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REINFORCED CONCRETE PAVEMENT

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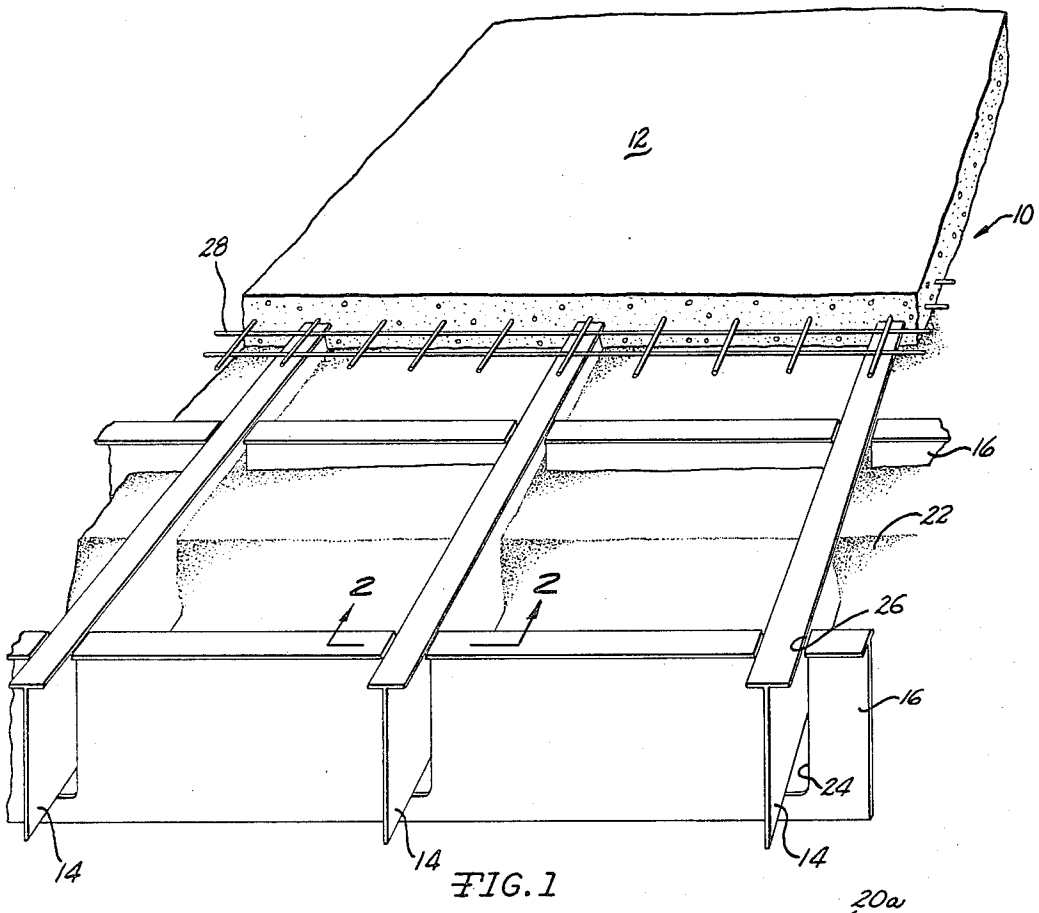


FIG. 1

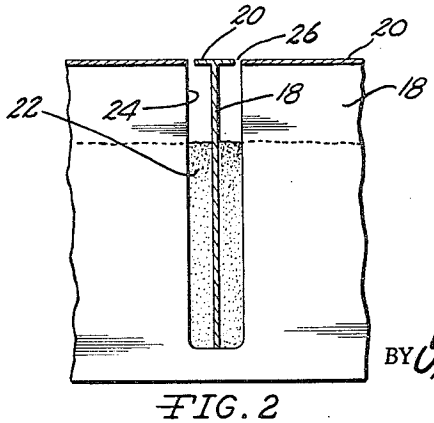


FIG. 2

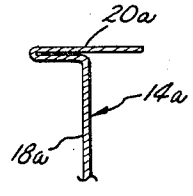


FIG. 3

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REINFORCED CONCRETE PAVEMENT

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ABSTRACT OF THE DISCLOSURE

A concrete pavement structure in which a plurality of upright metal strips are arranged in a crisscross pattern and embedded in the base course so that they extend upwardly therefrom a predetermined distance. The metal strips are provided with top flanges, conventional steel reinforcing is supported on the flanges, and a concrete slab is cast on the base course so as to envelop and extend above the portions of the strips extending above the base course and the steel reinforcing.

This invention relates generally to concrete load supporting structures, and more particularly to an improved reinforced concrete pavement structure having increased load supporting capabilities.

Conventional concrete pavement consists of a concrete slab and reinforcing steel which is usually in the form of spaced steel rods or a wire mesh, the slab being cast so as to envelop the reinforcing steel. Previous attempts to increase the load supporting capacity of concrete pavement have involved: (1) thickening the concrete slab; (2) increasing the rupture modulus (i.e., tensile strength) of the concrete in the slab; (3) increasing the effective subgrade modulus by strengthening supporting subsoil and/or base course; (4) developing initial compressive stress in the concrete pavement (i.e., longitudinal prestressing); and/or (5) addition of conventional reinforcing steel at top and bottom within the concrete pavement slab. The purpose of each of these approaches is to reduce the critical tensile stress in the concrete pavement to some acceptable limiting value. However, increasing the thickness of a concrete slab for the purpose of strengthening it is basically very inefficient. Since the tensile strength of concrete amounts to only 12% of the associated compressive strength, 88% of the potential strength capacity of the slab is in effect wasted when the slab is thickened. Moreover, since a thickened slab is still relatively thin compared to its width, it is inherently weak in bending resistance and has little ability to distribute applied surface loads. Approaches (2) and (3) above are inherently limited by the physical limitations involved. For practical and economic reasons, longitudinal prestressing of the concrete and addition of more reinforcing steel have not found widespread application. The addition of ordinary wire mesh or bar reinforcing does not significantly increase the load carrying capacity of the concrete pavement. The primary purpose of the reinforcing bars or mesh is to limit the width of cracks which form in the pavement. Because the effective depth of embedded mesh reinforcing is limited to the thickness of the slab, the potential increase in bending resistance and thus load distributing capacity is relatively low. It is an object of this invention, therefore, to provide improved reinforced concrete pavement structure which has a better load carrying capacity, better retention of riding quality, a longer useful service life, and can be economically maintained over its service life.

In the concrete structure of this invention, the pavement slab is supported on the usual underlying "base course," which term is used herein to mean either the existing subsoil, or a layer of sand, gravel, or the like which is first applied over the existing subsoil before the

pavement slab is cast. A plurality of upright metal strips are arranged in a crisscross pattern (i.e., the strips are arranged in crossing lines) and embedded in the base course so that they extend upwardly from the base course. The pavement slab is then cast so as to envelop the upper edges of the metal strips. This arrangement provides for a transfer of the applied load on the pavement over a relatively wide area, thus reducing the maximum pressures developed in the base course and thus reducing the consequent deflections of the slab due to compression or plastic displacement in the base course. The critical tensile stresses usually developed in the underside of the conventional concrete slab are, in this invention, developed in stead in the strips which are capable of efficiently withstanding these stresses. These advantageous results are obtained in the structure of this invention because loads applied to the concrete slab are: (a) partially reacted by the base course soil within the area bounded by the strips which surround the portion of the concrete slab to which the load is applied, and (b) partially delivered into the top of the adjoining strips. The strip loads are then distributed along the lengths of the strips by shear in the overlying slab and the portion of the strip embedded in the slab, and by bending reaction developing tensile stresses in the bottoms of the strips and compression stresses in the overlying portions of the strips embedded in the concrete slab. Consequently, downward pressures are distributed laterally so as to limit the total deflection of the slab and distribute the deflection over a wider area.

Further objects, features and advantages of this invention will become apparent from a consideration of the following description, the appended claims, and the accompanying drawing in which:

FIGURE 1 is a fragmentary perspective view illustrating the improved reinforced concrete pavement structure of this invention, with some parts broken away and other parts shown in section for the purpose of better illustrating the construction of the structure;

FIGURE 2 is an enlarged sectional view of a portion of the improved structure of this invention, as seen from substantially the line 2—2 in FIG. 1; and

FIGURE 3 is a fragmentary sectional view of another form of reinforcing strip usable in the structure of this invention.

With reference to the drawing, the improved reinforced concrete pavement structure of this invention, indicated generally at **10**, is illustrated in FIG. 1 as including a concrete slab **12** which is cast so as to envelop the upper ends of a plurality of generally upright metal strips **14** and **16** arranged in crossing lines below the slab **12**. In a preferred embodiment of the invention each of the metal strips **14** and **16** includes an upright web **18** formed at its top edge with a substantially horizontally extending integral flange **20**. As shown in FIG. 1, the strips **14** are arranged in a substantially parallel spaced-apart relation, and the strips **16** are similarly arranged so that they extend substantially perpendicularly with respect to the strips **14**. The strips **14** and **16** have their webs **18** deeply embedded in the base course **22** on which the slab **12** rests. The size of the strips **14** and **16** and the particular pattern configuration of the strips **14** and **16**, and the spacing of the strips may be varied to suit the particular circumstances. For example, deep, closely spaced relatively thick strips **14** and **16** can be used when the base course **22** is poor and/or extremely heavy applied loads are anticipated for the slab **12**, Shallow, widely spaced relaitvely thin webs **18** with small or in some cases no flange **20** are adequate in the case of an ideal base course **22** and light loads on the slab **12**. The strips **14** and **16** can be arranged in a variety of patterns, also depending on the particular circumstances. In addi-

tion to the preferred rectangular or square crisscross arrangement of the strips **14** and **16** illustrated in FIG. **1**, hexagonal, triangular, or rhomboid arrangements can be used.

In the installation of the structure **10** of this invention, the strips **16** are embedded in the base course **22** so that the base course material **22** is packed tightly against opposite sides of the webs **18** is the strips **16**. The strips **16** are spaced according to the condition of the base course **22** and the anticipated loads on the slab **12**. The strips **16** are formed with slots **24** in their webs **18** and communicating slots **26** in their flanges **20**, the spacing of the slots in each strip **16** corresponding to the desired spacing of the strips **14**. The widths of web slots **24** and flange slots **26** are adjusted as required to facilitate splicing of strips **16** and **14** to accommodate alignment deviations during installation, and to allow for angular displacement in alignment of consecutively spliced strips as necessary to extend an array of strips along a generally curving path. In general, the strips **14** and **16** are "loose fitting" at the slots to accommodate field adjustments and installation around curves.

The strips **14** are then positioned in a predetermined spaced relation so that they extend into the slots **24** in the strips **16**, slots **24** being of a depth such that the flanges **20** in the strips **14** and **16** are at the same height above the base course **22**. In the illustrated embodiment of the invention, conventional steel reinforcing **28**, which can take the form of rods or a wire mesh, is supported on the flanges **20**, the primary purpose of the reinforcing **28** being to limit the size of cracks which may develop in the slab **12**. The slab **12** is then cast so as to envelop the upper ends of the strips **14** and **16** and the reinforcing **28**, the underside of the slab **12** resting on the top surface of the base course **22**.

FIGURE 3 illustrates a modified reinforcing strip **14***a* having a web **18***a* and an integral flange **20***a* formed by return bending an upper portion of the flat plate from which the web **18***a* is formed so as to form the flange **20***a* at right angles to the web **18***a*. It is apparent that either form of the illustrated strips are usable in the pavement structure of this invention.

From the above description, it is seen that this invention provides an improved concrete pavement structure **10** having an increased load supporting capability by virtue of the strips **14** and **16**. Applied loads on the slab **12** are transferred to the strips **14** and **16** which are capable of efficiently withstanding the loads which would otherwise damage the slab **12**.

It will be understood that the reinforced concrete pavement which is herein disclosed and described is presented for purposes of explanation and illustration and is not intended to indicate limits of the invention, the scope of which is defined by the following claims.

What is claimed is:

1. In a concrete structure which includes a generally horizontally extending pavement slab supported on an underlying base course of existing subsoil or granular material applied thereto, a plurality of continuous upright metal strips arranged in crossing lines so that each strip is intersected by a plurality of crossing strips, said strips being embedded in and extending upwardly from said base course so that the upper edges of said strips are located above said base course a predetermined distance, said slab being cast on said base course so as to envelop and extend above the portions of said strips extending above said base course, the portions of said strips below said concrete being entirely embedded in said base course, and anchoring means on the portions of said strips enveloped by said slab anchoring said strips in said slab.

2. The structure according to claim **1** further including substantially horizontal metal reinforcing members overlying the upper edges of said embedded metal strips, and wherein said slab is cast so as to also envelop said reinforcing members.

3. The structure according to claim **2** where each of said strips is of a generally T-shape in vertical section having a substantially vertically extending web and an integral substantially horizontally extending flange on the upper end of said web.

4. The structure according to claim **3** wherein said reinforcing members are overlying the flanges in said strips.

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