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[54] PROCESS FOR STABILIZING SOILS

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 888,812, Dec. 29, 1969, abandoned.

[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **61/35,** 94/7

[51] **Int. Cl.** **E02d 3/00**

[58] **Field of Search** 61/35, 36, 38; 94/4, 7

[56] **References Cited**

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[57] **ABSTRACT**

In stabilizing soil for foundations for buildings or roads, a non-woven or spunbonded fabric, preferably of continuous filaments and preferably of a polyester or polyolefine, is used as an anti-contaminant layer over cleared soil, below the preparation layers and coating layers if these are used. The spunbonded fabric is pervious to water but not to mud.

6 Claims, No Drawings

PROCESS FOR STABILIZING SOILS

This application is a continuation-in-part of application Ser. No. 888,812, filed Dec. 29, 1969, now abandoned.

The present invention relates to a process for the stabilization of soils.

For the construction of buildings and land communication routes, especially road and railway communication routes, it is important for the base soil to be perfectly stable. For this reason a separating layer, generally called an anti-contaminant layer, is often spread over the cleared soil, optionally after it has been compacted but before the layers subsequently called "preparation layers" (foundation layer, base layer and the like) which are of a different material to that of the soil, are formed. This anti-contaminant layer, which is water-permeable, is intended to prevent the base soil being converted into mud which under the pressure exerted by the weight of a building or the passage of heavy vehicles (trains, lorries, or earthworking machinery), rises up through the preparation layers, with the result that these no longer react uniformly to the pressure exerted and subsidence occurs.

However, this anti-contaminant layer, which usually consists of so-called "drain sand", of gravel, or of an unsorted mixture of sand and gravel must, in order to be effective, be made sufficiently thick, especially if it rests on clay, sandy or marshy soils. Thus this expensive and in certain cases rather unreliable solution is not satisfactory.

It is an object of the present invention to provide a means of overcoming or mitigating the above disadvantages.

According to the invention soil is stabilized by spreading over the cleared soil as an anti-contaminant layer textile material comprising non-woven fabric formed from natural, artificial or synthetic fibers, preferably continuous filaments.

In itself, a non-woven web or fabric formed of continuous filaments arranged at random across the web is a known product. Such products are sometimes described by the general expression "spunbonded" and this expression will for simplicity be adopted hereinafter. The manufacture of these articles, which has frequently been described, consists in principle in extruding a molten or dissolved organic polymer through a spinneret pierced with holes, orienting the extruded filaments by stretching the bundle by means of one or more jets of fluid (compressed air), and finally receiving the bundle in a predetermined manner on a moving belt whose speed and direction of travel are regulated so as to form an essentially regular non-woven web of the desired thickness. In practice, at this stage of the process of manufacture, the material is calibrated or calendered, preferably hot, so that the elementary filaments are bonded to one another at least at the surface, thereby considerably increasing the cohesion of the web. In general, a gentle calibration suffices.

It has been found that it is preferable for the "spunbonded" web to be needle-punched, essentially to enmesh the continuous filaments and impart cohesion to the base layer.

For the present purpose there is preferably used a spunbonded web or oriented filaments of a polyester, especially polyethylene terephthalate, or a polyolefine, especially isotactic polypropylene, though other organic fibers (of for example a polyamide, polyvinyl chloride or polyvinylidene chloride or their derivatives, a cellulose acetate, polyacrylonitrile, vinyl alcohol or the like) can also be used.

The webs can optionally contain a filler, an adjuvant or a textile reinforcement, consisting for example of a web of filaments or of parallel coarse fibers, or wide-mesh woven fabric.

The spunbonded webs of the present invention, whether or not they have been needle punched have the property of being permeable to water while at the same time resisting the passage of mud.

The optimum weight of spunbonded webs employed depends on the nature of the base soil and of the preparation layers, as well as on the pressure which the soil will have to undergo. By way of example, a weight of 200 to 700 g/m² will be adequate for moderate or heavy duty roadways.

The spunbonded material can be placed in position very simply by unrolling on the soil. Optionally, a second fabric of the same or a similar kind and/or a conventional anti-contaminant layer can be laid down over it. Thereafter, the preparation layers and, where appropriate, the coating layers are formed in the ordinary manner.

Compared to the previously used anti-contaminant layers, the spunbonded material makes it possible, with greatly reduced volume and weight, (1) better to separate the base soil from the preparation layers, (2) more effectively to prevent the rise of mud and (3) better to distribute the load exerted at a point over a broader surface of the base soil. The use of this material thus considerably improves the stability even of soils which are by nature rather unstable, such as clay, sandy or marshy soils.

The spunbonded material is consequently particularly suitable firstly for stabilizing roadways such as ordinary roads, motorways, racing tracks, unmade road, tracks for the passage of heavy machinery in yards, and metalled roads, and secondly for stabilizing building land and areas which have been cleared and are to be used for the bulk storage of large amounts of building materials, coal and the like.

The examples which follow illustrate the invention.

EXAMPLE I

Polyethylene terephthalate granules dried to a residual moisture content of less than 0.01 percent and having an intrinsic viscosity of 0.65 (determined at 25° C. on an 0.5 percent solution in o-chlorophenol) are fused in a single-screw extruder. The fused mass is passed by means of a pump through a spinneret heated to 290° C. and pierced with 50 holes of diameter 0.6 mm. The flow of extruded material is regulated to 3.0 g/minute/hole. The bundle of filaments formed is collected continuously in a stretching nozzle situated 175 cm from the spinneret, so that while travelling from the spinneret to the nozzle the bundle cools. The stretching nozzle is supplied with air compressed to 6 kg/cm² gauge.

After the stretching, the filaments have the following properties:

Average gauge, 10 dtex (9 den);
Elongation, 130 percent
Tenacity, 28.8 Rkm (3.2 g/den).

The bundle of oriented filaments is laid down by means of an oscillating deflector onto an endless moving belt to form a non-woven web which consists of continuous filaments arranged at random and in a non-parallel manner and which weighs about 280 g/m². This web is continuously calibrated by passing it between two rollers heated to 120° C., the spacing of which is adjusted to 8 mm.

Thereafter the spunbonded web is passed into a needle-punching loom equipped with needles with nine hooks, and so regulated as to give a piercing density of 80 strokes/cm² and a thickness of about 3 mm; the resulting web weighs about 300 g/m².

A sample of this web, 20 meters long and 5 meters wide, was unrolled on a curved access ramp of clay soil sloping at about 5 percent, 80 tons of unsorted sand-gravel mixture of density about 1,600 kg/cm³ were spread above the web. After lorries and bulldozers of average weight 20 tons had passed, at the rate of 800 tons/day, for 15 days (during which it rained for the equivalent of 5 days, of which 3 were consecutive days), the profile of the ramp was only very slightly changed and all travel had taken place normally.

During the same time, on a ramp similar to the first to which only the 80 tons of the sand-gravel mixture but no non-woven web has been applied, the lorries and bulldozers became stuck in the mud after 1 day's rain and it was necessary to add further sand-gravel mixture. After 15 days, to fill up the ruts which had appeared either merely because of the lorries and bulldozers passing or because of the combined action of their passing and of the rain, it was necessary to add 170 tons of the mixture over a surface equal to that of the web, that is to say 100 m², representing a total application of 250 tons against a previous 80 tons.

EXAMPLE II

One prepares a zone of about 60,000 square meters of boggy, swampy, water laden land. The preparation of the ground consists only of removal of the large vegetation. One then spreads on this surface an assembly of sheets sewn together weighing 600 grams to the square meter. The desired thickness is obtained by superimposing two sheets such as are described in Example I, calibrated but not yet needle punched. The connection of the two sheets is then effected by needle punching the two superimposed sheets using the same density of piercing as in the preceding example but with greater depth of penetration of the needles. The thus connected double thickness sheets are sewn together to the area desired.

One puts on the sheet a layer 120 cm thick of ungraded product such as gravel which is then compacted. One obtains so a large surface terrain which is then utilized without disadvantage as a zone of industrial storage comprising flat storage surfaces and ways for the passage of large trucks.

Although heavy materials may be stored on the surface provide in Example II the mud does not pass through the sheets or webs of spunbonded material according to the present invention. The water will pass through this material, but the mud will not so that the spunbonded web functions as a filter as far as the mud is concerned. The web of Example I functions the same way and therefore permits water from below to pass through it and then to drain off at the sides of the road surface while the mud is contained underneath the web of spunbonded material. Thus the spunbonded material has the property of preventing the passage of mud through it, but because the water passes through the spunbonded web from below to above, the result is to make the remaining mud more stable by loss of some of its water.

The spunbonded material of Examples I and II is also a very strong material. It is normally covered with a preparation layer and when it is then subjected to heavy loads, for example the wheels of a heavy vehicle, the load is distributed over the area of the sheet which is in effect tensioned, under the preparation layer, by the load. The strength of the material is such that it resists tearing even under high load conditions.

What is claimed is:

1. The method of producing a load bearing surface over a base soil of high moisture content and low stability that comprises placing a non-woven sheet of spunbonded, essentially continuous organic filaments arranged at random across the sheet over said base soil and covering said sheet with preparation layers, said textile sheet preventing the rise of mud from the base soil while permitting the passage of water and co-mingling of the same with the preparation layers and distributing loads applied to said preparation layers over the area of said sheet.

2. The method as claimed in claim 1 wherein the weight of the textile fabric is from 200 – 700 g/m².

3. The method as claimed in claim 1 wherein the textile fabric is needle punched.

4. The method according to claim 1, wherein the non-woven fabric is made of fibers of a polyester.

5. The method according to claim 1, wherein the non-woven fabric is made of fibers of a polyolefine.

6. The method according to claim 1, wherein said non-woven sheet has at least two laminae connected to one another by needle punching.

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