

DEVELOPMENT OF METHODS FOR LIQUIDATION OF PIPELINES WHICH WERE BUILT BY HORIZONTAL DIRECTIONAL DRILLING*DZMITRY KISIALIOU, ANDREI KULBEI***Polotsk State University, Belarus**

The problem of the elimination of pipelines by HDD under natural and artificial barriers is examined in this article. The modern methods of the elimination of pipelines are analysed. The advantages and disadvantages of alternative methods are formulated. The alternative methods of the elimination of pipelines are suggested.

One of the alternative construction methods and perhaps the fastest-growing technology in the trenchless industry is horizontal directional drilling (HDD). HDD has experienced rapid growth in the construction industry over the past few decades. The horizontal-directional-drilling process represents a significant improvement over traditional cut-and-cover methods for installing pipelines beneath obstructions, such as roadways, driveways, historical areas, landscaped areas, rivers, streams, and shorelines, which warrant specialized construction attention.

The basic components of a horizontal directional drilling system include:

- Drill unit;
- Guidance system;
- Drilling fluid system;
- Drill pipe and downhole tools, including bits and back reamers;
- Drilling fluid mixing or recycling system.

Installation of a pipe by HDD is usually accomplished in three stages. The first stage involves directional drilling of a small-diameter pilot hole along a designed directional path. The second stage consists of enlarging (reaming) of the pilot hole to a diameter that will support the pipeline, and the third stage consists of pulling the pipeline back into the enlarged hole.

Pilot Hole. The first step in a HDD installation is to drill a carefully guided pilot hole that delivers the drill bit and bore head to the surface at the specified exit point. The bore is launched from the surface, and the pilot bore proceeds downward at an angle until the necessary depth is reached.

Reaming. Once the pilot hole is successfully drilled, the hole is often enlarged to a suitable diameter for the product pipeline. For instance, if the pipeline to be installed is 8 inches in diameter, the hole may be enlarged to 12 inches or more. This is accomplished by reaming the hole to successively larger diameters. Generally the reamer is attached to the drill string on the bank opposite the drilling rig, rotated, and pulled (pushed in some instances) back through the pilot hole.

Pullback. Once the drilled hole is enlarged, the product pipeline can be pulled through it. The pipeline is prefabricated and usually tested on the bank opposite the drilling rig. A reamer is attached to the drill string and then connected to the pipeline pull head via a swivel. The swivel prevents any translation of the reamer's rotation into the pipeline string, allowing for a smooth pull into the drilled hole. The product pipe has to be supported for the pullback operation [1, 2].

The process of liquidation pipelines can be accomplished by total unearthing, which involves a huge-scale digging. On the other hand, pipelines can be liquidated by pulling them out from the ground. This method demands a great force.

The main aims of this work are to elaborate on some methods for the liquidation of pipelines and to analyse some operational methods.

There are two methods of repairing pipelines: "pipe in pipe" and "breaking".

Method of "pipe in pipe". This method is based on the insertion of new pipelines in old ones. It is realized through the trench at the beginning of the site by pushing the previously welded stalk which has a smaller diameter.

The advantages of this method are:

- minimum friction in the inner surface;
- the pipe has no contact with the surrounding ground;
- repair works do not disturb the traffic;

The disadvantages of this method are:

- the decrease of pipelines diameter;
- the necessity of previous cleaning.

Method of “breaking”. This method is used when we need to keep or increase the diameter of pipelines. In this case we need to put some bars through the pipelines to be liquidated. Knife-reamer is fixed on the end of the initial bar which attaches with a new pipeline via a swivel. The bars are extracted cyclically and the process lasts until the full withdrawal of knife-reamer from the trench. The old pipeline is cut, widened and a new pipeline is pulled into an old one simultaneously [3].

The advantages of this method are:

- high performance (more than 100 meters of pipelines per day);
- the possibility of replacement of a similar pipe or the increase of the diameter of the existing pipe;
- repair works do not disturb traffic.

The disadvantages of this method are:

- environmentally unfriendly;
- the necessity of previous cleaning.

Then let us consider some alternative methods of the liquidation of pipelines.

The methods suggested below are aimed to decrease the force between the pipeline and the surrounding ground.

Method of parallel drilling. This method is based on drilling some parallel holes by HDD. The holes are drilled parallel with the old pipeline. It permits to decrease the force between the old pipeline and the surrounding ground. The quantity of holes is calculated. This method is presented in Figure 1.

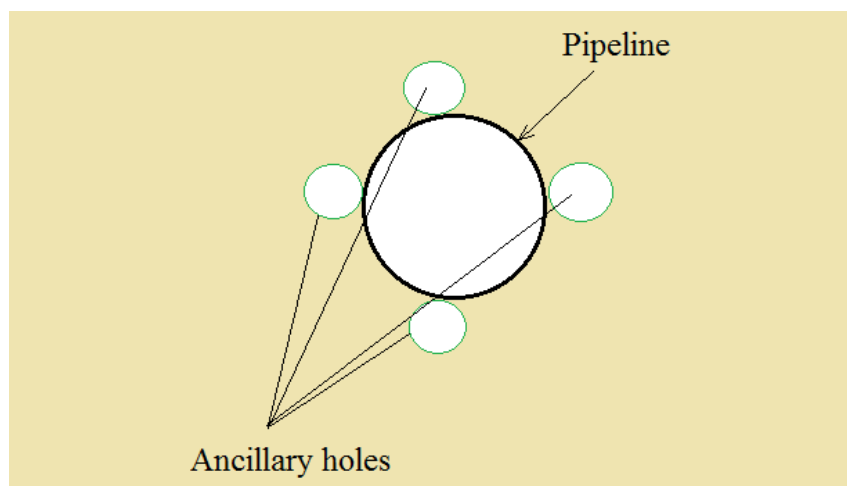


Fig. 1 Method of parallel drilling

The advantages of this method are:

- use of standard equipment (HDD rig);
- environmentally friendly;
- possibility of replacement of a similar pipe or the increase of the diameter of the existing pipe;
- repair works do not disturb traffic.

The disadvantages of this method are:

- high cost;
- demands high accuracy.

Method of the mechanical separation of pipelines from the ground. This method is based on the installation of some special equipment, which can separate the pipeline from the ground along the full length of the pipeline. This method is presented in Figure 2.



Fig. 2. Method of the mechanical separation of the pipelines from the ground

Technology, Machine-building, Geodesy

The advantages of this method are:

- environmentally friendly;
- possibility of replacement of the similar pipe or the increase the diameter of the existing pipe;
- repair works do not disturb traffic.

The disadvantages of this method are:

- use of special equipment;
- big power inputs of this method.

Conclusion. In this work the operational methods have been analysed. The advantages and the disadvantages of these methods have been presented. Some alternative methods of the liquidation of pipelines have been suggested. Their advantages and disadvantages have been discussed.

REFERENCES

1. David, A. Horizontal Directional Drilling / A. David. – Willoughby, 2005.
2. Сооружение подводных трубопроводов : учеб. пособие для вузов / Б.В. Самойлов [и др.]. – М. : Недра, 1995. – 304 с.
3. ООО «Микроцит» [Электронный ресурс]. – 2017. – Режим доступа: <http://www.beztranshey.ru/bestranshtech/methodsanac>. – Дата доступа: 03.01.2017.