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Techno-economic viability for development of two additional dry cargo berths at Kandla port for private sector investment

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TECHNO-ECONOMIC VIABILITY FOR DEVELOPMENT OF TWO ADDITIONAL DRY CARGO BERTHS AT KANDLA PORT FOR PRIVATE SECTOR INVESTMENT

By

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ABSTRACT

Title of Dissertation: **Techno-Economic Viability for Development of Two Additional Dry Cargo Berths at Kandla Port for Private Sector Investment.**

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This dissertation attempts to carry out a techno-economic feasibility study for expansion of the dry bulk handling facilities in the private sector at the major port of Kandla, in the state of Gujarat, on the west coast of India.

The study reviewed the existing hardware and operational conditions for the dry bulk facilities in this port thus establishing the need for her imminent development needs. Available literature for traffic, engineering and financial planning are surveyed. After carefully examining the macro and micro economic developments in the region, the geographic and economic hinterlands are identified. An integrated approach using quantitative and qualitative methods are adopted allowing the commodity-wise projections of traffic up to 2015, incorporating the effects of policies of the government.

The existing working and operational conditions in the port are examined. The planning, operations and management of successful ports in Europe were studied. Planning criterion and principles to be observed so as to optimise the uses of new facilities are delineated. The terminal design and determination of its capacity was followed by preliminary engineering design and estimates in line with the design specifications of the 7^{th} berth in the same port. An attempt was made to use the best available expertise and technology to suit the local environment.

Careful examination of the existing pricing schemes helped in recommending an innovative approach based on 'profit centre' concept. Detailed cost/revenue streams based on certain assumptions are generated and financial/economic viability studies done followed by recommendations on application of modern pricing techniques to achieve competitive advantage.

The concluding chapter summarises the findings of the study and discusses the potential ways of optimising use of facilities and mitigating the risks involved for the private entrepreneur. The report ends with listing the scope for further work for improving and refining the results of the analysis.

KEYWORDS: Kandla, Bulk, Expansion, Feasibility, Private, Economy.

Contents

Chapter 1

Introduction

1.0 Background

India enjoys a long maritime history. Her vast coastline of around 5,560Km is dotted with 11 major ports and 139 minor ports. While these ports play a strategic role in the international trade of the country, the import substitution policy adopted in the post independence era till 1991 resulted in a low share of India in International trade. As a result, the role of ports in the Indian Economy was rather limited with the import of petroleum products and export of Iron Ore forming the major component of traffic (Price Water House Coopers, 1998). As in most infrastructure sectors, the government had a monopoly in the operation of ports. The major ports are organised as trusts, governed by the Major Port Trust Act, 1963 and the Indian Ports Act, 1908. The minor ports are under the purview of the respective state governments (maritime boards).

With the commencement of the economic liberalisation following the Balance of Payment (BoP) crisis in 1991, the role of international trade in the Indian Economy has increased significantly.

The major ports handles nearly 95 per cent of the total sea-borne traffic of the country's international trade. They have been operating in the last few years at capacity utilisation ratios of 110-130%. With a capacity of 217.21 Million Tonnes (Mt.) as on 31March 1997, the overall traffic serviced by these ports were 252.7 Mt. in 1997-98 (IPA, 1998). Dogged by under developed capacities, obsolete cargo handling equipment and inadequate warehousing and storage facilities on the one hand and burgeoning demand of port services on the other, this crucial sub-system has become the bug bear of the transport sector. It is appreciated that the capacity

and efficiency of the ports have a direct bearing on the global competitiveness of the Indian Industry.

As per the India Infrastructure Report, the demand requirement by 2005-06 is expected to rise to 650 Mt. For an additional capacity of 350 Mt. an estimated USD 5.8 billion will be required. If the port's internal resource yields USD 3.1 billions as projected, the balance of USD 2.7 billion will need to be raised from domestic capital market or international capital flows. It is also believed that there is an over estimation of internal surpluses generated in the major ports, as financial cost and cost of capital are not fully captured. Thus, the government has been actively considering the development of major ports through corporatisation, privatisation or joint ventures. A series of initiatives taken in this direction are listed in Chapter 2. It is possible to attract private capital to a project, if only it is commercially viable.

Kandla Port is one of the major ports that are in the forefront of capitalising on the new economic reforms and privatisation wave sweeping the infrastructure sector. In the backdrop of this, an attempt is made to study the feasibility for development of two additional dry cargo berths in this port in the private sector.

1.1 Scope and Objectives of Research

The scope of this dissertation is to study the technical and commercial viability of developing and expanding the dry bulk facilities (but limited to two berths) in the port of Kandla by a private entrepreneur.

The objectives of each modules of this study may be briefly summarised as follows:

i. To collect all possible information about the port of Kandla, including existing traffic and projections and other trade statistics, layout, developmental projects planned at the port, operation costs etc.

ii. To project the traffic at the port for 15 years after carefully studying the existing traffic, international trade pattern and changes, and development and growth of nearby ports under likely scenarios in order to ascertain whether the construction of two additional berths will be justified.

iii. To plan and design the facilities and equipment (but limited to two - 9th and 10th berths) for catering to the guaranteed traffic, considering performance of existing berths, commodity-wise average berth output, parcel sizes, stock piles etc.

iv. To estimate the total capital costs as well as annual maintenance and operation costs for the berths and the shore side facilities.

v. To carry out a financial viability study.

vi. To make observations about the viability and recommendations on the future course of action.

1.2 Research Methodology

Approach to the study involved studying and analysing the existing conditions in the port in detail, literature survey for choosing the methodology and defining various parameters involved, collection of data and information, discussion with professors/experts and carrying out the feasibility. These steps are briefly explained below:

1.2.1 Literature Survey and Techniques Adopted

The available literature were surveyed to study the scientific procedures for traffic forecasting, to define the standards used in engineering and equipment design in a bulk terminal and for financial analysis, planning and pricing.

The methodology adopted is outlined in this section under relevant subheadings.

a) Traffic Studies

Traffic forecasts have been carried out based on standard traffic forecasting procedure. A standard forecasting procedure is shown in Figure 1.1. Every effort was made to adhere to this methodology, as far as the available information permits. The various steps adopted are explained below:

i) Hinterland Identification

One important aspect of any port analysis is the determination of actual and potential hinterland (Frankel, E.G, 1987,147). In this step the geographic and

economic area dependent on the specific port facilities is identified. It consists of evaluation of developments in any socio-economic activity likely to be affected by the demand for port commerce. The port hinterland may change with time and are usually different for different commodities.

ii). Analysis of past traffic

In this step, the existing traffic from 1991 till 1998 was examined on a year-by-year basis. For a better understanding, the data should be broken down into the country of loading and by major cargo class. Since information by country of origin is not available, cargo classification into major classes and their tabulation was done. Cargo was classified separately under the headings dry bulk, break-bulk and general cargo in metric tons of gross weight.

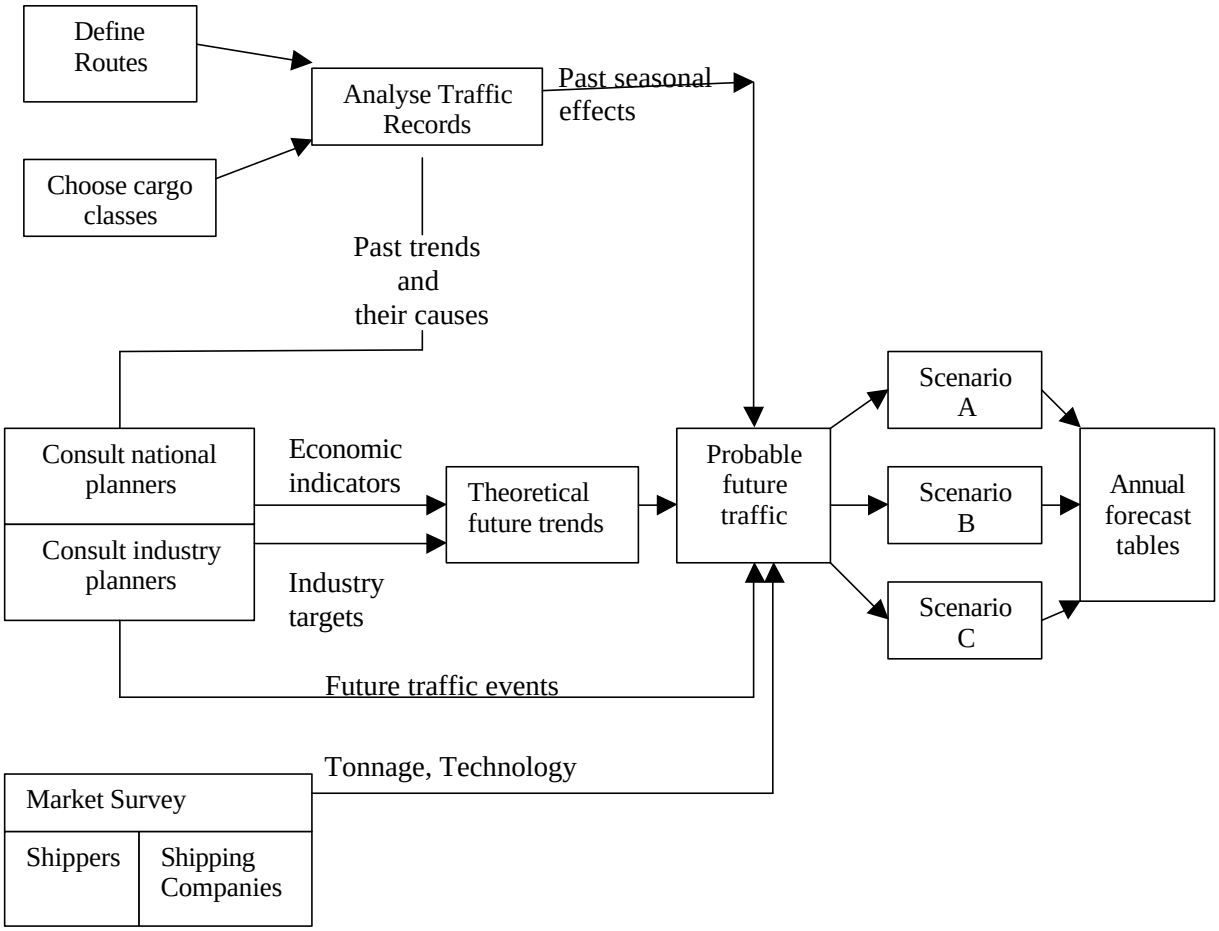


Figure 1.1

The forecasting procedure

(Source: UNCTAD, Port Development- A handbook for planners in developing countries)

The next step is to analyse the traffic for existing, potential users and the ability of the port to influence market. Users may be of two types, captive and non-captive. Captive users use the port because there is no other economic alternative route. Non-Captive users are those which, while obliged to move goods in and out of the region can use another port within the region. There is also another kind of users, which could cease trading activity with the region and inhibit local economic development. The non-captive users will react to the decision taken by a planner, by diversion and the resulting loss of cargo. Trends in traffic growth should also be analysed for influence of investments, major events (political, support infrastructure such as inland transport connections, changes in market prices of commodities) etc.

It is essential to study the reason for growth of traffic in the past. It may be i) directly dependent on GNP; ii) deliberately developed due to national self sufficiency, development of new industry or mines etc. iii) A gradual shift in regional centres of production/consumption; iv) A gradual shift in transport technology (UNCTAD, 1985, 47).

Detailed traffic records will also help in analysing seasonal/cyclic pattern.

iii). Trend forecasting

Three categories of forecasting techniques can be used (Frankel, E.G, 1987,150). They are time series and projections, model building and simulation and qualitative forecasting. There are many technical methods available for each group. The first category is based on series of historical data that are analysed in various statistical ways to arrive at forecasts of the future. The methods include trend extrapolation, pattern identification, and probabilistic forecasting. The second category includes dynamic models, cross-impact analysis, simulation projections, input-out put analysis, and policy capture. They are also called structural models. The last group includes scenario, expert opinion method, alternative futures, and values forecasting. This category is more global, more qualitative, and 'softer' than other conventional approaches.

This study has adopted the first category of techniques, which are the most comprehensive and commonly used. This model is used when not much is known

about the process of evolution of the dependent variable. The historical data for the cargo is analysed to find a trend or pattern, which is then extrapolated to obtain forecasts.

The two single variable models used in the analysis are:

1). $C = be^{pt}$

Where, C = weight of cargo in metric tonnes; e= base of the natural logarithm; b, p = regression coefficients, and t = time.

2). $C = mGNP + b$

Where, m, b are regression coefficients and C is the weight of Cargo in metric tonnes.

Accuracy of the models was tested using coefficient of determination, r^2 and standard error values.

iv). Correction for influencing factors

The above analysis gives reasonable accuracy if the conditions prevailing at the time historical data was collected are same as those prevailing over the forecasting period.

It is assumed in this analysis that, the charges and unit handling cost at this port is comparable with those applied at other installations of similar technology in the region and thus neither attract nor dissuade traffic. Factors such as economic, industrial, demographic, political, technological developments, and availability of feeder transport (road, rail and coastal transport costs, and their capacity) as well as the influence of competing upcoming ports and the resulting economic and operational changes affects cargo flow.

b) Engineering studies

Standard books from noted authors and publishers including that of UNCTAD on bulk terminal planning, design engineering & equipment and master plan preparation were studied to understand the procedure and methodology involved in

their design. Several articles and journals were consulted to understand modern port operations, their technology and equipment available for cargo handling. The handling operations in big as well as specialised bulk terminals in the ports of Rotterdam, Amsterdam, Flushing etc. were studied. Information and literature on equipment currently being used in Kandla and its neighbouring ports supplemented this.

c) Financial Analysis

Books, UNCTAD manuals and reports on port pricing as also appraisal of port investments were studied.

1.2.2 Collection of data and information

The major sources of information were the Kandla Port Trust (KPT), Indian Ports Association (IPA), experienced former engineers and consultants of the Port, Ministry of Surface Transport (MoST) and Ministry of Finance (MoF) of the Government of India and also various official and authentic internet sites of the state and central government, the Port Trusts, industries, developmental institutions, research institutes etc.

Information on the traffic handled commodity-wise since 1991, proximity to hinterland and neighbouring ports, number and type of industries in the hinterland (existing and planned), agricultural production and the cargo likely to be generated, berth occupancy, berth-day output, productivity, parcel sizes handled, layout of the port, availability of land for future expansion and development, development costs (engineering and equipment) for marine works, port tariffs, etc, were collected.

Information pertaining to the Indian economy, the economy of the state- past, present and likely was used to develop scenarios for traffic studies and to do a qualitative assessment of traffic growth.

1.2.3 Review and Discussions

Intensive self study and analysis was supplemented by discussions with experienced and renowned professionals in their fields of expertise from within the

World Maritime University (WMU) and outside (visiting) to ensure that no efforts was spared to carry out a comprehensive, exhaustive and as reliable a study as possible.

1.2.4 Design and analysis

The penultimate and most crucial stage in the whole exercise was the preparation of engineering design and estimates. It was possible to make comparison of performance of the existing facilities in the port with some typical international ports. After making suitable assumptions, knowing the commodity-wise proportion of traffic that is likely to be generated and the existing working conditions it was possible to design the cargo handling operations and facilities required at the new terminal. Then the actual capacity of the new facility was estimated. Defining the maximum vessel size possible, estimation of berth length and engineering design to take into account of the possible loads followed this study. It was assumed that new facilities would be designed in line with the design specifications of the existing berth 7 in the same port. The estimates for cost of construction and equipment were the prevailing local rates used by the port in 1995 increased by a compound rate of 7% to account for inflation/custom duty, and additional cost for import of plant and equipment.

This was followed by a Financial and Economic Viability study under two different scenarios.

1.3 Structure of this report

The report is organised in to 6 chapters.

Chapter 1 discusses the background of the study, research objectives, methodology and problems encountered.

Chapter 2 covers a review of the existing facilities and conditions in the port.

Chapter 3 deals with the traffic projections under different scenarios and assumptions.

Chapter 4 attempts to describe the procedure adopted and facilities proposed to be provided at the new terminal.

Chapter 5 discusses the financial and economic viability of the project.

Chapter 6 summarises the conclusions, recommendations and future scope of work.

Chapter 2

Kandla Port - A Review

2.1 Profile

Kandla Port, is the only major port in the state of Gujarat. Geographically located on the west coast of India, it is strategically connected to the Western, Central and Northern India and is located on the northern bank of Kandla creek, off the Gulf of Kutch, at a latitude of 22°50'42" North and longitude of 70° 07' 03" East. It is a tidal port and the water level ranges between 4-8 metres. Kandla creek has good depth, stable banks, is well sheltered from south-west monsoon and is navigable in all weather. The presence of shoals in the approach channel and frequent geo-morphological changes taking place at the creek entrance requires regular dredging in the port for maintaining the depth of 4.3 metres below the chart datum. Except in spring tide when the available draft goes up to 10.36 metres, the available draft ranges between 9.14 to 9.45 metres. Maximum LOA for vessel to enter port waters is 225 m, though there is no beam restrictions. The monsoon season in Kandla commences in July and lasts till September with rainfall averaging 36 cms.

The port is linked to important commercial and manufacturing centres in Gujarat and other states by National Highway 8A, State Highways and Railways. It caters to the trade requirements of one of the most highly productive granary and industrial belt of the country stretching across the hinterland states of Jammu and Kashmir, Punjab, Himachal Pradesh, Haryana, Rajastan, New Delhi and Gujarat (Refer figure 2.1). Parts of Uttar Pradesh and Madhya Pradesh also utilise the facilities at the port. The other important gateway ports catering to the needs of the traffic of this region includes the Jawaharlal Nehru Port and the Mumbai Port.

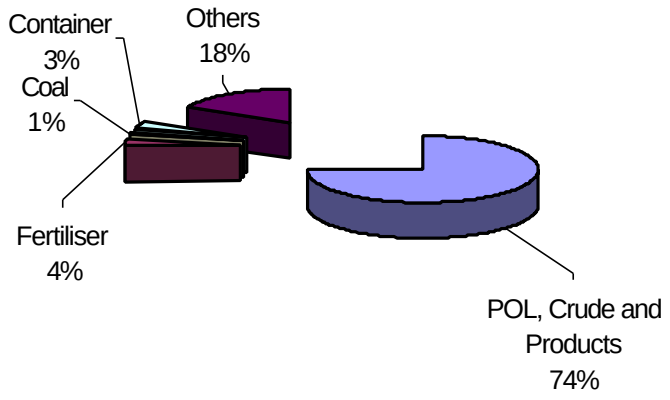
2.2 Review of the Port Performance

2.2.1 Traffic

The aggregate traffic throughput at this port including Vadinar in 1997-98 was an ever high of 38.90 million tonnes, 15.33% more than that of the previous year (IPA, 1998, 18). Of the aggregate traffic of 251.5 Mt. handled in the preceding fiscal by all the major ports combined, the port accounted for about 15.5%, and was the number one major port in India in terms of traffic handled.

The total traffic handled at the port in 1985-86 was 16.486 million tonnes (IPA, 1998, 65) thus registering a growth in traffic of about 11.5 per cent annually. The dry cargo handled at Kandla port (excluding Vadinar) between 1989-90 and 1997-98, increased from 3.631 Mt. to 7.71 Mt., representing an annual average growth of around 12.5%. The container traffic throughput went up from 112,000 tonnes (11,000 TEUs) in 1984 to 1,299,000 tonnes (84,000 TEUs) in 1997-98 (IPA, 1998, 63). Figure 2.2 shows the share of each cargo handled at the port in 1997-98.

Fig. 2.2
Traffic at the Port of Kandla



2.2.2 Port Berthing Facilities

At present, the port has seven general/break bulk and one fertiliser berth with a length of 1783m in straight line to accommodate 9/10 ships primarily handling dry cargo. Other facilities at the port include - four oil jetties, two Single Buoy Moorings (SBM), 5 Stream loading moorings and 2 independent Virtual Jetties. The oil jetties handle oil and other liquid cargo traffic at kandla. The SBMs are installed at Vadinar to handle large crude carriers for import of crude oil through submarine and shore

based pipelines. They feed Koyali (Baroda), Mathura and Karnal (Panipat) refineries.

Port capacity as on 31-3-'97 for POL[1-1] was 23 Million Tonnes (Mt.), and dry bulk, break bulk and containers together 3 Mt (IPA, 1998, 67).

2.2.3 Port Performance

The various performance indicators at the berth are analysed in table 2.1 and 2.2.

The average total output per ship berth-day of 7,716 tonnes is high due to that of the liquid bulk, which is as high as18,121 tonnes. But, the cargo handling productivity of 1,615 tonnes for break bulk is low. The average turn-round time for dry cargo operations was in between 5.11 days for container vessels to 13.27 days for break-bulk. This combined with the average pre-berthing detention constitutes a total delay at the port of 7.25 days for container vessels and 19.63 days for Break bulk vessels on an average. The berth occupancy ratios of 96-99 % are impermissibly high, when the acceptable level is only 74-78%(UNCTAD, 1985).

The traffic volumes have shown sustained increase as explained in the previous section. The woeful inadequacy of port capacity is underlined by the fact that against a total capacity of 3.0 Mt, the actual throughput was 7.71 Mt. It is obvious that the dry cargo traffic handling facilities in the port has been under tremendous strain. It is an imminent need, therefore that the shortfall in capacity of 4.71 Mt. is met with out any further compromise on operational efficiency and service levels. The traffic in the port is expected to grow at a rate of (realistic scenario) 7-8 % as the next chapter will explain. With this the operational efficiency will deteriorate further.

2.2.4 Projects under implementation and active consideration[1-2]

The port is in the process of setting up mechanised handling facilities at berth 6, through private sector (Geepee Corporation Limited, Bangkok). Berth number seven is dedicated to container handling and the mobile cranes and forklifts are provided by private firms.

[1-1] Petroleum, Oil and Lubricants
[1-2] Source: Kandla Port Trust and world wide web of the Port Trust

The berth number 8 is expected to be developed in the private sector. For liquid cargo handling, some other projects such as construction of captive jetty by Indian Farmers Fertiliser Co-operative Ltd., two virtual jetties by Indian Oil Corporation Ltd. and Hindustan Petroleum Corporation Ltd. respectively, SBM, 2 product jetties, Ro-Ro jetty etc. by Essar Ltd. are under implementation.

Table 2.1

Waiting time and Berth Occupancy

Year	Dry cargo Traffic in Mt.	Pre-berthing detention				Berth Occupancy (%)
		Dry bulk		Break bulk	Containers	
		Mechanical	Conventional			
1990-91	3.72		11.22	7.58	3.66	99
1991-92	3.36		5.00	6.20	1.60	99
1992-93	3.81		7.58	4.96	1.84	97
1993-94	4.81		4.32	4.31	0.95	97
1994-95	5.59		5.88	5.87	1.67	98.5
1995-96	5.96		7.70*			96
1996-97	6.72	2.02	8.38	6.09	2.14	
1997-98	7.71	1.99	4.77	6.36	2.14	

(Source: KPT and IPA Statistics)

* - Average for dry bulk

Table 2.2

Turn Round Time and Berth Output

Year	Dry cargo Traffic in Mt.	Turn-Round Time				Average Output per ship berth-day (in metric tonnes)			
		Dry bulk		Break bulk	Containers	Dry bulk		Break bulk	Containers
		Mech.*	Conv.**			Mech.*	Conv.**		
1996-97	6.72	13.12	16.09	12.41	5.23	2230	2570	1569	3476
1997-98	7.71	14.31	10.89	13.27	5.11	1896	3293	1615	3742

(Source: KPT and IPA Statistics)

* - Mechanical

** - Conventional

Other active proposals under consideration in the private sector includes:

1. Construction of four berths with a capacity of 5.0 million metric tonnes (Mt.).
2. Development of container handling facilities having capacity of 1.25 Mt. (82,000 TEUs approximately).

3. Development of a Container Freight Station (CFS).
4. Development of Tuna Port and Jafferwadi Bunder Basin for bulk and break bulk cargo.
5. Development of Truck parking complex which is under review.
6. Construction of liquid jetty by Ms. Bharat Petroleum Corporation Limited.
7. Laying of cross-country pipeline from Vadinar to Kandla by Ms. Petronet UK Limited.
8. Construction of additional liquid storage facilities.
9. Construction of go-downs and warehouses.

Thus, it is clear that the port trust has taken considerable initiatives to implement several projects inline with the federal governments policy of bridging the large supply – demand imbalance through private sector participation.

2.3 Private sector participation – policy initiatives

The Ministry of Surface Transport has projected the traffic arising due to international trade at the various Indian Ports to be 424 Mt. by 2001-02 and 850 Mt. by 2012 as against an existing capacity of 218 Mt. The funds required to meet this additional capacity building would be in the order of USD 4 billions till 2002 (Srivastava, 1998,2) and more than US $15-20 bn by 2012 (Ministry of Industry[1-3],1997). In view of the budgetary constraints and the need to bring in managerial expertise and latest technology, the scope for private sector participation is recognised and the Government of India has initiated policies towards achieving this goal.

The major initiatives as published by the Ministry of External Affairs[1-3],(MoEA, 1997) and Economic Survey 1997-98 (Ministry of Finance[1-3], 1999) are listed below:

1) Detailed guidelines with emphasis on transparency, competitiveness and fair contract conditions issued.

2) Major Port Trusts Act, 1963 amended to provide for an independent tariff Authority for Major Ports to fix and revise ceiling tariff.

[1-3] Abbreviated as MoI, MoEA and MoF

3) Concession period up to 30 years for leasing out existing assets of the port, construction/creation of additional assets and setting up of captive power plants.

4) Automatic approval of foreign equity up to 100 per cent in the construction of ports and harbours. Support services to water transport such as operation and maintenance of piers, loading and discharging of vessels have been allowed automatic foreign equity participation up to 51 per cent.

5) Foreign investors having necessary FIPB/Competent authority clearance and registered/propose to register as a company under Indian Companies Act can be considered for private sector projects other than pilotage.

6) Legislation is through The Major Port Trusts Act, 1963 and permits private investment in the creation and operation of port facilities. Greater administrative and financial powers have been delegated to ports.

7) Fiscal incentives for enterprises through i) Five years corporate tax holiday and deduction of 30% profits for purpose of tax during the next five years to be availed within the initial 12 years period. ii) Reduction in rate of import duty in respect of specified construction plant and equipment.

8) Fiscal incentives to lenders/investors i) Financial Institutions gets up to 40% deduction of their income derived from financing these investments provided income is kept in a special reserve. ii) Dividend and interest on long term capital gains from investments in the form of shares/long term set up to provide infrastructure. iii) Subscription to equities or debentures issued by public company registered in India and solely for Infrastructure is eligible for Income Tax exemption up to 20% with a maximum limit of US $1650.

9) Open competitive bidding, two cover system of technical and price bid and transparent evaluation criterion. The evaluation criteria are: i) maximum realisation to the port on NPV basis for leasing, construction, cranage and equipment as well as dry docking and ship repair facilities. ii) Lowest tariff for sale of electricity to port, and iii) least cost to port for pilotage and taking on lease equipment/port crafts.

10) Priority sectors identified and approved for private sector participation are:

i. Leasing out existing assets to port,
ii. Construction/creation of additional assets such as container terminals; bulk, break bulk, multi-purpose and specialised cargo berths;
iii. Warehousing, CFSs, storage facilities and tank farms;
iv. Cranage/handling equipment, setting up captive power plants;
v. Dry docking and ship repair;
vi. Leasing of equipment for cargo handling and leasing of floating crafts from private sector;
vii. Pilotage, and
viii. Captive facilities for port based industries.

Chapter 3

Traffic Projections

3.0 Review

This chapter outlines the traffic studies and projections in the light of a comprehensive study of the hinterland developments, international trade and analysis of the structure/composition of historical traffic data.

An analysis of the traffic projections for liquid, dry and containerised traffic for the port by various agencies are given below:

Table 3.1

Traffic Projections for 1999-2000 by Different Agencies

(In million Tonnes)

Type of Cargo	Master Plan (1985-86)	Consulting Engineering Services (CES: 1990)	Port estimates	Indian Ports Association (IPA:1993-'94)
Liquid Cargo	30.10	24.73	31.00	30.60
Dry cargo	15.20	3.49	6.20	6.08
Containers		2.84		1.70
Total	45.23	31.06	37.20	38.38

(Sources: Concerned agencies)

The actual traffic in 1997-98 for liquid, dry cargo and containerised respectively was 31.193Mt, 6.409Mt and 1.299Mt. This clearly depicts the unpredictability and unreliability of traffic projections, especially if it is made for long periods.

The main reason for this is that, the economic environment has passed through a severe restructuring since the time these projections were drawn up. The only study made in the post reform era of that of IPA is also different from reality. This is because the years 1990-92 were the years of economic crisis and severe

adjustment. It is only in the second half of 1993 that the economy went through the 'stabilisation and structural reform programme', after the decisive policy measures in the first two years aimed at reforming and restructuring the economy (Reddy, Y.V, 1998). There for the growth in national economy picked up momentum after 1992. Making the traffic projections compatible with sectoral growth through a post-mortem analysis of the economy with emphasis on the regional hinterland of the port is essential for the projections to be more meaningful and realistic. Towards the end of this chapter, an effort is made to carry out this adjustment.

In this chapter, an attempt is made to arrive at traffic forecasts up to 2015AD, applying a more scientific and practical approach to the analysis of current and future market fundamentals. A combination of statistical analysis, trade pattern analysis, likely share of GNP in sea-borne trade, and likely growth of the economy has been used. Assumptions for possible scenarios have been made to carry out the analysis.

3.1 Indian Economy and International Trade – Retrospect and prospects

India, the second most populous country in the world is the seventh largest in terms of area and fifth largest in terms of economy. Since Independence its economic development programmes has been based on the key objectives of self-reliance and social security. As a result of this strategy, the country has achieved self-sufficiency in agriculture, set up extensive infrastructural facilities, and created modern industrial base spanning almost all areas of manufacturing activities. A sophisticated research and development base, with a pool of scientific and technical manpower that is among the largest in the world came up (Ministry of Finance, GOI).

To quote Philip D. Murphy, Goldman Sach's (Asia) President recently, 'India is a cornerstone market for us and we have been consistent in our focus on this country'.

The reasons for the economic growth to remain above 5% in the worst case scenario as assumed for projecting the traffic in section 3.3 are as follows:

1) Since the beginning of development planning in 1950-51, when the agriculture and mining together accounted for 56% of the GDP, the economic structure of the country has changed dramatically. In 1992-93, the industry, trade and

services accounted for nearly 70% of India's GDP thus reducing the share of agriculture and mining sector to 30% (Ministry of Finance, GOI). Though the public sector plays an active part in the Indian economy, the private sector has always had a dominant share in the investment and production, contributing to over 75% of GDP.

2) The years 1990-92 were the years of crisis and severe adjustment. Thus, the GDP growth rate was quite low during 1990-92. The fiscal and external imbalances that followed resulted in mounting government and external debt, excessive liquidity, inflation and depreciation in the external value of rupee as well as a squeeze on development expenditure that was compounded by the Gulf War. However, the (BoP) crisis, resulted in some decisive policy measures followed by a comprehensive stabilisation and structural reform programme. Thus, the economy switched from an inward looking, government controlled one to an outward looking, liberalised one, which have had its effects on the economy resulting in an efficient, sustainable and more rapid trajectory of growth. There has been far reaching changes in external trade and payments, industrial and foreign investment policy, tax system and policy frame-work for the financial sector and capital markets. Industrial activities has been deregulated, unified market determined exchange rate of Rupee introduced, trade barriers progressively removed, tax system simplified, quantitative restrictions on imports removed and customs tariffs considerably reduced (Ministry of Finance, 1998). Privatisation and Competition has become the buzz-word.

3) These policy initiatives have taken the average GDP growth rate over 7 per cent in the 4-year period beginning 1993-94. In 1997-98 and 1998-99, the GDP growth was around 5.5 per cent and 6 per cent. This decline, however have to be viewed in the light of the turbulent and unfavourable international economic environment and reasons mentioned in point 4. On the whole however, the country's economy has been robust.

4) Since the advent of liberalisation, India's export sector, has been quite buoyant and have been rising at one and a half times the pace of growth in world exports. Major factors responsible for this are:

- The reform programme coincided with recovery of industrial economies

- Devaluation of rupee and its consequent effect on India's export competitive muscle
- Recovery of exports to the Eastern block states

- Removal of licensing and other bureaucratic and regulatory controls and reforms in financial markets

Exports in US Dollar terms, which grew at an average annual rate of 8.1 per cent during the eighties, went up to 20 per cent in 1993-94. This however has shown a decline in the last three years. This might be partly attributed to the deceleration in world trade volume and a sharp fall in world export prices. Other factors include, decline in agricultural out put, fund constraints, sharp decline in resources raised by companies through primary issues, reduction in lending/interest rates, slow down in utilisation rate and creation of capacity in infrastructure industries and seasonal downturn (Reddy, 1998). The government has formed an Economic Advisory Council in October 1998 to address these issues with concern.

5) The country still has a share of only 0.65 per cent in world trade (exports) and hence its scope for expansion remains unlimited.

6) Political consensus in economic reform, internal liberalisation and integration with the global economy. All sectors of the economy such as industry, agriculture, infrastructure, finance, tax system, capital markets, insurance etc. are being reformed and are backed by competent measures for export promotion.

7) Policy for development of trade liberalisation and globalisation includes:

- Convertibility of Rupee on current account
- Exporters in Export Processing Zones and Software Technology Parks, are allowed to retain a higher percentage of Forex earnings
- Launching of National Centre for Trade Information to facilitate greater access to trade information.
- Signing of the World Trade Organisation(WTO) agreement
- Introduction of Pass book scheme for export houses

- Introduction of a harmonised system of trade classification known as Indian Trade Classification.

8) Its skilled managerial and technical manpower that match the best available in the world, a middle class size that exceeds the population of the USA or European Union, which provides India with a distinct cutting edge in global competition.

9) The GATT/WTO accord provides for reduction in export subsidies by developed countries by 38% from 1986-90 level and subsidised exports by 21% within 6 years commencing 1995. This has opened up vast opportunities for giving a fillip to farm exports and increasing India's measly share of 1% of agri-exports in world trade of around $US 350 bn.

10) Vision 2020AD that put India in the league of four largest economies in the world.

11) Strong macro-economic fundamentals (Economic Survey, 1999) such as:

- Inflation has fallen below 8%

- Foreign exchange reserves (excluding Gold and SDRs), were US D27.4 billion by end of January 1999. The actual Foreign Direct Investment (FDI) which stood at USD 3.1 billion in 1997-98, is expected to climb up, due to several measures aimed at doubling FDI and Foreign Institution Investment (FII) in the present year.

- Industrial growth reached 12% in 1995-96, though it faltered to 6.6% in 1997-98. It is expected to maintain double-digit rates in the coming years as the Asian/global economy recovers.

- Commitment from the government, to bring out a document to encompass the second generation of reforms to cover the unfinished agenda. They include elimination of red tapism, taking the benefits of reforms to areas that have so far been neglected, continuing to encourage foreign investments-with transparency, continuity and stability as the corner stone. Focusing on

business based on values and principles as well as tackling problems in education are the other considerations.

- Recognition of Infrastructure Development as a high priority area complemented by measures to attract private and foreign capital.

3.2 Hinterland Identification

The most important aspect of port analysis is determination of hinterland or the area served by the port. Kandla port caters to different forms of cargo such as the containerised, break bulk, dry bulk and liquid cargo which makes the hinterland identification all the more difficult. The liberalisation policies of the government might attract more ports along the coastline of India, which might result in change of hinterland as well as economic activity within the hinterland.

The main advantage of this port is its strategic location. The Port presently services a vast hinterland of the northwest India, North India and part of central India. This is because of lower transport distance and time (refer table 3.2), as well as relatively economic operations, better productivity compared to Jawahralal Nehru Port (JNP) and Mumbai Port in respect of break bulk cargo and liquid cargo. However, for dry cargo and container cargo, JNP has clearly higher output per ship birthday. Cargo from the hinterland in northern India, has an additional distance to be transported, which acts in favour of Kandla port. Another major advantage of the port is its nearness to the markets of Middle East and Europe.

Table 3.2

Distance between major cities in the hinterland to Kandla and Mumbai

From	**To Kandla (Kms)**	**To Mumbai (Kms)**
Jammu	1602	1982
Shimla	1439	1750
Chandigarh	1326	1637
Delhi	1096	1407
Ahmedabad	365	545
Jaipur	838	1202

(Source: www: mapsofindia)

Though the direct port costs are low, indirect costs in terms of ship waiting time and service time are high, which emphasises the need for expansion of port capacity.

The immediate hinterland of Gujarat accommodates 4.88% of population of the country. Total population serviced by the port calculated from 1991 census figures is around 204 million. This is about 24% of the population of the country serving a hinterland of nearly 1million sq. kms.

All the ports of the country except New Mangalore and JNP (which has marginally higher capacity) are catering to more traffic than their designed capacity. With a total capacity of all major ports at 217.21Mt., they handled 251.5Mt. in 1997-98, thus having a capacity utilisation of 115.8%.

No port in the country is in a position to take additional traffic, and all ports require expansion and modernisation. If as per the liberalisation policies of the government, some green field sites are taken up for development, it requires participation of the private sector in a big way as the investment requirements are excessively high. This will need abolition of many of the hurdles including removal of bureaucratic bottlenecks. A clear direction and understanding of the port industry, and a co-ordinated policy, at least in terms of arranging for development of the correct supporting infrastructure such as roads, rail, power, telecom, water and community services at these sites as well as environmental clearances is essential.

In the present set up, without a second wave of major reforms towards privatisation and liberalisation, active involvement of the private sector cannot be expected. The only two minor ports that are functioning today are Mundhra and Pipavav, which are substantially supported by the state government in terms of equity as well as administrative support. Thus, the port's hinterland is not likely to change in the immediate future. If a devoted container terminal with modern facilities is set up on the 7th berth, the container terminal hinterland will also remain the same, if not increase a little.

3.3 Regression Analysis

The model explained in chapter 1, was used to carry out this analysis. Dry cargo traffic for the years, 1991-1998 was collected and categorised into dry bulk, break bulk and containerised cargo for forecasting using the models.

3.3.1 Linear growth with GNP

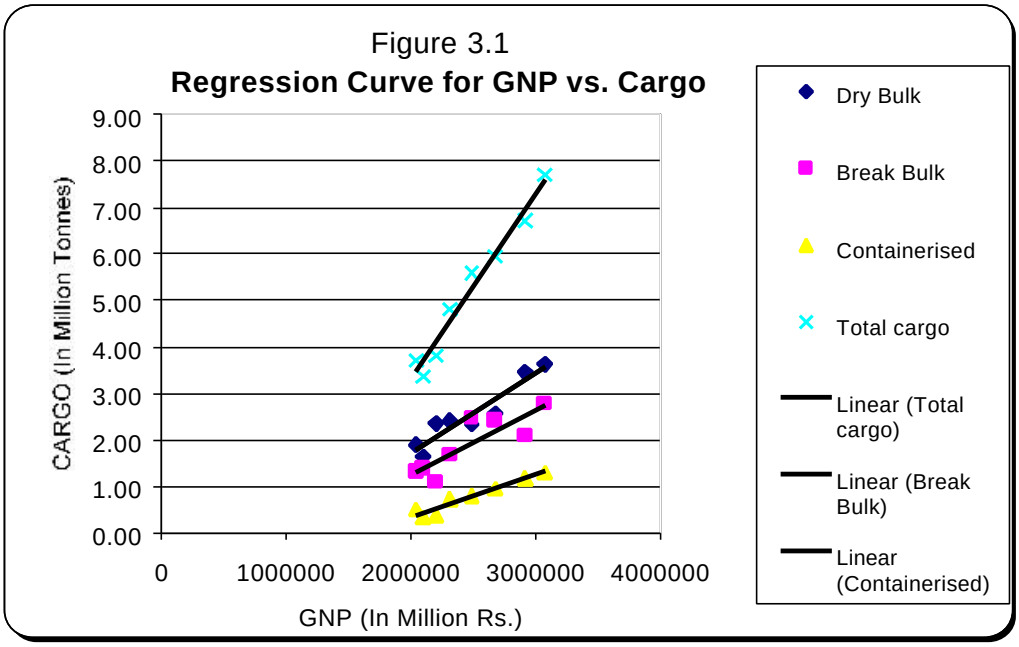
A simple model, C = mGNP + b, was used. Projections were carried out for two scenarios, the worst and best possible cases. The basis for the GNP growth rate in worst case scenario, are elaborated in section 3.1 and the general assumptions are given in this section. It is assumed that the port should be planned for catering to any situation falling with in this range of demand. Table 3.3 shows the growth percentages assumed for both optimistic and pessimistic scenarios. The results of the analysis are given in Appendix - 1A. The analysis shows that, 'the least squares fit' is very good. Figure 3.1 shows the regression curve. The statistic, coefficient of determination r^2, is 0.97 for the least squares fit between Total cargo and GNP meaning whereby that the fitted equation C = 0.00000403GNP – 4.75 explains 97% of the total variation in the data about the average 'C'. The standard error values for the dependent variable 'C', the coefficient 'm' and the constant 'b' are respectively 0.29, 0.000000289, and 0.72 respectively. This shows that there is a high degree of correlation between the variables. Other statistics for this relationships and equations for Break Bulk, Containerised cargo, and dry bulk cargo with GNP are given in Appendix -1A. The traffic projections in the port up to 2015 were carried out, year by year for both scenarios as explained below.

Table 3.3

Percentage growth for different scenarios

	GNP growth rates	
Year	Scenario 1- Optimistic	Scenario 2 - Pessimistic
1999	7.00	6.00
2000-02	7.00	5.00
2003-2007	8.00	5.00
2008-2012	9.00	5.00
2013-2015	10.00	5.00

Figure 3.1



a) Optimistic Scenario:

The assumptions underlying this scenario are:

1) In line with the new policy initiatives for liberalisation and private participation and the emphasis in building up the infrastructure, there is extensive building up of infrastructure.
2) There is political stability in the federal and state governments.
3) Global economy remains stable or continues to grow

The traffic forecasts are shown in Appendix - 1B. Projections demonstrate that in the best possible case, there is a total dry cargo of 12.75 Mt., in 2003. This comprises dry bulk, Break Bulk and Containerised cargo of 5.74Mt, 6.33Mt and 6.97Mt respectively.

b) Pessimistic Scenario

The assumptions underlying this scenario are :

1) Infrastructure development does not take place as per policy plans and new initiatives
2) Lack of political stability
3) Global economy stagnates or recedes.

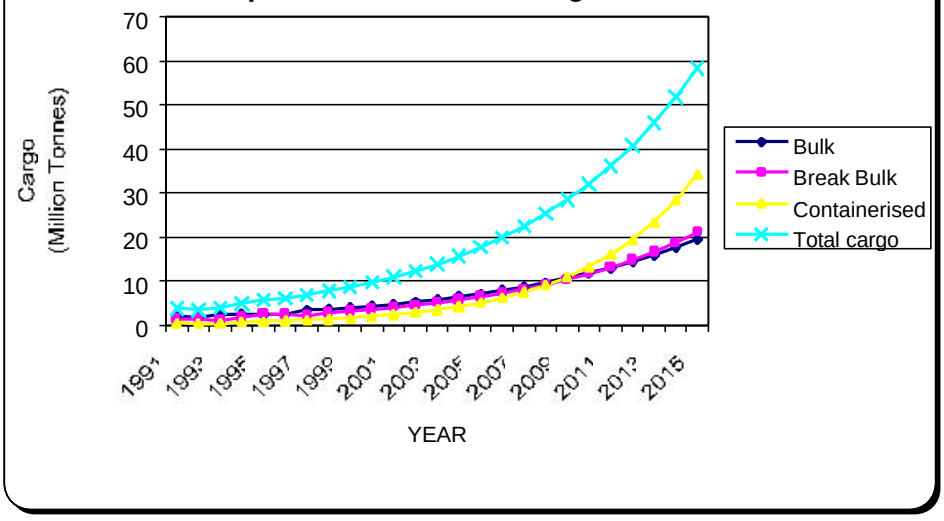
The traffic forecasts are shown in Appendix-1C. The analysis results show that in the worst case, there is a total dry cargo of 11.18 Mt., in 2003. This constitutes dry bulk, Break Bulk and Containerised cargo of 5.07Mt, 3.98Mt, and 2.13 Mt respectively.

3.3.2 Exponential Regression between Cargo and Time

The 'least squares fit' for this analysis is good with a correlation coefficient of 0.943 for the fit between total cargo and time. The result of the analysis is shown in Appendix -1D and the traffic forecasts are shown in Appendix-1E. The regression curve is shown in Figure 3.2. The respective port demand for dry bulk, break bulk, containerised, and total dry cargo for the year 2003 are 5.79 Mt, 5.01 Mt, 3.49Mt, and 13.86Mt.

Figure 3.2

Exponential Curve for Cargo Vs. Time



3.4 Growth and Developments in the Hinterland

The geographic and economic hinterlands of the port are witnessing impressive changes. Covering the regions in the north-western and north-central India, it is one of the most productive granary and industrial belt of the country. The main geographic hinterland state of Gujarat, constitutes about 4.88% of the population of the country and 11% of the nation's GDP. The infrastructure including road and rail network, investment in industrial sector, mandays lost, availability of power, industrial production etc. compare favourably with the rest of the country.

The state of Gujarat has an established economic and industrial policy. The main economy of the state, which was centred around agriculture in 1960s has considerably undergone reforms due to the paths of rapid economic growth through accelerated industrialisation, initiated by the policy makers then and now in the era of liberalisation. The economic and industrial activities in the restructured industrial climate includes in addition to agriculture and diary, textiles and its auxiliaries, chemicals and petrochemicals, engineering and electronics, gems and jewellery, glass and ceramics, food processing, marine products, packaging, information technology and infrastructure projects.

Several major industrial projects are coming up in the hinterland, for the:

Petrochemicals, manufacture of Phosphoric acid, caustic soda, chlorine, polybutadine rubber and polypropylene – Dahej, hydrogen peroxide – Vadodara, Calcium silicide, Calcium Carbide, Aceto acetamide and other acetic compounds, Pharmaceuticals, textiles, HR Coils, alloys and blends, News print, metallurgical coke, copper, fertilisers, containers, mineral based industries, acquaculture and shrimp farming, and a few power projects two of which with a capacity of 1500MW is likely to use imported coal as fuel.

Just as the immediate geographic hinterland state, other hinterland regions in the economic hinterland, under the influence of the opening up of the economy by the federal government are, undergoing massive structural changes. Various local governments through clear, well defined economic and industrialisation policies are competing to attract as much investment and capital inflows into their region. Involvement of the private sector in the building up of the country's infrastructure is seen all over. Efforts are being made to design policies conducive to greater private participation in the development of Power, Industrial Townships, Ports, Roads, Telecommunications, Irrigation, Social Infrastructure and others. Thus, there is a revitalisation of the economy and their contribution to trade will continue to grow.

The Gujarat Government has an ambitious plan for development and modernisation of ten minor ports on the coast. Pipavav port is coming up in the joint sector. Other ports are expected to come up in joint sector with involvement of the Gujarat Maritime Board and private sector. But, due to being purely green field sites, with massive investment required for the building up of hinterland infrastructure along

with that in the port, it will take time before they materialise. The traffic that can arise from the hinterland are analysed below:

3.5 Dry Cargo Traffic

3.5.1 Fertilisers

The demand–supply projections for finished fertilisers (MOP, DAP, and Urea) upto 2000AD displays significant supply side shortfall between indigenous production and availability. Official estimates show that the country will need to import around 7.5 Mt by the turn of the century. Assuming the present share of 30% continues, Gujarat ports will be required to service annually 2 Mt of this traffic. In 1997-98, it handled 0.88Mt. On a conservative level, the port can have a share in traffic of 1.2 Mt by 2003.

The National Academy of Agricultural research, has estimated that by 2025AD on a conservative estimate of 1.3 billion people, India would need 30 to 35Mt NPK from chemical fertilisers inaddition to 10Mt from organic and bio-fertilisers sources to produce the minimum foodgrain needs of 300Mt(WWW)[3-1]. Presently, it produces only around 13mT, which falls short of consumption by over 20 Per cent.

Fertiliser consumption in the country has increased considerably from a mere 0.6kg per hectare in 1951-52 to 86kg per hectare in 1995-96 (WWW)[3-2]. With the agri and mining sector accounting for about 30% of GDP of the country and more farmers resorting to scientific techniques and the use of high yielding varieties the consumption of fertilisers is likely to increase. However, firm projections cannot be made at this stage as a host of factors such as policies of the government on subsidy, privatisation etc. can change the consumption pattern as well as the demand. Production was behind targets by around 8-10% in 1997. Many manufacturing units are coming up within the country and in the Middle East. Statistics shows that by the end of 1996 around 35 fertiliser were proposed, of which 15 are under implementation.

The country also imports fertiliser raw materials, phosphate, potash and sulphur. For nitrogenous fertilisers, raw materials are available within the country. Fertilisers

[3-1] World Wide Web: International Fertiliser Industry Association (IFA) Statistics
[3-2] World Wide Web: Fertiliser Association of India Statistics

Association of India's statistics show that of the 130 fertiliser plants presently operating in the country, 40 units (9 nitrogenous and 31 phosphate) are located in the economic hinterland of Kandla Port. More plants are coming up in Uttar Pradesh and Rajastan. IIFCO is in the process of expanding the capacity at Kandla plant by more than 50%. These developments along with further liberalisation in imports will increase the import traffic. The national level demand by this period is expected to be 9Mt – rock phosphate 5.20 Mt and 3.50Mt sulphur. Around 2.5Mt of this will move through the ports of Gujarat. By 2003, it is safe to assume that a demand of more than 1.5Mt in this sector will develop.

3.5.2 Oil Seed and Extractions

Production of oil seeds and extractions including Soya has increased significantly in the last decade. Several plants for processing castor, rape seed and ground nuts, rice ban, etc. have come up. India is the largest producer of castor seeds in the world with Gujarat's hinterland accounting for 89%(WWW)[3-3] share of national production.

Substantial expansion in exports of these commodities is foreseen. Traffic in oil seeds and extractions from Kandla is expected to increase considerably in the coming future. Thus, the traffic in this sector is likely to reach a minimum of 1.5 Mt, by 2003.

3.5.3 Food grains

The Indian agricultural production has become less dependent on the fluctuations of the rainfall, and the net imports have become practically negligible in the last two and a half decades. The share of food grains in value of output of agriculture, has dropped to just 55% in 1992-93 suggesting an overall improvement in the availability of food per capita. The country's target for food production for 1997-98 was 200 Mt (Ramachandran, 1998), with a composition of around 83 Mt of rice, 68.5 Mt of wheat, 33.5 Mt of coarse cereals and 15 Mt of pulses, as per the agriculture commissioner's office. There has been both export and import of foodgrain alternatively. However, the imports are negligible and with the production going up as per the planner's estimate, there will be increasingly more quantity available for exports.

[3-3] World Wide Web: Gujarat Government

Kandla port accounted for 80% share of foodgrain exports serviced by all major ports (IPA, 1998). In 1995-96, it handled 2.025 Mt, 6.83 % more than the previous year. Recent figures show that it declined to 1.95 Mt. and 1.39 Mt. respectively in 1997 and 1998. This is due to an overall decline in growth of agricultural production, from 3.5 per cent in the eighties to 1.7 per cent. There is awareness at the policy making level downwards that the contribution of high yielding varieties which was the basis of green revolution has plateaued and there is hardly any fresh contribution to growth in yields. Efforts are being made to minimise the crop output lost, which is as high as 10 per cent. Multi-pronged irrigation programmes for irrigation and cultivation, and increased yield in the areas of Bihar, Orissa and Eastern Uttar Pradesh is being targeted. This would definitely reverse the trend and make more food grains available for exports. But, the woeful inadequacy of port, rail and road infrastructure is a major bottleneck in the food grain export growth and the economies arising there from. No seaport in the country today is in a position to load more than 3,000 tonnes/day (IPA, 1998). This rate of productivity can be substantially increased if mechanised system facilities are set up. If better system facilities were set-up, this traffic through the port would increase at a rate of around 5-6% for another 2 years and thereafter around 3-4% for another decade. An estimate of 1.7 Mt. by 2003 would be conservative.

3.5.4 Mineral Ores

Gujarat is one of the states blessed with the country's largest reserves of minerals. Government estimates shows about 11,500 Mt. of Limestone, 105 Mt of Bauxite, 700 Mt of Lignite, 720 Mt. Dolomite, 105 Mt. of Bentonite and 418 Mt. of crude (WWW-gujaratindustry) in the state apart from other reserves in Granite, Silica, China Clay, Fire Clay etc. offering scope for mineral based industries.

The Union government has de-reserved many of them from exclusive public sector production and approved many new mining investment (more than 34) proposals covering an area of 49,000 sq. km mainly in the states of Rajasthan, Maharashtra, Gujarat and Bihar. Australian, British, Canadian and US companies are involved in the same (WWW-miningindia). Many of these projects are in the hinterland of the Port of Kandla.

In recent years mineral ore traffic in Gujarat ports (mainly Kandla) has increased significantly. Demand for low-grade bauxite from countries in the Middle East is increasing. All considered, Kandla's share of traffic may be assumed rising from the present level of 0.35 Mt to 0.7 Mt in the next three years.

3.5.5 Iron/Steel

India has a large manufacturing base and is one of the world's major industrial powers and the fifth largest economy in the world. The economic reforms are enabling the country to attract multinationals that want to tap the huge market.

The sheer size of the consumer market makes India, an attractive destination for all global industrial leaders. The consumer class that spends on manufactures and services is expected to be in the range of 500 to 600 million (www-India trade point). The large industrial base spanning virtually every manufacturing activity implies an enormous domestic demand for industrial products. The reforms and liberalisation has attracted large investments in key infrastructure areas: electronics, industrial and agricultural machinery, components, agro-based inputs, chemicals, petro-chemicals, fertilisers, packaging material etc. The diversified industrial sector coupled with rich natural resources and large pools of skilled personnel provide a sound base for higher industrial activity.

Hinterland of the port is seeing increased industrial activity as most of the hinterland states have identified industrial parks and townships for development and streamlined the procedures for massive expansion and capacity building. Policy measures aimed at infrastructure development through private participation will, increase the Foreign Direct Investment as well as technology inflows and imports of in equipment and engineering which will intern boost the trade of this category of cargo.

Inaddition to the Gujarat state plans for massive expansion of power, industrial townships, ports, roads, irrigation projects and social infrastructure, industries are coming up for forged components, ball & roller bearings, precision valve and fitting, aluminium extrusion, containers etc. Thus conservatively, the present traffic of nearly 0.7 Mt. can be expected to grow marginally to 0.9 Mt.

3.5.6 Salt[3-5]

The coastal areas of Gujarat account for nearly 70% in the aggregate production of salt in India. The total salt produced in 1994 was 13.2 Mt. Though exportable surplus available was in excess of one Mt. yet less than half of it nearly 0.4 Mt. was actually exported. This is largely because no seaport in Gujarat or in other state for that matter, stands equipped with mechanised system facilities. The maximum handling rate of productivity achieved so far with manual handling does not exceed 1800 tonnes/day. In quality, Indian salt compares with the world's best offered by Mexico and Australia with Nacl contents of 99.25%. The Indian shippers are however at a disadvantage vis-à-vis their rivals due to the high trade logistic costs. Pre-berthing detention time of vessels now averages about five weeks. The shippers have to content with greater uncertainty of delivery schedules.

Though plans are afoot to set up mechanised salt handling facilities in neighbouring locations, the port still will have to service around 0.3-0.4 Mt of export traffic annually.

3.5.7 Coal

The demand for coal in the country has increased from 238 Mt in 1992-93 to about 311 Mt in 1996-97(www- miningindia). As against a production level of 279 Mt, the country had to resort to increased imports by more than 13 Mt in 1995-96 to meet the demand. In view of the crucial role played by coal in fuelling the industrial growth in the country, coal demand for India is projected at 340 Mt by the year 2000, 430 Mt by 2005 and 540 Mt by 2010, according to official estimates.

With declining trend of coal prices in international market and reduction in import duty, some powerhouses, particularly those located in the coastal areas, will resort to increase in imports of coal. In Gujarat alone, cement plant with 1M TPA(www-gujaratindustry), is being set up in the immediate future. Also, two large power plants using imported coal are coming up at Pipavav and Mundra. If facilities are provided, some of this traffic will be attracted to Kandla Port. In 1997-98, the port serviced 0.35 Mt (IPA, 1998), which would increase by conservative estimates to at least 0.8 Mt, by 2002 AD.

[3-5] most of the information was obtained from the Salt Commissioner's office and Chemical Industry Association.

3.5.8 General Cargo – Containerised and break bulk

Container traffic conventionally held at Kandla has gone up from 0.42 Mt in 1988-89 to 1.299 Mt in 1997-98 (IPA, 1998). Better railway facilities as planned, connecting Kandla and Delhi can substantially reduce the distance by more than 400 Kms, thus opening up immense possibilities of growth in dry cargo and containerised traffic. Modern and specialised handling facilities including induction of new equipment in berth No. 7, will result in attracting some of the cargo from the hinterland presently being handled through Mumbai and J.N. Ports, as a result of saving in time and distance.

The accentuating infrastructure constraints, has been a bottleneck in achieving the targeted ratio of containerised cargo to general cargo of 40:60 by end 1997, as per the 8th plan. If the berth no. 7 is devoted for container cargo handling, then a major portion of the container traffic (84,000TEUs in 1997-98), may be serviced by this berth. This berth which will mainly cater to combis and feeders may be able to service only around 1,00,000 TEUs annually at its peak. There fore there is need for additional facilities for handling the container cargo.

General break bulk cargo not covered in the above items such as plastics and chemicals, processed food, textiles etc. will also add to the growth of traffic in the port.

A summary of the traffic estimates based on the discussions outlined in section 3.4 is given in table 3.4 below.

Table 3.4

Anticipated traffic growth

Commodity/Year	1998 (in Million Tonnes)	2003 (in Million Tonnes)	Per centage increase
Fertilisers	0.73	1.20	63.93
Fertiliser raw materials	0.66	1.50	127.27
Iron Scrap/Steel	0.66	0.90	37.20
Food grains	1.39	1.70	22.66
Oil seed and extractions	1.10	1.50	35.87
Mineral Ores	0.34	0.70	108.96

Commodity/Year	1998 (in Million Tonnes)	2003 (in Million Tonnes)	Per centage increase
Salt	0.15	0.40	166.67
Coal	0.34	0.50	45.77
Containers	1.30	1.90	46.41
Others	1.04	2.00	91.75
Total	7.71	12.30	59.60

This is in agreement with the traffic forecasts done using the regression model, where the worst and best case displays a range of 11.18Mt to 12.75 Mt. Qualitative analysis from this section shows a likely traffic of 12.3Million Tonnes by 2003.

The projections of the planning commission for dry bulk and general cargo for 2002 (end of the ninth five-year plan) is 18.602 Mt., which as per this study is highly optimistic an estimate. However, that projection substantiates the validity of this exercise.

3.6 Conclusions

1. The dry cargo traffic in the port presently is 7.71 Mt. including 1.3 Mt. of container cargo.

2. The present dry cargo handling facilities at the port is 3.0 Mt. The ongoing projects of mechanisation of berth no.#6 by Geepee Corporation Ltd., dedicated use and up gradation of berth no. #7 for container operations and commissioning of berth no. # 8 can increase the capacity to about 3.9 to 4.0 Mt. Thus, the short fall in capacity even if the existing level of traffic prevails is 3.71 Mt.

3. Assuming the worst case prevails, the total dry cargo traffic can be expected to rise to 11.18 Mt. including 2.13 Mt. of containers. The new facility is not expected to handle container cargo. Considering only dry bulk and break-bulk traffic, the total traffic is 9.05 Mt, by 2003 thus showing a demand-supply gap of 6.05 Mt. with the existing facilities. Including containers, the gap is as high as 8.18 Mt. Individual commodity analysis consolidates these projections.

4. New ports on green field sites in Maharashtra and Gujarat may attract some of the cargo projected in Kandla Port. However, it will be some time before these projects come up, as another wave of liberalisation as explained in

this chapter combined with participation of the government in building up the support infrastructure only can result in such projects materialising. If that happens, the gestation period is going to be at least 2-4 years. If the port under study is able to build sufficient capacity it has the competitive advantages due to a well-developed support infrastructure as well as established systems and procedures.

5. Port capacity should be flexible enough to handle cargo projections in the range between best and worst cases with the minimum capacity designed for the worst case. The cost of not having adequate infrastructure is more than over-capacity.

Chapter 4

Infrastructure and Equipment Planning

The port of Kandla requires a massive infrastructure upgradation as a sequel to the discussions outlined in chapter 2 and 3. The port is also actively considering and has initiated the process of a huge investment to the tune of Rs. 22.14 bn (USD 520m) in the next five years (Lloyd's list, March27, 1999) to upgrade and expand its general cargo, liquid cargo and container handing facilities. In this study, the dry cargo facilities were studied and the urgent need for expansion was underlined. It was recommended to undertake a bulk terminal consisting of two new berths with scope for further expansion in the private sector. Since larger specialised vessels requiring deeper draughts more than 10.4m can not be serviced in this port, there are obvious limitations for the use of much sophisticated facilities and specialised terminals.

This project is only indicative of a typical expansion/development project for any of the major ports in the country. In this chapter, the various assumptions, design criterion and technical designs of the facilities, along with estimates are outlined.

4.1 Terms and Major Assumptions

The major assumptions are as follows. All other assumptions, if any, have been mentioned in the sub-sections as appropriate.

i) Two berths with a total length 400m may be constructed
ii) Storage should be planned in an available area of 130,000sq. m, which can extend up to a maximum of 598m[4-1] into the landside as indicated in the plans.

[4-1] Drawings from the port indicates an available land depth of only 598m.

iii) The Port Trust should undertake the responsibility for capital and maintenance dredging of the channel and the waterfront on contemplated lines at its own cost and through its own agency.

iv) The Port Trust Board should obtain all approvals and clearances including the environmental clearance from the concerned ministries. This is subject to lessee providing such assistance as may be required like the reimbursement of fees incurred in connection with the same.

v) Revenue obtained in terms of port dues, pilotage fees, mooring charges, stream dues, anchorage fees etc. shall accrue to the port.

vi) Since the intrinsic value of land is its potential for cargo handling and storage, a nominal lease rent for safeguarding KPT's title to property may be charged. This will be inaddition to the berth hire charges, wharfage and demurrage.

4.2 Performance of existing berths

This section analyses the productivity of the berths in detail and compares with prevailing international standards.

4.2.1 Throughput and berth day output

The actual performance of the existing dry cargo berths is analysed below:

Table 4.1

Annual Throughput

(In Million Tonnes)

Berth No.	1991-92	1992-93		1993-94		1996-97		1997-98	
			% age* increase		% age* increase		% age* increase		% age* increase
I	0.460	0.394	-14.35	0.520	31.98	NA		NA	
II	0.460	0.445	-3.26	0.561	26.07	NA		NA	
III	0.520	0.512	-1.54	0.536	4.69	NA		NA	
IV	0.411	0.482	17.27	0.483	0.21	NA		NA	
V	0.346	0.392	13.29	0.423	7.91	NA		NA	
VA	0.436	0.545	25.00	0.523	-4.04	NA		NA	
VIA	0.322	0.360	11.80	0.471	30.83	NA		NA	
VII	-	0.103		0.432	319.42	NA		NA	
VIIA	-	0.037		0.468	1164.86	NA		NA	
Total	2.955	3.27	10.66	4.417	35.08	6.72	52.14	7.71	14.73

* - Per cent increase over the previous year; NA - Not Available

(Source: Kandla Port Trust and IPA)

The above table shows a variation in throughput of 0.561 Mt. in 1993-94 at berth II to 0.322 Mt. in 1991-92 at VIA. As per UNCTAD handbook for Port development, a throughput of 150,000 tonnes a year at a berth with a predominant proportion of break-bulk cargo (constituting bagged and unitised cargo of 30 to 40 per cent) can be achieved with acceptable waiting times, in developing countries. If 4 gangs works 2 shifts per day with a gang productivity of 1000 tons per gang-day, at a berth occupancy of 70 per cent, the annual throughput would be slightly over 1000,000 tons. In the port under study there is an average throughput of 900,000 tonnes per year on an average that is comparable, but with a high price of waiting time.

There was a slight decline in throughput from 1991 to 1992 in berths I, II and III because two new berths started operation and thrust was for improving the performance of the newer facilities. But, in the following year this lacuna was filled and the performance of all the berths except VA, which declined slightly, increased. It can be seen that the total annual through put increased from about 3Mt. in 1991-92 to 7.71 Mt. in 1997-98. This was achieved through commissioning of the additional berths VII and VIIA as well as up gradation and modernisation of the existing berths. The leasing of berth 6 to private company for mechanisation and automation is worth mentioning. At this facility, a record 9,925 metric tonnes rice was loaded in less than 24 hours by the operators last year (World Wide Web: KPT home page).

The commodities handled during the above period, and their average berth output per day is given in the following table:

Table 4.2

Average Berth-Day Output

(In tonnes)

Commodity	Average Berth-day Output				
	1991-92	1992-93	1993-94	1996-97	1997-98
Break Bulk Cargo	846	960	1,212	1,569	1,615
Containerised Cargo	1,887	1,846	2,468	3,476	3,742
Commodities (in bulk and bagged form)					
Fertilisers	1,379	1,603	1,376	NA	NA
Sulphur	1,432	1,052	1,118	NA	NA
Rock Phosphate	1,469	1,082	2,041	NA	NA
Coking Coal	1,603	2,285	1,937	NA	NA
Iron Scrap	1,072	2,763	1,372	NA	NA
Food grains	1,885	1,340	1,098	NA	NA
Salt	2,064	2,615	1,824	NA	NA
Bauxite	-	-	3,376	NA	NA
Bentonite	936	1,411	1,812	NA	NA
Other Ores	621	534	2,445	NA	NA
Oil Extraction and Seed	584	870	1,012	NA	NA

Commodity	Average Berth-day Output				
	1991-92	1992-93	1993-94	1996-97	1997-98
Others	1,403	942	1,674	NA	NA

NA - Not Available

(Source: Kandla Port Trust and IPA)

The drop in berth-day output of Food grains over the years 1991 till 1994 is due to an overall decline in its production resulting in less exportable surplus. The food grain exports further deteriorated till 1998. Salt exports also reduced because of the increasing competition from Mexico and Australia. Inspite of its comparable quality, as explained in Chapter 3, the competitive advantage of Indian salt reduced due to its high trade logistics costs.

On the other hand, the substantial increase in productivity of minerals is a reflection of the increase in exports of mineral ores especially to the Middle East. The hinterland of Kandla Port covers one of the best reserves of minerals in the country. Similarly, availability and exports of Oil seeds and Extractions has increased considerably in the present decade, which is mirrored in the average berth day output increase from 584 Tons per day in 1991-92 to 1,012 tons per day in 1993-94.

4.2.2 International Comparison:

For planners of port development in developing countries, UNCTAD recommends the standards given in table 4.3, for a well trained and motivated team working the average number of hatches for each class of ship for a shift pattern which gives a fraction of time worked of 0.6.

Table 4.3

Tons per ship day for Different Types of Cargo

Sl. No.	Cargo Class	Tons per ship day
1.	Conventional general cargo	700
2.	Fully palletised general cargo	900
3.	Packaged forest products	1500
4.	Bundled Iron and Steel Products	2000
5.	Pre-slung Cargoes	900
6.	Containers *	275TEUs
7.	Dry Bulk i) Loading ii) Discharging	 - 70 per cent of ship loader rated capacity - 50 per cent of unloader rated capacity

* - Assuming multi-purpose vessels has the same rate as that of ships on short sea and feeder routes

(Source: UNCTAD, 1985, page 56)

The productivity in general cargo berths have not improved much with the standards as that of 1985. So, they are still applicable.

Inorder to understand the implications on the throughput of the facilities and equipment, a few world class ports were studied and the results are given in table 4.4.

Table 4.4

Handling Rates in some important ports (Dry Bulk)

Sl. No.	Port/Terminal	Quay length/ Max. vessel size	Equipment and Commodities	Discharge/ Loading Rate
1.	Rotterdam (EMO) - Mississippihaven	- 1050m - 350,000 dwt - 23m	- 2x85 t gantry - 2x50t gantry - 2x36t gantry (Coal, Iron Ore)	140,000 tpd * - 46,700 tpd per berth
	- Amazonehaven	- 800m - 150,000 dwt - 21m	1 loader @5000tph (Coal, Iron Ore)	50,000 t
2.	Amsterdam - OBA Bulk Terminal	- 900m - 13.7m draught	- 3x30 t gantry - 1x50t gantry - 1x16t floating (Coal, ores, industrial materials, scrap etc.)	65,000tpd * - 21,670 tpd per berth
3.	Zeeland Seaports - Terneuzen	- 750m with 12.25 draught and 650m with 8.25 m draught - 100,000dwt in the river (Outer Braakman Harbour) - 75,000dwt (inside the locks)	4x25 t floating cranes 2 gantry cranes each with 600 tph capacity (forest products, solid fuels, fertilisers, minerals, chemicals, ores etc.)	60,000 tpd

(Source: Publications and annual reports from individual ports)

It is obvious that the cargo handling capacity depends on the facilities and equipment at the port. With proper up-gradation of facilities in the port, the berth output can be improved, given that there are inherent limitations of parcel sizes and size of vessels that can be serviced in the port, as explained in latter section.

4.2.3 Parcel Sizes and their significance

The physical constraints at the port does not permit entry of vessels of different sizes in and out of its berths on all the 365 days but limited[4-2] to:

a) 16,000 DWT Vessels – 330 days/year
b) 20,000 DWT vessels – 300 days/ year
c) 30,000DWT vessels – 300 days/year

Available information shows that the parcel sizes handled in the first half of 1990's were in the range of 23 to 25 thousand tonnes for fertilisers. Details for various commodities are given in table 4.4.

Table 4.4

Parcel Sizes Handled

(In Thousand Tonnes)

Sl.No.	Commodity	Parcel Sizes		
		1991-92	1992-93	1993-94
1.	Fertilisers	24.365	24.883	23.672
2.	Rock Phosphate	15.118	12.849	13.955
3.	Sulphur	15.655	7.625	6.705
4.	Iron scrap	20.352	29.991	14.160
5.	Food grains	17.040	16.476	10.239
6.	Salt	10.902	14.400	11.840
7.	OIL Seeds & Extractions	7.135	8.900	7.880

(Source: Kandla Port Trust and IPA)

The parcel sizes have been relatively small due to inadequate warehousing facilities compounded by heavy idle time costs incurred by vessels due to long waiting time, Turn-Round-Time etc. There fore, addressing of these bottlenecks and shortages seems to be the most important need of the hour. This would in-turn allow vessels of younger vantage and larger DWT (Dead Weight Tonnage) to the Port and the resulting scale economies.

4.3 Traffic composition and criterion for planning

Detailed projections for the commodity traffic are given in Chapter 3. In this section, some principles to be observed to achieve higher productivity at the planned terminal are delineated.

[4-2] From Kandla Port Trust

i) Traffic comprising of bulk commodities and heavy unit loads such as pipes, heavy machinery and iron scrap reckoned as general cargo should be given precedence.

ii) Use of specialised equipment will help improve productivity. Since these are capital intensive, the construction of new berths should be planned for handling compatible cargo traffic. This will ensure smooth transfer of these commodities from ship to shore and vice versa and also lead to optimal utilisation of equipment.

iii) Improved logistics services and reduction of transportation and handling expenses, to improve the price competitiveness of the cargo.

iv) Provision will have to be made for a railway siding with a stabling length of about 684m at both loading/unloading points. This is due to the fact that, freight movement by rail is the cheapest, particularly in long overhauls. Indian Railways (IR) adopt the policy of affirmative discrimination for bulk movements, and hence the preference for block rake movements (full train movement from point to point) is understandable. Once the freight becomes available, the IR would improve the availability of wagons. The berths should also be planned for a group of bulk commodities that will help in optimal utilisation of assets including the rolling stock of railways.

v) Traffic in food grains (export) finished fertiliser and fertiliser raw materials (import) and iron scrap eminently satisfies the above criterion. Salt and oil seed extractions destined for foreign markets mostly originate from Gujarat and do not there fore require haulage over long distances. This demand can be largely serviced by road.

vi) Food grains, oil seeds & extractions and salt can be transferred and loaded by a single conveyor system. It cannot be used for transferring imported materials from ship-to-shore because they are not reversible. So heavy-duty wharf cranes can be installed to handle the traffic in fertilisers, raw materials, iron scrap and heavy unit loads (pipes, project equipment) with attachments such as slings, grabs and magnets.

vii) The projected traffic can be serviced by developing a bulk terminal and providing economically viable and suitable facilities, for handling a mix of cargoes mentioned in the table 4.4, at the new facility.

4.4 Planning Considerations and workings

The planning of port capacity should be on the basis of a set of berthing points that share the same stream of traffic (UNCTAD, 1985, 123). Provided ships can be equally serviced in each area, and several different berthing areas can deal with the same kinds of traffic, it is advantageous to consider the facilities as a group which constitute the break-bulk berth group. This will facilitate a smoothing effect, allowing ships to berth over the whole berth group in a co-ordinated way and help reduce waiting times. If the traffic is segregated then, traffic statistics, forecasts and capacity calculations have to be done separately. This normally happens when there is substantial draught difference or dedicated berths for conferences/trade routes etc. However, as per the UNCTAD handbook, it is better to plan the facilities separately.

This section outlines the planning considerations for the expansion of facilities.

4.4.1 Stockpiles and storage

Cost of sea freight is inversely proportional to the size of shipments and to the volume of trade. Vessels with a maximum size of 40,000 DWT are used for the transport of food grains, though the majority is in the range of 20,000 to 30,000 DWT[4-3]. Economies of scale can be realised if the Turn Round Time (TRT) of vessels in the port is reduced. Liquid cargo vessels have a discharging rate of 5-10%, (UNCTAD, 1985, 56) thus helping them to patronise ports where the TRT does not exceed 36hrs. This holds good for large purpose built dry bulk vessels also, whose economics is based on a TRT of 2 days with a typical pre-berthing detention of two days.

Peak rates of loading can be had where the entire quantity of shipment is stockpiled and ready for loading the vessel on arrival. Warehousing facilities should take into account of the random arrival pattern of the ships and its stochastic nature. For ensuring quick turn round of bulk vessels, the port storage capacity for a berth designed to accommodate a 20,000 DWT vessel and an annual throughput of 1 Mt.,

should be on an average 75,000 t and a maximum of 1,40,000t (UNCTAD, 1985, 188).

4.4.2 Handling and Transport

The various items of equipment for bulk cargo handling are subject to wide variations in performance as well as cost. In this project care has been taken to choose equipment and handling technology that provides an efficient service and is economical to the port users. Capital investment needed should also be reasonable.

Rail Mounted ship loaders/unloaders give very high transfer rates of the order of 600t/hr at peak capacity. This type of crane costs approximately USD 3.5 to 4 million, is costly and the envisaged returns may not be adequate to justify the investment for all operations. Fixed loaders/unloaders on the other hand, demand less investment but the rate of transfer is very slow. It also introduces rigidity in the use of berths. So the obvious choice is equipment that give reasonably good transfer rates, are mobile and admit flexibility in the use of berths.

The ship-shore transfer, for loading of food grains, salt, oil seeds and extractions for export, should be done through mobile conveyor systems. And for discharging / unloading, fertilisers, fertiliser raw materials, scrap iron and heavy unit loads, rail mounted heavy duty cranes with grabs, magnets and slings may be deployed.

The transfer of cargoes between the warehouses and ship-shore transfer equipment can be effected through dumpers, among other equipment for keeping the over-ground obstruction in the berth to the minimum. These would, in turn ensure free and flexible use of the berth complex and eliminate pre-berthing detention of the vessel.

a) Food Grains (Exports)

This traffic can be moved by rail in bags from Punjab, Haryana etc. to the port in block rakes. The bags unloaded from the train should be transferred to the silo in the port area through a conveyor belt to achieve the free unloading time of 10 hours allowed by the railways. In the silo area, these bags should be bled and bulk grain

[4-3] Statistics from the port trust provides information on this.

transferred through a bucket elevator for storage. The railway siding and silo should be accommodated in the available area of 130,000 sq.m, considered by KPT, so that the distance from the point of transfer to the ship for loading remains within acceptable limits.

b) Fertilisers and Fertiliser Raw Materials (Imports)

The imported cargo should be directly transferred to the bonded warehouse. Finished fertilisers could be bagged in the bonded warehouse. The bagged fertilisers and bulk fertiliser raw materials may be despatched to upcountry destinations, in the wagons emptied after unloading food grains, to the customers. A mechanical loading system could be used for loading bags into wagons and small portable pneumatic excavators deployed for loading bulk fertiliser raw materials into wagons.

c) Scrap Iron (Imports)

Scrap Iron should be transferred directly to an open bonded warehouse for bulk loading with the help of mobile cranes fitted with magnets on to rail wagons that become available after unloading food grains. This arrangement is expected to widen the hinterland of Kandla for this commodity.

d) Salt and Oil Seeds Extractions (Exports)

Since inland haulage is relatively short, the traffic will continue to move by road. Dumpers could be directly unloaded into warehouses to be built adjacent to the silos, so that the commodity can also move on the 'ship to shore transfer system' used for handling food grains.

4.5 Capacity of Transport facilities, Equipment and Port Storage

4.5.1 Railway Sidings

A full block rake needs a stabling length of 684m (source: Indian Railways). The length of both the berths considered together is 400m. The minimum rail loading/unloading facility would therefore need two stabling sidings of 400m length and another 400m long engine return siding.

The block rake can be broken into two trains each of 342 m length in the marshalling yard and two parts moved in succession to the berth and like wise return to the marshalling yard for reformation into a single block rake.

Assuming, a period of:

- 4 hours for inspection of wagons in the marshalling yard;
- 2 hours for shunting, movement and stabling of wagons on the berth;
- 10 hours for unloading of wagons;
- 1 hour for return of the two parts to the marshalling yard;
- 4 hours for re-inspection of wagons including shunting to form a block rake;
- Total turn around time of a block rake in port would be 21 hours. (i.e., one day)

The capacity of a block rake is 2000t. The three sidings on the berth would bring about 2000 t/day of food grains. With such a system stockpile of 20,000 t can be built in 10 days. For 300 days, the sidings would give an output of 600,000 tonnes per annum.

Initially 3 sidings may be provided and sites earmarked for constructing 2 more sidings for increasing the receiving capacity to 1.2 Mt. per annum.

The siding could be used for upcountry movement of imported fertilisers, fertiliser raw materials and scrap iron on their return journey. By combining loading and unloading operations, the turn around time will increase to 31 hour (36 hours including inspection, cleaning, non-working time etc.). This will bring down the annual capacity for receiving food grains to 0.4Mt. per annum. The food grain traffic is seasonal and therefore it is proper to provide for peak movements.

However, the necessity of an additional set of sidings becomes evident.

4.5.2 Roads

Cargo from the immediate hinterland such as oil seeds and extractions, salt and heavy unit loads will come by road. If trucks with an average capacity of 10t were used, 2000 vehicle trips would be needed for building a stockpile of 20,000t. Assuming 10 days for building a stockpile, it would need 200 truck trips per day for each commodity. The existing road corridor (National Highways and State

Highways) and the 30m wide road corridor to the port can accommodate this volume of traffic.

4.5.3 Equipment

a) Loading/Discharge of Vessels

Two mobile conveyors with a rated capacity of 500 t/hr are proposed for loading food grains. Their average performance may be taken as 70% (UNCTAD, 1985, 56). Assuming 15 hours per day of working, the daily loading rate would be 10,500t. Thus two berth-days would be required to load a parcel of 20,000t.

Two rail mounted grab cranes each of 20t capacity are proposed for discharge of fertilisers and fertiliser raw materials, scrap iron and unit loads. Their actual average capacity would be 50% (UNCTAD, 1985, 56). The daily discharge rate would thus be 4500t/day (15 moves per hour of working) and the berth day time for discharging 20,000t, 4 days. One more crane could be added at a later stage.

b) Transfer between Port Storage and Ship loading/unloading equipment.

Dumpers may be used for transferring grain, oil seeds, salt etc. from silo/stockpiles to the mobile conveyor. About 50 dumpers are required. They may be also deployed for transfer of imported fertilisers' etc. to the bonded warehouse. Incase there is need to concurrently food grains and discharge fertilisers, additional dumpers can be hired from the market.

The dumper system may be replaced by a belt conveyor system, when traffic volume rises appreciably.

c) Loading/Unloading Inland Transport Units to Port Storage

A belt conveyor with 300t/hr capacity can be used for transfer of food grain bags from the wagons to the silos. This will also be used for loading finished fertiliser bags into rail wagons. It would be duplicated along with the two railway sidings.

Oil seeds and extractions and salt would be discharged directly into the port storage and bulldozers used for building and trimming the stockpile.

4.5.4 Storage

As stated earlier in section 4.4.1, for servicing efficiently a 20,000 DWT vessel, an average storage capacity of 75,000t is desirable.

To begin with, a silo with capacity of 30,000t is proposed and space reserved to enhance it to 48,000t at a future date.

For oil seeds and extractions, fertilisers and scrap iron, open storage would be required. Parcel sizes of these cargoes are ordinarily in the range of 10,000t. to 25,000t. An area of 89,300 sq.m, has been allotted in the plan (Drawing No. 1) for storage. Detailed calculations are given in section 4.7.

4.6 Principles of Terminal Operations

The plans proposed above will attract a peak hourly movement of 100 trucks - in each direction between the port storage and berth. This level of intensive working by the shipside can be sustained, if the ship side space is kept out of bounds for vehicles not engaged in the actual loading/unloading activities of a vessel. This characteristic is universally true in most of the efficient ports[4-4].

Providing sufficient spatial separation of areas between shipside working, cargo arrival and delivery operations is very important for port efficiency. Traffic circulation should also be planned such that spatial separation on these lines is available[3].

Users should be charged for the services that they actually avail. Thus for exporters, charges should cover charges for loading into the ship, and warehousing charges, unloading and transport into port storage and their subsequent conveyance to the ship side etc. For Importers, charges should cover unloading activity from ship's side into a system conveying it to land storage. It will also include the storage charges for certain types of cargo which have to be stored for a short period before arrangements for transfer to land storage are made and documentary clearances obtained. Import cargo warehousing charges will cover conveying cargo from shipside to port warehouse, storage in the port area and loading onto transport vehicles bound for hinterland destinations.

[4-4] Improving Port Performance (IPP1)

This kind of an arrangement will:

a) Insulate the service and charges to the ship operators from the vagaries of inland transportation and stock piling operations
b) Help in determining the Payment of stockpiling charges to the operator, by the users and will depend on the extent of its actual use.

The berth hire, wharfage, demurrage (for storage over the free period) and Handling charges (loading/unloading and stevedore) charged for ship-side operations will be in accordance with the tariff notified by the Tariff Authority for Major Ports (TAMP). TAMP fixes tariffs after due consultation with the user, the operator and the Port Trust. TAMP was set up on 10 April 1997, after an amendment to the Major Ports Trust (MPT) Act in February 1997.

It is noteworthy that, the present wharfage rate for food grain of Rs. 30 per tonne is not adequate to give any satisfactory returns for the investor. One million tonne of food grain can at best generate an income of Rs. 30 million. But, the investment required on only the hardware (Civil engineering infrastructure on berth, transit area and equipment) is around Rs. 620 Million. This translates into an annual income of less than 5% save the physical operations, repairs and maintenance. At present, the cost profiles are confusing because the costs are incurred in different forms and are charged directly by different agencies. The spatial separation as suggested above would bring in more transparency and therefore, it would be easier to know, who charges how much and for what service. This would help focus attention on weak links in the operational chain and their speedy removal in the interest of maintaining the perceived levels of cargo handling productivity.

4.7 Terminal Layout and Capacity

The railway siding passing through the storage is certainly a bottleneck and will interrupt the railway loading/unloading operation, when the ship is being fed from the storage on the northern side. The sidings may be check railed to provide access over the railway line and some portion of the conveyor belt dipped underground across the access. The area allocations for the stockpiles and their capacities will be as follows:

4.7.1 Area Requirements

i) Berth 1.

a) Wheat (Silo)

Height = 16m; Cell Capacity = 400 m^3

$(\pi/4)xd^2x16$ = 400; therefore, d = 5.65m.

For each cell, allocate 10m x 10m.

Area allocated for silo 294 x 54;

No. of cells = (294 x 54)/100 = 158

Total Capacity (Volume) = 400 x 158 = 63,200 m^3

Stowage factor = 1.3

Total Capacity (Weight) = 63,200/1.3 = 48,000 t.

b) Oil Seeds and extractions

Area 294 x 54 = 15,876 m^2,

Stackable area @ 70% = 11,113 m^2 say 11,100 m^2

Angle of repose = 30^0

Stack height = 3 m

Each 100 m^2 holds ½ (10x10+6.54x6.54) x3 = 214 m^3, Say 200 m^3

Each 11,100 m^2 can hold 11,100 x 200/100 = 22,200 m^3

Stowage Factor = 1.8

Therefore by weight 22,200 m^3 can hold = 22,200/1.8

= 12,333 t (say 12,000 t)

c) Salt

Area 294 x 54 = 15,876 m^2.

Stackable area @ 70% = 11,113 m^2, say 11,100 m^2

Angle of repose = 45^0

Stack height = 3 m

100 m^2 unit will have a storage of ½ (100+16) x 3 = 174 m^3

Total volumetric Storage = 11,100 x 174/100 = 19,314 m^3

Stowage factor = 1

Capacity by weight = 19,344x1 = 19,314 m^3, say 19000t.

Future augmentation of capacities may be calculated from drawing No. 1.

d) AISLES

Railways - 5 sidings @ 12m/siding =60m,

Access road along eastern boundary = 30m wide,

Access road along western boundary = 30m

Central road = 40m wide,

ii) Berth 2

Covered Storage = 2 nos. x 294 x 54 = 2nos. X 15,876m^2

Stackable area = 2nos. X 0.7x15,876 = 2nos. x 11,100 m^2 (say)

Open storage = 2nos. each x 118x54 = 2nos.x 6,372 m^2

Stackable area = 2nos.x 0.7 x 6,372 = 2nos.x 4,460 m^2

a) Finished Fertilisers

Angle of repose = 35^0 to 40^0

Stocking height = 3m

Volume contained in 100 m^2 = ½ (10x10+5x5)x3 = 187.5 m^3

Holding capacity of 11,100 m^2 = 11,100x187.5/100= 20,812 m^3

Stowage Factor = 0.9

Holding Capacity by Weight = 20,812x0.9

= 18,731t (say 18,000t)

Assuming 1/6^{th} area used for the bagging plant,

Net storage = 18,000x5/6 = 15,000 t

b) Fertiliser raw materials (Sulphur/Rock Phosphate)

By the same calculations as in ii(a),

Area = 15,876 m^2,

Storage = 18,000 t

c) Scrap Iron

Area (54x118) = 6,372 m^2

Stackable area = 0.7x6,372 = 4,460 m^2, say 4000 m^2

Assume storage @ 3t/m^2,

Capacity = 4,000x3 = 12,000t.

d) Unit loads

Area = 6,372 m^2

Stackable area (assuming50%)	=	0.5x6,372	= 3,186m^2
Assume storage @ 4t/m^2			
Storage capacity	=	3,186x4	= 12,744 m^2
			(Say 12,000t)

4.7.2 Terminal Capacity

Terminal capacity calculated on the basis of average daily rates of the loading/discharge equipment and the berth occupancy factor gives higher values. This is because, some parts of the berth operations system are linked and the cargo has to pass through the entire links in the chain. The real capacity of a berth may be therefore considered as the capacity of the weakest link in the chain (UNCTAD, 1985,54). The two major capital costs in most of the terminals are those relating to berthing points along with their associated discharge equipment on the one hand, and storage areas on the other. The planning of these two important elements is based on the assumption that an equal level of capacity is provided in the other stages of the operation such as the onward distribution for imports and receipt of cargo for exports.

The actual capacity of the combined operations may be taken as the lower of the following:

i) Capacity for receiving cargo from hinterland/ delivery of cargo.
ii) Berth Capacity

i) Inland receipts and delivery capacity

a) Foodgrains, fertilisers and scrap iron

Since food grains, fertilisers and scrap iron are **proposed to be moved by rail**, in 36 hours (one cycle time of a block rake), 2,000t food grains enters the port and 2,000t fertilisers leave the port.
Assuming that the rail loading/unloading operation in a year is 300 days, the sidings will have an annual capacity of:

Food grains	= (300x24/36)x2000	=	400,000 tonnes
Fertilisers		=	400,000 tonnes

This cannot be fully utilised as the railway sidings passing through the storage area will interrupt the ship loading/unloading operations and have to be stopped. Applying an effective utilisation rate of 75% of days in a year, the **real annual capacity of the railway system would be 300,000 tonnes each** for both food grains and fertiliser respectively, with 3 sidings. If the number of sidings were increased to five, then the capacity would be respectively 600,000 tonnes each.

b) Oil Seeds and Extractions

The average numbers of truck currently entering the port for carrying general cargo are around 400 per day. These services handle a throughput of around 1.2million per annum. The new facility proposes a maximum of 200 trucks per day for receipt of each of the oil seeds and extractions as well as salt that will bring in a cargo of 2000t each per day. An **optimistic estimate for the annual capacity by road** would be:

Annual capacity = No. of trucks x capacity of truck x no. of operational days = 200 x 10 x 300 = 600,000 tonnes,

The annual receipts/deliveries of unit load cargo @1,000t/day is unlikely to be more than 300,000 tonnes. Thus, the anticipated maximum annual capacity for receipts and deliveries on implementation of the entire project is summarised in table 4.5.

Table 4.5

Capacity for receiving/delivery

Commodity	Capacity
Food grains	600,000 tonnes (t)
Fertilisers and scrap iron	600,000 t
Salt	600,000 t
Oil seeds and extractions	600,000 t
Unit loads	300,000 t
Total	**2,700,000 t**

ii) Berth Capacity

The various assumptions are shown in table 4.6.

Table 4.6

Assumptions and Estimates

Sl. No.	Description	Average	Optimistic
1.	Days ships are worked in the port (365 – 52 Sundays-13 holidays)	300 days	300 days
2.	Actual hours of ship working /day	15 hours	20 hours
3.	Loading rates of food grains, oil seeds and salt • Peak: 1000 t/hr. • Average @70% of peak = 700t/hr • Average daily	10,500t	14,000t
4.	Discharge of fertilisers Peak = 40t/move No. of moves/hr = 15 Peak hourly = 15x400 = 600t Average @ 50% of peak hourly = 300t Daily	4,500t	6,000t
5.	Scrap Iron – Daily (as above)	4,500t	6,000t
6.	Unit Loads – Daily	3,000t	3,000t

The weighted average daily rate would be:

✍ **Likely Estimates:**

$$= \frac{2x10,500 + 1x4,500 + 1x4,500 + 1x3,000}{5}$$

$$= \frac{33,000}{5} = 6,600 \text{ t/day}$$

✍ **Optimistic Estimates:**

$$= \frac{2x14000 + 1x6000 + 1x6000 + 1x3000}{5}$$

$$= \frac{43000}{5} = 8,600 \text{ t/day}$$

Assuming berth occupancy of 60%, the annual berth capacity as per different scenarios is:

Likely: 0.6x300x6,600x2 = 2.376 m t/annum

Optimistic: 0.6x300x8,600x2 = 3.096 m t/annum

✍ **Comments**

The trade of foodgrains, oil seeds and extractions, and fertilisers is seasonal. There will be fall in demand for these commodities during certain periods and could be partially offset by handling general cargo. But throughput of general cargo would be relatively smaller. Monsoon interruptions are also likely.

Thus, the upper limit to throughput would be less than 3.096Mt. but above 2.376Mt.. Inland receipt/delivery operation doesn't allow more than 2.7 Mt. throughput per annum. Thus an upper limit of 2.4 Mt./annum can safely be assumed.

4.7.3 Shipment Size

The shipment size would mainly depend on the size of the stockpile. It would take about 10days and 15days respectively to build a stockpile of 20,000t and 30,000t of food grains. In the latter case only one food grain vessel could be handled in a fortnight. This is true for other cargoes as well:

A range of possible shipment sizes are given in the following table:

Table 4.7

Possible Shipment Sizes

Commodity	Shipment size (T)	
	Likely	Maximum
Foodgrains	20,000	30,000
Fertilisers (finished)	15,000	30,000
Fertiliser raw materials	18,000	36,000
Oil seeds/extractions	12,000	17,000
Salt	22,000	17,000
Scrap Iron	12,000	24,000
Unit Loads	6,000	14,000

4.8 Engineering Aspects and Design

Factors that influence the design of facilities are - vessel sizes, alignment of berths, sub-soil conditions, and the various dead and live loads acting on the structure.

4.8.1 Vessel and Berth size

- The vessels with a maximum LOA of 225.55m are allowed by the Port Trust to enter the port.

- There is a sand bar at the entrance to the creek and the controlling depth here is – 4.3m, which has further got degraded. The use of a modern trailing suction dredger to dredge as per a predetermined programme would help increase and maintain controlling depth at about –5.3m. Since the M.H.W.N

is +5.71m, with long-term planning a vessel drawing a draft of 10.5m can be accommodated on most of the days. Size of vessel corresponding to this draft (Port development handbook) is:

$(10.5-5)^2$ x1000 = 30,250, (Say 30,000DWT) (1)

Displacement tonnage of such a vessel would be:

$2.463x(30,000)^{0.936}$ = 38,199 t (Say 38,000t)

- Berths should be designed for the maximum size of the vessel. The type of vessels that are likely to use the port for the various categories of cargo are given as under:

Type of Cargo	Maximum DWT of Vessel (t)	Maximum Parcel Size
Fertiliser	30,000	25,000
Fertiliser raw materials	20,000	15,000
Foodgrains	21,000	17,000
Oil seeds and extractions	14,000	9,000
Salt	18,000	14,000
Break Bulk/ Unit loads	12,000	5,000

- Handymax vessels have a LOA of 210m. Based on the analysis and observations in the preceding chapters, it is recommended that, one berth may be designed for the 'handy max' class of vessels and another one for servicing 'conventional' break bulk vessels.

The aggregate length of the berths may be arrived at as below:

LOA of handymax vessels	210m
LOA of conventional vessel	180m
Clearance between the berths	30m
Clearance from existing berths	15m
Clearance on the south	15m
Total	**450m**

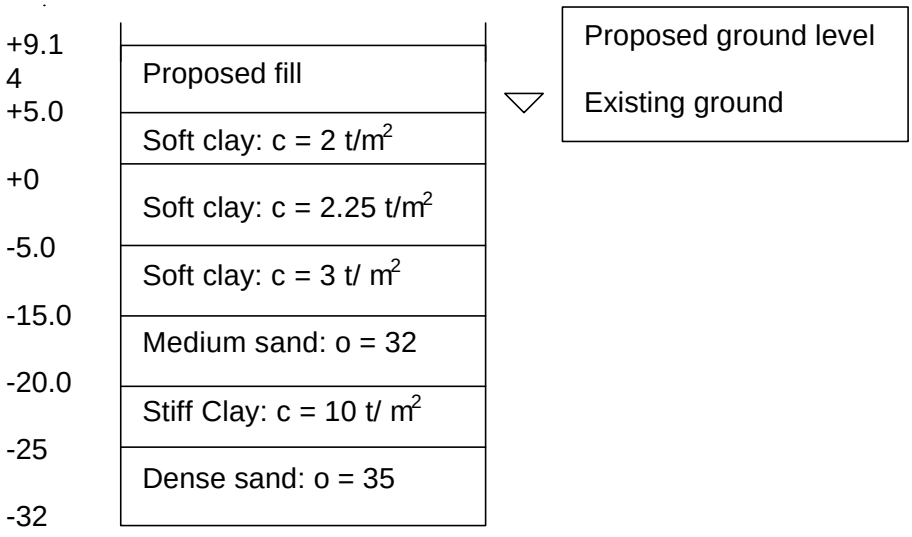
Thus, a length of 450m is recommended as the berth length. However, for the purposes of this study, a length of 400m has been adopted, as the Port Management has not made provisions for developing 450m long berths.

4.8.2 Engineering Proposals

- The proposed berths may be aligned at 15^0 to the existing berth line, after confirmation of the orientation using model studies.

- A part of the berth structure will comprise of R.C.C piles, beam and deck slabs.

- Soil data as obtained from the Kandla Port Trust are given below:



- The 20m thick clay layer may be anticipated to settle by about 1m.

- Pre-consolidation of the medium sand layer occurring between –15m to –20m will be necessary. This may be done using sand drains for the strip extending upto 150m to 170m behind the R.C.C deck construction, below area reserved for silos, roads, railways and area below warehouses. Pre-consolidation will help in negative skin friction on piles. It will also help minimise the risk of damage to the pavement.

4.8.3 Berth Structure

The civil constructions for berth structure could use various techniques such as bored cast-in-situ raker piles, pre-cast spun hume pipes raker piles, pre-cast and pre stressed concrete raker piles, steel sheet piles, etc. All these techniques are being used in Port constructions in India. At the time of detailed engineering studies a suitable method could be finalised.

In this study, it is assumed that the **design model is similar to the 7th berth in the Port**. Piles should be founded in dense sand strata and those with lighter loads may be terminated in the medium sand strata.

4.8.4 Design loads

The berth structure will be designed for the following loads:

a) From sea

- Wave action – negligible

b) From ship berthing

- Berthing impact – subject to a minimum point load of 8000 KN per 0.25m^2 and a uniform load of 35KN per linear meter of quay.

c) Ship

- Forces in a vertical direction of the berth structures face (e.g. to allow for ship 'hanging' itself on fenders due to large tidal variation) @ 25KN per linear meter of the berth.
- Current force – assume a current of 4 knots
- Wind force subject to a minimum of 0.65 KN/ m^2 or a minimum of 25 KN per linear meter of ship.
- Bollard pull 1,000 KN – subject to a minimum of 35 KN per linear meter of berth in transverse direction, 20KN per linear meter of berth in the longitudinal direction and 870 KN in the vertical direction.
- Vertical load of access at ladder: 1KN per linear meter acting either vertically or horizontally.

d) Cargo handling activities (Entire R.C.C Deck)

- Temperature and shrinkage stresses in the deck, as per B.I.S/B.S
- Loads imposed by portainer operations
- Deck slab would be designed for a uniformly distributed load of 50KN/m^2 and cleared for point loads of the outriggers of the 20t mobile cranes.

e) Pavements and Roads

- IRC class AA loading

f) Railway

- As per R.D.S.O standard loading

g) Warehouse and buildings

- Flooring will be designed for 50 KN/m^2

h) Seismic Load (Berths and Buildings)

- As per B.I.S. Specifications

- Materials Specifications

M40 grade concrete for all elements of berth structure and apron

Design would be done to B.I.S specifications, or B.I.S code of practices. The actual design loads would be firmed up at the stage of detailed engineering. Drawings 2 and 3, indicate tentative design for the new facilities.

4.8.5 Illumination

The illumination in all operational areas would be provided as per the standards of the DG-FAS, Govt. of India.

4.9 Facilities to be provide by the Port Trust

As a Landlord port, the Federal Government /Port Trust is expected to provide the following facilities.

4.9.1 Maintenance Dredging

It is not possible to undertake maintenance dredging separately for the two berths. The Port Trust should dredge the area along with other berths in the port.

The port and pilotage charges are expected to be included in the cost of dredging.

In Rotterdam where most of the port facilities are privatised, the port authority is responsible for capital and maintenance dredging as well as developing and managing the port infrastructure (such as quays, berths etc,). The port sites are leased/rented to private enterprises such as stevedoring companies, warehousing and distribution centres, industry and tank terminals. All industrial and cargo handling activities are executed by private companies, which after leasing a part of the infrastructure from Port Management provide their own superstructure and labour.

4.9.2 Gates

The existing gates will be inadequate to meet the envisaged volume of traffic moving through the port. The new facilities will be handling additional traffic of over 2Mt. per annum. Atleast one more gate adjacent to the new facilities would be required.

4.9.3 Transport facilities

The 30m wide corridor should be extended by the Port Management to the new facilities up to south end and maintained. All existing internal roads and railway lines should be extended and maintained by the Port Trust up to the southern boundary.

4.9.4 Other facilities

The port should arrange for the power requirement of about 750KW. Fire fighting infrastructure (especially the firewater ring main) from the existing berths should be extended to the new facilities.

The existing sludge removal facilities of the Port to separate bilge oil from water should be upgraded and made available for use in common with other users.

4.10 Estimates

The estimates of capital costs, phasing of capital expenditure, maintenance and operation expenditures are enclosed in Appendix-2.

Comparable costs of similar engineering works at the port, were adjusted upwards to account for inflation and increase in cost of materials/construction works at 7% per annum from a basic estimate[4-5] prepared in 1995.

In the case of plant, equipment and materials, comparable local, national and international cost was adjusted to account for additional cost of customs, import duty, etc.

In Appendix 2, table 1 gives a grand summary of the capital cost. Table 2, elaborates the phased capital expenditure over the project duration. Table 3, shows the annual cost of repair, maintenance and operations.

Schedule 1-Part A, gives the item-wise detailed estimates for berth-1 which can be duplicated for berth-2 (Part B). Schedule 2 and 3 explains the detailed estimates for export and import warehouse respectively. Schedule 4, shows the calculations for annual repair and maintenance cost of engineering works. Schedule 5 details the invest requirements for equipment, installation and lighting, and schedule 6, the recurring costs for the same facilities.

[4-5] A former engineer of the Mumbai Port Trust had made some basic estimates for developing facilities at Kandla Port

Chapter 5

Financial Appraisal

5.1 Background

The appraisal of a port investment project requires the evaluation of streams of costs and benefits extending into the future so that they can be compared with the initial capital cost investment. Depending on the nature of investment appraisal, whether economic or financial, the extent of costs and benefits will vary (UNCTAD, 1977, 4). For determining commercial profitability of the investor, the revenue/cost streams, as recorded on the balance sheet of the port authority/operator are used. Of particular relevance to the ports account are charges and dues levied on ships and cargoes, which are the direct stream of benefits. However, for an overall appraisal (from nations point of view), the benefits and cost streams would be broader and will include those incurred outside the port. Port user benefits that accrue to ship owners, shippers, producers and consumers of products both foreign and domestic should be considered, though correct quantification of these benefits poses major problems. They include saving in, inland transport costs, cargo-handling cost, insurance cost, interest expense on capital tied up in inventory, ship's cost in port, ship's operating cost arising from economies of scale, increasing output of port user industry etc. Cost/benefit elements such as foreign exchange, land, labour also need to be reassessed to determine their real value to the national economy as per Appraisal of Port Investments (UNCTAD, 1977, 4,7, 10)

Investors are interested in knowing the commercial profitability of a project and hence in this study the financial viability is determined using discounted cash flow technique (the IRR Criterion). The cost streams are arrived at as already explained in Chapter 4. Revenue streams are arrived at using assumptions delineated in section 5.2 and 5.4.

An economic analysis to include the saving in ship waiting time at the port is included as a sequel to the financial analysis in order to get an idea about the

savings to the national economy due to the construction of these additional facilities. Saving in ship waiting time is one of the major port user benefits.

For the analysis, the 'profit centre' concept is used which is explained in the following sections.

5.2 Profit Centres

An innovative approach is adopted, whereby the project is divided into two cost/profit centres, namely, Ship Operations, and Cargo Aggregation and Bonded Storage. These are explained below:

5.2.1 Ship Operations

This profit Centre will cover:

a) For Export Cargo

   i) Loading into ship the cargo delivered at the ship-side (excluding Dock Labour Board Services)

b) For Import Cargo

   i) Discharge and delivery of cargo directly into trucks/transfer equipment of the licensee for onward transfer to the warehouse
   ii) Discharge of cargo in the transit area for temporary storage not exceeding the maximum period of 4 days

Thus, the lessee's revenue will comprise:

i) Berth hire charges[5-1]: As the prevailing 'scale of rates' are too low as per international standards, the revised rates that is likely to be approved in the near future, of US $ 0.16 per GRT, by the Tariff Authority for Major Ports (TAMP) is used.

ii) Wharfage[5-1] and demurrage (for storage over and above the free period) on cargo in line with the scale of charges notified by TAMP/Kandla Port Trust.

iii) Handling Charges, presently worked out at Rs. 100/- (USD 2.33) per tonne will increase in future years in proportion to the increase in wharfage rates allowed by the TAMP.

5.2.2 Cargo Aggregation and Bonded Storage

This profit centre will cover:

a) Export Cargo

i) Unloading and stocking of export cargo to build up the stockpile to the extent required with reference to the ship size (Parcel size).
ii) Loading of export cargo in trucks/conveyors for delivery to the ship loading equipment.

b) Import Cargo

i) Receiving and stacking discharged cargo in the bonded warehouses till the stage it is out of customs charge.
ii) Loading, out of customs charge, into vehicles for movement to upcountry destinations.

The scale of charges for services provided by the profit centre no. 2 will be negotiated directly between the lessee and the concerned importer/exporter, in consultation with the Port Trust and TAMP.

Even at present, such a division of charges exists, though KPT does not have complete information about this activity. This bifurcation will help the Port to realistically estimate the port cost for each tonne of cargo. Thus, comparisons of operational efficiency with sister ports in the region as well as international ports become possible. It will also bring in more transparency in decision making as well as accountability to the service providers thus help improve performance levels.

[5-1] Berth-Hire and Wharfage cover charges for use of berth and all associated fixtures, facilities and services.

Needless to say that, only authentic information on total cost per tonne, will help determine whether a port is serving the overall national interest by offering reduced transportation cost of indigenous commodities in the overall value chain, yet increasing its competitive advantage. It is believed that per tonne cost of cargo including sea freight in Indian Ports is one of the highest in the world.

However, in the situation as it exists today consideration needs to be given to the profit centre called 'ship operation' and the analysis is done with respect to this centre. The financial and economic benefits have been estimated based on existing norms and practices as well as assumptions arising due to change in ownership.

5.3 Capital and Operation Cost

The Capital cost of the complete development works has been estimated at Rs. 1870.73 Million (USD 43.5Million). The total civil construction is limited to 3 years, which can further be abridged if newer techniques widely used in the construction of marine terminals and structures in industrialised countries can be harnessed and experts mobilised in time. It is in the interest of the Port Trust (Authority) that the facility comes up early. This will insulate the port against any further downslide in efficiency and reduce interest burden. The anticipated reduction in berth occupancy and pre-berthing detention would also help remove distortions in structure of sea freight experienced by the shippers from Kandla.

The annual operation and maintenance cost of the project is estimated to be Rs. 138.81 Million, excluding taxes and benefits.

The expenditure incurred in the profit centre-1 is as follows:

Capital Cost	:	Rs. 1252.5 Million
Annual cost of Operation and Maintenance	:	Rs. 41.48 Million

Phasing of expenditure:	0-12 months	Rs. 188 Million
	13-24 months	Rs. 689 Million
	25-36 months	Rs. 375.5 Million
	Total	Rs. 1252.5 Million

5.4 Major Assumptions

The major assumptions for the analysis are given below:

i) The project is financed by a combination of debt and equity and the leverage expressed in terms of the debt-equity ratio will be 1.86. The interest on debt portion will be 16% p.a.

ii) Guaranteed annual traffic of 2.1 million tonnes from 2004-05 onwards with a ratio of bulk to break bulk as 60:40

iii) Depreciation on straight-line basis over the lease period.

iv) Annual lease rent @ Rs. 15 per square metre increased by 5% every year.

v) Handling charges of Rs. 100 per tonne.

vi) Working capital is Rs. 10 Million

vii) Average Pre-berthing detention reduces from the present level of 4.87 days to 2 days and turn around time reduces from 12.25 days as per the new design standards. The savings per ship would be 12.36 days[1]. It is assumed that the average discharge rate at the new facilities would be 8,500 tonnes per day and average parcel size is 20,000 tonnes.

5.5 Financial and Economic Viability

In this study the financial appraisal has been made for the investment relating to the profit centre 1. Discounted Cash Flow Technique (IRR method) is used. Thus for the profit centre, 'ship operation', the FIRR has been estimated under two scenarios – Scenario A: based on 25 years lease period and scenario - B: based on 30 years. The results of the analysis are presented in Appendix - 3. The FIRR works out to 17% for Scenario- A and 18% for scenario - B.

The Economic Internal Rate of Return (EIRR) in both cases is also presented in Appendix - 3. The EIRR for Scenario- C: based on 25 years lease period and scenario - D: 30 years lease period works out to 18% in both cases. This is only indicative and if all the benefits to the port users, as mentioned in section 5.1 were considered, the economic returns would be much higher.

The IRR is above the cost of capital and hence the project is viable. This is subject to the condition that the berth hire charges will be revised from the existing level as being considered. However 18 % returns may not be sufficient to attract private participation, as the risks involved in infrastructure projects are high.

[1] TRT reduces from present level of 12.25 days to 2.82 days and Pre-berthing detention from 4.87days to 2 days

The charges for the profit centre-2, would have to be fixed on commercial basis and recovered from importers, exporters and other users separately in addition to wharfage/demurrage, berth hire and handling charges for ‘Ship Operation’ (Profit Centre 1). 'Users willingness to pay' should also be given due consideration. If income from commercial operations of profit centre-2 were also included in the analysis, the project would become viable.

Transparency in pricing strategy will help authorities to control freight per tonne of cargo in relation to the neighbouring ports with in and outside the country, and help achieve, competitive advantage for the port of Kandla. It deserves mention, according to the ports own estimate, the overall average operating income per tonne of traffic at Kandla is the lowest in any major port in India (Kandla Port, 1999, World Wide Web).

5.6 Strategic Port Pricing and Viability

Strategic Port Pricing is an important tool to achieve competitive advantage, in an increasingly competitive environment. Pricing can be used to improve productivity and performance- through fines or surcharges if the level of utilisation is high and lower tariff if level of utilisation is low. Correct Pricing also helps in generating funds as well as discouraging competition as per UNCTAD (Strategic Port Pricing, 1995, 5,6).

Cost-Performance-Value, popularly known as the CPV approach is a versatile technique which uses a mix of pricing strategies for individual tariff items as per Improving Port Performance (IPP)-4 participant's manual (UNCTAD, 1999, 41). Adopting this technique for profit centre -1, the tariff items such as berthage and demurrage should be cost/performance based, cargo handling- cost/value based, and wharfage-value based. There is substantial potential to use a discriminatory pricing strategy for each of these items to gain competitive advantage. For delays in starting operations at the berth, fines can be imposed and berth hire increased. Demurrage can be increased exponentially for longer time delays at the port.

The techniques allows increase in general tariff items, for provision of better facilities and value of services provided such as that of wharfage and cargo handling. Cargo handling rate is also cost driven and warrants an increase with increase in

operational expenditure. Both these tariff items can be raised at suitable intervals (say 3 to 4 years).

Profit Centre-2, includes the tariff items for providing receiving/delivery, warehousing and ancillary facilities. All of them are cost/value driven and should be set so as to cover the cost of providing the facilities along with decent profits. To account for inflation and operational expenditure, these rates may be suitably revised at regular intervals.

Chapter 6

Conclusions, Recommendations and Future Scope of Work

6.0 Background

The study has shown that Kandla Port's hinterland encompassing a region of nearly 1million sq. kms. extending up to Jammu & Kashmir in the North and serving a population of nearly 204 million (1991 census), representing about 11 per cent of the country's GDP is anticipated to have a spurt in Industrial activity. And hence, the Port Management will find the task of providing cost efficient services to port users much more daunting than it is today. Due to paucity of resources, the Federal and State Governments have initiated a series of policy initiatives to attract private capital for the expansion and development of various infrastructure facilities including that of ports. In this study an attempt was made to study the development of dry bulk facilities in the port of Kandla (but limited to two berths) through private capital and to determine its commercial and economic viability.

The major conclusions, recommendations and future scope of study are covered in this chapter.

6.1 Conclusions

Major conclusions of the study are:

1) The port caters to the trade requirements of one of the most highly productive granary and industrial belt of the country, serving about 24% of the population of the country.

2) The port was the number one in terms of the total traffic handled, aggregating to 15.5% of all the major Indian ports together in 1997-98. Though the bulk of the

cargo (about 78%) was liquid cargo, the port facilities for dry bulk/break bulk operations were grossly inadequate and the berth occupancy was above 95%.

3) The economy of the country has entered into a path of robust growth since the launching of a massive economic reform programme in 1991, though it suffered a setback in the last two years due to political uncertainty, unprecedented East Asian economy crisis and resistance from the industrialised countries. However, this downslide will not continue and the economy has already started recovering due to political consensus in economic reform from all quarters, which was clear after the recent government came to power.

4) The traffic projections based on quantitative and qualitative methods are agreeable. It shows that the dry bulk traffic will rise to a minimum of 11.18 Mt. by 2003-04, which can be a high of 12.75 Mt. in the optimistic case and 13.86Mt, as per exponential analysis.

5) The existing capacity of 3 Mt. is likely to increase to 3.9 to 4.0 Mt. if the average berth-day productivity can be raised to 2500 –2700 Tonnes/day as planned. Assuming a gestation period of 3-4 years for commissioning any project, i.e. by 2003-04, the capacity augmentation should have been planned for meeting an additional requirement of about 8.3 Mt. (6.05 Mt excluding containers).

6) The state government has ambitious plans for development and modernisation of the minor ports under its jurisdiction, on a major scale. There are also plans for modernisation and capacity augmentation of other major ports in the country. Hence, some of this traffic will be diverted to the new ports as explained in chapter 3. However, it will be sometime before this happens due to the following reasons:

   - Transport and hinterland infrastructure connecting new ports would demand huge investment and take time to come up.
   - Operators of the new ports would take time to infuse confidence among prospective users including those that are patronising Kandla Port at present.
   - The cost of capital to be invested would be high and the charges for using the facilities would have to be high to ensure viability of investments.

7) This study was carried out to understand the commercial viability of private sector investment in the port for development of two additional berths, to service a guaranteed traffic of 2.1 Mt. from 2004-05 onwards.

8) The overall investment required for development of these two berths along with the land side facilities will be of the order of USD 43.5 Million spread over a period of 4 years. Financial appraisal was done only for the profit centre 'ship operations', as per the existing norms, which covers a capital investment of approximately USD 29.1 Million. This is excluding the cost of capital and maintenance dredging, as it is assumed that this will be the responsibility of the Port Trust.

9) It was found that the investor could expect a return of about 17% for a 25-year period and 18% for a 30-year period. This is however low for an entrepreneur who has incurred a cost of capital of 16%, when the high risks involved in an infrastructure development project is considered, unless it is backed by counter guarantees from the government.

10) The economic returns on the project are handsome and this should provide as an incentive for the government to support this and many other similar projects.

6.2 Recommendations

There are two ways to deal with demand-supply gap in port capacity. One way is to improve the efficiency in utilisation of existing facilities and when optimal utilisation is reached, to provide for new facilities. The recommendations for forestalling any downhill slide in efficiency in the long-term as well as improvement in the short-term may be as below:

1) Optimisation

   a) Focussed attention on modernisation and phased programme for discarding obsolescent/obsolete equipment for improving productivity levels.
   b) Strict adherence to programmes for scheduled maintenance of all equipment and streamlining workshop efficiency for reducing down time of equipment.

c) Exploring avenues for improvement in operational and managerial practices and procedures as well as scope for development and expansion.

2) The annual targeted throughput of 2.1Mt. in the newly planned berths by 2004 AD, is possible if the licensee is able to draw up effective strategies for:

a) Recruitment, training and human resource development (HRD).
b) Mechanised facilities are set up in one-berth and compatible commodities to be handled by the above facilities identified so as to achieve a throughput of above 1.2Mt.
c) The other berth should cater to break bulk general cargo and residual dry bulk cargo. Break-bulk traffic demands extensive manual handling. But, good transport infrastructure and other facilities to ensure free egress and ingress of cargo from/to the port can help achieve high productivity.
d) Streamlining of operations and procedures.
e) By allowing the licensee to start commercial operations from the day the facility is ready for commissioning.

3) Introduction of transparency in tariff setting and division into two 'cost/profit centres' as suggested in chapter 5.

4) The liquid cargo traffic accounts for nearly 78% to 80% of the share of total cargo handled in Kandla port. It is believed that the tariff for handling liquid cargo in this port is the lowest compared to any other major ports in the country and the overall average operating income per tonne of traffic is also the lowest. The MPT Act advocates the principle of 'what the traffic can bear'. In most of the ports POL traffic is charged on this basis and part of this revenue goes into cross subsidising other low value traffic. There is thus a good case to rationalise port tariff and bring it in line with the tariff for use of port facilities and cost of services.

5) Government should guarantee a minimum return of 20% in-built into the scheme for privatisation of these facilities as in the case of Express ways and major road projects which comes under the purview of the same Ministry.

6) Commercialisation of port infrastructure implicit in the programme for marketisation of economy cannot be brought about so long as these major ports operate as extension of the administrative ministry with no real say allowed to the port management's to take commercial decisions. The existing management and organisational set up of these ports should be changed and independent companies formed to facilitate decision making within the level of port management.

6.3 Future Scope of work

Though considerable efforts have been made to do an exhaustive study, due to limitations of time, data and resources the study could not cover all features anticipated. Incorporating additional analysis in the following areas could further expand the study:

1) The actual returns on the project will become clear if only, the study incorporates both the profit centres, which are explained in chapter 5.

2) The case for different handling rates (for stevedoring charges and others) might simulate a more realistic scenario. It will also help in applying discriminatory tariff for different commodities. However, the present handling rates of Rs 100/ per tonne (USD 2.33) is very low compared to international standards.

3) There are lots of uncertainties involved in such large infrastructure projects. These include that of multiplicity of interest rates, degree of accuracy and reliability of cargo tonnage forecasts, estimates of cost and productivity etc. A risk analysis using 'Monte Carlo' method would help in understanding risks involved in the project.

4) A project implementation schedule using the Critical Path Method (CPM) would help in controlling the various stages of implementation of the project and preventing the project from overshooting the time period set for commissioning the facility.

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APPENDICES

APPENDIX 1

APPENDIX - 1A

REGRESSION ANALYSIS (TREND)

(For the expression C=mGNP+b)

In million tonnes

Dry cargo Traffic Handled at Kandla Port						
Year	**Dry Bulk**	**Break Bulk**	**Containerised**	**Total general Cargo***	**Total cargo**	**GNP at 1980-81 prices**
1991	1.90	1.31	0.50	1.81	3.72	2041354.00
1992	1.64	1.39	0.33	1.72	3.36	2098000.00
1993	2.35	1.10	0.36	1.46	3.81	2198704.00
1994	2.41	1.67	0.73	2.40	4.81	2311877.70
1995	2.33	2.46	0.80	3.26	5.59	2485890.00
1996	2.58	2.42	0.96	3.38	5.96	2673000.00
1997	3.45	2.09	1.18	3.27	6.72	2910360.00
1998	3.63	2.78	1.30	4.08	7.71	3070000.00

* - Total general cargo is sum of break bulk cargo and containerised cargo.

TREND BASED ON LINEAR REGRESSION FOR GNP FIGURES (1980-81)

LINEST results for Total Cargo Vs. GNP

M = 4.03E-06 B = -4.75

se1 = 2.89E-07 Seb = 0.72

r2 = 0.97 Sey = 0.29

F= 193.95 Df = 6.00

Ssreg = 16.48 Ssresid = 0.51

C=4.03E-06X-4.75

LINEST results for Break Bulk Cargo Vs. GNP

M = 1.40E-06	B = -1.56
Se1 = 0.00	Seb = 0.85
r^2 = 0.74	Sey = 0.34
F = 16.86	Df = 6.00
Ssreg = 1.99	Ssresid = 0.71

BB=1.40E-06X-1.56

LINEST results for Containerised Cargo Vs. GNP

M = 9.17E-07	B = -1.50
Se1 = 0.00	Seb = 0.25
r^2 =0.93	Sey = 0.10
F = 82.07	Df = 6.00
Ssreg = 0.85	Ssresid = 0.06

CC=9.17E-07X-1.5

LINEST results for Total General Cargo Vs. GNP

M = 2.32E-06	B = -3.06
Se1 = 0.00	Seb = 0.97
r^2 = 0.86	Sey = 0.39
F = 35.64	Df = 6.00
Ssreg = 5.46	Ssresid = 0.92

LINEST results for Dry Bulk Cargo Vs. GNP

M = 1.71E-06	B = -1.69
Se1 = 0.00	Seb = 0.60
r^2 = 0.89	Sey = 0.24
F = 51.01	Df = 6.00
ssreg = 2.97	Ssresid = 0.35

BC=1.71E-06X-1.69

M = coefficient; B = constant; Se1 = Standard error for Coefficient m; Seb = Standard error of constant b; **r^2** = coefficient of determination; Sey = Standard error of 'C' estimate; F=F static; Df = Degrees of Freedom; Ssreg = Regression sum of squares; Ssresid = Residual sum of squares

APPENDIX- 1B

Scenario –1

Optimistic Scenario

REGRESSION ANALYSIS (TREND)

(For the linear expression C=mGNP+b)

Dry cargo Traffic Handled at Kandla Port

In million tonnes

Year	Dry Bulk	Break Bulk	Containerised	Total cargo	GNP at 1980-81 prices*
Actual Figures upto 1998					
1991	1.90	1.31	0.50	3.72	2041354
1992	1.64	1.39	0.33	3.36	2098000
1993	2.35	1.10	0.36	3.81	2198704
1994	2.41	1.67	0.73	4.81	2311878
1995	2.33	2.46	0.80	5.59	2485890
1996	2.58	2.42	0.96	5.96	2673000
1997	3.45	2.09	1.18	6.72	2910360
1998	3.63	2.78	1.30	7.71	3070000
Projections					
1999	3.92	3.04	1.51	8.48	3284900
2000	4.32	3.36	1.72	9.40	3514843
2001	4.74	3.71	1.95	10.39	3760882
2002	5.19	4.07	2.19	11.45	4024144
2003	5.74	4.53	2.49	12.75	4346075
2004	6.33	5.01	2.81	14.15	4693761
2005	6.97	5.54	3.15	15.66	5069262
2006	7.67	6.11	3.52	17.30	5474803
2007	8.42	6.72	3.92	19.06	5912787
2008	9.33	7.47	4.41	21.20	6444938
2009	10.32	8.28	4.94	23.54	7024983
2010	11.40	9.16	5.52	26.08	7657231
2011	12.58	10.13	6.15	28.86	8346382
2012	13.86	11.18	6.84	31.89	9097556
2013	15.41	12.46	7.68	35.55	10007312
2014	17.13	13.86	8.59	39.58	11008043
2015	19.01	15.40	9.60	44.01	12108847

* - Rs. Millions

APPENDIX- 1C

Scenario –2

Pessimistic

REGRESSION ANALYSIS (TREND)

(For the linear expression C=mGNP+b)

In million tonnes

Dry cargo Traffic Handled at Kandla Port

Year	Dry Bulk	Break Bulk	Containerised	Total cargo	GNP at 1980-81 prices**
Actual Figures upto 1998					
1991	1.90	1.31	0.50	3.72	2041354.00
1992	1.64	1.39	0.33	3.36	2098000.00
1993	2.35	1.10	0.36	3.81	2198704.00
1994	2.41	1.67	0.73	4.81	2311877.70
1995	2.33	2.46	0.80	5.59	2485890.00
1996	2.58	2.42	0.96	5.96	2673000.00
1997	3.45	2.09	1.18	6.72	2910360.00
1998	3.63	2.78	1.30	7.71	3070000.00
Projections					
1999	3.87	3.00	1.49	8.35	3254200.00
2000	4.15	3.22	1.63	9.01	3416910.00
2001	4.44	3.46	1.79	9.70	3587755.50
2002	4.75	3.71	1.96	10.42	3767143.28
2003	5.07	3.98	2.13	11.18	3955500.44
2004	5.41	4.26	2.31	11.97	4153275.46
2005	5.76	4.55	2.50	12.81	4360939.23
2006	6.14	4.85	2.70	13.69	4578986.20
2007	6.53	5.17	2.91	14.61	4807935.51
2008	6.94	5.51	3.13	15.58	5048332.28
2009	7.37	5.86	3.36	16.59	5300748.89
2010	7.82	6.23	3.61	17.66	5565786.34
2011	8.30	6.62	3.86	18.78	5844075.66
2012	8.80	7.03	4.13	19.96	6136279.44
2013	9.32	7.46	4.41	21.19	6443093.41
2014	9.87	7.91	4.70	22.49	6765248.08
2015	10.45	8.39	5.02	23.85	7103510.49

** - Rs. Million

APPENDIX- 1D

REGRESSION ANALYSIS (LOGEST)				
(For the Exponential Function C = b*(m)^t; where m= e^p				
				In million tonnes
Dry cargo Traffic Handled at Kandla Port				
Year	**Bulk**	**Break Bulk**	**Containerised**	**Total cargo**
1991	1.90	1.31	0.50	3.72
1992	1.64	1.39	0.33	3.36
1993	2.35	1.10	0.36	3.81
1994	2.41	1.67	0.73	4.81
1995	2.33	2.46	0.80	5.59
1996	2.58	2.42	0.96	5.96
1997	3.45	2.09	1.18	6.72
1998	3.63	2.78	1.30	7.71

GROWTH BASED ON EXPONENTIAL REGRESSION

LOGEST results for Total Cargo Vs. Time

m = 1.127229476 B = 2.920538491

Se1 = 0.012028324 Seb = 0.060740058

R^2 = 0.94293137 Sey = 0.077952448

F = 99.1365695 Df = 6

Ssreg = 0.602411701 Ssresid = 0.036459505

$C=2.92*(1.127)^t$

LOGEST results for Break Bulk Cargo Vs. Time

M = 1.127307189 B = 1.055812357

se1 = 0.029034481 Seb = 0.146616942

R^2 = **0.73951513** Sey = 0.188164943

F = 17.03396741 Df = 6

Ssreg = 0.603105428 Ssresid = 0.212436274

$BB=1.056*(1.127)^t$

LOGEST results for Containerised Cargo Vs. Time

M = 1.209943649 B = 0.292804771

Se1 = 0.037294538 Seb = 0.188328183

R^2 = 0.813152471 Sey = 0.241696228

F = 26.11174388 Df = 6

Ssreg = 1.525371477 Ssresid = 0.350502399

CC=0.293*(1.21)^{t}

LOGEST results for Dry Bulk Cargo Vs. Time

M = 1.10613815 B = 1.560829753

Se1 = 0.017172414 Seb = 0.086716441

R^2 = 0.851876147 Sey = 0.111289963

F = 34.5066429 Df = 6

Ssreg = 0.427380504 Ssresid = 0.074312735

BC=1.56*(1.106)^{t}

m= coefficient; c= constant; se1 = Standard error for Coefficient m; Seb = Standard error of constant b; R^2 = coefficient of determination; Sey = Standard error of 'C' estimate; F = F static ; Df = Degrees of Freedom ssreg = Regression sum of squares; Ssresid = Residual sum of squares.

ANNEXURE - 1E

In Million Tonnes

REGRESSION ANALYSIS(LOGEST)

(For the Exponential Function $C = b*(m)^t$

Dry Cargo Traffic Handled at Kandla Port

Year	Dry Bulk	Break Bulk	Containerised	Total Cargo
1991	1.90	1.31	0.50	3.72
1992	1.64	1.39	0.33	3.36
1993	2.35	1.10	0.36	3.81
1994	2.41	1.67	0.73	4.81
1995	2.33	2.46	0.80	5.59
1996	2.58	2.42	0.96	5.96
1997	3.45	2.09	1.18	6.72
1998	3.63	2.78	1.30	7.71
1999	3.87	3.10	1.63	8.58
2000	4.28	3.50	1.97	9.67
2001	4.73	3.95	2.38	10.90
2002	5.24	4.45	2.88	12.29
2003	5.79	5.01	3.49	13.86
2004	6.41	5.65	4.22	15.62
2005	7.09	6.37	5.11	17.61
2006	7.84	7.18	6.18	19.85
2007	8.67	8.10	7.47	22.37
2008	9.59	9.13	9.04	25.22
2009	10.61	10.29	10.94	28.42
2010	11.74	11.60	13.24	32.04
2011	12.98	13.08	16.02	36.12
2012	14.36	14.74	19.38	40.71
2013	15.88	16.62	23.45	45.89
2014	17.57	18.73	28.38	51.73
2015	19.44	21.12	34.33	58.31

APPENDIX 2

Table 1

GRAND SUMMARY OF CAPITAL COSTS & ANNUAL MAINTENANCE & OPERATION COSTS*

Rs. Million

Sl. No.	Capital Cost Estimates	Berth No. 1	Export warehouse	Berth No. 2	Import warehouse	Total
1.	Civil Engineering	445	240	445	147	1277
2.	Equipment & Installation	164.5	162.7	179	4.33	510.53
3.	Lighting & Power	7.9	33.95	11.1	30.25	83.20
	Total	**617.4**	**436.65**	**635.1**	**181.58**	**1870.73**

i.e. USD 43.5 Million (Approximately)

Total Berths : Rs. 1252.5 Million
Total Warehouses : Rs. 618.23 Million

Table 2

PHASING OF CAPITAL EXPENDITURE

Assuming the full project including the warehouse construction, equipment installation and electrical works will be completed in 4 years and the total amount phased as per the following per centages:

	Total		Berths	
Year	**Percentage**	**Amount**	**Percentage**	**Amount**
1	15	280.00	15	188.00
2	50	935.00	55	689.00
3	30	561.00	30	375.50
4	5	94.73		
	Total	**1870.73 (USD 43.5 Million)**		**1252.50 (USD 29.1 Million)**

* Basic estimates for engineering works to develop a 200m berth at Kandla port was made by a former engineer of Mumbai Port, in 1995. Item-wise rates were adjusted upwards at 7% per annum to account for inflation, increase in cost of materials, construction, customs and other duties etc. to arrive at the present day costs.

Table 3

ANNUAL COSTS OF REPAIRS, MAINTENANCE & OPERATIONS*

Rs. Thousands

Sl. No.	Capital Cost Estimates	Berth No. 1	Export warehouse	Berth No. 2	Import warehouse	Total
1.	Civil Engineering (Schedule 4)	3,880	2,500	3,880	2,500	12,760
2.	Water Supply	125	260	125	260	770
3.	Electrical Energy - Schedule (Sc.)-6	1,200	12,840	4,790	5,980	24,810
4.	Fuel (Sc. 6)	3,360	28,050	1,340	2,620	35,370
5.	Repairs & Maintenance of Equipment Schedule (Sc. 6)	5,450	7,730	4,260	870	18,310
6.	Operation of Equipment(Sc. 6)	4,310	30,410	5,360	7	40,087
7.	Security	300	400	300	400	1,400
8.	Administration Staff	1,000	1,250	1,000	1,250	4,500
9.	Insurance	400	-	400	-	800
	TOTAL	**20,025**	**83,440**	**21,455**	**13,887**	**138,807**

Total for Berths : Rs. 41.48 Million
Total for warehouses : Rs. 97.33 Million

* Basic estimates for annual costs for a 200m berth at Kandla port was made by a former engineer of Mumbai Port, in 1995. Item-wise rates were adjusted upwards at 7% per annum to account for inflation, increase in cost of materials, construction, customs and other duties etc to get the present day costs.

Schedule 1

DETAILED ESTIMATES FOR EACH BERTH

CIVIL ENGINEERING WORKS – BERTH 1/BERTH 2

Sl. No.	Description	Quantity	Unit Rate (Rs. '000s)	Total Amount (Rs. '000s)
	Sub- Part I :Preliminary works			
1.	Engineering Surveys and Investigations	Job	Lump	2,000
2.	Temporary roads & fencing	Job	Lump	3,900
	Sub- Part II : Quay Wall and Apron			
1.	Mobilisation of Plant and Equipment	Job	Lump	13,000
2.	R.C.C. bored cast-in-situ piles			
I (a)	1.2 m dia. (+7.34 m to -32.0m)	20 nos.	600 each	12,000
I (b)	1.2 m dia.(+7.07 m to -28.0m)	120 nos.	590 each	70,800
II (a)	1.0 m dia. (+7.34 m to –32.0m)	137 nos.	490 each	67,130
II (b)	1.0 m dia. (+7.07 m to –28.0m)	120 nos.	470 each	56,400
II ©	1.0 m dia. (+0.30 m to muff)	18 nos.	390 each	7,020
III.	1.0 m dia. from 0.30 m to –32.0 m)	9 nos.	390 each	3,510
IV.	1.0 m dia. from +0.30 m to –32.0 m	18 nos.	420 each	7,560
V.	1.0 m. for rear cut off from +4.5 m. to –28 m.	60 nos.	240 each	14,400
3.	R.C.C muffs & facia	9 nos.	750 each	6,750
4.	Pile load tests	4 nos.	250 each	1,000
5.	R.C.C superstructure (M-40 grade) including beams for crane tracks	12500 sq.m.	5 per sq.m.	62,500
6.	Fender blocks	9 nos.	520 each	4,680
7.	Crane rail track	400m.	3 per m	1,200
8.	100 t bollards	18 nos.	200	3,600
	Sub-Total			**331,660**
	Sub- Part III: Transit Area			
1.	Filling (+5.0 to 9.14 m.) 40,000 sq.m.	160,000 cu.m.	90/cu. m	14,400
2.	Pre-consolidation	40,000 sq.m.	1600/sq. m	64,000
3.	Paving (including drains and roads)	40,000 sq.m.	525/sq.m.	21,000
4.	Sea water fire fighting ring main with hydrants	800 m.	1200/sq.m.	960
5.	Building (Office)	Job	Lump	660
6.	Facilities for reception &			

Sl. No.	Description	Quantity	Unit Rate (Rs. '000s)	Total Amount (Rs. '000s)
	treatment of bilge oil (common to both)	Job	Lump	6,600
7.	Fresh water main & storage tank		Lump	260
	Sub-Total			**107,880**
	Sub-Part IV – Capital Dredging (To be done by the Port)			
	TOTAL			**403,500**
	Physical Contigencies @5%			20,200
	Turn-over Tax@2%			8,060
	Design and Construction Supervision@3%			12,100
	GRAND TOTAL			**443,860**
				Say Rs. 445 Million

Schedule 2

DETAILED ESTIMATES FOR EXPORT WAREHOUSE

CIVIL ENGINEERING WORKS - BERTH 1: WARE HOUSING

Sl. No.	Description	Quantity	Unit Rate (Rs.)	Total Amount (Rs. '000s)
1.	Filling (90,000 sq.m.)	360,000 cu.m	90/cu.m	32,400
2.	Pre-consolidation below structure, Roads & Railways (30,000 sq.m)	30,000 sq.m	1,600/sq.m	48,000
3.	Grain Silo 30,000 t. capacity	30,000 t.	2,600/tonne	78,000
4.	Sheds for storage of oil seeds & extractions and salt.	20,000 sq.m	2,000/sq.m	40,000
5.	Roads	20,000 sq.m	525/sq.m	10,500
6.	Railways sidings (Berths 1)	600 m	13,000/m.	7,800
7.	Fire fighting sea water ring main	1000 m.	1,200/m.	1,200
8.	Fresh water line	Job	Lump	260
	Sub-Total			**218,160**
	Physical Contigencies@5%			10,900
	Turn Over tax@2%			4,400
	Design and Construction Supervision@3%			6,500
	Grand Total			**239,960**
				(Say Rs. 240 Million)

Schedule 3

DETAILED ESTIMATES FOR IMPORT WAREHOUSE

CIVIL ENGINEERING WORKS - BERTH 2: WARE HOUSING

Sl. No.	Description	Quantity	Unit Rate (Rs.)	Total Amount (Rs. '000s)
1.	Filling (1,00,000 sq. m)	400,000 cu.m.	90/cu.m	36,000
2.	Pre-consolidation below structure, Roads & Railways (30,000 sq.m)	30,000 sq.m	1,600/sq.m	48,000
3.	Sheds for storage of Fertiliser and Fertiliser raw materials including bagging.	15,000 sq.m.	2000/sq.m.	30,000
4.	Roads	20,000 sq.m	525/sq.m	10,500
5.	Railways sidings (Berths 1)	600 m	13,000/m.	7,800
6.	Fire fighting sea water ring main	1000 m.	1,200/m.	1,200
7.	Fresh water line	Job	Lump	260
	Sub-Total			**133,760**
	Physical Contigencies@5%			6,700
	Turn Over tax@2%			2,700
	Design and Construction Supervision@3%			4,000
	Grand Total			**146,860**
				(Say Rs. 147 Million)

Schedule 4

ANNUAL COSTS OF REPAIR AND MAINTENANCE
CIVIL ENGINEERING

BERTH		**Rs. Thousand**	
Sl. No.	Description	Berth 1	Berth2
1.	R.C.C Work in berth @0.25% of Capital Costs of Rs. 331.66 Million	830	830
2.	Filling depressions in the reclaimed ground	660	660
3.	Paving @10% of Rs.21m	2,100	2,100
4.	Miscellaneous	300	300
	Sub-Total	**3,880**	**3,880**
	WARE HOUSING		
1.	Filling depressions in reclaimed ground	600	600
2.	Silo, sheds and structures@0.5%	600	600
3.	Roads, Railways and Miscellaneous	1300	1300
	Sub-Total	**2,500**	**2,500**

Schedule 5

EQUIPMENT, INSTALLATION AND LIGHTING

BERTH PROPER			
Sl. No.	**Description**	**No. 1**	**No. 2**
		Rs. Thousands	Rs. Thousands
1.	**Equipment**		
	20 t rail mounted cranes		160,000
	20 t grabs		7,900
	Fork lifts – 3		1,200
	Mobile Crane – 1		3,300
	P&W Loaders – 2	160,000	
	Fork Lifts – 3	1,200	
	Mobile Crane – 1	3,300	
	Rotary Valves in 5 Fertiliser bins		6,600
	Sub-Total	**164,500**	**179,000**
2.	**Lighting**		
	Yard Lighting	6,600	9,800
	Street Lighting	1,300	1,300
	Sub-Total	**7,900**	**11,100**
WARE HOUSE			
1.	**Equipment**		
	Pneumatic loaders (salt and oil seed cargoes) for dumpers	13,000	
	Dumpers	63,000	
	Bonded warehouse stacking conveyors		1,050
	Bonded warehouse bag handlers		3,280
2.	**Installations**		
	Truck washing facility	400	
	Fuel facility	2,600	
	Conveyor belts	70,000	
	Bucket elevator for silo	3,900	
	Long hopper for bag bleeding	3,300	
	Arrangement to spread bags	2,600	
	Facility at Silo to load dumpers	3,900	
	Sub-Total (1+2)	**162,700**	**4,330**
3.	**Lighting**		
	Yard Lighting	6,600	9,800
	Street Lighting	1,300	1,300
	Office Lighting	150	150
	Small shed for export lighting	900	
	Warehouse for extractions lighting	6,000	
	Warehouse for salt lighting	6,000	
	Bonded warehouse lighting		6,000
	Electric Sub-station and cables	13,000	13,000
	Sub-Total	**33,950**	**30,250**

Schedule 6

RECURRING COSTS

Rs. Thousands

Sl. No.	BERTH – 1	Fuel	Manpower	Maintenance
1.	**Equipment**			
	P&W Shiploaders	2,000	2,360	4,700
	Forklifts – 3	1,000	500	130
	Mobile Crane - 1	360	850	260
	Sub-Total	**3,360**		
2.	**Lighting**			
	Yard Lighting	940	400	330
	Street Lighting	260	200	30
	Sub-Total	**1,200**	**4,310**	**5,450**
	WARE HOUSE - 1			
1.	**Equipment**			
	Pneumatic loaders for dumpers	1,840	2,100	1,310
	Dumpers - 40	26,210	12,600	3,150
	Sub-Total	**28,050**	**14,700**	**4,460**
2.	**Installations**			
	Truck washing facility	10	70	30
	Fuel Facility	10	130	10
	Conveyor System	2,000	2,000	2,000
	Bucket Elevator	1,110	390	330
	Labour to bleed bags		6,300	
	Bag spreading	230	330	70
	Silo loading for dumpers	2,230	3,150	200
	Sub-Total	**5,590**	**12,370**	**2,640**
3.	**Lighting**			
	Yard Lighting	940	390	330
	Street lighting	260	200	30
	Office Lighting	20	130	10
	Warehouse Lighting	6,030	2,620	260
	Sub-Total	**7,250**	**3,340**	**630**
	BERTH – 2			
1.	**Equipment**			
	Fork lift - 3	1,000	500	130
	Mobile Crane - 1	360	850	260
	Sub-Total	**1,340**		
	20t rail mounted crane - 2	2,620	1,310	3,150
	20t grabs			200
	Rotary valves	10	2,000	30
	Sub-Total	**2,630**	**4,660**	**3,770**
2.	**Lighting**			
	Yard lighting	1,900	500	460
	Street lighting	260	200	30
	Sub-Total	**2,630**	**4,660**	**3,770**

Sl. No.	BERTH – 1	Fuel	Manpower	Maintenance
	WARE HOUSE – 2			
1.	**Equipment**			
	Bonded warehouse bag handlers	2,620	3,280	130
	Bonded warehouse stack conveyors	790	1,570	70
	Sub-Total		**4,850**	**200**
2.	**Lighting**			
	Yard Lighting	1,900	500	500
	Street Lighting	260	200	30
	Office Lighting	20	130	10
	Warehouse lighting	3,010	1,310	130
	Sub-Total	**5,190**	**2,140**	**670**