

Experimental road infrastructure with marine sediments

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Introduction: Increasing environmental constraints, in regards of the traditional solution which consists in dumping dredged sediments at sea, has led to explore alternatives to manage fine dredged marine sediments [1], [2]. The use in road construction can be an interesting one as the consumption of materials in this domain is important [3] and resources are declining. In this context, the use of low polluted fine sediments (mainly composed of silt) from Dunkirk harbor (France) as sub-base layer material was investigated in the laboratory [4]. The evaluation of mechanical, as well as environmental performance of different mixtures has revealed the ability of fine dredged sediments to be used as sub-base layer material. In order to validate the performance of designed material at site scale, an experimental road was built in October 2005. This paper presents the first results of the study, which aims at monitoring the mechanical and environmental behavior of this road with time.

Methods: The high initial water content of fine dredged marine sediments makes difficulties in the methodology of re-use in road construction [5]. In order to reduce the initial water content, the fine sediments have been disposed on a terrestrial site at Dunkirk Harbor (Fig. 1). After three months, natural decantation has allowed to reduce the water content from 150 % to about 80 %.



Fig. 1: Disposal site

The designed material used as a sub-base layer is composed of fine dredged sediments, dredged sand, cement and lime. The homogenization of the granular skeleton with the treatment material was performed on the building site with a specific machine (Fig. 2).



Fig. 2: Homogenization and treatment

To evaluate the performance of designed material, mechanical and environmental tests are realized on cored samples after 180 days. For the mechanical study, elastic modulus and diametric compressive strengths are measured and compared to references values of French standard. For the environmental study, leaching on monolithic (NF X 31-211) and crushed samples (EN 12457-2) are performed to evaluate the environmental impacts.

Results: Mechanical tests results, performed on five samples, are reported in Figure 3 together with the classification according to the French standard NF P 98 114.

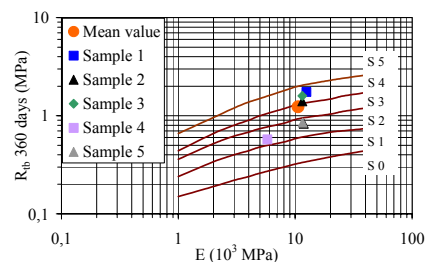


Fig. 3: Mechanical classification for use in sub-base

Discussion: Tested samples show good mechanical strength. Results are above the S2 class, fixed as reference to use a material in sub-base. These values are higher than measurements obtained in laboratory, on mixtures with higher sediment proportions. For the leaching tests results, the measurements of pollutants indicated only a high soluble fraction and large amount of chlorides, in the water phase.

References: [1] LIFE, "Méthodes de gestion et de réutilisation des sédiments pollués", European project, 2002. [2] Centre Saint Laurent, "Guide pour l'évaluation et le choix des technologies de traitement des sédiments contaminés", Montréal, 1993, p 10-227. [3] UNPG, "Le marché des granulats en 2004", 2005, 2p. [4] Dubois V., "Caractérisation physico-mécanique et environnementale des sédiments marins. Application en technique routière", Thesis, Ecole des Mines of Douai, France, 2006, 285 p. [5] Colin D., "Valorisation de sédiments fins de dragage en technique routière", Thesis, University of Caen, France, 2003, 147 p.