Considerations of state parameters during natural dehydration of dam dredged sediments

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Introduction: Dredging operations generate large amounts of sediments that they become waste for their land management. Recent research works have demonstrated some possible ways of sediment recycling in civil engineering field. But for the most of the applications at the beginning of any process, it is necessary to reduce the water content. Natural dehydration consists of removing the water content from sediments by evaporation and drainage. Present study concern dredged dam sediments behavior during natural dehydration. Natural dehydration tests (NDT) were carried out on initial high water content sediments. Some results are discussed including state parameters as reported by Serratrice [1] on soil shrinkage tests analysis.

Materials and method: NDT tests are performed using oedometer rings and specific elements as porous stones and filtering materials (geotextile). Measurements consist in the weighing of sediment during NDT testing obtained by difference of masses of each part of the experimental set up. All dimensions of sediments samples are measured along and at the end of the NDT test. The oedometer ring is filled with sediments mixed at the initial required high water content w_0. Then natural dehydration is operated in air curing condition at room average temperature of 20°C. Water balance is following with time of dehydration. By different weighing, it is deduced the water content of sediments samples *E1*, drained water *E2* and quantity of water evaporated *E3*. Water balances of 3 dam sediments are shown in Figure 1. In the same time, variation of sample diameter and height are measured. Finally so as to get the dry mass of solid particles M_d samples are oven dried at the end of the test. All these data allow defining state parameters as degree of saturation S_r, void ratio e, axial deformation ε_a. Parameters were determined using a specific weight γs of 26.5kN/m^3 and gravity g of 9.81 m/s². Selected initial high water contents w_0 are equals to 1.5LL, 2LL and 2.5LL, with LL as liquidity limit. Dam sediments tested for NDT tests are (i) fine silts from the French Alps referenced as *SPO* and *CLA* and (ii) *SAI* fine sands from Brittany (France). Their LL values are 31.57%, 34.41%, 64.66% respectively. As respectively $CaCO_3$ carbonate contents are 11.68%, 23.34% and $CaCO_3$=0.69%.

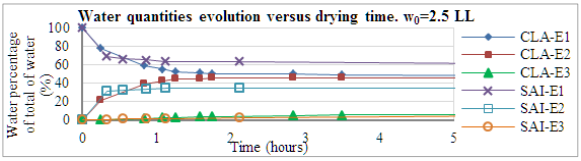

Fig. 1: Water balance during NDT test.

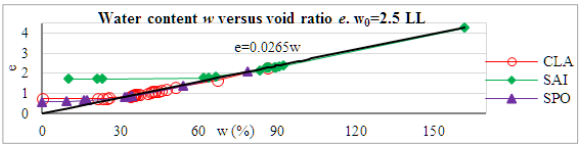

Fig. 2: *e-w* relationship for dam sediments.

Results and discussion: During NDT test, similar behaviors have been observed for dam sediments. Water is mainly drained during first hours of dehydration. Evaporation becomes more effective when drainage is stopped (figure 1). Sediments start at initial saturation state and e-w data measured follow first the saturation line as shown on figure 2. In that state, sediments have large axial deformations and significant decreases in water content. These parameters are stabilized when water content is exactly LL values. But it is observed that French Alps sediments do not behave as *SAI* ones. They have not the same ability to dehydration due to physical properties. From these observations, it will be important for practice (i) to define a ND ability criterion for sediments, and (ii) at what moment it is necessary to remove sediments deposited for ND to accelerate the dehydration.

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References: [1] Serratrice J-F., (2015). *Une représentation des courbes de retrait des sols argileux*. SEC 2015 International Symposium 179-186. [2] Boullosa Allariz B., (2017). *Sédiments de barrage en cours de séchage naturel*. M2C report, University of Normandy.37p.