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Feasibility Study and Planning of an Intermediate Port at Ponnani

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***Abstract*— Seaports or simply ports are the principal conduits through which the economic life of a maritime life flows. These are the links in the chain of transportation of cargo through sea, land, or pipeline. As maritime gateways, port serve as interface between sea and land links and have to handle enormous flow of goods, which are broken down to smaller for distribution to the hinterland by road, rail and inland waterways. This paper comes with the solution for Kerala's problems related to port development. This paper presents feasibility study and Planning of a Port at Ponnani. Ponnani is such a port to be developed in line to intensify coastal shipping. Ponnani is well located at an advantageous position with regard to the development of west coast canal system in Kerala. The port has to act as seaport as well as an IWT terminal. Ponnani although had great sea fairing tradition, presently it is only a fishing harbor with signal station. However among active ports in the state, it is listed along with Beypore , Vizhinjam, Thankassery, Neendakara and Azheekkal. Ponnani can also play a role as a satellite port for Cochin port in cruise tourism and support the major port by relieving it for Lakshadweep transportation. All these depend upon the development of the port for handling and berth facilities and increasing the draft of the channel, berth and anchorage in future. We have done the planning using the Indian Standard Code Of Practice For Planning and Design Of Ports and Harbours and UNCTAD manual.**

I. INTRODUCTION

All Seaports or simply ports are the principal conduits through which the economic life of a maritime life flows. As maritime gateways, port serve as interface between sea and land links and have to handle enormous flow of goods, which are broken down to smaller for distribution to the hinterland by road, rail and inland waterways. Port always plays a strategic role in the development of domestic and international trade of a country whether it's a developing or developed country. However in a globalised world where distances are becoming virtually squeezed, ports play an active role in sustaining the economic growth of a country. The planning of a port should not only be concerned by simply demand and supply of throughput but more than that of institutional framework, application of technology, marketing strategy and ultimately economic impact analysis for the development and implementation of a project. It may be via expansion of an existing port or may be green field project. The primary function of port is therefore to provide an efficient and low cost transfer of cargo from ship to shore and vice-versa, including inspection, storage and transportation. In order to achieve the above objective, the focus of the port is on one hand on the maritime side and on the other hand on the land side requirement. To fulfill this, a port requires sufficient maritime access for ships, sufficient space for maritime interface (the berths), sufficient land infrastructure (cranes, warehouses) and good hinterland connections. India has long coastal line of about 6000 Km; out of which, 3,300 km is on the east Coast and 2,700 km on the west coast. The future development of India requires an efficient national transport system. There are 12 Major ports, 185 non-major ports and several minor ports .The present paper enumerates the effort in this direction and hopes to provide useful inputs for expansion needs of new Ponnani port. Ponnani has been functioning an estuarine Port for a long time, even before the arrival of European traders. The Arab traders used to frequent to this Port. The activities of this old Port are having mention in the Malabar Manual by William Logan. The existing port wharf is situated on the left bank of Bharathappuzha about 500 meters upstream of its confluence with the sea .The traditional glory of the Port started dwindling from the last three decades. The dilapidated port wharf is being used for berthing fishing vessels. Ponnani has been central Kerala's preeminent port in the past. The region is now becoming primary service and supply base for fisheries, agricultural products and laterite building blocks. The significant growth in / proximity / development of , presents an immediate opportunity for Ponnai to further develop its logistical support capacity. Ponnani new port facility is planned as a totally integrated multi-modal transport project with emphasis on expansion and growth through the provision of efficient, world-class facilities.

This paper focuses on the development of Ponnani port as an intermediate port. The divertible traffic assessment done by the NATPAC. Based on that the various commodities are listed out from road, sea and inland water transportation and the quantity of divertible traffic is found out. The feasibility of project was decided based on this. Accordingly the traffic forecasting was done using the various methods. Out of the various methods used for forecasting considering all these facts and the coefficient of determination and R^2 values the AACGR method of forecasting was chosen as best and the forecasting was done upto the year 2055. The various infrastructure facilities was planned to accommodate so much of traffic.

II. TYPE METHODOLOGY DEVELOPED FOR STUDY

The methodology adopted for the study is shown in figure 1

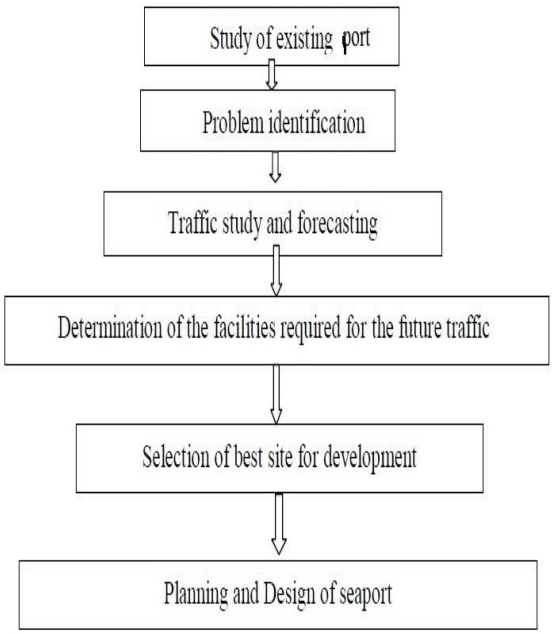

Fig 1: Methodology of Traffic Forecast

III. PROBLEM IDENTIFICATION

The India is a country that is devolping at a faster rate. The country has got a very vast coast line and if properly planned and utlize the marine resources it can add significant increase in the countrys economy. For the development of marine sector more ports has to come up and the existing ports has to be used efficiently. Coming to Kerala's situation it is also a coastal state and has one major port, intermediate ports and minor ports. Analyzing the problems of cochin port and Beypore port which are the major and minor ports of Kerala , we found that the following are the major draw backs .The main reason for this state of affairs is the lack of facilities at these ports. Loading and discharge facilities, and suitable storages are lacking at many of these ports. Crane facilities for unloading cargo are available to a limited extent at Beypore and Vizhinjam. Even here, chartering of gearless ships will end in spending more days for discharging cargo. Availability of draft at these ports prevents berthing of large capacity vessels which are shipping agencies prefer for its economics of operation. Beypore port centers to Lakshadweep transportation and cargo handled essentially can be grouped as coastal shipping. Loading and discharge time depends on the facilities at the ports. At Cochin port, it takes about four days to unload 8000 to 10,000 tonnes of break bulk goods. At beypore port, two cranes are available with capacities of 3 tonnes and 5 tonnes.. Unloading at these ports take 3 days for a shipload of 2000-2500 tonnes of break bulk cargo. with no return cargo the turnaround time of a voyage will be 13 days between Gujarat port and ports in the state. This creates loses for shippers. Insufficient draft, facilities etc are the main issues in Beypore port where as congestion in port and congestion in roads due to transport of goods from cochin port to northern parts of the state are the main problems in cochin port.next issue is regarding Lakshadweep transportation. Lakshadweep islands are situated 200 to 400 kms of the Malabar Coast. Till late fifties the islands did not have regular modern transport facilities between mainland islands. Traditional sailing vessels Uru supported the travelling. Recently transport capacity has been expanded by adding new passenger ships, cargos barges, catamarans and aircrafts. The newly introduced vessels operate from Cochin, Beypore, and Mangalore. Analyzing all these problems we can conclude that if there is a port in between the cochin port and Beypore port it can serve in many ways a port at Ponnani will also help the Lakshadweep transportation system to a considerable extent .

IV. PREPARE TRAFFIC STUDY

The development of a port is largely based on the traffic forecasts, which is essential for the efficient port planning, as it is required to provide adequate port facilities for present and future traffic that could be routed through the same. Main objectives of the traffic study are to assess the existing traffic demand which consists of Identification of hinterland and its traffic potential and Growth estimation of traffic and traffic forecasting. The second objective is to present the developmental profile of the port in terms of divertible traffic possible from all sections. Thus it can be possible to assess the kind and quantity of commodities that is likely to be generated in the hinterland, ascertain the extent to which cargoes could be transformed as maritime cargo that would pass through the port and to assess the types of ships and their arrivals to lift the cargo. Taking in to account the importance, National Transportation Planning and Research Centre have been appointed conducted a realistic traffic study and from the careful study of their report and from the survey conducted by us with the various industries and chamber of commerce the various divertable traffic was assessed and from that traffic forecasting upto the year 2055 was carried out.

The following are the important observations:

- Presently in Kerala only Beypore and to an extent Vizhinjam are the only minor port functional.
- others function as fishing harbours and signal stations.
- Competing modes of transports and lack of maintenance including dredging made minors ports to decay.
- Developing coastal shipping and integrating it both physically and functionally with Inland water Transportation is a good solution
- The bulk product marketing distribution system can be improved for stakeholders in the field.
- Ponnani is one of the nearest port to the major port of Cochin.

- It can act as a satellite port in Cruise tourism, Container barge operation, Coastal shipping and a terminal for Inland Water Transport.
- Ponnani can also play a pivotal role in Lakshadweep transportation.
- It is a close port in main land.
- . Existing Central Government's department of Shipping through consultants had prioritised Kerala's ports of Beypore, Vizhinjam, Thangassery, Azheekal and Ponnani for selection for development programmes.
- Ponnani has an added advantage of availability of land for port development and expansion.
- Ponnani can afford deeper dredging.
- The port influence area of Ponnani are Malappuram district, western portion including Palakkad town and northern portion of Thrissur district including coastal areas of Chavakkad and Chettuva.

A.Methodology of traffic forecast

The methodology adopted for traffic forecast is Depending on the type of developmental program for a specific port a suitable method is adopted for the purpose of traffic forecast. The different methods of traffic forecast have been discussed. In this study "theory of least square/regression method" has been used. This method involves examination of historical data to determine the underlying process generating the variables and assuming that the process is stable, and the use of this knowledge to extrapolate the process into future. Based on the figures for past traffic, a trend analysis and annual average growth rate method (AACGR) is done for using the theory of least square fit to find out the trends in traffic both at present and that the for future. The traffic of ponnani port from 2005-06 to 2054-55 has been analyzed using regression model to project traffic flow using the following trends.

- Linear trend
- Polynomial of order-2
- Exponential function
- Logarithmic function
- Power trend
- AACGR

Using the above trends, the regression analysis was carried out and best-fit curve was selected based on coefficient of determination of (R^2 value).The project traffic is compared with the actual traffic of past years and the one from among the various regression models which gives the estimated value closest to the actual are selected for future projection. the traffic projections up to year 2054-55 are found using the best regression model. The AACGR method or annual average growth rate method provided with the beat result with R^2value of 1. The methods are summarized in the table 1 shown below.

The forecast using different models are shown in figure 2.

Table 1: Various Models Adopted for Study

Model	**Forecasted Traffic**	**R^2value**	**Forecast 2054-2055 (T)**
Linear trend	$y = 14114x + 98748$	0.9890	1580261
Polynomial of order-2	$y = 1635.x^2 + 27195x + 1E+06$	0.9790	5032123
Exponential function	$y = 97500e^{0.015x}$	0.980	1895783
Logarithmic function	$y = -4E+0\ln(x) + 3E+06$	0.0610	1148783.08
Power trend	$y = 95357x^{0.029}$	0.9170	1071892
AACGR	$y = 1E+06e^{0.095x}$	1.00	57538168

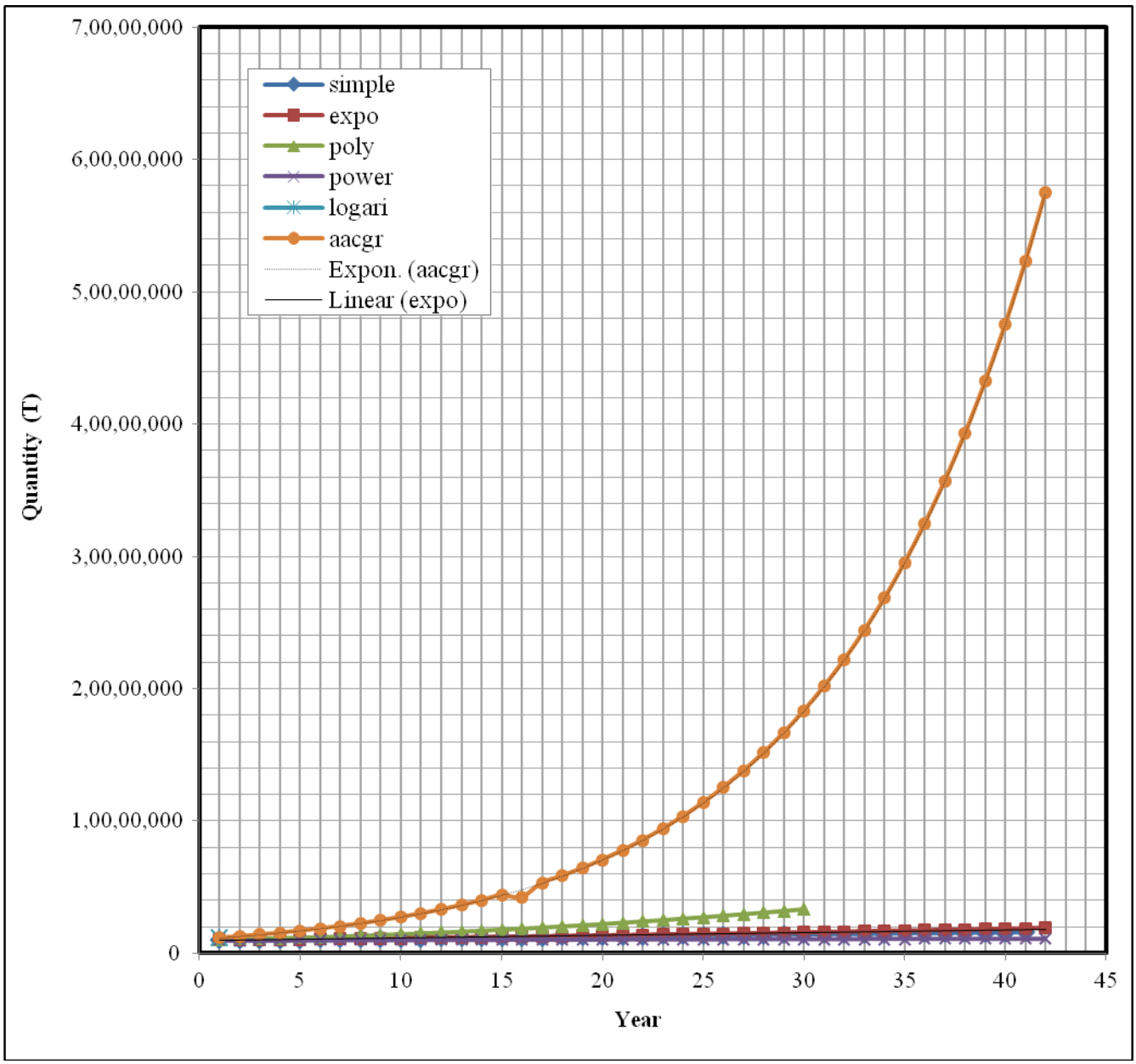

Fig 2: Graphical Representation of Various Models

V. SITE INVESTIGATION

After getting the future cargo traffic the existing site was investigated for developing it into a new port. The following site characteristics was collected as per IS 4651 part 1 and UNCTAD manual

A. Topography

Topography of the area shows generally a level ground without much of variation in the ground level. The area is dominated by coconut tree plantation. Paddy fields also are in the vicinity. Ground water level is high as 1.5M below ground level. The nearby land is of sandy soil.

B. Location

Ponnani is situated at Latitude 100 40' N and 750 55'E. The location of the Port is around 900m upstream of the confluence of the river Bharathapuzha with Lakshadweep Sea. The site is at a distance of about 150 m from the NH-1

C. Climate

The location of the Port is in the tropical area. Here there are predominantly four different seasons, the southwest monsoon from June to September, northeast monsoon from October to November, dry weather from December to February and hot and humid weather from March to May. The region receives more than 80% of its rainfall from south west monsoon.

D. Rainfall

The annual mean rainfall from the period from 1993 to 2004 in the Ponnani was 2891.20 mm.

E. Wind

The maximum wind velocities experienced in South-West monsoon is 100 km/hour

F. Tides

Ponnani experiences semi diurnal tides with a period of 12 hours and 40 minutes. The maximum tidal range is of 1.12m

G. Waves

The basin of Bharathappuzha upstream of its confluence is, however, well protected from turbulence of the off-shore waters of Arabian Sea by the two breakwaters at Ponnani to afford tranquility in the river basin, throughout a year.

The Harbour Engineering Department had taken wave observations and the wave data indicated that close to the coast, the wave direction is generally from SW to SSW directions. During the monsoon season, the visually observed maximum wave height near the coast was of the order of 1.0 m to 1.5 m whereas during the non-monsoon period, the maximum wave height was around 0.5 m.

H. Bathymetry

The seabed off the Ponnani estuary is predominantly sand. 9 m depth contour is available at a distance of about 1.75 nautical KM. There is rocky bed in the sea. The slope of the sea bed is 1:180. The slope is very mild. The depth at present in the area to be reclaimed for port land is less than 0.50 M. So there is no drastic change in bathymetry due to reclamation

VI. PLANNING OF PORT

df The complete planning of the port is carried out as per IS 4651 Indian port code and UNCTAD MANUAL. Referring to the UNCTAD manual we can see that the development of the port has to take place in stages only so we have divided the whole development to take place in 3 stages. The following are the details.

A. PLANNING FOR PHASE I

- The draught is 7.5m
- Navigation channel: we are providing unrestricted channel.
- Unrestricted Channels - here we provide unrestricted channel. An unrestricted channel is a channel of sufficient depth and which has a width of more than 10 times the beam of the largest ship likely to navigate the channel at all states of the tide.
- Entrance channel
- The entrance should be on leeward side of the harbour where possible.For the entrance channel we provide a width of (10 times the beam of the ship);
- 10B =10*20=200 m
- Turning Basin/Circle
- Where vessels turn by free interplay of the propeller and rudder assisted by tugs, the minimum diameter of the turning circle should be l.70 to 2.0 times (l.70 for protected locations and 2.0 for exposed locations) the length of the largest vessel to be turned. (Clause 5.3.3 of IS 4651 part v)
- Turning basin we provide= 2*length of largest vessel (195m) = 2*195 =390m
- Various berths to be provided (clause 6.2 of IS 4651 part v)
- General Cargo Berths
- Forecasted traffic for the first phase = 25, 95,380
- Freighter for the first phase=3000 DWT
- No: of ships = 2595380/3000 =865 no's (no: of ships in a year)
- Total commissioned days expected in a year for port = 255 days
- No: of ships expected in a day = 865/255=3 ships
- Length of 3000 DWT ships = 105 (IS 4651 part v; appendix)
- Berth length approximately equal to ship length+ clearance
- We provide a berth length of 105+15 =120m (IS 4651 part v)
- Berth width = 20m (IS 4651 part v)
- We've provided 3 berths of size 120m x 20m.
- Passenger Berths
- The berth should be located as far away as possible from bulk handling berths, tanker berths, and explosive berths.
- We've provided a passenger berth of size 120m x 20m
- Width of Apron –
- The minimum width of apron may be taken as 20m (IS :4651_5)
- Other facilities provided:
- 3 transit sheds are provided of area 4200 m2 each (IS :4651_5)
- 2 berths of size (70 x 20) for inland transportation is provided

B. PLANNING FOR PHASE II

- We've increased the draught to 9.5 m
- Various berths to be provided (clause 6.2 of IS 4651 part v)
- General Cargo Berths
- Forecasted traffic for the first phase = 1, 08, 41,543
- Freighter for the second phase=8000 DWT
- No: of ships = 10841543/8000 = 1355no's (no: of ships in a year)
- Total commissioned days expected in a year for port = 255 days
- No: of ships expected in a day = 1355/255=5 ship
- transit sheds of size 50x20 sq.m is provided
- for IWT Passenger terminal of size 120 x 20 is provided (IS :4651_5)
- A turning radius of 260m is provided (IS :4651_5)
- Office room of size 50m x 30m is provided
- 2 dormitory and 1 guest house of size 150m x 210m
- 3 open storage area of size 150 x 210 (IS :4651_5)
- 1 open storage area of size 100 x 270 (IS :4651_5)
- Internal roads and approach roads are provided of 20m width (IS :4651_5)
- Weigh bridge of size 30m x 15m is provided
- Water tank is of size 30m x 30m Security room is of size 15 x 15
- Canteen of size 50m x 20m is also provided
- Underground drainage of width 5m is provided
- A main gate is provided Length of 8000 DWT ships = 155 (IS 4651 part v)
- Berth length approximately equal to ship length+ clearance
- We provide a berth length of 155+15 =170m (IS 4651 part v) Berth width = 20m (IS 4651 part v)
- We've increased the no: of berths.2
- berths of size 170m x 20m are added.

- Width of Apron - The minimum width of apron may be taken as 20m (IS: 4651 5)

C. PLANNING FOR PHASE III

- We've increased the draught to 13.5m
- Various berths to be provided (*clause 6.2 of IS 4651 part v)*
- General Cargo Berths:
- Forecasted traffic for the third phase = 6,02,78,081 tonnes
- Freighter for the third phase=20,000 DWT
- No: of ships =6,02,78,081 /20000 = 3014 no's (no: of ships in a year)
- Total commissioned days expected in a year for port = 255 days
- No: of ships expected in a day = 3014/255=11 ships
- Length of 20000 DWT ships = 195 (*IS 4651 part v; appendix)*
- Berth length approximately equal to ship length+ clearance
- 4 berths of 240 x 20 is provided for general cargo and bulk cargo (IS :4651_5)
- 2 container berths of size 240 x 20 are provided (IS :4651_5)
- 1 POL birth of size 200m x 20m is provided (IS :4651_5)
- Berth width = 20m (*IS 4651 part v)*
- We've increased the no: of berths to 7, i.e. 1 POL birth, 2 container berth and 4 general cargo & bulk cargo berths.
- Width of Apron - The minimum width of apron may be taken as 20m (IS: 4651_5)

The detailed plan of phase 1,2 and 3 are shown below in figure 3,4,5.

VII. CONCLUSSION

Presently in Kerala only Beypore and to an extent Vizhinjam are the only minor ports functional. The others functions as fishing harbours and signal stations. Ponnani is one of the nearest port to the major port of Cochin. It can act as a satellite port in Cruise tourism. Ponnani can also play a pivotal role in Lakshadweep transportation. Ponnani has added advantage of availability of land for port development and expansion. While Beypore, the states most active minor port is at a disadvantage for deeper draft due to rocky formation, ponnani can afford deeper dredging. As a result of development of Ponnani port, appreciable industrial growth is expected in Malabar region. Also increase in revenue, reduced congestion in road, Cochin port and Beypore port are some advantages achieved once the Ponnani port is developed.

REFERENCES

[1] V Ansu, R K Dilba, "reincarnation of Beypore port as Kozhikode port ,international conference, NITC.

[2] NATPAC Traffic studies for preparation of master plan of Ponnani port .

[3] UNCTAD hand book of port development

[4] Indian standard for ports and harbours 4651

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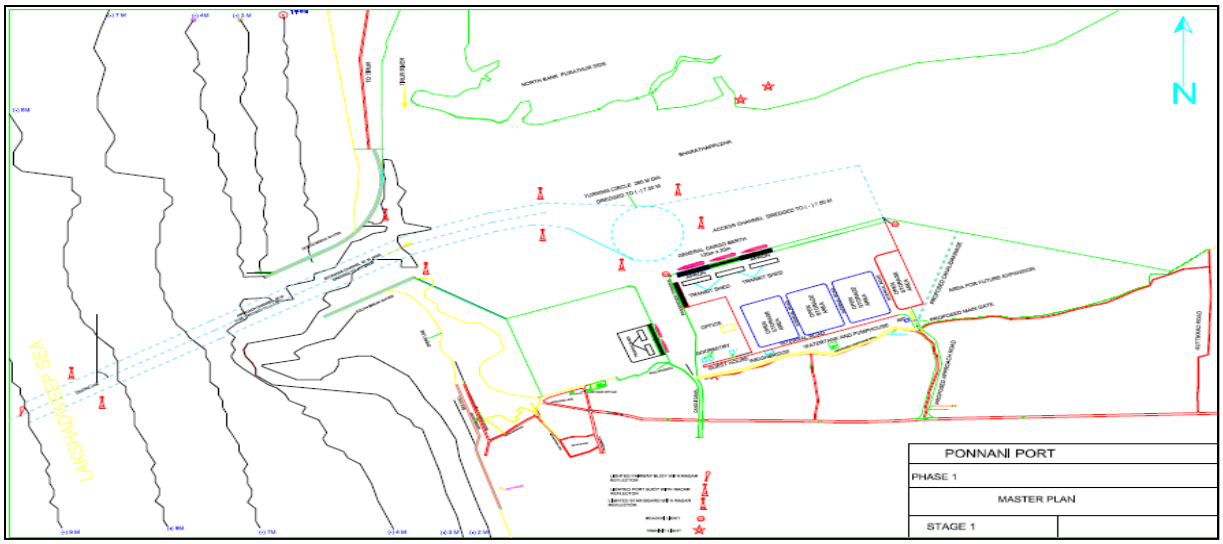

Fig 3: Planning Phase 1

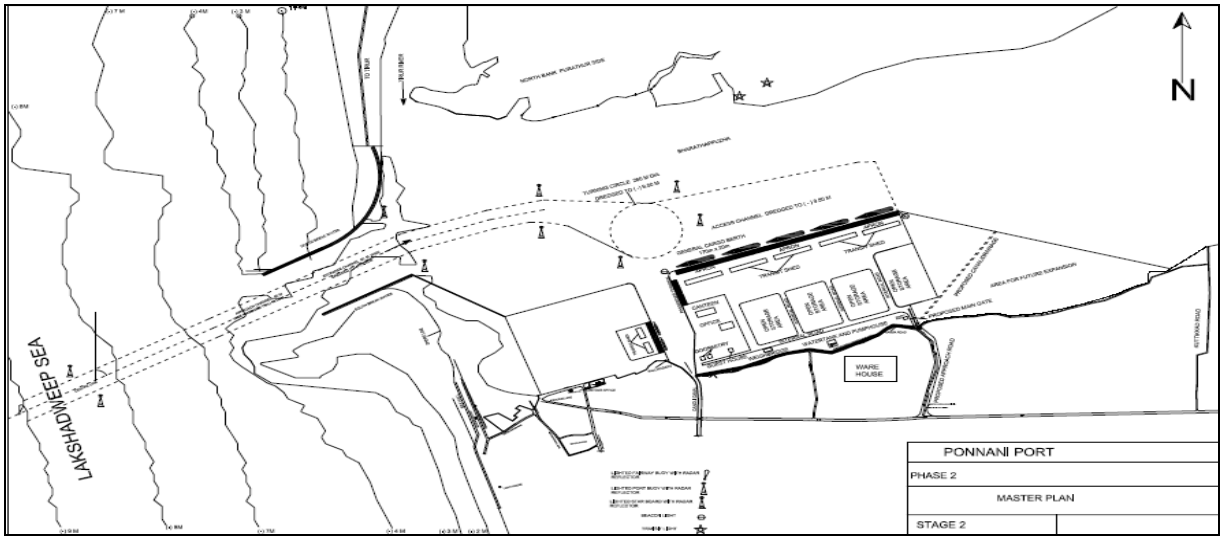

Fig 4: Planning Phase 2

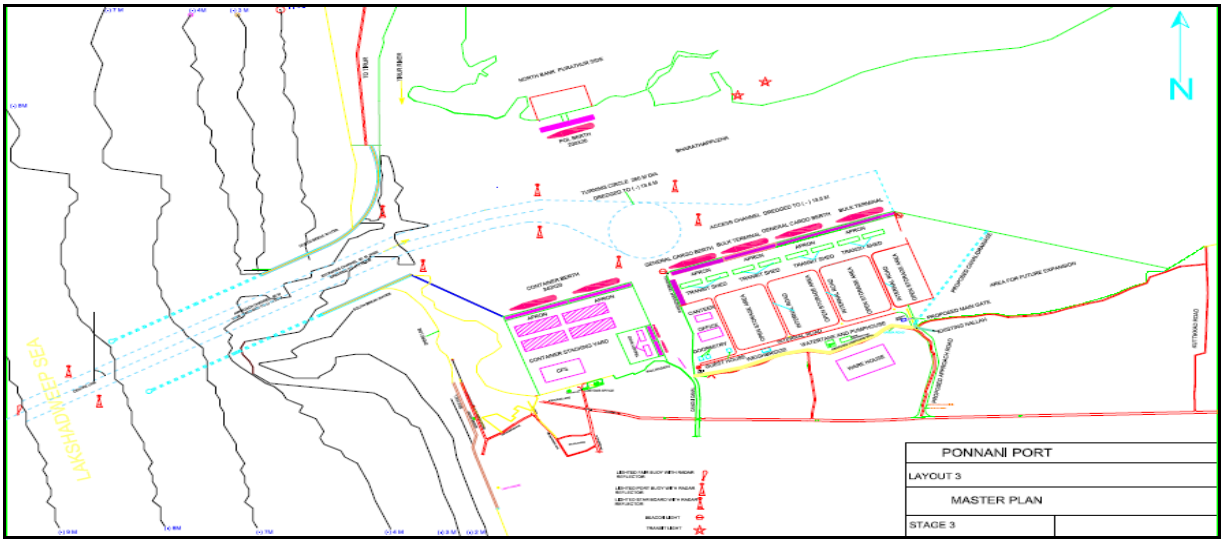

Fig 5: Planning Phase 3