

# **OPERATIONAL DIFFICULTIES OF COASTAL CUM RIVER VESSELS AND ITS POTENTIAL**

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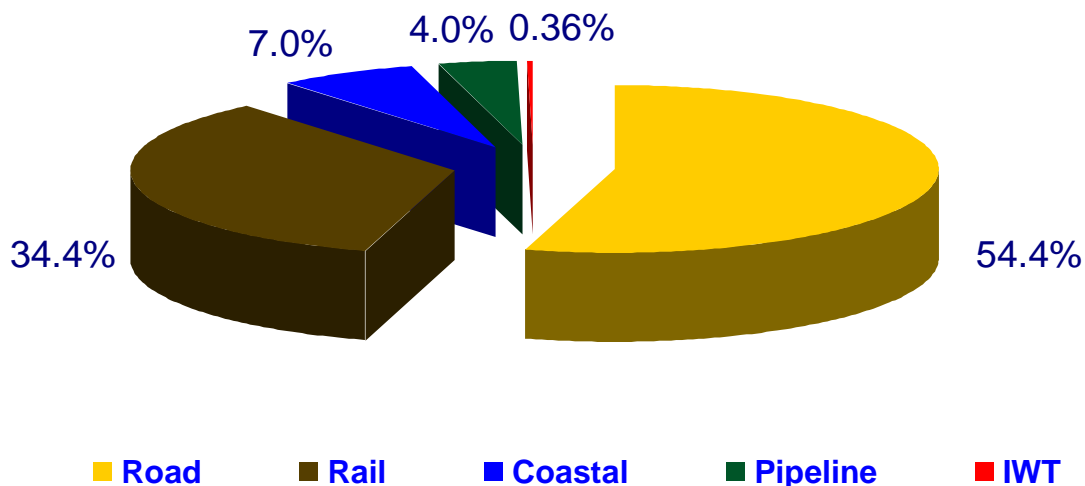
## **1. INTRODUCTION :**

Transportation through waterways both in Coastal or Inland has been universally accepted as the fuel efficient, environment friendly and economical than other two surface modes of transport i.e. rail and road. It is because of this inherent characteristic and advantages, both coastal shipping and Inland Water Transport have been playing vital role in the economy of any country where such facility exists. With this background most of the developed countries, have exploited this naturally gifted mode of transport to its full extent so as to derive the optimum benefit. Moreover, this mode of transport does not require huge investment as compared to rail and road transport for their development, maintenance and operation. Therefore, Govt of India is introducing a number of measures and promotional schemes for development of these sectors besides the seamless integration wherever such potential exists. The integration of both the sectors could be effectively exploited with the operation of suitable and optimum capacity of Coastal cum inland vessels, besides the development of the Inland Waterways and Coastal Shipping further. In this context, an attempt has been made in this paper to find out the potential area of operation, the possible cargo along with the difficulties during operation particularly in the inland waterways.

## **2. NEED FOR INTEGRATION :**

Despite of water transport being cheaper, its share in the total transportation scenario of the country is ironically only 7% in the case of coastal shipping and 0.17% for IWT (Figure 1). While these figures are compared with the developed countries India's position is quite abysmal and deplorable. Recently realizing the importance of water transport and its potential/suitable action plan and various schemes by the Govt are being introduced to increase the share of coastal shipping to 15% of the total cargo transportation of the country by 2015. There is also potential in IWT sector for its growth to increase the share upto 3% of the total transport of the country in near future with systematic and sustained development of the waterway systems. The achieving of the above increased share by both the sector could be translated into reality through an optimum inter-modal mix of various modes having lowest over all transport cost. In Indian scenario both the coastal shipping and Inland Water Transport can play a significant role to establish an efficient inter-modal mix to the total transport system of the country.

- Coastal sector has share of 7.0% and IWT 0.36% in Inland Transport Modal mix.
- Total Inland cargo transport 1000 btkm

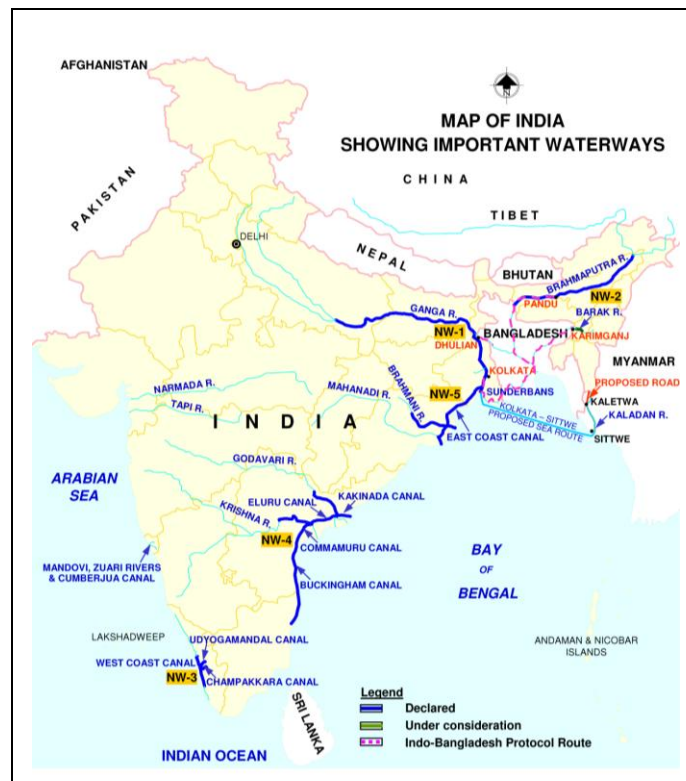


**Fig-1, Coastal Shipping & IWT scenario**

Due to the opening up of the Indian economy and its fast growth GDP, there has been an urgent need for efficient transport system in a large scale for movement of bulk goods for providing the infrastructure to the power sector, distribution of food grain, fertilizers, construction material, POL, ODC, etc. Rail and Road, modes are already over burdened, and congested. Their expansion requires huge capital investment, time, lot of land acquisition making it very often a difficult proposition. Hence, a need has arisen for the development as well as integration of both coastal shipping and inland water transport.

### 3. STATUS OF COASTAL SHIPPING AND INLAND WATERWAYS

India has total 7551 kms of coastline with 13 major ports trusts, approximately 200 no. minor ports controlled by Govt and private sector. On the other hand, 14500 kms of navigable waterways are available in the country for IWT. Out of which only 455 Kms has been considered and declared by Govt of India as National Waterways for their development leaving the balance waterways to the respective state Govts for their development and maintenance.



## **Fig-2, Important waterways of India**

The Ganga-Bhagirathi-hooghly river system for 1620 kms from Haldia to Allahabad is being developed as National Waterway No. 1. The Brahmaputra river system for 891 kms from Dhubri, at the international border with India and Bangladesh to Sadiya is the NW-2. NW-3 consist of West Coast Canal along with Champakara and Udyogmandal canal for 205 kms in Kerala. In the year 2008, two more waterways i.e. river Krishna, Godavari, Buckingham, Eluru – Kakinada canal system for 1095 kms from kakinda to Puducherry as NW-4 has been declared by the Govt. Similarly East Coast Canal in Orissa, Hijli tidal canal in West Bengal alongwith river Brahmani and Mahanadi river system for 623 kms has been declared as NW-5 in the same year. The Barak river for 121 kms in Assam is under active consideration of Govt for declaring as NW-6 .

Besides the above, the development and maintenance of Indian side of **“Indo Bangladesh Protocol Route”** for 172.5 kms in Sunderbans Delta of West Bengal has been taken up to promote inter-Govt Inland Water transport as well as to have passage to NE regions as per **Indo Bangladesh Protocol Treaty** existing between Govt of India and Bangladesh. Recently one prestigious project for development of an alternate transportation system to NE region consisting of coastal shipping, IWT and road sector namely **“Kaladan Multimodal transit transport and Project”** has been initiated to establish the linkage from Kolkata to Mizoram. This system will consist of 539 kms of Coastal shipping from Kolkata to Sitwae in Mynmar, 224 kms of inland waterways in Kaladan river and another 62 kms of road in Mynmar to have the access to NE Region through the state of Mizoram.

The Mandovi, Zuari river system developed and maintained by Goa State is the most vibrant and viable waterways in the country having annual movement of over 44 million tones of Iron ore. Similarly the Mumbai creek, the river Tapi in Gujarat are also important and significant.

#### **4. INFRASTRUCTURE ON THE NATIONAL WATERWAY**

4.1 Inland Waterways Authority of India (IWAI) a statutory body under Ministry of Shipping is responsible for the planning, development, maintenance and management of the national waterways for the purpose of shipping and navigation and promotion of Inland Water Transport in the country. Accordingly in phased manner, the development of first three NWs have been taken up for providing the required infrastructure and safe navigable channel. Balance two i.e. (NW-4 and NW-5) recently declared are to be taken up once the DPR of the same are approved by the Govt.

The success of the IWT being an economical and viable mode of transport depends on the four basic components i.e.

- i) safe navigable channel;
- ii) Navigational aids for day and night navigation;
- iii) Terminal facilities with requisite cargo handling equipment; and
- iv) Vessels .

While first three are developed through public fund, the operation of the vessels of fuel efficient and economic design are to be initiated primarily from private sector dictated by the market forces.

4.2 Navigable Channel : As a policy to operate the cargo vessels of minimum 500 tonnes capacity between Haldia to Allahabad in NW-1, it has been planned to provide LAD (Least Available Depth) of 2.0 mt in the entire stretch. However, at present, LAD of 2.0 m is available only upto Varanasi – Allahabad stretch 10 months a year. In the Varanasi – Allahabad stretch availability of LAD of 2.0 m is limited for 4 months during monsoon season. During rest of the period it is planned to provide atleast LAD of 1.5 mt In the Haldia – Farakka, stretch LAD of 3.0 m is being guaranteed for 9 months which may be extended upto Patna in near future atleast for 7 months, making the entire stretch of Haldia – Patna suitable for navigation of coastal-cum-river vessel in future for a considerable period in a year.

Similarly the LAD of 2.0 mt in other two waterways i.e. NW-2 and NW-3 is being provided for the considerable period in a phased manner. Various types of river conservancy work such as dredging, bandalling have been adopted to improve the water depth. The river training work in scientific manner and in a major scale are yet to be introduced due to the various factors.

4.3 Navigational aids : Besides the navigation aids for day navigation through suitable channel marking and signals, emphasis has been given to provide the night navigational aids with modern and reliable system in all three national waterways. The solar operated lights fitted on the FRP buoys have been installed and operated successfully in NW-3. The same system are to be provided in NW-1 and NW-2 by 2010. However, at present in the entire stretch of these waterways, the lights fitted on the country crafts have already been provided.

In addition to the above, the shore beacons at suitable interval have been planned to be provided in these waterways. The navigation through DGPS (Differential Global Positioning System) have already been introduced in NW-1 successfully, having one DGPS station at Bhagalpur. Within next three years similar stations are being planned to install at Katwa, Patna, varanasi in NW-1 to cover the entire stretch of NW-1 for navigation through DGPS system both during day and night with the help of the system already provided at Sagar Island by DGLL (Directorate General Light House and Light Ships). Operation of DGPS system at Jogighopa on NW-2 presently under installation is expected to be operational by end of December, 2009. Two more systems at Tejpur and Sadiya are planned within next three years so as to cover entire stretch of NW-2 as well. The DGPS system provided by DGLL at Cochin Port Trust can be used for navigation in NW-3 alongwith its night navigation system with lights on FRP buoys.

4.4 Terminal Facilities : In consideration to the unique characteristic of NW-1 and NW-2 being subjected to increase of water level during monsoon period and considerable fall during lean season associated with the shifting of the channel, the terminals of both floating and fixed types are being provided. While floating

terminals have been constructed and maintained at a number of locations in both waterways fixed one with RCC for catering to the vessels of different size, type and their operation throughout the year have been provided only at few places i.e. Patna, Pakur and Farakka in NW-1 and Pandu in NW-2. Fixed terminal for handling in future the cargo like containers, bulk cargo and POL are being planned/installed at Haldia, Kukrahati, Kolkata, Varanasi and Allhabad in NW-1. One high level jetty at Patna for operation during monsoon is under construction. On NW-2, one high level fixed jetty at Pandu is also under construction while another fixed jetty at Jogighopa for handling coal and POL has been planned. In NW-3, already seven fixed terminal of RCC are under operation at various locations like (i)Kottapuram, (ii)Alluva (iii) Maradu, (iv)Vakom, (v)Thaneermukkom, (vi)Trikunnapuzha, (vii)Kayamkulam. One container handling terminal at Kollam is under construction and another one at Kakkanad is on the anvil besides at Allapuzha and Chavra for general cargo. The cargo handling equipment have been provided and there is also scope for the operators/shipper to have their own equipment.



**Fig-3, IWT terminal at Patna, NW-1**



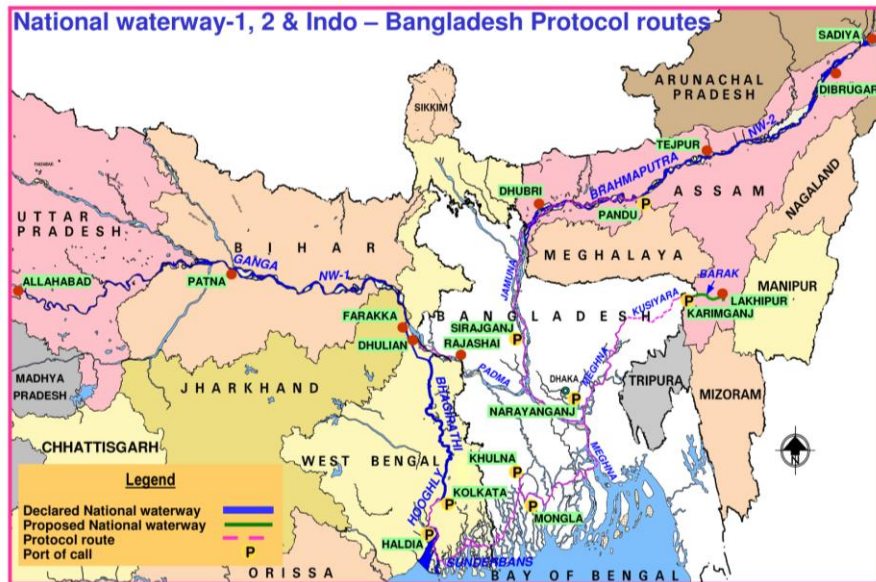
**Fig-4, IWT terminal at Pandu, NW-2**

4.5 River Charts & Atlas: In addition to the modern navigation aid, the navigation charts and atlas for all the three NWs and Sunderbans Waterways have been published. Shortly the river pilots with direction to navigation for all waterways will be published to make river navigation more safe and efficient. The rules on safety of

navigation and shipping as well as prevention of collision on National Waterways have also been enacted and notified.

**5. POTENTIAL WATERWAYS/STRETCHES FOR COSTAL-CUM-RIVER VESSEL :**

Due to the availability of water depth above 3 mt for a period of 9 months in Haldia - Farakka stretch of NW-1 which is planned to extend upto Patna in near future for atleast 7 months in a year these stretches are considered to be most potential for operation of coastal cum inland vessels with 2.5 m to 2.8 m draft having carrying capacity of 2500 to 3000 tonnes. The CR vessel may also operate upto Guwahati on NW-2 for a limited period during monsoon season through Indo-Bangladesh Protocol Route in Bangladesh. The other destination which can be considered for operation of CR vessels through Indo-Bangladesh Protocol route are Kachhar, Badarpur and Karimganj in Tripura during June to October in a year. In NW-3 (Kerala) the potential stretch is only for few km from Kochi (CPT) to Udyogmandal to cater the need of transportation of salt, coal, sulphur, zink and fertilizers for the industries located on the bank of Udyogmandal canal. Other potential waterways are the Goa waterways, the Mumbai creeks, the river Tapi up to Surat.



**Fig-5, National Waterway -1, 2 & Indo-Bangladesh protocol route**



## 6. POTENTIAL CARGO

The cargo usually transported through Coastal shipping i.e. coal, ore, steel, fertilizers, food grains, cement. General goods etc can be the potential cargo for coastal-cum-inland vessel. However, traffic for such cargo for different sectors may be different and for an assessment in this regard it needs a comprehensive study. Due to the location of a number of thermal power plants on the river front of the Ganges & the Brahmaputra river systems, the coal is considered to be most potential cargo. As per the recent preliminary studies, it is revealed that approx. 10 Nos Thermal power station (TPS)/Super Thermal Power Stations (STPS) are located on NW-1 owned by State Electricity Boards, NTPC and private sector. Ten more TPS/STPS on NW-1 are under various stages of construction for capacity expansion of the existing one as well as new stations. Some more STPS are also in planning stage in the private sector being the prominent ones are of M/S. Reliance Industries and M/S. J..P. Industries. All these, TPS/STPS are in West Bengal, Jharkhand, Bihar and U.P. in the vicinity of NW-1 with details as in Table I & II

Sr. #	Name of Thermal Power Station (TPS)	Installed Capacity (MW)	Owned by
West Bengal			
1	Bandel TPS	535 MW	WBPDCCL
2	Kolagahat TPS	1260 MW	WBPDCCL
3	Sagardighi TPS	600 MW	WBSEB
4	Budge Budge TPS	500 MW	CESC
5	New Cossipore TPS	130 MW	CESC
6	Southern Repl. TPS	130 MW	CESC
7	Farakka STPS	1600 MW	NTPC
Bihar			
8	Barauni TPS	310 MW	BSEB
9	Kahalgaon STPS	1840 MW	NTPC
10	Muzaffarpur TPS	220 MW	BSEB

**Table-1, Existing Thermal Power Plants**

Sr. #	Name of Thermal Power Station (TPS)	Proposed Capacity (MW)	Owned by
1	Kahalgaoon II	500 MW	NTPC
2	Barh I	1980 MW	NTPC
3	Farakka III	500 MW	NTPC
4	Barh II	1320 MW	NTPC
5	Barauni TPS (Extension)	500 MW	BSEB
6	Muzaffarpur TPS (Extension)	250 MW	BSEB
7	Chausa (Buxar) TPS	1320 MW	BSEB
8	Kajra (Lakhiserai) TPS	1320 MW	BSEB
9	Pirpainti (Bhagalpur) TPS	1320 MW	Nalanda Power Company Ltd.
10	NTPC-UP JV (Meja) TPS	2640 MW	
11	Budge Budge TPS (Extension) Unit 3	250 MW	CESC

**Table-2, Proposed Thermal Power Plants**

The requirement of coal for the operation of the existing TPS are to the tune of 7 MMtonnes and same are supplied partly from indigenous coal field located at Rajmahal/Santhaldihi in Jharkhand and balance from Talcher in Orissa. Once the TPS/STPS under construction become operational, the requirement will increase to manifold and annual requirement may be over 15 MMT per annum.

The sulphur content in the Indian Coal being higher and not suitable for the efficiency of the existing as well as the new plants, there has been heavy demand for imported coal with lower percentage of sulphur from Australia and Indonesia. The demand of imported coal is also roughly estimated to be over 12 MMT/annum which are to be transported from the ports like Paradip, Haldia and Vizag either by road or rail. Since both Rail and Road mode in this sector has already been congested, necessity for its transportation through inland waterways have been seriously felt. IWAI has already initiated to translate above venture of transporting imported as well as indigenous coal through NW-1 to cater to the need of power,

industries. IWAI has already entered into an MoU with NTPC for coal movement in the waterways and accordingly action being initiated. . Coastal cum river vessel alongwith Inland Vessel may play significant role to make the above project a grand success

The coal from Talcher after transportation to Paradip by rail/road mode can be delivered to some of the TPS located on NW-1 and Indian coasts through CRV. Similarly the coal from Rajmahal after being loaded at suitable location on NW-1 can be transported to various other destinations located on the coast.

## **7. FACTORS ON THE CONSTRUCTION AND OPERATION OF ECONOMICAL VESSELS**

The available water depth in the waterways during lean season is inadequate for designing an economical vessel having sufficient carrying capacity as well as to meet the requirement of classification society with respect to structural strength and Mercantile Marine Department (MMD) with respect to statutory safety requirement for operation in coastal waterways.

Recently D.G. Shipping vide the notification No. 6/C5-5(1)/2009 dated 10.7.2008 has amended the M.S. Act with the exemption of certain provisions on construction and operation of Coastal cum river vessel. While the above notification takes care on the statutory aspects with regard to safety construction, safety equipment, survey and certification, the structural strength as required to be constructed under the provision of the rule and regulations of classification society remain without any major change. As a result, it has been one of the major impediment to compromise in the scantling of the vessel vis-à-vis the cargo carrying capacity. This is quite important in the context of inadequate water depth in the waterways maintaining minimum draft for operation of an economically design vessel to be able to operate both in river as well as coastal waterways, satisfying to the provisions of all the regulatory as well as classification society.

Besides the above, the following factors are also equally important for optimum design :

- i) Width of the waterways
- ii) Low navigational clearance (both horizontal and vertical)
- iii) Existing of small size locks
- iv) Sharp river bends.
- v) Non availability of suitable terminal/ jetty.

The breadth of the waterways similar to water depths also restrict in the economical size of the vessel. At the same time, less breadth of the channel may seriously affect in providing the suitable turning circle for the vessel throughout the year.

Although IWAI has classified the Indian Waterways and accordingly made it mandatory for maintaining the minimum navigation clearances for the permanent structures/bridges over the waterways, the existing structures over many navigable waterways restrict the movement of vessels with higher draft. As per requirement of Class IV waterways, NW-1 should have minimum vertical clearance and horizontal clearance of 10 m and 100 m respectively. But the existing bridges at Ravindra setu and Bally bridge at Howrah have navigation clearances of only 9.5 and 8.5 m respectively. Similarly in NW-3 these clearances are extremely less. Therefore, designer may find difficulties in designing the CRV for suitable accommodation and operation of the vessel without ballast while operating without cargo.

Both the national waterways No-1 &2 being are meandering rivers, numbers of critical bends in the navigational channels are available. These bends influence the size of the vessel particularly its length for proper negotiation. Although the existing locks at Farakka constructed by Farakka Barrage Authority on NW-1 is comparatively higher for accommodating the suitable size of CRV, the locks at NW-3 and other waterways have serious problems. Suitable terminal jetty with the

required facilities are yet to be developed. However, this may be taken care of once the cargo movement with alternative arrangement.

The economy in operation of the vessel very often depends on the manning strength. As per the requirement of Type III and IV CRV, notified by D.G.Shipping in this regard, in comparison to Inland vessel it is considered to be on higher side. Similarly their wages being at par with the international shipping standard, it may not also be conducive towards the economical operation of CRV both for coastal as well as inland trade.

### **CASE STUDY**

In order to construct one CR Vessel on prototype basis for operation between Paradip port to Farakka on NW-1, a Committee under the Chairmanship of Nautical Adviser D.G. Shipping has recommended the broad parameters and specifications of the vessel. Based on the same, recently M/S. Cochin Shipyard through the Department of Ship Building Technology, Cochin University Science and Technology (CUSAT) as the Consultant has developed the preliminary design of the vessel. The principal dimension and other particulars are :

#### **Main Particulars**

Length Overall	100.50m
Length B.P.	95.0 m
Breadth mld	10.6 m
Depth mld.	4.4 m
Draft max.	2.8 m
Service Speed	9 knots

#### **Displacement and Deadweight**

Displacement at 2.8 m draft	: 3575 t
Deadweight (approx.)	: 2275 t
<b>Light Ship Weight</b>	<b>: 1300t</b>

**Hull Form** : Round bilge form with transom stern normal raked bow.

**Classification** : The vessel will be design and constructed under IRS class

**Powering :** Due to shallow draft the vessel will be twin screw powered by 2 diesel engines of approx. 310 KW MCR.

**Propellers; Steerable Rudder propellers 2 Nos :**

**Deck House :** A 3 tier deckhouse consisting of Main deck, A deck and navigation bridge deck is proposed located above the engine room. Accommodation is provided for total complement of 20 including owner and pilot with detail as follows :

### **Manning**

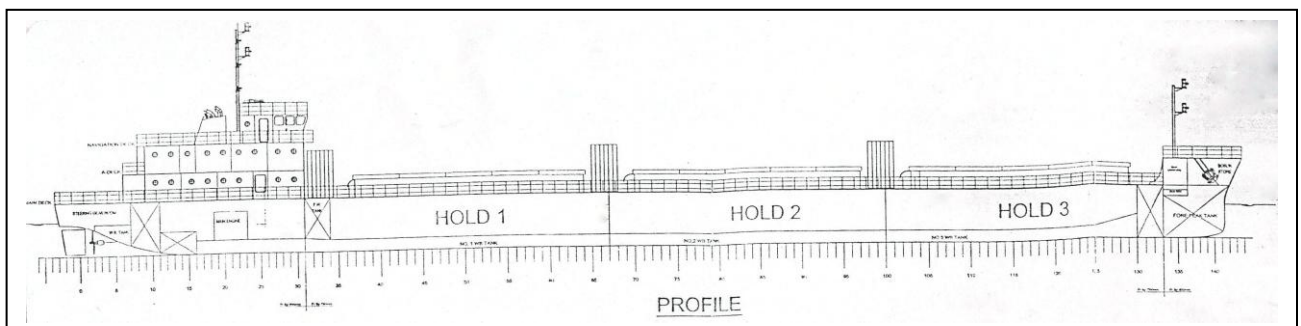
#### Deck :

Master	1 No.
Pilot when required	1 No.
1 <sup>st</sup> Navigation Watch	1 No.
2 <sup>nd</sup> Navigation Watch	1 No.
Cook	1 No.
Steward	1 Nos.
Ratings	4 Nos

#### Engine Room

Chief Engineer	1 No.
1 <sup>st</sup> Engine Watch	1 No.
2 <sup>nd</sup> Engine Watch	1 No.
Ratings	6 Nos.
Total	19 Nos.

**Bow Thruster :** It is proposed to provide a bow thruster to increase the maneuverability of the vessel while negotiating bends in rivers and passing between the piers of bridge.



### **Fig-6, Profile of the prototype coastal cum river vessel**

Examining the above particulars, it is observed in prima facie that the vessel may find difficult to operate in NW-1 during lean season on account of :-

- i. higher draft
- ii smaller turning circle
- iii negotiating the sharp bends.
- iv higher air draft
- v less keel clearance in the critical shoals and thereby less propulsion efficiency.

The carrying capacity is extremely less in comparison to the tug barge floatilla which can even carry more than 3000 Tonne with same size ,power & comparatively less investment.

All the above require critical examination for improving the design to make it economically viable.

## **8. CONCLUSION**

There is potential for integration of coastal shipping with Inland water Transport and thereby to enhance its share in the total transport system of the country. The seamless integration of the coastal shipping and inland water transport can be effective only when the vessels can operate in both the sectors economically. The availability of inadequate water depth in the inland waterways may have certain disadvantages for design and construction for an optimum designed vessel. But it is expected that with further development of the water ways and relaxation in the requirement of coastal shipping for operation in the coastal waterways along with same gesture by the classification society considering limited operation of the vessel in coastal waterways maintaining a balance with respect to safety and economy, perhaps there may be ample opportunity for success of CRV.

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