Politechnika Śląska
w Gliwicach

STRESZCZENIE I ABSTRACT
ROZPRAWY DOKTORSKIEJ

STABILIZACJA GRUNTÓW SPOISTYCH TECHNIKĄ KATALITYCZNO-FIZYCZNĄ

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Gliwice 2016

ABSTRACT

The Ph.D. dissertation regards the effectiveness of weak subgrade stabilization with catalythic-physical technique. This method was invented in the 60s and has been applied on the Polish market for over a dozen years. The author, having noticed the need of describing some less known research areas about cathalytic-physical technique, carried out laboratory, model and in-situ tests about the effectiveness of cohesive soils stabilization process with the above-mentioned technique.

Cohesive soils, because of their high physico-chemical activity, are usually classified as unacceptable for construction purposes. Using the cathalytic-physical technology in cohesive soils changes the phenomena occuring on the border of the liquid and solid phase such as: the adsorption of ion and water, elektrokinetic potential or cohesion. Accordingly, the soil‘s strength and strain properties and their engineering properties increased.

The cathalytic-physical technology is a system effected by two products (called *component 1* and *component 2* in this dissertation). The first one reduces the surface tension (which significantly facilitates water removal) and forms micro-agregates from fine soil particles (Fig. 0.1).

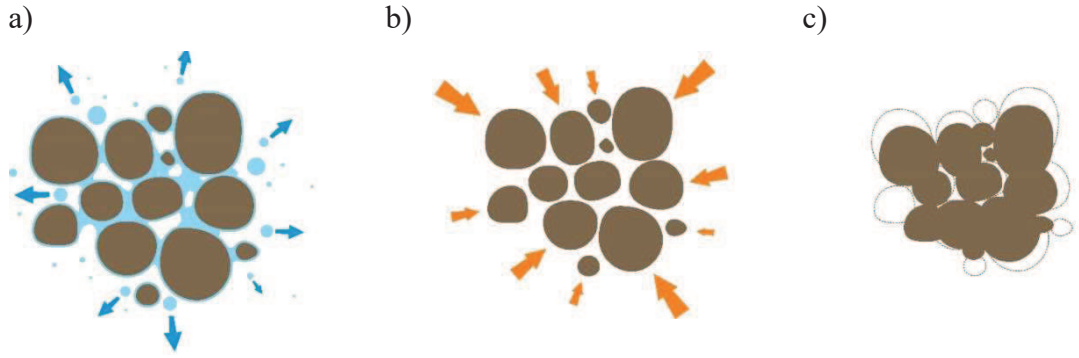

Fig. 0.1 The illustration of *component 1* action after being added to the soil; a) the reduction of thickness of adsorbed water as a consequence of an elektrokinetic potencial’s change, b) the particles coagulation, c) mikroagregate formation

Fig. 0.2. The structural hydrofobization of the soil – the impact of component 2 in the cathalytic-physical technology

The role of *component 2* strengthens the hydrofobization effect and the structure's change into a stabilized material. The main effect of the cathalytic-physical technology is limited capillary humidity and lower water absorbability (fig. 0.2)

The preliminary research has identified direction of the structure's transformation in stabilized selected soils by mixing them with *component 1* and *2*. It was noticed, that the content of clay fraction was reduced (even to 0) in connection with the increase of sand fraction content (in most of the soils). The thesis that strength and strain parameters increase after grain size change has been verified in preliminary research.

The interesting conclusions became an introduction to the basic research about the effectiveness of stabilization with the cathalythic-physical technology in selected cohesive soil – *sasiCl*, in the following areas: the identification of mineral composition and granulation, shear strength, deformation, absorbality and frost resistance.

The next stage was the model research. The values of deformation modulus E and their changes in time were measured with VSS plate on two double-layer subgrade models (one with the top layer made of sasiCl, and the second with the surface made of *sasiCl* after mixing with stabilizing components). Additionally, the author verified the impact of compacting the soil with the roller and the imitations of the rainfall.

All the results were verified with in-situ research on forest road in the Podkarpackie voivodship, whose constrution was stabilized with the cathalytic-physical technology The 2,5-year-lasting observation and measurements of dynamic deformation modulud E_{vd}, were made on two selected measurement points along the road. The research on measurement point I was helpful to assess the influence of traffic load on the bearing capacity of the treated substructure. The measuring on measurement point II was carried out in two bands on a stacking yard. Both of them were contructed using native soil, but in one of them the cathalytic-physical additives were mixed.

A long period of research and changing weather conditions during subsequent measurements, allowed to draw interesting conclusions concerning the impact of catalytic-physical technology on the change in susceptibility of stabilized structure in relation to the weather conditions, traffic load, bearing capacity changes as a function of time, as well as the deterioration of the structure.

This thesis is a specific compendium on the catalytic-physical technology. It includes information about the theoretical foundations of weak soil treatment, including the phenomena occurring on the border between solid and liquid, detailed information about the catalytic-physical technology, current realizations, and above all the results of the laboratory, model and field studies on the cohesive soil strengthening effectiveness done by the author, using the catalytic-physical technology.