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OPTIMIZATION TECHNOLOGY FOR THE CONSTRUCTION OF A PIT FOR A MULTI-STOREY BUILDING

Kurbanov Ravshan Ulmasovich
Department of Construction Technology and University Organization.

Normurodov Alisher Raufovich
Department of Construction Technology and University Organization.

Abstract: The latest developments in the design and construction of deep pits and slopes in urban development are described. The latest developments, especially in the fields of instrumentation and measuring methods, are considered. It is shown that investment in complex preparatory work and monitoring contributes to an increase in the efficiency of project implementation. Making an optimal decision requires not only time and knowledge, but also the conscious cooperation of all interested parties and specialists.

Keywords: a pit, multi-storey buildings, construction, machinery, material, layer

Introduction

The development of underground space is one of the most important directions in the development of large cities. At the same time, the urgent tasks are: ensuring the safety and maintaining the normal operation of existing buildings and structures (roads, bridges, tunnels and communications) and minimizing the timing of construction work, which creates inconveniences for traffic and city residents.

When designing and building pits with a depth of more than 10 m for industrial, civil or transport facilities in cramped urban conditions, the most common method of fencing is the "wall in the ground" technology. To ensure the stability of the pit walls, all existing methods of fastening the fence provide for a tiered excavation of soil with the installation of a spacer system on each tier. This significantly increases the labor intensity and timing of the work, and as practice shows, it cannot always ensure compliance with the regulatory requirements for

the deformations of the surrounding buildings and structures that arose as a result of the excavation of the pit.

Therefore, the tasks of reducing the labor intensity and time of arranging underground space, and most importantly, meeting the requirements for preserving the existing historical and modern buildings and the safe operation of transport facilities are relevant for the successful development of large cities.

In recent years, jet geotechnology has begun to be used to solve these problems, which makes it possible to create in the soil a soil-cement massif (hereinafter GCM) of almost any shape, the physical and mechanical properties of which can exceed the properties of the soil by several orders of magnitude. This increases the efficiency of the application of this technology in the design and construction of underground structures in comparison with other methods of soil consolidation.

A pit is a special recess of a given geometry, which is carried out in the ground to accommodate the foundations of buildings of any purpose, foundations for various structures and structures, for the construction of roads.

Also, pits are dug out when constructing ponds, pools, and other artificial reservoirs, for the construction of residential buildings, apartment buildings, hydraulic engineering, underground structures.

There are several technologies for the construction of pits, involving the use of different types of special machinery, equipment, devices and tools.

The main characteristics of the pit are determined at the design stage of a building or structure. This also applies to parameters such as:

- depth and dimensions;
- the presence and magnitude of the angle of slopes;
- the presence and type of fortifications, etc.

Fastening of pits, depending on the construction technology, can be anchor, grooved, braced.

Any technology for the construction of a pit always provides for the implementation of earthworks with the removal of soil, its shipment and removal. After reaching the required depth, the development, leveling and leveling of the bottom and walls surfaces are performed.

An obligatory stage of work today is also the waterproofing of the pit. The reliability and durability of the future structure directly depends on the quality of its implementation.

The need and methods of waterproofing

Surface and ground waters enter the pit through the walls and bottom, and the groundwater pressure can be quite significant. This leads to the gradual destruction of the foundation as a result of the washing out of its material, chemical action of aggressive substances on it. Water fills the pores of concrete and causes corrosion of the reinforcement of reinforced concrete products, and with alternating freeze-thaw cycles in winter, it causes mechanical destruction of the material from the inside. If the pit is made for the construction of a pool or pond, then the artificial reservoir will be polluted by penetrating groundwater.

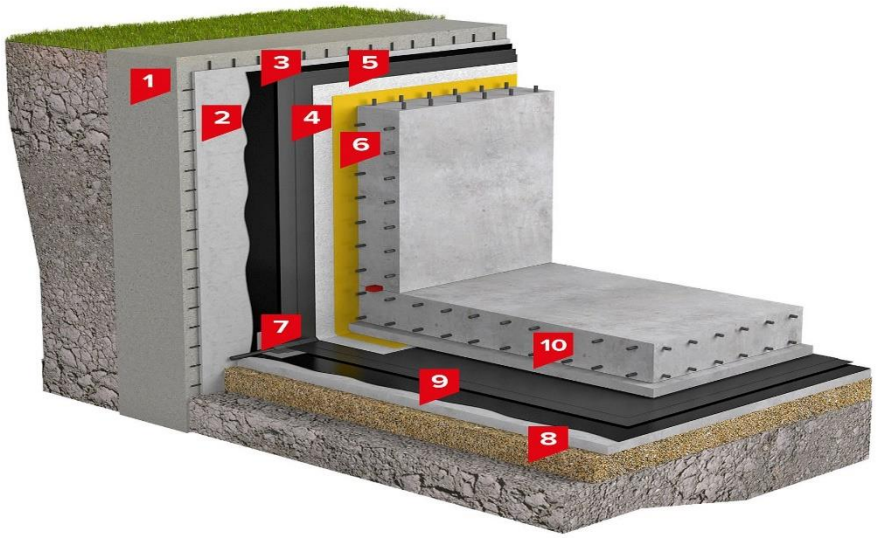

Figure 1. Laying the material on a concrete base (concrete preparation B10) under the foundation slab

In the drawing on the left, a node with a layer-by-layer illustration of the TechnoNIKOL foundation waterproofing technology, erected in pits according to the "wall in the ground" system (fences made of cut-through piles):

1. Vertical pit fence
2. Leveling layer

3. Bituminous primer TechnoNICOL No. 01
4. Waterproofing membrane Technoelast EPP (you can also use Technoelast TERRA)
5. Needle-punched geotextile TechnoNICOL 500 g / m2
6. TechnoNICOL vapor barrier film 150 g / m2
7. Baseless bitumen-polymer roll material Technoelast FLEX
8. Sand and gravel preparation
9. Concrete preparation
10. Protective screed

Taking into account these negative effects, when constructing a pit, measures for its waterproofing are necessarily provided, aimed at preventing the penetration of water from the ground.

Waterproofing can be performed in various ways, involving the use of liquid rubber, film and other materials. The use of geomembranes has become very popular today.

This is a modern type of waterproofing materials used in the construction of foundations, various underground and hydraulic structures, artificial reservoirs. The geomembrane has high barrier properties and completely excludes moisture penetration. It is also characterized by increased tensile strength, the ability to significantly stretch while maintaining operational properties. The material tolerates well the effects of aggressive substances, ultraviolet radiation, temperature effects.

The membrane can be used for pits of any depth and any degree of hydrostatic pressure from the groundwater side. The use of a geomembrane makes it possible to qualitatively isolate the foundation and other parts of structures and structures that are placed in the pit. Thanks to this, they are protected from moisture. In addition, the membrane provides additional reinforcement for the walls and bottom of the excavation, and also performs drainage functions.

The membrane is mounted on the bottom and the walls of the pit by hand or rolled out using traverses. Installation is overlapped. The air temperature during waterproofing work should not fall below -5 ° C, and there should be no strong wind. In addition, a mandatory requirement for weather conditions during installation work is the absence of precipitation.

After laying, individual sheets of material are joined together by welding to obtain a continuous and completely sealed joint. Contact welding is used to connect geomembrane rolls in straight sections, and extrusion welding in the corner zone.

The connections made must be checked for the level of tensile and tensile strength of the material. After welding, special locks are installed on the sides of the pit to securely fix the layer of the waterproofing membrane on the walls.

Pit for the foundation of a multi-storey building, residential buildings

The Russian company Technonikol is one of the main manufacturers producing waterproofing materials for various spheres of construction. The manufacturer offers a wide range of materials of various types. For waterproofing of pits and foundations, the company has developed materials for membrane and welded waterproofing.

Membrane waterproofing

The LOGICBASE V – SL (LOGICROOF T – SL) membrane is among the advanced materials of the TechnoNIKOL trademark, developed for waterproofing pits.

It is a completely waterproof PVC sheet, which has a homogeneous composition and is produced in rolls 2.05 m wide and 20 m long. Its thickness is 1.5 mm and 2.0 mm.

Figure 2. Installation of a membrane for vertical waterproofing of the foundation, work is carried out in the pit along the wall in the ground system, scaffolding is used

The membrane has high technical characteristics and performance and can be used in the construction of both small buildings or technical structures, and large facilities with a high level of responsibility. It is used for waterproofing:

- foundations of buildings for various purposes;
- underground passages;
- road and other tunnels;
- metro stations;
- tanks placed underground, etc.

The characteristics of the LOGICBASE V – SL (LOGICROOF T – SL) web allow to provide reliable protection of insulated structures from the negative effects of flood and ground waters, at any values of hydrostatic pressure.

The main technical parameters of the geomembrane:

- Complete water resistance at a maximum value of hydrostatic pressure up to 1 MPa;
- preservation of waterproofing at elongation up to 400%;
- tensile strength level - over 16 MPa;
- puncture resistance - over 150 N;
- maintaining flexibility when exposed to negative temperatures down to -45 ° C;
- preservation of shock resistance when exposed to negative temperatures down to -30 ° C;
- resistance to acidic and alkaline environments, microorganisms;
- resistance to germination of plant roots;
- the service life of the material is over 60 years.

Installation of waterproofing is carried out by the free-laying method, in which gluing to the base is not performed. Thanks to this, the waterproofing layer retains its integrity, compensating for ground movements and possible deformations of the insulated structure.

Installation technology allows laying on damp surfaces.

The material is characterized by high thermoplasticity, which allows the connection of individual rolls of fabric by welding with hot air without the need for an open flame.

In this case, the strength of the resulting seam exceeds the strength of the geomembrane itself. As a result, a continuous monolithic layer with complete tightness is created, which guarantees reliable protection of structures.

For effective waterproofing of pits and foundations, the manufacturer recommends using the repairable system TN-FUNDAMENT Prof. Wall in the ground, formed on the basis of the LOGICBASE V – SL (LOGICROOF T – SL) membrane.

In addition to the PVC membrane itself, it includes a special injection system. This makes it possible to easily detect emerging defects in the waterproofing layer and quickly restore its integrity.

Construction of foundation pits

During the construction of pits, a number of technological operations are carried out. Their composition and execution methods are determined by the design features of the future building or structure, soil properties at the construction site and other factors.

Figure 3. Requirements for the construction of walls and slopes of the pit

Earthworks

Excavation work begins after marking the site and preliminary measures, during which they prepare access roads and a place for storing part of the excavated soil, which will be used for backfilling.

Digging of a pit is performed by an excavator. This makes it possible to reduce the execution time many times over compared to the manual method. The bulk of the excavated soil is taken

out for disposal. A small part of it remains on the storage site for subsequent backfilling of the pit.

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