



CONSOLID UK LTD
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THE REASONS FOR SOIL STABILISATION

How the CONSOLID SYSTEM differs from all other methods in use for this purpose (2)

Last month we started the Monthly Letters with an abstract on the CONSOLID SYSTEM; WHY it was developed and HOW it differs from other methods of soil stabilisation.

The CONSOLID SYSTEM is unique in the world; it is without competition and can successfully be used with any kind of soil, and it can upgrade any low-class soil to risk free construction material.

Your possibility is a huge one: You can with the CONSOLID SYSTEM replace the conventional construction materials, such as gravel sand or crushed stones, for low-class in-situ soils, preventing the need of excavating and soil exchange to a high degree and achieving better results than before.

These results have to be proved. Many conventional testing methods for soils exist. Already a simple informative laboratory tests will show the difference between the same untreated and treated soil / soil mixes, which can be extended to any standard testing method, as long as you respect the modifications explained on the following pages.

Therefore this letter deals with the possible improvements and **HOW** to achieve them.

SOIL CLASSIFICATION: All types of soils are described and classified in different classification standards, e.g. the AASHTO classification for highway sub-grade material or the USCS (Unified Soil Classification System), with respect to their existing physical form. This cannot cover the specific, almost infinite variety of soils - there may exist worldwide more than 20'000 varieties of different soils. This figure may give you an idea that only a method like the CONSOLID SYSTEM can succeed in being independent to a high degree of these countless varieties of soils. Our system works with any kind of soil in a reliable and impressive way.

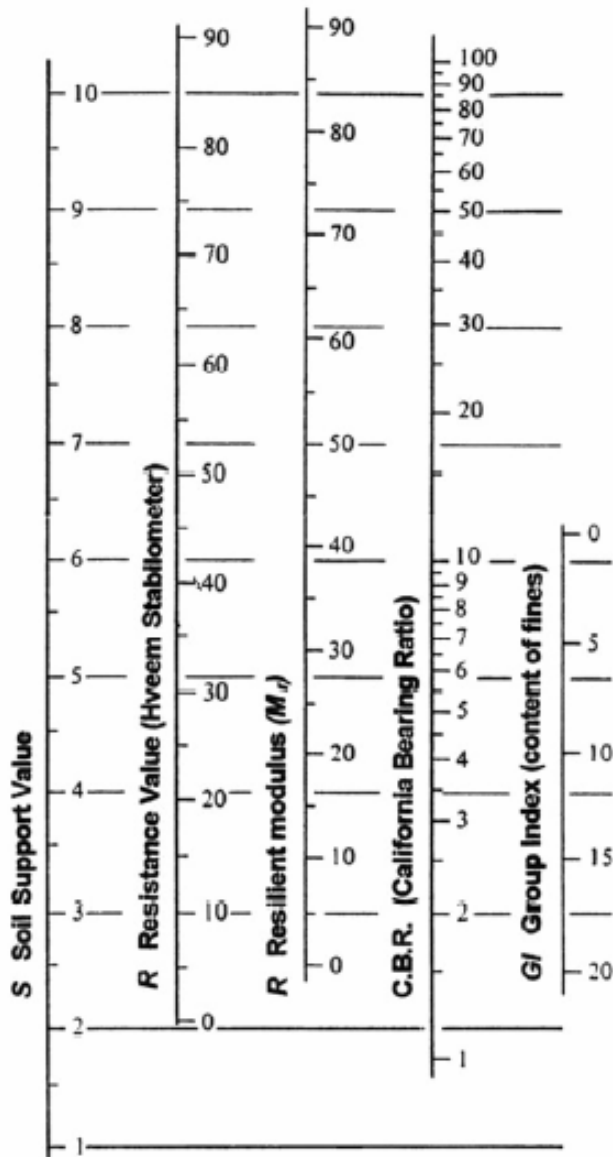
In any earthwork you will never find exactly the same soil over the whole area; the composition will sometimes change from meter to meter, physically as well as chemically - this makes soil stabilisation with other methods so difficult.

- The great advantage of the CONSOLID SYSTEM is that these variations will cause no problems.
- You will obtain with any soil the required improvement. But you can do more: adding missing fractions to the in-situ soils will improve their mechanical stability and multiply the effectiveness of the CONSOLID SYSTEM without using without quantities of additives.
- You can adjust the behaviour of the in-situ soils with the CONSOLID SYSTEM to the requirement of the construction site, and you know ahead of any field application how they will perform.
- Another great advantage is the fact that any soil can be treated "in place", using professional soil mixing equipment or "in plant" with a central mixing plant (bug mill), because stockpiling the treated material for a long time has no adverse effect in the performance of the treated material. You can in this way use the rainy or moist season for pre-mixing and supply the ready-to-use mixture on demand to the construction site, which will considerable reduce the construction time.

You become to a high degree independent of soil classifications, because you can improve any soil or soil mix for classes and use as much as possible of the in-situ material, rather than excavate and dispose of it in an expensive landfill.

- More than that, **you can even upgrade waste**, material from gravel pits quarries (crusherrun), recycle demolition waste or immobilise polluted material, e.g. worn railway ballast material.

For conventional construction material certain parameters are required, and in respect of stability certain figures have to be realised: these might be the E-modulus, R-value or C.B.R. (California Bearing Ratio), to name a few. In the following we are discuss the possible improvements shown with the widely used C.B.R. tests.



The C.B.R. test has become the most common strength test conducted on soils for the evaluation of sub-grade (but also subbase and base) quality. The measurements with this test can be compacted to the values of other design parameters, as shown in the graph below. The C.B.R. test values reflect the loading capacity of a certain soil and are taken soaked test blocks, due to the fact that soil, e.g. clay, show extremely high loading capacity when dry, but lose their strength and stability under the influence of moisture. Soaked C.B.R. values starts from <1-3% for clayey soils and range to >100% for crushed stones. The graph shows comparing values with different methods of measurement. *S* Soil Support Value *R* Resistance value (Hveem Stabilometer) *R* Resilient (M_r), a test which is widely accepted as being representative for soils and aggregates under highway loading conditions *GI* Group Index, indicating the content of clayey / silty fines in the material All the figures can very well be compared with the result of the soaked C.B.R. tests and therefore easily respected in the design.

The CONSOLID SYSTEM can upgrade any type of soil in respect of the soaked C.B.R. tests by 3 to 5 times of the value of the untreated soils; in more than 50% of all cases the improvement factor is more than 5. The lower the classification of the treated soil, the better the improvement, going up to >20 times of the soaked C.B.R. of the same untreated soil. This makes especially cohesive soils with a high content of fines available for construction purposes. Countless C.B.R. test results from all over the world confirm that the soaked C.B.R. values get substantial improvement by a treatment with the CONSOLID SYSTEM.

This means for the design the possibility of using much more in-situ soil material, which will substitute borrowed material to a high extent and save costs.

- Any untreated in-situ soil in the range of soaked C.B.R. of 1% - 20% can be upgrade with the CONSOLID SYSTEM to construction material in the range of soaked C.B.R. of 10% to >100%.
- In-situ soils with very low C.B.R. values, especially clays, can be used as natural binder in soil mixes, whereas missing fractions of soil (sands, coarse material) are added ahead of a treatment to obtain a better mechanical stability and also a control of the shrinkage potential of these soils.
- Due to the fact that the in-situ soils are cohesive or are made cohesive by adding enough clayey soil to those which are non-cohesive. The clay is used as, a natural binder, filling the voids and allowing dense packing by turning the mixtures to the behaviour of mineral concrete.
- The use of such soil mixtures in the sub-grade, sub-base and base course leads to naturally cemented layers, which resist the deformation by the dynamic forces of the traffic. The deflection will be reduced to marginal values; the once built-in level remains unchanged, securing longevity and durability of the construction.
- The fact that with the CONSOLID SYSTEM all soils can be brought under control against the softening effect of water up to complete impermeability secures stability and opens wide opportunities for uses in dams, dikes, protection of bottom layers in landfills, linings of artificial lakes and ponds, etc.
- And all these benefits can be realised by "mixing in place", but also in a central mixing plant, where you can compose the best possible soil mixture on the site and realise the required strength for the specific construction. Premixed material can be stockpiled for unlimited time without losing the effectiveness of the treatment. Once treated, the soil remains treated and will forever show its substantially improved behaviour.