Review Paper

Soil Survey Data used in design of highway

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Abstract: -

Several studies are there to understand the soil behavior under the heavy load and all the studies are based on fundamental diagrams only. These studies construct a base to characterize the behavior of soil under different type of loads. Several experiments have conducted to understand the soil capacity and its properties, likewise some field observations have done to represent fundamental diagrams. Therefore, before going to analyze the data from the observation, it is necessary to note down the soil properties parameters carefully. The aim of the paper is to build up the base to fundamental diagrams and for characterization of soil. And define the required test and results from the field observations. Field survey is conducted to know the vehicle heavy loads, and this field data with respect to soil behavior And the impact of vehicle load on the soil profile under the pressure how it behave this sections is to be studied.

To do this, several places are chosen from various sites of India and abroad. It is aimed to observing whether the soil profile diagram is different in alternate locations or not. In this study it is found that fundamental diagrams are different in different locations of India and abroad.

Keywords: Soil profile, weak sections of soil, Design of flexible pavements and rigid pavements Types of soil, Different horizon of soil.

Subtopics: -

Soil Profile

The soil is found in layers, which are arranged when the soil formation are occurred. These layers are known as the horizons of soil and the sequence of layers is the soil profile. The layers of soil can easily be observed by its particles and size. The main layers of the soil are of three types topsoil, subsoil and the parent rock. Each layer has its own characteristics.
These features of the layer of soil play a role to determine the use of the soil. Soil that has three layers in it is called as a mature layer. It takes many years under a favorable condition to take the proper shape in three layers. At some places founded that soil has only two layers. Such soil is immature soil. As soils are developed from the many times different type of layer are formed these combination of layer is called as horizons of soil or soil profile most of the soil profiles cover the earth in two main layers – (a) Topsoil, (b) Subsoil. Soil horizons are the different layers in the soil when you move down you see these different layers in it most of the soil has three main horizons but some soils also have the O horizon which are consist of plant litter which are found on the soil surface. The properties of these horizons are used in distinguish between soils and we used to determine potential of land which we are used in the engineering purpose.

Soil is formed continuously but slow in process due to the breakdown of the rocks through weathering action. In weathering there is some process which is as follows Physical, Chemical, And Biological. But there are some factors which affect the formation of soils which are as follows –

(1) Parent material.
(2) Living Organisms.
(3) Climate.
(4) Topography.
(5) Time.

Soil Survey Data Used In the Design of Flexible pavements: -

The usual concept of a flexible pavement has been a pavement consisting of aggregates bounded together with bitumen. While such a pavement is still known as a flexible pavement today, the definition of the flexible pavement is to include pavements consisting of sub base or base course

Composed of selected soil materials or soil-aggregate mixtures, which are covered with bitumen- oust wearing surfaces. By making use of the science of soil mechanics, it has been possible to construct flexible pavements at a cost and load-carrying capacity com- parable to that of the rigid type.
The mechanics of the design of a flexible pavement is different from that of the rigid type in that the flexible type is assumed to possess no slab strength. The strength of a flexible pavement lies in its ability to withstand the pressures imposed upon its surface and to distribute them to the under- lying sub grade in such a manner that their intensity is reduced to less than the bearing capacity of the sub grade soil. Both the rigid and the flexible types of pavement depend upon the strength of the sub grade; however, the nature of a flexible pavement permits utilization of the full strength of the sub grade, in most cases, instead of only a portion of it. Therefore, the bearing capacity of the sub grade may be used in the design of a flexible pavement instead of its bearing value. The bearing capacity of each layer of material in the pavement structure, including that of the wearing surface, can be utilized only if the layer has adequate support. In order to design flexible pavements

That will support vehicles of a definite type with axle loads of a stated maximum; the design engineer must know the bearing capacity of the sub grade and of each layer in the pavement structure. This requirement involves the determination of the bearing capacity of the sub grade soils to be encountered and the selection and determination of the bearing capacity of the materials used in each layer of the pavement structure. These bearing-capacity de- terminations of the materials must be made at the condition of moisture and degree of compaction under which they will serve. This information must be furnished by the soil engineer, who must make all of the necessary investigations and perform all of the necessary tests for its procurement. Obtaining this information, although not strictly a soil Survey procedure, is never- the less soil data, and will be discussed in this paper.

Test be made and, from the data obtained, arrive at its value. There are several methods of approach to this determination using test data from such teats as shear tests, penetration tests, and load tests, both miniature and full scale. In india full-scale load tests are con- ducted in the laboratory on prepared sub- grades composed of various soil materials. The soil is placed in a bin 14 ft. long, 3g ft.wide, and 2g ft. deep at a moisture content and degree of consolidation found to exist in this type of soil in service, and tested by loading round steel plates, 6$s, 8, 10, and 13/s in. in diameter. The mois- ture content of the soil and its degree of compaction is obtained from the results of moisture- density surveys, one of which was reported at the Twenty-Eighth Meeting of the Highway Research Board held in December 1948 and published in the pro- ceedings for that year (2). The load test technique follows that developed by Housel and reported by him in 193B (3).The writer has reported the use of this test in some detail in two other papers (4, 5) and will not discuss it here.
All soils are tested as sub grades whether they are used in sub grades or base courses. The bearing capacity of a material at certain moisture content, if tested as a sub grade, is the maximum for the material when used in a base course. The thickness of base course, placed on a given sub grade, that will produce this value of bearing capacity is the optimum thickness of base course for this material on this sub grade. For instance, if a base course material has a bearing capacity of 100 psi. When tested as a sub grade, and it is found that 12 in. of it placed on a 20 psi. Sub grade will still have a bearing capacity of 100 psi. , the optimum thickness for this base course material placed on a 20 psi. Sub- grade is 12 in. Greater thicknesses placed on a sub grade of this same strength will show no increase in bearing capacity.

Design of rigid pavements

A rigid pavement, as the name implies, is a slab of material rigid in nature, commonly supported by a foundation composed of soil, which is more or less flexible in nature. The strength of the rigid slab is measured in terms of its resistance to fiber stress, one half of which is used as the design stress while the sub grade support is measured by a modulus, designated as bearing value of the soil k. the bearing capacity of the soil is that pressure greater than which will produce plastic flow, while its bearing value is that pressure greater than which will produce plastic flow. About 10 year ago a type of failure of rigid pavements began to develop in India that had never been of much concern to anyone before. Water with sub grade material in suspension was being extruded at the edges and between the joints and cracks of the slabs of concrete pavements by the action of heavy vehicles. This extrusive action was called "pumping" because the action of traffic on the pave- ment slabs was not unlike that of a pump. As the pumping action progressed, suf- ficient sub grade material was removed to cause the slabs to break several feet from the joint or crack. These short slabs be- gan to rock and pumping developed at the new crack. It was noticed that this new type of failure was taking place on new pavements as well as those that had been in service for years, so it was know that the trouble was not in the slab but in the sub grade. The soils laboratory was called upon to investigate this new type of failure and develop some treatment of the sub grade, if possible, to prevent its occurrence on future work.

After Study, it was found that pumping of concrete pavement slabs was the result of heavy loads causing the slabs to deflect. When movement took place and free water was lying on the Sub grade, the water was ejected with some force, carrying with it some of the fine-grained sub grade material. If free water was not present on the sub grade, movement of the slab took place, but no harm are done as no sub- grade material was removed. It was also noticed that concrete pavements have the sandy soil in which sub grades showed no signs of pumping to the high performance of sub grade when soil was ejected. These facts led to the conclusion that pumping of concrete pavements was caused by three factors which had to exist at the same time: (1) axle loads sufficiently large to cause movement or deflection of the concrete slab, (2) water in sufficient quan- tity to be ejected when the slab deflected, and (3) a sub grade composed of soil suf- ficiently impervious to permit free water to lie on it. Since these three factors had to exist at the same time, the problem could be solved by the elimination of one of them. Reducing the weight of the axle loads was out of the question, and it was found that preventing the entrance of water or its drainage from the sub grade could not be effected to a satisfactory degree. The only remaining factor to be considered was the sub grade material. It was reasoned that the pervious layer of material are act as a blotter and suddenly absorb the water which are entering in the pavement cracks, joints and sides as a result, the water would not be in a free state to be pumped out carrying fine-grained sub grade soil with it.

Conclusions

In this paper, as in others, the author has stated that the use of the pedagogical system of soil classification for identifying soils is a valuable tool in making engineering soil surveys for airports and high- ways but has also emphasized that the method may not give all of the information desired and has pointed out that where precise data are needed, the information must be obtained by other methods. The type of soil data needed for the rational design of pavements, both rigid and flexi- ble, has been described by stating the problems confronting the design engineer. Also, the soil data needed in the selection of the pavement type most suited to the locality as well as that required by four forms of soil stabilization has been discussed. The selection and sampling of base -course materials has been discussed at some length in the first paper, published in Bulletin 22 and referred to at the beginning of this paper, and has not been mentioned.

Engineering soil surveys should be supervised by an experienced soils engineer who should be capable of understanding thoroughly the purpose of every particular survey, in order to assure the information necessary and not waste time and effort securing useless data. He should have knowledge of soil meets and its applications to pavement design, subsurface drainage, sub grades, embankments, and all other phase of highway and airport design that can be benefitted by this science.

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