United States Patent [19]

Medico, Jr.

[11] **3,870,422**

[45] **Mar. 11, 1975**

[54] **POROUS PAVEMENT**

[75] Inventor: **John J. Medico, Jr.**, Sarasota, Fla.

[73] Assignee: **Christine Medico**, Sarasota, Fla.

[22] Filed: **June 7, 1974**

[21] Appl. No.: **477,431**

[52] **U.S. Cl.** **404/31**, 404/17, 404/27, 404/28, 61/10

[51] **Int. Cl.** **E01c 11/00**

[58] **Field of Search** 404/17, 19, 27, 28, 31; 61/10

[56] **References Cited**

UNITED STATES PATENTS

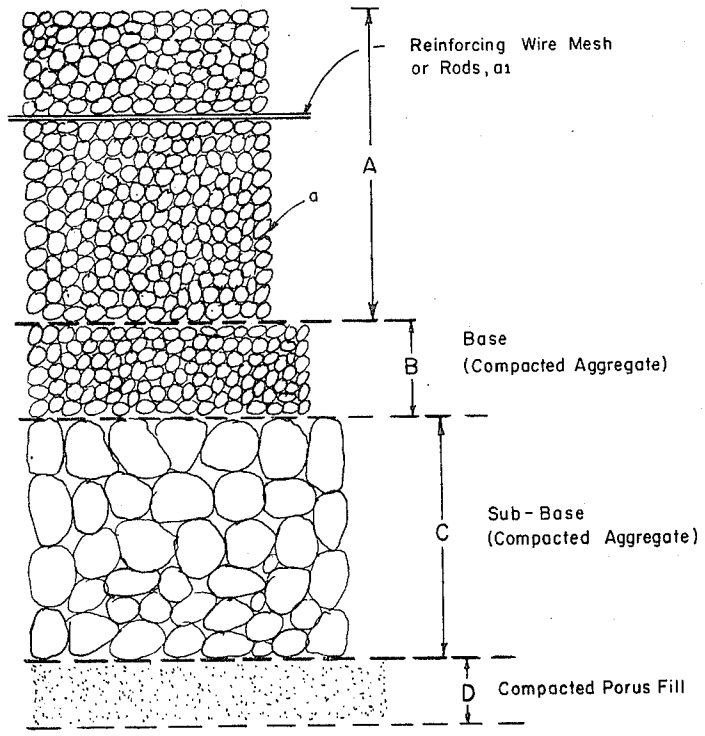
271,089	1/1883	Lynch	61/10
358,288	2/1887	Moore	404/27
1,665,104	4/1928	Martienssen	61/10
2,130,498	9/1938	Klemschofski	61/10

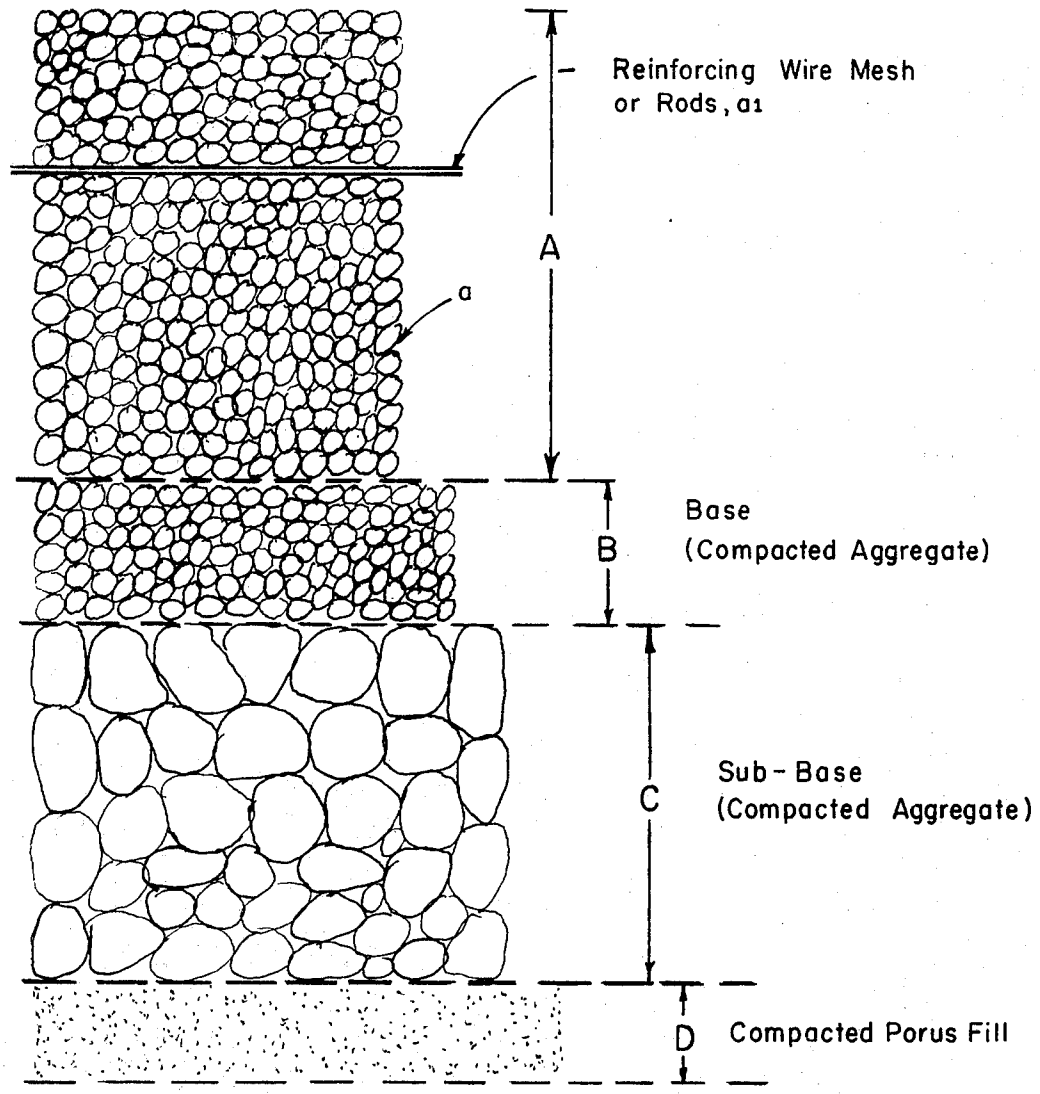
Primary Examiner—Mervin Stein
Assistant Examiner—Steven A. Hawkins

[57] **ABSTRACT**

This invention relates to a porous pavement for parking spaces, roadways, or streets, airfield runways and the like and it provides a porous pavement for such surfaces which allows water to pass through at a high absorption rate, thereby reducing water run-off and reducing flooding, and also allows pollutants to pass through the pavement to the sub-soil, reducing to a great extent the run-off of polluted water to lakes, rivers, bays and oceans. The invention comprises a paving admixture of aggregate, cement and a liquid adhesive mixture to ensure a firm pavement surface and at the same time providing voids or openings between the aggregates in the material to allow water to percolate therethrough.

9 Claims, 1 Drawing Figure




Reinforcing Wire Mesh
or Rods, a1
A
a
B
Base
(Compacted Aggregate)
C
Sub-Base
(Compacted Aggregate)
D
Compacted Porus Fill

POROUS PAVEMENT

The invention further embodies besides the solid supporting surface suitable sub-structures to facilitate the dispensing of water percolating through the upper porous surface.

The invention is porous pavement. This description of porous pavement is not to be confused with the natural porosity of solid concrete as we know it. The porous pavement that this invention contains is open passages between the aggregate elements so that it allows rain water, or other waters, to percolate through it at a high rate of velocity.

When the porous pavement is used as a surface for a parking area or roadway, the rainwater passes through concrete structure, reducing the degree of water runoff, thereby reducing flooding conditions. Storm sewers, water catch basins, curbing can be reduced in size and in many cases eliminated, reducing road construction costs. From an ecological standpoint, porous pavement allows pollutants on the surface of the parking areas and roadways to pass through the pavement structure to the base and sub-base soils, thereby reducing to a great extent polluted water normally entering nearby streams, rivers, bays and oceans.

These pollutants are in the form of hydro-carbons from gasoline, oil, rubber, constituents from automobile tires, etc. They form a detriment to drinking water, since these pollutants do enter streams, watersheds and water reservoirs.

Since the invention, porous pavement, does not have asphalt constituents in it, it does not contribute to pollution as does asphalt parking areas and roadbeds. The porous pavement, because it prevents water from accumulating on a roadway in the form of puddles, automobile skidding is greatly reduced, thereby reducing the number of accidents caused by this factor.

The porous pavement has an inherent high coefficient of friction surface, thereby creating a greater breaking force between the road and automobile tire.

The porous pavement causes rainwater to enter the soil, thereby restoring natural moisture and benefitting underground water supplies and preserving natural drainage patterns.

The porous pavement allows water to evaporate naturally from the sub-soil, and in the process, cools the roadway in the summer. This cooler roadway reduces the temperature of the tires, also reducing blowouts caused by high temperature.

The porous pavement allows more efficient operation of dry-wells, trench drains and other forms of subterrainian water storage systems, because a greater surface is available to absorb water.

The stone base reservoir, which stores the water, allows it to permeate the sub-soil and causes it to return to the water table. In areas of low water tables this is important, since water is restored to the natural levels instead of being run off into storm drainage systems. Water is usually lost to the rivers or seas without being used to supply water wells for drinking, irrigation, industrial, domestic and other uses. Porous pavement helps to retain the water in the area it is received. Porous pavement is especially adapted to the use of aircraft runways. These large concrete areas create problems that are easily solved with porous pavement. All the advantages mentioned for automobile road-beds are also applicable to runways. The advantages of reduced storm water runoff, elimination of water pockets

reducing runway accidents, greater coefficient of friction for breaking purposes when landing and taxing are very evident. Cooler runways reduce air temperatures just above the runway, because of the cooling effect of evaporation, creating a greater lift to the aircraft on take-off.

The invention, porous pavement, is designed to withstand various design loads depending upon the requirements, ranging from walk ways, light automobile traffic, medium truck loads to heavy truck and aircraft wheel loads. These design loads are satisfied by varying the thickness of the porous pavement, the thickness of base aggregate, the design of reinforced steel matting, etc., which are factors that are considered when designing conventional concrete roadways.

However, this invention includes the basic novel disclosure of the constituents of porous pavement. As indicated previously, the invention porous pavement is so structured that rainwater (and other water sources) penetrates through the structure at a relatively high rate, exceeding by many orders of magnitude the normal porosity of conventional concrete.

The drawings show a typical cross section of the pavement embodying the present invention.

The pavement contains the porous concrete in the first upper section A; the base, compacted aggregate B; the compacted sub-base C, and the compacted porous fill B.

SECTION - A POROUS PAVEMENT

The porous pavement, section A contains a mixture of cement, a medium sized crushed aggregate, admixture of single component water base epoxy vinyl acrylic emulsion, air-entraining agent, and water. No fine aggregate, such as sand, is used which would cause the clogging of the voids between the main aggregates. Although the proportion of cement and aggregate may be varied to achieve different porosities, the average mix involves one part cement with three parts of aggregate. The mixture would be designated (1-0-3); the one relating to volume of cement, the zero, relating to zero parts of sand; and the three, relating to three parts of aggregate. The usual size of aggregate will range from one fourth to one half inches. In applications where exceptionally large voids are required to percolate water at a high rate, exceeding 1 inch per second, small quantities of sand may be used. Small quantities of sand may be used when the aggregate sizes are relatively large, such as those ranging from 1 to 4 inches. The sand would then combine with the cement to form a bridge between the large aggregate. The mix would be approximately (1- ¼-3), one part cement, with one-quarter sand and three parts of aggregate. The admixture as described would be added to the water in a ratio of one part of admixture concentrate and three parts of water.

The admixture, single component water base epoxy vinyl acrylic emulsion, or equivalent, is used to increase the tensile strength of the cement and the adhesion between the aggregate elements. The fact that the admixture is a water base epoxy, it is compatable with cement, and therefore the epoxy element increases the strength of the entire structure and the strength between the aggregates.

Other admixtures that are compatable with cement and which increase the strength between the aggregate may be used. These admixtures will normally be chemicals containing molecules with long branch chains. An

example of one of these chemicals would be styrene butadiene. The average proportion of admixture to water would be in a ratio of one part of admixture concentrate to three parts of water. Greater concrete strengths may be achieved by increasing the proportion of admixture to water solution.

The use of air-entraining agent (which is well known and may be purchased on the open market) creates air bubbles in the mix, and helps to form the voids between the aggregate elements in the concrete, thereby increasing the porosity. The air bubbles also keep the water from getting to the surface when laying the pavement. This also keeps the top surface open, thereby maintaining porosity at the upper surface.

The porosity of the concrete mixture is controlled by the proper ratio of cement volume, aggregate volume, and water volume, together with the single component water base epoxy vinyl acrylic emulsion. No sand aggregate is used. Various degrees of porosity is achieved depending upon the variation of these volume ratios.

In order to maintain strength without loosing porosity, low slumps are used, e.g., zero to 1½ inches. Adding greater amounts of the admixture water solution increases the slump, reducing the porosity of the paving material.

Referring to the drawing, reinforcing wire mesh a_1 may be used in the porous pavement A when laying a pavement. This will increase the strength of the pavement. The voids or openings in the porous top surface A are indicated at *a*.

SECTION - B BASE

Section B contains compacted aggregate, such as graded crushed stone. This layer is usually the same size or slightly larger than the aggregate contained in the pavement upper surface A. This base aggregate helps to form the additional voids to store water while it is being percolated to the layers below. The average size is one half inch to three quarter inches.

SECTION - C SUB-BASE

Section C contains compacted aggregate, also graded crushed stone, which is larger than the base aggregate. It is in contact with the compacted porous fill D, such as sand, at the lowest level. This sub-base C containing large aggregates (and the base aggregates) form the water storage reservoir. By using a large coarse material, a large void space is formed for storage of water until it can percolate into the soil beneath at the rate that the soil will absorb it. The ability of the soil to transmit the water passing through the porous pavement will determine the thickness of the base reservoir needed. The average size is three quarters inches to one and one half inches.

COMPACTED POROUS FILL - D

The compacted porous fill can be sand or any good non-clay soil which absorbs or percolates water at a reasonably high rate. If the existing soil contains poor percolation characteristics, a clean compacted fill, such as sand, can be added, or the poor soil skimmed off and replaced with good water absorbing material. It is important that this sub-soil be compacted well in order to form a good stable pavement.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be modified within the invention defined in the claims.

What is claimed is:

1. A pavement for ground surfaces, such as parking lots, roadways, etc. formed of a mixture of aggregates, cement and an admixture of water and an adhesive compatible with water and cement to form a compact surface having voids between the aggregates to provide a porous hard surface of pavement and allow water to percolate through the voids to the surface below the pavement.

2. A pavement for ground surfaces, as claimed in claim **1**, wherein the admixture of water and adhesive consists of approximately three parts of water to one part of adhesive.

3. A pavement for ground surfaces, as claimed in claim **1**, wherein the aggregates have diameters of approximately one quarter of an inch.

4. A pavement for ground surfaces, as claimed in claim **1**, wherein the pavement includes a porous supporting sub-surface composed of aggregates which allows the water seeping through the porous pavement to pass to sub-soil therebeneath.

5. A pavement for ground surfaces, as claimed in claim **1**, wherein the pavement includes a porous subsurface composed of aggregates approximately the size of the aggregates in the pavement and a second subsurface of aggregates below the first sub-surface aggregates and being a larger size than the aggregates in the first sub-surfaces, the said sub-surfaces with the voids between the aggregates therein provide substantially a reservoir for receiving water percolating through the uppermost paving surface until the water is absorbed by the sub-soil therebeneath.

6. A pavement for ground surfaces, as claimed in claim **1**, wherein an air-entraining agent is added to the adhesive mixture to cause formation of bubbles therein and ensure the formation of the water percolating voids between the aggregates.

7. A pavement for ground surfaces, as claimed in claim **1**, wherein the adhesive fluid mixture includes an adhesive mixture of chemicals containing molecules with long branch chains.

8. A pavement for ground surfaces comprising a mixture of cement and aggregates of approximately having one quarter inch diameter and a liquid mixing agent having high adhesive properties mixed with cement and aggregates to form a compact surface, said liquid admixture including an air entraining agent for forming bubbles in the liquid mixture which results in voids between aggregates to allow water and any contained pollutants to percolate through the paving surface.

9. A pavement for ground surfaces, as claimed in claim **8**, and sub-surfaces beneath the porous paving surface forming supports for the paving surface and reservoirs for temporarily containing the water percolating through the porous upper surface until the water is absorbed by the sub-soil.

* * * * *