PLANNING, MANAGEMENT AND SUPERVISION OF DREDGING WORKS

by

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ABSTRACT

Brazil has 34 Public Maritime Ports distributed along about 7,500 km of coastline. In each of these Ports there are different terminals, some administered by public agencies, while others leased to private companies. Access to these terminals takes place through channels of different dimensions and intricacies to navigation whose competence to dredge, whether for maintenance or even deepening, pertains to the Federal Government or the local port authorities. Exceptions to this rule occur in the Private Terminals, located outside Public Ports jurisdiction and whose competence of dredging keep up to the administration part.

Significant advances have occurred in the last decade with foreign dredging companies enter in the Brazilian market, fact that enabled the implementation and maintenance of several navigable waterways in Brazilian Terminals. But if, on the one hand, legislation and even governmental programs made it feasible to carry out dredging works of greater magnitude and complexity in Brazilian jurisdictional waters, many works did not reach the proposed objectives due to the lack of planning before the dredging execution and precarious management and supervision of such works.

This article presents good practices of dredging control and management in maritime terminals that ensure the adequate technical, financial and environmental control of the works, and helping to reduce waste of public and private resources and minimizing risks.

1. INTRODUCTION

In 2007, Brazil instituted the National Dredging Program (PND), in which Federal Government resources were invested to carry out several dredging works in the Brazilian Public Maritime Ports. In addition to structuring a specific long-term program for dredging works, the PND facilitated the entry of foreign dredgers into Brazil, enabling large public and private works, and attempting to reduce the past and ongoing shortage of technologies and dredging companies in Brazil.

According to official data from the Brazilian Federal Government, during the first stage of the PND between 2008 and 2012, approximately 73.0 million cubic meters of sediment were dredged in 16 Brazilian Public Maritime Ports (SEP, 2015). In the second and last stage of the PND, expected to have occurred between 2012 and 2015, additional 44.0 million cubic meters of dredging were planned in 4 Brazilian Public Maritime Ports. There is no official study summarizing the results of the second stage of the program, but our estimates show that 50% of the expected amount was carried out by the end of 2017. Therefore, in a 10-year period (2008/2017), Brazil invested federal resources to dredge 95.0 million cubic meters.

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It is important to note that in Brazil some port dredging was also carried out with resources from the local port authorities, such as the Port of Itajaí, Port of Imbituba and Port of Santos, the latter annually dredging its berths, and more recently, investing in port channel dredging (CODESP, 2018). These cases, also carried out with public resources, represented in the last decade, according to our estimates, something close to 15.0 million cubic meters.

Considering also the significant dredging, especially of deepening dredging carried out by private terminals, such as dredging of Port of Açu (BOSKALIS, 2015 and 2016), Thyssen Krupp CSA Terminal (DEME, 2017); Port of Tubarão (CEPEMAR, 2010), Piaçaguera Channel (TORRONTEGUY *et al, in press*), Port of Sudeste (DEME, 2015), Jurong Shipyard (CTA, 2009), EMBRAPORT (CARVALHO, 2013); Terminal of Ponta da Madeira (DEME, 2015), among others, it is probable that Brazil dredged with private investments about 155.0 millions cubic meters in the period between 2008 and 2017.

Table 1 (below) presents an estimate of the total volume dredged in public ports and private terminals in Brazil in the last 10 years. It shows that the total volume dredged has been of circa 265.0 million cubic meters, averaging 26.5 million meters per year. It should be noted that the estimate presented here is a preliminary attempt based on information in the public domain but should be used with caution because it is not an official data source.

Resources	Total Volume, in Million m^3	Perceptual
Federal Government	95.00	35.80%
Local Port Authorities	15.00	5.60%
Private Terminals	155.00	58.60%
Total	265.00	100.00%

Table 1: Total Volume dredged in Public Ports and Private Terminal between 2008 and 2017.

To contextualize the Brazilian case in the international scenario, we have done a comparison with the survey conducted by the International Association of Dredging Contractors (IADC), which estimates the size of the open dredging market worldwide, including port dredging and works for mining, energy, tourism, urban infrastructure, among others. It is important to note that IADC does not compute the dredging carried out in the US and China as these are closed markets to international competition. Based on the latest IADC report (2017), the average dredging of 26.5 million cubic meters per year in Brazilian ports would amount to something like 3.5% of the total amount dredged in 2016 around the world (excluding China and the USA).

Brazil's position is relevant in the international open market, especially because in this percentage we do not compute dredging in waterways and in mining, two sectors that demand important dredging in Brazil. Besides the numbers expressed above, another robust evidence of the Brazilian relevance in the maritime port dredging international market is the presence, through either construction or commercial representation, of many of the main world's dredgers contractors.

Despite all the above, the fact is that the National Dredging Program has been practically deactivated, and today there is no new government program to replace it. In fact, the main current debates on port dredging focus on the search for a model that allows dredging in Public Ports to become the responsibility of the private sector, which, due to the success that privately funded port dredging projects in recent years, has been responsible for more than half of the volume dredged in the last decade, as shown in Table 1. Another point that has motivated the privatization debate is the evidence of lack of planning and supervision in some public works as indicated in the opinions of the Brazilian's Account Court (TCU), the control team of the Brazilian State that supervises federal fund distribution.

2. PLANNING OF DREDGING WORKS

The success of a dredging work depends initially on good planning and this is only possible if it is supported by appropriate contracts to the complexity, deadlines and resources involved in the work, as well as a detailed design that should be contains at least the following information:

- Areas to be dredged;
- Volume to be excavated;
- Depths to be reached;
- Horizontal and vertical tolerances to be adopted;
- Disposal site for the dredged material;
- Equipment's to be used;
- Productivity to be obtained;
- Works schedule;
- Costs estimated;
- Environmental constraints such as sedimentation rates, hydrodynamic conditions, sediment characteristics, presence of rocks or obstacles, proximity to sensitive environments such as corals, etc.

Unfortunately, some managers underestimate the importance of a detailed design before contracting the dredging works and neglect that it is one of the most fundamental steps for the proper planning of the work. This situation became more frequent in Brazil with the creation, in 2011, of the so-called Differential Recruitment Regime (RDC), a modality of contract in which the public manager, based on a conceptual design, can contract all kinds of infrastructure works, including dredging, while the responsibility of the basic and detailed design development belongs to future job executor.

Surely, as the projects are being developed, doubts and uncertainties arise, hampering the progress of the work due to lack of information and, in some cases, leading to errors in quantitative estimates and consequently, delays, interruptions and substantial cost increases.

It is not the objective of this publication to discuss if RDC funded works presented or present problems, but rather to alert to the fact that presently in Brazil there is a modality of contract that allows the public manager, under justification of less bureaucracy, to adopt the RDC contract model despite its obvious risks. Thus, although the RDC served to execute several public dredging works in Brazil, it opened the possibility of these works being contracted with insufficient design elements.

Finally, it should be pointed that risk reduction for both contractors and contracted is one of the main objectives of a construction contract, with general and specific contractual models for each type of construction. In the case of dredging works, the Blue Book, published by Fédération Internationale des Ingénieurs-Conseils (FIDIC), presents the minimum clauses and standards to be adopted in specific contracts for dredging and reclamations works (MADDOCK & VANDENBERGHE, 2016). It points out the concern in minimizing risks in dredging works, suggesting inclusion of a specific contractual clause of "Defined Risks", which in turn can only be determined and duly expressed in the contracts if there are studies and previous projects with appropriate level of detail that subsidize the identification of risks.

3. VOLUME ESTIMATES AND CHARACTERIZATION OF MATERIAL TO BE DRADGED

As obvious as it would be to estimate satisfactorily the volumes to be dredged and to know the soil type to be removed, it is important to state that in many dredge works, this information is treated in a superficial manner.

To get the volumes of material to be dredged in maritime areas, the internationally recognized methodology is to carry out bathymetric surveys. In this respect, Brazil has many companies capable of performing such

services with well-established standards, while adopting the specifications of the International Hydrographic Organization (IHO) for hydrographic surveys (DHN, 2017).

Despite the above favorable scenario, public ports and private terminals in Brazil seldom carry out continuous bathymetric surveys, which are often carried out in isolation without being part of a depth control program, usually executed in periods prior to work contracting and frequently being outdated at the beginning of the dredging, generating changes in the amount of the volume to be dredged and consequently changes in the prices and terms of the original contracts. Such situations are common in many Brazilian Terminals and could be avoided with a continuous and long-term program that would monitor the depths in waterways, generating a useful database for the updated calculations of volumes to be dredged and for studies of determination of the sedimentation rates, information fundamental to the correct maintenance of dredging planning.

Advances occurred in Brazil regarding the characterization of the material to be dredged from 2004 with the entry into force of a resolution of the National Council for the Environment (CONAMA), which required environmental licensing to assess the physical-chemical and ecotoxicological characteristics of the material to be dredged (MMA, 2012). The resolution is of an environmental nature and addresses aspects related to the granulometry of the material but does not deal with the geotechnical characteristics of the material to be dredged, such as hardness and resistance, fundamental information in the decision-making process regarding the required equipment and in getting estimates of their productivity. To determine this information, geotechnical surveys are necessary, while geophysical surveys are fundamental for the correct spatial distribution of these properties. These effective methods are frequently neglected by the contractors, often leading to overestimated prices by the dredgers, due to the risk imposed by the uncertainties, difficulties of excavation or, otherwise, opening for works stoppages due to initially underestimated difficulties.

4. MANAGEMENT AND SUPERVISION

The management and supervision of dredging works aims to ensure that the work is executed as foreseen in the detailed design and in the terms and prices established in contract. In addition, it aims to comply with the environmental licenses and authorizations in force and the reduction of any risks to the contractors, especially with regards to navigation and the environment.

The most effective way for proper management and supervision is the contractor making himself present at the construction sites. For this, it is recommended that specialized companies be contracted to maintain a technical team capable of checking and recording the progress of the works and to promote the necessary project adjustments when necessary. Thus, it is suggested that contractors adopt the following management and control procedures in dredging works:

- Allotment of land and board inspectors during the entire period of the work to record if all excavations and disposal of material are carried out as planned in the design and in the sites previously determined and authorized, pointing out and correcting any deviations;
- Allocation of designers throughout the execution of the work whom make the necessary changes in the designs as interferences arise that affect the progress of the services;
- Allocation of HSE technicians throughout the project execution period to ensure that activities are performed in accordance with HSE related legislation and maritime standards;
- Allocation of managers during the entire period of work execution that assess whether the expected productivity is effectively achieved and whether work is performed within the parameters and goals established in the contract;
- Monitoring and continuous registration of the navigation and positioning of the vessels and boats allocated in the work to ensure, above all, that the disposals are carried out in the areas duly licensed;
- Frequent monitoring of bathymetric conditions in the dredging areas to monitor the evolution of changes in depths and for the calculation of dredged volumes for the purposes of measurement and payment of the companies responsible for the execution of the works;

- Frequent bathymetric or topographic monitoring in the areas of material disposal to monitor changes in the bottom level conditions of these areas.

It is also recommended that the management company should work together with the contractor not only during the construction work, but also from the initial phases, such as the elaboration of the technical dredging requisition, as well as the hiring of the executing company, evaluating the following items in the dredgers before their actual contracting:

- Technical qualification of the company to carry out the dredging works;
- Previous experience in similar works;
- Construction methods presented in the proposals;
- Dredging equipment and proposed productivities including navigation and production control systems;
- Support estruture;
- Capacity of the technical team and Organization chart;
- Plan of preventive maintenance of equipment and eventual impacts on the execution schedule;
- Execution schedule, which should clearly establish the planned deadlines for mobilization, execution and demobilization;
- HSE Procedures and Policy;
- Ability to meet the internal standards of the contractor;
- Responsibilities and costs due to possible changes in the schedule of execution of the work, considering breaking of equipment, passage and maneuvers of ships; environmental licenses, replacement of equipment, alterations of projects, and others;
- Responsibilities and costs due to design or execution errors;
- Price and forms of measurement and payment;
- Criteria for termination or contractual additions because of: delay, design changes, changes in the type of dredged material, changes in the location of dredging or dumping areas, changes in input costs such as fuel; excessive paralyzes, environmental liabilities, and others.

5. FINAL CONSIDERATIONS

The port dredging market in Brazil has been promising in the last decade, mainly due to the opening of the sector to the major players in the international market and private investments in the period.

There are still uncertainties about the future of public investments in port dredging in Brazil, however, it is quite likely that such uncertainties will be remedied in the short term, and new investment programs or even new contract modalities will be idealized by permitting dredging on waterways of responsibility from the government.

Our recommendations on dredging engineering design, characterization of material to be dredged and estimates of volumes, as well as on the management and inspection procedures of works are common practices around the world (USACE, 2015) and that already were implanted in Brazilian works, including public works, but have been more frequent and really institutionalized by private contractors, which is very probably a determining factor for the good performance that the private dredging presented in the last decade in Brazil.

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