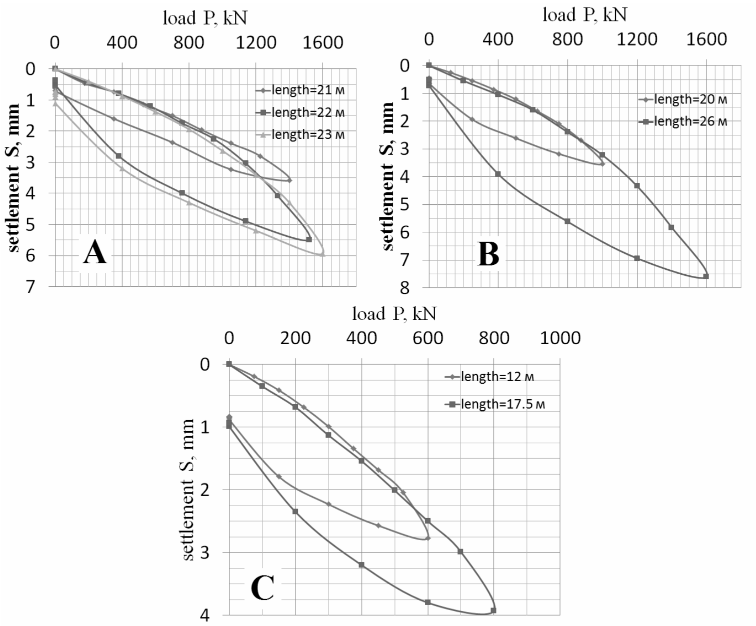

Fig. 2. The graph depending S = ƒ(P) (A) Al-Nasiriyah, (B) Al-Diwaniyah, (C) Khder

Practiced Iraq method ASTM piles comprise studies lack of exposure time on loading levels within 1 hour - for this stabilization time cannot end.

In this regard, it is appropriate to use in Iraq techniques Belarusian standard TKP [3], which contains requirements excerpts load steps to stabilize settlements.

Field test piles pressed load in different areas of Mesopotamia have confirmed the possibility of transferring heavy loads on piles, cutting through clay strata and to wipe them with the lower end on the sandy ground they spread. However, due to the limited ability to create value of the pinch load and low precipitation (a few millimeters) of the complete failure of the shear forces along the barrel did not happen.

For accurate final assessment of bearing capacity of piles bases in Mesopotamia they should be tested on the pinch load with bringing settlement trunks to values not less than ten millimeters in which the resistance of the soil under the lower end and the side surface can be realized in full.

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UDC 721.011+69.03

THE STRENGTH CALCULATION FOR BULK MATERIALS STORAGE

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Silage bunker, lateral pressure, Kuhlmann's graphical method, bulk materials, bending moment, symmetry of the load, calculation of strength. The aim of this work is to study issues of identifying the lateral pressure of loose bodies on the walls of bunkers and calculation of internal forces arising from this load. As a result, studies have shown that the presence of a hard core of loose body significantly reduces the amount of sliding wedge, thus reducing the design load. In this work the calculation of the horizontal belt hopper with the use of force in the calculation of statically indeterminate systems is carried out. The result of the studies shows that the presence of the hard core in granular material significantly reduces the amount of sliding wedge, thus reducing the design load.

Storage tanks for bulk materials have acquired wide usage in various industries. The most technologically advanced in the process of construction and operation are tanks of rectangular shape. In the design of silo, bunkers, bridges and retaining walls are used Kulmann's graphical methods [1, 2] to determine the lateral pressure of bulk materials, Kennen-Jansen's and Erie's formula [3]. The derivation of Erie's formulae to determine the horizontal pressure on high walls of infinite height, limiting the granular medium is based on the classical solution of the equilibrium conditions of sliding wedge ACDE, (Fig. 1).

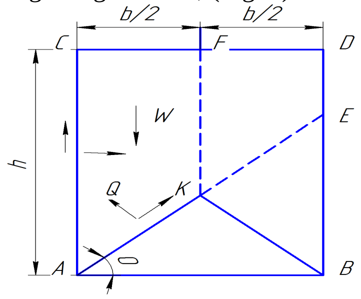

Fig. 1. Design scheme

In calculation of the lateral pressure by Erie's formulas there is a significant discrepancy with the experimental results, which suggests the formation of a hard core of a rechargeable battery (AKB), were the sag of the sliding wedge ACFK and KFDB can occur. To establish this claim we introduce the following assumptions: the backfilling material is taken incoherent by the plane of break of the AU and AK frictional forces. From exercise, the equilibrium conditions of the prism ACFK we obtain:

$$Q = W\frac{tg\theta - \mu}{1 - \mu\mu' + (\mu + \mu')\,\mathrm{tg}\,\theta},$$

$$W = \frac{\gamma b}{2}\left(h - \frac{btg\theta}{4}\right),$$

Here θ – the plane angle with the horizon collapse, μ – the coefficient of the backfill internal friction and μ´– the coefficient of friction of the backfill against the containers, γ – the density of the backfilling material. Lateral pressure is the biggest when substituted into the formula of the determined value:

$$tg\theta = \sqrt{\frac{4h}{b}\frac{1+\mu^2}{\mu+\mu'} + \frac{\mu}{\mu+\mu'} + \frac{(\mu-\mu\mu')^2}{(\mu+\mu')^2}} - \frac{1-\mu\mu}{\mu+\mu'}$$

$$\mathrm{tg}\,\theta = \sqrt{Z} - \frac{1-\mu\mu}{\mu+\mu'}$$

The intensity of the lateral wall pressure can be obtained from the condition $q = \frac{dQ}{dn}$,

$$\frac{\gamma b}{2(\mu+\mu')}\left\{1 - 1{,}5\frac{1+\mu'^2}{(\mu+\mu')\sqrt{z}} + \frac{(1+\mu')\left[\frac{2h}{b} + \frac{1-\mu\mu'}{2(\mu+\mu')}\right]}{(\mu+\mu')\sqrt{z}\left[\frac{4h}{b} + \frac{-\mu}{1+\mu'^2} + \frac{(1-\mu\mu')^2}{(\mu+\mu')(1+\mu'^2)}\right]}\right.$$

The equation (4) can be simplified if we take:

$$\left[\frac{2h}{b} + \frac{1-\mu\mu'}{2(\mu+\mu')}\right] \div \left[\frac{4h}{b} + \frac{\mu}{1+\mu^2} + \frac{(1-\mu\mu')^2}{(\mu+\mu')(1+\mu^2)}\right] = 0.5$$

$$q = \frac{\gamma b}{2(\mu+\mu')}\left[1 - \frac{1+\mu^2}{(\mu+\mu')\sqrt{z}}\right]$$

$$z \to \infty\, q = q_{max} = \left[1 - \frac{1+\mu^2}{(\mu+\mu')\sqrt{z}}\right]$$

The largest determining lateral pressure appeared twice as low as that calculated by Erie's formula. On the ground of the analysis of the results obtained in [1] and [2] we propose the replacement of the lateral pressure uniformly distributed around the perimeter by the loading zone of the silo according to the scheme: the short side of the triangle and the long side of the trapezoid. Such horizontal pressure distribution allows to consider understatement of the value which confirms the results presented in [3].

The rectangular belt hopper is a closed out line, id est, three times not identified by the system. The calculation of the frame is made by force method [4] and [5], the basic system of the force method is shown on the Figure 2.

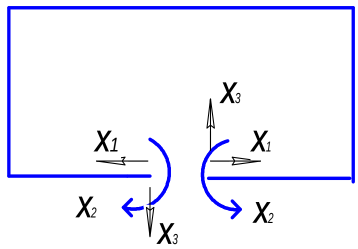

Fig. 2

The System of canonical equations of the force method has the following form:

$$\begin{aligned} \sigma_{11}X_1+\ \sigma_{12}X_2+\ \sigma_{13}X_3+\Delta_{1p}=0 \\ \sigma_{21}X_1+\ \sigma_{22}X_2+\ \sigma_{23}X_3+\Delta_{2p}=0 \\ \sigma_{31}X_1+\ \sigma_{32}X_2+\ \sigma_{33}X_3+\Delta_{3p}=0 \end{aligned} \qquad (1)$$

The primary system is formed by using the symmetry properties that allows you to divide the system of equations (1) into the subsystem.

$$\sigma_{11}X_1+\left\{\begin{aligned} &\sigma_{12}X_2+\Delta_{1p}=0 \qquad (2)\\ &\sigma_{33}X_3+\Delta_{3p}=0 \\ \sigma_{21}X_1+&\sigma_{22}X_2+\Delta_{2p}=0 \qquad (3)\end{aligned}\right.$$

The last of the equations (2,3) becomes an identity due to the symmetry of load. Thus, the problem reduces to solving a system of two equations (2).For calculation the dimensions of the rectangle frame are as follows a = 3m b= 4m.The determination of the coefficients of the unknowns and free members of the canonical equations are satisfied by the graphic-analytical method. Mp diagram is presented in Figure 3.

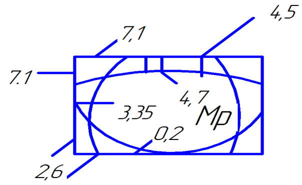

Fig. 3

Solving the system of equations (2)X_1 = -1,52, X_2 = -1,22.

The final diagram is constructed by the formula:

$$M = Mp + M_1X_1 + M_2\,X_2.$$

The moment diagram is shown in Figure 4.

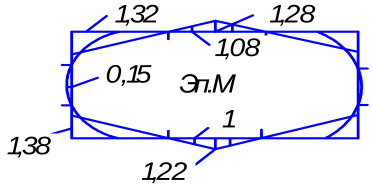

Fig. 4

Comparison of the results of the above calculation with those obtained in [6], [7] are presented in Table.

Point	1	2	3	4	5
Uniform Load	1,31	1,55	0,16	1,55	1,31
The specified load	1,22	1,38	0,15	1,32	1,28

The comparative analysis of the results obtained together with the solutions presented in the [6], [7], where the load is regarded as uniformly distributed along the perimeter of the frame and shows the following. Bending moments in the long side of the middle section are less than 7 %, the average cross-section is less than the short side by 9 %.The greatest reduction of bending moments coincides with the constructional unit and makes about 12 %.

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TO ROOF FRAME OPTIMIZATION

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This paper shows the design criteria truss, identified optimization problem for such structures. Shows an example of calculation for optimization lattice girder supporting roof trusses with a triangular lattice in order to find the most efficient configuration of the body structure.

In the modern industrial, civil, agricultural, construction, and are often used in bridge girders [1, p. 77]. Material for their manufacture may serve as concrete, metal, wood. The geometrical dimensions of the farms are more dependent on the operating conditions. In general, the choices of geometrical parameters are taken into account the requirements of minimum weight farms, as well as the smallest area of the outer contour of the farm. Weight structures made up of weight belts and grids [2, p. 118]. With increasing height the belts farm weight decreases and increases the weight of the lattice due to increase in length and bracing struts. Determining the most effective configuration of the body farm is a major task of optimization.

Lattice trusses should be used small element, a simple form. The choice depends on the type of lattice design features of the farm; method nodal lattice compounds belts bearing on the kind of the column, the desired dimensions of the space between the array elements. The most commonly used with additional triangular lattice struts, since it has the least number of rods and assemblies.

Design criteria such as farm structures are the economic indicators – the cost, weight, complexity, and duration of erection or unique design and aesthetic aspects [3, p. 37]. However, in the latter case, the criteria for examining hard and their use do not fit into the framework of mathematical programming problems. There are currently quite a lot of approximate methods for solving optimization problems of building structures [4, p. 8]. One of the important problems in this area is the development and improvement of methods for solving engineering problems of structural mechanics, which have a maximum simplicity, reasonable accuracy. These methods include the isoperimetric, solving complex optimization for prestressed trusses [4; 5, p. 143]. When using the isoperimetric method in the classical sense solutions are obtained in the form of unilateral or bilateral isoperimetric inequalities characterizing a set of geometric shapes. These inequalities have some practical value and give satisfactory evaluation of physical-mechanical and geometrical characteristics (area, perimeter, aspect ratio, etc.).

As is known, various types of lattice trusses perceive lateral forces [6, p. 121]. As a rule, the system determines the overall complexity of grids manufacturing farm, its metal consumption [7, p. 78]. For example, for farms with parallel belts effective are the use of a triangular lattice, which allows you to obtain the minimum number of identical units and the minimum length of array elements [8, p. 301; 9, p. 113].

Exemplas of optimization farm with a triangular lattice

Consider the example of optimization roof frame triangular lattice (Fig. 1).