

**CASE STUDY OF MAGDALLA, SURAT PORT FOR FINDING  
EFFICIENCY OF IMPORT & EXPORT BASED ON  
INFRASTRUCTURE FACILITIES**Sumedha R Mahajan<sup>1</sup>, Dr. Gargi Rajpara<sup>2</sup>, Mr. Mukesh Dave<sup>3</sup><sup>1</sup>Infrastructure Engineering, LDRP-ITR, Gandhinagar<sup>2</sup>Civil Engineering, LDRP-ITR, Gandhinagar

**Abstract**—Having proper understanding of ports operations as well as utilizing methods of development by the means of value-added service, could change a role of a port from a transportation node to an efficient point in a transportation chain. Trend of globalization has been followed by an increase in level of demand for freight transportation and thereafter establishing suitable port services. Developments of transportation chains, logistics and progress of these networks have enhanced the sustainable condition and level of transportation. To increase efficiency in the performance of the ports is to provide an environment for the activities that can meet high potential, reduce cost and increase replacement speed in parallel with the development of international business. Gujarat is strategically located with a coastline of 1600 km and has 42 ports. It has the highest number of operational ports & commercial cargo ports. Gujarat is strategically positioned to act as the hub of coastal trade. Already, minor ports in Gujarat account for 76% of the total cargo handled in the country. This is expected to rise further with development of more ports. The Gulf of Cambay and Gulf of Kutch provides natural navigational safety and logistical advantage, so by studying the various potentials and factors affecting the port infrastructure we can make Ports – “As an Integral Part of Gujarat’s Development Process”.

**Keywords**—Ports, Globalization, Logistic, Cargo, Development, Gujarat, Infrastructure Facilities

**I. INTRODUCTION**

Infrastructure plays a very important role in the economic progress of the nation. No country can think of economic progress & development without the development of efficient infrastructure. Especially in age of Globalization where international goods & commodities are to be transported from one country to the other, efficient infrastructure is the key to the success. India has a strategic location in the Indian Ocean with a coast line of 7517 kms with 13 major ports. In addition, there are 200 minor and intermediate ports, out of which 41 minor ports are based in Gujarat. Gujarat has emerged as a leading industrial and business Centre in the country. Gujarat has a coastline of 1600 km providing ideal location with proximity to international maritime routes for port as well as port led development. The astonishing growth pattern of the ports of Gujarat continued from last ten years has also been reflected in the annual growth of 35% in the traffic handled by GMB ports in 2009-10. Indian ports handle 95% of India’s foreign trade in terms of volume and 70% in terms of value. Of this Gujarat accounts for about 75% of total traffic handled by non-major ports of India. Gujarat also has the highest number of operational ports and commercial ports and commercial cargo ports in India. Industries like petro chemicals, metal, cement, fertilizer and power have built their competitive edge from close proximity to ports for import of raw materials and/or export finished products after value addition. Gujarat’s port sector has substantially consolidated itself in the last decade and now is favorably poised to tap opportunities emerging from the Dedicated Freight Corridor (DFC), Delhi Mumbai Industrial Corridor (DMIC), Special Economic Zones (SEZ) and Special Investment Region (SIR).

**1.1 Objective of Study**

- To carry out the pre-feasibility study for the port development.
- To identify the size of Logistics infrastructure facilities to handle the anticipated traffic in an efficient and cost effective way.
- To create basic cargo handling facilities at a minimum cost and allowing flexibility for extension/additions of infrastructure with traffic build up.

**1.2 Scope of Work**

- Port Planning
- To access the past traffic analysis
- Provide infrastructure facilities
- Provide design facility of planned facility.

**II. BACKGROUND AND LITERATURE REVIEW**

Large number of studies has been reported on developing port infrastructure with different logistics chain. Many research have been examined for the development of port facility some of the researchers are Aecom (2010), have studied the

benefits & impacts associated with the Inland Port's presence in Will Country. The key element to succeed was the need for increased effectiveness of truck transportation in the Country and need for defining an enhanced contribution from freight transportation connected to the inland waterway system. *P. Taneja (2012)*, have promoted use of flexible and sustainable infrastructures –though initially more costly, in view of the uncertainty; they may prove more economical over their entire life cycle & so the use of flexible and sustainable solutions infrastructures needs to be promoted. *G.S. Dwarakish (2015)* have presented a review on the role of ports on the development of a nation. The growth and development of ports leads to

greater trade activity, increased supply, greater foreign reserves and reduced prices for commodities as a whole. If port systems are not continuously updated, they face threat of becoming obsolete and eventually too inefficient to run. As a result, port owners need to constantly reserve funds for upgrades and maintenance costs.

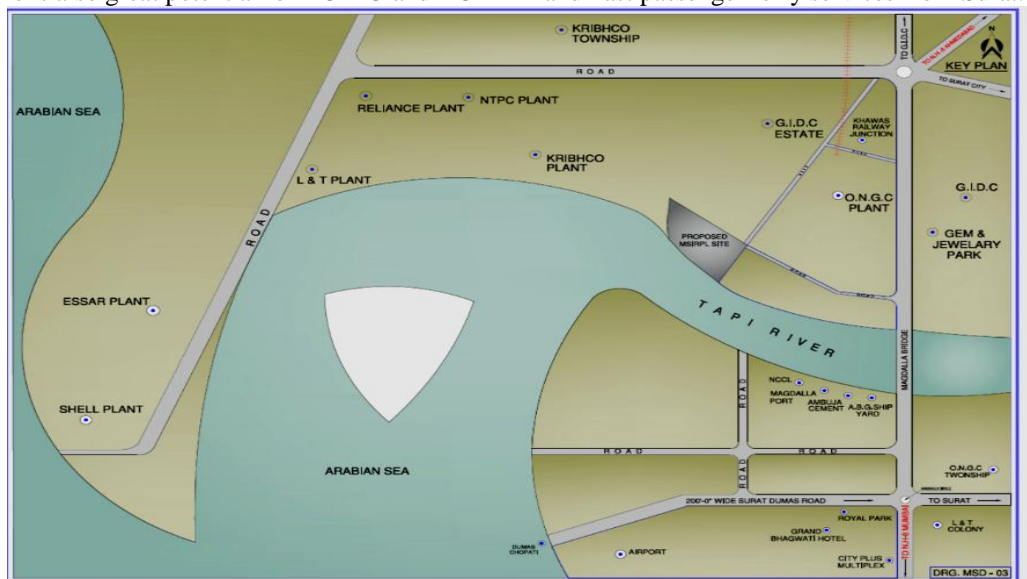
### III. METHODOLOGY

#### 3.1 Selection of Proposed Location

The promoter has a vision to develop port terminal at this location to serve the export-import of various dry cargoes. Magdalla is well connected excellent road network. Magdalla/Surat being on strategic location can be important links in the logistics chain. There is an attractive scope to establish port terminal at such strategic location. Various industries are established in Surat and around the Surat like textiles, sugarcane, handicraft, sea food; food processing units, cold storage, milk products, farmer's co-operatives society in addition to many small and medium size industries located in this region.

The following are the advantages of this location:

- The proposed land is within sheltered area of Tapi channel. The location is in less cyclone prone region. Traffic flow is continuous.
- Site is located in the heart of the Surat/Hazira Industrial area.
- Broad gauge railway line is readily available at a distance of 2.5 Kms.
- Proposed location is well connected with state and national highways.
- Located far from residential area.
- There is also great potential for RO-RO and RO-PAX and Fast passenger ferry services from Surat.



**Figure 1. Key Plan of Proposed Location**

#### 3.2 Problem Identification

There are several problems that cause a serious obstruction to the flow of different commodities at the study area. Magdalla Port is handling all types of cargo, but presently due to limitations, only coal is being handled. Shell - Hazira is importing gas, while all other Industries import/export their own captive cargo. Apart from GMB owned Magdalla port all other existing jetties in this area are developed as captive jetty by the various industries for their individual cargo handling. Hence there is no other jetty available in this region, for handling general cargo. GMB Magdalla jetty is now dedicated to handle only coal. There is a great potential of a privately owned jetty to handle various commodities as required by the requirement in this industrially well-developed region.

#### 3.3 Problem Solution

After observing the difficulties of handling different commodities and identifying the problems causing these inefficiencies, there are various solution for improving the facilities for handling commodities safely.

- By Improving Facility
  - ✓ Providing facilities for the port to handle the anticipated cargo.
  - ✓ Developing the nearby-areas.
  - ✓ Developing port with infrastructure facilities.

- ✓ Marine development
- ✓ Onshore development

### 3.4 Data collection and Analysis

A preliminary traffic analysis has been done at this stage. A comprehensive detailed analysis shall be undertaken at DPR stage. The State of Gujarat has in total 42 ports (including 1 major port) that serve the needs of a variety of industries and industrial areas. Many of these ports are already operational and additionally, the State's Port Policy has identified various new sites for development.

Given in the figure below is the list of all the existing 41 Ports in Gujarat (both operational and non-operational). This list does not include the upcoming ports which are in the development stage.

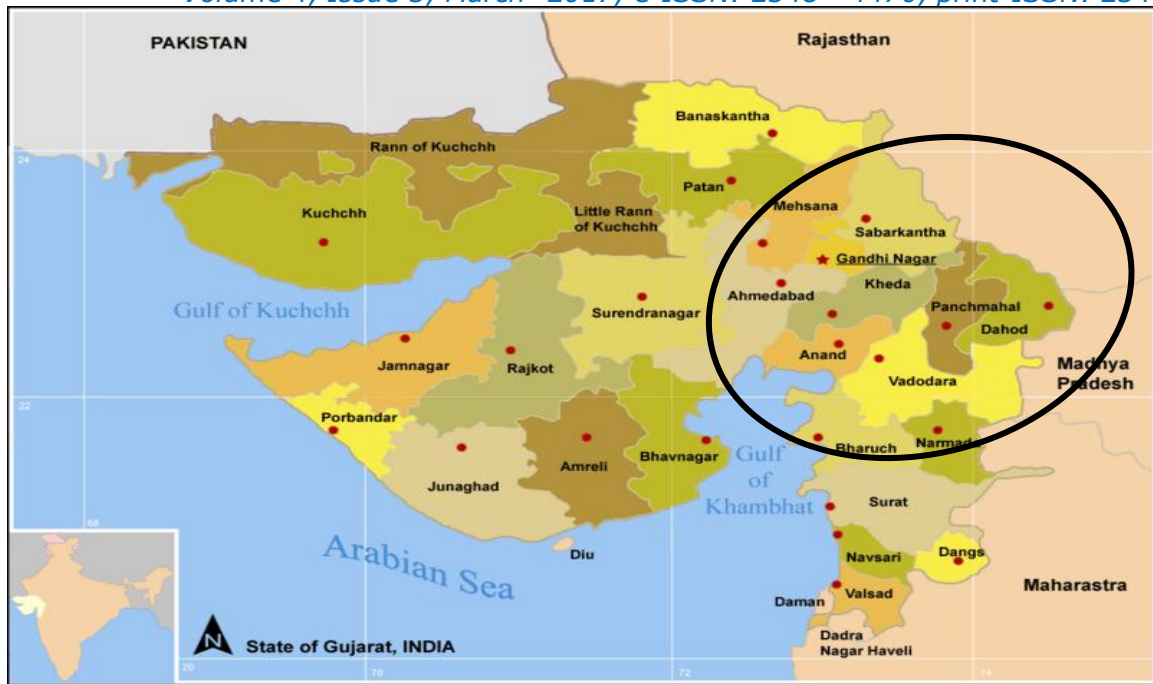


*Figure 2. Ports in Gujarat*

### 3.5 Identification of Hinterland

It is necessary to identify the hinterland that the Magdalla Port can be expected to serve. For this purpose, the entire hinterland can be divided into two parts:

- **Primary Hinterland** – approximately representing the region of 100Kms from the port in all directions. This denotes the region where, at least based on generalized costs, cargo can be expected to be captive in nature for the port to a large extent. However due to the existence of various other reasons, some specific cargo may not be captive for the port. For Surat, as given in the diagram below, primary hinterland consists of two major industrial clusters – Bharuch, Vapi.
- **Secondary Hinterland** – representing the region extending from the end of the identified boundaries of the primary hinterland which typically can be served by other ports in the vicinity as well. For Magdalla Port, secondary hinterland will consist of north Gujarat, South Gujarat and western Madhya Pradesh and North Maharashtra. Some parts of Saurashtra may also consider as part of this hinterland.



Figure

### 3.Hinterland of Magdalla, Surat

The proposed port is well connected by rail and road network to rest of country hence it is feasible to serve the hinterlands.

### 3.6Traffic Projection Summary

*Table 1. Potential cargo projection for new facilities in MMT*

Commodity	2020-25
Fertilizers	1.00
Cement & Clinker	1.0
Fruit, Vegetable and Food grains	0.10
Soya bin	0.50
Molasses	0.10
Sugar	0.10
Project cargo for heavy engineering	0.10
Cattle feed extraction	0.30
General cargo from local industries	0.20
Coal	5.00
Container Cargo	10000 TEU
TOTAL	8.40

The above table represents the cargo potential for new port facilities in the region. However, to realize the same potential, adequate infrastructure has to be developed.



**Table 2. Cargo Projection – Realistic**

Commodity	Cargo Projection in Million Tones
Fertilizers	0.5
Cement & Clinker	1
Fruit, Vegetable and Food grains	0.1
Soya bin	0.1
Sugar	0.05
Project cargo for heavy engineering	0.1
General cargo from local industries	0.25
Coal	2.1
Container Cargo	8,000 TEU
TOTAL	4.296

However potential for other cargos are not ruled out in future based on the development of the hinterland traffic and scenario.

#### IV. PORT PLANNING

For evaluation of the proposed infrastructure, the first step is to assess the facility requirements like berth length, cargo handling facilities, navigational and operational parameters etc.

The next step is to identify suitable location for the stock pile requirements, cargo transfer systems from storage area to berth area including the logistic systems.

##### 4.1 NAVIGATIONAL & OPERATIONAL REQUIREMENTS

- For planning the required facilities, it is essential to set the basic criteria like operational aspects to handle different type of vessels likely to call at the terminal for loading / unloading operations.
- Aspects such as : Vessel type and dimension – Ships/Self – Propeller Barges
- Operational criteria – In Planning Port facilities for handling different type of cargo, the operational criteria for ship/barges handling and ship to shore transfer
- Transshipment Operations- if demand for cargo is low vessels can unload using ships own cranes and once demand is increased than floating cranes will be considered for faster loading & unloading of vessels.
- In order to reduce huge capital cost of building deep water & direct berthing port infrastructure, it is planned to develop barge handling facilities for up to 2500DWT barges.
- The main export /import vessels will be handled in the deep sea at Hazira Port's anchorage point. The flat bottom barges with lesser draft requirements may be used at the proposed facilities.

**Table 3. Dimension of Anticipated Barges for Proposed Facility**

Barge Size	Length	Width	Loaded Draft
1500 to 2500 DWT	50 – 70 m	10 – 15 m	2.0 – 2.8 m



**Figure 4. Navigation Channel**

#### 4.2 BERTH REQUIREMENTS

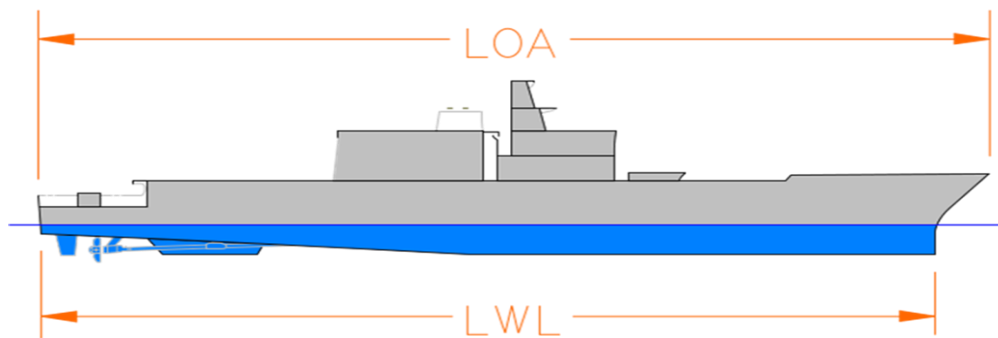
- Operation time - The proposed terminal will work seven days a week, which brings the effective number of working days to 350 days per year. It is further assumed that proposed facilities will work for 20 hours a day.
- Additional time is required for peripheral activities such as berthing and de-berthing of the barges, customs clearance, cargo surveys, waiting for clearance to sail, waiting at anchorage etc. activities are assumed to take, on an average, 3 hours per vessel call.
- It is estimated that 4 nos. of barge berths will be required to handle ultimate cargo projection of 4.3 Million tones.



*Figure 5. Self-Propelled Barge*

#### 4.3 BERTH PLANNING

- **Length of berths**– for 2500 DWT barges Length Overall (LOA) is 70m.
- As per BIS: 4651 (Part V) – 1980, for preliminary assessment, the length of the berth is recommended to be 10% more than the overall length of the largest vessel expected.
- **Turning Circle**- As per IS 4651 (Part V) – 1980, Where vessels turn by free interplay of the propeller and rudder assisted by tug, the minimum diameter of turning circle should be 1.70 length of largest vessel to be turned.



*Figure 6. Length of berth*

- The turning circle will have a diameter of 120 m with a depth of -3.2 m.
- **Width of Bulk Berth**- based on functional requirements of conveyors, loading equipment's & so total width 40m is provided.

#### 4.4 STORAGE AREA REQUIREMENTS

- The project is envisaged to handle 4.3 MMTPA of cargo.
- Proposed stockyard is considered to take care of uneven flow rate of incoming and outgoing cargo.
- Stockyard is proposed to be located behind of berthing facilities.
- Cargo is likely to be arrived by dumpers and trucks.
- Stock pile will generate with dozer & excavator.

#### 4.5 STORAGE AREA PLANNING

**Table 4. Storage Area Planning**

Coal	Coal will be stored in open in long stockpiles. Based on the cargo projection 50,000 Sq.m storage area is required.
Fertilizer, Agro, Soybean, Sugar	Commodities such as Fertilizer, Agro, Soybean and Sugar in bulk must be kept undercover. Dedicated warehouse (200m * 52m) will be used for storage of material.
Cement	This facility is for importing the cement ( steel silos 12m dia& 48m height) in small barges, storage and distribution nearby market (7000 Sq.m of land)

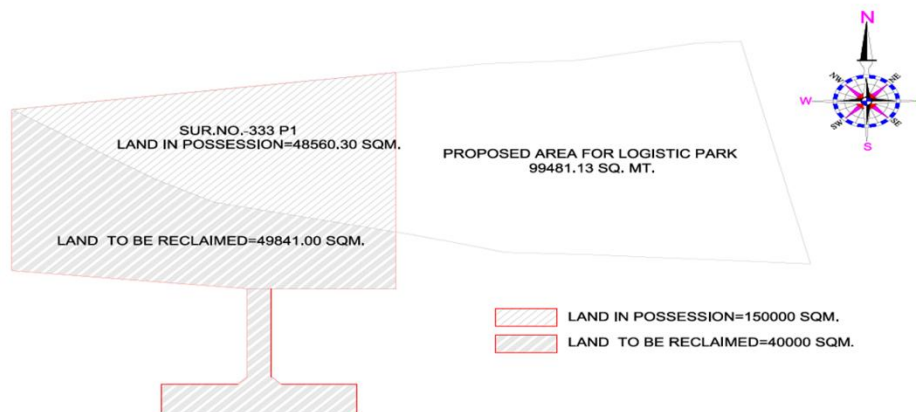
#### 4.6 EQUIPMENTS

- According to type of cargo different equipment will be used like for coal barge berth 2 unloaders with adequate rated capacity provided.
- Conveyor system shall have rated capacity of 1000MT/hour.
- The Unloaders & Conveyor system including transfer towers should be provided in which galleries should be lit and for inspection & maintenance purpose catwalks must be provided.
- For multipurpose berths mobile harbour cranes unloaders of rated capacity 1000MT/hour & it will also have attachments to carry dry bulk and containers.
- Other equipment like weigh bridge for trucks, Pay loaders, excavators, Bagging Machines, weighment systems etc. should be provided in numbers for Dry Bulk Yards.
- Mobile cranes for cargo, Forklifts for containers will be provided.

#### 4.7 TOTAL AREA AVAILABLE

**Table 5. Area Planning**

Type of Ownership Area	in Sq.m
Land in possession	48560.30
Land to be reclaimed	49841.00
Proposed Area for Logistics Park	99481.13



**Figure 6. Area of Possession**

#### 4.8 BATHYMETRY NEAR PROJECT SITE

- Location of berth and plot are shown.
- Berths shall be piled structures having total length 200 Meters.
- Berths shall be designed for handling 2 barges up to 2500 DWT.
- Fenders should be M type or as suitable.

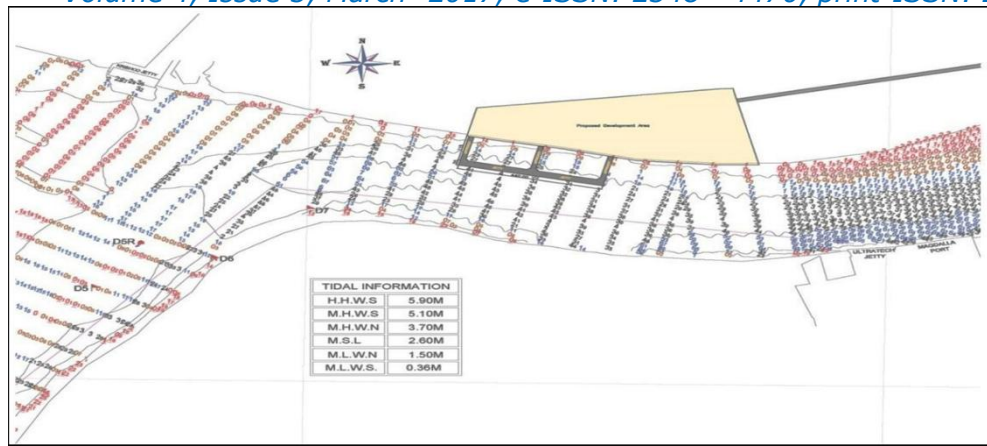


Figure 7. Bathymetry of Project Site

#### 4.9 DESIGN LOADS

- As per IS 4651 (Part IV), addition to dead loads and soil pressures, the other forces that can act upon maritime structures are those arising from natural phenomena such as winds, temperature variations, tides, currents, waves, earthquakes and those imposed by operational activities are berthing, mooring, storage and handling.
- Dead load of jetty structure –for Material Properties IS 875 (Part)
- Live load –Vertical Live Loads such as general cargo, bulk cargo, containers & loads from vehicular traffic etc.
- Crane loads -Concentrated loads from crane wheels and other specialized mechanical handling equipment.
- Special loads- like pipeline loads or conveyor loads or exceptional loads of heavy machinery.
- Berthing- loads are generated between the vessel and the berthing structure from the moment at which contact is first made until the vessel is finally brought to rest.
- Mooring loads- those loads imposed on a maritime structure by a vessel tied up alongside, both through contact between the vessel and its fendering system and through tension in mooring ropes.
- Earthquake Forces- Port Site falls in seismic zone III. The design forces are calculated according to IS 1893.
- Current Forces- Pressure due to current will be applied to the area of the vessel below the water line when fully loaded.
- Wind Forces- The design wind speed will be taken accordingly as per the IS- 875 (Part III).
- Temperature Variations- Load effects arising from thermal expansion or contraction of the structure.
- Combination of Loads, Forces & Stresses- As per IS: 4651 (Part IV) the load combinations must be taken as per type of loading (partial safety factors).

### V. LOGISTICS PARK

Logistics is the management of the flow of goods and other resources between the point of origin and the point of consumption in order to meet the requirements of consumers.

#### 5.1 BASIC REQUIREMENTS OF LOGISTICS PARK

- Land Area Requirement-** The proposed development at Magdalla has adequate land for development of Logistics Park. The logistics park will be expanded once the cargo is ramped up.
- Connectivity-** The key transport infrastructure required for moving goods from one place to another involve roads, rail, shipping and ports.
- Human Resource Availability-** The proposed facilities are located in the industrial belt of Surat/haziratherefore manpower will be available for logistics operations.

#### 5.2 FACILITIES WITHIN LOGISTICS PARK

- Transportation Facility-** Road , Water & Rail
- Warehousing Facility Storage-** Open storage area, customized warehouse, general warehouse etc.
- Support & Social Infrastructure Facilities**

#### 5.3 PLANNED FACILITIES WITHIN LOGISTICS PARK

- Port infrastructure



- Storage area
- Warehouses
- Spacious Layout with Green Belt.
- World Class Amenities.
- Good Drainage Sewerage Facilities.
- Integrated web based technology wherever possible.
- Token system for entry of the vehicles in the hub.
- State of the art monitoring Centre.
- Rain Water Harvesting System.
- All Concrete Roads.
- Parking facilities for about 600 + transport vehicles.
- Weigh bridge.
- Fuel pumps.
- Medical and Health Care Facilities.
- Offices for transporters.
- IT Integrated Customized Warehousing.
- Restrooms / Dormitory
- Computerized information system.

## **VI. INFRASTRUCTURE FACILITIES**

### **6.1 ROAD & RAIL LINK**

- Distance from Surat city to proposed site-25kms
- Railway Station – 1kms.

### **6.2 ELECTRIC POWER**

- Power requirement for Un Loaders, conveyors, other Plant and equipment at the Berths, Approach Bridge, Stack Yards, Administration/ operational / amenities buildings, Area Lighting, Pump Houses, Environment Protection and Dust prevention and suppression systems etc. is estimated to be about 25 MVA.

### **6.3 WATER**

- Total demand for water is estimated to be about 450 Kilo Liters per day.

### **6.4 STORM WATER DRAINAGE SYSTEM**

- General area drainage system shall be designed to harvest as much rain water as possible.
- Area drainage system shall be designed for sufficiently for flood and connect to natural streams in the vicinity of the Terminal.

### **6.5 SEWERAGE SYSTEM**

- The system would be sewer lines leading to Sewage Treatment Plant designed for treating water for recirculation for horticulture purposes.

### **6.6 COMMUNICATION**

- Provisions will be made in the civil works for the installation of fiber optic data and telephone cables.

### **6.7 FIRE FIGHTING SYSTEM**

- The system of fire lines and hydrants will be designed to ensure that adequate quantity of water is available at all times, at all areas of the facility where a potential fire hazard exists.

### **6.8 DUST SUPPRESSION SYSTEM**

- Dust suppression system will be provided at the stockpiles and the head ends of the conveyors at transfer points to control the dust generated during operations.

### **6.9 MAJOR BUILDINGS IN THE TERMINAL**

- Administration & Operations Building, Canteen, Locker Room, Time office and Medical Center, Gate House, Fire Stations, Main and Secondary Sub stations, Control Room.

### **6.10 ENVIRONMENT PROTECTION MEASURES**

- Environment protection measures, as recommended in the Environment Management Plan which is part of EIA shall be implemented.

#### **6.11 GREEN BELT**

- A green belt shall be developed around the periphery of the Terminal by dense plantation of suitable trees and bushes as required.

#### **6.12 DISASTER MANAGEMENT**

- Prior to commencement of Operations at the Terminal, a comprehensive Disaster Management Plan shall be prepared in consultation with other industrial units viz. Power Plants and District Officials.

### **VII. CONCLUSION**

In this research paper study was taken into account to identify the size of Logistics infrastructure facilities to handle the anticipated traffic in an efficient and cost effective way. The study reviews options for the development of cargo handling facilities using the available data. The development plan has been evolved taking into account the technical, economic and environmental aspects. There is a need of good infrastructure facilities to be provided at the proposed site for handling different commodities. Such activities and services at proposed location of Magdalla have the potential to generate large employment as also make industry competitive.

### **REFERENCES**

- [1] G.S DWARAKISH, A. M. "Review on the Role of Ports in the Development of a Nation. International Conference on Water Resources, Coastal and Ocean Engineering", Elsevier 2015
- [2] P. TANEJA, R. R, "Flexibility in Port Infrastructures", June 2012
- [3] <http://www.gmbports.org>
- [4] I.S 4651 (Part 4 ) : 1989 Planning and design of Ports & Harbour.