Special Dredging Equipment, a special position within IHC

When you think of IHC and dredging, usually the first things that come to mind are jumbo trailing suction hopper dredgers, (self-propelled) cutter suction dredgers and wheel suction dredgers. Evidently, the bigger custom-built dredgers grab the headlines. Yet there is a huge market for other, specialised dredging equipment, such as mechanical dredgers, combinations of different types of dredgers (combi-dredgers) and ancillary equipment. Within IHC we refer to it as Special Dredging Equipment and IHC Engineering & Renovation (E&R) gets the job.

Background

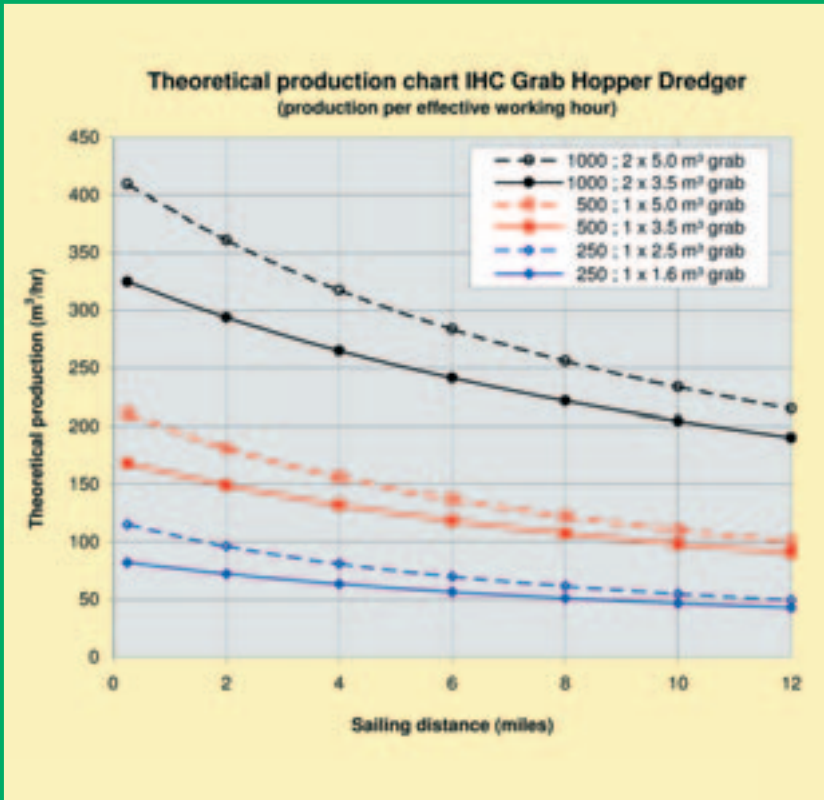
Special Dredging Equipment is one of the four main activities of E&R. The other activities are; basic engineering and feasibility studies, renovation work and new-building in cooperation with local shipyards.
Special Dredging Equipment's projects are often carried out in cooperation with third parties and the choice of shipyard tends to be crucial in winning an order. Although the prices of Special Dredging Equipment are under pressure, the budget is not the only beacon to steer by. Specifications, delivery time and the equipment's complexity are equally important in the choice of partner.

Over the past decades IHC E&R has delivered on a turn-key basis a range of split-hopper barges (non-propelled and self-propelled, seagoing and for inland waterway use) to various customers, as well as the grab hopper dredger/buoy tender SAMO to Gambia's harbour authority. More recently, the DIYA KOWULLA grab hopper was built and delivered to the Sri Lanka Ports Authority. The most recent order for Special Dredging Equipment, a crane unit for DRAPOR, the port authority of Morocco, will have arrived in the harbour of Casablanca by the time this article is published.

Expanding business

Two years ago, as business increased, E&R established Special Dredging Equipment as a dedicated division for the management of these orders.
Special Dredging Equipment's tasks are:
- consultancy
- naval architecture and design of dredging equipment in this field

Figure 1



Theoretical production chart

The theoretical production chart is based on the following dredging cycle:
- Filling the hopper by means of the dredge crane at maximum dredging depth, with free running sand, without any delay to shift the vessel (efficiency factor = 1)
- Sailing to the dump area, at a specified distance at maximum speed
- Dumping the hopper load via the bottom doors
- Returning to the dredging site at maximum speed

Other assumptions:
- Grab filling factor = 1
- Specific gravity of the spoil = 1.7 ton/m³
- Mean angle of swing of grab crane = 90 °

Figure 2

Principal characteristics

Type	250	500	1000	
Length overall	39.00	48.40	64.40	m
Length between perpendiculars	36.40	45.60	60.50	m
Breadth, moulded	10.60	11.80	13.60	m
Depth, moulded	3.25	3.95	5.00	m
Draught (International Freeboard)	2.80	3.30	4.10	m
Hopper capacity	250	500	1,000	m^3
Spoil loading capacity (basic designs)	425	850	1,700	tons
Deadweight (basic designs)	485	935	1,870	tons
Number of grab cranes	1	1	2	
Basic grab crane capacity (nominal grab size for heavy spoil)	1.6	3.5	3.5	m^3
Increased grab crane capacity (nominal grab size for heavy spoil)	2.5	5.0	5.0	m^3
Dredging depth below light waterline	15	16	18	m
Propulsion power	1 x 339	1 x 638	2 x 638	kW
Trial speed at maximum draught	8.4	9.2	10.8	knots
Accommodation	9	10	12	persons

- technical support
- centre of knowledge
- Develop design series for various equipment types in which the design philosophy and technology of IHC are incorporated.

Special Dredging Equipment concentrates mainly on grab hopper dredgers, hopper barges in different configurations, backhoe dredgers and clamshell dredgers, although booster units, crawl cats, crane pontoons and a split barge with grab crane have recently been offered as well, all on a turn-key basis.

The entire series of designs is described in specification sheets, which include:
- The main features of the basic designs, including theoretical performance curves to serve as a selection tool.
- Options and their consequences
- Possibilities for customising the basic designs

A series of grab hopper dredgers with 250m^3, 500m^3 and 1,000m^3 hopper capacities has already been designed, but we should stress that developing such series does not mean that IHC is "standardising" or will be limited to the capacities mentioned.
The series data will be used both for creating new, custom-built designs and as basis for design tools/computer modelling to find optimum sizes for given dredging equipment.
For customers, this means that we can easily advise which size of grab hopper dredger fits their specific job best.

Figure 3

Calculation model

Required production volume		150,000 m^3/year
Effective working hours per year excluding time for repair and maintenance 40 (weeks) x 5 (days a week) x 8 (hours a day)	=	1,600 hours/year
Downtime for shifting the vessel during dredging		20%
Net effective working hours per year 1,600/(1 – 0.20)	=	1,280 hours/year
Required production per hour 150,000/1,280	=	117 m^3/hour
Expected grab filling factor		0.9
Required theoretical production per hour **117/0.9**	=	**130 m^3/hour**

Selection tool

The theoretical production chart as displayed in figure 1 is based on the principle characteristics outlined in figure 2, for the basic grab crane capacities and the increased grab crane capacities. The production chart can assist in the selection of a grab hopper dredger of a suitable size for a required production volume.

Figure 3 shows a calculation model of a realtime situation.

For this required theoretical production and a mean sailing distance of 4 miles, IHC E&R would recommend a grab hopper dredger with a hopper capacity of 500m^3, equipped with a 3.5m^3 grab and a suitable grab crane (see figure 1).

For the same production and a sailing distance of 7 miles, the same grab hopper dredger is recommended, however provided with a 5.0m^3 grab.
If the point in the chart lies far apart from the curves, IHC E&R has the tools to select a suitable combination of hopper capacity and grab size and will be glad to advise.

Grab crane during dredging trials

The 2m³ grab during dredging trials

Wheelhouse

Recently delivered

DIYA KOWULLA

Recently a 300m³ grab hopper dredger was built for and delivered to the Sri Lanka Ports Authority (see principal characteristics on page 34).
The vessel is suitable for both capital and maintenance dredging in all ports of Sri Lanka, especially Colombo and is performing very well indeed, exactly living up to expectations.
The design was based on an international tender including a full technical specification.

This resulted in the following special features:

- Large accommodation for 16 crew members
- Dredging depth of 20m below light waterline
- Engine control room
- Flexible Deckhouse mountings on main deck
- Workboat on main deck forward.

IMTIAZ

Even more recent was the order for a pontoon with assisted propulsion, carrying a self-supporting hydraulic deck crane suitable for grab dredging as well as for hoisting heavy loads (see principal characteristics on page 35).

The 4-rope type crane comes with a choice of equipment:

- One 5.0m³ grab for comparatively light material
- One 3.5m³ grab with teeth for comparatively heavy material
- One 3.0m³ 'orange peel' excavator for stones and rocks
- One hoisting block for two part hoisting of weights up to 70 tons
- One rock breaking ramp with a weight of 6 tons
- One rock breaking ramp with a weight of 11 tons.

A 4-rope crane has standard three winches: one hoisting winch, one closing winch and one luffing winch. For rock breaking the crane has an additional "controlled free fall" winch. In rock breaking and grab dredging mode only the standard counter weight of the crane is used. For hoisting loads up to 35 tons, an additional counter weight can be placed onto the crane by its own means. For hoisting loads in the range of 35 to 70 tons, the total counter weight will be pushed out hydraulically over 1m.

The pontoon provides night accommodation for 9 crew, partly below and partly on main deck. For manoeuvring and shifting the pontoon, it has two thrusters, each powered by a diesel engine situated in the engine room. Four anchors, each with chain cables, and windlass, can cope with open sea conditions, with waves up to 1.5m and 4 Beaufort wind speed, with one hopper barge of 700m³ alongside. Clearly, the pontoon has all the necessary equipment and auxiliary facilities to fulfil its duties. During the construction period, three groups of DRAPOR's personnel have visited Holland to attend a training program organised by IHC's Training Institute for Dredging. The course paid special attention to the operation and maintenance of the mechanical, hydraulic and electrical equipment of the pontoon and the crane.

These two orders are typical "Special Dredging Equipment" projects and they will serve as a reference for future projects.

The 5m³ grab during dredging trials in Rotterdam Europoort

Training DRAPOR's personnel were trained in Holland by IHC's Training Institute for Dredging TID