The Formal Language for Describing Technological Processes in Construction

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ABSTRACT

The problem of describing the technological processes in construction with through formal languages.

The significant section of building design both in content and in labor, is the organizational and technological design. Formation and process automation of organizational and technological documentation in the building has its own specific characteristics.

Underestimating the need for and importance of complex organizational and technological documentation, which takes into account the development of construction master plan, technology, construction and installation works, the requirements for quality control and safety standards often results in emergency and conflict situations, overuse, an increase in construction time and cost increase [1].

INTRODUCTION

The efficiency of construction work depends on the perfection of the process, the quality and range of building materials, the technical level of applied tools, equipment and technological devices, scientific organization of labor. According to the regulations and methods of the Federal Agency for Construction and Housing and Communal Services, the following main activities: preparation, excavation, piling, installation and dismantling of prefabricated concrete and reinforced concrete structures, the device roofs, protection of equipment and construction, commissioning, etc.

One of the important parts of organizational and technical documentation is to make flow charts which are part of the production design work. Technological cards provide a detailed description of the construction process. In order to facilitate the formation of technological cards and automate their creation may apply existing languages formal descriptions of technological processes, or develop a new one.

Technological cards consists of eight sections:

• scope - terms of execution of the construction of a lengthy process (including

climatic);
• organization and technology of the construction process - requirements to the completeness of the prior or preparatory process; the composition of used machines, equipment and mechanisms, with indication of their technical characteristics, types, brands and number etc.;
• requirements to the quality and acceptance of work - the list of transactions or processes subject to control; types and methods of control, and others;
• costing, working time machines and wage - list of the performed operations and processes with the scope of work; standards of working and machine time and prices;
• schedule of manufacture of works - graphic expressions of the sequence and duration of operations and processes on the basis specified in the cost estimate of expenses of work and time of work of cars;
• material-technical resources - data for materials, products and constructions on the agreed scope of works, instrument, inventory and fixtures;
• safety - measures and rules without-a dangerous processes, the design studies for specific conditions of construction;
• technical-economic indicators - labour costs; the costs of time of the work of machines; wages; wage drivers; the duration of the execution process in accordance with the schedule; output per worker shift; the cost of mechanization and other

METHODOLOGY

Typical process as the object of an automated process design - is ordered (by execution sequence) a set of descriptions of technological operations [2]. Design process in the construction of large volumes of raw data. In this context of rationality and simplicity of the original descriptions of technological information to a large extent on the preparation of the data , the amount of computer memory occupied by the source of technological information , the complexity of the algorithms and software design, as well as the time to solve the problem.

Analysis of the existing model maps shows that they are relative to any of the component, which depends on material; geometrical characteristics; a set of activities with the regulations in labor costs; skilled performers; a set of materials, machinery, equipment and fixtures.

Based on the specific characteristics, in accordance with the classical definition of routing, forming text and graphics in the form of guidance schemes right to perform quality control, security [3]. In some cases, the standard process maps are constructed using a generalized indicator of construction: for 1 m3 per 100 m^2, etc. For example, in laying of concrete unit for the automated preparation of routings can be represented as follows:

№	Name work	Composition and durationoperations, h	Fixed time	The composition of managers
1	Concreting mobility A4 and A5 in the device monolithic walls up to 3.5 m, thickness of 0.15 - 0.2 m and height of the layer stacking of 1.5 m	- submission of the PC and vibration - 0.6; -0,2-moving equipment	0,8	Concreter 4d -1 2d -1
2	…	…	…	…

The system should also provide a description of the completeness of the data required for the computer-aided design. If conditionally constant information (reference standard, standard solutions, the selection algorithms making) quite easily converted to a formalized form (lookup tables, decision tables, tables of correspondences), the variable information for this task is much more difficult.

For information about building processes, materials are diagrams, drawings, sets of numbers, symbols, and text description. The system should describe all this information to present different character in a single alphanumeric form [4].

The majority of formal languages (created structures) are constructed as follows: first, select the alphabet, or a combination of the original characters that will build all the expressions of the language, and then describes the syntax of the language, that is, the rules for constructing meaningful expressions. The letters in the alphabet of a formal language may be letters of the alphabets of natural languages , and the brackets, and special characters, etc. [5].

Of the letters, according to certain rules can make words and expressions. Meaningful expressions are obtained in a formal language, only if certain rules in the language of education. For each set of formal language of these rules should be strictly defined and the modification of any of them usually leads to the emergence of new varieties (dialect) of the language. On the issue of formalizing the description of technological information are two fundamental methodological approach: the development of a set of coding sheets and the use of a special formal language.

In the design based on standard processes, you must first find an appropriate standard process. In systems engineering unit processes to describe the background using formal problem- oriented languages that are more invariance and therefore more versatile. For example, in mechanical processes described using the grammars and language [6].

Applying this method to process card payments, for example, for the production of spatial reinforcement cage of the column should write phrases (preparation and cutting rebar to length, bending clamps; production of inserts, assembly, mounting the heating cable; slinging and submission to the installation site, installing spacers; installation and mounting design position, checking the accuracy of the installation, etc.).

Next, organize, and select components: the action chosen, the object on which the action takes place, the tool .Based on these components, you can make the alphabet of non-terminal symbols for the future of grammar. It will take the form:

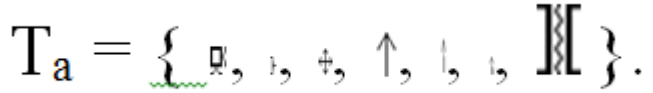
N = {A, O, I, S},

where A - Action, O - Object, I - Instrument, S - Start character . Each variable has to take a certain value. From the set of all possible values of the alphabet of terminal symbols.

For simplicity, divide it into four subalphabet according to the partition of phrases into components. Then Ta - subalphabet constants denoting action.

T_a = {"Fix", "Collect", "Craft", "Set", "Bent", "Rigging", "Check"}.

For convenience, define each constant icon , then

$T_a =$  .

Similarly, Ta - subalphabet constants denoting objects .

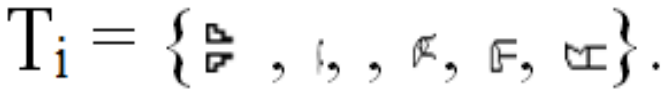
T_o = {"Valves", "Clamps", "Bonnet spacer", "Cable"}.

Or what is the same

$T_o =$  .

Finally, T_i - subalphabet constants indicating instrument.

T_i = {"Workbench with manual machine for bending", "Container blanks rods", "Container for finished products", "Crane ", "Rulers"}, or

$T_i =$  .

It remains to add additional subalphabet Td = {d1, d2, d3}, where d1 - null character («»), d2 - a symbol that separates the operation of our production

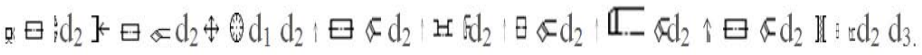
process from each other (. _), d3 - symbol of the end of the process. The union of the

T = TaToTiTd.

The pre- recorded phrases by using the above constants and variables:

1. - "Secure" () "Valves" () "Workbench with manual machine for bending" ().
2. " Rigging " () "Valves " () " Crane " ().
3. d1 - « Collect " () "Cable » () «» (d1) , etc.

As a result, it becomes possible to describe the process of making parts:



Structure of the products shows that formed grammatical phrase that describes an action process . When the grammar's start symbol takes the value d_3, which means that the description of the process is completed.

Based on the collected raw materials for technological design in construction, and based on a study of the formalization process, it can be concluded that it is possible to form the main sections of standard routings in an automated mode.

CONCLUSIONS

1. The analysis of the theory and practice of automation of designing of organizational and technological documentation, and also the analysis of the existing approaches in the description of the technological process revealed the need to develop a formal language for the description of technological processes to increase efficiency of production of concrete and reinforcement works.
2. Developed production base of technological cards.
3. Developed a language for description of the technological processes with the help of methods of languages and grammars.

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