Proposal For

DEMONSATATION OF DRAGFLOW DREDGER SILT TRAP & SHOAL DREDGING

Coordinator: Prof. R. SUNDARAVADIVELU. F.N.A.E

Prof.K.MURALI

DEPARTMENT OF OCEAN ENGINEERING

INDIAN INSTITUTE OF TECHNOLOGY MADRAS

CHENNAI – 600036

1.0 INTRODUCTION:

Dredging can be termed as an activity usually carried out underwater, in shallow seas or freshwater areas for the purpose of excavating bottom sediments and disposing of them at a different location. This technique is often used to keep waterways navigable. It is also used as a way to replenish sand on beaches, where sand had been lost due to coastal erosion.

Dragflow dredger is a type of hydraulic dredger specifically designed and built to work in harsh (river mouth, estuary) conditions where normal conventional dredger cannot operate effectively. The advanced design, which includes agitators, hydraulic cutters and pressure compensation equipment, allows for high-efficiency dredging. Further, the dragflow agitator and pump combiation enables to rise and convey liquids and mixtures such as mud, slime, silt, sand and gravel; can handle mixtures with large size solids up to about 120mm. However, dragflow dredgers are of recent origin and so the technology is not prevalent. Besides, the cost is prohibitive compared to the conventional dredgers already in use, could be due to the import content.

2.0 DRAGFLOW DREDGER

The main purpose of this proposal is to undertake a systematic scientific investigation on a dragflow dredger by indigenously building a prototype, put it to use in selected sites and study its performance, thereby gaining technical knowhow on building and operating such dredgers.

1. Conventional dredgers

   Presently, Conventional dredgers such as Cutter Suction Dredger (CSD), Trailing Suction Hopper Dredger (TSHD), Grab Bucket Dredger (GBD) are used for dredging. TSHD can be used for water depths more than 6 m, however not effective in lower depths. CSD are not stable in river mouth or estuary and so the operation is time consuming and expensive. GBD have limited flexibility.

2. Dragflow dredger

   Dragflow dredger consists of a pontoon on which equipment are mounted. A special slurry/solid handling pump is suspended into water using winch and pulleys or hydraulic/mechanical boom. The pontoon is kept in position by 4 spud jack up

arrangement. The pontoon is kept raised above water level to a required height such that waves do not impact the functioning and stability. Electric power for opearting the equipment is provided by an onboard diesel engine driven generator or can be drawn from shore based source. A typical dragflow dredger is shown in Fig.1.

The pump is placed suitably at the location of dredging. The pump and agitator combination breaks/stirrs up solid particles, sucks the resultant slurry and transports it to the desired location. The main advantage is by laying required length of pipeline, the dredged material can be dumped at the desired location without moving the dredger. This type of dredger has been found to be very useful in applications such as filling of geo tube. Fig.2 shows a geo tube being filled by dredged slurry. Nevertheless, the dragflow dredger is yet to be demonstrated in the field.

Further, the expected cost of dreding usuing dragflow dredger is about Rs.150/- per cubic metre compared to Rs.300 to Rs.400 by using conventional dredgers.

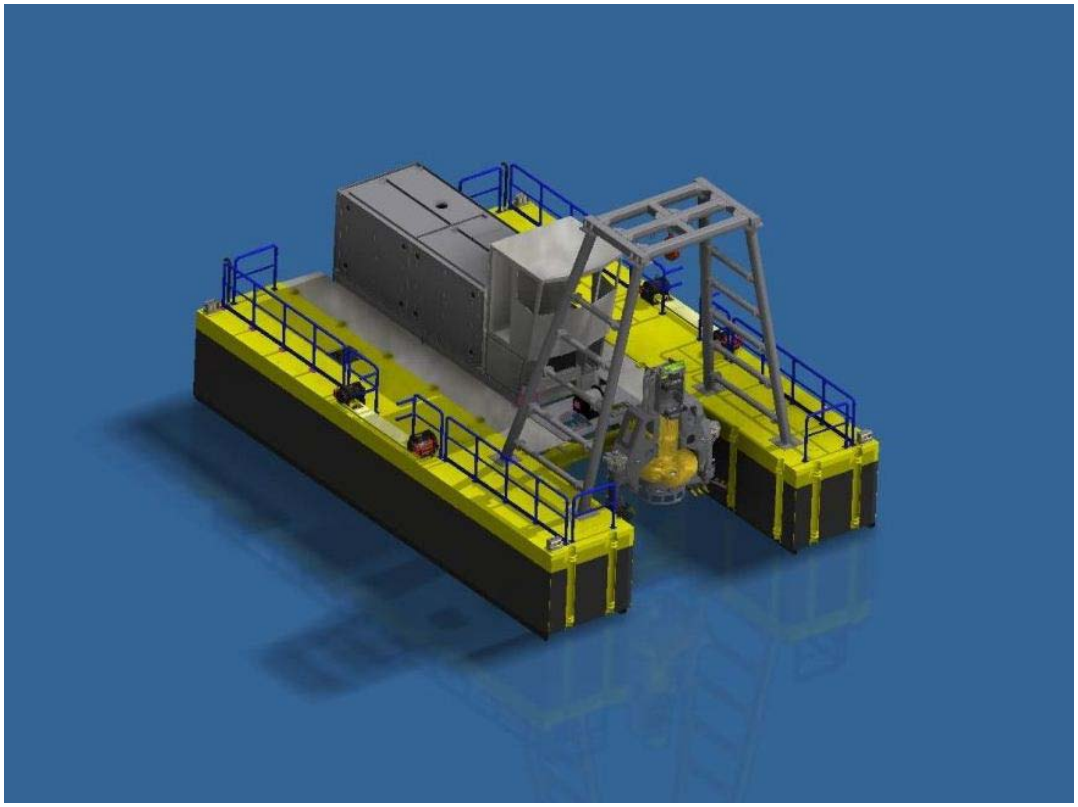

Figure 1: Dragflow Dredger

Figure 2: Geo-tube filling using drag pump

3.0 DEVELOPMENT OF TECHNOLOGY AND DEMONSTRATING DRAGFLOW DREDGER

In order to create a knowhow of technology for dragflow dredger, it is proposed to undertake the design of a prototype dredger inhouse considering various requirements specific to Indian conditions. The prototype dredger of 120HP capacity, capable of 480m3/h slurry discharge can be taken up for design. As a next step, such a prototype would be fabricated and assembled to the specifications derived from the design. These activities are expected to provide opportunities for development and assimilation of relevant technology. Design and fabrication of such prototype dredger is expected to cost about Rs. 5 Crores; a break up of cost is given in Annexure.

The next phase of activities would be to deploy the dredger at suitable location/s and monitor its performance. For this purpose, five different sites/locations have been selected such that each of them is unique and dredging is necessary. The cost of dredging at some pilot locations is estimated to be about Rs. 3.5 Crores. Some potential locations identified are described below:

i) Haldi river confluence, HALDA.

The Kolkata Port Trust and especially Haldia Dock Complex (HDC) have been facing siltation issues over the past several years. The Jellingham shoal, which is like door step of HDC, continuously faces sudden shoaling at a few points on the navigational channel. Right now, the

Jellingham shoal appears to be in a dynamic equilibrium as depths appear to be oscillating at about 3.7-4.1m at the shoal (Fig.3). However, there is frequent encroachment from the east due to the slowing of currents adjacent to the western banks of Nayachara and from the west due to the influx of sediments from the Haldi river. It has been observed in the past that the influence of Haldi river influx is much greater on the shoal formation over upper Jellingham. Moreover, the confluence area of Haldi river itself sometimes shows rapid encroachment from the west. In order to maintain the minimum required draft, the authorities of KoPT has been continuously exploring new techniques by improving the dredging methods and in discharging the dredged spoil. In this connections, KoPT will be creating a silt trap as per recommendations of IITM. The silt trap and Haldi confluence are very good locations for demonstration of drag flow dredger.

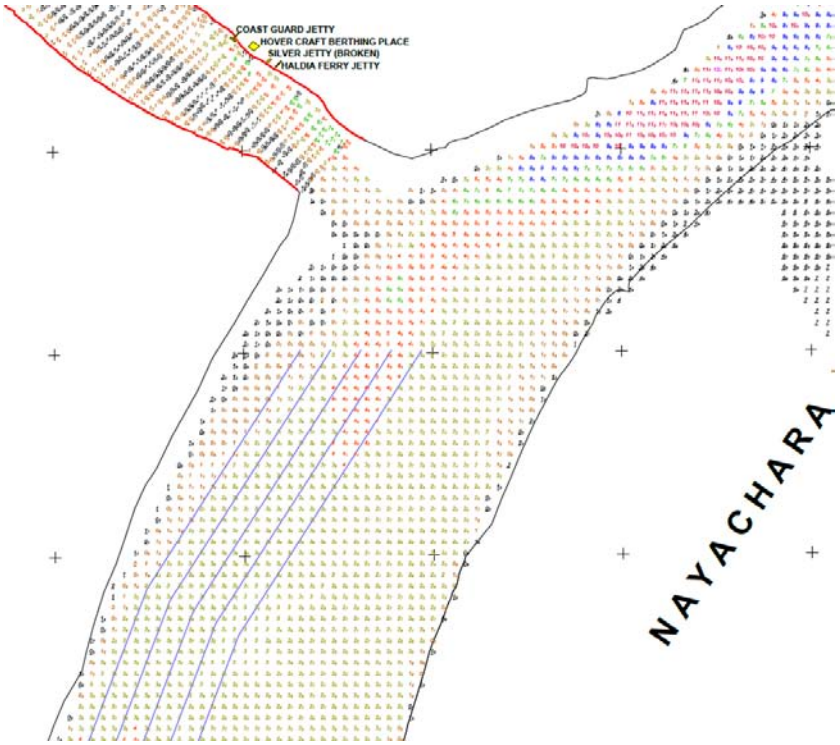

Fig.3 Bathymetry of Haldi Confluence, Dec 2015-May 2016.

ii) Dhaudia (Mangala) River

The Dhaudia river mouth, South of Puri in Orissa, is blocked by sediments moving from SW to NE during April to August. This leads to formation of sand bar preventing natural movement of sediments during the NE monsoon months August. Due to depletion of natural supply of sediments the sand in the Puri beach is scoured resulting

in beach erosion. To mitigate the scouing of Puri beach, the sand bar is dredged and the scoured beach is replenished with the dredged material. Service of dragflow dredger is expected to be very useful here.

Figure 3: Dhaudia river mouth

Total project period: 3 Years

DREDGER- Construction consists of 3 pontoon, 4 hydraulic operating spuds arrangements, 3 electrically operated winches and electrically or hydraulic operating DRAGFLOW PUMP. The construction cost of dredger is about Rs. 5.0 crores.

Specifications and Cost:

Pumping system rating	:	120HP
Slurry output	:	480 m^3per hour.
Discharge solid	:	70 m^3per hour
Working hrs a day	:	20 hrs
Out turn per day	:	1400 m^3.
Expected dredging cost	:	Rs.150/m^3

Responsibilities of IITM:

The duties and responsibilities during Project execution in brief are as follows:

a. Design of dredger and supervision of construction
b. Conducting Pre- dredged survey and post dredged survey for determining dredged quantity using suitable survey methods.
c. Supervise works and to approve the workmanship of the works.
d. Review and ensure that the work is carried out in accordance with the Specification and Standards and Good Industry practice and as per time schedule and adopt measures to bring it back to the original scheduled date of completion if delayed.
e. Identify delays in completion and recommend the remedial measures to expedite the progress.
f. Review the safety measures provided.
g. Issue the Completion Certificate, in accordance with the provisions of the Contract.
h. Determine and recommend changes to the Project Completion Schedule and Schedule Project Completion Date.
i. Check and certify all requests for advances, all monthly bills and interim bills, escalation bills excess/extra/substitute items of work and final bill of the contractor. (Note: Measurement and preparation of bills for these works shall be done by Water Resource Department).
j. Scrutinize and advise Employer upon the claims raised by the contractor if any.

4. Personnel

a) The service shall be carried out by the personnel specified below hereof (hereinafter called the Personnel) for the respective expertise indicated therein.

SI. No.	Designation and Task Assignment	Number of personnel
1.	Team Leader (Port Engineer)	1
2.	Senior Project Advisor (Design of Port & Harbor structures)	1
3.	Project Associate (Construction Associate)	5

4.	Project Technician (Construction Associate)	2

5. Payments

An estimate of the cost of the Services payable is set forth in hereunder:

Sl.No	Description	Man Visit	Man months	Rate per month/man visit in Rs. Lakhs	Amount in Rs. Lakhs
1	Team Leader	36x1		0.50	18.00
2	Sr.Project Advisor twice in a month	36x2		0.25	18.00
3	Resident Project Engineer		36x5	0.40	72.00
4	Office expenses		36	0.30	10.80
5	Travel expenses and boarding charges of Project Engineers to their office one person once in 3 months (to and from and lodging expenses)		30	0.35	10.50
6	Visit cost for Monthly visit by Team Leader/Faculty and One Senior Project Advisor to conduct review meeting	36		0.30	10.80

Total: Rs. 140.1 lakhs for 36 months.

The **total remuneration shall be Rs.140.1 lakh including Service Tax @ 15.00** ***(Rupees one hundred and fourty Lakhs and ten Thousand Only)*** for the project duration of 36 months comprising of project management period inclusive of travel and other expenses. The fabrication cost of dredger is estimated to be 5crores and the dredging cost Rs. 3.5crores.