Designing of organizational and technological solutions for construction in constrained urban environments

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Abstract. The article substantiates the need to improve the quality of design work on the construction site in the context of the existing urban development taking into account specific criteria and gradations. The features and problems of the main periods of construction are investigated. To improve the quality of the design documentation, in particular, of the construction work program in constrained urban conditions, the authors conducted the research of the influence of a complex of constraint factors affecting construction preparation activities. Recommendations of construction site organization in the current conditions are given. The results are presented and further research stages of technological processes in constrained urban conditions are outlined. We show the expediency of a systematic approach to improving the quality of construction's process. We are taking into account the assessment of environment state and the need to reduce the negative impact of construction and assembly works on nearby already built-up areas. The need to take into account the above factors for developing a project of works execution is justified.

1. Introduction
Each construction object has its own specific criteria and gradations and entails certain, characteristic costs. That’s why, when developing a project of work execution, it is important to consider external and internal constraints. The development of organizational and technological solutions for construction in constrained urban conditions requires an analysis of constraint factors and making a sequence of construction, which could reduce risks and increase safety.

2. Relevance
Because of periodic requirements increasing for sanitary and hygienic of environment and for the construction safety, at present, is a pressing issue of the development of organizational and technological solutions for construction in constrained urban conditions. Thus, when organizing construction, reconstruction under the conditions of existing urban buildings, the sequence of activities for organizing work should increase the level of safety for nearby already built-up areas and reduce the level of physical impact on atmospheric air. A number of literary sources provide a list of constraint factors affecting construction safety.
3. The scientific significance of the issue

The developed sequence and composition of organizational and technological construction solutions in constrained urban conditions are necessary for the implementation of technical measures to increase the level of safety beyond the boundaries of the construction site and reduce the level of physical impact on atmospheric air.

The main external factors of constraint: restriction of the dimensions of the working areas of construction machines and mechanisms; restriction of the driveways of construction machines and vehicles with natural artificial obstacles; traffic intensity in the built-up area; availability of housing in the area of which it is necessary to maintain a favorable living environment during the construction period. Internal factors of constraint: foundations installation; laying of underground communications; organization of warehouse space; movement of building materials, structures, parts; a possibility of the location of vehicles, construction machines, passages inside the object in the dimensions of the construction site. [1-7]

The purpose of the study: the design of organizational and technological solutions for construction in constrained urban environments.

Objectives of the study:
- identification of features of organizational and technological solutions in the constrained urban conditions;
- assessment of constraining factors of construction;
- development of organizational and technological solutions for construction in constrained urban environments.

4. Theoretical part

Considering the above data, the authors' team proposes a methodology for designing organizational and technological solutions for building a shopping center in constrained urban conditions.

For the work period, it is necessary to perform temporary fencing of the construction site on the borders of the land. Equip the construction site with an information board, signs indicating the passage of pedestrians and cars, as well as a set of primary fire extinguishing equipment - sand, shovels, hooks, and fire extinguishers.

In order to minimize the territory occupied by temporary engineering communications they should lie in trenches or elevated on supports to a height that ensures unimpeded passage of vehicles, unloading facilities and installation cranes under them.

Arrange a temporary household town. Temporary buildings and structures take in the form of inventory container. Place household premises in compliance with fire safety requirements with installation on a rigid base. The household town provides the needs of all construction in everyday needs. Outside the hazardous area of cranes should be installed temporary buildings.

In the form of an open area should be organized an on-site warehouse for building materials. Prefabricated products, parts, and materials should be stored in coverage areas of erecting cranes. For the organization of trouble-free work, accept the installation method "off the wheels". Storage of materials provides passageways for workers in order to ensure ease of slinging prior to installation.

At the exit from the construction site, arrange a site for "dry cleaning" of the wheels by installation on the base of the compressor. This item of wheel cleaning allows shooting down dirt and frost using a jet of high-pressure air. In the mode of wheels blowing, the air from a pneumatic gun removes mechanically pre-cleaned contaminants from the wheels, sides and the bottom. In winter, the compressor places in a warm box heated by a fan heater (to prevent oil and condensate from freezing in the hoses and receiver).

When organizing the construction industry, it is necessary to take measures to protect the environment. It is necessary to minimize the negative impact of construction processes on the hydrosphere and atmospheric air [8-20].

When developing measures for the environment protection, special attention should be paid to the assessment of the physicochemical and aerodynamic properties of the released during the construction
processed dust. The most dangerous are the emissions of fine dust PM 10 and PM 2.5. During dispersion calculations it is obligatory to take into account these fractions of fine dust. [21, 22]

5. Practical relevance, suggestions and results of implementations, the results of experimental studies

For the construction of a shopping complex in the Volgograd region, a construction master plan was developed. On the basis of the developed construction plan, organizational and technological schemes were determined, which resolve the sequence of the building construction process.

In connection with the developed construction master plan, the organizational and technological schemes that determine the sequence of building construction are as follows:

The preparatory period includes: development of the work project; coordination with the city administration and controlling organizations about the time terms and methods of organizing the construction site, as well as work conduction; obtaining permission from balance holders of engineering networks passing in the area of the construction site for the production and method of construction work; arrangement of temporary fencing, domestic campus and temporary road; creation of general warehousing facilities; laying of temporary engineering networks; organization of "dry cleaning" of wheels on the road from a construction site; implementation of fire safety measures; construction site equipment with separate collection of construction waste system.

The decision about completion of the preparatory work on the construction site accepts under implementation act of labor safety measures.

The main construction period includes: pit construction; frame construction of the underground part of the building; foundation’s waterproofing; backfilling of the basement pockets; framework construction of the above-ground part of the building along the span: mounting of walls, partitions; bridging mounting; mounting of a coating; installation of external enclosing structures; roofing device; floor device; installation of gates, stained glass windows and windows; laying of external and internal engineering communications; equipment installation; interior decorating; works on landscaping.

Prior to the start of production of the main construction and installation work, it is necessary to complete the works of the preparatory period, including: garbage collection, provision of a preliminary vertical planning of the site, placement of temporary utility rooms for builders (with a dry closet), construction of a temporary fence of the construction site.

When developing a project for construction organization, in order to shorten the construction time it is better to accept year-round construction and installation works in a contractual manner.

For the production of special installation works, specialized assembly organizations are involved.

In the course of experimental studies at the construction site, by conducting timekeeping and consistent assessment of construction operations' safety's level for the test object, the administrative building of a shopping complex, a number of additional recommendations were developed for construction and assembly works.

Complex mechanization of construction and installation works accept with the use of mechanisms in 1-2 shifts and with the use of small-scale mechanization tools ensuring the erection of the building in optimum terms.

Supply of an object under construction provides from building industry enterprises by centralized delivery by small-sized vehicles. The construction master plan of the building should be developed for all periods of construction, indicating the main machines and mechanisms by means of which the building, temporary buildings and structures, permanent and temporary passages are being built.

Across construction territory, temporary roads from airfield road slabs provide regular and safe movement of vehicles on the construction site.

6. Conclusions

These recommendations are necessary to improve the design of organizational and technological solutions for construction in constrained urban environments and their aim is to ensure the quality of
construction objects due to use of formalized techniques to optimize the main technical and economic indicators of buildings construction, taking into account the features of the construction site.

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