Alphasoil®-06 Technology

Improvement and soil stabilization for any kind of upcoming earthworks, road construction, dam construction, hydraulic construction, railway line construction, landfill, et cetera with NANO-TECHNOLOGY.

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1. Starting Point and Goal

The depletion of deposits of classical materials in earthworks and road construction and the attempt to save through inexpensive building material costs, resulted in recent decades to develop and market a wide range of chemical products for soil stabilization.

With these products, the undesirable characteristics can be eliminated, especially in upcoming soils, which produce the cause of the inferiority of these materials. In contrast to traditional building materials like flint and broken gravel, such "inferior" soils are freely available. Finishing materials to their leads, inevitably to significant construction cost savings.
This requires that the undesired characteristics of these materials can be brought under control, the soil is improved with the treatment reliably and permanently and stabilized. This refining of low-grade soils, is for the large network of subordinated streets a major importance; which represent 80-90% of all roads and are those for which the lowest financial resources are available.

Alphasoil®-06 was developed because none of the existing products for the chemical soil stabilization brought satisfactory results. The main reasons for their lack of effect is the fact, that they do not as a binding agent with the constantly changing surface area of the soil to tackle, while the continuously changing chemical composition of the soil makes it impossible to bring the chemical reactions to an adequate success.

Soil material is constantly changing in its physical and chemical composition. A successful system must being largely independent of such changes and leading the same treatment with the same application rates to the same result. This goal was achieved after several years of development with Alphasoil®-06.

The standard application provides that the soil layer will treated at a depth of 25cm-30cm with Alphasoil®-06.

Alphasoil®-06 causes irreversible agglomeration of fine particles in the soil and a partial charge reversal, so that higher densities and a strong reduction of swelling and shrinking capacity of the soil is possible.

The recent experience confirms the expectation that Alphasoil®-06 can improve the soil permanently.

A key feature of Alphasoil®-06 is, that it can not only be used on construction sites "in place" with the existing soil there. Also a work “in-plant”, so a pre-mixing in a gravel pit, a gravel pit on a landfill in a central mixing plant with specific mixed together but always with up to 30% clay content containing material approaches is possible. Periods of unfavorable weather conditions may be used herewith optimal.

Pre-mixed material can be stored without loss for a long time and can always be built from stock.
The previously built roads with Alphasoil®-06 have shown that the effect arrives safely with any soil and remains there permanently.

Construction of a mountain road in southern Anatolia.

Measuring of the viability of a forestry-economic road in Germany.

Rehabilitation of a road at the Black Sea.

Completed coast road at the Black Sea.
2. Description of Alphasoil®-06

ALPHASOIL®-06 is a chemical product what is surface-active and thereby releases the adhesive water film of the soil colloids. This allows an irreversible agglomeration of the fine and fine particles of the treated soils.

Alphasoil®-06 is not a binding agent like cement. But it can release the own ground bonding force of the soil and affect soil behavior like this, that a permanent increase of compaction under load and transport occurs.

Soil material, treated with Alphasoil®-06 has the following characteristics, compared with the same untreated material:

Characteristics

► Better compressibility by changing the nature of water;
► Greatly reduced water absorption by capillarity-stopping;
► Reduced fluid and water permeability;
► Extensively reduced source and shrinkage behavior;
► Extensively reduced Water sensitivity;
► The effect of the consolidation/agglomeration is continued in the treated soil; under load and transport the density reaches values in excess of 100%;
► The Proctor Optimum of the treated soil is lower, the density higher.

In such cases where these general characteristics are not visible, you will find a corresponding increase of the voids in the soil, which is triggered by the particle size distribution change due to the irreversible agglomeration.
Alphasoil®-06 will be delivered as a concentrate and must be mixed 1:4 with water to produce Alphasoil®-06! The thus prepared Alphasoil®-06 will be diluted again with water in an amount of 0.6l/m³ into Alphasoil®-06-Working-Solution, what will be mixed into the soil. Take as much water for dilution, with regard to its own water content, to come after the incorporation into the soil near the OMC (optimal moisture content) after Proctor optimum.

As an standard, Alphasoil®-06 will be mixed in an 25 to 30cm layer in an appropriate amount.

So that the full effect of Alphasoil®-06 is visible and measurable, the so treated soil must have the opportunity to dry back once to at least 50% of the P.O. (Proctor optimum).

3. Application Range

1. Roads, Transportation-Routes

a. All kind of roads

b. Agricultural- and forest-roads and -tracks

c. Cycling-, hiking- and riding- trails

d. Parking- and storage-areas

e. Road reconstruction

f. Railway lines and dams
2. Erosion Reduction

a. Dams & Dikes
b. Drains & Wireways
c. Trash Dumps
d. Bio-Treatment Plants

3. more applications ...

a. Reservoirs and Dams
b. Playgrounds and Sports-fields
c. Dumping grounds
d. Storage- or Silo Surfaces
e. Manufacturing of unfired Bricks
3.2 Advantages and Disadvantages

The development of Alphasoil®-06 resulted in a system with 100% of processing appreciate cohesive soils can be substantially improved.

Exceptions are non-cohesive soils and heavy clay soils but they can also be made useable by adding the necessary fractions. Non-cohesive material like sand and gravel, will be mixed with up to 30% clay material and bound. Too heavy clay soils will be mixed with sand and gravel to low the heavy clay fraction down to the necessary value for the mixing.

There are precisely the most water sensitive clayey- sandy-silts soils, what showing a particularly marked improvement of their properties. The grading curve of soil needs to be flattened by adding missing fractions where it is needed. Through this, the mechanical strength is improved. Such a measure will cost little, but enhanced the load values and can achieve much more with the same effort.

It was found that the target of Alphasoil®-06 in each soil, with roughly equal rates of application, a time approximately equal improvement was possible. This provides a reliable method for permanent improvement and a substantial financial savings of road projects are available.

The advantages of Alphasoil ® -06 may be described as follows:

3.2.1. Improvement of the Soil Material

► Reduces the water permeability and capillary water management;
► Reduces P.I. (plasticity index);
► Shifts the Proctor Optimum to left to an lowered OWG and to an higher density;
► Massively increased the carrying value (with soaked CBR 3 -5 times in more than 50% of cases by more than 5 times);
► Reduces the water absorption and thus the swelling - and shrinkage behavior of the treated soil;
► Reduces the softening due to water absorption; after the soil has dried out even in part, the moisture content levels off at or below the PO (Proctor optimum);
► The full effect of the treatment is visible after the treated soil under the PO could dry out and improved by time under traffic load enormously. The improvement effect is permanent.
3.2.2. Consolidation

► Facilitates and improves the soil compaction;
► No air pockets in the correct compacted base course;
► No traffic stop; traffic can be used to compress;
► Under traffic there is a permanent densification, which leads to a continuous increase in strength.

3.2.3. Execution of Construction Work

► The incorporation of Alphasoil®-06 is relative simple;
► The soil treatment could made by pre-mixing, wherein the mixed soil material, stored in piles, at any time without further processing can be incorporated. Thereby the effect is not lost;
► The installation work on site may be interrupted any time without incurring adverse consequences.

3.2.4. Generally

► Low water content means less sensitivity to frost;
► Alphasoil®-06 turns any existing soil used as an building material;
► The expected effect can be easily demonstrated on small laboratory samples;
► It is achieved by replacing conventional building materials by cheap soil and execute the construction with much thinner wearlayers, savings of between 20 to 30% during construction.

3.2.5. Disadvantages

► Alphasoil®-06 works in the base layer-range, and makes a wear-layer required to prevent mechanical removal;
► The so treated ground roads without wear layer is not recommended; the mechanical abrasion would dissipate the so treated layer and slowly but surely raising dust, because of the high fines content!
► These fine particles make the surface slippery and offer no grip.
► Extremely water-soaked soil what want to be treated with Alphasoil®-06, must be dry down to the below the recommended moisture content of 14% for the P.O. (Proctor optimum). Therefore is to consider, the weather conditions and the addition of Alphasoil®-06-Working-Solution.

► Laboratory investigations in advance: Determination of the pH value of the soil (too acidic or too alkaline); determination of salinity in the soil over 2% (hygroscopic); gradation analysis to determine the grain size distribution; bearing capacity measurement of the bedrock (CBR-value); water storage test by producing a soil test specimen treated with Alphasoil®-06.

3.3. Recommendation

Because of such advantages and disadvantages, we recommend the use of Alphasoil®-06 for the following purposes:

3.3.1. Alphasoil®-06 allows the installation of low-quality raw materials with which to enhance risk-free base-course material. The high CBR values provide a solid bridge for the loads and allow the strong reduction of the wear layer and hence massive cost savings.

3.3.2. Alphasoil®-06 allows an appreciation inferior material in one or more options:

► Increase the carrying values (ME, CBR, etc.);
► Reduction of the P.I. (plasticity index);
► Reduced water permeability;
► Strong reduced capillary water management;
► Improving the compression and processing;
► Once treated material can be reused; the effect of additives is maintained;
► Good effect where present swelling or shrinking problems;
► The additive can also be used to pre-mixing of material and its long-term storage before installation without loss;
Street banquets can be kept stable so that the wearlayer can not be destroyed from there;

Pre-mixed material can always be ready for installation transported to where there is no viable local base-course material.

Other successful applications include the control of soil erosion, the reclamation of eroded soil and already the production of building and paving stones with hydraulic presses.

4. Construction Methods

4.1. Mixing methods

4.1.1. "mix in place" mixing method

Often the "mix in place" mixing process, is the demanded strategy to improve existing soil material by mixing in Alphasoil®-06. In this method, the mixing equipment is brought to the material; The transport of material is omitted for the most part.

The experimentally determined amounts of Alphasoil®-06, is here applied to the loosened soil and mixed intensively. Before the Alphasoil-06-Mix, additional material can added and mixed, for the improve the mechanical capacity if necessary!

The Alphasoil ®-06-Working-Solution, applied with that much diluted water to the soil to bring the moisture content as close as possible to the P.O. (14% optimal moisture content, Proctor Optimum) what is needed for the right compression.

4.1.2 Central Mixing Process „mix in-plant“

The advantage that Alphasoil®-06 knows no setting time, makes it possible to pre-mix soil material in plants, no time limit to take the mix of stock and install at the construction site any time without loss of activity. This opens up especially for the grit- and gravel-generating industry the opportunity to process their overburden materials such as gravel washing mud or overflow material in combination with dirt-gravel to correct, always evenly mounted sub base and to produce a quality product that always has the same properties.

The effect of Alphasoil®-06 directly enters with the mixing into the soil material and is irreversible. This opens up the possibility to use mixed material once again.

Pre-mixed material will be used especially where very high demands on the uniformity of the material and its characteristics have to be made, such as for upper base layers, outer layers, or even where impractical due to space reasons, the local mixing process would be like at banquets or in Road construction during the day in mines.
4.2. Necessary Equipment

To build a road quickly and in a good quality, the following equipment is needed:

Machines - for milling of the street, for insertion Alphasoil®-06, for mixing the to be treated soil, to create a formation level, for the compression of the treated soils. With modern equipment it is possible to build 1 - 1.5 km road per day and to use it for construction-traffic-wise.

With special stone-cutter-equipment called "Stone-Crusher", first crushing the soil-layer.

Stone-containing material can thus be processed in addition to the required gravel grain in one operation.

A possible previously created road-leveling will not change.

Using a special mixing mill, is injected Alphasoil®-06-Working-Solution in a single operation and with the soil material mixed adequately.

By an spray-bar, mounted in front of the "Stone-Crusher", the Alphasoil®-06-Working-Solution can be sprayed and mix in to the soil, after the first crushing process. This method is an good alternative and make sense for smaller construction projects.
With a grader, the surface can be leveled before the rollers start the pure static compression of the Alphasoil®-06 treated soil without any vibration on the rollers.

The sub-floor should have an sufficient strength, to generate an adequate roller-counter-pressure. The subfloor should not float or be soft.

With sheep-foot and smooth-drum roller, the street where compacted that it is prepared for the final surface.

Rollers are optimal, which have at least 15 tones on the roller-body. An increase in weight due to vibration should be avoided generally. This is not beneficial for the soil structure!

Finally, the thus produced viable underbody is protected with a wear layer.

This may, as required, consisting of gravel with or without bitumen spray in a sandwich- construction or of asphalt. The bottom layer and wear layer can be halved in thickness in comparison to the conventionally construction wise.
4.3. Application of Alphasoil®-06

Alphasoil®-06 is used in aqueous solution, wherein the determined amount of Alphasoil®-06 is diluted in enough water, as the ground is ready to take to achieve the Proctor Optimum for the necessary 10% to 14% soil moisture. The Proctor Optimum (OMC) of the soil, was determined in an geotechnical labor before!

The Alphasoil®-06-Working-Solution is to prepared in the tank of the miller or a tank-truck, by distributing from the surface dependent amount of Alphasoil®-06 to the right amount of water.

If prior to the inserting the Alphasoil®-06-Working-Solution the floor is extremely dry as by strong wind and sunlight, can before and at any time with additional water application, the necessary moisture in the soil to be regulated.

If bad weather (thunderstorms) occurs, the soil-treatment can be interrupted any time and resumed later. If at the time of the interruption the soil is loosened, it must be closed immediately with all available compaction equipment to avoid the soil soaking with water!

Resume:

The fitting of Alphasoil®-06 is relatively simple and possible with conventional road construction equipment and some special machines.

When installation it is only necessary to ensure, that Alphasoil®-06 is mixed thoroughl, while the moisture is held slightly above the Proctor Optimum. Each soil particle should come in contact with Alphasoil®-06.

The required quantity of Alphasoil®-06-Working-Solution per square meter or per cubic meter are calculated on the basis of the results of previous laboratory studies and result in the field reliably comparable good results. It was determine in advance exactly what results and effects are to expect.
5. Environmental Compatibility

During the development of Alphasoil®-06 was the greatest diligence to ensure that the chemicals are environmentally friendly and no contamination of water and air can occur.

The environmental compatibility of Alphasoil®-06 has been demonstrated by an approval certificate of a renowned German Scientific Institute.

Fire Safety

Alphasoil®-06

The product comes as a dispersion in water in the trade, is not flammable and releases no toxic fumes. It can therefore be stored with the usual care for industrial chemicals.

Protection of health

Alphasoil®-06 is made of industrial chemicals and the uses of usual care in handling is required. If the product is handled properly, this caused no threat to health.

Avoid the contact with skin, spray-fog and the swallowing of solutions and contact with mucous membranes and eyes. If it comes to such contacts, so treat them as follows:

Skin Contact:

Wash the contaminated skin areas thoroughly with soap. In stronger skin contact neutralize the chemicals with a 3% solution of acetic acid in water and after this you wash the skin thoroughly with soap. If greater skin irritation, please looking for a doctor.

Eye Contact:

Flush eyes with water as soon as possible for about 15 - 20 minutes. For security reasons you should visit a doctor.

If you already have swallowed the material, drink plenty of milk or water and seek medical advice.

Wear Safety Glasses, Work Gloves and Work Clothes!