

The Importance of Execution Design as an Important Element of Improving Construction Projects

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Abstract

The scope of executive designs for the implementation of construction projects is specified in the regulations only in relation to investments implemented with public funds. However, there are no legal regulations regarding executive projects in relation to investments carried out with funds other than public ones. The article presents an example scope of an executive project for investments financed from non-public funds and proposes a procedure for its development.

Key words: construction process, design documentation, detailed design.

1. Introduction

A construction project is treated as a set of interdependent activities including the preparation and construction of a building in a specific place, which requires many interdependent activities and includes technical, economic and environmental studies, development of the concept of activities and construction design, as well as organizational preparation and implementation of construction together with putting the facility into operation [5].

An important element of the project implementation process is design documentation. The design documentation consists in particular of: a construction design taking into account the specificity of construction works, an executive design and a bill of quantities. The scope of design documentation is determined by the ordering party.

The construction design (PB design) contains information necessary to construct a building that meets the investor's expectations, including: a descriptive part, technical drawings and diagrams of individual solutions that will be used for its implementation. According to the law, a construction design is part of the design documentation and consists of three parts: a plot or area development design, an architectural and construction design and a technical design. The legislator specified in detail what each of the above-mentioned parts of the construction design should contain [20].

The executive design (PW design) supplements and details the construction design in the scope and degree of accuracy necessary to prepare the bill of quantities, the investor's cost estimate, the preparation of the offer by the contractor and the implementation of construction works in the form of drawings on a scale taking into account the specificity of the ordered works and the drawing scales used in the construction design along with descriptive explanations regarding: parts of the facility, construction and material solutions, architectural details and construction equipment, or the land infrastructure network, installations

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and technical equipment. Depending on the scope and type of construction works that are the subject of the contract, *the PW project* concerns:

- preparation of the site for construction;
- construction works in the field of construction of complete buildings or their parts and works in the field of civil and water engineering, including finishing works in the field of buildings;
- works in the field of construction installations;
- works related to land development.

It is assumed that the requirements regarding the form of *the PW design* are the same as for the construction design.

On the one hand, the PW design is an important document for the investor, as it is used to select a contractor, perform construction works, control their quality and accept the completed facilities, and on the other hand, it complements and details the construction design to the extent and accuracy necessary to prepare the bill of quantities, cost estimate and offer by the contractor.

The scope of *PW projects* is defined in the regulations only in relation to investments implemented with public funds. They are made available to bidders participating in public proceedings for the performance of construction works. Sharing it enables questions to be asked and explanations provided between the participants of the proceedings, it constitutes the basis for the execution of works, their control and acceptance, and may be a component of as-built documentation [6,7]. There are no legal regulations regarding *PW projects* in relation to investments carried out with funds other than public ones.

The bill of quantities includes a list of the basic works to be performed in the technological sequence of their execution, together with their detailed description or an indication of the basis for establishing a detailed description and with an indication of the relevant technical specifications for the execution and acceptance of construction works, as well as with the calculation and summary of the number of bill of quantities units of the basic works. . The bill of quantities consists of the following elements: the title page of the bill of quantities, the list of sections of the bill of quantities, the table of the bill of quantities [17].

2. Procedure for developing executive documentation

The executive documentation of a specific construction site should be developed on the basis of scientific premises of the technology of construction processes, their organization, management and economics of construction implementation [13]. The aim of developing the executive documentation is to obtain an optimal solution of construction technology, proper planning and appropriate organization of implementation in specific construction conditions [20]. The executive documentation during the implementation of the investment is the basis for the construction manager to organize and control the progress of the works, and for the investor it is used to enforce implementation in accordance with the project and to control the quality, acceptance and costs of the completed investment works.

Technology design and work organization are closely related - without a technology design, it is not possible to prepare a work organization design [8, 11, 12].

2.1. Designing construction works technology

Designing construction works technology includes the following activities:

- identification of construction works that occur in the process;
- calculation of the number of works that will occur during the construction of the facility, mainly on the basis of the architectural and construction design and Material Outlay Catalogs);
- selection of machines and devices (technical facilities) needed to perform the planned works;
- calculation of the efficiency and working time of machines and devices along with the development of their work patterns on the construction site.

The diagram of the work technology design procedure is presented in Fig. 1.

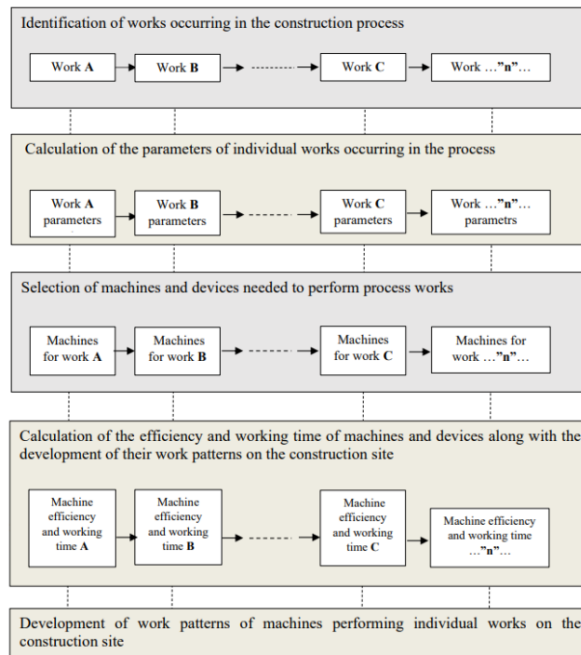


Fig.1. Scheme of the procedure for designing construction works technology [12]

2.2. Designing work organization

After completing the technological design, you can start designing a safe organization of works [1, 10, 14, 15, 16]. The procedure for designing the organization of construction works includes the following activities:

- preliminary selection of the method of organizing works;
- calculation of the duration of individual works occurring in the process and the number of work teams;
- development of a network of dependencies between robots occurring in the process;
- execution of schedules: construction and/or individual works;
- development of construction site development: based on the calculated amounts of individual resources: construction workers, construction materials and equipment for carrying out works.

The diagram of the procedure for designing the organization of works is shown in Fig. 2.

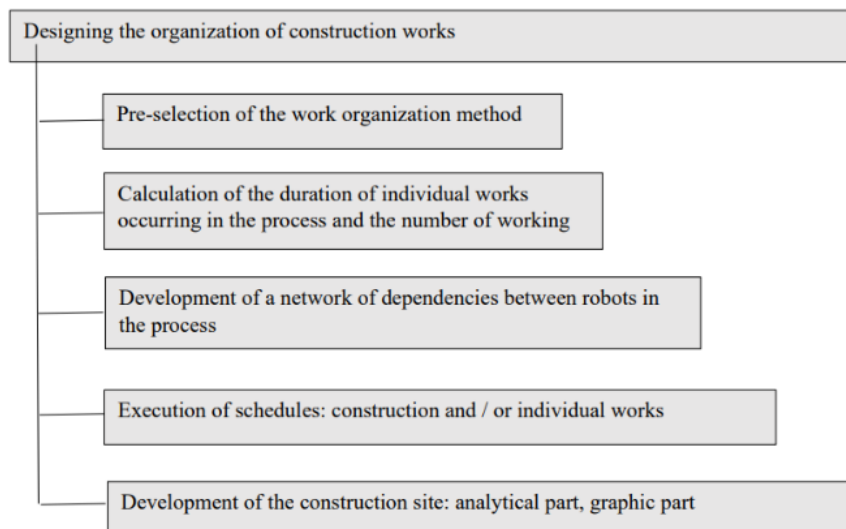


Fig. 2. Scheme of the procedure for designing the organization of works [12]

2.3. Selection of the method of organizing works

In designing the organization of works, one of three main methods of organizing works on the construction site can be adopted [2, 3, 4, 9, 18, 19]:

- sequential execution method - involves the successive execution of works one after the other on individual working plots - for example: the investment includes the construction of three multi-family residential buildings - according to this method they will be performed one after the other, the construction of the second one will start only after the first one is completed and so on,
- parallel execution method - is the complete opposite of the sequential execution method. Using the earlier example, all three structures are being built at the same time, by three independent construction crews,
- uniform work method - the works carried out during the construction of a building are divided according to technological criteria into individual stages, performed one by one by specialized teams on working plots. Referring to the example under consideration: the brigade performing earthworks performs them on the first object. After their completion, it moves to the second one, and at the same time, foundation works are carried out on the first structure.

Each of the methods described above has both its advantages and disadvantages (Table 1).

Table 1. Advantages and disadvantages of work organization methods in construction [12]

Method	Disadvantages	Advantages
Successive execution method	- long construction time of the facility; - lack of continuity of work of individual working teams.	- a small number of simultaneously needed workers and machines.
Parallel execution method	- very high demand for both employees and equipment and construction machinery, and thus very high costs.	- definitely the shortest completion time of the facility.
Smooth work methods	- the need to skillfully divide the erected object into individual plots of land - so that they are characterized by a similar labor consumption; - the need to complete specialized brigades for individual works.	- the structures are erected evenly and continuously; - after some time, "you get" specialized brigades.

The steps in the design procedure for the organization of construction works (Fig. 2) allow for the proper management of the resources necessary to construct a building in a specific area. Development of the construction site is carried out at least in the scope of:

- fencing the area and designating danger zones,
- construction of roads, exits and pedestrian crossings,
- supply of electricity and water, hereinafter referred to as "utilities", and disposal or disposal of sewage,
- equipment of hygienic, sanitary and social rooms,
- providing natural and artificial lighting,
- ensuring proper ventilation,
- ensuring telephone communication,
- equipment for storage of materials and products.

2.4. Construction cost estimation

After preparing a design of the technology and organization of work necessary to perform the work in the process, the costs can be calculated - a cost estimate can be prepared. The cost estimate should include:

- labour cost;

- costs of materials, including a bill of materials with a list of all tools, raw materials and elements necessary to carry out the construction process;
- operating margin: the profit a company makes after paying all costs;
- cost of depreciation of machines, materials and premises;
- the cost of temporary structures and rooms installed during construction works.

3. Conclusions

Executive designs are an important part of the design documentation for all participants of the construction process. At the stage of project preparation, they are made available to bidders participating in public proceedings for the performance of construction works and constitute the basis for the bidders to prepare and submit an offer. However, as part of bidders' questions regarding the tender documents, questions are raised on their basis regarding providing explanations if the design documentation is ambiguous or defective.

At the construction stage, detailed designs are necessary for the selected contractor, as they constitute the basis for the execution of works, their control and acceptance of the works being carried out, as well as the final acceptance of the completed construction works. They also constitute, after any changes introduced during the execution of the works, the basic a component of as-built documentation, which constitutes the basis for the use of completed facilities and should constitute the main appendix to the building operation book.

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