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OPTIMIZATION IN THE MANAGEMENT OF INVESTMENT AND CONSTRUCTION PROJECTS

V. S. Fedorov, N. V. Kupchikova

Moscow State University of Railway Engineering,

Astrakhan State University of Architecture and Civil Engineering

A detailed analysis of the practical implementation of measures to optimize modern investment and construction projects aimed at choosing the best option possible to achieve the goal has been made.

Keywords: *investment and construction project, optimization of the investment and construction project, stages of implementation of the investment and construction project, optimization methods.*

ОПТИМИЗАЦИЯ В УПРАВЛЕНИИ ИНВЕСТИЦИОННЫМИ И СТРОИТЕЛЬНЫМИ ПРОЕКТАМИ

В. С. Федоров, Н. В. Купчикова

Московский государственный университет путей сообщения,

Астраханский государственный архитектурно-строительный университет

Проведён детальный анализ практической реализации мер по оптимизации современных инвестиционных и строительных проектов, направленных на выбор наилучшего варианта достижения цели.

Ключевые слова: *инвестиционно-строительный проект, оптимизация инвестиционно-строительного проекта, этапы реализации инвестиционно-строительного проекта, методы оптимизации.*

Introduction

The recent increase in investment activity in the construction industry shows that the task of choosing efficient investment projects becomes urgent and depends on a number of parameters characterizing the technical, economic and resource-saving efficiency in implementation. The most effective management principle in the implementation of an investment and construction project is its optimization, i.e. selection of the best option possible to achieve the goal.

The new approach in the theory of the construction of building systems is due to the mathematical and physical formulation of the tasks of optimal design of construction projects and work projects. The goal of this approach is to determine the only design and technical solution that will be the best of all the possible set and satisfy the set requirements.

Analysis of the current state

Compared with the extensive foreign, the Russian experience of optimal design in the implementation of investment and construction projects is very small [1, 2].

Let us turn to optimization models. The conceptual basis for methodological developments in this direction can be applied to the principles of a systematic approach, within which the system of investment and construction activities is considered

as a single object with an ordered structure and interrelations. From the point of view of scientific logic, this method can be characterized as the most complete, accurate and reliable, able to theoretically substantiate an economically viable solution and suggest ways of its practical implementation.

Methods

Optimization models together with imitation and expert form a block of problem-oriented models aimed at finding the best developer (entrepreneurial) solutions and providing for their subsequent implementation [1].

The principle of decision optimization is quite common in the theory of management, planning, forecasting in construction activities, as well as in design, production, and commercial activities. However, usually its use is usually of a simplified (truncated) form and is associated with the choice of the best available option. The choice of this kind does not meet the optimality condition, it corresponds to the so-called rationality condition, when the range of options under consideration is limited, and the best option may be outside of it.

The difference between simulation and optimization models of management is manifested only in the methods of their construction (simulation models provide for the reproduction of the process flow, optimization models – the use of analytical methods).

The property of optimality is also manifested in the variation of the modeling process. Variance (variant method, variant approach) is the process of developing preliminary drafts of a model, according to which the appropriate managers decide.

Proposals that form the basis of a management decision should always contain a number of options – different directions of action to achieve the goal, among which the decision maker can choose. No alternative proposal is not actually a well thought-out recommendations, as an ultimatum. [2]. For example, the studies of the authors [3–7] on optimizing the parameters of fixing the soil massifs around deep pits and under the lower end of the pile foundations during the construction of the zero cycle were carried out as a result of an integrated approach to optimal design using mathematical and physical modeling, as well as observation and carrying out technical examinations of the facilities in operation, which allowed builders, designers and experts to choose the most efficient technology.

An example of optimizing the consolidation of soils and foundations

The choice of the method of fixing and the solution for injection hardening is based on the permeability characteristics of the soil massif. The properties of the injection solutions, as a rule, are regulated by the ratio of the initial components by the introduction of active mineral and chemical additives. The national standard SS NOSTROY 2.3.18-2011 "Strengthening of soil injection methods in construction" in each case, when injection solutions are appointed after conducting laboratory studies to strengthen the soil and in production conditions. In general, plasticizing agents are surface-active substances and, by the nature of their action, they distinguish between hydrophilic-plasticizing and hydrophobic-plasticizing additives that can increase mobility, the degree of interaction with other reagents, and increase the strength of a fixed array of soil. However, despite the widespread use of physicochemical methods of fixing soils in construction, the use of chemical and mineral additives, plasticizers in injection solutions has not yet been fully investigated, and scientists have different opinions on their use. So A.I. Churakov in his work [11] wrote in 1976 about the experimental studies conducted at the All-Russian Research Institute of Hydraulic Engineering named after B. Ye. Vedeneva, who showed that the use of cement-colloidal plasticized solutions with the use of additives of hydrophilic and hydrophobic types when administered together had a stronger plasticizing effect when fixing not only coarse, but also fine sand. In the experiments on the cementation of coarse sand with a filtration coefficient of 100 to 250 m / day, pure cement mortars with plasticizing agents of the hydrophobic type were used to facilitate the penetration of the solution into the pores of the soil.

In the modern standard of work organization in the construction of service stations. Nostroy 2.3.18-2011 set the basic requirements for the design and production of soil reinforcement by injection methods in construction, a flow chart of soil consolidation through cuff columns using cement-bentonite solution, the binding agent “Microdur” and plasticizer C-3 is presented, however, there are no specific recommendations on their use.

Additives of various kinds in the injecting composition allow:

- penetrate deeply into the pores of the soil and cavities of concrete structures with minimal forced effects;
- quickly harden, forming a solid array of soil (for example, after 48 hours microdur has 60–80 % of the final strength);
- create a durable, effective barrier to groundwater;
- freezing at elevated or negative temperatures.

In this regard, the author in this work was set the goal – to explore the effectiveness of the use of modern additives in low-viscosity and mobile chemical compounds to strengthen the soil under the foundation. To achieve this goal, the following tasks were solved:

- evaluation of the market of existing modern classifying additives introduced in building mixtures and mortars, studying their properties and compositions;
- identification of the most frequently used methods and technologies for injection of chemical solutions under foundations with rational technological and economic indicators;

• carry out laboratory tests on soil consolidation under the lower end of the pile with the use of various low-viscosity solutions without additives and with their use;

• perform statistical processing of the obtained experimental data;

• develop some recommendations for the implementation and their use for use in low-viscosity solutions of the most effective additives.

The use of physico-chemical methods of injecting injection solutions is the most effective way to increase the bearing capacity of existing or newly built foundations, especially deep foundations, when building on weak soils with simultaneous end-broadening equipment under the lower end of the pile [16–18].

As part of this goal, experimental studies were conducted in the laboratory "Construction Mechanization" of the SARI AR HE «Astrakhan State University of Architecture and Civil Engineering» for injecting various low-viscosity chemical solutions under the lower end of the pile. In the experiments, the change in strength of the hardened soil was investigated, depending on the type of physicochemical method and the composition of the injecting solution. The experiments used traditional methods of cementation, silicatization and bituminization.

In construction, cementing, cement-sandy or cement-clay mortar is injected into the ground through cementation in the injectors and the method is used to anchor sandy coarse-grained soils and fractured rocks. For silicatization, the main material is liquid glass - a colloidal solution of sodium silicate, which, in the process of interaction with the ground and a solution of potassium chloride, forms a hydrogel of silicic acid. Soil silication is subdivided into one solution, two solution, gas and electro silicate. Thus, the plasticizer C-3 is quite suitable for the grouting of the soil under the lower end of the pile, which will sufficiently facilitate the injection of the cement mixture with the W / C ratio of more than 0.8. The C-3 plasticizer in the experiments was introduced into the cement mortar in the amount of 0.3–1 % dry matter relative to the weight of the cement.

An example of optimizing the construction of low-rise buildings

In 2011, on the construction site of Astrakhan, located on Amurskaya Street, by the construction company INVEST-STROY, a method of anchoring a weak foundation, cementation using chemical additives, was used to erect a pile foundation of a transformer and electrical substation on subsiding soils. The author of the studies calculated the optimum water-cement ratio, the injection pressure of the solution, the ground fixing radius under the lower end of the pile and the cement mortar consumption per 1 m^3 of reinforced soil volume, as well as recommendations for implementation, as evidenced by the act of completed work.

In the optimization design they will involve the following main stages in the implementation of the investment and construction project: preliminary; stage of preparation of administrative documents; the stage of development of initial permits, obtaining technical specifications; conclusion of a short-term land lease agreement, development and approval of a project, obtaining a building permit; the stage of tendering, the conclusion of a general contract; construction, technical supervision; acceptance and commissioning of the completed project.

Also speaking about building construction projects, it should be noted that the final performance indicator will depend on such factors as the macroeconomic situation and business activity in the country. Most of the economic sphere can always reorient on export activities. For example, agriculture, metallurgy, production of goods and others. However, real estate cannot be physically moved to another country, as a result, the macroeconomic situation in the country affects the efficiency of managing the competitiveness of development enterprises. In recent years, Russia has witnessed a crisis associated with lower energy prices, corruption, and an ineffective system for resolving disputes through legal proceedings. This leads to a lack of opportunities for stable economic development in the long term. In such conditions, we can expect the containment of the development process of domestic enterprises engaged in real estate development or redevelopment.

Another feature of the work in the implementation of real estate development projects is the extremely negative impact of inaccuracies in the legislation, the corruption of the judicial system, and other legal problems. As a result, the substantial value of real estate objects leads to the possibility of conflicts on property issues. A raider seizure of property in a criminal way has already become a thing of the past, but new schemes have emerged, for example, lending or buying debts of a company of interest from lenders in order to sell its assets.

Taking into account the existing features, it is necessary to use tools that will improve the efficiency of managing the competitiveness of enterprises operating in the field of development. To level or reduce currency risk, use currency hedging tools. This includes not only financial instruments of the stock market, for example, various futures and forwards, the value of which is tied to the underlying asset "US dollar". You can use other tools available for domestic enterprises.

For example, the strategy of quickly investing free cash in fixed assets that the company plans to purchase will also be a measure that will reduce currency risk. At the planning stage, the company generates a forecast of all fixed assets, machinery, equipment, trucks, equipment. This forecast can be used at the initial stage by investing all the financial resources received that will not be used as working capital.

As for the problems of crisis processes that have been observed in Russia in recent years, as well as the current slow growth of gross domestic product, then for a company that works in the field of devel-

opment, the orientation towards projects in the lower price segment will be optimal. This means that if an enterprise that currently owns real estate plans to upgrade the class of such real estate in order to receive a higher rental rate, then this issue should be carefully considered. Most likely, low business activity will lead to the fact that the return on such a project will be extremely low or even negative.

Considering the significant problems in the legal field for domestic enterprises investing in the development of real estate projects, it is extremely important to build a clear management scheme that can take into account not only the specifics of the business, but also the agreement of the owners. Particular attention should be paid to the elaboration of internal documentation, since their contradiction to the law and the lack of proper regulation of various corporate aspects make it easier for raiders to seize the assets of an enterprise. All real estate property of an enterprise must be legally registered and situations where property has not been properly registered for a long time should not be allowed.

Attention should be paid to the following circumstance. Currently, a significant part of development enterprises attracts borrowed resources, and therefore it is important to keep track of debt obligations and avoid late payments, since the lender may deliberately bring the company to bankruptcy and get the right to dispose of its assets on perfectly legal grounds. Of course, all these measures will not allow solve the relevant problems, but their implementation will help minimize the risks of the development enterprise.

Significant problems that impede the development of development enterprises should recognize the influence of the currency factor, dependence on the macroeconomic state of the state, insufficient legislative measures to ensure the protection of property owners.

To solve the above problems and ensure high competitiveness in the long term, it is necessary to use currency risk hedging tools, build a clear enterprise management scheme, track debt obligations, register ownership of real estate under Russian law, and take into account the lowest price based on the situation in the country segment in the implementation of development projects.

Summary

Analysis of practical examples of optimization in the implementation of construction projects showed the following most effective measures:

- reducing the estimated cost of the investment and construction project due to new structural and technological solutions, energy-efficient and material aspects aimed at reducing the cost of resources, without reducing its strength characteristics;
- correct personnel policy, consisting in adjusting the number of certain categories of employees, clarifying job descriptions and subdivisions regulations in order to transfer some functions and jobs from one position to another, proper use of working time and qualification of employees, uniform loading of workers during the working day, week, months;
- optimization of the use of transport (transport task), due to the rationalization of the formation of routes for the delivery of building materials, structures, semi-finished products, etc. [8, 9].

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