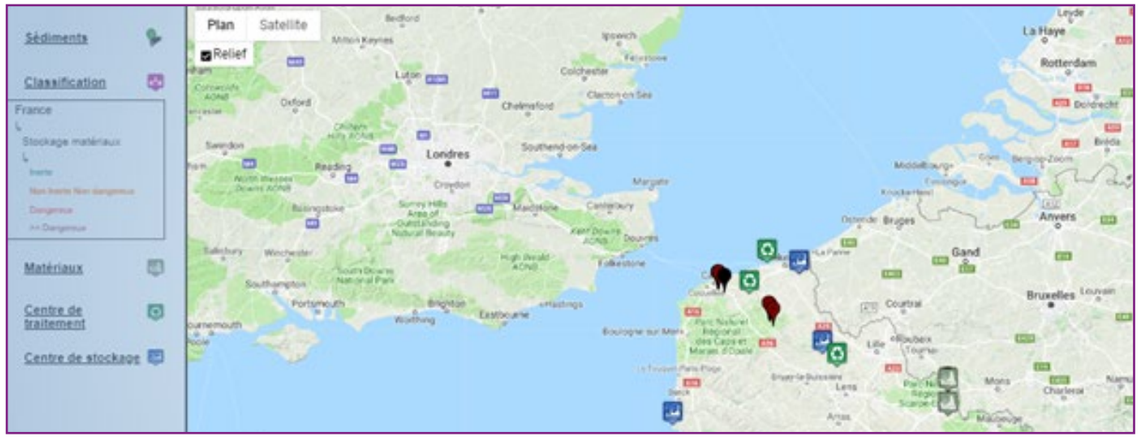
Operational Sediment Management System

Introduction

In France, more than 50 million m³ of sediments are dredged every year. Dredging operations are necessary to maintain sufficient water depth for navigation in ports and waterways. The management of dredged sediments can be problematic because of the large dredging volumes and their environmental impact. Therefore, the sediment-related environmental emergency has become a necessity and needs to be addressed in order to find alternative solutions to traditional management methods, such as dumping and storage.

Armines, through its Civil Engineering laboratory, has been working on the dredged sediments issues in order to develop innovative and eco-friendly solutions aiming at fulfilling the different constantly evolving socioeconomic requirements.



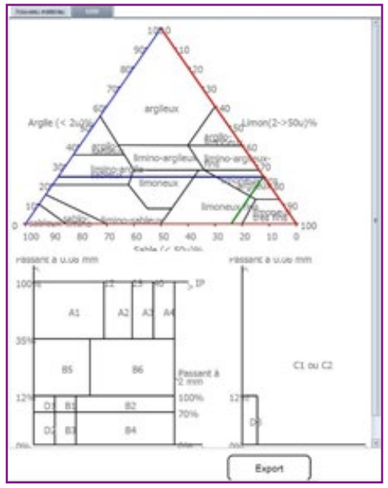
Problem

According to directive no. 2002-540 of April, 17, 2002, dredging sediments are considered as waste as soon as they are managed on land. Several ways of valorisation of sediments were developed in civil engineering, however, their use raises several socioeconomic and environmental challenges which limit it. The solution which allows to overcome these challenges is to predict the behaviour of works that incorporate sediments. The use of numerical tools seems to be a major asset, in this context IMT Lille Douai worked, in collaboration with other partners from USAR project, on the development of a numerical tools: Operational Sediment Management System (OSMS) in order to bring innovative solutions up to the challenges encountered nowadays.

Case Study

OSMS was developed to allow the optimization of the formulation and the treatment of dredged sediments by performing technical, environmental and economic analysis. The four areas concerned in this work are: road application, concrete, dike and spreading. The purpose of the OSMS software is to propose an optimal solution that meets the different technical and environmental requirements at a lower cost.

In order to reach this goal, for each application, constraints linked to the sizing of the works and materials used for each type of work were defined. (For example, to use a sediment for a road layer, it has to have a compressive strength of at least 1 MPa, and amongst the conditions of use, the organic matter content MO has to be less than 3%.) These technical and environmental constraints are modelled as mathematical equations and are then implemented in OSMS software.



Sediments and their parameters are imported into the software as an XLS file. Other materials such as sand or gravel may also be introduced into the software. OSMS allows, thanks to geolocation, displaying of sediments on a map in order to visualize them, as well as the other materials. It is also possible to add one or several classifications of each sediment. Treatment centres are inserted into the software in order to take into account possible treatments of the sediments. The geolocation of each centre, the cost of each treatment, as well as the impact of the treatment on the sediments' parameters are also introduced. The location of storage centres, as well as storage costs, are also information that the user could indicate in the software. The geolocation allows to compute the distance between each treatment centre, storage centre and location of materials (sediments and quarry) and to introduce the transportation cost into the optimization process.

Thanks to all of this information, OSMS can simulate a project computation for the four previously cited applications (route, dike, concrete and spreading). The optimal solution proposed by the software will be a new material composed of an optimal mixture of sediments and materials chosen for the project. The cost of each operation (dredging, treatment, transport, etc.) is detailed in the display of the optimal solution and the global cost of the operation is also indicated.

Lesson Learned

Given the complexity of the issue of dredged sediment management, it is necessary to have a decision support tool in order to guide the valorization domain efficiently. OSMS is a numerical tool at the heart of this procedure for dematerialisation and exploitation of numerical and IT means for the development and the promotion of the valorisation of dredging sediments.