THE MINISTRY OF THE HIGHER AND AVERAGE VOCATIONAL EDUCATION OF REPUBLIC UZBEKISTAN

THE TASHKENT ARCHITECTURALBUILDING INSTITUTE

As the manuscript

UTASHEV NODIR KOMILOVICH

MAINTENANCE OF SEISMOSTABILITY OF CONSTRUCTIONS ON THE SANDY BASES.

Speciality: 5A 580201«BUILDING AND CONSTRUCTION»

THE MASTERS DISSERTATION

On competition of the academic degree of the master of building

Work is considered and .

the Manager is supposed

to protection.

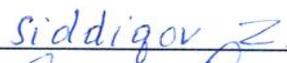Chair «Buildings and constructions»

dot. Sayfiddinov.S

«_____» _____ 2012y

The supervisor of studies:

d.t.s. Rasulov.H.Z

the Scientific adviser
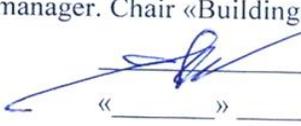
Siddiqov Z.

:

Tashkent-2012

The task on preparation and a writing master dissertations

The master dissertation on a theme: _Maintenance of seismostability of constructions on the sandy bases_

Confirmed by the order of the rector of institute from «_____» _____ 20____

Behind number _____ on chair «Buildings and constructions»

For master's _Utashev N. K._____ the supervisor of studies _d.t.s., prof Rasulov Khayat Zoirovich_

First name, middle initial, last name, a post, a scientific degree, an academic status

Should be prepared and presented to preliminary protection on chair

30. 06. 2012 year.

Number, month, year

In work will be used: _Results of experiments, works_

Results of experiments,.The given publications, works etc.
Legislative and statutory acts, the instruction and position

In work are provided _Tables, schemes, diagrammes_

Tables, traffic, schemes, diagrammes, mathem.Models, etc.

In work the statement of following groups of questions is provided:

1st group _Dynamic stability of sand bases._

2nd group _Labaratory methods of research_

3rd group _Maintenance of dynamic stability osthe bases_

The task is given out _____

Date, month, year

The supervisor of studies _____ _Rasulov Kh. Z._

The signature, S. N.

The task has accepted master _____ _Utashev Nodir Komilovich_

The signature, S.N, date

2

THE SCHEDULE OF END OF THE MASTERS DISSERTATION
IN THE INITIAL VARIANT

I. _Methods of research of dynamic_
<div align="center">Chapter 1 name in an initial variant</div>

stability of the water-sated sand. 15.01.2011year.
<div align="center">The working plan and representation terms</div>

II. _The filtrational theory of stability_
<div align="center">Chapter 1 name in an initial variant</div>

of the water-sated sand. 10.06.2011y.
<div align="center">The working plan and representation terms</div>

III. _Laboratory methods of research._
<div align="center">Chapter 1 name in an initial variant</div>

11.02.2012y.

<div align="center">Chapter 1 name in an initial variant</div>

<div align="center">The working plan and representation terms</div>

IV. _Maintenance of dynamic stability_
<div align="center">Chapter 1 name in an initial variant</div>

of the bases of constructions
<div align="center">Chapter 1 name in an initial variant</div>

15.06.2012y.
<div align="center">The working plan and representation terms</div>

Preliminary protection on chair ___30.06.2012 year___
<div align="center">Term, date, year</div>

The task is given out

<div align="center">The supervisor of studies, date, month, year</div>

Rasulov Khayat Zoirovich.
<div align="center">The signature, S.N. The Island</div>

The task has accepted _Utashev Nodir Komilovich._
<div align="center">S.N.master's the signature, date</div>

THE MAINTENANCE

INTRODUCTION

The basic indicators of development of economy of Uzbekistan and branches conducting it in 2012 are directed on preservation of high and steady rates of growth, the further strengthening of macroeconomic stability.

Rates of a gain of a total internal product (gross national product) will make 8,2 percent, industrial production – 8,6, agriculture – 5,8 percent. The consumer price index in annual calculation is planned with growth within 7-9 percent, the rate of refinancing of the Central bank is provided to be kept at level of 12 percent.

In the confirmed State budget of the country for 2012 it is planned to direct over 60 percent of all expenses on social sphere and social support of the population.

Considerably volumes of the capital investments directed on development of a national economy increase. By last year 109,3 percent, and a share in gross national product – 24,5 percent should make rates of their growth.

Volumes of foreign investments and involved credits will increase for 16 percent and will make over 3,3 billion dollars, including direct foreign investments – more than 2,3 billion dollars, or about 70 percent from their total amount, that in itself is the concrete certificate of growing interest and trust of the foreign capital to reliability and stability of our economy and that is especially important – to prospects of development of Uzbekistan.

Proceeding from tendencies developing in economic, and also strategy of perspective economic and social development of the country, the major value in 2012 and the next years is got by realization of following priorities.

The paramount attention should be given preparation and Program realization on increase of competitiveness of a national economy.

The urgency and the importance of statement of this purpose is dictated first of all to that as main our strategy at the present stage we have set for ourselves a problem of an exit of our economy in intermediate term prospect on level of the developed democratic countries.

Necessity of statement of this problem is caused also by deepening of crisis situations, reduction of world demand and, accordingly, a competition increasing every year in the world markets of raw materials, materials and especially finished goods.

Experience of countries much developed and dominating today in economic unequivocally proves, that achievement of competitiveness and an exit on the world markets can be provided first of all at the expense of consecutive reforming, deepening of structural transformations and диверсификации economy, maintenance of advancing development of the new hi-tech enterprises and manufactures, accelerations of processes of modernization and technical updating of operating capacities.

Especially would like to underline an escalating role in realization of processes of modernization, technical and technological re-equipment of the enterprises of Fund of reconstruction and the Republic Uzbekistan development which capital has exceeded now 9 billion dollars. In 2012 at the expense of Fund means it is provided to provide about financing29 strategic investment projects in leading industries and an industrial infrastructure in volume more than 758 million dollars, that for 38,2 percent more than last year.

We declared 2012 «Year of a family».

The major purposes which we put before ourselves on the further strengthening and development of institute of a family as the basic link of our society, to increase on new level of work spent today on material and to encouragement of a young family, strengthening in it of a role and values, to creation more ample opportunities for women, to increase of a role of a family in education of physically healthy, spiritually mature and harmoniously developed generation, and many other things – well-known. Finally it is a question of the further increase of well-being of a family and on this basis of well-being of all our people.

Necessity of the given researches is caused by an insufficient level of scrutiny problems of seismic stability water-sated sandy grounds, absence of generalizations and the recommendations, allowing to solve theoretical and practical questions at designing and erection of constructions.

The urgency of statement of a problem communicates with significant scope of capital construction in republic Uzbekistan and the necessity of construction of large and responsible buildings connected with it and constructions in areas described a various sort adverse soil conditions. For example, in district the sated water, high seismicity, etc.

Designing and erection of buildings and constructions on water-sated graunds in seismic areas with maintenance of their durability and stability is one of challenges of building practice.

At performance of civil work in a zone with high seismicity soil conditions influence in the strongest degree on seismic stability of buildings erected on them and constructions. As practice of the construction shows, especially dangerous in this respect are water-sated sandy graund, lying in the basis of the constructions, described the residual deformations caused by earthquakes.

Necessity of the account of soil conditions at designing constructions in seismic areas now is put forward by the practice of construction.

To building practice numerous cases of formation a deposit and skews of buildings and constructions are known at earthquakes. Thus the significant role in damage of constructions of non-uniformity a deposit of a ground was always marked. Presence even small non-uniform a deposit in грунтах causes additional pressure in constructions, an overstrain and deformation in separate constructive elements that increases a degree of damages at earthquakes.

From told development of the questions connected with display a deposit at

earthquake follows, that, represents significant interest.

In work have received reflections results of research of the author under direction of d.t.s.,prof. Rasulova H.Z. in the field of seismic-stability water-sated sandy grounds, buildings lying in the basis and constructions. On the basis of the lead researches actions on maintenance of seismic stability of the buildings erected on the water-sated sandy bases are developed.

Chapter I. METHODS of RESEARCH DYNAMIC

STABILITY OF THE WATER-SATED SAND.

1.1 Critical porosity (K.Tertsagi's)

In the most near past infringement of dynamic stability of the water-sated sand contacted so-called « spontaneous condensation and deposits of sand ». In a view of such estimation of the described phenomenon, A.Kazagrande (USA) has been put forward so-called « the theory of critical porosity ». According to this theory the water-sated sandy weight admitted in threatened in sense of its stability a condition all cases when porosity of sand π appeared above, than it answered its value to " critical porosity »n_{cr}

Loss by the water-sated sand of the stability under the theory of «critical porosity» is connected:

1) With necessity of occurrence for thickness of sand on to this or that reason of deformation of shift;

2) With a condition of density of the sand, having porosity above critical ($n > n_к$).

As we see, « the theory of critical porosity » in the practical application is represented rather simple. The basic requirements shown to sandy constructions and the bases from the point of view of this theory are reduced only to a condition that in all cases porosity of used sand was below critical ($n < n_к$). It the circumstance has drawn to the specified theory attention of many experts and has created the big circle of its numerous supporters . Finally for definition of critical porosity them original devices and the techniques which are differing enough from each other have been offered.

It is necessary to note, that results of definition of size of " critical porosity » sand by these techniques and in particular in an establishment of dependence of this parameter from those or other factors (bigger and uniformity of sand, influence of loading, etc.) in many cases appeared inconsistent. This circumstance, certainly first

of all testifies to insufficient clearness of the parameter and simultaneously puts in inconvenient position of the researcher.

1.2. Dynamic infringement of structure of sand(N.M.Gersevanov)

The founder of " the Theory of dynamic infringement of structure of sand » is. M. Hersevanov. The further development of this theory is executed by works of Century A.Florina and its pupils .

Unlike the author of the theory of " critical porosity » which gave during deliquating sand taking priority value of deformation of shift. M. Hersevanov saw a principal cause of this phenomenon in infringement of structure of friable sand due to concussion during vibration, as local and the general.

Position. M. Hersevanov about a role of concussion of the sand, being consequence of vibration and the sand connected simultaneously with condensation, in loss Water-sated sand of the stability was exclusively progressive.
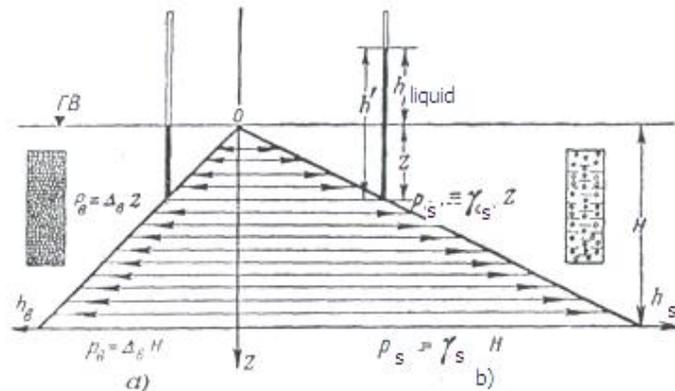
Fig. 1.1. pressure and holes of sandy thickness up to (a) and after (b) it deliquating on Century L.Florinu.

One of the most essential conclusions of the theory of dynamic infringement of structure of the sand which has been put forward by N.M.Hersevanov are the regulations about linear character of distribution on depth of diluted sandy thickness arising in drink an additional pressure h_z.

Let's address to fig. 1.1. Here it is considered two conditions:

1. Initial stable position (fig. 1.1,).

2. The Subsequent position with transition of sand in deliquate a condition as result of infringement of its structure at dynamic influence on it (fig. 1.1).

1.3. Filtrational theory(N.N.Maslov's)

Unlike the theory of dynamic infringement of structure of the sand, sandy thickness of the stability connecting loss from a degree of density (porosity) of sand and intensity dynamic influence, « the Filtrational theory » approves, that in this sense, besides other factors, the main role is played with capacity of sandy thickness (H). This position in many cases appears solving.

At the same time разжижение sand in that kind as it is perceived. M. Gersevanov in a view of « the Filtrational theory » dynamic stability of the water-sated sand, represents only extreme degree of loss by it of the stability. Before this moment sandy thickness at dynamic influence passes a long cycle of the transformations connected with its filtrational mode. In this process, in sharp difference from the theory of " Dynamic infringement of structure of the water-sated sand », distribution of a dynamic pressure (h_z) on depth of thickness occurs under the parabolic law and as consequence of it dependence of a gradient on depth of a dynamic pressure I_z has a linear appearance. These divergences between two considered theories have for reaching consequences.

With a view of disclosing the specified process of N.N.Maslov special researches have been put.

At the first stage these experiences pursued the purpose to reveal conditions of infringement of friable structure of sand.

Experiences were spent with various sand in a different condition of density. For experiences wide vessels with installation in them of some pythometres were used. Sand was translated in a unstable condition (observed that sharp a deposit of metal cores) to piercing by its metal spoke of different section and with different intensity. It has appeared, as in this case crucial importance has not a limit of density of the sand, taken separately, and its density in aggregate with intensity of dynamic influence. As we see, and from a considered position critical porosity as the criterion for values degrees of stability of sandy weight is far defective.

These experiences which were made with different sand, had been received interesting results. First of all limitation of a zone deliquating sand has been established. This position is illustrated fig. 1.2. In conditions of described experience with extremely friable fine-grained sand (n=45 %) the area deliquating depending on intensity of fluctuation (on frequency of fluctuation) was defined at rather high intensity of vibration in radius only from 5 up to 13 see obviously, that provided that about a little significant display of "chain reaction" to speak it is not necessary. It has been further quite distinctly established, that at means of the used vibrator it is possible to translate in deliquating a condition the sand laid with the big density, much higher, than it was defined by size of critical porosity corresponding them ($n < n_{\kappa}$). By That for the first time it has been established repeatedly confirmed by all subsequent both laboratory, and field experiences true, that under all other equal conditions loss by the water-sated sand of the stability by direct image contacts intensity of power influence on them.
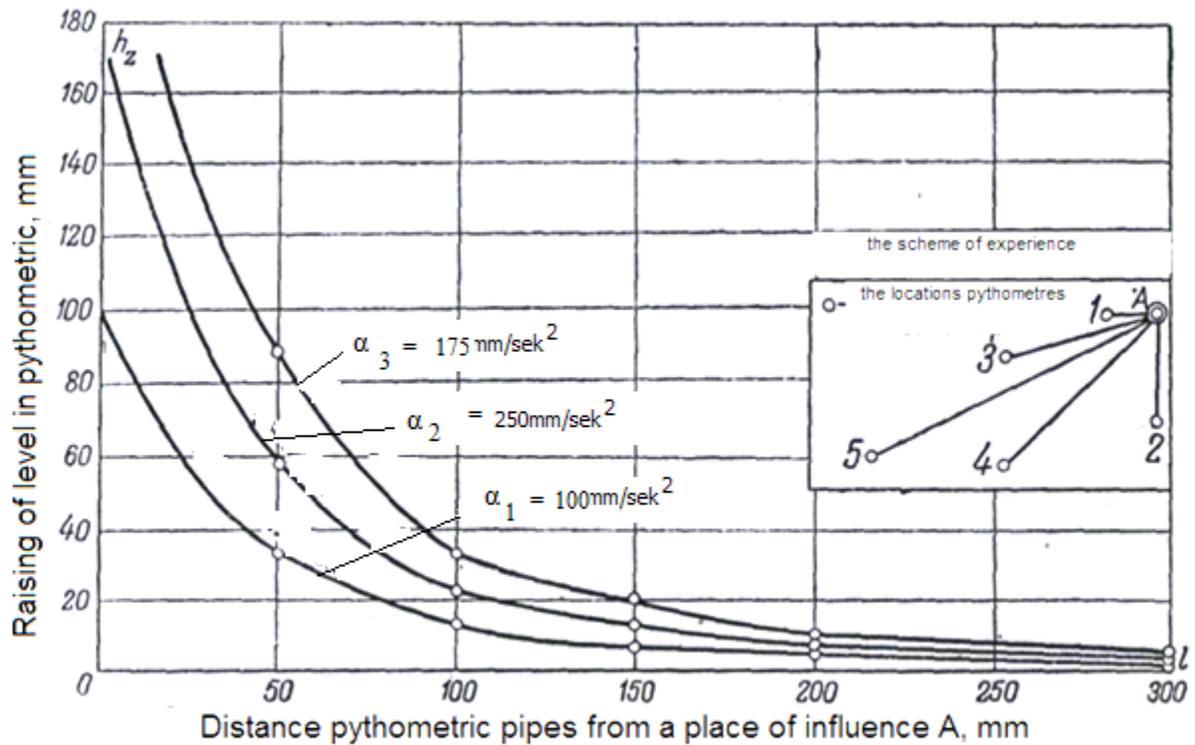
pic.1-2. Attenuation dynamic pressure hz at removal from a source of dynamic influence(on size of maximal acceleration)a

It has simultaneously been established (fig. 1.3), that long before even before transition of sand in deliquatinging the condition in sandy thickness arises a dynamic pressure h_z, changing on the size from a place and depth of a point of supervision, and also intensity of power influence.

These supervision have shown decrease in a pressure, to one and the same depth z with removal of a point of supervision from a source of fluctuation and simultaneously increase of a pressure with increase in depth in the same point and with strengthening fluctuation. Under all these conditions became quite obvious, that the hypothesis of " avalanche disintegration » in the given process in any way does not reflect an essence of the phenomenon.
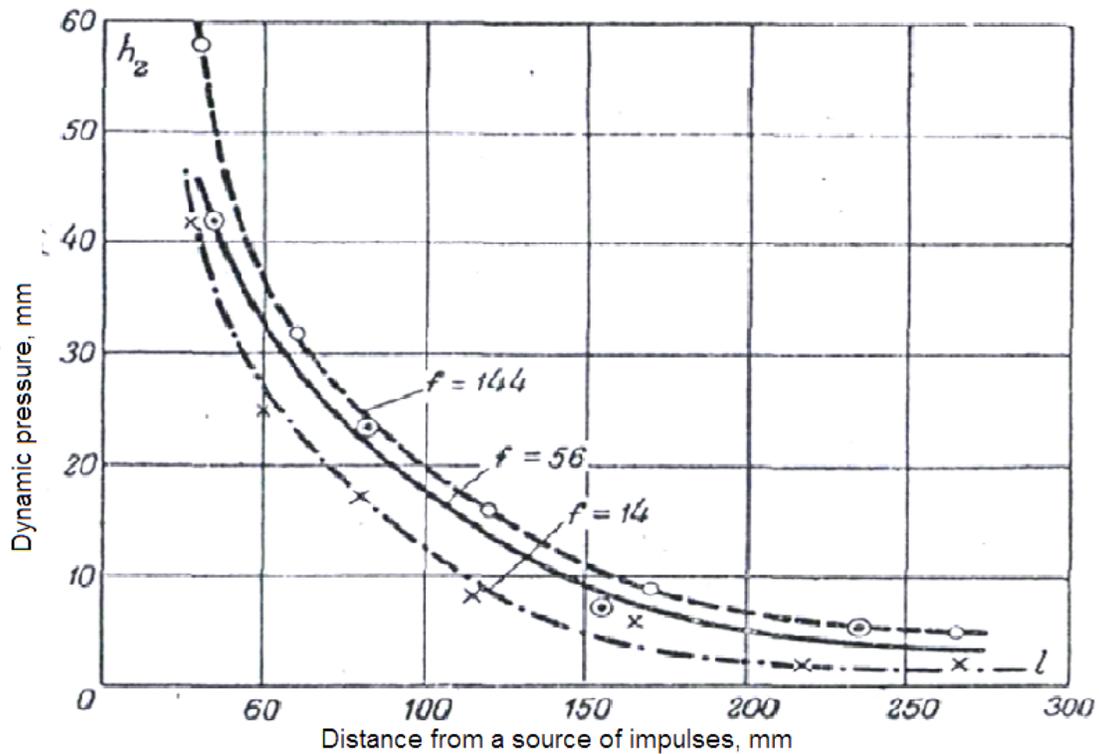
pic.1.3. Attenuation of dynamic pressure hz at removal I from a source of dynamic influence at different frequency of fluctuation f (in hertz)

In summary we shall note, that rather careful analysis has forced N.N.Maslov to recognize limitation of the theory of " Dynamic infringement of structure of the water-sated sand » and to search for other ways of the decision of a problem. The result of numerous laborious researches with various sand in various dynamic influences on them has allowed it to offer « the Filtrational theory of dynamic stability of structure of sand » which has been taken for a basis of our below-mentioned researches.

Chapter II. The FILTRATIONAL THEORY of STABILITY

THE WATER-SATED SAND.

2.1 Filtrational hypothesis

In a basis of " the Filtrational theory of seismic stability of the water-sated sand », the offered N.N.Maslov puts a following hypothesis .

At strong enough concussion homogeneous sand can easily pass in the movement, having the ultimate goal the greatest possible degree of density.

Under water such movement inevitably should lead to the phenomenon of fluidity. This phenomenon, well-known in a geotechnical practice, is accompanied by the following phenomenon. At transition from concussion of sand in movement its condensation is inevitably accompanied by expression of excessive water from times of a ground. At sharp concussion of a ground there is its intensive condensation, that, in turn, conducts to sharp hydrodynamical effect. Grains of sand lose the weight. It is weakened and even friction between particles as in sand friction between grains is caused in essence completely vanishes has put only in weight of breed. All weight of sand deprived friction, spreads as a deliquating, getting very insignificant corner of a slope.

2.2. Substantive provisions of " the Filtrational theory »

The hypothesis resulted above also has been put in a basis of its further theoretical and experimental study begun under direction of N.N.Maslova per 1951-1952.

According to starting positions of " the Filtrational theory » infringement of stability of the water-sated sandy weights at dynamic influence on them contacts falling in these conditions of their resistibility to shift.

As a rule, resistibility to shift of such sand in dynamic conditions (s_{dyn}) appears below, than in static s_{cr} or, as a last resort, remains without change. At the same time at full loss by such sand of the stability with their transition in deliquating a condition resistibility to their shift, naturally, is equal to zero.

Hence, we can speak about change of resistibility to shift (s_{dyn}) water-sated sand at their transition from static in a dynamic condition in such limits:

$$s_{st} > s_{dyn} > 0. \qquad (2\text{-}1)$$

Condition $s_{dyn} = s_{st}$ testifies to such position when resistibility of sand to shift with their transition to a dynamic mode does not vary. As we shall see from the further, this condition corresponds to position when sand possess the raised density or are exposed to rather weak dynamic influence (concept about critical acceleration a_{cr}).

It is natural, that at full loss by sand of the stability ($s_{dyn} = 0$), that takes place at their transition in deliquating a condition, they are not capable to bear even the smallest loading. In these conditions inevitably sharp procorf any constructions. However similar position can arise how sand will pass in deliquating a condition and completely will lose the resistibility to shift. It is obvious, that in this case solving there will be relative sizes of tangents acting to these or those platform or shifting pressure (t) and resistibility of sand to shift (s_{dyn}).

Thus, from the point of view of « the Filtrational theory » the estimation of a degree of dynamic stability of this or that basis demands a preliminary establishment of resistibility of sand to the shift, adequating to the given conditions (s_{dyn}).

As is known, resistance of sand to shift in static conditions s_{st} can be generally presented by following dependence:

$$s_{st} = p_{st} \, tg\varphi + c \qquad (2\text{-}2)$$

Our problem as the practice shows, gets the greatest and has in essence put

exclusive value with reference to friable sand. Coupling in such sand, naturally, is absent (c = 0). For such sand the expression resulted above (2-2) gets a following kind:

$$S_{st} = p_{st} \, tg\varphi + c \qquad\qquad (2\text{-}3)$$

In both these expressions p_{st} answers a normal pressure of compression in static conditions.

Change of resistibility of the water-sated sandy weights to shift in dynamic conditions according to expression (2-3) could go essentially due to decrease in sizes either p_{st}, or tg φ or, at last, both sizes simultaneously. With this purpose special experiences and the researches executed by R.D.Filippov have been put. These researches had the purpose check of one of the major postulates of " the Filtrational theory » about independence in sand of a corner of internal friction φ from dynamic influence, certainly, within the limits of practical statement of a problem. The analysis of a question was conducted with studying factor of lateral pressure for sand in static and dynamic conditions.
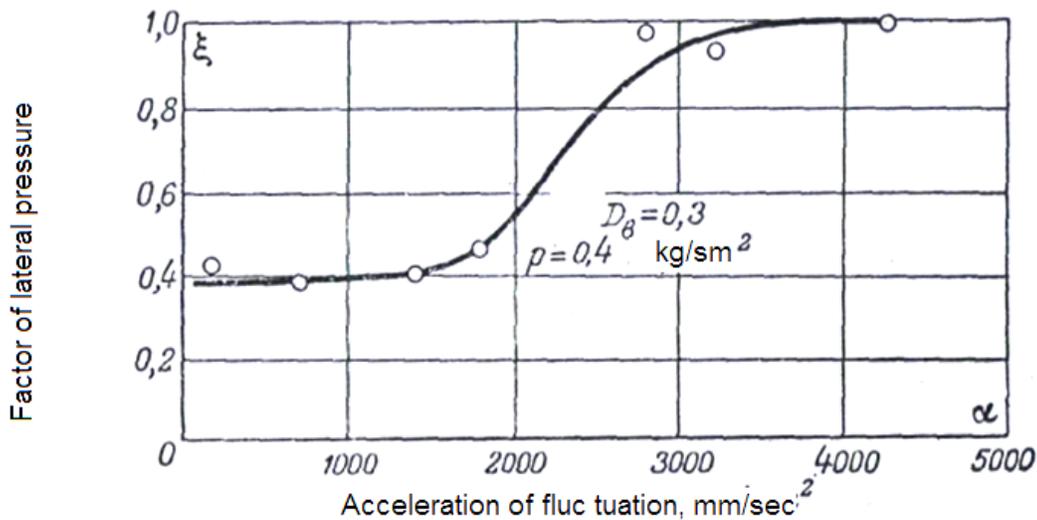

pic.2.1. The schedule of dependence of size of factor of
lateral pressure ξ from acceleration of fluctuation α.

Results of one such experience are resulted on fig. 2.1. As we see, within the limits of acceleration and a<1500 mm/sek^2 the factor of lateral pressure and, hence, a corner φ remain without change. We shall remind, that such acceleration of oscillatory movement is answered with earthquake by force in 10 points, characterized on a seismic scale as "destroying".

Besides experiences on studying resistibility to shift of sand on specially designed without the inertial the device were spent.

Results of one of these experiences are resulted on fig. 2.2. As we see (parallelism of lines s=f(p) in static and dynamic conditions), the corner internal friction remains, according to this experience, to constants at acceleration 5000 mm/sek^2 ("catastrophic" earthquake power 11 points).

However, being based on results of these experiences, N.N.Maslov approved, that change of resistibility of sand to shift in dynamic conditions, within the limits of practical statement of a question, arises in connection with reduction in these conditions of size of a normal pressure with its transition from value p_{st} to value p_{dyn}. Thus, the factor of friction and, hence, a corner of internal friction of sand in this process is accepted constant and independent of conditions of loading.
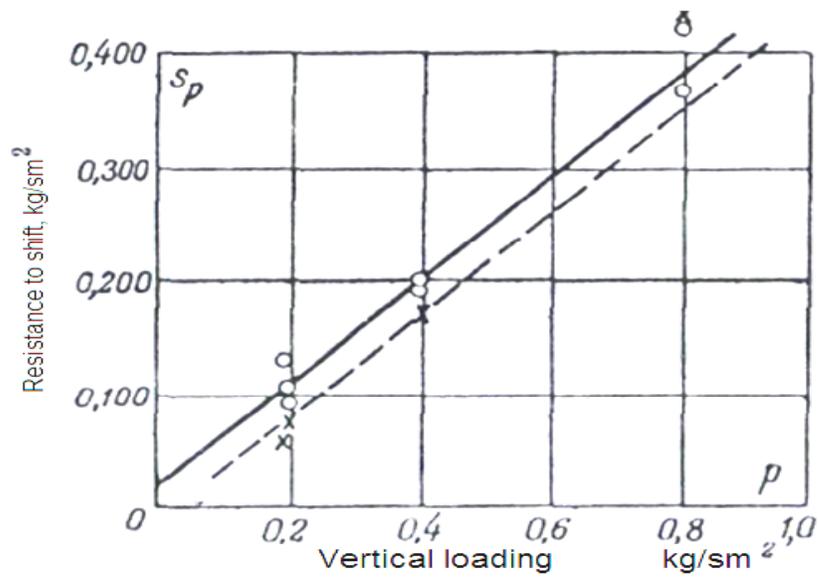
Pic. 2.2. Resistance to shift watersated
fine-grained sand   a= 5000 mm/s^2 and the
porosity, equal 40-41 %
----------------------- In static conditions
- - - - - - - - - - In dynamic conditions

Water-proof layer
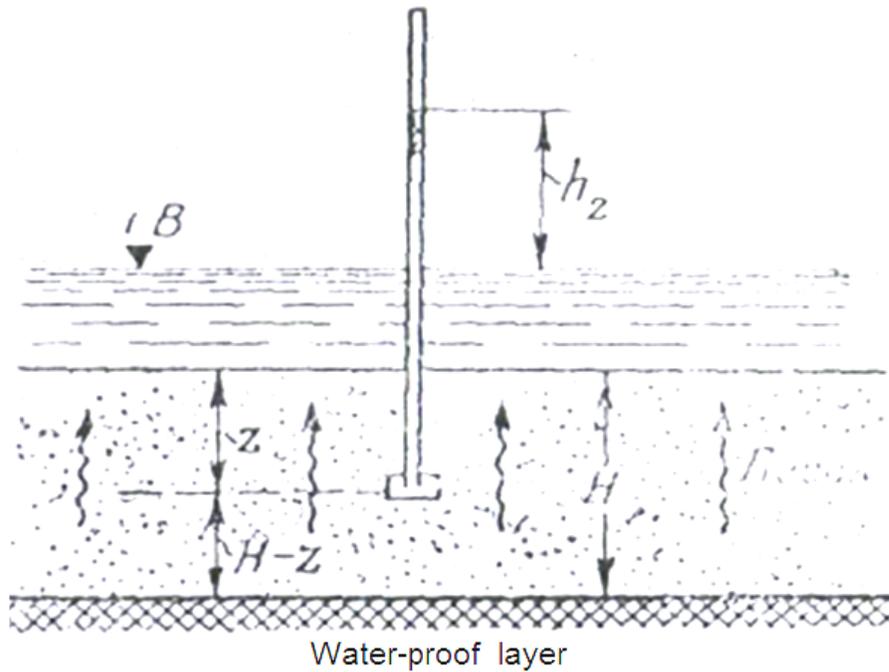
Pic.2.3. Dynamic mode in the flooded sandy thickness.

With reference to a considered case expression (2-3) can be copied in a following kind:

$$S_{dyn} = p_{dyn} \text{tg } \varphi \tag{2-4}$$

Let's address to pic.2.3 according to « the Filtrational theory » in the flooded sandy thickness which is spread by a water-emphasis and being under dynamic influence (concussion, oscillatory movement), arises the certain mode of its work.

At concussion of sandy thickness there is a condensation of sand. Such condensation of sand can find the place in conditions of full water-saturation of thickness only in case of outflow from thickness of some volume of the water filling times in sand, and superfluous for a new condition of its density.

In conditions of an one-dimensional problem and at presence in the basis of sandy thickness of waterproof horizon outflow of this water is possible only a side a free surface.

Thus, in sandy thickness, in those or its other limits on capacity, the ascending filtrational stream with the certain gradient (I_z) is formed. This gradient is supported arising in sandy thickness at dynamic influence on it by dynamic pressures h_z, increasing on depth of thickness. Thus, in sandy thickness it appears operating non-pressure, weighing grains of sand.

It is obvious, that non-pressure, is numerically equal:

$$\omega_z = \Delta_\text{B} h_z \tag{2.5}$$

In conditions of an one-dimensional problem non-pressure ω_z in the direct image leads to reduction of size of a normal pressure p_{st} in expression (2-3). It is obvious, that in this case the normal pressure in dynamic conditions p_{dyn} will be defined by a condition:

$$P_{dyn} = p_{st} - \Delta_\text{B} h_z \tag{2.6}$$

Then expression (2.4) can be copied as follows:

$$S_{dyn} = (p_{st} - \Delta_B h_z) \, tg \, \varphi \qquad (2\text{-}7)$$

To give final expression for definition of resistance to shift of the sandy water-sated thickness in dynamic conditions, it is necessary to note, that generally

$$P_{st} = \gamma_B z + p_z \qquad (2\text{-}8)$$

In last expression γ_B in-volumetric weight of sand in a underwater condition and a p_g-normal compressing pressure from external loading p_0, acting horizon z (in view of distribution of a pressure on depth of thickness).

For definition of volumetric weight γ in it is had still following dependence:

$$\gamma_B = (\gamma_B - \Delta_p)(1 - n) \qquad (2\text{-}9)$$

Let's remind, that γ in it appears usually close on the value to 1,0 т/м³. It is obvious, that in expression (2-8) the first member $(\gamma_B z)$ represents a body weight of the sandy thickness overlapping given horizon z and lying below a level of superficial or soil water. External underloading p_0 can be, but can and be absent.

In the last, essentially the most important case (p = 0) expression (2-7) at the account of dependence (2-8) signs a following kind:

$$S_{dyn} = (\gamma_B z - \Delta_B h_z) \, tg \, \varphi \qquad (2\text{-}10)$$

It is obvious, that at $h_z = 0$ we shall receive for the flooded condition of sand:

$$S_{dyn} = \gamma_B z . tg \, \varphi \qquad (2.11)$$

$$S_{dyn} = s_{st}$$

Hence, at achievement in size of a dynamic pressure h_z the value on expression (2.11) sand passes in deliquating a condition.

This condition again, already on the other hand, leads to the conclusion, that at deliquating sand the dynamic pressure on some depth in sandy thickness is

numerically equal to this depth.

$$h_z=z. \tag{2.12}$$

At the same time the same value for a dynamic pressure h_z on expressions (2.11) and (2-12) is maximal, is limiting for it possible, Above this size h_z cannot be.

Thus, considering this remark and simultaneously expressions (2.12), we can write:

$$h_{z,max} = \frac{(\gamma_0 - \Delta_в)(1-n)}{\Delta_в} Z \tag{2.13}$$

Or, more shortly, accepting, that $\Delta_в = 1 т/м^2$ and γ_0 in the same measurement:

$$h_{z,max} = (\gamma_0 - 1)(1-n) z \tag{2.14}$$

Let's remind, that

$$Iz = \frac{dh_z}{dz} \tag{2.15}$$

Then on expression (2.13) мФ we shall have for a limiting case:

$$I_{max} = \frac{(\gamma_0 - \Delta_в)(1-n)}{\Delta_в} \tag{2.16}$$

Addressing again to the simplifications used at a conclusion (2.15), we shall receive:

$$I_{max} = (\gamma_0 - 1)(1-n) \tag{2.17}$$

It is obvious, that in the given limiting case. At deliquating sand and only in this case, h_{Max} it will be connected with depth z linear dependence. At all other values $h_z < z$ or, it is more exact according to expression (2.13), at $h_z < h_{мак}$ specified above dependence for h_z and I_z will be broken and will get already other kind considered further.

2.3. A dynamic pressure.

The decision of a problem according to a degree of stability water- sated sandy thickness in various conditions according to put forward by «the Filtrational theory » demands definition of size arising and acting the given horizon z a dynamic pressure h_z let's address again to fig. 2.3.

Let's consider most a simple case of an one-dimensional problem in conditions when sandy thickness capacity H is exposed to concussion with identical intensity in its all points.

For a case of an one-dimensional problem the size h_z can be certain (neglecting a body weight of thickness) proceeding from following positions. We shall enter the first concept about factor dynamic consolidations - v_n. Under factor of dynamic condensation understand some parameter describing speed of condensation of given sand with the set density (n) under influence of dynamic loading with the certain intensity defined by period T, amplitude A and acceleration of oscillatory movement and according to the definition of factor of dynamic condensation v_n resulted above we can write:

$$v_n = \frac{dn}{dt}$$ (2.18)

Morenumerical the experiences lead by various scientists, specify that at an initial stage of condensation of sand speed of condensation remains practically constant. This circumstance proves to be true character of dependence of change of porosity of sand in time, is usual at this stage of process close to linear.

Let's address to fig. 2.4. Here the diagram of change of porosity of some version of fine-grained sand is resulted at dynamic influence in the form of separate impulses - impacts. Experience
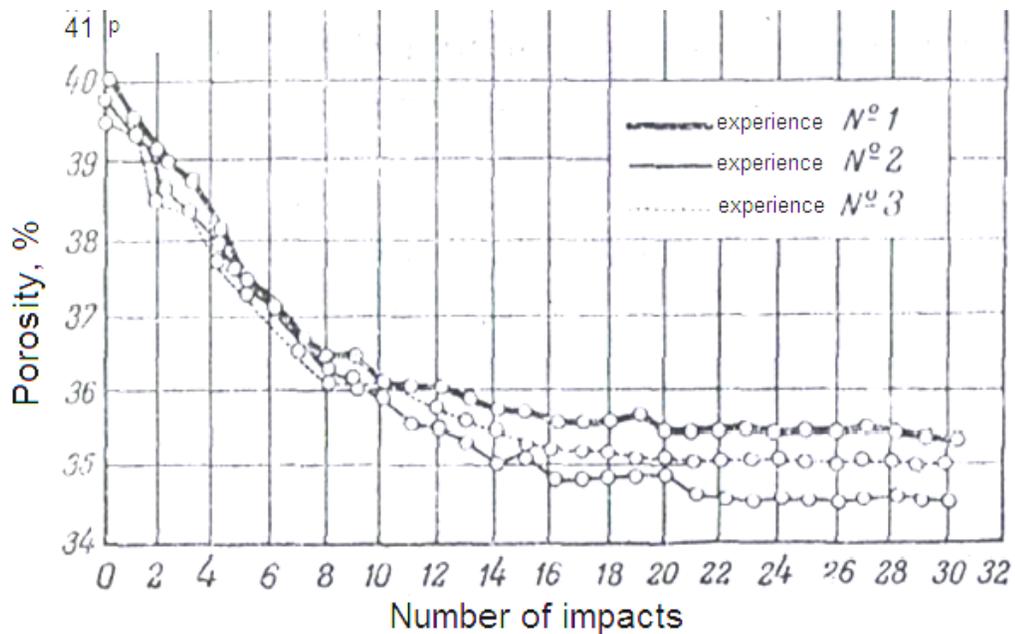
pic.2.4. Process of condensation of sand under influence of a series of impacts.

With condensation of sand it was spent in a measured vessel, to placed on an elastic platform. The impulse was informed laboratory which was located on the same platform.

On the following fig. 2.5 is resulted a number of curves of a kind n=f (t) with condensation of the same sand at vibration c various intensity. For the given test fine-grained sand with prevalence of fraction 0,25-0,10 and with the maintenance of grains of this size is used in to breed up to 65-70 %. This sand was widely used in our experiments. Intensity of dynamic influence is estimated here by acceleration of mm/s^2 (figures) and in points of a seismic scale (the Roman figures on curves).

From fig. 2.5 appears, that change of porosity of sand during the first 8-10 impacts has in this case practically linear character.

Curves n=f (t) fig. 2.5 are characterized by rather flat character. Provided that flattening them in a range 10-15 with it is quite admissible. In other cases
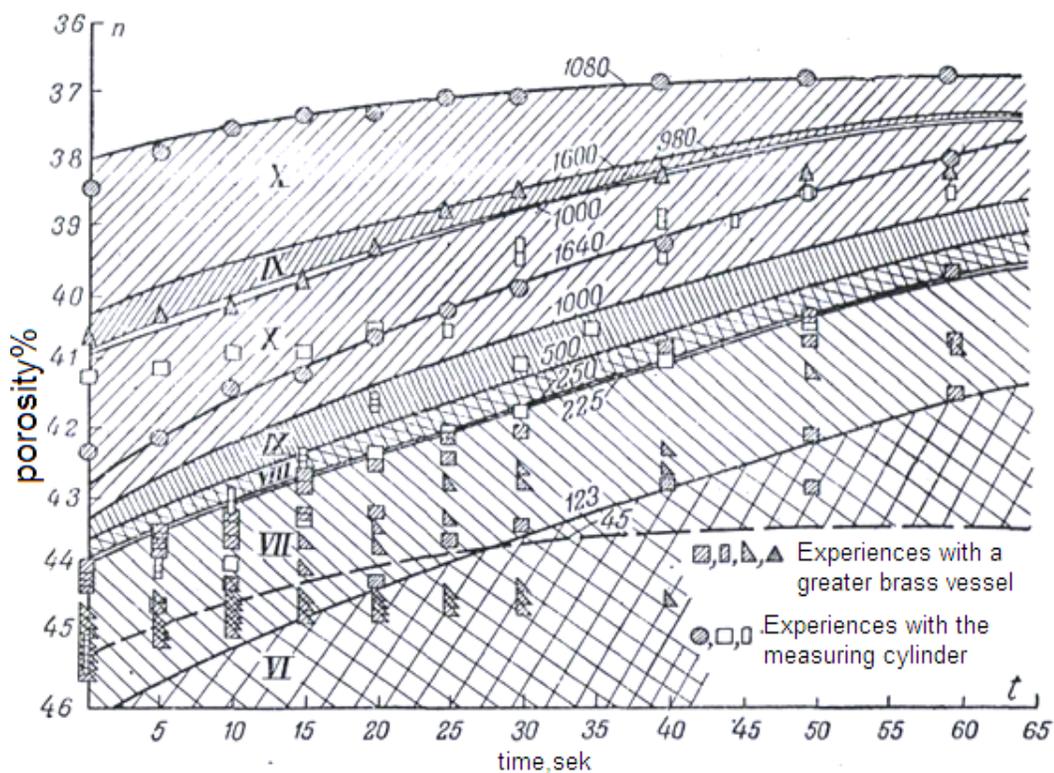
pic. 2.5. Reduction of porosity of fine-grained sand at different intensity of vibration. Numbers at curves designate acceleration α in mm/sek^2 By the Roman figures it is designated ball on a seismic scale.

Curvature of these lines is expressed much more clearly. However we shall note, that at the decision of a problem us the first period of the appendix to sandy thickness of dynamic loading interests. In all the subsequent moments porosity of sand in process of its condensation will decrease. At the same time speed of its condensation will go down also. Under these conditions as it follows from our researches, the construction in sense of the stability will be in the heaviest position at the first initial stage of process.

Data cited above and reasons allow us to accept within the limits of accuracy of our decision of a problem value of factor of dynamic condensation v_n on the some in time an initial site to constants, т. e. To believe: v_n= const.

Let's note, that dimension of factor of dynamic condensation v_n corresponds

t^{-1}, 1/sek, 1/min.

At the same time according to a condition of our problem. Intensity of condensation of sand is kept by a constant and on all depth z sandy thickness. Provided that we have also:

$$v_z = v_n = \text{const} \tag{2.19}$$

The factor of dynamic condensation v_n defines itself volume of the water departing from unit of volume of sand at its condensation for a time unit (charge).

Last condition allows us to express the charge of water liberated from times for some volume V of sand dependence:

$$q = v_n . V \tag{2.20}$$

At thicknesses water-proof breed in conditions of an one-dimensional problem through some horizontal section with the area ω passes all quantity of water liberated at condensation of weights of sand below considered horizon z (see fig. 2.3).

Proceeding from the accepted position v_n = const, we can to express this charge q_z, passing through section on depth z, as follows:

$$q_z = \omega v_n (\text{H-z}) \tag{2.21}$$

At z = 0, The charge will be equal a superficial layer:

$$q_0 = \omega v_n \text{H} \tag{2.22}$$

Clearly, that in this case through superficial section in unit of time should pass all quantity of water liberated for same time from all volume of sand V = γH, captured by dynamic influence. At the same time it is obvious, that on border with the waterproof layer excluding an opportunity of outflow of water through

it, the charge $q_z = 0$. This conclusion, logical in itself, directly follows from expression (2.24) at substitution in it values $z = H$. At the same time the condition of the miss of water through an elementary layer on depth z from a surface will be expressed as follows:

$$q_z = K \; \omega \frac{dh_z}{dz} \tag{2.23}$$

Here to factor a filtration of sand.

Having compared with expressions (2.25) and (2.26) and having made the elementary transformations, it is possible to receive the initial differential equation for definition of a dynamic pressure on depth z in a following kind:

$$h_z = \frac{v_n}{\kappa} \; (H\text{-}z) \; dz \tag{2.24}$$

Having made integration and having defined value of a constant of integration C=0 from a condition, that at z=0 (surface) the dynamic pressure h_z also is equal to zero, we shall receive:

$$h_z = \frac{v_n}{\kappa} \; (Hz\text{-} \frac{z^2}{2}) \tag{2.25}$$

Under the set condition (v_n= const) expression (2.25) in our problem is the core and allows in each special case at the certain values v_n, To and H to find size of a dynamic pressure h_z in thickness of sand on any depth z from its surface. Simultaneously same expression receives wide application in a laboratory practice at definition of the parameters describing a dynamic mode of water-sated sand.

As we see, dependence of a dynamic pressure h_z from

Parabolic character has depths. On a surface сдоя at z=0 a dynamic pressure h_z =0. The maximal value h_z reaches in a sole of a layer on contact to a water-emphasis at z = N.let's note as rather important factor, that the size h_z under all

other equal conditions is defined by capacity of sandy layer H and increase in last.

In differencial the basic expression (2.25) on z we shall receive rather important formula for us for definition in considered conditions of size of hydraulic gradient Iz:

$$Iz \quad = \quad \frac{v_n}{K} \ (H\text{-}z) \tag{2.26}$$

Dependence I_z on depth z has linear character. On a surface of a sandy layer the gradient at $z = 0$ reaches the maximal value, testifying that about the heaviest operating conditions of sand in a superficial layer. On contact to a water-emphasis size of dynamic gradient $I_z=0$ that is quite logical.

Thus it is possible to note that, in the forecast of dynamic stability of the water-sated sand the size of a dynamic pressure h_z, arising and operating in considered conditions on this or that horizon has the most essential value.

Already the very first experiences on studying a dynamic mode of the water-sated sand have specified increase of a dynamic pressure h_z on depth of thickness z (fig. 2.6).

Simultaneously these experiences have confirmed a conclusion drawn already earlier about limiting values of a dynamic pressure (h_{zmax}) with increase of this parameter in direct dependence from depth z to lie down considered horizon below a surface of sandy thickness.
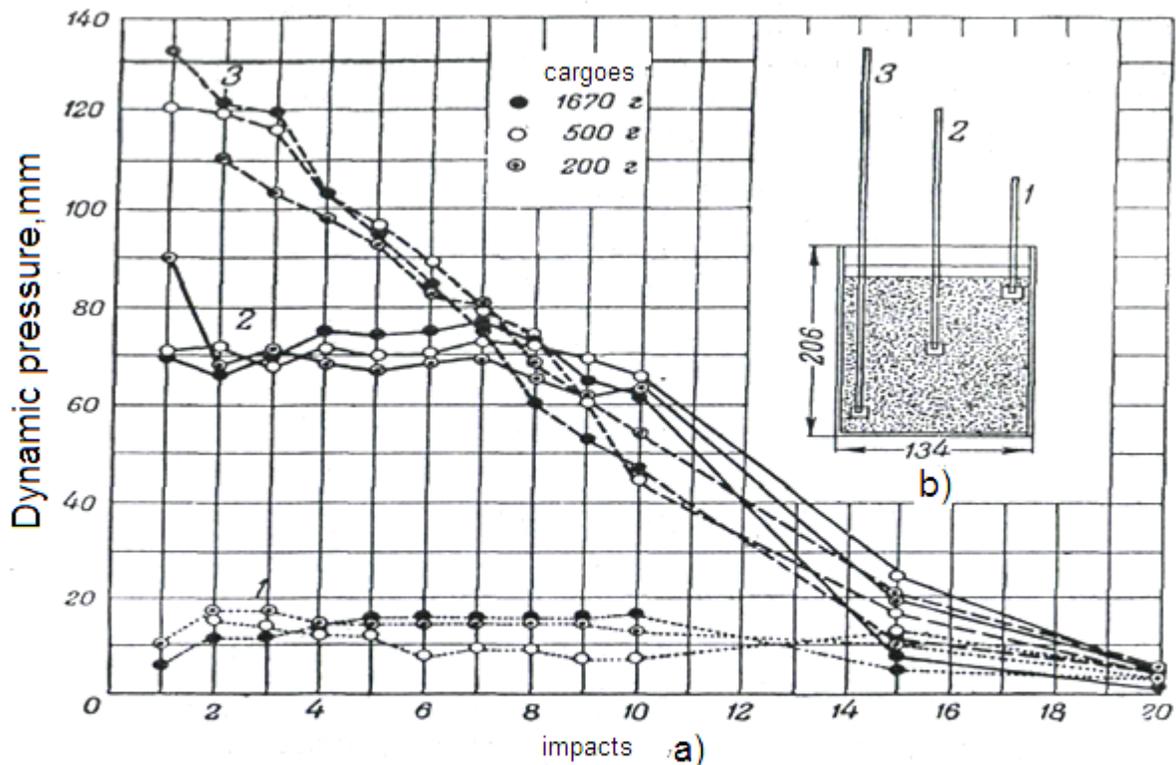
pic.2.6. Distribution of dynamic pressures $h_z^!$ on depth of sandy
thickness from influence of a series of impacts:
a-Results of experiences;   b-The scheme of experiences;
1-Top pythometr;   2-Average pythometr;   3-Bottom pythometr.

Let's note, that serial numbers of consecutive impacts which were put still to a test platform where skilled vessels with sand were placed are postponed for fig. 2.6 on an axis абсцисс. At means of these impacts dynamic influence on the sand concluded in a vessel also was carried out.

As it follows from considered figure, the deepest (benthonic) pythometr №3, gives decrease in a level at consecutive impacts already с the beginning of process.

Thus, it is necessary to recognize, that dynamic times h_z fixed as it pythometric during all process, it appears below the greatest possible valueh_{max}.
Otherwise business with two others more highly located pythometres is: average 2 and top 1. As we see from fig. 2.6, average pythometr up to 7-8 impact practically keeps a constancy of the level within the limits of, close to 70 mm. Its falling further begins.

This falling, undoubtedly, contacts increase of density of sand progressing during experience. From here it is possible to make also rather important conclusion which with reference to the given experience will look as follows. Value h_z and limits of first seven impacts is limited size h_{zmax} ($h_{max=}$lim h_z). Thus, if this restriction was absent, value h_z at a considered stage of experience would be below size h_{zmax}. At 7-th impact the pressure h_z appears already equal h_{Max}. In this case $h_z=h_{Max}$. At the subsequent impacts the dynamic pressure will be already in all cases below the limiting value ($h_z < h_{Max}$). Top pythometr 1 keeps a constancy of the level an even greater interval of time (before 15-th impact).

Such position is represented quite logical: this pythometr is incorporated on small depth. The dynamic pressure here is limited to the maximal value close only to 15 mm. Hence, its downturn is possible only when the valid size

Pressure in the constant decrease becomes equal 15 mm will be below this value. The same position, naturally, will arise and with reference to values of the dynamic gradient I_z, integrally connected with size of a pressure h_z. Two circumstances noted above should be considered rather precisely at statement and carrying out of experiences. Everyones, even short-term, dynamic influences on sandy thickness change conditions of its dynamic mode.

At the same time the valid representation about natural values of a pressure h_z can be received only on that site of experience, where $h_z < h_{Max}$. On fig. 2.6 finds the reflection one more rather important fact.
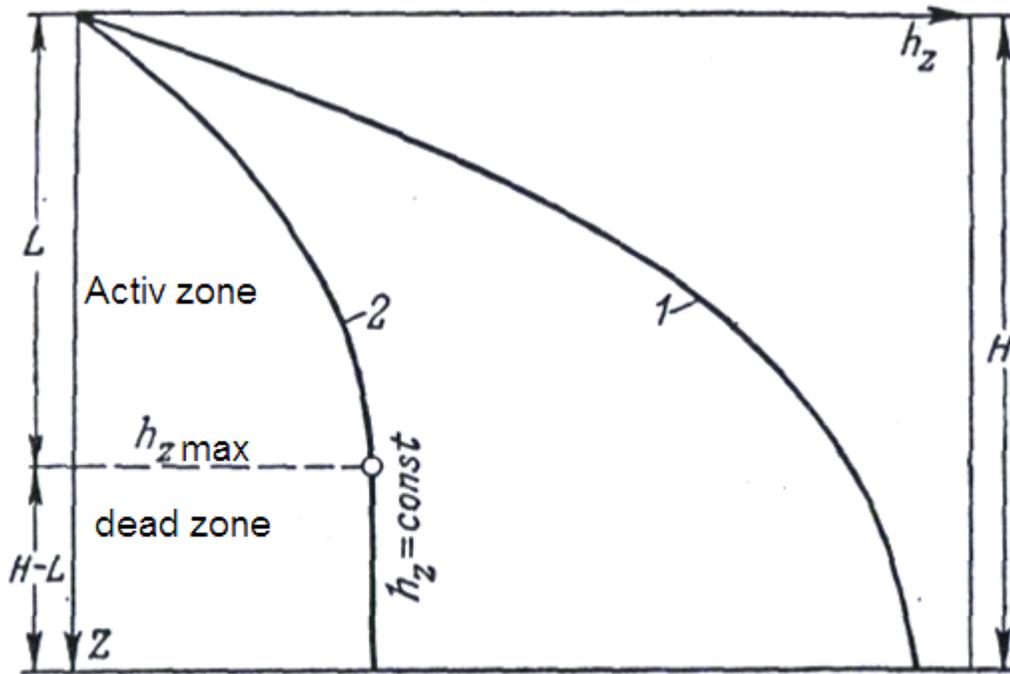
pic.2.7. Distribution of dynamic pressures h_z on depth of
sandy thickness

t- At condensation of all thickness by capacity H
2-At presence in thicknesses of a dead zone

As show experiments, during dynamic influence on the water-sated sand equality of dynamic pressures within the limits of some zone on depth is quite often observed. Such phenomenon in experience fig. 2.6 also is observed in indications of average and top pythometres during accordingly 8-20 impacts.

The essence of this phenomenon which finds the expression usually already at some subsequent stage of experience, is reflected precisely enough on fig. 2.7.

As it follows from « the Filtrational theory », at the initial stage of dynamic influence characterized by a course of process of condensation of sand on all thickness simultaneously, the law of distribution of a dynamic pressure $_{hz}$ on depth carries a curvilinear (parabolic) kind.

This position is consequence of necessity of tap in a direction to a surface of sandy thickness of escalating quantities of the water liberated at condensation of thickness, spreading considered horizon z.

This stage of studied process on a fig. 4-5 is illustrated by curve I. It is obvious, that for a considered stage all thickness of sand actively reacts to dynamic influence. Hence, in this case all sandy thickness can be considered, how an active zone.

During concussion sand in thickness starts to be condensed. Water from condensed thickness of sand according to conditions of a problem can depart only upwards, in a direction to the open surface. Hence, condensation of a superficial zone of sandy thickness can come only at the termination of the approach to it of water from spreading horizons. The unbiased fact from here follows, that condensation of sand at concussion should go from below thicknesses. Thus some separate surface between the sand which has already reached limiting condensation for given dynamics, and the sand continuing actively to be condensed is created. During a proceeding concussion this separate surface gradually rises all above and above and, at last, reaches a surface of sand. Under last condition the further condensation of sandy thickness under influence of dynamics set on intensity is excluded. Thus, in described process in thickness of sand there will be since some moment already two zones: Active where process of condensation of sand still proceeds, and a dead zone where such condensation is already excluded. In a dead zone by virtue of absence of condensation of sand the withdrawal of water from sandy thickness has no place. Hence, current of water here is not present; is not present and ascending currents. Hence, in this zone hydraulic gradient $I_z=0$. In other words, but all depth in a dead zone the dynamic pressure h_z should be kept to constants (h_z =const) as only movement of water in thickness in this case is excluded. This circumstance also finds the reflection on a vertical site of a line 2 fig. 2.7.

It is obvious, that on the value the dynamic pressure in this zone should correspond to its maximal value corresponding a contact surface between active and dead zones.

Hence in to a dead zone:

$$h_z = h_{zmax} = const \qquad (2.27)$$

Such position is quite logical. If in a dead zone h_z, would be less h_{zmax} in this case, there would be an outflow of water from active in a dead zone.

Owing to absence of the specified phenomenon such The assumption is improbable (absence of an opportunity of the further water drainage). At the same time in a dead zone h_z cannot be more h_{zMax}. If this condition would take a place we would collide with the phenomenon of outflow of water from a dead zone in active that contradicts the concept of a dead zone.

Needless to say, that in process of promotion of a separate surface upwards thicknesses capacity of an active zone all time decreases. This circumstance already under all other equal conditions leads to reduction of size h_{zMax}. To same results and progressing, during experience, increase of density of the sand, shown in reduction of the charge (q) water wrung out from sandy thickness and, hence, in value of size of a gradient (I_z), necessary for movement of this water in a free surface. Condensation of sand, naturally, causes some reduction of its factor of a filtration (q), that could find the reflection in increase of dynamic gradient I_z. However, as shows experience, last factor has less essential value, as leads to reduction of size h_z during studied process.

The question on restriction of size h_z and I_z, proceeding from a condition, that at $I_z = h_{zmax}$ occurs already break of sandy weight by ascending currents of water to its transformation into suspension, and it appears to a considered problem exclusively important.

Let's address to fig. 2.8. Here we have two basic schemes: one with images on depth of thickness z dynamic pressures hz and the second, too dynamic gradients I_z. Various lines on these diagrams correspond to various conditions of experiences concerning intensity of the dynamic influence enclosed to sandy weight. This intensity is estimated by size of acceleration of oscillatory movement (concussion) and. It is

natural, that with increase and sizes h_z and I_z increase, but up to the certain limit h_{zmax} and I_{zmax}.

Exact value h_{zMax} and $I_{z\,Max}$ is established thus on expressions (2.25) and (2.26).

Approximately, as it also was specified above, these sizes are defined by their values:

$$H_{max} = z\ I_{max} = 1,0$$

Thus, as a limit for lines $I_z = f(z)$ the straight line lead under a corner in 45 to horizon will serve. Lines $H_z = f(z)$ according to the instructions resulted above have parabolic character. However this параболичность is kept on all depth of thickness only
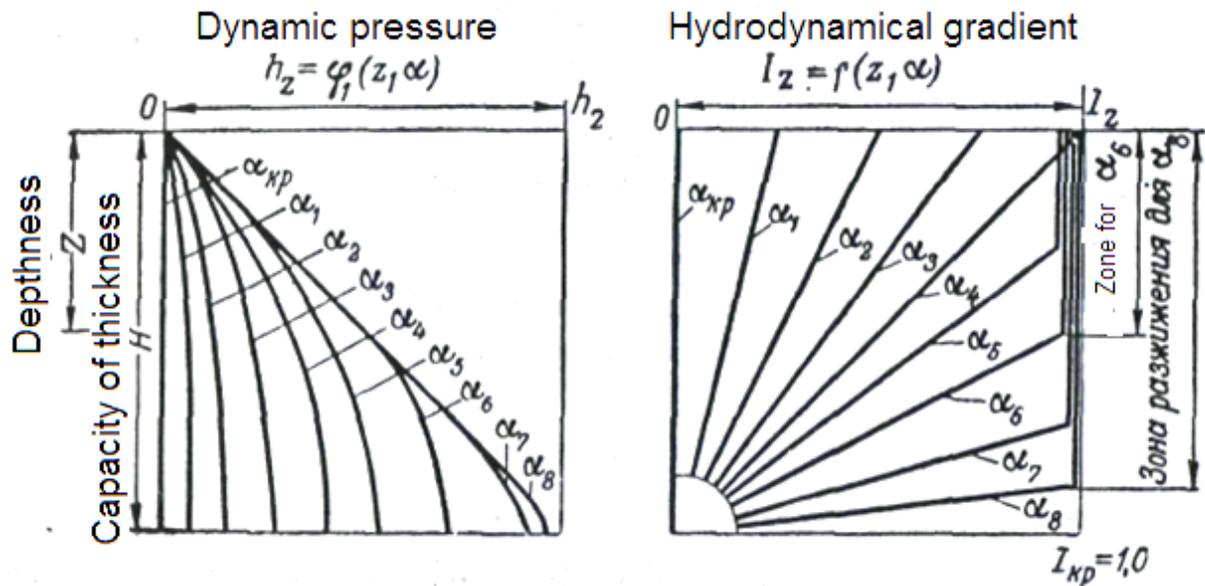

Fig. 4-6. Change of a dynamic pressure h_z and gradient I_z on depth of sandy thickness capacity H at increase in intensity of dynamic influence (on acceleration of fluctuations).

UP TO some limiting value ampere-second increase and, at achievement h_z on this or that depth from a surface of the limiting value h_{zmax} the

pressure h_z is defined already size z. Hence, in this zone sand passes in deliquating a condition.

At some value certain on size and all thickness of sand passes practically in deliquating a condition. In this case, and only in this case, the line $h_z = f(z)$ gets the linear character adequating theory $h_z = z$,.To a case of superfluous hydrostatic pressure on depth z some heavy deliquating.

Addressing to the second fig. 2.8, we see its direct communication with the first diagram. Function $I_z = f(z)$ has clearly expressed linear character at all values and. A limit of value I_z, its size $I_z = h_{max} = 1,0$ is. This condition answers a condition full deliquating sand. At achievement and some limit after the intensity and its excess $1_g = f(z)$ as we see, gets broken character. The zone characterized by value $I_z = I_{Max} = 1, 0$ with increase a gradually extends in depth of sandy thickness and, at last, practically it grasps completely. Provided that sand on all thickness is passed in deliquatinging with a condition (suspension).

Noted above a condition on limiting values h_z and I_z appear rather important at interpretation of results of experiments and by their comparison to theoretical data.

Chapter III. LABORATORY RESEARCHES

One of essential elements of the labware for studying conditions of dynamic (seismic) stability of the water-sated sand are vibroinstallation this or that system.

Vibroinstallation serve for reduction oscillatory movement of some volume of tested sand.

The basic part vibroinstallation any type is vibroplatform, resulted that or otherwise in harmonious oscillatory movement. On this platform the special skilled vessel fastens in order to prevent chaotic movements. This vessel serves for a premise in it of tested sand. Sand keeps within a skilled vessel in the way described above excluding a jamming in it of air.

With a view of maintenance of carrying out of experiences with sand under that or other pressure in all cases the special loading adaptation is provided. The skilled vessel is supplied with the corresponding equipment for measurement of sand of a dynamic pressure arising in thickness (h_z) and registration of change of its density (n).

These vibroinstallation differ from usual to using, for example, for preparation of concrete samples, a lot of attributes. First of all it is necessary to note, that, answering the purposes of research, concussion on vibroinstallation considered type should to be carried out by beforehand set image with the certain intensity. This circumstance causes to have vibroinstallation the directed action: with vertically and horizontally directed fluctuations. Intensity of fluctuation in described vibroinstallation is much lower, than vibrotable for manufacturing concrete samples, and should lay over a wide range, defined by the practical purposes, from 1/200 up to 1/2 accelerations of a gravity (from 50 up to 5000 mm/sek^2). In an ideal case necessary intensity of fluctuation on size of acceleration (n) should be reached on vibrotable as due to the set amplitude, so; and frequencies of fluctuation.

Depending on the purpose and the purposes of research vibrotables should to provide frequency of fluctuation in 1 up to 30 hertz at corresponding amplitudes from the tenth mm up to several see

Needless to say, that vibroinstallation should be supplied by the corresponding equipment for registration of parameters of intensity of oscillatory movement.

In connection with absence ready vibroinstallation their described type it was necessary during development of a problem always specially to design and produce, that, naturally, it has been interfaced to considerable difficulties. At the same time vibroinstallation in this process gradually were modernized and improved.

Below the description of several types vibroinstallation, since the first model on time at which means experiences described in the present work were carried out is resulted. As we can notice after acquaintance with them, all these vibroinstallation are still very far from perfect and demand on the design of the further improvement and development.

Vibroinstallation horizontally directed action (VNJJG)

Vibroinstallation it is created on the basis of the usual device used for dispersion of sand by their preparation for the mechanical analysis (fig. 3.1). Redesigning the device it is executed K.Kornilevem's.

Lack: low frequency and a small range the reached intensity of fluctuation.
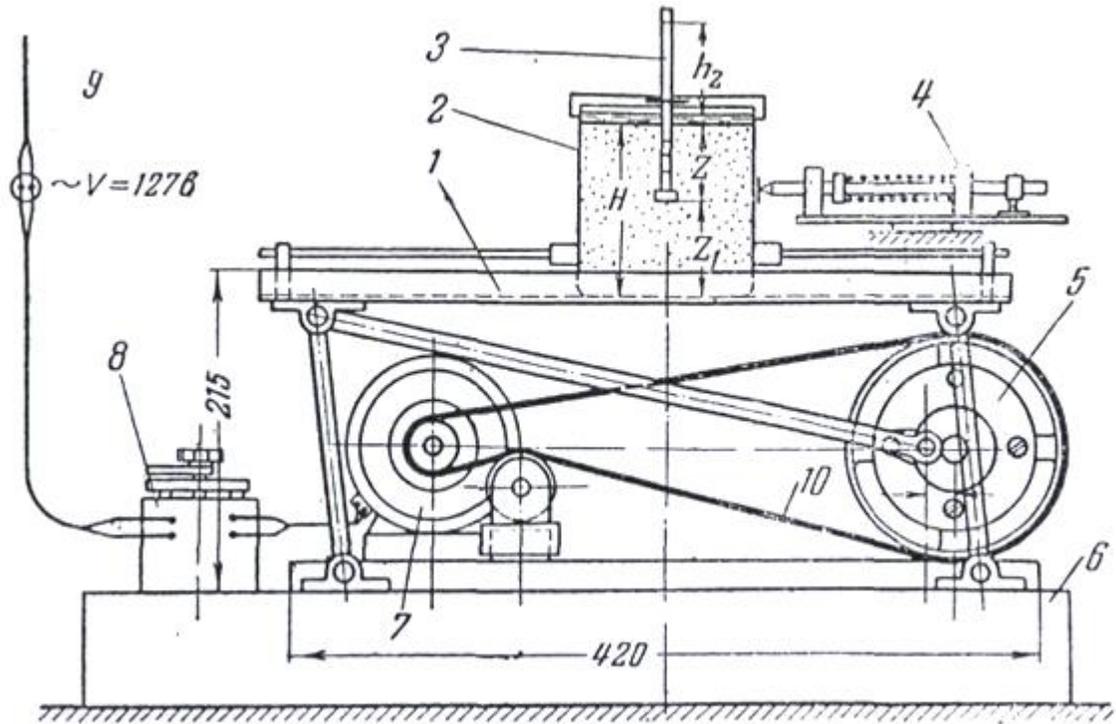
Pic. 3.1. The scheme of oscillatory installation VNJJG

1 vibrating; 2 - a glass vessel with sand; 3-pythometr with the holder; 4 - a measuring instrument of frequency and amplitude; 5 - the clown of adjustment of amplitude; 6 - a support; 7 - the electromotor; 8-autotransformer of adjustment of frequency; 9- a plug receptacle with inclusion by a plug; 10 - belt transfers.

Installation did not provide necessary cleanliness of an orientation of fluctuations.

Vibroinstallation with horizontally directed fluctuations. (SPJSA)

Installation consists of following basic parts (fig. 3.2).

1. The Vibrating plate and the vessel attached by it with investigated sand.
2. Krivoshippo-shatunpago the mechanism the clown type for transformation of rotary movement of the motor to harmonious fluctuations of a vibrating plate.
3. The Welded frame on which details of installation become stronger all.

4. The electromotor of an alternating current of collector type for a single-phase current capacity 300.

5. Adaptations for additional at loading sand and installation of auxiliary adaptations.
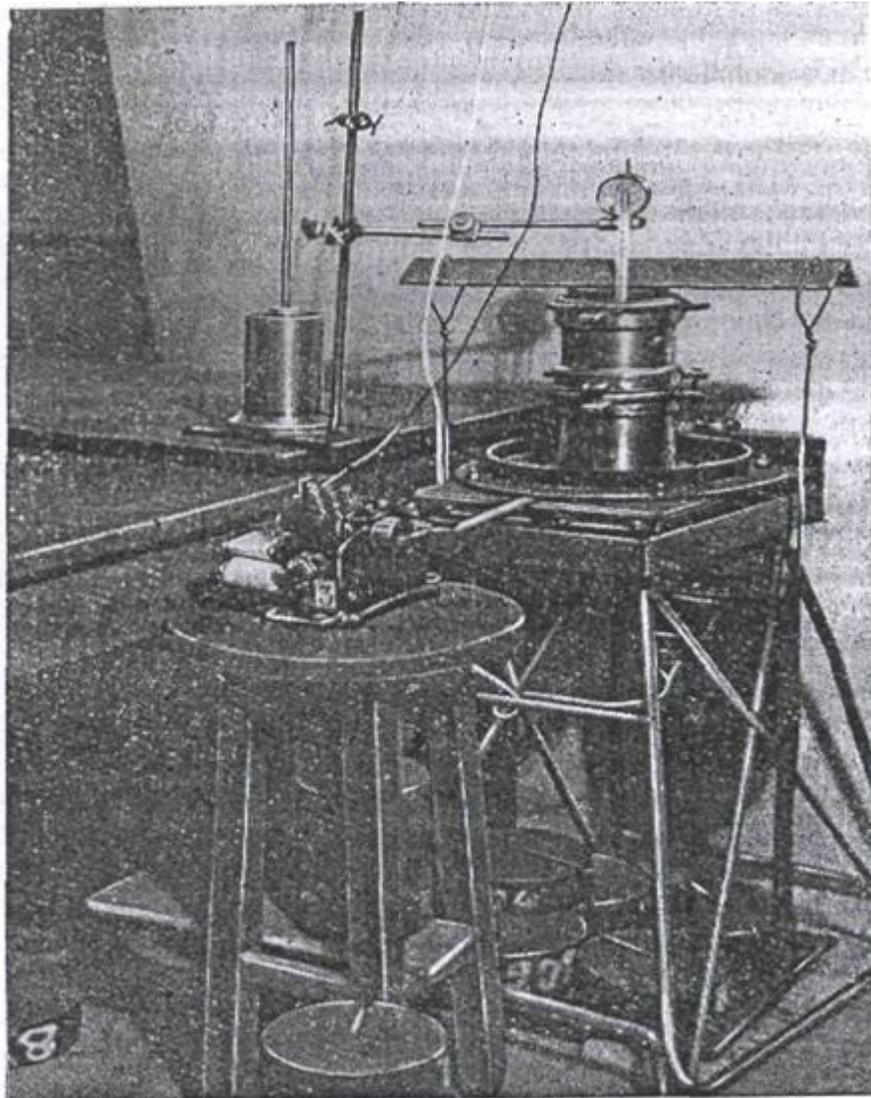
Pic.3.2.Vibroinstallation with horizontally directed
fluctuations, model LISI 1952-1953y

The design of installation allows to change smoothly amplitude of fluctuations within the limits of from 0,05 up to 1 mm and frequency of fluctuations from 4 up to 40 hertz. Smooth adjustment of frequency of fluctuations turns out by change of a

pressure of a current in a circuit of the electromotor.

This installation in due time provided successful carrying out of experiences with the water-sated sand.

Vibroinstallation with vertically directed fluctuations (SPJSA)

The general view of this installation developed by K.A.Olehnovich is resulted on fig. 3.3

As the direct activator of fluctuations of the given installation the vibrator attached on bolts to vibroplace from its local party serves.

By change of a pressure of a current in a circuit of the electromotor frequency of fluctuations vibroplace was represented possible to be adjusted smoothly from 4 up to 15 hertz. For this purpose autotransformer LATR-1 was used.
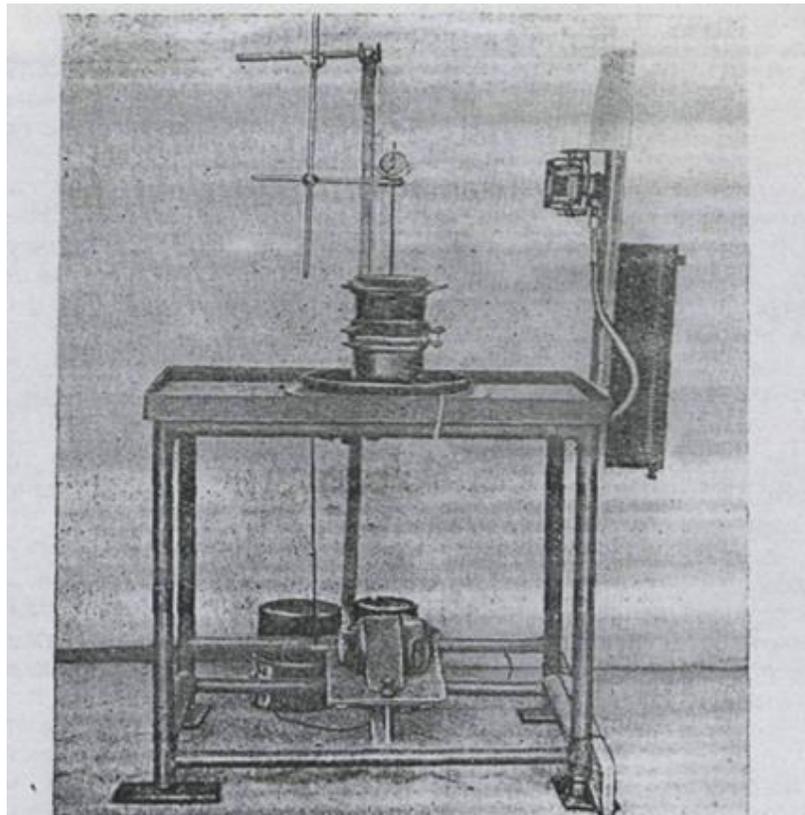
Pic.3.3. General view vibrotable with vertically directed fluctuations, model

1953-1954year.

Change of intensity of fluctuation on a kynimatic circuitry of the instrument was reached by increase in frequency of fluctuations.

Change of amplitude of fluctuations at constant frequency managed to be received, using additional loading on a platform. Unfortunately, and given vibroinstallation also did not provide to the full cleanliness of an orientation of fluctuations. This feature of the device was its essential lack.

Vibrating installation with horizontally directed fluctuations (SPJSA)

Shown on fig. 3.4 vibroinstallation it has been designed on N.N.Maslova's ideas. Installation differs low frequency of fluctuations (from 0,5 up to 4 hertz) and significant amplitudes (from 1 up to mm). The central part of installation is the basic plate to which bolts attach a skilled vessel. The power system of installation is presented by the motor of electrodrill 1-28 of a single-phase current with a pressure to 220 century vibroinstallation has allowed to execute a number of rather responsible experiments quite well.
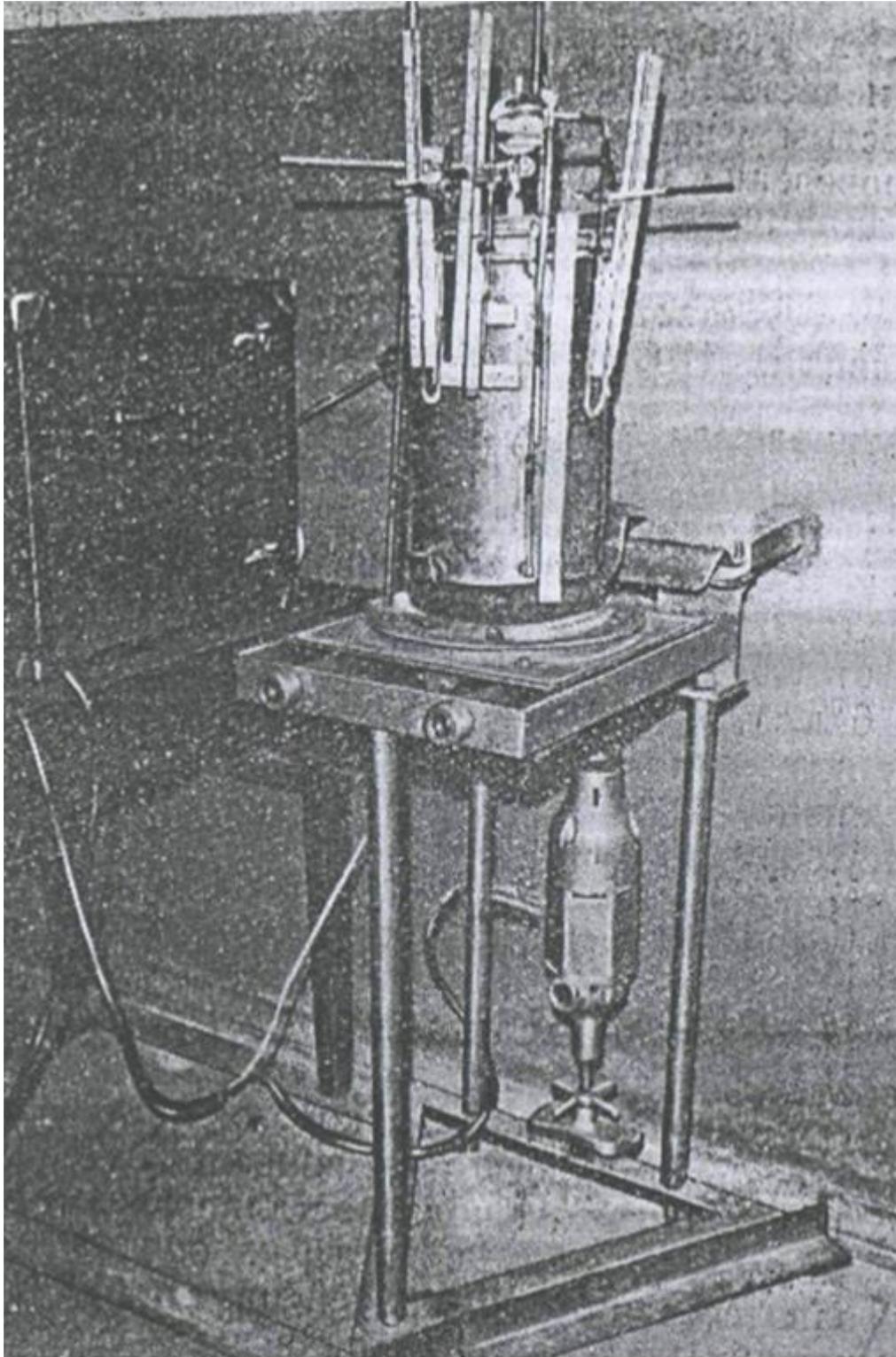
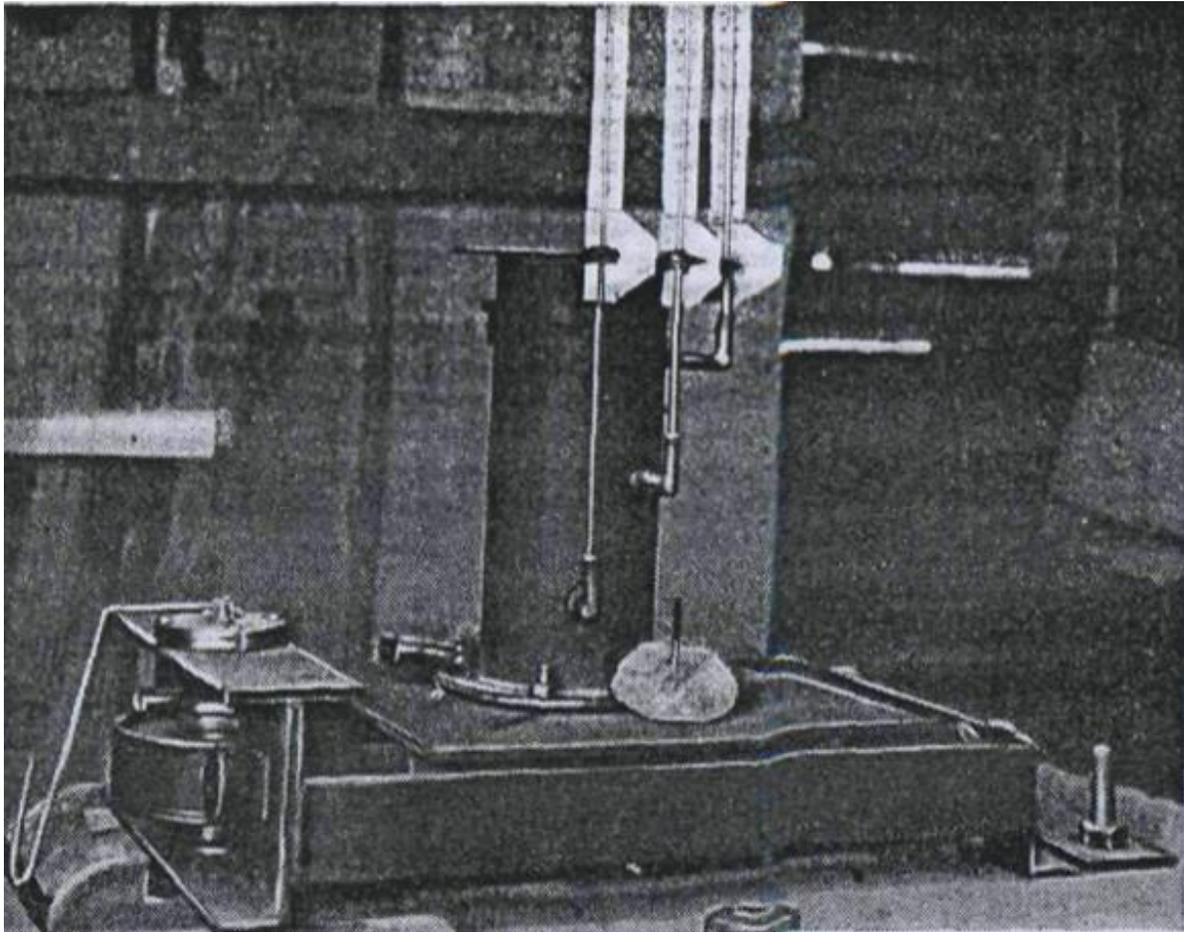Pic.3.2. Vibroinstallation with horizontally directed fluctuations, model
1952-1953 year.

Fig. 3.5. Vibrating installation of horizontally directed action.

Vibrating installation (N.T.Valisheva's Design)

Described vibrating installation (fig. 3.5) consists of a frame, a working platform, krivoships the mechanism with directing, a drive and the container with a ground. Regulation of frequency of fluctuations (from 5 up to 50 hertz) is made by rearrangement of replaceable pulleys on a shaft of the engine and a shaft of installation. Regulation of amplitude of fluctuations (from 0,2 up to 6,0 mm) is carried out by turn exentric plugs on exentrics parts of a shaft. Maintenance of necessary amplitude is made by overlapping corresponding risks on a shaft with riscs and and the plug. The plug is fixed by means of two fixing bolts and a nut with a counternut.
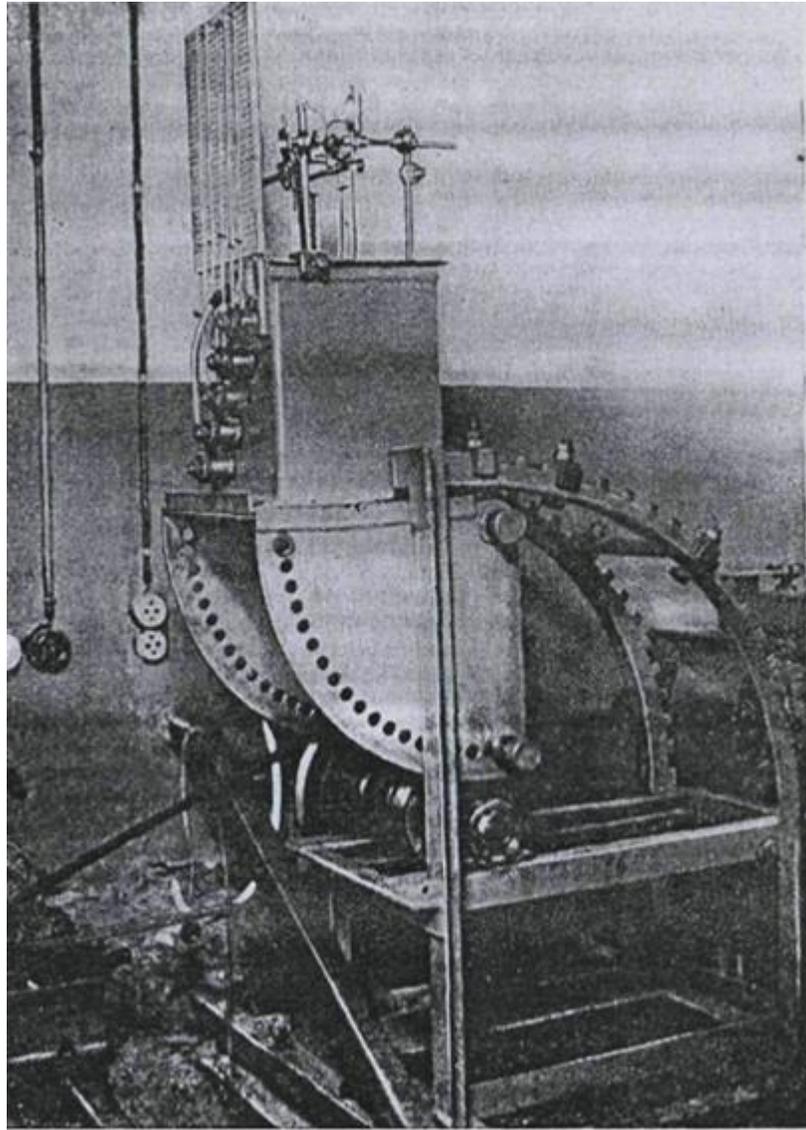
Pic.3.6 Vibrating installation, mark M-3,1957 year(N.T.Valishevs designs)

Change of a corner of a direction of fluctuations is made by change of an inclination directing.

Installation allows to experiment on adjustable amplitude and frequency of fluctuations at various directions of influence.

Vibrating installation TASI (H.Z.Rasulov)

To installation with horizontally directed fluctuations allows to spend experiences with samples grounds in various modes of fluctuations (fig. 3.7). Since 1970 it has formed a basis of experimental checks of numerous problem questions of theoretical and applied character in the field of dynamics (seismicity) grounds.

One of prominent features of vibrating installation - a mode of its fluctuations, allowing to spend опиты at the set acceleration due to change of amplitude of fluctuations at constant value of frequencies or on the contrary.

Рис3.7. A general view of vibrating installation TASI

3.1 Vibrating installations and the measuring equipment

Indispensable part of any of described above vibrating installations was the skilled vessel.
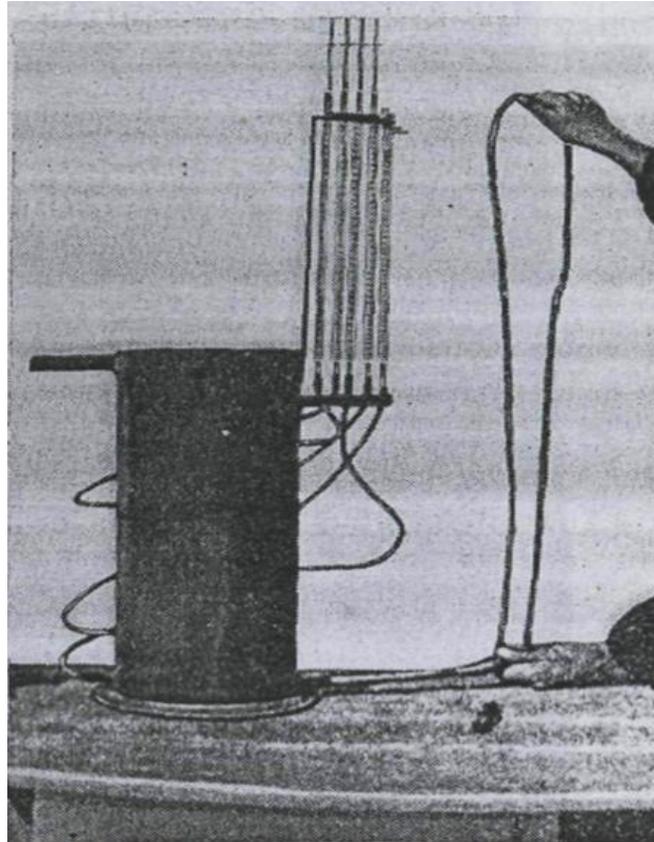

Pic.3.8. Skilled vessel with allocated pythometric system

In practice of experimental researches vessels cylindrical forms with a diameter from 12 up to 25 sm were used at height from 25 up to 160 see and vessels of square sections with the various sizes. For the considered purposes glass vessels have appeared less strong. By virtue of it for experiences were usually used metal (steel or brass) vessels. In some cases there were convenient for the use demountable metal vessels (fig. 3.8). By a fastening of several секций such vessel it was possible to provide its necessary height without replacement of the vessel that caused more complex operation for its fastening on vibroplatform.

Integral part of a skilled vessel were devices for gauging arising in sandy to thickness at its concussion of a dynamic pressure. For this purpose in laboratory

experiences were used, basically, usual pythometrics tubes in diameter in 1,4 and (more often) 3 mm.. The Opportunity and an admissibility of use for present purposes pythometrics tubes have been confirmed by special methodical experiences with application трубок various section. In the subsequent experiences have been added by new experiments with comparison of sizes of dynamic pressures h_z, measured in the usual way at means pythometres and special electromanometers with ossilography process.
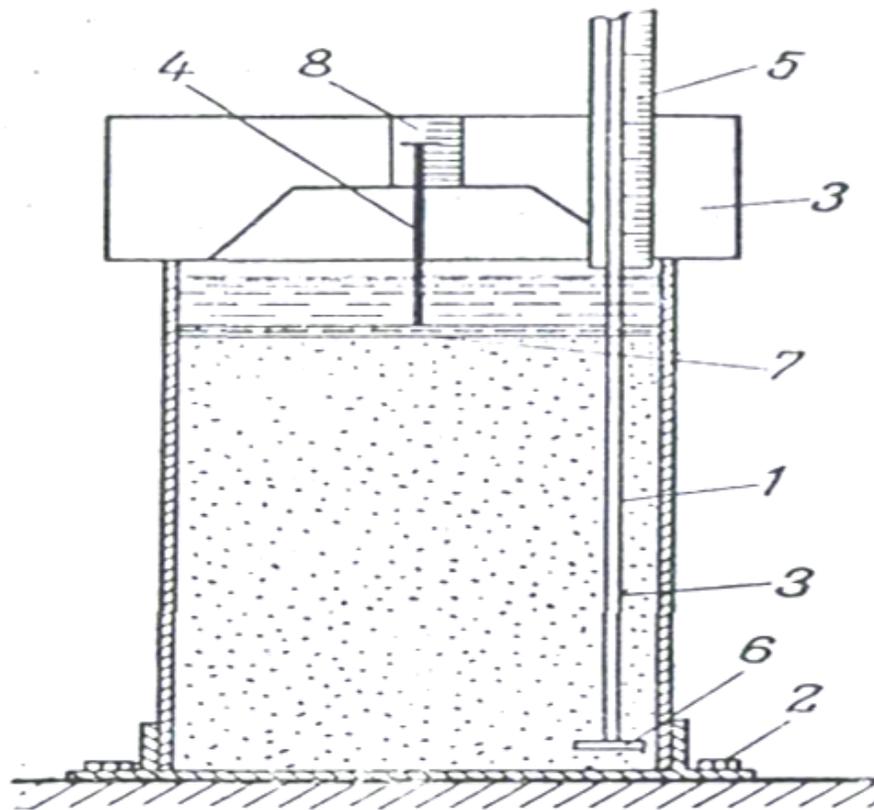

Pic.3.9. The scheme of control adaptations in the working
cylinder.
1-cylinder;   2-fastening of the cylinder;
3-pythometric tube;   4-core of a reference point;
5-scale eeeee;   6-filter;
7-superficial reference point
8-scale of gauging deposits

Pythometrics tubes or were simply established in a vessel with a tip (fig. 3.9) on this or that depth or allocated a wall of a vessel on the general board at means rubber tubes. Stream waters in necessary volume installation low pythometres was made for maintenance on some centimeters above a bottom of a vessel.

Rather important operation at carrying out of described experiences was supervision over change in their process of density of sand. For this purpose have appeared rather convenient superficial a reference point with a pattern. The way of installation of such reference point on a skilled vessel is seen from fig. 3.10. On a pattern there is a scale, specially based for the given vessel. On moving the core connected with a superficial reference point in the form of a disk, it was possible directly, making readout on a scale to judge porosity of sand during this or that moment of course of experience.
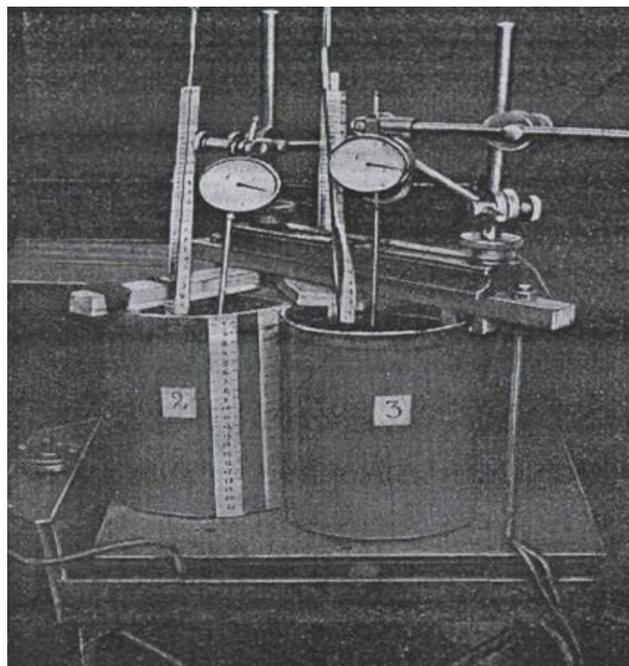
Pic.3.10. Arrangement of the measuring equipment at carrying out of experience on vibroinstallation.

More exact measurements of porosity of sand were made by means of messur.

The accepted mode of fluctuation at experiences was registered at means vibrography stationary type (usually system Gejgera) or with vibrography BP-1.

Typical kind « received (vibrogramm it is seen from fig. 3.11).
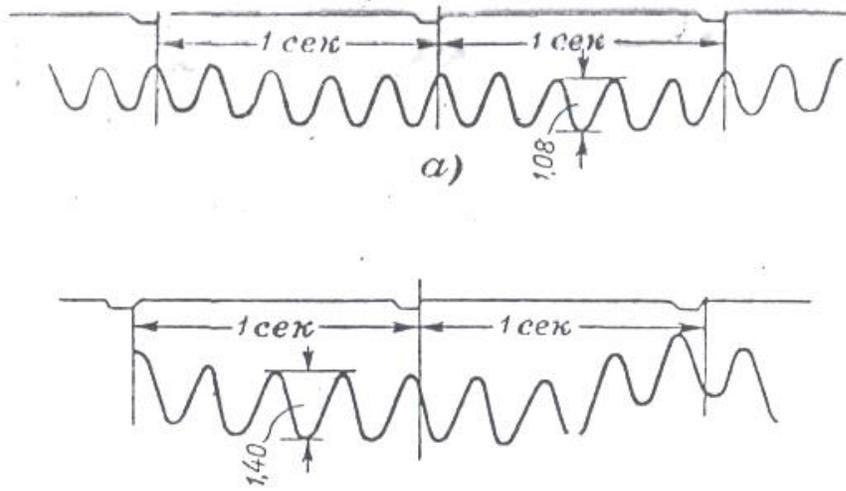
Pic.3.11vibrogramm

3.2. Definition of factor of dynamic condensation V_n

Let's remind, that the factor of dynamic condensation V_n reflects itself speed of condensation of the given sand at the corresponding dynamic influence characterized by acceleration and, period T and amplitude And oscillatory movement.

Numerically the factor V_n is expressed in a following kind:

$$V_n = \frac{dn}{dt} \qquad (3\text{-}1)$$

From here appears, that the basic dynamic characteristic of sand is the factor dynamic condensation V_n. We shall remind, that dimension of factor of dynamic condensation V_n - return time (1/with).

As show experiments, the size ν_n depends from many factors and first of all from:

1) granulometrics structure of sand and in particular

From a degree of its uniformity and clayness;

2) From a degree its grains;

3) From a degree of its density (porosity);

4) From intensity of dynamic influence (and, T,);

5) From size external at cargoes (P_0) ',

6) For clay sand and the more so for coherent

grounds from duration of dynamic influence on them.

Generally the size of factor ν_n increases with increase in frequency and uniformity of sand, a degree окатонности grains composing it with increase of porosity of sand, with increase in intensity of dynamic influence, in the certain cases, with increase in its duration.
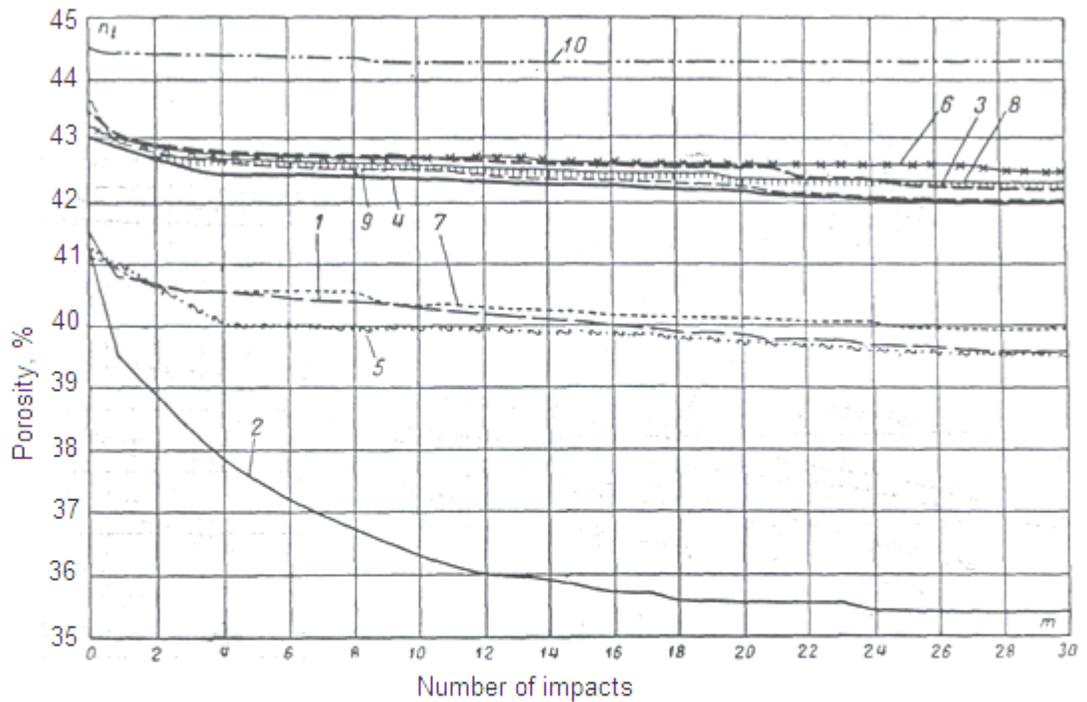
Pic.3.11. Compactibility of sand depending on the sizes of fraction in a dry kind and under water:

1-Sand dry.
2-Sand under water.

3-Sand dry.
4-Sand under water.Fraction 1-3mm.

5-Sand dry.
6-Sand under water.Fraction 3-5mm.

7-Sand dry.
8-Sand under water. Fraction 5-7mm.

9-Sand dry.
10-Sand under water. Fraction >7mm.

3-site - constant value v_n and A_n for various sizes of acceleration and (a mode « zones deliquating »)
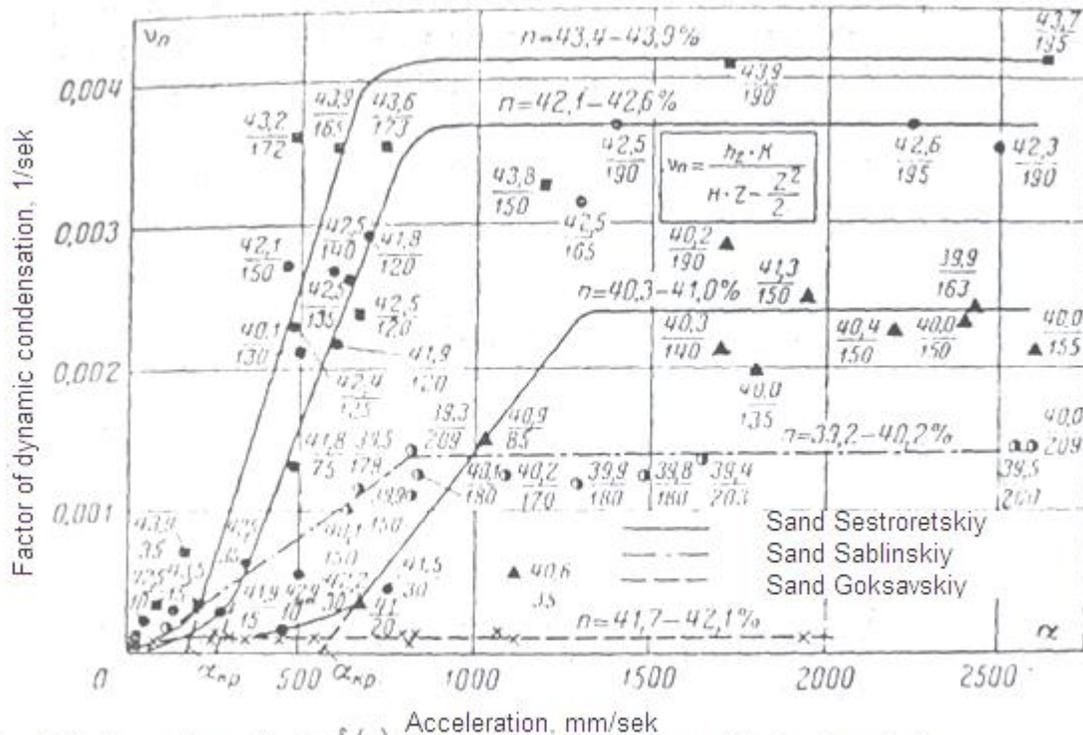
Pic. 3.13. Dependence $V_n = f(\alpha)$ for various sand. By figures it is designated: in numerator-porosity, in a denominator-dynamic a pressure h_z.

The factor of dynamic condensation V_n represents rather important characteristic for the forecast of a dynamic mode of the water-sated sand.

Sizes of factor V_n even at close values of porosity of sand appear sharply various for those or other sand (fig. 3.13).

These factors (clayness) provide some connectivity of grains of sand among themselves. That the degree of dynamic stability of such sand raises. The positive role of a clay impurity in the given sense is obvious. The question on a role in this respect particles remains up to the end obscure. Apparently, the salutary role will be played only with particles of a thin dust (0,01-0,005мм). Additional researches Here are required.

Definition of factor of dynamic condensation V_n is made for sand as follows.

Sand is loaded by the way described above into a skilled vessel. The initial

density of sand is defined. The vessel that or a different way is equipped pythometrics with system.

To pythometrics to a tube the scale with the millimetric divisions, combined by zero reading with a meniscus in a tube prior to the beginning of vibration is attached. Further the vessel with sand is exposed to vibration with the set dynamic mode. Supervision for осадкой sand in a vessel is continuously conducted. These data allow to establish па this or that moment of supervision value of density (porosity) of sand. At vibration of sand supervision over height of a raising pythometrics a level is conducted also and thus the size maximal is defined for the given case of a dynamic pressure (h_{zmax}) with reference to capacity of a sandy layer (n) and depth to put in pawn pythometr from a surface of sand (z).

Experience with the same vessel without it spent some times successively. It is natural, that initial density of sand (porosity) at each subsequent test as the result of previous vibration of sand, will become the lesser. It is obvious, that will decrease in this case and size h_{zmax}. From here, at constant values H and z, we shall collide with smaller sizes $v_{п}$, that will be connected in a significant part with increase of density of the examinee of sand.

Observing the way described above (for example, at means messur - the indicator) to a deposit of a surface of sand in a skilled vessel during experience in time, we can in the usual way, by recalculation establish change in time as well average on a vessel of porosity (n) sand. From here any more will not present difficulty to establish on expression

$$v_n = \frac{\Delta n}{\Delta t} \tag{3.2}$$

and the factor of dynamic condensation carried to some condition of density (on porosity) sand. It is obvious, that in expression (3.2) under dn reduction of porosity in shares of unit for some, whenever possible shorter, the period of time t is meant.

For gauging size deposits of a surface of sand in a vessel in many cases it appears expedient to apply this or that design (for example,systems prof. N.N.Aistova). They possess indisputable advantage to carrying out of supervision at fast current deposits.

In summary we shall result pic. 3.14 where values of factor v_n for fine-grained sand are given, for this or that intensity of fluctuation with reference to points of a known seismic scale.
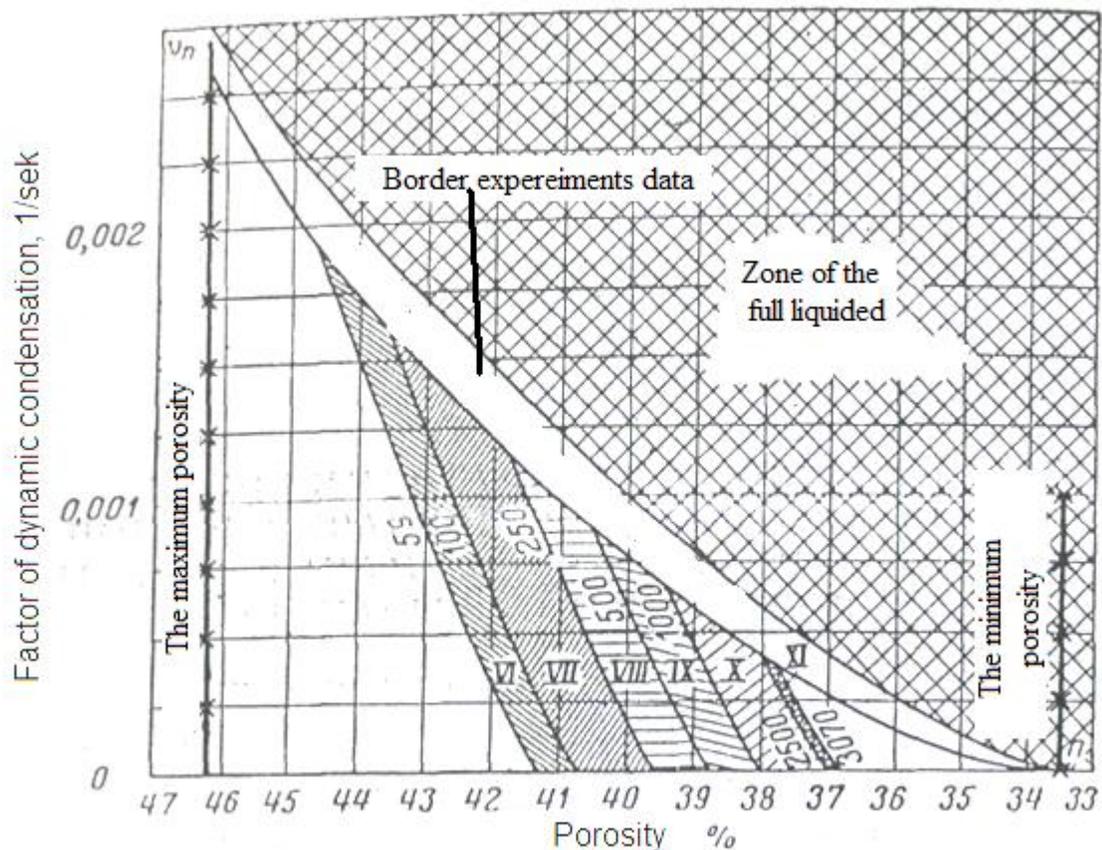
Pic.3.14. Dependence of factor of dynamic condensation Vn on porosity for fine-grained sand with reference to a seismic scale (the Roman figures specify accelerations in points, numbers at curves designate accelerations in mm/sek^2,

3.3 Definition of a dynamic pressure h_z

It has been lead over 25 experiences for an establishment h_z first of all as functions from depth at constant capacity of a sandy layer of H. Experiences were resulted in laboratory installation TASI.

On fig. 3.15-3.17 some schedules constructed monotonously by results of the subsequent experiences are resulted for an example. Each of these schedules concerns to dynamic test of some certain sand lying with certain capacity H of a layer and subject to fluctuation with certain intensity (a).

On some of these графикой data on test of sand with various porosity and under influence of dynamics with various intensity are cited (acceleration). The size of a dynamic pressure was measured In all cases h_z for various horizons z, measured from a surface of sand. On schedules points are put, to a floor by experience, and curves $h_z = f (z)$, the expressions constructed theoretically with use (2-25) are simultaneously lead.
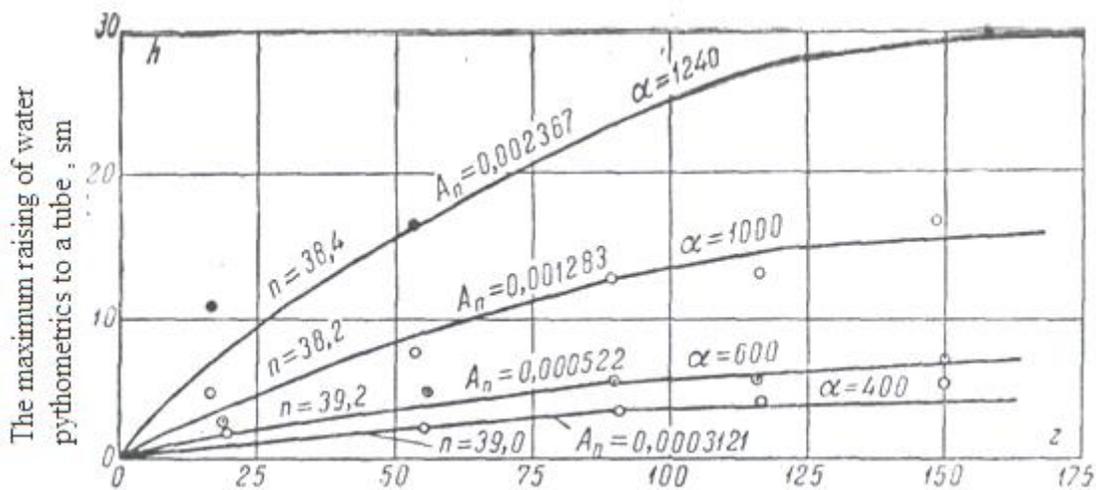
Deepest pythometrics

Pic.3.15.Skilled check of dependence $h_z = f(z)$ for sand a layer 163 sm

(n-%; A_n -1/sm; α-mm/sek^2).

55
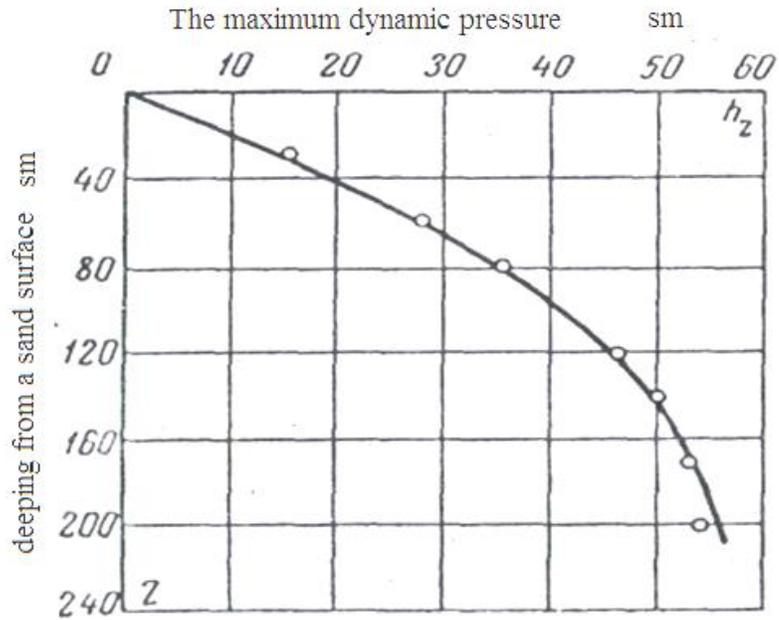
Pic.3.16. Skilled check of dependence $h_z = f(z)$ in field vibrotank at capacity of a layer of sand of 218 sm and acceleration $\alpha = 250$mm/sek^2. A curve is constracted under the formula of the author, skilled points according to experiment.

All the resulted experimental materials concern to the maximal values of dynamic pressures (h_{max}), reached during carrying out of each of these experiences. It is necessary to note also, that experiences, which results advantages at construction of resulted schedules, were spent at vibration with frequency of fluctuation within the limits of 15 - 25 hertz.

Already the passing on these schedules shows, that in the given cases, as, however, and in all others, concerning the specified mode of test, skilled points very well lay down concerning theoretical curves, keeping as it and follows from theoretical dependence (2-25), in all cases parabolic character.
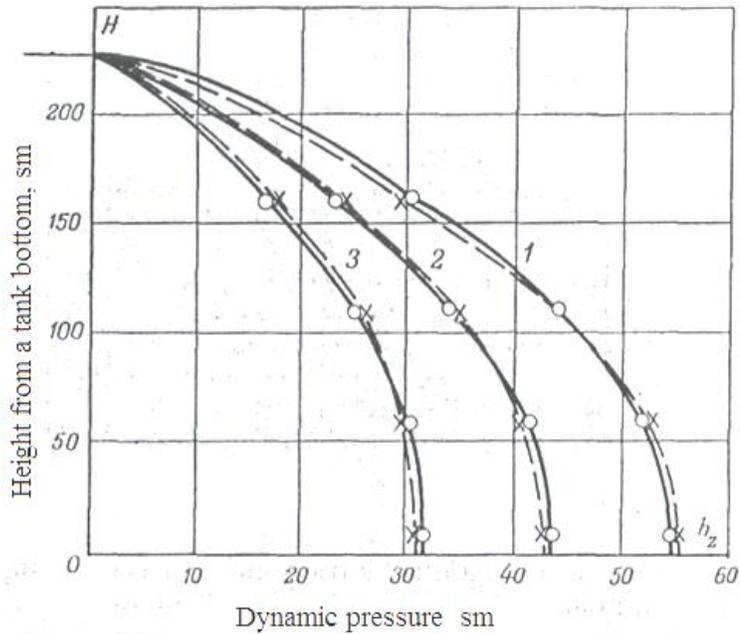
Pic.3.17. Skilled check of dependence $h_z=f(z)$ in to shift to the left vibrotank at capacity of a layer of sand of 225 sm and acceleration $\alpha=150$mm/sek^2.

In all resulted experiences, answering conditions test, sand was translated in the dynamic raised condition on all depth of a layer d, in this case we collided, with position when all thickness of the examinee of sand was in the field of „ an active zone " and when „ the dead zone " practically was absent. As we shall see it from the further, this condition is observed only at rather low power

Sandy layer, sufficient duration of fluctuation and, the main thing, at enough high frequency (f) oscillatory movement. Otherwise restriction of an active zone and occurrence of " a dead zone " is inevitable. Provided that the schedule of dependence $h_z=f(z)$ gets a kind on fig. 3.18.

The chart shows "Dynamic pressure, sm" on y-axis (125, 100, 75, 50, 25, 0) and "Depth of a layer, sm" on x-axis (0, 25, 50, 75, 100, 125, 150, 175), with curves labeled I, II, III, IV, V.
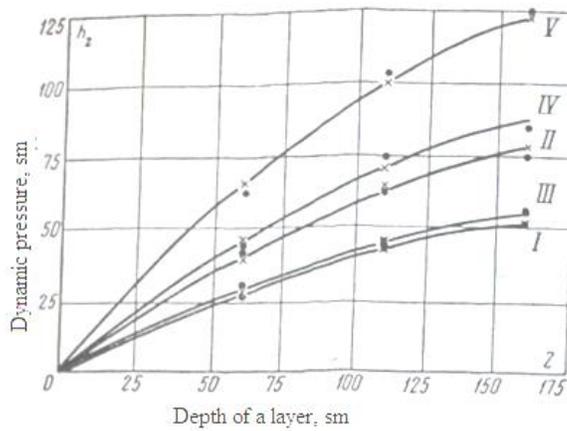
z, sm	Curve	Theoretical values	The skilled	% Divergences
63	I	28,50	30,0	5
	II	40,7	42,0	3
	III	28,0	27,0	7
	IV	46,0	44,0	—4
	V	66,0	63,0	—4,5
112.5	I	43,5	44,0	1
	II	62,5	62,0	0
	III	42,5	44,0	3
	IV	70,0	740	6
	V	100,0	104,0	4
162.5	I	54,0	—	—0,5
	II	77,8	—	—4
	III	53,0	—	4
	IV	87,0	—	—3,5
	V	125,0	—	1

Pic. 3.18.Skilled check of dependence h_z-$f_{(z)}$ on field vibrotank at capacity of a layer sand in 216 sm; crosses designate the theoretical values calculated under the formula

$$hz = An(Hz - \frac{z2}{2}), \quad \text{by points - skilled values.}$$

3.4. Definition of critical acceleration a_{cr}

Methods of definition of critical acceleration

At intensity of concussion and $a<a_c$ factor V_l and module A_n are equaled to zero. Hence, in these conditions it appears equal to zero and dynamic pressure H_g. This circumstance allows to formulate concept about critical acceleration and, as corresponding that critical intensity of dynamics above which and water sated to sandy thickness already there is dynamic pressure H_g. At the same time in exact concept critical acceleration a_{cr} answers that critical intensity of fluctuation when the sand which is being up to it in a stable condition, starts over again to be condensed. From here two methods mutually supervising and supplementing each other by definition $<x_{cr}$ are possible. Experience it is conducted on this or that vibrating installation described above. Sand is loaded into a skilled vessel with limiting friability. Muddled other devices conduct supervision over occurrence in the water-sated sandy thickness of dynamic pressure H_g and deposits surfaces sand as consequences its new condensation. The certain dynamic mode with the minimal

intensity and anyway with acceleration and below expected an a_{cr}, is set a $<a_{cr}$ Intensity of dynamics gradually increases down to that moment when the expected moment of transition of sandy weight in dynamically raised 1 condition admits reached.

According to our practice the mode corresponding critical acceleration, is considered reached at presence of dynamic pressure $H_g\sim1\sim2$ mm or at condensation of sand (with its measurement after a deposit ' заглубленного on some centimeters from a surface of a reference point) on 0,1 % about on porosity. After end of the first cycle of experience the experimeter repeats already at new value of porosity of the sand reached at its vibration, etc.

About values critical of acceleration for various sand and $(a_{кр})$.

The numerous experiences lead in various conditions at a different dynamic mode, had been established strongly pronounced direct dependence critical accelerations and from density of sand. This position with full distinctness is
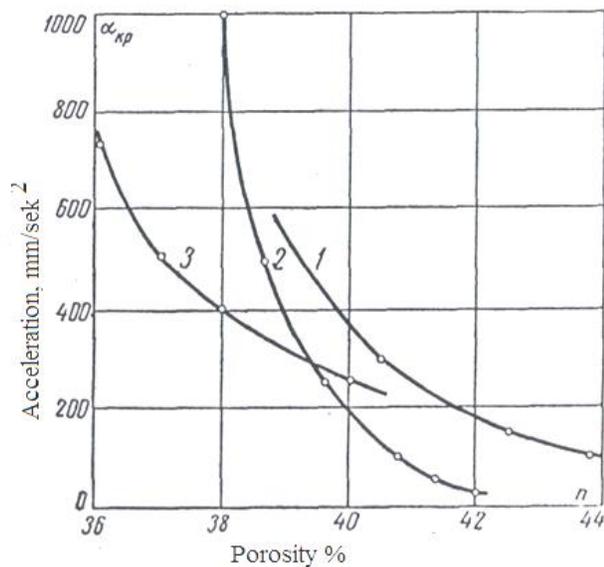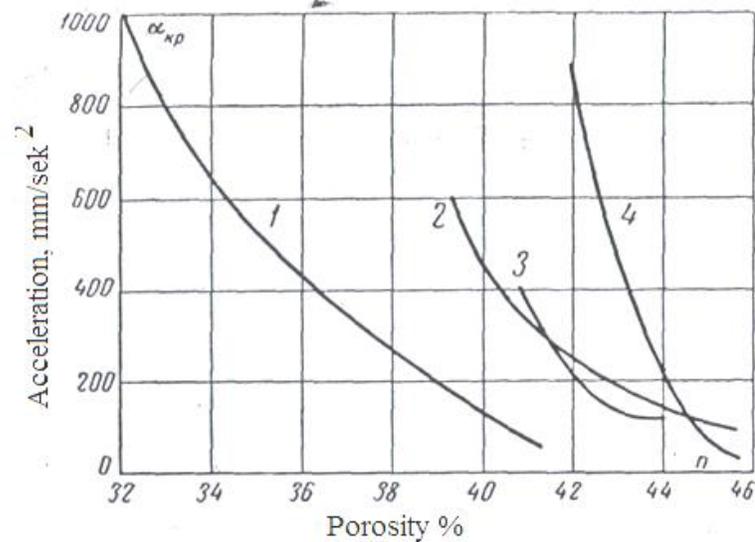

Pic.3.19. Dependence of critical acceleration α_{cr} from porosity.

1-For sand;   2-For fine-grained sand;   3-For sand;

illustrated by a number resulted fig. 3.19,3.24 where values and for various are resulted sand depending on their porosity of or relative density O_p.

Limits are planned for fig. 3.21 a_{cr} for sand depending on them the biggest (under the maintenance of fractions <0,25 mm) at average density at Alluvium $/)_v$= 0,27 0,33.

Pic.3.20. Dependence of critical acceleration α_{cr} from porosity n for sand.

1-for sand, f=2-8 hertz   2-for sand, f=2-8 hertz

3- sand, f=2-6 hertz   4-for sand, f=1-2 hertz

№ sands	Granulometrichesk structure, mm				
	>1	1—0,5	0,5—0,25	0,25—0,10	<0,10
1	0,4	1,4	26,2	69,1	2,9
2	3,3	22,2	46,0	28,2	0,3
3	0,2	0,3	4,1	86,1	9,5
4	2,1	3,5	37,3	49,0	8,1

Fig. 3.22 with definition of critical acceleration of the sand which has gone on erection of one constructions is rather indicative in the considered attitude. The mechanical analysis of this sand is resulted in tab. 2. A number of data on a_{cr} as functions from relative density 1>v Stalengrad hydrounit is given on

fig. 3.23. Essentially fig. 3.24 constructed according to test is rather important the sand executed by D.A.Trifon-Jakov.
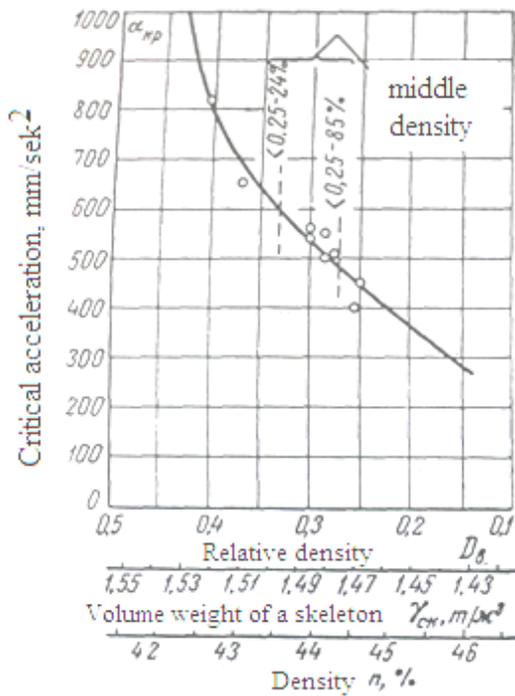
Pic.3.21.Dependence of critical acceleration α_{cr} from density of the sand taken from an end face of a dam, the maintenance of fractions d<0.25mm-55.4%
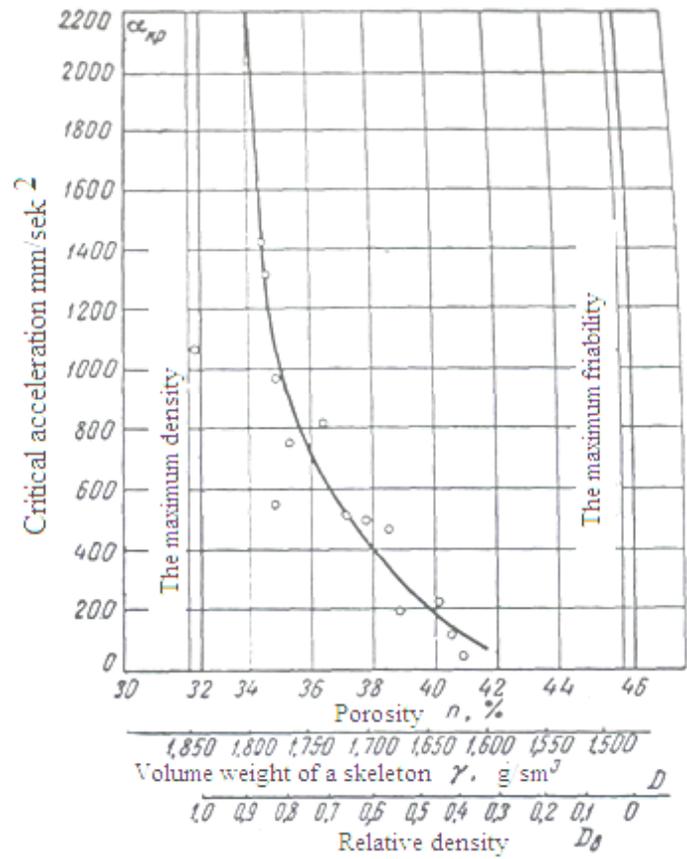
Pic.3.22.Dependence of critical acceleration α_{cr} from porosity of sand n, taken from a dam podhods channel for sand.

Pic.3.23.Dynamic characteristic of various sand .

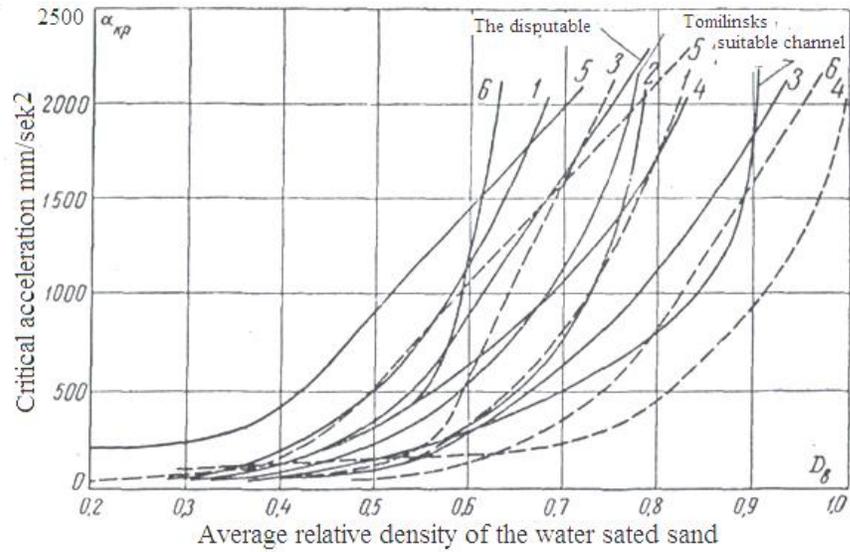| Sand | Granulometrichesk structure. mm | | | | | Uniformity factor |
	2—1	1—05	0,5—0,25	0,25—0,1	<0,10	η
Mix 1	—	8	42	45	5	2,94
Mix 2	—	5	20	45	30	2,916
Mix 3	—	5	25	60	10	2,14
Mix 4	3	15	24	55	3	2,365
Mix 5	10	30	25	30	5	4,23
Mix 6	—	5	10	75	10	1,84
The disputable	0,36	1,46	26,18	69,15	2,85	1,945
The suitable channel	0,03	0,24	5,89	84,35	9,49	1,74
Tomilinsks	25,25	50,8	15,60	5,90	2,45	3,114
For concrete works . . .	11,26	23,52	47,52	17,26	0,44	2,766

This schedule represents already the general interest and enables, the truth roughly roughly to estimate values and for good rolling homogeneous quartz sand with reference to their density and the maintenance in them fraction <0,25mm. As it follows from all resulted above materials, the size of critical acceleration appears various for different sand, even at their one density (porosity) N.N.Maslov.
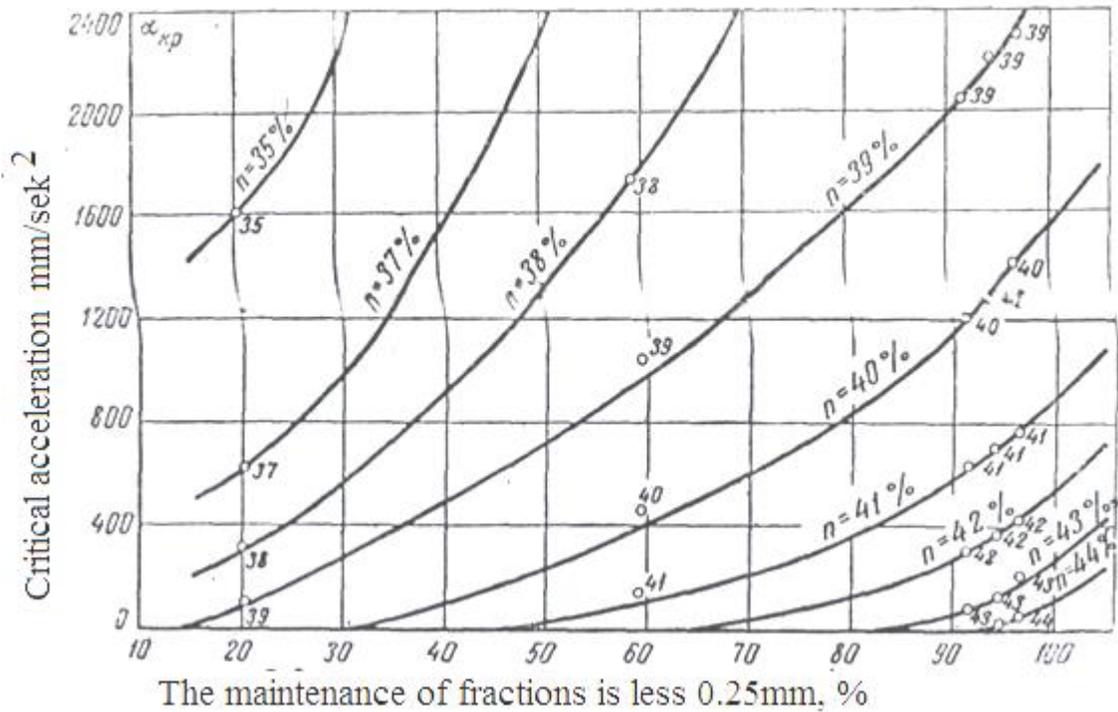
Pic.3.24.Dependence of critical acceleration α_{cr} from mechanical structure
and porosity n- for sand. Skilled points are received according to five tests.
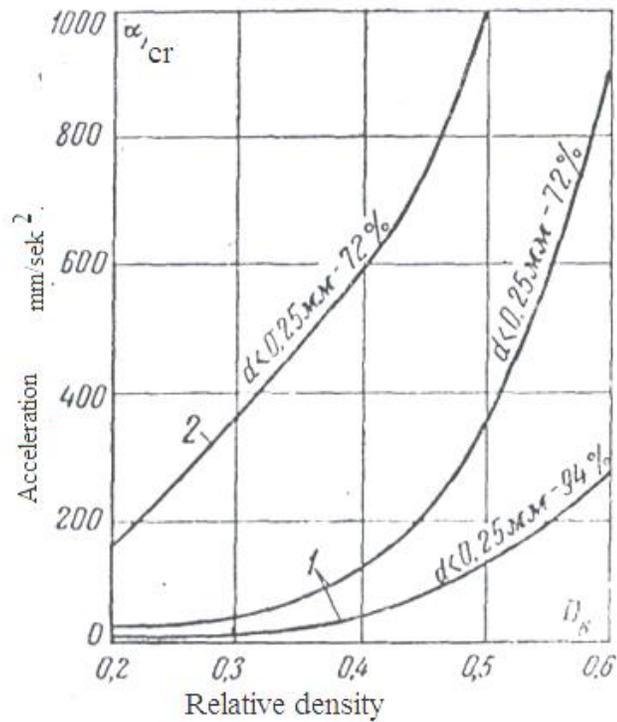
Dependence of critical acceleration α_{cr} on relative density D_b for good rollings sand (1) and acute-angled sand (2).

This circumstance with all evidence testifies that the size of critical acceleration is defined not only density of sand, but also and its other properties defining it more or less significant at concussion.

To number properties in the first time need to be carried, besides density of sand, a horsefly her of uniformity and grains. Influence on size a_{cr} last factor (a degree grains of sand) I bury it is seen from fig.3.24. I.A.Kridner constructed according to the analysis. As we see, at the same mechanical structure (and. <0,25 orders 72 %) acuteangled sand appears much more seismically steady, than well sand.

Chapter IV. MAINTENANCE of SEISMIC STABILITY
THE BASES OF CONSTRUCTIONS

4.1. General provisions

Already it is a lot of years ago at an estimation of consequences of earthquakes it has noted been, that most of all suffered, the constructions erected on lowered sites of a relief, combined impregnated by a moisture grounds and first of all the friable water-sated sand. So, for example, according to earthquake 1923, force of earthquake for the lowered sites of Tokyo (Japan) combined by sandy alluvial adjournment, has appeared in 1,5 2 times above, than for the riding part of city incorporated on dense grounds. As especially striking example consequences of the known earthquake which has burst in 1936 in a valley the rivers Ganges (India) can serve in this sense. On force of the display earthquake on a seismic scale has been carried to X to points. During this earthquake has hard suffered over 400 constructions. All the suffered constructions have been erected on thickness of alluvial adjournment with rather big capacity (hundred meters) both presented and the core small sand. The territory in the significant part has been boggy at high standing a level of subsoil waters. Thus, the sand formed the basis for had an accident constructions, were here in the flooded condition. At earthquake many of noted constructions completely have plunged in deliquatinging a ground and have disappeared.

The territory on huge space has lowered on 0,3 - 1,0 m. But many places were formed gushing forth and ascending sources. We have stopped па this example as it is rather indicative.

At designing the constructions which are a subject erection in seismic areas, in calculations the method of «inertial forces » was most often used.

The essence of this method consist in the appendix to the centre of gravity of weight of a construction of some horizontally directed seismic inertial energies S.

This force was defined from expression:

$$S = \pm \varepsilon P, \tag{4.1}$$

Where P - weight of a construction;

ε - Factor of concussion.

Let's remind, that the factor ε represents the attitude of size of the maximal seismic acceleration a to acceleration of a gravity g,.

$$\varepsilon = \frac{a}{g} \tag{4.2}$$

At calculation of a construction action of seismic inertial force S is accepted static and all further calculation is conducted by rules of a statics.

Thus, the construction pays off on a combination of vertical and horizontal forces.

According to « the filtrational theory » in seismic stability of constructions on the flooded sandy adjournment those processes which arise in sandy thickness at dynamic influence on it and which were described above are solving. In this respect the example of consequences of earthquake resulted above 1936 in a valley P is rather indicative.

Solving not infringement of durability of buildings and constructions, and loss of the general stability by them here was. The reason disappeared not in constructions, and in them

The basis. It is curious to note, that elements of considered process have been in this case rather boldly shown all. Rather favorable preconditions for its wide display, somehow Here took place: powerful thickness of fenny and fine-grained sand (H); high standing of a level of subsoil waters; greater intensity of seismicity (X points). The phenomena which have found here the place, and including first of all deep просадка a construction (the certificate of loss by sand of the stability) are rather characteristic also all; lowering of territory (consequence of condensation of sand),

spouting of waters (a withdrawal from thickness superfluous for a new condition of density of sand of volumes of water) .

Our predecessors, not knowing these processes, have been compelled for maintenance of seismic stability of constructions па weak bases to use and in similar cases the method noted above « inertial forces ».

Using this method in noted purposes, naturally, it was necessary to increase size of factor of concussion accordingly. However, as practice of operation of similar constructions has shown, infringement of their stability found a place in many cases at very weak seismic phenomena.

Provided that the amendment to factor of concussion to in the formula (4.1), naturally, should be rather significant, that we and see actually.

According to known scale to Ziber the degree of seismicity for similar conditions should be is raised on 3-4 points against normal for the given area.

At designing constructions in seismic areas it is necessary to meet seismic force in VIII points more often. Entering the amendment to scale to Ziber, it should to count constructions on seismicity with intensity in XI or even XII points ("catastrophic" earthquake and « strong accident »). Some norms recommend to increase for considered cases factor of concussion e for damp sand up to 4,4 times and the flooded adjournment in 12 times.

It is obvious, that carrying out of calculations according to these recommendations leads sharp at weighting constructions and, naturally, to their big rise in price and, unfortunately, not justified. Last circumstance is clear, as increase in inertial force, even in very greater limits, cannot compensate process of loss by sand of the stability, as the phenomenon absolutely other nature.

Last years discrepancy of the calculation described above a method for a considered case becomes more and more obvious to the increasing circle of experts.

Now abroad gets пce increasing influence judgement about necessity to have in

maintenance of seismic stability of constructions in considered conditions sand with density not below

D = (0,85 - 0,90) D*. Here D - relative density of sand.

Naturally (alluvial adjournment) we often meet sand with density D = 0,40-0,50. At an alluvium from sand of artificial territories the density of sand often appears much lower (D=0,25-0,35). Under similar circumstances according to the recommendations resulted above there is one of two: or to refuse construction in the given conditions, or to resort to artificial condensation of sand in the basis of constructions. Last action is rather dear and complex.

Under similar circumstances again there is a question, whether these recommendations for all without exception of cases are justified?

The answer arises by itself: certainly, no.

However for such answer it is necessary to know and be able to estimate operating conditions of constructions in similar conditions. Clearly, that consideration of a question thus and from other positions absolutely inevitably.

4.2. A method of an estimation of a degree of stability of the bases constructions.

The offered method of an estimation of seismic stability of the constructions erected on the flooded sandy bases, is based on necessity of consecutive performance of two operations:

I operation - according to a degree of dynamic stability of the basis of a construction in order to prevent loss of the general stability by it.

II operation - according to durability of a construction under influence of the inertial forces enclosed to them.

Below data but are stated to performance of the first part of calculation with an estimation of stability of the basis. The description of methods of calculation of durability of the construction at the seismic phenomena, carried out usually in view of inertial seismic forces is beyond пашей a problem and consequently here is not resulted.

The filtrational theory as it was more than once marked, regards transition of sand in deliquating a condition as an extreme, limiting degree of easing of resistibility of sand to shift. This easing of resistibility of sand to shift is caused in a view of the filtrational theory as a result of decrease in a normal pressure under influence of a dynamic pressure arising in thickness.From these positions infringement of stability of constructionsin considered conditions finds the expression at falling bearing ability of thickness up to the degree insufficient for perception of weight of a construction and forces enclosed to them. Thus, there is a problem of an estimation of a degree steady constructions in communication with weighing influence on thickness of the sandy basis dynamic pressure h_z. Generally the course of the decision of this problem is drawn in a following kind (pic.4.1).

For an estimation of stability of the construction which are being under

cumulative influence of forces enclosed to them, the usual method round the cylindrical surfaces of sliding is recommended to use with some additions. At values of a dynamic pressure $\underline{h}_z = 0$. At absence in sandy thickness of a dynamic mode, we have following expression for definition of factor of a stock η

$$\eta = \frac{\Sigma\, p_i\, cosa_i\, tg\,\varphi\, R}{p_a + (W + S)d} \qquad\qquad (4.3)$$

In this expression: P_i - weight of the next soil block in view of (at need) parts of weight of a construction;

P - weight of a construction with simplification due to taken out at it deepest the grounds;

W-horizontal force;

S-inertial force;

d - a shoulder equally effective horizontal forces.
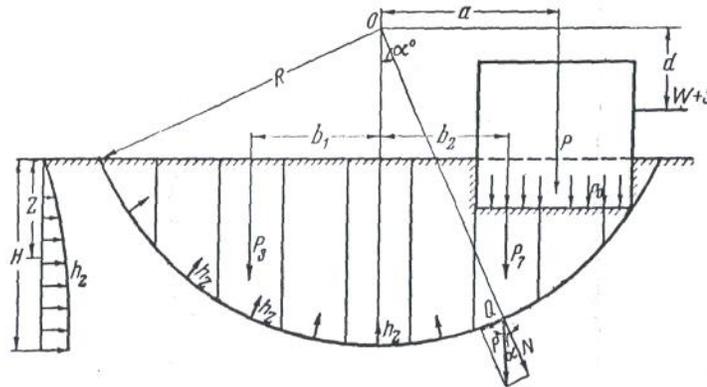
Values R and and-are well-known

Fig. 4-1. A method of an estimation of stability of a construction on the flooded sandy basis at dynamic influence.

At the same time it is obvious, that at occurrence in thickness of a dynamic filtrational stream the dynamic pressure in those or other points of thickness gets values above zero. Provided that the factor of a stock η accordingly decreases.

Under similar conditions, at an estimation of size of the moment decrease in normal forces to their new value (N_i and N_i ') is necessary to consider resistance in addition. In this case we can write:

$$N_i^I = N_i - \omega \Delta_\text{B} h_z = p_i \cos a_i - \omega \Delta_\text{B} h_z \tag{4-4}$$

Here N_i - a normal component from weight P_i of the next block allocated in thickness with the area of the basis on a surface sliding ω_i; Δ_B - density of water and $\underline{h_z}$- the dynamic pressure operating on the basis ω_i

The block. In last expression the member $\omega \Delta_\text{B} h_z$ naturally, corresponds to force non-pressure, enclosed to the block as a whole. Under the specified condition the formula for an estimation of a degree of stability of a construction on size of factor of a stock η gets a following kind:

$$\eta = \frac{\Sigma(p_i \cos a_{i-}\omega\Delta_\text{B} h_z)tg\,\varphi\,R}{p_a+(W+S)d} \tag{4-5}$$

Let's note, that formulas (4.3) - (4.5) are written by us for a case of drift sand when coupling in thickness probably to neglect (with = 0).

It is quite clear, that infringement of stability of a construction will find the place in all cases, when $\eta_i<1,0$. Thus, already partial weighing of the basis as a

result of influence of a dynamic pressure $\underline{h}_z$ can lead to emergency consequences.

The described position especially easily can arise in that case when in static conditions the construction already possesses an insignificant stock of stability.

Needless to say, that calculation under the formula (4-5) should be carried out with reference to several surfaces of sliding with the purpose of revealing of the least, possible in this case values of factor of a stock η (by selection).

4.3. Actions on increase of dynamic stability the bases of constructions

In some cases, when bases of buildings and constructions are presented by the weak water-sated sand at which concussion can will arise a dynamic pressure, with a view of maintenance of necessary stability a construction those should be used or others « protective actions ».

These actions can carry as the general (protective and prohibitive), and constructive character.

Character of those or others « protective actions » and their purpose follow from the essence of considered dynamic process.
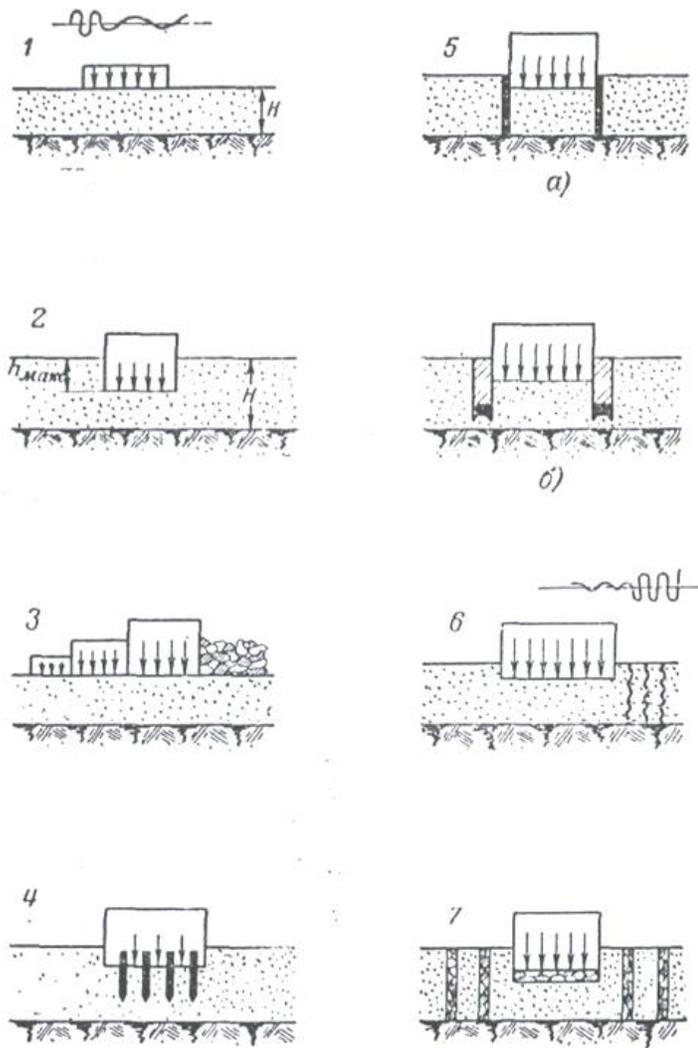
Pic.4.2.Actions for increase of seismic stability of the bases of constructions.

1-Dynamics easing; 2-deepest constructions; 3-At cargo; 4-Consolidation and reduction of capacity of a layer; 5-Isolation; 6-Layer consolidation; 7-pressing;

Kinds and types of actions which could be used in the protective purposes, are diverse enough (fig. 4.2).

The majority of them in this or that plan are used by building practice and now, however it is frequent with other special-purpose designation.

Let's address to brief basic consideration of these actions:

Easing of intensity of dynamic influence

Work of the basis in seismic areas, naturally, is predetermined by an environment. Weight elements of a dynamic mode (amplitude A, period T and duration of fluctuation) in this case appear outside of an opportunity of influence on them the person.

In absolutely other position there is a question at the analysis of a dynamic mode of thickness under influence of a superficial dynamic source.

In considered conditions at influence on thickness fluctuation, вызнанных the superficial source, in many cases arises an opportunity of corresponding influence on a dynamic mode appropriate designing of a construction (fig. 4.2).

In this plan if necessary to reckon with adverse conditions of erection of a construction (high porosity of sand n_0, greater capacity of sandy thickness) can always arise a question on more favorable mode of clearing of energy of falling water on water-fights, increase in massiveness of a construction or the base with the purpose of appropriate influence on size of amplitude and the period of fluctuation, etc.).

Corresponding use of these and other actions, well-known in practice of designing of the bases under machines, the opportunity a little to soften intensity of dynamic influence on thickness of the basis always is represented.

This circumstance conducts to decrease in dynamic parameters and by that to reduction of a dynamic pressure $_{hz}$ with all favorable consequences following from here. At the same time at decrease in settlement acceleration a_{cal} at and =const we collide with decrease in capacity of active zone L and by that again with reduction of a pressure h_z.

Increase in depth puts the base

At increase deepest constructions of a condition of its work at dynamic influence become more favorable (fig. 4.2).

First of all it is necessary to note, that in many cases at deeper puts constructions it can be proved on sand already other horizon, with other mechanical structure, with other density and by virtue of it on sand with the raised dynamic stability.

Besides follows to note, that owing to more significant depth constructions the general degree of its stability raises, as more favorable conditions for perception by a ground of loading from a construction in this case are created.

Thus it is necessary to mean, that at check of stability of a construction us values of a dynamic pressure only on the most adverse line of sliding interest. At the same time, as a rule, increase of a dynamic pressure h_z with depth z lags behind increase with the same depth of weight of thickness γz (parabolic character of dependence on depth of a dynamic pressure and linear dependence on depth of weight I block Russian cabbage soup of thickness).

Defining stability of the basis and a construction a dynamic pressure h_z and a dynamic gradient $_{1z}$ in the direct image contact capacity of sandy thickness.

With increase in capacity of thickness of a condition of stability the basis and constructions worsen, and features when on those or other circumstances capacity of an active zone appears significant or even falling outside the limits a sandy layer. Besides it is not necessary to forget, that sizes all of a dynamic pressure defining by self h_z u gradient I_z with depth sharply enough decrease. Thus, at sufficient in depth constructions it can appear incorporated in a zone of weak influence of ascending filtrational currents.

In connection with these conditions always it is represented expedient with a view of increase of stability of a construction, certainly, when it appears necessary, to reduce a part remaining under a construction [H – h_{depth}] the capacity of a sandy layer actively influencing a dynamic mode of thickness directly under by a construction. In this plan essentially the most simple action also is the increase depth constructions.

Loading lateral boundary zones of a building

With a view of increase of dynamic stability of the sandy bases of constructions quite often with greater success the action connected with loading of lateral boundary zones of a construction (fig. 4.2) can be used.

These actions have the purpose before mine to lower capacity of active zone L.

At the same time it is necessary to note, that size and especially at low frequency of fluctuation, is external loading P_0 very sensitive to increase.

This circumstance in very many cases leads to that condition, that the most insignificant on size loading P_0 can already affect in the most favorable image increase of stability of sand in the given zones.

Very often it appears, that on design features of a construction these zones happen loadings those or other elements of the construction as a whole.

In other cases it appears necessary to think of special measures on loading these sites.

Use of the pile bases

The importance of use of piles for increase of stability and bearing ability of the bases (in appropriate cases) is estimated to the full (fig. 4.2-3). We shall note first of all, that application piles conducts to condensation of sand with all favorable consequences following from here and including concerning increase of value a. Provided that the opportunity deliquating or anyway easings of bearing ability of sand in a zone directly spreading a construction is avoided. It is obvious, that this circumstance conducts to increase of the general stability of a construction.

Together with, that at use of the pile bases deepest constructions as though increases.

This circumstance conducts to increase in depth $z = H - h_{depth}$ settlement horizon that leads to decrease in dynamic pressures in the basis of the construction.

In this case, as well as at increase loading constructions, this condition in many cases is most simply provided with transfer of loading on the spreading horizons combined by sand, with the raised dynamic stability.

Use of protections

In some cases appropriate stability of constructions in considered conditions can be provided by application of those or other protections in the form of shpunts walls (fig. 4.2-5 and 6).

Finally, the principle of use of these devices is reduced again to increase of size loading constructions. In this case sand in a protection is included as though into structure of a construction.

Preliminary condensation of a ground

We had already many cases to note an exclusive role in maintenance of dynamic stability of the water-sated sandy bases of the factor of density of sand.

Let's remind, that increase of density of sand conducts to increase in bearing ability of a ground and, that, to restriction of capacity of active zone L down to zero (absence of dynamic effect) and simultaneously to decrease in size of factor ν_n dynamic condensation. That with increase in density of sand the degree of stability of the basis under all other equal conditions can sharply increase. From here all importance, as the protective action directed to increase of density of sand in the basis of a construction and first of all in lateral boundary zones with a construction, being in considered sense the most dangerous (fig. 4.2-6) becomes clear.

Drainage actions.

The essence of drainage actions with reference to a considered case is obvious (fig. 4.2-7). As we know, value of dynamic pressures in the water-sated sandy thickness under all other equal conditions decreases with increase in water-conductivity of thickness. Thus, essentially it is obviously possible to facilitate by means of drainage chinks a withdrawal of water from sandy thickness at its further condensation at a dynamic mode and by that to lower dynamic effect from the basis of a construction.

THE CONCLUSION

Bringing a brief result on the actions, having the purpose to raise in necessary cases a degree of seismic stability of the flooded sandy bases, it is necessary to emphasize special technical and economic efficiency of such actions, as:

Increase in depth puting the bases of a building; use of the pile bases and shpunts protections; loading in lateral boundary zones with a construction.

It is curious to note, that all these actions for a long time well-known in a building practice and with success are used in appropriate cases.

Now owing to conclusions we can approach « the Filtrational theory » to use of these means more meaningly. Besides we have now the corresponding theoretical device for more productive designing and designing of a construction as a whole.

In this plan as it is represented to us, the opportunity of an establishment of conditions of partial or full loss by the water-sated sand of the bearing ability is especially important.

At the same time at reasonable use of the specified actions requirement dynamic stability of considered constructions can be provided in overwhelming majority of cases by the elementary means. It is impossible to bypass, certainly, these questions and to not take them into consideration at designing similar constructions.

LITERATURE

1. Hersevanov.N.M.theoretical of a basis of mechanics grounds and their practical application.-M:Stroyizdat, 1948

2. Goldstein M.N.Vnezapnoe deliquating sand. » Hydraulic engineering construction »,1952

3. Ivanov P.L deliquating of sand.-M.: Energoizdat, 1962

4. Maslov N.N. condition of stability water-sated sands.-M: Gosenergoizdat, 1961

5. Definition of critical porosity. » Hydraulic engineering construction », 1951, №5

6. Rasulov.H.Z. seismic stabilit of the soil bases. Tashkent, « Uzbekistan, 1983

7. Sidorov N.N. simpl methods of definition of critical porosity.: « Hydraulic engineering construction », 1958, №9

8. V.A.phenomen's florin deliquate and ways of condensation of the friable sandy bases. News AH, 1952, №6

9. Casagrande A. New facts in soil mechanics from the research laboratories. Ing. News-Record.vol.115,1953