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FEASIBILITY STUDY OF USING DIAPHRAGM WALL IN URBAN CONSTRUCTION

In modern urban planning, membrane walls provide a safe and cost-effective solution for temporary and permanent retaining wall construction. The method is suitable for urban environments, as well as when working near existing buildings and where the water level is high and the soil is highly permeable [1]. And although it is quite expensive, this method is actively used in the construction of Kyiv metro stations.

A diaphragm wall is a structural concrete wall built in deep trenches of an excavation, using reinforced concrete elements (Figure 1). Diaphragm walls are often used in congested areas, near existing structures where space is limited, or where earthworks are performed at depths that would otherwise require the removal of much larger volumes of soil to ensure stable damaged slopes [2,3].

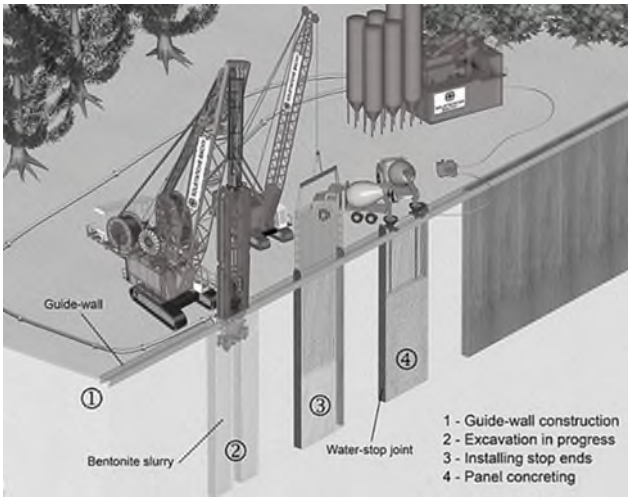

Figure 1 – The scheme of stages of works at construction of a diaphragm wall.

The paper compares the results of calculations in the Plaxis program of the expediency not only of the required depth of penetration of the DIAPHRAGM WALL structure, but also of the need to install a retaining fixture from soil anchors. After the displacements and forces in the deep structure of the recess wall were calculated, the stability of the structure was evaluated. This algorithm was also used for subsequent versions of the wall structure. The results of simulation are presented in the following table:

	Length of the slurry wall	Penetration depth, m	Displacement of the slurry wall	Bending moment, tm	Stability coefficient
					Plaxis
1	12 m– without anchorage	6	107	40,1	0,93
2	12 m – anchorage	6	13	28,2	1,5
3	11 m – anchorage	5	13,5	26,2	1,42
4	10 m – anchorage	4	14,3	22,7	1,34

The results show that the use of ground anchors significantly reduced the penetration into the depth of the wall when obtaining the conditions of structural stability. The introduction of a layer of soil anchors in the calculation procedure led to a significant reduction in wall displacement (13 mm), while the stability calculations showed that the coefficient of stability of the trench wall structure significantly exceeds the values specified in the regulations [4].

The analysis of efficiency of use of anchor fastening in comparison with shooting carried out on the basis of data of the specialized construction firms of the USA (3) showed that labor productivity increases at earthworks by 42,5%, backfilling - 32,8%, at installation of prefabricated designs on 15 %. In general, during the construction of metro stations, the anchoring of ditches increases productivity by 11% and reduces construction time [5,6].

The article presents an analysis of direct costs in the construction of the metro station "Lybidska". In construction projects, the direct costs are the cost of labor, materials, equipment, and so on. These construction project costs are developed as an estimate through a detailed analysis of the contracting activity, construction method, site conditions and resources. The economic assessment of the distribution of direct costs for the stages of construction of the diaphragm wall is presented in Figure 2.

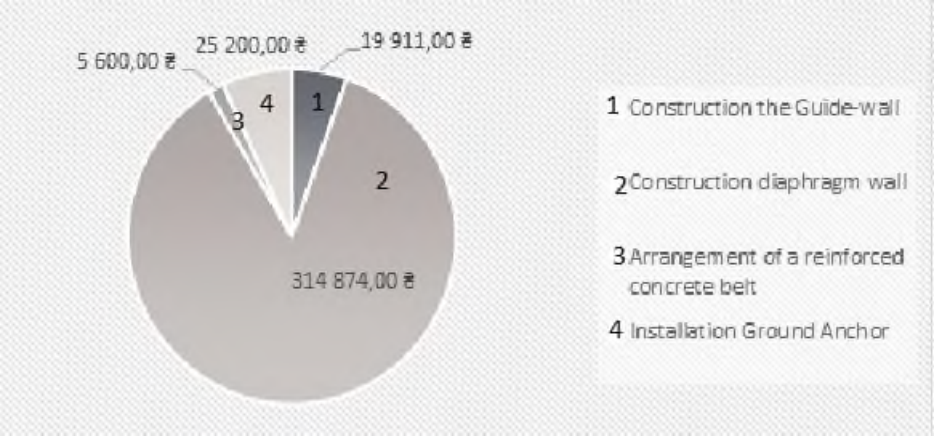

Figure 2 – Direct costs at the construction of the diaphragm wall.

The Plaxis software system allows us to model the behavior of the soil in conditions of any degree of complexity and to study the changes in the stress-strain state of the soil mass depending on the performance of geotechnical structures. This will allow you to choose the optimal design of the wall in the ground and reduce construction costs and construction time.

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