the port area delays cargo movement and requests for strict and detailed documentation prolong the documentation clearance procedure.
- Lack of yard planning and inventory control of containers in container yards is a factor in the

low productivity of yard operation.

Table 6.7.2 shows the gross productivity of cargo handling by commodity at Takoradi Port in 2000.

Table 6.7.2 Gross Cargo Handling Productivity at Takoradi Port in 2000

Commodity	L/D	Type	Productivity	Unit	Remark
Cocoa Beans	L	BC	29.7	t/hour/vessel	
Cont	L/D	CO	107.9	t/hour/vessel	CO Vessel
Cont (Boxes)	L/D	CO	9.3	box/hour/vessel	CO Vessel
Cont (TEUs)	L/D	CO	12.0	TEU/hour/vessel	CO Vessel
Bauxite	L	DB	193.6	t/hour/vessel	
Clinker	D	DB	269.4	t/hour/vessel	
Cocoa Beans	L	DB	66.9	t/hour/vessel	
Manganese	L	DB	164.9	t/hour/vessel	
Wheat	D	DB	92.5	t/hour/vessel	
S/Timber	L	GC	32.7	t/hour/vessel	
Petroleum	D	LB	82.0	t/hour/vessel	
RoRo Cargo	L/D	RO	68.1	t/hour/vessel	

Source: Study team

(4) Imbalance of Containerized Cargo

- Imbalance of volume of containerized cargo between import and export causes additional transportation cost.

(5) Institutional Matters

- Lack of practical competition on port operation and vague responsibility demarcation system between the port authority and port users make the responsibility for cargo handling ambiguous and weakens initiative of the both sides to improve operation.