A.V. Shkola, ScD, Professor
Odessa State Academy of Building and Architecture (Ukraine)
A.A. Aniskin, post-graduate, lecturer
Politechnic in Varazdin (Croatia)

INTERACTION OF BREASTING AND MOORING DOLPHIN STRUCTURES WITH ANISOTROPIC SOIL FILL

Calculating methods for determination of anisotropic discrete medium lateral pressure on closely spaced fences and walls of buildings are not developed enough. Among such objects are filling dolphin structures of sea berths, warehouses and silos for the storage and transport of bulk discrete medium, etc. buildings, where construction walls are placed at a close distance.

Keywords: *anisotropy, discretemedium, lateral pressure, closespacedwalls*

О.В. Школа, д.т.н., професор
Одеська державна академія будівництва та архітектури (Україна)
О.А. Аніскін, аспірант, викладач
Політехнічний Університет в Вараждіну (Хорватія)

ВЗАЄМОДІЯ ВІДБІЙНО-ШВАРТОВИХ ПАЛІВ З АНІЗОТРОПНИМ ГРУНТОВИМ СЕРЕДОВИЩЕМ

Методи розрахунку визначення бокового тиску анізотропних сипучих середовищ на близькорозташовані огородження та стінки будівельних об'єктів розроблені недостатньо. До подібних об'єктів відносяться грунтозаповнені пали морських причалів, склади та силоси для зберігання й транспортування сипучих дискретних середовищ та ін., а також споруди, де конструкції огородження розташовані на близькій відстані.

Ключові слова: *анізотропія, дискретні середовища, бічний тиск, близькорозташовані стінки.*

А.В. Школа, д.т.н., профессор
Одесская государственная академия строительства и архитектуры (Украина)
А.А. Анискин, аспирант, преподаватель
Политехнический Университет в Вараждине (Хорватия)

ВЗАИМОДЕЙСТВИЕ ОТБОЙНО-ШВАРТОВЫХ ПАЛОВ С АНИЗОТРОПНОЙ ГРУНТОВОЙ СРЕДОЙ

Методы расчета определения бокового давления анизотропных сыпучих сред на близкорасположенные ограждения и стены строительных объектов разработаны недостаточно. К подобным объектам относятся грунтозаполняемые палы морских причалов, склады и силосы для хранения и транспортировки сыпучих дискретных сред и т.п., строения, где конструкции ограждения размещены на близком расстоянии.

Ключевые слова: *анизотропия, дискретные среды, боковое давление, близкорасположенные стены.*

Problem setting. This article is a part element of the PhD dissertation devoted to the study of determining the lateral pressure of anisotropic soil filling in breasting and mooring dolphins structures on their thin fence. The studies were performed in OGASA and in Polytechnic of Varazdin in Croatia.

Due to the relatively low energy of cargo transportation by water transport, water ports development is an essential element of coast-economy countries and continents.

Ports cargo turnover is determined by many factors, in particular, the depth to handle ships of significant displacements in harbors.

Common design that ensures the safety of navigation in the port waters and water areas are breasting and mooring dolphins structures, which are subdivided by structural features into solid, pile and mixed structures.

Solid structured dolphins are built as a concrete monolithic or prefabricated elements that placed in courses of arrays, as well as concrete slabs, sheet piles driven in closed loops filled with stone, sand, local soil, waste, etc.

As a rule, filled dolphins structures are treated as construction with closely-spaced walls. On these dolphin structures acts load of soil fill, identical to load of grain on the wall of the silo.

Researches and publications analysis. They were most prevalent in the transport hydro technical construction of the sea and inland waterways, rivers, lakes, etc.

In the design of dolphin structure when determining the loads of the discrete filling are used calculation schemes, with assumption of a homogeneous and isotropic filling medium. In the calculations of loads, usually used the results of the Janssens theory [1-3].

In fact, as evidenced by numerous studies materials, artificial filling of stone, soil, discrete medium, in particular soils of underwater pits, soil of dredging works of the water areas and aquatic approaches are highly heterogeneous and anisotropic [4] by the natural environment of sedimentation and lithification.

In addition, both factors, heterogeneity and anisotropy, are significantly dependent on the technology of construction work of the formation of fillings and fillings, the nature and sequence of creating ground mass.

In the practice of construction, this is confirmed by the practical impossibility of creating perfectly homogeneous and isotropic soil mass.

Taking into account these factors should be based on the most adverse conditions during the construction works.

Perfectly homogeneous isotropic soil, usually presented as ideal spheres [5] with centers at the sites of a regular spatial grid. It is, of course not the real soil ground.

The refore, the Janssen's theory needs to be developed for practical application in the design and the generalization to the in homogeneity and anisotropy.

So far, with the calculations of lateral pressure taking into account the anisotropy studied number of scientists: Janssen, Kandaurov I.I., Muller R.A., Kostyukov V.D., Karavaev V.N., Shkola A.V. etc. [6-12].

Studies of the PhD dissertation consists of determining the effect of anisotropy and heterogeneity of artificial filling of dolphin construction on the load of lateral pressure transmitted to their fences, taking into account the technology of formation and properties of backfills.

Paper purpose: Formulation of problems and their solutions are considered for the conditions of arbitrary hodograph for soil shear resistance indicators, randomly oriented in the medium.

Paper content. In addition to the theoretical results obtained on the basis of the theory of limit equilibrium stress state of anisotropic discrete medium, proposed and developed by prof. Shkola A.V., obtained results of the model laboratory experiments on different anisotropic medium with various heterogeneity.

The anisotropy of the internal friction angle and cohesion of soil filling was measured by means of direct shear tests first on the model material without cohesion − rice, flax seeds, and then the Croatian sand at a given technology of test samples filling.

The reliability of the results is due to the use of known physical laws and proven methodologies as well as confirmed by comparison of the theory with experimental results, that is, shown the accordance of laboratory tests and theoretical solutions.

As a model of the medium used samples tested in direct shear apparatus of square cross-section of the company «ELLA» with electronic deformation measuring sensors.

In experiments worked out testing technique of getting hodograph, their trends of internal friction angle and cohesion, in line with the trajectories of discrete filling ie technology of backfilling soil.

In carried out tests on anisotropic discrete medium models such as rice, observed strong anisotropy of angle internal friction and cohesion in the position of grain filling model under advantageous angle of 0° to the slice plane, in comparison with a primary grain filling position at an angle of 90° to the slice.

Using the experimental data performed a theoretical calculation in accordance with the generalized theory of Janssen and on the basis of the proposed solutions [4].

It is assumed in what follows to execute a complex of semi-natural experiments, given the technology and performance of backfill comparing them with the results of the proposed theoretical development.

Conclusions: For practical use in designs is considered the worst case, when the work on the formation of backfill, like in practice, be made from one

side, ie in development process should be taken into account such a situation of works.

In the regulations methods of calculation of such a structures in anisotropic discrete medium is not available. It is proposed to develop them on the basis of the results of the dissertation.

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