

Reliability of mobile systems in construction

Tamara Narezhnaya¹ and Larisa Prykina¹

¹ Moscow State University of Civil Engineering, Yaroslavskoye Shosse, 26, Moscow, 129337, Russia

E-mail: narejnaya@mail.ru

Abstract. The purpose of the article is to analyze the influence of the mobility of construction production in the article taking into account the properties of reliability and readiness. Basing on the studied systems the effectiveness and efficiency is estimated. The construction system is considered to be the complete organizational structure providing creation or updating of construction facilities. At the same time the production sphere of these systems joins the production on the building site itself, material and technical resources of the construction production and live labour in these spheres within the construction dynamics. The author concludes, that the estimation of the degree of mobility of systems the of construction production makes a great positive effect in the project.

1. Introduction

Construction production, unlike other types of productions, has the increased mobility. Mobility of construction is the mobility and capability of construction systems to urgent actions and movements at different stages or periods of time. The mobile construction system exists during two interconnected states. Firstly, it exists in the movement and concentration in time during those states because those processes in their combination change in space and in time within the organizational structures and power. Secondly, those processes are connected with various material and technical resources, which are often located at long distances. Thirdly, for each construction project social spheres in the form of household, social, public health and entertaining facilities are newly created [1, 2].

2. Methodology

Mobile systems in construction are characterized by the fact that the combination of their elements (means of production, tools of production, labour) throughout all the production process change considerably.

In economics and sociology, the means of production are physical, non-human inputs used for the production of economic value, such as facilities, machinery, tools, [1] infrastructural capital and natural capital. The means of production includes two broad categories of objects: instruments of labor (tools, factories, infrastructure, etc.) and subjects of labor (natural resources and raw materials). If creating a good, people operate on the subjects of labor, using the instruments of labor, to create a product; or, stated another way, labour acting on the means of production creates a good.

As for labour, according to the Cambridge Dictionary it is all the effort and hard work that have been involved in doing a particular piece of work. Labour can also refer to “Employment, a relationship between an employer and an employee”.

The technical-and-economic aspect of the problem of these spheres mostly depends on their proportional infrastructure interaction.



The scheme below (Figure 1) demonstrates, that each of the elements of the production represents the large diverse integration, consisting of numerous differentiated small groups. It creates the single dynamic system, which is able to carry out purposeful transactions and movements. The variety of interrelations of the separate elements of the construction production is functionally connected with the infrastructures of the servicing processes.

The construction system will be ready to accomplish its functions at the settlement power only if the elements of temporary construction infrastructure is in the rational and sufficient combination for the expansion of the corresponding specialized flows and their smooth functioning. To provide the set construction parameters they have to fulfill the following main characteristics on reliability, mobility, readiness, focus, efficiency, lifecycle duration.

Reliability is the concept which characterizes the property of construction production with its capability to perform certain functions, at the same time keeping the main characteristics in the fixed limits. Reliability covers non-failure maintenance, durability, maintainability and saving of construction systems. The main measure of reliability of the technology is the refusal, that is the complete or partial being of the system out of operation with loss of its main property. Complete and partial failures which can be eliminated are the characteristics of systems of the construction production. Sharp complication of the construction processes leads to the increase in quantity of consistently connected elements (crews, cars, means, suppliers) [3, 4]. Reliability as the stability of numerous specific qualities of construction systems demand systematic assessment of the design, production, transportation, construction, functioning of construction elements.

Mobility are the properties which characterize construction or its separate elements according to their mobility, capability to their urgent movement. Therefore the level of mobility of the construction system (including the construction division) is determined according to the intensity of the works demanding certain movement of their constructive elements in time. The construction mobility can be determined by the relation of the intensity of works on preparation and improvement of their reliable functioning to the intensity of their accomplishment [5].

3. Results

Readiness of is defined by the fact that the construction system in the chosen time point will be efficient. Readiness of accomplishment of construction-and-installation works is considered in all the organizational-and-technology calculations. On the one hand, we reduce the readiness of the construction project during its detailing, and on the other hand – this is the way we reduce the terms of the structure construction.

The focus of the accomplishment of construction-and-installation works plays a large role at determination and establishment of duration of the production cycles which are interconnected with each other. Therefore the calculation of focus of the construction-and-installation works is performed on the base of [6-8]:

- the integrated approach providing sufficient or reasonable accounting external and internal environments of construction systems and their interrelation with the production sphere;
- the dynamic approach describing all the lifecycle of the project taking into account its communications with the previous and subsequent phenomena and processes changing in time and causing some swings of their effectiveness;
- the alternative approach which is connected with the valuation methods of purposeful development of the construction processes performed and compared by separate options of accomplishment of construction-and-installation works.

The efficiency of the construction process is estimated, on the one hand, by the means of the comparison of the technology of the construction production and the availability of contradictions in them during the improvement of the social labour under the influence of complex mechanization, specialization, availability of change of scientific and technical process, and on the other hand, it is defined by the discrete character of some parameters of the engineering procedures [13, 14].

The effects of the lifecycle of a construction project are shown at the same time during different stages of its construction in the space and in time and they are defined by the interrelation and the assessment of their interaction (figure 1).

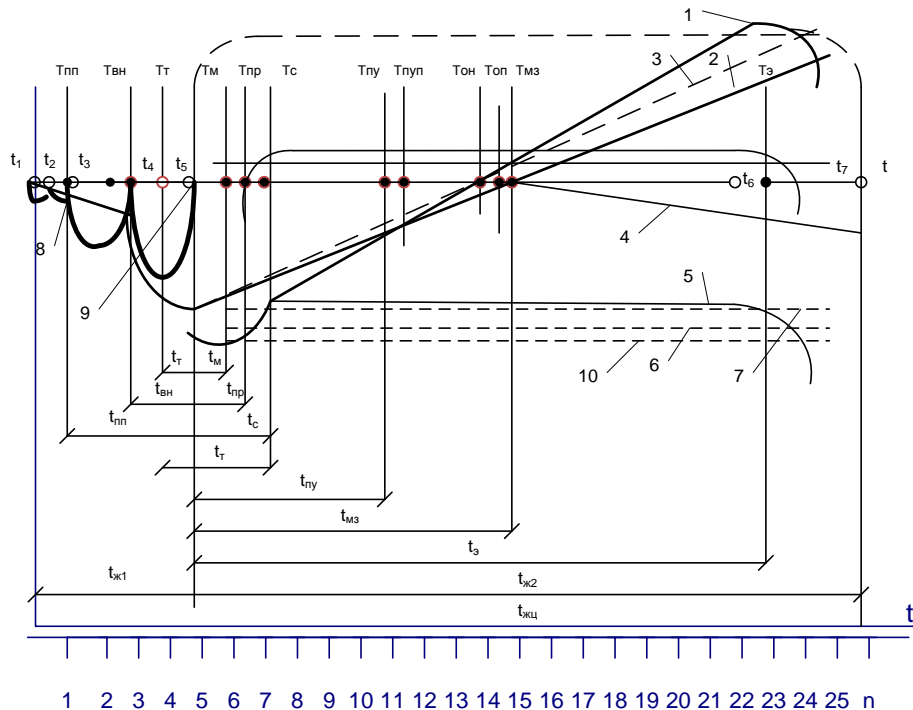


Figure 1. The constituent elements and critical points in the life cycle of the object.

Epyura of the increasing values: 1 – characteristics of accumulation from flows of profit and depreciation on the project; 2 – normative efficiency of the capital investments; 3 – similarly, taking into account scientific and technical progress; 4 – losses of cost under the influence of wear of the project; 8 – formations of funds (the capital investments into the project).

Epyura of annual values: 5 – product costs; 6 – standard of the profit inflow; 7 – standard of renovative flows (depreciation); 9 – capital investments; 10 – product sales.

Therefore, the lifecycle of technology construction system (LcTS) allows to establish some rational timepoint it the moment of emergence and justification of the project until its maintenance. Such a cycle passes and integrates all the technical, organizational, economic conditions of a construction object and the purpose of the analysis is finding of their combinations.

4. Discussion

Reliability of the results when forming and functioning the reliability of the construction system is calculated taking into account its potential capacity, the arising effects for the lifecycle of a construction project.

Thus, the following rules of the solution of the problem of the assessment of expediency of increase in level of mobility of construction system can be used within dynamic and complex statement: they are the creation of the model providing the accounting of expenses and results in the complex and dynamics throughout all the lifecycle; definition of rational zones and restrictions of change of results depending on time of creation of an object; determination of rational level of mobility of the construction system which will create a structure in some specific conditions of the region; establishment of compliance of the received results at the rational level of mobility of construction system with some boundary conditions of the lifecycle of the project.

The analysis of comparison of elements and critical points of the lifecycle of the project can be carried out in the following situations:

1st situation. An structure is created in the region where there are no resources for his construction. All the resources are delivered to the building site from the mother residential-and-production base. In this case the conditions for the reduction of terms of commissioning of the facility ($T_b \rightarrow \min$) are created; the level of mobility of the construction system ($Y_m \rightarrow \max$) increases and that leads to some additional works; the estimated cost of the project ($K_{bo} \rightarrow \max$) at the expense of costs of the increase in the mobility of the system increases.

2nd situation. The structure is created in the region in which the creation of the production and social spheres of the corresponding power is planned before its construction. All the works entering components of the lifecycle of the project are carried out consistently. In this case the minimum level of the mobility of the construction system ($Y_m \rightarrow \min$) is reached; the minimum volume of capital investments directly into the project ($K_{bo} \rightarrow \max$), but additional capital investments for the production and social spheres of the construction system are required ($K_{no} \rightarrow \max$), and, therefore, that leads to the increase in terms of commissioning of the facility ($T_b \rightarrow \max$) as it is necessary to perform some additional works on the events 4-5.

3rd situation. The structure is created in the conditions which provide the rational combination of the use of mother stationary, mobile and regional production bases.

The scheme of the analysis of the critical points of the lifecycle of the construction project is characterized with the epyury constructions of t_{l1} and epyury maintenance of the structure of t_{l2} . At the same time the points of the cycle of reproduction of the project are estimated:

T_{pp} - is the beginning of the organizational-and-technological preparation for creation or updating of a structure; T_{vn} - is the beginning of creation of temporary construction infrastructure; T_t - is the projection of the center of gravity of the epyura of capital investments; T_m - is the achievement of design capacity of the project; T_{pr} - is the beginning of profit receiving; T_s - is the development of the designed level of the product cost for the project; $T_{p..u}$, $T_{p..up}$ - is the repayment of damage from some unprofitable work during the power development; T_{on} , T_{op} - standard respective payback and payback taking into account use of the achievements of scientific-and-technical progress; T_{mz} - the beginning of losses of cost due to moral and technical wear of the project; T_{ae} - the beginning of fading of an project.

In order to analyse the lifecycle (reproduction) of the project it is necessary to use several values of logs which characterize the intervals of time of manifestation of critical points from two values of the lifecycle. The moment of commissioning of the facility of t_5 is considered to be such a key point. In relation to her logs are defined: $t_{p.p}$ - is the preparation and construction of an object; t_{vn} - is the creation of temporary construction infrastructure; t_t - is the average duration of freezing of capital investments; t_m - is the development of power; t_{pr} - is the beginning of receiving profit; t_c - is the achievements of planned level of product cost; $t_{p.u}$ - is the amount of repayments of the damage suffered during development of power; t_{mz} - is the the beginning of moral and technical wear of an object; t_e - its effective operation. The logs characterizing time of creation or updating of an object t_{zh1} and time of life of the project during operation of t_{zh2} are especially important. Defining the relationship of various logs, it is possible to receive comparative efficiency of the periods of the lifecycle of the project.

5. Conclusions

Thus, the estimation of the degree of mobility of systems the of construction production allows:

- 1) to estimate the periods of the lifecycle of a construction project;
- 2) to consider payback periods of options of mobility of the construction production;
- 3) to reflect the interrelations of links and stages of the lifecycles of construction production;
- 4) to show the influence of construction on the efficiency of functioning of the asset construction;
- 5) to establish precisely the level of mobility of the construction systems in the specific conditions of their accomplishment.

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