Multi Cargo Port Terminal
at
Hazira, Surat

ADANI

Adani Hazira Port Private Limited

Multi Cargo Terminal at Hazira (Surat) Port

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1 INTRODUCTION

1.1 BACKGROUND

1.1.1 Historical development:

Government of Gujarat has announced a Port Policy in year 1995 and offered various locations for development of Private Ports under the Built-Own-Operate and Transfer (BOOT) basis. In April 2002, GMB approved the detailed Project Report (DPR Rev 2, April 2002) for Construction of Port facilities at Hazira Port and granted concession through a Concession Agreement, to Hazira Port Private Limited (HPPL). HPPL is a joint venture between Shell Gas BV Netherland & Total Gaz Electrical Holdings France. The location of Hazira Port is near the city of Surat, in the state of Gujarat, on the western coast of India.

The development of Hazira Port is planned Phase-wise. In Phase 1A HPPL has created facilities, specifically for handling of LNG Cargo. HPPL has developed a harbour with two arm breakwater and dredged the area to approach the LNG Berth and Turning circle for manouring of LNG ships. The Hazira Port is operational since April 2005.

Figure 1-1 Existing Layout of Port

As per the Concession Agreement HPPL can consider granting a Sub-concession to the eligible port developer to develop multi-cargo (Non-LNG) terminal(s) and related infrastructure at Hazira. HPPL has identified M/s. Mundra Port and Special Economic Zone Limited (MPSEZL) for development of its Phase I B of the Hazira Port through global bidding process. HPPL has issued Letter of Intent (LoI) to MPSEZL on November 19, 2009.

1.1.2 Development of phase 1B

HPPL has issued a Letter of Intent ("LOI") to Mundra Port and Special Economic Zone Limited (MPSEZL) for the development, construction, operation, and maintenance of multi-cargo terminals and related infrastructure (excluding LNG-related marine assets and the LNG terminal) at the Port.

MPSEZL has now formed a separate company for the construction and operation of Bulk/General Cargo Terminal(s) at the Hazira (Surat) Port, namely Adani Hazira Port Private Limited (AHPPL).

A sub-concession agreement ("Bulk/General Cargo Agreement" or "BGCA") already executed by HPPL, AHPPL and GMB as conferming party.

The five year Development shall include seven (7) berths and associated facilities to handle dry bulk, liquid, Container, Ro-Ro and general cargo as described in this report. In future AHPPL shall undertake development of subsequent phases.

1.1.3 Subsequent phases

Although this report addresses development of next five year development facilities, the Port has potential to add 5 or more non LNG berths in future which could handle containers, RO-RO, liquid, bulk cargo & general cargo. The expansion shall be carried out in phases subject to commercial viability.

1.2 OBJECTIVES

Following objects have been identified for the waterfront development.

- To establish a regional and coordinated approach to the development of the maritime industry which is ecologically, socially and culturally appropriate whilst supporting the economic development of the region.
- To ensure that natural resources are utilized and preserved in a coordinated, consultative and ecologically sustainable manner.
- To promote sustainable economic development to have a strong competitive advantage.
- To improve and maintain the regional road transportation network, including linkages to centers external to the region for use for trade, freight, emergency and community access as well as for providing key linkages with other modes of transportation.
- To provide an integrated transport system that supports the social and economic development needs of the trade and community in an ecologically sustainable manner.
- To ensure that all development is ecologically sustainable and that environmental impacts are identified, minimized and contained.

1.3 PROGRESS OF THE PROJECT

1.3.1 Design evolution

The Phase 1A port facilities were conceptualised in a manner that made the development of a multi-cargo port possible while recognising the potential limiting factors such as constricted availability of back-up land, legislation, the need for rail connectivity and the difficult marine conditions in and around the Sutherland Channel. This was a fundamental test that the HPPL sought to clear while designing the facilities. Accordingly, a relatively simpler and limited solution of creating stand alone LNG facilities, with a jetty head located in deep waters and a long trestle connecting the jetty head to the shore was abandoned and altered to facilitate wider port development

During Phase 1A (development of LNG handling facilities), significant common marine infrastructure like the spurs, access channel, common manoeuvring area and southern reclamation were created. These common marine infrastructures were planned in such a way that non-LNG cargo handling facilities can be developed in an organic manner.

The layout for next five year development addresses the requirements of tranquilly and higher operational windows for entry and exit of the vessels. The multipurpose berths are located inside a slot into the present southern reclamation, which provides the required tranquillity for the bulk /general cargo berths.

The port development shall include reclamation of various parcels of land in phased manner. GMB shall lease these land areas in favour of HPPL, which would be further subleased to AHPPL.

Multi Cargo Terminal at Hazira (Surat) Port

Chapter -2

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2 SITE LOCATION AND ENVIRONMENTAL DATA

2.1 FUTURE GROWTH POTENTIAL AND TRAFFIC PROJECTIONS

The potential of Hazira (Surat) Port's container traffic hinges significantly on the following factors.

(a) Strong economic growth potential for India

(b) Vibrant economy of Gujarat

(c) Vast container cargo hinterland

Further due to strategic location of the port and resultant logistics advantages, substantial traffic may be attracted to the container terminal. This is the primary basis for establishing a container terminal in Hazira (Surat) Port.

2.2 LOCATION:

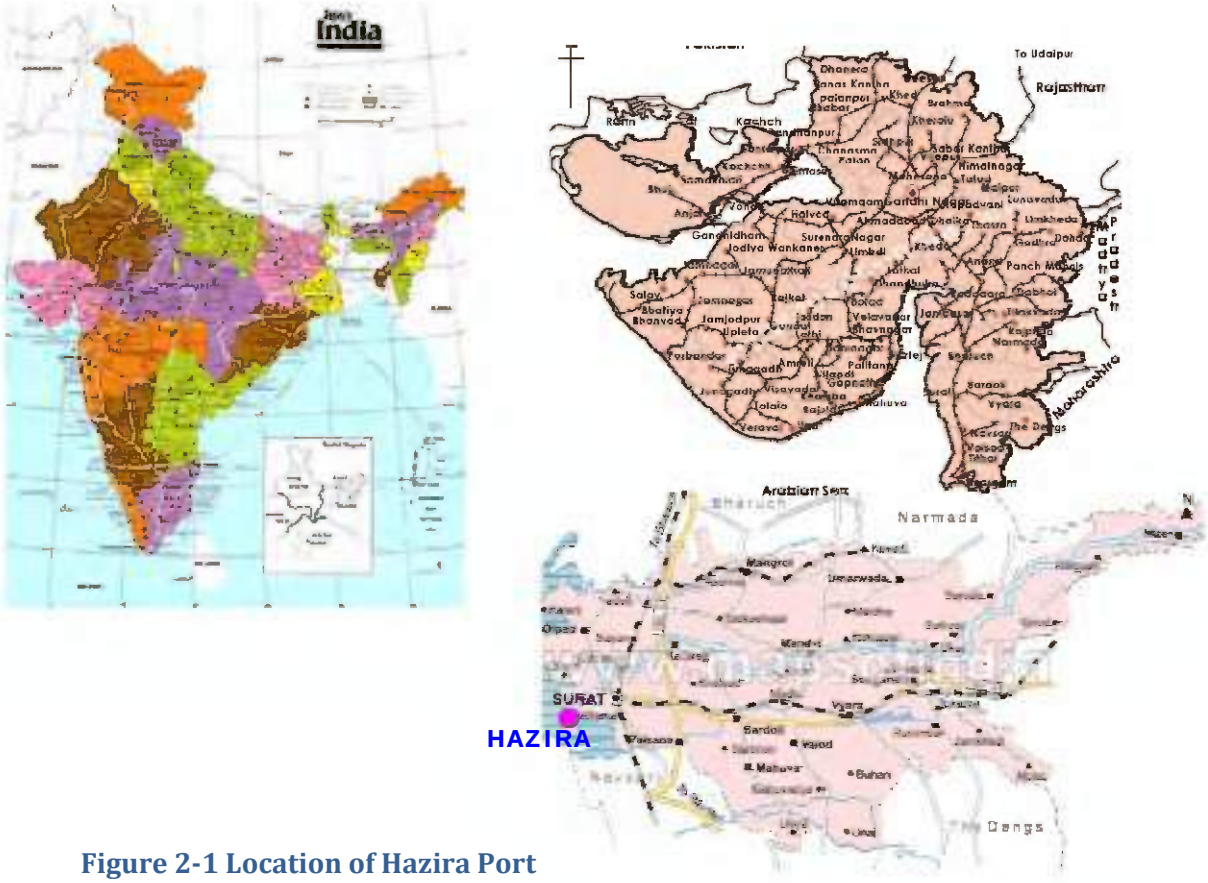

Figure 2-1 Location of Hazira Port

Hazira port is situated in the state of Gujarat on the west coast of India, and is about 25 km from Surat and 130 nautical miles north of Mumbai. The Hazira (Surat) Port is operational since April 2005 and is located at Hazira in Gujarat, on the western coast of India.

2.3 METEOROLOGICAL DATA

'Climatological Tables of Observatories in India (1931-1960)', an India Meteorological Department publication, provided historical data of the region. Surat is the nearest

observatory of the met office. The climate at Hazira is tropical and characterized by annual recurring seasons, as mentioned below in Table 2-1. The long-term analysis of micro-meteorological conditions based on 30 years data, was carried out for the post-monsoon, winter and summer seasons.

Table 2-1 Typical annual seasons

Period	Name of Season	Characteristics
Mid June – Sept	SW monsoon	Moderately strong SW winds, occasional cyclones
Oct – Nov	Interim period	Lighter winds, occasional cyclones
Dec – Feb	NE monsoon	Light NE winds, effectively no cyclones
March – Mid June	Summer	Moderately strong SW winds, frequent mostly distant cyclones in May/ June

2.3.1 Temperature

The information for Surat Airport on air temperatures was used for design purposes and is summarized below. The highest recorded temperature during September 2007 to August 2008 is 44.0^{0}C and the lowest recorded temperature is 9.0^{0}C.

Table 2-2 Air temperatures at Surat Airport

Month (2007-2008)	Daily minimum (°C)	Daily maximum (°C)	Daily Average (°C)
September	21	37	29
October	18	38	29
November	13	35	25
December	11	34	23
January	9	33	21
February	13	37	27
March	16	40	26
April	18	40	33
May	21	44	36
June	25	42	33
July	26	40	27
August	28	31	29
Average	**18.3**	**37.6**	

(Source: IMD)

2.3.2 Relative humidity

The records for Surat airport show an annual average humidity of 61.4 %, with a maximum of 100 % and a minimum of 11 %.

Table 2-3 Relative Humidity at Surat Airport

Month (2007-2008)	Minimum RH %	Maximum RH %	Average RH %
September	47	100	79.8
October	17	98	68.2
November	21	88	55.6
December	20	99	60

Month (2007-2008)	Minimum RH %	Maximum RH %	Average RH %
January	16	96	50.8
February	18	90	47.4
March	11	89	42.1
April	10	88	44.6
May	11	86	53.2
June	18	98	65.2
July	50	96	81.7
August	49	97	87.7
Average	24	93.75	61.4

(Source: IMD)

The mean monthly average of Relative Humidity values for Surat station was recorded for 02.30 hrs, 05.30 hrs, 08.30 hrs, 11.30 hrs, 14.30 hrs, 17.30 hrs, 20.30 hrs and 23.30 hrs. Relative Humidity is generally high during the period from June to September. The diurnal variations are least during monsoon season. The diurnal variation is highest during summer period.

2.3.3 Barometric pressure

The barometric pressure has been measured over a period of 30 years at Surat Meteorological Station. The average pressures found at station level, which is 12 meters above MSL, are presented in Table below:

Table 2-4 Average Barometric Pressure

Month	Morning (mbar)	Evening (mbar)
January	1013.9	1010.8
February	1012.9	1009.1
March	1011.1	1007.1
April	1009.0	1004.0
May	1004.1	1002.4
June	1002.4	999.5
July	1001.2	999.2
August	1003.2	1000.8
September	1004.4	1003.5
October	1010.1	1004.4
November	1012.8	1009.3
December	1014.4	1010.9

2.3.4 Rainfall

Rainfall figures observed at Surat airport during a period of September 2007 to August 2008 are presented in Table below:

Table 2-5 Monthly Rainfall

Month (2007-2008)	Monthly Total (mm)	No. of Rainy Days
September	171.3	12
October	0	0

Month (2007-2008)	Monthly Total (mm)	No. of Rainy Days
November	0	0
December	0	0
January	0	0
February	0	0
March	4.6	3
April	0	0
May	0	0
June	158.5	7
July	355.8	20
August	500.2	28
Total	**1190.4**	**70**

The rainy season in the area extends from June to September. The mean total rainfall, during the monsoon period (June to September), has been recorded as 1190.4 mm at Surat Station. The rainfall data indicates that the rainfall is not spread through out the year since nearly 97.09 % of the total rainfall occurs during the periods from June to September.

2.3.5 Visibility

Measurements taken over the last 28 years at Surat give a good overview of the visibility at the port location. The morning period, which is generally worse than the afternoon, is characterized by the figures presented in Table below:

Table 2-6 Monthly Visibility figures

Month	Up to 1 Km (days)	1 to 4 Km (days)
January	0.9	4.0
February	0.4	4.0
March	0.3	3.0
April	0.0	0.7
May	0.0	0.2
June	0.0	1.0
July	0.0	2.0
August	0.1	1.9
September	0.1	1.2
October	0.1	0.7
November	0.3	1.6
December	0.6	2.0

Annual figures for the visibility are as follows:

Table 2-7 Annual visibility figures

	Up to 1 Km (days)	1 to 4 Km (days)
Morning	3	23
Afternoon	0	3

2.3.6 Wind Conditions

Wind velocities were concluded from measured wind speed and direction at site by HPPL The prevailing wind direction is from 2400. The wind rose diagram and wind class frequency diagram for year 2009 has been shown below.

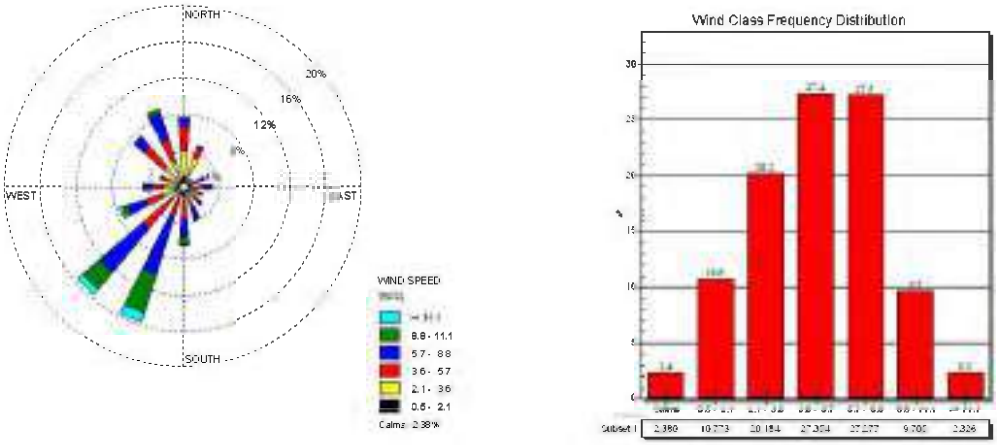

Figure 2-2 Wind class Frequency Diagram and Wind Rose Diagram FY 2009

2.3.7 Tidal data

All Principal levels are referred with Chart Datum as defined on Admiralty Chart 2021 are given below.

Maximum Recorded Tide Level.	: (+) 8.26m CD
MHWS	: (+) 7.67m CD
MHHW	: (+) 6.83 m CD
MHW	: (+) 6.38 m CD
MHWN	: (+) 4.94 m CD
MLWN	: (+) 3.01 m CD
MLW	: (+) 1.63 m CD
MLLW	: (+) 1.28 m CD
MLWS	: (+) 0.39 m CD
LAT	: (-) 0.27 m CD
Anticipated maximum water level including surge	: (+) 9.20m CD

2.3.8 Waves

The harbour is protected by a combination of spur.

The southern basin is well protected by the waves propagating outside the harbour area and common manoeuvring area. The wave condition inside the southern basin is suitable for handling Dry bulk, Ro-Ro, Container and Liquid cargo.

2.3.9 Current

Design current velocity: 0.5 m/s shall be considered for the design of the berths. However during detailed design, current velocity for design of piles will be reviewed again.

Multi Cargo Terminal at Hazira (Surat) Port

Chapter -3

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3 MARKET SURVEY AND MULTI CARGO TRAFFIC FORECAST

3.1 INTERNATIONAL AND DOMESTIC FACTORS RELATED TO SEABORNE TRADE

3.1.1 World seaborne trade

Foreign trade flows are improving sharply after the global economic slowdown during second half of 2008 and first half of 2009 that impacted the world trade significantly. The global GDP grew by 2.2% in the 4th quarter of 2009. Most of the leading sea trading nations also registered improvement in 4th quarter of 2009 compared to that of 3rd quarter of 2009. As per International Monetary Fund (IMF) estimates, overall global GDP grew by 2.5 % (annualized) in the fourth quarter of 2009. During the past 10 years, world seaborne trade grew at an estimated CAGR of 3.1% and with the reviving global economy it is expected that world seaborne trade would achieve a healthy growth rate over the next decade.

Table 3-1 World Seaborne trade figures

WORLD SEABORNE TRADE , Million Tonnes															
Year	Iron Ore	Coal		Grain	Baux. Alum	Phos. Rock	Minor Bulk	Cont-ainer	Other Dry Trade	Total Dry Trade	Crude Oil	Oil Products	Total Oil	Gas Trade		Grand Total
		Coking	Steam											LPG	LNG	
2000	447	174	342	264	54	30	749	628	903	3,591	1,656	523	2,180	39	104	5,913
2001	450	169	381	260	52	31	765	647	893	3,647	1,684	553	2,237	36	107	6,027
2002	480	171	402	271	55	30	776	718	941	3,844	1,667	556	2,223	36	113	6,216
2003	516	178	441	264	60	29	815	805	925	4,032	1,770	586	2,356	36	125	6,549
2004	587	179	481	275	68	31	873	918	899	4,310	1,850	636	2,486	38	131	6,965
2005	658	184	504	272	78	31	900	1,020	870	4,516	1,885	691	2,576	38	142	7,272
2006	723	190	539	292	79	30	952	1,134	831	4,771	1,933	736	2,668	40	159	7,639
2007	783	207	565	305	84	32	987	1,259	769	4,990	1,984	763	2,746	39	171	7,947
2008	843	219	576	322	86	31	988	1,318	795	5,178	1,964	771	2,735	42	173	8,128
2009	849	205	572	320	81	27	935	1,198	765	4,953	1,920	746	2,666	39	192	7,850

Source – Clarkson Dry Bulk Trade Outlook, Clarkson Oil & Tanker trade Outlook & Dewy research report

Despite the global meltdown, India remains the second fastest growing economy globally, with a real GDP growth rate of 6.3 % in 2008-09. India's GDP grew by 7.9% as per 3rd quarter 2009-10 result compared to 6.1% of 2nd quarter of the year 2009-10. A surging economy places a huge demand on the port industry.

The Table 3-2 shows that growth in 2008 for developing economies dropped to 5.4%, from 7.3% achieved in 2007. Although significantly reduced, compared to double digit growth rate of the past few years, China continued to lead, with growth rate of 9.0% in 2008 and 7.8% in 2009. Other major developing economies, including India also recorded robust positive growth compared to contraction seen in developed economies.

Table 3-2 World Economic Growth, 2006 – 09 (annual percentage change)

Region/ Country [b]	2006	2007	2008	2009
WORLD	3.9	3.7	2.0	-2.7
Developed Economies	2.8	2.5	0.7	-4.1

Region/ Country [b]	2006	2007	2008	2009
Of which United States	2.8	2.0	1.1	-3.0
Japan	2.0	2.4	-0.6	-6.5
European Union (27)	3.1	2.9	0.9	-4.6
Of which: Germany	3.0	2.5	1.3	-6.1
France	2.4	2.1	0.7	-3.0
Italy	1.9	1.5	-1.0	-5.5
United Kingdom	2.9	3.1	0.7	-4.3
Developing Economies	7.2	7.3	5.4	1.3
China	11.1	11.4	9.0	7.8
India	9.8	9.3	7.8	6.3
Brazil	4.0	5.7	5.1	-0.8
South Africa	5.4	5.1	3.1	-1.8
Transition Economies	7.5	8.4	5.4	-6.2
Of which Russian Federation	6.7	8.1	5.6	-8.0

Source: IMF Report 2009

3.1.2 India's seaborne trade

India's foreign trade comprises of export-import trade in various bulk commodities including crude oil, petroleum products, iron, coal, and general cargo. Since the onset of economic liberalization in 1990, there has been a significant spurt in Indian foreign trade.

Among all the maritime states & union territories, Gujarat is the leading and most successful state in the port sector in terms of length coastline, number of operational ports, cargo traffic handled and attracting private investment. Of the total Indian port traffic of 738 mT in 2008-09, Gujarat handled the maximum traffic at 225 mT, which accounts around 33% of the total national traffic.

Traffic handled at Indian ports has grown at a significantly higher rate compared to growth in the world seaborne trade. To the large extent the strong growth of India's seaborne cargo traffic reflected buoyancy in India's overall Gross Domestic Product (GDP) and robust growth in merchandise trade in recent years. India's seaborne cargo traffic grew by 2 % in 2008-09 compared to decline of 6 % in world seaborne cargo traffic over the same period

During the last five years (2004-05 to 2008-09), India's exports and imports have grown at an impressive rate of CAGR 21% and 29% respectively in terms of value . Although growth in exports and imports were impacted in 2008-09 due to global economic slowdown, exports grew by 3% in 2008-09 and imports grew by 14% in 2008-09.

3.1.3 Indian economy overview

India is the second most populous country and the largest democracy in the world. The far-reaching and sweeping economic reforms undertaken since 1991 have unleashed the enormous growth potential of the economy. Aided by structural reforms and other policy calibration India has indeed come a long way since its 1991 balance-of-payments crisis. By the middle of 1990s, GDP growth had accelerated to an average of 7% per annum, and substantial improvements had been achieved in a number of social indicators, including health, education and poverty.

Economic activity did slow down in the latter part of the decade, and since 1997/98 to 2002-03, average growth had been around 6%. This reflected the temporary effects of various shocks- including the Asian financial crisis, volatile world oil prices, patchy monsoons leading to weak agricultural output and natural calamities. During 2003-04 to 2008-09, Indian economy grew at significantly higher rate of 8.2%. In 2008-09 India's economy has again proved its resilient character by performing far better than most of the developed nations during the current global financial meltdown.

Table 3-3 World vs. India GDP growth (%)

	2006	2007	2008	2009
World	3.9	3.7	2.0	-2.7
India	9.8	9.3	7.8	6.3

(source: IMF website)

The rapid move towards deregulation and liberalization has resulted in India becoming a favourite destination for foreign investment. India has emerged as one of the most vibrant and dynamic developing economy that is expected to attract higher investments and economic growth.

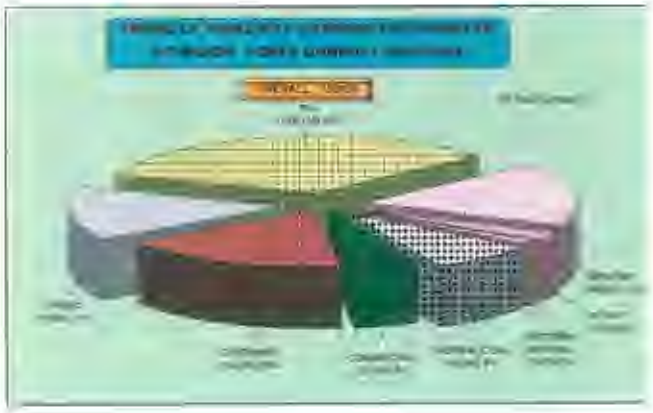
3.2 CARGO TRAFFIC

3.2.1 Cargo traffic at Indian ports

The growth in cargo handled at major and non-major ports in India in 2008-09 was 2.1% and 2.0% respectively compared to 12% and 6.5% achieve in year 2007-08. The deceleration in the growth was on account of severe slowdown in world trade during second half of 2008-09. However, with revival in world economy the traffic handled at major ports was 430 mT in 2009-10(April-Dec) compared to 411 mT handled last year i.e., growth rate of 4.6%.

Figure 3-1: Year wise cargo traffic for Indian Ports

Source: IPA



Source: IPA

Figure 3-2: Cargo Mix at Indian ports

As seen from the Figure 3-2, POL is the largest cargo handled at Indian ports, followed by coal, iron ore, containers and fertilizers. Cargo mix for the Indian ports is likely to remain similar in the near term.

3.2.2 Cargo traffic at Gujarat

Gujarat has the longest coast line in India with approximately 1600 km and it handled almost 33% of total cargoes handled at Indian ports in 2008-09. Gujarat ports cater to the north and west India, which is the largest hinterland in the country. Consequently Gujarat ports have grown at a higher CAGR of 12.9% compared to total Indian ports growth of CAGR of 8.3% over past 5 years.

Figure 3-3: Cargo Traffic at Gujarat Ports

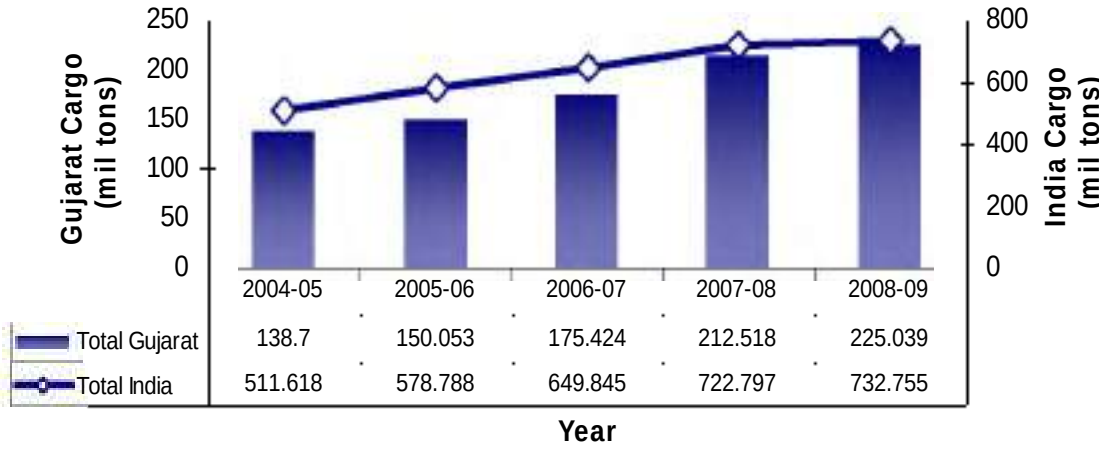


Table 3-4 Cargo breakup for west coast ports (2008-09)

State wise (West Coast) Breakup of Cargoes handled in 2008-09 , Mil Tones							
West Coast	**POL**	**Iron Ore**	**Coal**	**Fertilizer**	**Container**	**Others**	**Total**
Gujarat	137	6	18	12	14	38	225
Maharashtra	39	4	5	0	52	18	118
Goa	1	46	5	0	0	3	54

Source: IPA

It is evident from the Table 3-4 that POL, coal, fertilizer and containers are the major cargoes being handled at the port on the west coast of India. Gujarat leads in cargo handling of all cargoes except container cargo.

The Port has a locational advantage for attracting the cargoes from western, northern and parts of central India (its primary and secondary hinterland). The hinterland can be demarcated as follows:

North India: Haryana, NCR region, Punjab
West India: Rajasthan, Gujarat, Maharashtra
Central India: Madhya Pradesh.

Based on the above traffic figures, the target commodities from the hinterland the Port shall be:

1) Coal
2) Steel Product
3) Fertilizer
4) POL
5) Container

TARGET COMMODITIES

3.3 COAL

Overview:

India is the 4th largest coal producer and the third largest coal consumer in the world and imports 4% of the total world coal imports. Coal industry is a highly regulated

sector, regulated by Ministry of Coal. Commercial production of coal is under the purview of public sector undertaking Coal Indian Limited and its subsidiaries. Private sector is permitted to engage in coal mining activities for captive use only. Total demand for coal in India in the year 2008-09 was 494 mT, with CAGR of 5% over last 5 years.

Table 3-5 Year-wise Total Demand for Coal in India (mT).

Coal Demand	2004 - 05	2005 - 06	2006 – 07	2007 - 08	2008 – 09
Power	280	303	310	320	335
Steel	34	42	43	45	42
Cement	19	20.2	25	25	22
Others	72	79	82	93	95
TOTAL	**404**	**445**	**474**	**483**	**494**

Source: imaritime

Thermal power generation is the single biggest user of domestic and imported coal in India. Sponge iron plants and cement plants are the other key users of thermal coal. In FY 2009, thermal power plants consumed around 330 million ton of thermal coal which is 68% of total coal consumption in India. The domestic coal is typically characterized with high ash content and low calorific value. The Table 3-6 shows the comparison of quality of domestic coal and imported coal wherein the domestic coal has around 40 % of ash content whereas imported coal has 5-15% of ash content.

Table 3-6 : Coal quality of Domestic port and Imported Coal

Parameters	Domestic Indian (Grade F)	Australian Coal	South African Coal	Indonesian Coal
Ash Content (%)	40	12	15	5
Sulphur Content (%)	0.5	0.5	0.6	0.5
Gross Calorific Value	4100	6800	6600	5800

Source: imaritime

Indian coal is cheaper in terms of landed price for power producers but proves to be expensive in terms of boiler efficiency and ash disposal. Blending of imported coal to the domestic coal reduces the ash content of 40% to 34% and improves boiler efficiency by 2.6 % points translating to lower cost of power production.

Table 3-7 shows that 63 % of the total power produced in the country is through the thermal power plants. The installed power generation capacity of India stood at 147,900 MW, which translates to a shortage of 12 % compared to the demand. (Ministry of Power)

Table 3-7 : Capacity of Indian Power Plants

Energy	Capacity (MW)	%
Hydro	36878	25%
Thermal	93726	63%
Nuclear	4120	3%

Energy	Capacity (MW)	%
Renewal	13242	9%
Total	147966	

(Ministry of Power: Annual Report 2008-09)

Demand for power in India is increasing at an annual rate of 8-10 % and is expected to cross 955,000 MW by 2030 as per a report of Government of India (Ministry of Power). In line with national ambition to add 100,000 MW of capacity by 2012, various private and public sector players are setting up power plant in hinterland as well as coastal regions. The power plants located at coastal region will be fed both by domestic coal, transported through rail / sea route and by imported coal. The power plants located at pit head would require imported coal for blending and optimization purpose as explained above. Gujarat and Maharashtra are considered to be India's one of the most industrialized states and are expected to continue to have higher industrial growth. The expansions of existing industry and the upcoming industries would drive the demand for power in these states.

On account of limited availability of gas and hydro locations, significant portion of the planned additional capacity is based on coal as a source of fuel. About 75,570 MW of power generation capacity is being planned through coal based thermal power projects. With significant growth in the thermal power generation capacity, demand for the coal has increased significantly. Domestic supply of coal has not been able to keep up with the demand leading to rise in import of coal. Going further demand supply gap for the coal is expected to accentuate on account of large thermal plants coming on stream. This would lead to higher import of coal and is expected to reach a figure of 138 mT by 2016-17.

Table 3-8 Expected Demand and Supply of Coal in India (mT)

Particulars	2008 - 09	2009 - 10	2010 - 11	2011 - 12	2016 – 17
Production	418	439	480	520.5	**664**
Consumption	494	519	565	616.5	**802**
Import	76	80	85	96	**138**

Source: Coal India Ltd. (CIL)

The power plants located in the hinterland of the Port are shown below in the Table 3-9 wherein the power plant of Ahmadabad, Surat, and Wanakbori in Gujarat, and Bushawal and Karadi in north Maharashtra are potential target. The Port has logistical advantage in catering to these power plants compared to competing ports at Mundra, Dahej and Navlakhi as shown in Table 3-10. The combined coal import requirement of these power plants is 4.9 mT, which can be directly targeted by the Port.

Table 3-9 Imported Coal Requirement in the Primary and Secondary Hinterland

Power Plants	Location	Present capacity (MW)	Present (Major) Competing Port	Coal Req. (mT)	Import Coal Req. (mT)
GEB	Gandhinagar	870	Mundra, Navlakhi	4.35	0.761

Power Plants	Location	Present capacity (MW)	Present (Major) Competing Port	Coal Req. (mT)	Import Coal Req. (mT)
	Ukai	850	Mundra, Navlakhi	4.25	0.744
	Wanakbori	1470	Mundra, Navlakhi	7.35	1.286
TORRENT AEC	Ahmadabad	1150	Mundra, Navlakhi	5.75	1.006
	Surat	1150	Magadalla, Dahej(E)	5.75	1.006
PSEB	Bhatinda	1070	Mundra, Navlakhi	5.35	0.936
	Ropar	1260	Mundra, Navlakhi	6.30	1.103
RRVUNL	*Kota	1045	Mundra, Navlakhi	5.225	0.914
	Suratgarh	1000	Mundra, Navlakhi	5.00	0.875
MSEB	Bhusawal, Maharashtra	483	Magdalla	2.50	0.6
	Koradi	850	Magdalla	4.25	1.0
	Nasik	910	Magdalla, Mumbai	4.60	1.092

Source- Adani Power Limited

Table 3-10 Details of Railway distance advantages of Hazira (Surat) Port over competing Ports for Thermal Coal

RAILWAY MATRIX IN KM									
Destination	Ahmadabad	Ukai	Wanakbori	Koradi	Suratgarh	Kota	Bhatinda	Bhusawal	Nasik
Hazira	266	106	266	775	1160	692	1315	375	470
Dahej Port	234	200	240	864	1129	663	1285	458	556
Navlakhi Port	251	558	380	1278	1128	846	1232	813	1851
Mundra Port	374	690	502	1340	1135	970	1291	937	2098

Source : Website http://rbs.indianrail.gov.in

The neighbouring port, Magdalla managed by GMB handles 2.0 mT of coal. This coal is used by the industries located at Panoli, Ankleshwar, north Maharasthra and west Madhya Pradesh. The Table 3-11 shows the increasing trend of imports of coal at Magdalla port.

Table 3-11 : Trend of Coal Import at Magdalla Port. (mT)

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Coal	1.02	1.30	1.70	2.11	1.76	2.00

The Magdalla port operates only 8 months in a year, as it does not operate during monsoon period (May 15 to September 15). Moreover, the port being a lighterage port, the vessel discharges coal in the barges at the anchorage point, which then brings the cargo to the port. For a vessel of 50,000 T parcel size of coal, the turnaround time would be six and half (6.5) days, which translates in to higher shipping and port costs. Moreover, the ships calling at the Magdalla port are mainly Handymax type (55000

dwt) equipped with ship gears and grabs. Currently the evacuation of the cargo from the port is managed through road transport.

As the proposed Port would be an all weather port, operations at the port can be on 24x7 basis and will also be able to operate during 4 months of monsoon compared to Magdalla port which remains closed during monsoon. At present prorated monthly cargo handled at Magdalla port is 0.25 mT per month for eight months of operation which translate to 3.0 mT for 12 months.

The complete cargo of 2.0 mT handled at Magdalla port can be shifted to the Port. The Port being all weather port with direct berthing facility and planned to be equipped with efficient equipments would ensure faster turnaround of the vessels. Further, evacuation of this imported trading coal can be through both road and rail for distant locations.

Moreover, Adani Enterprises Limited (AEL), the flagship company of Adani Group is active in coal trading. AEL is the largest importer of coal in India. The company has also entered into long-term strategic arrangement for supply of imported coal, which has lesser ash content and better calorific value with the largest mining company of Indonesia. The potential for the AEL coal is expected at the Port is up to 1.0 mT in the initial years which can further increase based on the business of AEL. The evacuation of imported coal is expected to be through both rail and road.

Considering the figures of approx. 4.9 mT of coal from the targeted power plants, the shifting of Magdalla port coal of approx. 2.0 mT and additional AEL trading coal to 1.0 mT, the target in totality would be around 7.9 mT of coal. The targeted quantity is expected to increase based on the demands from primary and secondary hinterland.

The Table 3-12 projects the hinterland coal demand from primary and secondary hinterland of the Port. As per market intelligence of MPSEZL, the hinterland coal demand is expected to be handled at ports other than Hazira are mainly Navlakhi and Dahej Ports. Some portions of the hinterland demand would also be handled by Kandla port and Mundra port. With the development of adequate transport linkages at the Port and the availability of more dedicated coal berths, the Port would be a key port to cater to the hinterland traffic potential.

Based on the market intelligence and analysis, the traffic potential for the Port could be up to 45% of the targeted demand (7.9 mT) for coal in the initial year. The potential is expected to increase gradually and attain the targeted demand by year 2016-17. The potential is further expected to increase based on the upcoming coal based power plants in the vicinity of the Port.

Out of the potential cargo, the firm traffic projection for coal is expected to be approx. 70% of the potential cargo traffic in the first two years. On increasing awareness of the benefits of the Port to the hinterland coal users/ importers, the Port is expected to capture 80% of the potential traffic within three years.

Table 3-12 Coal Demand, Potential and Firm Traffic for Hazira (Surat) Port (mT)

Year	Coal Demand from Primary & Secondary Hinterland	Potential Traffic	Firm Traffic forecast
2013 – 14	16.0	3.5	2.5
2014 – 15	17.0	4.5	3.0
2015 – 16	18.5	5.5	4.5
2016 – 17	22.0	8.9	7.5
2017 – 18	25.0	12.2	10.4
2018 – 19	28.0	15.6	13.2
2019 - 20	31.0	18.9	16.1
2020 - 21	34.0	22.3	18.9
2021 – 22	37.0	25.6	21.8
2022 – 23	40.0	29.0	24.6
2023 – 24	43.0	32.3	27.5
2024 – 25	46.0	35.7	30.3
2025 – 26	49.0	39.0	33.2
2026 – 27	52.0	42.4	36.0

Source: Hazira hinterland demand for Coal -MPSEZL market intelligence

Dahej terminal and Hazira terminal intends to cater to different coal markets. In context of imported coal, Dahej is logistically better placed as compared to Hazira for power plants of North and Central Gujarat, Rajasthan and Western M.P. Further, with Adani group's power plant coming up at Dahej, a part of the capacity at Dahej terminal would be utilized for importing coal for this power plant.

Hazira terminal would primarily cater to local cargo of Surat and surrounding area, South Gujarat and North Maharashtra. Hazira terminal would also be able to compete and attract 2 MT of cargo currently handled by GMB run Magdalla port.

3.4 STEEL PRODUCT

India's steel pipe production capacity in 2009 was 4.8 mT in comparison to global production capacity of 27.8 mT which translates to 14.7 % of the world production capacity. Within next 7-10 years, on account of robust development in the Middle East, India, US & Africa, the production of steel pipes is expected increase further. In case of Middle East market, Indian firms have competitive advantage compared to Japanese & European firms as landed cost for Indian pipes in the Middle East is US$1210 /T, compared to US$1425/T for European pipes and US$ 1350/T for Japanese pipes. Most of the steel pipe manufacturers have their presence in Gujarat and has almost 85% of the share in the total Indian pipe exports. (Source: Simdex)

Business Drivers for Steel Pipe:

- Major domestic boost in pipe market for gas transportation in the Middle East countries
- Replacement of existing gas pipe line in US and Russia

- Improvement in infrastructure of water supply system (both sewerage & drinking) in India and developing countries.
- Antidumping restrictions on Chinese pipes by US & Middle East authorities.

Table 3-13 Global demand scenario for next 5 years

Geographical Region	Total Length (Km)	Equivalent (mT)	Demand distribution	Equivalent (US $ Bn)	Assumed Market
North America	57920	17.55	23%	18.43	5%
Latin America	34278	10.39	14%	10.91	5%
Europe	33822	10.25	14%	10.76	2%
Africa	11610	3.52	5%	3.69	10%
Middle East	21541	6.53	9%	6.85	50%
Asia	81736	24.77	33%	26.00	33%
Australia	5566	1.69	2%	1.77	2%
Total		**74.68**		**78.42**	

Source: Simdex

** Assumptions: 1 Km = 303.50 tonne; Average realization = US$1050 per tonne

Table 3-14 Capacity of Steel Pipe manufactures (Western India)

Manufacturer	Capacity (mT) Western India.
Welspun Ltd	1.3 – Kutch (Mundra) **0.3 - Dahej**
Jindal SAW Ltd	0.5 – Kutch (Mundra)
Maharashtra Seamless Ltd	0.4 – Mah.
PSL Limited	0.9 – Kutch (Kandla)
Man Industries Ltd	1– Kutch **0.4 - Indore**
Total	**4.8 mT.**

Source: Individual company profiles.

The export of steel pipes from Gujarat was 2.3 mT in FY 2008-09 of which 1.27 mT was exported through Mundra and 1.0 mT was exported through Kandla.

The exports of the pipe manufactured at the production location of Dahej (Welspun) and Indore (Man Industries) is currently handled through Mundra and Kandla ports. The table 3-15 shows the inland logistical advantage of transporting cargoes from Indore and Dahej through the Port compared to the other pipe exporting ports i.e. Mundra and Kandla. The movement of pipes from these locations is presently handled through road.

Table 3-15 : Port Distance Matrix - Indore and Dahej Manufacturing location.

Port	Indore		Dahej	
	Rail(Km)	Road(Km)	Rail (Km)	Road(Km)
Hazira	604	489	130	140
Mundra	880	1090	602	708
Kandla	810	1020	532	638

As the pipes are being transported through road, the cost of inland transportation is in the range of INR 0.86 -1.10 per km / T (PKPT). Considering the transportation cost as INR. 1.0 (average) PKPT, cargo originating from Indore would save approx. INR 531 / T and Dahej would save Rs. 498 / T if exported through the Port compared to Kandla port. This substantial savings for the exporter and would attract the pipe manufacturing locations of Dahej and Indore to export from the Port.

Considering the inland transportation cost benefits, it is expected that pipes originating from Dahej and Indore manufacturing locations and exported at Mundra and Kandla ports can be completely shifted to the Port. The shift in cargo is expected to be 0.6 mT in the first year of operations of the Port and expected to increase gradually. The firm traffic of steel pipes would be 100% of the potential traffic.

Table 3-16 : Traffic projection for steel cargo for Hazira (Surat) Port.

Year	Traffic Potential , mT	Firm Traffic, mT
2013 -14	0.6	0.6
2014 -15	0.7	0.7
2015 – 16	0.8	0.8
2016 -17	0.9	0.9
2017 – 18	1.0	1.0
2018 – 19	1.0	1.0
2019 – 20	1.1	1.1
2020 – 21	1.1	1.1
2021 – 22	1.1	1.1
2022 – 23	1.2	1.2
2023 – 24	1.2	1.2
2024 – 25	1.2	1.2
2025 – 26	1.3	1.3
2026 – 27	1.3	1.3

Source: AHPPL Estimate

Dahej terminal will eventually have 2 berths mechanized, and hence will primarily be a coal terminal, hence Hazira terminal would not face any competition from the Dahej terminal. In medium term, the non-mechanized berth will be used for steel handling till Hazira facility comes up. The steel cargo comprising plates, coils, pipes will come from Welspun Dahej and Man, Indore and from other steel plants of North Maharashtra & North India.

The Steel forecast for Hazira terminal is based on a growth rate of 6% of CAGR upto year 2027. This is based on the expected demand of the steel pipes for exports to the developing countries in the areas of Oil and Gas and water distribution. Some of the developed countries have started replacing the old pipeline networks with new thus contributing demand.

According to Simdex, 714 pipeline projects of 324,301 km are to be implemented over next eight years. The demand is estimated to be coming largely for North America, Asia and the Gulf countries wherein Indian steel industries would be the largest beneficiary due to its logistic benefit to Asian and Gulf countries.

3.5 FERTILIZER

Agriculture which accounts for one fifth of Indian GDP provides sustenance to two-thirds of the country's population. Besides, it provides crucial backward and forward linkages to the rest of the economy. Successive five-year plans have laid stress on self-sufficiency and self-reliance in food grains production and concerted efforts in this direction have resulted in substantial increase in agriculture production and productivity. This is clear from the fact that from a very modest level of 52 mT in 1951-52, food grain production rose to about 230.78 mT in 2007-08. In India's success in agriculture sector, not only in terms of meeting total requirement of food grains but also generating exportable surpluses, significant role played by chemical fertilizers is well recognized and established.

The annual consumption of fertilizers in nutrient terms (N, P & K), has increased from 0.07 mT in 1951-52 to 22.57 mT 2007-08, while per hectare consumption of fertilizers, which was less than 1 kilogram in 1951-52 has risen to the level of 116.51 kilogram (estimated) in 2007-08.

3.5.1 Development and growth of fertilizer industry

At present, there are 56 large size fertilizer units in the country manufacturing a wide range of nitrogenous, phosphatic and complex fertilizers. Of these, 30 units (as on date 28 units are functioning) produce urea, 21 units produce DAP and complex fertilizers, 5 units produce low analysis straight nitrogenous fertilizers and 9 units manufacture ammonium sulphate as by-product. Besides, there are about 72 small and medium scale units in operation, producing single super phosphate (SSP). As on March 2009, total installed capacity of fertilizer plants was 12.06 mT of nitrogen and 5.66 mT of phosphate.

The production of fertilizers during 2007- 08 was 10.9 mT of nitrogen and 3.81 mT of phosphate. The production for 2008-09 was 10.87 mT of nitrogen and 3.465 mT of phosphate, representing a growth rate of (-) 0.3% in nitrogen and (-) 9% in Phosphate as compared to production in 2007-08. Production for nitrogenous fertilizer was less than the installed capacity on account of constraints in supply and quality of natural gas for Rashtriya Chemicals & Fertilizers (RCF), Trombay and Bramaputra Valley Fertilizer Corporation Ltd. (BVFCL), Namrup. Similarly, the production for phospahtic fertilizer was less than the installed capacity due to constraints in availability of raw materials/ intermediates which are substantially imported.

3.5.2 Joint venture abroad

Due to constraints in the availability of gas, which is the preferred feedstock for production of nitrogenous fertilizers and near total dependence of the country on imported raw materials for production of phosphatic fertilizers, the Government of India has been encouraging Indian companies to establish joint venture production

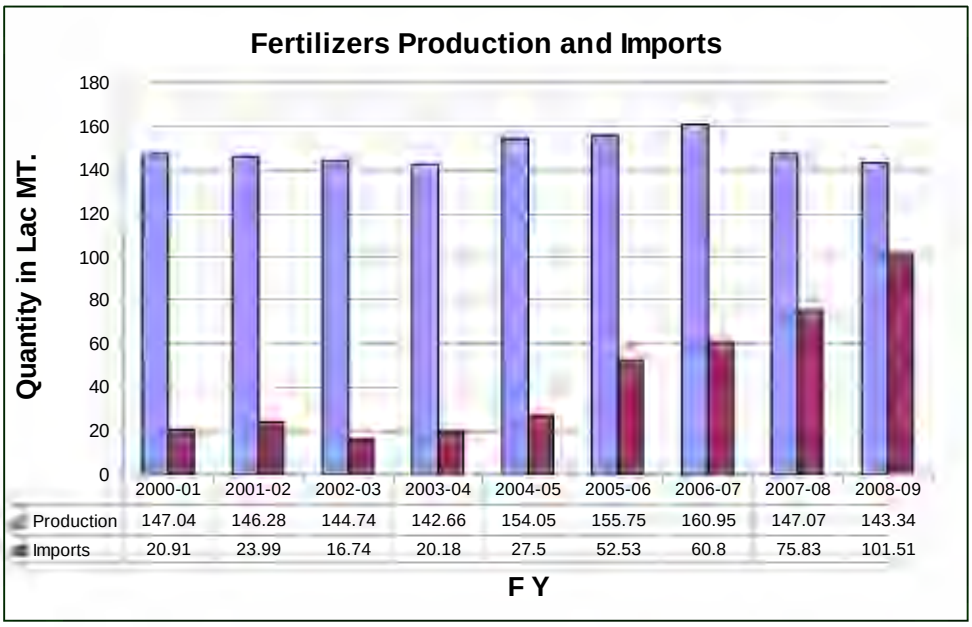
facilities, with buy back arrangement, in other countries, which have rich reserves of natural gas and rock phosphate.

The joint ventures already established, have given the country an assured source of supply of urea and phosphoric acid, a vital input in manufacturing DAP and other phosphate and complex fertilizers.

3.5.3 Production vs. Imports of fertilizers

The imports have increased at a CAGR of 22 over last eight years. It is expected that in future the demand for imported fertilizer would continue to increase. Hence considering the Port's strategic location, fertilizer would be an important cargo for the Port.

Figure 3-4: Year wise fertilizers production and imports



Source: Ministry of Fertilizers Annual Report 2008-09, 1 Lac = 0.01 million

Looking at the figures of imports of fertilizers in the west coast of India (Table 3-17) the maximum fertilizer is handled at Kandla port (3.0 mT 2008-09) followed by Mundra port (2.7 mT 2008-09).

Table 3-17 Year wise detail of fertilizer handling at West Coast (mT)

Ports	2005-06	2006-07	2007-08	2008-09
Mundra	1.6	1.4	1.9	2.7
Mumbai	0.6	0.5	0.3	0.3
Mangalore	0.7	1	0.8	0.9
Kandla	2.0	2.2	4.0	3.0
Goa	0.2	0.2	0.2	0.2

Source: IPA. MPSEZL data

Based on the fertilizer imports growth in India, it is expected that the growth shall continue in future. The growth is shown in the table 3-18 which also provides the west

coast port share. Approximately 75 % of the total fertilizer imports are expected to be handled at west coast of India.

Table 3-18 : Year wise detail of fertilizer handling expected at Indian Ports and west coast ports.

[A]

Particular	2013-14	2015-16	2017-18	2019-20	2021-22	2023-24	2025-26
Indian Fertilizer Imports (mT)	13	15	17	18	20	22	24
West Coast Share (%)	70%	75%	75%	75%	75%	75%	75%
West Coast Share , (mT)	9.1	11.25	12.75	13.5	15	16.5	18

[B] (mT)

Ports	2013-14	2015-16	2017-18	2019-20	2021-22	2023-24	2025-26
Mundra	3.8	5.2	5.4	5.9	6.9	6.9	7.4
Mumbai	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Mangalore	1	1.1	1.2	1.3	1.4	1.6	1.7
Kandla	3.3	3.7	4.72	4.9	5.2	6.2	7
Goa	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Others*	0.8	1	1.2	1.25	1.3	1.63	1.72
Total Western	9.1	11.2	12.7	13.5	15.0	16.5	18.0

Source: AHPPL Estimate

The table 3-18 [B] shows the traffic projection in the coming years at the west coast ports of India. The Port has a potential to share major traffic from the others ports which includes GMB ports. Approx 75-80% of the expected traffic of the others port can be diverted to the Port due to its advantage of being all weather port and direct road and rail connectivity.

Based on the forecasts above, the table 3-19 shows the potential traffic forecast for fertilizer at the Port. As the import of fertilizer is directly controlled by the Government of India it would take some time to shift the majority of potential traffic. In the initial year (2013-14) the firm cargo is expected to be 50% of the potential traffic. The firm traffic would gradually increase to 70% of the potential traffic by the year 2017-18 and to 85% of the potential traffic by year 2026-27 translating to 2.9 mT of cargo. This would be purely based on the rail logistic advantages the Port has for distributing the fertilizers to the locations in Kota region, central Gujarat, west Madhya Pradesh and north Maharashtra.

It is expected that the Port shall be a port of choice for the fertilizer imports.

Table 3-19 Potential and Firm Traffic forecast for Fertilizer and FRM Cargo (mT)

Year	Potential Traffic	Firm Traffic forecast
2013 -14	0.60	0.30

Year	Potential Traffic	Firm Traffic forecast
2014 -15	0.70	0.40
2015 – 16	0.80	0.60
2016 -17	0.95	0.60
2017 – 18	1.20	0.83
2018 – 19	1.45	1.06
2019 – 20	1.70	1.29
2020 – 21	1.95	1.52
2021 – 22	2.20	1.75
2022 – 23	2.45	1.98
2023 – 24	2.70	2.21
2024 – 25	2.95	2.44
2025 – 26	3.20	2.67
2026 – 27	3.45	2.90

Source: AHPPL Estimate

3.6 LIQUID CARGO OVERVIEW

3.6.1 Vegetable oil

Indian vegetable oil industry is world's fifth largest after US, Brazil, China and Argentina. The Indian market is estimated to be INR 675 billion and is growing at the rate of 5-6% per annum.

India accounts for 9% of world's oilseed output, 6% of the world's vegetable oil production, 12% of world's imports of vegetable oil and 10% of world's edible oil consumption. The market is dominated by unorganized players as the unbranded products accounts for ~80% of the total trade. Oil seed crops accounts for 14% of the cropped area in India. Three oil seeds – groundnut, soybean and rapeseed/ mustard together account for over 80% of aggregate cultivated oilseed output.

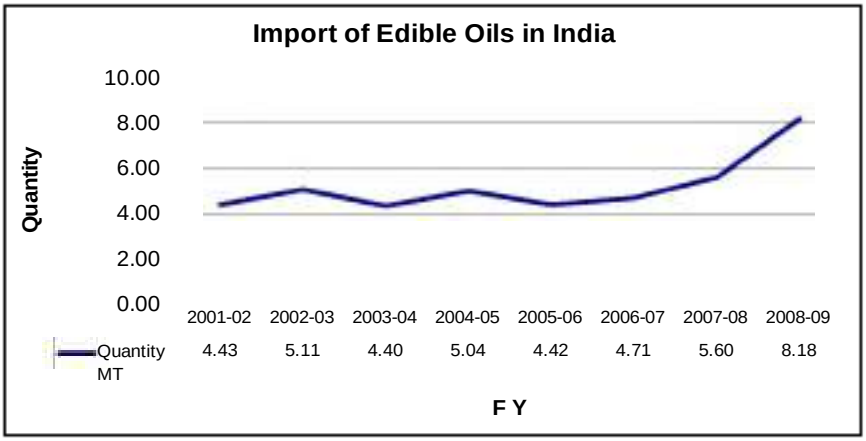
India still lagging behind in terms of crop area, yield and production of oilseed due to factors like improper irrigation facilities, traditional inefficient farming practices and policies favouring production of competing crops. The gap between domestic demands and supply for edible oil is still wide which lead to imports of ~35-40% of its total demand.

India lags behind in terms of per capita consumption at 12 kg / annum as compared to the world average per capita consumption of 23 Kg / annum.

Import of other edible oils has also placed under OGL, except coconut oil. In order to harmonize the interest of farmers, processors and consumers and at the same time, regulate large import of edible oils to the extent possible, import duty structure on edible oils is reviewed from time to time. Import of edible oil has grown at a CAGR of 9% over 2001-02 to 2008-09 periods. Most of the prominent edible oil manufacturing company has their presence in west and central India and the demand for edible oil is

expected to increase in future based on growth in population. The Figure 3-5 shows the quantity of edible oil imported in India.

Figure 3-5: Year wise edible oil imports in India.



Source: Solvent Extractors Association of India.

Indian edible oil industry is fragmented and is expected to consolidate in future. The trend of imports is based on speculation in prices of the edible oil and government regulations. The nearest port to the Port where edible oil is imported is Mumbai and JNPT. Most of the edible oil cargo is evacuated through road. With the inherent logistical advantage of the Port cargo shift from Mumbai and JNPT port can reasonably be assumed for the Port as there is no other port handling edible oils between Kandla port and Mumbai/JNPT ports.

Table 3-20 Year wise detail of edible oil handled at west coast Indian ports. (mT)

Ports	2005-06	2006-07	2007-08	2008-09
Mundra	0.3	0.18	0.19	0.436
Mumbai	0.2	0.18	0.26	0.38
JNPT	0.56	0.54	0.54	0.95
Mangalore	0.35	0.36	0.33	0.54
Kandla	1	1.33	1.6	2.3
Goa	0.2	0.2	0.2	0.2
Cochin	0.02	0.06	0.32	0.63
Total West Coast Port	**2.63**	**2.85**	**3.44**	**5.436**
Total Indian Imports	**4.42**	**4.71**	**5.6**	**8.18**
West Coast share (%)	**60%**	**61%**	**61%**	**66%**

Source: AHPPL Estimate

Based on the growth of imports of edible oil, it is expected that the imports of edible oil shall increase in future. The futuristic trend of imports of edible oil in India is shown below in the table 3-21

Table 3-21 Future imports of edible oil. (mT)

Particular	2013-14	2015-16	2017-18	2019-20	2021-22	2023-24	2025-26
Indian Edible Oil Imports	10	13.5	15.5	16	17.6	20.7	22.7
West Coast Share (%)	65%	65%	65%	65%	65%	65%	65%

Particular	2013-14	2015-16	2017-18	2019-20	2021-22	2023-24	2025-26
West Coast Share	7.2	8.8	10.1	10.4	11.5	13.5	14.8

We are assuming that the west coast share (%) will remain constant at 50 %

Ports	2013-14	2015-16	2017-18	2019-20	2021-22	2023-24	2025-26
Mundra	1.2	1.82	2.3	2.5	2.8	3.8	4.5
Mumbai	0.5	0.5	0.7	0.7	0.7	0.7	0.7
Mangalore	0.7	0.7	0.7	0.8	0.8	0.8	0.8
Kandla	3.9	4.4	5	5	5.7	6.7	7.3
Goa	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Others*	0.6	1.1	1.1	1.1	1.2	1.2	1.2
Total Western	**7.2**	**8.82**	**10.1**	**10.4**	**11.5**	**13.5**	**14.8**

Projection data: Adani Willmar Limited

It is expected that with the increase in population, purchasing power and changing food habits, consumption of edible oil is expected to increase further. As observed in the past 5 years, import of edible oil is expected to continue to increase over the medium term. Logistics advantages of the Port for edible oil manufacturing plant in Indore (Madhya Pradesh) and other Gujarat locations would be critical in attracting traffic of edible oil cargo that is currently handled at Mumbai and JNPT port.

Table 3-22 shows the traffic projection in the coming years at the west coast ports of India. The Port has potential to share major traffic from the others (*) ports, which include GMB ports. Approx 80% of the expected traffic of the others port can be attracted by the Port due to its advantage of being in near to users.

Based on the study by Adani Wilmar Limited, the edible oil cargo potential that can be diverted from Mumbai, JNPT and Kandla ports is appox. 0.5 mT for the year 2013-14 and can grow up to 1.0 mT in future. Out of the potential traffic at the Port, the firm traffic cargo is expected to be 60-70% of the potential traffic. The port is expected to handle 0.3 mT in the year 2013-14 which is expected to increase to 0.7 mT in 2017-18 and to 0.9 mT by 2026 - 27.

Table 3-22 Edible Oil Cargo Potential at the Port (mT)

Year	Potential Traffic	Firm Traffic Forecast
2013 -14	0.50	0.30
2014 -15	0.75	0.40
2015 – 16	1.00	0.45
2016 -17	1.00	0.60
2017 – 18	1.00	0.60
2018 – 19	1.10	0.70
2019 – 20	1.10	0.70
2020 – 21	1.10	0.70
2021 – 22	1.20	0.85
2022 – 23	1.20	0.85
2023 – 24	1.20	0.85
2024 – 25	1.30	0.90

Year	Potential Traffic	Firm Traffic Forecast
2025 – 26	1.30	0.90
2026 – 27	1.30	0.90

Source: AHPPL Estimate

3.6.2 Liquid bulk chemical (mainly petrochemicals)

The Indian chemical industry is a highly fragmented and widely dispersed. In the year 2008-09, it achieved growth rate of 8.9%. As per MOSPI (Ministry of Statistics and Program Implementation) the total investment in the chemical sector (excluding fertilizers) was INR 4500 billion translating to 10% of the total industrial investment of INR 44030 billion

Indian per capita consumption of chemicals is 1/8th to that of world indicating a significant scope for domestic growth.

Chemical industry sector is highly heterogeneous with following sub-sectors as

- Petrochemicals
- Organic chemicals
- Inorganic chemicals
- Bulk drugs
- Fine and special chemicals
- Agrochemicals
- Paints and dyes, inks and intermediates.

Table 3-23 State-wise Percentage Share of Chemical and Petrochemical Production (%)

State	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Gujarat	59.93	59.54	58.7	58.14	61.86	62.05
Maharashtra	17.03	15.99	16.9	17.69	14.84	15.1
West Bengal	10.08	12.22	12.38	11.87	10.65	10.6
Other State	12.96	12.25	12.03	12.29	12.65	12.25

Source: AHPPL Estimate

The below Figure 3-6 and 3-7 shows the exports and imports of the chemical and petrochemical industry.

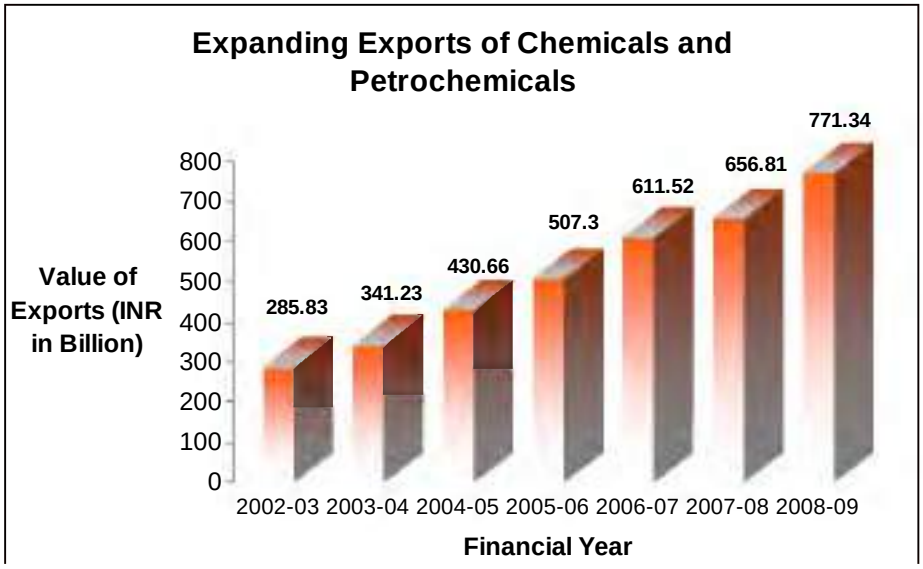


Figure 3-6: Expanding Exports of Chemicals and Petrochemicals (Value)

Source: Ministry of Chemicals and Fertilizers

Figure 3-7: Imports of Chemicals and Petrochemicals (Value)

Based on the above figures for the import and export values of the Indian chemical sectors, the major contribution is from the petrochemical industry.

Of the total imports and exports of the bulk liquid petrochemicals at the port, the major cargo consists of the following commodities.

Alkali Chemicals (not petrochemical)	Caustic Soda Lye
Organic Chemicals	Acetic acid, Acetone, Phenol, Mehtanol, Aniline, Chloromethane, Ethyl Acetates, Ethylene Dichloride, Acrylonytrile, Mono-ethylene Glycol, Butadiene, Ethylene, Propylene, Benzene, Mixed Xylenes, Ortho and Para Xylenes, Toluene, Linear Alkyl Benzene, Styrene

The Table 3-23 shows that the west coast port of India handles almost 75% of the bulk liquid petrochemicals handled in the country.

Table 3-24 : Bulk Liquid Chemicals handling at Indian Ports (mT)

	2006-07	2007-08	2008-09
West Coast Ports	11.2	12.7	12.3
East Coast Ports	3.6	2.8	2.9

Source: MPSEZL data, IPA

For the petrochemical plants located near to the port, the transportation of the petrochemical bulk liquid is through pipeline whereas for the plants located farther to the ports, the petrochemicals are transported through road tankers.

In west coast of India, Kandla, Mumbai, JNPT, Mundra and Dahej (GCPTCL) are the major ports handling petrochemical cargoes. In 2008-09 chemical cargoes handled at Kandla port was 2.0 MT, JNPT & Mumbai was 2.5 MT, Mundra was 0.5 MT and Dahej (GCPTCL) was 0.5 MT.

The Port will be able to leverage its proximity to the production facilities of oil, petroleum products & chemicals, and the vast hinterland spanning entire western and central India including the chemical industries of north Maharashtra, Vapi, Hazira, Panoli, Ankleshwar and Vadodara to attract chemical cargo to the Port.

Dahej (GCPTCL) is a dedicated petroleum and petrochemical port which currently handles around 2.0 MT of cargo, out of which approx. 0.4 MT of cargo is destined for Hazira (Reliance), Vapi and Silvassa.

Considering the logistic advantage of the Port for cargo destined for Hazira, Vapi and Silvassa based industries the potential traffic of liquid bulk petrochemicals at the Port is 0.25 MT which could increase to 0.6 MT by 2017-18 and 0.75 mT by 2026-27.

The immediate bulk liquid petrochemical cargo that can be handled at the Port would be 0.2 MT in 2013-14, which is expected to grow up to 0.3 MT by 2017-18

Table 3-25 Potential and firm traffic projection for bulk liquid petrochemicals (mT)

Year	Potential Traffic	Firm Traffic Forecast
2013 -14	0.25	0.20
2014 -15	0.40	0.20
2015 – 16	0.45	0.25
2016 -17	0.50	0.30
2017 – 18	0.50	0.30
2018 – 19	0.54	0.35
2019 – 20	0.59	0.39
2020 – 21	0.63	0.44
2021 – 22	0.67	0.48
2022 – 23	0.72	0.53
2023 – 24	0.76	0.57
2024 – 25	0.80	0.62
2025 – 26	0.84	0.66
2026 – 27	0.89	0.71

Source: AHPPL Estimate

Based on the fact that the petrochemical industry is expanding and the future plans of Gujarat to develop a PCPIR (Petroleum, Chemical and Petrochemical Investment Region) at Dahej, which would be connected with the Delhi Mumbai Industrial Corridor would certainly contribute to the growth prospect of the Port for handling petrochemical and petroleum products.

3.6.3 Petroleum products (pol)

With a GDP of USD 1.23 trillion, India is currently the world's fourth largest economy in Purchasing Power Parity (PPP) terms (the GDP in PPP terms is estimated at approximately USD 3.2 trillion) and the fifth largest energy consumer in the world. However, due to its high population of approximately 1.1 billion, the per-capita consumption of most energy related products is extremely low. The per capita energy consumption for India is estimated to be a very modest 530 kg of oil equivalent (kgoe) while the world average is approximately 1800 kgoe, which would mean demand for POL is likely to grow further in future.

Demand-Supply Imbalance

Stagnating crude-oil production and the rapid economic growth has led to increase in demand- supply mismatch for crude oil and gas in India (the gas shortage is likely to be mitigated to some extent through RIL's KG Basin gas production). Consumption in India grew by 6.8 % in 2007, the third largest volumetric increment after China and United States on a yearly basis. This growth in demand is likely to be sustained over time, creating an ever-increasing need for imports. The following table 3-26 provides the status of import & export of POL in India.

Table 3-26 : Import of crude and import/ exports of Petroleum Product (mT)

Year /Growth	Crude Oil Import	Products Import	Product Exports
2004-05	95.86	8.83	18.21
Growth (%)	6	10.3	24.6
2005-06	99.41	13.44	23.46
Growth (%)	3.7	52.3	28.8
2006-07	111.5	17.66	33.62
Growth (%)	12.2	31.4	43.3
2007-08	121.67	22.46	40.78
Growth (%)	9.1	27.2	21.3
2008-09	128.16	18.29	36.93
Growth (%)	5.3	-18.6	-9.4

Source: Website www.indianpetro.com

The above table shows the sharp decrease in the petroleum products import and exports in 2009, due to the heavy fluctuation in the crude prices and the commissioning of the 29 mT additional capacity of Reliance refinery. However, the demand of petroleum products in India is expected to continue to grow.

The below figures of POL handled at Mumbai, Mangalore and Kandla include crude oil which is not the target commodity for the Port. However, the demand for petroleum products in India would be met through the refining capacities installed in the country for processing 178 mT of crude.

Table 3-27 : Year wise Details of POL Cargo Handled at West Coast. (mT)

Ports	2005-06	2006-07	2007-08	2008-09
Mundra	0.24	3.8	7.4	7.4
Mumbai	27.7	32.2	37	34.4
Mangalore	22.3	21.8	21.7	21.3
Kandla	24.2	29.7	38.2	45.5
Goa	0.9	0.8	0.9	0.9
West Coast share (%)	55%	54%	57%	60%

Source: AHPPL Estimate

The refinery closely located to the Port is the ONGC refinery. The crude is supplied through the Ankleshwar oil fields and Bombay High offshore rig. ONGC has entered into a contract with Reliance Industries to hire the Single Point Mooring facility for export of Naphtha and other petroleum products.

The petroleum products mainly Naphtha is expected to be diverted to the Port. The diversion of such products is based on the enhanced refining capacity of the Hazira refinery of ONGC and commissioning of petrochemical complex (OPAL) in PCPIR at Dahej. Combined developments of the refinery and the petrochemical plants would provide a potential of generating cargo of 2.0 mT in the year 2016-17.

Table 3-28 Petroleum products traffic potential at Hazira (Surat) Port.

Year	Potential Traffic	Firm Traffic Forecast
2013 -14	0.0	0.0
2014 -15	0.0	0.0
2015 – 16	0.0	0.0
2016 -17	2.0	0.60
2017 – 18	2.2	0.90
2018 – 19	2.4	1.20
2019 – 20	2.8	1.40
2020 – 21	3.0	1.80
2021 – 22	3.3	2.00
2022 – 23	3.6	2.40
2023 – 24	3.9	2.60
2024 – 25	4.0	2.90
2025 – 26	4.4	3.10
2026 – 27	5.0	3.35

Source: AHPPL Estimate

3.7 De-oiled cake (DOC)

Edible oil production in India has been stagnant for last few years due to limited supply of domestic oil seeds for oil production. India presently imports nearly 40% of its requirement of 20 mT per annum. Main reason for stagnant edible oil production is stagnant production of oil seeds in India. Details of oil seed production in India is presented in table 3-29.

Table 3-29 Oil Seed Production in India as follows

Sr. No.	Oil Seed Production					
	Oilseeds	2008-09	2007-08	2006-07	2005-06	2004-05
1	Groundnut	7.5	7.29	4.86	7.99	6.77
2	Rapeseed & Mustard	7.33	7.06	7.44	8.13	7.59
3	Sesame	0.87	0.73	0.62	0.64	0.67
4	Soybean	9.8	9.45	8.85	8.27	6.87
5	Sunflower	1.5	1.12	1.23	1.44	1.19
6	Safflower	0.25	0.22	0.24	0.23	0.17
7	Niger	0.14	0.11	0.12	0.11	0.11
8	Linseed	0.17	0.13	0.17	0.17	0.17
9	Castor	1.1	1.04	0.76	0.99	0.79
	Total	**28.66**	**27.16**	**24.28**	**27.98**	**24.35**

Souce: i-maritime Report

In the last five years, the soybean seed production has registered a CAGR of 9.2% as shown in Table 3-30. This growth is driven by increasing demand for DeOiled Cakes (DOC) in the foreign countries as protein supplement.

Table 3-30 De-Oiled Cakes (DOC) exports (mT)

Year	Soybean	Rapseed	Groundnut	Ricebran	Castor	Total
2008-09	4.2	0.95	0.008	0.18	0.35	**5.69**
2007 – 08	3.9	0.93	0.08	0.19	0.33	**5.44**
2006 – 07	3.66	0.97	0.08	0.25	0.2	**5.17**
2005 – 06	3.42	0.53	0.14	0.13	0.2	**4.42**
2004 – 05	1.86	0.59	0.12	0.04	0.07	**2.69**
2003 – 04	2.68	0.45	0.13	0.00	0.07	**3.32**

Source: i-maritime Report

As observed form the Table 3-30, majority of oil cakes exported from India was made from soybean. For the last 5 years, share of soyaben based DOC was on average 70% of the total DOC exported. Gujarat has the largest share of total DOC exported from India. Majority of the DOC exported from Gujarat is through ports at Kandla, Bedi & Mundra.

Table 3-31 Port wise Export Details of DOC (mT)

Port wise Export Details of DOC							
Year	Bedi	Mumbai	Others	Kandla	Kakinada	Mundra	Total
2008 – 09	0.55	1.05	0.48	3.14	0.09	0.20	**5.52**
2007 – 08	0.74	0.98	0.49	3.24	0.18	0.00	**5.63**
2006 - 07	0.77	1.08	0.29	2.76	0.27	0.00	**5.18**

Source – GMB and IPA

DOC exported from M.P., Gujarat, Punjab, Rajasthan, parts of Maharashtra is largely handled at Kandla. Currently just 30% of traffic in Bedi is captive (Ruchi Soya), which earlier used to be 50%. Ruchi Soya has shifted part of their DOC traffic from Bedi port to Kandla port. Hence, this DOC traffic that is a floating traffic and can be considered as potential traffic for the Port. Currently, the Port's hinterland (Mahdya Pradesh) exports more than 70% of India's DOC exports. This traffic would be prime target for the Port.

Table 3-32 Details of Railway Distance Advantage of Hazira (Surat) Port over Competing Ports for DOC Cargo

Railway Distance Matrix			
Start	Destination	Railway Distance Km	Benefit of Hazira (Surat) Port over others ports
Indore	Hazira (Surat) Port	604	0
	Kandla Port	810	206
	Mundra Port	880	276

Source: AHPPL Estimate

Table 3-33 Export of DOC from Gujarat Port

Port	Quantity	Exporters
Bedi Port	0.72	Minermet, Ruchi Soya, Others
Kandla Port	1.59	Sharda Solvent, ITC, Jayant Agro, Gokul, DR Export, Suraj Complex, Ruchi Soya, Adani Exports, Friends Group, Gujarat Ambuja, Kandla Exports, Others

Source: Adani Enterprises Limited

In the initial year of operations it is expected that the Port will attract more than 10% of the current trade of DOC mainly originating from MP, Rajasthan and Gujarat due to its logistics cost advantage. With dedicated DOC handling facility at the Port likely share of the Port in the hinterland traffic is expected to go up to 20% of total exports from the west coast and would stabilize at 2.5 mT.

It is estimated that DOC export potential for the Port is 0.8 mT during the initial year of operations i.e. 2013-14 which is expected to increase gradually.

It is expected that due to the strategic locational advantage of the Port, the DOC potential would transform 100% into the firm traffic for the Port, which would attain stagnancy at 2.5 mT in 2017-18.

Table 3-34 Potential and firm traffic forecast for DOC (mT)

Year	Traffic Potential MMTPA	Traffic Projection MMTPA
2013 -14	0.8	0.8
2014 -15	1.0	1.0
2015 – 16	1.5	1.5
2016 -17	2.0	2.0
2017 – 18	2.5	2.5
2018 – 19	2.5	2.5
2019 – 20	2.5	2.5
2020 – 21	2.5	2.5
2021 – 22	2.5	2.5

Year	Traffic Potential MMTPA	Traffic Projection MMTPA
2022 – 23	2.5	2.5
2023 – 24	2.5	2.5
2024 – 25	2.5	2.5
2025 – 26	2.5	2.5
2026 – 27	2.5	2.5

Source: AHPPL Estimate

3.8 AUTOMOBILE CARGO

The automobile industry in India is the ninth largest in the world with an annual production of over 2.3 mT in 2008. In 2009, India emerged as Asia's fourth largest exporter of automobiles, behind Japan, South Korea and Thailand.

India has emerged as one of the world's largest manufacturers of small cars. According to New York Times, India's strong engineering base, expertise in the manufacturing of low-cost, fuel-efficient cars has resulted in the expansion of manufacturing facilities of several automobile companies like Hyundai Motors, Nissan, Toyota, Volkswagen and Suzuki.

In 2008, Hyundai Motors exported 240,000 cars made in India. Nissan Motors plans to export 250,000 vehicles manufactured in its India plant by 2011. Similarly, General Motors announced its plans to export about 50,000 cars manufactured in India by 2011.

In September 2009, Ford Motors announced its plans to setup a plant in India with an annual capacity of 250,000 cars at an investment of US$500 million. The cars will be manufactured both for the Indian market and for exports. The company said that the plant was a part of its plan to make India the hub for its global business. Recently Volkswagen has also opened a small car manufacturing plant in Pune with an initial capacity of 1.1 Lakhs car per annum.

In India automobile is exported through a limited number of ports, which have RoRo facilities. Mumbai, Chennai & Mundra port are few players which have these facilities. As Mumbai port is getting congested due to land constraint, there is a business opportunity for the Port to attract this target market of Pune (Maharashtra), Pithampura (MP), Alwar (Rajasthan) & central Gujarat.

Table 3-35 Total Auto (Export) Cargo Generated from Hazira (Surat) Port Hinterland

	Tata (Pune & Sanand)	Volkswagen (Pune)	GM (Vadodara)	Ashok Leyland (Alwar)	Eicher (Pithampura MP & Thane)	Others	Total (MMT) *
2016 – 17	87800	5000	3500	1000	1200	1500	0.1
2017 – 18	87800	5000	3500	1000	1200	1500	0.1
2018 – 19	181500	10000	3500	1000	1500	2500	0.2
2019 – 20	181500	10000	3500	1000	1500	2500	0.2
2020 – 21	181500	10000	3500	1000	1500	2500	0.2
2021 – 22	270000	20000	3905	1100	1860	3135	0.3
2022 – 23	270000	20000	3905	1100	1860	3135	0.3
2023 – 24	270000	20000	3905	1100	1860	3135	0.3
2024 – 25	270000	20000	3905	1100	1860	3135	0.3

	Tata (Pune & Sanand)	Volkswagen (Pune)	GM (Vadodara)	Ashok Leyland (Alwar)	Eicher (Pithampura MP & Thane)	Others	Total (MMT) *
2025 – 26	367000	20000	4296	1210	4046	3449	0.4
2026 – 27	367000	20000	4296	1210	4046	3449	0.4

*** Basis: 1 automobile unit is equivalent to 1 Ton. (Conversion of Unit automobile to weight is done for ease of summing up the cargo forecast)**

The Port being a new port, the space for cargo storage can be optimally planned with required back up facilities for handling automobiles. Mumbai and Mundra ports are the only ports handling automobiles on the west coast of India. As explained above, Mumbai port has space constraint, which would translate into an opportunity for the Port to attract this traffic.

The potential traffic for the Port is expected from year 2016-17, as such traffic is expected to be a diversion from Mumbai port and expanded production capacity, firm traffic is expected to be the same as potential traffic for the Port.

Table 3-36 Potential and Firm Traffic Forecast for Automobiles (m units)

Year	Potential Traffic	Firm Traffic Forecast
2013 -14	0.0	0.0
2014 -15	0.0	0.0
2015 – 16	0.0	0.0
2016 -17	0.1	0.1
2017 – 18	0.1	0.1
2018 – 19	0.2	0.2
2019 – 20	0.2	0.2
2020 – 21	0.2	0.2
2021 – 22	0.3	0.3
2022 – 23	0.3	0.3
2023 – 24	0.3	0.3
2024 – 25	0.3	0.3
2025 – 26	0.4	0.4
2026 – 27	0.4	0.4

Source: AHPPL Estimate

3.9 CONTAINER CARGO

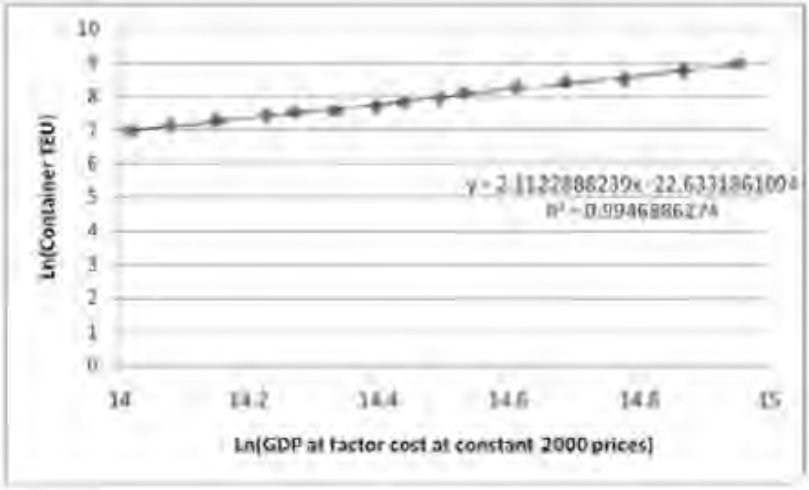
3.9.1 Overview

India's container traffic has been growing at a CAGR of 14% over the past decade. The major containerized commodities driving volumes in India are textile, automobile, auto components, engineering and capital goods.

Container traffic in India in 1990-91 was only 0.68 m TEUs, which has grown at a CAGR of 14% to 2.19 m TEUs by 1999-00 and at a CAGR of 15% to 8 m TEUs by 2008-09. Level of containerization has also increased from 37% in 1995 to 52% in 2009. Various studies have established that increase in GDP by 1% leads to an increase in container trade by 1.5-2%. In fact the general purpose cargo growth at major ports of India during 1995 to 2009 has shown correlation of 1.78 times the GDP growth rate and in the last 5 years the same has been 1.87 times the GDP growth of the country.

The two major contributors to this growth in container traffic are - growth in trade (in turn fuelled by India's economic growth), and growing containerization levels. According to a study conducted by ILFS, the projected rate of growth in container traffic for India is 10% per annum.

Figure 3-8 illustrates the correlation between natural Log of past container traffic out of India & natural Log of GDP for the corresponding year.



Source: IL&FS research report

Figure 3-8: Correlation of GDP and Container Throughput in India

Using the same correlation to estimate the all India traffic assuming a 6% average GDP growth rate during the period of 2009-25 , the estimated container traffic through Indian ports is 27 mTEUs by 2018 and 63 mTEUs by 2025 as shown in the table 3-37

Table 3-37: National Container Traffic Potential.

Particulars	2009	2012	2015	2018	2021	2025
National container traffic Potential , m TEUs	9	13	18	27	38	63

Source: AHPPL Estimate

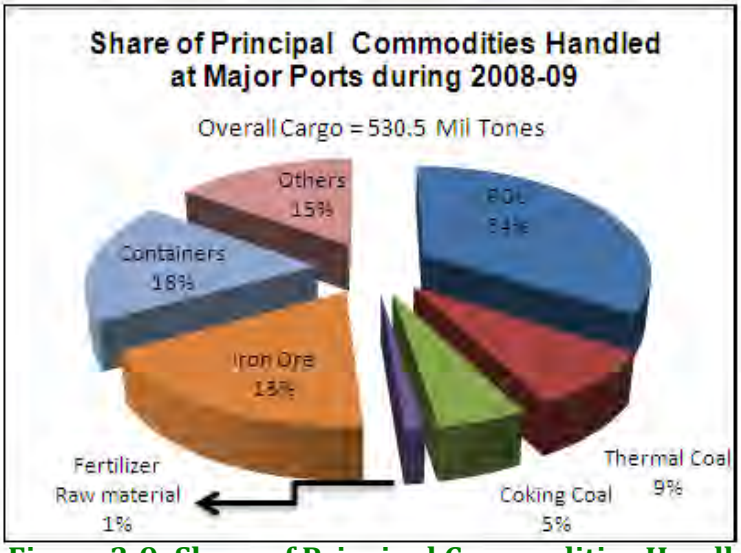


Figure 3-9: Share of Principal Commodities Handled at Indian ports.

3.9.2 Detailed container traffic profile :

For the year 2008-09 the total container traffic handled by Major Ports in India was 6.8 million TEUs. Out of this total traffic the laden containers accounted for 82% of traffic at 5.6 million TEUs. The balance traffic comprised of empties - 0.81 million TEUs, and transhipment traffic of 0.39 million TEUs.

Port on the west coast of India handle 665 of the total container traffic of India. The level of containerization & industrialization is increasing in the western & northern part of India. Thus it is expected that container traffic growth at ports on the west coast would continue to have robust growth.

Table 3-38: Container Traffic at West Coast.

Year wise Details of West Coast Container Cargo							All India Container ,m TEU's	West Coast Share (%)
Year	JNPT	Mumbai	Pipavav	Kandla	Mundra	Total		
2004-05	2.4	0.22	0.19	0.18	0.22	**3.21**	4.8	67%
2005-06	2.7	0.16	0.2	0.15	0.3	**3.51**	5.1	69%
2006-07	3.3	0.14	0.19	0.18	0.54	**4.35**	6.4	68%
2007-08	4	0.11	0.2	0.16	0.72	**5.19**	7.93	65%
2008-09	4	0.1	0.2	0.1	0.8	**5.2**	8.1	64%

Source: AHPPL Estimate

Based on the past trend in the container cargo, future trend for the cargo is expected to be as follows: (Table 3-39)

Table 3-39: Forecasted Container Traffic at West Coast.

Ports	2013-14	2015-16	2017-18	2019-20	2021-22	2023-24	2025-26
Mundra	2	2.4	2.9	3.5	4.1	5.0	6.0
JNPT(Including Mumbai Port)	5.1	5.5	6	6.5	7.3	8	8
Kandla	0.2	0.2	0.5	0.5	0.5	0.5	0.5
Pipavav	0.5	0.3	0.2	0.3	0.3	0.8	0.8
Others	1.0	1.0	1.5	2.0	2.5	3.0	3.5
Total Western	8.8	9.4	11.1	12.8	14.7	17.3	18.8

Source: AHPPL Estimate

3.9.3 Competition assessment and plans:

Gujarat is home of 41 Minor ports and Maharashtra about 56 minor ports. In addition there are three major ports of which 1 are in Gujarat and 2 are in Maharashtra. Of these only 5 ports are Viz. JNPT, Mumbai, Pipavav, Kandla and Mundra Commercially handle container Cargoes. Table 3-40, provides a comparison of present status and the future plans of the competing ports.

Table 3-40: Competing Port Comparison

Competing Port Comparison						
Parameter	**JNPT**	**Mumbai**	**Hazira**	**Pipavav**	**Kandla**	**Mundra**
Container handled in 2008-09 , mTEU's	4	0.1	NA	0.2	0.1	0.8

Rail Connectivity	Double line connectivity to almost all major cities in India	Double line Connectivity to almost major cities	Hazira- Surat Connectivity planned by RVNL ,from Surat connected to all most all major cities in India	Pipavav Railway corporation Ltd. has implemented the 271 km BG rail connection between Surendranagar and Pipavav Port	Connected with the national network	7 Railway sidings and 65 km railway the line has been developed which connects the port with the national rail network at Adipur
Road Connectivity	NH-8,NH-4,NH-3,NH-17	NH-8,NH-4,NH-3,NH-17	NH-8, NH-6	NH-8E	NH-8A	NH-8A
Draft (Metre)	12.5+	8.84+	12.5+	12.5+	12.5+	17.5
Deviation from Shipping Routes	Least	Least	Higher than JNPT , less than Mundra	Higher than JNPT less than Mundra	Higher than Pipavav , Hazira	Higher than Pipavav , Hazira
Congestion	High , Proximity to Mumbai City	High , Proximity to Mumbai City	Low	Low	Low	Low
Connectivity to Ahmadabad (One of the Major Cargo Destination of Hazira (Surat) Port's Primary Hinterland)	NH-8,545 km, Mumbai - Vadodara to be converted to express highway , Vadodara-Ahmadabad Express Highway	NH-8,545 km, Mumbai - Vadodara to be converted to express highway , Vaadodara-Ahmadabad Express Highway	NH-8, 255 km , Ahmadabad - Vadodara Express Highway Surat -Vadodara	NH-8E, 337 km	Above 400 km, NH-8A	Above 400 km , NH-8A
Number of CFS	38 including 18 upcoming			One	Above 12 Exclude upcoming	Above 12 excluding upcoming
SEZ Planned	16 Non -IT ITES SEZs Notified in Maharashtra		19 SEZs non IT /ITES SEZs approved in the captive Hinterland (For Container traffic) 11 notified among the above	7 Non- IT/ITES SEZs approved and 5 non IT/ITES SEZs notified SEZs in Kutch		
Capacity Utilization	110.0%	112.5%	NA	40.0%	104.0%	74.0%
Quay Length (M)	1992	1056	NA	780 m (395 present and 385 in subsequent phases)	545	632
No. Of Cranes	RMQC =24 RTGC=76 RMGC=11	2 Quay side Gantry , 3 Yard Gantry crane and 2 tower crane	NA	3	RMQC=2 RTGC=2 2 nos of Mob Harbour crane	RMQC-12 RTGC=34 RMGC=2
Future Plans						
Number of Berths	2 Terminals 1000m quay length each by 2015		Proposed 5 Berths with total Quay length of 1.8 Km		10(4 dry 2 wet & 4 offshore by 2011)	
Drafts (Metre)	14		NA	14.5 by 2011	14.5 by 2011	
Dredging	14		NA	Planned for 14.5	14.5 by 2011	
Total Container Handling Capacity	10 mTEUs by 2015	1.092 mTEUS by2015	NA	Investment in Railway Rakes	no	A basin with about 4 container Berths is under consideration (Approx 4 mTEUs by 2012)
Investments in Hinterland Cargo	No	No	NA	Investment in Railway rakes		6000 Acres 14 ICDs 5 rakes

Aggregation Infrastructure					under operation 20 rakes estimated

Source: MPSEZ Computation

Based on the above comparison, MPSEZL is the most important competitor to the Port on account of the draught available at port, the inland rail and road distances from the major traffic generating nodes, distances to existing and proposed industrial regions, proposed capacity enhancement plans.

The Port has direct competition to Mundra, Kandla, Pipavav and JNPT and share a significant portion of common hinterland with these four ports. JNPT has emerged as the largest container handling facility on the west coast and has been registering a robust growth over last five years. However, increasing traffic at JNPT has resulted in a capacity constraint coupled with logistics bottlenecks. Although Mumbai port is near to JNPT due to transport infrastructure and backup area constraint, Mumbai port has not been able to get the benefit of the JNPT congestion. The Port shall be an option for the liners to switch some of the container traffic to avoid the congestion and save on time and cost.

On the basis of our analysis of the container throughput from major ICD/CFS of the country, following nodes are short listed as representatives of the state under consideration:

Table 3-41: Competing Port Comparison

Representative nodes	State	% of share capital
Agra	UP	2%
Delhi	Delhi	38%
Ahmadabad	Gujarat	8%
Vadodara	Gujarat	2%
Indore	MP	3%
Ludhiana	Punjab	8%
Mumbai	Maharashtra	14%
Nagpur	Maharashtra	4%
Jaipur	Rajasthan	7%
Total of Representative nodes		86%
Others		14%
Total ICD /CFS		100%

Source: IL&FS research report

The total traffic of containers handled by the above selected ICD and CFS accounted for 30% the total container throughput for the country.

Table 3-42: Rail Distance Matrix for ICDs.

ICD/CFS -Port Rail Distance Matrix , Km							
Representative nodes	Unit	Hazira	Mundra	Kandla	GPPL	JNPT	Mumbai
Agra	Km	1005	1124	1064	1227	1251	1251
Delhi	Km	1120	1063	1009	1279	1366	1366
Ahmadabad	Km	250	361	307	394	496	496

Vadodara	Km	129	466	412	499	391	391
Indore	Km	582	867	807	905	828	828
Ludhiana	Km	1141	1301	1241	1522	1688	1688
Mumbai	Km	278	851	791	890		
Nagpur	Km	744	1317	1257	1356	916	916
Jaipur	Km	871	849	789	952	1118	1118
ICD /CFS Port Road Distance Matrix , Km							
Representative nodes	Unit	Hazira	Mundra	Kandla	GPPL	JNPT	Mumbai
Agra	Km	1063	1130	1083	1216	1197	1197
Delhi	Km	1170	1156	1096	1242	1407	1407
Ahmadabad	Km	255	425	365	327	545	545
Vadodara	Km	177	538	478	323	448	448
Indore	Km	465	807	747	709	593	593
Ludhiana	Km	1399	1461	1401	1527	1704	1704
Mumbai	Km	263	970	910	872		
Nagpur	Km	747	1395	1335	1297	863	863
Jaipur	Km	922	898	838	984	1202	1202
Representative nodes	Unit	Hazira	Mundra	Kandla	GPPL	JNPT	Mumbai

Source: IL&FS research report

As revealed from the Table 3-42, container traffic originating from/ destined for ICD /CFS for Agra, Ahmadabad, Vadodara, Indore and Nagpur, the Port has the logistics cost advantages compared to competing ports. The potential of the Port's container traffic hinges significantly on the following factors.

(a) Strong economic and infrastructure growth of India including proposed developments such as Delhi – Mumbai Industrial Corridor (DMIC) and Dedicated Freight corridor (DFC) that are expected to increase traffic at western ports.

(b) Vibrant economy of Gujarat - Gujarat's gross domestic product (GDP) rose in double digits thrice during the last decade. In comparison, India's GDP could never cross single-digit growth even once. Clearly, if the country posted robust growth during 2000-2009, it was on the back of a strong performance states like Gujarat. The Table 3-43 and Figure 3-10 show the Gujarat GDP.

Table 3-43: Gujarat vs. India GDP.

Year	Growth Rate (%)	
	India	Gujarat
2001-02	5.22	8.41
2002-03	3.77	8.14
2003-04	8.7	14.77
2004-05	8.3	8.88
2005-06	9.33	13.44
2006-07	9.67	9.09
2007-08	9.06	12.19
2008-09	6.3	7.33

Source: Times news network, 31st Dec 2009

Figure 3-10: Share of Gujarat's GDP in India's GDP

Source: Times news network, 31st Dec 2009

(c) **Vast container cargo hinterland**

Figure 3-11: Hinterland for the Port

Selection of port for container cargo not only depends on logistics cost advantages but also depend on several other parameters. Hence, for this cargo to materialize, it is important that the prospective developers invest in backup yard , space for CFS , linkages with logistics service providers and other related activities either directly or through developing association with service providers to lock –in/ attract the container liners.

The potential for of the Port is estimated on the basis of Gujarat State Domestic Product (GSDP), present trend, logistics cost advantages and other non-cost parameters. Container traffic forecasted at the Port is as follows

Table 3-44 Potential and Firm Traffic forecast for Containers (mTEU)

Year	Based on GSDP	Based on Present cargo trend	Potential Container Cargo	Firm Traffic Forecast
2013 -14	1.4	1.7	0.5	0.2
2014 -15	1.5	2	0.6	0.3

Year	Based on GSDP	Based on Present cargo trend	Potential Container Cargo	Firm Traffic Forecast
2015 – 16	1.7	2.2	0.7	0.6
2016 -17	2.0	2.4	1.0	1.0
2017 – 18	2.2	2.6	1.2	1.2
2018 – 19	2.4	2.7	1.4	1.3
2019 – 20	2.7	3.1	1.6	1.5
2020 – 21	3.1	3.5	1.8	1.6
2021 – 22	3.5	4	1.9	1.7
2022 – 23	3.8	4.6	2.0	1.9
2023 – 24	4.5	5.2	2.4	2.1
2024 – 25	5.0	6.1	2.8	2.5
2025 – 26	5.5	6.9	3.0	2.7
2026 – 27	6.0	7.9	3.5	3.0

Source: AHPPL Estimate

It is expected that Port would handle 40% of cargo potential during initial years of operations due to its new entry in competitive container handling business. However over period of time it would be able to reach nearly 100% of potential cargo by the year 2016 - 17 & will continue to grow up to 3.0 m TEU in year 2026-27.

Normally, it is experienced that a new port is able to achieve 70% capacity utilization by 5th-6th year of operations with favourable economic trade condition of its hinterland. However, subsequent expansions are expected to attain faster growth in capacity utilization. Also capacity expansions are executed in phases based on potential cargo of the hinterland.

3.10 SUMMARY

Based on the above traffic study, summary of the expected cargo traffic at the Port is shown in the Table 3-45.

Table 3-45 Firm Traffic Forecast for the Port (mT)

Year	Coal	Fertilizer & FRM	Liquid	Steel	DOC & Others	Auto-mobile	Container M TEU	Total Cargo MMT
2013 – 14	2.50	0.30	0.50	0.60	0.80	0.00	0.20	**7.10**
2014 – 15	3.00	0.40	0.60	0.70	1.00	0.00	0.30	**9.30**
2015 – 16	4.50	0.60	0.70	0.80	1.50	0.00	**0.60**	**15.30**
2016 – 17	7.50	0.60	1.50	0.90	2.00	0.10	1.00	**24.62**
2017 -18	**10.40**	**0.83**	**1.95**	**1.00**	**2.50**	**0.10**	**1.20**	**31.15**
2018 -19	13.20	1.06	2.29	1.00	2.50	0.20	1.30	**35.87**
2019 -20	16.10	1.29	2.54	1.10	2.50	0.20	1.50	**41.69**
2020 – 21	18.90	1.52	3.13	1.10	2.50	0.20	1.60	**46.56**
2021 – 22	21.80	1.75	3.38	1.10	2.50	0.30	1.70	**51.19**
2022 -23	24.60	1.98	3.82	1.20	2.50	0.30	1.90	**57.21**
2023 -24	27.50	2.21	4.12	1.20	2.50	0.30	2.10	**62.98**
2024 -25	30.30	2.44	4.46	1.20	2.50	0.30	2.50	**71.20**
2025 -26	33.20	2.67	4.71	1.30	2.50	0.40	2.70	**77.13**
2026 -27	**36.00**	**2.90**	**5.00**	**1.30**	**2.50**	**0.40**	**3.00**	**84.10**

Source: AHPPL Estimate

Multi Cargo Terminal at Hazira (Surat) Port

Chapter -4

ADANI

AHPPL

4 PORT DEVELOPMENT OVERVIEW

4.1 TRAFFIC

Based on the above traffic study, summary of the expected cargo traffic at the Port is shown in the Table 4-1.

Table 4-1 Firm Traffic Forecast for the Port (mT)

Year	Coal	Fertilizer & FRM	Liquid	Steel	DOC & Others	Auto-mobile	Container M TEU	Total Cargo MMT
2013 – 14	2.50	0.30	0.50	0.60	0.80	0.00	0.20	**7.10**
2014 – 15	3.00	0.40	0.60	0.70	1.00	0.00	0.30	**9.30**
2015 – 16	4.50	0.60	0.70	0.80	1.50	0.00	**0.60**	**15.30**
2016 – 17	7.50	0.60	1.50	0.90	2.00	0.10	1.00	**24.62**
2017 -18	**10.40**	**0.83**	**1.95**	**1.00**	**2.50**	**0.10**	**1.20**	**31.15**
2018 -19	13.20	1.06	2.29	1.00	2.50	0.20	1.30	**35.87**
2019 -20	16.10	1.29	2.54	1.10	2.50	0.20	1.50	**41.69**
2020 – 21	18.90	1.52	3.13	1.10	2.50	0.20	1.60	**46.56**
2021 – 22	21.80	1.75	3.38	1.10	2.50	0.30	1.70	**51.19**
2022 -23	24.60	1.98	3.82	1.20	2.50	0.30	1.90	**57.21**
2023 -24	27.50	2.21	4.12	1.20	2.50	0.30	2.10	**62.98**
2024 -25	30.30	2.44	4.46	1.20	2.50	0.30	2.50	**71.20**
2025 -26	33.20	2.67	4.71	1.30	2.50	0.40	2.70	**77.13**
2026 -27	**36.00**	**2.90**	**5.00**	**1.30**	**2.50**	**0.40**	**3.00**	**84.10**

Increase in traffic requires more facilities and better port productivity, which could be achieved by integration and up-gradation of various supporting infrastructure, so that port is able to respond to demand without suffering from congestion.

4.2 DESIGN VESSELS SIZE

4.2.1 General

The sizes of the vessels that will be serviced at the port terminal are determined on one hand by the yearly throughput volumes as discussed above and the origin/destination of the cargo and on the other hand by the draft limitation at Terminal.

Based on the detailed shipping trend analysis, the following design vessel sizes have been considered for planning the marine facilities.

The terminals have been planned for the following ship related data:

Table 4-2 Design Vessel Size

Sr No.	Cargo	Vessel Size	LOA in m	Beam in m	Loaded Draft in m
1	Bulk Carrier	80000 dwt	225.0	37.0	13.1
2	Container	6500 TEU	300.0	43.0	13.5
3	Liquid Tanker	85000 dwt	244.0	42.0	12.6

Table 4-3 Average Vessel Size

Sr No.	Cargo	Vessel Size	LOA in m	Beam in m	Loaded Draft in m
1	Bulk Carrier	65000 dwt	216.0	32.3	11.2
2	Container	4000 TEU	280.0	32.2	11.8
3	Liquid Tanker	60000 dwt	228.6	32.2	11.0

4.3 PROPOSED DEVELOPMENT IN NEXT 5 YEAR

Table 4-4 Summary of proposed Development in next 5 years and further phases

Location	Proposed Activities
Non LNG Berths	**First five year development plan** • Total 7 nos. of berths with (-) 15.0 m CD draft. • 2 container berth, 1 coal berth, 3 multipurpose berth and 1 berth for liquid. • Cargo handling Equipments • Tug berth and marine crafts. • Backup facilities like Container yard, Rail sidings, Rail & truck loading facility, Open Paved Areas, and associated buildings, utilities, amenities etc. • Support Back up Infrastructure for operations and maintenance of the Port facilities (Buildings, services, utilities and amenities including Fire Fighting, safety and security systems and environment protection measures). • Utility Corridor **Future Development Plan** • It will include 2 Container berth, 2 liquid berths and 1 Automobile berth with pontoon facility. • Backup facilities like, rail sidings, rail & truck loading facility, open paved areas, and associated buildings, utilities, amenities etc. with adequate cargo handling facilities.
Dredging & level filling	• Dredging up to (-) 15.0 m CD • Level filling of all backup areas • The annual and capital dredging quantity has been approved earlier i.e. annual 37 M m^3, capital 11 M m^3. However additional dredging quantity will be identified.
Associated Infrastructure development	
Road Network	• Arterial road network connecting Hazira Port to NH - 6 • Internal roads
Rail Network	• Rail connectivity to all the terminals • External connectivity for evacuation of cargo

4.4 MARINE FACILITIES

The following functional requirements are considered in planning the marine facilities for first five year development:

4.4.1 Limiting criteria for marine operations

While planning the layout of the port, care shall be taken to ensure that the port basin is suitably protected against external waves so that required tranquillity is available inside the harbour to carry out cargo handling operations without interruption. Further, for the pilot to board the ship in the anchorage and for the tugs to be fastened to the ship in the outer channel, significant (limiting) wave height (Hs) should not exceed a certain value.

4.4.2 Pilot boarding

Whenever a vessel enters/leaves the port, it will be piloted by the port pilot. The pilot would board the vessel at the outer anchorage and navigate it through the approach channel to the designated berth. The limiting wave conditions for the pilot launch to operate and the pilot to board the vessel is Hs = 2.5 m.

4.4.3 Tug operation

The tugs, which assist the vessel in stopping, turning in the turning circle and in manoeuvring to the berth, normally meet the vessel in the outer channel. The limiting wave conditions (Hs) for tugs to fasten to a vessel is 2.5 m.

4.4.4 Ship-to-shore cargo transfer

Maximum acceptable wave conditions for cargo handling operations at the berth are dependent on following factors.

- Ship size.
- The type and method of cargo handling.
- The direction of the wave attack.

Beam waves cause the vessel to roll and hence has higher effect on cargo handling operations than head waves. The Hs for different wave directions for cargo handling operations, beyond which the cargo handling operations have to be suspended, are summarized in the Table 4-5.

Table 4-5 - Limiting wave heights for cargo handling

Type of ship	Limiting wave height (Hs)	
	Head or stern (0°)	Quadrant (45° - 90°)
Dry bulk carrier	1.5 m	1.0 m
Liquid bulk carrier	1.5 –2.5 m	1.0 – 1.2 m
Container ships	0.6m	0.5m

4.5 SIZING OF THE HARBOUR AREA

The port layout shall aim at maximum operability and expansion potential. The multipurpose berth location has been selected after a feasibility and master plan study. The primary objective of the planning is to ensure an average 22 hours per day, 7 days per week operability.

The water area - the plan, dimensions and the water depths (Draft) in the entrance/access channel, common manoeuvring basin and at the berths, would be sufficient to permit the largest vessels as specified below in terms of L, B and D (LOA, Beam and fully laden Draft) to be serviced without causing the vessels to take undue risks for a 6500 TEU container vessel, 80,000 dwt bulk cargo vessel and 85,000 dwt liquid tanker.

From the Table 4-2 the design vessel for the port will be 6500 TEU container vessel, which has highest dimension in terms of L, B and D (LOA, Beam and fully laden Draft).

4.5.1 Under keel clearance and water depth

The depth in the channel should be adequately greater than the static draft of the vessels using the waterway to ensure safe navigation. Generally, the depth in the channel is determined by:

- Vessel's loaded draft
- Trim or tilt due to the loading within the holds
- Ship's motion due to waves, such as pitch, roll and heave
- Character of the sea bottom : soft or hard
- Wind influence of water level and tidal variations.

Based on the PIANC guidelines, the following general recommendations on under keel clearances shall be adopted to determine the dredge depths:

- Open sea area (in outer approach channel) : for those exposed to strong and long stern or quarter swell, where speed may be high, gross underkeel clearance should be about 20% of the maximum draft of ships.
- Channel: for sections exposed to strong and long swell, gross underkeel clearance should be about 15% of the draft.
- Channel: less exposed to swell, gross underkeel clearance should be about 10% of the draft.
- Manoeuvring and berthing areas for those exposed to swell (without full protection of breakwater): gross underkeel clearance should be about 10 to 15% of the draft.
- Manoeuvring and berthing areas protected (full protection by breakwater): gross underkeel clearance to be about 7% of the draft.

Based on the above, the under keel clearances for different vessel sizes have been determined and added to the draft of the vessel in order to arrive at the required dredged depth for safe handling of the vessel size. It should be noted that the allowances indicated hereunder can be considered as design cases for approach wave conditions. Outside the monsoon, the conditions will be more favourable. The required allowances for vessel dynamics will then be less and hence arrivals will be possible with smaller underkeel clearances, which will be addressed in the Port Operating Procedure.

4.5.2 Dredge depth

The dredged depths provided at different ship manoeuvring and service areas, and at berths, are worked out based on the figures indicated below in table. The MLWS is +1.37 m CD. To ensure sufficient keel clearance during majority of the low spring tides, a value of 1.5 m was selected for arrival conditions.

Table 4-6 Required Dredged Depth for different vessel

Description	Berth (7% draft)	Turning Circle (15% draft)	Approach Channel (20% draft)
Bulk Carrier			
Water level (m CD)	0.0	+1.5	+1.5
Water Depth required (m)	14	15.1	15.7
Dredged depth (Draft) required (m CD), excluding over dredging to allow for siltation	**-14.0**	**-13.6**	**-14.5**
Container			
Water level (m CD)	0.0	+1.5	+1.5
Water Depth required (m)	14.4	15.5	16.2
Dredged depth (Draft) required (m CD), excluding over dredging to allow for siltation	**-14.4**	**-14.0**	**-15.0**
Liquid Tanker			
Water level (m CD)	0.0	+1.5	+1.5
Water Depth required (m)	13.5	14.5	15.1
Dredged depth (Draft) required (m CD), excluding over dredging to allow for siltation	**-13.5**	**-13.0**	**-13.9**

Hence the following depths are required in the various part of the port

- Southern Basin: -15.0m CD (including 0.5m for siltation allowance, sounding accuracy, dredging tolerance, etc.)
- Common Manoeuvring Area (Turning Circle): -15.0m CD (including 1.0m siltation and other allowance)
- Access Channel : -15.0m CD

The required depth in front of berth has to be maintained. Cargo will be handled with mechanized handling system, so cargo spillage is minimized.

Initial dredged depth and dredge depth to be maintained for the safe operations are given in table below.

Table 4-7 Dredged Depth for different Area

Description	Initial Dredge Depth in m CD	Dredge Depth to be maintained in m CD
Approach Channel	-15.0	-15.0
Turning Circle and Common Manoeuvring Area	-15.0	-14.0
Berth Area (Southern Basin)	-15.0	-14.4

4.5.3 Turning circle

The port contains a turning basin with adequate dimensions for the manoeuvring of a tug-assisted design vessel size during berthing and un-berthing. As per IS: 4651 (Part

V), where vessels turn by free interplay of the propeller and assisted by tugs, the minimum diameter of the turning circle should be 1.7 to 2.0 times (1.70 for protected locations and 2.0 for exposed locations) the length of the largest vessel to be turned. In some location where the winds are not strong, turning circle radius is as small as 1.5 times the length of the largest ship. In case of the Port, the largest calling vessel is 6500 TEU container ship with an overall length of 300m. These ships would be assisted with tugs in manoeuvring in the approach channel, in the harbour basin and to and from the berth. However the turning circle area is exposed during the monsoon. Therefore a turning circle diameter of 600m i.e. 2.0 times the LOA of the ship is required.

4.5.4 Stopping distance

The length of the protected approach channel up to the centre of the turning circle provides safe stopping distance for all vessels. The stopping distance depends upon the approach velocity of the vessel. A stopping distance of 800 m is proposed.

4.5.5 Channel alignment and width

The channel is aligned considering the following aspects:

- Predominant wind, wave and current directions
- Channel aligned to reach the required deep water contour in the shortest possible distance and aligned along the deepest available bed depths (to reduce the quantity of dredging required)

The orientation of the channel is 250^0 North.

Based upon the guidelines given in the PIANC document titled "Approach Channels – A Guide to Design" approach channel width has been calculated.

Table 4-8 Width of the outer channel exposed

Description	Width Requirement
WBM, Basic Manoeuvring Lane (moderate)	1.5 B
W1, Prevailing Cross Wind (moderate)	0.4 B
W2, Prevailing Cross Current (Strong- 45 0 drift angle)	5.0 B
W3, Prevailing Longitudinal Current (moderate)	0.2 B
W4, Significant wave height and length	0.5 B
W5, Aids to Navigation (moderate)	0.1 B
W6, Bottom surface (smooth or sloping and hard)	0.1 B
W7, Depth of Waterway	0.1 B
WBC, Bank clearance (both sides)	0.6 B
Width of single lane channel = WBM + W1 + W2 + …+ W7 + WBC	8.5 B

The width of required channel has been worked out using a 6500 TEU design vessel having a width of 43.0 m

From the above table, it is observed that the width of the access channel needs to be a minimum of 365m for one-way movement. It is proposed to consider in master plan two separate approaches for the flood and ebb tides. A single access channel will accommodate both the approaches. As a result of two separate approaches, the channel

is 750m wide at the deep water and 475 m wide at the entrance to the harbour considering access of the vessel in +1.5m CD tide level.

Width of Southern Basin

The proposed multi-purpose berths are planned inside a slip (or a dock like structure). This slip is called as Southern Basin. The design beam of the largest vessel in the slip is 43.0 m.

For the liquid vessels and bulk carrier the desirable basin width for one sided use of the basin is 100 + 4B + 100 m (100m +4 X43 m + 100m = 372m) as shown in below mention.

The estimation of width of southern basin is 372.0 m. Also as per IS – 4651 Part – v, the width of the basin shall not be less than 4 times the beam of design vessel plus 45m.

4.5.6 Breakwater protection

For the protection of the port, the existing basin where proposed developments are planned is sheltered from currents and waves by a breakwater. This has increased tranquillity. The alignment and orientation of the existing breakwater has been determined by:

- Bottom depth contours
- Approach channel
- Nautical aspects
- Wave and current climate
- Sediment transport
- Provision of sufficient harbour space within the port.
- Operability in channel

As the proposed development is to be carried out in the existing harbour protected by the existing breakwater, no new breakwater is planned for the development.

4.5.7 Berth orientation and configuration

The berths in the harbour will be oriented so as to have minimum downtime.

The berth configuration is governed by the type of cargo handled and the characteristics of the design vessel sizes. The concept has been designed on the basis of minimum and easy execution of maintenance.

The berth shall be constructed with Precast RCC beams and slab supported on bored cast in situ piles or by other method which is found technically efficient during detail engineering. Berths shall be constructed after completion of dredging in the berth pocket area and simultaneous reclamation in back up yard.

Seven berths in total, two berths for container and two multi purpose berths on eastern side shall be planned with continuous type structures and two coal berths, one multi purpose and liquid cargo berth on western side could be planned with approaches,

which will be needed to support the travelling cranes. The spacing of fenders will be such that the berths have the flexibility to handle smaller bulk cargo vessels as well.

The length of the berth area and the berth depends upon the dimensions of the largest ship and the marine (wind and tide) conditions.

The total quay length has been calculated based on the following factors are as given in table below.

Table 4-9 Quay Length

Length of the berth		
Total Length of the Western side Berth	1220	m
Total Length of the Eastern side Berth	955	m

All the seven berths shall be designed for the same set of maximum specifications to allow all berths to handle all type of vessels. The fenders and mooring arrangement shall be designed to allow berthing and mooring of the entire range of vessels sizes for which the facilities are planned.

4.5.8 Harbour crafts

All vessel-handling operations inside the port area will be assisted by tugs. The number and capacity of the tugs will depend upon the size of the largest vessel, and number of vessels to be handled. The effect of wind on container vessels is highest. The largest vessel likely to be handled will be a 6500 TEU container vessel. These tugs will be sufficient to handle vessels up to 6500 TEU or 80,000 DWT bulk vessels.

4.6 NAVIGATIONAL ASPECTS

As a pre-requisite for planning the layout of a port for the required facilities, it is essential to set the basic criteria for the design of various components like navigational aspects to handle different types of vessels that are likely to call at the Port and for loading / unloading operations. These conditions are related to the marine environmental conditions at the location.

4.6.1 Protection against waves

Location of the proposed jetties and turning circle for the proposed development has been decided based on following factors.

- Predominant wave direction and protection from existing breakwater.
- Water area requirement
- Tranquility from the existing breakwater
- Stopping distance for the vessel.

4.6.2 Navigation channel dimensions

Existing channel alignment is oriented considering the following aspects:

- The channel is aligned in a straight line as far as possible.
- The channel is oriented so as to reach the deep-water contours in shortest possible distance.

Dimensions of the navigation channel are dependent on the vessel size, the behaviour of the vessel when sailing through the channel, the environmental conditions (winds, currents and waves) and the channel bottom conditions. Channel design primarily involves the determination of the safe channel width and depth for the dimensions of the design vessel.

4.7 CARGO HANDLING OPERATIONS

4.7.1 Coal

Coal would be mainly imported cargo. The coal would be handled by Grab Unloaders at berth. In the stockyard, mechanical equipments such as conveyers, stacker, reclaimer and silos would be there.

4.7.2 Fertilizer and FRM

These materials would be handled similarly to coal. The berths would be equipped with cranes, equipped with grabs.

4.7.3 DOC

DOC would be handled with cranes with sufficient capacity, fed from trucks. Retrieval at the storage sheds will be by manual operation using trucks.

4.7.4 Containers

Container terminal shall be equipped with RMQC at Berths with sufficient out reach to service 6500 TEU vessels. RTGC in Container yards and RMGCs for Rail loading and unloading will be used.

4.7.5 Liquids

Liquid discharge is assumed to be via flexible hose and ships pump at sufficient capacity. Pumping rates are assumed to grow with vessel sizes so that a typical time alongside is not more.

4.7.6 Break-bulk

Break-bulk cargoes will be handled by slewing cranes, with various attachments for specific cargoes like steel plate, pipes or steel coils.

4.8 BERTH REQUIREMENT

4.8.1 Cargo throughput

The port is planned for the following cargo mix and throughput as identified in Traffic chapter of this report:

Table 4-10 - Probable cargo throughput after 5 year development

Sr. No.	Cargo Type	Design cargo throughput (in MTPA)
1.	Coal	10.4
2.	Fertilizer	0.8
3.	Liquid	2.0
4.	Steel	1.0
5.	DOC	2.5

Sr. No.	Cargo Type	Design cargo throughput (in MTPA)
6.	Container	1.2 m TEU
7.	Automobile	0.1
	Total	**31.2**

1 TEU=12MT.

The number of berths required, is a function of cargo type and volume, and the expected cargo handling rates. Certain cargoes can be handled at the same (multi-purpose) berth, while others require dedicated facilities. Other factors that would influence are:

- the vessel sizes and parcel sizes
- the number of operational days per year
- number of working hours per day
- the time required for peripheral activities and
- The allowable berth occupancy.

The cargo handling rates and the other factors are discussed in the subsequent sections:

4.8.2 Cargo handling rates

The average cargo handling rates based on the productivity of the topsides for various commodities. The handling rates indicated in Table 4-12 are worked out, for effective topside working hours of 22 hours per day and other factors that influences the berth and stack yard operation.

Table 4-11 - Proposed cargo-handling rates at the port (based on productivity of topside facilities)

Sr No	Cargo Type	Avg. Handling Rate
1.	Coal	50000 T / Day
2.	Break Bulk/General Dry Cargo	10000 T / Day
3.	Container	3520 TEU/Day
4.	Liquid	12000 T / Day
5.	Steel	6000 T / Day
6.	Automobile	1000 Nos / Day

4.8.3 Parcel size

The expected parcel sizes of the cargo are indicated in Table 4-13

Table 4-12 – Average Parcel size at the port.

Sr No	Cargo Type	Avg. Parcel Size
1.	Coal	1,00,000 MT
2.	Break Bulk/General Dry Cargo	15,000 MT
3.	Container	2000 TEU
4.	Liquid	15,000 MT
5.	Steel	10,000 MT
6.	Automobile	1000 Nos.

4.8.4 Operational time

It is assumed that the facilities will work round the clock, seven days a week. Allowing 15 days weather downtime, the effective number of working days will be 350 days / year, subject to limiting current and tide conditions.

4.8.5 Time required for peripheral activities

Apart from the time involved in the handling of cargo, additional time will be required for other activities such as the berthing and de-berthing of the vessels, customs clearance, cargo surveys, positioning and hook up of equipment, waiting for clearance to sail, etc. As per industry standards, these activities are assumed to take on an average, 6 (six) hours per vessel call. This does not include downtime due to currents and tidal conditions.

4.8.6 Allowable level of berth occupancy

Berth occupancy is expressed as the ratio of the total number of days per year that a berth is occupied by a vessel (which includes the time lost in peripheral activities), to the number of port operational days in a year. The berth occupancy percentage is an indication of the time that a vessel calling at the port will have to wait on an average for a berth – higher berth occupancy will entail a longer pre-berthing detention, and lower level berth occupancy will ensure the least waiting time.

The main consideration while planning the number of berths, is to ensure that the ratio of waiting time to service time be kept at an acceptable level, in order to avoid paying demurrage.

The norms generally followed for planning the numbers of berths in ports worldwide and in Indian ports are indicated in Table 4-14. The norms indicated for Indian ports also conform to planning charts prescribed by UNCTAD for port planning in developing countries. In general, higher berth occupancy has been allowed to limit the CAPEX on the topside facilities. It should also be noted that the present berth occupancy at many of the Indian container terminals are higher than the figures specified below.

Table 4-13 - Recommended berth occupancy factors

Number of Berths	International Standards	Indian Practice*	
		Bulk Cargo	General Cargo and Container
1	40 %	60 %	70 %
2	50 %	70 %	70 %
3	55 %	70 %	70 %
4	60 %	70 %	75 %
5	65 %	70 %	75 %
6 and above	70 %	70 %	75 %

(* As recommended by the Ministry of Shipping and Transport, Government of India)

Table 4-14 - Berth Requirement

Sr No	Cargo Type	Year – 5	Year – 15
1.	Coal	1	2
2.	Container	2	4
3.	Liquid	1	1
4.	Break Bulk/General Dry Cargo	3	3
5.	Steel		1
6.	Automobile		1
	Total	7	12

Considering the levels of berth occupancy and the compatibility of cargo, it is proposed to construct two berths each for coal and container and three more berth for other dry, automobile and liquid cargo as envisaged.

4.9 CARGO TERMINALS

The functional requirements of Topside Facilities and yard requirements are discussed hereunder and subsequent chapters.

The dredged material will be used for level rising of the back-up area. After the berth construction, the backup area, truck parking area, other storage facilities and operational buildings for customs, maritime offices, etc. will be developed depending on user requirement.

Back up infrastructure for container terminals shall be standard. Coal terminal shall be supported by conveyers, stackers, reclaimers and other supporting facilities. Multipurpose terminal shall be supported by an open area with heavy duty paving. Liquid berth shall be provided by installing requisite number of Marine Loading /Unloading arms. Port crafts Terminal shall support large flotilla of the ports on vessels comprising Tugs, pilots and Mooring launches etc.

Green belt development will be taken up from the initial stage. Environmental management and pollution control measures as stipulated by the Ministry of Environment and State Pollution Control Board will be adopted.

Following table represents the total port backup area for overall development.

Table 4-15 - Area Requirement

Area description	Total Area (Approx) in Ha.
Port Backup Area	356
Road and Rail	185
CFS	145
Warehousing	51
Steel & Project Cargo Assembling	22
Truck Parking Area	22
Amenities and Utilities	34
Green Belt	110
Port Backup and Future development	86
TOTAL	**1011**

4.10 CONCEPT LAY OUT PLAN

Based on above planning considerations a concept lay out plan has been finalized as attached in Attachments. This concept plan will be studied in detail by NIO and their findings will be incorporated in the planning and development process.

4.11 PROPOSED TERMINALS

Proposed terminals are represented in the following sections.

4.11.1 Coal terminal

Special dedicated terminal for meeting the needs of the industry with a capacity of more than 40 MMTPA is planned in Hazira.

Table 4-16 Description of Coal berth

Sr No	Type of Berth	No. of Berth
1.	Coal berth	1

In additional to berths following facilities are planned for dedicated coal terminal.

- Sets of Stack Yards for Coal.
- Rail and Truck Loading Facilities adjacent To the Stack Yards.
- Sufficient capacity unloaders at the berths.
- Sufficient capacity conveyor systems connecting the Berths to the stack Yards.
- Stackers and Reclaimers plus conveyor system in side the Stack Yards.
- Support Back up Infrastructure for operations and maintenance of the Port facilities (Buildings, services, utilities and amenities including Fire Fighting, Dust suppression system, safety and security systems and environment protection measures).
- Electric and Water supply systems, storm drainage and sewage systems.

4.11.2 Container terminals

Container terminals near side of the berths are proposed. Terminal will have paved ground surface and TGS for storage of sufficient numbers of container.

Table 4-17 Description of Container berth

Sr No	Type of Berth	No. of Berth
1.	Container berth	2

Container Terminal, in addition to Quays, shall have the following main elements

- Container yard
- Container rail yard (for ICD operations)
- Workshop
- Administration and operational building complex
- Gate complex
- Separate yards for longstanding, Hazardous and damage containers as well as empties.

- Reefer yard (within container yard)
- Utilities, amenities and bunkering facilities
- Fire fighting, security and safety systems
- Communication networks
- Software and supporting hardware for operations of the terminals
- Container handling equipments
- Internal roads etc & Enclosure fencing

Container handling operations shall be designed matching world class standards and shall be the state- of- the- art. The major equipments for the container terminals will be:

- Rail Mounted Quay (Gantry) Cranes capable of servicing 6500 TEU vessels
- Rubber Tyred Gantry Cranes for Container yard operations
- Rail Mounted Gantry Cranes for container rail operations
- Reach stackers
- Fork lifts
- ITVs

Each terminal shall have a support rail yard for handling ICD traffic. Each yard shall have four lines.

The terminals shall have adequate number of full ground slots including slots for refrigerated containers (Reefers).

The container terminals shall have heavy duty concrete blocks paving and RTGCs shall run on specially designed concrete tracks and Turning pads located at suitable places.

The Quay side, Container yards, Container Rail yards, Internal and external roads shall have area lighting, mostly using High masts, ensuring illumination conforming standard norms.

4.11.3 Steel and automobile terminal

It is recommended that the berth with link span be designed as a regular RO – RO facility to accommodate rising demand for international plus coastal movement of Containers, tankers and projected cargo on chassis.

Table 4-18 Description of Automobile cum Steel Berth

Sr No	Type of Berth	No. of Berth
1.	Steel and Automobile Berth	1

The width of berth is proposed same as for multipurpose terminal to provide flexibility of operations. With wide Apron behind these berths, it should be possible to use these berths for cargo handling operations, when free from designated usage.

4.11.4 Break Bulk/General Dry Cargo terminals

It is proposed to have multipurpose terminals to cater cargo demand. The terminal will have open storage area. This terminal shall be used as a multipurpose facility for dry bulk and miscellaneous cargo, handled in conventional manner. Berth design provides

the flexibility for easy conversion of this facility in to a container terminal for feeder vessels in the long term, should the market conditions so warrant.

Table 4-19 Description of Break Bulk/General Dry Cargo berth

Sr No	Type of Berth	No. of berth
1.	Multipurpose berth	2

4.11.5 Liquid terminals

It is proposed to have two liquid terminals. The berth shall connect with tank terminal via a Pipe rack running along the break water up to common user manifold in existing port. ROW for the Pipe rack shall be 20 m and pipelines shall be on a multi tier rack. Berth shall be equipped with sufficient loading and unloading arms. It shall also have manifolds for hose connections to serve smaller tankers. Pigging arrangements shall be installed. The berth shall comprise an ensemble of breasting and mooring dolphins and capable of serving designed size tankers. Fire fighting, safety, security and alarm systems shall confirm to OISD guide lines and Indian standards.

Quick release, electric driven, remote operated mooring hooks shall be provided for handling emergency situations. Berth shall have stand alone fire fighting system. All electric fittings shall be flame proof on Water curtain system and monitors / sprinkles shall be operated from a control room located on Break water side at a suitable distance.

Table 4-20 Description of Liquid berth

Sr No	Type of Berth	No. of berth
1.	Liquid berth	1

4.11.6 Tug Berths

It is proposed to have tug berth facility for tug assistance near container terminal to accommodate minimum four tugs.

Multi Cargo Terminal at Hazira (Surat) Port

Chapter -5

ADANI

AHPPL

5 SUPPORTING INFRASTRUCTURES

The essential utility system such as roads, electric power, water supply, communication network, area lightning, fire fighting system, liquid and solid waste collection and treatment as well as site drainage etc are to be provided by the terminal authority as an essential supporting infrastructure.

5.1 GENERAL LAYOUT

General layout of the multi cargo port terminal provides description of

- Access Roads within battery limit;
- Coal Areas
- Container Areas;
- Steel cargo storage area
- Fertilizer, DOC and Others Storage area
- Liquid area
- Automobile storage area
- Entrances, Exits, etc.

The potential of the Port's container, coal, bulk/general, liquid cargo traffic hinges significantly on the following factors.

(a) Strong economic growth potential for India

(b) Vibrant economy of Gujarat

(c) Vast multi purpose cargo hinterland

(d) Proper road and rail connectivity for the port

Further due to strategic location of the port and resultant logistics advantages, substantial traffic may be attracted to the terminal. This is the primary basis for establishing a multi purposed terminal in the Port.

5.2 DEVELOPMENT PLAN FOR INFRASTRUCTURE LINKAGES

5.2.1 Road Connectivity to State Highway & National Highway

5.2.1.1 Background

Road connectivity from the Port to its identified hinterland (market) is a key 'competitive advantage' factor vis-à-vis competing ports in the Western India region, particularly with respect of multi - purpose cargoes. In this respect the Port has a key strategic advantage since it is located just 40 km away from National Highway No. 8 (NH-8). Country's major cargo traffic plies on this highway. Further the Port is just 25 km from Surat city, a thriving top-10 city of India. Hazira peninsula houses country's largest cluster of industries and is within 10 km of the Port. In many ways road connectivity will be the key to success for the multi purpose terminal at the Port.

5.2.1.2 Road Corridors

The road connectivity for the Port can be defined in terms of logistics corridors, namely North Corridor & South Corridor-

- North Corridor- a 46 km link, from the Port -Mora Junction- Navi Pardi (NH8). Of the total 46 km corridor, first 26 km starting from the Port is proposed to planned to be developed by GoG as 'Escape Corridor" for Hazira peninsula and the balance 20 km of the state highway connecting NH8 at Navi Pardi.
- South Corridor (NH6)- a 42 km link, from Hazira Port-Mora Junction-Icchapore Jn-Sachin SEZ-Palsana. The corridor is part of NH-6 , starting from the Port.

Presently road based traffic to the Port is supported by the road network of South Corridor. However this road will be heavily congested considering the projected cargo of the region. Hence the northern corridor development is most important.

5.2.2 Rail connectivity

The location of the Port, about 25 km from Surat, gives a strategic advantage to the port operator in terms of rail connectivity. Surat is located on the main broad gauge rail route between Delhi and Mumbai that caters to the key Delhi-JNPT container traffic. This rail route is double-track, fully electrified and designed for fast trains. The current transit time of CONCOR trains moving between JNPT and Delhi is around 40 hours. A new rail siding connecting the Port to Delhi-Mumbai rail corridor will lead to a transit time of about 30 hours. Thus the Port can offer a saving of about 10 hours of transit time, as compared to JNPT for North India traffic. This gives a potential saving for the users of the Port.

The Port currently lacks the rail connectivity to this Delhi-Mumbai trunk route. Hence it is imperative to have rail connectivity between the Port and Delhi-JNPT route. A 36 km rail-link between the Port and Kosad junction on Bombay-Delhi trunk route is planned by RVNL, who is leading the implementation of the rail-link. At GoG level, various alignments have been studied and final alignment is decided for the Port rail connectivity.

5.3 FIRE SAFETY

Fire fighting facilities have been considered in the planning and design of the multipurpose terminal. All the controls will be located in the Operations Building. Any emergency occurrences shall be reported to the operators in the main office via the PABX system. Fire detection and warning system will be provided in the control office and connected to the nearest fire station. A closed loop fire hydrant system will be provided as fire fighting facilities for the berths and the stack yard. Fire hydrants shall be arranged in a manner that all parts of the operational areas will be easily accessible, with flexible hose connection to some hydrant points in the line. The system will be

designed to maintain appropriate pressure at the hydrant outlets. Electric pumps, supplemented by diesel pumps will be provided for the purpose.

Another closed loop fire hydrant system will be provided in the utility area to serve for fire-fighting purpose for the buildings in which non-saline service water will be used as firewater. Firewater for this system will be pumped from the underground fresh water tank, which will be located near the sewerage treatment plant in the utility area. The tank shall be filled with non-saline service water and the capacity of such shall be allowed for six hours of firewater demand. A back-up connection will also be provided which allows seawater to be pumped into the system in the event of prolonged incident requiring more than six hours of firewater supply.

Foam or carbon-dioxide type portable fire extinguishers will be provided in the Staff Amenity Area near the berths as well as in all other buildings.

5.3.1 Fire hydrant

Two interconnected Fire Hydrant ring mains should be provided for protection of Berths, jetty and Coal terminal. The water pressure in the ring mains should be maintained as per relevant standard.

Required fresh water should be stored in underground (u/g) water tank. This tank should be in the form of two interconnected tanks such that the storage tank can be taken up for cleaning without starving the system.

The system should be maintained under pressure with the help of a jockey pump. There will be two electrically driving fire water pumps and one diesel driven fire water pump of equal capacities.

A saline water fire pump house should provide as a backup. This pump house will house diesel driven fire pumps. The fire hydrant outlets should be double headed.

5.3.2 Fire tenders

Multipurpose fire tenders with CO2/Foam/DCP/Water fire fighting systems should be stationed near the berths and near the storage areas. The fire station should also house water tankers and emergency van with personal protective equipment, Self contained Breathing Apparatus, fire suits etc.

5.3.3 Fire extinguishers

Fire extinguishers of CO2, DCP type should be placed near electrical systems in Fire pump houses, Transformer areas, electrical Distribution Boards, electrical switch panels etc.

Water type of fire extinguishers should be placed in areas where a class fires could occur like coal storages so that small smouldering coal fires can be handled immediately.

Foam type of fire extinguishers should be placed near diesel driven fire water pumps on the engine side and near diesel storages.

Fire extinguishers of various capacities should be distributed at the site.

5 Kg DCP Extinguishers
10 Kg DCP Extinguishers
4.5 Kg CO2 Extinguishers
22.5 Kg CO2 Extinguisher
9 litres Mechanical Foam Extinguisher
9 litters pressurised Water Extinguisher

Following equipment shall be deployed with appropriate size and numbers. If required.

- Trolley mounted portable water monitors.
- The hand operated fire extinguishers should be placed at suitable distances.
- The fire hydrant outlets should be placed at suitable distance.

5.3.4 Auto sprinklers

- Auto sprinklers or water spray systems should be provided for coal handling structures (if any), where coal dust/coal could get accumulated.
- Sprinklers/water spring system should be designed for required minimum of density over a suitable area as per relevant standard.

5.3.5 Fire alarm

Fire alarm activation call points should be located throughout the site such that a person has not to move more than 15 m to reach one.

5.4 BUNKERING

Bunkering facilities are also envisaged and storage will be done in proposed liquid tank farm area. Potable water from the underground fresh water tank could be provided to recharge the vessels.

5.5 BUILDINGS

The following building facilities shall be provided.

- Office accommodation cum operational building.
- Electric sub station
- Workshop
- Gate complex
- Customs and documentation building
- Other buildings

Buildings will have all necessary supporting utilities and facilities

5.6 DUST SUPPRESSION SYSTEM

Dust suppression system will be provided at the stockpiles and the head ends of the conveyors at transfer points to control the dust generated during operations. Spraying the stockpile will be carried out with spray guns. Spray water will be recycled by collection in peripheral trenches alongside the stockpiles leading into a lined pond of designed capacity. After decanting and filtration the water will be returned to the

system. The remaining water after recirculation from the stockyard shall be discharge in to the sea after necessary treatment to meet the pollution control board standard.

5.7 POWER

66 kV incoming power is planned to be tapped from the GEB's nearest substation. The main receiving substation in the port area shall be built by AHPPL. Other HT and LT substation will be handled at particular sub-station depending upon the planning of the cargo. Sufficient area lighting shall be provided from the CSS (Compact substation) placed at suitable location.

5.8 WATER

Water will be tapped from nearby available source. A water tank will be constructed in the utility area. Fresh water will be delivered to the terminal regularly to maintain the level of available fresh water sufficient for the routine operation, plus any emergency happenings, such as fire events including the water requirement to be supplied to ships.

5.9 DRAINAGE AND SEWERAGE

As no public drainage or sewerage system is planned in the Port area, the construction of a Package Sewerage Treatment Plant has been considered in the planning and design. Sewerage, including grey water, will be treated as per norms. All treated sewerage should be disposed at a location approved by GPCB in their consent to construct.

The surface runoff from the stockyard shall be treated using dump pond (Settlement Pit) of suitable sizes so as to allow the settlement of coal dust particle prior to discharge. (As per EC 2003). Internal roads and pavements shall be designed to have a slope of 2% and 1% respectively to provide adequate drainage. Interceptors will be provided to collect surface run off from the berths to remove the solids before discharging to the sea.

5.10 IT & TELE-COMMUNICATIONS

Telecommunication system will be provided to ensure quality communications at all times. As the existing land-lines may not provide all the necessary level of reliability, a PABX system, radio communications and wireless LAN for yard operations and fibre optic cables will be installed in the terminal to facilitate communications within the entire terminal. The administration offices will be linked to the existing landline telephone systems and data exchange cables will also be provided for EDI and Internet access.

5.11 SECURITY

The security systems of the terminal shall be designed to comply with International Shipping and Port Security Code (ISPS). The following security measures will be provided in the terminal:

- Chain Link Fence of 2.4m height along the eastern site boundary
- Flood lighting

- Access Control System for restricted entry to certain places
- Barricading of storm water drains against human entry
- Provision of emergency exit gate
- Additional fence lights and area lights
- CCTV cameras covering the sensitive terminal areas
- Security booth at gate for 24 hours security guard
- Mobile security patrols in vicinity of terminal facilities.

5.12 ENVIRONMENT PROTECTION MEASURES

Environment protection measures, as recommended in the Environment Management Plan which is part of EIA shall be implemented in addition to Dust Prevention and Control measures, Green belt development around the periphery of the port area, Controlling the contaminated surface run off, entrapment of contaminants in the Spray water run off, treatment of Domestic and municipal sewage, safe disposal of municipal waste, noise control by proper traffic management, security and safety measures, protection of local ecology etc.

5.13 GREEN BELT

A green belt shall be developed around the periphery of the port terminal by dense plantation of suitable trees and bushes by the horticulture department. Open area pockets inside the port not required for hard core operations shall be landscaped and greened. Avenue plantation shall be undertaken by planting ornamental trees and bushes along side internal roads.

5.14 DISASTER MANAGEMENT & THE PORT

Disaster management plan will be prepared for the port. There are established guidelines for the disaster management at the port like;

- Anti-earthquake reinforcement of facilities which are integral to maintaining the marine transport of emergency supplies & evacuees just after disaster.
- Maintaining the function of trunk line cargo transportation which has great impacts on social & economic activities.
- Securing shelter bases & open spaces for refuge :
    - Open spaces for housing sites.
    - Bases for repairing works.
    - Temporary stockyard or disposal site.
    - Target Area.
    - Target ports & harbour.
    - Facilities to be built.
    - Anti earthquake reinforced wharves.
    - Dock roads designed to connect with trunk line road networks.
    - Yard & parking lots – 30% for quake resistant.
    - Equipment for counter measures / maintaining the record of pooled inventory.

  - Preventing measures – drills, Enlightenment.
  - Warning & transmissions
- Oil contingency plan
- Vulnerability Reduction
  - Altering the environment erosion control, roadways realignment.
  - Strengthening the built environment, wind proofing, wet/dry flood proofing, elevating structures etc.

5.15 DESALINATION PLANT

A desalination plant with a capacity of 600 m^3 has been earlier approved by MoEF, which would now would require to be revised.

In order to meet fresh water demand to the consumers within the port and port backup area, AHPPL envisages developing approx. 6 MLD sea water desalination facilities at this location. The facility will come up in a modular and expandable manner in phases, with an initial phase of approx. 2 MLD.

5.16 EFFLUENT TREATMENT PLANT

In order to treat the various effluents generated from the port terminal and its port user's facilities, STP and ETP would be developed. These plants would come up in a phase wise manner and would be built based on the requirements.

It is proposed to have an ETP of 2.5 MLD and STP of 2.0 MLD to treat the wastewater. AHPPL will monitor quality of effluent discharge from the various port user facilities and treat them as required which would be later on disposed so as to meet the outfall parameters as set by the respective pollution control board. AHPPL will be encouraged the treated water for use of green belt development.