CONSTRUCTION OF UNDERWATER GAS PIPELINE PASSAGE

Dnipro University of Technology

Kiselyova Olga Serhiyivna, group 185-20-1 FNST
***Scientific supervisor*: PhD, Assoc. Prof. Rastsvietaiev V.O.**

There are many methods of laying pipelines through natural and artificial obstacles and constructions of such transitions.

The choice of a specific method (or design) in each specific case should be based on the consideration of the set of conditions of passage and requirements for the transition - technical, economic, environmental, etc. [1]

The experience of many countries, for example, Germany, Japan, Great Britain, proves that the cheapness of traditional laying of pipelines at transitions is an illusion, and the indirect losses from the construction of transitions by traditional methods are significant.

Trenchless construction methods are more cost-effective than traditional methods. This is explained by the saving of funds, which, with the open method of replacing communications, go to the construction of tranches, garbage removal, restoration of banks, improvement of territories, landscaping and much more.

A significant number of works [2, 3, 4, 5, 6] are devoted to the topic of construction of underwater crossings of main pipelines.

Having considered this literature, we can say that the choice of HDD is an ecologically and economically beneficial method.

Modern drilling equipment allows you to work in difficult geological conditions almost without restrictions due to seasonal factors. And modern technologies of trenchless laying make it possible to conduct work quickly, qualitatively and aesthetically, at the same time it is possible to preserve all objects of external improvement, architectural and natural landscape, to avoid blocking highways, railway tracks and overland pedestrian crossings.

Trenchless methods of laying underwater crossings solve the following tasks:

- the high quality of the constructed transition due to the deepening of the pipeline is significantly lower than the line of limit deformations of the bottom and banks of the river, as well as due to the use during construction of high-quality pipes with a factory insulating coating made of extruded polyethylene;
- the need for shore fortification works is excluded;
- a sharp reduction in the amount of compensatory costs for compliance with nature protection and fisheries services;
- Ensuring the repairability of the pipeline, in case it is laid in a protective casing or in a tunnel during construction by the microtunneling method [7].

When choosing a method of construction of transitions, it is necessary to take into account its advantages and limitations regarding its application.

The advantages of the method of horizontal directional drilling during the construction of underwater transitions of pipelines are [8, 9]:

- the ability to lay pipelines below predicted channel deformations, which reliably protects the pipeline from any mechanical damage;

- during construction and operation, the natural regime of the water obstacle is preserved, which meets the increased environmental requirements and is of particular importance when pipelines cross a river from the list of specially protected natural territories;

- the HNB method excludes the need for dredging, underwater engineering, diving and shore fortification works during the construction of crossings over water obstacles, which account for more than 50% of the cost of the crossing;

- the need for ballasting of pipelines (ballast loads and weighting coatings) is excluded;

- no explosive work is required to loosen dense soils for further digging of an underwater trench;

- construction of the transition is possible at any time of the year, and agreements with interested organizations (Rybnadzor and others) are simplified.

The conditions that limit the possibility of using the method of directional drilling are unfavorable soil conditions: directional drilling is a significant difficulty in gravel soils (gravel over 30%), in soils of the floating type, in soils with the inclusion of boulders and stones [9]. In such cases, it becomes difficult to control when drilling a pilot well, a possible collapse of the soil during the expansion of the pilot well and jamming of the working pipeline during its pulling.

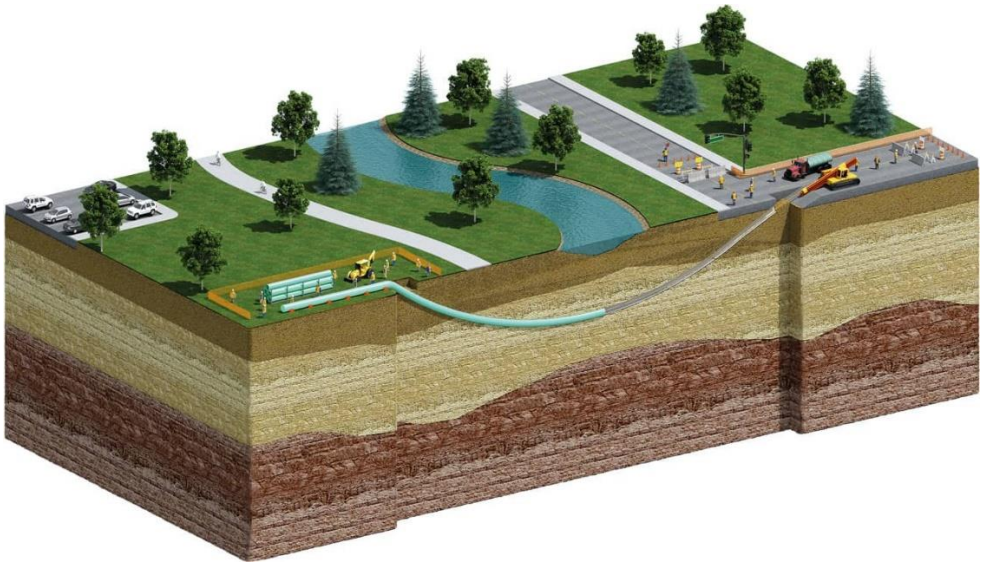

Fig. 1 Construction of an underwater passage of a gas pipeline

Drilling rigs of the Mini, Midi (partially Maxi) classes are, as a rule, self-propelled devices on a crawler track. Mega (partially Maxi) class installations, as well as specialized mine or well drilling systems, are not equipped with a drive and running mechanism, but are placed on a support frame that is directly installed on the planned soil surface and fixed with anchor devices (frame drilling rig). Large drilling rigs can be placed on a trailer truck (trailer rigs), or arranged in the form of separate modules, transported in standard containers by motor vehicles and mounted at the work site.

The selection of a drilling rig for a specific object is carried out on the basis of data on the type, diameter and length of the pipeline intended for laying, on the engineering and geological conditions of construction, taking into account the

requirements for ensuring the necessary values of traction forces and torque.

The HNB method is cost-effective when crossing large rivers, since the cost of 1 p.m. pipeline built by the method of directional drilling, taking into account construction, operation and compensation costs, can be compared with the cost of 1 p.m. dyke sites built by the traditional method and operated with the constant danger of their erosion in the bottom and banks of the crossing water obstacle.

In connection with the above, this work will consider the construction of the transition of the main gas pipeline using the trenchless method, namely the method of horizontal directional drilling.

References

1. Ratov B.T., Fedorov B.V., Khomenko V.L., Baiboz A.R., Korgasbekov D.R. (2020). Some features of drilling technology with PDC bits. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, (3), 13-18. https://doi.org/10.33271/nvngu/2020-3/013

2. Drilling and operation of oil and gas wells in difficult conditions : monograph / O.O. Aziukovskyi, Ye.A. Koroviaka, A.O. Ihnatov; Ministry of Education and Science of Ukraine, Dnipro University of Technology. – Dnipro: Zhurfond, 2023. – 159 p.

3. Ганкевич, В. Ф., Пащенко, О. А., & Киба, В. Я. (2015). Вплив вібрацій на буровий інструмент. Вібрації в техніці та технологіях, (4), 132-135.

4. Пащенко, О. А. Шляхи підвищення надійності та ефективності бурового обладнання. In Форум гірників–2016: матеріали міжнар. конф., м. Дніпропетровськ (pp. 5-6).

5. Ihnatov, A., Koroviaka, Y., Rastsvietaiev, V., Tokar, L. (2021). Development of the rational bottomhole assemblies of the directed well drilling. Gas Hydrate Technologies: Global Trends, Challenges and Horizons – 2020, E3S Web of Conferences 230, 01016 (2021). https://doi.org/10.1051/e3sconf/202123001016

6. Пащенко, О. А., & Хоменко, В. Л. (2011). Визначення оптимального кроку різців у породоруйнівному інструменті. Породоруйнівний та металообробний інструмент - техніка та технологія його виготовлення та застосування.

7. Shapoval, V.G., Pashchenko, O.A., Zhilinska, S.R., Khomenko, V.L., Ivanova, H.P. (2021). Application of shashenko criterion to predicting the strength of sandy loam soils during horizontal directional drilling. Інструментальне матеріалознавство: Збірник наукових праць ІНМ ім. В.М. Бакуля НАН України, 24, 114-120. http://www.ism.kiev.ua/images/24_2021.pdf

8. Yevhenii Koroviaka, Artem Pavlychenko, Andrii Ihnatov, Valerii Rastsvietaiev. Developing Parameters of Well Construction Method in Terms of Thick Sediments. Aspects Min Miner Sci. 10(1). AMMS. 000730. 2022. DOI: 10.31031/AMMS.2022.10.000730

9. Транспортування нафти, нафтопродуктів і газу: навч. посіб. / Л.Н. Ширін, О.В. Денищенко, С.Є. Барташевський, Є.А. Коровяка, В.О. Расцвєтаєв; М-во освіти і науки України; Нац. техн. ун-т. «Дніпровська політехніка». – Дніпро: НТУ «ДП», 2019. – 203 с.