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DESIGNING SOIL BASES

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Conditions for designing of facilities' ground bases are summarized in this publication.
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The concentration of construction activities in urban development area is a characteristic feature of the last decade. Erection of new buildings abutting existing ones became the real disaster for urban development. The analysis of the causes of buildings deformations development has shown that half of the cases of deformations related to the errors in survey and design.

It's important to develop a methodology for the combined calculation of bases and buildings which can be realized on computing facilities. The prediction for displacements and forces in constructions is desirable to do with regard to the time factor.

In some models the V.Z Vlasov – N.N Leont'ev theory of calculation for ground bases is used. It based on the fundamental equations of mechanics and the solution of differential equations for the expected draft at the point.

In this study, subgrade strength variability and flexible foundation and pavement designs are evaluated for reliability. Reliability is an important factor design to consider the variability associated with the design inputs. Parameters such as mean, maximum likelihood, median, coefficient of variation, and density distribution function of subgrade strength are determined [1]. The approach is based on an extensive literature review of current damage concepts included in current mechanistic-based design procedures, soil permanent deformation laboratory data. Design outputs are compared in terms of reliability and thickness using these design procedures. It is shown that the provides higher reliability values compared to the probabilistic procedure. All the existing subgrades fail distress reliability such as rutting and top down cracking reliabilities. Currently uses a single design P value to deal with variability associated with subgrade strength design.

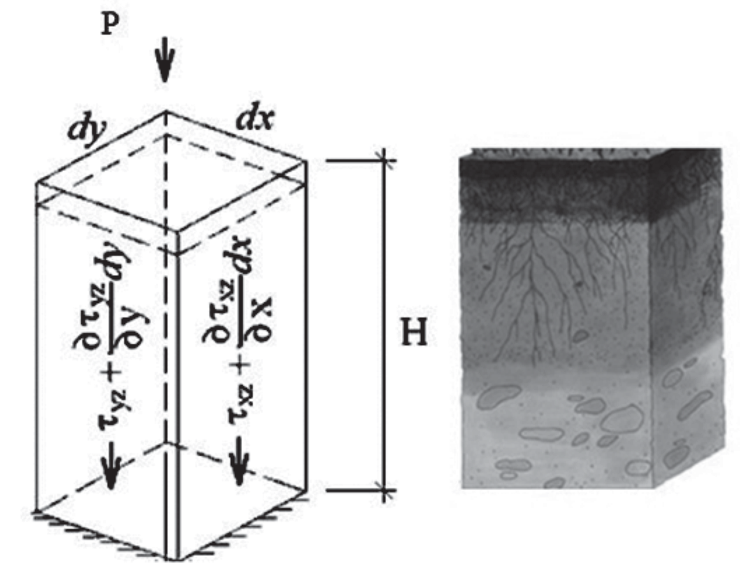

Fig.1.

Is used to generate full scale subgrades response and performance data for development and verification of subgrades design criteria. The physical properties of subgrades structures significantly influence both the response of the subgrades to applied loads and the long-term performance. It is, therefore, of the utmost importance that full scale test subgrades be constructed with uniformity in material properties, layer thicknesses, and other considerations for which non-uniformity might result in nonrepresentative and nontypical behavior and failures [1, 2]. Current mechanistic-based design methods for the design of subgrades use vertical strain criteria to consider foundation rutting.

A considerable number of measurements of the physical properties test pavements were made at all stages of construction and after construction was completed. The measurements were made for three purposes: construction quality control, construction acceptance, and material characterization. The material characterization tests were performed to provide information for theoretical modeling and were not related to construction and contractual requirements. Tests were conducted on the subgrade materials, base subbase, and surface layers. For a basis of model building we take the model of elastic foundation, Vlasov - Leont'ev [2] (fig.1).

Here [4]:

$$u(x,y,z)=0;\ v(x,y,z)=0\ ;$$

$$D_1 = \frac{\partial^4 \Delta w}{\partial x^4} + 2D_3 \frac{\partial^4 \Delta w}{\partial x^2 \partial y^2} + D_2 \frac{\partial^4 \Delta w}{\partial y^4} + cw = \Delta q(x,y),$$

$$D_1 = \frac{E_1^* h^3}{12(1-\mu_1\mu_2)};\ D_2 = \frac{E_2^* h}{12(1-\mu_1\mu_2)};\ (1)$$

$$D_3 = D_1\mu_1 + 2D_k; \qquad D_k = Gh^3/12.$$

Tests performed during construction consisted of measuring insitu moisture content and density. Tests were performed to characterize the variation of subgrade strength with depth and over a tight horizontal grid. Width of the subgrade surface was divided into equally sized quadrants and a location within each quadrant determined by randomly selected x and y coordinates. The choice of the appropriate type of foundation is governed by some important factors such as: the nature of the structure; the loads exerted by the structure; the subsoil characteristics; the allotted cost of foundations. Therefore to decide about the type of foundation, subsoil exploration must be carried out. Then the soil characteristics within the affected zone below the building should be carefully evaluated. The allowable bearing capacity of the affected soil strata should then be estimated. Theory of elasticity analysis indicates that the stress distribution beneath footings, symmetrically loaded, is not uniform. The actual stress distribution depends on the type of material beneath the footing and the rigidity of the footing. For footings on loose cohesion-less material, the soil grains tend to displace laterally at the edges from under the load, whereas in the center the soil is relatively confined.It is shown in this study that single design strain value for a roadway section does not yield an effective design regarding target reliability [3].

References:

1. Petrov V.V. Construction of a model of the non-uniform basis at a varied level of earth waters. Interuniversity scientific collection.- Saratov., SSTU, 2000., pp. 6-10.
2. Petrov V.V. Dimensional model of non-linear deformable heterogeneous basis. Interuniversity scientific collection. – Saratov., SSTU, 2007., pp. 6-12.
3. Artamonova E.N. On the design of slabs on the non-uniform basis. - Moskva., INGN; 2012., p.4.

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