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# EXPERIMENTAL STUDIES TO DETERMINE THE SHEAR STIFFNESS OF THE SOIL

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**Abstract**

The article discusses the theoretical study of soil shear hardness and experimental

Fig. 1 General view of a flat tray in an experimental state

The task is carried out using a flat tray, which allows simulating the interaction of the bending structure and the subgrade layer under various external loads. The flat tray (Fig. 1.) is made in the form of a frame structure made of channels №22. The tray test chamber has the following dimensions: AxBxH = 120x22x120 sm. The frame consists of two side posts (1) and two horizontal beams (2). The lower beam of the chute (3) rests freely on two side posts (1).

The stiffness of a metal strip EI is determined by its deflection, depending on the loads, and therefore, it is considered known. The experiment is carried out in two ways: in the first case, a soil layer Hi is poured onto the metal beam and the maximum deflection of the beam fi is measured. The experiment continues until the moment when the thickness of the backfill has no significant effect on the deflection of the beam, i.e. $\Delta f\_i \cong 0$. At the same time, for this type of soil, the ratios Hi = Hs and Hs/L are fixed.

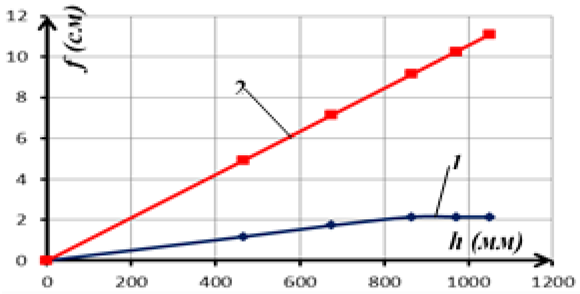


Fig. 2. Graph of the maximum bends f of the soil and the beam with increasing thickness of the soil layers h. 1- determined on the basis of experiment; 2- determined by theory.

According to the experimental data, the required stiffness of the "elastic beam - soil layer" system is determined. And in this case, for a given type of soil, the ratios Hi = Hs and Hs/L are fixed. The load on the beam from the soil is determined by the deflection. The deflection of the beam from gravitational and measured reactive loads is used to determine the stiffness of the soil to bending [1].

As can be seen from the graphs in Fig. 2, on the one hand, according to the calculation, a proportional increase in the gravitational pressure of the soil with respect to the layer height is expected, i.e. P(x) = γbH. In fact, the measured compensating loads, as well as the deflection of the soil layer, show that with an increase in its height, the increment of these loads (deflections) gradually decreases. If the condition $H \geq H_s$ is fulfilled, the layer height will practically not affect the gravitational pressure P(x) [2].

The comparative diagram shown in Fig. 2 was obtained from the results of an experiment with coarse-grained sand.

The deflection, hingedly supported on two supports, of a metal strip loaded with a uniformly distributed load, is determined by the expression:

$$f = \frac{5qL^4}{384E_0I_0}, \qquad (1)$$

where f-is the deflection of a beam of length L from a uniformly distributed load of intensity q from soil with stiffness $t = E_0I_0$. From expression (1), we determine the value of the shear stiffness of the soil:

$$t = E_0I_0 = \frac{5qL^4}{384f_{max}} - E_cI_c. \qquad (2)$$

Based on the experimental studies carried out, we will determine the physical essence of the calculated parameters of the equations that allow us to determine the contact stresses, displacements and forces in the body of the foundations.

In accordance with expression (1), the soil deflection will be considered together with a beam pivotally supported on two conventional supports. For the case of a uniformly distributed load, the deflection of such a beam is determined by the well-known expression:

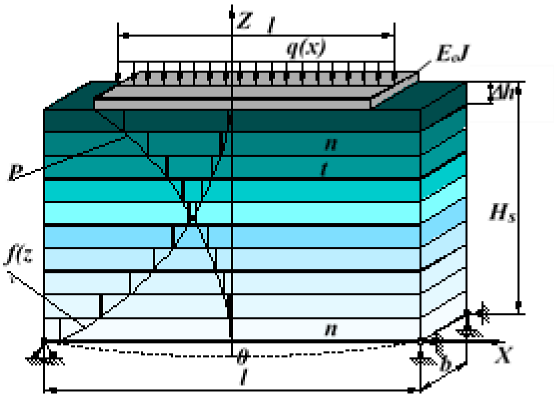


Fig. 3. Mechanical model for determining the shear stiffness of the soil.

$$q(x_{sL}) + q(x_c) = \frac{384EIf}{5L^4}, \qquad (3)$$

where $q(x_{sL})$, $q(x_c)$ – is the distributed gravitational load from the soil and the beam structure;

$EI = E_0I_0 + E_cI_c$ – reduced stiffness of the beam;

$t = E_0I_0$ - shear stiffness of the soil;

$E_cI_c$ - the stiffness of the experimental metal strip.

An analysis of the experiments carried out with sand and crushed stone showed that the value of the ratio $\frac{H_s}{(l/2)}$ can be approximately determined by the expression:

$$\frac{H_S}{(l/2)} \cong tg\varphi. \qquad (4)$$

The parameter of the stiffness of the soil layer to bending t characterizes the deflection of one layer of the soil layer with a thickness $H_s$ with geometric dimensions in plan (Lb), loaded with a single distributed gravitational load P(x). The design diagram of the proposed model is shown in Fig. 3. Using the above expression (4), it can be argued that the shear stiffness of the soil layer (soil massif) t with a thickness $H_s$ can be determined by the expression (5):

$$t = \omega I_0 E_0 = \omega E_0 \frac{bH_S^3}{12}, \qquad (5)$$

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Thus, for practical purposes, the shear stiffness t of the active soil layer, thickness $H_s$ and width b, can be determined with accuracy by expression (5).
Experiments have shown that with an increase in the soil layer, with a soil layer thickness of H≈60 sm, the shear resistance of the soil will increase, that is, with an increase in the height of the soil layer, the shear stiffness of the soil increases. (Fig. 2) [3].

**References**

1. Khasanov, A.Z., Khasanov, Z.A. and others. (2017) Determination of stresses in the soil massif from the action of external loads. Journal "Problems of Mechanics", №2-3 2017. Tashkent. 38-46.
2. 2.Tursunov Sh.A. "The interaction of the base with the structure of the strip foundation, taking into account the soil resistance to shear" Abstract of the dissertation of Doctor of Philosophy (PhD) in technical sciences Samarkand. 2021
3. Khasanov A.Z., Tursunov Sh. "Experimental and theoretical studies of the calculated parameters of the stiffness of soils." Conference proceedings. Novocherkask. 2018 Nov.