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"Methodology of schedule planning of flow-line construction on the initial stage of technical-economic substantiation of capital investments"

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Content

Introduction

The situation in the construction industry of the Republic of Uzbekistan develops dynamically. Modern market economy as demonstrated of new trends makes fundamentally different demands on organizational and technological preparation of the construction industry. The main task of the manufacturing is to prepare for the construction of complex buildings, structures, or the whole complex.

Significant construction, which presupposed and continue to be aim at the erection of entire complexes, including industrial and social objects, determined the rapid development of the industry over the years of independence. An important step in this direction, no doubt, was the implementation of the state target program of construction in areas such as individual housing and complex construction. [3]

In the practice of designing scheduling planning is acceptable to present it in the form of assimilation of capital investments (as part of POC) and the production of works (as part of PICO). In the archive of the project evidence base of calculations not preserved, which allows monitoring the results of formation graphs. As the analysis shows, it is due to the *lack of detailed enough elaborated measures, calculation rules and criteria for comparison of the results with the requirements of the standards, and the lack of evidence-based methods.* Obviously, for this reason, resulting in the definition of the duration of the construction of the norm "СНиП 1-04.03-85*", backlog of construction standards of in the projects the organization of the construction is not mentioned. In the reference manual [15], developed by «ЦНИИОМТП[1]» to implement the «СНиП 1.04.03-85[2]», also no requirements, on the need backlog of construction standards. There is a paradoxical situation - the *norm is, but it is not supported methodically compliance.* Therefore, in the practice of engineering construction organization schedules strictly justified only in terms of the duration of the

[1] Centre of the scientific studies to organizations, mechanizations, technologies and building production.

[2] Given СНиП is enclosed in list of the rates, recommended «Госкомархитектстрой РУз» to use.

construction and *the graph of capital investments, which made, without compliance of backlog norms.*

Compliance with the rules is particularly important groundwork for terms of satisfying the requirements «110 Regulation of the Cabinet Ministry of the Republic of Uzbekistan» [4] by term technical-economic substantiation of innovative projects, which provide the need to comply with international rules, and, finally, it is important to meet customer and the contractor's interests. It is also important for the series of arranging whole system of control stages of construction work in the construction of and objects are able to compete in the market for construction services. Cost of the process and return on investment depends on the software reasonably justified costs of labor, resources and money.

Theme of thesis and actuality based on the fact, that resources and timing of the proposed implementation of the project are the main cause of success or failure of its construction. Therefore, already at the stage of technological preparation of the construction is necessary to take adequate organizational-technical solutions of successful, ensuring the achievement of the project with reference to time the onset of the project's key events. Thus, it is one of the determining factors in the assessment of the project's success. In addition, considerable importance is the development of resources, closely linked, primarily, with the capital investments.

Consequently one of the main problems of technological preparation of building a schedule, which developed in accordance «ШНК 3.01.01-03». More details on this issue is described in the reference manual to the «СНиП 3.01.01-85», "Organization of building production" developed by "ЦНИИОМТП" «Elaboration projects of construction organization and work production projects for industrial buildings» [15]. «СНиП 3.01.01-85» approved by «ШНК 3.01.01-03» question development schedule of the complex of buildings and structures is still open due to lack of organic development of its methods, in particular with regard to the existing backlog norms in the construction standards. ШНК and referred to the handbook on the issue of the development schedule results in only

its form, limited to the general requirements for its content, which is before presepose actuality of the theme of this research.

Object of the research is a calendar plan to build a complex of buildings and structures at the stage of feasibility study of the project of the complex of buildings and structures in the system of organizational and technical preparation of building manufacture.

The subject of the study serve on the organizational and technological parameters of the production organization of the construction of buildings and structures, presented in the form of its graph-analytic model, which allows the development of automated schedule of construction in accordance with the requirements of the norms backlog construction.

The purpose of the research is to develop theoretical and methodological provisions of the organizational and technical preparation of construction. At the stage of feasibility study of the project, particularly in leveling techniques and the development schedule of the complex of buildings and structures carried out in-line method and is base relevant of principles resource criteria and time of capital investment, a comprehensive approach, information technology and interfaces.

In accordance with putted by purpose ***in thesis solved following problems:***

- studied on printed and thesis's source theoretical and methodological approaches and positions to shaping the calendar plan construction complex under its flow organization in Uzbekistan and abroad;

- are revealed and outline factors, defining organizing-technical parameters of the calendar plan flow construction complex;

- is implemented categorization on external and internal civil-technical parameter and degree of their influence upon rational use resource;

- is received earl-analytical model to flow organization construction complex on result of the formalizations object flow on three criteria: purpose of the object; the nature of the development of the flow; the requirements to sequence of the entering object in usage;

- are determined organizing-technical parameters to models, providing development of the plan of the mastering the capital investments in accordance with requirements of the rates;

- is optimized schedule plan flow construction complex;

- is designed program of the automatic development of the schedule plan and is formed recommendations on use in practice of design.

The main issues addressed in the thesis and the working hypothesis consist that through organizational and technological parameters of the graphical-analytical model developed, based on the method of construction organization and requirements placed on the resources - time and development capital investments. It is possible to develop a schedule of the project, based on the resource provision of time continuously and monetary nature, providing and building code requirements.

The extent of the problem scheduling and flow-line construction with left fundamental works of local and foreign scientists in the field of organizational and technological preparation of building production, mainly construction scheduling and ideas developed by them amounted to ***theoretical bases of research.***

For decision of the putted problems in dissertation work are ***used in complex theoretical and empirical methods***, including: in a review of the used methods of scientific analysis, synthesis, the construction of a working hypothesis - hypothetical-deductive, abstraction, idealization, the justification method development schedule plan of graph-analytical model as, information technology. When writing the text of the dissertation has been paid attention to the strict adherence to the dialectical law of pairing (structural and temporary), the correct definition of concepts.

As ***facility of the study*** in thesis are used information, mathematical and language facilities of the study. As a whole, at interpretation диссертационных material was paid attention internal relationship of the logical buildings, escalated use taken grammatical and stylistic locution of the scientific language.

Information and regulatory framework research based on the legal acts of the Republic of Uzbekistan, regulations and guidance documents State Committee on architecture and construction «Госкомархитектстрой»[2] of the Republic of Uzbekistan, articles published in scientific monographs and periodicals, as well as own calculations of dissertation.

About substation elaborate on the methodology of development schedule of the complex flow-line method taking into account the implementation of the requirements, of the rules in the construction backlog norms defines ***theoretical significance.*** Its use as a tool for organizational and technological preparation of building production at the design stage, namely, in the composition of the POC or when signing a contract for services - ***practical significance of the research.***

Scientific novelty of the research determined by the author's development on the reasonableness of theoretical and methodical positions and practical recommendations for generating automated mechanism of development schedule of the project, founded on resource provision of time and monetary nature, which provides building code requirements.

Thesis presented in accordance with the requirements for registration of master's theses and contains 85 pages of text, including 6 tables, 14 figures, 5 pages of references used by local and foreign literature, and consists of an introduction, overview, the main part of the conclusions of the chapter, as well as the conclusion and application on 8 pages.

I Chapter. PRIORITY APPROACHES TO ORGANIZATION OF CONSTRUCTION OF THE COMPLEX OF BUILDINGS AND STRUCTURES

1.1. Theoretical foundations of scheduling planning of flow line organization of construction of the complex in Uzbekistan and abroad

As demonstrated local and international experience [5, 7], the effectiveness of the process of construction of buildings and structures is not feasible without following the introduction of the two fundamental principles of the construction work. As a rule, they reduced to the following important factors:

1. Use of meticulously-designed and upgraded technology
2. Effective organization of all phases of work on construction sites.

It should be remember about the inalienable x derivatives of the process, including not only the choice of effective and avant-garde techniques, but also the use of advanced technological means of production.

With about memo examines the organization of construction of building complexes and structures expressed in the systematic implementation of the various stages of the whole range of activities. The complex includes efforts to create conditions for the implementation of preparatory works and maintenance building, meets all required standards. Delivery and commissioning of facilities, in a strictly scheduled are the final stages of construction operations.

In this regard, it is clear that the rational planning of the construction process requires special attention. This procedure serves as an integral link in the chain of activities related to the coordination of different types of work in time and in space. Steps involving the implementation and coordination of the distribution of material resources are also important components of *the entire construction-planning period.*

Manage complex is expressed in a consistent building up of the whole system to address all phases of construction works for the purpose of construction of quality projects capable of competing in the market for construction services.

Cost of the process and return on investment includes the provision of reasonable labor costs, resources and money.

According to experts [3, 6, 7], in the conditions of successful development of a competitive environment and a market economy organizational and technological derivative of the construction process is not possible without modern and advanced technologies. They must meet the highest requirements and the growing consumer demand for the construction of the complex in its structure and technological parameters like buildings, and ultra-modernized complexes.

Large scale construction, which provided and continues to be aim at the construction of entire complexes, including industrial and social objects and determined the rapid development of the industry over the years of independence. An important step in this direction, no doubt, was the implementation of the target state program of construction in areas such as personal property, and complex construction. The final results of which must be laid long before the construction site, at the stage of organizational and technological preparation of construction, when, in particular, the development of the calendar plan to build as part of the project construction organization, which defines the queue commissioning of the complex, the distribution of capital investments for the projects and in time.

In Republic of the Uzbekistan, many design institutes successfully function of PIC department [2,3,4] (organization construction project) - aimed at the development of projects involving the application of avant-garde and progressive methods of construction, development and use of advanced technological processes to ensure high quality of construction. It also carried out a rational distribution of construction embodied in the calendar plan, the construction master plan with the provided calculations of resource consumption.

Scheduling should cover the completely complex process of construction of its initial derivative to the final stage of being, as rightly emphasize the leading local and foreign experts[2,3,4,5,6], an integral part of the organization of the construction complex of buildings and structures at all stages and levels.

Adequate construction progress can be achieve only if the creation of the most favorable construction creative environment adapted to the construction of a particular building project. This approach usually involves primarily the development of the Inalienable making up their schedule and precisely in advance of deliberate steps, providing precisely calculated sequence, according to which the work will carried out. This kind of order of the can be detailed to set forth in the accompanying explanatory memorandum or related documents.

In the case of the development of high-quality schedule to specify as much as possible accurate and specific information, including the details to avoid underestimation of the required resources, and, consequently , and the inconsistency of implementing acts, interruptions in their work, delaying the timing of and as a result the output of the budgetary framework of the planned construction time.

Considering the timing of construction, it should be note that there are certain standards that define the duration of the construction. In each country, as a rule, are the rules enshrined in the specially designed instruments. For example, in Uzbekistan and Russia - a «СНиП 1.04.03-85* Standards of construction duration …»[3], in the United States - " Construction Building Code "[4], in the UK - “UK Construction Norms”[5].

In the case of increasing the size and complexity of projects under construction, types and power industries and in certain individual cases, the duration of the construction can be differentiate and planned in some contrast to the normative and usually more often in the direction of tightening deadlines. This occurs only in those cases, when it dictated by the needs of production and special terms and conditions, including economic, geopolitical, and others.

In order to achieve significant and effective results in the construction of buildings and structures developed and widely used a variety of methods of

[3] СНиП 3.01.01-85 «Организация строительного производства»

[4] Kerzner, H. Project management: a system approach to planning, scheduling and controlling. 6th ed. - John Wiley & Sons, Inc., 1998 - 1180 p., ISBN: 0-471-28835-7.

[5] www.Planningportal.co.uk

construction organization. Among them should be allocate most commonly used in practice:

1. consequence;
2. parralel;
3. flow-line:

Among them are particularly popular and are more in demand in-line method of construction organization, which is widely, used in the US, the UK, Russia and so in Uzbekistan. This degree of recognition of the people in the field is not accidental. This method is consider more efficient in terms of performance, which is achieved due to the distribution in accordance with the qualification and specialization of artists performing a particular job for each stream, combining and combining the processes of production.

Most experts are often unite in the opinion that the use of in-line method improves the efficiency of construction companies because labor productivity is increasing. In the case, when the same work done for a long time, this law is the basis of industrial activity of any scale.

The absolute increase in performance when using the line method is natural due to the following factors in:

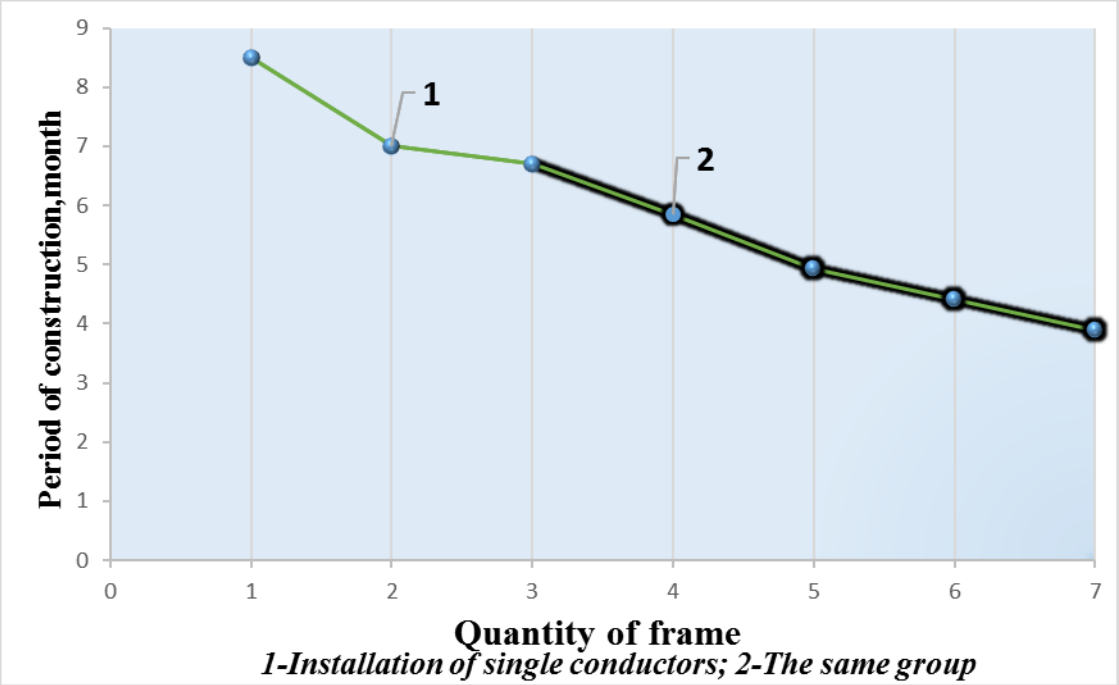
1. improvement labor skill at time;
2. advancement of technologies of production;
3. upgrading and modernization of machinery and equipment ;
4. increasing the flexibility and adaptability of building design solutions, under the influence of builders feedback effect on designers ;
5. improvement of organizational skills in;
6. forming efficiency of the construction of the conveyor ;
7. union and rallying together all the construction units:

The above-mentioned advantages of in-line method shows domestic and foreign building structure, carrying out construction of complex projects on a production basis. Referring to a well-known example, when all of these features appeared during quite time-consuming construction of 16-storey prefabricated

houses and trust "Mosstroy-3" in Russia. In the in-line construction of houses, it was and put s a number of specialized teams [6].

It turned out that because of development of new practices and types of work teams, who worked in the original composition, that is, without undergoing change, with time, have improved their employment skills. All this affected the duration of the construction. If the first house built of 8.5 months, the third house for 6.7 months.

As demonstrated, below chart showing the dependence of duration on the developing trend of sharp decline in construction time.



1-Installation of single conductors; 2-The same group

Fig.1- The dependence of duration of the construction of prefabricated buildings

Evidence of successful rapid response to the appearance on the market of modernized technology with means is the following example. Mounting of conductor set to 16 columns, entered into active use and obtained instead of single conductors, clamps, ladders, struts, and other disparate devices allowed to reduce labor costs and crane time installation and alignment elements mounted almost doubled at high precision mounting. The lack of the same in welders has been eliminate due to the mastery of skills to work with semi-automatic welding joints in the bathrooms.

Duration of construction reducing familiarize as the development of new tools. Thus, it was achieved additional benefits and assured cost recovery even at very considerable cost of the conductor group, which was acquire through specialized teams and long-term flow.

Given the fact that the use of in-line method is not completely new, it began to popularize in the 50-ies of XX century, in recent decades, it has been greatly improve and to some extent modern approaches within line method characterized by greater mobility and efficiency. This is explained by the fact that scientists and engineers with theoretical and practical designs were developed, which allowed gradually mustache of improve and increase efficiency of this method.

As another quite remarkable example of the introduction and active use of flow-line, methods can serve the development of housing estates in the United States. As noted by historians construction, appeared after the war topical need to solve the housing problem has arisen for the return of a large number of soldiers [5, 6, 7].

In order to create the necessary conditions for a life of veterans known for its developments in the field of Bill Levitt [7].He showed vision and courage, the developed technology applications and embedded in construction principles of operation of the conveyor during vehicle assembly. As a result, the construction firm in "Leviticus and Sons" reached a record of the results: in the first year of construction was constructed about 2 thousand houses and within four years -17.5 thousand according to Leviticus [5] labor and materials were sent to the stationary outer assembly line, instead of the assembly inside the factory.

In this regard, it has been developed and provided for the implementation of 27 separate operations [6] carried out by highly specialized on a different object.
Assembles easily frame house at the same time succeeded roofers, tillers, painters. Narrow specialization supposed strict separation and distribution not only by type of activity, but also on the specific characteristics even within the specialization: were for example, links, color only one color, and links, its glory to another.

At the same time, there was a clear day norm providing the volume and direction of the works, in particular day-to-day job for one business could be washing machine in the house. Thus, was started construction of one-stored houses an area not exceeding 70 square meters and used as camping is not only accessible from an economic standpoint, but also was the state of affairs , in which the construction of bypasses at first unskilled labor. Which is the beginning of the construction of the following buildings has acquired the necessary skills and was able to have a qualitatively carry out the construction work. Thus, due to the massive use of in-line method, as statistics show that time, the majority of construction firms and companies, is attached in-line construction technology, everywhere was build 1.25 million. Subsequently, for kind of village got the name "Levitt towns" cities of the Levites.

The above-described quite good experience, which brought significant results, was use in many building structures and abroad. In this case, it is necessary to talk about the effectiveness of factors like construction adaptability and builders to improve skills. These factors are not less effectively applied and in the construction industry. In particular, the quality and the rapid pace of construction of such buildings as the “Stoilensky” [6] was to be provided for, substantial way, by improving the design decisions.

In the first place, as the experts, it was provide with a smooth transition to the prefabricated. Earlier structures traditionally in progress were in the monolith. Thus, visible results have been achieved place was built more than two years, and the subsequent uniformly introduced throughout the year.

Such practices labor costs, duration, and therefore the cost. In addition, it is necessary to take into account and no less important factors, including the improvement of labor skills, the introduction and use of modern equipment and tooling to ensure uninterrupted supply. When at warns practice, even a small break leading to the fact that the performance indicators more reduced. Understandably, then it takes time to achieve the previously achieved levels.

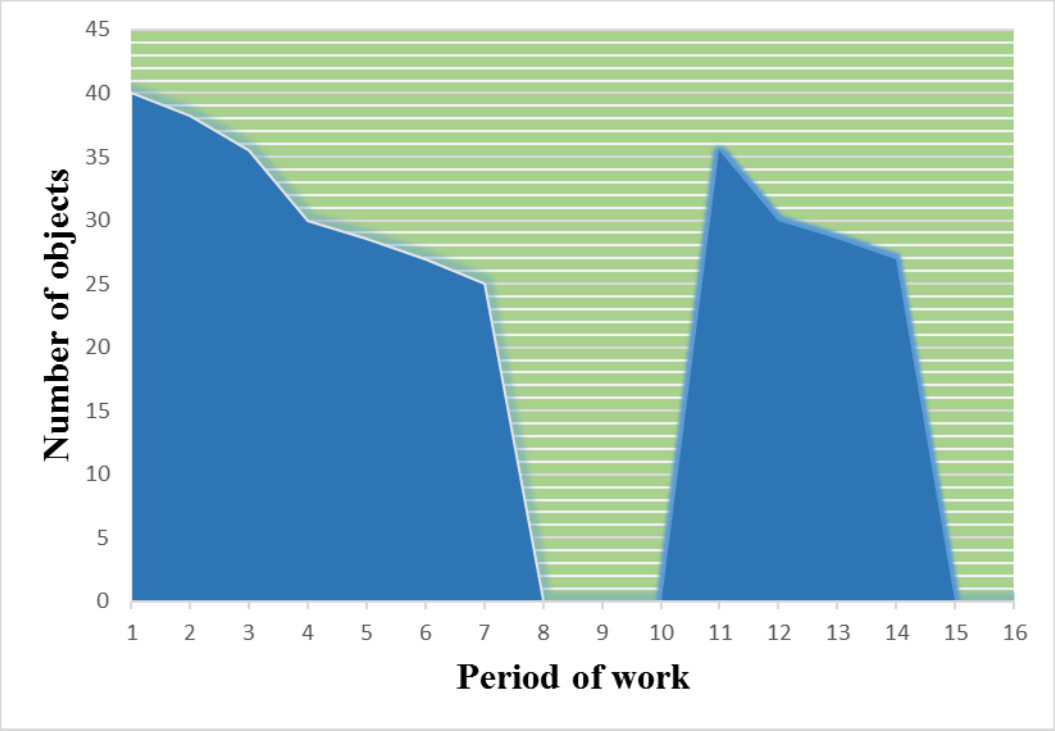


Fig.2 - Effect of flow interruption in operations on the effectiveness of the organization.

In this connection, examples considered allow to conclude that in smiling methods of promoting:

1. compressed deadlines construction and commissioning of construction objects into operation;
2. acceleration of the process of the appropriation design capacity;
3. with development methods of application of fixed assets and working capital:

A comprehensive economic effect of the introduction line method achieved at the expense of early entry facilities; reduction of conditional permanent part of overhead costs due to the reduction of the total duration of the construction, and improve it the use of fixed assets and working capital.

An important, as the experience of building structures, it is also the factor that n cities account for major returns by using in-line method of construction is achieved in the construction of arrays and industrial complexes.

It should be note that flow organization works is the relaxed and natural configuration for all professionals involved in the construction work. This is because the volume of work is reduced by 25 ... 40%. Moreover, if you turn to the inline construction of large industrial facilities is a clear and intelligent organization of work to reduce the volume of work in the 15 ... 20%, and the cost - 2 ... 3%. [5, 6, 7]

However, it must be remembered that of flow-line construction of industrial facilities require significant efforts in the process flow planning, so in the course of its implementation. This raises the legitimate question: what caused that to the second level and designs of industrial structures and buildings the complexity of coordinating the flow of work, organization of material and technical supply and completing.

It is well known that flow-line of total process of construction is divided into derivatives. About other crews perform work on laying the foundation, floors and coatings. These units size move from site to site work zone, and on each of them in parallel are implemented construction works in accordance with their technological procedures. At the same time, completing the work in the allotted it work zone, team or unit of preparing a site for the next cycle of works other specialized brigade.

With prescribed manner makes it possible to maximally combined work in works. Therefore, in this scenario, the work is done without interruption and, if necessary, in parallel. Experience shows that the transition to a "stream" construction time reduced to an average of 20%, labor productivity increased by 8-10%.

Due to the basic character flow-line method, namely the organization of a coherent, continuous and rhythmic construction works certainly reached the level at which the efficient use of material and labor resources, in regular intervals are planned volumes of construction products, the profitability of construction increases.

1.2. Methodological studies and approaches to the formation of a schedule plan for the organization of the complex by flow-line.

Nowadays, construction of industrial complexes meeting modern requirements of construction and operation, are with aggregate of various objects of all kinds of industrial, energy, first, vehicle, auxiliary, housing and cultural and community purpose [6]. It well known that their construction takes place with the active participation of many organizations, with mandatory the use of large-sized construction machinery.

As order of the building construction of objects contained in the complex directly, so and the distribution of them investment and working personnel may vary. For this reason, it is assumed that the efficient planning of the construction of industrial particular complexes on the complexity and sketchy equal to the maximum complexity for the presence of variations of the technical and economic problem.

Among the modern trends, characterizing the building services market is the need for improvement and development of general contracting management system, which according to experts is having trouble today. The difficulties are generally associated with the fact that in number of implementing organizations at subcontracting method of construction may be a few tens.

In such circumstances, requires coordination and coherence of the activities of all the performers. The main stumbling stone lies in the fact that usually organizations involved in this building are not linked administrative ties and cooperate within the framework of contractual obligations. In all likelihood, which a well designed for the future, well-designed and clearly prescribed contractual obligations are a key success factor. At the same time, the establishment and effective functioning of a coordination center and dramatically simplify the process of construction.

Organizational and technological design of the main documents in the field of construction organization, which displays the duration of the construction, distribution investments to chosen method of organization of the construction

carried out in a project document governing the need of labor, construction machinery, material and technical resources, vehicles, temporary buildings and structures.

Building organizational-technologic design includes several stages of the project:

The first stage - the need to study the basic characteristics of the future facility:

- General plan;
- Report on the geotechnical investigations;
- Architectural and engineering sections, estimate calculation;
- Determine the method of construction organization;
- To reveal the duration of the construction of the facility;
- The calculation of the estimated allocate investments for the entire period of construction.

The second phase - the development of the project of construction organization (POC), [15, 16] that is, implementation schedule, planning construction and installation work, supply of technological equipment, etc.

The third phase - the development of the project of works (PICO), and planning certain types of work.

The duration of the facility may include prescriptive or normative term.

Policy terms may establish public administration bodies, as well as the customer.

Normative period - to be determined in accordance with “СНиП 1.04.03-85”, which revealed the duration of construction, which is taken into account during the construction of the object and in the timetable.

Calculation of the duration of the construction of the T_2 can be find in the normative document СНиП 1.04.03-85* «Standards of construction duration and grazed in the construction of enterprises, buildings and structures", [15] or calculated in accordance with this normative document, according to the formula:

$$T_{2\ total} = T_1 x K_1 \times K_2 \times K_3$$

The main data are:

- Construction period T_1 is determined according to «СНиП» and by linear interpolation, depending on the type and the total area of the object;

- The preparatory period - Тп months.

$К_1$ - coefficient of seismicity;

$К_2$ - coefficient combined with the production of works in shifts;

$К_3$ - coefficient, on tightness;

It is in accordance with existing rules «ШНК 3.01.01-03» « Organization of building production» recommended by powers of the center and to provide general contractor. Thus, in the case of the selection of its solutions are rigorously to perform all the participants of construction with different departmental affiliation spine and form property [1, 6] (JSC, JSC, LLC, etc.). However, it should be note that although the n like these are mode control established in most cases and justified in most settings, it is not mandatory.

Practice shows that often organizations exercising is, the role of the general contractor not directly involved in the construction work. This has a negative e impact negatively reflected on the quality of norm the preparation and management of organizational and technological documentation. Because interest of the general contractor and connected so as soon as possible in the design of another kind will be developed organizational and technological documents.

It seems undesirable effects is not exclude, as the issue of quality of organizational and technological activity fades into the background. In this regard, on some major projects, lead role assumes the customer; company not having in it is the number of relevant experts from outside. All this, in turn, increases not only the deadlines, but as a result the cost of organizational and technological documentation. It is understandable that in such a scenario, the organizational activities of realization control construction is difficult. Among the adverse factors, experts distinguish lack of facilities and trained workers in the construction companies.

Taking into account the increasing requirements to the functioning of modern industrial enterprises today are increasingly used methods of strategic management. The advantage of this method is that it provides for account of emerging risks, including sudden and abrupt changes in weather conditions, violation of technologies and the tightening of competition as an important element of the modern economy, in such cases, rapid response and the development of more effective methods of management.

Produced about organization mechanisms increasingly reflect and contribute to the identification of emerging issues to develop the necessary solutions. Most experts, in the field of construction is considered suitable development of flexible organizational structures capable of promptly and effectively respond to emerging changes and needs. The flexibility means the ability of securing of most rational connections and interaction between various management levels. In this regard, the experts determined the following criteria:

1) the nearest way from the source and the command to the control object;
2) the required number of steps, and links;
3) minimum flash the number of "inputs" and "outputs" of each link;
4) efficient participation of each link in the governance process;
5) the optimal composition of the types of work management;
6) the inadmissibility of duplication.

Increasingly used today, taking into account the criteria mentioned, way solution seems transition to SIS engineering construction management topic. Among the reasons for this choice and transition from subcontracting to engineering management scheme is smiling stuff-listed reasons:

1) noticeable in difficult s construction management tasks;
2) increased responsibility ;
3) the creation of a single center of decision-administrative, technical, technological and organizational solutions ;

4) more careful delineation of spheres of competence ;

5) forming a simple but reliable circuit flow of information.

Thus, the operation of the organizer construction as a single entity may provide a likely effective solution to the problems that arise directly at the construction site. Moreover, in an organizer of the construction can act as specialized engineering company divisions to manage the investment and construction projects, as well as stand-alone engineering company engaged in the duties of building organizer. Experience shows that the involvement of engineering departments is due to the necessity of solving technological, organizational, economic and managerial tasks.

The use of engineering control scheme on the construction site, based on the operation of the construction of the organizer, you can go to the cluster model building production. Two types of clusters can be distinguish the main-construction and service logistics. Depending on the nature, scale construction industry, as well as other conditions specific logistics cluster object can be part of building a cluster, or take a separate place on the construction site.

It seems reasonable to give the following definition of the above-mentioned structural elements.

Finding the best way to implement the project on time with the most efficient use of resources are key factors for success, while growing with each passing day competition guarantor of the survival of the organization. Engineering construction management of system scheme based on the functioning of the construction of the organizer as a separate entity, as well as possible the requirements of modern economic realities. The transition to the cluster model of construction, enables organizations to carry out activities with minimal costs, with considerable territorial remoteness of objects from each other

In this connection, a flow method divided into the construction of these species.[1,16]

1) Batch flow - technologically and organizationally indivisible homogeneous process characterized by constant composition of performers and consistently executing on different work zone. Products and services for the stream made in certain types of work.

2) Specialized flow - aggregate fractions. Products specializing of flow can be either completed jobs, or separate parts of the building.

3) Object Stream - association. Specialized streams, its products are individual objects or their parts.

4) Integrated flow - connection of specialized and object flows. Its products are residential areas and neighborhoods.

In developing, the schedule provides for mainstreaming of work, ie, alignment and displacement of each subsequent object relative to the preceding with the possibility of moving from one brigade of the object stream to another. Rightly noted that these kinds of complex flows should also take account of calendar planning:

1) Combined - CCP, which is complete with guarding structure of object streams, but is characterized by idle crews;

2) Compact - the CPU, providing a minimum total duration of the set of work, avoiding downtime and resource fronts.

3) Aggregated, providing no downtime during the transition teams from one stream to another object, but characterized by the increase of time fronts downtime and increase the duration of the construction of each individual stream.

Complex flows can be optimize by means of changing the sequence of input flows into a complex object and by designating additional similar teams.

Total construction time are determined for individual objects according to the norms «ШНК 3.01.01-03 "Organization construction industry"»[16].

The consolidated calendar plan specified objects and volumes financing for each quarter. For example, for an enlarged figure taken 1 billion sums estimated cost.

Classification of CP below to show a variety of schedules:

- ✓ construction of the complex;
- ✓ construction of individual objects, developed in the framework of the project and the works;
- ✓ construction of individual construction processes developed as part of PICO and routings;

CP to a separate quarter;

- ✓ on-operative party (month, decade, week);
- ✓ installation of transport schedules.

Thus, from the previously mentioned it follows that:

By schedule-planning complex should be carry out within the framework of the project of construction organization (PIC) for determining the timing of construction and the estimated value of the object.

This requires special attention to the design and graphics parts, main component plan, units of measure, which time is a year and a quarter.

1.3. Factors determining the technological parameters of the production schedule of construction organization complex.

Considering how camshaft scheduling of tool distribution building resource organization in space and time. It should be note [1], that this task is always wearing actual character and refers to the main tasks of the organizational and technological design, it is necessary to define the basic requirements that allow its use in modern conditions.

Building organization mainly determined by the need for a particular form of life, in its turn, scheduling as resource allocation tool, has far greater potential. At present, in addition to problems of supply, there is a problem of lack of working capital, which raises the problem of the distribution of financial flows in several directions in order to ensure maximum efficiency of invested funds, as well as fulfillment of contractual obligations, together with uniform loading of the structural production units.

With this, exists a related problem of optimal infestation of financial resources, model resource of investment complexes with waist financing systems. It should be noted that in the absence of centralization, there is a need to apply principles of management to ensure that the interests of all participants of investment and construction activities.

In this context, we see necessity implementation method based on the use of in-line method of building the organization. Implementation of construction to use it the organizer of the construction allows realizing the agreed principle of management throughout the organizational process of the building complex.

We should not forget that flow in the construction of the organization called the method that provides continuous and uniform work of labor collectives of constant composition and thus sustainable use of material and energy resources. It well known that productivity increases dramatically, if the contractor performs the same job for a long time. The growth of the performance is due to the acquisition and improvement of skills, the use of special tools, equipment and tools, reducing unproductive time spent moving from one job to another, etc.

It is quite understandable that this e is the pattern lies at the basis of specialization. Specialization requires maximum dismemberment of any work on the part of the individual process (work processes, operations) requested the implementation of each of the individual performers. Flow method, while maintaining the advantages of the respective series and parallel methods, avoiding their disadvantages.

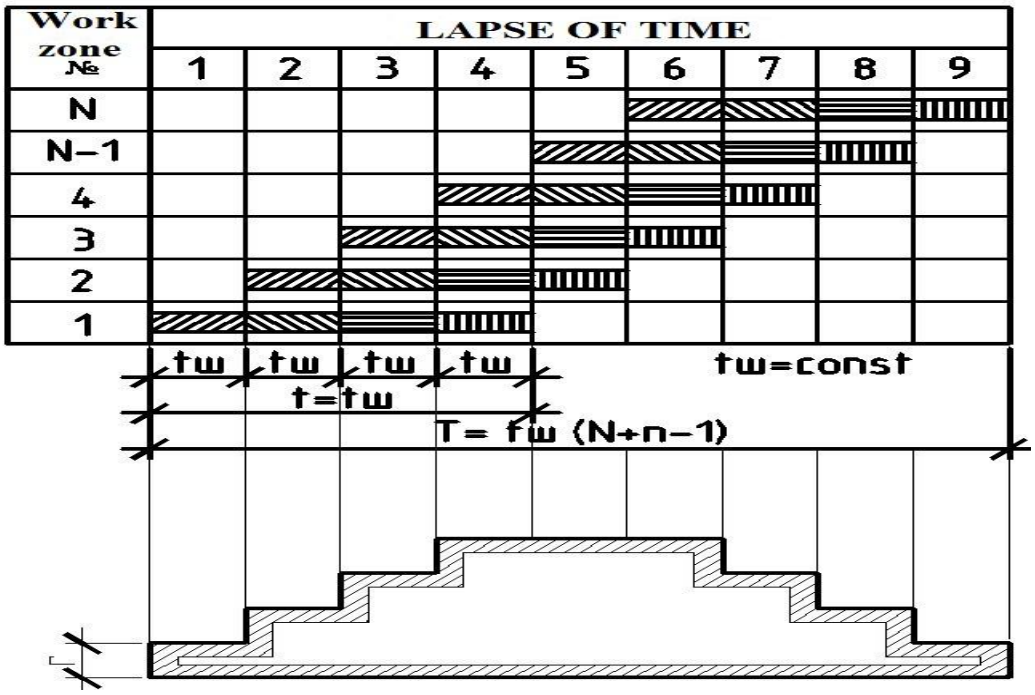


Fig.3 - Using the flow-line of the building complex

As seen from the above the given schedule, etc. When in-line method of work on the construction of each of the objects divided into n processes in the implementation of which, given the same time. In the complex of **N** objects homogeneous processes carried out one after the other and diverse processes in parallel. The duration of the construction of buildings **N** dismembered on the n processes, will be greater than in parallel, but less than the sequential method.

The intensity of resource consumption there will also be more than the sequential method, but less than in parallel. Thus, highlighted the following characteristic is, features in-line method , in particular grinding operation on the components of the processes in accordance with the specialty and qualification of performers; the division of the front work on separate areas to create the most

favorable conditions for the work of individual artists and a maximum combination of processes in time.

Determination of backlog in the construction of e can be found in the «СНиП 1.04.03-85* «Standards of construction duration and grazed in the construction of enterprises, buildings and structures», as well as calculated in accordance with this normative document».

As the rules in norm of work zone of construction, object indicators:

К - readiness of the facility;

В - intermediate input of fixed assets;

W –work zone;

Readiness indicator object **K** is determined by the ratio of the estimated construction cost (the cost of construction and installation work), which must be mastered on the project from the beginning of construction to the end of the *n* -th quarter (month), for a complete budget with cost of the facility and the estimated stand STI construction and installation works.

The interim commissioning of fixed assets **B** defined ratio of fixed assets administered by starting complexes to the total estimated cost of the facility or its queue (the estimated cost of construction and installation work).

Indicator reserve on investment **W** (construction and installation work) determined by the difference between the indices of availability of the facility and an intermediate input in fixed assets.

To determine the performance work zone, objectified by formula coefficient:

$$\delta_{\text{п}} = \frac{\text{Т}_{\text{н}}}{\text{Т}_{\text{р}}} \text{п},$$

where, T_n - the duration of the construction companies in the norm;

T_p - estimated duration based on the binding object to specific conditions;

n - number of quarters during the construction period of the object.

Work zone for capital investments $К'_п$ for the estimated duration of the construction determined by the formula:

$$K'_{п} = K_{п_n} + \frac{(K_{п_{n+1}} - K_{п_n})\alpha_n^3}{m},$$

Where, $K_{п_n}$, $K_{п_{n+1}}$ - Performance reserve on investment (construction and installation work) for the duration of construction, adopted at the rate at the end of the *n* - quarter, which is determined by the serial number of the quarter, corresponding to an integer factor δ_n;

α_n - factor of a fractional part of the ratio δ_n;

m - the number of months in n quarter.

Deductions.

1. Discussed in chapter features and characteristics of the line method allow carefully trace its advantages and disadvantages. Thus, based on the identified criteria, it is possible the most effective use of this information for the development of flexible and efficient schedule.
2. Flow method provides a uniform resource consumption and the rhythm of the finished product (in this example, houses). Flow organization creates in turn favorable conditions for allied organizations. Contractors, factories, suppliers, transport, procurement officials going into detail, it should be note that the organization of the construction of buildings and structures reflected in the systematic implementation of the various stages of the whole range of activities. The complex includes efforts to create conditions for the implementation of preparatory works and maintenance building, meets all required standards. Delivery and commissioning of facilities, in a strictly scheduled are the final stages of construction operations.
3. In this regard, it is clear that the rational planning of the construction process requires special attention. This procedure serves as an integral link in the chain of activities related to the coordination of different types of work in time and in space. Steps involving the implementation and coordination of the distribution of material resources are also important components of the entire construction-planning period.

Manage complex is expressed in a consistent building up of the whole system to address all phases of construction works for the purpose of construction of quality projects capable of competing in the market for construction services. Cost of the process and return on investment includes the provision of reasonable labor costs, resources and money.

According to experts, in the conditions of successful development of a competitive environment and a market economy organizational and technological derivative of the construction process is not possible without modern and

advanced technologies. They must meet the highest requirements and the growing consumer demand for the construction of the complex in its structure and technological parameters like buildings, and ultra-modernized complexes.

In this connection, examples considered allow to conclude that the whole methods of promoting:

1) compressed deadlines construction and putting into operation of construction projects;

2) acceleration of the process of the appropriation design capacity;

3) with developing methods of application of fixed assets and working capital.

A comprehensive economic effect of the introduction line method achieved at the expense of early entry facilities; reduction of conditional permanent part of overhead costs due to the reduction of the total duration of the construction, and improve it use the main production governmental assets and working capital.

Through the main to have five-line method the organization of a coherent, continuous and rhythmic construction works certainly reached the level at which efficiently uses material and human resources, in regular intervals are planned volumes of construction products, increases the profitability of construction. In developing, the schedule provided mainstreaming work, alignment and subsequent displacement of each preceding object relative to the possibility transition teams from one thread to another object. Scheduling of the complex should be carry out within the framework of the project of construction organization (PIC) for determining the timing of construction and the estimated value of the object. This emphasis requires the design and graphics parts, as the main component plan, the units of which are time and year quarter.

II CHAPTER. CHARACTERISTICS OF THE OBJECT, METHODS AND RESEARCH FACILITIES

2.1. Characteristics of the research object

The object of research is the schedule of construction of buildings and structures at the stage of feasibility study of the project of the complex of buildings and structures in the system of organizational and technical preparation of building manufacture.

As an example, taken " Man the Auto-Uzbekistan " - a joint Uzbek-German company for the production of trucks, special vehicles and trailers «MAN» brand. The company was founded [1,3] in August 2009 between the Uzbek company "Uzavtosanoat" and a subsidiary of MAN " MAN Truck is & Bus". The plant is located on the outskirts of the city of Samarkand. The corresponding agreement for the formation of the joint venture was reached on September 4 , 2009 at the residence president The Republic of Uzbekistan .

Construction of the main frame of building for heavy vehicles «MAN AUTO-UZBEKISTAN" in Samarkand region. Government of the Republic of Uzbekistan has issued a decree "On measures for further development of the production of heavy auto transport funds MAN» [3].

Fig.4 - Construction of the main frame of building for heavy vehicles «MAN AUTO-UZBEKISTAN» in Samarkand region.

According to the decree, the customer of the project is "JV MAN Auto-Uzbekistan". General developer and pre-design estimates one to JSC «Uzog`irsanoatloyiha».

2.2 Research methods used in the thesis

Theoretical basis of research made fundamental works of local and foreign scientists in the field of organizational and technological preparation of building production, mainly construction scheduling.

To solve the problems in the thesis use in a complex theoretical and empirical methods[3], including: in a review of the used methods of scientific analysis and synthesis, the construction of a working hypothesis, hypothesis-hypothetical-deductive, abstraction, idealization, the justification method development schedule of graph-analytical modeling and information technology. When writing the text of the dissertation has been paid attention to the strict adherence to the dialectical law of pairing (structural and temporary), the correct definition of the term second, the ascent from simple to complex, consistency and reliability of the results.

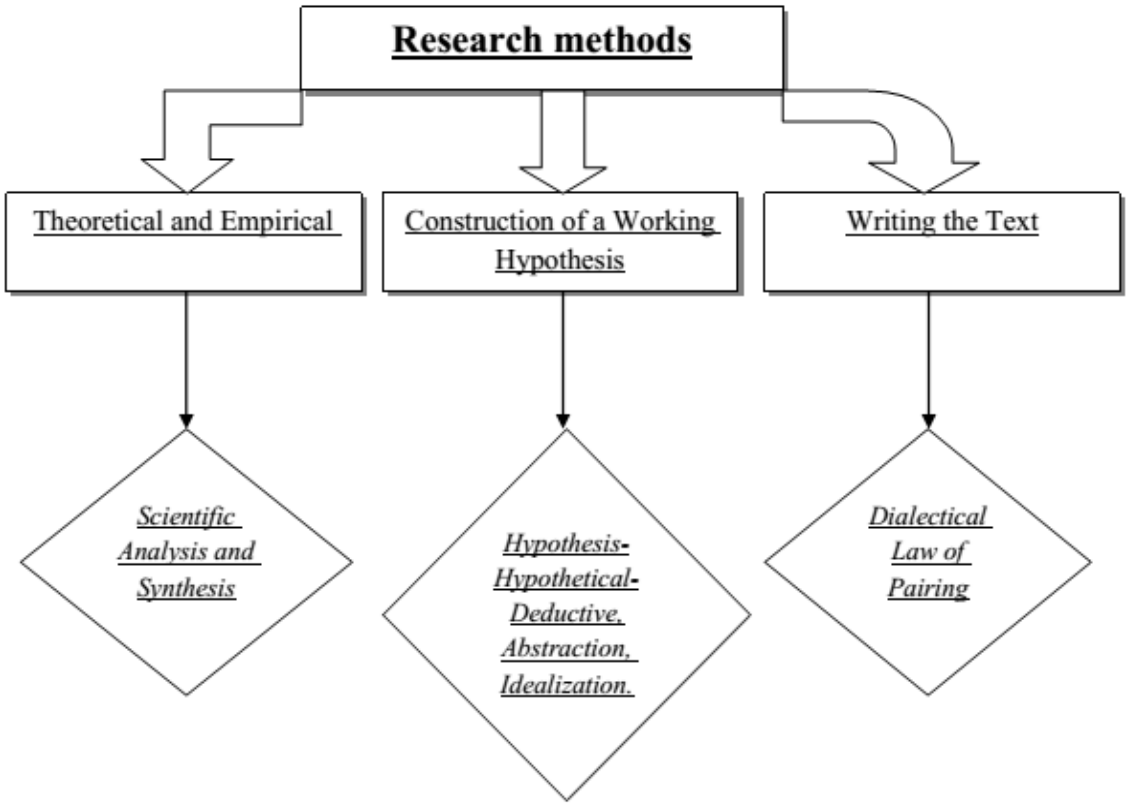


Fig.5 - Research methods used in the thesis

2.3 Means of research used in the thesis

As a means of research in the thesis used the information, math and language research tools. In general, when presenting dissertations materials [3] paid attention to internal communication logic constructions; reinforced using accepted grammatical and stylistic turns of phrase scientific language.

The use of information as technologies, including programming in the language of the Visual Studio[6], implements the algorithm calculations. Which based on graph-analytical model mainstreaming building complex of experiments patterns, and consisting minutes from the main and auxiliary flow and communications construction flow, differing from each other in purpose and nature of the development stream, achieved significant of simplifying and transparency of the research's procedures and contraction development of time schedule of construction of the complex. As well as its compliance with the requirements of work zone achieved directional change in construction and technological parameters of streams other than those defined norm.

Used in the dissertation mathematical tools used to describe the algorithm for calculating allowed to consider not only the direct quantitative relationships abstracted space and form, but also the possible of logical relationship.

Widely used language agents in hold introduction concepts symbol and the sign.

The work within the framework of common sense used assumptions about the need to comply with the requirements of regulations and the possibility of their satisfaction qualitative description and then quantitative assessment using construction and technological parameters of interconnected streams, clothed in graph-analytical form, of compliance with the principle of unity of form and content.

[6] DGU 03620 17.03.2016 «Бино ва иншоотлар мажмуини оқим услубида қурилишининг тақвимий режасини тузиш"/ Мирахмедов М., Расулмухамедов М., Рашидов Ж., Елубаев К. –Ташкент: ЎРИМА, 2016.

Deductions.

1. Thus, the thesis considered descriptive, graphic and analytical assumptions that formed the basis of research hypothesis, and the ability to obtain adequate norm will allow the results is to speak about the reliability of the resulting hypothetical-deductive fired by the graphical-analytical model for the development schedule of the complex at the stage of feasibility study project.
2. We used a set of interrelated research methods and facilities allow identified it as a scientific degree.

III CHAPTER. THE SPECIFIES OF THE ORGANIZATIONALAND TECHNICAL PARAMETERS AND PRINCIPLES OF RESOURCE SUPPORT CONSTRUCTION IN MARKET CONDITIONS

3.1. Definition and classification of external and internal organizational-technic parameters.

Nowadays, construction industry of Uzbekistan is an advanced system of building production well [2], exercising guide the whole cycle of works on creation of construction projects from design to putting them in place with the necessary basis for this construction and production of special s kinds of material resources. The complex includes industrial for the production of building materials, components and structures, as well as construction, contracting, installation of organizations and bodies of their management. Construction has specifies features that distinguish it from other material production. Construction products stationary and geographically fixed. In this regard, after the completion of a single object of working tools and move to another object.

Construction characterized by relatively long duration of the production cycle, the significant diversity of constructed buildings, structures and objects of various production and social facilities, a significant impact on the production process of geographical, climate and conditions[2,6]. The basis of the construction as, a sector of the economy are contracting construction organizations.

The development and deepening of specialization of construction, the sequence of its industrialization leads to separation under construction on the industry and the formation of appropriate organizational systems separate contract construction.

The first is to big construction company (group of companies, and others.), which implement investment and construction projects, covering most of the country, as well as special projects in other countries, and offer a wide range of services.

Second, a relatively small company (up to 10 people), which operate simultaneously on one or more small projects and provide highly specialized services.

The average number of employees in an organization up to 20 people. Given the trend in declining employment ratio of people in the construction of a number of construction companies, you can make a reasonable conclusion that the construction industry includes more small companies than the first, and in total, they carry a significant percentage of the total volume of construction.

Based on the derived law in the framework of the research, the model of organizational and technological design should be apply as in the first type of organization, and in the second. This requirement ensured by the fact that the research should be focused on demand and most organizations, but tangible, financial. Resources have just large companies that have a great opportunity to introduce new systems of organizational and technological design.

Quality organizational and technological design is largely dependent on the availability of skilled designers for so constant a particular specialty. The presence of a significant number of small and highly specialized organizations in the construction market shows a significant fragmentation of organizations use a variety of methods and approaches for most purposes.

Under these circumstances, a large gap between the designer and the contractor leads to a "design for show" or need substantial revision of certain sections of the working documentation. This process contributes to the existing regulatory framework, which contains a large amount of freedom to make a decision immediately designer. In addition, most importantly, that all of these factors largely not only reduce the quality of the project documentation, but also seriously reduce the actual use of contractors executing.

Based on the concept of building complex as the system will inevitably have to face the task of organizing the effective operation of this system, as well as the optimization of relations within the system, taking into account the

development of technologies for construction and technology system construction industry Uzbekistan[2] as a whole .

In view of the association in the construction industry technical and social subsystems wearing stochastic nature, must be rational to develop methods for developing organizational and technological documentation. Which, in turn requires a large extent, updating the regulatory framework of construction, as well as the infusion of e resources in the development of e methodologies and methodologies, organizational and technological design with gradation construction industry based on the organizations leading the industry value.

The main indicators in the organizational and technological design is to ensure the construction industry personnel, finance, material resources, construction machinery, vehicles; quality management, occupational safety and health, fire safety, conservation, resource saving.

The task of increasing the reliability of the organizational and technological design to perform specified (contractual) terms of building facilities and to minimize costs due to delays in the adoption of organizational and technological solutions that provide subsystems for the supply of resources and linear production units, for the organization of the production process.

A clear organizational and technological design to provide subsystems creates conditions for the concentration of respective capabilities, delineates responsibilities and increases the degree of responsibility for their implementation.

An important feature is the technical equipment of the building organizations-performers, but it can be see only in the ideal case, if the contractors defined at the design stage. These groups actually linked to varying degrees affect the adoption of organizational and technological parameters.

Table1.

External and internal organizational-technic parameters

Internal	External
1.Baseline data (technical task); 2.State regulatory framework; 3.Required level quality; 4.The limited budget; 5.The time frame; 6.Requirements, imposed by the platform construction.	1.The internal organizational structure; 2.Intra regulatory framework; 3.Technological equipment; 4.Availability and availability of labor resources; 5. Availability developed the model of organizational and technological parameters, methodologies and others; 6.Availability construction resources its own or local production.

Implement the project of building the organization as a system is necessary to comply with project design manufacturability, using a set of techniques and methods for the preparation and processing of information, the implementation processes of organizational and technological parameters of interlink ages with solutions other parts of the project.

Based on the conventional element analysis of feasibility and technical systems, the factors affecting the choice of a system of organizational and technological parameters to internal, subject to regulation by the economic operator and external, independent, to be considered, but that the subject of economic activity can not impact.

Working as part of schedule on the project "Construction of long wall housing complex of buildings for heavy vehicles «MAN AUTO-UZBEKISTAN" performed by volume and value indicators. Proceeding from the schedule solved the problem of efficient use of productive resources, the distribution of investments, taking into account the construction backlog.

The cost of construction for the object streams taken based on the calculation of the cost estimate for the project tab. 2 performed by the Institute of "Uzog`irsanoatloyiha" in accordance with the decision [4] of №66 / 03-32-0324

of 24/03/15. The construction cost at current prices amounted to 6 063 311.0 thousand UZS, other costs and customer costs total to 545 698.0 thousand, UZS. The total cost of construction of 7 821 671.2 thousand, UZS.

Table 2.

The title list of construction projects and the formation of the object flows

Flow	**№ objects**	**The names of objects**	**Price, UZS**	**The cost of flows, thous. UZS**
I	1	Main building	4 828 535.0	**4 828535.0**
II	2	Checkpoint	21763.0	
	3	Dining room with 60 seats	830 320.0	
	4	Parking lot	15 213.0	
	Total of II flow		867 296.0	**867 296.0**
III	5	Steel guard	29318.0	
	6	Telephone (city)	51193.0	
	7	Electric 0.4 kV networks	87085.0	
	8	Fire alarm	7036.0	
	9	Landscaping	38736.0	
	10	Outdoor water supply and sewerage	72622.0	
	Total of III flow		285990.0	**285 990.0**
Preparatory works	11	Preparatory works: Vertical planning	46179.0	
	12	Belt of building	35311.0	**81490.0**
Complex		The total cost of construction	6 063 311.0	**6 063311.0**
Expenses related to the entire period of construction		Other costs and expenses of the customer	545 698.0	
		Other costs and expenses of the contractor without temporary buildings	1 212 662.2	**1 758 360.2**
The total cost of construction			7 821 671.2	**7 821 671.2**

The basis of the development schedule laid the organizational and technological schemes for the project "Construction of long wall housing complex of buildings for heavy vehicles «MAN AUTO-UZBEKISTAN" and line method of organizing the construction of the complex. Accordance with the buildings and structures, as well as utilities and fencing, reduced flows in the object I of - III of , the parameters of which are linked with the term of the construction СНиП 1.04.03-85* "Standards of construction duration and backlog in the construction of enterprises, buildings and structures",[15] which is defined by the calculation.

3.2. Peculiarities of the degree of influence of internal and external organizational- technic parameters on the rational use of resources.

In the construction of necessary organizational and technological parameters to compare both the organizational and technological model with the actual state of the building project. However, the construction is characterize [5] by diversity in time during design and construction phase of the object, this is the main difficulty of such an analysis. To organize and influence internal and external organizational and technological parameters of the construction there is a need simulation of the construction process, the use of imaging techniques of construction processes will allow labor-intensive form to carry out an evaluation of the both organizational and technological solutions of the draft. The process is iterative, allowing, use a variety of visual detail model building and appropriate work breakdown structure. The iterative approach allows us not only with sufficient clarity to predict the stage of implementation of the object, but also to formulate concrete solutions in the early stages of project development, which allows the system to organizational and technological design to solve tasks. The process of creating a comprehensive system of visual organizational and technological design can be divide into several stages: The first stage - development of conceptual solutions of organizational and technological plan, with the formation of the basic fundamental system. This model system of organizational and technological solutions that take into account the technological solutions such as the choice of the type of foundations, building a constructive solution to the scheme, the choice of material walling and others. At this stage, the model only reflects the real state of the design as a whole, and can be using for conceptual and strategic planning. This model based on the types of document, the provisions of other regulations. In the first phase created a three-dimensional conceptual model of the object construction.

Second stage characterized by the emergence of an information model based on the received at this moment of technological and organizational solutions. One of the important components at this stage is to work with an

existing base of contractors in the framework of the adoption of more detailed technical solutions for specific types of work. Full implementation of this phase depends on the quality of teamwork design organizations directly from the implementing agencies. Because designers cannot always make the best decision at the lack of practical experience of construction work at the site. Another characteristic of the second stage is to link design decisions to the individual conditions of the construction site, such as the actual transport accessibility, remoteness from major construction resources, especially manufactured origin, and others.

The visual model at this stage becomes more information-rich, that is the result of a complex work as a designer and contractor organizations, with the participation of suppliers of equipment and large construction elements. Conceptual and strategic planning at this stage undergoes refinements and optimization of double-sided, [10, 14] with the aim of improving the reliability and adequacy of the strategic plans.

The third stage, whose main task - fixing connections between the visual model and the organizational and technological model. At this stage, the problem solved spatial conflicts that arise when mounting is technically complicated and bulky equipment. Because of, this audit revealed errors in the preparation of the network model, which tend to be an afterthought, and in the absence of visualization is difficult to find. This mechanism can be regard as a synergistic effect of the aggregate consideration of organizational and technological systems and visual modeling process of building objects that.

Fourth stage - optimization of the design model, which, implemented in parallel with the construction process of a building or structure. The essence of this stage is the ability to exercise control over a standard construction progresses (acts of acceptance, bill of materials consumption, the development of investment statements, etc.) Moreover, visual inspection. The last advantage is the efficiency of this process, since the use of modern technology to monitor one computer; you can see a picture of a real object in real time and compare the data with the visual

model built into the design process, which reflects the targets of the project. Such control promotes responsiveness to unplanned construction delays; the result of this reaction must be express in concrete actions for the lag compensation from corresponding strategic plan.

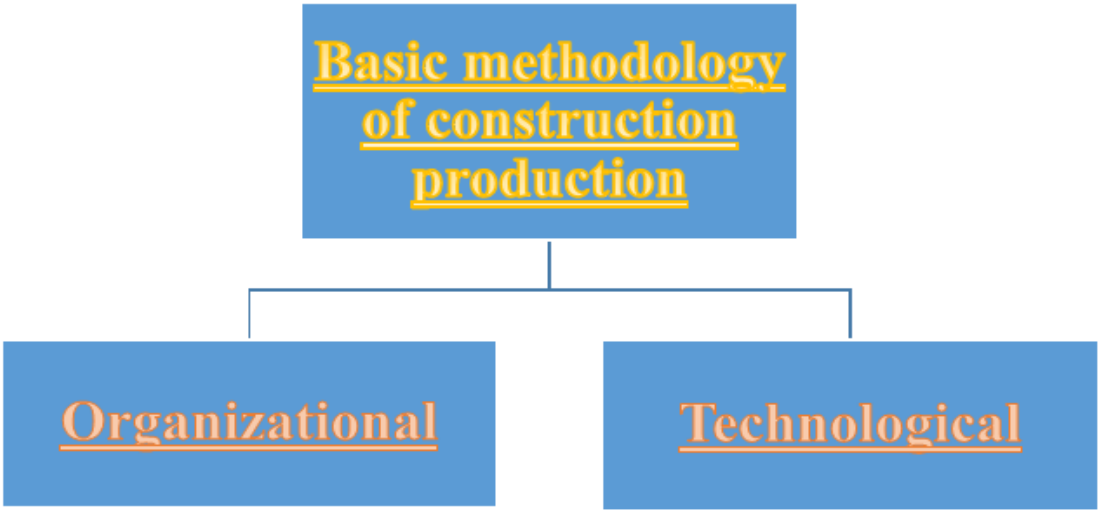


Fig.6- Scheme of building production.

The effectiveness of this phase will be fully disclose using a complex organizational and technological model of development in operational, weekly, and daily planning. This approach requires a high level of working breakdown of complex model, but on the other hand allows you to plan and predict processes with great accuracy, and most importantly contribute to the ultimate goal - putting into the project life to the achievement of specified levels of quality.

3.3. Principles of resource provision of construction in market conditions

The most important reserve for the empowerment of innovation-based growth across the construction industry is the development of its innovative potential as well as the alignment of the resource potential of the individual enterprises in the industry by enhancing not used in the full scientific and technical resources.

The main directions of innovative development of the resource potential of the enterprises of a building complex are:

- Creation of a developed innovation infrastructure that can quickly and flexibly implement innovation and enable the creation and development of national information resources to the extent necessary to maintain a high rate of innovation development;

- Development of a flexible system of advanced training and retraining of personnel in the field of innovation and management innovation, capable of implementing complex projects of reconstruction and development of industries and territories;

- Creation of modern information technology and computerized systems, providing innovative development of resource potential;

- The creation of telecommunication systems and automated systems for access to information on innovation and innovation processes, new technologies, materials, equipment, methods of organization and management of production;

- The implementation of a radical change of social structures in order to enhance the innovation of human behavior in various spheres of activity.

In addition to professional skills increasingly important for employers in the construction of the so-called, acquire functional skills. These include universal jurisdiction, the need for ownership, which arises not so much in connection with the performance of work on a particular profession, as the general technological and social changes in the nature of employment in the construction industry. It is about adding value to people's ability to work in a team, to find a consensus of interests, to prevent conflicts.

The increasingly important role in the work of the builders are beginning to play the key skills of working with information resources, research and information processing, etc.[14] Thus, there are two key ways of solving the problems of formation and development of personnel potential of the construction industry:

- Management of labor resources balance (quantitative aspect);
- Management of labor quality (qualitative aspect).

Management of labor resources balance regulation is the basic macro proportions of the distribution of the labor force (in the industry, professional and territorial sections). Innovative staffing building complex is one of the subsystems of the formation of modern organizational and economic mechanism in construction.

The building has always been widely used collective forms of labor use, as it was require by the organization of construction. Contract method caused a genuine self-financing, the rights guaranteed by the brigade, mutual responsibility for the performance of the employment contract. Within the works contract from the team the opportunity to establish their own production activities, to establish work and rest, to determine responsibility for the results of labor, and each member of the team to take the initiative and enterprise.

When the contracting method earnings has become dependent on the product of the whole team. However, the team contract method required changes to the quantitative composition of teams and quality management of grass-roots units of building production. It is no coincidence contract method has been called a new form of grassroots construction management units, based on the extended brigade cost accounting.

Deductions.

1. Detected external and internal organizational and technological parameters.
2. Tribute to analyze the influence of internal and external organizational and technological parameters on the rational use of resources.
3. Defined principles of resource maintenance of building in market conditions.

IV CHAPTER. FEATURES OF THE DEFINITION, FORMALIZATION AND CONSTRUCTION OF GRAPH-ANALYTICAL MODEL OF ORGANIZATION FLOW-LINE CONSTRUCTION

4.1. Construction and formalization graph-analytical model of organization by flow-line method.

Nowadays, graphic-analytical method is the ability to portray the results of the economic analysis graphically [6]. Graphic-analytical method is recommend in the development of standards of time on manual processes with little quantitative influencing factors (up to three). Application of the method makes it possible to obtain the sought directly dependent on a graph or in the form of an empirical formula [1].

Least squares method also involves the construction of a regulatory line and the conclusion of the empirical formula. The most common method used in the study of the equipment operating conditions and taking into account the large number of influencing factors. When the number of influencing factors should be use for more than five correlation and regression analysis, and information technology; with their help, you can get a graphical construction of a regulatory line or ready s table normative values. With the help of the methods of queuing theory to study the processes that are, probabilistic in nature in terms more operation, maintenance, automatic-aided manufacturing, etc.

When using graphic-analytical method of calculation of the graph is plotted labor costs on one factor at fixed values of the other. Normative line determined according to the following order:

- Determine the amount of factor values, which time measurement: n = P max / P min + 3, where P max - maximum value of the factor; P min - the minimum value of the factor 3 - the minimum amount of factor values required for study;

- Determine the value of the interval between the values of the factor by the formula:

I = (P max - P min) / (n - 1)

where, I - interval value; n - amount of the factor values;

- Defines a specific value factor. The first value is the initial value of influence factor; the second value is equal to the initial interval, plus the value, etc.

- For each of the factor values held chronometry series of observations and determined the average time for each chronometer series;

- Term of factor and conforming them to the time value is marked on the graph with scales and time factor to yield point; they are connect by segments and identify the nature of time changes depending on the factor (linear relationship, the relationship type parabola or hyperbole). If the relationship is linear, a straight line expresses it: Y = an X + V, where V - the value of the function (in this case, time); X - the argument value (in this case a factor); *а* – the slope of the line, *в* – free term of the equation;

- Find the arithmetic mean value of the factor (X) - X and compare the cost of time (t) – $t_{average}$ all points on the graph is divided into two groups: the first includes the point of having the value of $X < X_{average}$, and the second - all the values $X > X_{average}$. For each group, mean values are X and t, thereby yielding the coordinates of two points (the first point with coordinates X cf., $t_{average}$ and the second point with coordinates X cf., $t_{average}$). Through two points obtained, spend a straight line, which is the regulatory time-dependent changes of the change factor;

- The coefficient (a) in the equation of a straight line, it is the slope of a regulatory line, it determined by the formula: $a = (t_{average} - {}_{average}\, t) / (cf.\ X - X_{average})$;

- The value of the free member of the equation direct - (c) can be determined in two ways.

The first is to measure the magnitude of the segment, which cuts the ordinate regulatory line. The second method - analytical: the value (a) can be determined from the straight-line equation, substituting the coordinates of the first

or second point, which are carry out through standard line, and the value of the slope inclination regulatory line.

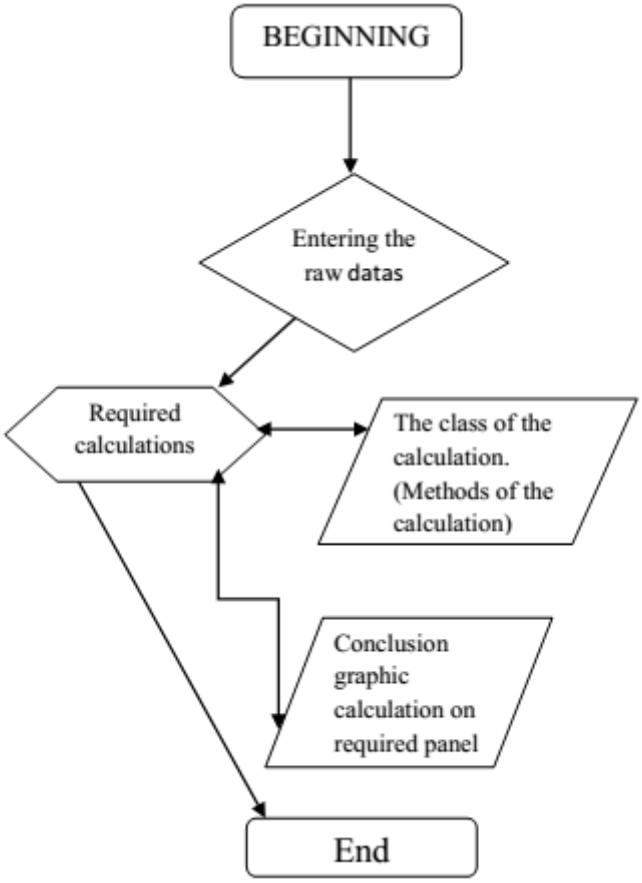


Fig.7- Block diagram. Elaboration of a comprehensive schedule calculation cyclorama of flow organization construction

Algorithm of automated calculation of complex sequence diagrams mainstreaming building with on-board schedule construction of the complex of enterprises, buildings and structures of relevant standards in the construction backlog.[7]

Design parameters of the complex sequence diagrams mainstreaming of construction: **temporary - *unchanging T, T_n*** and ***modified*** in the following steps of calculations T_{p1}, T_{np1}, T_{p2}, T_{np2}, T_{p3}, T_{np3}, O_1, O_2

and **monetary – P_1, P_2, P_3**

where, ***T*** - the total of construction period, months;

T_n - the duration of the preparatory period, months;

[7] DGU 03620 17.03.2016 «Бино ва иншоотлар мажмуини оқим услубида қурилишининг тақвимий режасини тузиш”/ Мирахмедов М., Расулмухамедов М., Рашидов Ж., Елубаев К. –Ташкент: ЎРИМА, 2016.

T_{n2} – the duration of the preparatory period of the second flow per month;

T_{p1} - the duration of the deployment period of one (primary) flow months;

T_{np1} - during production of finished products 1st flow per month;

T_{n3} – the duration of the preparatory period, the third stream, months;

T_{p2} - the duration of the deployment period two (auxiliary) flow months;

T_{np2} - period of the 2nd release of the finished product flow per month;

T_{p3} - the duration of the deployment period 3 (communications) flow months;

T_{np3} - period of the finished product third flow per month;

O_1 - advance readiness of the second flow per month;

O_2 - advance preparedness third flow months.

P_1, P_2, P_3 - The total value of construction projects, respectively, 1, 2 and 3 flows million UZS.

Restrictions:

T given or received for building regulations "СНиП 1.04.03-85 Standards of construction duration and backlog in the construction of enterprises, buildings and structures";

T_n is take on СНиП 1.04.03-85;

$0{,}5T_n <= T_{n2} <= T_n$; $T_{n3} = 0$;

T_{p1} = (0,1-0,25 depending on the construction industry)T;

T_{p2}; T_{p3} of the first embodiment taken in the range from 10 to 25% of the total length of the construction,

$T_{p2} >= (0{,}1\text{-}0{,}25)T$; $T_{p3} >= (0{,}1\text{-}0{,}25)T$

$T_{np1} = T - (T_n + T_{p1})$; $T_{np2} = (O_1 + T_{n2} + T_{p2})$; $T_{np3} = O_1 + O_2 + T_{p3}$;

$T_{np1} >= O_1$; $O_2 >= 0{,}5$ months

Results:

Development of volumes of construction and assembly works:

I_j where $j = 1,2,3$;

Then the development of the volume of construction and installation work on the flows I_1, I_2, in time allows you to get the monthly i their distribution so that the sum i construction period is T.

$$I_1=P_1/T_{np1};\ I_2=P_2/T_{np2};\ I_3=P_3/T_{np3};$$

Generalized timetable volume of construction works to be development on a complex of buildings is determined by summing up for each month of the flows 1, 2 and 3, for I_1, I_2, I_3.

By summing the results by increasing the volume of construction and installation work to be determined by the development of the monthly amount to be development by the end of each month so that you end up with the value of P is equal to the sum of P_j , like, $P = P_1 + P_2 + P_3$.

The values of volume of construction works by the end of each month, the construction related to the total volume of construction activities and expressed as a percentage are a "backlog", which should correspond to normative of “СНиП 1.04.03-85”. Otherwise, change the timing sequence diagram T_{p1}, T_{np1}, T_{p2}, T_{np2}, T_{p3}, T_{np3}, O_1, O_2 in automatic mode to count a sequence diagram to obtain construction financing of schedules [1].

Calculated and regulatory groundwork must match with an accuracy of ± 1%.

Subject to this condition in the latter, case from the corresponding differentiated. Schedules are automatically displayed in a tabular form, the schedule plan of construction of the values of volumes of construction and installation work on the flow $j=1,2,3$ in time t_i so that their sum for each thread p_i $(i=1,2,3,\ldots, T)$ is equal to P_j , and their sum over $j=1,2,3$ equals P.

At the same time, the amount of the $j=1,2,3$ for the month i is equal to the volume of construction and installation works of the corresponding $(\pm 1\%)$ regulatory reserve, and the sum of the amounts P_{ij} $(i=1,2,3,\ldots, T;\ j=1,2,3)$ are also displayed on the panel is equal to P in mln. UZS.

Developed by the calculated program can automatically carry out the distribution to obtain capital investment in the composition of the PIC in the first stage of technological preparation of construction.

Duration of construction on the project **Tk**=18 months.

1. The main flow.

The main flow is a sequence diagram for the calculation of the main frame of the building for heavy vehicles «MAN AUTO-UZBEKISTAN"

1.1 The duration of the preparatory period of 1 month, **Tn** = one (months).

1.2 The duration of the period of work deployment **Tp** by object flows varies, it depends on the nature of the builder operations complex and the volume of construction and installation work, the degree of preparation of the construction site in engineering terms, being of housing, roads and trunk pipelines (water, gas, etc.).

Normative dividing, allowing of establishing the duration of the deployment periods are absent. Roughly, until it can be determined based on experimental data, according to which the value of **Tp** adopted:

- In the construction of buildings up to 5 floors - 90 days, **Tp**= 3 months.

1.3 During the period of deployment, the period of release production $\mathbf{T_{вп}}$, when all the teams involved in the work gives the builder tion products in the form of finished floors, sections, parts of plants suitable for the installation of the process equipment. But, before commissioning the necessary inspection and testing of the entire complex, the minimum term of this period is 0.5 months.

For the case when the construction time of construction of the complex is the same as the main subject, т.е. $\mathbf{Tk = T_{total}}$, duration of release of construction production $\mathbf{T_{вп}}$ determined by the formula:

$$\mathbf{T_{вп}} = T_{total} — (Tп + Tр+0,5),$$

$$\mathbf{T_{вп}} = 18- (1+3+0,5) =13,5 \text{ (months)}$$

2. The second flow.

The second stream is auxiliary buildings: checkpoint, dining room and parking.

2.1 The duration of the preparatory period of 0.5 month, **Тп**= 0,5 (month.) Since PPC (object II flow) provided during the construction of production preparatory, work for it as a dispatcher and guard post.

The period of 2.2 second current is calculate by the formula:

$$\mathbf{T_{total}} = Tk - (Tп + 0,5 + 0,5),$$

$$\mathbf{T_{total}} = 18 – (0,5+0,5+0,5) = 16,5 (мес.)$$

Completion of the object ahead streams provided by two weeks II -th flow towards the main flow (main frame).

2.2 The duration of periods of deployment papers, **Тр** = 3 (month.)

2.3 Release of period production for objects that the second flow by the formula:

$$\mathbf{Твп} = T_{total} – Tp,$$

$$\mathbf{Твп} = 16,5 - 3 =13,5 (month)$$

3. The third flow.

The third stream is - device external utilities and site improvement.

3.1 The duration of the preparatory period is zero, **Тп**=0 as well, as Since from disorder of external engineering communications including the fencing of the area (III of the stream), starting in the preparatory period, that is, the first day of the start of construction.

3.2 The duration of the third flow is calculate by the formula:

$$\mathbf{T_{total}} = Tk - (0,5 + 0,5 + 0,5),$$

$$\mathbf{T_{total}} = 18 – (0,5+0,5+0,5) = 16,5 (month.)$$

Completion of the object ahead flows provided by two weeks II - flow towards the main flow (mainframe) and III flow towards II flow.

3.3 The duration of periods of deployment papers, **Тр** = 3 (month)

3.4 Release of period production for the object and the third stream by the formula:

$$\mathbf{Твп} = 16,5 - 3 =13,5 (month).$$

4.2. Identify organizational and technical parameters of the model and the development of capital investments

Planning of capital investments is an integral part of the planning of capital construction. The plan of capital construction has sections: HF plan; PIR design and survey work; plan of building production. Capital investment planning is one of the main functions of the customer.

In a market economy, centralized capital investments planned for public needs (army, transport, communications, medicine, education, and culture). The basis of capital investment planning adopted the principle of creating specific basic production assets in a given period of the contract price. The basis of the methodology of capital investment planning is a comprehensive system of planned all material, labor and the financial balances. Individual construction projects and sites called titular list of capital construction.

According to non-centralized capital investments, itemized lists are approve by the enterprises themselves. They contain under object, setting for the commissioning of production facilities and fixed assets, as well as the required amount of capital investment, including the construction activities and the distribution of data for the entire period of construction. It is also planned the construction and creation of a reserve for the next period in the form of unfinished construction projects. The system of indicators of capital investment plan is divide into 3 groups: approved, evaluation, settlement. The composition of the indices for each group depends on the level of control and the type of plan (prospective, current).

Capital investment plan in its entirety generally contains a plan for the limits of capital investments; plan of modernization and reconstruction of existing enterprises; implementation plan of production facilities and fixed assets; itemized lists of buildings. The limit of capital investment - is limiting their size, directed to the creation of fixed assets specified destination. It is determined based on specific capital investments. The specific investment costs limit value refers to the creation of the production capacity of the unit and the basic

production assets. Regulations specific capital investments developed, based on realized, reusable object with technical and economic indices of greater than and average.

Indicators of specific capital investments are used to preliminary calculations. The duration of the construction of the customer determines independently or guided by the norms of construction duration (СНиП 1.04.03-85). If planning capital investments tend to increase their effectiveness. At the same time take into account also the associated investments, also, invested in the industry, the company that will deliver the products, raw materials, etc. for the enterprise.

The duration of the facility may include prescriptive or normative term. Policy terms may establish public administration bodies, as well as the customer. Normative period to be determined in accordance with «СНиП», which revealed the duration of construction, which is taken into account during the construction of the object and in the timetable.

For an object inherent select line method of construction, since it is the most suitable for the project "Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN», also ensures the uniformity of consumption of resources and the rhythm of production of finished products, and favorable conditions for work.

Calculation of terms of reference of the project "Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN», is made according to «СНиП 1.04.03-85*» (change in 4 part. II) chapter «3» section - 2.r.11. (relation) at:

Total square = 16136 m ^{2} is $-T_1$ = 15,0 months.

The preparatory period -1.0 month.

The total duration of the construction determined by linear interpolation, and the total duration of construction projects included in the complex of distribution of data for the entire period of construction,

The total duration of the construction will be:

T_{2total}.=15,0 x 1,1 x 0,9 x 1,2 = 17,82 months.

Take 18,0 month, including preparatory period1.0 month.

$K_1 = 1.1$

$K_2 = 0.9$

$K_3 = 1.2$

Defining line method of construction for the project "Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN», it is necessary to perform the calculation and design of the complex sequence diagrams the flow of all buildings and structures are part of the object.

The essence of the calculation is in fact that, to determine the duration of the construction period of the deployment, the release period production for all buildings and structures of object.

Cyclorama is a graphical image sequence construction projects included in the complex, with the distribution of resource allocation by year of construction.

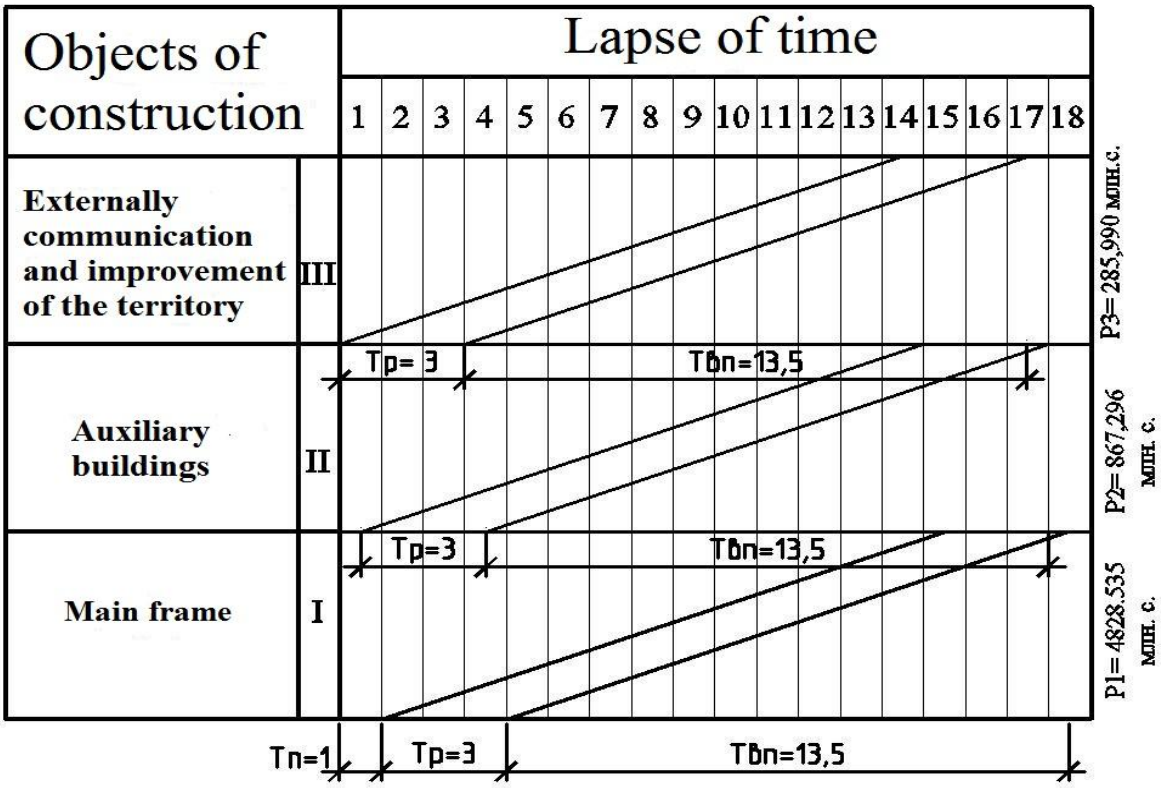


Fig.8- Design of scheme cyclorama integrated of flow for the project "Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN»,

After defining all the data on all flows getting to the construction sequence diagrams.

Calculation of reserve in the building for "Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN», is made according to «СНиП 1.04.03-85*» "Standards of construction duration and grazed in the construction of enterprises, buildings and structures ", (change 4) part I of "appendix 5".

The estimated duration of the construction of the facility 18 months; at a rate of 15 months;

To determine the performance touched determined one to rate the formula:

$$\delta_n = \frac{T_f}{T_D} n = \frac{15}{18} 6 = 3,6$$

where, Тн = 15 (months).

Tp = 18 (months);

n = 6

Backlog for capital $К'_п$ for the estimated duration of construction determined by the formula:

$$K'_п = K_{п_n} + \frac{(K_{п_{n+1}} - K_{п_n})\alpha_n^3}{m},$$

where, $K_{п_n}$, $K_{п_{n+1}}$ - performance reserve on investment (construction and installation work) for the duration of the construction adopted in the norm (Table 3.), at the end of the *n* - quarter, which is determined by the serial number of the quarter, corresponding to an integer factor δ_n;

α_n – coefficient of a fractional part of the ratio δ_n;

m - number of months in *n* quarter.

For this example, the values of coefficients, calculated according to the formula given in table 4.

Table 3.

Indicators touched on capital investments

Company	Index	Standards backlog in construction by quarters, % of the estimated cost					
		1	2	3	4	5	6
"Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN»	K	3	28	46	67	87	100
		12	37	52	73	90	100

Table 4.

The values of the coefficients δ_n, α_n

Company	Coefficient for calculation index of backlog	Standards backlog in construction by quarters, % of the estimated cost					
		1	2	3	4	5	6
"Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN»	δ_n	3,6	7,2	10,8	14,4	18,0	21,6
	α_n	3,6	1,06	1,21	1,16	1,12	0,99

Performance reserve on investment for the project "Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN», are defined by the formula:

$$K_1' = K_0 + \frac{(K_1 - K_0)3.6 \cdot 3}{3} = 0 + \frac{(3-0)3,6 \cdot 3}{3} = 10,8 \approx 10,8\%;$$

$$K_2' = K_1 + \frac{(K_2 - K_1)0,11 \cdot 3}{3} = 10,8 + \frac{(28-10,8)1,06 \cdot 3}{3} = 29,03 \approx 29\%;$$

$$K_3' = K_2 + \frac{(K_3 - K_2)1,21 \cdot 3}{3} = 28 + \frac{(46-28)1,21 \cdot 3}{3} = 49,78 \approx 49,8\%;$$

$$K_4' = K_3 + \frac{(K_4 - K_3)1,16 \cdot 3}{3} = 46 + \frac{(67-46)1,16 \cdot 3}{3} = 70,4 \approx 70,5\%;$$

$$K_5' = K_4 + \frac{(K_5 - K_4)1,12 \cdot 3}{3} = 67 + \frac{(87-67)1,12 \cdot 3}{3} = 89,4 \approx 89,5\%$$

$$K_6' = K_5 + \frac{(K_6 - K_5)0,99 \cdot 3}{3} = 89,5 + \frac{(100-89,5)0,99 \cdot 3}{3} = 99,9 \approx 100\%$$

Defining indicators of hurt investment by quarters is necessary to identify the intensity of the use of funds, which tabulates of capital investments, development parameters of the object on the flow of table 5.

Table 5.

Estimated parameters of assimilation capital investments by object flows

№	Object flow	The cost of construction (P) thousands UZS	Period of output, (Твп) months	The intensity of the assimilation of capital investments, (*I*) thou.UZS/month.
I	Main building	4 828 535.0	13,5	357 669,26
II	Auxiliary buildings	867 296.0	13,5	64 244,15
III	Devices exterior utilities and landscaping	285990.0	13,5	21184,44
	Preparatory works	81490.0	1	81 490,0
	The costs for the entire period of construction	1 758360.2	18	97 686,68
	Total cost of construction			**7 821 671.2**

Calculation of the intensity of the assimilation capital investment, given by:

$$I = \frac{P}{Твп}$$

After all indicators developed by the schedule plan of assimilation capital investment table. 6.

Table 6.

Schedule plan of assimilation capital investment for object

"Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN»

Flow	Object name	Cost UZS/month.	Intensity USZ/month.	2015 y.								
				1	2	3	4	5	6	7	8	9
I	Main building	4 828 535.0	**357669,26**		178834,63	178834,63	178834,63	357669,26	357669,26	357669,26	357669,26	357669,26
II	Auxiliary buildings	867 296.0	**64244,15**	16061,1	32122,1	32122,1	48183,14	64244,15	64244,15	64244,15	64244,15	64244,15
III	Externally com-ons and imp-ment of the territory	285 990.0	**21184,44**	10592,22	10592,22	10592,22	21184,44	21184,44	21184,44	21184,44	21184,44	21184,44
	Preparatory works	81490.0	**81490,0**	81490,0								
	The costs for the whole of period of construction	1 758 360.0	**97 686,68**	97 686,68	97 686,68	97 686,68	97 686,68	97 686,68	97 686,68	97 686,68	97 686,68	97 686,68
	Total	7 821 671.2		**205829,78**	**319 235,63**	**319 235,63**	**345888,9**	**540784,53**	**540784,53**	**540784,53**	**540784,53**	**540784,53**
	Execution capital investments			**205829,78**	**525065,6**	**844301,3**	**1190190,2**	**1730974,7**	**2271759,2**	**2812543,8**	**3353328,3**	**3894112,8**
	Execution%			2,6	**6,7**	**10,8**	**15,2**	**22,1**	**29**	**36**	**42,9**	**49,8**

Continuation of Table 6.

Schedule plan of assimilation capital investment for object

"Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN»

Flow	Object name	2016 y.									
		10	11	12	13	14	15	16	17	18	Calculation
I	Main building	357669,26	357669,26	357669,26	357669,26	357669,26	268252,0	178834,63	178834,63	89417,32	**4 828 535.0**
II	Auxiliary buildings	64244,15	64244,15	64244,15	64244,15	64244,15	32122,1	32122,1	32122,1		**867 296.0**
III	Externally com-ons and imp-ment of the territory	21184,44	21184,44	21184,44	21184,44	15888,33	10592,22	10592,22	5296,11		**285 990.0**
	Preparatory works										
	The costs for the whole of period of construction	97 686,68	97 686,68	97 686,68	97 686,68	97 686,68	97 686,68	97 686,68	97 686,68	97 686,68	**1 758 360.0**
	Total	**540784,53**	**540784,53**	**540784,53**	**540784,53**	**535488,42**	**408653,0**	**319235,63**	**313939,52**	**187104,0**	**7 821 671.2**
	Execution capital investments	**4434897,3**	**4975681,9**	**5516466,4**	**6057250,9**	**6592739,4**	**7001392,4**	**7321331,9**	**7635271,4**	**7821671,2**	
	Execution%	**56,7**	**63,6**	**70,5**	**77,4**	**84,3**	**89,5**	**93,6**	**97,6**	**100**	

Based on the schedule of development investment on the project "Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN», elaboration of graph financing, fig. 9

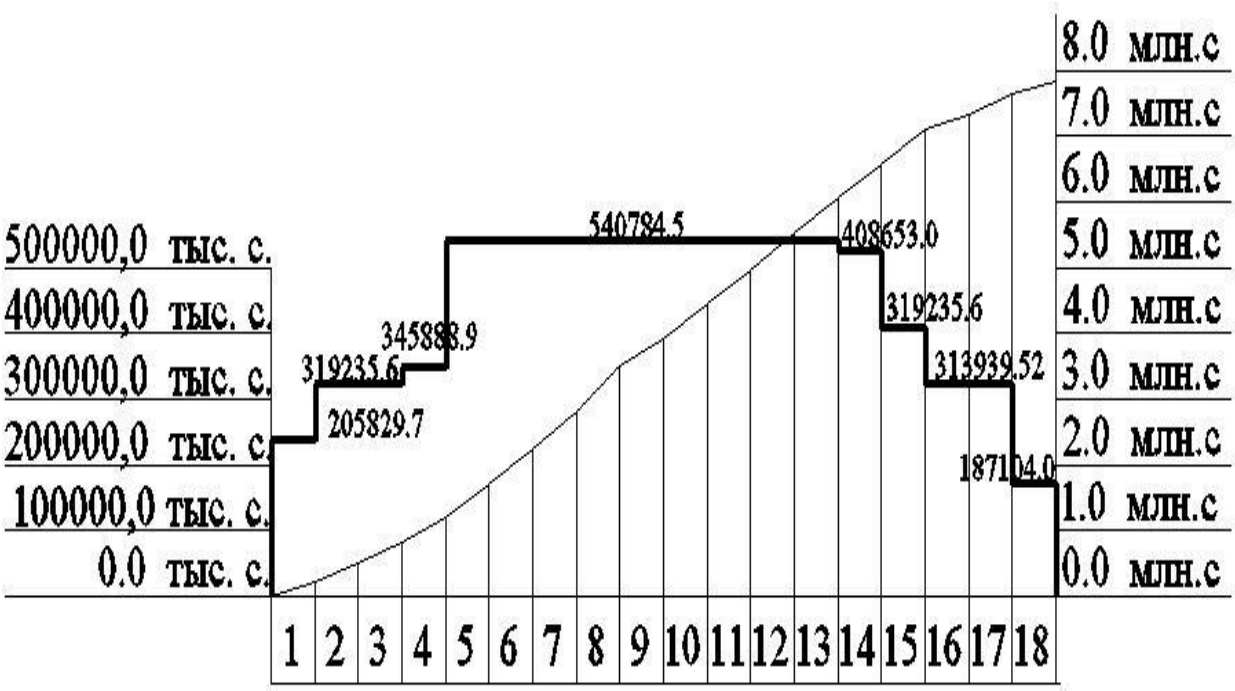


Fig.9 - Graph financing for object "Construction of the main frame of building for heavy vehicles" «MAN AUTO-UZBEKISTAN»

4.3. Elaboration and use automation program of schedule planning

Schedule planning based on the organizational and technological model of the construction process of the construction of an object or the entire complex. The main time-consuming and demanding task in this case is the scheduling of works [5].

Various organizational and technological documents provided «ШНК» rules differ only in the degree of detail schedule. At the same time, it should be note, that the schedule of construction linked with the available building enterprise resources, to meet the decisions taken by the technology and organization of work at the facility, keep within deadlines stipulated by the contract. Consequently, on schedule-imposed restrictions, which divided into logical constraints such as for example, the technological sequence of works and limitations of resource type for example can serve as a composition on the job. Construction work schedules in the schedule of the construction process involves determining the complex terms of the beginning and end of each of the works on the project, with all the constraints must be satisfied.

Organizational and technological model of the facility provides for a decision on the construction of buildings that need to be address, taking into account, as an aspect of organizational and technological aspects, performed in the course of construction. That is, the organization establishes and describes the sequence, direction and duration of the process, as a result of which are different types of designs and technology determines for each of these production processes scheme list and methods of use of machines, part of the equipment and the need for workers, as well as temperature, humidity other modes.

For the development of the production organization of construction projects are currently several methods are used. Flow system, this system involves selection of the optimum variant of a number of the most appropriate options from the perspective of the designer. The selection is make on an assessment of options in

terms of the quality of the stream or the optimal consumption of resources. These methods are imperfect estimates; because it does not provide for consideration of possible technical solutions do not analyze the conditions of the placement of structures, changes in the sequence of the processes and areas of development in the construction. All these figures are not intended to be a comprehensive assessment of the decision, but only evaluate each individually solutions, all of which does not guarantee the selection of the most rational option.

The method of network planning, a feature of this method is the ability to monitor and adjust the performance of complex processes on time or resource indicators [1]. Based on these results possible rationale for the changes in the technology of erection of buildings. Data approach reduces the amount of operational information and discloses the probabilistic problem areas and difficulties that may arise, etc., and the implementation of the construction. The problem is that with the help of network methods, there is not always possible to establish a plan of works, depending on the technical solution will be optimal and, in some cases, does not specify an effective means of ensuring construction. This disadvantage of the method of network planning, in recent years, partially offset the use of mathematical programming. The perfection of the organization of the construction of a building complex due to the use of cybernetic control systems construction. Multivariate problems arising in the construction of large buildings and structures can be address in an integrated method associated with the selection of the range of processes, their development conditions, division into parts and others. Thus, revealed and updated to provide a process by means of which, can be choose the best possible solution for organizational technological design.

Another method of developing the construction project is the integration of the flow from principles comprehensive mechanization. Linking processes carried out in time by the use of the flow system. A method of comprehensive mechanization is responsible for the selection of the effective means of labor.

However, none of these methods does not provide a joint solution of these tasks necessary for optimal decision-making.

There is also an energy method, which based on the use patterns of interaction of working bodies of the equipment with the products processed by them. As part of this method does not address the construction technology, and no description of the algorithm of choosing the optimal organizational and technological solutions.

The above methods are not multivariate analysis of organizational and technological solutions with a comprehensive assessment of the cost of time, capacity, cost and manufacturability.

Selection of the optimal organizational and technological solutions adopted to implement the methods in the vast majority of which is applied the method of comparing the technical and economic assessments and indicators of a number of options. Therefore, for the development of methods of organizational and technological design of the building process, it is necessary to develop a user-friendly in practical terms, and not time-consuming way to select the optimal variant. Such a system will allow in the future finding the most efficient and appropriate in the current situation, the decision on the construction of the object and accountability of the decision in the building management system.

Organizational and technological design includes sequential steps in space and time, taking into account the supply of material and technical resources, space-planning restrictions, as well as other issues affecting the construction industry. To plan the progress of the projects are traditionally used bar graphs, but they are unable to show how and why certain actions are connected in sequence, and do not reveal the longest (critical) path.

Today, planners tend to use the critical path method (PCR) and related software, such as Microsoft Project, Primavera, SureTrak and others [5, 6, 9], to create, update and transmit the schedule of production, using a wide variety of

reports and charts. These software systems show how the associated action, their influence on the critical path and the availability of reserves.

Specialized software packages that are most appropriate for construction, such as Vico Control [5, 6], allow planners to make a decision based on the location of the object to identify the composition of units operating technological systems work in multiple locations. Some packages implemented sophisticated methods of planning of resources based on balancing and capacity planning for uncertainty. The same software can be used in the construction of detailed schedules for short periods (one or two weeks), which is considered the technology of erection of individual components and resource security.

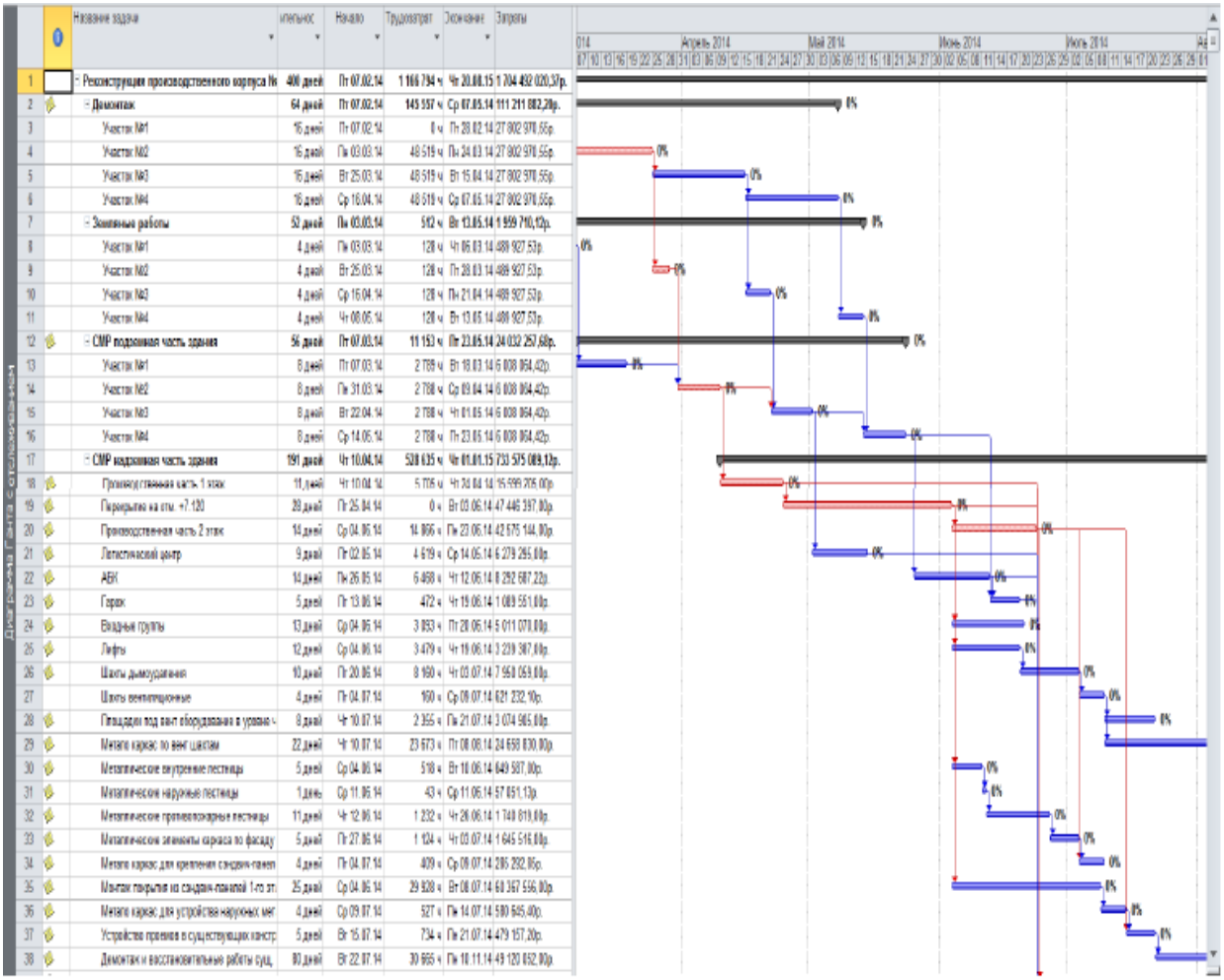


Fig.10- Planning example with the aid of Microsoft Project program.

Traditional methods correctly reflect the spatial components related to a specific job, and at the same time, they are not directly link with the building model. Planning is an intensive manual task, and it is often uncoordinated with the space planning and design of the project solutions, which creates significant challenges for the participants in the design process. Using the graph easy to understand its impact on the internal logistics of the construction site.

Evaluation of the quality of graphics-based planning, with the aid of Microsoft Project program (MP). As well as its feasibility for the participants of the construction project rather laborious process that requires significant resources of time because, it requires a manual alignment of each work with the regions or elements of the project, as there are no visual associations with design solutions that referenced.

In addition, in the early stages of technological preparation of the construction of the development of the PIC list of works known as a whole without idealization that arise after the development of working documentation (RD). Consequently, in MR applicable CPD i.e. the last stage of the preparation process of construction.

To date, there is urgent need to eliminate the above drawbacks of the classical organizational and technological design in construction.

There are three types of technologies, which address the shortcomings of the two-dimensional organizational and technological design [5, 6]:

• First *4D the product range CAD* is a three-dimensional model, which also contains a timeline. The construction schedule is associated with a three-dimensional model that allows us to visualize the building serial construction.

4D CAD tools enable professionals to visually plan and coordinate the actions of entities in space and time;

• Second approach uses analytical tools, including BIM components, information technology and construction standards of construction to optimize

sequential activities. These tools include space, resources, capacity building of participants [];

• Third approach *«Pull Driven»*, as the world practice shows; it used as an additional method. Includes the preparation and analysis of the accumulated problems, as well as the selection of the current list of tasks for their implementation to obtain the maximum effect. This often means that the work is just beginning, when all the conditions are satisfied, holding the task to the most appropriate moment. This approach, coupled with a corresponding detailed planning in the long term one - three weeks - there is actually a production control. This technology called Last Planner System (Ballard 2000). This approach may be integrate into the information model of the building in numerous ways, for example by visualizing the construction process.

Variety contractors defines a wide range of processes and tools used in construction now. Large firms tend to use a mechanized system for almost all the key processes of investment and construction cycle, including pre-assessment, construction planning, cost control, logistics, transportation, scheduling.

For problems related to the design, such as the evaluation of resources, security, coordination and planning, plans and technical specifications - a typical starting point. Even if you create a job project used three-dimensional system of the product range CAD, the customer usually requires that contractors manually performed calculations of quantities in order to perform an accurate valuation and formation of schedule production hours that is a time-consuming and costly process. In this regard, cost estimates, drawings orientated, detailed graphics are often not, carried out until the completion of the design process, which adversely affects the duration and cost of the investment and construction project, especially at the design stage. No less important point is that the involvement of the contractor in the design and registration of its proposals would reduce the cost side the

investment and construction of the project without compromising on quality and reliability.

In practice, the construction is changing the methodology of organizational, technological projection in the direction of overcoming the above-mentioned construction of problematic global community, this methodology will change today, as major participants of investment, and construction projects have already seen in practice whether to use modern technologies of building design. The most promising technology in building design is the technology «Building Information Modeling» - Building Information Modeling (BIM) [6].

In the construction of technically complex objects, when working in confined spaces as well as the need for a significant reduction in the duration of the construction works by combining the most effective planning tool is a model building otherwise known as 4D, 5D, 6D, multi D, BIM .

Such models of imagination construction processes in time and space. The combined use of three-dimensional model of the object and Network Schedules investment and construction of the project allows you to select the sequence and production technology of construction and assembly works, taking into account space constraints at a particular time. The same manner to carry out zoning of the building site, the most rational arrangement of lifting equipment, choose the path of movement of large components and structures for the construction site, as well as to establish the organizational and spatial modules.

Visualized models construction organization solve problems detection and prevention of spatial and station-temporal inconsistencies. That is why robotized-effective innovative model not only for the contractors in the planning of the construction work with the production organization of the construction of the building complex, but also for the designers involved in the development of the whole spectrum of organizational and technological documentation.

Deductions

1. Review of formalization and graphical-analytical model used in the production organization of the building complex, identification of organizational and technological solutions of the production organization building on planning capital for investments.

2. Not use analysis and evaluation of existing automated calendar program planning applicable at the stage of development schedules in a PICO, to stage the POC. Therefore, the model developed by graph analytical mainstreaming of construction of the complex of buildings fills the gap that exists in the construction and technological preparation.

3. As a result, we investigated, also determined that the auto- and enshrined - An innovative models are effective not only for the contractors in the planning of the construction work with the production organization of the construction of the building complex, but also for the designers involved in the development of the whole spectrum of organizational and technological documentation..

Conclusions

The construction industry is distinguished evolutionary development, accompanied by a constant need for timely response to the demands of rapidly transforming construction services market. According to experts, in a market economy, organizational and technological derivative of the construction process is not possible without modern and advanced technologies. They must meet the highest requirements and the growing consumer demand for the construction of the complex in its structure and technological parameters like buildings, and ultra-modernized complexes.

Significant construction, which provided for and continues to be aim at the construction of entire complexes, including industrial and social objects and determined the rapid development of the industry over the years of independence. An important step in this direction no doubt has become a target implementation of the state program of construction, in areas such as personal property and complete the construction of model projects. As well known, the implementation of any significant project due to the presence of the resource (capital investments) and a temporary building. In this regard, it should be note that these derivatives is explained by the importance of the adoption of organizational and technological solutions that correspond to the tasks and capacities. Of particular importance acquired data solutions already at the stage of construction and technological preparation. Experts rightly point out that the success of the project, in most cases, is directly in close relationship with the main stages and milestones set out in the framework of the intended target systems of a particular project.

Timely decisions in terms of time governmental capital investments and cause the production of an effective schedule that, in principle, included in the spectrum of the main tasks of technological preparation of the construction.

The development carried out in accordance with the «ШНК 3.01.01-03». Experts

[6, 7] agree that a backlog of methodical basis, taking into account the existing rules in the construction backlog, provide an opportunity to further improved the approaches and scientific developments in this area. Thus, the relevance of the question due to the lack of detail in the design schedule in the existing reference sources.

Theoretical and methodical aspects of organizational and technological preparation of construction, including the method of scheduling (when the production organization of the complex at the stage of feasibility study of the project). It must be justified in accordance with the application guidelines on the practice of resource time criterion and the development of capital investments, as in the individual, and an integrated approach. An important derivative of the expected success to date is the account of the level and frequency of use of efficient technologies, including information and mobile communication tools. All this will enable a more productive to implement practical activities in the processes that use in projection and construction.

Therefore, the entire system of organizational and technological preparation of building production at the stage of feasibility study of the project of the complex of buildings is the target of the research process and the final development schedule with the production organization of the complex.

The legal acts of the Republic of Uzbekistan, standards and guidance documents “Госкомархитектстрой” of Uzbekistan [1, 2, 6], materials published in scientific monographs and periodicals, the fundamental achievements of modern local construction science and works of scientists in the field. Organizational and technological preparation of building manufacture consistently provide important information, the regulatory and scientific theoretical - practical basis any forward-looking studies on improving and bringing up to meet the ever processes and the growing demands of the construction industry.

In this context, methods of scientific abstraction, idealization, synthesis and analysis, and the reliance on a comprehensive approach, application techniques and optimization models play an equally important role in conducting research.

Ability to develop the planned schedule of the project saw through the prism of evaluation parameters graph analytical model developed based on the method of construction and organization to the requirements of resources. Make sure to note that the study conducted, were with the prospect of authoring and validation of the theoretical and methodical positions and practical recommendations on the formation mechanism of the automated schedule of the project, confirmed to apply for a patent.

All this before, the determined for setting targets aimed at the study of theoretical and methodological approaches and principles to the formation of the calendar plan of the complex with its flow in Uzbekistan and abroad, identifying and structuring factors determining the organizational and technological parameters of the schedule-line construction of the complex. Determining and classification of external and internal construction of process parameters and their influence a rational use of resources; defining the principles of resource maintenance of building in market conditions. The formalization and construction of graph analytical model of the production organization of the complex as well as the definition of organizational and technological parameters of the model will help in the automated mode to provide effective elaboration at the schedule-line construction of the complex.

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Appendix A

O'ZBEKISTON RESPUBLIKASI INTELLEKTUAL MULK AGENTLIGI
АГЕНТСТВО ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ
РЕСПУБЛИКИ УЗБЕКИСТАН

ELEKTRON HISOBLASH MASHINALARI UCHUN YARATILGAN DASTURNING RASMIY RO'YXATDAN O'TKAZILGANLIGI TO'G'RISIDAGI GUVOHNOMA
СВИДЕТЕЛЬСТВО ОБ ОФИЦИАЛЬНОЙ РЕГИСТРАЦИИ ПРОГРАММЫ ДЛЯ ЭЛЕКТРОННО-ВЫЧИСЛИТЕЛЬНЫХ МАШИН

№ DGU 03620

Ushbu guvohnoma O'zbekiston Respublikasining «Elektron hisoblash mashinalari uchun yaratilgan dasturlar va ma'lumotlar bazalarining huquqiy himoyasi to'g'risida»gi Qonuniga asosan quyidagi EHM uchun dasturga berildi:

Настоящее свидетельство выдано на основании Закона Республики Узбекистан «О правовой охране программ для электронно-вычислительных машин и баз данных» на следующую программу для ЭВМ:

Бино ва иншоотлар мажмуини оқим услубида қурилишининг тақвимий режасини тузиш
Разработка календарного плана строительства комплекса зданий и сооружений поточным методом

Talabnoma kelib tushgan sana:
Дата поступления заявки: **19.02.2016**

Talabnoma raqami:
Номер заявки: **DGU 2016 0088**

Huquq egasi(egalari):
Правообладатель(и): **Мирахмедов Махамаджан, UZ**

Dastur muallif(lar)i:
Автор(ы) программы: **Мирахмедов Махамаджан, Расулмухамедов Маҳамадазиз Махамадаминович, Рашидов Жасур Гайрат ўғли, Елубаев Куат Талгатович, UZ**

O'zbekiston Respublikasi elektron hisoblash mashinalari uchun dasturlar davlat reestrida 17.03.2016 yilda Toshkent shahrida ro'yxatdan o'tkazilgan.

Зарегистрирован в государственном реестре программ для электронно-вычислительных машин Республики Узбекистан, в г. Ташкенте, 17.03.2016 г.

Bosh direktor o'rinbosari
Заместитель генерального директора **М. Бобожанов**

Appendix B

Программа для ЭВМ: «Разработка календарного плана строительства комплекса зданий и сооружений поточным методом»

Аннотация:

Календарное планирование строительства в условиях недостатка сведений на ранних этапах технологической подготовки строительства, когда еще нет конструктивных решений, поэтому, невозможности определения объемов работ, следовательно и затрат труда, применение известных программ автоматизированной разработки достоверных календарных графиков невозможно. В то же время без утвержденного графика распределения капитальных вложений финансирование строительства по установленному порядку невозможно. Поэтому, имеется настоятельная необходимость разработки методики поточной организации строительства комплексов в составе проектов организации строительства (ПОС) и автоматизированного получения календарного плана, отвечающего требованиям норм продолжительности и задела строительства.

Разработанная расчётная программа позволяет в автоматическом режиме осуществлять получение распределения капитальных вложений в составе ПОС на первом этапе технологической подготовки строительства.

Область применения:

Проектирование комплексов зданий и сооружений.

Назначение:

Календарное планирование в составе проекта организации строительства в технико-экономическом обосновании строительства комплексов зданий и сооружений.

Функционнальные возможности:

Автоматизированный расчет циклограммы комплексного потока и получение календарного плана строительства комплекса зданий и сооружений.

Тип ЭВМ: PENTIUM IV.

Язык программирования: VISUAL STUDIO 2013, C#.

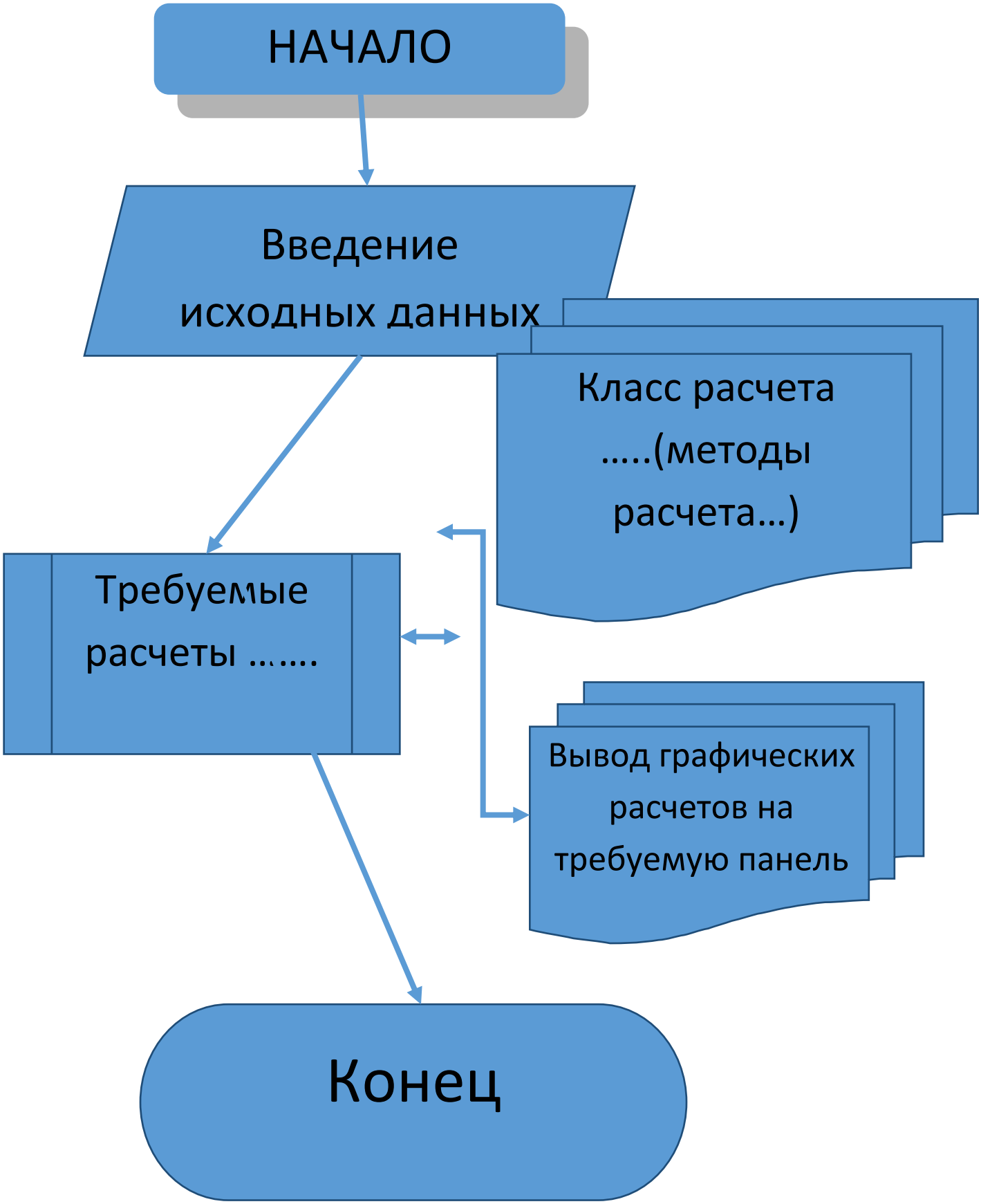
Операционная среда: WINDOWS-7.

Объём регистрируемой программы: 2.28 гигабайт.

Appendix C

БЛОК-СХЕМА

Разработка календарного плана расчетом комплексной циклограммы поточной организации строительства



Appendix D

АЛГОРИТМ

Автоматизированного расчета комплексной циклограммы поточной организации строительства с выводом на панель календарного плана строительства комплекса предприятий, зданий и сооружений соответствующих нормам задела в строительстве

Расчетные параметры комплексной циклограммы поточной организации строительства: **временные – *неизменяемые* T, T_n** и ***изменяемые*** на следующих шагах расчетов T_{p1}, $T_{пр1}$, T_{p2}, $T_{пр2}$, T_{p3}, $T_{пр3}$, O_1, O_2

и **монитарные – P_1, P_2, P_3**

где, T - общий срок строительства, месяцах;
T_n - продолжительность подготовительного периода, месяцах;
T_{n2} – продолжительность подготовительного периода 2го потока, месяцах;
T_{p1} - продолжительность периода развертывания 1 (основного) потока, месяцах;
$T_{пр1}$ - период выпуска готовой продукции 1го потока, месяцах;
T_{n3} – продолжительность подготовительного периода 3го потока, месяцах;
T_{p2} - продолжительность периода развертывания 2 (вспомогательного) потока, месяцах;
$T_{пр2}$ - период выпуска готовой продукции 2го потока, месяцах;
T_{p3} - продолжительность периода развертывания 3 (коммуникаций) потока, месяцах;
$T_{пр3}$ - период выпуска готовой продукции 3го потока, месяцах;
O_1 - опережение готовности 2го потока, месяцах;
O_2 - опережение готовности 3го потока, месяцах.
P_1, P_2, P_3 - суммарные стоимости объектов строительства соответственно по 1, 2 и 3 потокам, млн. сум.

Ограничения:

T задано или принимается по строительным нормам и правилам СНиП 1.04.03-85 «Нормы продолжительности строительства и задела в строительстве предприятий, зданий и сооружений;
T_n принимается по СНиП 1.04.03-85;
$0{,}5T_n <= T_{n2} <= T_n$; $T_{n3} = 0$;
T_{p1} = (0,1-0,25 в зависимости от отрасли строительства)T;
T_{p2}; T_{p3} для первого варианта принимаются в интервале от 10 до 25% от общей продолжительности строительства, т.е.

T_{p2} >= (0,1-0,25)T; T_{p3} >= (0,1-0,25)T

$T_{пр1} = T - (T_{п} + T_{p1})$; $T_{пр2} = (O_1 + T_{п2} + T_{p2})$; $T_{пр3} = O_1 + O_2 + T_{p3}$;

$T_{пр1} >= O_1$; $O_2 >= 0,5$ месяца

Результаты:

Освоение объемов строительно-монтажных работ: I_j где $j = 1,2,3$;

Тогда освоение объемов строительно-монтажных работ по потокам I_1, I_2, I_3 во времени позволяет получить помесячное i их распределение так, что сумма i равна сроку строительства T.

$$I_1=P_1/ T_{пр1}; \quad I_2=P_2/ T_{пр2}; \quad I_3=P_3/ T_{пр3};$$

Обобщенный график объемов строительно-монтажных работ подлежащих освоению по комплексу зданий и сооружений определяется суммированием для каждого месяца по потокам 1,2 и 3, т.е. по I_1, I_2, I_3 .

Суммированием по нарастающим итогам объемов строительно-монтажных работ подлежащих освоению по месяцам определяется этот объем, подлежащий освоению к концу каждого месяца так, что в итоге получается величина P равная сумме P_j , т.е. $P = P_1 + P_2 + P_3$.

Величины объемов строительно-монтажных работ к концу каждого месяца строительства отнесенные к общему объему СМР и выраженные в процентах представляют собой «заделы», которые должны соответствовать нормативному из СНиП 1.04.03-85. В противном случае следует изменить временные параметры циклограммы $T_{p1}, T_{пр1}, T_{p2}, T_{пр2}, T_{p3}, T_{пр3}, O_1, O_2$ и в автоматизированном режиме пересчитать циклограмму, получить графики финансирования строительства.

Расчетные и нормативные заделы должны соответствовать друг другу с точностью ± 1%.

При соблюдении этого условия для последнего варианта из соответствующих дифференцированных графиков автоматически выводятся в табличной форме календарный план строительства со значениями объемов строительно-монтажных работ по потокам $j=1,2,3$ во времени t_i так, что их сумма для каждого потока p_i $(i=1,2,3,…., T)$ равна P_j , а их сумма по $j=1,2,3$ равна P.

В то же время сумма по $j=1,2,3$ для данного месяца i равна объему строительно-монтажных работ соответствующего $(\pm 1\%)$ нормативному заделу, а сумма сумм P_{ij} $(i=1,2,3,…, T; j=1,2,3)$ также выводится на панель равной P в млн. сум.

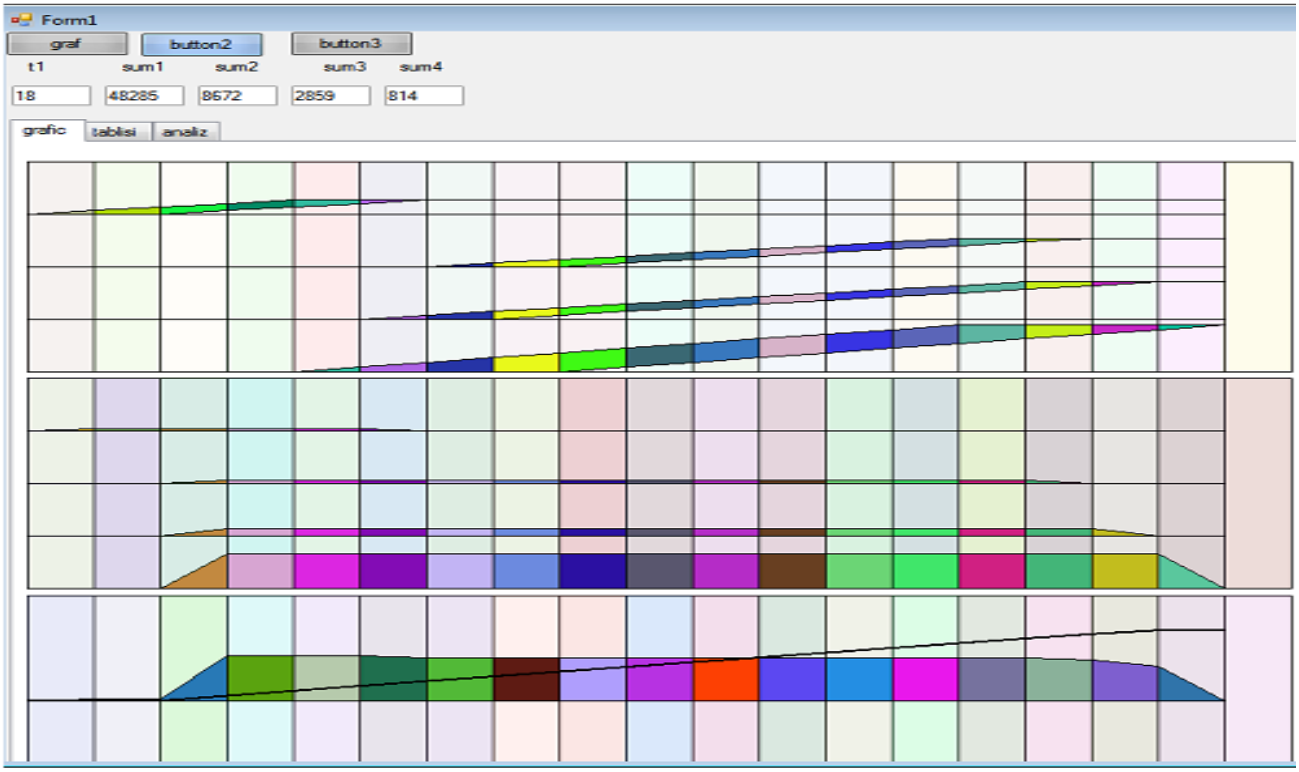
Appendix E

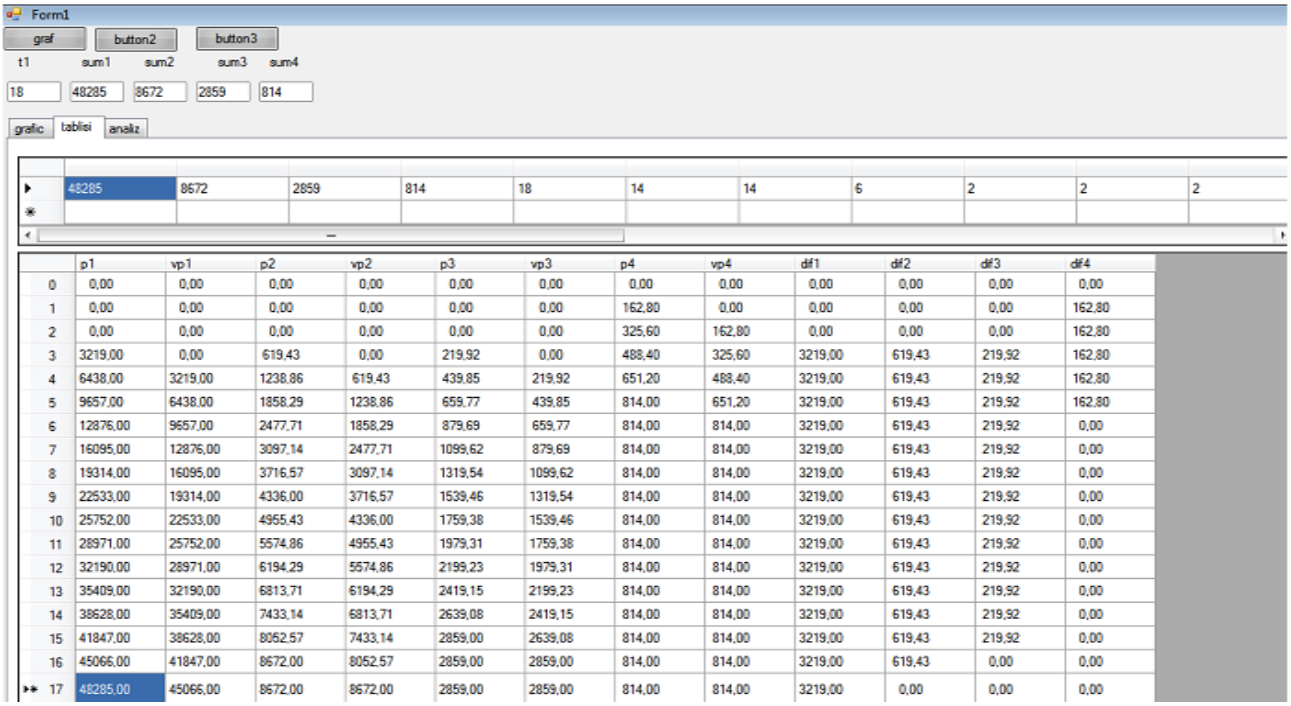
Calculation

Cyclorama of the complex flow and receipt schedule plan

Расчет

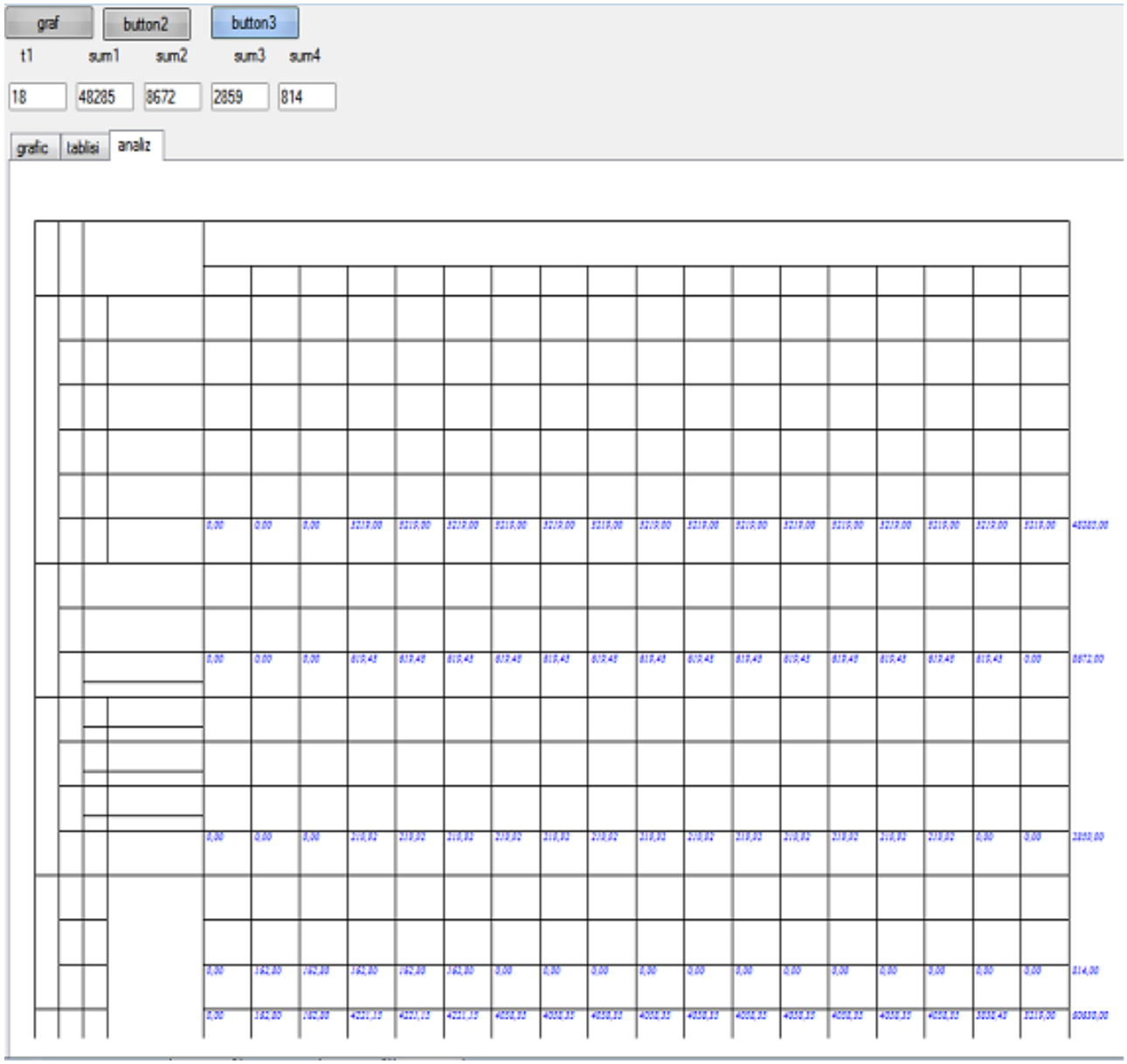
Циклограммы комплексного потока и получение календарного плана





	48285	8672	2859	814	18	14	14	6	2	2	2

	p1	vp1	p2	vp2	p3	vp3	p4	vp4	dif1	dif2	dif3	dif4
0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1	0,00	0,00	0,00	0,00	0,00	0,00	162,80	0,00	0,00	0,00	0,00	162,80
2	0,00	0,00	0,00	0,00	0,00	0,00	325,60	162,80	0,00	0,00	0,00	162,80
3	3219,00	0,00	619,43	0,00	219,92	0,00	488,40	325,60	3219,00	619,43	219,92	162,80
4	6438,00	3219,00	1238,86	619,43	439,85	219,92	651,20	488,40	3219,00	619,43	219,92	162,80
5	9657,00	6438,00	1858,29	1238,86	659,77	439,85	814,00	651,20	3219,00	619,43	219,92	162,80
6	12876,00	9657,00	2477,71	1858,29	879,69	659,77	814,00	814,00	3219,00	619,43	219,92	0,00
7	16095,00	12876,00	3097,14	2477,71	1099,62	879,69	814,00	814,00	3219,00	619,43	219,92	0,00
8	19314,00	16095,00	3716,57	3097,14	1319,54	1099,62	814,00	814,00	3219,00	619,43	219,92	0,00
9	22533,00	19314,00	4336,00	3716,57	1539,46	1319,54	814,00	814,00	3219,00	619,43	219,92	0,00
10	25752,00	22533,00	4955,43	4336,00	1759,38	1539,46	814,00	814,00	3219,00	619,43	219,92	0,00
11	28971,00	25752,00	5574,86	4955,43	1979,31	1759,38	814,00	814,00	3219,00	619,43	219,92	0,00
12	32190,00	28971,00	6194,29	5574,86	2199,23	1979,31	814,00	814,00	3219,00	619,43	219,92	0,00
13	35409,00	32190,00	6813,71	6194,29	2419,15	2199,23	814,00	814,00	3219,00	619,43	219,92	0,00
14	38628,00	35409,00	7433,14	6813,71	2639,08	2419,15	814,00	814,00	3219,00	619,43	219,92	0,00
15	41847,00	38628,00	8052,57	7433,14	2859,00	2639,08	814,00	814,00	3219,00	619,43	219,92	0,00
16	45066,00	41847,00	8672,00	8052,57	2859,00	2859,00	814,00	814,00	3219,00	619,43	0,00	0,00
17	48285,00	45066,00	8672,00	8672,00	2859,00	2859,00	814,00	814,00	3219,00	0,00	0,00	0,00


graf
button2
button3
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sum4
18
48285
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analiz

Appendix F

Vocabulary of keywords
(Словарь ключевых слов)

Backlog - Задел

Capital investments- Капиталовложения

Flow-line method construction- Поточный метод строительства

Schedule plan – Календарный план

PICO – ППР (Проект Производства Работ)

POC - ПОС (Проект Организации Строительства)

Work zone - Захватка

Глоссарий

Строительный задел - (задел по объему капитальных вложений) КЗ – Суммарный объем капитальных вложений, который должен быть осуществлен или уже осуществлен по задельным объектам. Этот задел для объектов, по которым рассчитывается задел по мощности, может быть определен прямым счетом по каждому объекту на основе данных о их сметной стоимости, норм продолжительности строительства, рекомендуемого указанными нормами распределения капитальных вложений по годам строительства, а также намечаемых сроков ввода в действие.

Захватки - Представляют собой части объектов, в пределах которых повторяются одинаковые объемы по ведущему виду работ.

Календарный план строительства - Проектный документ, который определяет последовательность и сроки выполнения отдельных работ, устанавливает их технологическую взаимосвязь в соответствии с характером и объемом строительно-монтажных работ. В составе ПОС разрабатывается сводный календарный план строительства, в составе ППР — календарные планы производства работ по отдельным объектам.

Капитальные вложения - расходы на приобретение основного капитала, например покупку оборудования или строительство новых зданий.

Организация строительного производства – Система взаимоувязанных организационно-технологических решений, мероприятий и работ по обеспечению эффективного выполнения строительно-монтажных работ по возведению (реконструкции) объекта запроектированными темпами и в установленные сроки.

Организационно-технологические решения - Решения по организации и технологии строительного производства, принятые в организационно-технологических документах.

Поточный метод - Метод организации строительства, обеспечивающий ритмичность производства, высокую производительность труда и равномерный выпуск готовой строительной продукции.

Проекты производства работ - Разрабатываются по рабочей документации, утверждаются подрядной организацией и служат основой для определения эффективных методов выполнения строительно-монтажных работ.

Проекты организации работ – Предусмотренных производственной программой строительной организации разрабатываются на основе увязки деятельности общестроительных и специализированных подразделений и бригад и утверждаются руководством строительной организации.