Formation of management mechanisms for network planning of the transport system of the region

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Abstract. A network for a large transport complex can consist of hundreds and thousands of jobs. Before creating a network, the people responsible for the schedule should think about how to highlight the most difficult parts of it. Therefore, the planning center developing the network schedule must study the designs of structures, establish the manufacturability of building structures, a list of the main technological equipment, the load of the organizations involved in the construction and determine the labor intensity of the main work. Therefore, the purpose of this article is to develop scientific and methodological approaches to the formation of management mechanisms for network planning of the transport system of the region.

1 Introduction

Network planning is the theoretical basis for managing large projects in both residential and transport construction. The main aspects and stages of network planning are: preparatory, drawing up private network schedules (first stage), connecting private schedules to a common network (second stage) and optimizing the schedule in terms of time and resources (third stage). The paper presents a developed model based on the adaptive mechanisms of the strategic management plan (SMP) for organizing management impacts through the use of operational data from construction sites.

2 Theoretical and calculated part of the study

Two components are distinguished: the first, information from the group of decision makers (DM) and various levels of the hierarchy (I_P) in the SMP, the second from the SMP to the DM (I_e). The information component I_P represents the set of DM goals, resource estimates R = $\{r_i\}$ aimed at achieving ci and hierarchy levels $C = \{c_i\}$, i ϵ {1,2, ... n}. One of the assumptions is that ri is a scalar. The information component I_e represents a variety of programs P_i to achieve c_i. The program P_i is a set of control decisions (SD) or inference rules $P_{i,j,}$ $l\epsilon$ *{1,2, ... d}*, the implementation of which is based on real data about the situation

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at the facility. For any SD P_{il} there is a corresponding procedure for its implementation $P^k i$, j, $k \epsilon K = \{1,2,\ldots w\}$. The dynamics of resource estimates is also determined by the choice of SD $P_{i,l}$. It should be noted that the execution of all programs $P^k i, j$ depends on the state of the system [1-12].

The implementation of all goals of the SMP is provided by a set of programs:

$$P_j, j = \overline{1,m}, m \leq n. \quad (1)$$

The structure of the SMP has the form of a set:

$$M = (R, S, P_i, \varphi, f, \psi, \chi, \lambda) \quad (2)$$

where R defines system resources; S is the internal state of the system; φ: $R \times ci \rightarrow V(R)$ - functional for assessing system resources that ensure the performance of actions for a given goal; $V(R)$; f: $V(R(t)) xPi, l \rightarrow V(R(t+l))$ is the outcome assessment functional depending on the current state of the system resource and SD, where $t \epsilon T = \{1,2,\}$ - discrete moments in time; ψ: $V(R(t+1)) \times P_{i,j} \rightarrow P_{i,g}$ $(g \epsilon l)$ is the SD selection function, taking into account the assessment of possible outcomes; χ: $Pi, g \times S \rightarrow P^k i, j$ is the function of choosing the program for executing the SD $P_{i,g}$, for the given internal states; λ: $Pi, l \times S \rightarrow [0,1]$ is a fuzzy binary ratio that determines the evaluation of the program for a given internal state [1-12].

The choice of the target can be determined by both the decision maker and the SMP. SMP offers a ranked sample of programs for achieving goals, taking into account resource constraints. Further, the SMP analyzes possible SDs and stops at control, for which $V(R) / ci \rightarrow max$. This control is consistent with the decision maker [1-12].

Intellectual tasks are always associated with formal models of fuzziness in describing a control object and they have a number of characteristic properties, namely: the absence of a formalized goal and optimality in the classical sense; dynamism; uniqueness; incomplete description of the system.

In general, the general principles of SMP and decision support models, built on the basis of fuzzy situational networks, make it possible to form a constructive methodology for planning the production activities of a construction organization.

The methodology includes a set of models of network planning, resource allocation and others necessary to support management activities. It is assumed that all models have an appropriate software implementation, an agreed universal interface and form a model base (BM). The proposed technique includes various stages.

3 Results and discussion

If we take as an axiom the need for government bodies to shift from a departmental, technological orientation to focus on the needs and tasks of citizens, and to improve the quality of life of the population as a whole, then it is the needs of the population that become fundamental in the formation of a system of goals, and, therefore, aimed at achieving these goals. activities (processes) and the technical, informational and, finally, organizational structure supporting their implementation.

Developing this approach, it can be assumed that a citizen, periodically faced with various problem (life) situations, counts on the help of state bodies in resolving them. These problem situations, in a number of works, are tied to certain phases of life activity, however, even without such a tie, it is obvious that each problem life situation should be in the area of responsibility of some structure. Moreover, the authorities should integrate their efforts to obtain the final effect for the population, and the organizational structure should facilitate such integration, not allowing interdepartmental barriers to create obstacles to the successful

solution of the tasks set. At the moment, in the city of Krasnoyarsk, a structure has developed that suggests the distribution of responsibility at the highest level of generalization.

Today, traffic management is under the authority of one Department, and the provision of transport infrastructure is under the authority of two other departments. The integration of the tasks of the departments is carried out only at the level of the Ministry of Transport of the region, which should allow balancing and managing development projects, but it is ineffective for solving everyday urban problems.

As a basic proposal for improving (reorganizing) the management system of the city's road transport complex, it is proposed to consider the possibility of creating generalized structures of the city administration for transport services and construction of the road traffic system.

The search for these reserves lies in the path of accurate modeling and reengineering of processes in this area. For example, the key postulate of reengineering, put forward by its ideologists, is the restructuring, first of all, of the organization of activities, and then of the organizational structure. At the same time, the organization of the processes should exclude possible contradictions in their execution. And even if contradictions did arise, mechanisms for their automatic elimination were worked out and launched. However, the reengineering of processes requires not only their identification at all levels, but it also requires the most accurate description, preliminary design (modeling) of the process, as well as the design of their information support tools based on new IT (information technology) capabilities. In the course of reengineering, it is planned to restructure the organizational structure in order to empower those structures that use its result. This restructuring can be carried out in stages during the implementation of the reengineering project.

At the same time, service departments: are responsible to functional units (units performing the main processes) and are evaluated according to criteria related to their satisfaction with the services provided; do not work with letters from citizens and are not directly responsible for the target performance of functional units; manage funds allocated to functional units from the budget; are staffed with the necessary (technical) specialists.

4 Conclusion

When distributing powers among departments, it is proposed to build on the traditional allocation of the following levels of management, namely, strategic, tactical and operational. But it is important that all the previously designated levels of management are also present within the service departments (or service systems), from strategic (for example, a strategy for providing human resources) to operational (operational management of personnel selection and filling vacancies).

Organizational engineering technologies will make it possible to systematically and accurately determine the composition of the necessary tasks (processes), establish the requirements for these processes, indicators of the efficiency of processes and assign to the performers not only indicators, but also the previously designed processes as accurately as possible. Without such measures, any changes in the organizational structure do not guarantee the rapid achievement of the required performance.

In addition to the "main processes" directly related to the implementation of the targeted purpose of the road transport complex and oriented to external consumers of its services, there are "provision (service) processes" that supply internal resources and services to the main processes. Internal resources and services are understood as material and technical, financial, informational support, provision of human resources and resources of relations. The securing of the supporting activity is carried out, for the so-called service services, formed according to the technological principle.

At the strategic level, priorities and development directions are determined, the operational level is planning to achieve the required values of performance indicators, the scope of work and the required resources on a horizon from a year to a week, the operational level is the direct management of the execution of the main processes, their administration and dispatching.

As a result of the study, the authors systematized the approach to assessing environmental performance when changing the coordination plan of a traffic light object. Based on the experiment performed using the simulation product, the developed approach was tested and an environmental assessment was carried out, which, within the framework of the object of study, an isolated intersection, allowed us to determine the reduction of harmful emissions into the atmosphere by an average of 11%, which generally improves the environmental situation.

References

1. Novikov A, Novikov I and Shevtsova A 2018 Study of the impact of type and condition of the road surface on parameters of signalized intersection *Transportation Research Procedia* Volume **36** pp. 548-555.
2. Novikov A, Novikov I and Shevtsova A 2019 Measures to ensure road traffic safety on controlled intersections *MATEC Web of Conferences* Volume **298** p. 00046
3. Novikov A N, Eremin S V, Eroshok I D and Baldin A V 2020 Hybrid environment for assembling heterogeneous applications for modeling transport systems *World of Transport and Technological Machines* No. **2 (69)**. pp. 47-55.
4. Emelyanov D I Ponyavina N A Chesnokova E A 2017 Solution of the problem of planning complex production processes at an enterprise based on network planning methods *News of higher educational institutions*. *Textile industry technology* No. **5 (371)** pp. 28-32.
5. Novikov A, Glagolev S, Novikov I and Shevtsova A 2019 Information technologies and management of transport systems development of the approach to assessing adaptation of the intersection transport model *IOP Conference Series: Materials Science and Engineering* Volume **632(1)** pp. 012052
6. Emelyanov D I, Ponyavina N A and Chesnokova E A 2017 Solution of the problem of planning complex production processes at an enterprise based on network planning methods *News of higher educational institutions*. *Textile industry technology* No. **5 (371)** pp. 28-32.
7. Dolenko D V 2018 Methods of network planning *Truck* No. **8** pp. 40-48.
8. Shevtsova A, Novikov I, Borovskoy A 2015 Research of influence of time of reaction of the driver on the calculation of the capacity of the highway *Transport Problems* Volume **10 (3)** pp. 53-59.
9. Dorokhin S V, Novikov A N, Zelikov V A, Strukov Y V, Novikov I A, Shevtsova A G and Likhachev D V 2018 Investigation of methods for calculating duration of lightsignal regulation cycle *Journal of Physics: Conference Series* Volume **1015(3)** pp. 032128
10. Borovskoy A E and Shevtsova A G 2016 Study of the degree of intersection saturation taking into account the classification of cars *Science and technology of transport* Volume **1** pp. 88-93
11. Fedotov V N and Afanasiev A S 2018 Concept of air environment cleaning of natural and technogenic system of motor transport using mobile devices *Transport Res*. **36** pp. 179-84
12. Vlasov V M, Novikov A N, Novikov I A and Shevtsova A G 2018 Definition of perspective scheme of organization of traffic using methods of forecasting and modeling

IOP Conference Series: Materials Science and Engineering Volume **327(4)** pp. 042116