5.5 Maintenance System of Port Equipment

The major port equipment owned by MBPT is roughly classified into such categories as cargo handling equipment, oil handling facilities, fire-fighting equipment at the oil terminal, work vessels and port service vessels, and other mechanical/electrical facilities including electrical distribution network, dock gates and their related machinery, ship repair dock cranes, etc. This report describes mainly cargo handling equipment, oil handling facilities, and work vessels. As for other mechanical equipment, the brief information is given in the Appendix.

5.5.1 Present States of Cargo Handling Equipment

The existing cargo handling equipment for containers and general cargoes has the following features.

(1)Container Handling Equipment

MBPT has two units of quay side gantry crane (QGC), three units of rubber tired gantry crane (RTG) and two units of reach stacker (RS).

1) Container crane

The QGC, or container crane, has the following leading parameters. As for the detailed information, refer to Appendix A.2.

Location	:	Ballard Pier Station Berth
Rated load	:	35.5 MT
Number of cranes available	:	2 units
Date of commissioning	:	1984 and 1987, respectively.
Outreach	:	38.0 m
Lift above/below the rail level	:	26.0 m / 14.0 m
Portal clearance	:	15.5 m and 15.2 m, respectively.
Span of rail	:	20.0 m
Power source	:	6.6 kV, 50Hz, 3-phase

2) Transfer crane

The RTG, or transfer crane, has the following leading parameters. As for the detailed

information, refer to Appendix A.2.

Location	:	Ballard Pier Station Stacking Yard
Rated load	:	35.5MT
Number of cranes available	:	3 units
Date of commissioning	:	1982
Span	:	23.47m (6 rows of container with an additional lane for chassis)
Lift above the land level	:	15.855m (1 over 4-tear stacking of 9'6" high containers)
Power source	:	Diesel engine and generator, 312BHP

3) Reach stacker

The RS, or reach stacker for handling containers, has the following leading parameters. As for the detailed information, refer to Appendix A.2.

Location	:	Rail Container Depot
Rated load	:	42MT at 1800mm
Number of stackers available	:	2 units
Date of commissioning	:	1996
Power source	:	Diesel engine, 250HP

(2)Electric Wharf Cranes for Handling General Cargoes

Electric level luffing wharf cranes are used for handling general cargoes and also to carry out the Department work. They number 68 units, all of which are installed at the wharves of Indira Dock excepting four units at the Ballard Pier Extension. The outline of these cranes is as described hereunder. As for the detailed information, refer to Appendix A.3.

1) 3-Ton capacity electric wharf crane

Rated Load	:	3 Ton
Number of cranes available	:	44 units
Year of built	:	4 nos. in 1961, 38 nos. in 1962, and 2 nos. in 1963. (Year of built is based on a capacity plate on each crane.)
Working radius	:	Max. 63ft. / Min. 20ft. for 36 nos. Max. 75ft. / Min.22ft. for 8 nos.
Span of crane rail	:	3.66m or 4.27m

Eleven(11) nos. of 3-Ton electric wharf crane are out of use due to being damaged or lack

of spare parts, and to be disposed.

2) 6-Ton capacity electric wharf crane

Rated Load	:	6 Ton
Number of cranes available	:	20 units
Year of built	:	9 nos. in 1963, 9 nos. in 1970, and 2 nos. in 1973.
		(Year of built is based on a capacity plate on each crane.)
Working radius	:	Max. 63ft. / Min. 20ft. for 9 nos.
		Max. 23m / Min. 7m for 11 nos.
Span of crane rail	:	3.66m or 4.27m

Four(4) nos. of 6-Ton electric wharf crane are out of use due to being damaged or lack of spare parts, and to be disposed.

3) 13-Ton capacity electric wharf crane

Rated Load	:	13 Ton / 21Ton
Number of cranes available	:	4 units
Year of built	:	1976
		(Year of built is based on a capacity plate on each crane.)
Working radius	:	Max. 22.5m / Min. 6m
Span of crane rail	:	7.00m

(3)Mobile Type Cargo Handling Equipment

The mobile type cargo handling equipment includes mobile cranes, forklift trucks, and tractors. The floating cranes are also used for handling heavy cargoes, which are described in Clause 5.5.6.

1) Mobile cranes

The following three types of mobile crane are used for shifting import and export cargoes at the wharves and also used to carry out the Department work. As for the detailed information, refer to Appendix A.4.

Crawler crane	Capacity	:	30 Ton
	Number of units available	:	2 units
	Year of purchase	:	1965 and 1966
Port tower crane	Capacity	:	20 Ton

	Number of units available	:	2 units
	Year of purchase	:	1981 to 1983
Mobile crane	Capacity	:	14 Ton
	Number of units available	:	25 units
	Year of purchase	:	15 nos. in 1983 and 1984
			10 nos. in 1991 and 1992.

2) Forklift truck

The 3-Ton capacity Diesel driven forklift trucks are used for handling loose packages, small light steel coils, palletized cargoes, paper rolls, paper wood pulp, liquid containers, wooden logs and other general cargoes, and also to carry out the Department work. The 1.5-Ton and 1-Ton capacity battery operated electric forklift trucks are used for handling loose packages, palletized cargoes, small liquid containers and other general cargoes in the multistory warehouse. Heavy duty Diesel driven forklift trucks with 16-Ton capacity are used for heavy loose packages, steel coils, palletized cargoes, liquid container and other general heavy cargoes. Forklift trucks are summarized in the followings. As for the detailed information, refer to Appendix A.4.

a) 3-Ton forklift truck (Diesel driven)

Number of units available	:	43 units
Year of purchase	:	1988 to 1995

b) 1.5-Ton and 1-Ton forklift truck (Battery operated electric motor driven)

Number of units available	:	10 units
Year of purchase	:	1993 and 1994

c) 16-Ton heavy duty forklift truck

Number of units available	:	4 units
Year of purchase	:	1995 and 1996

3) Tractor

There are 32 units of tractor with draw bar pull capacity of 2,800kgs, which are used for pulling trolleys and water tankers, and also to carry out the Department work. They were procured in from 1980 to 1992. As for the detailed information, refer to Appendix A.4.

5.5.2 Present States of Oil Handling Facilities

Oil loading/unloading is carried out at Marine Oil Terminal, Jawahar Dweep. Liquid chemicals, LPG, LSHS, and others are handled at New Pir Pau Pier. The schematic diagram of the existing pipelines is given in Figure 5.5.1 and the outline of these facilities is as under.

(1)Marine Oil Terminal

1) Ship berthing facility

Number of jetties	:	4 nos.	
Tonnage of the ships berthed	:	Jetty No.1	55,000DWT
		Jetty No.2	55,000DWT
		Jetty No.3	55,000DWT
		Jetty No.4	120,000DWT

2) Loading/Unloading facilities at Jetty Nos.1, 2 and 3

Method of ship to shore connection	:	By flexible hoses.
Method of product evacuation	:	Through pipe lines.
No. of pipe lines	:	7 nos.
Length of pipe lines up to Pir Pau Manifold	:	4.7km

3) Nomenclature, size and discharge rate of all the 7 pipe lines

Table 5.5.1 Outline of the Pipelines at MOT

Nomenclature	Size	Product handled	Discharge rate
Bombay High	24"	Crude oil	4,000t/h at 150psi (for loading)
C-1	24"	Crude oil	2,000t/h at 150psi
C-2	24"	Crude oil	2,000t/h at 150psi
B-1	24"	Black oil Product (LDO, FO)	2,000t/h at 150psi
W-1	16"	White oil / Naphtha, LAM/HAN	800t/h at 150psi
W-2	16"	White oil , HSD	800t/h at 150psi
W-3	12"	White oil flushing line for SKO, MS, AFT	250t/h at 150psi

All the above lines except Bombay High are connected to Manifold at Pir Pau. From Manifold to BPCL and HPCL Refineries the pipe lines are owned by the Refineries themselves. The lines leading to marketing installations at Sewree and Wadala, and Bunker lines for Docks and Indian Navy are owned by MBPT.

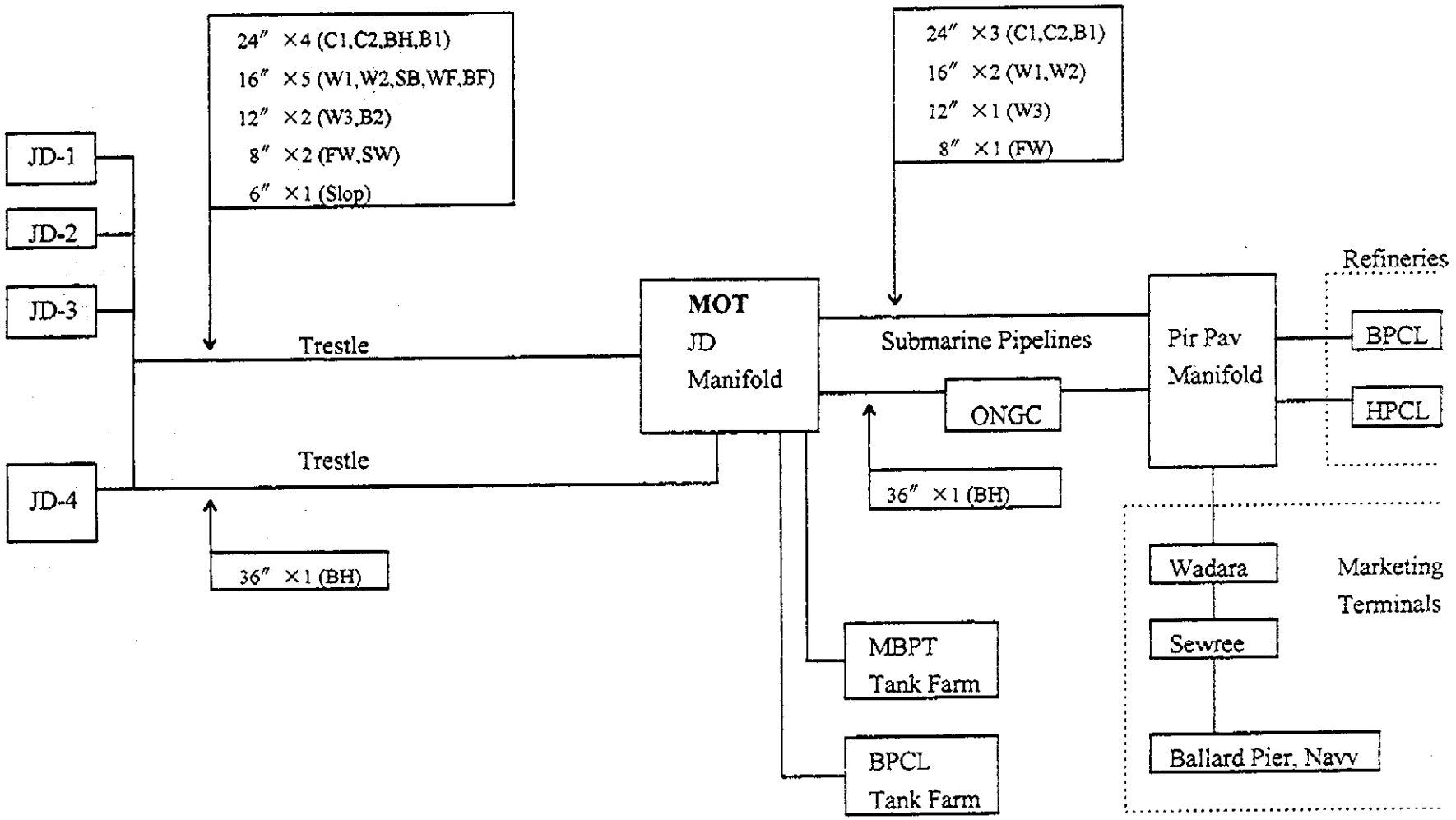


Figure 5.5.1 Schematic Diagram of Existing Pipelines of Marine Oil Terminal (MOT)

4) Loading facilities at Jetty No.4

Mode of ship to shore connection	:	Through marine loading arms.
No. of loading arms and their discharge rate	:	5 nos., 1,700 t/h at 10kg/cm^2
Dimensions of loading arms	:	Bore size 12"
		Height 74 ft.
Method of product loading	:	Through pipe line.
Number of pipe lines	:	5 nos.
Name, size and length of the pipe lines	:	Bombay High Line 36"×7.2km
		Import Crude Line 36"×2.5km
		Bunker Oil Line 12"×2.5km
		Dirty Ballast Line 18"×2.5km
		Slop Line 6"×2.5km
Discharge rate permitted through the pipe line:		6,000 t/h at 150psi

5) Details of pipe lines from Jetty Nos.1, 2, and 3 to MBPT Tank Farm at MOT , J.D.

Slop Line	:	6"
Dirty Ballast Line	:	16"
Fresh Water Line	:	8"
Salt Water Line	:	8"
Bunker Line	:	12"
Black Oil Flushing Line	:	16"

6) Details of Tanks of MBPT Tank Farm

Table 5.5.2 Tanks of MBPT Tank Farm

Tank No.	Capacity in kilo litre	Product stored	Year of installation
1	6,752.83	F.O.	1954
2	7,513.61	Fresh water for flushing	1954
3	2,647.40	LDO	1954
4	2,572.47	LDO	1954
5	770.63	Slop	1954
6	4,544.61	Dirty Ballast	1954
7	4,544.61	Naphtha	1954
8	10,244.00	Dirty Ballast	1984
9	101,841.00	LDO (for MBPT Power House)	1954
10	101,841.00	LDO (for MBPT Power House)	1954

7) Details of Tanks of M/s BPCL Tank Farm

Table 5.5.3 Tanks of M/s BPCL Tank Farm

Tank No.	Capacity in kilo litre	Product stored	Year of installation
11	32,000	HSD	1984
12	32,000	HSD	1984
13	32,000	SKO	1984
14	22,000	SKO	1984
15	22,000	HSD	1984
16	22,000	HSD	1984

8) Details of pipe lines from Pir Pau Manifold to Marketing Installations of Oil Companies

Table 5.5.4 Pipelines from Pir Pau Manifold to Marketing Installations of Oil Company

Name	Size	Product handled	Length	Year of installation
Flushing Line	14"	SKO, MS	7.8km	1987/88
Black Oil Line	14"	LDO and F.O.	7.6km	1955
HSD Line Flushing	14"	HSD	7.6km	1966
Cast Iron Line	12"	SKO, MS	7.6km	1954
SKO Product Line	14"	SKO	7.6km	1966
Bunker Line from Sewree Point up to Naval Dock	12"	LDO and F.O.	12km	1994

Note: One Bunker Outlet is provided on each berth in Prince's Dock, Victoria Dock and Indira Dock.

(2)Loading/Unloading of Liquid Chemicals, LPG, LSHS, etc.

Liquid chemicals, LPG, LSHS, and others are loaded and unloaded at New Pir Pau Pier. The outline of the facilities is as under.

1) General details

Name of Jetty	:	New Pir Pau Pier
Number of Jetties	:	1 nos.
Tonnage of ships berthed	:	35,000DWT
Length of Jetty	:	200m
Date of construction	:	1996

2) Loading/Unloading facilities

Method of ship to shore connection : By marine loading arms.

Method of product evacuation : Through pipe lines.

Number of pipe lines : 10 nos.

Length of pipe lines : Average 6km to 7km

3) Details of pipe lines

Table 5.5.5 Pipelines and their Owner

Name of Owner	Size	Product handled	Discharge rate
Tata Electric Co.	24"	LSWR/LSHS	1,000t/h
BPCL	300mm	Pressurized LPG	250t/h
IOBL	350mm	Lube Oil	300-450 kilo litre/h
HPCL	300mm	Lube Oil	300-450 kilo litre/h
CTTL	200mm	Chemicals	300-350 kilo litre/h
CTTL	200mm	Chemicals	300-350 kilo litre/h
AGIES	300mm	Cryogenic LPG	450 t/h
AGIES	150mm	Cryogenic LPG	450 t/h
AGIES	300mm	Chemicals	600 kilo litre/h
AGIES	300mm	Chemicals	600 kilo litre/h

4) Details of loading arms

Table 5.5.6 Loading Arms and their Owner

Owner	Size	Mode of operation	Product handled
Tata Electric Co.	12"	Hydraulic	LSHS/LSWR
AGIES	8"	Manual	LPG
AGIES	8"	Manual	Chemicals
IOBL	12"	Hydraulic	Lube Oil
CTTL	8"	Manual	Chemicals

5.5.3 Present States of Fire-fighting Equipment

The general information about the fire-fighting facilities at MOT, J.D. and Pir Pau oil handling installation/jetties is as follows.

(1)Fire-fighting Facilities Provided at New Pir Pau Pier for Handling Liquid Chemicals

The size of fire water mains is 250mm diameter along the length of trestle between Oil Pier

and New Pier, and 450mm diameter between Pump House and Water/Foam Monitors at the Jetty, respectively. The length of fire mains is 2.1km for 250mm diameter line and 160m for 450mm diameter line. There are 77 nos. hydrants located at 30m intervals along 250mm diameter fire water main. As fire alarm system 56 manual call points are located along the length of old and new trestle. These are divided into 11 zones and are connected to the fire alarm panel located above the pump house. Heat detectors and smoke detectors are also provided in the transformer rooms and the electric panel room, respectively.

The leading particulars of the equipment are as follows;

Main Pumps	Capacity	:	$600m^3/h$ at 160m Aq.
	Quantity	:	3 nos.
	Date of installation	:	October, 1996.
	Type of prime mover	:	2 nos. Diesel Engine driven
			1 no. Electric motor driven
	Diesel engine	:	604BHP×1500rpm×2 nos.
	Electric motor	:	380kW×1500rpm×1 no.
Jocky Pumps	Capacity	:	$48m^3/h$ at 70mAq.
	Quantity	:	2 nos.
Foam Pumps	Capacity and nos.	:	$77m^3/h$ at 1900mAq.×2 nos.

(2)Fire-fighting Facilities Provided at Pir Pau Manifold and Old Pier for Handling Liquid Chemicals

The leading particulars of the equipment are as follows;

Size and length of fire main		:	300mm ϕ ×2km
Hydrants		:	At 30m intervals along the length of fire main.
Main Pumps	Capacity	:	$270m^3/h$ at 150m Aq.
	Quantity	:	2 nos.
	Date of installation	:	1991 and 1992, respectively
	Type of prime mover	:	1 no. Diesel Engine driven
			1 no. Electric motor driven
	Diesel engine	:	250BHP×1500rpm

Electric motor		:	180kW×1500rpm

(3)Fire-fighting Facilities at MOT

There are two facilities, i.e. Old Salt Water Pump House and Fourth Oil Berth Pump House. Old Salt Water Pump House, of which replacement is planned under modernization programme of berth Nos. 1, 2 and 3, has the following specifications;

Main Pumps	Capacity	:	600GPM at 500FT bowl head
	Quantity	:	3 nos.
	Type	:	Vertical Turbine Pump
	Type of prime mover	:	2 nos. Electric motor driven
			1 no. Diesel engine driven
	Date of installation	:	1954

Fourth Oil Berth Pump House has the following specifications;

Size of fire water mains		:	8"diameter for Jetty Nos.1, 2 and 3, and Tank Farm
			18" diameter for Jetty No.4
Length of fire mains		:	6km
Hydrants		:	At 30m intervals along the length of fire main
Fire-fighting equipment provided at Jetties		:	2 nos. of Tower Monitors for water/ foam on each jetty.
Main Pumps	Capacity	:	540m^3/h at 150mAq.
	Quantity	:	2 nos.
	Type	:	Vertical Turbine Pump
	Type of prime mover	:	Electric motor driven
	Electric motor	:	425 HP×1500rpm
	Date of installation	:	1984

5.5.4 Availability and Utilization of Cargo Handling Equipment

(1)Container Handling Equipment

Availability and utilization of the existing two units of QGCs and three units of RTGs for the latest three years are summarized in Table 5.5.7 and Table 5.5.8, respectively.

Table 5.5.7 shows that the percentage of availability of QGCs is about 83% on the average for the latest three years, while the percentage of utilization about 36% on the average. MBPT has norms with respect to availability and utilization of QGCs, which shall be 85% and 35%, respectively.

Number of containers handled per engine hour is about 11.4 boxes per hour on the average, i.e. about 14.6 TEUs per hour on the average. This result seems to be rather low when compared with an average of other ports out of the country. Although number of containers handled will increase in proportion to the operation hours, container handling efficiency depends greatly on a systematic operation of the terminal, and the good combination of operations among quay side gantry cranes, marshaling yard equipment and inter-linking transporting vehicles is very important. In this sense there are much room for improvement of container handling efficiency in the Port.

Table 5.5.8 shows the same format of data with respect to the transfer cranes in the container stacking yard. The percentage of availability and that of utilization are almost of same values as those of container cranes. MBPT's norms with respect to availability and utilization of RTGs shall be 85% and 35%, respectively.

Containers handled per engine hour by these RTGs are about 12.5 boxes per hour on the average, i.e. 15.8 TEUs per hour on the average. Systematic operation and management should also be studied to improve a container handling efficiency in the Port.

As for the reach stackers which were just introduced into the Port in October 1996, there are few actual data obtained yet. According to the data so far the percentage of availability and that of utilization are about 87% and 33%, respectively.

Table 5.5.7 Availability and Utilization of Quayside Gantry Cranes at BPS

SR No.	Description	QGC-1			QGC-2			Remarks (Average)
		1994-95	1995-96	1996-97	1994-95	1995-96	1996-97	
1	No. of containers handled	31220	48983	44805	35541	28803	23713	36549.0
2	No. of TEUs handled	42300	60242	60101	43153	35105	30229	46557.0
3	No. of engine hours worked	2605.1	3864.1	3414.3	3017.4	3270.8	2458.9	3194.1
4	No. of actual shifts worked	703.5	862	831	833	816	742	821.8
5	Hours lost due to B/D	2117.8	492.3	184.5	280.3	368.2	584.2	682.9
6	Hours lost due to change over shift	1088.5	1016	746	1332.5	1203	1052	1100.2
7	Hours lost due to maintenance	425	710	811	876.2	720.25	792.7	746.8
8	Hours lost due to labour problem	0	0	0	0	0	0	0
9	Shifts lost due to bad weather	0	0	0	0	0	0	0
10	Shifts lost due to other reasons *1	390.5	234	171	257	283	260	272.4
11	Max. availability during the year *2	8760	8784	8016	8760	8784	8016	8762.9
12	Time lost due to B/D and maintenance	2542.8	1202.3	995.5	1156.5	1088.5	1376.9	1429.7
13	Actual available hours *3	6217.2	7581.7	7020.5	7603.5	7695.6	6639.1	7333.2
14	No. of Idle hours *4	3612.1	3717.6	3606.2	4586.1	4424.8	4180.2	4139.1
15	Percentage of availability *5 (%)	70.97	86.31	87.58	86.80	87.61	82.82	83.68
16	Percentage of utilization *6 (%)	29.74	43.99	42.59	34.45	37.24	30.67	36.45
17	Container handled per shift	44.38	56.82	53.92	42.67	35.30	31.96	44.48
18	TEUs handled per shift	60.13	69.89	72.32	51.80	43.02	40.74	56.66
19	Container handled per engine hour	11.98	12.68	13.12	11.78	8.81	9.64	11.44
20	TEUs handled per engine hours	16.24	15.59	17.60	14.30	10.73	12.29	14.58

(Source : MBPT)

Note: *1 : Reasons are classified into Supplied but not used, Not supplied due to shortage of staff, Not required by Traffic Dept., Breakdown shifts, Maintenance shifts, Holidays, Rain, Accident and Fuel shortage.

*2 : Item 11 = Available days per year x 24 hours per day

*3 : Item 13 = Item 11 - Item 12

*4 : Item 14 = Item 13 - Item 3

*5 : Iten 15 = Item 13 / Item 11 x 100%

*6 : Item 16 = Item 3 / Item 11 x 100%

** The data of 1996-97 include those up to Feb.1997. In calculation of average their annual values are assumed by multiplying 12/11 to the actual values up to Feb. 1997.

Table 5.5.8 Availability and Utilization of Rubber Tyred Gantry Cranes at BPS

SR No.	Description	RTG-1			RTG-2			RTG-3			Remarks (Average)
		1994-95	1995-96	1996-97	1994-95	1995-96	1996-97	1994-95	1995-96	1996-97	
1	No. of containers handled	44170	31564	23649	44316	39498	31478	30742	38825	30541	35841.2
2	No. of TEUs handled	55659	38794	32580	55642	49688	39839	38751	49107	39452	45520.2
3	No. of engine hours worked	3432.3	2549.3	1981.1	3621.5	3074.8	2437.4	2483.8	3222.1	2455.3	2875.8
4	No. of actual shifts worked	928	710	590	955	845	720	755	864	701	805.6
5	Hours lost due to B/D	93.5	764	222.4	263	547.5	412	1107.5	864.1	207.5	506.4
6	Hours lost due to change over shift	1401	1023	912.7	1330.25	1258.5	1076.5	1326.2	1203	1052	1206.6
7	Hours lost due to maintenance	502	1782.25	1928.5	443.5	644	713.25	492.25	491	952.5	919.6
8	Hours lost due to labour problem	0	0	0	0	0	0	0	0	2	0.2
9	Shifts lost due to bad weather	0	0	0	0	0	0	0	0	0	0
10	Shifts lost due to other reasons *1	166	387	416	166	253	281	324	243	257	286.6
11	Max. availability during the year *2	8760	8784	8016	8760	8784	8016	8760	8784	8016	8762.9
12	Time lost due to B/D and maintenance	595.5	2546.3	2150.9	706.5	1191.5	1125.3	1599.8	1355.1	1160.0	1426.0
13	Actual available hours *3	8164.5	6237.8	5865.1	8053.5	7592.5	6890.8	7160.3	7428.9	6856.0	7336.9
14	No. of Idle hours *4	4732.2	3688.5	3884.0	4432.0	4517.7	4453.4	4676.5	4206.8	4400.7	4461.1
15	Percentage of availability *5 (%)	93.20	71.01	73.17	91.93	86.44	85.96	81.74	84.57	85.53	83.73
16	Percentage of utilization *6 (%)	39.18	29.02	24.71	41.34	35.00	30.41	28.35	36.68	30.63	32.82
17	Container handled per shift	47.60	44.46	40.08	46.40	46.74	43.72	40.72	44.94	43.57	44.49
18	TEUs handled per shift	59.98	54.64	55.22	58.26	58.80	55.33	51.33	56.84	56.28	56.50
19	Container handled per engine hour	12.87	12.38	11.94	12.24	12.85	12.91	12.38	12.05	12.44	12.46
20	TEUs handled per engine hours	16.22	15.22	16.45	15.36	16.16	16.34	15.60	15.24	16.07	15.83

(Source : MBPT)

Note: *1 to *6 : Refer to Note *1 to *6 in Table 5.5.7.

(2)Electric Wharf Cranes

Electric wharf cranes of both 3-Ton and 6-Ton capacity are rather aged. Fifty-five cranes of the sixty-four ones, or about 86% of the whole cranes, were manufactured in 1961/1963.

Table 5.5.9 shows the availability and the utilization of 3-Ton and 6-Ton capacity electric wharf cranes for the latest four years. The sum of hours lost due to scheduled maintenance and hours under major breakdown occupied about 13% (Gross) of the maximum hours available during the year on the average, and the hours lost due to breakdown required 2.3 times the hours lost due to scheduled maintenance.

Availability on the basis of Gross ranges from about 84% to 90%, and that on the basis of Net about 30% to 40%, while utilization on the basis of both Gross and Net ranges from 24% to 32% and from 71% to 96%, respectively. The difference between Gross basis index and Net basis index depends on whether hours lost due to recess and non-working hours are considered or not. MBPT has norms with respect to the availability and the utilization of 3-Ton and 6-Ton capacity electric wharf cranes, which shall be 85% and 35%, respectively.

As for 13-Ton capacity electric wharf cranes, the same format of data is shown in Table 5.5.10. The sum of hours lost due to scheduled maintenance and hours under major breakdown occupied about 17% (Gross) of the maximum hours available during the year on the average. The hours lost due to breakdown are also greater than those lost due to scheduled maintenance.

Availability on the basis of Gross ranges from about 74% to 94%, and that on the basis of Net about 36% to 52%, while utilization on the basis of both Gross and Net ranges from 16% to 19% and from 30% to 46%, respectively. MBPT has norms with respect to availability and utilization of 13-Ton capacity electric wharf cranes, which shall be 85% and 35%, respectively.

Table 5.5.9 Availability and Utilization of Electric Wharf Cranes of MBPT (1)

Year in service		Apr.1993-Mar.1994		Apr.1994-Mar.1995		Apr.1995-Mar.1996		Apr.1996-Feb.1997	
Rated capacity of the equipment		3T, 6T		3T, 6T		3T / 6T		3T / 6T	
No. of equipment	(unit)	NOTE *A		NOTE *B		NOTE *C		49	
1. Total No. of hours available (Gross) *1	(h/y)	591,240		515,140		434,808		392,784	
2. No. of hrs. lost due to scheduled maintenance	(h/y)	26,380	4.5% *2	17,576	3.4%	21,108	4.9%	13,184	3.4%
3. No. of hours under major breakdown	(h/y)	32,272	5.5% *3	47,232	9.2%	49,378	11.4%	29,088	7.4%
4. Actual equipment available hours (Gross) *4	(h/y)	529,588		450,332		364,322		350,512	
5. Hours lost due to recess and non-working hrs.	(h/y)	353,990	59.9% *5	282,830	54.9%	218,148	50.2%	194,360	49.5%
6. Actual equipment available hours (Net) *6	(h/y)	175,598		167,502		146,174		156,152	
7. Availability on the basis of Gross *7			89.57%		87.42%		83.8%		89.2%
8. Availability on the basis of Net *8			29.70%		32.52%		33.6%		39.8%
Availability Norms		85%		85%		85%		85%	
9. Hours actually worked during the year	(h/y)	143,568		142,480		140,950		110,014	
10. Utilization on the basis of Gross *9			24.28%		27.66%		32.4%		28.0%
11. Utilization on the basis of Net *10			81.76%		85.06%		96.4%		70.5%
Utilization Norms		35%		35%		35%		35%	

(Source : Administration Report of MBPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : Item 4 = Item 1 - Item 2 - Item 3
*5 : = Item 5 / Item 1 x 100%
*6 : Item 6 = Item 4 - Item 5
*7 : Item 7 = Item 4 / Item 1 x 100%
*8 : Item 8 = Item 6 / Item 1 x 100%
*9 : Item 10 = Item 9 / Item 1 x 100%
*10 : Item 11 = Item 9 / Item 6 x 100%

NOTE *A : From Apr. 93 to Jun. 93 75 Nos.
: From July 93 to Mar. 94 65 Nos.

*B : From 01/04/94 to 31/10/94 65 Nos.
From 01/11/94 to 31/03/95 50 Nos.

*C : From 01/04/95 to 30/06/95 50 Nos.
From 01/07/95 to 31/03/96 49 Nos.

Remarks : Availability has been calculated on the basis of 24 hours while utility has been calculated on the basis of 20 hours (i.e. day shifts-8 hours and II and III shift-6hours).

Table 5.5.10 Availability and Utilization of Electric Wharf Cranes of MBPT (2)

Year in service		Apr.1993-Mar.1994		Apr.1994-Mar.1995		Apr.1995-Mar.1996		Apr.1996-Feb.1997	
Rated capacity of the equipment		13T		13T		13T		13T	
No. of equipment	(unit)	4		4		4		4	
1. Total No. of hours available (Gross) *1	(h/y)	35,040		35,040		35,136		32,064	
2. No. of hrs. lost due to scheduled maintenance	(h/y)	1,584	4.5% *2	56	0.2%	1,304	3.7%	888	2.8%
3. No. of hours under major breakdown	(h/y)	4,244	12.1% *3	2,158	6.2%	4,131	11.8%	7,488	23.4%
4. Actual equipment available hours (Gross) *4	(h/y)	29,212		32,826		29,701		23,688	
5. Hours lost due to recess and non-working hrs.	(h/y)	14,600	41.7% *5	14,600	41.7%	14,584	41.5%	12,024	37.5%
6. Actual equipment available hours (Net) *6	(h/y)	14,612		18,226		15,117		11,664	
7. Availability on the basis of Gross *7			83.37%		93.68%		84.53%		73.88%
8. Availability on the basis of Net *8			41.70%		52.01%		43.02%		36.38%
Availability Norms		88%		88%		85%		85%	
9. Hours actually worked during the year	(h/y)	5,944		5,474		6,696		5,396	
10. Utilization on the basis of Gross *9			16.96%		15.62%		19.06%		16.83%
11. Utilization on the basis of Net *10			40.68%		30.03%		44.29%		46.26%
Utilization Norms		35%		35%		35%		35%	

(Source : Administration Report of MBPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : Item 4 = Item 1 - Item 2 - Item 3
*5 : = Item 5 / Item 1 x 100%
*6 : Item 6 = Item 4 - Item 5
*7 : Item 7 = Item 4 / Item 1 x 100%
*8 : Item 8 = Item 6 / Item 1 x 100%
*9 : Item 10 = Item 9 / Item 1 x 100%
*10 : Item 11 = Item 9 / Item 6 x 100%

Remarks : Availability has been calculated on the basis of 24 hours while utility has been calculated on the basis of 20 hours (i.e. day shift-8 hours and II and III shift-6 hours).

(3)Mobile Type Cargo Handling Equipment

Table 5.5.11 shows the availability and the utilization of Crawler Cranes for the latest four years. The availability on the basis of Gross ranges from 84% to 94%, and that on the basis of Net from 17% to 27%, while the utilization on the basis of Gross ranges from 2% to 6%, and that on the basis of Net from 7% to 25%. The difference between Gross basis index and Net basis index depends on whether hours lost due to recess and non-working hours are considered or not. Those hours occupied 67% (Gross) of the maximum availability during the year.

Table 5.5.12 shows the availability and the utilization of Tower Cranes for the same period. The availability on the basis of Gross ranges from 66% to 85%, and that on the basis of Net from 25% to 43%, while the utilization on the basis of Gross ranges from 15% to 22%, and that on the basis of Net from 51% to 62%. Hours lost due to recess and non-working hours occupied about 42% (Gross) of the maximum availability during the year. MBPT has norms with respect to the availability and the utilization of Tower Cranes, which shall be 85% and 30%, respectively.

Table 5.5.13 shows the availability and the utilization of Mobile Cranes for the latest four years. The availability on the basis of Gross ranges from 83% to 88%, and that on the basis of Net from 66% to 72%, while the utilization on the basis of Gross ranges from 19% to 23%, and that on the basis of Net from 28% to 35%. Hours lost due to recess and non-working hours occupied about 17% (Gross) of the maximum availability during the year. MBPT has norms with respect to the availability and the utilization of Mobile Cranes, which shall be 83.5% and 30%, respectively.

Table 5.5.14 shows the availability and the utilization of Forklift trucks for the same period. The availability on the basis of Gross ranges from 87% to 90%, and that on the basis of Net from 65% to 72%, while the utilization on the basis of Gross ranges from 19% to 26%, and that on the basis of Net from 26% to 40%. Hours lost due to recess and non-working hours occupied about 17% to 25% (Gross) of the maximum availability during the year. MBPT has norms with respect to the availability and the utilization of Forklift trucks, which shall be 77.5% and 35%, respectively.

Table 5.5.15 shows the availability and the utilization of Tractors for the same period. The availability on the basis of Gross ranges from 82% to 91%, and that on the basis of Net from 65% to 74%, while the utilization on the basis of Gross ranges from 23% to 25%, and that on

the basis of Net from 30% to 36%. Hours lost due to recess and non-working hours occupied about 17% (Gross) of the maximum availability during the year. MBPT's norms as to the availability and the utilization of Tractors shall be 90% and 60%, respectively.

Table 5.5.11 Availability and Utilization of Crawler Cranes of MBPT

Year in service		Apr.1993-Mar.1994		Apr.1994-Mar.1995		Apr.1995-Mar.1996		Apr.1996-Feb.1997	
Rated capacity of the equipment		30T		30T		30T		30T	
No. of equipment	(unit)	2		2		2		2	
1. Total No. of hours available (Gross) *1	(h/y)	17,520		17,520		17,568		16,032	
2. No. of hrs. lost due to scheduled maintenance	(h/y)	432	2.5% *2	344	2.0%	392	2.2%	240	1.5%
3. No. of hours under major breakdown	(h/y)	616	3.5% *3	720	4.1%	1,360	7.7%	2,312	14.4%
4. Actual equipment available hours (Gross) *4	(h/y)	16,472		16,456		15,816		13,480	
5. Hours lost due to recess and non-working hrs.	(h/y)	11,680	66.7% *5	11,680	66.7%	11,712	66.7%	10,688	66.7%
6. Actual equipment available hours (Net) *6	(h/y)	4,792		4,776		4,104		2,792	
7. Availability on the basis of Gross *7			94.02%		93.93%		90.03%		84.08%
8. Availability on the basis of Net *8			27.35%		27.26%		23.36%		17.42%
Availability Norms									
9. Hours actually worked during the year	(h/y)	314		448		1,018		454	
10. Utilization on the basis of Gross *9			1.79%		2.56%		5.79%		2.83%
11. Utilization on the basis of Net *10			6.55%		9.38%		24.81%		16.26%
Utilization Norms									

(Source : Administration Report of MBPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : Item 4 = Item 1 - Item 2 - Item 3
*5 : = Item 5 / Item 1 x 100%
*6 : Item 6 = Item 4 - Item 5
*7 : Item 7 = Item 4 / Item 1 x 100%
*8 : Item 8 = Item 6 / Item 1 x 100%
*9 : Item 10 = Item 9 / Item 1 x 100%
*10 : Item 11 = Item 9 / Item 6 x 100%

Remarks : Crawler cranes are utilized in the day shift only.
Availability has been calculated on the basis of 24 hours while utility has been calculated on the basis of 20 hours (i.e. day shift 8 hours and evening shift 6 hours and night shift 6 hours).

Table 5.5.12 Availability and Utilization of Tower Cranes of MBPT

Year in service		Apr.1993-Mar.1994		Apr.1994-Mar.1995		Apr.1995-Mar.1996		Apr.1996-Feb.1997	
Rated capacity of the equipment		20T		20T		20T		20T	
No. of equipment	(unit)	2		2		2		2	
1. Total No. of hours available (Gross) *1	(h/y)	17,520		17,520		17,568		16,032	
2. No. of hrs. lost due to scheduled maintenance	(h/y)	736	4.2% *2	456	2.6%	416	2.4%	272	1.7%
3. No. of hours under major breakdown	(h/y)	1,928	11.0% *3	2,376	13.6%	5,528	31.5%	2,480	15.5%
4. Actual equipment available hours (Gross) *4	(h/y)	14,856		14,688		11,624		13,280	
5. Hours lost due to recess and non-working hrs.	(h/y)	7,300	41.7% *5	7,300	41.7%	7,320	41.7%	6,680	41.7%
6. Actual equipment available hours (Net) *6	(h/y)	7,556		7,388		4,304		6,600	
7. Availability on the basis of Gross *7			84.79%		83.84%		66.17%		82.83%
8. Availability on the basis of Net *8			43.13%		42.17%		24.50%		41.17%
Availability Norms		85%		85%		85%		85%	
9. Hours actually worked during the year	(h/y)	3,816		3,798		2,656		2,750	
10. Utilization on the basis of Gross *9			21.78%		21.68%		15.12%		17.15%
11. Utilization on the basis of Net *10			50.50%		51.41%		61.71%		41.67%
Utilization Norms		30%		30%		30%		30%	

(Source : Administration Report of MBPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : Item 4 = Item 1 - Item 2 - Item 3
*5 : = Item 5 / Item 1 x 100%
*6 : Item 6 = Item 4 - Item 5
*7 : Item 7 = Item 4 / Item 1 x 100%
*8 : Item 8 = Item 6 / Item 1 x 100%
*9 : Item 10 = Item 9 / Item 1 x 100%
*10 : Item 11 = Item 9 / Item 6 x 100%

Remarks : Tower cranes are utilized for day shift and evening shift.
Availability has been calculated on the basis of 24 hours while utility has been calculated on the basis of 20 hours (i.e. day shift 8 hours and evening shift 6 hours and night shift 6 hours).

Table 5.5.13 Availability and Utilization of Mobile Cranes of MBPT

Year in service		Apr.1993-Mar.1994		Apr.1994-Mar.1995		Apr.1995-Mar.1996		Apr.1996-Feb.1997	
Rated capacity of the equipment		11T / 14T		14T		14T		14T	
No. of equipment	(unit)	NOTE *A		NOTE *B		NOTE *C		25	
1. Total No. of hours available (Gross) *1	(h/y)	251,328		243,120		232,800		200,400	
2. No. of hrs. lost due to scheduled maintenance	(h/y)	2,744	1.1% *2	2,472	1.0%	2,464	1.1%	2,216	1.1%
3. No. of hours under major breakdown	(h/y)	26,712	10.6% *3	37,944	15.6%	37,416	16.1%	31,574	15.8%
4. Actual equipment available hours (Gross) *4	(h/y)	221,872		202,704		192,920		166,610	
5. Hours lost due to recess and non-working hrs.	(h/y)	41,888	16.7% *5	40,520	16.7%	38,800	16.7%	33,404	16.7%
6. Actual equipment available hours (Net) *6	(h/y)	179,984		162,184		154,120		133,206	
7. Availability on the basis of Gross *7			88.28%		83.38%		82.87%		83.14%
8. Availability on the basis of Net *8			71.61%		66.71%		66.20%		66.47%
Availability Norms		83.5%		83.5%		83.5%		83.5%	
9. Hours actually worked during the year	(h/y)	56,750		56,750		45,278		37,196	
10. Utilization on the basis of Gross *9			22.58%		23.34%		19.45%		18.56%
11. Utilization on the basis of Net *10			31.53%		34.99%		29.38%		27.92%
Utilization Norms		30%		30%		30%		30%	

(Source : Administration Report of MBPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : Item 4 = Item 1 - Item 2 - Item 3
*5 : = Item 5 / Item 1 x 100%
*6 : Item 6 = Item 4 - Item 5
*7 : Item 7 = Item 4 / Item 1 x 100%
*8 : Item 8 = Item 6 / Item 1 x 100%
*9 : Item 10 = Item 9 / Item 1 x 100%
*10 : Item 11 = Item 9 / Item 6 x 100%

NOTE *A : 30 Nos. / 126 days
: 28 Nos. / 238 days

*B : From 01/04/94 to 30/12/94 28 Nos.
From 01/01/95 to 31/03/95 27 Nos.

*C : From 01/04/95 to 31/12/95 27 Nos.
From 01/01/96 to 31/03/96 25 Nos.

Remarks : Availability has been calculated on the basis of 24 hours while utility has been calculated on the basis of 20 hours (i.e. day shift 8 hours and evening shift 6 hours and night shift 6 hours).

Table 5.5.14 Availability and Utilization of Forklift Trucks of MBPT

Year in service		Apr.1993-Mar.1994		Apr.1994-Mar.1995		Apr.1995-Mar.1996		Apr.1996-Feb.1997	
Rated capacity of the equipment		3T, 1.5T, 1T		3T, 1.5T, 1T		16T, 3T, 1.5T, 1T		16T, 3T, 1.5T, 1T	
No. of equipment	(unit)	NOTE *A		NOTE *B		NOTE *C		57	
1. Total No. of hours available (Gross) *1	(h/y)	310,560		451,080		493,128		456,912	
2. No. of hrs. lost due to scheduled maintenance	(h/y)	2,752	0.9% *2	4,688	1.0%	7,416	1.5%	6,872	1.5%
3. No. of hours under major breakdown	(h/y)	26,880	8.7% *3	41,872	9.3%	55,456	11.2%	44,588	9.8%
4. Actual equipment available hours (Gross) *4	(h/y)	280,928		404,520		430,256		405,452	
5. Hours lost due to recess and non-working hrs.	(h/y)	78,200	25.2% *5	97,080	21.5%	104,148	21.1%	76,152	16.7%
6. Actual equipment available hours (Net) *6	(h/y)	202,728		307,440		326,108		329,300	
7. Availability on the basis of Gross *7			90.46%		89.68%		87.25%		88.74%
8. Availability on the basis of Net *8			65.28%		68.16%		66.13%		72.07%
Availability Norms		77.5%		77.5%		77.5%		77.5%	
9. Hours actually worked during the year	(h/y)	80,978		93,736		93,406		86,758	
10. Utilization on the basis of Gross *9			26.07%		20.78%		18.94%		18.99%
11. Utilization on the basis of Net *10			39.94%		30.49%		28.64%		26.35%
Utilization Norms		35%		35%		35%		35%	

(Source : Administration Report of MBPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : Item 4 = Item 1 - Item 2 - Item 3
*5 : = Item 5 / Item 1 x 100%
*6 : Item 6 = Item 4 - Item 5
*7 : Item 7 = Item 4 / Item 1 x 100%
*8 : Item 8 = Item 6 / Item 1 x 100%
*9 : Item 10 = Item 9 / Item 1 x 100%
*10 : Item 11 = Item 9 / Item 6 x 100%

NOTE *A : 30 Nos. / 166 days
: 40 Nos. / 198 days

*B : From 01/04/94 to 05/04/94 40Nos.
From 06/04/94 to 05/05/94 42Nos.
From 06/05/94 to 06/06/94 48Nos.
From 07/06/94 to 31/03/95 53Nos.

*C : From 01/04/95 to 19/05/95 53Nos.
From 20/05/95 to 31/05/95 54 Nos.
From 01/06/95 to 04/07/95 55 Nos.
From 05/07/95 to 19/07/95 56 Nos.
From 20/07/95 to 31/03/96 57 Nos.

Remarks : Availability has been calculated on the basis of 24 hours while utility has been calculated on the basis of 20 hours (i.e. day shift 8 hours and evening shift 6 hours and night shift 6 hours).

Table 5.5.15 Availability and Utilization of Tractors of MBPT

Year in service		Apr.1993-Mar.1994		Apr.1994-Mar.1995		Apr.1995-Mar.1996		Apr.1996-Feb.1997	
Rated capacity of the equipment		2.8T Draw bar pull		2.8T Draw bar pull		2.8T Draw bar pull		2.8 Draw bar pull	
No. of equipment	(unit)	40		35		NOTE *A		32	
1. Total No. of hours available (Gross) *1	(h/y)	350,400		306,600		300,888		256,512	
2. No. of hrs. lost due to scheduled maintenance	(h/y)	2,752	0.8% *2	3,032	1.0%	4,656	1.5%	4,272	1.7%
3. No. of hours under major breakdown	(h/y)	28,728	8.2% *3	37,968	12.4%	43,112	14.3%	41,528	16.2%
4. Actual equipment available hours (Gross) *4	(h/y)	318,920		265,600		253,120		210,712	
5. Hours lost due to recess and non-working hrs.	(h/y)	58,400	16.7% *5	51,100	16.7%	50,148	16.7%	42,752	16.7%
6. Actual equipment available hours (Net) *6	(h/y)	260,520		214,500		202,972		167,960	
7. Availability on the basis of Gross *7			91.02%		86.63%		84.12%		82.15%
8. Availability on the basis of Net *8			74.35%		69.96%		67.46%		65.48%
Availability Norms		90%		90%		90%		90%	
9. Hours actually worked during the year	(h/y)	79,026		76,308		72,116		60,030	
10. Utilization on the basis of Gross *9			22.55%		24.89%		23.97%		23.40%
11. Utilization on the basis of Net *10			30.33%		35.57%		35.53%		35.74%
Utilization Norms		60%		60%		60%		60%	

(Source : Administration Report of MBPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : Item 4 = Item 1 - Item 2 - Item 3
*5 : = Item 5 / Item 1 x 100%
*6 : Item 6 = Item 4 - Item 5
*7 : Item 7 = Item 4 / Item 1 x 100%
*8 : Item 8 = Item 6 / Item 1 x 100%
*9 : Item 10 = Item 9 / Item 1 x 100%
*10 : Item 11 = Item 9 / Item 6 x 100%

NOTE *A : From 01/04/95 to 31/12/95 35 Nos.
: From 01/01/96 to 31/03/96 32 Nos.

Remarks : Availability has been calculated on the basis of 24 hours while utility has been calculated on the basis of 20 hours (i.e. day shift 8 hours and evening shift 6 hours and night shift 6 hours).

5.5.5 Maintenance System of Cargo Handling Equipment

(1)Container Handling Equipment

1) Time lost due to scheduled maintenance and breakdown

As far as QGCs are concerned, Table 5.5.7 shows that annual total hours lost due to both scheduled maintenance and breakdown of the equipment occupied about 16% of maximum available hours (Gross) during the year, or 1,430 hours per year on the basis of average. Therefore, the percentage of availability of QGCs is calculated to be 83.7% on the average for the latest three years.

As for RTGs, Table 5.5.8 shows that annual total hours lost due to both scheduled maintenance and breakdown of the equipment occupied almost the same percentage as that of QGCs. Therefore, the percentage of availability of RTGs is also calculated to be 83.7% on the average for the latest three years.

2) Periodic inspection and maintenance carried out

Periodic maintenance, i.e. daily, weekly, monthly, quarterly, and annual maintenance, is carried out for those container handling equipment. Although MBPT has been trying to carry out the periodic maintenance on schedule, it is said to be rather difficult to follow the pre-determined maintenance schedules due to acute work requirements, and actual maintenance is carried out whenever there is availability of cranes for maintenance purpose. Followings are the tentative check-ups and schedules.

a) Daily check-up

At the starting of day shift the Technicians/Tradesmen are posted on the cranes for operation work checking. The followings are the main points to be checked;

- Previous shifts Log Book Report for the crane
- Functioning of all operations (Hoist, Lock/Unlock, Gantry movement, etc.)
- Checking of spreader operations and general condition
- Checking of hydraulic system
- Checking of incomming supply voltage (QGCs)
- Checking of operation of engine (RTGs)
- Checking of radiator water level and engine oil level (RTGs)

b) Weekly/Monthly Maintenance (100 hrs/400hrs)

It is difficult to get the cranes for weekly maintenance on schedule due to work load. Generally monthly maintenance is carried out in the following points;

- Spreader cleaning and greasing
- Checking of carbon brushes of all the motors and generators
- Greasing of personal lift (QGCs)
- Checking of hydraulic system for proper functioning and leakage, etc.
- Cleaning of electrical panels and contactors
- Battery check of engine (RTGs)
- Brake liner checking

c) Quarterly Maintenance (1000 hrs)

In quarterly maintenance, monthly maintenance procedure is basically repeated and in addition to that any abnormality reported during the period the following work shall be carried out.

- Inspection of trolley wheels for wear and tear
- Inspection of brakes and setting
- Checking and adjustment of sub-assemblies like rope tensioning device, trimming device, anti-sway system, etc.
- Inspection and greasing of all wire ropes

d) Annual Maintenance (4000-5000 hrs)

Annual maintenance is carried out every year for each crane and the testing of crane is done in the presence of competent person. Beside these annual tests overload tests (with the 125% rated load) are also carried out in the presence of competent person, which is a Statutory requirement according to the Indian Dock Labour Boards regulations.

As for RTGs engines, there is Maintenance Contract with authorized service dealers of CUMMINS Engine. Their representative inspects every week all the engines and gives report regarding the condition of the engines.

All the above mentioned periodic inspection and maintenance are carried out in accordance with the check and maintenance lists. Table 5.5.16 shows items to be checked at time of an annual inspection of QGCs and RTGs.

Table 5.5.16 Items to be checked at time of Annual Inspection of QGC and RTG

1. Mechanical Part

Sr. No.	Major Inspection Item	QGC	RTG
1	Overall inspection of crane structure.	*	*
2	Inspection and greasing of all sheaves on crane.	*	*
3	Inspection and greasing of all trolley wheel points and sheaves on trolley.	*	*
4	Inspection and greasing of main hoist wire rope and wire rope sheaves.	*	*
5	Inspection and greasing of anti-sway wire rope.	*	*
6	Inspection and lubrication of trolley travel wire rope.	*	
7	Inspection and lubrication of boom hoist wire rope.	*	
8	Greasing and checking of gantry wheels.	*	
9	Checking of hydraulic rail cramp mechanism.	*	
10	Spreader cleaning and greasing.	*	*
11	Spreader sheaves greasing and checking.	*	*
12	Spreader limit switches inspection and replacement if necessary.	*	*
13	Inspection and lubrication of Twist rock pins.	*	*
14	Checking of fuel line and water line for leakage.		*
15	Radiator cleaning.		*
16	Inspection of tires and inflating if necessary.		*

2. Electrical Part

Sr. No.	Major Inspection Item	QGC	RTG
1	Checking of all controls in operation cabin.	*	*
2	Checking of rope tensioning device controls, oil level, solenoid coils, etc.	*	
3	Inspection and adjustment of main hoist motor brake.	*	*
4	Inspection and adjustment of boom hoist motor brake.	*	
5	Inspection and adjustment of trolley travel motor brake.	*	*
6	Inspection of all carbon brush holders, rocker arms and carbon brushes of all motors and generators and replacement if required.	*	*
7	Inspection of boom latching devices.	*	
8	Inspection of cable reeling motor and mechanism.	*	
9	Festoon cable bracket and rollers greasing.	*	*
10	Inspection of all electrical contactors and adjustment if required.	*	*
11	Cleaning of electrical panel.		*
12	'B' check of engine.		*
13	Checking of steering pump and coupling.		*
14	Greasing of steering lock cylinder pin, wheel bearing and pivot bearing.		*

(Source : MBPT)

(2)Electric Wharf Cranes

1) Time lost due to scheduled maintenance and breakdown

As far as 3-Ton and 6-Ton capacity electric wharf cranes are concerned, Table 5.5.9 shows that annual total hours lost due to both scheduled maintenance and breakdown of the equipment occupied about 13% of maximum available hours (Gross) during the year on the basis of average, and the percentage of availability was more than 85%.

As for 13-Ton capacity electric wharf cranes, Table 5.5.10 shows that annual total hours lost due to scheduled maintenance and breakdown of the equipment occupied about 17% of maximum available hours (Gross) during the year on the average, and the percentage of availability was about 85%.

Even though electric wharf cranes are available for 24 hours in one day, the supplied cranes are working as per shift timing as under.

I -shift	:	8.00 AM to 12.00 PM Noon and 1.00 PM to 5.00 PM	= 8.00 Hrs.
II -shift	:	5.00 PM to 8.00 PM and 8.30 PM to 11.30 PM	= 6.00 Hrs.
III-shift	:	11.30 PM to 3.00 AM and 3.30 AM to 6.00AM	= 6.00 Hrs.
Total working hours			= 20.00 Hours

Supplied cranes remain idle for 1 hour in I -shift, 0.5 hour each in II - and III-shift for lunch time and tea time, and 2 hours from 6.00 AM to 8.00 AM for change over of shift from III-shift to the day shift. There is fix quota system in I -, II -and III-shift, viz. 36, 36 and 15 Nos. of crane of 3T/6T and 3, 3 and 2 Nos. of crane of 13T, respectively.

2) Periodic inspection and maintenance carried out

The major causes of major breakdown are summarized as follows;

Structural part	:	Damage due to dash by vessel, truck, etc., corrosion, etc.
Mechanical part	:	Breakage of slew wheel bearings, slackening of slew wheels, etc.
Electric part	:	Trouble in motor, breakage of control circuit, defects in trailing cable plug, defects in control pintal pin connection, etc.

The following statement shows periodical inspection and maintenance of 68 nos. of electric level luffing wharf crane in Indira Dock, which have been performed by the Cranes and Dock Machinery Section, Indira Dock.

a) General checking (Monthly)

Checking all units of cranes carried out in accordance with the General Checking Form.

b) Annual thorough examination

Cleaning, overhauling, changing oil of gear boxes, checking and greasing of all units of cranes such as wire rope, gears, and others in accordance with the Annual Thorough Examination Form.

c) Checking and greasing hoist/lufling wire ropes (Monthly, Quarterly : as per condition of wire rope)

Inspection and greasing of lifting tackles, wire ropes, socket, all pulleys, hoist and luff wire ropes of cranes, and others in accordance with an Inspection Report of Wire Ropes and Lifting tackles.

d) Load test (Within 5 years and biannually)

Cranes are to be tested with Safety Working Load and Proof Load (25% extra S.W.L.) under D.W.R., i.e. Dock Worker (Safety, Health and Welfare) Regulation.

Load test is to be done in presence of competent person.

e) Lubrication (Quarterly)

Cleaning and greasing of movable parts of cranes.

f) Changing Lifting Tackles (Annually)

Removing of hook, chain swivel, 'D' shackles, and others of cranes. They are tested on the testing machine in the workshop under D.W.R.

g) Painting

Scraping and painting of the cranes, which is done once in three years.

h) Annual overhauling of hoist motor

Periodical overhauling of hoist motor of cranes.

i) General maintenance (Annually)

Inspection, repairing, changing, overhauling of electric equipment.

Date of last annual through examination, Date of next annual through examination and Date of last periodical load tests are clearly noticed on the main steel frame of every crane.

The governing problems at the time of repair are pointed out that there are a shortage of staff and man power and lack of spare parts. Disposal of the existing cranes is discussed from such standpoints as surplus to requirements and change of cargo pattern.

(3)Mobile Type Cargo Handling Equipment

1) Time lost due to scheduled maintenance and breakdown

From Table 5.5.11 through Table 5.5.15, the percentage of total hours due to scheduled maintenance and hours under major breakdown of each equipment against maximum availability (Gross) during the year are summarized as follows;

Crawler cranes	:	Approx. 9%
Tower cranes	:	Approx. 21%
Mobile cranes	:	Approx. 16%
Forklift trucks	:	Approx. 11%
Tractors	:	Approx. 14%

2) Periodic inspection and maintenance carried out

Periodic inspection and maintenance of mobile type cargo handling equipment are carried out in the following general check points.

- Checking of engine, transmission, etc.
- Checking of steering system, including steer axle assembly, etc.
- Checking of brake system, including wheel assembly, etc.
- Checking of hydraulic system
- Checking of frame and body
- Checking of electrical system

The following specified check points are also inspected and maintained according to each type of equipment.

- Checking of hoist system including, wire ropes, bearings, etc.
- Checking of derrick system, slew system, travel system, etc.(Mobile cranes)
- Checking of clutch, mast assembly, etc. (Forklift trucks)
- Checking of clutch, etc. (Tractors)

As for forklift trucks, night maintenance list is provided.

Load testing is carried out after periodic maintenance for S.W.L. at various radius.

5.5.6 Workvessels and Port Service Vessels

MBPT owns the following fleet of working crafts and port service vessels. Dredgers owned by MBPT are described in Section 7.5 of this report.

Tug boat	:	27 Nos.
Floating crane	:	2 Nos.
Survey launch/Survey boat	:	1 No.
Pilot vessel/Pilot launch	:	6 Nos.
Mooring launch	:	12 Nos.
Self-propelled water barge	:	2 Nos.
Hopper barge/ Flat barge	:	7 Nos.
Others	:	3 Nos.

Further detailed information with respect to the above vessels is described in Appendix A.5.

5.5.7 Other Mechanical Facilities

MBPT has two ship repair dry docks, one of which is located near the entrance of Indira Dock, i.e. Hughes Dry Dock, and the other in the bottom of Prince's Dry Dock, i.e. Merewether Dry Dock. Their features are described in Appendix A.6. And the major dock machinery of the Port is described briefly in Appendix A.7.

5.6 Port Services

5.6.1 Pilotage and Towage

24 hours operation (no shift concept staff fixed for 24 hours basis)

Number of closing days 12 days (Jan.26, Mar.24, Apr.14,18, May 1,8,18, Aug.15, Sep.6, Oct.11, Nov.1, Dec.25 in 1997)

5.6.2 Container and Break Bulk Cargo Handling

The Mumbai Port Trust adopts a three working shift system and operates 20 hours a day and 352 days per year.

Operation Time	Meal Time
08:00-17:00	13:00-14:00
17:00-23:30	20:00-20:30
23:30-06:00	03:00-03:30

Net working hours per day 20 hours

Number of closing days 13 days (Jan.26, Feb.10, Mar.24, Apr.14,18, May 1,8,18, Aug.15, Sep.6, Oct.11, Nov.1, Dec.25 in 1997)

5.6.3 Stuffing/Destuffing Containers and Delivering/Receiving Cargoes

Operation time	Meal Time
08:00-17:00	13:00-14:00
17:00-23:30	20:00-20:30

Net working hours per day 14 hours

Number of closing days 13 days (Jan.26, Feb.10, Mar.24, Apr.14,18, May 1,8,18, Aug.15, Sep.6, Oct.11, Nov.1, Dec.25 in 1997)

5.6.4 Port Railway

The Port of Mumbai operates its own railway which is connected to the broad gauge main lines of the Central and Western Railway at its Interchange Railway Yard at Wadala. MBPT has 11 diesel locomotives. The railway handled around 2.35 million tons of traffic during 1995-96.

5.6.5 Water Supply

Water is supplied from hydrants alongside berths, and vessels in anchorage receive supply from water boats. But the demand for water supply is not gerat.

5.6.6 Garbage Collection

Operation Time	Meal Time
08:00-17:00	13:00-14:00

Net working hours per day 8 hours

Number of closing days 13 days (Jan.26, Feb.10, Mar.24, Apr.14,18, May1,8,18, Aug.15, Sep.6, Oct.11, Nov.1, Dec.25 in 1997)

5.6.7 Office Work

Working time	Meal Time
10:30-17:30	13:30-14:00

Net working hours per day 6.5 hours

closing days Sundays and Holidays

Chapter VI Present Conditions of Jawaharlal Nehru Port (JNP)

6.1 Port Facilities

6.1.1 General

JNPT, which came into cargo services in 1989 as a new port, is situated in the Nhava-Sheva area at the eastern end of Mumbai Bay.

Vessel bound for JNPT sail through the -11.0 m deep Approach Channel of Mumbai Port and switch to the JNPT Channel to reach its berthing facilities. The depth alongside the JNPT berths are maintained at -13.5 m. The port was planned in such a way that large vessel can use the JNPT channel at high water level.

JNPT consists of the Container Terminal and Dry Bulk Terminal. The basin area called Elephanta Dweep has a natural depth of varying from 12 to 17 meters below CD and requires almost no maintenance dredging. Figure 6.1.1 is the plan view of JNPT.

6.1.2 Container Terminal

(1) Berthing Facility

The berth is a pier type structure supported on cast in situ concrete piles and having a concrete deck measuring 680 m long and about 35 m wide. The pier is connected to the Container Yard by a four crossover bridge.

Table 6.1.1 gives basic data of the pier and summarized data of six (6) cranes operating on the pier.

(2) Container Yard and CFS

The Container Yard, 350,000 m2 in total area, has a stacking area equipped with ground slots for 4,120 TEU's, a 1,000 m long railway transhipment yard, an administration building, and other facilities.

The transfer crane system is used for container handling in the stacking area where 14 tire mounted container cranes capable of 3-tier stacking and 4-tier clearance are in operation.

A Container Freight Station is located 6 km away from the Container Yard and is connected to it by road and railway.

6.1.3 Dry Bulk Terminal

(1) Berthing Facility

The berth is a Pier type structure supported on steel pipe piles and have a concrete deck of 712 m in length and about 30 m in width. The pier is connected to storage and bagging facilities by a crossover bridge and a causeway. Table 6.1.1 gives its berth data.

Two unloaders are in operation on the pier and the unloaded fertilizers and feedstuff are transported directly to the storage and bagging facilities by a belt conveyor system. Table 6.1.1 provides a summary of the unloader data.

(2) Yard facilities

Four transit sheds with capacities ranging from 40,000 to 140,000 tons provide temporary storage of imported fertilizers and feedstuff. Other facilities of the yard include a bagging building (capacity of 30,000 tons), a railway transhipment building (800 m in total length and equipped with two platforms) and an administration building, and this total operation system is fully computerized.

Table 6.1.1
BERTH AND CARGO HANDLING FACILITIES AT JAWAHARLAL NEHRU PORT

1. Container Terminal

1-1. Container Berth

No.	Type of Structure	Depth	Length	Remarks
CB-1	Deck type jetty supported by in situe concrete pipe pile	13.5 m	680 m	Concrete deck slab type

1-2. Quay Container Crane

No.	Type of Crane	Lifting Capacity	Out Leach	Commission	Maker
		(tons)	(meter)		
QC-1	Rail Mounted Gantry Crane	35.5	39.0	1989	KHIC
QC-2	Rail Mounted Gantry Crane	40.0	39.0	1997	BM,TITAN
QC-3	Rail Mounted Gantry Crane	35.5	39.0	1989	KHIC
QC-4	Rail Mounted Gantry Crane	35.5	39.0	1989	KHIC
QC-5	Rail Mounted Gantry Crane	40.0	39.0	1995	Hanjung
QC-6	Rail Mounted Gantry Crane	40.0	39.0	1997	Hanjung

1-3. Yard Container Crane

No.	Type of Crane	Number	Remarks
YC-1	Rubber Tyred Transfer Crane	8	JNPT's own crane
YC-2	Rubber Tyred Transfer Crane	6	Hired on a 10 year lease
YC-3	Rail Mounted Transfer Crane	3	JNPT's own crane
YC-4	Reach stacker	3	JNPT's own crane

1-4. Container Yard

No.	Item	Description
GS-1	Ordinary Container	4 Tiers and 30,000TEU's Capacity
GS-2	Reefer Container	240 slots

2. Dry Bulk Terminal

2-1. Dry Bulk Berth

No.	Type of Structure	Depth	Length	Remarks
DB-1	Deck type jetty supported by in situe concrete pipe pile	13.5 m	712 m	Concrete deck slab type

2-2. Quay Unloader Crane

No.	Type of Crane	Number	Capacity	Commission	Remarks
			(ton/hr)		
QC-1	Grab type unloader	2	400	1989	
QC-2	Continuous unloader	2	450	1989	

2-3. Storage Shed

No.	Description	Number	Storage Capacity	Remarks
SS-1	Fertiliser shed	2	80,000 - 115,000 tons	
SS-2	Sulphur shed	1	140,000 tons	
SS-3	Foodgrains shed	1	42,000 tons	
SS-4	Bag storage shed	1	30,000 tons	

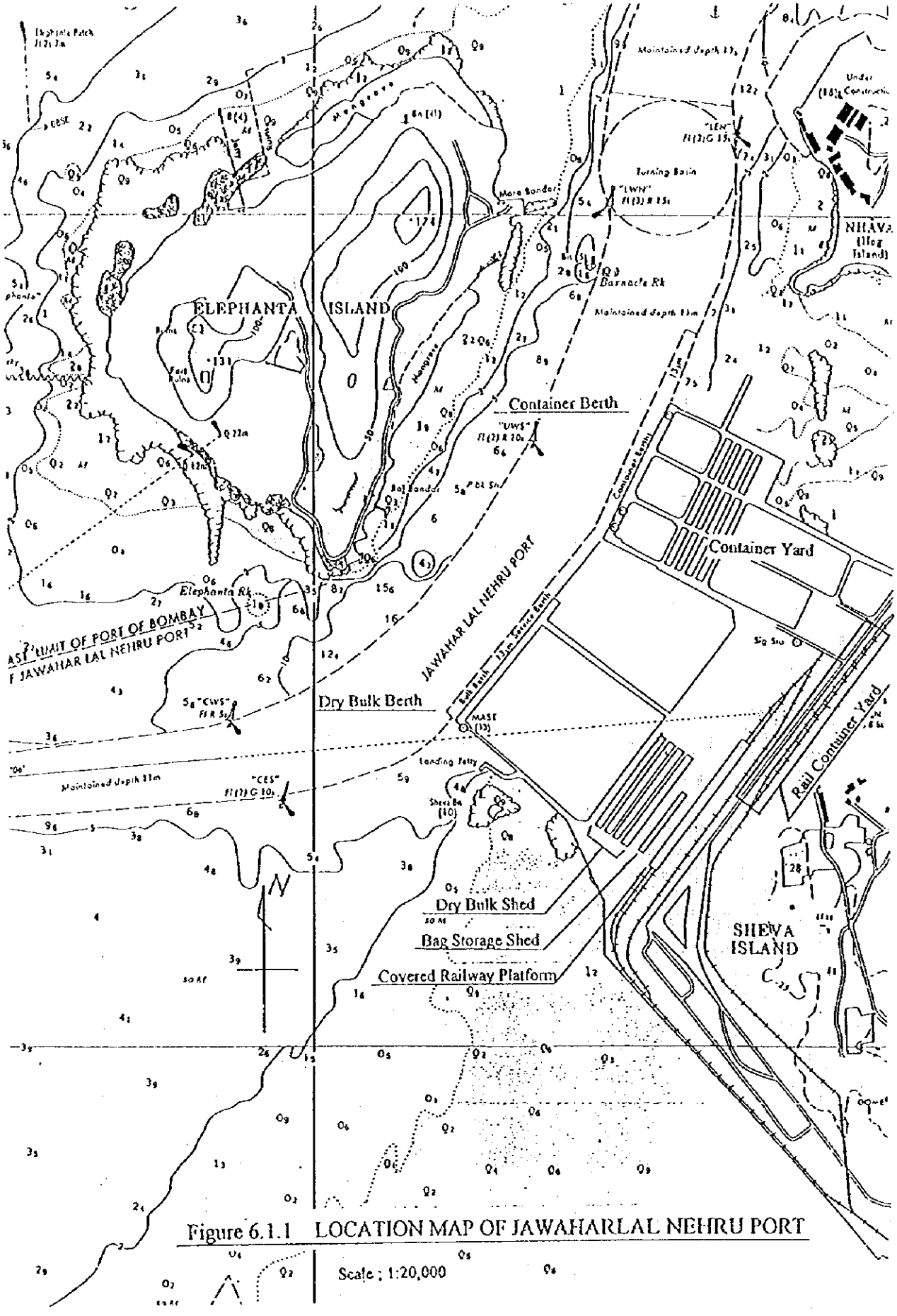


Figure 6.1.1 LOCATION MAP OF JAWAHARLAL NEHRU PORT

6.2 Port Traffic

6.2.1 Cargo Traffic

Trends of import and export cargo (excluding transhipment cargo) volumes are shown in Table 6.2.1 and Figure 6.2.1. The volume of cargo handled in Jawaharlal Nahru Port has been steadily increasing since Jawaharlal Nehru Port started its operation in 1989, and reached 7.8 million tons in 1996-97. As to the balance between import and export, volume of import cargo had been far greater than that of export cargo. However, volume of export cargo started increasing at higher rate than import cargo since 1993-94.

Table 6.2.1 Trends of Import and Export Cargo Volume in JNP

(Unit: tons)

Year	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
Import	507,515	1,645,200	2,046,606	2,070,000	2,037,000	3,021,000	4,138,000	4,535,000
Export	189,700	376,668	710,496	902,000	1,299,000	1,718,000	2,558,000	3,261,000
Total	697,215	2,021,868	2,757,102	2,972,000	3,336,000	4,739,000	6,696,000	7,796,000

Source) "Administration Report 1990-91 to 1996-97", JNPT
Remarks) Transhipment cargo is excluded from the figures in Table.

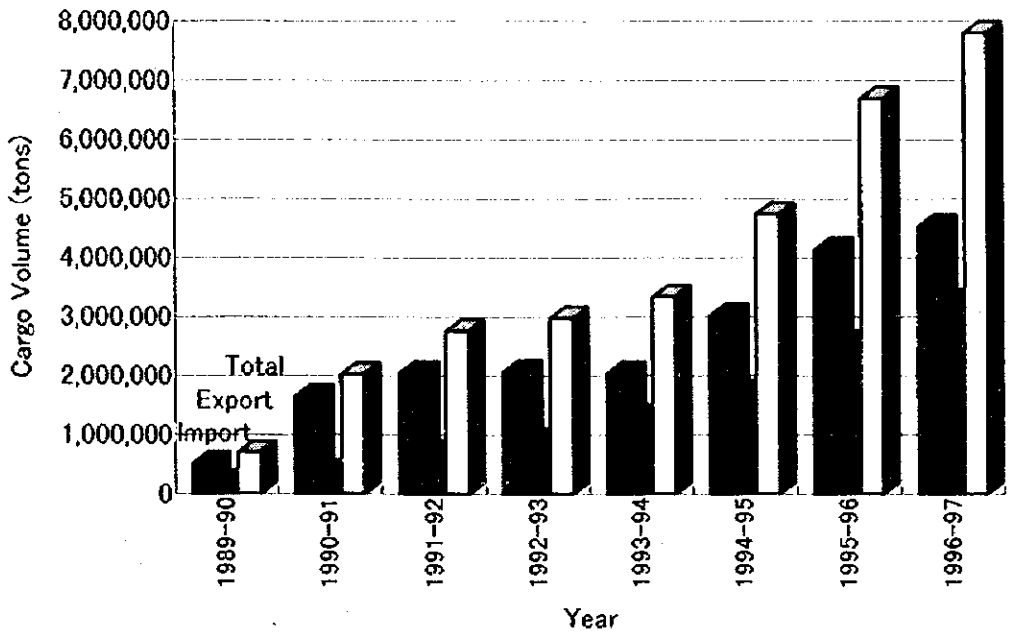


Figure 6.2.1 Trend of Import and Export Cargo Volume in JNP

Trends of import and export cargo by package style are shown in Table 6.2.2. Container cargo accounts for 4.81 million tons (61.6%), Non-container cargo (Bulk Cargo) accounts for 2.99 million tons (38.4%) in 1996-97.

Jawaharlal Nehru Port is planned especially for handling container and dry bulk. Major commodities for dry bulk cargo handled (imported) in the port are "Fertilizer" (1.29 million tons / 43.0% of Bulk) and "HBI/Iron" (0.69 million tons / 23.0% of Bulk) in 1996-97.

Only a small amount of bulk cargoes is exported; "Food Grain" (0.38 million tons) and "Vehicle" (0.05 million tons) in 1996-97.

Table 6.2.2 Trends of Cargo Volume by Package Style in JNP

Year	1989-90 (tons)	1990-91 (tons)	1991-92 (tons)	1992-93 (tons)	1993-94 (tons)	1994-95 (tons)	1995-96 (tons)	1996-97 (tons)
Import								
Bulk	290,715	1,366,152	1,443,162	1,276,000	1,155,000	1,921,000	2,452,000	2,497,000
Container	216,800	279,048	603,444	794,000	882,000	1,100,000	1,686,000	2,038,000
Container (TEUs)	17,237	23,254	50,287	66,215	73,520	91,959	140,556	169,881
Sub Total (tons)	507,515	1,645,200	2,046,606	2,070,000	2,037,000	3,021,000	4,138,000	4,535,000
Export								
Bulk	0	0	0	11,000	156,000	158,000	350,000	494,000
Container	189,700	376,668	710,496	891,000	1,143,000	1,560,000	2,208,000	2,767,000
Container (TEUs)	16,643	31,389	59,208	74,179	95,258	130,060	183,985	230,574
Sub Total (tons)	189,700	376,668	710,496	902,000	1,299,000	1,718,000	2,558,000	3,261,000
Total								
Bulk	290,715	1,366,152	1,443,162	1,287,000	1,311,000	2,079,000	2,802,000	2,991,000
Container	406,500	655,716	1,313,940	1,685,000	2,025,000	2,660,000	3,894,000	4,805,000
Container (TEUs)	33,880	54,643	109,495	140,394	168,778	222,019	324,541	400,455
Grand Total (tons)	697,215	2,021,868	2,757,102	2,972,000	3,336,000	4,739,000	6,696,000	7,796,000

Source) "Administration Report 1990-91 to 1996-97", JNPT
Remarks) Transhipment cargo is excluded from the figures in Table.

6.2.2 Container Cargo Traffic

(1) Outline of Container Cargo

Historical trends of container cargo volume and TEUs are shown in Table 6.2.2. The container cargo volume and TEUs handled in Jawaharlal Nehru Port continue to increase at high rate reaching 4.81 million tons and 400 thousand TEUs respectively in 1996-97. Container cargo volume has almost grown by a factor of 12 in seven years.

(2) Empty Container Ratio to Total TEUs

Empty Container Ratio to Total TEUs is shown in Table 6.2.3. Empty Ratios for import and export container cargoes in 1996-97 are 41.9% and 4.3% respectively.

(3) 20 foot Container Ratio to Total TEUs

20 foot Container Ratio to total TEUs has been slightly decreasing for the last 5 years reaching 52%. However, the number of 20 foot containers is still greater than that of the 40 foot containers (see Table 6.2.4).

Table 6.2.3 Trends of Empty Container Ratio to Total TEUs handled in JNP

	Import				Export				Total			
Year	Empty	Loaded	Total	Empty Ratio	Empty	Loaded	Total	Empty Ratio	Empty	Loaded	Total	Empty Ratio
	(TEUs)	(TEUs)	(TEUs)	(%)	(TEUs)	(TEUs)	(TEUs)	(%)	(TEUs)	(TEUs)	(TEUs)	(%)
1992-93	30,349	35,866	66,215	45.8%	2,633	71,546	74,179	3.5%	32,982	107,412	140,394	23.5%
1993-94	30,093	43,427	73,520	40.9%	3,210	92,048	95,258	3.4%	33,303	135,475	168,778	19.7%
1994-95	32,019	59,940	91,959	34.8%	7,403	122,657	130,060	5.7%	39,422	182,597	222,019	17.8%
1995-96	51,638	88,918	140,556	36.7%	9,718	174,267	183,985	5.3%	61,356	263,185	324,541	18.9%
1996-97	71,151	98,730	169,881	41.9%	9,806	220,768	230,574	4.3%	80,957	319,498	400,455	20.2%

Source) "Administration Report 1990-91 to 1996-97", JNPT
Remarks) Transhipment cargo is excluded from the figures in Table.

Table 6.2.4 Trends of 20 foot Container Ratio to Total TEUs handled in JNP

	Import				Export				Total			
Year	20 Foot	40 Foot	Total	20 Foot Ratio	20 Foot	40 Foot	Total	20 Foot Ratio	20 Foot	40 Foot	Total	20 Foot Ratio
	(TEUs)	(TEUs)	(TEUs)	(%)	(TEUs)	(TEUs)	(TEUs)	(%)	(TEUs)	(TEUs)	(TEUs)	(%)
1992-93	40,513	25,702	66,215	61.2%	47,537	26,642	74,179	64.1%	88,050	52,344	140,394	62.7%
1993-94	46,270	27,250	73,520	62.9%	57,586	37,672	95,258	60.5%	103,856	64,922	168,778	61.5%
1994-95	55,003	36,956	91,959	59.8%	75,222	54,838	130,060	57.8%	130,225	91,794	222,019	58.7%
1995-96	80,708	59,848	140,556	57.4%	108,377	75,608	183,985	58.9%	189,085	135,456	324,541	58.3%
1996-97	86,379	83,502	169,881	50.8%	122,146	108,428	230,574	53.0%	208,525	191,930	400,455	52.1%

Source) "Administration Report 1990-91 to 1996-97", JNPT
Remarks) Transhipment cargo is excluded from the figures in Table.

6.2.3 Container Cargo Flow in and around JNP

Statistics of container movement in and around Jawaharlal Nehru Port in 1996-97 is shown in Table 6.2.5.

As to Import cargo, approximately 54% of laden containers directly go to CFS and complete customs clearance, and the remaining 46% go to ICD (through RCD).

As to export container, 76% of laden containers cargo come from CFS to quay side after completing customs clearance. The remaining 24% directly come from ICD (through RCD).

Table 6.2.5 Statistics of Container Traffic Movement in 1996-97

		20 Foot (boxes)	40 Foot (boxes)	Total (boxes)	TEUs (TEUs)
Import					
	FCL	32,260	22,771	55,031	77,802
	LCL	528	200	728	928
	Empty	33,591	18,780	52,371	71,151
	Total	66,379	41,751	108,130	149,881
Export					
	FCL	119,111	49,500	168,611	218,111
	LCL	1,325	666	1,991	2,657
	Empty	1,710	4,048	5,758	9,806
	Total	122,146	54,214	176,360	230,574
Grand Total		188,525	95,965	284,490	380,455
Quay side to ICD		14,686	10,905	25,591	36,496
ICD toQuay side		32,634	9,582	42,216	51,798

Source) "Administration Report 1996-97", JNPT
Remarks) Transhipment cargo is excluded from the figures in Table.

6.3 Port Activities

6.3.1 Vessels Calls

The number of vessels which called Jawaharlal Nehru Port was 99 when the port started its operation in 1989. Since then the number of vessels calling the port has been rapidly increasing and reached 640 in 1996-97 (see Table 6.3.1).

Table 6.3.1 Trends of Number of Vessels Calling JNP

Year	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
No. of Vessels	99	170	416	418	422	540	546	640

Source) "Administration Report from 1990-91 to 1996-97", JNPT

Average pre-berthing time is about 2.09 days. Vessel type-wise average pre-berthing times are shown in Table 6.3.2. Not only dry bulk cargo vessels but also container vessels are required to wait for a couple of days but less than that of Port of Mumbai before entering the port. A long detention time is expected due to higher level of berth occupancy rate.

Table 6.3.2 Average Pre-berthing Time by Vessel Type called to JNP in 1996-97

Vessel Type	Others	Dry Bulk	Car Carrier	Container
Average Pre-berthing Time	3.96 (days)	0.34 (days)	0.19 (days)	1.45 (days)

Source) "Administration Report 1996-97", JNPT

6.3.2 Berth Occupancy Conditions

According to berthing records of vessels calling Jawaharlal Nehru Port in 1996-97, 640 cargo vessels called the port. Berth type-wise occupancy rate by calling cargo vessels in 1996-97 is shown in Table 6.3.3.

Table 6.3.3 Berth-wise Occupancy Rate by Vessels Type in 1995-96

Berth Type	Container Berth	Bulk Berth	Service Berth
Berth Occupancy Rate	81.6%	74.0%	44.5%

Source) "Administration Report 1996-97", JNPT

6.3.3 Cargo Handling Productivity

Cargo handling productivities for each cargo type are calculated in the following equation.

Productivity (ton/hour/vessel) = Total Cargo Volume handled (tons) / Total Berth Time (hours)

Productivities calculated for cargo type using berth records in 1996-97 are shown in Table 6.3.4.

Table 6.3.4 Cargo Handling Productivity by Cargo Type in JNP

Cargo Type	Total Cargo Volume (tons or boxes)	Total Berth Time (days)	Productivity
Container Cargo	304,490 (boxes)	893 (days)	14.2 (box/hour/vessel)
Bulk Cargo (Mechanized)	2,991,000 (tons)	540(days)	230.8 (ton/hour/vessel)

Source) "Administration Report 1996-97", JNPT

6.4 Present Container Handling System

6.4.1 Export Container Handling Procedures

Export container handling procedures for 1) shipping agent, 2) transportor, 3) JNPT, and 4) stevedore (tally clerk) are summarized in Table 6.4.1.

Table 6.4.1 Export Container Handling Procedures

	Job Flow / Concerned Body	Shipping Agent	Transportor	JNPT	Stevedore (Tally Clerk)
1	Pre-information of ship arrival	Prepare "Identification-Advice" by standard format	Arrange tractors and trailers for ships operation	Prepare export container stacking yard allocation	
2	Dispath empty container to stuffing places (factory or CWC)	Prepare container cargo stuffing application document		Confirm container number at container depot and park and prepare Equipment Interchange Report (EIR)	
3	Load empty container onto trailer			Release container number at container depot and park to yard equipment operators and tally clerks	Load empty container onto trailer by yard equipment
4	Move empty container to stuffing places		Move empty container to stuffing places by tractors and trailers	Issue Equipment Interchange Report (EIR) by gate clerk	
5	Stuff container at stuffing places (factory or CWC)	Confirm seal number and cargo conditions by shipping agent surveyer		Issue cargo stuffing documents; 1) Container Load Plan, 2) Other special export cargo documents	Cargo stuffing and sealing under the customs officers or tally clerks
6	Container movement from factory or CWC to the port gate	Confirm detailed condition of container		Verify export documents confirmed at terminal gate; 1) Issued EIR, 2) Upated container stacking place	
7	Planning work of export container	Prepare stowage plan by discharging port and by hatch (bay)		Prepare export container loading sequence check list	Record actual yard spot and container number on tally sheet
8	Load export container onto vessel			Physical operation	Record actual container number, ship stowage spot on tally sheet
9	Export shipping documentation	Issue B/L for each shippers		Issue stowage bay plan and special cargo list; 1) Hazardous cargo list, 2) Reefer cargo list, 3) Exception cargo list	Record operation result on daily report by standard format
10	Ship departure	Prepare sailing clearace application and sailing data to next port	Loading record of each container movement to raise the bill to shipping agent	Loading record of each container movement and raise the port charge bill to shipping agent	

6.4.2 Import Container Handling Procedures

Import container handling procedures for 1) shipping agent, 2) transportor, 3) JNPT, and 4) stevedore (tally clerk) are summarized in Table 6.4.2.

Table 6.4.2 Import Container Handling Procedures

	Job Flow / Concerned Body	Shipping Agent	Transportor	JNPT	Stevedore (Tally Clerk)
1	Pre-information of ship arrival	Prepare "Identification-Advice" by standard format		Prepare import container stacking allocation	
2	Prepare import container and cargo documentation	Withdraw B/L and issue cargo delivery order and prepare cargo manifest and collect container handling charges		Confirm import container to be unloaded in the container terminal by advance list	
3	Plan unloading container operation	Confirm container stowage bay plan for each import container		Prepare unloading container sequence list by container stowage bay plan	Confirm unloading container sequence list and yard allocation spot
4	Ship arrival application	Prepare ship entering application by standard format		Arrange pilot, tugs and line handling labour and allow berthing	
5	Physical container unloading operation			Update container unloading data by import tally sheet	Confirm container number, seal number and container box condition
6	Import container documentation	Prepare container delivery list by B/L number and by customer		Handle import container to raise bill to shipping agent	
7	Move import container to CFS (CWC)	Prepare container movement document and request destuffing labours at CFS (CWC)	Move container to CFS (CWC) by tractors and trailers	Transfer handling data to yard equipment operators or yard clerks and prepare EIR at gate	Destuff and stack cargo at warahouse storage spot
8	Deliner FCL container directly to consignees		Move container to consignee's warehouse or factory	Confirm customs clearance and container storage place	Load FCL container onto trailer by yard equipment
9	Ship departure	Withdraw original cargo delivery order	Loading record of each container movement and to raise the bill to shipping agent	Loading record of each container movement and raise the port charges bill to shipping agent	

6.4.3 Present Container Handling System

On August 4, 1997, JNPT commissioned a buffer yard near the existing CFS having area of 45,000 square meters which can accommodate approximately 2,000 containers at a time. This buffer yard will serve the purpose of storing the container arrival from up country without properly customs cleared documents. After the customs clearance these containers will be shifted to container yard inside the port to get connected with respective vessels. The facility will lead to reduce the unproductive moves as well as de-congestion of the port operational area.

6.5 Maintenance System of Port Equipment

6.5.1 Container Handling Equipment

1) Container crane

Location	:	JNP Container Berths
Rated load	:	35.5 MT (3 nos.) and 40.0 MT (3 nos.)
Number of cranes available	:	6 nos.
Date of commissioning	:	3 nos. in 1989, 1 no. in 1995 and 2 nos. in 1997
Outreach	:	39.0 m
Lift above/below rail	:	28 m/15 m for 3 nos. and 30 m/17 m for 3 nos.
Span of rail	:	20 m
Power source	:	3.3 kV, 50Hz, 3 ϕ

As for the detailed information, refer to Appendix A.8.

2) Transfer crane

Location	:	JNP Container Yard
Rated load	:	35.5 MT for JNP and 40 MT for leased cranes
Number of cranes available	:	8 nos. owned by JNPT and 6 nos. Leased
Date of commissioning	:	JNPT's cranes in 1989
		ABG's leased cranes in 1995/97
Span	:	23.47 m
Lift above the land level	:	14.8 m
Power source	:	Diesel engine and generator

As for the detailed information, refer to Appendix A.8.

3) Rail mounted transfer crane

Location	:	JNP
Rated load	:	35.5 MT
Number of cranes available	:	1 no. belonging to JNPT
		2 nos. leased from A.B.G.
Date of commissioning	:	JNPT's crane in 1989
		ABG's leased cranes in 1995 and 1997
Span	:	25.5 m

Power source : 3.3 kV, 50 Hz, 3 ϕ

As for the detailed information, refer to Appendix A.8.

4) Reach stacker

Location : JNP Container Yard

Rated load : 35.5 MT

Number of cranes available : 3 nos.

Power source : Diesel engine

5) Tractor and Trailer

Rated capacity : 41 MT

Number of units available : 38 units (Tractor) and 136 units (Trailer)

Date of commissioning : 1989

6.5.2 Dry Bulk Cargo Handling Equipment

1) Grab-bucket type unloader

Location : JNP Bulk Berth

Type of unloader : Grab-bucket type

Capacity : 400 m^3/h

Number of unloaders available : 2 nos.

Date of commissioning : 1989

Kind of cargo handled : Mainly fertilizers, raw material for fertilizer, and food grains

2) Continuous unloader

Location : JNP Bulk Berth

Type of unloader : Continuous type

Capacity : 450 m^3/h

Number of unloaders available : 2 nos.

Date of commissioning : 1989

Kind of cargo handled : Mainly fertilizers, raw material for fertilizer, and food grains.

As for the detailed information, refer to Appendix A.9.

6.5.3 Other Equipment

In addition to the above cargo handling equipment, JNP has 3 nos. of scrap reclaimer, 30 nos. bagging machine, 2 nos. bag stackers/reclaimers, etc. (Source : JNPT Brochure)

6.5.4 Flotilla

JNP owns the following port service vessels;

Pilot launch	:	3 nos.
Tug boat	:	4 nos.
Mooring boat	:	2 nos.
Survey launch	:	1 no.
Bilge barge	:	1 no.

6.5.5 Availability and Utilization of Cargo Handling Equipment

(1)Container Handling Equipment

From Tables 6.5.1, 6.5.2, and 6.5.3, the percentage of availability and that of utilization of QGCs, RTGs and RMG (on the basis of Gross) for the latest four years will be summarized as follows;

QGC	:	Availability = 83%-90%,	Utilization = 36%-63%
RTG	:	Availability = 63%-81%,	Utilization = 43%-60%
RMG	:	Availability = 89%-93%,	Utilization = 36%-64%

Table 6.5.4 shows that the percentage of availability of Tractors and Trailers ranges from 67% to 79%, and that of utilization from 19% to 50%.

(2)Dry Bulk Cargo Handling Equipment

The unloaders for handling dry bulk cargoes have been in service with the following efficiency as shown in Tables 6.5.5 and 6.5.6.

ULCs	:	Availability = 67%-76%,	Utilization = 14%-25%
ULGs	:	Availability = 50%-71%,	Utilization = 14%-24%

Table 6.5.1 Availability and Utilization of Container Cranes of JNPT

Year in service		1992 - 1993		1993 - 1994		1994 - 1995		1995 - 1996	
Rated capacity of the equipment	(MT)	35.5		35.5		35.5		35.5	
No. of equipment	(unit)	3		3		3		3	
1. Total No. of hours available (Gross) *1	(h/y)	26,280		26,280		26,280		26,352	
2. Non-availability due to overhaul	(h/y)	4,053	15.4% *2	2,246	8.5%	3,018	11.5%	3,303	12.5%
3. Non-availability due to holiday and off time	(h/y)	504	1.9% *3	504	1.9%	504	1.9%	336	1.3%
4. Non-availability due to other reasons	(h/y)	3,285	12.5% *4	0	0.0%	0	0.0%	0	0.0%
5. Lack of Demand / no vessel	(h/y)	2,628	10.0% *5	4,736	18.0%	967	3.7%	700	2.7%
6. Non-utilization due to out of commission for		6,277	23.9% *6	2,662	10.1%	5,439	20.7%	5,513	20.9%
Spare parts		0		0		0		0	
Staff		0		0		0		0	
Repairs		0		0		0		0	
Meal break and shift change		0		1,629		4,324		5,408	
Other (Bad weather, staff shortage, etc.)		6,277		1,033		1,115		105	
7. Available working hours (Gross) *7	(h/y)	21,723	82.7% *8	23,530	89.5%	22,758	86.6%	22,713	86.2%
8. Available working hours (Net) *9	(h/y)	18,438	70.2% *10	23,530	89.5%	22,758	86.6%	22,713	86.2%
Availability Norms									
9. Hours actually worked during the year	(h/y)	9,533		16,132		16,352		16,500	
10. Utilization on the basis of gross *11	(%)	36.3%		61.4%		62.2%		62.6%	
11. Utilization on the basis of net *12	(%)	51.7%		68.6%		71.9%		72.6%	
Utilization Norms									

(Source : Administration Report of JNPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : = Item 4 / Item 1 x 100%
*5 : = Item 5 / Item 1 x 100%
*6 : = Item 6 / Item 1 x 100%
*7 : Item 7 = Item 1 - Item 2 - Item 3
*8 : = Item 7 / Item 1 x 100%
*9 : Item 8 = Item 1 - Item 2 - Item 3 - Item 4
*10 : = Item 8 / Item 1 x 100%
*11 : = Item 9 / Item 1 x 100%
*12 : = Item 9 / Item 8 x 100%

Table 6.5.2 Availability and Utilization of Transfer Crane of JNPT

Year in service		1992 - 1993		1993 - 1994		1994 - 1995		1995 - 1996	
Rated capacity of the equipment	(MT)	35.5		35.5		35.5		35.5	
No. of equipment	(unit)	7		8		8		8	
1. Total No. of hours available (Gross) *1	(h/y)	61,320		61,608		70,080		70,272	
2. Non-availability due to overhaul	(h/y)	21,735	35.4% *2	10,611	17.2%	17,007	24.3%	19,407	27.6%
3. Non-availability due to holiday and off time	(h/y)	1,176	1.9% *3	1,176	1.9%	1,263	1.8%	683	1.0%
4. Non-availability due to other reasons	(h/y)	7,665	12.5% *4	0	0.0%	0	0.0%	3,672	5.2%
5. Lack of Demand / no vessel	(h/y)	6,132	10.0% *5	3,278	5.3%	1,396	2.0%	1,653	2.4%
6. Non-utilization due to out of commission for		1,626	2.7% *6	9,683	15.7%	15,406	22.0%	13,659	19.4%
Spare parts		0		0		0		0	
Staff		0		0		0		0	
Repairs		0		0		0		0	
Meal break and shift change		0		4,607		12,034		13,604	
Other (Bad weather, staff shortage, etc.)		1,626		5,076		3,372		55	
7. Available working hours (Gross) *7	(h/y)	38,409	62.6% *8	49,821	80.9%	51,810	73.9%	50,182	71.4%
8. Available working hours (Net) *9	(h/y)	30,744	50.1% *10	49,821	80.9%	51,810	73.9%	46,510	66.2%
Availability Norms									
9. Hours actually worked during the year	(h/y)	26,238		36,860		35,008		31,195	
10. Utilization on the basis of gross *11	(%)	42.8%		59.8%		50.0%		44.4%	
11. Utilization on the basis of net *12	(%)	85.3%		74.0%		67.6%		67.1%	
Utilization Norms									

(Source : Administration Report of JNPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : = Item 4 / Item 1 x 100%
*5 : = Item 5 / Item 1 x 100%
*6 : = Item 6 / Item 1 x 100%
*7 : Item 7 = Item 1 - Item 2 - Item 3
*8 : = Item 7 / Item 1 x 100%
*9 : Item 8 = Item 1 - Item 2 - Item 3 - Item 4
*10 : = Item 8 / Item 1 x 100%
*11 : = Item 9 / Item 1 x 100%
*12 : = Item 9 / Item 8 x 100%

Table 6.5.3 Availability and Utilization of Rail-mounted Transfer Cranes of JNPT

Year in service		1992 - 1993		1993 - 1994		1994 - 1995		1995 - 1996	
Rated capacity of the equipment		35.5		35.5		35.5		35.5	
No. of equipment	(unit)	1		1		1		1	
1. Total No. of hours available (Gross) *1	(h/y)	8,760		8,760		8,760		8,784	
2. Non-availability due to overhaul	(h/y)	538	6.1% *2	490	5.6%	579	6.6%	864	9.8%
3. Non-availability due to holiday and off time	(h/y)	168	1.9% *3	168	1.9%	120	1.4%	104	1.2%
4. Non-availability due to other reasons	(h/y)	1,095	12.5% *4	0	0.0%	0	0.0%	192	2.2%
5. Lack of Demand / no vessel	(h/y)	876	10.0% *5	1,106	12.6%	957	10.9%	193	2.2%
6. Non-utilization due to out of commission for		2,950	33.7% *6	1,377	15.7%	1,774	20.3%	1,875	21.3%
Spare parts		0		0		0		0	
Staff		0		0		0		0	
Repairs		0		0		0		0	
Meal break and shift change		0		626		1,722		1,790	
Other (Bad weather, staff shortage, etc.)		2,950		751		52		85	
7. Available working hours (Gross) *7	(h/y)	8,054	91.9% *8	8,102	92.5%	8,061	92.0%	7,816	89.0%
8. Available working hours (Net) *9	(h/y)	6,959	79.4% *10	8,102	92.5%	8,061	92.0%	7,624	86.8%
Availability Norms									
9. Hours actually worked during the year	(h/y)	3,133		5,619		5,330		5,557	
10. Utilization on the basis of gross *11	(%)	35.8%		64.1%		60.8%		63.3%	
11. Utilization on the basis of net *12	(%)	45.0%		69.4%		66.1%		72.9%	
Utilization Norms									

(Source : Administration Report of JNPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : = Item 4 / Item 1 x 100%
*5 : = Item 5 / Item 1 x 100%
*6 : = Item 6 / Item 1 x 100%
*7 : Item 7 = Item 1 - Item 2 - Item 3
*8 : = Item 7 / Item 1 x 100%
*9 : Item 8 = Item 1 - Item 2 - Item 3 - Item 4
*10 : = Item 8 / Item 1 x 100%
*11 : = Item 9 / Item 1 x 100%
*12 : = Item 9 / Item 8 x 100%

Table 6.5.4 Availability and Utilization of Tractors and Trailers of JNPT

Year in service		1992 - 1993		1993 - 1994		1994 - 1995		1995 - 1996	
Rated capacity of the equipment	(MT)	41		41		41		41	
No. of equipment	(unit)	19		19		19		19	
1. Total No. of hours available (Gross) *1	(h/y)	166,440		166,440		166,440		166,152	
2. Non-availability due to overhaul	(h/y)	32,037	19.2% *2	49,543	29.8%	51,950	31.2%	39,723	23.9%
3. Non-availability due to holiday and off time	(h/y)	3,192	1.9% *3	3,192	1.9%	3,192	1.9%	2,008	1.2%
4. Non-availability due to other reasons	(h/y)	20,805	12.5% *4	0	0.0%	0	0.0%	0	0.0%
5. Lack of Demand / no vessel	(h/y)	16,644	10.0% *5	0	0.0%	0	0.0%	7,263	4.4%
6. Non-utilization due to out of commission for		62,652	37.6% *6	65,297	39.2%	43,204	26.0%	34,940	21.0%
Spare parts		0		0		0		0	
Staff		0		0		0		0	
Repairs		0		0		0		0	
Meal break and shift change		0		10,147		10,147		33,459	
Other (Bad weather, staff shortage, etc.)		62,652		55,150		33,057		1,481	
7. Available working hours (Gross) *7	(h/y)	131,211	78.8% *8	113,705	68.3%	111,298	66.9%	124,421	74.9%
8. Available working hours (Net) *9	(h/y)	110,406	66.3% *10	113,705	68.3%	111,298	66.9%	124,421	74.9%
Availability Norms									
9. Hours actually worked during the year	(h/y)	31,110		48,408		68,094		82,218	
10. Utilization on the basis of gross *11	(%)	18.7%		29.1%		40.9%		49.5%	
11. Utilization on the basis of net *12	(%)	28.2%		42.6%		61.2%		66.1%	
Utilization Norms									

(Source : Administration Report of JNPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : = Item 4 / Item 1 x 100%
*5 : = Item 5 / Item 1 x 100%
*6 : = Item 6 / Item 1 x 100%
*7 : Item 7 = Item 1 - Item 2 - Item 3
*8 : = Item 7 / Item 1 x 100%
*9 : Item 8 = Item 1 - Item 2 - Item 3 - Item 4
*10 : = Item 8 / Item 1 x 100%
*11 : = Item 9 / Item 1 x 100%
*12 : = Item 9 / Item 8 x 100%

Table 6.5.5 Availability and Utilization of Continuous Type Unloader of JNPT

Year in service		1992 - 1993		1993 - 1994		1994 - 1995		1995 - 1996	
Rated capacity of the equipment	(m^3/h)	450		450		450		450	
No. of equipment	(unit)	2		2		2		2	
1. Total No. of hours available (Gross) *1	(h/y)	17,520		17,520		17,520		17,528	
2. Non-availability due to overhaul	(h/y)	4,320	24.7% *2	3,906	22.3%	5,148	29.4%	5,221	29.8%
3. Non-availability due to holiday and off time	(h/y)	336	1.9% *3	336	1.9%	432	2.5%	624	3.6%
4. Non-availability due to other reasons	(h/y)	2,190	12.5% *4	1,463	8.4%	970	5.5%	0	0.0%
5. Lack of Demand / no vessel	(h/y)	4,044	23.1% *5	4,370	24.9%	3,889	22.2%	4,380	25.0%
6. Non-utilization due to out of commission for		2,298	13.1% *6	5,001	28.5%	3,309	18.9%	4,104	23.4%
Spare parts		865		0		0		0	
Staff		0		0		0		0	
Repairs		1,433		0		0		0	
Meal break and shift change		0		1,188		1,517		2,095	
Other (Bad weather, staff shortage, etc.)		0		3,813		1,792		2,009	
7. Available working hours (Gross) *7	(h/y)	12,864	73.4% *8	13,278	75.8%	11,940	68.2%	11,683	66.7%
8. Available working hours (Net) *9	(h/y)	10,674	60.9% *10	11,815	67.4%	10,970	62.6%	11,683	66.7%
Availability Norms									
9. Hours actually worked during the year	(h/y)	4,334		2,444		3,772		3,199	
10. Utilization on the basis of gross *11	(%)	24.7%		13.9%		21.5%		18.3%	
11. Utilization on the basis of net *12	(%)	40.6%		20.7%		34.4%		27.4%	
Utilization Norms									

(Source : Administration Report of JNPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : = Item 4 / Item 1 x 100%
*5 : = Item 5 / Item 1 x 100%
*6 : = Item 6 / Item 1 x 100%
*7 : Item 7 = Item 1 - Item 2 - Item 3
*8 : = Item 7 / Item 1 x 100%
*9 : Item 8 = Item 1 - Item 2 - Item 3 - Item 4
*10 : = Item 8 / Item 1 x 100%
*11 : = Item 9 / Item 1 x 100%
*12 : = Item 9 / Item 8 x 100%

Table 6.5.6 Availability and Utilization of Grab-bucket Type Unloader of JNPT

Year in service		1992 - 1993		1993 - 1994		1994 - 1995		1995 - 1996	
Rated capacity of the equipment	(m^3/h)	400		400		400		400	
No. of equipment	(unit)	2		2		2		2	
1. Total No. of hours available (Gross) *1	(h/y)	17,520		17,520		17,520		17,528	
2. Non-availability due to overhaul	(h/y)	5,606	32.0% *2	8,365	47.7%	4,593	26.2%	5,419	30.9%
3. Non-availability due to holiday and off time	(h/y)	336	1.9% *3	336	1.9%	432	2.5%	624	3.6%
4. Non-availability due to other reasons	(h/y)	1,642	9.4% *4	744	4.2%	1,309	7.5%	0	0.0%
5. Lack of Demand / no vessel	(h/y)	7,068	40.3% *5	3,701	21.1%	3,305	18.9%	3,703	21.1%
6. Non-utilization due to out of commission for		468	2.7% *6	1,366	7.8%	3,651	20.8%	3,936	22.5%
Spare parts		112		0		0		0	
Staff		0		0		0		0	
Repairs		356		0		0		0	
Meal break and shift change		0		721		1,747		2,001	
Other (Bad weather, staff shortage, etc.)		0		645		1,904		1,935	
7. Available working hours (Gross) *7	(h/y)	11,578	66.1% *8	8,819	50.3%	12,495	71.3%	11,485	65.5%
8. Available working hours (Net) *9	(h/y)	9,936	56.7% *10	8,075	46.1%	11,186	63.8%	11,485	65.5%
Availability Norms									
9. Hours actually worked during the year	(h/y)	2,400		3,008		4,230		3,846	
10. Utilization on the basis of gross *11	(%)	13.7%		17.2%		24.1%		21.9%	
11. Utilization on the basis of net *12	(%)	24.2%		37.3%		37.8%		33.5%	
Utilization Norms									

(Source : Administration Report of JNPT)

NOTE *1 : Item 1 = No. of days available x 24 hours per day x No. of equipment available.
*2 : = Item 2 / Item 1 x 100%
*3 : = Item 3 / Item 1 x 100%
*4 : = Item 4 / Item 1 x 100%
*5 : = Item 5 / Item 1 x 100%
*6 : = Item 6 / Item 1 x 100%
*7 : Item 7 = Item 1 - Item 2 - Item 3
*8 : = Item 7 / Item 1 x 100%
*9 : Item 8 = Item 1 - Item 2 - Item 3 - Item 4
*10 : = Item 8 / Item 1 x 100%
*11 : = Item 9 / Item 1 x 100%
*12 : = Item 9 / Item 8 x 100%

6.6 Port Services

6.6.1 Pilotage and Towage

24 hours operation and no closing day

6.6.2 Container and Bulk Cargo Handling

24 hours operation (3 shifts)

Working Time

07:00-15:00

15:00-23:00

23:00-07:00

no closing day

6.6.3 Stuffing/Destuffing Containers

16 hours a day (2 shifts)

Working Time

07:00-15:00

15:00-23:00

De-stuffing closing days Sundays and holidays

Stuffing closing days No closing days

6.6.4 Delivering/Receiving Cargoes

24 hours operation and no closing day

6.6.5 Loading/Unloading Container to/from Rail Wagon

24 hours operation and no closing day

6.6.6 Office Work of the Port Trust

Working Time

10:00-17:00

Closing days Sundays and holidays

6.6.7 Customs Clearance

(1) 24 hours operation

(2) Closing days Sundays

(3) Required document Bill of entry (import)

(4) Procedure of inspection

Import	Visual inspection, sometimes for drugs etc., sent to Custom Approved Laboratory
Export	5 to 10% examination of loose cargo and 20 to 40 bags per 1000 bags are being checked (On random)

(5) Average number of days necessary for customs clearance

Import	96% on same day, 4% in one or two days
Export	99% on same day

(6) Present procedure of customs clearance for containerized cargo

Import	Open seal, destuffing, if necessary and examine as much as required, endorse examination, report-clearance. Bulk cargo is being examined by visual inspection at bulk gate only.
Export	Open seals and C.E. Officers examine the goods

(7) Designated places for above inspections

Import	CWC and Maersk's CFS, bulk gate for bulk cargo
Export	Dronageeri office and preventive officer at Port gates

6.6.8 Water Supply

24 hours operation and no closing days except shutdown by MWSSB

6.6.9 Garbage Collection

As & when required

Chapter VII Access Channels

7.1 Alignment and Dimensions of the Channels

Mumbai (18°-54' N, 72°-49' E) is the premier port on the west coast of India. Its fine harbour, about 26 km long and with a general width of about 9 km, lies east of a number of islands, including Bombay Island, joined together by causeways and reclamation.

The harbour entrance is lying between south-west of the Prongs Light-buoy and the light-buoy moored north of the Thal Shoal. The dredged entrance channel lies about midway between these two light-buoys.

The channel in <063°> direction from the entrance is curved at an angle of <33°> north-ward at south of the Sunk Rock Light-beacon heading for the Tucker Beacon in <030°>. Thence it curves at an angle of <25°> east-ward off the South Breakwater heading to the Elephanta Island Leading Beacons in <055°>.

In close proximity to south off the Butcher Beacon, it branches into two channels : one leads to the oil terminal and the other bounds for JNP. (see **Figure 7.1.1**)

The outline of the channel dimensions is given in **Table 7.1.1**.

Table 7.1.1 Outline of the Channel Dimensions

Main Channel (Entrance - Oil terminal)

Location	Alignment (°)	Leg (km)	Depth (m)	Width (m)
Entrance (18-50.6N,72-47.5E)	063	5.5	-11.0 to -10.9	420 to 440
S off Sunk R. Light Beacon	030	6.8	-12.0 to -10.5	450 to 325
E off South Break Water	055	4.6	-11.5 to -9.4	470 to 500
S off Butcher Beacon	042	2.4	-15.0 to -9.1	600 to 700
E off Butcher Oil terminal	-	-	-	-

Approach Channel (Main channel - Ballard Pier/Indira Dock)

Location	Alignment (°)	Leg (km)	Depth (m)	Width (m)
Main Channel Branch	305	3.1	-8.5 to -5.5	390
Off Ballard Pier / Indira Dock	-	-	-	-

INDIA—WEST COAST

PORT OF BOMBAY

DEPTHS IN METRES

SCALE 1:20000

BOMBAY

BACK BAY

COLABA

NAVAL ANCHORAGE

BEWAR MUD FLAT

Figure 7.1.1 Outline of Port of Mumbai

North Channel (Cross Is. NE - Victoria/Prince's Dock)

Location	Alignment (°)	Leg (km)	Depth (m)	Width (m)
7 c. E of N Channel Beacon	256/276	1.0	- 4.7 to -3.2	185
Victoria / Prince's Dock	-	-	-	-

Trombay Channel / Pir Pau Deep (Oil Terminal - New Oil Terminal)

Location	Alignment (°)	Leg (km)	Depth (m)	Width (m)
E of Oil Terminal	010	1.8	-10.9 to 5.6	700 to 950
W off Elephanta Patch	042 / var.	5.0	-5.5	200
Pir Pau Jetty	-	-	-	-

Jawahar Lal Nehru Channel (Main Channel - J N P)

Location	Alignment (°)	Leg (km)	Depth (m)	Width (m)
S off Butcher Beacon	085	2.9	-11.0	230 to 330
S off Elephanta Is..	045 / 023 /.var.	2.3	-11.0	430 to 500
JNP Container Terminal	-	-	-	-

Source: Combined UK chart, 2621,2627 with survey results by MBPT,1996

In addition , bathymetric survey results relevant to the channels by the Team are given in Chapter II 2.7.

7.2 Navigational Aids

7.2.1 Landmarks in the Approaches to Mumbai

(1) **Kankeshwar** (18° 45' N, 72° -55' E), a mountain 384 m high and, surmounted by a pagoda, and the Sagargarh Ranges to the SE can be found from off sea.

(2) **Ashuera Hill** stands 3.4 km NNE of Kankeshwar with two hummocks named **The Paps.**

(3) **North Pap Beacon**, 26 m in height and black, stands at an elevation of 267 m on the N hummock of Ashuera Hill and is conspicuous.

(4) **Thal Knob,** 1.3 km ESE of the SE entrance point of Mumbai port is a hill with a conspicuous white beacon, 18 m in height, standing at an elevation of 74 m on its summit; **False Knob,** 0.9 km SSW, looks similar but is lower. In thick weather these two hills stand out well among the coconut trees, being detached from the distant high land.

If approaching from NW, North Pap Beacon (3) in line with Thal Knob Beacon (4), bearing

<121°.5>leads close SW of SW Prongs Light-buoy.

(5) **Trombay Peak** (19°-02' N, 72°- -55' E) rises to a height of 305m with a conspicuous TV tower on it.

(6) **Kanhoji Angre Is.** (18°-42' N, 72°-49' E) has two hills upon it and is sparsely covered with trees and scrub.

7.2.2 Lights, Beacons and Buoys

The captioned navigational aids are under control of The Deputy Conservator, MBPT.

The Maritime Buoyage System of The International Association of Lighthouse Authority (IALA), which is widely adopted among maritime nations, is being introduced throughout Indian Ocean, and hence existing marks at this port are in conformity with IALA region "A" system in terms of classification by colour.

According to the "WEST COAST OF INDIA PILOT, UK 1986 EDITION", UK chart 2624, 2627 and "BROCHURE, 1996, PORT OF MUMBAI", an outline of the marks is as follows;

In the approaches to Mumbai :

(1) **Kanhoji Angre Light** (Fl.,<2> WR. 10sec. 49 m, 25 M) is exhibited from an octagonal tower surmounting a flat roofed house on top. A racon (K) transmits from the light. The lighthouse is connected by telephon with Mumbai.

(2) **Santa Cruz Aero Light** is exhibited from the control tower of **Santa Cruz International Airport.**, 25 km N of **Prongs Reef Light-tower.**

Inner approaches to Mumbai :

(3) **Thal Shoal Buoy** (black conical) is moored off the NW side of **Thal Shoal** which has several detached shoals lying 10 km N of **Kanhoji Angre Is.**

(4) **S side of Entrance Light Buoy** (Fl. 4sec.) moored 3.5 km N of **Thal Shoal,** marks the S side of the main channel into **Mumbai Port.**

(5) **Spoil Ground Buoy** (black and yellow ; can) marks a spoil ground lying 4 km SSW of **Thal Shoal Bouy.**

(6) **Prongs Reef Light** (Fl. 10sec. 43m 22M) is exhibited from a round tower, painted in red, black and white bands, standing on **Prongs Reef.**

(7) **SW Prongs Light-buoy** (Fl.<2> R. 10sec port hand mark) is moored 2.6 km SSW of **Prongs Reef Light** and marks the edge of the shoal water SW of **Prongs Reef.**

(8) **N side of Entrance Light Buoy** (Fl. R 1.5sec) moored 2.6 km SSE of Prongs Light, marks the N side of the main channel into **Mumbai Port**.

Colaba Point to Middle Ground Islet :

(1) **Sunk Rock Light** (Gp. Fl.<2> W.R. 5sec. 22m 13.7M) is exhibited from a round red and yellow chequered tower on **Sunk Rock** (18° -53' N, 72° -50' E) which lies, awash, W of the Main channel.

(2) **Dolphin Rock Light** (Gp. Fl.<4> W. R. 20sec. 11m 11.5M) is exhibited from a grey masonry tower with a white dome 17 m in height on **Dolphin Rock** 1.6 km NE of **Oyster Rock.**

(3) **Colaba Reef Beacons ; North Beacon**, a stone cylinder 5 m high painted black and white in bands marks close off the N end of **Colaba Reef** lying 500 m SW **Dolphin Rock, South Beacon,**

7 m high and similar in colour, stands 370 m S of the S end of **Colaba Reef.**

(4) **Middle Ground Islet** (18° -55' N, 72° -51'E) is rocky with two towers standing upon it.

(5) **North Light Buoy of Middle Ground Islet** (Fl. R. 1.5sec) marks the N end of a shoal extending NE from **Middle Ground Islet.**

(6) **South Break Water Light** (Fl. R.3sec. 17m 5M) is exhibited from the head of the break water which forms an enclosed area E of the **Naval Dockyard**.

(7) **M Light Buoy** (Fl. 3sec) is moored at the S end of **Cross Island Reef** and marks the N side of the approach channel to **Indira Dock.**

(8) **Three buoys** (red can) mark the W side of the channel that lead to the North channel abreast **Cross Island Reef** and **Cross Island** to the N.

(9) **North Channel Beacon Light** (Occ. W.R. 5sec. 6m 8M) is exhibited from cylindrical structure with red bands, 8m in height, standing on a shoal bank.

(10) **Malet Shelf,** a rocky drying patch 180 m W of the **fish wharf,** is marked by **a beacon** with an iron drum topmark.

(11) **Three light buoys** (red can) and **two light buoys** (black conical) are moored off the mud flats lying between the **fish wharf** and **Mazagaon Dockyard** 1.1 km NNW. They donate a fairway abreast the dhow anchorage.

Karanja Island and vicinity :

(1) **Karanya Beacon** (black, cone topmark), 10 m in height, stands near the NW end of **Karanya reefs** extending about 3.7 km off the W end of **Karanya Island.**

(2) **South Karanya Buoy** (black, cone topmark) is moored off the SW end of **Karanya reefs.**

(3) **North Karanya Light -buoy** (Fl.<2> G. 10sec) is moored 0.7 km NNW of **Karanya Beacon.**

(4) **Gull Islet Light** (Fl. 5sec. 26m 7M) is exhibited from an aluminum framework tower on the summit of the islet (18° -50' N, 72° -54' E).

North-eastern part of Mumbai Port :

(1) **Butcher Island (18° -58' N, 72° -54'E) Signal Station** stands at an elevation of 35 m at the SE end of the island.

(2) **Elephanta Beacon B** (iron tripod, black cage topmark) stands at the N end of a pier which extends from the NW end of **Elephanta Island.**

(3) **Elephanta Patch Light** (Fl. 2sec 7m) is exhibited from a beacon marking **Elephanta Patch** 1.1 km NW of **Elephanta Island.**

(4) **W Elephanta Buoy** marks the E side of the channel, W of **Elephanta Island.**

Dredged Channel :

The channel is marked on its SE side by three marks, and on its SW side by three marks, respectively.

(1) **W Uran Light Buoy** (Fl<3> 10sec)

(2) **Uran Patch Light Beacon** (Q. 7m), a black circular structure.

(3) **Uran Light Beacon** (Q. 12m 5M)

(4) **Tucker Light Beacon** (Oc. WR.5sec 21m 13M) consists of a white metal framework structure, fitted with a radar reflector, on a red round masonry tower, its lower part painted white and black in bands. It marks the edge of the 5 m depth contour 3.7 km SW of Butcher Island, with **a buoy** (red can) midway between.

(5) **Butcher Light Beacon** (Fl.<4> WR.10sec 9m) marks the NW side of the dredged channel between oil berth No.4 and the three oil berths off the E side of Butcher Island.

(6) **Leading Lights** in line bearing <055° >, exhibited on the SW side of **Elephanta Island,** lead through the dredged channel to a position 0.6 km S of **Butcher Light Beacon.**

(7) **Uran Patch Light** in line with **Uran Beacon Light,** exhibited from a black circular

stone structure 0.9 km SSW, in line bearing <203° >astern, lead through the channel between **Butcher** and **Elephanta Island.**

JMP Channel :

(1) **Leading Lights** exhibited on **Shiva Island,** in line bearing <085° >, lead to a position W of the **Shiva Becon.**

(2) The channel, turning circle and anchorage area are marked with **nine light buoys** in accordance with the IALA Maritime Buoyage System (region A).

(3) **Shiva Beacon** (black pillar, pole and ball topmark) stands at an elevation of 10 m on a drying reef situated at the S end of the harbour.

(4) **A latticed mast,** 13 m in height, stands on the SW end of the bulk berth jetty, 0.4 km N of **Shiva Becon.**

7.3 Navigation Control

7.3.1 Administration

The Deputy Conservator's office of MBPT is the sole executive body on maritime affairs, and controls over following matters: maintenance of the harbor; the regulations of navigation; the harbor communication ; the pilotage; towage; and dredging.

7.3.2 Sailing Rules

The Port Rules and Docks By-laws are stipulated in **The Indian Port Act, 1908 (Act No. 15 of 1908)** and **Bombay Port Rules,1966.**

The basic sailing rules are found in those Act/Rules, that is (1) Vessels, while under way, shall observe **The International Convention Preventing Collision at Sea,** and (2) No vessel of the measurement of two hundred tons or upwards shall enter, leave, or be moved in any port to which this section has been especially extended without having a pilot, harbor-master or assistant of the port officer onboard (Indian Port Act, 1908 special rule 31), and (3) other practical issues concerning sailing are left to the pilot's circumstantial judgment.

7.3.3 Pilots

Twenty nine licensed pilots (including one on deputation to JNPT and two under training) are in service at the Port of Mumbai.

The required qualification for the pilot is (1) Certification of Competency as Master of Foreign-going Ship issued by the Ministry of Shipping and Transport, Govt. of India or the board of Trade U.K or any other common-wealth Country whose certificate of competency was common-wealth validity, and (2) Three years experience as Chief Officer or a Master of Foreign-going vessel.

The service shift of duty pilots is one day in service followed by one day off, thus the average working days of each pilot through the year are assumed 180 days.

In addition to the pilots, the port provides nine Dock Masters and five Master Pilots, who are senior than the above mentioned pilots, serving in berthing/unberthing maneuvers mainly.

The age structure of the dock masters and pilots is from 36 to 56, and the age limit is 58.

Age Structure (as of Apr. 1997)

Age	Heads
36 to 39	4
40 to 49	25
50 to 56	15

Table 7.3.1 The Result of Piloting in the Last Three Years

	1993 -1994	1994 -1995	1995 - 1996
Calling Vessels (A)	-	5,371	5,417
Total GRT	N.A.	40,170,637	40,253,106
No. of Piloting (B)	18,342	18,545	13,465
(B) / (A)	-	3.45	2.4 9
Average duty Pilot per Month	23.3	23.8	23.6
Average Piloting per Pilot per Month (excluding piloting by the Master Pilot)	66	65	47

Source: MBPT

7.3.4 Floating Equipment

The port provides abundant floating equipment, which is under control of The Deputy Conservator and consists of 26 tug boats, one survey launch, six pilot launches, three inspection launches, 12 mooring launches, four dredgers, two floating cranes, two water barges, and eight barges.

Among the 26 tug boats, five for the Butcher/ Pir Pau oil berth, 11 for the Indira Dock, six for the Prince's/Victoria Dock, are in service to assist maneuvering of calling vessels, and the other four are operated for the works relevant to dredging.

With the exception of 13 fairly new tugs (five at the oil terminal, four at the Indira Dk., two at the Prince's. & Victoria. Dk, and two for dredging), others are rather aged boats over 25 to 31years as of 1997. Assuming that the service life of those harbor tugs would be 20 years according to accepted wisdom, the replacing of over aged tugs is one of the important issues awaiting solution, and another point is that no firebrigade is provided.

The Outline of Tug Fleet, Desired Replacing Schedule of Existing Tug Fleet, and Other Port Craft are shown in Table **7.3.1, Table 7.3.2** and **Table 7.3.3** respectively.

7.3.5 Accidents in the Last Five Years

According to a statement of The Deputy Conservator's Office, there have been nine accidents within the harbor area in this period. Seven cases involved vessels crashing into the port facilities, and the other two were groundings.

The distinctive feature of those accidents is that they all occurred at the quay or dock gate side at the stage of berthing/unberthing vessels. In most cases, an accident involves a variety of complex factors. Although its difficult to straightforwardly conclude the true causes, the Study Team outlined the reported accidents in **Table 7.3.4**.

7.3.6 Traffic Control of the Vessel in the Port

Until April of 1997, vessel traffic in the port of Mumbai has been managed as follows:
When a vessel approaches in the calling range, the captain makes contact with the Harbor Master

through VHF communication; the Harbor Master then guides the vessel as far as the port limit. Sailing within the port area is conducted by a licensed pilot and position of the vessel is marked on the chart in the harbor control room.

In this process, the entire monitoring is carried out only through voice contact, in other words, in most cases the Harbor Master manages blindly without any visual aid.

The traditional Vessel Traffic Service (VTS) described above just meets the minimum safety requirement of harbor traffic.

In compliance with the changing situation of increasing vessels in terms of number, size and various dangerous cargoes, MBPT has been planning to replace the system since the early 1990's with a most advanced system known as Vessel Traffic Management System (VTMS).

The plan has been supported by the Second Port Project of ADB both financially and technically, and the new system is to be in full operation in April 1997.

(1) The Designed System

The basic requirements to be fulfilled by the system are as follows:

- Acquisition and tracking of vessels in the harbor and its approach for effective monitoring of movements in all weather and conditions.
- Realistic, visual presentation of vessel movements, i.e. positions, courses, speeds and etc.
- Obtaining and recording of pre-arrival/pre-departure information on all calling vessels.
- Observation of actual position of floating objects, such as buoys, beacons, dredgers, etc.
- Obtaining all of this information without extra assistance, i.e. onboard equipment or services of crew.

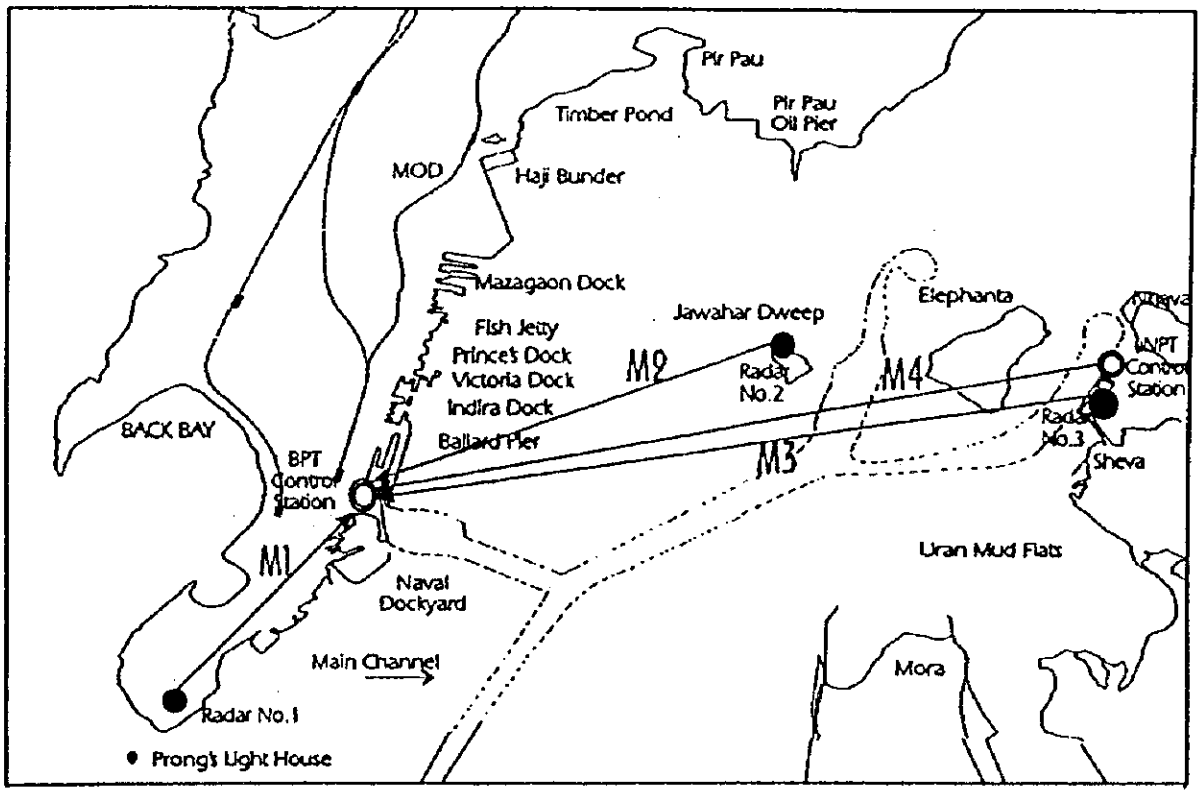
(2) Configuration

The new VTMS for the Port consists of following components to perform the above functions:

- Two Control Center Computers and Display Processing Systems at Ballard Pier and JNP.

- Three Radar Stations with Data Processing System at Colaba, Jawahar Dweep and Sheva.
- One Radio Direction Finder at Ballard Control Center.
- Five Display Workstations.
- VHF Communication Systems at each of the two Control Stations.
- Meteorological Sensor Equipment at Ballard Pier.
- Four Communication links.
- Voice Recording System.
- GPS and Hydrographic Survey Equipment installed onboard Survey Boat, "SUJATA".
- One Radio Tidal Gauge

A schematic diagram of the system configuration is shown in **Figure 7.3.1**.



Source: A report by S.N. Nayak, MBPT

Source: A report by S.N. Nayak, MBPT

Figure 7.3.1 Arrangement of VTMS Component

(3) The Possible Benefit of the New System

Once the System if fully operationally, it will be of great benefit to both the Port and the Users. Through integrating all information concerning vessel movements and terminal activities, various forecasts could be made, e.g.:

- Future position of vessels,
- Estimated times of arrival (ETA) of vessels
- Vessels crossing of check points, such as port boundary, anchorage, channel entrance,
- Closest point of approach (CPA) and time to CPA,
- Collision survey or analysis,
- Grounding prediction,
- Appropriate berth appointment to vessels for the most effective use of each berth/jetty.

However, minimizing sea accidents within the Port is one of the most important goals for all concerned in Harbor/Shipping circles, and new standards relevant to vessels' movements should thus be set up on following issues, in accordance with the coming situation:

- Minimum under keel clearance of vessels by channel,
- Maximum length of vessels by berth/jetty,
- Speed limit within the Port area,
- Maximum distance between vessels sailing in same direction,
- Giving priority to large /dangerous cargo carriers in possible meeting/crossing situation,
- Prohibition of overtaking/parallel sailing in channels,
- Priority of vessel sailing within channel along the channel,
- Special measures against dangerous cargo carriers such as escorting of tug(s),
- Prohibition of possible meeting of vessels in specified areas,
- Observance of International Maritime Conventions,

Compliance with the Harbor Master's requests .

Table 7.3.2 Existing Tug Fleet

No.	Name	L x B x D (m)	Propulsion Type	PS	B.Pull (t)	Speed	Builder	Built	Service
1	AAKASH	33.1 x 9.5 x 4.6	Voith Tractor	N.A.	32.5	12.0	Hooghly	1984	Oil Terminal
2	ABHIMAN	33.1 x 9.5 x 4.6	Voith Tractor	N.A.	32.5	12.0	Hooghly	1984	Oil Terminal
3	VS ANUKOOL	33.0 x 10.0 x 4.3	2 Voith Schneider	1500 x 2	30.0	11.0	Mazagoan	1985	Oil Terminal
4	VS AMIT	33.0 x 10.0 x 4.3	2 Voith Schneider	1500 x 2	30.0	11.0	Mazagoan	1986	Oil Terminal
5	VS ARUL	33.0 x 10.0 x 4.3	2 Voith Schneider	1500 x 2	30.0	11.0	Mazagoan	1986	Oil Terminal
6	DT RAJIV	23.5 x 6.5 x 3.9	2 Voith Schneider	453 x 2	10.0	10.0	N.N.	1987	Indira Dk.
7	DT DAULAT	22.2 x 6.5 x 2.7	Twin Screw	270 x 2	6.5	9.5	Vipul	1988	Dred'g Tug
8	RAJESH	22.4 x 7.4 x 3.3	2 Rudder Prop.	496 x 2	12.4	11.0	Vipul	1991	Indira Dk.
9	RUDRA	22.9 x 6.7 x 3.6	2 Rudder Prop.	450 x 2	10.0	9.8	Vipul	1959	Indira Dk.
10	RAHUL	22.9 x 6.7 x 3.6	2 Rudder Prop.	450 x 2	10.0	9.8	Vipul	1959	Indira Dk.
11	DHANANJAYA	21.5 x 5.5 x 3.0	Twin Screw	496 x 2	7.0	9.5	Dempo	1987	Dred'g. Tug
12	ANKUSH	33.7 x 8.9 x 4.3	Twin Screw	700 x 2	22.5	12.0	Kremersohn	1966	Indira Dk.
13	ATUL	33.7 x 8.9 x 4.3	Twin Screw	700 x 2	22.5	12.0	Kremersohn	1966	P.&V. Dk.
14	AMOL	33.7 x 8.9 x 3.9	Twin Screw	700 x 2	22.5	12.0	Kremersohn	1967	Indira Dk.
15	ARVIND	33.7 x 8.9 x 3.9	Twin Screw	700 x 2	22.5	12.0	Kremersohn	1967	Indira Dk.
16	BHARAT	20.4 x 5.6 x 3.0	Single Screw	358 x 1	6.5	8.5	Sodeno	1967	P.&V. Dk.
17	BRAHMA	20.4 x 5.6 x 3.0	Single Screw	358 x 1	6.5	8.5	Sodeno	1967	P.&V. Dk.
18	BAHADUR	20.4 x 5.6 x 3.0	Single Screw	358 x 1	6.5	8.5	Sodeno	1967	P.&V. Dk.
19	RAMESH	23.0 x 6.4 x 3.8	Single Screw	525 x 1	10.5	9.8	Sodeno	1968	Indira Dk.
20	RANJIT	23.0 x 6.4 x 3.8	Single Screw	525 x 1	10.5	9.8	Sodeno	1968	Indira Dk.
21	DHRUVA	21.2 x 5.5 x 2.6	Single Screw	272 x 1	3.5	9.5	M.D.L.	1972	Dred'g Tug
22	DHARMA	21.2 x 5.5 x 2.6	Single Screw	272 x 1	3.5	9.5	M.D.L.	1972	Dred'g Tug
23	RAJAN	22.4 x 7.4 x 3.3	2 Rudder Prop.	496 x 2	12.4	11.0	Bharati	1991	Indira Dk.
24	BHASKAR	21.0 x 5.6 x 3.4	Single Screw	488 x 1	7.0	8.5	N.N.	1983	P.&V. Dk.
25	BHISHMA	21.0 x 6.0 x 2.9	Single Screw	488 x 1	7.0	8.5	N.N.	1983	P.&V. Dk.
26	RAGHU	23.5 x 6.5 x 3.9	2 Voith Schneider	453 x 2	10.0	10.0	N.N.	1987	Indira Dk.

Source: MBPT

Table 7.3.3 Desired Replacing Schedule of Existing Tug Fleet

No.	Name	Service	Built	Age	1997	2002	2007	2012	2017
1	AAKASH	Oil Terminal	1984	13		*			
2	ABHIMAN	Oil Terminal	1984	13		*			
3	VS ANUKOOL	Oil Terminal	1985	12		*			
4	VS AMIT	Oil Terminal	1986	11			*		
5	VS ARUL	Oil Terminal	1986	11			*		
6	DT RAJIV	Indira Dk.	1987	10			*		
7	DT DAULAT	Dred'g Tug	1988	9				*	
8	RAJESH	Indira Dk.	1991	6				*	
9	RUDRA	Indira Dk.	1959	38	*				
10	RAHUL	Indira Dk.	1959	38	*				
11	DHANANJAYA	Dred'g. Tug	1987	10			*		
12	ANKUSH	Indira Dk.	1966	31	*				
13	ATUL	P.&V. Dk.	1966	31	*				
14	AMOL	Indira Dk.	1967	30	*				
15	ARVIND	Indira Dk.	1967	30	*				
16	BHARAT	P.&V. Dk.	1967	30	*				
17	BRAHMA	P.&V. Dk.	1967	30	*				
18	BAHADUR	P.&V. Dk.	1967	30	*				
19	RAMESH	Indira Dk.	1968	29	*				
20	RANJIT	Indira Dk.	1968	29	*				
21	DHRUVA	Dred'g Tug	1972	25	*				
22	DHARMA	Dred'g Tug	1972	25	*				
23	RAJAN	Indira Dk.	1991	6				*	
24	BHASKAR	P.&V. Dk.	1983	14		*			
25	BHISHMA	P.&V. Dk.	1983	14		*			
26	RAGHU	Indira Dk.	1987	10			*		
		Desired new tugs			13	2	2 1 2 3 1	2	

Table 7.3.4 Other Port Craft

No.	Name	L x B x D (m)	Propulsion Type	PS	Speed	Builder	Built	Service
	Survey Launch							
1	SUJATA	17.5 x 4.5 x 2.1	Twin Screw	185 x 2	10.0	SCINDIA	1976	Surveying
	Pilot Launches							
1	BOMBAY	13.7 x 3.5 x 1.7	Single Screw	84	8.0	J. S. White	1949	Pilot Launch
2	PRABHA	13.7 x 4.0 x 1.3	Twin Screw	234 x 2	16.0	Alcock	1983	Pilot Launch
3	PRUTHVI	13.7 x 4.0 x 1.3	Twin Screw	234 x 2	16.0	Alcock	1984	Pilot Launch
4	PUSHPA	13.7 x 4.0 x 1.3	Twin Screw	234 x 2	16.0	Alcock	1984	Pilot Launch
5	PRAGNYA	13.7 x 4.1 x 1.3	Twin Screw	235 x 2	15.0	Gladstone	1983	Pilot Launch
6	PURNIMA	13.7 x 4.1 x 1.3	Twin Screw	235 x 2	15.0	Gladstone	1983	Pilot Launch
	Inspection Launches							
1	TARANGANI	12.2 x 3.0 x 1.5	Single Screw	90	10.0	AFCO	1953	General
2	KAMINI	16.8 x 4.0 x 1.8	Twin Screw	90 x 2	11.3	AFCO	1955	General
3	SHALINI	16.8 x 4.0 x 2.0	Twin Screw	90 x 2	11.1	AFCO	1959	General
	Mooring Launches							
1	MEENA	12.2 x 3.4 x 1.7	Single Screw	90	9.0	AFCO	1955	-
2	USHA	12.2 x 3.4 x 1.7	Single Screw	90	9.0	AFCO	1955	-
3	SHOBHA	12.2 x 3.4 x 1.4	Single Screw	90	9.0	AFCO	1957	-
4	SUDHA	12.2 x 3.4 x 1.4	Single Screw	90	9.0	AFCO	1957	-
5	SHARDA	12.1 x 3.7 x 1.5	Single Screw	92	9.0	SCINDIA	1970	-
6	SUSHAMA	12.1 x 3.7 x 1.5	Single Screw	92	9.0	SCINDIA	1970	-
7	SAROJ	12.1 x 3.7 x 1.5	Single Screw	92	9.0	SCINDIA	1970	-
8	SAVITRI	12.1 x 3.7 x 1.5	Single Screw	92	9.0	SCINDIA	1970	-
9	SONALI	11.9 x 3.2 x 1.7	Single Screw	108	10.5	Gladstone	1986	-
10	SHRADDHA	11.9 x 3.2 x 1.7	Single Screw	108	10.5	Gladstone	1986	-
11	SUNITA	11.9 x 3.2 x 1.7	Single Screw	108	10.5	Gladstone	1986	-
12	SHAILA	11.9 x 3.2 x 1.7	Single Screw	108	10.5	Gladstone	1986	-
	Water Barges							
1	KUMKUM	28.1 x 6.5 x 2.8	Twin Screw	191 x 2	-	Howrah.	1969	100 t
2	KALPANA	32.0 x 7.0 x 3.0	Twin Screw	276 x 2	-	Uran	1990	N.A.

Table 7.3.5 Major Sea Accidents (1991 to 1996)

No.	Vessel	Date	Kind	Outline of Incident	Cause(assumed)
1	M.V.KHUSAM-II	05-01-1993	Crashing into Quay-crane while unberthing	The vessel left Indira Berth 18 being towed by two tugs, her stern approached close to Ballard Pier owing to E'ly wind with ebb tide. In front of the quay wall, the dock master ordered to operate engine ahead to stop her astern movement, but the engine failed to respond. To make matters worse, her astern way tore the towing lines of both tug boats, and the anchor couldn't be dropped, as a result, her stern crane crashed into No. 2 gantry crane of Ballard Pier. Damage to the quay crane with its cable was estimated at about US$ 5,700.	1 Malfunction or mishandling of the vessel's engine and anchor apparatus. 2 Over-aged tug boat and her towing line.
2	M.V.SPIC EMERALD GRT : 11,712 L : 149.4 B : 22.4 FLAG : INDIA	07-01-1993	Crashing into Dock-wall while berthing	While the vessel was backing astern towards Indira Berth 13 assisted by three tugs, the dock master ordered to operate engine ahead to reduce her stern way, but the engine failed to start because of lack of the compressed air, then in spite of the anchor dropping, its holding power was insufficient. As a result, the port quarter of the vessel crashed into the quay wall, caused damages to the quay wall and the bollard on it.	1 Malfunction or mishandling of the vessel's engine. 2 Timely and best use of the tug boats was not made.
3	M.V. GULF PRINCE GRT : 3,278 L : 105.3 B : 14.1 FLAG : ST. VINCENT	10-04-1993	Crashing into Dock-wall while berthing	While the vessel was approaching towards the entrance of Victoria Dock, her engines failed to respond to astern order. Then the port anchor was dropped, but the remained head way had her to crash into No.15 dock wall, caused damages to both the dock wall and her bow. Damages were estimated at about US$ 8,600.	1 Malfunction or mishandling of the vessel's engine. 2 Imprudence of approaching maneuver into narrow dock gate without tug.
4	M.V. ALESEEVSK GRT : 3,142 L : 105.1 B : 14.8 FLAG : RUSSIA	08-10-1993	Crashing into Dock-gate while docking	While the vessel proceeded towards Indira Dock entrance using her engine as required and assisted by two tug boats, she was required once to stop her head way and make her fast to the quay to wait for a rise in the tide level. And then the engines were ordered to run astern together with both tugs and mooring wires to restrain her head way. But her engines ran ahead, contrary to the order, and she crashed into the outer lock gate, caused severe damage to the gate. The amount of damage was estimated at about US$ 433,000, and the vessel was sold to compensate for the damage.	1 Mishandling of the vessel's engines.
5	M.T. ATI GRT : 35,986 L : 261.5 B : 32.4 Draft : 11.5 FLAG : MALTA	12-12-1993	Grounding	While approaching SW entrance of the port, the vessel ran aground on west of SW Prongs Light-buoy, where the Chart datum indicates the depth of water of - 9 m. The vessel didn't provide necessary chart to access to the port, and her radar didn't function satisfactorily. The circumstances were very poor visibility and ebbing tide.	1 Negligence of the ordinary practice of seafarer. 2 Poor maintenance of the important equipment.

(continued)

No.	Vessel	Date	Kind	Outline of Incident	Cause(assumed)
6	M.V. VEGA GRT : 13,297 L : 178.5 B : 22.9 FLAG : SINGAPORE	04-07-1994	Crashing into Dock-gate and Tug-boats	The vessel left Indira-berth 12 B and entered into the basin in between the outer and inner locks. While waiting in the basin for the rising of the sea water level, the outer gate was opened automatically to respond to flooding tide of the sea, then ship began to drift astern. The vessel's engine and mooring wires couldn't control her astern way, and her stem crashed into the inner gate, resulting in damages to the lock gate and two attending tug-boats.	1 Insufficient attention to the situation of the tide, securing condition of the vessel and lock-gate. Stand-by station including engine handling should be kept in such a situation. 2 Possible malfunction of her engine.
7	M.T. MAHARSHI DAYANAND GRT : 66,644 L : 256.5 B : 39.1 FLAG : INDIA	20-07-1994	Contact with a loading-arms while mooring at No.4 oil jetty.	The vessel had been made fast to No. 4 oil jetty with 20 ropes. On the morning of the day, in response to the Capt.'s report that the vessel is moving owing to the tidal stream, a duty dock master, then sent two tug boats to secure her to the jetty. After a while she drifted 10 to 12 m again, and before arrival of assisting tugs, No. 2, 3 and 4 loading arms were seriously damaged and caused some oil flooding in relation with the accident.	1 Negligence in adjusting mooring ropes to the change of the tide level. 2. Poor handling of emergency situation.
8	M.V. LEEFORT GRT : 5,967 L : 127.7 B : 20.4 FLAG:ANTIGUA &BARMUDA	14-11-1996	Crash into Dock-gate while docking.	While proceeding inwards in between the Indira Dock gates assisted by a tug, the vessel's stern was getting likely to contact with the inner gate. The dock master then ordered to steer hard over using with ahead engine at dead slow to escape the contact. But the CPP propellers functioned corresponding to her full ahead motion, and the effects of both the engine and the tug assistance in full power astern came to nothing, caused crashing of her bulbous bow into the west leaf of the gate. Damage to the dock gate was estimated at about US$ 28,600.	1 Malfunction and or mishandling of the vessel's engines.
9	M.V. JO LIND GRT : 18,697 L : 182.7 B : 29.5 FLAG : NETHERLAND	27-12-1996	Grounding	The vessel was forced to delay her scheduled leaving time from Pir Pau Berth for about one hour due to the busy channel traffic. The changed leaving time was assumed to be just before the deadline in terms of the tide level. After casting off and had been turning the head, her bottom grounded on contact with the East Bank of the Pir Pau Channel. The Buoy which is exhibiting the channel boundary had been moved about 40 m from its original position. Eventually she left the port on the next day, after confirmation that there was no damage to her bottom.	1 Rather imprudent judge of the changed leaving time. 2 An optimistic view on the Buoy position. 3 Insufficient control of the Nav. Aids Authority. 4 Malfunction of towing gear of the tug boat.

Source: The Study Team outlined based on a report of MBPT

7.4 Dredging and Dumping Areas and Volume

7.4.1 General

Mumbai port is a naturally protected harbour, quite unaffected by littoral drift. However, the problem of siltation does exist which can be attributed to various factors, viz., tidal action, alteration of currents, nature of bed material, and the inflow from various creeks joining the harbour. The tidal deposits of suspended material and river sediments within the harbour necessitate considerable maintenance dredging. The alluvium deposits in the harbour consist of mainly silty marine clay.

In the earlier years of the port, a nominal amount of dredging was adequate for maintaining the required depths, especially in the main channel. With the construction of new terminals and the increasing trend in deeper draft vessels visiting the port, some of the channels and few other areas at the new berths were to be further deepened or freshly dredged and the requisite depths maintained during the year. Probably, the influx of sediments from the creeks due to various reasons has also added on to the increase in siltation. A cumulative effect of the above factors resulted in the gradual increase of dredge quantities over the years and may have stabilized after a certain period. However, this cannot be confirmed since there has been no systematic detailed study carried out to ascertain the annual volume of siltation taking place in the harbour. Table 7.4.1 summarizes the depth to which the areas in the harbour have been deepened and the minimum maintained depths in the channels and alongside berths during the year.

Until 1986, maintenance dredging was being carried out exclusively by MBPT's own dredgers. The sinking of MBPT's suction dredger 'Vishal' in 1984, reduced the dredging capacity of port owned dredgers considerably. With the remaining available dredgers unable to meet the dredging requirement, they had to be supplemented by dredgers from Dredging Corporation of India (DCI) in 1986. Between 1986 to 1993 DCI was directly authorized by MBPT to carry out the major part of maintenance dredging, especially in the channels. It was only in 1994 that MBPT adopted the procedure of selecting contractors based on open tenders for supplementing the dredging.

Table 7.4.1 Deepened Depths and Minimum Working Depths at Different Locations in the Port

Sl. No.	Location	Deepened to Depth (m)	Minimum Maintained Depth (m)
1	Tanker Anchorages	11.58	11.27
2	Emergency Anchorages	11.58	11.27
3	Indira Dock Approach Channel	8.53	7.62
4	Indira Dock Entrance Channel	8.23	7.62
5	Ballard Pier South Face	4.57	3.35
6	Ballard Pier Extension	10.66	9.75
7	Mail Berth	10.00	9.14
8	East Mole	8.53	7.62
9	Indira Dock Entrance Lock	8.23	7.62
10	Indira Dock	7.62	6.09
11	Indira Dock Harbour Wall Channel	7.31	6.09
12	Indira Dock Harbour Wall Berth No18 To 22	8.53	7.01
13	Indira Dock Harbour Wall Tug Berth	3.96	3.35
14	Indira Dock Harbour Wall Launch Berth	3.96	2.44
15	Barge Berth No 1	5.18	4.26
16	Barge Berth No 2	4.27	3.35
17	Dredger Berth	5.18	4.26
18	P. & V. Docks Channel	5.18	4.26
19	Victoria Dock	5.79	4.87
20	Victoria Dock Harbour Wall Berth No 15	5.18	4.26
21	Prince's Dock	5.18	4.26
22	Prince's Dock Harbour Wall Berths K & M	5.18	4.26
23	Ferry Terminal Jetty Berths 1 To 4	5.18	4.26
24	Pir Pau Pier Head	9.75	8.83
25	Pir Pau Turning Circle	8.83	6.09
26	Pir Pau Access Channel Including Neck	6.09	5.48
27	M. O. T. Butcher Island Berth No 1 & 3	11.58	10.97
28	M. O. T. Butcher Island Berth No 2	10.97	10.36
29	M. O. T. Butcher Island Berth No 4	14.30	13.70
30	Bunders	Not Specified	
31	Main Harbour Channel Section 1	11.10	11.10
32	Main Harbour Channel Section 2	11.00	11.00
33	Main Harbour Channel Section 3	10.90	10.90
34	Main Harbour Channel Section 4	10.90	10.90
35	Main Harbour Channel Section 5	10.80	10.80
36	New Pir Pau Channel & Berth	9.00	8.70

Source : MBPT