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THE ORGANIZATION AND MANAGEMENT OF INDUSTRIAL CONSTRUCTION IN THE USSR 1/

by

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1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO.

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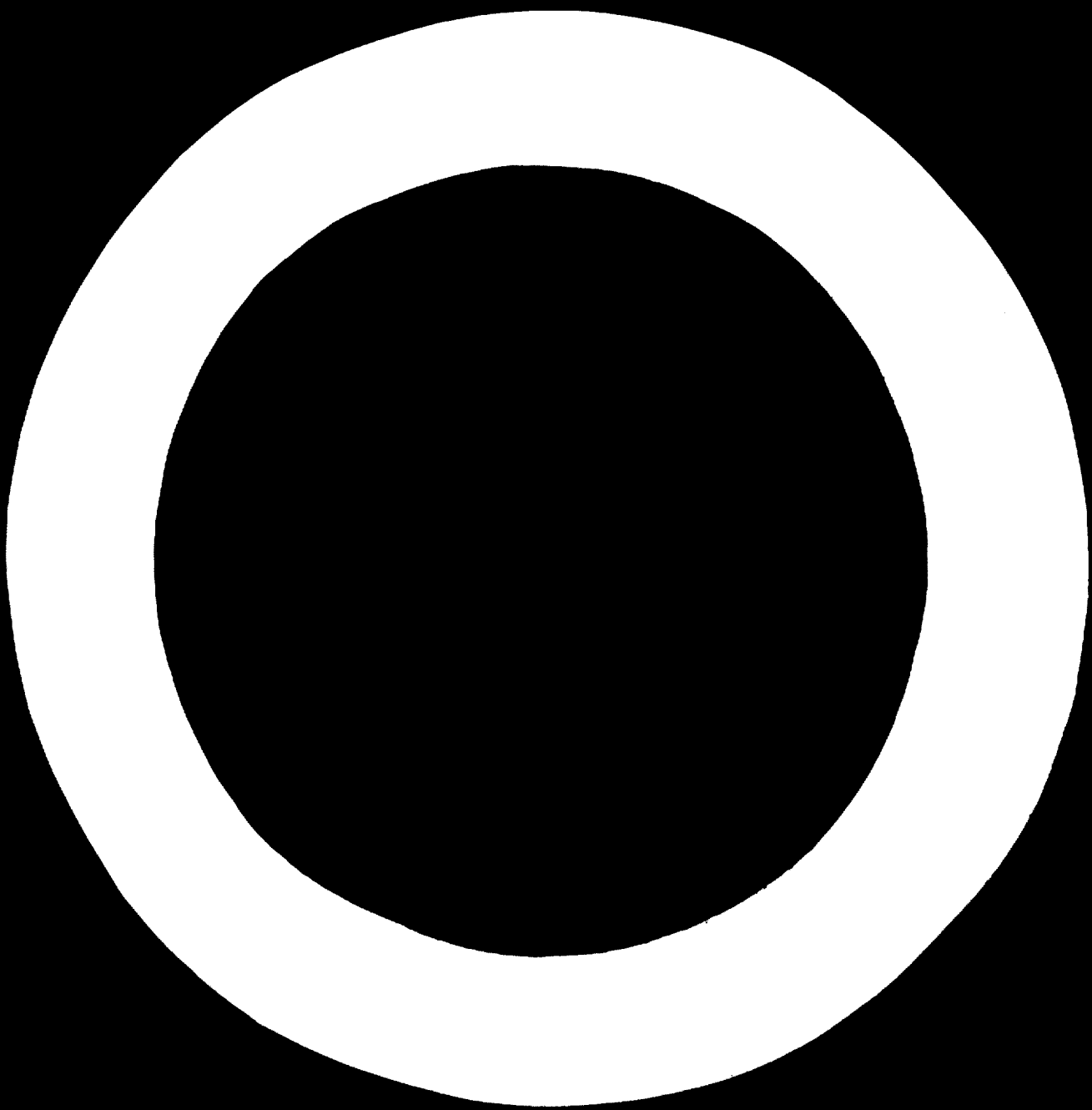

1. The basic features and trends of industrial construction

The basic trend in the development of capital construction in the Soviet Union is the industrialization of this sector, as a basis for technological progress and an essential prerequisite for the radical improvement of all technical and economic indicators in construction organizations.

Industrial construction is characterized by the widespread use of composite prefabricated units, elements and components for buildings and structures, produced on a factory basis, the all-round mechanization of production processes at building sites through the use of automatic equipment, and the use of technologically advanced and assembly line procedures in building and assembly operations. The modern building site has become an area where buildings and structures are assembled by mechanical means from factory-produced large prefabricated units, using cranes and other highly productive equipment. As a result, labour and financial outlays on the production and assembly of structural elements are being dramatically reduced, the time spent on these operations is being cut back considerably and it is no longer necessary to construct the temporary buildings and installations which were formerly used for processing and producing materials, solvents and concrete, metal structural elements, wooden units, sanitary installations, etc. The industrialization of construction has almost completely eliminated the adverse effects of climatic conditions on the quality of construction and the time spent on operations and is enabling work to be maintained at a steady pace the whole year round.

Industrialization provides a sound base for a steady increase in the scale of construction, a growth in the productivity of labour and a reduction in construction and installation costs.

An important factor in industrialization is the extensive development of construction using pre-case ferro-concrete and other advanced construction components. This presupposes the standardization and unification of buildings and structures intended for various purposes, constructed on the basis of standard projects using standardized units and structural elements.

The industrialization of construction has brought about radical changes in the organization of the sector's production and supply system, which now consists mainly of specialized highly efficient enterprises producing various prefabricated structural elements from modern materials.

An indispensable condition for industrialization is the broadly-based mechanization and automation of production whereby the entire range of operations coming under the heading of general and specialized construction, including auxiliary operations, is performed mechanically by a series of mutually complementary machines, co-ordinated on the basis of productivity. The mechanization and automation of production are improving and drastically changing the nature of the work done by construction workers and are making it possible to reduce working hours and eliminate fundamental differences between mental and physical work.

The mechanization of construction and installation operations has radically altered the personality of construction organizations; these are now large mechanized subdivisions, equipped with the latest technology, which carry out large-scale construction operations.

The extensive industrialization of construction has required the establishment of construction organizations specializing in particular types of work, thus stimulating the development and introduction of highly advanced construction organization and technology and the training of highly skilled engineering and technical personnel and workers.

The industrialization of construction increases demand for skilled construction workers. To enable them to assimilate new technology and processes rapidly, workers and engineers must be given special training, designed to transform them into highly competent personnel with a sound grasp of modern technology and advanced construction and installation processes.

The basic characteristics of the industrialization of construction enumerated above affect the organization and management of construction, and corresponding changes are also taking place in this area.

2. The fundamental principles of the management of industrial construction

In the USSR, the management of industrial construction, as one of the branches of physical production, is organized in line with the basic requirements of socialist management, the basis of which is the principle of democratic centralism - a combination of centrally planned management on the one hand and a broad degree of initiative among local bodies, organizations and enterprises on the other, together with the active participation of workers' collectives in the production and management processes.

In the construction sector, the principle of democratic centralism finds expression in:

The centralized planning of capital investment and project acceptance;

The planned allocation of construction and installation projects to the various contracting organizations;

The planned guidance of the central State organs;

The granting to local construction organizations of both functional and economic autonomy and a considerable degree of latitude in the selection of procedures for executing assignments and ensuring that a project is executed efficiently.

Under the principle of democratic centralism, construction organizations are accountable to their superiors in the management hierarchy and may be inspected by the latter.

The principle of democratic centralism in management is directly linked to the concept of the indivisibility of political and economic management. This means that in addition to being responsible for the industrial and economic management of their enterprises, managerial staff must ensure that the directives of the Soviet State and Party organs are strictly complied with.

The principle of one-man management (whereby the workers as a whole are subordinate to one person - the manager - who is given the necessary managerial authority in the production unit assigned to him and bears absolute responsibility for the work of this unit) is applied to the management of industrial construction, as to other branches of industry.

One-man management is combined with the active participation of workers in management and a broad degree of social control of the administration's activities. Social control, which does not violate the principle of one-man management, allows a large proportion of the workers to become involved in following the implementation of State plans and discussing and resolving important problems related to the operation of enterprises and construction organizations.

One of the fundamental principles of the management of socialist production is the principle of financial concern whereby individual workers and collectives are given a material stake in increased production.

The principle of financial concern is inseparably linked to the system of profit and loss accounting, whereby the interests of the State are weighed against the interests of individual workers' collectives and the financial concern and responsibility of construction organizations and their sub-divisions in the rational functioning of the economy and the implementation of plans is increased.

3. The central organs for the management of industrial construction

The State organs of the USSR which are responsible for the development planning of the national economy and the management of industry and construction are guided in their activities by the State's decisions on construction management.

The State planning Commission of the Council of Ministers of the USSR (Gosplan of the USSR) is the State planning organ. It formulates State plans for the development of the national economy of the USSR and on the basis of the goals set forth in these plans, identifies capital construction targets and maps a programme for the construction industry, solves planning and research problems and draws up measures designed to keep the programme supplied with manpower, equipment, materials and financial and other resources.

An important role in construction management is played by the State Construction Committee of the Council of Ministers of the USSR and the state construction committees of the councils of ministers of the union republics. The main functions of these committees are: to formulate an overall technical policy designed to accelerate technical progress in construction and upgrade its efficiency; to supervise the introduction of sophisticated scientific and technological techniques and advanced methods of design and construction; to prepare measures designed to reduce construction costs, improve the quality of work and cut down the construction time of enterprises and other structures; to further improve costing techniques, and to check the implementation of the decisions of the Governments of the USSR and the union republics relating to construction.

The tasks of the State Construction Committee of the USSR include participation in the formulation of construction development plans and the solution of important and complex scientific and technical problems and of questions related to the development of the building materials industry. It has wide-ranging powers in the formulation

of all-union output standards and technical regulations for construction design, norms for the duration of construction, costing and price lists and schedules, unified output and job prices for construction and installation, standard projects and designs, and standards for building materials, elements and instruments.

The functions of the State Committee on Civil Construction and Architecture, which is attached to the USSR State Committee for Construction, include town planning and standard designs for housing and community facilities and amenities; quality control of these installations; the preparation of design standards for housing and civil construction; the commissioning of expert appraisals of projects, and the organization of research.

The management of construction organizations is currently carried out by the union republican and republican ministries of construction and the territorial administrations, the ministries and departments subordinate to them and the local soviets of working peoples' deputies.

The union republican ministries are organized on a territorial and sectoral basis. Thus, the construction of enterprises of the metallurgical industry in union republics, territories and regions where this branch is of major significance is the responsibility of the USSR Ministry for the Construction of Heavy Industry Establishments. Enterprises of the chemical, petrochemical, petroleum refining and pulp and paper industries in republics, territories and regions where these industries predominate are constructed by the Ministry for Industrial Construction of the USSR. In the areas of their jurisdiction, these ministries also construct installations for other branches of industry, as well as housing, and cultural and community facilities and amenities.

The construction of industrial enterprises for sectors of the economy being developed in any other republic, territory or region, as well as housing and community facilities, is the responsibility of the Ministry of Construction of the USSR.

Agricultural construction is carried out by the Ministry of Agricultural Construction of the USSR. It constructs industrial and residential buildings and cultural and community facilities in rural areas, oversees agricultural construction in the country, works out general questions related to the organization of agricultural construction, and ensures that scientific and technological achievements and advanced ideas are introduced into agricultural construction.

In addition, the Ministry of Agricultural Construction controls (in an organizational and technical sense) the system of inter-district construction organizations which are established by mutual agreement with agricultural collectives (kolkhozi) on a sharing basis. The resources of these organizations consist of Kolkhoz contributions, supplemented by the profits earned. Inter-district construction organizations are financially autonomous and all projects carried out for kolkhozi and other clients are done in accordance with contracts drawn up in the same manner as those concluded with State construction organizations.

Apart from the union republican construction ministries of the USSR, similar ministries exist in the Union Republics. Thus, for example, there is a ministry for the construction of heavy industry establishments in both the Ukraine and Kazakhstan, while there are ministries for industrial construction in the Ukraine, Byelorussia, Georgia, Armenia and Azerbaidzhan, etc.

The union republican construction ministries located in the union republics are subordinate to the councils of ministers of the union republics and the competent union republican ministries of the USSR. In managing enterprises and organizations, they are guided by the directives drawn up by the union republican ministries of the USSR.

Organizations which specialize in the construction of railways, roads, underground railways, tunnels, bridges, airports and river and sea-port facilities come under the Ministry of Transport Construction, while those specializing in the construction of trunk pipelines and gas pipelines come under the Ministry for the Construction of Establishments of the Oil and Gas Industry.

Construction industries specializing in reclamation and irrigation come under the Ministry of Irrigation and Water Economy of the USSR, organizations which construct all types of major power installations (thermal power stations, hydro-electric power stations, power transmission lines) come within the Ministry of Power and Electrification of the USSR, the Ministry of Water Management of the USSR and the Ministry of Petroleum and Gas Construction of the USSR. These ministries oversee, in addition to construction work, the functioning of enterprises in their areas of competence.

Assembly and certain other organizations which serve all union republics are concentrated in the Union Republican Ministry of Installation and Special Construction Work of the USSR.

A considerable proportion of building and installation operations is done by organizations of local soviets of working peoples' deputies which mainly service trade, housing, cultural and recreation and community enterprises and organizations. In large cities, the construction organizations of local soviets of working peoples' deputies are combined into large territorial sub-divisions which construct housing and cultural and recreational facilities and amenities, and in certain cases industrial enterprises and agricultural units as well. These organizations include for example, the Main Administration for Housing and Civil Engineering Construction in Moscow (Glavmosstroy), the Main Administration for Industrial Construction in Moscow (Glavmospromstroy), the Main Administration for Housing, Civil Engineering and Industrial Construction in Leningrad Glavleningradstroy, the Main Administration for Housing, Civil Engineering and Industrial Construction in Tashkent (Glavtashkentstroy) etc.

4. The structure, network and composition of agencies for the management of the construction industry

By structure, we mean the composition of the chain of management command in construction, while network denotes the sum total of construction organizations of various sizes and types (classified according to the volume and nature of the work done) which come under a given management organ and are located in a particular area.

The fixing of construction and installation output is done by trusts, administrations and organizations of similar standing to them.

The system most commonly used in the construction industry is a three-tier operational-economic management structure. The basic levels are, as a rule: central territorial administration or combine → construction and installation trust → construction (construction and installation) board.

Construction or construction and installation administrations and work supervisors' offices (which have the same standing) enjoy complete financial autonomy and are the primary construction organisations.

Subordinate to these organisations are engineering units which do not have full economic autonomy. x/

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x/ In a number of cases, particularly within the Ministry of Installation and Special Construction Operations of the USSR, installation units keep their own accounts and operate on a financially autonomous basis. Such units are equal to the primary construction organisations.

Both primary construction organizations (administrations) and auxiliary industrial and service undertakings are subordinate to trusts.

Technical and organizational supervision of operations is carried out directly at construction sites by the staff of the construction administrations - technical engineers and foremen.

At the ministerial level, the management of administrations or combines and trusts is effected by means of a system of central boards (classified by function, branch or territory) which form part of the ministry concerned.

An effective type of primary construction organization are mobile mechanized units or construction and installation trains which are set up within combines, plants, trusts and other economic organizations.

These mobile groups are equipped with portable construction machinery, tools, storage facilities, sleeping cars and other facilities. They are made up of fully qualified permanent staff and are thus able to use modern techniques in remote areas. They work mainly on transport and agricultural projects and projects in the following sectors: the light industry; the food industry; the meat and dairy products industry; ferrous metallurgy; mineral fertilizers and the construction of timber enterprises and water management facilities.

As industrial construction and the activities of construction agencies continue to develop, particularly under the new system of management, the organizational structure of construction management is being constantly improved.

5. New methods of industrial construction management

As already noted, primary contracting organizations are still, as a rule, controlled by territorial and regional (calculated on the basis of 2 - 3 regions) central construction boards, and regional construction boards (combines).

However, a structure of this type, consisting of four or even five levels makes it difficult to co-ordinate the activities of general construction, specialised and other organizations of the construction industry and delays the solution of day-to-day problems.

Consequently, the State organs of the USSR decided to establish combines and complexes as the basic economic tool of social production.

A number of construction ministries have established large industrial complexes, abolished trusts and strengthened the primary construction organizations. Thus, the Ministry of Industrial Construction of the USSR has turned over the functions of trusts in some areas to regional boards which perform the same functions as combines in industry.

The Ministry for the Construction of Enterprises of the Oil and Gas Industry has replaced a number of trusts by large combines or financially autonomous central committees to which all construction sub-divisions (now strengthened) and enterprises servicing construction are directly subordinate.

The Ministry of Agricultural Construction of the USSR has replaced trusts in a number of regions, territories and autonomous republics by combine-type boards whose direct area of jurisdiction includes mechanized units, construction boards, mechanization boards and building materials suppliers.

The new economic bodies - combines, complexes and financially autonomous main committees - have been transformed from administrative management organs into economic complexes. These complexes form a single economic system linking construction organizations and other territorial and sectoral sub-divisions in a system of industrial integration. As a rule, management structure in these cases takes the following form: primary organization - complex (combine, financially autonomous main committee, etc.) - ministry.

The creation and development of production complexes in industry and construction is changing economic relations, management methods and the very system of production control.

Thus, major changes are taking place in the management structure of the construction sector in the USSR: small lower-echelon organizations are being replaced by large sub-divisions subordinate to complexes, combines and financially autonomous main committees which have taken the place of a number of small trusts.

6. How building and installation work is carried out

There are two methods of carrying out industrial construction work: the contract and the economic system. Under the contract system, construction work is taken on by a permanent financially autonomous construction contractor operating on behalf of various clients.

Construction contractors are basically subordinate to the central construction boards of construction ministries, the construction boards of non-construction ministries and also to the main construction boards of the executive committees of municipal soviets of working peoples' deputies.

Construction contractors carry out work on the basis of contracts for capital construction concluded with clients (the party for whom the buildings are being constructed). The procedures for concluding and executing contracts, and the mutual relations and obligations of the parties are regulated by the following civil legislative enactments: "Regulations governing construction agreements and contracts"; "Regulations for financing construction", as well as the "Special conditions" attached to the contract.

Contracts may be concluded for new projects or for the reconstruction or extension of existing structures. They cover the entire volume of work, execution being calculated on the basis of output norms over a period of several years. For each year of construction (apart from the first) the parties conclude supplementary agreements to the basic contract which determine how much work must be done for capacities and basic facilities to be brought into operation within the time-limits stipulated in the basic contract.

In order to carry out the installation and special construction work provided for in the basic contract, the main contractor may (and usually does) call upon specialized organizations with which he concludes subcontracting agreements in accordance with established procedures. In such cases, the main contractor acts as a client while the subcontractor becomes the contractor.

Nowadays, the contract method of building is doing much to hance the economic effectiveness of capital investments and to promote further progress in industrialisation. Consequently, the vast majority of construction work in the USSR (more than 90 per cent) is carried out by this method.

It is anticipated that contract construction will be expanded, as an economically efficient means of performing construction and installation operations.

Under the economic system, construction is carried out by the party requiring the facilities himself (the organization or enterprise). He is the operational manager and construction engineer. He sets up his own organization and production system for the duration, acquires or loans construction machinery, arranges for the delivery of construction materials to the site, and recruits temporary workers and engineering and technical personnel.

Generally speaking, this method is used only for small construction projects in areas where there are no construction contractors, or for the partial reconstruction and large-scale repair of industrial enterprises.

The client makes a construction site available to the contractor and at the same time hands over to him the approved itemized lists of construction units, the financing plan; and the project estimates within the time stipulated in the contract.

In industrial construction, the client provides technical and other types of equipment and certain special materials (cables, ferrous metals etc.). In certain cases, he agrees to provide supplies of electricity, water, steam, as well as rail transport, temporary facilities and living quarters, etc.

The client oversees the progress of construction and ensures that it is in line with the project estimates, (particularly so far as cost and quality are concerned) and that the construction and installation operations and finished units meet current technical specifications for production and buildings acceptance.

7. Specialisation and collaboration in industrial construction

Specialisation is an advanced form of the social division of labour both between various branches and areas of social production and within branches and enterprises at different stages of the production process.

There are two basic forms of specialization in construction: sectoral and technological.

Sectoral specialisation takes the form of the establishment of financially independent specialised organisations which carry out construction operations for specific sectors of the economy - industry, transport, agriculture, and also for specific branches of industry - chemistry, metallurgy, etc.

The further development of specialization leads to construction organizations concentrating on the building of certain types of industrial installations and structures (for example blast furnace shops, elevators, etc.). In housing and civil construction, enterprises specialize in the construction of housing, schools, children's establishments, etc.

Technological specialization takes the form of the establishment of financially independent construction organizations which specialize in one type of work or a series of construction and installation operations (equipment assembly, sanitary engineering, electrical installation, decorative work, etc.). This type of specialization is a function of the variety of general construction and specialized operations (from the technological and organizational point of view).

When assembly-line production procedures are used, the process of erecting buildings and structures is divided into separate stages: excavation, above-ground operations, etc., which are carried out by specialized technological organizations.

Nowadays, specialized construction agencies account for about 75 per cent of all industrial construction organizations.

The specialization of industrial construction is increasing the economic effectiveness of this activity through:

A marked improvement in process technology;

The highly-developed division of labour; upgrading of skills and qualifications;

Increased mechanization of operations; greater use of small-scale mechanization;

Improved productivity and higher wages;

Better use of construction machinery and equipment, tailored precisely to the type of work done;

Reduced construction time, improved quality and lower costs;

The establishment of conditions conducive to the further industrialization of specialized construction and installation operations (centralized mechanized production of semi-finished goods, finished items and units, etc.), and to the introduction of assembly-line procedures and industrial collaboration.

In the construction industry, collaboration means the strengthening of production relations between economically autonomous organizations and enterprises, by means of the joint execution of various operations involved in the erection of buildings and structures and joint deliveries of equipment and services (for example, transport).

There is a difference between sectoral and inter-sectoral collaboration. Collaboration between organizations and enterprises belonging to the same branch of industry is called sectoral (for example, collaboration between general construction and specialized organizations, which both belong to the construction industry).

Collaboration between organizations and enterprises belonging to different branches of industry is called inter-sectoral.

Industrial collaboration is indissolubly bound up with specialization in construction. The higher the degree of specialization, the more developed collaboration will be; collaboration, in its turn, is making specialization more effective and promoting its further development.

8. The concentration of industrial production

Concentration means the consolidation of production in ever-larger enterprises. In the construction industry, concentration has a special meaning which has to do with the specific nature of the finished product. This makes concentration in construction more difficult and lends it a special character. Concentration in industrial construction thus expresses itself in the following two ways:

The process of consolidating construction organizations, i.e. the conentration of production and manpower resources (and thus the execution of building and installation operations) in ever-larger organizations;

The process of steadily increasing the size of projects, i.e. the consolidation of the volume of operations at one construction site.

The first type of concentration - the consolidation of construction organizations - is the most common. However, the second type of concentration - increasing the volume of on-site construction operations - has also been gaining ground recently, particularly as a result of the directives on construction design using large aggregates. The level of concentration in construction is always expressed in terms of the annual volume of work.

Industrial complexes, large hydro-electric power facilities and railway lines are now built by large construction organizations with annual work programmes totalling more than 40-50 million roubles.

The consolidation of construction organizations is clearly illustrated by the establishment of large territorial combines - Glavmosstroy, Glavleningradstroy, Galvkievstroy, etc. to carry out housing and civil construction in major cities of the Soviet Union. The relevant trusts have been handed over to these combines and the building and installation boards strengthened and specialized, while small unprofitable agencies have been eliminated. The establishment of large contracting territorial-sectoral combines has helped to improve construction in these cities and promoted the more effective use of the productive capacities of construction organizations and the large-scale introduction of industrial construction methods.

9. Integration in industrial construction

The rapid development of technology and the social division of labour have lead to the use of an advanced form of production organization - integration - in industrial construction.

Integration in construction, as in industry, develops in organic unity with other forms of production organization - concentration, specialization and collaboration.

The value of integration can be seen in the improved use of material resources and equipment, reduced outlay on production and storage space (as the result of a relative reduction in requirements for them), as well as the reduction of administrative and works costs and the establishment of conditions favourable to a steady tempo of work etc. Integration, as an economically sound system, helps to increase productivity and reduce costs.

Integration in the construction sector takes many different forms. The development of integration should be tied in with the so-called combines of industrial enterprises, combining the open-cast mining of materials and the production of a variety of products (manufacture of semi-finished goods, concrete elements, joinery and the like).

An important stage in the development of integration in industrial construction has been the establishment of housing construction combines and, in recent years, plant and agricultural construction combines.

Housing construction combines as a new form of integration in industrial construction were first introduced in Leningrad in 1959. Having rapidly proved their technical and economic worth, housing construction combines began to develop at a rapid rate. They now provide 60 per cent of all large-panel housing construction.

Housing construction combines are industrial construction enterprises which produce elements for standard large-panel buildings, transport them to construction sites, assemble the buildings (usually directly from the transportation), finish homes and hand them over to the client in a fully finished state. Their end products are living quarters ready for occupancy.

Housing construction combines most often building large housing estates.

The advantages of the construction of large-panel buildings by housing construction combines as opposed to usual methods can be summarized as follows:

The management of industrial production and construction can be unified and conditions established which enable housing to be provided at a more rapid rate;

Since a large part of production has been transferred from the assembly site to the factory floor, elements leave the factory in a more finished state, and thus working conditions are improved. Building and installation is gradually losing its special personality and is becoming a normal form of in-plant industrial production;

New possibilities are being provided for improving the quality of the finished product - ready-for-occupancy housing. Better use is made of the materials resulting from productive processes;

Under the former system, workers in industrial enterprises were not always interested in organizing the production of advanced structural elements, since that would have meant readjusting production. Under the new system, the management is equally interested in the state of finish of the goods, in the rate of assembly and in quality. The new system is the improvements in all phases of the production process, and the reduction of the weight and cost of structural elements and components of houses;

It is becoming possible to dispense with storage facilities at construction sites, while the reduction of transportation costs and outlays on loading and unloading operations is reducing production costs; the introduction of a dispatching system (centralized traffic control) is being facilitated;

Contra-accounts are simplified and the quantity of accounts and other documents prepared is being reduced, while management staff can be cut back and administrative and works costs reduced;

Conditions are being established for regulating the amount of construction work in progress and accelerating the turnover of resources.

All housing construction combines can be classified under more general categories which are common to each of them and at the same time distinguish them from each other.

The type of housing construction combine and its organizational and economic structure depends on the technological sophistication of the construction organizations and plants engaged in large-panel housing construction which are grouped within the combine, their location, capacity, etc.

In Leningrad, all housing construction combines operate on a construction balance. They perform the functions of subcontracting organizations insofar as general construction operations (excluding foundation operations) are concerned. The main contracting organizations are the dwelling unit construction trusts which themselves carry out all preparatory work (clearing of the site, demolition of existing buildings, construction of temporary roads, etc.) develop a "zero cycle" and also do engineering and installation work inside buildings and organize public services and amenities.

The Moscow housing construction Combines consist of plants for large-panel housing construction and building and installation administrations. They are all financially autonomous and have two independent balances - industrial and construction. The subdivisions of the housing construction combines specialize in the production of different elements and in building and installation and special works: they act as subcontractors for the administration of the housing construction combines. The housing construction combine itself does not do such work - it acts as a general subcontractor. The general contractor is Glavmosstroy. The housing construction combine performs all building and installation operations in the above-ground section of the building. Foundation operations are done by the specialist organizations of Glavmosstroy - the Mosfundamentstroy trusts.

All the Moscow housing construction combines and the two Mosfundamentstroy trusts are combined to form an independent housing construction board of Glavmosstroy (UZHS-3).

Housing construction combines in Kiev and other large cities of the Soviet Union are organized along the same lines as in Moscow.

In the Lithuanian SSR (Vilnius) a new type of housing construction combine - the general contractor - has been introduced. These housing construction combines act as general contractors for the construction of satellite towns. They themselves perform

all operations involved in the construction of satellite towns and housing estates, including the laying of underground communications, foundation operations, the construction and finishing of the main part of buildings, the provision of public services and amenities in the area and the construction of cultural and recreational facilities.

Under a system of this type, construction has a clearly organizational nature which is a function of steady technological progress in modern industrial enterprises. The housing construction combine is fully responsible for making housing available on schedule, and all its efforts and resources are directed towards achieving its end goal - the completion and handing over of both individual units and the dwelling complex as a whole.

When the housing construction combine is organized in this fashion, there is no need to co-ordinate the work of subcontracting organizations for each project and type of work. The entire construction process, starting with the production of components and ending with the handing over of the dwelling complex for occupancy, is a single and uninterrupted process carried out in accordance with a predetermined schedule. The time required to manufacture prefabricated units is less than that needed for assembly.

On the basis of the accumulated experience of housing construction combines in housing and civil construction, attempts have recently been made to establish plant construction combines for industrial construction and rural construction combines for agricultural construction.

The first plant construction combines were set up in Brovarakh in the Ukraine and in the Donets.

The experience of the first plant and rural construction combines has been encouraging from the technical and economic point of view. Nevertheless, bearing in mind the special features of industrial and agricultural construction, the establishment of combines in these sectors should still be viewed as an experimental exercise.

Integration in construction, which is expressed by a growing degree of specialization and industrialization and improved economic efficiency, has a sure future.

10. The introduction of automatic control systems in industrial construction

The development of the economy is causing a sharp rise in the amount of information which has to be processed in order to ensure control of enterprises, sectors and the national economy of the country as a whole. Merely increasing administrative personnel does not guarantee that all management problems will be dealt with competently. Since management staff cannot process essential information fast enough, management problems have to be solved by guesswork and rational solutions are often delayed. This disrupts the synchronisation of production processes and the distribution of production. In the final analysis, it is reflected either in loss of working time, equipment idle time and reduced productivity generally, or in the need to keep substantial stocks in reserve at all stages of production and distribution.

The modern scientific technological revolution is characterized by the rapid development and introduction of automation and computer techniques. These are providing substantial opportunities for further improving production management and control.

Automatic control systems (ACS) are being set up in various parts of the national economy (enterprises, industrial units, combines).

These systems include the whole range of economic and mathematical methods used in different management processes and computer techniques for the mechanical and automatic collection, transfer and processing of data. A system of this type can solve planning, accounting and management problems arising in sub-divisions and units.

The improvement of the system for the planning and management of the national economy in modern times requires the extensive use of computer techniques.

Automatic control systems (ACS) make it possible to organize economic production in such a way that maximum economic impact is achieved through the improved use of labour, material and equipment and financial resources.

Sectoral automatic control systems are established for different sectors (classified by ministries). Local control systems (at enterprises, sites and other units) are used by the sectoral system as sources of basic information.

An ACS is expected to perform the following tasks: the automatic processing of long-term sectoral planning and day-to-day production planning estimates; the organization of sectoral resource control, and the introduction of a system for supervising the achievement of planning targets.

Functional inter-departmental automatic control systems have also been set up (in the State Planning Commission of the USSR, the Gossnab of the USSR, the State Committee of the USSR on Science and Technology, etc.). Using data provided by the sectoral systems, these systems eliminate obstacles to the balanced development of the national economy, the achievement of established targets and the co-ordination of sectoral activities. In addition, it is planned to establish a general State system for the collection and processing of information to be used for accounting, planning and the national economic management purposes. This system will embrace automatic systems of all levels and types. The technical infrastructure of this system will be provided by the network of State computer centres. It will include interacting sectoral, departmental (functional), republican and territorial computer centres.

The work of an automatic control system can be illustrated by the work of the Moscow Central Construction Board. The Board has an ACS which plans, controls and regulates construction operations with a total value of more than 1,000 million roubles per year, mostly in the Moscow area.

In establishing this system, the special features of construction organization in Moscow were taken into account, primarily the specialization of the central boards involved in construction and of the organizations which form part of the Board itself.

The Board, in its turn, specializes in certain types of construction: housing, special purpose buildings and community facilities.

The main area in which the help of the Board's ACS is enlisted is the organization and provision of a building production line operating on daily and hourly schedules. The production line includes the following operations: the loading of components, supplies and equipment required for construction at plants, warehouses and storage depots; the transport of these to building sites; the carrying out of work.

The technical infrastructure of the system consists of: a central computer centre equipped with an electronic computer; production control points at major sites; control points at enterprises, supply depots, service points and transport establishments control points in construction and specialized sub-divisions.

The Board's automatic control system is divided into 3 sub-systems:

The planning and processing of on-going production documentation; the control and regulation of production; and accounting.

The first sub-system is a series of inter-connected programmes on the basis of which the computer prepares long-term and annual work plans and hourly installation and transport schedules, designed to organize work at enterprises and the transport and assembly of buildings, broken down into five-minute intervals, and other planning documents.

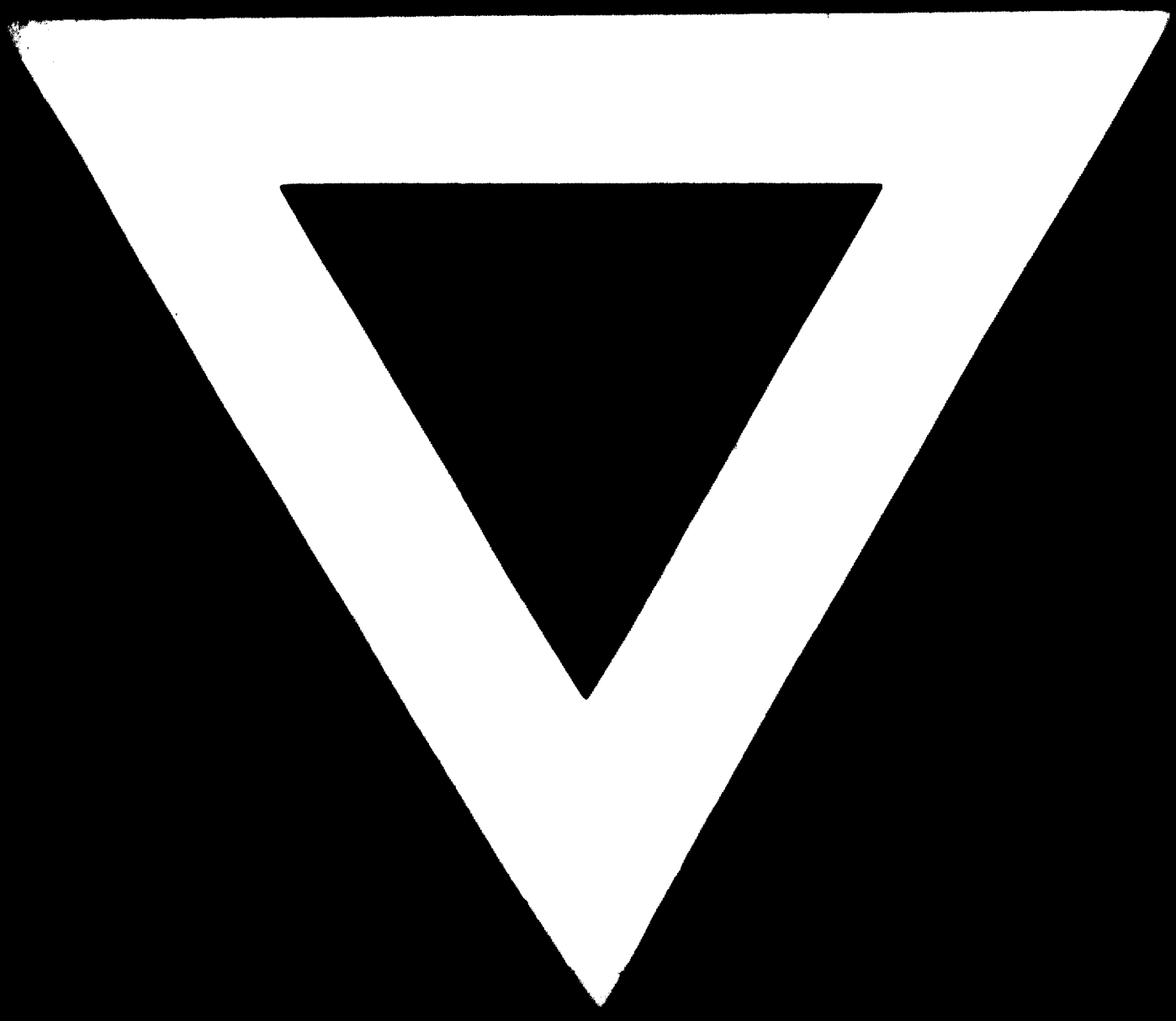
The second sub-system checks the assembly of buildings and structures, the activities of works depots and supply and transport depots on the basis of hourly and daily schedules for the delivery and assembly of components, schedules for the transport of supplies and other materials, the plan of work for machinery and mechanical devices, and the results of periodic checks and analysis of the completion of critical path schedules and progress charts.

The third sub-system keeps a direct record of the progress of production processes (unloading, making up of units, assembly, special operations, machining, etc.) on the basis of information supplied by control points at building sites, enterprises and supply depots. The findings are transferred to the main computer centre where they are processed and analysed by computer by means of comparison with plans, schedules and other operational production documentation.

If this analysis shows up discrepancies, the remedial measures required are passed on to the governing organs of the ACS. Information on the progress of production processes not only serves as a check on the work schedule and reveals any discrepancies which have arisen; on the basis of this data, the computer complex processes various types of information including data on the assembly of units and components as well as the results of critical path scheduling, etc.

Separate ACS sub-systems have been established in the Ministry of Industrial Construction of the Byelorussian SSR, in the Ministries of Construction of the Estonian, Lithuanian and Uzbekhistan SSR, in the Main Construction Board for the Western Regions of the Ministry of Construction of the USSR, in the Main Construction Board for the Moscow Region, the Leningrad, Kiev and Tashkent main construction boards, in many construction trusts and in housing construction combines.

In addition to automatic control systems for construction there has been developed an automatic system for the planning of construction projects. The basic aims of this system are to improve the quality of planning and to reduce both the time spent on drawing up plans and labour costs. The system deals with problems of district planning, urban development, general plans for industrial and civil complexes, the designing of buildings and structures for industrial and civil construction and the design and production of structual elements.



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