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(54) Geocomposite system for roads and bridges and construction method

(57) A geocomposite system (10,40) for increasing the service life of roads, bridges, or the like, includes a geocomposite layer (12,42) having a geomembrane (18,60) disposed between two geotextile backings (20,22,56,58), a structural layer (14,44) for supporting the geocomposite layer (12,42), and a base layer (16,46) formed on top of the geocomposite layer (12,42). The geomembrane (18,60) is impermeable and the geotextile backings (20,22,56,58) are sufficiently porous to provide a wicking action of moisture or liquid laterally along the geomembrane (18,60) and out of the geocomposite system (10,40) to prevent moisture or liquid damage. The geomembrane (18,60) prevents the intrusion of liquids including deicing salts into the structural layers of roads, bridges, or the like abating deterioration in the structural layers such as corrosion of reinforcing steel. The geocomposite layer (12,42) is bonded to and conforms to the structural layer (14,44), thus reducing reflective, shrinkage and fatigue cracking and increasing the structural capacity of the road or bridge. Preferably, the geomembrane (18,60) is an extruded polyvinylchloride web and the geotextile backings (20,22,56,58) are fabricated of a mat of non-woven polyester fibers. The geotextile backings (20,22,56,58) are heat coupled to the geomembrane (18,60), preferably using a calendaring process. The geocomposite layer (12,42) is also bonded to the base layer (16,46). In the related method, the geocomposite system is constructed by fabricating the geocomposite layer, applying a tack coat to the structural layer, placing the geocomposite layer with the geotextile backing down on the prepared structural layer, rolling the geocomposite to provide conformity with the structural layer, applying a tack coat to the other geotextile backing and forming and bonding the base layer on the geocomposite layer.

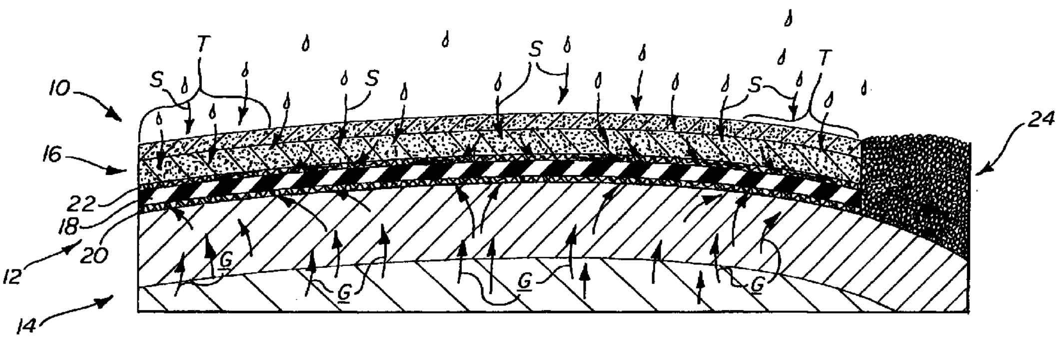

FIG. 1

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Description

Technical Field

[0001] The present invention relates generally to geocomposite systems, and more particularly to using a geocomposite layer in the construction of roads and bridges.

Background of the Invention

[0002] The United States has a public roadway infrastructure of more than 6.2 million kilometers with more than 575,000 bridges which is traveled by more than 2.4 trillion vehicle-miles per year. Approximately 3.8 million kilometers of the system are paved road, 96% of these paved roads have flexible, or hot-mix asphalt, pavements. It is estimated that approximately one sixth of the more than 90 billion dollars spent annually by U.S. governmental agencies to enhance, rehabilitate, and maintain the public roadway infrastructure is spent on constructing and maintaining these paved roads.

[0003] Considering the magnitude of this type of annual investment the potential savings from developing improved and longer lasting pavement systems is substantial. For example, if the service life of a new pavement system is extended by three years, i.e., twenty percent considering the average life of a pavement system is 15 years, the savings in hot-mix asphalt alone is estimated to be three billion dollars per year. Furthermore, the labor cost savings are estimated to be at least ten times this amount.

[0004] Another substantial expense involving the public highway infrastructure is the rehabilitation and maintenance costs associated with the corrosion of reinforcing steel in bridge decks. In 1991, the backlog of public bridge repair and maintenance costs was estimated to be 78 billion dollars. It is also estimated that 40% of the 575,000 bridges are structurally or functionally obsolete with reinforcing steel corrosion being the major cause of deterioration at more than 31 billion dollars.

[0005] In order to stem the overwhelming costs associated with the enhancement, rehabilitation, and maintenance of the public highway infrastructure, several techniques have been developed which attempt to prevent or deter the deterioration and eventual breakdown of roads and the corrosion of reinforcing steel in bridges. For example, several techniques were used to abate corrosion in bridge decks including the use of sealers, coated reinforcing bars, cathodic protection, low permeability concrete, and waterproofing membranes, among others.

[0006] Possibly the most popular of these techniques is shown in one form in U.S. Patent 4,362,780 to Marzocchi et al, wherein a single thickness fiber web is asphalt impregnated and laid between layers of the pavement system to impede the downward migration of water (or other liquids) into the roadbed or the bridge deck. Although successful in reducing the downward migration of some moisture, the web in the '780 patent falls short in several functional areas, such as the ability to laterally drain the water away and providing a cushioning effect to alleviate weather and traffic related damage.

[0007] Accordingly, while the use of impregnated fiber webs is generally known in the art of constructing roads and bridges, to date no one has recognized and adequately addressed the advantages of providing a prefabricated, composite layer, including an impermeable membrane. Thus, there is a need to provide an improved geocomposite system to extend the service life of roads, bridges, or the like, and an improved method of construction with such a composite layer. The geocomposite system and method should make the best use of a flexible geomembrane combined with at least one geotextile backing to form a geocomposite layer to be located between adjacent geocomposite layers. This geocomposite layer so constructed should prove to provide water impregnability in a vertical direction, but allow lateral drainage. Indeed, it is contemplated that utilizing a flexible geomembrane, and geotextile backings on both sides, can best carry out these intended purposes. In addition, there should be a significant improvement in the structural capacity and cushioning of the road or bridge to withstand rigorous dynamic loading by traffic. Costly cracking and deterioration, including due to water, is to be significantly reduced, and the life of the road or bridge significantly extended.

Summary of the Invention

[0008] Accordingly, the primary object of the present invention is to provide an improved geocomposite system for extending the service life of roads, bridges, or the like by overcoming the limitations and disadvantages of the prior art and adopting the improvement features contemplated above.

[0009] Another object of the present invention is to provide a geocomposite system wherein a geocomposite layer or web placed between an upper base layer and a lower structural layer of a roadway or bridge eliminates the vertical migration of water.

[0010] A further object of the present invention is to provide a geocomposite layer having a geomembrane disposed between first and second geotextile backings, which have sufficient porosity to provide a wicking action of water along both sides of the geomembrane and out of the geocomposite system.

[0011] It is still another object of the present invention to provide a geocomposite system of the type described, which provides cushioning so as to dissipate stress loads to a level supportable by the base layer, and thus to alleviate load-related cracking.

[0012] Still another object of the present invention is to provide a geocomposite system utilizing a flexible and cushioned geomembrane capable of conforming to the base and structural layers of the roads and bridges.

[0013] Yet another object of the present invention is to provide a geocomposite layer of the type described having a geomembrane of sufficient thickness to allow easy coupling of the geotextile backings prior to installation in the road or bridge.

[0014] Another object of the present invention is to provide a geocomposite system including a geocomposite layer with thermal properties sufficient to withstand the temperature of the base layer (e.g., hot-mix asphalt) during application of the base layer and having sufficient thickness so that milling of a wear surface of the base layer will not affect the geocomposite layer, thus allowing repair and replacement of a portion of the wear surface.

[0015] Yet another and related object of the present invention is to provide a method of constructing a geocomposite system for use in a road, bridge, or the like, wherein the method includes fabricating a geocomposite layer, applying a tack coat to a structural layer of the road or bridge, laying the geocomposite layer on the prepared structural layer and rolling the geocomposite layer to insure conformity and coupling, and applying a tack coat to the geotextile backing on the exposed side of the geocomposite layer, and forming a base layer on the geocomposite layer.

[0016] Additional objects, advantages and other novel features of the invention will be set forth in part in the description that follows and in part will become apparent to those skilled in the art upon examination of the following or may be learned with the practice of the invention. The objects and advantages of the invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

[0017] To achieve the foregoing and other objects, and in accordance with the purposes of this invention, an improved geocomposite system is provided, and is contemplated to be utilized to increase the service life of roads, bridges, or the like. The geocomposite system includes a geocomposite layer disposed between and bonded to a structural layer and a base layer. More specifically, the geocomposite layer is securely bonded to each of the structural and the base layers by means of a tack coat of a suitable adhesive. Within the broadest aspects of the present invention, the geocomposite layer provides a barrier against the penetration or permeation of surface moisture or liquid into the structural layer, as well as, upward migration of ground moisture or liquid into the base layer. Additionally, the geocomposite layer placed in between conforms to the base and structural layers such that the load of passing vehicles is transferred through the geocomposite layer to the structural layer efficiently by dissipating the applied stress.

[0018] In accordance with an important aspect of the present invention, the geocomposite layer includes a geomembrane disposed between first and second geotextile backings. The geotextile backings are fabricated of a mat of non-woven polypropylene fibers or, in the present preferred embodiment, as a mat of non-woven polyester fibers. The geotextile backings are securely adhered to the geomembrane through a heat coupling process, such as calendaring. Advantageously, this process allows the geocomposite to be fabricated and quality tested prior to installation in the road or bridge. The geomembrane is preferably extruded having a thickness in the range of 30 to 100 millimeters. In accordance with the broader aspects of the present invention, the geomembrane can be formed utilizing various known processes and utilizing a material selected from the group consisting of polyvinylchloride, very flexible polyethylene, linear low density polyethylene, low density linear polyethylene, ethylene propylene diene terpolymer, or chlorosuphonated polyethylene.

[0019] In accordance with another feature of the invention, the geomembrane is impermeable and the geotextile backings are sufficiently porous to provide a wicking action of the moisture or liquid along the geomembrane. Advantageously, the geotextile backings direct the moisture or liquid laterally, toward the edges of the road or bridge, while the geomembrane prevents the migration of water between the base layer and the structural layer. This is effective in preventing downward penetration or permeation of surface moisture into the structural layer, as well as, upward migration of ground moisture into the base layer. Overall, the combination of impeding and directing the flow of moisture or liquid is effective in preventing pooling within or between the layers, dissipating pore water pressure, limiting soil movement and/or providing a moisture barrier that prevents water movement between layers. Each of these scenarios, unless corrected by use of the present invention, is singly capable of causing minor to severe damage to a road or bridge.

[0020] The geomembrane is also flexible and elastic allowing the geocomposite layer to substantially conform to the structural and base layers of the road or bridge. Specifically, these positive conformal properties allow loads created by constant traffic to be transferred directly, but in a cushioned fashion and thus more efficiently, to the structural layer. The reduction or elimination of these undesirable load conditions reduces the proliferation of reflective (or rebound), shrinkage and fatigue cracking in the road or bridge. Even more specifically, the elasticity of the geomembrane allows the geomembrane to temporarily deform, thus cushioning and absorbing a significant portion of the lateral stresses imparted to the base layer by passing vehicles. This increases the effective overall tensile strength of the base layer, and necessarily, the overall structural capacity and durability of the road or bridge.

[0021] The geocomposite layer of the present invention preferably includes a geomembrane having a thickness in the range of between 30 and 100 millimeters. Preferably, the thickness of the base layer is sufficient to allow an upper portion to be removed and replaced without adversely affecting the geocomposite system, and specifically, the bonds between the geocomposite layer and the structural and base layers. It is contemplated that the thickness of the base layer including the upper wear surface should be thick enough to allow milling of the wear surface/base layer up to one-half inch above the geocomposite layer to accommodate the later removal and replacement of a worn out wear surface. Advantageously, this greatly reduces the costs associated with maintenance of roads or bridges constructed in accordance with the present invention.

[0022] In accordance with the broadest aspects of the present invention, the geocomposite system can be utilized for new roads and bridges, or the like. However, it is further contemplated that a specific form of the geocomposite system of the present invention may be further utilized in the repair or rehabilitation of existing roads and bridges, and in known trouble spots in new construction areas, such as in transition areas between roads and bridges, or between train tracks at crossings, for example.

[0023] Preferably, the structural layer in a geocomposite system utilized with a road includes a common sub-grade (road bed) or soil base, a subbase, and a drainage layer of aggregate stone, for example. Alternatively, the structural layer of a geocomposite system utilized with a bridge may simply include a steel deck and/or a reinforced concrete deck. The base layer for either may include one or more layers of asphalt including an asphalt wear surface.

[0024] In the related method, the geocomposite system is constructed by first fabricating the geocomposite layer. Preferably, the geomembrane is extruded and the geotextile backings are securely adhered to the geomembrane through a heat coupling process, such as by calendaring, just after extrusion. Advantageously, this step is preferably carried out prior to installation in the road or bridge. Necessarily, this provides a geocomposite of superior quality and uniformity than heretofore achieved utilizing known prior art methods.

[0025] Next, the structural layer of the road or bridge is prepared to receive the geocomposite layer, preferably by applying a tack coat of a suitable adhesive on top of the structural layer. The geocomposite layer with a geotextile backing engaging the prepared structural layer absorbs a portion of the tack coat. A suitable force is applied to enhance the absorption of the tack coat into the geotextile backing and to insure substantial conformity of the geocomposite layer with the structural layer. An additional tack coat is applied to the top of the remaining exposed geotextile backing prior to forming the base layer. This insures a secure bond between the geotextile backing and both of the base and structural layers in either a road or bridge.

[0026] Still other objects of the present invention will become apparent to those skilled in this art from the following description wherein there is shown and described a preferred embodiment of this invention, simply by way of illustration of one of the modes best suited to carry out the invention. As it will be realized, the invention is capable of other different embodiments and its several details are capable of modification in various, obvious aspects all without departing from the invention. Accordingly, the drawings and description will be regarded as illustrative in nature and not as restrictive.

Brief Description of the Drawings

[0027] The accompanying drawings incorporated in and forming a part of the specification, illustrate several aspects of the present invention and together with the description serve to explain the principles of the invention. In the drawings:

Figure 1 is a cross sectional view of the geocomposite system constructed in accordance with the present invention, illustrating the geocomposite layer within a road and indicating the drainage movement of moisture or liquid through the geotextile backings to one edge of the geocomposite system and road edge;

Figure 2 is a perspective exploded view of the geocomposite system for a road including the geocomposite layer, the preferred structural layer, and the preferred base layer, all cut away in cross section for clarity;

Figure 3 is a cross sectional view of the geocomposite system for a bridge, again illustrating the geocomposite layer within the geocomposite system, and indicating the lateral drainage of moisture or liquid through the geotextile backings to a suitable weep collection channel and exit passage;

Figure 4 is a side cross sectional view showing the preferred method of forming the geocomposite layer including heat coupling, utilizing a calendaring process, the geotextile backings to the geomembrane prior to installation in the road or bridge;

Figure 5 is an illustrated view showing the preferred method of constructing the road or bridge including laying the geocomposite layer with the geotextile backing on top of the prepared structural layer, and applying a force, in the form of a roller, to enhance the absorption of adhesive and to conform the geocomposite layer to the face of the structural layer; and

Figure 5a is a side enlarged cross sectional view taken from Figure 5 showing the spray application of the tack coats, the conforming effect of the applied force on the geocomposite layer, and the enhanced absorption of the tack coat into the geotextile backing to form a secure bond.

[0028] Reference will now be made in detail to the present preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings.

Detailed Description of the Preferred Embodiment

[0029] Reference is now made to the drawings showing a geocomposite system 10 forming a road in accordance with the present invention. As indicated above, the particular preferred embodiment chosen to illustrate the invention, and best shown in Figure 2, includes a geocomposite layer 12 disposed between a structural layer 14 and a base layer 16 for extending the service life of the road. While the pavement system 10 is a preferred embodiment that takes full advantage of the present invention, it is to be understood that equivalent systems for extending the service life of roads, bridges, or the like are deemed to be within the broadest aspects of the present invention.

[0030] As best shown in Figure 1, the geocomposite layer 12 provides a barrier against the penetration or permeation of surface moisture or liquid (S) into the structural layer 14, as well as, upward migration of ground moisture or liquid (G) into the base layer 16. In other words, geocomposite layer 12 provides a barrier sufficient to prevent the vertical penetration or migration of moisture or liquid between the layers of the geocomposite system 10. Additionally, the geocomposite layer 12, and specifically geotextile backings 20 and 22 retain sufficient porosity to provide a path based on wicking action for the moisture or liquid horizontally along geomembrane 18 out of the geocomposite system 10 to a suitable stabilized edge drain system 24 for release beyond the shoulder of the road.

[0031] More specifically, the moisture or liquid (S or G) entering the geocomposite system 10 is absorbed and flows or weeps trough the geotextile backings 20 and 22 to the edge drain system 24. The edge drain system 24, in the present preferred embodiment, is a trough formed beyond the edge of the emergency travel shoulder T of the pavement system 10. The semi-permeable stabilized aggregate stone and/or soil receives the flow of moisture or liquid from the geotextile backings 20 and 22 and directs it away from the road.

[0032] While the preferred edge drain system 24 is one commonly utilized along roadways and in other applications, it is to be understood that other like systems for moving moisture or liquids away from the geocomposite system 10 are deemed to be within the broadest aspects of the present invention. For example, a sub-surface geotextile wrapped permeable pipe with spaced weep passages directed away from the shoulder could also perform the function.

[0033] The geocomposite layer 12 is both flexible and elastic. Advantageously, these properties allow the geocomposite layer 12 to conform to the structural layer 14 and the base layer 16. This allows the dynamic loading of passing vehicles to be transferred directly through the geocomposite layer 12 which acts as a stress absorption layer above the structural layer 14. This is of increased importance in geocomposite systems wherein the structural layer is subjected to more severe stress, or in transition areas such as between a road and a bridge, for example. Absent these stress absorption properties, the geocomposite layer 12 would transmit all loads into the structural layer from the passing vehicles. The reduction or elimination of these undesirable stress loading conditions reduces the proliferation of reflective (or rebound), fatigue and shrinkage cracking in roads or bridges.

[0034] The elasticity of the geomembrane allows the geomembrane 18 to temporarily deform up to 250 percent. This property allows a large portion of the vertical stresses, but especially the lateral stresses, imparted to the base layer by passing vehicles to be cushioned, and in effect absorbed by the geomembrane 18, thus preventing the transfer of stresses to the structural layer 14. As noted above, this increases the overall tensile strength of the structural layer 14 and the durability of the geocomposite system, and decreases the possibility of excessive sub grade deformation which may occur resulting in pavement cracking, rutting and other distresses.

[0035] As indicated above, the preferred geocomposite system 10 includes the geocomposite layer 12 disposed between the structural layer 14 and the base layer 16. Specifically, the structural layer 14 (shown in Figure 2) includes a sub grade 26, an aggregate layer 28, and a treated aggregate layer 30. The base layer 16 comprises a base hot-mix asphalt course 32 and a wear hot-mix asphalt course 34. In this preferred embodiment, the geocomposite layer 12 is specifically disposed between the upper most layer of the structural layer 14, i.e., it is between the treated aggregate layer 30 and the base hot-mix asphalt course 32.

[0036] In accordance with the broadest aspects of the present invention, the structural layer 14 and the base layer 16 may include several distinct and varying layers and layer combinations dependent upon the specific road or bridge application. While the preferred structural layer 14 takes full advantage of the present invention, it is to be understood that other combinations and methods for forming the structural layer 14 are deemed to be within the broadest aspects of the present invention. For example, the structural layer 14 may include more than one aggregate or treated subbase layer. Further, the base layer 16 could include an additional intermediate hot-mix asphalt layer, for example, or it could be made semi-rigid, including a stabilized aggregate layer and/or a concrete slab.

[0037] In addition to the various possible combinations of layers forming the structural layer 14 and the base layer 16, the placement of the geocomposite layer 12 within the geocomposite system 10 may also vary dependent upon the specific required application. For instance, the geocomposite layer 12 may alternatively be placed between the base hot-mix asphalt course 32 and the wear hot-mix asphalt course 34 within the base layer 16. This placement may be preferred for certain repair or rehabilitation purposes to reduce fatigue cracking due to its ability to absorb stress/strain energy. Similarly, it could be placed between the sub grade 26 and the aggregate layer 28 within the structural layer 14 for specific wetland applications.

[0038] As shown in Figure 3, an alternate embodiment of the present invention includes a geocomposite system 40 for a bridge having a geocomposite layer 42 disposed between a structural layer 44 and a base layer or overlay 46. In this preferred alternate embodiment the structural layer 44 includes a bridge deck 48 and a reinforced concrete deck 50, with or without reinforcement bars 52. The base layer 46, on the other hand, is simply a hot-mix asphalt wear course 54. As in the geocomposite system 10 utilized for roads, the geocomposite layer 42 and specifically geotextile backings 56 and 58 provide a wicking action for lateral movement of moisture or liquids along the geomembrane 60 to the channel 62 and weep passages 64.

[0039] As clearly shown in Figure 3, the geocomposite system 40 is designed to extend the service life of the bridge primarily by providing a baffler against the penetration of surface moisture or liquid into the structural layer 44. More specifically, the geocomposite system 40 protects the bridge deck 48 and the reinforcement bars 52 from the corrosive properties typically associated with moisture and other liquids, such as chloride ions and other solutions, that result from use of ice and snow control materials in the colder climates and/or splashing of seawater.

[0040] According to the present invention, the geocomposite layer 12 is completely fabricated and quality tested prior to installation in the road geocomposite system 10 or bridge geocomposite system 40. Advantageously, this provides a superior quality and uniformity than was heretofore available with prior road or bridge geocomposite systems where the impermeable barriers are formed at the worksite.

[0041] In accordance with the broadest aspects of the present invention, the geomembrane 18 is a plastic or rubber web. Preferably, the web is selected from the group consisting of polyvinylchloride, a very flexible polyethylene, a linear low density polyethylene, a low density linear polyethylene, an ethylene propylene diene terpolymer, or a chlorosuphonated polyethylene and has a thickness in the range of 30 to 100 millimeters. More preferably, the geomembrane 18 is an extruded polyvinyichloride plastic web with a thickness in the range of 60 to 100 millimeters and most preferably, the thickness is substantially 80 millimeters. It is generally accepted that a 20 millimeter plastic or rubber membrane is sufficient to provide the impermeable barrier capable of preventing the migration or permeation of moisture or liquid. However, a 20 millimeter membrane provides no margin to protect against damage during construction. Thus, the present preferred geomembrane 18 inherently provides a margin (50 to 400 percent) against damage during construction, or during repair work, such as resurfacing.

[0042] The geotextile backings 20 and 22 are fabricated of a mat of non-woven polyester or polypropylene fibers having a density in the range of 100-400 grams per square meter (g/m^2). Most preferably, the geotextile backings 20 and 22 are non-woven polyester fibers having a density of 150-200 grams per square member (g/m^2). As shown in Figure 4, the geotextile backings 20 and 22 are heat bonded to the geomembrane 18, preferably just after extrusion, such as by calendaring or rolling under pressure. The preferred range of thickness of the geomembrane 18 is necessary to accommodate proper bonding, while assuring retention of the proper wicking action in the backings 20, 22.

[0043] Advantageously, the fabricated geocomposite layer 12 may be transported to the construction site on a conventional transport vehicle T in a roll (shown in Figure 5a), where it is easily unrolled during construction of the road or bridge.

[0044] The road or bridge construction method of the present invention can now be explained in more detail. As a first step, the geocomposite layer 12 is formed off-site (see Figure 4), by a calendaring process, and brought to construction site on a trailer T (see Figure 5). The structural layer 14 of the road or bridge geocomposite system 10 or 40 is prepared in the cut of the ground or on the bridge deck. It is leveled to receive the geocomposite layer 12. A tack coat C_1 forming a suitable adhesive is applied, such as by a sprayer E_1 (Figure 5a). Preferably, the tack coat C_1 is an asphalt elastormeric composition. For example, an emulsified, liquid asphalt, which includes bituminous and/or non-bituminous components, can be economically used. The composition selected should be capable of assuring that the geotextile backing 20 is securely mechanically bonded to the upper face of the structural layer 14.

[0045] As shown in Figures 5 and 5a, the geocomposite layer 12 is thus laid onto the upper face of the prepared structural layer 14. The geotextile backing 20 advantageously generally conforms to the face, and absorbs the tack coat C_1 for bonding.

[0046] In the preferred method, an outside force sufficient to insure full conformity of the geocomposite layer 12 to the structural layer 14, and a more complete absorption of the tack coat C_1, is applied. The force may be applied in the form of a conventional road construction roller R. The roller R thus forces the geocomposite layer 12 into intimate contact with the tack coat C_1 and the structural layer 14 so that the geotextile backing 20 is now securely adhered to the structural layer 14.

[0047] Of course, several webs of the geocomposite layer 12 are laid in an abutting end-to-end/side-to-side relationship with overlapping edges to form a road/bridge section. Next, the geotextile backing 22 is prepared to receive the base layer 16. Specifically, tack coat C_2, the same as described above, is sprayed on the geotextile backing 22 by sprayer E_2. The base layer 16, for example, is then formed by a mechanical paver, and simultaneously bonded to the geotextile backing 22. Again, a conventional roller (not shown) used in road construction (see the roller R) finishes the road or bridge deck through compacting the base layer 16, and in turn pressing the backing 22 into the tack coat C_2 .

[0048] In summary, the results and advantages of the present invention can now be fully understood. The road and bridge geocomposite systems 10 and 40 include a geocomposite layer 12 having a geomembrane 18 disposed between two geotextile backings 20, 22, a structural layer 14 for supporting the geocomposite layer 12, and a base layer 16 formed on top of the geocomposite layer 12. Advantageously, the geomembrane 18 is impermeable to block the movement of moisture vertically between the structural and base layers 14, 16. At the same time, the geotextile backings 20, 22 are sufficiently porous to provide horizontal wicking action for the moisture or liquids causing it to move harmlessly to the lateral edges of and away from the road or bridge. Additionally, the geomembrane 18 is sufficiently flexible and resilient to conform to the layers 14, 16 of the geocomposite system 10, thereby providing a cushioning effect that is operative in increasing the structural capacity. As a result, reflective, shrinkage and fatigue cracking and other damage is minimized.

[0049] The foregoing description of a preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Obvious modifications or variations are possible in light of the above teachings. The embodiment was chosen and described to provide the best illustration of the principles of the invention and its practical application to thereby enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as is suited to the particular use contemplated. All such modifications and variations are with in the scope of the invention as determined by the appended claims when interpreted in accordance with breadth to which they are fairly, legally and equitably entitled.

Claims

1. A geocomposite system for a road or the like, comprising:

   a geocomposite layer including an impermeable geomembrane disposed between first and second geotextile backings;
   a structural layer for supporting said geocomposite layer; and
   a base layer formed on top of said geocomposite layer,
   whereby the service life is extended through said geocomposite layer by increasing the structural capacity and providing protection against moisture or liquid damage.

2. The geocomposite system of Claim 1, wherein said geocomposite layer is bonded to said structural layer by said first geotextile backing and to said base layer by said second geotextile backing and substantially conforms to said structural layer,
   whereby reflective, shrinkage and fatigue cracking are minimized.

3. The geocomposite system of Claim 2, wherein said first and second geotextile backings have sufficient porosity to provide wicking action of liquids laterally along said geomembrane out of said geocomposite system.

4. The geocomposite system of Claim 3, wherein said geomembrane is a plastic or rubber web and has a thickness in the range of between 30 and 100 millimeters.

5. The geocomposite system of Claim 4, wherein said geomembrane has a thickness of substantially 80 millimeters.

6. The geocomposite system of Claim 4, wherein said plastic web is a material selected from the group consisting of polyvinyichloride, very flexible polyethylene, liner low density polyethylene, low density linear polyethylene, ethylene propylene diene terpolymer, chlorosuphonated polyethylene and mixtures thereof.

7. The geocomposite system of Claim 4, wherein said plastic web is polyvinylchloride.

8. The geocomposite system of Claim 1, wherein said first and second geotextile backings are heat coupled to opposite sides of said geomembrane.

9. The pavement system of Claim 8, wherein each of said geotextile backings are fabricated of a mat of non-woven polyester or polypropylene fibers.

10. The geocomposite system of Claim 8, wherein said geotextile is a mat of non-woven polyester fibers.

11. A geocomposite system for a bridge or the like, including a deck having an upper surface for supporting the geocomposite system comprising:

    a geocomposite layer including an impermeable geomembrane disposed between first and second geotextile backings;

a structural layer on the bridge deck for supporting said geocomposite layer; and

a base layer formed on top of said geocomposite layer,

whereby the service life of the bridge is extended through said geocomposite layer by increasing the structural capacity and providing protection from moisture or corrosion damage.

12. The geocomposite system of Claim 11, wherein said geomembrane is a plastic or rubber web; and

said first and second geotextile backings have sufficient porosity to provide wicking action for liquids laterally along said geomembrane and out of said geocomposite system.

13. The geocomposite system of Claim 12, wherein said structural layer is reinforced concrete; and

said base layer includes a hot-mix asphalt wear surface.

14. The geocomposite system of Claim 12, wherein said first and second geotextile backings are heat coupled to said geomembrane.

15. A method of constructing a geocomposite system for roads, bridges, or the like having a structural layer, and a base layer, comprising the steps of:

fabricating a geocomposite layer including an impermeable geomembrane disposed between first and second geotextile backings;

preparing the structural layer to receive said geocomposite layer;

placing said geocomposite layer with the first geotextile backing in engagement with the structural layer;

preparing said second geotextile backing of said geocomposite to receive said base layer; and

forming said base layer on said geocomposite layer in engagement with said second geotextile backing,

whereby the service life of the road, bridge or the like is extended through said geocomposite layer by increasing the structural capacity and providing protection against moisture, liquid damage or deicing solutions.

16. The method of constructing a geocomposite system of Claim 15 wherein the step of forming said geocomposite layer includes heat coupling said first and second geotextile backings to opposing sides of said geomembrane and substantially conforming to said structural layer,

whereby reflective, shrinkage and fatigue cracking are minimized.

17. The method of constructing a geocomposite system of Claim 16, wherein the step of heat coupling includes calendaring said first and second geotextile backings by applying roller pressure to said opposing sides.

18. The method of constructing a geocomposite system of Claim 15, wherein the step of preparing the structural layer includes applying a tack coat on said structural layer for bonding said geocomposite layer.

19. The method of constructing a geocomposite system of Claim 18, further comprising the step of applying a sufficient force to said geocomposite layer to substantially conform the same including said first geotextile backing to the structural layer, whereby loads are absorbed and transferred more efficiently through the geocomposite layer to the structural layer and said backing is coupled to said structural layer.

20. The method of constructing a geocomposite system of Claim 19, wherein the step of applying a force includes rolling said geocomposite layer with a roller.

21. The method of constructing a geocomposite system of Claim 18, wherein the step of preparing said second geotextile backing of said geocomposite layer to bond to the base layer includes applying a tack coat to said second geotextile backing.

22. A method of constructing a geocomposite system for roads, bridges, or the like having a structural layer and a base layer comprising the steps of:

fabricating a geocomposite layer including a geomembrane sufficient to support the base layer disposed between first and second geotextile backings, said base layer including an upper portion capable of removal and replacement;

bonding said first geotextile backing of said geocomposite to the structural layer;

forming and bonding said base layer to said second geotextile backing of said geocomposite; and

wherein said upper portion of said base layer may be removed and replaced without disturbing the bonds between said structural layer, said geocomposite layer, and said base layer.

23. The method of constructing a geocomposite system of Claim 22 wherein said upper portion of said base layer forms a wear surface having a thickness of at least substantially one and a half inches.

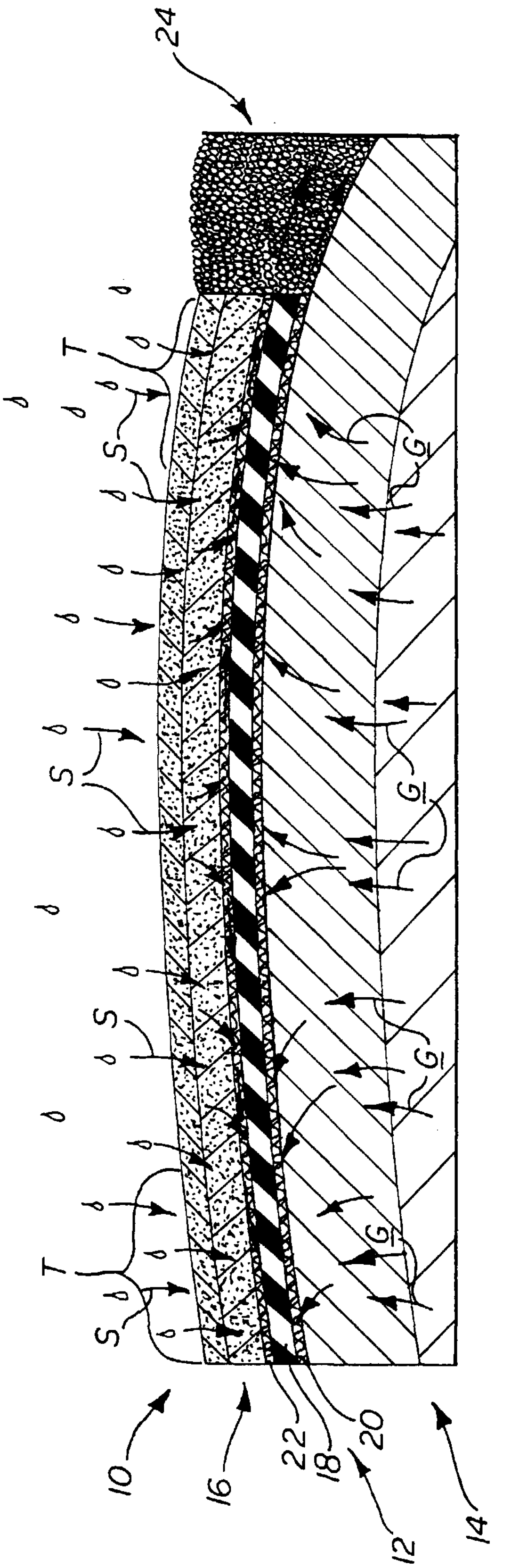

FIG. 1

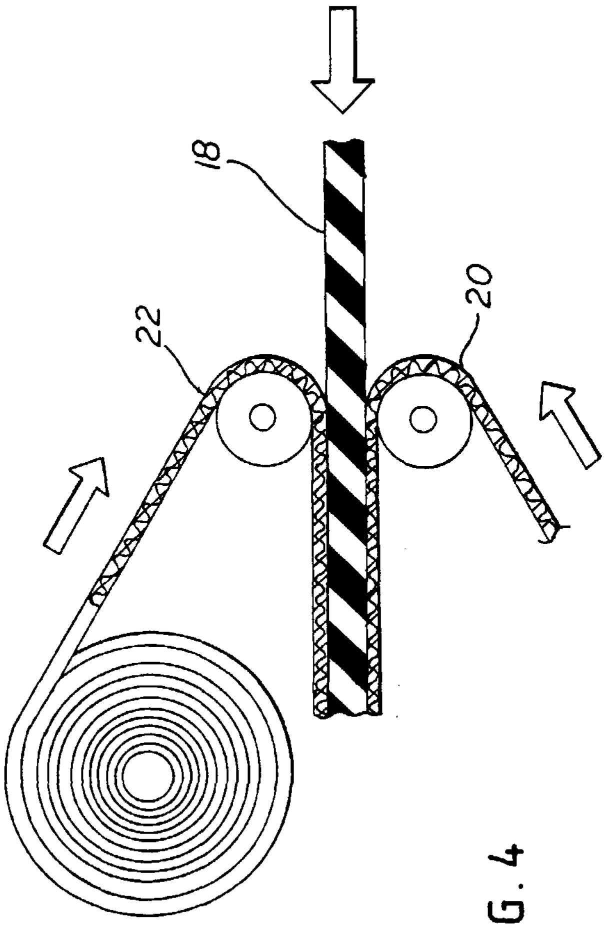

FIG. 4

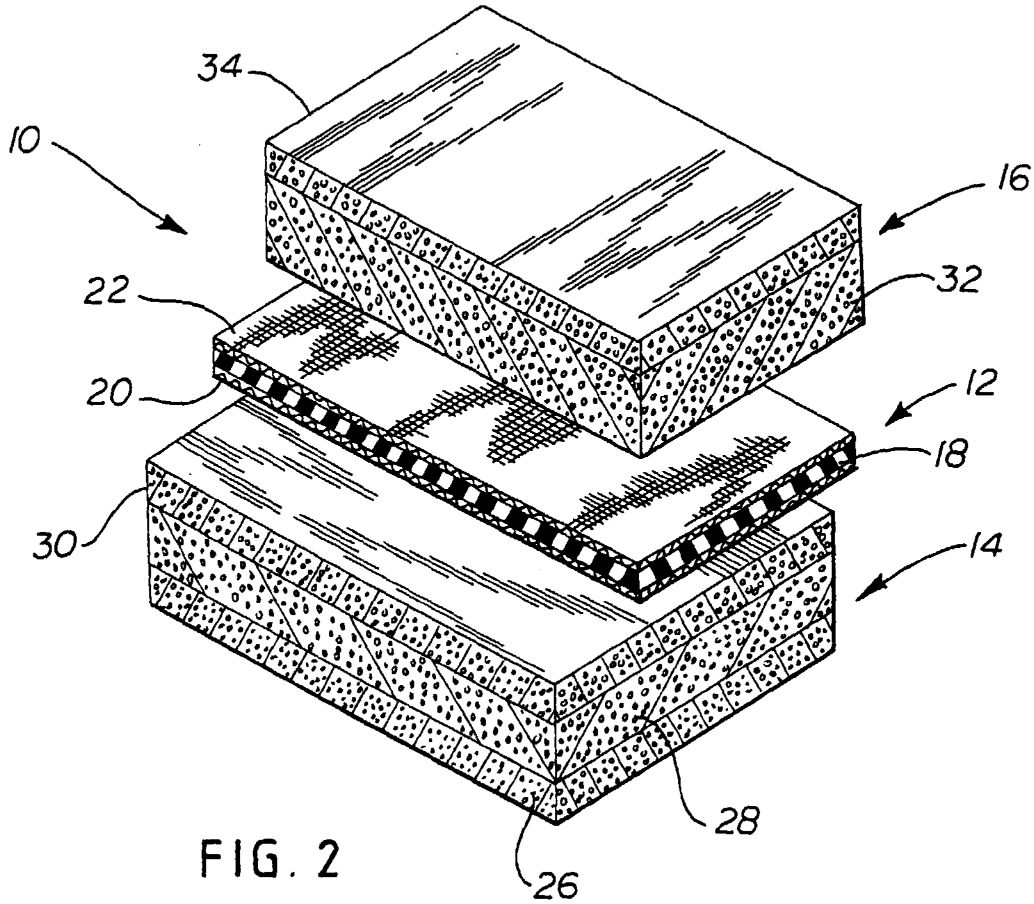
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FIG. 2

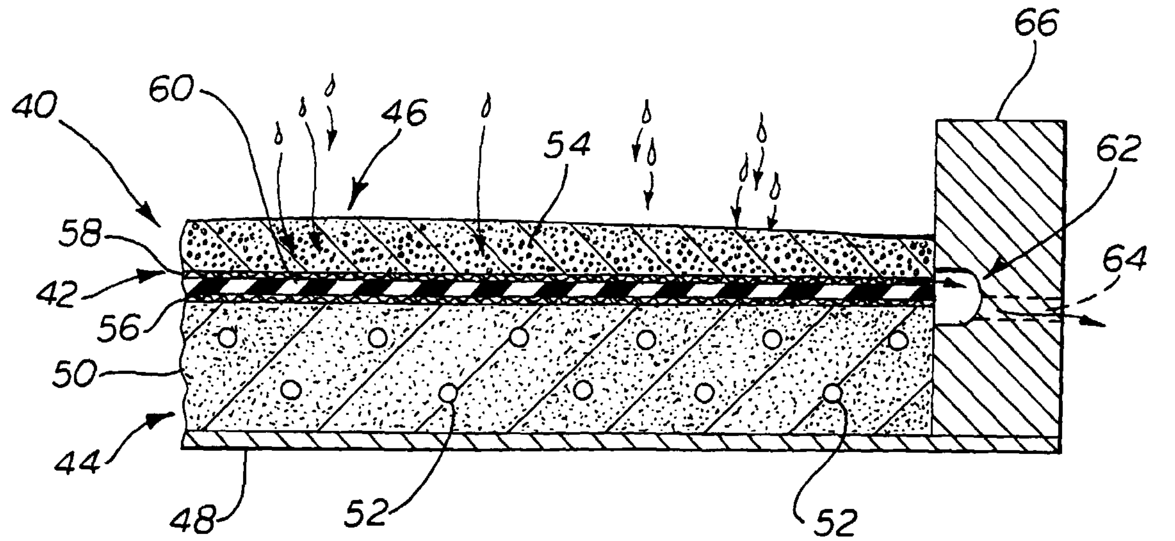
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FIG. 3

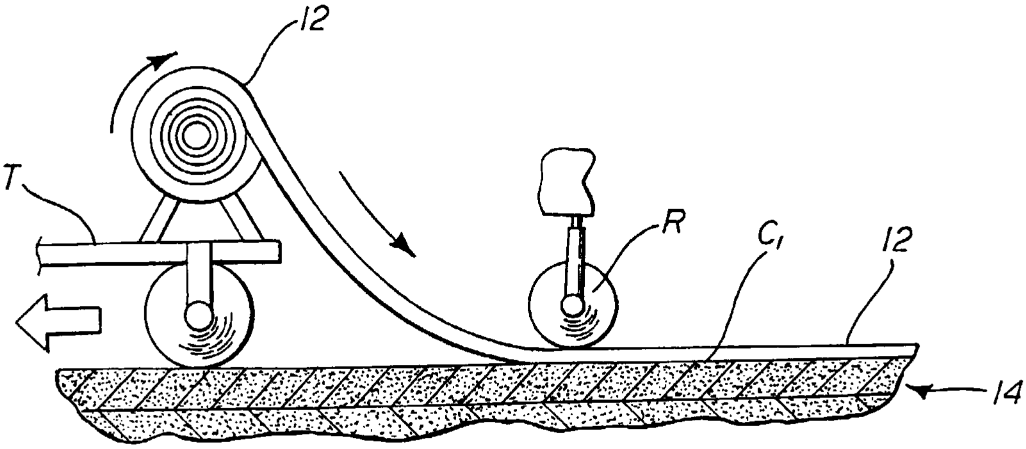

FIG. 5

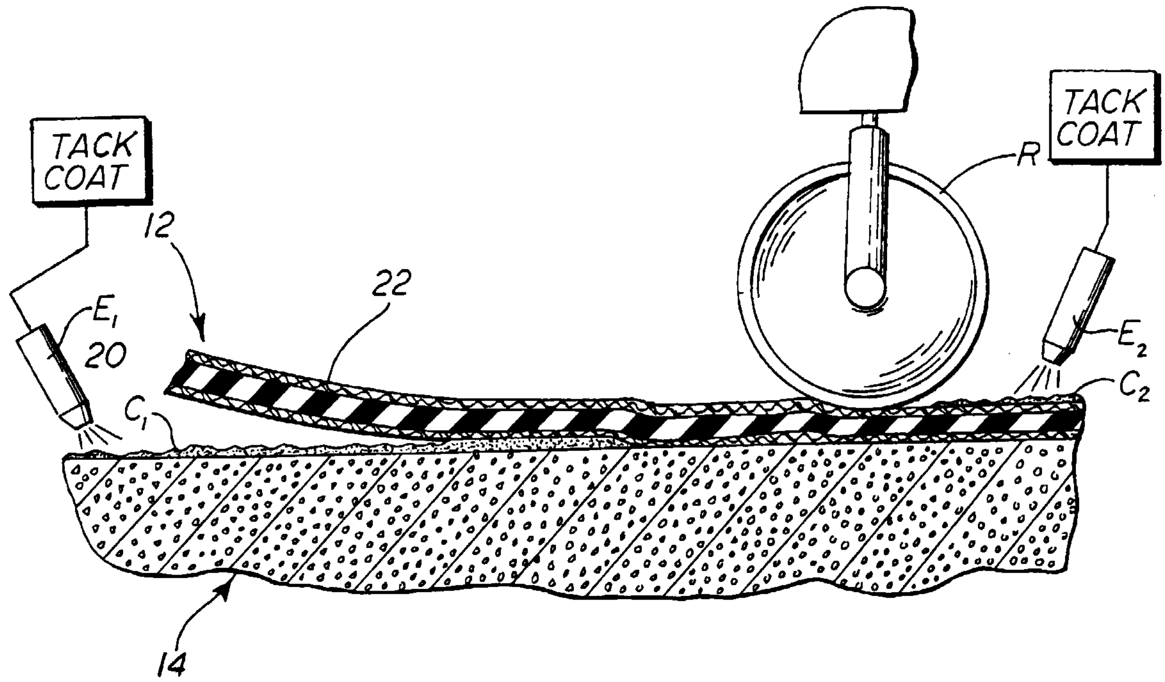

FIG. 5a